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TEST REPORT

DPS BRF210 Rev 1 Contactless 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

Direct Payment Solutions 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

Table of Contents

1. STATEMENT OF COMPLIANCE

The **DPS BRF210 Rev 1 Contactless 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 in October and November 2013 are detailed 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 5.750 kHz.
15.207	Conducted limits	Complies with a 9.1 dB margin at 13.5605 MHz (Average).
15.209	Radiated emission limits - Emissions < 30 MHz	Complies with a 2.1 dB margin at 6.436 MHz (Loop).
15.209	Radiated emission limits – Emissions > 30 MHz	Complies with a 2.4 dB margin at 40.690 MHz (Vertical).
15.225	Radiated emission limits - Fundamental	Complies with a 44.8 dB margin (Loop).
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	Direct Payment Solutions Ltd
Address	PO Box 8400
City	Auckland 1150
Country	New Zealand
Contact	Mr Ameer Ivoghlian

5. DESCRIPTION OF TEST SAMPLE

Brand Name	DPS
Model Number Tested	BFR210 Rev 1
Product	Contactless Card Reader
Manufacturer	Direct Payment Solutions Ltd (DPS)
Country of Origin	New Zealand
Serial Number	100000040

The device tested is a contactless card reader that is used with for financial transactions from credit cards.

It operates on 13.560 MHz and uses digital modulation to interact with the credit card.

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

The device has an internal antenna for the 13.560 MHz transmitter.

Result: Complies.

Section 15.204: External radio frequency power amplifiers and antenna modifications

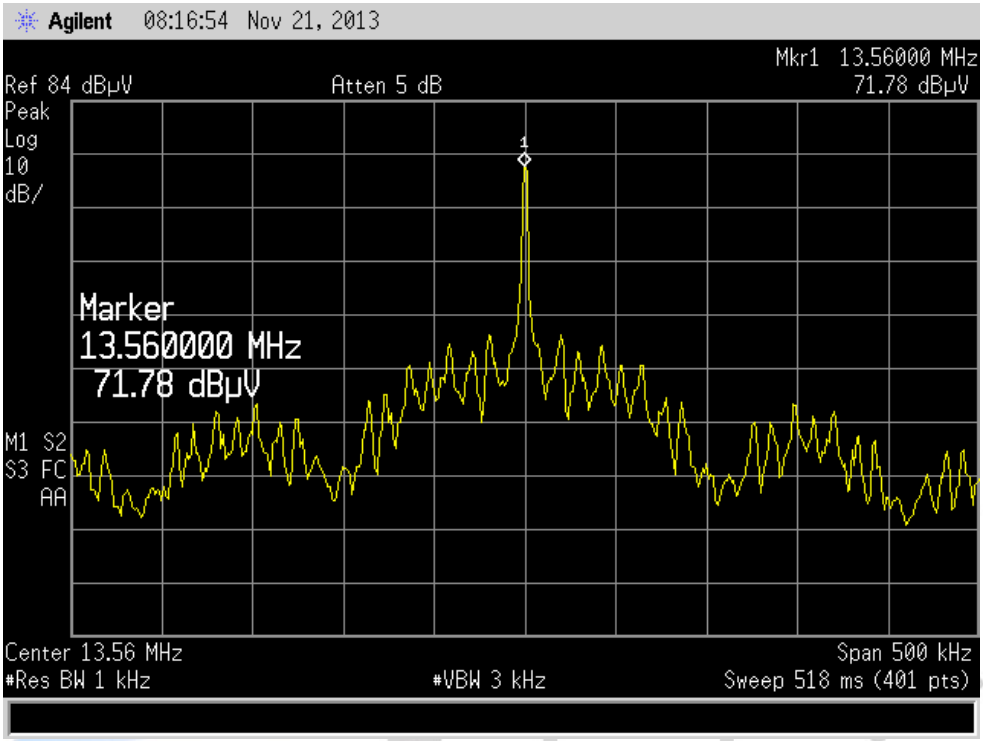
It is not possible to attach an external power amplifier to this transmitter.

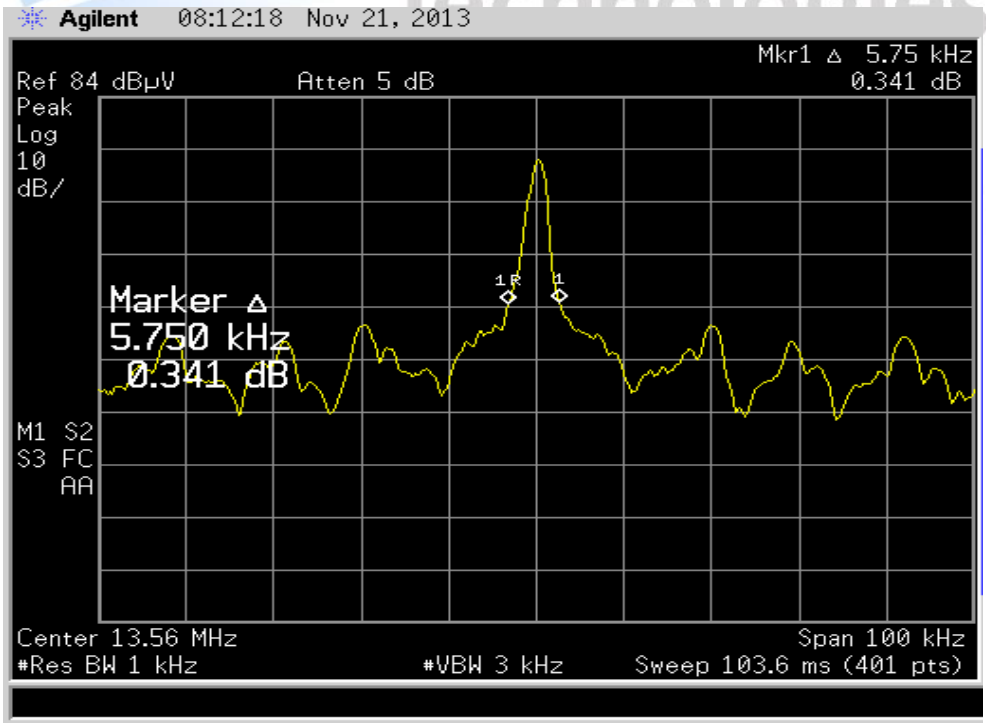
Result: Complies.

Section 15.205: Restricted bands of operation

The transmitter transmits on 13.560 MHz.

This device would fall into the 13.110 – 14.010 MHz band that is covered by Section 15.225.





The device can be seen to have a 99% power bandwidth of 5.750 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

As it is possible for this device to be directly or indirectly connected to the Public AC mains supply testing was carried out using a representative AC power supply system that was powered at 120 Vac 60 Hz which supplied 12 Vdc to the device in order to test it.

The device operates on 13.560 MHz.

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.

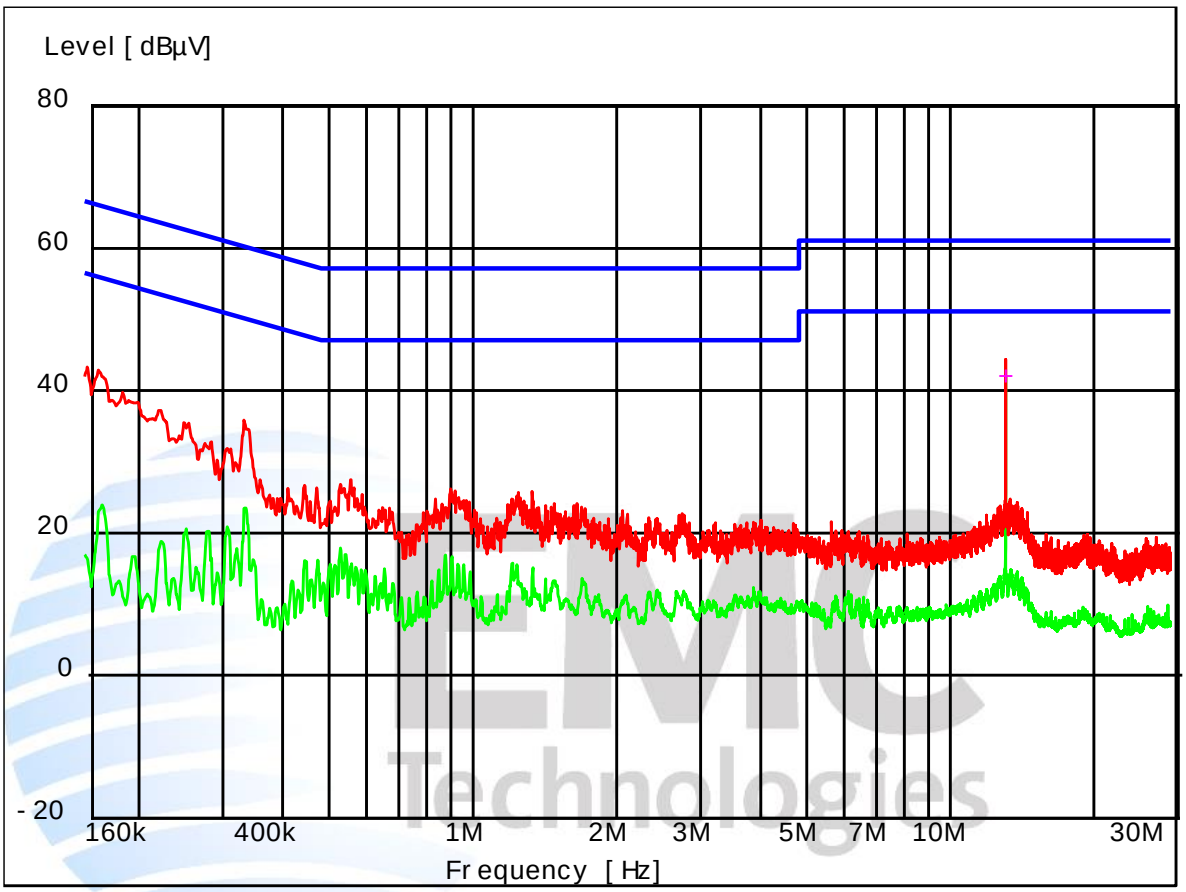
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

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

Setup:	Device tested when powered at 120 Vac 60 Hz using a representative power supply when continuously reading a card that was presented to the device.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
	No emissions recorded within 15 dB of the limit				

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
13.560500	40.90	50.0	9.1	N	43.1

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 10 kHz to 2000 MHz.

The client has declared that the device operates using frequencies of 32.768 kHz, 12 MHz, 13.560 MHz, 27.120 MHz and 120 MHz.

As the highest frequency in use is greater than 108 MHz but less than 500 MHz a highest frequency of 2000 MHz has been applied

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 12.0 Vdc battery supply.

Testing was carried out with the device being placed in the centre of the test table laying flat with a jig holding the card to be read at a pre-determined distance.

The serial cable was terminated using a resistive termination.

A laptop computer was initially attached to the serial port to confirm that the device operating correctly but this was then removed and replaced with the resistive termination once correct operations were observed

The device was transmitting, with modulation continuously, on 13.560 MHz while interacting with the supplied card.

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/m) + Coax Loss (dB)

Result: Complies

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 2000 MHz) ± 4.1 dB
- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

Section 15.209: Spurious Emissions (below 30 MHz)

A receiver with an average detector and a peak detector using a 9 kHz bandwidth was used between 10 – 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
6.436	47.4	49.5	2.1	Quasi Peak
18.580	40.1	49.5	9.4	Quasi Peak
22.460	44.6	49.5	4.9	Quasi Peak
27.120	19.8	49.5	29.7	Quasi Peak

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 was scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The 30 metre limit between 490 kHz – 30.0 MHz was 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 (10 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.

Card attached and data flowing

Frequency MHz	Vertical dBµV/m	Horizontal dBµV/m	Limit dBµV/m	Margin dB	Detector	BW
40.690	37.6	26.4	40.0	2.4	Quasi Peak	120 kHz
46.600	23.1		40.0	16.9	Quasi Peak	120 kHz
48.320	21.6		40.0	18.4	Quasi Peak	120 kHz
53.400	13.6		40.0	26.4	Quasi Peak	120 kHz
54.240	15.4		40.0	24.6	Quasi Peak	120 kHz
67.800	36.7	28.5	40.0	3.3	Quasi Peak	120 kHz
94.920	32.1		43.5	11.4	Quasi Peak	120 kHz
122.040	19.7		43.5	23.8	Quasi Peak	120 kHz
122.040	19.7		43.5	23.8	Quasi Peak	120 kHz
162.720	22.4		43.5	21.1	Quasi Peak	120 kHz
189.840	20.4		43.5	23.1	Quasi Peak	120 kHz
203.400	27.4		43.5	16.1	Quasi Peak	120 kHz
269.760		25.4	46.0	20.6	Quasi Peak	120 kHz
298.320		27.4	46.0	18.6	Quasi Peak	120 kHz

Card removed with device in standby

Frequency MHz	Vertical dBµV/m	Horizontal dBµV/m	Limit dBµV/m	Margin dB	Detector	BW
32.000	20.4		40.0	19.6	Quasi Peak	120 kHz
46.480	17.8		40.0	22.2	Quasi Peak	120 kHz
47.800	18.9		40.0	21.1	Quasi Peak	120 kHz
63.960	17.4		40.0	22.6	Quasi Peak	120 kHz

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 104.0 dBuV/m.

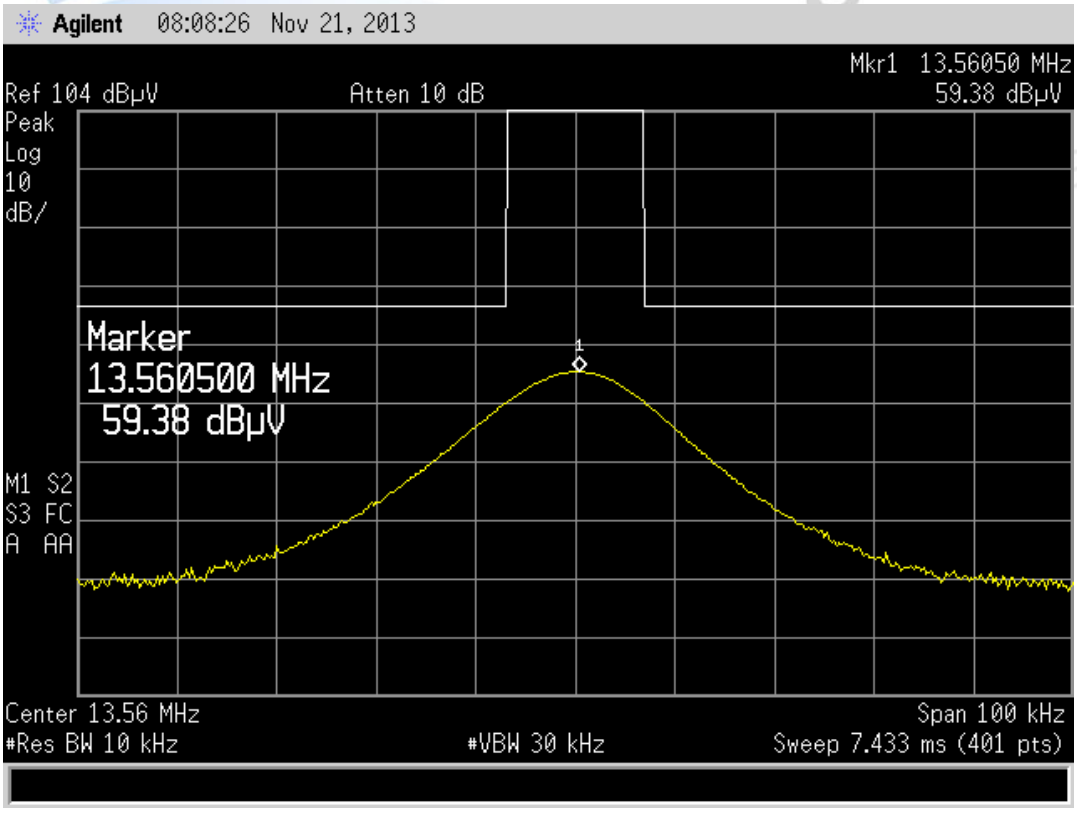
Testing was also carried out to determine whether a variation in the supply voltage would cause a significant change in field strength.

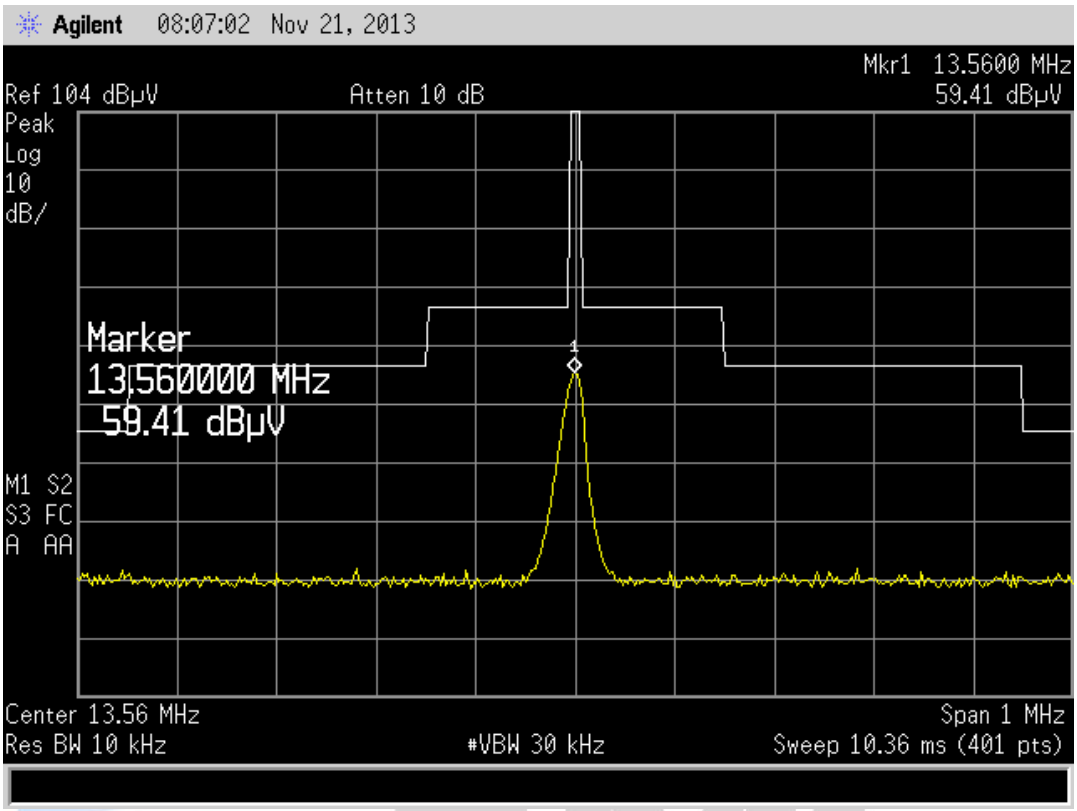
The device can normally operate over the range of 12 – 24 Vdc.

The DC supply was varied by +/- 15%.

Voltage Vdc	Frequency MHz	Level dBuV/m	Limit dBuV/m	Margin dB	Detector	Distance metres
10.2	13.560	59.1	104.0	44.9	Quasi Peak	10.0
12.0	13.560	59.2	104.0	44.8	Quasi Peak	10.0
24.0	13.560	59.2	104.0	44.8	Quasi Peak	10.0
27.6	13.560	59.2	104.0	44.8	Quasi Peak	10.0

A representative spectrum analyser plot shows that the carrier and modulation peaks within +/- 100 kHz and +/- 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	13.560 400	+400
-10.0	13.560 350	+350
0.0	13.560 275	+275
10.0	13.560 175	+175
20.0	13.560 275	+275
30.0	13.560 200	+200
40.0	13.560 175	+175
50.0	13.560 150	+150

The device can normally operate over the range of 12 – 24 Vdc.

The DC supply was varied by +/- 15% at an ambient temperature of 20 degrees.

Voltage Vdc	Frequency MHz	Difference Hz
10.2	13.560 275	+275
12.0	13.560 275	+275
24.0	13.560 275	+275
27.6	13.560 275	+275

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
AC Supply	APT	7008	4170003	-	Not applicable
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applicable
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applicable
Biconical Ant	Schwarzbeck	BBA 9106	-	RFS 3612	7 Feb 2014
Log Periodic Ant	Schwarzbeck	VUSLP 9111	9111-228	3785	7 Feb 2014
Loop Antenna	EMCO	6502	9003-2485	3798	7 Feb 2014
Mains Network	R & S	ESH2-Z5	881362/032	3628	21 Aug 2014
Receiver	R & S	ESHS 10	828404/005	3728	21 Nov 2014
Receiver	R & S	ESIB-40	100171	R-27-1	21 April 2014
Spec Analyser	Hewlett Packard	E7405A	US39150142	3771	20 April 2014
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applicable
VHF Balun	Schwarzbeck	VHA 9103	-	RFS 3603	7 Feb 2014

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 in July 2013.

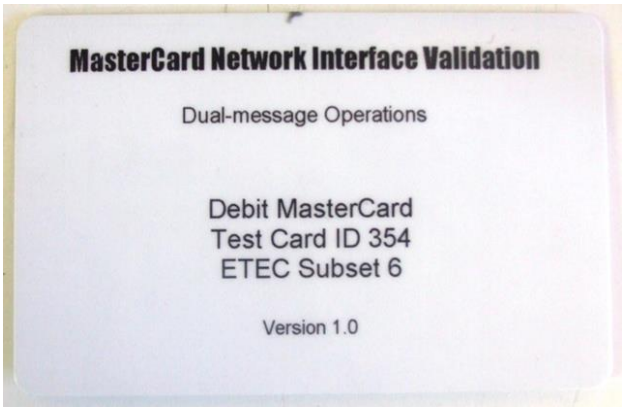
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005.

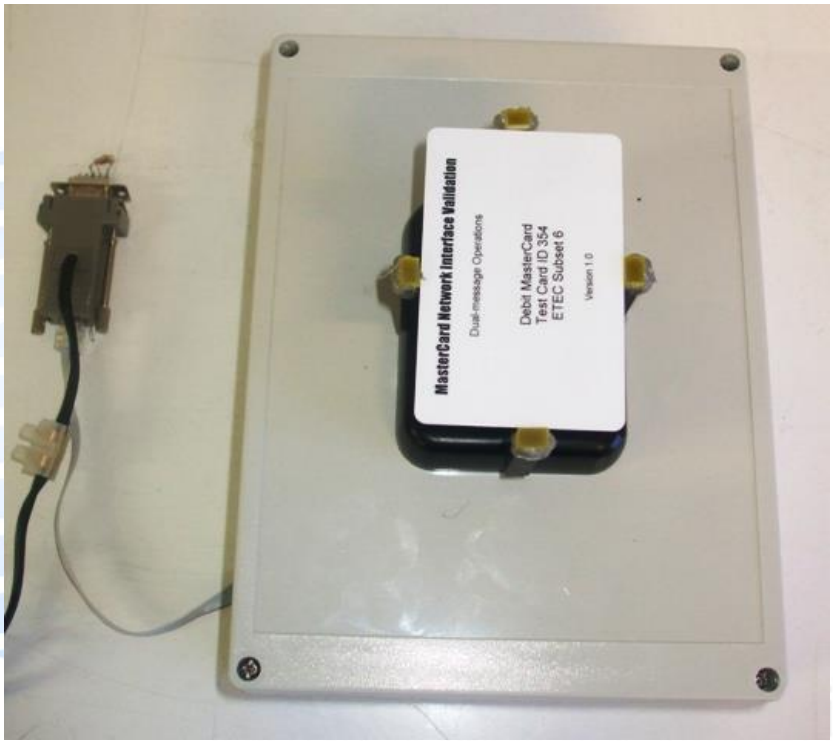
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025, 2005

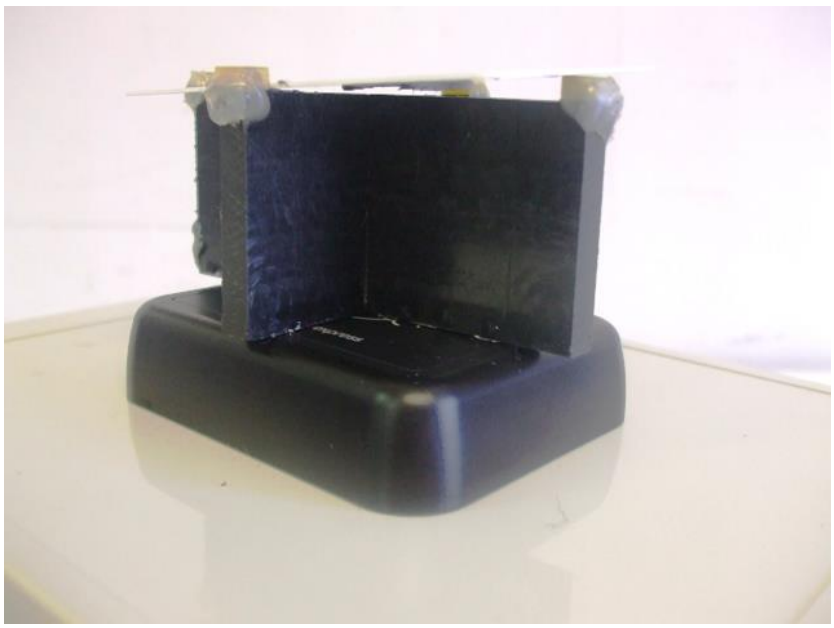
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

9. PHOTOGRAPHS

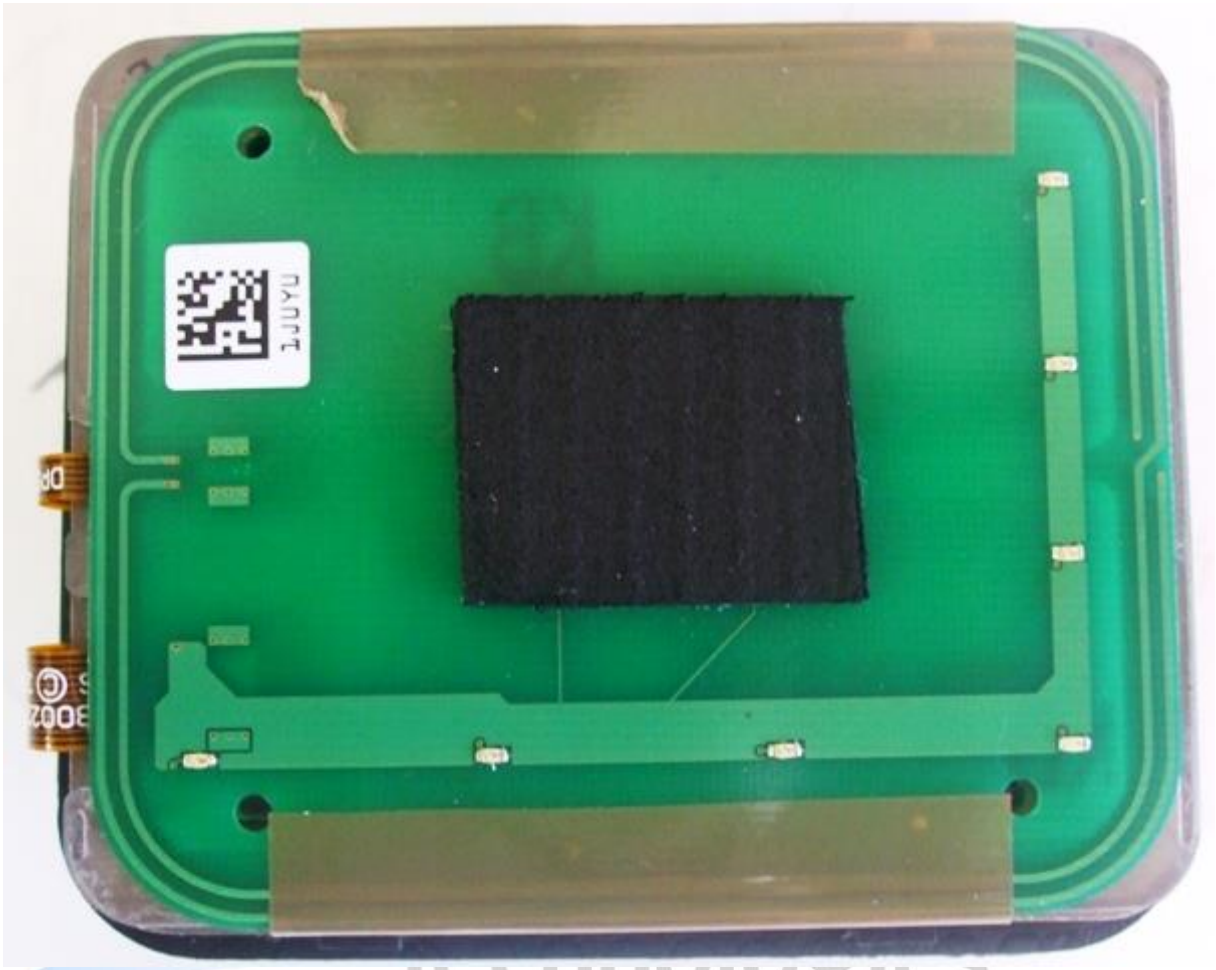
External Views

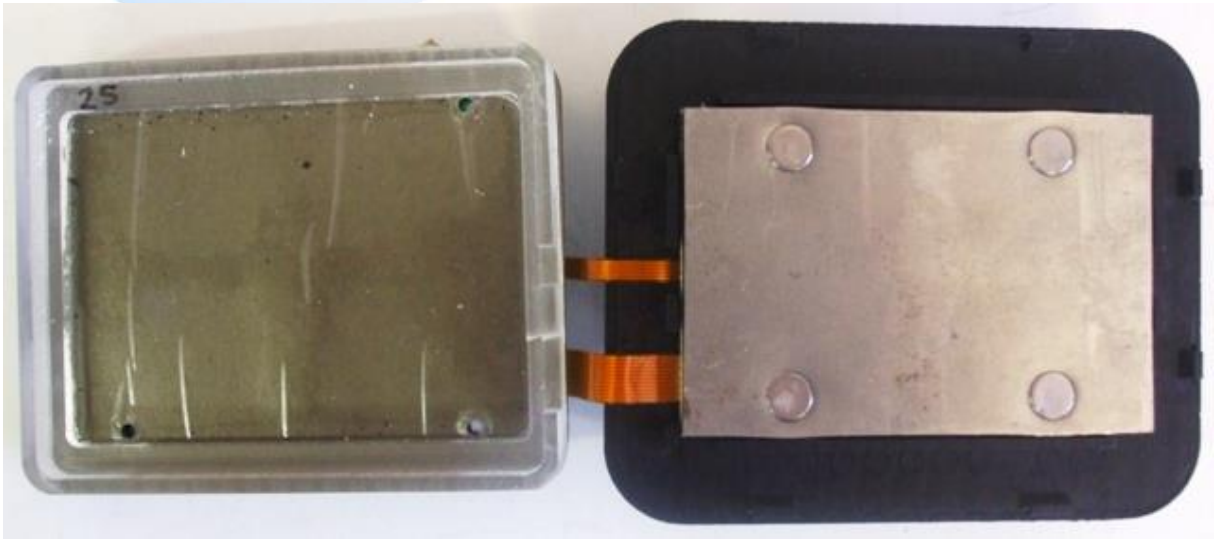




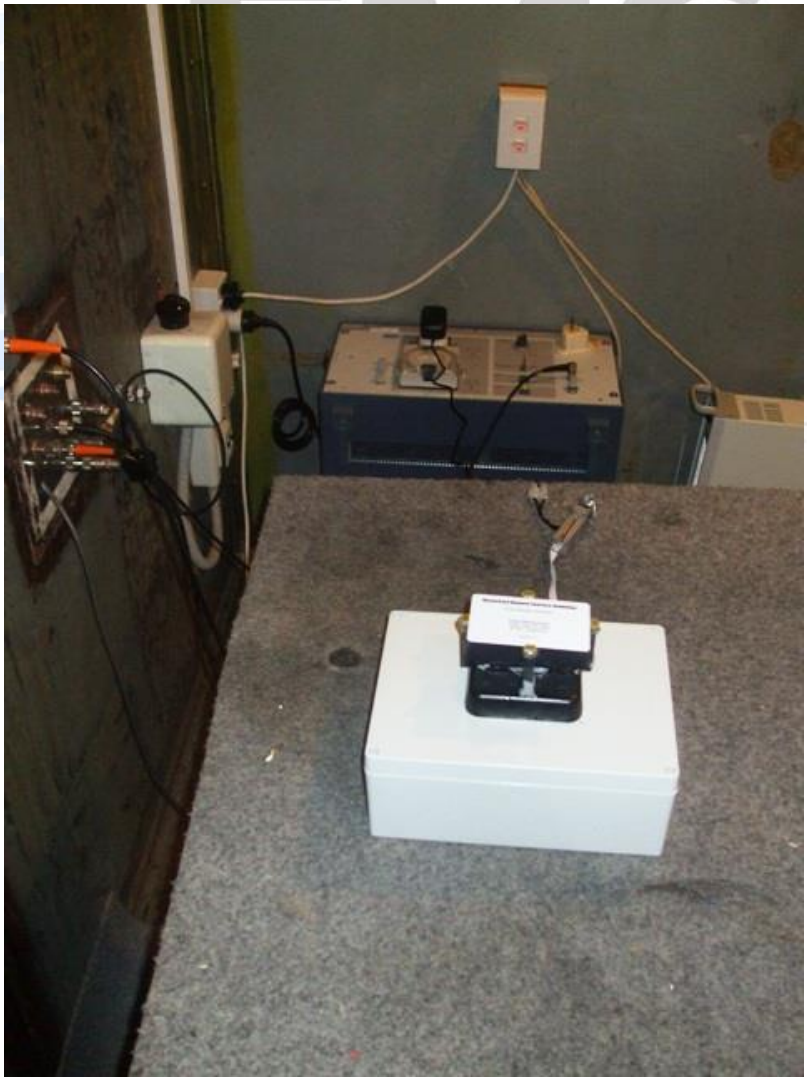


Internal Views





Conducted Emissions Test Set Up



Radiated Emissions Test Set Up