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TEST REPORT

Gallagher T20 (C300450 + C300460)
Proximity Card Reader

tested to

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.225
Operation within the band 13.110 -14.010 MHz

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

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1. STATEMENT OF COMPLIANCE

The **Gallagher T20 (C300450 + C300460) Proximity Card Reader** complies with FCC Part 15 Subpart C Section 15.225 as an Intentional Radiator when the methods as described in ANSI C63.4 - 2003 are applied.

2. RESULTS SUMMARY

The results from testing carried out between the 16th and 30th January 2013 are summarised in the following table:

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required.
15.203	Antenna requirement	Complies. Antennas internal to the device.
15.204	External PA and antenna modifications	Not applicable. No external devices.
15.205	Restricted bands of operation	Complies. Device transmits on 13.560 MHz with an occupied bandwidth of 435 kHz. It also transmits on 125 kHz with an occupied bandwidth of 625 Hz
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Emissions < 30 MHz	Complies with a 32.1 dB margin at 125 kHz.
15.209	Radiated emission limits – Emissions > 30 MHz	Complies with a 0.0 dB margin at 261.815 MHz (Horizontal).
15.225	Radiated emission limits - Fundamental	Complies with a 51.0 dB margin at 13.560 MHz.
15.225	Frequency stability	Complies

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 replaces report number 121107.1 dated 1st February 2013 to include additional model information.

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.

4. CLIENT INFORMATION

Company Name	Gallagher Group Ltd
Address	Kahikatea Drive
City	Hamilton
Country	New Zealand
Contact	Mr Brian Rose

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Gallagher
Model Number Tested	T20 (C300460)
Product	Proximity Card Reader
Manufacturer	Gallagher Group Ltd
Country of Origin	New Zealand
Serial Number	1303300033

The model tested, C300460, is a dual mode transmitter operating on 125 kHz and 13.560 MHz.

This report also covers a single mode transmitter, C300450 which operates on 13.560 MHz only, as the dual mode model was determined to be a worst case version based upon the test results in this report.

6. SETUPS AND PROCEDURES

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

This device has internal antennas for the 125 kHz and 13.560 MHz transmitters.

Result: Complies.

Section 15.204: External radio frequency power amplifiers and antenna modifications

It is not possible to attach an external power amplifier to this transmitter.

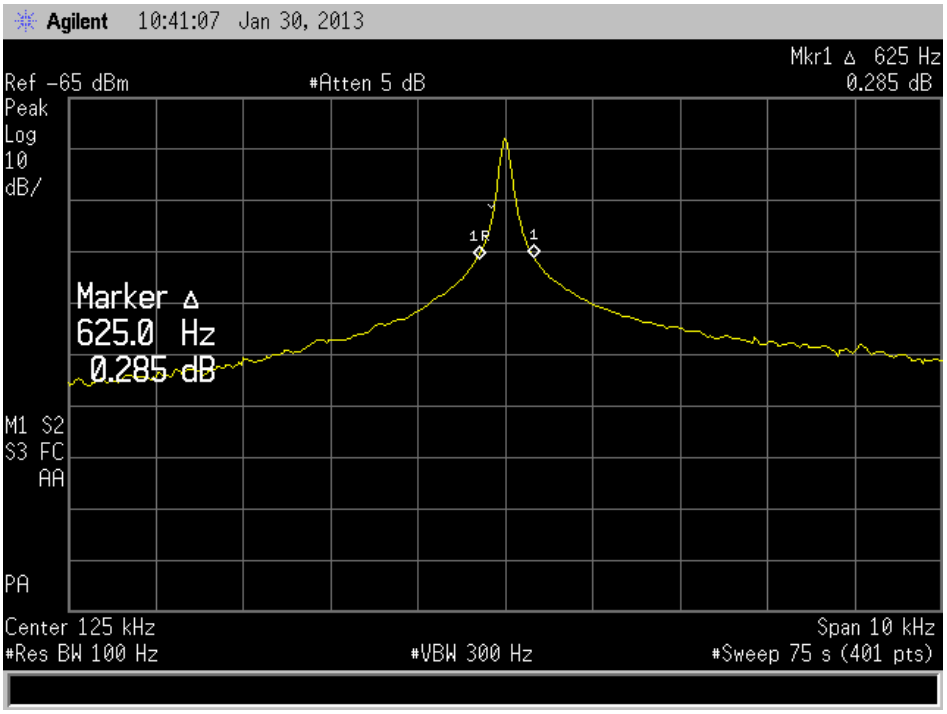
Result: Complies.

Section 15.205: Restricted bands of operation

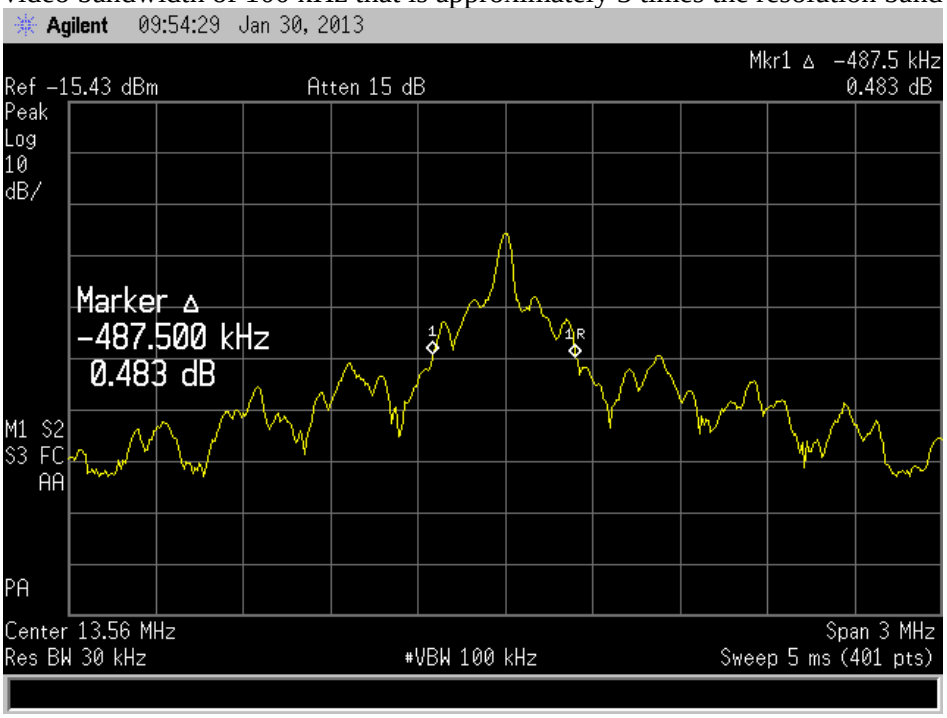
The transmitter transmits on 125.000 kHz and 13.560 MHz.

This device would therefore fall between the restricted bands of 90 – 110 kHz and 495 – 505 kHz into the band of 13.110 – 14.010 MHz that is covered by Section 15.225.

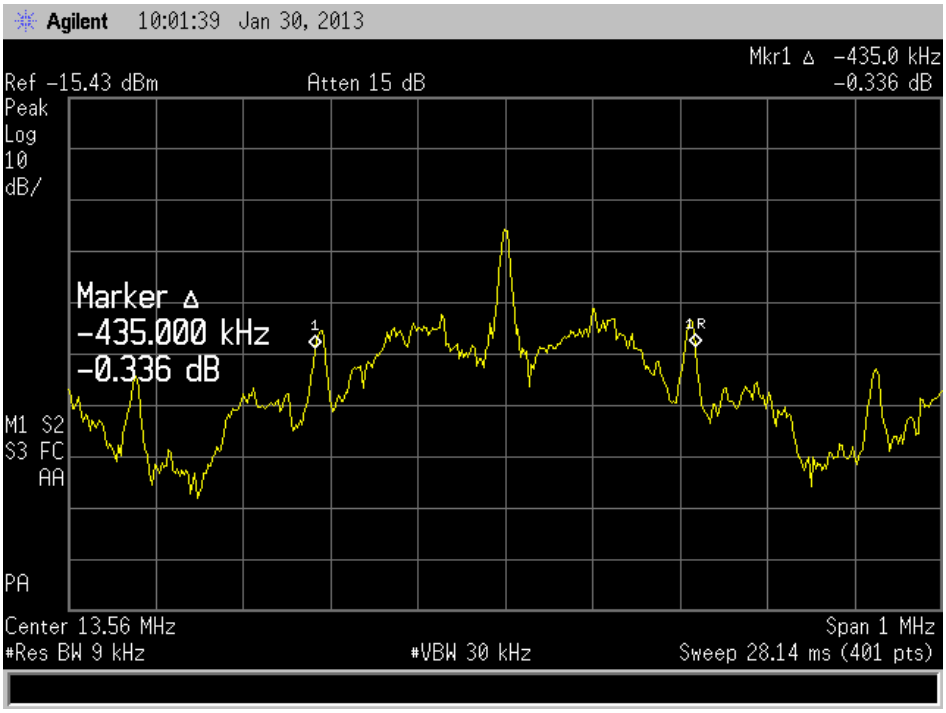
125 kHz modulation bandwidth = 625 Hz



The plot below shows that the device has an occupied bandwidth of 487.5 kHz when measured using a resolution bandwidth of 30 kHz (1% of the 3 MHz span) and with a video bandwidth of 100 kHz that is approximately 3 times the resolution bandwidth.



The 99% power bandwidth was then measured using a resolution bandwidth of 9 kHz which is as close to 1% of the occupied bandwidth of 487.5 kHz as was possible (analyser had settings of 3 kHz or 9 kHz and not 5 kHz) with measurements being made at the -23 dB points which give a bandwidth of 435 kHz



Result: Complies.

Section 15.207: Conducted emissions testing

Conducted Emissions testing was carried out over the frequency range of 150 kHz to 30 MHz which was carried out 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 using a representative AC power supply system that was powered at 120 Vac 60 Hz which supplied 12 Vdc to a Gallagher Controller 6000 device which in turn powered the Card Reader also at 12 Vdc.

The device operates on 125 kHz and 13.560 MHz.

Testing was carried out with both transmitters operating with their standard antennas attached and when the antennas were removed and replaced with a dummy loads.

The device is deemed to comply providing it complies when the test is carried out with the dummy loads attached and the overall emission signature for the product remains similar with no additional emissions being detected.

This is the case with this device.

The device was placed on top of the emissions table, which is 1 m x 1.5 m, 80 cm above the screened room floor which acts as the horizontal ground plane.

In addition the device was positioned 40 cm away from the screened room wall which acts as the vertical ground plane.

The artificial mains network was bonded to the screened room floor.

At all times the device was kept more than 80 cm from the artificial mains network.

The Class B limits have been applied.

The supplied plot is combined plot showing the worst case quasi peak and average results of both the phase and neutral lines to the representative AC power supply.

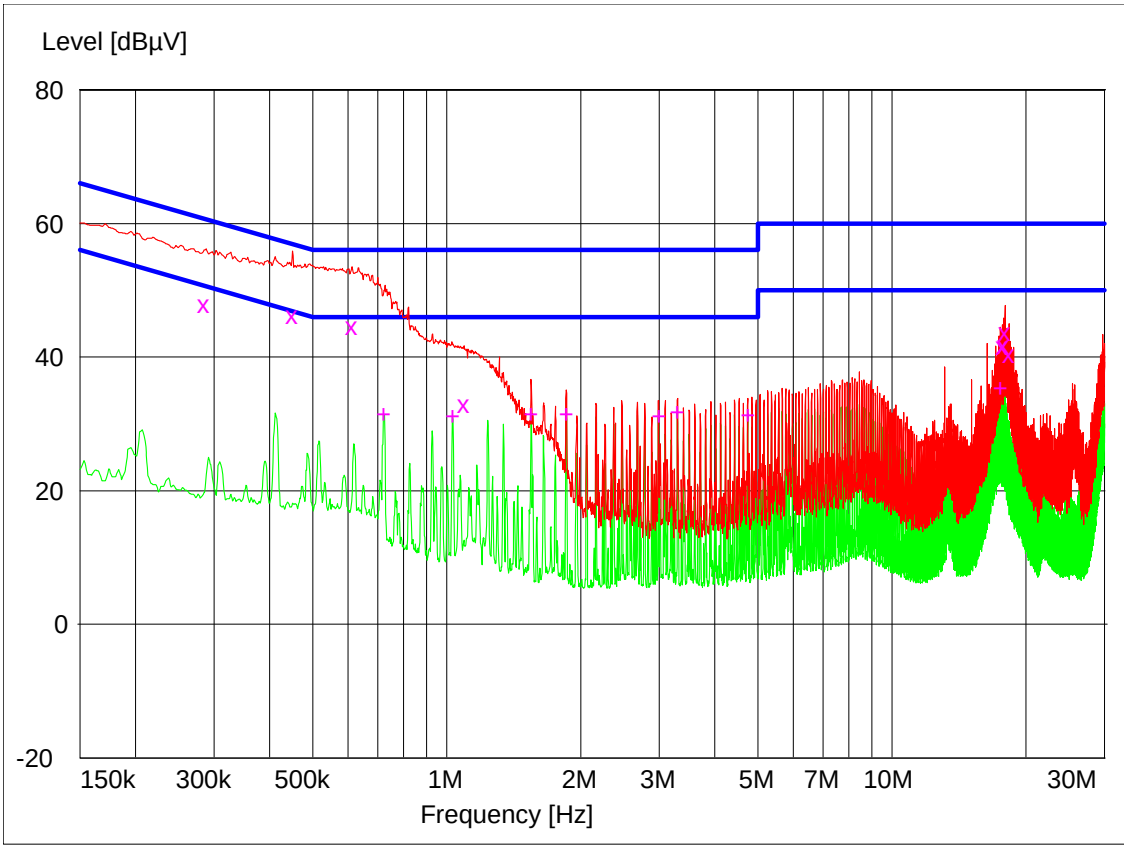
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

Measurement uncertainty with a confidence interval of 95% is:
- AC Mains port (0.15-30 MHz) ± 2.8 dB

Conducted Emissions – AC Input Power Port – Dummy Load

Setup:	Device tested when powered at 120 Vac 60 Hz while transmitting normally on 125 kHz and 13.560 MHz with the 13.560 MHz antenna replaced with a dummy load.

Peak ---	Average --	Quasi Peak X	Average +



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.285000	47.90	60.6	12.7	N	
0.450000	46.30	56.8	10.5	N	
0.612000	44.60	56.0	11.4	L1	
1.092000	33.00	56.0	23.0	L1	
17.691500	41.60	60.0	18.4	L1	
17.813000	41.80	60.0	18.2	L1	
17.930000	43.70	60.0	16.3	L1	
18.344000	40.50	60.0	19.5	L1	

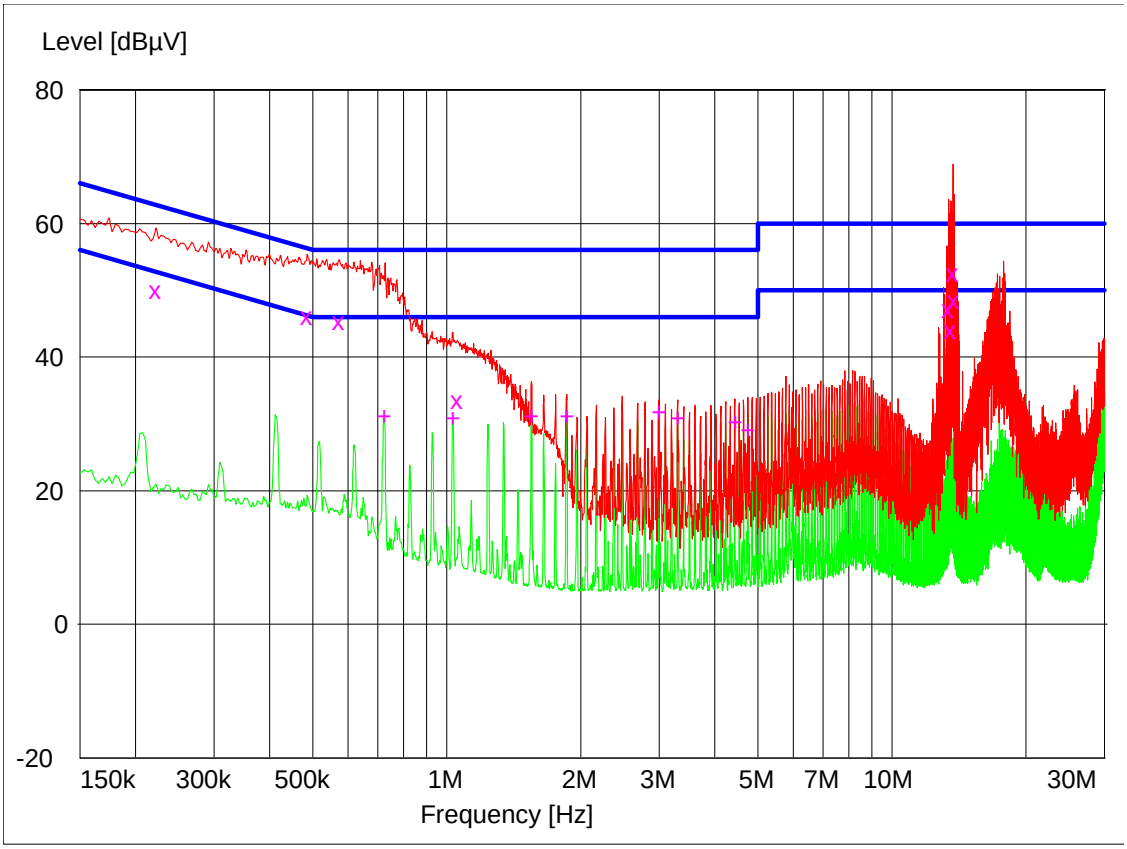
Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.720000	31.50	46.0	14.5	N	
1.029000	31.10	46.0	14.9	N	
1.545000	31.50	46.0	14.5	N	
1.854000	31.50	46.0	14.5	N	
2.990000	31.20	46.0	14.8	N	
3.296000	31.80	46.0	14.2	N	
4.740500	31.40	46.0	14.6	N	
17.516000	35.30	50.0	14.7	L1	

Conducted Emissions – AC Input Power Port – Antennas Connected

Setup:	Device tested when powered at 120 Vac 60 Hz while transmitting normally on 125 kHz and 13.560 MHz with both antennas attached.

Peak ---	Average --	Quasi Peak X	Average +



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.222000	50.00	62.8	12.8	L1	
0.486000	46.10	56.2	10.1	N	
0.573000	45.40	56.0	10.6	L1	
1.056000	33.60	56.0	22.4	L1	
13.412000	47.10	60.0	12.9	L1	
13.542500	44.10	60.0	15.9	N	
13.560000	84.50	60.0	-24.5	L1	
17.756500	48.50	60.0	11.5	L1	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.723000	31.20	46.0	14.8	N	
1.032000	30.90	46.0	15.1	N	
1.548000	31.10	46.0	14.9	N	
1.857000	31.10	46.0	14.9	N	
2.990000	31.70	46.0	14.3	N	
3.300500	30.90	46.0	15.1	N	
4.434500	30.30	46.0	15.7	N	
13.560000	56.00	46.0	-10.0	N	

Section 15.209: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 100 kHz to 2000 MHz as the highest frequency in use has stated to 200 MHz which is greater than 108 MHz but less than 500 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.

Testing was carried out using a representative AC power supply system that was powered at 120 Vac 60 Hz which supplied 12 Vdc to a Controller 6000 device which in turn powered the Card Reader also at 12 Vdc.

The Controller 6000 and representative AC power supply were placed 5 metres directly behind the device under test (in the coffin).

Testing was carried out with the device being placed in the centre of the test table standing vertically upright using a test jig that was supplied by the client.

The device was transmitting continuously on 125 kHz and 13.560 MHz.

Correct operation was confirmed periodically by placing a suitable card in front of the device which would give an audible beep.

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.

Below 30 MHz a magnetic loop is used with the centre of the loop being 1 metre above the ground with measurements being made using a quasi peak detector.

Above 30 MHz the emission is measured in both vertical and horizontal antenna polarisations, where appropriate, using a quasi peak detector.

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

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

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 1000 MHz) ± 4.1 dB
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: 125 kHz 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

Frequency kHz	Level dBuV/m	Limit (dBuV/m)	Margin (dB)	Detector	Distance metres
125.000	52.0	84.1	32.1	Average	10
125.000	66.7	104.1	37.4	Peak	10

Measurements were made at a distance of 10 metres with the limit being determined by using the extrapolation factor of 40 dB per decade limit as detailed in section 15.31 f (2).

The average limit at 300 m at 134.2 kHz is 17.8 uV/m or 25 dBuV/m and 45 dBuV/m in peak.

This gives a limit at 10 m at 134.2 kHz of 84.1 dBuV/m and 104.1 dBuV/m in peak

Testing was also carried out to determine whether a variation in the supply voltage would cause a significant change in field strength with the 120 Vac supply being varied by +/- 15% between 102 Vac and 138 Vac.

Voltage (Vdc)	Field Strength (dBuV/m)
102.0	52.0
120.0	52.0
138.0	52.0

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: 125 kHz Spurious Emissions (below 30 MHz)

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.

Frequency kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
250.000	44.0	78.7	-	Average	Noise Floor
250.000	54.0	98.7	-	Peak	Noise Floor
375.000	46.0	75.2	-	Average	Noise Floor
375.000	56.0	95.2	-	Peak	Noise Floor
500.000	43.0	52.7	-	Quasi Peak	Noise Floor
625.000	40.0	50.8	-	Quasi Peak	Ambient
750.000	34.0	49.2	-	Quasi Peak	Noise Floor
875.000	33.0	47.8	-	Quasi Peak	Ambient
1000.000	30.0	46.7	-	Quasi Peak	Noise Floor
1125.000	32.0	45.7	-	Quasi Peak	Noise Floor
1250.000	35.0	44.7	-	Quasi Peak	Ambient
1375.000	26.0	43.9	-	Quasi Peak	Noise Floor
1500.000	28.0	43.2	-	Quasi Peak	Noise Floor
1625.000	24.0	42.5	-	Quasi Peak	Noise Floor
1750.000	24.0	48.6	-	Quasi Peak	Noise Floor
1875.000	22.0	48.6	-	Quasi Peak	Noise Floor

No spurious emissions were detected from the 125 kHz transmitter

Magnetic loop measurements were made a distance of 10 metres.

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

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).

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.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: 13.560 MHz transmitter below 30 MHz spurious emission measurements

Frequency MHz	Level dBµV/m	Limit dBµV/m	Margin dB
27.120	13.3	48.6	35.4

Testing was carried out when the device was transmitting continuously.

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

A receiver with a quasi peak detector with a 9 kHz bandwidth was used between 490 kHz – 30.0 MHz.

The 30 metre limit between 1.705 MHz – 30 MHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The limit at 27.120 MHz when measured at 30 metres is 30 uV/m or 29.54 dBuV/m.

Therefore the scaled limit at 10 metres will be 48.6 dBuV/m.

The spurious emission observed does not exceed the level of the fundament emission.

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: Spurious Emissions (above 30 MHz)

Measurements between 30 –2000 MHz have been made at a distance of 3 metres.

A receiver with a quasi peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz and with a peak and average detector with a 1 MHz bandwidth was used between 1000 – 2000 MHz.

The limits as described in Section 15.209 have been applied.

Frequency MHz	Vertical dBµV/m	Horizontal dBµV/m	Limit dBµV/m	Margin dB	Detector	BW
33.719	36.4		40.0	3.6	Quasi Peak	120 kHz
35.225	32.8		40.0	7.2	Quasi Peak	120 kHz
38.368	33.8		40.0	6.2	Quasi Peak	120 kHz
70.421	21.0		40.0	19.0	Quasi Peak	120 kHz
75.563	22.2		40.0	17.8	Quasi Peak	120 kHz
78.176	20.4	16.6	40.0	19.6	Quasi Peak	120 kHz
83.267	18.7	22.9	40.0	17.1	Quasi Peak	120 kHz
108.872	22.2	23.1	43.5	20.4	Quasi Peak	120 kHz
121.689	23.1		43.5	20.4	Quasi Peak	120 kHz
134.506	21.7		43.5	21.8	Quasi Peak	120 kHz
147.323	24.5		43.5	19.0	Quasi Peak	120 kHz
198.581	25.3		43.5	18.2	Quasi Peak	120 kHz
237.042	21.0		46.0	25.0	Quasi Peak	120 kHz
261.815	42.9	46.0	46.0	0.0	Quasi Peak	120 kHz
392.714	39.5	32.1	46.0	6.5	Quasi Peak	120 kHz
454.738	33.1		46.0	12.9	Quasi Peak	120 kHz
523.622	39.1	36.3	46.0	6.9	Quasi Peak	120 kHz
785.430		35.1	46.0	10.9	Quasi Peak	120 kHz
922.030	36.3	29.9	46.0	9.7	Quasi Peak	120 kHz
1047.260		45.6	74.0	28.4	Peak	1 MHz
1047.260		30.9	54.0	23.1	Average	1 MHz
1701.761		56.1	74.0	17.9	Peak	1 MHz
1701.761		37.3	54.0	16.7	Average	1 MHz

All other emissions observed had a margin to the limit that exceeded 20 dB when measurements were attempted over the range of 30 – 1000 MHz using both vertical and horizontal polarisations.

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

Section 15.225: Fundamental emission:

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

Measurements were made at a distance of 10 metres with the limit being determined by using the extrapolation factor of 40 dB per decade limit, as detailed in section 15.31 f (2).

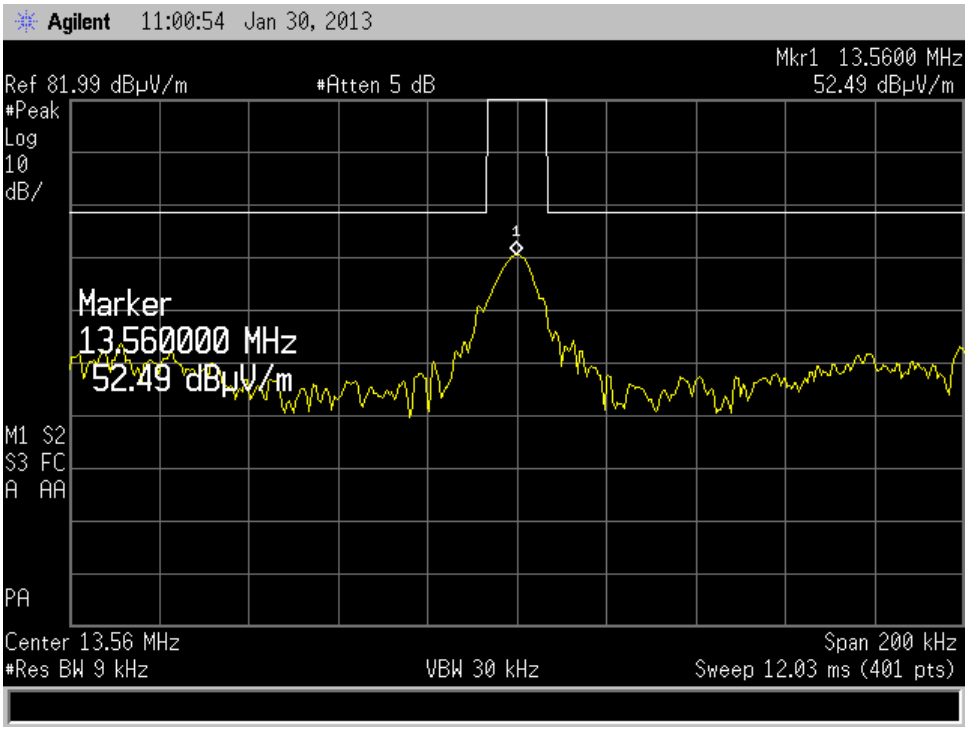
The limit at 30 m at 13.560 MHz is 15,848 uV/m or 84.0 dBuV/m.

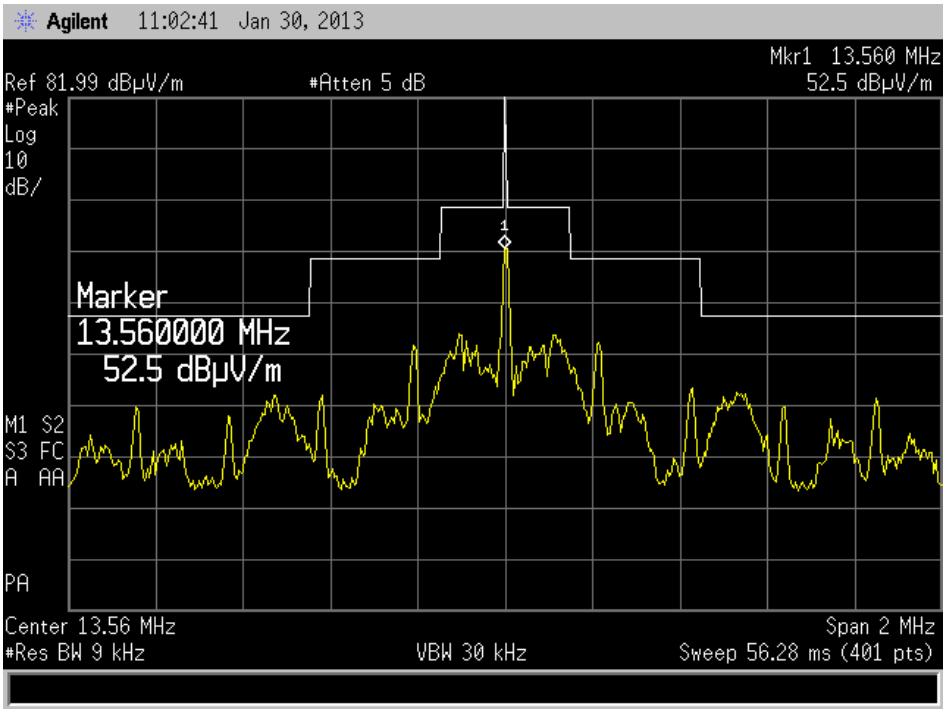
Applying the extrapolation factor of 40 dB/ per decade, the limit is 103.1 dBuV/m.

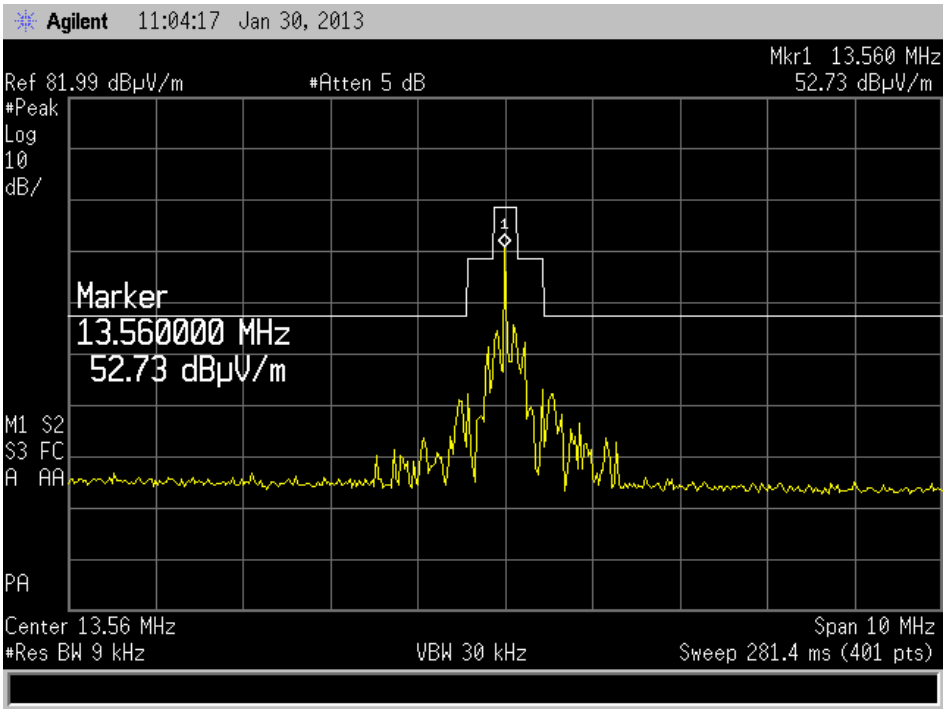
Testing was carried out when the device was transmitting continuously when the 120 Vac supply to the device was varied by +/- 15%.

Frequency MHz	Level dBuV/m	Distance metres	Limit dBuV/m	Voltage Vac	Margin dB
13.560	52.1	10.0	103.1	102.0	51.0
13.560	52.1	10.0	103.1	120.0	51.0
13.560	52.1	10.0	103.1	138.0	51.0

A representative spectrum analyser plot shows that the carrier and modulation peaks within +/- 100 kHz, +/- 1 MHz and +/- 5 MHz of the carrier.







Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

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

Section 15.225: Frequency tolerance:

The frequency tolerance of the carrier is required to be +/- 0.01% of operating frequency when the temperature is varied between -20 degrees and +50 degrees.

The device operates nominally on 13.560 MHz which gives a frequency tolerance of +/- 1,356 Hz.

Temperature	Frequency MHz	Difference Hz
-20.0	13.559 375	-625
-10.0	13.559 375	-625
0.0	13.559 375	-625
10.0	13.559 375	-625
20.0	13.559 375	-625
30.0	13.559 375	-625
40.0	13.559 375	-625
50.0	13.559 375	-625

Variation of the 120 Vac 60 Hz supply to the AC power supply did not vary the 12 Vdc supply to the Controller 6000 or the device under test.

As a worst case scenario the 12 Vdc supply to the device was varied between 85% and 115% of the supply voltage at +20 degrees.

Voltage Vdc	Frequency MHz	Difference Hz
10.2	13.559 375	-625
12.0	13.559 375	-625
13.8	13.559 375	-625

Result: Complies
Measurement uncertainty with a confidence interval of 95% is:
- Frequency tolerance ± 50 Hz

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
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applicable
AC Supply	APT	7008	4170003	-	Not applicable
Receiver	R & S	ESHS 10	828404/005	3728	21 Nov 2013
Mains Network	R & S	ESH2-Z5	881362/032	3628	21 Aug 2013
Receiver	R & S	ESIB-40	100171	R-27-1	21 Oct 2013
Spec Analyser	Hewlett Packard	E7405A	US39150142	3771	20 April 2013
Loop Antenna	EMCO	6502	9003-2485	3798	7 Feb 2013
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2013
Biconical Ant	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2013
Log Periodic Ant	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2013

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 February 15th, 2011.

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

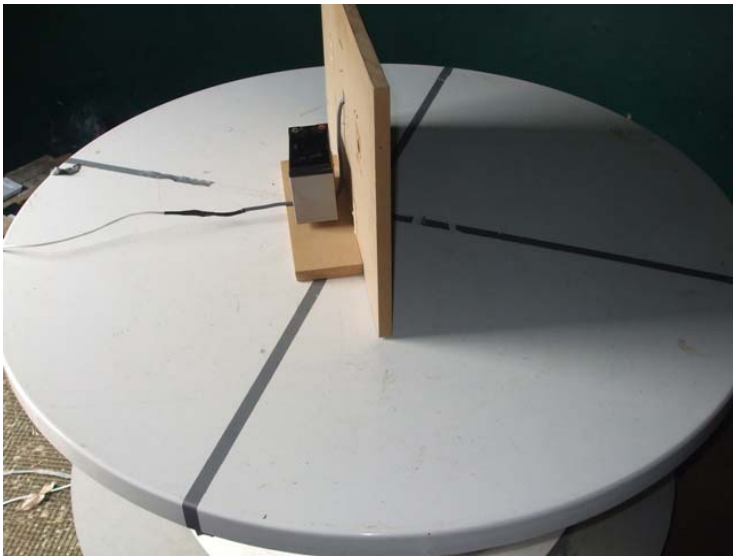
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

9. PHOTOGRAPHS

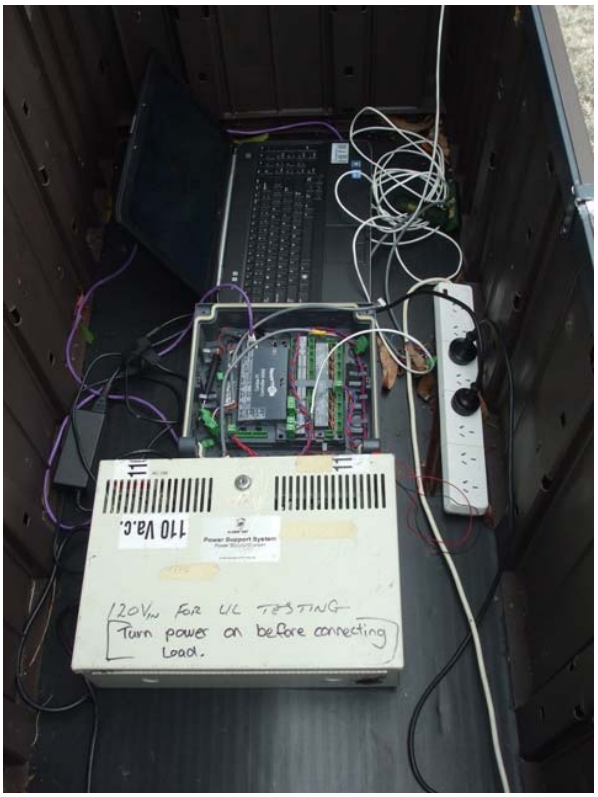
Identification Label

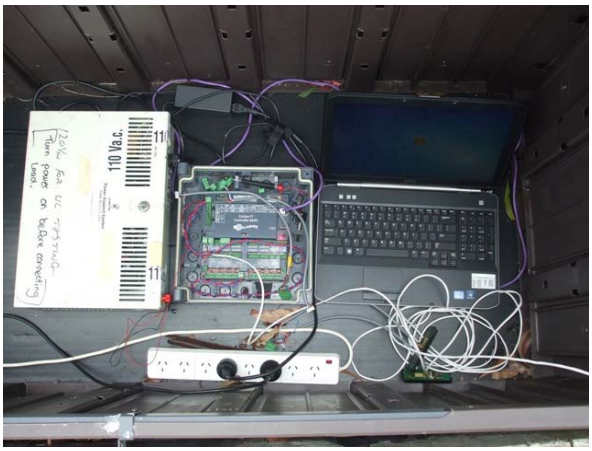
External photographs

Radiated emissions test set up (battery not connected and was used as a counter balance)



Ancillary equipment test set up





Conducted emissions test set up