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MPBT Report No.: m01e2708 Rev: 2 Date: 16 Jauary 2003

Report for Emissions Testing of the Waverider EUM3003 wireless modem

In accordance with FCC Part 15, Subpart C (2000).

Test Personnel: David Raynes, James MacKay

Prepared for: Waverider Communications Inc.
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Client Acceptance
Authorized Signatory

David Raynes, James MacKay
Laboratory Supervisor
Electronics Test Centre (Airdrie)
Authorized Signatory

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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 15, Subpart C, Intentional Radiators.

1.2 APPLICANT

This test report has been prepared for Waverider Communications Inc., located in Toronto, Ontario, Canada.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the Waverider Communications Inc. EUM3003 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 A2LA, or the Canadian or US governments.

1.4 TEST SAMPLE DESCRIPTION

The test sample provided for testing was a EUM3003:

Product Type:	wireless modem
Model Number:	EUM3003
Serial Number:	n/a
Cables:	ethernet, power, RF to antenna
Power Requirements:	120 VAC 60 Hz to AC-DC power adaptor
Peripheral Equipment:	Personal Computer

More detailed information is provided by Waverider Communications 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.

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1.6 SCOPE OF TESTING

Testing was performed in accordance with FCC Part 15 Subpart C (2000), and ANSI C63.4 (1992).

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

The EUT, EUM3003, underwent the following equipment modifications during test performance:

A Ferrico™ p/n NF-65 clamp-on ferrite bead was installed on the LAN cable next to the connector.

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

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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.

TEST CASE	TEST TYPE	SPECIFICATION	TEST SAMPLE	MOD. STATE	CONFIGURATION	RESULT
§4.1	Conducted Emissions	FCC Part 15.207 and 15.247	EUM3003	See § 1.6.3	Simulated Installation	**PASS**
§4.2	Radiated Emissions including Restricted Bands of Operation	FCC Part 15.209 and 15.205	EUM3003	See § 1.6.3	Simulated Installation	**PASS**

STATEMENT OF COMPLIANCE

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

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4.1 CONDUCTED EMISSIONS ON AC POWER LINES

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: James MacKay Test Date: 8 January 2003	Product: EUM3003
Test Result, EUM3003: **PASS**	
Objectives/Criteria The Conducted emissions produced by a system or sub-system shall not exceed the limits for the specifications as stated. Temperature = 19 °C Humidity = 27%	Specifications: FCC Part 15.107 & 15.207 250 µV (48 dBµV) **Emission levels should meet the requirements with a margin of 6dB**.

Line 1 Rx mode:			Line 2 Rx mode:		
Frequency [MHz]	RF Voltage [dBµV]	Delta [dB from limit]	Frequency [MHz]	RF Voltage [dBµV]	Delta [dB from limit]
0.50532	46.51	-1.49	0.50479	45.53	-2.47
0.50433	46.37	-1.63	0.50784	45.09	-2.91
0.46168	40.34	-7.66	0.46119	37.98	-10.02
There were no more emissions measured within -10 dB of the specified limit. Refer to the test data and plots for more detail.					

Line 1 Tx mode:			Line 2 Tx mode:		
Frequency [MHz]	RF Voltage [dBµV]	Delta [dB from limit]	Frequency [MHz]	RF Voltage [dBµV]	Delta [dB from limit]
0.50761	44.62	-3.38	0.50352	44.91	-3.31
0.50472	33.75	-3.45	0.50632	44.73	-3.27
0.50254	44.02	-3.98	0.50347	44.69	-3.31
0.46103	38.06	-9.94	0.45976	39.40	-8.60
There were no more emissions measured within -10 dB of the specified limit. Refer to the test data and plots for more detail.					

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Conducted Emissions Data:

The emissions data is presented in tabular form, showing the uncorrected spectrum analyzer reading, the type of detector, 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     Meter   Gain/Loss Transducer Level Limit:1     2     3     4
Frequency Reading  Factor    Factor    [dB(uVolts)]
  [MHz]   [dB(uV)]  [dB]      [dB]
==========================================================================
L1
.3052      35.6 pk   10        1.1       46.7   66       79      50.1   60.1
                             Margin [dB]  -19.3    -32.3  -3.4    -13.4
```

L1		This reading was taken on Line 1
Test Frequency [MHz}	.3052	Test Frequency f = 0.3052 MHz (305.2 kHz)
Meter Reading [dB (uV)]	35.6 pk	The reading with Peak detector
Gain/Loss Factor [dB]	10	Net correction for preamp gain & cable loss
Transducer Factor [dB]	1.1	Correction for LISN loss
Level [dB (uVolts)]	46.7	Corrected value for voltage measurement
Limit: 1	66	The value of Limit 1 at 0.3052 MHz
Margin [dB]	-19.3	The measured voltage is 19.3 dB below Limit 1
Limit: 2	79	The value of Limit 2 at 0.3052 MHz
Margin [dB]	-32.3	The measured voltage is 32.3 dB below Limit 2
Limit: 3	50.1	The value of Limit 3 at 0.3052 MHz
Margin [dB]	- 3.4	The measured voltage is 3.4 dB below Limit 3
Limit: 4	60.4	The value of Limit 4 at 0.3052 MHz
Margin [dB]	-13.4	The measured voltage is 13.4 dB below Limit 4

Meter Reading in dBuV + Gain/Loss Factor in dB + Transducer Factor in dB = Corrected Voltage

Notes: When a preamp is used, the resulting gain is compensated.
Margin of less than 6 dB is indicated by highlighting.

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```
 Murandi Communictions Ltd.

 Receive Mode

 Line 1 & 2

 Project number m01e2708

  Test      Meter     Gain/Loss  Transducer  Level  Limit:1      2
Frequency  Reading     Factor     Factor   [dB(uVolts)]
 [MHz]     [dB(uV)]     [dB]       [dB]
=====================================================================
Line 1:
Range: 1 .45 - 30MHz
.50532    35.71qp         10          .8        46.51    48        60
                                  Margin [dB]:          -1.49     -13.49

.46168    29.44qp         10          .9        40.34    48        60
                                  Margin [dB]:          -7.66     -19.66

.50433    35.57qp         10          .8        46.37    48        60
                                  Margin [dB]:          -1.63     -13.63
Line 2:
Range: 1 .45 - 30MHz
.50784    34.29qp         10          .8        45.09    48        60
                                  Margin [dB]:          -2.91     -14.91

.46119    27.08qp         10          .9        37.98    48        60
                                  Margin [dB]:          -10.02    -22.02
.50479    34.73qp         10          .8        45.53    48        60
                                  Margin [dB]:          -2.47     -14.47
qp = Quasi-Peak detector
LIMIT 1: CFR 47 PART 15 CLASS B
LIMIT 2: CFR 47 PART 15 CLASS A
File: qp for all emissions - Rx.TXT
```

Murandi Communictions Ltd.

Transmit Mode

Line 1 & 2

Project number m01e2708

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Line 1:					
Range: 1 .45 - 30MHz					
.50761	33.82qp	10	.8	44.62	48
			Margin [dB]:		-3.38
.46103	27.16qp	10	.9	38.06	48
			Margin [dB]:		-9.94
.50254	33.22qp	10	.8	44.02	48
			Margin [dB]:		-3.98
.50472	33.75qp	10	.8	44.55	48
			Margin [dB]:		-3.45

qp = Quasi-Peak detector

LIMIT 1: FCC Part 15.207

File: qp for all emissions - Line 1.TXT

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB(uVolts)]	Limit:1
Line 2:					
Range: 1 .45 - 30MHz					
.50347	33.89qp	10	.8	44.69	48
			Margin [dB]:		-3.31
.45976	28.5qp	10	.9	39.4	48
			Margin [dB]:		-8.6
.50352	34.11qp	10	.8	44.91	48
			Margin [dB]:		-3.09
.50632	33.93qp	10	.8	44.73	48
			Margin [dB]:		-3.27

qp - Quasi-Peak detector

LIMIT 1: FCC Part 15.207

File: qp for all emissions - Line 2.TXT

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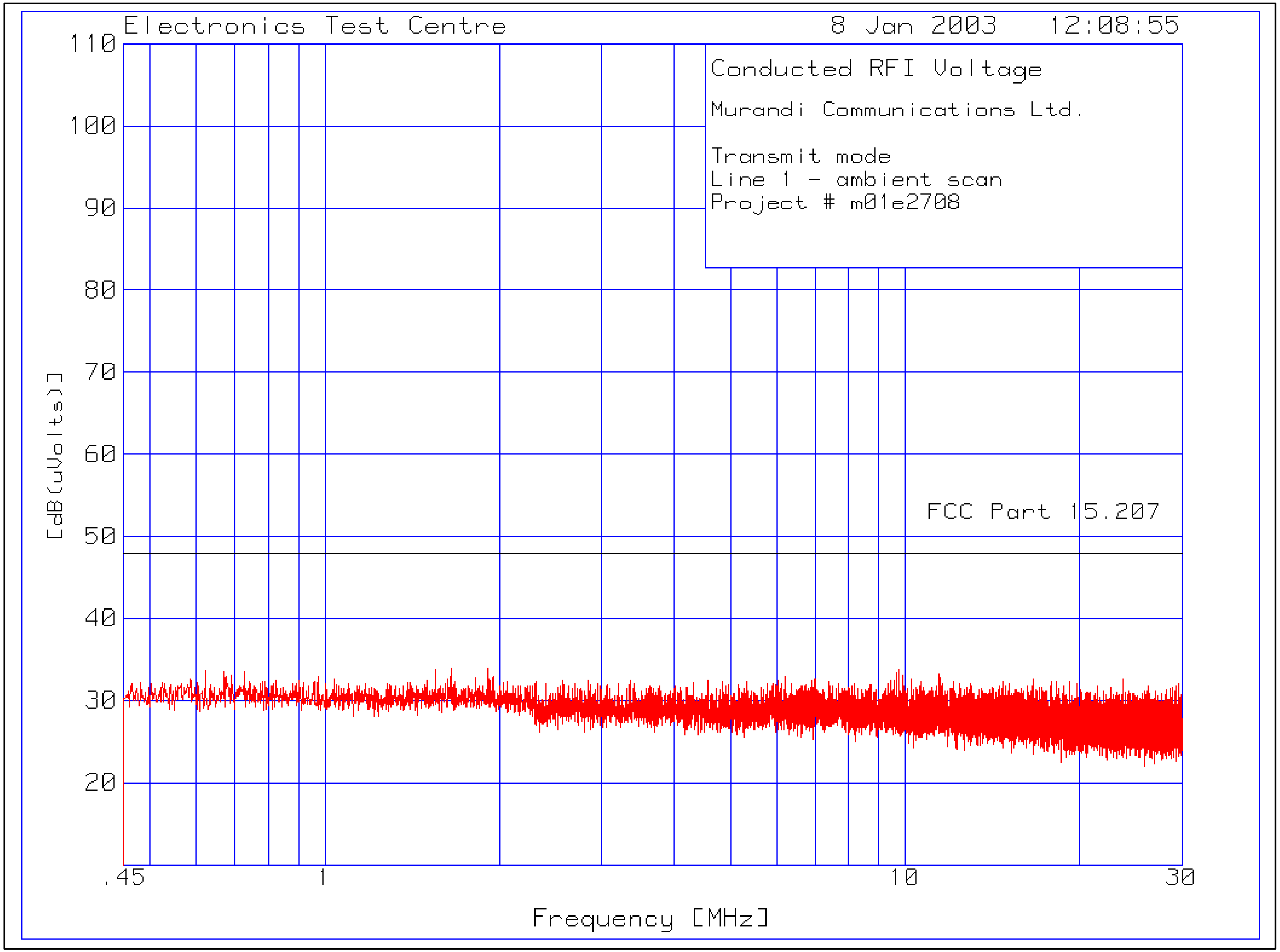
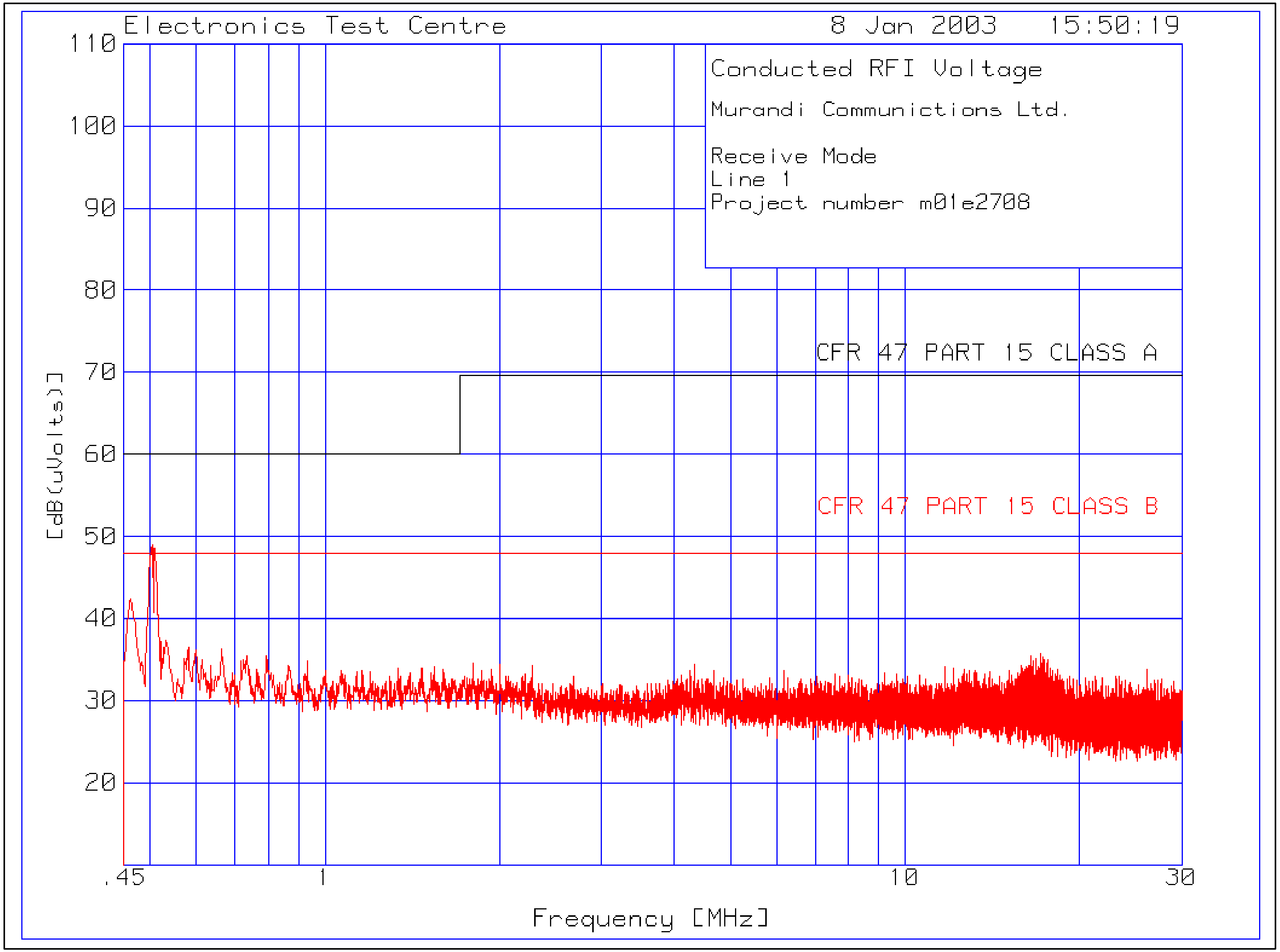
Plot of Conducted Emissions Test Chamber Ambient:



Plot of Conducted Emissions:



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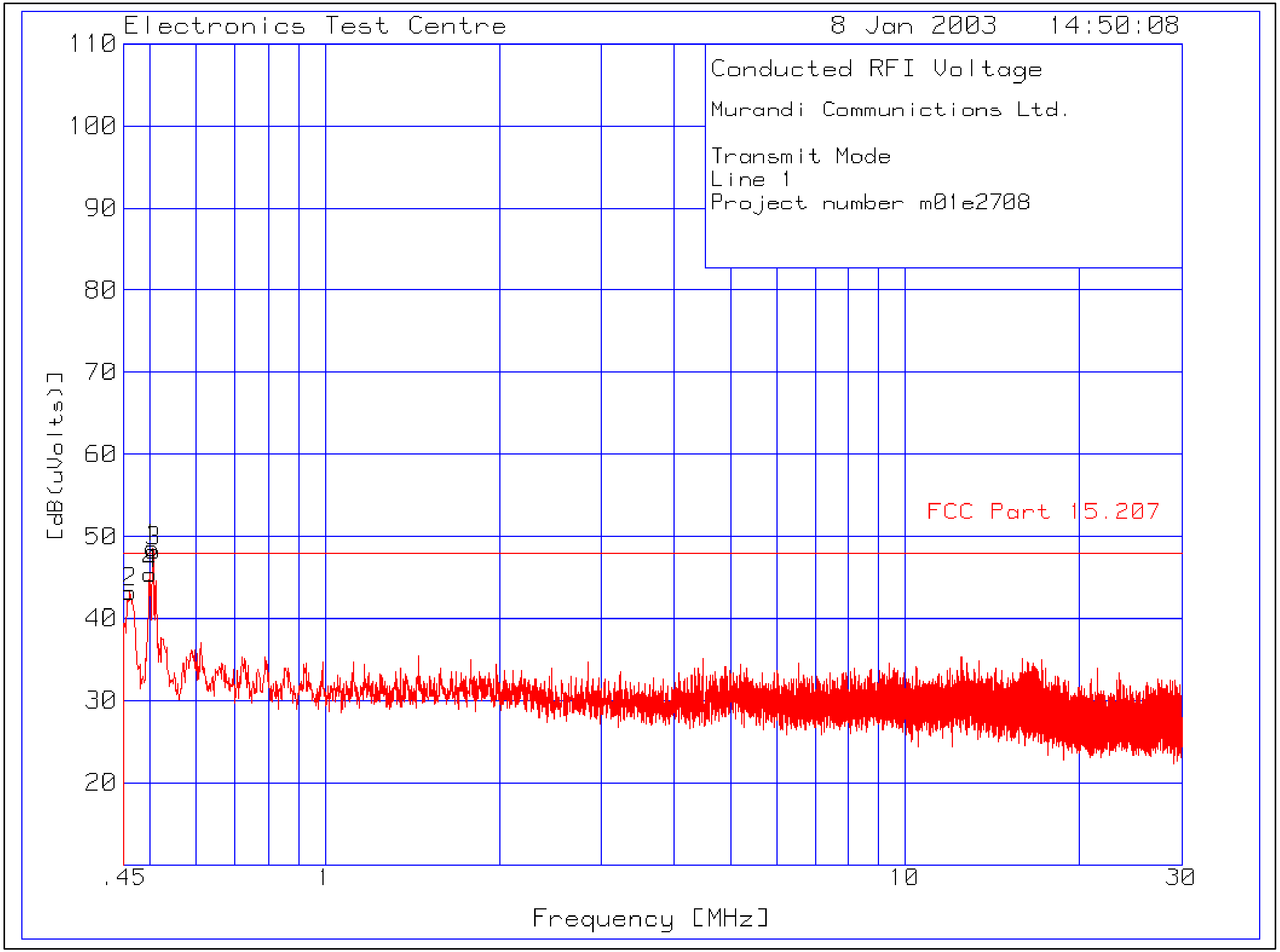

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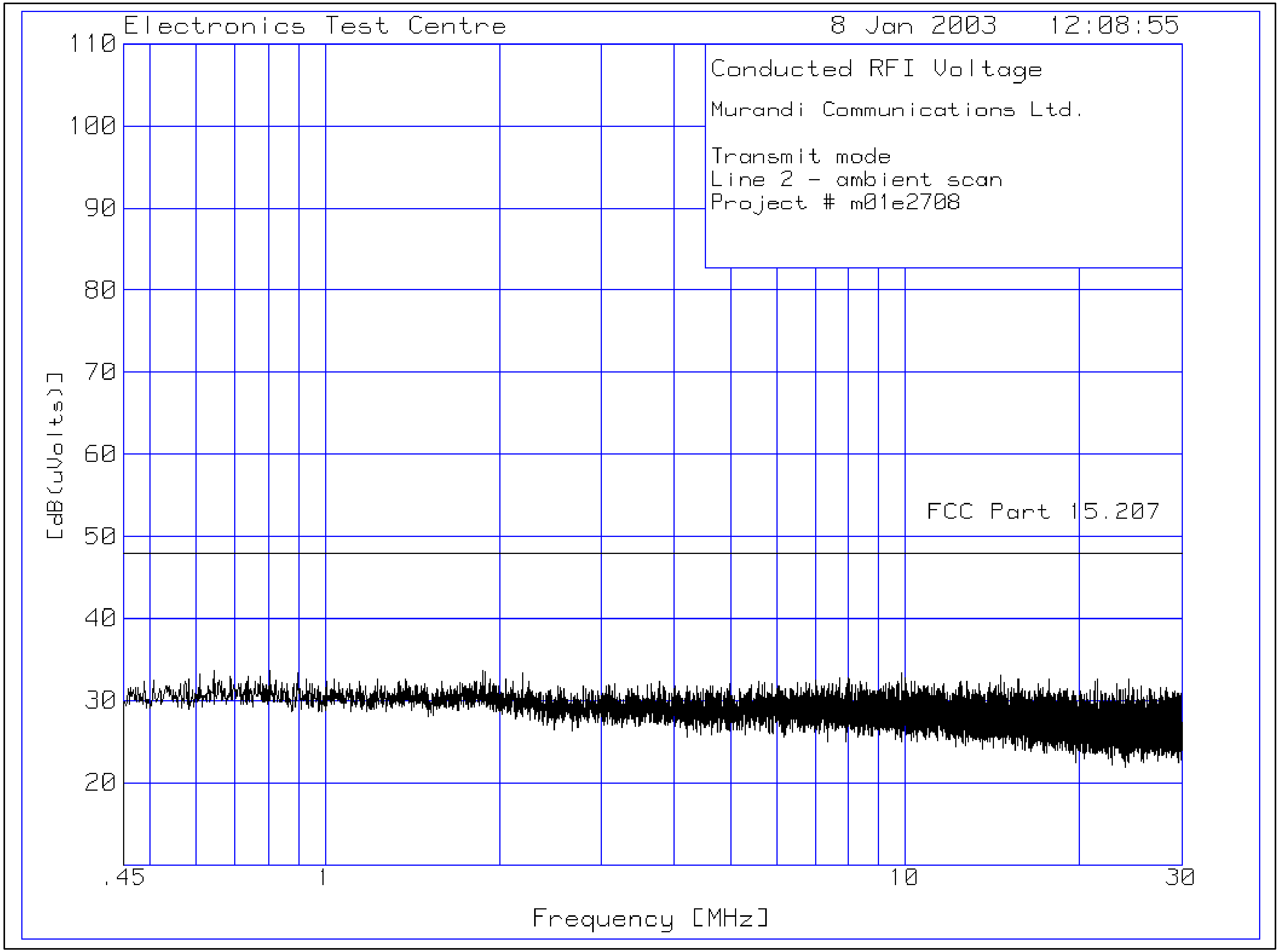

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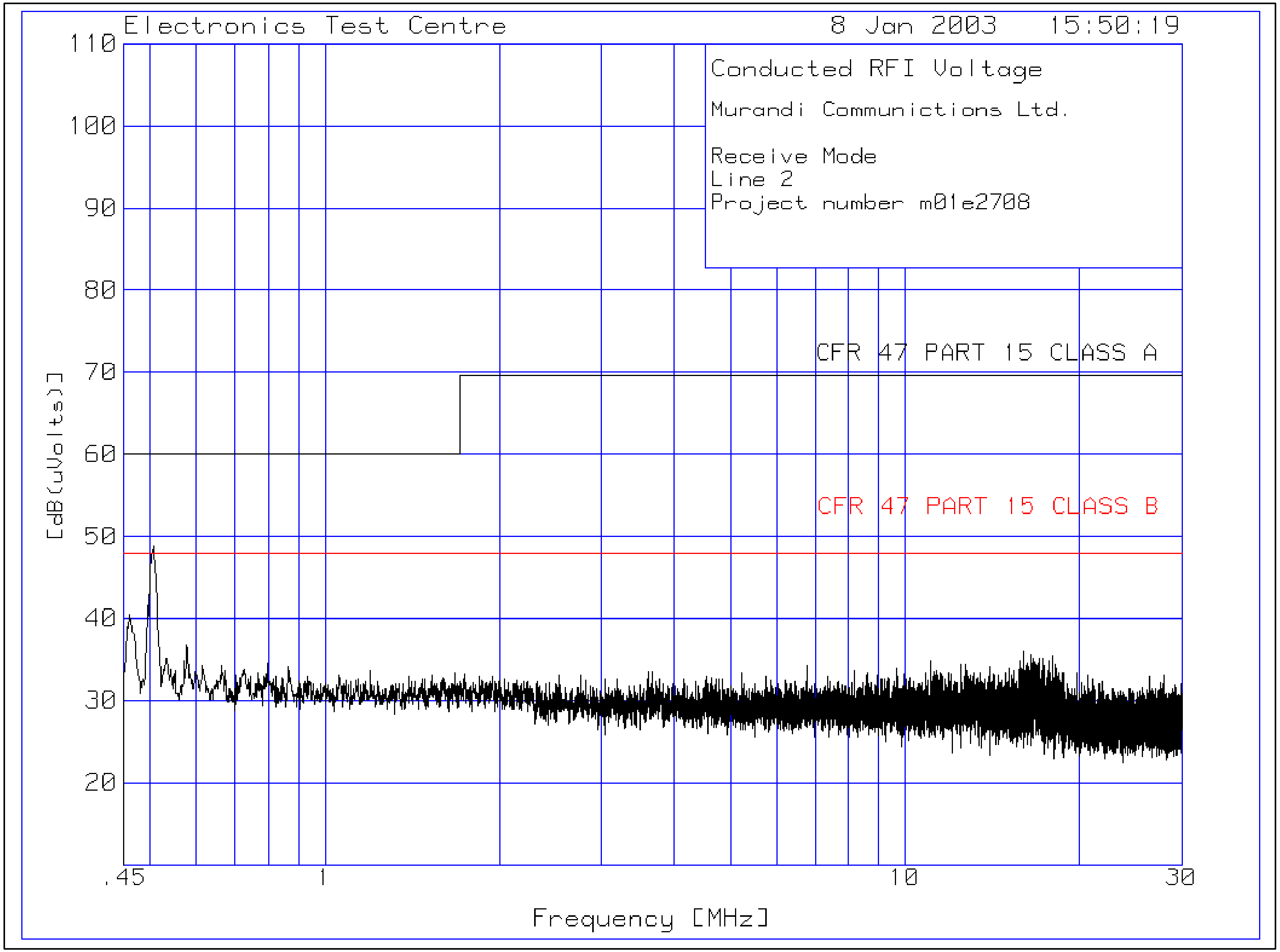
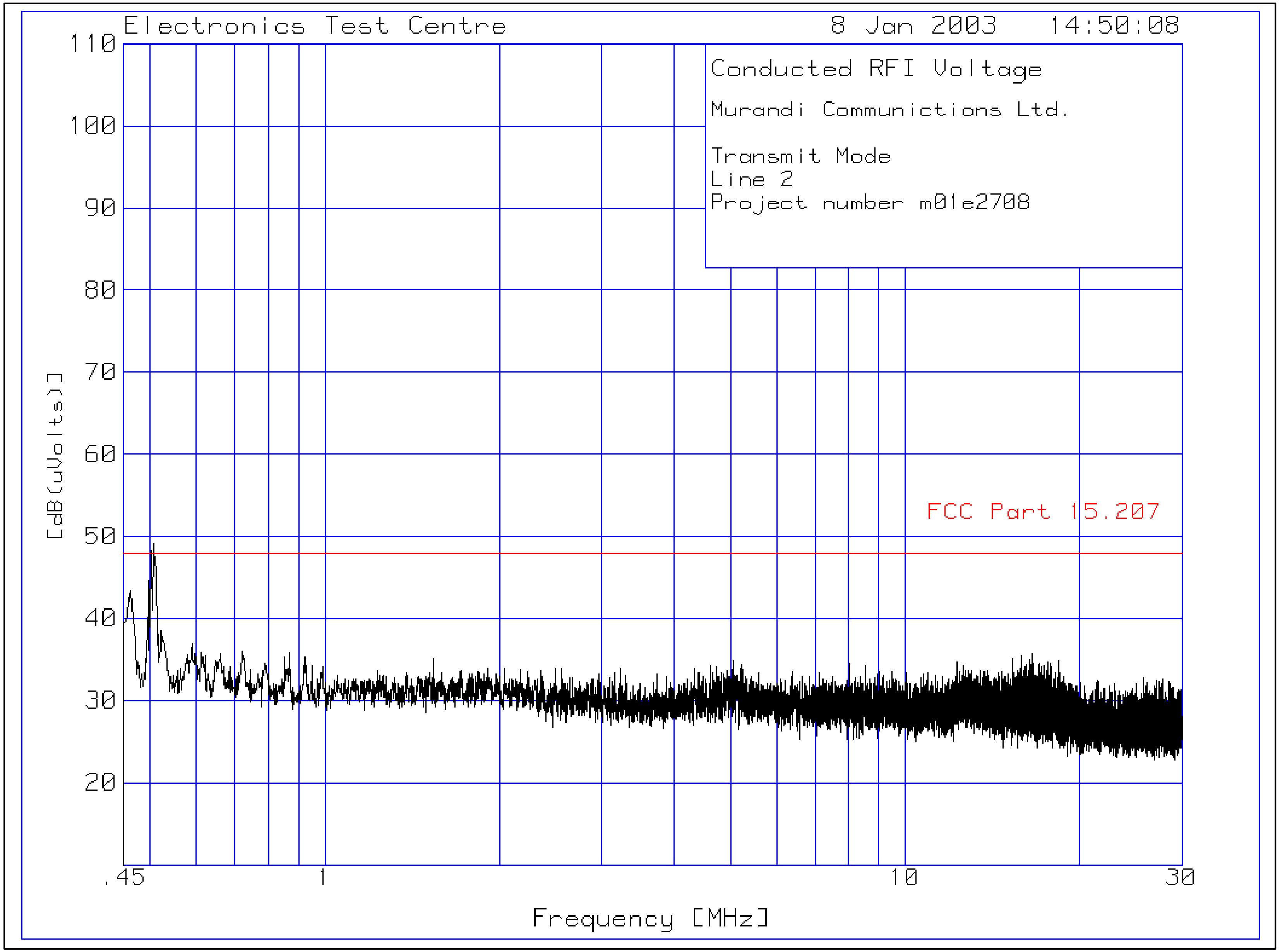
Plot of Conducted Emissions:



Plot of Conducted Emissions:



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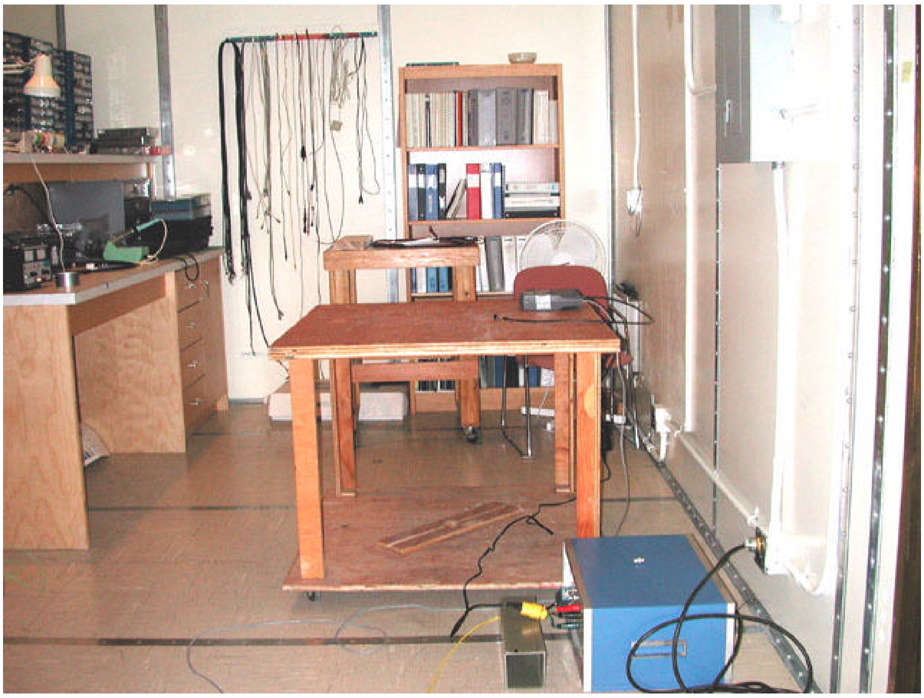
Picture of Conducted Emissions test setup:



Picture of Conducted Emissions test setup:

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Picture of Conducted Emissions test setup:

Picture of Conducted Emissions test setup:

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4.2 CONDUCTED EMISSIONS MEASURED AT ANTENNA PORT

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: David Raynes Test Date: 20 December 2002	Product: EUM3003
Test Result, EUM3003: **PASS**	
Objectives/Criteria The Conducted emissions produced by a system or sub-system shall not exceed the limits for the specifications as stated. Temperature = 19 °C Humidity = 27%	Specifications: FCC Part 15.247c **Emission levels should meet the requirements with a margin of 6dB**.

15.247(a): BW ≥ 500 kHz			15.247(b): 1 Watt (30 dBm)		
Carrier Frequency [MHz]	Bandwidth [MHz]	Delta from limit [MHz]	Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from limit]
905	> 2.50	> 2.00	905	24.7	-5.3
915	> 2.48	> 1.98	915	25.2	-4.8
925	> 2.41	> 1.91	925	25.4	-4.6

15.247(c): -20 dB f_c			15.247(d): 8 dBm (115 dBµV)		
Carrier Frequency [MHz]	RF Voltage [dBµV]	Limit [dBµV]	Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from limit]
905	120.4	100.4	905	2.7	-5.3
915.08	120.9	100.9	915	2.5	-5.5
925.29	121.1	100.8	925	4.4	-3.6

There were no other emissions measured within -10 dB of the specified limits. Measurements were performed while the EUM3003 was transmitting contiuously in CCU mode.

Refer to the test data and plots for more detail.

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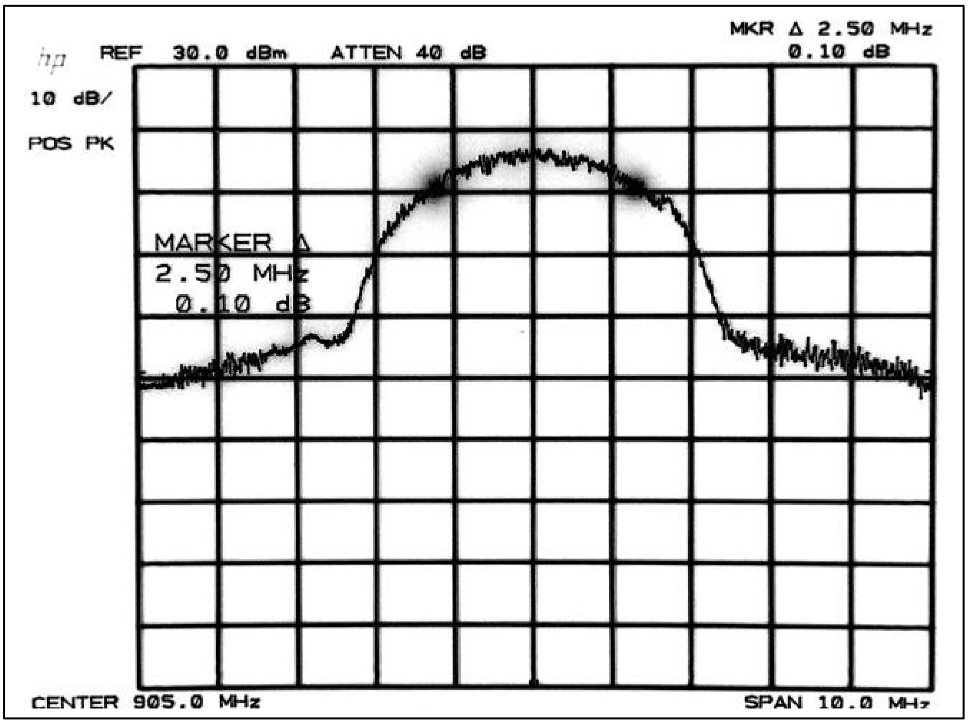
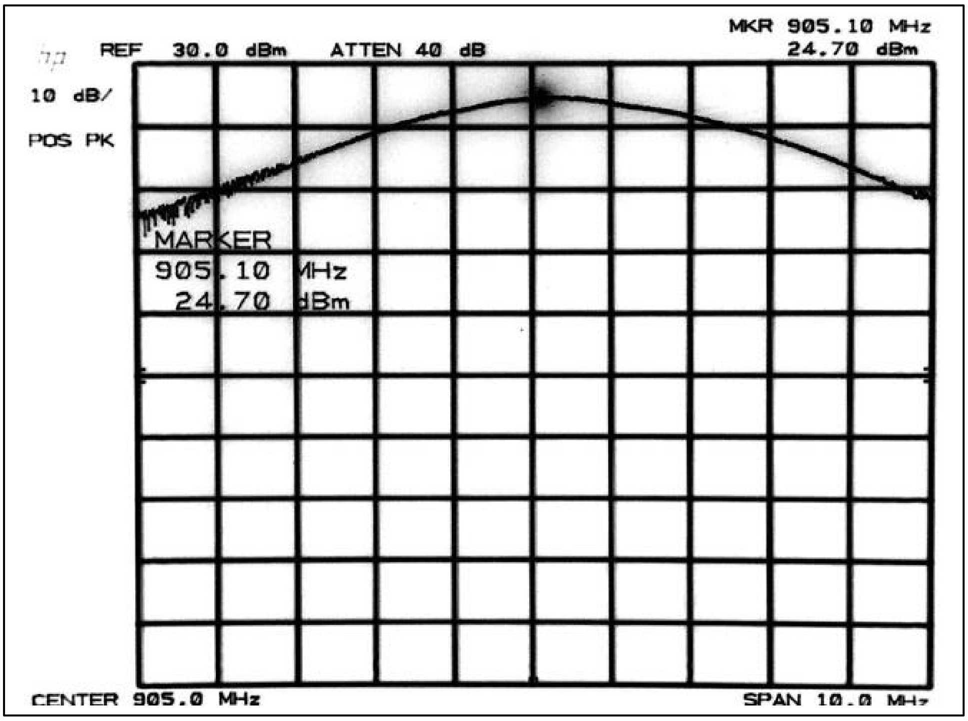
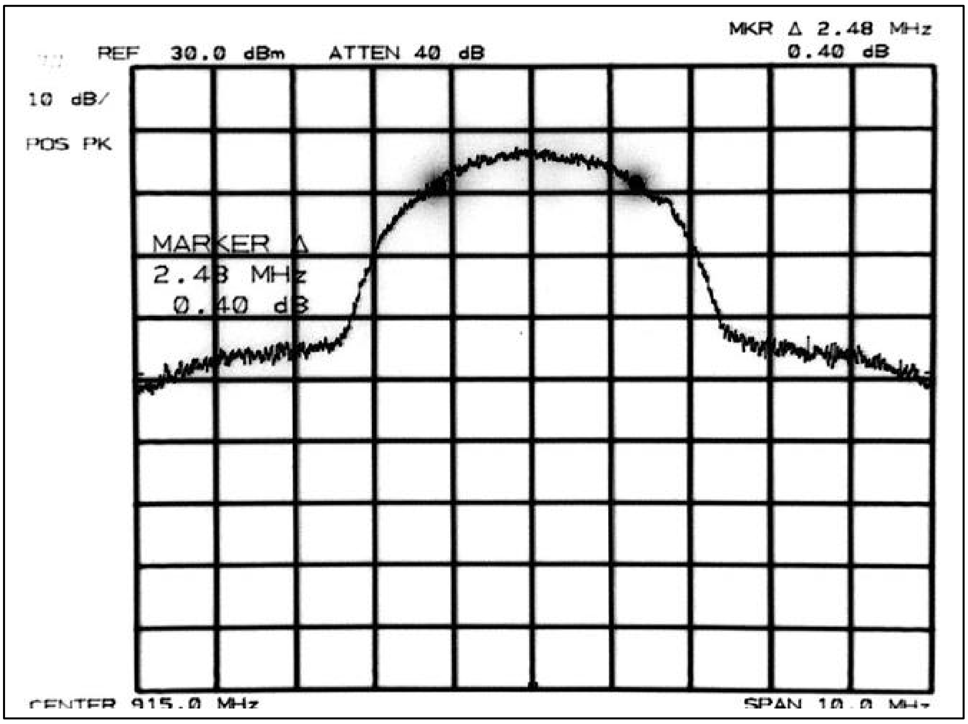
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 905 MHz



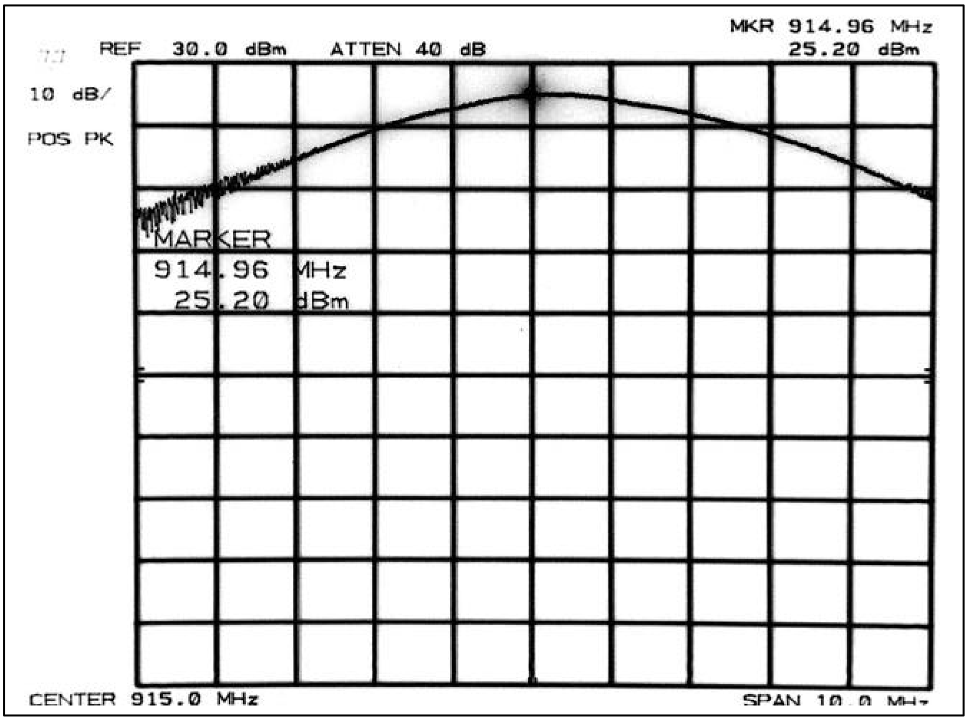
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 905 MHz



Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 915 MHz



Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 915 MHz



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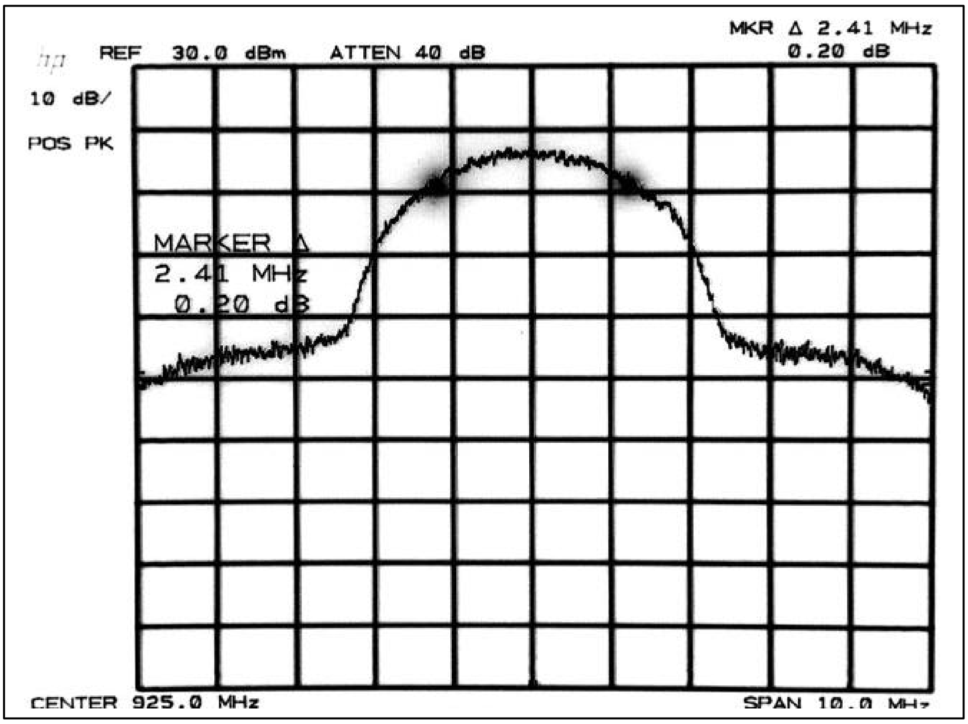
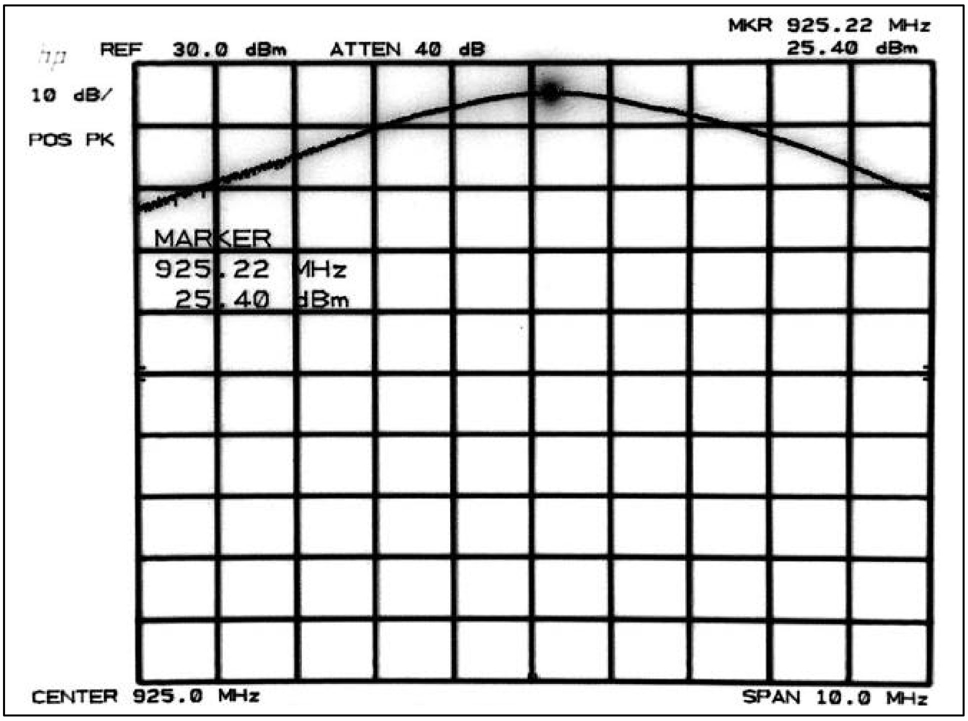
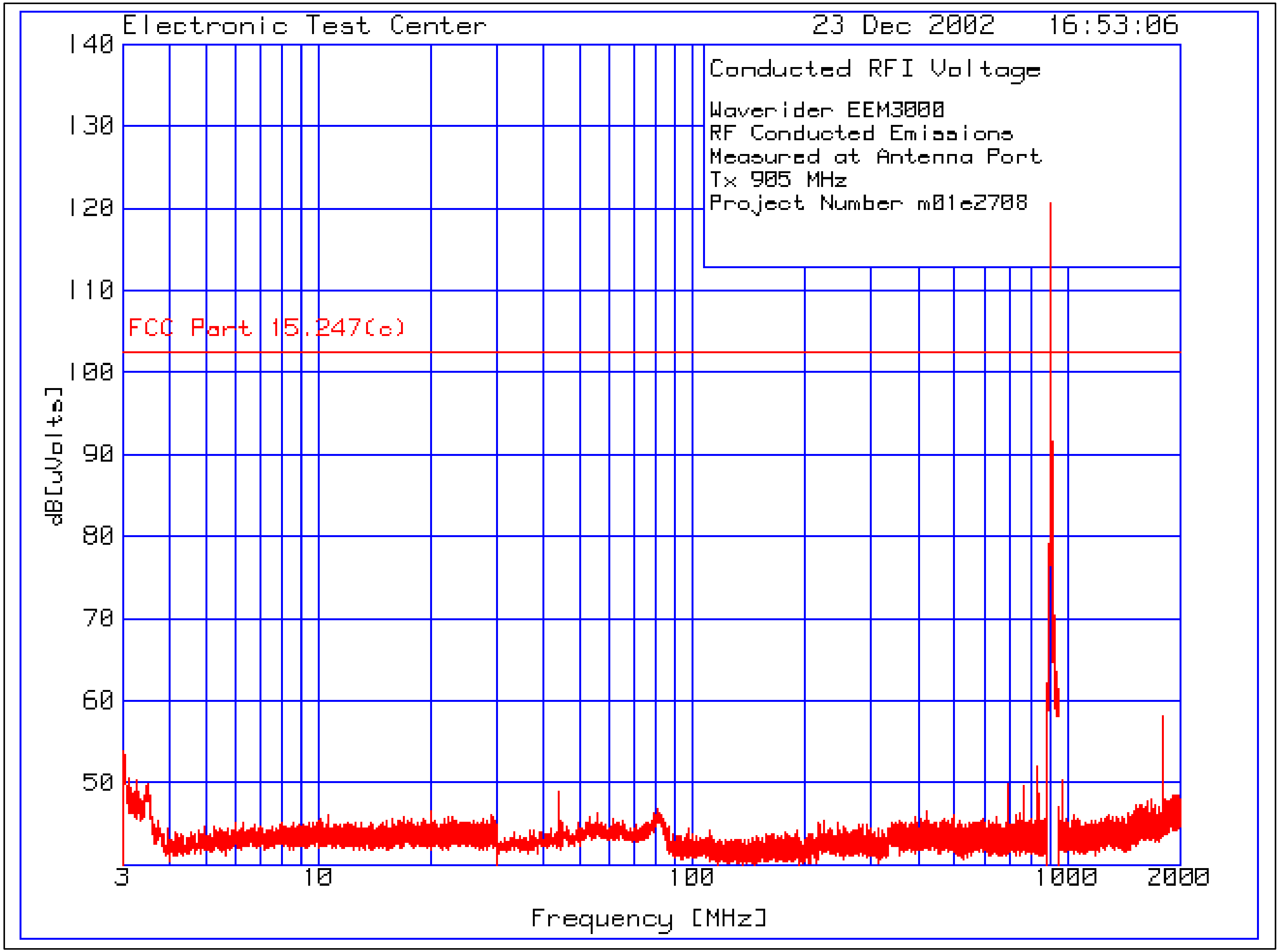
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 925 MHz



Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 925 MHz





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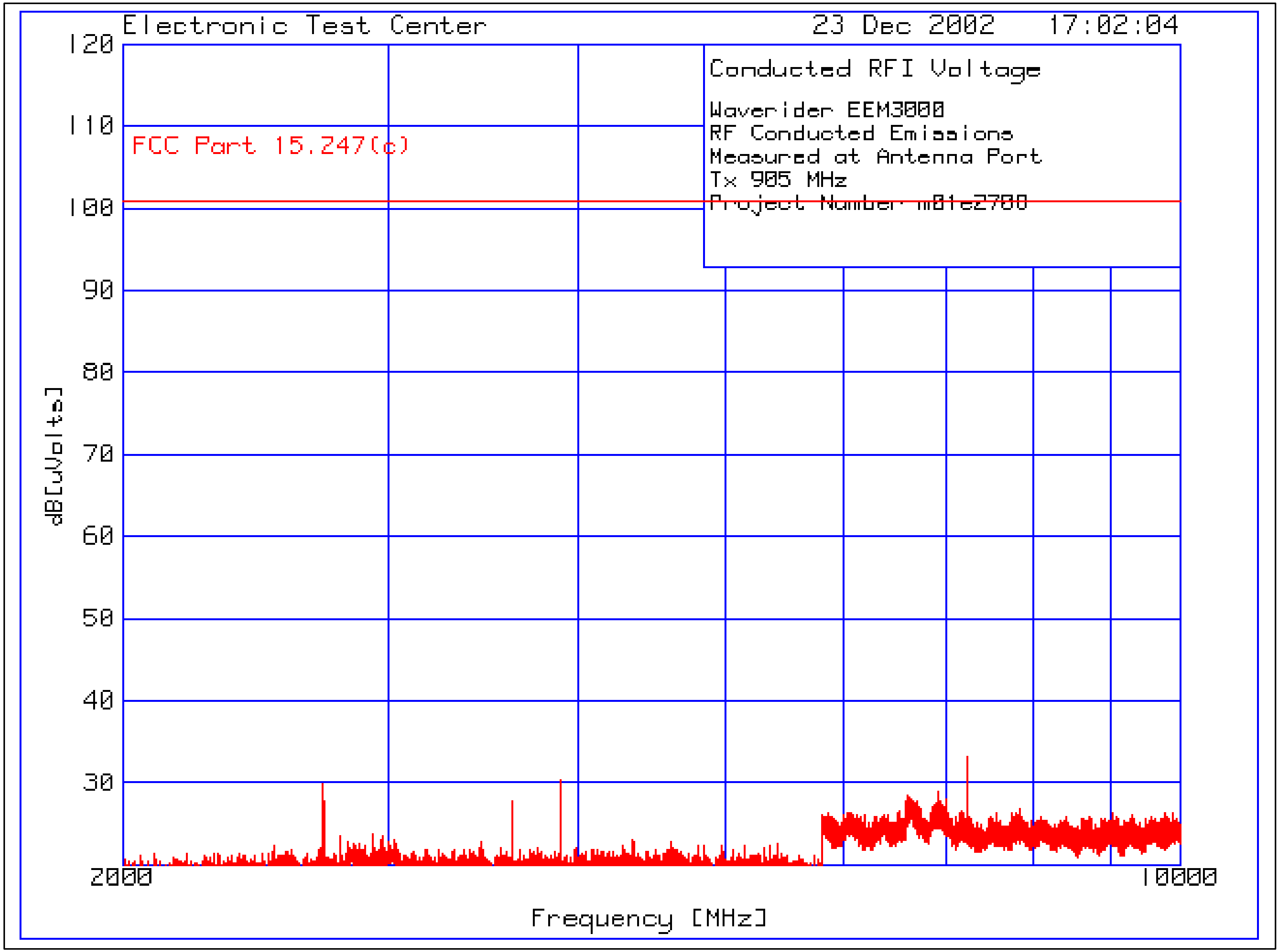
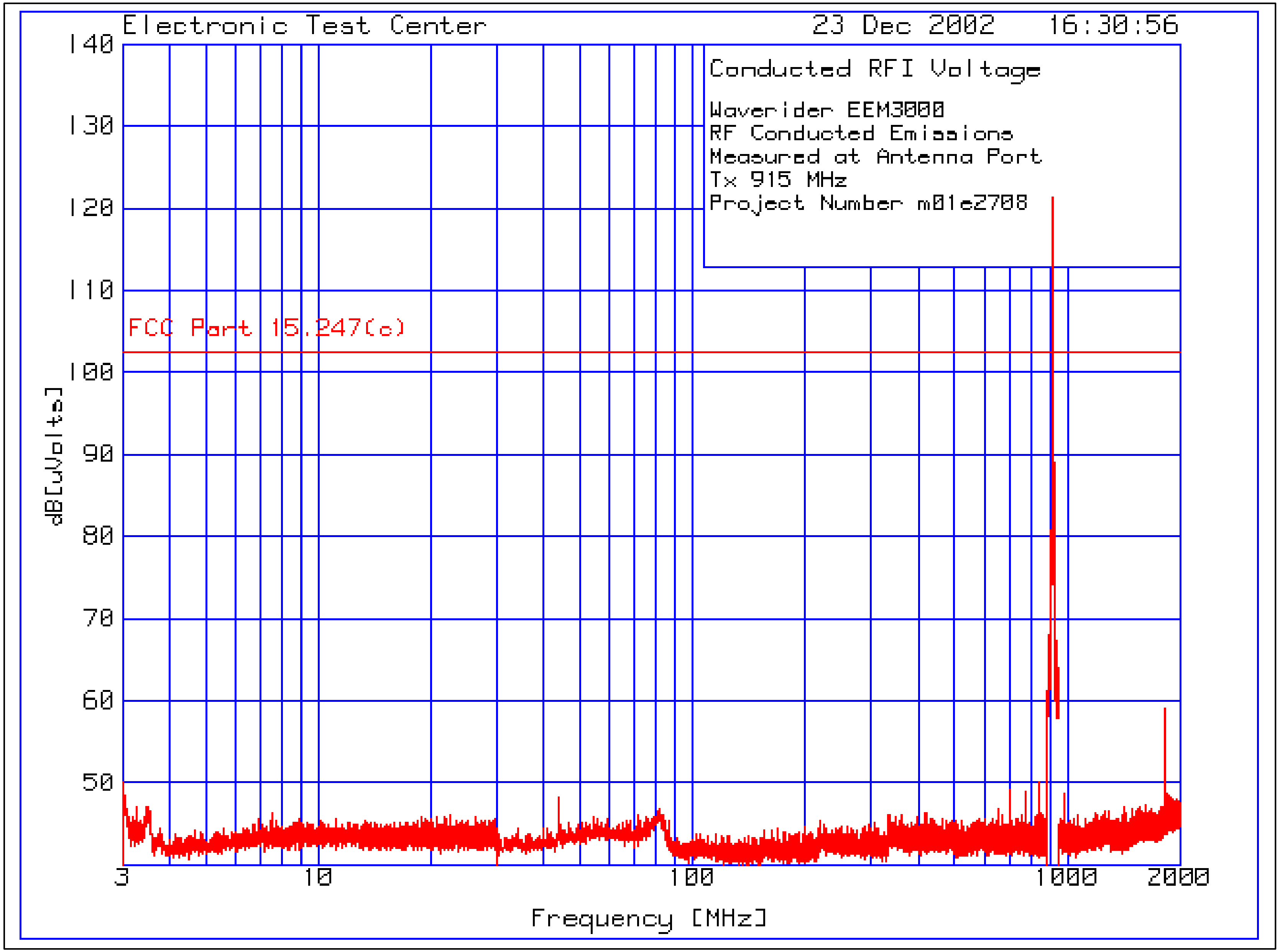

Electronic Test Center
23 Dec 2002
17:02:04
Conducted RFI Voltage
Waverider EEM3000
RF Conducted Emissions
Measured at Antenna Port
Tx 905 MHz
Project Number m01e2708
FCC Part 15.247(c)
120
110
100
90
80
70
60
50
40
30
dB[uVolts]
2000
10000
Frequency [MHz]



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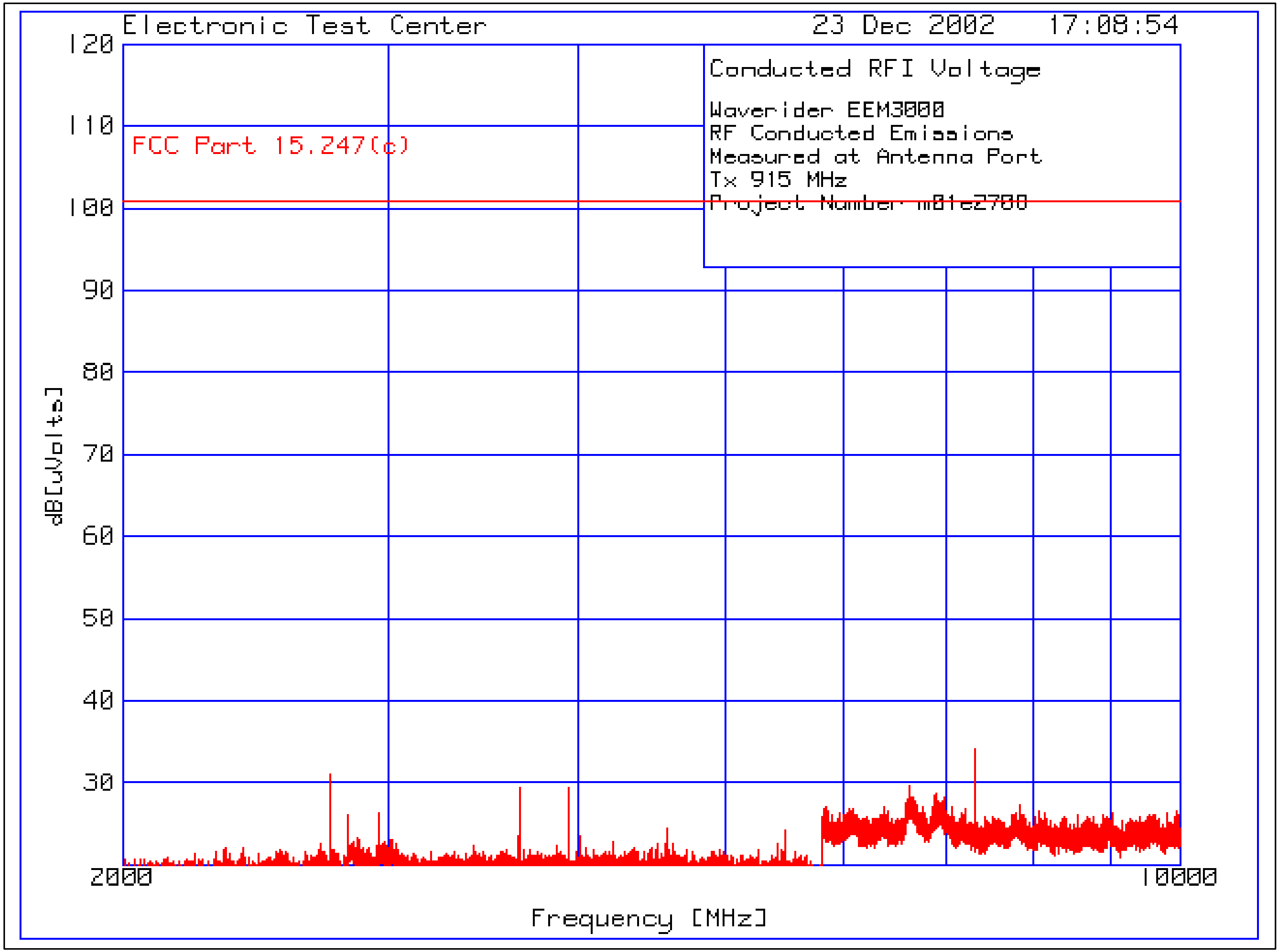

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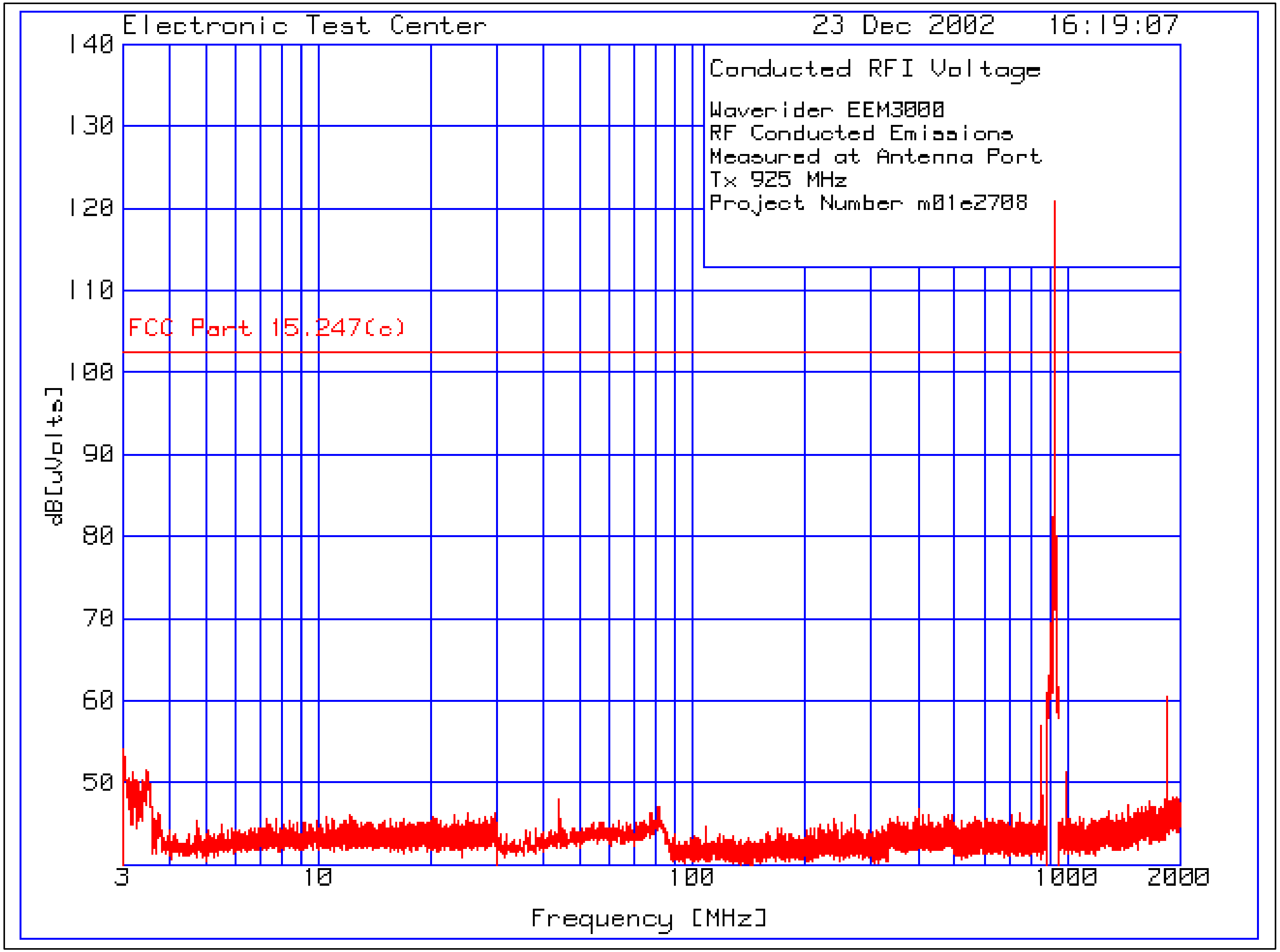

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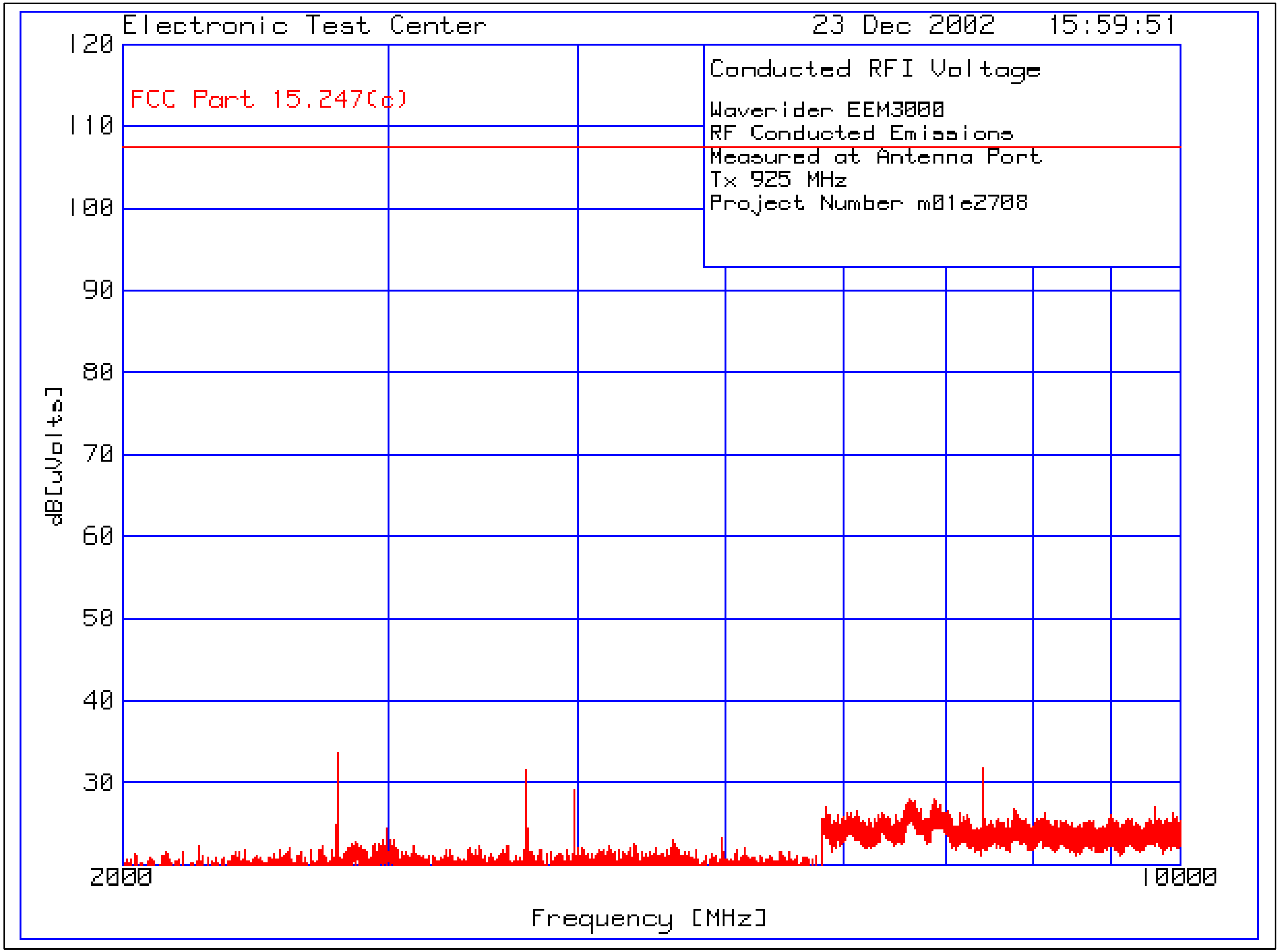

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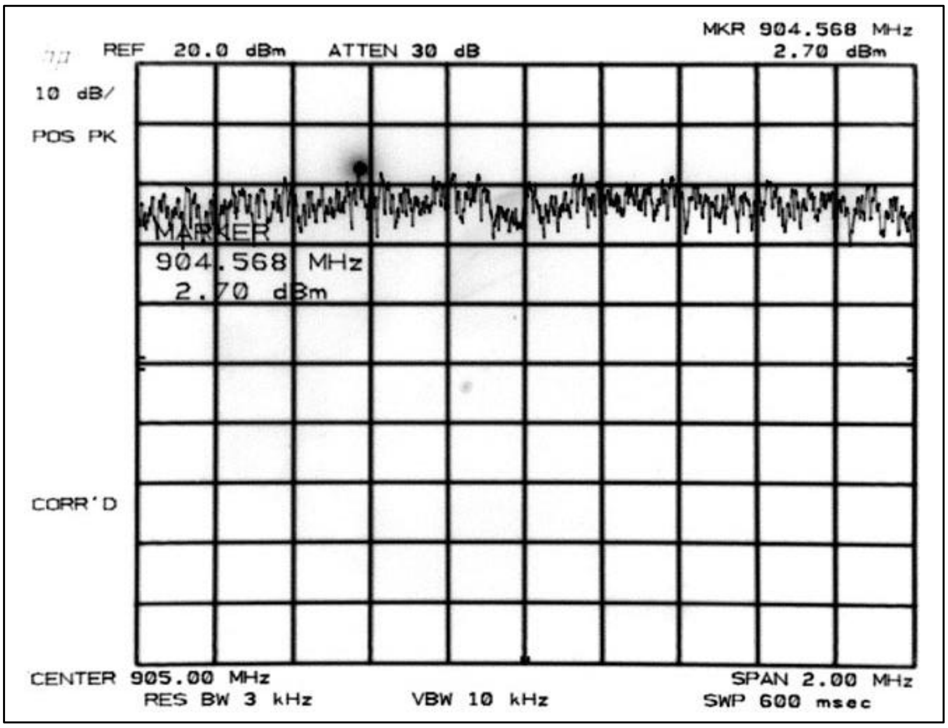
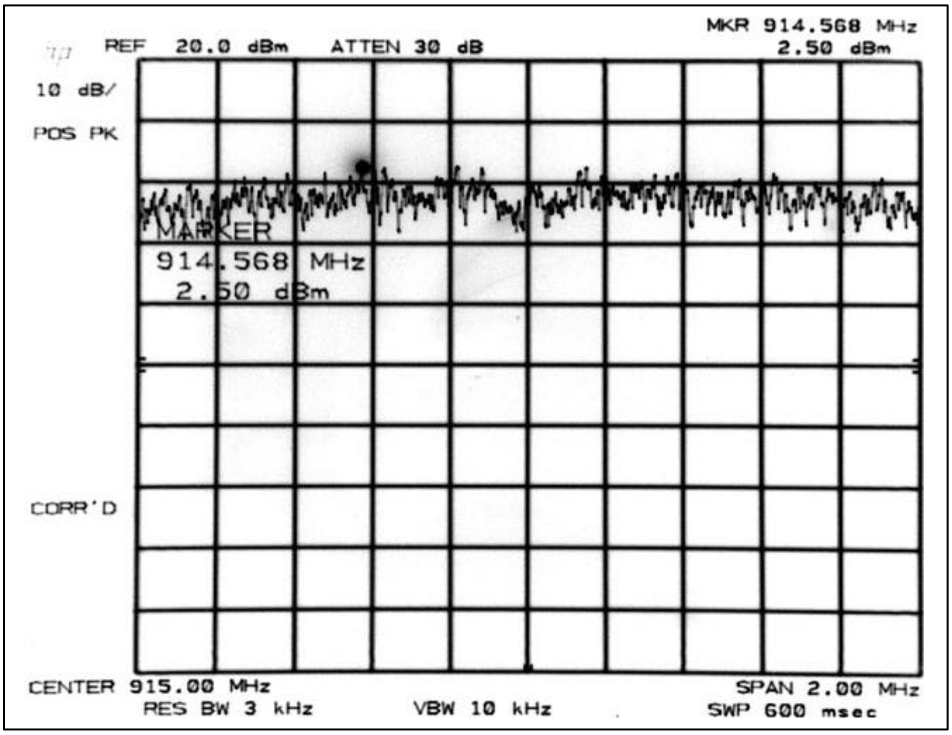
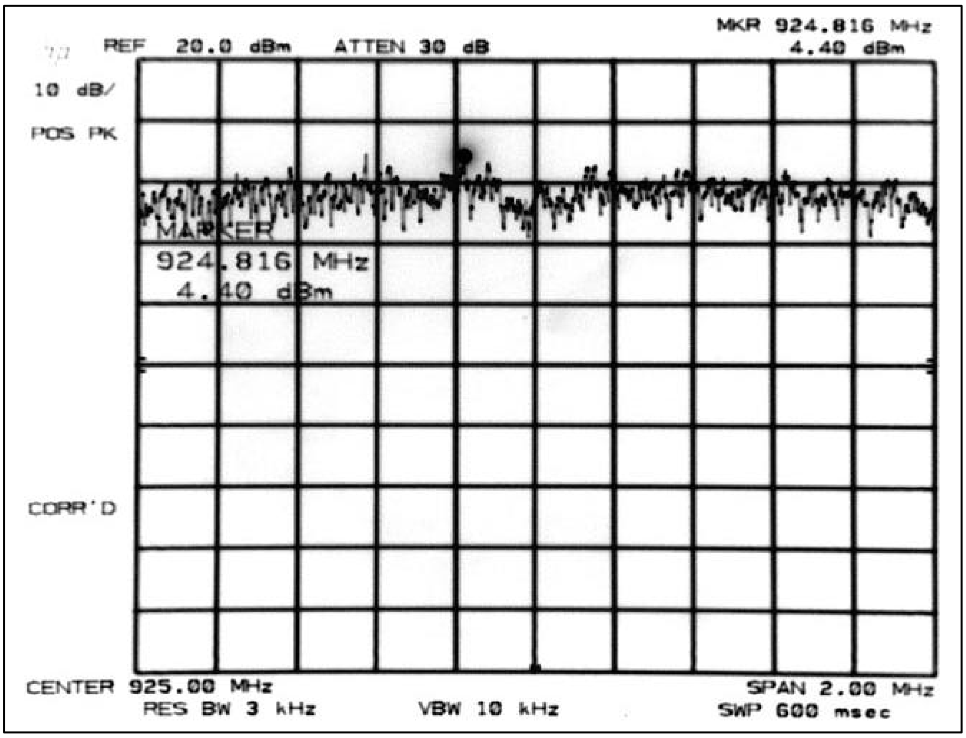
Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 905 MHz



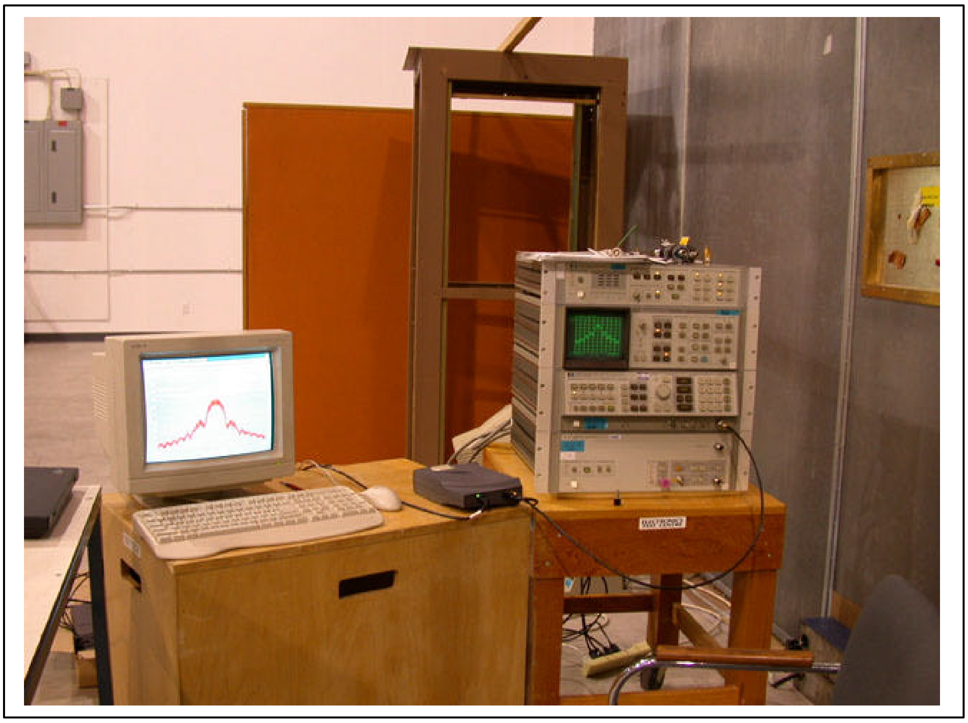
Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 915 MHz



Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 925 MHz



Picture of setup for measuring Conducted Emissions at Antenna Port:



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4.3 RADIATED EMISSIONS INCLUDING RESTRICTED BANDS OF OPERATION

4.3a Receive Mode

Test Lab: MPB Technologies Inc. Airdrie Test Personnel: David Raynes, James MacKay Test Dates: 2 to 7 December 2002	Product: EUM3003
Test Result, EUM3003: **Pass**	
Objectives/Criteria	Specifications
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 = 27 %	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** Units of measurement are [dBµV/m].

Vertical:			Horizontal:		
Frequency [MHz]	Field Strength [dBµV/m]	Delta [dB from limit]	Frequency [MHz]	Field Strength [dBµV/m]	Delta [dB from limit]
43.9516	37.10	-2.9	729.2956	38.91	-7.11
74.9462	36.86	-3.14	564.0229	38.74	-7.28
563.9913	39.93	-6.09			
497.6229	39.22	-6.80			

There were no more emissions measured within -6 dB of the specified limit. Refer to the test data and plots for more detail.

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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     Meter   Gain/Loss Transducer Level Limit:1     2     3     4
Frequency Reading  Factor     Factor     [dB(uVolts)]
  [MHz]   [dB(uV)]  [dB]       [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

Notes: When a preamp is used, the resulting gain is compensated.
Margin of less than 6 dB is indicated by highlighting.

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```
 Waverider Communications Inc.
 EUM3003
Project Number m02e2708

                                                          ⇓
  Test      Meter     Gain/Loss  Transducer  Level  Limit:1      2
Frequency  Reading    Factor     Factor  dB[uVolts/meter]
 [MHz]     [dB(uV)]     [dB]       [dB]
========================================================================

Range: 1 30 - 1000MHz HORIZONTAL POLARIZATION

79.3064    10.04 qp      2.93      7.16       20.13   49.54    40
Azimuth: 79   Height:400 Horz         Margin [dB]:   -29.41   -19.87

81.6461    10.82 qp      3.01      7.33       21.16   49.54    40
Azimuth: 78   Height:355 Horz         Margin [dB]:   -28.38   -18.84

81.6796    15.63 qp      3.01      7.33       25.97   49.54    40
Azimuth: 103  Height:222 Horz         Margin [dB]:   -23.57   -14.03

81.7064    8.05 qp       3.01      7.34       18.4    49.54    40
Azimuth: 34   Height:156 Horz         Margin [dB]:   -31.14   -21.6

83.1604    8.13 qp       3.06      7.45       18.64   49.54    40
Azimuth: 18   Height:345 Horz         Margin [dB]:   -30.9    -21.36

85.787     11.03 qp      3.15      7.73       21.91   49.54    40
Azimuth: 89   Height:161 Horz         Margin [dB]:   -27.63   -18.09

529.619    8 qp          7.39      18.69      34.08   56.9     46.02
Azimuth: 6    Height:196 Horz         Margin [dB]:   -22.82   -11.94

564.0229   12.91 qp      7.15      18.68      38.74   56.9     46.02
Azimuth: 138  Height:102 Horz         Margin [dB]:   -18.16   -7.28

696.2087   10.04 qp      7.95      20.42      38.41   56.9     46.02
Azimuth: 138  Height:120 Horz         Margin [dB]:   -18.49   -7.61

728.1976   9.79 qp       8.11      21.37      39.27   56.9     46.02
Azimuth: 262  Height:117 Horz         Margin [dB]:   -17.63   -6.75

729.2956   9.46 qp       8.12      21.33      38.91   56.9     46.02
Azimuth: 261  Height:112 Horz         Margin [dB]:   -17.99   -7.11

749.7557   6.06 qp       8.15      21.49      35.7    56.9     46.02
Azimuth: 264  Height:112 Horz         Margin [dB]:   -21.2    -10.32

910.1099   6 qp          9.11      23.6       38.71   56.9     46.02
Azimuth: 0    Height:168 Horz         Margin [dB]:   -18.19   -7.31

LIMIT 1: FCC Part 15  Class A 3m
LIMIT 2: FCC Part 15  Class B 3m

qp = Quasi-Peak detector
```

```
  Test      Meter     Gain/Loss  Transducer  Level  Limit:1       2
Frequency  Reading     Factor     Factor   dB[uVolts/meter]
 [MHz]     [dB(uV)]     [dB]        [dB]
=======================================================================

Range: 1 30 - 1000MHz VERTICAL POLARIZATION

43.9516    20.04 qp      2.51       14.55     37.1     49.54     40
Azimuth: 210  Height:111 Vert          Margin [dB]:   -12.44    -2.9

74.9462    26.42 qp      2.74       7.7       36.86    49.54     40
Azimuth: 7    Height:186 Vert          Margin [dB]:   -12.68    -3.14

75.9382    13 qp         2.79       7.68      23.47    49.54     40
Azimuth: 7    Height:127 Vert          Margin [dB]:   -26.07    -16.53

78.1819    18.09 qp      2.89       7.64      28.62    49.54     40
Azimuth: 113  Height:149 Vert          Margin [dB]:   -20.92    -11.38

78.5458    16.01 qp      2.9        7.63      26.54    49.54     40
Azimuth: 132  Height:102 Vert          Margin [dB]:   -23       -13.46

78.8692    13.68 qp      2.91       7.62      24.21    49.54     40
Azimuth: 259  Height:271 Vert          Margin [dB]:   -25.33    -15.79

79.2769    21.14 qp      2.93       7.61      31.68    49.54     40
Azimuth: 40   Height:166 Vert          Margin [dB]:   -17.86    -8.32

79.5704    14.02 qp      2.94       7.61      24.57    49.54     40
Azimuth: 162  Height:347 Vert          Margin [dB]:   -24.97    -15.43

79.8188    21.19 qp      2.94       7.6       31.73    49.54     40
Azimuth: 103  Height:187 Vert          Margin [dB]:   -17.81    -8.27

80.1217    21.49 qp      2.96       7.59      32.04    49.54     40
Azimuth: 196  Height:131 Vert          Margin [dB]:   -17.5     -7.96

80.2119    17.98 qp      2.96       7.58      28.52    49.54     40
Azimuth: 235  Height:235 Vert          Margin [dB]:   -21.02    -11.48

80.2397    19.15 qp      2.96       7.58      29.69    49.54     40
Azimuth: 226  Height:203 Vert          Margin [dB]:   -19.85    -10.31

80.3659    15.36 qp      2.96       7.57      25.89    49.54     40
Azimuth: 62   Height:298 Vert          Margin [dB]:   -23.65    -14.11

80.4091    18.04 qp      2.97       7.57      28.58    49.54     40
Azimuth: 226  Height:172 Vert          Margin [dB]:   -20.96    -11.42

81.8604    20.53 qp      3.02       7.45      31       49.54     40
Azimuth: 83   Height:126 Vert          Margin [dB]:   -18.54    -9

82.0002    13.13 qp      3.02       7.44      23.59    49.54     40
Azimuth: 356  Height:286 Vert          Margin [dB]:   -25.95    -16.41

LIMIT 1: FCC Part 15  Class A 3m
LIMIT 2: FCC Part 15  Class B 3m

qp = Quasi-Peak detector
```

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Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	⇓ 2
82.2809	17.85 qp	3.03	7.42	28.3	49.54	40
Azimuth: 230	Height:158 Vert			Margin [dB]:	-21.24	-11.7
82.4616	15.89 qp	3.04	7.4	26.33	49.54	40
Azimuth: 204	Height:102 Vert			Margin [dB]:	-23.21	-13.67
82.4897	19.76 qp	3.04	7.4	30.2	49.54	40
Azimuth: 104	Height:103 Vert			Margin [dB]:	-19.34	-9.8
82.494	17.75 qp	3.04	7.4	28.19	49.54	40
Azimuth: 166	Height:103 Vert			Margin [dB]:	-21.35	-11.81
82.8248	16.28 qp	3.05	7.37	26.7	49.54	40
Azimuth: 98	Height:103 Vert			Margin [dB]:	-22.84	-13.3
82.8314	19.71 qp	3.05	7.37	30.13	49.54	40
Azimuth: 124	Height:102 Vert			Margin [dB]:	-19.41	-9.87
84.0249	17.51 qp	3.09	7.28	27.88	49.54	40
Azimuth: 108	Height:137 Vert			Margin [dB]:	-21.66	-12.12
84.1565	21.4 qp	3.1	7.27	31.77	49.54	40
Azimuth: 164	Height:102 Vert			Margin [dB]:	-17.77	-8.23
84.1817	17.99 qp	3.1	7.27	28.36	49.54	40
Azimuth: 243	Height:105 Vert			Margin [dB]:	-21.18	-11.64
88.0231	22.83 qp	3.23	7.44	33.5	53.98	43.52
Azimuth: 97	Height:194 Vert			Margin [dB]:	-20.48	-10.02
95.2874	9.97 qp	3.04	8.87	21.88	53.98	43.52
Azimuth: 173	Height:149 Vert			Margin [dB]:	-32.1	-21.64
497.6229	15.1 qp	6.92	17.2	39.22	56.9	46.02
Azimuth: 100	Height:124 Vert			Margin [dB]:	-17.68	-6.8
561.1355	5.6 qp	7.05	18.25	30.9	56.9	46.02
Azimuth: 113	Height:102 Vert			Margin [dB]:	-26	-15.12
563.9913	14.42 qp	7.15	18.36	39.93	56.9	46.02
Azimuth: 104	Height:102 Vert			Margin [dB]:	-16.97	-6.09
867.4838	5.36 qp	8.72	21.25	35.33	56.9	46.02
Azimuth: 3	Height:125 Vert			Margin [dB]:	-21.57	-10.69
895.3428	5.71 qp	8.91	21.91	36.53	56.9	46.02
Azimuth: 205	Height:158 Vert			Margin [dB]:	-20.37	-9.49

LIMIT 1: FCC Part 15 Class A 3m
LIMIT 2: FCC Part 15 Class B 3m

qp = Quasi-Peak detector

File: Rx2 30-1000 QPall.TXT

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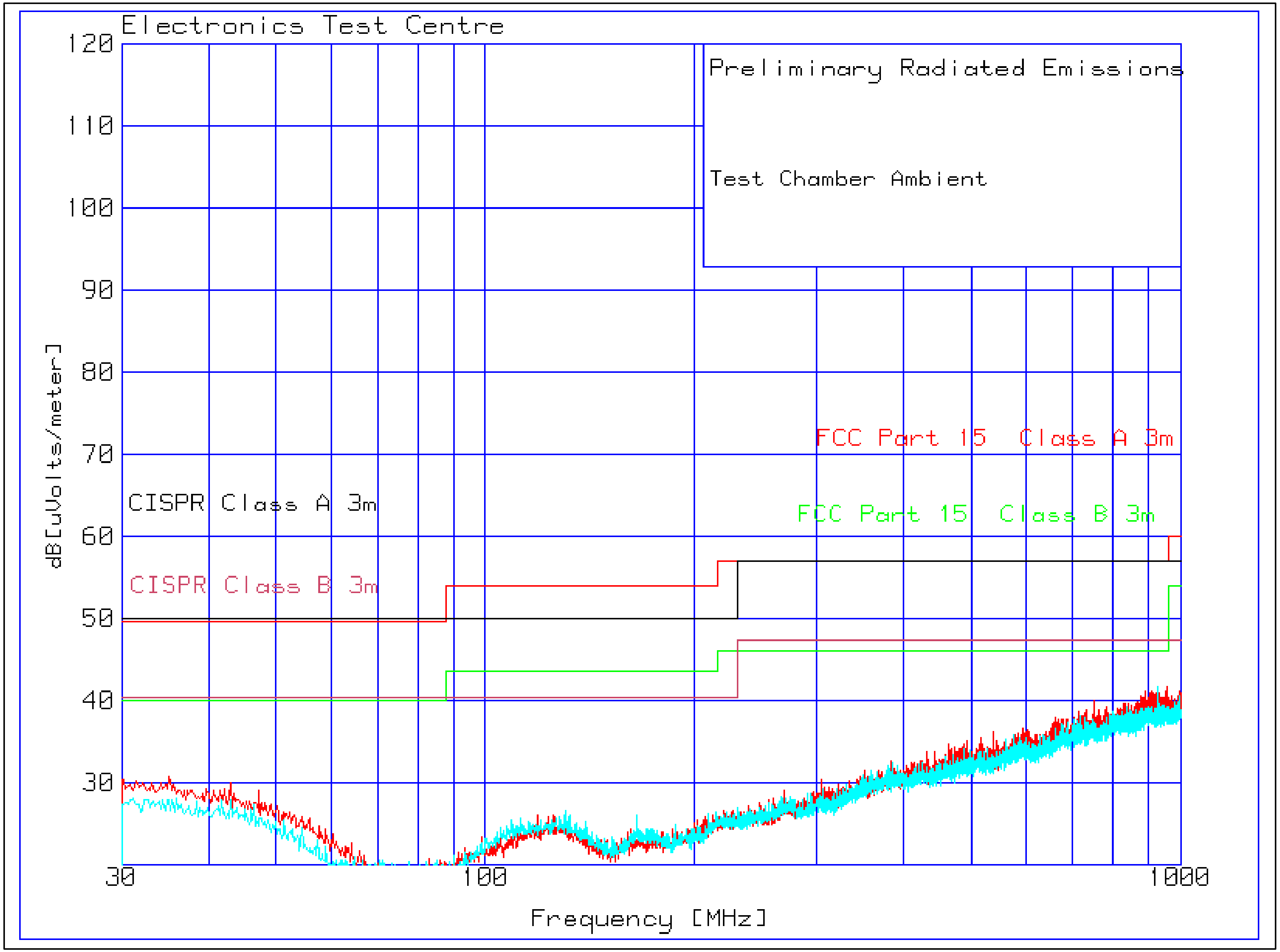
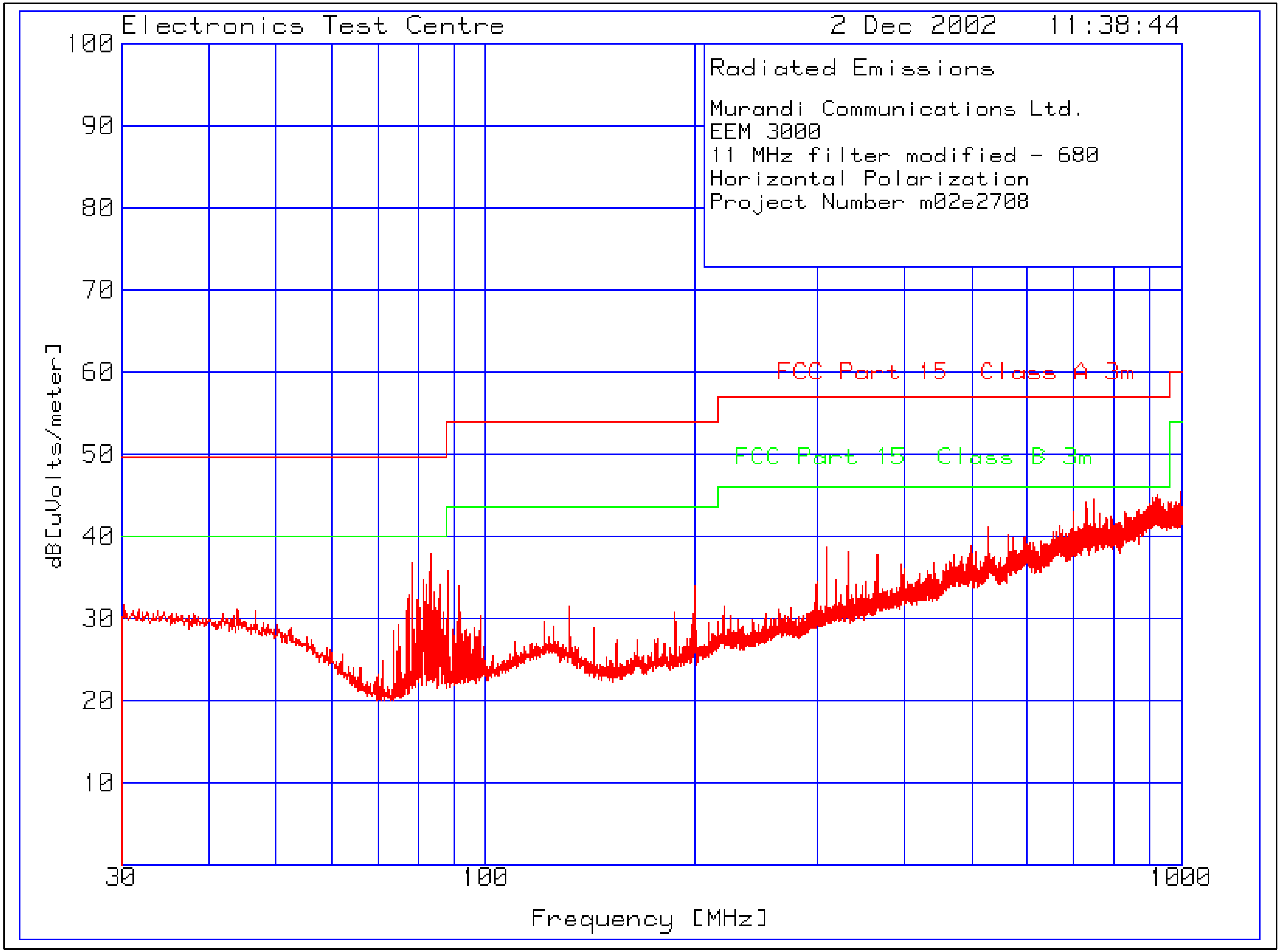
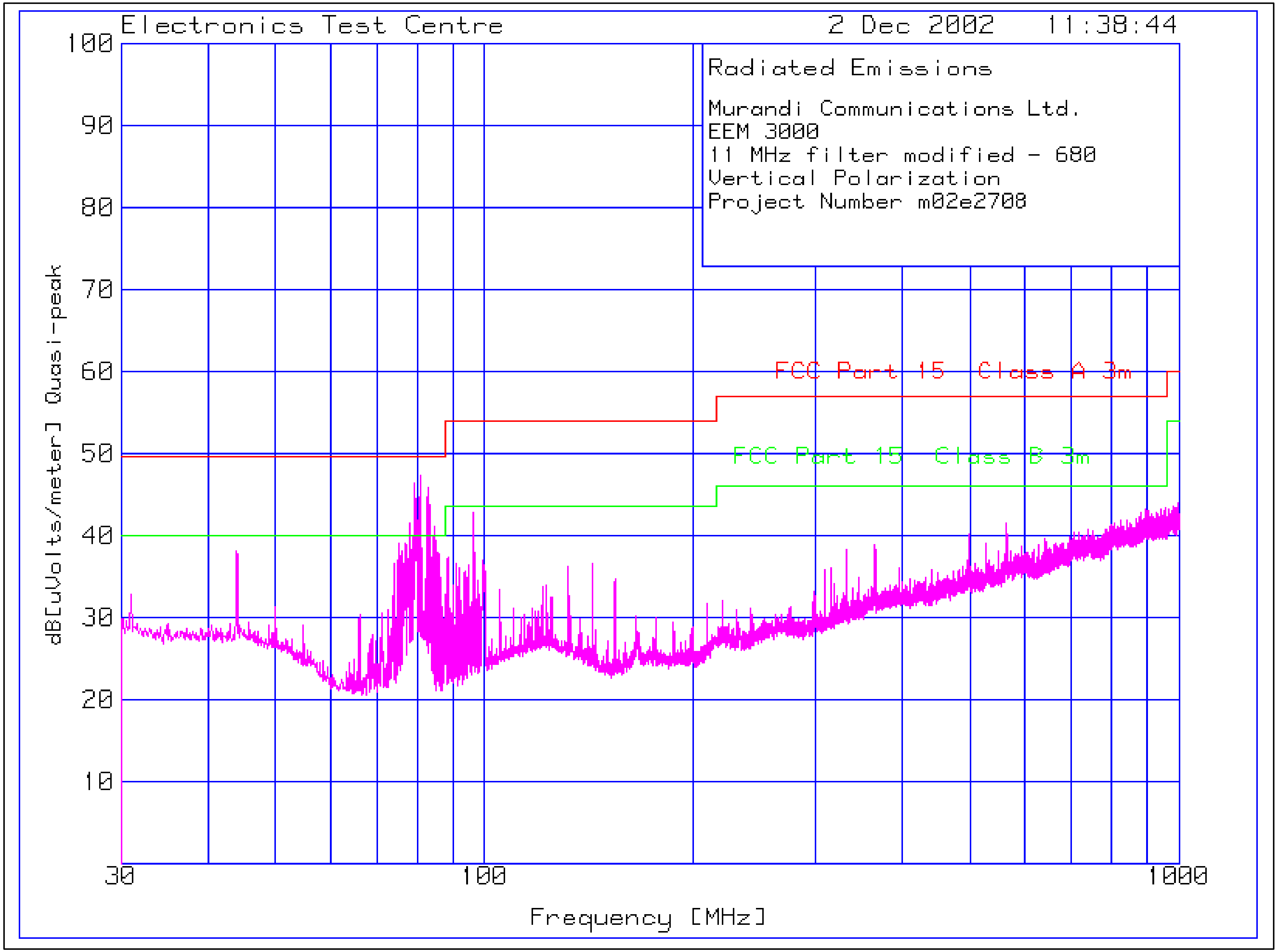
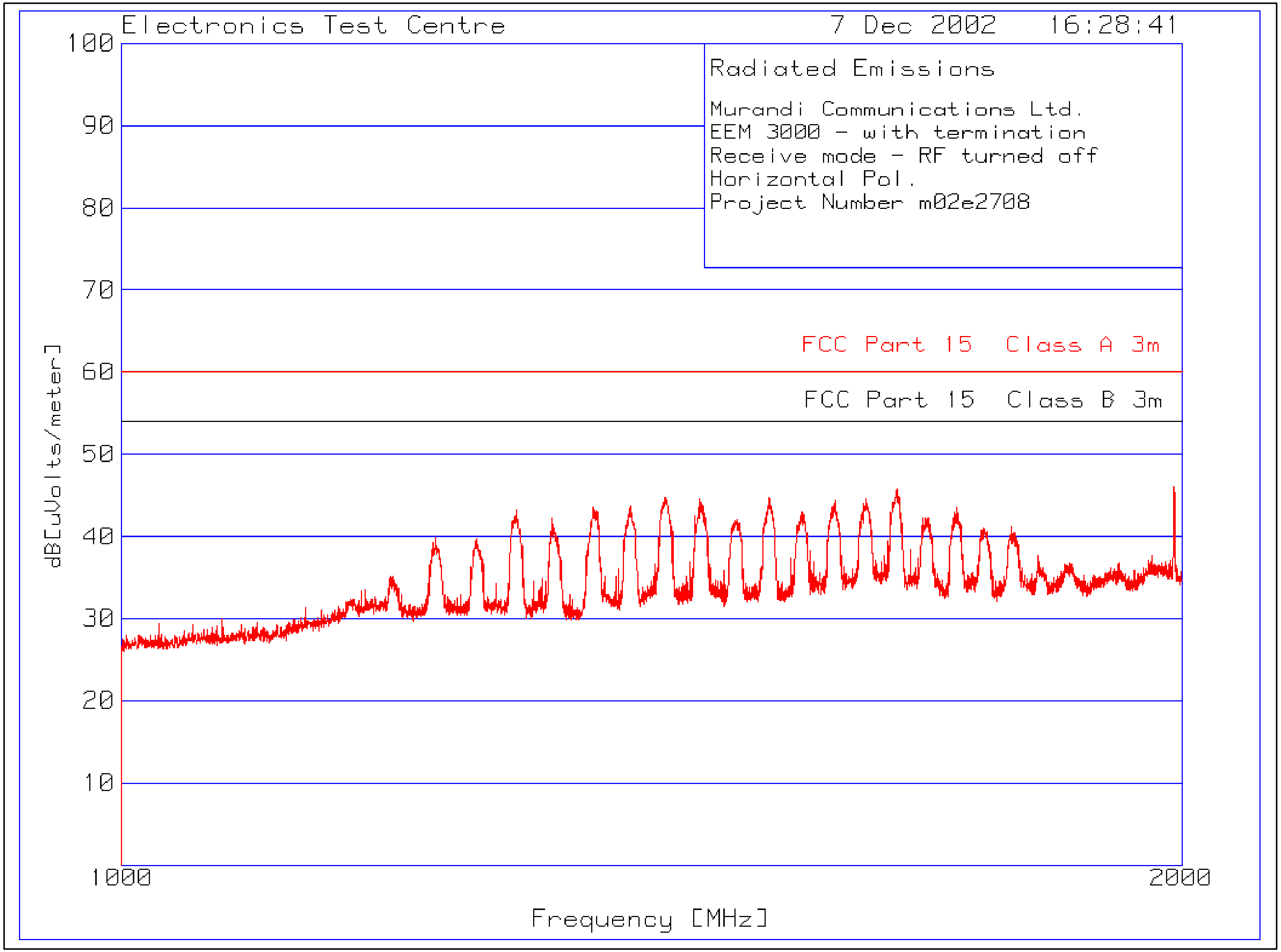
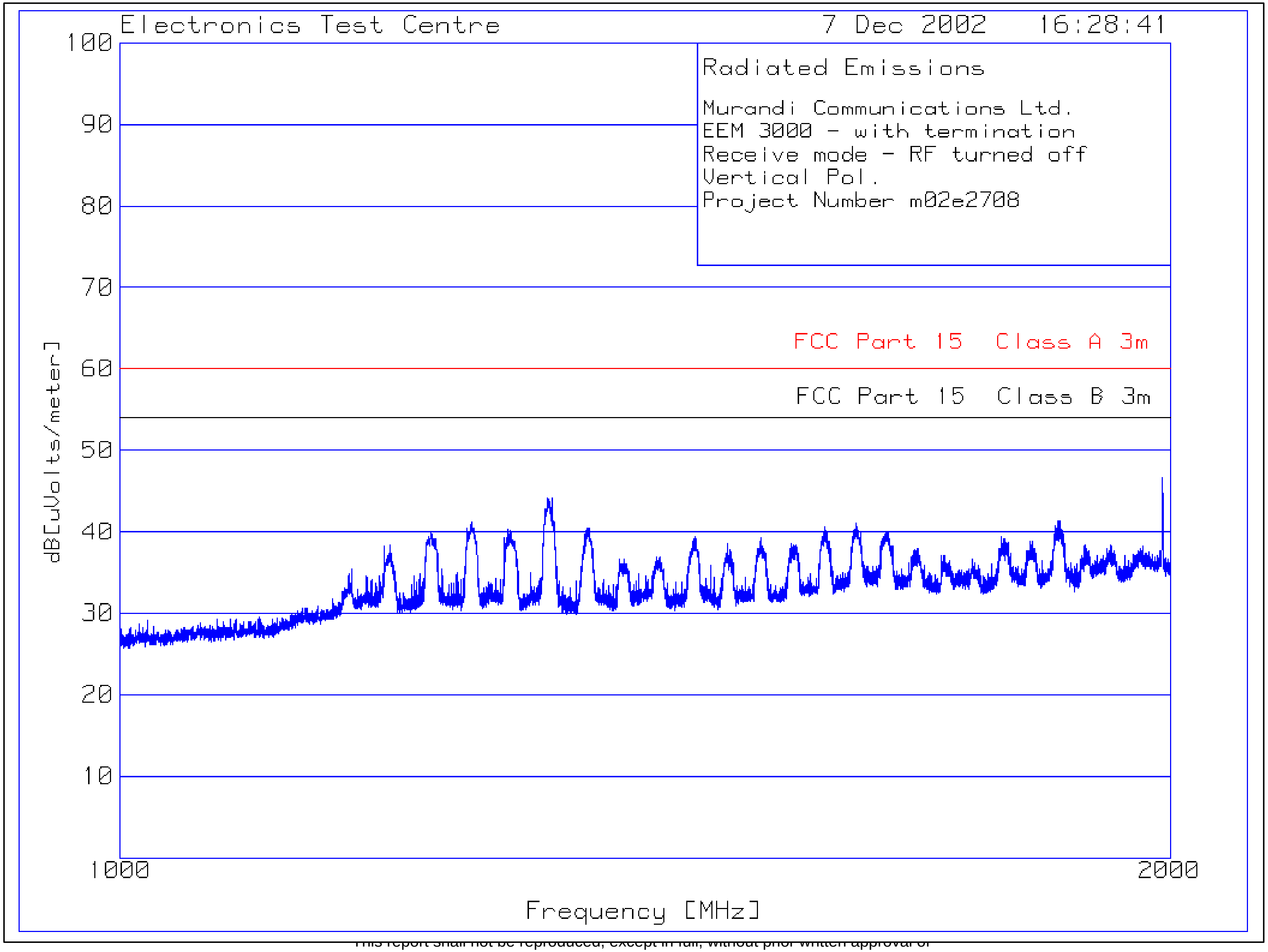
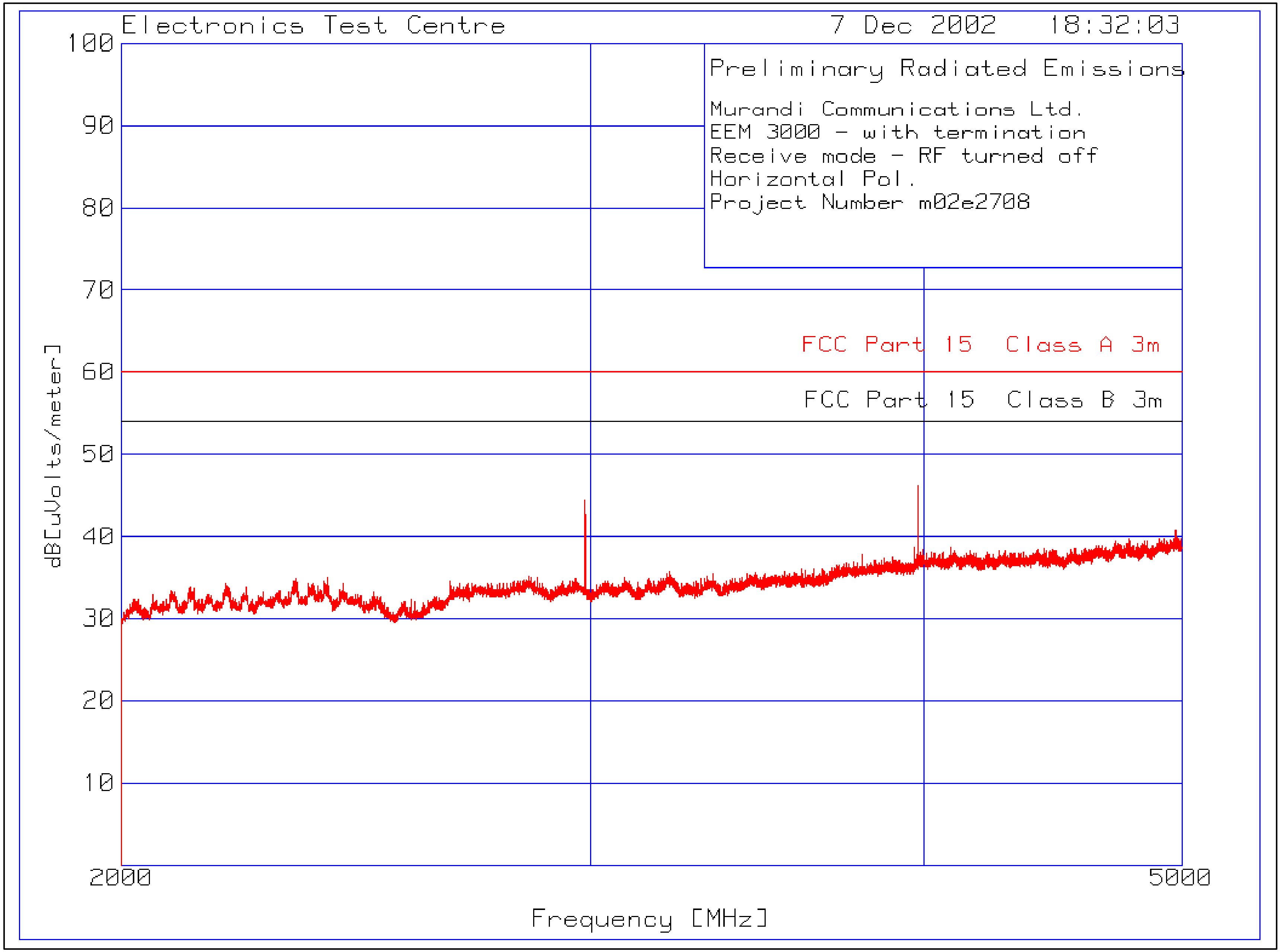

Electronics Test Centre
Preliminary Radiated Emissions
Test Chamber Ambient
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
CISPR Class A 3m
CISPR Class B 3m
dB[uVolts/meter]
120
110
100
90
80
70
60
50
40
30
30
100
1000
Frequency [MHz]

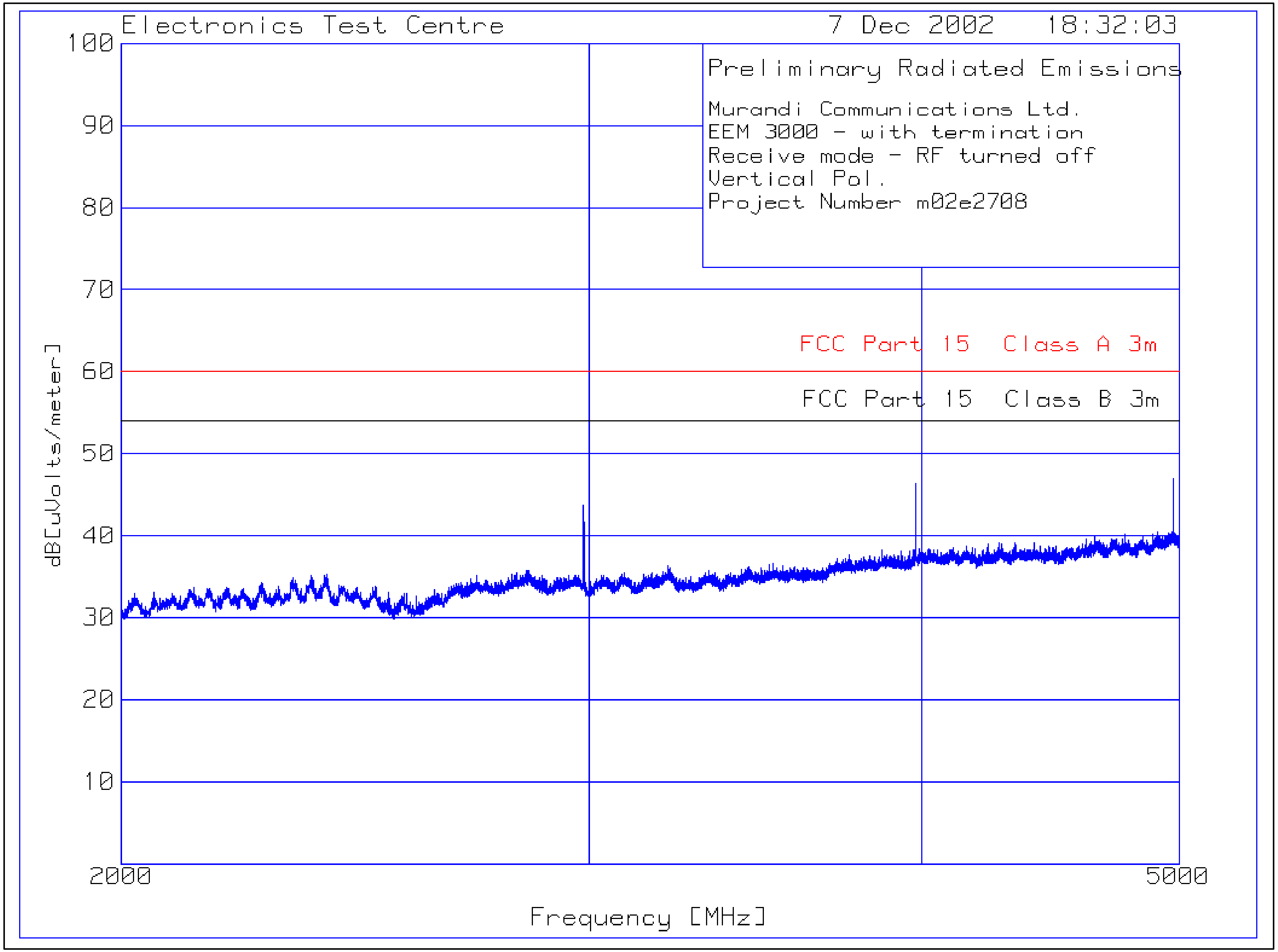

Electronics Test Centre
2 Dec 2002 11:38:44
Radiated Emissions
Murandi Communications Ltd.
EEM 3000
11 MHz filter modified - 680
Horizontal Polarization
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter]
100
90
80
70
60
50
40
30
20
10
30
100
1000
Frequency [MHz]


Electronics Test Centre
2 Dec 2002 11:38:44
Radiated Emissions
Murandi Communications Ltd.
EEM 3000
11 MHz filter modified - 680
Vertical Polarization
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter] Quasi-peak
100
90
80
70
60
50
40
30
20
10
30
100
1000
Frequency [MHz]


Electronics Test Centre
7 Dec 2002 16:28:41
Radiated Emissions
Murandi Communications Ltd.
EEM 3000 - with termination
Receive mode - RF turned off
Horizontal Pol.
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter]
100
90
80
70
60
50
40
30
20
10
1000
2000
Frequency [MHz]


Electronics Test Centre
7 Dec 2002 16:28:41
Radiated Emissions
Murandi Communications Ltd.
EEM 3000 - with termination
Receive mode - RF turned off
Vertical Pol.
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter]
100
90
80
70
60
50
40
30
20
10
1000
2000
Frequency [MHz]


Electronics Test Centre
7 Dec 2002 18:32:03
Preliminary Radiated Emissions
Murandi Communications Ltd.
EEM 3000 - with termination
Receive mode - RF turned off
Horizontal Pol.
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter]
100
90
80
70
60
50
40
30
20
10
2000
5000
Frequency [MHz]



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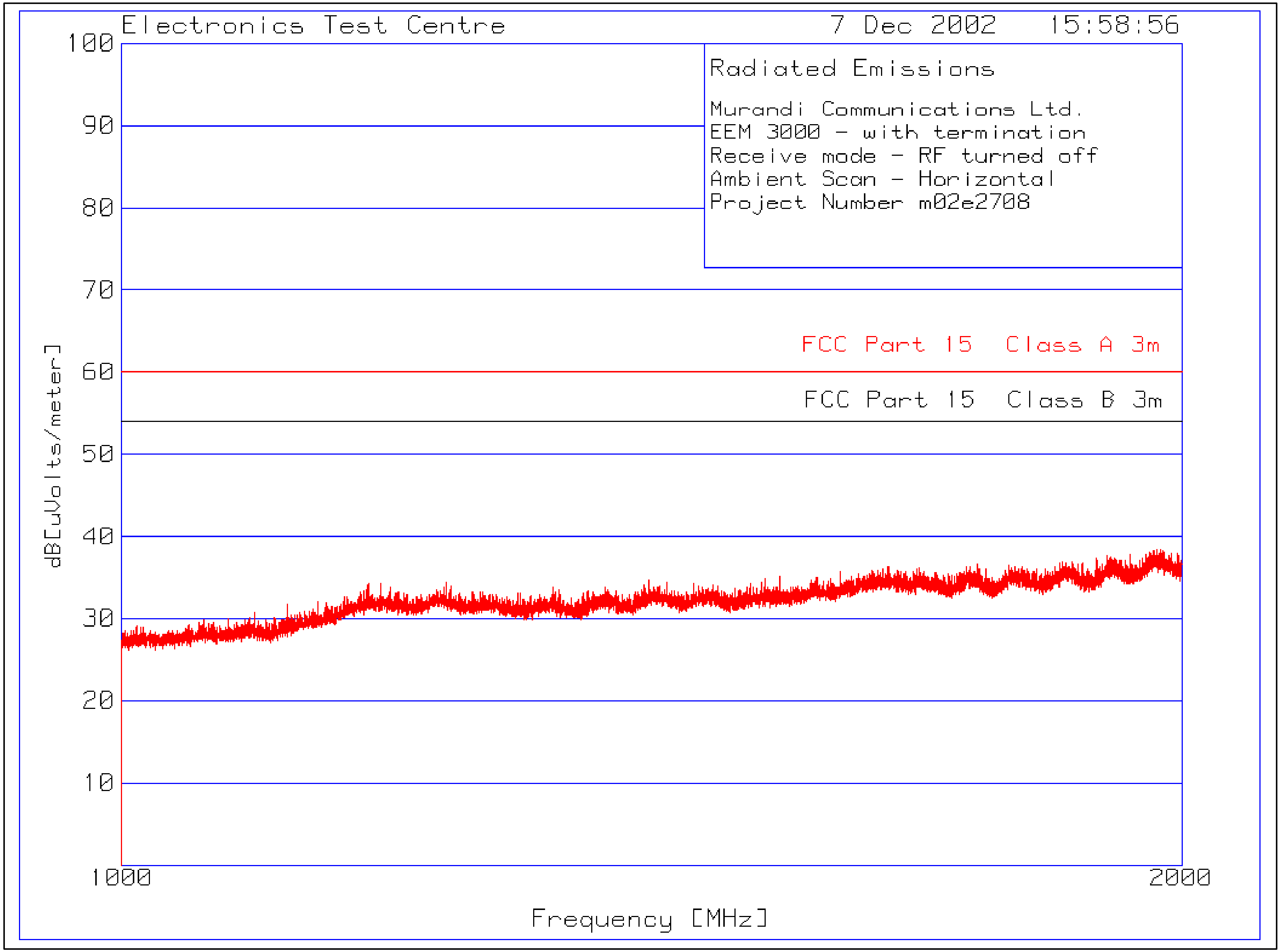
Electronics Test Centre
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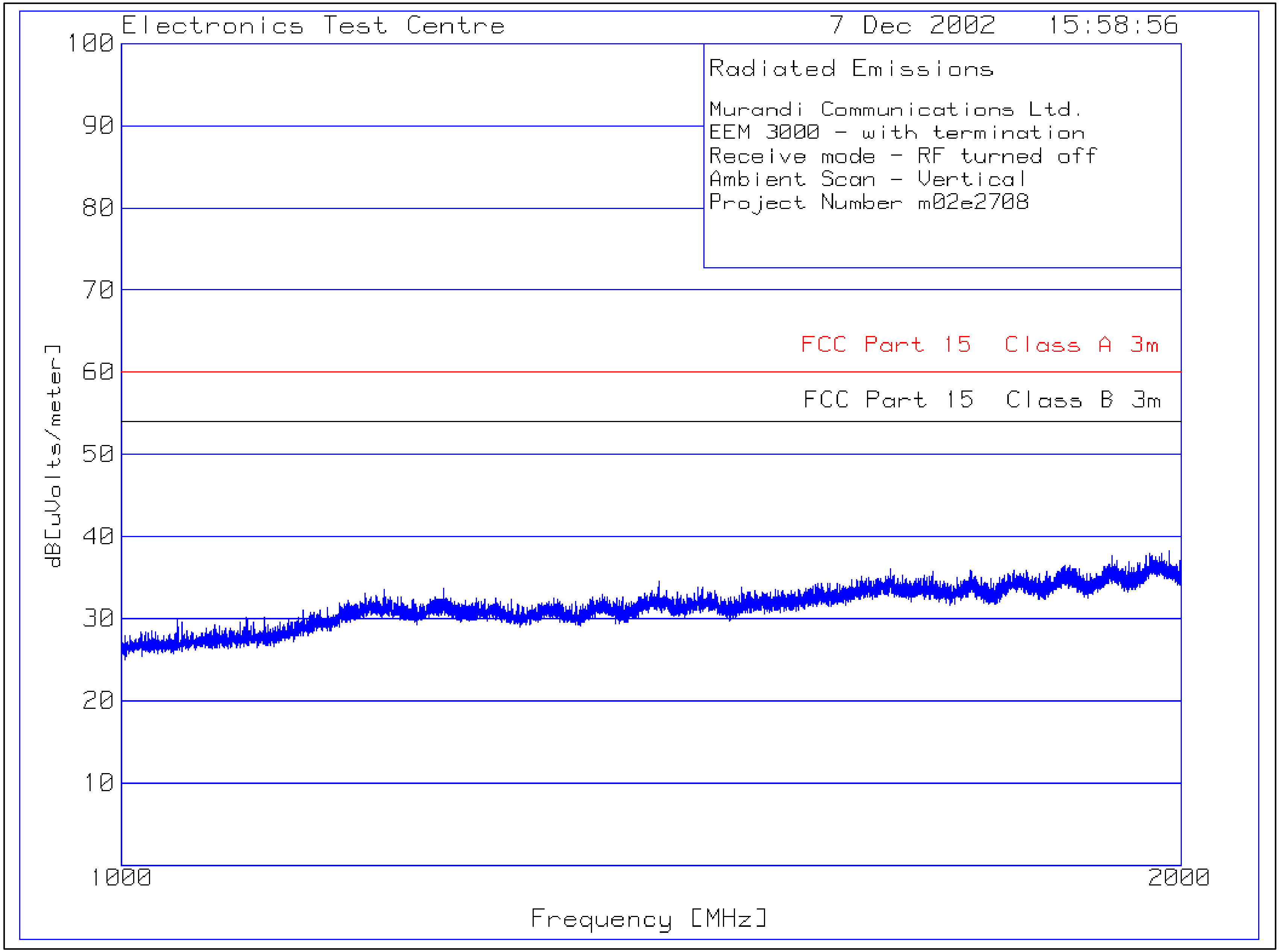
Radiated Emissions
Murandi Communications Ltd.
EEM 3000 - with termination
Receive mode - RF turned off
Ambient Scan - Horizontal
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
100
90
80
70
60
50
40
30
20
10
dB[uVolts/meter]
1000
2000
Frequency [MHz]



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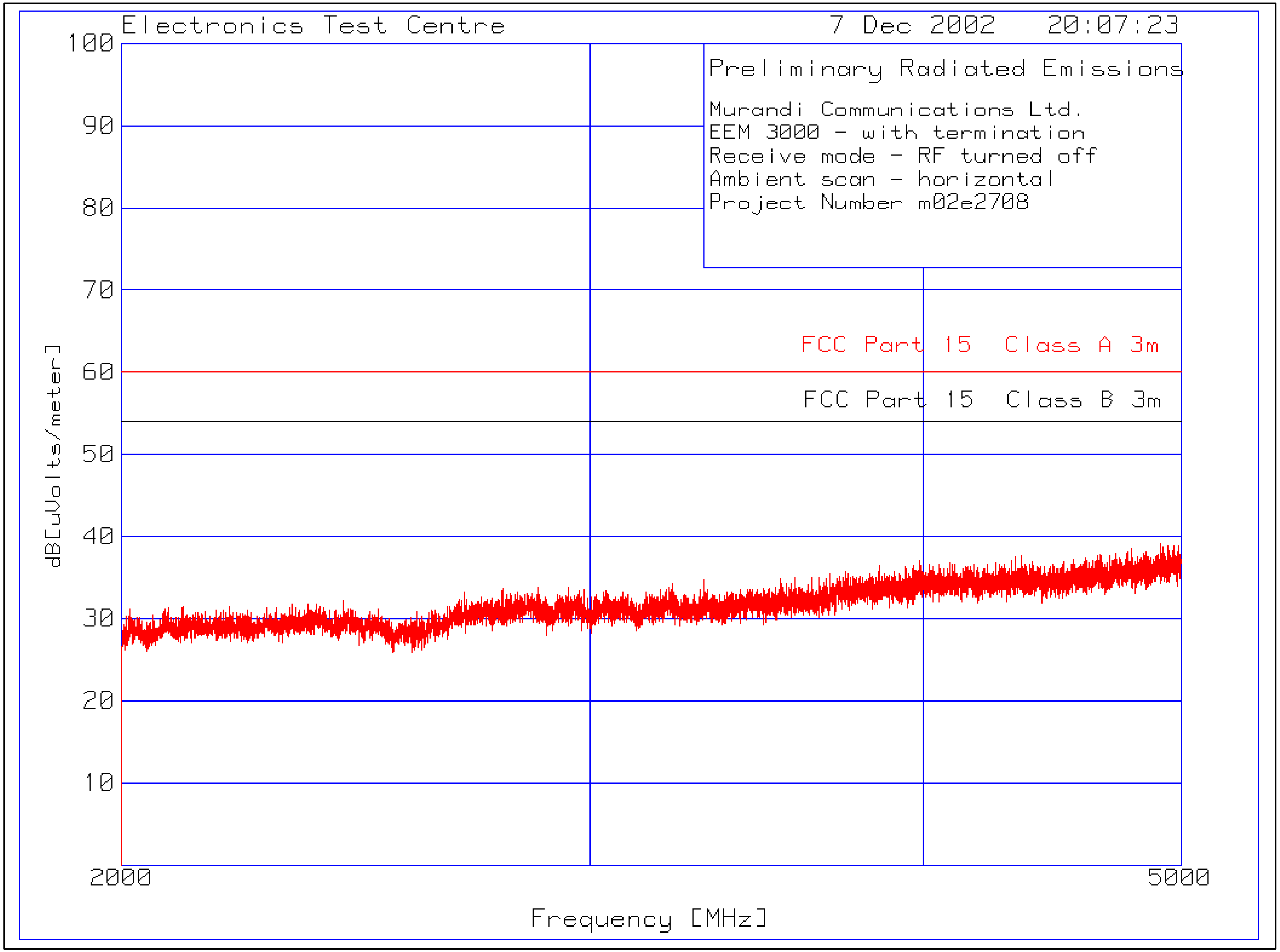
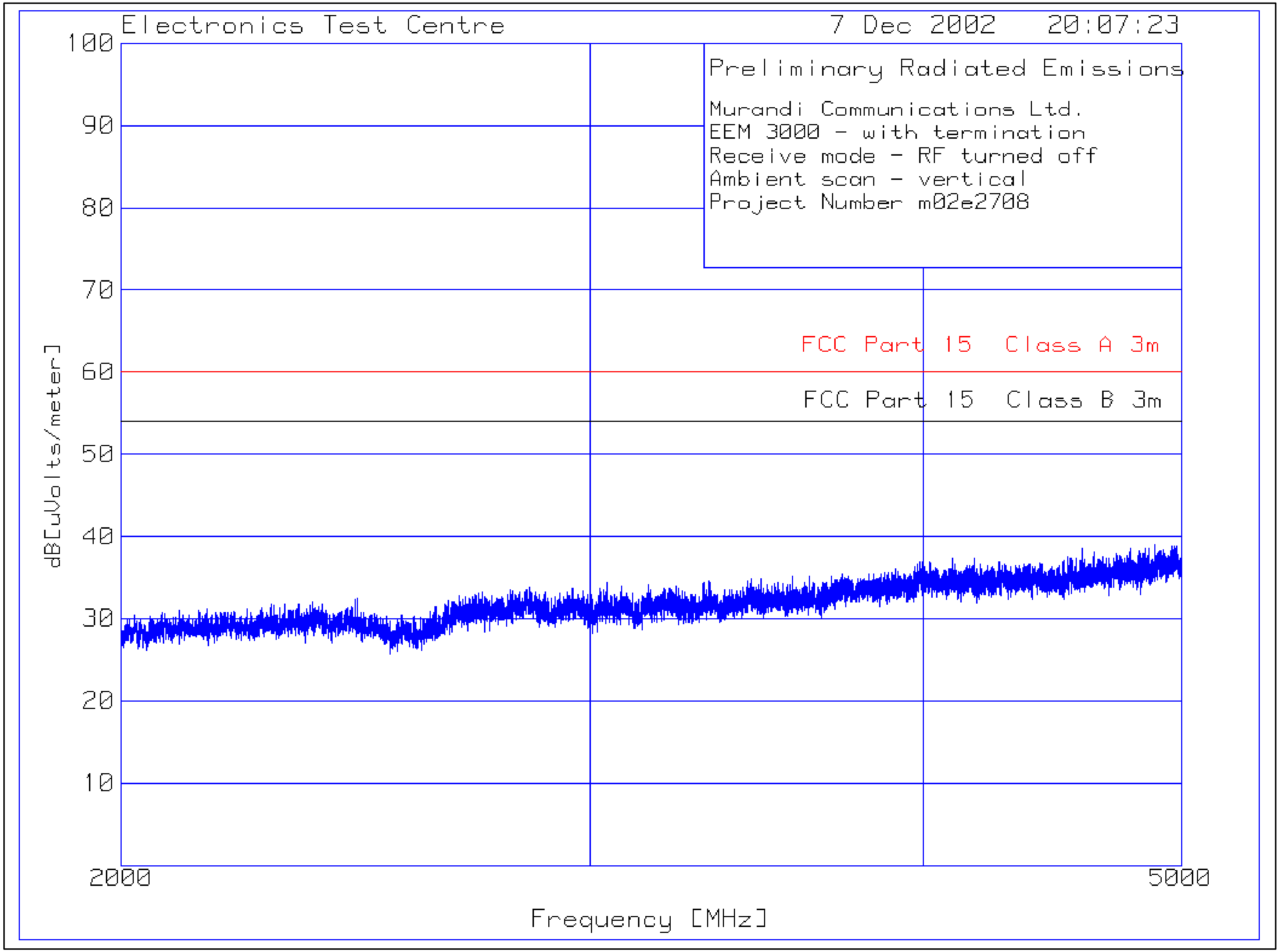

Electronics Test Centre
7 Dec 2002 20:07:23
Preliminary Radiated Emissions
Murandi Communications Ltd.
EEM 3000 - with termination
Receive mode - RF turned off
Ambient scan - horizontal
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter]
100
90
80
70
60
50
40
30
20
10
2000
5000
Frequency [MHz]


Electronics Test Centre
7 Dec 2002 20:07:23
Preliminary Radiated Emissions
Murandi Communications Ltd.
EEM 3000 - with termination
Receive mode - RF turned off
Ambient scan - vertical
Project Number m02e2708
FCC Part 15 Class A 3m
FCC Part 15 Class B 3m
dB[uVolts/meter]
100
90
80
70
60
50
40
30
20
10
2000
5000
Frequency [MHz]

4.3b Transmit Mode

<table>
<tr><td>Test Lab: MPB Technologies Inc. Airdrie
Test Personnel: David Raynes,
James MacKay
Dates: 28 November 2002 to 7 January 2003</td><td>Product:
EUM3003</td></tr>
<tr><td colspan="2">Test Result, EUM3003: PASS</td></tr>
<tr><td>Objectives/Criteria
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.
Note: See the below for the Restricted Bands of Operation per Part 15.205</td><td>Specification: FCC Part 15.209
Frequency [MHz] — Limit (QP @ 3m) [dBμV/m]
30 – 88 — 40.00
88 – 216 — 43.52
216 – 960 — 46.02
above 960 — 53.98
Emission levels should meet the requirements with a margin of 6dB.</td></tr>
</table>

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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

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Diversity Antenna:

nominal **f**$_c$ (MHz)	**f** (MHz)	Field Strength (dBµV/m) Average	Limit (dBµV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
905	2714.6918	26.26	53.98	-27.72	H	133	60
905	2714.9044	42.22	53.98	-11.76	H	133	60
905	2715.1040	46.12	53.98	-7.86	V	102	30
905	3619.9400	33.14	53.98	-20.84	H	101	30
905	3619.9790	46.25	53.98	-7.73	V	102	192
905	4525.0200	33.76	53.98	-20.22	H	103	90
905	4524.9288	45.23	53.98	-8.75	V	117	334
915	2745.0000	46.42	53.98	-11.56	V	127	11
915	2745.1727	42.62	53.98	-11.36	H	120	244
915	2775.0260	42.85	53.98	-11.13	V	112	128
915	2775.0360	44.54	53.98	-9.44	H	112	128
915	3600.3000	38.82	53.98	-15.16	H	103	1
915	3659.7950	43.94	53.98	-10.04	V	111	7
915	3660.3000	38.21	53.98	-15.77	H	102	115
915	3699.9406	45.40	53.98	-8.58	V	121	236
915	3700.4230	41.48	53.98	-12.50	H	102	44
915	4574.4000	42.66	53.98	-11.32	V	101	146
915	4575.3000	39.85	53.98	-14.13	H	102	115
915	4624.3900	42.65	53.98	-11.33	H	151	115
915	4625.0534	44.67	53.98	-9.31	V	143	44
925	2775.0260	42.85	53.98	-11.13	V	114	144
925	2775.0360	44.54	53.98	-9.44	H	112	128
925	3699.9406	45.40	53.98	-8.58	V	121	236
925	3700.4230	41.48	53.98	-12.50	H	102	44
925	4624.3900	42.65	53.98	-11.33	H	151	115
925	4625.0534	44.67	53.98	-9.31	V	143	44
40 dBµV/m ≥ All other emissions							

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Notes:

Except where indicated otherwise, for the rest of the atenna permutations, Peak measurements were performed with a broadband DRG horn.

Comparison of the Peak results with the Average values obtained during the engineering phase of this project indicates that the Average value is typically 20 dB down from the measured Peak.

During the test, the maximum emission from these directional antennas was invariably found to be on-axis, at an antenna height of 100 or 101 cm.

Emissions measuring below 100 µV per meter (40 dBµV/m) are not reported.

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Panel Antenna: Tx 905 MHz

f (MHz)	Field Strength (dBµV/m) (peak)	Limit (dBµV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2715.7550	45.78	53.98	≥ -8.2	V	101	360
3619.1270	42.16	53.98	≥ -11.82	V	101	360
4524.7820	39.36	53.98	≥ -14.62	V	101	360
5429.8840	38.54	53.98	≥ -15.44	V	101	360
8145.4620	46.08	53.98	≥ -7.9	V	101	360
9050.5530	47.99	53.98	≥ -5.99	V	101	360

Panel Antenna: Tx 915 MHz

f (MHz)	Field Strength (dBµV/m) (peak)	Limit (dBµV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2744.818	44.65	53.98	≥ -9.33	V	101	360
2754.33	44.67	53.98	≥ -9.31	V	101	360
3660.306	41.94	53.98	≥ -12.04	V	101	360
6404.1290	46.17	53.98	≥ -7.81	V	101	360
7319.483	44.67	53.98	≥ -9.31	V	101	360
8234.58	47.79	53.98	≥ -6.19	V	101	360
9149.626	47.07	53.98	≥ -6.91	V	101	360

Panel Antenna: Tx 925 MHz

f (MHz)	Field Strength (dBµV/m) (peak)	Limit (dBµV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2775.0900	45.54	53.98	≥ -8.44	V	101	360
3700.8440	42.50	53.98	≥ -11.48	V	101	360
6475.7610	46.54	53.98	≥ -7.44	V	101	360
7400.8090	44.38	53.98	≥ -9.6	V	101	360
8324.0670	47.48	53.98	≥ -6.5	V	101	360
9249.5780	47.05	53.98	≥ -6.93	V	101	360

40 dBµV/m ≥ All other emissions

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Patch Antenna: Tx 905 MHz

f (MHz)	Field Strength (dBμV/m) Quasi-Peak	Limit (dBμV/m) Average	Delta (dB)
all emissions	< 40	53.98	≥ 13.98

Patch Antenna: Tx 915 MHz

f (MHz)	Field Strength (dBμV/m) (peak)	Limit (dBμV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2744.2190	53.35	53.98	≥ -.33	H	101	0
2744.5700	53.65	53.98	≥ -.63	H	101	0
4574.9560	48.39	53.98	≥ -5.59	H	101	0
5490.4020	47.07	53.98	≥ -6.91	H	101	0
6405.4040	53.57	53.98	≥ -.41	H	101	0
6405.9430	53.27	53.98	≥ -.71	H	101	0
7320.5930	51.17	53.98	≥ -2.81	H	101	0
8235.1280	52 .60	53.98	≥ -1.38	H	101	0
9149.1770	53.88	53.98	≥ -.10	H	101	0

Patch Antenna: Tx 925 MHz

f (MHz)	Field Strength (dBμV/m) (peak)	Limit (dBμV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2774.7000	53.04	53.98	≥ -.94	V	101	0
3699.2280	52.09	53.98	≥ -1.89	V	101	0
3699.2780	51.29	53.98	≥ -2.69	V	101	0
4625.2180	47.13	53.98	≥ -6.85	V	101	0
5550.4200	45.79	53.98	≥ -8.19	V	101	0
6475.0240	53.24	53.98	≥ -.74	V	101	0
7399.6800	50.58	53.98	≥ -3.4	V	101	0
8324.6460	52.37	53.98	≥ -.71	V	101	0
9250.9290	53.17	53.98	≥ -.81	V	101	0

40 dBμV/m ≥ All other emissions

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Yagi Antenna: Tx 905 MHz

f (MHz)	Field Strength (dBμV/m) (peak)	Limit (dBμV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2714.393	46.46	53.98	≥ -7.52	V	101	0
3619.363	42.66	53.98	≥ -11.32	V	101	0
6335.551	46.3	53.98	≥ -7.68	V	101	0
7239.133	43.97	53.98	≥ -10.01	V	101	0
8145.254	46.88	53.98	≥ -7.1	V	101	0
9050.751	47.88	53.98	≥ -6.1	V	101	0

Yagi Antenna: Tx 915 MHz

f (MHz)	Field Strength (dBμV/m) (peak)	Limit (dBμV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2744.1660	46.15	53.98	≥ -7.83	V	101	0
3660.316	41.94	53.98	≥ -12.04	V	101	0
6405.224	46.37	53.98	≥ -7.61	V	101	0
7319.636	44.07	53.98	≥ -9.91	V	101	0
8234.039	47.38	53.98	≥ -6.6	V	101	0
9149.295	53.08	53.98	≥ -.9	V	101	0

Yagi Antenna: Tx 925 MHz

f (MHz)	Field Strength (dBμV/m) (peak)	Limit (dBμV/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
2774.554	53.44	53.98	≥ - 0.54	V	101	0
3699.392	49.49	53.98	≥ -4.49	V	101	0
4624.852	45.52	53.98	≥ -8.46	V	101	0
5549.174	44.69	53.98	≥ -9.29	V	101	0
6474.970	52.45	53.98	≥ -1.53	V	101	0
7400.649	52.45	53.98	≥ -3.20	V	101	0
8324.177	50.77	53.98	≥ -3.21	V	101	0
9250.474	53.06	53.98	≥ -.92	V	101	0

40 dBμV/m ≥ All other emissions

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Picture of Radiated Emissions Setup: EUM 3003.

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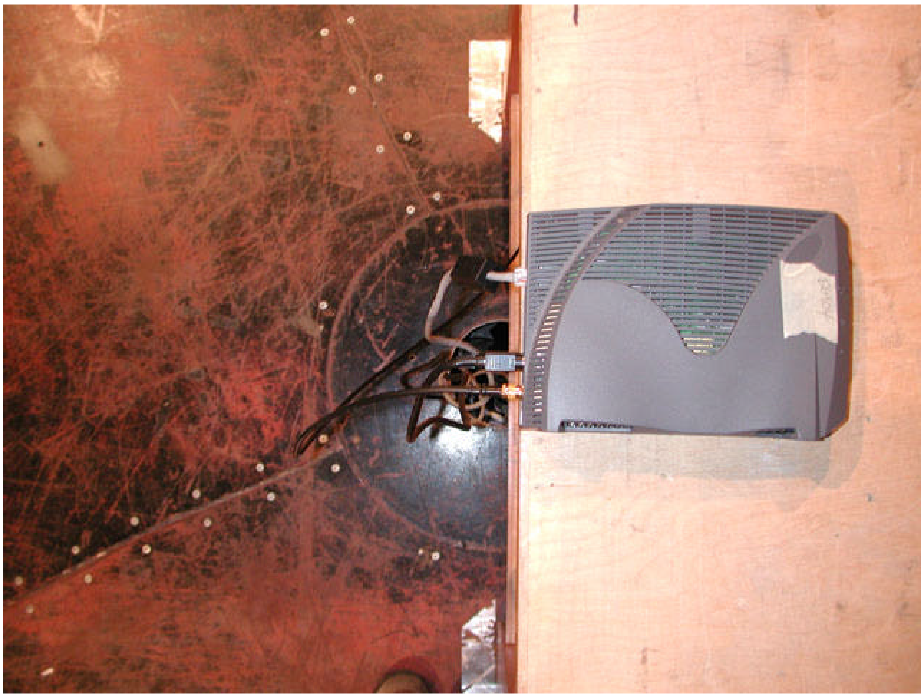
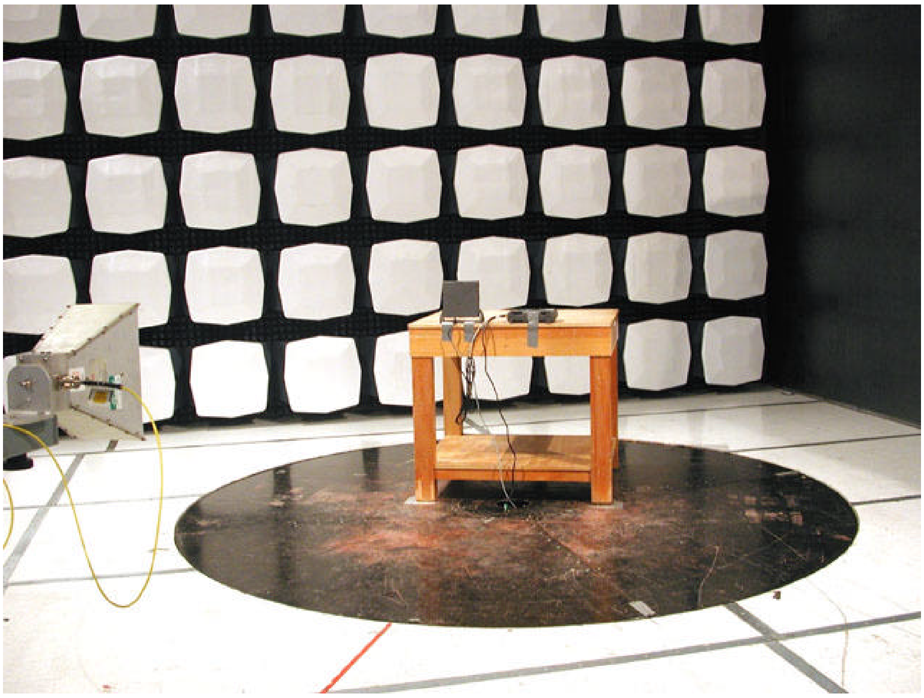
Picture of Radiated Emissions Setup: EUM 3003.



Picture of Radiated Emissions Setup: EUM 3003 with Diversity Antenna.



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Picture of Radiated Emissions Setup: EUM 3003 with Diversity Antenna.

Picture of Radiated Emissions Setup: EUM 3003 with Diversity Antenna.

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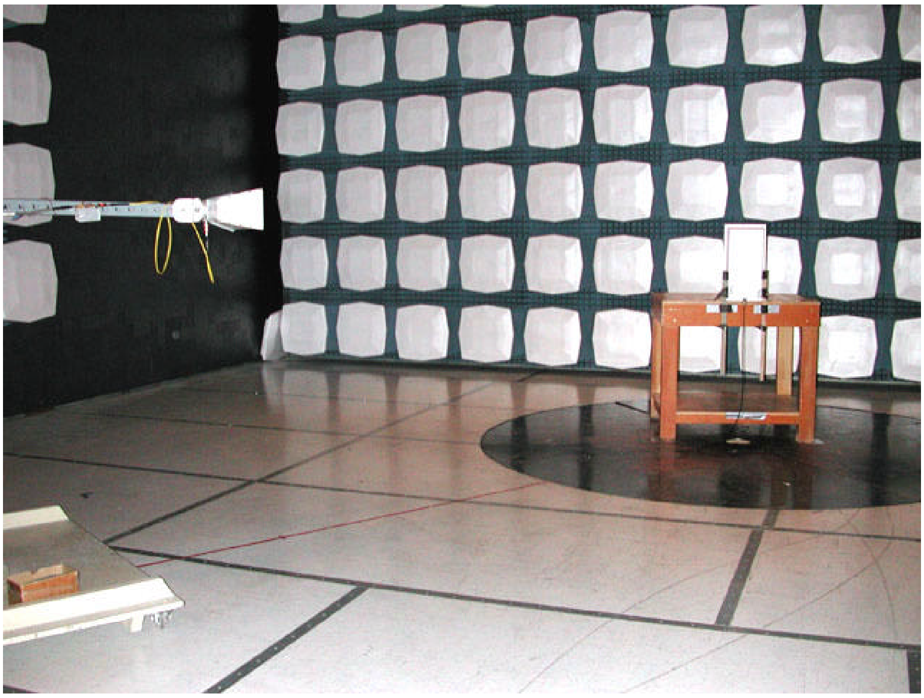
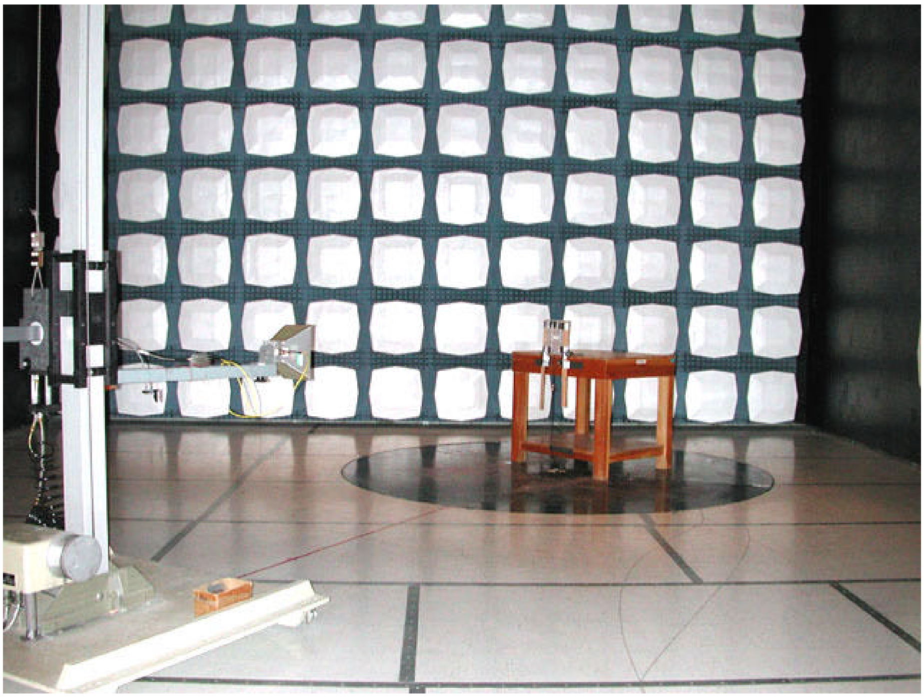
Picture of Radiated Emissions Setup: Panel Antenna



Picture of Radiated Emissions Setup: Patch Antenna



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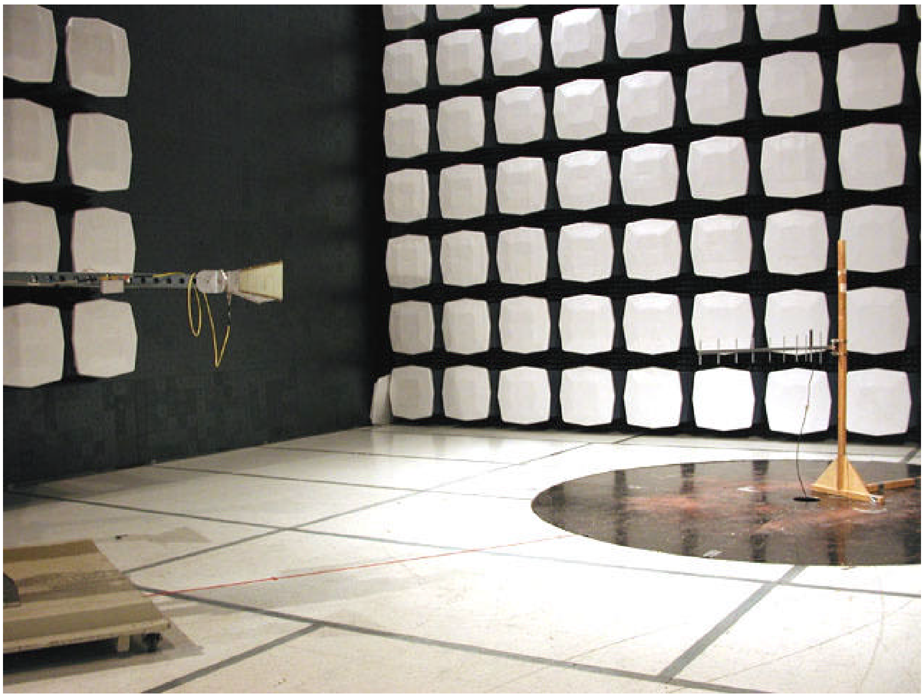
Picture of Radiated Emissions Setup: Yagi Antenna



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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. In accordance with Waverider Communications Inc. specifications, the EUT was not grounded.

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.

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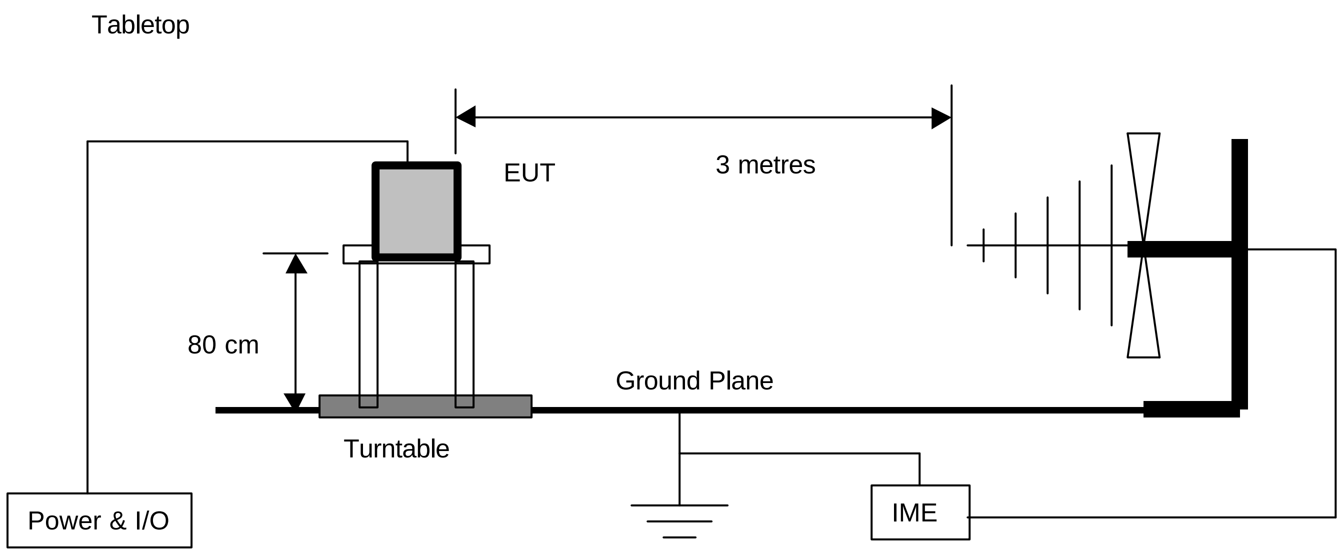
5.5 TEST CONFIGURATION

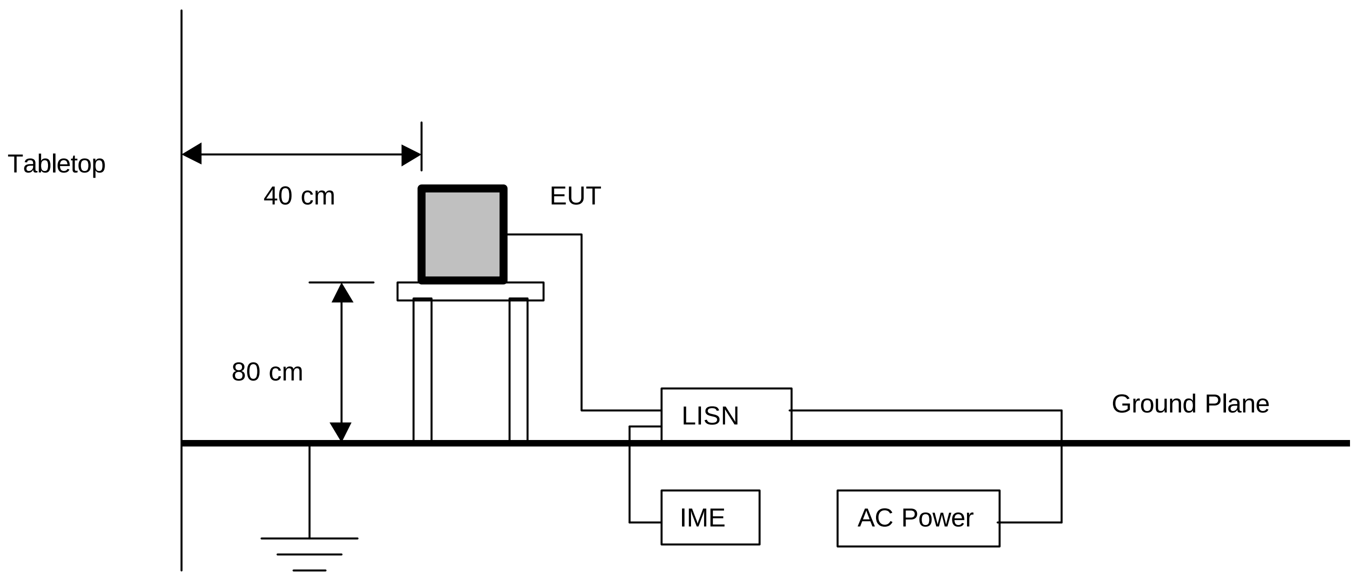
Tabletop Equipment

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



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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

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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	Hewlett Packard	8566B	9565	13 November 2003
Spectrum Analyzer	Hewlett Packard	8566B	9168	10 December 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	4411	30 July 2004
Quasi-Peak Adapter	Hewlett Packard	85650A	9243	7 August 2004
Line Impedance Stabilization Network	EMCO	3825/2r	9331	2 November 2003
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	4 Decenber 2003

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Appendix A

EUM3003

Test Sample Description
(from data provided by Waverider Communications Inc.)

Product Application	**Product Category**
Commercial ✓ Military o	Telecommunications o Aerospace o Information Technology ✓ Test & Measurement o Surface Transportation o Other o ________________________
Product Name	EUM3003
Part/Model No.	EUM3003
Serial Number	n/a
Power Requirements: **(Voltage, AC/DC, Hz, Current)**	120 VAC 60 Hz to AC-DC adaptor
Typical Installation Instructions or Configuration	Connected via an Ethernet cable with a ferrite bead to a personal computer or an Ethernet router. Antenna fixed mounted at a minimum of 20cm from user.
Ground Connection **(in addition to power cord)**	Nil
Internally Generated Frequencies	32.768 kHz (microprocessor) 3.6864 MHz (microprocessor) 11 MHz (DSSS BBP) 22 MHz (synthesizer reference) 25 MHz (Ethernet reference) 44 MHz (reference oscillator) 70 MHz (Intermediate Frequency) 140 MHz (IF Oscillator) 905 – 925 MHz (RFLO – IF) 975 – 995 MHz (Radio Frequency Local Oscillator)
Peripheral Support Equipment	Personal Computer
Description and number of interconnecting Leads & Cables	One Ethernet cable with ferrite bead attached. One power supply cable One Antenna
Brief Functional Description	The EUM3003 is a 900MHz radio module intended to provide connectivity between an end-user's computer and an Internet Service Provider. It is a single PCB wireless solution based on the Intersil PRISM II Direct Sequence Chip Set. Data from the I/O port is spread using a defined PN code and then modulated using CCK modulation. The modulated signal is then up-converted to the 900MHz band. In receive mode, the signal from the antenna port is amplified and then down converted to an IF freqeuncy of 70MHz before it is demodulated and despread.

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