Curtis-Straus Test Report

Report No	ED0923-1
Client	YDI Wireless 20 Industrial Drive East South Deerfield, MA 01373
Phone	413-665-8551
Fax	413-665-7090
FRN	0006891675
Models	CX-DS3-24-HI, CX-DS3-24-LO, CX-ETH-24-HI, CX-ETH-24-LO
FCC ID	NM5-CX-DS3-ETH-24
Equipment Type	Low Power Communication Device Transmitter
Equipment Code	DXX
Results	As detailed within this report
Prepared by	Mairaj Hussain – Test Engineer
Authorized by	Michael Buchholz – EMC Manager
Issue Date	3/12/04
Conditions of issue	This Test Report is issued subject to the conditions stated in 'terms and conditions' section of this

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Summary

This report is an application for certification of a transmitter operating under 47 CFR 15.249 of the FCC rules provided for operation of fixed, point-to-point operation in the frequency band of 24.05-24.25GHz. The product covered by this report is Link CX 24GHz, which is a Digital Relay Radio System (DRRS).

The manufacturer requires the following antenna to be used with Link CX 24GHz:

i) Andrews model #: BCP-030-245-003

A detailed description of the above-mentioned antenna can be found in the antenna exhibit.

Modifications

The product was found to be failing spurious emissions at several frequencies. Modifications were required, as given below, to pass the radiated emissions test. See modification section.

1) Fair-Rite ferrite pn: 0443166651 added on the ethernet ribbon cable.
2) Fair-Rite ferrite pn: 0443163951 added on the power ribbon cable.
3) Two pieces of ARC absorber LS-10211 added to inside cover.

Test Methodology

All testing was performed according to the procedures specified in ANSI C63.4 (2002). The product was tested with modulation on and peak readings were compared against the average limit presented in section CFR 15.249.

Frequency range investigated:	30MHz – 100GHz

Frequency (MHz)	*Distance (m)*	*Comments*
Fundamental (Two channels high, low)	3 m	Radiated
30MHz – 100GHz except 24-24.25GHz band	3, 1m, 0.1m, & 0.03 m	Radiated Spurious Measurements

The emissions from EUT were fully maximized. The EUT antenna can not be maximized separately. The product was evaluated at two channels of operation, as it only has two channels. Furthermore, EUT was tested with two different data formats, DS3 and Ethernet. The out put power was set at the maximum allowable level of 0dBm.

The product is DC powered. The product was tested with an AC adaptor made buy Cincon Electronics model # TR45A48.

All readings are peak unless otherwise noted.

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EUT Configuration

EUT Configuration

Work Order: D0923
Company: YDI Wireless
Company Address: 20 Industrial Drive
South Deerfield, MA
Contact: Chris Koh

MN

EUT: Link CX-24

Models covered by this configuration	SN	FCC ID
CX-DS3-24-HI	033251993	NM5-CX-DS3-ETH-24
CX-ETH-24-HI	033251993	NM5-CX-DS3-ETH-24
CX-DS3-24-LO	032801684	NM5-CX-DS3-ETH-24
CX-ETH-24-LO	032801684	NM5-CX-DS3-ETH-24

EUT Description: Point-to-point radio link
EUT Max Frequency: 24.25 GHz

Support Equipment:	MN	SN	FCC ID
IBM laptop	2640-70U	78-ABB14	-

EUT Cables:	Qty	Shielded?	Length	Ferrites
Power	1	No	> 3 m	None
Ethernet	1	No	> 3 m	None

Unpopulated EUT Ports:	Qty	Reason
Craft	1	Not used in the configuration
Ethernet #2	1	Redundant
Coax OUT	1	Worst case ethernet used instead
Coax IN	1	Worst case ethernet used instead

Software / Operating Mode Description:

Transmitting ethernet or DS3 packets.

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Statement of Conformity

The Link CX-24 has been found to conform with the following parts of the 47 CFR as detailed below:

47 CFR Part #	47 CFR Part #	Comments
	15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels. Controls are limited to access by professional installer.
2.925	15.19	The label is shown in the label exhibit. The label is permanently attached.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are required for compliance.
	15.31(e)	The input power was varied from its nominal value (48V) to 21 and 60V. The respective radiated power was measured see table 6.
	15.203	The device utilizes antenna specific to the product.
	15.204	See attached documentation describing the antenna.
	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.
	15.207	Unit is DC powered and derives its power from an AC adaptor through the Ethernet cable. Conducted EMI on AC side of the adaptor were measured. See table 9.
15.249	15.249 (a)	The EUT's operation is classified as fixed, point-to-point and limits in this paragraph do not apply.
15.249(b)	15.249 (b)(1)	The field strength of emissions in this band do not exceed 2500mV/m (128 dBuV/m).
	15.249 (b) (2)	The frequency tolerance of the fundamental is maintained within ±0.001% of the operating frequency over –20°C to 50°C at normal supply voltage, and for a variation in the primary supply voltage 85% to 115% of the rated supply voltage @ 20°C see table 5 & 6.
	15.249 (b) (3)	The antenna gain is atlest 33 dBi. See antenna exhibit.
	15.249 (d)	Spurious emissions meet the general radiated emissions limits of section 15.209.
	15.249 (e)	Spurious emissions found above 1GHz meet the FCC class B limits.

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Test Data and Plots

Section 15.249 (b) – Band Edge

Table #1

Band Edge — *Curtis-Straus LLC*

Date: 08-Jan-04 **Company:** YDI
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24 **Work Order:** D0923
Measurement Distance: 0.03 m
Notes: **Tx High unit** **EUT Max Freq:** 24.228 GHz
RBW 1MHz, VBW 3MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Distance 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)	Margin (dB)	Result (Pass/Fail)
Ethernet Mode												
CH1	24050.0	33.7	40.0	40.3	5.0	39.0				54.0	-15.0	Pass
CH1	24000.0	33.6	40.0	40.3	5.0	38.9				54.0	-15.1	Pass
CH2	24250.0	32.0	40.0	40.3	5.1	37.4				54.0	-16.6	Pass
DS3 Mode												
CH1	24000.0	32.8	40.0	40.3	5.0	38.1				54.0	-15.9	
CH1	24050.0	33.4	40.0	40.3	5.0	38.7				54.0	-15.3	Pass
CH2	24250.0	32.7	40.0	40.3	5.1	38.1				54.0	-15.9	Pass

Table Result: Pass by -49.0 dB ***Worst Freq:*** 24050.0 MHz

Test Site: "F" **Pre-Amp:** none **Cable:** 7 Microflex **Analyzer:** Orange **Antenna:** 18-26.5GHz Horn

Table #2

Band Edge — *Curtis-Straus LLC*

Date: 23-Jan-04 **Company:** YDI
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24 **Work Order:** D0923
Measurement Distance: 0.03 m
Notes: TxLow Unit (DS3 mode) **EUT Max Freq:** 24.228 GHz
RBW 1MHz, VBW 3MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Distance 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)	Margin (dB)	Result (Pass/Fail)
CH1	24050.0	31.8	40.0	40.3	5.0	37.1				54.0	-16.9	Pass
CH2	24250.0	34.0	40.0	40.3	5.1	39.4				54.0	-14.6	Pass

Table Result: Pass by 14.6 dB ***Worst Freq:*** 24250.0 MHz

Test Site: "T" **Pre-Amp:** none **Cable:** 7 Microflex **Analyzer:** Orange **Antenna:** 18-26.5GHz Horn

Note: All readings are peak unless otherwise noted.

Conclusion:	The product meets the respective limit at lower restricted band edge.

Sample calculation:
Adjusted Reading = reading + cable factor + antenna factor – distance factor

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Section 15.249 (b) (1)

Data Showing fundamental.

Table #3

Fundamental — *Curtis-Straus LLC*

Date: 08-Jan-04 **Company:** YDI
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24 **Work Order:** D0923
Measurement Distance: 3 m
Notes: TX High Unit **EUT Max Freq:** 24.228 GHz

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)	FCC15.249 Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Ethernet Mode												
CH1	24.2145	77.3	0.0	40.3	5.0	122.6				128.0	-5.4	Pass
CH2	24230.6	78.3	0.0	40.3	5.0	123.6				128.0	-4.4	Pass
DS3 Mode												
CH2	24.2306	78.8	0.0	40.3	5.0	124.1				128.0	-3.9	Pass
CH1	24214.6	78.7	0.0	40.3	5.0	124.0				128.0	-4.0	Pass

Table Result: Pass by -3.9 dB ***Worst Freq:*** 24229.8 MHz

Test Site: "F" **Pre-Amp:** none **Cable:** 7 Microflex **Analyzer:** Orange **Antenna:** 18-26.5GHz Horn

Table #4

Fundamental — *Curtis-Straus LLC*

Date: 23-Jan-04 **Company:** YDI **Work Order:** D0923
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24
Measurement Distance: 3 m
Notes: Tx Low Unit **EUT Max Freq:** 24.088GHz

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)	Margin (dB)	Result (Pass/Fail)
Ethernet mode												
CH1-Hpk	24067.7	78.1	0.0	40.3	5.0	123.4				128.0	-4.6	Pass
CH2-Hpk	24083.8	78.0	0.0	40.3	5.0	123.3				128.0	-4.7	Pass
DS3 mode												
CH1-Hpk	24067.7	78.5	0.0	40.3	5.0	123.8				128.0	-4.2	Pass
CH2-Hpk	24088.7	77.6	0.0	40.3	5.0	122.9				128.0	-5.1	Pass

Table Result: Pass by -4.2 dB ***Worst Freq:*** 24067.7 MHz

Test Site: "T" **Pre-Amp:** none **Cable:** 7 Microflex **Analyzer:** Orange **Antenna:** 18-26.5GHz Horn

Sample calculation:

Adjusted reading = Reading + Antenna factor + Cable factor

Bandwidth settings for above tables:

RBW	1 MHz
VBW	3 MHz

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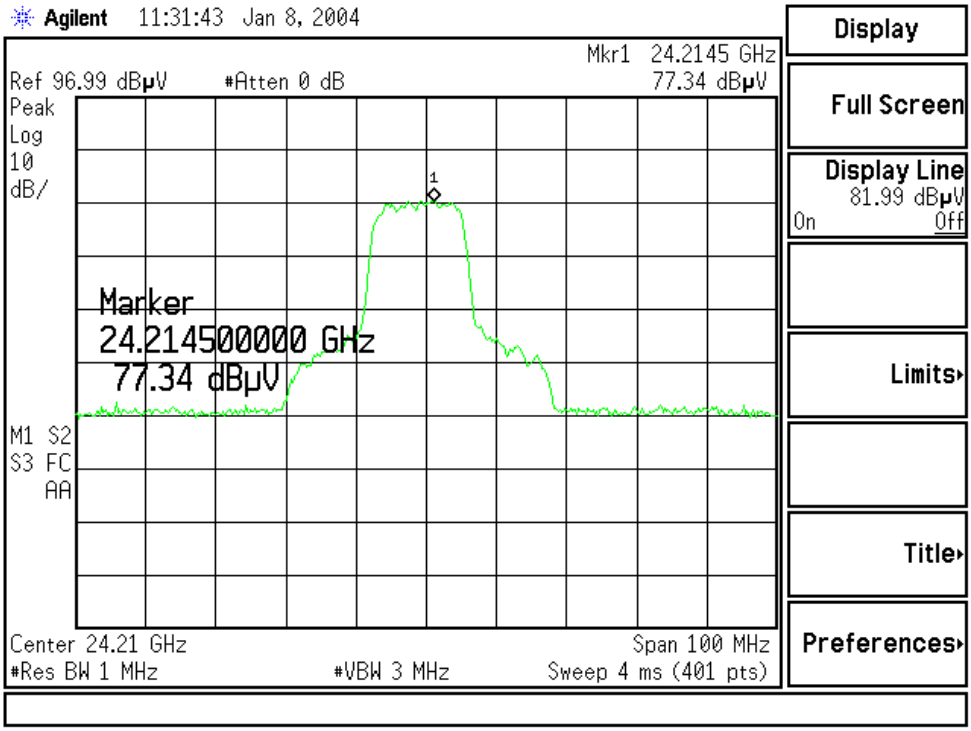
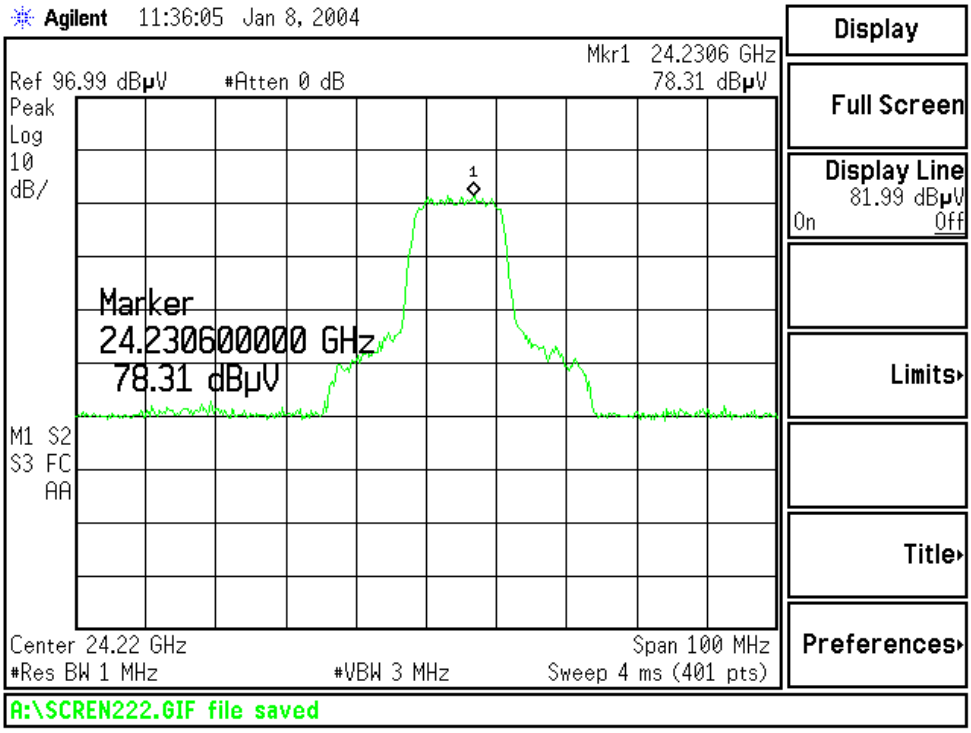
Fundamental Tx High Unit



Plot showing channel 1; Ethernet mode



Plot showing channel 2; Ethernet mode

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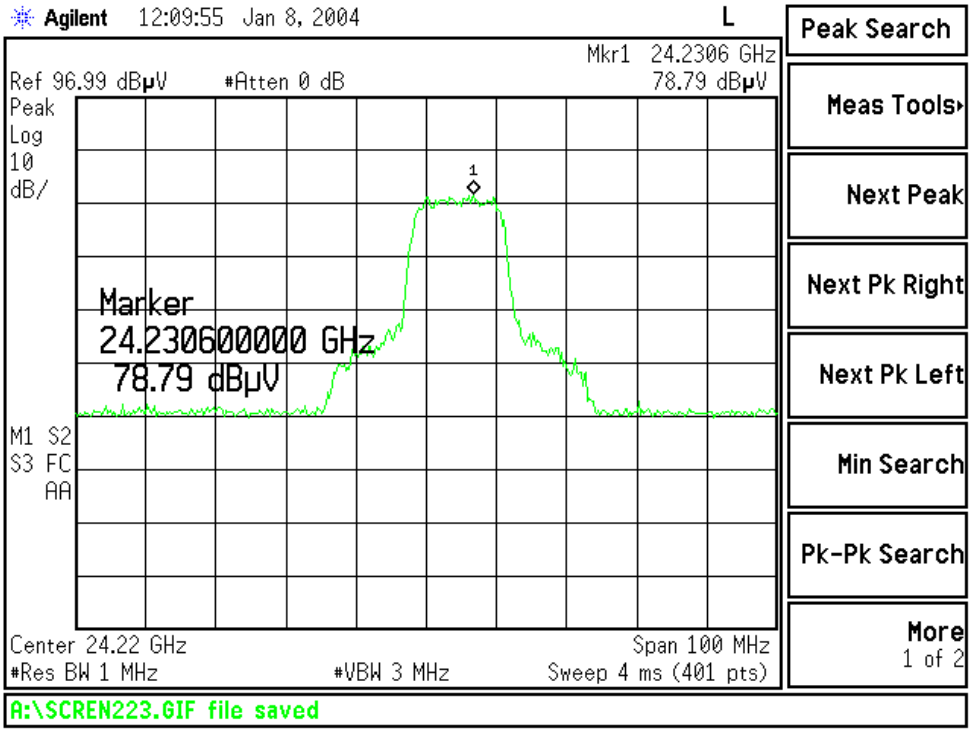
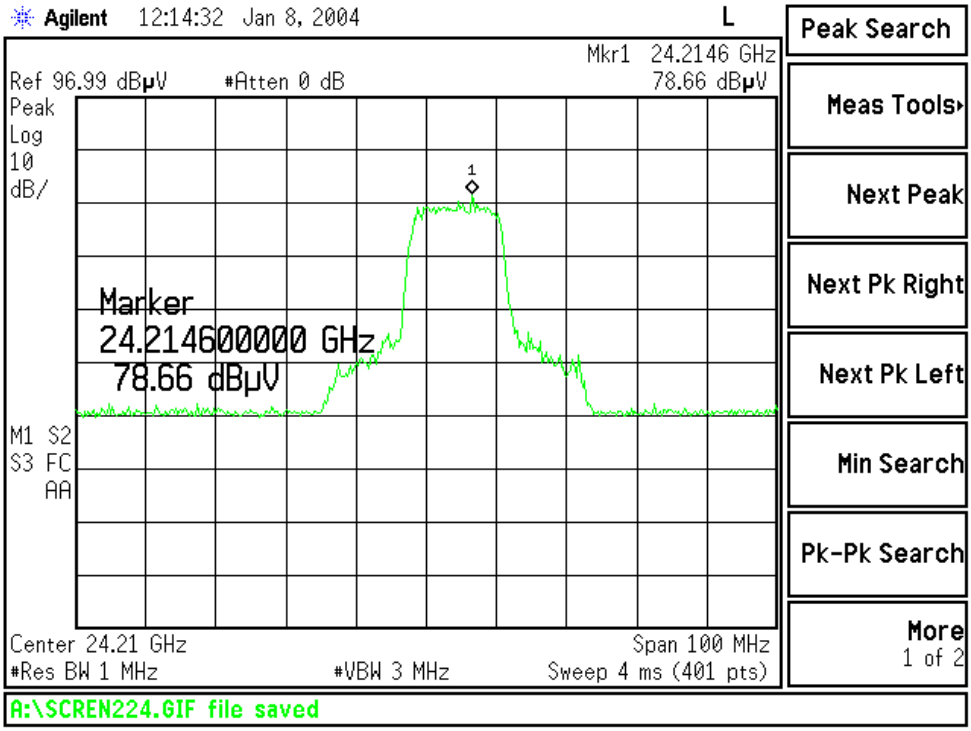


Plot showing channel 2; DS3 mode



Plot showing channel 1; DS3 mode

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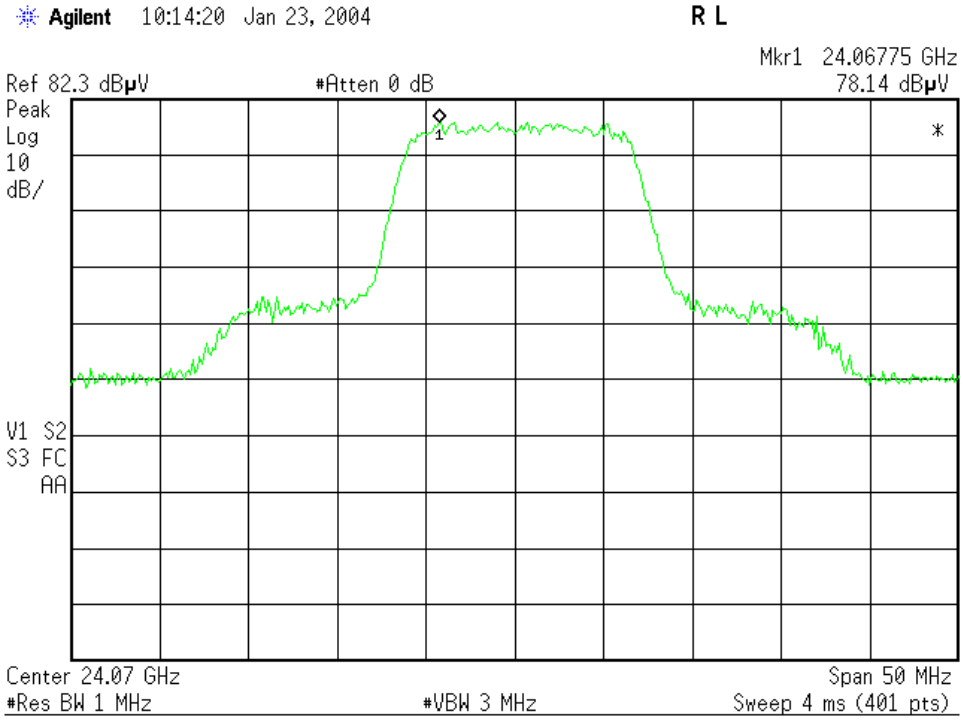
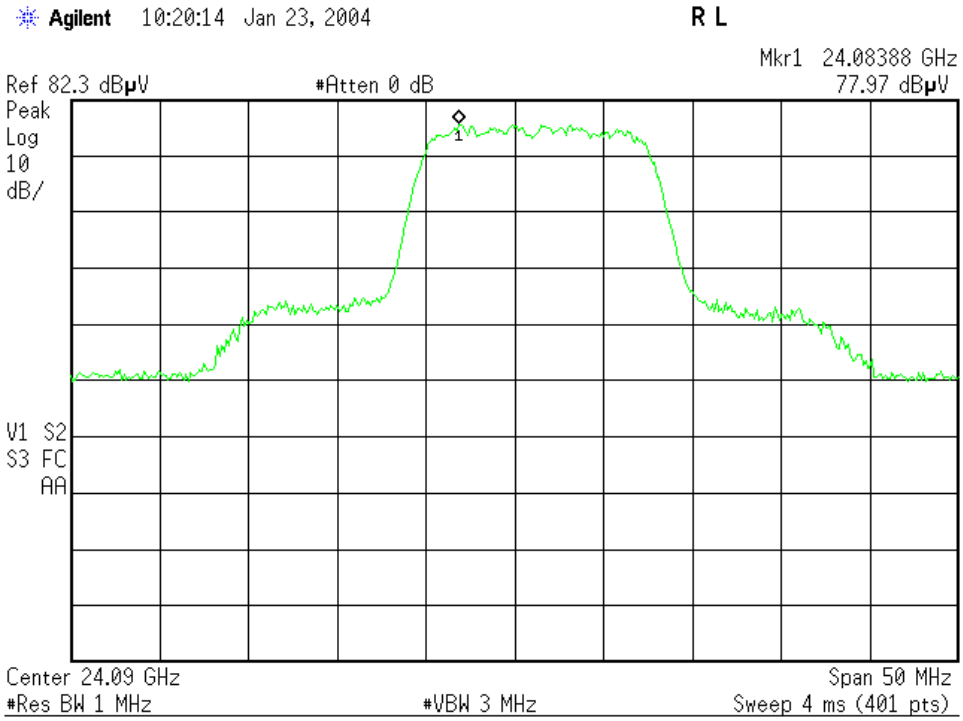
Fundamental Tx Low Unit



CH1-Ethernet Mode



CH2-Ethernet Mode

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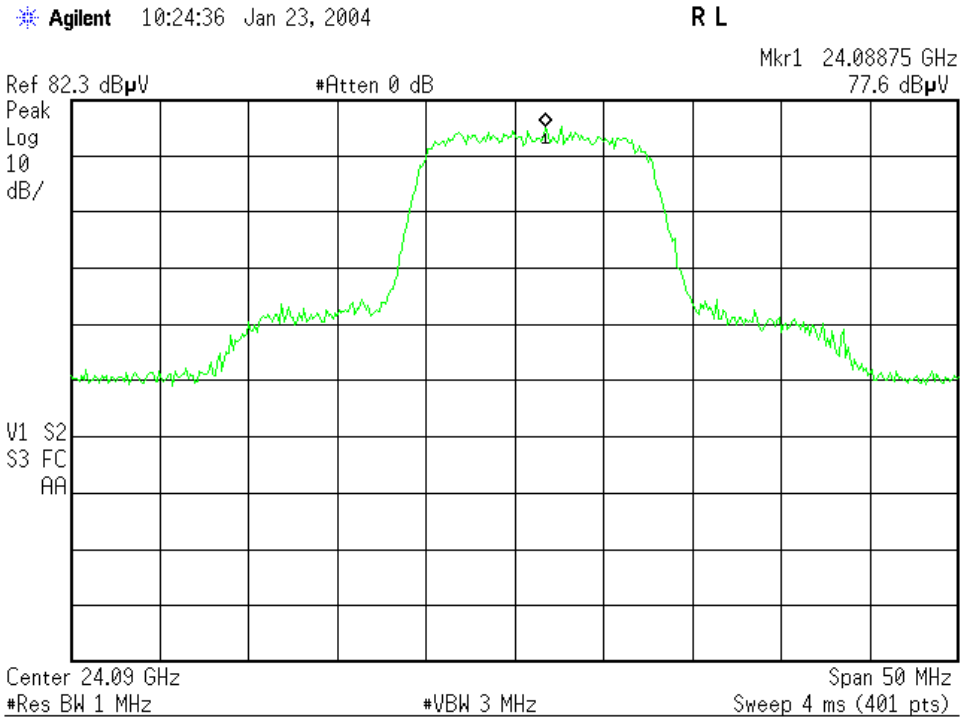
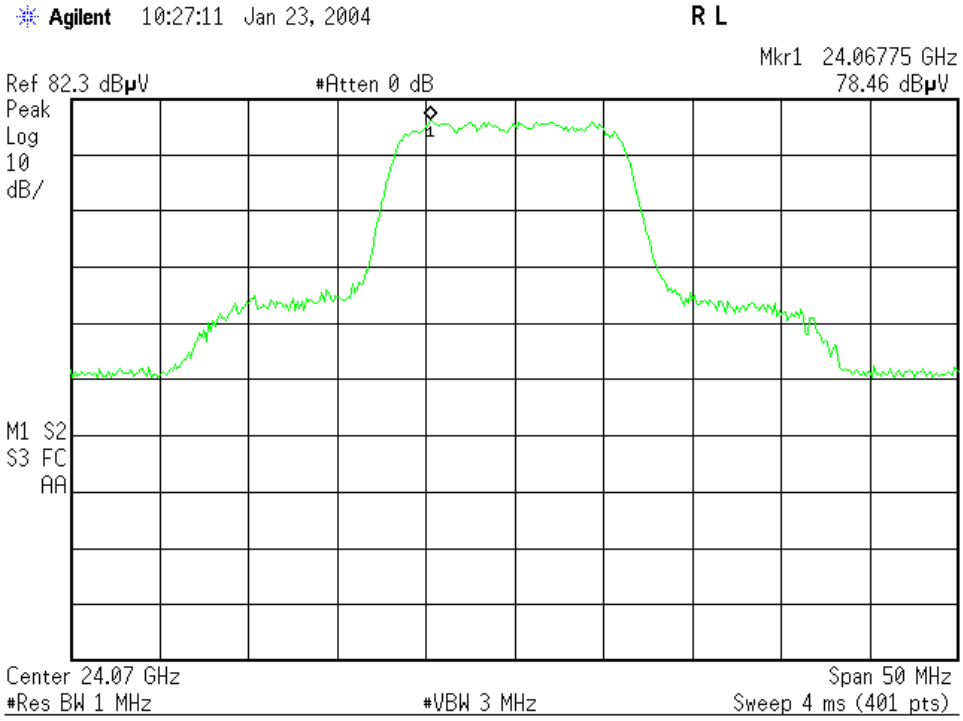


CH2-DS3 Mode



CH1-DS3 Mode

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Section 15.249 (b) (2)

Table #5

FCC Part 15.249 (b)(2)

Temperature and Frequency Stability

Company: YDI **Work Order:** D0923
EUT: LinkCX-24 TxLow **Date:** 1/12/04
Engineer: Mairaj Hussain

Test Equipment Used:
Spectrum Analyzer: Green
Environmental Chamber

RBW: 1KHz

Nominal Freq (Hz)	0.001 % of nominal frequency (Hz)
2.40721745E+10	240721.745

Allowed Frequency Variation

(Hz)	(Hz)
24072415221.75	24071933778.26

Input Voltage: 48V

Temperature (ºC)	Frequency (Hz)	Frequency (delta) (Hz)	Result
-20	2.40721700E+10	4500.00	Pass
-10	2.40721703E+10	4200.00	Pass
0	2.407217650E+10	-2000.00	Pass
10	2.407217600E+10	-1500.00	Pass
20	2.407217450E+10	0.00	Pass
30	2.40721763E+10	-1800.00	Pass
40	2.40721788E+10	-4300.00	Pass
50	2.40721780E+10	-3500.00	Pass

Conclusion:	The product meets the frequency tolerance criteria over the temperature range of -20°C to 50°C

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Table #6

FCC Part 15.249 (b)(2)

Voltage Variation and Frequency Stability

Company: YDI **Work Order:** D0923
EUT: LinkCX-24 TxLow **Date:** 1/12/04
Engineer: Mairaj Hussain

Test Equipment Used:
Spectrum Analyzer: Green
Environmental Chamber

RBW: 1KHz

Input Voltage (V)	Frequency (Hz)	Temperature °C	Amplitude (dBuV)	Amplitude (delta) (dBuV)	Frequency (delta) (Hz)
48	2.40721745E+10	20	65	-	-
21	2.40721753E+10	20	65.6	-0.6	-800.00
60	2.40721763E+10	20	65.6	-0.6	-1800.00

Conclusion:	The product meets the voltage tolerance criteria.

Section 15.249 (d)

Spurious Radiated Emissions

Bandwidth settings for spurious emissions:

Frequency < 1GHz

RBW	120 KHz
VBW	300 KHz

Frequency > 1 GHz

RBW	1 MHz
VBW	3 MHz

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Table #7

Spurious Emissions

Curtis-Straus LLC

Date: 23-Jan-04 **Company:** YDI **Work Order:** D0923
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24

Frequency Range: 30-1000MHz **Measurement Distance:** 3 m

Notes: TxHigh Unit
Add ferrite pn:044316651 on ribbon cable (for enet). Add ferite on the power cable (ribbon cable) pn: 0443163951

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)	Margin (dB)	Result (Pass/Fail)
H	160.0	39.2	20.4	9.3	1.7	29.8				43.5	-13.7	Pass
H	200.0	46.2	20.4	10.5	1.9	38.2				43.5	-5.3	Pass
H	231.2	38.1	20.4	11.9	2.1	31.7				46.0	-14.3	Pass
H	250.0	43.8	20.4	12.8	2.2	38.4				46.0	-7.6	Pass
H	262.5	35.1	20.3	13.1	2.3	30.2				46.0	-15.8	Pass
H	280.0	35.0	20.3	13.6	2.3	30.6				46.0	-15.4	Pass
H	320.0	32.0	20.3	14.6	2.5	28.8				46.0	-17.2	Pass
H	384.0	15.0	20.2	16.3	2.8	13.9				46.0	-32.1	Pass
V	400.0	38.4	20.2	16.7	2.9	37.8				46.0	-8.2	Pass
H	960.0	28.0	19.6	24.0	5.2	37.6				46.0	-8.4	Pass

Table Result: Pass by -5.3 dB ***Worst Freq:*** 200.0 MHz

Test Site: "T" **Pre-Amp:** Green **Cable:** 65 ft RG8A/U **Analyzer:** Yellow **Antenna:** Red

Table#8

Spurious Emissions

Curtis-Straus LLC

Date: 23-Jan-04 **Company:** YDI **Work Order:** D0923
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24

Frequency Range: 1-100GHz **Measurement Distance:** 3 m

Notes: Tx Hi Unit

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)				FCC Class B Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
V	5794.5	27.0	23.0	36.7	2.0	42.7				54.0	-11.3	Pass
H	9207.0	18.5	21.8	40.1	2.9	39.7				54.0	-14.3	Pass
H	9176.0	18.3	21.8	40.1	2.9	39.5				54.0	-14.5	Pass

Table Result: Pass by -11.3 dB ***Worst Freq:*** 5794.5 MHz

Test Site: "T" **Pre-Amp:** Or-Blk **Cable:** 7 Microflex **Analyzer:** Orange **Antenna:** Orange Horn/HF Mixers

Sample calculation:
Adjusted reading = Reading + Antenna factor + Cable factor – Pre amp factor

Note: *No emissions were found in the frequency range of 10 GHz – 100 GHz except fundamental, see table 3 & 4.*
Note: *Readings taken in the frequency range of 30-1000 MHz are QP.*
Note: *Ethernet and DS3 input cables cannot be used simultaneously. When operating in DS3 mode, traffic was generated internal to the EUT and the Ethernet cable was attached since it is unshielded and considered worst case.*

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AC Line Conducted Emission Measurements

Table #9

AC Mains Conducted Emissions — *Curtis-Straus LLC*

Date: 12-Jan-04 **Company:** YDI
Engineer: Mairaj Hussain **EUT Desc:** LinkCX-24 **Work Order:** D0923
Notes: TxLow Unit AC side of adapter **Test Site:** EMI2
LISN(s): Red Orange
Range: 0.15-30Mhz **Other Equipment:** --- **Spectrum Analyzer:** Green

Frequency (MHz)	Q.P. Readings QP1 (dBµV)	Q.P. Readings QP2 (dBµV)	Ave. Readings AV1 (dBµV)	Ave. Readings AV2 (dBµV)	Impedance Factor (dB)	--- Limit (dBµV)	--- Margin dB	FCC/CISPR B qp Limit (dBµV)	FCC/CISPR B qp Margin dB	FCC/CISPR B AVE Limit (dBµV)	FCC/CISPR B AVE Margin dB	Overall Result (Pass/Fail)
0.15	32.0	36.6	24.0	20.0	20.0			66.0	-9.4	56.0	-12.0	Pass
0.22	22.3	25.3			20.0			62.8	-17.5	52.8	-7.5	Pass
0.81	16.8	11.8			20.0			56.0	-19.2	46.0	-9.2	Pass
1.18	16.7	11.7			20.0			56.0	-19.3	46.0	-9.3	Pass
2.50	15.7	5.0			20.0			56.0	-20.3	46.0	-10.3	Pass
5.16	12.5	10.0			20.0			60.0	-27.5	50.0	-17.5	Pass
10.79	13.7	11.5			20.0			60.0	-26.3	50.0	-16.3	Pass
13.92	19.2	18.9			20.0			60.0	-20.8	50.0	-10.8	Pass

Table Result: Pass by -7.50 dB ***Worst Freq:*** 0.22 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]

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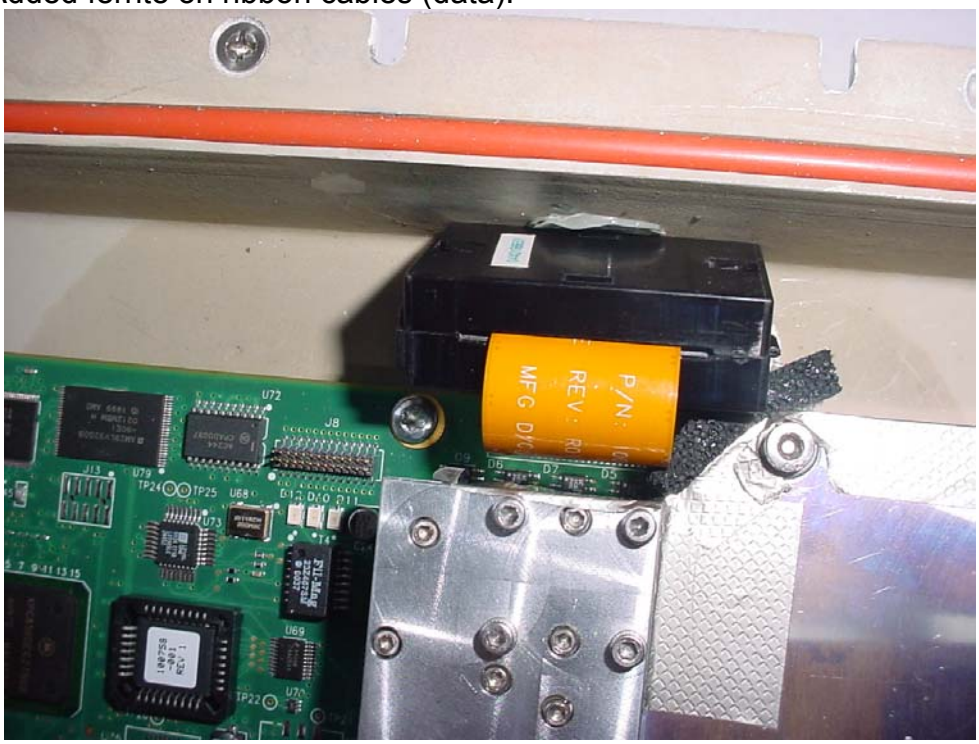
Modifications Required for Compliance

1) Added ferrite on ribbon cables (data).



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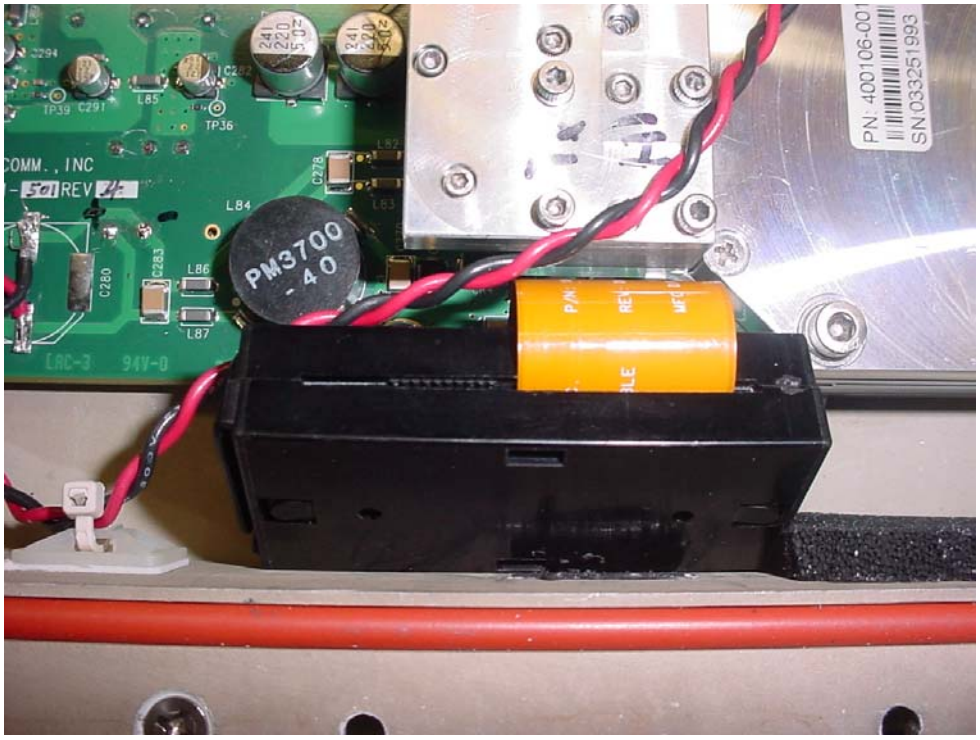

2) Added ferrite on ribbon cables (power).

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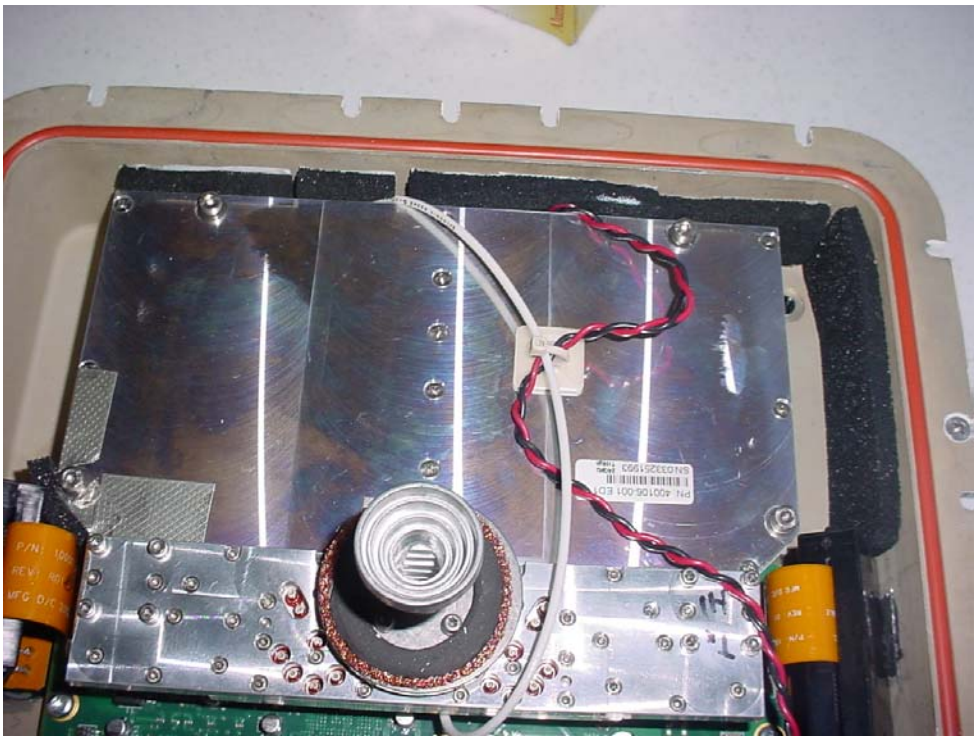
3) Two pieces of ARC absorber LS-10211 added to inside cover.
   Also showing Al tape behind the absorber and ferrites on respective ribbon cables.



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Test Equipment Used

REV. 1/20/04

SPECTRUM ANALYZERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	9kHz-1.8GHz	8591E	HP	3441A03559	00024	21-MAY-2004
WHITE	9kHz-22GHz	8593E	HP	3547U01252	00022	25-FEB-2004
BLUE	9kHz-1.8GHz	8591E	HP	3223A00227	00070	30-SEP-2004
YELLOW	9kHz-2.9GHz	8594E	HP	3523A01958	00100	08-JUL-2004
GREEN	9kHz-26.5GHz	8593E	HP	3829A03618	00143	10-OCT-2004
BLACK	9kHz-12.8GHz	8596E	HP	3710A00944	00337	15-JUL-2004
YELLOW-BLACK	20Hz-40.0MHz	3585A	HP	2504A05219	00030	02-DEC-2004
ORANGE	9kHz-26.5GHz	E4407B	HP	US39440975	00394	27-JUN-2004

LISNS/MEASUREMENT PROBES	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	10KHZ-30MHZ	8012-50-R-24-BNC	SOLAR	956348	00753	01-APR-2004
BLUE	10KHZ-30MHZ	8012-50-R-24-BNC	SOLAR	956349	00752	01-APR-2004
YELLOW-BLACK	10KHZ-30MHZ	8012-50-R-24-BNC	SOLAR	984735	00248	01-APR-2004
ORANGE	10KHZ-30MHZ	8012-50-R-24-BNC	SOLAR	903707	00754	16-OCT-2004
GOLD	10KHZ-30MHZ	8012-50-R-24-BNC	SOLAR	984734	00247	24-JUL-2004
WHITE-BLACK	10KHZ-30MHZ	8610-50-TS-100-N	SOLAR	972019	00678	01-APR-2004
BLACK	10KHZ-30MHZ	8610-50-TS-100-N	SOLAR	972017	00675	01-APR-2004
RED-BLACK	10KHZ-30MHZ	8610-50-TS-100-N	SOLAR	972016	00677	01-APR-2004
BLUE-BLACK	10KHZ-30MHZ	8610-50-TS-100-N	SOLAR	972018	00676	01-APR-2004
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-2004
GREEN CURRENT TRANSFORMER	40HZ-20MHZ	150	PEARSON	10226	00793	03-APR-2004
CISPR LINE PROBE	150KHZ-30MHZ	N/A	C-S	01	00805	20-DEC-2004
CISPR TELCO VOLTAGE PROBE	150KHZ-30MHZ	CS A/C-10	C-S	CS01	00296	11-SEP-2004
CISPR 22 TELCO ISN	9KHZ-30MHZ	FCC-TLISN-T4	FISCHER	20115	00746	15-OCT-2004

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

ANTENNAS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN BILOG	30MHZ-2GHZ	CBL6112B	CHASE	2742	00620	06-JAN-2006
GREEN-BLACK BILOG	30MHZ-2GHZ	CBL6112B	CHASE	2412	00127	06-JAN-2006
GREEN-WHITE BILOG	30MHZ-2GHZ	CBL6112B	CHASE	2574	00319	19-MAY-2005
RED BILOG	30MHZ-1GHZ	3143	EMCO	1270	00042	17-MAR-2005
BLUE BILOG	30MHZ-1GHZ	3143	EMCO	1271	00803	17-MAR-2005
GRAY BILOG	26MHZ-2GHZ	3141	EMCO	9703-1038	00066	19-MAY-2005(EMI) / 06-JUN-2004(RFI)
YELLOW-BLACK BILOG	20-2000MHZ	CBL6140A	CHASE	1112	00126	19-MAY-2005(EMI) / 09-JUN-2004(RFI)
YELLOW HORN	1-18GHZ	3115	EMCO	9608-4898	00037	22-MAY-2005
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	9KHZ-30MHZ	PLA-130/A	ARA	1024	00755	27-JAN-2004
LARGE LOOP	20HZ-5MHZ	6511	EMCO	9704-1154	00067	12-NOV-2005
ACTIVE MONOPOLE	30HZ-30MHZ	3301B	EMCO	3824	00068	08-APR-2004
INDUCTION COIL	50-60HZ	1000-4-8	C-S	N/A	00778	16-SEP-2004
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

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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

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	09-JUL-2004
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-DEC-2004
Mixer / Horn	140-220 GHz	MO5HW/A	OML	G21206-1	00812	05-DEC-2004
Diplexer		DPL.26	OML	N/A	00813	05-DEC-2004

Preamps / Attenuators / Filters	Range	MN	Mfr	SN	Asset	Calibration Due
Red	0.10-2000MHz	ZFL-1000-LN	C-S	N/A	00798	17-MAR-2004
Blue	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00759	31-JUL-2004
Blue-Black	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00800	08-APR-2004
Green	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00802	17-MAR-2004
Black	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00799	17-MAR-2004
Orange	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00765	17-MAR-2004
White	1-20GHz	SMC-12A	C-S	426643	00760	29-JUL-2004
Yellow-Black	1-20GHz	SMC-12A	C-S	535055	00801	19-AUG-2004
Orange-Black	1-20GHz	SMC-12A	C-S	637367	00761	29-JUL-2004
HF (Yellow)	18-26.5GHz	AFS4-18002650-60-8P-4	C-S	467559	00758	15-JUL-2004
High Pass Filter	1-18 GHz	SPA-F-55204	K&L	36	00817	31-JAN-2004
Low Pass Filter	1-9 GHz	11SL10-4100/X4400-O/O	K&L	4	00816	31-JAN-2004
HF 20dB Attenuator	0.03-20 GHz	PE 7019-20	Pasternack	01	00791	21-MAY-2005

Absorbing Clamps	Range	MN	Mfr	SN	Asset	Calibration Due
Fischer Clamp	30-1000MHz	F-201-23mm	Fischer	10	00081	04-JAN-2004

EFT	MN	Mfr	SN	Asset	Calibration Due
EFT Direct Coupling Cap	N/A	C-S	01	00794	10-JAN-2004

ESD Generators	MN	Mfr	SN	Asset	Calibration Due
Green	NSG435	Schaffner	000839	00763	02-DEC-2004
Red	NSG435	Schaffner	001625	00762	09-DEC-2004
Yellow	930D	ETS	201	00673	11-JUN-2004

BEST EMC-2	MN	Mfr	SN	Asset	Calibration Due
Blue	711-1100	Schaffner	199824-002SC	00117	16-JUN-2004 (Surge) / 03-SEP-2004 (D+I) / 05-NOV-2004 (EFT)
Red	711-1100	Schaffner	200122-074SC	00623	17-JUN-2004 (Surge) / 03-SEP-2004 (D+I) / 05-NOV-2004 (EFT)

Chambers and Stripline	MN	Mfr	SN	Asset	Calibration Due
RFI 1 Chamber	3 Meter Compact	Panashield	N/A	00797	09-JUN-2004
RFI 2 Chamber	04' x 07' Shielding System	Lindgren	13329	00795	06-JUN-2004
RFI 3 Stripline	N/A	C-S	N/A	00796	22-JUL-2005
Environmental (Safety)	SGTH-31S	B-M-A Inc.	2245	00321	03-JAN-2004

Amplifiers	Range	MN	Mfr	SN	Asset	Calibration Due
Red	0.5-1000MHz	10W1000B	AR	18708	00032	12-MAY-2004
Green	0.5-1000MHz	10W1000B	AR	23423	00123	24-MAY-2004
Blue	0.01-250MHz	75A250	AR	19165	00039	14-JAN-2004(CRFI) / 12-MAY-2004 (RFI)
Black	0.01-250MHz	75A250	AR	23411	00122	14-JAN-2004(CRFI) / 28-MAY-2004(RFI)
Orange	0.01-250MHz	75A250	AR	26827	00367	14-JAN-2004(CRFI) / 28-MAY-2004(RFI)
HP489A	1.0-2.0GHz	HP489A	HP	1144AU1780	00083	14-OCT-2004
HP491C	2.0-4.0GHz	HP491C	HP	449-00638	00764	14-OCT-2004
HP493A	4.0-8.0GHz	HP493A	HP	171402242	00085	14-OCT-2004
HP495A	7.0-12.0GHz	HP495A	HP	904-00237	00086	14-OCT-2004

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Field Probes	Range	MN	Mfr	SN	Asset	Calibration Due
Red	0.01-1000MHz	HI-4422	Holaday	90369	00031	14-APR-2004
Green	0.01-1000MHz	HI-4422	Holaday	97363	00136	02-APR-2004

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	15-JUL-2004
Green	0.09-2000MHz	HP8648B	HP	3623A02072	00125	10-SEP-2004
Orange	0.1-1000MHz	HP8648B	HP	3537A01210	00025	21-MAY-2004
Black	15MHz	HP33120A	HP	US36004674	00766	12-NOV-2004
Yellow	15MHz	HP33120A	HP	US36014119	00249	21-MAY-2004
Blue-White	0.1Hz-13MHz	HP3312A	HP	1432A07632	00775	27-FEB-2004
Sweeper	0.01-20.0GHz	HP83752A	HP	3610A01133	00087	04-APR-2004

Bulk Injection Clamps	Range	MN	Mfr	SN	Asset	Calibration Due
Red	0.01-100MHz	95236-1	Tegam	12248	00035	14-JAN-2004
Green	0.01-100MHz	95236-1	EMCO	50215	00118	14-JAN-2004

CDN Networks	Range	MN	Mfr	SN	Asset	Calibration Due
Black	0.15-100MHz	20A M-2	C-S	04	00783	14-JAN-2004
Blue	0.15-100MHz	15A M-3	C-S	05	00806	14-JAN-2004
Red	0.15-100MHz	15A M-3	C-S	06	00780	14-JAN-2004
White	0.15-100MHz	15A M-3	C-S	07	00782	14-JAN-2004
Yellow-Black	0.15-100MHz	15A M-3	C-S	08	00784	14-JAN-2004
Blue-Black	0.15-100MHz	15A M-3	C-S	09	00781	14-JAN-2004
Green	0.15-100MHz	30A M-3	C-S	10	00779	14-JAN-2004
Yellow	0.15-100MHz	30A M-5	C-S	11	00804	14-JAN-2004
Blue-White	0.15-100MHz	15A M-5	C-S	12	00788	14-JAN-2004
Yellow (res)	0.15-100MHz	100Ω Resistor Nwk	C-S	01	00810	10-SEP-2004
Green (res)	0.15-100MHz	100Ω Resistor Nwk	C-S	02	00785	10-SEP-2004

Harmonic Analyzer	MN	Mfr	SN	Asset	Calibration Due
HFTS	HP6842A	HP	3531A-00169	00738	03-DEC-2005

Frequency Counter	MN	Mfr	SN	Asset	Calibration Due
5340A	HP5340A	HP	1440A02320	00787	30-JUL-2004

Surge Generators	MN	Mfr	SN	Asset	Calibration Due
Transient Waveform Monitor	TWM-5	CDI	003982	00323	18-JUN-2004
Universal Surge Generator	M5	CDI	003966	00324	13-JUN-2004
Three Phase Coupling Nwk	3CN	CDI	003455	00325	13-JUN-2004
1.2x50uS Plugin Module	1.2x50uS Plugin	CDI	N/A	00842	13-JUN-2004
10x160uS Plugin Module	10x160uS Plugin	C-S	N/A	00843	12-JUN-2004
10x560uS Plugin Module	10x560uS Plugin	C-S	N/A	00841	12-JUN-2004
10x700uS Plugin Module w/ Extension Box	10x700uS Plugin	C-S	N/A	00844/845	12-JUN-2004
PSurge Controller Module	PSURGE 8000	Haefely	150267	00879	11-JUN-2004
Coupling/Decoupling Module	PSD 900	Haefely	149213	00880	11-JUN-2004
Impulse Module	PIM 900	Haefely	149202	00881	11-JUN-2004
High Voltage Cap Nwk 5kVDC, 18µF	CS-HVCC	C-S	01	00772	15-OCT-2004
NEBS Surge Generator	N/A	C-S	N/A	00088	17-JUN-2004
2x10uS Surge Generator	2x10uS	C-S	N/A	00846	18-JUN-2004
10x700uS Surge Generator	10x700uS	C-S	N/A	00847	12-JUN-2004
12 Pair Surge Resistor Module	N/A	C-S	N/A	00768	18-SEP-2004

Oscilloscopes	MN	Mfr	SN	Asset	Calibration Due
Oscilloscope 100MHz	TDS 220	Tektronix	B068748	00885	03-JUN-2004
Oscilloscope 100MHz (Safety)	TDS 340	Tektronix	B012357	00737	16-OCT-2004
Oscilloscope 100MHz (Telecom)	54645A	HP	US36320452	00103	30-JUN-2004

Power Supplies	MN	Mfr	SN	Asset	Calibration Due
10001/2 AC Power System	(2) 500I	California Instruments	HK53687/HK53688	00376	31-JAN-2004

RMS Voltmeters/Current Clamp	MN	Mnfr	SN	Asset	Calibration Due

WHITE RMS VOLTMETER	3400A	HP	1218A14427	00809	09-JAN-2004
TRUE-RMS VOLTMETER	79III	FLUKE	71700298	00769	15-OCT-2004
TRUE-RMS CLAMP METER (SAFETY)	36	FLUKE	68805882	00700	31-MAR-2004

POWER/NOISE METERS	MN	MFR	SN	ASSET	CALIBRATION DUE
POWER METER	435B	HP	2445A11012	00773	07-APR-2004
POWER SENSOR	8481A	HP	2702A61351	00774	07-APR-2004
TRANSMISSION LINE TESTER (DBRNC)	185T	AMREL	998658	00823	14-JAN-2004

OVERVOLTAGE CHAMBERS	MN	MFR	SN	ASSET	CALIBRATION DUE
72KW POWER FAULT SIMULATOR	OV1	C-S	N/A	00792	14-MAR-2004
POWER FAULT SIMULATOR	OV2	C-S	N/A	00116	14-MAR-2004

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
ATMOSPHERIC PRESSURE GAUGE	BA928	OREGON SCIENTIFIC	C3166-1	00831	03-MAR-2004

TRACEABLE CLOCKS	MN	MFR	SN	ASSET	CALIBRATION DUE
5003	5003	CONTROL COMPANY	99026940	00808	09-DEC-2004

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

Unless otherwise noted the calibration interval is one year. All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

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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.

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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.

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