EMC Technologies (NZ) Ltd

Test Report No **090710.1**
Report date: 25 August 2009

TEST REPORT

ELPRO E2_900M Wireless Data Modem

tested to the

Code of Federal Regulations (CFR) 47

Part 15 – Radio Frequency Devices,

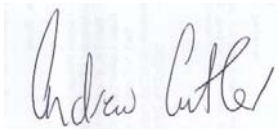
Subpart B – Unintentional Radiators

Subpart C – Intentional Radiators

Section 15.247 – Operation in the bands 902 – 928 MHz

for

ELPRO Technologies PTY Ltd



This Test Report is issued with the authority of:

Andrew Cutler - General Manager

EMC Technologies (NZ) Ltd
STREET ADDRESS - 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand
POSTAL ADDRESS - PO Box 68 307, Newton, Auckland, New Zealand
Telephone: +64 9 360 0862 Fax: +64 9 360 0861
E-mail: aucklab@ihug.co.nz
Web Site: www.emctech.com.au

Table of Contents

1. STATEMENT OF COMPLIANCE 3

2. RESULTS SUMMARY 3

3. CLIENT INFORMATION 4

4. DESCRIPTION OF TEST SAMPLE 4

5. RESULTS 6

6. TEST EQUIPMENT USED 32

7. ACCREDITATIONS 32

8. PHOTOGRAPHS 33

1. STATEMENT OF COMPLIANCE

The **ELPRO E2_900M Wireless Data Modem** complies with FCC Part 15 subparts A, B and C as described below when tested in accordance with ANSI C63.4, 2003.

2. RESULTS SUMMARY

Testing was carried out in accordance with the test methods defined in 47 CFR Part 15 and in particular Subparts A and C as described below.

Subpart B

Clause	Description	Results
15.101	Equipment authorisations	Digital devices classed as Class A devices
15.103	Exempted devices	Device is not exempt
15.107	Conducted emissions	Complies – See 15.207
15.109	Radiated emissions	Complies
15.111	Antenna power conducted limits	Complies

Subpart C

Clause	Description	Results
15.203	Antenna requirement	Complies
15.207	Conducted emissions	Complies
15.209	Radiated emissions	See 15.247(d)
15.247		
(a)(1)	Hopping channel separation	Complies
(a)(1)(i)(iii)	Channel occupancy / Bandwidth	Complies
(b)(1)(2)	Peak output power	Complies
(b)(4)	Antenna gain less than 6 dBi	Complies
(d)	Out of band emissions	Complies
(g)	Use of all channels	Not applicable
(h)	Intelligent frequency hopping	Not applicable
(i)	Radio frequency hazards	Complies

3. CLIENT INFORMATION

Company Name ELPRO Technologies PTY Ltd

Address PO Box 1544
Stafford

State Queensland

Country Australia

Contact Mr Scott Bowman

4. DESCRIPTION OF TEST SAMPLE

Brand Name ELPRO

Model Number E2_900M

Product Wireless Data Modem

Manufacturer ELPRO Technologies PTY Ltd

Country of Origin Australia

Serial Number 2160905

FCC ID Not yet determined

Ancillaries Not applicable

The system tested is a 900 MHz wireless data modem that operates in the 902 – 928 MHz band using frequency hopping spread spectrum techniques.

The transmitter can operate over the following frequency ranges in 250 kHz steps
- 902.625 MHz to 927.375 MHz with 100 channels
- 902.625 MHz to 914.875 MHz with 50 channels
- 915.125 MHz to 927.375 MHz with 50 channels

Test software allowed the device to operate over these 3 bands in frequency hopping mode and also on specific channels

The test software also allowed for the modulation to be turned off for testing purposes

The rated output conducted power is 1 watt (+30 dBm)

The default speed of operation is 115.2 kbaud which is the speed at which all testing has been carried out at.

The sample tested has a standard SMA antenna connector. The user manual will state "End user products that have this device embedded must be installed by experienced radio and antenna personnel, or supplied with non standard antenna connectors and antennas available from vendors specified by ELPRO"

The follow antenna combinations were supplied which were tested with this transmitter
- CC20 (20 metre cable) with 6 element Yagi antenna giving a combined gain of 4 dBi
- CC20 (20 metre cable) with Collinear antenna giving a combined gain of 2 dBi
- CC20 (10 metre cable) with Collinear antenna giving a combined gain of 5 dBi

Testing was carried out at 24 Vdc using a representative 110 Vac to 24 Vdc power supply

The test sample has the following ports that were appropriately terminated during the various tests:

- RS-232 serial port
- Ethernet port
- USB port
- 20 way phoenix connector for digital and analogue IO
- 4 way phoenix connector for RS-485
- 4 way phoenix connector for DC power input

5. RESULTS

Section 15.101 – Equipment authorisation

This device contains a number of interfaces that run using digital devices.

As this device is intended to be marketed for use in a commercial, industrial or business environment these digital devices have been classed as Class A digital devices with the applicable limits being applied accordingly

Section 15.107 – Conducted emissions

See section 15.207

Section 15.109 – Radiated emissions

Radiated emission testing was carried out over the frequency range of 30 to 2000 MHz.

Testing was carried out at the laboratory's open area test site - located at Driving Creek, Orere Point, Auckland, New Zealand.

This site conforms to the requirements of CISPR 16 and ANSI C63.4 - 2003.

Before testing was carried out, a receiver Self Test and Internal Calibration was undertaken along with a check of all connecting cables and programmed antenna factors.

The device was placed on the fibreglass test table that has a dielectric constant near 1 which is a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made with the antenna located at a 10 metre horizontal distance from the boundary of the digital devices under test.

Testing is carried out by manually scanning between 30 and 1000 MHz in 100 kHz steps while aurally and visually monitoring for emissions.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height with an automated antenna tower.

Below 1 GHz the emission is measured in both vertical and horizontal antenna polarisations using a Quasi Peak detector with a bandwidth of 120 kHz.

During the test, a number of ambient emissions are identified (list of which can be provided upon request).

The emission level is determined in field strength by taking the following into consideration:

Level (dBμV/m) = Receiver Reading (dBμV) + Antenna Factor (dB/m) + Coax Loss (dB)

Measurements were made while the device was being powered using a representative 110 Vac to 24 Vdc power supply.

Testing was carried out when the transmitter was transmitting continuously in frequency hopping spread spectrum mode with all interconnecting cables having droops not exceeding 40 cm which were attached to the following ports of a peripheral laptop computer that was located not less than 10 cm from the digital device:

- USB port was connected to the laptop computer
- RS-485 port was terminated with a 50 cm long data cable that was terminated in a 120 ohm resistor
- LAN port connected to a laptop computer using a looped 1 metre loop back data cable
- Flying lead Serial port was connected to the laptop computer
- RS 232 port was terminated with a 50 cm long data cable that was terminated with 1 nF and 3.3 kohm resistors on each pin to ground

The limits as described in Section 15.109 have been applied as follows:

30.0 – 88.0 MHz	90 uV/m	39.0 dBuV/m
88.0 – 216.0 MHz	150 uV/m	43.5 dBuV/m
216.9 – 960.0 MHz	210 uV/m	46.4 dBuV/m
above 960.0 MHz	300 uV/m	49.4 dBuV/m

Result: Complies with an 8.0 dB margin at 250.000 MHz (Horizontal).

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 – 2000 MHz) ± 4.1 dB

Results:

Frequency MHz	Vertical dBuV/m	Hort dBuV/m	Limit dBuV/m	Margin dB	Antenna Polarisation	Detector
43.178	25.3		39.1	13.8	Vertical	QP
44.170	25.8		39.1	13.3	Vertical	QP
144.000	20.6	19.3	43.5	22.9	Vertical	QP
150.000		17.1	43.5	26.4	Horizontal	QP
192.000	19.1	20.8	43.5	22.7	Horizontal	QP
219.240	22.5		46.4	23.9	Vertical	QP
240.000		20.4	46.4	26.0	Horizontal	QP
250.000	30.9	38.4	46.4	8.0	Horizontal	QP
288.000	22.0	21.6	46.4	24.4	Vertical	QP
350.000	21.0	20.1	46.4	25.4	Vertical	QP
375.000	24.8	26.5	46.4	19.9	Horizontal	QP
400.000	23.0	18.2	46.4	23.4	Vertical	QP
450.000	22.8	24.5	46.4	21.9	Horizontal	QP
480.000	22.8		46.4	23.6	Vertical	QP
500.000	32.3	38.3	46.4	8.1	Horizontal	QP
550.000	27.3	24.5	46.4	19.1	Vertical	QP
575.975	26.9	33.6	46.4	12.8	Horizontal	QP
650.000	22.5	24.1	46.4	22.3	Horizontal	QP
672.000	27.6	32.3	46.4	14.1	Horizontal	QP
700.000	25.4		46.4	21.0	Vertical	QP
768.000	27.5		46.4	18.9	Vertical	QP
864.000	27.6	24.4	46.4	18.8	Vertical	QP
875.000	32.7	32.3	46.4	13.7	Vertical	QP
960.000		21.1	46.4	25.3	Horizontal	QP
999.995	39.4	38.1	49.5	10.1	Vertical	QP

A number of emissions were observed but not recorded between 30 – 2000 MHz to have a margin to the limit that was greater than 20 dB in both vertical and horizontal polarisations.

Section 15.111 – Antenna power conduction limits for receivers

Measurements were attempted when this device was operated in receive mode with a spectrum analyser attached to the antenna port.

The following measurements were made

Receiver frequency (MHz)	Emission frequency (MHz)	Level (dBm)
902.625	792.125	-72.1
915.125	804.625	-69.4
927.625	817.125	-66.2

No further emissions were detected that exceeded a level of -90 dBm when measurements were attempted on the above frequency between 30 MHz and 9 GHz

A limit of -57 dBm was applied

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

(30 MHz - 18 GHz) ± 3.5 dB

Section 15.203 – Antenna requirement

The sample tested has a standard SMA antenna connector. The user manual will state "End user products that have this device embedded must be installed by experienced radio and antenna personnel, or supplied with non standard antenna connectors and antennas available from vendors specified by ELPRO"

The follow antenna combinations were supplied which were tested with this transmitter
- CC20 (20 metre cable) with 6 element Yagi antenna giving a combined gain of 4 dBi
- CC20 (20 metre cable) with Collinear antenna giving a combined gain of 2 dBi
- CC20 (10 metre cable) with Collinear antenna giving a combined gain of 5 dBi

Section 15.205 – Restricted bands of operation

Refer to measurements made with reference to Section 15.247 (d).

Section 15.207 – Conducted emissions

Testing has been carried out using a representative 110 Vac to 24 Vdc power supply.

Testing was carried out over the frequency range of 150 kHz to 30 MHz at the Laboratory's MacKelvie Street premises in a 2.4 m x 2.4 m x 2.4 m screened room.

Testing was carried out in accordance with section 15.207 using a measuring receiver and a 50 uH / 50 ohm artificial mains network which is also known as a line impedance stabilisation network (LISN).

Measurements on both the phase and neutral lines were made using either a Quasi Peak or an Average detector with a 9 kHz bandwidth.

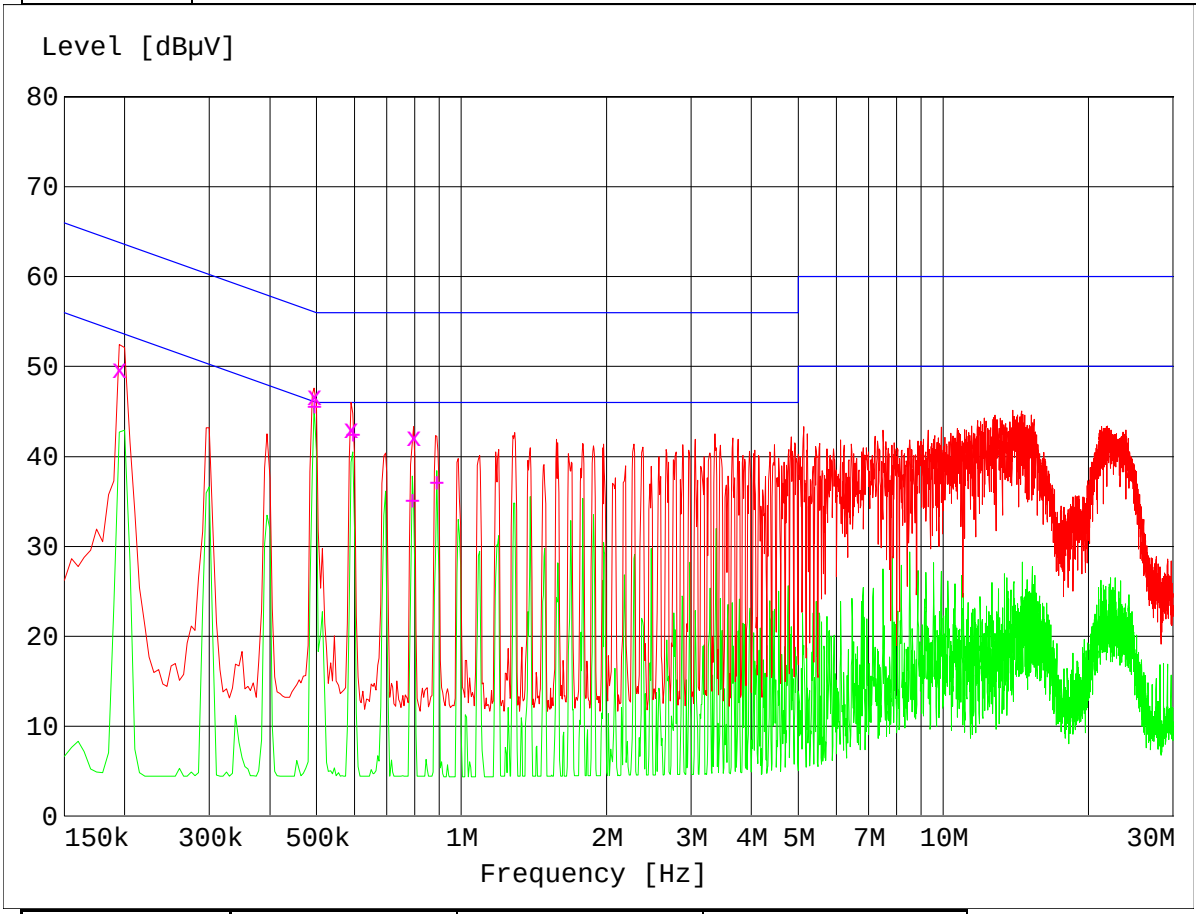
The supplied conducted emission plot is a combined plot showing the worst case of the Peak, Quasi Peak and Average levels for both phase and neutral.

The class B limits have been applied as a worst case option even though the digital devices have been classed as class A devices

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Mains terminal tests (0.15 - 30 MHz) ± 2.2 dB

Conducted emissions

Comments:	Device tested when transmitting continuously in hop mode between 902 – 928 MHz when powered using a representative 110 Vac power supply



Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.195000	49.70	63.8	14.1	N	
0.495000	46.70	56.0	9.3	N	
0.590000	43.00	56.0	13.0	N	
0.795000	42.10	56.0	13.9	N	

Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.495000	45.40	46.0	0.6	N	45.6
0.595000	42.30	46.0	3.7	N	
0.790000	35.00	46.0	11.0	N	
0.890000	37.00	46.0	9.0	N	

Section 15.209 – Radiated emissions

See the results in section 15.109 and also those in 15.247

Section 15.247(a)(1)(i) - Channel occupancy / bandwidth

The results are summarised as follows:

Parameter	Limit	Observation	Result
Number of channels	Minimum of 50 channels	50 or 100 channels	Pass
20 dB bandwidth	Not greater than 250 kHz	230 kHz	Pass
Hop interval	Greater than 20 dB bandwidth	250 kHz	Pass
Dwell time	Not exceed 400 ms in any 20 second period	81 ms with 100 channels 161 ms with 50 channels	Pass

Result: Complies

This device operates using Frequency Hopping Spread Spectrum techniques over the following frequency ranges in 250 kHz steps

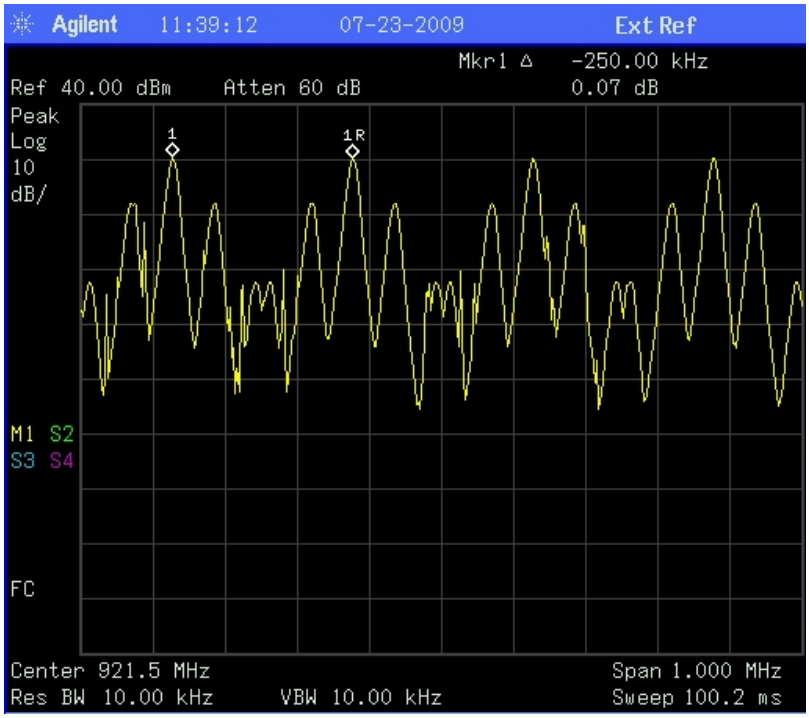
- 902.625 MHz to 927.375 MHz with 100 channels as shown below

- 902.625 MHz to 914.875 MHz with 50 channels

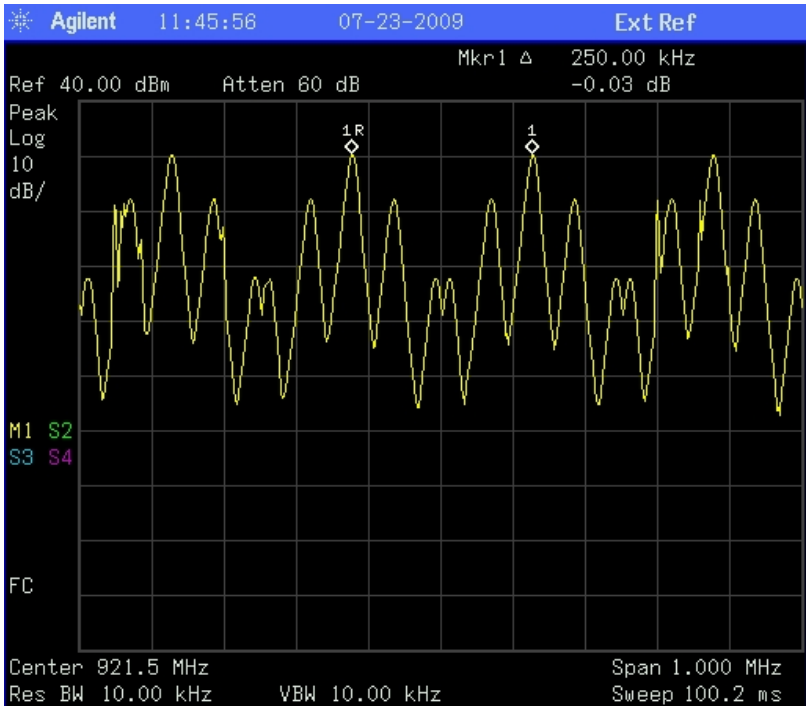
- 915.125 MHz to 927.375 MHz with 50 channels

The channels were observed to 250 kHz spaced when operating with either 50 or 100 channels

100 channels which shows 250 kHz between channels

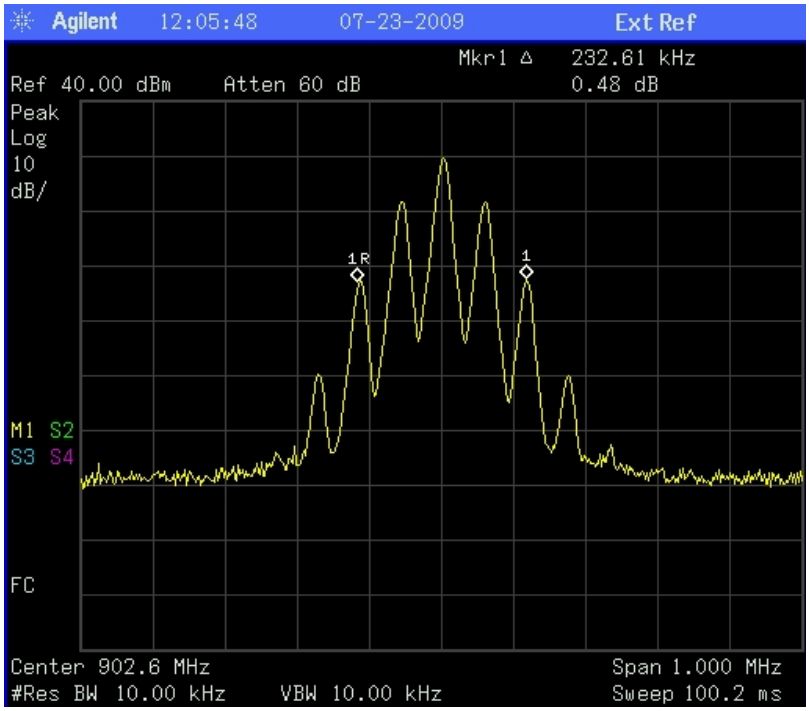


50 channels which shows 250 kHz between channels

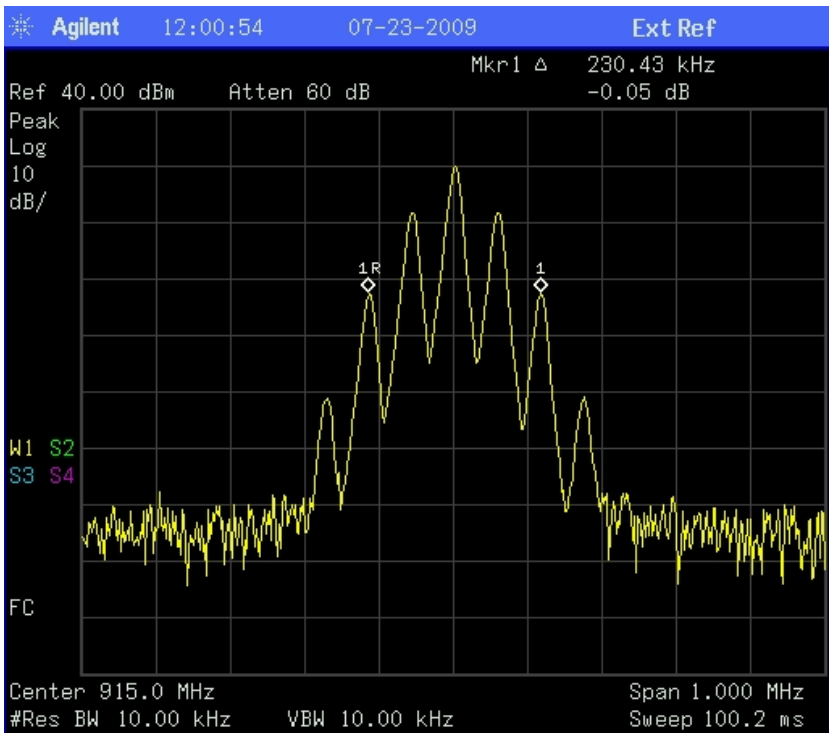


The 20 dB bandwidth measurements were made at 902.625 MHz, 915 MHz and 927.625 MHz when the transmitter was being modulated at rate of 115.2 kbaud which gives an average bandwidth of 230 kHz.

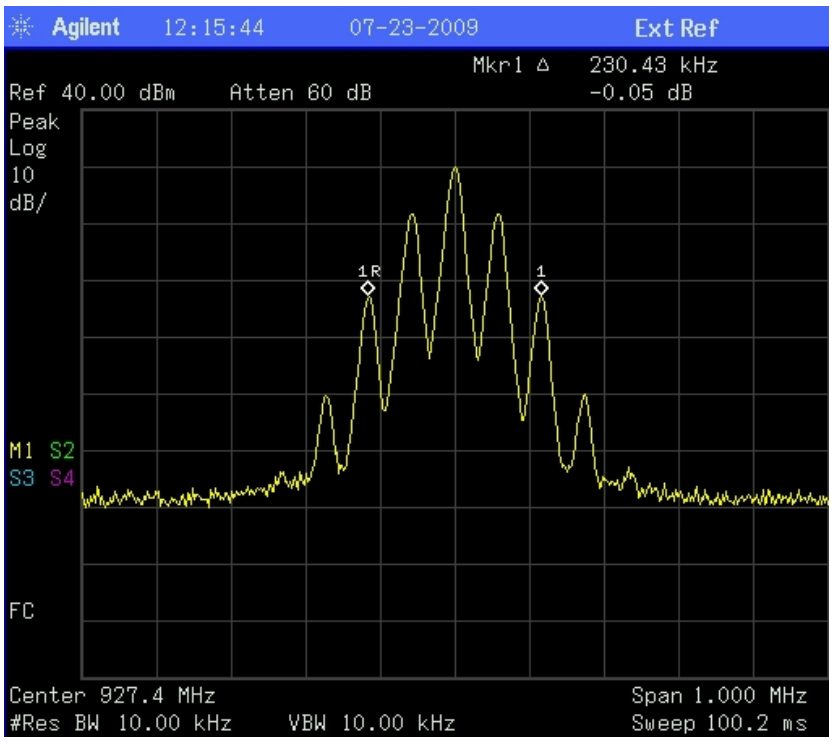
902.625 MHz with a -20 dB bandwidth of 232.61 kHz



915 MHz with a -20 dB bandwidth of 230 kHz

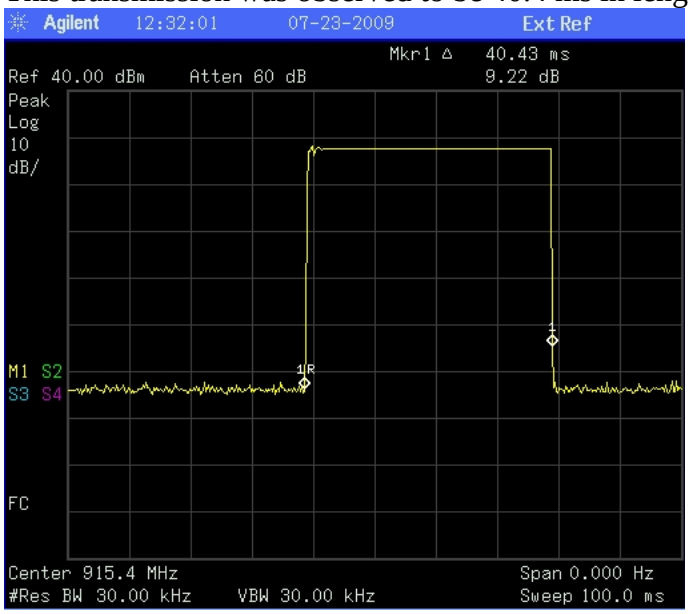


927.375 MHz with a bandwidth of 230.43 kHz



When operating with 100 channels, in any 20 second period the transmitter was observed to transmit twice transmitting every 10 seconds.

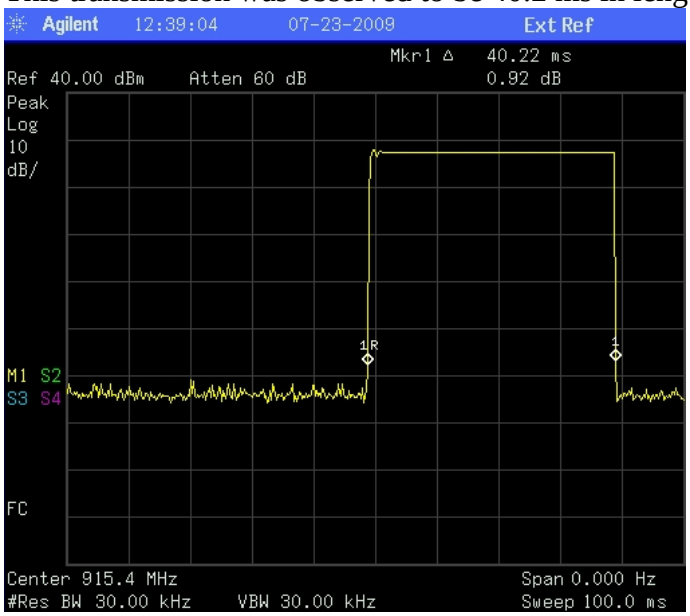
This transmission was observed to be 40.4 ms in length



This gives an average occupancy of 2 x 40.4 ms = 80.8 ms in any 20 second period

When operating with 50 channels, in any 20 second period the transmitter was observed to transmit four times

This transmission was observed to be 40.2 ms in length



This gives an average occupancy of 4 x 40.2 ms = 160.8 ms in any 20 second period

Section 15.247(b)(1)+(2)– Peak output power

The conducted output power has been measured directly at the antenna port when the transmitter was modulated at 115.2 kbaud.

Measurements were made using a spectrum analyser with a resolution bandwidth of 1 MHz when the transmitter was setup to operate on discrete frequencies.

Frequency (MHz)	Power (dBm)	Power (watts)	Limit (watts)
902.6250	29.1	0.813	1.0
915.1250	29.4	0.871	1.0
927.3750	29.3	0.851	1.0

A conducted limit of 1 watt (+30 dBm) has been applied as more than 50 channels are in use.

The antenna systems to be used have declared gains of

2 dBi – Colinear Antenna with 20 metre cable
4 dBi - Colinear Antenna with 10 metre cable
5 dBi – Yagi Antenna with 20 metres cable

As these gains are less than 6 dBi a radiated limit of 36 dBm has been applied.

Radiated power measurements were using each antenna and cable combination to confirm that the +36 dBm limit has not exceeded.

2 dBi – Colinear Antenna with 20 metre cable

Frequency (MHz)	Conducted dBm	Radiated dBuV/m	Radiated dBm	Gain dBi	PolarisatIon
902.6250	29.1	122.7	27.5	-1.6	Vertical
915.1250	29.4	123.6	28.4	-1.0	Vertical
927.3750	29.3	123.1	27.9	-1.4	Vertical

4 dBi - Colinear Antenna with 10 metre cable

Frequency (MHz)	Conducted dBm	Radiated dBuV/m	Radiated dBm	Gain dBi	PolarisatIon
902.6250	29.1	127.1	31.9	2.8	Vertical
915.1250	29.4	127.2	32.0	2.6	Vertical
927.3750	29.3	127.5	32.3	3.0	Vertical

Horizontal measurements not recorded as the collinear antenna was vertically polarised and observations showed a much reduced power output.

5 dBi – Yagi Antenna with 20 metres cable

Frequency (MHz)	Conducted dBm	Radiated dBuV/m	Radiated dBm	Gain dBi	PolarisatIon
902.6250	29.1	128.5	33.5	4.1	Horizontal
915.1250	29.4	129.2	34.0	4.6	Horizontal
927.3750	29.3	127.7	32.5	3.3	Horizontal

Vertical measurements not recorded as the yagi antenna was tested horizontally polarised and observations showed a much reduced power output.

The power level in dBm was determined by formula from the field strength using the formula Field strength (V/m) = (square root of (30 x transmitter power (watts))) / distance (metres)

The transmitter itself was placed in the centre of the test table at a height of 80 cm above the ground plane.

The collinear antenna was placed vertically on top of the test table and the yagi antenna was tested horizontally polarised approximately 50 cm above the test table

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland.

Result: Complies
Measurement Uncertainty: ±4.1 dB

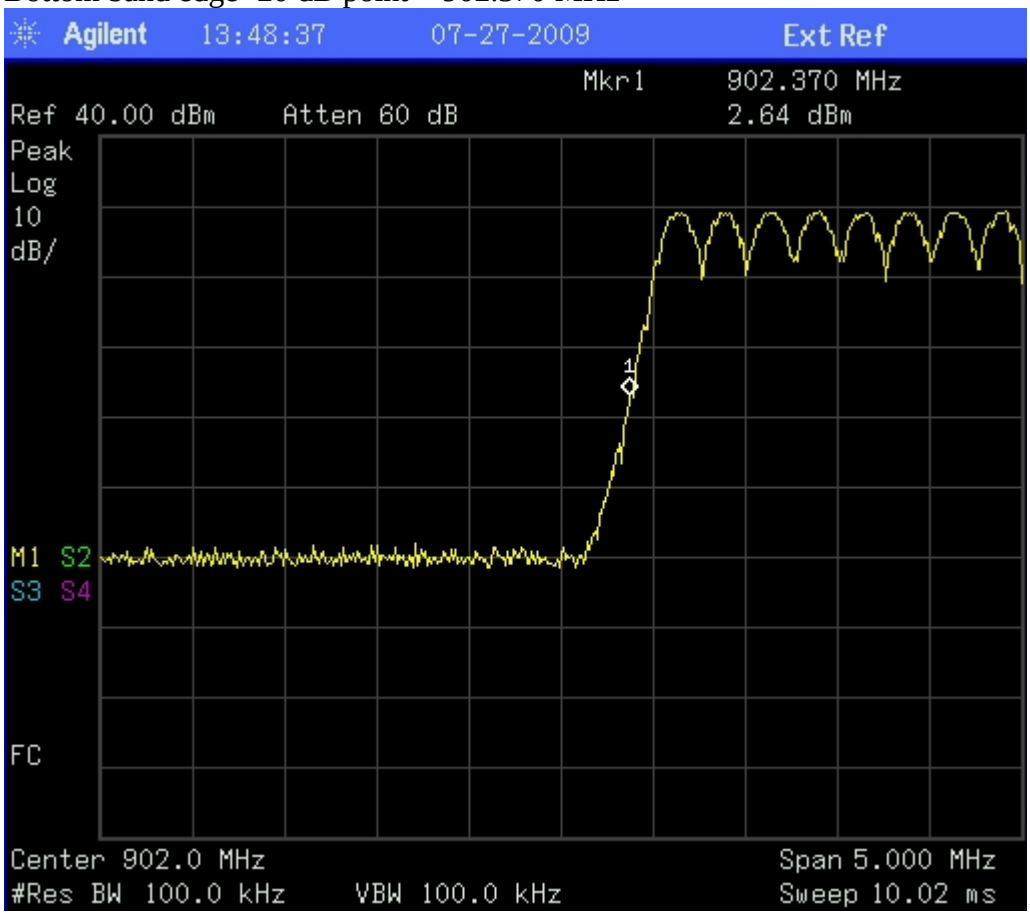
Section 15.247 (d) – Out of band emissions

Band edge measurements:

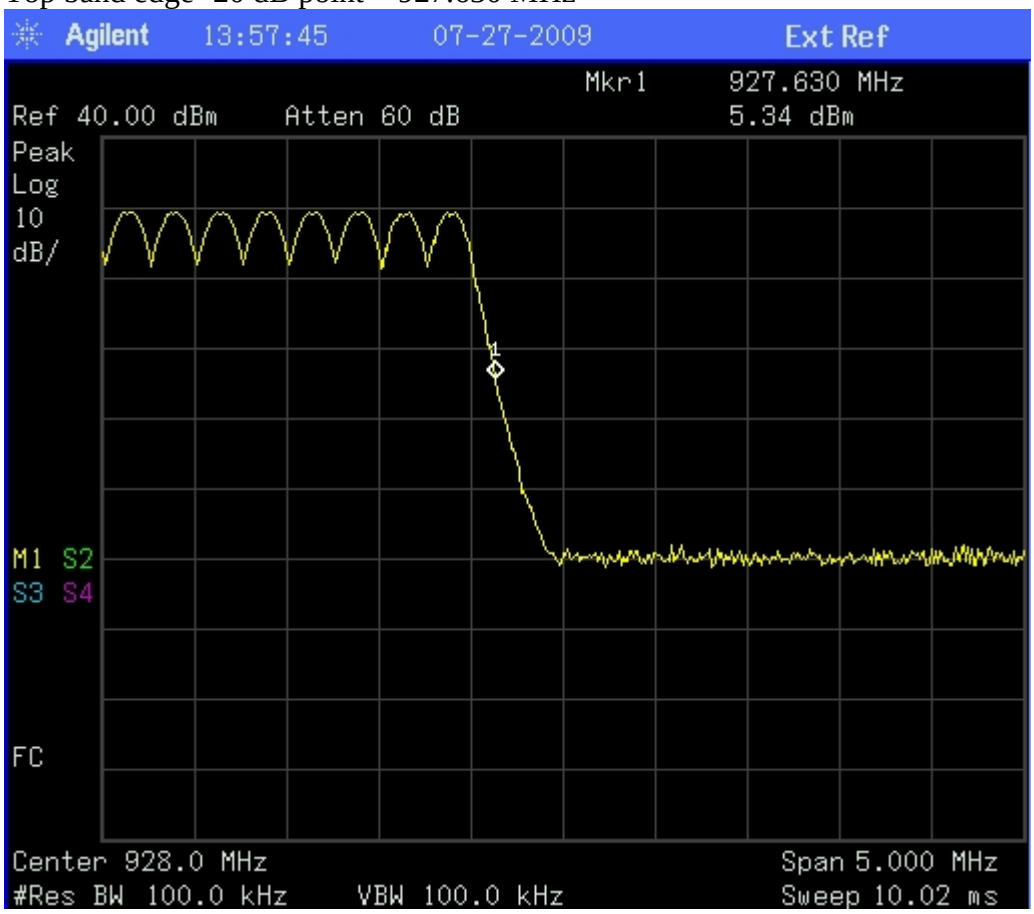
At the band edges of 902 MHz and 928 MHz all emissions are required to be attenuated by more than 20 dB relative to the highest 100 kHz resolution bandwidth emission level observed in the band of operation.

The transmitter was configured to operate in hop mode with 100 channels between 902 MHz and 928 MHz with measurements being made using a 100 kHz RBW.

Bottom band edge -20 dB point = 902.370 MHz



Top band edge -20 dB point = 927.630 MHz



Conducted spurious emissions

Using a spectrum analyser conducted spurious emission measurements were made at the antenna port which the transmitter was operating continuously in single frequency mode.

A limit of -20 dBc has been applied.

Frequency (MHz)	Level (dBm)	Limit (dBm)
902.625	29.1	-
1805.250	-61.0	9.1
2707.875	-64.0	9.1
3610.500	< -75.0	9.1
4513.125	< -75.0	9.1
5415.750	< -75.0	9.1
6318.375	-64.0	9.1
7221.000	< -75.0	9.1
8123.625	< -75.0	9.1
9026.250	< -75.0	9.1

Frequency (MHz)	Level (dBm)	Limit (dBm)
915.125	29.4	-
1830.250	-62.0	9.4
2745.375	-60.0	9.4
3660.500	< -75.0	9.4
4575.625	< -75.0	9.4
5490.750	< -75.0	9.4
6405.875	-65.0	9.4
7321.000	< -75.0	9.4
8326.125	< -75.0	9.4
9131.250	< -75.0	9.4

Frequency (MHz)	Level (dBm)	Limit (dBm)
927.3750	29.3	-
1854.750	-60.0	9.4
2782.125	-59.3	9.4
3709.500	< -75.0	9.4
4636.875	< -75.0	9.4
5564.250	< -75.0	9.4
6491.625	-67.6	9.4
7419.000	< -75.0	9.4
8346.375	< -75.0	9.4
9273.750	< -75.0	9.4

Spurious emissions and restricted band radiated emission measurements

A number of out of band emissions have been shown to fall within the restricted bands of operation as defined in section 15.205(a).

Radiated emission measurements were carried out with the limits as per section 15.209 applied when these emissions fell within the restricted bands.

All other emissions are required to meet a limit of -20 dBc with relation to the highest in band emission.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland.

The transmitter was placed on the test table top which was a total of 0.8 m above the test site ground plane.

Measurements of the radiated field were made 3 metres from the transmitting antenna.

No other spurious emissions, except the digital device emissions that are described in section 15.109, other than harmonics were observed.

Measurements below 1000 MHz were made using a Quasi Peak Detector with a bandwidth of 120 kHz.

Measurements above 1000 MHz were made using an average detector with a bandwidth of 1.0 MHz and also a peak detector with a bandwidth of 1.0 MHz.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height with an automated antenna tower.

All emissions were measured in both vertical and horizontal antenna polarisations.

The emission level is determined in field strength by taking the following into consideration:

Level (dBμV/m) = Receiver Reading (dBμV) + Antenna Factor (dB) + Coax Loss (dB) – Amplifier Gain (dB)

Testing was carried out using the 3 antenna combinations that have been previously described on 902.625 MHz, 915.125 MHz and 927.375 MHz

Full testing was carried out on the yagi antenna and the collinear antenna with the short length of coax

However testing was only carried out at 915.125 MHz on the collinear antenna using the long length of coax

Yagi antenna with long coax

902.625 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1805.250	37.1	40.2	54.0	Average
	45.2	48.5	74.0	Peak
2707.875	42.0	42.5	54.0	Average
	45.5	50.3	74.0	Peak
3610.500	-	-	54.0	Average
	-	-	74.0	Peak
4513.125	-	-	54.0	Average
	-	-	74.0	Peak
5415.750	-	-	54.0	Average
	-	-	74.0	Peak
6318.375	-	-	54.0	Average
	-	-	74.0	Peak
7221.000	-	-	54.0	Average
	-	-	74.0	Peak
8123.625	-	-	54.0	Average
	-	-	74.0	Peak
9026.250	-	-	54.0	Average
	-	-	74.0	Peak

915.125 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1830.250	34.1	45.3	54.0	Average
	46.2	53.1	74.0	Peak
2745.375	39.8	42.3	54.0	Average
	44.6	50.2	74.0	Peak
3660.500	-	-	54.0	Average
	-	-	74.0	Peak
4575.625	-	-	54.0	Average
	-	-	74.0	Peak
5490.750	-	-	54.0	Average
	-	-	74.0	Peak
6405.875	-	-	54.0	Average
	-	-	74.0	Peak
7321.000	-	-	54.0	Average
	-	-	74.0	Peak
8236.125	-	-	54.0	Average
	-	-	74.0	Peak
9151.250	-	-	54.0	Average
	-	-	74.0	Peak

927.375 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1854.750	36.5	43.1	54.0	Average
	47.1	52.9	74.0	Peak
2782.125	43.1	43.5	54.0	Average
	50.1	51.5	74.0	Peak
3709.500	-	-	54.0	Average
	-	-	74.0	Peak
4636.875	-	-	54.0	Average
	-	-	74.0	Peak
5564.250	-	-	54.0	Average
	-	-	74.0	Peak
6491.625	-	-	54.0	Average
	-	-	74.0	Peak
7419.000	-	-	54.0	Average
	-	-	74.0	Peak
8346.375	-	-	54.0	Average
	-	-	74.0	Peak
9273.750	-	-	54.0	Average

When the peak level was below the average limit no attempt was made to measure the emission using a peak detector.

Collinear Antenna with long coax

915.125 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1830.250	43.8	-	54.0	Average
	48.5	-	74.0	Peak
2745.375	48.5	-	54.0	Average
	53.9	-	74.0	Peak
3660.500	-	-	54.0	Average
	43.4	-	74.0	Peak
4575.625	-	-	54.0	Average
	39.4	-	74.0	Peak
5490.750	-	-	54.0	Average
	-	-	74.0	Peak
6405.875	-	-	54.0	Average
	50.6	-	74.0	Peak
7321.000	-	-	54.0	Average
	49.3	-	74.0	Peak
8236.125	-	-	54.0	Average
	52.5	-	74.0	Peak
9151.250	-	-	54.0	Average
	-	-	74.0	Peak

As this antenna was vertically polarised, horizontal measurements were not recorded as intial observations showed that these levels were significantly lower.

When the peak level was below the average limit no attempt was made to measure the emission using a peak detector.

Collinear antenna with short coax

902.625 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1805.250	37.2	28.6	54.0	Average
	47.4	41.2	74.0	Peak
2707.875	42.8	38.7	54.0	Average
	50.5	45.6	74.0	Peak
3610.500	-	-	54.0	Average
	44.3	-	74.0	Peak
4513.125	-	-	54.0	Average
	39.5	-	74.0	Peak
5415.750	-	-	54.0	Average
	41.6	-	74.0	Peak
6318.375	-	-	54.0	Average
	50.4	-	74.0	Peak
7221.000	-	-	54.0	Average
	50.1	-	74.0	Peak
8123.625	-	-	54.0	Average
	50.9	-	74.0	Peak
9026.250	-	-	54.0	Average
	-	-	74.0	Peak

915.125 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1830.250	46.3	-	54.0	Average
	54.1	-	74.0	Peak
2745.375	43.9	-	54.0	Average
	49.5	-	74.0	Peak
3660.500	-	-	54.0	Average
	47.1	-	74.0	Peak
4575.625	-	-	54.0	Average
	40.5	-	74.0	Peak
5490.750	-	-	54.0	Average
	-	-	74.0	Peak
6405.875	-	-	54.0	Average
	50.7	-	74.0	Peak
7321.000	-	-	54.0	Average
	49.0	-	74.0	Peak
8236.125	-	-	54.0	Average
	53.7	-	74.0	Peak
9151.250	-	-	54.0	Average
	-	-	74.0	Peak

927.375 MHz

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Detector
1854.750	46.1	-	54.0	Average
	52.5	-	74.0	Peak
2782.125	41.5	-	54.0	Average
	46.6	-	74.0	Peak
3709.500	-	-	54.0	Average
	40.3	-	74.0	Peak
4636.875	-	-	54.0	Average
	-	-	74.0	Peak
5564.250	-	-	54.0	Average
	-	-	74.0	Peak
6491.625	-	-	54.0	Average
	50.6	-	74.0	Peak
7419.000	-	-	54.0	Average
	-	-	74.0	Peak
8346.375	-	-	54.0	Average
	50.5	-	74.0	Peak
9273.750	-	-	54.0	Average

As this antenna was vertically polarised, horizontal measurements were not recorded as intial observations showed that these levels were significantly lower.

When the peak level was below the average limit no attempt was made to measure the emission using a peak detector.

Result: Complies
Measurement uncertainty: ± 4.1 dB

Section 15.247(i) – Radio Frequency Hazard Information

As per Section 15.247 (b) (4) spread spectrum transmitters operating in the 902 – 928 MHz band are required to be operated in a manner that ensures that the public is not exposed to RF energy levels in accordance with CFR 47, Section 1.1307(b)(1).

The device when in operation is fixed and a safe distance could be maintained when events are undertaken.

In accordance with Section 1.1310 the Maximum Permissible Exposure (MPE) limits for the General Population / Uncontrolled Exposure of f/1500 have been applied.

The maximum distance from the antenna at which the MPE is met or exceeded is calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain and separation distance in metres:

E, V/m = (√ (30 * P * G)) / d
Power density, mW/m2 = E2/3770
E for MPE: (920/1500) = E2/3770
E = √(920/1500)*3770
E = 48.1 V/m

The highest radiated power has been measured to be 34.0 dBm or 2.51 watts EiRP when operating on 915.125 MHz using the Yagi Antenna

Therefore:
E = √ (30 * P * G) / d
d = √ (30 * P * G) / E
d = √ (30 * 2.51) / 48.1
d = 0.18 m or 18 cm

Result: Complies if a minimum safe distance of 20 cm is specified in the set up instructions for this system.

6. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref	Cal Due
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applicable
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applicable
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2010
Receiver	R & S	ESCS 30	847124/020	E1595	21 Mar 2010
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2010
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applicable
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2010
Pre Amplifier	Hewlett Packard	8349B	2644A01659	-	14 May 2010
Horn Antenna	Electrometrics	RGA-60	6234	E1494	14 May 2010
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3776	26 July 2010

7. ACCREDITATIONS

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on January 25th, 2007.

All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ISO 17025.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/IEC/ISO 17025.

International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with a number of accreditation bodies in various economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

8. PHOTOGRAPHS