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TEST REPORT

Gallagher T10 Mifare Proximity Card Reader

tested to

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.255
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 T10 Mifare 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 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.
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies with a 34.2 dB margin at 27.120 MHz
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies with a 10.4 dB margin at 867.840 MHz (Vertical).
15.225	Radiated emission limits - Fundamental	Complies with a 46.2 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 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.

4. CLIENT INFORMATION

Company Name	Gallagher Group Ltd
Address	181 Kahikatea Drive
City	Hamilton
Country	New Zealand
Contact	Mr Brian Rose

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Gallagher
Model Number	T10 Mifare Reader
Product	Mifare Proximity Card Reader
Manufacturer	Gallagher Group Ltd
Country of Origin	New Zealand
Serial Number	T10103526

The device was retested at the request of the client due to a component change made to the device.

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 an internal antenna.

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 13.561 MHz.

This falls into the band 13.110 – 14.010 MHz that is covered by Section 15.225.

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 which supplied 12 Vdc to a GBUS URI device which in turn powered the Card Reader also at 12 Vdc.

The device operates on 13.560 MHz.

Testing was carried out with the 13.560 MHz transmitter operating with the standard antenna attached and with this antenna removed and replaced with a dummy load.

The device is deemed to comply providing it complies when the test is carried out with a dummy load 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.

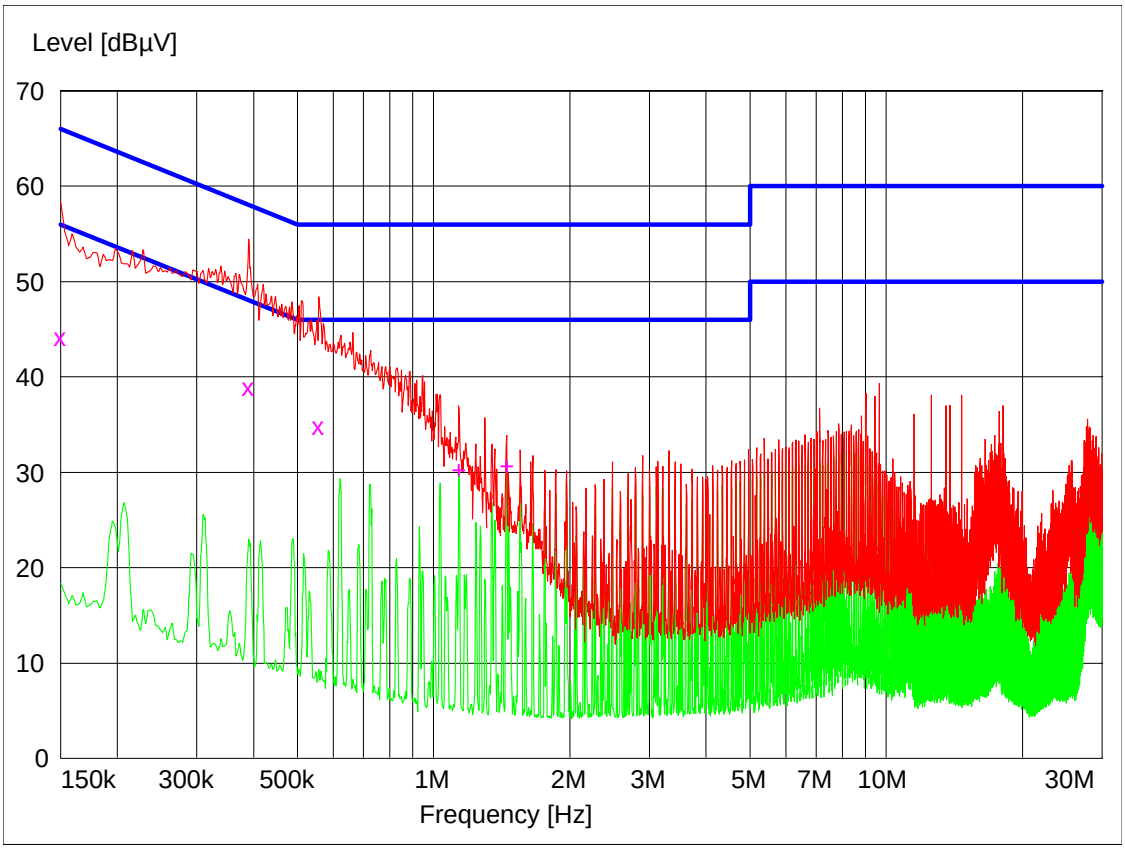
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

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

Conducted Emissions – AC Mains Port

Setup:	Device tested when powered at 120 Vac using a representative ac power supply that in turn powered a GBUS URI device which powered the device under test that was transmitting continuously with the antenna not attached.

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



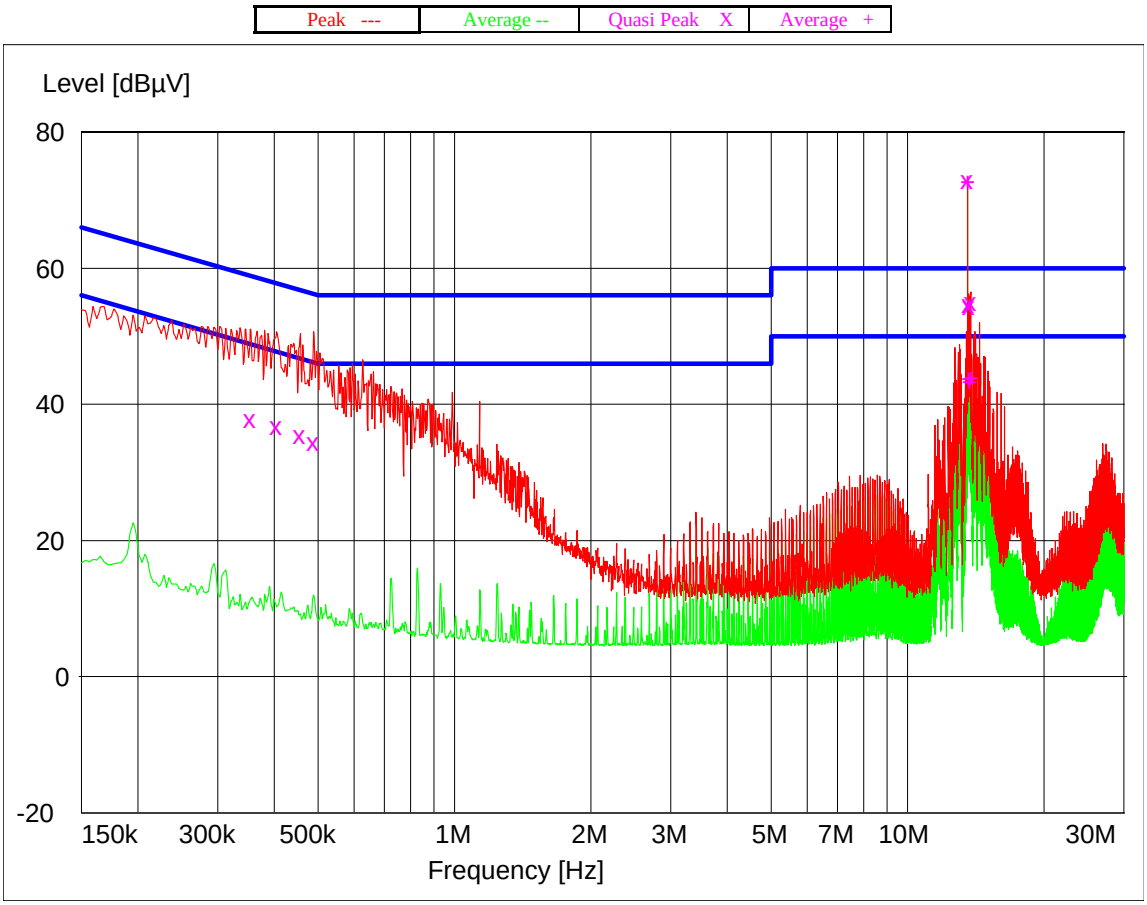
Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.150000	44.20	66.0	21.8	L1	
0.390000	38.90	58.1	19.2	L1	
0.558000	34.90	56.0	21.1	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
1.137000	30.30	46.0	15.7	N	
1.449000	30.70	46.0	15.3	N	

Setup:	Device tested when powered at 120 Vac using a representative power supply that was in turn powering a URI device. Testing was carried out while the device transmitting continuously with the antenna attached.



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.354000	37.90	58.9	21.0	N	
0.405000	36.90	57.7	20.8	N	
0.456000	35.50	56.8	21.3	N	
0.489000	34.50	56.0	21.7	N	
13.560500	73.00	60.0	-13.0	L1	73.1
13.637000	54.80	60.0	5.2	L1	
13.691000	54.40	60.0	5.6	L1	
13.772000	55.10	60.0	4.9	L1	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.560500	72.70	50.0	-22.7	L1	
13.637000	43.80	50.0	6.2	L1	
13.691000	43.40	50.0	6.6	L1	
13.772000	43.90	50.0	6.1	N	

Section 15.209: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 13 MHz to 1000 MHz as the highest frequency in use is less than 108 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 when the device was powered at 12 Vdc from a GBUS URI device which was in turn powered at 12 Vdc from a 120 Vac to 12 Vdc representative AC power supply.

The GBUS URI and representative AC power supply were placed 5 metres directly behind the device under test.

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 transmitted continuously on approximately 13.560 MHz throughout the test.

Periodically a swipe card was run over the device to ensure that the system was operating correctly which was indicated by an audible beep after the card had been swiped.

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: Spurious Emissions (below 30 MHz)

Frequency MHz	Level dBµV/m	Limit (dBµV/m)	Margin (dB)
27.120	15.3	49.5	34.2

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 49.54 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 –1000 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.

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

The limits as described in Section 15.209 have been applied.

Frequency MHz	Vertical dBµV/m	Horizontal dBµV/m	Limit dBµV/m	Margin dB	Result
40.680	26.1	-	40.0	13.9	Pass
108.453	15.1	-	43.5	28.4	Pass
135.600	22.0	21.8	43.5	21.5	Pass
162.720	22.5	-	43.5	21.0	Pass
189.814	23.8	24.1	43.5	19.4	Pass
216.960	24.3	24.0	46.0	21.7	Pass
244.044	25.9	29.1	46.0	16.9	Pass
271.168	22.3	25.3	46.0	20.7	Pass
298.292	28.1	29.5	46.0	16.5	Pass
325.412	27.8	29.9	46.0	16.1	Pass
352.532	29.9	32.2	46.0	13.8	Pass
406.772	30.8	28.1	46.0	15.2	Pass
488.160	29.7	-	46.0	16.3	Pass
501.720	31.4	-	46.0	14.6	Pass
515.280	30.8	30.1	46.0	15.2	Pass
542.372	30.3	30.1	46.0	15.7	Pass
555.960	31.2	29.9	46.0	14.8	Pass
569.492	33.4	32.0	46.0	12.6	Pass
623.760	30.1	-	46.0	15.9	Pass
705.120	32.2	-	46.0	13.8	Pass
732.240	32.2	-	46.0	13.8	Pass
759.360	33.8	-	46.0	12.2	Pass
786.480	33.1	-	46.0	12.9	Pass
813.600	34.6	-	46.0	11.4	Pass
840.720	34.3	-	46.0	11.7	Pass
867.840	35.6	-	46.0	10.4	Pass
881.400	34.6	-	46.0	11.4	Pass
908.520	31.3	-	46.0	14.7	Pass
949.200	34.9	-	46.0	11.1	Pass
976.320	34.2	-	54.0	19.8	Pass

All other emissions observed at a margin to limit that exceeded 20 dB when measurements were attempted using vertical and horizontal polarisations.

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 - 1000 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).

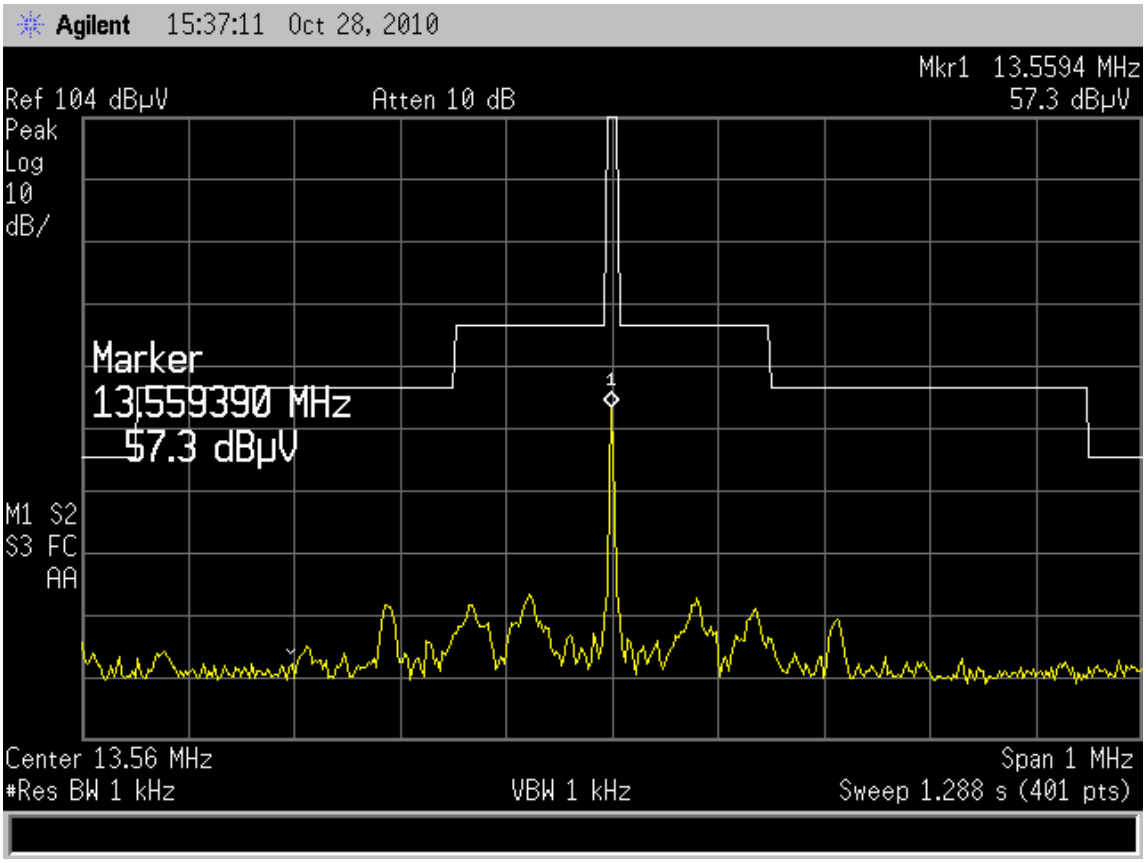
The limit at 30 m at 13.561 MHz is 15,848 uV/m or 84.0 dBuV/m.

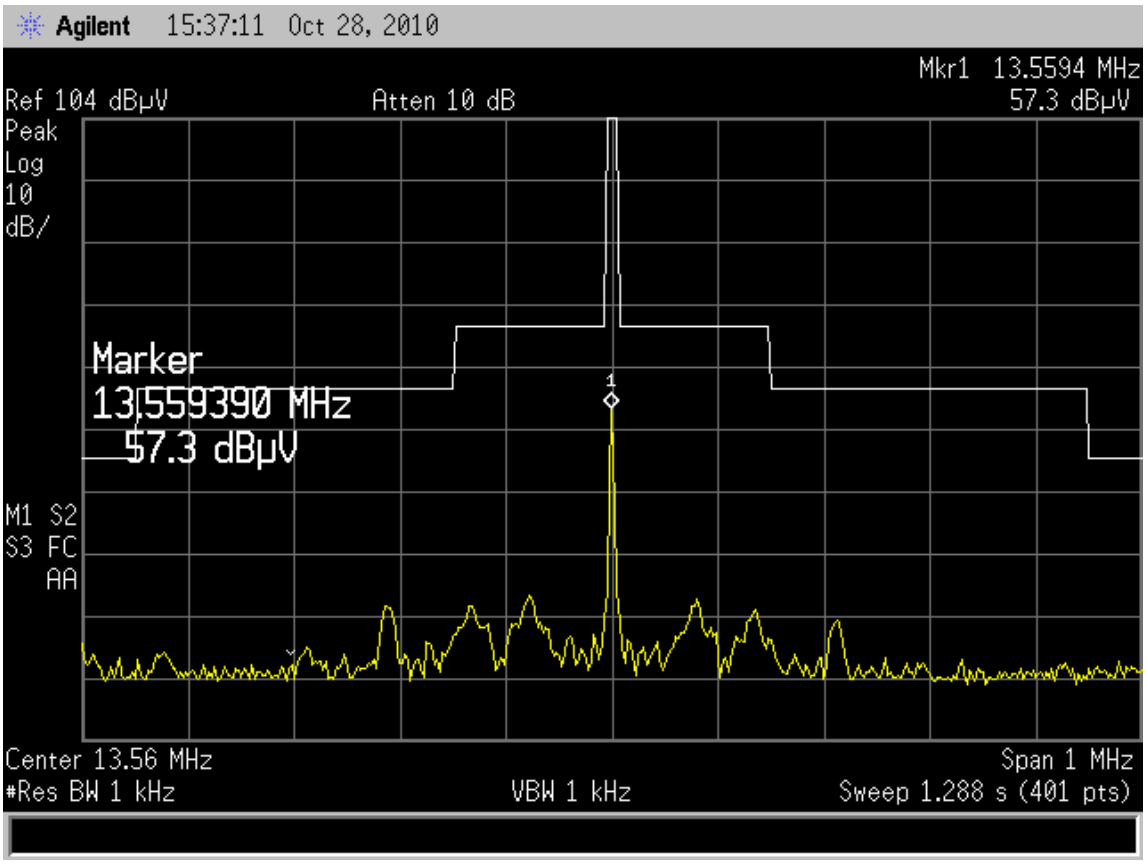
Applying the extrapolation factor of 40 dB/ per decade, the limit is 104 dBuV/m.

Testing was carried out when the device was transmitting continuously with the AC power supply was varied by +/- 15%.

Frequency MHz	Level dBµV/m	Distance metres	Limit (dBµV/m)	Voltage (Vac)	Margin (dB)
13.560	57.4	10.0	104.0	102.0	46.6
13.560	57.8	10.0	104.0	120.0	46.2
13.560	57.4	10.0	104.0	138.0	46.6

A representative spectrum analyser plot shows that the carrier and modulation peaks within +/- 50 kHz of the carrier and within +/- 500 kHz 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 on approximately 13.560 MHz which gives a frequency tolerance of +/- 1,356 Hz.

Temperature	Frequency (MHz)	Difference (Hz)
50.0	13.559 550	-450.0
40.0	13.559 440	-560.0
30.0	13.559 424	-576.0
20.0	13.559 425	-575.0
10.0	13.559 420	-580.0
0.0	13.559 420	-580.0
-10.0	13.559 410	-590.0
-20.0	13.559 410	-590.0

Variation of the 120 Vac supply to the AC power supply did not vary the 12 Vdc supply to the GBUS URI or the device under test.

Therefore 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	13.559 410	-590.0
12.0	13.559 410	-590.0
13.8	13.559 410	-590.0

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 applic
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic
Receiver	R & S	ESHS 10	828404/005	3728	21 Nov 2010
Mains Network	R & S	ESH2-Z5	881362/032	3628	21 Aug 2011
Receiver	R & S	ESIB	100171	R-27-1	21 Feb 2011
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3771	20 April 2011
Loop Antenna	EMCO	6502	9003-2485	3798	7 Feb 2011
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2011
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2011
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2011

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, 2010.

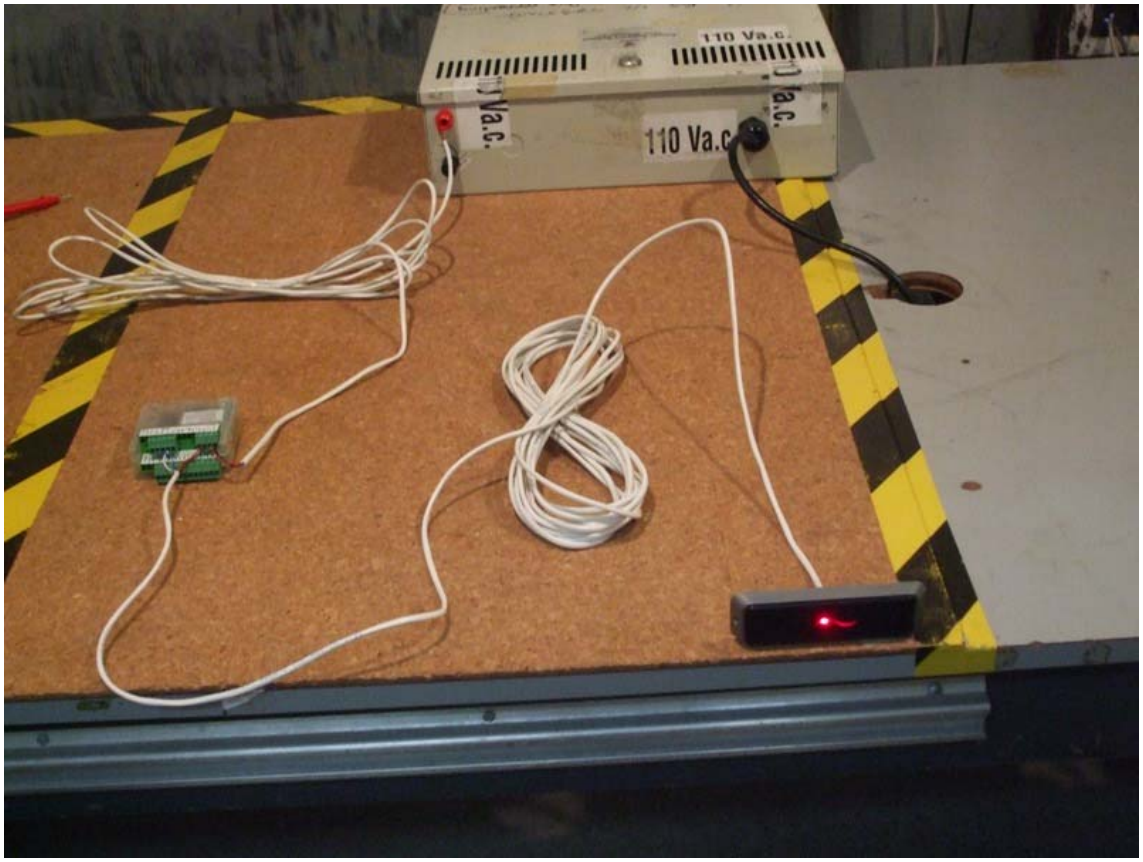
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

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

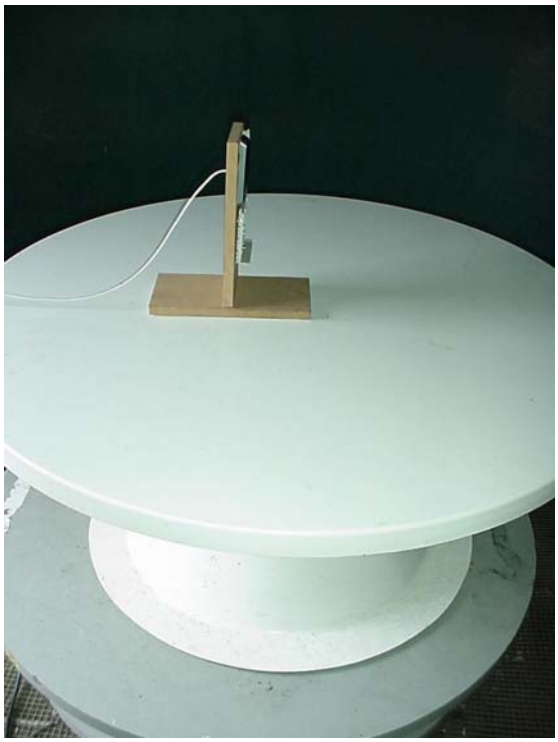
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

9. PHOTOGRAPHS

Conducted emissions test set up



Radiated emissions test set up – Device under test



Ancillary equipment – GBUS URI and the representative AC power supply