



## FCC 47 CFR PART 15 SUBPART C

### TEST REPORT

For

**Compal Electronics Inc.**

**Wireless LAN module built in Notebook PC**

**Model No.: CL32**

**Trade Name: acer / Compal**

*Prepared for*

**Compal Electronics Inc.  
No. 581, Jui Kuang Rd., Neihu,  
Taipei, (114) Taiwan, R.O.C.**

*Prepared by*

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# 1. TEST RESULT CERTIFICATION

<b>Applicant:</b>	Compal Electronics Inc. No. 581, Jui Kuang Rd., Neihu, Taipei, (114) Taiwan, R.O.C.
<b>Equipment Under Test:</b>	Wireless LAN module built in Notebook PC
<b>Trade Name:</b>	acer / Compal
<b>Model No.:</b>	CL32
<b>Report Number:</b>	B30827206-RP
<b>Date of Test:</b>	September 3 ~ 4, 2003

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC Part 15 Subpart C	No non-compliance noted

### We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (1992) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

*Approved by:*

*Reviewed by:*

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**Jonson Lee**  
Director of Linkou Laboratory  
Compliance Certification Services Inc.

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**Eric Wong**  
Vice Manager of RF Section  
Compliance Certification Services Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	Wireless LAN module built in Notebook PC
<b>Trade Name</b>	acer / Compal
<b>Model No.</b>	CL32
<b>Model Discrepancy</b>	None
<b>Power Supply</b>	ADP-65DB (Input: 100-240V, 50-60Hz, 1500mA Output: 19V, 3420mA)
<b>Frequency Range</b>	801.11a: 5.15 ~ 5.35GHz 801.11b: 2412 ~ 2462 MHz
<b>Transmit Power</b>	801.11a: 14dBm 801.11b: 16 dBm
<b>Modulation Technique</b>	801.11a: OFDM 801.11b: DSSS (CCK; DQPSK; DBPSK)
<b>Transmitting Speed</b>	801.11a: 54 Mbps 801.11b: 11, 5, 5, 2, 1 Mbps
<b>Number of Channels</b>	801.11a: Up to 8 non-overlapping Channels 801.11b: Up to 14 Channels
<b>Antenna Designation</b>	Two types (PIFA / PCB antenna) Embedded non-user changeable, two provided. Tx and Rx Diversity

*Note: This submittal(s) (test report) is intended for FCC ID: GKRWM3BAB32 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a DoC procedure.*

*Note: The 2.4GHz bands is applicable to this report; another band of operation (5.2 GHz) is documented in a separate report*



### **3. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with ANSI C63.4 (1992) and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and 15.407.

#### **3.1 EUT CONFIGURATION**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

#### **3.2 EUT EXERCISE**

The EUT (Wireless LAN module built in Notebook PC) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.247 under the FCC Rules Part 15 Subpart C. The composite system (Digital device) is compliance with the Subpart B is authorized under the DoC procedure.

#### **3.3 GENERAL TEST PROCEDURES**

##### **Conducted Emissions**

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-1992. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

##### **Radiated Emissions**

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-1992.

**3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS**

- (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 - 5.15
<sup>1</sup> 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

- (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.

**3.5 DESCRIPTION OF TEST MODES**

The EUT has been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Peak Output Power was tested for both Antenna ports J5 and J6. The port J5 is higher than J6. The other test items of worst case at Antenna port A.

Channel 1 (2412MHz), Channel 6 (2437MHz) and Channel 11 (2462MHz) with 11Mbps highest data rate are chosen for the final testing.



#### **4. INSTRUMENT CALIBRATION**

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.



## **5. FACILITIES AND ACCREDITATIONS**

### **5.1 FACILITIES**

All measurement facilities used to collect the measurement data are located at

- No. 81-1, Lane 210, Pa-de 2<sup>nd</sup> Road, Luchu Hsiang, Taoyuan Hsien, Taiwan
- No. 199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4-1992 and CISPR Publication 22.

### **5.2 EQUIPMENT**

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.








All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### **5.3 LABORATORY ACCREDITATIONS AND LISTING**

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200600-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: 93105 and 90471).



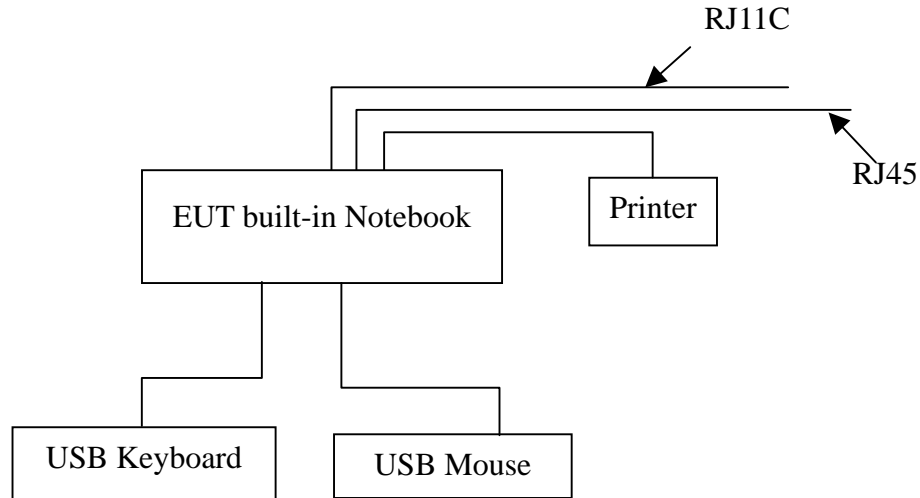
### 5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	EN 55011, EN 55014-1, AS/NZS 1044, CNS 13783-1, EN 55022, CNS 13438, EN 61000-3-2, EN 61000-3-3, ANSI C63.4, FCC OST/MP-5, AS/NZS 3548 IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11	 200600-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 93105, 90471
Japan	VCCI	4 3/10 meter Open Area Test Sites to perform conducted/radiated measurements	 R-393/1066/725/879 C-402/747/912
Norway	NEMKO	EN 50081-1/2, EN 50082-1/2, IEC 61000-6-1/2, EN 50091-2, EN 50130-4, EN 55011, EN 55013, EN 55014-1/2, EN 55015, EN 55022, EN 55024, EN 61000-3-2/3, EN 61326-1, IEC 61000-4-2/3/4/5/6/8/11, EN 60601-1-2, EN 300 328-2, EN 300 422-2, EN 301 419-1, EN 301 489-01/03/07/08/09/17, EN 301 419-2/3, EN 300 454-2, EN 301 357-2	 ELA 124a ELA 124b ELA 124c
Taiwan	CNLA	EN 300 328-1, EN 300 328-2, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS 3548, CNS 13022-1, IEC 1000-4-3/4/5/6/8/11, CNS 13022-2/3	 0363 ILAC MRA
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	 SL2-IS-E-0014 SL2-IN-E-0014 SL2-A1-E-0014 SL2-R1-E-0014 SL2-R2-E-0014 SL2-L1-E-0014
Canada	Industry Canada	RSS212, Issue 1	 IC 3991-3 IC 3991-4

\* No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.

## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1 SETUP CONFIGURATION OF EUT



### 6.2 SUPPORT EQUIPMENT

Device Type	Brand	Model	FCC ID	Series No.	Data Cable	Power Cord
USB Keyboard	Logitech	M-MM43	FCC DoC	LZE94052771	N/A	Unshielded, 1.8m
USB Mouse	Logitech	M-CAA43	FCC DoC	PHB02400489	N/A	Unshielded, 1.8m
Printer	HP	3137S01428	FCC DoC	DSI6XU2225	Unshielded, 1.8m	Unshielded, 1.8m

**Notes:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



## 7. FCC PART 15.247 REQUIREMENTS

### 7.1. BAND EDGES MEASUREMENT

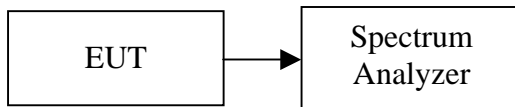
#### LIMIT

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	5386A	2704A1209	10/22/2004
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2004
Low loss cable	Huber + Suhner	Sucoflex 104	N/A	N/A

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

#### TEST RESULTS

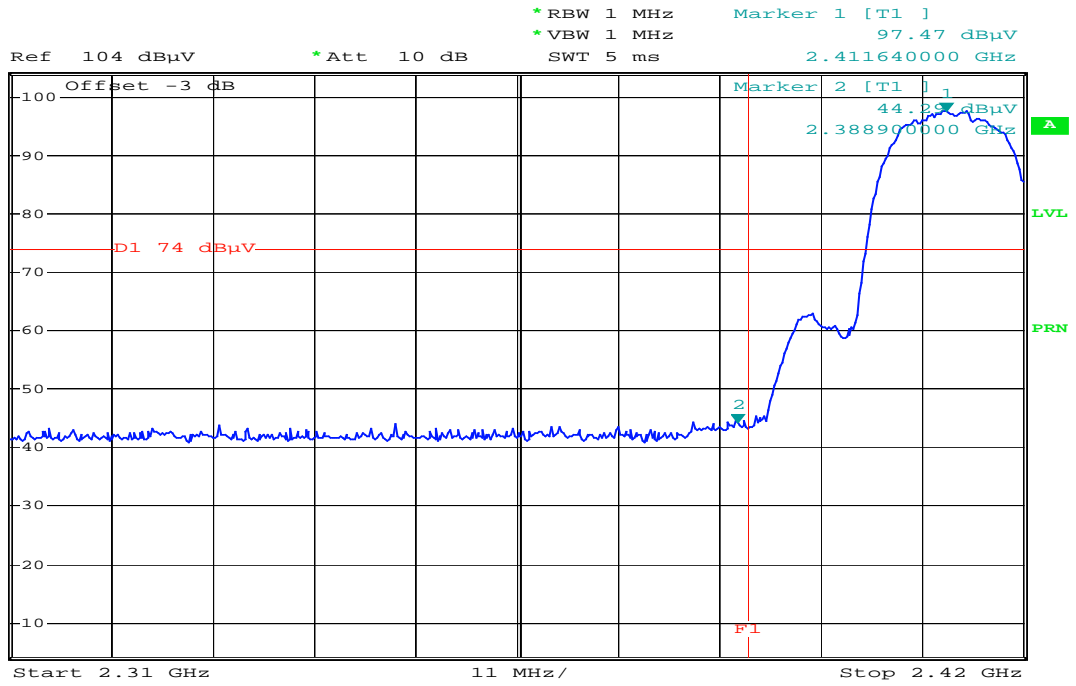
Refer to attach spectrum analyzer data chart.



### Band Edges (CH-Low)

Detector mode: Peak

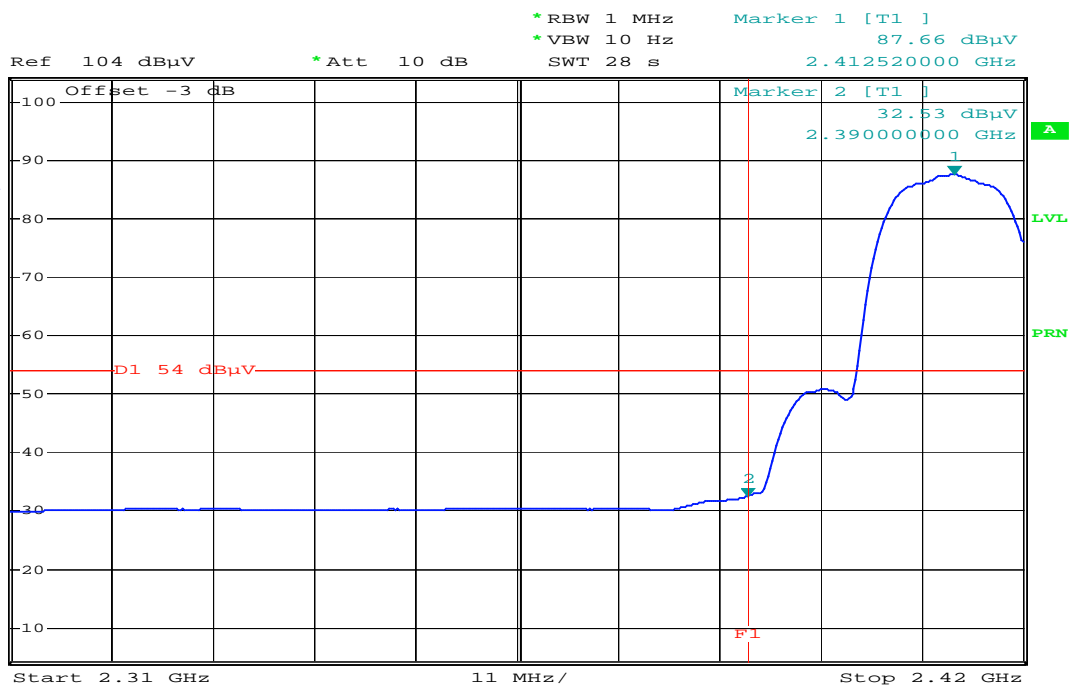
Polarity: Vertical



Date: 3.SEP.2003 17:31:36

Detector mode: Average

Polarity: Vertical



Date: 3.SEP.2003 17:30:41

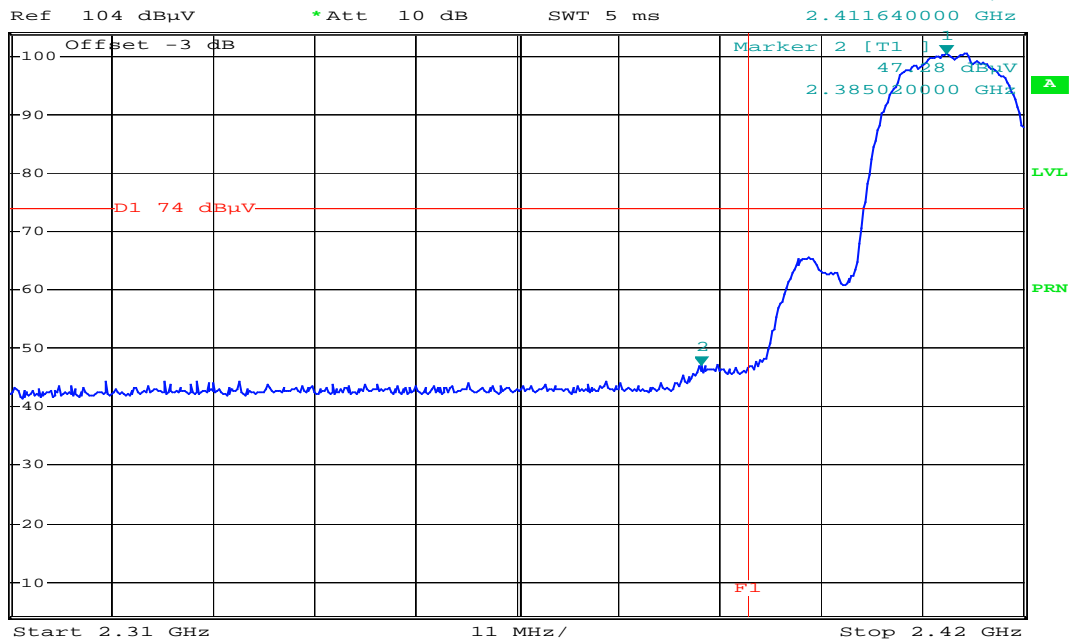


Detector mode: Peak

Polarity: Horizontal



\*RBW 1 MHz      Marker 1 [T1 ]  
\*VBW 1 MHz      100.33 dBμV  
SWT 5 ms      2.411640000 GHz



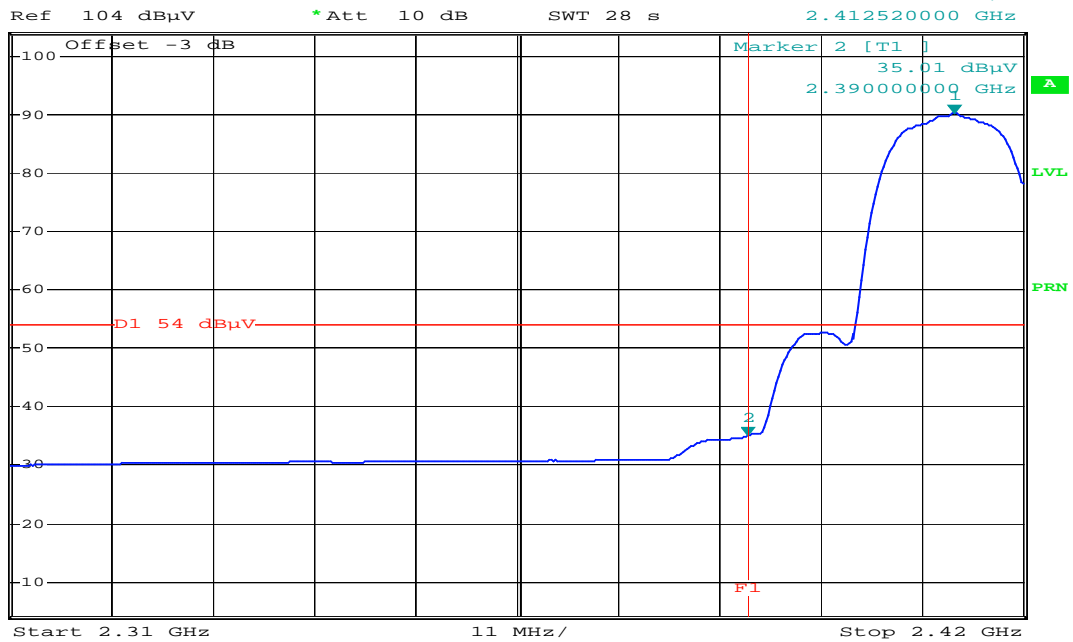
Date: 3.SEP.2003 17:26:09

Detector mode: Average

Polarity: Horizontal



\*RBW 1 MHz      Marker 1 [T1 ]  
\*VBW 10 Hz      90.19 dBμV  
SWT 28 s      2.412520000 GHz



Date: 3.SEP.2003 17:29:01



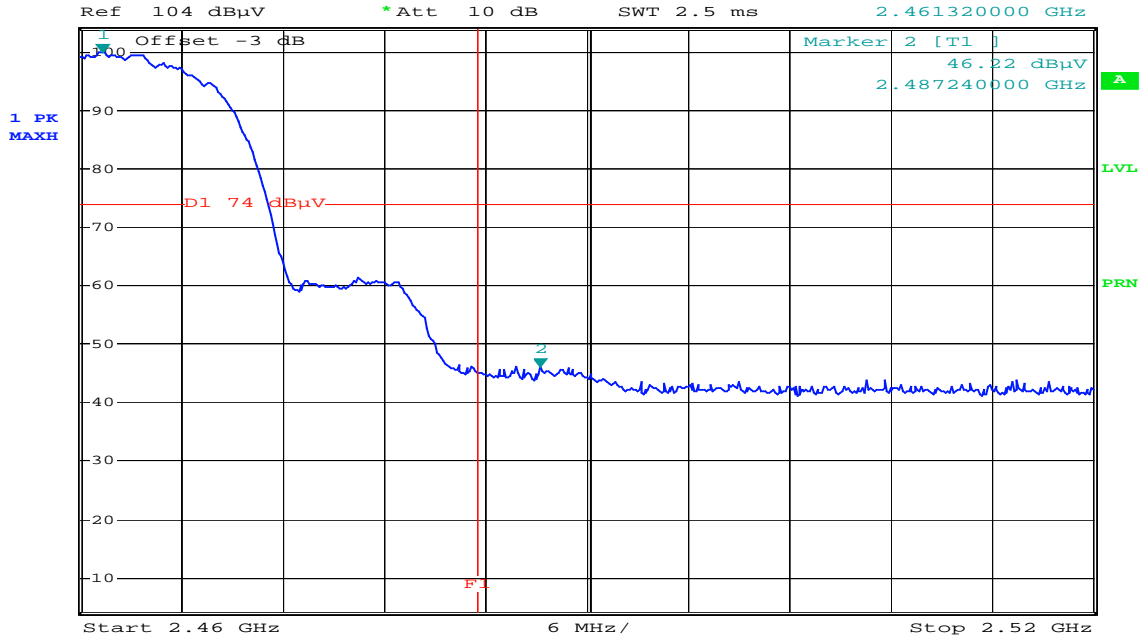
### Band Edges (CH-High)

Detector mode: Peak

Polarity: Vertical



\*RBW 1 MHz      Marker 1 [T1 ]  
\*VBW 1 MHz      99.93 dBμV  
SWT 2.5 ms      2.461320000 GHz



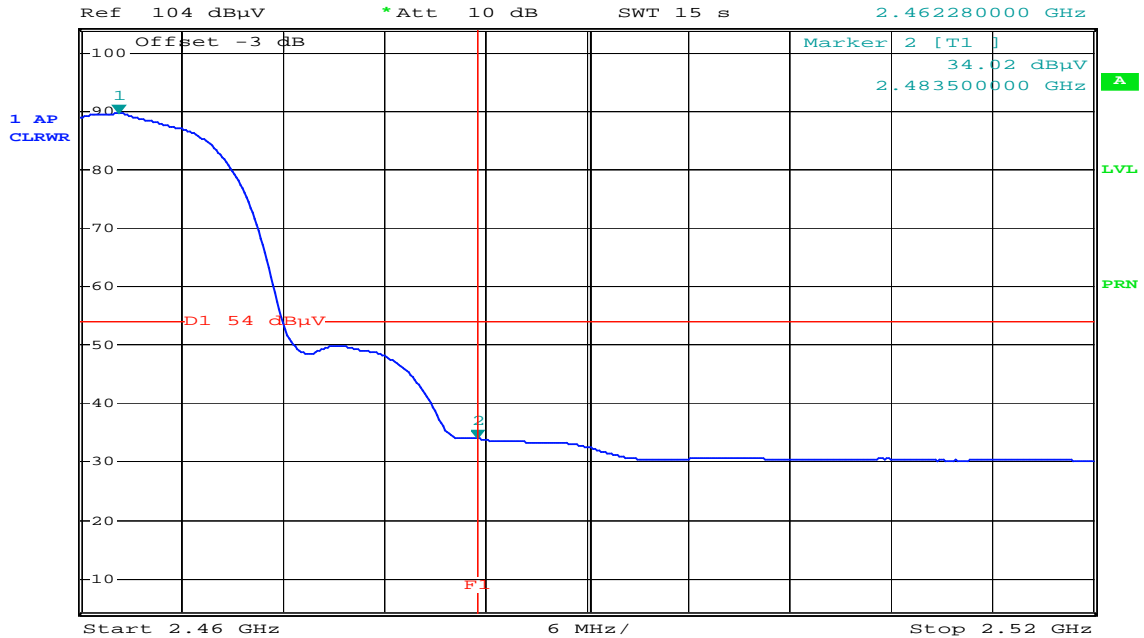
Date: 3.SEP.2003 17:35:19

Detector mode: Average

Polarity: Vertical



\*RBW 1 MHz      Marker 1 [T1 ]  
\*VBW 10 Hz      89.67 dBμV  
SWT 15 s      2.462280000 GHz

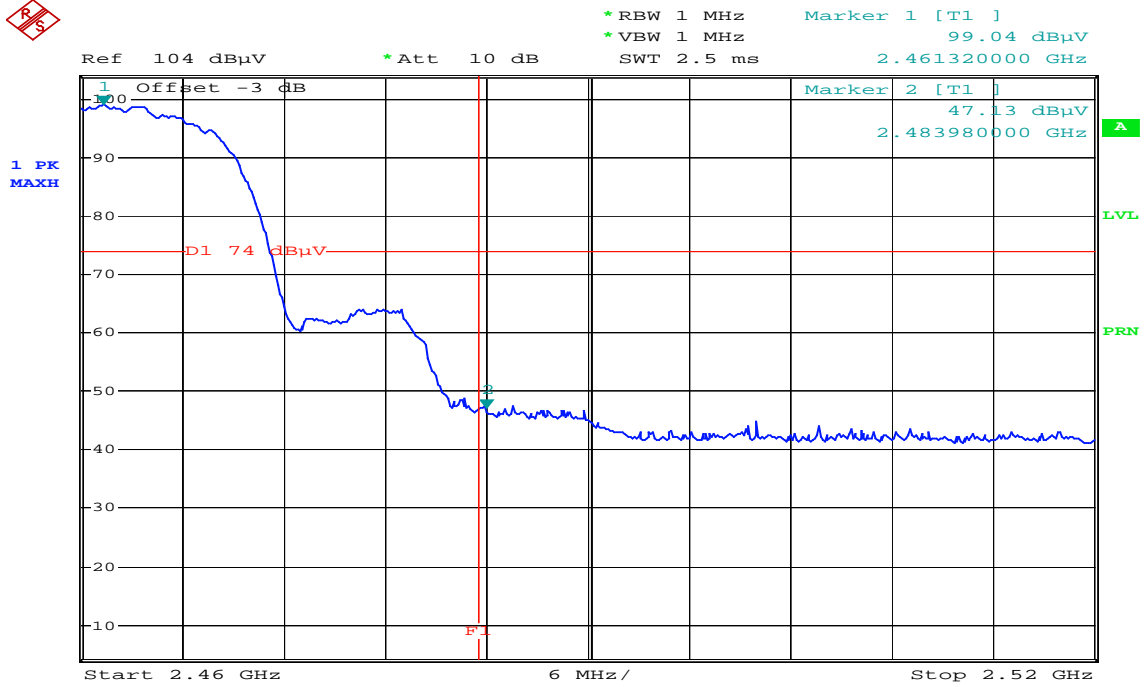


Date: 3.SEP.2003 17:36:33



Detector mode: Peak

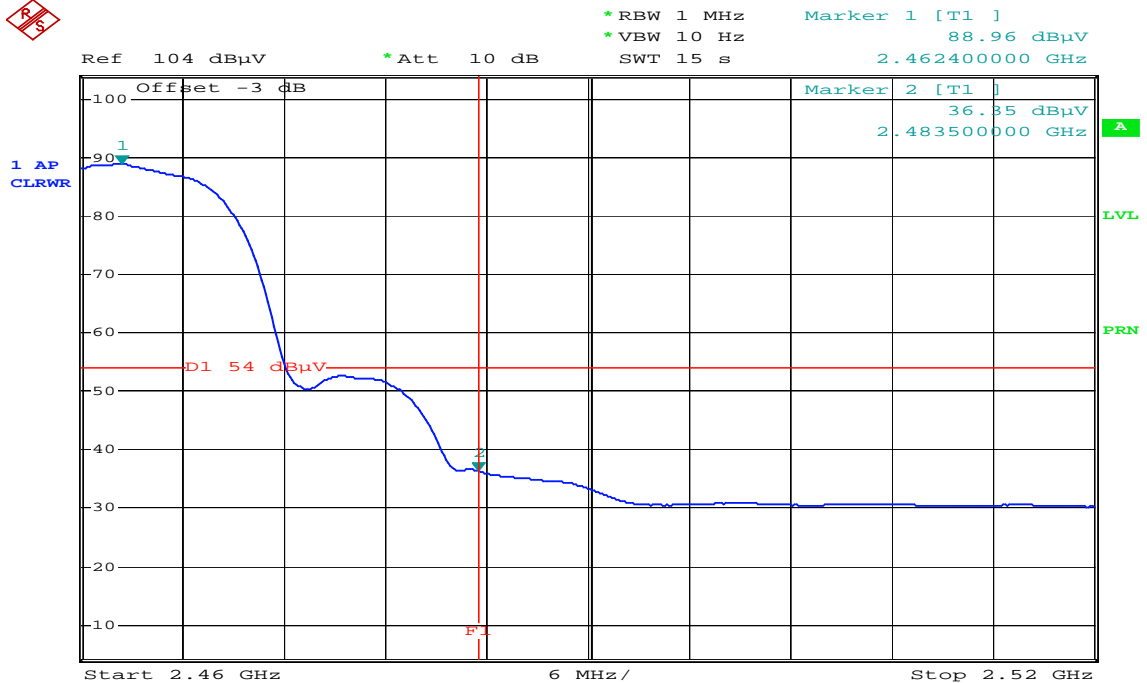
Polarity: Horizontal



Date: 3.SEP.2003 17:38:19

Detector mode: Average

Polarity: Horizontal



Date: 3.SEP.2003 17:37:22



## 7.2. 6DB BANDWIDTH

### LIMIT

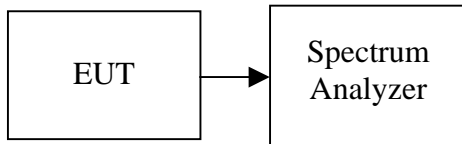
For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	5386A	2704A1209	11/15/2003
Low Loss RF Cable	Huber + Suhner	Sucoflex 104	N/A	N/A

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=100KHz, VBW = RBW, Span = 20MHz, Sweep = auto.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

### TEST RESULTS

*No non-compliance noted*

### TEST DATA

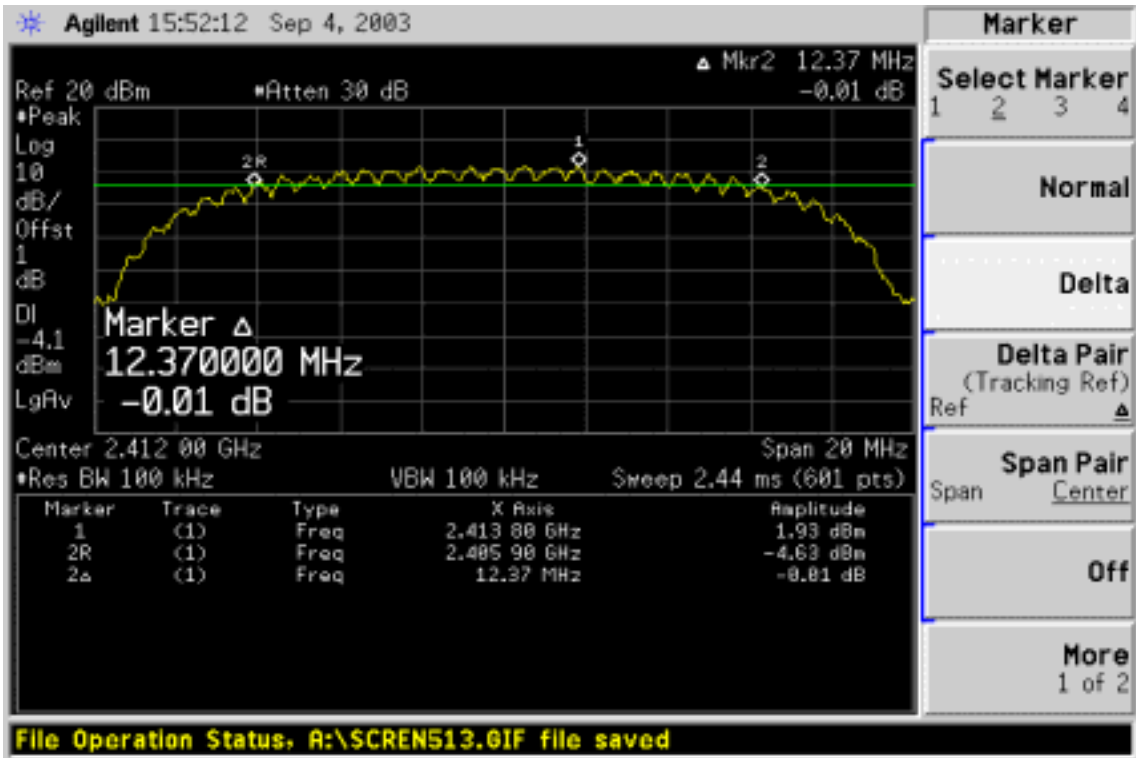
Channel	Frequency (MHz)	6dB BW (kHz)	Limit (kHz)	Margin (kHz)
Low	2412	12370	500	-11870
Mid	2437	12400	500	-11900
High	2462	12400	500	-11900



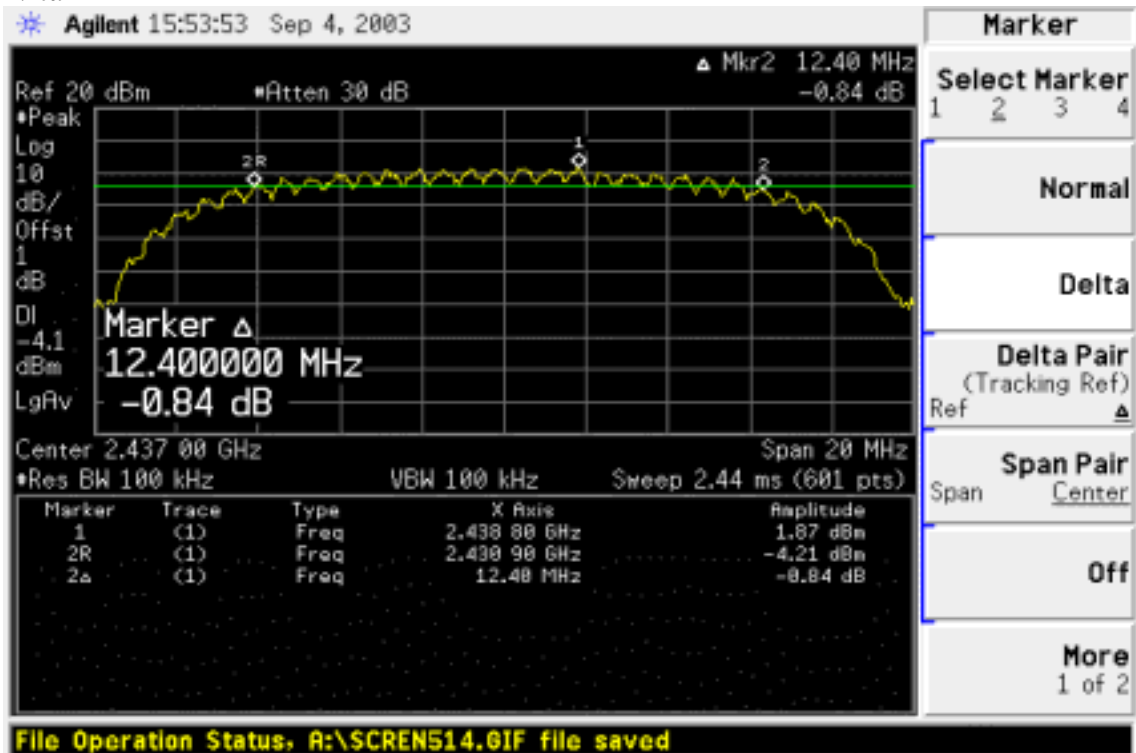


### Test Data Plot

#### Ch Low

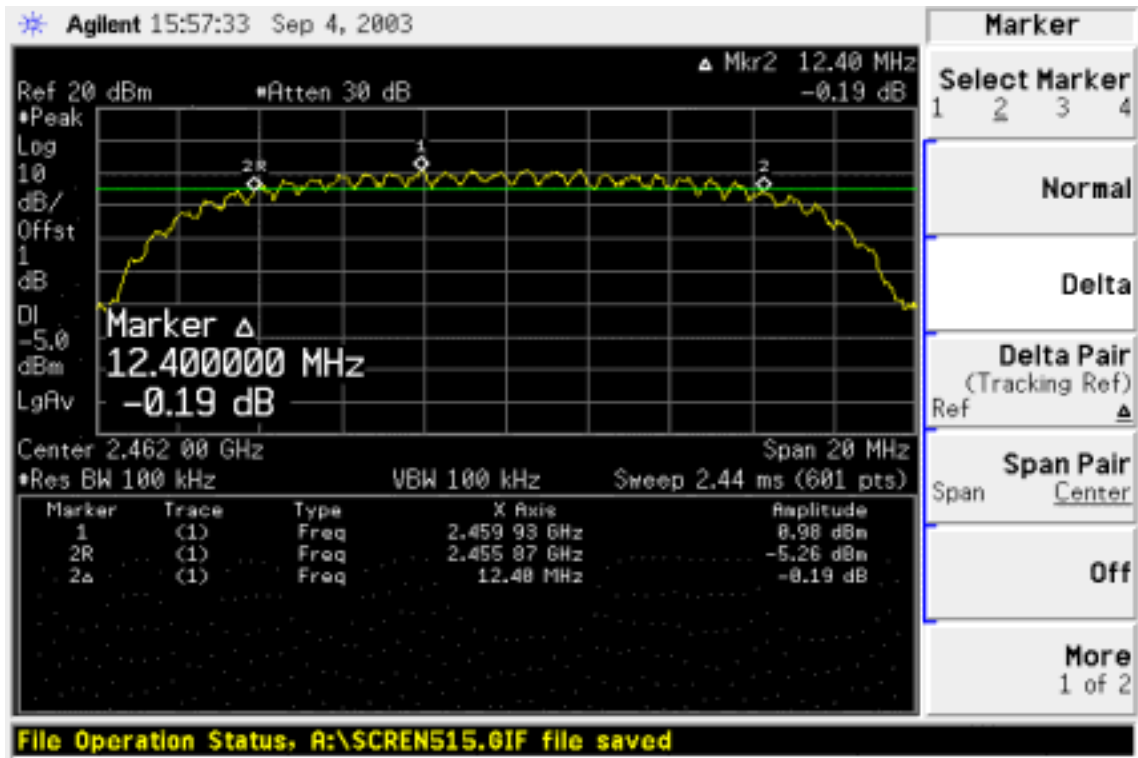


#### Ch Mid





Ch High





### 7.3. PEAK POWER

#### LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	5386A	2704A1209	10/22/2004
Low Loss Cable	Huber + Suhner	Sucoflex 104	N/A	N/A

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=1MHz, VBW = 3MHz, Span = 27MHz, Sweep = auto.
4. Select the frequency to be investigate and measure the peak power by the pre-define function in the spectrum analyzer.
5. Repeat until all the rest channels are investigated.

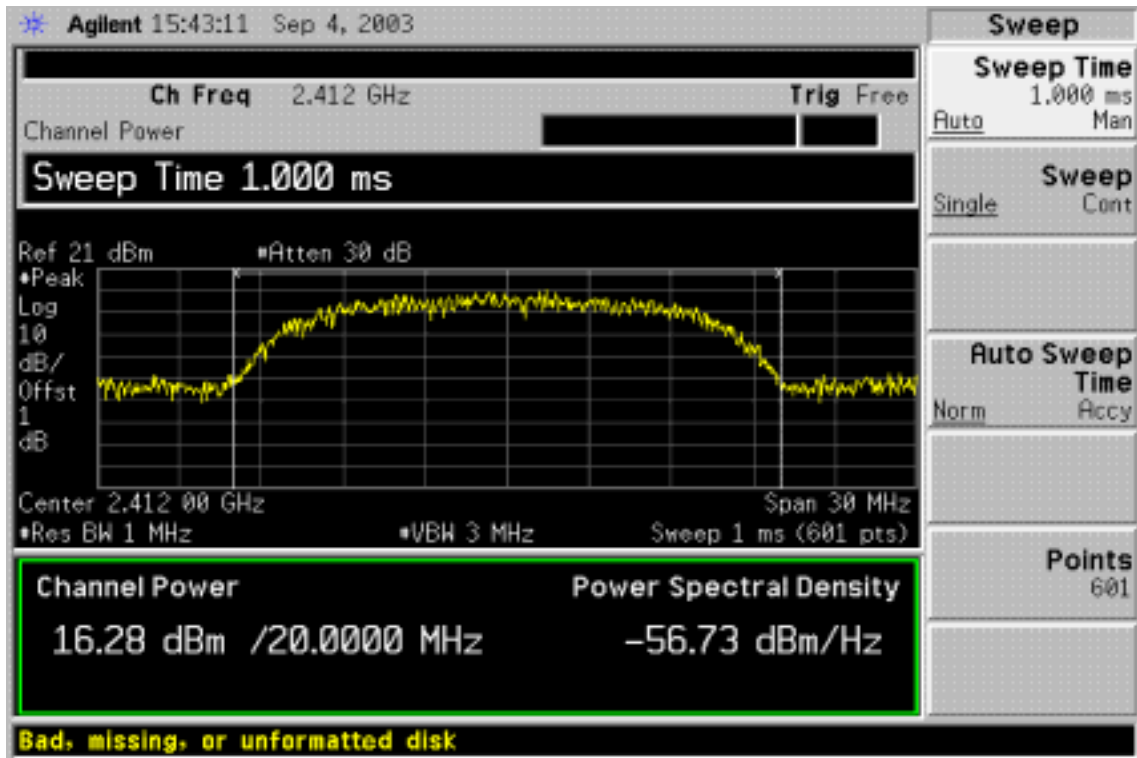
#### TEST RESULTS

Channel	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	15.28	1.00	16.28	0.04246	1	PASS
Mid	15.26	1.00	16.26	0.04227	1	PASS
High	14.68	1.00	15.68	0.03698	1	PASS

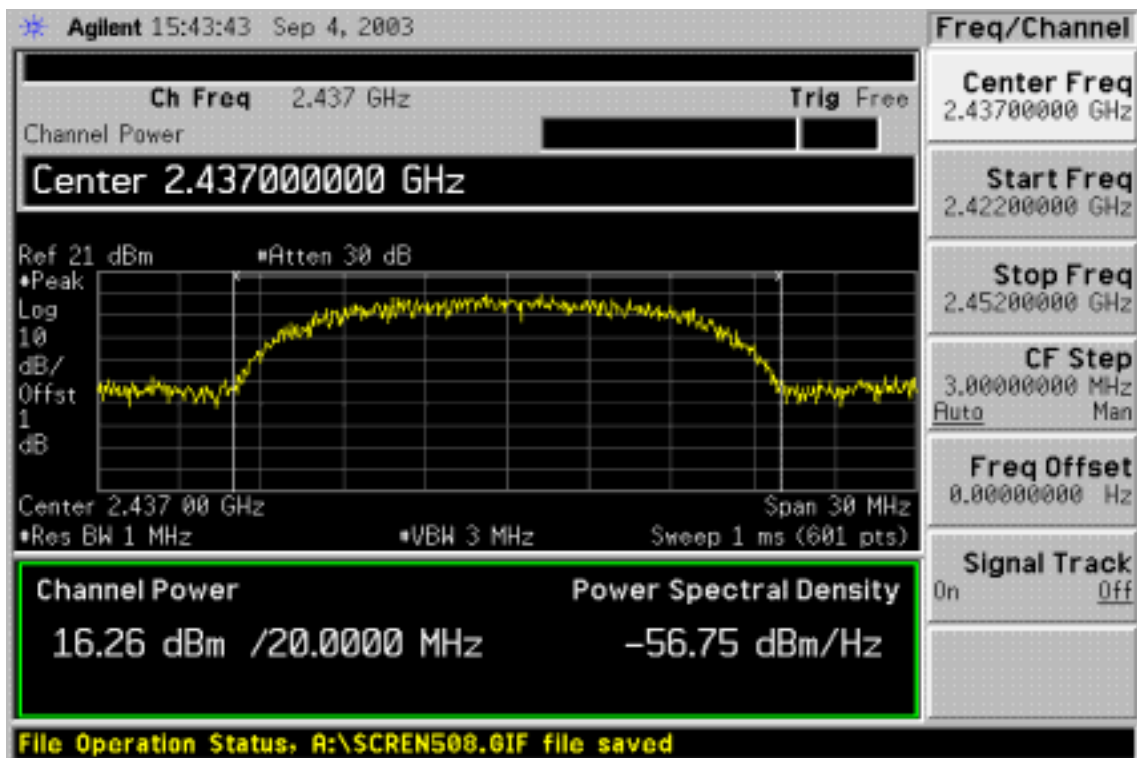
*No non-compliance noted*



*Ch Low*

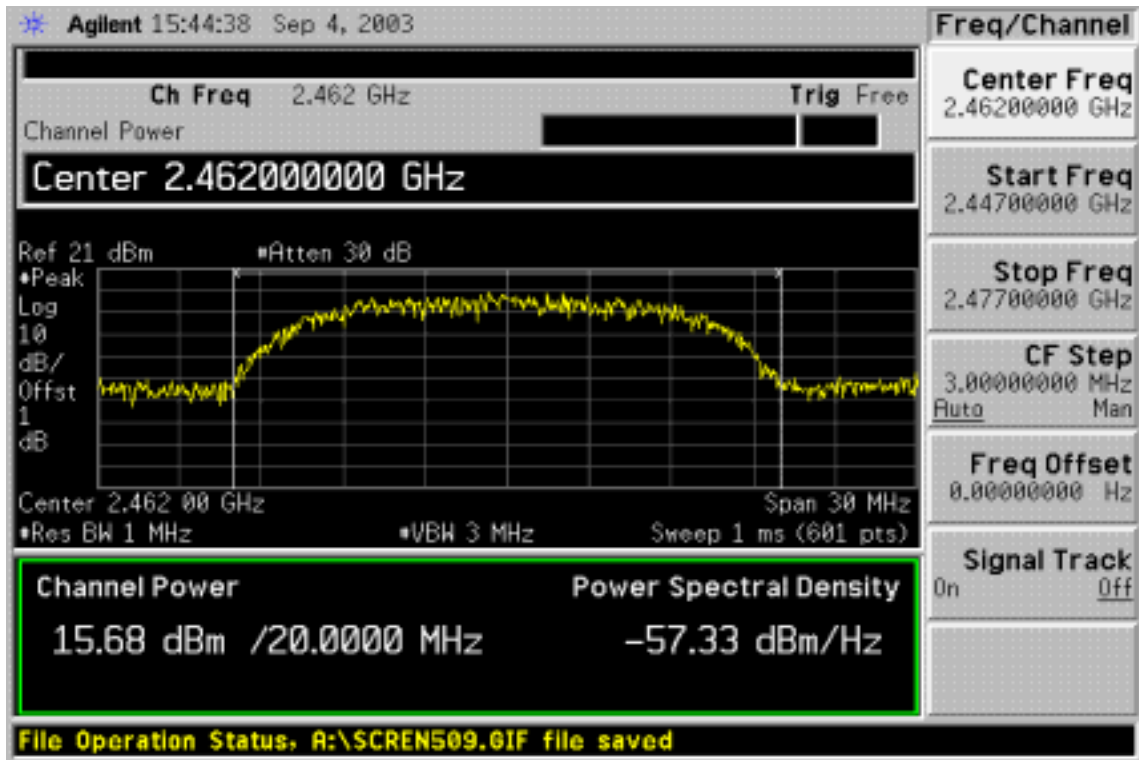


*Ch Mid*





*Ch High*





## 7.4. PEAK POWER SPECTRAL DENSITY

### LIMIT

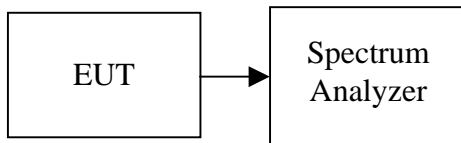
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	5386A	2704A1209	11/15/2003
Low Loss Cable	Huber + Suhner	Sucoflex 104	N/A	N/A

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3KHz, VBW = 3KHz, Span = 300KHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are complete.

### TEST RESULTS

No non-compliance noted

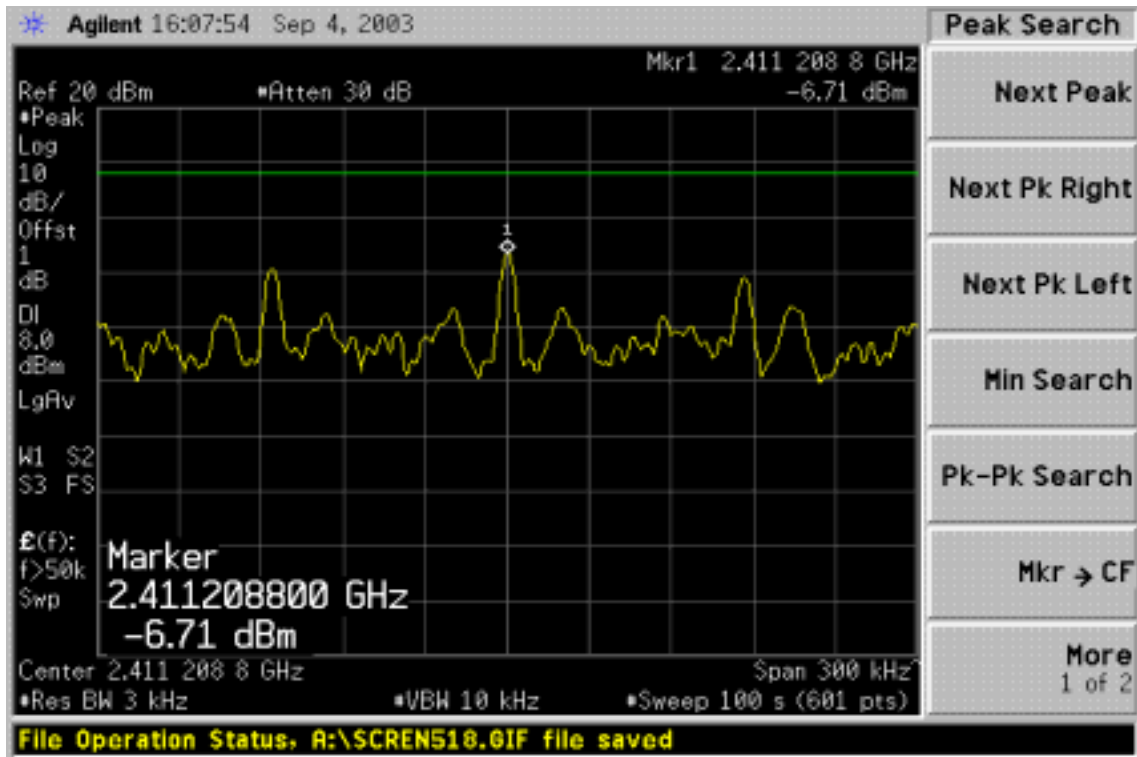
### TEST DATA

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412.00	-6.71	8.00	-14.71
Mid	2437.00	-6.70	8.00	-14.70
High	2462.00	-7.11	8.00	-15.11

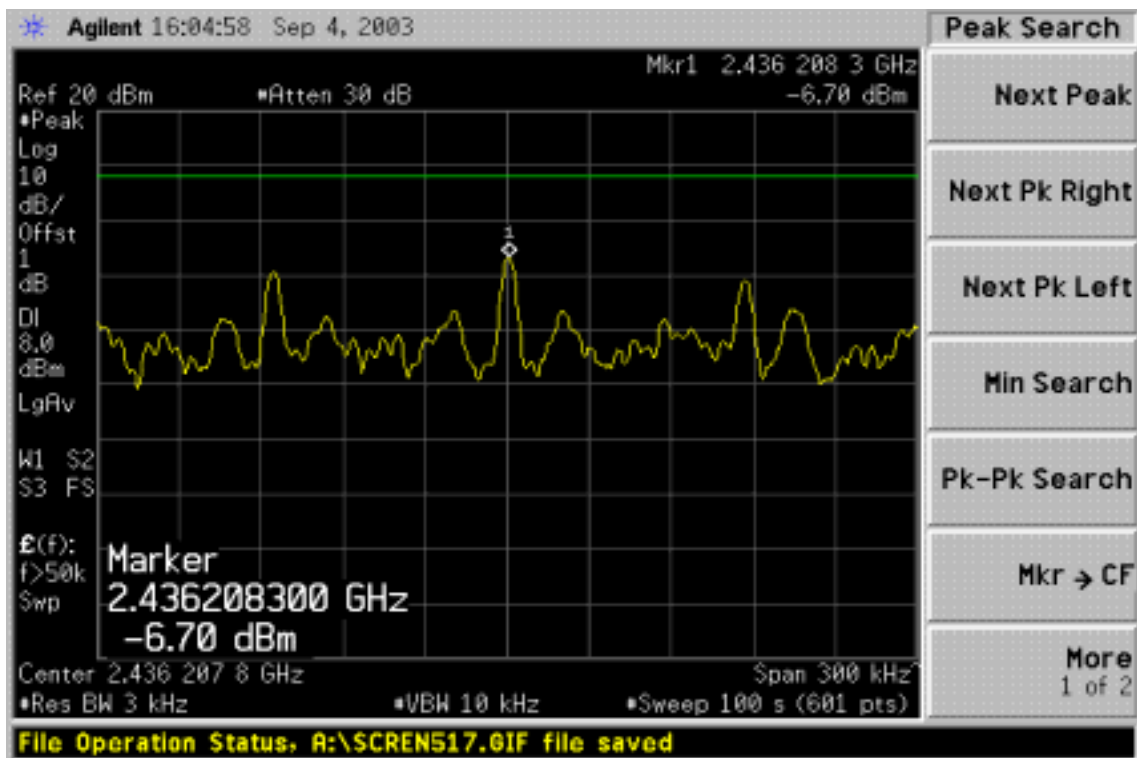


## TEST DATA PLOT

### Ch-Low

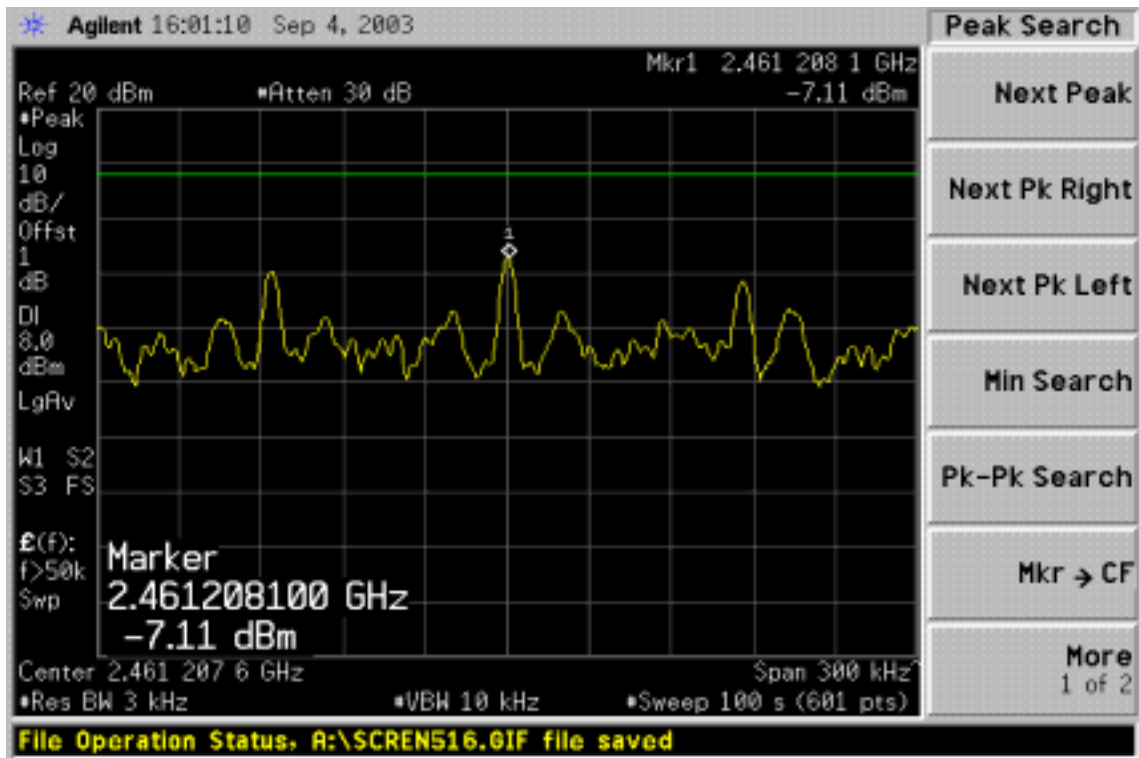


### Ch-Mid





*Ch-High*







## 7.5. RADIO FREQUENCY EXPOSURE

### LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §15.247(b)(4) and §1.1307(b)(1) of this chapter.

### EUT Specification

<b>EUT</b>	Wireless LAN module built in Notebook PC
<b>Frequency band (Operating)</b>	<input checked="" type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input checked="" type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5825GHz <input type="checkbox"/> Others _____
<b>Device category</b>	<input checked="" type="checkbox"/> Portable (<20cm separation) <input type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____
<b>Exposure classification</b>	<input type="checkbox"/> Occupational/Controlled exposure ( $S = 5mW/cm^2$ ) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ( $S = 1mW/cm^2$ )
<b>Antenna diversity</b>	<input type="checkbox"/> Single antenna <input checked="" type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input checked="" type="checkbox"/> Tx/Rx diversity
<b>Max. output power</b>	16.28 dBm (42.46mW)
<b>Antenna gain (Max)</b>	2.73 dBi (Numeric gain: 1.875)
<b>Evaluation applied</b>	<input type="checkbox"/> MPE Evaluation <input checked="" type="checkbox"/> SAR Evaluation*
<p><i>Note:</i></p> <ol style="list-style-type: none"> <li><i>*The maximum output power is 16.28dBm(42.46mW) at 2402MHz, which is greater than general population low threshold <math>60/F</math> (<math>60/2.437=24.62mW</math>). SAR is required.</i></li> <li><i>For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.</i></li> </ol>	

### TEST RESULTS

*Note: Please refer to the separate SAR report.*



## 7.6. RADIATED EMISSIONS

### LIMIT

1. 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 (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

*Note: 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.*

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength ( $\mu$ V/m at 3-meter)	Field Strength (dB $\mu$ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

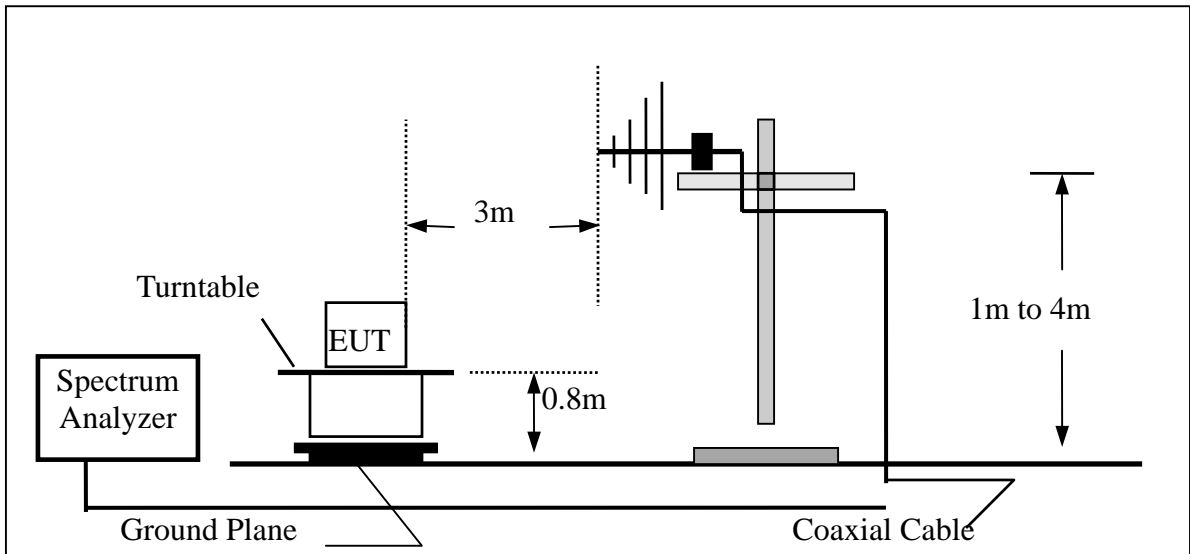
### MEASUREMENT EQUIPMENT USED

Open Area Test Site # 3				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	ADVANTEST	R3261A	N/A	03/18/2004
EMI Test Receiver	R&S	ESVS20	838804/004	01/04/2004
Pre-Amplifier	HP	8447D	2944A09173	03/03/2004
Bilog Antenna	SCHWAZBECK	VULB9163	145	07/05/2004
Turn Table	EMCO	2081-1.21	9709-1885	N.C.R
Antenna Tower	EMCO	2075-2	9707-2060	N.C.R
Controller	EMCO	2090	9709-1256	N.C.R
RF Switch	ANRITSU	MP59B	M53867	N.C.R
Site NSA	C&C	N/A	N/A	09/06/2004
Horn antenna	Schwarzbeck	BBHA 9120	D210	2/23/2004
Loop Antenna	EMCO	6502	2356	7/10/2004
Pre-Amplifier	HP	8449B	3008B00965	10/02/2003

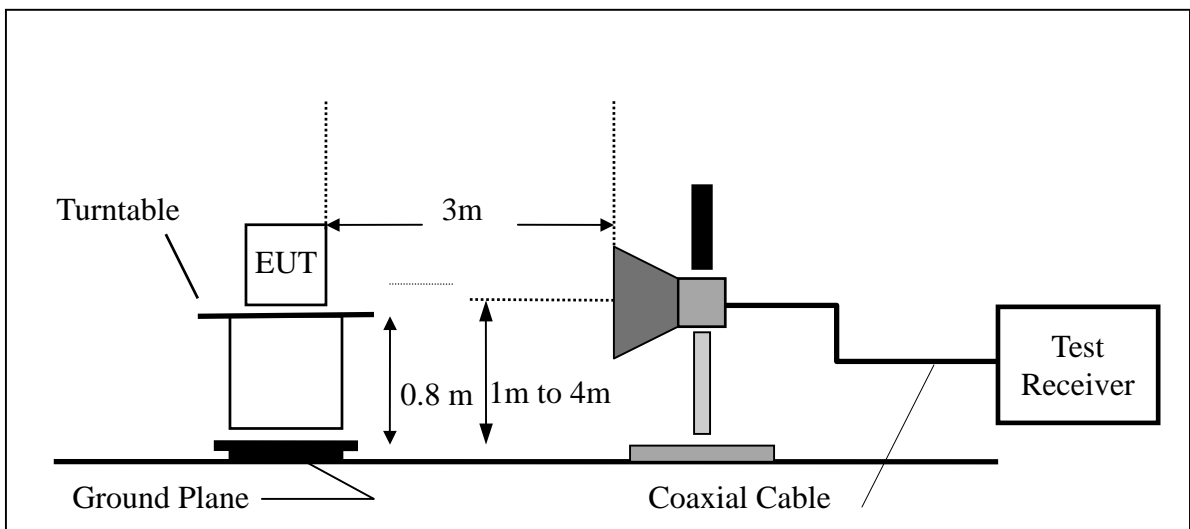
**Remark:** Each piece of equipment is scheduled for calibration once a year.

## TEST CONFIGURATION

### For Frequencies Below 1 GHz



### For Frequencies Above 1 GHz





## **TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

**TEST RESULTS****For Frequency Below 1 GHz****Operation Mode:** Tx CH Low Mode**Test Date:** September 3, 2003**Temperature:** 20°C**Tested by:** Devin**Humidity:** 70 % RH**Polarity:** Ver. / Hor.

<b>Freq. (MHz)</b>	<b>Ant.Pol. H/V</b>	<b>Detector Mode (PK/QP)</b>	<b>Reading (dBuV)</b>	<b>Factor (dB)</b>	<b>Actual FS (dBuV/m)</b>	<b>Limit 3m (dBuV/m)</b>	<b>Safe Margin (dB)</b>
300.00	V	Peak	13.34	16.68	30.02	46.00	-15.98
399.40	V	Peak	9.88	20.69	30.57	46.00	-15.43
489.00	V	Peak	17.90	22.00	39.90	46.00	-6.10
503.00	V	Peak	18.59	22.62	41.21	46.00	-4.79
664.00	V	Peak	5.84	25.13	30.97	46.00	-15.03
799.80	V	Peak	5.23	26.14	31.37	46.00	-14.63
400.80	H	Peak	7.35	20.71	28.06	46.00	-17.94
498.80	H	Peak	13.53	22.45	35.98	46.00	-10.02
664.00	H	Peak	7.30	25.13	32.43	46.00	-13.57
799.80	H	Peak	4.57	26.14	30.71	46.00	-15.29
867.00	H	Peak	3.02	27.58	30.60	46.00	-15.40
899.20	H	Peak	2.70	28.14	30.84	46.00	-15.16

**Notes:**

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.*
3. *Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.*

**Operation Mode:** Tx CH Mid Mode**Test Date:** September 3, 2003**Temperature:** 20°C**Tested by:** Devin**Humidity:** 70 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
399.40	V	Peak	11.26	20.69	31.95	46.00	-14.05
498.00	V	Peak	18.25	22.00	40.25	46.00	-5.75
501.60	V	Peak	18.55	22.57	41.12	46.00	-4.88
666.80	V	Peak	5.83	25.18	31.01	46.00	-14.99
799.80	V	Peak	3.17	26.14	29.31	46.00	-16.69
899.20	V	Peak	0.95	28.14	29.09	46.00	-16.91
300.00	H	Peak	12.53	16.68	29.21	46.00	-16.79
498.80	H	Peak	13.01	22.45	35.46	46.00	-10.54
666.80	H	Peak	7.37	25.18	32.55	46.00	-13.45
799.80	H	Peak	4.82	26.14	30.96	46.00	-15.04
867.00	H	Peak	2.66	27.58	30.24	46.00	-15.76
899.20	H	Peak	1.74	28.14	29.88	46.00	-16.12

**Notes:**

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.
3. Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

**Operation Mode:** Tx CH High Mode**Test Date:** September 3, 2003**Temperature:** 20°C**Tested by:** Devin**Humidity:** 70 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
399.40	V	Peak	11.13	20.69	31.82	46.00	-14.18
489.00	V	Peak	17.24	22.00	39.24	46.00	-6.76
503.00	V	Peak	18.31	22.62	40.93	46.00	-5.07
664.00	V	Peak	5.66	25.13	30.79	46.00	-15.21
799.80	V	Peak	3.39	26.14	29.53	46.00	-16.47
899.20	V	Peak	1.64	28.14	29.78	46.00	-16.22
399.40	H	Peak	7.68	20.69	28.37	46.00	-17.63
498.80	H	Peak	13.02	22.45	35.47	46.00	-10.53
664.00	H	Peak	8.10	25.13	33.23	46.00	-12.77
799.80	H	Peak	6.34	26.14	32.48	46.00	-13.52
867.00	H	Peak	2.84	27.58	30.42	46.00	-15.58
899.20	H	Peak	1.69	28.14	29.83	46.00	-16.17

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms

**For Frequency Above 1 GHz**

**Operation Mode:** Tx CH Low Mode                      **Test Date:** September 4, 2003  
**Temperature:** 20°C    **Tested by:** Devin  
**Humidity:** 70 % RH    **Polarity:** Ver.

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1328.00	46.00	---	-8.55	37.45	---	74.00	54.00	-16.55	Peak
1396.00	45.20	---	-8.28	36.92	---	74.00	54.00	-17.08	Peak
1464.00	45.85	---	-7.84	38.01	---	74.00	54.00	-15.99	Peak
4824.00	--	--	--	--	--	74.00	54.00	--	--
7236.00	--	--	--	--	--	74.00	54.00	--	--
9648.00	--	--	--	--	--	74.00	54.00	--	--
12060.00	--	--	--	--	--	74.00	54.00	--	--
14472.00	--	--	--	--	--	74.00	54.00	--	--
16884.00	--	--	--	--	--	74.00	54.00	--	--
19296.00	--	--	--	--	--	74.00	54.00	--	--
21708.00	--	--	--	--	--	74.00	54.00	--	--
24120.00	--	--	--	--	--	74.00	54.00	--	--

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms





**Operation Mode:** Tx CH Low Mode                      **Test Date:** September 4, 2003  
**Temperature:** 20°C    **Tested by:** Devin  
**Humidity:** 70 % RH    **Polarity:** Hor.

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1332.00	45.35	---	-8.53	36.82	---	74.00	54.00	-17.18	Peak
1596.00	46.96	---	-6.82	40.14	---	74.00	54.00	-13.86	Peak
4824.00	--	--	--	--	--	74.00	54.00	--	--
7236.00	--	--	--	--	--	74.00	54.00	--	--
9648.00	--	--	--	--	--	74.00	54.00	--	--
12060.00	--	--	--	--	--	74.00	54.00	--	--
14472.00	--	--	--	--	--	74.00	54.00	--	--
16884.00	--	--	--	--	--	74.00	54.00	--	--
19296.00	--	--	--	--	--	74.00	54.00	--	--
21708.00	--	--	--	--	--	74.00	54.00	--	--
24120.00	--	--	--	--	--	74.00	54.00	--	--

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms



**Operation Mode:** Tx CH Mid Mode      **Test Date:** September 4, 2003  
**Temperature:** 20°C      **Tested by:** Devin  
**Humidity:** 70 % RH      **Polarity:** Ver.

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1328.00	45.76	---	-8.55	37.21	---	74.00	54.00	-16.79	Peak
1396.00	45.33	---	-8.28	37.05	---	74.00	54.00	-16.95	Peak
1592.00	44.61	---	-6.85	37.76	---	74.00	54.00	-16.24	Peak
1748.00	47.95	---	-6.00	41.95	---	74.00	54.00	-12.05	Peak
4874.00	--	--	--	--	--	74.00	54.00	--	--
7311.00	--	--	--	--	--	74.00	54.00	--	--
9748.00	--	--	--	--	--	74.00	54.00	--	--
12185.00	--	--	--	--	--	74.00	54.00	--	--
14622.00	--	--	--	--	--	74.00	54.00	--	--
17059.00	--	--	--	--	--	74.00	54.00	--	--
19496.00	--	--	--	--	--	74.00	54.00	--	--
21933.00	--	--	--	--	--	74.00	54.00	--	--
24370.00	--	--	--	--	--	74.00	54.00	--	--

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms



**Operation Mode:** Tx CH Mid Mode                      **Test Date:** September 4, 2003  
**Temperature:** 20°C    **Tested by:** Devin  
**Humidity:** 70 % RH    **Polarity:** Hor.

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1332.00	45.16	---	-8.53	36.63	---	74.00	54.00	-17.37	Peak
1600.00	43.68	---	-6.79	36.89	---	74.00	54.00	-17.11	Peak
4874.00	--	--	--	--	--	74.00	54.00	--	--
7311.00	--	--	--	--	--	74.00	54.00	--	--
9748.00	--	--	--	--	--	74.00	54.00	--	--
12185.00	--	--	--	--	--	74.00	54.00	--	--
14622.00	--	--	--	--	--	74.00	54.00	--	--
17059.00	--	--	--	--	--	74.00	54.00	--	--
19496.00	--	--	--	--	--	74.00	54.00	--	--
21933.00	--	--	--	--	--	74.00	54.00	--	--
24370.00	--	--	--	--	--	74.00	54.00	--	--

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms



**Operation Mode:** Tx CH High Mode      **Test Date:** September 4, 2003  
**Temperature:** 20°C      **Tested by:** Devin  
**Humidity:** 70 % RH      **Polarity:** Ver.

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1328.00	45.28	---	-8.55	36.73	---	74.00	54.00	-17.27	Peak
1396.00	45.74	---	-8.28	37.46	---	74.00	54.00	-16.54	Peak
1428.00	45.45	---	-8.08	37.37	---	74.00	54.00	-16.63	Peak
4924.00	--	--	--	--	--	74.00	54.00	--	--
7386.00	--	--	--	--	--	74.00	54.00	--	--
9848.00	--	--	--	--	--	74.00	54.00	--	--
12310.00	--	--	--	--	--	74.00	54.00	--	--
14772.00	--	--	--	--	--	74.00	54.00	--	--
17234.00	--	--	--	--	--	74.00	54.00	--	--
19696.00	--	--	--	--	--	74.00	54.00	--	--
22158.00	--	--	--	--	--	74.00	54.00	--	--
24620.00	--	--	--	--	--	74.00	54.00	--	--

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms



**Operation Mode:** Tx CH High Mode      **Test Date:** September 4, 2003  
**Temperature:** 20°C      **Tested by:** Devin  
**Humidity:** 70 % RH      **Polarity:** Hor.

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
1332.00	45.35	---	-8.53	36.82	---	74.00	54.00	-17.18	Peak
1596.00	46.96	---	-6.82	40.14	---	74.00	54.00	-13.86	Peak
4924.00	--	--	--	--	--	74.00	54.00	--	--
7386.00	--	--	--	--	--	74.00	54.00	--	--
9848.00	--	--	--	--	--	74.00	54.00	--	--
12310.00	--	--	--	--	--	74.00	54.00	--	--
14772.00	--	--	--	--	--	74.00	54.00	--	--
17234.00	--	--	--	--	--	74.00	54.00	--	--
19696.00	--	--	--	--	--	74.00	54.00	--	--
22158.00	--	--	--	--	--	74.00	54.00	--	--
24620.00	--	--	--	--	--	74.00	54.00	--	--

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Data of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
5. Spectrum AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms



## 7.7. POWERLINE CONDUCTED EMISSIONS

### LIMIT

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB $\mu$ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (*Live Line* and *Neutral Line*) and ground at the power terminals.

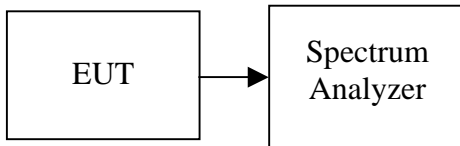
### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	847793/012	12/20/2003
LISN	R&S	ESH2-Z5	843285/010	12/15/2003
LISN	EMCO	3825/2	9003-1628	07/25/2004
Spectrum Analyzer	ADVANTEST	R3261A	91720031	N/A
2X2 WIRE ISN	R&S	ENY22	100020	06/19/2004
FOUR WIRE ISN	R&S	ENY41	100006	06/19/2004

**Remark:** Each piece of equipment is scheduled for calibration once a year.



### **Test Configuration**



1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-1992.
2. The EUT was plug-in the host PC via USB port. The host PC system was placed on the center of the back edge on the test table. The peripherals like modem, monitor printer, K/B, and mouse were placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The keyboard was placed directly in the front of the monitor, flushed with the front tabletop. The mouse was placed next to the Keyboard, flushed with the back of keyboard.
4. The spacing between the peripherals was 10 centimeters.
5. External I/O cables were draped along the edge of the test table and bundle when necessary.
6. The host PC system was connected with 110Vac/60Hz power source.

*The EUT is set to transmit in a continuous mode.*

### **TEST PROCEDURE**

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.



## TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

**Operation Mode:** Tx + Rx mode                      **Test Date:** September 3, 2003  
**Temperature:** 28°C                                      **Tested by:** Devin  
**Humidity:** 62 % RH

FREQ MHz	P.K. Raw dBuV	Q.P. Raw dBuV	AVG Raw dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.152	69.00	55.60	38.00	65.89	55.89	-10.29	-17.89	L1
0.225	58.80	46.40	23.80	62.63	52.63	-16.23	-28.83	L1
0.301	52.20	39.80	17.80	60.22	50.22	-20.42	-32.42	L1
0.365	48.80	35.80	15.50	58.61	48.61	-22.81	-33.11	L1
0.438	44.40	---	---	57.10	47.10	---	---	L1
0.562	43.40	---	---	56.00	46.00	---	---	L1
0.174	68.60	53.70	31.80	64.77	54.77	-11.07	-22.97	L2
0.235	57.00	45.20	23.80	62.27	52.27	-17.07	-28.47	L2
0.361	51.40	37.80	18.10	58.71	48.71	-20.91	-30.61	L2
0.462	46.40	33.10	14.20	56.66	46.66	-23.56	-32.46	L2
0.505	43.80	---	---	56.00	46.00	---	---	L2
0.575	41.20	---	---	56.00	46.00	---	---	L2

**Note:**

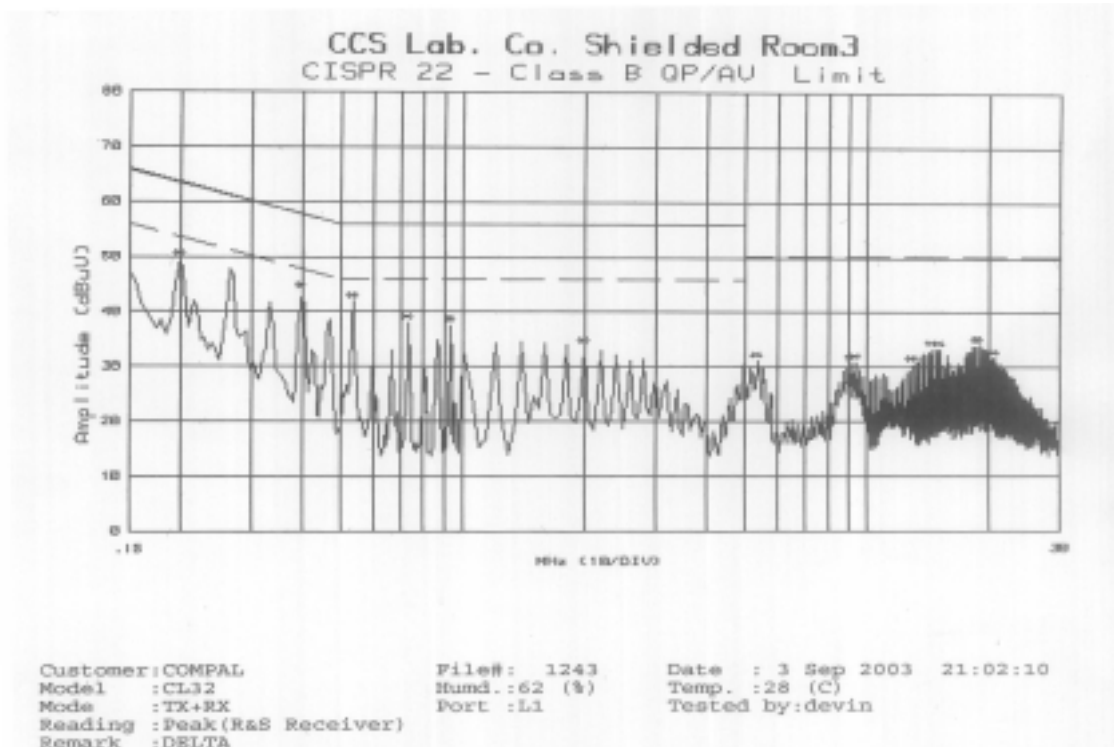
1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-Peak detector and Average detector.
3. “---” denotes the emission level was or more than 2dB below the Average limit
4. The IF bandwidth of SPA between 0.15MHz to 30MHz was 10KHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9KHz;
5. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)





## TEST DATA PLOTS

### *Conducted emissions (Line 1)*



### *Conducted emissions (Line 2)*

