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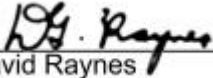
**Report for Emissions Testing of the Crane Smart System Display  
In accordance with FCC Part 15, Subpart B (2000).**

Test Personnel: David Raynes

Prepared for: The Load & A2B Company Inc.  
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Canada  
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Client Acceptance  
Authorized Signatory

  
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David Raynes  
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Electronics Test Centre (Airdrie)  
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APPENDIX A: Test Sample Description: Crane Smart System Display

## **1.0 INTRODUCTION**

### **1.1 SCOPE**

The purpose of this report is to present the findings and results of compliance testing performed in accordance with FCC Part 15, Subpart B (2000).

### **1.2 APPLICANT**

This test report has been prepared for The Load & A2B Company Inc., located in Calgary, Alberta, Canada.

### **1.3 APPLICABILITY**

All test procedures, limits, and results defined in this document apply to the The Load & A2B Company Inc. Crane Smart System Display unit, referred to herein as the Equipment Under Test (EUT).

The results contained in this report relate only to the item tested.

This report does not imply product endorsement by AALA, NVLAP, or the Canadian or US governments.

### **1.4 TEST SAMPLE DESCRIPTION**

The test sample provided for testing was a Crane Smart System Display:

Product Type:	display panel, operational monitor
Model Number:	Crane Smart Display
Serial Number:	n/a
Cables:	power
Power	nominal 12 VDC
Requirements:	
Peripheral Equipment:	sensors for boom position and load

More detailed information is provided by The Load & A2B Company Inc. in Appendix A.

### **1.5 GENERAL TEST CONDITIONS AND ASSUMPTIONS**

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

Where relevant, the EUT was only tested using the monitoring methods and test criteria defined in this report.

## 1.6 SCOPE OF TESTING

Testing was performed in accordance with FCC Part 15, Subpart B (2000).

### 1.6.1 VARIATIONS IN TEST METHODS

There were no variations from the test procedures outlined above.

### 1.6.2 MARGINAL EMISSIONS MEASUREMENTS

As noted in Section 4, some emissions were measured to be within -6 dB of the specified limit.

### 1.6.3 TEST SAMPLE MODIFICATIONS

There were no equipment modifications during test performance.

## 2.0 ABBREVIATIONS

AP	-Average Peak
CE	-Conducted Emissions
E	-Field - Electric Field
H	-Field - Magnetic Field
N/T	-Not Tested
N/A	-Not Applicable
PK	-Peak
QP	-Quasi Peak
RE	-Radiated Emissions

## 3.0 MEASUREMENT UNCERTAINTY

For Radiated E-Field Emissions and Conducted Emissions, the uncertainties in the measurements were calculated using the methods outlined in the NAMAS document, NIS81: May 1984.

Frequency	= ± 1 kHz
Amplitude (RE)	= ± 4.01 dB
Amplitude (CE)	= ± 3.25 dB

#### **4.0 TEST CONCLUSION**

The EUT was subjected to the following tests. Compliance status is indicated as **PASS** or **FAIL**.

The following table summarizes the test results in terms of the specification and class or level applied, the unique test sample identification, the EUT modification state, and configuration as applicable.

<b>TEST CASE</b>	<b>TEST TYPE</b>	<b>SPECIFICATION</b>	<b>CLASS/ LEVEL</b>	<b>TEST SAMPLE</b>	<b>MOD. STATE</b>	<b>CONFIGURATION</b>	<b>RESULT</b>
§4.1	Conducted Emissions	FCC Part 15 Subpart B	n/a	Crane Smart System Display	nil	n/a	<b>N/A</b>
§4.2	Radiated Emissions	FCC Part 15 Subpart B	A	Crane Smart System Display	nil	See § 1.6.3	<b>PASS</b>

#### **STATEMENT OF COMPLIANCE**

The client equipment referred to in this report was found to comply with the requirements as stated above.

#### 4.1 CONDUCTED EMISSIONS

The was not tested for Conducted Emissions. This is a DC powered device. The power source is provided by the end user, not The Load & A2B Company Inc. There is no direct connection to the AC mains.

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: David Raynes Test Date: n/a	Product: Crane Smart System Display
Test Result, Crane Smart System Display: <b>Not Applicable</b>	

#### 4.2 RADIATED EMISSIONS

Test Lab: MPB Technologies Inc. Airdrie Test Personnel: David Raynes Test Date: 18 February 2003	Product: Crane Smart System Display																																										
Test Result, Crane Smart System Display: <b>Pass</b>																																											
Objectives/Criteria The Radiated E-Field emissions produced by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for the specifications as stated. <b>Emission levels should meet the requirements with a margin of 6dB.</b> The EUT was assessed against the requirements of <b>Class A</b> . Temperature = 19 °C Humidity = 35 %	Specification: FCC Part 15 Subpart B Frequency <b>Class A</b> Class B [MHz] <b>QP @ 3m</b> QP @ 3m 30 – 88 <b>49.54</b> 40.00 88 – 216 <b>53.98</b> 43.52 216 – 960 <b>56.90</b> 46.02 above 960 <b>60.00</b> 53.98																																										
<table border="1"> <thead> <tr> <th colspan="3">Horizontal:</th> <th colspan="3">Vertical:</th> </tr> <tr> <th>Frequency [MHz]</th> <th>Field Strength [dBµV/m]</th> <th>Delta [dB from limit]</th> <th>Frequency [MHz]</th> <th>Field Strength [dBµV/m]</th> <th>Delta [dB from limit]</th> </tr> </thead> <tbody> <tr> <td>184.2719</td> <td>49.56</td> <td>-4.42</td> <td>194.1032</td> <td>49.70</td> <td>-4.28</td> </tr> <tr> <td></td> <td></td> <td></td> <td>130.2037</td> <td>49.51</td> <td>-4.47</td> </tr> <tr> <td></td> <td></td> <td></td> <td>100.7096</td> <td>49.34</td> <td>-4.64</td> </tr> <tr> <td></td> <td></td> <td></td> <td>186.7307</td> <td>48.53</td> <td>-5.45</td> </tr> <tr> <td></td> <td></td> <td></td> <td>184.2734</td> <td>48.39</td> <td>-5.59</td> </tr> </tbody> </table>		Horizontal:			Vertical:			Frequency [MHz]	Field Strength [dBµV/m]	Delta [dB from limit]	Frequency [MHz]	Field Strength [dBµV/m]	Delta [dB from limit]	184.2719	49.56	-4.42	194.1032	49.70	-4.28				130.2037	49.51	-4.47				100.7096	49.34	-4.64				186.7307	48.53	-5.45				184.2734	48.39	-5.59
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There were more emissions measured within -6 dB of the specified limit. Refer to the test data and plots for more detail.																																											

Radiated Emissions Data:

The emissions data is presented in tabular form, showing the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value(s) of up to 4 limits at the frequency measured, and the margin between the result and the limit(s).

For example:

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1 [dB]	2 [dB]	3 [dB]	4 [dB]	
94.0036	37.1 qp	2.2	8.5	47.8	54	43.5	50.5	40.5	
Azimuth: 156 Height:113 Vert					Margin [dB]	-6.2	4.3	-2.7	7.3

Test Frequency [MHz]	94.0036	Test Frequency f = 94.0036 MHz
Meter Reading [dB (uV)]	37.1 qp	The reading with Quasi-Peak detector
Gain/Loss Factor [dB]	2.2	Net correction for preamp gain & cable loss
Transducer Factor [dB]	8.5	Correction for antenna loss
Level [dB (uVolts)]	47.8	Corrected value for field strength
Limit: 1	54	The value of Limit 1 at 94.0036 MHz
Margin [dB]	-6.2	The field strength is 6.2 dB below Limit 1
Limit: 2	43.5	The value of Limit 2 at 94.0036 MHz
Margin [dB]	4.3	The field strength is 4.3 dB above Limit 2
Limit: 3	50.5	The value of Limit 3 at 94.0036 MHz
Margin [dB]	-2.7	The field strength is 2.7 dB below Limit 3
Limit: 4	40.5	The value of Limit 4 at 94.0036 MHz
Margin [dB]	7.3	The field strength is 7.3 dB above Limit 4

**Meter Reading in dBuV + Gain/Loss Factor in dB + Transducer Factor in dB = Corrected Field Strength**

Note: When a preamp is used, the resulting gain is compensated.

The Load & A2B Company Inc.  
Crane Smart Receiver  
Project Number t11e2736



Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level Limit:1 dB[uVolts/meter]	2	3	4
=====							
Range: 1 30 - 1000MHz							
56.9617	4.85 qp	2.78	12.68	20.31	49.54	50	40.46
Azimuth: 101	Height:101	Horz	Margin [dB]:	-29.23	-29.69	-19.69	-20.15
181.8238	33.16 qp	4.43	10.03	47.62	53.98	50	40.46
Azimuth: 159	Height:193	Horz	Margin [dB]:	-6.36	-2.38	4.1	7.16
184.2719	35.16 qp	4.47	9.93	49.56	53.98	50	40.46
Azimuth: 159	Height:183	Horz	Margin [dB]:	-4.42	-.44	6.04	9.1
186.7304	33.03 qp	4.51	9.97	47.51	53.98	50	40.46
Azimuth: 159	Height:178	Horz	Margin [dB]:	-6.47	-2.49	3.99	7.05
191.6538	32.82 qp	4.48	10.3	47.6	53.98	50	40.46
Azimuth: 161	Height:171	Horz	Margin [dB]:	-6.38	-2.4	4.08	7.14
194.1046	32.54 qp	4.38	10.59	47.51	53.98	50	40.46
Azimuth: 162	Height:169	Horz	Margin [dB]:	-6.47	-2.49	3.99	7.05
199.0382	32.09 qp	4.16	11.18	47.43	53.98	50	40.46
Azimuth: 163	Height:164	Horz	Margin [dB]:	-6.55	-2.57	3.91	6.97
Range: 1 30 - 1000MHz							
100.7096	36.16 qp	2.91	10.27	49.34	53.98	50	40.46
Azimuth: 314	Height:100	Vert	Margin [dB]:	-4.64	-.66	5.82	8.88
103.171	34.25 qp	3.01	10.86	48.12	53.98	50	40.46
Azimuth: 274	Height:99	Vert	Margin [dB]:	-5.86	-1.88	4.6	7.66
120.3714	31.76 qp	3.63	12.21	47.6	53.98	50	40.46
Azimuth: 225	Height:102	Vert	Margin [dB]:	-6.38	-2.4	4.08	7.14
130.2037	33.53 qp	3.6	12.38	49.51	53.98	50	40.46
Azimuth: 238	Height:100	Vert	Margin [dB]:	-4.47	-.49	5.99	9.05
176.8991	32.19 qp	4.29	10.55	47.03	53.98	50	40.46
Azimuth: 300	Height:100	Vert	Margin [dB]:	-6.95	-2.97	3.51	6.57
181.8258	33.1 qp	4.43	10.15	47.68	53.98	50	40.46
Azimuth: 298	Height:101	Vert	Margin [dB]:	-6.3	-2.32	4.16	7.22
184.2734	33.96 qp	4.47	9.96	48.39	53.98	50	40.46
Azimuth: 283	Height:99	Vert	Margin [dB]:	-5.59	-1.61	4.87	7.93
186.7307	34.05 qp	4.51	9.97	48.53	53.98	50	40.46
Azimuth: 278	Height:99	Vert	Margin [dB]:	-5.45	-1.47	5.01	8.07
191.6564	32.95 qp	4.48	10.17	47.6	53.98	50	40.46
Azimuth: 268	Height:99	Vert	Margin [dB]:	-6.38	-2.4	4.08	7.14
194.1032	35.06 qp	4.38	10.26	49.7	53.98	50	40.46
Azimuth: 267	Height:102	Vert	Margin [dB]:	-4.28	-.3	6.18	9.24

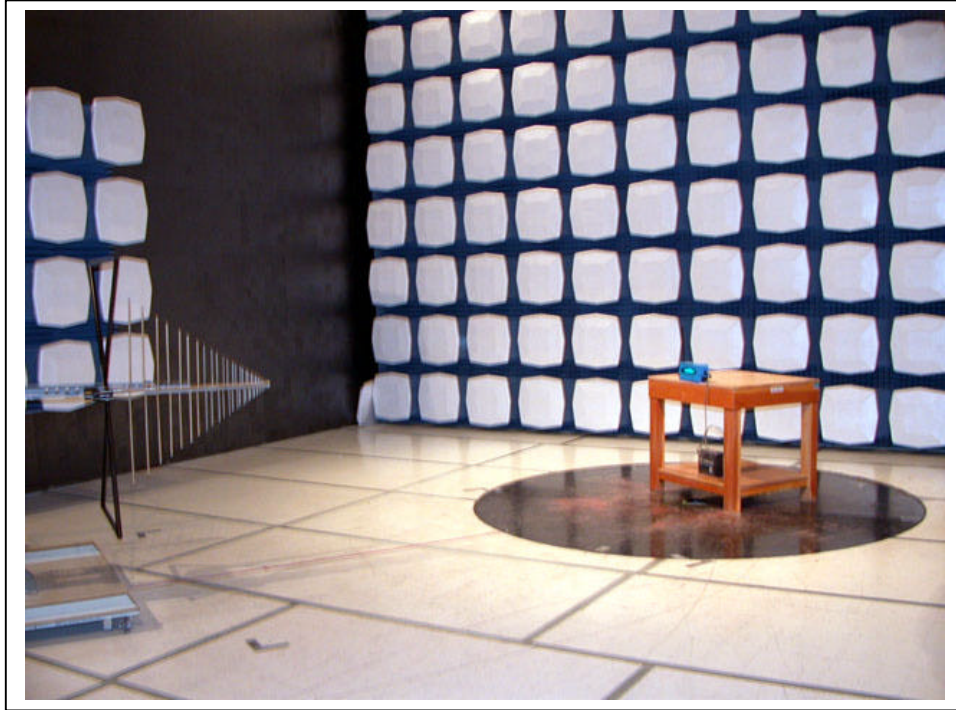
LIMIT 1: FCC Part 15 Class A 3m  
LIMIT 3: FCC Class B 3m

LIMIT 2: CISPR Class A 3m  
LIMIT 4: CISPR Class B 3m

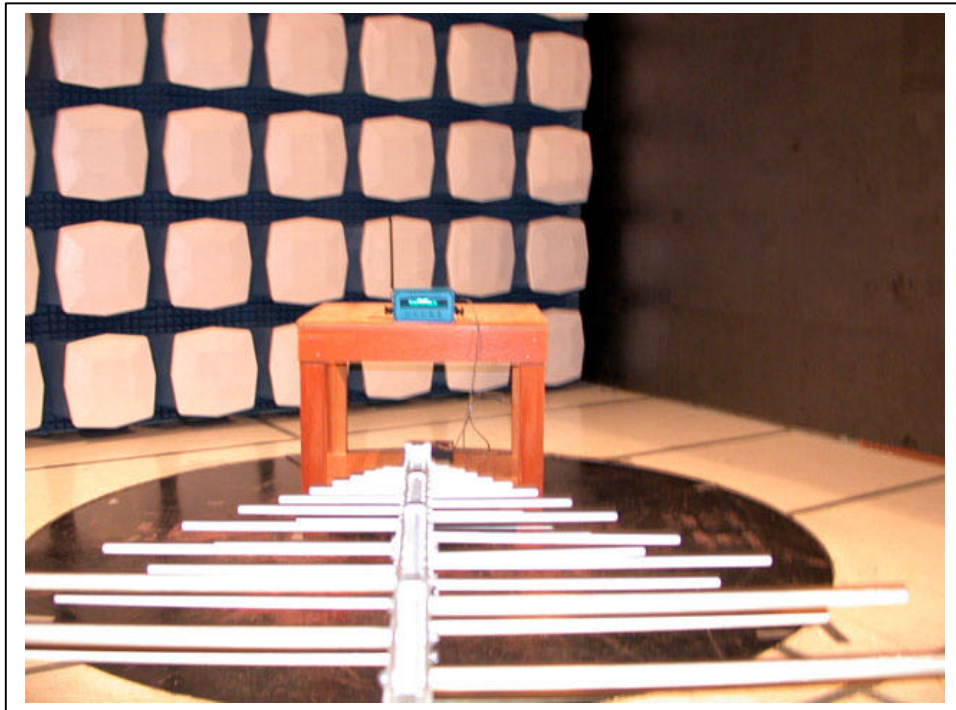
qp - Quasi-Peak detector  
File: QP 30-1000.TXT



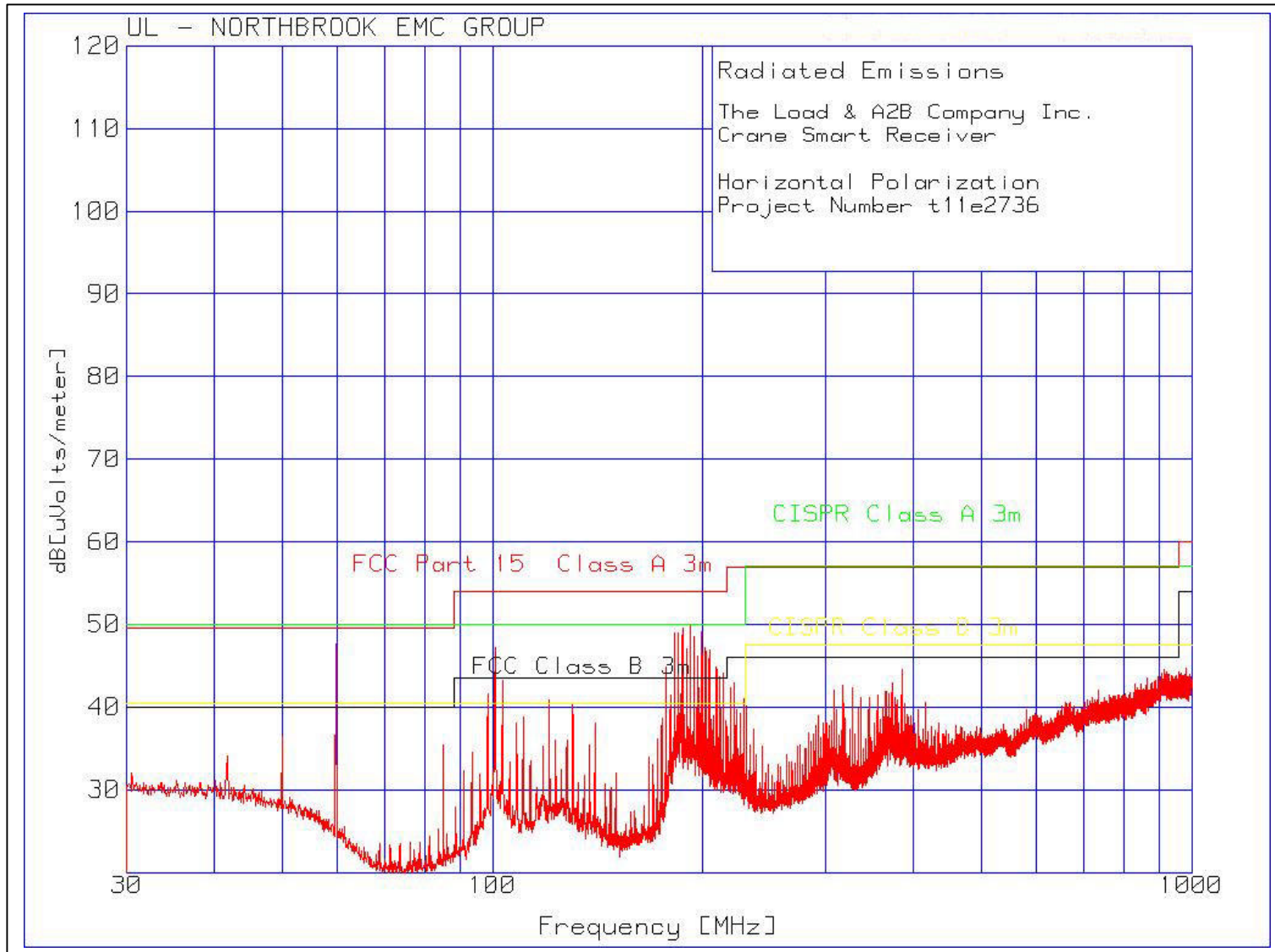
Picture of Radiated Emissions test setup:



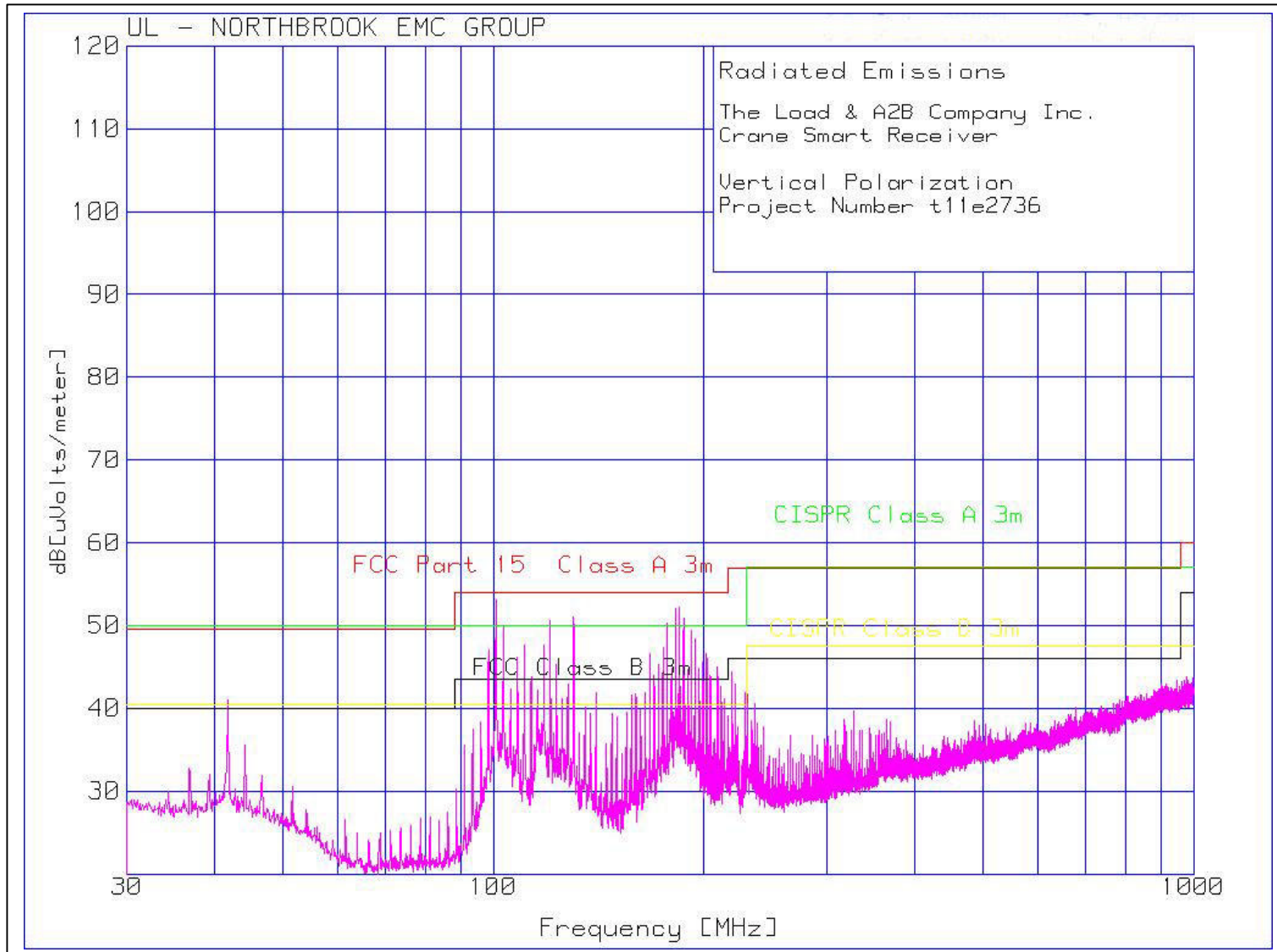
Picture of Radiated Emissions test setup:



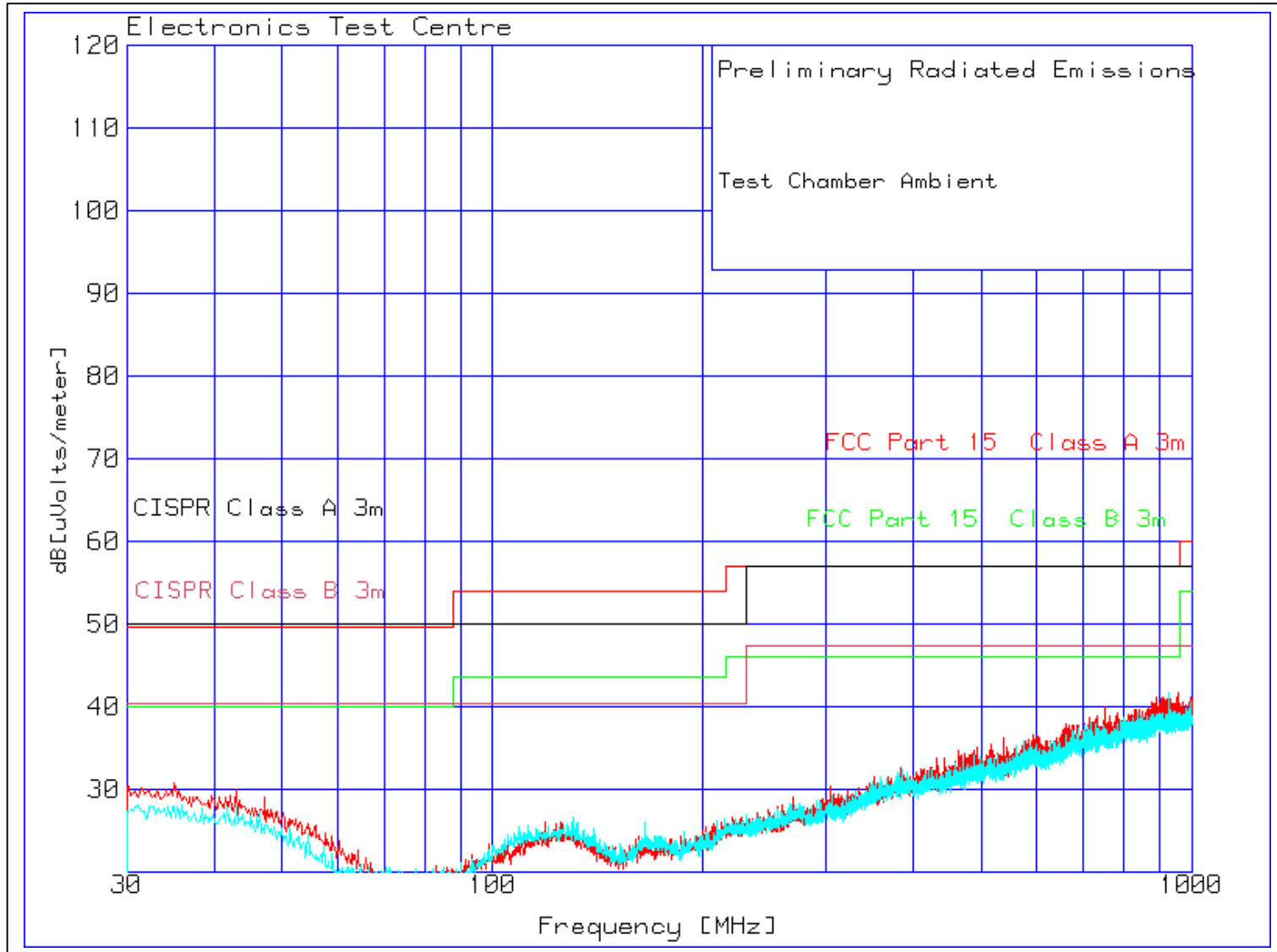
Plot of Radiated Emissions:



Plot of Radiated Emissions:



Plot of Radiated Emissions Test Chamber Ambient:



## **5.0 TEST FACILITY**

### **5.1 LOCATION**

The EUT was tested for Electromagnetic Compatibility at the Electronics Test Centre, located in Airdrie, Alberta, Canada.

The RF Anechoic Chamber (RFAC) is identified as Chamber 1, located in the main building complex at the Electronics Test Centre. Its usable working space measures 10.6 m long x 7.3 m wide x 6.5 m high.

This test site is listed with the FCC under Registration Number 99541. Measurements taken at this site are accepted by Industry Canada per file number IC 2046-1.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in two shielded vestibules located at the side of the main room. Cables are routed through bulkhead panels between the rooms as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

### **5.2 GROUNDING PLAN**

The EUT was located on a wooden table 80 cm above the ground plane. In accordance with The Load & A2B Company Inc. specifications, the EUT was not grounded.

### **5.3 POWER**

DC power was supplied to the EUT via client-supplied cable connected to a battery positioned beneath the table.

### **5.4 EMISSIONS PROFILE**

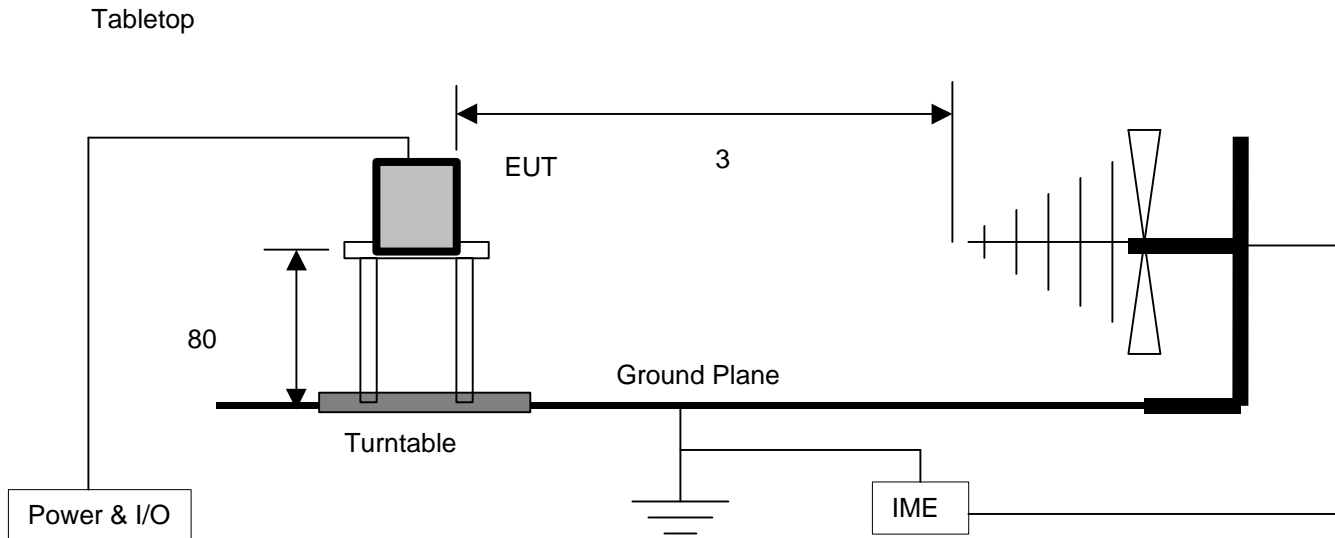
Ambient radiated electromagnetic emission profiles were generated throughout the tests and are included in the test data.

## 5.5 TEST CONFIGURATION

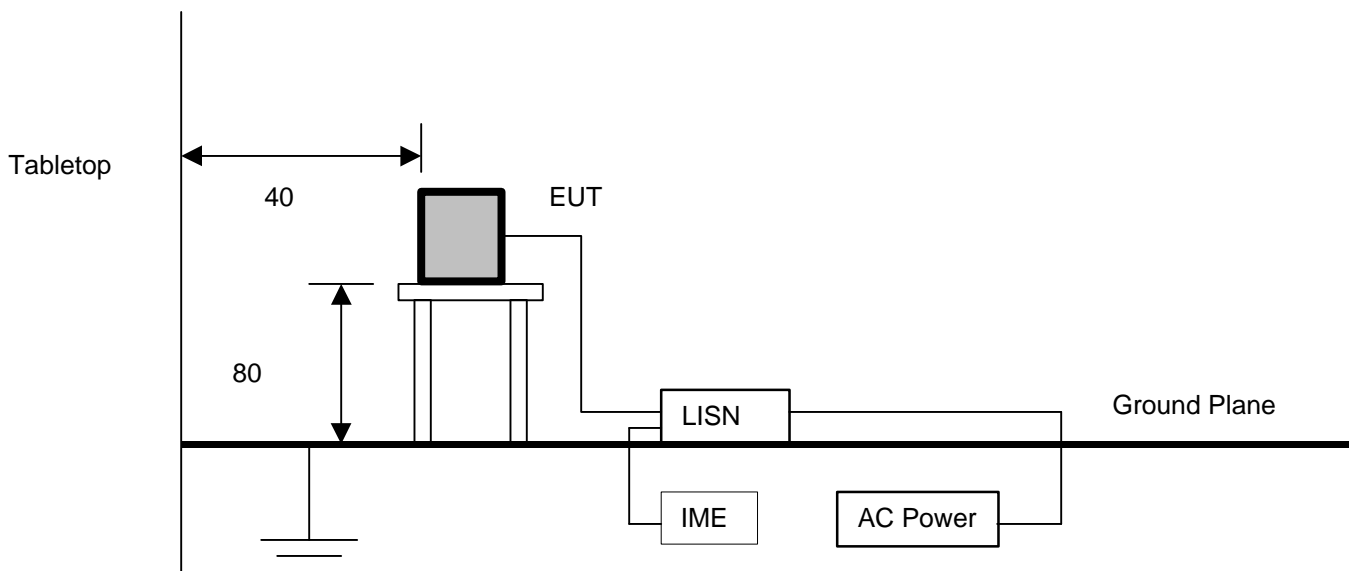
### 5.5.1 Tabletop Equipment

The following diagrams illustrate the configuration of the EUT test and measurement equipment for Radiated and Conducted Emissions Testing of tabletop equipment.

#### Radiated Emissions



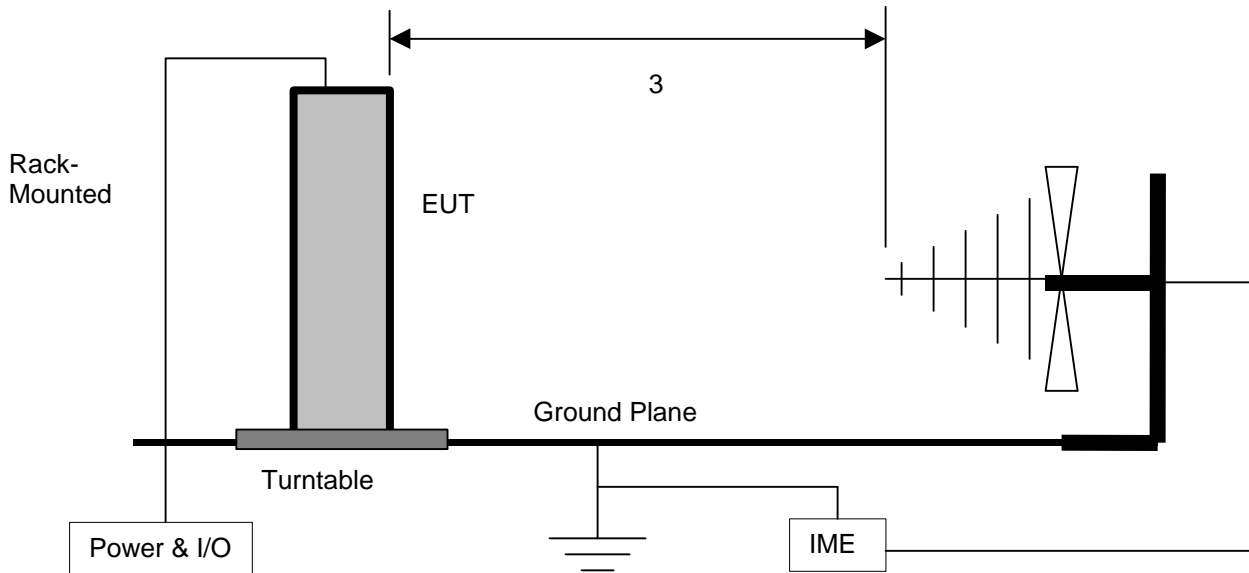
#### Conducted Emissions



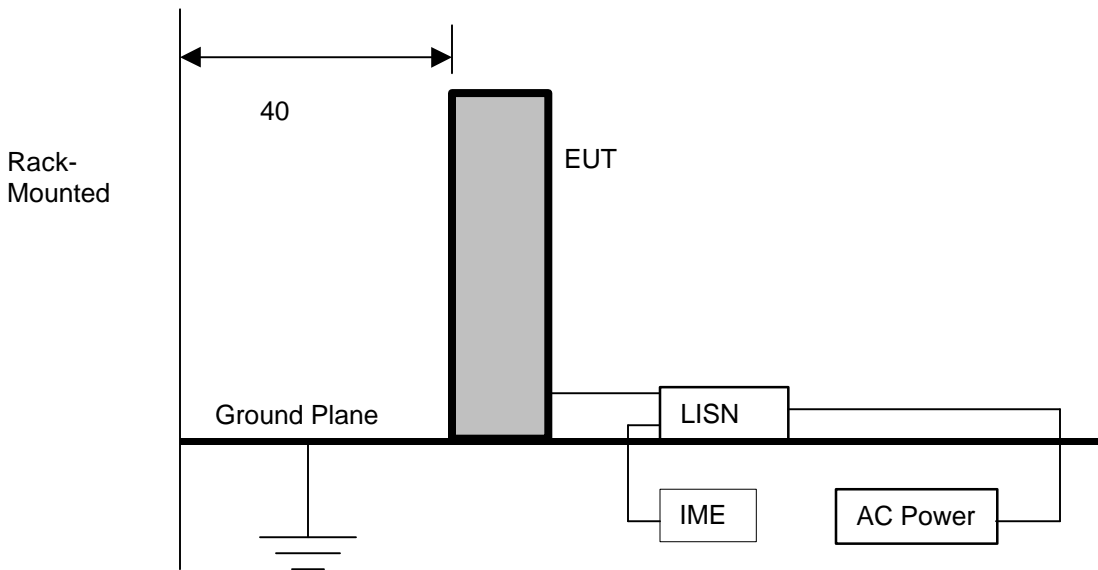
### 5.5.2 Rack Mount

The following diagrams illustrate the configuration of the EUT test and measurement equipment for Radiated and Conducted Emissions Testing of rack mounted equipment.

#### Radiated Emissions



#### Conducted Emissions



## **6.0 TEST EQUIPMENT**

The following equipment was used for this procedure. All measurement devices are calibrated annually, traceable to NIST.

### **6.1 RADIATED EMISSIONS**

- a) Spectrum Analyzer with RF Preselector
- b) CISPR Quasi-peak Adapter
- c) Power Isolation Transformers
- d) Biconilog antenna (20 MHz to 2 GHz)
- e) Antenna mast positioner, and controller
- f) Flush-mounted turntable, and controller
- g) Personal Computer and EMC software

### **6.2 CONDUCTED EMISSIONS**

- a) Spectrum Analyzer with RF Preselector
- b) Line Impedance Stabilization Network, 50  $\mu$ H
- c) CISPR Quasi-peak Adapter
- d) Isolation Transformer
- e) Personal Computer and EMC software

### **6.3 CALIBRATION**

All measurement instrumentation conforms to ANSI C63.2. Calibration is maintained in accordance with manufacturer recommendations. Each measurement device is labeled with its ETC asset number and calibration due date.

#### **6.3.1 CALIBRATION ACCURACY**

Test equipment used to provide quantitative measurements are calibrated with standards traceable to the National Research Council, National Institute of Standards and Technology or other national standards. Instrumentation systems for emissions measurements have the following accuracies:

Frequency =  $\pm$  1 kHz  
Amplitude (RE) =  $\pm$  4.01 dB  
Amplitude (CE) =  $\pm$  3.25 dB



### 6.3.2 TEST EQUIPMENT DESCRIPTION

The equipment used in the tests was selected from the following list.

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Asset No.</b>	<b>Calibration Due</b>
Spectrum Analyzer	Hewlett Packard	8566B	9565	13 November 2003
Spectrum Analyzer	Hewlett Packard	8566B	9168	10 Deceember 2003
RF Preselector	Hewlett Packard	85685A	9563	14 August 2004
RF Preselector	Hewlett Packard	85685A	9728	30 July 2004
Quasi-Peak Adapter	Hewlett Packard	85650A	9243	7 August 2004
Active monopole	EMCO	3301B	9705	6 August 2004
Biconilog Antenna	ARA	LPB-2520/A	4318	3 August 2004
Dual Ridged Guide Antenna	EMCO	3115	19357	2 August 2004
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	14 February 2004

