



CONFORMANCE TEST REPORT FOR FCC 47 CFR, Part 15 Subpart C

Report No.: ET93S-06-079-01

Client: Chung Nam Electronics Co., Ltd.
 Product: CNE 802.11a/g WLAN PCI Card (with MiniPCI module WLG500-3B)
 Model: WLG500-PCI
 FCC ID: Q72WLAG
 Manufacturer/supplier: Chung Nam Electronics Co., Ltd.

Date test item received: 2004/06/09
 Date test campaign completed: 2004/06/23
 Date of issue: 2004/08/10

The test result only corresponds to the tested sample. It is not permitted to copy this report, in part or in full, without the permission of the test laboratory.

Total number of pages of this test report: 67 pages

Total number of pages of photos: External photos 1 pages

Internal photos 4 pages

Setup photos 2 pages

Test Engineer	Checked By	Approved By
 Lee-Ying Hsu	 Joe Hsieh	 Tsung-Ching Lin

ELECTRONICS TESTING CENTER, TAIWAN
 NO.8, LANE 29, WEN-MING RD.,
 LO-SHAN TSUN, KUI-SHAN HSIANG,
 TAOYUAN HSIEN 333
 TAIWAN, R.O.C.

TEL: (03) 3276170~4
 INT: +886-3-3276170~4
 FAX: (03) 3276188
 INT: +886-3-3276188



TEST REPORT CERTIFICATION

Client : Chung Nam Electronics Co., Ltd.
Address : 12/F, Chung Nam Building, No. 1 Lockhart Road, Hong Kong
Manufacturer : Chung Nam Electronics Co., Ltd.
Address : 12/F, Chung Nam Building, No. 1 Lockhart Road, Hong Kong
EUT : CNE 802.11a/g WLAN PCI Card (with MiniPCI module WLG500-3B)
Trade name : CNE
Model No. : WLG500-PCI
Power Source : 5V DC via PC
Regulations applied : FCC 47 CFR, Part 15 Subpart C (2003)
Test Result : PASS
Note : The 5.2GHz band is applicable to this report; the other bands (2.4GHz and 5.8GHz) of operation are documented in a separate report.

The testing described in this report has been carried out to the best of our knowledge and ability, and our responsibility is limited to the exercise of reasonable care. This certification is not intended to believe the sellers from their legal and/or contractual obligations.

The compliance test is only certified for the test equipment and the results of the testing report relate only to the item tested. The compliance test of this report was conducted in accordance with the appropriate standards. It's not intention to assure the quality and performance of the product. This report shall not be reproduced except in full, without the approval of ETC. This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

Laboratory Introduction: Electronics Testing Center, Taiwan is recognized, filed and mutual recognition arrangement as following:

- ① ISO9001: TÜV Product Service
- ② ISO/IEC 17025: BSMI, CNLA, DGT, NVLAP, CCIBLAC, UL, Compliance
- ③ Filing: FCC, Industry Canada, VCCI
- ④ MRA: Australia, Hong Kong, New Zealand, Singapore, USA, Japan, Korea, China, APLAC through CNLA



NVLAP Lab Code 200133-0

Table of Contents	Page
1 GENERAL INFORMATION	5
1.1 Product Description.....	5
1.2 Characteristics of Device	5
1.3 Test Methodology	6
1.4 Test Facility.....	6
2 PROVISIONS APPLICABLE	7
2.1 Definition	7
2.2 Requirement for Compliance	8
2.3 Restricted Bands of Operation	11
2.4 Labeling Requirement.....	11
2.5 User Information	12
3. SYSTEM TEST CONFIGURATION	13
3.1 Justification	13
3.2 Devices for Tested System.....	13
4 CONDUCTED EMISSION MEASUREMENT	14
4.1 Standard Applicable	14
4.2 Measurement Procedure.....	14
4.3 Conducted Emission Data	15
4.4 Result Data Calculation	18
4.5 Conducted Measurement Equipment	18
5 ANTENNA REQUIREMENT	19
5.1 Standard Applicable	19
5.2 Antenna Construction and Directional Gain	19
5.3 Result.....	19
6 EMISSION BANDWIDTH MEASUREMENT	20
6.1 Standard Applicable	20
6.2 Measurement Procedure.....	20
6.3 Measurement Equipment	20
6.4 Measurement Data	21
6.5 Result.....	21
7 OUTPUT POWER MEASUREMENT	26
7.1 Standard Applicable	26
7.2 Measurement Procedure.....	27
7.3 Measurement Equipment	27

7.4 Measurement Data	27
7.5 Result.....	27
8 POWER DENSITY MEASUREMENT	32
8.1 Standard Applicable	32
8.2 Measurement Procedure.....	32
8.3 Measurement Equipment	32
8.4 Measurement Data	33
8.5 Result.....	33
9 PEAK EXCURSION MEASUREMENT.....	38
9.1 Standard Applicable	38
9.2 Measurement Procedure.....	38
9.3 Measurement Equipment	38
9.4 Measurement Data	39
9.5 Result.....	39
10 SPURIOUS EMISSION - RF CONDUCTED MEASUREMENT	44
10.1 Standard Applicable	44
10.2 Measurement Procedure.....	44
10.3 Measurement Equipment	44
10.4 Measurement Data	45
10.5 Result.....	45
11 RADIATED EMISSION MEASUREMENT.....	50
11.1 Standard Applicable	50
11.2 Measurement Procedure.....	51
11.3 Measuring Instrument	53
11.4 Radiated Emission Data	54
11.4.1 Harmonic and Spurious Radiated Emission Above 1GHz	54
11.4.2 Other Emission Below 1 GHz With Worst-Case Configuration	56
11.5 Field Strength Calculation	57

1 GENERAL INFORMATION

1.1 Product Description

- a) Type of EUT : CNE 802.11a/g WLAN PCI Card (with MiniPCI module WLG500-3B)
- b) Trade Name : CNE
- c) Model No. : WLG500-PCI
- d) Power Supply : 5V DC from PC
- e) Peak Antenna Gain : 1.5 dBi

1.2 Characteristics of Device

The CNE 802.11a/b/g WLAN NIC is a complete wireless high speed Network Interface Card (NIC). It conforms to the IEEE 802.11a and IEEE 802.11g protocol and operates in both the 2.45GHz and 5GHz ISM frequency bands.

- . Fully compliant with the IEEE 802.11a, 802.11b and 802.11g WLAN standards.
- .Support for 54,48,36,24,18,12,9 and 6 Mbps OFDM, 11 and 5.5 Mbps CCK and legacy 2 and 1 Mbps data rates.
- .Driver Supports Microsoft Windows XP and 2000 (SR1).

1.3 Test Methodology

All testing were performed according to the procedures in ANSI C63.4 and FCC CFR 47 Part 2 and Part 15.

1.4 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wen-ming Road, Lo-shan Tsun, Kweishan Hsiang, Taoyuan, Taiwan, R.O.C.

This site has been accreditation as a FCC filing site.

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business or industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Emission Bandwidth

Section 15.403 (i) Emission bandwidth : For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

(2) Peak Power

Section 15.407 (a) (1) : For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Section 15.407 (a) (2) : For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak transmit power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10\log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) Peak Power Spectral Density

Section 15.407 (a) (1) : For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Section 15.407 (a) (2) : For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak transmit power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(4) Peak Excursion

Section 15.407 (a) (6) : The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

(5) Antenna Requirement

Section 15.203 Antenna requirement : 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.

(6) Undesirable Emission

Section 15.407 (b) (1) : For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

Section 15.407 (b) (2) : For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

(7) Radiated Emission

Section 15.209 : (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/m)	Measurement Distance (Meters)
30 - 88	100 **	40.0	3
88 - 216	150 **	43.5	3
216 - 960	200 **	46.0	3
above 960	500 **	54.0	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

Section 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

(8) Power Conducted Emissions

Section 15.207 (a) : Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	Quasi Peak	Average
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

*Decreases with the logarithm of the frequency.

2.3 Restricted Bands of Operation

Section 15.205 Restricted bands of operation : (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

Section 15.205 (b) : Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

Both radiated and conducted emissions, EUT was configured for testing and embeded in a Desktop PC as a customer would normally use it. Measurement was performed under the condition that a computer program, cTxRx 2.1.0.0, was exercised to simulate data communication of EUT, and the transmission rate can be set by this program.

3.2 Devices for Tested System

Device	Manufacture	Model No.	S/N No.	Cable Description
CNE 802.11a/g WLAN PCI Card (with MiniPCI module WLG500-3B)*	Chung Nam Electronics Co., Ltd.	WLG500-PCI	84500012398	N/A
LCD monitor	HP	D5063	----	1.7m Shielded VGA Cable (with a core) Adaptor: (with a core) 3.6m Unshielded Power Line
Keyboard	IBM	KB-9910	----	2.0m Unshielded Line
Mouse	IBM	M-SAU-IBM6	----	1.8m Unshielded Line
Desktop PC	Compaq	D380mx	----	1.8m Unshielded Power Line
Modem	ACEEX	1414	----	1.7m Shielded Line (RS232) Adaptor: 1.7m Unshielded Power Line
Printer	HP	DeskJet 400	----	1.7m Shielded Line (LPT) Adaptor: 2.4m Unshielded Power Line

Remark “*” means equipment under test.

The software and parameter setting :

Software:	CTxRx 2.1.0.0	
Parameter:	Calibrated Power Level	0 dBm

4 CONDUCTED EMISSION MEASUREMENT

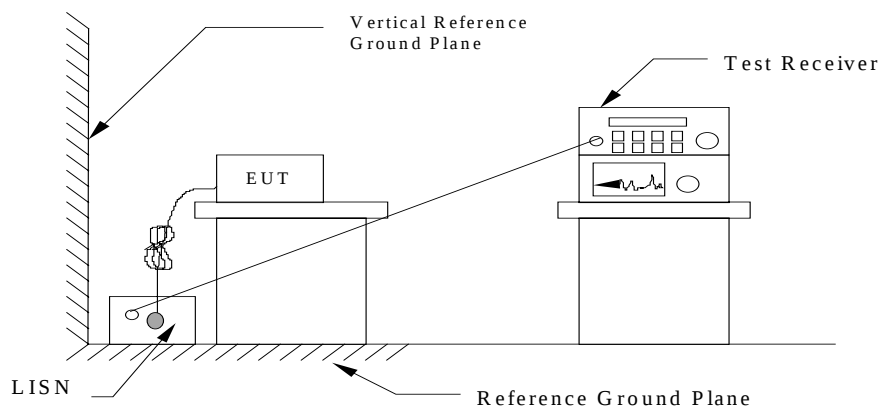
4.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to § 15.107(a) and §15.207(a) respectively. Both Limits are identical specification.

4.2 Measurement Procedure

1. Setup the configuration per figure 1.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 1 : Conducted emissions measurement configuration



4.3 Conducted Emission Data

Operation Mode: CH 36

Test Date: Jun. 18, 2004Temperature: 24Humidity: 58 %

Freq. (MHz)	Meter Reading (dBuV)				Factor (dB)	Result (dBuV)				Limit (dBuV)		Margins (dB)
	Q.P Value		AVG. Value			Q.P Value		AVG. Value		Q.P Value	AVG. Value	Q.P. or AVG
	L1	L2	L1	L2		L1	L2	L1	L2			
0.181	***	45.3	----	----	0.2	***	45.5	----	----	64.4	54.4	-18.9
0.248	49.4	***	----	----	0.2	49.6	***	----	----	61.8	51.8	-12.2
0.282	49.9	***	25.3	----	0.2	50.1	***	25.5	----	60.8	50.8	-10.7
0.290	49.3	***	----	----	0.2	49.5	***	----	----	60.5	50.5	-11.0
0.364	***	40.2	----	----	0.2	***	40.4	----	----	58.6	48.6	-18.2
0.544	***	33.7	----	----	0.2	***	33.9	----	----	56.0	46.0	-22.1
0.630	44.5	***	18.0	----	0.2	44.7	***	18.2	----	56.0	46.0	-11.3
0.638	***	36.9	----	----	0.2	***	37.1	----	----	56.0	46.0	-18.9
0.650	46.1	***	21.8	----	0.2	46.3	***	22.0	----	56.0	46.0	-9.7
0.821	***	35.1	----	----	0.2	***	35.3	----	----	56.0	46.0	-20.7
1.345	35.2	***	----	----	0.2	35.4	***	----	----	56.0	46.0	-20.6
1.732	***	33.5	----	----	0.2	***	33.7	----	----	56.0	46.0	-22.3

Note:

1. "****" means the value was too low to be measured.
2. If the data table appeared symbol of "----" means the Q.P. value is under the limit of AVG. so, the AVG. value doesn't need to be measured.
3. The estimated measurement uncertainty of the result measurement is ± 2.5 dB.

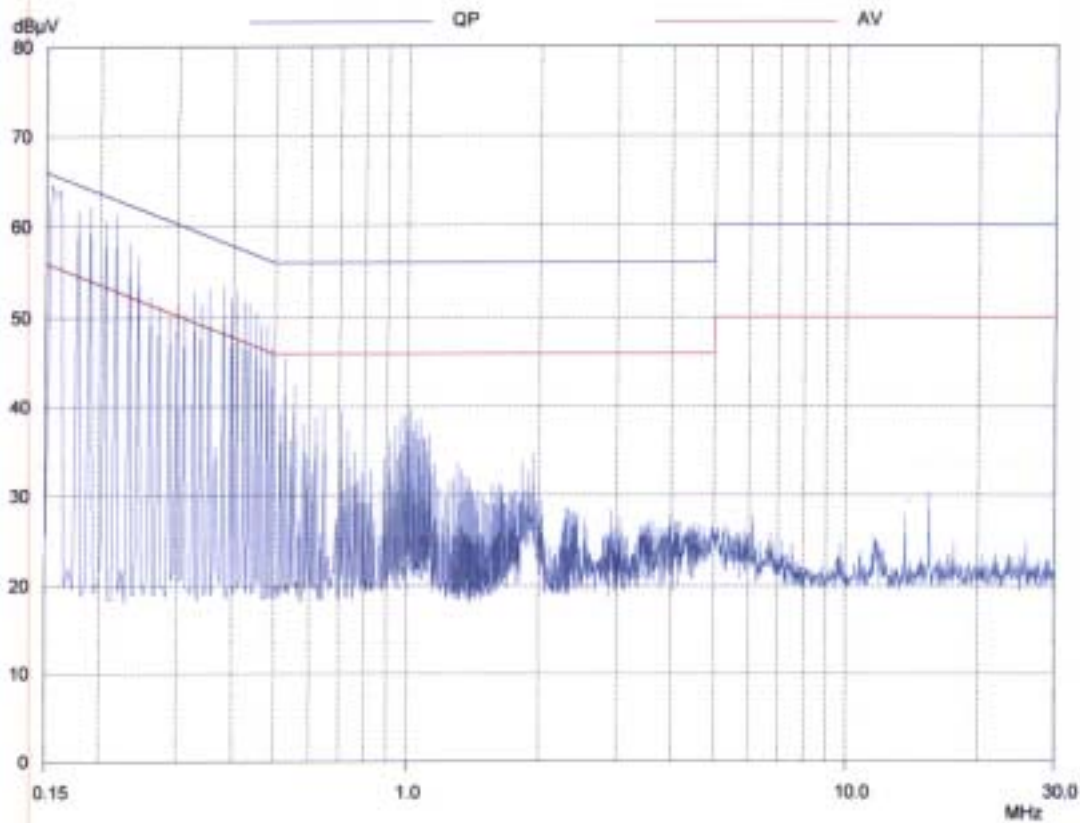
Note : Please refer to page 16 to page 17 for chart

Conducted Emission Test
Peak Value

EUT: Wireless LAN (WLG 500 - 3B)
Manuf:
Op Cond: 802.11a(5180MHz)
Operator: LeeYing
Test Spec:
Comment: L1

Result File: : New Measurement

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 8
Acc Margin: 30 dB

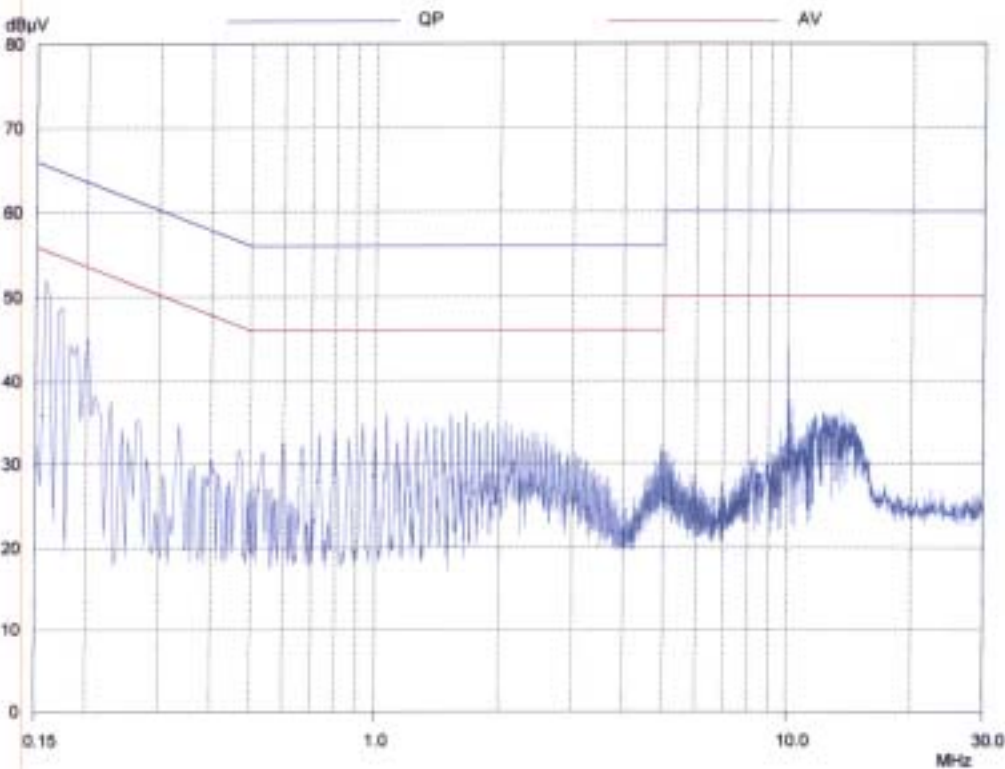


Conducted Emission Test
Peak Value

EUT: Wireless LAN (WLG 500 - 3B)
Manuf:
Op Cond: 802.11a(5180MHz)
Operator: LeeYing
Test Spec:
Comment: L2

Result File: : New Measurement

Final Measurement: Detector: X QP
Meas Time: 1sec
Peaks: 8
Acc Margin: 30 dB



4.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\text{RESULT} = \text{READING} + \text{LISN FACTOR (Included Cable Loss)}$$

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB μ V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB } \mu \text{ V}$$

$$\begin{aligned} \text{Level in } \mu \text{ V} &= \text{Common Antilogarithm}[(22.6 \text{ dB } \mu \text{ V})/20] \\ &= 13.48 \text{ } \mu \text{ V} \end{aligned}$$

4.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test.

Equipment	Manufacturer	Model No.	Next Cal. Due
RF Test Receiver	Rohde and Schwarz	ESCS30	09/18/2004
Line Impedance Stabilization network	EMCO	3825	11/01/2004

5 ANTENNA REQUIREMENT

5.1 Standard Applicable

For intentional device, according to §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.

5.2 Antenna Construction and Directional Gain

The antenna cable of EUT is fixed on the PCI Card.

Antenna type: Monopole Antenna.

Antenna gain: 1.5 dBi.

Cable loss: 7.7 dB @ 5 GHz band

5.3 Result

PASS

6 EMISSION BANDWIDTH MEASUREMENT

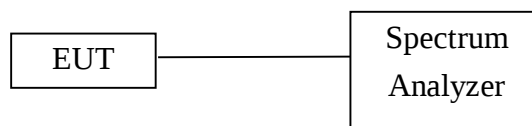
6.1 Standard Applicable

Section 15.403 (i) Emission bandwidth : For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

6.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 26 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Figure 1: Emission bandwidth measurement configuration.



6.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

6.4 Measurement Data

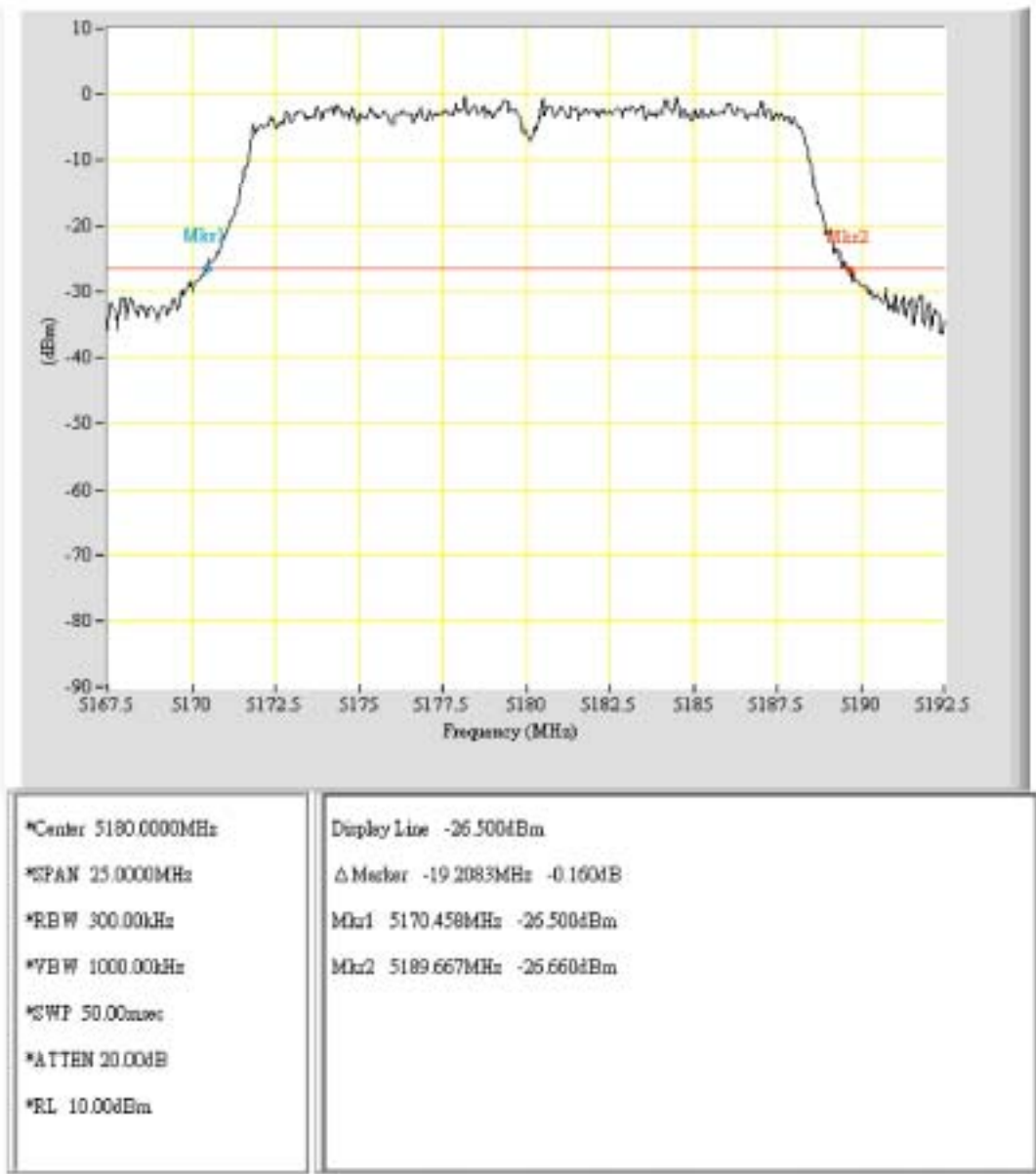
Test Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

Channel	Frequency (MHz)	26 dB Bandwidth (B)	10 log B (dB)	Chart
36	5180	19.208	12.83	Page 22
48	5240	19.333	12.86	Page 23
52	5260	19.333	12.86	Page 24
64	5320	19.250	12.84	Page 25

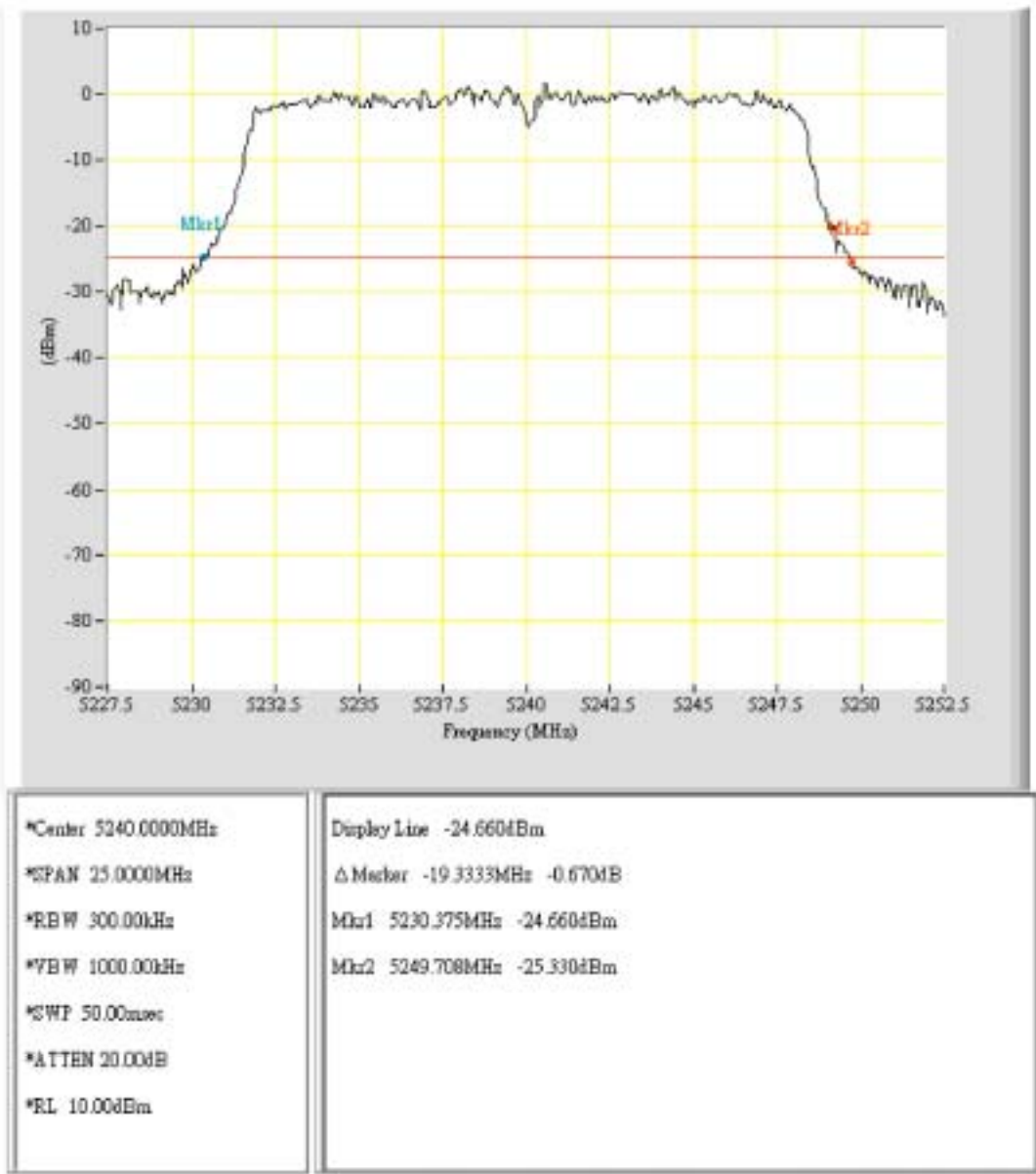
Note: Please refers to the page 22 - 25 for detail plot.

6.5 Result

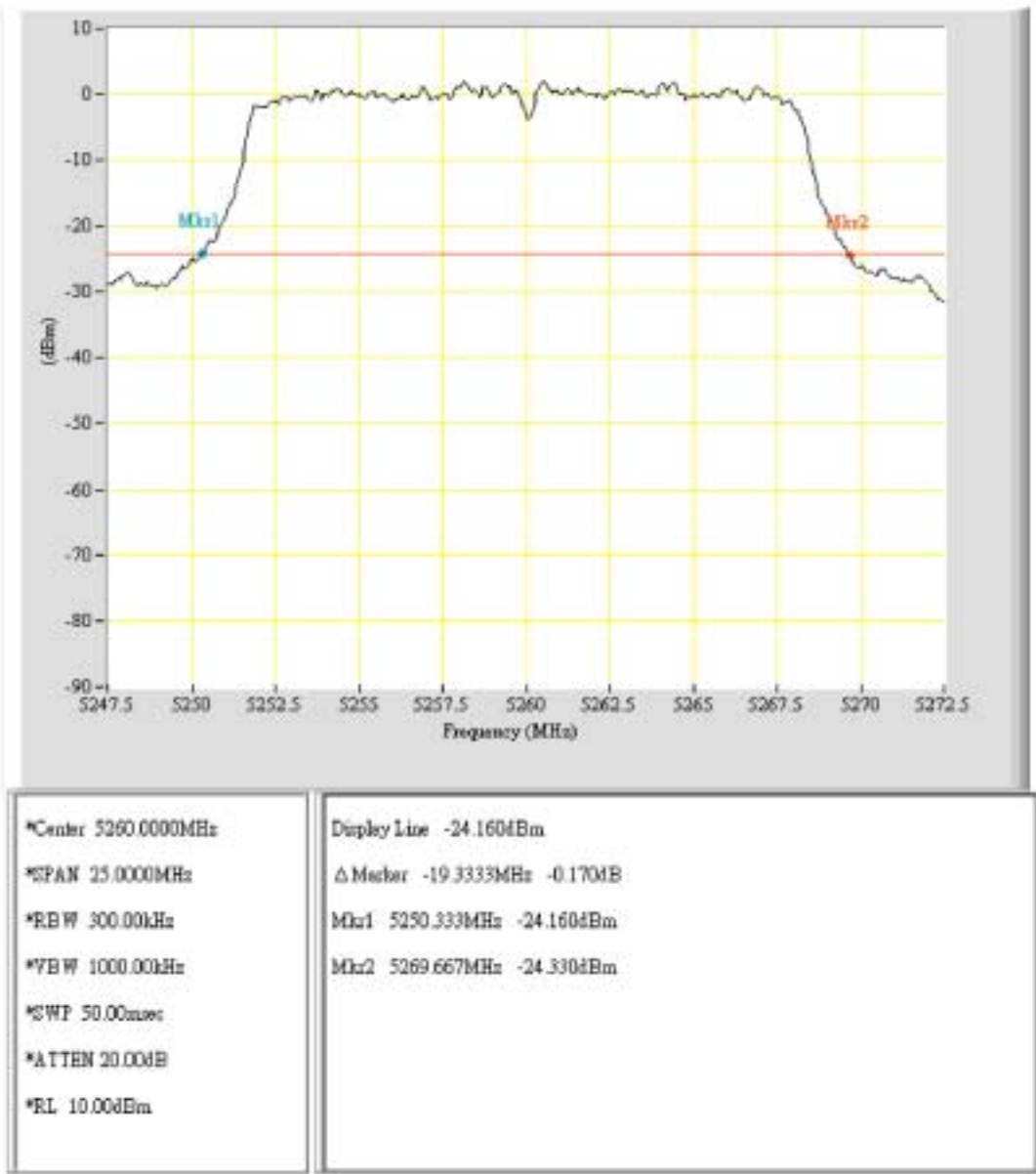
PASS



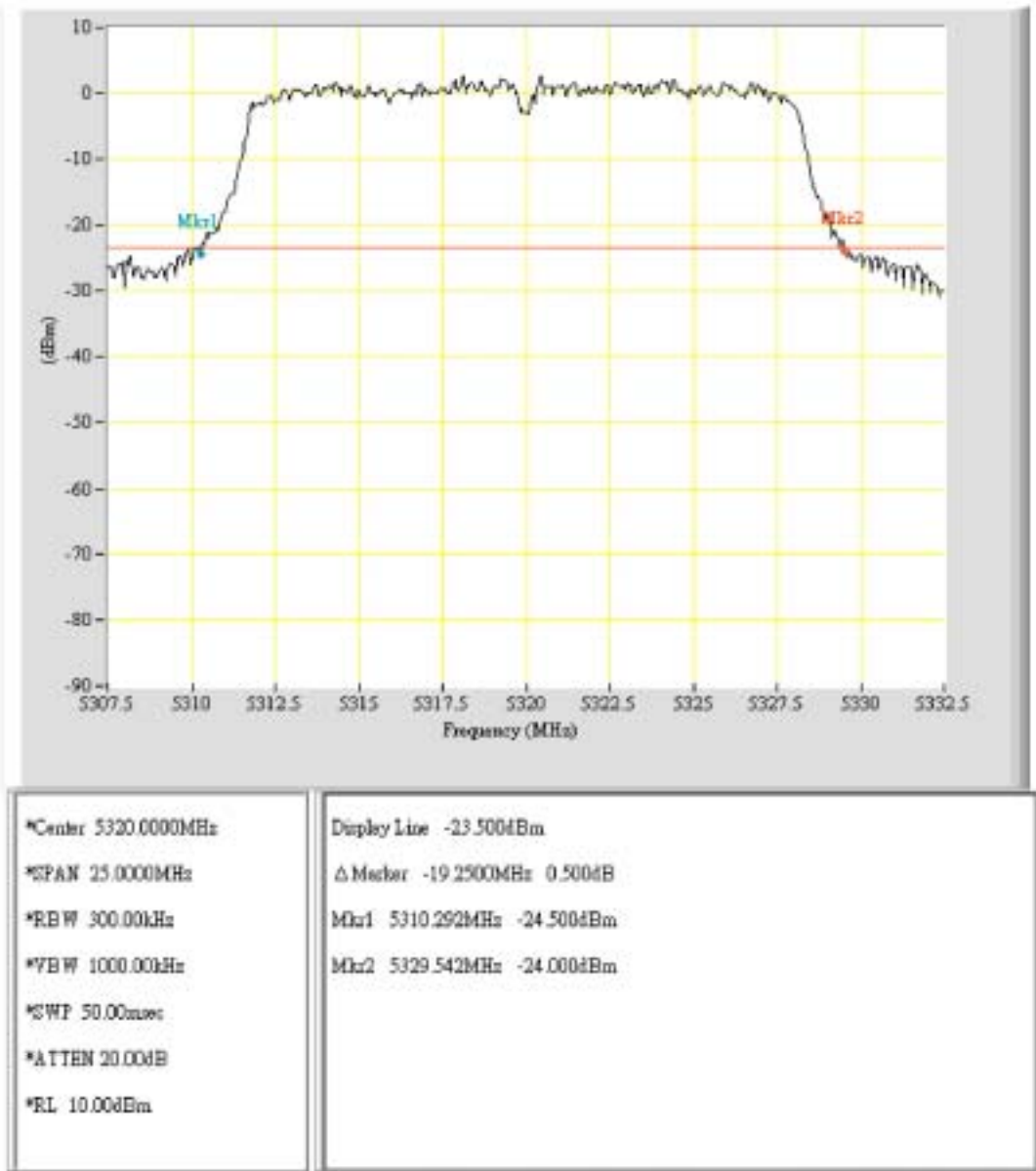
EUT: WLG500
Purpose: 26dB_BW
Condition: 5180MHz_54Mbps
Note:



EUT: WLG500
Purpose: 26dB_BW
Condition: 5240MHz_54Mbps
Note:



EUT: WLG500
Purpose: 26dB_BW
Condition: 5260MHz_54Mbps
Note:



EUT: WLG500
Purpose: 26dB_BW
Condition: 5320MHz_54Mbps
Note:

7 OUTPUT POWER MEASUREMENT

7.1 Standard Applicable

Section 15.407 (a) (1) : For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Section 15.407 (a) (2) : For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak transmit power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10\log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fix Limit (dBm)	B (MHz)	$4 + 10 \log B$ Limit (dBm)	Excess Antenna Gain (dB)	Limit (dBm)
36	5180	17	19.208	16.83	0.00	16.83
48	5240	17	19.333	16.86	0.00	16.86

The Limit in 5250 to 5350 MHz Band

Channel	Frequency (MHz)	Fix Limit (dBm)	B (MHz)	$11 + 10 \log B$ Limit (dBm)	Excess Antenna Gain (dB)	Limit (dBm)
52	5260	24	19.333	23.86	0.00	23.86
64	5320	24	19.250	23.84	0.00	23.84

7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. From Public Notice : Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Device - Part 15, Subpart E, AUGUST 2002, the transmitter output operates continuously therefore Method #1 is used.
4. Measure the highest amplitude appearing on spectral display and record the level to calculate result data.
5. Repeat above procedures until all frequencies measured were complete.

7.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

7.4 Measurement Data

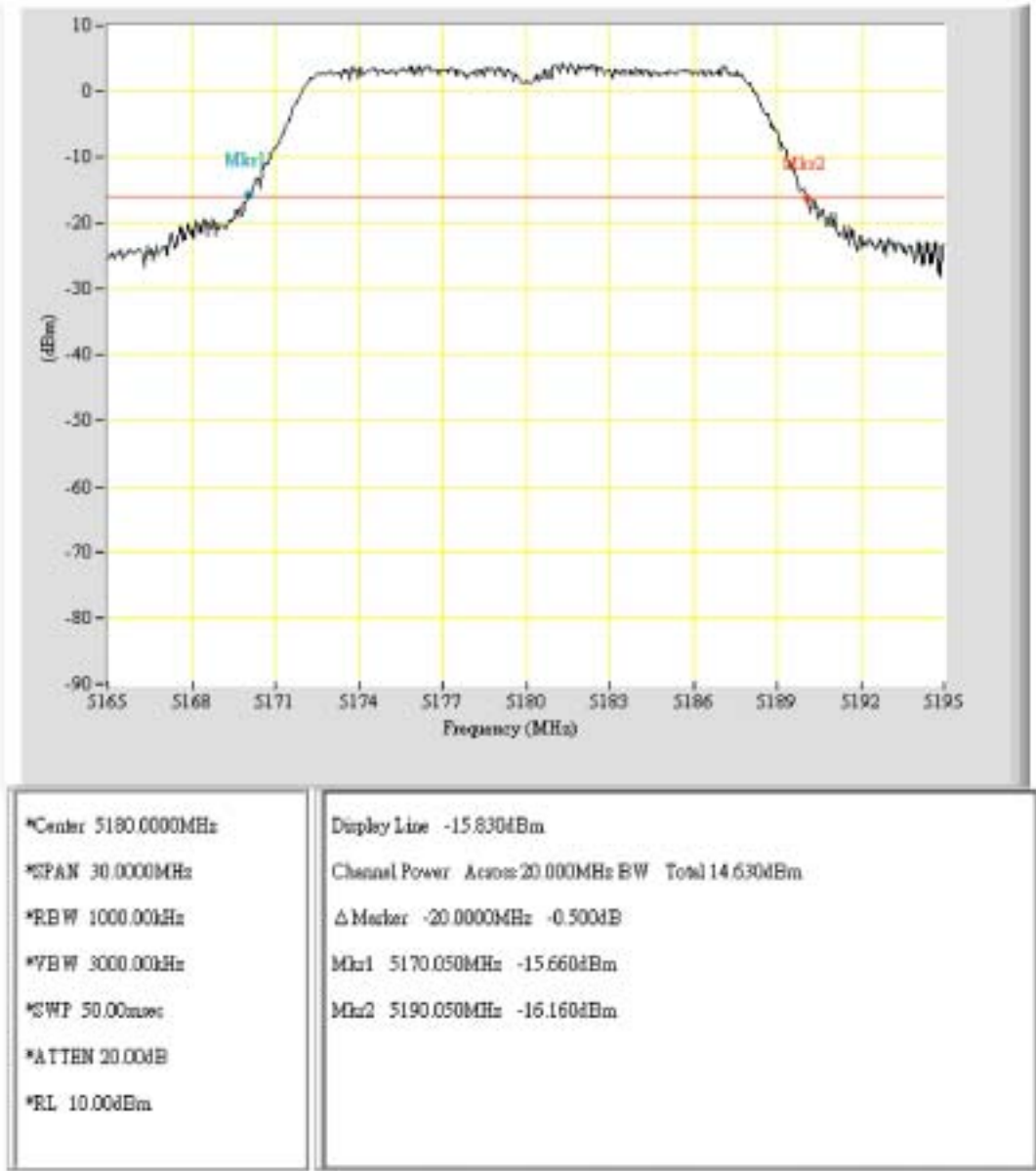
Test Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

Channel	Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Maximum Peak Output Power (dBm)	Limit (dBm)	Chart
32	5180	14.63	1.2	15.83	16.83	Page 28
48	5240	13.40	1.2	14.24	16.86	Page 29
52	5260	13.10	1.2	14.30	23.86	Page 30
64	5320	14.22	1.3	15.52	23.84	Page 31

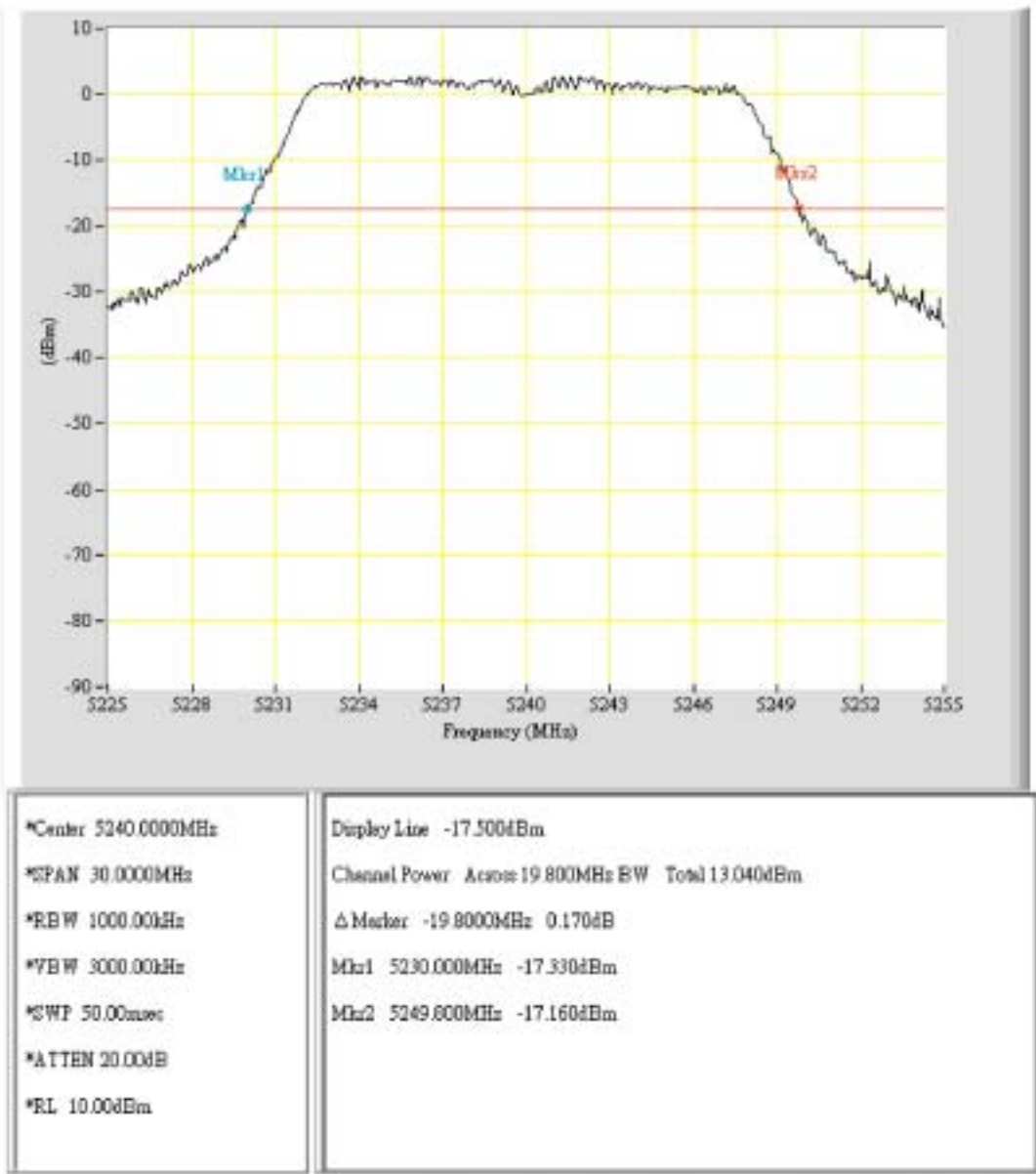
Note: Please refers to the page 28 - 31 for detail plot.

7.5 Result

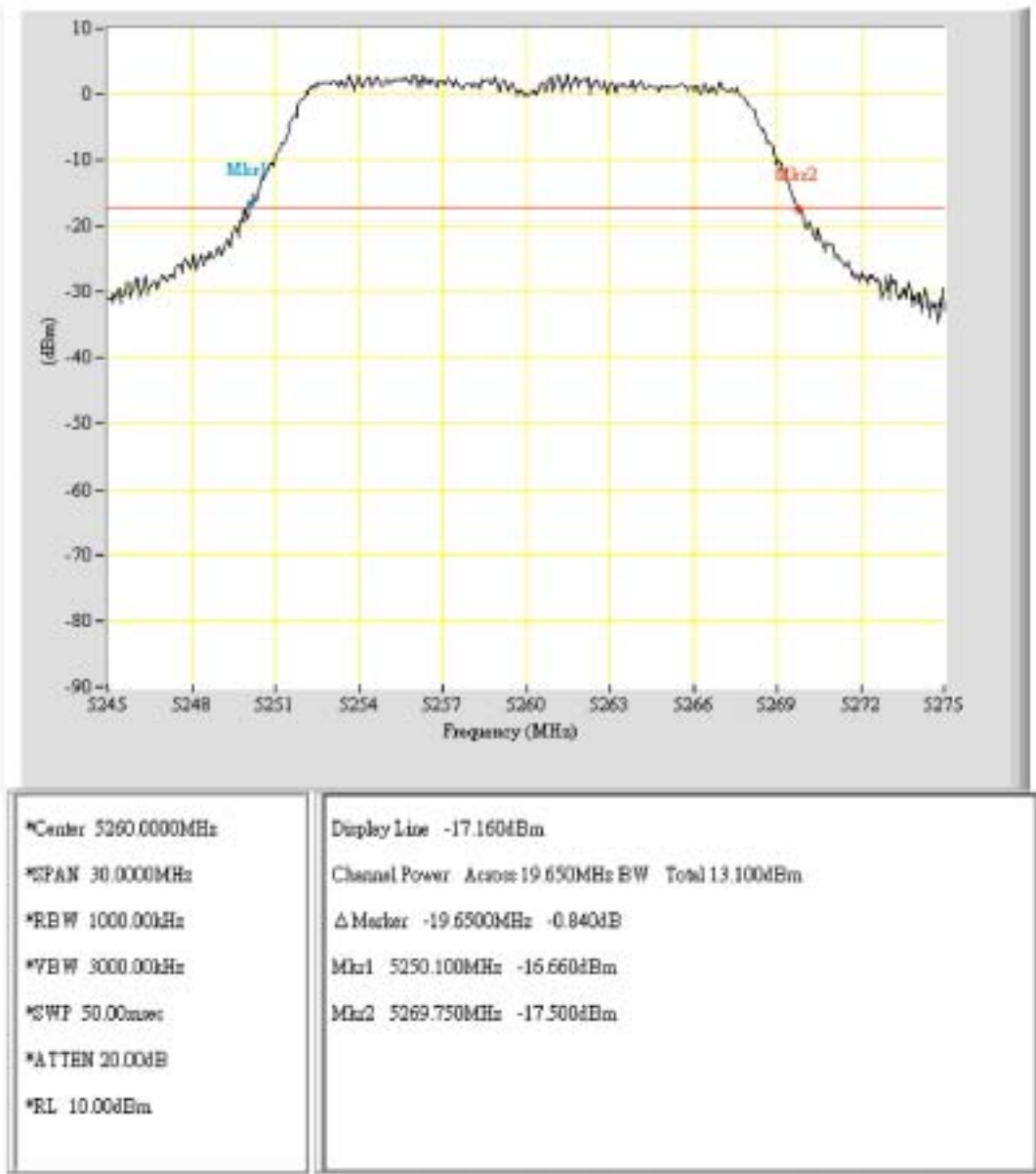
PASS



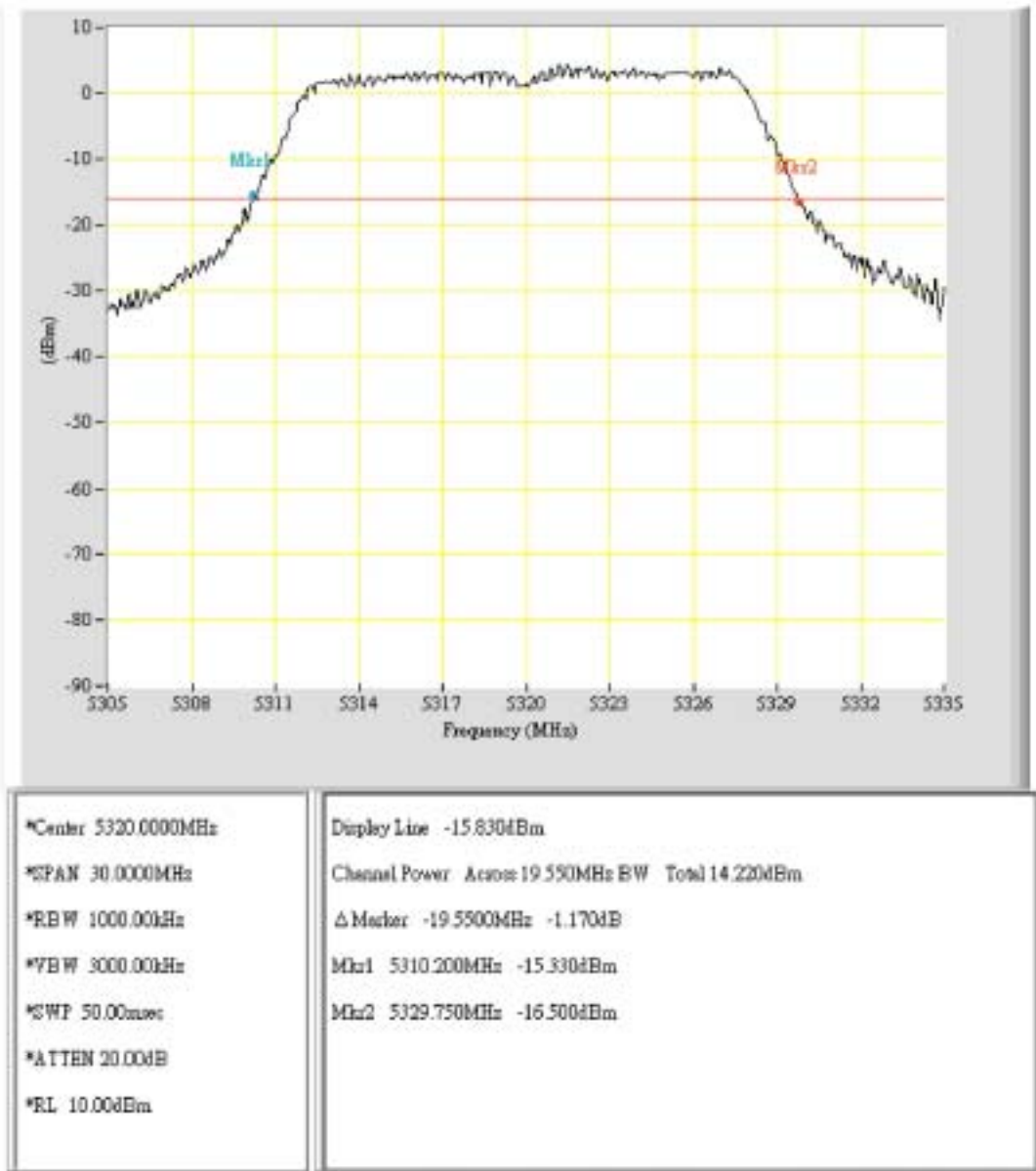
EUT: WLG500
Purpose: Output_Pwr
Condition: 5180MHz_54Mbps
Note:



EUT: WLG500
Purpose: Output_Pwr
Condition: 5240MHz_54Mbps
Note:



EUT: WLG500
Purpose: Output_Pwr
Condition: 5260MHz_54Mbps
Note:



EUT: WLG500
Purpose: Output_Pwr
Condition: 5320MHz_54Mbps
Note:

8 POWER DENSITY MEASUREMENT

8.1 Standard Applicable

Section 15.407 (a) (1) : For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Section 15.407 (a) (2) : For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the peak transmit power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10\log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. From Public Notice : Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Device - Part 15, Subpart E, AUGUST 2002, the PPSD Method #2 was used.
4. Adjust the frequency of spectrum analyzer on highest level appearing on spectral display.
5. Repeat above procedures until all measured frequencies were complete.

8.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

8.4 Measurement Data

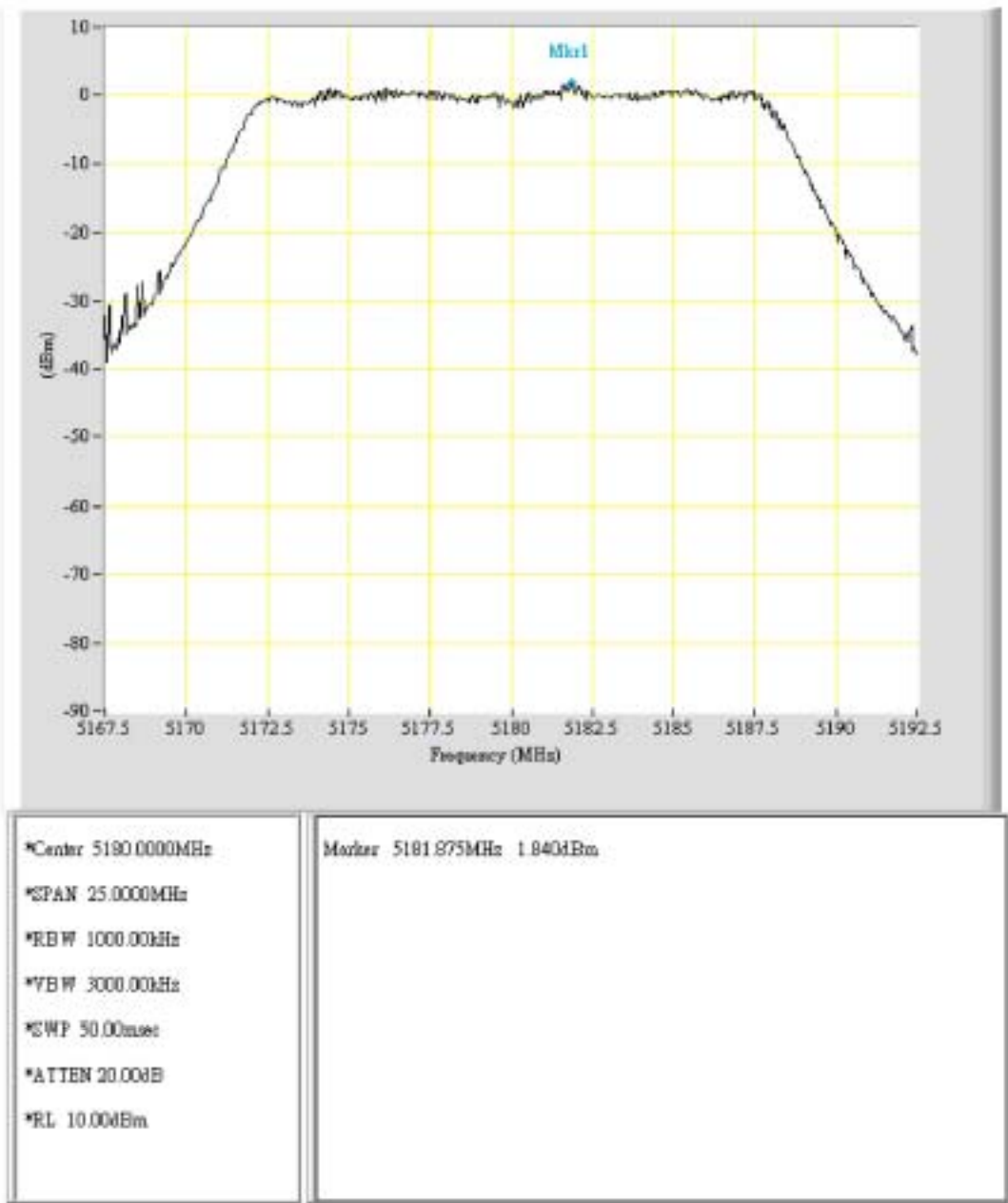
Test Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

Channel	Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Peak Power Spectral Density (dBm)	Limit (dBm)	Chart
36	5180	1.84	0.18	2.02	4.0	Page 34
48	5240	1.34	0.22	1.56	4.0	Page 35
52	5260	2.34	0.22	2.56	11.0	Page 36
64	5320	2.34	0.24	2.58	11.0	Page 37

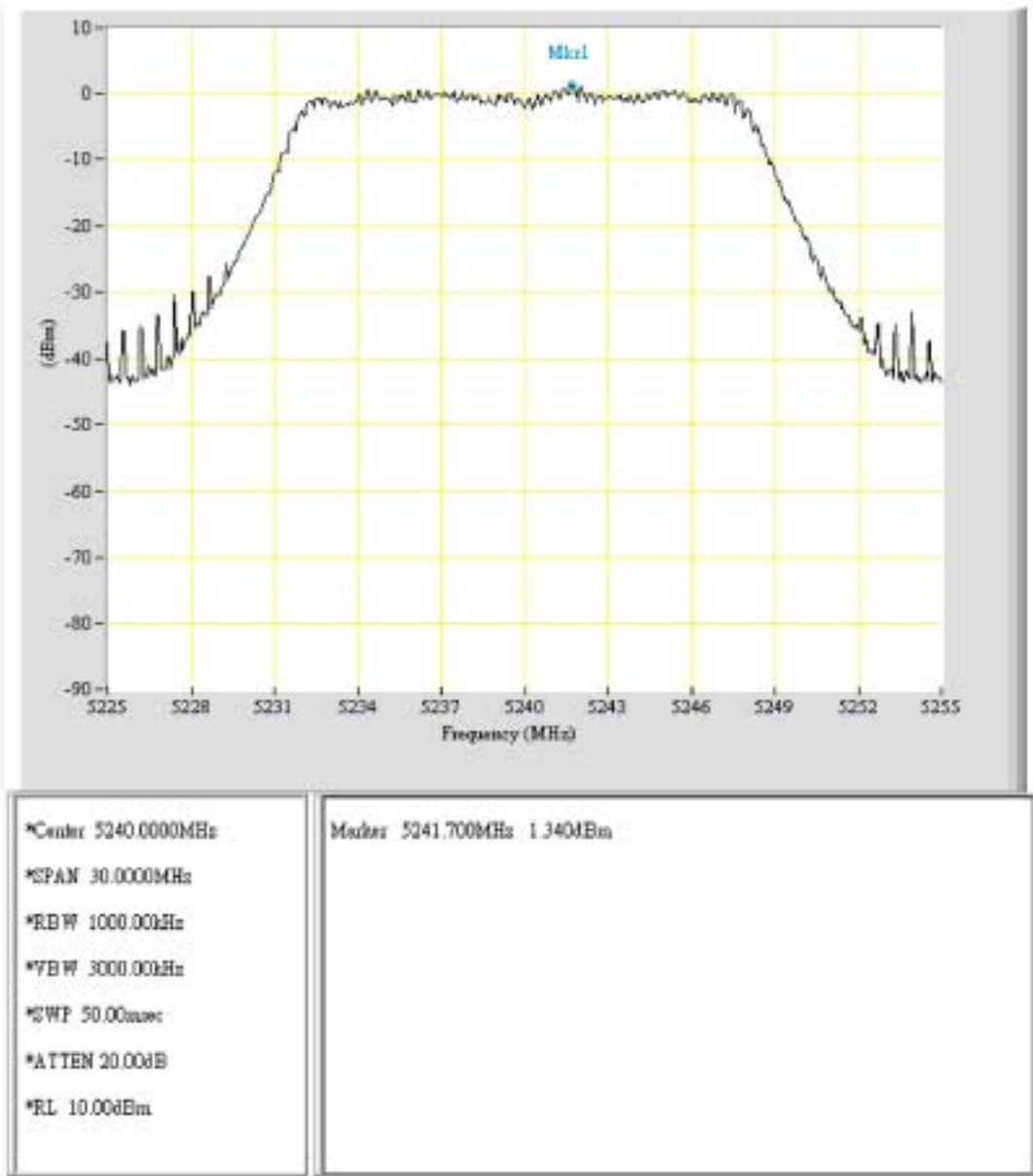
Note: Please refers to the page 34 - 37 for detail plot.

8.5 Result

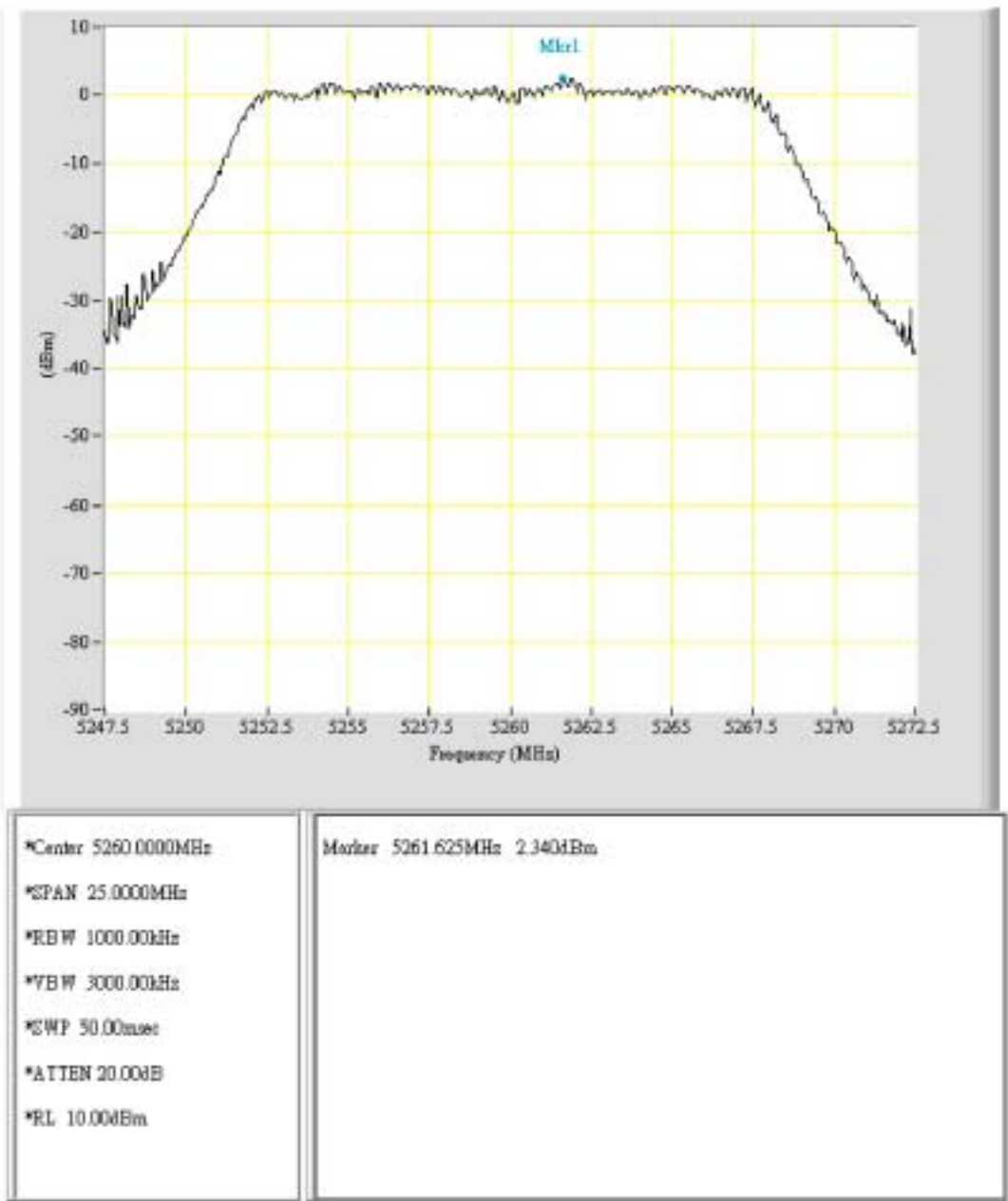
PASS



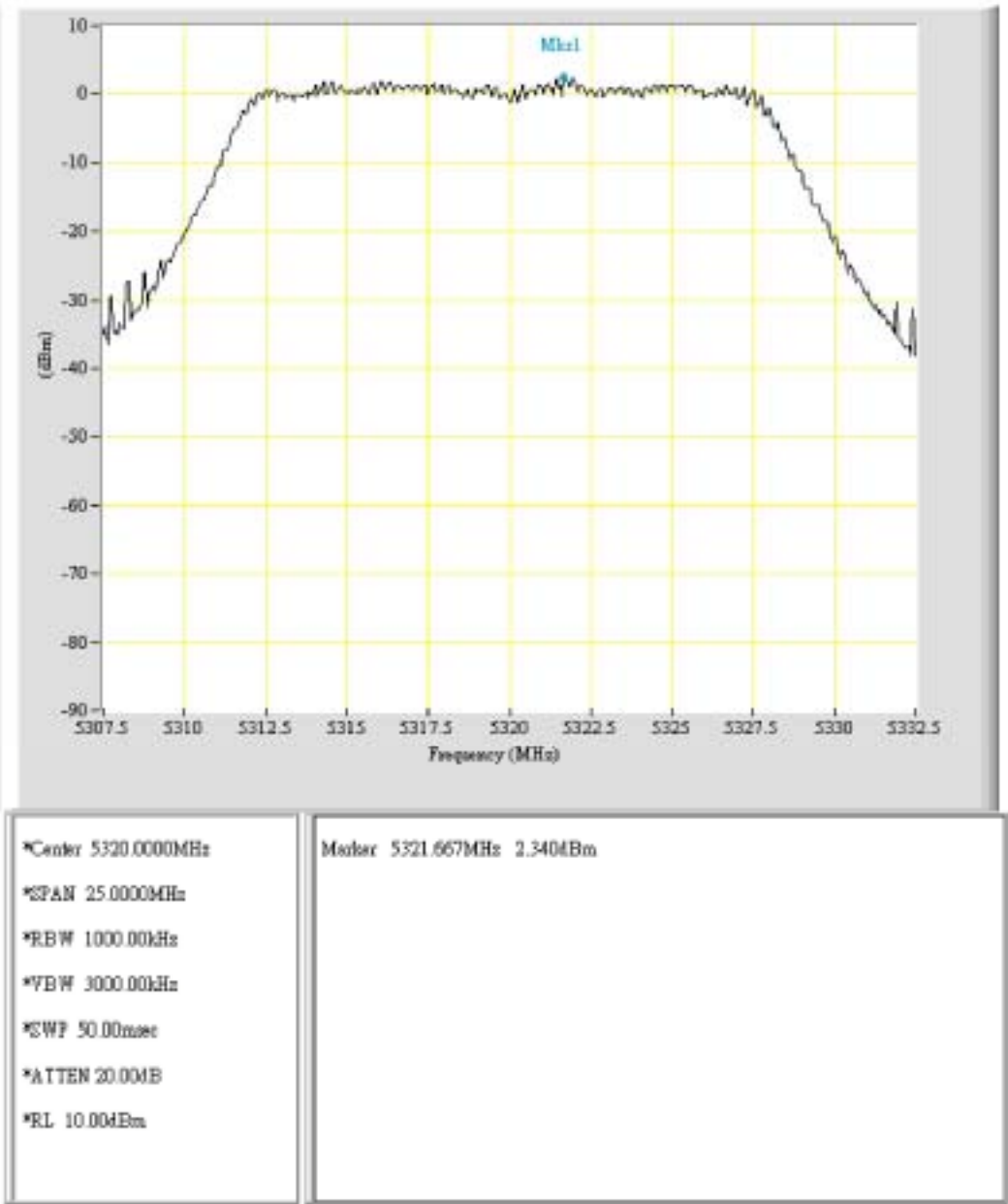
EUT: WLG500
Purpose: PwrDensity
Condition: 5180MHz_54Mbps
Note:



EUT: WLG500-3B
Purpose: PwrDensity
Condition: 802.11a_5240MHz_54Mbps
Note:



EUT: WLG500
Purpose: PwrDensity
Condition: 5260MHz_54Mbps
Note:



EUT: WLG500
Purpose: PwrDensity
Condition: 5320MHz_54Mbps
Note:

9 PEAK EXCURSION MEASUREMENT

9.1 Standard Applicable

Section 15.407 (a) (6) : The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and makes sure the instrument is operated in its linear range.
3. From Public Notice : Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Device - Part 15, Subpart E, AUGUST 2002.

Since Method #1 was used for peak power measurement Method #1 settings are used for the second PPSD trace.

4. Plot the graph with marking the highest point.
5. Repeat above procedures until all measured frequencies were complete.

9.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

9.4 Measurement Data

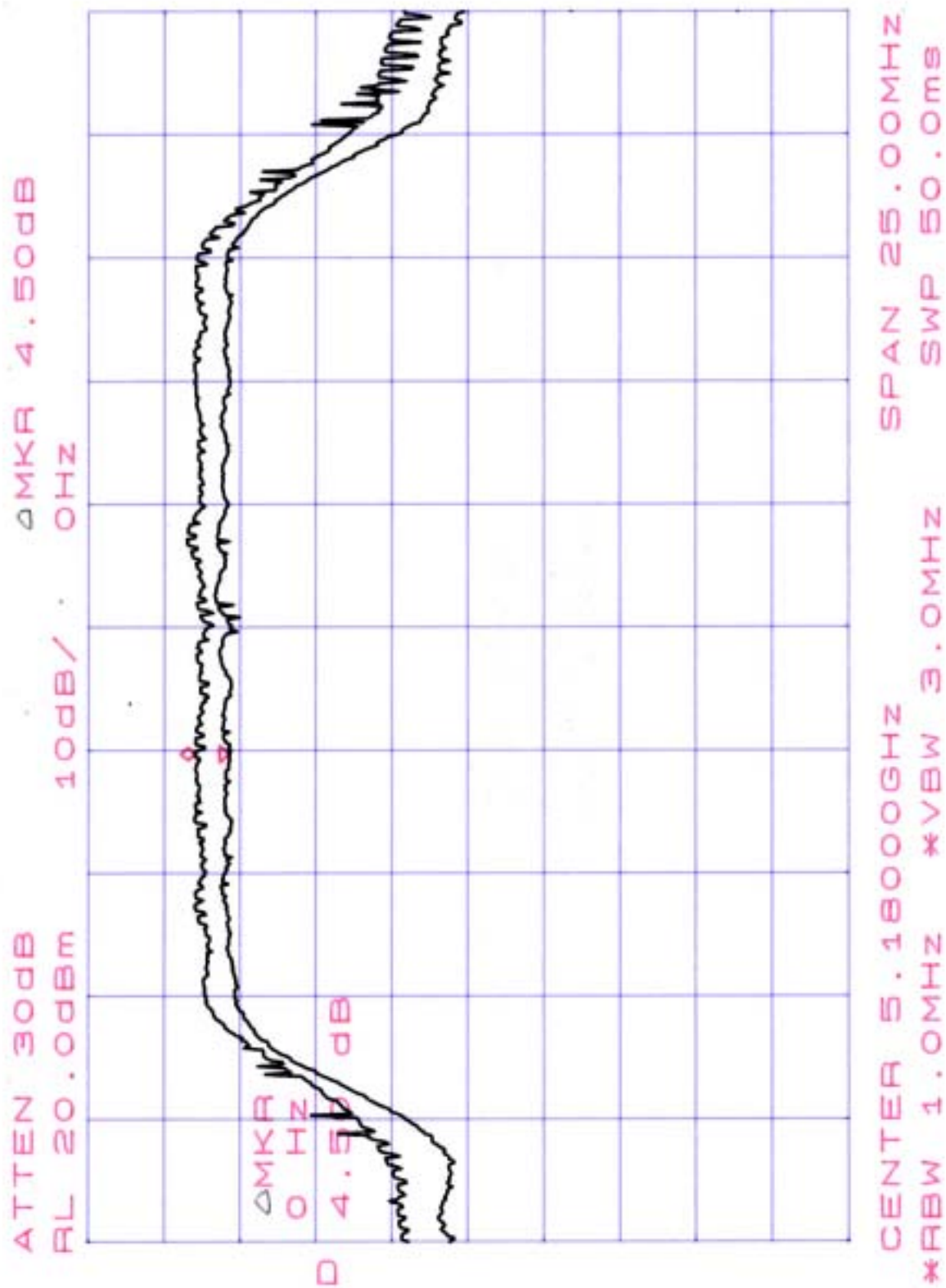
Test Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

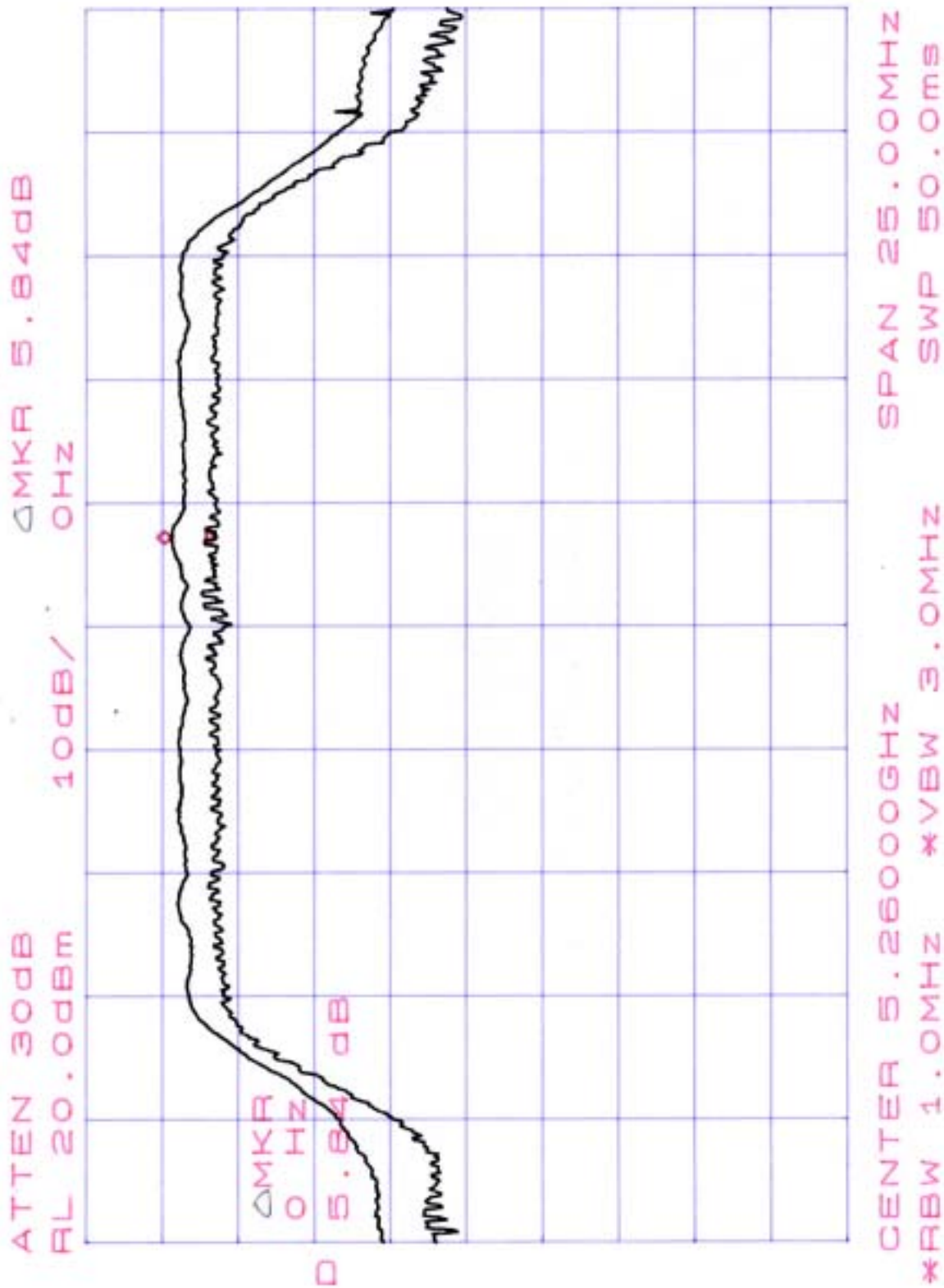
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Chart
36	5180	4.50	13	Page 40
48	5240	5.50	13	Page 41
52	5260	5.84	13	Page 42
64	5320	5.33	13	Page 43

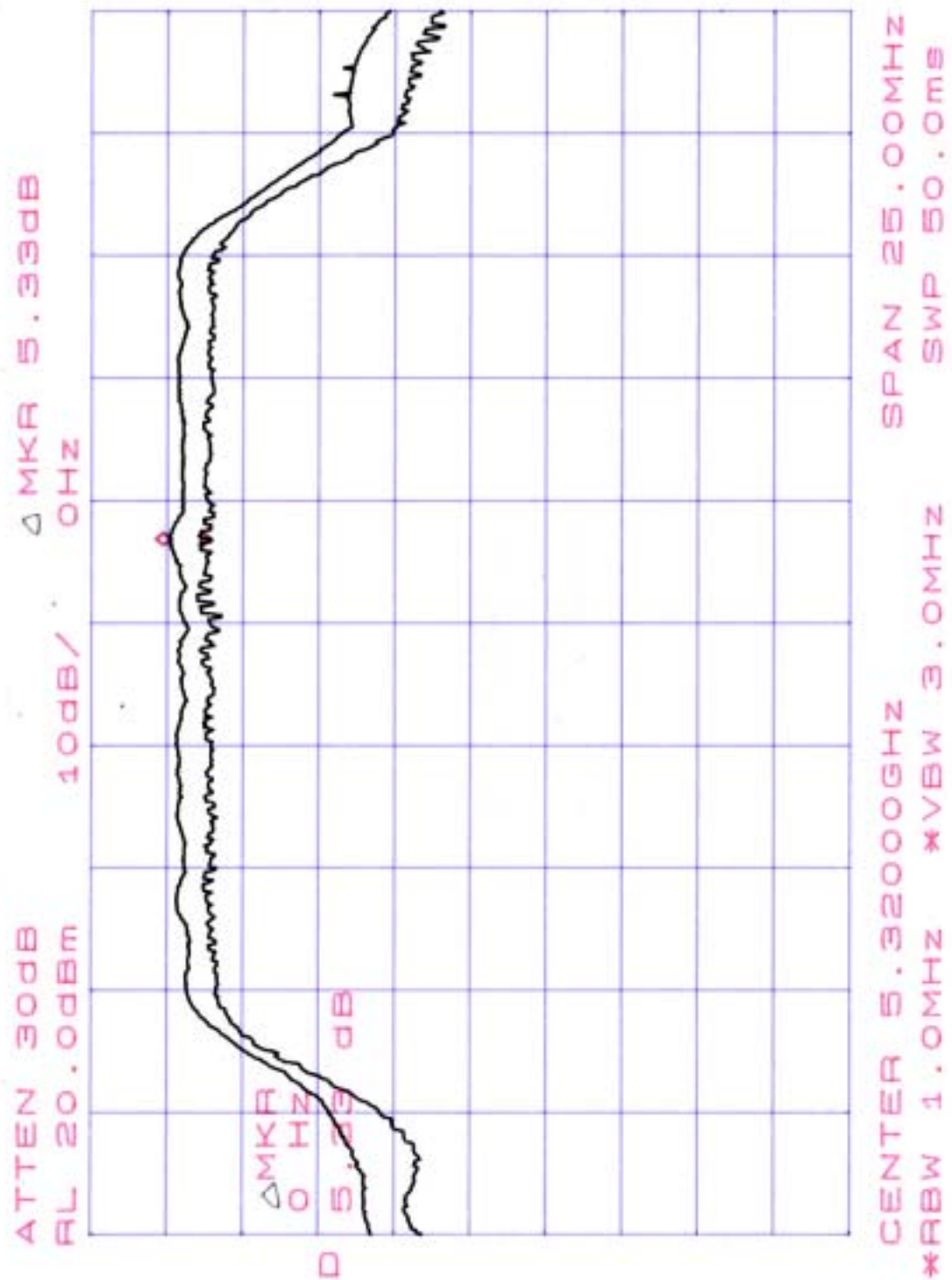
Note: Please refers to the page 40 - 43 for detail plot.

9.5 Result

PASS







10 SPURIOUS EMISSION - RF CONDUCTED MEASUREMENT

10.1 Standard Applicable

Section 15.407 (b) (1) : For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

Section 15.407 (b) (2) : For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

10.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 1 MHz with a convenient frequency span including 1MHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

10.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

10.4 Measurement Data

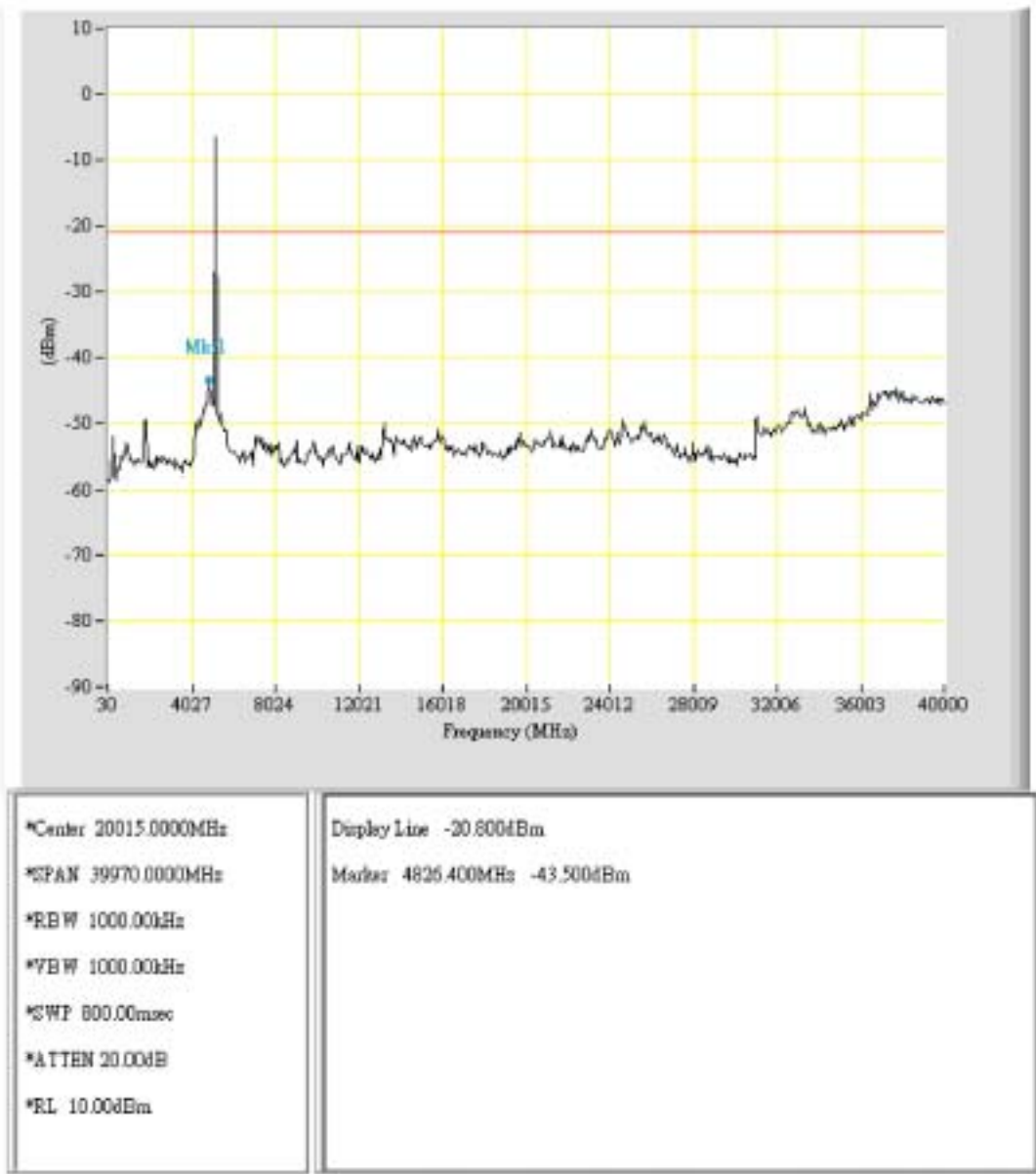
Test Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

Channel	Frequency(MHz)	Chart
36	5180	Page 46
48	5240	Page 47
52	5260	Page 48
64	5320	Page 49

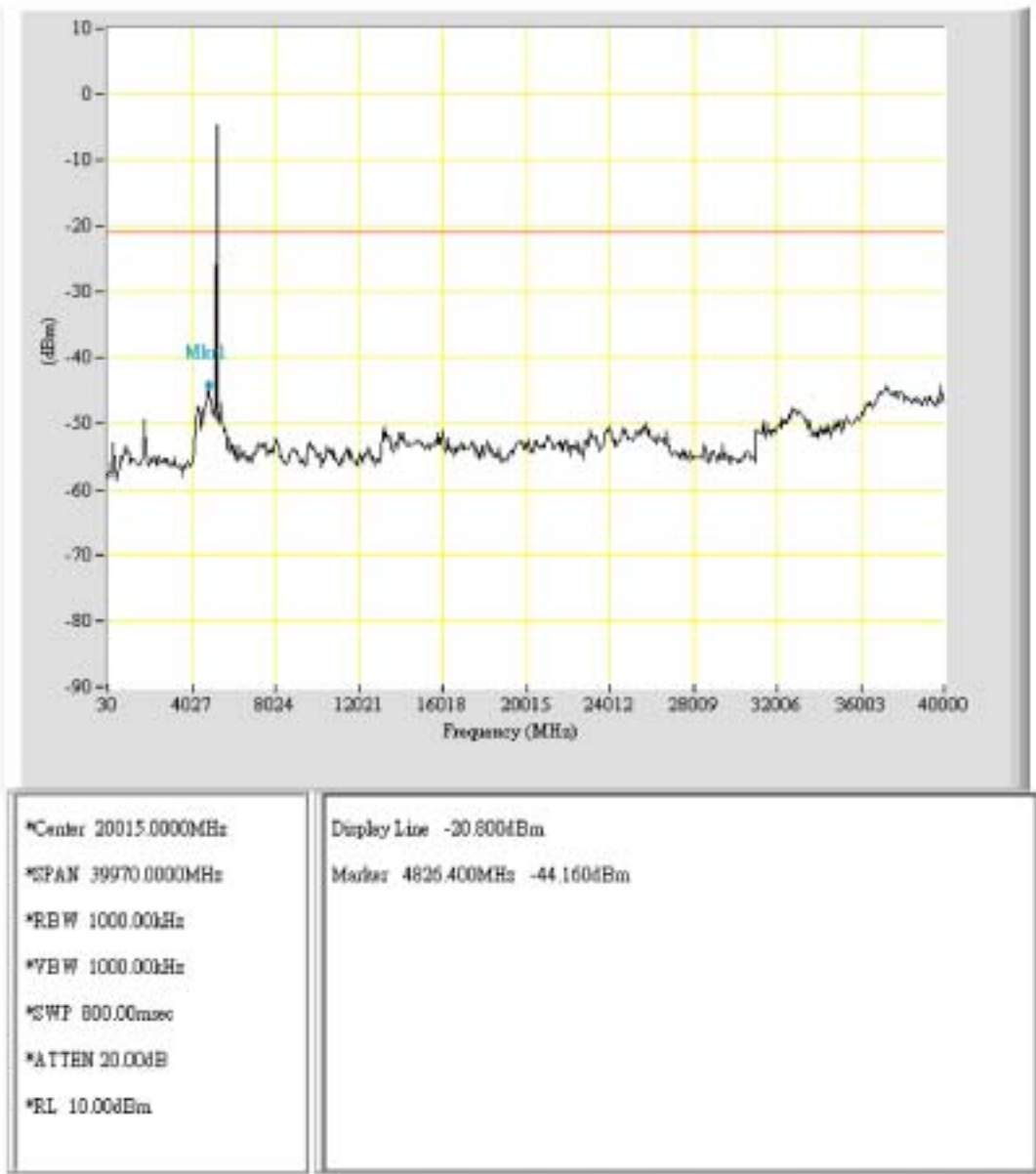
Note: Please refers to the page 46 – 49 for detail plot.

10.5 Result

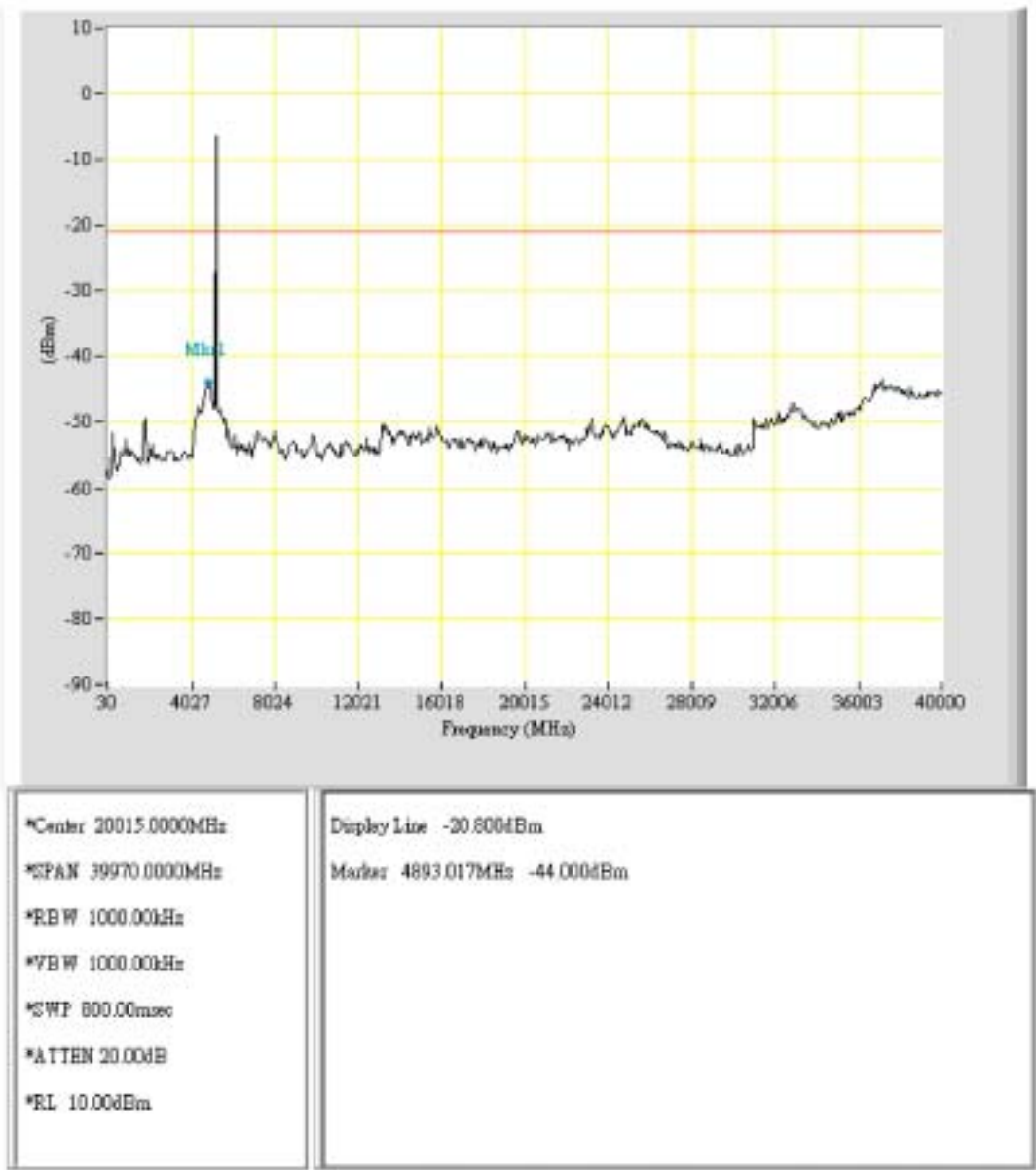
PASS



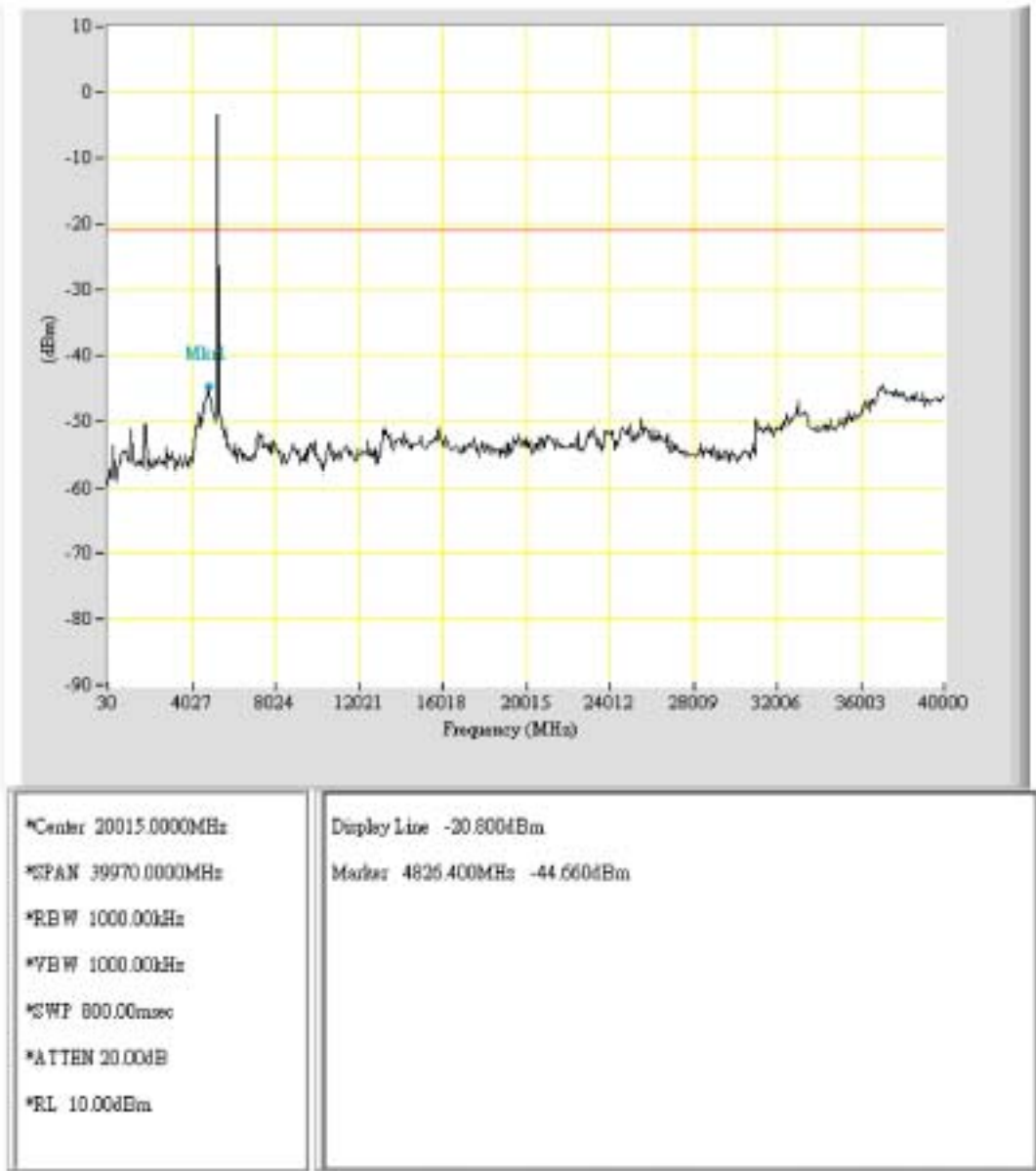
EUT: WLG500
Purpose: 30MHz-40GHz
Condition: 5180MHz
Note:



EUT: WLG500
Purpose: 30MHz-40GHz
Condition: 5240MHz
Note:



EUT: WLG500
Purpose: 30MHz-40GHz
Condition: 5260MHz
Note:



EUT: WLG500
Purpose: 30MHz-40GHz
Condition: 5320MHz
Note:

11 RADIATED EMISSION MEASUREMENT

11.1 Standard Applicable

Section 15.205 Restricted bands of operation : (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

Section 15.205 (b) : Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Section 15.209 : (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/m)	Measurement Distance (Meters)
30 - 88	100 **	40.0	3
88 - 216	150 **	43.5	3
216 - 960	200 **	46.0	3
above 960	500 **	54.0	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

Section 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

11.2 Measurement Procedure

1. Setup the configuration per figure 2 and 3 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, it is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions. For emission frequencies measured above 1 GHz, a pre-scan be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 120 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

Note : A band pass filter was used to avoid pre-amplifier saturated when measure TX operation mode in frequency band above 1 GHz.

5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the data rate, placement of antenna and cables associated with EUT to obtain the worse case and record the result.

Figure 2 : Frequencies measured below 1 GHz configuration

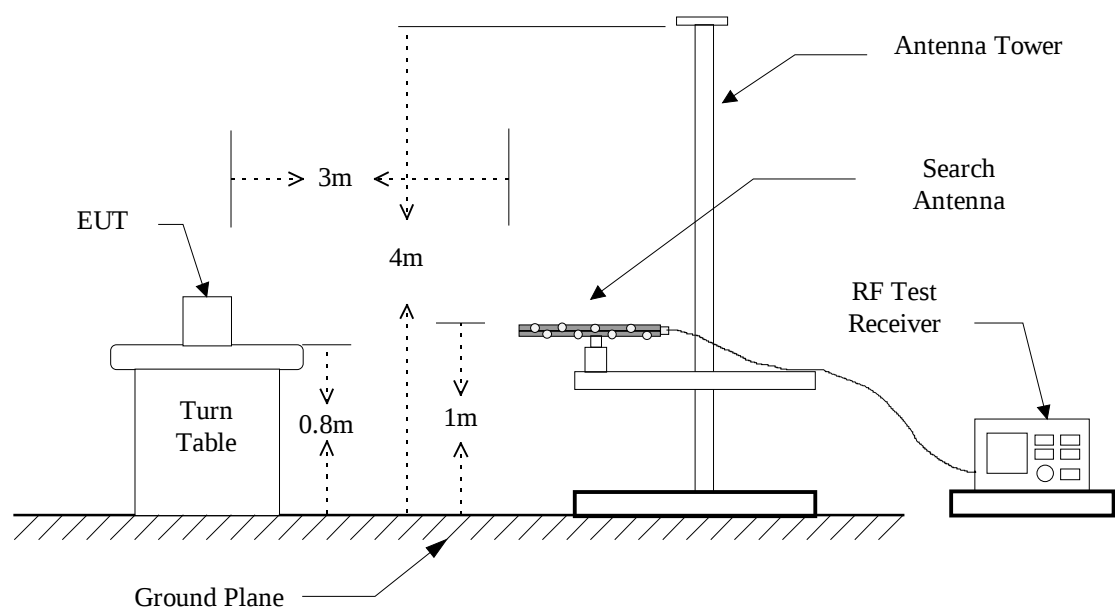
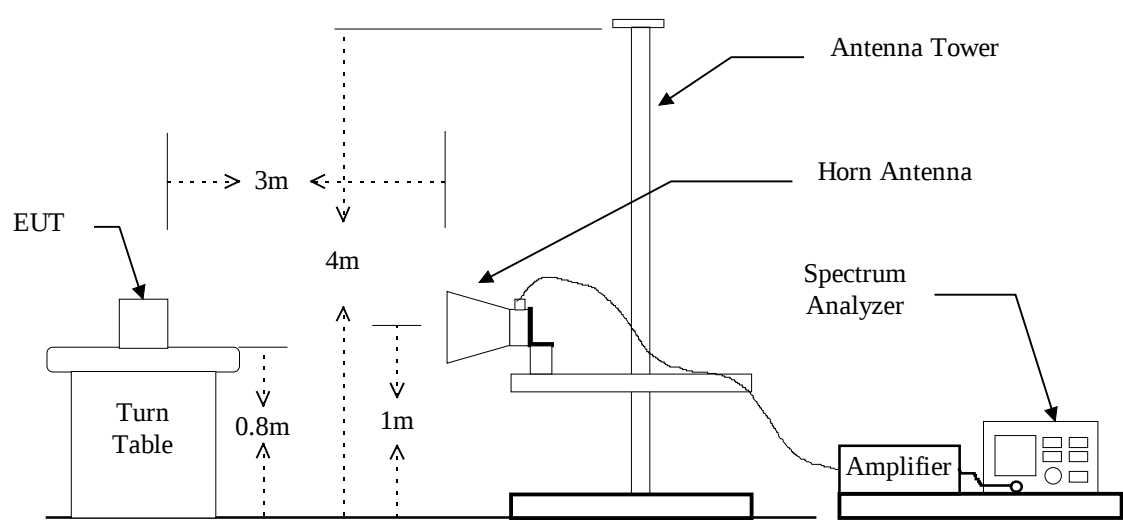


Figure 3 : Frequencies measured above 1 GHz configuration



11.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	Hewlett-Packard	8546A	01/31/2005
BiconiLog Antenna	Schwarzbeck	9160	10/18/2004
Horn Antenna	EMCO	3115	05/09/2005
Horn Antenna	EMCO	3116	06/28/2005
Preamplifier	Hewlett-Packard	8449B	09/17/2005
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	300 kHz
	Spectrum Analyzer	Peak	120 kHz	300 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

11.4 Radiated Emission Data

11.4.1 Harmonic and Spurious Radiated Emission Above 1GHz

Operation Mode: Transmitting

Test Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

a) Channel 36

Fundamental Frequency: 5180 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Peak Margin (dB)	Ave Margin (dB)	Note
	H		V			(dBuV/m)		(dBuV/m)				
	Peak	Ave	Peak	Ave		Peak	Ave	Peak	Ave.			
15540	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
20720	---	---	---	---	---	---	---	74.0	54.0	---	---	NF

b) Channel 48

Fundamental Frequency: 5240 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Peak Margin (dB)	Ave Margin (dB)	Note
	H		V			(dBuV/m)		(dBuV/m)				
	Peak	Ave	Peak	Ave		Peak	Ave	Peak	Ave.			
15720	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
20960	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
31440	---	---	---	---	---	---	---	74.0	54.0	---	---	NF

c) Channel 52

Fundamental Frequency: 5260 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Peak Margin (dB)	Ave Margin (dB)	Note
	H		V			(dBuV/m)		(dBuV/m)				
	Peak	Ave	Peak	Ave		Peak	Ave	Peak	Ave.			
15780	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
21040	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
31560	---	---	---	---	---	---	---	74.0	54.0	---	---	NF

d) Channel 64

Fundamental Frequency: 5320 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Peak Margin (dB)	Ave Margin (dB)	Note
	H		V			Peak	Ave	Peak	Ave.			
	Peak	Ave	Peak	Ave								
10640	47.5	34.8	47.2	34.8	4.7	52.2	39.5	74.0	54.0	-21.8	-14.5	NF
15960	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
21280	---	---	---	---	---	---	---	74.0	54.0	---	---	NF
31920	---	---	---	---	---	---	---	74.0	54.0	---	---	NF

Note : “---” means that the emissions level is too low to be measured.

“NF” means that the readings were essentially at noise floor.

11.4.2 Other Emission Below 1 GHz With Worst-Case ConfigurationTest Date: Jun. 23, 2004Temperature: 26Humidity: 73 %

Emission Frequency (MHz)	Meter Reading (dBuV)		CORR'd Factor (dB/m)	Results (dBuV/m)		Limit (3m) (dBuV/m)	Margins (dB)
	HOR.	VERT.		HOR.	VERT.		
140.580	17.9	***	15.1	33.0	***	43.5	-10.5
223.030	27.3	***	13.7	41.0	***	46.0	-5.0
307.420	***	20.2	16.8	***	37.0	46.0	-9.0
315.180	***	22.4	17.5	***	39.9	46.0	-6.1
327.790	26.5	23.0	17.5	44.0	40.5	46.0	-2.0
366.590	21.9	24.1	18.8	40.7	42.9	46.0	-3.1
446.130	17.9	***	20.7	38.6	***	46.0	-7.4
523.730	***	17.0	22.3	***	39.3	46.0	-6.7
678.930	***	16.3	25.7	***	42.0	46.0	-4.0
974.780	7.5	***	30.1	37.6	***	54.0	-16.4

Note:

1. AH means antenna height, DRT means degrees of rotation of turntable.
2. If the data table appeared symbol of "****" means the value was too low to be measured.
3. The estimated measurement uncertainty of the result measurement is
 $\pm 4.6\text{dB}$ (30MHz $\leq$ f $\leq$ 300MHz).
 $\pm 4.4\text{dB}$ (300MHz < f $\leq$ 1000MHz).
4. Please refer to page 58 to page 67 for chart

11.5 Field Strength Calculation

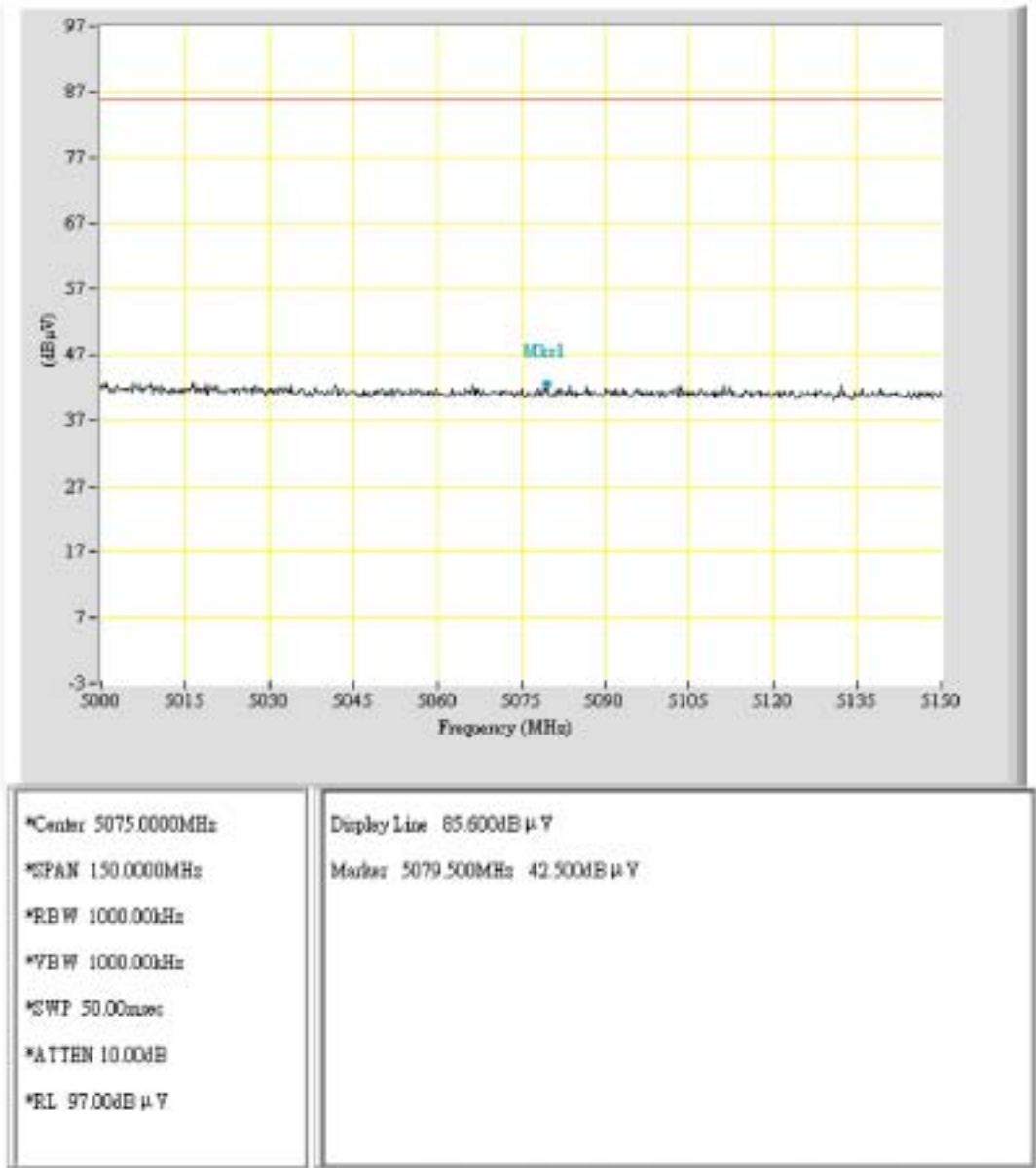
The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\textbf{Result} = \textbf{Reading} + \textbf{Corrected Factor}$$

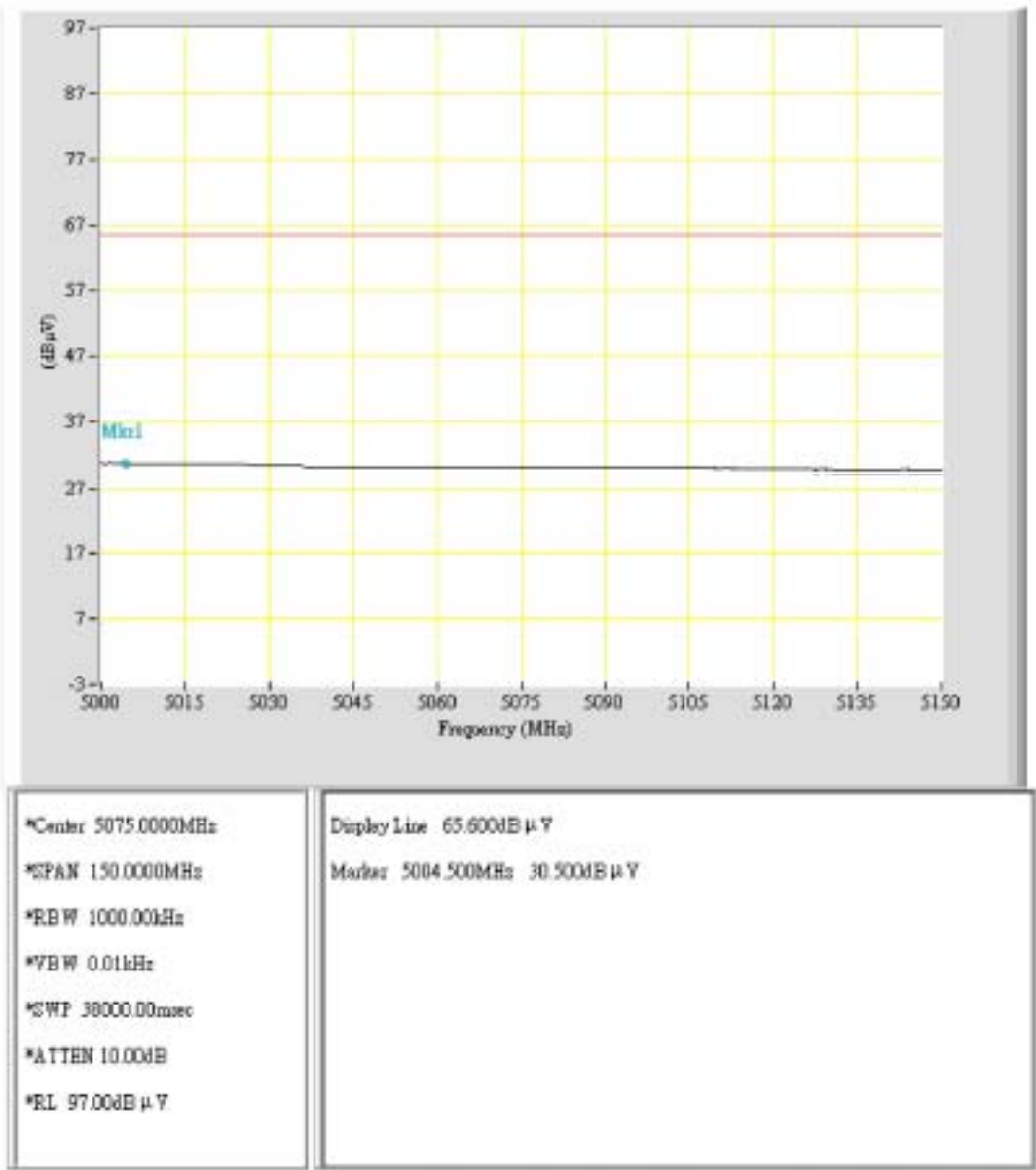
where

$$\text{Corrected Factor} = \text{Antenna Factor} + \text{Cable Loss} + \text{High Pass Filter Loss} - \text{Amplifier Gain}$$

Adjacent Restricted Band (Low Channel, Horizontal)

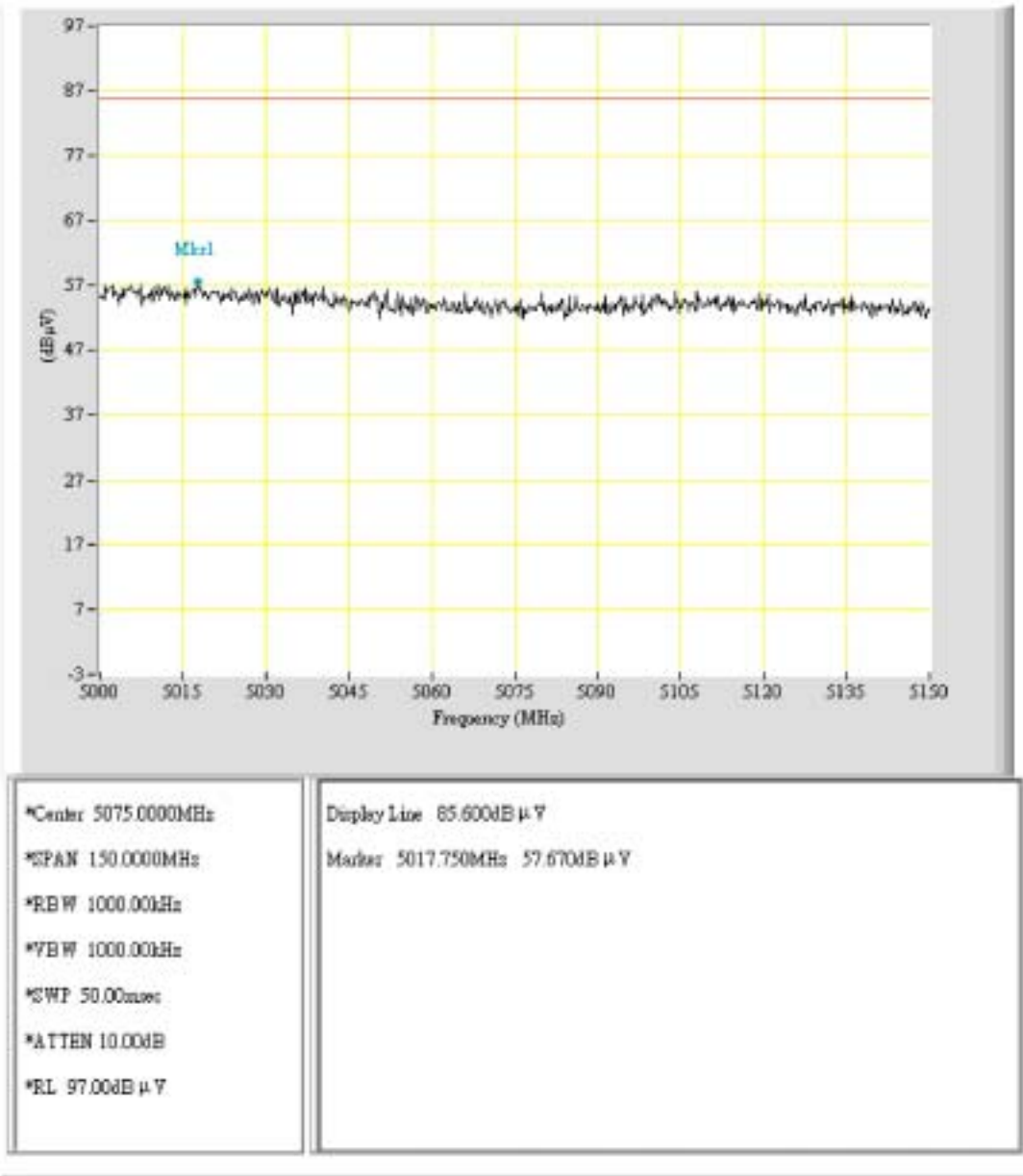


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: PEAK_HORIZONTAL
Note:

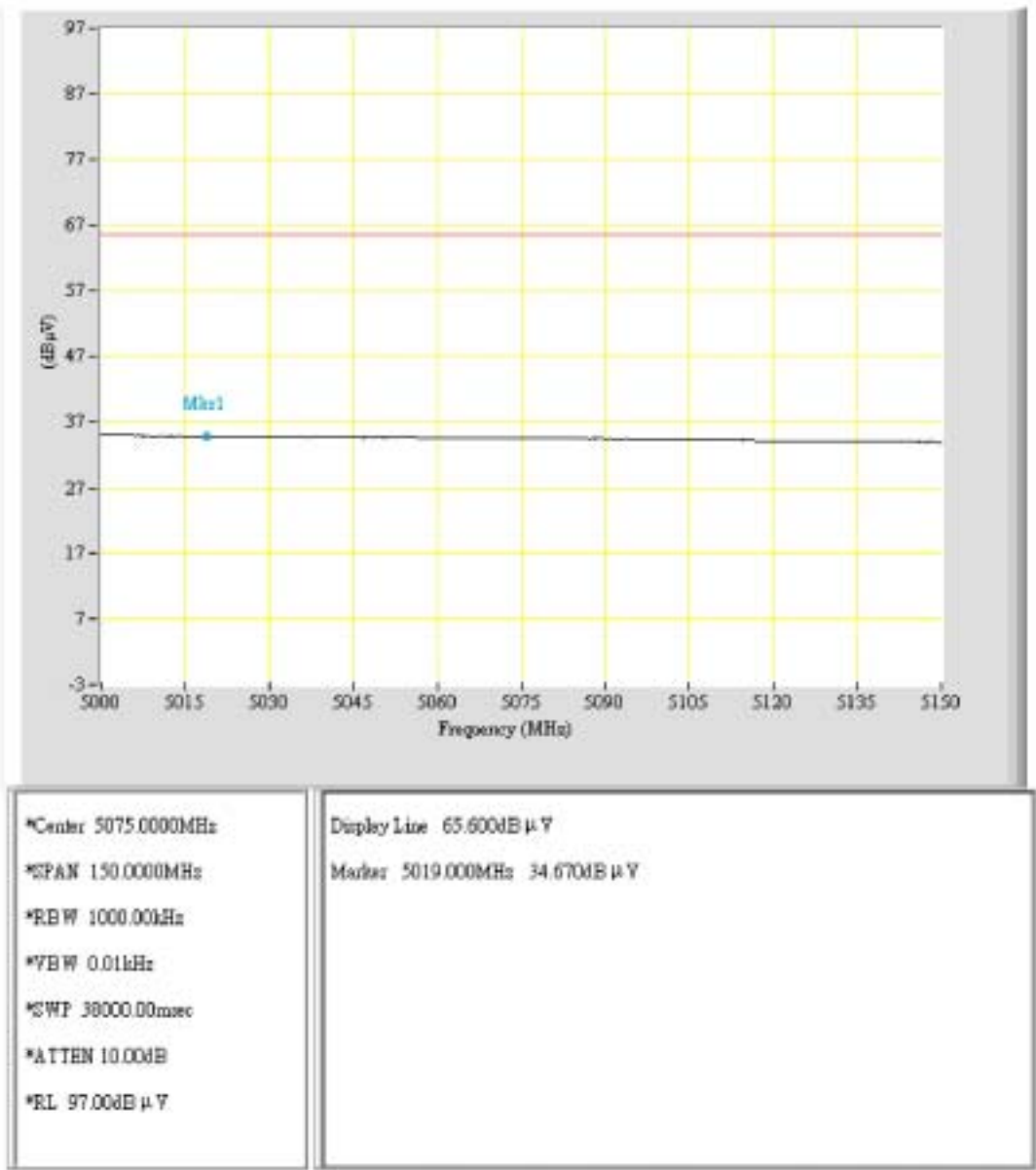


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: AVG_HORIZONTAL
Note:

Adjacent Restricted Band (Low Channel, Vertical)

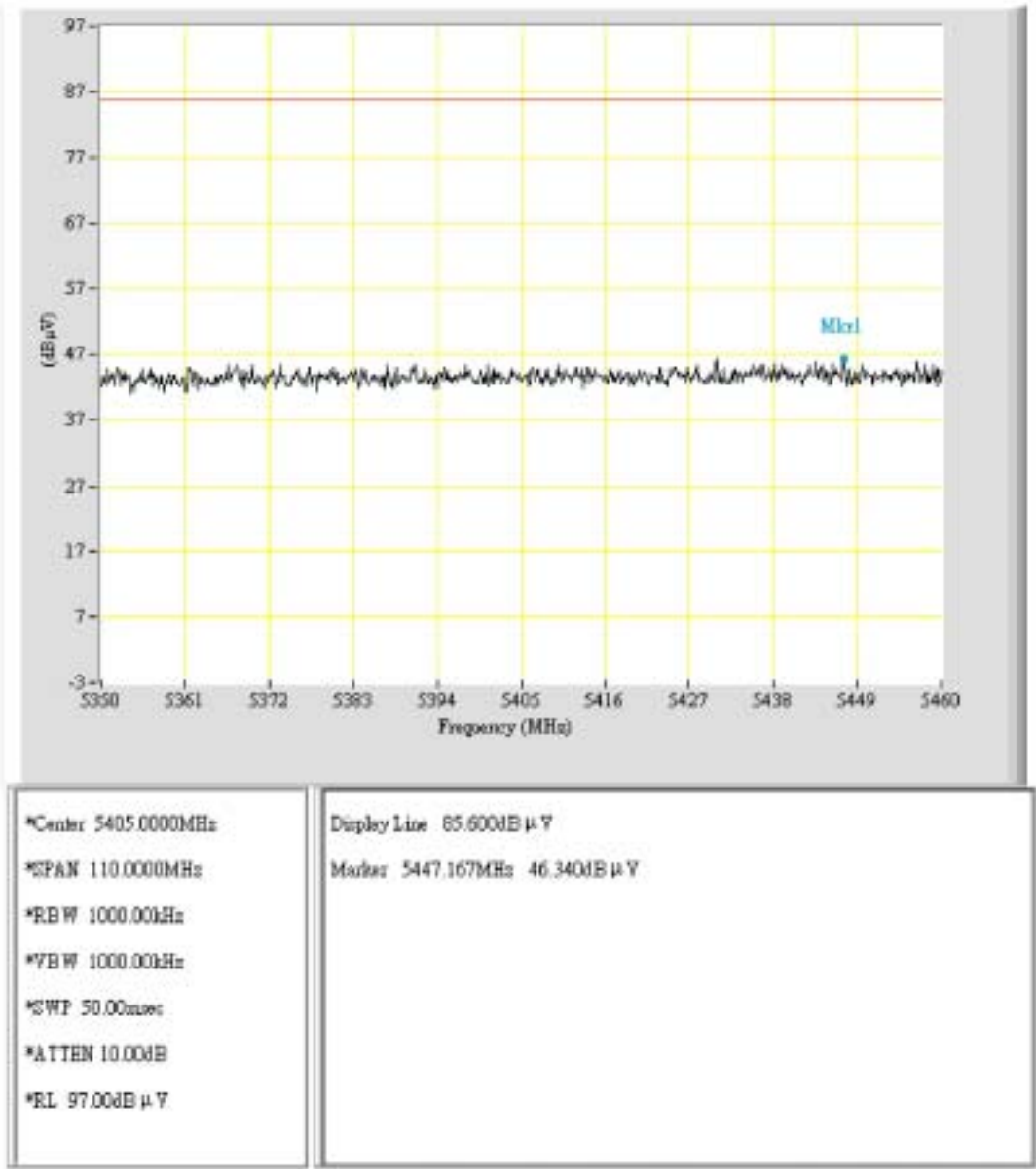


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: PEAK_VERTICAL
Note:

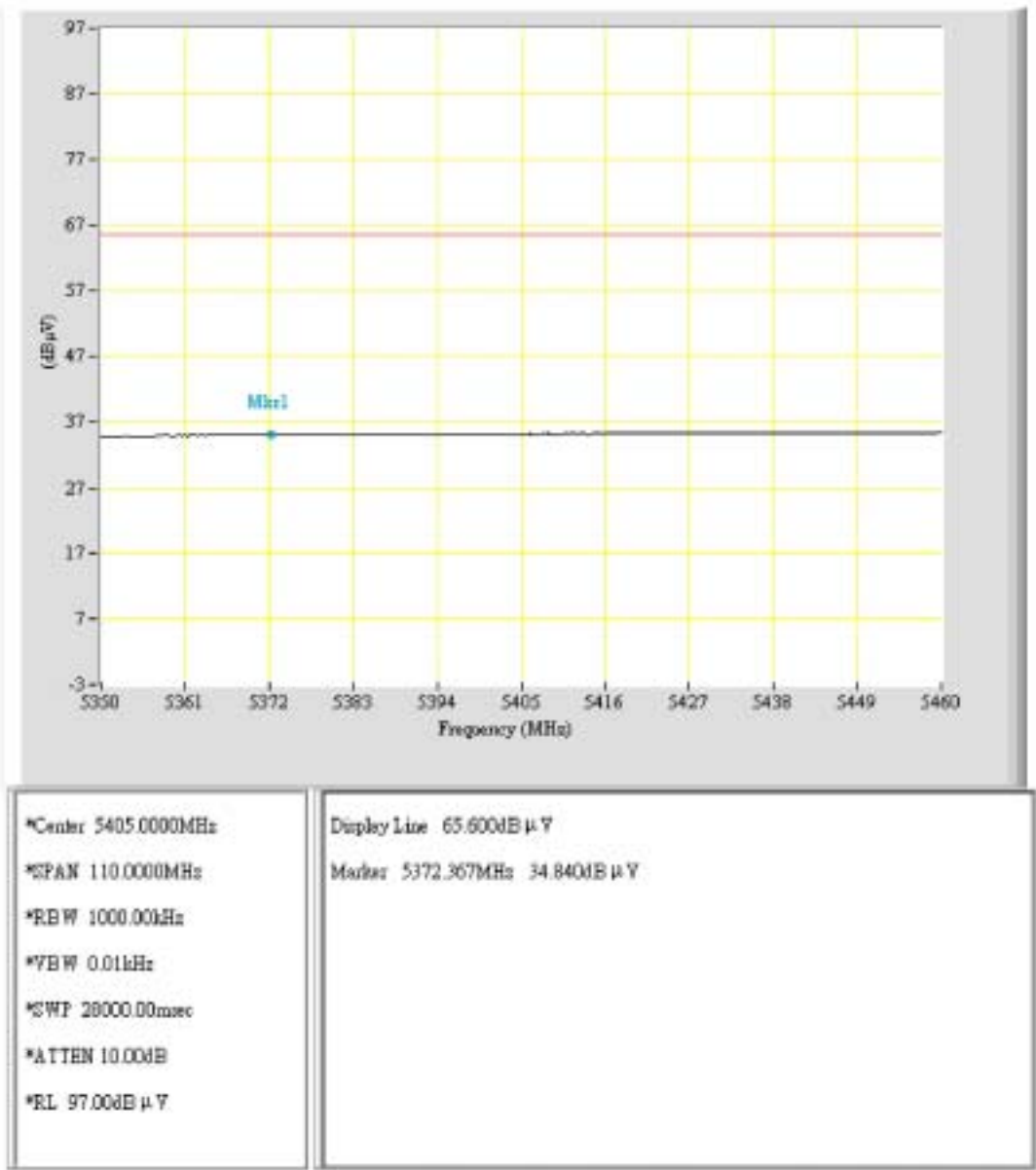


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: AVG_VERTICAL
Note:

Adjacent Restricted Band (High Channel, Horizontal)

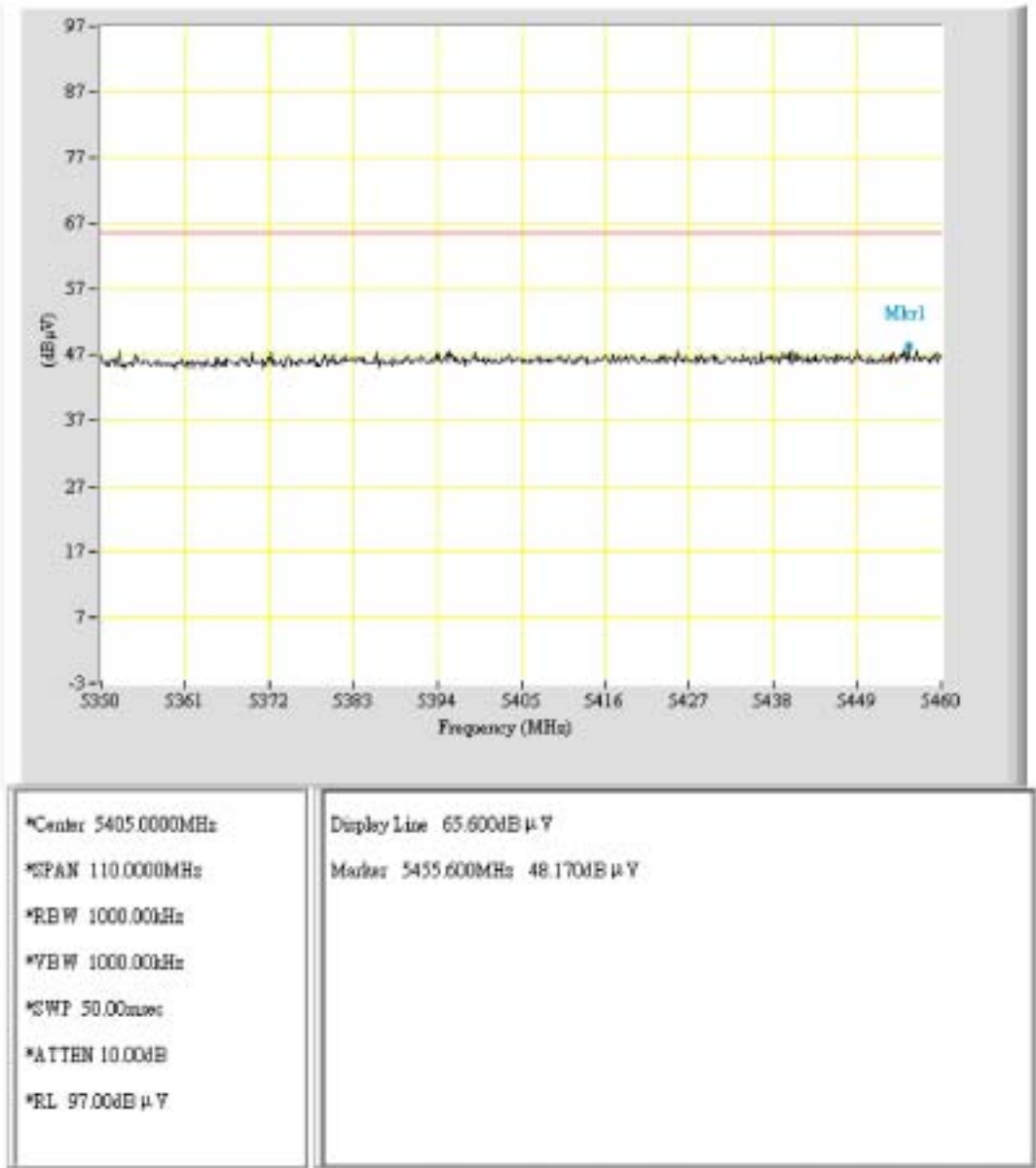


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: PEAK_HORIZONTAL_H_CH
Note:

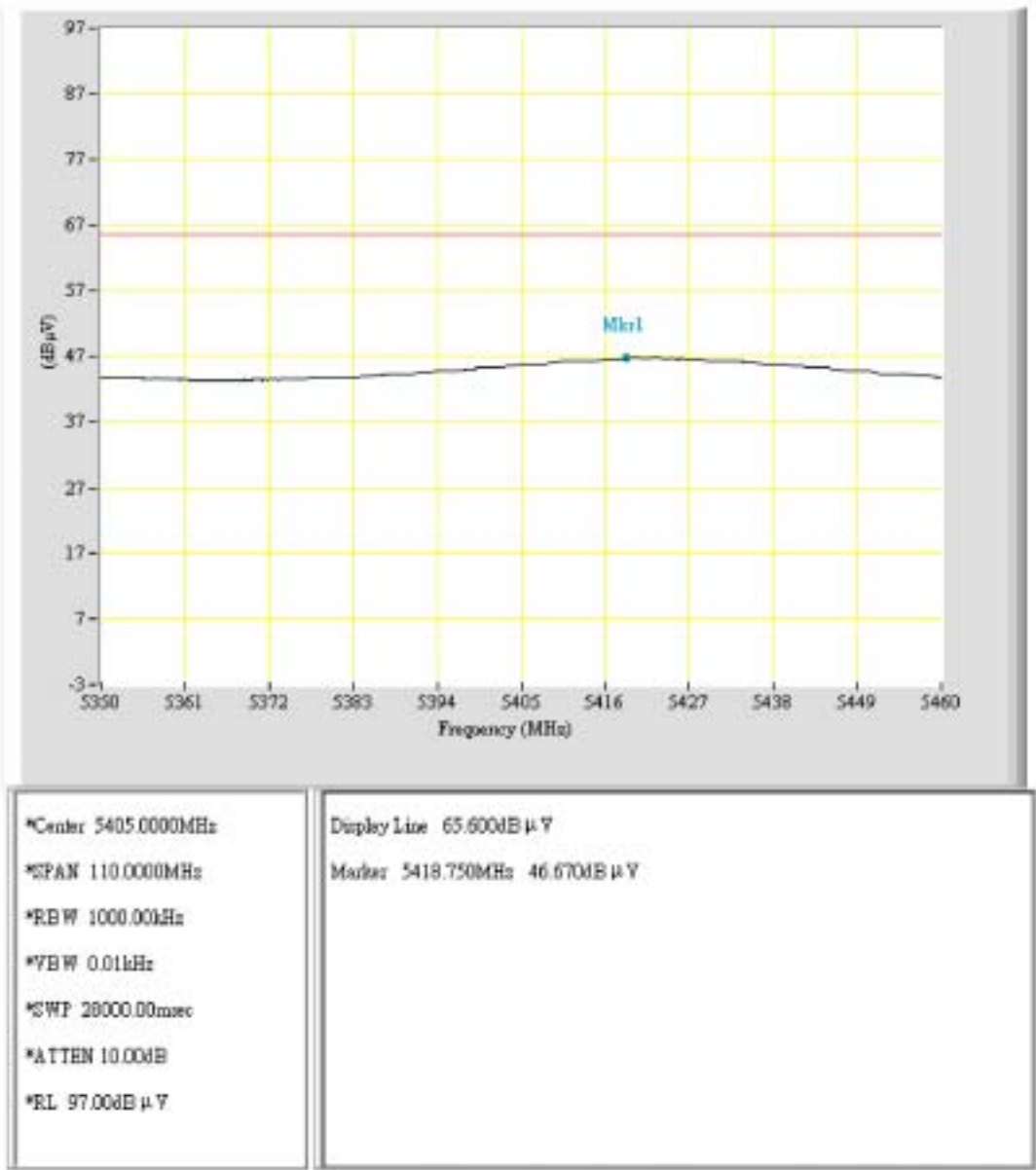


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: AVG_HORIZONTAL_H_CH
Note:

Adjacent Restricted Band (High Channel, Vertical)

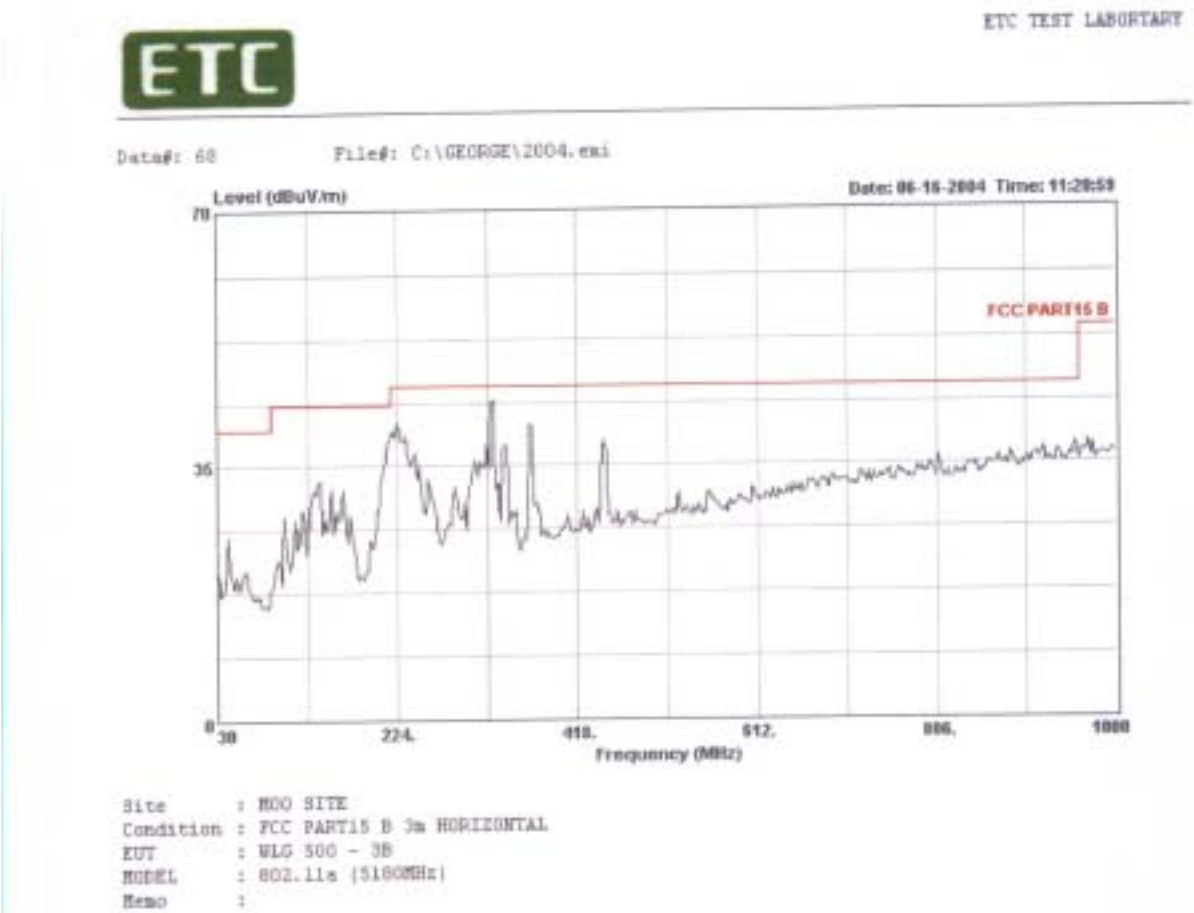


EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: PEAK_VERTICAL_H_CH
Note:



EUT: WLG500
Purpose: Adjacent Restricted Band
Condition: AVG_VERTICAL_H_CH
Note:

Other Emission Below 1 GHz With Worst-Case Configuration (Horizontal)



Other Emission Below 1 GHz With Worst-Case Configuration (Vertical)

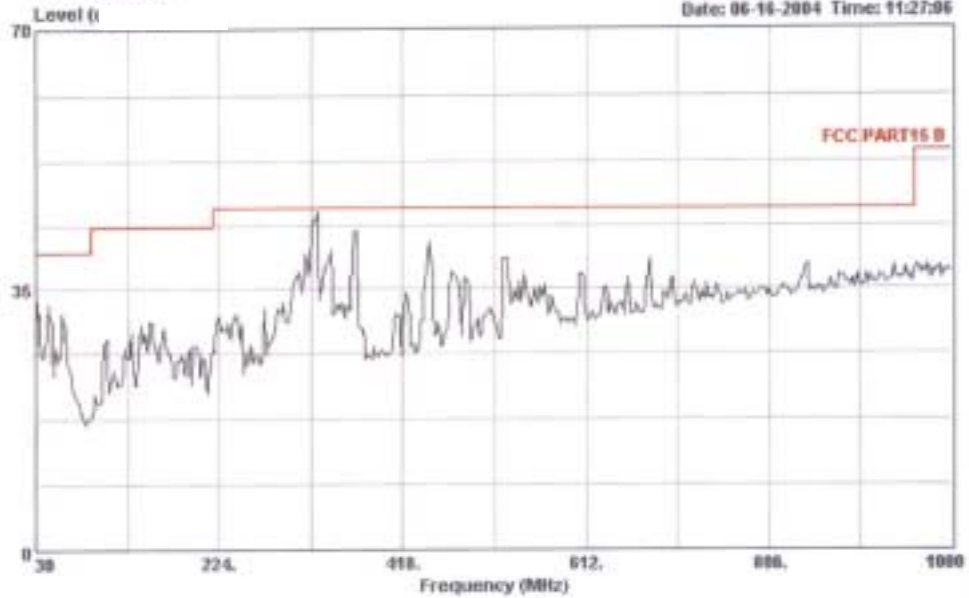


ETC TEST LABORATORY

Data#: 78

File#: C:\GEORGE\2004.emi

Date: 06-16-2004 Time: 11:27:06



Site : MD0 SITE
Condition : FCC PART15 B 3m VERTICAL
EUT : WLG 500 - 3B
MODEL : 602.11a (5180MHz)
Memo : 1