# FCC CFR47 PART 15 SUBPART E
# CERTIFICATION
# TEST REPORT

**FOR**

**802.11 a/b/g MINI PCI MODULE**

**MODEL NUMBER: PH1117-E & PH12127-E**

**BRAND NAME: PHILIPS**

**FCC ID: PUBWCM1010**

**REPORT NUMBER: 03U2040-2**

**ISSUE DATE: JUNE 26TH, 2003**

*Prepared for*
**ACCTON AND PHILIPS WIRELESS NETWORKING**
**1962 ZANKER ROAD**
**SAN JOSE, CA 95122, U.S.A**

*Prepared by*
**COMPLIANCE CERTIFICATION SERVICES**
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# 1. TEST RESULT CERTIFICATION

**COMPANY NAME:** ACCTON AND PHILIPS WIRELESS NETWORKING
1962 ZANKER ROAD
SAN JOSE, CALIFORNIA 95122 U.S.A

**EUT DESCRIPTION:** 802.11 a/b/g MINI PCI MODULE

**MODEL:** PH1117-E & PH12127-E

**MODEL DIFFERENCE:** The two models are identical. Two model names are for marketing Purposes only.

**DATE TESTED:** JUNE 9 – JUNE 26, 2003

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 15 SUBPART E | NO NON-COMPLIANCE NOTED |

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note**: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

**Note:** The 5.2 GHz band is applicable to this report; other bands of operation (2.4 and 5.8 GHz) are documented in a separate report.

Approved & Released For CCS By:

MIKE HECKROTTE
CHIEF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

THANH NGUYEN
EMC ENGINEER
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# 2. EUT DESCRIPTION

The Philips PH1117-E is a high performance 802.11 a/b/g WLAN client product intended for a laptop application. The difference between PH1117-E and PH12127 is model designation, which is for marketing purposes only.

The EUT uses two Dual Band F Type antennas for diversity operation. Each antenna is mounted in a laptop 15" LCD display. The Main antenna has a gain of 2.98 dBi in the 5.15 – 5.35 GHz band. The Auxiliary antenna has a gain of 1.96 dBi in the 5.15 – 5.35 GHz band. The peak output power is 18.61 dBm (73 mW) in the 5150 to 5350 MHz band.

For test purposes, the EUT is installed on a cardbus to Mini-PCI extender / adapter, which is subsequently installed in a laptop computer equipped with a cardbus slot and the appropriate radio testing software. The antennas are mounted in a separate LCD display.



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# 3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/1992, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

# 4. FACILITIES AND ACCREDITATION

## 4.1. FACILITIES AND EQUIPMENT

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

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




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## 4.2. TABLE OF ACCREDITATIONS AND LISTINGS

| Country | Agency | Scope of Accreditation | Logo |
|---|---|---|---|
| USA | FCC | 3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements | 1300 |
| Japan | VCCI | CISPR 22 Two OATS and one conducted Site | VCCI<br>R-1014, R-619, C-640 |
| Norway | NEMKO | EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1 | ELA 117 |
| Norway | NEMKO | EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC | ELA-171 |
| Taiwan | BSMI | CNS 13438 | SL2-IN-E-1012 |
| Canada | Industry Canada | RSS210 Low Power Transmitter and Receiver | Canada<br>IC2324 A,B,C, and F |




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# 5. CALIBRATION AND UNCERTAINTY

## 5.1. MEASURING INSTRUMENT CALIBRATION

The measurement instruments utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and are traceable to national standards.

## 5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| | |
|---|---|
| Radiated Emission, 30 to 200 MHz | +/- 3.3 dB |
| Radiated Emission, 200 to 1000 MHz | +4.5 / -2.9 dB |
| Radiated Emission, 1000 to 2000 MHz | +4.5 / -2.9 dB |
| Power Line Conducted Emission | +/- 2.9 dB |

Uncertainty figures are valid to a confidence level of 95%.




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## 5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| Name of Equipment | Manufacturer | Model No. | Serial No. | Due Date |
| Antenna, Horn 1 ~ 18 GHz | EMCO | 3115 | 2238 | 2/4/2004 |
| Amplifier 1-26GHz | MITEQ | NSP2600-SP | 924341 | 4/25/2004 |
| Amplifier 1-26GHz | MITEQ | NSP2600-SP | 924342 | 4/25/2004 |
| LISN, 10 kHz ~ 30 MHz | Solar | 8012-50-R-24-BNC | 837990 | 9/6/2003 |
| Line Filter | Lindgren | LMF-3489 | 497 | CNR |
| LISN, 10 kHz ~ 30 MHz | FCC | 50/250-25-2 | 114 | 9/6/2003 |
| EMI Test Receiver | R & S | ESHS 20 | 827129/006 | 7/17/2004 |
| PSA | AGILENT | E4446A | US42070220 | 1/13/2004 |
| Peak Power Meter | AGILENT | E4416A | 6B41291160 | 8/9/2003 |
| Power Sensor | AGILENT | E9327A | US40440755 | 8/9/2003 |
| EMI Test Receiver | HP | 8542E | 3942A00286 | 11/20/2003 |
| RF Filter Section | HP | 85420E | 3705A00256 | 11/20/2003 |
| Bilog Antenna | ARA | LPB-25201A | 1185 | 3/6/2004 |
| 10dB Pad | WEINSCHEL | 56-10 | K16148 | N/A |
| 2.4-2.5 GHz Reject Filter | MICROTRONICS | BRM50702 | 1 | N/A |
| 5.725-5.875 GHz Reject Filter | MICROTRONICS | BRC13192 | 1 | N/A |




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# 6. SETUP OF EQUIPMENT UNDER TEST

## SUPPORT EQUIPMENT

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| Device Type | Manufacturer | Model | Serial Number | FCC ID |
| LAPTOP | IBM | THINKPAD A-30 | N/A | DoC |
| AC ADAPTER | IBM | 02K6744 | 11302K67442S1 | N/A |
| LCD DISPLAY | N/A | N/A | N/A | N/A |

## I/O CABLES

| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length | Remarks |
|---|---|---|---|---|---|---|
| 1 | PWR | 1 | DC PWR | UNSHIELDED | 1.86M | N/A |
| 2 | PWR | 1 | AC PWR | UNSHIELDED | 1.86M | N/A |
| 3 | ANTENNA | 2 | UFL | COAXIAL | 0.1M | N/A |

## TEST SETUP

The EUT is connected to the laptop via a Cardbus-to-MiniPCI adapter / extender and the antennas are mounted within an external LCD laptop display.



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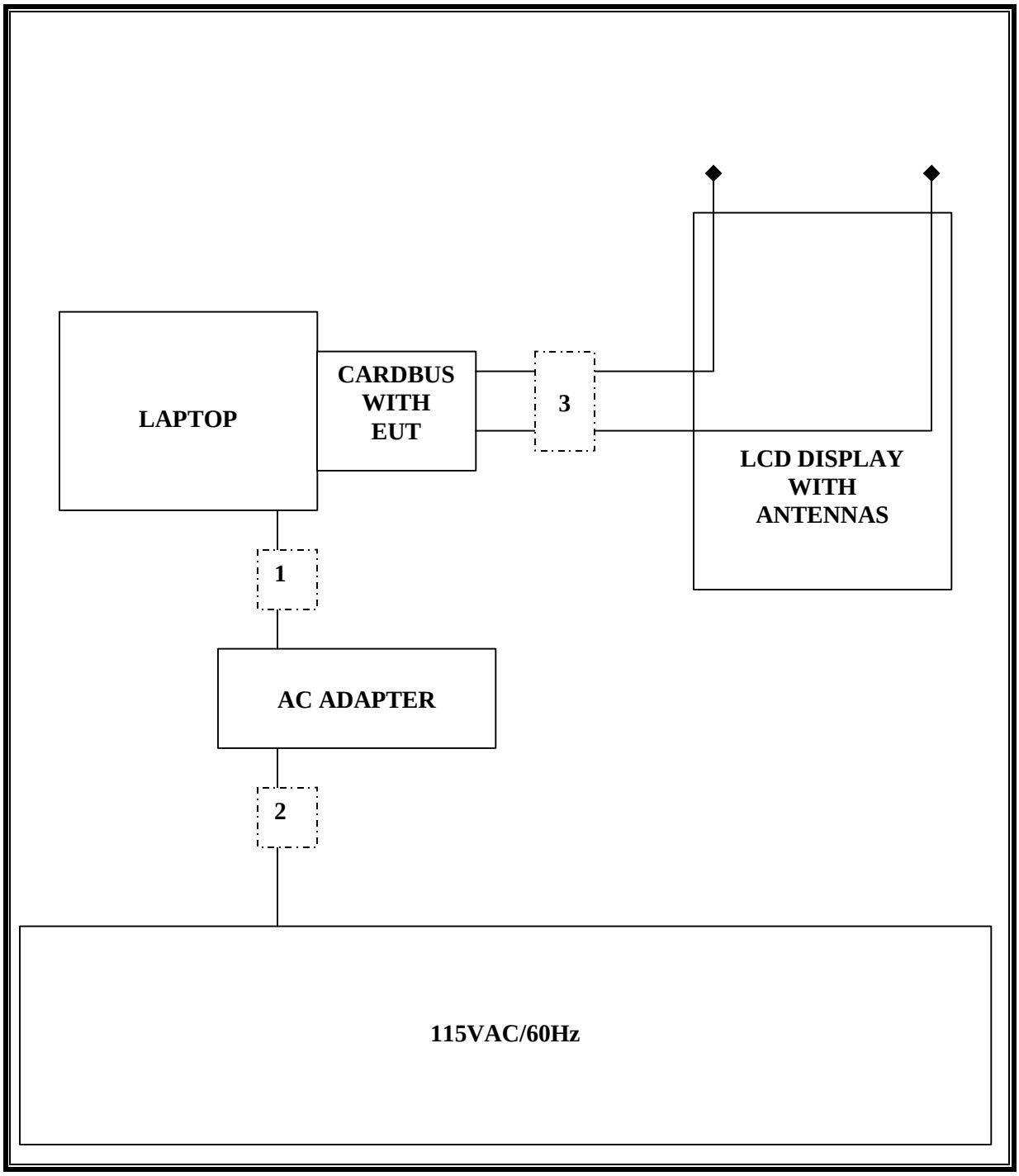
**SETUP DIAGRAM**







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# 7. APPLICABLE LIMITS AND TEST RESULTS

## 7.1. EMISSION BANDWIDTH

**LIMIT**

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

**TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB EMISSION bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

**RESULTS**

No non-compliance noted:

Normal Mode

| Channel | Frequency (MHz) | B (MHz) | 10 Log B (dB) |
|---|---|---|---|
| Low | 5180 | 44.38 | 16.47 |
| Middle | 5260 | 48.13 | 16.82 |
| High | 5320 | 44.88 | 16.52 |




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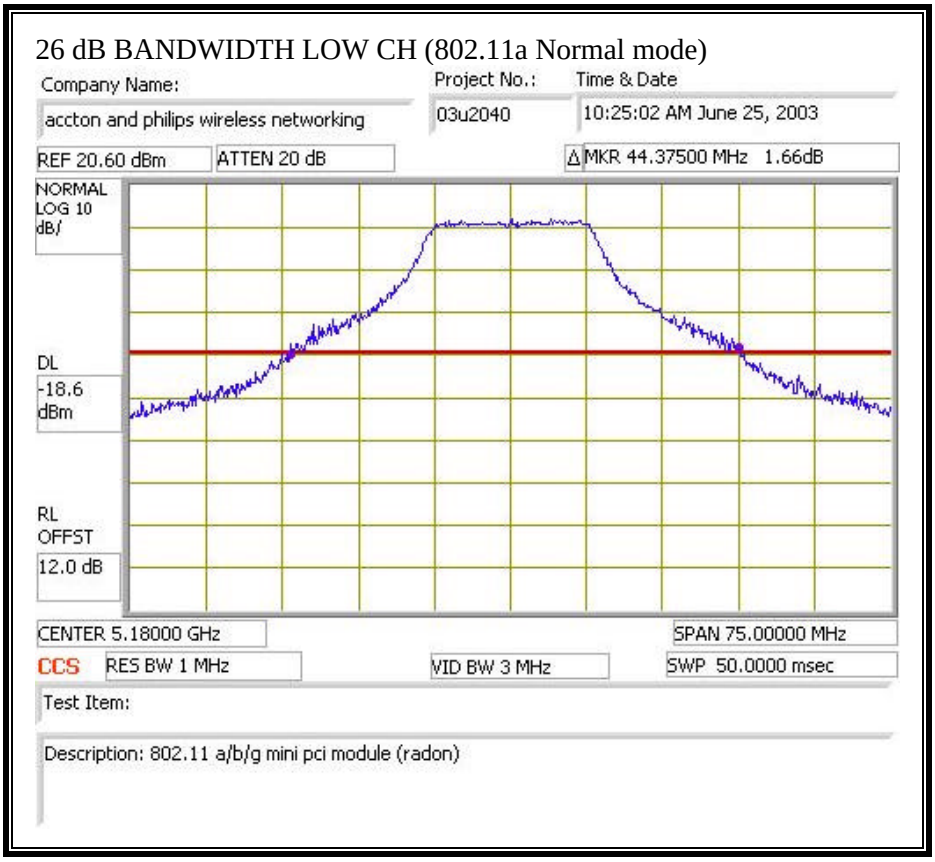
**26 dB EMISSION BANDWIDTH (802.11a NORMAL MODE)**







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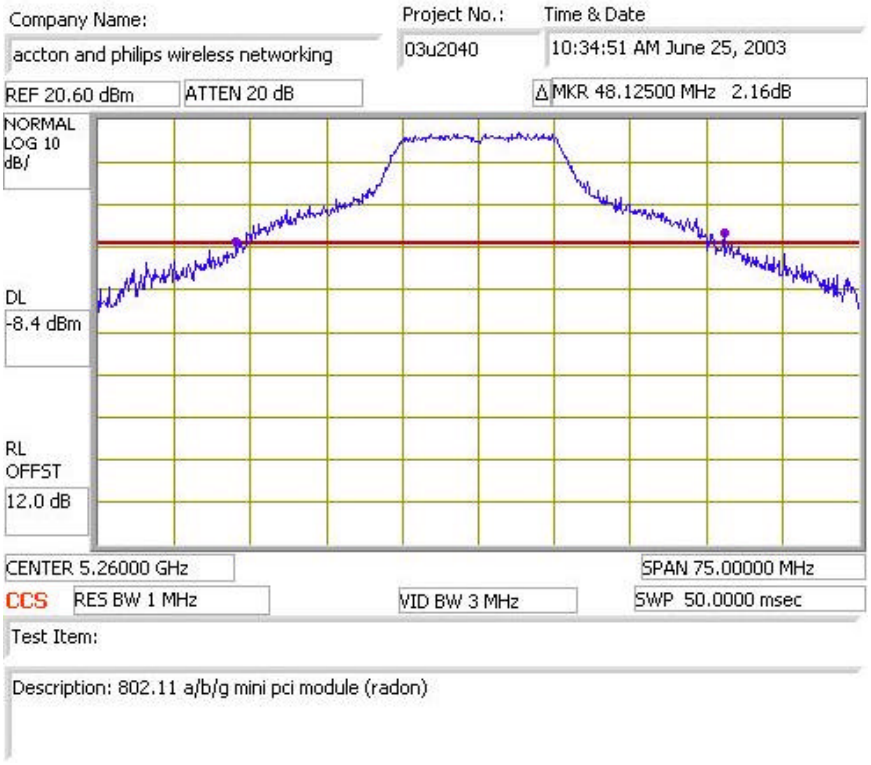
26 dB BANDWIDTH MID CH (802.11a Normal mode)







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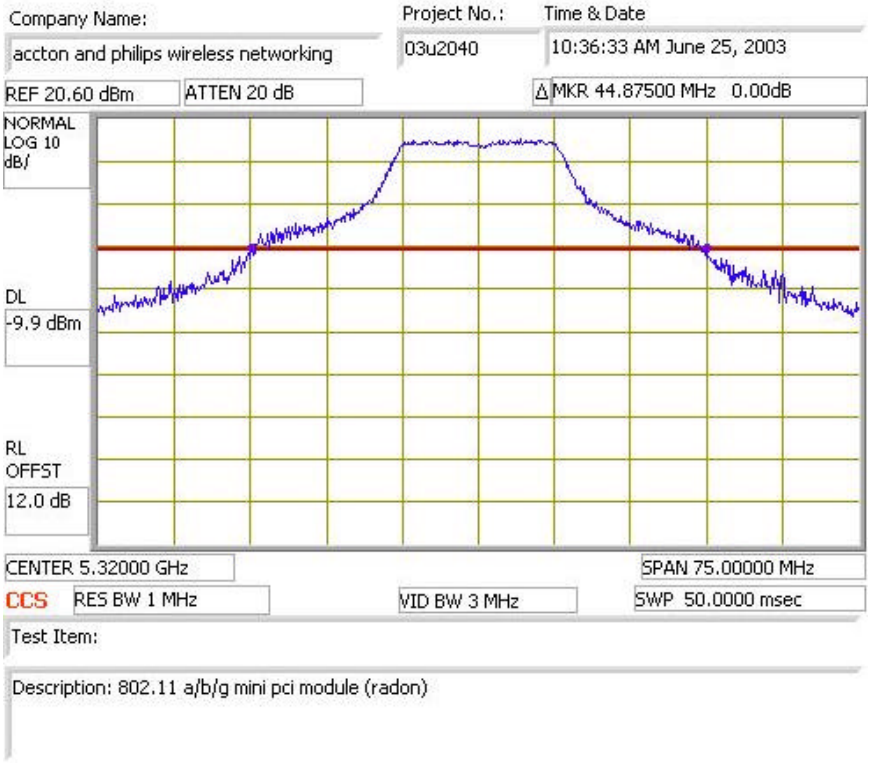
26 dB BANDWIDTH HIGH CH (802.11a Normal mode)







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## 7.2. PEAK POWER

**LIMIT**

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW (17 dBm) or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW (24 dBm) or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.




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**LIMITS AND RESULTS**

No non-compliance noted:

Limit in 5150 to 5250 MHz Band

| Mode | Frequency (MHz) | Fixed Limit (dBm) | B (MHz) | 4 + 10 Log B Limit (dBm) | Excess Antenna Gain (dB) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Normal | 5180 | 17 | 44.375 | 20.47 | 0.00 | 17.00 |

Limit in 5250 to 5350 MHz Band

| Mode | Frequency (MHz) | Fixed Limit (dBm) | B (MHz) | 11 + 10 Log B Limit (dBm) | Excess Antenna Gain (dB) | Limit (dBm) |
|---|---|---|---|---|---|---|
| Normal | 5260 | 24 | 48.125 | 27.82 | 0.00 | 24.00 |
| Normal | 5320 | 24 | 44.875 | 27.52 | 0.00 | 24.00 |

Normal Mode Results

| Channel | Frequency (MHz) | Power (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5180 | 14.44 | 17.00 | -2.56 |
| Middle | 5260 | 18.61 | 24.00 | -5.39 |
| High | 5320 | 18.53 | 24.00 | -5.47 |



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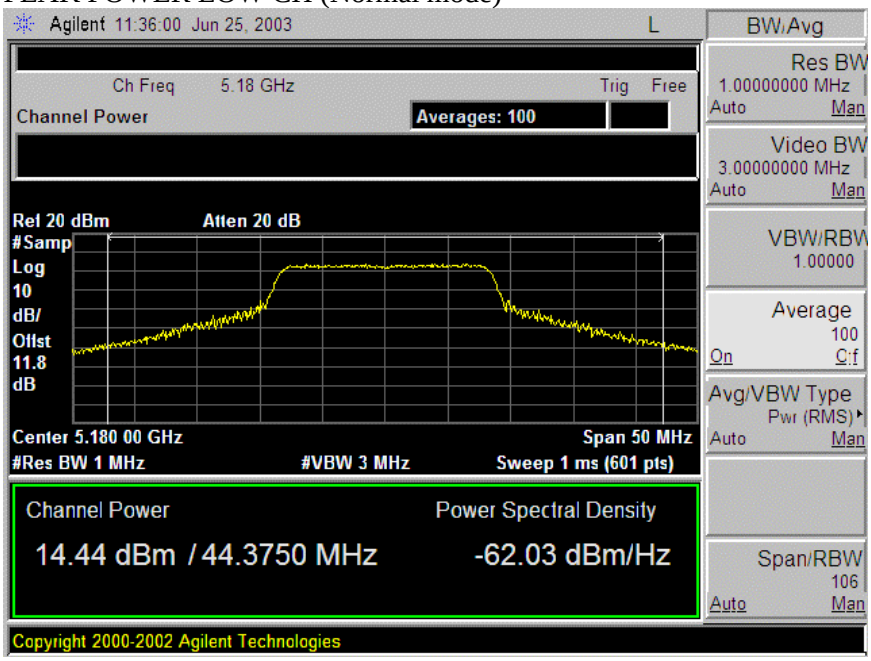
**PEAK POWER (NORMAL MODE)**

PEAK POWER LOW CH (Normal mode)







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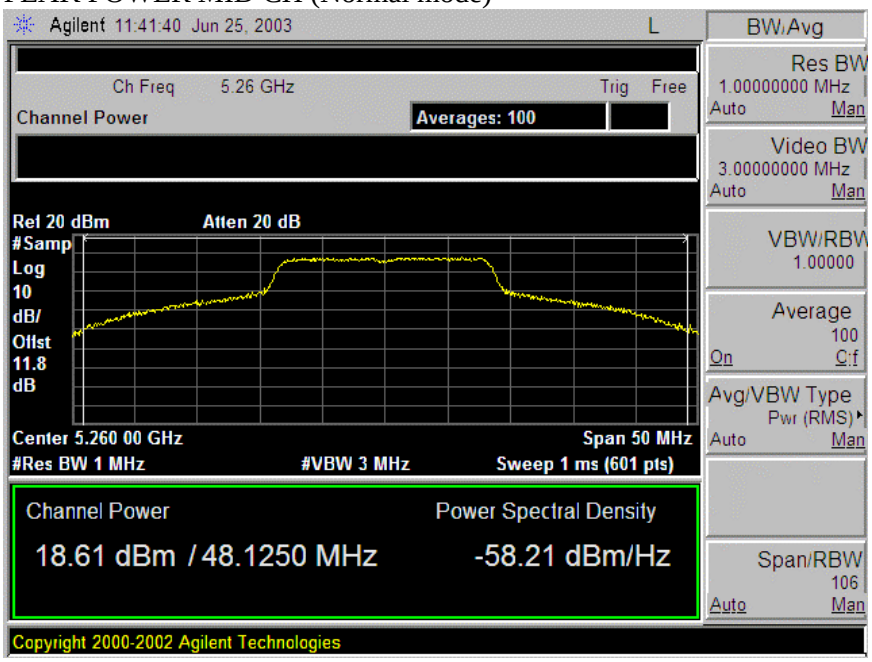
PEAK POWER MID CH (Normal mode)







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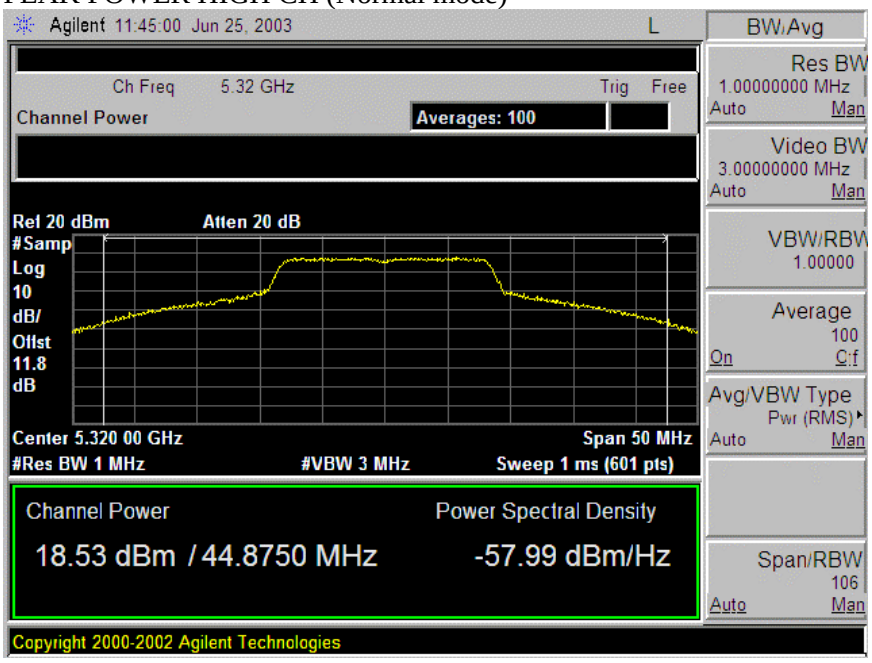
PEAK POWER HIGH CH (Normal mode)







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## 7.3. MAXIMUM PERMISSIBLE EXPOSURE

**LIMITS**

§15.247 (b) (5) 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 §1.1307(b)(1) of this chapter.

**CALCULATIONS**

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = distance in meters
S = Power Density in milliwatts / square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$

$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW / cm^2



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Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and

G (numeric) = 10 ^ (G (dBi) / 10)

yields

$$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S} \qquad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW / cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.

## LIMITS

S = 1.0 mW / cm^2 from 1.1310 Table 1

## RESULTS

No non-compliance noted:

| Mode | Power Density Limit (mW/cm^2) | Output Power (dBm) | Antenna Gain (dBi) | MPE Distance (cm) |
|---|---|---|---|---|
| Normal | 1.0 | 18.61 | 2.98 | 3.39 |

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.




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## 7.4. AVERAGE POWER

### AVERAGE POWER LIMIT

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

### RESULTS

No non-compliance noted:

The cable assembly insertion loss of 11.8 dB (including 10 dB pad and 1.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Normal Mode

| Channel | Frequency (MHz) | Average Power (dBm) |
|---|---|---|
| Low | 5180 | 14.23 |
| Middle | 5260 | 17.90 |
| High | 5320 | 17.99 |




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## 7.5. PEAK POWER SPECTRAL DENSITY

**LIMIT**

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW (17 dBm) or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW (24 dBm) or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain = 2.98 dBi, therefore there is no reduction due to antenna gain.

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.




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**RESULTS**

No non-compliance noted:

Normal Mode

| Channel | Frequency (MHz) | PPSD (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| Low | 5180 | 3.82 | 4.00 | -0.18 |
| Middle | 5260 | 7.53 | 11.00 | -3.47 |
| High | 5320 | 7.30 | 11.00 | -3.70 |



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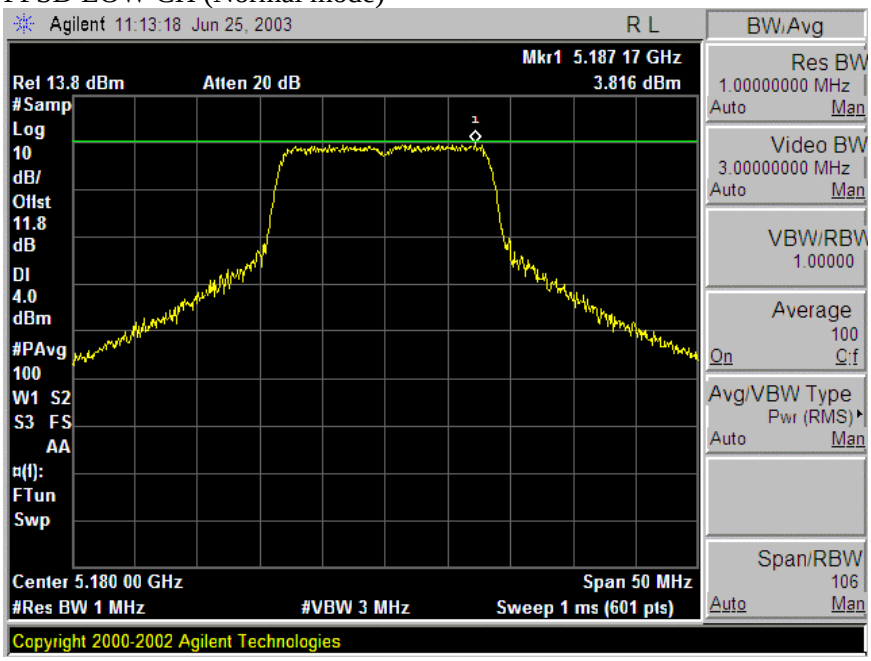
**PEAK POWER SPECTRAL DENSITY (NORMAL MODE)**

PPSD LOW CH (Normal mode)







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PPSD MID CH (Normal mode)

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PPSD HIGH CH (Normal mode)

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## 7.6. PEAK EXCURSION

**LIMIT**

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

**TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

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

**RESULTS**

No non-compliance noted:

Normal Mode

| Channel | Frequency (MHz) | Peak Excursion (dB) | Limit (dB) | Margin (dB) |
|---|---|---|---|---|
| Low | 5180 | 8.27 | 13 | -4.73 |
| Middle | 5260 | 8.36 | 13 | -4.64 |
| High | 5320 | 8.99 | 13 | -4.01 |




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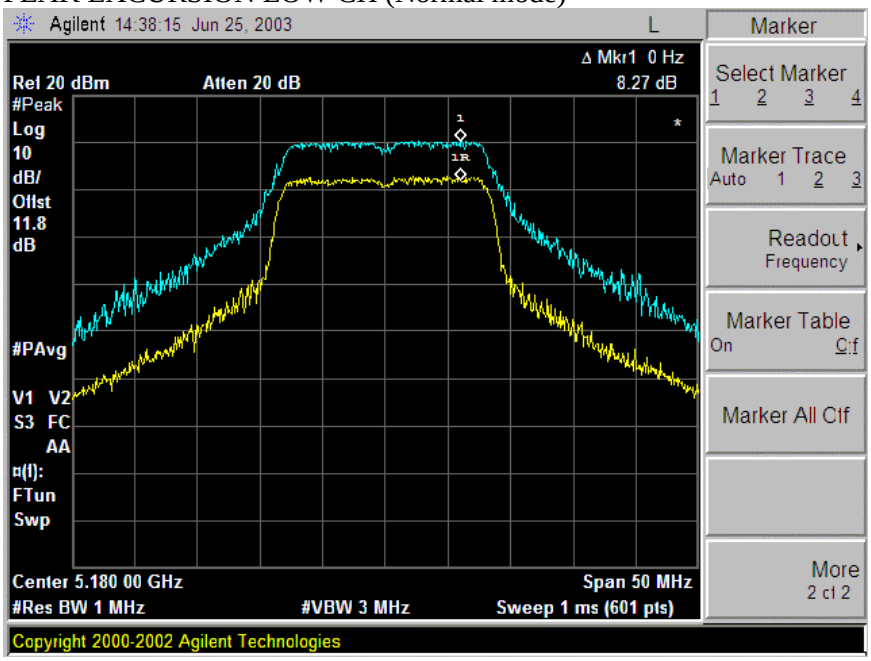
**PEAK EXCURSION (NORMAL MODE)**

PEAK EXCURSION LOW CH (Normal mode)







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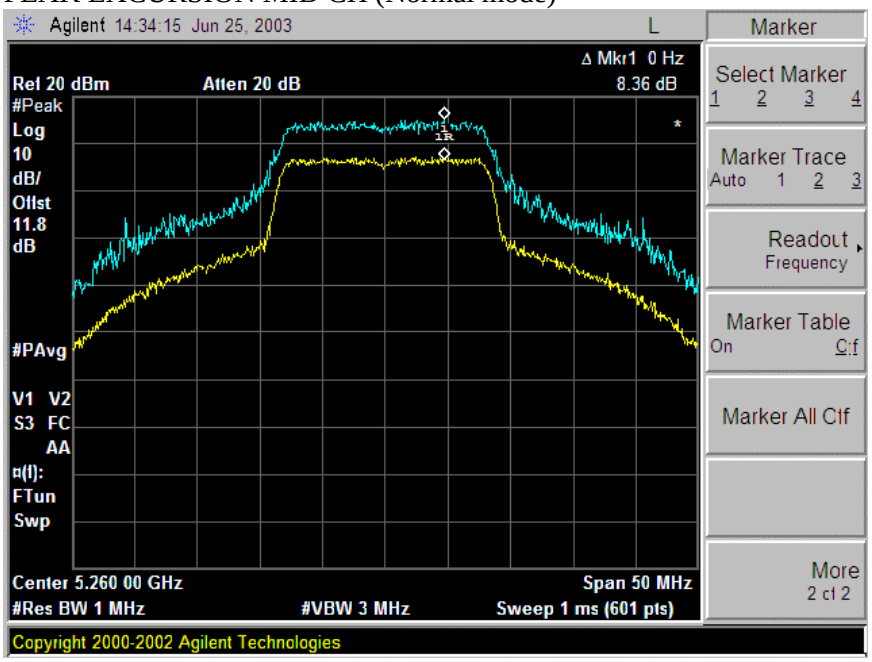
PEAK EXCURSION MID CH (Normal mode)







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