FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

FOR

MICROWAVE RF REPEATER

MODEL NUMBER: RF2500E-SS

FCC ID: QFT-RF2500E-SS

REPORT NUMBER: 03U2442-1

ISSUE DATE: FEBRUARY 20, 2004

Prepared for
PENINSULA ENGINEERING SOLUTIONS, INC
39 GRAND CANYON LANE
SAN RAMON, CALIFORNIA 94583
U.S.A

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD,
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1. TEST RESULT CERTIFICATION

COMPANY NAME: PENINSULA ENGINEERING SOLUTIONS, INC.
39 GRAND CANYON LN
SAN RAMON, CA 94583, U.S.A

EUT DESCRIPTION: MICROWAVE RF REPEATER

MODEL: RF2500E-SS

DATE TESTED: JANUARY 5 – FEBRUARY 18, 2004

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: 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.

Approved & Released For CCS By:

MIKE HECKROTTE
CHIEF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

NEELESH RAJ
EMC TECHNICIAN
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The EUT is a Microwave RF Repeater operating in the 2400-2483.5 MHz band.

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

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
2408-2467	24.79	301.30

The repeater is designed to be used exclusively for fixed point-to-point systems that incorporate Proxim model 31350 radios, FCC IC number HZB-S24-08. The repeater will be professionally installed and connected to dish type antennas. The power is adjusted during installation to comply with FCC 15.247 requirements. The highest gain antenna is 36 dBi.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/2001, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. 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.

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:

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%.

5.3. 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
Spectrum Analyzer	Agilent	E4446A	MY43360112	1/13/2005
Power Meter	HP	436A	2709A29209	7/15/2004
Power Sensor, 100 kHz ~ 4.2 GHz	HP	8482A	2349A08568	7/15/2004
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	3/4/2004
Amplifier 1-26GHz	MITEQ	NSP2600-SP	924341	4/25/2004
Antenna, Biconical	Eaton	94455-1	1197	3/6/2004
Site A Preamplifier, 1300MHz	HP	8447D	2944A06833	8/18/2004
SA RF Section, 22 GHz	HP	85660B	3014A06685	11/1/2004
SA Display Section 1	HP	85662A	3026A19146	2/2/2005
Quasi-Peak Adaptor	HP	85650A	3145A01654	11/1/2004
Antenna, Log Periodic 200 ~ 1000 MHz	EMCO	3146	2120	3/6/2004
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/13/2004
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	10/13/2004
Site A Line Stabilizer / Conditioner	Tripplite	LC-1800a	A0051681	CNR
Peak / Average Power Sensor	Agilent	E9327A	US40440755	11/7/2004
10dB Attenuator	Weinschel	56-10	k16148	N/A
2.4 GHz Reject Filter	Micro-Tronics	BRM50702	1	N/A
10dB Attenuator	Pasternack	PE7014-10	N/A	N/A

6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
DC POWER SUPPLY	KRM	AEE-350	9712154746	N/A
AC ADAPTER	FORESITE ELECTRONICS	7600-10847-000A	N/A	N/A
SPREAD SPECTRUM RADIO	PROXIM	31350-10A1	N/A	HZB-S24-08
SPREAD SPECTRUM RADIO	PROXIM	31350-10A2	N/A	HZB-S24-08
TRANSMIT ANTENNA	GABRIEL TERRESTRIAL MICROWAVE ANTENNA PRODUCTS	P-24A144G-S	N/A	N/A
30dB ATTENUATOR	PASTERNACK	N/A	N/A	N/A

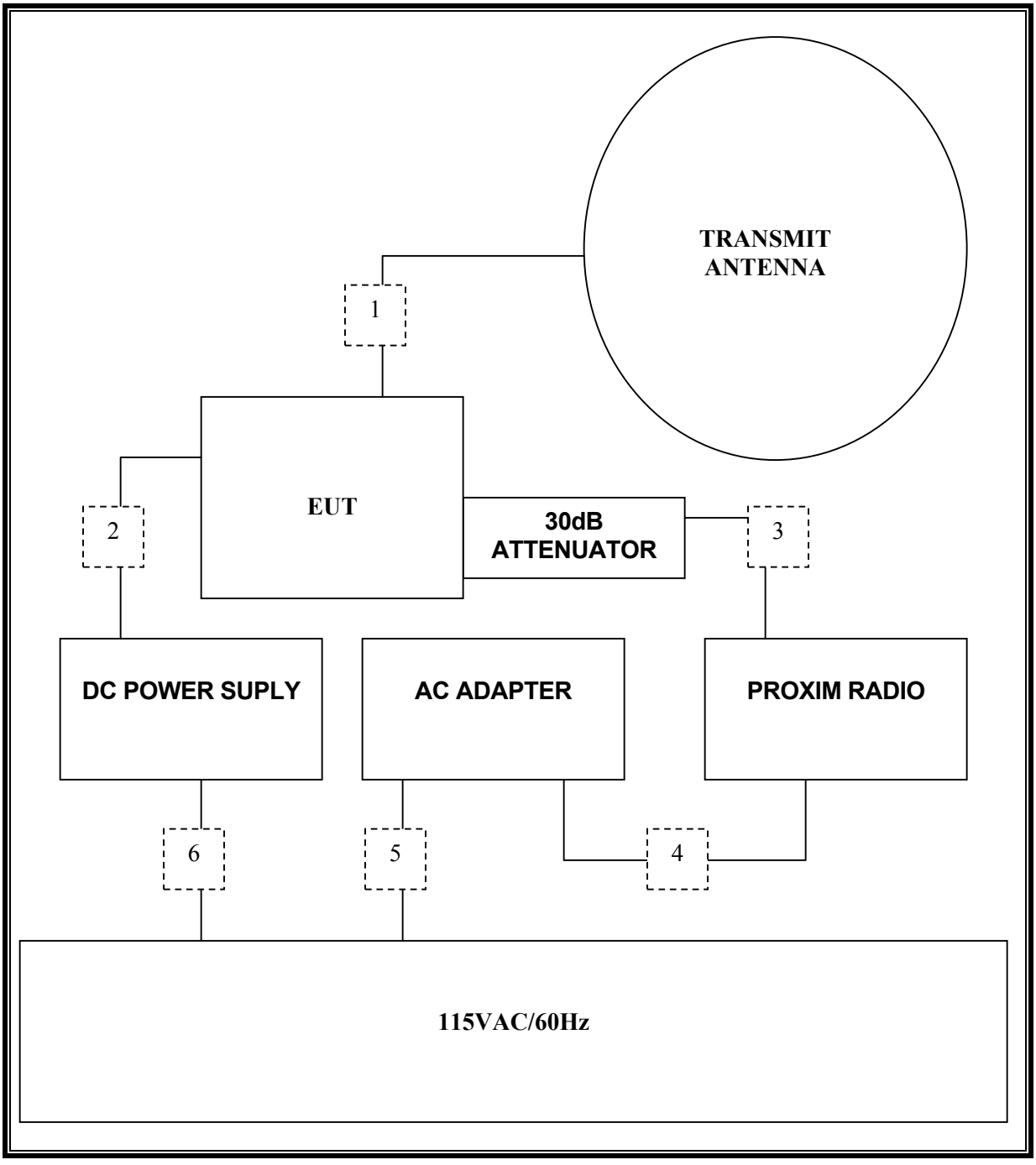
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	TX	1	N-TYPE	SHIELDED (RG-58)	6.2M	5.7dB LOSS AT 2.4 GHz
2	DC PWR	2	TERMINAL	UNSHIELDED	1M	12VDC, 2.2AMPS
3	RX	1	N-TYPE	SHIELDED (RG-58)	2M	N/A
4	DC PWR	1	DC PWR	UNSHIELDED	1.86M	N/A
5	AC PWR	1	AC PWR	UNSHIELDED	1.86M	N/A
6	AC PWR	1	AC PWR	UNSHIELDED	1.86M	US (3 PRONG)

TEST SETUP

A Proxim radio was connected to the receive port of the EUT and the transmit port of the EUT was connected to the 36 dBi dish antenna. The Proxim radio was set in continuous transmit mode.

SETUP DIAGRAM FOR TESTS



SETUP FOR LINE CONDUCTION TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
DC POWER SUPPLY	KRM	AEE-350	9712154746	N/A
RECEIVE ANTENNA	ANDREWS	T-2400	411755	N/A
TRANSMIT ANTENNA	GABRIEL TERRESTRIAL MICROWAVE ANTENNA PRODUCTS	P-24A144G-S	N/A	N/A

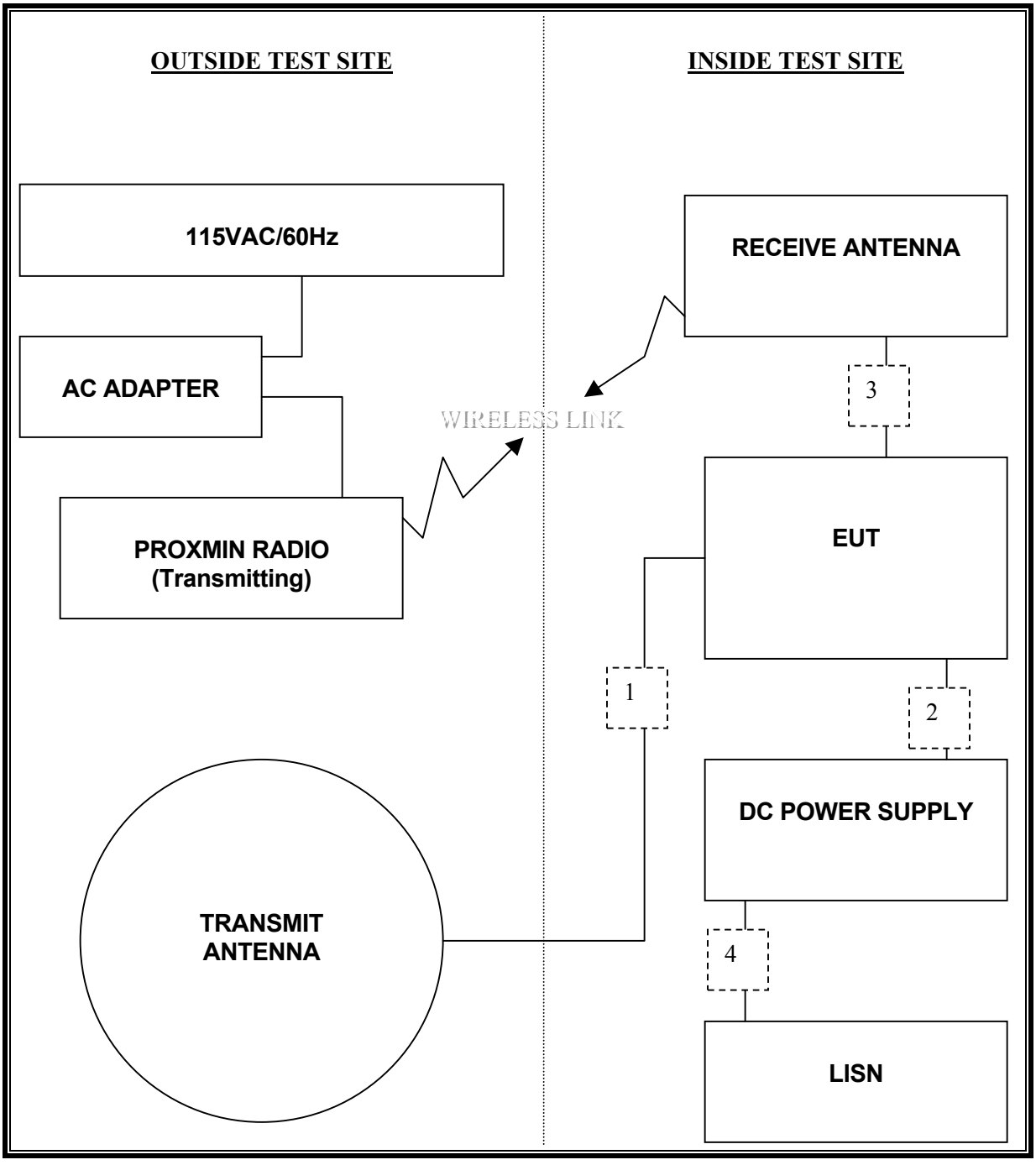
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	TX	1	N-TYPE	SHIELDED (RG-58)	6.2M	5.7dB LOSS AT 2.4 GHz
2	DC PWR	2	TERMINAL	UNSHIELDED	1M	12VDC, 2.2AMPS
3	RX	1	N-TYPE	SHIELDED (RG-58)	2M	N/A
4	AC PWR	1	AC PWR	UNSHIELDED	1.86M	US (3 PRONG)

TEST SETUP

The receive port of the EUT was connected to a 4 foot dish antenna and the transmit port of the EUT was connected to the 10 foot diameter, 36 dBi dish antenna. The Proxim radio was driving a broadband horn antenna and was set in continuous transmit mode. The power output of the Repeater was measured prior to the start of testing to confirm that the receive port was picking up an adequate signal from the Proxim radio.

SETUP DIAGRAM FOR LINE CONDUCTION TESTS



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 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 100 kHz. The sweep time is coupled.

RESULTS

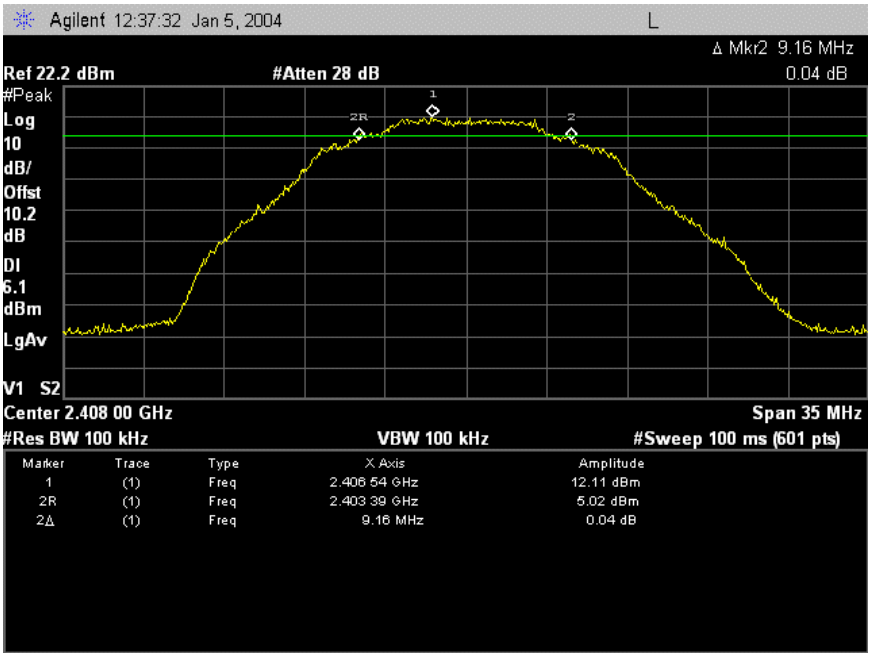
No non-compliance noted:

Spread Spectrum Repeater

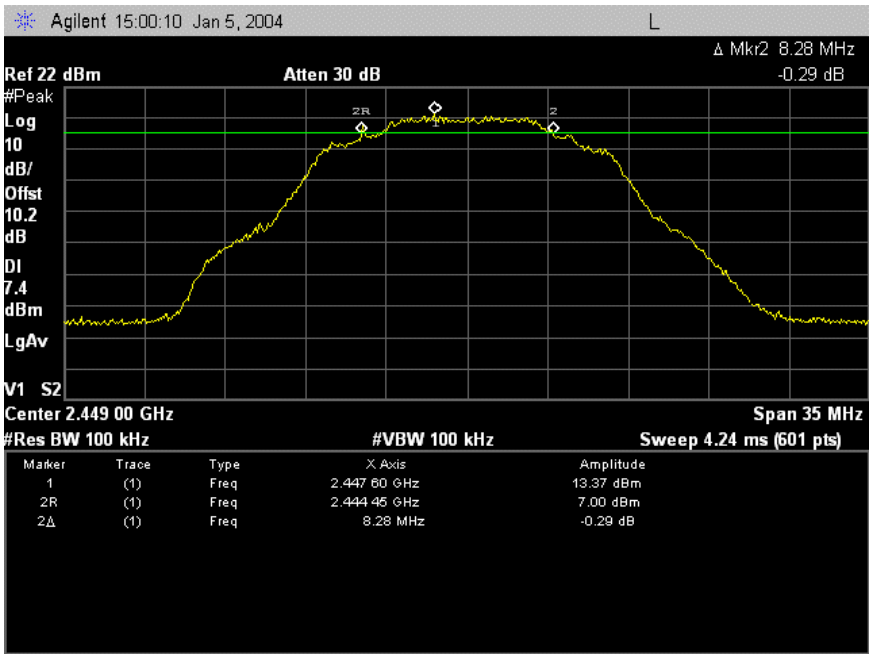
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2408	9160	500	8660
Middle	2449	8280	500	7780
High	2467	8690	500	8190

6 DB BANDWIDTH

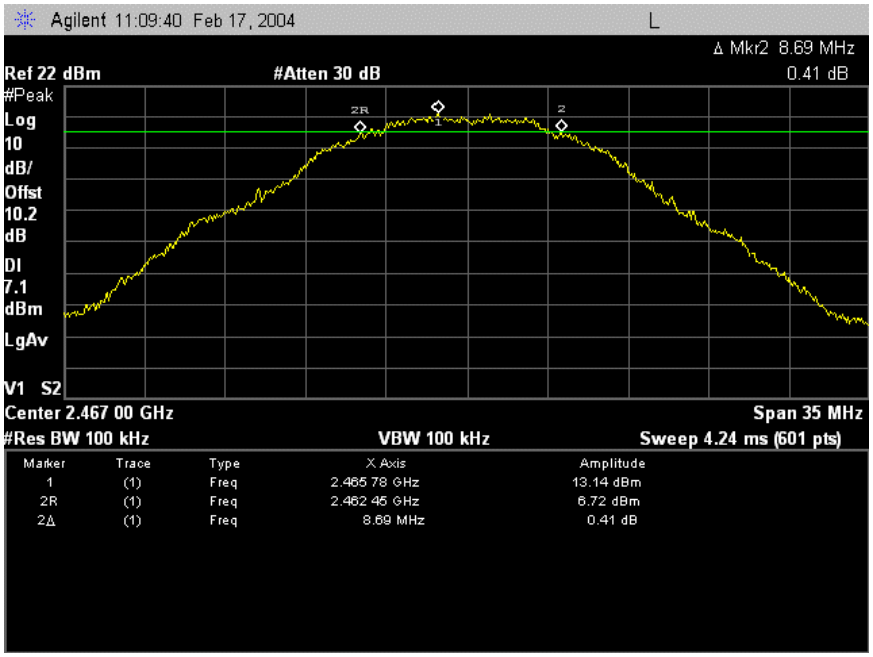
6 DB BANDWIDTH LOW CHANNEL



6 DB BANDWIDTH MIDDLE CHANNEL



6 DB BANDWIDTH HIGH CHANNEL



7.2. 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

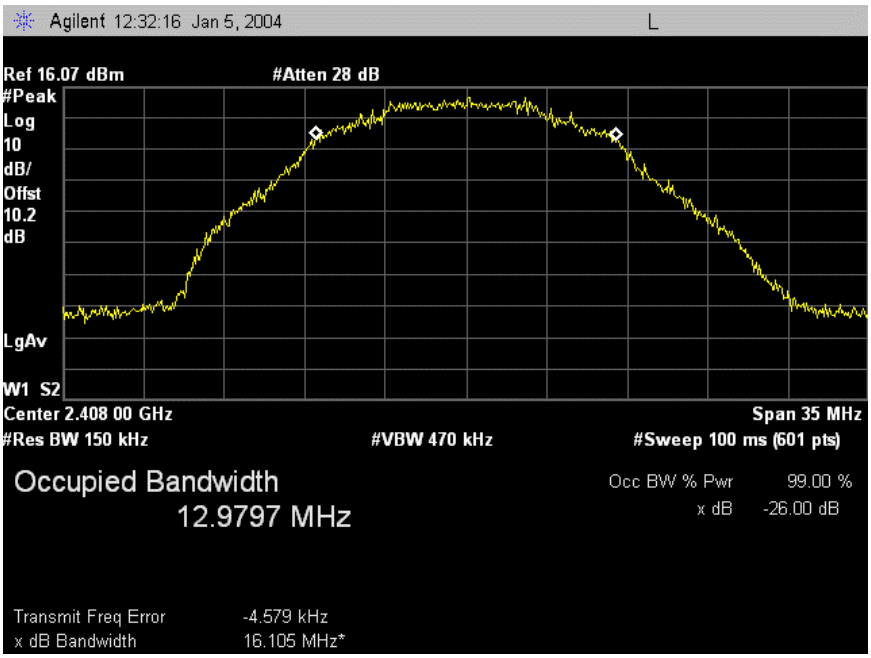
No non-compliance noted:

Spread Spectrum Repeater

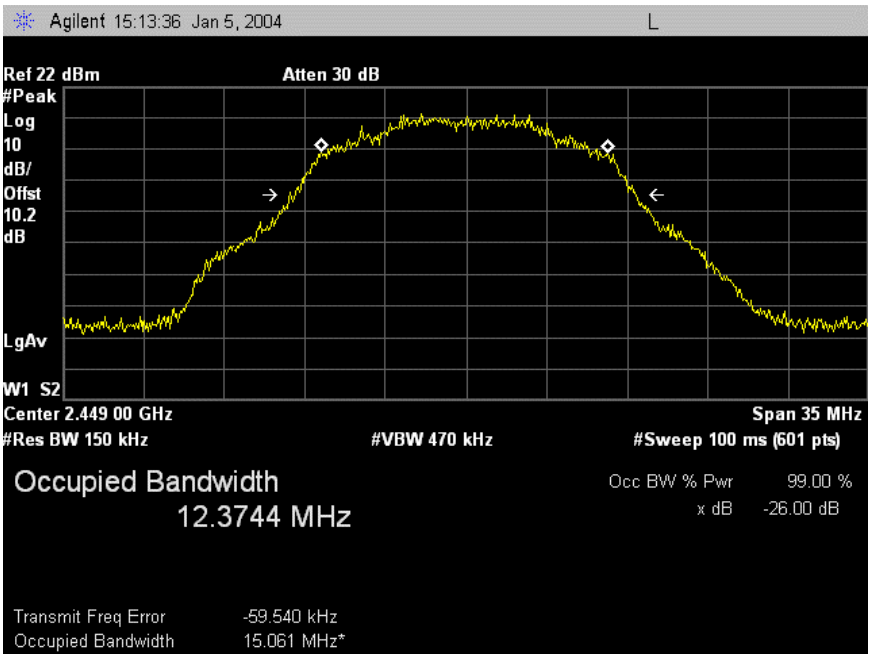
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2408	12.9797
Middle	2449	12.3744
High	2467	13.0054

99% BANDWIDTH

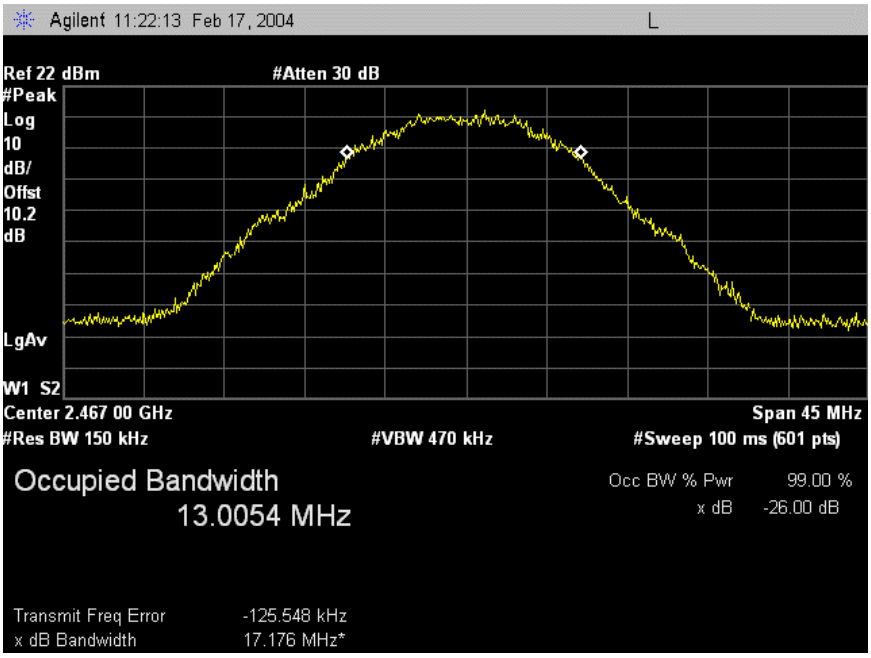
99% BANDWIDTH LOW CHANNEL



99% BANDWIDTH MIDDLE CHANNEL



99% BANDWIDTH HIGH CHANNEL



7.3. 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) (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 transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.

RESULTS

No non-compliance noted:

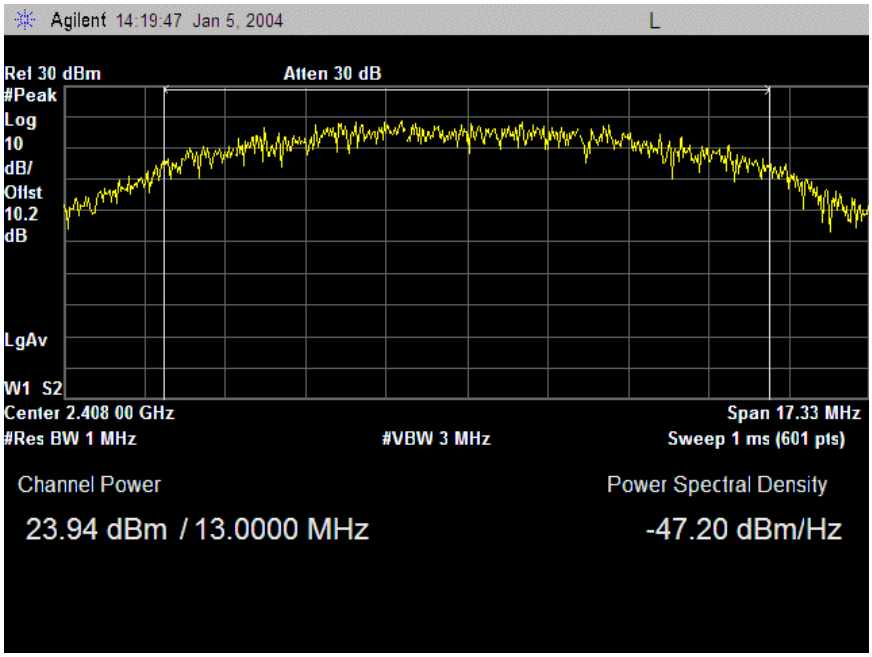
Spread Spectrum Repeater

Channel	Frequency (MHz)	Peak Power (dBm)	Limit* (dBm)	Margin (dB)
Low	2408	23.94	30	-6.06
Middle	2449	24.01	30	-5.99
High	2467	24.79	30	-5.21

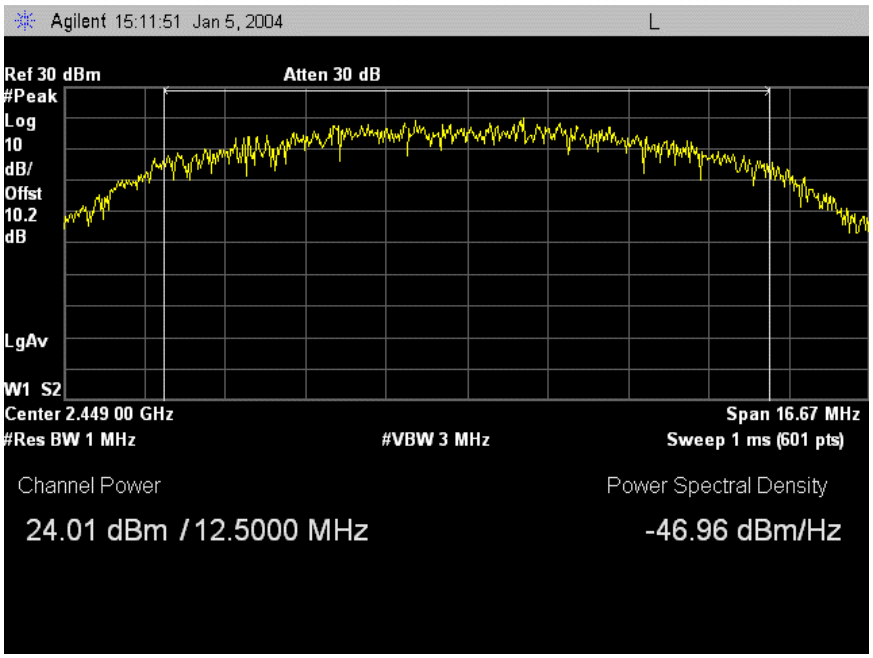
*Note: The limit depends on the gain of the antenna used for each installation; the power output will be adjusted during installation to comply with FCC 15.247 Rules.

OUTPUT POWER

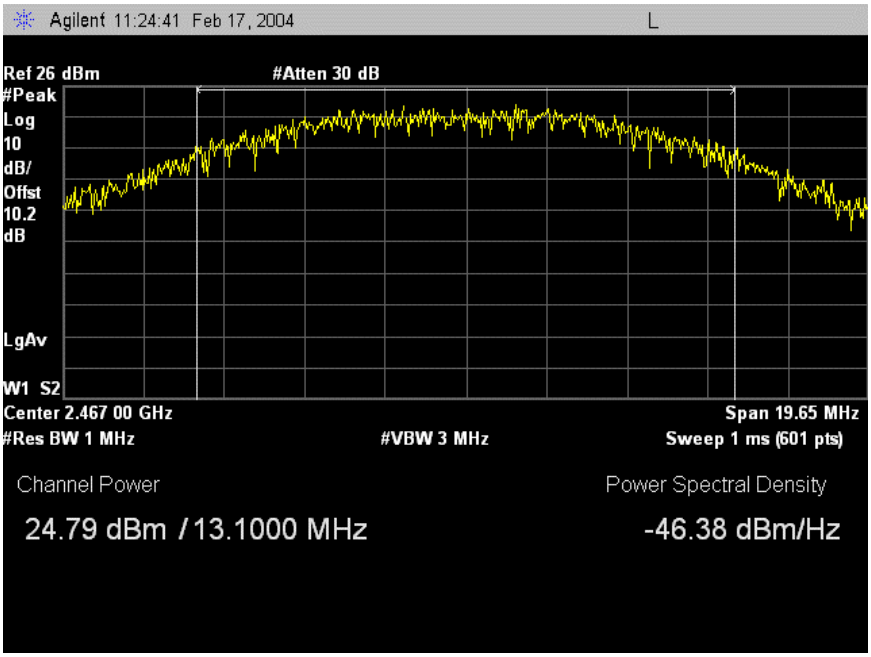
PEAK POWER LOW CHANNEL



PEAK POWER MID CHANNEL



PEAK POWER HIGH CHANNEL



7.4. 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	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (m)
37 dBi Dish	1.0	20.00	36.00	1.78

NOTE: The maximum Power Density occurs with the maximum gain antenna, assuming the power output is adjusted to the maximum permissible under FCC 15.247 rules. The maximum antenna gain is 36 dBi. The maximum allowable power for this antenna gain is 30 dBm – (36 dBi – 6 dBi)/3 = 20 dBm

7.5. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter is adjusted for maximum rated power and the output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 10.2 dB was entered as an offset in the power meter to allow for direct reading of power.

Spread Spectrum Repeater

Channel	Frequency (MHz)	Average Power (dBm)
Low	2408	21.00
Middle	2449	21.05
High	2467	21.31

7.6. 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

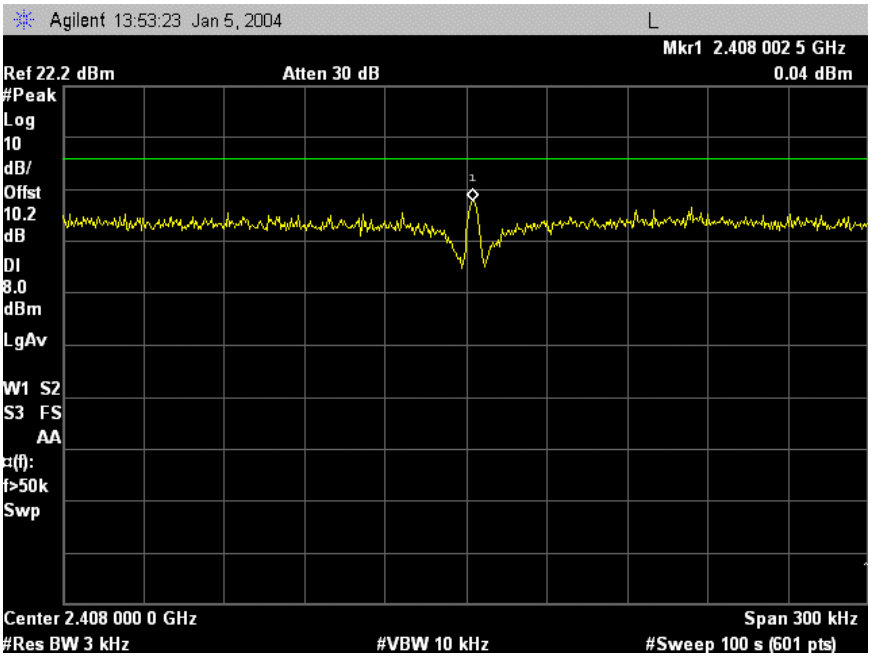
No non-compliance noted:

Spread Spectrum Repeater

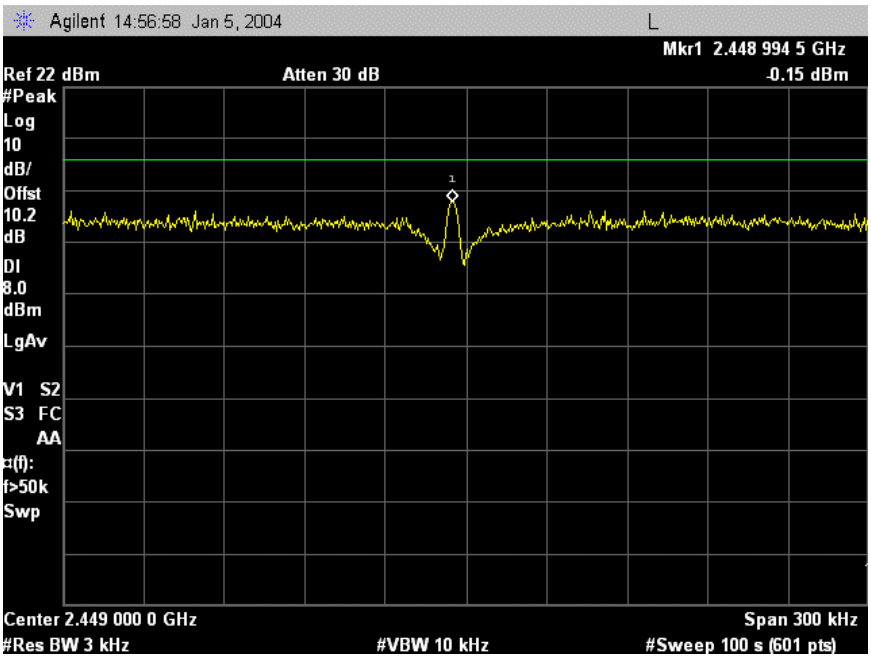
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2408	0.04	8	-7.96
Middle	2449	-0.15	8	-8.15
High	2467	-0.83	8	-8.83

PEAK POWER SPECTRAL DENSITY

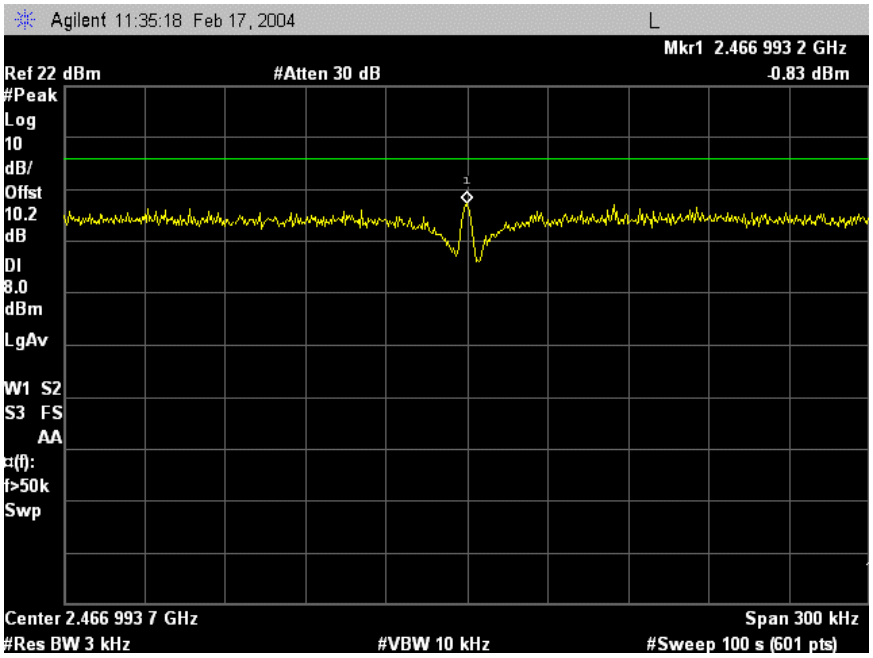
PPSD LOW CHANNEL



PPSD MIDDLE CHANNEL



PPSD HIGH CHANNEL



7.7. 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)).

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 100 kHz.

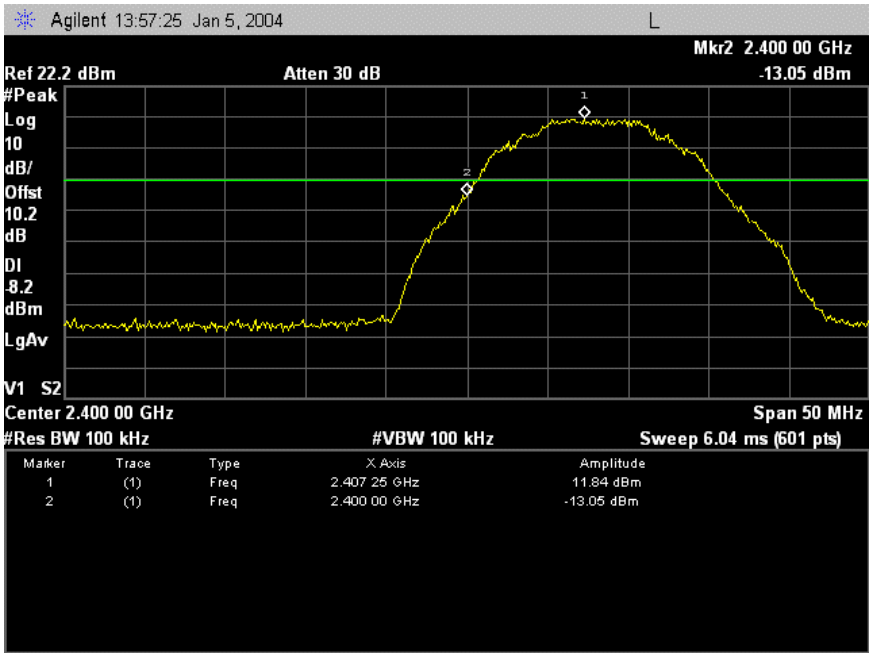
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

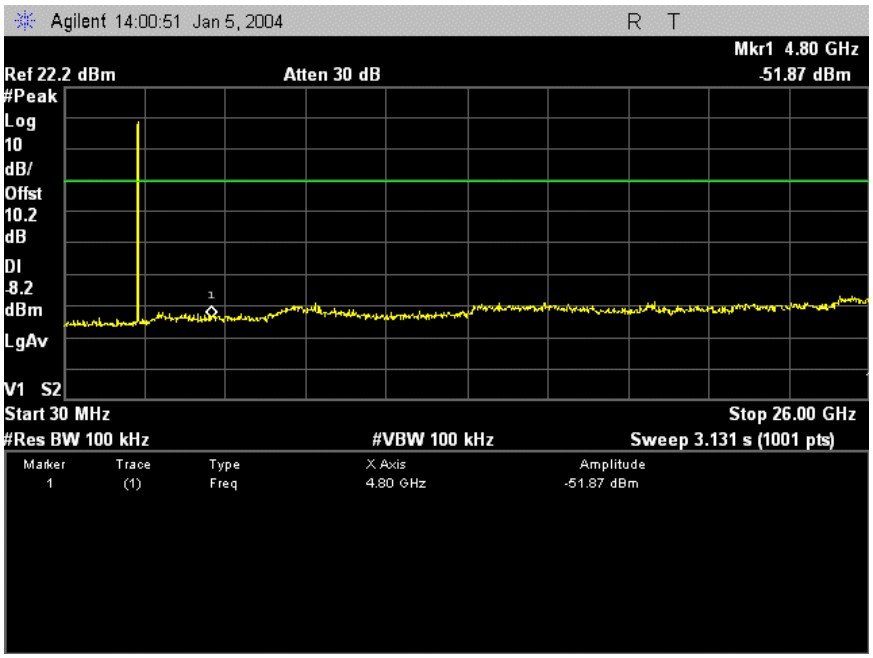
No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

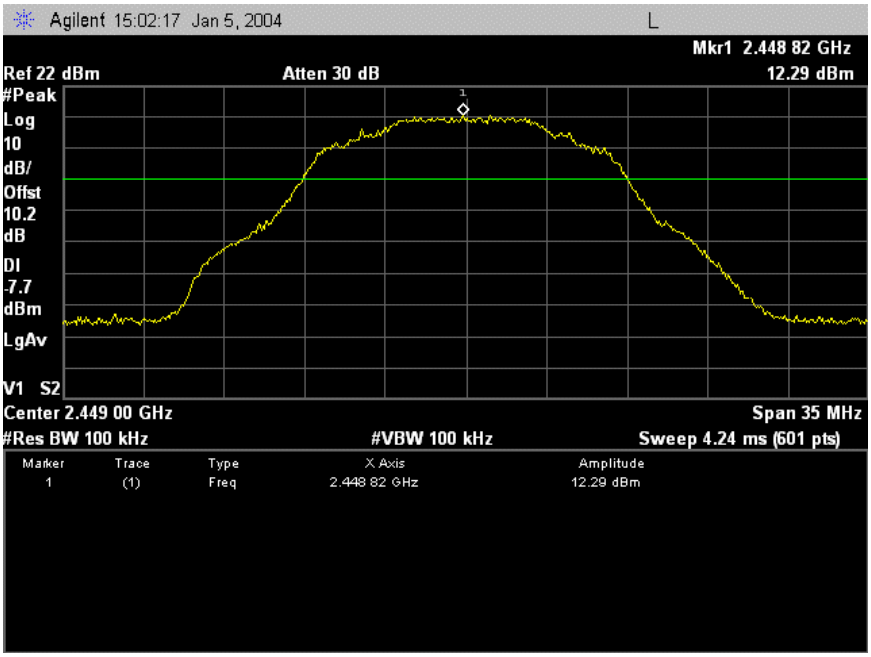


LOW CHANNEL SPURIOUS

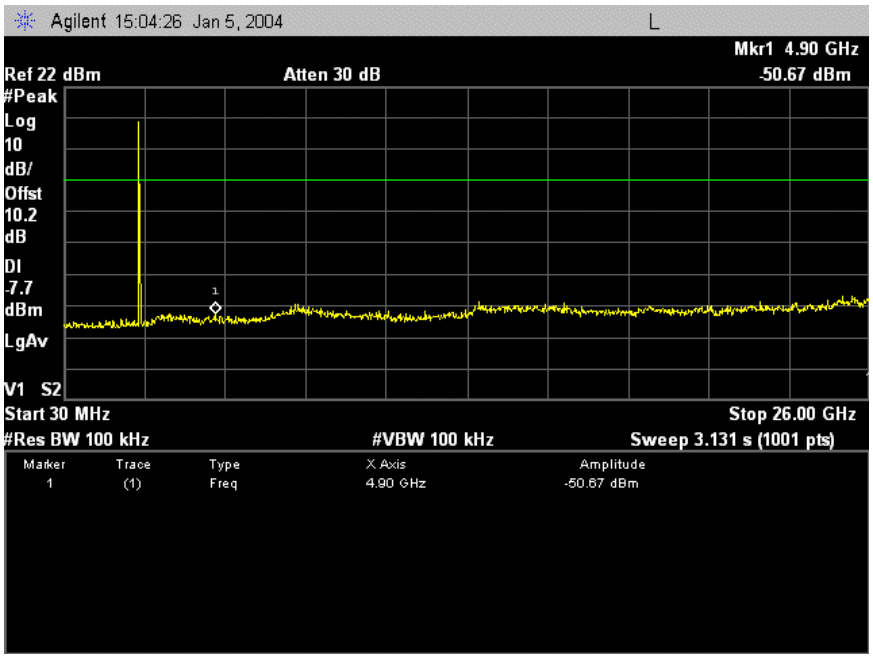


SPURIOUS EMISSIONS, MIDDLE CHANNEL

MIDDLE CHANNEL REFERENCE

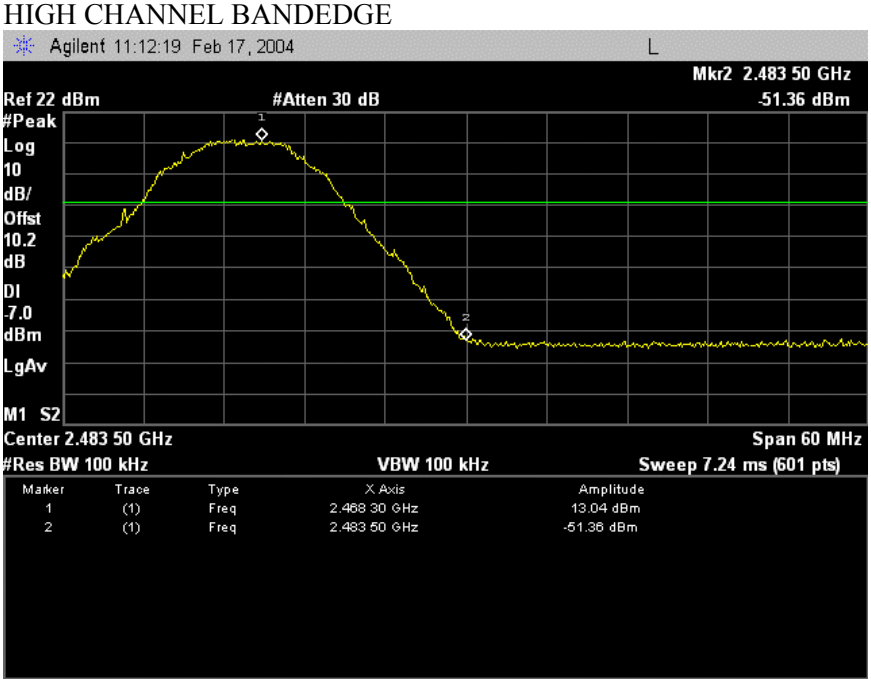


MIDDLE CHANNEL SPURIOUS

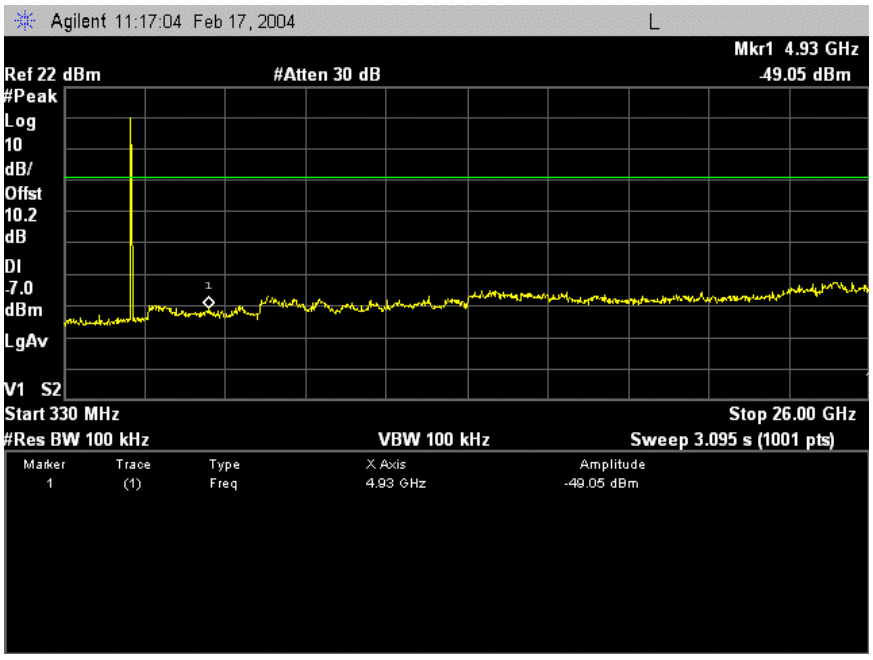


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE



HIGH CHANNEL SPURIOUS



7.8. RADIATED EMISSIONS

7.8.1. 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.

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.

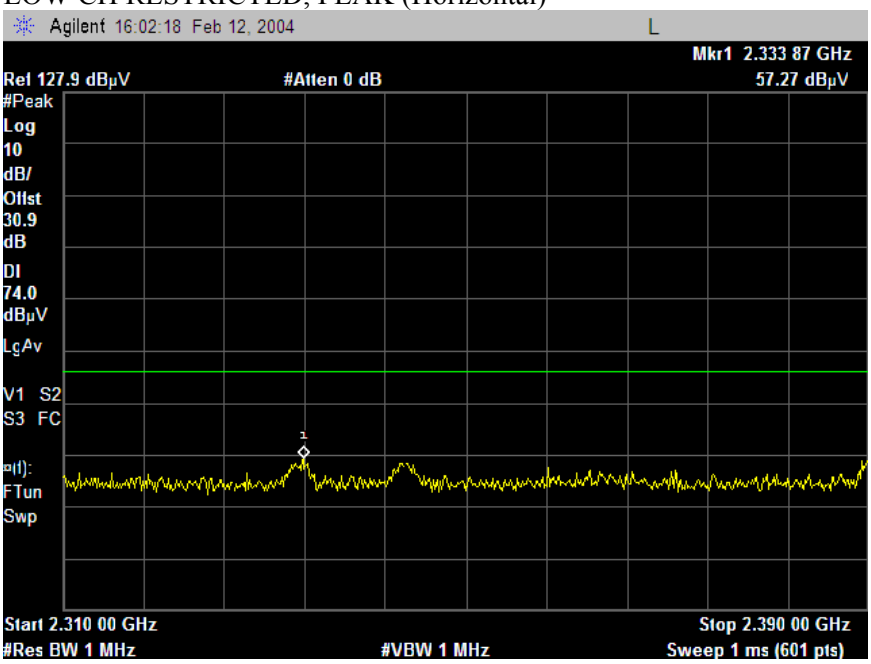
RESULTS

No non-compliance noted:

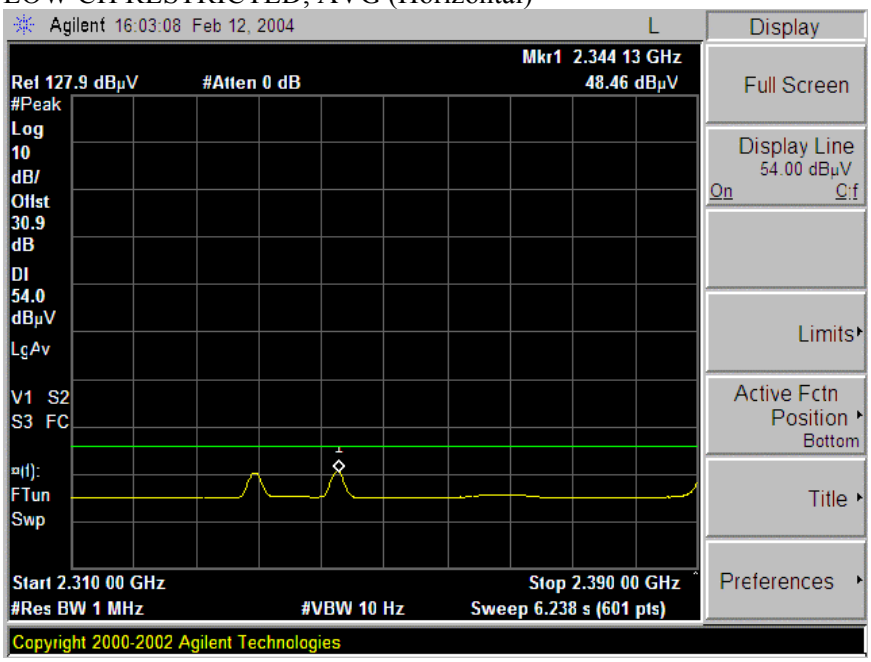
7.8.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CH RESTRICTED, PEAK (Horizontal)

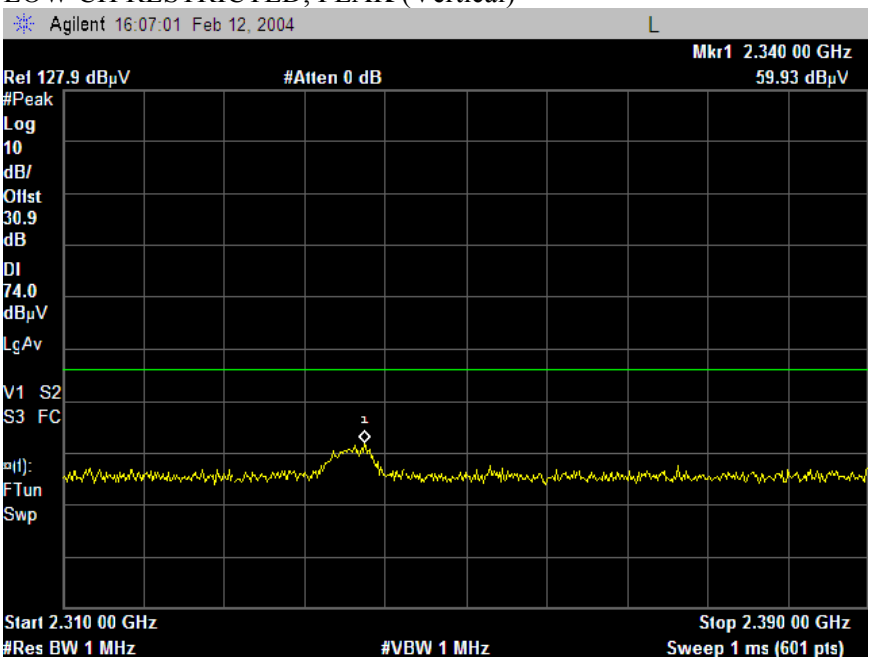


LOW CH RESTRICTED, AVG (Horizontal)

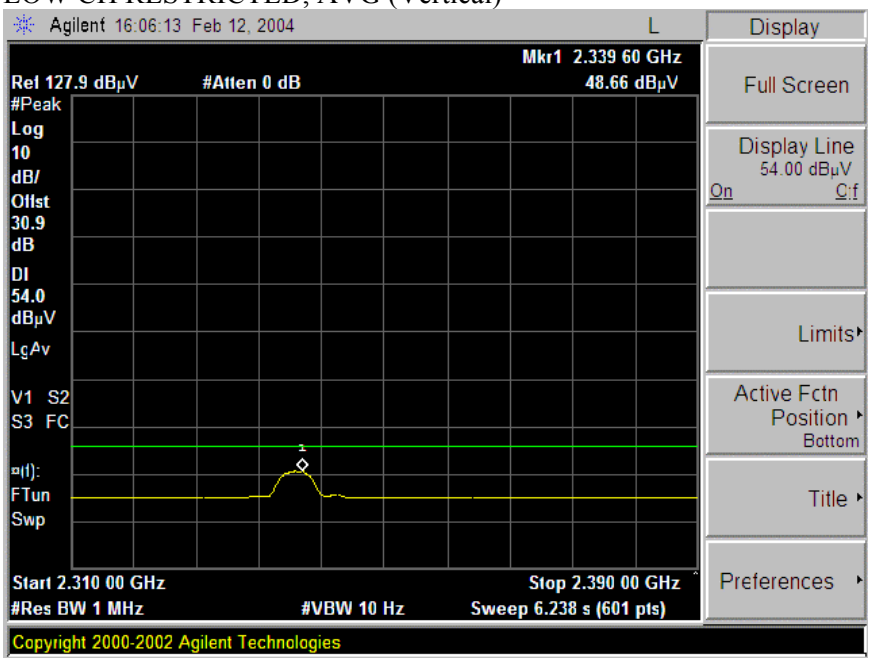


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CH RESTRICTED, PEAK (Vertical)

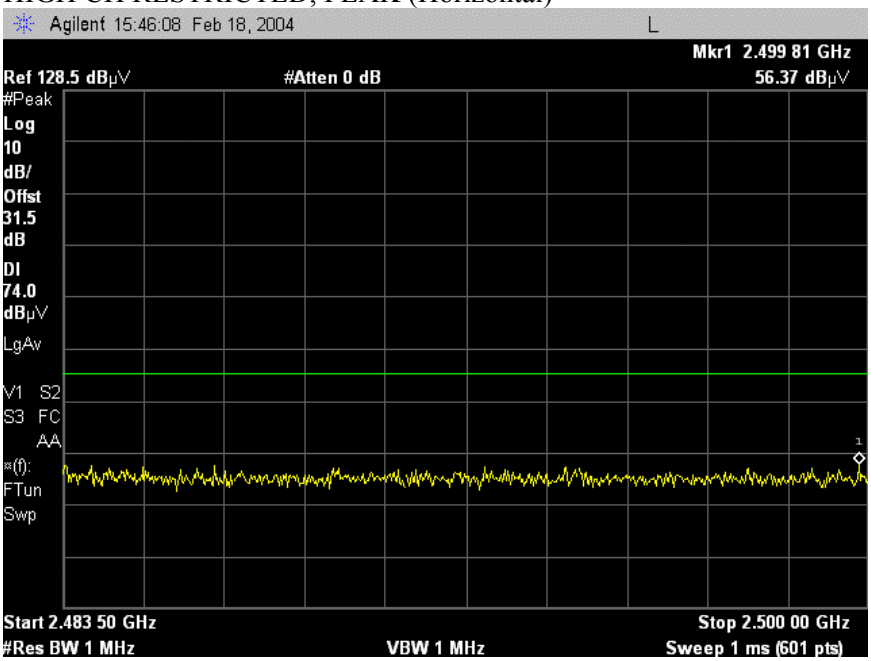


LOW CH RESTRICTED, AVG (Vertical)

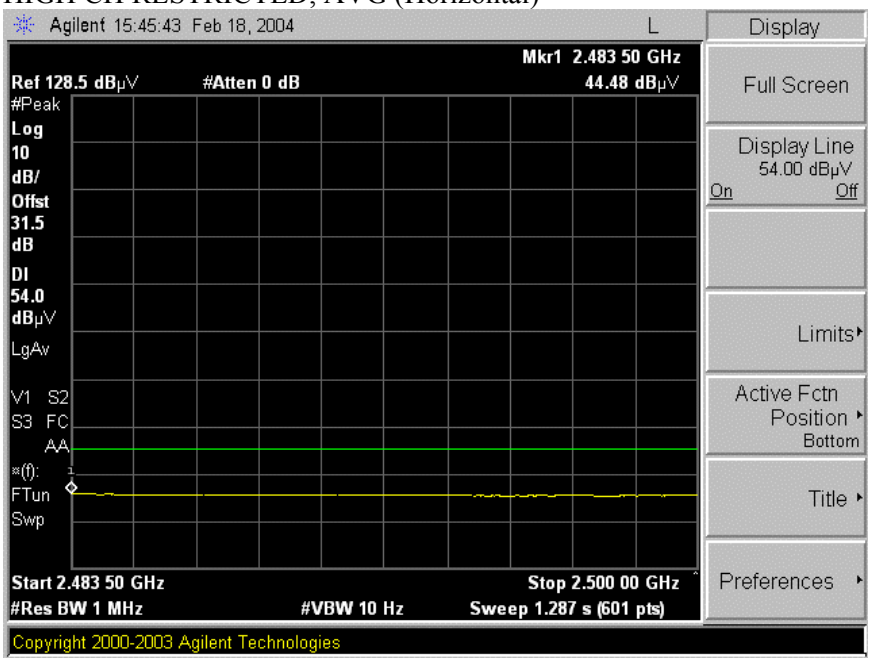


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CH RESTRICTED, PEAK (Horizontal)

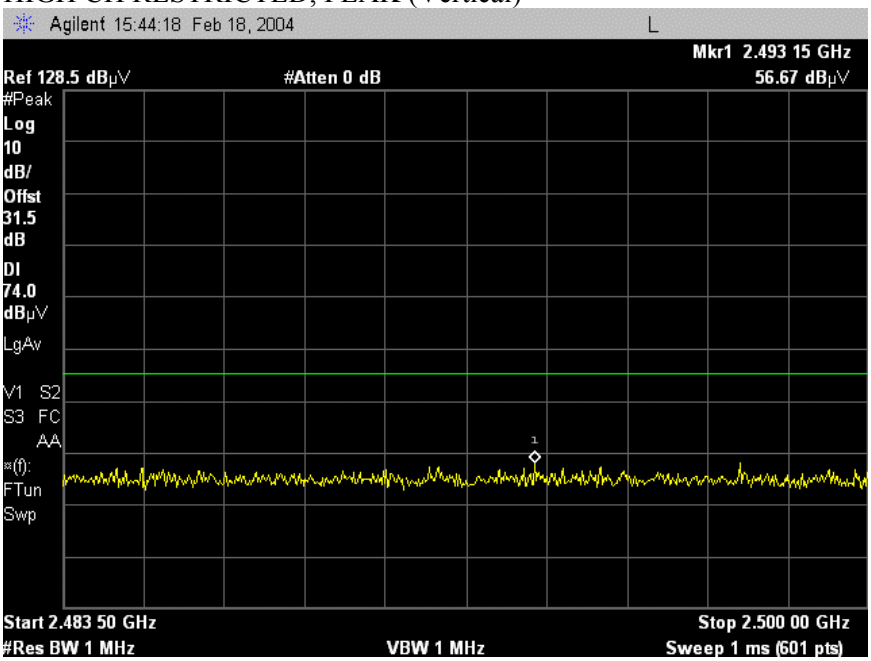


HIGH CH RESTRICTED, AVG (Horizontal)

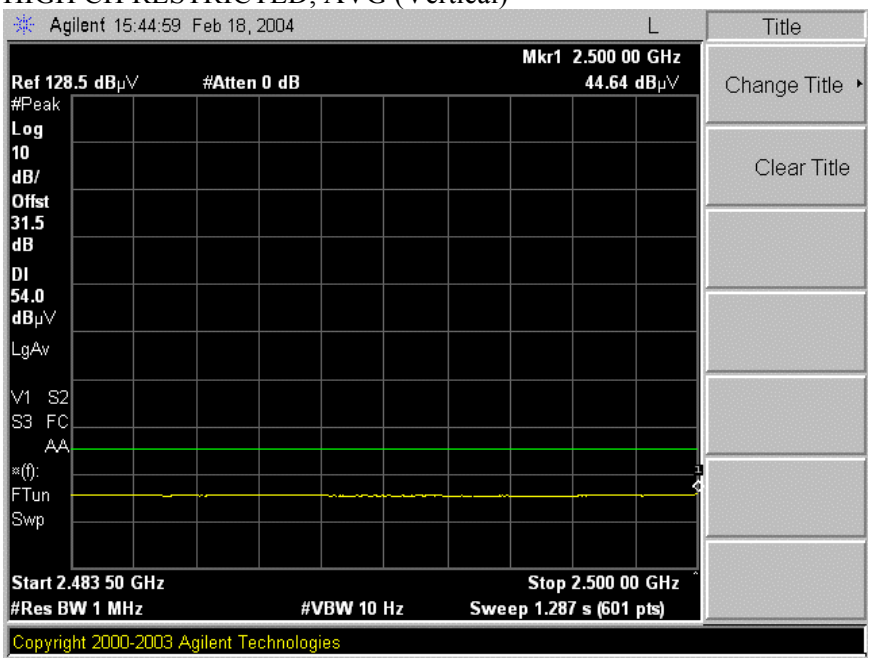


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CH RESTRICTED, PEAK (Vertical)



HIGH CH RESTRICTED, AVG (Vertical)



HARMONICS AND SPURIOUS EMISSIONS (b MODE)

02/12/04 High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: NEELESH RAJ
Project #: 03U2424
Company: PENINSULA ENGINEERING SOLUTIONS
EUT Descrip.: MICROWAVE RF REPEATER
EUT M/N: RF2500E-SS
Test Target: FCC
Mode Oper: TX

Test Equipment:

EMCO Horn 1-18GHz	Spectrum Analyzer	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz
T73; S/N: 6717 @1m	e4440a	T86 Miteq 924341		

Hi Frequency Cables: ☐ (2 ft) ☑ (2 ~ 3 ft) ☐ (4 ~ 6 ft) ☑ (12 ft)

Limit: FCC 15.205

Peak Measurements: 1 MHz Resolution Bandwidth, 1MHz Video Bandwidth
Average Measurements: 1 MHz Resolution Bandwidth, 10Hz Video Bandwidth

f GHz	Dist feet	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	HPF	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes
						LOW CHANNEL 2408MHz									
4.816	9.8	48.7	39.9	33.9	3.2	-45.6	0.0	1.0	41.3	32.4	74.0	54.0	-32.7	-21.6	V (NOISE FLOOR)
12.040	9.8	45.0	36.7	39.4	5.9	-45.4	0.0	1.0	45.9	37.6	74.0	54.0	-28.1	-16.4	V (NOISE FLOOR)
4.816	9.8	45.2	38.3	33.9	3.2	-45.6	0.0	1.0	37.7	30.8	74.0	54.0	-36.3	-23.2	H (NOISE FLOOR)
12.040	9.8	45.2	36.6	39.4	5.9	-45.4	0.0	1.0	46.1	37.5	74.0	54.0	-27.9	-16.5	H (NOISE FLOOR)
						MIDDLE CHANNEL 2449MHz									
4.898	9.8	48.0	38.0	34.0	3.3	-45.6	0.0	1.0	40.5	30.5	74.0	54.0	-33.5	-23.5	V (NOISE FLOOR)
7.347	9.8	47.4	39.1	36.9	4.3	-46.6	0.0	1.0	42.9	34.7	74.0	54.0	-31.1	-19.3	V (NOISE FLOOR)
12.245	9.8	46.7	37.6	39.6	6.0	-45.7	0.0	1.0	47.6	38.5	74.0	54.0	-26.4	-15.5	V (NOISE FLOOR)
4.898	9.8	47.5	37.7	34.0	3.3	-45.6	0.0	1.0	40.0	30.3	74.0	54.0	-34.0	-23.7	H (NOISE FLOOR)
7.347	9.8	47.1	39.4	36.9	4.3	-46.6	0.0	1.0	42.7	35.0	74.0	54.0	-31.3	-19.0	H (NOISE FLOOR)
12.245	9.8	47.8	38.8	39.6	6.0	-45.7	0.0	1.0	48.7	39.6	74.0	54.0	-25.3	-14.4	H (NOISE FLOOR)
						HIGH CHANNEL 2467MHz									
4.934	9.8	48.1	37.6	34.0	3.3	-45.7	0.0	1.0	40.7	30.2	74.0	54.0	-33.3	-23.8	V (NOISE FLOOR)
7.401	9.8	47.5	39.0	37.0	4.3	-46.5	0.0	1.0	43.2	34.7	74.0	54.0	-30.8	-19.3	V (NOISE FLOOR)
12.335	9.8	47.0	38.0	39.7	6.0	-45.8	0.0	1.0	47.9	38.9	74.0	54.0	-26.1	-15.1	V (NOISE FLOOR)
4.934	9.8	47.9	37.7	34.0	3.3	-45.7	0.0	1.0	40.5	30.3	74.0	54.0	-33.5	-23.7	H (NOISE FLOOR)
7.401	9.8	47.3	39.6	37.0	4.3	-46.5	0.0	1.0	43.0	35.3	74.0	54.0	-31.0	-18.7	H (NOISE FLOOR)
12.335	9.8	47.9	39.1	39.7	6.0	-45.8	0.0	1.0	48.8	40.0	74.0	54.0	-25.2	-14.0	H (NOISE FLOOR)
			NO OTHER SPURIOUS EMISSIONS DETECTED ABOVE THE SYSTEM NOISE FLOOR IN THE RESTRICTED BANDS												

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		

7.8.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz

No spurious emissions detected above the system floor noise.

7.9. POWERLINE CONDUCTED EMISSIONS

LIMIT

§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 µH/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 of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

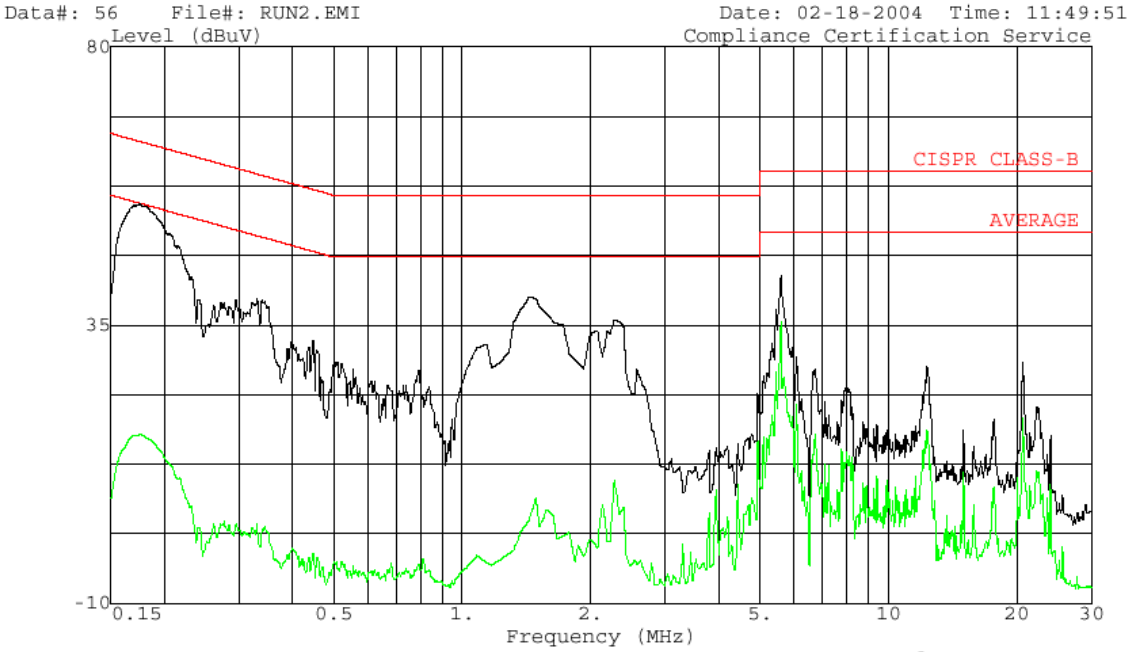
No non-compliance noted:

6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	54.56	--	17.39	0.00	65.26	55.26	-10.70	-37.87	L1
5.59	42.94	--	35.49	0.00	60.00	50.00	-17.06	-14.51	L1
1.43	39.46	--	7.01	0.00	56.00	46.00	-16.54	-38.99	L1
0.18	54.08	--	16.73	0.00	65.23	55.23	-11.15	-38.50	L2
5.68	40.64	--	31.44	0.00	60.00	50.00	-19.36	-18.56	L2
0.34	39.58	--	2.17	0.00	60.54	50.54	-20.96	-48.37	L2
6 Worst Data									

LINE 1 RESULTS

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



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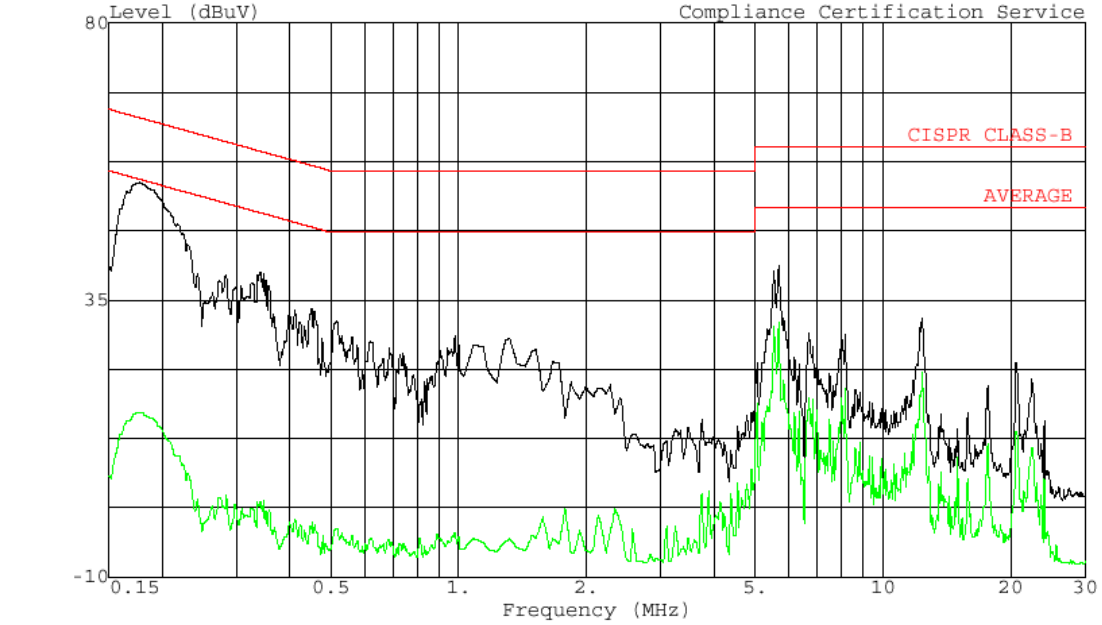
Project # : 03u2442-1
Test Operator : NEELESH RAJ
Company : PENINSULA ENGINEERING SOLUTIONS
EUT : 2.4GHz MICROWAVE RF REPEATER
Model : RF-2500E-SS
Configuration : EUT/DC PWR/RADIO
Mode of Operation: TX (WORST CASE)
Target of Test : CLASS B
Voltage : 115VAC/60Hz
: L1(PEAK;BLACK AVG;GREEN)

LINE 2 RESULTS

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



Trace: 47 Ref Trace:
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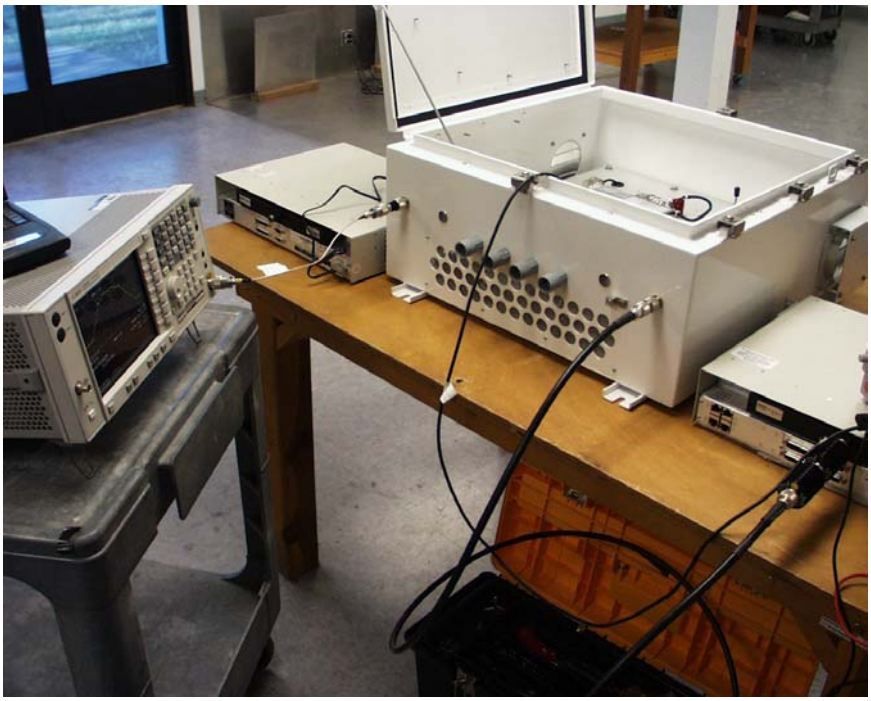
Test Operator : NEELESH RAJ
Company : PENINSULA ENGINEERING SOLUTIONS
EUT : 2.4GHz MICROWAVE RF REPEATER
Model : RF-2500E-SS
Configuration : EUT/DC PWR/RADIO
Mode of Operation: TX (WORST CASE)
Target of Test : CLASS B
Voltage : 115VAC/60Hz
: L2(PEAK;BLACK AVG;GREEN)

8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO



RADIATED RF MEASUREMENT SETUP

RADIATED FRONT PHOTO

RADIATED BACK PHOTO

POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO

END OF REPORT