FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

FOR

PROXIM INC

802.11a WIRELESS LAN CARDBUS CARD

MODEL NUMBER: 8455

BRAND NAME: HARMONY OR SKYLINE 802.11a

FCC ID: IMK-8455

REPORT NUMBER: 02U1295

ISSUE DATE: JULY 11, 2002

Prepared for
PROXIM
510 DEGUIGNE DRIVE
SUNNYVALE, CA 94085
USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
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1. TEST RESULT CERTIFICATION

COMPANY NAME: **PROXIM INC**
510 DEGUIGNE DRIVE
SUNNYVALE, CA 94085 USA

CONTACT PERSON: **QUINN KUNZ**

TELPHONE NO: **(801) 292-2909 EXT. 10**

EUT DESCRIPTION: **802.11a WIRELESS LAN CARDBUS CARD**

MODEL NUMBER: **8455**

DATE TESTED: **MAY 7, 2002 – JULY 11, 2002**

TYPE OF EQUIPMENT	INTENTIONAL RADIATOR
EQUIPMENT TYPE	5.725 – 5.850 GHz TRANSCEIVER *
MEASUREMENT PROCEDURE	ANSI 63.4 / 1992, TIA/EIA 603
PROCEDURE	CERTIFICATION
FCC RULE	CFR 47 PART 15.C

* The 5.8 GHz band is applicable to this report; another band of operation (5.2 GHz) is documented in a separate report.

Compliance Certification Services, Inc. tested the above equipment for compliance with the requirements set forth in CFR 47, PART 15, Subpart C. The equipment in the configuration described in this report, shows the measured emission levels emanating from the equipment do not exceed the specified limit.

Note: This document reports the conditions under which testing was conducted and results of the 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.

Approved & Released For CCS By:

MIKE HECKROTTE
CHIEF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

THU CHAN
SENIOR EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The Proxim 8455 is a high performance 802.11a-only WLAN client product intended for laptop applications. It operates in the 5.15 – 5.35 GHz and 5.725 – 5.850 GHz bands with a maximum average Tx output power of 97 mW. The product uses two symmetric integral antennas for diversity operation. Each has a 1.5dBi gain.

The 8455 design is based on an Atheros two chip, AR5001A, solution implementing the IEEE 802.11a stand. The two chips include:

AR5211: Multiprotocol MAC/baseband processor, and CardBus/PCI bus interface.

AR5111 Radio-on-a-Chip (RoC): An all-CMOS single-chip radio transceiver that includes a power amplifier, and integrated dual conversion filters to convert signals from 5 GHz to the baseband range for use by the AR5211. The AR5111 offers fully integrated transmitter, receiver, and frequency synthesizer functions; eliminating the need for external voltage controlled oscillators (VCOs) and surface acoustic wave (SAW) filters.

3. TEST METHODOLOGY

Tests were performed according to the procedures documented on chapter 13 of ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, and 15.407.

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.

Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specifications for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

4.2. LABORATORY ACCREDITATIONS AND LISTINGS

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: 200065-0 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 (reference no: 31040/SIT (1300B3) and 31040/SIT (1300F2)).

4.3. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP*	FCC Part 15, CISPR 22, 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, CNS 13438	NVLAP 200065-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	FC 1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	VCCI 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	N 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	N ELA-171
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	Canada IC2324 A,B,C, and F

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

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2. Measurement Uncertainty

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

Radiated Emission	
30MHz – 200 MHz	+/- 3.3dB
200MHz – 1000MHz	+4.5/-2.9dB
1000MHz – 2000MHz	+4.6/-2.2dB
Power Line Conducted Emission	
150kHz – 30MHz	+/-2.9

Any results falling within the above values are deemed to be marginal.

5.3. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENTS LIST				
Name of Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Due Date**
Spectrum Analyzer	**HP**	**8593E**	**3710A00205**	**6/11/03**
Spectrum Analyzer	**HP**	**E4404B**	**US40240772**	**3/25/03**
Spectrum Analyzer	**HP100Hz - 22GHz**	**8566B**	**3140A06685**	**6/1/03**
Spectrum Display	**HP**	**85662A**	**2152A03066**	**6/1/03**
Quasi-Peak Detector	**HP9K - 1GHz**	**85650A**	**3145A01654**	**6/1/03**
Pre-Amplifier, 25 dB	**HP 0.1 - 1300MHz**	**8447D (P_8)**	**2944A06589**	**8/10/02**
Antenna, BiLog	**Chase 30 - 2000MHz**	**CBL6112B**	**2586**	**3/30/03**
Line Filter	**Lindgren 10k - 10GHz**	**LMF-3489**	**497**	**N.C.R.**
LISN	**Fisher Cus. Comm.**	**LISN-50/250-25-2**	**2023**	**4/23/3**
EMI Test Receiver	**Rohde & Schwarz**	**ESHS 20**	**827129/006**	**4/17/03**
Pre-amplifier, (1 - 26.5GHz)	**Miteq**	**NSP2600-44**	**646456**	**4/26/03**
Microwave Amplifier (2 – 8 GHz)	**HP**	**11975A**	**2517A01067**	**8/23/02**
Horn Antenna (1-18GHz)	**EMCO**	**3115**	**6739**	**1/31/03**
Horn Antenna,(18 - 26GHz)	**Antenna Research Associate**	**MWH 1826/B**	**1013**	**7/26/02**
Harmonic Mixer (26.5-40GHz)	**HP**	**11970A**	**3003A04190**	**9/23/02**
Horn Antenna(26.5 - 40GHz)	**Dico**	**1149**	**2**	**9/22/02**
High Pass Filter(7.6GHz)	**FSY Microwave**	**7600-9SS**	**1**	**N.C.R.**
6 dB Attenuator	**Mini-Circuits**	**MCL BW-S6W2**	**0021**	**In House Cal**
10 dB Attenuator	**Mini-Circuits**	**MCL BW-S10W2**	**0026**	**In House Cal**
20 dB Attenuator	**Mini-Circuits**	**MCL BW-S20W2**	**0025**	**In House Cal**

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

Device Type	Manufacturer	Model	Serial Number	FCC ID
Laptop	Toshiba	Tecra 8200	NA	DoC
AC Power Adapter	Toshiba	PA3048U-IACA	NA	DoC
Printer	HP	842C	NA	DoC
PDA	3COM	Palm III	10841CD887AJ	DoC

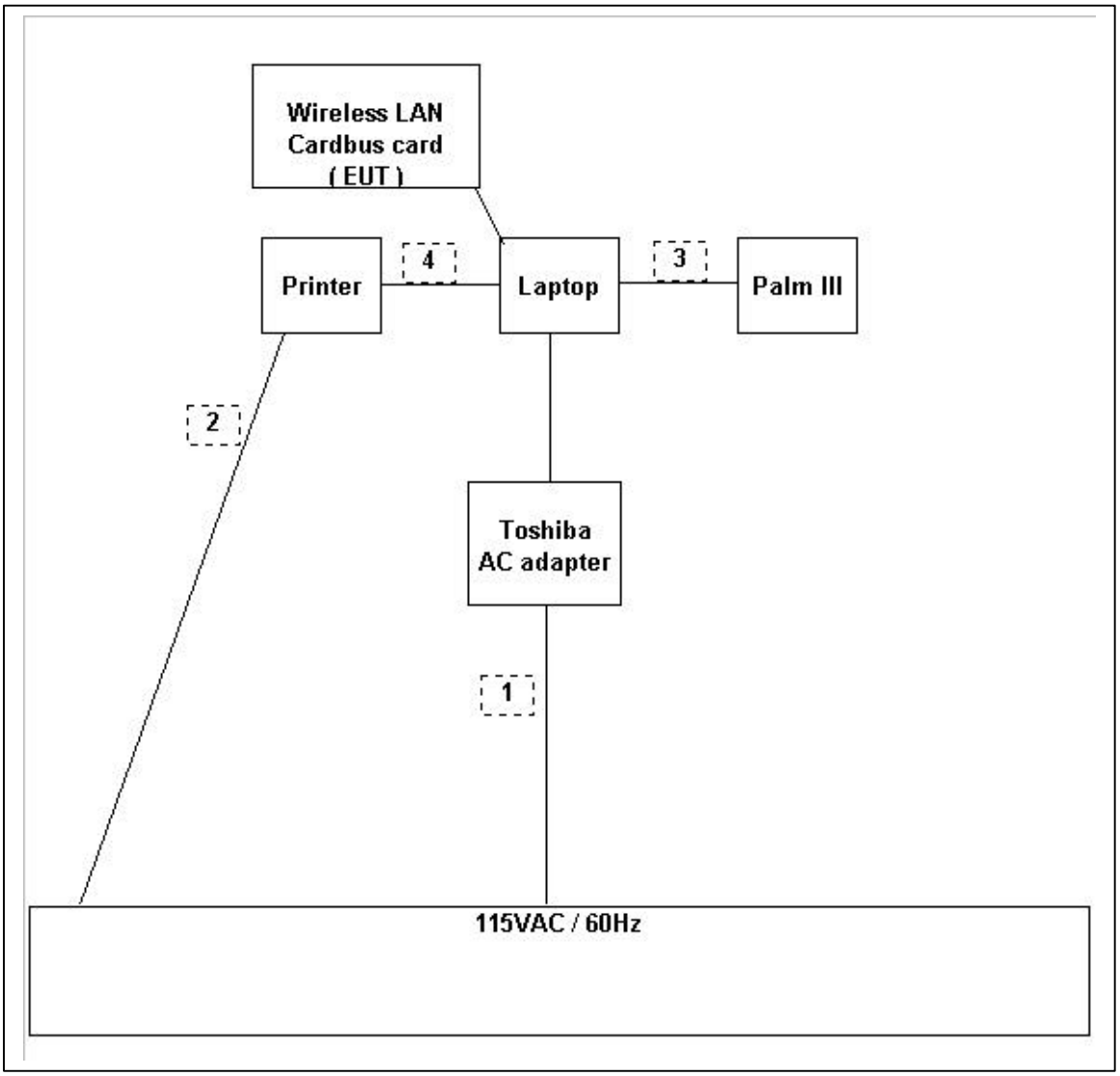
I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115	Unshielded	2 m	Part of AC Adapter
2	AC	1	US115	Unshielded	2 m	
3	Serial	1	DB9	Shielded	2 m	
4	Parallel	1	DB25	Shielded	1.5 m	

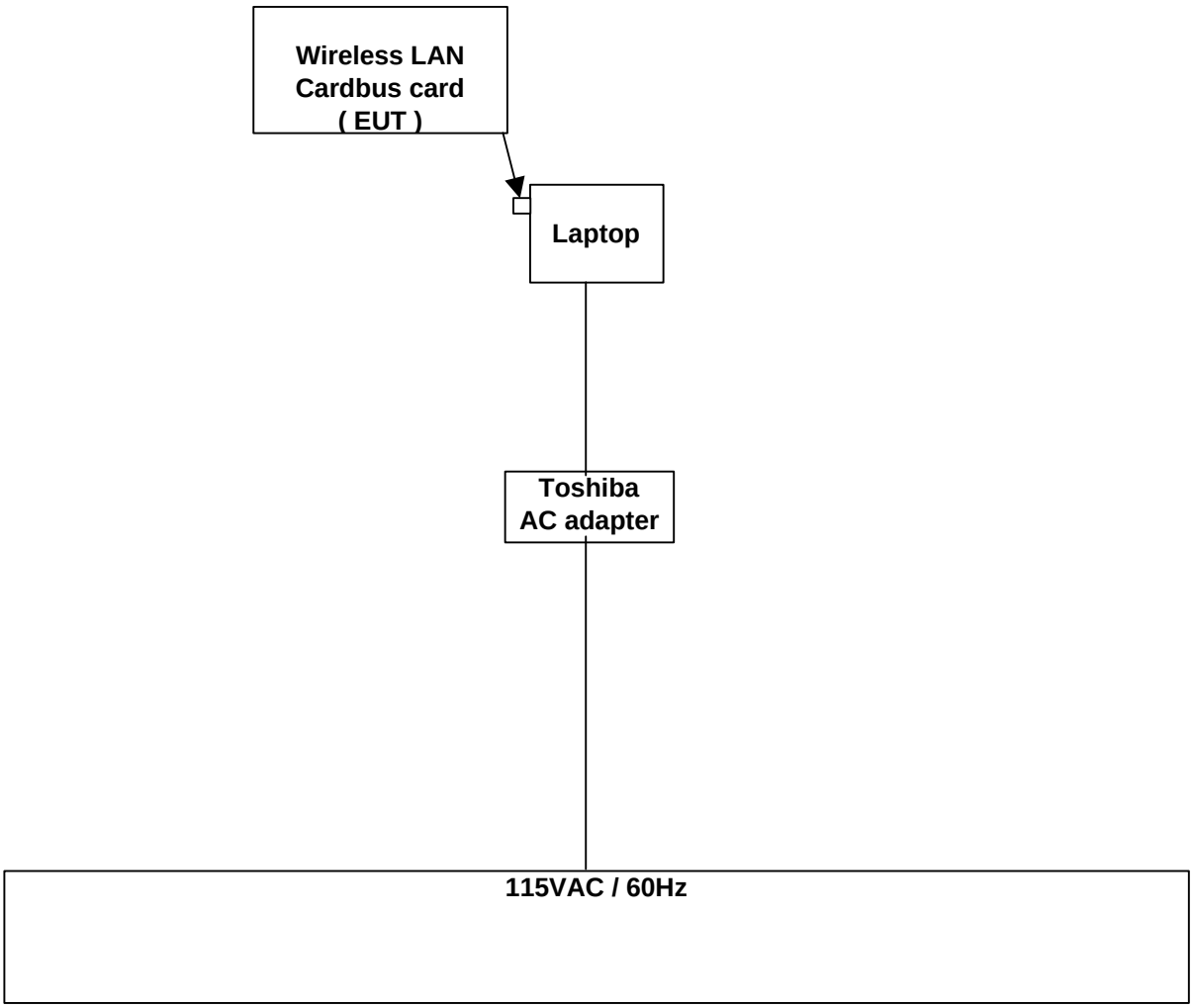
TEST SETUP

The EUT is installed into a laptop computer during the test.

SETUP DIAGRAM FOR DIGITAL DEVICE TESTS



SETUP DIAGRAM FOR TRANSMITTER TESTS



7. APPLICABLE RULES

§15.247 (a)- BANDWIDTH

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

§15.247 (b)- POWER OUTPUT

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

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt.

(4) 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.

Specification Limit: Antenna Gain = 1 dBi, therefore the limit is 30 dBm

§15.247 (b)- RADIO FREQUENCY EXPOSURE

(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.

§15.247 (c)- SPURIOUS EMISSIONS

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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. Attenuation below the general limits specified in §15.209(a) is not required. 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 §15.205(c)).

§15.247 (d)- PEAK POWER SPECTRAL DENSITY

(d) For direct sequence systems, the peak 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.

§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
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] 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.

§15.207- CONDUCTED LIMITS

(a) 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 450 kHz to 30 MHz shall not exceed 250 microvolts. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

FCC PART 15.207

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-30MHz	250	48

§15.209- RADIATED EMISSION LIMITS; GENERAL REQUIREMENTS

(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 (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

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

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

FCC PART 15.209

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

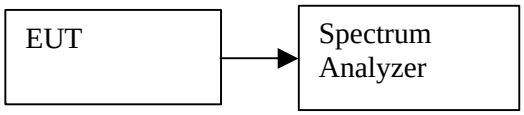
8. TEST SETUP, PROCEDURE AND RESULT

8.1. NUMBER OF CHANNELS

In the Turbo Mode, there are only two frequencies of operation. Thus only Low and High channels are tested in this mode, and the Middle channel is not applicable.

8.2. 6 dB BANDWIDTH

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection is used. The 6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 6 dB.

RESULTS

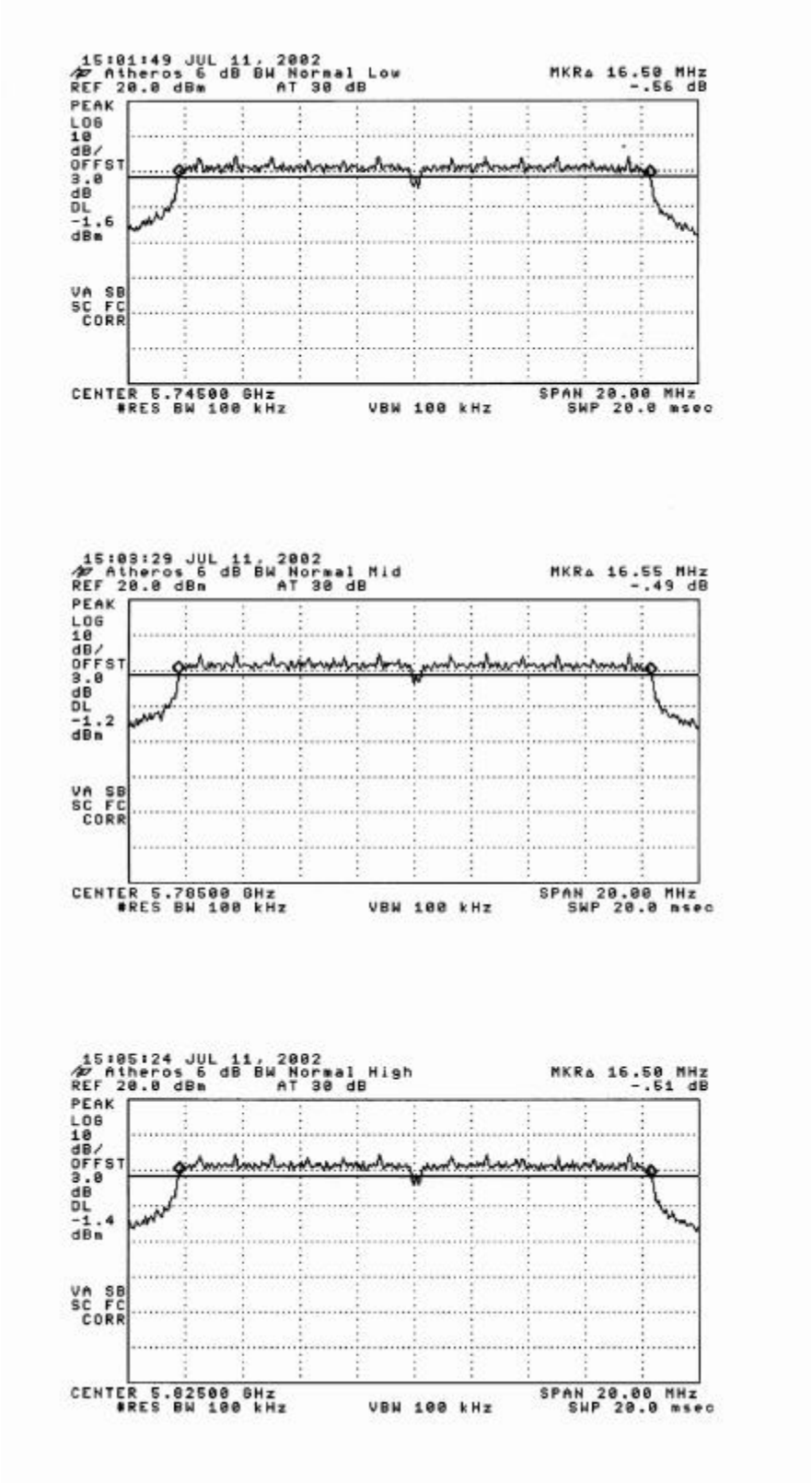
No non-compliance noted:

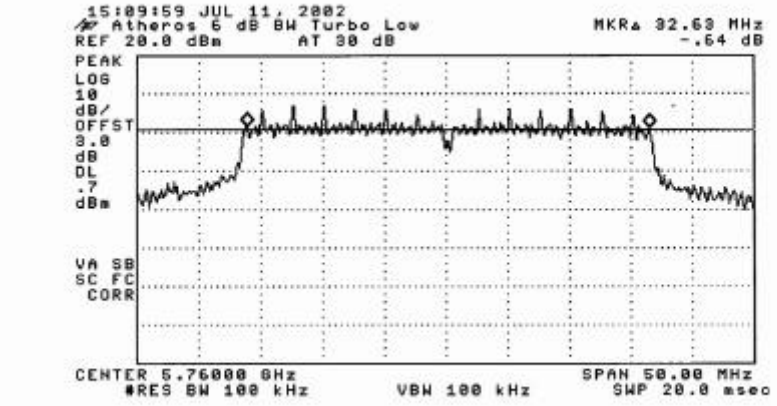
5.8 GHz Band, Base Mode

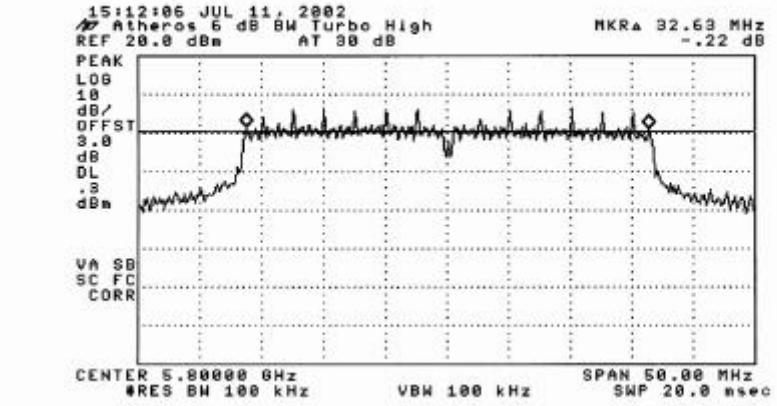
Channel	Frequency (MHz)	B (kHz)	Limit (kHz)	Margin (kHz)
Low	5745	16500	500	16000
Middle	5785	16550	500	16050
High	5825	16500	500	16000

5.8 GHz Band, Turbo Mode

Channel	Frequency (MHz)	B (kHz)	Limit (kHz)	Margin (kHz)
Low	5760	32630	500	32130
Middle	N/A	N/A	N/A	N/A
High	5800	32630	500	32130

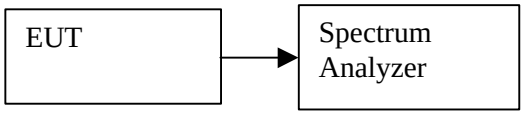






8.3. EMISSION BANDWIDTH

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to approximately 1% of the emission bandwidth and peak detection is used. The emission bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB.

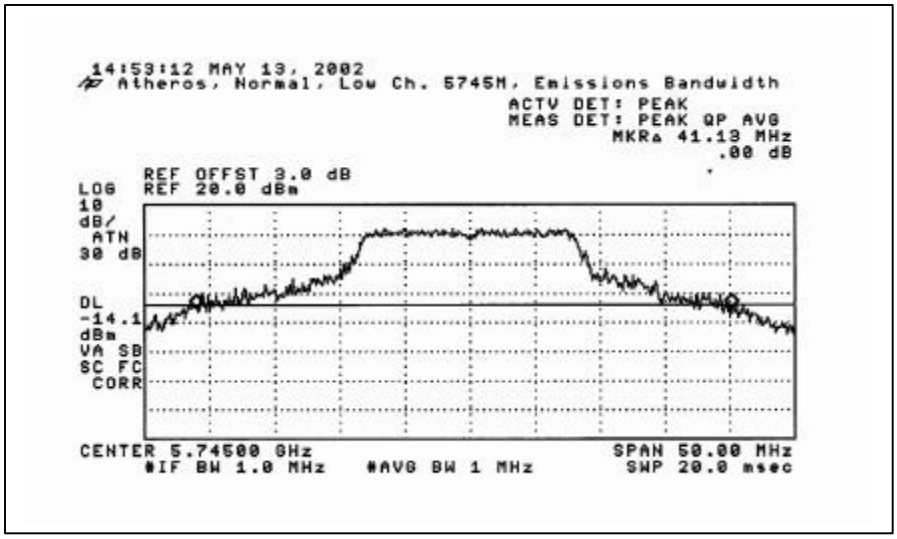
RESULTS

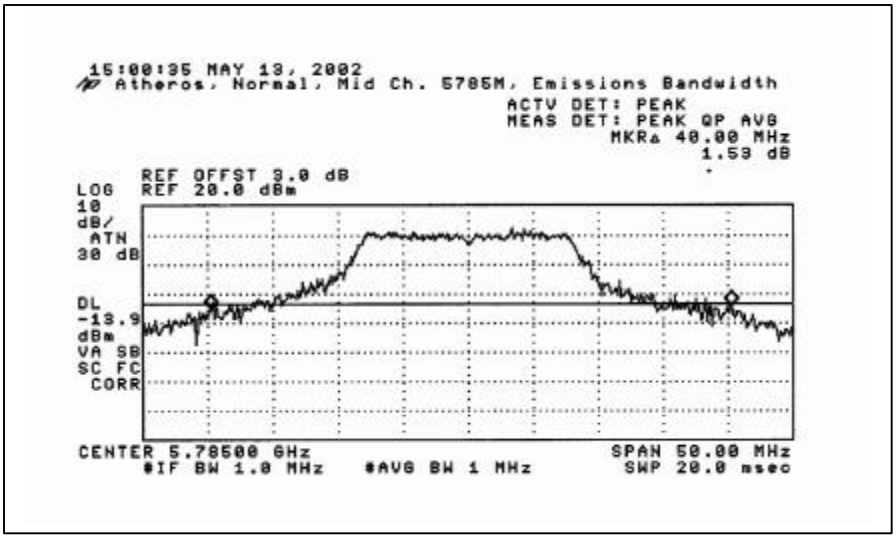
Normal Mode

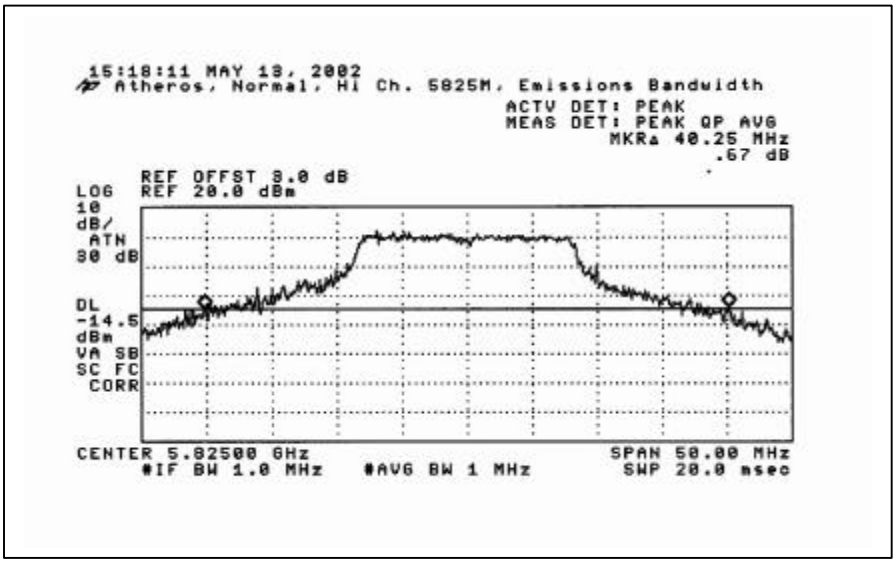
Channel	Frequency (MHz)	B (MHz)
Low	5745	41.13
Middle	5785	40.00
High	5825	40.25

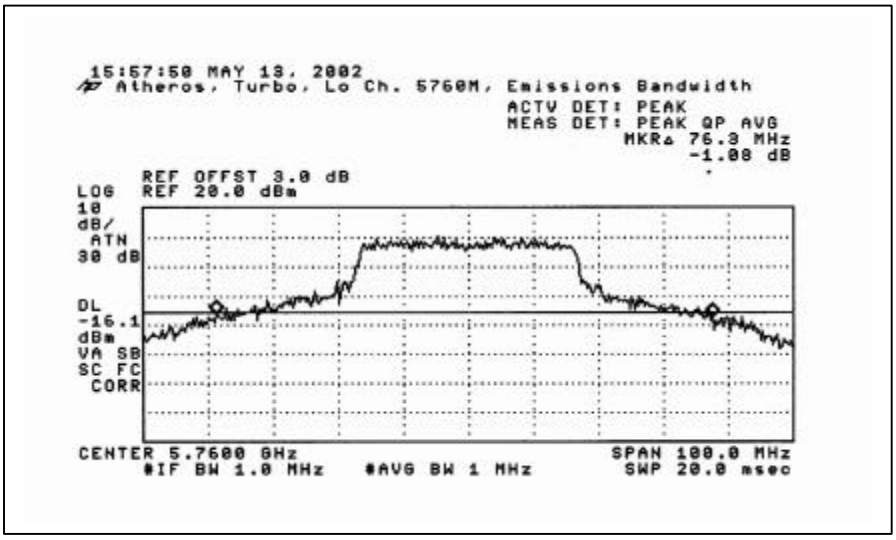
Turbo Mode

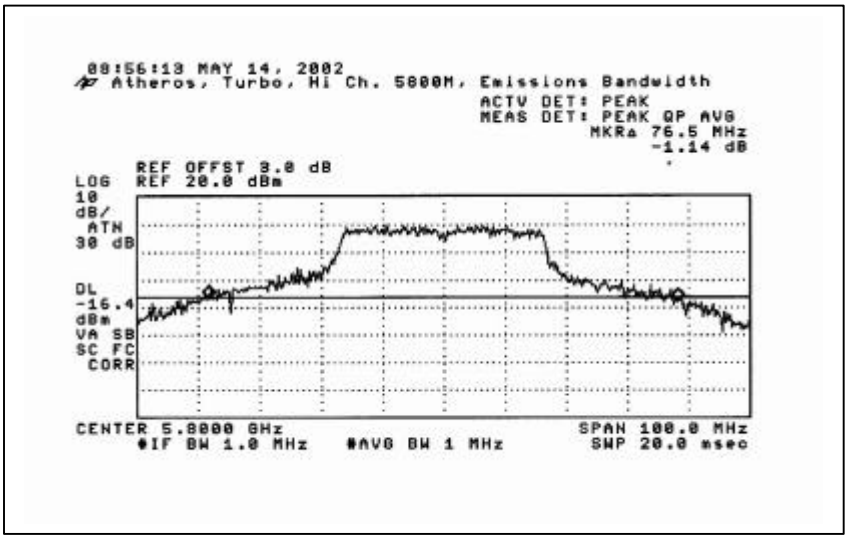
Channel	Frequency (MHz)	B (MHz)
Low	5760	76.30
Middle	N/A	N/A
High	5800	76.50





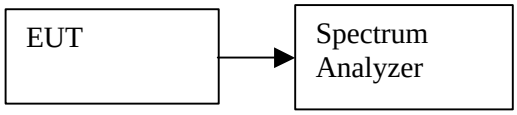






8.4. PEAK POWER

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz, and the video bandwidth is greater than or equal to the larger of:
EBW / (2 * pi * 30) where EBW is the emission bandwidth
or 1 / (2 * pi * T) where T is the transmission pulse duration over which the transmission is continuous and average symbol envelope power is constant.

Peak detection is used, and the peak power is determined by channel integration over the previously measured emission bandwidth.

Pulse duration limitation: T = 2.1 msec, VBW = 75 Hz, therefore the minimum video bandwidth is determined by the emission bandwidth rather than the pulse duration.

RESULTS

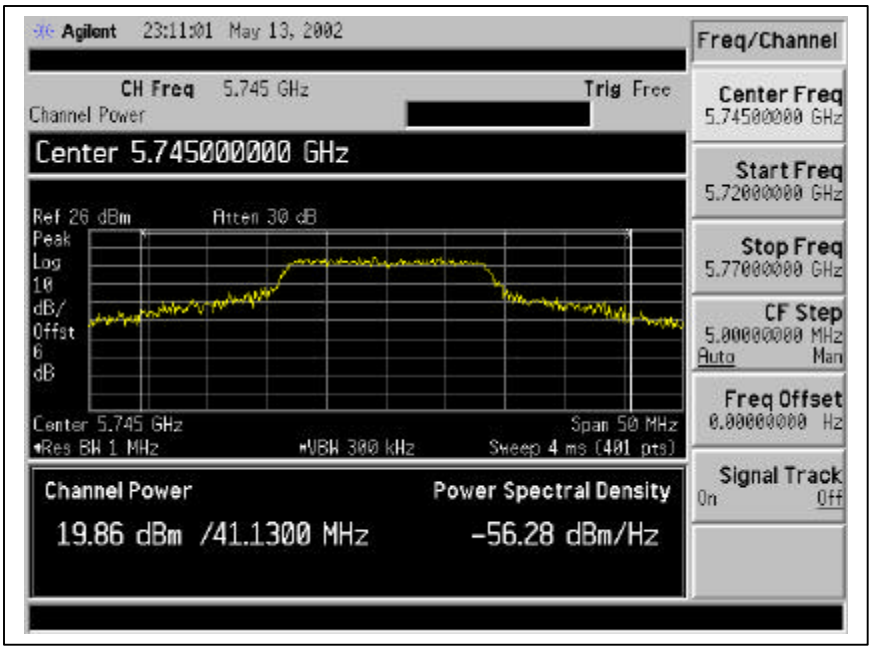
No non-compliance noted:

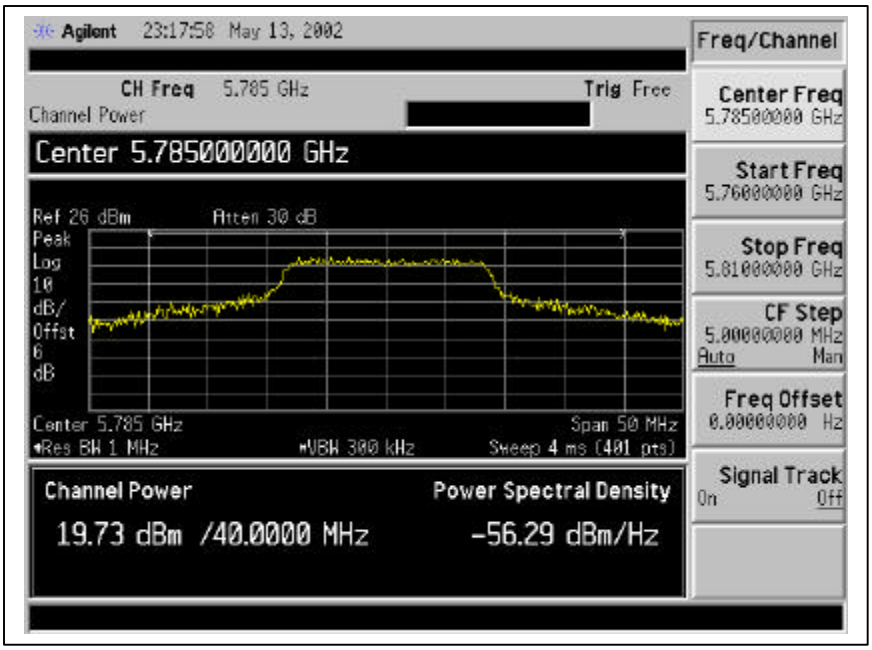
Normal Mode

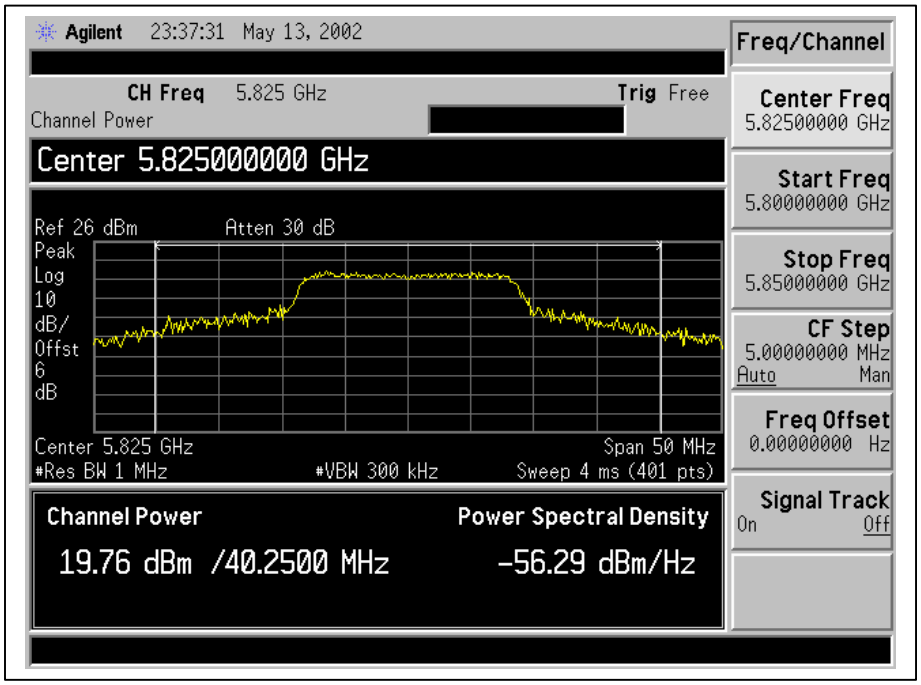
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin dB
Low	5745	19.86	30	-10.14
Middle	5785	19.73	30	-10.27
High	5825	19.76	30	-10.24

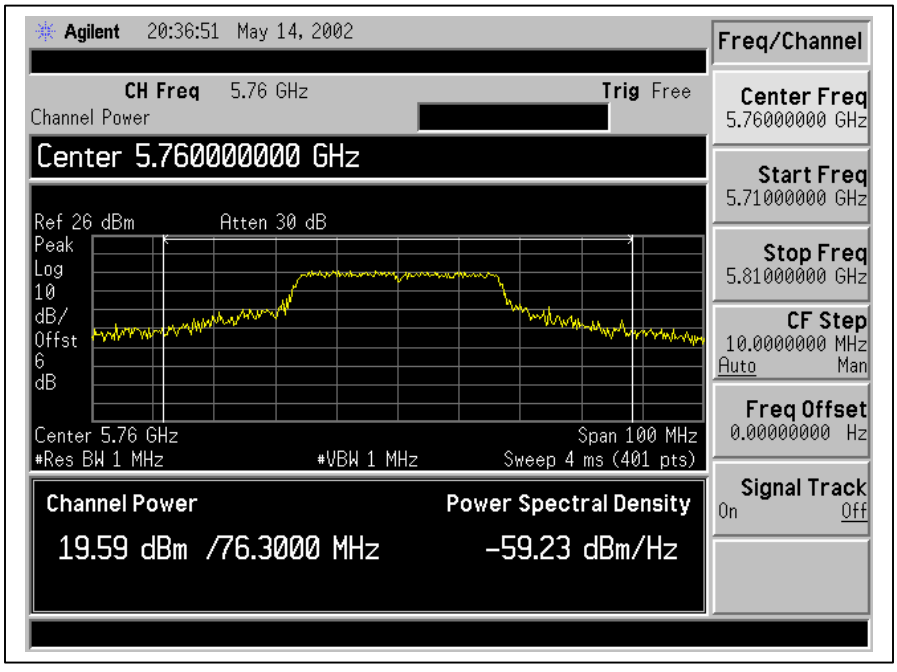
Turbo Mode

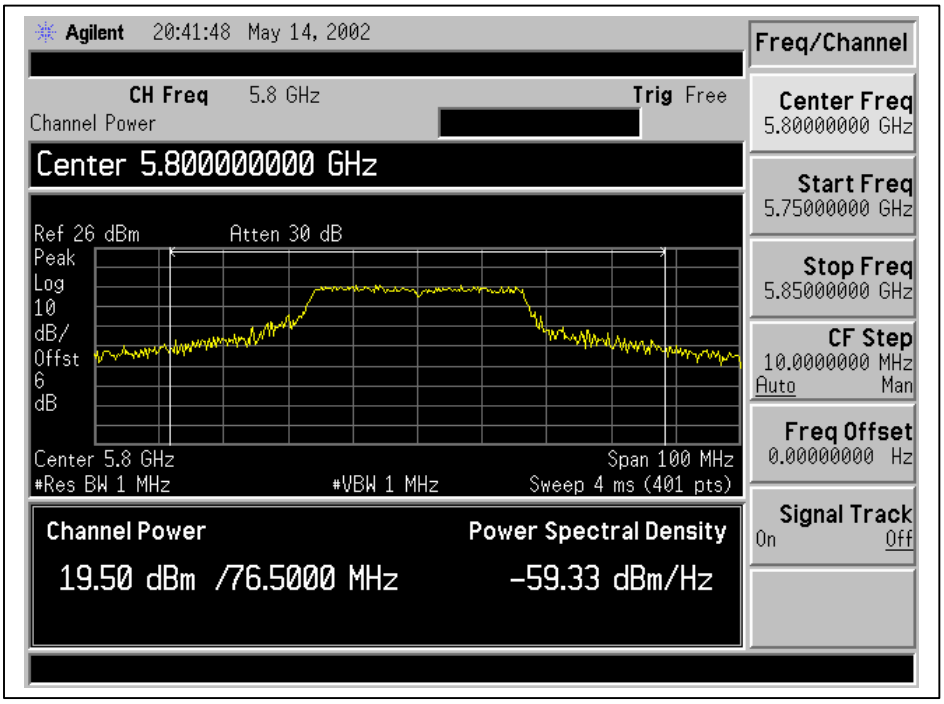
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin dB
Low	5760	19.59	30	-10.41
Middle	N/A	N/A	N/A	N/A
High	5800	19.50	30	-10.50





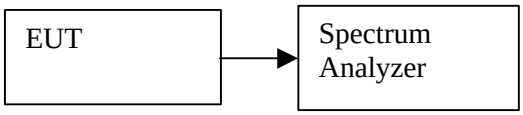






8.3. PEAK POWER SPECTRAL DENSITY

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = VBW = 3KHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

RESULTS

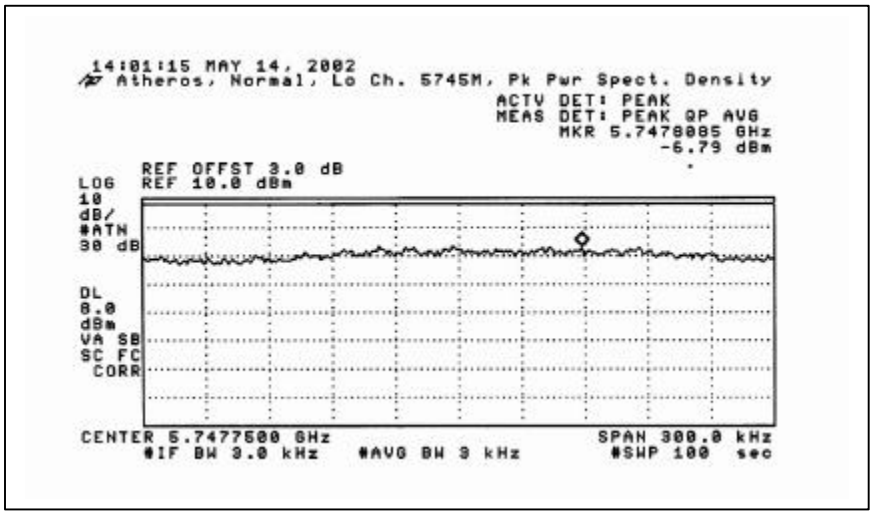
No non-compliance noted:

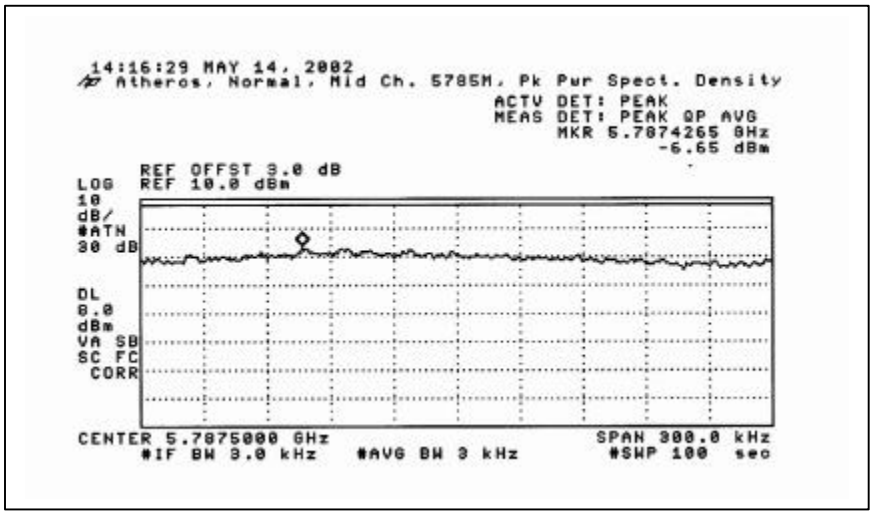
Base Mode

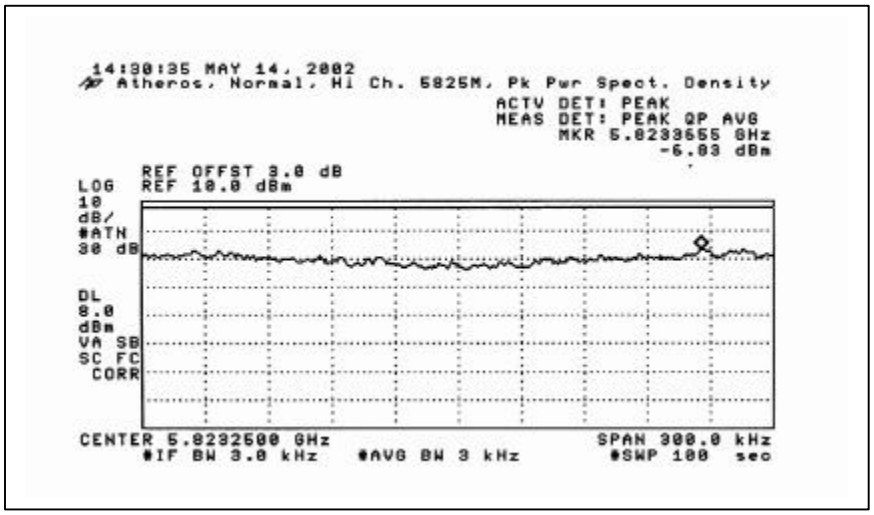
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin dB
Low	5745	-6.79	8	-14.79
Middle	5785	-6.65	8	-14.65
High	5825	-6.83	8	-14.83

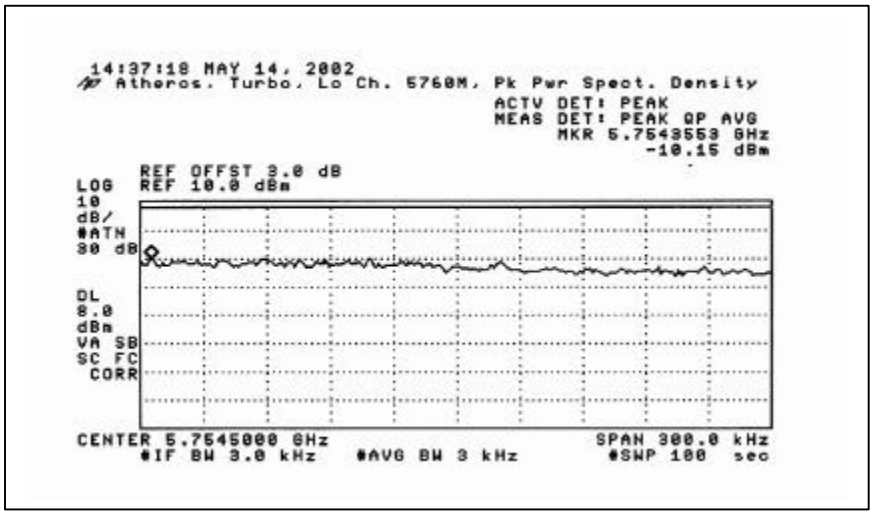
Turbo Mode

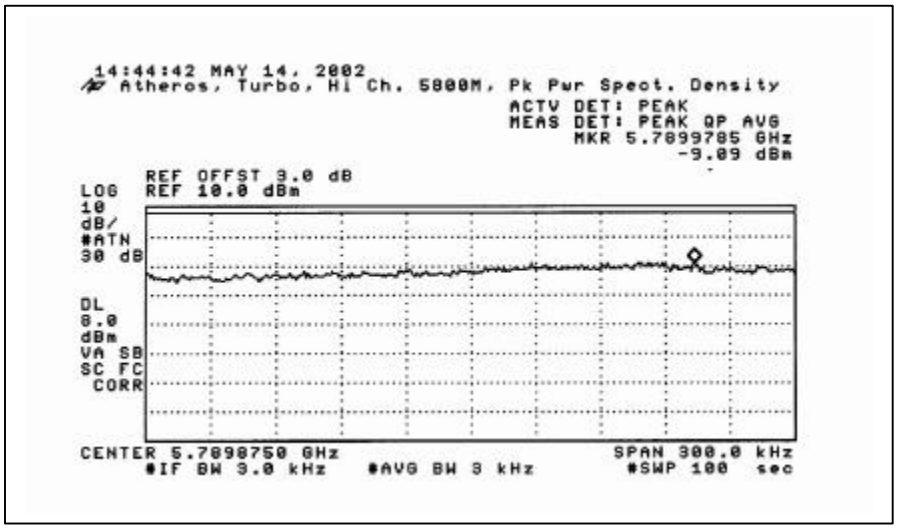
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin dB
Low	5760	-10.15	8	-18.15
Middle	N/A	N/A	N/A	N/A
High	5800	-9.09	8	-17.09











8.4. RADIO FREQUENCY EXPOSURE (MPE)

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