ITS Intertek Testing Services
ETL SEMKO

Test Report
for
Colubris Networks
on the
Access Point
Model: Optimist

to

FCC Part 15.247 Subpart C

Test Report #: 3051978
Date of Report: March 5, 2004

Project #s: 3051978
Dates of Test: December 15, 2003 - February 7, 2004

Total No of Pages Contained in this Report: 17

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1.0 Summary of Tests

Colubris Networks's

Access Point Model: Optimist Serial #: M033-00015

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2.0 General Description

2.1 Product Description

The Access Point, Model: Optimist, is a wireless LAN router conforming to the IEEE 802.11a/b/g standards. The normal temperature range of operation is from 0 to 50 degrees celsius. The Optimist unit contains an 802.11a/b/g radio module.

A production version of the EUT was received on December 8, 2003 in good operating condition. As declared by the Applicant, it is identical to production units.

Overview of the EUT

Description	Access Point
Model No. , Part No.	Access Point Model: Optimist Serial #: M033-00015
Operating Frequency	IEEE 802.11b/g: 2.412 – 2.462 GHz (Channels 1 – 11) IEEE 802.11a: 5.18-5.32 GHz (Channels 36 – 64) 5.745 – 5.805 GHz (Channels 149 – 161)
Number of Channels	IEEE 802.11b/g: 11 Channels, IEEE 802.11a: 19 Channels
Type of Modulation	IEEE 802.11a/b/g
Operating Temperature	0^0C to +50^0C
Antenna	IEEE 802.11b/g: Cushcraft SRSM2400MRA 2.0 dBi Gain Reverse-SMA IEEE 802.11a: Cushcraft SRSM5150MRA 2.0 dBi Gain Reverse-SMA

The Colubris Networks Access Point, Model: Optimist, has been tested at the request of:

Company: Colubris Networks
420 Armand-Frappier Suite 200
QC, H7V 4B4, Canada

Name of contact: Mr. Claude Robitaille
Telephone: 450-680-1661
Fax: 450-680-1910
Email: claude.robitaille@colubris.com

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

Site 2C (Middle Site) is a 3m and 10m sheltered EMI measurement range located in a light commercial environment in Boxborough, Massachusetts. It meets the technical requirements of ANSI C63.4-1992 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets of metal are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. A copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

2.4 Test Equipment and Support Equipment

Test Equipment

Description	Manufacturer	Model Number	ITS ID	Serial Number	Cal Due Date
Antenna	EMCO	3142	LOG4	9711-1225	02/18/2004
EMI Receiver Set	Hewlett Packard	8542E	REC2	3520A00125	12/18/2004
RF Filter	Hewlett Packard	85420E	RECFL2	3427A00126	12/18/2004
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL030	CBL030	11/11/2004
Signal Generator	Hewlett Packard	AT-83640B/1	TMP001	3844A00757	10/05/2005
Horn Antenna	EMCO	3115	HORN2	9602-4675	09/03/2004
Horn Antenna	EMCO	3115	HORN1	9512-4632	10/24/2004
Spectrum Analyzer	Rohde & Schwarz	FSEK-30	ROS001	100225	05/26/2004
Temperature/Humidity Chamber	Bryant Manufacturing	TH-5S	SAF187	1207	07/16/2004
Universal Power Meter	Gigatronics	8651A	GIG1	8651298	10/24/2004
Peak Power Sensor	Gigatronics	80354A	GIG2	1821196	10/24/2004
Spectrum Analyer	Agilent	E7405A	AGL001	US40240205	07/02/2004
Attenuator	Weinschel Corporation	47-10-34	WEI8	BD8309	02/15/2004
Attenuator	Mini Circuits	20 dB, 50 Ohm	DS21	DS21	07/08/2004
LISN, 50 uH, 0.01-50 MHz, 24A	Solar Electronics	9252-50-R-24-BNC	LISN11	941713	05/29/2004
Cable, BNC-BNC 10m	Alpha	RG-58C/U	CBLBNC2	CBLBNC2	07/20/2004
Digital Multimeter	Fluke	87	SAF270	52951774	02/24/2004
LISN, 50 uH, 0.01-50 MHz, 24A	Solar Electronics	9252-50-R-24-BNC	LISN13	955107	03/11/2004
Cable, BNC-BNC 10m	Alpha	RG-58C/U	CBL10MS3	CBL10MS3	01/07/2004+
High Frequency Cable	Megaphase	TM40 K1K1 197	CBL027	CBL027	11/11/2004
High Frequency Cable	Megaphase	TM40 K1K1 80	CBL029	CBL029	11/11/2004
High Frequency Horn Antenna	EMCO	3116	TMP002	9310-2222	03/06/2004
Preamplifier 1-40 GHz	Miteq	NSP4000-NF	PRE8	507145	10/22/2004
Variac	Powerstat	3PN236B	POW4	POW4	*
Attenuator	Mini Circuits	20 dB, 50 Ohm	DS26A	DS26A	01/07/2004+
Digital Multimeter	BK Precision	391	SAF013	099050522	5/19/2004
High Frequency Horn Antenna	EMCO	3116	EMCO4	2090	08/28/2004
Digital 4 Line Barometer	Mannix	0ABA116	BAR2	BAR2	07/09/2004

+ - Note that these items were used prior to the calibration due date

Support Equipment			
Description	**Manufacturer**	**Model Number**	**Serial Number**
AC Adapter	Delta Electronics	ADP-10MB	DNT0104007805
Laptop	Dell	Latitude CPt	6V5IL

* - AC Power Voltage was verified using a digital multimeter, listed in the test equipment section.

Cables					
Quantity	**Type**	**Length (m)**	**Shielding**	**Ferrite**	**Connector Type**
1	Ethernet Crossover Cable	2	Foil	None	Metal Side Plating
1	Ethernet Cable	4	Foil	None	Metal Side Plating
1	Serial Cable	1.5	None	None	Plastic
1	AC Adapter AC Cable	2	None	None	Plastic
1	AC Adapter DC Cable	2	None	Built-in	Metal/360

3.0 RF Output Power and Exposure, and 6 dB Bandwidth

15.247(a)(2), (b)(3)

3.1 Test Procedure

The EUT was connected to a spectrum analyzer through a cable with suitable attenuation not to overload the analyzer. An offset in the analyzer compensated for the cable and attenuation loss. Measurement values are adjusted to include antenna gain. Channels were selected for testing at the low, middle, and high end of the transmit band. To measure the 6 dB bandwidth of the fundamental the EUT was then connected to a spectrum analyzer with resolution bandwidth of approximately 1% of the signal bandwidth and a marker delta function was used to find the 6 dB down points.

Requirement: The RF Power Output must be below 1 W (30 dBm) and the 6 dB bandwidth must be greater than 500 kHz. RF exposure must not exceed 1 mW/cm^2 at any distance greater than 20 cm from the EUT.

3.2 Test Results

Results: Passed

Performed 12/11/2003 Equipment: WEI8, ROS001, CBL027

Frequency (GHz)	Description	Power Reading (dBm)	Antenna Gain (dBi)	EIRP Value (dBm)	EIRP Limit (dBm)	6 dB Bandwidth (MHz)	Bandwidth Limit (MHz)
2.412	Channel 1	12.00	2.0	14.00	30.0	13.1	>0.5
2.437	Channel 6	12.35	2.0	14.35	30.0	13.0	>0.5
2.462	Channel 11	12.70	2.0	14.70	30.0	13.0	>0.5

Using the maximum measured power of 12.70 dBm plus the 2 dBi antenna gain, the EIRP is 14.70 dBm (29.5 mW). The radius at which the EIRP/(4*Pi*r^2) is equal to 1 mW/cm^2 is 1.5 cm, well within 20cm.

4.0 Peak Power Spectral Density
15.247(d)

4.1 Test Procedure

The EUT was activated and the fundamental was observed on a spectrum analyzer through sufficient attenuation to prevent overloading the analyzer. The resolution bandwidth of the spectrum analyzer was set at 1 MHz, the detector was set to positive peak and a max hold function was used. The maximum value of the fundamental was located and the resolution bandwidth was set to 3 kHz. Using a marker peak search, the maximum power level was recorded as the peak spectral density.

Requirement: The peak power spectral density shall not exceed 8 dBm in any 3 kHz bandwidth.

4.2 Test Results

Performed 12/11/2003 Equipment: ROS001, CBL027, WEI8

Results: Passed

Frequency (GHz)	Description	Peak Power Spectral Density Reading (dBm)	Limit (dBm)
2.412	Channel 1	-8.12	8.0
2.437	Channel 6	-7.69	8.0
2.462	Channel 11	-6.65	8.0

5.0 Antenna Conducted Spurious Emissions and Band Edge Compliance
15.247(c)

5.1 Test Procedure

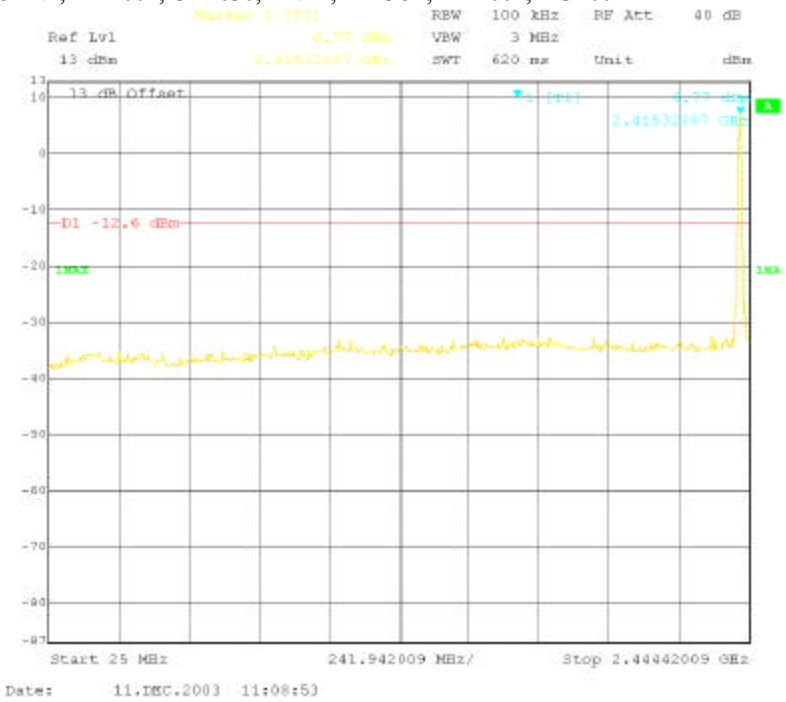
The EUT was activated at nominal power and connected to a spectrum analyzer via a cable with sufficient attenuation to prevent overloading of the analyzer. Conducted plots of emissions at the antenna port were made using a 100 kHz bandwith. A display line was used to indicate the level 20 dB lower than the level of the fundamental frequency. The attenuation and cable losses were accounted for with an offset in the analyzer. When a conducted emission was found in a restricted band, an antenna was used to find the field strength. No significant difference was observed between 802.11b or g modulation, or between channels 1, 6, and 7. Plots of 802.11b modulation with the EUT transmitting on channel 6 are shown as a representative sample.

Requirement: All emissions in any 100 kHz bandwidth outside the frequency band of operation must be attenuated by at least 20 dB below the highest level of fundamental emission in any 100 kHz band inside the frequency band of operation.

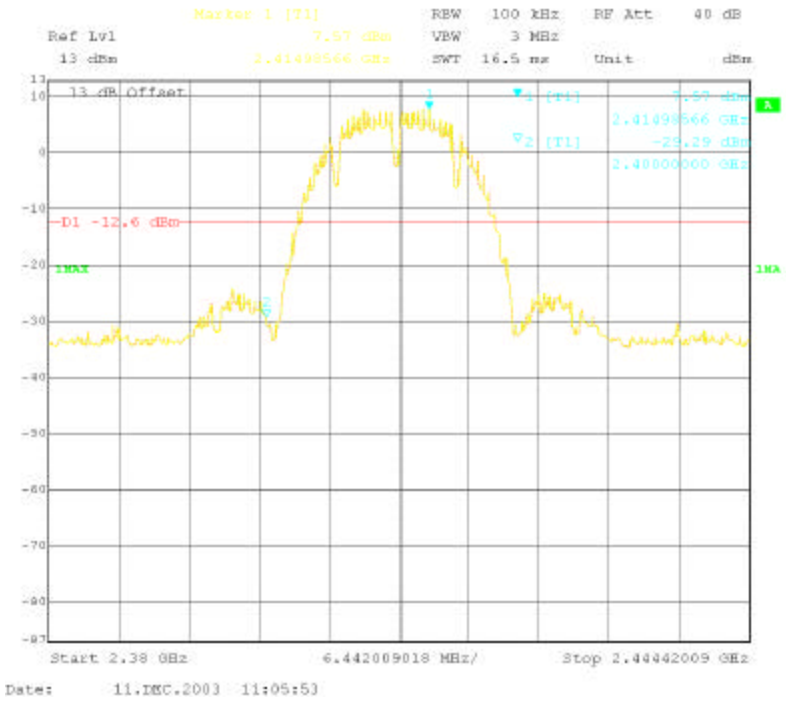
5.2 Test Results

Results: Pass

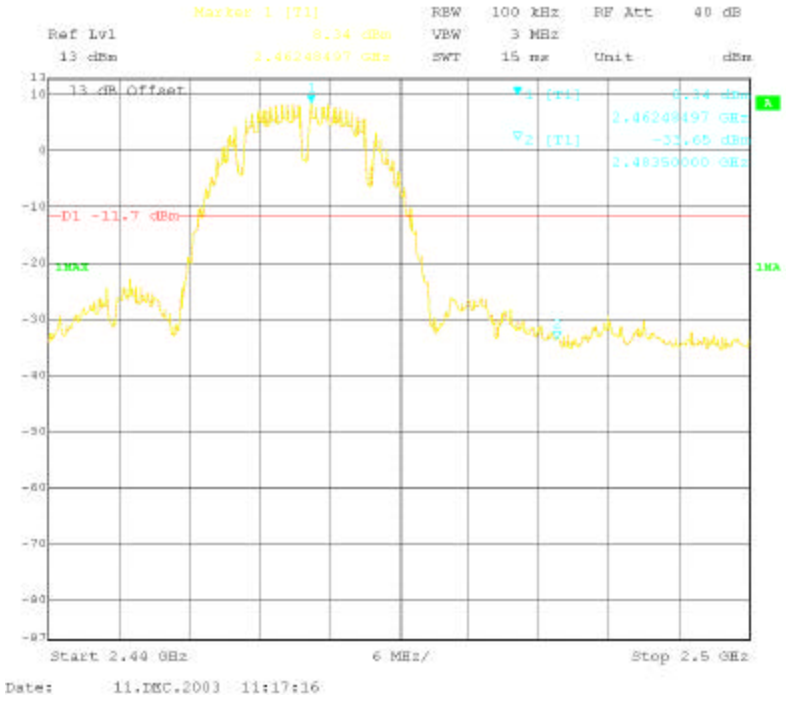
Performed 12/11/2003, 2/7/2004 Equipment: REC2, RECFL2, CBL027, CBL029, PRE8, ROS001, HORN1, LOG4, HORN2, TMP001, CBL030, ANT4, EMCO4, TMP002, AGL001



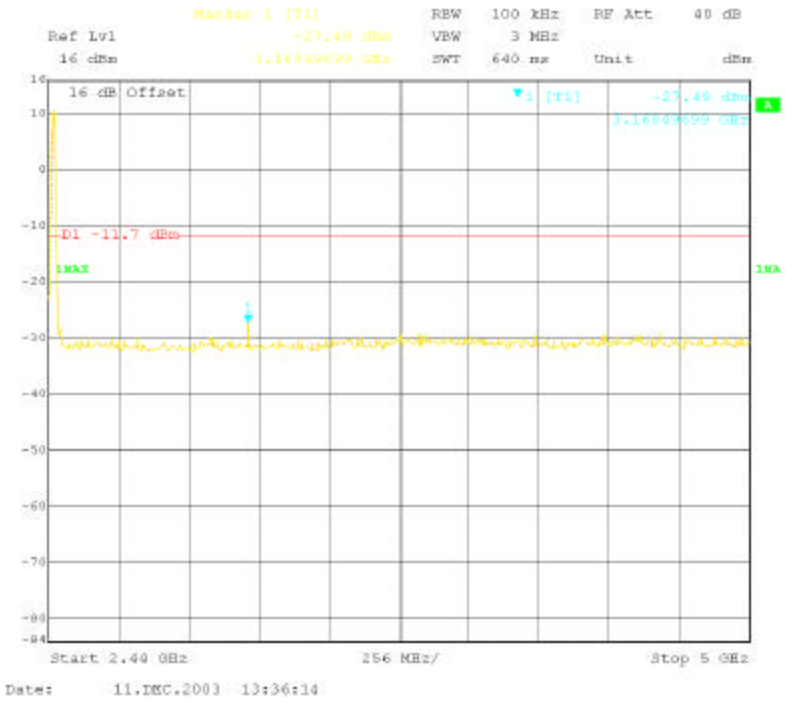
Conducted Spurious, 25 MHz – 2.48 GHz



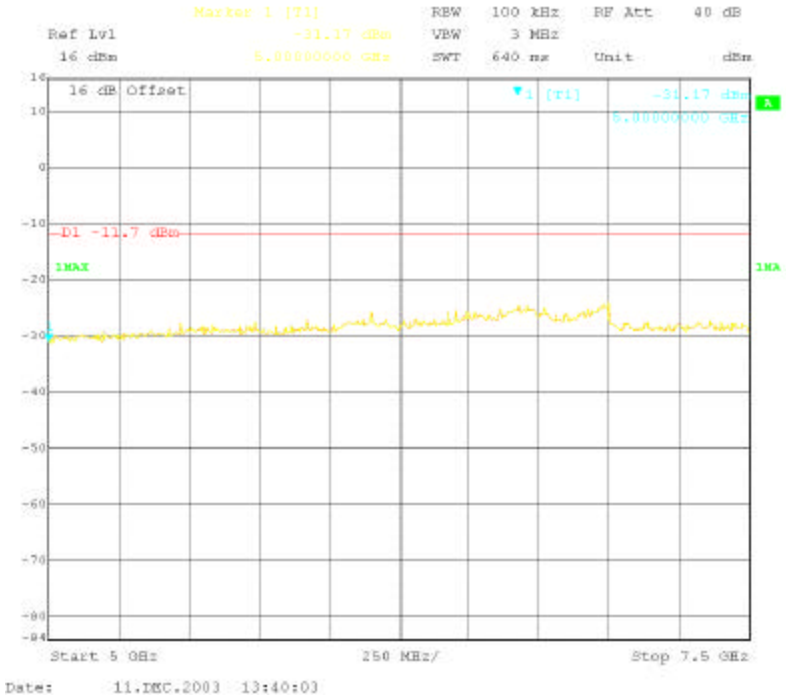
Band Edge Compliance (marker denotes lower band edge)



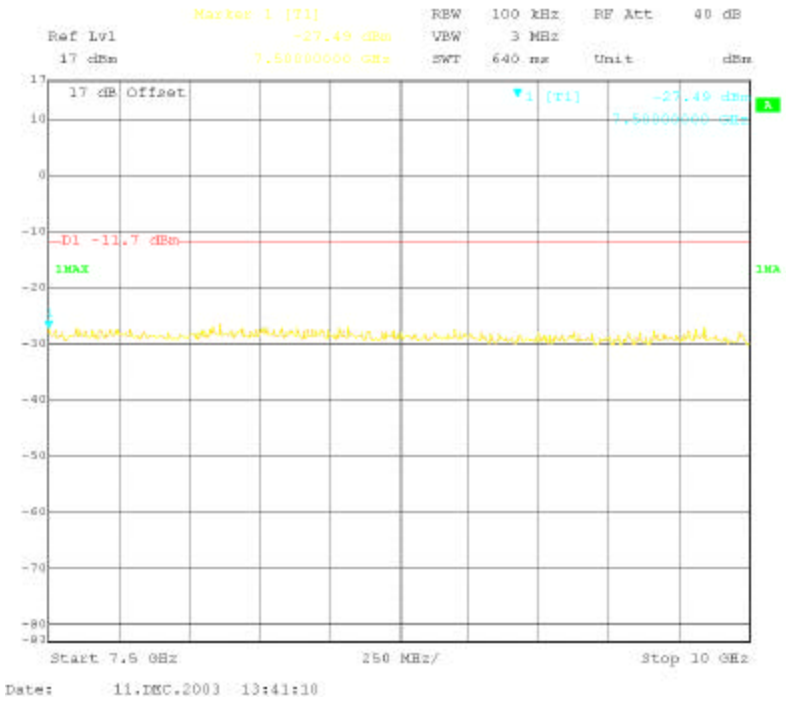
Band Edge Compliance (marker denotes upper band edge)



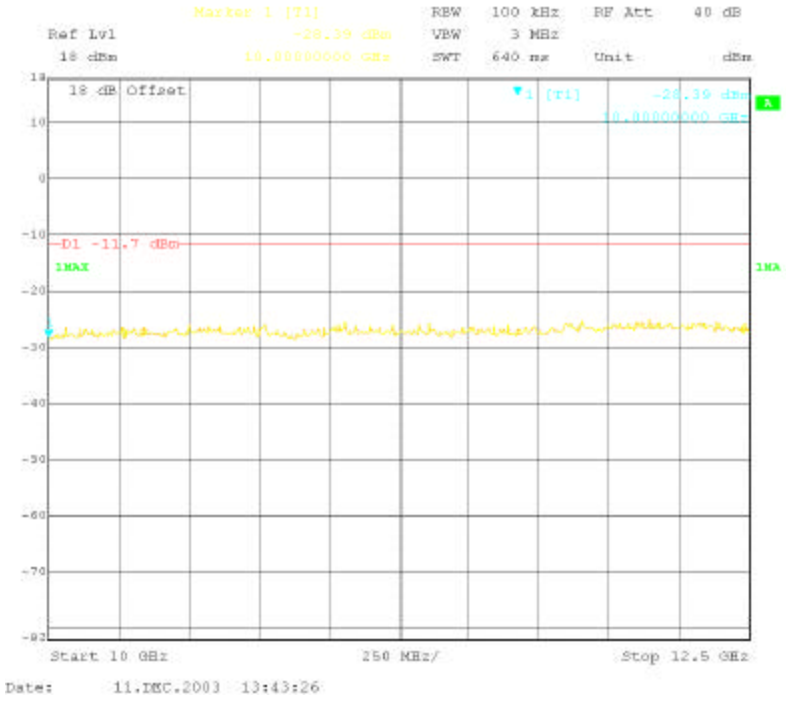
Conducted Spurious, 2.4 GHz – 5 GHz



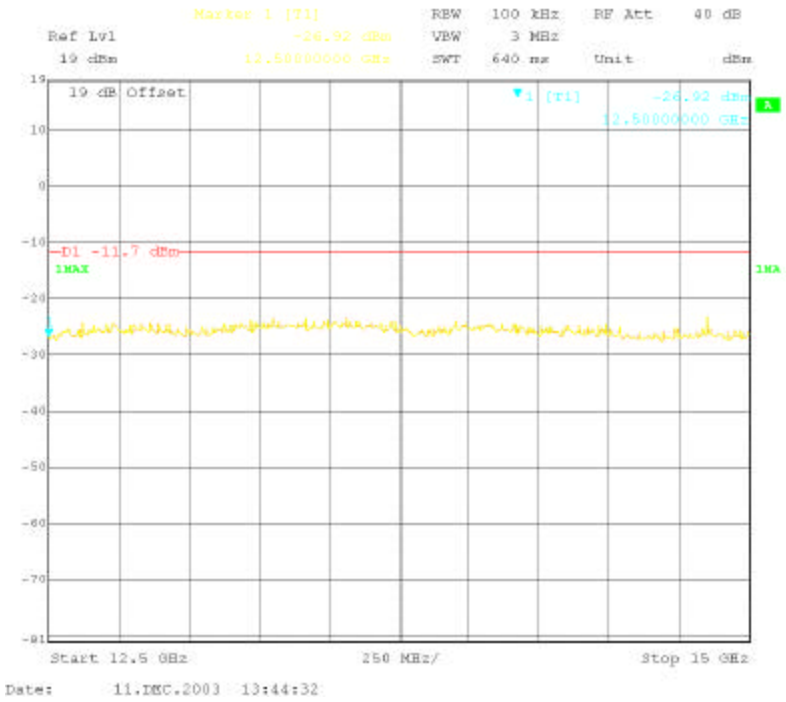
Conducted Spurious, 5 GHz – 7.5 GHz



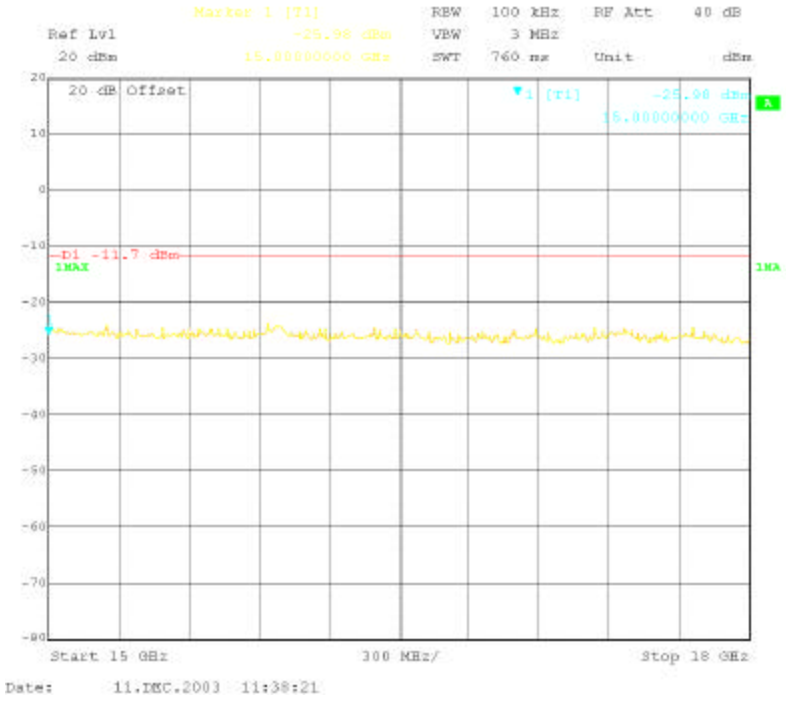
Conducted Spurious, 7.5 GHz – 10 GHz



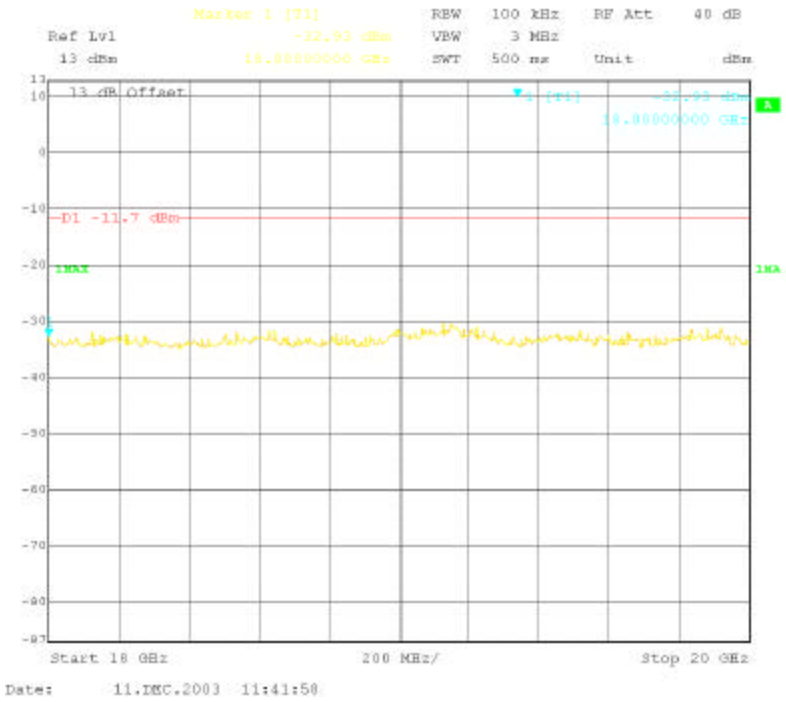
Conducted Spurious, 10 GHz – 12.5 GHz



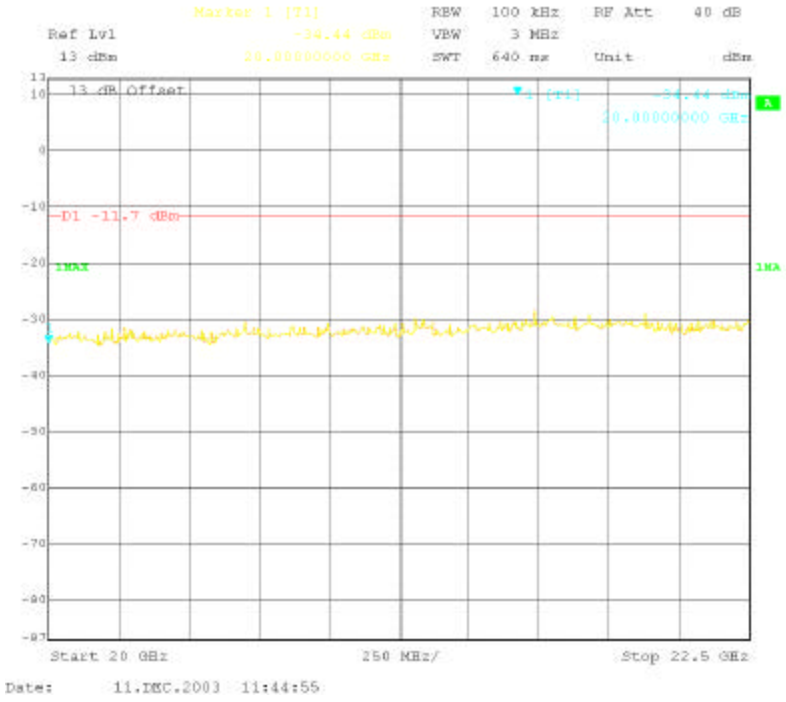
Conducted Spurious, 12.5 GHz – 15 GHz



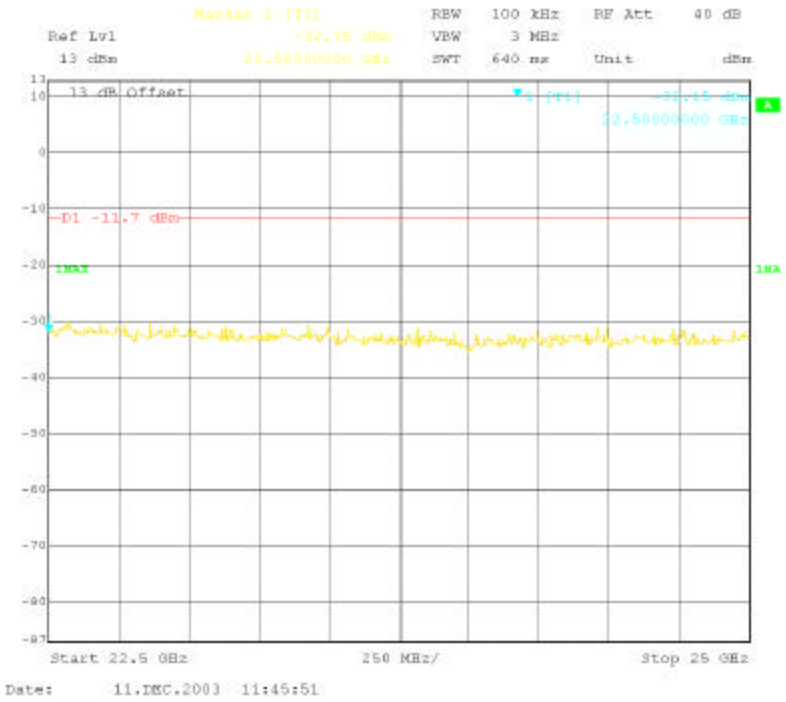
Conducted Spurious, 15 GHz – 18 GHz



Conducted Spurious, 18 GHz – 20 GHz



Conducted Spurious, 20 GHz – 22.5 GHz



Conducted Spurious, 22.5 GHz – 25 GHz

6.0 Radiated emissions in restricted bands
15.247(c)

6.1 Test Procedure

Since the EUT passed the out-of-band (spurious) antenna conducted emission test, the only radiated emission measurements in the restricted bands were performed.

Radiated emission measurements were performed from 30 MHz to 25,000 MHz. Spectrum Analyzer Resolution Bandwidth of 100 kHz or greater is used for frequencies 30 MHz to 1000 MHz. Above 1 GHz the resolution bandwidth of 1 MHz is used, and peak and average measurements were performed.

The EUT is placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 m unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three-meter reading using inverse scaling with distance.

Requirement: Radiated emissions in restricted bands must meet the general limits of 15.209.

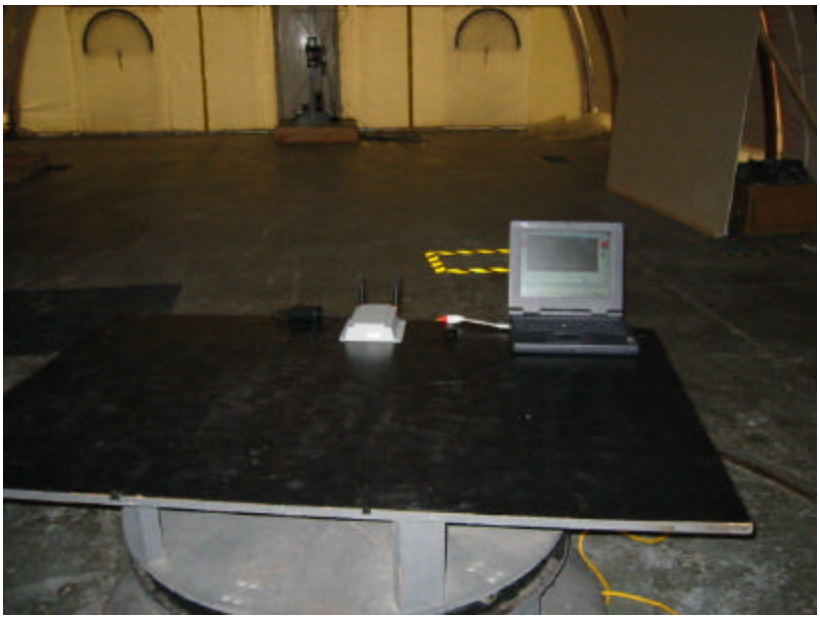
6.2 Test Results

Results: Pass

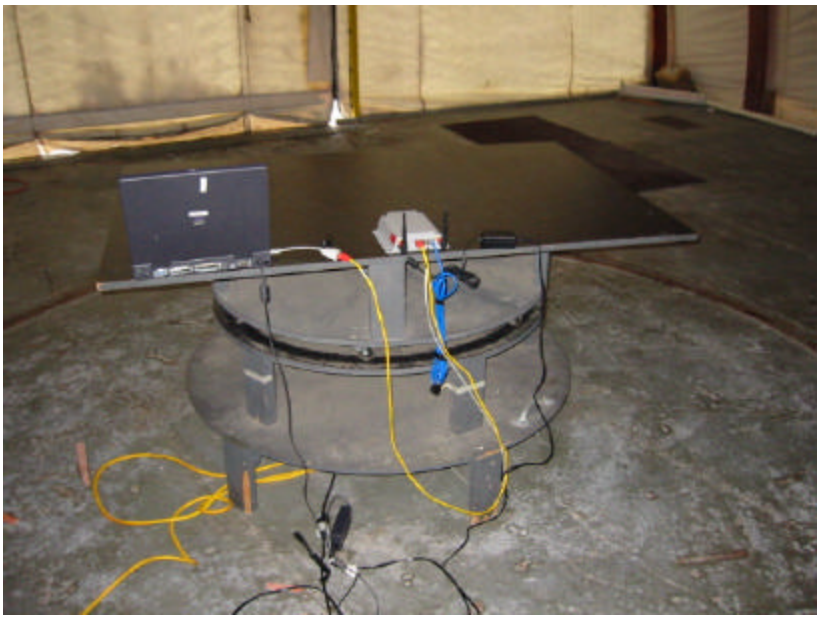
Performed 2/7/2004 Equipment: REC2, RECFL2, CBL027, CBL029, PRE8, ROS001, HORN1, LOG4, HORN2, TMP001, CBL030, ANT4, EMCO4, TMP002, AGL001

No radiated emissions in restricted bands, including the emissions in the adjacent channels, were detected above the measuring equipment noise floor which is at least 6 dB below the limit.

6.3 Configuration Photographs – Radiated Emissions



Spurious Test Setup, Front View



Spurious Test Setup, Back View