FCC CFR47 PART 90 SUBPART Y
CERTIFICATION
TEST REPORT

FOR

POINT TO POINT WIRELESS ETHERNET BRIDGE

MODEL NUMBER: P4900M-INT-18, P4900M-INT-23, P4900M-EXT*

FCC ID: NCYP4900M

REPORT NUMBER: 06U10226-1, REVISION B

ISSUE DATE: JUNE 20, 2006

Prepared for
TRANGO SYSTEMS
15070 AVENUE OF SCIENCE, SUITE 200
SAN DIEGO, CA 92128, USA

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*Details of specific model(s) tested and model differences are identified in the body of report.

LAB CODE:200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	6/09/06	Initial Issue	A. Ilarina
B	6/20/06	Update table under section 5.3; update Test Procedure under section 7.1.3; update Limits description under section 7.2; update band references to reflect 4940-4990MHz band	A. Ilarina

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TRANGO SYSTEMS
15070 AVENUE OF SCIENCE, SUITE 200
SAN DIEGO, CA 92128
U.S.A.

EUT DESCRIPTION: POINT TO POINT WIRELESS ETHERNET BRIDGE

MODEL: P4900M-INT-18, P4900M-INT-23, P4900M-EXT

SERIAL NUMBER: 0508011

DATE TESTED: APRIL 7 – APRIL 20, 2006

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 90 SUBPART Y	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:

ALVIN ILARINA
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

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, TIA-603-C and FCC CFR 47 Part 90.

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 4.9 GHz point to point wireless Ethernet bridge.

The radio module is manufactured by Trango Systems.

5.2. MANUFACTURER'S DESCRIPTION OF MODEL DIFFERENCES

There are three models under the P4900M model series**,** which are: P4900M -INT-18, P4900M-INT-23 and P4900M-EXT. The particular device that was tested is a sample of one version within the P4900M model series. The following shows the model differences:

P4900M-INT-18: Atlas4900-INT18 point-to-point radio with integrated 18 dBi panel antenna
P4900M-INT-22: Atlas4900-INT22 point-to-point radio with integrated 22 dBi panel antenna
P4900M-EXT: Atlas4900-EXT point-to-point radio with external h/v polarization antenna connectors

5.3. MAXIMUM OUTPUT POWER

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

4940 to 4990 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
4950 - 4980	20 MHz Bandwidth	21.46	139.96

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the following antennas:

2 Trango Systems, Patch array antennas with 18 and 23 dBi gains respectively.
1 mWave, Dish antenna with 27 dBi gain.

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 1p0a2.

The test utility software used during testing was telnet.

5.6. 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 4950 MHz.

The worst-case data rate for this channel is determined to be 6 Mb/s for 20 MHz channel bandwidth based on previous experience with 4.9 GHz WLAN product design architectures.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Toshiba	PS183U-00K0X	91617937.00	DoC
AC Adapter	Toshiba	PA3083U-1ACA	0043423G	N/A
POE Adapter	Trango	POE	N/A	N/A
AC Adapter	Technics	Tesa1-240075	N/A	N/A

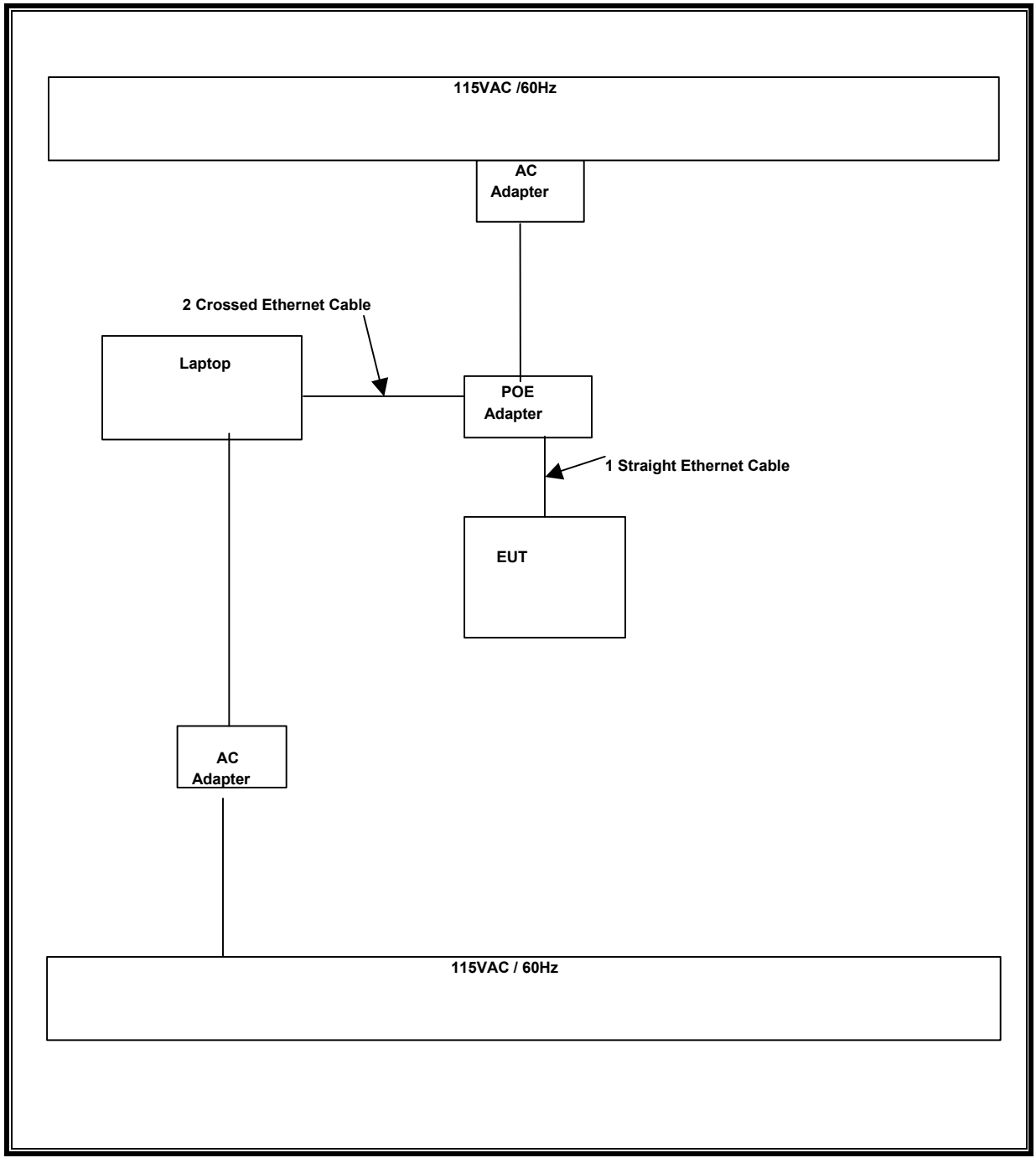
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	LAN	1	RJ45	Straight Ethernet	1 m	none
2	LAN	1	RJ45	Crossed Ethernet	1 m	none

TEST SETUP

The EUT is connected to a host laptop computer via an unshielded crossover LAN cable during the tests. Test software exercised the radio card.

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	ESHS 20	827129/006	6/3/2006
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent	E4446A	US42510266	10/19/2006
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	29800	6/10/2006
Antenna, Horn 1 ~ 18 GHz	Erctco	3115	6717	4/22/2006
Preamplifier, 1 ~ 26 GHz	Miteq	NSP2600-SP	924342	9/2/2006
Antenna, Bilog 30MHz ~ 2Ghz	Sunol Sciences	JB1	A121003	9/3/2006
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	2/4/2007
RF Filter Section	HP	85420E	3705A00256	2/4/2007
Peak Power Meter	Agilent	E4416A	GB41291160	12/2/2007
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/2/2007
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	8/20/2006
Site A Line Stabilizer/Conditioner	Tripplite	LC-1800a	A005181	CNR
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	8/30/2006
4.0 High Pass Filter	Micro Tronics	HPM13351	3	N/A

7. LIMITS AND RESULTS

7.1. CHANNEL TESTS FOR THE 4940 TO 4990 MHz BAND

7.1.1. EMISSION BANDWIDTH (20 MHz CHANNEL BANDWIDTH)

LIMIT

For reporting purposes only.

TEST PROCEDURE

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

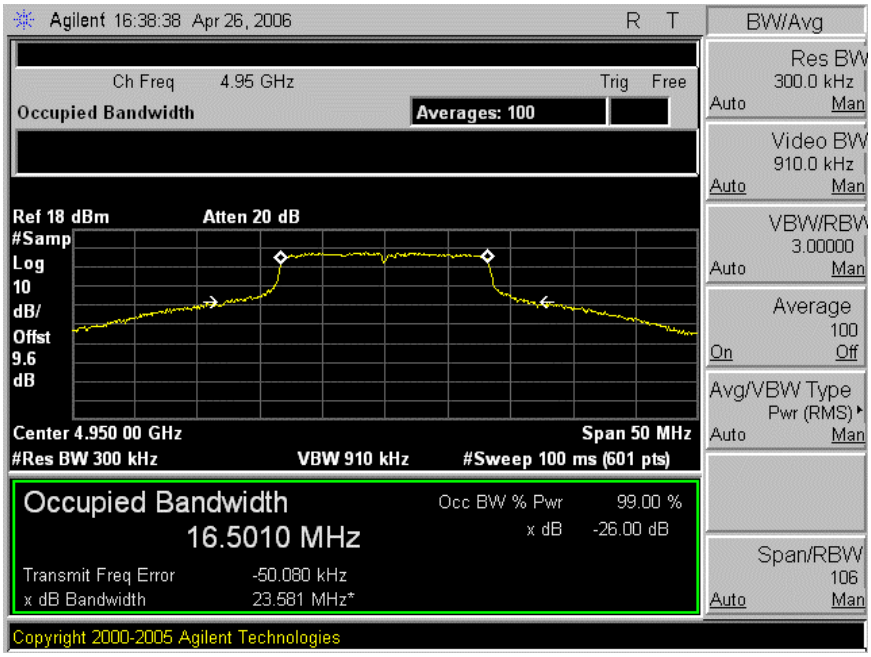
RESULTS

No non-compliance noted:

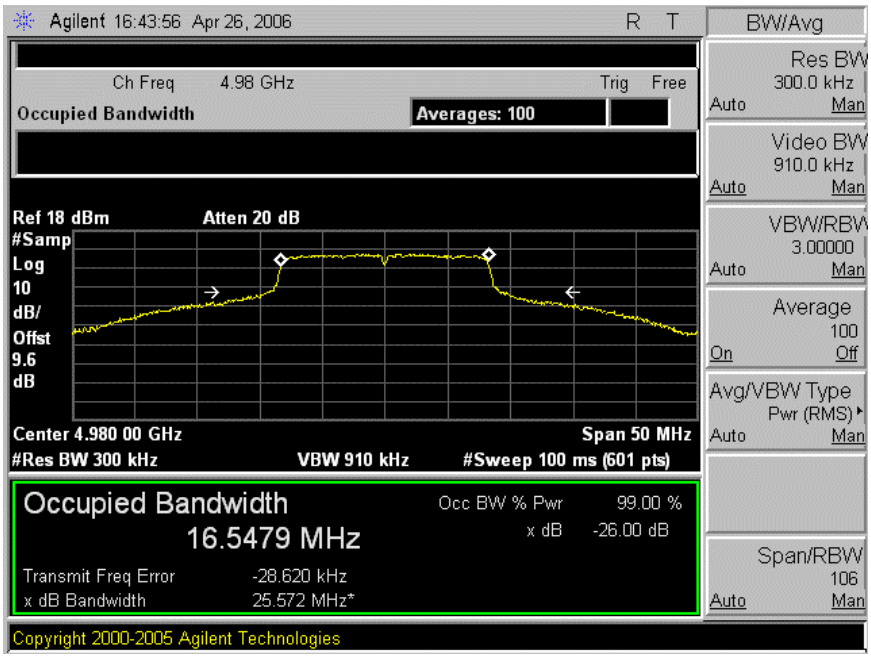
Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	4950	16.50	12.17
High	4980	16.55	12.19

26 dB EMISSION BANDWIDTH

26 dB BANDWIDTH LOW CH



26 dB BANDWIDTH HIGH CH



7.1.2. PEAK OUTPUT POWER

PEAK POWER LIMIT

§ 90.1215 The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a) The peak transmit power should not exceed:

Channel bandwidth (MHz)	Low power Device Peak transmitter Power (dBm)	High power Device Peak transmitter Power (dBm)
1.....	7	20
5.....	14	27
10.....	17	30
15.....	18.8	31.8
20.....	20	33

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 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 26 dB bandwidth. The peak transmit power is measured as a conducted emission over any interval of continuous transmission calibrated in terms of an rms-equivalent voltage.

RESULTS

For antenna gains up to 27dBi the limit is 32dBm.

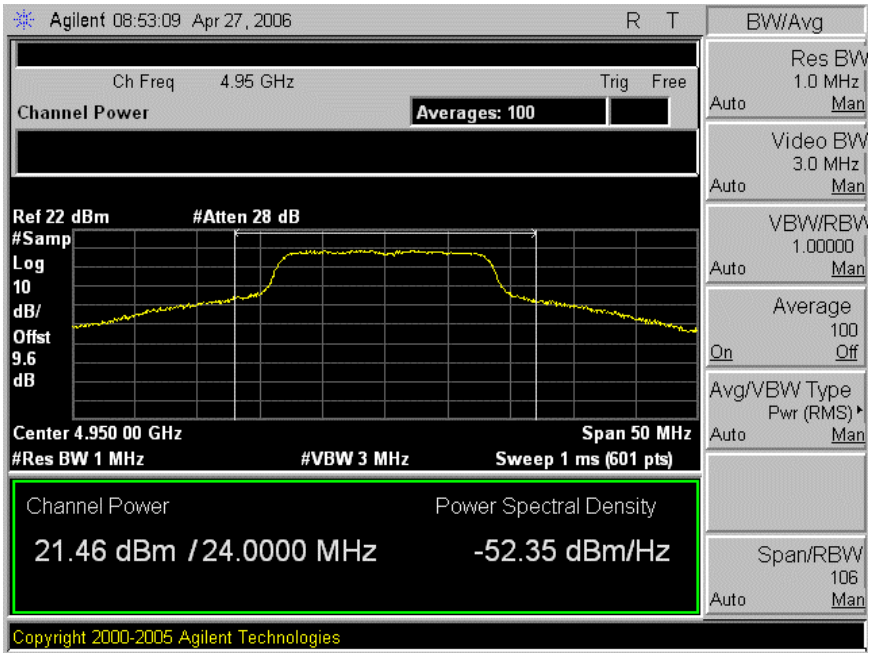
No non-compliance noted:

For antennas up to 27 dBi

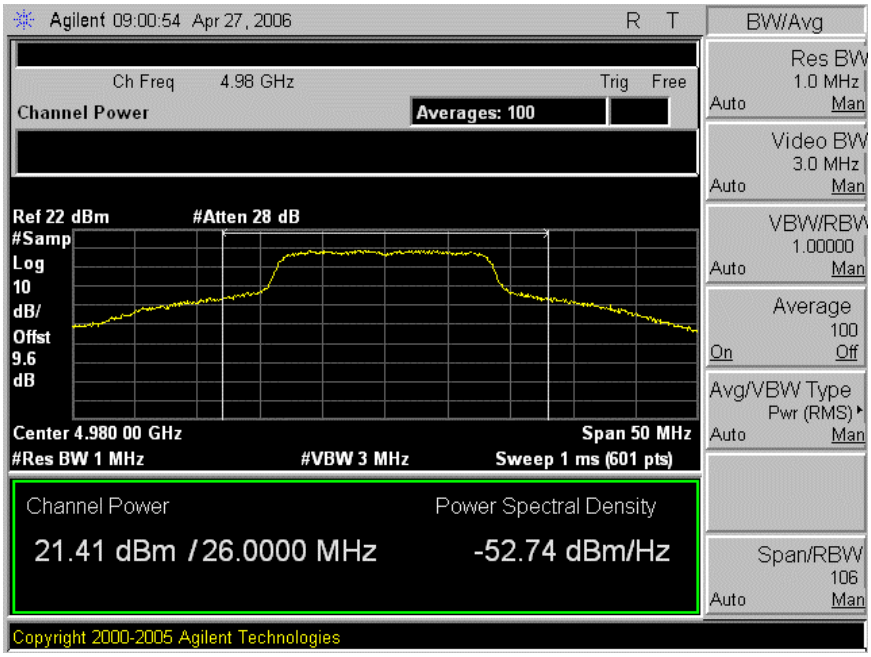
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	4950	21.46	32	-10.54
High	4980	21.41	32	-10.59

OUTPUT POWER (ANTENNAS UP TO 27dBi)

PEAK POWER LOW CH



PEAK POWER HIGH CH



7.1.3. 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

$S = E \wedge 2 / 3770$

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 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

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

Mode	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
20 MHz Channel BW	1.0	21.46	27.00	38.84

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.

7.1.4. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 10.1dB was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	4950	22.06
High	4980	22.14

7.1.5. PEAK POWER SPECTRAL DENSITY

LIMIT

§ 90.1215 (a) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(c) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

Limits as determined by antenna Gain:

Antenna Gain dBi	Limit dBm
Up to 26	21

TEST PROCEDURE

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

The transmitter output is connected to a spectrum analyzer, the maximum level is measured with the spectrum analyzer using RBW = 1 MHz and VBW 3 MHz. The PPSD is the highest level found across the emission in any 1 MHz band.

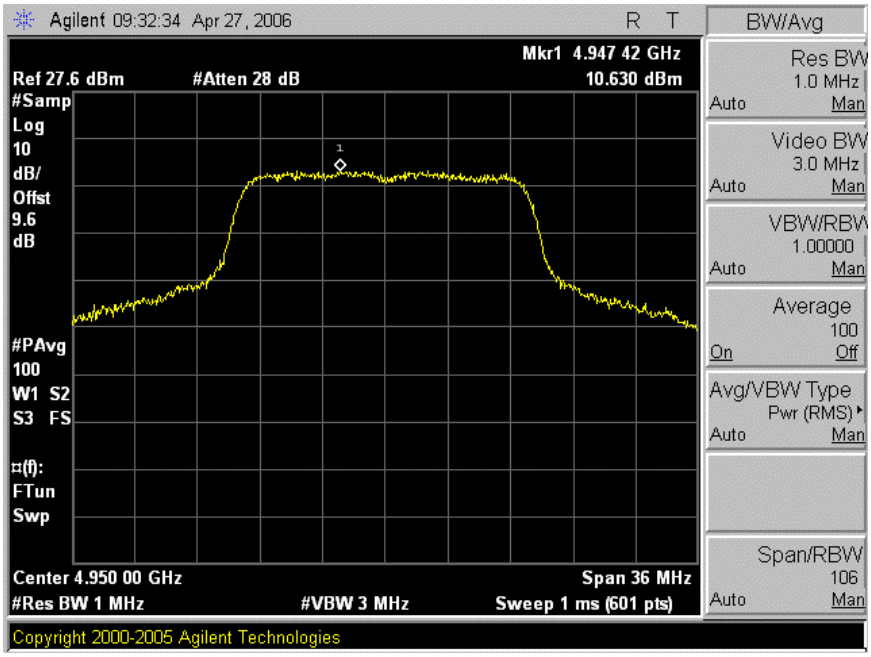
RESULTS

No non-compliance noted:

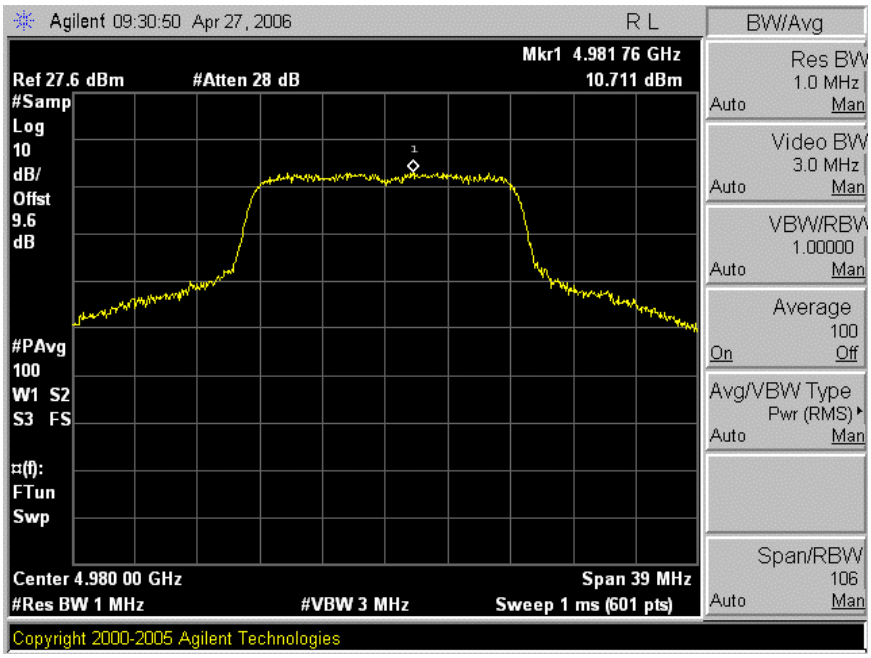
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	4950	10.63	20	-9.37
High	4980	10.71	20	-9.29

PEAK POWER SPECTRAL DENSITY (FOR UPTO 27dBi ANTENNA GAIN)

PPSD LOW CH



PPSD HIGH CH



7.1.6. EMISSION MASK AND CONDUCTED SPURIOUS

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.
(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

TEST PROCEDURE

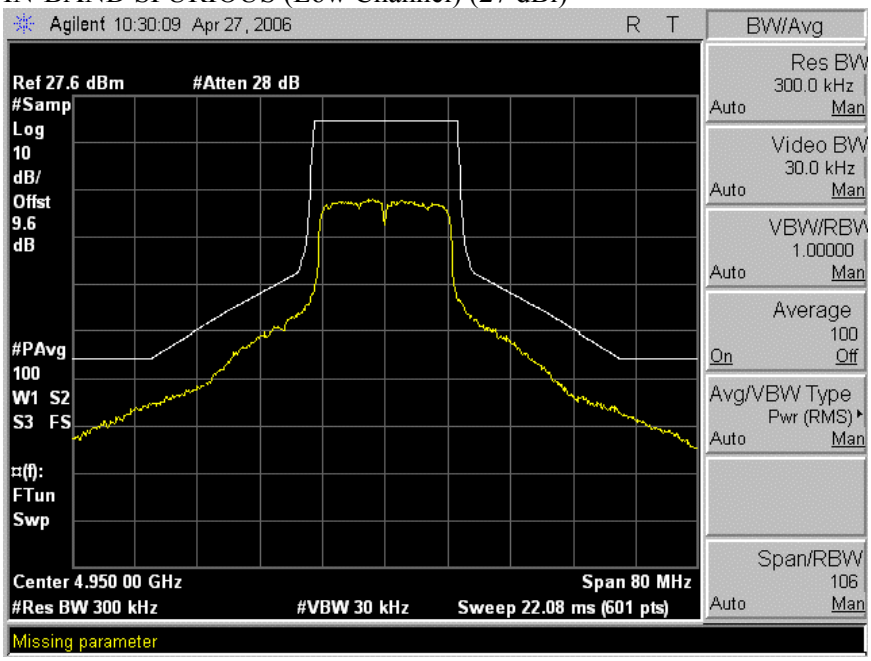
The EUT is connected to the spectrum analyzer, the average peak amplitude is used as the reference value for the mask, and the trace is compared to the mask.

RESULTS

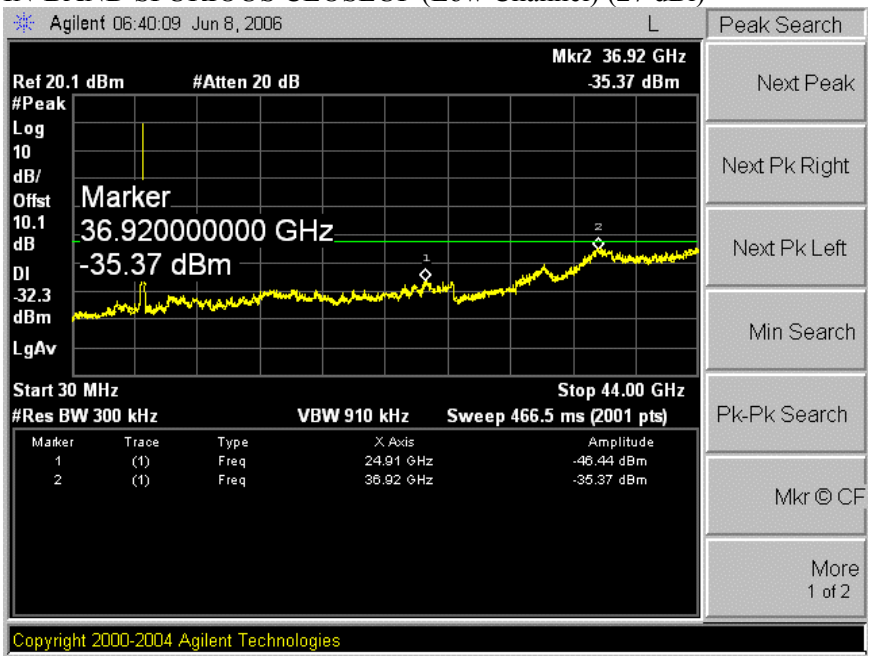
No non-compliance noted:

IN-BAND SPURIOUS EMISSIONS

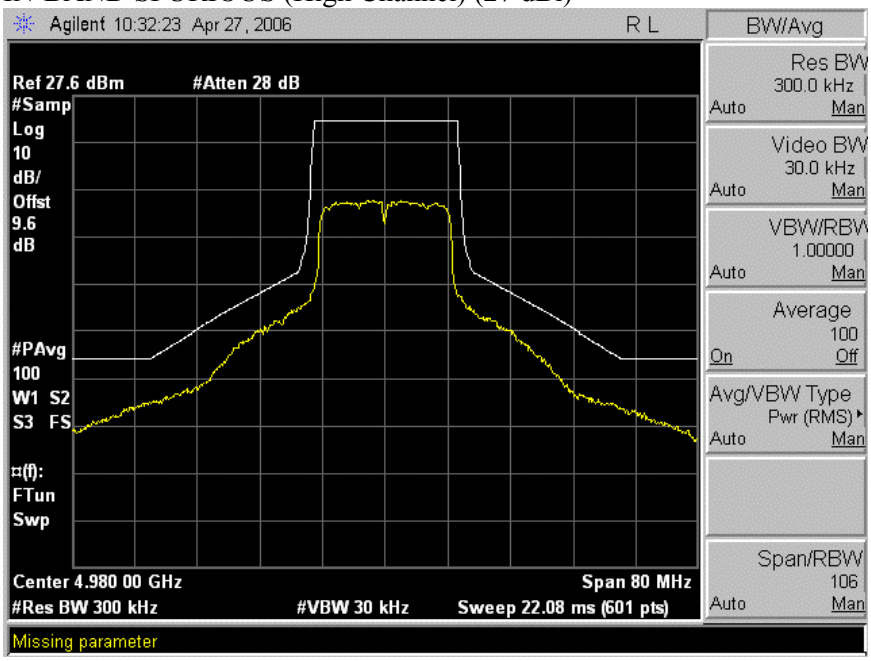
IN-BAND SPURIOUS (Low Channel) (27 dBi)



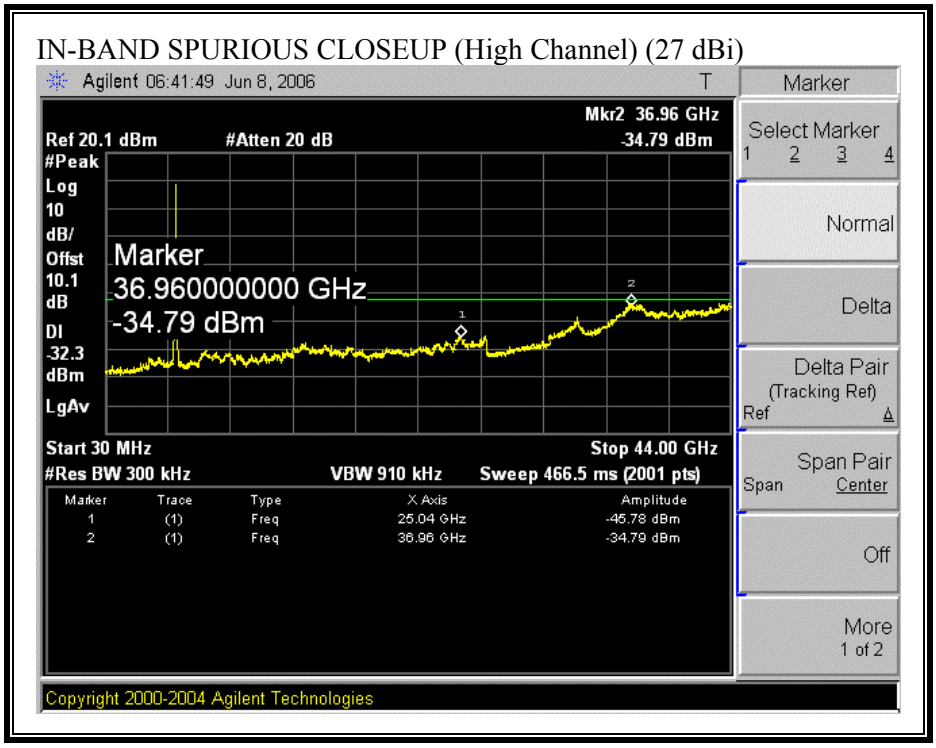
IN-BAND SPURIOUS CLOSEUP (Low Channel) (27 dBi)



IN-BAND SPURIOUS (High Channel) (27 dBi)



IN-BAND SPURIOUS CLOSEUP (High Channel) (27 dBi)



7.1.7. FREQUENCY STABILITY

LIMIT

§ 90.213 (a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table (See FCC § 90.1215 rules for table).

Above 2450 MHz: Frequency stability to be specified in the station authorization.

For equipment authorization purposes, this is a reporting requirement only.

TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

RESULTS

No non-compliance noted:

NORMAL VOLTAGE EXTREME TEMPERATURE RESULTS

Temp. Celsius	Channel Frequency (MHz)	Measured Frequency (MHz)	Delta Frequency (kHz)	ppm
-30	4950	4949.9737	-26.30	5.31
-20	4950	4949.9975	-2.50	0.51
-10	4950	4950.0014	1.40	-0.28
0	4950	4950.0012	1.20	-0.24
10	4950	4949.9898	-10.20	2.06
20	4950	4949.9868	-13.20	2.67
30	4950	4949.9777	-22.30	4.51
40	4950	4949.9713	-28.70	5.80
50	4950	4949.9702	-29.80	6.02

LOW VOLTAGE NORMAL TEMPERATURE RESULTS

Temp. Celsius	Channel Frequency (MHz)	Measured Frequency (MHz)	Delta Frequency (kHz)	ppm
20	4950	4949.977401	-22.60	4.57

HIGH VOLTAGE NORMAL TEMPERATURE RESULTS

Temp. Celsius	Channel Frequency (MHz)	Measured Frequency (MHz)	Delta Frequency (kHz)	ppm
20	4950	4949.977778	-22.22	4.49

7.2. RADIATED EMISSIONS

LIMITS

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.
(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

§15.109 (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

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

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.

The field strength of the fundamental is measured to provide a reference value for the –50 dBc limit. All measurements are peak.

The resolution bandwidth is set to 1 MHz, and the video bandwidth is set to 1 MHz for peak measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels. Conducted measurements are made of spurious signals removed by less than 150% of the authorized bandwidth. Conducted and radiated measurements are made of spurious signals removed by more than 150% of the authorized bandwidth.

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.

7.2.1. TRANSMITTER ABOVE 1 GHz FOR 4940 TO 4990 MHz BAND

FUNDAMENTAL EMISSIONS PATCH ANTENNA

04/20/06 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 06U10226
Company: Trango
EUT Descrip.: 4.9 GHz Bridge
EUT M/N: P4900M
Test Target: FCC Pt. 90
Mode Oper: Tx, Patch antenna
Fundamental measurement for -50 dBc limit use

Test Equipment:

Horn 1-18GHz: T73; S/N: 6717 @3m
Pre-amplifer 1-26GHz:
Pre-amplifer 26-40GHz:
Horn > 18GHz:

Hi Frequency Cables
2 foot cable:
3 foot cable:
12 foot cable: Gordon 203134001
HPF:
Reject Filter:

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)
Fundamental															
4.950	3.0	74.1		33.9	2.3	0.0	0.0	0.0	110.3				110.3		V
4.980	3.0	77.8		33.9	2.3	0.0	0.0	0.0	114.0				114.0		V
4.950	3.0	98.7		33.9	2.3	0.0	0.0	0.0	134.9				134.9		H
4.980	3.0	98.5		33.9	2.3	0.0	0.0	0.0	134.8				134.8		H

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		

HARMONICS AND SPURIOUS EMISSIONS PATCH ANTENNA

04/20/06 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 06U10226
Company: Trango
EUT Descrip.: 4.9 GHz Bridge
EUT M/N: P4900M
Test Target: FCC Pt. 90
Mode Oper: Tx, Patch antenna

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz
T73; S/N: 6717 @3m	T34 HP 8449B		

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Gordon 177080004	Gordon 203134001	HPF_7.6GHz	

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)
4950 Channel															
9.900	3.0	46.5		37.6	4.4	-32.9	-10.5	0.8	46.0	-0.5	84.9	49.5	-38.9		H
9.900	3.0	44.1		37.6	4.4	-32.9	-10.5	0.8	43.6	-0.5	60.3	49.5	-16.7		V
4980 Channel															
9.960	3.0	48.3		37.7	4.4	-32.8	-10.5	0.8	48.0	-0.3	84.8	49.5	-36.8		H
9.960	3.0	44.5		37.7	4.4	-32.8	-10.5	0.8	44.2	-0.3	64.0	49.5	-19.8		V
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		

FUNDAMENTAL EMISSIONS DISH ANTENNA

04/20/06 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 06U10226
Company: Trango
EUT Descrip.: 4.9 GHz Bridge
EUT M/N: P4900M
Test Target: FCC Pt. 90
Mode Oper: Tx, Dish antenna
Fundamental measurement for -50 dBc limit use

Test Equipment:

Horn 1-18GHz: T73; S/N: 6717 @3m
Pre-amplifer 1-26GHz:
Pre-amplifer 26-40GHz:
Horn > 18GHz:

Hi Frequency Cables
2 foot cable:
3 foot cable:
12 foot cable: Gordon 203134001
HPF:
Reject Filter:

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)
Fundamental															
4.950	3.0	99.9		33.9	2.3	0.0	0.0	0.0	136.1				136.1		V
4.980	3.0	99.6		33.9	2.3	0.0	0.0	0.0	135.8				135.8		V
4.950	3.0	83.2		33.9	2.3	0.0	0.0	0.0	119.4				119.4		H
4.980	3.0	83.6		33.9	2.3	0.0	0.0	0.0	119.8				119.8		H

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		

HARMONICS AND SPURIOUS EMISSIONS DISH ANTENNA

04/20/06 **High Frequency Measurement**
Compliance Certification Services, Morgan Hill Open Field Site

Test Engr: David Garcia
Project #: 06U10226
Company: Trango
EUT Descrip.: 4.9 GHz Bridge
EUT M/N: P4900M
Test Target: FCC Pt. 90
Mode Oper: Tx, Dish antenna

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz
T73; S/N: 6717 @3m	T34 HP 8449B		

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Gordon 177080004	Gordon 203134001	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

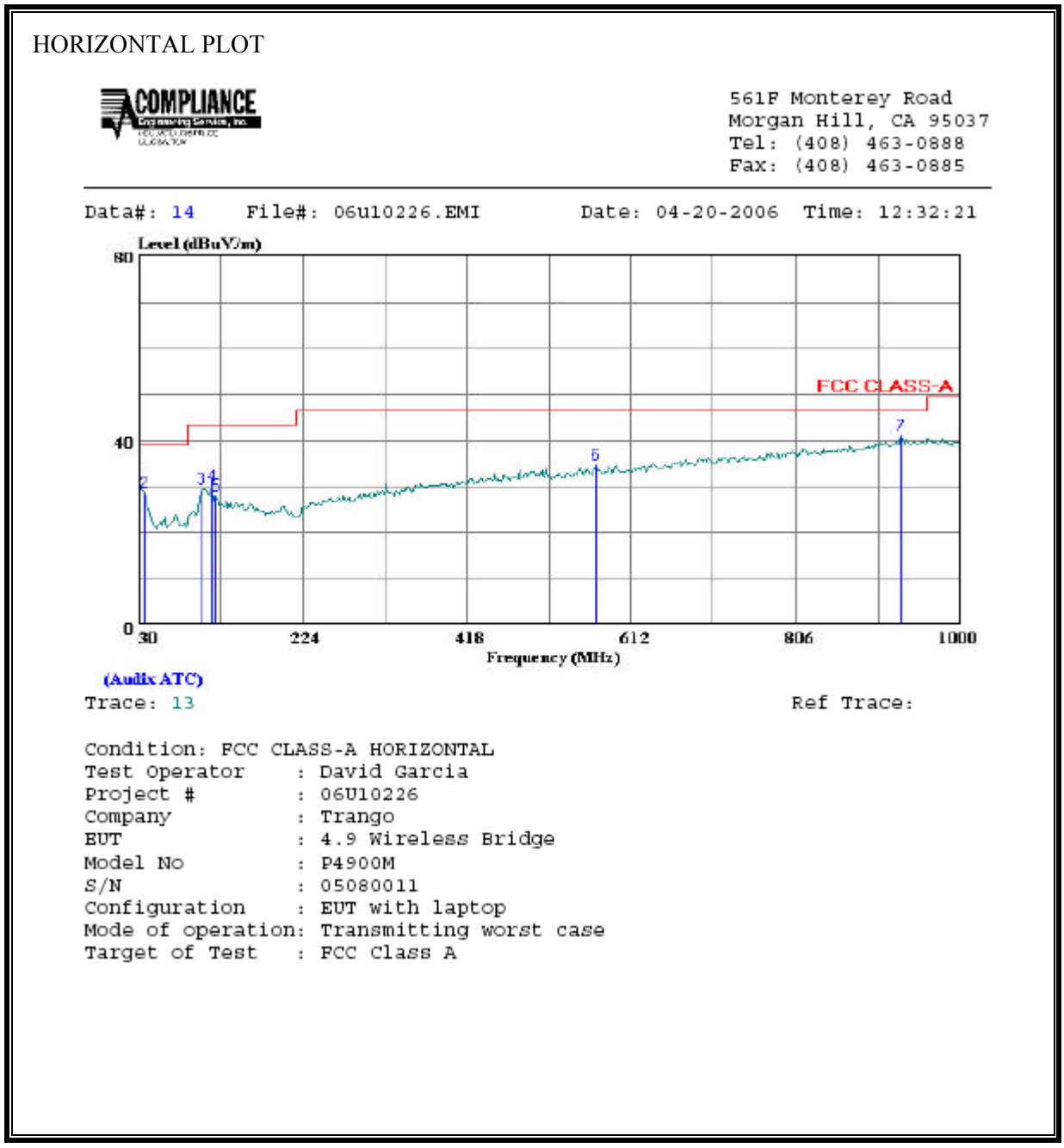
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
4950 Channel															
9.900	3.0	51.8		37.6	4.4	-32.9	-10.5	0.8	51.3	-0.5	69.4	49.5	-18.1		H
14.850	3.0	53.2		40.4	5.8	-32.3	-10.5	0.8	57.3	4.1	69.4	49.5	-12.1		H
9.900	3.0	56.7		37.6	4.4	-32.9	-10.5	0.8	56.2	-0.5	69.4	49.5	-13.2		V
14.850	3.0	57.6		40.4	5.8	-32.3	-10.5	0.8	61.7	4.1	69.4	49.5	-7.7		V
4980 Channel															
9.960	3.0	55.1		37.7	4.4	-32.8	-10.5	0.8	54.8	-0.3	86.1	49.5	-31.3		H
14.940	3.0	50.7		40.4	5.8	-32.3	-10.5	0.8	54.9	4.2	85.9	49.5	-31.0		H
9.960	3.0	58.5		37.7	4.4	-32.8	-10.5	0.8	58.2	-0.3	69.5	49.5	-11.3		V
14.940	3.0	60.2		40.4	5.8	-32.3	-10.5	0.8	64.4	4.2	69.5	49.5	-5.1		V
No further emissions were detected above the noise floor of the 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		

7.2.2. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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

HORIZONTAL PLOT



HORIZONTAL DATA

Page: 1

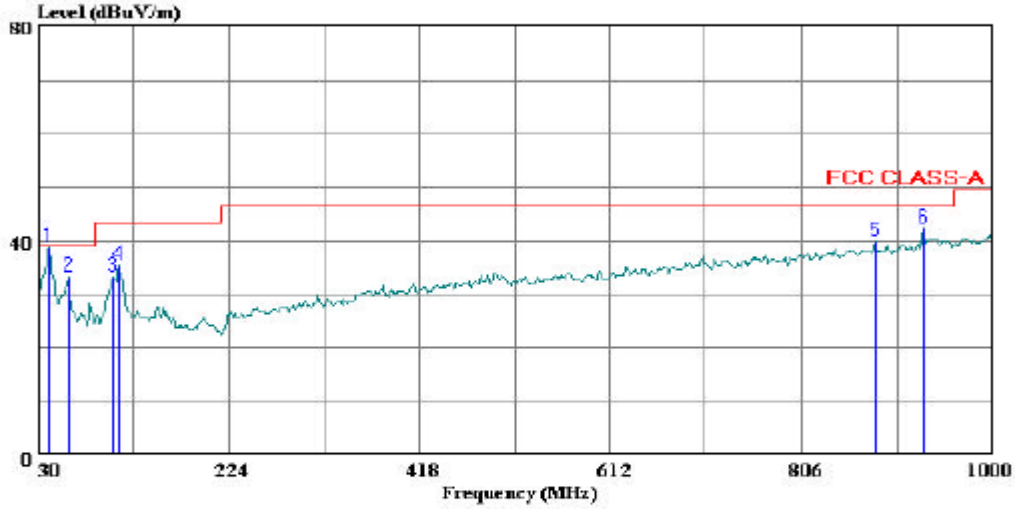
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	31.940	10.77	19.94	30.71	39.00	-8.29	Peak
2	36.790	11.02	17.44	28.46	39.00	-10.54	Peak
3	104.690	16.86	12.38	29.24	43.50	-14.26	Peak
4	116.330	15.29	14.71	30.00	43.50	-13.50	Peak
5	121.180	12.93	15.16	28.09	43.50	-15.41	Peak
6	570.290	13.41	21.14	34.55	46.40	-11.85	Peak
7	929.190	14.85	26.25	41.10	46.40	-5.30	Peak

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

VERTICAL PLOT

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

Data#: 12 File#: 06u10226.EMI Date: 04-20-2006 Time: 12:28:41



(Audix ATC)
Trace: 11 Ref Trace:

Condition: FCC CLASS-A VERTICAL
Test Operator : David Garcia
Project # : 06U10226
Company : Trango
EUT : 4.9 Wireless Bridge
Model No : P4900M
S/N : 05080011
Configuration : EUT with laptop
Mode of operation: Transmitting worst case
Target of Test : FCC Class A

VERTICAL DATA

Page: 1

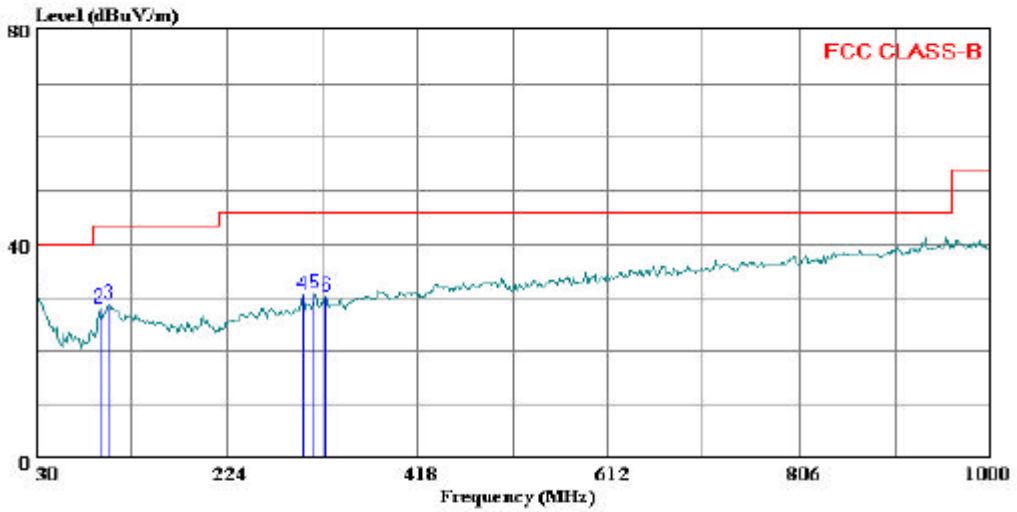
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	41.640	23.78	14.90	38.68	39.00	-0.32	Peak
2	61.040	24.40	8.78	33.18	39.00	-5.82	Peak
3	106.630	20.35	12.87	33.22	43.50	-10.28	Peak
4	111.480	21.67	13.82	35.49	43.50	-8.01	Peak
5	880.690	14.16	25.71	39.87	46.40	-6.53	Peak
6	929.190	15.99	26.25	42.24	46.40	-4.16	Peak

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

HORIZONTAL PLOT

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

Data#: 16 File#: 06u10226.EMI Date: 04-20-2006 Time: 13:51:50



(Audix ATC)
Trace: 15 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator : David Garcia
Project # : 06U10226
Company : Trango
EUT : 4.9 Wireless Bridge
Model No : P4900M
S/N : 05080011
Configuration : EUT with laptop
Mode of operation: Transmitting worst case
: Patch Antenna
Target of Test : FCC Class B

HORIZONTAL DATA

Page: 1

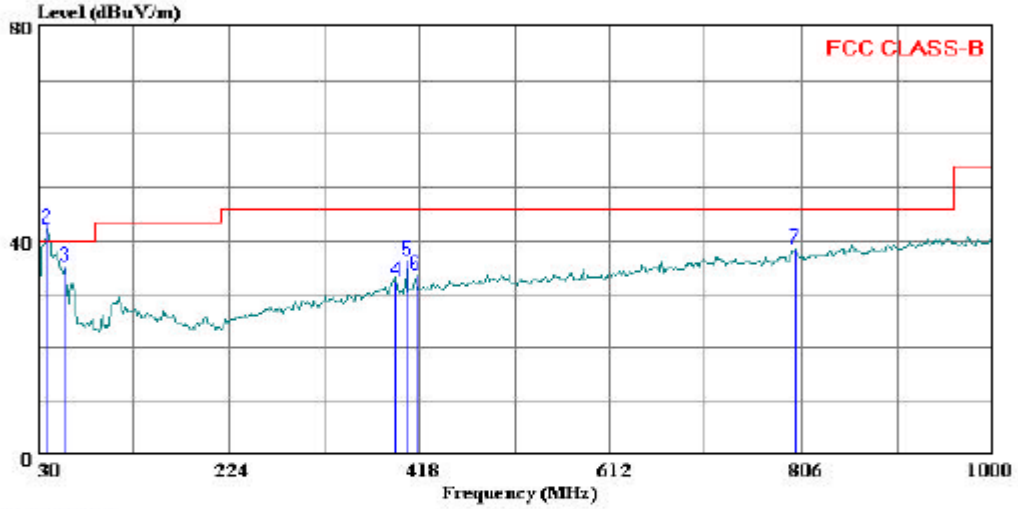
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.970	10.25	20.45	30.70	40.00	-9.30	Peak
2	94.990	17.88	10.12	28.00	43.50	-15.50	Peak
3	104.690	16.51	12.38	28.89	43.50	-14.61	Peak
4	300.630	14.70	15.67	30.37	46.00	-15.63	Peak
5	313.240	14.60	16.05	30.65	46.00	-15.35	Peak
6	324.880	13.82	16.28	30.10	46.00	-15.90	Peak

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

VERTICAL PLOT

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

Data#: 20 File#: 06u10226.EMI Date: 04-20-2006 Time: 13:59:40



(Audix ATC)
Trace: 17 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator : David Garcia
Project # : 06U10226
Company : Trango
EUT : 4.9 Wireless Bridge
Model No : P4900M
S/N : 05080011
Configuration : EUT with laptop
Mode of operation: Transmitting worst case
: Patch Antenna
Target of Test : FCC Class B

VERTICAL DATA

Page: 1

		Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1		38.730	23.10	16.83	39.93	40.00	-0.07	QP
2	*	38.730	26.27	16.12	42.39	40.00	2.39	Peak
3		58.130	26.61	8.61	35.22	40.00	-4.78	Peak
4		393.750	14.44	17.88	32.31	46.00	-13.69	Peak
5		405.390	18.20	18.18	36.38	46.00	-9.62	Peak
6		415.090	15.12	18.42	33.54	46.00	-12.46	Peak
7		798.240	13.89	24.53	38.42	46.00	-7.58	Peak

7.3. 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:

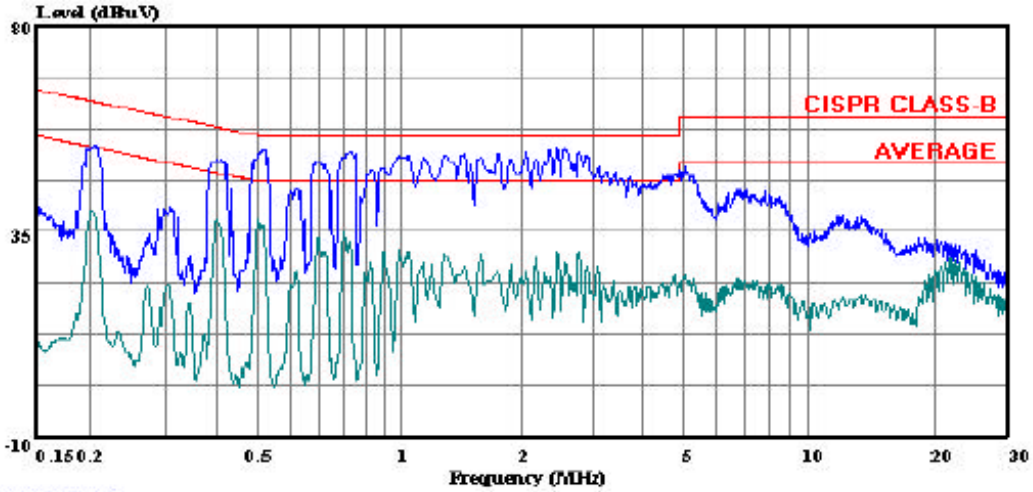
6 WORST EMISSIONS WITH

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.21	53.86	--	39.33	0.00	63.37	53.37	-9.51	-14.04	L1
2.57	53.48	--	29.97	0.00	56.00	46.00	-2.52	-16.03	L1
5.17	49.06	--	24.52	0.00	60.00	50.00	-10.94	-25.48	L1
0.51	53.42	--	37.88	0.00	56.00	46.00	-2.58	-8.12	L2
2.45	53.50	--	31.29	0.00	56.00	46.00	-2.50	-14.71	L2
5.14	49.28	--	27.67	0.00	60.00	50.00	-10.72	-22.33	L2
6 Worst Data									

LINE 1 RESULTS

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

Data#: 7 File#: FCC CLASS B.EMI Date: 04-13-2006 Time: 12:14:33



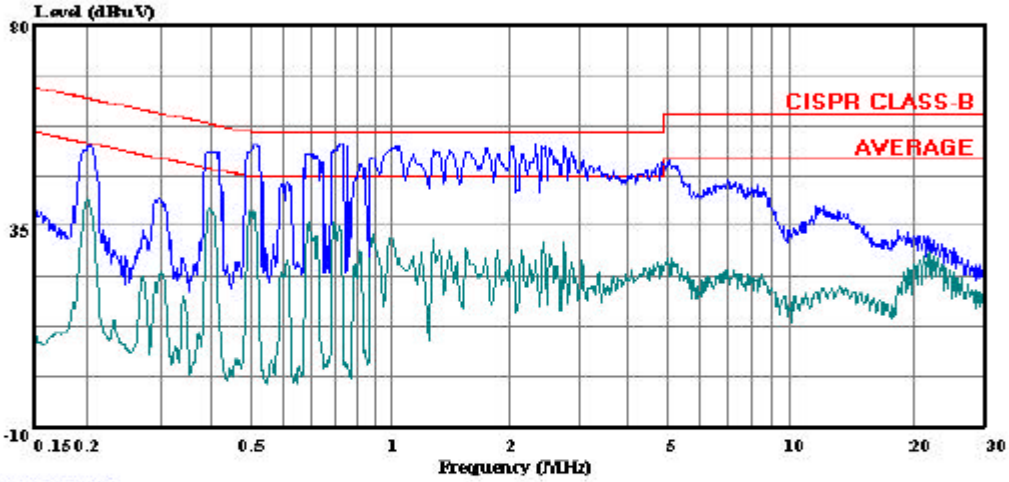
Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Can Ming Chung
Project # : 06U10226
Company : Trango
EUT Description : 4.9 GHz Wireless Bridge AC Powered
Model : P4900-INT-18, P4900-INT-23, P4900M-EXT
EUT Config : EUT/Laptop
Mode Of Operation: TX
Target : FCC CLASS B
: L1 Peak (Blue), Avg (Green)
Power Source : 115 V, 60 Hz

LINE 2 RESULTS

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

Data#: 14 File#: FCC CLASS B.EMI Date: 04-13-2006 Time: 13:40:21



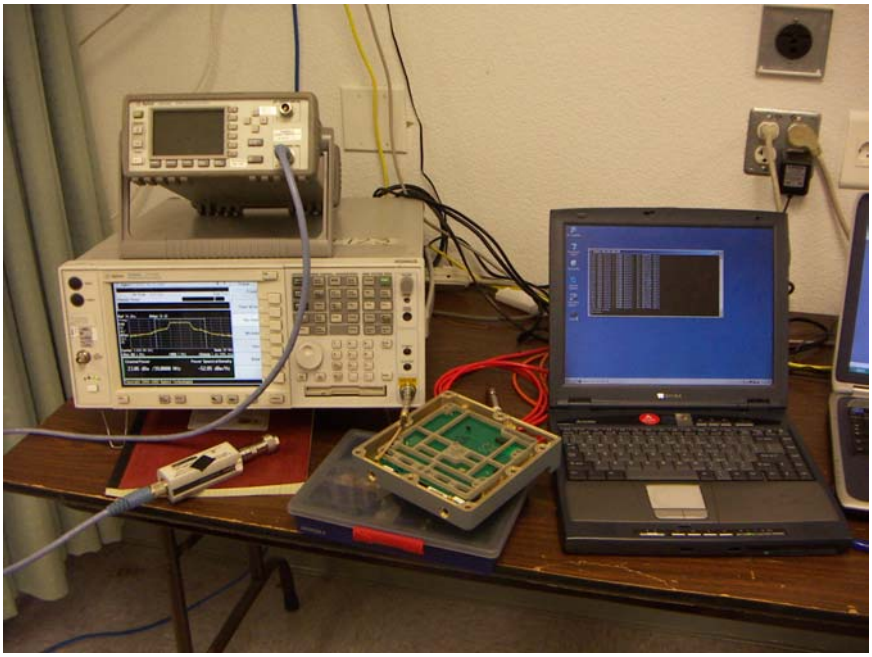
Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Can Ming Chung
Project # : 06U10226
Company : Trango
EUT Description : 4.9 GHz Wireless Bridge AC Powered
Model : P4900-INT-18, P4900-INT-23, P4900M-EXT
EUT Config : EUT/Laptop
Mode Of Operation: TX
Target : FCC CLASS B
: L2 Peak (Blue), Avg (Green)
Power Source : 115VAC, 60 Hz

8. SETUP PHOTOS

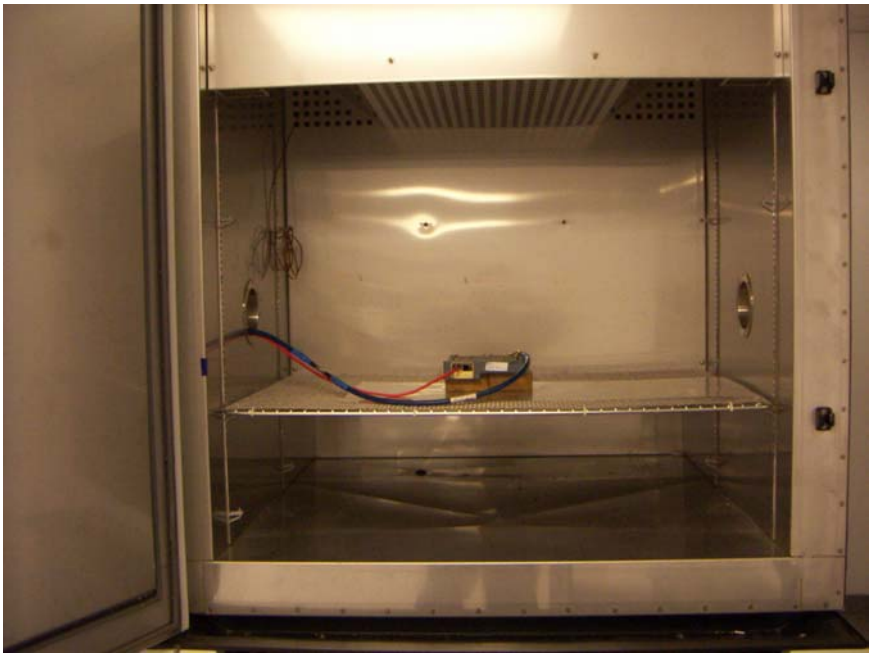
ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO

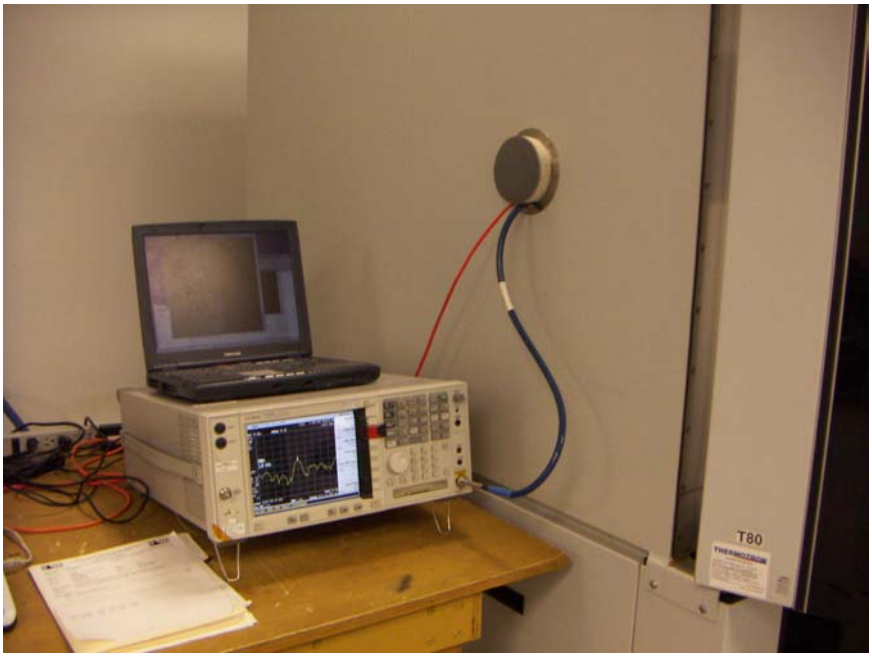


TEMPARATURE CHAMBER MEASUREMENT SETUP

TEMPERATURE CHAMBER PHOTO

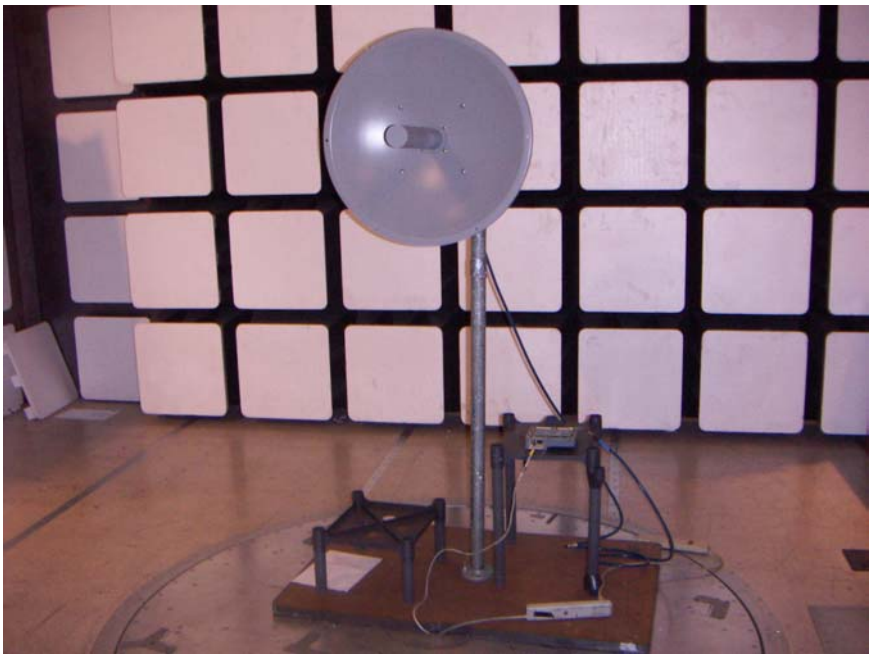


TEMPERATURE CHAMBE RECEIVER PHOTO

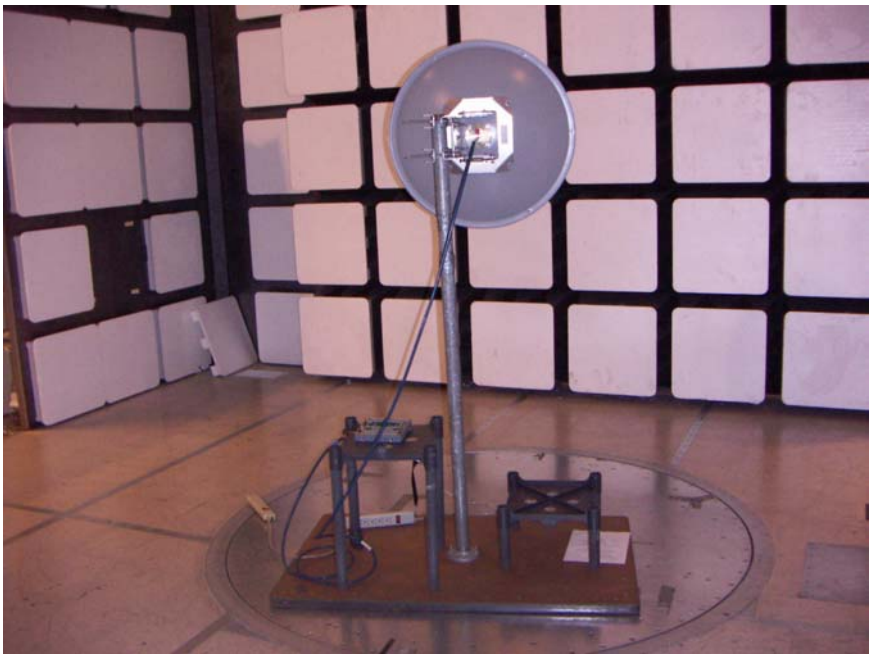


RADIATED RF MEASUREMENT SETUP WITH DISH ANTENNA

RADIATED FRONT PHOTO



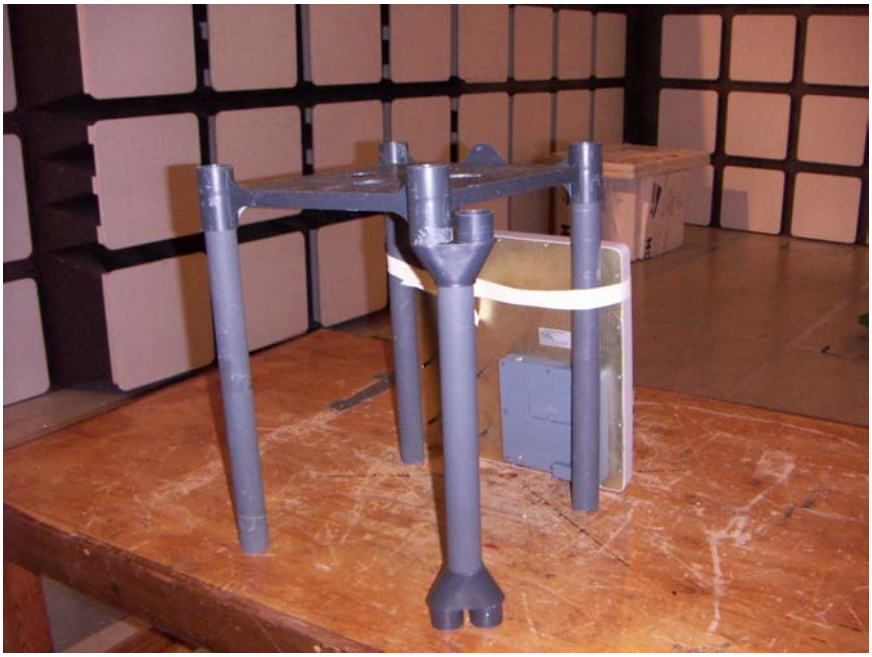
RADIATED BACK PHOTO



RADIATED RF MEASUREMENT SETUP WITH PATCH ANTENNA

RADIATED FRONT PHOTO

RADIATED BACK PHOTO



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO

END OF REPORT