

EMC Technologies (NZ) Ltd

Test Report No 70934.1a

Report date: 12 November 2007

TEST REPORT

Gallagher R Series Smart Reader with Small and Large Panel Antennas

tested to

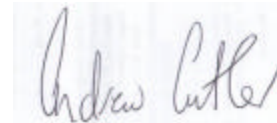
47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

for

Gallagher Group Ltd



This Test Report is issued with the authority of:

Andrew Cutler - General Manager



All tests reported
herein have been
performed in accordance
with the laboratory's
scope of accreditation

EMC Technologies (NZ) Ltd

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EMC Technologies (NZ) Ltd

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1. STATEMENT OF COMPLIANCE

The **Gallagher R Series Smart Reader with Small and Large Panel Antennas** complies with FCC Part 15 Subpart C as an Intentional Radiator when the methods, as described in ANSI C63.4 - 2003, are applied.

2. RESULTS SUMMARY

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required.
15.203	Antenna requirement	Complies. Antenna connector unique.
15.204	External PA and antenna modifications	Not applicable. No external devices.
15.205	Restricted bands of operation	Complies. Device transmits on 134.2 kHz.
15.207	Conducted limits	Complies with an 8.4 dB margin at 8.190 MHz (Average) when the large antenna was attached.
15.209	Radiated emission limits - Fundamental	Complies with a 5.2 dB margin when extrapolated to 300 metres when tested with the small panel antenna.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies with an 8.3 dB margin at 671 kHz when tested with the large panel antenna.
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies with a 10.6 dB margin at 103.578 MHz (Horizontal) when the large panel antenna was attached.

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3. INTRODUCTION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification.

The client selected the test sample.

This report relates only to the sample tested.

This report contains no corrections or erasures.

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

NB: This report replaced report number 70934.1a to include a statement that field strength measurements were made when the supply voltage was varied by +/- 15%.

4. CLIENT INFORMATION

Company Name	Gallagher Group Ltd
Address	Private Bag 3026
City	Hamilton
Country	New Zealand
Contact	Mr Murray Long

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5. DESCRIPTION OF TEST SAMPLE

Brand Name	Gallagher
Model Number	R Series
Product	Smart Reader with Small and Large Panel Antennas
Manufacturer	Gallagher Group Ltd
Country of Origin	New Zealand
Serial Number	0708370021
FCC ID	Not yet determined
Ancillary Equipment	as detailed below

- Ruddweigh 880 Weigh Scale. Device not serialised.

- FranMar FDF0503-C Switch Mode Power Supply. Device not serialised

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6. RESULTS

Standard

The sample was tested in accordance with 47 CFR Part 15 Subpart C.

Methods and Procedures

The measurement methods and procedures as described in ANSI C63.4 - 2003 were used.

Section 15.201: Equipment authorisation requirement

Certification as detailed in Subpart J of Part 2 is required for this device.

Section 15.203: Antenna requirement

As can be seen from the attached photographs the device has an internal unique connector. The connector type is a Hirschmann CA series part number 932-325-100 connector.

Result: Complies.

Section 15.204: External radio frequency power amplifiers and antenna modifications

From the attached photographs it can be seen that it is not possible to attach an external power amplifier to this transmitter.

Result: Complies.

Section 15.205: Restricted bands of operation

The transmitter transmits on 134.2 kHz.

This falls between the restricted bands of 90 – 110 kHz and 495 – 505 kHz.

Result: Complies.

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Section 15.207: Conducted limits

Conducted emission testing has been carried out as the device using a representative 110 Vac switch mode power supply

The device was operated transmitting continuously with correct operation being observed when a tag is placed in the presence of the transmitter causing the reader to beep.

Testing was carried out with a small and a large panel antenna attached.

Conducted emissions 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.

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.

Result: Complies with a 8.4 dB margin at 8.190 MHz (Average), when the large panel antenna was attached.

Measurement uncertainty with a confidence interval of 95% is:

- Mains terminal tests (0.15 - 30 MHz) \pm 2.2 dB

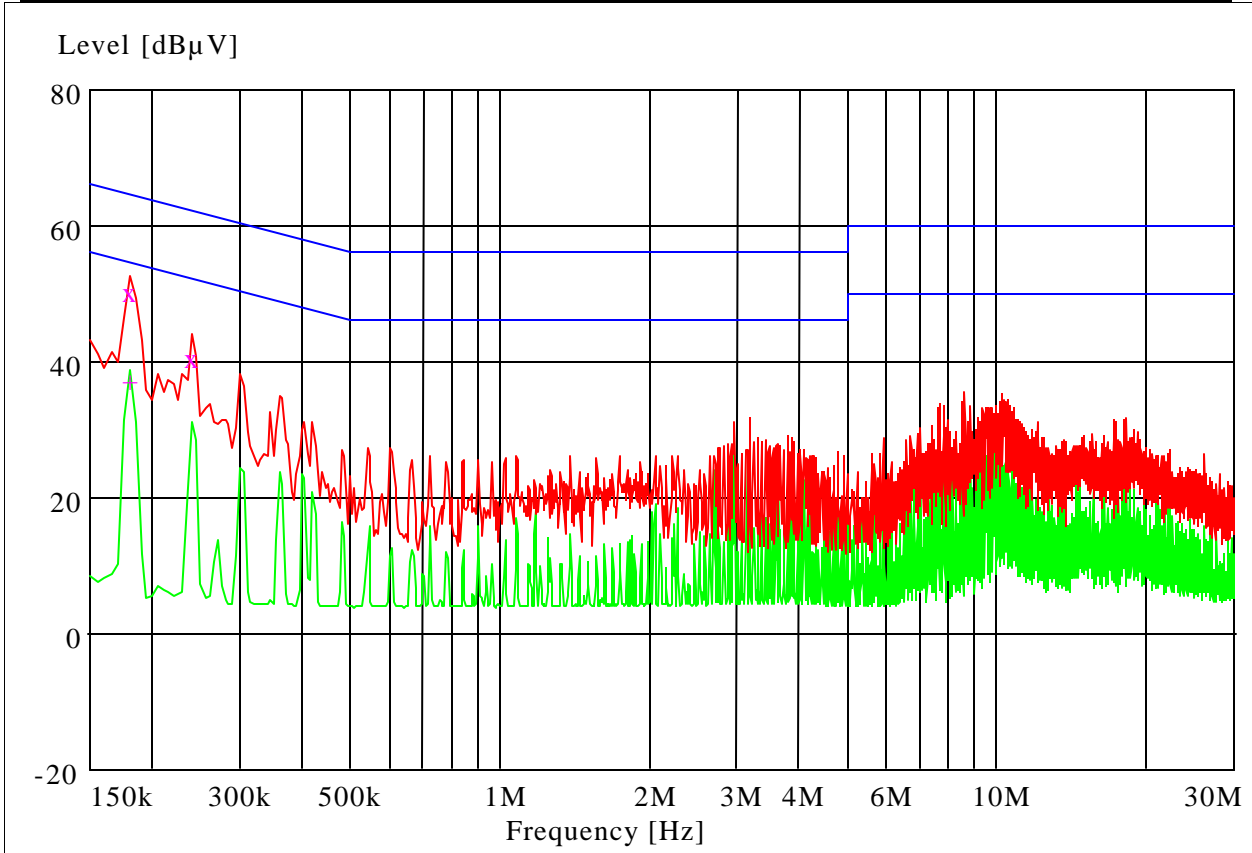
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Conducted emissions

Comments:	Device tested operating continuously when the small panel antenna was attached while powered at 110 Vac.
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Peak -----	Average -----	Quasi Peak X	Average +
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Quasi-Peak Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
0.180000	50.90	64.4	13.5	N	50.0
0.240000	41.10	62.0	20.9	N	

Average Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
0.180000	37.80	54.4	16.6	L1	36.5
2.960000	15.00	46.0	30.0	N	
7.610000	30.70	50.0	19.3	L1	
7.720000	28.50	50.0	21.5	N	

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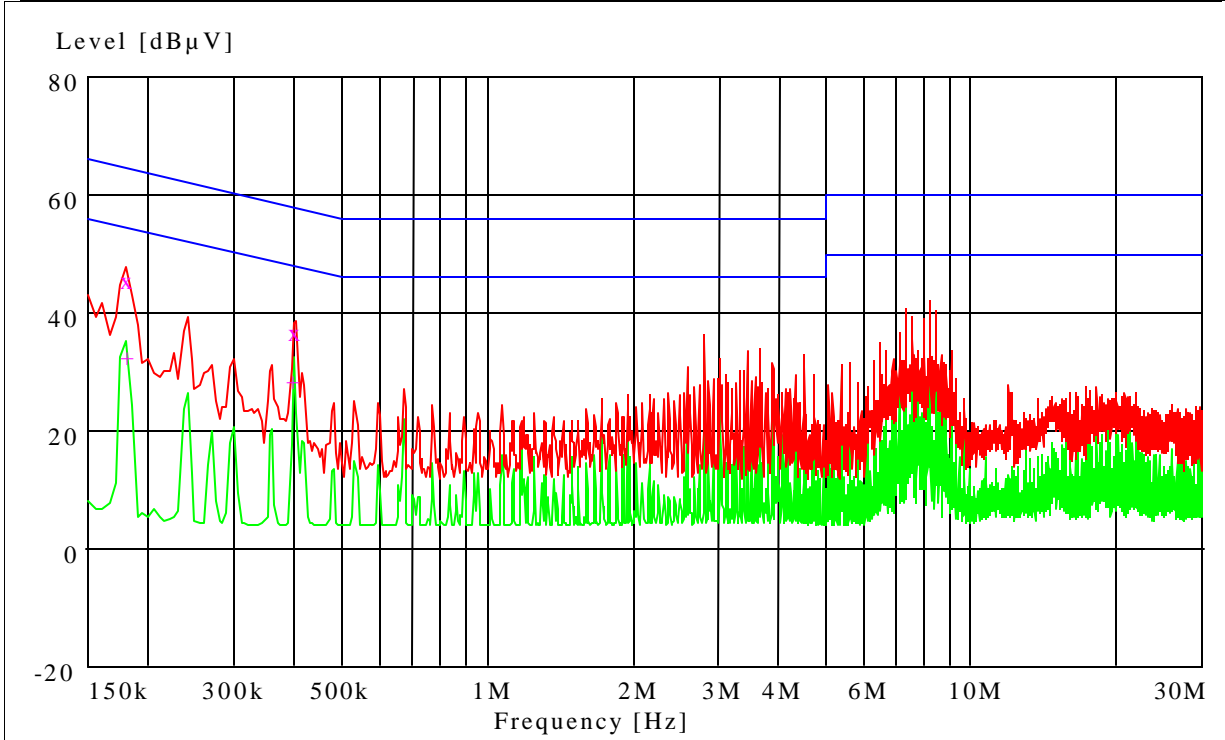
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Conducted emissions

Comments:	Device tested operating normally with a large panel antenna connected while being powered at 110 Vac.
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Peak -----	Average -----	Quasi Peak X	Average +
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Quasi-Peak Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
0.180000	46.40	64.4	18.0	N	45.7
0.405000	37.40	57.7	20.3	N	
7.330000	38.10	60.0	30.9	L1	
8.190000	42.30	60.0	18.7	L1	
8.420000	38.60	60.0	21.4	N	

Average Measurements

Frequency MHz	Level dBmV	Limit dBmV	Margin dB	Phase	Rechecks dBmV
0.180000	33.60	54.4	20.8	L1	
0.400000	29.30	47.8	18.5	L1	
7.560000	37.90	50.0	12.1	N	
8.190000	41.60	50.0	8.4	L1	
8.420000	38.40	50.0	11.6	N	

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Section 15.209: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 100 kHz to 1000 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, Part 1, Clause 16, and ANSI C63.4 - 2003.

The device was placed in a wooden cradle on top of the turntable containing the panel antenna and reader that positioned the reader approximately 0.8 m above the test site ground plane.

Testing below 30 MHz and above 30 MHz was carried out with a small and a larger panel antenna attached.

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, where appropriate, with an automated antenna tower.

The emission is measured in both vertical and horizontal antenna polarisations, where appropriate.

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

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

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Fundamental emission:

Measurements were made using a magnetic loop antenna and a receiver with an average detector and a peak detector both using a 9 kHz bandwidth

Measurements were initially made at a distance of 10 metres then also at 30 metres.

Using these measurements a 300 metre extrapolated level has been determined as detailed in section 15.31(f)(2) as measurements were made at two distances on the radial that was determined to give the highest field strength.

The highest radial was determined during the pre screening of the device when it was rotated on the test site using a turntable.

During the final test at the grass test site the device was positioned along the highest radial with the measurement antenna being further adjusted to give the highest field strength.

The maximum field strength was found to be where the transmitting antenna was facing the measurement antenna (see photographs at the back of this report).

Measurements were made while the device was being powered using an external 110 Vac switch mode power supply.

Large panel antenna

Frequency (kHz)	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Distance
134.200	93.9	-	-	10 metres
134.200	67.8	-	-	30 metres
134.200	13.1	25.0	-11.9	300 metres

Frequency (kHz)	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Distance
134.200	102.0	-	-	10 metres
134.200	76.0	-	-	30 metres
134.200	21.5	45.0	-23.5	300 metres

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Small panel antenna

Frequency (kHz)	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Distance
134.200	93.8	-	-	10 metres
134.200	69.9	-	-	30 metres
134.200	19.8	25.0	-5.2	300 metres

Frequency (kHz)	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Distance
134.200	101.1	-	-	10 metres
134.200	77.4	-	-	30 metres
134.200	27.7	45.0	-17.3	300 metres

The peak limit is the average limit plus 20 dB

Sample Calculation (Average detector) for the Small Antenna :

10 metre to 30 metre roll off = 23.9 dB

10 metres to 30 metres is 0.477 of a decade

30 metres to 300 metres is 1 decade.

Therefore 10 metres to 300 metres is 1.477 of a decade

10 metres to 300 metres roll off is $23.9 \text{ dB} \times (1.477 / 0.477) = 74.0 \text{ dB}$

10 metre measurement 93.8 dBuV/m – 74.0 dB = 19.8 dBuV/m at 300 metres

See photos at the end of this report for the highest field strength test set up.

Measurements were also carried out when the 110 Vac mains supply was varied by +/- 15% (93.5 Vac to 126.5 Vac) however the observed field strength with both antennas remained the same as the field strength observed when 110 Vac was applied.

Result: Complies with a 5.2 dB margin when measured using an average detector with the small panel antenna attached.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (100 kHz – 30 MHz) $\pm 4.8 \text{ dB}$

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Section 15.209: Spurious Emissions (below 30 MHz)

Small antenna

Frequency kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector
268.400	44.6	79.0	34.4	Average
268.400	52.2	99.0	46.8	Peak
402.600	50.9	75.5	24.6	Average
402.600	58.0	95.5	37.5	Peak
536.800	41.7	53.0	11.3	Quasi Peak
671.000	40.1	51.0	10.9	Quasi Peak
805.200	-	49.5	-	Quasi Peak
939.400	-	49.5	-	Quasi Peak
1073.600	-	49.5	-	Quasi Peak
1207.800	-	49.5	-	Quasi Peak
1342.000	-	49.5	-	Quasi Peak

Large antenna

Frequency kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector
268.400	44.4	79.0	34.6	Average
268.400	52.5	99.0	46.5	Peak
402.600	52.2	75.5	23.3	Average
402.600	59.3	95.5	36.2	Peak
536.800	40.2	53.0	12.8	Quasi Peak
671.000	42.7	51.0	8.3	Quasi Peak
805.200	-	49.5	-	Quasi Peak
939.400	-	49.5	-	Quasi Peak
1073.600	-	49.5	-	Quasi Peak
1207.800	-	49.5	-	Quasi Peak
1342.000	-	49.5	-	Quasi Peak

No other emissions detected from the transmitter that were within 20 dB of the applicable limit.

Magnetic loop measurements were made at a distance of 10 metres.

Pre screening of the device of the device was carried on the test site using a turntable which showed that the maximum field strength of the spurious emissions was in the same radial as for the fundamental emission.

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At each frequency the measurement antenna was further adjusted to give the highest field strength.

Measurements were made while the device was being powered using a 110 Vac switch mode power supply.

Testing was carried out with a small and a large antenna panel attached.

A receiver with an average detector and a peak detector using a 9 kHz bandwidth was used between 110 – 490 kHz and a quasi peak detector with a 9 kHz bandwidth was used between 490 kHz – 30.0 MHz.

The 300 metre limit between 125 – 490 kHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2) and the 30 metre limit between 490 – 1705 kHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The limit between 110 – 490 kHz was increased by 20 dB when the peak detector was used.

The spurious emissions observed do not exceed the level of the fundament emission.

Result: Complies with a margin of 8.3 dB at 671 kHz when the large panel antenna is used.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (100 kHz – 30 MHz) \pm 4.8 dB

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Section 15.209: Spurious Emissions (above 30 MHz)

Measurements between 30 – 1000 MHz have been made at a distance of 3 metres.

Measurements were made while the device was being powered at 110 Vac using a representative switch mode power supply

Testing was carried out when the transmitter was operating continuously with either the small or large panel antennas attached.

A receiver with a quasi peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz.

Measurements were carried out as the device contains several digital devices.

Attached to the serial port of the device was a powered Ruddweigh 880 weigh scale that was located approximately 5 metres away which was provided to load this port.

When a tag was placed in the presence of the antenna the reader was observed to beep and an output was observed on the weigh scale.

The limits as described in Section 15.209 have been applied as follows:

30.0 – 88.0 MHz	100 uV/m	40 dBuV/m
88.0 – 216.0 MHz	150 uV/m	43.5 dBuV/m
216.9 – 960.0 MHz	200 uV/m	46.0 dBuV/m

Result: Complies with a 10.6 dB margin at 103.578 MHz (Horizontal) when the large panel antenna was attached.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 1000 MHz) \pm 4.1 dB

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Small panel antenna attached to the reader when it was transmitting continuously

Frequency MHz	Vertical dBuV/m	Hort dBuV/m	Limit dBuV/m	Margin dB	Result	Antenna
85.883	21.5	18.0	40.0	18.5	Pass	Vertical
101.790	24.3		43.5	19.2	Pass	Vertical
103.578	26.9	16.6	43.5	16.6	Pass	Vertical
107.283	26.1		43.5	17.4	Pass	Vertical
112.378	29.0		43.5	14.5	Pass	Vertical
120.980	26.8		43.5	16.7	Pass	Vertical
122.165	29.5		43.5	14.0	Pass	Vertical
128.823	28.3		43.5	15.2	Pass	Vertical
137.413	32.0	18.5	43.5	11.5	Pass	Vertical
137.993	25.6		43.5	17.9	Pass	Vertical
142.322	29.3		43.5	14.2	Pass	Vertical
144.830	30.6		43.5	12.9	Pass	Vertical
147.400	30.7		43.5	12.8	Pass	Vertical
154.591	29.5		43.5	14.0	Pass	Vertical
163.174		28.1	43.5	15.4	Pass	Horizontal
171.763		29.8	43.5	13.7	Pass	Horizontal
177.878		32.6	43.5	10.9	Pass	Horizontal
180.352		26.1	43.5	17.4	Pass	Horizontal
188.945	23.8	25.7	43.5	17.8	Pass	Horizontal
240.476		29.3	46.0	16.7	Pass	Horizontal
274.833	23.5	28.6	46.0	17.4	Pass	Horizontal
309.174		27.5	46.0	18.5	Pass	Horizontal
326.351		28.1	46.0	17.9	Pass	Horizontal
343.500		28.7	46.0	17.3	Pass	Horizontal
412.245	28.5	25.1	46.0	17.5	Pass	Vertical
472.366		29.4	46.0	16.6	Pass	Horizontal
480.955	30.1	34.0	46.0	12.0	Pass	Horizontal
489.539		29.6	46.0	16.4	Pass	Horizontal
506.717		30.3	46.0	15.7	Pass	Horizontal
515.306		26.1	46.0	19.9	Pass	Horizontal
532.483		29.9	46.0	16.1	Pass	Horizontal
549.660		30.3	46.0	15.7	Pass	Horizontal

No further emissions detected within 20 dB of the applicable limit.

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Large panel antenna attached to the reader when it was transmitting continuously

Frequency MHz	Vertical dBuV/m	Hort dBuV/m	Limit dBuV/m	Margin dB	Result	Antenna
43.073	21.0		40.0	19.0	Pass	Vertical
62.650	20.1		40.0	19.9	Pass	Vertical
66.565	20.4		40.0	19.6	Pass	Vertical
80.460	23.8		40.0	16.2	Pass	Vertical
85.883	24.2	18.0	40.0	15.8	Pass	Vertical
101.790	25.1		43.5	18.4	Pass	Vertical
103.578		32.9	43.5	10.6	Pass	Horizontal
106.898	23.3		43.5	20.2	Pass	Vertical
112.645	26.6		43.5	16.9	Pass	Vertical
120.235	28.4		43.5	15.1	Pass	Vertical
122.165	26.5		43.5	17.0	Pass	Vertical
128.823	22.0		43.5	21.5	Pass	Vertical
137.413	30.1	25.1	43.5	13.4	Pass	Vertical
137.993	25.6		43.5	17.9	Pass	Vertical
144.830	27.3		43.5	16.2	Pass	Vertical
188.945	23.8		43.5	19.7	Pass	Vertical
223.298		25.6	46.0	20.4	Pass	Horizontal
240.476		25.8	46.0	20.2	Pass	Horizontal
240.478	20.6		46.0	25.4	Pass	Vertical
274.831		25.2	46.0	20.8	Pass	Horizontal
274.833	28.9		46.0	17.1	Pass	Vertical
343.500		28.7	46.0	17.3	Pass	Horizontal
360.712		25.1	46.0	20.9	Pass	Horizontal
412.245	27.8	26.8	46.0	18.2	Pass	Vertical
472.366		29.7	46.0	16.3	Pass	Horizontal
480.955		33.4	46.0	12.6	Pass	Horizontal
489.539		32.3	46.0	13.7	Pass	Horizontal
498.128		24.3	46.0	21.7	Pass	Horizontal
506.717		30.3	46.0	15.7	Pass	Horizontal
515.306		26.1	46.0	19.9	Pass	Horizontal
532.483		28.6	46.0	17.4	Pass	Horizontal
549.660		30.3	46.0	15.7	Pass	Horizontal

No further emissions detected within 20 dB of the applicable limit.

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7. 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 2009
Receiver	R & S	ESCS 30	847124/020	E1595	21 Dec 2007
Receiver	R & S	ESHS 10	828404/005	RFS 3728	11 July 2008
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2009
Loop Antenna	EMCO	6502	9003-2485	HTS0201	11 July 2008
Mains Network	R & S	ESH2-Z5	881362/032	3628	8 June 2008
Variac	General Radio	1592	-	RFS 3690	Not applicable
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applicable
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2009

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies Ltd registration with the Federal Communications Commission as a listed facility, registration number: 90838, which was updated on January 23rd, 2007.

All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

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

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Web Site: www.emctech.com.au

EMC Technologies (NZ) Ltd

Test Report No 70934.1a

Report date: 12 November 2007

9. PHOTOGRAPH (S) Device tested external views



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Ancillary equipment – Power Supply



Ancillary equipment – Weigh Scale



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Conducted emissions test set up – Small Panel Antenna



Conducted emissions testing – Large Panel Antenna



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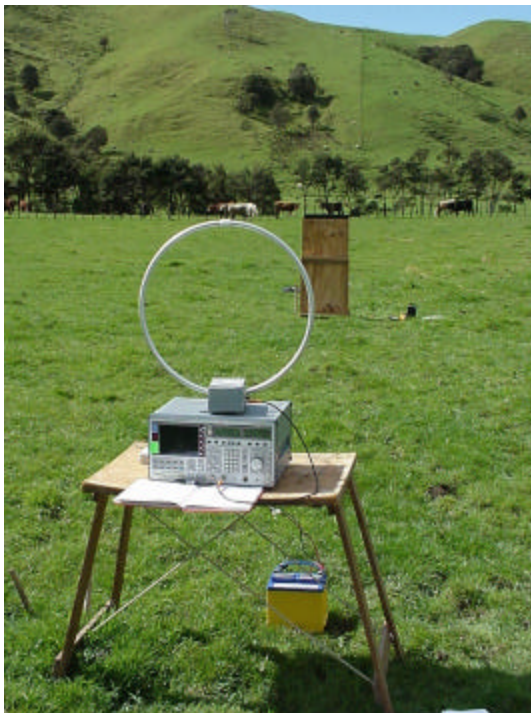
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Radiated emissions testing below 30 MHz – Worst case orientations



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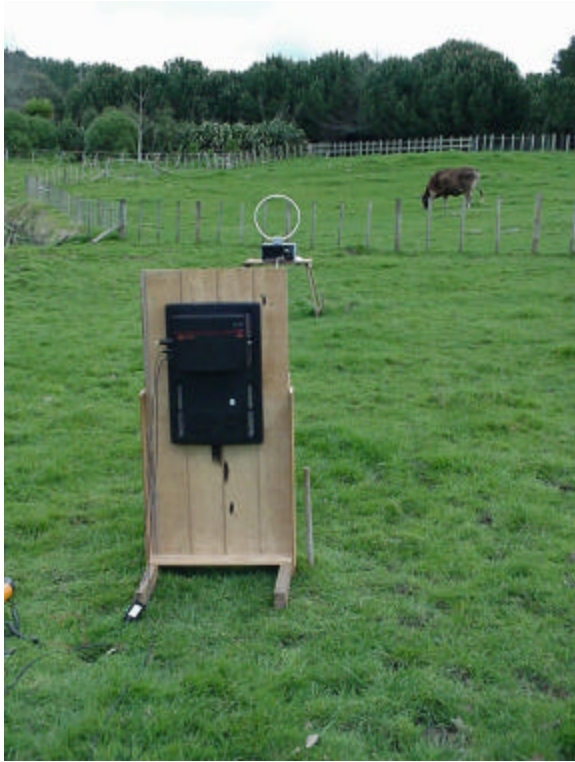
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Radiated Emissions testing above 30 MHz



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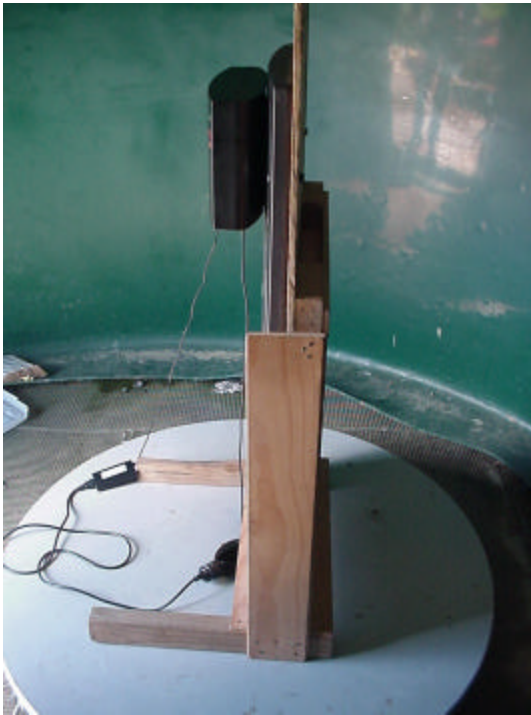
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