Report No.: SZ080324B06-RP

## **FCC TEST REPORT**

for

802.11 b/g Mini-PCI Card

**MODEL: WLANTPBGV2** 

Test Report Number: SZ080324B06-RP

Issued for

CHUNG NAM ELECTRONICS CO., LTD

12/F, Chung Nam Building, No. 1 Lockhart Road, Wanchai, Hong Kong

Issued by:

COMPLIANCE CERTIFICATION SERVICES (SHENZHEN) INC.
NO. 5, JINAO INDUSTRIAL PARK, NO. 35 JUKENG ROAD,
DASHUIKENG VILLAGE, GUANLAN TOWN, BAOAN
DISTRICT, SHENZHEN, CHINA

TEL: 86-755-28055000 FAX: 86-755-28055221 Issued Date: April 26, 2008



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## **Revision History**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 26, 2008	Initial Issue	ALL	Clinton Kao



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## 1 TEST CERTIFICATION

Product: 802.11 b/g Mini-PCI Card

Model: WLANTPBGV2

Brand: N/A

**Tested:** March 26-May 12, 2008

Applicant: CHUNG NAM ELECTRONICS CO., LTD

12/F, Chung Nam Building, No. 1 Lockhart Road, Wanchai, Hong Kong

Manufacturer: CHUNG NAM ELECTRONICS CO., LTD

12/F, Chung Nam Building, No. 1 Lockhart Road, Wanchai, Hong Kong

	APPLICABLE STANDARDS							
Standard	Test Type	Standard	Test Type					
15.207(a)	Power Line Conducted Emissions	15.247(d) 15.209(a)	<ul><li>Spurious Emissions</li><li>Conducted Measurement</li><li>Radiated Emissions</li></ul>					
15.247(a)(2)	6dB Bandwidth Measurement	15.247(b)(3) 15.247(b)(4)	Peak Power Measurement					
15.247(d)	Band Edges Measurement	15.247(e)	Peak Power Spectral Density					

DEVIATION FROM APPLICABLE STANDARD	
None	

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: 2003** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

Approved by:	Reviewed by:
Mente Las	Voncent Yao
Clinton Kao Manager	Vincent Yao Assistant manager
Compliance Certification Service Inc.	Compliance Certification Service Inc.

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## 2 TEST RESULT SUMMARY

	APPLICABLE STANDARDS							
Standard	Test Type	Result	Remark					
15.247(a)(2)	6dB Bandwidth Measurement	Pass	Meet the requirement of limit.					
15.247(b)(3) 15.247(b)(4)	Peak Power Measurement	Pass	Meet the requirement of limit.					
15.247(d)	Band Edges Measurement	Pass	Meet the requirement of limit.					
15.247(e)	Peak Power Spectral Density	Pass	Meet the requirement of limit.					
15.247(d) 15.209(a)	<ul><li>Spurious Emissions</li><li>Conducted Measurement</li><li>Radiated Emissions</li></ul>	Pass	Meet the requirement of limit.					
15.207(a)	Power line Conducted Emissions	Pass	Meet the requirement of limit.					

Note: 1. The test result judgment is decided by the limit of test standard

2. The information of measurement uncertainty is available upon the customer's request.

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## **EUT DESCRIPTION**

Product	802.11 b/g Mini-PCI Card
Trade Name	N/A
Model Number	WLANTPBGV2
Model Discrepancy	N/A
Serial Number	N/A
Power Supply	Powered by Notebook
Frequency Range	IEEE 802.11b mode: 2412 ~ 2462 MHz IEEE 802.11g mode: 2412 ~ 2462 MHz
Transmit Power	IEEE 802.11b mode: 16.12dBm IEEE 802.11g mode: 12.22dBm
Modulation Technique	802.11b: DSSS (CCK; DQPSK; DBPSK) 802.11g: OFDM
Transmit Data Rate	802.11b: 11Mbps(CCK) with fall back rates of 5.5, 2, and 1Mbps 802.11g: 54Mbps with fall back rates of 48/36/24/18/12/9/6 Mbps (OFDM)
Number of Channels	IEEE 802.11b/g :11 Channels
Antenna Specification	1.5 dBi (Max) for Planner inverted F Antenna 0.5 dBi (Max) for Planner inverted F Antenna

<sup>\*\*</sup>For this antenna, 1.5 dBi (Max) for Planner inverted F Antenna, was tested and its test results were reported.

Note: 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2. This submittal(s) (test report) is intended for FCC ID: <u>Q72WLC100GA</u> filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.

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## 4 TEST METHODOLOGY

## 4.1. 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.

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 11Mbps highest data rate (worst case) are chosen for the final testing.

IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6Mbps data rate (the worst case) are chosen for the final testing.

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## SETUP OF EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF SUPPORT UNITS

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

Device Type	Brand	Model	FCC ID	Series No.	Data Cable	Power Cord
Notebook	Lenovo	SOLELE E260	DoC	EB02929383	N/A	Unshielded 1.8m

#### Note:

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

### 5.2. CONFIGURATION OF SYSTEM UNDER TEST

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

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## 6 FACILITIES AND ACCREDITATIONS

## 6.1. FACILITIES

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

No. 5, Jinao industrial park, No.35 Jukeng Road, Dashuikeng Village, Guanlan Town, Baoan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

#### 6.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA FCC Japan VCCI

Canada INDUSTRY CANADA

Taiwan BSMI

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsemc.com.tw

#### 6.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in ETR 028:

Measurement	Frequency		Uncertainty
Conducted emissions	9kHz~30MHz		± 3.5863
	Horizontal	30MHz ~ 200MHz	± 4.7685
Radiated emissions	Honzontai	200MHz ~1000MHz	± 4.9330
Radiated emissions	Vortical	30MHz ~ 200MHz	± 5.0411
	Vertical 200MHz ~1000MHz		± 4.9262

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 7 LIMITS AND RESULTS

## 7.1. POWER LINE CONDUCTED EMISSIONS MEASUREMENT

#### 7.1.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

According to §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  $\mu$ 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 Range	Limits (dBµV)			
(MHz)	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		

#### NOTE:

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

#### **TEST INSTRUMENTS**

Conducted Emission Test Site G							
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due			
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100088	02/24/2009			
LISN	EMCO	3825/2	1371	02/24/2009			
LISN	EMCO	3825/2	8901-1459	02/24/2009			

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

2. N.C.R = No Calibration Request.

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### **7.1.2. TEST PROCEDURES** (please refer to measurement standard)

- The EUT and Support equipment, if needed, was placed on a non-conducted table, which is 0.8m above the ground plane and 0.4m away from the conducted wall.
- The test equipment EUT installed received AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane. All support equipment power received from a second LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The frequency range from 150 kHz to 30 MHz was searched. The test data of the worst-case condition(s) was recorded. Emission levels under limit 20dB were not recorded.

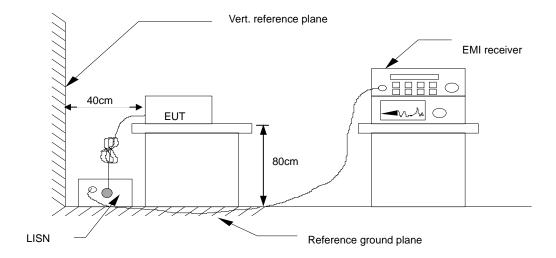
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## **7.1.3. TEST SETUP**



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

## 7.1.4. Data Sample:

Freq. (MHz)	Peak Raw (dBuV)	Q.P. Raw (dBuV)	Average Raw (dBuV)	Q.P. Limit (dBuV)	Average Limit (dBuV)	Q.P. Margin (dB)	Average Margin (dB)	Note
XX	38.10	36.01	31.18	60.00	50.00	-23.99	-18.82	L1

Frequency (MHz) = Emission frequency in MHz

= Uncorrected Analyzer/Receiver reading Reading (dBuV)

Correction factor (dB) = Insertion loss of LISN Limit (dBuV) = Limit stated in standard

Margin (dB) = Reading (dBuV) - Limit (dBuV) = Current carrying line of reading Note

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## 7.1.5. TEST RESULTS

Model No.	WLANTPBGV2	Test Mode	Normal Link
Environmental Conditions	25deg.C,43% RH, 991 hPa	6dB BANDWIDTH	9 kHz
Tested by:	Tom Gan		

FREQ	PEAK	Q.P.	AVG	Q.P.	AVG	Q.P.	AVG	NOTE
MHz	RAW	RAW	RAW	Limit	Limit	Margin	Margin	
	dBuV	dBuV	dBuV	dBuV	dBuV	dB	dB	
0.194	55.53	48.31	33.75	64.73	54.73	-16.42	-20.98	L1
0.402	47.59	44.64	29.84	58.80	48.80	-14.16	-18.96	L1
0.583	46.91	44.08	28.90	56.00	46.00	-11.92	-17.10	L1
0.761	48.12	45.20	29.51	56.00	46.00	-10.80	-16.49	L1
1.032	47.97	44.87	29.94	56.00	46.00	-11.13	-16.06	L1
9.238	48.86	43.18	37.23	60.00	50.00	-16.82	-12.77	L1
0.198	63.34	53.47	34.95	64.62	54.62	-11.15	-19.67	L2
0.242	57.28	48.25	30.21	63.35	53.35	-15.10	-23.14	L2
0.761	47.71	44.20	28.39	56.00	46.00	-11.80	-17.61	L2
1.050	47.38	44.18	28.85	56.00	46.00	-11.82	-17.15	L2
2.617	45.35	42.39	33.09	56.00	46.00	-13.61	-12.91	L2
8.997	48.36	43.18	35.76	60.00	50.00	-16.82	-14.24	L2

**REMARKS:** L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)

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## 7.2. SPURIOUS EMISSIONS MEASUREMENT

#### 7.2.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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) (see Section 15.205(c)).

#### 7.2.2. TEST INSTRUMENTS

Conducted Emissions Test Site									
Name of Equipment   Manufacturer   Model   Serial Number   Calibration Due									
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009					

#### **7.2.3. TEST PROCEDURE** (please refer to measurement standard)

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site. The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

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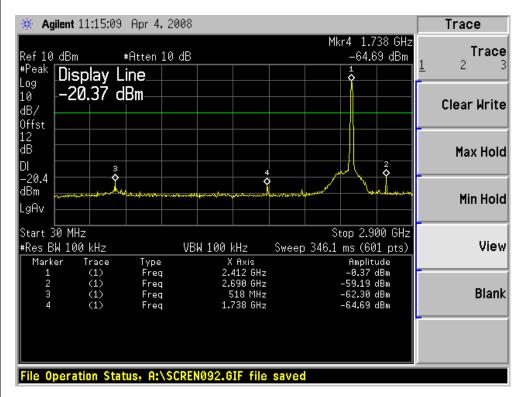
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#### 7.2.4. TEST RESULTS

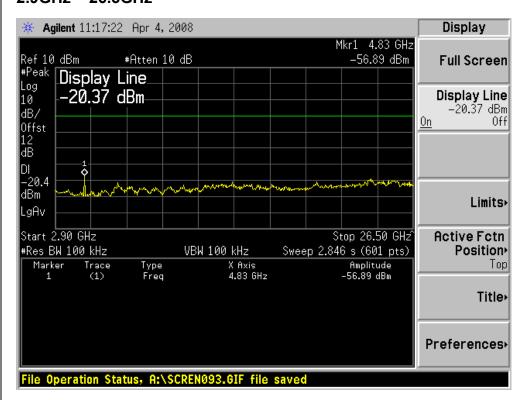
Test Plot (IEEE 802.11b mode)

**CH Low** 

30MHz ~ 2.9GHz



### 2.9GHz ~ 26.5GHz



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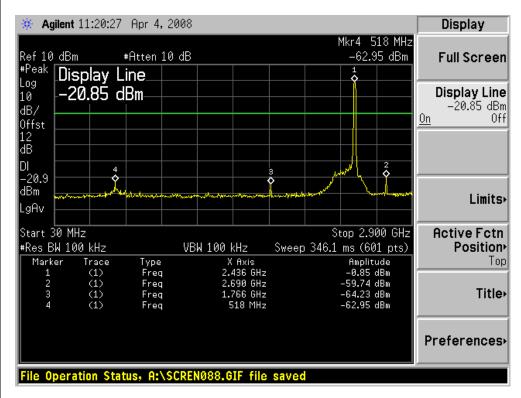
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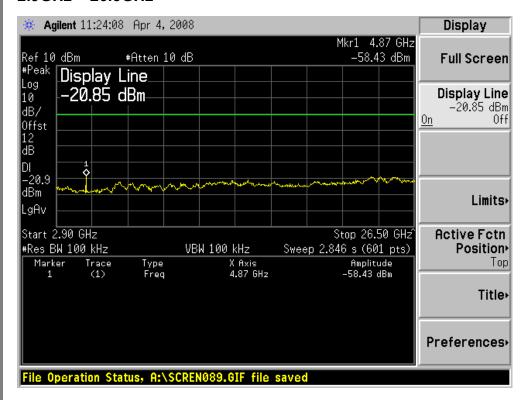
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## **CH Mid**

#### 30MHz ~ 2.9GHz



#### 2.9GHz ~ 26.5GHz

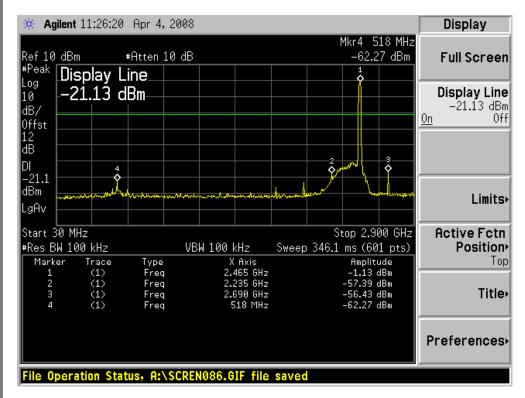


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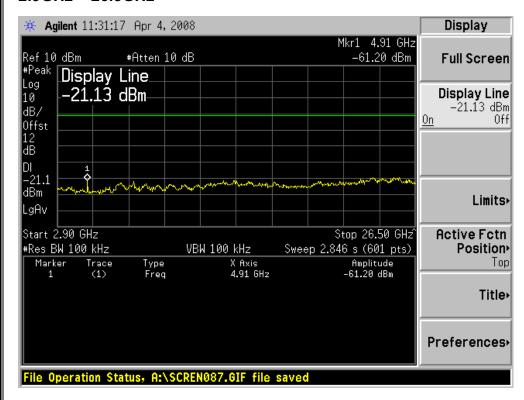
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## CH High

#### 30MHz ~ 2.9GHz



#### 2.9GHz ~ 26.5GHz



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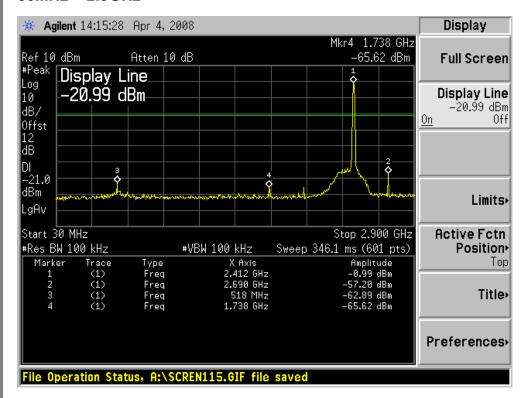
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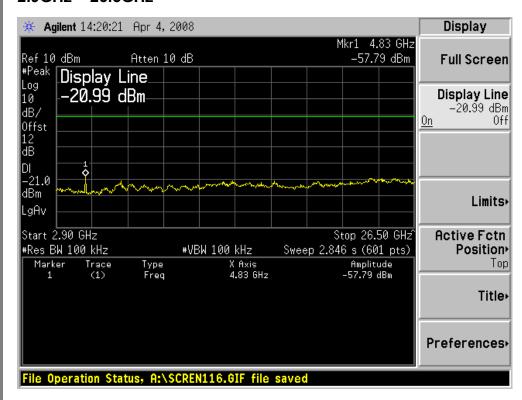
## Test Plot (IEEE 802.11g mode)

### **CH Low**

#### 30MHz ~ 2.9GHz



#### 2.9GHz ~ 26.5GHz

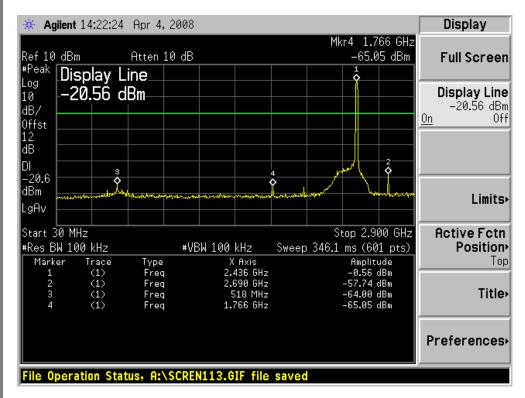


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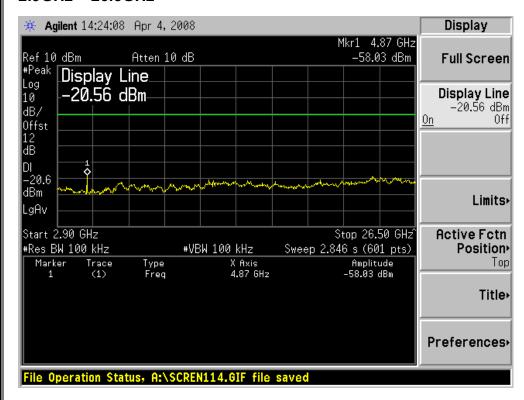
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### **CH Mid**

#### 30MHz ~ 2.9GHz



#### 2.9GHz ~ 26.5GHz

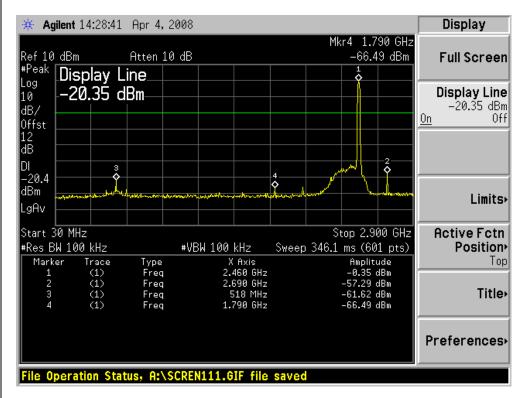


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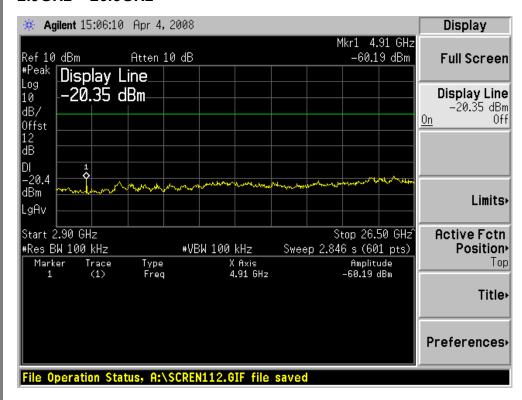
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## CH High

#### 30MHz ~ 2.9GHz



#### 2.9GHz ~ 26.5GHz



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#### 7.2.5. RADIATED EMISSIONS

### 7.2.5.1. LIMITS OF RADIATED EMISSIONS MEASUREMENT

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

Remark: 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 emission table above, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)		
30-88	100	40		
88-216	150	43.5		
216-960	200	46		
Above 960	500	54		

**NOTE**: (1) The lower limit shall apply at the transition frequencies.

(2) Emission level (dBuV/m) = 20 log Emission level (uV/m).

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#### 7.2.5.2. TEST INSTRUMENTS

	966 R	F CHAMBER 2		
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009
EMI Test Receiver	R&S	ESCI	1166.5950 03	01/13/2009
Pre-Amplifier	MITEQ	N/A	AFS42-00102650-4 2-10P-42	02/14/2009
Bilog Antenna	SCHWAZBECK	CBL6143	5082	06/09/2008
Turn Table	EMCO	2081-1.21	N/A	N.C.R
Antenna Tower	СТ	N/A	N/A	N.C.R
Controller	СТ	N/A	N/A	N.C.R
RF Comm. Test set	HP	8920B	US36142090	N.C.R
Site NSA	C&C	N/A	N/A	06/09/2008
Horn Antenna	TRC	TRC0301	100204	03/04/2009
Signal Generator	Anritsu	MG3694A	#050125	02/24/2009

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

- 2. The FCC Site Registration number is 101879.
- 4. N.C.R = No Calibration Required.

#### **7.2.5.3. TEST PROCEDURE** (please refer to measurement standard)

- 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.
- EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 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. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.

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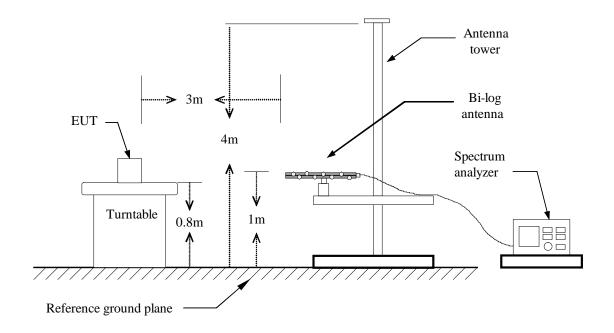


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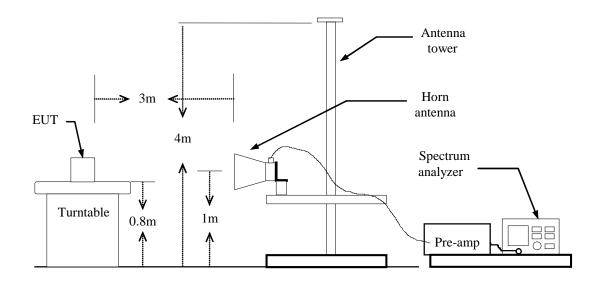
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## **7.2.5.4. TEST SETUP**

### **Below 1 GHz**



## **Above 1 GHz**



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



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## 7.2.5.5. Data Sample:

## **Below 1 GHz**

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Remark) (dBuV)	Correction Factor (dB/m)	Result (Remark) (dBuV/m)	Limit (Peak) (dBuV/m)	Margin (dB)	Remark
XXX	V	12.12	10.21	22.33	40.00	-17.67	Peak

## **Above 1 GHz**

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	` '	Limit (Average) (dBuV/m)	(ar)	Remark
XXX	V	65.45	63.00	-11.12	54.33	51.88	74.00	54.00	-2.12	AVG

Frequency (MHz) = Emission frequency in MHz

Ant.Pol. (H/V) = Antenna polarization

Reading (dBuV) = Uncorrected Analyzer / Receiver reading
Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)

Limit (dBuV/m) = Limit stated in standard

Margin (dB) = Remark Result (dBuV/m) – Limit (dBuV/m)

Peak = Peak Reading

QP = Quasi-peak Reading AVG = Average Reading

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Reference No.:

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## **7.2.5.6. TEST RESULTS**

**Below 1 GHz** 

Operation Mode: Normal Link Test Date: April 11, 2008

**Temperature:** 26°C **Tested by:** Tom Gan

**Humidity:** 50 % 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)
67.800	V	Peak	48.18	-17.55	30.63	40.00	-9.37
96.150	V	Peak	51.67	-15.63	36.04	43.50	-7.46
118.200	V	Peak	57.09	-16.58	40.51	43.50	-2.99
443.500	V	Peak	46.13	-8.24	37.89	46.00	-8.11
598.666	V	Peak	41.85	-5.68	36.17	46.00	-9.83
799.333	V	Peak	40.78	-3.85	36.93	46.00	-9.07
106.050	Н	Peak	45.30	-15.81	29.49	43.50	-14.01
132.150	Н	Peak	47.96	-16.60	31.36	43.50	-12.14
166.800	Н	Peak	52.74	-14.94	37.80	43.50	-5.70
291.450	Н	Peak	48.75	-11.19	37.56	46.00	-8.44
350.166	Н	Peak	45.99	-9.34	36.65	46.00	-9.35
443.500	Н	Peak	48.51	-8.24	40.27	46.00	-5.73

#### **REMARKS**:

- 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/quasi-peak detector mode.
- 3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
- 4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 5. Margin (dB) = Remark result (dBuV/m) Quasi-peak limit (dBuV/m).

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Reference No.:

Report No.: SZ080324B06-RP

Above 1 GHz

Operation Mode: TX / IEEE 802.11b / CH Low Test Date: April 11, 2008

**Temperature:** 26°C **Tested by:** Tom Gan **Humidity:** 50% RH **Polarity:** Ver. / Hor.

Even	Ant Dal	Peak	AV	Ant. / CL	Actu	al Fs	Peak	AV	Morain	
Freq. (MHz)	Ant. Pol H/V	Reading (dBuV)	Reading (dBuV)	CF (dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1596.66	V	60.60		-8.65	51.95		74.00	54.00	-2.05	Peak
1736.66	V	57.12		-7.55	49.57		74.00	54.00	-4.43	Peak
1993.33	V	56.13		-5.51	50.62		74.00	54.00	-3.38	Peak
4491.66	V	45.34		2.11	47.45		74.00	54.00	-6.55	Peak
N/A										
1596.66	Н	56.62		-8.65	47.97		74.00	54.00	-6.03	Peak
1846.66	Н	56.10		-6.67	49.43		74.00	54.00	-4.57	Peak
1930.00	Н	56.66		-6.01	50.65		74.00	54.00	-3.35	Peak
4150.00	Н	45.86		1.80	47.66		74.00	54.00	-6.34	Peak
N/A										

### REMARKS:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. 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.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).

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Reference No.:

Report No.: SZ080324B06-RP

Operation Mode: TX / IEEE 802.11b / CH Mid Test Date: April 11, 2008

Temperature:26°CTested by:Tom GanHumidity:50% RHPolarity:Ver. / Hor.

Freq.	Ant. Pol	Peak	AV	Ant. / CL	Actu	al Fs	Peak	AV	Margin	
(MHz)	H/V	Reading	Reading	CF	Peak	AV	Limit	Limit	(dB)	Remark
(111112)	11, 4	(dBuV)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(u <b>D</b> )	
1366.66	V	56.74		-10.15	46.59		74.00	54.00	-7.41	Peak
1590.00	V	58.03		-8.71	49.32		74.00	54.00	-4.68	Peak
2133.33	V	56.87		-4.93	51.94		74.00	54.00	-2.06	Peak
4150.00	V	47.24		1.80	49.04		74.00	54.00	-4.96	Peak
N/A										
1736.66	Н	55.67		-7.55	48.12		74.00	54.00	-5.88	Peak
1916.66	Н	56.20		-6.12	50.08		74.00	54.00	-3.92	Peak
2093.33	Н	55.99		-5.09	50.90		74.00	54.00	-3.10	Peak
4241.66	Н	47.32		1.88	49.20		74.00	54.00	-4.80	Peak
N/A										

#### **REMARKS**:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. 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.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).

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Reference No.:

Report No.: SZ080324B06-RP

Operation Mode: TX / IEEE 802.11b / CH High April 11, 2008 Test Date:

Temperature: 26°C Tested by: Tom Gan **Humidity:** 50 % RH **Polarity:** Ver. / Hor.

Freq.	Ant. Pol	Peak	AV	Ant. / CL	Actu	al Fs	Peak	AV	Margin	
(MHz)	H/V	Reading	Reading	CF	Peak	AV	Limit	Limit	(dB)	Remark
(141112)	11/ 🗸	(dBuV)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(ub)	
1290.00	V	57.19		-10.57	46.62		74.00	54.00	-7.38	Peak
1593.33	V	59.01		-8.68	50.33		74.00	54.00	-3.67	Peak
1690.00	V	56.94		-7.92	49.02		74.00	54.00	-4.98	Peak
4650.00	V	46.53		2.38	48.91		74.00	54.00	-5.09	Peak
N/A										
1590.00	Н	58.55		-8.71	49.84		74.00	54.00	-4.16	Peak
1710.00	Н	55.91		-7.76	48.15		74.00	54.00	-5.85	Peak
2023.33	Н	56.55		-5.39	51.16		74.00	54.00	-2.84	Peak
4291.66	Н	46.61		1.93	48.54		74.00	54.00	-5.46	Peak
N/A										

#### **REMARKS**:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. 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.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).

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Reference No.:

Report No.: SZ080324B06-RP

Operation Mode: TX / IEEE 802.11g / CH Low Test Date: April 11, 2008

Temperature:26°CTested by:Tom GanHumidity:50 % RHPolarity:Ver. / Hor.

Eroa	Ant. Pol	Peak	AV	Ant. / CL	Actu	al Fs	Peak	AV	Morain	
Freq. (MHz)	H/V	Reading (dBuV)	Reading (dBuV)	CF (dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1596.66	V	58.17		-8.65	49.52		74.00	54.00	-4.48	Peak
1763.33	V	55.90		-7.33	48.57		74.00	54.00	-5.43	Peak
1990.00	V	57.26		-5.54	51.72		74.00	54.00	-2.28	Peak
4775.00	V	46.54		2.59	49.13		74.00	54.00	-4.87	Peak
N/A										
1593.33	Н	57.19		-8.68	48.51		74.00	54.00	-5.49	Peak
1733.33	Н	56.44		-7.57	48.87		74.00	54.00	-5.13	Peak
2030.00	Н	56.78		-5.34	51.44		74.00	54.00	-2.56	Peak
4583.33	Н	46.52		2.26	48.78		74.00	54.00	-5.22	Peak
N/A										

#### **REMARKS**:

- Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. 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.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).

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Reference No.:

Report No.: SZ080324B06-RP

Operation Mode: TX / IEEE 802.11g / CH Mid Test Date: April 11, 2008

Temperature:26°CTested by:Tom GanHumidity:50 % RHPolarity:Ver. / Hor.

Freq.	Ant. Pol	Peak	AV	Ant. / CL	Actu	al Fs	Peak	AV	Margin	
(MHz)	H/V	Reading	Reading	CF	Peak	AV	Limit	Limit	(dB)	Remark
		(dBuV)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(db)	
1590.00	V	59.90		-8.71	51.19		74.00	54.00	-2.81	Peak
1823.00	V	57.41		-6.86	50.55		74.00	54.00	-3.45	Peak
2130.00	V	56.87		-4.95	51.92		74.00	54.00	-2.08	Peak
4416.66	V	46.16		2.04	48.20		74.00	54.00	-5.80	Peak
N/A										
1760.00	Н	56.01		-7.36	48.65		74.00	54.00	-5.35	Peak
1986.66	Н	56.07		-5.57	50.50		74.00	54.00	-3.50	Peak
2143.33	Н	56.16		-4.89	51.27		74.00	54.00	-2.73	Peak
3883.33	Н	47.79		0.58	48.37		74.00	54.00	-5.63	Peak
N/A										

#### **REMARKS**:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. 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.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).

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Reference No.:

Report No.: SZ080324B06-RP

Operation Mode: TX / IEEE 802.11g / CH High Test Date: April 11, 2008

Temperature:26°CTested by:Tom GanHumidity:50 % RHPolarity:Ver. / Hor.

Freq.	Ant. Pol	Peak	AV	Ant. / CL	Actu	al Fs	Peak	AV	Margin	
(MHz)	H/V	Reading	Reading (dBuV)	CF (dB)	Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)	(dB)	Remark
1310.00	V	56.56		-10.46	46.10		74.00	54.00	-7.90	Peak
1536.66	V	56.48		-9.13	47.35		74.00	54.00	-6.65	Peak
1903.33	V	55.58		-6.23	49.35		74.00	54.00	-4.65	Peak
4741.66	V	46.03		2.54	48.57		74.00	54.00	-5.43	Peak
N/A										
1660.00	Н	57.92		-8.15	49.77		74.00	54.00	-4.23	Peak
2023.33	Н	56.17		-5.37	50.80		74.00	54.00	-3.20	Peak
2123.33	Н	56.13		-4.97	51.16		74.00	54.00	-2.84	Peak
4491.66	Н	45.24		2.11	47.35		74.00	54.00	-6.65	Peak
N/A										

#### **REMARKS**:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. 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.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).

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#### 7.3. 6dB BANDWIDTH MEASUREMENT

#### 7.3.1. LIMITS

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

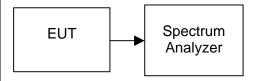
#### 7.3.2. TEST INSTRUMENTS

Conducted Emissions Test Site								
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due				
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009				

### **7.3.3. TEST PROCEDURES** (please refer to measurement standard)

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

#### **7.3.4. TEST SETUP**



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## 7.3.5. TEST RESULTS

No non-compliance noted

## **Test Data**

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	12830		PASS
Mid	2437	12800	>500	PASS
High	2462	11600		PASS

## **Test Data**

Test mode: IEEE 802.11g

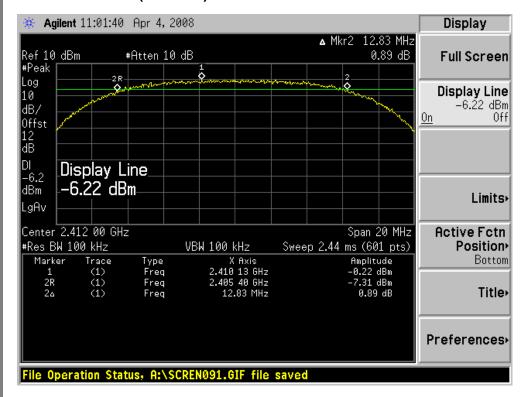
Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	16430		PASS
Mid	2437	16400	>500	PASS
High	2462	16370		PASS

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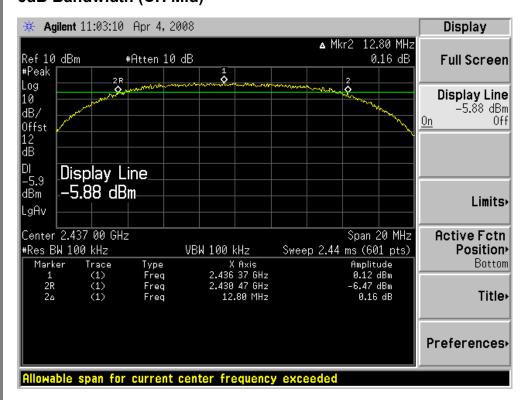
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## Test Plot (IEEE 802.11b mode)

#### 6dB Bandwidth (CH Low)



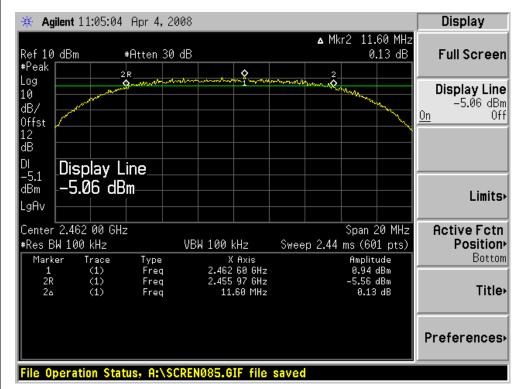
## 6dB Bandwidth (CH Mid)



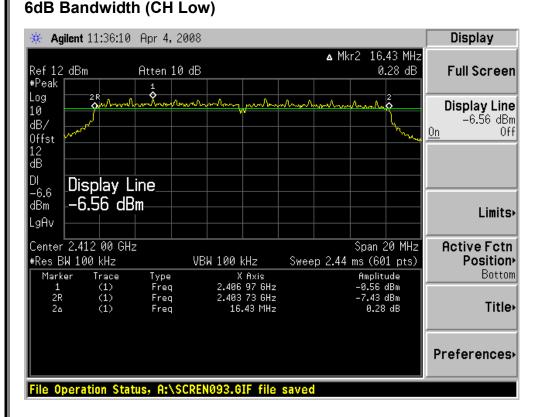
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## 6dB Bandwidth (CH High)



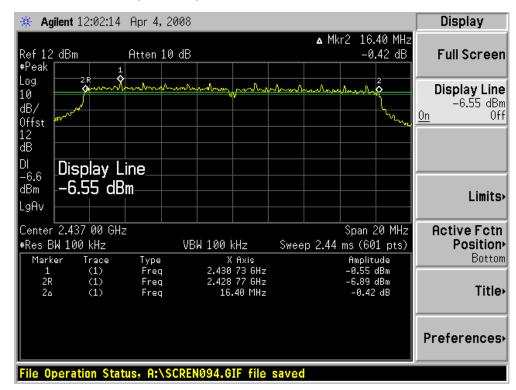
# Test Plot (IEEE 802.11g mode)



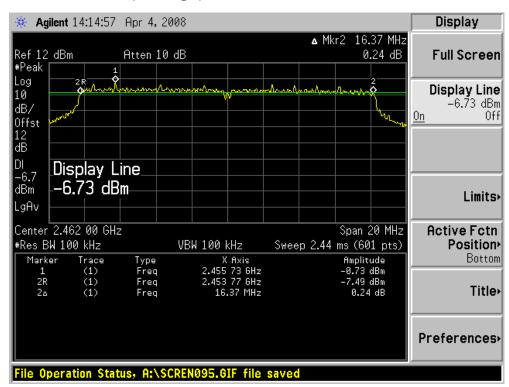
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## 6dB Bandwidth (CH Mid)



## 6dB Bandwidth (CH High)



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Reference No.:

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#### 7.4. PEAK OUTPUT POWER

#### 7.4.1. LIMITS

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

- 1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
- 2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

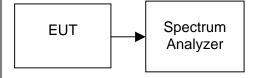
#### 7.4.2. TEST INSTRUMENTS

Conducted Emissions Test Site					
Name of Equipment Manufacturer		Model	Serial Number	Calibration Due	
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009	

#### **7.4.3. TEST PROCEDURES** (please refer to measurement standard)

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

#### 7.4.4. TEST SETUP



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## 7.4.5. TEST RESULTS

No non-compliance noted

## **Test Data**

Test mode: IEEE 802.11b

Channel	y /MU=\	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	16.12	0.04093		PASS
Mid	2437	15.95	0.03936	1	PASS
High	2462	15.70	0.03715		PASS

Test mode: IEEE 802.11g

Channel	y /MU=\	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2412	11.81	0.01517		PASS
Mid	2437	11.12	0.01294	1	PASS
High	2462	12.22	0.01667		PASS

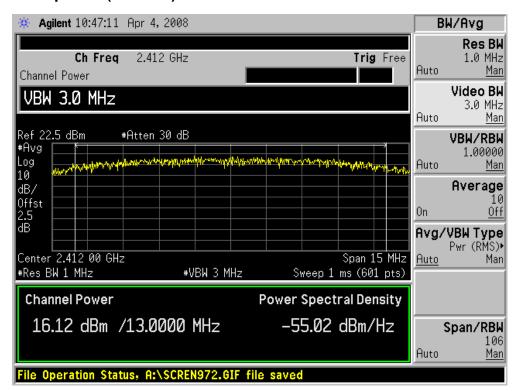
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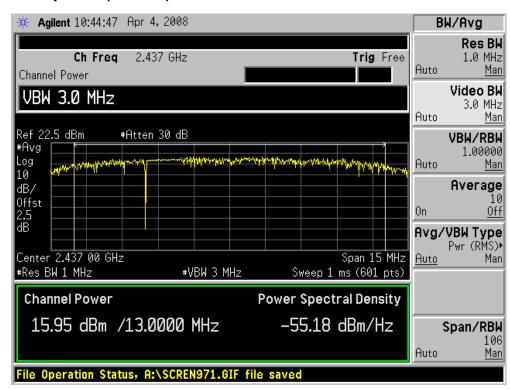
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### Test Plot (IEEE 802.11b mode)

#### Peak power (CH Low)



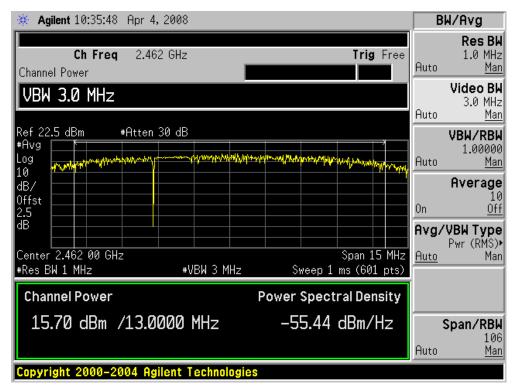
#### Peak power (CH Mid)



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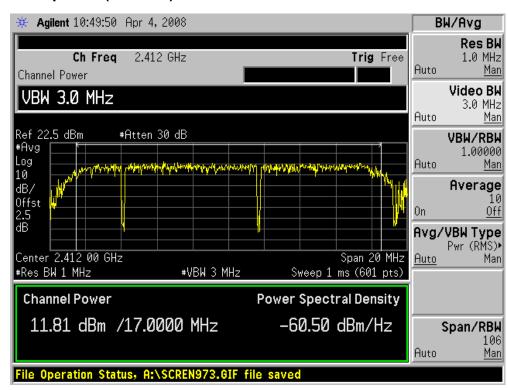
Report No.: SZ080324B06-RP

## Peak power (CH High)



## Test Plot (IEEE 802.11g mode)

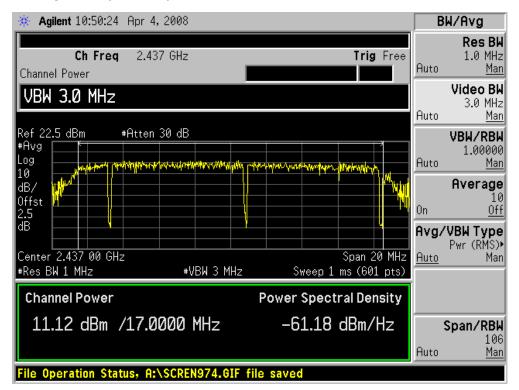
#### Peak power (CH Low)



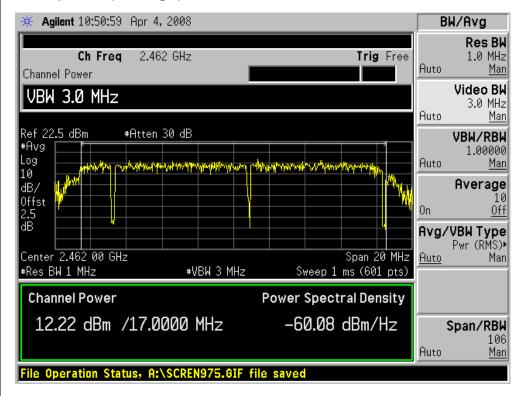
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### Peak power (CH Mid)



### Peak power (CH High)



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#### 7.5. BAND EDGES MEASUREMENT:

#### 7.5.1. LIMITS

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. 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) (see Section 15.205(c)).

#### 7.5.2. TEST INSTRUMENTS

966 RF CHAMBER 2					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due	
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009	
EMI Test Receiver	R&S	ESCI	1166.5950 03	01/13/2009	
Pre-Amplifier	MITEQ	N/A	AFS42-00102650-4 2-10P-42	02/14/2009	
Bilog Antenna	SCHWAZBECK	CBL6143	5082	06/09/2008	
Turn Table	EMCO	2081-1.21	N/A	N.C.R	
Antenna Tower	СТ	N/A	N/A	N.C.R	
Controller	СТ	N/A	N/A	N.C.R	
RF Comm. Test set	HP	8920B	US36142090	N.C.R	
Site NSA	C&C	N/A	N/A	06/09/2008	
Horn Antenna	TRC	TRC0301	100204	03/04/2009	
Signal Generator	Anritsu	MG3694A	#050125	02/24/2009	

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

- 2. The FCC Site Registration number is 101879.
- 4. N.C.R = No Calibration Required.

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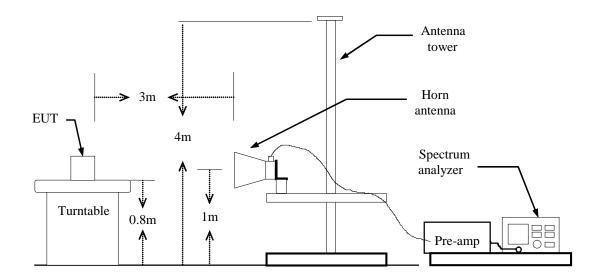
Reference No.:

Report No.: SZ080324B06-RP

#### **7.5.3. TEST PROCEDURES** (please refer to measurement standard)

- 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

#### 7.5.4. TEST SETUP





Reference No.:

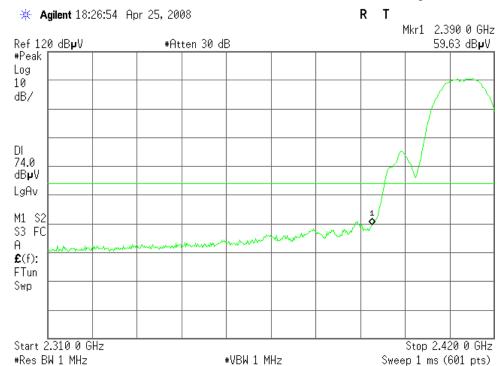
Report No.: SZ080324B06-RP

#### 7.5.5. TEST RESULTS

Test Plot (IEEE 802.11b mode)

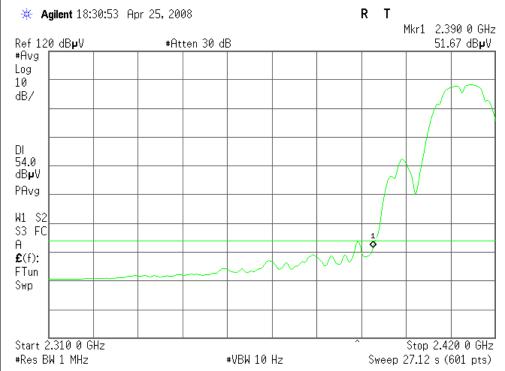
**Band Edges (CH Low)** 

Detector mode: Peak Polarity: Vertical



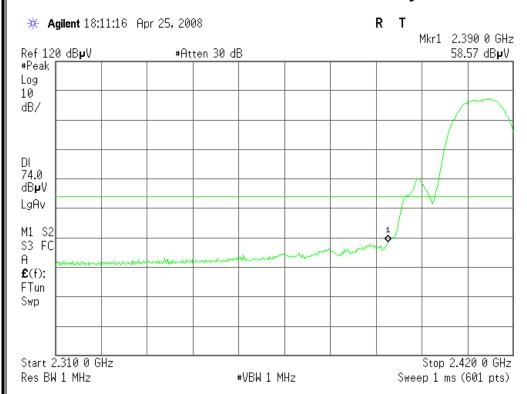
## **Detector mode: Average**

### **Polarity: Vertical**



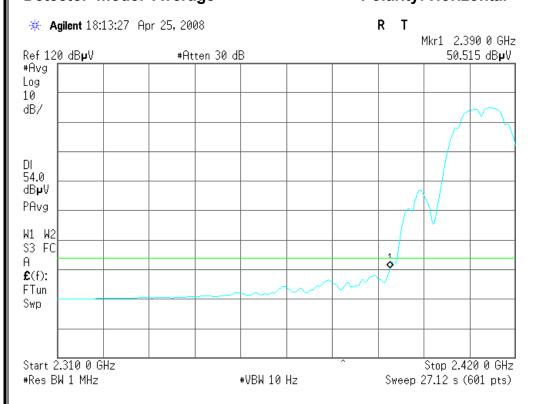
Report No.: SZ080324B06-RP

### Detector mode: Peak Polarity: Horizontal



## Detector mode: Average

## **Polarity: Horizontal**



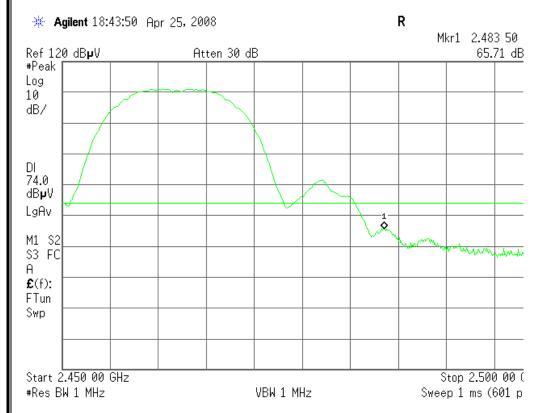


Reference No.:

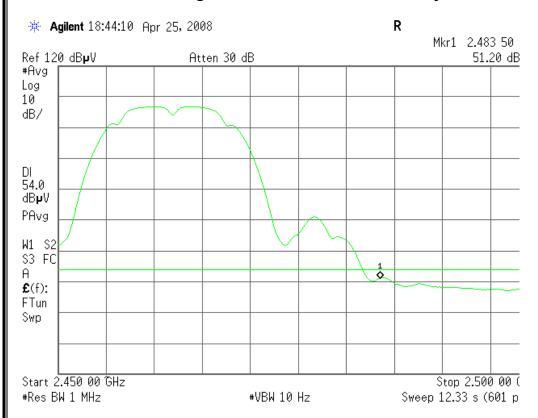
Report No.: SZ080324B06-RP

## **Band Edges (CH High)**

Detector mode: Peak Polarity: Vertical



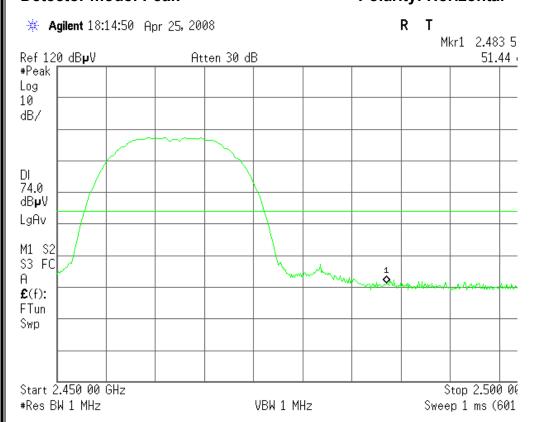
Detector mode: Average Polarity: Vertical



Reference No.:

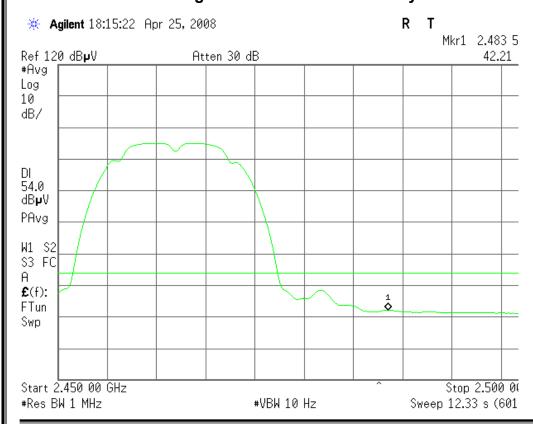
Report No.: SZ080324B06-RP

## Detector mode: Peak Polarity: Horizontal



#### **Detector mode: Average**

#### **Polarity: Horizontal**





Reference No.:

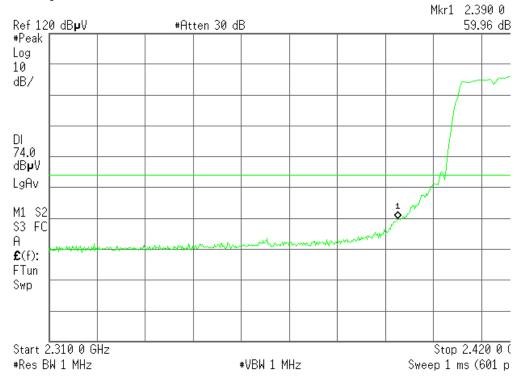
Report No.: SZ080324B06-RP

## Test Plot (IEEE 802.11g mode)

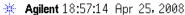
**Band Edges (CH Low)** 

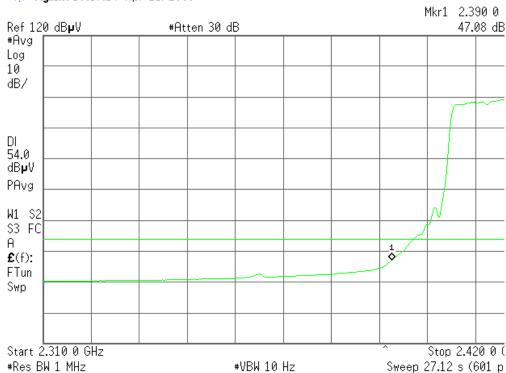
Detector mode: Peak Polarity: Vertical

\* Agilent 18:55:58 Apr 25, 2008



Detector mode: Average Polarity: Vertical

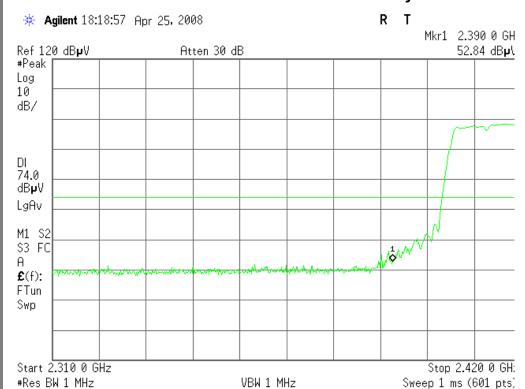




Reference No.:

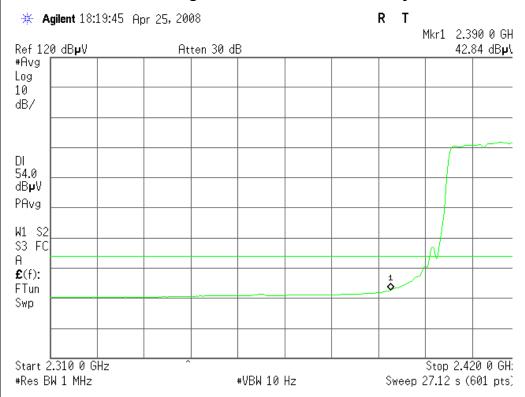
Report No.: SZ080324B06-RP

## Detector mode: Peak Polarity: Horizontal



#### **Detector mode: Average**

#### **Polarity: Horizontal**



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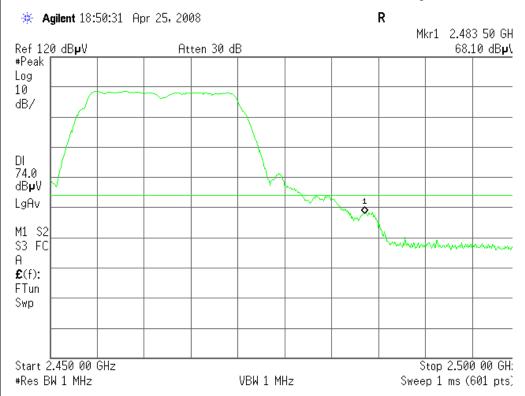


Reference No.:

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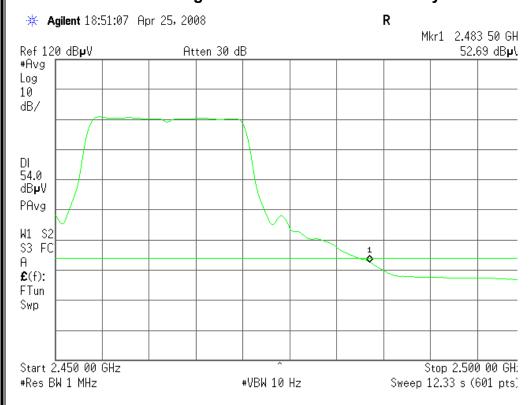
## **Band Edges (CH High)**

Detector mode: Peak Polarity: Vertical



## **Detector mode: Average**

**Polarity: Vertical** 

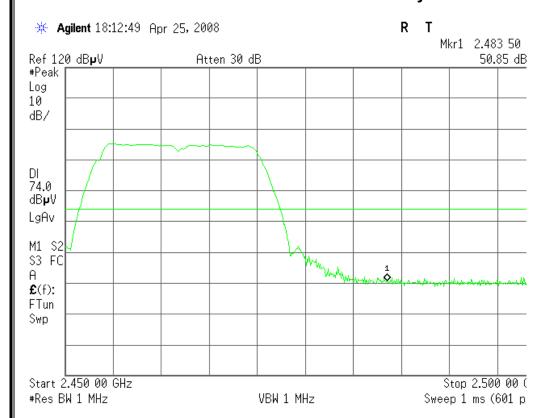


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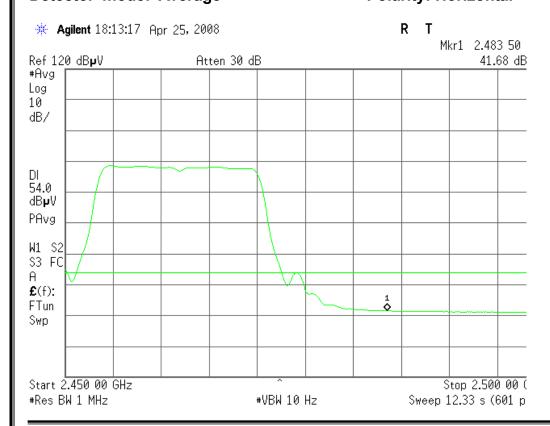
Report No.: SZ080324B06-RP

### Detector mode: Peak Polarity: Horizontal



## Detector mode: Average

#### Polarity: Horizontal



Reference No.:

Report No.: SZ080324B06-RP

#### 7.6. PEAK POWER SPECTRAL DENSITY MEASUREMENT

#### 7.6.1. LIMITS

- According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
- 2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

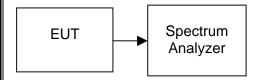
#### 7.6.2. TEST INSTRUMENTS

Conducted Emissions Test Site					
Name of Equipment   Manufacturer   Model   Serial Number   Calibration I					
Spectrum Analyzer	Agilent	E4446A	US44300399	02/24/2009	

#### **7.6.3. TEST PROCEDURES** (please refer to measurement standard)

- Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
- 3. Record the max. reading.
- 4. Repeat the above procedure until the measurements for all frequencies are completed.

#### 7.6.4. TEST SETUP



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#### 7.6.5. TEST RESULTS

No non-compliance noted

## **Test Data**

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-11.39		PASS
Mid	2437	-7.55	8.00	PASS
High	2462	-10.86		PASS

## **Test Data**

Test mode: IEEE 802.11g

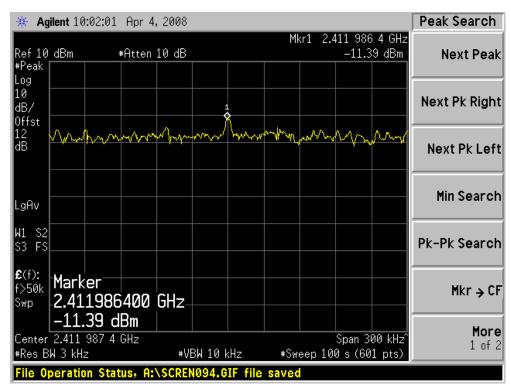
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-12.37		PASS
Mid	2437	-15.51	8.00	PASS
High	2462	-15.89		PASS

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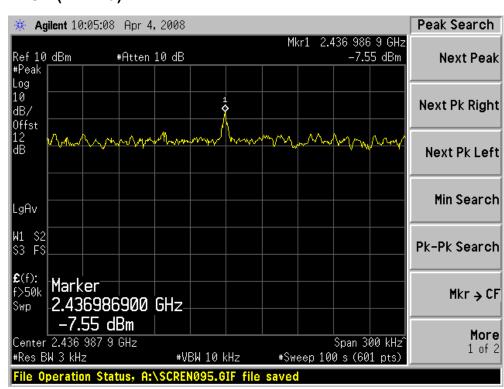
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## <u>Test Plot</u> (IEEE 802.11b mode)

PPSD (CH Low)

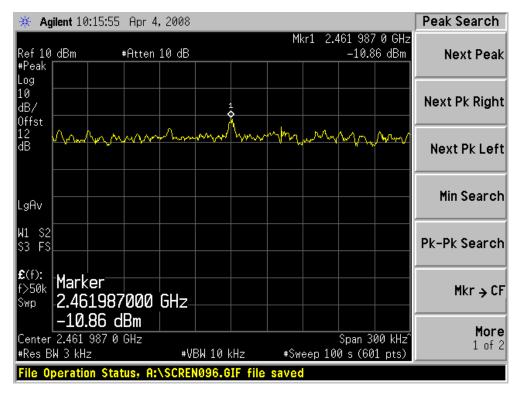


### PPSD (CH Mid)

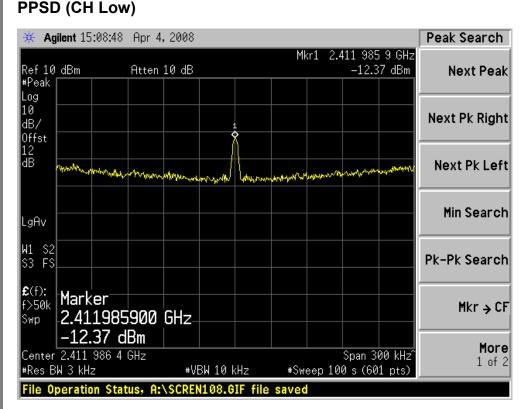


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## PPSD (CH High)

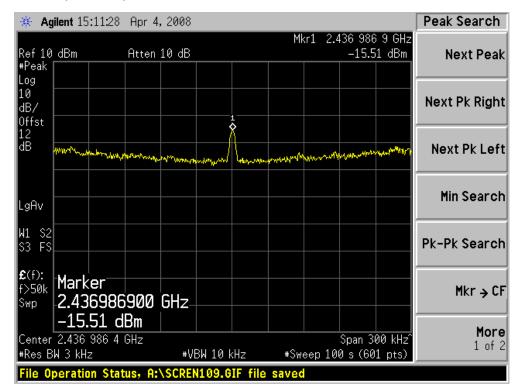


# Test Plot (IEEE 802.11g mode)

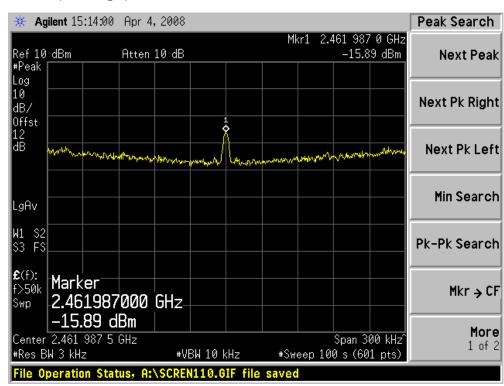


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### PPSD (CH Mid)



## PPSD (CH High)



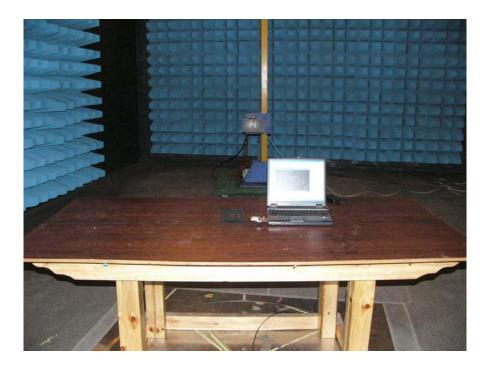
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## **APPENDIX I PHOTOGRAPHS OF THE TEST CONFIGURATION**

**Radiated Emissions Setup Photos** 





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## **Power Line Conducted Emissions Setup Photos**



