



FCC TEST REPORT

REPORT NO.: RF911220R07

MODEL NO.: WLL220

RECEIVED: Dec. 20, 2002

TESTED: Dec. 25, 2002 ~ Jan. 04, 2003

APPLICANT: ASKEY COMPUTER CORP.

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0528
ILAC MRA



Lab Code: 200102-0



Table of Contents

1.	CERTIFICATION	5
2.	SUMMARY OF TEST RESULTS	6
3.	GENERAL INFORMATION	8
3.1	GENERAL DESCRIPTION OF EUT	8
3.2	DESCRIPTION OF TEST MODES	9
3.3	GENERAL DESCRIPTION OF APPLIED STANDARDS	10
3.4	DESCRIPTION OF SUPPORT UNITS	11
4.	TEST TYPES AND RESULTS (FOR PART 802.11b)	12
4.1	CONDUCTED EMISSION MEASUREMENT	12
4.1.1	LIMITS OF CONDUCTED EMISSION MEASUREMENT	12
4.1.2	TEST INSTRUMENTS	12
4.1.3	TEST PROCEDURES	13
4.1.4	DEVIATION FROM TEST STANDARD	13
4.1.5	TEST SETUP	14
4.1.6	EUT OPERATING CONDITIONS	14
4.1.7	TEST RESULTS	15
4.2	RADIATED EMISSION MEASUREMENT	21
4.2.1	LIMITS OF RADIATED EMISSION MEASUREMENT	21
4.2.2	TEST INSTRUMENTS	22
4.2.3	TEST PROCEDURES	22
4.2.4	DEVIATION FROM TEST STANDARD	23
4.2.5	TEST SETUP	24
4.2.6	EUT OPERATING CONDITIONS	24
4.2.7	TEST RESULTS	25
4.3	6dB BANDWIDTH MEASUREMENT	29
4.3.1	LIMITS OF 6dB BANDWIDTH MEASUREMENT	29
4.3.2	TEST INSTRUMENTS	29
4.3.3	TEST PROCEDURE	30
4.3.4	DEVIATION FROM TEST STANDARD	30
4.3.5	TEST SETUP	30
4.3.6	EUT OPERATING CONDITIONS	30
4.3.7	TEST RESULTS	31
4.4	MAXIMUM PEAK OUTPUT POWER	35
4.4.1	LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT	35
4.4.2	INSTRUMENTS	35
4.4.3	TEST PROCEDURES	36
4.4.4	DEVIATION FROM TEST STANDARD	36
4.4.5	TEST SETUP	36
4.4.6	EUT OPERATING CONDITIONS	36
4.4.7	TEST RESULTS	37
4.5	POWER SPECTRAL DENSITY MEASUREMENT	38
4.5.1	LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT	38
4.5.2	TEST INSTRUMENTS	38
4.5.3	TEST PROCEDURE	39
4.5.4	DEVIATION FROM TEST STANDARD	39
4.5.5	TEST SETUP	39
4.5.6	EUT OPERATING CONDITION	39
4.5.7	TEST RESULTS	40



4.6	BAND EDGES MEASUREMENT	44
4.6.1	LIMITS OF BAND EDGES MEASUREMENT	44
4.6.2	TEST INSTRUMENTS	44
4.6.3	TEST PROCEDURE	44
4.6.4	DEVIATION FROM TEST STANDARD.....	44
4.6.5	EUT OPERATING CONDITION	45
4.6.6	TEST RESULTS.....	45
4.7	ANTENNA REQUIREMENT	48
4.7.1	STANDARD APPLICABLE.....	48
4.7.2	ANTENNA CONNECTED CONSTRUCTION.....	48
5.	TEST TYPES AND RESULTS (FOR PART 802.11a).....	49
5.1	CONDUCTED EMISSION MEASUREMENT	49
5.1.1	LIMITS OF CONDUCTED EMISSION MEASUREMENT	49
5.1.2	TEST INSTRUMENTS	49
5.1.3	TEST PROCEDURES	50
5.1.4	DEVIATION FROM TEST STANDARD.....	50
5.1.5	TEST SETUP	51
5.1.6	EUT OPERATING CONDITIONS.....	51
5.1.7	TEST RESULTS.....	52
5.2	RADIATED EMISSION MEASUREMENT	54
5.2.1	LIMITS OF RADIATED EMISSION MEASUREMENT	54
5.2.2	LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS	55
5.2.3	TEST INSTRUMENTS	56
5.2.4	TEST PROCEDURES	57
5.2.5	DEVIATION FROM TEST STANDARD.....	57
5.2.6	TEST SETUP	58
5.2.7	EUT OPERATING CONDITIONS.....	58
5.2.8	TEST RESULTS.....	59
5.2.9	TEST RESULTS.....	60
5.3	PEAK TRANSMIT POWER MEASUREMENT	71
5.3.1	LIMITS OF PEAK TRANSMIT POWER MEASUREMENT	71
5.3.2	TEST INSTRUMENTS	71
5.3.3	TEST PROCEDURE	72
5.3.4	DEVIATION FROM TEST STANDARD.....	72
5.3.5	TEST SETUP	72
5.3.6	EUT OPERATING CONDITIONS.....	72
5.3.7	TEST RESULTS.....	73
5.4	PEAK POWER EXCURSION MEASUREMENT	97
5.4.1	LIMITS OF PEAK POWER EXCURSION MEASUREMENT	97
5.4.2	TEST INSTRUMENTS	97
5.4.3	TEST PROCEDURE	98
5.4.4	DEVIATION FROM TEST STANDARD.....	98
5.4.5	TEST SETUP	98
5.4.6	EUT OPERATING CONDITIONS.....	98
5.4.7	TEST RESULTS.....	99
5.5	PEAK POWER SPECTRAL DENSITY MEASUREMENT.....	112
5.5.1	LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT	112
5.5.2	TEST INSTRUMENTS	112
5.5.3	TEST PROCEDURES	113
5.5.4	DEVIATION FROM TEST STANDARD.....	113
5.5.5	TEST SETUP	113



5.5.6	EUT OPERATING CONDITIONS.....	113
5.5.7	TEST RESULTS.....	114
5.6	FREQUENCY STABILITY.....	127
5.6.1	LIMITS OF FREQUENCY STABILITY MEASUREMENT	127
5.6.2	TEST INSTRUMENTS	127
5.6.3	TEST PROCEDURE	127
5.6.4	DEVIATION FROM TEST STANDARD.....	128
5.6.5	TEST SETUP	128
5.6.6	EUT OPERATING CONDITION	128
5.6.7	TEST RESULTS.....	129
5.7	BAND EDGES MEASUREMENT	130
5.7.1	TEST INSTRUMENTS	130
5.7.2	TEST PROCEDURE	130
5.7.3	EUT OPERATING CONDITION.....	130
5.7.4	TEST RESULTS.....	131
5.8	ANTENNA REQUIREMENT	140
5.8.1	STANDARD APPLICABLE.....	140
5.8.2	ANTENNA CONNECTED CONSTRUCTION.....	140
6.	PHOTOGRAPHS OF THE TEST CONFIGURATION	141
7.	INFORMATION ON THE TESTING LABORATORIES.....	145



1. CERTIFICATION

PRODUCT : 2.4GHz/5GHz Mini - PCI Card
BRAND NAME : Linksys
MODEL NO. : WLL220
APPLICANT : ASKEY COMPUTER CORP.
STANDARDS : 47 CFR Part 15, Subpart C (Section 15.247),
Subpart E (Section 15.407), ANSI C63.4-1992

We, **Advance Data Technology Corporation**, hereby certify that one sample of the designation has been tested in our facility from Dec. 25, 2002 ~ Jan. 04, 2003. The test record data evaluation and Equipment under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions herein specified.

CHECKED BY: Kelsey Chang **DATE:** Jan. 05, 2003
Kelsey Chang
APPROVED BY: Ellis Wu for, **DATE:** Jan. 05, 2003
Dr. Alan Lane
Manager

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: 47 CFR Part 15, Subpart C			
Standard Section	Test Type and Limit	Result	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit Minimum passing margin is -15.73dBuV at 0.170MHz
15.247(a)(2)	Spectrum Bandwidth of a Direct Sequence Spread Spectrum System Limit: min. 500kHz	PASS	Meet the requirement of limit
15.247(b)	Maximum Peak Output Power Limit: max. 30dBm	PASS	Meet the requirement of limit
15.247(c)	Radiated Emissions Limit: Table 15.209	PASS	Meet the requirement of limit Minimum passing margin is -5.50dBuV at 6336.00MHz
15.247(d)	Power Spectral Density Limit: max. 8dBm	PASS	Meet the requirement of limit
15.247(c)	Band Edge Measurement Limit: 20dB less than the peak value of fundamental frequency	PASS	Meet the requirement of limit



APPLIED STANDARD: 47 CFR Part 15, Subpart E			
Standard Section	Test Type	Result	REMARK
15.407(b)(5)	AC Power Conducted Emission	PASS	Meet the requirement of limit Minimum passing margin is -14.47dBuV at 0.173MHz
15.407(b/1/2/3)(b)(5)	Electric Field Strength Spurious Emissions, 30 MHz – 40000 MHz	PASS	Meet the requirement of limit Minimum passing margin is -2.5dBuV at 11490.00MHz
15.407(a/1/2/3)	Peak Transmit Power	PASS	Meet the requirement of limit
15.407(a)(6)	Peak Power Excursion	PASS	Meet the requirement of limit
15.407(a/1/2/3)	Peak Power Spectral Density	PASS	Meet the requirement of limit
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	2.4GHz/5GHz Mini - PCI Card
MODEL NO.	WLL220
POWER SUPPLY	3.3VDC from host equipment
MODULATION	802.11b: DSSS 802.11a: OFDM
TRANSFER RATE	802.11b: 1 / 2 / 5.5 / 11Mbps 802.11a: 6 to 54Mbps *(Turbo mode : up to 108Mbps)
FREQUENCY RANGE	802.11b: 2412MHz ~ 2462MHz 802.11a: 5.15GHz ~ 5.35GHz, 5.725GHz ~ 5.825GHz
NUMBER OF CHANNEL	802.11b: 11 802.11a: 12 for Normal mode / 5 for Turbo mode
CHANNEL SPACING	802.11b: 5MHz 802.11a: 20MHz for Normal mode / 40MHz for Turbo mode
OUTPUT POWER	802.11b: 16.60dBm 802.11a: 16.78dBm
DATA CABLE	NA
ANTENNA TYPE	Printed Inverted F antenna
I/O PORTS	NA
ASSOCIATED DEVICES	NA

NOTE:

1. The EUT operates in both the 5GHz and 2.4GHz Bands and compatibility with 802.11a and 802.11b technology.
2. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.



3.2 DESCRIPTION OF TEST MODES

For 802.11b: Eleven channels are provided to this EUT.

Channel	Frequency	Channel	Frequency
1	2412 MHz	7	2442 MHz
2	2417 MHz	8	2447 MHz
3	2422 MHz	9	2452 MHz
4	2427 MHz	10	2457 MHz
5	2432 MHz	11	2462 MHz
6	2437 MHz		

NOTE:

1. Below 1 GHz, the channel 1, 6, and 11 were pre-tested in chamber. The channel 11, worst case one, was chosen for final test.
2. Above 1 GHz, the channel 1, 6, and 11 were tested individually.

For 802.11a: Eight channels are provided to this EUT for Normal mode.

Channel	Frequency	Channel	Frequency
1	5180 MHz	7	5300 MHz
2	5200 MHz	8	5320 MHz
3	5220 MHz	9	5745MHz
4	5240 MHz	10	5765MHz
5	5260 MHz	11	5785MHz
6	5280 MHz	12	5805MHz

Five channels are provided to this EUT for Turbo Mode.

Channel	Frequency	Channel	Frequency
1	5210 MHz	4	5760MHz
2	5250 MHz	5	5800MHz
3	5290 MHz		

NOTE:

1. The EUT was transmitting at full power on the specified channel with a duty cycle of 99% (maximum allowed). The EUT was tested in both normal mode (channel bandwidth of approximately 30MHz) and turbo mode (channel bandwidth of approximately 60MHz).
2. "Normal Mode" allows data rates of up to 54Mbps. The device was, therefore, tested in Normal mode at the data rate that produced the highest output power for normal mode (6Mbps).
3. "Turbo Mode" allows data rates of up to 108Mbps. At data rates higher than 12Mbps the PA gain is reduced to improve signal fidelity. The device was, therefore, tested in turbo mode at the data rate that produced the highest output power for turbo mode (12Mbps).
4. Channel 1, 4, 5, 8, 9 and 12 are the closest frequencies to the band edge, were chosen for final test of Normal Mode.
5. Channel 1 ~ 5 were chosen for final test of turbo mode.



3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a 2.4GHz/5GHz Mini - PCI Card. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC 47CFR Part 15, Subpart C. (15.247),
Subpart E (15.407). ANSI C63.4 : 1992**

All tests have been performed and recorded as per the above standards.

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.



3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK	DELL	PP01L	TW-09C748-12800-19O-B220	FCC DOC APPROVED
2	PRINTER	EPSON	LQ-300+	DCGY017096	FCC DOC APPROVED
3	MODEM	ACEEX	1414	980020569	IFAXDM1414

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA
2	1.2m braid shielded wire, terminated with DB25 and Centronics connector via metallic frame, w/o core
3	1.2 m braid shielded wire, terminated with DB25 and DB9 connector via metallic frame, w/o core.

NOTE: All power cords of the above support units are non shielded (1.8m).



4. TEST TYPES AND RESULTS (FOR PART 802.11b)

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
ROHDE & SCHWARZ Test Receiver	ESCS30	847793/022	Mar. 12, 2003
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	828075/003	July 23, 2003
ROHDE & SCHWARZ 200-A Four-line V-Network	ENV4200	830326/018	Oct. 30, 2003
* ROHDE & SCHWARZ 4-wire ISN	ENY41	838119/028	Nov. 29, 2003
* ROHDE & SCHWARZ 2-wire ISN	ENY22	837497/018	Nov. 29, 2003
EMCO-L.I.S.N. (for peripheral)	3825/2	90031627	July 23, 2003
Software	Cond-V2M1	NA	NA
RF cable (JYEBAO)	5D-FB	Cable-C05.01	July 19, 2003
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-305	Feb. 20, 2003
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-306	Feb. 20, 2003

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. "*" : These equipment are used for conducted telecom port test only (if tested).
 3. The test was performed in ADT Shielded Room No. 5.
 4. The VCCI Site Registration No. is C-1093.



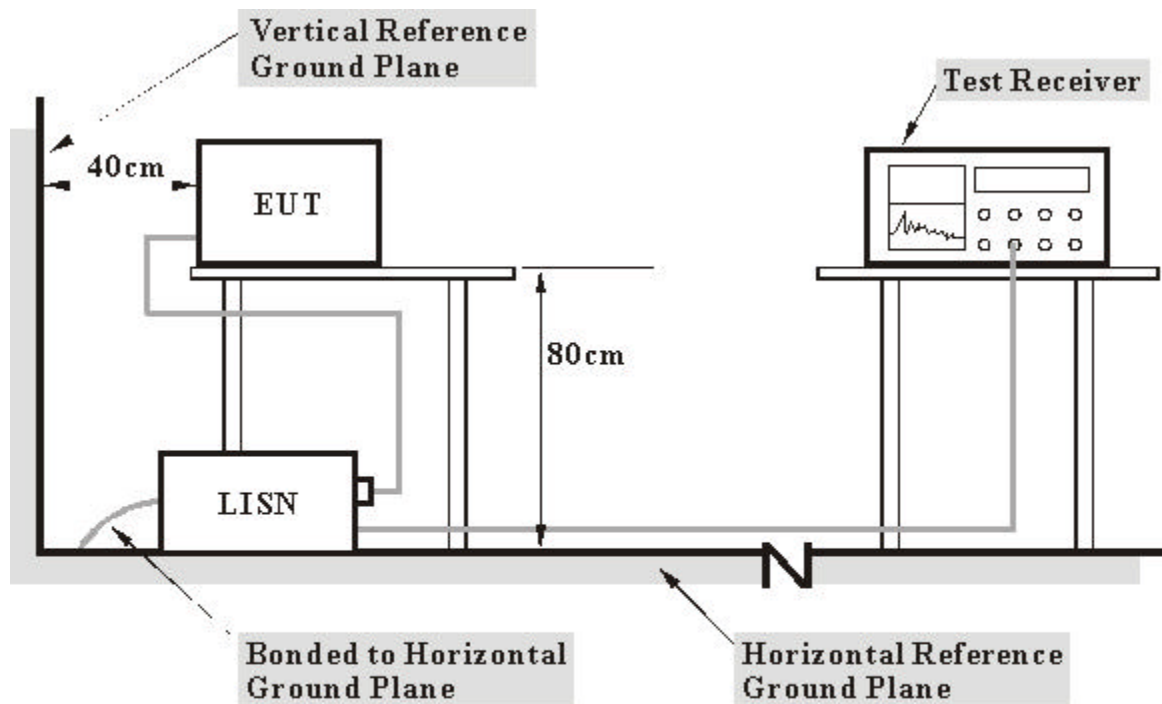
4.1.3 TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits could not be reported

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.1.6 EUT OPERATING CONDITIONS

- a. Plug the EUT into the PCMCIA to Mini PCI extender which connected to a computer system placed on a testing table.
- b. The computer system ran a test program to enable EUT under transmission/receiving condition continuously at specific channel frequency.
- c. The computer system sent "H" messages to its screen.
- d. The computer system sent "H" messages to modem.
- e. The computer system sent "H" messages to printer, and the printer prints them on paper.



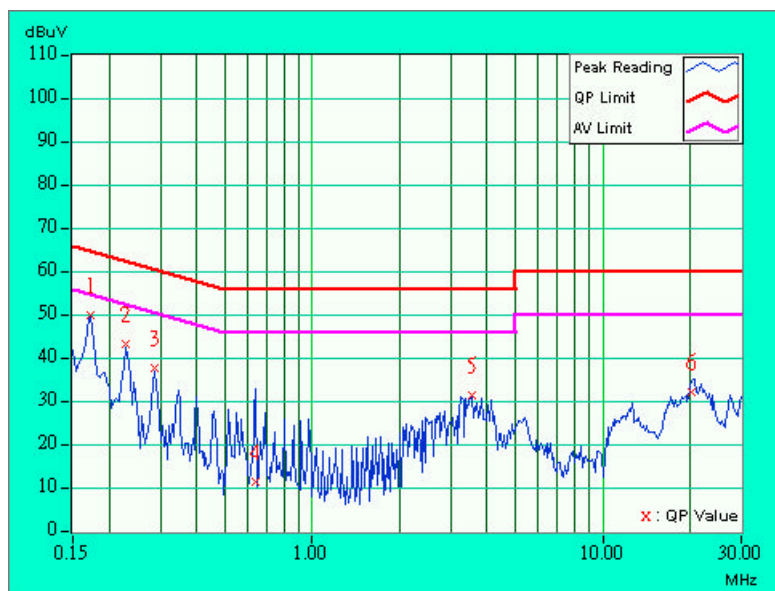
4.1.7 TEST RESULTS

EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 1	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	PHASE	Line (L)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

No	Freq. (MHz)	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			QP.	AV.	QP.	AV.	QP.	AV.	QP.	AV.
1	0.173	0.10	48.77	-	48.87	-	64.79	54.79	-15.92	-
2	0.228	0.10	42.25	-	42.35	-	62.52	52.52	-20.17	-
3	0.287	0.10	36.49	-	36.59	-	60.62	50.62	-24.03	-
4	0.638	0.14	10.32	-	10.46	-	56.00	46.00	-45.54	-
5	3.551	0.36	30.36	-	30.72	-	56.00	46.00	-25.28	-
6	20.289	1.11	31.19	-	32.30	-	60.00	50.00	-27.70	-

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



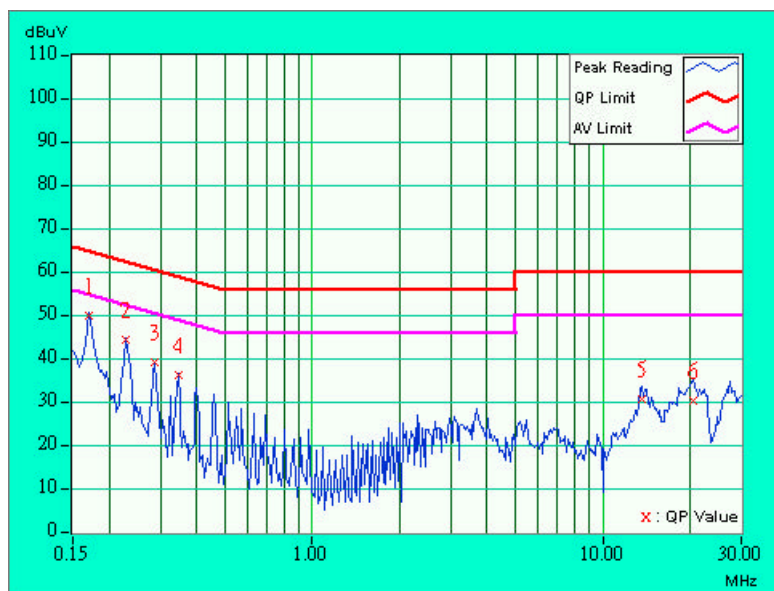


EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 1	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

No	Freq. (MHz)	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			QP.	AV.	QP.	AV.	QP.	AV.	QP.	AV.
1	0.170	0.10	49.15	-	49.25	-	64.98	54.98	-15.73	-
2	0.228	0.10	43.80	-	43.90	-	62.52	52.52	-18.62	-
3	0.287	0.10	38.52	-	38.62	-	60.62	50.62	-22.00	-
4	0.345	0.10	35.56	-	35.66	-	59.07	49.07	-23.41	-
5	13.641	0.47	30.06	-	30.53	-	60.00	50.00	-29.47	-
6	20.414	0.79	29.60	-	30.39	-	60.00	50.00	-29.61	-

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



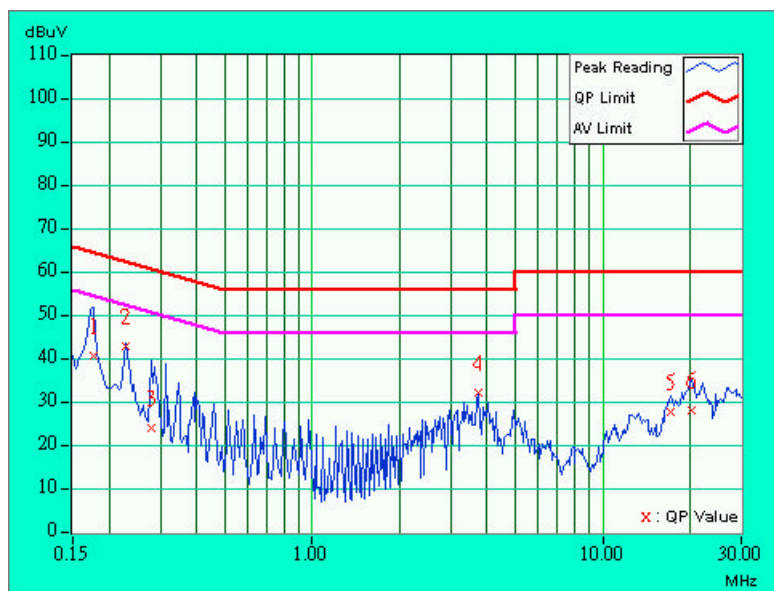


EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 6	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	PHASE	Line (L)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

No	Freq. (MHz)	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			QP.	AV.	QP.	AV.	QP.	AV.	QP.	AV.
1	0.177	0.10	39.48	-	39.58	-	64.61	54.61	-25.03	-
2	0.228	0.10	41.89	-	41.99	-	62.52	52.52	-20.53	-
3	0.279	0.10	23.03	-	23.13	-	60.85	50.85	-37.72	-
4	3.727	0.37	31.24	-	31.61	-	56.00	46.00	-24.39	-
5	17.254	0.94	26.76	-	27.70	-	60.00	50.00	-32.30	-
6	20.340	1.11	26.90	-	28.01	-	60.00	50.00	-31.99	-

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



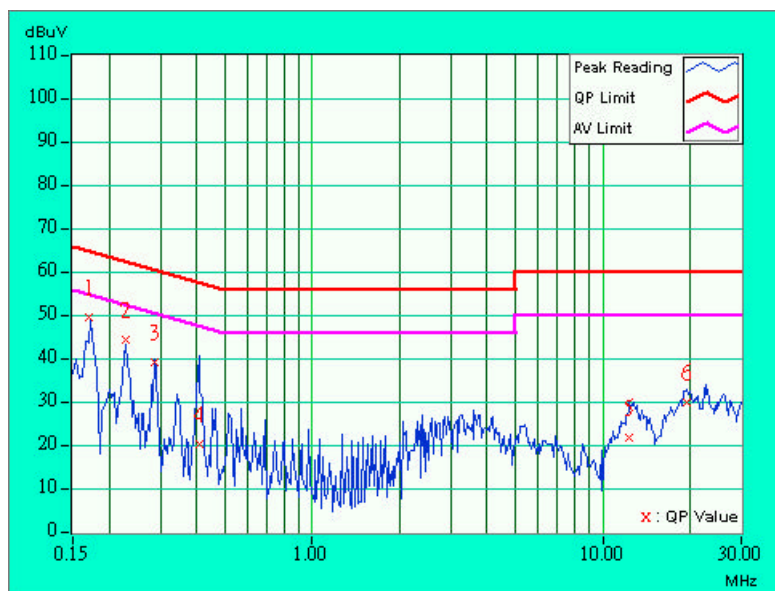


EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 6	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

No	Freq. (MHz)	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			QP.	AV.	QP.	AV.	QP.	AV.	QP.	AV.
1	0.170	0.10	49.03	-	49.13	-	64.98	54.98	-15.85	-
2	0.228	0.10	43.72	-	43.82	-	62.52	52.52	-18.70	-
3	0.287	0.10	38.60	-	38.70	-	60.62	50.62	-21.92	-
4	0.408	0.10	19.54	-	19.64	-	57.69	47.69	-38.05	-
5	12.383	0.45	21.14	-	21.59	-	60.00	50.00	-38.41	-
6	19.527	0.77	29.21	-	29.98	-	60.00	50.00	-30.02	-

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



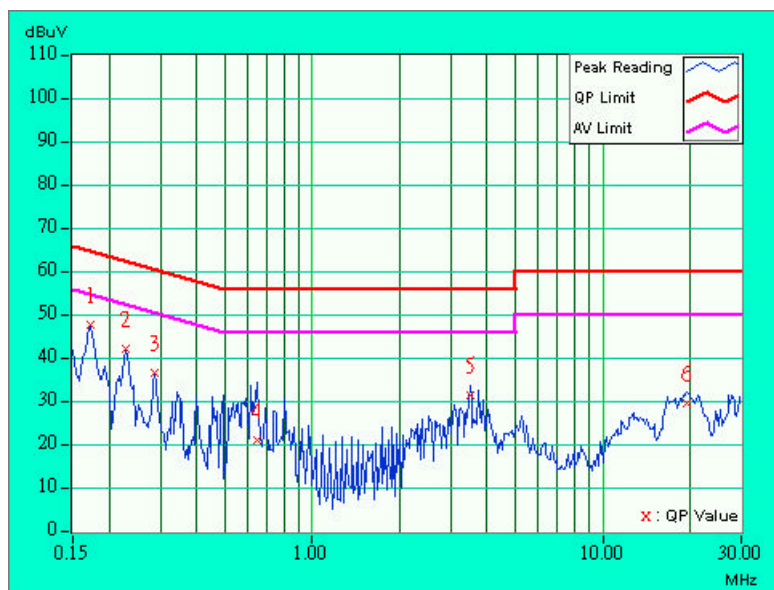


EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 11	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	PHASE	Line (L)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

No	Freq. (MHz)	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			QP.	AV.	QP.	AV.	QP.	AV.	QP.	AV.
1	0.173	0.10	46.54	-	46.64	-	64.79	54.79	-18.15	-
2	0.228	0.10	41.03	-	41.13	-	62.52	52.52	-21.39	-
3	0.287	0.10	35.51	-	35.61	-	60.62	50.62	-25.01	-
4	0.646	0.14	20.01	-	20.15	-	56.00	46.00	-35.85	-
5	3.496	0.35	30.40	-	30.75	-	56.00	46.00	-25.25	-
6	19.465	1.07	28.63	-	29.70	-	60.00	50.00	-30.30	-

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

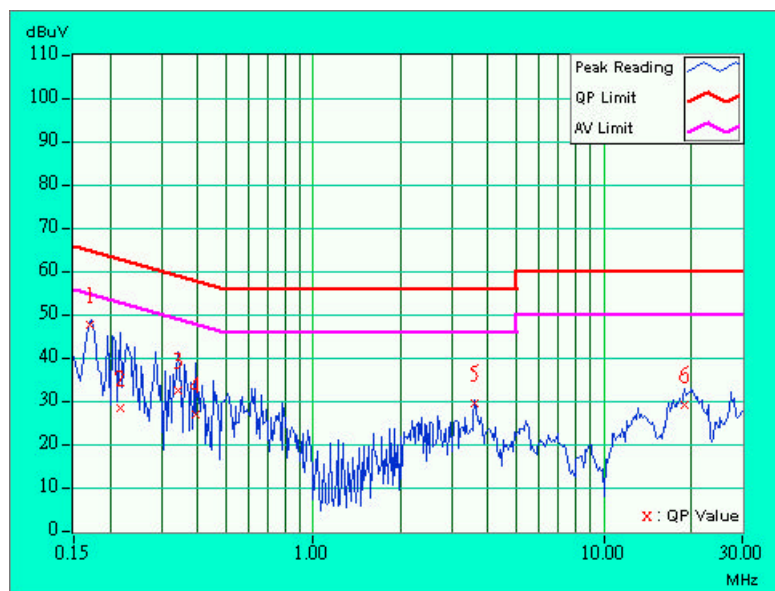




EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 11	6dB BANDWIDTH	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	25deg. C, 62%RH, 1005 hPa	TESTED BY: Gary Chang	

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]		QP.	AV.	QP.	AV.	QP.	AV.	QP.	AV.
1	0.170	0.10	46.91	-	47.01	-	64.98	54.98	-17.97	-
2	0.216	0.10	27.93	-	28.03	-	62.96	52.96	-34.93	-
3	0.341	0.10	31.69	-	31.79	-	59.17	49.17	-27.38	-
4	0.392	0.10	26.24	-	26.34	-	58.02	48.02	-31.68	-
5	3.613	0.28	28.71	-	28.99	-	56.00	46.00	-27.01	-
6	19.039	0.74	28.34	-	29.08	-	60.00	50.00	-30.92	-

- Remarks:
1. "**": Undetectable
 2. QP. and AV. are abbreviations of quasi-peak and average individually.
 3. "-": NA
 4. The emission levels of other frequencies were very low against the limit.
 5. Margin value = Emission level - Limit value
 6. Emission Level = Correction Factor + Reading Value.





4.2 RADIATED EMISSION MEASUREMENT

4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
* HP Spectrum Analyzer	8590L	3544A01176	May 13, 2003
* HP Preamplifier	8447D	2944A08485	Apr. 29, 2003
* HP Preamplifier	8449B	3008A01201	Dec. 01, 2003
* HP Preamplifier	8449B	3008A01292	Aug. 07, 2003
* ROHDE & SCHWARZ TEST RECEIVER	ESMI	839013/007 839379/002	Jan. 27, 2003
SCHAFFNER Tunable Dipole Antenna	VHBA 9123	459	Nov. 22, 2003
SCHWARZBECK Tunable Dipole Antenna	UHA 9105	977	
* CHASE BILOG Antenna	CBL6112A	2221	Aug. 2, 2003
* SCHWARZBECK Horn Antenna	BBHA9120-D1	D130	July 3, 2003
* EMCO Horn Antenna	3115	9312-4192	April 9, 2003
* EMCO Turn Table	1060	1115	NA
* SHOSHIN Tower	AP-4701	A6Y005	NA
* Software	ADT_Radiated_V5.09	NA	NA
* ANRITSU RF Switches	MP59B	M35046	July 11, 2003
* TIMES RF cable	LMR-600	CABLE-ST5-01	July, 11, 2003

NOTE: 1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

2. "*" = These equipment are used for the final measurement.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The test was performed in ADT Open Site No. 5.
5. The VCCI Site Registration No. is R-1039.



4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using the quasi-peak method or average method as specified and then reported in Data sheet peak mode and QP mode.

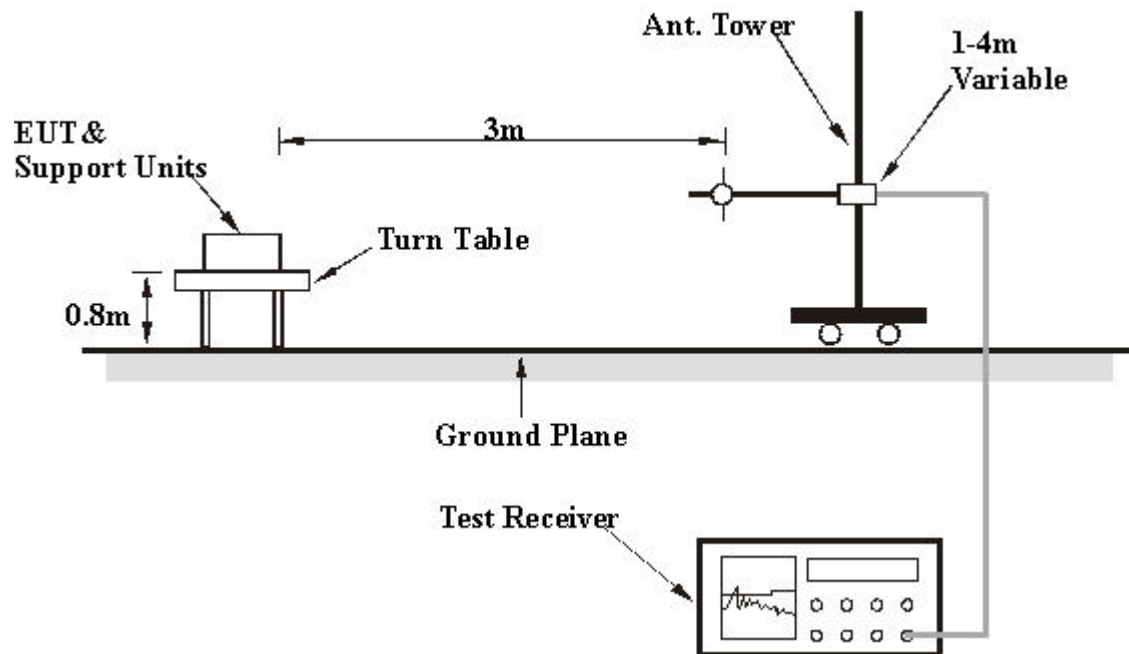
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 300 Hz for Average detection (AV) at frequency above 1GHz.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation

4.2.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6



4.2.7 TEST RESULTS

EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 11	FREQUENCY RANGE	Below 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	256.00	31.0 QP	46.00	-15.00	1.57 H	45	11.70	19.30
2	288.00	30.5 QP	46.00	-15.50	1.17 H	25	10.80	19.70
3	320.00	29.2 QP	46.00	-16.80	1.43 H	82	8.70	20.50
4	384.00	29.2 QP	46.00	-16.80	1.12 H	184	6.70	22.50
5	480.00	28.2 QP	46.00	-17.80	1.31 H	50	3.60	24.60
6	576.00	30.4 QP	46.00	-15.60	1.05 H	156	3.80	26.60
7	768.00	31.0 QP	46.00	-15.00	1.15 H	27	1.10	29.90

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	160.00	34.2 QP	43.50	-9.30	1.17 V	104	21.30	12.90
2	256.00	35.7 QP	46.00	-10.30	1.54 V	118	16.40	19.30
3	288.00	31.4 QP	46.00	-14.60	1.08 V	270	11.70	19.70
4	320.00	30.5 QP	46.00	-15.50	1.21 V	316	10.00	20.50
5	384.00	30.5 QP	46.00	-15.50	1.13 V	158	8.00	22.50
6	480.00	31.2 QP	46.00	-14.80	1.27 V	53	6.60	24.60
7	576.00	27.5 QP	46.00	-18.50	1.15 V	24	0.90	26.60
8	736.00	32.4 QP	46.00	-13.60	1.37 V	216	3.40	29.00

NOTE:

1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 1	FREQUENCY RANGE	Above 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	DETECTOR FUNCTION	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2412.00	105.2 PK			1.23 H	213	73.60	31.60
1	*2412.00	99.2 AV			1.23 H	213	67.60	31.60
2	3168.00	42.6 PK	74.00	-31.40	1.18 H	12	8.90	33.70
3	4824.00	49.7 PK	74.00	-24.30	1.08 H	52	11.40	38.20
4	6336.00	54.5 PK	74.00	-19.50	1.58 H	242	13.10	41.40
4	6336.00	48.5 AV	54.00	-5.50	1.58 H	242	7.10	33.70
5	7236.00	52.5 PK	74.00	-21.50	1.33 H	335	7.90	44.50
5	7236.00	42.5 AV	54.00	-11.50	1.33 H	335	-2.10	38.20

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2412.00	99.0 PK			1.24 V	15	67.40	31.60
1	*2412.00	92.5 AV			1.24 V	15	60.90	31.60
2	3168.00	43.6 PK	74.00	-30.40	1.18 V	24	9.90	33.70
3	4824.00	57.5 PK	74.00	-16.50	1.29 V	204	19.20	38.20
3	4824.00	43.5 AV	54.00	-10.50	1.29 V	204	5.20	33.70
4	6336.00	52.5 PK	74.00	-21.50	1.54 V	315	11.10	41.40
4	6336.00	47.5 AV	54.00	-6.50	1.54 V	315	6.10	38.20
5	7236.00	53.5 PK	74.00	-20.50	1.37 V	4	8.90	44.50
5	7236.00	43.7 AV	54.00	-10.30	1.37 V	4	-0.90	41.40

- NOTE:**
1. Emission level = Raw Value - Correction Factor
 2. Correction Factor = External Preamp. Gain - Ant. Factor - Cable loss
(External Preamp. Gain = 0, when the test receiver is used for the test.)
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. The limit value is defined as per 15.247
 6. " * " : Fundamental frequency



EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 6	FREQUENCY RANGE	Above 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	DETECTOR FUNCTION	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	107.1 PK			1.00 H	145	75.50	31.60
1	*2437.00	101.0 AV			1.00 H	145	69.40	31.60
2	3168.00	43.8 PK	74.00	-30.20	1.07 H	135	10.10	33.70
3	4874.00	49.9 PK	74.00	-24.10	1.54 H	239	11.40	38.50
4	6336.00	53.2 PK	74.00	-20.80	1.27 H	104	11.80	41.40
4	6336.00	-	54.00	-	1.27 H	104	-	33.70
5	7311.00	44.2 PK	74.00	-29.80	1.36 H	175	-0.80	45.00

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	99.8 PK			1.53 V	272	68.10	31.60
1	*2437.00	92.4 AV			1.53 V	272	60.80	31.60
2	3168.00	42.4 PK	74.00	-31.60	1.51 V	247	8.70	33.70
3	4874.00	53.7 PK	74.00	-20.30	1.19 V	248	15.20	38.50
3	4874.00	41.7 AV	54.00	-12.30	1.19 V	248	3.20	33.70
4	6336.00	52.2 PK	74.00	-21.80	1.43 V	125	10.80	41.40
4	6336.00	46.6 AV	54.00	-7.40	1.43 V	125	5.20	38.50
5	7311.00	53.9 PK	74.00	-20.10	1.14 V	15	8.90	45.00
5	7311.00	43.9 AV	54.00	-10.10	1.14 V	15	-1.10	41.40

- NOTE:**
1. Emission level = Raw Value - Correction Factor
 2. Correction Factor = External Preamp. Gain - Ant. Factor - Cable loss
(External Preamp. Gain = 0, when the test receiver is used for the test.)
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. The limit value is defined as per 15.247
 6. " * " : Fundamental frequency



EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
MODE	Channel 11	FREQUENCY RANGE	Above 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60Hz	DETECTOR FUNCTION	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 1005 hPa	TESTED BY: Gary Chang	

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2463.00	101.0 PK			1.52 H	62	69.30	31.70
1	*2463.00	95.0 AV			1.52 H	62	63.30	31.70
2	3168.00	44.0 PK	74.00	-30.00	1.16 H	23	10.30	33.70
3	4924.00	53.9 PK	74.00	-20.10	1.94 H	16	15.20	38.70
3	4924.00	42.9 AV	54.00	-11.10	1.94 H	16	4.20	33.70
4	6336.00	53.5 PK	74.00	-20.50	1.54 H	13	12.10	41.40
4	6336.00	46.2 AV	54.00	-7.80	1.54 H	13	4.80	38.70
5	7388.00	53.8 PK	74.00	-20.20	1.34 H	15	8.90	44.90
5	7388.00	44.8 AV	54.00	-9.20	1.34 H	15	-0.10	41.40

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2463.00	95.2 PK			1.02 V	346	63.50	31.70
1	*2463.00	88.0 AV			1.02 V	346	56.30	31.70
2	3168.00	45.2 PK	74.00	-28.80	1.61 V	184	11.50	33.70
3	4924.00	56.1 PK	74.00	-17.90	1.75 V	61	17.40	38.70
3	4924.00	44.4 AV	54.00	-9.60	1.75 V	61	5.70	33.70
4	6336.00	48.2 PK	74.00	-25.80	1.51 V	115	6.80	41.40
5	7386.00	54.3 PK	74.00	-19.70	1.34 V	297	9.40	44.90
5	7386.00	45.3 AV	54.00	-8.70	1.34 V	297	0.40	38.70

- NOTE:**
1. Emission level= Raw Value - Correction Factor
 2. Correction Factor = External Preamp. Gain - Ant. Factor - Cable loss
(External Preamp. Gain = 0, when the test receiver is used for the test.)
 3. The other emission levels were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. The limit value is defined as per 15.247
 6. " * " : Fundamental frequency



4.3 6dB BANDWIDTH MEASUREMENT

4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	July 24, 2003

NOTE:

The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW and 100kHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

4.3.5 TEST SETUP



4.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.



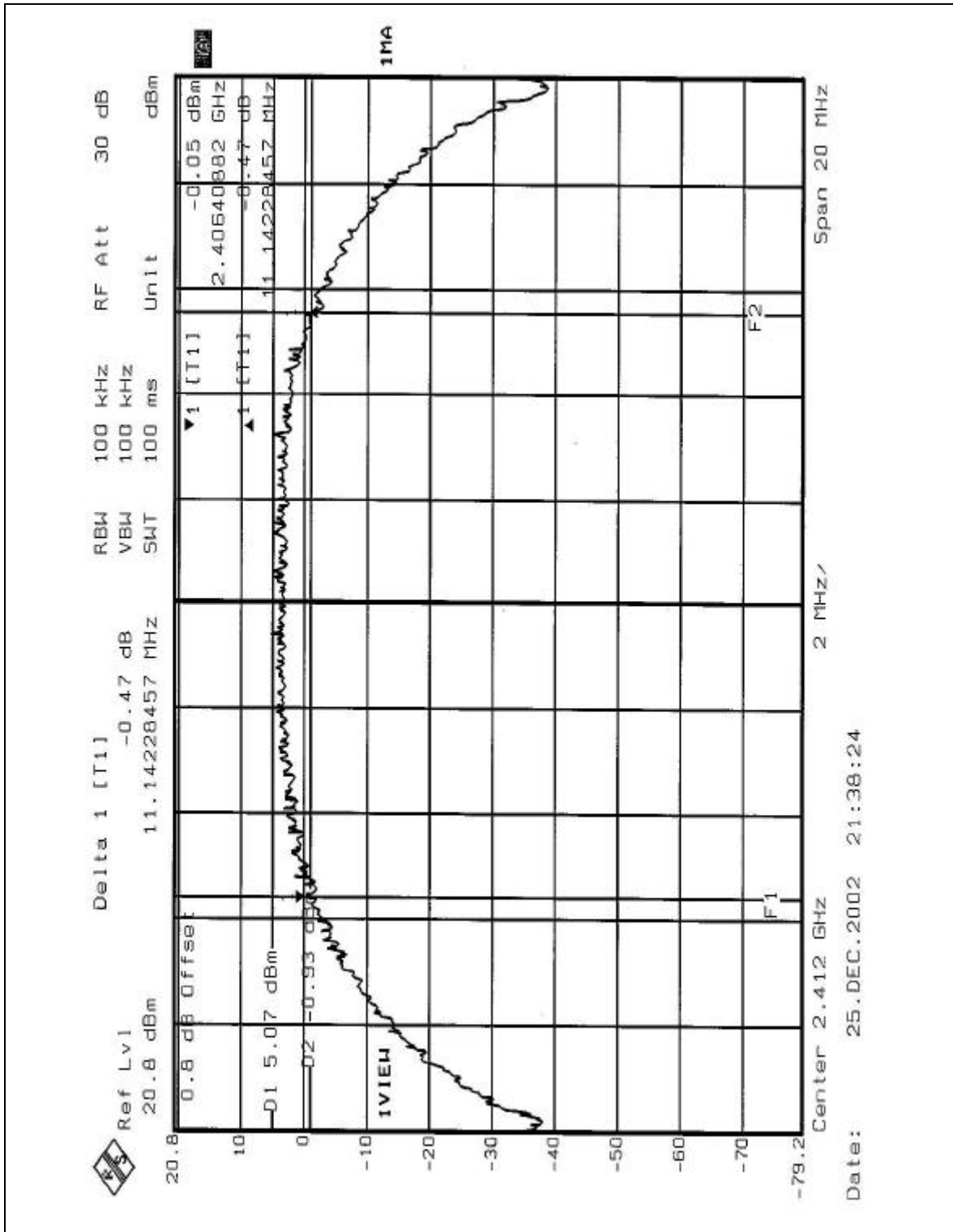
4.3.7 TEST RESULTS

EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
INPUT POWER (SYSTEM)	120Vac, 60Hz	ENVIRONMENTAL CONDITIONS	18g. C, 69RH, 1005 hPa
TESTED BY: Hardaway Lee			

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS/FAIL
1	2412	11.142	0.5	PASS
6	2437	11.222	0.5	PASS
11	2462	11.824	0.5	PASS

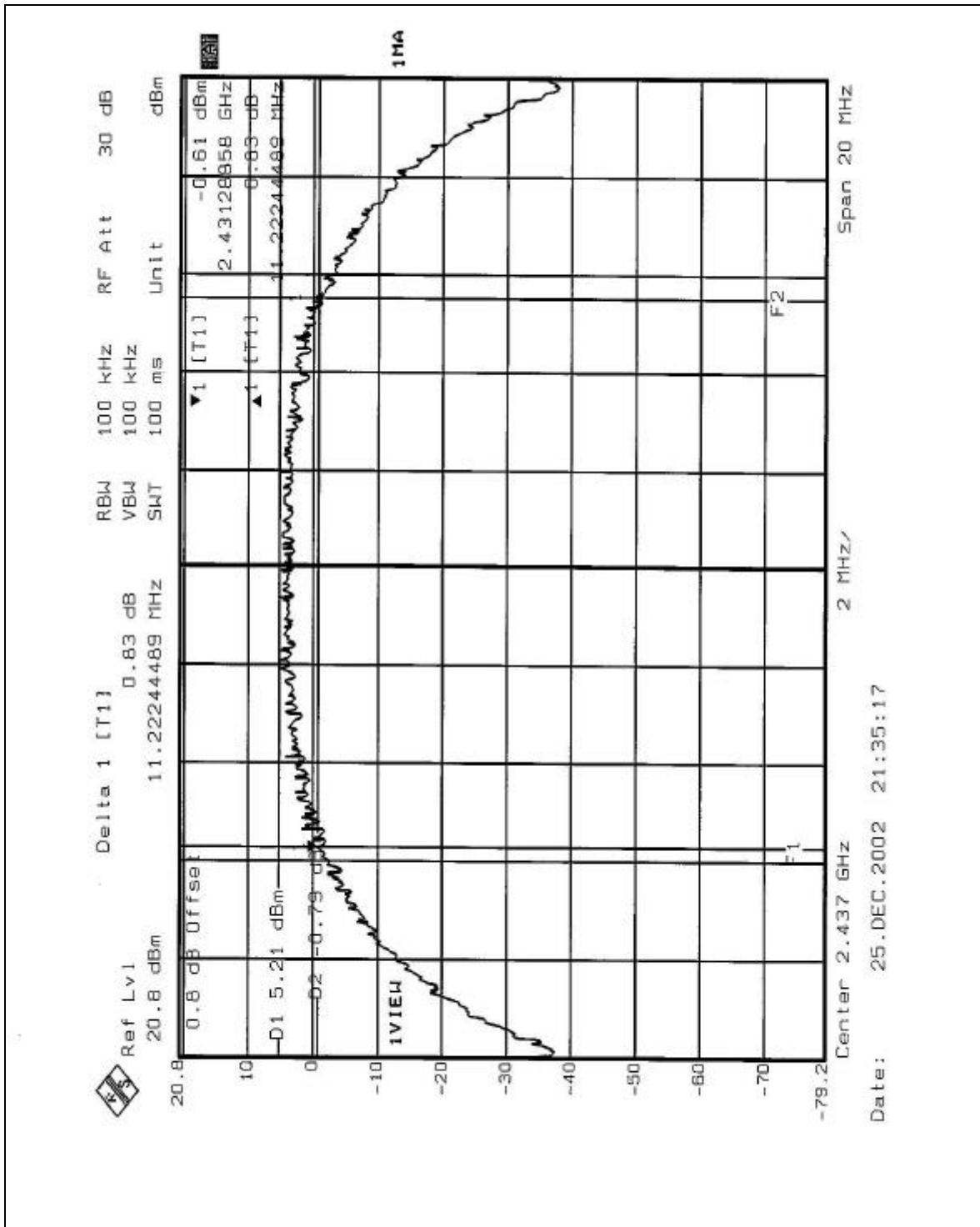


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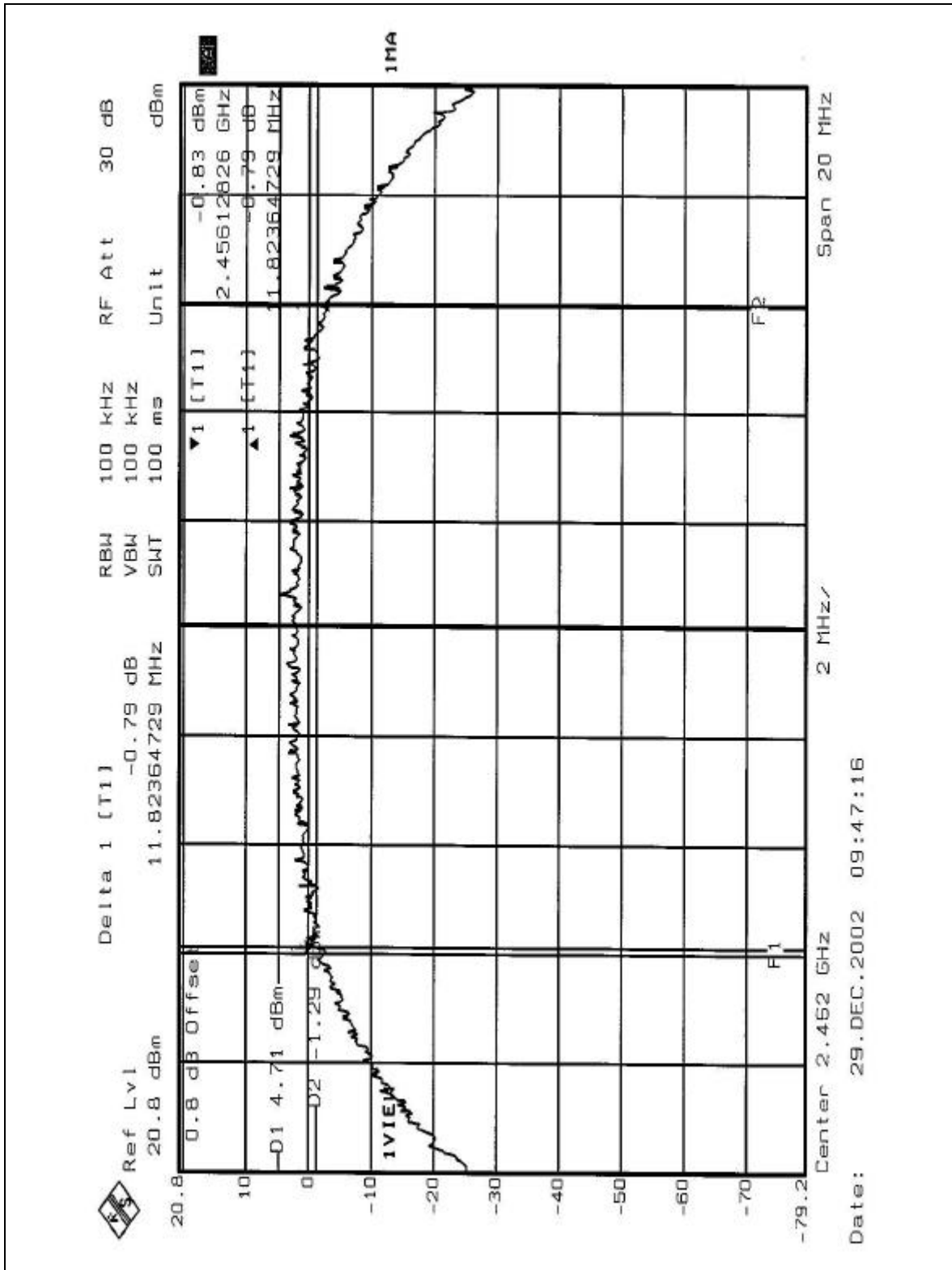


CH6





CH11





4.4 MAXIMUM PEAK OUTPUT POWER

4.4.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 30dBm.

4.4.2 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SINGLE CHANNEL POWER METER	E4416A	GB41291118	Jul. 30, 2003
PEAK POWER SENSOR	E9327A	US40440722	Jul. 30, 2003

NOTE:

The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

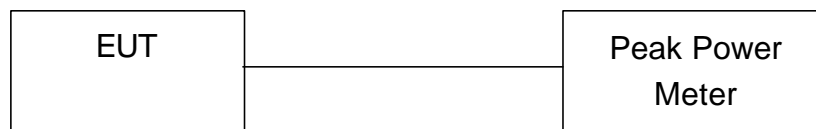
4.4.3 TEST PROCEDURES

The transmitter output was connected to the peak power meter.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation

4.4.5 TEST SETUP



4.4.6 EUT OPERATING CONDITIONS

Same as Item 4.3.6



4.4.7 TEST RESULTS

EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
INPUT POWER (SYSTEM)	120Vac, 60Hz	ENVIRONMENTAL CONDITIONS	18g.C, 69RH, 1005 hPa
TESTED BY: Hardaway Lee			

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
1	2412	16.14	30	PASS
6	2437	16.60	30	PASS
11	2462	16.28	30	PASS



4.5 POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	July 24, 2003

NOTE:

The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.5.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3 kHz RBW and 30 kHz VBW, set sweep time = span/3 kHz. The power spectral density was measured and recorded.

The sweep time is allowed to be longer than span/3 kHz for a full response of the mixer in the spectrum analyzer.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 TEST SETUP



4.5.6 EUT OPERATING CONDITION

Same as Item 4.3.6



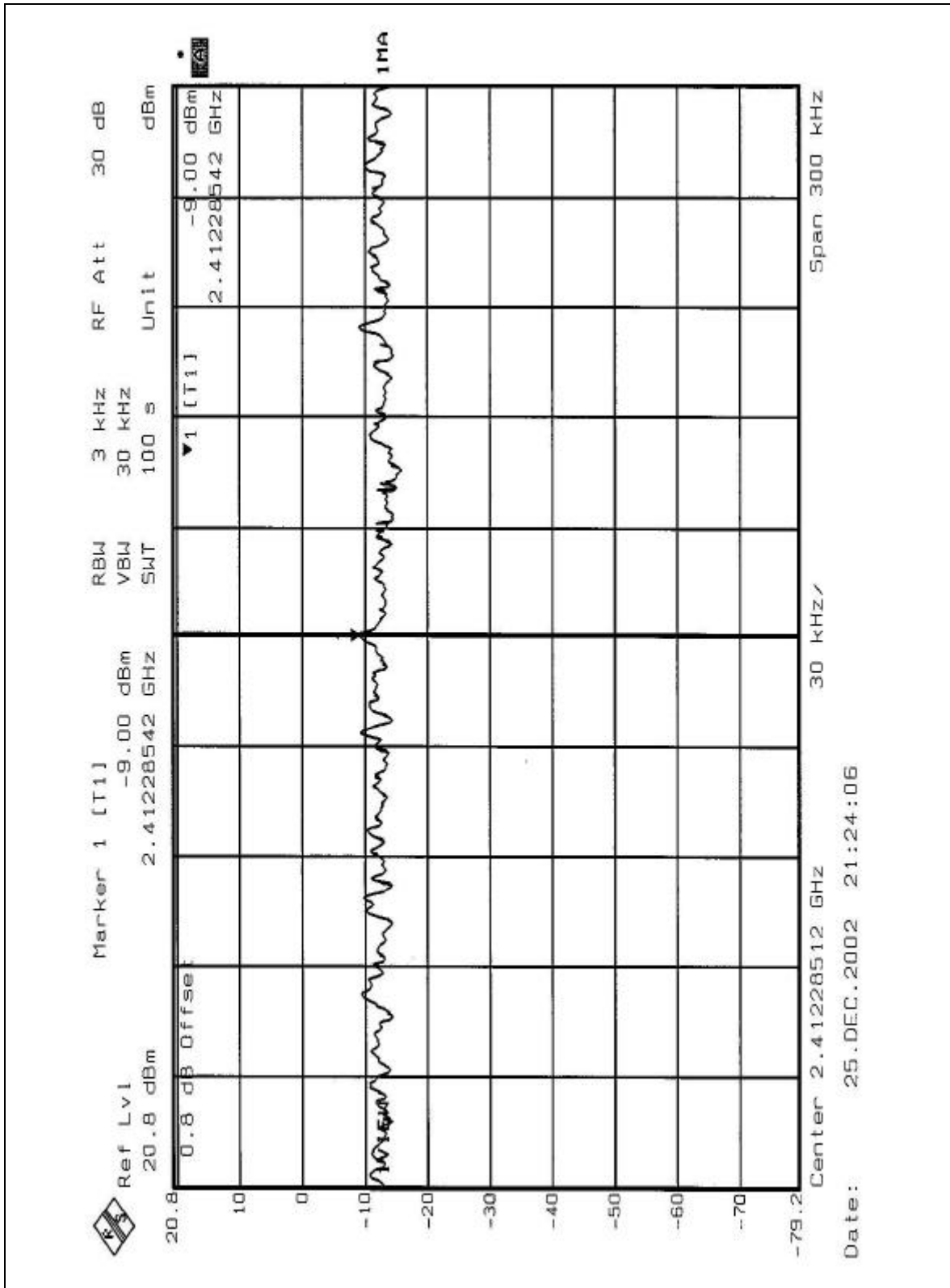
4.5.7 TEST RESULTS

EUT	2.4GHz/5GHz Mini - PCI Card	MODEL	WLL220
INPUT POWER (SYSTEM)	120Vac, 60Hz	ENVIRONMENTAL CONDITIONS	18g. C, 69RH, 1005 hPa
TESTED BY: Hardaway Lee			

CHANNEL NUMBER	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 3 kHz BW (dBm)	MAXIMUM LIMIT (dBm)	PASS/FAIL
1	2412	-9.00	8	PASS
6	2437	-8.44	8	PASS
11	2462	-7.35	8	PASS

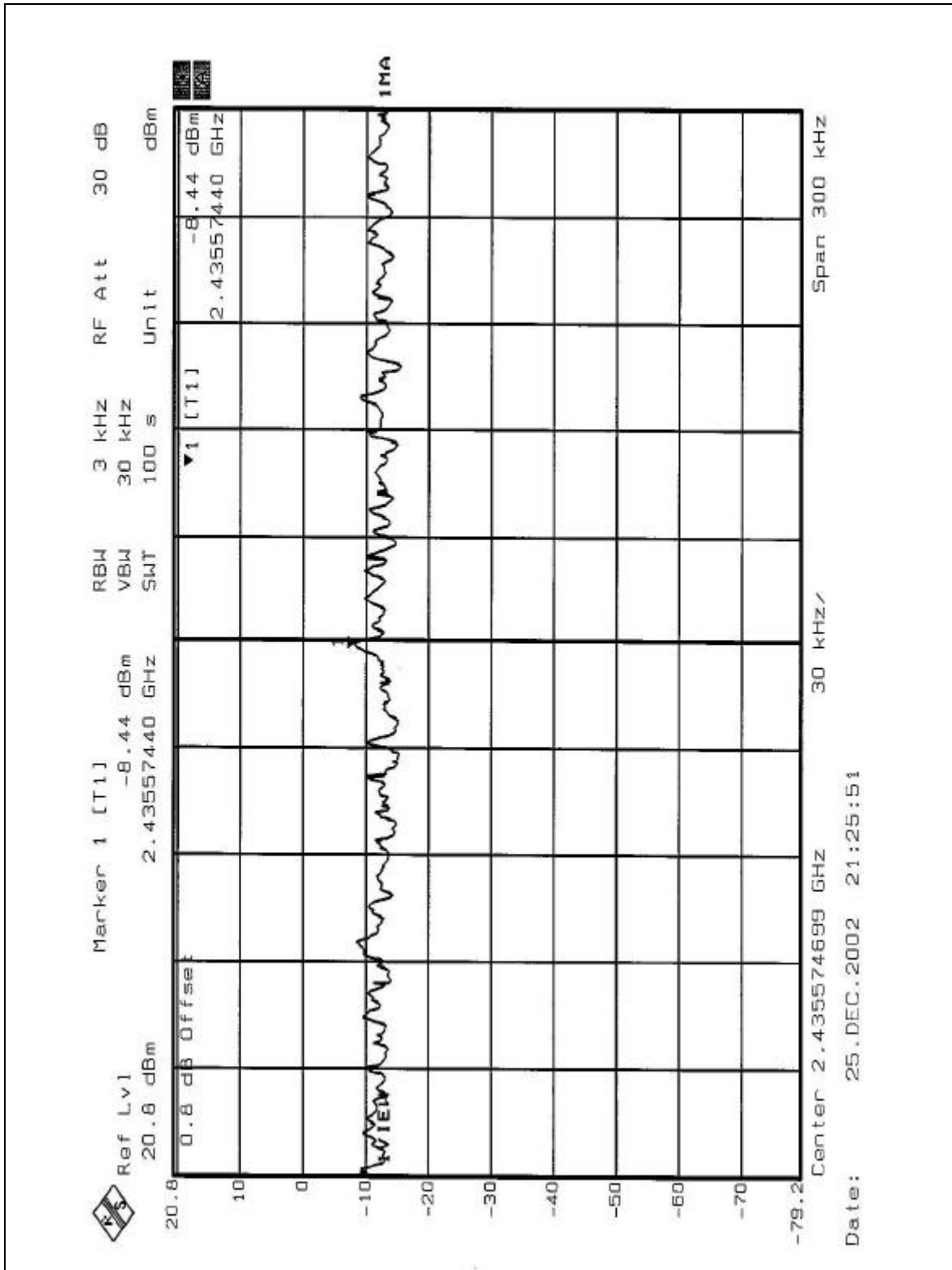


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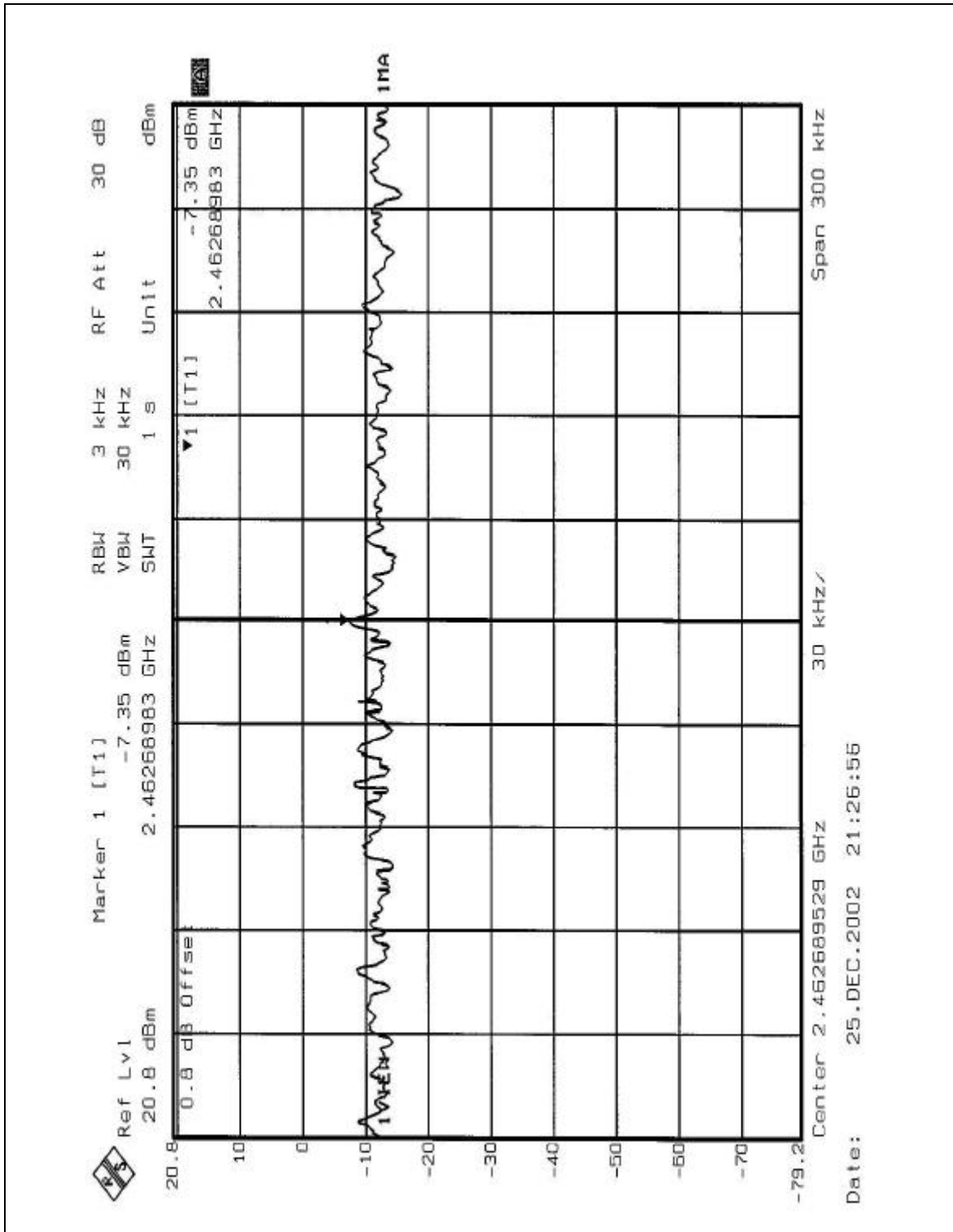


CH6





CH11





4.6 BAND EDGES MEASUREMENT

4.6.1 LIMITS OF BAND EDGES MEASUREMENT

Below -20dB of the highest emission level of operating band (in 100KHz Resolution Bandwidth).

4.6.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	July 24, 2003

NOTE:

The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.6.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz with suitable frequency span including 100 kHz bandwidth from band edge. The band edges was measured and recorded.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation



4.6.5 EUT OPERATING CONDITION

Same as Item 4.3.6

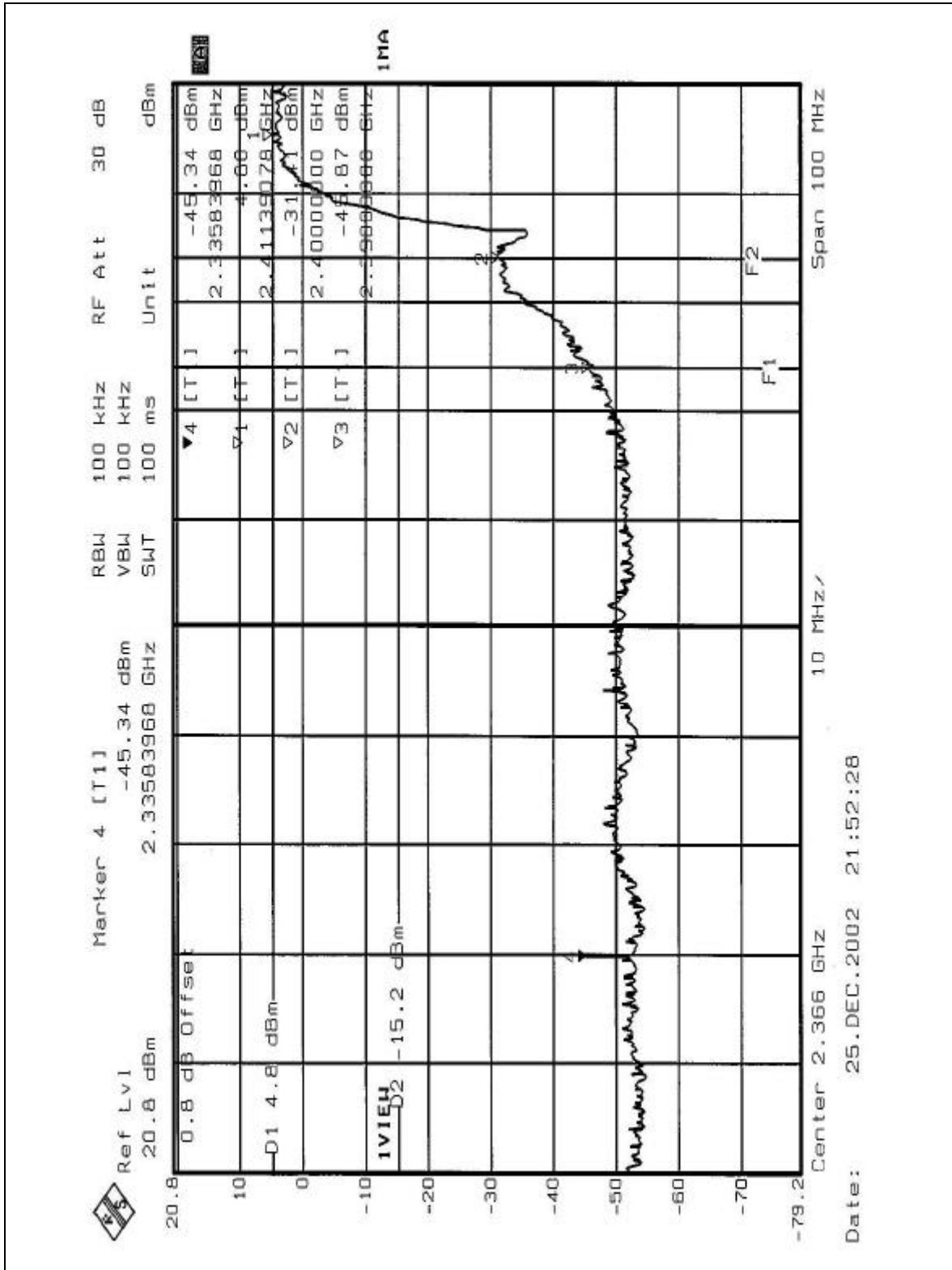
4.6.6 TEST RESULTS

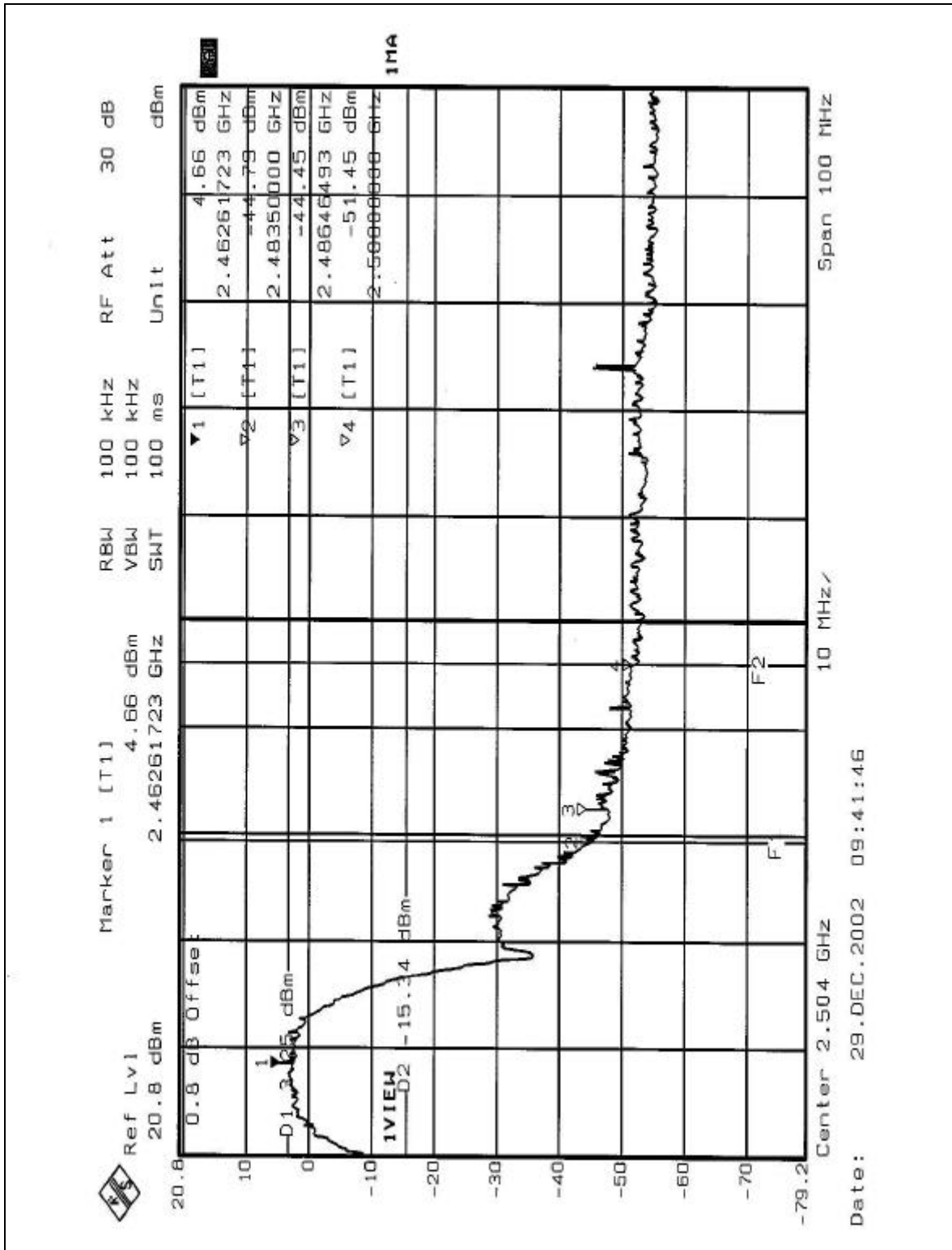
The spectrum plots are attached on the following 2 pages. D2 line indicates the highest level, and D1 line indicates the 20dB offset below D2. It shows compliance with the requirement in part 15.247(C).

NOTE:

The band edge emission plot on the following first show 50.14dB delta between carrier maximum power and local maximum emission in restrict band (2.3358GHz). The emission of carrier strength list in the test result of channel 1 at the item 4.2.7 is 99.20dBuV/m, so the maximum field strength in restrict band is $99.20 - 50.14 = 49.06$ dBuV/m which is under 54dBuV/m limit.

The band edge emission plot on the following second page shows 47.7dB delta between carrier maximum power and local maximum emission in restrict band (2.4864GHz). The emission of carrier strength list in the test result of channel 11 at the item 4.2.7 is 95.0dBuV/m, so the maximum field strength in restrict band is $95.0 - 47.7 = 47.30$ dBuV/m which is under 54dBuV/m limit.







4.7 ANTENNA REQUIREMENT

4.7.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.7.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Printed Inverted F Antenna with UFL connector. The maximum Gain of the antenna is 0.39dBi



5. TEST TYPES AND RESULTS (FOR PART 802.11a)

5.1 CONDUCTED EMISSION MEASUREMENT

5.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

- NOTE:**
1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

5.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
ROHDE & SCHWARZ Test Receiver	ESCS30	847793/022	Mar. 12, 2003
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH2-Z5	828075/003	July 23, 2003
ROHDE & SCHWARZ 200-A Four-line V-Network	ENV4200	830326/018	Oct. 30, 2003
* ROHDE & SCHWARZ 4-wire ISN	ENY41	838119/028	Nov. 29, 2003
* ROHDE & SCHWARZ 2-wire ISN	ENY22	837497/018	Nov. 29, 2003
EMCO-L.I.S.N. (for peripheral)	3825/2	90031627	July 23, 2003
Software	Cond-V2M1	NA	NA
RF cable (JYEBAO)	5D-FB	Cable-C05.01	July 19, 2003
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-305	Feb. 20, 2003
LYNICS Terminator (For EMCO LISN)	0900510	E1-01-306	Feb. 20, 2003

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. "*" : These equipment are used for conducted telecom port test only (if tested).
 3. The test was performed in ADT Shielded Room No. 5.
 4. The VCCI Site Registration No. is C-1093.



5.1.3 TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels over 10dB under the prescribed limits could not be reported

5.1.4 DEVIATION FROM TEST STANDARD

No deviation