

Test Report Prepared By:

Electronics Test Centre

27 East Lake Hill

Airdrie, Alberta

Canada

T4A 2K3

[airdrie@etc-mpbtech.com](mailto:airdrie@etc-mpbtech.com)

<http://www/etc-mpb.com/>

Telephone: (403) 912-0037

Facsimile: (403) 912-0083

MPBT Report Number m01e3533 Release 1

Date: 23 March 2006

**Emissions Testing of the WaveRider EUM 3005**

**in accordance with FCC Part 15.247 (2004)**

**Spread Spectrum Operation 902 – 928 & 2400 – 2483.5 & 5725 – 5850 MHz.**

Test Personnel: T. Nguyen, H. Shahryar, I. Romanov

Prepared for: Murandi Communications Ltd.

240, 6715 – 8<sup>th</sup> Street N.E.

Calgary, Alberta

Canada

T2E 7H7

Telephone: 403-777-9988 x226 or 252

Facsimile: 403-777-9989

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

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APPENDIX A: Test Sample Description: WaveRider EUM 3005

## **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 15.247 (2004), Spread Spectrum Operation 902 - 928 & 2400 - 2483.5 & 5725 – 5850 MHz.

All test procedures, limits, and results defined in this document apply to the Murandi Communications Ltd. WaveRider EUM 3005 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.

### **1.2 APPLICANT**

This test report has been prepared for Murandi Communications Ltd., located in Calgary, Alberta, Canada.

### **1.3 TEST SAMPLE DESCRIPTION**

The test sample provided for testing was a WaveRider EUM 3005.

Product Type:	Wireless Modem
Model Number:	WaveRider EUM 3005
Serial Number:	N/A
Cables:	Ethernet cables, Power cable, RF Antenna
Power Requirements:	120 VAC
Peripheral Equipment:	Personal Computer

More detailed information is provided by Murandi Communications Ltd. in Appendix A.

### **1.4 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.

## 1.5 SCOPE OF TESTING

Testing was performed in accordance with FCC Part 15 Subpart C (2004), and ANSI C63.4 (2004).

### 1.5.1 VARIATIONS IN TEST METHODS

There were no variations from the test procedures outlined above.

### 1.5.2 TEST SAMPLE CONFIGURATION & MODIFICATIONS

The EUT met the requirements without modification.

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

### **3.0 TEST RESULTS**

#### **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 **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.

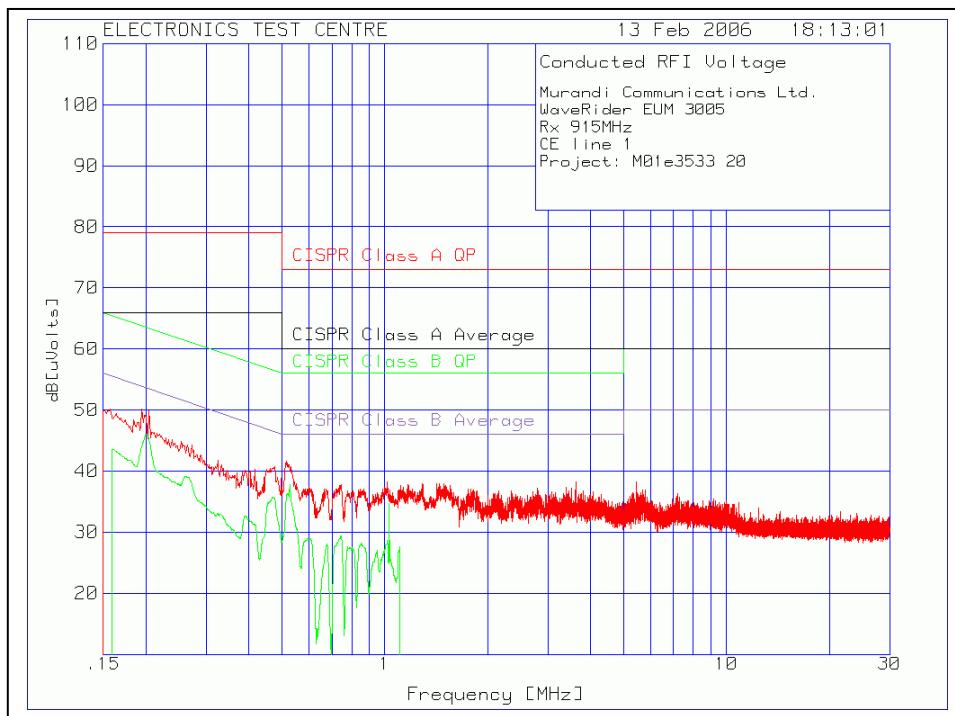
TEST CASE	TEST TYPE	SPECIFICATION	TEST SAMPLE	MOD. STATE	CONFIGURATION	RESULT
§ 3.1	Conducted Emissions at AC lines	FCC Part 15.107 and 15.207	WaveRider EUM 3005	nil	See § 1.6.2	<b>PASS</b>
§ 3.2	Conducted Emissions at Antenna Port	FCC Part 15.247	WaveRider EUM 3005	nil	See § 1.6.2	<b>PASS</b>
§ 3.3.1	Radiated Emissions (Rx Mode)	FCC Part 15.109	WaveRider EUM 3005	nil	See § 1.6.2	<b>PASS</b>
§ 3.3.2	Radiated Emissions (Tx Mode)	FCC Parts 2.1053, 15.205, 15.209 & 15.247	WaveRider EUM 3005	nil	See § 1.6.2	<b>PASS</b>

### 3.1 CONDUCTED EMISSIONS ON AC POWER LINES (15.107 & 15.207)

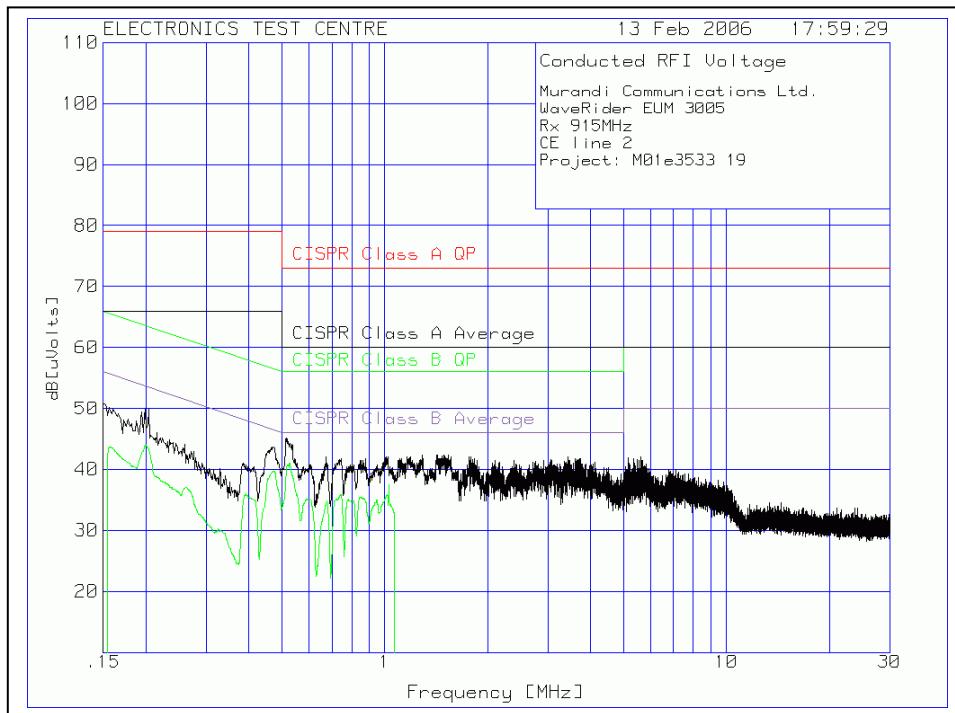
#### 3.1.1 Receive Mode (Part 15.107)

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: T. Nguyen H. Shahryar, I. Romanov Test Date: 13 February 2006	Product: WaveRider EUM 3005																									
Test Result, WaveRider EUM 3005 : <b>PASS</b>																										
Objectives/Criteria  The Conducted emissions produced by a system or sub-system shall not exceed the limits for the specifications as stated.  The EUT was assessed against the requirements for <u><b>Class B</b></u> .  Temperature = 22.5 °C   Humidity = 25 %	Specification:  <table><thead><tr><th>Frequency (MHz)</th><th colspan="2">Class A</th><th colspan="2">Class B</th></tr><tr><th></th><th>QP</th><th>Avg</th><th>QP</th><th>Avg</th></tr></thead><tbody><tr><td>0.150 - 0.50</td><td>79</td><td>66</td><td>66 - 56</td><td>56 - 46</td></tr><tr><td>0.50 - 5.0</td><td>73</td><td>60</td><td>56</td><td>46</td></tr><tr><td>5 - 30</td><td>73</td><td>60</td><td>60</td><td>50</td></tr></tbody></table> Units of measurement are dB $\mu$ V.	Frequency (MHz)	Class A		Class B			QP	Avg	QP	Avg	0.150 - 0.50	79	66	66 - 56	56 - 46	0.50 - 5.0	73	60	56	46	5 - 30	73	60	60	50
Frequency (MHz)	Class A		Class B																							
	QP	Avg	QP	Avg																						
0.150 - 0.50	79	66	66 - 56	56 - 46																						
0.50 - 5.0	73	60	56	46																						
5 - 30	73	60	60	50																						
<p>There were no emissions measured within -6 dB of the specified limit. Refer to the test data and plots for more detail.</p>																										

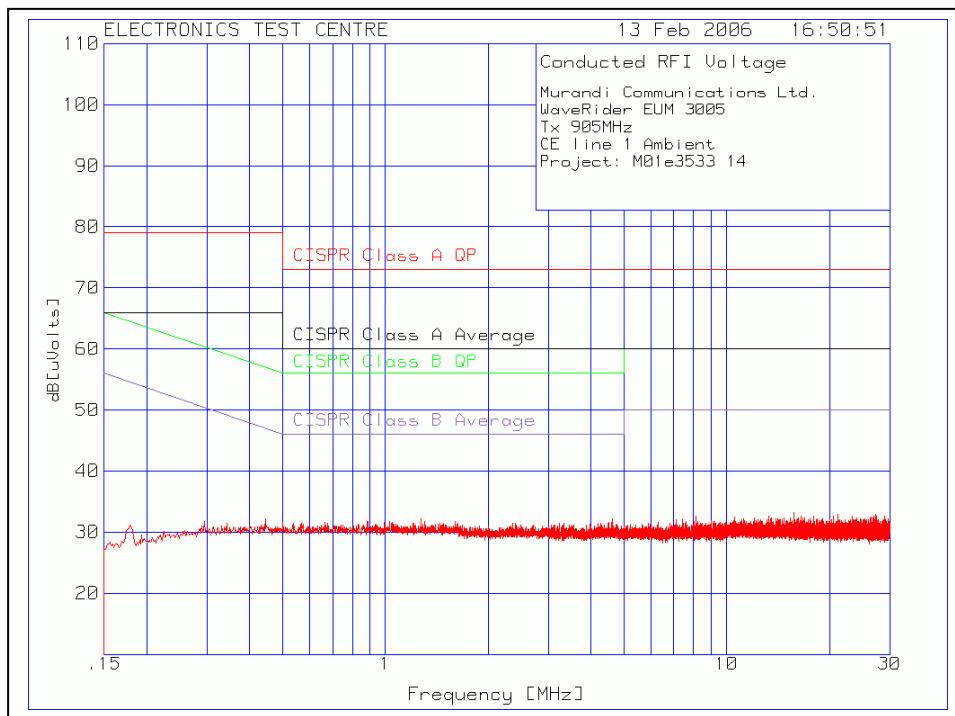
Plot of Conducted Emissions on AC Power Lines: Line 1 Peak



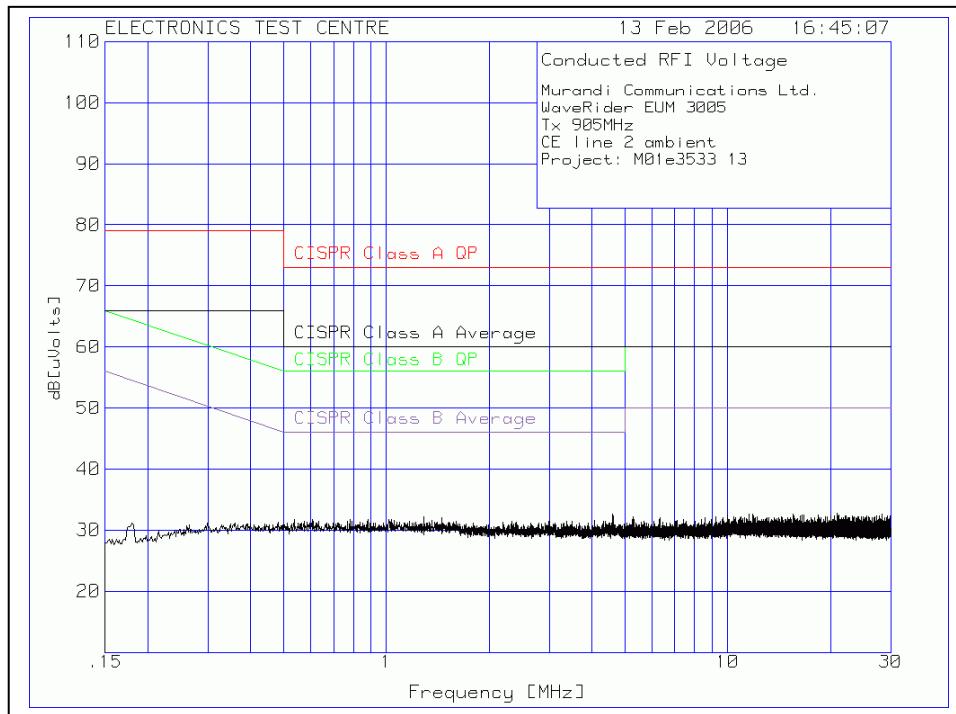
Plot of Conducted Emissions on AC Power Lines: Line 2 Peak



Plot of Conducted Emissions Test Chamber Ambient: (measurement noise floor): Line 1



Plot of Conducted Emissions Test Chamber Ambient: (measurement noise floor): Line 2

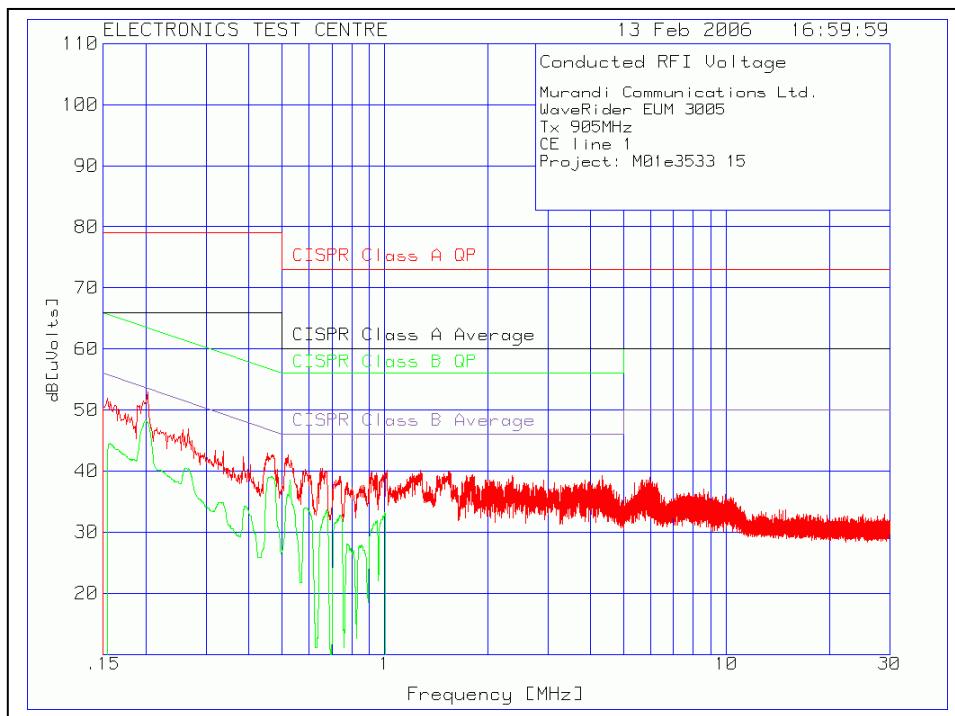


### 3.1.2 Transmit Mode (Part 15.207)

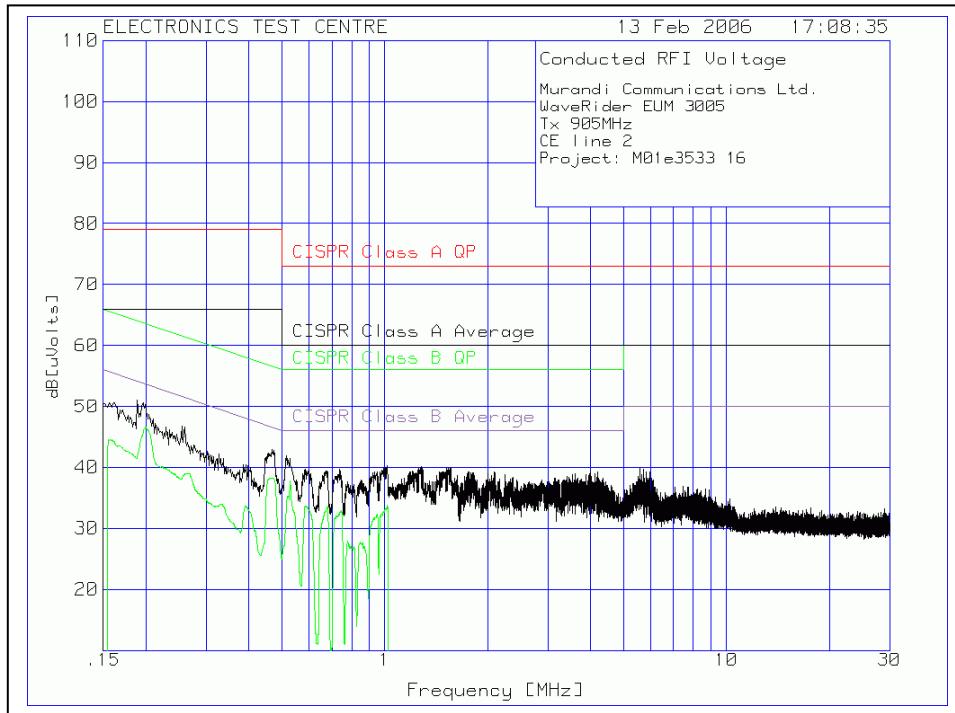
**f<sub>c</sub> = 905 MHz**

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: T. Nguyen, H. Shahryar, I. Romanov Test Date: 13 February 2006	Product: WaveRider EUM 3005																									
<b>Test Result, WaveRider EUM 3005 : PASS</b>																										
Objectives/Criteria  The Conducted emissions produced by a system or sub-system shall not exceed the limits for the specifications as stated.  The EUT was assessed against the requirements for <u>Class B</u> .  Temperature = 22.5 °C   Humidity = 25 %	Specification:  <table><thead><tr><th>Frequency (MHz)</th><th colspan="2">Class A</th><th colspan="2">Class B</th></tr><tr><th></th><th>QP</th><th>Avg</th><th>QP</th><th>Avg</th></tr></thead><tbody><tr><td>0.150 - 0.50</td><td>79</td><td>66</td><td>66 – 56</td><td>56 - 46</td></tr><tr><td>0.50 – 5.0</td><td>73</td><td>60</td><td>56</td><td>46</td></tr><tr><td>5 – 30</td><td>73</td><td>60</td><td>60</td><td>50</td></tr></tbody></table> Units of measurement are dB $\mu$ V.	Frequency (MHz)	Class A		Class B			QP	Avg	QP	Avg	0.150 - 0.50	79	66	66 – 56	56 - 46	0.50 – 5.0	73	60	56	46	5 – 30	73	60	60	50
Frequency (MHz)	Class A		Class B																							
	QP	Avg	QP	Avg																						
0.150 - 0.50	79	66	66 – 56	56 - 46																						
0.50 – 5.0	73	60	56	46																						
5 – 30	73	60	60	50																						
<p>There were no emissions measured within -6 dB of the specified limit. Refer to the test data and plots for more detail.</p>																										

Plot of Conducted Emissions on AC Power Lines: Line 1 Peak



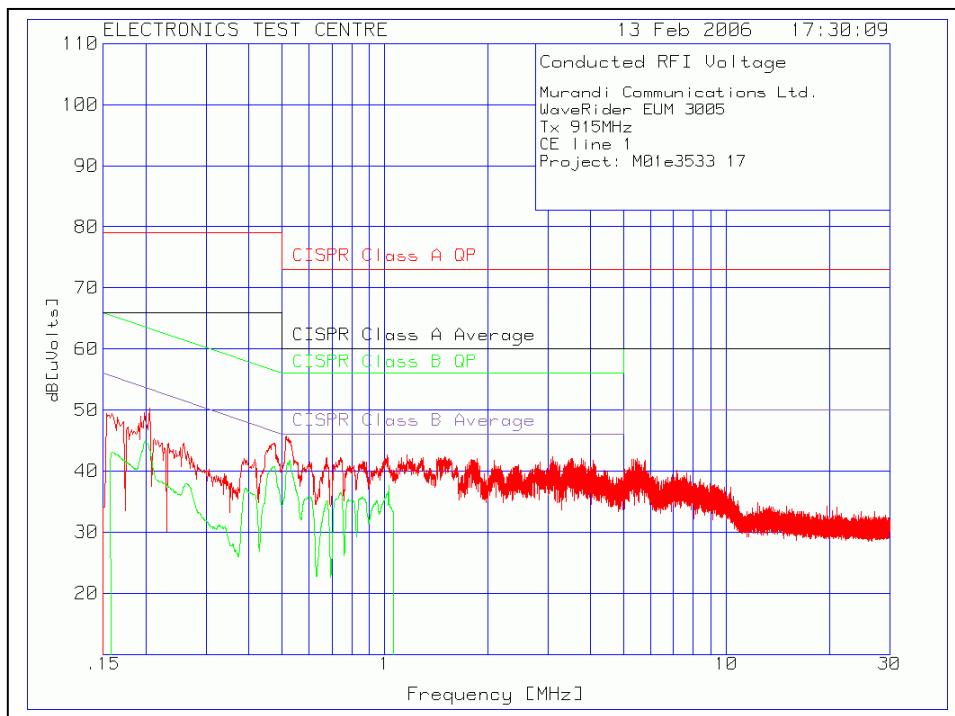
Plot of Conducted Emissions on AC Power Lines: Line 2 Peak



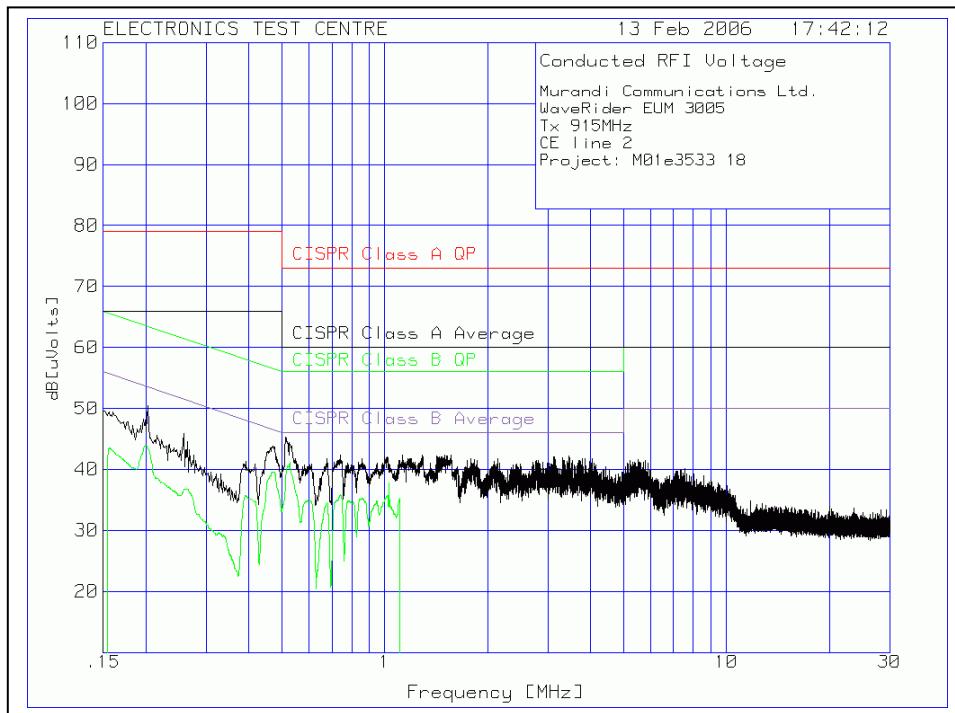
**f<sub>c</sub> = 915 MHz**

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: T. Nguyen, H. Shahryar, I. Romanov Test Date: 13 February 2006	Product: WaveRider EUM 3005																									
<b>Test Result, WaveRider EUM 3005 : PASS</b>																										
Objectives/Criteria  The Conducted emissions produced by a system or sub-system shall not exceed the limits for the specifications as stated.  The EUT was assessed against the requirements for <b>Class B</b> .  Temperature = 22.5 °C   Humidity = 25 %	Specification:  <table><thead><tr><th>Frequency (MHz)</th><th colspan="2">Class A</th><th colspan="2">Class B</th></tr><tr><th></th><th>QP</th><th>Avg</th><th>QP</th><th>Avg</th></tr></thead><tbody><tr><td>0.150 - 0.50</td><td>79</td><td>66</td><td>66 – 56</td><td>56 - 46</td></tr><tr><td>0.50 – 5.0</td><td>73</td><td>60</td><td>56</td><td>46</td></tr><tr><td>5 – 30</td><td>73</td><td>60</td><td>60</td><td>50</td></tr></tbody></table> Units of measurement are dB $\mu$ V.	Frequency (MHz)	Class A		Class B			QP	Avg	QP	Avg	0.150 - 0.50	79	66	66 – 56	56 - 46	0.50 – 5.0	73	60	56	46	5 – 30	73	60	60	50
Frequency (MHz)	Class A		Class B																							
	QP	Avg	QP	Avg																						
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0.50 – 5.0	73	60	56	46																						
5 – 30	73	60	60	50																						
<p>There were no emissions measured within -6 dB of the specified limit. Refer to the test data and plots for more detail.</p>																										

Plot of Conducted Emissions on AC Power Lines: Line 1 Peak



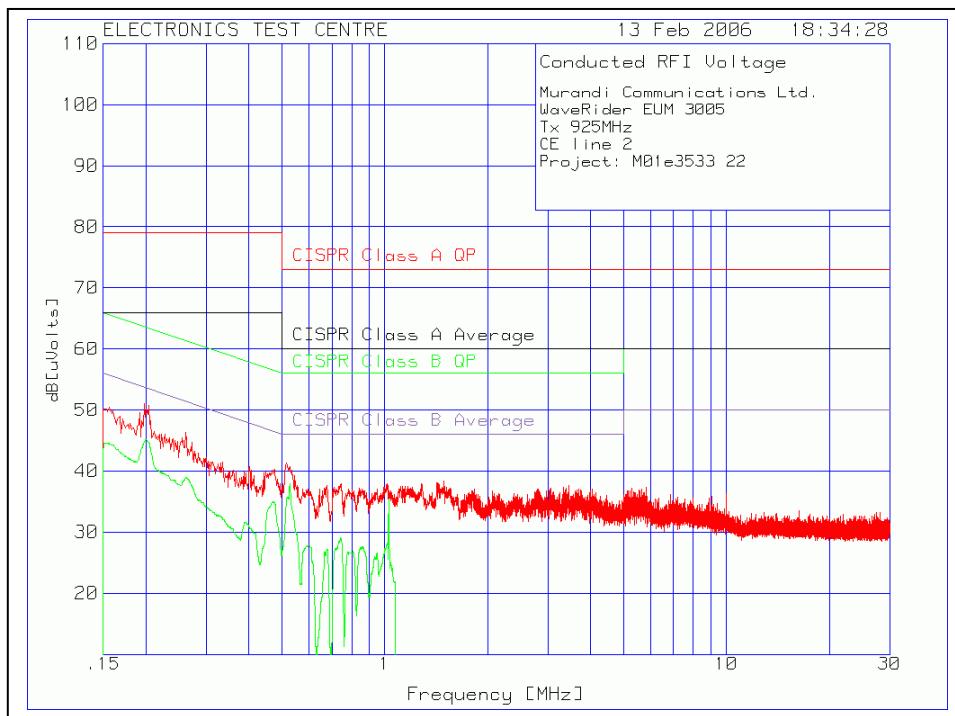
Plot of Conducted Emissions on AC Power Lines: Line 2 Peak



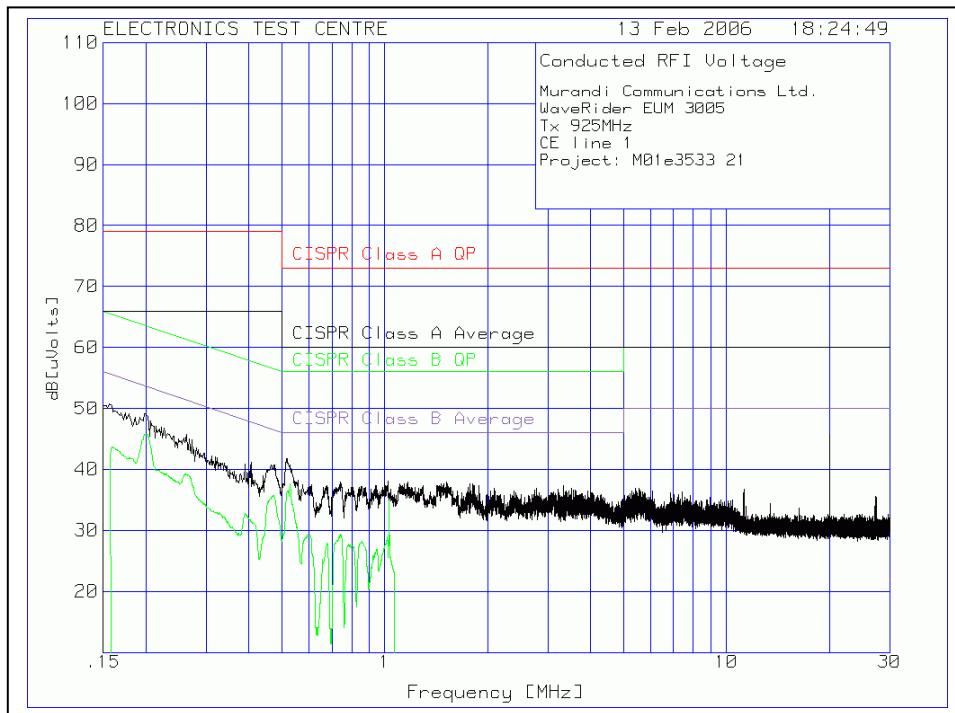
**f<sub>c</sub> = 925 MHz**

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: T. Nguyen, H. Shahryar, I. Romanov Test Date: 13 February 2006	Product: WaveRider EUM 3005																									
<b>Test Result, WaveRider EUM 3005 : PASS</b>																										
Objectives/Criteria  The Conducted emissions produced by a system or sub-system shall not exceed the limits for the specifications as stated.  The EUT was assessed against the requirements for <b>Class B</b> .  Temperature = 22.5 °C   Humidity = 25 %	Specification:  <table><thead><tr><th>Frequency (MHz)</th><th colspan="2">Class A</th><th colspan="2">Class B</th></tr><tr><th></th><th>QP</th><th>Avg</th><th>QP</th><th>Avg</th></tr></thead><tbody><tr><td>0.150 - 0.50</td><td>79</td><td>66</td><td>66 – 56</td><td>56 - 46</td></tr><tr><td>0.50 – 5.0</td><td>73</td><td>60</td><td>56</td><td>46</td></tr><tr><td>5 – 30</td><td>73</td><td>60</td><td>60</td><td>50</td></tr></tbody></table> Units of measurement are dB $\mu$ V.	Frequency (MHz)	Class A		Class B			QP	Avg	QP	Avg	0.150 - 0.50	79	66	66 – 56	56 - 46	0.50 – 5.0	73	60	56	46	5 – 30	73	60	60	50
Frequency (MHz)	Class A		Class B																							
	QP	Avg	QP	Avg																						
0.150 - 0.50	79	66	66 – 56	56 - 46																						
0.50 – 5.0	73	60	56	46																						
5 – 30	73	60	60	50																						
<p>There were no emissions measured within -6 dB of the specified limit. Refer to the test data and plots for more detail.</p>																										

Plot of Conducted Emissions on AC Power Lines: Line 1 Peak



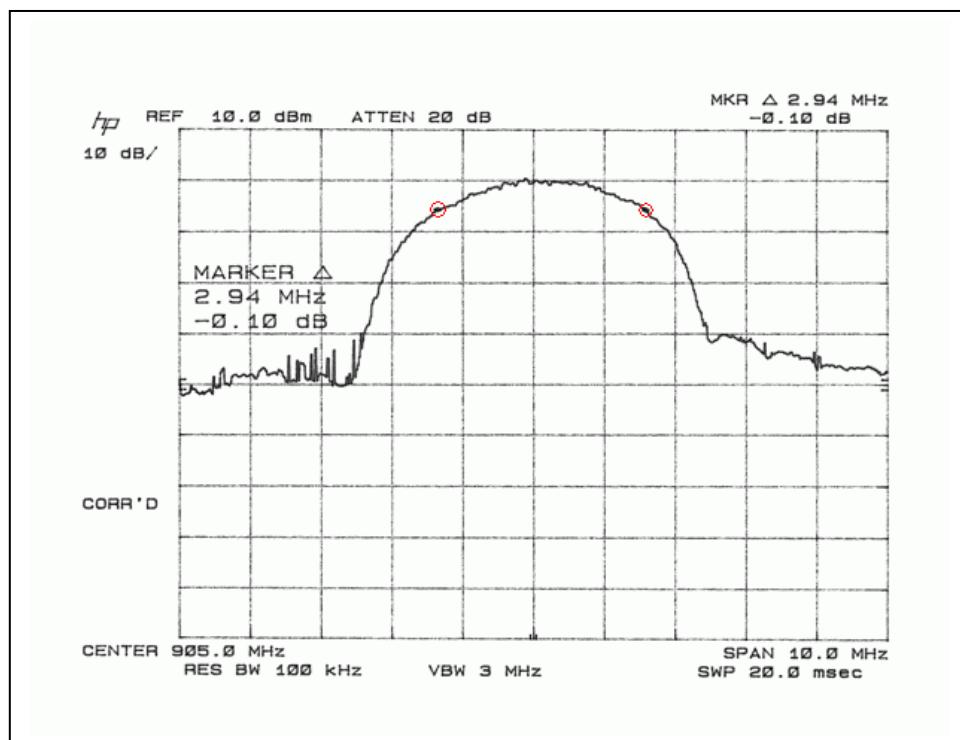
Plot of Conducted Emissions on AC Power Lines: Line 2 Peak



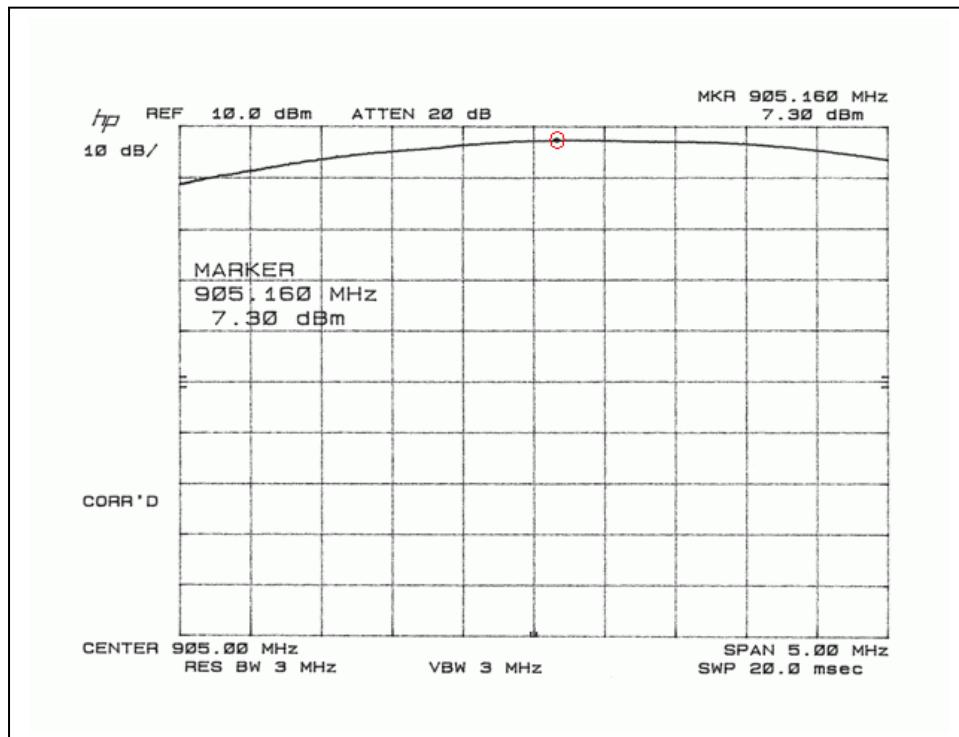
**3.2 CONDUCTED EMISSIONS MEASURED AT ANTENNA PORT  
(PART 15.247 & 15.31)**

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: T. Nguyen, H. Shahryar, I. Romanov Test Date: 13 February 2006			Product: WaveRider EUM 3005					
Test Result, WaveRider EUM 3005 : <b>PASS</b>								
Objectives/Criteria The Conducted emissions produced by a device shall meet the specifications as stated. Temperature = 22.5 °C    Humidity = 25 %								
15.247(a): 6 dB BW $\geq$ 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	2.94	+ 2.44	905	27.9	- 2.1			
915	2.74	+ 2.24	915	27.9	- 2.1			
925	2.77	+ 2.27	925	27.6	- 2.4			
15.31(e) RF output @ 85% supply voltage			15.31(e) RF output @ 115% supply voltage					
Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from 100% supply]	Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from 100% supply]			
905	27.6	- 0.3	905	27.5	- 0.4			
915	27.7	- 0.2	915	27.5	- 0.4			
925	27.5	- 0.1	925	27.3	- 0.3			
15.247(c): -20 dB fc			15.247(d): 8 dBm (115 dB $\mu$ V)					
Carrier Frequency [MHz]			Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from limit]			
905	There were no emissions measured within -10 dB of the specified limits.		905	7.1	- 0.9			
915			915	7.8	- 0.2			
925			925	7.5	- 0.5			
Measurements were performed while the WaveRider EUM 3005 was transmitting continuously. Refer to the test data and plots for more detail.								

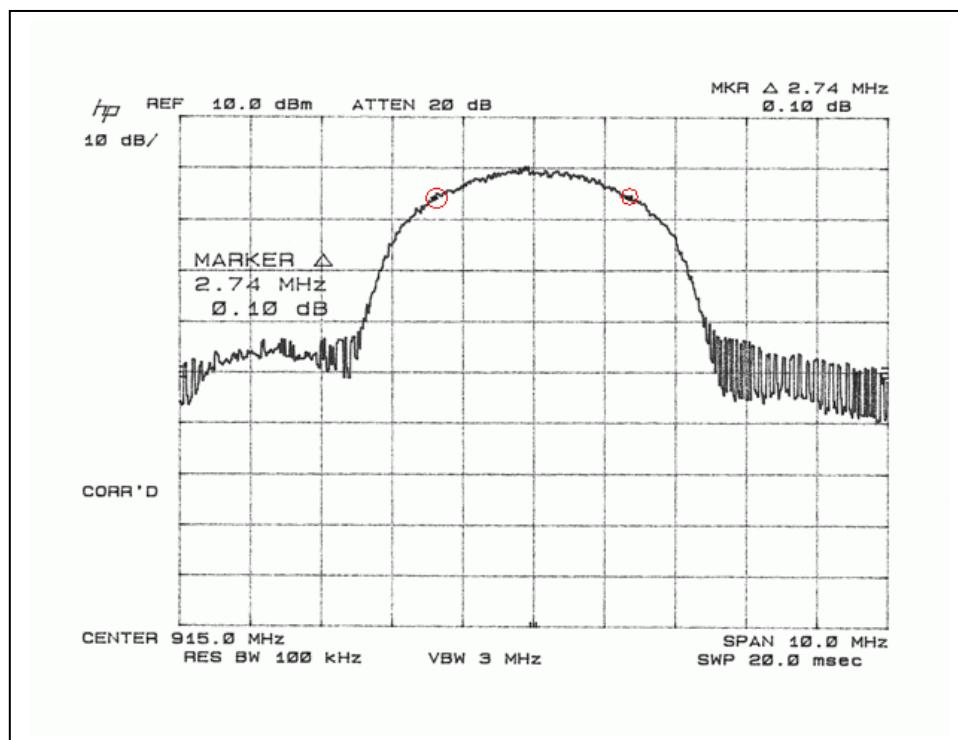
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 905 MHz



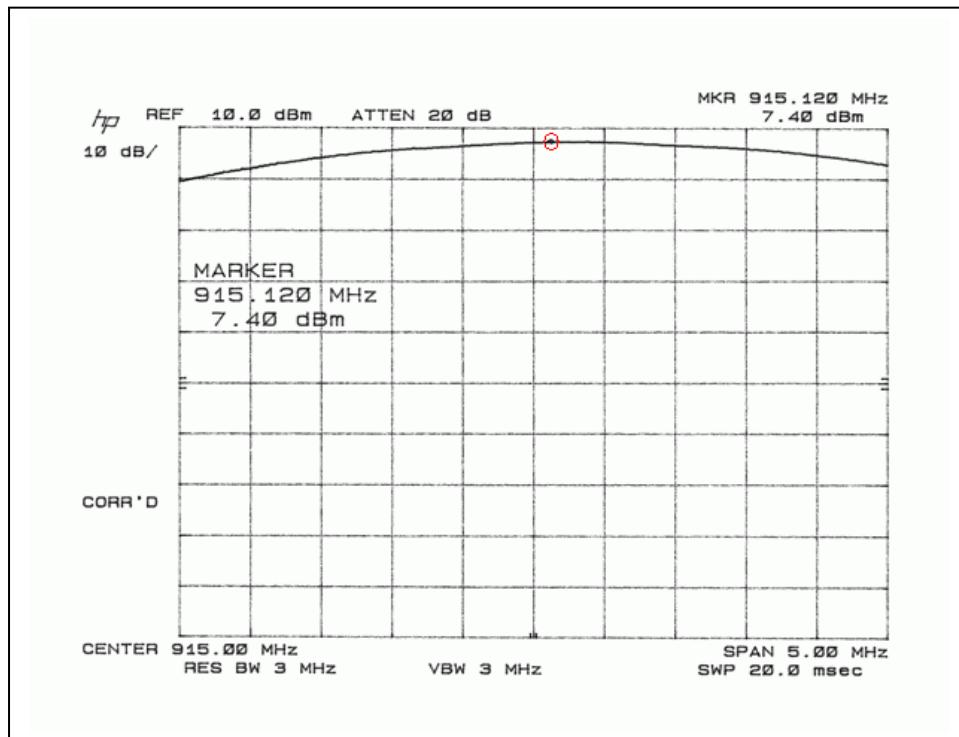
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 905 MHz  
Attenuation = 20.6 dB  $\Rightarrow$  27.9 dBm



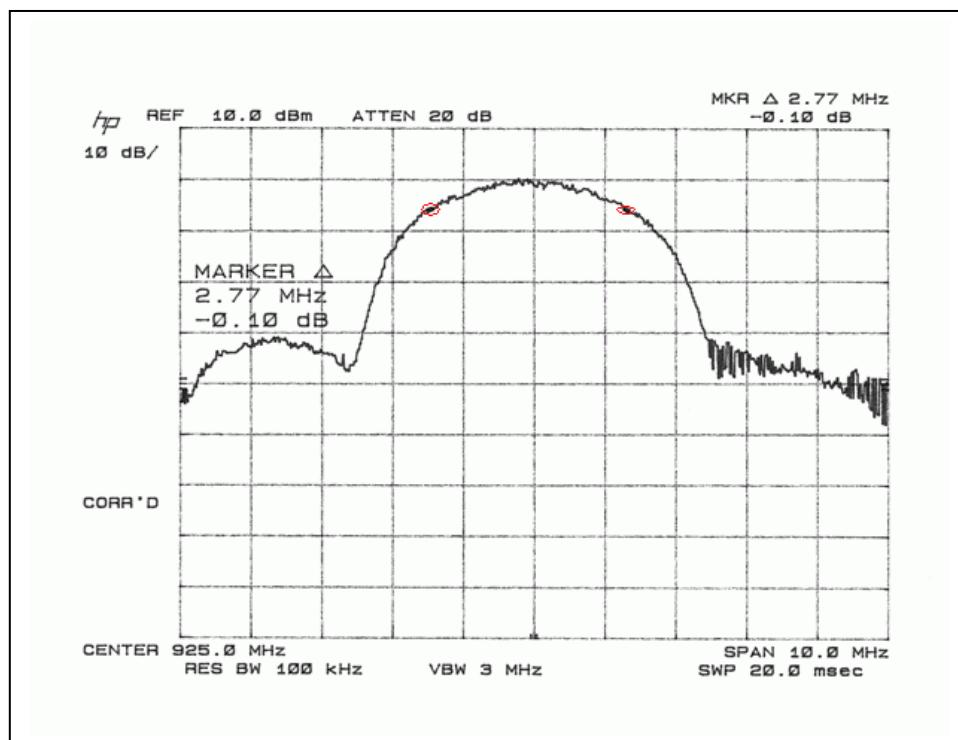
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 915 MHz



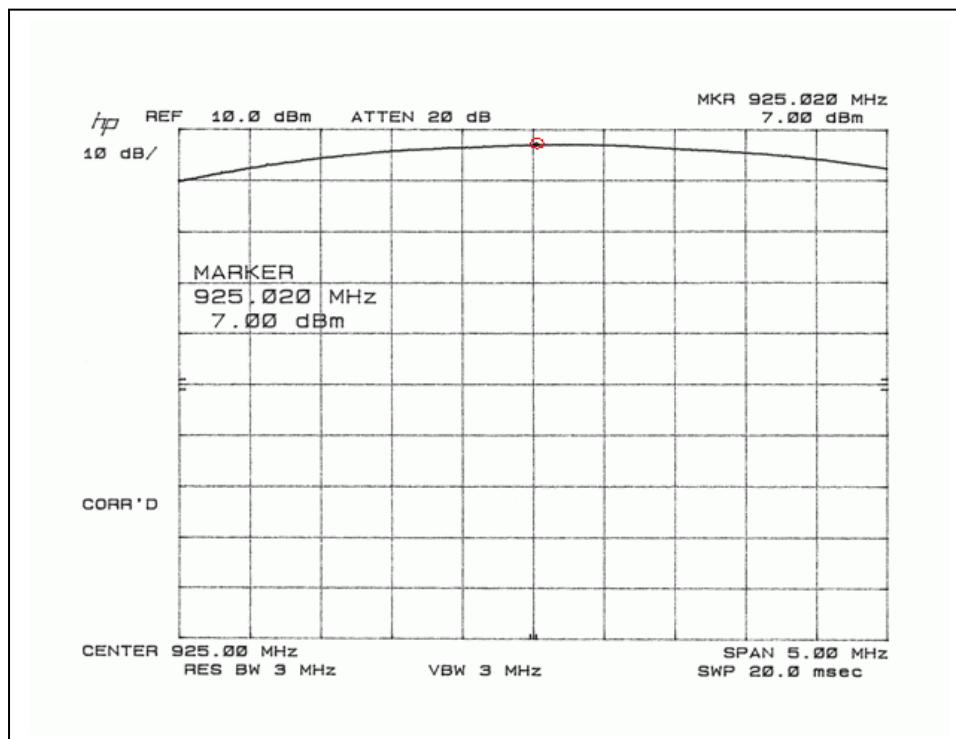
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 915 MHz  
Attenuation = 20.5 dB  $\Rightarrow$  27.9 dBm



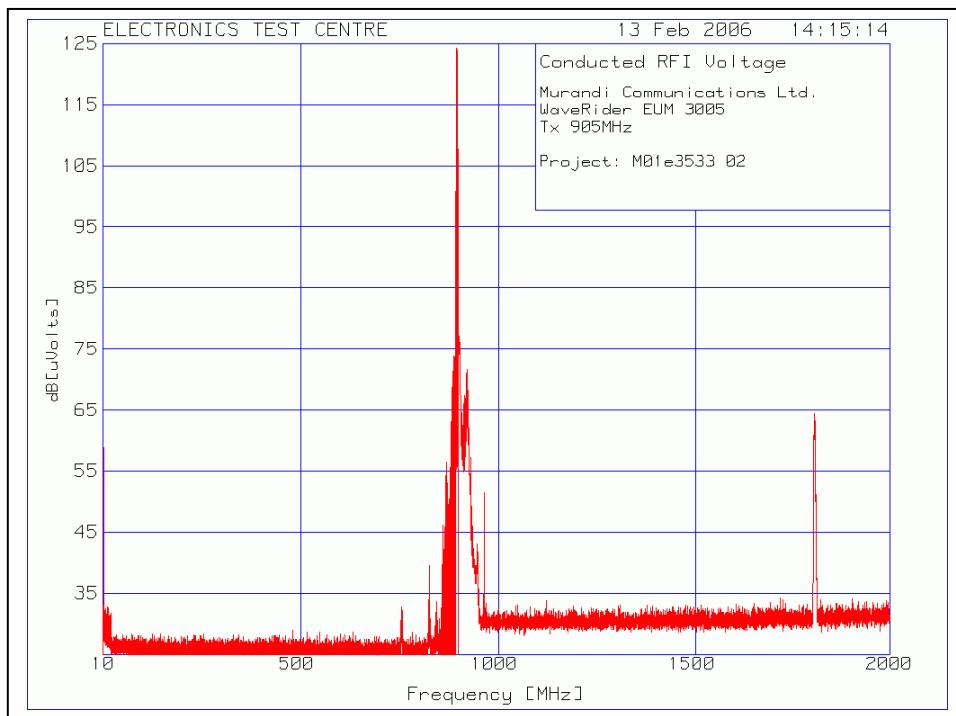
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 925 MHz



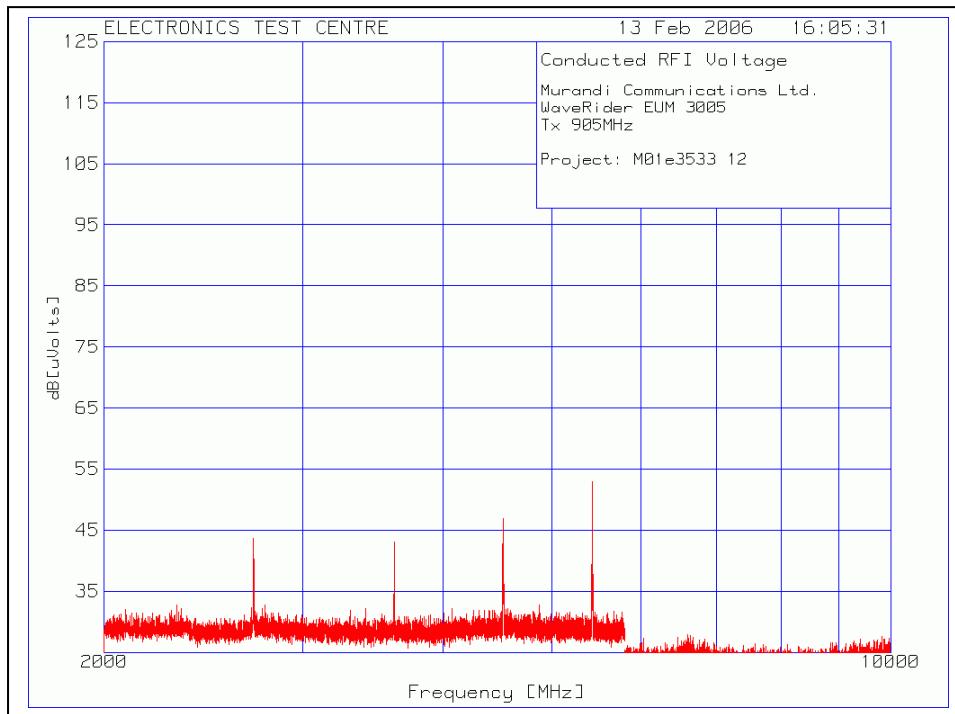
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 925 MHz  
Attenuation = 20.6  $\Rightarrow$  27.6 dBm



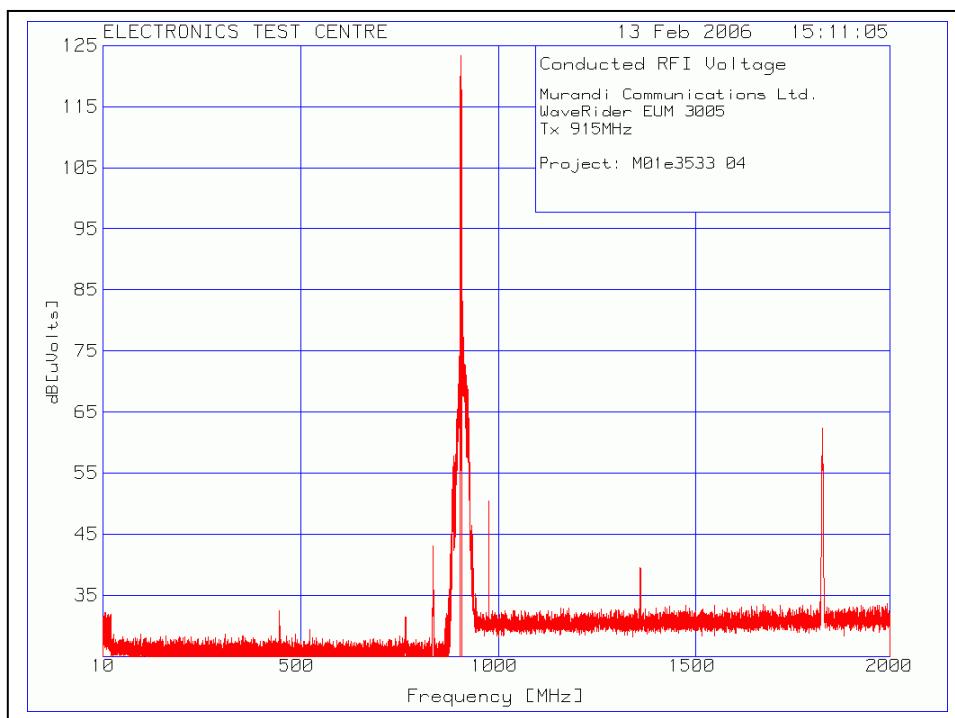
Plot of Conducted Emissions at Antenna Port:



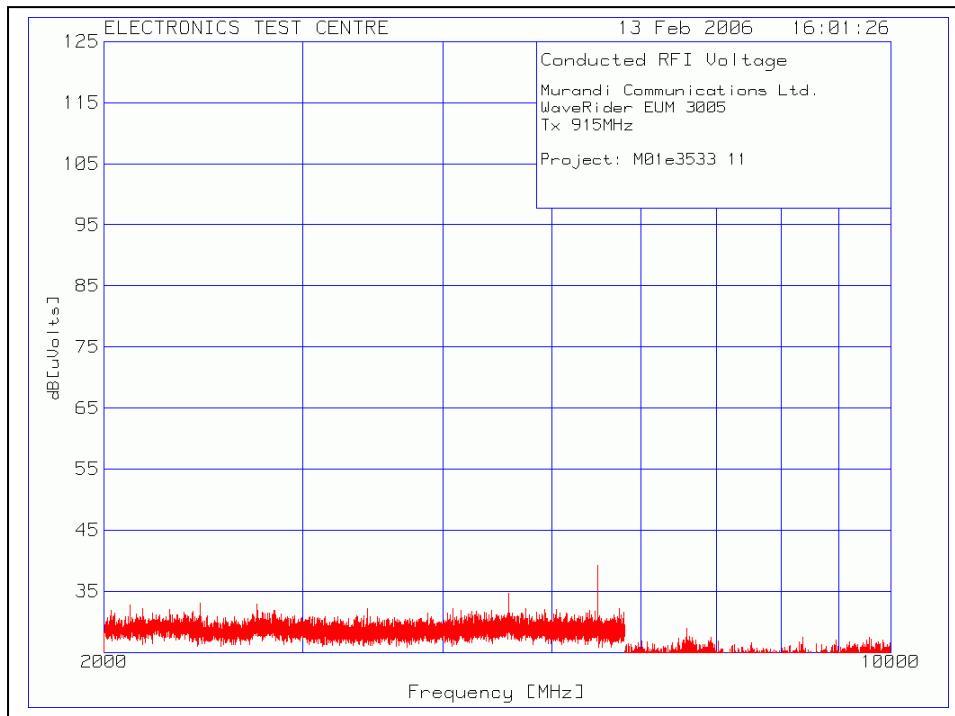
Plot of Conducted Emissions at Antenna Port:



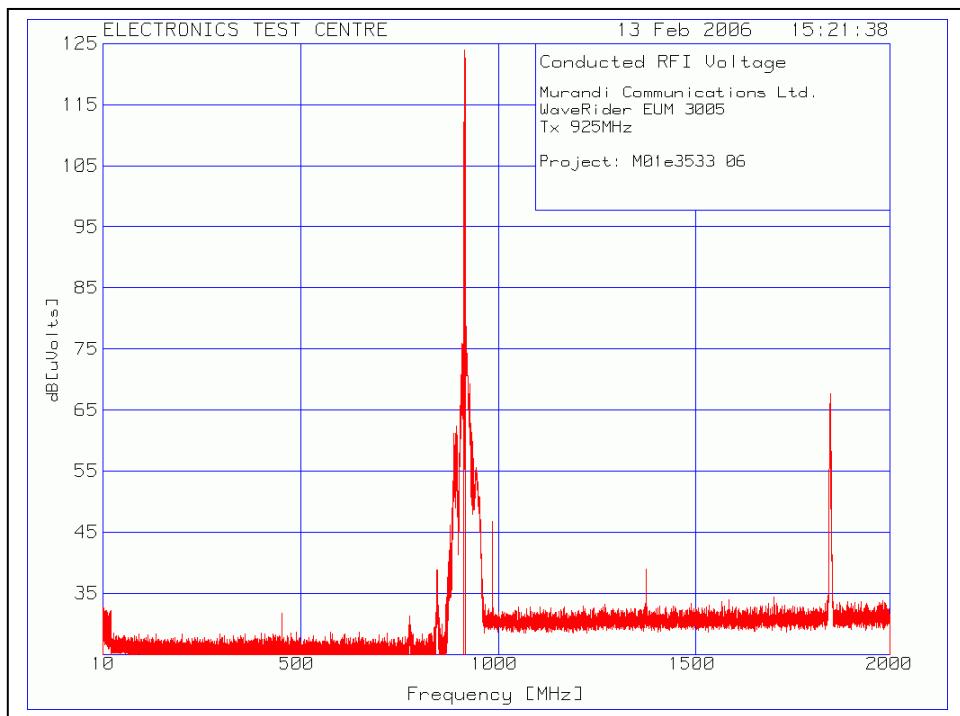
Plot of Conducted Emissions at Antenna Port:



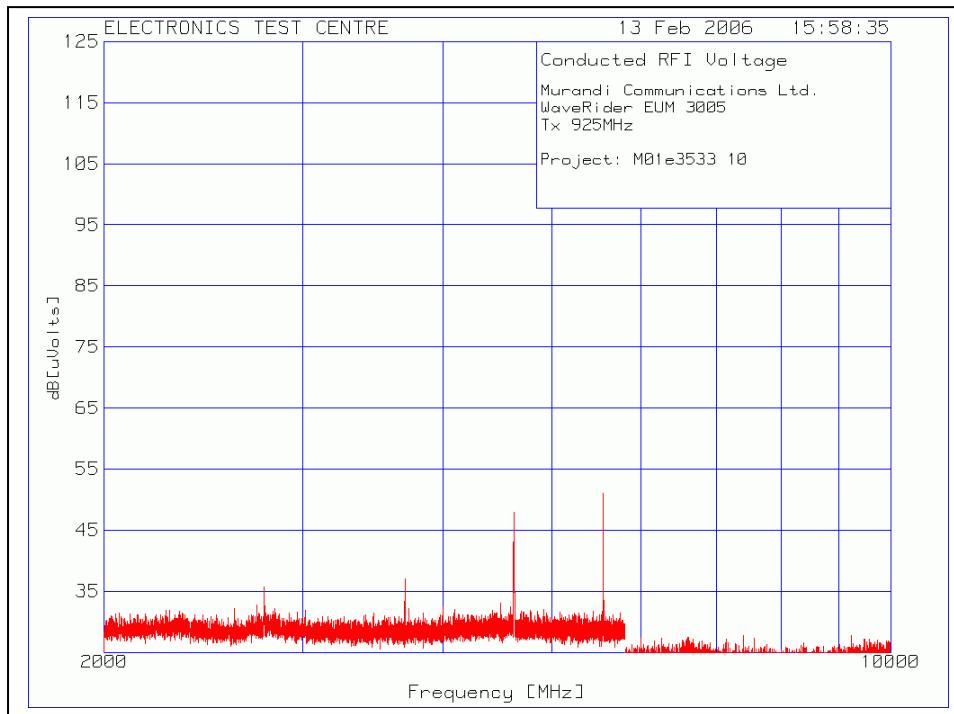
Plot of Conducted Emissions at Antenna Port:



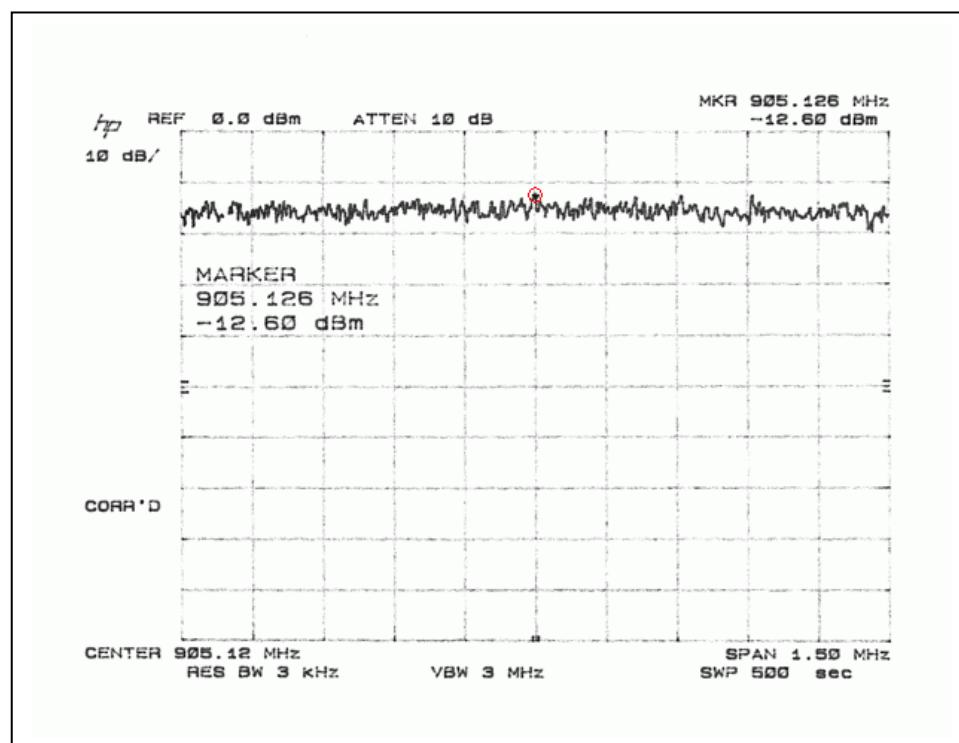
Plot of Conducted Emissions at Antenna Port:



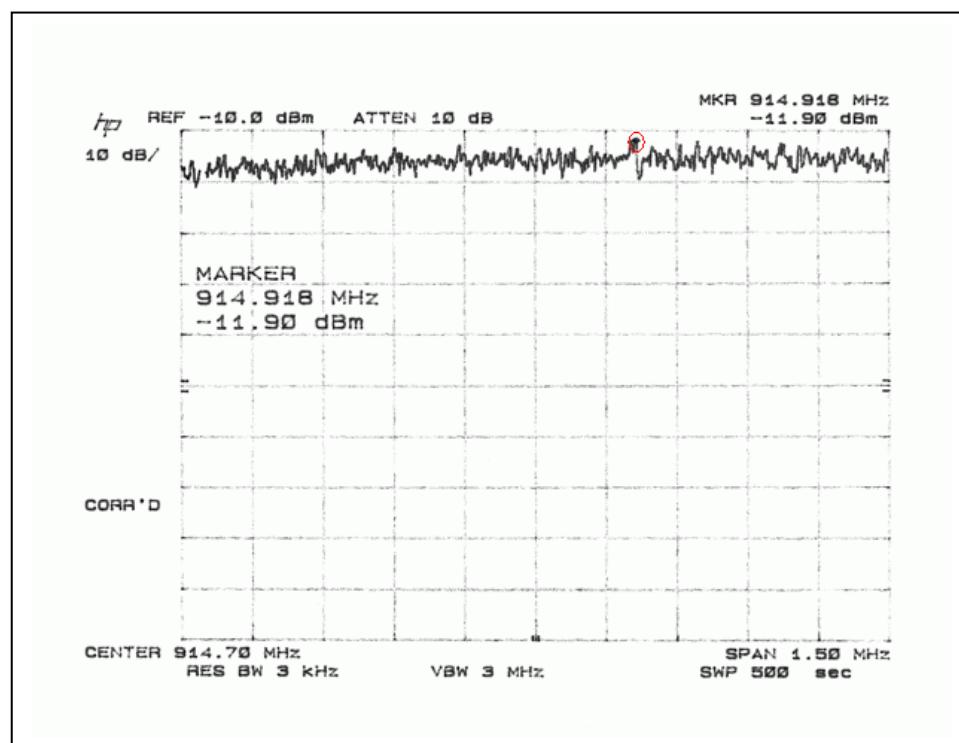
Plot of Conducted Emissions at Antenna Port:



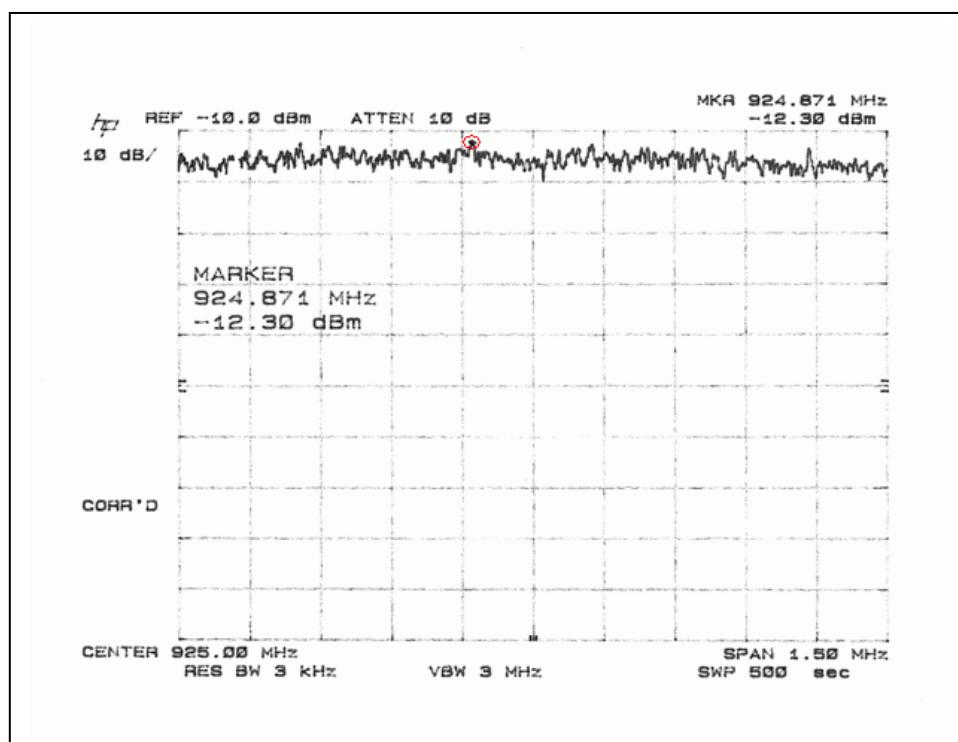
Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 905 MHz  
Attenuation = 19.7 dB  $\Rightarrow$  7.1 dBm



Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 915 MHz:  
Attenuation = 19.7 dB  $\Rightarrow$  7.8 dBm



Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 925 MHz  
Attenuation = 19.8  $\Rightarrow$  7.5 dBm



### 3.3 RADIATED EMISSIONS INCLUDING RESTRICTED BANDS OF OPERATION

#### 3.3.1 Receive Mode (Part 15.109)

Test Lab: MPB Technologies Inc. Airdrie Test Personnel: H. Shahryar Test Date: 13 February 2006	Product: WaveRider EUM 3005															
Test Result, WaveRider EUM 3005 : <b>PASS</b>																
Objectives/Criteria  The Radiated E-Field emissions produced by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for the specifications as stated.  The EUT was assessed against the requirements of <u><b>Class B</b></u> .  Temperature = 22.5 °C   Humidity = 25 %	Specification: FCC Part 15 Subpart C  <table><thead><tr><th>Frequency [MHz]</th><th>Class A QP @ 3m</th><th>Class B QP @ 3m</th></tr></thead><tbody><tr><td>30 – 88</td><td>49.54</td><td>40.00</td></tr><tr><td>88 – 216</td><td>53.98</td><td>43.52</td></tr><tr><td>216 – 960</td><td>56.90</td><td>46.02</td></tr><tr><td>above 960</td><td>60.00</td><td>53.98</td></tr></tbody></table>	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
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														
<b>Horizontal:</b>	<b>Vertical:</b>															
Frequency [MHz]	Field Strength [dB $\mu$ V/m]	Delta [dB from limit]	Frequency [MHz]	Field Strength [dB $\mu$ V/m]	Delta [dB from limit]											
			139.9388	38.32	- 5.2											
			307.9358	35.70	- 10.32											
			100.7233	23.87	- 19.65											
There were no more emissions measured within -10 dB of the specified limit. Refer to the test data and plots for more detail.																

Radiated Emissions Data:

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

For example:

Test Frequency [MHz]	Meter Reading [dB (uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level [dB (uVolts)]	Limit:1 [dB]	2	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 Margin [dB]	54 -6.2	The value of Limit 1 at 94.0036 MHz The field strength is 6.2 dB below Limit 1
Limit: 2 Margin [dB]	43.5 4.3	The value of Limit 2 at 94.0036 MHz The field strength is 4.3 dB above Limit 2
Limit: 3 Margin [dB]	50.5 -2.7	The value of Limit 3 at 94.0036 MHz The field strength is 2.7 dB below Limit 3
Limit: 4 Margin [dB]	40.5 7.3	The value of Limit 4 at 94.0036 MHz 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.

Murandi Communications Ltd.  
WaveRider EUM 3005  
Rx 915  
QS 100cm/20Deg H/V  
Project: M01e3533 24

Test Frequency	Meter Reading	Gain/Loss Factor	Transducer Factor	Level	Limit:1	2	3	4
[MHz]	[dB(uV)]	[dB]	[dB]					
Range: 1 30 - 1000MHz								
100.7233	11.64 qp	2	10.23	23.87	53.98	50.46	43.52	40.46
Azimuth: 81	Height:107	Vert		Margin [dB]:	-30.11	-26.59	-19.65	-16.59
139.9388	25.62 qp	2.4	10.3	38.32	53.98	50.46	43.52	40.46
Azimuth: 241	Height:101	Vert		Margin [dB]:	-15.66	-12.14	-5.2	-2.14
307.9358	18.14 qp	3.56	14	35.7	56.9	57.46	46.02	47.46
Azimuth: 225	Height:100	Vert		Margin [dB]:	-21.2	-21.76	-10.32	-11.76

LIMIT 1: FCC Part 15 Class A 3m

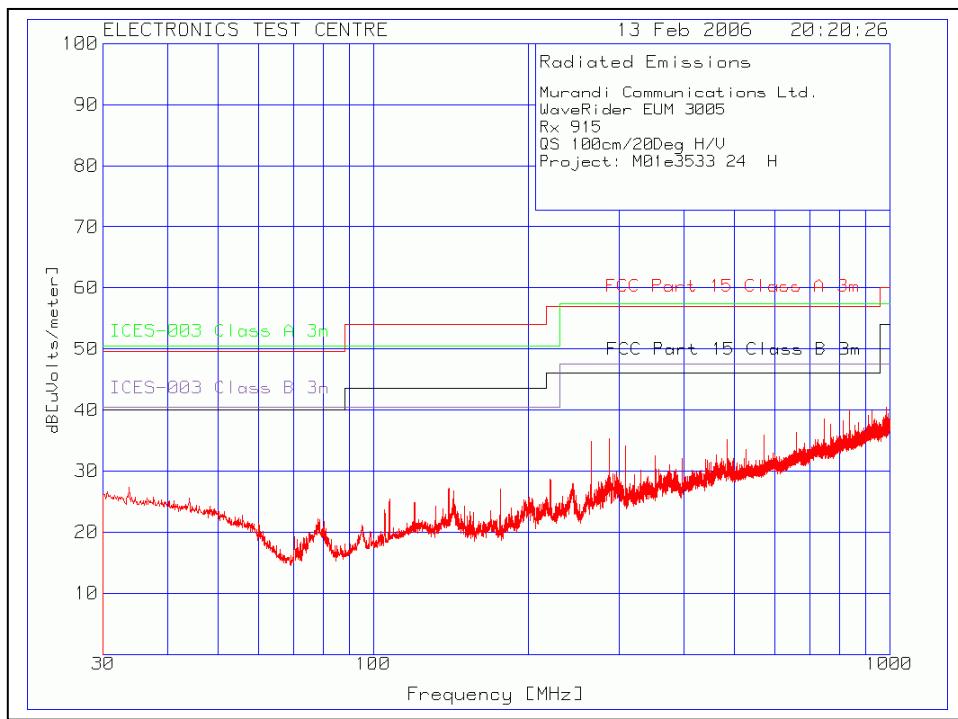
LIMIT 2: ICES-003 Class A 3m

LIMIT 3: FCC Part 15 Class B 3m 

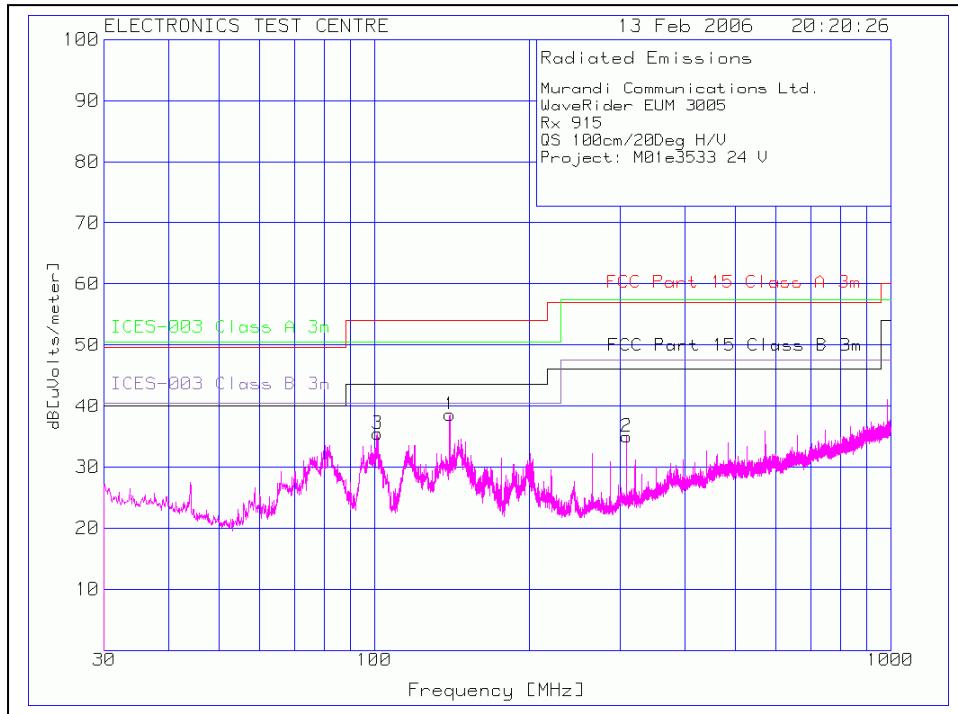
LIMIT 4: ICES-003 Class B 3m

qp - Quasi-Peak detector

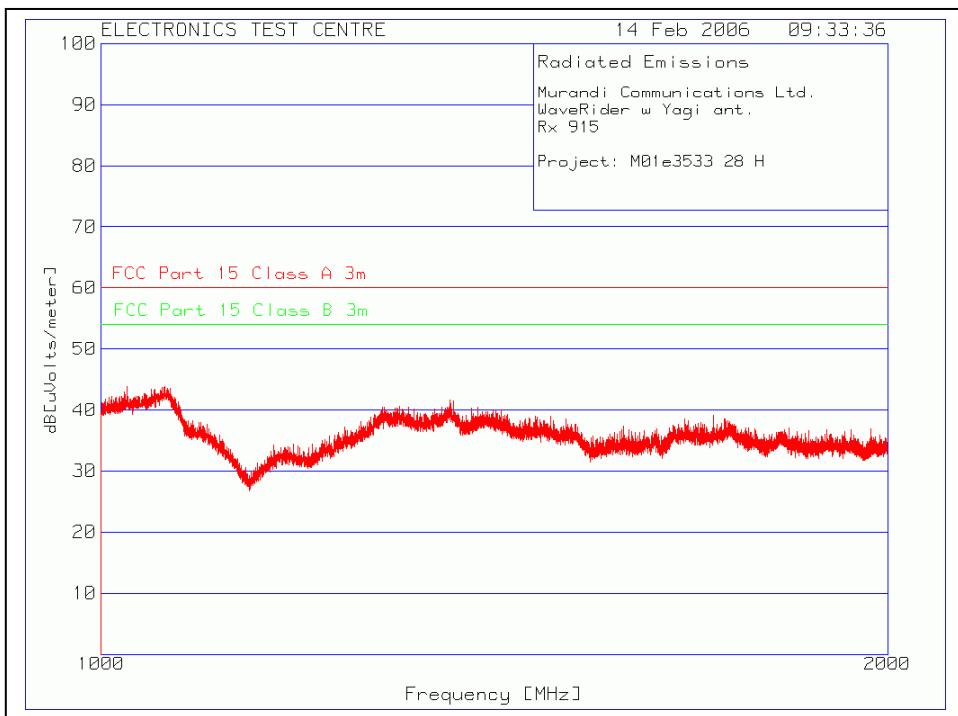
Plot of Radiated Emissions:



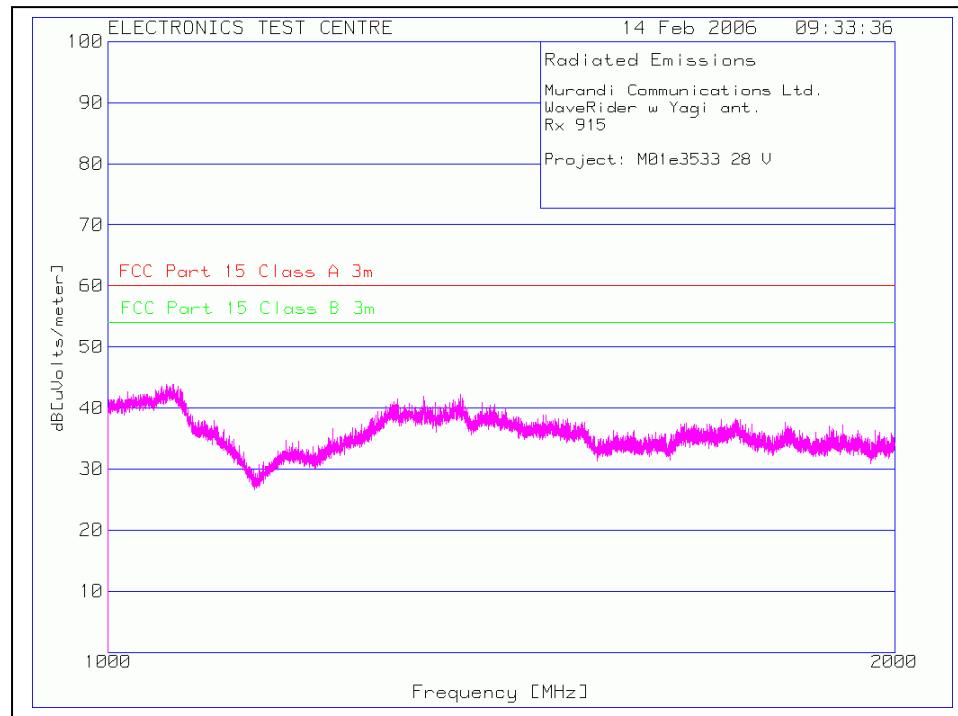
Plot of Radiated Emissions:



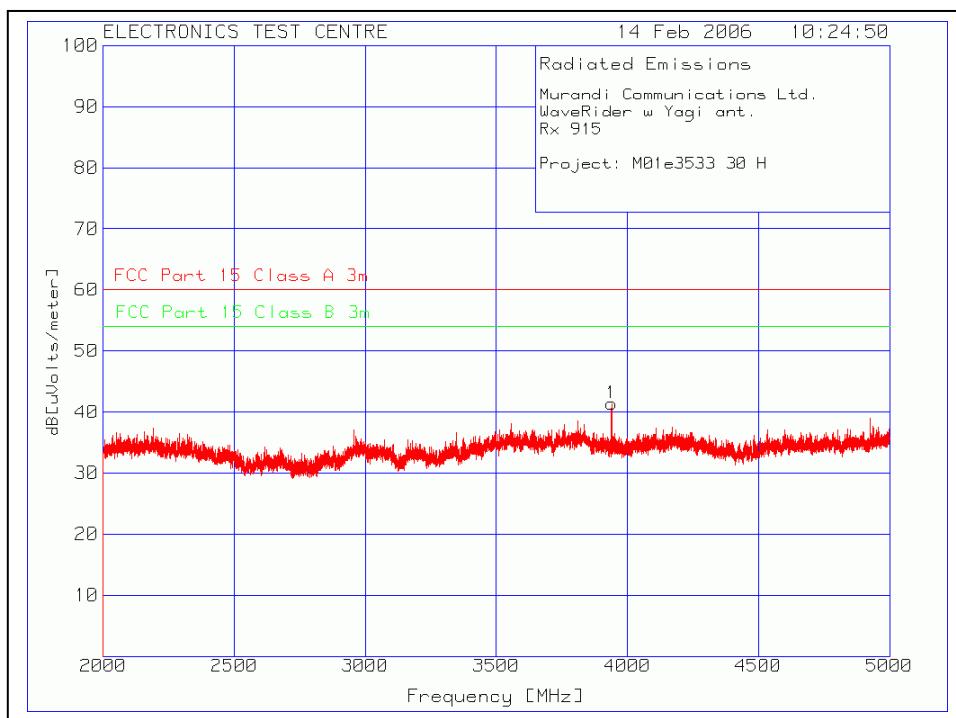
Plot of Radiated Emissions:



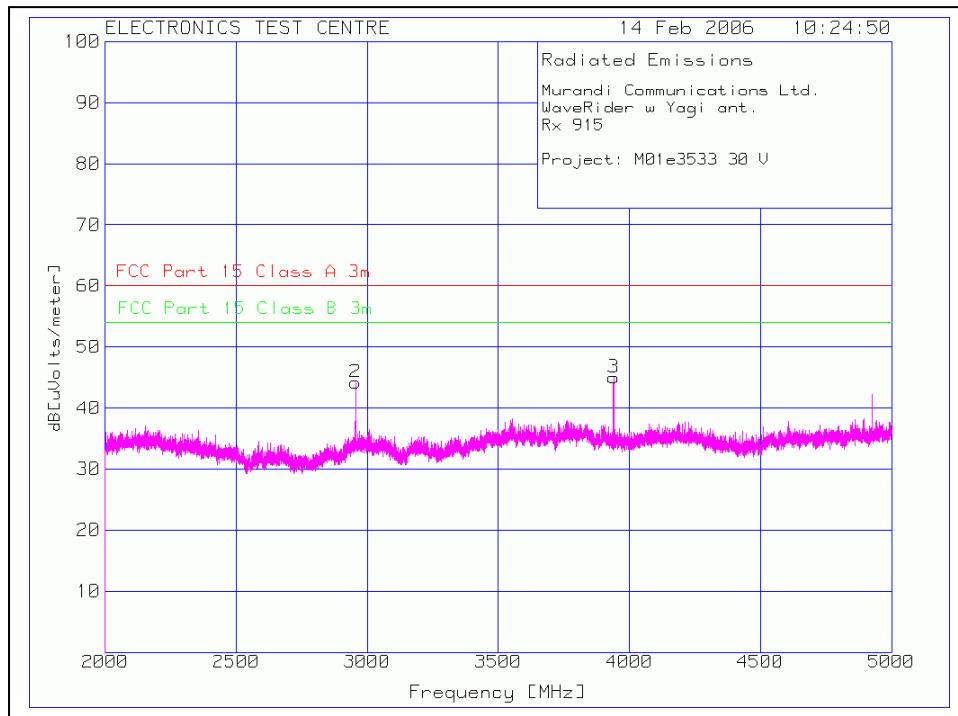
Plot of Radiated Emissions:



Plot of Radiated Emissions:



Plot of Radiated Emissions:



## 3.3.2 Transmit Mode (Part 2.1053, 15.205, 15.209 &amp; 15.247)

## 3.3.2.1 Diversity Antenna

Test Lab: Electronics Test Centre (Airdrie)	Product:	
Test Personnel: T. Nguyen, H. Shahryar, I. Romanov	WaveRider EUM 3005	
Test Date: 13 February – 10 March 2006		
Test Result, WaveRider EUM 3005 : <b>PASS</b>		
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.	Frequency [MHz]	Limit (QP @ 3m) [dB $\mu$ V/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

## Operation in Restricted Bands: Diversity Antenna

nominal $f_c$ (MHz)	f (MHz)	Field Strength (dB $\mu$ V/m) Peak	Limit (dB $\mu$ V/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
905	2714.9880	49.17	53.98	- 4.81	H	128	185
905	2715.4010	29.30	53.98	$\leq$ - 20 dB	V	131	197
905	3620.1360	31.58	53.98	$\leq$ - 20 dB	H	105	124
905	3619.6520	31.59	53.98	$\leq$ - 20 dB	V	107	238
905	4524.7840	32.33	53.98	$\leq$ - 20 dB	H	162	38
905	4525.1860	32.37	53.98	$\leq$ - 20 dB	V	100	183
<hr/>							
915	2745.4850	29.41	53.98	$\leq$ - 20 dB	H	124	48
915	2745.4910	29.40	53.98	$\leq$ - 20 dB	V	127	176
915	3659.6820	31.68	53.98	$\leq$ - 20 dB	H	132	246
915	3659.6820	31.69	53.98	$\leq$ - 20 dB	V	131	300
915	4574.8740	32.43	53.98	$\leq$ - 20 dB	H	130	307
915	4574.4720	32.47	53.98	$\leq$ - 20 dB	V	133	12
<hr/>							
925	2775.3420	29.50	53.98	$\leq$ - 20 dB	H	139	16
925	2775.0001	29.49	53.98	$\leq$ - 20 dB	V	142	113
925	3700.2880	31.77	53.98	$\leq$ - 20 dB	H	125	142
925	3700.4670	31.80	53.98	$\leq$ - 20 dB	V	100	180
925	4625.1740	32.52	53.98	$\leq$ - 20 dB	H	107	177
925	4625.0900	32.58	53.98	$\leq$ - 20 dB	V	108	308

Investigation was performed up to 9.5 GHz

System attenuation between modem output and antenna during measurement = 1.4 dB

Minimum system attenuation between modem output and antenna to achieve compliance = 0 dB

All unreported emissions were found to be more than 20 dB below the applicable limit.

## Carrier and spurious emissions: Diversity Antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP (W)	ERP Limit (W)	Delta (W)
905.1020	163	100	H	62.2	23.02	5.85	28.87	26.72	0.47	4.00	- 3.53
905.1290	260	106	V	66.2	27.57	4.40	31.97	29.82	0.96	4.00	- 3.04
914.9690	257	104	H	66.9	27.72	5.80	33.52	31.37	1.37	4.00	- 2.63
915.0640	256	100	V	67.1	28.57	4.30	32.87	30.72	1.18	4.00	- 2.82
924.9050	263	100	H	67.2	28.15	5.90	34.05	31.90	1.55	4.00	- 2.45
924.8730	263	100	V	67.4	29.04	4.30	33.34	31.19	1.32	4.00	- 2.68

System attenuation between modem output and antenna during measurement = 1.4 dB

Minimum system attenuation between modem output and antenna to achieve compliance = 0 dB

Investigation was performed up to 9.5 GHz

ERP of all spurious emissions was found to be  $\leq$  -33 dBm

### 3.3.2.2 Yagi Antenna

Test Lab: Electronics Test Centre (Airdrie)	Product:																
Test Personnel: T. Nguyen, H. Shahryar, I. Romanov	WaveRider EUM 3005																
Test Date: 13 February – 10 March 2006																	
<b>Test Result, WaveRider EUM 3005 : PASS</b>																	
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.	<table> <thead> <tr> <th>Frequency [MHz]</th> <th>Limit (QP @ 3m) [dB<math>\mu</math>V/m]</th> </tr> </thead> <tbody> <tr> <td>.009 – 0.490</td> <td>88.5 – 53.8</td> </tr> <tr> <td>.490 – 1.7</td> <td>53.8 – 43</td> </tr> <tr> <td>1.7 – 30</td> <td>49.50</td> </tr> <tr> <td>30 – 88</td> <td>40.00</td> </tr> <tr> <td>88 – 216</td> <td>43.52</td> </tr> <tr> <td>216 – 960</td> <td>46.02</td> </tr> <tr> <td>above 960</td> <td>53.98</td> </tr> </tbody> </table>	Frequency [MHz]	Limit (QP @ 3m) [dB $\mu$ V/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
Frequency [MHz]	Limit (QP @ 3m) [dB $\mu$ V/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 <span style="color: blue;">*</span>	1660.0000 – 1710.0000	3.6000000 – 4.4000000	14.470000 – 14.500000
0.4950000 – 0.5050000 <span style="color: blue;">*</span>	8.3620000 - 8.3660000	25.500000 - 25.670000	167.72000 - 173.20000 <span style="color: blue;">*</span>	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 <span style="color: blue;">*</span>	8.0250000 – 8.5000000	23.600000 – 24.000000
4.2072500 - 4.2077500	12.519750 - 12.520250	108.00000 - 121.94000 <span style="color: yellow;">**</span>	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 <span style="color: yellow;">**</span>	960.00000 – 1240.0000 <span style="color: yellow;">***</span>	3260.0000 – 3267.0000	9.3000000 – 9.5000000	36.430000 – 36.500000
6.2150000 - 6.2180000	13.360000 - 13.410000	149.90000 - 150.05000 <span style="color: blue;">*</span>	1300.0000 – 1427.0000 <span style="color: yellow;">***</span>	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 <span style="color: red;">****</span>		

\* US only

\*\* Canada 108 – 138 MHz

\*\*\* Canada 960 – 1427 MHz

\*\*\*\* Canada only

Operation in Restricted Bands: Yagi Antenna

nominal $f_c$ (MHz)	$f$ (MHz)	Field Strength (dB $\mu$ V/m) Peak	Limit (dB $\mu$ V/m) Average	Delta (dB)	Antenna Polarization	Antenna Height (cm)	Azimuth (Degrees)
915	2743.9740	29.41	53.98	$\leq$ - 20 dB	H	124	196
915	2744.8090	29.39	53.98	$\leq$ - 20 dB	V	127	212
915	3661.0430	31.68	53.98	$\leq$ - 20 dB	H	133	336
915	3660.6670	31.70	53.98	$\leq$ - 20 dB	V	116	235
915	4574.6200	32.43	53.98	$\leq$ - 20 dB	H	119	105
915	4574.7000	32.47	53.98	$\leq$ - 20 dB	V	121	177
<hr/>							
925	2775.198	29.50	53.98	$\leq$ - 20 dB	H	123	185
925	2775.1500	29.49	53.98	$\leq$ - 20 dB	V	100	214
925	3700.1320	31.77	53.98	$\leq$ - 20 dB	H	100	179
925	3700.0410	31.80	53.98	$\leq$ - 20 dB	V	100	288
925	4625.2270	32.52	53.98	$\leq$ - 20 dB	H	116	28
925	4625.2880	32.58	53.98	$\leq$ - 20 dB	V	118	174

Investigation was performed up to 9.5 GHz

All unreported emissions were found to be more than 20 dB below the applicable limit.

Carrier and spurious emissions: Yagi Antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Spectrum Analyzer Reading (dB $\mu$ V)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP (W)	ERP Limit (W)	Delta (W)
905.0450	0	101	H	71.5	31.92	5.85	37.77	35.62	3.65	4.00	- 0.35
905.1200	135	116	V	49.2	10.57	4.40	14.97	12.82	0.02	4.00	- 3.98
915.1390	4	100	H	69.8	30.63	5.80	36.43	34.28	2.68	4.00	- 1.32
914.9430	350	109	V	51.6	13.07	4.30	17.37	15.22	0.03	4.00	- 3.97
924.9240	360	100	H	67.3	28.25	5.90	34.15	32.00	1.58	4.00	- 2.42
924.7280	124	129	V	47.8	9.44	4.30	13.74	11.59	0.01	4.00	- 3.99

System attenuation between modem output and antenna during measurement = 1.4 dB

Minimum system attenuation between modem output and antenna to achieve compliance = 0.4 dB

Investigation was performed up to 9.5 GHz

ERP of all spurious emissions was found to be  $\leq$  -33 dBm

## **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 Murandi Communications Ltd. 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.

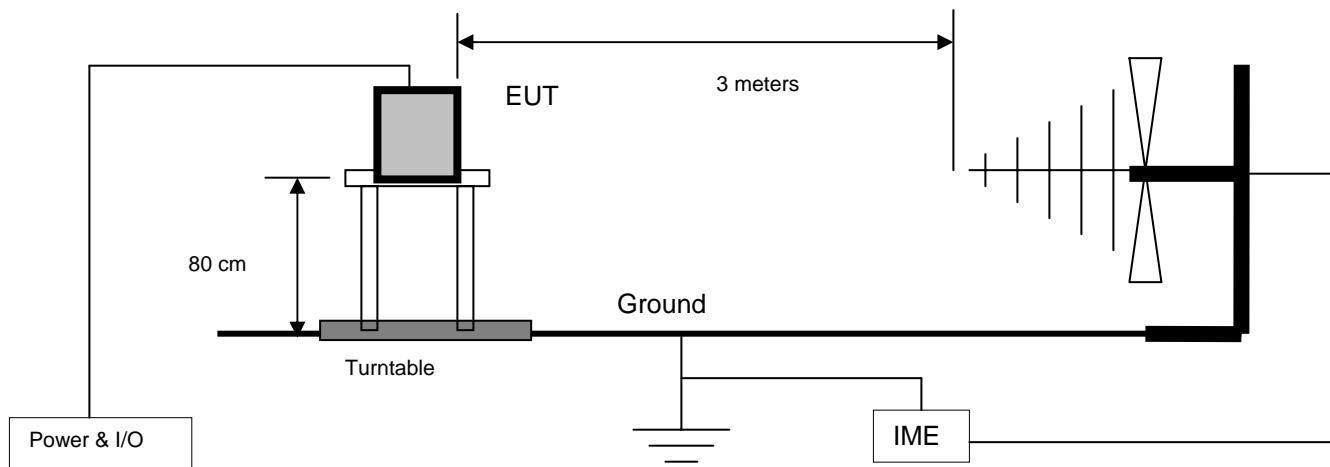
## 5.5 TEST CONFIGURATION

### 5.5.1 Tabletop Equipment

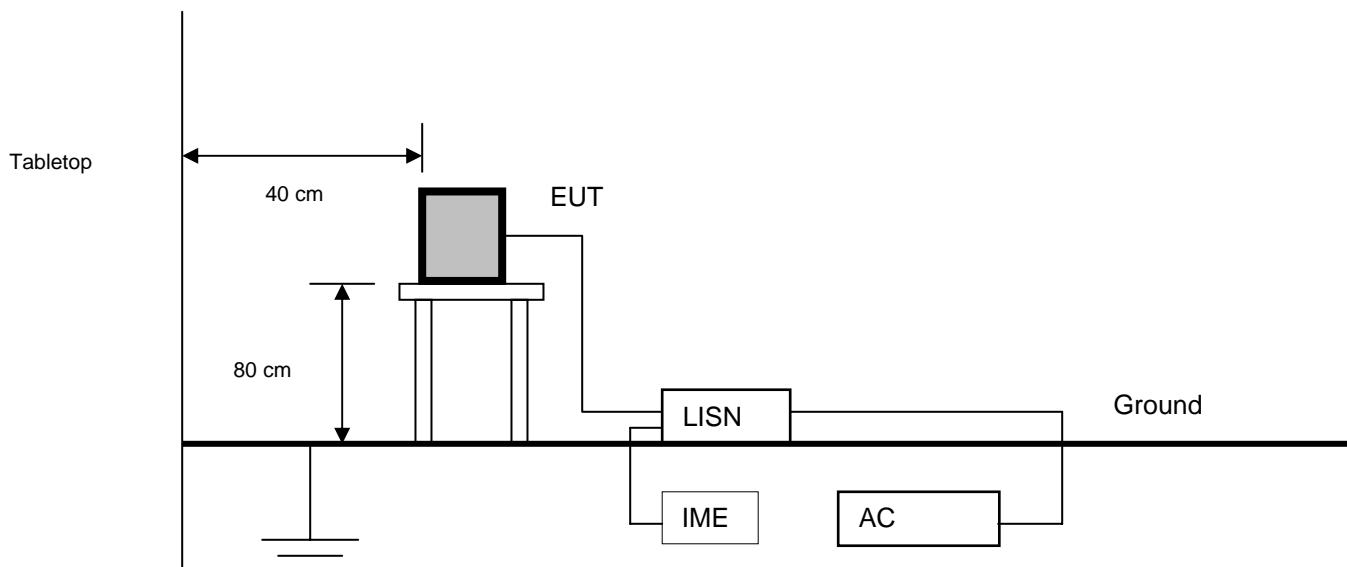
The following diagrams illustrate the configuration of the EUT test and measurement equipment for Radiated and Conducted Emissions Testing of tabletop equipment.

#### Radiated

Tabletop



#### Conducted



## 6.0 TEST EQUIPMENT

Testing was performed with equipment selected from the following list.

Instrument	Manufacturer	Model No.	Asset No.	Calibration Due
Spectrum Analyzer & Display	Hewlett Packard	8566B & 85662	9565	26 April 2006
Spectrum Analyzer & Display	Hewlett Packard	8566B & 85662	9168	7 September 2006
RF Preselector	Hewlett Packard	85685A	9728	8 September 2006
RF Preselector	Hewlett Packard	85685A	4464	26 April 2006
Quasi-Peak Adapter	Hewlett Packard	85650A	4411	26 April 2006
Quasi-Peak Adapter	Hewlett Packard	85650A	9243	8 September 2006
Measurement System Software	Underwriters Laboratories	Version 6.0	4443	n/a
Inverter (single phase)	California Instruments	5000iX	4378	6 September 2007
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	7 January 2007
Line Impedance Stabilization Network	EMCO	3825/2r	9331	5 January 2007
Line Impedance Stabilization Network	EMCO	3825/2r	9259	5 January 2007
Line Impedance Stabilization Network	EMCO	38100/1SPEC	9331	5 January 2007
Line Impedance Stabilization Network	EMCO	38100/1SPEC	9259	5 January 2007
Active Monopole	EMCO	3301B	9764	21 July 2007
Biconilog Antenna	ARA	LPB-2520/A	4318	7 January 2007
Biconical Antenna	EMCO	3104	9257	12 January 2007
Log-periodic Array	EMCO	3147	20721	18 January 2007
DRG Horn	EMCO	3106	9699	10 August 2007
DRG Horn	Tensor	4106	9576	11 January 2007
DRG Horn	EMCO	3115	9588	5 January 2007
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	7 January 2007

**Appendix A**  
**WaveRider EUM 3005**  
**Test Sample Description**

(from data provided by Murandi Communications Ltd.)

Company Name : Murandi Communications		Contact Name : Shane Phillips	
Address : 6715 8 <sup>th</sup> Street NE, Suite 300		Phone : 403-777-9988 x252	
Calgary, AB		Fax : 403-777-9989	
T2E 7H7		E-mail : shane.phillips@murandi.com	
Product Name: Waverider EUM-3005 Re-spin		# of units to be tested : 1	
Part/Model # : EUM-3005		Serial # :	
<b>Product Application</b>	<b>Designated Marketplaces</b>		
	Commercial <input checked="" type="checkbox"/>	Canada <input checked="" type="checkbox"/>	Other <input type="checkbox"/>
	Military <input type="checkbox"/>	United States of America <input checked="" type="checkbox"/>	<input type="checkbox"/>
		European Union <input type="checkbox"/>	<input type="checkbox"/>

**GENERAL INFORMATION REQUIRED FOR ALL PRODUCTS**

Dimensions (L x W x H) 8.3"X5.8"X2.0"	Weight: <u>2</u> lbs.				
Power Requirements: AC <input checked="" type="checkbox"/> Voltage: <u>120</u> VAC # of AC phases: <u>1</u> current: <u>  </u> Amps frequency: <u>60</u> Hz					
Product Intended Application Wireless Ethernet modem					
Product Deployment Environments Outdoors -40C to 50C					
Description of interconnecting leads & cables (Attach separate sheet, if required)	Type:  Connectors:  Terminations :  Shielding:  Length:	Cable 1  Cross-over Ethernet cable  RJ-45  None  None  ~ 15 ft.	Cable 2	Cable 3	Cable 4
List of internally generated frequencies: Crystal / Oscillator / Switcher / LO		11 MHz (DSSS BBP reference) 22 MHz (Microprocessor reference) 25 MHz (Ethernet reference) 22 MHz (Reference oscillator) 70 MHz (Intermediate frequency) 140 MHz (IF Oscillator) 905 – 925 MHz (Desired frequency) 975 – 995 MHz (Radio Frequency Local Oscillator)			

**CLIENT SAMPLE DESCRIPTION  
WIRELESS PRODUCT INFORMATION**

**Type of Radio Device** (check all applicable Equipment Configurations)

Intentional transmitter <input checked="" type="checkbox"/>	Receiver <input checked="" type="checkbox"/>	Transceiver <input type="checkbox"/>
---	--	--------------------------------------

**Type of Radio Operating License**

Unlicensed Personal Communication <input checked="" type="checkbox"/>	Unlicensed National Information Infrastructure <input type="checkbox"/>	Ultra-Wideband Operation <input type="checkbox"/>	Licensed <input type="checkbox"/>
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**Type of Modulation of Radio Device**

CDMA <input type="checkbox"/>	TDMA <input type="checkbox"/>	Other <input type="checkbox"/>
Spread Spectrum Technology <input checked="" type="checkbox"/>	Direct sequencer <input type="checkbox"/>	Frequency hopper <input type="checkbox"/>
Transmitter Power Output : 32.2 dBm EIRP, 26dBm conducted		Emission Designator :

**Information on Radio Frequencies**

Transmitter Operating Frequency(s) & Bandwidth	<b>905 – 925 MHz, 5MHz BW</b>
Transmitter Channel Frequencies & separations (If required, attach a separate sheet)	<b>905, 915 and 925 to be used for testing</b>
Receiver Operating Frequency(s) & Bandwidth	<b>905 – 925 MHz, 5MHz BW</b>
Receiver Channel Frequencies & separations (If required, attach a separate sheet)	<b>905, 915 and 925 to be used for testing</b>

**Information on Antenna(s)**

Is the antenna removable? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/>	Antenna Connector Type : <b>Tensolite</b>	Number of Antennas : <b>1 (diversity antenna)</b>
Gain of Each Antenna (and tolerance)	6.2 ± 0.5 dBi and 2 ± 0.5 dBi (vertical and horizontal polarization, respectively)	
Activity and State of Digital Circuitry during ON Time	Active	

**Radio Transmission Type**

Continuous <input checked="" type="checkbox"/>	Intermittent <input type="checkbox"/>	ON Time/ OFF Time :
Activity and State of Digital Circuitry during OFF Time	Active	

**Pre-Approved Radio Systems & Sub-Assemblies**

Prepared By: Shane Phillips	Title: RF Engineer	Date: January 18, 2006
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