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## **TEST REPORT**

### **Gallagher T11 Dual Flush Mifare Card Reader and 125 kHz 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:

A handwritten signature in black ink, appearing to read "Andrew Cutler".

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**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 T11 Dual Flush Card Reader and 125 kHz 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 125 kHz and 13.560 MHz.
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Fundamental	Complies when transmitting on 125 kHz
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies with a 32.9 dB margin at 27.120 MHz
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies with a 10.3 dB margin at 569.520 MHz
15.225	Radiated emission limits - Fundamental	Complies with a 45.4 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

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

### 5. DESCRIPTION OF TEST SAMPLE

<b>Brand Name</b>	Gallagher
<b>Model Number</b>	T11
<b>Product</b>	Dual Flush Card Reader and 125 kHz Card Reader
<b>Manufacturer</b>	Gallagher Group Ltd
<b>Country of Origin</b>	New Zealand
<b>Serial Number</b>	T11103526

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 internal antennas for both 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.

The 125 kHz device falls between the 0.090 – 0.110 MHz band and the 0.495 – 0.505 MHz band.

The 13.560 MHz device 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 125 kHz and 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 and this process was not required to be carried out on the 125 kHz transmitter.

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.

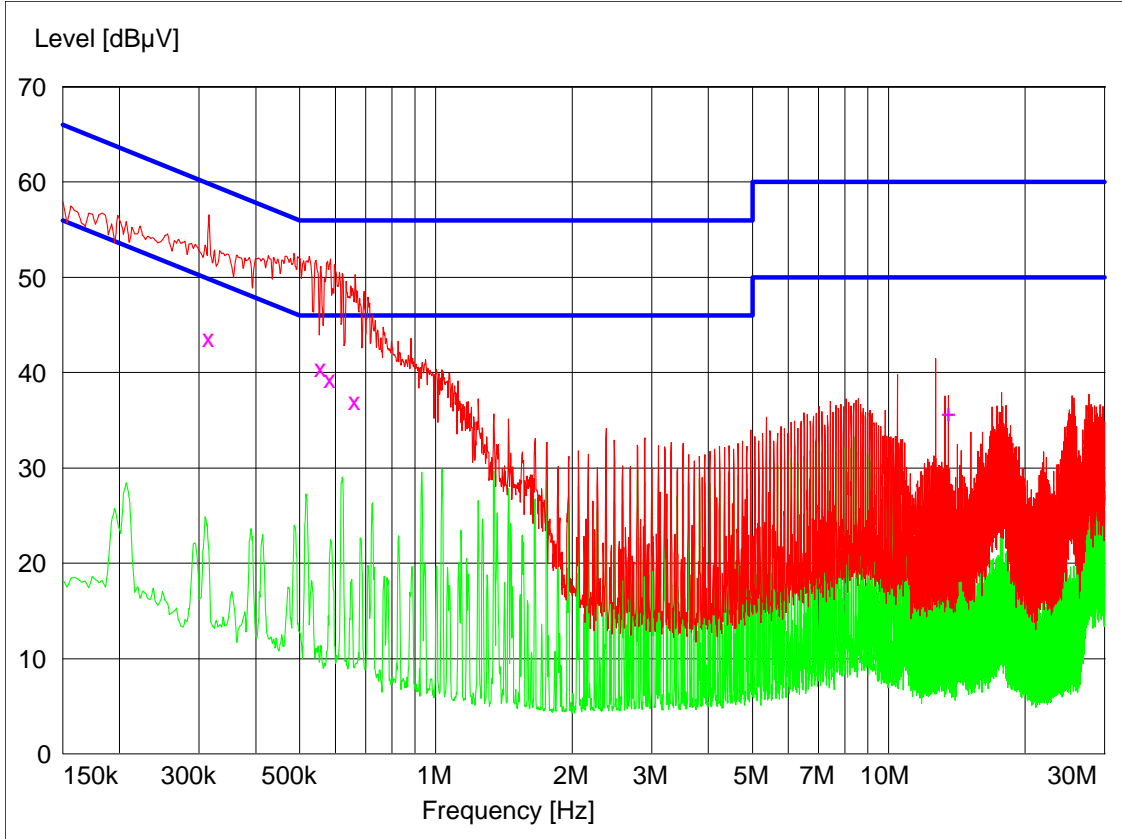
Measurement uncertainty with a confidence interval of 95% is:

- AC Mains port (0.15-30 MHz)  $\pm$  2.8 dB

### Conducted Emissions – AC Mains Port

**Setup:** Device tested when powered at 120 Vac using a representative power supply that in turn powered a GBUS URI that powered the device that was transmitting continuously with a dummy load placed on the antenna

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.315000	43.60	59.9	16.3	N	
0.558000	40.50	56.0	15.5	N	
0.585000	39.40	56.0	16.6	L1	
0.663000	37.10	56.0	18.9	L1	

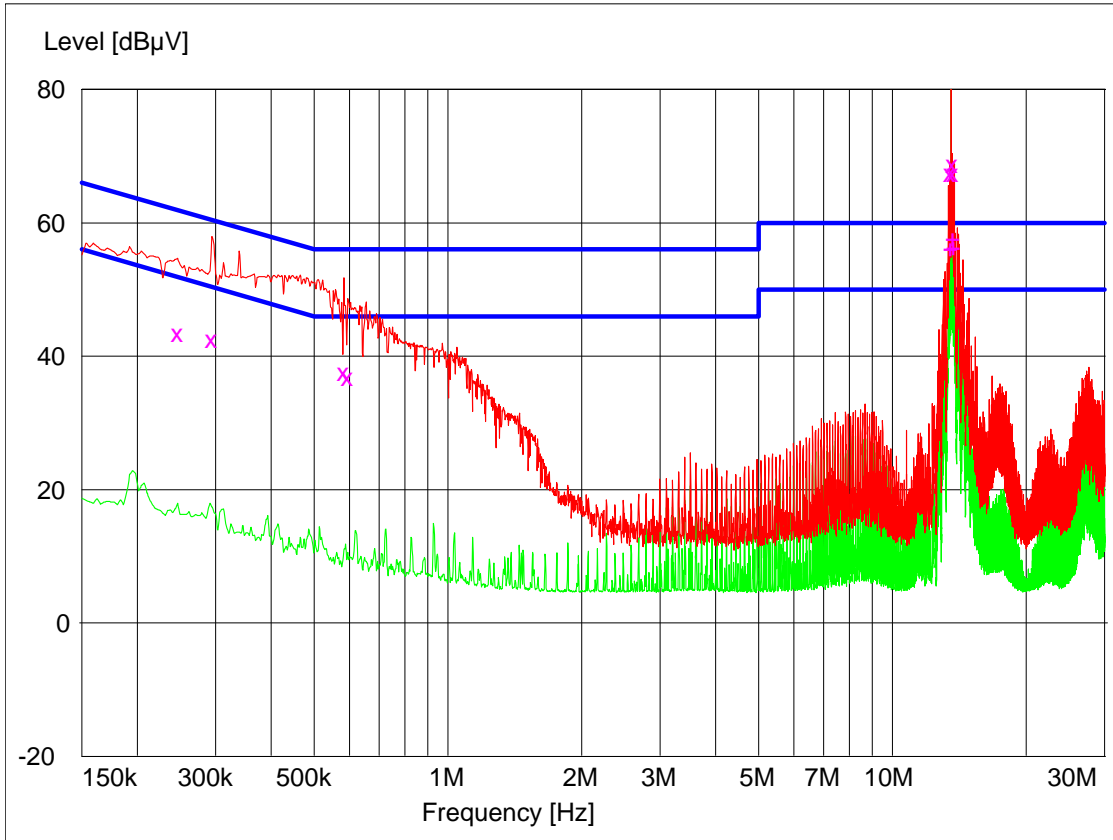
Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.560500	35.80	50.0	14.3	N	

### Conducted Emissions – AC Mains Port

**Setup:** Device tested when powered at 120 Vac using a representative power supply that in turn powered a GBUS URI that powered the device that was transmitting continuously.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.246000	43.50	61.9	18.4	L1	
0.294000	42.50	60.5	18.0	L1	
0.582000	37.70	56.0	18.3	N	
0.594000	36.80	56.0	19.2	L1	
13.479500	67.50	60.0	-7.5	N	
13.560500	88.90	60.0	-28.9	N	89.1
13.637000	68.80	60.0	-8.8	N	
13.691000	67.50	60.0	-7.5	N	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.479500	56.30	50.0	-6.3	N	
13.560500	88.60	50.0	-38.6	N	
13.637000	57.70	50.0	-7.6	N	
13.691000	56.40	50.0	-6.4	N	



## Section 15.209: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 125 kHz 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 125 kHz and 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 (dB $\mu$ V/m) = Receiver Reading (dB $\mu$ V) + Antenna Factor (dB) + Coax Loss (dB)

**Result:** Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 1000 MHz)  $\pm$  4.1 dB
- Free radiation tests (100 kHz – 30 MHz)  $\pm$  4.8 dB

## Section 15.209: 125 kHz transmitter measurements

### Fundamental measurements

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 made at a distance of 10 metres.

The limit at 300 metre has been extrapolated to measurement distance of 10 metres using a factor of 40 dB per decade as detailed in section 15.31(f)(2).

The maximum field strength was found by rotating the product using the turntable 360 degrees while it was transmitting continuously while using several loop orientations.

In addition measurements were made when the AC power supply was varied by +/- 15%.

Frequency (kHz)	Average dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Voltage Vac	Distance Metres
125.000	52.6	85.7	33.1	102.0	10
125.000	52.3	85.7	33.4	120.0	10
125.000	52.2	85.7	33.5	138.0	10

Frequency (kHz)	Peak dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Voltage Vac	Distance metres
125.000	67.3	105.7	38.4	102.0	10
125.000	67.1	105.7	38.6	120.0	10
125.000	67.4	105.7	38.3	138.0	10

The peak limit is the average limit plus 20 dB

**Result:** Complies.

Measurement uncertainty with a confidence interval of 95% is:

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

## Spurious emissions

Frequency kHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Detector
250.000	-	79.6	-	Average
250.000	-	99.6	-	Peak
375.000	-	76.1	-	Average
375.000	-	96.1	-	Peak
500.000	-	53.6	-	Quasi Peak
625.000	-	51.7	-	Quasi Peak
750.000	-	50.1	-	Quasi Peak
875.000	-	48.8	-	Quasi Peak
1000.000	-	47.6	-	Quasi Peak
1125.000	-	46.6	-	Quasi Peak
1250.000	-	45.7	-	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 10metres.

The maximum field strength was found by rotating the product using the turntable 360 degrees while it was transmitting continuously while using several loop orientations.

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). 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)  $\pm$  4.8 dB

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

<b>Frequency MHz</b>	<b>Level dB<math>\mu</math>V/m</b>	<b>Limit dB<math>\mu</math>V/m</b>	<b>Margin dB</b>
27.120	16.6	49.5	32.9

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 27.122 MHz when measured at 30 metres is 30  $\mu$ V/m or 29.54 dB $\mu$ V/m.

Therefore the scaled limit at 10 metres will be 49.54 dB $\mu$ V/m.

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

**Result:** Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (100 kHz – 30 MHz)  $\pm$  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 limits as described in Section 15.209 have been applied.

Frequency MHz	Vertical dB $\mu$ V/m	Horizontal dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB	Result
94.920	-	23.8	43.5	19.7	Pass
108.480	19.1	-	43.5	24.4	Pass
122.040	22.9	22.1	43.5	20.6	Pass
149.160	28.1	27.5	43.5	15.4	Pass
176.280	-	25.1	43.5	18.4	Pass
203.400	-	24.5	43.5	19.0	Pass
244.080	-	28.0	46.0	18.0	Pass
257.000	-	28.5	46.0	17.5	Pass
311.880	-	22.1	46.0	23.9	Pass
325.440	-	24.1	46.0	21.9	Pass
339.000	-	23.5	46.0	22.5	Pass
352.560	-	21.8	46.0	24.2	Pass
366.120	29.6	28.1	46.0	16.4	Pass
488.160	-	23.0	46.0	23.0	Pass
542.376	32.8	28.3	46.0	13.2	Pass
555.960	31.4	28.3	46.0	14.6	Pass
569.520	35.7	33.7	46.0	10.3	Pass
583.080	31.0	29.2	46.0	15.0	Pass
596.616	34.5	34.1	46.0	11.5	Pass
610.200	-	31.1	46.0	14.9	Pass
623.760	34.9	31.8	46.0	11.1	Pass

**Result:** Complies.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 MHz – 1000 MHz)  $\pm$  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).

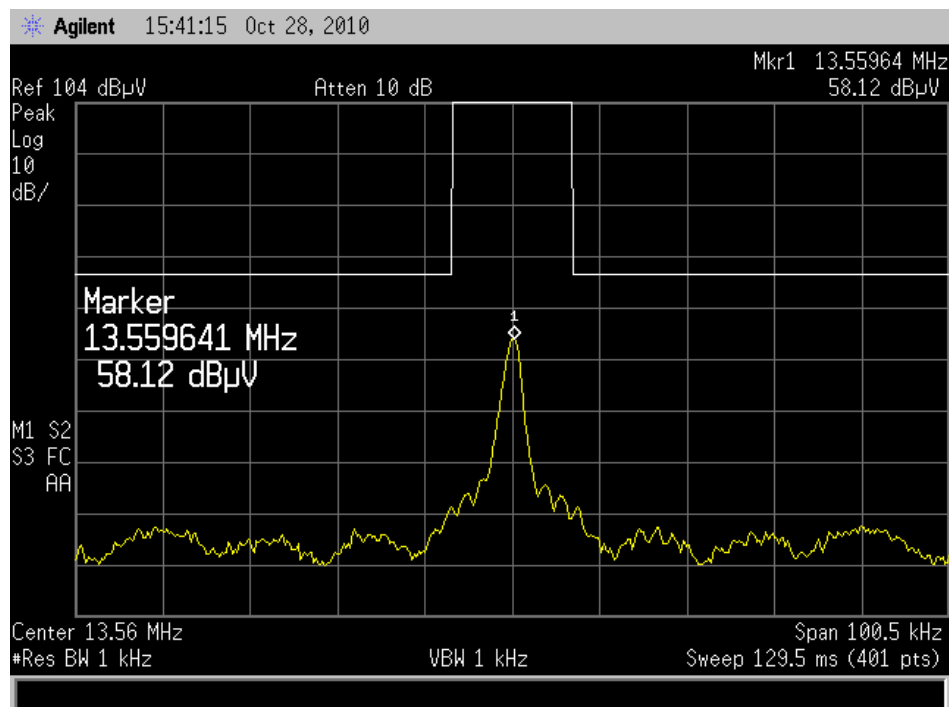
The limit at 30 m at 13.561 MHz is 15,848 uV/m or 84.0 dBuV/m.

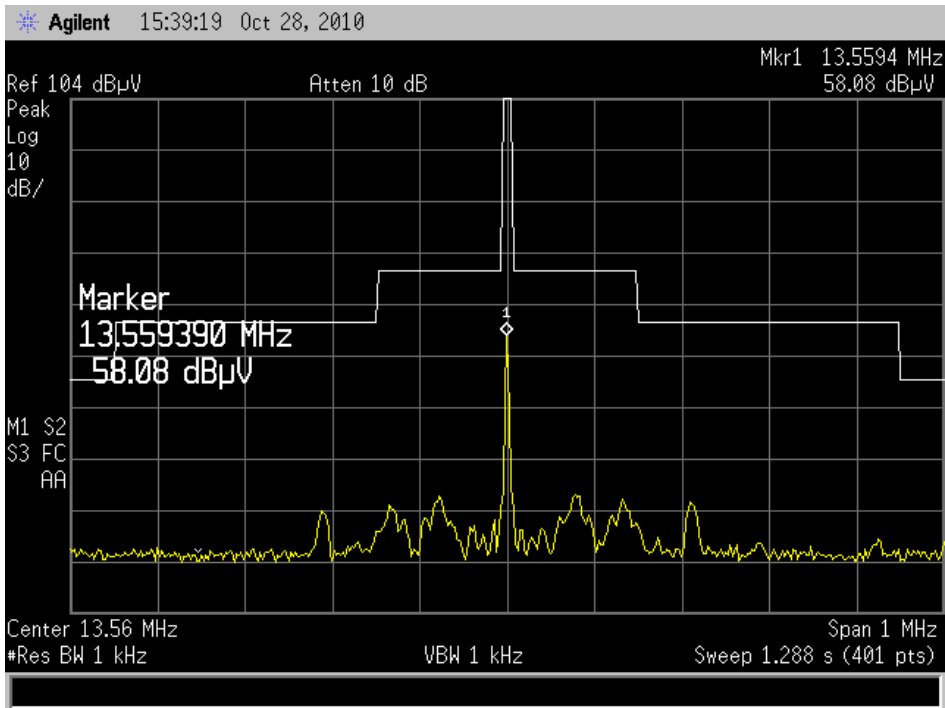
Applying the extrapolation factor of 40 dB/ per decade, the limit is 104 dBuV/m.

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

Frequency MHz	Level dBuV/m	Distance metres	Limit dBuV/m	Voltage Vac	Margin dB
13.560	58.6	10.0	104.0	102.0	45.4
13.560	58.6	10.0	104.0	120.0	45.4
13.560	58.6	10.0	104.0	138.0	45.4

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)  $\pm$  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	13.559 525	-475.0
40.0	13.559 499	-501.0
30.0	13.559 524	-476.0
20.0	13.559 520	-480.0
10.0	13.559 510	-490.0
0.0	13.559 510	-490.0
-10.0	13.559 515	-485.0
-20.0	13.559 385	-615.0

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.

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	13.559 385	-615.0
12.0	13.559 385	-615.0
13.8	13.559 385	-615.0

**Result:** Complies

Measurement uncertainty with a confidence interval of 95% is:

- Frequency tolerance  $\pm$  50 Hz



## 7. TEST EQUIPMENT USED

<b>Instrument</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No</b>	<b>Asset Ref</b>	<b>Cal Due</b>
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-40	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 23<sup>rd</sup>, 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.

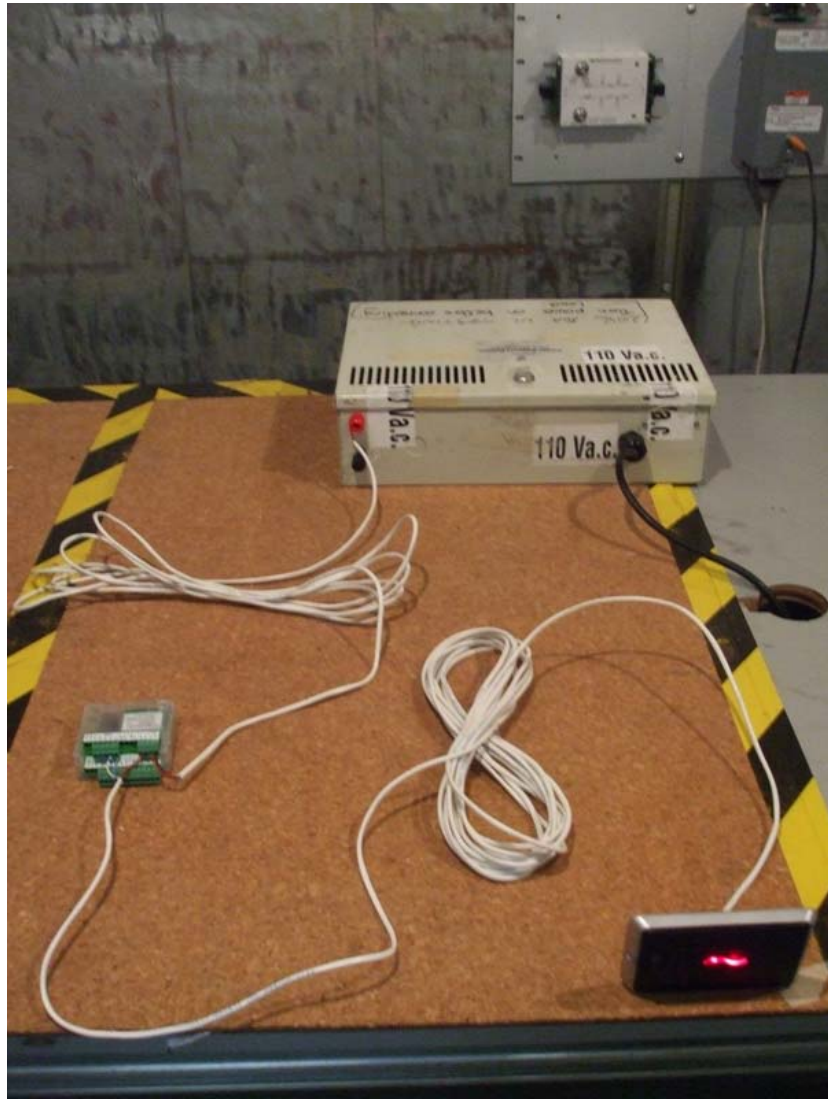
## 9. PHOTOGRAPHS



## Radiated emissions test set up



## Conducted emissions test set up



Ancillary equipment – GBUS URI and the representative AC power supply

