FCC CFR47 PART 15 SUBPART C
CERTIFICATION
TEST REPORT

FOR

ArcXtend TM

MODEL NUMBER: AX1455

FCC ID: PLRAX145500

REPORT NUMBER: 05U3489-1B

ISSUE DATE: JUNE 23, 2005

Prepared for

ARCWAVE INCORPORATED
910 CAMPISI WAY, #1C
CAMPBELL, CA 95008, USA

Prepared by

COMPLIANCE ENGINEERING SERVICES, INC.
d.b.a.
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885
FAX: (408) 463-0888

LAB CODE:200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
A	6/23/05	Initial Issue	YZ
B	8/22/05	Corrected typo in section 5.2	MH

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ARCWAVE, INC.
910 CAMPISI WAY, #1C
CAMPBELL, CA 95008
U.S.A

EUT DESCRIPTION: ArcXtend TM

MODEL: AX1455 (TESTED AX1455-SM-25 AND AX1455-SM-60)

SERIAL NUMBER: 00001

DATE TESTED: JUNE 13 –JUNE 14, 2005

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	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: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. 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. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By: Tested By:

MIKE HECKROTTE
ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

DAVID GARCIA
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, California, USA. 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."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://www.ccsemc.com.

4. CALIBRATION AND UNCERTAINTY

4.1. 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.

4.2. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
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%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a 5.8GHz point to multipoint hub.

The radio module is manufactured by Arcwave Inc.

The EUT was tested in two configurations. The only difference between the two configurations was the antenna. One antenna is a 20 degree beam-width, patch array antenna with a gain of 19 dBi and the other is a 60 degree beam-width, patch array antenna with a gain of 15 dBi.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Antenna Applied	Output Power (dBm)	Output Power (mW)
5813 - 5843	19 dBi Antenna	15.50	35.48
5813 - 5843	15 dBi Antenna	20.80	120.23

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a patch array antenna. There are two options available. One antenna is a 20 degree beam-width, patch array antenna with a maximum gain of 19 dBi and the other is a 60 degree beam-width, patch array antenna with a maximum gain of 15 dBi.

5.4. SOFTWARE AND FIRMWARE

1. Firmware Installed on EUT
   Total of 4
   AX500 (Cable Tuner)= 2.7 Rev. 1
   AX150 (transmitter) = 2.6 Rev. 0
   AX106 (Receiver) = 2.6 Rev. 0
   BRM3202 (embedded Cable modem) = 2.00.04A1 Rev 1

2. Host support Equipment
   Laptop = Windows 2000 Server SP2
   Arris CMTS = 4.2.414

3. Test Utility Software
   MS Internet Explorer = 5.00.3315.1000

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 5825 MHz.

The worst-case data rate for this channel is determined to be 40 Mb/s, based on previous experience with the similar product design architectures.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
CMTS	Nortel Networks	ARCD0145	11500491201	N/A
Laptop	Sony	Vaio PCG-Z505HE	28305630	DoC
Diplexer	Blonder Tonque	ZUVSJ	N/A	N/A
Power Injector	ChannelVision	CVT-P1	N/A	N/A
AC Power Supply	Alpha Technologies	APC 6014PM	NC0100463-ATN	N/A
AC Adapter	Sony	PCGA-ACX1	418880	N/A

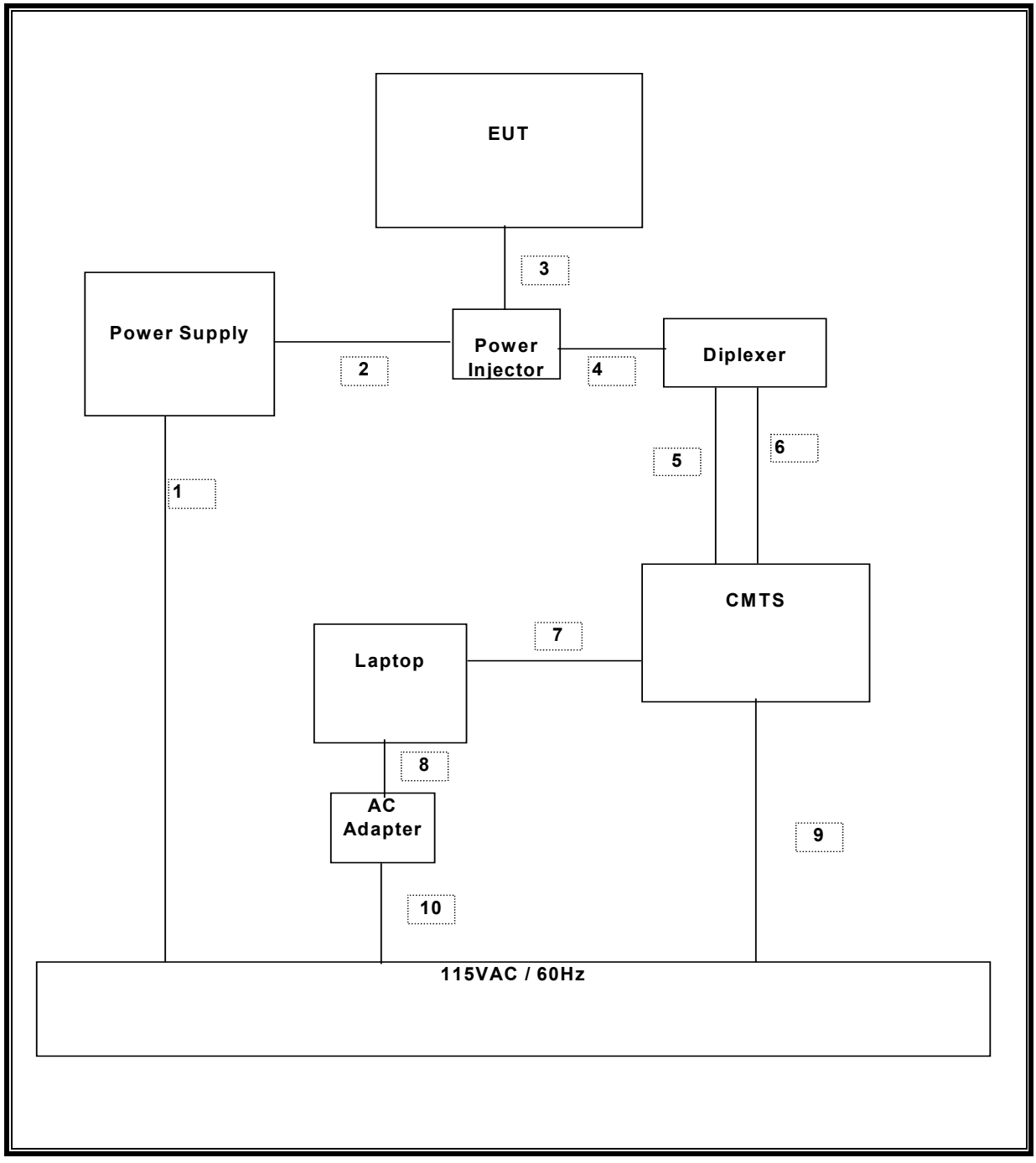
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	IEC	Unshielded	1.8m	
2	Power	1	F	Shielded	0.5m	
3	Data/Power	1	F	Shielded	20m	
4	Data	1	F	Shielded	0.5m	
5	Data	1	F	Shielded	0.5m	
6	Data	1	F	Shielded	0.5m	
7	Data	1	RJ-45	Unshielded	1.5m	
8	DC	1	DC	Unshielded	1.5m	
9	AC	1	AC	Unshielded	1.8m	
10	AC	1	IEC	Unshielded	1.8m	

TEST SETUP

The EUT is a stand alone unit and was tested while connected to remote support equipment. Test software exercised the EUT.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**Cal Due**
EMI Test Receiver	R & S	ESIB40	100192	5/9/2006
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent	E4446A	US42510266	8/25/2005
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	3/29/2006
RF Filter Section	HP	85420E	3705A00256	3/29/2006
Antenna, Bilog 30MHz ~ 2Ghz	Sunol Sciences	JB1	A121003	3/3/2006
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	9/12/2005
Preamplifier, 1 ~ 26 GHz	Miteq	NSP2600-44	646456	8/17/2005
Peak Power Meter	Agilent	E4416A	GB41291160	2/9/2006
Peak / Average Power Sensor	Agilent	E9327A	US40440755	2/10/2006
5.725 - 5.825 GHz Rejection Filter	MicroTronics	BRC13192	2	CNR
4.0 GHz High Pass Filter	MicroTronics	HPM13351	4	CNR

7. CHANNEL TESTS

7.1.1. 6 dB BANDWIDTH

LIMIT

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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

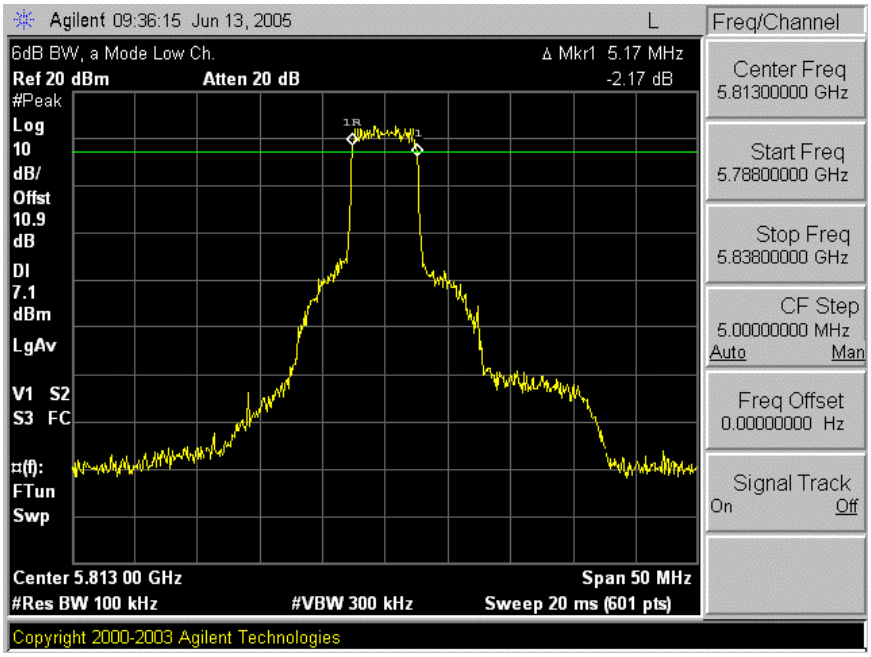
RESULTS

No non-compliance noted:

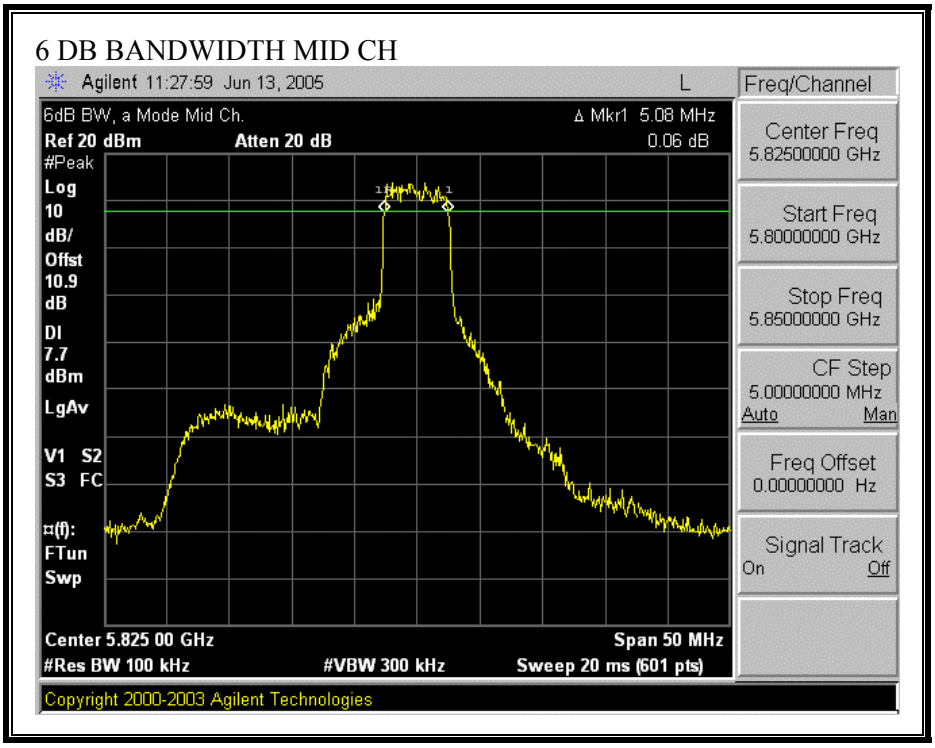
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	5813	5166.667	500	4667
Middle	5825	5083.333	500	4583
High	5843	5083.333	500	4583

6 DB BANDWIDTH

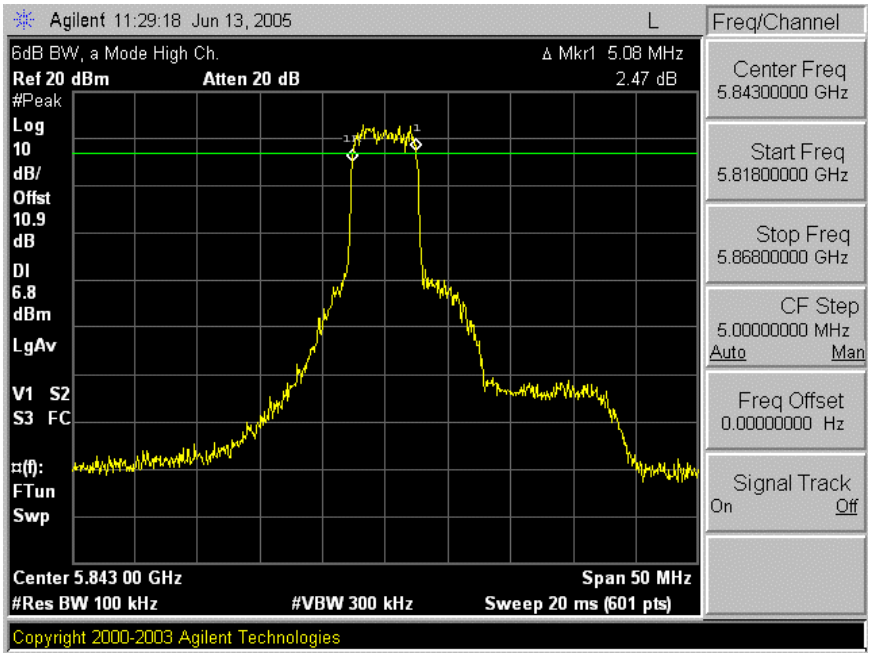
6 DB BANDWIDTH LOW CH



6 DB BANDWIDTH MID CH



6 DB BANDWIDTH HIGH CH



7.1.2. 99% BANDWIDTH

LIMIT

None: for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

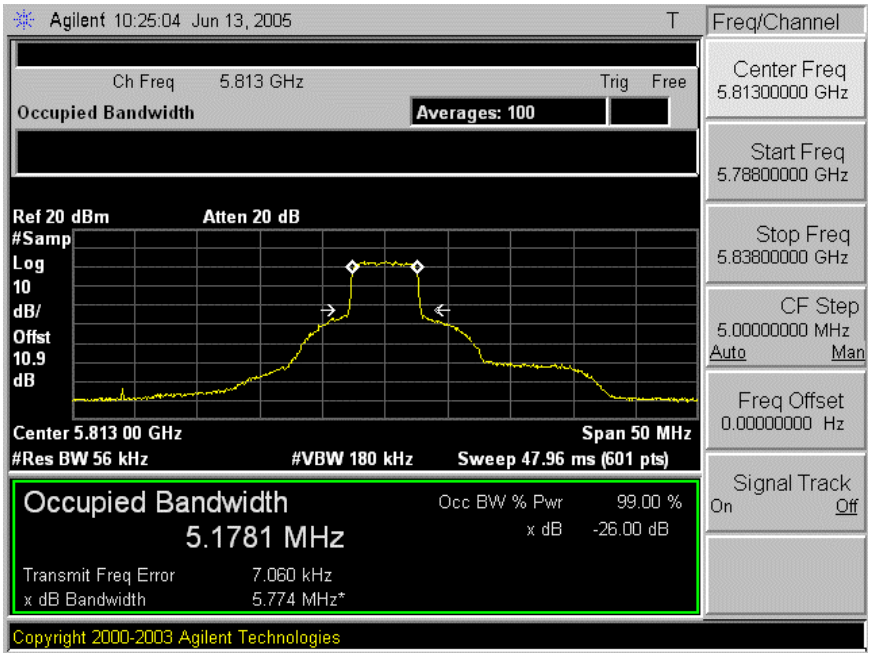
RESULTS

No non-compliance noted:

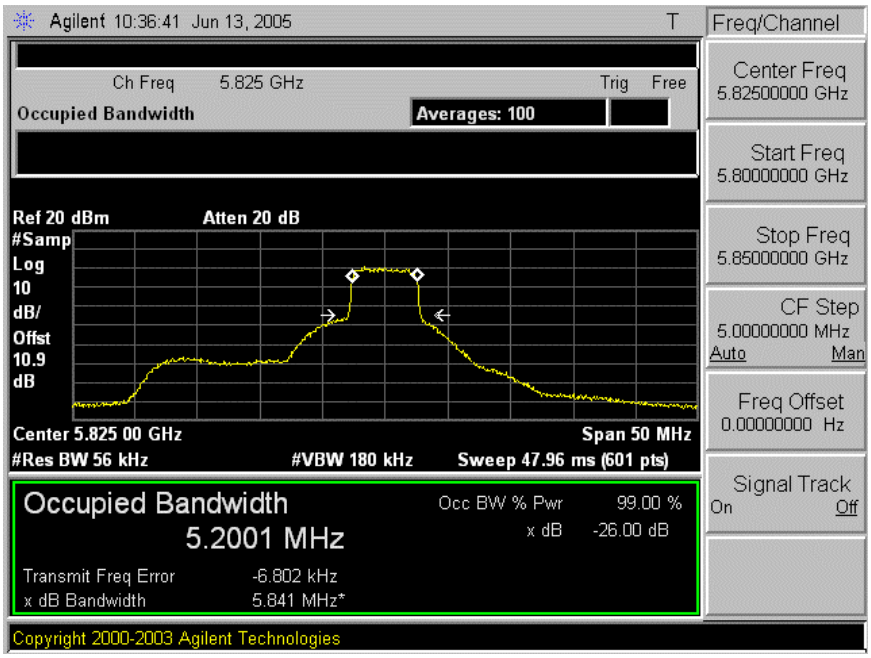
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5813	5.1781
Middle	5825	5.2001
High	5843	5.163

99% BANDWIDTH

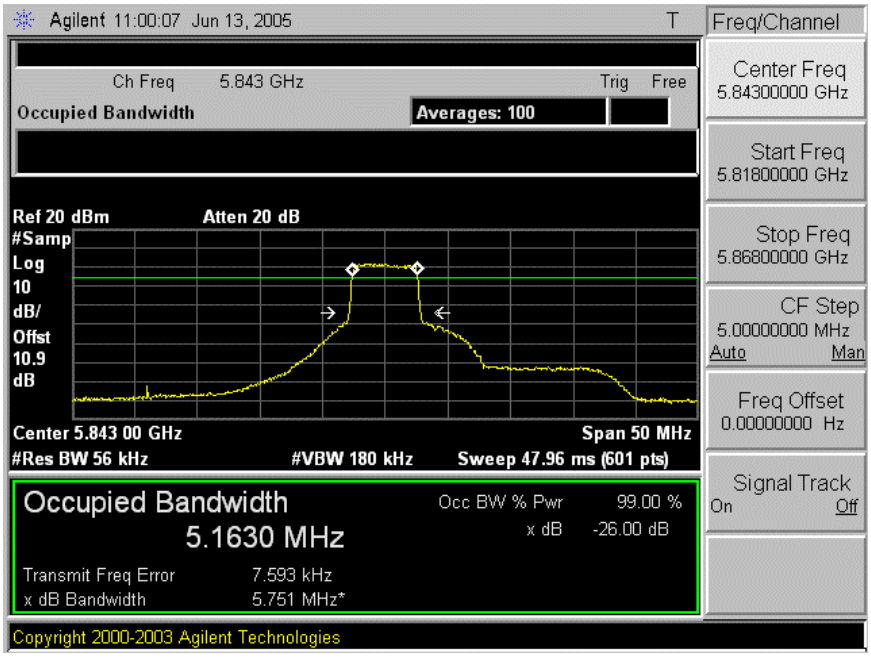
99% BANDWIDTH LOW CH



99% BANDWIDTH MID CH



99% BANDWIDTH HIGH CH



7.1.3. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

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

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt. As an alternative to a peak power measurement, compliance with the one-Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

§15.247 (b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005. The transmitter operates continuously therefore Power Output Option 2, Method # 1 is used.

RESULTS

This is not a fixed, point-to-point operation system. Therefore, for the maximum antenna gain of 19 dBi, the limit is 17 dBm; and for the maximum antenna gain of 15 dBi, the limit is 21dBm.

No non-compliance noted:

For 19 dBi Antenna

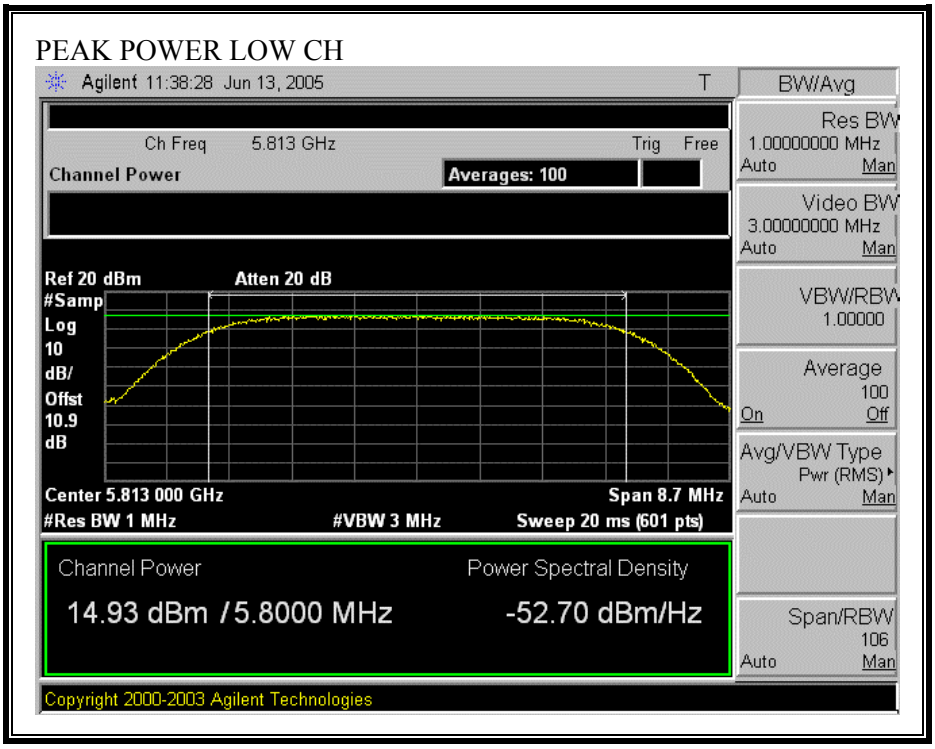
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5813	14.93	17	-2.07
Middle	5825	15.50	17	-1.50
High	5843	13.97	17	-3.03

For 15 dBi Antenna

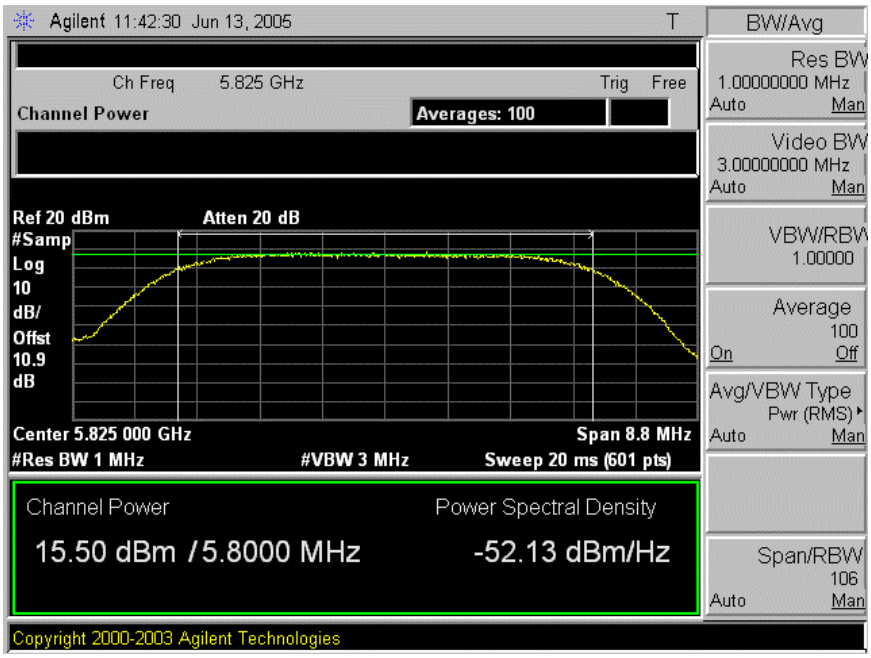
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5813	20.24	21	-0.76
Middle	5825	20.80	21	-0.20
High	5843	19.87	21	-1.13

OUTPUT POWER FOR 19 dBi ANTENNA

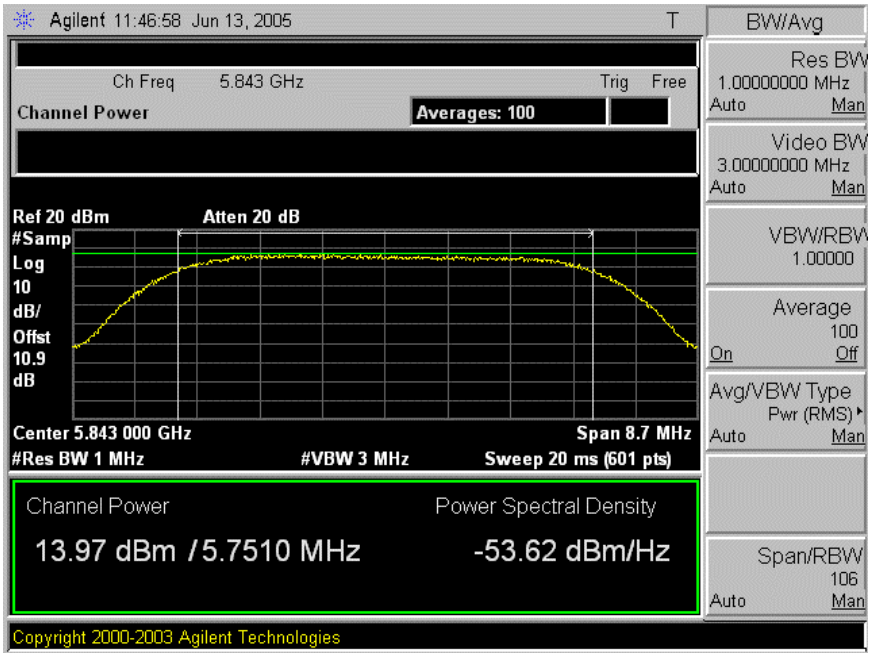
PEAK POWER LOW CH



PEAK POWER MID CH

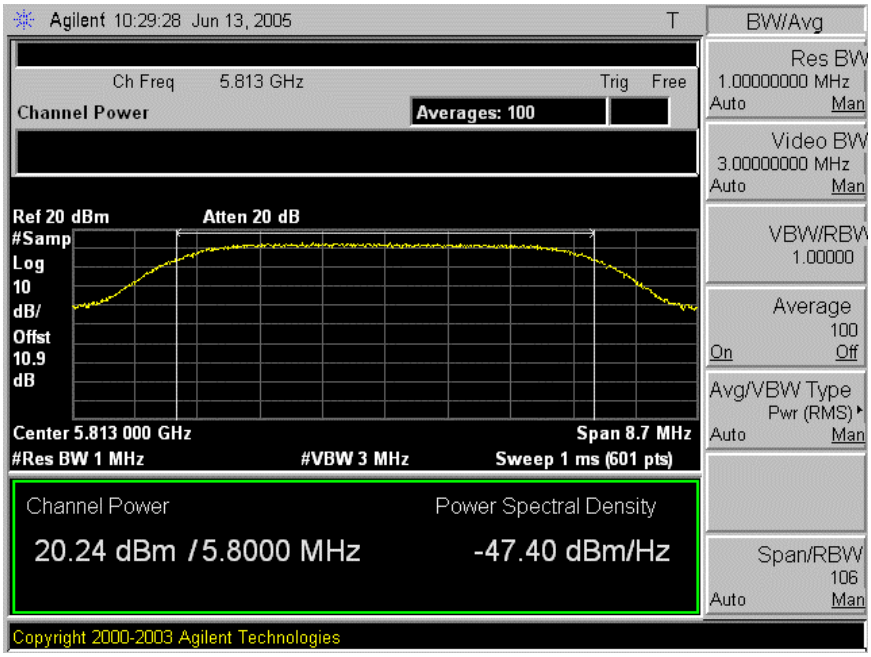


PEAK POWER HIGH CH

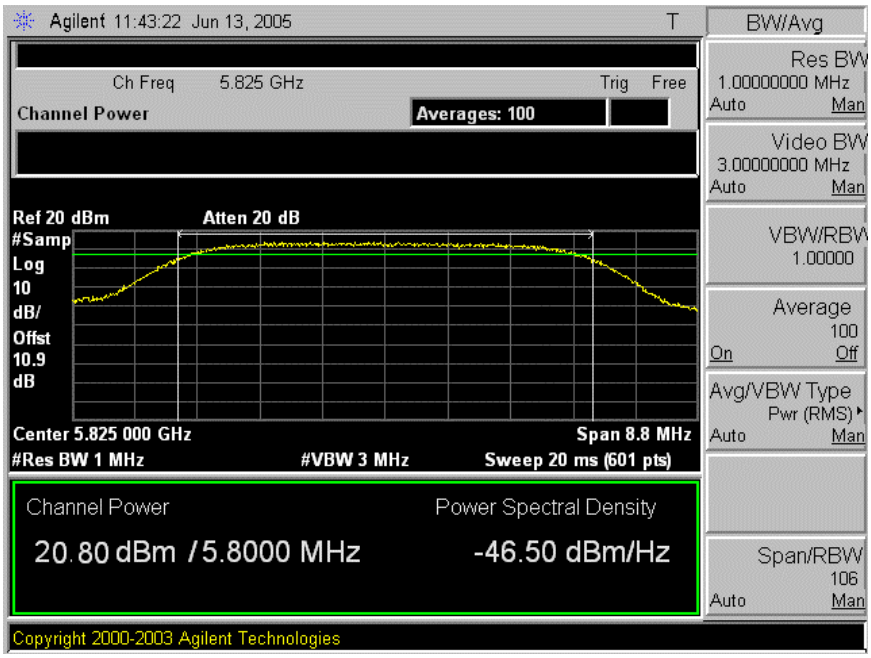


OUTPUT POWER FOR 15 dBi ANTENNA

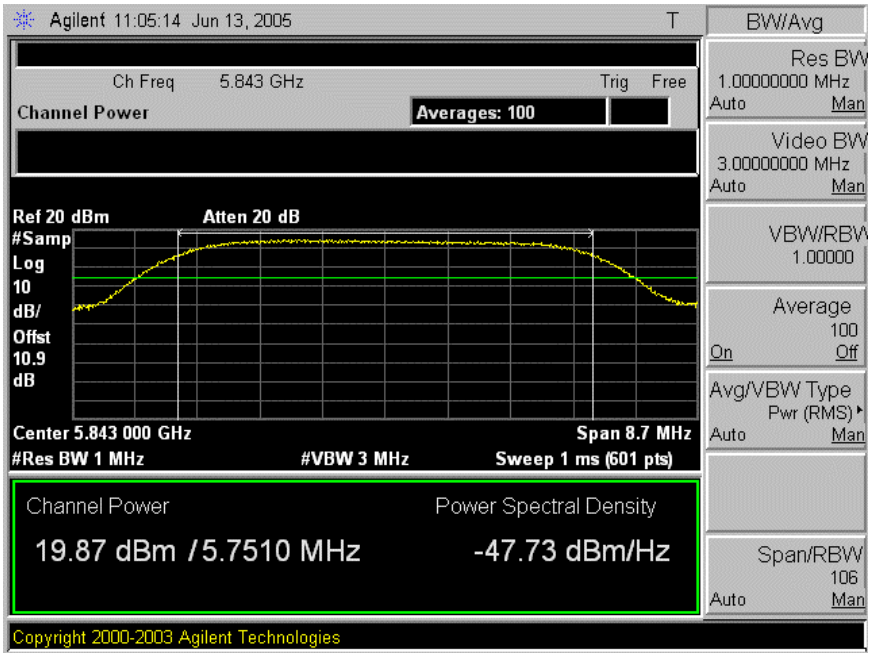
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



7.1.4. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500	.....	.....	f/1500	30
1500–100,000	.....	.....	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

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

and

$S = E ^ 2 / 3770$

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 Power to mW and Distance to 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

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

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

From §1.1310 Table 1 (B), S = 1.0 mW/cm^2

RESULTS

No non-compliance noted:

Antenna Applied	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
For 19dBi Antenna	1.0	15.50	19.00	14.97
For 15dBi Antenna	1.0	20.80	15.00	17.39

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.

7.1.5. 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 10.9 dB (including 10 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

For 19 dBi Antenna

Channel	Frequency (MHz)	Average Power (dBm)
Low	5813	14.50
Middle	5825	14.90
High	5843	13.40

For 15 dBi Antenna

Channel	Frequency (MHz)	Average Power (dBm)
Low	5813	20.20
Middle	5825	20.60
High	5843	19.40

7.1.6. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, 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:

For 19 dBi Antenna

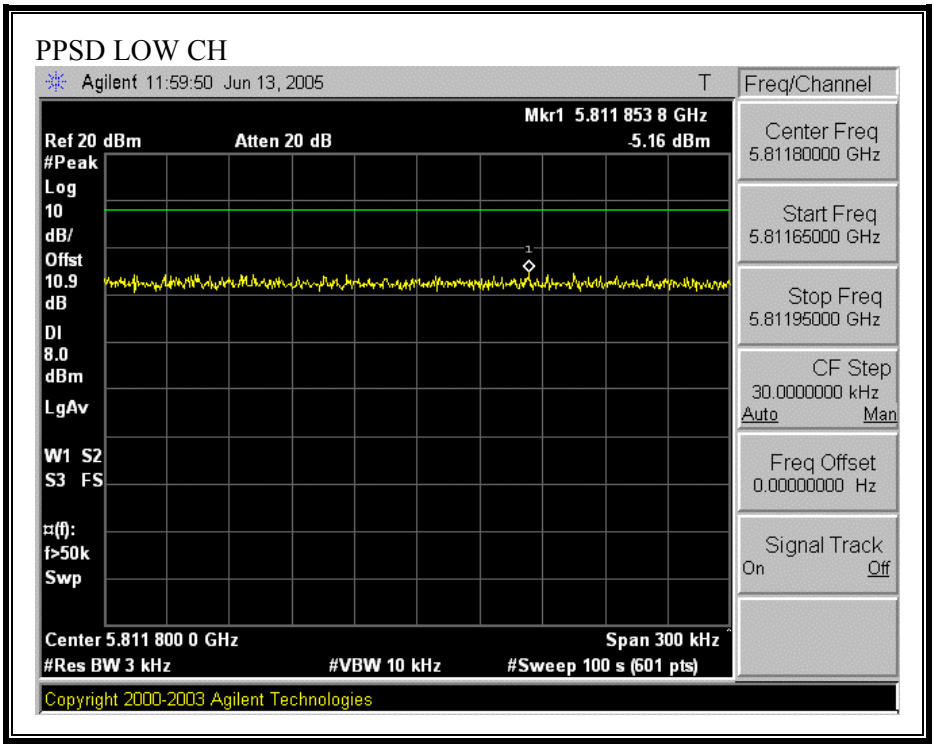
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5813	-5.16	8	-13.16
Middle	5825	-3.63	8	-11.63
High	5843	-7.29	8	-15.29

For 15 dBi Antenna

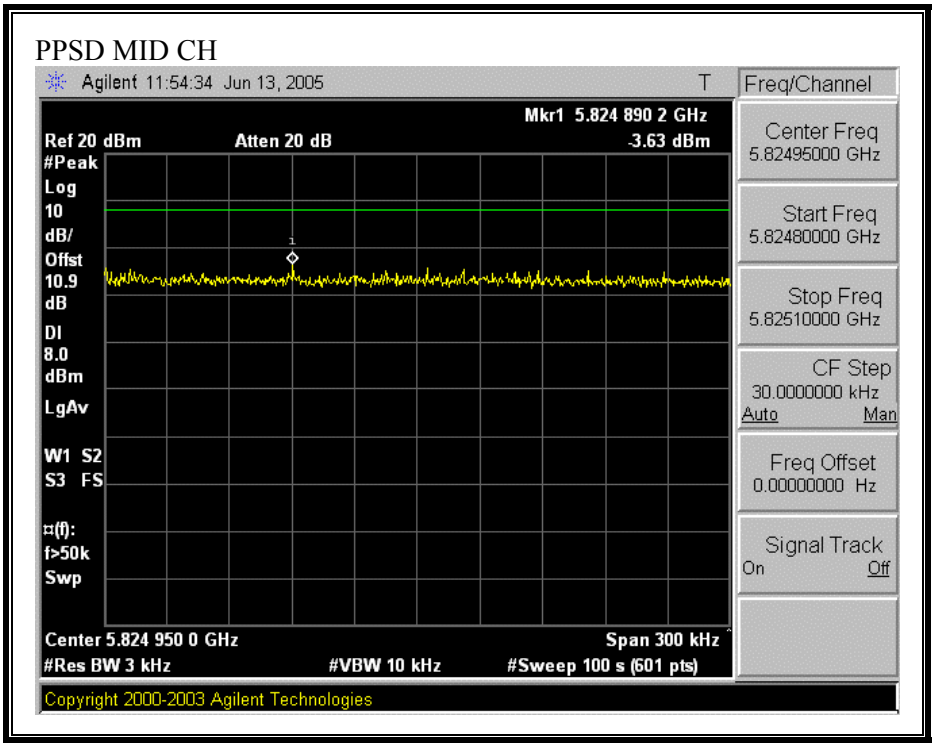
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5813	0.24	8	-7.76
Middle	5825	1.49	8	-6.51
High	5843	-1.55	8	-9.55

PEAK POWER SPECTRAL DENSITY FOR 19 dBi ANTENNA

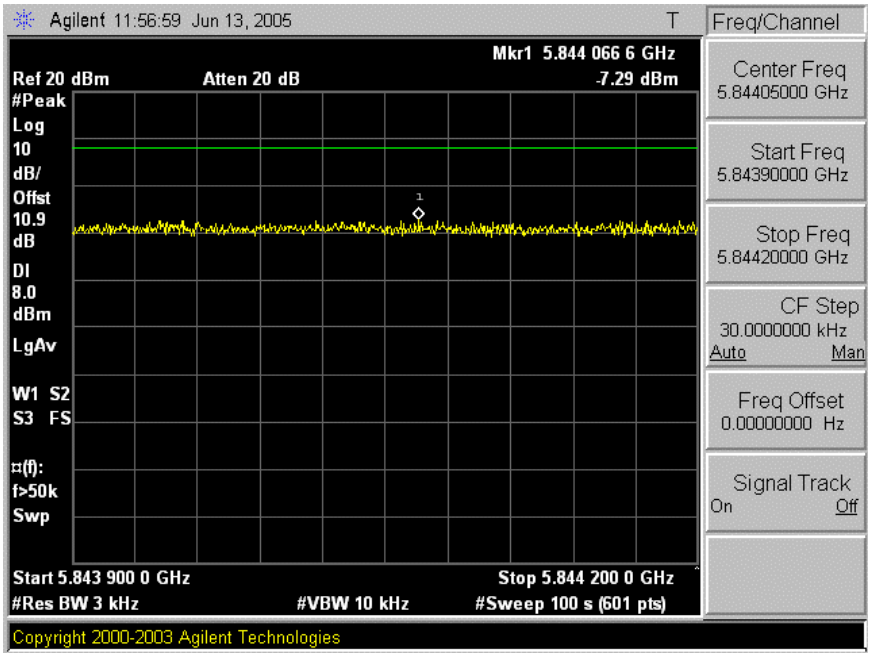
PPSD LOW CH



PPSD MID CH

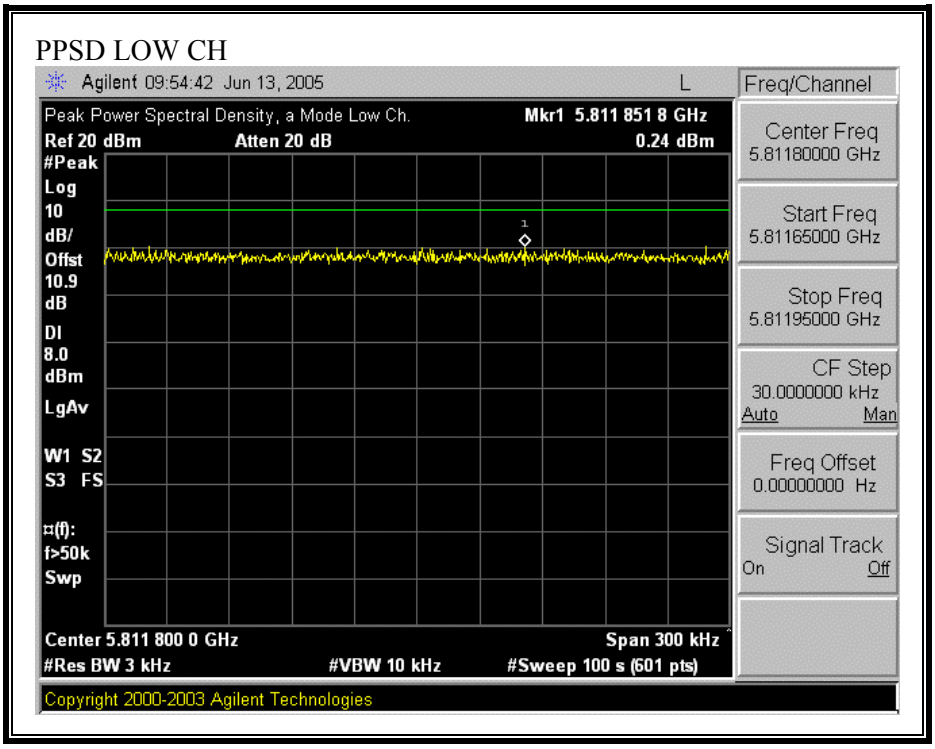


PPSD HIGH CH

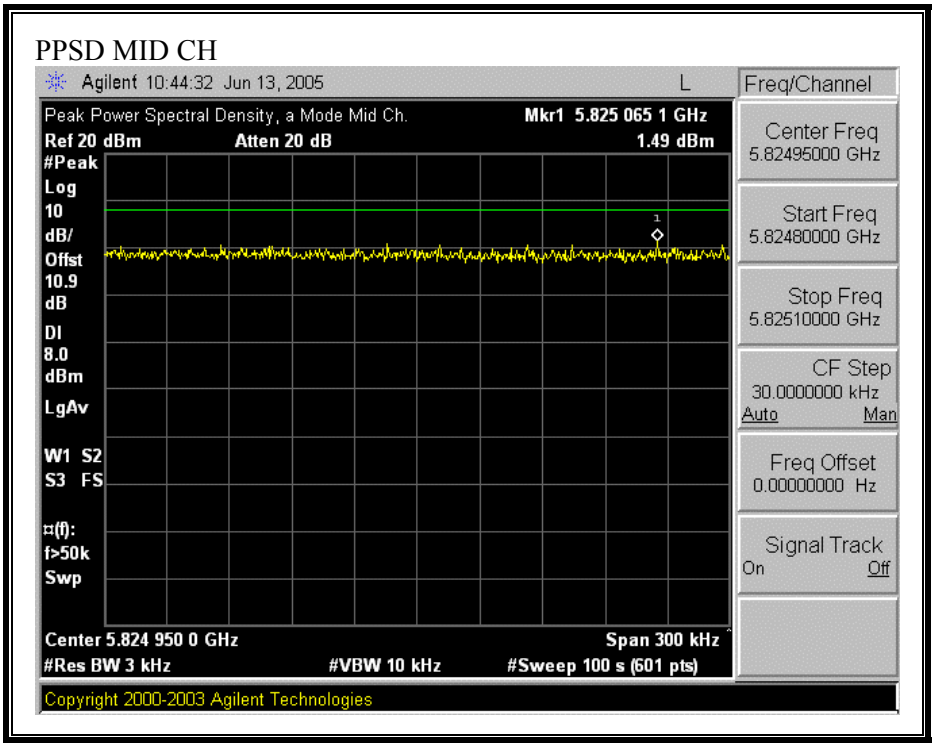


PEAK POWER SPECTRAL DENSITY FOR 15 dBi ANTENNA

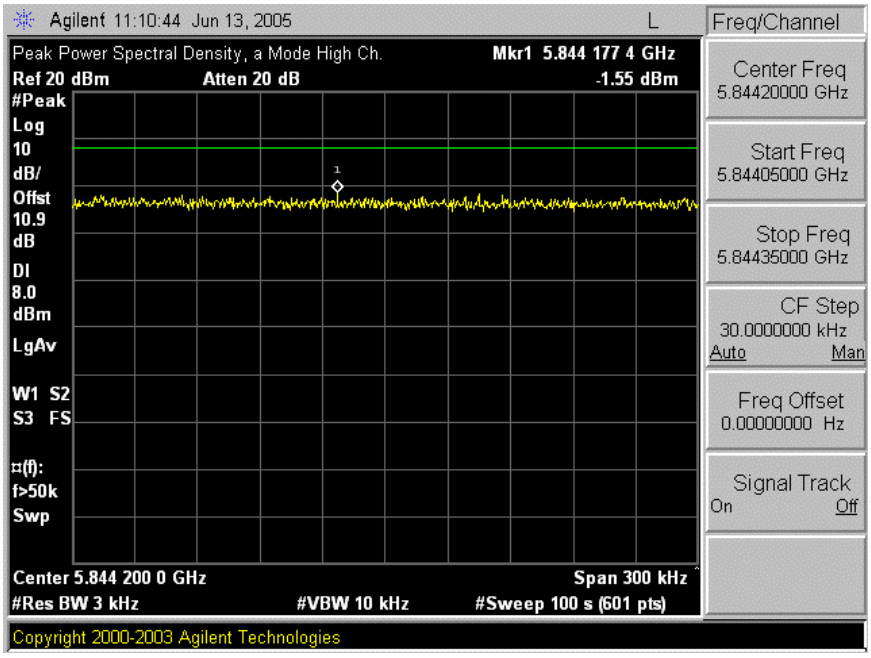
PPSD LOW CH



PPSD MID CH



PPSD HIGH CH



7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) 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)).

Conducted power was measured based on the use of RMS averaging over a time interval, therefore the required attenuation is 30 dB.

TEST PROCEDURE

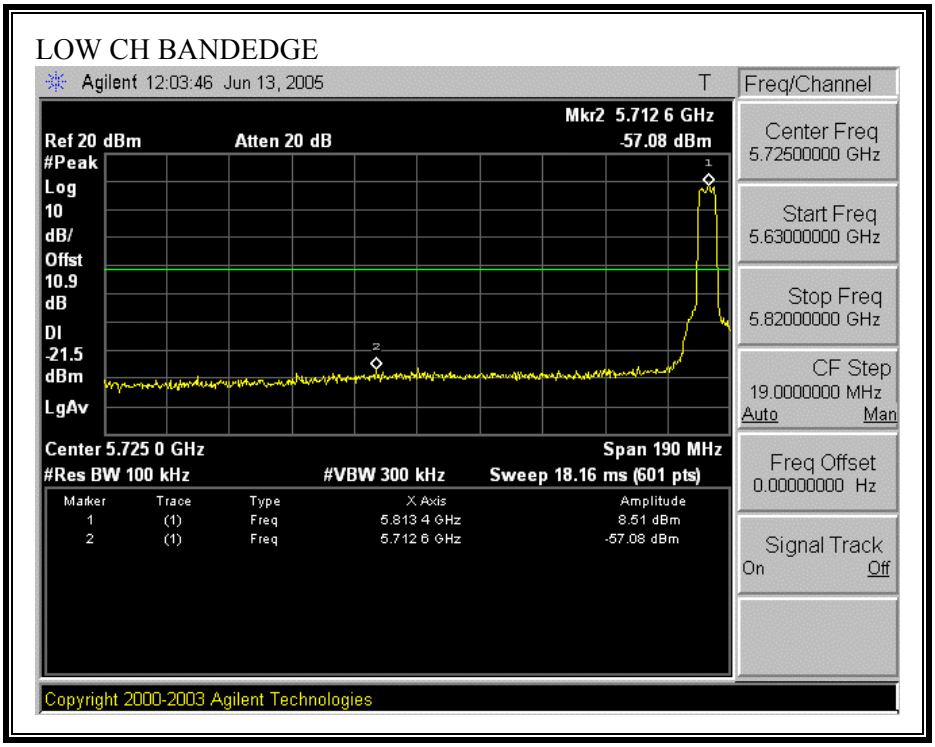
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

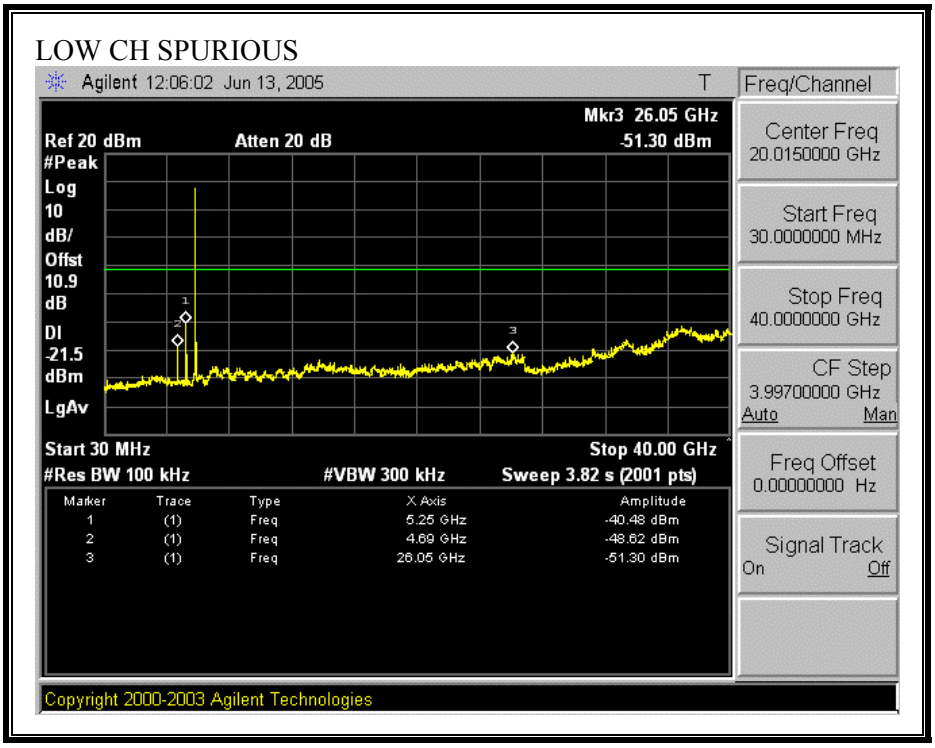
RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL FOR 19 dBi ANTENNA

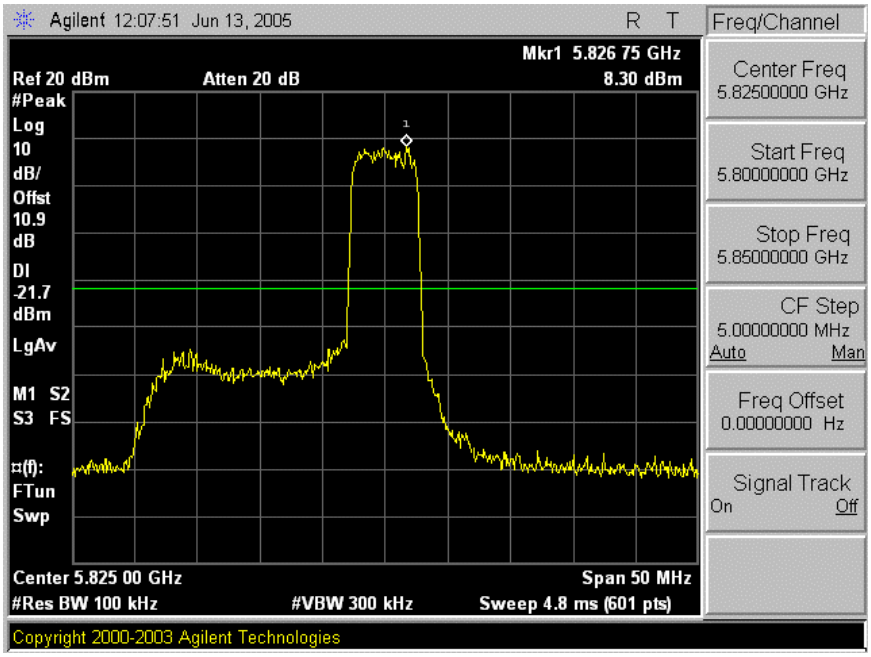


LOW CH SPURIOUS

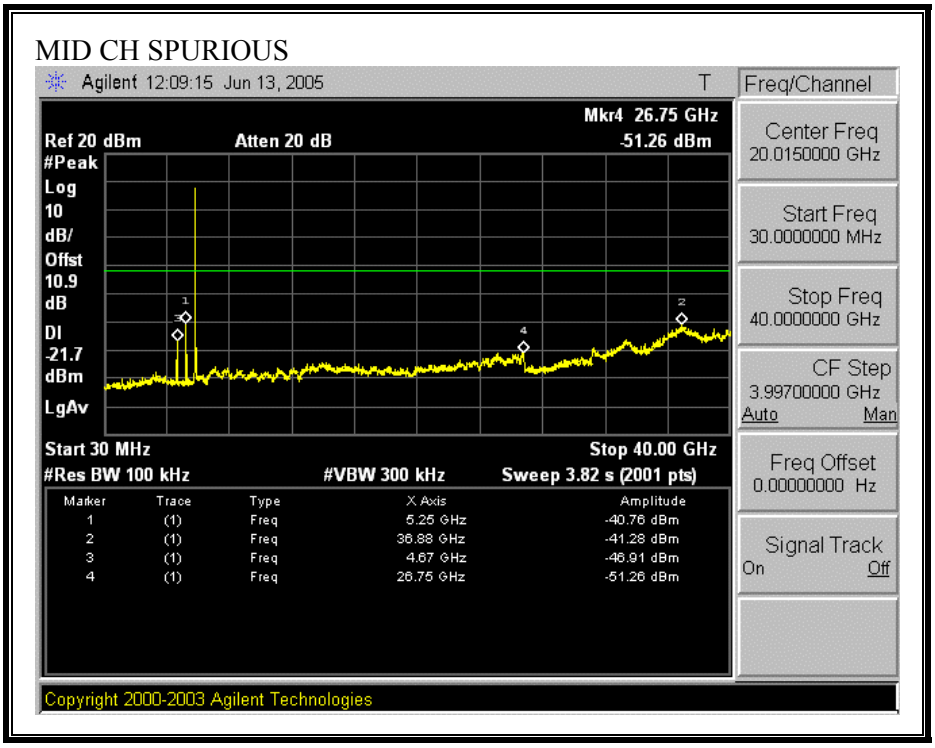


SPURIOUS EMISSIONS, MID CHANNEL FOR 19 dBi ANTENNA

MID CH REFERENCE

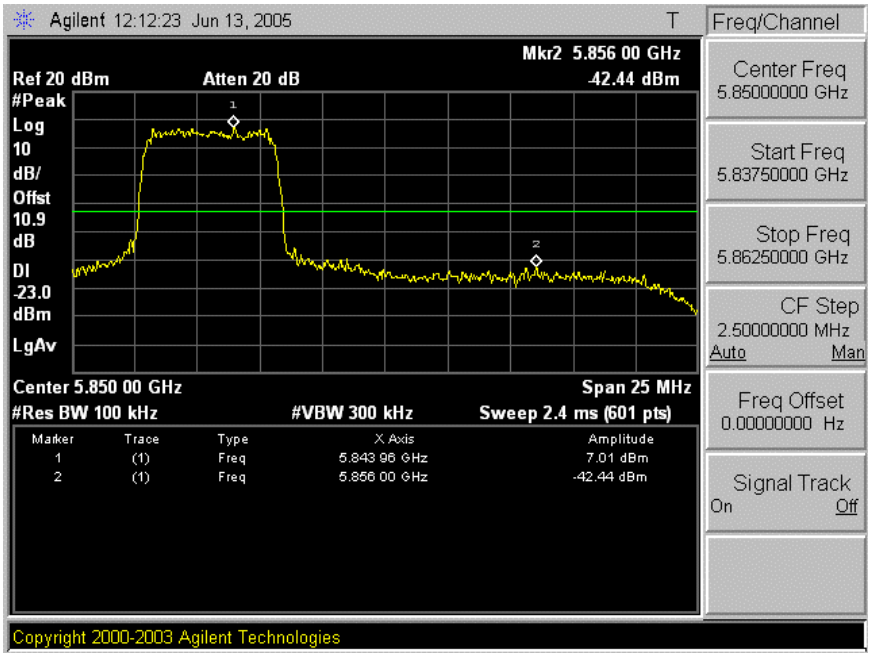


MID CH SPURIOUS

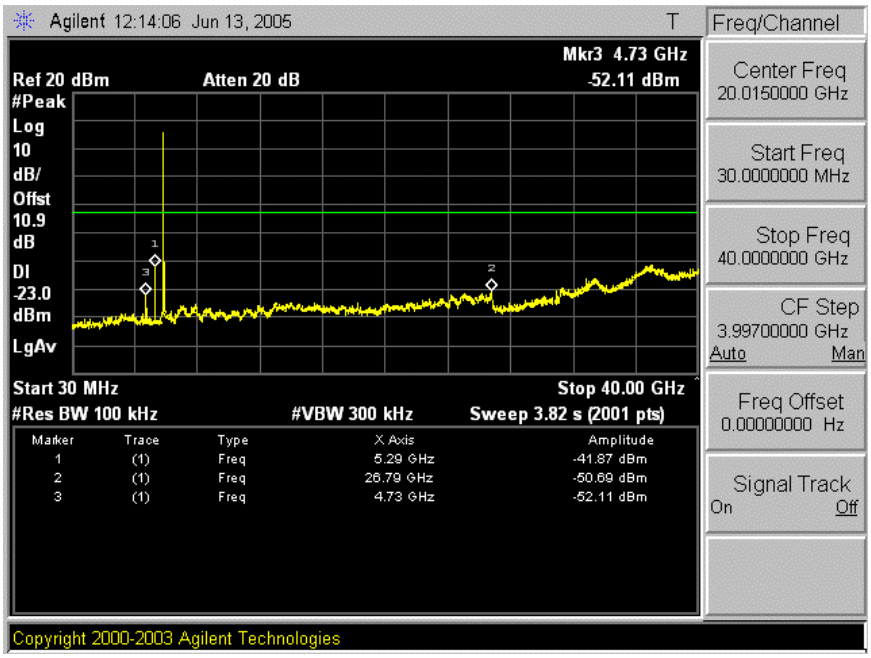


SPURIOUS EMISSIONS, HIGH CHANNEL FOR 19 dBi ANTENNA

HIGH CH BANDEDGE

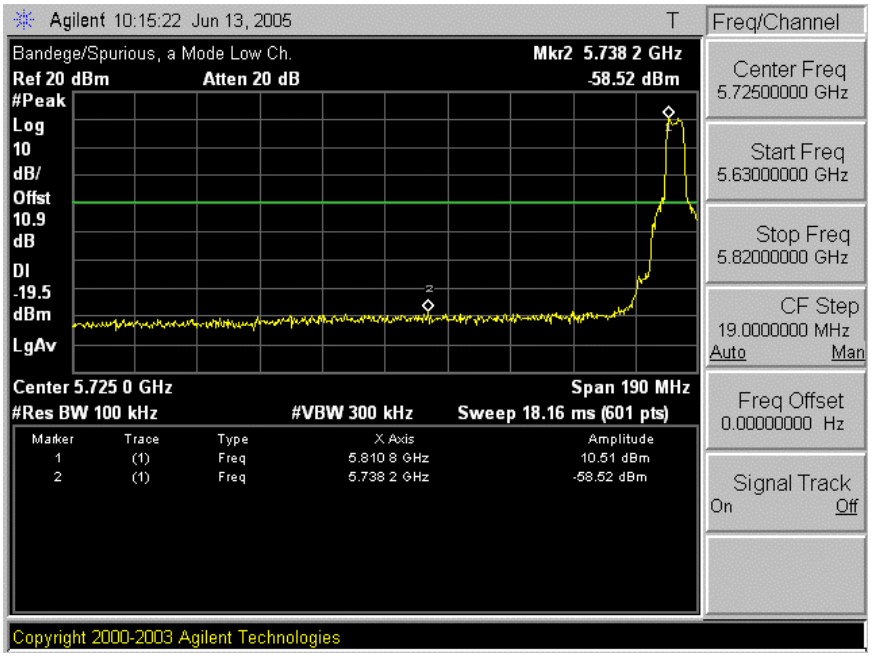


HIGH CH SPURIOUS

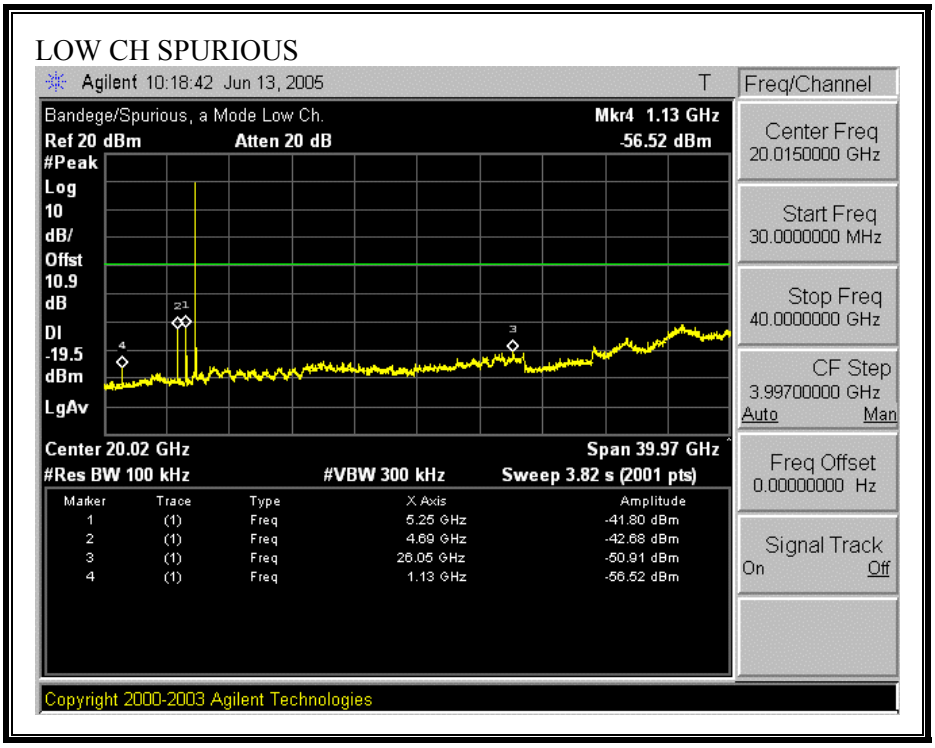


SPURIOUS EMISSIONS, LOW CHANNEL FOR 15 dBi ANTENNA

LOW CH BANDEDGE

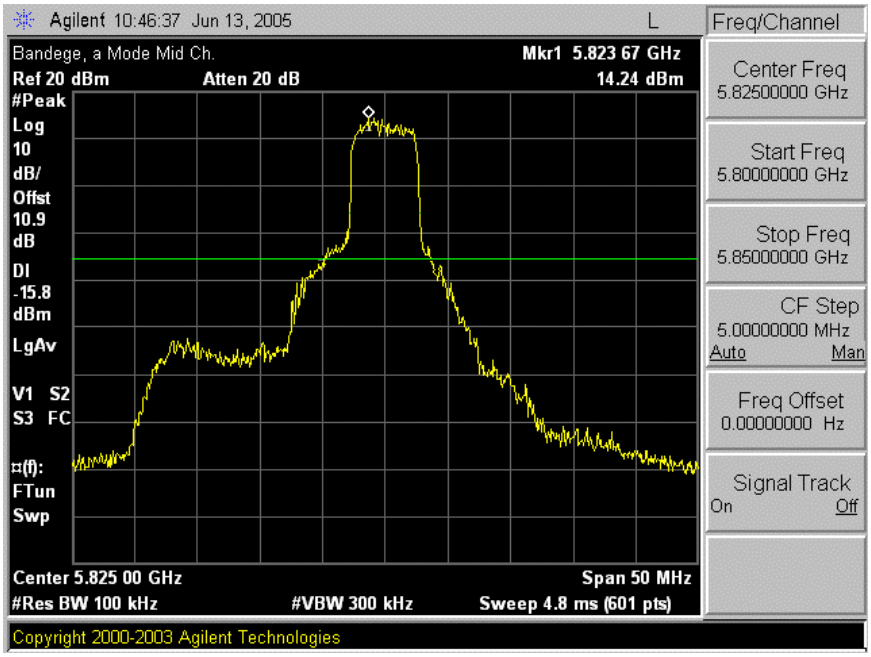


LOW CH SPURIOUS

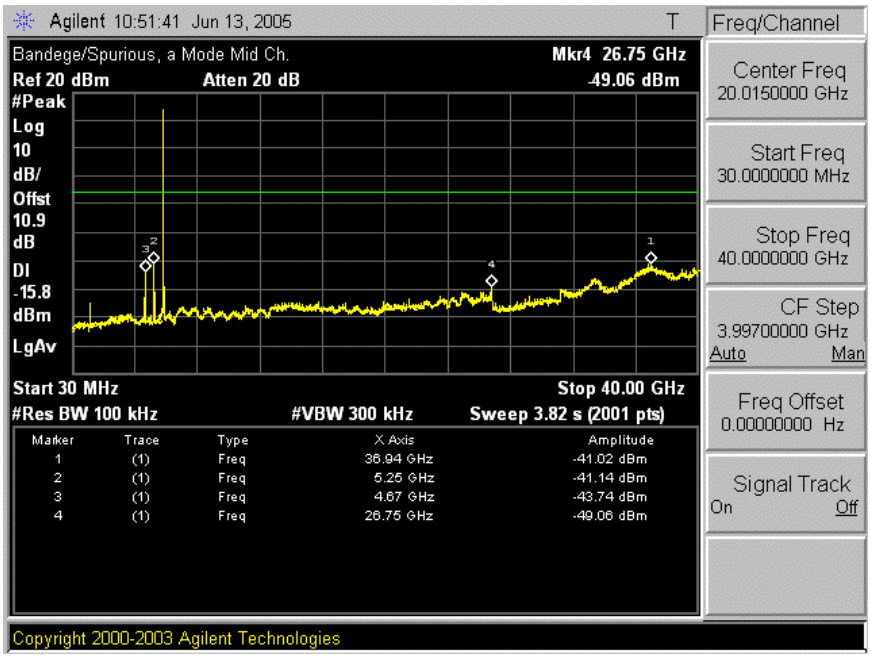


SPURIOUS EMISSIONS, MID CHANNEL FOR 15 dBi ANTENNA

MID CH REFERENCE

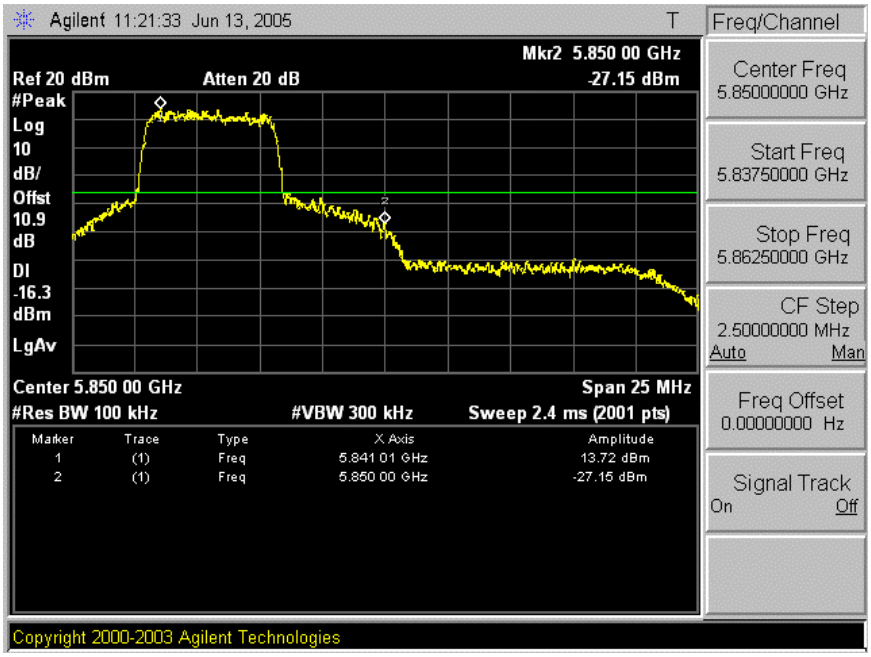


MID CH SPURIOUS

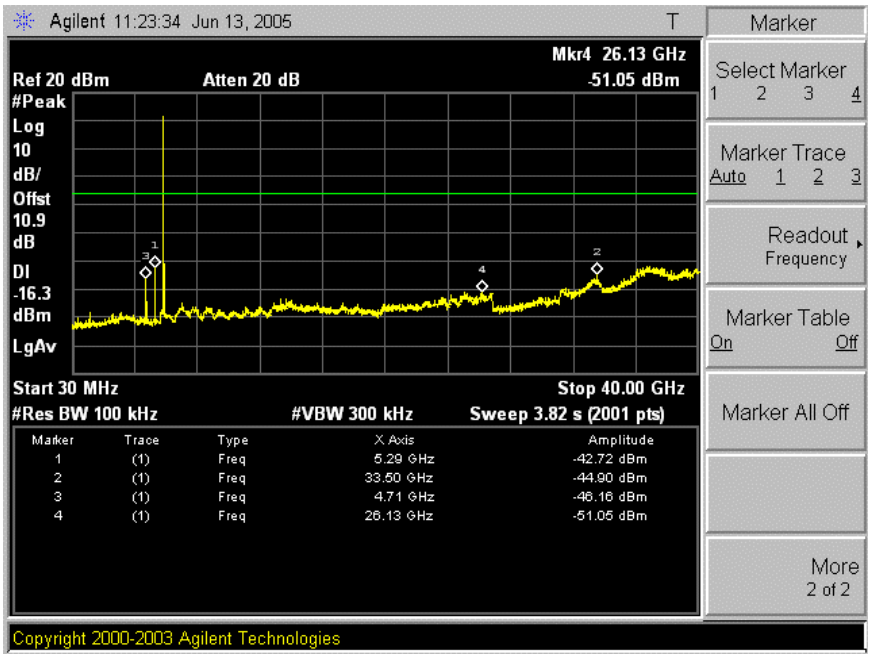


SPURIOUS EMISSIONS, HIGH CHANNEL FOR 15 dBi ANTENNA

HIGH CH BANDEDGE



HIGH CH SPURIOUS



7.2. RADIATED EMISSIONS

7.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (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

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

§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 (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.

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

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

7.2.2. TRANSMITTER ABOVE 1 GHz WITH 19dBi ANTENNA

HARMONICS AND SPURIOUS EMISSIONS WITH 19 dBi ANTENNA

06/14/05 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 05U3489-2
Company: Arcwave
EUT Descrip.: Point to multipoint WLAN hub
EUT M/N: AX1455-SM-25
Test Target: FCC 15.205
Mode Oper: Tx, Mid Power Setting
Average Power Meter: Low = 14.5 dBm, Mid = 14.9 dBm, High = 13.4 dBm
Added Gore shielding material to Transmitter box section.

Test Equipment:

EMCO Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @1m	T63 Miteq 646456		T39; ARA 18-26GHz; S/N:1013	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	4 foot cable	12 foot cable	HPF	Reject Filter
2_David		4_David	12_Yan	HPF_4.0GHz	R_002

Peak Measurements
RBW=VBW=1MHz

Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
5813 Channel															
11.626	3.0	46.0	34.0	38.3	9.2	-37.3	0.0	0.9	57.2	45.2	74	54	-16.8	-8.8	V
15.744	3.0	47.2	36.4	39.2	10.1	-38.4	0.0	1.1	59.3	48.5	74	54	-14.7	-5.5	V
20.992	3.0	42.0	33.2	33.1	12.9	-33.9	0.0	0.0	54.1	45.3	74	54	-19.9	-8.7	V
11.660	3.0	48.3	33.4	38.4	9.3	-37.3	0.0	0.9	59.5	44.6	74	54	-14.5	-9.4	H
15.744	3.0	49.3	40.6	39.2	10.1	-38.4	0.0	1.1	61.4	52.7	74	54	-12.6	-1.3	H
20.992	3.0	41.7	31.2	33.1	12.9	-33.9	0.0	0.0	53.8	43.3	74	54	-20.2	-10.7	H
5825 Channel															
11.650	3.0	44.6	32.0	38.4	9.2	-37.3	0.0	0.9	55.8	43.2	74	54	-18.2	-10.8	V
15.744	3.0	47.9	38.4	39.2	10.1	-38.4	0.0	1.1	60.0	50.5	74	54	-14.0	-3.5	V
20.992	3.0	42.6	32.7	33.1	12.9	-33.9	0.0	0.0	54.7	44.8	74	54	-19.3	-9.2	V
11.650	3.0	46.0	33.4	38.4	9.2	-37.3	0.0	0.9	57.2	44.6	74	54	-16.8	-9.4	H
15.744	3.0	49.3	40.6	39.2	10.1	-38.4	0.0	1.1	61.4	52.7	74	54	-12.6	-1.3	H
20.992	3.0	41.4	31.3	33.1	12.9	-33.9	0.0	0.0	53.5	43.4	74	54	-20.5	-10.6	H
5843 Channel															
11.686	3.0	45.5	31.6	38.4	9.3	-37.3	0.0	0.9	56.7	42.8	74	54	-17.3	-11.2	V
11.686	3.0	46.7	33.0	38.4	9.3	-37.3	0.0	0.9	57.9	44.2	74	54	-16.1	-9.8	H
No further emissions were detected above the noise floor of the test receiver.															

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

7.2.3. TRANSMITTER ABOVE 1 GHz WITH 15dBi ANTENNA

HARMONICS AND SPURIOUS EMISSIONS WIHT 15 dBi ANTENNA

06/14/05 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 05U3489-2
Company: Arcwave
EUT Descrip.: Point to multipoint WLAN hub
EUT M/N: AX1455-SM-60
Test Target: FCC 15.205
Mode Oper: Tx, High Power Setting
Average Power Meter: Low = 20.2 dBm, Mid = 20.6 dBm, High = 19.4 dBm
Added Gore shielding material to Transmitter box section.

Test Equipment:

EMCO Horn 1-18GHz: T73; S/N: 6717 @1m
Pre-amplifer 1-26GHz: T63 Miteq 646456
Pre-amplifer 26-40GHz:
Horn > 18GHz: T39; ARA 18-26GHz; S/N:1013

Hi Frequency Cables
2 foot cable: 2_David
3 foot cable:
4 foot cable: 4_David
12 foot cable: 12_Yan

HPF: HPF_4.0GHz
Reject Filter: R_002

Peak Measurements
RBW=VBW=1MHz

Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
5813 Channel															
11.626	3.0	46.0	34.0	38.3	9.2	-37.3	0.0	0.9	57.2	45.2	74	54	-16.8	-8.8	V
15.744	3.0	50.4	40.3	39.2	10.1	-38.4	0.0	1.1	62.5	52.4	74	54	-11.5	-1.6	V
20.992	3.0	44.0	33.7	33.1	12.9	-33.9	0.0	0.0	56.1	45.8	74	54	-17.9	-8.2	V
11.660	3.0	48.5	35.8	38.4	9.3	-37.3	0.0	0.9	59.7	47.0	74	54	-14.3	-7.0	H
15.744	3.0	49.3	41.5	39.2	10.1	-38.4	0.0	1.1	61.4	53.6	74	54	-12.6	-0.4	H
20.992	3.0	41.9	31.5	33.1	12.9	-33.9	0.0	0.0	54.0	43.6	74	54	-20.0	-10.4	H
5825 Channel															
11.650	3.0	46.6	32.6	38.4	9.2	-37.3	0.0	0.9	57.8	43.8	74	54	-16.2	-10.2	V
15.744	3.0	47.6	37.9	39.2	10.1	-38.4	0.0	1.1	59.7	50.0	74	54	-14.3	-4.0	V
20.992	3.0	44.0	33.7	33.1	12.9	-33.9	0.0	0.0	56.1	45.8	74	54	-17.9	-8.2	V
11.650	3.0	49.8	35.9	38.4	9.2	-37.3	0.0	0.9	61.0	47.1	74	54	-13.0	-6.9	H
15.744	3.0	48.9	41.3	39.2	10.1	-38.4	0.0	1.1	61.0	53.4	74	54	-13.0	-0.6	H
20.992	3.0	41.9	31.5	33.1	12.9	-33.9	0.0	0.0	54.0	43.6	74	54	-20.0	-10.4	H
5843 Channel															
11.686	3.0	46.0	32.6	38.4	9.3	-37.3	0.0	0.9	57.2	43.8	74	54	-16.8	-10.2	V
11.686	3.0	46.7	33.0	38.4	9.3	-37.3	0.0	0.9	57.9	44.2	74	54	-16.1	-9.8	H
No further emissions were detected above the noise floor of the test receiver.															

f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

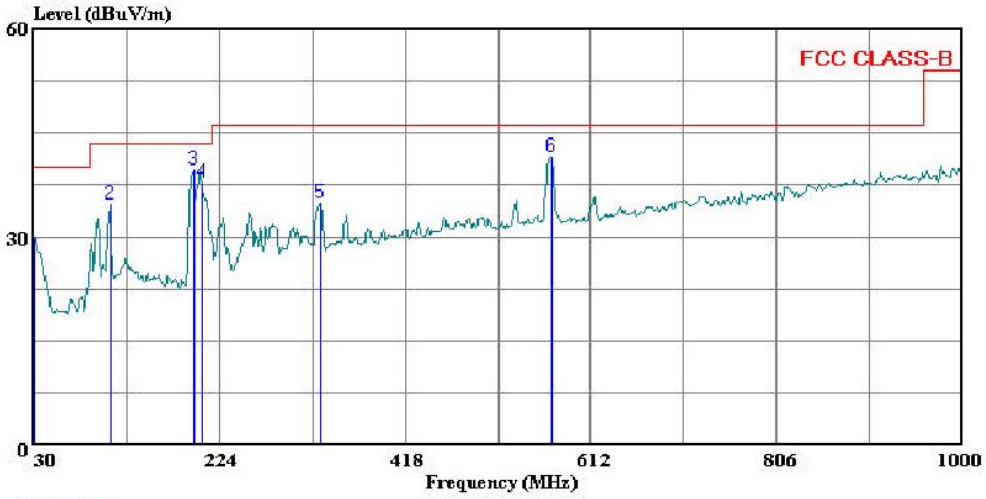
7.2.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz WITH 19dBi ANTENNA

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL, 19 dBi ANTENNA)

HORIZONTAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 4 File#: 05U3489.EMI Date: 06-13-2005 Time: 14:10:25



Trace: 3 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : David Garcia
Project #: : 05U3489-2
Company: : Arcwave
EUT: : Point to Multipoint WLAN Hub
Model No. : AX1455-SM-25
Configuration : EUT Stand alone w/20 degree antenna
Target of Test : FCC Class B
Mode of Operation: High Channel on Downstream
: Upstream at 10 MHz, Medium Power Setting

HORIZONTAL DATA

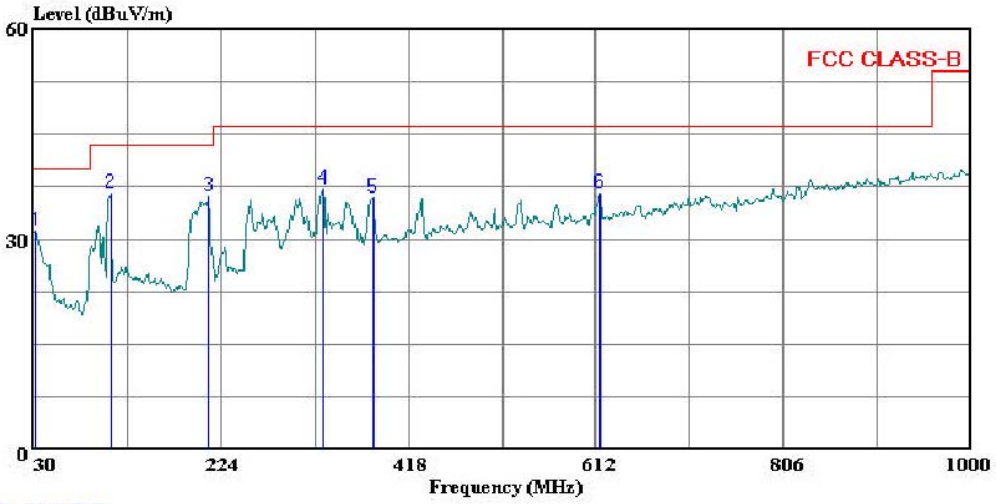
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.000	9.44	20.45	29.89	40.00	-10.11	Peak
2	109.540	21.21	13.44	34.65	43.50	-8.86	Peak
3	196.840	25.59	14.00	39.59	43.50	-3.91	Peak
4	205.570	24.03	13.71	37.73	43.50	-5.77	Peak
5	329.730	18.46	16.44	34.90	46.00	-11.10	Peak
6	570.290	20.46	21.14	41.60	46.00	-4.40	Peak

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL, 19 dBi ANTENNA)

VERTICAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 2 File#: 05U3489.EMI Date: 06-13-2005 Time: 14:03:45



(Audix ATC)

Trace: 1 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : David Garcia
Project #: : 05U3489-2
Company: : Arcwave
EUT: : Point to Multipoint WLAN Hub
Model No. : AX1455-SM-25
Configuration : EUT Stand alone w/20 degree antenna
Target of Test : FCC Class B
Mode of Operation: High Channel on Downstream
: Upstream at 10 MHz, Medium Power Setting

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	31.940	11.11	19.94	31.05	40.00	-8.95	Peak
2	109.540	23.04	13.44	36.48	43.50	-7.02	Peak
3	211.390	23.13	12.92	36.05	43.50	-7.45	Peak
4	329.730	20.71	16.44	37.15	46.00	-8.85	Peak
5	381.140	18.23	17.62	35.85	46.00	-10.15	Peak
6	615.880	14.64	21.81	36.45	46.00	-9.55	Peak

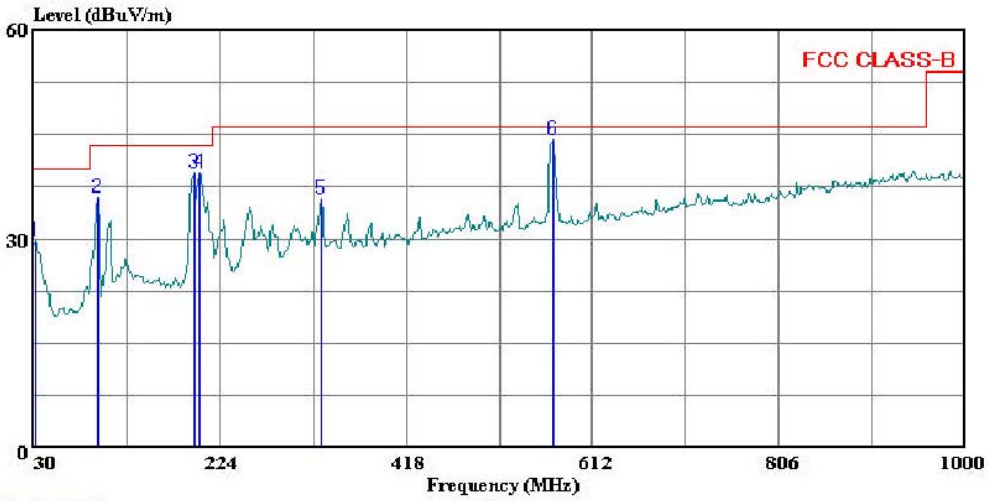
7.2.5. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz WITH 15dBi ANTENNA

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL, 15 dBi ANTENNA)

HORIZONTAL PLOT

COMPLIANCE Engineering Services, Inc.
561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 6 File#: 05U3489.EMI Date: 06-13-2005 Time: 14:21:53



(Audix ATC)

Trace: 5 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : David Garcia
Project #: : 05U3489-2
Company: : Arcwave
EUT: : Point to Multipoint WLAN Hub
Model No. : AX1455-SM-25
Configuration : EUT Stand alone w/60 degree antenna
: High Power Setting
Target of Test : FCC Class B
Mode of Operation: High Channel on Downstream
: Upstream at 41 MHz

HORIZONTAL DATA

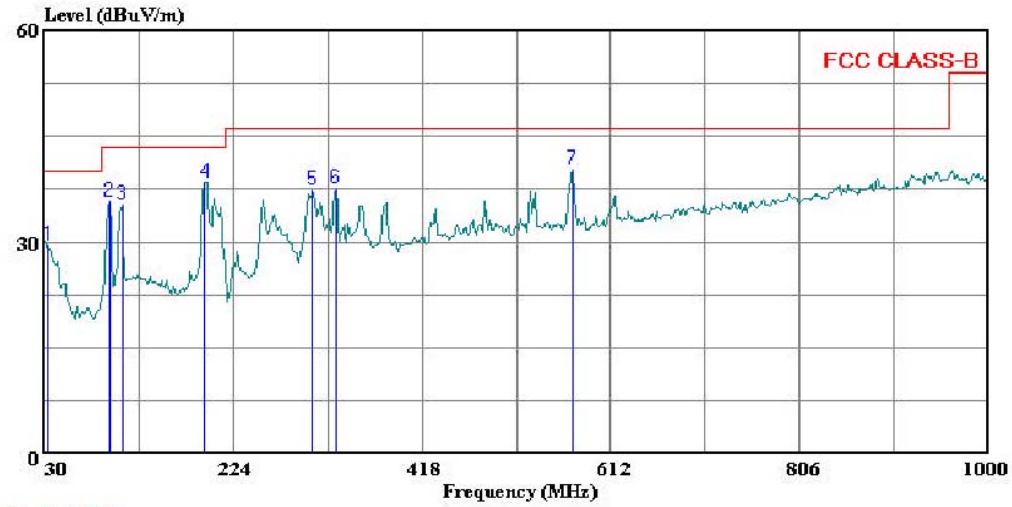
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.970	9.30	20.45	29.75	40.00	-10.25	Peak
2	96.930	25.37	10.58	35.95	43.50	-7.55	Peak
3	196.840	25.50	14.00	39.50	43.50	-4.00	Peak
4	201.690	25.17	14.32	39.49	43.50	-4.01	Peak
5	329.730	19.33	16.44	35.77	46.00	-10.23	Peak
6	570.290	23.02	21.14	44.16	46.00	-1.84	Peak

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL, 15 dBi ANTENNA)

VERTICAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 8 File#: 05U3489.EMI Date: 06-13-2005 Time: 14:28:15



(Audix ATC)

Trace: 7 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : David Garcia
Project #: : 05U3489-2
Company: : Arcwave
EUT: : Point to Multipoint WLAN Hub
Model No. : AX1455-SM-25
Configuration : EUT Stand alone w/60 degree antenna
: High Power Setting
Target of Test : FCC Class B
Mode of Operation: High Channel on Downstream
: Upstream at 41 MHz

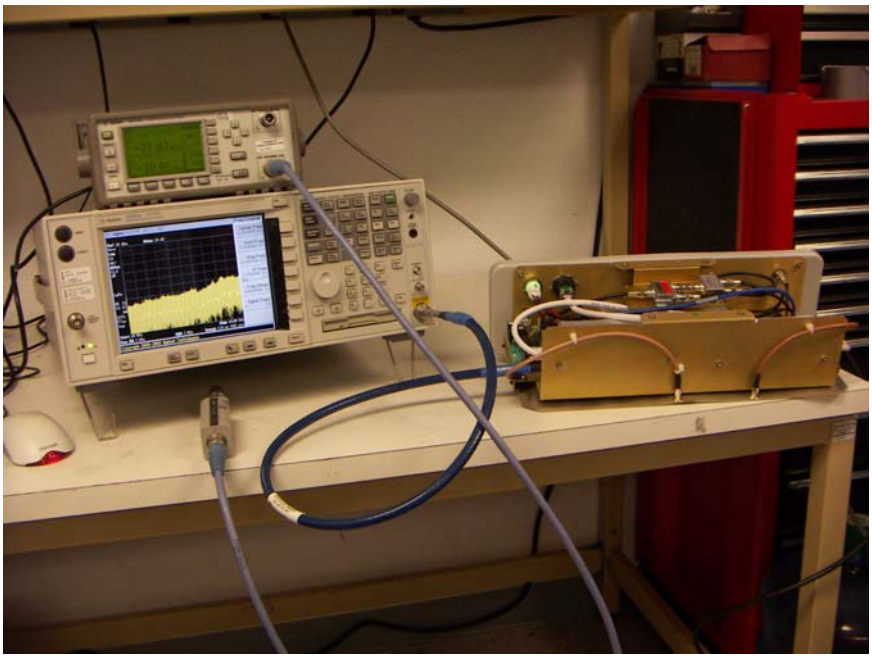
VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	33.880	10.53	19.05	29.58	40.00	-10.42	Peak
2	96.930	25.12	10.58	35.70	43.50	-7.80	Peak
3	109.540	21.95	13.44	35.39	43.50	-8.11	Peak
4	194.900	24.74	13.76	38.50	43.50	-5.00	Peak
5	305.480	21.59	15.80	37.39	46.00	-8.61	Peak
6	329.730	21.12	16.44	37.56	46.00	-8.44	Peak
7	572.230	19.12	21.14	40.26	46.00	-5.74	Peak

8. SETUP PHOTOS

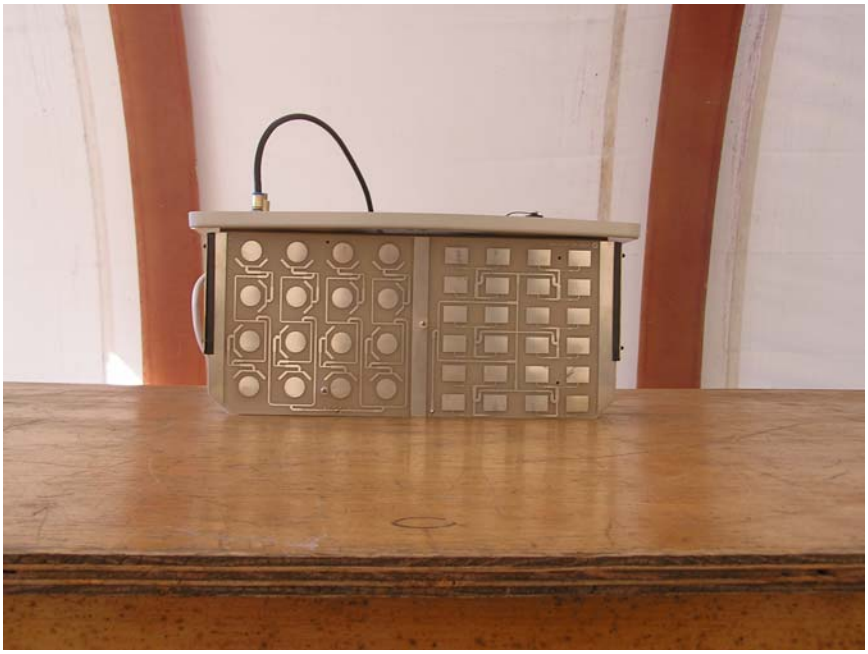
ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO

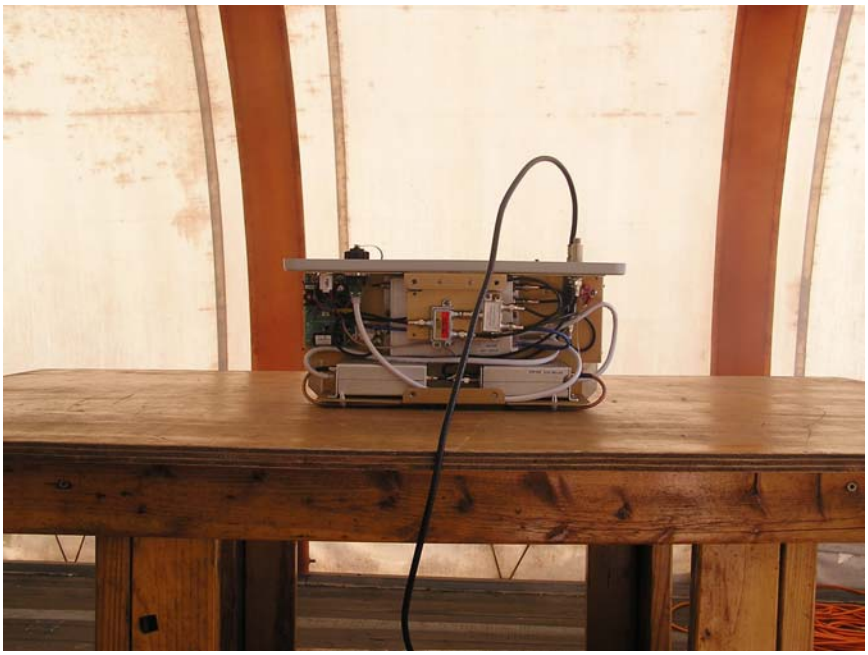


RADIATED EMISSION SETUP WITH 19 dBi ANTENNA

RADIATED FRONT PHOTO



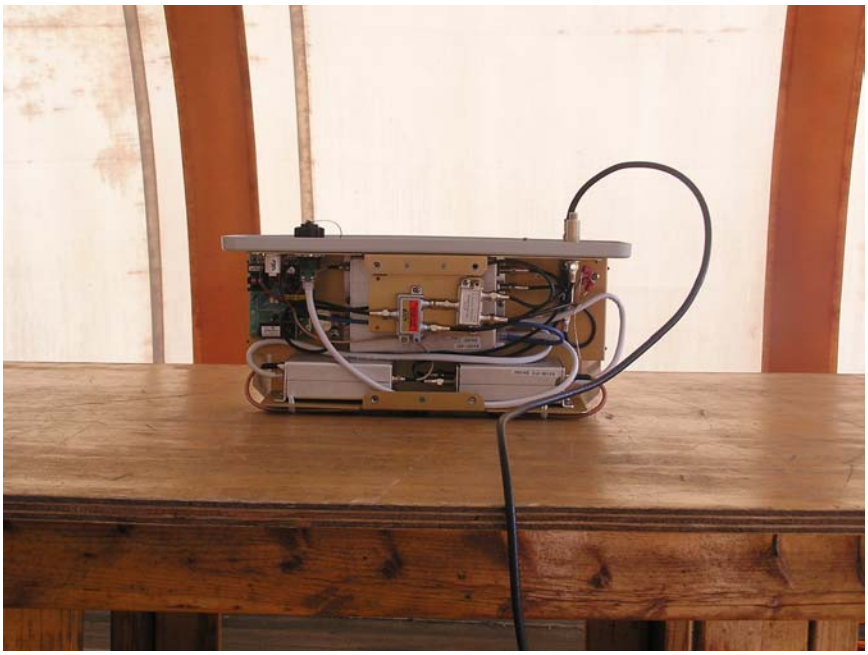
RADIATED BACK PHOTO



RADIATED EMISSION SETUP WITH 15 dBi ANTENNA

RADIATED FRONT PHOTO

RADIATED BACK PHOTO



END OF REPORT