

## Conducted Band Edges

### LIMITS

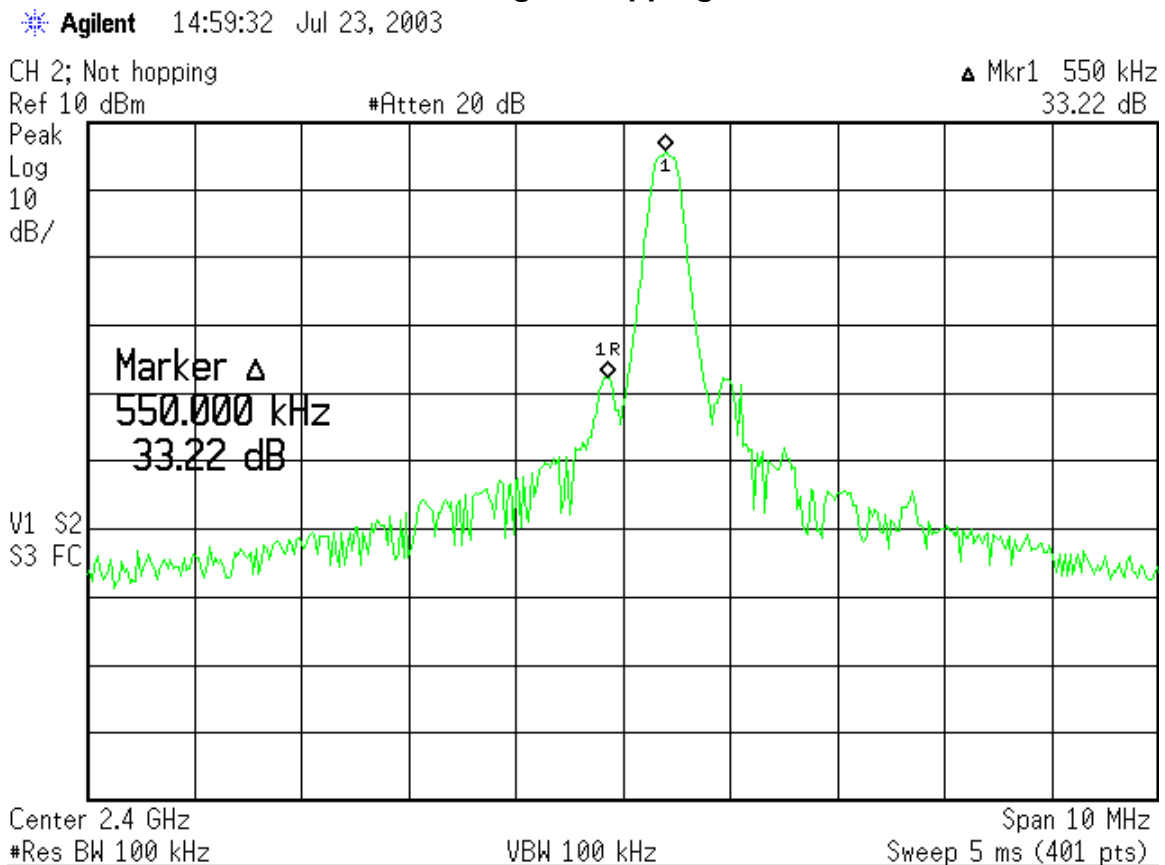
Peak: 20dB down from fundamental [15.247(c)]

### RESULTS

It can easily be seen in the plots shown below that the conducted band edges are at least 20dB down from the peak of the fundamental.

### ANALYZER PLOT

#### Low Band Edge – Hopping Disabled



## Low Band Edge – Hopping Enabled

\* Agilent 15:03:03 Jul 23, 2003

CH 2; hopping

Ref 10 dBm

#Atten 20 dB

▲ Mkr1 3.20 MHz

43.34 dB

Peak  
Log  
10  
dB/Marker ▲  
3.200000 MHz  
43.34 dBV1 S2  
S3 FCCenter 2.4 GHz  
#Res BW 100 kHz

VBW 100 kHz

Span 10 MHz  
Sweep 5 ms (401 pts)

## High Band Edge – Hopping Disabled

\* Agilent 15:06:04 Jul 23, 2003

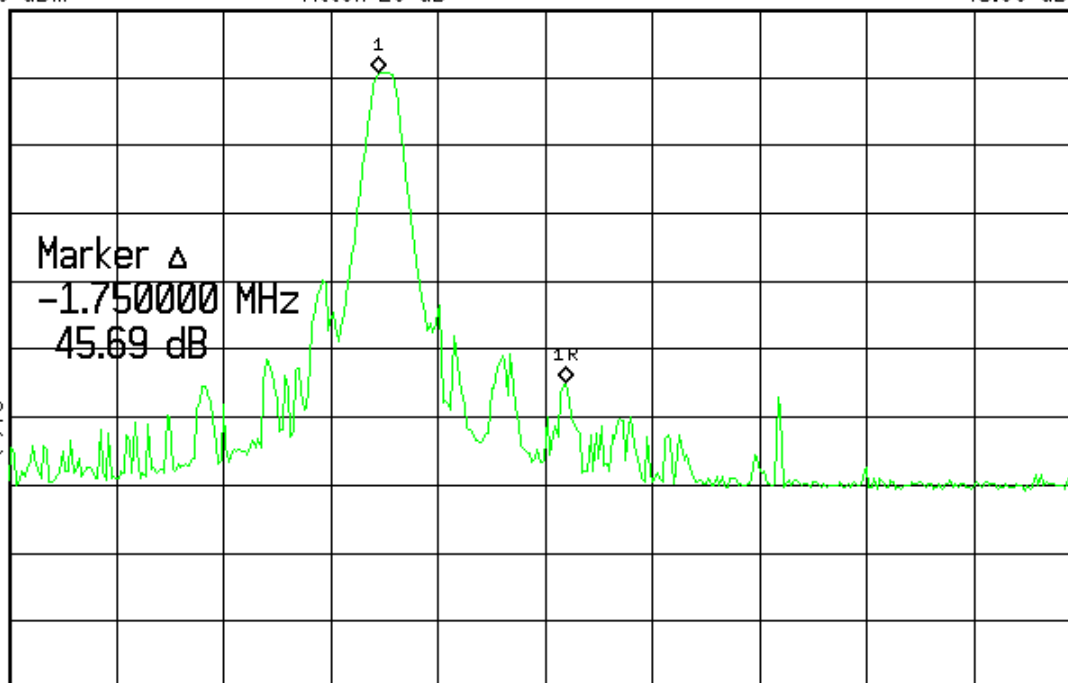
CH 206; Not hopping

▲ Mkr1 -1.75 MHz

Ref 10 dBm

#Atten 20 dB

45.69 dB

Peak  
Log  
10  
dB/Marker ▲  
-1.750000 MHz  
45.69 dBV1 S2  
S3 FC

Center 2.483 GHz

Span 10 MHz

#Res BW 100 kHz

VBW 100 kHz

Sweep 5 ms (401 pts)

**High Band Edge – Hopping Enabled**

\* Agilent 15:09:25 Jul 23, 2003

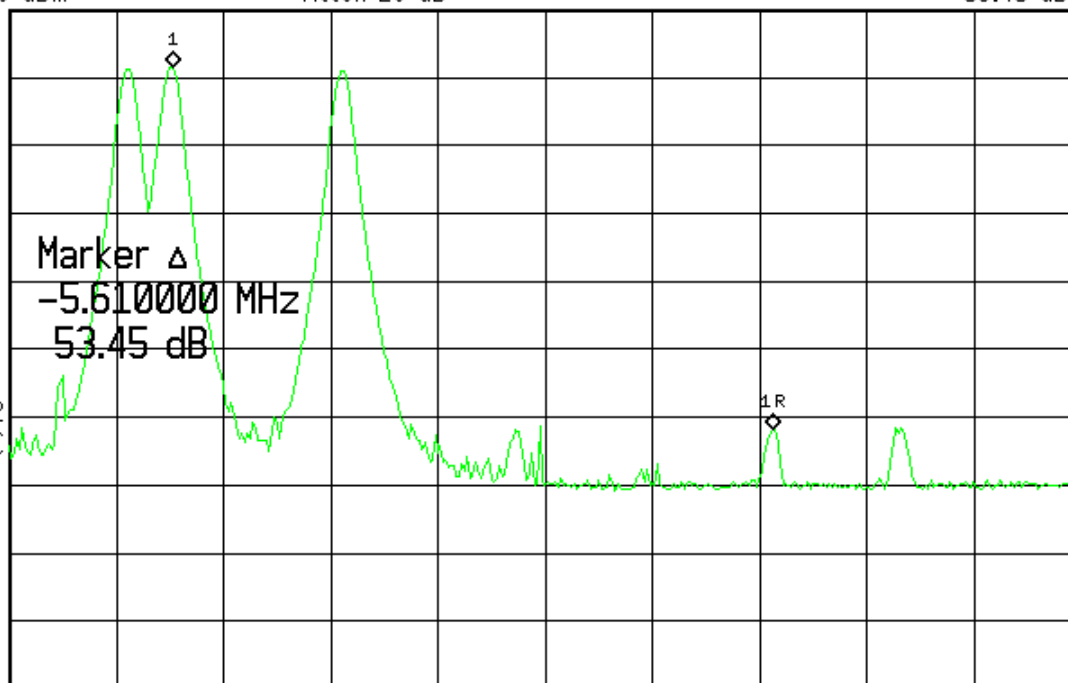
hopping

Ref 10 dBm

#Atten 20 dB

▲ Mkr1 -5.61 MHz

53.45 dB

Peak  
Log  
10  
dB/V1 S2  
S3 FC

Center 2.483 GHz

#Res BW 100 kHz

VBW 100 kHz

Span 10 MHz

Sweep 5 ms (401 pts)

## Antenna Gains

### REQUIREMENT

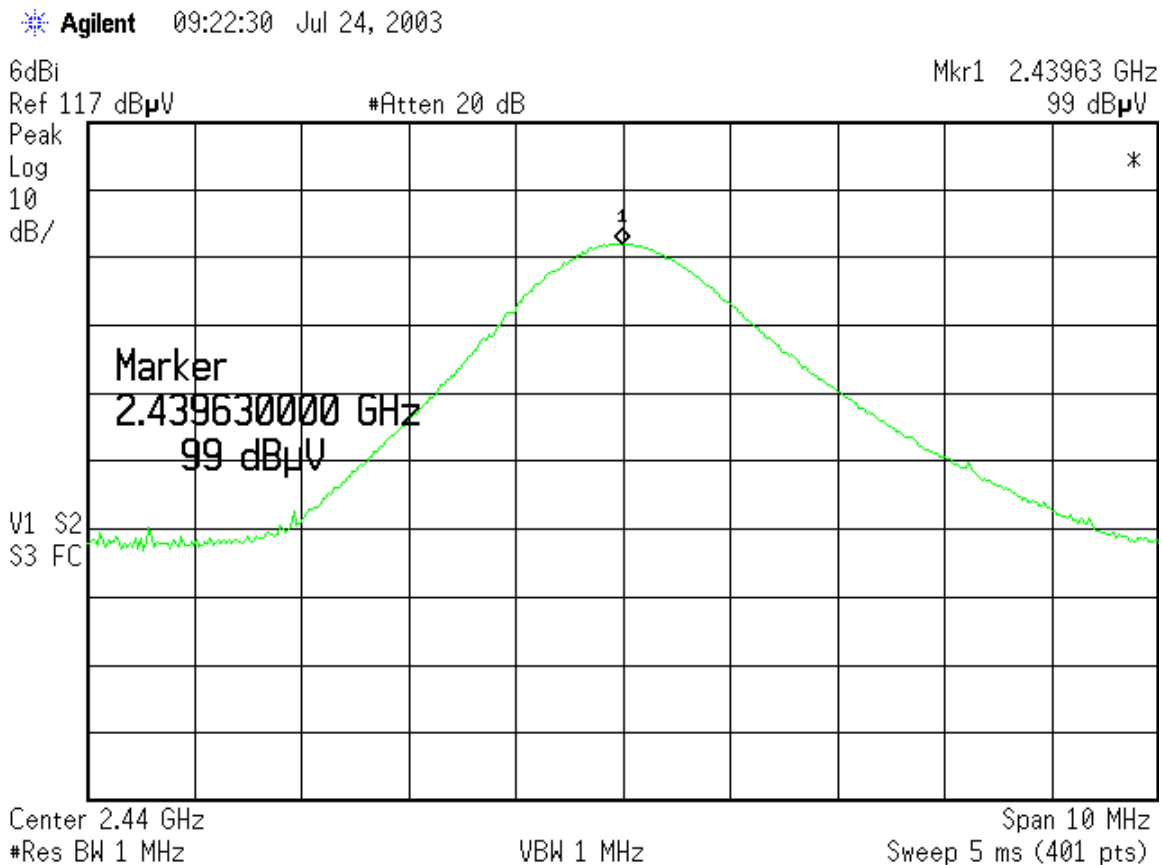
This purpose of this section is to demonstrate that the actual directional gains of the antennas are no larger than that stated.

### MEASUREMENTS

Antenna Directional Gain							Curtis-Straus LLC		
Date: 24-Jul-03			Company: Seimac			Table: 2			
Engineer: Evan Gould			EUT Desc: Solid Link			Work Order: D0522			
Frequency Range: Channel 100					Measurement Distance: 3 m				
Notes: The "Limit" is the permitted peak output power for each type of antenna (based on the directional gains stated) added to their respective stated directional gains.									
Antenna			Antenna		Cable Factor (dB)	Adjusted Field Strength (dBuV/m)	EIRP (dBm)	47 CFR 15.247(b)(4)(i)	
Polarization (H / V)	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Factor (dB)				Limit (dBm)	Margin (dB)
6dBi Omnidirectional			29.8	1.9	130.7	35.5	36.0	-0.5	Pass
Vpk	2439.6	99.0							
16dBi Dual Yagi			29.8	1.9	137.1	41.9	42.7	-0.8	Pass
Hpk	2439.6	105.4							
24dBi Parabolic			29.8	1.9	142.0	46.8	48.0	-1.2	Pass
Vpk	2439.6	110.3							
Test Site: "A"			Cable: 5 RG142LL			Analyzer: Orange		Antenna: Orange Horn	

### ANALYZER PLOTS

#### 6dBi Omnidirectional



**16dBi Dual-Yagi**

\* Agilent 10:35:39 Jul 24, 2003

16dBi

Mkr1 2.43958 GHz

Ref 117 dB $\mu$ V

#Atten 20 dB

105.4 dB $\mu$ VPeak  
Log  
10  
dB/

Marker  
2.439580000 GHz  
105.4 dB $\mu$ V

V1 S2  
S3 FCCenter 2.44 GHz  
#Res BW 1 MHz

VBW 1 MHz

Span 10 MHz  
Sweep 5 ms (401 pts)

**24dBi Parabolic**

\* Agilent 11:33:15 Jul 24, 2003

24dBi

Ref 117 dB $\mu$ V

#Atten 20 dB

Mkr1 2.43961 GHz

110.3 dB $\mu$ VPeak  
Log  
10  
dB/

Marker  
2.439610000 GHz  
110.3 dB $\mu$ V

V1 S2  
S3 FCCenter 2.44 GHz  
#Res BW 1 MHz

VBW 1 MHz

Span 10 MHz  
Sweep 5 ms (401 pts)

## Radiated Band Edge

### LIMIT

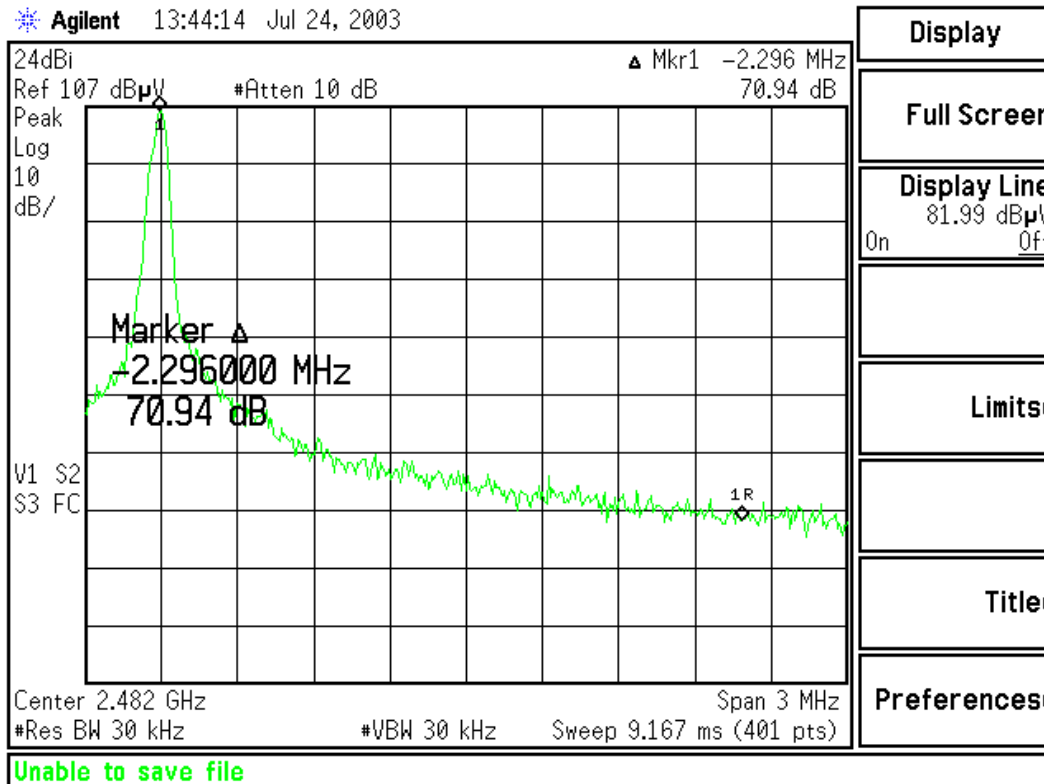
"...radiated emissions which fall in the restricted bands, as defined in §15.209(a), must also comply with the radiated emission limits specified in §15.209(a)" [15.247(c)]

### MEASUREMENTS

Radiated Band Edge Measurements (High)										Curtis-Straus LLC		
Date: 24-Jul-03			Company: Seimac					Table: 3				
Engineer: Evan Gould			EUT Desc: Solid Link					Work Order: D0522				
Frequency Range: 2483.5MHz (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)	Marker-Delta (dB)	Duty Cycle Factor (dB)	Adjusted Reading (dBμV/m)	47 CFR 15.209(a)			
									Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)	
24dBi Parabolic												
Vpk	2483.5	106.6	19.7	30.0	1.9	70.9	0.0	47.9	74.0	-26.1	Pass	
Vav	2483.5	103.8	19.7	30.0	1.9	70.9	12.0	33.1	54.0	-20.9	Pass	
16dBi Dual Yagi												
Hpk	2483.5	99.2	19.7	30.0	1.9	68.5	0.0	42.9	74.0	-31.1	Pass	
Hav	2483.5	96.3	19.7	30.0	1.9	68.5	12.0	28.0	54.0	-26.0	Pass	
6dBi Omnidirectional												
Vpk	2483.5	96.8	19.7	30.0	1.9	63.0	0.0	46.0	74.0	-28.0	Pass	
Vav	2483.5	93.7	19.7	30.0	1.9	63.0	12.0	30.9	54.0	-23.1	Pass	
Test Site: "A"			Pre-Amp: White		Cable: 5 RG142LL			Analyzer: Orange		Antenna: Orange Horn		

### SAMPLE ANALYZER PLOTS

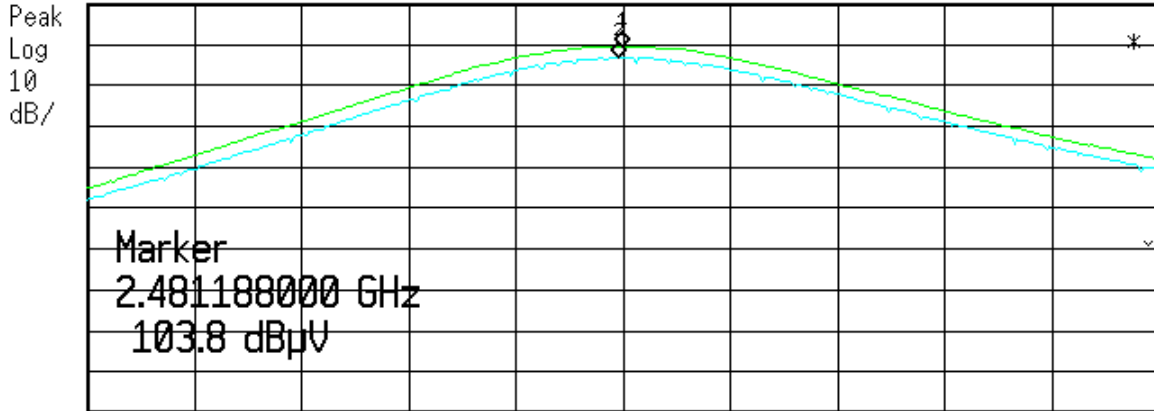
#### 24dBi Marker-Delta



### 24dBi Band Edge Peak and Average

Agilent 13:37:41 Jul 24, 2003

24dBi  
Ref 117 dBμV  
Peak  
Log  
10  
dB/  
#Atten 20 dB  
Mkr2 2.481188 GHz  
103.8 dBμV



Center 2.481 GHz  
#Res BW 1 MHz  
#VBW 30 Hz  
Sweep 1.767 s (401 pts)  
Span 5 MHz

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.481213 GHz	106.6 dBμV
2	(2)	Freq	2.481188 GHz	103.8 dBμV

## 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)]

### MEASUREMENTS

Radiated Spurious Emissions								Curtis-Straus LLC		
Date: 09-Jul-03			Company: Seimac					Table: 4		
Engineer: Evan Gould			EUT Desc: Solid Link					Work Order: D0522		
Frequency Range: 30-1000MHz						Measurement Distance: 3 m				
Notes: used a Mini-Circuits NLP-1200 low pass filter in taking the 24dBi parabolic measurement checking restricted bands from 15.205										
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Filter Factor (dB)	Adjusted Reading (dBμV/m)	47 CFR 15.209(a)		
								Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
6dBi omnidirectional			---	---	---		---	---	---	---
H qp	325.7	39.7	20.7	14.5	2.1	0.0	35.6	46.0	-10.4	Pass
16dBi dual yagi			---	---	---		---	---	---	---
H pk	325.7	41.1	20.7	14.5	2.1	0.0	37.0	46.0	-9.0	Pass
24dBi parabolic			---	---	---		---	---	---	---
H pk	325.7	45.8	20.7	14.5	2.1	1.0	42.7	46.0	-3.3	Pass
Test Site: "A"		Pre-Amp: Black		Cable: 65 ft RG8A/U			Analyzer: Green		Antenna: Grn-Wht	

Radiated Spurious Emissions									Curtis-Straus LLC		
Date: 24-Jul-03			Company: Seimac						Table: 5		
Engineer: Evan Gould			EUT Desc: Solid Link						Work Order: D0522		
Frequency Range: 1-5.46GHz					Measurement Distance: 3 m						
Notes: used K&L 11SH10 hi-pass filter for readings at 4879.2MHz checking restricted bands from 15.205											
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Filter Factor (dB)	Duty-Cycle Factor (dB)	Adjusted Reading (dBµV/m)	47 CFR 15.209(a)		
									Limit (dBµV/m)	Margin (dB)	Result (Pass/Fail)
Vpk	2389.7	55.9	19.6	29.7	1.9	0.0	0.0	67.9	74.0	-6.1	Pass
Vav	2389.7	52.0	19.6	29.7	1.9	0.0	12.0	52.0	54.0	-2.0	Pass
Vpk	2770.8	45.1	20.1	30.9	2.1	0.0	0.0	58.0	74.0	-16.0	Pass
Vav	2770.8	41.8	20.1	30.9	2.1	0.0	12.0	42.7	54.0	-11.3	Pass
Hpk	4879.2	40.5	19.0	35.5	2.8	1.0	0.0	60.8	74.0	-13.2	Pass
Hav	4879.2	36.5	19.0	35.5	2.8	1.0	12.0	44.8	54.0	-9.2	Pass
Test Site: "A"		Pre-Amp: White		Cable: 5 RG142LL			Analyzer: Orange		Antenna: Orange Horn		

Radiated Spurious Emissions									Curtis-Straus LLC		
Date: 24-Jul-03			Company: Seimac			Table: 6					
Engineer: Evan Gould			EUT Desc: Solid Link			Work Order: D0522					
Frequency Range: 7.25-18GHz					Measurement Distance: 1 m						
Notes: using K&L SPA-F-55204 hi-pass filter checking restricted bands from 15.205											
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Filter Factor (dB)	Duty-Cycle Factor (dB)	Adjusted Reading (dBμV/m)	47 CFR 15.209(a)		
									Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
Vpk	7318.8	42.7	18.4	37.7	4.0	0.6	0.0	66.6	83.5	-16.9	Pass
Vav	7318.8	40.3	18.4	37.7	4.0	0.6	12.0	52.2	63.5	-11.3	Pass
Vpk	12198.0	43.9	16.5	40.4	5.0	0.8	0.0	73.6	83.5	-9.9	Pass
Vav	12198.0	40.5	16.5	40.4	5.0	0.8	12.0	58.2	63.5	-5.3	Pass
Hpk	14474.4	43.5	18.1	41.8	5.1	1.4	0.0	73.7	83.5	-9.8	Pass
Hav	14474.4	39.9	18.1	41.8	5.1	1.4	12.0	58.1	63.5	-5.4	Pass
Test Site: "A"			Pre-Amp: White		Cable: 5 RG142LL		Analyzer: Orange		Antenna: Orange Horn		

Radiated Spurious Emissions								Curtis-Straus LLC		
Date: 24-Jul-03		Company: Seimac				Table: 7				
Engineer: Evan Gould		EUT Desc: Solid Link				Work Order: D0522				
Frequency Range: 18-25GHz					Measurement Distance: 1 m					
Notes: checking restricted bands from 15.205										
Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBμV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty-Cycle Factor (dB)	Adjusted Reading (dBμV/m)	47 CFR 15.209(a)		
								Limit (dBμV/m)	Margin (dB)	Result (Pass/Fail)
Vpk	19299.2	44.1	21.3	40.2	3.9	0.0	66.9	83.5	-16.6	Pass
Vav	19299.2	38.6	21.3	40.2	3.9	12.0	49.4	63.5	-14.1	Pass
Test Site: "A"		Pre-Amp: 18-26.5C		Cable: 7 Microflex		Analyzer: Orange		Antenna: 18-26.5GHz Horn		

Spurious emissions above 1GHz were measured with the 6dBi omnidirectional antenna because it was allowed the most output power. The range 1500 – 3500MHz was also checked with the 16dBi and 24dBi directional antennas.

**Duty-Cycle Factor =  $20 \cdot \log(25\text{ms}/100\text{ms}) = 12\text{dB}$**

25ms is the length of time the EUT dwells on a single channel before hopping.

**AC Line Conducted Emission Measurements****LIMITS**

Frequency of emission (MHz)	Quasi-peak limit (dB $\mu$ V)	Average limit (dB $\mu$ V)
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)]

**MEASUREMENTS**

AC Mains Conducted Emissions										Curtis-Straus LLC
Date: 10-Jul-03		Company: Seimac		Table No: 8						
Engineer: Evan Gould		EUT Desc: Solid Link		Work Order: D0522						
Notes:				Test Site: EMI 1						
LISN(s): Red Yellow-Black										
Range: 0.15-30Mhz		Other Equipment:		Spectrum Analyzer: Red						
Frequency (MHz)	Q.P. Readings		Ave. Readings		Impedance Factor (dB)	FCC/CISPR B		FCC/CISPR B		Overall Result (Pass/Fail)
	QP1 (dB $\mu$ V)	QP2 (dB $\mu$ V)	AV1 (dB $\mu$ V)	AV2 (dB $\mu$ V)		qp Limit (dB $\mu$ V)	qp Margin dB	AVE Limit (dB $\mu$ V)	AVE Margin dB	
0.15	29.5	32.3	-4.5	-3.9	20.0	66.0	-13.7	56.0	-39.9	Pass
7.10	11.8	11.1			20.0	60.0	-28.2	50.0	-18.2	Pass
14.80	8.5	6.7			20.0	60.0	-31.5	50.0	-21.5	Pass
19.80	6.3	1.2			20.0	60.0	-33.7	50.0	-23.7	Pass
24.20	4.1	1.2			20.0	60.0	-35.9	50.0	-25.9	Pass
26.50	4.3	2.5			20.0	60.0	-35.7	50.0	-25.7	Pass
<b>Table Result:</b> Pass by -13.70 dB <b>Worst Freq:</b> 0.15 MHz										

## Voltage Variation

### REQUIREMENT

*"For intentional radiators, measurements of the variation of the...radiated signal level of the fundamental frequency component of the emission...shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage." [15.31(e)]*

### MEASUREMENTS

Voltage Variations						Curtis-Straus LLC		
Date: 10-Jul-03		Engineer: Evan Gould			Work Order: D0522			
Company: Seimac		EUT: Solid Link			Fundamental Frequency: 2439.6MHz			
Test Site: "A"					Cable: 142LL#2			
Attenuator: PE7019-20					Analyzer: Orange			
Measurement: Conducted					Resolution BW: 1MHz			
Detector Type: Peak					Video BW: 1MHz			
Notes: power level setting is 2000 Channel 100 Nominal Voltage Range: 10-26V								
Supply Voltage	Frequency (MHz)	Reading (dBm)	142LL #5 Factor (dB)	PE7019-20 Factor (dB)	Adjusted Reading (dBm)			
8.5V	2439.6	8.4	2.0	19.9	30.3			
12V	2439.6	8.4	2.0	19.9	30.3			
30V	2439.6	7.8	2.0	19.9	29.7			

## Test Equipment Used

REV. 7/23/03

<b>SPECTRUM ANALYZERS</b>	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	9kHz-1.8GHz	8591E	HP	3441A03559	00024	21-MAY-2004
GREEN	9kHz-26.5GHz	8593E	HP	3829A03618	00143	02-OCT-2003
ORANGE	9kHz-26.5GHz	E4407B	HP	US39440975	00394	27-JUN-2004
<b>LISNS/MEASUREMENT PROBES</b>	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	956348	00753	01-APR-2004
YELLOW-BLACK	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	984735	00248	01-APR-2004
<b>OPEN AREA TEST SITE (OATS)</b>		FCC CODE	IC CODE	VCCI CODE		CALIBRATION DUE
SITE A		93448	IC 2762-A	R-903		25-MAR-2005
<b>LINE CONDUCTED TEST SITES</b>		FCC CODE	IC CODE	VCCI CODE		CALIBRATION DUE
EMI 1		93448	N/A	C-480		01-MAY-2006
<b>ANTENNAS</b>	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN-WHITE BILOG	30MHz-2GHz	CBL6112B	CHASE	2574	00319	19-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
<b>PREAMPS / ATTENUATORS / FILTERS</b>	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
BLACK	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00799	17-MAR-2004
WHITE	1-20GHz	SMC-12A	C-S	426643	00760	27-AUG-2003
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-DEC-2003
HF 20DB ATTENUATOR	0.03-20 GHz	PE 7019-20	PASTERNAK	01	00791	21-MAY-2005
<b>RMS VOLTMETERS</b>		MN	MNFR	SN	ASSET	CALIBRATION DUE
TRUE-RMS VOLTMETER		79III	FLUKE	71700298	00769	03-OCT-2003

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.

## SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

ELECTRICAL

Certificate Number: 1627-01

## 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 Emissions	Title		
CISPR 22 1997 with amendments 1 and 2	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.	CNS 13439 AS/NZS 1053: 1999	Broadcast receiver and associated equipment Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.
CNS13438 1994	Limits and methods of measurement of radio interference characteristics of information technology equipment.	CISPR 14 1993	Limits and methods of measurement of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electric tools and electric apparatus.
EN55022:1994 and 1998	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.	EN 55014 1993, 1997	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.
SABS CISPR 22:1997	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement	AS/NZS 1044: 1995	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.
Canada ICES-003 1997 AS/NZS 3548 1995	Digital apparatus Australian/New Zealand Standard Limits and methods of measurement of radio disturbance characteristics of information technology equipment		
CISPR 11 1990, 1997	Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.	<i>Immunity</i> CNS13783-1 SABS CISPR 14-1 1993	Household Electrical Appliances Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus Part 1: Emission – Product family standard
EN 55011 1991, 1998	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.	SABS CISPR 14-2 1997	Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus Part 2: Immunity - Product family standard
SABS CISPR 11:1997	Industrial, scientific and medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics Limits and methods of measurement	CISPR 14-2 1996	Immunity requirements for household appliances, tools and similar apparatus.
Canada ICES-001 1998	Industrial, scientific and medical radio frequency generators	CISPR 20 with amendment 3	Limits and methods of measurement of immunity characteristics of sound and television broadcast receivers and associated equipment.
CNS13803 AS/NZS 2064: 1997	Industrial, Scientific and Medical Instrument Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.	EN 55020 1995	Electromagnetic immunity of broadcast receivers and associated equipment.
CSA C108.8 – M1983	Electromagnetic Emission from Data Processing Equipment and Electronic Office Machines	CISPR 24	Information technology equipment – Immunity characteristics – Limits and methods of measurement
CISPR 13 1996, 1998	Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.	SABS CISPR 24 1997	Information technology equipment – Immunity characteristics – Limits and methods of measurement
EN 55013 1990	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.	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 55013 Amend 12 1994	Limits and methods of measurement of radio disturbance characteristics of broadcast receivers and associated equipment. Amendment 12	<i>European Union Basic EMC Standards</i> EN 61000-4-2 1995, 1999	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge immunity test – Basic EMC Publication
SABS CISPR 13: 1996	Limits and methods of measurement of radio interference characteristics of sound and television broadcast receivers and associated equipment.	EN 61000-4-3 1997, 1998 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 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 61326 1998	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61000-4-5 1995	(EMC) Part 4: Testing and measurement techniques. Section 5: Surge immunity test.	EN 61547 1996	Equipment for general lighting purposes – EMC immunity requirements
AS/NZS 61000.4.5 1999	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 6: Immunity to conducted disturbances, induce by radio-frequency fields	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 61000-4-6 1996	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test.	EN 55104 1995	Electromagnetic compatibility immunity – requirements for household appliances, tools and similar apparatus. Product family standard.
AS/NZS 61000.4.6 1999	(EMC) Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage variations immunity tests.	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 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)	EN 60601-1-2 1993	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 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)	IEC 1800-3 1995	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods.
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)	EN 60555 Part 2 1987	Disturbances in supply systems caused by household appliances and similar electrical equipment. Part 2: Harmonics
<i>EU Product Family Standards</i>		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	Electromagnetic compatibility (EMC). Part 3: Limits
EN 50081-2 1993	Electromagnetic compatibility – Generic emission standard. Part 2: Industrial environment	AS/NZS 61000.3.2 1998	Section 2: Limits for harmonic current emissions
EN 50082-1 1992, 1998	Electromagnetic compatibility – Generic emission standard. Part 1: Residential, commercial and light industry	EN 61000-3-3 1995	Electromagnetic compatibility (EMC). Part 3: Limits
EN 50082-2 1995	Electromagnetic compatibility – Generic immunity Standard. Part 2: Industrial environment	AS/NZS 61000.3.3 1999	Section 2: Limitation of voltage fluctuations and flicker in low-voltage supply systems.
EN 61000-6-1 1997	Electromagnetic Compatibility (EMC)- Part 6: Generic standards- Section 1: Immunity for residential, commercial and light-industrial environments	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
EN 61000-6-2 1998	Electromagnetic Compatibility (EMC)- Part 6: Generic standards- Section 2: Immunity for industrial environments	ETS EN 300 386-2 1997, 1998	Electromagnetic compatibility and radio spectrum matters (ERM); Telecommunication network equipment; Electromagnetic compatibility (EMC) requirements; Part 2: Product family standard.
EN 50091-2 1996	Specification for Uninterruptible Power Systems (UPS). Part 2: EMC requirements	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
EN 55024 1998	Information technology equipment – Immunity Characteristics – Limits and methods of measurement.	ETS 300 132-2 1996	Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)
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	ETR 283 1997	Equipment Engineering (EE); Transient voltages at interface A on telecommunications direct current (DC) power distributions.
EN 55103-2 1997	Electromagnetic Compatibility – Product family standard for audio, video, audio-visual and entertainment lighting control professional use. Part 2: Immunity		
(A2LA Cert. No. 1627-01) Revised 02/21/02	Page 4 of 9	(A2LA Cert. No. 1627-01) Revised 02/21/02	Page 5 of 9

<i>EU radio standards</i>		47 CFR FCC Unlicensed Personal Communications System (PCS) devices	Scope A3
(ETS) EN 300 385 v1.2.1 1998	Electromagnetic compatibility and Radio spectrum matters (ERM); ElectroMagnetic Compatibility (EMC) standard for fixed radio links and ancillary equipment	47 CFR FCC Unlicensed National Information Infrastructure devices and low power transmitters using spread spectrum techniques.	Scope A4
(ETS) EN 300 220-1 v1.2.1 1997	Electromagnetic compatibility and Radio spectrum matters (ERM); Short range devices; Technical characteristics and test methods for radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 1: Parameters intended for regulatory purposes	47 CFR FCC Personal mobile Radio Services in the following FCC Rule Parts 22, 24, 25, 27.	Scope B1
(ETS) EN 300 220-2 v1.2.1 1997	Electromagnetic compatibility and Radio spectrum matters (ERM); Short range devices; Technical characteristics and test methods for radio equipment to be used in the 25 MHz to 1000 MHz frequency range with power levels ranging up to 500 mW; Part 2: Supplementary parameters not intended for regulatory purposes	47 CFR FCC General Mobile Radio Services in the following FCC Rule Parts 22, 74, 90, 95, 97.	Scope B2
(ETS) EN 300 330 v1.2.1 1998	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	47 CFR FCC Maritime and Aviation RadioServices in 47 CFR Parts 80 and 87	Scope B3
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	47 CFR FCC Microwave Radio Services in 47 CFR Parts 21, 74 and 101.	Scope B4
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	FCC/OST MP-5 1986	FCC (Federal Communications Commission) methods of measurement of radio noise emissions from industrial, scientific and medical equipment.
<i>Canada Radio Standards</i>		GR-1089-CORE 1997, 1999	Bellcore electromagnetic compatibility and electrical safety – Generic criteria for network telecommunications equipment.
Canadian GL-36 1995	Industry Canada – technical requirements for low power Devices in the 2400 – 2483.5 MHz band.	<i>ANSI EMC Standards</i>	
Canadian RSS-119 1996	Industry Canada – Land mobile and fixed radio transmitters and receivers, 27.41 to 960.0 MHz	ANSI C63.4 1992, 1999	American National Standard of methods of measurement of radio-noise emissions for low-voltage electrical and electronic equipment in the range of 9 kHz to 40GHz.
Canadian RSS-134 1996	Industry Canada – 900 MHz narrowband personal communications services	ANSI C63.5 1988	American National Standard for electromagnetic compatibility – radiated emissions measurements in electromagnetic interference (EMI) control – calibration of antennas.
Canadian RSS-210 Issue 3, Feb 5, 2000	Industry Canada – Low power license-exempt radio communication devices	<i>IEEE EMC Standards</i>	
RFS29 1998	Specification for Restricted Radiation Radio Apparatus (New Zealand)	IEEE C62.41 1980	IEEE recommended practice on surge voltages in low-voltage AC power circuits
<i>FCC Standards</i>		<i>Swedish EMC Standards</i>	
47 CFR FCC low power transmitters operating on frequencies below 1 GHz, emergency alert systems, unintentional radiators and ISM devices.	Scope A1	BAKOM 3336.3 1995	Electromagnetic compatibility and electrical safety (EMC & S) for wired terminal equipment. Harmonization documentation information over the OFCOM requirements.
47 CFR FCC low power transmitters operating on frequencies above 1 GHz, with the exception of spread spectrum devices.	Scope A2	<i>South African EMC standards other than CISPR equivalents</i>	
(A2LA Cert. No. 1627-01) Revised 02/21/02	Page 6 of 9	SABS 1718-1: 1996	South African Bureau of Standards: Specification for Gaming equipment. Part 1: Casino equipment.
		<i>Japanese VCCI Standards</i>	
		VCCI V-3/99.05 1999	Technical Requirements
		VCCI V-4/99.05 1999	Instruction for Test Conditions for Requirement under test
(A2LA Cert. No. 1627-01) Revised 02/21/02	Page 7 of 9		

**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; Protocol analysis and Jitter testing.

Telecom Standards	Title		
FCC 47 CFR Part 68 Telephone Terminal Equipment	Connection of terminal equipment to the telephone network. Analog and Digital Equipment. TCB Scope C1.	TBR 013 : 1996	Business TeleCommunications (BTC); 2 048 kbit/s digital structured leased lines (D2048S); Attachment requirements for terminal equipment interface
CS-03 Issue 8 1996 through amendment 3	Specification for terminal equipment, terminal systems, Network protection devices, connection arrangements and hearing aids compatibility. Bulletin Part 68 Rationale and Measurement Guidelines (Feb 1998)	TBR 21 : 1998	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
TIA/EIA TSB31-B 1998	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 signalling rate up to, and including, 1 984 kbit/s	TBR 24 : 1997	<b>Business TeleCommunication s (BTC); 34 Mbit/s digital unstructured and structured leased lines (D34U and D34S); Attachment requirements for terminal equipment interface</b>
TBR 1 : 1995	Attachment requirements for Data Terminal Equipment (DTE) to connect to Packet Switched Public Data Networks (PSPDNs) for CCITT Recommendation X.25 interfaces at data signalling rates up to 1 920 kbit/s utilizing interfaces derived from CCITT Recommendations X.21 and X.21 bis	Australia TS 002 : 1997	
TBR 2 : 1997	Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN basic access	TS 016 : 1997	
TBR 3 : 1995 + Amdt : 1997	Integrated Services Digital Network (ISDN); Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access	TS 031 : 1997	
TBR 4 : 1995 + Amdt : 1997	Attachment requirements for terminal equipment to connect to an ISDN using ISDN primary rate access	TS 038 : 1997	
TBR 012 : 1993 + Amdt : 1996	Business TeleCommunications (BT); Open Network Provision (ONP) technical requirements; 2 048 kbit/s digital unstructured leased line (D2048U) Attachment requirements for terminal equipment	AS/ACIF S043.2:2001	
(A2LA Cert. No. 1627-01) Revised 02/21/02			Analogue Interworking and Non interference Requirements for Customer Equipment Connected to the Public Switched Telephone Network General Requirements for Customer Equipment Connected to Hierarchical Digital Interfaces Requirements for ISDN Basic Access Interface Requirements for ISDN Primary Rate Access Interface Requirements for Customer Equipment for connection to a metallic loop interface of a Telecommunications Network – Part 2 Broadband

Page 8 of 9

**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; Overvoltage/power cross tests.

Product Safety Standards <i>P. May</i>	Title		
<i>Specific Product Safety Standards</i> IEC 950 1991 Includes Amendments 1, 2, 3 and 4 UL 1950 1998	Safety of information technology equipment including electrical business equipment.	UL 3111-1 1996 UL 3121-1 1995 IEC 60601-1 1995	Electrical measuring and test equipment. Part 1: General requirements.
CSA C22.2 No.950-95	Safety of information technology equipment, including electrical business equipment.	EN 60601-1 UL 2601-1 1997	Medical electrical equipment. Part 1: General requirements for safety.
UL 60950 2000 IEC 60950 2000 EN 60950 1997, 1998 IEC 60950-1 2001 AS/NZS 3260 1993	Safety of Information Technology Equipment (UL 1950) Safety of information technology equipment Safety of information technology equipment, including Electrical business equipment.	IEC 60065 1998, 2000 ANSI/UL 6500: 1998 CAN/CSA 60065-00	Medical electrical equipment. Part 1: General Requirements for safety.
AS/NZS 3260 Supp 1 1996	Approval and test specification – Safety of information technology equipment including electrical business Equipment.	AS/NZS 3250 1995 AS/NZS 60065 2000	Audio, video and similar electronic apparatus – Safety requirements
ACA TS 001 1997	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)	Canadian C22.2 No. 1-94 (1-98) 1994, 1998 EN 60065 1994	Audio/video and musical instrument apparatus for Household, commercial and similar general use
UL 1459 1995 IEC 1010-1 1990 IEC 61010-1 1993	Australian Communications Authority – Safety requirements for customer equipment. Telephone Equipment	IEC 60825 1990	Australian/New Zealand Standard – Approval and test Specification – Mains operated electronic and related Equipment for household and similar general use
EN 61010-1 1993 IEC 61010-1 2000	Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements.	EN 60825-1 1994 IEC 60825-1 2001 IEC 60825-2 2000-5	Audio, video and similar electronic equipment. Consumer and commercial products
UL 3101-1 1993 CAN/CSA 1010-1 1999 (Including AM 2)	Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements.	IEC 60825-4 1997-11 IEC 60335-1 1995 (Including AM2 – 1997 & AM 12 – 1997) EN 60335-1 2001 UL 60335-1 1998 CAN/CSA E335-1 1994	Safety requirements for main operated electronic and related apparatus for household and similar general use.
	Electrical equipment for laboratory use Part 1: General requirements.		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 systems
			Safety of laser products – Part 4: Laser guards
			Safety of household and similar electrical appliances Part 1: General requirements
(A2LA Cert. No. 1627-01) Revised 02/21/02			Page 9 of 9