



Report No	EE0056-2
Client	Voxware, Inc. 185 Alewife Brook Parkway Cambridge, MA 02138
Phone	617-497-0200
Fax	617-576-2123
FRN	0010250033
<hr/>	
Model	VLS-410
FCC ID	SC6VLS410C352
Equipment Type	Digitally Modulated Transmitter
Equipment Code	DTS
Results	As detailed within this report
<hr/>	
Prepared by	 Evan Gould – Test Engineer
Authorized by	 Michael Buchholz – EMC Manager
Issue Date	8/31/04
Conditions of issue	This Test Report is issued subject to the conditions stated in 'terms and conditions' section of this report.

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Summary

This test report supports an application for certification of a transmitter operating pursuant to 47 CFR 15.247. The product is the Voxware VLS-410 with the Cisco LMC352 card. It is a spread spectrum transmitter that operates in the range 2412 - 2462MHz. The LMC352 card has previously been certified as FCC ID LDK102040. The purpose of this application is to certify the VLS-410 which utilizes this radio with a new antenna (Proxim 7742 0dBi omnidirectional antenna) in a body worn configuration. See the following attached files for information on the original application for the Cisco card:

LDK102040 – Block Diagram
LDK102040 – Schematic
LDK102040 – Circuit Description

Test Methodology

Radiated emissions testing is performed according to the procedures specified in ANSI C63.4 (2003). Emissions were maximized by rotating the EUT around three orthogonal axes as well as varying the height and polarity of the receiving antenna. The EUT antenna can not be maximized separately. Testing was performed with fresh batteries. For the purposes of this report, operating channels 1, 5, and 11 were investigated. Channel 5 was determined to be the worst case channel.

Frequency range investigated: 30MHz – 25GHz

Measurement distance:	30 - 1000MHz	3m
	1 – 25GHz	3m

Statement of Conformity

The VLS-410 has been considered by Curtis-Straus LLC to conform to the following parts of 47 CFR as detailed below:

Part 2	Part 15	Comments
	15.15(b)	There are no controls accessible to the user that adjust the power level on this device.
2.925	15.19	The label is shown in the label exhibit.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are required for compliance.
	15.203	The antenna connector is reverse MCX.
	15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209.
	15.207	This EUT is battery powered.
	15.247	EUT meets the requirements of 47 CFR 15.247
	15.247(b)(5)	See attached file: EMC15036-SAR FCC.pdf

EUT Configuration

EUT Configuration					
Work Order: E0056					
Company: Voxware, Inc.					
Company Address: 185 Alewife Brook Parkway Cambridge, MA 02138					
Contact: Fred Earthrowl					
Person Present: Fred Earthrowl					
MN		SN	FCC ID		
EUT: VLS410		38520007	LDK102040		
Cisco Tx/Rx card: LMC352					
Antenna type: Proxim 7742 0dBi omnidirectional antenna					
EUT Max Frequency: 2.483GHz					
Support Equipment:		MN	SN	FCC ID	
Head set		1108-XXQDS	03061031	-	
Metrologic Scanner		IS4220	1603390165	-	
EUT Cables:	Qty	Shielded?	Length	Ferrites	
Head set cable	1	No	4 feet	None	
Scanner cable	1	Yes	5 feet	None	
Unpopulated EUT Ports:		Qty	Reason		
None					
Software / Operating Mode Description:					
EUT established connection to server and running a voice XML file.					



6dB Bandwidth

LIMIT

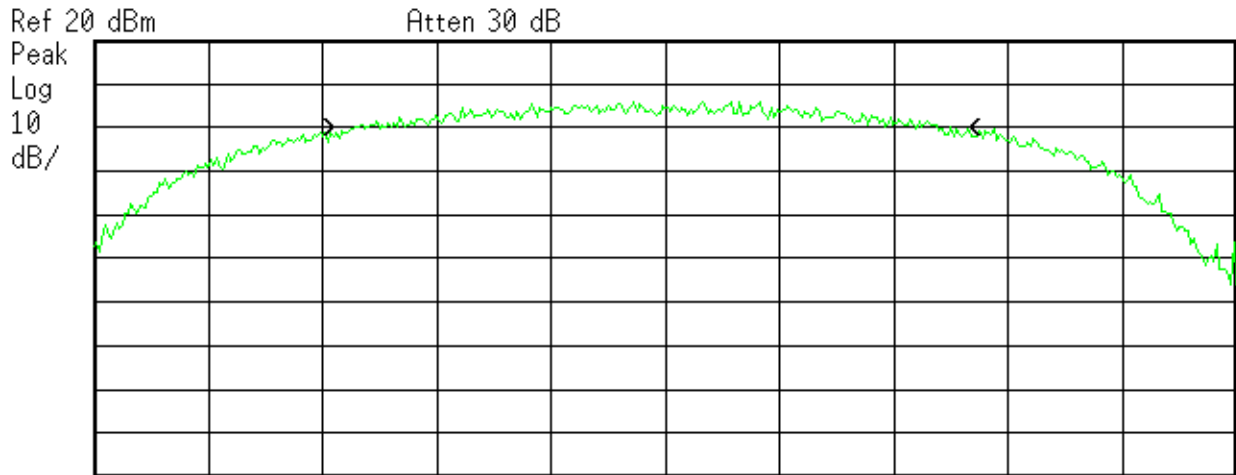
"Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz." [15.247(a)(2)]

PLOT

Channel 5

Agilent 10:49:03 Aug 5, 2004

R L



Center 2.432 GHz Span 20 MHz
 #Res BW 100 kHz #VBW 1 MHz Sweep 4.348 ms (401 pts)

Emission Bandwidth Results (paused)	
Emission Bandwidth	Emiss BW X dB
10.43 MHz	-6.0 dB



Peak Output Power

LIMIT

“For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.” [15.247(b)(3)]

1 Watt = 30dBm

METHOD

The power was manually integrated across the 6dB bandwidth. The trace was taken with RBW=1MHz, VBW=3MHz, and Peak detector function. The calculation follows.

Power Per 1MHz (dBm)	Power Per 1MHz (mW)	Sum of Powers (mW)	Integrated Power (dBm)	Cable Factor (dB)	Adjusted Integrated Power (dBm)
10.29	10.69314745	204.3258389	23.1032329	1	24.10323291
11.67	14.67930708	Average Power Per 1MHz [mW] = 10 ^ (Power[dBm]/10) Sum of Powers = Sum of values in previous column Integrated Power = 10 log (Sum of Powers[mW])			
12.97	19.79728137				
13.71	23.47724987				
14.03	25.2766459				
14.07	25.50987516				
13.96	24.86693289				
13.39	21.83735328				
12.34	17.13409266				
11.13	12.97602479				
9.07	8.077928411				

MEASUREMENT

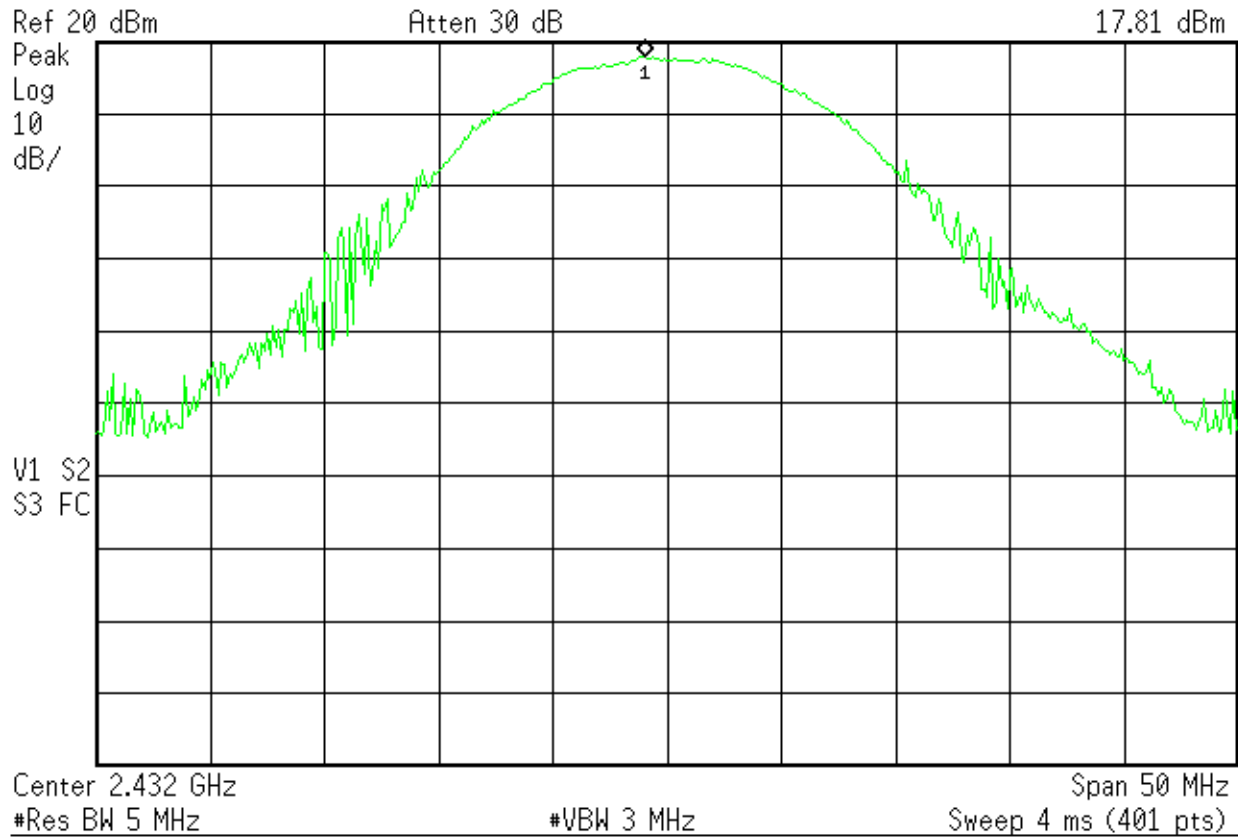
Peak Output Power				Curtis-Straus LLC			
Date: 5-Aug-04		Company: Voxware		Work Order: E0056			
Engineer: Evan Gould		EUT: VLS410					
Analyzer: Orange				Cable: Microflex #8			
Channel	Center Frequency (GHz)	Measured Peak Output Power (dBm)	Cable Factor (dB)	Adjusted Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result (Pass/Fail)
5	2.434	23.1	1.0	24.10	30.00	-5.90	Pass



Agilent 10:45:27 Aug 5, 2004

R L

Mkr1 2.43138 GHz
17.81 dBm



Peak Power Spectral Density

LIMIT

“For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.” [15.247(d)]

Detector function = Peak

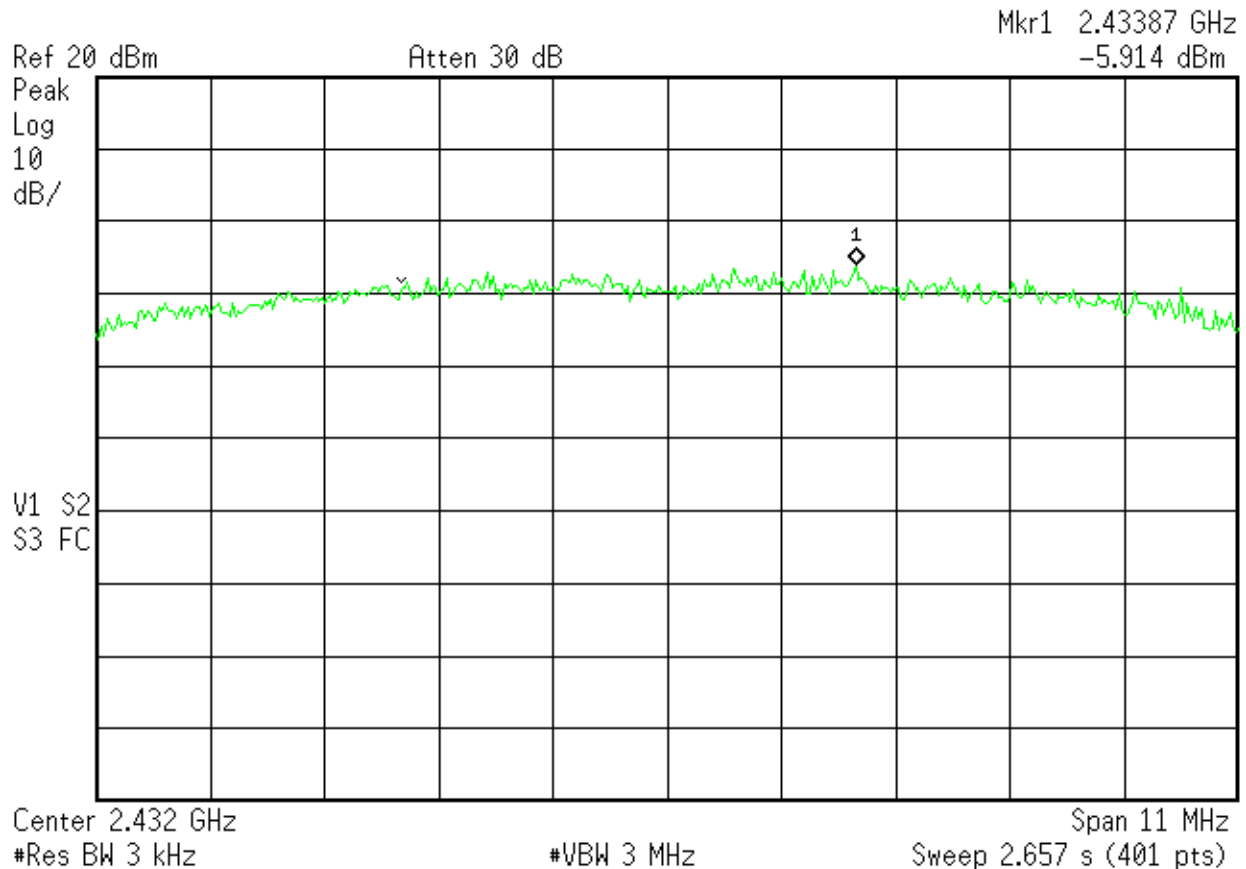
MEASUREMENTS

Peak Power Spectral Density					Curtis-Straus LLC		
Date: 5-Aug-04		Company: Voxware			Work Order: E0056		
Engineer: Evan Gould		EUT: VLS410					
Analyzer: Orange				Cable: Microflex #8			
RBW: 3kHz				VBW: 3MHz			
Channel	Center Frequency (GHz)	Measurement (dBm)	Cable Factor (dB)	Adjusted Measurement (dBm)	Limit (dBm)	Margin (dB)	Result (Pass/Fail)
5	2.434	-5.91	1.0	-4.91	8.00	-12.91	Pass

ANALYZER PLOT

Agilent 13:33:40 Aug 5, 2004

R L



Radiated Spurious Emissions

LIMITS

"...radiated emissions which fall in the restricted bands, as defined in §15.209(a), must also comply with the radiated emission limits specified in §15.209(a)" [15.247(c)]

Bandwidth Settings: 30-1000MHz
1-25GHz

RBW=120kHz VBW=300kHz
RBW=1MHz VBW=3MHz

MEASUREMENTS

Spurious Emissions Table							Curtis-Straus LLC		
Date: 22-Jan-04		Company: Voxware, Inc.			Work Order: E0056				
Engineer: Mairaj Hussain		EUT Desc: VLS410 with Cisco LMC352 card							
Frequency Range: 30 - 1000 MHz				Measurement Distance: 3 m					
Notes: Use shielded cable for the scanner port							EUT Max Freq: 2.47GHz		
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	47 CFR 15.209		
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
H	110.6	34.0	20.4	7.0	1.4	22.0	43.5	-21.5	Pass
H	122.8	30.0	20.4	7.2	1.4	18.2	43.5	-25.3	Pass
H	132.0	41.2	20.4	8.3	1.5	30.6	43.5	-12.9	Pass
H	170.5	31.1	20.4	9.4	1.7	21.8	43.5	-21.7	Pass
H	176.0	44.7	20.4	9.4	1.8	35.5	43.5	-8.0	Pass
H	220.0	44.1	20.4	11.4	2.0	37.1	46.0	-8.9	Pass
H	231.0	34.0	20.4	11.9	2.1	27.6	46.0	-18.4	Pass
H	234.0	41.2	20.4	12.1	2.1	35.0	46.0	-11.0	Pass
H	264.0	44.2	20.3	13.2	2.3	39.4	46.0	-6.6	Pass
H	308.0	38.0	20.3	14.3	2.5	34.5	46.0	-11.5	Pass
H	313.5	33.0	20.3	14.4	2.5	29.6	46.0	-16.4	Pass
H	534.5	31.0	20.0	18.3	3.5	32.8	46.0	-13.2	Pass
H	559.1	26.5	20.0	18.8	3.6	28.9	46.0	-17.1	Pass
H	657.5	28.2	20.0	20.3	4.0	32.5	46.0	-13.5	Pass
Table Result: Pass		by		-6.6 dB		Worst Freq: 264.0 MHz			
Test Site: "T"		Pre-Amp: Green		Cable: 65 ft RG8A/U		Analyzer: Yellow		Antenna: Red	

Radiated Emissions Table							Curtis-Straus LLC		
Date: 05-Aug-04		Company: Voxware			Work Order: E0056				
Engineer: Evan Gould		EUT Desc: VLS 410							
Frequency Range: High Band Edge				Measurement Distance: 3 m					
Notes:									
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	47 CFR 15.209		
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Hav (30HzVBWpk)	2483.5	33.8	24.2	30.0	1.9	41.5	54.0	-12.5	Pass
Hpk	2483.5	61.9	24.2	30.0	1.9	69.6	74.0	-4.4	Pass
Table Result: Pass		by		-4.4 dB		Worst Freq: 2483.5 MHz			
Test Site: "T"		Pre-Amp: Or-Blk		Cable: 2 RG142LL		Analyzer: Orange		Antenna: Orange Horn	



Radiated Emissions Table										Curtis-Straus LLC				
Date: 22-Jan-04			Company: Voxware, Inc.				Work Order: E0056							
Engineer: Mairaj Hussain			EUT Desc: VLS410 with Cisco LMC352 card											
Frequency Range: 1 - 25 GHz (except 2.4GHz-2.483GHz band)						Measurement Distance: 3 m								
Notes: Use shielded cable for the scanner port						EUT Max Freq:								
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	---			47 CFR 15.209				
							Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)	Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)		
No emissions found														
Table Result:			---			by			---			dB		
Worst Freq:			---			MHz								
Test Site: "T"		Pre-Amp: Or-Blk		Cable: 9 Microflex		Analyzer: Orange		Antenna: Orange Horn		Pre-Amp: Yellow		Antenna: White Horn		



Conducted Spurious Emissions

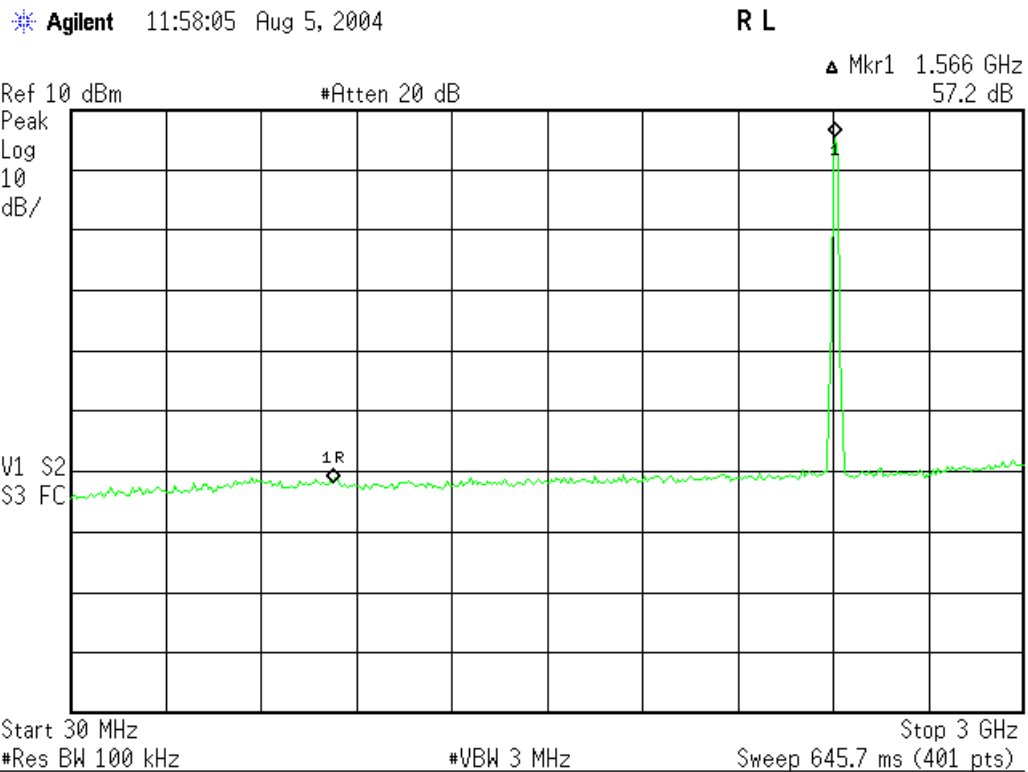
LIMITS

"In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power..."
[15.247(c)]

As can be seen in the following analyzer plots, conducted spurious emissions and band edge measurements pass.

ANALYZER PLOTS

Conducted Spurious 30MHz – 3GHz

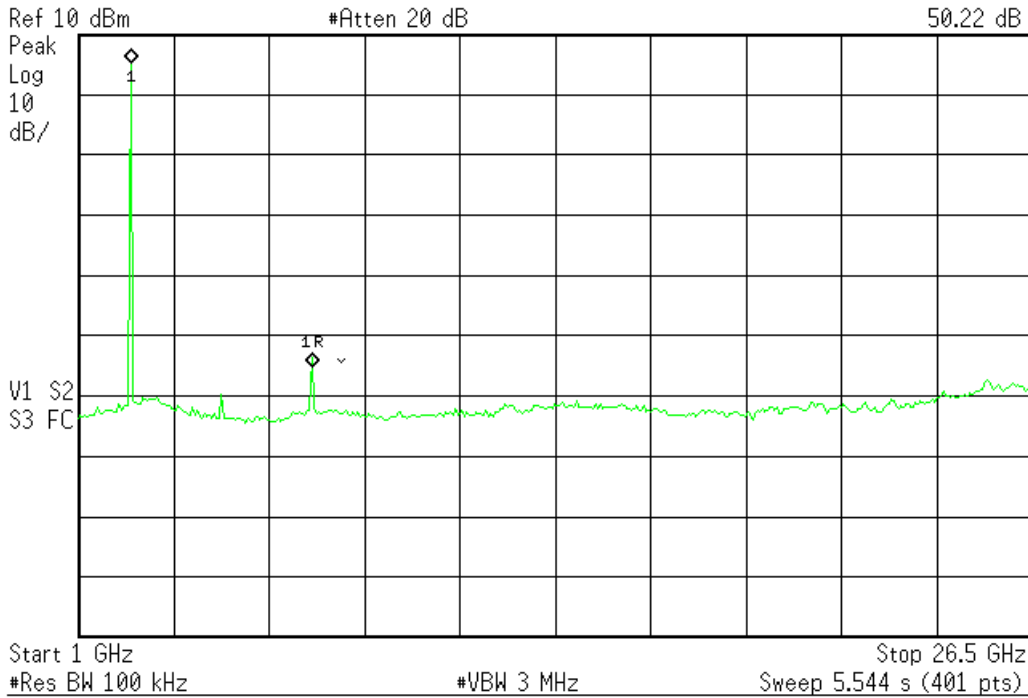


Conducted Spurious 1-26.5GHz

Agilent 12:00:21 Aug 5, 2004

R L

Mkr1 -4.85 GHz
50.22 dB

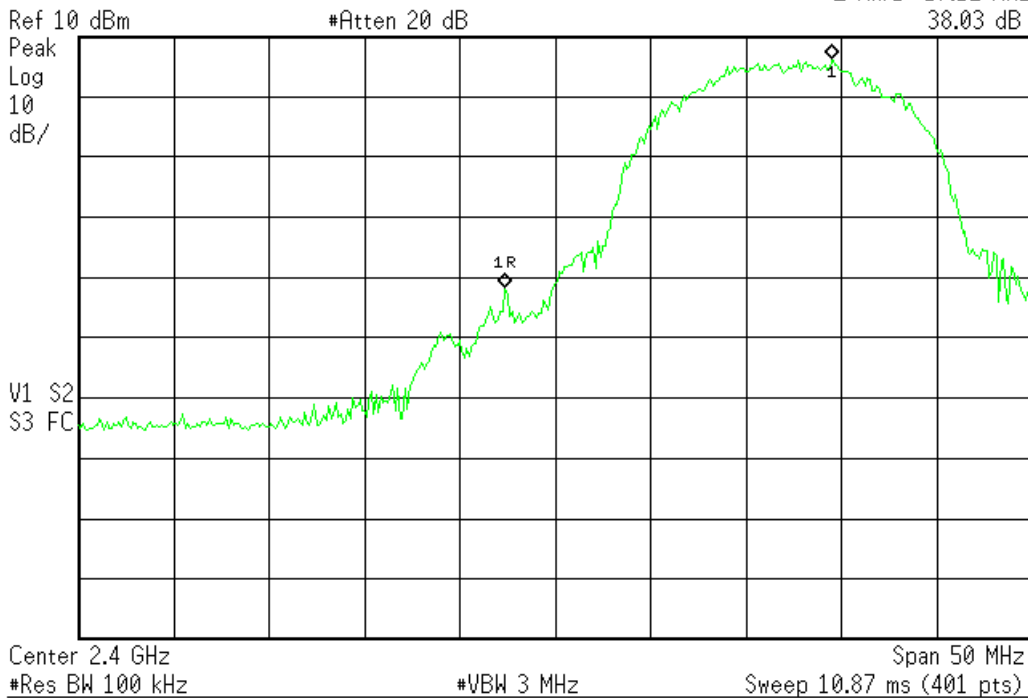


Low Band Edge

Agilent 11:55:07 Aug 5, 2004

R L

Mkr1 17.12 MHz
38.03 dB

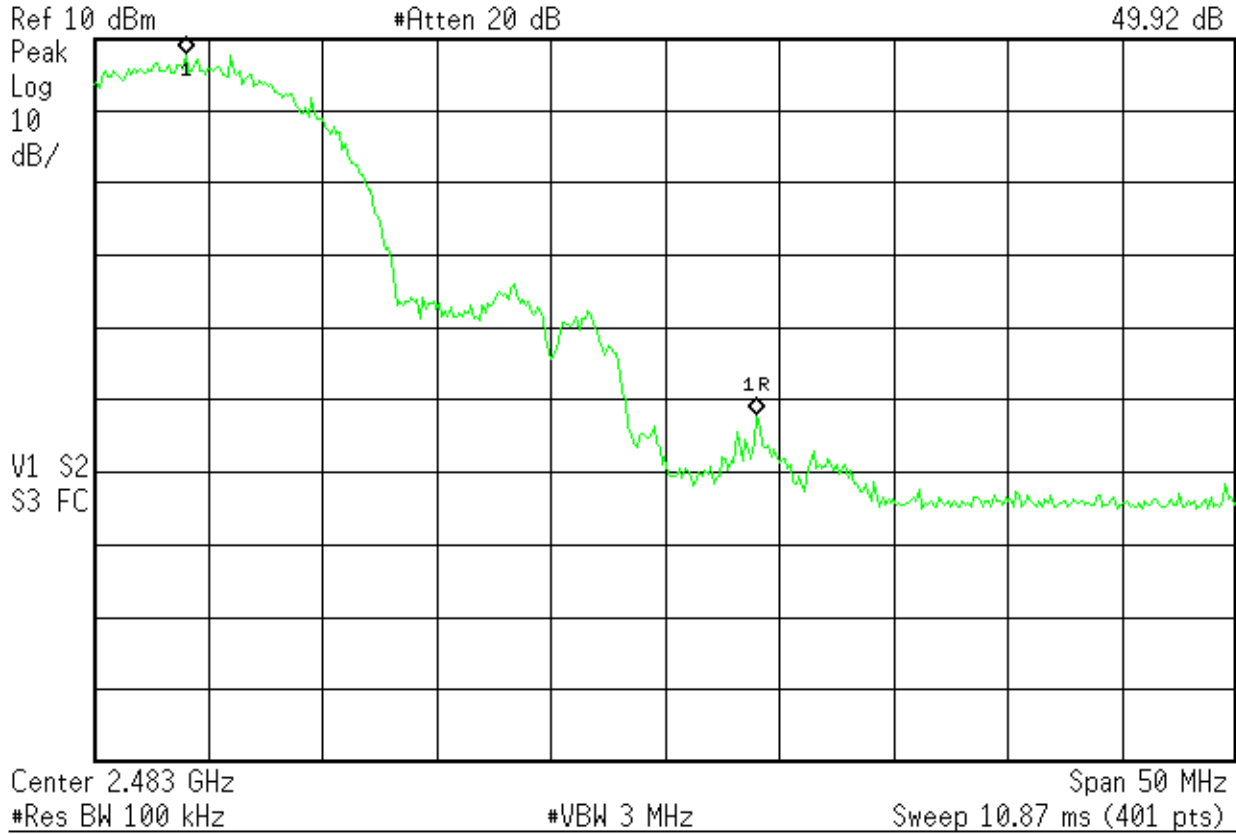


High Band Edge

Agilent 13:25:57 Aug 5, 2004

R L

Mkr1 -25.00 MHz
49.92 dB



Test Equipment Used
Spurious emissions 1/22/04

REV. 1/20/04

SPECTRUM ANALYZERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
YELLOW	9kHz-2.9GHz	8594E	HP	3523A01958	00100	08-JUL-2004
ORANGE	9kHz-26.5GHz	E4407B	HP	US39440975	00394	27-JUN-2004

OPEN AREA TEST SITE (OATS)	FCC CODE	IC CODE	VCCI CODE	CALIBRATION DUE
SITE T	93448	IC 2762-T	R-905	25-MAR-2005

ANTENNAS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED BILOG	30MHz-1GHz	3143	EMCO	1270	00042	17-MAR-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

PREAMPS / ATTENUATORS / FILTERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00802	17-MAR-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

Conducted Measurements 8/5/04

REV. 05-AUG-2004

SPECTRUM ANALYZERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
ORANGE	9kHz-26.5GHz	E4407B	HP	US39440975	00394	03-JUN-2005

OPEN AREA TEST SITE (OATS)	FCC CODE	IC CODE	VCCI CODE	CALIBRATION DUE
SITE T	93448	IC 2762-T	R-905	25-MAR-2005

PREAMPS / ATTENUATORS / FILTERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
ORANGE-BLACK	1-20GHz	SMC-12A	C-S	637367	00761	21-JUL-2005

ANTENNAS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
ORANGE HORN	1-18GHz	3115	EMCO	0004-6123	00390	04-JUN-2005

Unless otherwise noted the calibration interval is one year. 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			
<p>CURTIS-STRAUS¹ 527 Great Road Littleton, MA 01460 Barry Quinlan Phone: 978-486-8880</p> <p>ELECTRICAL</p>		<p>EN 55011 1991, 1998 characteristics of SABS CISPR 11: 1997</p> <p>Canada ICES-001 1998 CNS13803 AS/NZS 2064: 1997</p> <p>CSA C108.8 – M1983</p> <p>CISPR 13:1996, 1998, 2001</p> <p>EN 55013: 1990, 2001</p> <p>EN 55013 Amend 12 1994</p> <p>SABS CISPR 13: 1996</p> <p>CNS 13439 AS/NZS 1053: 1999</p> <p>CISPR 14 1993 (except discontinuous disturbances)</p> <p>EN 55014 1993, 1997 discontinuous disturbances)</p> <p>AS/NZS 1044: 1995 discontinuous disturbances)</p> <p>Immunity CNS13783-1 SABS CISPR 14-1 1993</p> <p>SABS CISPR 14-2 1997 + A1:2001</p>	<p>Limits and methods of measurement of radio disturbance industrial, scientific and medical (ISM) radio-frequency equipment. Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics Limits and methods of measurement</p> <p>Industrial, scientific and medical radio frequency generators</p> <p>Industrial, Scientific and Medical Instrument</p> <p>Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.</p> <p>Electromagnetic Emission from Data Processing Equipment and Electronic Office Machines</p> <p>Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.</p> <p>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.</p> <p>Limits and methods of measurement of radio disturbance characteristics of broadcast receivers and associated equipment. Amendment 12</p> <p>Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.</p> <p>Broadcast receiver and associated equipment Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.</p> <p>Limits and methods of measurement of radio disturbance characteristics of electrical motor- operated and thermal appliances for household and similar purposes, electric tools and similar electric apparatus.</p> <p>Limits and methods of measurement of radio disturbance (except characteristics of electrical motor- operated and thermal appliances for household and similar purposes, electric tools and similar electric apparatus.</p> <p>Household Electrical Appliances</p> <p>Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus Part 1: Emission – Product family standard</p> <p>Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus Part 2: Immunity - Product family standard</p>
Valid until: July 31, 2005	Certificate Number: 1627-01		
<p>In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following <u>Electromagnetic Compatibility (EMC), Telecommunications, and Product Safety tests:</u></p>			
<p>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</p>			
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.		
<p>¹ Note: This accreditation covers testing performed at the laboratory listed above and the satellite facility located at 168 Ayer Rd, Littleton, MA 01460</p>			
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CISPR 14-2 1996, 1997 + A1:2001	Immunity requirements for household appliances, tools and similar apparatus.	EN 61000-6-1: 1997, 2001	Electromagnetic Compatibility (EMC)- Part 6: Generic standards- Section 1: Immunity for residential, commercial and light-industrial environments
CISPR 20: 1995, 2002 with amendment 3 (associated group only)	Limits and methods of measurement of immunity characteristics of sound and television broadcast receivers and associated equipment.	EN 61000-6-2: 1998, 2001	Electromagnetic Compatibility (EMC)- Part 6: Generic standards- Section 2: Immunity for industrial environments
EN 55020: 1995, 2002 (associated group only)	Electromagnetic immunity of broadcast receivers and Associated equipment.	EN 50091-2 1996	Specification for Uninterruptible Power Systems (UPS). Part 2: EMC requirements
CISPR 24	Information technology equipment – Immunity characteristics – Limits and methods of measurement	EN 55024 1998	Information technology equipment – Immunity Characteristics – Limits and methods of measurement.
SABS CISPR 24 1997	Information technology equipment – Immunity characteristics – Limits and methods of measurement	EN 55103-1 1997	Electromagnetic Compatibility – Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 1: Emission
AS/NZS 3200.1.2: 1995	Approval and test specification – Medical electrical Equipment – General requirements for safety – Collateral Standard: Electromagnetic compatibility – Requirements and tests.	EN 55103-2 1997 (excluding Annex A3)	Electromagnetic Compatibility – Product family standard for audio, video, audio-visual and entertainment lighting control professional use. Part 2: Immunity
European Union Basic EMC Standards		EN 61326 1998	Electrical equipment for measurement, control and laboratory use – EMC requirements
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 61547 1996	Equipment for general lighting purposes – EMC immunity requirements
EN 61000-4-3:1997, 1998, 2002 AS/NZS 61000.4.3 1999	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 3: Radiated, radio-frequency, electromagnetic field immunity test	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 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 55104 1995	Electromagnetic compatibility immunity – requirements for household appliances, tools and similar apparatus. Product family standard.
EN 61000-4-5 1995 AS/NZS 61000.4.5 1999 EN 61000-4-6 1996 AS/NZS 61000.4.6 1999	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 5: Surge immunity test.	EN 50083-2 1995	Cabled distribution systems for television and sound signals. Part 2: Electromagnetic compatibility for equipment.
EN 61000-4-8 1994	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 6: Immunity to conducted disturbances, induce by radio-frequency fields.	EN 60601-1-2: 1993, 2002	Medical electrical equipment Part 1: general requirements for safety Section 2: Collateral standard: Electromagnetic compatibility – requirements and tests
EN 61000-4-11 1994	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test.	IEC 1800-3 1995	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods.
ENV 61000-2-2 1993	(EMC) Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage Variations immunity tests.	EN 60555 Part 2 1987	Disturbances in supply systems caused by household appliances and similar electrical equipment. Part 2: Harmonics
EU Product Family Standards		EN 60555 Part 3 1987	Disturbances in supply systems caused by household appliances and similar electrical equipment. Part 3: Voltage fluctuations.
EN 50081-1 1992	Electromagnetic capability – Generic emission standard. Part 1: Residential, commercial and light industry. (I.S.)	EN 61000-3-2: 1995, 2000 AS/NZS 61000.3.2 1998 EN 61000-3-3 1995 AS/NZS 61000.3.3 1999	Electromagnetic compatibility (EMC). Part 3: Limits Section 2: Limits for harmonic current emissions
EN 50081-2 1993	Electromagnetic compatibility – Generic emission standard. Part 2: Industrial environment	ETS 300 386-1 1994	Electromagnetic compatibility (EMC). Part 3: Limits Section 2: Limitation of voltage fluctuations and flicker in low-voltage supply systems.
EN 50082-1 1992, 1998	Electromagnetic compatibility – Generic emission standard. Part 1: Residential, commercial and light industry		Equipment Engineering (EE); Public telecommunication network equipment electro-magnetic compatibility (EMC) requirements Part 1: Product family overview, compliance criteria and test levels
EN 50082-2 1995	Electromagnetic compatibility – Generic immunity Standard. Part 2: Industrial environment		
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<p>ETS EN 300 386-2 1997, 1998, ETS EN 300 386 2000 v1.2.1, 2001 v1.3.1</p> <p>ETS 300 132-1 1996</p> <p>ETS 300 132-2 1996</p> <p>ETR 283 1997</p> <p><i>EU radio standards</i> (ETS) EN 300 385 v1.2.1: 1998, 1999</p> <p>EN 300 330 v1.2.1: 1998, 1999</p> <p>ETS 300 328 1996</p> <p>ETS EN 300 440 v1.2.1 1999</p> <p>EN 301 893:2002 v1.2.1</p> <p>ETS 300 836-1:1998</p> <p>EN301 489-17:2002 v1.2.1</p> <p>(A2LA Cert. No. 1627-01) 10/31/03</p> <p style="text-align: right;">Page 5 of 11</p>	<p>Electromagnetic compatibility and radio spectrum matters (ERM); Telecommunication network equipment; Electromagnetic compatibility (EMC) requirements; Part 2: Product family standard.</p> <p>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</p> <p>Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)</p> <p>Equipment Engineering (EE): Transient voltages at Interface A on telecommunications direct current (DC) power distributions.</p> <p>Electromagnetic compatibility and Radio spectrum matters (ERM); Electromagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment (ETS)</p> <p>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</p> <p>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</p> <p>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</p> <p>Broadband Radio Access Networks (BRAN); 5 GHz (draft) high performance RLAN; Harmonized EN covering Essential requirements of article 3.2 of the R&TTE Directive</p> <p>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</p> <p>Electromagnetic compatibility and Radio spectrum Matters (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</p> <p>EN 300 328-2:2001 v1.2.1</p> <p>EN 301 489-1:2002</p> <p>EN 60669-2-1:2002</p> <p><i>Canada Radio Standards</i> Canadian GL-36 1995</p> <p>Canadian RSS-119 1999, 2000 Issue 6</p> <p>Canadian RSS-134 1996 & 2000, Issue 1</p> <p>Canadian RSS-210 2000 Issue 3,</p> <p>RFS29 1998 Specification for Restricted Radiation Radio Apparatus (New Zealand)</p> <p><i>FCC Standards</i> 47 CFR FCC low power transmitters operating on frequencies below 1 GHz, emergency alert systems, unintentional radiators and ISM devices.</p> <p>47 CFR FCC low power transmitters operating on frequencies above 1 GHz, with the exception of spread spectrum devices.</p> <p>47 CFR FCC Unlicensed Personal Communications System (PCS) devices</p> <p>47 CFR FCC Unlicensed National Scope Information Infrastructure devices and low power transmitters using spread spectrum techniques.</p> <p>47 CFR FCC Personal mobile Radio Services in the following FCC Rule Parts 22, 24, 25, 27.</p> <p>47 CFR FCC General Mobile Radio Scope Services in the following FCC Rule Parts 22, 74, 90, 95, 97.</p> <p>47 CFR FCC Maritime and Aviation Scope RadioServices in 47 CFR Parts 80 and 87</p> <p>47 CFR FCC Microwave Radio Services Scope in 47 CFR Parts 21, 74 and 101.</p> <p>Electromagnetic compatibility and Radio spectrum Matters (ERM); 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</p> <p>Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements</p> <p>Switches for household and similar fixed electrical installations -- Part 2-1: Particular requirements -- Electronic switches</p> <p>Industry Canada -- technical requirements for low power Devices in the 2400 -- 2483.5 MHz band.</p> <p>Industry Canada -- Land mobile and fixed radio Transmitters and receivers, 27.41 to 960.0 MHz</p> <p>Industry Canada -- 900 MHz narrowband personal communications services</p> <p>Industry Canada -- Low power license-exempt radio 2001 Issue 5 communication devices</p> <p>Scope A1</p> <p>Scope A2</p> <p>A3</p> <p>A4</p> <p>B1</p> <p>B2</p> <p>B3</p> <p>B4</p> <p>(A2LA Cert. 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<p>FCC/OST MP-5 1986</p> <p>GR-1089-CORE: 1997, 1999 issue 2/ 2002 Issue 3</p> <p><i>ANSI EMC Standards</i> ANSI C63.4: 1992, 1999, 2001</p> <p>ANSI C63.5 1988</p> <p><i>IEEE EMC Standards</i> IEEE C62.41: 1980, 1991</p> <p><i>Swedish EMC Standards</i> BAKOM 3336.3 1995</p> <p><i>South African EMC standards other than CISPR equivalents</i> SABS 1718-1: 1996</p> <p><i>Japanese VCCI Standards</i> VCCI V-3/99.05 1999 VCCI V-4/99.05 1999</p> <p>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 (<i>excluding volume control</i>); Protocol analysis and Jitter testing.</p> <p>Telecom Standards</p> <p>FCC 47 CFR Part 68 Telephone</p> <p>CS-03 Issue 8 1996 through amendment 5</p> <p>TIA/EIA TSB31-B 1998</p> <p>(A2LA Cert. No. 1627-01) 10/31/03</p> <p style="text-align: right;">Page 7 of 11</p>	<p>FCC (Federal Communications Commission) methods Of measurement of radio noise emissions from industrial, scientific and medical equipment.</p> <p>Bellcore electromagnetic compatibility and electrical safety -- Generic criteria for network telecommunications equipment.</p> <p>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.</p> <p>American National Standard for electromagnetic compatibility -- radiated emissions measurements in electromagnetic interference (EMI) control -- calibration of antennas.</p> <p>IEEE recommended practice on surge voltages in low-voltage AC power circuits</p> <p>Electromagnetic compatibility and electrical safety (EMC & S) for wired terminal equipment. Harmonization document information over the OFCOM requirements.</p> <p>South African Bureau of Standards: Specification for Gaming equipment. Part 1: Casino equipment.</p> <p>Technical Requirements</p> <p>Instruction for Test Conditions for Requirement under Test</p> <p>TIA/EIA-IS-968</p> <p>TIA/EIA-IS-883</p> <p>TIA-968-A</p> <p>T1.TRQ.6-2001</p> <p>Canada VDSL Issue 1 January 2003</p> <p>AS/ACIF S002-2001</p> <p>AS/ACIF S016-2001</p> <p>AS/ACIF S031-2001 AS/ACIF S038-2001 AS/ACIF S043-2001</p> <p>ITU-T G.703 HKTA 2028</p> <p>HKTA 2029</p> <p>TBR 1 : 1995</p> <p>TBR 2 : 1997</p> <p>Telecommunications Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network</p> <p>Telecommunications Telephone Terminal Equipment Supplemental Technical Requirements for Connection of Stutter Dial Tone Detection Devices and ADSL Modems to the Telephone Network</p> <p>Telecommunications Telephone Terminal Equipment Technical Requirements for Connection of Terminal Equipment to the Telephone Network</p> <p>Technical Requirements for SHDSL, HDLSL2, HDLSL4 Digital Subscriber Line Terminal Equipment to Prevent Harm to the Telephone Network Industry</p> <p>Terminal Attachment Program Requirements and Test Methods for Very-High-Bit-Rate Digital Subscriber Line (VDSL) Terminal Equipment</p> <p>Analogue interworking and non-interference requirements for Customer Equipment for connection to the Public Switched Telephone Network</p> <p>Requirements for Customer Equipment for connection to hierarchical digital interfaces</p> <p>Requirements for ISDN Basic Access Interface</p> <p>Requirements for ISDN Primary Rate Access Interface</p> <p>Requirements for Customer Equipment for Connection to a Metallic Local Loop Interface of a Telecommunications Network --</p> <p>Part 1: General</p> <p>Part 2: Broadband</p> <p>Part 3: DC, Low Frequency AC and Voiceband</p> <p>Physical/electrical characteristics of hierarchical Digital interfaces</p> <p>Network connection specification for connection of CPE to the PTNs in Hong Kong using digital leased circuits at data rate of 1544 kbit/s</p> <p>Network connection specification for connection of CPE to the PTNs in Hong Kong using digital leased circuits at data rate of 2048 kbit/s</p> <p>Attachment requirements for terminal equipment to be connected to circuit switched data networks and leased circuits using a CCITT Recommendation X.21 interface, or at an interface physically, functionally and electrically compatible with CCITT Recommendation X.21 but operating at any data signaling rate up to, and including, 1 984 kbit/s</p> <p>Attachment requirements for Data Terminal Equipment (DTE) to connect to Packet Switched Public Data Networks (PSPDNs) for CCITT Recommendation X.25 interfaces at data signaling rates up to 1 920 kbit/s utilizing interfaces derived from CCITT Recommendations X.21 and X.21 bit</p> <p>(A2LA Cert. No. 1627-01)</p> <p style="text-align: right;">10/31/03 Page 8 of 11</p>



<p>TBR 3 : 1995 + Amdt : 1997</p> <p>TBR 4 : 1995 + Amdt : 1997</p> <p>TBR 012 : 1993 + Amdt : 1996</p> <p>TBR 013 : 1996</p> <p>TBR 21 : 1998</p> <p>TBR 24 : 1997</p> <p><i>Australia</i> TS 002 : 1997</p> <p>TS 016 : 1997</p> <p>TS 031 : 1997</p> <p>TS 038 : 1997</p> <p>AS/ACIF S043.2:2001</p> <p>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 (<i>excluding x-ray tests</i>).</p> <p><u>Product Safety Standards</u></p> <p>Specific Product Safety Standards IEC 950 1991</p> <p>UL 1950 1998</p> <p>CSA C22.2 No.950-95 UL 60950 2000</p> <p>(A2LA Cert. No. 1627-01) 10/31/03</p>	<p>Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN basic access</p> <p>Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access</p> <p>Business Telecommunications (BT); Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U) Attachment requirements for terminal equipment</p> <p>Business Telecommunications (BTC); 2 048 kbit/s digital structured leased lines (D2048S); Attachment requirements for terminal equipment interface</p> <p>Terminal Equipment (TE); Attachment requirements for pan-European approval for connection to the analogue Public Switched Telephone Networks (PSTNs) of TE (excluding TE supporting the voice telephony service) in which network addressing, if provided, is by means of Dual Tone Multi Frequency (DTMF) signaling</p> <p>Business Telecommunications (BTC); 34 Mbit/s digital Unstructured and structured leased lines (D34U and D34S); Attachment requirements for terminal equipment interface</p> <p>Analogue Interworking and Non interference Requirements for Customer Equipment Connected to the Public Switched Telephone Network</p> <p>General Requirements for Customer Equipment Connected to Hierarchical Digital Interfaces</p> <p>Requirements for ISDN Basic Access Interface</p> <p>Requirements for ISDN Primary Rate Access Interface</p> <p>Requirements for Customer Equipment for connection to a metallic loop interface of a Telecommunications Network – Part 2 Broadband</p> <p>Title Safety of information technology equipment including Amendments 1, 2, 3, and 4 electrical business equipment. Safety of information technology equipment, including electrical business equipment. Safety of Information Technology Equipment (UL 1950) Safety of information technology equipment</p> <p>Page 9 of 11</p>	<p>IEC 60950 2000 EN 60950 1997, 1998, 2000 IEC 60950-1 2001 UL 60950-1 2003 CSA C22.2 No. 60950-00 CSA C22.2 No. 60950-1 03 AS/NZS 3260 1993</p> <p>AS/NZS 3260 Supp 1 1996</p> <p>ACA TS 001 1997</p> <p>UL 1459 1995 IEC 1010-1 1990 IEC 61010-1 1993 EN 61010-1 1993, 2001 IEC 61010-1 2001 UL 61010B-1 2003 UL 3101-1 1993 CAN/CSA 1010-1 1999 (<i>Including AM 2</i>) UL 3111-1 1996 UL 3121-1 1995 IEC 60601-1 1995 EN 60601-1 1995 (<i>Including AM 2</i>) UL 2601-1 1997 IEC 60065 1998, 2000 ANSI/UL 6500: 1998 CAN/CSA 60065-00 AS/NZS 3250 1995 AS/NZS 60065 2000</p> <p>Canadian C22.2 No. 1-94 (1-98) 1998 EN 60065 1994</p> <p>IEC 60825 1990</p> <p>EN 60825-1 1994 IEC 60825-1 2001 IEC 60825-2 2000-5 systems IEC 60825-4 1997-11 IEC 60335-1 1995 (<i>Including AM2 – 1997 & AM 12 – 1997</i>) EN 60335-1 2001 UL 60335-1 1998 CAN/CSA E335-1 1994</p> <p>Safety of information technology equipment Safety of information technology equipment, including Electrical business equipment.</p> <p>Approval and test specification – Safety of information technology equipment including electrical business Equipment. Approval and test specification – Safety of information technology equipment including electrical business equipment – Alphabetical reference index to IEC 950 (Supplement to AS/NZS 3260:1993) Australian Communications Authority – Safety requirements for customer equipment. Telephone Equipment Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements. Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements.</p> <p>Electrical equipment for laboratory use Part 1: General requirements. Electrical measuring and test equipment. Part 1: General requirements.</p> <p>Medical electrical equipment. Part 1: General requirements for safety. Medical electrical equipment. Part 1: General Requirements for safety. Audio, video and similar electronic apparatus – Safety requirements Audio/video and musical instrument apparatus for Household, commercial and similar general use Australian/New Zealand Standard – Approval and test Specification – Mains operated electronic and related Equipment for household and similar general use Audio, video and similar electronic equipment. Consumer and 1994, commercial products Safety requirements for main operated electronic and related apparatus for household and similar general use. Radiation safety of laser products, equipment Classification, requirements and user’s guide Safety of laser products Part 1: equipment Classification, requirements and user’s guide. Safety of laser products – Part 2: Safety of optical communication Safety of laser products – Part 4: Laser guards Safety of household and similar electrical appliances Part 1: General requirements</p> <p>(A2LA Cert. No. 1627-01) 10/31/03</p>
<p>UL 61010A-1 : 2002</p> <p>EN 61010-1 : 2001</p> <p>AS/NZS 60950 : 2000</p> <p>Environmental²</p> <p><u>Environmental Standards</u></p> <p>GR-63-CORE ETS 300 019 (vibration up to 1000Hz)</p> <p>Page 11 of 11</p>	<p>Electrical equipment for laboratory use; part 1: General requirements</p> <p>Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements</p> <p>Safety information technology equipment</p> <p>Title NEBS Requirements: Physical Protection Environmental conditions and environmental tests For telecommunications equipment</p>	<p>Electrical equipment for laboratory use; part 1: General requirements</p> <p>Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements</p> <p>Safety information technology equipment</p>

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

