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TEST REPORT

Payment Express CMV300
Secure Payment Terminal

tested to the specification

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

Payment Express Ltd

This test report is issued with the authority of:

Andrew Cutler - General Manager

IANZ ACCREDITED LABORATORY

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 **Payment Express CMV300 Secure Payment Terminal** complies with FCC Part 15 Subpart C Section 15.225 as an Intentional Radiator when the methods as described in ANSI C63.10 - 2013 are applied.

2. RESULTS SUMMARY

The results from testing carried out in June and July 2017 are detailed in the following table:

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required.
15.203	Antenna requirement	Complies. Antenna 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 a nominal frequency of 13.560 MHz.
15.207	Conducted limits	Complies.
15.209	Radiated emission limits - Emissions < 30 MHz	Complies.
15.209	Radiated emission limits – Emissions > 30 MHz	Complies.
15.225	Radiated emission limits - Fundamental	Complies.
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	Payment Express Ltd
Address	PO Box 8400 33 Wilkinson Rd Ellerslie
City	Auckland 1060
Country	New Zealand
Contact	Mr Jonathon Bradshaw

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Payment Express
Product	Secure Payment Terminal
Model Number	CMV300
Manufacturer	Payment Express Ltd
Country of Origin	New Zealand
Serial Number	2717100056
FCC ID	2AC2O-CMV300

The device tested is a NFC card reader that operates on 13.560 MHz that would normally be attached to another device that would supply power and data processing capabilities.

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 C63.10 - 2013 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 a permanently attached internal 13.560 MHz 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 device transmits on a nominal frequency of 13.560 MHz.

13.560 MHz transmissions would fall into the 13.110 – 14.010 MHz band 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

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.

Testing was carried out with the NFC transmitter operating while periodically reading a card that was placed close to the device.

Testing was carried out when the transmitting device was attached to an aluminium sheet which was in turn connected to the chassis of the artificial mains network.

This arrangement simulates a typical application environment for the device as it would normally be mounted in an earthed metal chassis which would be typically be a metal payment kiosk.

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.

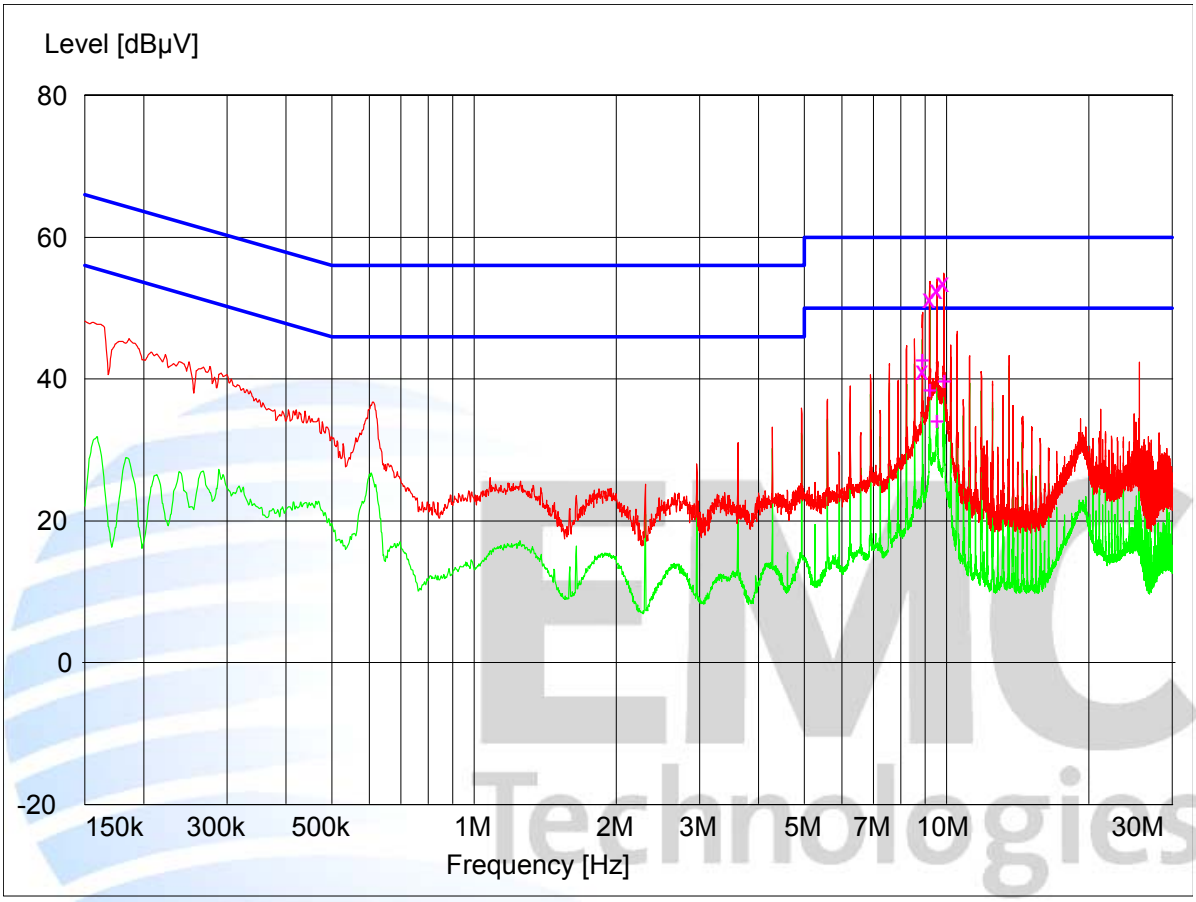
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

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 12 Vdc using a representative power supply that was powered at 120 Vac 60 Hz. Device was mounted on metal sheet simulating the effect of a metal kiosk that was earthed to the frame of the artificial mains unit. NFC transmitter was transmitting continuously and a card inserted in the slot was being read continuously.

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



Final Quasi-Peak Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
8.889500	41.20	60.0	18.8	N	
9.209000	51.40	60.0	8.6	N	
9.533000	52.70	60.0	7.3	L1	
9.861500	53.70	60.0	6.3	L1	

Final Average Measurements

Frequency MHz	Level dBµV	Limit dBµV	Margin dB	Phase	Rechecks dBµV
8.876000	42.60	50.0	7.5	L1	
9.209000	38.40	50.0	11.6	N	
9.537500	34.00	50.0	16.0	N	
9.866000	39.70	50.0	10.3	N	

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 10 kHz to 2000 MHz as the highest frequency declared by the client is higher than 108 MHz (168 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.

Testing was carried out using a representative AC power supply at 120 Vac 60 Hz that supplied 12.0 Vdc to the device under test.

Testing was carried out when the device was standing upright (X), on its edge (Z) and laying flat (Y) on the test table without the aluminium sheet with the laying flat plane giving the worst case results which have been recorded.

Attached to the device was a data interface board that supplied voltage to the device.

This also allowed a serial interface to a laptop computer that was attached to the serial port on the interface board.

A custom programme was run on the computer which exercised all operation aspects of the device.

The device was transmitting continuously on 13.560 MHz with a NFC card being placed close to the card reader which was periodically read by the card reader.

A standard card was also placed in the card slot which was also read by the card reader.

Correct operations were indicated by an indication on the computer screen.

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 at a distance of 10 metres.

Above 30 MHz the emission is measured in both vertical and horizontal antenna polarisations, where appropriate at a distance of 3 metres

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: 13.560 MHz transmitter below 30 MHz spurious emission measurements

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)
27.120	18.9	48.6	Pass

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 fundamental emission.

No other low frequency spurious emissions were detected from the device when measurements were attempted from 10 kHz - 30.0 MHz

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.

Between 1000 - 2000 MHz a peak and an average detector was used with a bandwidth of 1 MHz.

The limits as described in Section 15.209 have been applied.

Radio Emissions

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarisation	Detector
40.680	34.5	28.3	40.0	5.5	Vertical	QP
54.240	25.8		40.0	14.2	Vertical	QP
67.800	31.0	23.9	40.0	9.0	Vertical	QP
81.360	19.5		40.0	20.5	Vertical	QP
122.040	33.8	34.2	43.5	9.3	Horizontal	QP
149.160		27.6	43.5	15.9	Horizontal	QP
162.720		29.1	43.5	14.4	Horizontal	QP
176.280		29.5	43.5	14.0	Horizontal	QP
257.640		28.7	46.0	17.3	Horizontal	QP
284.760		29.2	46.0	16.8	Horizontal	QP
339.000		29.1	46.0	16.9	Horizontal	QP

Other Emissions

Frequency (MHz)	Vertical (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarisation	Detector
46.380	27.1		40.0	12.9	Vertical	QP
30.525	27.7		40.0	12.3	Vertical	QP

All other emissions observed had a margin to the limit that exceeded 20 dB when measurements were attempted over the range of 30 – 2000 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.

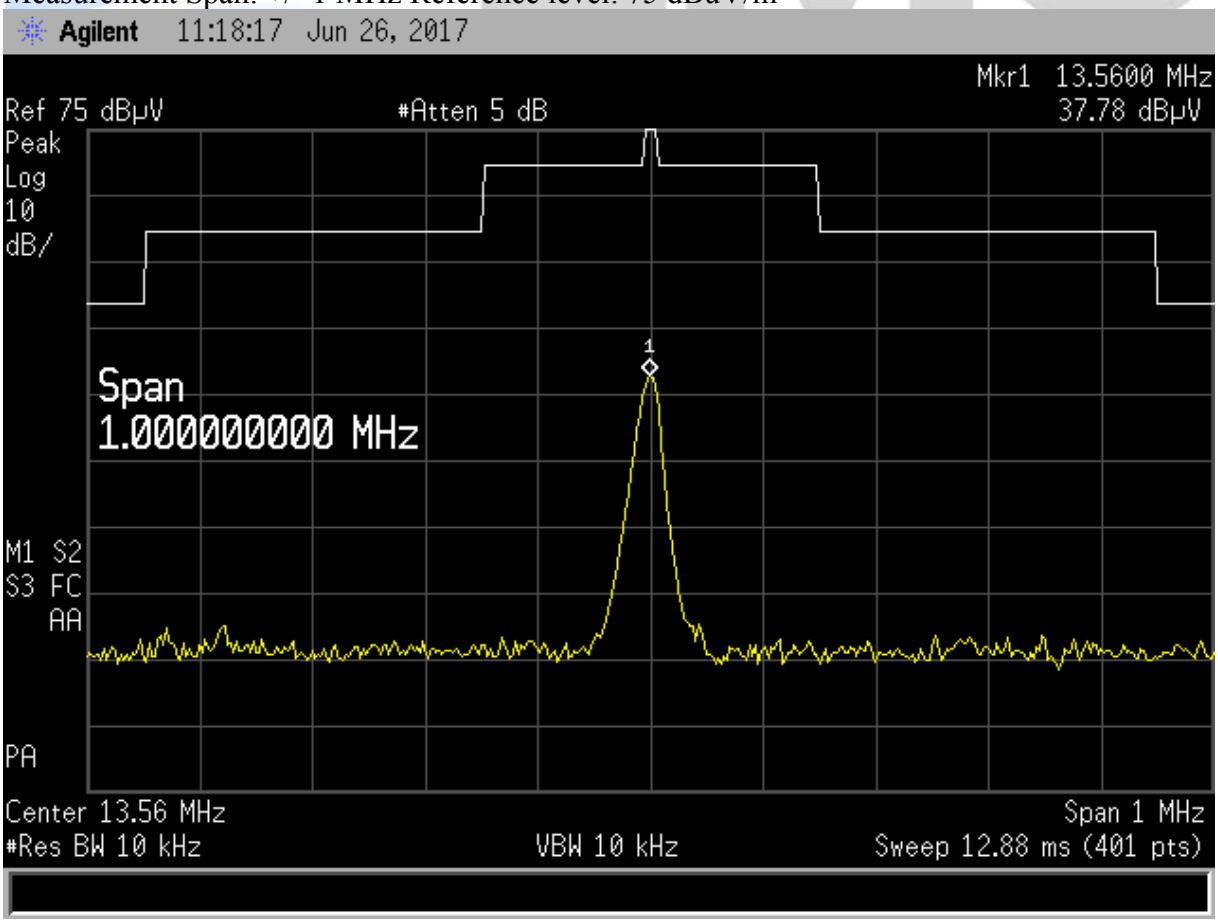
Applying the extrapolation factor of 40 dB/ per decade, the limit is 103.1 dBuV/m.

Testing was also carried out to determine whether a variation in the supply voltage would cause a significant change in field strength with the 12.0 Vdc supply to the device being varied by +/- 15% between 10.2 Vdc and 13.8 Vdc however no variation was observed as detailed below.

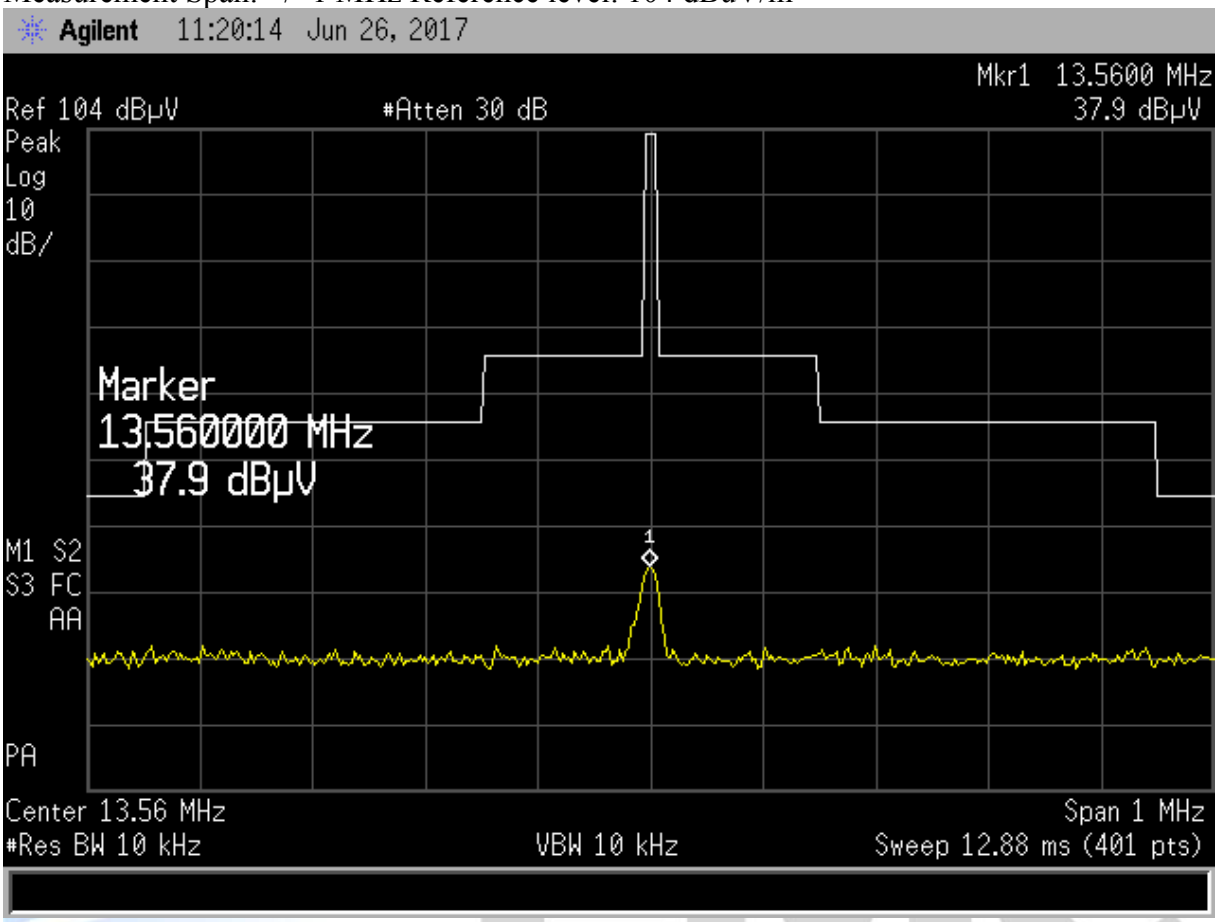
Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10.2	13.560	37.7	103.1	65.4
12.0	13.560	37.7	103.1	65.4
13.8	13.560	37.7	103.1	65.4

Representative spectrum analyser plots show the carrier and modulation peaks within +/- 500 kHz and +/- 2500 kHz of the carrier.

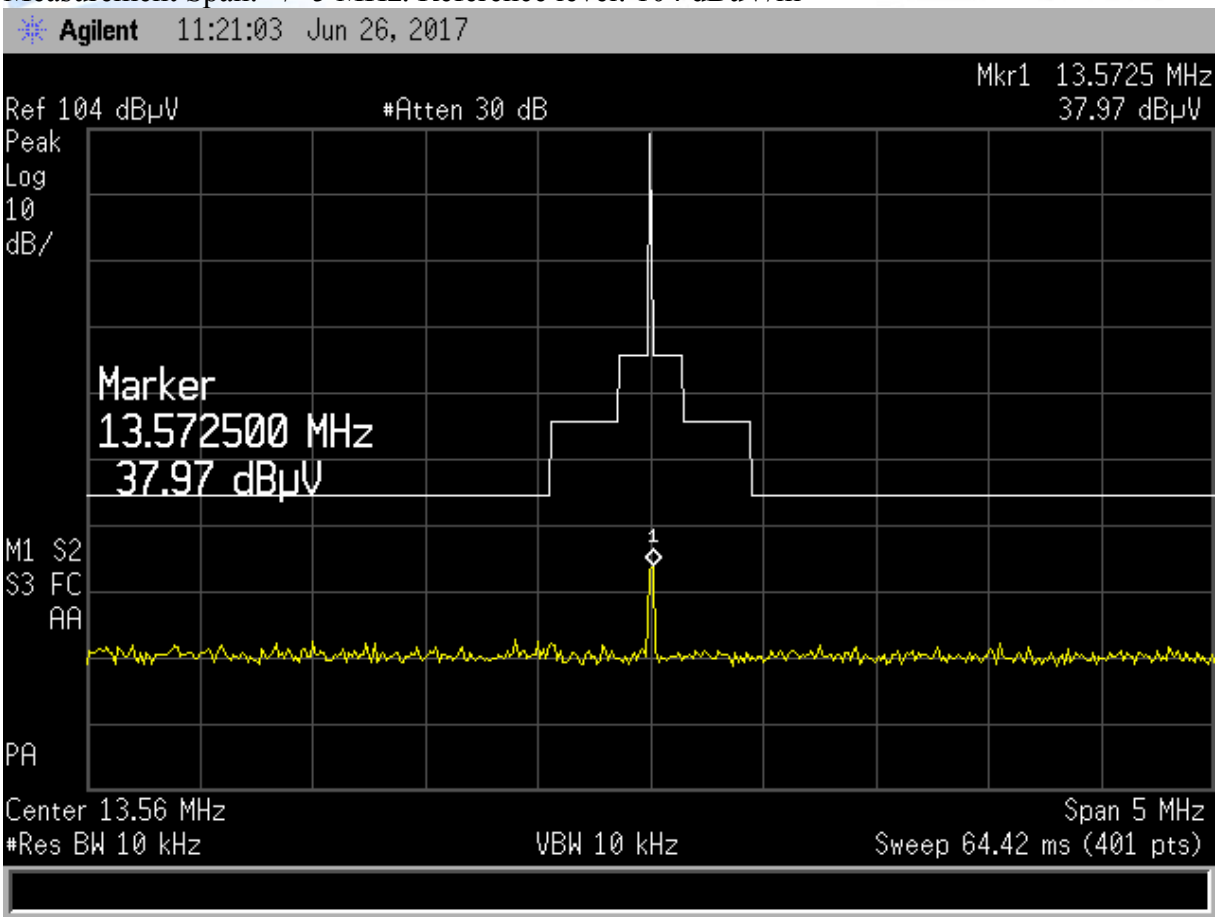
Measurement Span: +/- 1 MHz Reference level: 75 dBuV/m



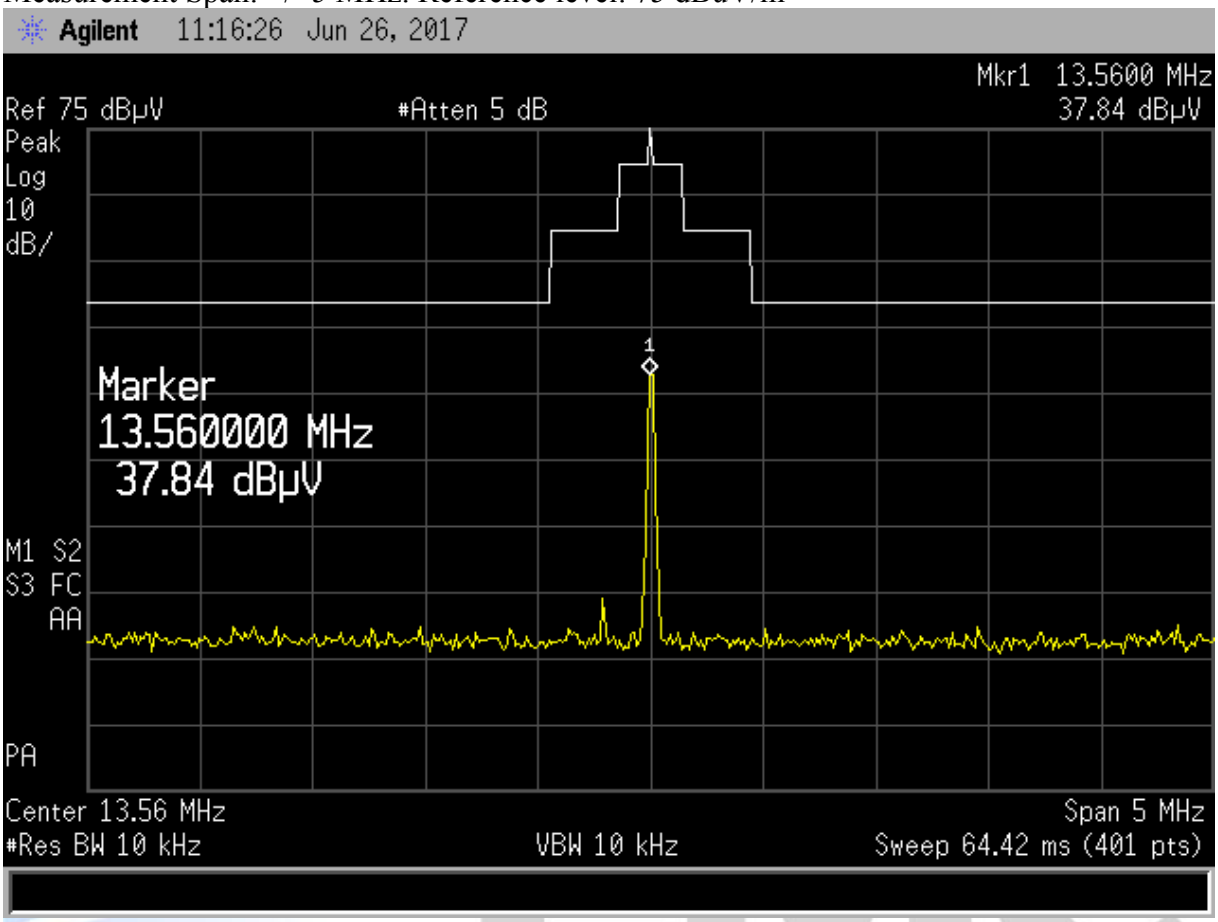
Measurement Span: +/- 1 MHz Reference level: 104 dBuV/m



Measurement Span: +/- 5 MHz. Reference level: 104 dBuV/m



Measurement Span: +/- 5 MHz. Reference level: 75 dBuV/m



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 13.562 MHz which gives a frequency tolerance of +/- 1,356.2 Hz.

Temperature (°C)	Frequency (MHz)	Difference (Hz)
50.0	13.560 052	+52
40.0	13.560 069	+69
30.0	13.560 094	+94
20.0	13.560 109	+109
10.0	13.560 062	+62
0.0	13.560 144	+144
-10.0	13.560 179	+179
-20.0	13.560 237	+237

The device normally operates on 12 Vdc.

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

Voltage (Vdc)	Frequency (MHz)	Difference (Hz)
10.2	13.560 109	+109
12.0	13.560 109	+109
13.8	13.560 109	+109

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	Period
Aerial Controller	EMCO	1090	9112-1062	RFS 3710	Not applic	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708	Not applic	Not applic
Biconical Antenna	Schwarzbeck	BBA 9106	-	3680	3 Feb 2018	3 years
Horn Antenna	EMCO	3115	9511-4629	E1526	4 June 2018	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-228	3785	1 Dec 2017	3 years
Loop Antenna	EMCO	6502	9003-2485	3798	4 July 2018	1 year
Mains Network	R & S	ESH2-Z5	881362/032	3628	2 Oct 2017	2 years
Receiver	R & S	ESHS 10	828404/005	3728	27 June 2018	1 year
Receiver	R & S	ESIB 40	100295	INV0818	28 Aug 2018	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709	Not applic	Not applic
VHF Balun	Schwarzbeck	VHA 9103	9594	3696	3 Feb 2018	3 years
Power Supply	APT	7008	4170003	-	Not applic	Not applic

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 June 2014.

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.

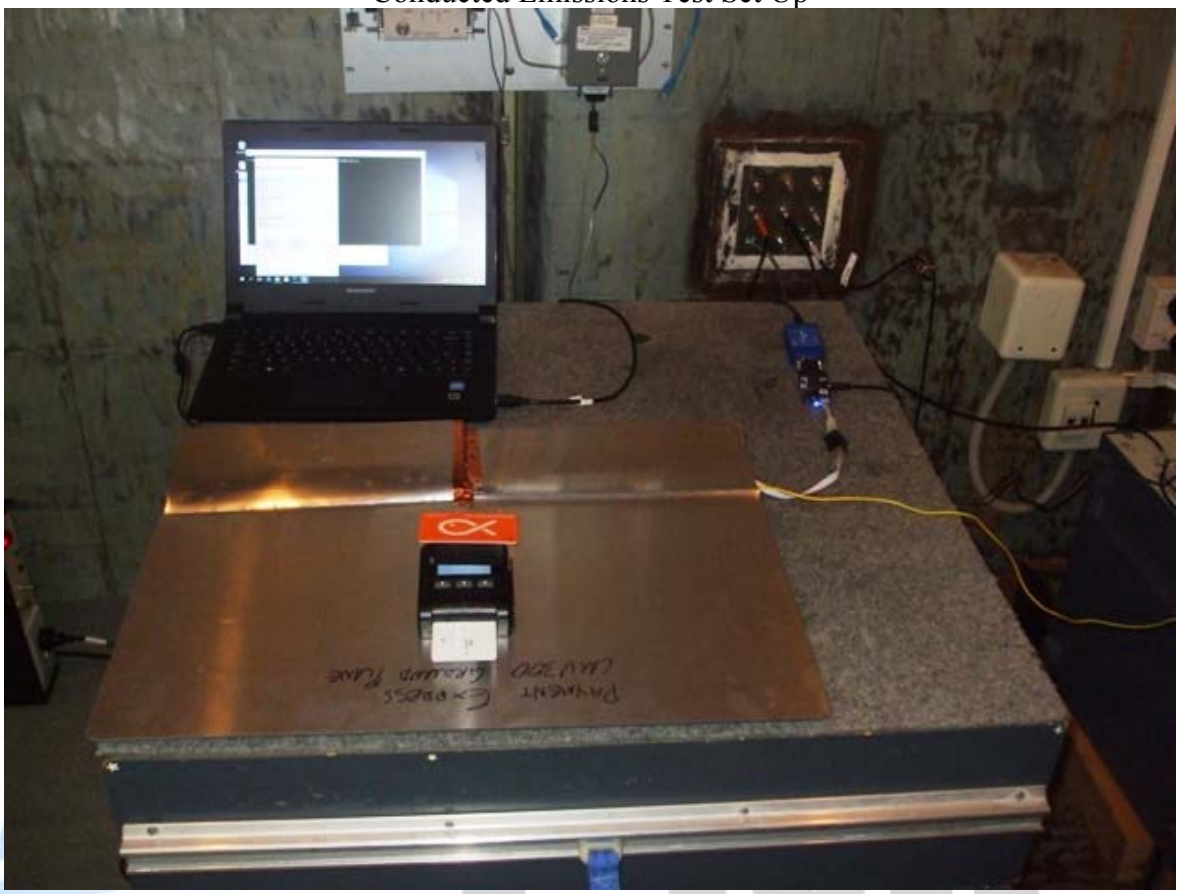
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

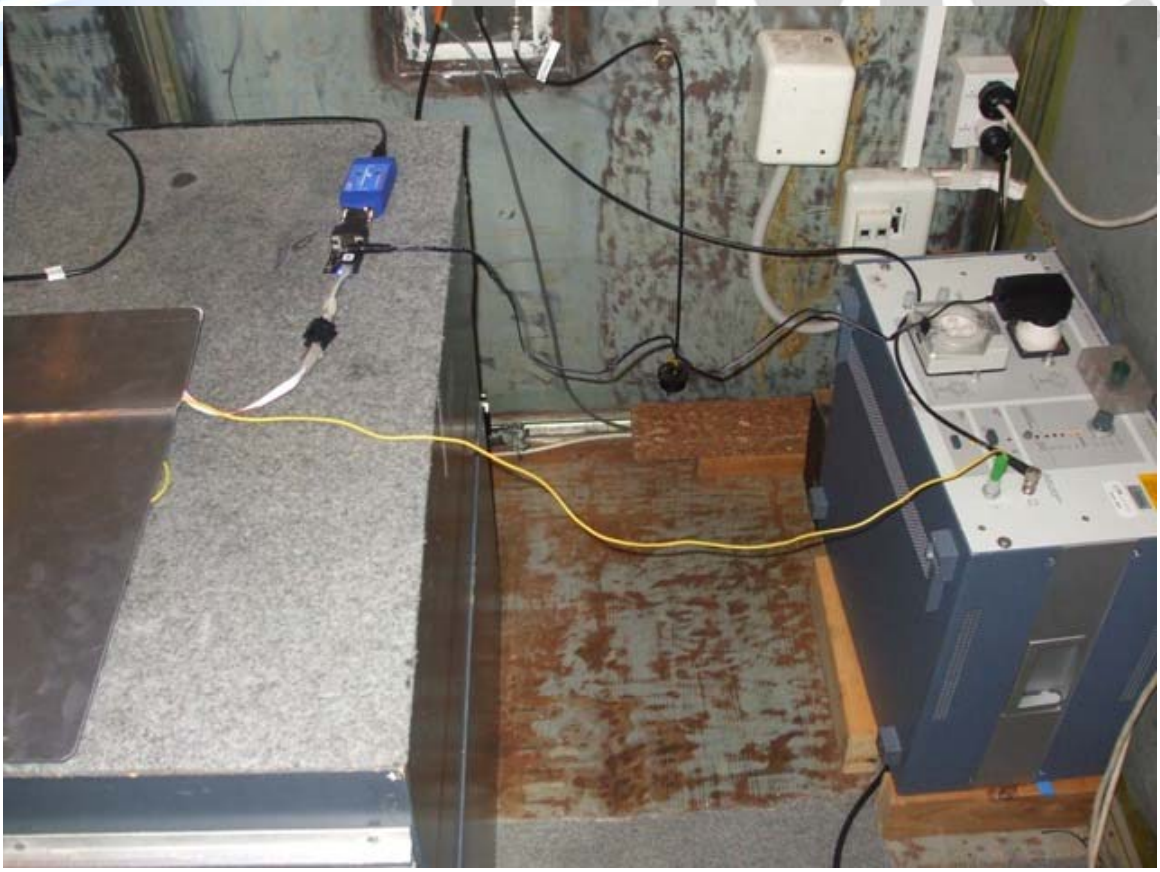
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

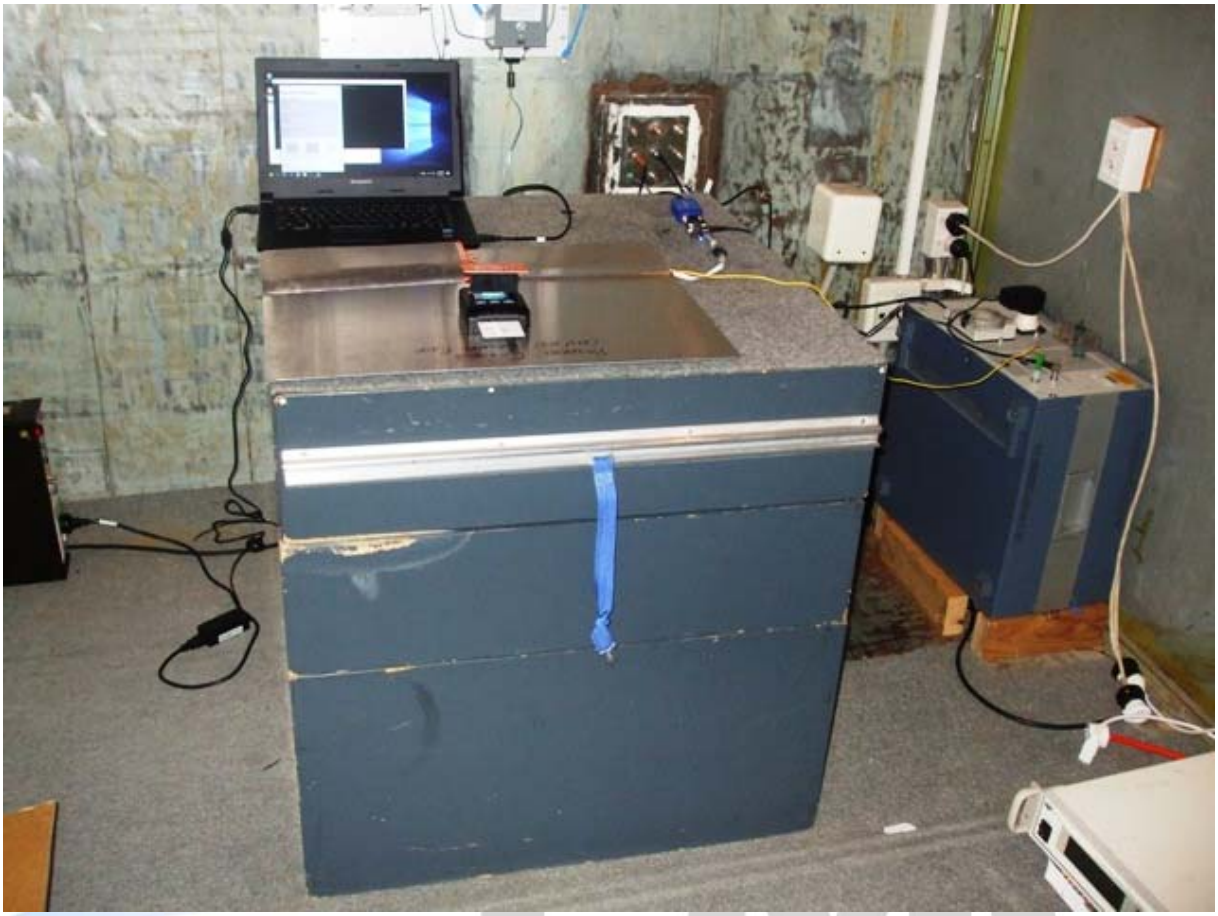
9. PHOTOGRAPHS

External View Device Under Test

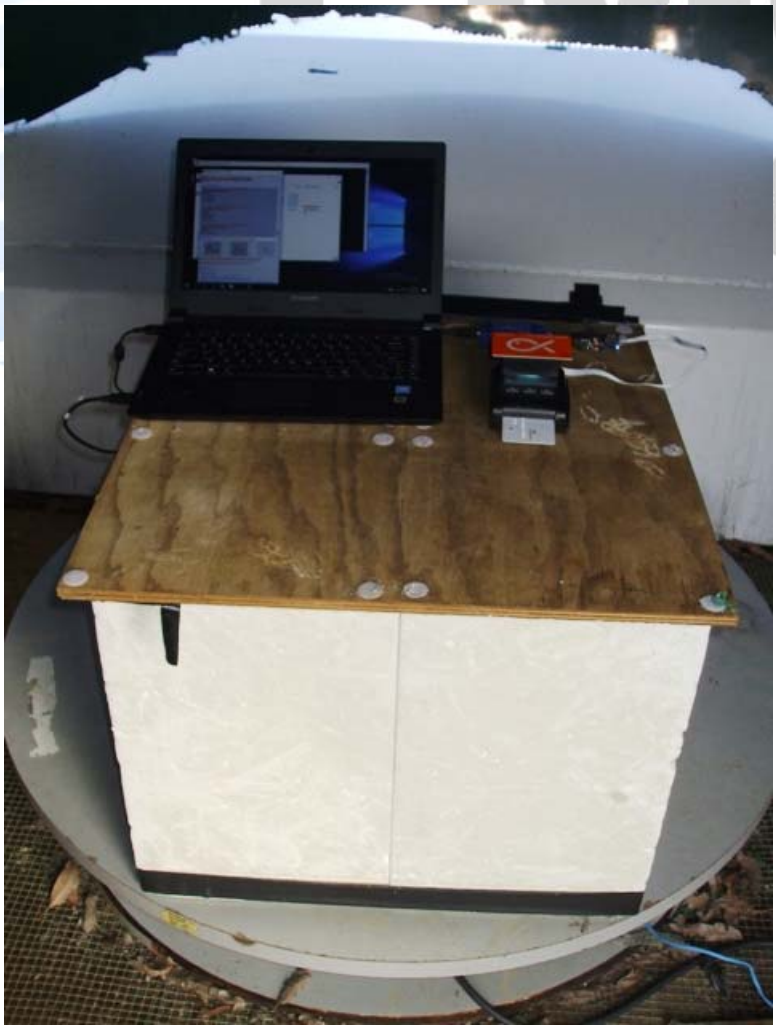
Conducted Emissions Test Set Up





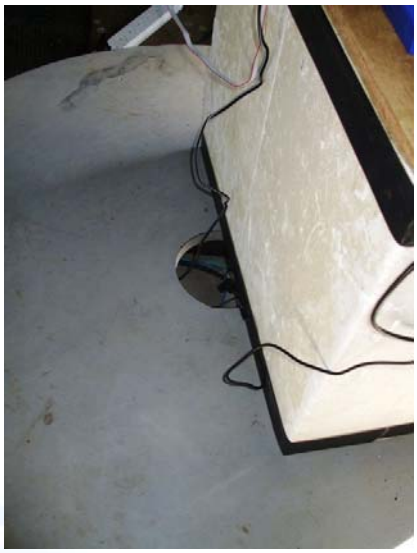


Radiated Emissions Test Set Up at a height of 80 cm



Location of laptop power supply and representative power supply for device under test

Power supplies place at the centre / base of the test table on top of the ground plane.



Looking from the top of the turntable down the centre hole

A side view

Test set up 1000 – 2000 MHz at 1.5 metres above ground plane