FCC CFR47 PART 15 SUBPART C
CERTIFICATION TEST REPORT

FOR

802.11a POINT TO POINT TRANSCEIVER

MODEL NUMBERS: P5055M-INT-19, P5055M-INT-23, P5055M-EXT

FCC ID: NCYP5055M

REPORT NUMBER: 06U10393-2

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Prepared for
TRANGO SYSTEMS, INC.
15070 AVENUE OF SCIENCE, SUITE 200
SAN DIEGO, CA 92128, U.S.A.

Prepared by
COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	04/27/07	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	TRANGO SYSTEMS, INC. 15070 AVENUE OF SCIENCE, SUITE 200 SAN DIEGO, CA 92128 U.S.A.
EUT DESCRIPTION:	802.11a POINT TO POINT TRANSCEIVER WITH PATCH AND DISH ANTENNAS
MODELS:	P5055M-INT-19, P5055M-INT-23, P5055M-EXT
SERIAL NUMBER:	06380011
DATE TESTED:	JULY 03, 2006 TO JANUARY 04, 2007

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:

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

THANH NGUYEN
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 47173 Benicia Street, Fremont, California, USA and 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 an 802.11a Point to Point transceiver.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power, utilized with the lowest antenna gain, as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5755 - 5835	802.11a	28.49	706.32

The power is adjustable for higher antenna gains.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio can be configured with a 19 dBi patch antenna (Model P5055M-INT-19), a 23 dBi patch antenna (Model P5055M-INT-23), or dish antennas with gains in the range of 27 to 33dBi (Model P5055M- EXT). These antenna gain specifications are applicable to the 5.8 GHz band.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was P5055.

The EUT driver software installed in the host support equipment during testing was Window XP, rev. 5.1.2600

The test utility software used during testing was Command Prompt.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
PoE	Trango	N/A	8/22/1904	N/A
Switching Adapter	Technics	TESA1-240075	1726	DoC
Laptop	SONY	PCG-R50SEL	1695	DoC
AC/DC Adapter	SONY	PCGA-AC19V1	044D0183529	N/A

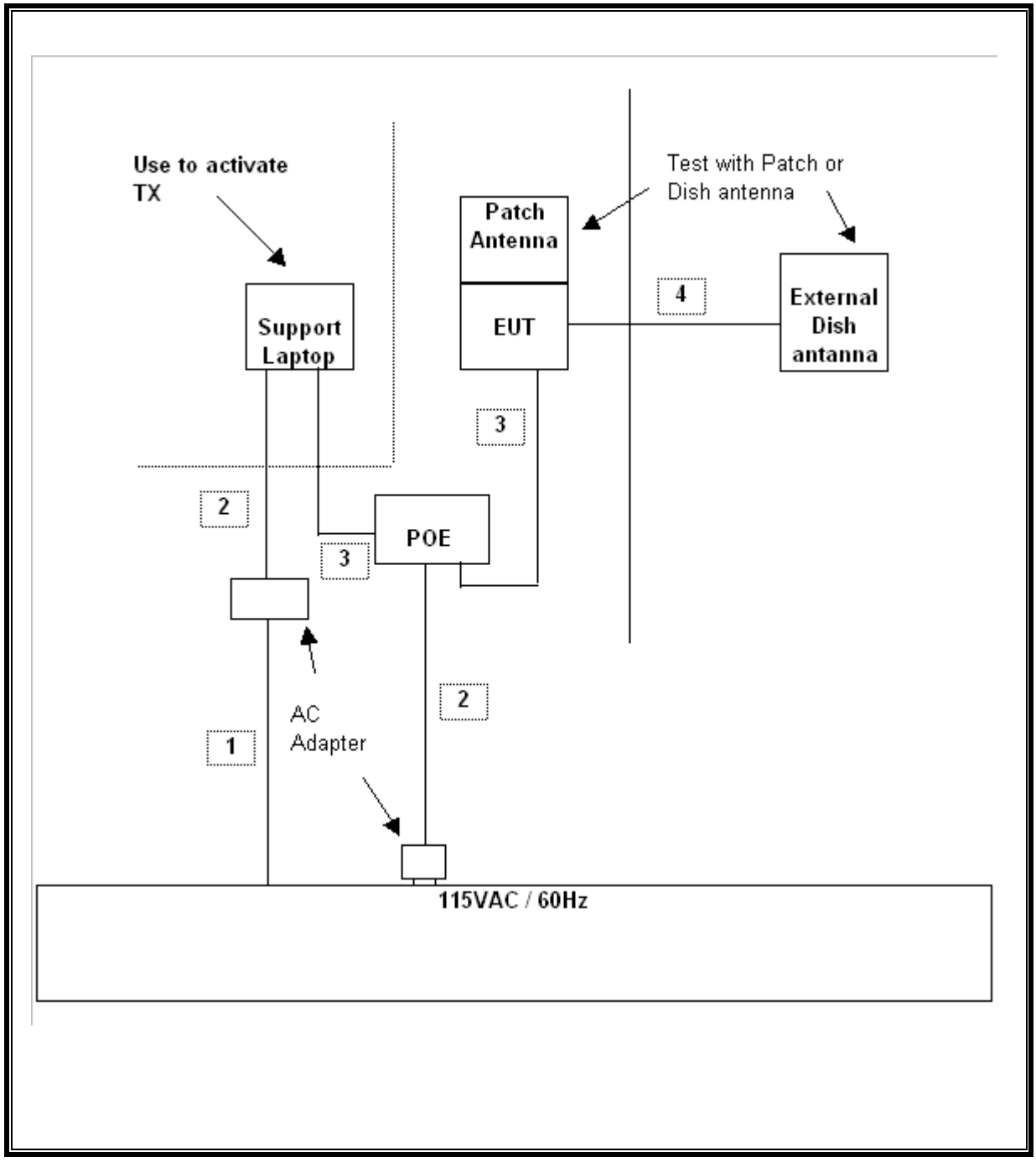
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US 115V	Un-shielded	1m	No
2	DC	2	DC Plug	Un-shielded	1.5m	No
3	WLAN	3	RJ45	Un-shielded	1.5m	Yes
4	BNC	1	BNC	Shielded	1.5m	Yes

TEST SETUP

The EUT is connected to a host laptop computer via a PoE 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**	**S/N**	**Cal Due**
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	9001-3245	04/22/07
Antenna, Horn 1 ~ 18 GHz	ETS	3117	29301	04/22/07
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/03/07
Preamplifier, 26 ~ 40 GHz	Miteq	NSP4000-SP2	924343	08/18/07
Antenna, Horn 18 ~ 26 GHz	ARA	MWH-1826/B	1049	09/12/07
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	1029	04/13/07
EMI Test Receiver	R & S	ESHS 20	827129/006	06/03/07
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	08/30/07
Bilog Antenna 30 MHz ~ 2 GHz	Sunol Sciences	JB1	A121003	09/03/07
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	01/23/08
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08
Quasi-Peak Adaptor	Agilent / HP	85650A	3145A01654	01/21/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/02/07
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/02/07
Spectrum Analyzer	Agilent / HP	E4446A	MY43360112	05/03/07
7.6GHz HPF	MicroTronic	HPM13195	1	CNR

7. LIMITS AND RESULTS

7.1. CHANNEL TESTS FOR THE 5725 TO 5850 MHz BAND

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

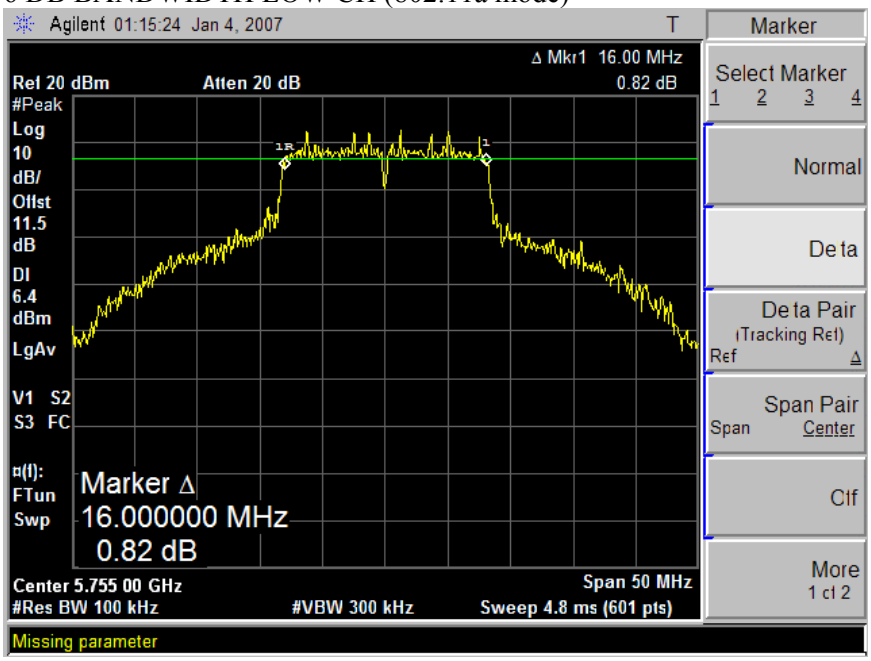
No non-compliance noted:

802.11a Mode

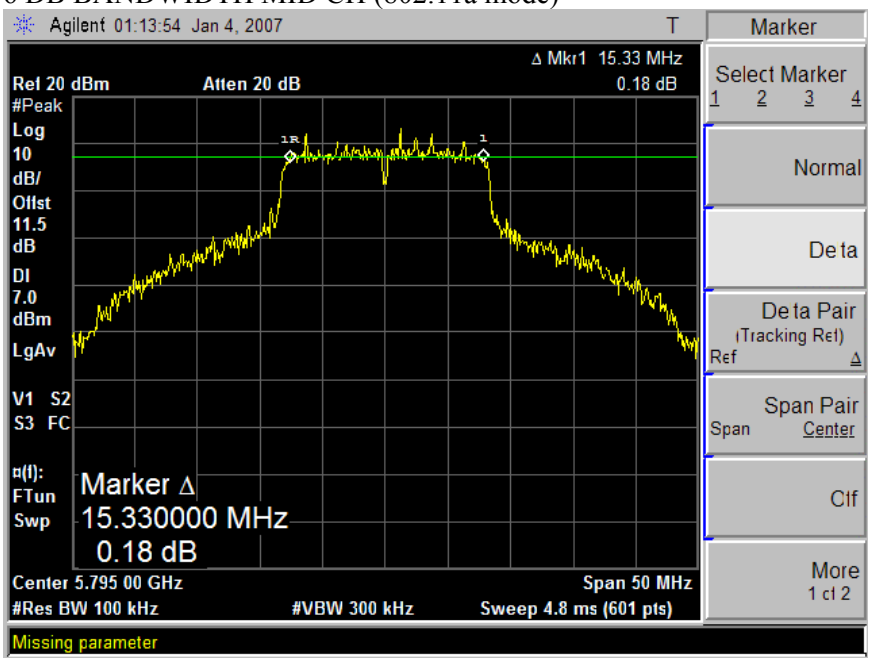
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	5755	16000	500	15500
Middle	5795	15330	500	14830
High	5835	15500	500	15000

6 DB BANDWIDTH (802.11a MODE)

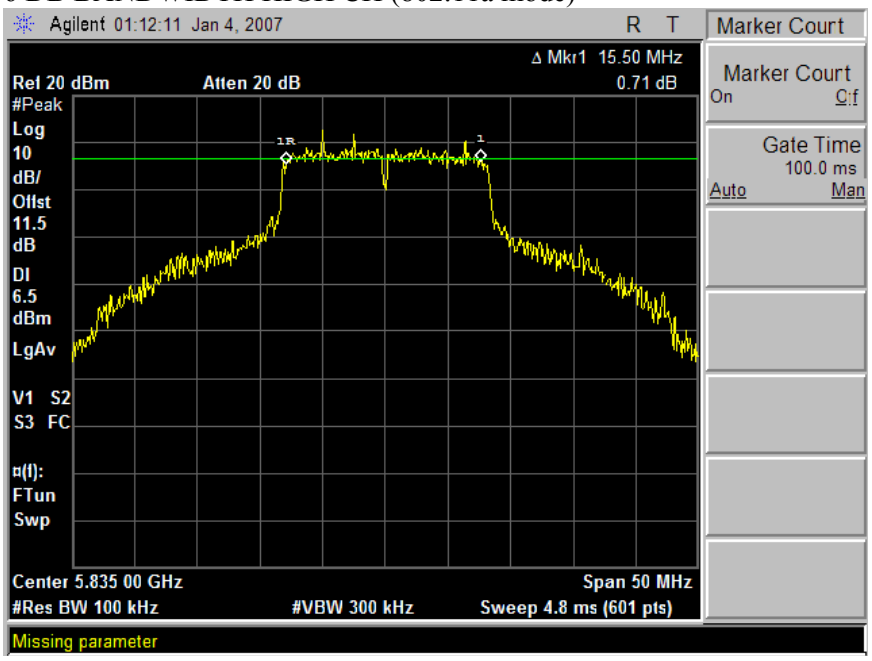
6 DB BANDWIDTH LOW CH (802.11a mode)



6 DB BANDWIDTH MID CH (802.11a mode)



6 DB BANDWIDTH HIGH CH (802.11a mode)



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

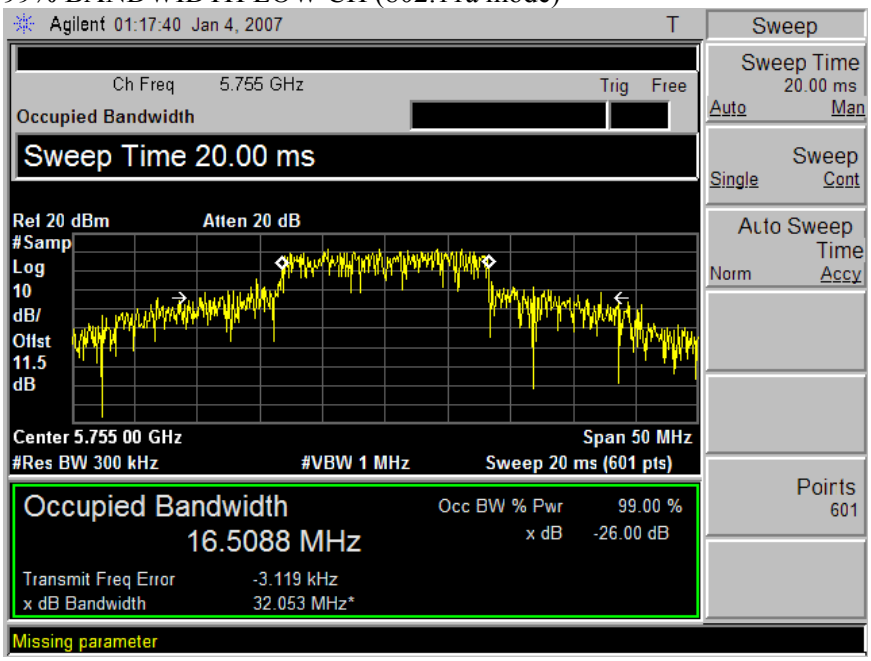
No non-compliance noted:

802.11a Mode

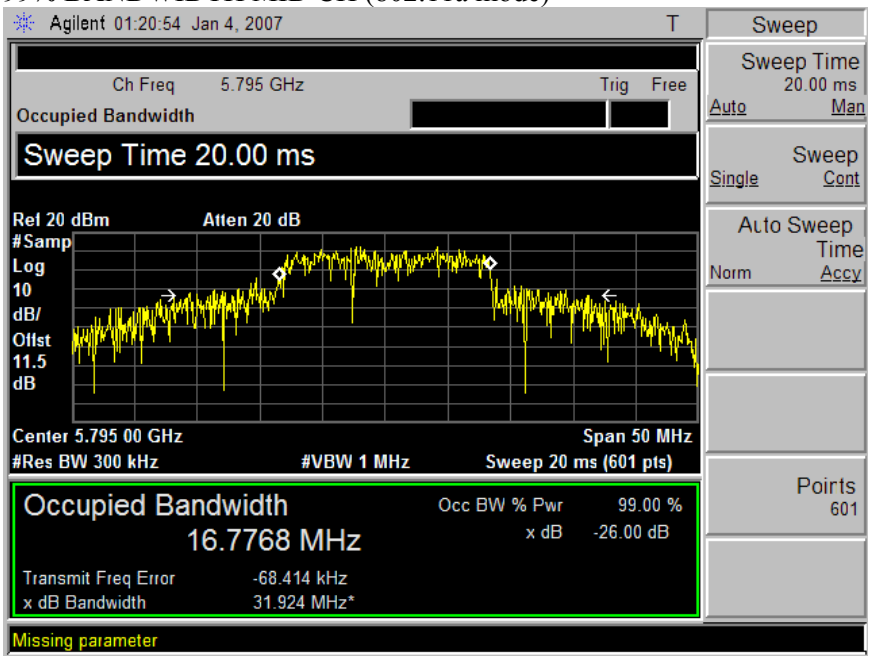
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5755	16.5088
Middle	5795	16.7768
High	5835	17.0410

99% BANDWIDTH (802.11a MODE)

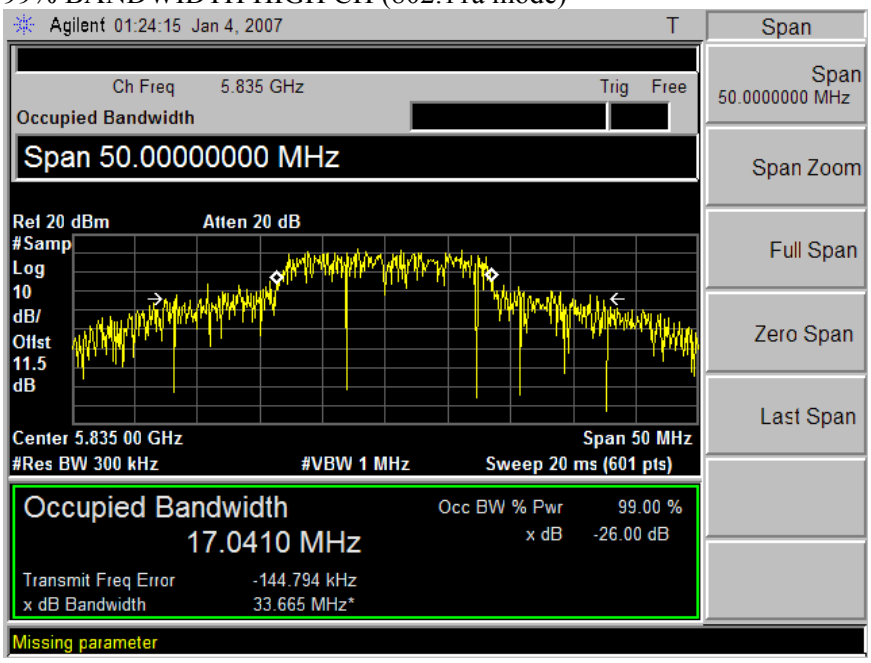
99% BANDWIDTH LOW CH (802.11a mode)



99% BANDWIDTH MID CH (802.11a mode)



99% BANDWIDTH HIGH CH (802.11a mode)



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) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.247 (b) (4) (ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

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

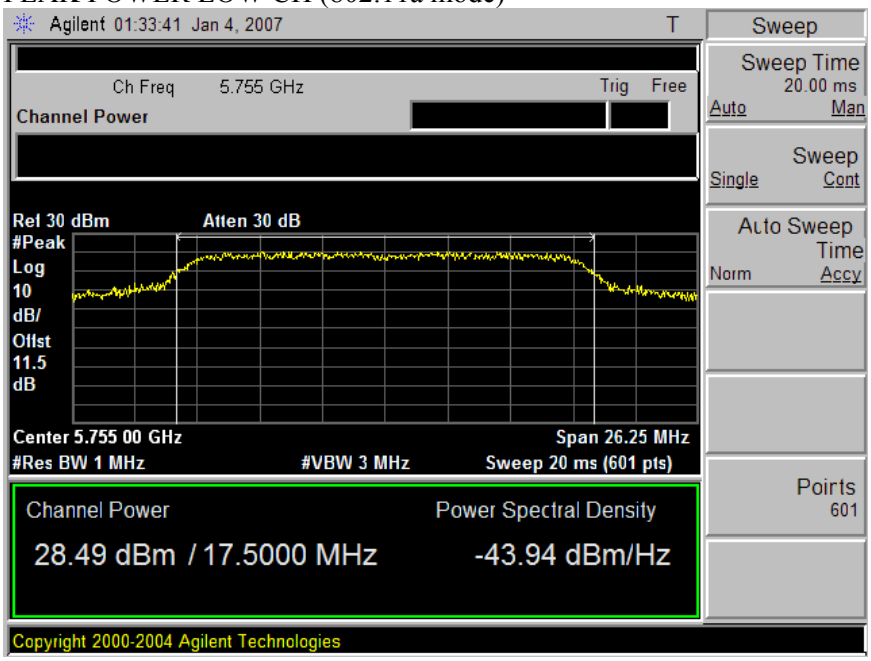
The application of the EUT is fixed point-to-point operation; therefore the limit is 30 dBm.
No non-compliance noted:

802.11a Mode

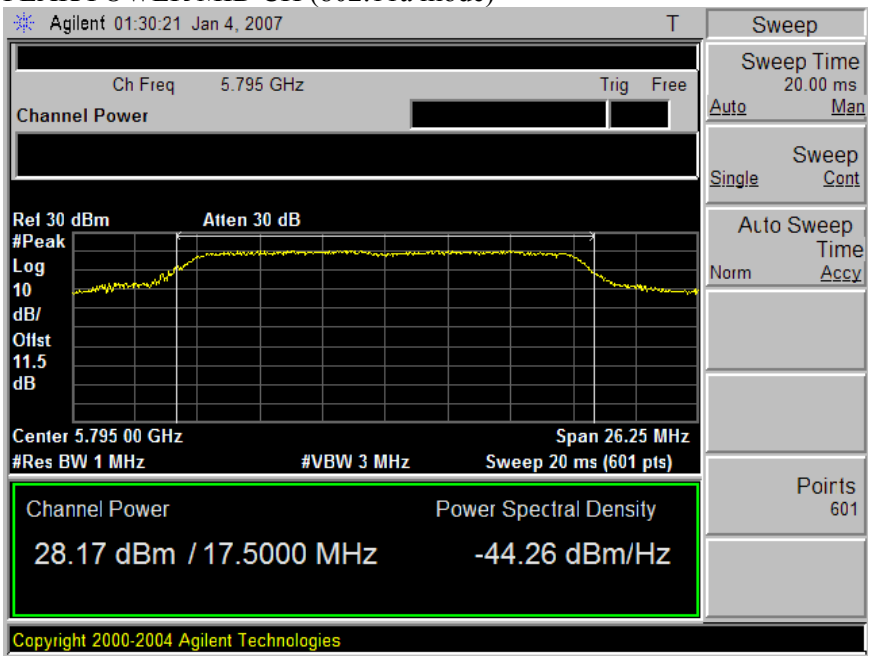
Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5755	28.49	30	-1.51
Middle	5795	28.17	30	-1.83
High	5835	28.08	30	-1.92

OUTPUT POWER (802.11a MODE)

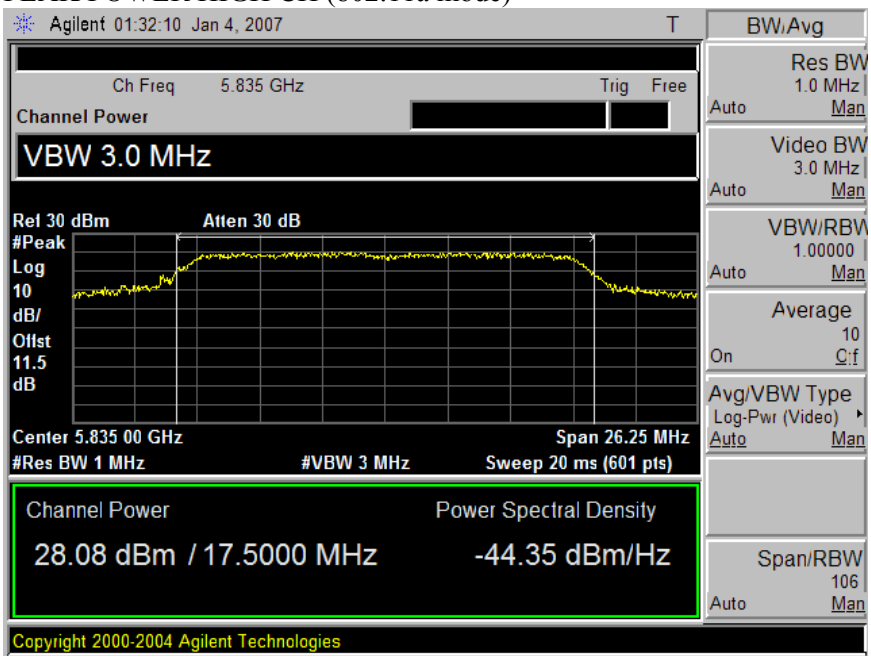
PEAK POWER LOW CH (802.11a mode)



PEAK POWER MID CH (802.11a mode)



PEAK POWER HIGH CH (802.11a mode)



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) = 1000 * P (W) 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

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

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Rearranging terms to calculate the power density at a specific distance yields

$S = 0.0795 * 10 ^ ((P + G) / 10) / (d^2)$

LIMITS

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

RESULTS

No non-compliance noted: (MPE distance is greater than 20 cm)

Mode	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a	1.0	28.49	18.00	59.53

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 11.5 dB (including 10 dB pad and 1.5 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5755	21.85
Middle	5795	22.12
High	5835	21.98

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

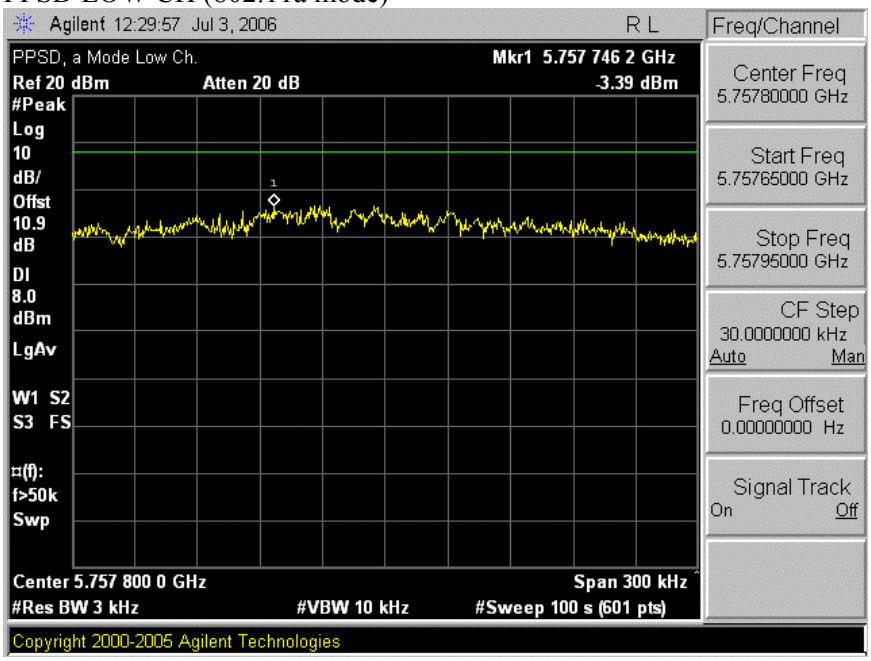
No non-compliance noted:

802.11a Mode

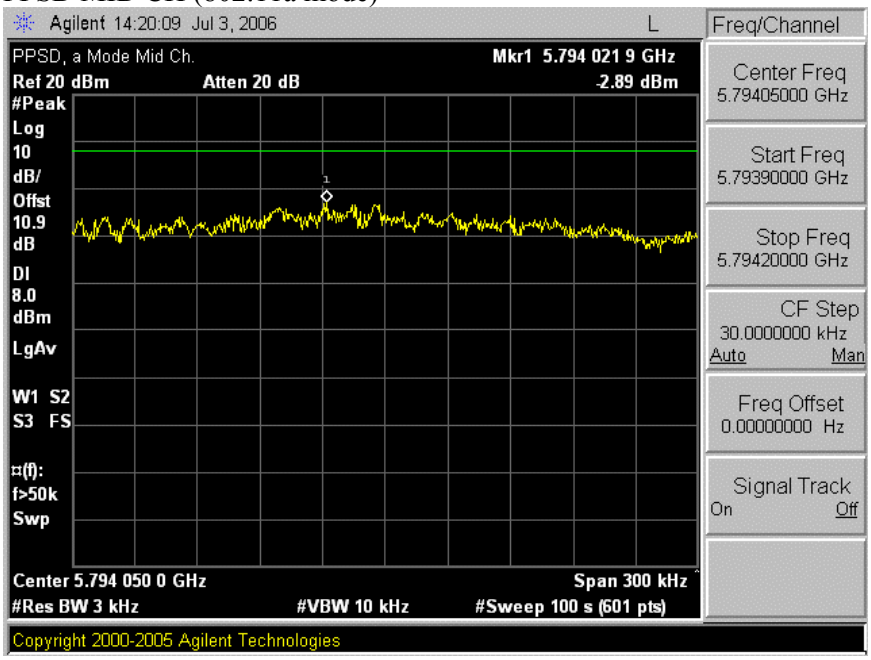
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5755	-3.39	8	-11.39
Middle	5795	-2.89	8	-10.89
High	5835	-3.62	8	-11.62

PEAK POWER SPECTRAL DENSITY (802.11a MODE)

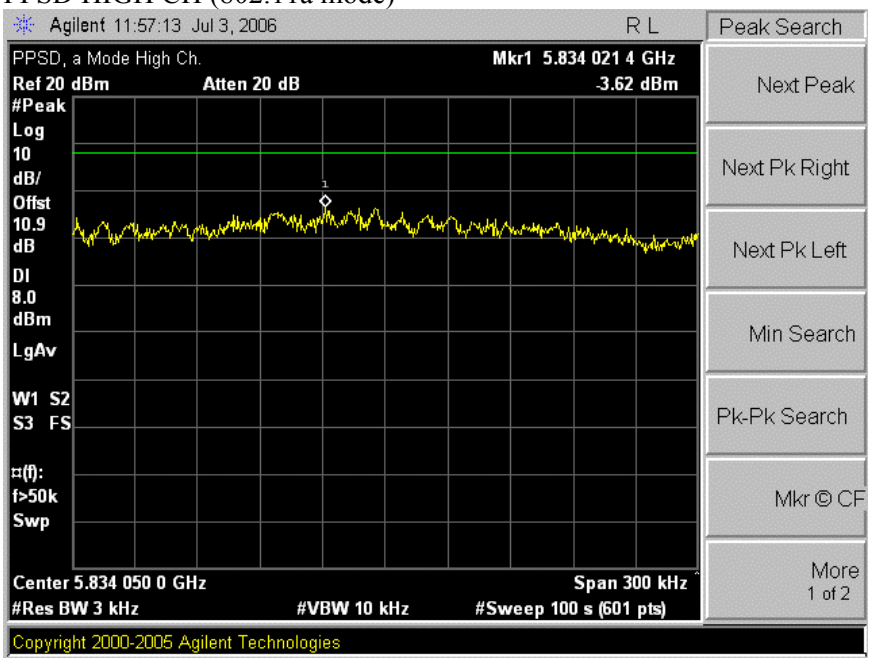
PPSD LOW CH (802.11a mode)



PPSD MID CH (802.11a mode)



PPSD HIGH CH (802.11a mode)



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)).

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.

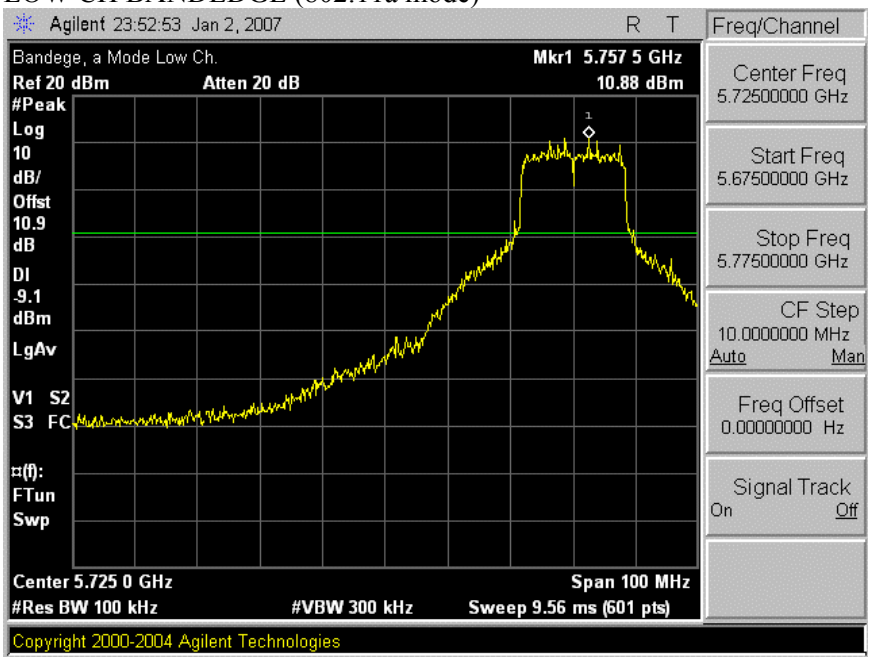
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL (802.11a MODE)

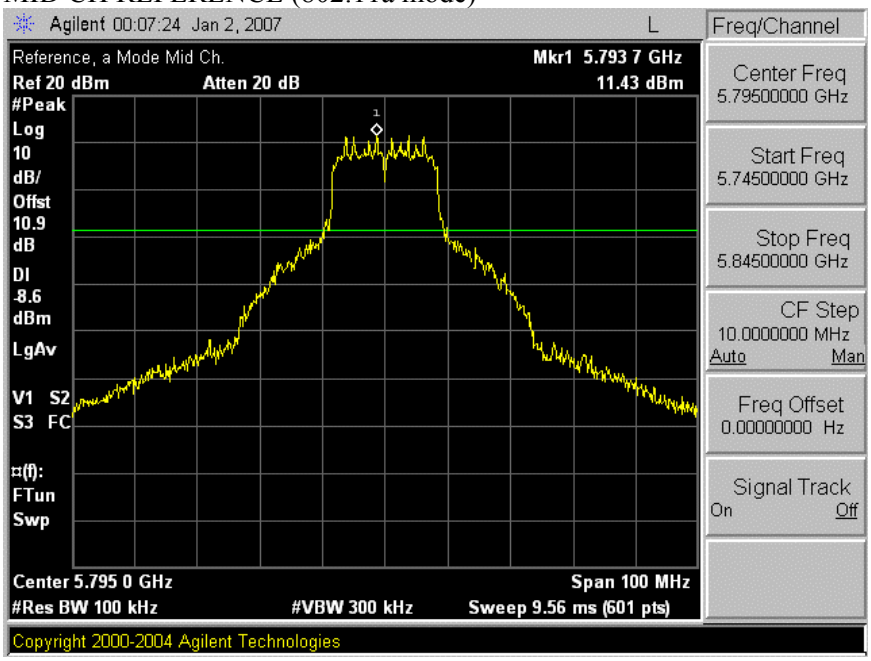
LOW CH BANDEDGE (802.11a mode)



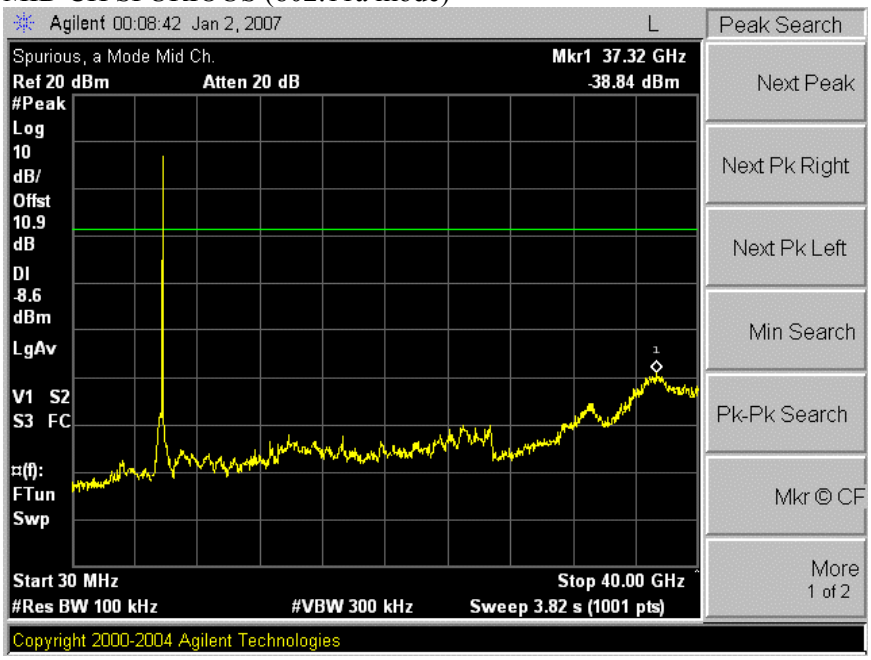
LOW CH SPURIOUS (802.11a mode)

SPURIOUS EMISSIONS, MID CHANNEL (802.11a MODE)

MID CH REFERENCE (802.11a mode)

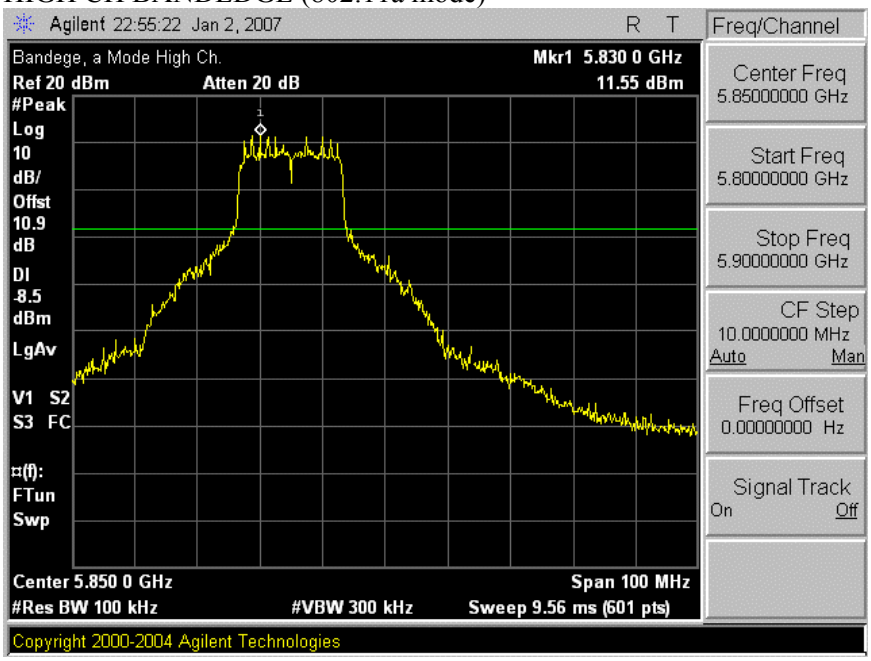


MID CH SPURIOUS (802.11a mode)

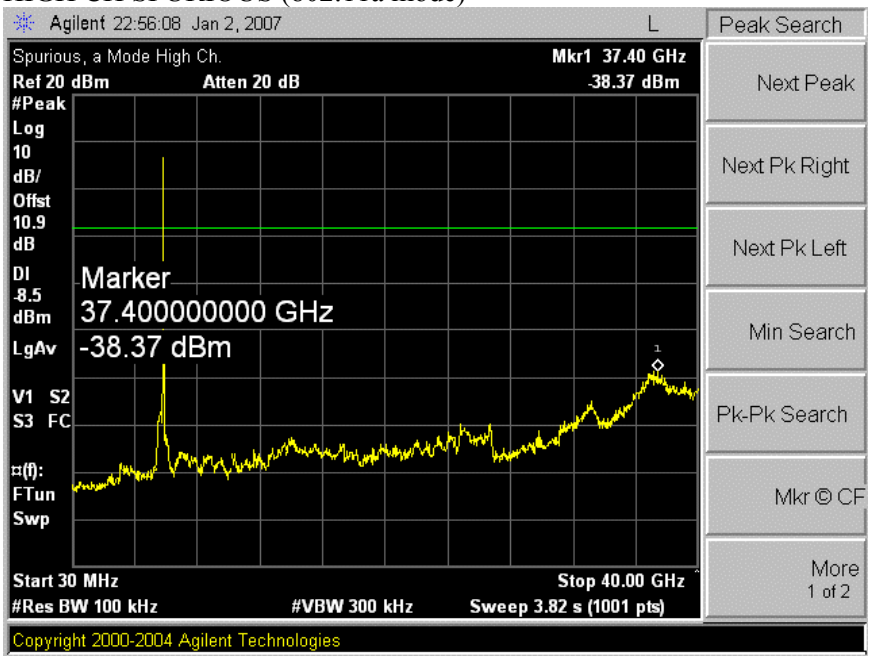


SPURIOUS EMISSIONS, HIGH CHANNEL (802.11a MODE)

HIGH CH BANDEDGE (802.11a mode)



HIGH CH SPURIOUS (802.11a mode)



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 FOR 5725 TO 5850 MHz BAND

33 dBi DISH ANTENNA

HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Trango
Project #:06U10393
Date: 7/31/06
Test Engineer: Thanh Nguyen
Configuration: EUT w/RadioWave Dish Antenna SPD4-5.2
Model: P5055M-EXT

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T119; S/N: 29301 @3m	T87 Miteq 924342			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
Thanh 177079008		Thanh 208946003	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)
Low Ch. 5755 MHz															
11.510	3.0	50.3	36.0	37.2	4.2	-39.8	0.0	0.7	52.6	38.3	74	54	-21.4	-15.7	V
17.265	3.0	50.5	37.4	40.3	5.2	-40.6	0.0	0.6	56.0	42.9	74	54	-18.0	-11.1	Noise floor
11.510	3.0	49.3	36.1	37.2	4.2	-39.8	0.0	0.7	51.6	38.4	74	54	-22.4	-15.6	H
17.265	3.0	50.4	37.3	40.3	5.2	-40.6	0.0	0.6	55.9	42.8	74	54	-18.1	-11.2	Noise floor
Mid Ch. 5795 MHz															
11.590	3.0	55.2	39.8	37.2	4.2	-39.8	0.0	0.7	57.5	42.1	74	54	-16.5	-11.9	V
17.595	3.0	51.3	37.8	40.4	5.3	-40.3	0.0	0.6	57.2	43.8	74	54	-16.8	-10.2	Noise floor
11.590	3.0	49.9	35.9	37.2	4.2	-39.8	0.0	0.7	52.2	38.2	74	54	-21.8	-15.8	H
17.595	3.0	51.3	37.8	40.4	5.3	-40.3	0.0	0.6	57.2	43.8	74	54	-16.8	-10.2	Noise floor
High Ch. 5835 MHz															
11.670	3.0	58.5	41.8	37.2	4.2	-39.9	0.0	0.7	60.8	44.1	74	54	-13.2	-9.9	V
17.505	3.0	50.6	35.7	40.3	5.3	-40.4	0.0	0.6	56.4	41.6	74	54	-17.6	-12.4	Noise floor
11.670	3.0	52.1	39.3	37.2	4.2	-39.9	0.0	0.7	54.4	41.6	74	54	-19.6	-12.4	H
17.505	3.0	50.3	37.9	40.3	5.3	-40.4	0.0	0.6	56.2	43.7	74	54	-17.8	-10.3	Noise floor

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		

23 dBi PATCH ANTENNA

HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Trango
Project #:06U10393
Date: 7/13/06
Test Engineer: William Zhuang
Configuration: EUT w/ 23dBi Patch Antenna
Model: P5055M-INT

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T34 HP 8449B			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		William 187209004		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)
Low Ch. 5755 MHz															
11.510	3.0	55.3	40.5	37.4	5.3	-32.5	0.0	0.0	65.4	50.6	74	54	-8.6	-3.4	V
11.510	3.0	54.5	40.5	37.4	5.3	-32.5	0.0	0.0	64.6	50.6	74	54	-9.4	-3.4	H
Mid Ch. 5795 MHz															
11.590	3.0	55.8	40.2	37.4	5.3	-32.5	0.0	0.0	66.0	50.4	74	54	-8.0	-3.6	V
11.590	3.0	55.7	40.5	37.4	5.3	-32.5	0.0	0.0	65.9	50.7	74	54	-8.1	-3.3	H
High Ch. 5835 MHz															
11.670	3.0	59.5	42.0	37.4	5.3	-32.5	0.0	0.0	69.7	52.2	74	54	-4.3	-1.8	V
11.670	3.0	52.3	41.5	37.4	5.3	-32.5	0.0	0.0	62.5	51.7	74	54	-11.5	-2.3	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 (802.11a MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Trango
Project #:06U10393
Date: 7/13/06
Test Engineer: William Zhuang
Configuration: EUT w/ 19dBi Patch Antenna
Model: P5055M-INT

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T34 HP 8449B			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
William 177079009		William 187209004		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)
Low Ch. 5755 MHz															
11.510	3.0	54.8	39.2	37.4	5.3	-32.5	0.0	0.0	64.9	49.3	74	54	-9.1	-4.7	V
11.510	3.0	52.7	39.5	37.4	5.3	-32.5	0.0	0.0	62.9	49.6	74	54	-11.1	-4.4	H
Mid Ch. 5795 MHz															
11.590	3.0	55.2	39.8	37.4	5.3	-32.5	0.0	0.0	65.4	50.0	74	54	-8.6	-4.0	V
11.590	3.0	53.2	39.5	37.4	5.3	-32.5	0.0	0.0	63.3	49.6	74	54	-10.7	-4.4	H
High Ch. 5835 MHz															
11.670	3.0	58.5	41.8	37.4	5.3	-32.5	0.0	0.0	68.7	52.0	74	54	-5.3	-2.0	V
11.670	3.0	52.0	40.0	37.4	5.3	-32.5	0.0	0.0	62.2	50.2	74	54	-11.8	-3.8	H

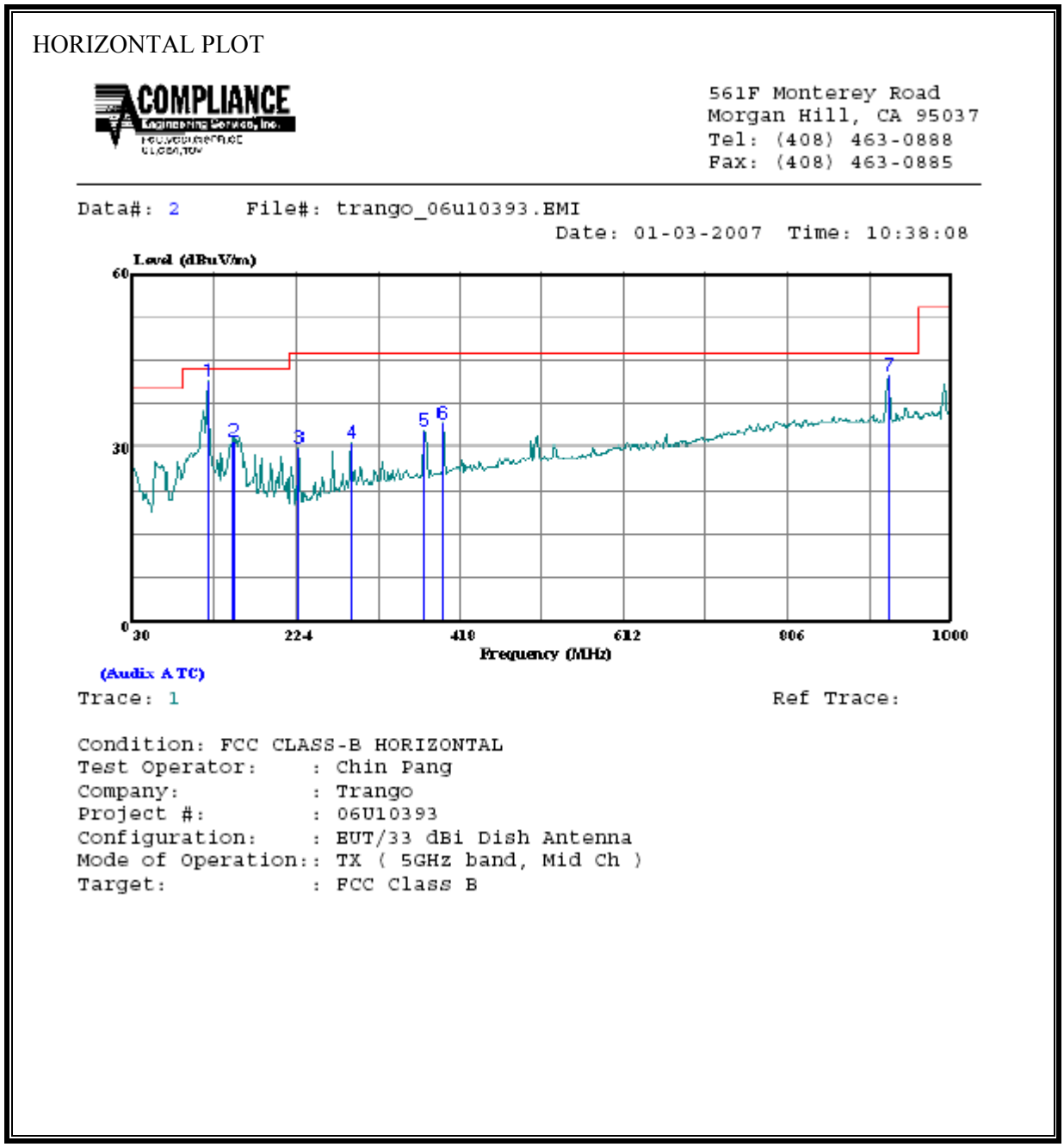
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

7.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

With 33 dBi Dish Antenna:

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

HORIZONTAL PLOT



HORIZONTAL DATA

Page: 1

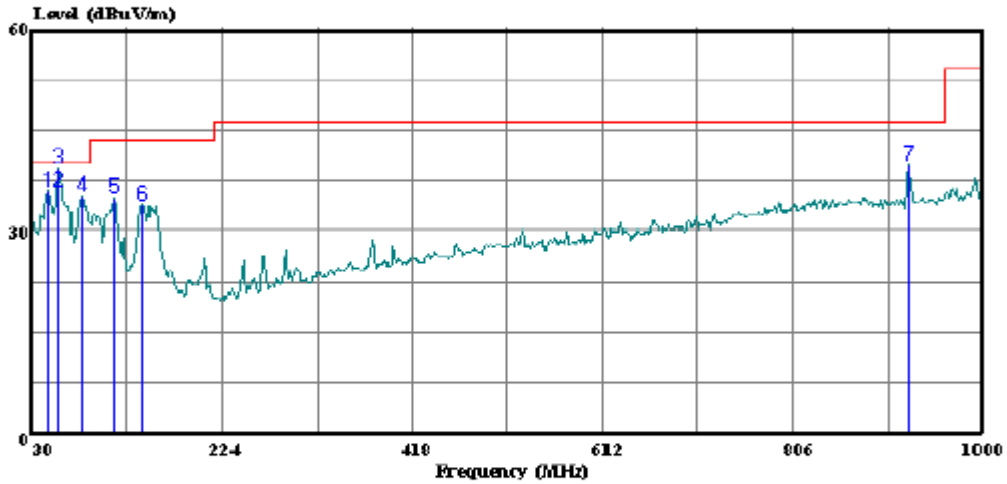
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	119.240	26.17	15.05	41.22	43.50	-2.28	Peak
2	149.310	16.60	14.26	30.86	43.50	-12.64	Peak
3	227.880	16.93	12.95	29.88	46.00	-16.12	Peak
4	288.990	15.50	15.26	30.76	46.00	-15.24	Peak
5	376.290	15.10	17.53	32.63	46.00	-13.37	Peak
6	397.630	16.00	17.99	33.99	46.00	-12.01	Peak
7	926.280	16.00	26.23	42.23	46.00	-3.77	Peak

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

VERTICAL PLOT

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

Data#: 6 File#: trango_06u10393.EMI
Date: 01-03-2007 Time: 10:48:51



(Audix A TC)
Trace: 3 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Chin Pang
Company: : Trango
Project #: : 06U10393
Configuration: : EUT/33 dBi Dish Antenna
Mode of Operation:: TX (5GHz band, Mid Ch)
Target: : 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	46.490	24.08	11.79	35.87	40.00	-4.13	Peak
2	58.130	27.15	8.61	35.76	40.00	-4.24	QP
3	58.130	30.71	8.61	39.32	40.00	-0.68	Peak
4	80.440	26.29	8.81	35.11	40.00	-4.90	Peak
5	114.390	20.38	14.46	34.84	43.50	-8.66	Peak
6	143.490	19.13	14.63	33.76	43.50	-9.75	Peak
7	924.340	13.60	26.20	39.80	46.00	-6.20	Peak

With 23 dBi Dish Antenna:

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

HORIZONTAL PLOT

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

Data#: 15 File#: trango_06u10393.EMI
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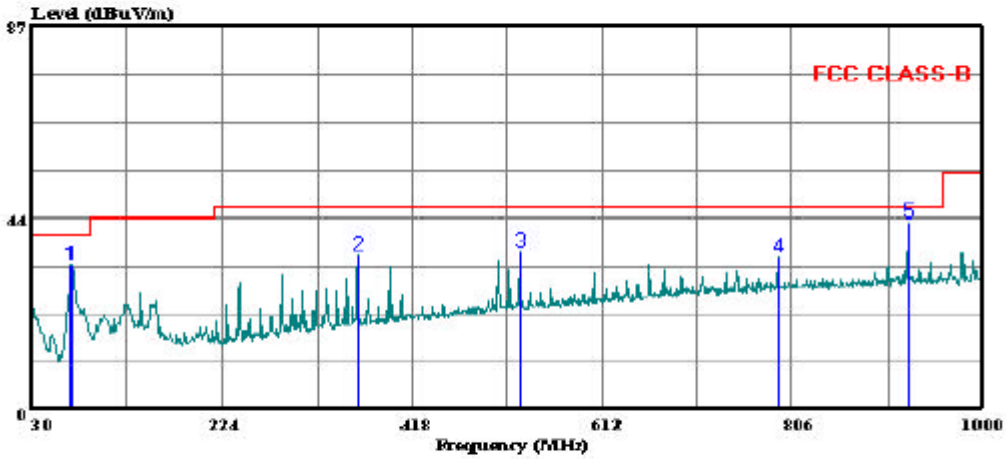

Trace: 14 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : Thanh Nguyen
Company: : Trango
Project #: : 06U10393
Configuration: : EUT/ 23dBi Patch Antenna
Mode of Operation:: TX 5.5GHz band, Mid Ch.
Target: : FCC Class B

HORIZONTAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	70.740	51.90	-18.80	33.10	40.00	-6.90	Peak
2	362.710	45.90	-10.43	35.47	46.00	-10.53	Peak
3	527.610	42.70	-6.65	36.05	46.00	-9.95	Peak
4	792.420	37.10	-1.98	35.12	46.00	-10.88	Peak
5	924.340	43.40	-0.69	42.71	46.00	-3.29	Peak

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

VERTICAL PLOT

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

Data#: 17 File#: trango_06u10393.EMI
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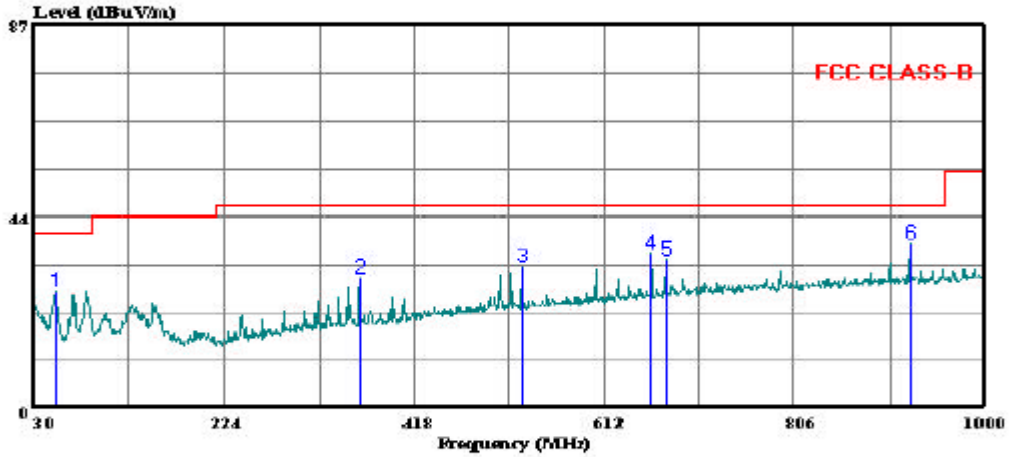

Trace: 16 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Thanh Nguyen
Company: : Trango
Project #: : 06U10393
Configuration: : EUT/ 23dBi Patch Antenna
Mode of Operation:: TX 5.5GHz band, Mid Ch.
Target: : FCC Class B

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	52.310	46.00	-19.26	26.74	40.00	-13.26	Peak
2	362.710	40.00	-10.43	29.57	46.00	-16.43	Peak
3	527.610	38.90	-6.65	32.25	46.00	-13.75	Peak
4	659.530	39.60	-4.16	35.44	46.00	-10.56	Peak
5	675.050	37.80	-3.80	34.00	46.00	-12.00	Peak
6	924.340	38.20	-0.69	37.51	46.00	-8.49	Peak

With 19 dBi Dish Antenna:

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

HORIZONTAL PLOT

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

Data#: 13 File#: trango_06u10393.EMI
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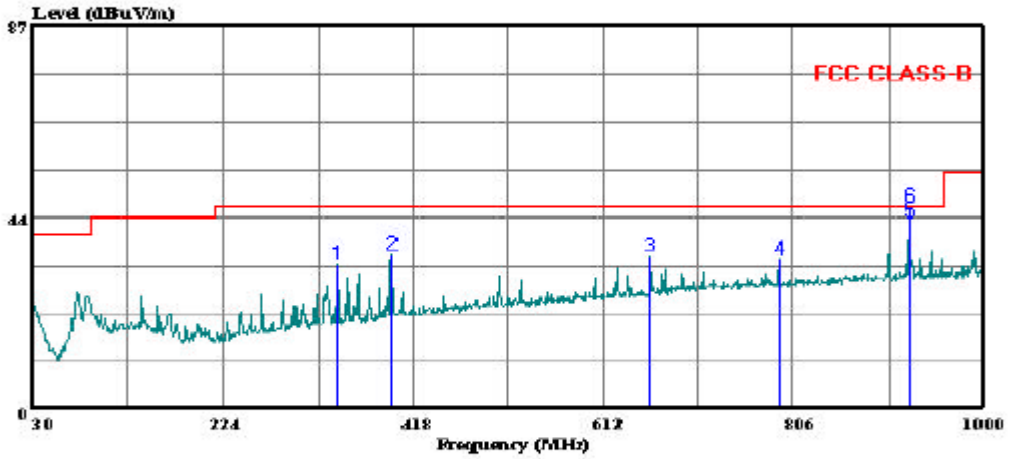


Trace: 10 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator: : Thanh Nguyen
Company: : Trango
Project #: : 06U10393
Configuration: : EUT/ 19dBi Patch Antenna
Mode of Operation:: TX 5.5GHz band, Mid Ch.
Target: : FCC Class B

HORIZONTAL DATA

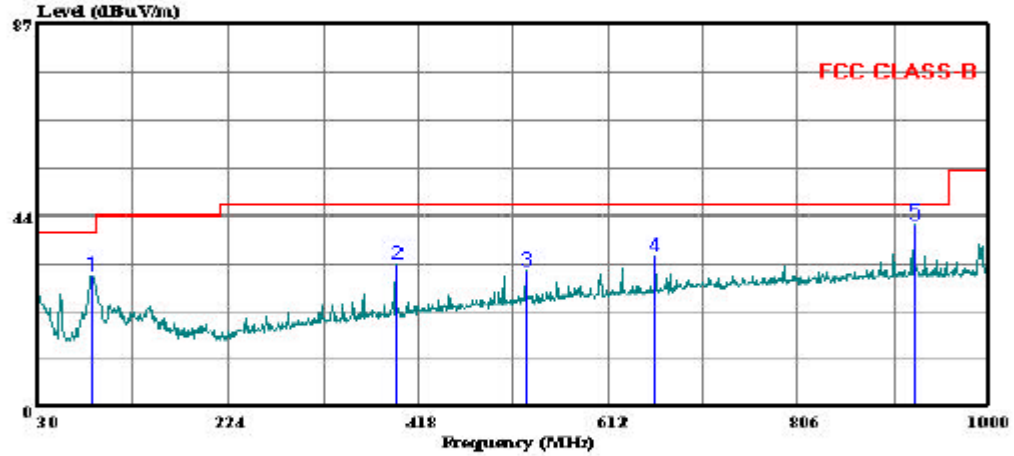
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	340.400	44.00	-11.00	33.00	46.00	-13.00	Peak
2	395.690	45.10	-9.69	35.41	46.00	-10.59	Peak
3	659.530	39.30	-4.16	35.14	46.00	-10.86	Peak
4	792.420	36.20	-1.98	34.22	46.00	-11.78	Peak
5	924.340	43.25	-0.69	42.56	46.00	-3.44	QP
6	924.340	46.50	-0.69	45.81	46.00	-0.19	Peak

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

VERTICAL PLOT

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

Data#: 9 File#: trango_06u10393.EMI
Date: 02-16-2007 Time: 16:31:25



Trace: 8 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Thanh Nguyen
Company: : Trango
Project #: : 06U10393
Configuration: : EUT/ 19dBi Patch Antenna
Mode of Operation:: TX 5.5GHz band, Mid Ch.
Target: : FCC Class B

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	84.320	49.50	-19.54	29.96	40.00	-10.04	Peak
2	395.690	42.40	-9.69	32.71	46.00	-13.29	Peak
3	527.610	37.90	-6.65	31.25	46.00	-14.75	Peak
4	659.530	38.70	-4.16	34.54	46.00	-11.46	Peak
5	924.340	42.60	-0.69	41.91	46.00	-4.09	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:

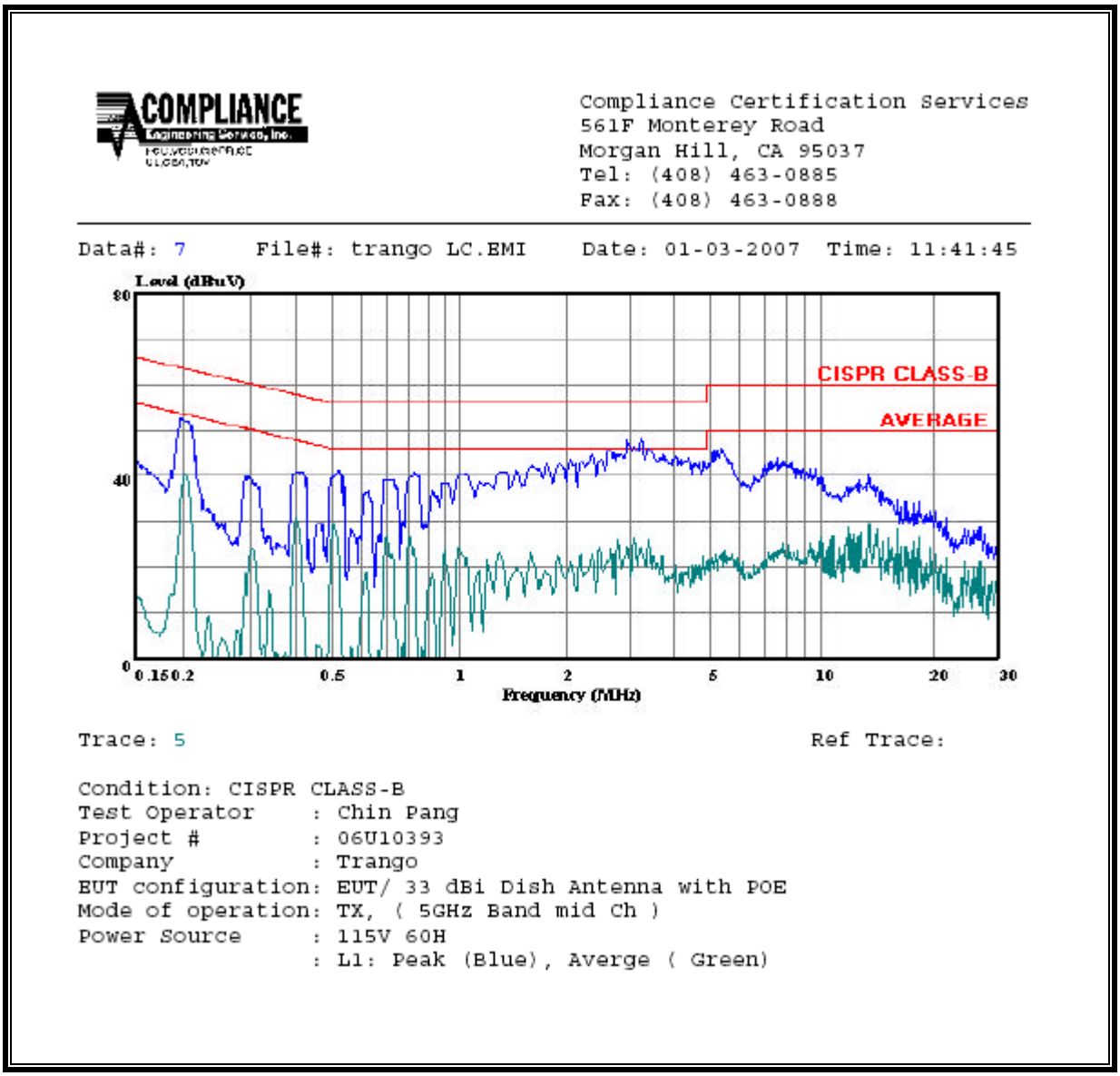
6 WORST EMISSIONS, POE:

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
0.20	52.03	--	40.53	0.00	63.53	53.53	-11.50	-13.00	L1
3.33	48.00	--	26.12	0.00	56.00	46.00	-8.00	-19.88	L1
5.51	45.74	--	22.51	0.00	60.00	50.00	-14.26	-27.49	L1
0.20	47.45	--	41.06	0.00	63.69	53.69	-16.24	-12.63	L2
3.51	47.64	--	26.76	0.00	56.00	46.00	-8.36	-19.24	L2
5.51	46.42	--	26.21	0.00	60.00	50.00	-13.58	-23.79	L2
6 Worst Data EUT with POE									

6 WORST EMISSIONS, Laptop:

CONDUCTED EMISSIONS DATA (230VAC 50Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.17	53.13	--	41.09	0.00	64.82	54.82	-11.69	-13.73	L1
0.29	42.10	--	27.12	0.00	60.55	50.55	-18.45	-23.43	L1
13.55	32.98	--	28.51	0.00	60.00	50.00	-27.02	-21.49	L1
0.17	52.33	--	40.90	0.00	64.77	54.77	-12.44	-13.87	L2
0.23	44.62	--	32.10	0.00	62.45	52.45	-17.83	-20.35	L2
3.82	32.01	--	27.87	0.00	56.00	46.00	-23.99	-18.13	L2
6 Worst Data EUT/ Lapotop AC Adapter									

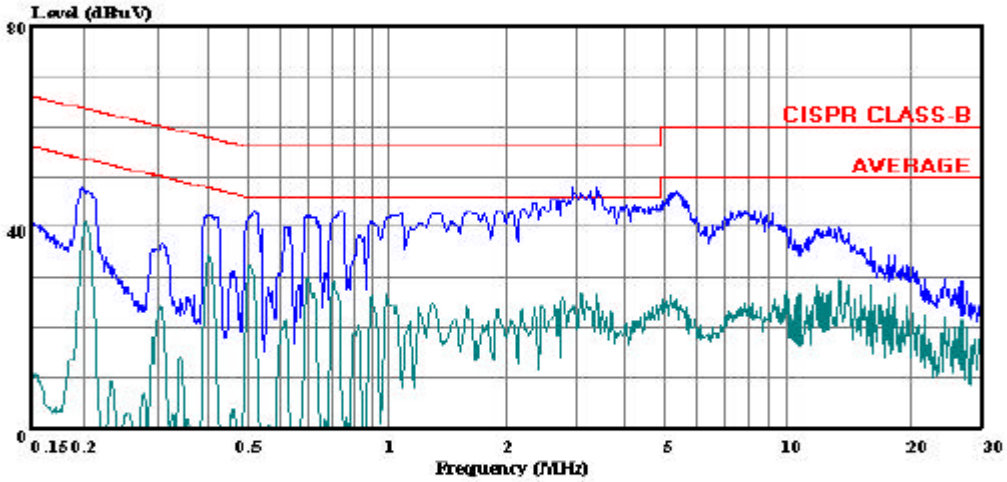
LINE 1 RESULTS (POE)



LINE 2 RESULTS (POE)

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

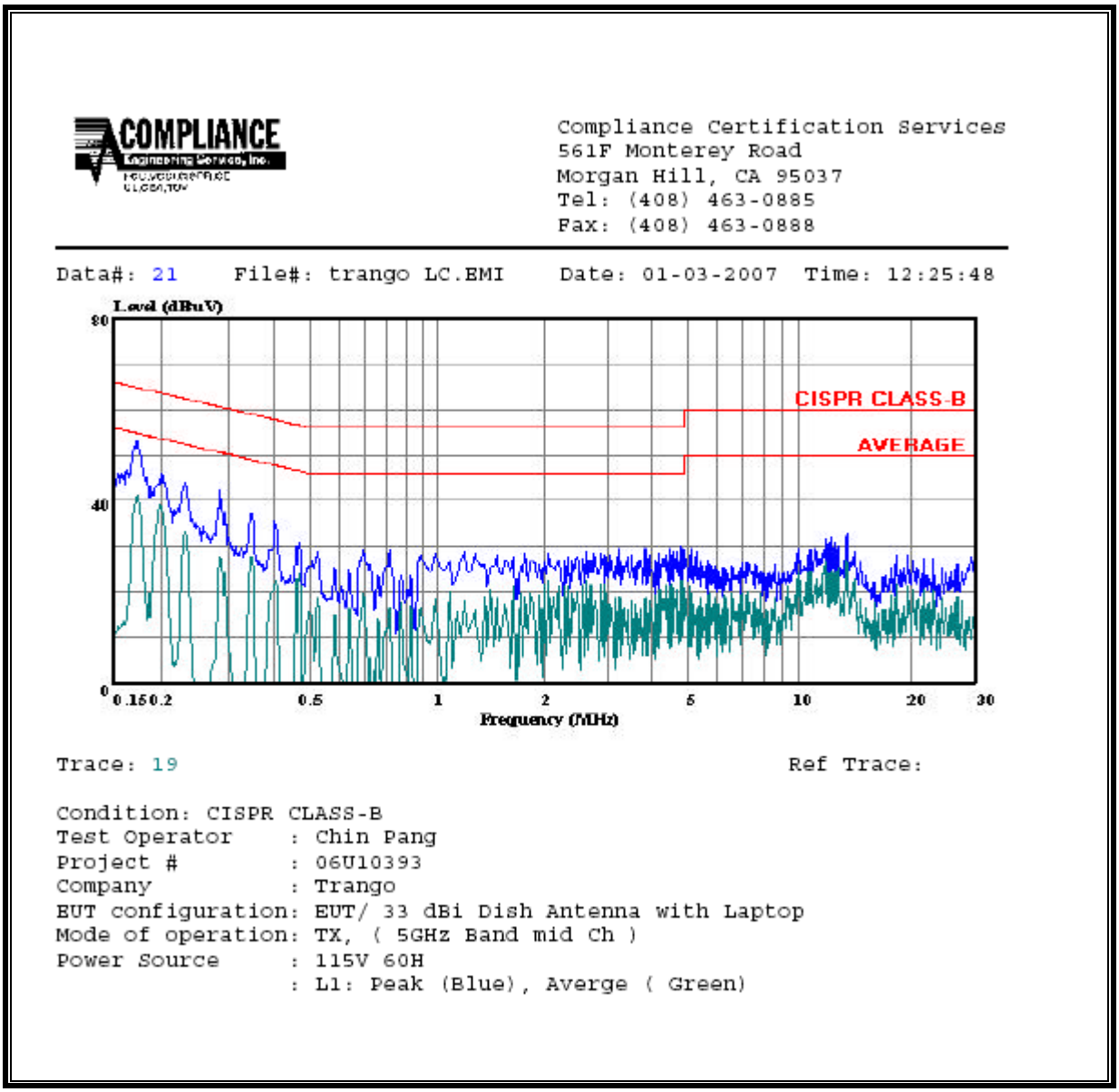
Data#: 14 File#: trango LC.EMI Date: 01-03-2007 Time: 12:01:26



Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Chin Pang
Project # : 06U10393
Company : Trango
EUT configuration: EUT/ 33 dBi Dish Antenna with POE
Mode of operation: TX, (5GHz Band mid Ch)
Power Source : 115V 60H
: L2: Peak (Blue), Averge (Green)

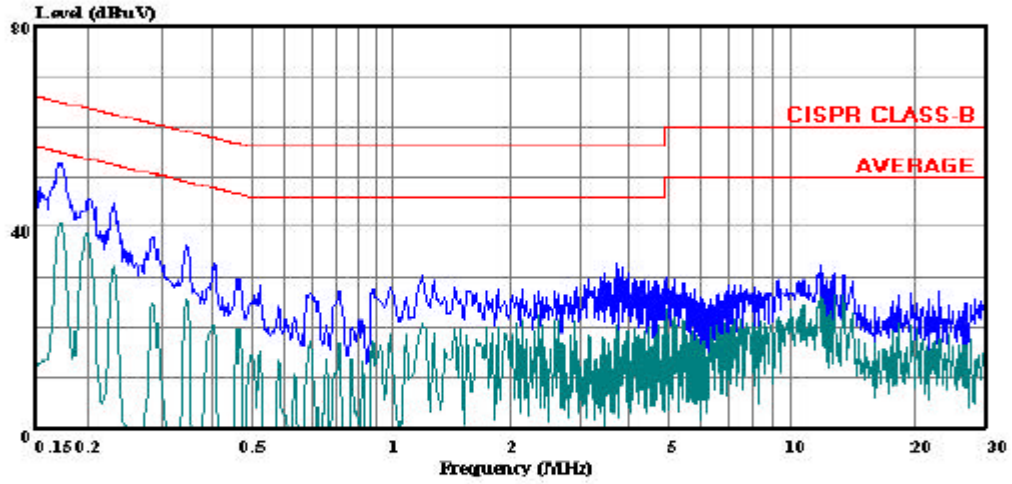
LINE 1 RESULTS (LAPTOP)



LINE 2 RESULTS (LAPTOP)

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

Data#: 28 File#: trango LC.EMI Date: 01-03-2007 Time: 13:31:05



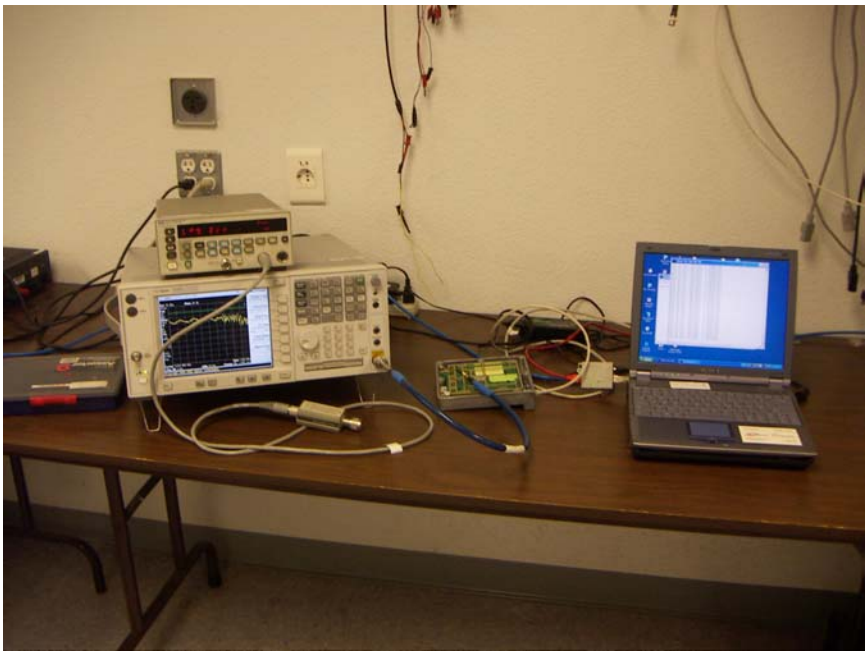
Trace: 26 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Chin Pang
Project # : 06U10393
Company : Trango
EUT configuration: EUT/ 33 dBi Dish Antenna with Laptop
Mode of operation: TX, (5GHz Band mid Ch)
Power Source : 115V 60H
: L2: Peak (Blue), Averge (Green)

8. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

ANTENNA PORT CONDUCTED PHOTO

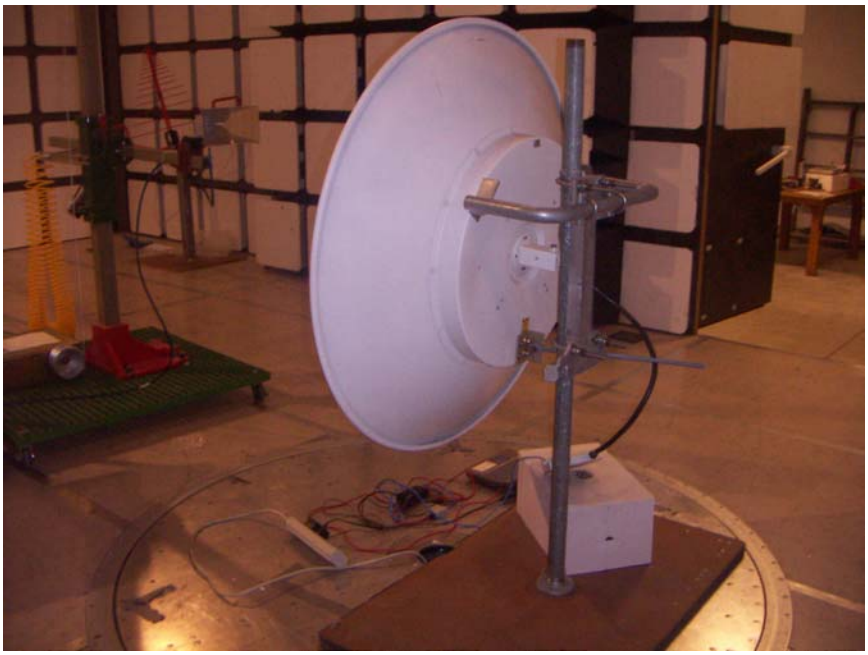


RADIATED RF MEASUREMENT SETUP:

33 dBi Dish Antenna:

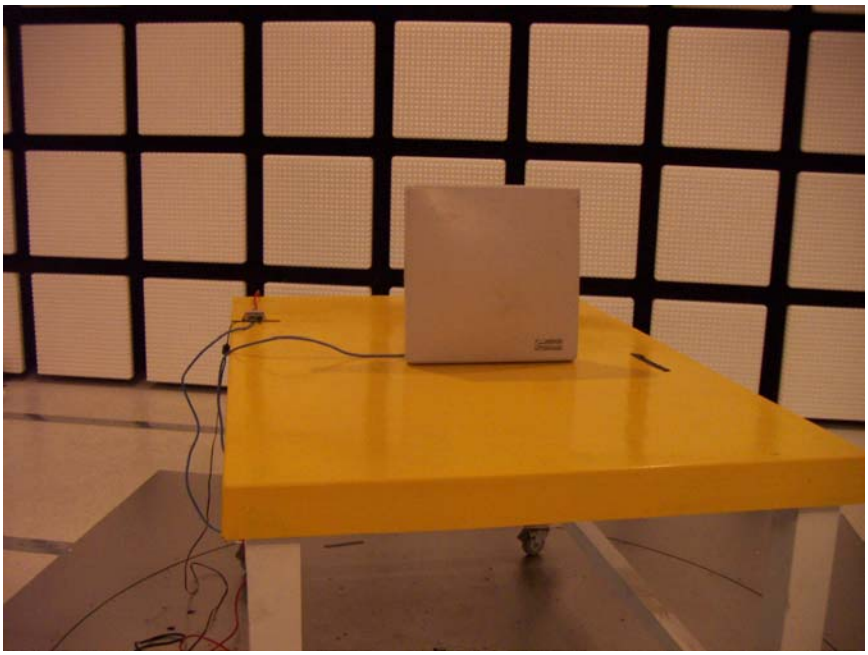
RADIATED FRONT PHOTO

RADIATED BACK PHOTO

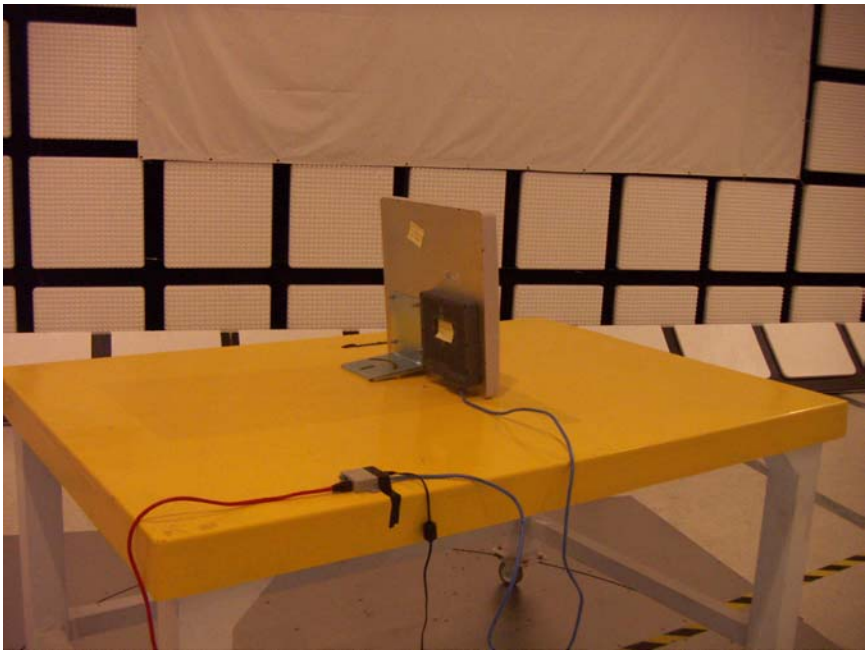


23 dBi Patch antenna:

RADIATED FRONT PHOTO

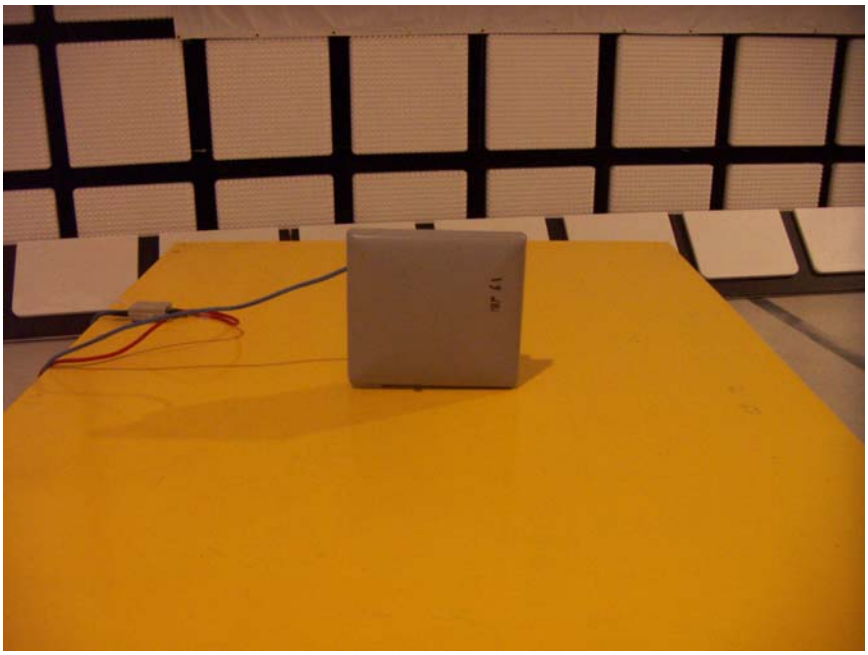


RADIATED BACK PHOTO

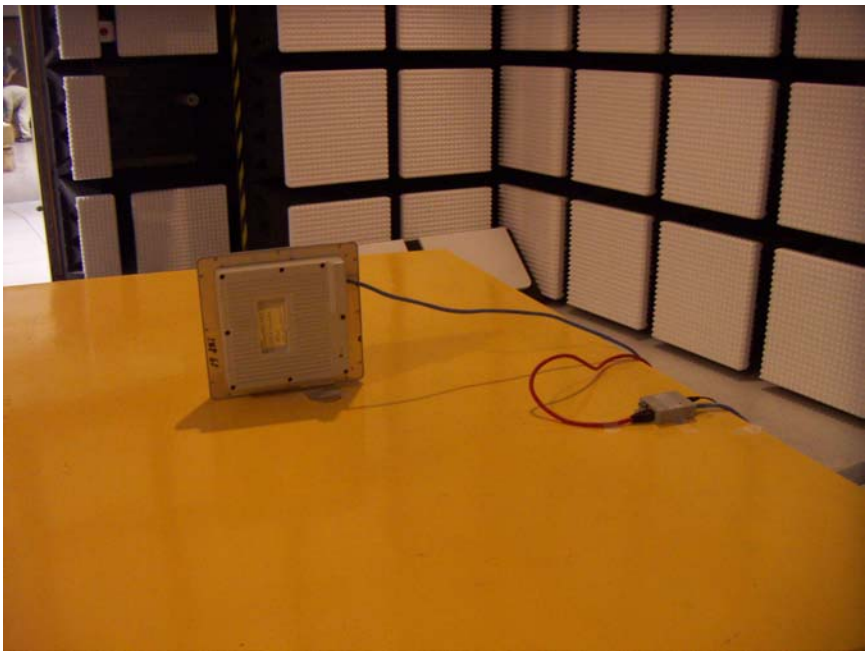


19 dBi Patch Antenna:

RADIATED FRONT PHOTO



RADIATED BACK PHOTO



POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO

END OF REPORT