EMC Technologies (NZ) Ltd
47 Mackelvie St, Grey Lynn
Auckland 1021
New Zealand
Phone 09 360 0862
Fax 09 360 0861
E-Mail Address: aucklab@emctech.co.nz
Web Site: www.emctech.co.nz

TEST REPORT

Payment Express SCR 200 VN
Secure Payment Terminal with NFC Transmitter

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

This report may not be reproduced except in full.

Table of Contents

This report may not be reproduced except in full.

1. STATEMENT OF COMPLIANCE

The **Payment Express SCR 200 VN Secure Payment Terminal with NFC Transmitter** 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 2018 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.

This report may not be reproduced except in full.

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	33 Wilkinson Road Ellerslie
City	Auckland 1150
Country	New Zealand
Contact	Mr Niel (Pieter) Vivier

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Payment Express
Product	Secure Payment Terminal with NFC Transmitter
Model Number	SCR 200VN
Manufacturer	Payment Express Ltd
Country of Origin	New Zealand
Serial Number	Sample not serialized
FCC ID	2AC2O-SCR200VN

The device tested is a Secure Payment Terminal with NFC Transmitter that operates on 13.560 MHz

This device tested would normally be attached to a host device that would supply power and data processing capabilities.

This report may not be reproduced except in full.

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.

This report may not be reproduced except in full.

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 has NFC (Near Field Communications) which operates at 13.560 MHz.

The NFC transmitter was connected to its antenna and was operating while periodically reading a card that was placed close to the device.

Then NFC transmitter was disconnected from its antenna and its output was terminated onto a dummy load.

The device is deemed to comply providing it complies when the test is carried out with the dummy load attached and the overall emission signature for the product remains similar in both the test configurations with no additional emissions being detected.

The device was placed on top of the emissions table, which is 0.8 m x 0.8 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 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.

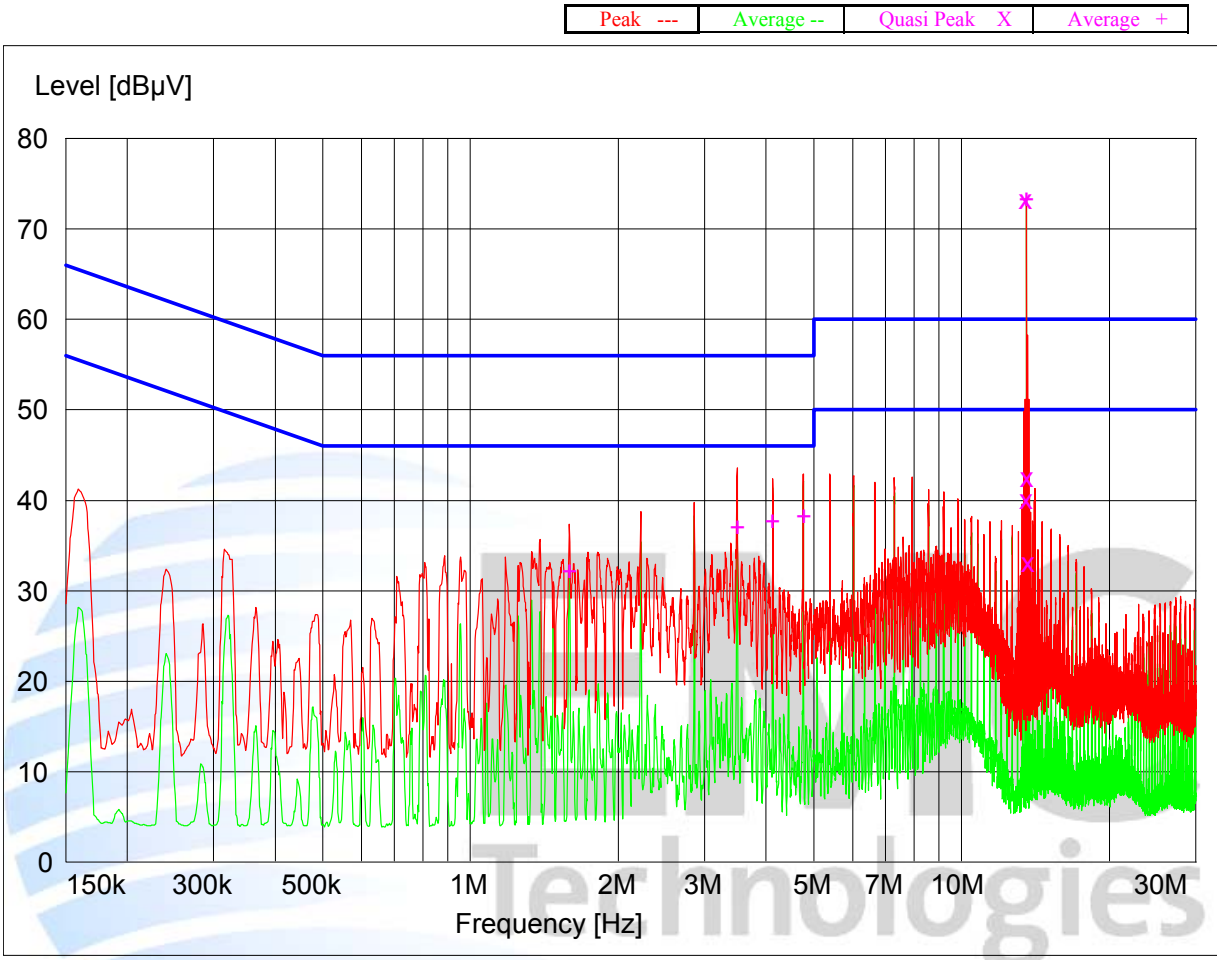
Quasi peak and average detectors have been used with resolution bandwidths of 9 kHz.

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

This report may not be reproduced except in full.

Conducted Emissions – AC Input Power Port

Setup:	The NFC was operational and the transmitter was connected to an internal antenna. The EMC representative AC power adapter was powered through 120 Vac 60 Hz via AMN. The RS232-UART cable was connected to the client test laptop which was running the software.



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
*13.560500	73.30	60.0	-13.3	L1	*73.2*
13.614500	40.10	60.0	19.9	N	
13.650500	42.60	60.0	17.4	L1	
13.722500	33.20	60.0	26.8	N	

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
1.587000	32.10	46.0	14.0	N	
3.494000	37.10	46.0	8.9	N	
4.128500	37.70	46.0	8.3	N	
4.763000	38.30	46.0	7.7	N	
*13.560500	73.30	50.0	-23.3	L1	*73.2*

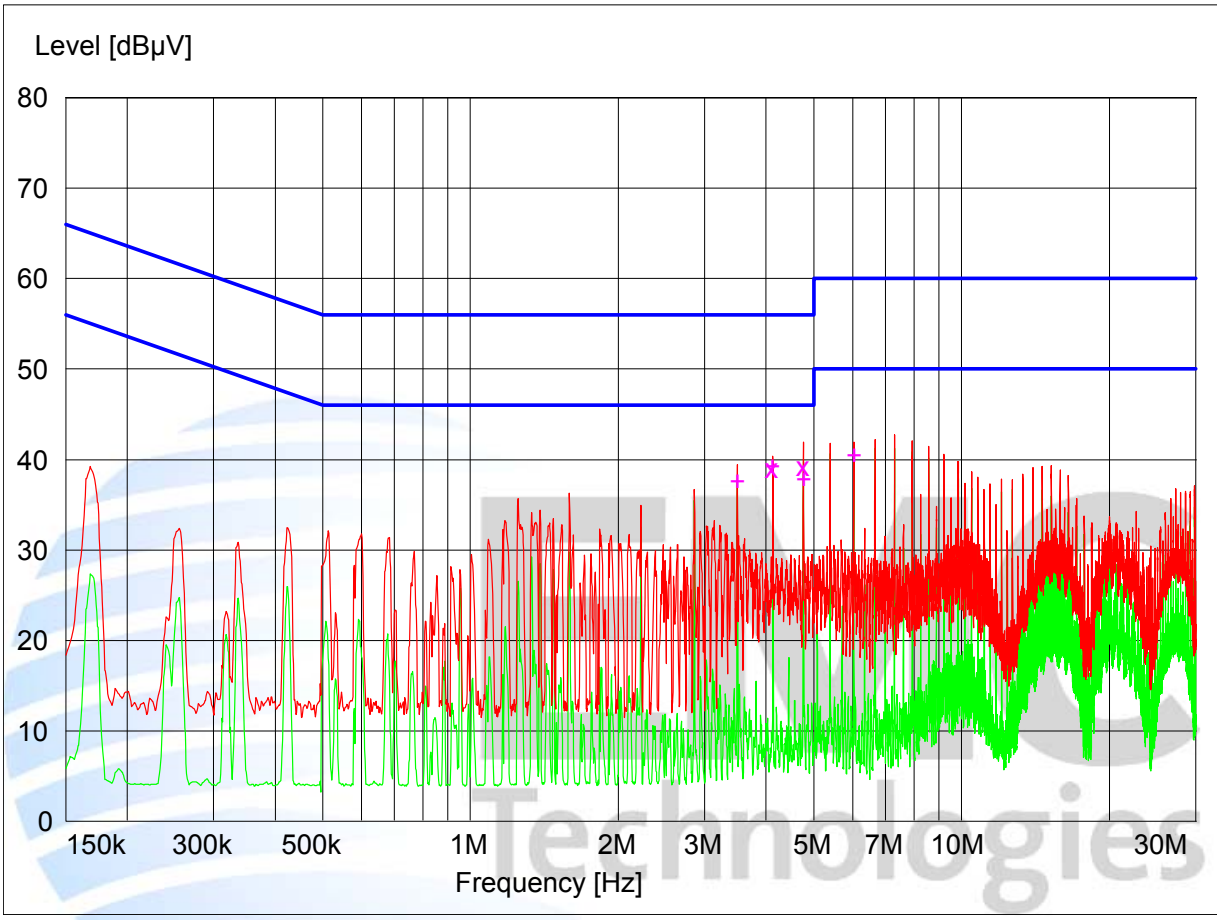
* NFC Frequency

This report may not be reproduced except in full.

Conducted Emissions – AC Input Power Port

Setup:	The NFC was operational and the transmitter was connected to a dummy load. The EMC representative AC power adapter was powered through 120 Vac 60 Hz via AMN. The RS232-UART cable was connected to the client test laptop which was running the software.

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



Final Quasi-Peak Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
4.128500	39.00	56.0	17.0	L1	
4.767500	39.20	56.0	16.8	N	*41.0*

Final Average Measurements

Frequency (MHz)	Level (dBµV)	Limit (dBµV)	Margin (dB)	Phase	Rechecks (dBµV)
3.494000	37.60	46.0	8.4	N	
4.128500	39.20	46.0	6.8	N	*40.0*
4.767500	37.80	46.0	8.2	N	
6.036500	40.50	50.0	9.5	N	

This report may not be reproduced except in full.

Section 15.209: Radiated emission limits, general requirements

Radiated emission testing was carried out over the frequency range of 30 MHz to 1000 MHz as the device contains a 13.560 MHz NFC transceiver.

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.

Attached to the NFC card reader was a serial ribbon cable for DC power and RS232 interface including flow control.

This serial ribbon cable was attached to a data interface board which provides connections for DC and RS232 signals. RS232 to USB adaptor with a 1m long cable was used for connecting the laptop with the data interface board. All interconnecting cables were bundled in 40 cm long bundles.

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.

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.

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 (100 kHz – 30 MHz) ± 4.8 dB
- Free radiation tests (30 – 1000 MHz) ± 4.1 dB

This report may not be reproduced except in full.

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

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
27.120	19.0	48.6	29.6	Pass

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.

Magnetic loop measurements were made at a distance of 10 metres.

Measurement receiver with a quasi peak detector with a 9 kHz bandwidth was used.

The 30 metre limit 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

This report may not be reproduced except in full.

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 (dBµV/m)	Horizontal (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Antenna Polarisation	Result
40.680	38.5	31.1	40.0	1.5	Vertical	Pass
67.800	34.8	28.2	40.0	5.2	Vertical	Pass
122.040	28.7	30.8	43.5	12.7	Horizontal	Pass
149.160	36.2	33.9	43.5	7.3	Vertical	Pass
176.280	31.5	30.5	43.5	12.0	Vertical	Pass
203.400	21.6	28.3	43.5	15.2	Horizontal	Pass
311.880	28.6	30.5	46.0	15.5	Horizontal	Pass
366.120	29.7	-	46.0	16.3	Vertical	Pass
393.240	31.7	30.1	46.0	14.3	Vertical	Pass

No further emissions were detected within 20 dB of the limit when the measurements were made between 30 - 1000 MHz using both vertical and horizontal polarisations.

Result: Complies.

This report may not be reproduced except in full.

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.

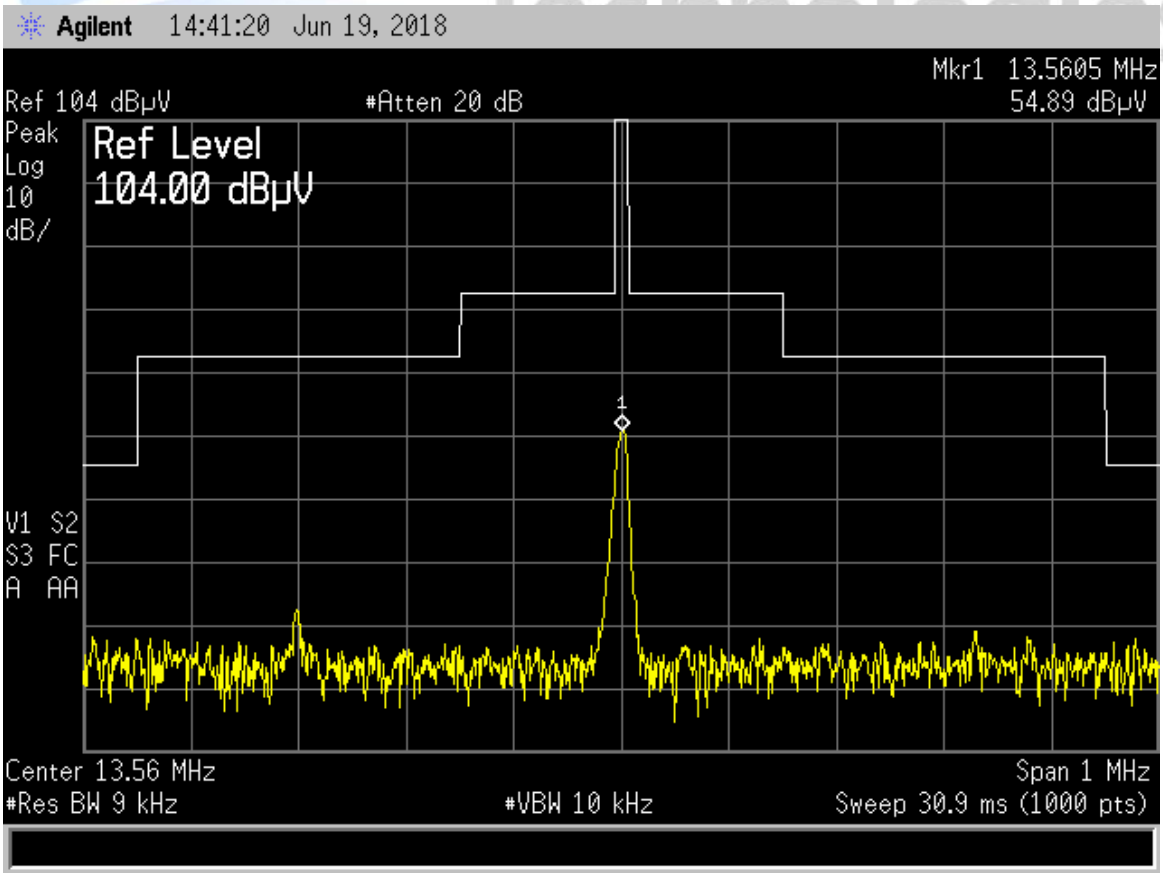
Applying the extrapolation factor of 40 dB/ per decade, the limit at 10 m is 103.1 dBuV/m.

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. A measurement was also taken at 28 Vdc (as per client request) however no variation was observed as detailed below.

Voltage (Vdc)	Frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
10.2	13.560	55.4	103.1	47.7
12.0	13.560	55.4	103.1	47.7
13.8	13.560	55.4	103.1	47.7
28.0	13.560	55.4	103.1	47.7

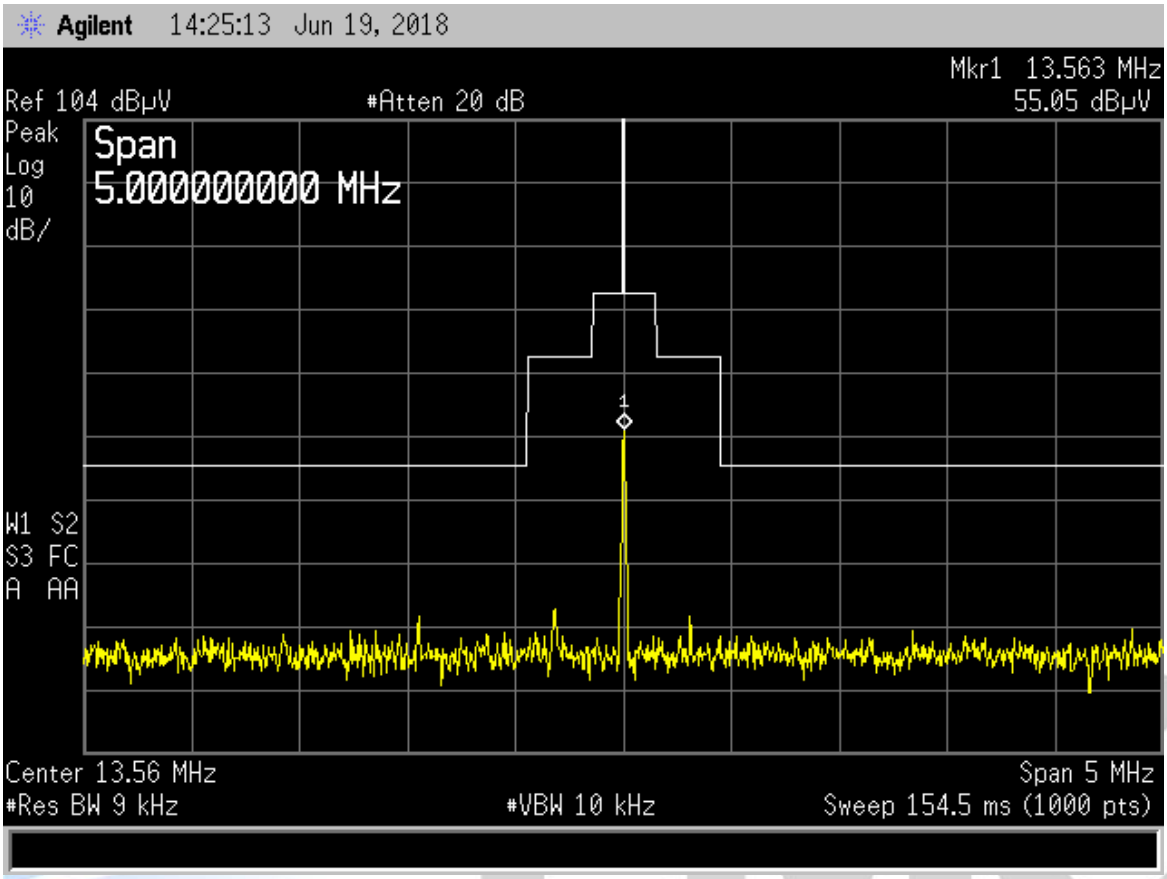
Representative spectrum analyser plots show the carrier and modulation peaks within +/- 500 kHz and +/- 2500 kHz of the carrier.

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



This report may not be reproduced except in full.

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



Result: Complies.

Measurement uncertainty with a confidence interval of 95% is:

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

This report may not be reproduced except in full.

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 C and +50 degrees C.

The device operates nominally on 13.560 MHz which gives a frequency tolerance of +/- 1,356.0 Hz.

Temperature (°C)	Frequency (MHz)	Difference (Hz)
50.0	13.560152	+152
40.0	13.560166	+166
30.0	13.560165	+165
20.0	13.560177	+177
10.0	13.560210	+210
0.0	13.560177	+177
-10.0	13.560227	+227
-20.0	13.560245	+245

The device normally operates on 12 Vdc. As per the client the device can also operate at 24 Vdc.

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

Voltage (Vdc)	Frequency (MHz)	Difference (Hz)
10.2	13.560170	+170
12.0	13.560177	+177
13.8	13.560175	+175
28.0	13.560178	+178

Result: Complies.
Measurement uncertainty with a confidence interval of 95% is:
Frequency tolerance ± 50 Hz

This report may not be reproduced except in full.

7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Last Cal	Cal Due	Period
Aerial Controller	EMCO	1090	9112-1062	Not applic	Not applic	Not applic
Aerial Mast	EMCO	1070-1	9203-1661	Not applic	Not applic	Not applic
Biconical Antenna	Schwarzbeck	BBA 9106	3680	28 Sept 2017	28 Sept 2020	3 years
Horn Antenna	EMCO	3115	9511-4629	8 Aug 2017	8 Aug 2020	3 years
Log Periodic	Schwarzbeck	VUSLP 9111	9111-112	24 Sept 2017	24 Sept 2020	3 years
Loop Antenna	EMCO	6502	9003-2485	4 July 2017	4 July 2020	3 years
Mains Network	R & S	ESH2-Z5	881362/032	12 Oct 2017	12 Oct 2019	2 years
Receiver	R & S	ESHS 10	828404/005	27 Sept 2017	27 Sept 2018	1 year
Receiver	R & S	ESIB 40	100295	28 Aug 2017	28 Aug 2018	1 year
Turntable	EMCO	1080-1-2.1	9109-1578	Not applic	Not applic	Not applic
VHF Balun	Schwarzbeck	VHA 9103	9594	29 Sept 2017	29 Sept 2020	3 years
Power Supply	APT	7008	4170003	Not applic	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 2018.

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.

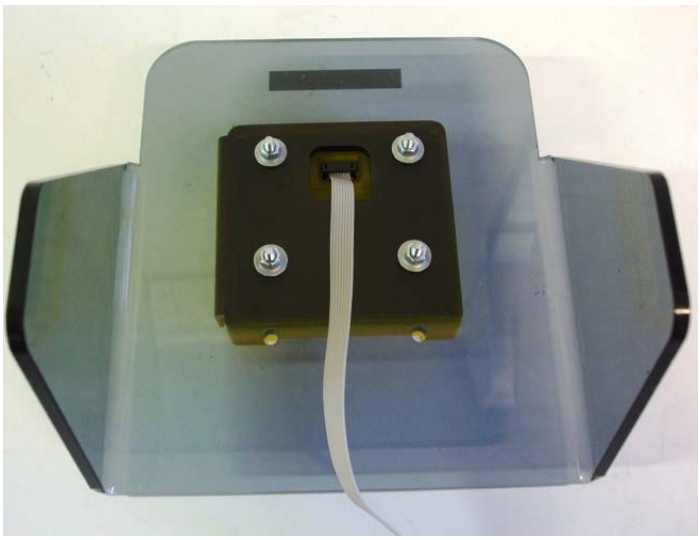
International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with various accreditation bodies in a number of economies.
This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied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

This report may not be reproduced except in full.

9. PHOTOGRAPHS

Top View with unit mounted on a plastic bracket

Back View with unit mounted on a plastic bracket

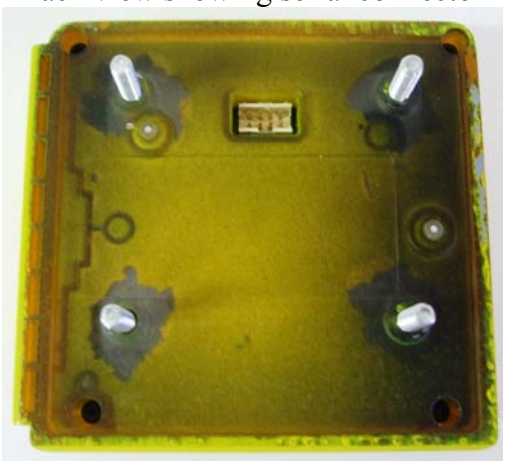


Left hand side view

Right hand side view

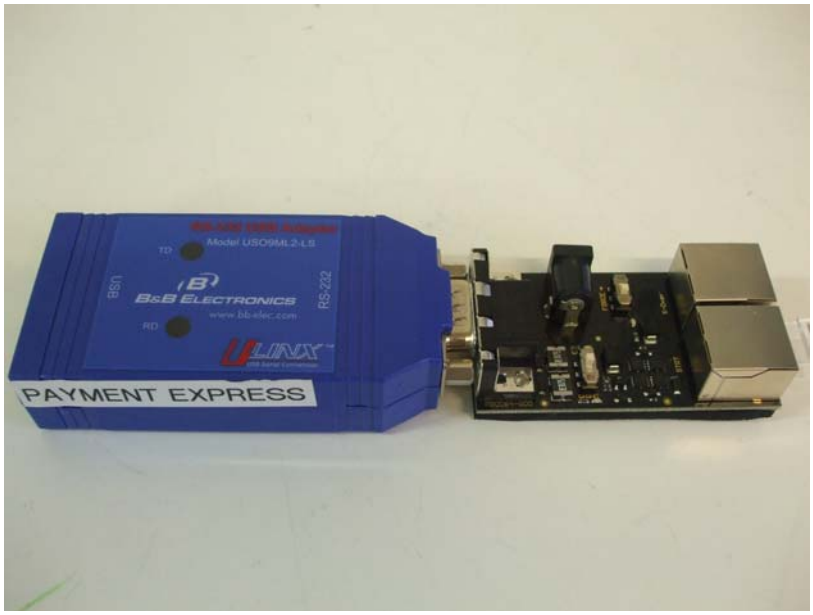
Front View

Back view showing serial connector



This report may not be reproduced except in full.

Ancillary Items - Serial to USB Interface and Power Supply Interface



Card for operation of NFC in the card reader

This report may not be reproduced except in full.

Conducted Emissions Test Set Up

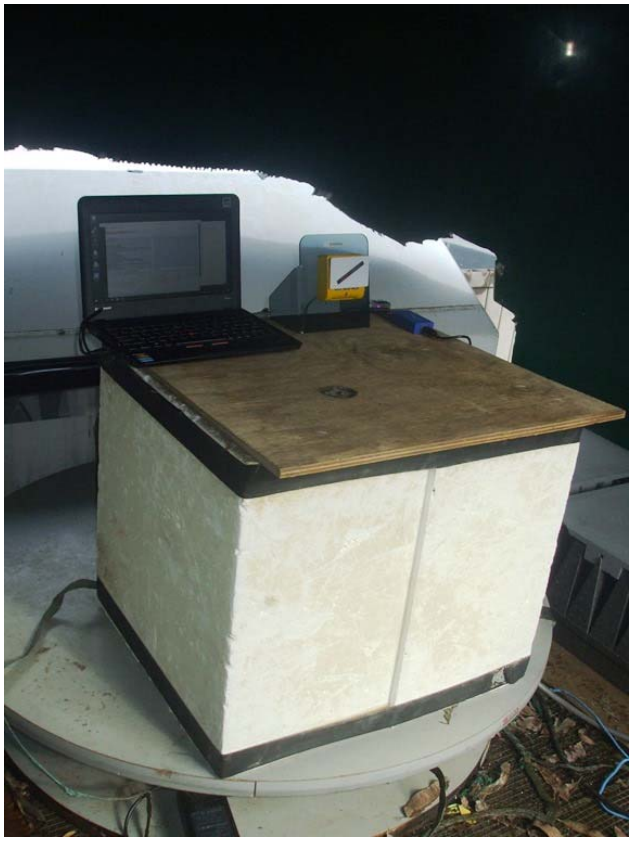
Technologies

This report may not be reproduced except in full.

Radiated Emissions Test Set Up at a height of 80 cm

Left hand side

Rear and right hand side



This report may not be reproduced except in full.