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Emissions Testing of the BBX in accordance with FCC Part 90 (2003)

Private Land Mobile Radio Services

Test Personnel: Trung Nguyen, Jianming Zhang, David Raynes

Prepared for: Mentor Engineering Inc.

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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 CFR Title 47 FCC Part 90 (2003), Private Land Mobile Radio Services.

1.2 APPLICANT

This test report has been prepared for Mentor Engineering Inc., located in Calgary, Alberta, Canada.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the Mentor Engineering Inc. BBX 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 NVLAP or the Canadian or US governments.

1.4 TEST SAMPLE DESCRIPTION

The test sample provided for testing was a BBX:

Product Type:	mobile dispatch
Model Number:	BBX
Serial Number:	n/a
Power Requirements:	12 VDC
Peripheral Equipment:	roof-mount antenna

More detailed information is provided by Mentor Engineering 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.

Environmental conditions are recorded for each test.

1.6 SCOPE OF TESTING

Testing was performed in accordance with FCC Part 90 (2003), and ANSI C63.4 (2003).

1.6.1 VARIATIONS IN TEST METHODS

There were no variations from the test procedures outlined above.

1.6.2 TEST SAMPLE CONFIGURATION & MODIFICATIONS

The EUT met the requirements without modification.

2.0 ACRONYMS

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

STATEMENT OF COMPLIANCE

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

The EUT was subjected to the following tests. Compliance status is reported as a **PASS** or **FAIL**. Test conditions that are not applicable to the EUT are marked **n/a**. If testing was not performed at this time, the appropriate field is marked **n/t**.

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.

TEST CASE	TEST TYPE	SPECIFICATION	TEST SAMPLE	MOD. STATE	CONFIGURATION	RESULT
§4.1	Conducted Emissions at AC lines	FCC Part 15.107 and 15.207	BBX	nil	See § 1.6.2	**n/a**
§4.2	Conducted Emissions at Antenna Port	FCC Part 90	BBX	nil	See § 1.6.2	**PASS**
§4.3a	Radiated Emissions (Rx Mode)	FCC Part 15.109	BBX	nil	See § 1.6.2	**PASS**
§4.3b	Radiated Emissions (Tx Mode)	FCC Parts 2.1053, 15.205, 15.209 and 90	BBX	nil	See § 1.6.2	**PASS**
§4.4	Frequency Stability	FCC Part 2.1055	BBX	nil	See § 1.6.2	**n/a**

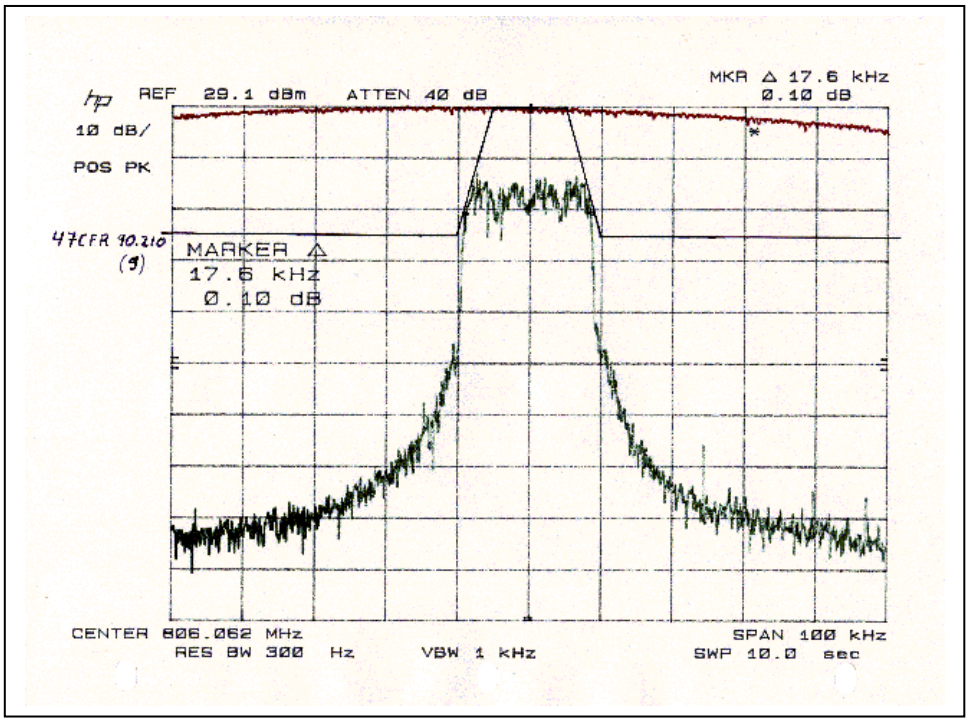
4.1 CONDUCTED EMISSIONS ON AC POWER LINES

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: Test Date: n/a	Product: BBX
Test Result, BBX: **Not Applicable**	
The BBX was not tested for Conducted Emissions. This is a DC powered device. The power source is provided by the end user, not Mentor Engineering Inc. There is no direct connection to the AC mains.	

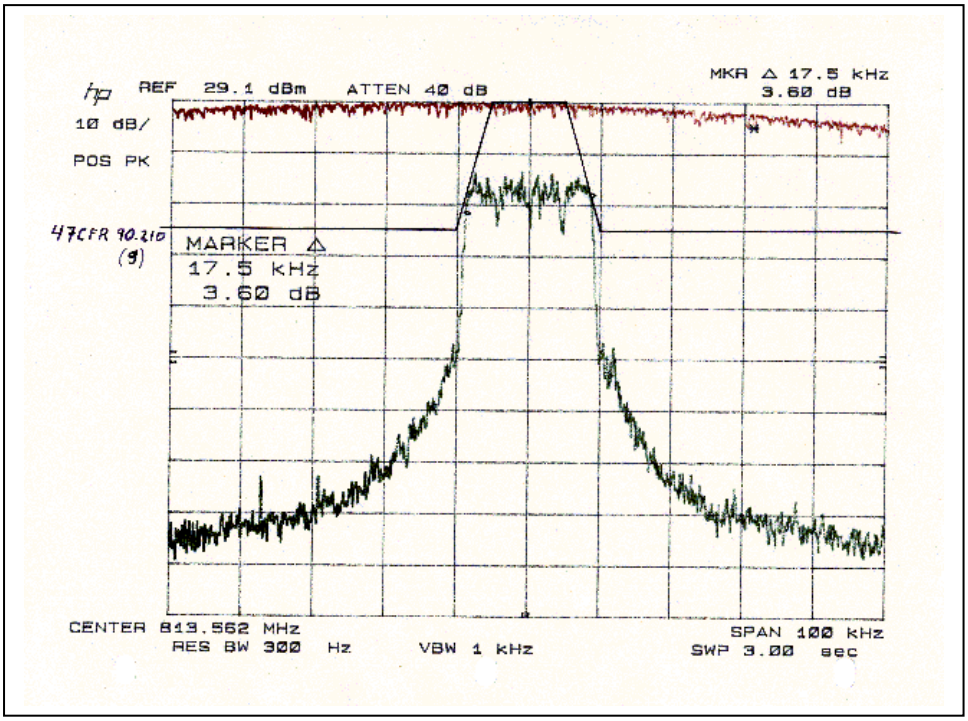
4.2 CONDUCTED EMISSIONS MEASURED AT ANTENNA PORT

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: David Raynes Test Date: 16 November 2004			Product: BBX		
Test Result, BBX: **PASS**					
90.209: BW ≤ 20 kHz			90.210 Emission mask G		
Carrier Frequency [MHz]	99% Bandwidth [kHz]	Delta from limit [kHz]	Carrier Frequency [MHz]	Low RF Power	High RF power
806	17.6	-2.4	806	n/a	**PASS**
813	17.5	-2.5	813	n/a	**PASS**
821	17.6	-2.4	821	n/a	**PASS**
Measurements were performed while the BBX was transmitting continuous pulses. The RF output power is not user-adjustable. Testing was only conducted at the default power level. The RF section is an OEM module, pre-approved under FCC ID # AZ492FT5826. Refer to the test data and plots for more detail.					

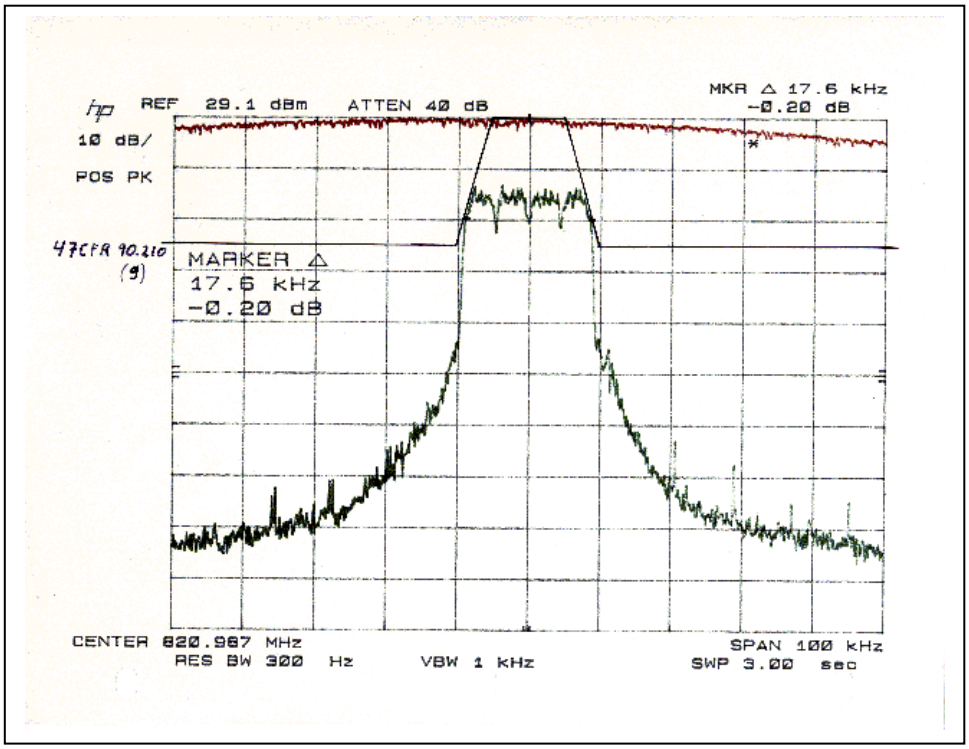
Spectrum Analyzer Plot: Emission Mask G: Tx @ 806 MHz



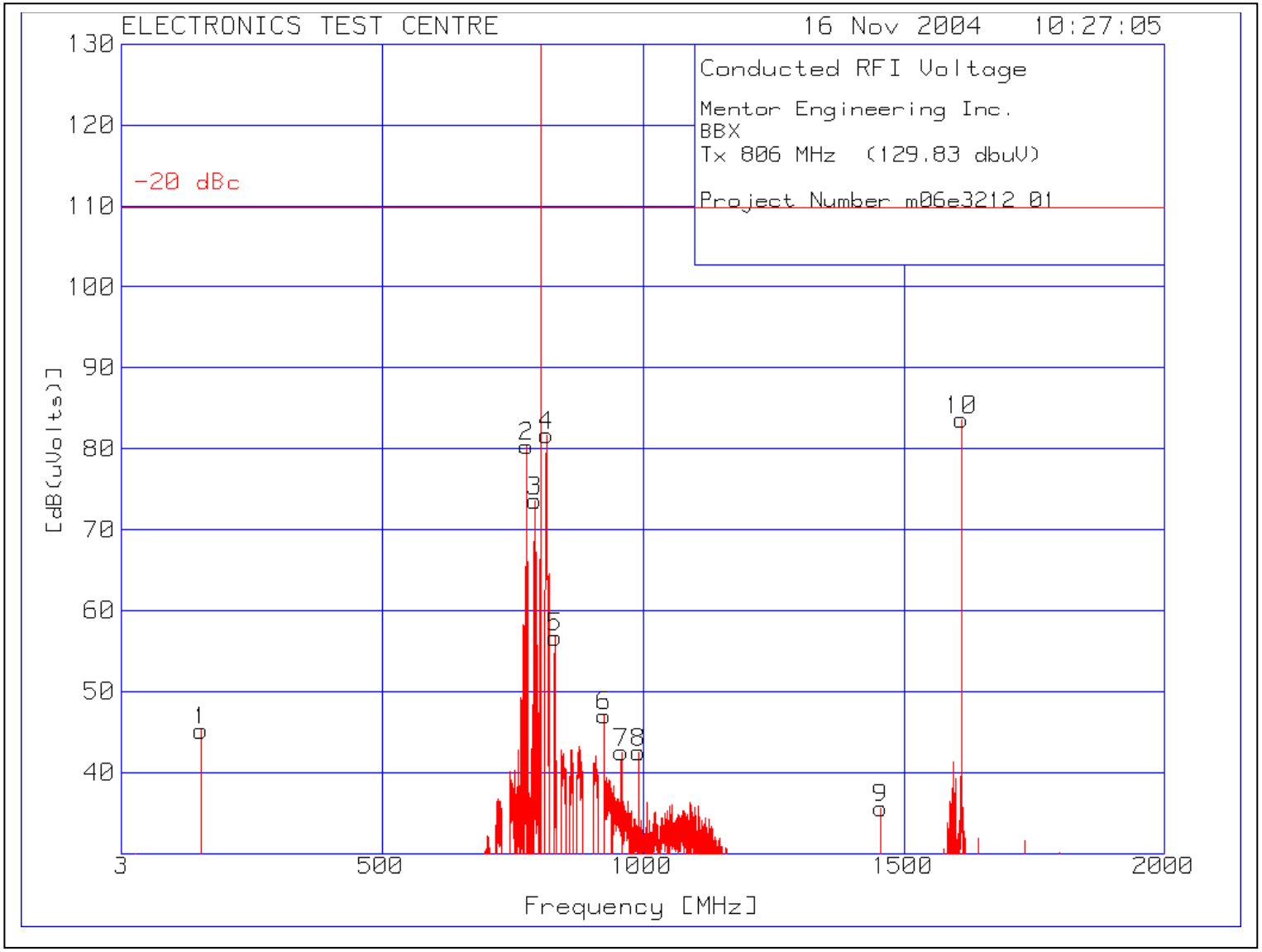
Spectrum Analyzer Plot: Emission Mask G: Tx @ 813 MHz



Spectrum Analyzer Plot: Emission Mask G: Tx @ 821 MHz



Plot of Conducted Emissions: -13 dBm = 94 dBµV



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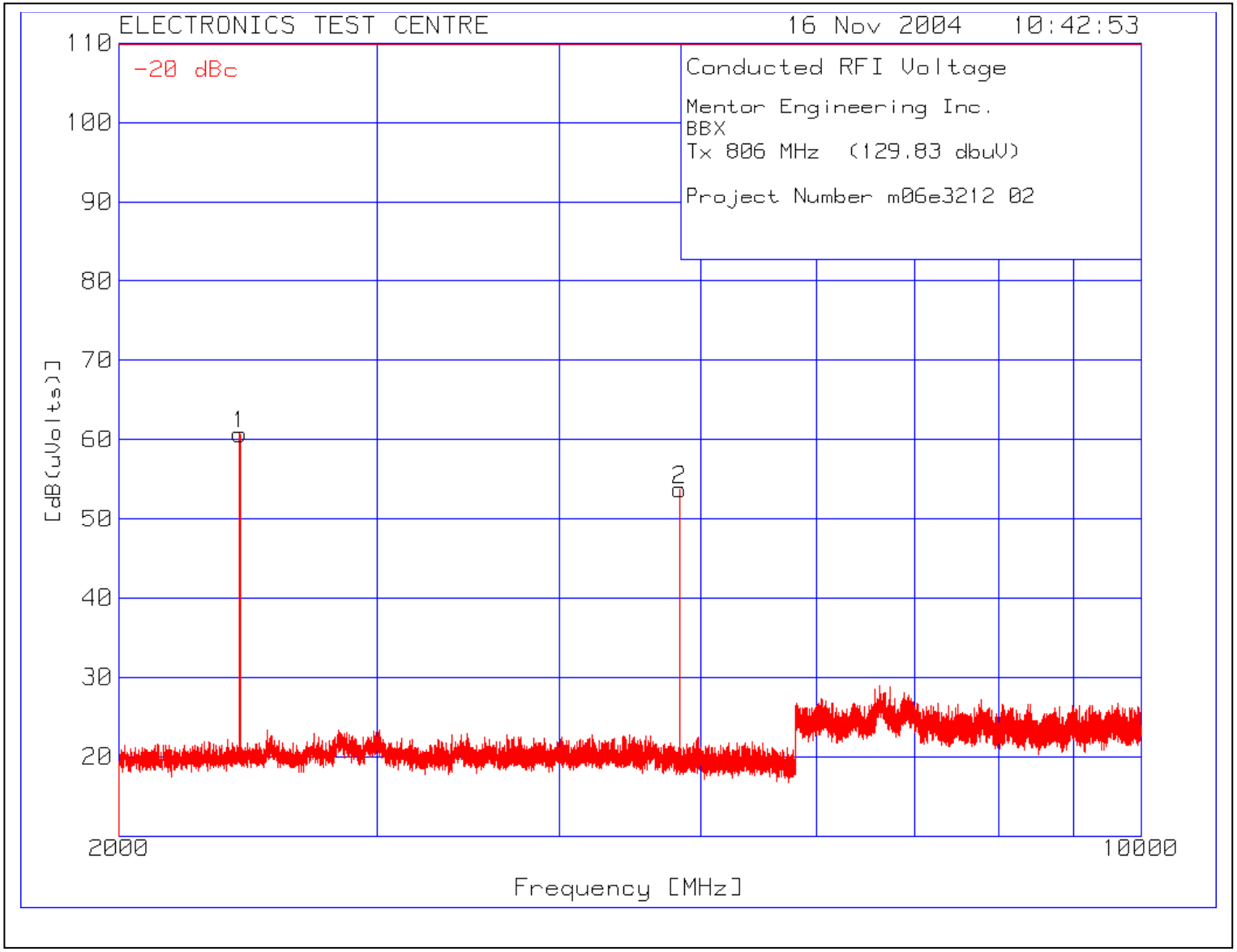
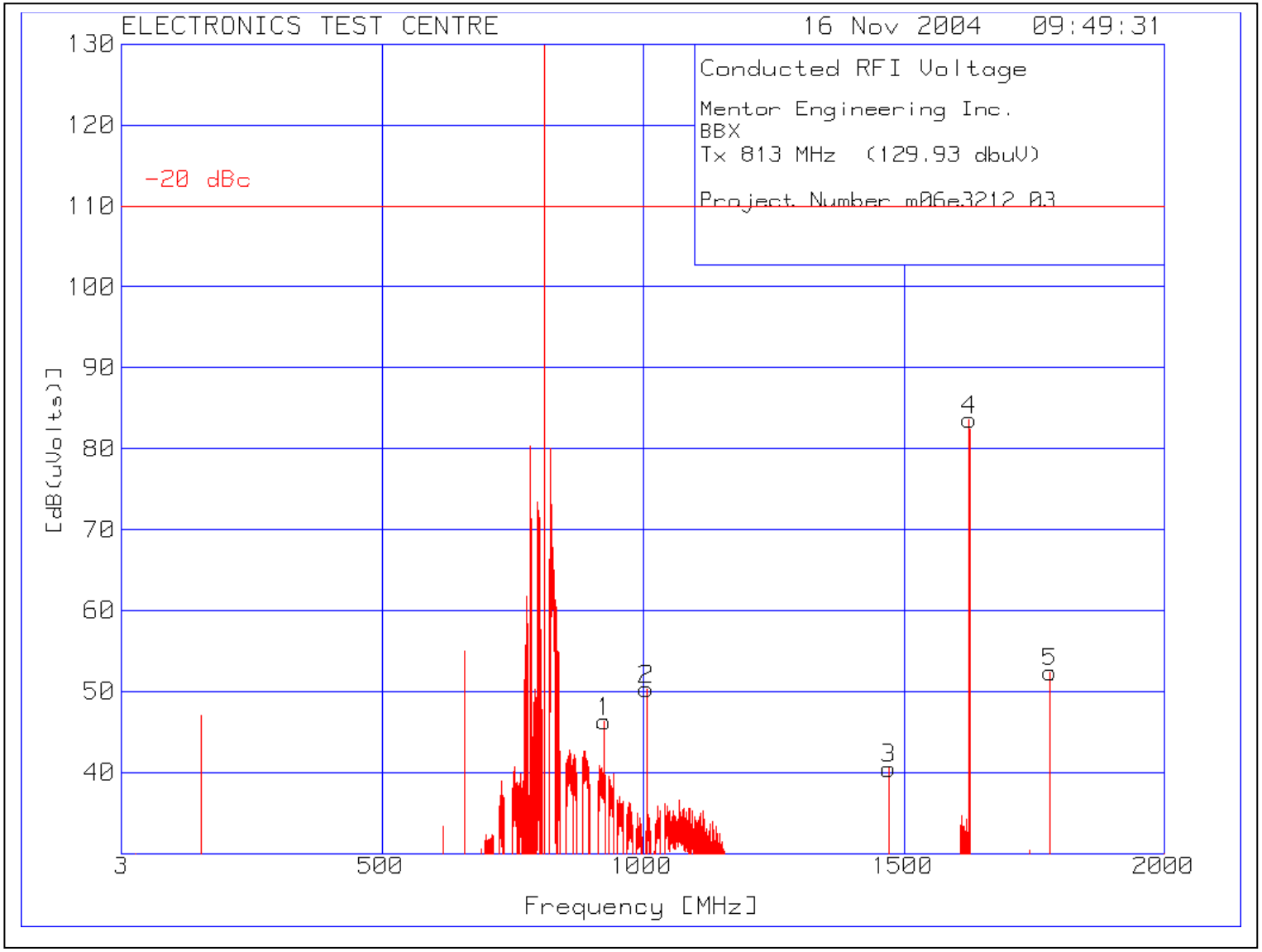
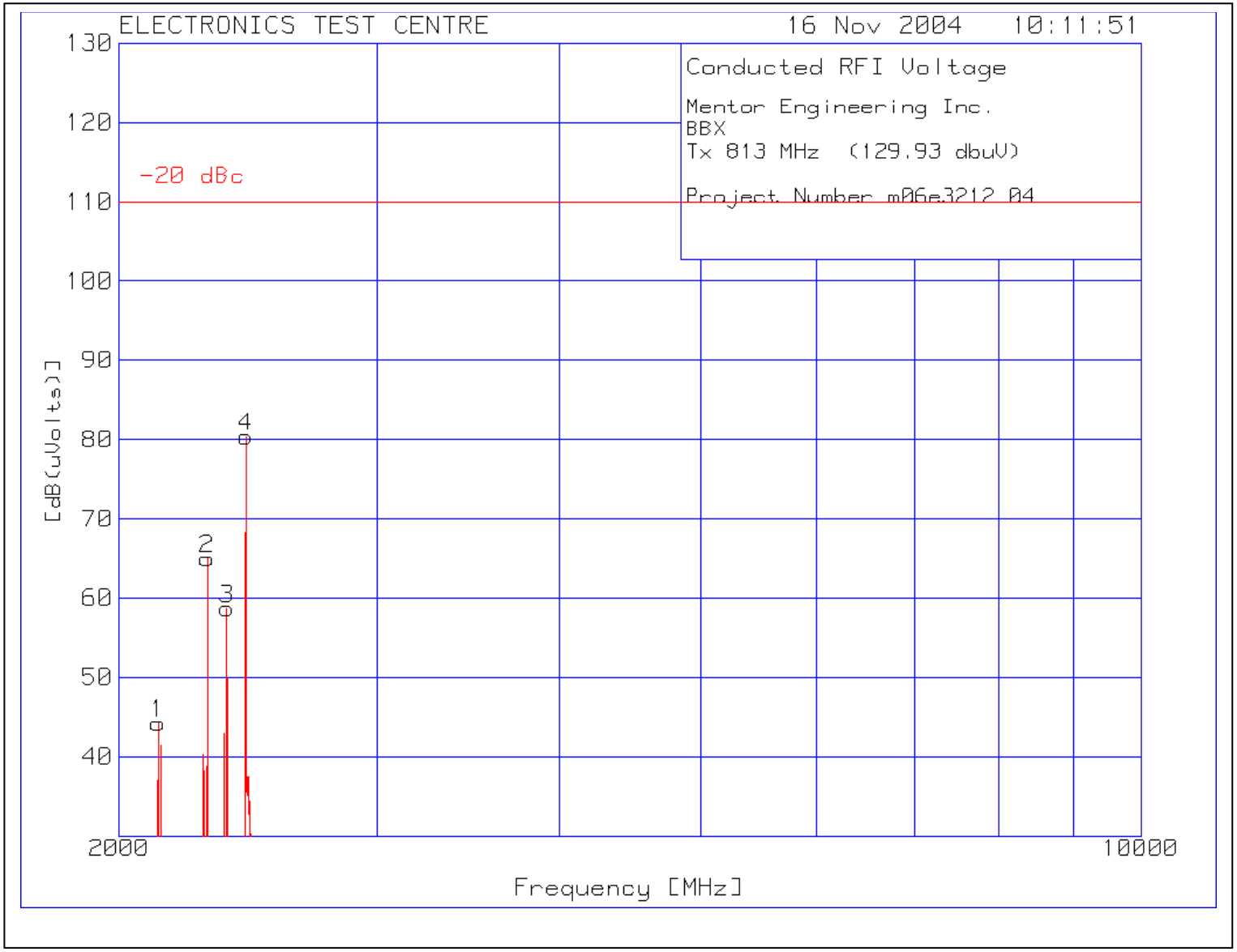


Plot of Conducted Emissions: -13 dBm = 94 dBµV



Plot of Conducted Emissions: -13 dBm = 94 dBµV



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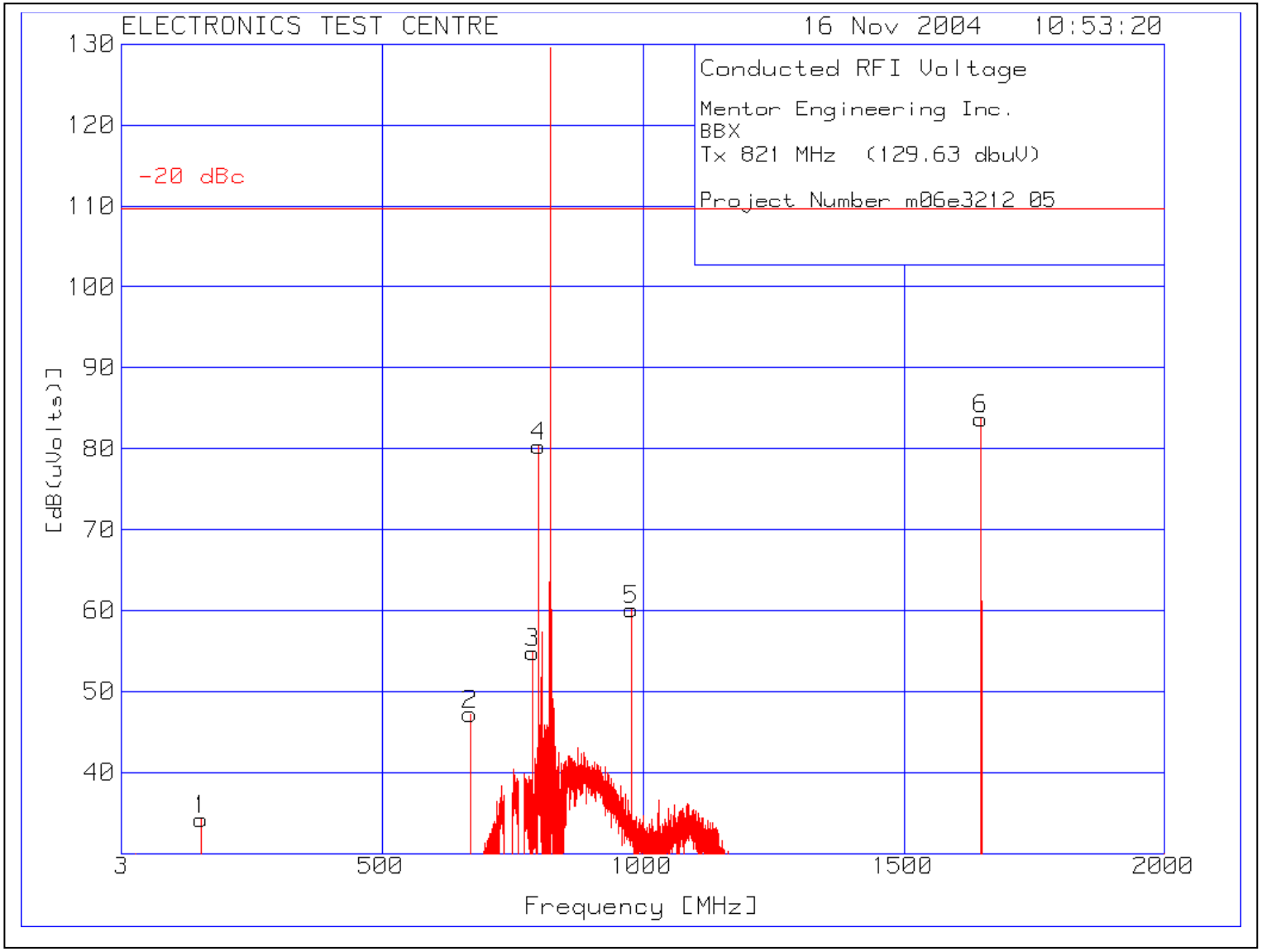
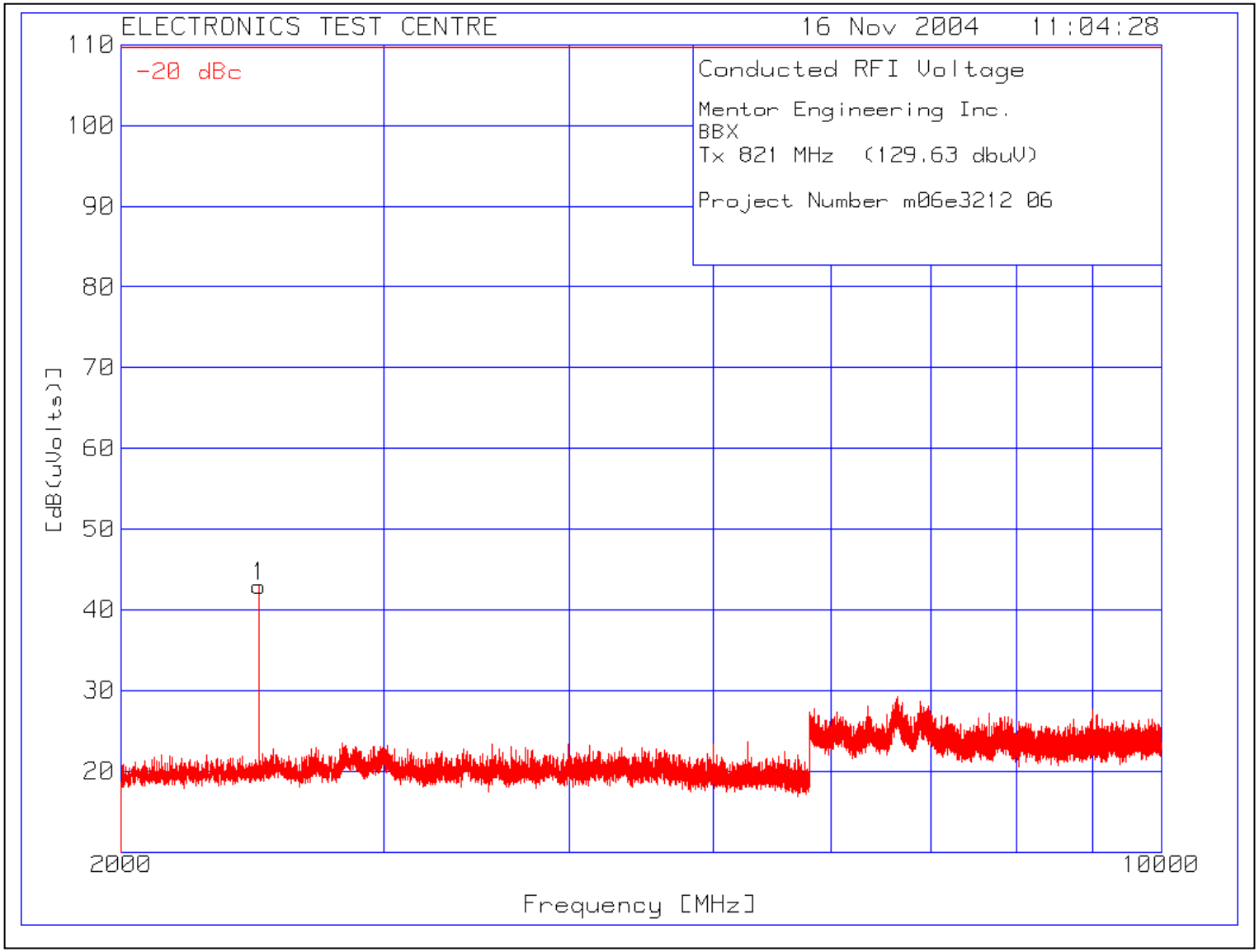


Plot of Conducted Emissions: -13 dBm = 94 dBµV



4.3 RADIATED EMISSIONS INCLUDING RESTRICTED BANDS OF OPERATION

4.3a Receive Mode

Test Lab: MPB Technologies Inc. Airdrie Test Personnel: David Raynes Test Date: 17 November 2004	Product: BBX
Test Result, BBX: **PASS**	
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. **Emission levels should meet the requirements with a margin of 6dB.** The EUT was assessed against the requirements of **Class B**. Temperature = 19 °C Humidity = 29 %	Specification: FCC Part 15 Subpart C Frequency [MHz] / Class A QP @ 3m / Class B QP @ 3m 30 – 88 / 49.54 / 40.00 88 – 216 / 53.98 / 43.52 216 – 960 / 56.90 / 46.02 above 960 / 60.00 / 53.98

Horizontal:			**Vertical:**		
Frequency [MHz]	Field Strength [dBμV/m]	Delta [dB from limit]	Frequency [MHz]	Field Strength [dBμV/m]	Delta [dB from limit]
704.8262	43.08	-2.94	69.9631	35.46	-4.54
637.7345	41.55	-4.47	65.9534	34.67	-5.33
604.2090	41.15	-4.87	73.9498	34.31	-5.69
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	2	3 ⇓	4
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

⇓		The applicable Limit
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
Azimuth:	156	The turntable was 156 degrees CW from facing the antenna
Height:	113	The antenna was 113 cm above the ground
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.

Company: Mentor Engineering
BBX
Rx mode
Project Number: M06e3212

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3 ⇓	4
Range: 1 30 - 1000MHz								
201.3383	18.71 qp	3.85	9.54	32.1	53.98	50	43.52	40.46
Azimuth: 252	Height:147 Horz			Margin [dB]:	-21.88	-17.9	-11.42	-8.36
218.1156	21.06 qp	4.11	10.51	35.68	56.9	50	46.02	40.46
Azimuth: 264	Height:117 Horz			Margin [dB]:	-21.22	-14.32	-10.34	-4.78
604.209	16.09 qp	6.74	18.32	41.15	56.9	57	46.02	47.46
Azimuth: 128	Height:130 Horz			Margin [dB]:	-15.75	-15.85	-4.87	-6.31
637.7345	16.04 qp	6.88	18.63	41.55	56.9	57	46.02	47.46
Azimuth: 130	Height:133 Horz			Margin [dB]:	-15.35	-15.45	-4.47	-5.91
670.23	10.87 qp	7.08	19.96	37.91	56.9	57	46.02	47.46
Azimuth: 109	Height:126 Horz			Margin [dB]:	-18.99	-19.09	-8.11	-9.55
704.8262	16.27 qp	7.27	19.54	43.08	56.9	57	46.02	47.46
Azimuth: 95	Height:115 Horz			Margin [dB]:	-13.82	-13.92	-2.94	-4.38
738.4515	10.31 qp	7.46	19.8	37.57	56.9	57	46.02	47.46
Azimuth: 89	Height:101 Horz			Margin [dB]:	-19.33	-19.43	-8.45	-9.89

LIMIT 1: FCC Part 15 Class A 3m
LIMIT 2: ICES-003 Class A 3m
LIMIT 3: FCC Part 15 Class B 3m ⇐
LIMIT 4: ICES-003 Class B 3m

qp - Quasi-Peak detector

Company: Mentor Engineering
BBX
Rx mode
Project Number: M06e3212

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3 ⇓	4
Range: 1 30 - 1000MHz								
65.9534	25.72 qp	2.25	6.7	34.67	49.54	50	40	40.46
Azimuth: 36	Height:104 Vert			Margin [dB]:	-14.87	-15.33	-5.33	-5.79
65.9632	25.04 qp	2.25	6.7	33.99	49.54	50	40	40.46
Azimuth: 48	Height:100 Vert			Margin [dB]:	-15.55	-16.01	-6.01	-6.47
69.9631	26.42 qp	2.34	6.7	35.46	49.54	50	40	40.46
Azimuth: 79	Height:112 Vert			Margin [dB]:	-14.08	-14.54	-4.54	-5
73.9498	25.17 qp	2.44	6.7	34.31	49.54	50	40	40.46
Azimuth: 352	Height:114 Vert			Margin [dB]:	-15.23	-15.69	-5.69	-6.15
184.5504	19.35 qp	3.89	8.64	31.88	53.98	50	43.52	40.46
Azimuth: 270	Height:101 Vert			Margin [dB]:	-22.1	-18.12	-11.64	-8.58
201.0151	20.66 qp	3.85	8.95	33.46	53.98	50	43.52	40.46
Azimuth: 258	Height:101 Vert			Margin [dB]:	-20.52	-16.54	-10.06	-7
217.9792	22.24 qp	4.11	10.62	36.97	56.9	50	46.02	40.46
Azimuth: 92	Height:240 Vert			Margin [dB]:	-19.93	-13.03	-9.05	-3.49

LIMIT 1: FCC Part 15 Class A 3m
LIMIT 2: ICES-003 Class A 3m
LIMIT 3: FCC Part 15 Class B 3m ⇐
LIMIT 4: ICES-003 Class B 3m

qp - Quasi-Peak detector

4.3b Transmit Mode

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: Trung Nguyen, Jianming Zhang Test Date: 17 November – 1 December 2004	Product: BBX
Test Result, BBX: **PASS**	
The Radiated E-Field emissions produced by EUT, measured at a distance of 3m, shall not exceed these limits within the restricted bands of operation. Any emissions lying outside these bands shall be at least 20 dB down from the level of the fundamental. Attenuation below the limits of 15.209 is not required. ERP for harmonics and spurious must be less than -13 dBm,	Frequency [MHz] / Limit (QP @ 3m) [dBμV/m] .009 – 0.490: 88.5 – 53.8 .490 – 1.7: 53.8 – 43 1.7 – 30: 49.50 30 – 88: 40.00 88 – 216: 43.52 216 – 960: 46.02 above 960: 53.98

Restricted Bands of Operation per Part 15.205:

MHz	MHz	MHz	MHz	MHz	GHz	GHz
0.0900000 – 0.1100000	8.2910000 - 8.2940000	16.804250 - 16.804750	162.01250 - 167.17000 *	1660.0000 – 1710.0000	3.6000000 – 4.4000000	14.470000 – 14.500000
0.4950000 - 0.5050000 *	8.3620000 - 8.3660000	25.500000 - 25.670000	167.72000 - 173.20000 *	1718.8000 – 1722.2000	4.5000000 – 5.1500000	15.350000 – 16.200000
2.1735000 - 2.1905000	8.3762500 - 8.3867500	37.500000 - 38.250000	240.00000 – 285.00000	2200.0000 – 2300.0000	5.3500000 – 5.4600000	17.700000 – 21.400000
4.1250000 - 4.1280000	8.4142500 - 8.4147500	73.000000 - 74.600000	322.00000 - 335.40000	2310.0000 – 2390.0000	7.2500000 – 7.7500000	22.010000 – 23.120000
4.1772500 - 4.1777500	12.290000 - 12.293000	74.800000 - 75.200000	399.90000 – 410.00000	2483.5000 – 2500.0000 *	8.0250000 – 8.5000000	23.600000 – 24.000000
4.2072500 - 4.2077500	12.519750 - 12.520250	108.00000 - 121.94000 **	608.00000 – 614.00000	2655.0000 – 2900.0000	9.0000000 – 9.2000000	31.200000 – 31.800000
5.6770000 - 5.6830000	12.576750 - 12.577250	123.00000 - 138.00000 **	960.00000 – 1240.0000 ***	3260..0000 – 3267.0000	9.3000000 – 9.5000000	36.430000 – 36.500000
6.2150000 - 6.2180000	13.360000 - 13.410000	149.90000 - 150.05000 *	1300.0000 – 1427.0000 ***	3332.0000 – 3339.0000	10.600000 – 12.700000	Above 38.600000
6.2677500 - 6.2682500	16.420000 - 16.423000	156.52475-156.52525	1435.0000 – 1626.5000	3345.8000 – 3358.0000	13.250000 – 13.400000	
6.3117500 - 6.3122500	16.694750 - 16.695250	156.70000 - 156.90000	1645.5000 – 1646.5000	3500.0000 – 3600.0000 ****		

* US only ** Canada 108 – 138 MHz *** Canada 960 – 1427 MHz **** Canada only

Radiated Emissions Data:

Operation in Restricted Bands:

nominal f_c (MHz)	**f** (MHz)	Field Strength (dBμV/m)	Limit (dBμV/m)	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
806	73.7116	34.77	40	-5.33	V	149	144
806	1612.1250	≤ 34	54	≥ 20			
806	4030.3125	≤ 34	54	≥ 20			
806	4836.3750	≤ 34	54	≥ 20			
806	7254.5625	≤ 34	54	≥ 20			
806	8060.6250	≤ 34	54	≥ 20			
813	73.7068	34.75	40	-5.25	V	117	224
813	4067.8125	≤ 34	54	≥ 20			
813	4881.3750	≤ 34	54	≥ 20			
813	7322.0625	≤ 34	54	≥ 20			
813	8135.6250	≤ 34	54	≥ 20			
821	73.9498	34.31	40	-5.69	V	114	352
821	4104.9375	≤ 34	54	≥ 20			
821	4925.9250	≤ 34	54	≥ 20			
821	7388.8875	≤ 34	54	≥ 20			
821	8209.8750	≤ 34	54	≥ 20			

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 806 MHz

Frequency (MHz)	EUT Spectrum Analyzer Reading (dBuV)	Substitute Tx Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Corrected Tx Antenna Power (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)	ERP (Watts)
806.0625	73.70	75.45	17.75	16.00	6.3	22.30	20.15			0.10
806.0625	75.90	75.60	17.75	18.05	6.6	24.65	22.50			0.18
960							≤ 33	-13	≥ 20	
2 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
3 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
4 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
5 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
6 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
7 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
8 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
9 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
10 $\mathbf{f}_c$							≤ 33	-13	≥ 20	

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 813 MHz

Frequency (MHz)	EUT Spectrum Analyzer Reading (dBuV)	Substitute Tx Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Corrected Tx Antenna Power (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)	ERP (Watts)
813.5625	73.90	74.15	16.00	15.75	6.5	22.25	20.10			0.10
813.5625	76.10	76.00	18.15	18.25	6.6	24.85	22.70			0.19
960							≤ 33	-13	≥ 20	
2 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
3 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
4 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
5 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
6 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
7 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
8 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
9 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
10 $\mathbf{f}_c$							≤ 33	-13	≥ 20	

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 821 MHz

Frequency (MHz)	EUT Spectrum Analyzer Reading (dBuV)	Substitute Tx Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Corrected Tx Antenna Power (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)	ERP (Watts)
820.9875	73.40	73.50	15.85	15.75	6.4	22.15	20.0			0.10
820.9875	75.60	75.05	17.50	18.05	6.5	24.55	22.4			0.17
960							≤ 33	-13	≥ 20	
2 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
3 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
4 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
5 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
6 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
7 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
8 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
9 $\mathbf{f}_c$							≤ 33	-13	≥ 20	
10 $\mathbf{f}_c$							≤ 33	-13	≥ 20	

4.4 FREQUENCY STABILITY (§ 2.1055)

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: n/a Test Date: n/a	Product: BBX
Test Result, BBX: **Not Tested**	
The BBX was not tested for frequency stability. The RF section is an OEM module, pre-approved under FCC ID # AZ492FT5826.	

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.

The EUT was grounded in accordance with Mentor Engineering Inc. specifications.

5.3 POWER

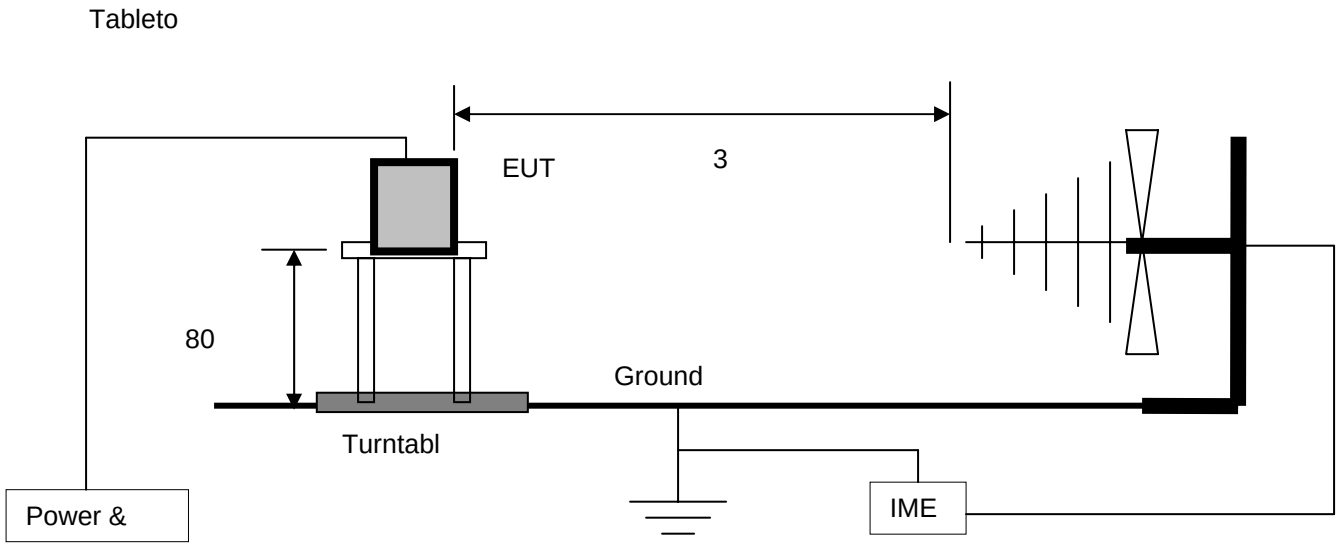
AC power was supplied via an Underwriter's Laboratories ULW100-69, 100 dB, 100 Ampere wall mounted filter. Bonding to ground is implemented at the chamber wall.

5.4 TEST CONFIGURATION

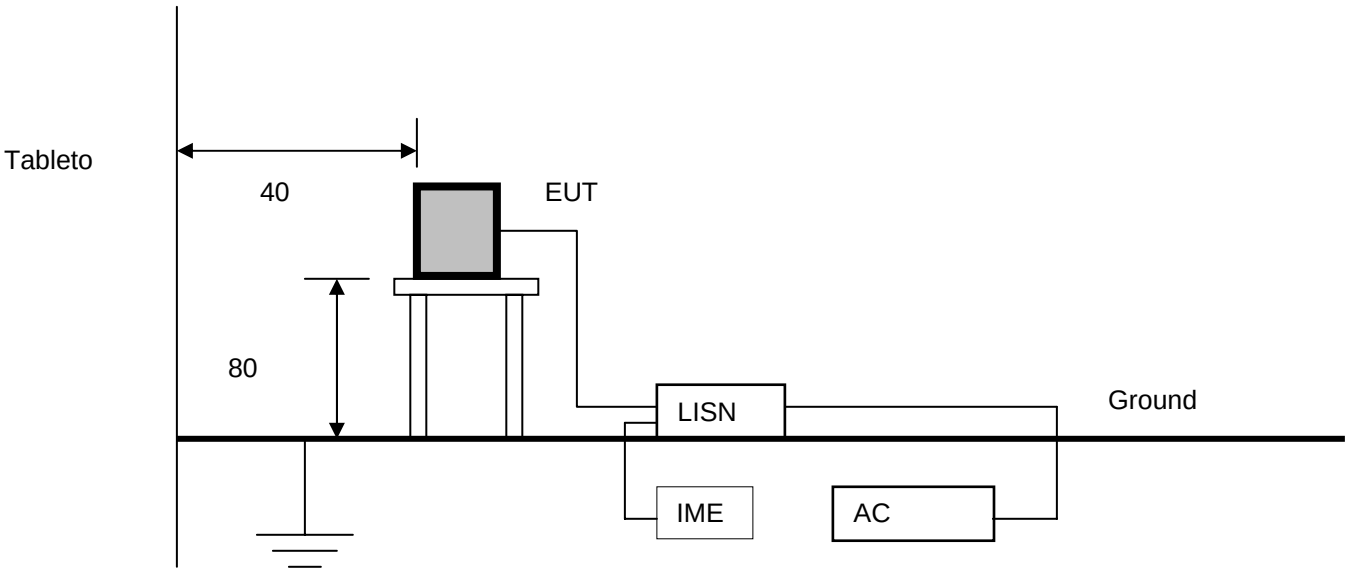
5.4.1 Tabletop Equipment

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

Radiated



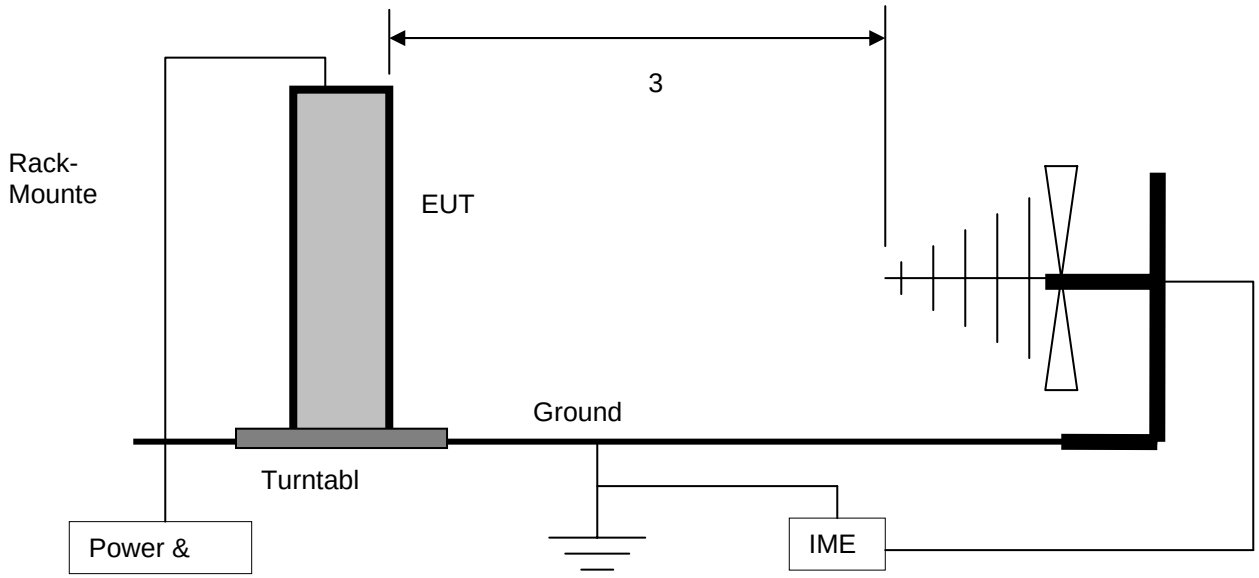
Conducted



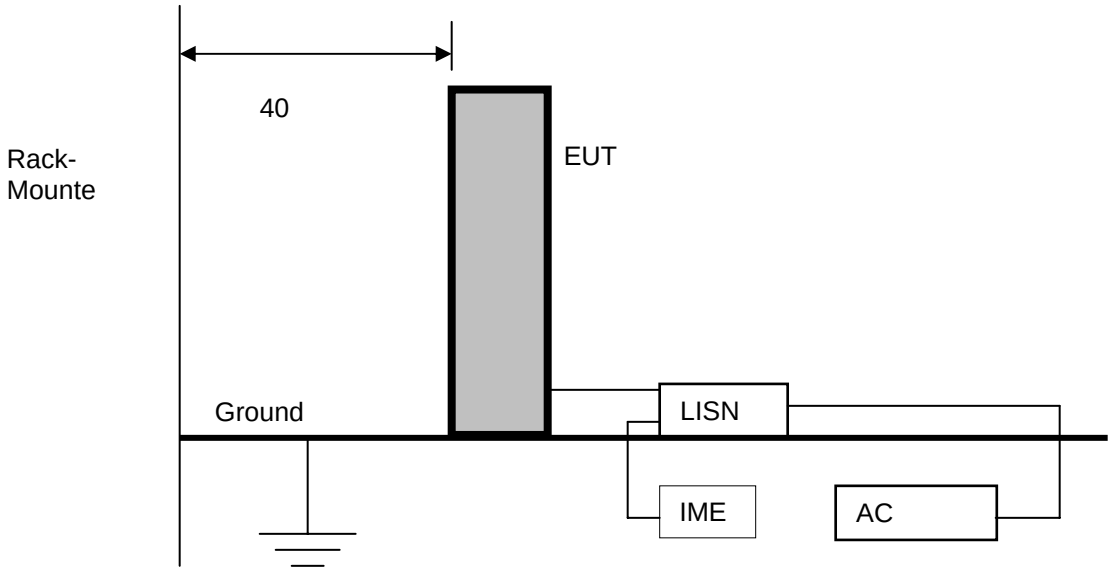
5.4.2 Rack Mount

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

Radiated



Conducted



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) DRG horn antenna (1 – 18 GHz)
f) Antenna mast positioner and controller
g) Flush-mounted turntable and controller
h) Personal Computer and EMC software

6.2 CONDUCTED EMISSIONS

a) Spectrum Analyzer with RF Preselector
b) Line Impedance Stabilization Network, 50 μH
c) CISPR Quasi-peak Adapter
d) Power Isolation Transformers
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 = ± 1 kHz
Amplitude (RE) = ± 4.01 dB
Amplitude (CE) = ± 3.25 dB

6.3.2 TEST EQUIPMENT DESCRIPTION

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

Instrument	Manufacturer	Model No.	Asset No.	Calibration Due
Spectrum Analyzer & Display	Hewlett Packard	8566B & 85662	9565	20 April 2005
Spectrum Analyzer & Display	Hewlett Packard	8566B & 85662	9168	17 August 2005
RF Preselector	Hewlett Packard	85685A	9728	19 August 2005
Quasi-Peak Adapter	Hewlett Packard	85650A	4411	20 August 2005
Measurement System Software	Underwriters Laboratories	Version 6.0	4443	n/a
Line Impedance Stabilization Network	EMCO	3825/2r	9331	2 November 2005
Line Impedance Stabilization Network	EMCO	3825/2r	9259	2 November 2005
Biconilog Antenna	ARA	Lpb-2520/A	4318	2 August 2005
Dual Ridged Guide Antenna	EMCO	3115	9588	2 August 2005
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	3 November 2005

Appendix A

BBX

Test Sample Description
(from data provided by Mentor Engineering Inc.)

CLIENT SAMPLE DESCRIPTION

Company Name :	Mentor Engineering Inc.	Contact Name :	Stephen Hickle
Address :	Suite 230, 2891 Sunridge Way NE	Phone :	(403) 777-3760
	Calgary, Alberta T1Y7K7	Fax :	(403) 777-3769
		E-mail :	shickle@mentoreng.com
Product Name: BBX		# of units to be tested : One	

Product Application	**Designated Marketplaces**			
Commercial ■	Canada	■	Other	☐
Military ☐	United States of America	■	_____	☐
	European Union	☐	_____	☐

GENERAL INFORMATION REQUIRED FOR ALL PRODUCTS

Dimensions (L x W x H) **6”x5.5”x2”**	Weight: __0.5 lbs			
Power Requirements: **AC** ☐	Voltage: _____VAC	# of AC phases: ___	current: ____ Amps	frequency: ____ Hz
DC ■	Voltage: __12_VDC		current: _>5 Amps	
Product Intended Application	Mobile Dispatching Applications			
Product Deployment Environments	Automotive with antenna mounted on the roof of the vehicle			

Type of Radio Device (check all applicable Equipment Configurations)

Intentional transmitter ■	Receiver ☐	Transceiver ☐

Type of Radio Operating License

Unlicensed Personal Communication ☐	Unlicensed National Information Infrastructure ☐	Ultra-Wideband Operation ☐	Licensed ■

Type of Modulation of Radio Device : Quad-64 QAM, Quad-16 QAM and QPSK;

CDMA ☐	TDMA ☐	Other ■
Spread Spectrum Technology ☐	Direct sequencer ☐	Frequency hopper ☐
Transmitter Power Output **: Average 0.6W (1.5W ERP)**	Emission Designator **: 18K3D7W**	

Information on Radio Frequencies

Transmitter Operating Frequency(s) & Bandwidth	**806.0 – 821.0 MHZ This device also operates at 821 - 825 MHz which are not operational in U.S. territories.**
Transmitter Channel Frequencies & separations (If required, attach a separate sheet)	
Receiver Operating Frequency(s) & Bandwidth	**851-866 MHz**
Receiver Channel Frequencies & separations (If required, attach a separate sheet)	

Information on Antenna(s)

Is the antenna removable? **YES** ■ **NO** ☐	Antenna Connector Type **: SMA**	Number of Antennas **: One**
Gain of Each Antenna (and tolerance)	**Maximum of 4.9dBi**	

Radio Transmission Type

Continuous ☐	Intermittent ■	ON Time/ OFF Time **:**

Pre-Approved Radio Systems & Sub-Assemblies

FCC ID: **92FT5826**	Grantee Code: **AZ4**	Approval Agency /TCB: **PCTEST Engineering Laboratory, Inc.**
Hardware additions to the Pre-Approved Equipment?	Integration into Mentor product	
Prepared By: Stephen Hickle	Title: Director	Date: Oct 22, 2004

Appendix B

Multiconnect

FCC Part 15, Subpart B Test Report

Test Report Prepared By:

Electronics Test Centre
27 East Lake Hill
Airdrie, Alberta
Canada
T4A 2K3

airdrie@etc-mpbtech.com
http://www.etc-mpb.com/
Telephone: (403) 912-0037
Facsimile: (403) 912-0083

MPBT Report No.: m06e3230 Release 1 Date: 10 January 2005

Emissions Testing of the Multiconnect

In accordance with FCC Part 15, Subpart B (2004).

Test Personnel: Jianming Zhang

Prepared for: Mentor Engineering Inc.

2891 Sunridge Way N.E.
Suite 230
Calgary, Alberta
Canada
T1Y 7K7

Telephone: 1-403-777-3760
Facsimile: 1-403-777-3769

David Raynes
draynes@etc-mpbtech.com
Laboratory Supervisor
Electronics Test Centre (Airdrie)
Authorized Signatory

TABLE OF CONTENTS

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 (2004).

1.2 APPLICANT

This test report has been prepared for Mentor Engineering Inc., located in Calgary, Alberta, Canada.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to Mentor Engineering Inc. Multiconnect 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 Multiconnect:

Product Type:	mobile dispatch
Model Number:	Multiconnect
Serial Number:	n/a
Power Requirements:	12 VDC
Peripheral Equipment:	roof-mount antenna

More detailed information is provided by Mentor Engineering 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 (2004).

1.6.1 VARIATIONS IN TEST METHODS

There were no variations from the test procedures outlined above.

1.6.2 MARGINAL EMISSIONS MEASUREMENTS

There were no emissions measured to be closer to the specified limits than -6 dB.

1.6.3 TEST SAMPLE CONFIGURATION & MODIFICATIONS

The EUT met the requirements without modifications.

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 reported as **PASS** or **FAIL**. Test conditions that are not applicable to the EUT are marked **n/a**. If testing was not performed at this time, the appropriate field is marked **n/t**.

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.

TEST CASE	TEST TYPE	SPECIFICATION	CLASS/ LEVEL	TEST SAMPLE	MOD. STATE	CONFIGURATION	RESULT
§4.1	Conducted Emissions	FCC Part 15 Subpart B	B	Multiconnect	nil	See § 1.6.3	**N/A**
§4.2	Radiated Emissions	FCC Part 15 Subpart B	B	Multiconnect	nil	See § 1.6.3	**PASS**

STATEMENT OF COMPLIANCE

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

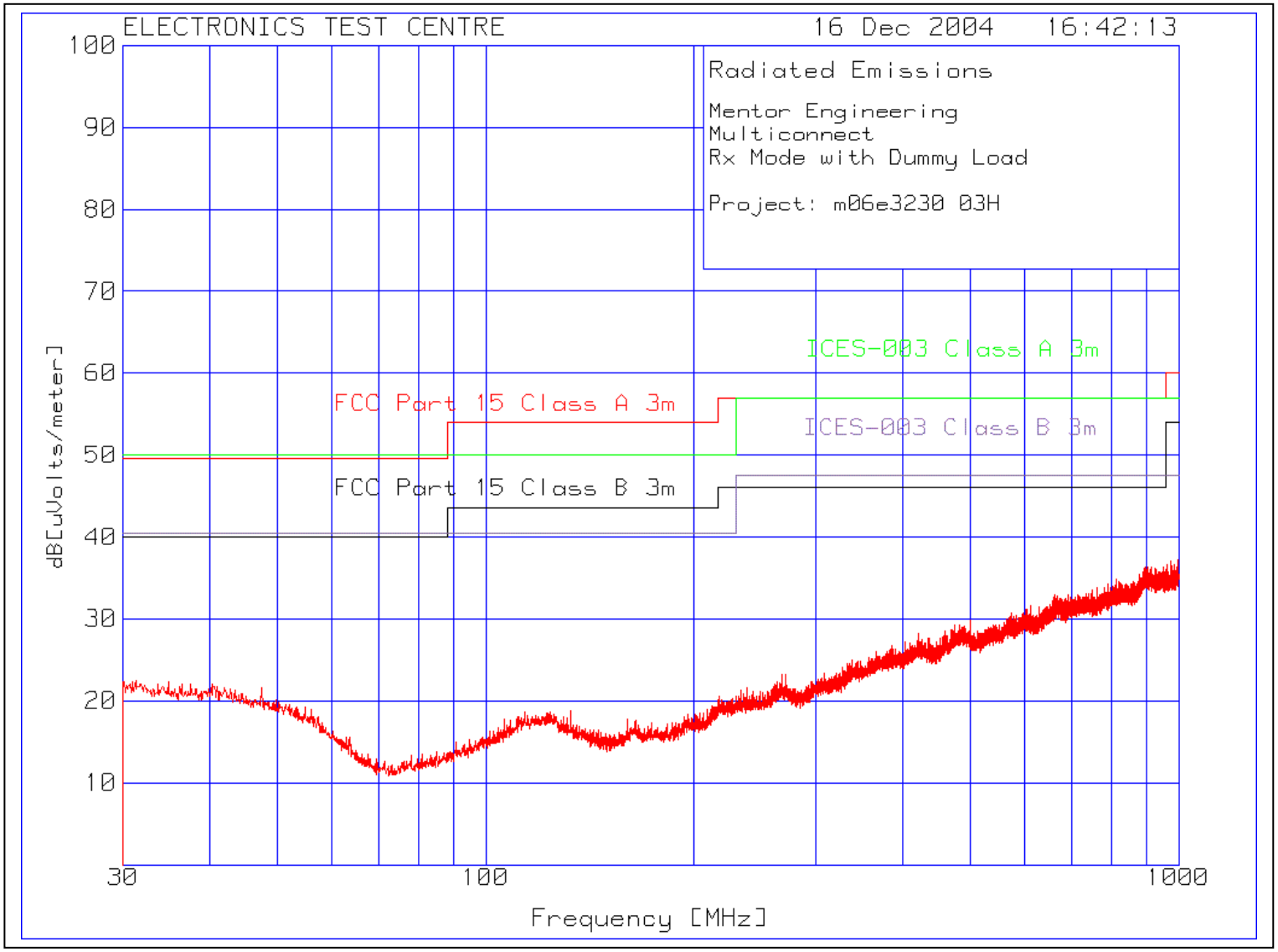
4.1 CONDUCTED EMISSIONS

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: Jianming Zhang Test Date: N/A	Product: Multiconnect
Test Result, Multiconnect: **Not Applicable**	
The Multiconnect was not tested for Conducted Emissions. This is a DC powered device. The power source is provided by the end user, not Mentor Engineering Inc. There is no direct connection to the AC mains.	

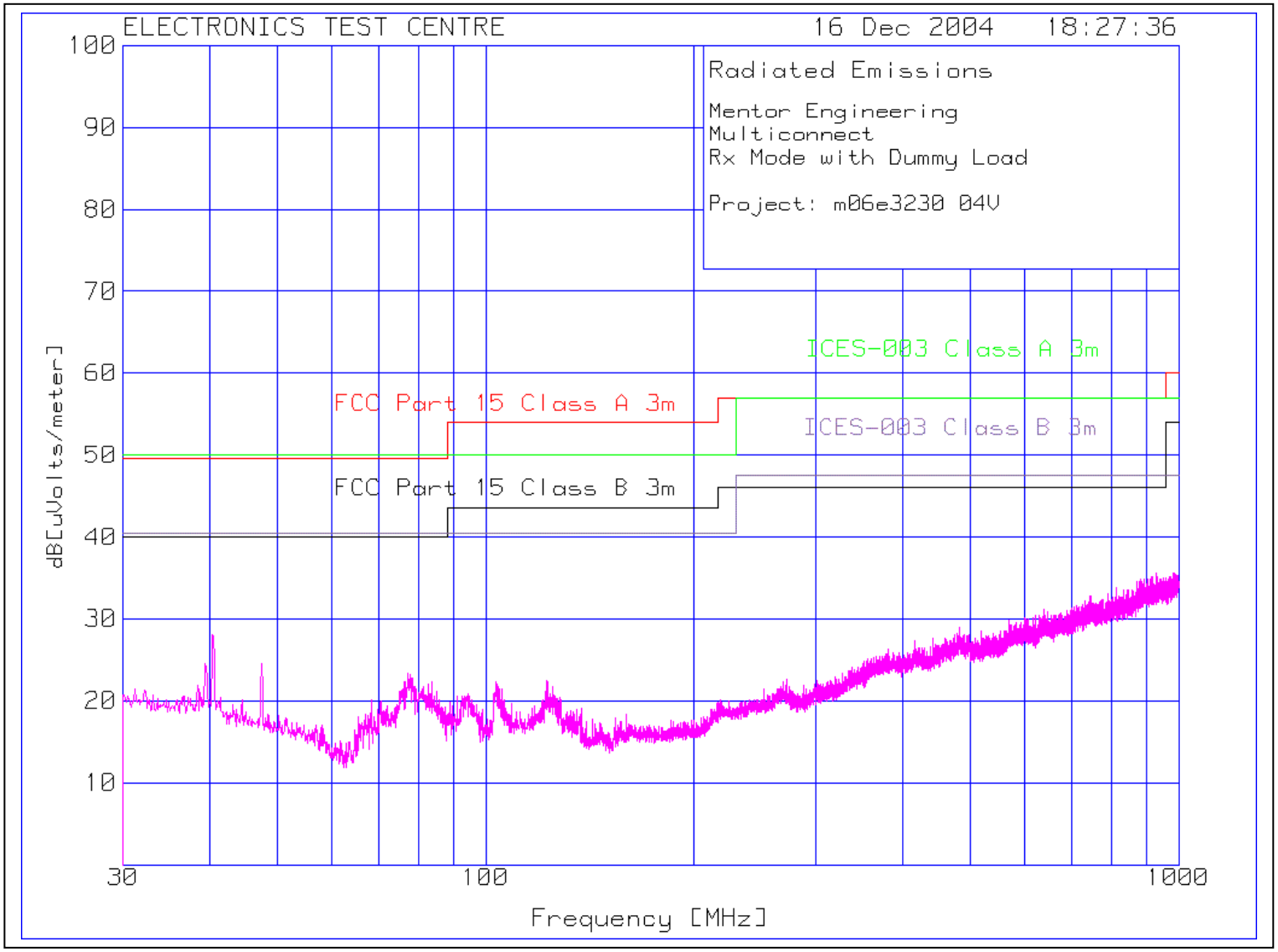
4.2 RADIATED EMISSIONS

Test Lab: MPB Technologies Inc. Airdrie Test Personnel: Jianming Zhang Test Date: December 16, 2004	Product: Multiconnect
Test Result, Multiconnect: **PASS**	
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. **Emission levels should meet the requirements with a margin of 6dB.** The EUT was assessed against the requirements of **Class B**. Temperature = 20 °C Humidity = 30 %	Specification: FCC Part 15 Subpart B Frequency [MHz] / Class A QP @ 3m / Class B QP @ 3m 30 – 88 / 49.54 / 40.00 88 – 216 / 53.98 / 43.52 216 – 960 / 56.90 / 46.02 above 960 / 60.00 / 53.98
There were no emissions measured within -10 dB of the specified limit. Refer to the test data and plots for more detail.	

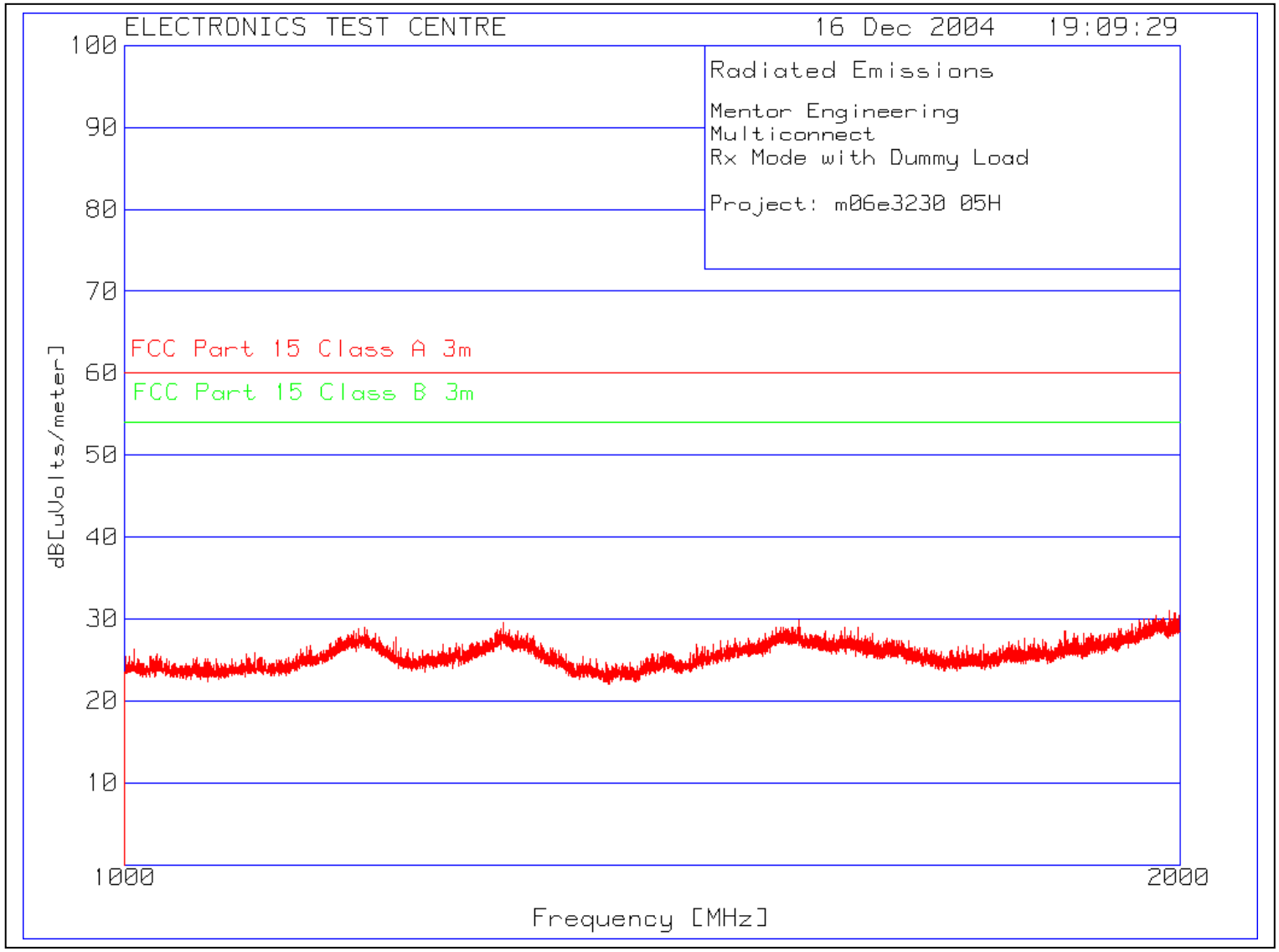
Plot of Radiated Emissions:



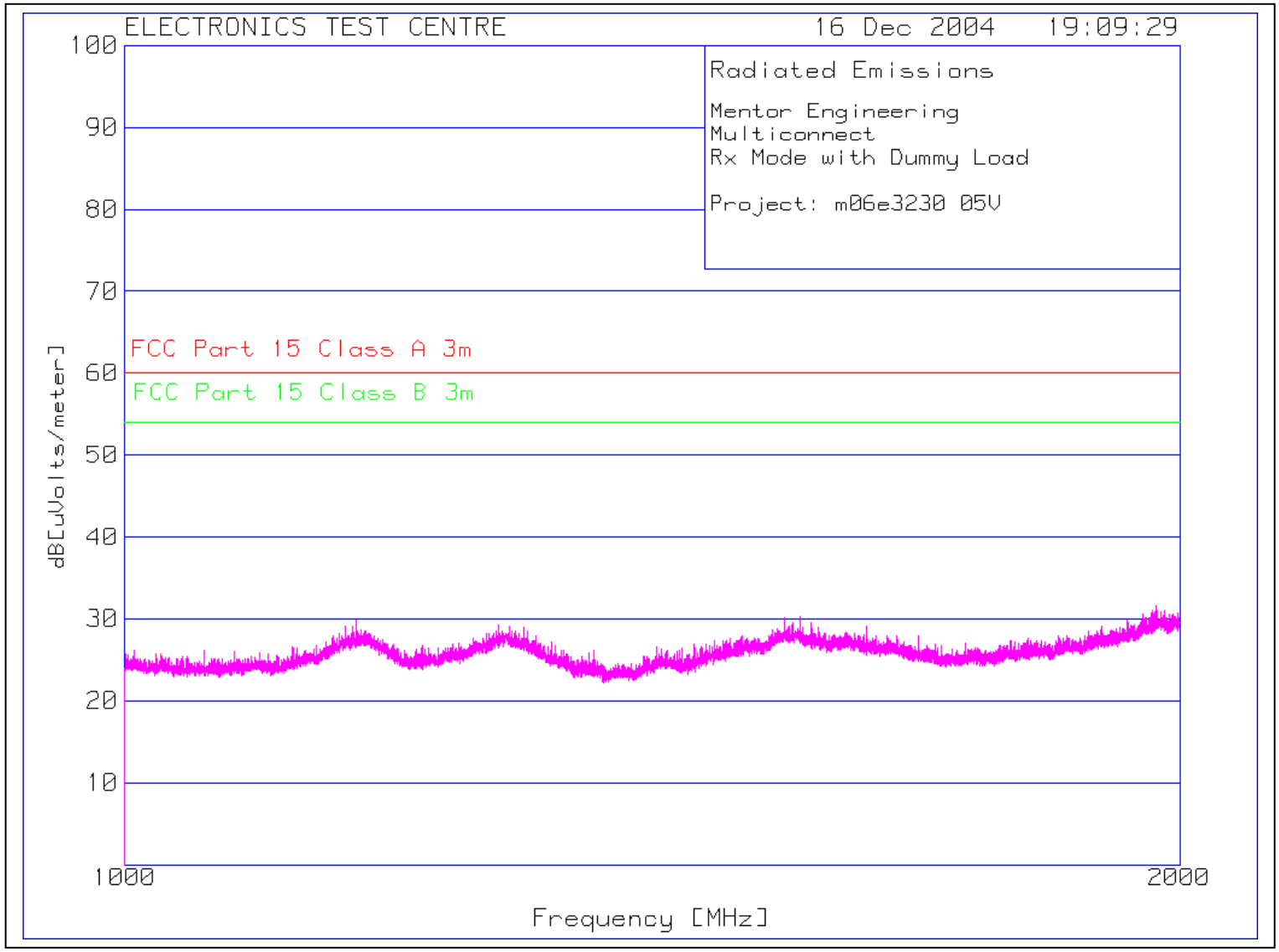
Plot of Radiated Emissions:



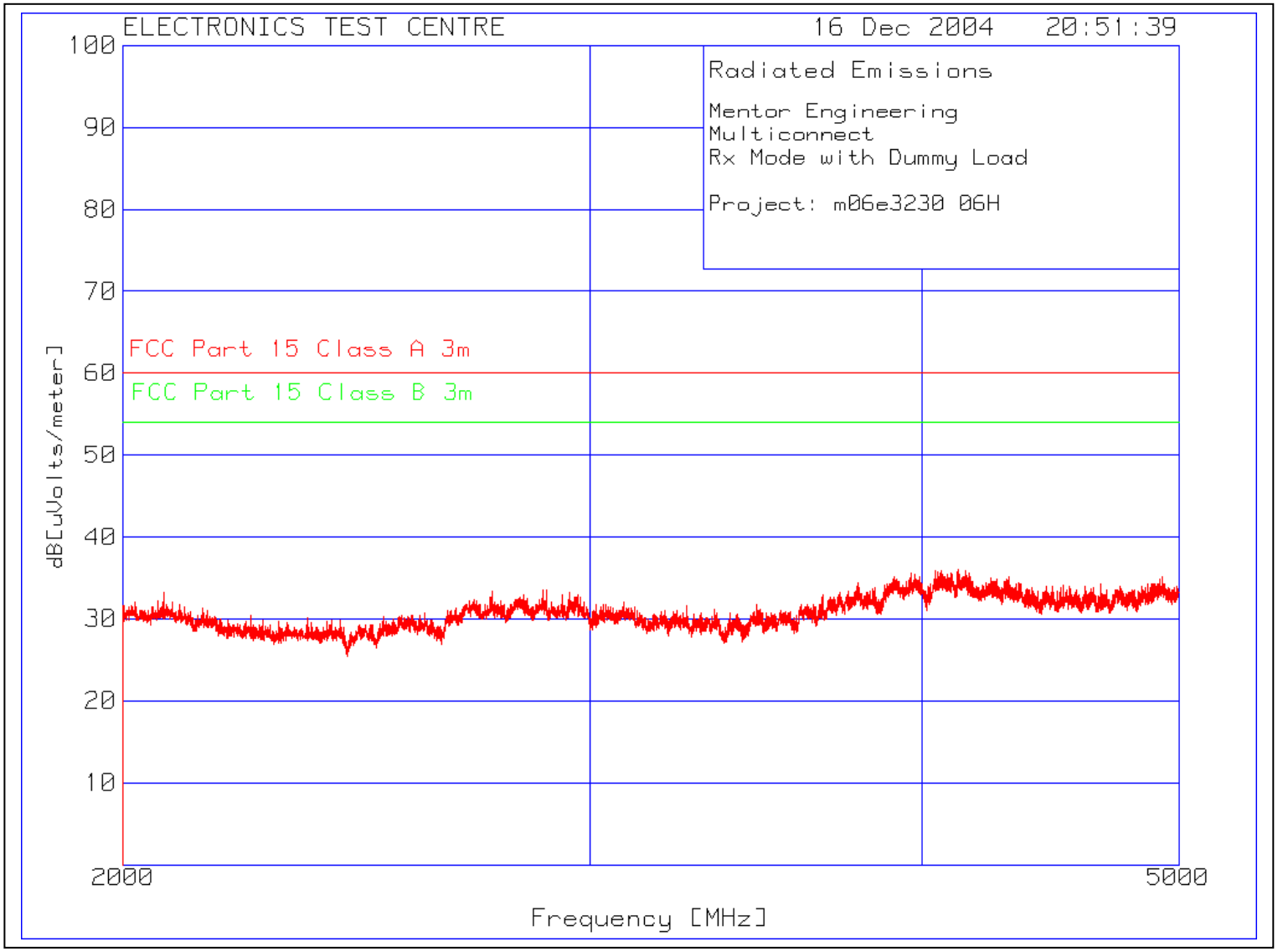
Plot of Radiated Emissions:



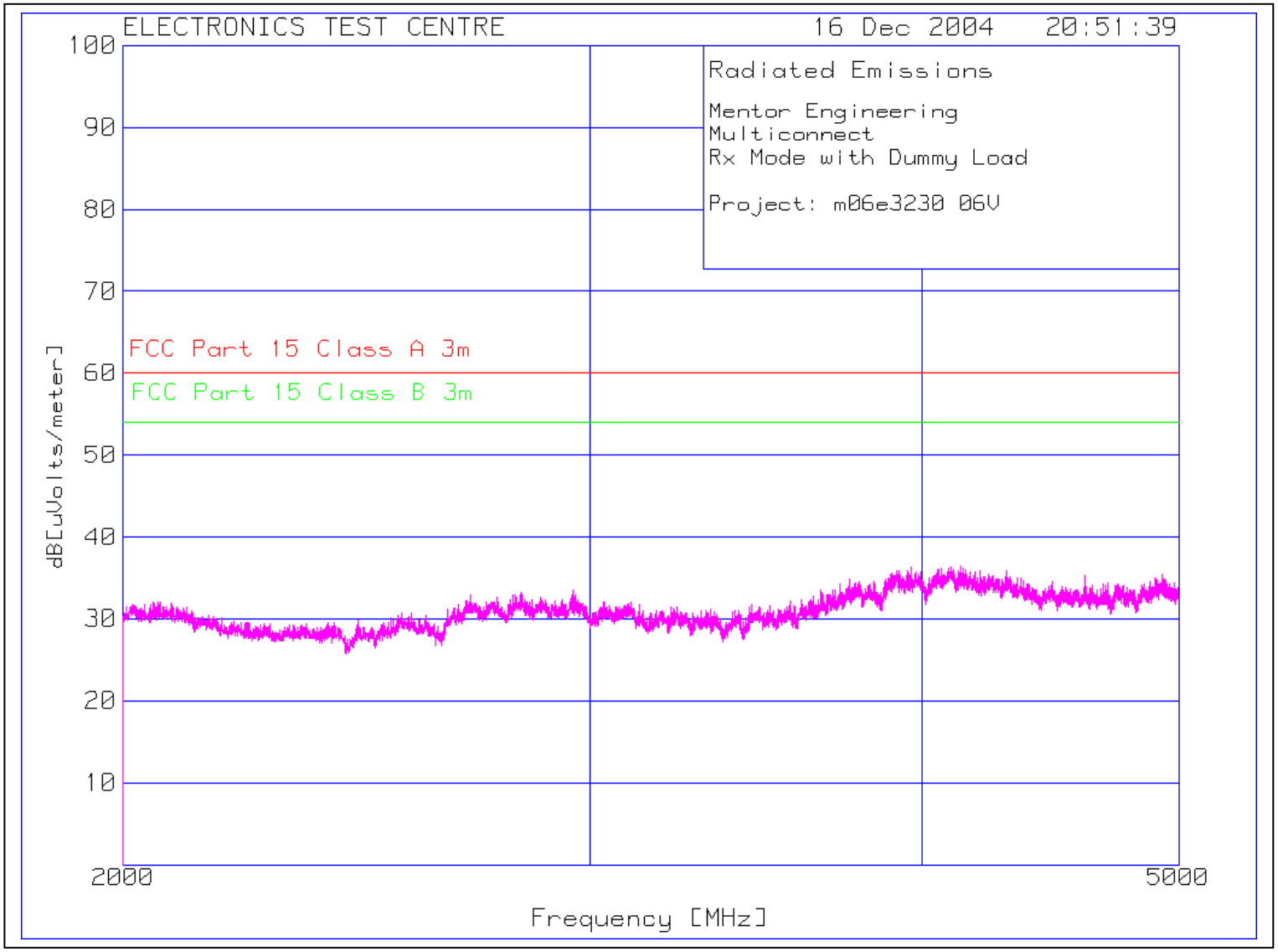
Plot of Radiated Emissions:



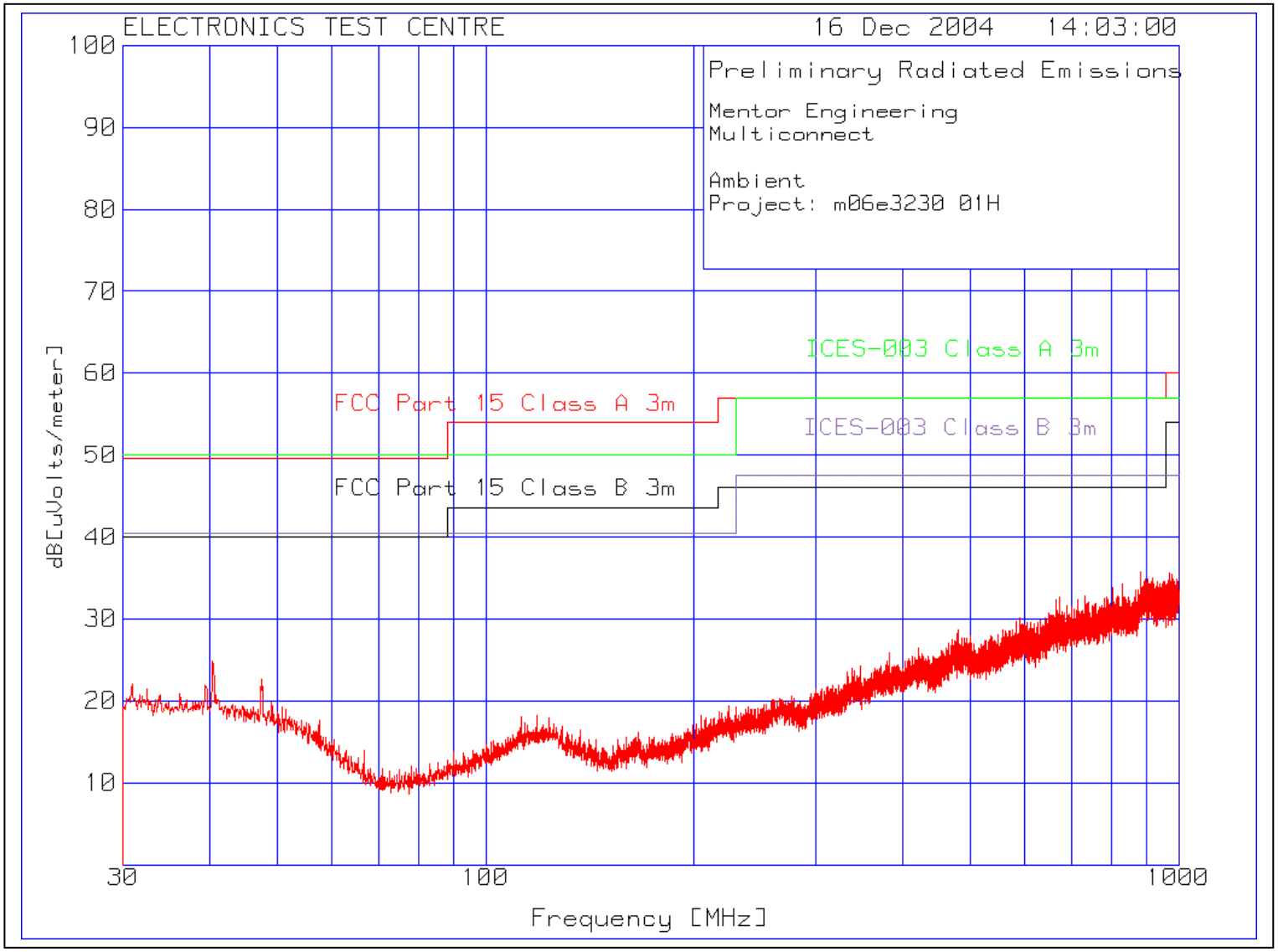
Plot of Radiated Emissions:



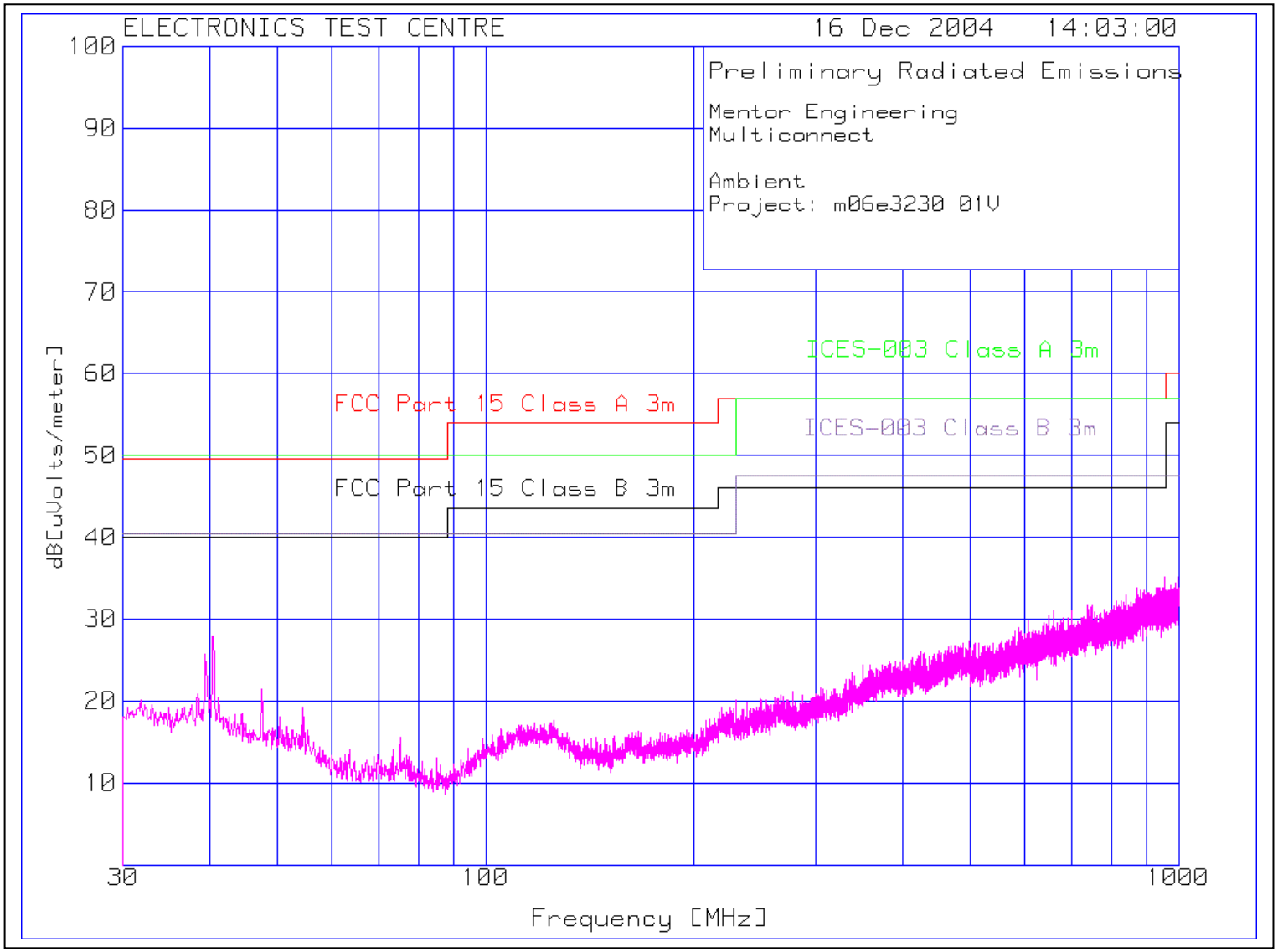
Plot of Radiated Emissions:



Plot of Radiated Emissions Test Chamber Ambient (measurement noise floor)



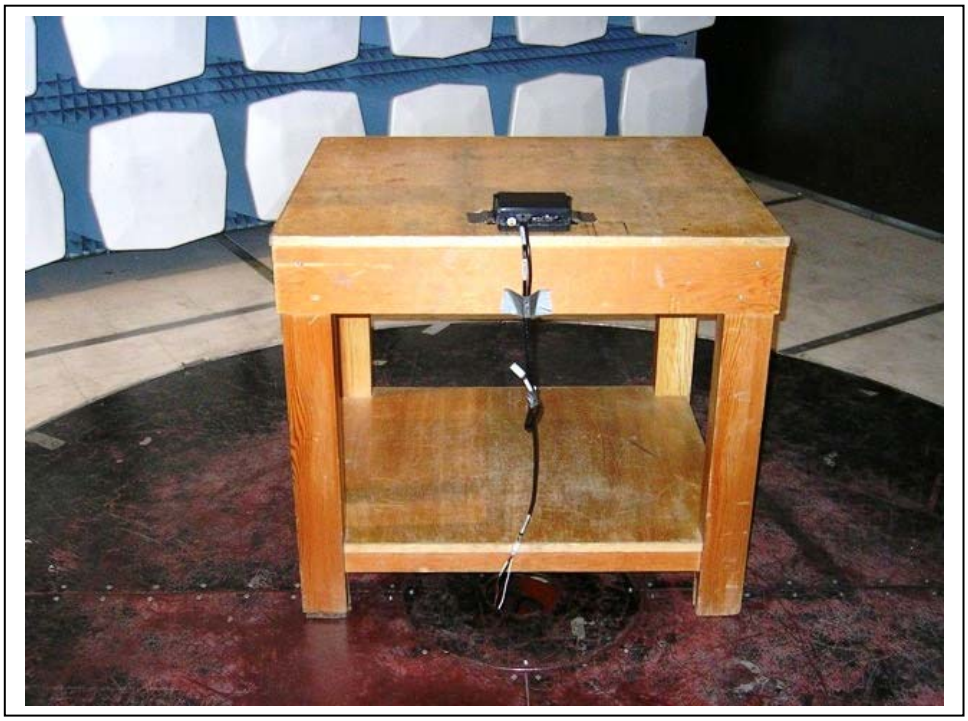
Plot of Radiated Emissions Test Chamber Ambient (measurement noise floor)



Picture of Radiated Emissions test setup:

Picture of Radiated Emissions test setup:

Picture of Radiated Emissions test setup:



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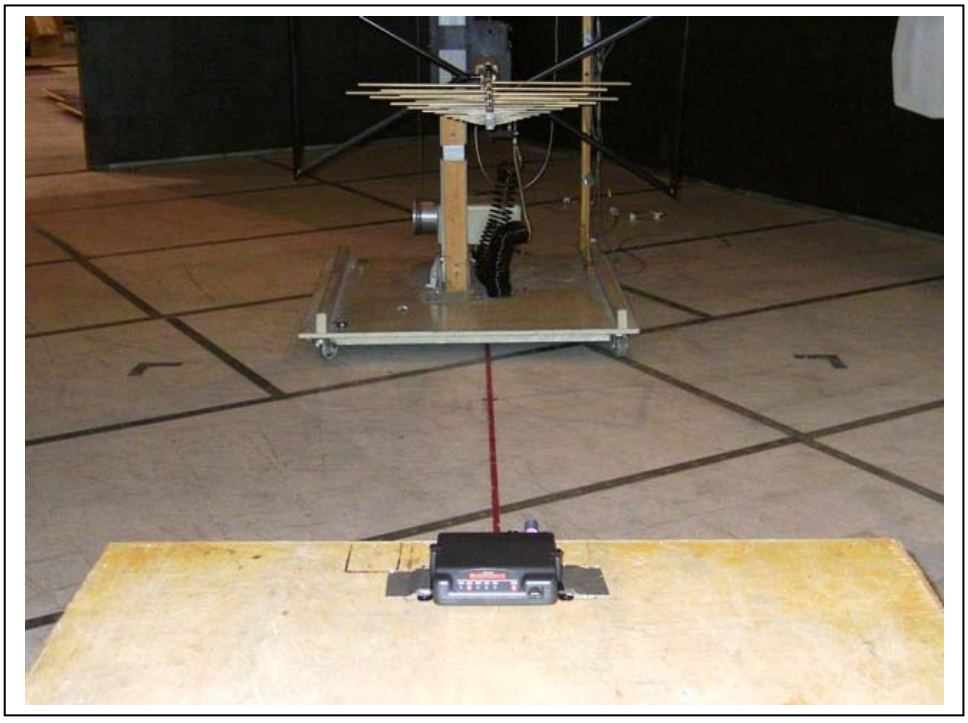


5.0 TEST FACILITY

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

The EUT was grounded in accordance with Mentor Engineering Inc. specifications.

5.3 POWER

AC power was supplied via an Underwriter's Laboratories ULW100-69, 100 dB, 100 Ampere wall mounted filter. Bonding to ground is implemented at the chamber wall.

5.4 EMISSIONS PROFILE

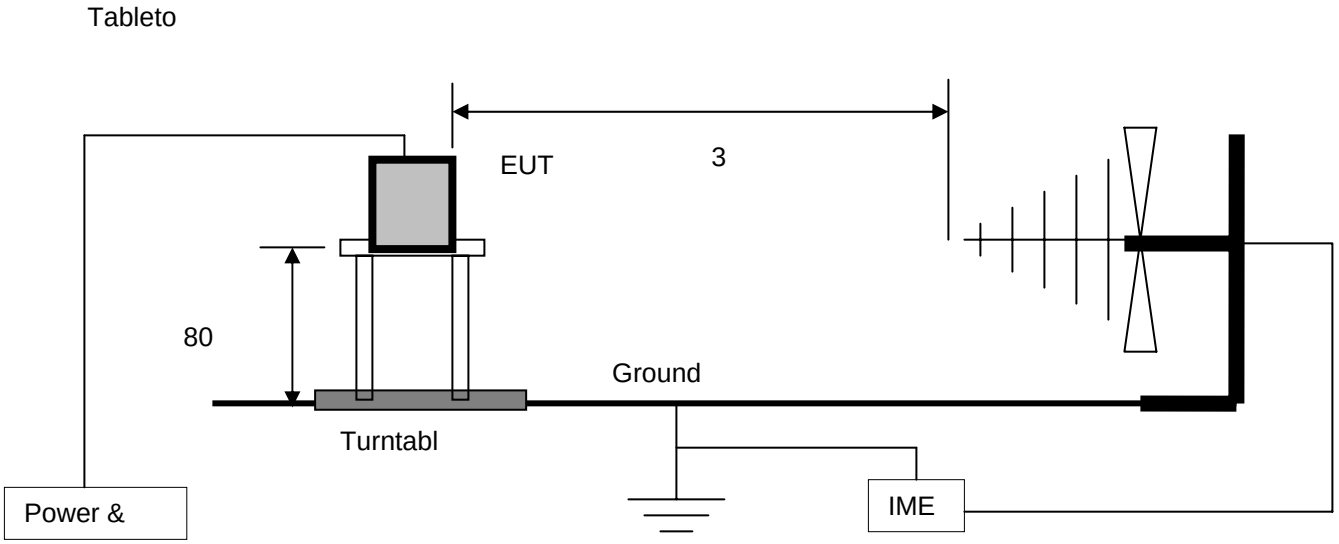
Ambient conducted and radiated electromagnetic emission profiles were generated throughout the tests and are included in the test data.

5.5 TEST CONFIGURATION

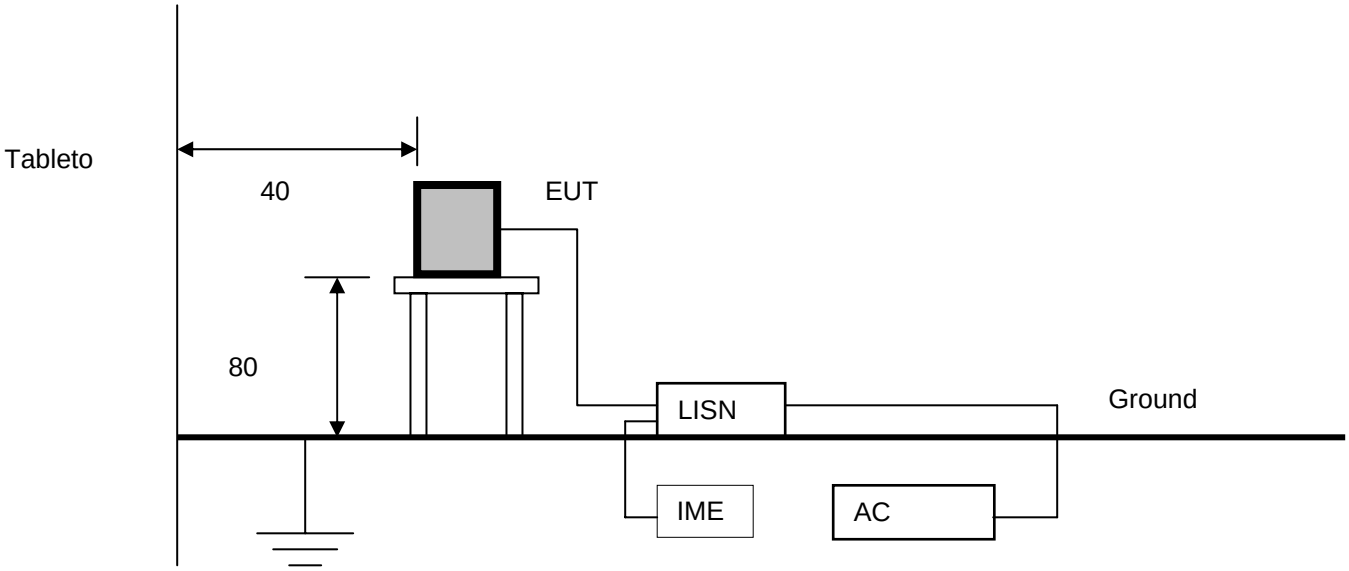
5.5.1 Tabletop Equipment

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

Radiated



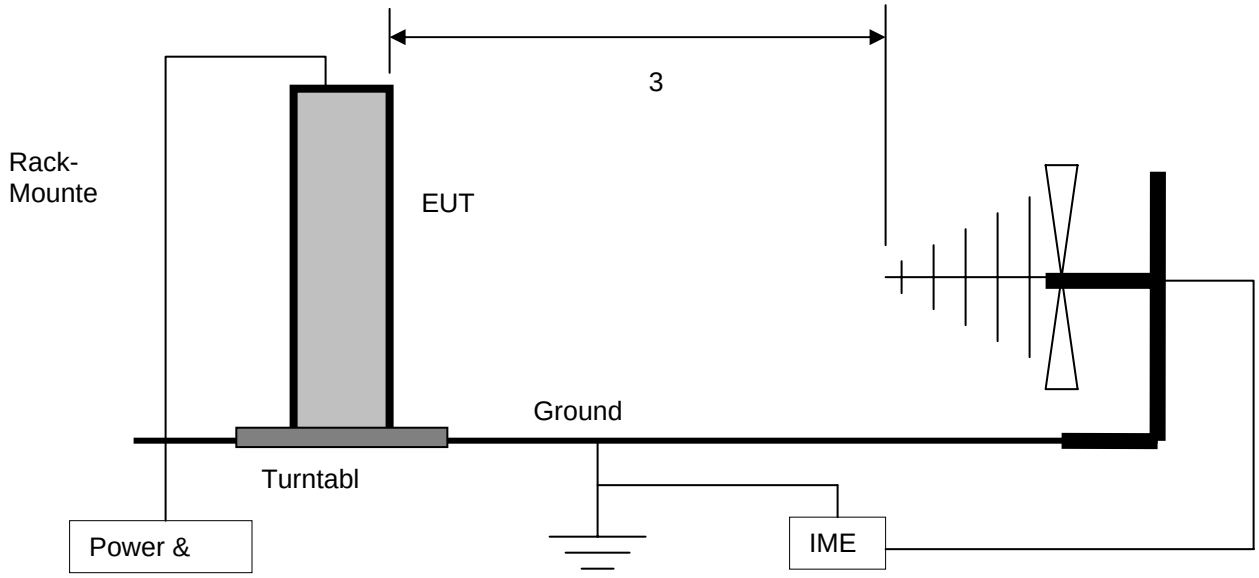
Conducted



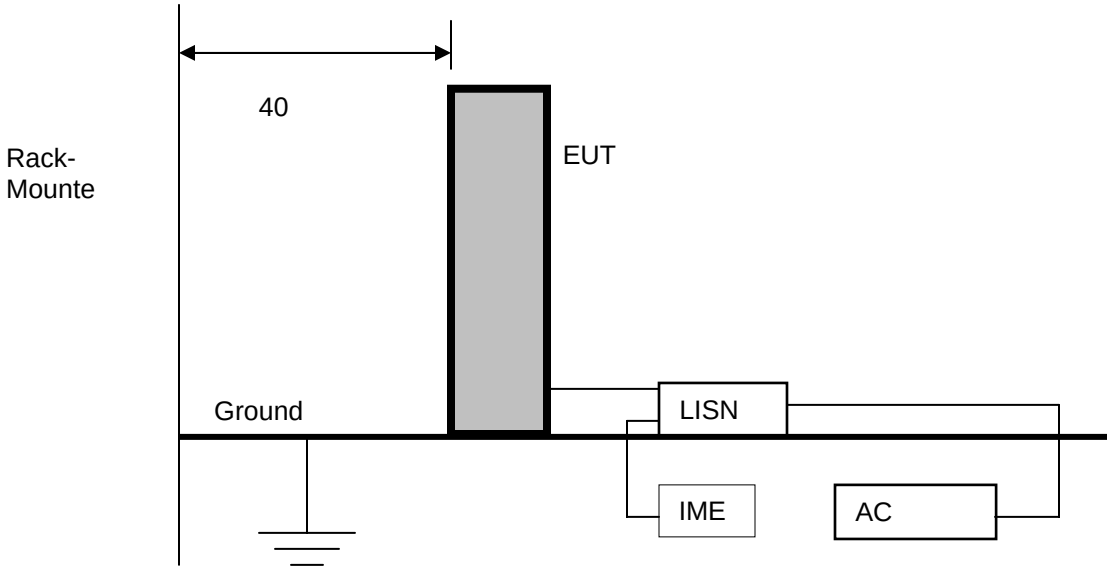
5.5.2 Rack Mount

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

Radiated



Conducted



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

6.3.2 TEST EQUIPMENT DESCRIPTION

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

Instrument	Manufacturer	Model No.	Asset No.	Calibration Due
Spectrum Analyzer & Display	Hewlett Packard	8566B & 85662	9565	20 April 2005
Spectrum Analyzer & Display	Hewlett Packard	8566B & 85662	9168	19 August 2005
RF Preselector	Hewlett Packard	85685A	9728	19 August 2005
Quasi-Peak Adapter	Hewlett Packard	85650A	4411	20 August 2005
Measurement System Software	Underwriters Laboratories	Version 6.0	4443	n/a
Line Impedance Stabilization Network	EMCO	3825/2r	9331	2 November 2005
Line Impedance Stabilization Network	EMCO	3825/2r	9259	2 November 2005
Biconilog Antenna	ARA	Lpb-2520/A	4318	2 August 2005
Dual Ridged Guide Antenna	EMCO	3115	9588	2 August 2005
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	5 January 2006

Appendix A

Multiconnect

Test Sample Description
(from data provided by Mentor Engineering Inc.)

Quotation Number:	m06q130a	Project Number::	m06e3212
Company Name :	Mentor Engineering Inc.	Contact Name :	Stephen Hickle
Address :	Suite 230, 2891 Sunridge Way NE	Phone :	(403) 777-3760
	Calgary, Alberta T1Y7K7	Fax :	(403) 777-3769
		E-mail :	shickle@mentoreng.com
Product Name: Multiconnect		# of units to be tested : One	

Product Application	**Designated Marketplaces**			
Commercial ■	Canada ■		Other ☐	
Military ☐	United States of America ■		_____	☐
	European Union ☐		_____	☐

GENERAL INFORMATION REQUIRED FOR ALL PRODUCTS

Dimensions (L x W x H) **6”x5.5”x2”**	Weight: __0.5 lbs	Engineering Evaluation? No		**YES** ☐ **NO (compliance test only)** ■
Power Requirements: **AC** ☐	Voltage: _____VAC	# of AC phases: ___	current: ____ Amps	frequency: ____ Hz
DC ■	Voltage: __12_VDC		current: _>5 Amps	
Product Intended Application	Mobile Dispatching Applications			
Product Deployment Environments	Automotive with antenna mounted on the roof of the vehicle			

CLIENT SAMPLE DESCRIPTION
WIRELESS PRODUCT INFORMATION

Type of Radio Device (check all applicable Equipment Configurations)

Intentional transmitter ■	Receiver ☐	Transceiver ☐

Type of Radio Operating License

Unlicensed Personal Communication ☐	Unlicensed National Information Infrastructure ☐	Ultra-Wideband Operation ☐	Licensed ■

Type of Modulation of Radio Device : Quad-64 QAM, Quad-16 QAM and QPSK;

CDMA ☐	TDMA ☐	Other ■
Spread Spectrum Technology ☐	Direct sequencer ☐	Frequency hopper ☐

Transmitter Power Output **: Average 0.6W (1.5W ERP)**	Emission Designator **: 18K3D7W**

Information on Radio Frequencies

Transmitter Operating Frequency(s) & Bandwidth	**806.0 – 821.0 MHZ This device can also function at 821 - 825 MHz which are not operational (disabled) in U.S. territories.**
Receiver Operating Frequency(s) & Bandwidth	**851-866 MHz**

Information on Antenna(s)

Is the antenna removable? **YES** ■ **NO** □	Antenna Connector Type **: SMA**	Number of Antennas **: One**
Gain of Each Antenna (and tolerance)	**Maximum of 4.9dBi**	

Radio Transmission Type

Continuous □	Intermittent ■	ON Time/ OFF Time **:**
Activity and State of Digital Circuitry during OFF Time		

Pre-Approved Radio Systems & Sub-Assemblies

FCC ID: **92FT5826**	Grantee Code: **AZ4**	Approval Agency /TCB: **PCTEST Engineering Laboratory, Inc.**
Software changes to the Pre-Approved Equipment?	None	
Software additions to the Pre-Approved Equipment	None	
Hardware changes to the Pre-Approved Equipment?	None	
Hardware additions to the Pre-Approved Equipment?	Integration into Mentor product	

Prepared By: Stephen Hickle	Title: Director	Date: Oct 22, 2004