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Emissions Testing of the MMT9000 in accordance with FCC Part 15.247 (2004) Spread Spectrum Operation 902 - 928 & 2400 - 2483.5 & 5725 - 5850 MHz.

Test Personnel: Jianming Zhang, Trung Nguyen, David Raynes

Prepared for: WaveRider Communications Inc.

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1.0 INTRODUCTION

1.1 SCOPE

The purpose of this report is to present the findings and results of compliance testing performed in accordance with CFR Title 47 FCC Part 15.247 (2004), Spread Spectrum Operation 902 - 928 & 2400 - 2483.5 & 5725 – 5850 MHz.

1.2 APPLICANT

This test report has been prepared for WaveRider Communications Inc., located in Calgary, Alberta, Canada.

1.3 APPLICABILITY

All test procedures, limits, and results defined in this document apply to the WaveRider Communications Inc. MMT9000 unit, referred to herein as the Equipment Under Test (EUT).

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

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

1.4 TEST SAMPLE DESCRIPTION

The test sample provided for testing was a MMT9000:

Product Type:	Mobile wireless modem
Model Number:	MMT9000
Serial Number:	61012F-OPUS
Cables:	Ethernet, RF antenna, DC power
Power Requirements:	12 VDC
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.

1.6 SCOPE OF TESTING

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

1.6.1 VARIATIONS IN TEST METHODS

The RF output Spectral Density data were taken with a Peak Hold function rather than with an average detector. Experience with this particular device has shown that the average value is typically 1.3 dB down from the peak values reported in this document.

1.6.2 TEST SAMPLE CONFIGURATION & MODIFICATIONS

The EUT met the requirements without modification.

2.0 ACRONYMS

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

3.0 MEASUREMENT UNCERTAINTY

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

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

4.0 TEST CONCLUSION

STATEMENT OF COMPLIANCE

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

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

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

TEST CASE	TEST TYPE	SPECIFICATION	TEST SAMPLE	MOD. STATE	CONFIGURATION	RESULT
§4.1	Conducted Emissions at AC lines	FCC Part 15.107 and 15.207	MMT9000	nil	See § 1.6.2	**n/a**
§4.2	Conducted Emissions at Antenna Port	FCC Part 15.247	MMT9000	nil	See § 1.6.2	**PASS**
§4.3a	Radiated Emissions (Rx Mode)	FCC Part 15.109	MMT9000	nil	See § 1.6.2	**PASS**
§4.3b	Radiated Emissions (Tx Mode)	FCC Parts 2.1053, 15.205, 15.209 & 15.247	MMT9000	nil	See § 1.6.2	**PASS**
§4.4	Frequency Stability	FCC Part 2.1055	MMT9000	nil	See § 1.6.2	**PASS**

4.1 CONDUCTED EMISSIONS ON AC POWER LINES (15.107 & 15.207)

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: n/a Test Date: n/a	Product: MMT9000
Test Result, MMT9000: **Not Applicable**	
The MMT9000 was not tested for Conducted Emissions. This is a DC powered device. The power source is provided by the end user, not WaveRider Communications Inc.. There is no direct connection to the AC mains.	

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

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: David Raynes Test Date: 11 & 22 July 2005	Product: MMT9000

Test Result, MMT9000: **PASS**

Objectives/Criteria
The Conducted emissions produced by a device shall meet the specifications as stated.

Temperature = 22 °C Humidity = 43 %

15.247(a): BW ≥ 500 kHz

Carrier Frequency [MHz]	Bandwidth [MHz]	Delta from limit [MHz]
905	2.615	+ 2.115
915	2.555	+ 2.055
925	2.540	+ 2.040

15.247(b): 1 Watt (30 dBm)

Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from limit]
905	26.0	- 4.0
915	26.2	- 3.8
925	25.9	- 4.1

15.31(e) RF output @ 85% supply voltage

Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from 100% supply]
905	26.1	+ 0.1
915	26.2	0
925	25.8	- 0.1

15.31(e) RF output @ 115% supply voltage

Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from 100% supply]
905	26.0	0
915	25.9	- 0.3
925	25.8	- 0.1

15.247(c): -20 dB **f**c

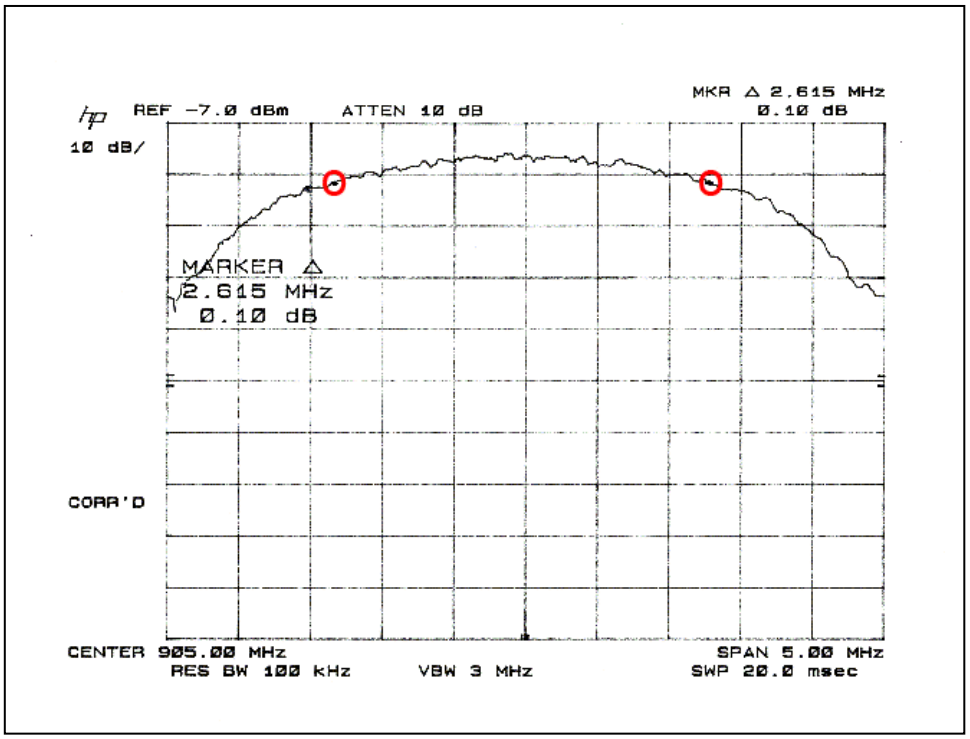
Carrier Frequency [MHz]	RF Voltage [dBμV]	Limit [dBμV]
905	126.2	106.2
915	127.0	107.0
925	127.1	107.1

15.247(d): 8 dBm (115 dBμV)

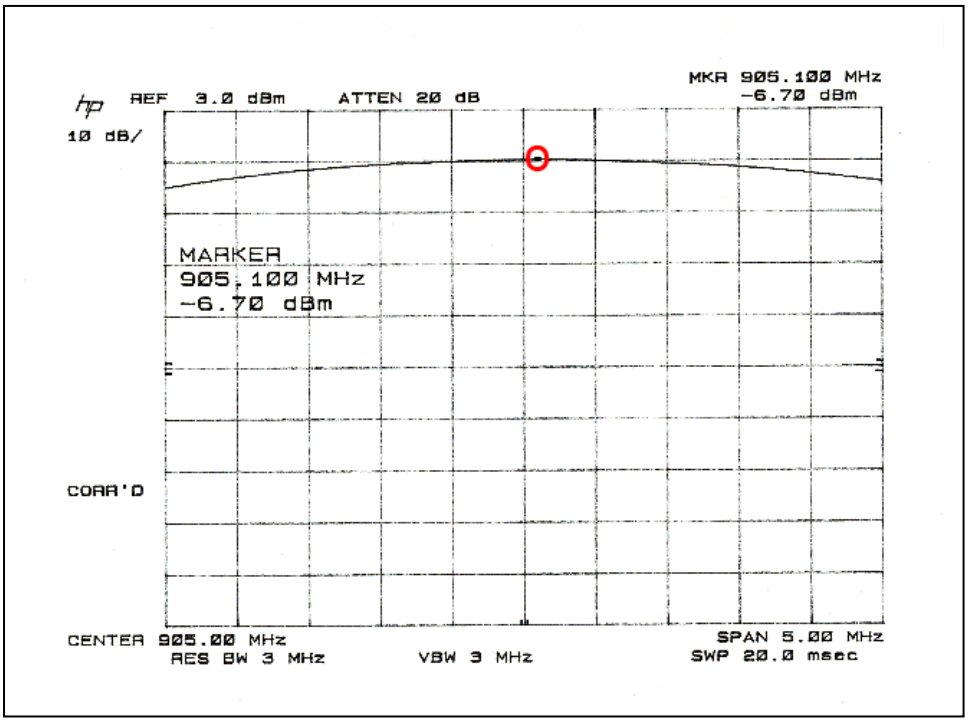
Carrier Frequency [MHz]	RF Power [dBm]	Delta [dB from limit]
905	7.4	- 0.6
915	6.3	- 1.7
925	6.8	- 1.2

Measurements were performed while the MMT9000 was transmitting continuously.
Refer to the test data and plots for more detail.

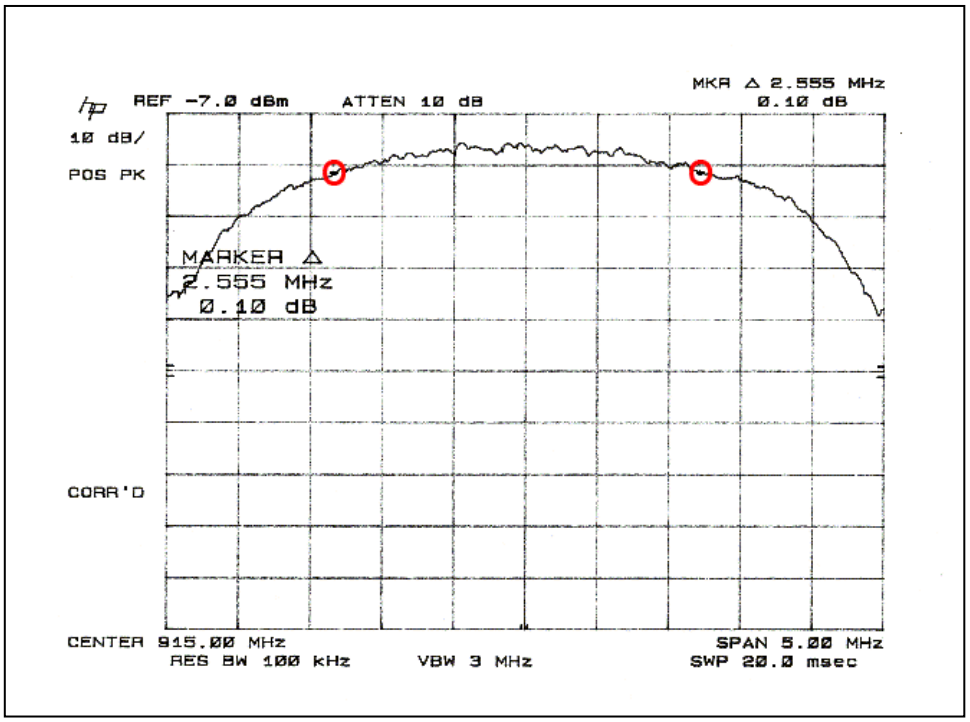
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 905 MHz



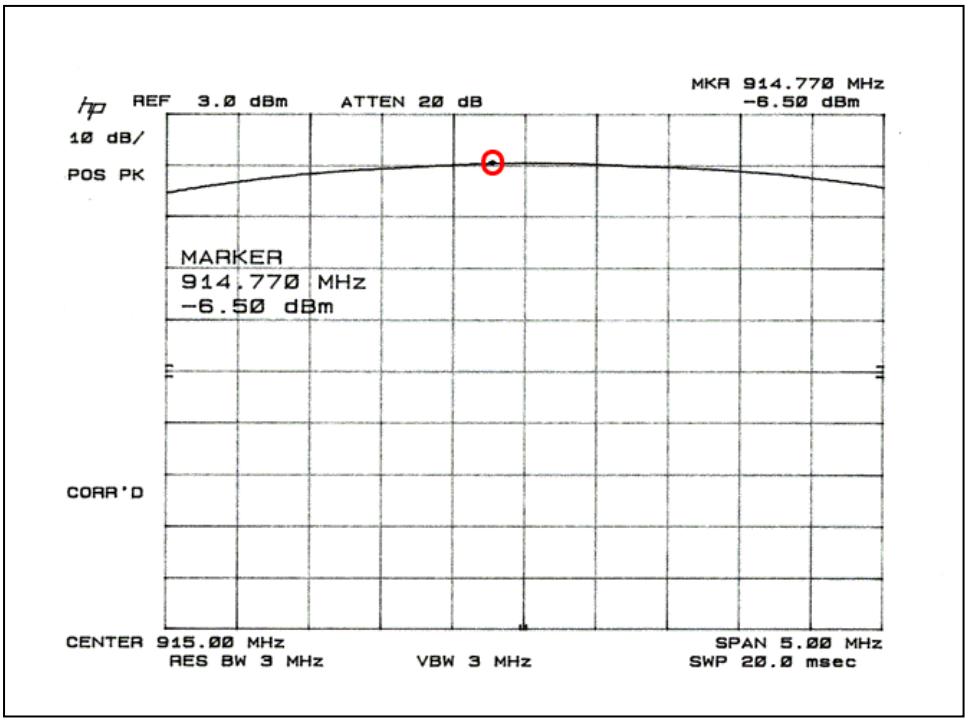
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 905 MHz
Attenuation = 32.7 dB ⇒ 26.0 dBm



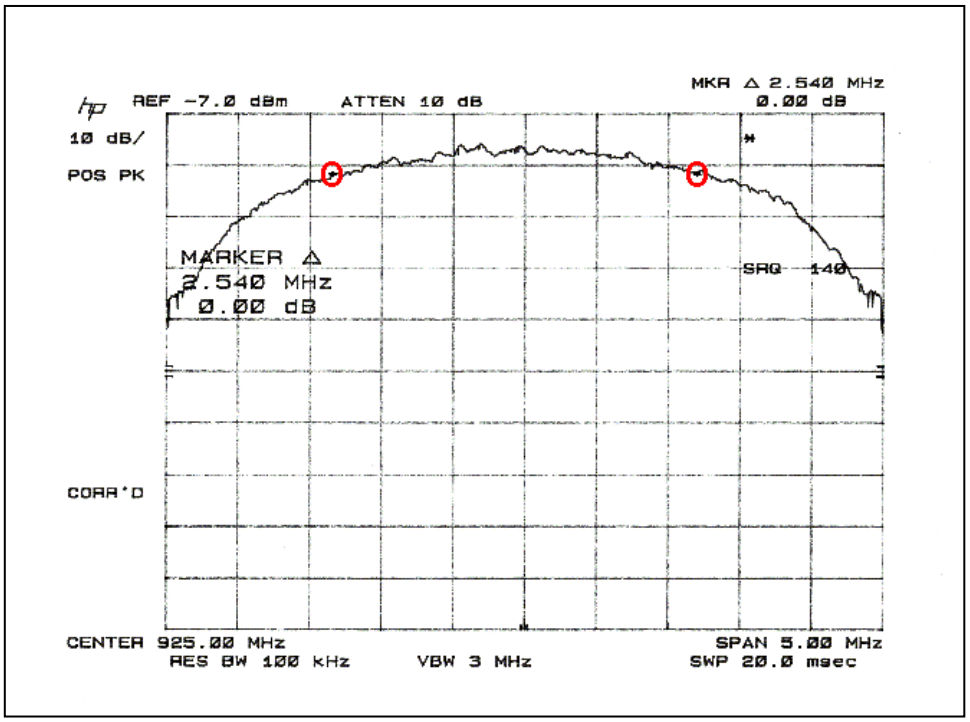
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 915 MHz



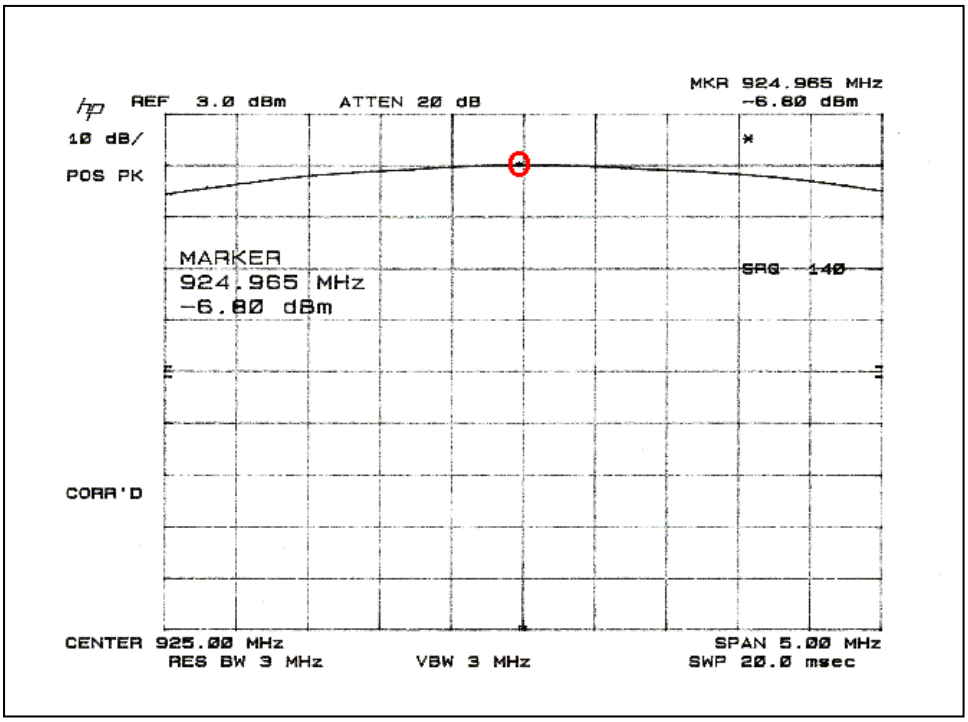
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 915 MHz
Attenuation = 32.7 dB ⇒ 26.2 dBm



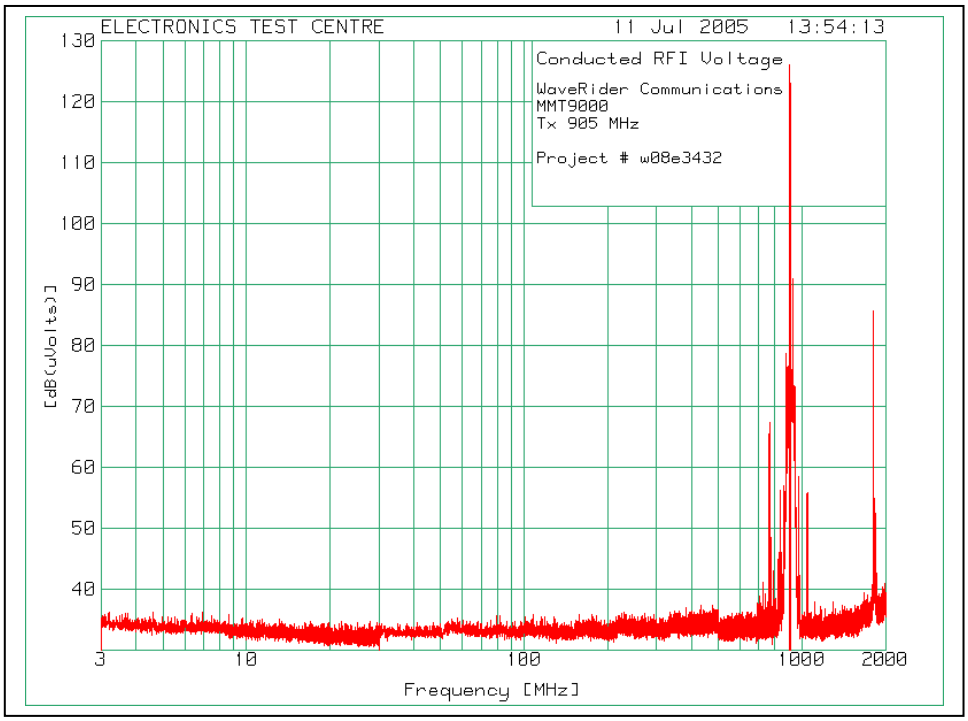
Spectrum Analyzer Plot of 6 dB Bandwidth: Tx @ 925 MHz



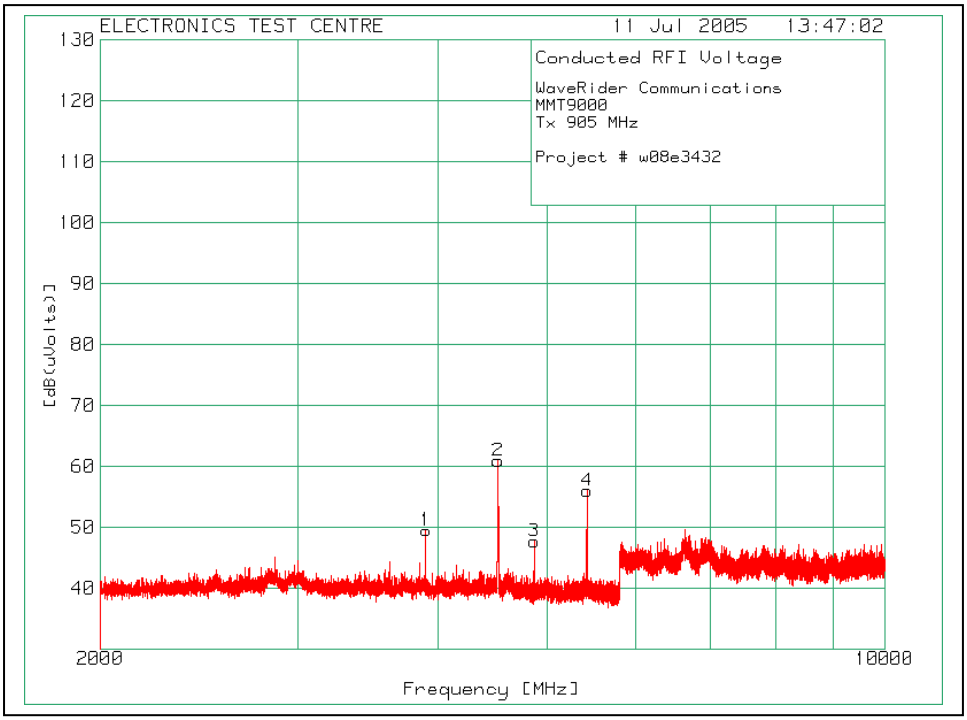
Spectrum Analyzer Plot of Maximum Peak Output Power: Tx @ 925 MHz
Attenuation = 32.7 dB ⇒ 25.9 dBm



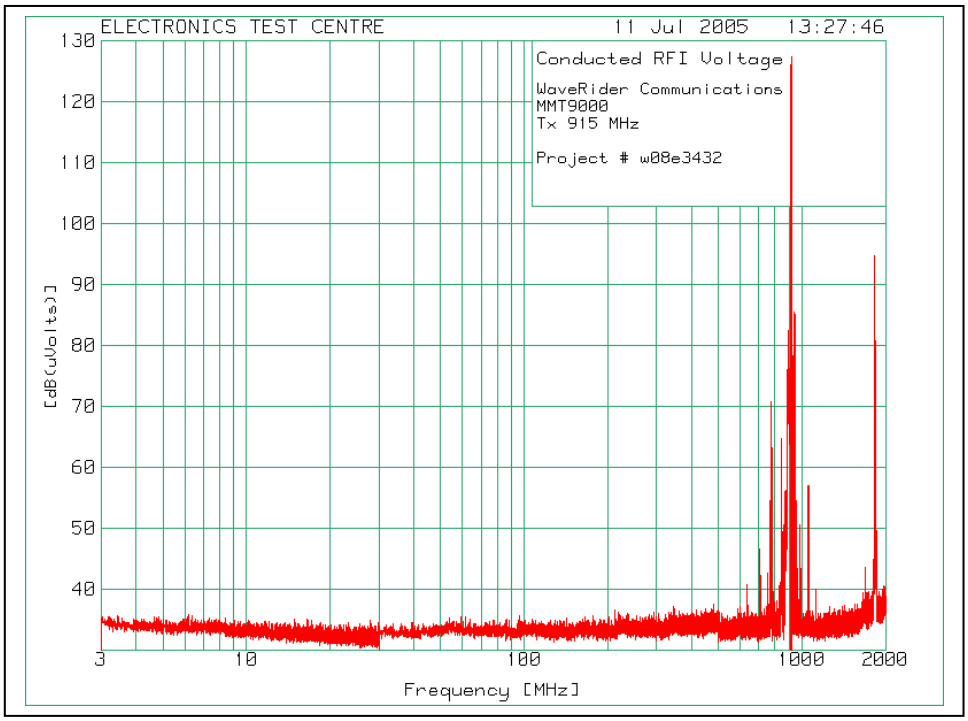
Plot of Conducted Emissions at Antenna Port:



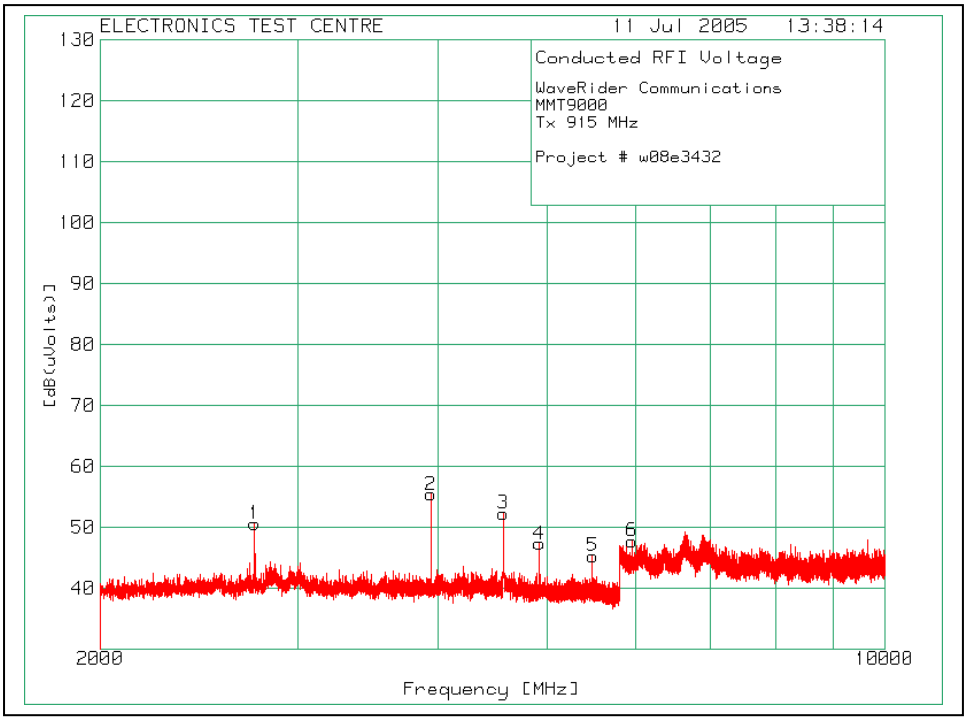
Plot of Conducted Emissions at Antenna Port:



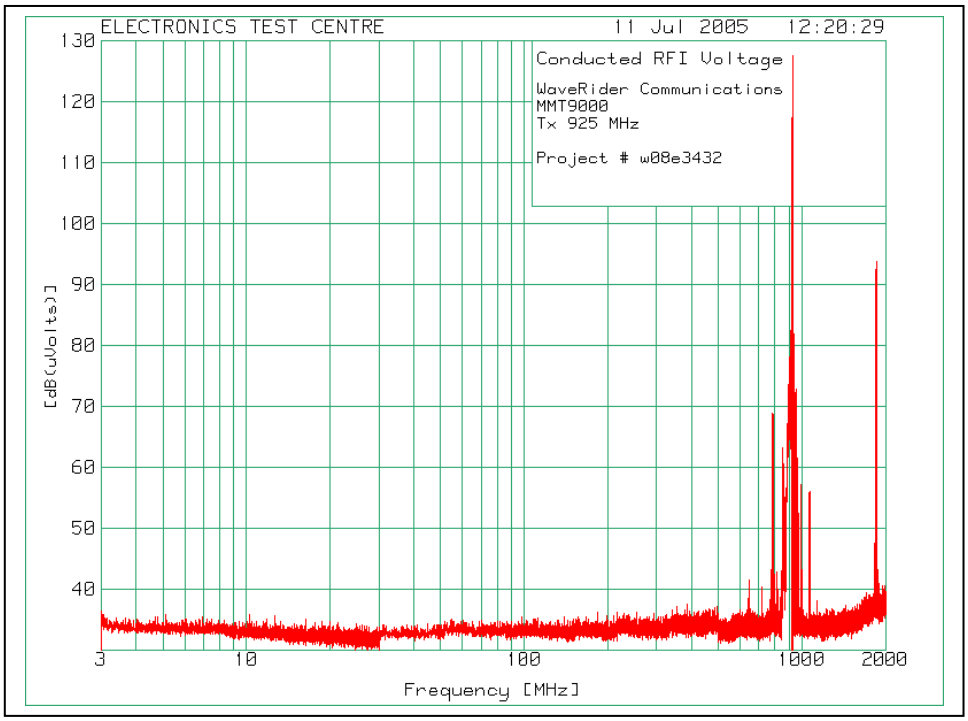
Plot of Conducted Emissions at Antenna Port:



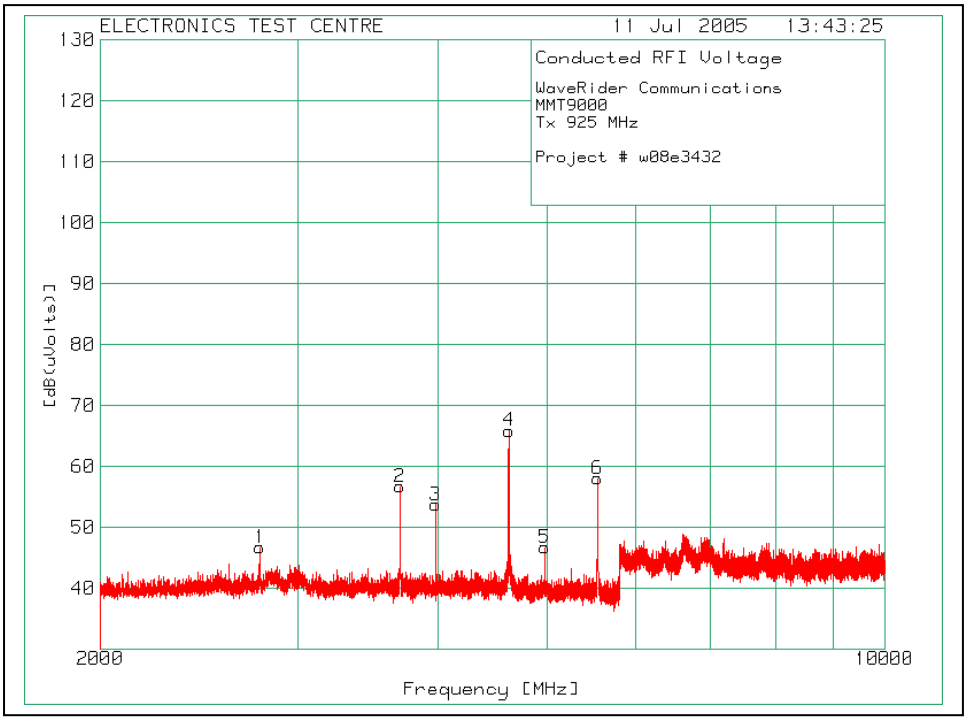
Plot of Conducted Emissions at Antenna Port:



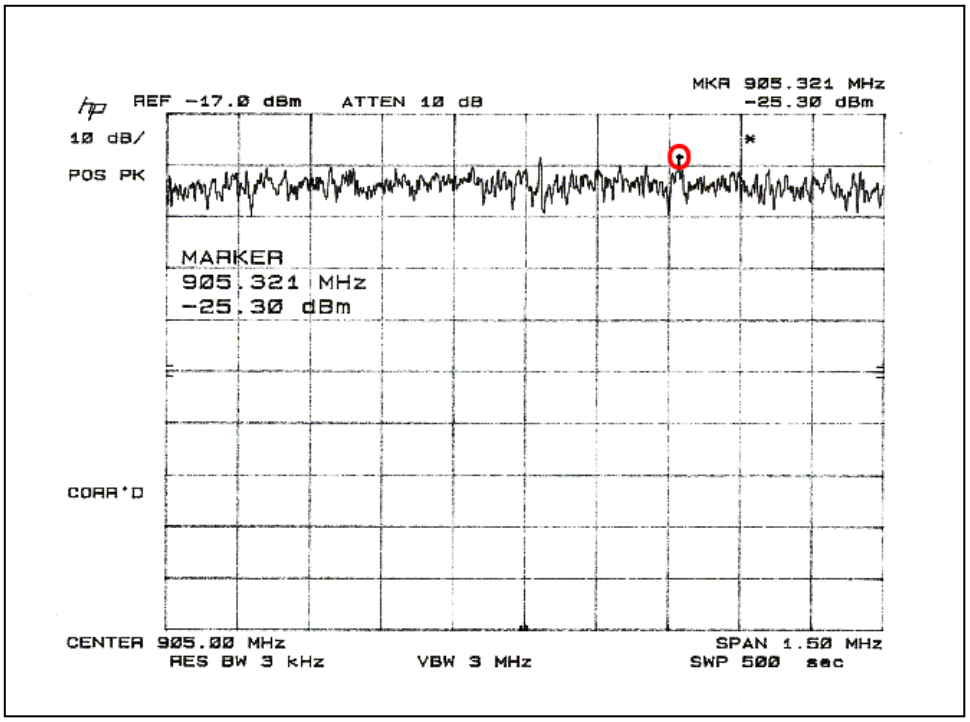
Plot of Conducted Emissions at Antenna Port:



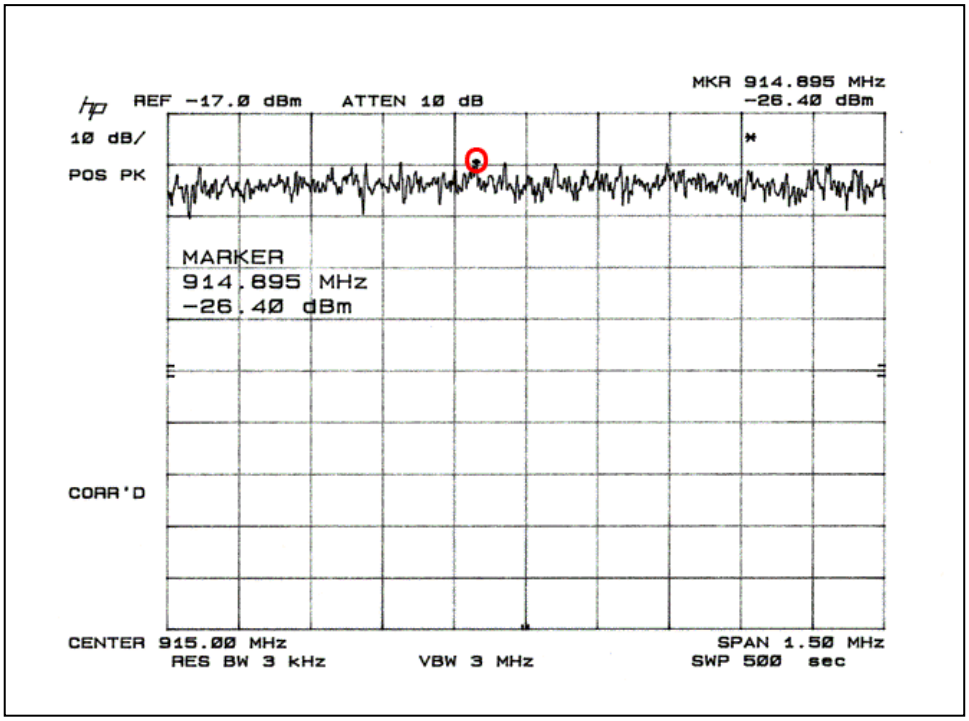
Plot of Conducted Emissions at Antenna Port:



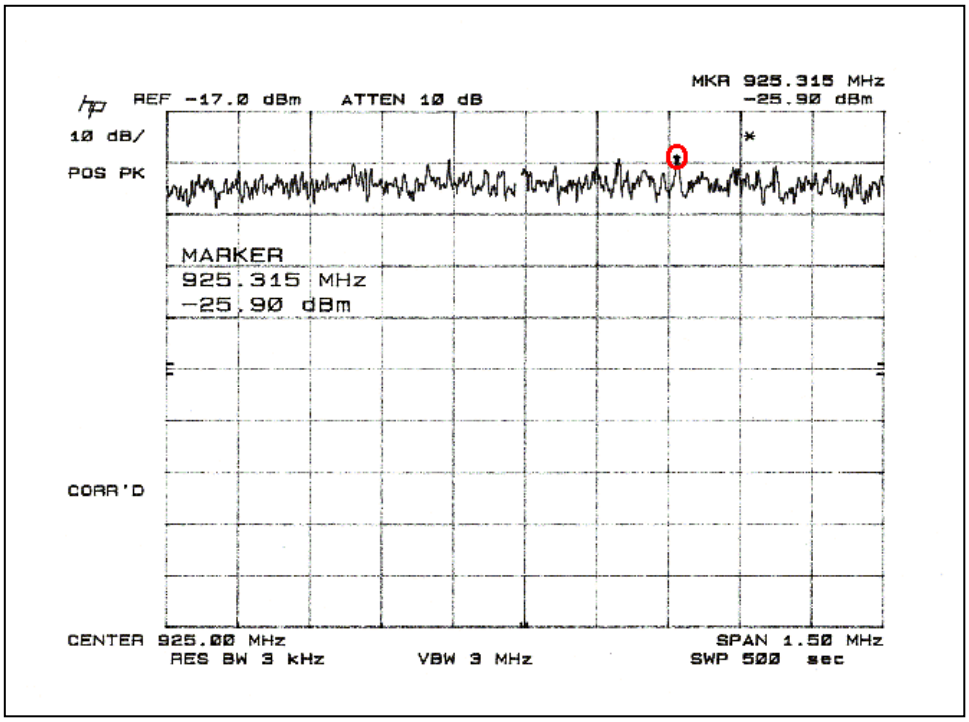
Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 905 MHz
Attenuation = 32.7 dB ⇒ 7.4 dBm



Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 915 MHz:
Attenuation = 32.7 dB ⇒ 6.3 dBm



Spectrum Analyzer Plot of Power Spectral Density per Part 15.247(d): Tx @ 925 MHz
Attenuation = 32.7 dB ⇒ 6.8 dBm



4.3 RADIATED EMISSIONS INCLUDING RESTRICTED BANDS OF OPERATION

4.3a Receive Mode (Part 15.109)

Test Lab: MPB Technologies Inc. Airdrie Test Personnel: Jianming Zhang Test Date: 11 July 2005	Product: MMT9000

Test Result, MMT9000: **PASS**

Objectives/Criteria The Radiated E-Field emissions produced by a system or sub-system, measured at a distance of 3m from the EUT, shall not exceed the limits for the specifications as stated. **Emission levels should meet the requirements with a margin of 6dB.** The EUT was assessed against the requirements of **Class B**. Temperature = 22 °C Humidity = 43 %	Specification: FCC Part 15 Subpart C Frequency [MHz] / Class A QP @ 3m / Class B QP @ 3m 30 – 88 / 49.54 / 40.00 88 – 216 / 53.98 / 43.52 216 – 960 / 56.90 / 46.02 above 960 / 60.00 / 53.98

Horizontal:			**Vertical:**		
Frequency [MHz]	Field Strength [dBμV/m]	Delta [dB from limit]	Frequency [MHz]	Field Strength [dBμV/m]	Delta [dB from limit]
175.9350	37.91	-5.61	219.9356	42.46	-3.56
219.9341	36.55	-9.47	175.9377	35.72	-7.80
197.9472	32.49	-11.03	197.9327	34.62	--8.90
			99.9343	30.99	-12.53

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	2	3 ⇓	4
94.0036	37.1 qp	2.2	8.5	47.8	54	43.5	50.5	40.5
Azimuth: 156	Height:113 Vert			Margin [dB]	-6.2	4.3	-2.7	7.3

⇓		The applicable Limit
Test Frequency [MHz]	94.0036	Test Frequency f = 94.0036 MHz
Meter Reading [dB (uV)]	37.1 qp	The reading with Quasi-Peak detector
Gain/Loss Factor [dB]	2.2	Net correction for preamp gain & cable loss
Transducer Factor [dB]	8.5	Correction for antenna loss
Level [dB (uVolts)]	47.8	Corrected value for field strength
Azimuth:	156	The turntable was 156 degrees CW from facing the antenna
Height:	113	The antenna was 113 cm above the ground
Limit: 1	54	The value of Limit 1 at 94.0036 MHz
Margin [dB]	-6.2	The field strength is 6.2 dB below Limit 1
Limit: 2	43.5	The value of Limit 2 at 94.0036 MHz
Margin [dB]	4.3	The field strength is 4.3 dB above Limit 2
Limit: 3	50.5	The value of Limit 3 at 94.0036 MHz
Margin [dB]	-2.7	The field strength is 2.7 dB below Limit 3
Limit: 4	40.5	The value of Limit 4 at 94.0036 MHz
Margin [dB]	7.3	The field strength is 7.3 dB above Limit 4

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

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

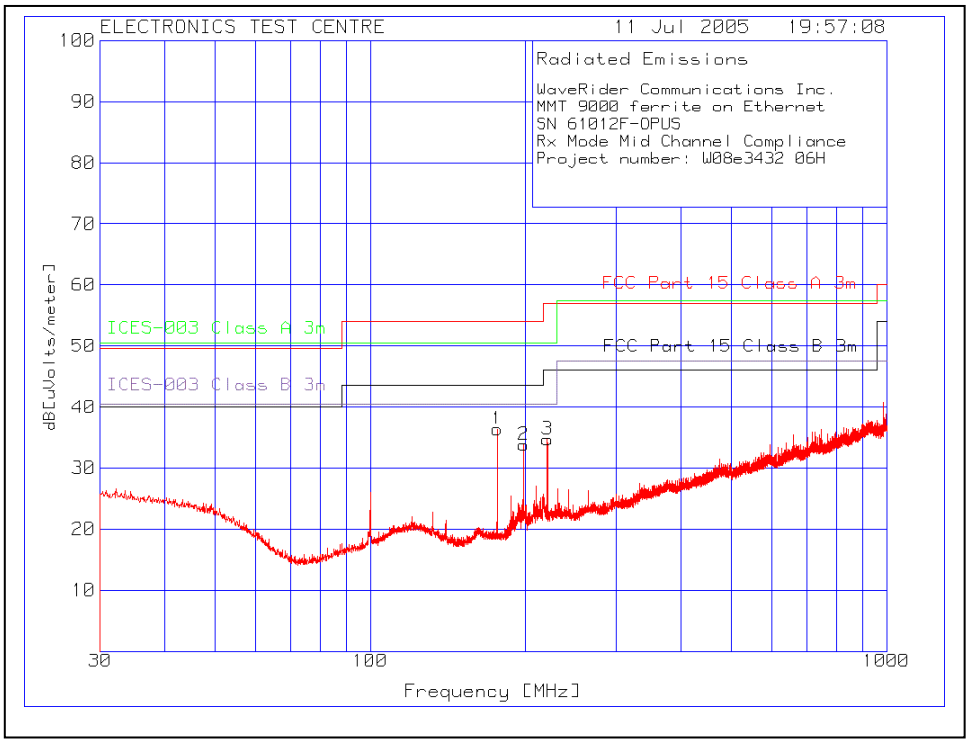
WaveRider Communications Inc.
MMT 9000 ferrite on Ethernet
SN 61012F-OPUS
Rx Mode Mid Channel Compliance
Project number: W08e3432 06

Test Frequency [MHz]	Meter Reading [dB(uV)]	Gain/Loss Factor [dB]	Transducer Factor [dB]	Level dB[uVolts/meter]	Limit:1	2	3 ⇓	4
Range: 1 30 - 1000MHz								
175.935	25.28 qp	2.72	9.91	37.91	53.98	50.46	43.52	40.46
Azimuth: 70	Height:183 Horz		Margin [dB]:		-16.07	-12.55	-5.61	-2.55
197.9472	18.73 qp	2.9	10.86	32.49	53.98	50.46	43.52	40.46
Azimuth: 54	Height:124 Horz		Margin [dB]:		-21.49	-17.97	-11.03	-7.97
219.9341	21.65 qp	3	11.9	36.55	56.9	50.46	46.02	40.46
Azimuth: 31	Height:119 Horz		Margin [dB]:		-20.35	-13.91	-9.47	-3.91
Range: 1 30 - 1000MHz								
99.9343	18.8 qp	2	10.19	30.99	53.98	50.46	43.52	40.46
Azimuth: 132	Height:101 Vert		Margin [dB]:		-22.99	-19.47	-12.53	-9.47
175.9377	21.46 qp	2.72	11.54	35.72	53.98	50.46	43.52	40.46
Azimuth: 179	Height:225 Vert		Margin [dB]:		-18.26	-14.74	-7.8	-4.74
197.9327	20.7 qp	2.9	11.02	34.62	53.98	50.46	43.52	40.46
Azimuth: 200	Height:99 Vert		Margin [dB]:		-19.36	-15.84	-8.9	-5.84
219.9356	27.46 qp	3	12	42.46	56.9	50.46	46.02	40.46
Azimuth: 286	Height:100 Vert		Margin [dB]:		-14.44	-8	-3.56	2

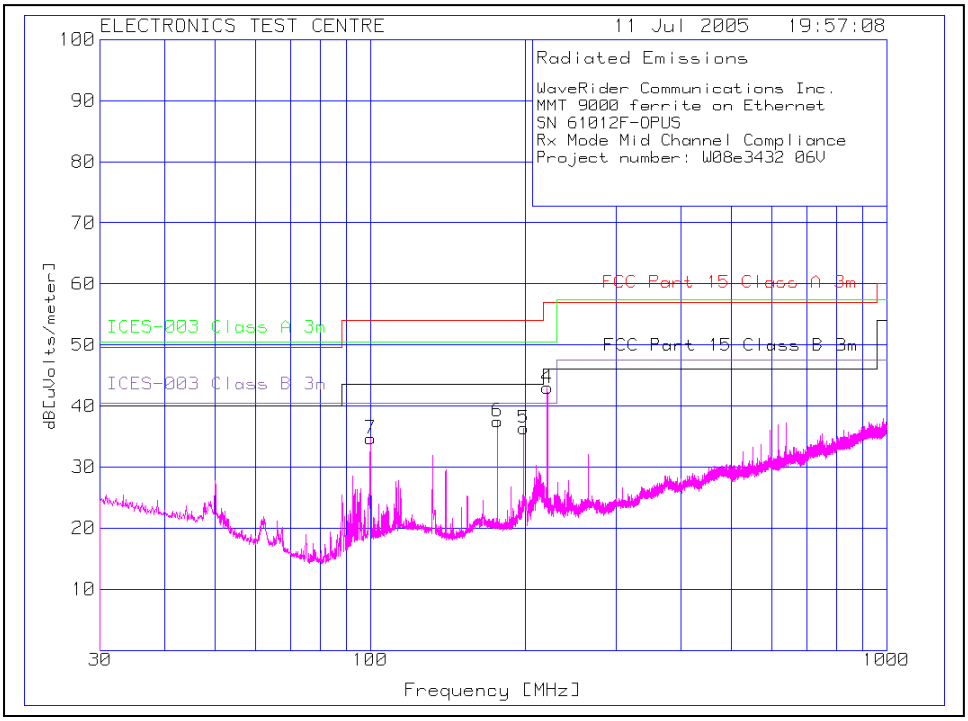
LIMIT 1: FCC Part 15 Class A 3m
LIMIT 2: ICES-003 Class A 3m
LIMIT 3: FCC Part 15 Class B 3m ⇐
LIMIT 4: ICES-003 Class B 3m

qp - Quasi-Peak detector

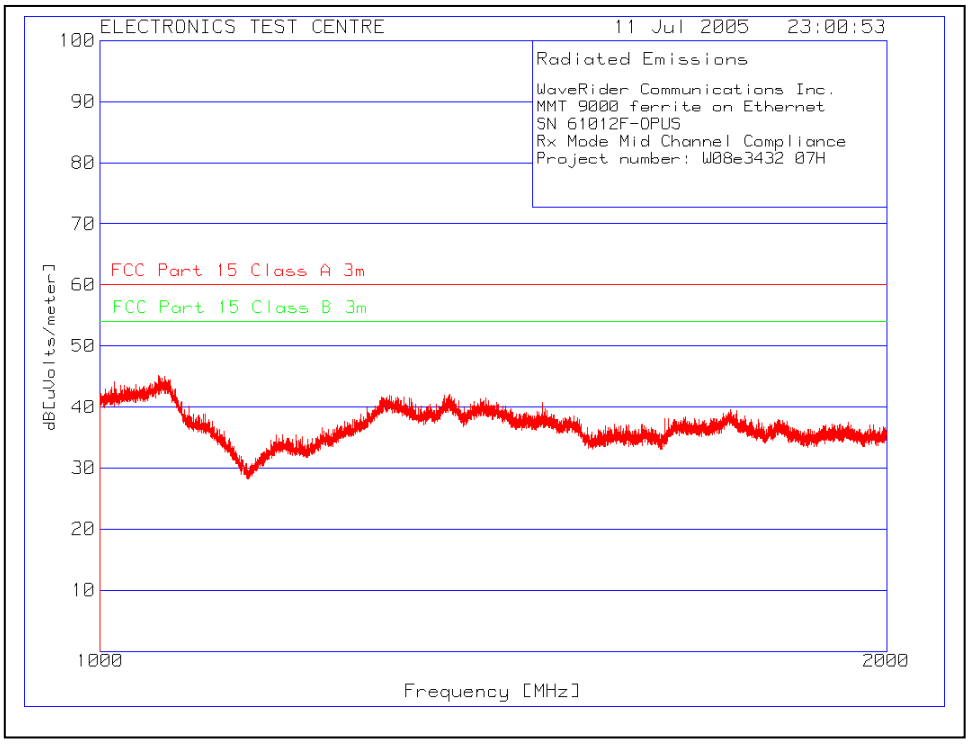
Plot of Radiated Emissions:



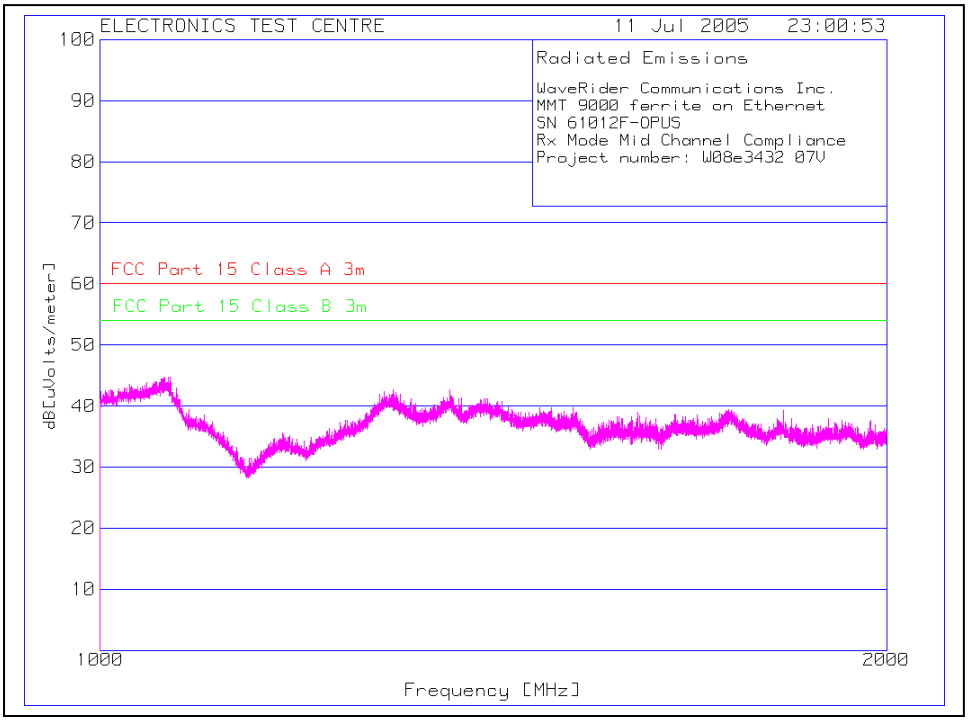
Plot of Radiated Emissions:



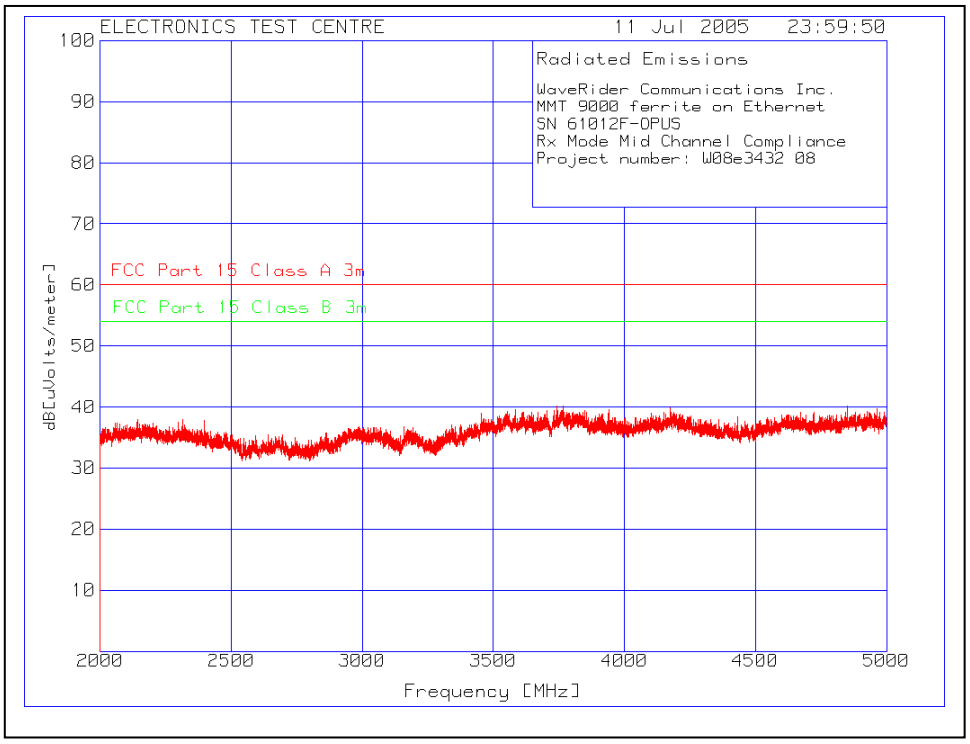
Plot of Radiated Emissions:



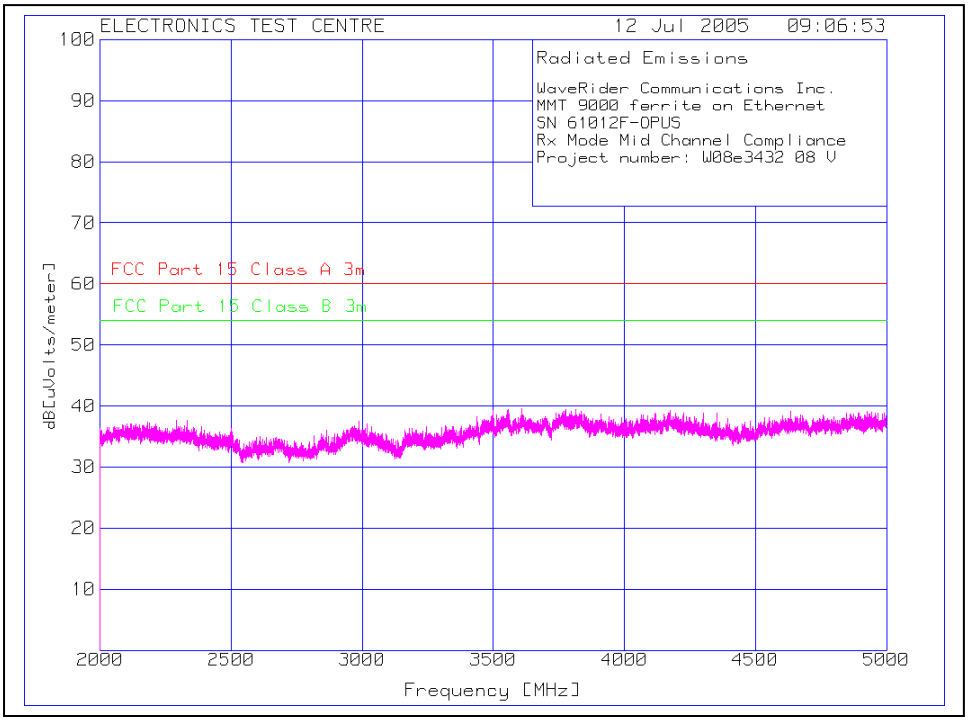
Plot of Radiated Emissions:



Plot of Radiated Emissions:



Plot of Radiated Emissions:



4.3b Transmit Mode (Part 2.1053, 15.205, 15.209 & 15.247)

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: Jianming Zhang Test Date: 12 – 15 July 2005	Product: MMT9000
Test Result, MMT9000: **PASS**	
The Radiated E-Field emissions produced by EUT, measured at a distance of 3m, shall not exceed these limits within the restricted bands of operation. Any emissions lying outside these bands shall be at least 20 dB down from the level of the fundamental. Attenuation below the limits of 15.209 is not required. **Emission levels should meet the requirements with a margin of 6dB.**	Frequency [MHz] / Limit (QP @ 3m) [dBμV/m] .009 – 0.490 : 88.5 – 53.8 .490 – 1.7 : 53.8 – 43 1.7 – 30 : 49.50 30 – 88 : 40.00 88 – 216 : 43.52 216 – 960 : 46.02 above 960 : 53.98

Restricted Bands of Operation per Part 15.205:

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

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

Radiated Emissions Data: Chrome Coil antenna

Operation in Restricted Bands:

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	974.9900	38.00 (qp)	90.78	- 53.98	H	139	323
905	975.0000	41.82 (qp)	90.78	- 53.98	V	100	260
	1809.8322	16.04	53.98	- 81.97	H	102	89
	1809.9896	7.19	53.98	- 88.03	V	198	75
905	2217.712	16.99	90.78	- 81.97	H	366	6
905	2218.0019	17.91	90.78	- 88.03	V	308	188
915	985	40.27 (qp)	53.98	- 13.71	H	123	97
915	985	44.66 (qp)	53.98	- 09.32	V	139	263
925	994.6968	30.06 (qp)	53.98	- 23.92	H	146	355
	994.9837	40.35 (qp)	53.98	- 13.63	V	262	141
	1850.0200	21.85	82.98	- 61.13	H	213	359
925	1850.0440	22.16	87.7	- 65.54	V	207	69
925	2352.4698	16.84	82.98	- 66.14	H	309	50
925	2352.0340	17.78	87.7	- 69.92	V	312	246

Radiated Emissions Data: Omni antenna

Operation in Restricted Bands:

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	974.5509	29.87 (qp)	53.98	- 24.11	H	304	355
905	974.4519	28.37 (qp)	53.98	- 25.61	V	153	358
905	1809.6000	14.34	73.02	- 58.68	H	100	209
905	1809.9620	13.53	90.04	- 76.87	V	100	200
905	2718.1217	14.71	73.02	- 58.31	H	100	23
915	984.9993	33.67 (qp)	53.98	- 20.31	H	128	251
915	984.923	30.35 (qp)	53.98	- 23.63	V	317	294
915	1830.0879	13.05	73.12	- 60.07	H	51	397
915	1829.8398	13.34	89.5	- 76.16	V	100	318
925	994.9887	31.58 (qp)	53.98	- 22.4	H	150	118
925	994.993	44.80 (qp)	53.98	- 9.18	V	100	121
925	1849.904	14.05	73.74	- 59.69	H	100	207
925	1849.9	12.96	90	- 77.04	V	100	266

Radiated Emissions Data: Directional Panel antenna

Operation in Restricted Bands:

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	976.4962	29.97 (qp)	53.98	- 24.01	H	182	359
905	974.9867	49.9 (qp)	53.98	- 04.08	V	100	122
905	1809.2500	13.73	68.74	- 55.01	H	401	1
905	1811.3011	13.74	91.1	- 77.36	V	399	297
905	2218.2420	15.61	68.74	- 53.13	H	399	1
905	2212.9646	16.08	91.1	- 75.02	V	398	86
915	985.4183	30.07	53.98	-23.91	H	106	359
915	984.9838	51.43	53.98	-02.55	V	100	121
915	1830.015	13.44	69.93	- 56.49	H	399	33
915	1829.8398	13.41	90.92	- 77.51	V	336	331
925	995.5151	30.24 (qp)	53.98	-23.74	H	204	358
925	995.177	30.13 (qp)	53.98	- 23.85	V	104	128
925	1849.92	13.45	69.66	- 56.21	H	100	116
925	1850.048	13.36	91.3	- 77.94	V	397	126

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 905 MHz
Chrome Coil antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
905.0002	320	119	H	49.6	11.92	5.8	17.72	15.57	0.04	4	-3.96
905.0001	26	122	V	64.7	28.85	4.3	33.15	31.00	1.26	4	-2.74

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenn a Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1810	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1810	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2715	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2715	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3620	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3620	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4525	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4525	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 915 MHz
Chrome Coil antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
914.9999	307	129	H	50.0	14.53	5.8	20.33	18.18	0.07	4	-3.93
914.9998	32	119	V	63.1	29.05	4.3	33.35	31.20	1.32	4	-2.68

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1830	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1830	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2745	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2745	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3660	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3660	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4575	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4575	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 925 MHz
Chrome Coil antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
924.9999	300	128	H	49.9	14.57	5.8	20.37	18.22	0.66	4	-3.34
924.9998	347	119	V	62.2	28.75	4.3	33.05	30.90	1.23	4	-2.77

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenn a Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1850	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1850	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2775	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2775	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3700	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3700	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4625	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4625	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 905 MHz
Omni antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
904.9999	26	193	H	46.9	14.33	5.8	20.13	17.98	0.06	4	-3.94
905.0000	106	102	V	61.6	30.83	4.3	35.13	32.98	1.99	4	-2.01

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1810	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1810	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2715	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2715	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3620	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3620	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4525	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4525	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 915 MHz
Omni antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
915.0000	36	199	H	50.1	18.24	5.8	24.04	21.89	1.54	4	-2.46
914.9998	106	103	V	61.4	31.00	4.3	35.30	33.15	2.07	4	-1.93

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1830	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1830	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2745	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2745	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3660	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3660	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4575	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4575	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 925 MHz
Omni antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
925.0000	34	208	H	49.5	16.01	5.8	21.81	19.66	0.09	4	-3.91
925.0000	269	123	V	62.3	30.70	4.3	35.00	32.85	1.93	4	-2.07

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1850	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1850	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2775	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2775	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3700	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3700	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4625	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4625	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 905 MHz
Directional Panel antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
904.9998	25	115	H	52.9	12.95	5.8	18.75	16.60	0.05	4	-3.95
904.9997	350	118	V	70.6	32.73	4.3	37.03	34.88	3.08	4	-0.92

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1810	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1810	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2715	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2715	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3620	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3620	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4525	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4525	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 915 MHz
Directional Panel antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
915.0001	25	179	H	52.5	12.86	5.8	18.66	16.51	0.04	4	-3.96
915.0000	351	117	V	70.6	32.93	4.3	37.23	35.08	3.22	4	-0.78

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1830	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1830	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2745	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2745	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3660	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3660	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4575	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4575	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

Carrier and spurious emissions: nominal $\mathbf{f}_c$ = 925 MHz
Directional Panel antenna

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Peak 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)
925.0001	31	192	H	51.3	10.99	5.8	16.79	14.64	0.03	4	-3.97
924.9998	354	115	V	71.0	32.63	4.3	36.93	34.78	3.01	4	-0.99

Frequency (MHz)	Azimuth (Degrees)	Height (cm)	Ant. Pol.	Average Spectrum Analyzer Reading (dBuV)	Power Delivered To Tx Antenna After Cable Loss (dBm)	Tx Antenna Gain (dBi)	EIRP (isotropic) (dBm)	ERP (dipole) (dBm)	ERP Limit (dBm)	Delta (dB)
1850	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
1850	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
2775	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
2775	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
3700	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
3700	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20
4625	0	100	H	≤ 20	-	-	-	≤ -33	-13	≥ -20
4625	0	100	V	≤ 20	-	-	-	≤ -33	-13	≥ -20

4.4 FREQUENCY STABILITY (Part 2.1055)

Test Lab: Electronics Test Centre (Airdrie) Test Personnel: Trung Nguyen Test Date: 13 July 2005	Product: MMT9000
Test Result, MMT9000: **PASS**	

Objectives/Criteria

The Tx frequency must remain within specified limits when the EUT is operated at ambient temperatures specified for the service environment, and at power supply voltages ± 15% of nominal.

Specification: FCC Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 deg. to +50 deg. centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Temperature (°C)	Frequency (Hz)	Temperature (°C)	Frequency (Hz)	Temperature (°C)	Frequency (Hz)
-30	914993930	0	914995946	+30	914993512
-20	914995278	+10	914994911	+40	914993879
-10	914995961	+20	914994085	+50	914994857

Frequency drift range: 2449 Hz $\Rightarrow$ ±1.34 ppm

f_{nom} (MHz)	Line VDC	Frequency (Hz)	Line VDC	Frequency (Hz)	Line VDC	Frequency (Hz)
915	10.2	914996650	12.0	914996698	13.8	914996664

Frequency drift range: 48 Hz $\Rightarrow$ ± 0.0 ppm

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 WaveRider Communications Inc. specifications.

5.3 POWER

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

5.4 EMISSIONS PROFILE

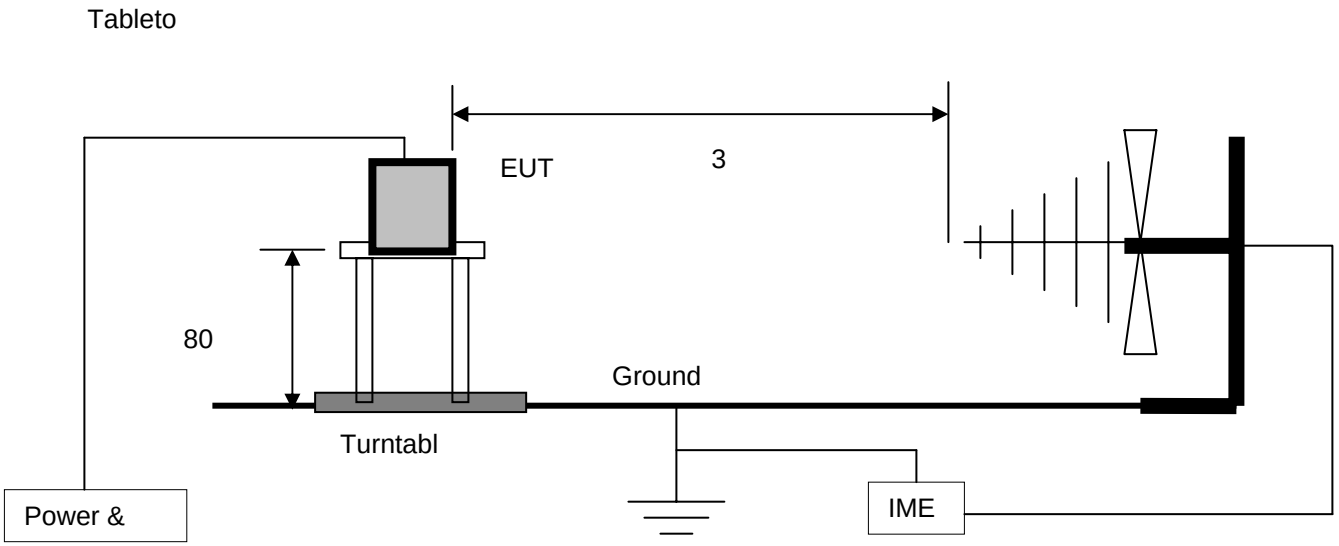
Ambient conducted and radiated electromagnetic emission profiles were generated throughout the tests and are included in the test data.

5.5 TEST CONFIGURATION

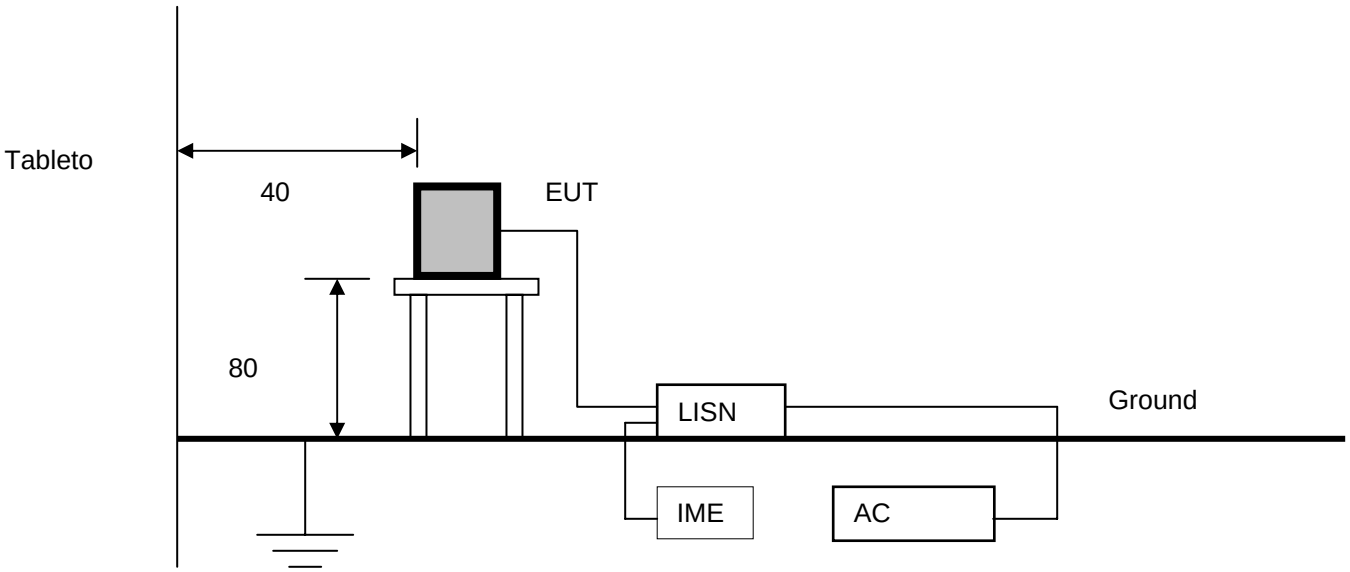
5.5.1 Tabletop Equipment

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

Radiated



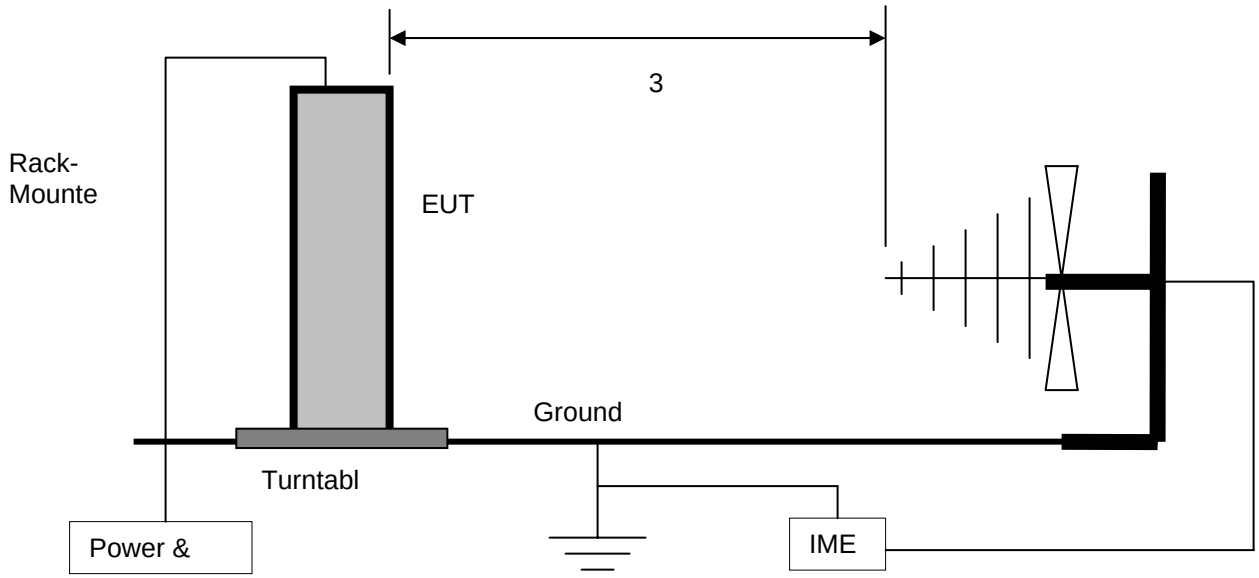
Conducted



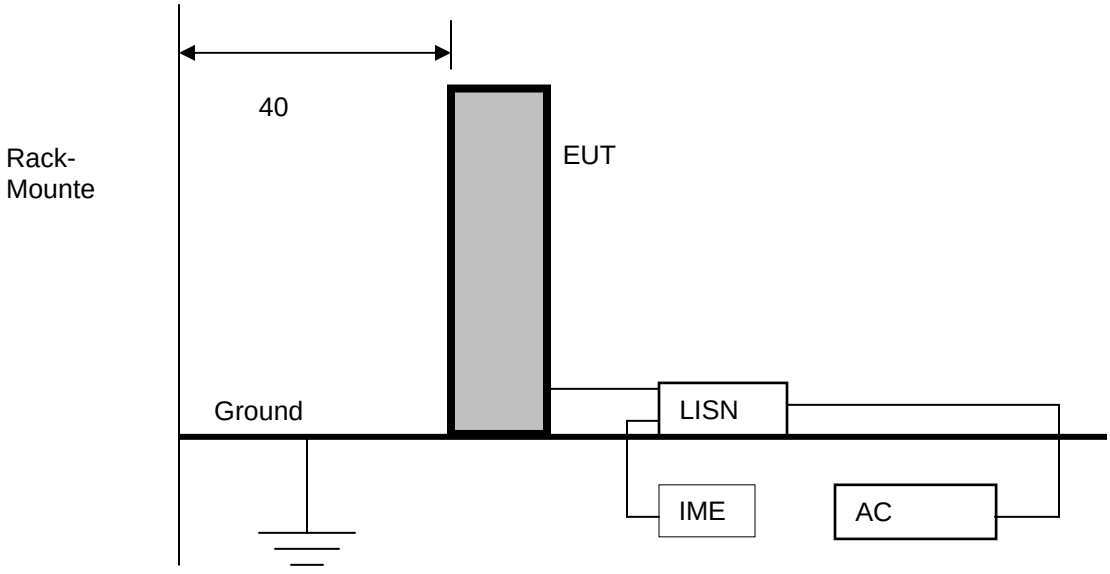
5.5.2 Rack Mount

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

Radiated



Conducted



6.0 TEST EQUIPMENT

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

6.1 RADIATED EMISSIONS

a) Spectrum Analyzer with RF Preselector
b) CISPR Quasi-peak Adapter
c) Power Isolation Transformers
d) Biconilog antenna (20 MHz to 2 GHz)
e) DRG horn antenna (1 – 18 GHz)
f) Antenna mast positioner and controller
g) Flush-mounted turntable and controller
h) Personal Computer and EMC software

6.2 CONDUCTED EMISSIONS

a) Spectrum Analyzer with RF Preselector
b) Line Impedance Stabilization Network, 50 μH
c) CISPR Quasi-peak Adapter
d) Power Isolation Transformers
e) Personal Computer and EMC software

6.3 CALIBRATION

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

6.3.1 CALIBRATION ACCURACY

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

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

6.3.2 TEST EQUIPMENT DESCRIPTION

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	17 August 2005
RF Preselector	Hewlett Packard	85685A	9728	19 August 2005
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	20 August 2005
Measurement System Software	Underwriters Laboratories	Version 6.0	4443	n/a
Inverter (one phase)	California Instruments	5000iX	4378	22 January 2007
Low Noise Amplifier	MITEQ	JS43-01001800-21-5P	4354	7 January 2007
Line Impedance Stabilization Network	EMCO	3825/2r	9331	5 January 2006
Line Impedance Stabilization Network	EMCO	3825/2r	9259	5 January 2006
Line Impedance Stabilization Network	EMCO	38100/1SPEC	9331	5 January 2006
Line Impedance Stabilization Network	EMCO	38100/1SPEC	9259	5 January 2006
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

Appendix A

MMT9000

Test Sample Description

(From data provided by WaveRider Communications Inc.)

Product Application	**Product Category**
Commercial X Military o	Telecommunications o Information Technology X Surface Transportation o Aerospace o Test & Measurement o Other o _____
Product Name	MMT9000
Part/Model No.	MMT9000
Serial Number	61012F-OPUS
Power Requirements: **(Voltage, AC/DC, Hz, Current)**	12 VDC
Typical Installation Instructions or Configuration	Connected via an Ethernet cable to a personal computer.
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 One power supply cable One Antenna
Brief Functional Description	The MMT9000 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 frequency of 70MHz before it is demodulated and despread.