Curtis-Straus

Test Report

Report No	EE1000-1
Client	Colubris Networks
Phone	781-547-0378
Fax	781-684-0009
Models	CN200
FRN	0010292464
FCC ID	RTP-550-10016-4
IC	4891A-0100164
Equipment Type	Low Power Communication Device Transmitter
Equipment Code	DTS/NII
Standards	47CFR15.247, 15E, RSS-210 Issue 5
Results	As detailed within this report
Prepared by	Mairaj Hussain – Test Engineer
Authorized by	Michael Buchholz – EMC Manager
Issue Date	12/28/04
Conditions of issue	This Test Report is issued subject to the conditions stated in 'terms and conditions' section of this

Summary

This report is an application for certification of a transmitter operating under 47 CFR 15.247 of the FCC rules provided for operation of Digital Transmissions Systems and 15.407 Unlicensed National Information Infrastructure Devices operating in the frequency bands of 5.15-5.25GHz and 5.725 – 5.825 GHz. The product covered by this report is wireless LAN access device. The product was tested using the methods outlined in FCC public notice DA 02-2138, released August 30, 2002 and ANSI C63.4 (2003).

Spurious emissions testing was performed using 2.5dBi antennas. Furthermore, spurious emissions were tested in transmit and receive modes.

Test Methodology

Frequency range investigated:	150KHz – 40GHz

Measurement Distance:		
Frequency (MHz)	*Distance (m)*	*Comments*
0.15 – 30MHz	-	AC line Conducted
30MHz – 26.5GHz	3	Fundamental & Spurious, Conducted
30MHz – 40GHz	3	Spurious Radiated

EUT antennas were maximized within their range of motion.

The product was powered by a support AC/DC power supply. Voltage variations were performed on the DC side of the supply. AC line conducted emissions were performed on AC side of the supply using a 50Ω/50μH LISN.

All readings are peak unless otherwise noted.

Equipment Operation and FCC Rule Part		
CFR 47 Section	*Band of Operation*	*Yes/No*
15.247	2.4GHz – 2.4835GHz	Yes
15.247	902MHz – 928MHz	No
15.247	5.725GHz – 5.850GHz	No
15.407	5.15GHz – 5.25GHz	Yes
15.407	5.25GHz – 5.35GHz 5.47GHz – 5.725GHz 5.725GHz – 5.825GHz	No No Yes

Modifications for Compliance

i) Ferrite (steward pn:HFA187102-0A2) added on DC power cable at the power supply end.
ii) Caps C578 & 579 removed .
iii) Switch to lower gain antennas (2dBi)
iv) Max value for PCDAC must be set at 44 for 5.15 - 5.25 GHz UNI band.
v) Max value for PCDAC must be set at 30 for 5.725 – 5.825 GHz UNI band.
vi) Max value for PCDAC must be set at 44 for 15.247 operation.
vii) Switch to lower gain antennas (2dBi at 2.4GHz and 2.5dBi at 5.1 – 5.8GHz)

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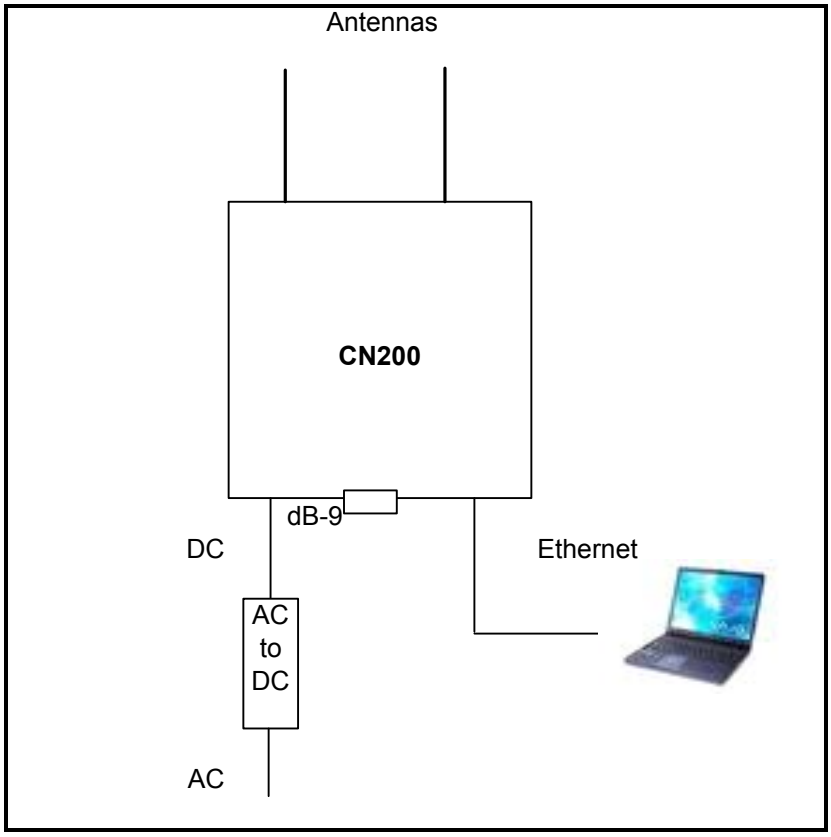
EUT Configuration

EUT Configuration					
Work Order:	E1000				
Company:	Colubris Networks				
Company Address:	200 west Street Waltham, MA 02451				
Contact:	Gerrett Durling				
Person Present:	Gerrett Durling				
	MN	**SN**			
EUT:	CN 200	Sample 1			
FSP power supply	9NA0150201	H00006938			
EUT Description:	802.11a/b/g wireless access point				
EUT Max Frequency:	5.8GHz				
Support Equipment:	**MN**	**SN**			
Dell latitude	PPX	-			
EUT Cables:	**Qty**	**Shielded?**	**Length**	**Ferrites**	
AC power	1	No	1.5 m	None	
DC	1	No	1 m	one	
Ethernet	1	No	1.5 m	None	
Unpopulated EUT Ports:	**Qty**	**Reason**			
dB-9	1	diagnostics only			
Software / Operating Mode Description:					
Operating continuously in Tx or Rx modes during the testing. A representative sample of available data rates, channels, and modulation techniques was picked for testing in order to represent different modes of operation.					

802.11g	Data Rate(mbps)	Modulation
	1 2 5.5 11 6 12 9	DSS
	18 24 36 48 54	OFDM
802.11b	1 2 5.5 11	DSS
802.11a	6 9 12 18 24 36 54	OFDM

Modulation Schemes	Data Rates (mbps)
BPSK	6 & 9
QPSK	12 & 18
16-QAM	24 & 36
64-QAM	48 & 54

Test Setup Diagram


Antennas
CN200
dB-9
DC
Ethernet
AC
to
DC
AC

Statement of Conformity

The CN200 unit has been found to conform with the following parts of the 47 CFR as detailed below:

RSS- 210	47 CFR Part #	47 CFR Part #	Comments
5.7		15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels.
5.10	2.925	15.19	The label is shown in the label exhibit.
5.11		15.21	Information to the user is shown in the instruction manual exhibit.
		15.27	Please see the modification section of the report.
		15.31(e)	The input power was varied from its nominal value to 3.3V and 5.0V. The respective radiated power was measured see table.
5.5		15.203	The device utilizes reverse sex SMA type antenna connector.
5.5		15.204	See attached documentation describing the antenna(s).
6.2.1		15.205 15.209	The fundamental is not in a Restricted band and the spurious emissions in the Restricted bands comply with the general emission limits of 15.209.
6.6		15.207	Unit is DC powered. Conducted EMI data is provided in this report.
		15.247(a)(2)	EUT complies with minimum 6dB BW requirement.
6.2.2(o)(b)		15.247(b)(3)	EUT complies with conducted POP requirement.
		15.247(b)(4)	Antennas used with the product have gain of 2dBi.
6.2.2(o)(e1)		15.247(d)	Spurious emissions comply with the requirements of this section and 15.205.
6.2.2(o)(b)		15.247(e)	EUT's power spectral density complies with the requirements of this section.
		15.247(i)	RF exposure exhibit for this section is attached.
		15.407(a)	EUT complies with the requirements of PoP of 50mW and PSD limit of 4dBm.
		15.407(a)(3)	EUT complies with the requirements of

			PoP of 1W and PSD limit of 17dBm.
		15.407(b)(1)	Spurious emissions above 1GHz comply with the requirements of this section and 15.205.
		15.407(b)(4)	Spurious emissions above 1GHz comply with the requirements of this section and 15.205.
		15.407(b)(6)	Unwanted emissions below 1GHz comply with section 15.209 and AC conducted emissions comply with section 15.207.
		15.407(g)	Product meets the requirements of frequency stability.
		15.407(f)	RF exposure exhibit for this section is attached.

Test Data and Plots

Section 15.31(e)

Voltage Variation FCC 47CFR 15.31(e)			
Date: 12/9/2004			
Company: Colubris Networks			
EUT: CN200			
Engineer: Mairaj Hussain			
Nominal Temp: 20 degC PDAC set at 44			
Operating Frequency (MHz)	**Nominal**	**-15%**	**15%**
	5VDC	4.25 VDC	5.75 VDC
	Amplitude (channel power)		
2462	-6.01	-6.5	-6.1
5220	-9.9	-9.7	-9.5
5765	-5.1	-5.1	-4.7

Conclusion:	The peak output power does not change with input voltage.

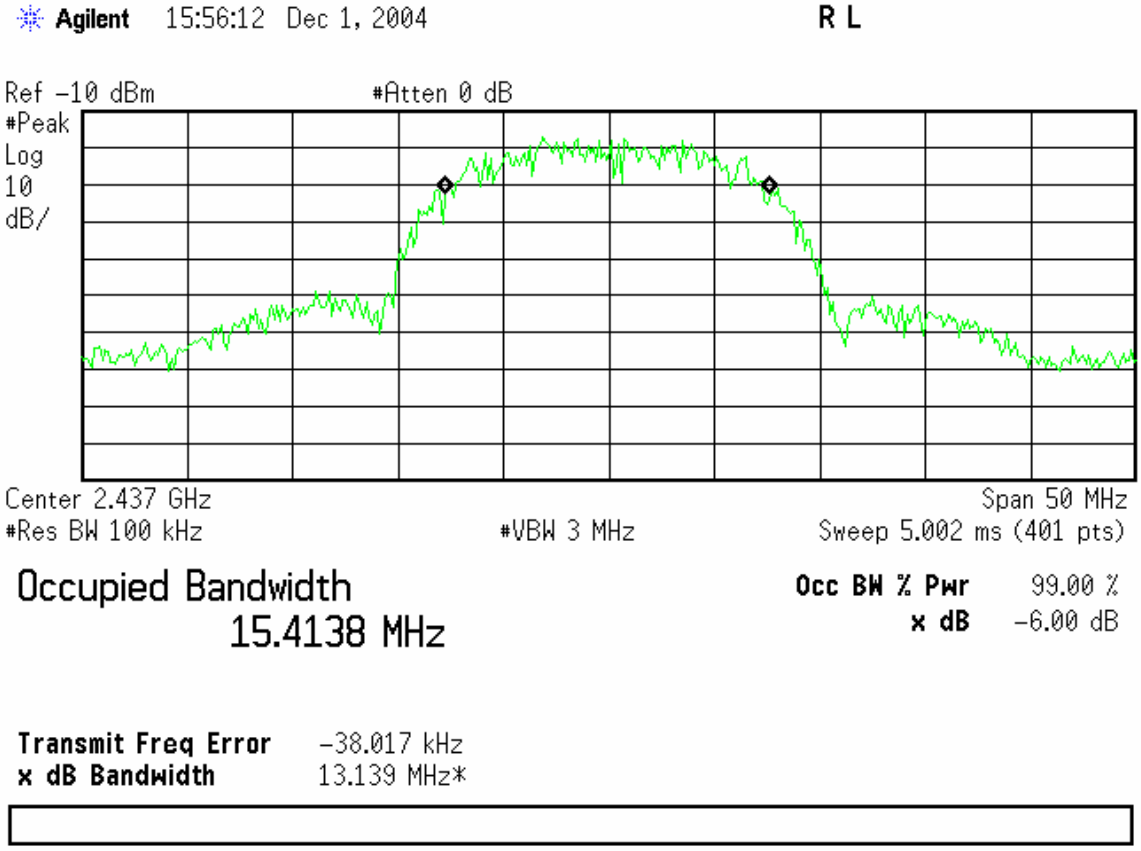
Note: Above PoP readings are off of spectrum analyzer and do not take in account for cable loss and any attenuator used.

15.247(a)(2)

6db Bandwidth shall be at least 500KHz

Operating mode: 802.11b

Sample plot of 6dB/Occupied bandwidth



CH6; DR 11mbps Long

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15.247(a)(2)

Date: 12/1/2004
Company: Colubris Networks
EUT: CN200
Engineer: Mairaj Hussain

Analyzer: Orange **Cable:** #6

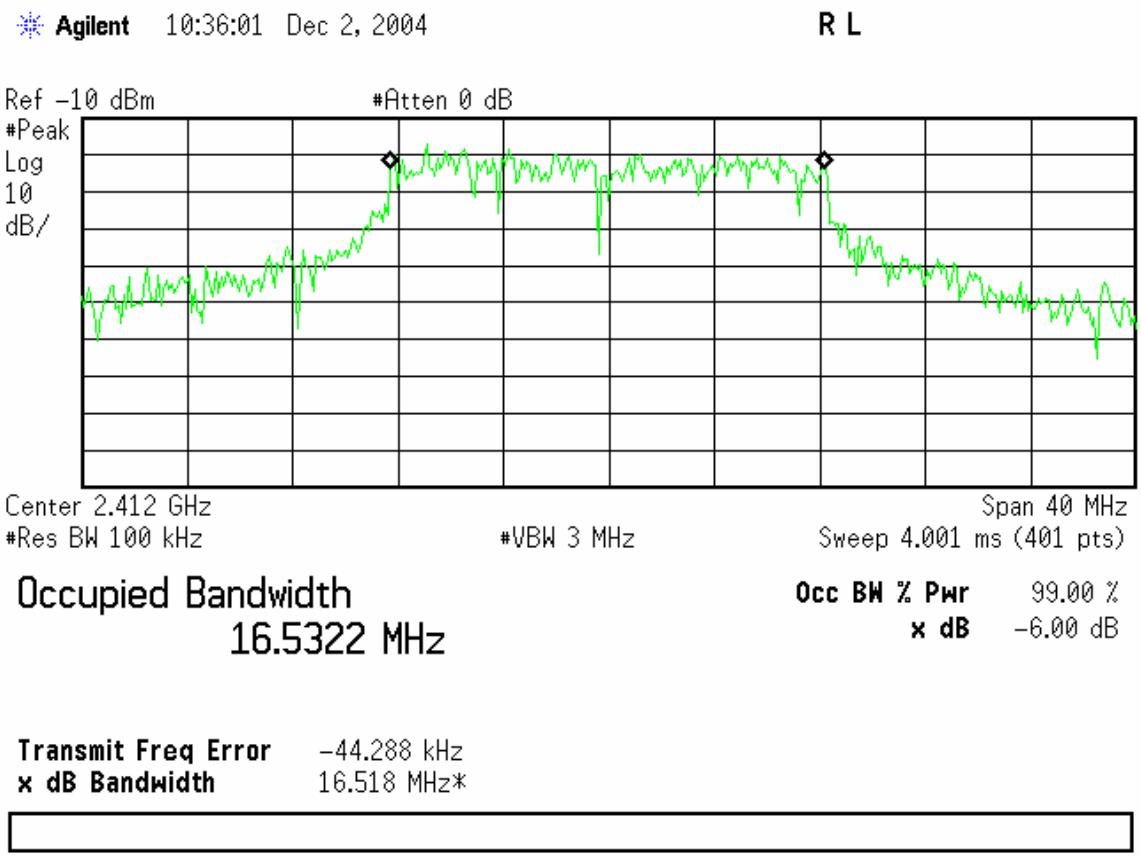
RBW: 100KHz VBW: 3MHz
Operating: 80211b

Channel /Data Rate		6dB BW (MHz)	Occupied Bandwidth (MHz)	Minimum 6dB BW Requirement (MHz)
CH	1			
	1 mbps L	10.7	15.5	0.5
	5.5 mbps L	10.4	15.3	0.5
	11 mbps S	11	15.6	0.5
CH	6			
	1 mbps L	11	15.6	0.5
	5.5 mbps L	12.6	15.2	0.5
	11 mbps S	13.1	15.4	0.5
CH	11			
	1 mbps L	9.8	15.4	0.5
	5.5 mbps L	11.6	15.3	0.5
	11 mbps S	10.6	15.3	0.5

Operating mode: 802.11g

Sample 6dB/Occupied BW plot

CH1; 54mbps Long



15.247(a)(2)

Date: 12/2/2004
Company: Colubris Networks
EUT: CN200
Engineer: JL
Analyzer: Orange **Cable:** #6
RBW: 100KHz **VBW:** 3MHz
Operating: 802.11g

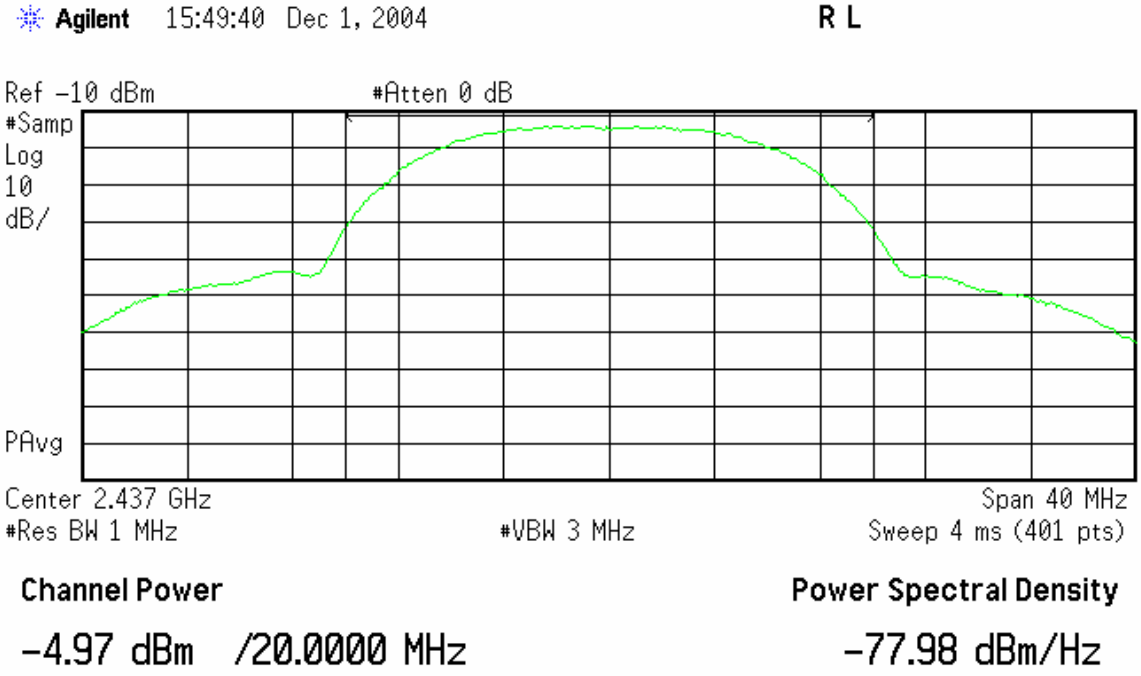
	Channel /Data Rate	6dB BW (MHz)	Occupied Bandwidth (MHz)	Minimum 6dB BW (MHz)
CH (2412MHz)	1			
	1 mbps L	12.4	15.6	0.5
	5.5 mbps L	10	15.4	0.5
	11 mbps L	11.9	15.5	0.5
	18 mbps	16.5	17	0.5
	54 mbps	16.5	16.5	0.5
CH (2437MHz)	6			
	1 mbps L	11	15.6	0.5
	5.5 mbps L	11	15.2	0.5
	11 mbps L	12	15.1	0.5
	18 mbps	16.5	16.6	0.5
	54 mbps	16.3	16.8	0.5
CH (2462MHz)	11			
	1 mbps L	11.4	15.4	0.5
	5.5 mbps L	10.5	15.3	0.5
	11 mbps L	12.3	15.2	0.5
	18 mbps	16	16.5	0.5
	54 mbps	15.7	16.7	0.5

15.247(b)(3)

Maximum conducted output power shall be 1W or less.

Operating mode: 802.11b

Sample plot of conducted peak out put power.



CH6; DR 5.5mbps

15.247(b)(3)

Date: 12/1/2004
Company: Colubris Networks
EUT: CN200
Engineer: Mairaj Hussain

Analyzer: Orange **Cable:** #6

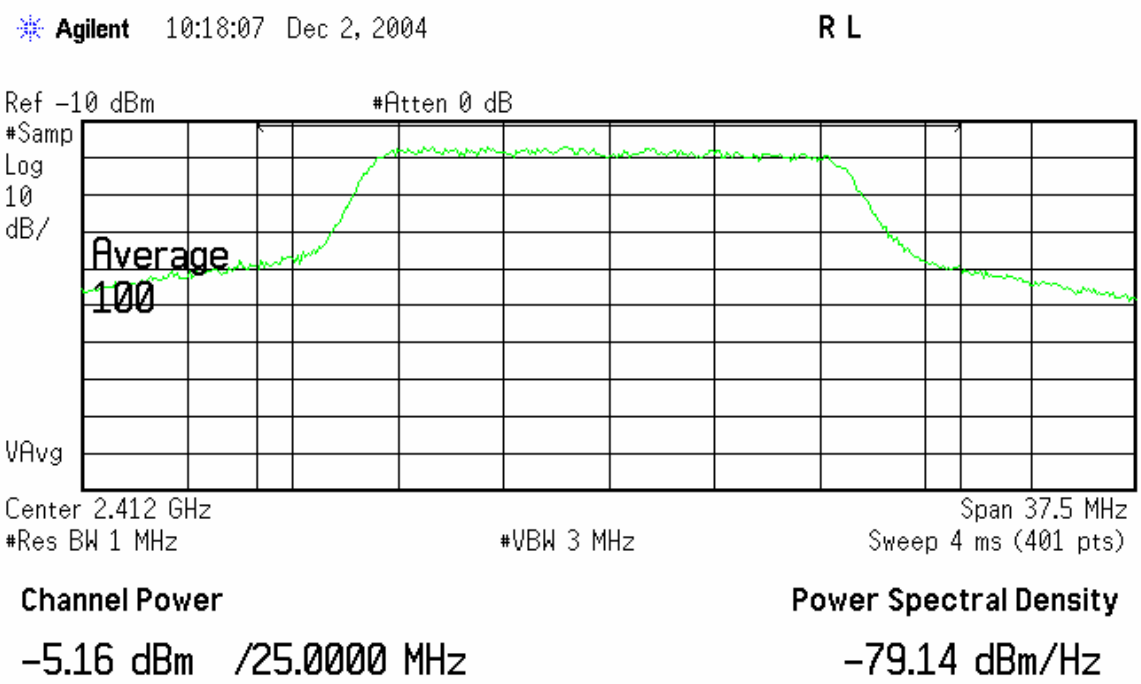
RBW: 1MHz **VBW:** 3MHz
Measurement method: Integrated channel power

	Channel /Data Rate	PoP measured (dBm)	PoP limit (dBm)	Margin (dB)
CH	1			
	1 mbps L	16	30	-14
	5.5 mbps L	16.2	30	-13.8
	11 mbps S	16	30	-14
CH	6			
	1 mbps L	15.4	30	-14.6
	5.5 mbps L	16.2	30	-13.8
	11 mbps S	15.7	30	-14.3
CH	11			
	1 mbps L	15.3	30	-14.7
	5.5 mbps L	15.4	30	-14.6
	11 mbps S	14.7	30	-15.3

Note: Above readings include a 1.1dB loss for cable and 20dB attenuator used at the input of analyzer.

Operating mode: 802.11g

Sample PoP Plot
CH1; 18mbps



15.247(b)(3)				
Date: 12/2/2004				
Company: Colubris Networks				
EUT: CN200				
Engineer: Mairaj Hussain/JL				
Analyzer: Orange		**Cable:** #6		
RBW: 1MHz		**VBW:** 3MHz		
Operating mode: 802.11g		**PCDAC setting:** 44		
Measurement method:		Integrated channel power		
	Channel /Data Rate	**PoP measured (dBm)**	**PoP Limit (dBm)**	**Margin (dB)**
CH (2412MHz)	1			
	1 mbps L	15.7	30	-14.3
	5.5 mbps L	16.1	30	-13.9
	11 mbps L	16.3	30	-13.7
	18 mbps	15.9	30	-14.1
	54 mbps	16	30	-14
CH (2437MHz)	6			
	1 mbps L	15.8	30	-14.2
	5.5 mbps L	16.2	30	-13.8
	11 mbps L	15.7	30	-14.3
	18 mbps	15.6	30	-14.4
	54 mbps	15.5	30	-14.5
CH (2462MHz)	11			
	1 mbps L	15.5	30	-14.5
	5.5 mbps L	15.3	30	-14.7
	11 mbps L	15.1	30	-14.9
	18 mbps	14.5	30	-15.5
	54 mbps	14.7	30	-15.3
Note: Above readings include a 1.1dB loss for cable and 20dB attenuator used at the input of analyzer.				

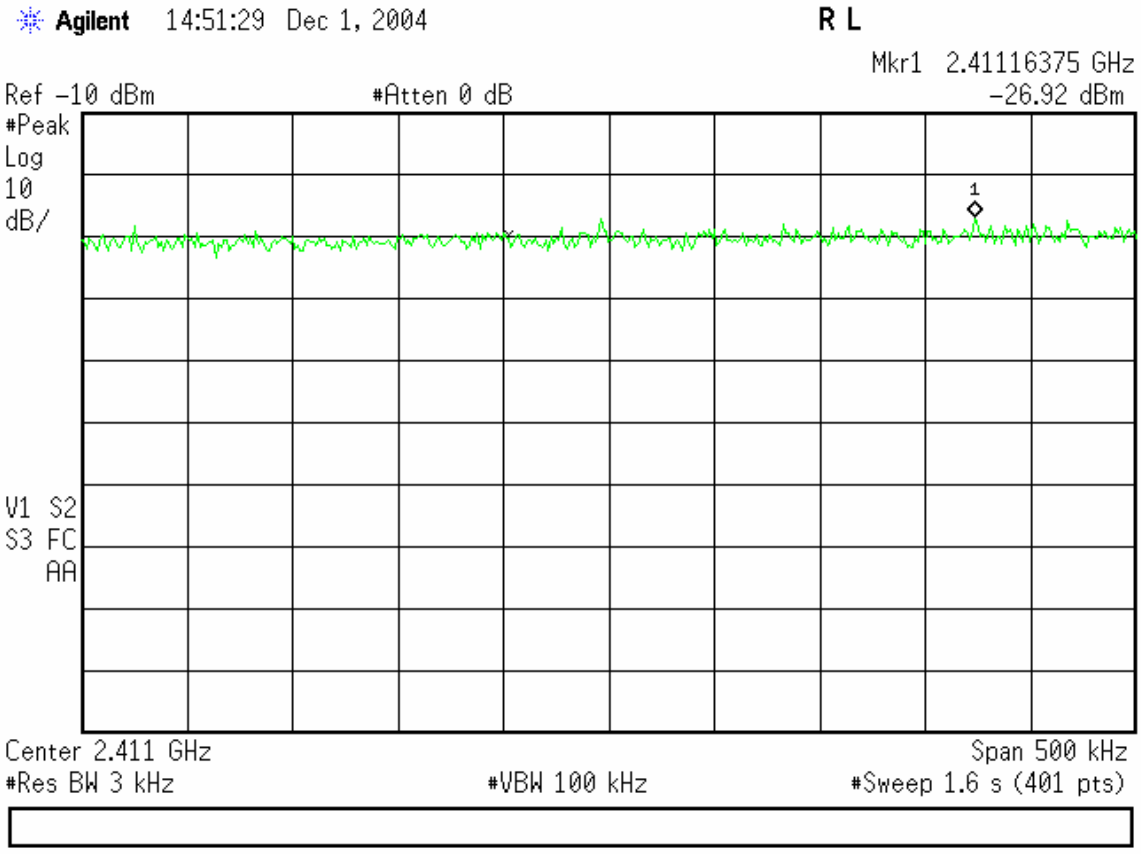
Note: POP option 2 method 1 as outlined in FCC document.

15.247(e)

Operating mode: 802.11b

Power spectral density shall be 8dBm or less.

Sample plot of PSD
CH1; DR 1 mbps Long



15.247(e)

Date: 12/1/2004
Company: Colubris Networks
EUT: CN200
Engineer: Mairaj Hussain

Analyzer: Orange **Cable:** #6

RBW: 3KHz **VBW:** 100KHz

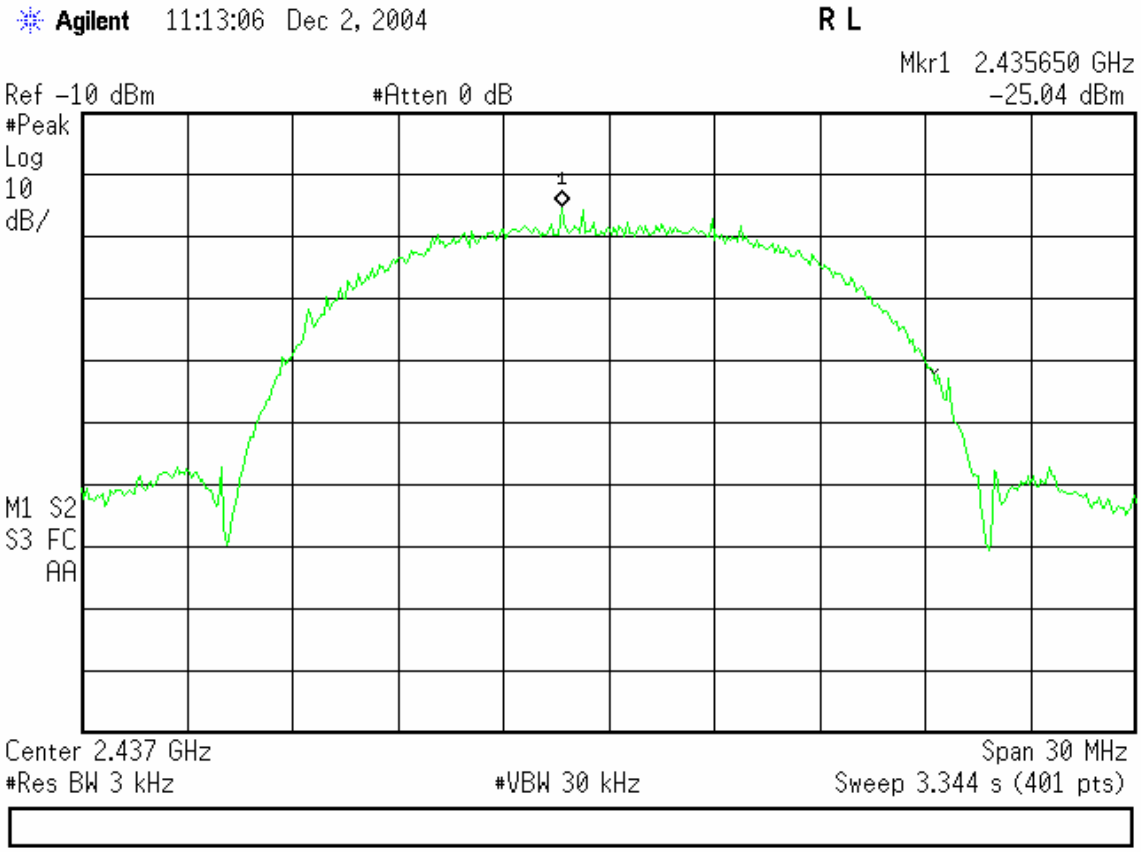
Measurement method: PSD option 2 as outlined in FCC guidelines for DTS. Max hold readings.

	Channel /Data Rate	PSD (dBm)	PSD Limit (dBm)	Margin (dB)
CH	1			
	1 mbps L	-5.8	8	-13.8
	5.5 mbps L	3.5	8	-4.5
	11 mbps S	2.4	8	-5.6
CH	6			
	1 mbps L	3.5	8	-4.5
	5.5 mbps L	2.7	8	-5.3
	11 mbps S	3	8	-5
CH	11			
	1 mbps L	3.3	8	-4.7
	5.5 mbps L	2.1	8	-5.9
	11 mbps S	1.7	8	-6.3

Note: Above readings include a 1.1dB loss for cable and 20dB attenuator used at the input of analyzer.

Operating mode: 802.11g

Sample plot
CH6; 5.5mbps L



15.247(e)

Date: 12/2/2004
Company: Colubris Networks
EUT: CN200
Engineer: JL

Analyzer: Orange **Cable:** #6

RBW: 3KHz **VBW:** 30KHz
Operating mode: 802.11g **PCDAC setting:** 44
Measurement method: PSD option 2 as outlined in FCC guidelines for DTS. Max hold readings

Channel /Data Rate		PSD (dBm)	PSD Limit (dBm)	Margin (dB)
CH (2412MHz)	1			
	1 mbps L	-7.1	8	-15.1
	5.5 mbps L	-6.4	8	-14.4
	11 mbps L	-7.3	8	-15.3
	18 mbps	-7.4	8	-15.4
	54 mbps	-6.9	8	-14.9
CH (2437MHz)	6			
	1 mbps L	-6.4	8	-14.4
	5.5 mbps L	-3.9	8	-11.9
	11 mbps L	-5.5	8	-13.5
	18 mbps	-7.7	8	-15.7
	54 mbps	-7.8	8	-15.8
CH (2462MHz)	11			
	1 mbps L	-6.8	8	-14.8
	5.5 mbps L	-6.3	8	-14.3
	11 mbps L	-3.1	8	-11.1
	18 mbps	-8.2	8	-16.2
	54 mbps	-8.7	8	-16.7

Note: Above readings include a 1.1dB loss for cable and 20dB attenuator used at the input of analyzer.

15.247(d)

"Radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz BW within the band that contains the highest level of desired power."

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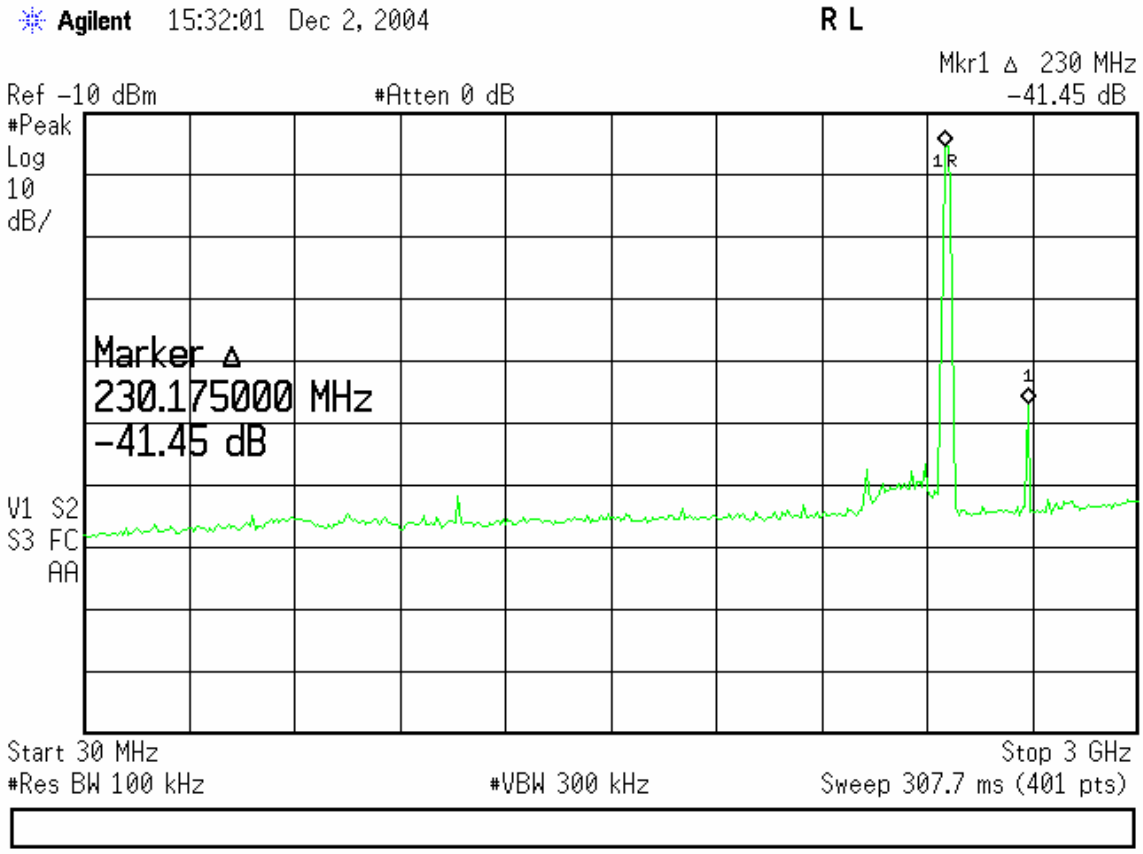
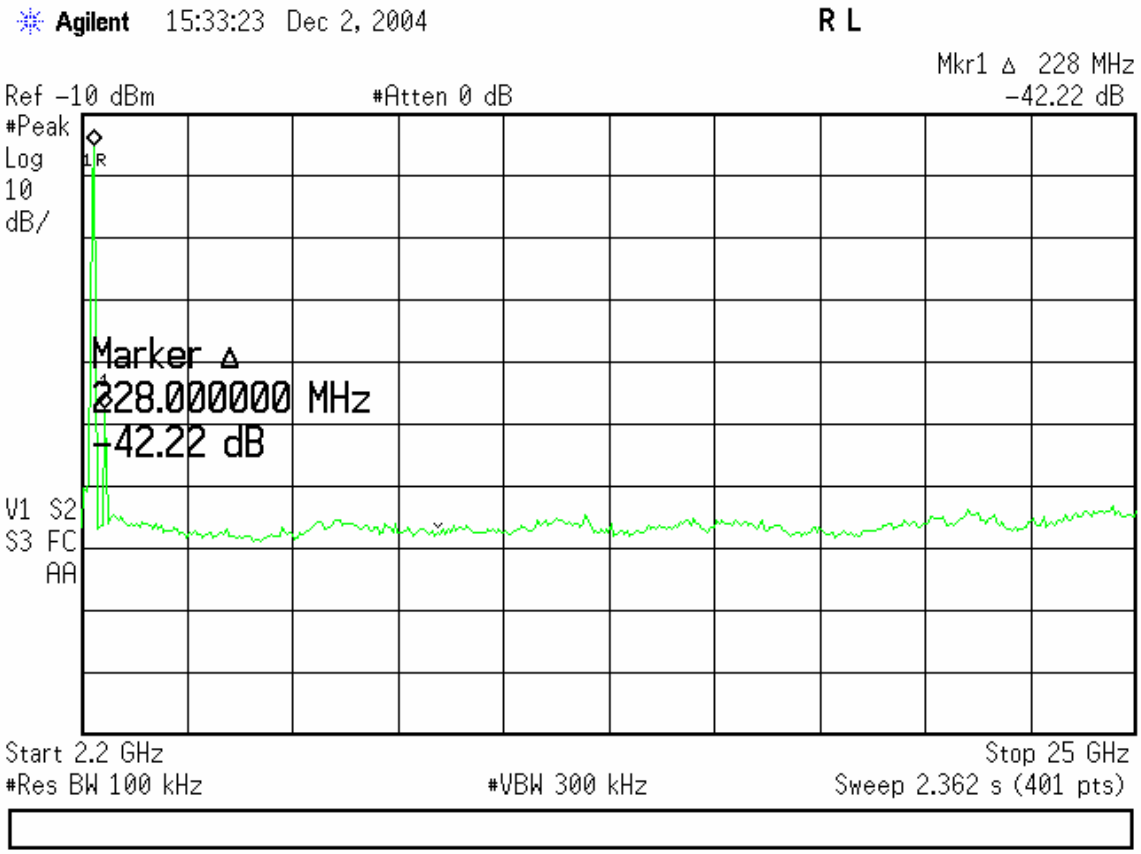
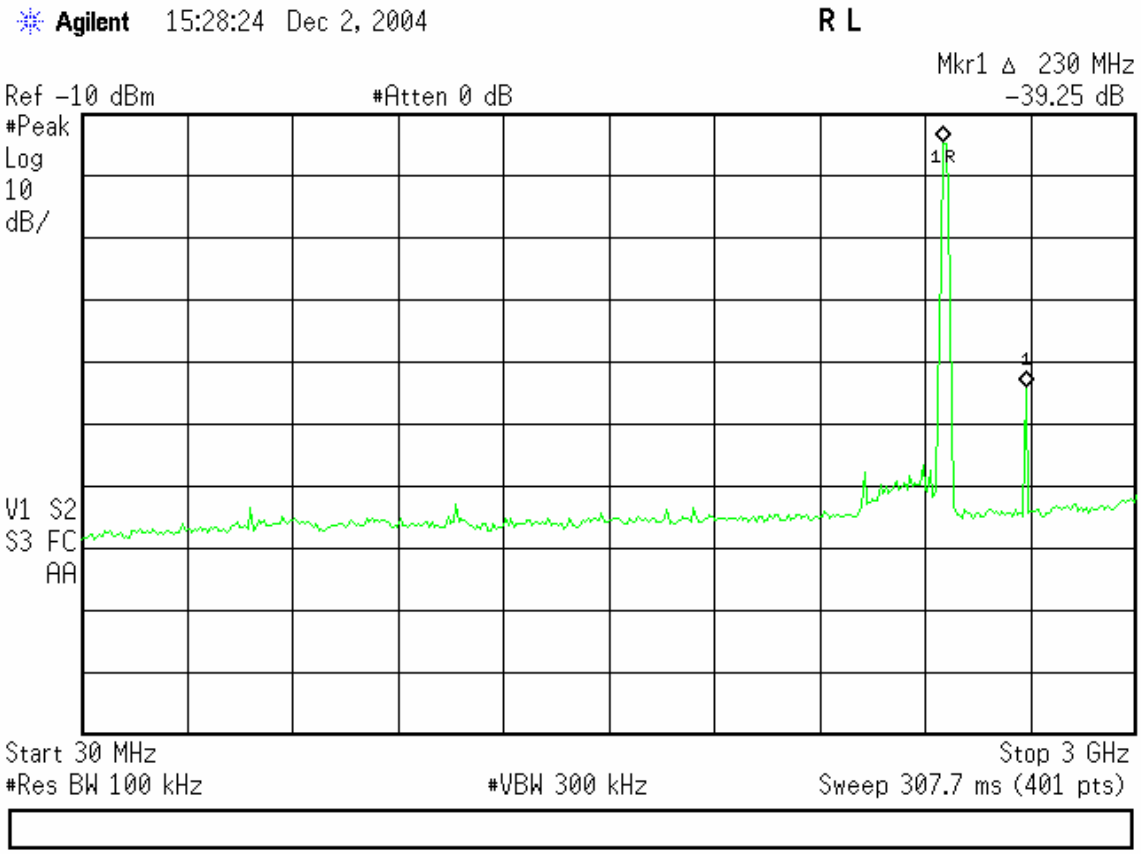
Conducted Spurious Emissions Operating mode: 802.11g
PCDAC 44, Ch11; 11mbps long
30-3000MHz



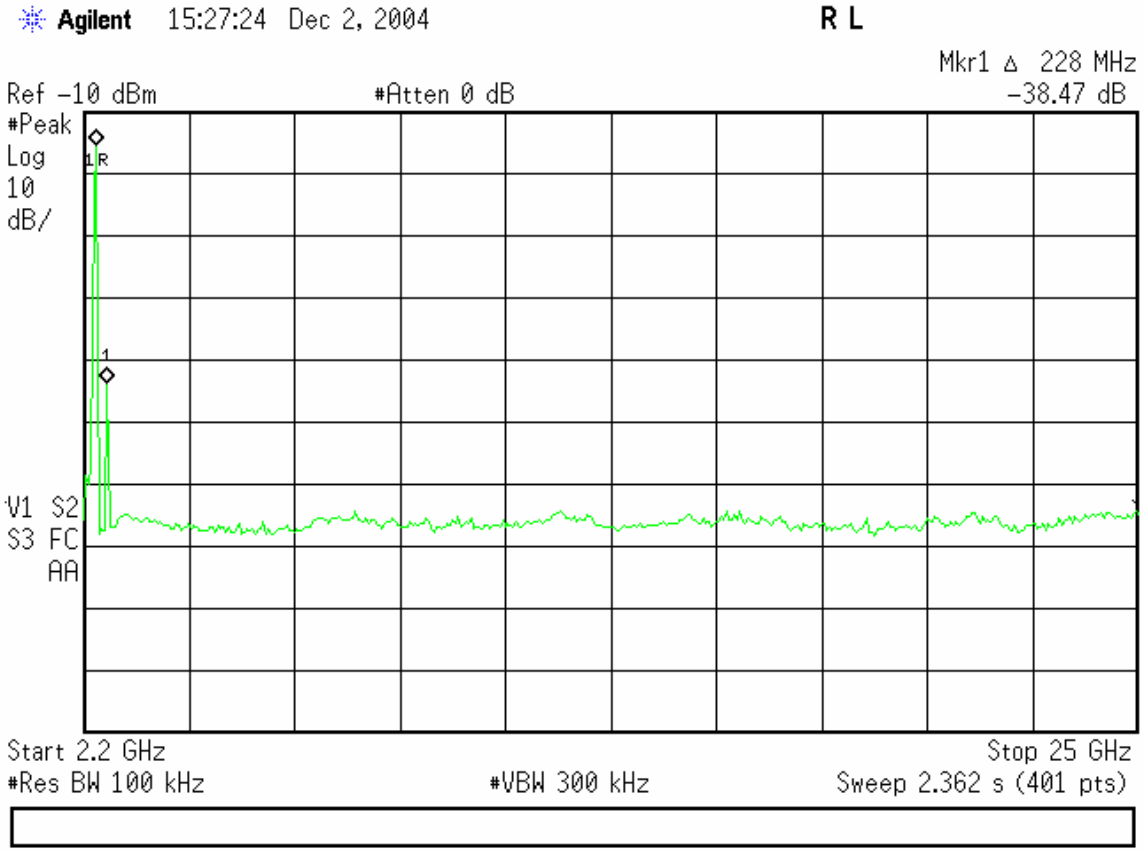
3-25GHz


Agilent 15:33:23 Dec 2, 2004
R L
Mkr1 Δ 228 MHz
-42.22 dB
Ref -10 dBm
#Atten 0 dB
#Peak
Log
10
dB/
1R
Marker Δ
228.000000 MHz
-42.22 dB
V1 S2
S3 FC
AA
Start 2.2 GHz
Stop 25 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.362 s (401 pts)

Conducted Spurious Emissions Operating mode: 802.11b
PCDAC 44, Ch11; 11mbps short
30-3000MHz



3-25GHz



Radiated Spurious Emissions

Radiated Emissions Table — *Curtis-Straus LLC*

29-Nov-04 **Company:** Colubris Networks **Work Order:** E1000
Engineer: Mairaj Hussain **EUT Desc:** CN 200

Frequency Range: 30 - 2000MHz **Measurement Distance:** 3 m
Notes: Tx and Rx modes **EUT Max Freq:** 5805MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	CISPR Class B Limit (dBµV/m)	CISPR Class B Margin (dB)	CISPR Class B Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
v	46.5	35.7	24.9	11.2	0.8	22.8	40.5	-17.7	Pass	40.0	-17.2	Pass
h	180.0	36.0	24.6	9.6	1.8	22.8	40.5	-17.7	Pass	43.5	-20.7	Pass
v	270.0	53.1	24.3	13.4	2.3	44.5	47.5	-3.0	Pass	46.0	-1.5	Pass
h	360.0	39.4	24.1	15.4	2.7	33.4	47.5	-14.1	Pass	46.0	-12.6	Pass
h	450.0	37.2	24.0	17.3	3.2	33.7	47.5	-13.8	Pass	46.0	-12.3	Pass
h	809.9	32.0	23.9	20.7	4.6	33.4	47.5	-14.1	Pass	46.0	-12.6	Pass
h	900.0	39.0	23.9	21.5	4.9	41.5	47.5	-6.0	Pass	46.0	-4.5	Pass

Removed C578 and C579 from the board. Added full loop ferrite (steward pn: HFA187102-0A2) on the DC power at the power supply end.

Table Result: Pass by -1.5 dB ***Worst Freq:*** 270.0 MHz

Test Site: "T" **Pre-Amp:** Orange **Cable:** 65 ft RG8A/U **Analyzer:** White **Antenna:** Grn-Red

Spurious Emissions												*Curtis-Straus LLC*
Date: 09-Dec-04			**Company:** Colubris								**Work Order:** E1000	
Engineer: Mairaj Hussain			**EUT Desc:** CN 200									
Frequency Range: 1 - 25GHz										**Measurement Distance:** 3 m		
Notes: Operating at 2462MHz Tx and Rx modes * Spurious emissions in Restricted band										**EUT Max Freq:** 5785MHz		
Antenna			**Preamp**	**Antenna**	**Cable**	**Adjusted**	**---**			**FCC Class B**		
Polarization	**Frequency**	**Reading**	**Factor**	**Factor**	**Factor**	**Reading**	**Limit**	**Margin**	**Result**	**Limit**	**Margin**	**Result**
(H / V)	(MHz)	(dBµV)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dBµV/m)	(dB)	(Pass/Fail)
*Havg	2360.0	42.2	24.2	29.6	1.9	49.5	---	---	---	54.0	-4.5	Pass
Hpk	2360.0	52.8	24.2	29.6	1.9	60.1	---	---	---	74.0	-13.9	Pass
Table Result: Pass by -4.5 dB										***Worst Freq:*** 2360.0 MHz		
Test Site: "A"			**Pre-Amp:** Or-Blk		**Cable:** 6 RG142LL		**Analyzer:** Orange			**Antenna:** Orange Horn		

Band edge data at the upper channel which falls at the edge of restricted band is given below.

Band Edge												*Curtis-Straus LLC*
Date: 16-Dec-04			**Company:** Colubris Networks								**Work Order:** E1000	
Engineer: Mairaj Hussain			**EUT Desc:** CN200									
										Measurement Distance: 3 m		
Notes: PCDAC at 44												
Antenna			**Preamp**	**Antenna**	**Cable**	**Adjusted**	**---**			**FCC Class B**		
Polarization	**Frequency**	**Reading**	**Factor**	**Factor**	**Factor**	**Reading**	**Limit**	**Margin**	**Result**	**Limit**	**Margin**	**Result**
(H / V)	(MHz)	(dBµV)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(Pass/Fail)	(dBµV/m)	(dB)	(Pass/Fail)
11g; CH11; 2462MHz; DR54mbps												
Hpk	2483.5	58.0	24.2	30.0	2.0	65.8				74.0	-8.2	Pass
Hpk	2485.8	55.3	24.2	30.0	2.0	63.1				74.0	-10.9	Pass
Havg	2483.5	36.8	24.2	30.0	2.0	44.6				54.0	-9.4	Pass
Havg	2485.5	32.0	24.2	30.0	2.0	39.8				54.0	-14.2	Pass
11b; CH112462MHz; DR 11mbps												
Hpk	2483.5	39.8	24.2	30.0	2.0	47.6				54.0	-6.4	Pass
Hpk	2484.3	51.0	24.2	30.0	2.0	58.8				74.0	-15.2	Pass
Hpk	2490.1	49.9	24.2	30.0	2.0	57.7				74.0	-16.3	Pass
Havg	2490.1	24.2	24.2	30.0	2.0	32.0				54.0	-22.0	Pass
Havg	2483.3	27.0	24.2	30.0	2.0	34.8				54.0	-19.2	Pass
Table Result: Pass by -6.4 dB										***Worst Freq:*** 2483.5 MHz		
Test Site: "T"			**Pre-Amp:** Or-Blk		**Cable:** 6 RG142LL		**Analyzer:** White			**Antenna:** Orange Horn		

Sample Calculation:

Adjusted Reading = Reading – Pre $Amp_{(factor)}$ + $Antenna_{(factor)}$ + $Cable_{(factor)}$

15.407(a)(1) & (6)

FCC 15.407(a)(1) & (6)

Work Order: E1000
Company: Colubris Networks
EUT: CN 200

Engineer: Mairaj Hussain **Date:** 11/30/2004 and 12/08/04

Site: T **Spectrum analyzer:** Orange **Cable:** #7

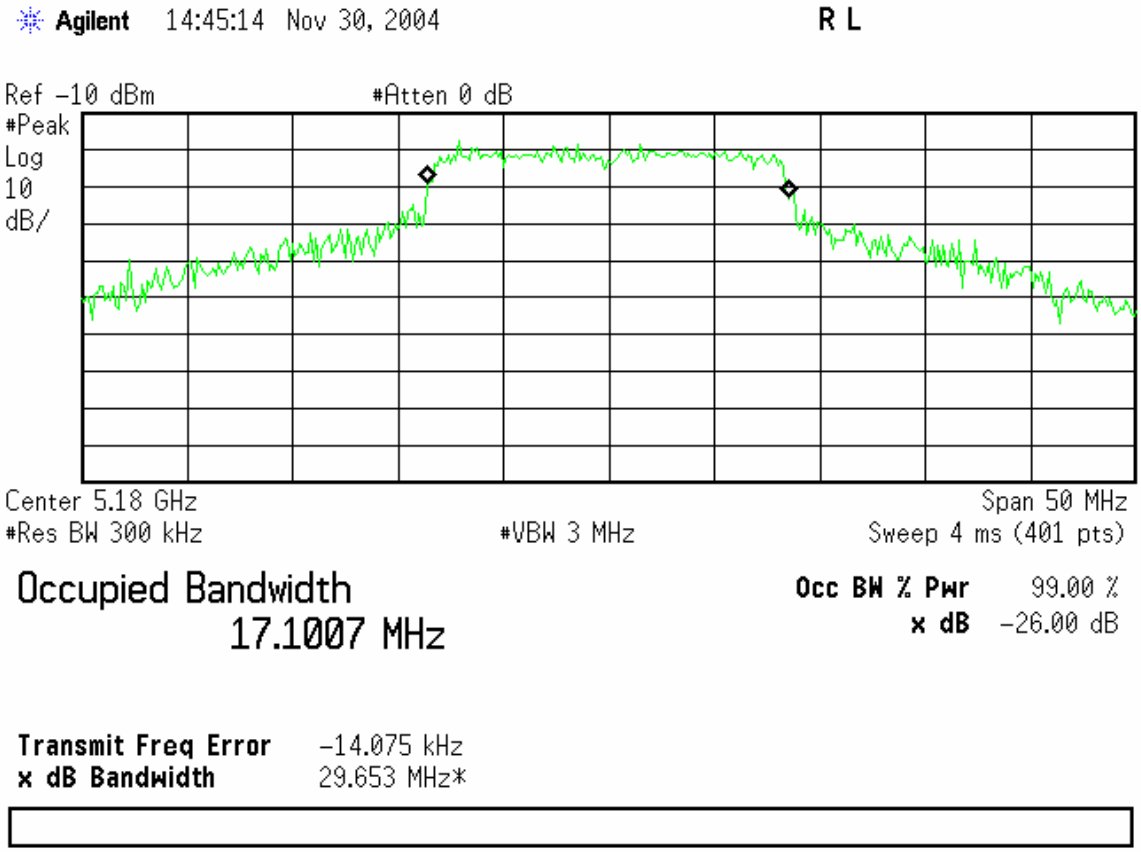
Note: 20dB pad used PC DAC at 44

Band 5.15-5.25GHz								**Limits**		
Channel/Data Rate		**26dB BW (MHz)**	**OCC BW (MHz)**	**Peak Power (dBm)**	**PPSD (dBm)**	**Peak Ex (dB)**		Peak Power (dBm)	PPSD (dBm)	Pk Excu (less than)
CH	44									
DR	6 mbps	31.6	17	13.54	2.62	10		**17**	**4**	13dB
	18 mbps	26.7	16.8	15	3.4	10.8		**17**	**4**	13dB
	36 mbps	29.1	16.7	13.3	2.43	10.6		**17**	**4**	13dB
	54 mbps	25	16.8	13.42	2.54	10.8		**17**	**4**	13dB
CH	48									
DR	6 mbps	26.9	16.7	13.4	2.7	10.1		**17**	**4**	13dB
	18 mbps	26.3	16.7	14.4	3.5	10.5		**17**	**4**	13dB
	36 mbps	26.8	16.78	13.71	2.81	11.1		**17**	**4**	13dB
	54 mbps	27.1	16.8	13.41	2.56	10.9		**17**	**4**	13dB
CH	36									
DR	6 mbps	29.6	17.1	12.6	1.9	10.6		**17**	**4**	13dB
	18 mbps	29.7	16.8	13.34	3	9.9		**17**	**4**	13dB
	36 mbps	32	17.1	12.43	1.8	11.1		**17**	**4**	13dB
	54 mbps	33.6	16.87	12.48	1.7	11.4		**17**	**4**	13dB

Note: Above readings include factors for 20dB pad and cable loss(1.8dB)

Sample BW plot

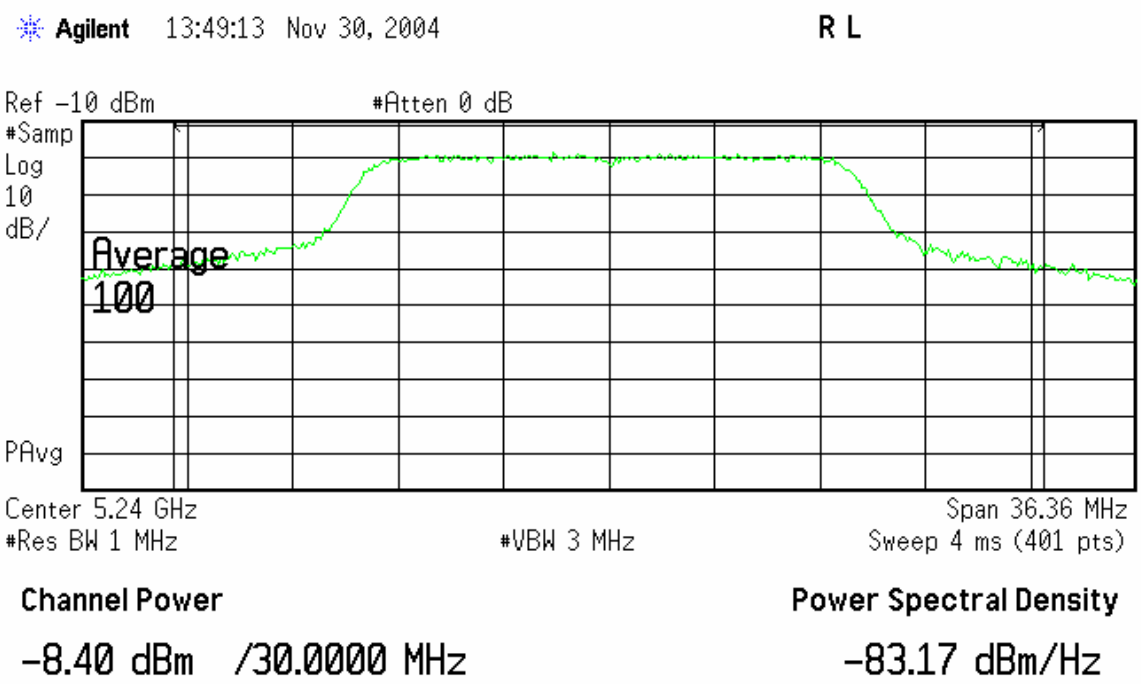
CH36; DR 6 mbps



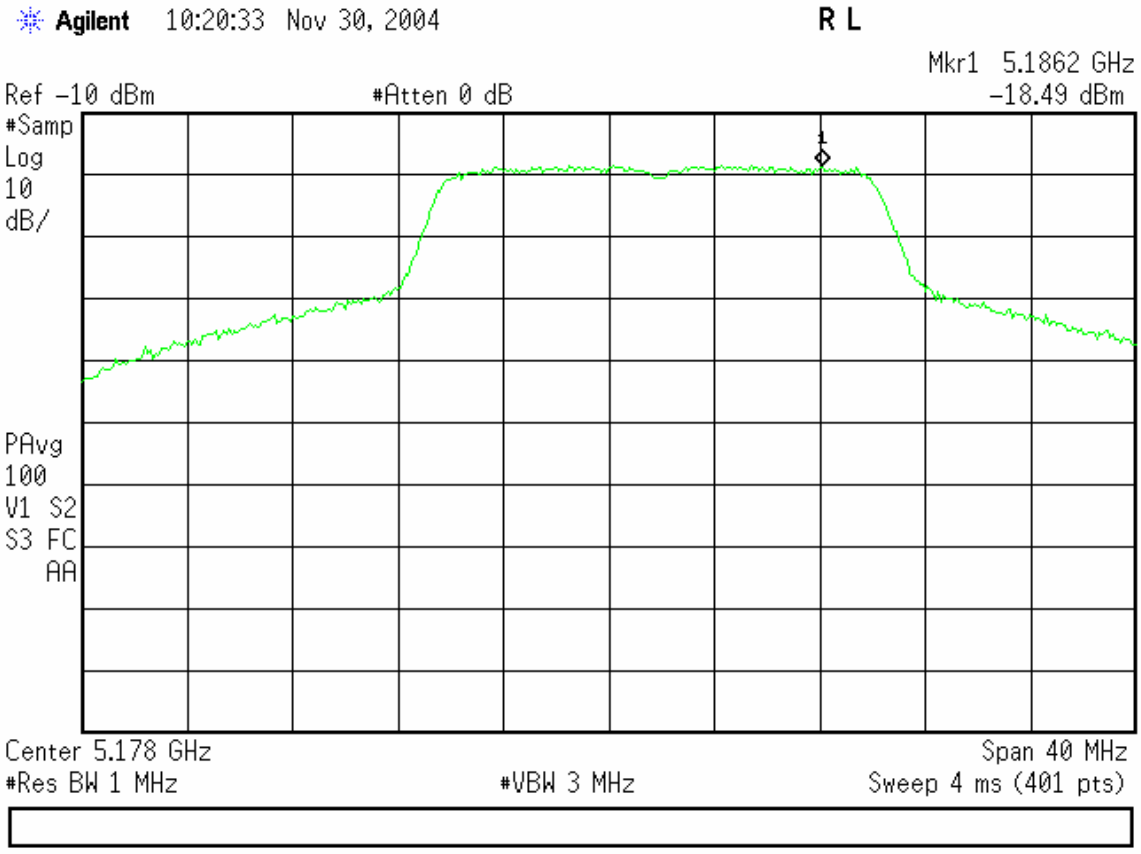
Sample PoP plot

CH 48; 5240 MHz

DR 6 mbps



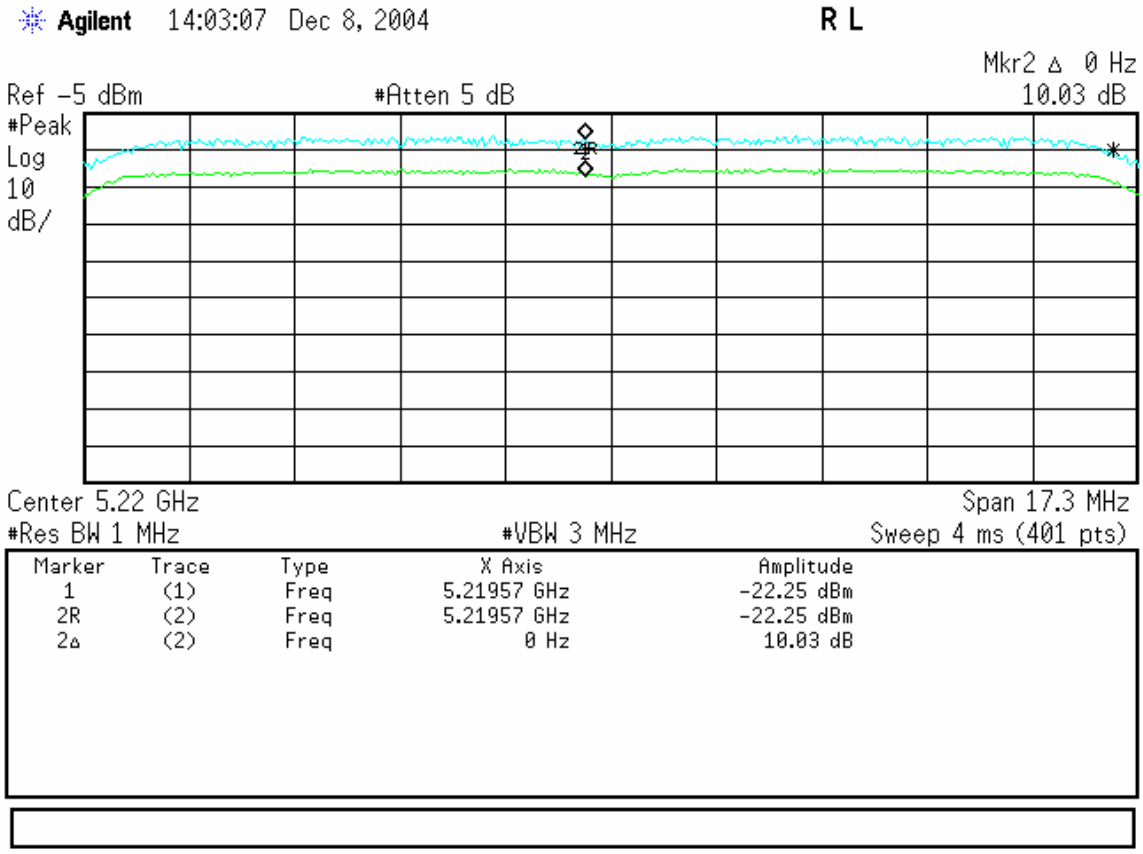
Sample PPSD Plot
CH36; DR 54 mbps



Sample Peak Excursion Plot

CH 44; 5220 MHz

DR 6 mbps



15.407(a)(3)

-26dB Bandwidth and Occupied Bandwidth

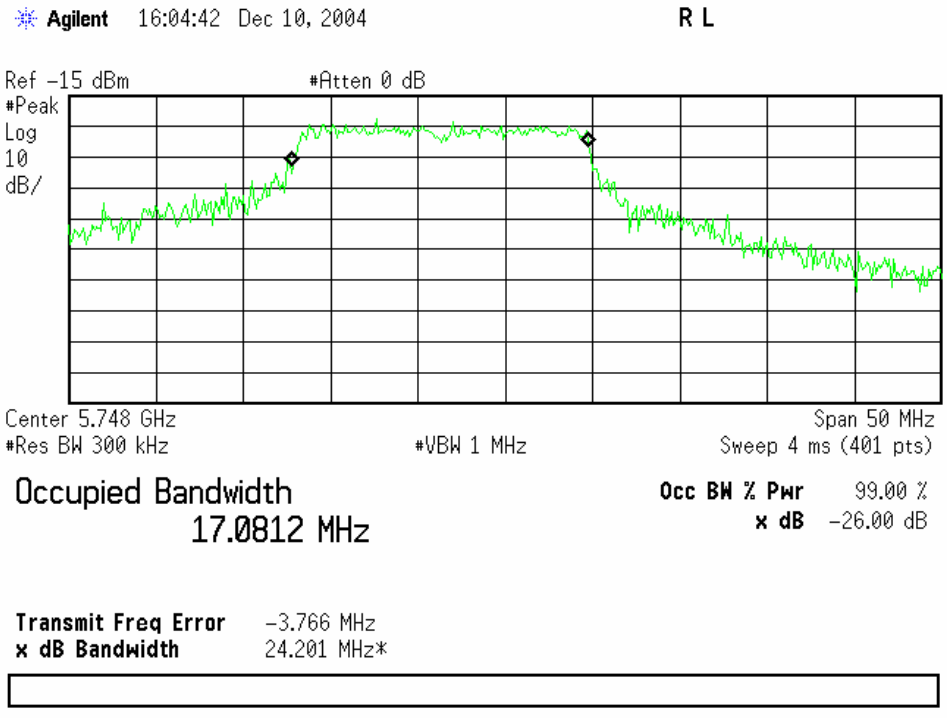
Work Order: E1000
Company: Colubris
Date: 12-10-13-04
Engineer: Mairaj Hussain
EUT: CN200

Analyzer: Orange **Cable:** #6

CH	DR mbps	-26dB BW (MHz)	OCC BW (MHz)
149	6	24.2	17
	18	26.6	16.9
	36	16.8	16.9
	54	25.6	16.6
153	6	29.7	17.8
	18	27.4	16.9
	36	28.3	16.6
	54	28.7	16.8
161	6	27.8	17
	18	27.7	16.8
	36	27.3	16.8
	54	27.4	17.1

Sample BW Plot

CH149; DR 6mbps



15.407(a)(3) 5.725 - 5.825 GHz Band
Peak Output Power Readings

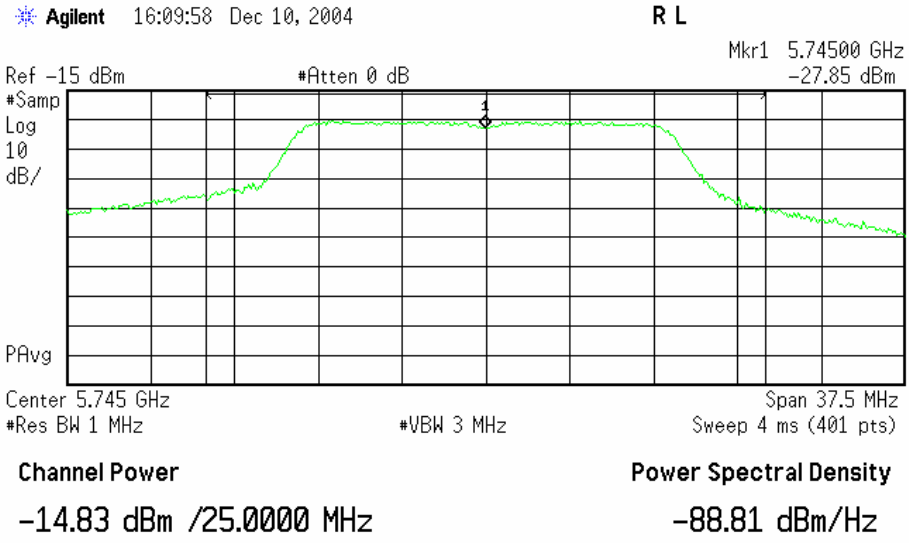
Work Order: E1000
Company: Colubris
Date: 12-10-13-04
Engineer: Mairaj Hussain

Analyzer: Orange **Cable:** #6
PCDAC set at: 30
Note: FCC Public Notice DA 02-2138; Method 1

CH	Data rate (mbps)	Center Frequency (MHz)	Channel Power (dBm)	Cab Factor (dB)	Pad (dB)	Adjusted Reading (dBm)	Limit (dBm)	Margin (dB)
149	6	5745	-14.8	3.3	20	8.5	30	-21.5
	18	5745	-14.8	3.3	20	8.5	30	-21.5
	36	5745	-14.1	3.3	20	9.2	30	-20.8
	54	5745	-14.9	3.3	20	8.4	30	-21.6
153	6	5765	-14	3.3	20	9.3	30	-20.7
	18	5765	-13.3	3.3	20	10	30	-20.0
	36	5765	-13.8	3.3	20	9.5	30	-20.5
	54	5765	-13.8	3.3	20	9.5	30	-20.5
161	6	5805	-12.3	3.3	20	11	30	-19
	18	5805	-13.2	3.3	20	10.1	30	-19.9
	36	5805	-12.4	3.3	20	10.9	30	-19.1
	54	5805	-12.6	3.3	20	10.7	30	-19.3

Sample Peak out put power plot

PCDAC at 30
CH149; DR 6mbps



15.407(a)(3) 5.725 - 5.825 GHz Band
Peak Power Spectral Density

Work Order: E1000
Company: Colubris
Date: 12-10-13-04
Engineer: Mairaj Hussain

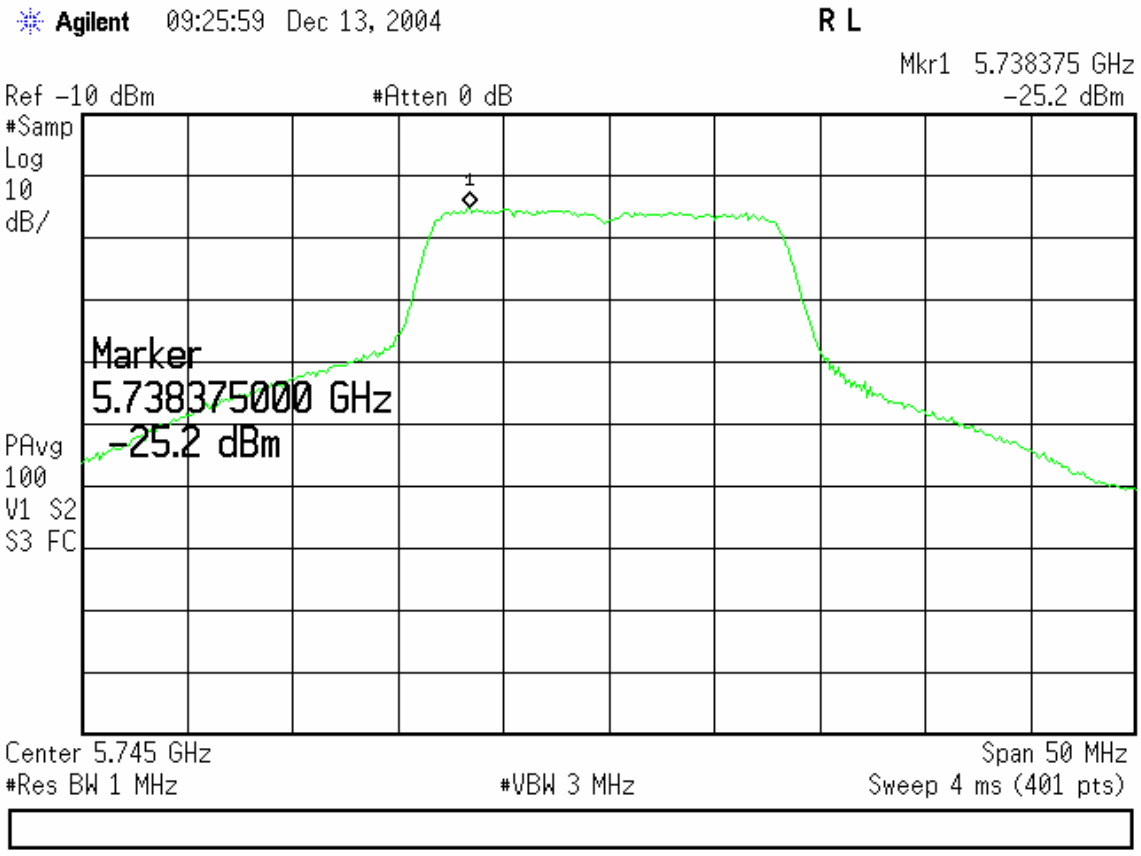
Analyzer: Oeange **Cable:** #6

Note: FCC Public Notice DA 02-2138; Method 2
PCDAC set at 30

CH	Data rate (mbps)	Center Frequenc (MHz)	PPSD (dBm)	Cab Factor (dB)	Pad (dB)	Adjusted Reading (dBm)	Limit (dBm)	Margin (dB)
149	6	5745	-25.6	3.3	20	-2.3	17	-19.3
	18	5745	-25.2	3.3	20	-1.9	17	-18.9
	36	5745	-25.3	3.3	20	-2	17	-19
	54	5745	-25.3	3.3	20	-2	17	-19
153	6	5765	-25.8	3.3	20	-2.5	17	-19.5
	18	5765	-24.2	3.3	20	-0.9	17	-17.9
	36	5765	-24.3	3.3	20	-1	17	-18
	54	5765	-24.3	3.3	20	-1	17	-18
161	6	5805	-23.5	3.3	20	-0.2	17	-17.2
	18	5805	-23.8	3.3	20	-0.5	17	-17.5
	36	5805	-23.8	3.3	20	-0.5	17	-17.5
	54	5805	-23.6	3.3	20	-0.3	17	-17.3

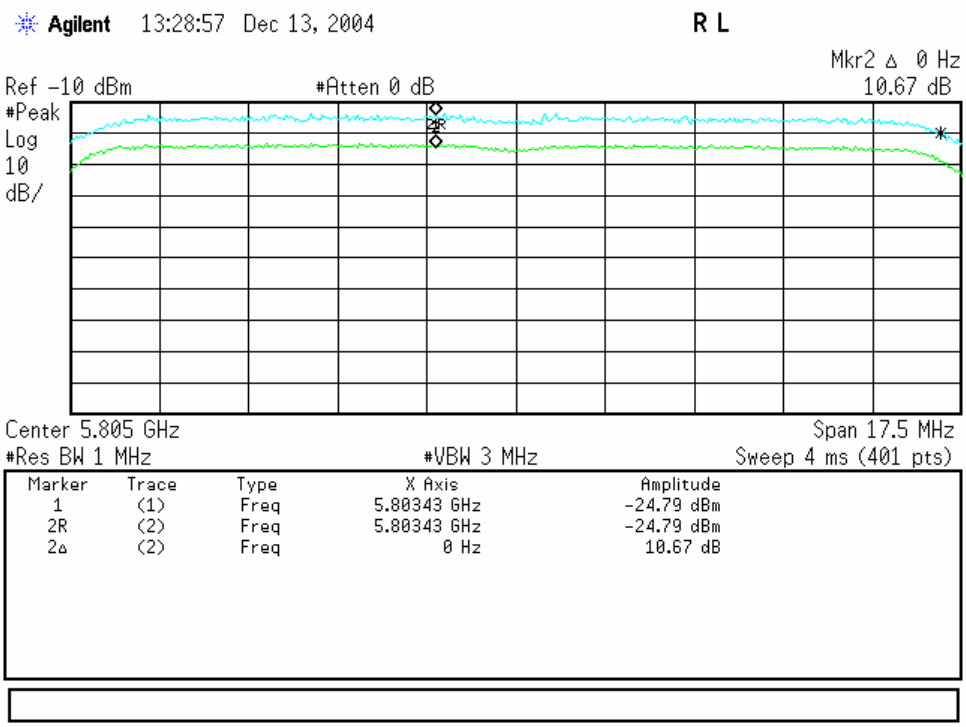
Sample PPSD plot

CH149; DR 18mbps



15.407(a)(3) 5.725 - 5.825 GHz Band *Peak Excursion*				
Work Order: E1000 **Company:** Colubris **Date:** 12-10-13-04 **Engineer:** Mairaj Hussain				
Note: FCC Public Notice DA 02-2138 **Analyzer:** Oeange **Cable:** #6				
CH	**Data rate** (mbps)	**Excu Frequenc** (MHz)	**Peak Excursion** (dBm)	**Limit** (dBm)
149	6	5754	11.26	13
	18	5739	11.28	13
	36	5751.2	10.5	13
	54	5744.7	11.1	13
153	6	5756.1	11.5	13
	18	5765..4	10.6	13
	36	5773.9	11.3	13
	54	5773	11.4	13
161	6	5804	10.5	13
	18	5805.7	10.1	13
	36	5803.4	10.7	13
	54	5804.6	10.5	13

Sample Peak excursion plot
CH161; DR 36mbps


Agilent 13:28:57 Dec 13, 2004
R L
Mkr2 Δ 0 Hz
10.67 dB
Ref -10 dBm
#Atten 0 dB
#Peak
Log
10
dB/
Center 5.805 GHz
Span 17.5 MHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 5.80343 GHz -24.79 dBm
2R (2) Freq 5.80343 GHz -24.79 dBm
2Δ (2) Freq 0 Hz 10.67 dB

14.407(b)(1)

Band Edge 15.407(b)(1) *Curtis-Straus LLC*

Date: 20-Dec-04 **Company:** Colubris Networks **Work Order:** E1000
Engineer: Mairaj Hussain **EUT Desc:** CN200

Notes: RBW: 1MHz; VBW: 3MHz

Channel/ Data Rate	Frequency (MHz)	Reading (dBm)	Antenna Gain (dBi)	Cable Factor (dB)	Attenuator (dB)	Adjusted EIRP (dBm)	FCC 15.407(b)(1) Limit (dBm)	Margin (dB)	Result (Pass/Fail)
36/6mbps	5150.0	-61.8	2.5	3.0	20.0	-36.3	-27.0	-9.3	Pass
36/6mbps	5148.6	-60.0	2.5	3.0	20.0	-34.5	-27.0	-7.5	Pass
36/54mbps	5150.0	-61.8	2.5	3.0	20.0	-36.3	-27.0	-9.3	Pass
36/5mbps	5145.9	-60.4	2.5	3.0	20.0	-34.9	-27.0	-7.9	Pass

Cable: 6 RG142LL **Analyzer:** Orange **Antenna:** Yellow Horn

14.407(b)(4)

For spurious emissions below 1GHz please see table under section 15.247(d).

Radiated Spurious Emissions Table *Curtis-Straus LLC*

Date: 10-Dec-04 **Company:** Colubris **Work Order:** E1000
Engineer: Mairaj Hussain **EUT Desc:** CN200

Frequency Range: 1 - 40MHz **Measurement Distance:** 3 m

Notes: Recheck failing spurious emissions with new radio sample PDAC at 30; operating at 5765MHz
RBW:1MHz
VBW:3MHz, 30Hz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
Havg	4979.0	36.0	22.5	35.7	2.8	52.0				54.0	-2.0	Pass
Hpk	4979.0	45.0	22.5	35.7	2.8	61.0				74.0	-13.0	Pass
Hpk	5020.0	32.3	22.5	35.8	2.8	48.4				54.0	-5.6	Pass

Table Result: Pass by -2.0 dB ***Worst Freq:*** 4979.0 MHz

Test Site: "F" **Pre-Amp:** Or-Blk HF PA **Cable:** 6 RG142LL Microflex # 9 **Analyzer:** Orange **Antenna:** Orange Horn HF Horn 26.6-40GHz Mixer

Band Edge15.407(b)(4)

Date: 10-Dec-04 **Company:** Colubris
Engineer: Mairaj Hussain **EUT Desc:** CN200
Work Order: E1000

cable # 6 Orange Spectrum Analyzer RBW: 1MHz; VBW: 3MHZ

Channel	Frequency (MHz)	Reading (dBm)	Cab. Factor (dB)	Pad (dB)	Ant gain (dBi)	Adj Reading (dBm)	Limit (dBm)
149	5725	-43.3	3.3	20	2.5	-17.5	-17
	5715	-53.3	3.3	20	2.5	-27.5	-27
	5723	-44.2	3.3	20	2.5	-18.4	-17
161							
	5825	-45.8	3.3	20	2.5	-20	-17
	5835	-60.4	3.3	20	2.5	-34.6	-27
	5826.9	-46	3.3	20	2.5	-20.2	-17

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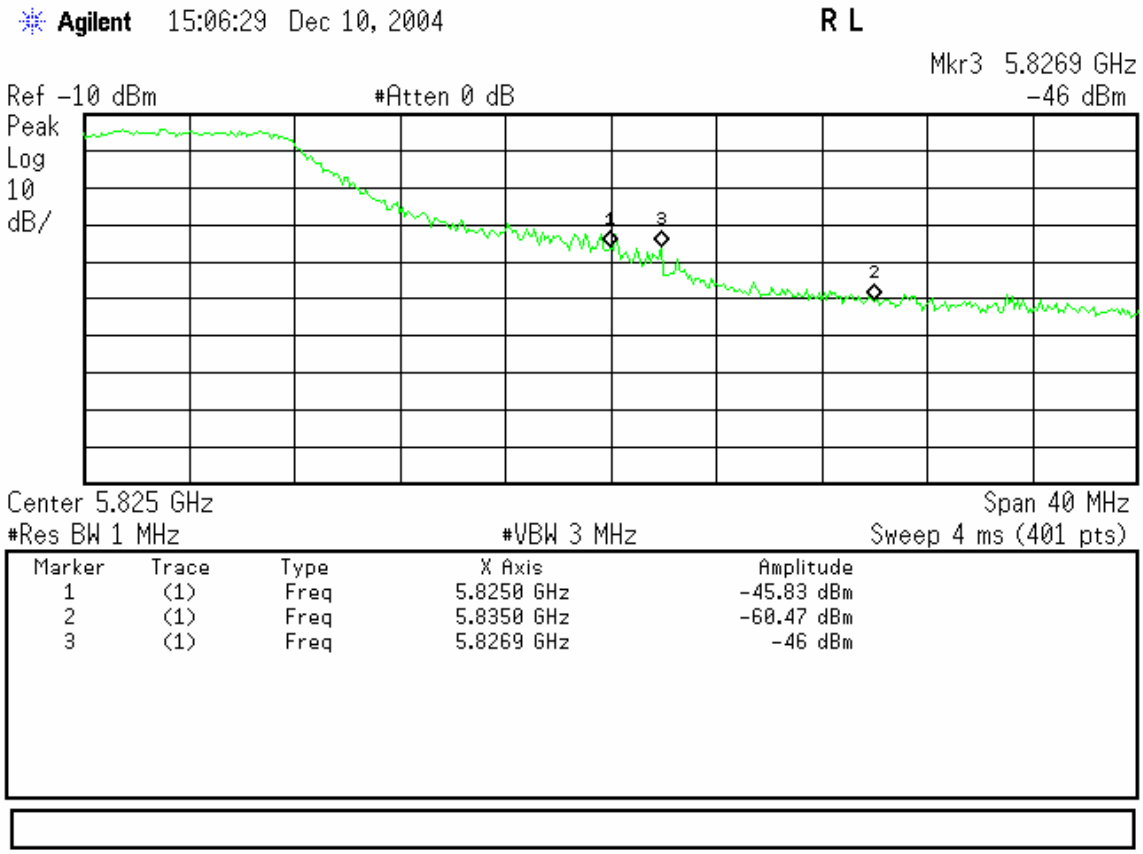
Sample band edge plot

PCDAC set at 30; Operating at 5805MHz; CH161



Upper Channel Band edge

Spurious emissions while running at 5.18GHz, lower UNI band.

Radiated Emissions Table

Curtis-Straus LLC

Date: 09-Dec-04 **Company:** Colubris Networks **Work Order:** E1000
Engineer: Mairaj Hussain **EUT Desc:** CN200

Frequency Range: 1 - 40 GHz **Measurement Distance:** 3 m

Notes: Operating at 5.18GHz (Tx/Rx modes checked) RBW: 1MHz; VBW: 30Hz & 3MHz **EUT Max Freq:** 5785MHz
No other spurious emissions found above 18GHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	FCC 15.407(b)			FCC Class B		
									EIRP	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Hpk	4319.0	47.0	23.0	34.3	2.7	61.0			-34.2	-27	-7.2	Pass
HpkBand edge	5150.0	45.0	22.5	36.0	2.9	61.4			Pass	74.0	-12.6	Pass
Havg	5150.0	34.0	22.5	36.0	2.9	50.4			Pass	54.0	-3.6	Pass
Havg	5147.5	34.8	22.5	36.0	2.9	51.2			Pass	54.0	-2.8	Pass
Hpk	5147.5	37.4	22.5	36.0	2.9	53.8			Pass	74.0	-20.2	Pass
Hpk	5960.0	41.0	22.7	36.8	3.4	58.5			-36.7	-27.0	-9.7	Pass

Test Site: "A" **Pre-Amp:** Or-Blk **Cable:** 6 RG142LL Microflex #7 **Analyzer:** Orange **Antenna:** Orange Horn HF horn 26.5-40GHz mixer

IC Peak Excursion and PPSD Data

RSS 210 Issue 5

Work Order: E1000
Company: Colubris Networks
Date: 12-10-13-04
Engineer: Mairaj Hussain

Peak Excursion

CH	DR (mbps)	Peak Excursion (dB)	6.2.2(q1)(iv)(b) Limit (dB)	Reduction in PPSD limit (dB)
36	6	10.6	3	7.6
	18	9.9	3	6.9
	36	11.1	3	8.1
	54	11.4	3	8.4
44	6	10	3	7
	18	10.8	3	7.8
	36	10.6	3	7.6
	54	10.8	3	7.8
48	6	10.1	3	7.1
	18	10.5	3	7.5
	36	11.1	3	8.1
	54	10.9	3	7.9

Peak Power Spectral Density

CH	DR	PPSD (dBm)	6.2.2(q1)(iii) Adjusted PPSD (dBm)	Margin (dB)	Result (Pass/Fail)
36	6	-2.3	9.4	-11.7	Pass
	18	-1.9	10.1	-12	Pass
	36	-2	8.9	-10.9	Pass
	54	-2	8.6	-10.6	Pass
44	6	-2.5	10	-12.5	Pass
	18	-0.9	9.2	-10.1	Pass
	36	-1	9.4	-10.4	Pass
	54	-1	9.2	-10.2	Pass
48	6	-0.2	9.9	-10.1	Pass
	18	-0.5	9.5	-10	Pass
	36	-0.5	8.9	-9.4	Pass
	54	-0.3	9.1	-9.4	Pass

RSS 210 Issue 5

Work Order: E1000
Company: Colubris Networks
Date: 12-10-13-04
Engineer: Mairaj Hussain

Peak Excursion

CH	DR (mbps)	Excursion Frequency (MHz)	Peak Excursion (dB)	6.2.2(q1)(iv)(b) Limit (dB)	6.2.2(q1)(iv)(b) Reduction in PPSD limit (dB)
149	6	5754	11.26	3	8.26
	18	5739	11.28	3	8.28
	36	5751.2	10.5	3	7.5
	54	5744.7	11.1	3	8.1
153	6	5756.1	11.5	3	8.5
	18	5765.4	10.6	3	7.6
	36	5773.9	11.3	3	8.3
	54	5773	11.4	3	8.4
161	6	5804	10.5	3	7.5
	18	5805.7	10.1	3	7.1
	36	5803.4	10.7	3	7.7
	54	5804.6	10.5	3	7.5

Peak Power Spectral Density

CH	DR	Center Frequency (MHz)	PPSD (dBm)	6.2.2(q1)(iii) Adjusted PPSD Limit (dBm)	Margin (dB)	Result (Pass/Fail)
149	6	5745	-2.3	8.74	-11.04	Pass
	18	5745	-1.9	8.72	-10.62	Pass
	36	5745	-2	9.5	-11.5	Pass
	54	5745	-2	8.9	-10.9	Pass
153	6	5765	-2.5	8.5	-11	Pass
	18	5765	-0.9	9.4	-10.3	Pass
	36	5765	-1	8.7	-9.7	Pass
	54	5765	-1	8.6	-9.6	Pass
161	6	5805	-0.2	9.5	-9.7	Pass
	18	5805	-0.5	9.9	-10.4	Pass
	36	5805	-0.5	9.3	-9.8	Pass
	54	5805	-0.3	9.5	-9.8	Pass

15.407(g)

Frequency Stability				Curtis-Straus LLC
Engineer:	Evan Gould		**Company:**	Colubris
Date:	12/15/2004		**EUT:**	CN200
Analyzer:	Green		**Work Order:**	E1000
Cable:	142LL#6			
Note:	Nominal values are taken at 20°C, 5VDC			

Temperature	Supply Voltage	Channel	Center Frequency	Frequency Delta
(°C)	(VDC)	(#)	(Hz)	(Hz)
-10	5	36	5179990586	30162
-10	5	149	5744988504	34039
20	4.25	36	5179961599	1175
20	4.25	149	5744955065	600
20	5	36	5179960424	0
20	5	149	5744954465	0
20	5.75	36	5179960510	86
20	5.75	149	5744954428	-37
60	5	36	5179994638	34214
60	5	149	5745046453	91988

AC Line Conducted Emission Measurements

AC Mains Conducted Emissions — *Curtis-Straus LLC*

Date: 20-Dec-04 **Company:** Colubris Networks **Work Order:** E1000
Engineer: Mairaj Hussain **EUT Desc:** EMI2 **Test Site:** EMI2
Notes:
LISN(s): Red Yellow-Black
Range: 0.15-30Mhz **Other Equipment:** --- **Spectrum Analyzer:** Blue

	Q.P. Readings		Ave. Readings		Impedance Factor	---		FCC/CISPR B		FCC/CISPR B		Overall
Frequency (MHz)	QP1 (dBµV)	QP2 (dBµV)	AV1 (dBµV)	AV2 (dBµV)	(dB)	Limit (dBµV)	Margin dB	qp Limit (dBµV)	qp Margin dB	AVE Limit (dBµV)	AVE Margin dB	Result (Pass/Fail)
0.16	24.7	24.0			20.0	---	---	65.5	-20.8	55.5	-10.8	Pass
0.22	21.6	26.0			20.0	---	---	62.8	-16.8	52.8	-6.8	Pass
0.28	16.0	15.8			20.0	---	---	60.8	-24.8	50.8	-14.8	Pass
0.33	17.8	18.5			20.0	---	---	59.4	-20.9	49.4	-10.9	Pass
0.56	12.0	13.5			20.0	---	---	56.0	-22.5	46.0	-12.5	Pass
0.96	12.0	10.5			20.0	---	---	56.0	-24.0	46.0	-14.0	Pass
4.10	9.6	7.7			20.0	---	---	56.0	-26.4	46.0	-16.4	Pass
9.87	11.5	11.2			20.0	---	---	60.0	-28.5	50.0	-18.5	Pass

Table Result: Pass by -6.80 dB ***Worst Freq:*** 0.22 MHz

AC line conduct emissions were also performed with power over ether net option. Below is the data obtained for conducted emissions with this option.

AC Mains Conducted Emissions — *Curtis-Straus LLC*

Date: 20-Jan-05 **Company:** Colubris Networks **Work Order:** E1000
Engineer: Ozgur Ozturk **EUT Desc:** CN200 **Test Site:** EMI3
Notes: AC side of PowerDsine 3001 power over ethernet adapter
LISN(s): Orange
Range: 0.15-30Mhz **Other Equipment:** --- **Spectrum Analyzer:** Red

	Q.P. Readings		Ave. Readings		Impedance Factor	FCC B Applicable until July 12, 2004		FCC/CISPR B		FCC/CISPR B		Overall
Frequency (MHz)	QP1 (dBµV)	QP2 (dBµV)	AV1 (dBµV)	AV2 (dBµV)	(dB)	Limit (dBµV)	Margin dB	qp Limit (dBµV)	qp Margin dB	AVE Limit (dBµV)	AVE Margin dB	Result (Pass/Fail)
3.55	19.6	16.7			20.0	47.9	-8.3	56.0	-16.4	46.0	-6.4	Pass
7.64	14.8	15.8			20.0	47.9	-12.1	60.0	-24.2	50.0	-14.2	Pass
17.95	16.7	16.1			20.0	47.9	-11.2	60.0	-23.3	50.0	-13.3	Pass
21.24	18.7	19.1			20.0	47.9	-8.8	60.0	-20.9	50.0	-10.9	Pass
23.29	19.6	20.2			20.0	47.9	-7.8	60.0	-19.9	50.0	-9.9	Pass
24.19	21.4	21.5			20.0	47.9	-6.4	60.0	-18.5	50.0	-8.5	Pass

Table Result: Pass by -6.37 dB ***Worst Freq:*** 24.19 MHz

LIMITS

Quasi-Peak: 250µV = 47.9dBµV in the range 450kHz to 30MHz

[47 CFR 15.207(a) Revised as of October 1, 2001]

Note: On July 12, 2004, FCC adopts the conducted emissions limits of the European CISPR 22 standard as outlined below

Frequency of emission (MHz)	Quasi-peak limit (dBµV)	Average limit (dBµV)
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.

[47 CFR 15.207(a) Revised as of October 1, 2002; amended by ET Docket 98-80; FCC 02-157, published in the Federal Register Vol. 67, No. 132, on Wednesday, July 10, 2002]

Test Equipment Used

REV. 07-DEC-2004

SPECTRUM ANALYZERS / RECEIVERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	9kHz-1.8GHz	8591E	HP	3441A03559	00024	26-MAY-2005
WHITE	9kHz-22GHz	8593E	HP	3547U01252	00022	04-MAR-2005
BLUE	9kHz-1.8GHz	8591E	HP	3223A00227	00070	03-NOV-2005
YELLOW	9kHz-2.9GHz	8594E	HP	3523A01958	00100	11-AUG-2005
GREEN	9kHz-26.5GHz	8593E	HP	3829A03618	00143	02-AUG-2005
BLACK	9kHz-12.8GHz	8596E	HP	3710A00944	00337	18-AUG-2005
YELLOW-BLACK	20Hz-40.0MHz	3585A	HP	2504A05219	00030	08-OCT-2005
TELECOM 3583A	20Hz-40.0MHz	3585A	HP	1750A02762	01067	03-SEP-2005
ORANGE	9kHz-26.5GHz	E4407B	HP	US39440975	00394	05-NOV-2005
EMI TEST RECEIVER	20-1000MHz	ESVS30	R&S	827957/001	01098	27-OCT-2005

LISNS/MEASUREMENT PROBES	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	956348	00753	02-APR-2005
BLUE	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	956349	00752	02-APR-2005
YELLOW-BLACK	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	984735	00248	02-APR-2005
ORANGE	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	903707	00754	02-APR-2005
GOLD	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	984734	00247	02-APR-2005
WHITE-BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972019	00678	02-APR-2005
BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972017	00675	02-APR-2005
RED-BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972016	00677	02-APR-2005
BLUE-BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972018	00676	02-APR-2005
BLUE MONITORING PROBE	0.01-150MHz	91550-2	TEGAM	12350	00807	21-MAY-2005
YELLOW MONITORING PROBE	0.01-150MHz	91550-2	ETS	50972	00493	24-NOV-2005
GREEN CURRENT TRANSFORMER	40Hz-20MHz	150	PEARSON	10226	00793	03-APR-2005
CISPR LINE PROBE	150kHz-30MHz	N/A	C-S	01	00805	20-DEC-2004
CISPR TELCO VOLTAGE PROBE	10kHz-30MHz	CS A/C-10	C-S	CS01	00296	28-SEP-2005
CISPR 22 TELCO ISN	9kHz-30MHz	FCC-TLISN-T4	FISCHER	20115	00746	26-OCT-2006

OPEN AREA TEST SITE (OATS)	FCC CODE	IC CODE	VCCI CODE	CALIBRATION DUE
SITE F	93448	IC 2762-F	R-1688	25-MAR-2005
SITE T	93448	IC 2762-T	R-905	25-MAR-2005
SITE A	93448	IC 2762-A	R-903	25-MAR-2005
SITE M	93448	IC 2762-M	R-904	25-MAR-2005
BUBBLE (HP FACILITY)	N/A	N/A	R-1467	16-MAY-2005

LINE CONDUCTED TEST SITES	FCC CODE	IC CODE	VCCI CODE	CALIBRATION DUE
EMI 1	93448	N/A	C-1801	01-MAY-2006
EMI 2	93448	N/A	C-1802	01-MAY-2006
EMI 3	93448	N/A	C-1803	01-MAY-2006
BUBBLE (HP FACILITY)	N/A	N/A	C-1556	16-MAY-2005

MIXERS/DIPLEXERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
MIXER / HORN	26.5-40 GHz	11970A/28-442-6	HP/ATM	2332A00900/A046903-01	00369	N/A
MIXER / HORN	26.5-40 GHz	11970A/28-442-6	HP/ATM	2332A01695/A046903-01	1087	23-AUG-2005
MIXER / HORN	26.5-40 GHz	11970A/28-442-6	HP/ATM	3003A07825/A046903-01	1086	23-AUG-2005
MIXER / HORN	40-60 GHz	M19HW/A	OML	U30110-1	00821	03-JAN-2005
MIXER / HORN	60-90 GHz	M12HW/A	OML	E30110-1	00822	03-JAN-2005
MIXER / HORN	90-140 GHz	MO8HW/A	OML	F21206-1	00811	05-JAN-2005
MIXER / HORN	140-220 GHz	MO5HW/A	OML	G21206-1	00812	05-JAN-2005
DIPLEXER		DPL.26	OML	N/A	00813	05-JAN-2005

ABSORBING CLAMPS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE

FISCHER CLAMP	30-1000MHZ	F-201-23MM	FISCHER	10	00081	16-JAN-2006

PREAMPS / ATTENUATORS / FILTERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	0.10-2000MHZ	ZFL-1000-LN	C-S	N/A	00798	31-MAR-2005
BLUE	0.01-2000MHZ	ZFL-1000-LN	C-S	N/A	00759	26-JUL-2005
BLUE-BLACK	0.01-2000MHZ	ZFL-1000-LN	C-S	N/A	00800	31-MAR-2005
GREEN	0.01-2000MHZ	ZFL-1000-LN	C-S	N/A	00802	27-FEB-2005
BLACK	0.01-2000MHZ	ZFL-1000-LN	C-S	N/A	00799	27-FEB-2005
ORANGE	0.01-2000MHZ	ZFL-1000-LN	C-S	N/A	00765	27-FEB-2005
WHITE	1-20GHZ	SMC-12A	C-S	426643	00760	21-JUL-2005
YELLOW-BLACK	1-20GHZ	SMC-12A	C-S	535055	00801	21-JUL-2005
ORANGE-BLACK	1-20GHZ	SMC-12A	C-S	637367	00761	21-JUL-2005
HF (YELLOW)	18-26.5GHZ	AFS4-18002650-60-8P-4	C-S	467559	00758	20-JUL-2005
HIGH PASS FILTER	1-18 GHZ	SPA-F-55204	K&L	36	00817	06-JAN-2006
LOW PASS FILTER	1-9 GHZ	11SL10-4100/X4400-O/O	K&L	4	00816	06-JAN-2006
HF 20DB ATTENUATOR	0.03-20 GHZ	PE 7019-20	PASTERNACK	01	00791	21-MAY-2005
LOW FREQ LPF	10-100KHZ	L200K1G1	MICROWAVE CIRCUITS	4460-01 DC0432	1019	30-AUG-2005
LOW FREQ LPF	10-100KHZ	L200K1G1	MICROWAVE CIRCUITS	4777-01 DC0434	1088	30-AUG-2005

ANTENNAS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN BILOG	30-2000MHZ	CBL6112B	CHASE	2742	00620	06-APR-2006
GREEN-BLACK BILOG	30-2000MHZ	CBL6112B	CHASE	2412	00127	06-JAN-2006
GREEN-RED BILOG	30-2000MHZ	CBL6112B	CHASE	2435	00990	06-APR-2006
BLUE-WHITE BILOG	30-2000MHZ	3142B	EMCO	1527	TELOGY RENTAL	03-AUG-2006
RED BILOG	30-1000MHZ	3143	EMCO	1270	00042	17-MAR-2005
BLUE BILOG	30-1000MHZ	3143	EMCO	1271	00803	17-MAR-2005
GRAY BILOG	26-2000MHZ	3141	EMCO	9703-1038	00066	19-MAY-2005(EMI) / 21-JUN-2005(RFI)
YELLOW-BLACK BILOG	20-2000MHZ	CBL6140A	CHASE	1112	00126	19-MAY-2005(EMI) / 25-JUN-2005(RFI)
RED-WHITE BILOG	30-2000MHZ	JB1	SUNOL	A091604-1	01105	28-SEP-2005
RED-BLACK BILOG	30-2000MHZ	JB1	SINOL	A091604-2	01106	28-SEP-2005
YELLOW HORN	1-18GHZ	3115	EMCO	9608-4898	00037	22-MAY-2005(EMI) / 29-NOV-2005 (RFI)
BLACK HORN	1-18GHZ	3115	EMCO	9703-5148	00056	12-JUN-2005
ORANGE HORN	1-18GHZ	3115	EMCO	0004-6123	00390	04-JUN-2005
HF (WHITE) HORN	18-26.5GHZ	801-WLM	WAVELINE	00758	00758	15-JUL-2005
SMALL LOOP (RENTAL)	10KHZ-30MHZ	PLA-130/A	ARA	1009	TELOGY	11-FEB-2006
SMALL LOOP	9KHZ-30MHZ	PLA-130/A	ARA	1024	00755	23-FEB-2006
LARGE LOOP	20HZ-5MHZ	6511	EMCO	9704-1154	00067	12-NOV-2005
ACTIVE MONOPOLE	30HZ-30MHZ	3301B	EMCO	3824	00068	05-MAY-2005
INDUCTION COIL	50-60HZ	1000-4-8	C-S	N/A	00778	13-SEP-2006
ADJUSTABLE DIPOLE	30-1000MHZ	3121C	EMCO	1370	00757	26-JUN-2005
ADJUSTABLE DIPOLE	30-1000MHZ	3121C	EMCO	1371	00756	26-JUN-2005
RE101 LOOP SENSOR	30HZ-100KHZ	RE101-13.3CM	C-S	N/A	00818	07-JAN-2005
RS101 RADIATING LOOP	30HZ-100KHZ	RS101-12CM	C-S	N/A	00819	07-JAN-2005
RS101 LOOP SENSOR	30HZ-100KHZ	RS101-4CM	C-S	N/A	00820	07-JAN-2005

EFT	MN	MFR	SN	ASSET	CALIBRATION DUE
EFT DIRECT COUPLING CAP	N/A	C-S	01	00794	29-JAN-2006

ESD GENERATORS	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN	NSG435	SCHAFFNER	000839	00763	02-DEC-2004
RED	NSG435	SCHAFFNER	001625	00762	09-JAN-2005
YELLOW	930D	ETS	201	00673	16-JUN-2005

BEST EMC-2	MN	MFR	SN	ASSET	CALIBRATION DUE
BLUE	711-1100	SCHAFFNER	199824-002SC	00117	28-JUL-2005 (SURGE/D+I/EFT)
RED	711-1100	SCHAFFNER	200122-074SC	00623	24-JUN-2005 (SURGE) / 28-JUL-2005 (D+I) / 03-DEC-2005 (EFT)

HARMONIC ANALYZER	MN	MFR	SN	ASSET	CALIBRATION DUE
HFTS	HP6842A	HP	3531A-00169	00738	03-DEC-2005

CHAMBERS AND STRIPLINE	MN	MFR	SN	ASSET	CALIBRATION DUE
RFI 1 CHAMBER	3 METER COMPACT	PANASHIELD	N/A	00797	25-JUN-2005
RFI 2 CHAMBER	04' X 07' SHIELDING SYSTEM	LINDGREN	13329	00795	21-JUN-2005
RFI 3 STRIPLINE	N/A	C-S	N/A	00796	22-JUL-2005
ENVIRONMENTAL (SAFETY)	SGTH-31S	B-M-A INC.	2245	00321	31-DEC-2004

AMPLIFIERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	0.5-1000MHZ	10W1000B	AR	18708	00032	23-JUN-2005
GREEN	0.5-1000MHZ	10W1000B	AR	23423	00123	01-JUN-2005
BLUE	0.01-250MHZ	75A250	AR	19165	00039	19-JAN-2005(CRFI) / 23-JUN-2005 (RFI)
BLACK	0.01-250MHZ	75A250	AR	23411	00122	22-JUN-2005(CRFI)/ 25-JUN-2005(RFI)
ORANGE	0.01-250MHZ	75A250	AR	26827	00367	19-JAN-2005(CRFI) / 02-JUN-2005(RFI)
HP489A	1.0-2.0GHZ	HP489A	HP	449-00762	00971	28-SEP-2005
HUGHES 10W	1.0-2.0GHZ	1177H09	HUGHES	143	RENTAL	29-NOV-2005
HP491C	2.0-4.0GHZ	HP491C	HP	449-00638	00764	29-NOV-2005
HUGHES 10W	4.0-8.0GHZ	1177H02	HUGHES	092	RENTAL	23-NOV-2005
HP493A #1	4.0-8.0GHZ	HP493A	HP	17140224 2	00085	28-SEP-2005
HP493A #2	4.0-8.0GHZ	HP493A	HP	449-00562	00771	28-SEP-2005
HP495A	7.0-12.0GHZ	HP495A	HP	904-00237	00086	29-NOV-2005

FIELD PROBES	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	0.01-1000MHZ	HI-4422	HOLADAY	90369	00031	11-OCT-2005
GREEN	0.01-1000MHZ	HI-4422	HOLADAY	97363	00136	05-AUG-2005
BLUE	0.01-1000MHZ	HI-4422	HOLADAY	95696	01100	27-OCT-2005

SIGNAL GENERATORS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	0.09-2000MHZ	HP8648B	HP	3847U02192	00366	15-JAN-2005
BLUE	0.1-1000MHZ	HP8648A	HP	3426A00548	00034	20-JUL-2005
GREEN	0.09-2000MHZ	HP8648B	HP	3623A02072	00125	12-OCT-2005
ORANGE	0.1-1000MHZ	HP8648B	HP	3537A01210	00025	26-MAY-2005
BLACK (TELECOM)	15MHZ	HP33120A	HP	US36004674	00766	21-OCT-2005
YELLOW	15MHZ	HP33120A	HP	US36014119	00249	26-MAY-2005
BLUE-WHITE	0.1HZ-13MHZ	HP3312A	HP	1432A07632	00775	09-MAR-2005
SWEEPER	0.01-20.0GHZ	HP83752A	HP	3610A01133	00087	04-APR-2005
AM/FM STEREO SIG. GEN.	0.1-170MHZ	LG3236	LEADER	3687301	00959	03-SEP-2005

BULK INJECTION CLAMPS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN	0.01-100MHZ	95236-1	ETS	50215	00118	22-JUN-2005
RED	0.01-100MHZ	95236-1	ETS	34026	1020	07-JUL-2005

CDN NETWORKS	RANGE	MN	MFR	ASSET	CALIBRATION DUE
BLACK	0.10-100MHZ	20A M-2	C-S	00783	22-JUN-2005
BLUE	0.10-100MHZ	15A M-3	C-S	00806	22-JUN-2005
ORANGE	0.10-100MHZ	15A M-2	C-S	00786	22-JUN-2005
RED	0.10-100MHZ	15A M-3	C-S	00780	22-JUN-2005
WHITE	0.10-100MHZ	15A M-3	C-S	00782	22-JUN-2005
YELLOW-BLACK	0.10-100MHZ	15A M-3	C-S	00784	22-JUN-2005
BLUE-BLACK	0.10-100MHZ	15A M-3	C-S	00781	22-JUN-2005
GREEN	0.10-100MHZ	30A M-3	C-S	00779	22-JUN-2005
YELLOW	0.10-100MHZ	30A M-5	C-S	00804	22-JUN-2005
BLUE-WHITE	0.10-100MHZ	15A M-5	C-S	00788	22-JUN-2005
YELLOW (RES)	0.10-100MHZ	100Ω RESISTOR NWK	C-S	00810	28-SEP-2005
GREEN (RES)	0.10-100MHZ	100Ω RESISTOR NWK	C-S	00785	09-MAR-2005

OSCILLOSCOPES	MN	MFR	SN	ASSET	CALIBRATION DUE
OSCILLOSCOPE 100MHZ	TDS 220	TEKTRONIX	B068748	00885	02-JUN-2005
OSCILLOSCOPE 100MHZ (SAFETY)	TDS 340	TEKTRONIX	B012357	00737	05-OCT-2005
OSCILLOSCOPE 100MHZ (TELECOM)	54645A	HP	US36320452	00103	02-JUL-2005

POWER SUPPLIES	MN	MFR	SN	ASSET	CALIBRATION DUE
10001I/2 AC POWER SYSTEM	(2) 500I	CALIFORNIA INSTRUMENTS	HK53687/HK53688	00376	16-JUL-2005

RMS VOLTMETERS/CURRENT CLAMP	MN	MNFR	SN	ASSET	CALIBRATION DUE
TRUE-RMS MULTIMETER	79III	FLUKE	71700298	00769	21-OCT-2005
TRUE-RMS MULTIMETER	177	FLUKE	83390024	00973	08-MAR-2005
TRUE-RMS MULTIMETER (REFERENCE)	177	FLUKE	83390025	00974	08-MAR-2005
TRUE-RMS MULTIMETER (TELECOM)	177	FLUKE	83430419	00975	08-MAR-2005
TRUE-RMS CLAMP METER (SAFETY)	36	FLUKE	68805882	00700	05-MAR-2005

SURGE GENERATORS	MN	MFR	SN	ASSET	CALIBRATION DUE
TRANSIENT WAVEFORM MONITOR	TWM-5	CDI	003982	00323	17-JUN-2005
UNIVERSAL SURGE GENERATOR	M5	CDI	003966	00324	09-JUN-2005
THREE PHASE COUPLING NWK	3CN	CDI	003455	00325	09-JUN-2005
1.2X50US PLUGIN MODULE	1.2X50US PLUGIN	CDI	N/A	00842	09-JUN-2005
10X160US PLUGIN MODULE	10X160US PLUGIN	C-S	N/A	00843	09-JUN-2005
10X560US PLUGIN MODULE	10X560US PLUGIN	C-S	N/A	00841	09-JUN-2005
10X700US PLUGIN MODULE W/ EXTENSION BOX	10X700US PLUGIN	C-S	N/A	00844/845	23-JUN-2005
PSURGE CONTROLLER MODULE	PSURGE 8000	HAEFELY	150267	00879	11-JUN-2005
COUPLING/DECOUPLING MODULE	PSD 900	HAEFELY	149213	00880	11-JUN-2005
IMPULSE MODULE	PIM 900	HAEFELY	149202	00881	11-JUN-2005
HIGH VOLTAGE CAP NWK 5KVDC, 18µF	CS-HVCC	C-S	01	00772	28-SEP-2006
NEBS SURGE GENERATOR	N/A	C-S	N/A	00088	17-JUN-2005
2X10US SURGE GENERATOR	2X10US	C-S	N/A	00846	23-JUN-2005
10X700US SURGE GENERATOR	10X700US	C-S	N/A	00847	17-JUN-2005
12 PAIR SURGE RESISTOR MODULE	N/A	C-S	N/A	00768	28-SEP-2005

POWER/NOISE METERS	MN	MFR	SN	ASSET	CALIBRATION DUE
POWER METER	435B	HP	2445A11012	00773	07-APR-2005
POWER METER	437B	HP	2912A01367	01099	27-OCT-2005
POWER SENSOR	8481A	HP	2702A61351	00774	07-APR-2005
PSOPHOMETER	2429	BRUEL & KJAER	1237642	00585	18-FEB-2005
TRANSMISSION LINE TESTER (DBRNC)	185T	AMREL	998658	00823	08-MAR-2005

OVERVOLTAGE CHAMBERS	MN	MFR	SN	ASSET	CALIBRATION DUE
72KW POWER FAULT SIMULATOR	OV1	C-S	N/A	00792	31-MAR-2005
POWER FAULT SIMULATOR	OV2	C-S	N/A	00116	31-MAR-2005

DIPOLE TAPE MEASURES	MN	MFR	SN	ASSET	CALIBRATION DUE
26FT TAPE #1	2338CME	LUFKIN	C3166-1	00776	26-FEB-2005
26FT TAPE #2	2338CME	LUFKIN	C3166-2	00777	26-FEB-2005

METEOROLOGICAL METERS	MN	MFR	SN	ASSET	CALIBRATION DUE
TEMP./HUMIDITY/ATM. PRESSURE GAUGE	7400 PERCEPTION II	DAVIS	N/A	00965	19-JAN-2005
TEMPERATURE /HUMIDITY GAUGE	THG-912	HUGER	4000562	00789	08-JAN-2005

TRACEABLE CLOCKS	MN	MFR	SN	ASSET	CALIBRATION DUE
5003	5003	CONTROL COMPANY	99026940	00808	09-JAN-2005

CONSUMABLES	SPEC.	MFR	STOCK/MN	ASSET	CALIBRATION DUE
NEBS CHEESECLOTH	26-28M/KG	ED&D	ACC-01	N/A	N/A
NEBS CARBON BLOCK	3-MIL-GAP 1KV SURGE	RELIABLE	3AB	N/A	N/A

All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Terms And Conditions

Paragraph 1. SERVICES. LABORATORY will:

1.1 Use the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.
1.2 Perform all technical services in substantial accordance with the generally accepted laboratory principles and practices.
1.3 Retain all pertinent records relating to the services performed for a period of three (3) years following submission of the report describing such services, during which period the records will be made available to CLIENT upon reasonable request.

Paragraph 2. CLIENT'S RESPONSIBILITIES. CLIENT or his authorized representative will:

2.1 Provide LABORATORY with all plans, schematics, specifications, addenda, change orders, drawings and other information for the proper performance of technical services.
2.2 Designate a person to act as CLIENT's representative with respect to LABORATORY's services to be performed on behalf of the CLIENT; such person or firm to have complete authority to transmit instructions, receive information and data, interpret and define CLIENT's policies and decisions with respect to the LABORATORY's work on behalf of the CLIENT and to order, at CLIENT's expense, such technical services as may be required.
2.3 Designate a person who is authorized to receive copies of LABORATORY's reports.
2.4 Undertake the following:
(a) Secure and deliver to LABORATORY, without cost to LABORATORY, preliminary representative samples of the equipment proposed to require technical services, together with any relevant data.
(b) Furnish such labor and equipment needed by LABORATORY to handle samples at the LABORATORY and to facilitate the specified technical services.

Paragraph 3. GENERAL CONDITIONS:

3.1 LABORATORY, by the performance of services covered hereunder, does not in any way assume any of those duties or responsibilities customarily vested in the CLIENT, its employees, or any other party, agency or authority.
3.2 LABORATORY shall not be responsible for acts of omissions of any other party or parties involved in the design, manufacture or maintenance of the equipment or the failure of any employee, contractor or subcontractor to undertake any aspect of equipment's design, manufacture or maintenance.
3.3 LABORATORY is not authorized to revoke, alter, release, enlarge or release any requirement of the equipment's design, manufacture or maintenance unless specifically authorized by CLIENT or his authorized representative.
3.4 THE ONLY WARRANTY MADE BY LABORATORY IN CONNECTION WITH ITS SERVICE PERFORMED HEREUNDER IS THAT IT WILL USE THAT DEGREE OF CARE AND SKILL AS SET FORTH IN PARAGRAPH 1 ABOVE. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE OR INTENDED FOR SERVICES PROVIDED HEREUNDER.
3.5 Where the LABORATORY indicates that additional testing is advisable to obtain more valid or useful data, and where such testing has not been authorized, CLIENT agrees to view such test reports as inconclusive and preliminary.
3.6 The LABORATORY will supply technical service and prepare a report based solely on the sample submitted to the LABORATORY by the CLIENT. The CLIENT understands that application of the data to other devices is highly speculative and should be applied with extreme caution.
3.7 The LABORATORY agrees to exercise ordinary care in receiving, preserving and shipping (F.O.B. Littleton, MA) any sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise from loss, damage or destruction of the samples due to the act of examination, modification or testing, or technical services or circumstances beyond LABORATORY's control.
3.8 The LABORATORY will hold samples for thirty (30) days after tests are completed, or until the CLIENT's outstanding debts to the LABORATORY are satisfied, whichever is later.
3.9 The CLIENT recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.
3.10 It is agreed between LABORATORY and CLIENT that no distribution of any tests, reports or analysis other than that described below shall be made to any third party without the prior written consent of both parties unless such distribution is mandated by operation of law. It is agreed that tests, reports, or analysis results may be disclosed to third party auditors of the laboratory at the laboratory facility in the course of accreditation maintenance audits. No reference to reports or technical services of the LABORATORY shall be made in any advertising or promotional literature without the express written permission of the LABORATORY.
3.11 The CLIENT acknowledges that all employees of LABORATORY operate under employment contracts with the LABORATORY and CLIENT agrees not to solicit employment of such employees or to solicit information related to other clients from said employees.
3.12 In recognition of the relative risks and benefits of the project to both CLIENT and LABORATORY, the risks have been allocated such that the CLIENT agrees, to the fullest extent permitted by law, to limit the liability of the LABORATORY to the CLIENT for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, including attorneys' fees and costs and expert witness fees and costs, so that the total aggregate liability of the LABORATORY to the CLIENT shall not exceed $100,000, or the LABORATORY'S total fee for services rendered on this project, whichever is greater. It is intended that this limitation apply to any and all liability or cause of action however alleged or arising, unless otherwise prohibited by law.

Paragraph 4. INSURANCE:

4.1 LABORATORY shall secure and maintain throughout the full period of the services provided to the CLIENT adequate insurance to protect it from claims under applicable Workmen's Compensation Acts and also shall maintain one million dollars of general liability coverage to cover claims for bodily injury, death or property damage as may arise from the performance of its services.

4.2 The CLIENT hereby warrants that it has sufficient insurance to protect its employees adequately under applicable Workmen's Compensation Acts and for bodily injury, death, or property damage.
4.3 No insurance of whatever kind or type, which may be carried by either party is to be considered as in any way limiting any other party's responsibility for damages resulting from their operations or for furnishing work and materials.

Paragraph 5. PAYMENT:

5.1 CLIENT shall pay to LABORATORY such fees for services as previously agreed, orally or in writing, within 30 days of presentment of a bill for such services performed. In the event CLIENT ordered, orally or in writing, services but such services were not assigned a rate for billing, such services shall be billed at the LABORATORY's reasonable and customary rate.
5.2 CLIENT shall be responsible for all shipping, customs and other expenses related to services provided by LABORATORY to the CLIENT, and shall fully insure any test sample or other equipment provided to LABORATORY by the CLIENT.
5.3 Amounts overdue from CLIENT to LABORATORY shall be charged interest at a rate of 1½% per month.

Paragraph 6. ISO/IEC GUIDE 17025 ADDITIONS:

6.1 CLIENT agrees that this test report will not be reproduced except in full, without written approval from the LABORATORY.
6.2 CLIENT agrees that this test report shall not be used to claim product endorsement by A2LA or ANSI or any agency of the U.S. Government.
6.3 CLIENT agrees that test results presented herein relate only to the sample tested by the LABORATORY.

A2LA Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

CURTIS-STRAUS[1]
527 Great Road
Littleton, MA 01460
Barry Quinlan Phone: 978-486-8880

ELECTRICAL

Valid until: July 31, 2005 Certificate Number: 1627-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Electromagnetic Compatibility (EMC), Telecommunications, and Product Safety tests:

Electromagnetic Compatibility (EMC)
Radiated emissions testing (electric and magnetic fields); Conducted emissions testing (voltage and current); Electrostatic Discharge testing; Electrical Fast Transient testing; Radiated Immunity testing; Conducted Immunity testing; Lightning Immunity testing; Voltage Dips, Interrupts and Voltage Variations testing; Magnetic Immunity testing; RF Power measurements; Frequency Stability measurements; Longitudinal Induction measurements; Harmonic emissions testing; Light flicker testing; Low frequency disturbance voltage testing; Disturbance Power measurements

EMC Standards	Title
Emissions	
CISPR 22 1997 with amendments 1 and 2	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
CNS13438 1994	Limits and methods of measurement of radio interference characteristics of information technology equipment.
EN55022:1994 and 1998	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
SABS CISPR 22:1997	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement
Canada ICES-003 1997	Digital apparatus
AS/NZS 3548 1995	Australian/New Zealand Standard Limits and methods of measurement of radio disturbance characteristics of information technology equipment
CISPR 11 1990, 1997, 1999	Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
EN 55011 1991, 1998	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) frequency equipment.
SABS CISPR 11:1997	Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics Limits and methods of measurement
Canada ICES-001 1998	Industrial, scientific and medical radio frequency generators
CNS13803	Industrial, Scientific and Medical Instrument
AS/NZS 2064: 1997	Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
CSA C108.8 – M1983	Electromagnetic Emission from Data Processing Equipment and Electronic Office Machines
CISPR 13:1996, 1998, 2001	Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.
EN 55013: 1990, 2001	Sound and television broadcast receivers and associated equipment: Electromagnetic compatibility. Part 1: Specification for limits and methods of measurement of radio disturbance characteristics of broadcast receivers and associated equipment.
EN 55013 Amend 12 1994	Limits and methods of measurement of radio disturbance characteristics of broadcast receivers and associated equipment. Amendment 12
SABS CISPR 13: 1996	Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.
CNS 13439	Broadcast receiver and associated equipment Limits and methods of
AS/NZS 1053: 1999	measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.
CISPR 14 1993	Limits and methods of measurement of radio disturbance characteristics of electrical motor- operated and thermal household and similar purposes, electric tools and electric appliances for apparatus.
EN 55014 1993, 1997	Limits and methods of measurement of radio disturbance characteristics of electrical motor- operated and thermal household and similar purposes, electric tools and similar apparatus.
AS/NZS 1044: 1995	Limits and methods of measurement of radio disturbance characteristics of electrical motor- operated and thermal household and similar purposes, electric tools and similar apparatus.
Immunity	
CNS13783-1	Household Electrical Appliances
SABS CISPR 14-1 1993	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus Part 1: Product family standard
SABS CISPR 14-2 1997 + A1:2001	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus Part 2: Product family standard
CISPR 14-2 1996, 1997 + A1:2001	Immunity requirements for household appliances, tools similar apparatus.
CISPR 20: 1995, 2002 with amendment 3	Limits and methods of measurement of immunity characteristics of sound and television broadcast receivers and associated equipment.
EN 55020: 1995, 2002	Electromagnetic immunity of broadcast receivers and Associated equipment.
CISPR 24	Information technology equipment – Immunity characteristics – Limits and methods of measurement
SABS CISPR 24 1997	Information technology equipment – Immunity characteristics – Limits and methods of measurement
AS/NZS 3200.1.2: 1995	Approval and test specification – Medical electrical Equipment – General requirements for safety – Collateral Standard: Electromagnetic compatibility – Requirements and tests.
European Union Basic EMC Standards	
EN 61000-4-2: 1995, 1999, 2001	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge immunity test – Basic EMC Publication
EN 61000-4-3:1997, 1998, 2002	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 3: Radiated, radio-frequency, electromagnetic field immunity test
AS/NZS 61000.4.3 1999	
EN 61000-4-4 1995	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 4: Electrical fast transient/burst immunity test – Basic EMC publication
EN 61000-4-5 1995	(EMC) Part 4: Testing and measurement techniques. Section 5:
AS/NZS 61000.4.5 1999	Surge immunity test.
EN 61000-4-6 1996	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 6: Immunity to disturbances, induce by radio-frequency fields.
AS/NZS 61000.4.6 1999	
EN 61000-4-8 1994	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test.
EN 61000-4-11 1994	(EMC) Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage Variations immunity tests.
ENV 61000-2-2 1993	Electromagnetic compatibility (EMC). Part 2: Environment, Section 2: Compatibility levels for low-frequency conducted disturbances and signaling in public low-voltage power supply systems (IEC 1000-2-2:1990)
EU Product Family Standards	
EN 50081-1 1992	Electromagnetic capability – Generic emission standard. Part 1: Residential, commercial and light industry. (I.S.)
EN 50081-2 1993	Electromagnetic compatibility – Generic emission standards- industrial
EN 61000-6-1: 1997, 2001	Electromagnetic Compatibility (EMC)- Part 6: Generic Section 1: Immunity for residential, commercial and light-industrial environments
EN 61000-6-2: 1998, 2001	Electromagnetic Compatibility (EMC)- Part 6: Generic Section 2: Immunity for industrial environments
EN 50091-2 1996	Specification for Uninterruptible Power Systems (UPS). Part 2: EMC requirements
EN 55024 1998	Information technology equipment – Immunity Characteristics – Limits and methods of measurement.
EN 55103-1 1997	Electromagnetic Compatibility – Product family standard for audio, audio-visual and entertainment lighting control apparatus for professional use. Part 1: Emission
EN 55103-2 1997	Electromagnetic Compatibility – Product family standard for audio, (*excluding Annex A3*) video, audio-visual and entertainment lighting control professional use. Part 2: Immunity
EN 61326 1998	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61547 1996	Equipment for general lighting purposes – EMC immunity
EN 50130-4 1996	Alarm Systems. Part 4: Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder and social alarm systems.
EN 55104 1995	Electromagnetic compatibility immunity – requirements for household appliances, tools and similar apparatus. Product family standard.
EN 50083-2 1995	Cabled distribution systems for television and sound signals. Part 2: Electromagnetic compatibility for equipment.
EN 60601-1-2: 1993, 2002	Medical electrical equipment Part 1: general requirements for safety – Section 2: Collateral standard: Electromagnetic compatibility requirements and tests
IEC 1800-3 1995	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods.
EN 60555 Part 2 1987	Disturbances in supply systems caused by household appliances and similar electrical equipment. Part 2: Harmonics
EN 60555 Part 3 1987	Disturbances in supply systems caused by household appliances and similar electrical equipment. Part 3: Voltage fluctuations.
EN 61000-3-2: 1995, 2000	Electromagnetic compatibility (EMC). Part 3: Limits Section 2: Limits AS/NZS 61000.3.2 1998 for harmonic current emissions
EN 61000-3-3 1995	Electromagnetic compatibility (EMC). Part 3: Limits Section 2: AS/NZS 61000.3.3 1999 Limitation of voltage fluctuations and flicker in low-voltage supply systems.
ETS 300 386-1 1994	Equipment Engineering (EE); Public telecommunication network equipment electro-magnetic compatibility (EMC) requirements Part 1: Product family overview, compliance criteria and test levels

[1] Note: This accreditation covers testing performed at the laboratory listed above and the satellite facility located at 168 Ayer Rd, Littleton, MA 01460

standard. Part	2: Industrial environment
EN 50082-1 1992, 1998	Electromagnetic compatibility – Generic emission
standard. Part	1: Residential, commercial and light industry
EN 50082-2 1995	Electromagnetic compatibility – Generic immunity
	Standard. Part 2: Industrial environment

ETS EN 300 386-2 1997, 1998,	Electromagnetic compatibility and radio spectrum
matters	(ERM);
ETS EN 300 386 2000 v1.2.1, 2001 v1.3.1	Telecommunication network equipment;
Electromagnetic	compatibility (EMC) requirements; Part 2: Product
family	standard.
ETS 300 132-1 1996	Equipment Engineering (EE); Power supply interface
at the	input to telecommunications equipment; Part 1:
Operated by	alternating current (ac) derived from direct current (dc)
sources	
ETS 300 132-2 1996	Equipment Engineering (EE); Power supply interface
at the	input to telecommunications equipment; Part 2:
Operated by	direct current (dc)
ETR 283 1997	Equipment Engineering (EE): Transient voltages at
Interface A	on telecommunications direct current (DC) power
distributions.	
EU radio standards	
(ETS) EN 300 385 v1.2.1: 1998, 1999	Electromagnetic compatibility and Radio spectrum
matters	(ERM); Electromagnetic Compatibility (EMC)
standard for	fixed radio links and ancillary equipment (ETS)
EN 300 330 v1.2.1: 1998, 1999	Electromagnetic compatibility and Radio spectrum
matters	(ERM); Short range devices (SRD); Technical
characteristics	and test methods for radio equipment in the range 9
kHz to 25	MHz and inductive loop systems in the frequency
range 9 kHz	to 30 MHz
ETS 300 328 1996	Radio Equipment and Systems (RES); Wideband
transmission	systems; Technical characteristics and test conditions
for data	transmission equipment operating in the 2,4 GHz ISM
band and	using spread spectrum modulation techniques
ETS EN 300 440 v1.2.1 1999	Electromagnetic compatibility and Radio spectrum
matters	(ERM); Short range devices; Technical characteristics
and test	methods for radio equipment to be used in the 1 Ghz to
40 Ghz	frequency range
EN 301 893:2002	Broadband Radio Access Networks (BRAN); 5 GHz
(draft) v1.2.1	high performance RLAN; Harmonized EN covering
Essential	requirements of article 3.2 of the R&TTE Directive
ETS 300 836-1:1998	Broadband Radio Access Networks (BRAN); High
Performance	Radio Local Area Network (HIPERLAN) Type 1;
Conformance	testing specification; Part 1: Radio Type approval and
Radio	Frequency (RF) conformance test specification
EN301 489-17:2002	Electromagnetic compatibility and Radio spectrum
Matters v1.2.1	(ERM); Electromagnetic Compatibility (EMC)
standard for	radio equipment and services; Part 17: Specific
conditions for	2,4 GHz wideband transmission systems and 5 GHz
high	performance RLAN equipment

EN 300 328-2:2001	Electromagnetic compatibility and Radio spectrum Matters
(ERM);	
v1.2.1	Wideband Transmission systems; Data transmission
equipment	operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques; Part 2: Harmonized EN covering
essential	requirements under article 3.2 of the R&TTE Directive
EN 301 489-1:2002	Electromagnetic compatibility and Radio spectrum Matters
(ERM);	Electromagnetic Compatibility (EMC) standard for radio
equipment	and services; Part 1: Common technical requirements
EN 60669-2-1:2002	Switches for household and similar fixed electrical
installations -- Part	2-1: Particular requirements – Electronic switches
Canada Radio Standards	
Canadian GL-36 1995	Industry Canada – technical requirements for low power
Devices in the	2400 – 2483.5 MHz band.
Canadian RSS-119 1999, 2000 Issue 6	Industry Canada – Land mobile and fixed radio Transmitters
and	receivers, 27.41 to 960.0 MHz
Canadian RSS-134 1996 & 2000, Issue 1	Industry Canada – 900 MHz narrowband personal
communications	
Rev 1	services
Canadian RSS-210 2000 Issue 3,	Industry Canada – Low power license-exempt radio 2001
Issue 5	communication devices
RFS29 1998	Specification for Restricted Radiation Radio Apparatus (New
Zealand)	
FCC Standards	
47 CFR FCC low power transmitters	Scope A1
operating on frequencies below 1 GHz,	
emergency alert systems, unintentional	
radiators and ISM devices.	
47 CFR FCC low power transmitters	Scope A2
operating on frequencies above 1 GHz,	
with the exception of spread spectrum	
devices.	
47 CFR FCC Unlicensed Personal	Scope A3
Communications System (PCS) devices	
47 CFR FCC Unlicensed National	Scope A4
Information Infrastructure devices and	
low power transmitters using spread	
spectrum techniques.	
47 CFR FCC Personal mobile	Scope B1
Radio Services in the following FCC	
Rule Parts 22, 24, 25, 27.	
47 CFR FCC General Mobile Radio	B2
Scope Services in the following FCC	
Rule Parts 22, 74, 90, 95, 97.	
47 CFR FCC Maritime and Aviation	B3
Scope RadioServices in 47 CFR Parts	
80 and 87	
47 CFR FCC Microwave Radio Services	B4
Scope in 47 CFR Parts 21, 74 and 101.	

FCC/OST MP-5 1986	FCC (Federal Communications Commission) methods
Of	measurement of radio noise emissions from industrial,
scientific	and medical equipment.
GR-1089-CORE: 1997, 1999 issue 2/	Bellcore electromagnetic compatibility and electrical
safety –	
2002 Issue 3	Generic criteria for network telecommunications
equipment.	
ANSI EMC Standards	
ANSI C63.4: 1992, 1999, 2001	American National Standard for methods of
measurement of	radio-noise emissions for low-voltage electrical and
electronic	equipment in the range of 9 kHz to 40GHz.
ANSI C63.5 1988	American National Standard for electromagnetic
compatibility –	radiated emissions measurements in electromagnetic
	interference (EMI) control – calibration of antennas.
IEEE EMC Standards	
IEEE C62.41: 1980, 1991	IEEE recommended practice on surge voltages in low-
voltage	AC power circuits
Swedish EMC Standards	
BAKOM 3336.3 1995	Electromagnetic compatibility and electrical safety
(EMC & S)	for wired terminal equipment. Harmonization
document	information over the OFCOM requirements.
South African EMC standards other than CISPR equivalents	
SABS 1718-1: 1996	South African Bureau of Standards: Specification for
Gaming	equipment. Part 1: Casino equipment.
Japanese VCCI Standards	
VCCI V-3/99.05 1999	Technical Requirements
VCCI V-4/99.05 1999	Instruction for Test Conditions for Requirement under
Test	

TIA/EIA-IS-968	Telecommunications Telephone Terminal Equipment
Technical	Requirements for Connection of Terminal Equipment to the
Telephone	Network
TIA/EIA-IS-883	Telecommunications Telephone Terminal Equipment
Supplemental	Technical Requirements for Connection of Stutter Dial Tone
Detection	
	Devices and ADSL Modems to the Telephone Network
TIA-968-A	Telecommunications Telephone Terminal Equipment
Technical	Requirements for Connection of Terminal Equipment to the
Telephone	Network
T1.TRQ.6-2001	Technical Requirements for SHDSL, HDSL2, HDSL4 Digital
	Subscriber Line Terminal Equipment to Prevent Harm to the
Telephone	Network Industry
Canada VDSL	Terminal Attachment Program Requirements and Test
Methods for Issue 1 January 2003	Very-High-Bit-Rate Digital Subscriber Line (VDSL) Terminal
	Equipment
AS/ACIF S002-2001	Analogue interworking and non-interference requirements for
	Customer Equipment for connection to the Public Switched
Telephone	Network
AS/ACIF S016-2001	Requirements for Customer Equipment for connection to
hierarchical	digital interfaces
AS/ACIF S031-2001	Requirements for ISDN Basic Access Interface
AS/ACIF S038-2001	Requirements for ISDN Primary Rate Access Interface
AS/ACIF S043-2001	Requirements for Customer Equipment for Connection to a
Metallic	Local Loop Interface of a Telecommunications Network —
	Part 1: General
	Part 2: Broadband
	Part 3: DC, Low Frequency AC and Voiceband
ITU-T G.703	Physical/electrical characteristics of hierarchical Digital
interfaces	
HKTA 2028	Network connection specification for connection of CPE to
the PTNs in	Hong Kong using digital leased circuits at data rate of 1544
kbit/s	
HKTA 2029	Network connection specification for connection of CPE to
the PTNs in	Hong Kong using digital leased circuits at data rate of 2048

Telecommunications
Telecommunications Registration; General test methods; Lightning surge; Drop testing; Balance testing; Signal power (metallic and longitudinal); Frequency measurements; Pulse templates; Leakage testing; Impedance testing; Hearing Aid Compatibility testing (*excluding volume control*); Protocol analysis and Jitter testing.

Telecom Standards	Title
FCC 47 CFR Part 68 Telephone Terminal TCB Scope	Connection of terminal equipment to the telephone Equipment network. Analog and Digital Equipment.
CS-03 Issue 8 1996 through amendment 5 and TIA/EIA TSB31-B 1998 Guidelines (Feb	C1. Specification for terminal equipment, terminal systems, Network protection devices, connection arrangements hearing aids compatibility. Bulletin Part 68 Rationale and Measurement 1998)

kbit/s	
TBR 1 : 1995 connected to CCITT Recommendation including,	Attachment requirements for terminal equipment to be circuit switched data networks and leased circuits using a Recommendation X.21 interface, or at an interface physically, functionally and electrically compatible with CCITT X.21 but operating at any data signaling rate up to, and 1 984 kbit/s
TBR 2 : 1997 to for rates up to 1 Recommendations	Attachment requirements for Data Terminal Equipment (DTE) connect to Packet Switched Public Data Networks (PSPDNs) CCITT Recommendation X.25 interfaces at data signaling 920 kbit/s utilizing interfaces derived from CCITT X.21 and X.21 bit

TBR 3 : 1995 + Amdt : 1997 Attachment ISDN	Integrated Services Digital Network (ISDN); requirements for terminal equipment to connect to an using ISDN basic access
TBR 4 : 1995 + Amdt : 1997 Attachment ISDN	Integrated Services Digital Network (ISDN); requirements for terminal equipment to connect to an using ISDN primary rate access
TBR 012 : 1993 + Amdt : 1996 Provision unstructured terminal	Business Telecommunications (BT); Open Network (ONP) technical requirements; 2 048 kbit/s digital leased line (D2048U) Attachment requirements for equipment
TBR 013 : 1996 digital requirements for	Business TeleCommunications (BTC); 2 048 kbit/s structured leased lines (D2048S); Attachment terminal equipment interface
TBR 21 : 1998 pan- (excluding TE network	Terminal Equipment (TE); Attachment requirements for European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE supporting the voice telephony service) in which addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signaling
TBR 24 : 1997 D34S); interface	Business TeleCommunications (BTC); 34 Mbit/s digital Unstructured and structured leased lines (D34U and Attachment requirements for terminal equipment
Australia	
TS 002 : 1997 Requirements for	Analogue Interworking and Non interference Customer Equipment Connected to the Public Switched Telephone Network
TS 016 : 1997 Connected to	General Requirements for Customer Equipment Hierarchical Digital Interfaces
TS 031 : 1997	Requirements for ISDN Basic Access Interface
TS 038 : 1997	Requirements for ISDN Primary Rate Access Interface
AS/ACIF S043.2:2001 a Network – Part	Requirements for Customer Equipment for connection to metallic loop interface of a Telecommunications 2 Broadband

Product Safety
General test methods; Input tests; Electric strength tests; Impulse tests; Permanency of marking tests; Accessibility tests; Energy Hazard measurements; Capacitor discharge tests; Humidity conditioning; Earthing tests; Limited power source measurements; Stability tests; Steel ball tests; Lithium Battery Reverse Current measurements; Leakage current tests; Transformer abnormal tests; Telecom leakage tests; Over voltage/power cross tests (*excluding x-ray tests*).

Product Safety Standards	Title
Specific Product Safety Standards	
IEC 950 1991 Includes equipment.	Safety of information technology equipment including Amendments 1, 2, 3, and 4 electrical business
UL 1950 1998	Safety of information technology equipment, including electrical business equipment.
CSA C22.2 No.950-95	Safety of Information Technology Equipment (UL 1950)
UL 60950 2000	Safety of information technology equipment

IEC 60950 2000	Safety of information technology equipment
EN 60950 1997, 1998, 2000	Safety of information technology equipment, including
IEC 60950-1 2001	Electrical business equipment.
UL 60950-1 2003	
CSA C22.2 No. 60950-00	
CSA C22.2 No. 60950-1 03	
AS/NZS 3260 1993 technology	Approval and test specification – Safety of information equipment including electrical business Equipment.
AS/NZS 3260 Supp 1 1996 technology	Approval and test specification – Safety of information equipment including electrical business equipment –
Alphabetical 3260:1993)	reference index to IEC 950 (Supplement to AS/NZS
ACA TS 001 1997 for	Australian Communications Authority – Safety requirements customer equipment.
UL 1459 1995	Telephone Equipment
IEC 1010-1 1990 measurement, control IEC 61010-1 1993	Safety requirements for electrical equipment for and laboratory use, Part 1: General requirements.
EN 61010-1 1993, 2001 measurement, control IEC 61010-1 2001	Safety requirements for electrical equipment for and laboratory use, Part 1: General requirements.
UL 61010B-1 2003	
UL 3101-1 1993 requirements.	Electrical equipment for laboratory use Part 1: General
CAN/CSA 1010-1 1999 (*Including AM 2*)	
UL 3111-1 1996 requirements.	Electrical measuring and test equipment. Part 1: General
UL 3121-1 1995	
IEC 60601-1 1995 for safety.	Medical electrical equipment. Part 1: General requirements
EN 60601-1 1995 (*Including AM 2*)	Medical electrical equipment
UL 2601-1 1997 for safety.	Medical electrical equipment. Part 1: General Requirements
IEC 60065 1998, 2000 requirements	Audio, video and similar electronic apparatus – Safety
ANSI/UL 6500: 1998	Audio/video and musical instrument apparatus for
CAN/CSA 60065-00	Household, commercial and similar general use
AS/NZS 3250 1995	Australian/New Zealand Standard – Approval and test
AS/NZS 60065 2000 Equipment for	Specification – Mains operated electronic and related household and similar general use
Canadian C22.2 No. 1-94 (1-98) and 1994, 1998	Audio, video and similar electronic equipment. Consumer commercial products
EN 60065 1994 apparatus	Safety requirements for main operated electronic and related for household and similar general use.
IEC 60825 1990	Radiation safety of laser products, equipment Classification, requirements and user's guide
EN 60825-1 1994 requirements	Safety of laser products Part 1: equipment Classification,
IEC 60825-1 2001	and user's guide.
IEC 60825-2 2000-5 communication	Safety of laser products – Part 2: Safety of optical systems
IEC 60825-4 1997-11	Safety of laser products – Part 4: Laser guards
IEC 60335-1 1995 (*Including AM2 – 1997 & AM 12 – 1997*)	Safety of household and similar electrical appliances Part 1: General requirements
EN 60335-1 2001	
UL 60335-1 1998	
CAN/CSA E335-1 1994	

UL 61010A-1 : 2002	Electrical equipment for laboratory use; part 1: General requirements
EN 61010-1 : 2001 measurement, requirements	Safety requirements for electrical equipment for control, and laboratory use - Part 1: General
AS/NZS 60950 : 2000	Safety information technology equipment

Environmental [2]

Environmental Standards	Title
GR-63-CORE	NEBS Requirements: Physical Protection
ETS 300 019 (vibration up to 1000Hz)	Environmental conditions and environmental tests For telecommunications equipment

[2] Environmental testing is performed at the satellite facility located at 168 Ayer Rd, Littleton, MA 01460