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

## Windcave SCR200MO
## Near Field Contactless Secure Card Reader

*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*

## Windcave 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

# Table of Contents

# 1. STATEMENT OF COMPLIANCE

The **Windcave SCR200MO Near Field Contactless Secure Card Reader** 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 between February 4th to 20th, 2020 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.

All compliance statements have been made with respect of the specification limit with no reference to the measurement uncertainty.

All testing was carried out as per the standard in the worst-case configuration with no deviations being applied.

# 4. CLIENT INFORMATION

| | |
|---|---|
| **Company Name** | Windcave Ltd |
| **Address** | 33 Wilkinson Rd,<br>Ellerslie |
| **State** | Auckland 1060 |
| **Country** | New Zealand |
| **Contact** | Mr Mark England |

# 5. DESCRIPTION OF TEST SAMPLE

| | |
|---|---|
| **Brand Name** | Windcave |
| **Product** | Near Field Contactless Secure Card Reader |
| **Model Number** | SCR200MO |
| **Manufacturer** | Windcave Limited |
| **Country of Origin** | New Zealand |
| **Serial Number** | 2419090004 |
| **FCC ID** | 2AC2O-SCR200MO |

The device tested is a Near Field Contactless Secure Card Reader (NFC Card Reader) that operates on 13.560 MHz.

When operating this device would normally be installed with in a host device that would supply power and data processing capabilities.

Testing was carried out using ancillary items that consisted of a laptop computer and a USB to serial conversion device which supplied 5 Vdc which powered the device.

The client has not supplied a highest frequency in use in the device but based upon the results obtained this has been assumed to be less than 108 MHz.

# 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 under test via the USB to Serial interface device.

The NFC Card Reader operates at 13.560 MHz.

Initial testing was carried out when the NFC Card Reader was operating normally with the internal antenna connected while continuously reading a card was placed close to the reader such that a card read beep was heard.

A second test was then carried out with the NFC Card Reader internal antenna being disconnected and replaced with a resistive dummy load.

The device is deemed to comply providing if the dummy load test complies and the overall emission signature for the product remains similar in both 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.

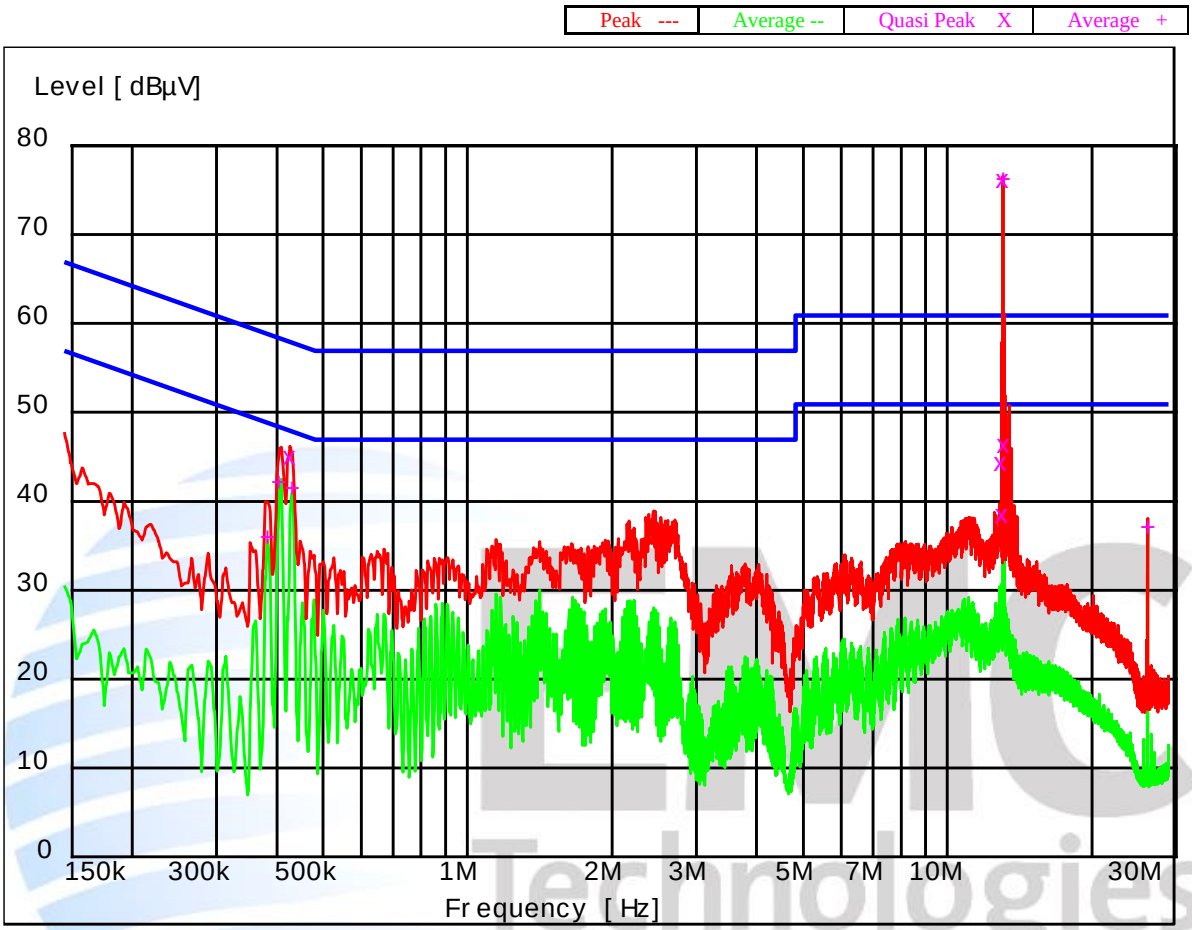
The supplied plot is combined plot showing the worst case quasi peak and average results of both the phase and neutral lines to the representative AC power supply.

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

## Conducted Emissions – AC Input Power Port

| | |
|---|---|
| **Setup:** | Device tested when powered at 120 Vac 60 Hz via an RS-232 to Serial Convertor with the NFC transmitter continuously interrogating a payment card. |




Final Quasi-Peak Measurements

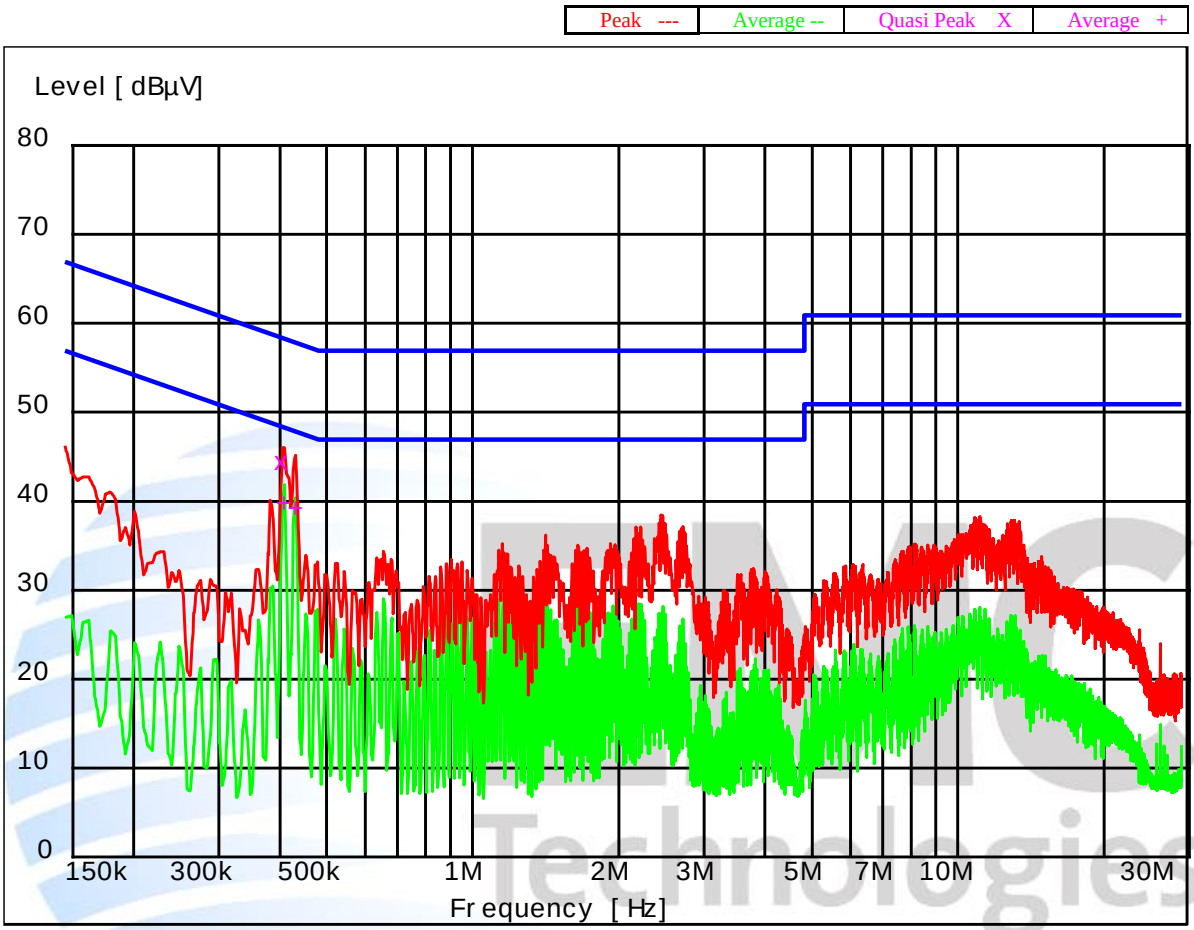
| Frequency (MHz) | Level (dBµV) | Limit (dBµV) | Margin (dB) | Phase | Rechecks (dBµV) |
|---|---|---|---|---|---|
| 0.442500 | 44.10 | 57.0 | 12.9 | N | |
| 13.435000 | 43.50 | 60.0 | 16.5 | N | |
| 13.530000 | 37.70 | 60.0 | 22.3 | N | |
| 13.560000 | 75.40 | 60.0 | -15.4 | L1 | 75.0 |
| 13.650000 | 45.50 | 60.0 | 14.5 | N | |

Final Average Measurements

| Frequency (MHz) | Level (dBµV) | Limit (dBµV) | Margin (dB) | Phase | Rechecks (dBµV) |
|---|---|---|---|---|---|
| 0.397500 | 35.10 | 47.9 | 12.8 | L1 | |
| 0.420000 | 41.30 | 47.5 | 6.2 | L1 | |
| 0.447000 | 40.60 | 46.9 | 6.3 | N | |
| 13.560000 | 75.30 | 50.0 | -25.3 | L1 | 74.9 |
| 27.120000 | 36.20 | 50.0 | 13.8 | N | |

## Conducted Emissions – AC Input Power Port

| | |
|---|---|
| **Setup:** | Device tested when powered at 120 Vac 60 Hz via an RS-232 to Serial Convertor with the NFC transmitter antenna replaced with a dummy load. |




Final Quasi-Peak Measurements

| Frequency (MHz) | Level (dBµV) | Limit (dBµV) | Margin (dB) | Phase | Rechecks (dBµV) |
|---|---|---|---|---|---|
| 0.420000 | 43.60 | 57.5 | 13.9 | L1 | |

Final Average Measurements

| Frequency (MHz) | Level (dBµV) | Limit (dBµV) | Margin (dB) | Phase | Rechecks (dBµV) |
|---|---|---|---|---|---|
| 0.424500 | 38.90 | 47.4 | 8.5 | L1 | |
| 0.447000 | 38.30 | 46.9 | 8.6 | N | |

**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 to 12 Vdc that powered the device under test.

Attached to the NFC card reader was serial ribbon cable that was approximately a 0.5 metre long which was connected to the data / DC power interface board.

This interface board was in turn attached to a USB to Serial data convertor which then attached to a laptop computer using a USB cable that was approximately 30 cm long.

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)

For example, if an emission of 30 dBµV was observed at 30 MHz.

45.5 dBµV/m = 30.0 dBµV + 14 dB/m + 1.5 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

**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 | 18.2 | 48.6 | 30.4 | 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

**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) | Result | Antenna Polarisation |
|---|---|---|---|---|---|---|
| 33.760 | 35.2 | 27.8 | 40.0 | 4.8 | Pass | Vertical |
| 40.680 | 34.7 | | 40.0 | 5.3 | Pass | Vertical |
| 52.400 | 30.2 | | 40.0 | 9.8 | Pass | Vertical |
| 67.800 | 26.7 | 20.6 | 40.0 | 13.3 | Pass | Vertical |
| 81.360 | 19.2 | 21.9 | 40.0 | 18.1 | Pass | Horizontal |
| 108.480 | 20.1 | | 43.5 | 23.4 | Pass | Vertical |
| 122.040 | | 25.6 | 43.5 | 17.9 | Pass | Horizontal |
| 176.280 | 26.8 | 36.3 | 43.5 | 7.2 | Pass | Horizontal |
| 227.320 | | 32.7 | 46.0 | 13.3 | Pass | Horizontal |
| 231.400 | | 33.4 | 46.0 | 12.6 | Pass | Horizontal |
| 235.520 | | 34.2 | 46.0 | 11.8 | Pass | Vertical |
| 239.800 | | 33.6 | 46.0 | 12.4 | Pass | Vertical |
| 243.720 | | 32.9 | 46.0 | 13.1 | Pass | Vertical |
| 247.800 | 27.4 | 32.8 | 46.0 | 13.2 | Pass | Vertical |
| 251.880 | | 32.5 | 46.0 | 13.5 | Pass | Vertical |
| 311.880 | | 27.8 | 46.0 | 18.2 | Pass | Vertical |

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.

**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).

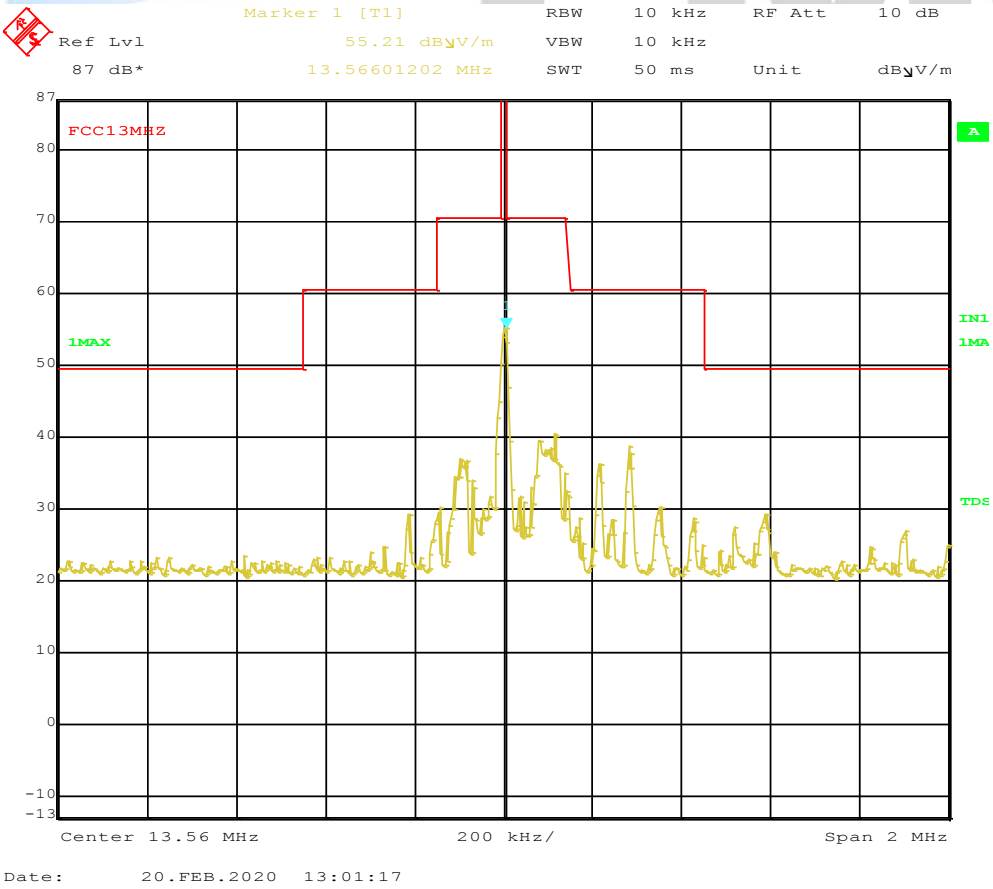
The limit at 30 m at 13.560 MHz is 15,848 uV/m or 84.0 dBuV/m.

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.

| Voltage (Vdc) | Frequency (MHz) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|
| 10.2 | 13.560 | 55.5 | 103.1 | 47.7 |
| 12.0 | 13.560 | 55.5 | 103.1 | 47.7 |
| 13.8 | 13.560 | 55.5 | 103.1 | 47.7 |

Representative spectrum analyser plots show the carrier and modulation peaks within +/- 1 MHz.




**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 C and +50 degrees C.

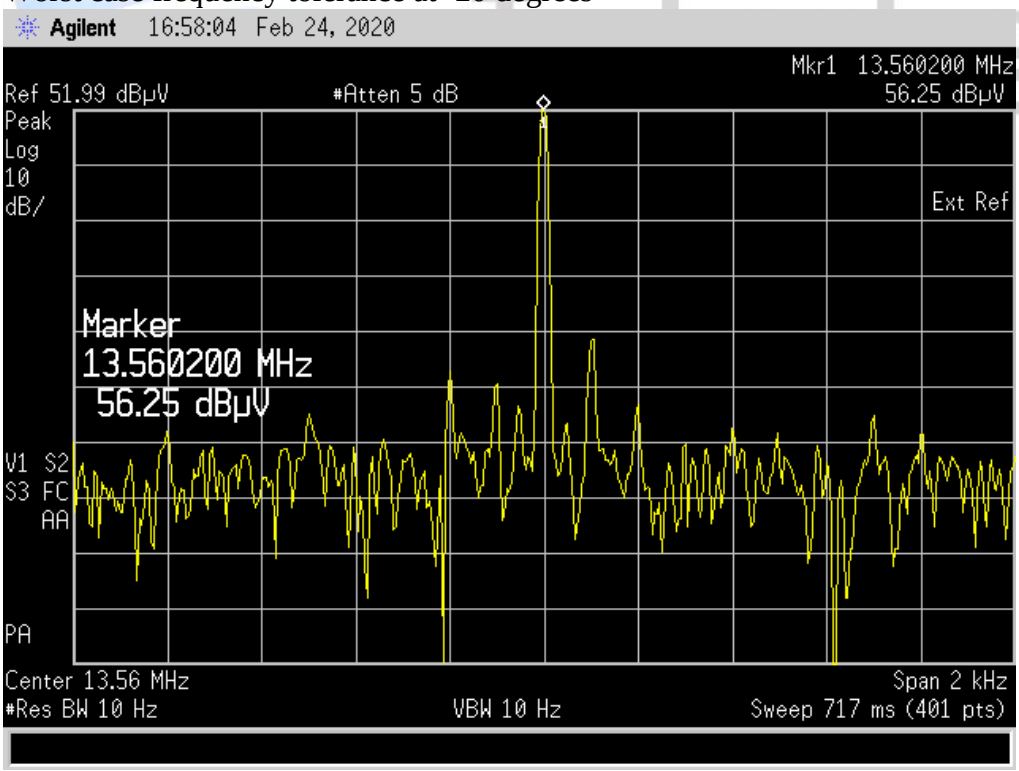
The device operates nominally on 13.560 MHz which gives a frequency tolerance of +/- 1,356.0 Hz.

| Temperature (°C) | Frequency (MHz) | Difference (Hz) |
|---|---|---|
| 50.0 | 13.560 110 | +110 |
| 40.0 | 13.560 070 | +70 |
| 30.0 | 13.560 065 | +65 |
| 20.0 | 13.560 105 | +105 |
| 10.0 | 13.560 080 | +80 |
| 0.0 | 13.560 130 | +130 |
| -10.0 | 13.560 135 | +135 |
| -20.0 | 13.560 200 | +200 |

The 12.0 Vdc supply voltage was varied by +/- 15% at 20 degrees C (ambient).

| Voltage (Vdc) | Frequency (MHz) | Difference (Hz) |
|---|---|---|
| 10.2 | 13.560 105 | +105 |
| 12.0 | 13.560 105 | +105 |
| 13.8 | 13.560 105 | +105 |

Worst case frequency tolerance at -20 degrees




**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 | 28 Sept 2020 | 3 years |
| Horn Antenna | EMCO | 3115 | 9511-4629 | E1526 | 8 Aug 2020 | 3 years |
| Log Periodic | Schwarzbeck | VUSLP 9111 | 9111-112 | EMC4025 | 24 Sept 2020 | 3 years |
| Loop Antenna | EMCO | 6502 | 9003-2485 | 3798 | 4 July 2020 | 3 years |
| Mains Network | R & S | ESH2-Z5 | 881362/032 | 3628 | 12 Oct 2020 | 2 years |
| Receiver | R & S | ESHS 10 | 828404/005 | 3728 | 27 Sept 2020 | 1 year |
| Receiver | R & S | ESIB 40 | 100295 | INV0818 | 28 Aug 2020 | 1 year |
| Turntable | EMCO | 1080-1-2.1 | 9109-1578 | RFS 3709 | Not applic | Not applic |
| VHF Balun | Schwarzbeck | VHA 9103 | 9594 | 3696 | 29 Sept 2020 | 3 years |
| Power Supply | APT | 7008 | 4170003 | - | Not applic | Not applic |

# 8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd designation as a FCC Accredited Laboratory by International Accreditation New Zealand, designation number: NZ0002 under the APEC TEL MRA.

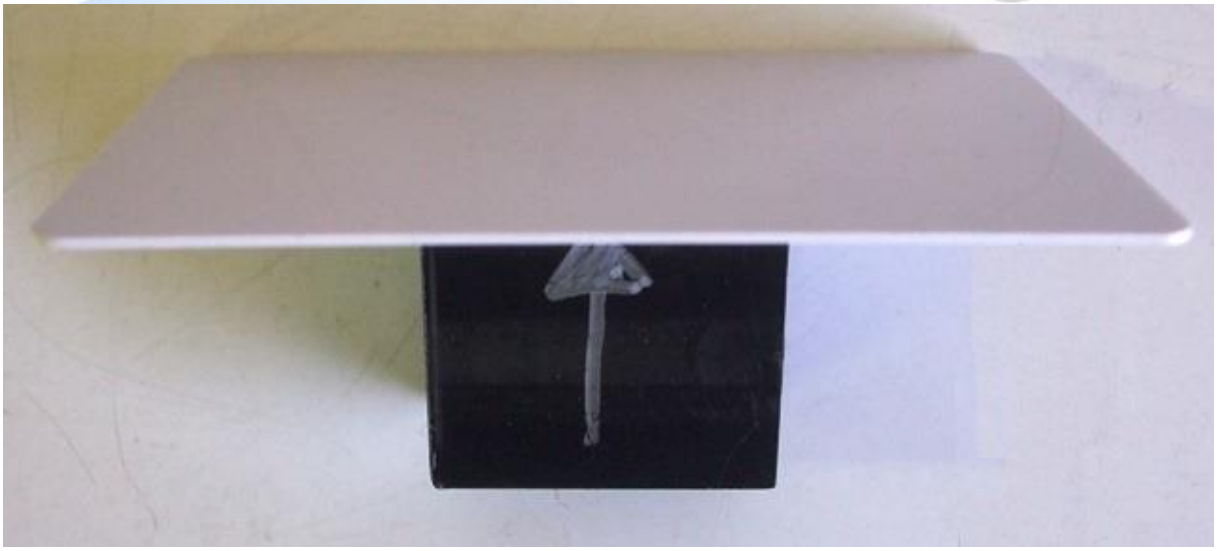
All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

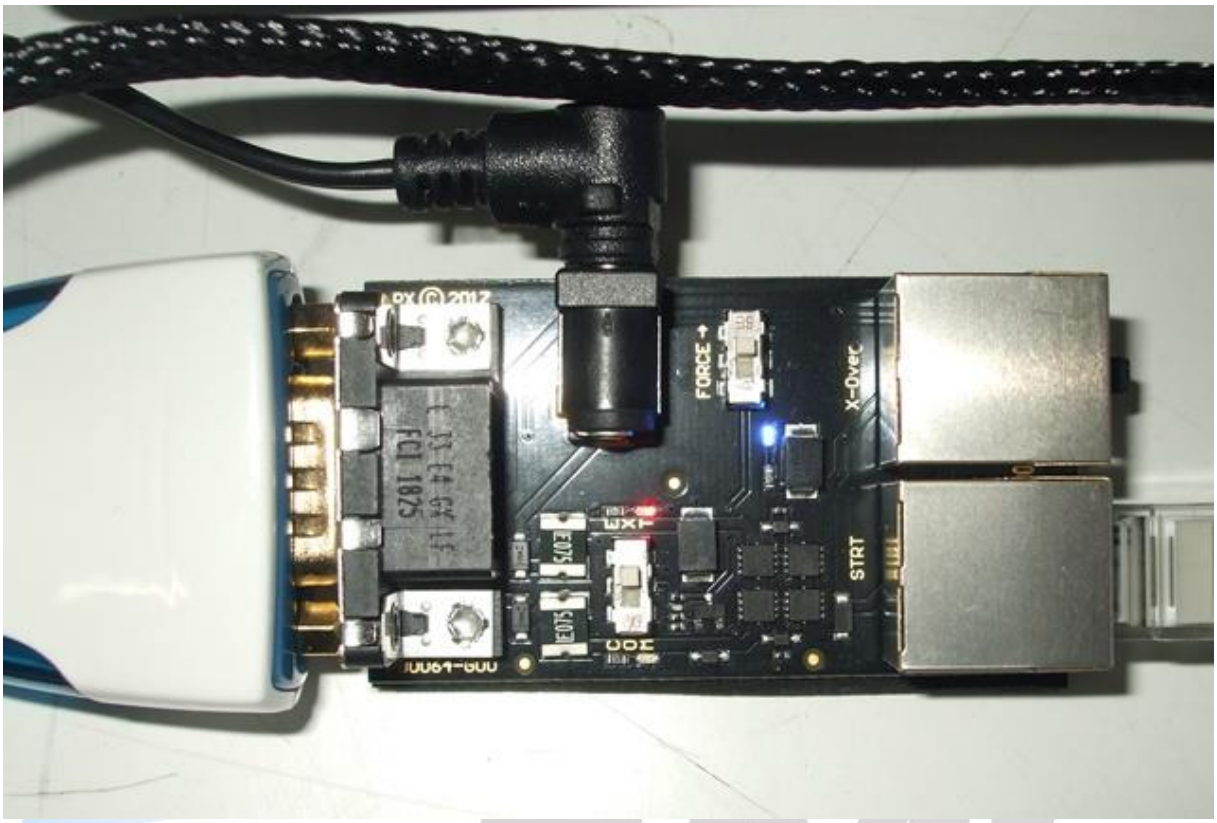
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

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.

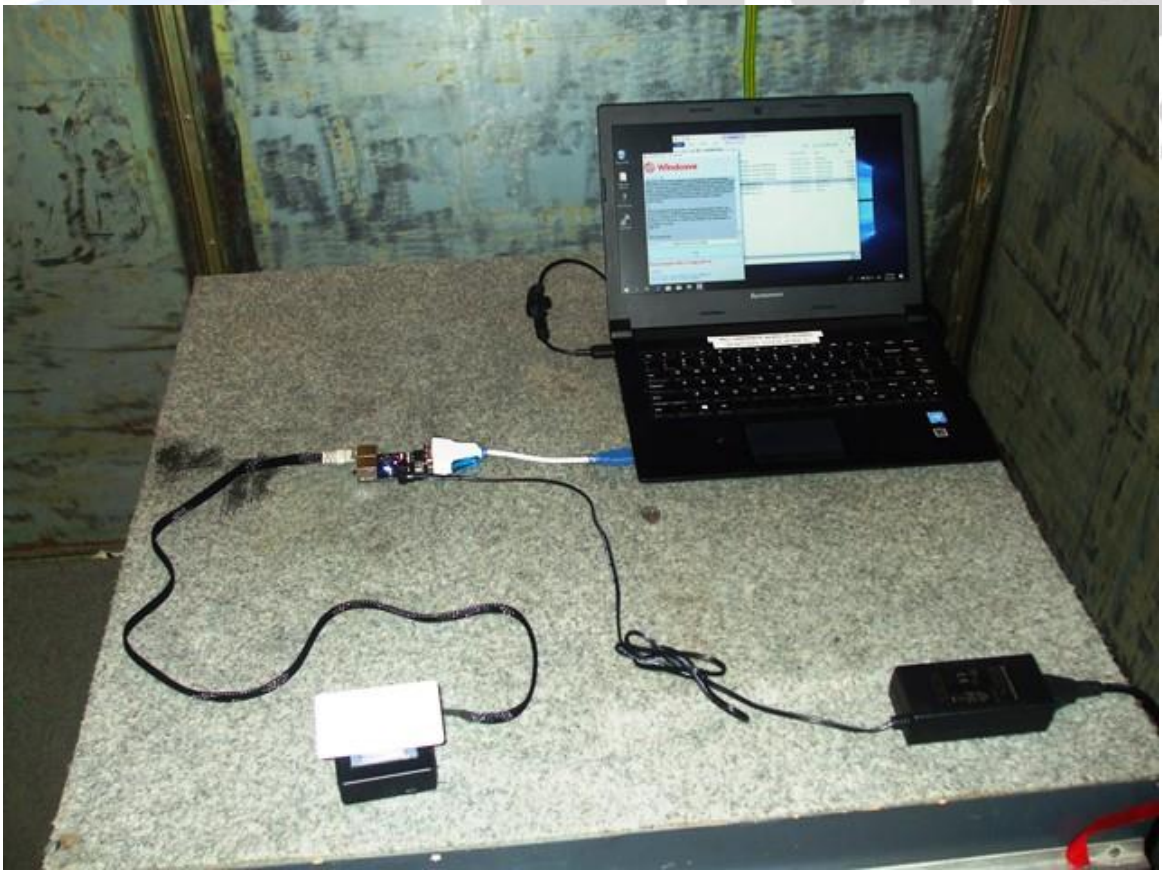
# 9. PHOTOGRAPHS








Conducted emissions test set up



Radiated emissions test set up