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## **TEST REPORT**

### **Gallagher T11 Multi-Tech 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:

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

## **Table of Contents**

<b>1.</b>	<b>STATEMENT OF COMPLIANCE</b>	<b>3</b>
<b>2.</b>	<b>RESULTS SUMMARY</b>	<b>3</b>
<b>3.</b>	<b>INTRODUCTION</b>	<b>4</b>
<b>4.</b>	<b>CLIENT INFORMATION</b>	<b>4</b>
<b>5.</b>	<b>DESCRIPTION OF TEST SAMPLE</b>	<b>4</b>
<b>6.</b>	<b>SETUPS AND PROCEDURES</b>	<b>5</b>
<b>7.</b>	<b>TEST EQUIPMENT USED</b>	<b>19</b>
<b>8.</b>	<b>ACCREDITATIONS</b>	<b>19</b>
<b>9.</b>	<b>PHOTOGRAPHS</b>	<b>20</b>

## 1. STATEMENT OF COMPLIANCE

The **Gallagher T11 Multi-Tech 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 with an occupied bandwidth of 442.5 kHz and it transmits on 125 kHz with an occupied bandwidth of 875 Hz
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Emissions < 30 MHz	Complies with a 32.7 dB margin at 125 kHz.
15.209	Radiated emission limits – Emissions > 30 MHz	Complies with a 5.2 dB margin at 253.973 MHz (Horizontal).
15.225	Radiated emission limits - Fundamental	Complies with a 46.8 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 120712.1b of 13<sup>th</sup> November 2012 to further update the photographs and IDs.**

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>	Multi-Tech Proximity Card Reader
<b>Manufacturer</b>	Gallagher Group Ltd
<b>Country of Origin</b>	New Zealand
<b>Serial Number</b>	1228107067 + 1226307275
<b>FCC ID</b>	M5VC30044X
<b>IC ID</b>	7369A-C30024X

## **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.

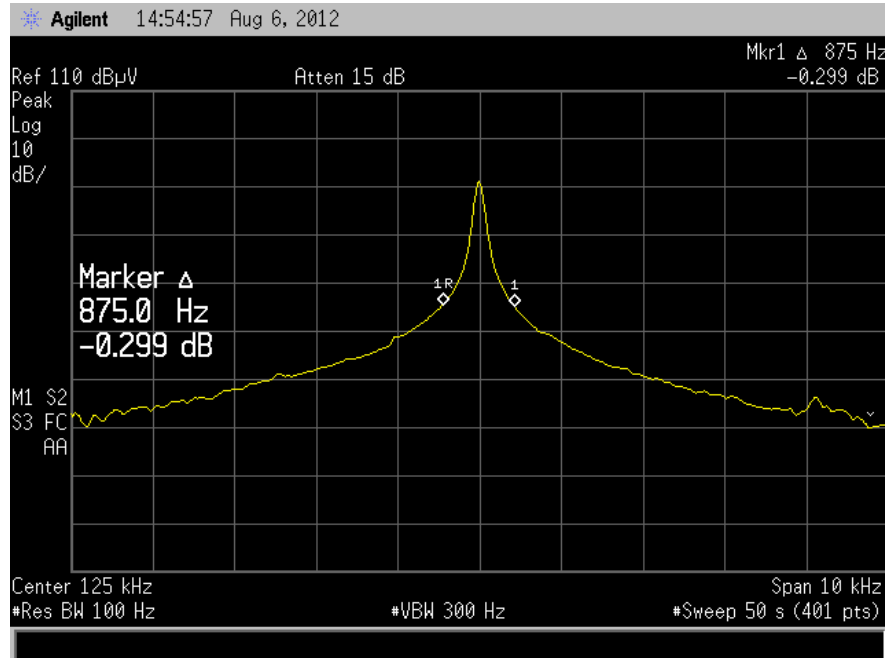
**Result:** Complies.

## Section 15.205: Restricted bands of operation

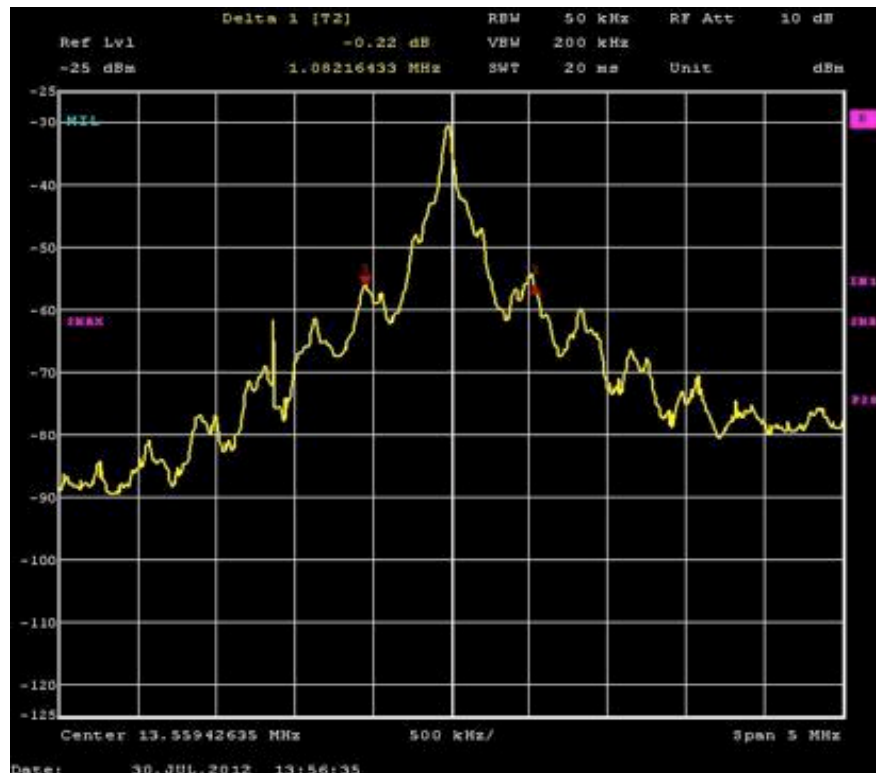
The transmitter transmits on 125.000 kHz and 13.560 MHz.

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.

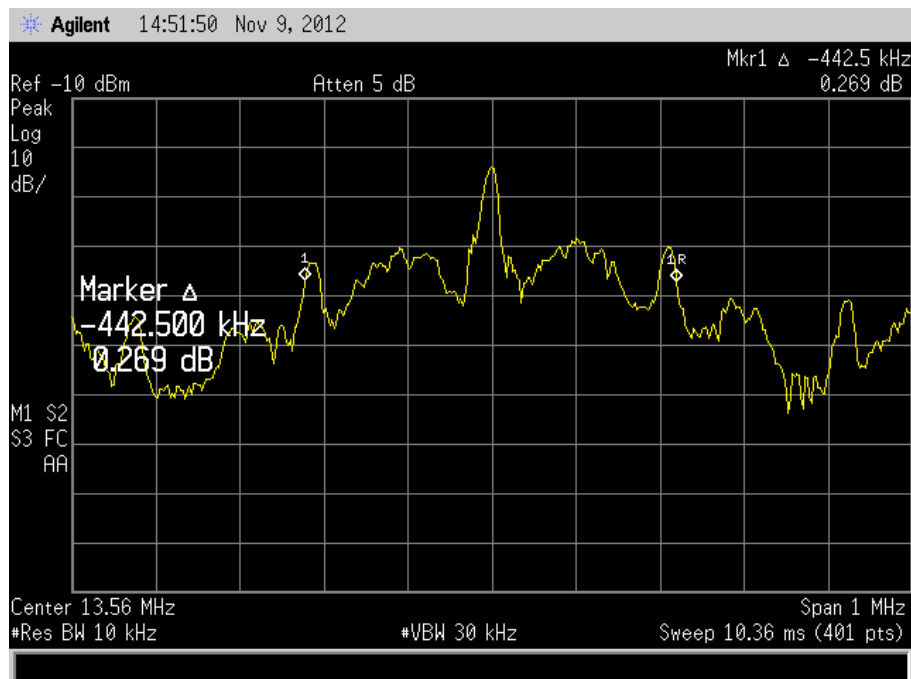
125 kHz modulation bandwidth = 875 Hz



The plot below shows that the device has an occupied bandwidth of 1.082 MHz when measured using a resolution bandwidth of 50 kHz (1% of the 6 MHz span) and with a video bandwidth of 200 kHz that is approximately 3 times the resolution bandwidth.



The 99% power bandwidth was then measured using a resolution bandwidth of 10 kHz which is 1% of the occupied bandwidth of 1.106 MHz with measurements being made at the -23 dB points which give a bandwidth of 442.5 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 GBUS URI device which in turn powered the Card Reader also at 12 Vdc.

The device operates on 125.000 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:

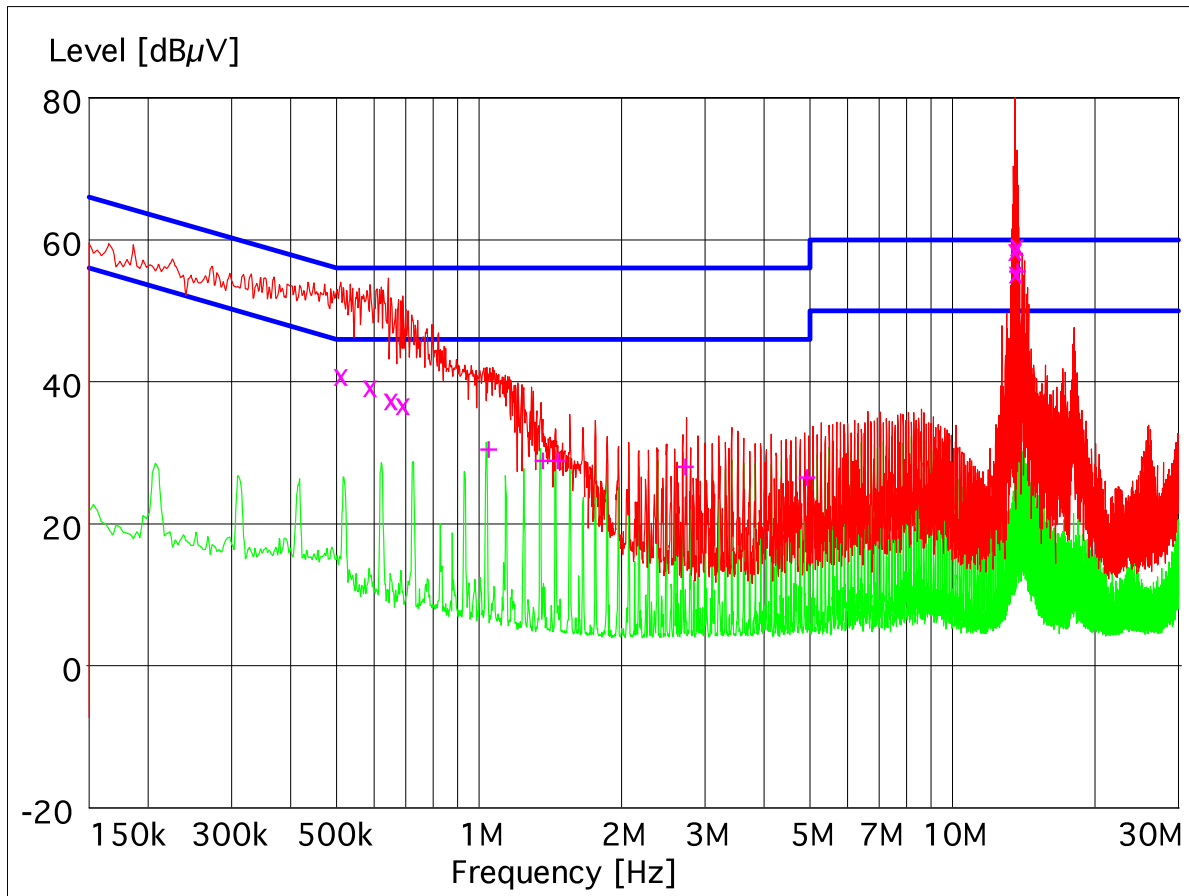
- AC Mains port                      (0.15-30 MHz)  $\pm$  2.8 dB



### Conducted Emissions – AC Input Power Port

**Setup:** Device test transmitting continuously on 125 kHz and 13.560 MHz when powered at 120 Vac 60 Hz with the antenna connected.

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



**Final Quasi-Peak Measurements**

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.510000	41.60	56.0	14.4	N	
0.588000	40.00	56.0	16.0	L1	
0.651000	38.20	56.0	17.8	N	
0.690000	37.50	56.0	18.5	L1	
13.547000	59.20	60.0	0.8	L1	
13.565000	81.40	60.0	-21.4	L1	81.5
13.578500	56.00	60.0	4.0	L1	
13.691000	59.90	60.0	0.1	L1	

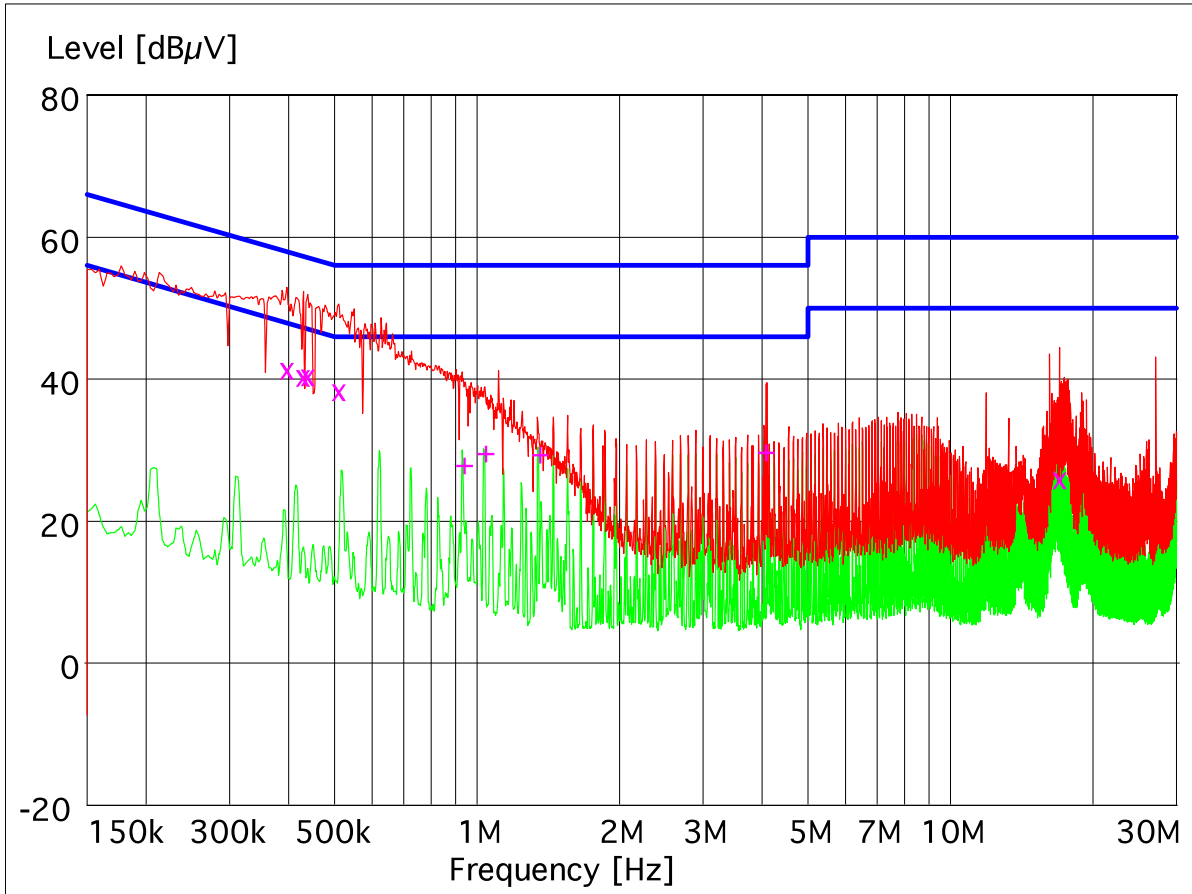
**Final Average Measurements**

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
1.035000	31.50	46.0	14.5	N	
1.347000	29.90	46.0	16.1	N	
1.449000	29.90	46.0	16.1	N	
2.693000	29.00	46.0	17.0	N	
4.866500	27.50	46.0	18.5	N	
13.565000	56.50	50.0	-6.5	L1	

### Conducted Emissions – AC Input Power Port

**Setup:** Device test transmitting continuously on 125.000 kHz and 13.560 MHz when powered at 120 Vac 60 Hz with the antenna disconnected and replaced with a resistive dummy load.

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



**Final Quasi-Peak Measurements**

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.396000	42.10	57.9	15.8	L1	
0.429000	41.10	57.3	16.2	N	
0.438000	41.20	57.1	15.9	L1	
0.510000	39.10	56.0	16.9	N	
16.980500	26.70	60.0	33.3	L1	

**Final Average Measurements**

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
0.930000	28.80	46.0	17.2	N	
1.032000	30.50	46.0	15.5	N	
1.344000	30.30	46.0	15.7	N	
4.034000	30.60	46.0	15.4	N	

## Section 15.209: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 100 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 60 Hz 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 (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 (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 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	52.3	84.1	31.8	Average	10
125.000	64.2	104.1	39.9	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	52.3
120.0	52.3
138.0	52.3

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

Frequency MHz	Level dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
27.120	15.2	48.6	33.4

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)  $\pm$  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	Antenna
Harmonics						
40.680	31.0		40.0	9.0	Pass	Vertical
54.250	26.1		40.0	13.9	Pass	Vertical
108.480	17.2		43.5	26.3	Pass	Vertical
230.520	31.9		46.0	14.1	Pass	Vertical
Others						
30.232	26.3		40.0	13.7	Pass	Vertical
37.550	23.8		40.0	16.2	Pass	Vertical
46.853	29.3		40.0	10.7	Pass	Vertical
223.800	24.9		46.0	21.1	Pass	Vertical
238.116		33.1	46.0	12.9	Pass	Horizontal
252.040		38.5	46.0	7.5	Pass	Horizontal
253.973		40.8	46.0	5.2	Pass	Horizontal
256.800	32.8		46.0	13.2	Pass	Vertical
258.560	29.2		46.0	16.8	Pass	Vertical
308.410	27.1		46.0	18.9	Pass	Vertical
319.639		28.2	46.0	17.8	Pass	Horizontal
322.380	28.5		46.0	17.5	Pass	Vertical
507.600			46.0	46.0	Pass	Vertical
514.629	32.3	29.6	46.0	13.7	Pass	Vertical
534.268	29.5	26.5	46.0	16.5	Pass	Vertical

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 – 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).

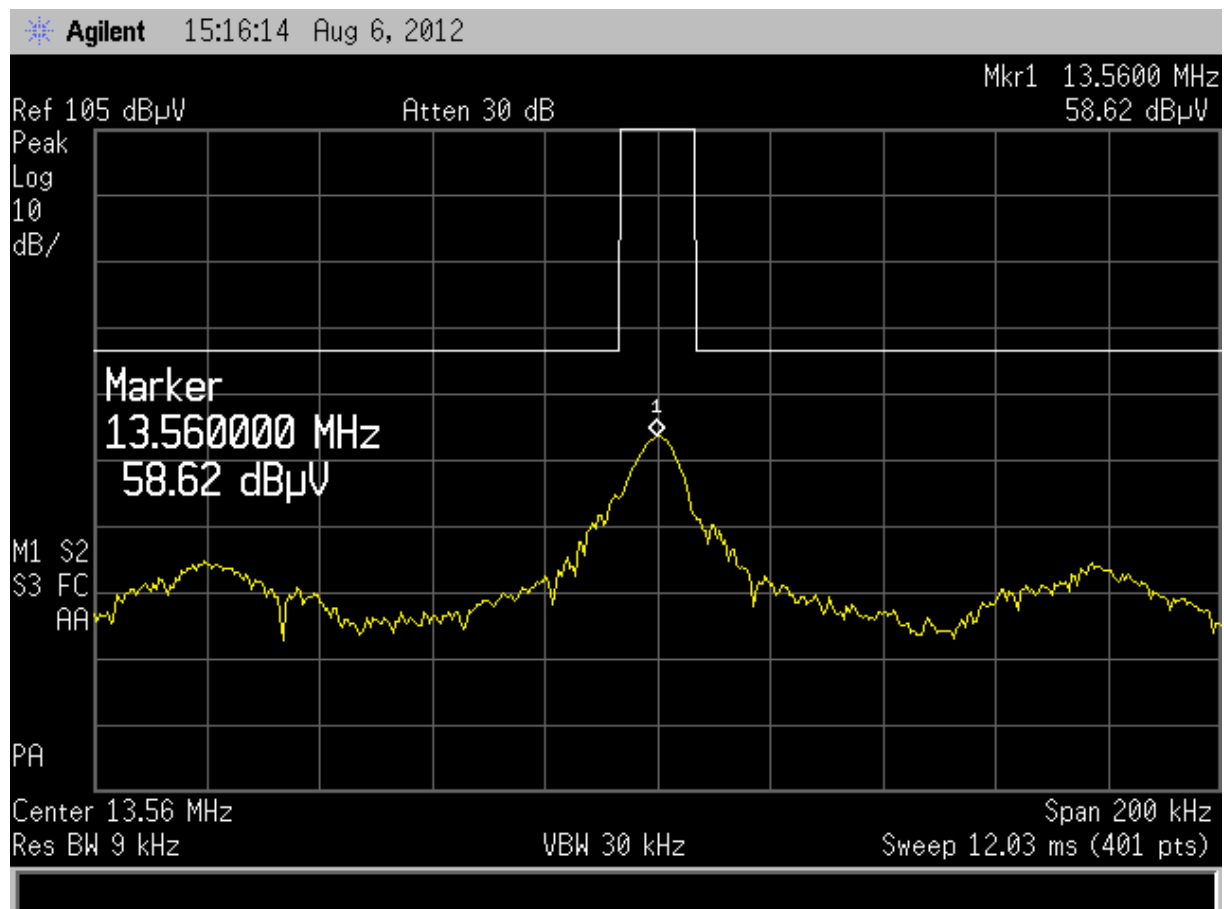
The limit at 30 m at 13.560 MHz is 15,848 uV/m or 84.0 dBuV/m.

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

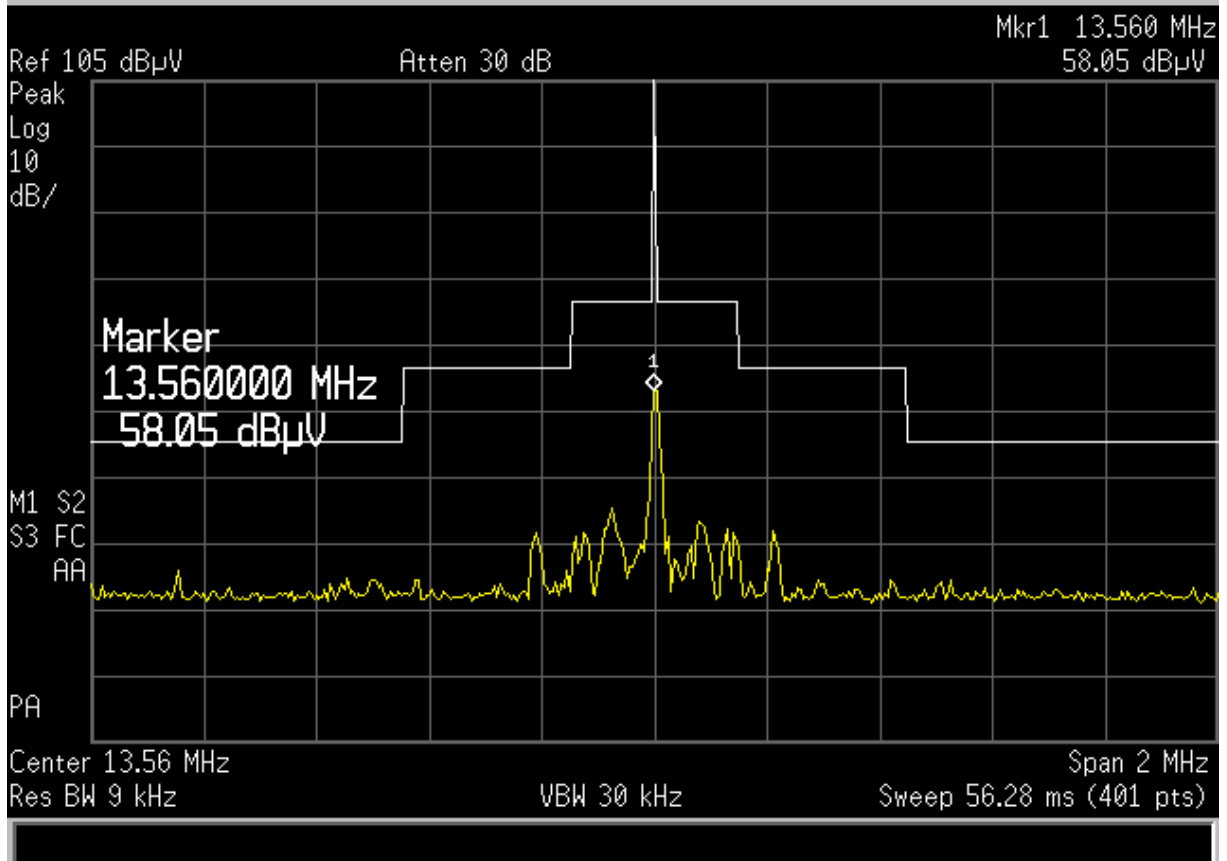
Testing was carried out when the device was transmitting continuously when the 120 Vac supply to the device was varied by +/- 15%.

Frequency MHz	Level dBuV/m	Distance metres	Limit dBuV/m	Voltage Vac	Margin dB
13.560	52.7	10.0	103.1	102.0	50.4
13.560	52.7	10.0	103.1	120.0	50.4
13.560	52.7	10.0	103.1	138.0	50.4

A representative spectrum analyser plot shows that the carrier and modulation peaks within +/- 100 kHz of the carrier and within +/- 1 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	13.559 431	-569.0
-10.0	13.559 475	-525.0
0.0	13.559 473	-527.0
10.0	13.559 463	-537.0
20.0	13.559 471	-529.0
30.0	13.559 451	-549.0
40.0	13.559 447	-553.0
50.0	13.559 453	-547.0

Variation of the 120 Vac 60 Hz 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	13.559 471	-529.0
12.0	13.559 471	-529.0
13.8	13.559 471	-529.0

**Result:** Complies

Measurement uncertainty with a confidence interval of 95% is:

- Frequency tolerance  $\pm$  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 Power Source	APT	7008	4170003	-	Not applicable
Receiver	R & S	ESHS 10	828404/005	3728	21 Nov 2012
Mains Network	R & S	ESH2-Z5	881362/032	3628	21 Aug 2012
Receiver	R & S	ESIB-40	100171	R-27-1	21 Oct 2012
Spectrum 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 Antenna	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2013
Log Periodic	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 15<sup>th</sup>, 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

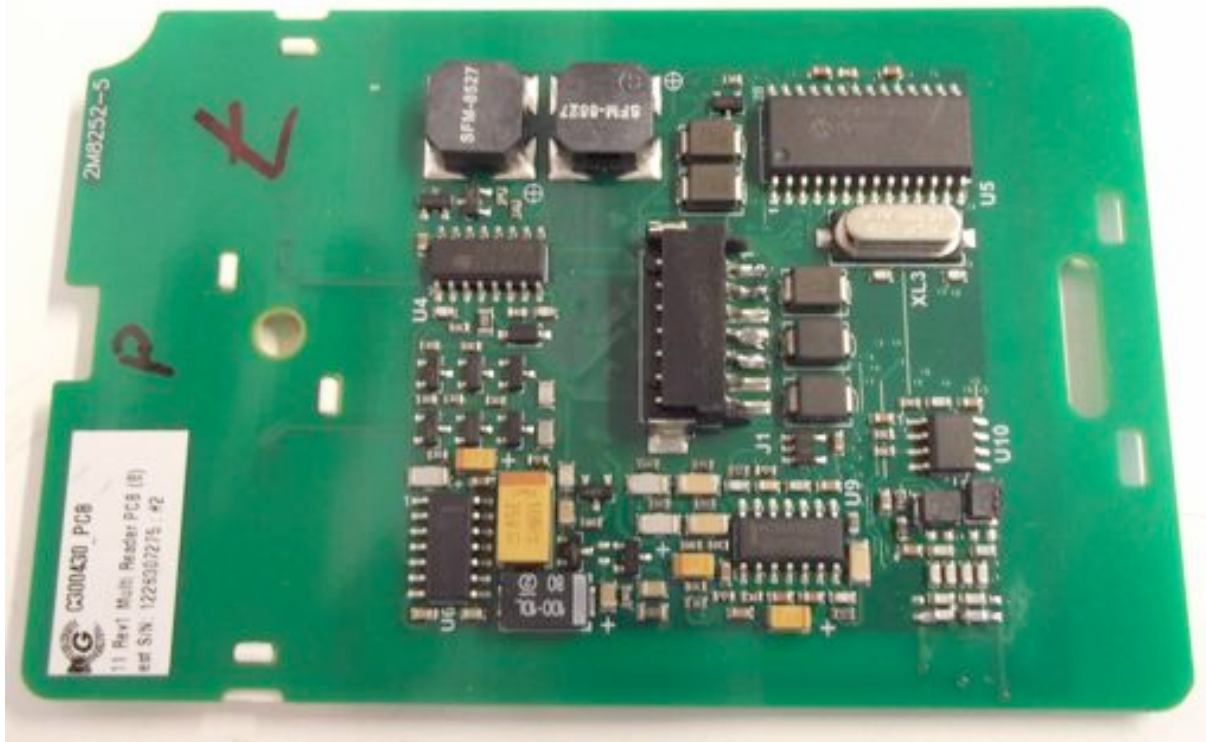
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

## 9. PHOTOGRAPHS

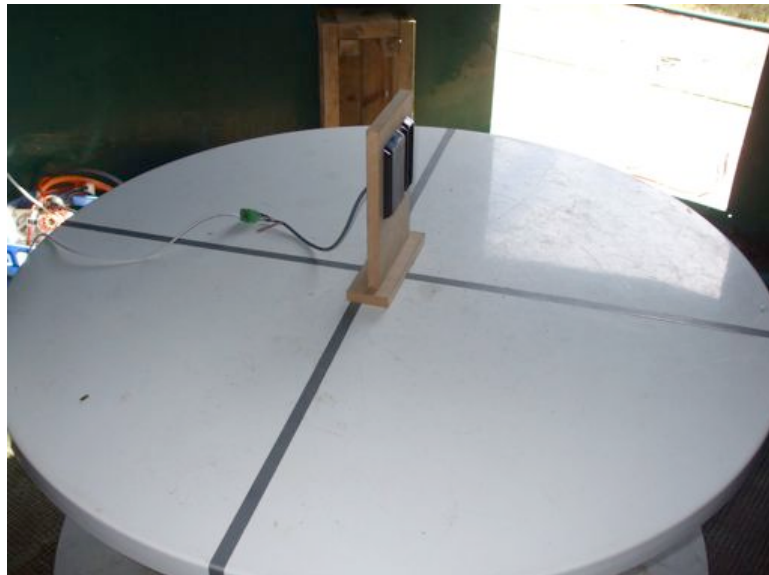
External photos

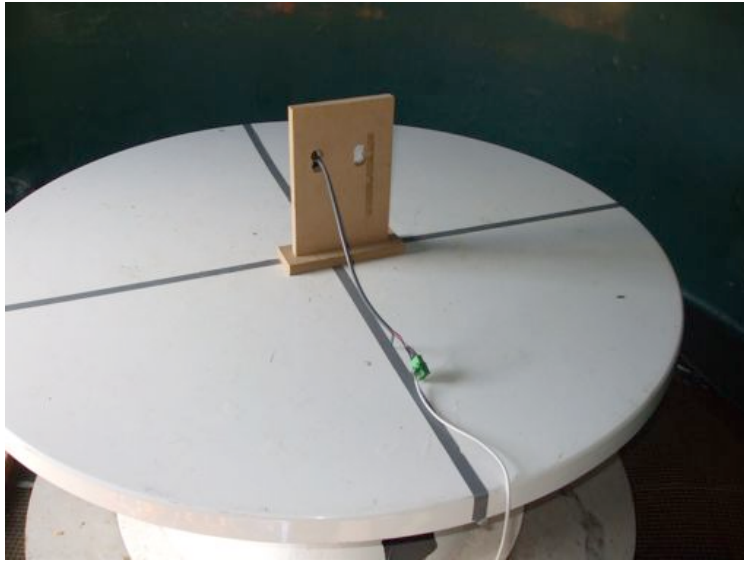


Internal Photos

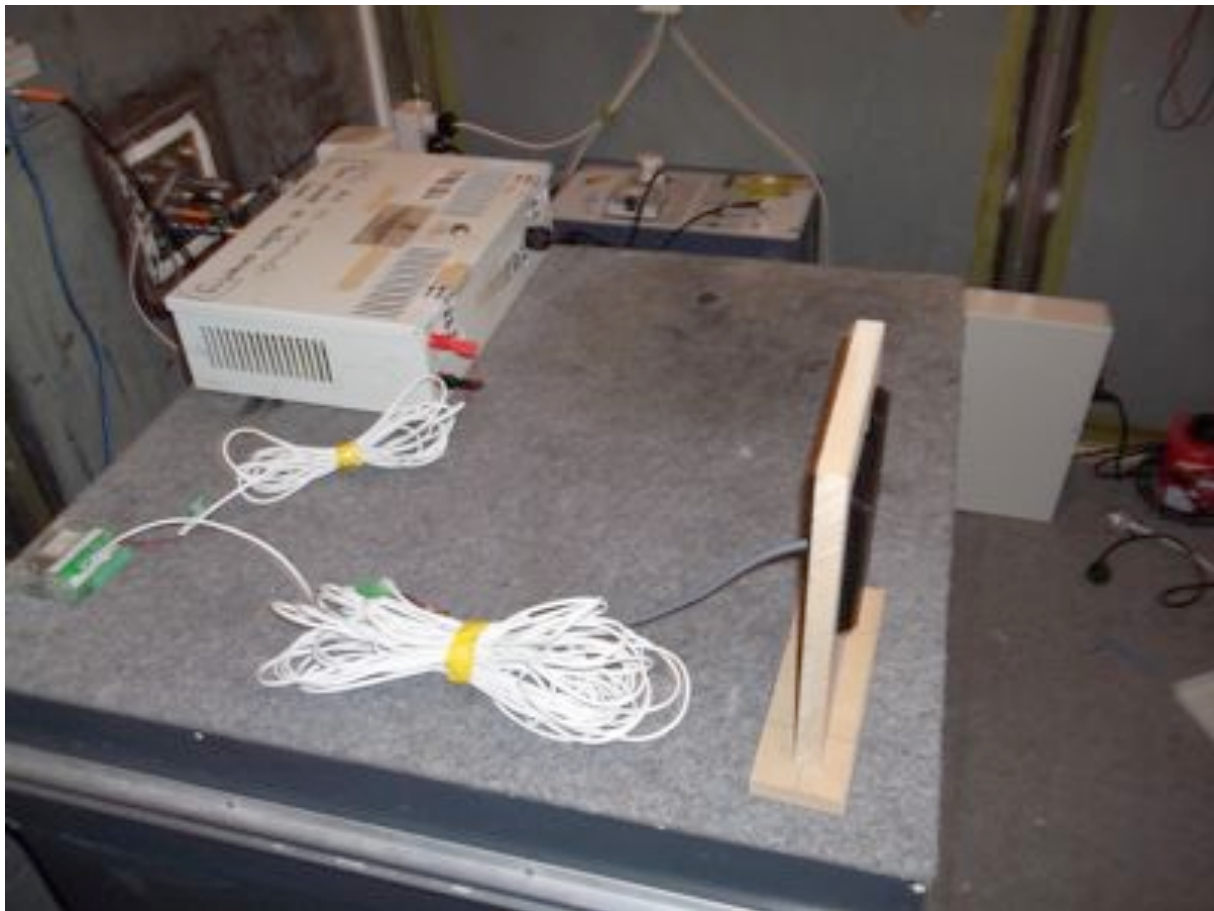


Radiated emissions test set up





Conducted emissions test set up





Ancillary equipment – GBUS URI and the representative AC power supply

