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# EMC COMPLIANCE REPORT
# Certification Test Report
# *In accordance with:*
# CFR47 FCC Part 15, Subpart C

## Inner Range Pty Ltd

## 994725

## SiferPad, NFC Reader with Keypad

REPORT: E1902-1136C-2 Rev1
DATE: May, 2020

*This report replaces the previously issued report E1902-1136C-2.*
*Please refer to section 2 of this report for details of any previously issued reports.*

WORLD RECOGNISED ACCREDITATION

Accreditation Number: 18553
Accredited for compliance with ISO/IEC 17025

# Certificate of Compliance

## EMC Bayswater Test Report: E1902-1136C-2 Rev1
## Issue Date: May, 2020

| | |
|---|---|
| **Test Sample(s):** | SiferPad, NFC Reader with Keypad |
| **Model No:** | 994725 |
| **Serial No:** | None stated |
| **Part No:** | 964725REVD Subassembly |
| **FCC ID:** | 2ASIN-994725 |

**Client Details:**

Mr Thomas Kowalczyk
Inner Range Pty Ltd
1 Millennium Court
Knoxfield, Victoria, 3180, Australia

Phone No: 03 9780 4300
e-mail: thomas.kowalczyk@innerrange.com

**Test Specification:** CFR47 FCC Part 15, Subpart C

**Results Summary:**

| | |
|---|---|
| 15.203 – Antenna Requirement | ***Complied*** |
| 15.225 (a) - Field Strength within the band 13.553 - 13.567MHz | ***Complied*** |
| 15.225 (b) - Field Strength within the bands 13.410 - 13.553MHz and 13.567-13.710 MHz | ***Complied*** |
| 15.225 (c) - Field Strength within the bands 13.110 - 13.410MHz and 13.710-14.010 MHz | ***Complied*** |
| 15.225 (d) - Field Strength outside the band 13.110-14.010 MHz | ***Complied*** |
| 15.225 (e) - Frequency tolerance of the carrier signal | ***Complied*** |
| 15.215 (c) - 20dB Emission Bandwidth | ***Complied*** |

**Test Date(s):** 26th March to 18th April, 2019

**Test House (Issued By)**

EMC Bayswater Pty Ltd
18/88 Merrindale Drive
Croydon South
Victoria, 3136
Australia

FCC Accredited Test Firm Registration number: 527798

Phone No: +61 3 9761 5888 e-mail: sales@emcbayswater.com.au
Fax No: +61 3 8761 6547 Web: www.emcbayswater.com.au

This is to certify that the necessary measurements were made by EMC Bayswater Pty Ltd, and that the Inner Range Pty Ltd, 994725, SiferPad, NFC Reader with Keypad (Serial No: None stated), has been tested in accordance with requirements contained in the appropriate commission regulations.

| Prepared by: | Tested by: | Approved by: | |
|---|---|---|---|
| | | | 21/05/2020 11:27 |
| Kalyan Tej Guntur (EMC Test Officer) | Fabio D'Amico (EMC Test Engineer) | Neville Liyanapatabendige (Manager) | Date |

# EMC Compliance Report *for* Inner Range Pty Ltd

## Contents

## 1. Introduction

Electromagnetic Compatibility (EMC) tests were performed on an Inner Range Pty Ltd, 994725, SiferPad, NFC Reader with Keypad in accordance with the requirements of Title 47 of the standard CFR47 FCC Part 15, Subpart C.

## 2. Test Report Revision History

| Issue | Date | Description | Authorised by |
|---|---|---|---|
| E1902-1136C-2 | 20/05/19 | Original | Neville Liyanapatabendige (Manager) |
| E1902-1136C-2 Rev1 | 21/05/20 | The FCC ID was included in Certificate page (Page 2) and Section 5 of this report. | Neville Liyanapatabendige (Manager) |

## 3. Report Information

EMC Bayswater Pty Ltd reports apply only to the specific samples tested under the stated test conditions. All samples tested were in good operating condition throughout the entire test program unless otherwise stated. EMC Bayswater Pty Ltd does not in any way guarantee the later performance of the product/equipment. It is the manufacturer's responsibility to ensure that additional production units of the tested model are manufactured with identical electrical and mechanical components. EMC Bayswater Pty Ltd shall have no liability for any deductions, inference or generalisations drawn by the clients or others from EMC Bayswater Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Bayswater Pty Ltd. This report shall not be reproduced except in full (with the exception of the certificate on page 2) without the written approval of EMC Bayswater Pty Ltd. This document may be altered or revised by EMC Bayswater Pty Ltd personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by EMC Bayswater Pty Ltd will nullify the document.

## 4. Summary of Results

The EUT complied with applicable requirements of CFR47 FCC Part 15, Subpart C. Worst-case results are tabled as follows:

| FCC Part 15C sections | Test | Result |
|---|---|---|
| 15.203 | Antenna Requirement | Complied[#1] |
| 15.225 (a) | Field Strength within the band 13.553 - 13.567MHz | Complied by 46.9dB |
| 15.225 (b) | Field Strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz | Complied by 28.2dB |
| 15.225 (c) | 15.225 (c) - Field Strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz | Complied by 20.7dB |
| 15.225 (d), 15.209 | Field Strength outside the band 13.110-14.010 MHz | Complied by 2.4[+]dB |
| 15.225 (e) | Frequency tolerance of the carrier signal | Complied |
| 15.215 (c) | 20dB Emission Bandwidth | Complied |

*[#1]The Antenna is permanently attached, internal to the device*

*[+]Refer to relevant section for statement of Measurement Uncertainty*

Table 1: Summary of test results

# 5. Product Sample, Configuration & Modifications

## 5.1. EUT Description

The EUT (Equipment Under Test), as supplied by the client, is described as follows:

| | | |
|---|---|---|
| Product: | SiferPad, NFC Reader with Keypad | |
| Model No: | 994725 | |
| Part No: | 2ASIN-994725 | |
| Serial No: | None stated | |
| Firmware: | None Stated | |
| Software: | None Stated | |
| Dimensions: | 106(L) x 64(W) x 20(H) (mm) | |
| Weight: | ~50g | |
| Power Specifications | 10VDC – 16VDC, ~100mA | |
| Orientation: | The EUT is typically used in one orientation only | |
| RFID Transceiver: | Description: | NFC device |
| | Type: | 13.56MHz RFID Transceiver |
| | Modulation: | NFC, RFID reader<br>Reader to Card: ASK<br>Card to Reader: BPSK |
| | Channels: | Single Channel |
| | Max power: | Less than 100mW |
| | Antenna Type: | PCB Antenna |
| | Antenna Gain: | None stated |
| | FCC ID: | 2ASIN-994725 |

*(Customer supplied product information)*

*(Refer to photographs in Appendix B for views of the EUT)*

## 5.2. Product description

The EUT (Equipment Under Test) has been described by the customer as follows:

“NFC reader with Keypad”

The highest fundamental frequency generated or used within the EUT, or the highest frequency at which it operates as specified by the customer is 192MHz.

*(Customer supplied product description information)*

## 5.3. Support Equipment

| | | |
|---|---|---|
| Support Equipment 1: | Description: | Inception Security Controller |
| | Manufacturer: | Inner Range |
| | Model: | 996300 |
| | Serial number: | IN73840010 |
| Support Equipment 2: | Description: | Passive RFID Tag |
| | Manufacturer: | Inner Range |
| | Model: | Not stated |
| | Serial number: | P 199734 |

### 5.4. Product operating modes

The customer described the products normal operation modes as the following:

Mode 1: Normal operation, on line, waiting for RFID - tag not presented.

Mode 2: RF Transmitter ON - continuous TX/RX - tag present.

*(Customer supplied product operating mode information)*

### 5.5. Product operating mode for testing

As declared by the customer, the product operating mode for testing as follows:

Mode 2: RF Transmitter ON - continuous TX/RX - tag present.

### 5.6. Configuration

The EUT was either configured by the customer or configured using the customer's instructions:

The EUT was connected to the customer supplied inception controller. Power to the EUT was supplied via the inception controller except for Frequency tolerance of the carrier signal testing. For Frequency tolerance of the carrier signal testing, power to the EUT was supplied via a Laboratory DC power supply. The customer supplied passive RFID Tag was attached to the EUT during testing to enable continuous transmit and receive operation of the EUT.

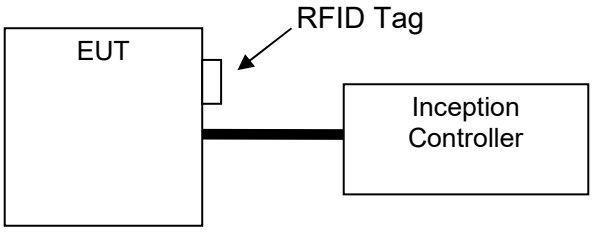



Table 2: Block diagram of EUT test configuration with Host

| Port | Cable type | Cable Brand | Cable Model | Length (m) | Termination |
|---|---|---|---|---|---|
| RS-485 LAN | 4 core un-shielded, Twisted Pair cable | Altronic | W2360 | 15m | Inception Reader Port |

Table 3: List of ports, loads and cable lengths used for testing

### 5.1. Modifications

EMC Bayswater Pty Ltd did not modify the EUT.

# 6. Test Facility & Equipment

## 6.1. Test Facility

Radiated Field Strength emissions and 20dB Emission Bandwidth measurements were taken in the indoor Open Area Test Site (iOATS) facility at EMC Bayswater Pty Ltd, located at 18/88 Merrindale Drive, Croydon South, Victoria, 3136, Australia.

Frequency tolerance of the carrier signal measurements were performed in an environmental chamber at EMC Bayswater Pty Ltd, located at 18/88 Merrindale Drive, Croydon South, Victoria, 3136, Australia.

EMC Bayswater Pty Ltd's FCC Accredited Test Firm Registration number: 527798.

## 6.2. Test Equipment

Refer to Appendix A for the measurement instrument list.

## 7. Referenced Standards

CFR47 FCC Part 15, Subpart C

CFR47 FCC Part 15, Subpart B

ANSI C63.10 - 2013
American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

ANSI C63.4 - 2014
American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

## 8. Referenced Documents

Test Plan
Not provided

# 9. Antenna Requirement – FCC Part 15.203

## 9.1. Requirements

As per section 15.203 of CFR47 FCC Part 15, Subpart C:

- An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

## 9.2. Result

The EUT uses permanent, internally attached antenna which is etched in to the PCB. Therefore the EUT complied with the antenna requirements of CFR47 FCC Part 15, Subpart C Section 15.203.

# 10. Field Strength within the 13.110MHz to 14.010MHz bands - FCC Part 15.225 (a), (b) and (c)

## 10.1. Test Procedure

The field strength of any emissions within the band 13.110MHz to 14.110MHz was measured 3 metres away from the EUT in the iOATS (indoor Open Area Test Site) facility, which is an ANSI C63.4 compliant semi-anechoic chamber with ground plane.

The field strength measurements (Radiated Emissions) were performed in accordance with the ANSI C63.10 – 2013.

The EUT was placed on a polystyrene support at a height of 0.8m above the ground reference plane. The measuring antenna was located at a distance of 3m from the EUT. The spectrum analyser peak detector was set to MAX-HOLD and the range selected continuously scanned with 10kHz RBW and 30kHz VBW. The antenna height was fixed at 1 meter and the turntable slowly rotated. The EUT was also orientated in each of the X, Y and Z-axis, in-turn in order to find the worst-case emission arrangement.

Plots of the accumulated measurement data for X (Parallel), Y (Perpendicular) and Z (Ground-Parallel) antenna orientations, including all transducer correction factors and other measuring system correction factors were produced using commercially available compliant software (as listed in the test equipment list of this report).

*(Refer to photographs 1 to 6 in Annex C for views of the test configuration)*

## 10.2. Requirements

The EUT must comply with field strength limits defined in section 15.225 (a), (b) and (c) of CFR47 FCC Part 15, Subpart C:

| Frequency Band (MHz) | Limit at 30m (dBµV/m) | Limit at 3m *Note 1* (dBµV/m) |
|---|---|---|
| 13.110 to 13.410 | 40.5 | 80.5 |
| 13.410 to 13.553 | 50.5 | 90.5 |
| 13.553 to 13.567 | 84.0 | 124.0 |
| 13.567 to 13.710 | 50.5 | 90.5 |
| 13.710 to 14.010 | 40.5 | 80.5 |

*Note 1: The measurements were performed at 3m distance therefore the square of an inverse linear distance extrapolation factor (40 dB/decade) was applied to 30m limits.*

Table 4: Limits for Field Strength within the 13.110MHz to 14.010MHz bands – FCC Part 15.225 (a), (b) and (c)

### 10.3.Test Results

Worst-case Field Strength measurements are tabulated below.

*(Refer to graphs in Appendix C.1)*

| FCC Par 15 Section | Frequency Band (MHz) | Frequency (MHz) | Measured Field Strength at 3m Peak (dBµV/m) | Limit at 3m (dBµV/m) | Delta limit (dB) |
|---|---|---|---|---|---|
| 15.225 (a) | 13.553 to 13.567 | 13.561 | 77.1 | 124.0 | -46.9 |
| 15.225 (b) | 13.410 to 13.553 | 13.456 | 60.9 | 90.5 | -29.6 |
| | 13.567 to 13.710 | 13.668 | 62.3 | 90.5 | -28.2 |
| 15.225 (c) | 13.110 to 13.410 | 13.347 | 55.7 | 80.5 | -24.8 |
| | 13.710 to 14.010 | 13.772 | 59.8 | 80.5 | **-20.7*** |

**Worst-case emissions*

Table 5: Field Strength within the 13.110MHz to 14.010MHz bands

The measurement uncertainty was calculated as follows:

| Measurement frequency range | Calculated measurement uncertainty |
|---|---|
| 9kHz to 30MHz | ±4.3dB |

The reported uncertainty is an expanded uncertainty calculated using a coverage factor of *k=2* which gives a level of confidence of approximately 95%. The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement uncertainty. However, the measurement uncertainty shall appear in the test report.

| Climatic Conditions | |
|---|---|
| Temperature: | 20°C |
| Humidity: | 48% |
| Atmospheric pressure: | 997.7hPa |

Table 6: Climatic Conditions

**Notes:** The Field Strength of any emissions within the band 13.110MHz to 14.010 MHz were below the applicable limits.

**Assessment:** The EUT complied with the Field Strength requirements of CFR47 FCC Part 15, Subpart C Section 15.225 (a), (b) and (c).

# 11. Field Strength outside the band 13.110-14.010 MHz – FCC Part 15.225 (d), FCC 15.209

## 11.1. Test Procedure

The Radiated Emissions were performed in accordance with the ANSI C63.10 - 2013.

Radiated Emissions were measured 3 metres (from 9kHz to 2GHz) away from the EUT in the iOATS (indoor Open Area Test Site) facility, which is an ANSI C63.4 compliant semi-anechoic chamber with ground plane. The EUT was placed on a non-conductive support at a height of 0.8m (below 1GHz measurements) and 1.5m (above 1GHz measurements) above the ground plane.

In the frequency range of 9kHz to 30MHz, an Active loop antenna was used. For X (Parallel), Y (Perpendicular) and Z (Ground-Parallel) antenna polarizations, the peak detector was set to MAX-HOLD and the range selected continuously scanned. The measuring antenna was positioned at 1m fixed height and the turntable slowly rotated. The peak preview measurements were performed with a resolution bandwidth of 200Hz (9kHz to 150kHz), 9kHz (150kHz to 30MHz) and a video bandwidth of 30kHz. Peak emissions that exceeded the limit or were close to the applicable limit were investigated further. The frequency of each emissions was then accurately determined. Each emission of interest was then in-turn maximised by using the turntable to rotate the EUT through 360 degrees to find the worst-case emission arrangement. Quasi peak or CISPR Average measurements were then performed using a measuring time of no less than 15 seconds. The final quasi-peak or CISPR Average measurements were performed using a receiver bandwidth of 6dB and a resolution bandwidth of 200 Hz (9kHz to 150kHz) and 9kHz (150kHz to 30MHz).

In the frequency range of 30MHz to 1GHz, a Biconilog antenna was used. For both horizontal and vertical antenna polarizations, the peak detector was set to MAX-HOLD and the range selected continuously scanned. The measuring antenna was positioned at 4 different fixed height positions and the turntable slowly rotated. The peak preview measurements were performed with a resolution bandwidth of 120kHz and a video bandwidth of 300kHz. Peak emissions that exceeded the limit or were close to the applicable limit were investigated further. The frequency of each emissions was then accurately determined. Each emission of interest was then in-turn maximised by using the turntable to rotate the EUT through 360 degrees and varying the height of the antenna between 1 and 4 metres to find the worst-case emission arrangement. Quasi peak measurements were then performed using a measuring time of no less than 15 seconds. The final quasi-peak measurements were performed using a receiver bandwidth of 6dB and a resolution bandwidth of 120kHz.

In the frequency range 1GHz to 2GHz a Horn antenna was used and an area of 3m x 3m was covered between the antenna and the EUT using RF absorbing material with a rated attenuation more than 20dB over the frequency range. The height of the horn antenna was varied using the antenna bore-sighting technique and the turntable slowly rotated to maximise the emissions. For both horizontal and vertical antenna polarizations, the Peak and Average preview measurements were performed with a resolution bandwidth of 1MHz and a video bandwidth of 3MHz. Peak and average emissions that exceeded the applicable limit or were close to the applicable limit were investigated further. Each emission of interest was then in-turn maximised by using the

turntable to rotate the EUT through 360 degrees and the antenna height varied (if applicable, using the antenna bore-sighting technique) to find the worst-case emission arrangement. Peak and CISPR Average measurements were then performed using a measuring time of 1 second with a number of repetitions to ensure a minimum observation time of 15 seconds, the maximum emission level in the observed duration was recorded as the final result. The final peak and CISPR Average measurements were performed using a receiver bandwidth of 6dB and a resolution bandwidth of 1MHz. Peak and Average measurements were performed at spot frequencies where the peak or average emission was close to, or exceeded the applicable limit line with the EUT rotation and antenna height varied (if applicable, using the antenna bore-sighting technique) to produce the highest emission.

| Horn | Frequency (GHz) | Degrees | Measuring Distance (m) | Illumination (m) | Measuring Distance (m | Illumination (m) |
|---|---|---|---|---|---|---|
| EMCO 3115 | 1 to 2 | 55.00 | 3 | 3.12 | 1 | 1.04 |
| | 2 to 4 | 50.00 | 3 | 2.80 | 1 | 0.93 |
| | 4 to 6 | 34.00 | 3 | 1.83 | 1 | 0.61 |
| AH SAS-584 | 6 to 8 | 30.00 | 3 | 1.61 | 1 | 0.54 |
| AH SAS-585 | 8 to 12 | 30.00 | 3 | 1.61 | 1 | 0.54 |
| AH SAS-586 | 12 to 18 | 30.00 | 3 | 1.61 | 1 | 0.54 |
| AH SAS 587 | 18 to 26.5 | 30.00 | 3 | 1.61 | 1 | 0.54 |
| AH SAS 588 | 26.5 to 40 | 31.00 | 3 | 1.66 | 1 | 0.55 |

Table 1: Worst case Maximum size of measuring envelope for Horn antennas

Plots of the accumulated measurement data for both horizontal and vertical antenna polarizations, including all transducer and other measuring system correction factors were produced using commercially available compliant software (as listed in the test equipment list of this report).

*(Refer to photographs 1 to 10 in Annex C for views of the test configuration)*

## 11.2. Requirements

As per section 15.225 (d) of CFR47 FCC Part 15, Subpart C:

- The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in 15.209 of CFR47 FCC Part 15, Subpart C

As per section 15.209 of CFR47 FCC Part 15, Subpart C (Radiated emissions, general requirements) the EUT is required to meet the limits specified in the following table:

| Frequency Range (MHz) | Limits at 3m (dBμV/m) |
|---|---|
| 0.009 to 0.490 | 128.5 to 93.8 |
| 0.490 to 1.705 | 73.8 to 62.9 |
| 1.705 to 30.0 | 69.5 |
| 30.0 to 88 | 40.0 |
| 88.0 to 216.0 | 43.5 |
| 216.0 to 960.0 | 46.0 |
| Above 960 | 54.0 |
| NOTE: The lower limit shall apply at the transition frequency. | |

*Note 1: as per CFR FCC Part 15 section15.209 (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector*

*Note 2: as per CFR FCC Part 15.35 (b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.*

Table 7: Limits for Radiated Spurious Emissions at distance of 3m

## 11.3. Test Results

Radiated Emissions measurements are tabulated below. For below 1GHz measurements, Quasi-peak measurements were performed at spot frequencies where the peak emission was close to, or exceeded the applicable limit line. For above 1GHz measurements, Peak or CISPR Average measurements were performed at spot frequencies where the peak or average emission was close to, or exceeded the applicable limit line.

*(Refer to graphs in Appendix C.2)*

| Antenna Orientation | Frequency (MHz) | Result Quai peak/ Average (dBµV/m) | Limit Quasi-peak/ Average (dBµV/m) | Delta limit (dB) |
|---|---|---|---|---|
| X | Peak emissions were not above the measurements system noise floor or at least 20dB below the limit outside the band 13.110 to 14.010MHz | | | |
| Y | 0.353 | 62.1 | 96.6 | -34.5 |
| | 0.588 | 50.6 | 72.2 | -21.6 |
| | 0.989 | 49.7 | 67.6 | -17.9 |
| | 1.390 | 48.9 | 64.8 | **-15.9*** |
| Z | Peak emissions were not above the measurements system noise floor or at least 20dB below the limit outside the band 13.110 to 14.010MHz | | | |

**Worst-case emission*

Table 8: Radiated Spurious Emissions – 9kHz to 30MHz

| Antenna polarisation | Frequency (MHz) | Result Quasi-peak (dBµV/m) | Limit Quasi-peak (dBµV/m) | Delta limit (dB) |
|---|---|---|---|---|
| Horizontal | 216.968 | 35.4 | 46.0 | -10.6 |
| | 230.548 | 35.9 | 46.0 | -10.1 |
| | 244.079 | 43.6 | 46.0 | **-2.4*+** |
| | 257.659 | 35.7 | 46.0 | -10.4 |
| | 271.239 | 43.3 | 46.0 | -2.7+ |
| Vertical | 135.585 | 34.2 | 43.5 | -9.3 |
| | 162.696 | 35.1 | 43.5 | -8.5 |
| | 176.276 | 35.3 | 43.5 | -8.2 |
| | 203.388 | 35.0 | 43.5 | -8.5 |
| | 216.968 | 43.2 | 46.0 | -2.8+ |
| | 244.079 | 42.6 | 46.0 | -3.5+ |
| | 257.659 | 38.7 | 46.0 | -7.3 |
| | 271.191 | 40.2 | 46.0 | -5.8 |

**Worst-case emissions, +Refer to measurement uncertainty statement*

Table 9: Radiated Spurious Emissions – 30MHz to 1GHz

| Antenna polarisation | Peak Measurements | | | | Average Measurements | | | |
|---|---|---|---|---|---|---|---|---|
| | Frequency (MHz) | Result (dBµV/m) | Limit (dBµV/m) | Delta Limit (dB) | Frequency (MHz) | Result (dBµV/m) | Limit (dBµV/m) | Delta Limit (dB) |
| Horizontal | Peak emissions were not above the measurements system noise floor or at least 20dB below the limit | | | | Average emissions were not above the measurements system noise floor or at least 20dB below the limit | | | |
| Vertical | Peak emissions were not above the measurements system noise floor or at least 20dB below the limit | | | | Average emissions were not above the measurements system noise floor or at least 20dB below the limit | | | |

Table 10: Radiated Spurious Emissions – 1GHz to 2GHz

The measurement uncertainty was calculated as follows:

| Measurement frequency range | Calculated measurement uncertainty |
|---|---|
| 0.009MHz to 30MHz | ±4.3dB |
| 30MHz to 1GHz | ±4.6dB |
| 1GHz to 6GHz | ±4.8dB |

The reported uncertainty is an expanded uncertainty calculated using a coverage factor of *k=2* which gives a level of confidence of approximately 95%. The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement uncertainty. However, the measurement uncertainty shall appear in the test report.

| Climatic Conditions | |
|---|---|
| Temperature: | 20°C |
| Humidity: | 48% |
| Atmospheric pressure: | 1016.1 to 1017.6hPa |

Table 11: Climatic conditions

**Calculation:** The above results are based upon the following calculation:

$$E = V_{QP/PK/AV} + AF - G_{Amp} + L_C$$

Where:

| | | |
|---|---|---|
| $E$ | = | E-field in dBμV/m |
| $V_{QP/PK/AV}$ | = | Measured Voltage (Quasi Peak, Peak or Average) in dBμV |
| $AF$ | = | Antenna Factor in dB(/m) |
| $L_C$ | = | Cable and attenuator Loss in dB |
| $G_{Amp}$ | = | Pre Amplifier Voltage Gain in dB |

Example calculation:

$E = V_{PK} + AF - G_{Amp} + L_C$
$E = 30dB\mu V + 12dB/m - 0dB + 2.3dB$
$E = 44.3\ dB\mu V/m$

**Notes:** The field strength of any emissions appearing outside of the 13.110-14.010 MHz band measurements were below the specified CFR47 FCC Part 15, Subpart C 15.209 limits.

**Assessment:** The EUT complied with the field strength of any emissions appearing outside of the 13.110-14.010 MHz band requirements of CFR47 FCC Part 15, Subpart C 15.225 (d)

# 12. Frequency tolerance of the carrier signal - FCC Part 15.225 (e)

## 12.1. Test Procedure

The Frequency tolerance of the carrier signal (Frequency Stability) measurements were performed as per section 6.8 of ANSI C63.10 - 2013.

A near field probe was placed at least 15cm away from the EUT inside the environmental chamber and connected to an external spectrum analyser. The spectrum analyser was tuned to the fundamental (transmit frequency) of the transmitter. While maintaining a constant temperature inside the environmental chamber the operating frequency measurements were performed at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total were made at each temperature.

The frequency stability measurements were performed over the +50°C to -20°C with 10°C temperature steps at nominal supply voltage and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C.

| Voltage Specification | Voltage |
|---|---|
| Nominal | 13.75VDC |
| 85% of nominal | 11.68VDC |
| 115% of nominal | 15.81VDC |

Table 12: Frequency tolerance of the carrier signal – Voltage variation

*(Refer to photograph 11 & 12 in Annex A for views of the test configuration)*

## 12.2. Requirements

As per section 15.225 (e) of CFR47 FCC Part 15, Subpart C:

- The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to + 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Reference operating frequency at ambient (+20°C): 13.560781 MHz.

| Reference Frequency (MHz) | 0.01% Bandwidth (MHz) | Lower Frequency Limit (MHz) | Upper Frequency Limit (MHz) |
|---|---|---|---|
| 13.560781 | 0.001356 | 13.559425 | 13.562137 |

Table 13: Frequency tolerance of the carrier signal - Limits

### 12.3.Test Results

The Frequency tolerance of the carrier signal (Frequency Stability) are tabulated below:

| Reference Frequency: 13.560448MHz, Limit: 0.01% | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Temperature (°C) | Measured Frequency (MHz) | | | | Frequency Tolerance (%) | | | | Result |
| | at startup | After 2 min | After 5 min | After 10 min | at startup | After 2 min | After 5 min | After 10 min | |
| +50 | 13.560820 | 13.560820 | 13.560820 | 13.560830 | -0.0002 | -0.0002 | -0.0002 | -0.0001 | Complied |
| +40 | 13.560820 | 13.560820 | 13.560820 | 13.560823 | -0.0002 | -0.0002 | -0.0002 | -0.0002 | Complied |
| +30 | 13.560835 | 13.560823 | 13.560823 | 13.560835 | -0.0001 | -0.0002 | -0.0002 | -0.0001 | Complied |
| +20 | 13.560850 | 13.560850 | 13.560850 | 13.560850 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | Complied |
| +10 | 13.560865 | 13.560865 | 13.560865 | 13.560865 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | Complied |
| 0 | 13.560865 | 13.560878 | 13.560878 | 13.560878 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | Complied |
| -10 | 13.560850 | 13.560863 | 13.560863 | 13.560863 | 0.0000 | 0.0001 | 0.0001 | 0.0001 | Complied |
| -20 | 13.560808 | 13.560823 | 13.560835 | 13.560835 | -0.0003 | -0.0002 | -0.0001 | -0.0001 | Complied |

Table 14: Frequency tolerance of the carrier signal – Temperature variation at nominal voltage

| Reference Frequency: 13.560448MHz, Limit: 0.01% | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Supply Voltage | Measured Frequency (MHz) | | | | Frequency Tolerance (%) | | | | Result |
| | at startup | After 2 min | After 5 min | After 10 min | at startup | After 2 min | After 5 min | After 10 min | |
| 13.75 VDC (Nominal) | 13.560850 | 13.560850 | 13.560850 | 13.560850 | Reference | | | | |
| 11.69 VDC | 13.560850 | 13.560850 | 13.560850 | 13.560850 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | Complied |
| 15.81 VDC | 13.560860 | 13.560850 | 13.560850 | 13.560850 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | Complied |

Table 15: Frequency tolerance of the carrier signal – Voltage variation at +20°C

The measurement uncertainty was calculated as follows:

| Measurement Parameter | Calculated measurement uncertainty |
|---|---|
| Operating Frequency | ±10.5kHz |

The reported uncertainty is an expanded uncertainty calculated using a coverage factor of *k=2* which gives a level of confidence of approximately 95%. The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement uncertainty. However, the measurement uncertainty shall appear in the test report.

| Climatic Conditions | |
|---|---|
| Temperature: | 20°C |
| Humidity: | 38% |
| Atmospheric pressure: | 1017.6hPa |

Table 16: Climatic conditions

**Calculations:** Frequency Tolerance (%) = (($F_{measued}$ - $F_{reference}$)/ $F_{reference}$) x 100

$F_{measued}$ = Measured Frequency

$F_{reference}$ -= Reference Frequency

**Notes:** The Frequency tolerance of the carrier signal was maintained within ±0.01% of the operating frequency over a temperature variation of −20°C to +50°C at normal supply voltage (13.75VDC), and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of +20°C.

**Assessment:** The EUT complied with the Frequency tolerance of the carrier signal requirements of CFR47 FCC Part 15, Subpart C, Section15.225 (e).

# 13. 20dB Emission Bandwidth - FCC Part 15.215 (c)

## 13.1. Test Procedure

The 20dB Bandwidth was performed in accordance with the section 6.9 of ANSI C63.10 - 2013.

The EUT was placed on a polystyrene support at a height of 0.8m above the ground reference plane. The measuring antenna was located at a distance of 3m from the EUT, using the spectrum analyser. The worst-case transmitter orientation, measurement antenna polarization were used for each measurement. The spectrum analyzer centre frequency was tuned to the fundamental (transmit frequency) of the transmitter with span range between two times and five times the OBW (-20dB bandwidth). The nominal IF filter bandwith (RBW) was set to 1% to 5% of the OBW and video bandwidth (VBW) was set to three times the RBW. The peak detector was used with trace mode to max hold. The resultant bandwidth measurement was recorded.

*(Refer to photograph 1 to 6 in Annex A for views of the test configuration)*

## 13.2. Requirements

As per section 15.215 (c) of CFR47 FCC Part 15, Subpart C:

- Intentional radiators operating under the alternative provisions to the general emission limits, as contained in 15.217 through 15.257 of CFR47 FCC Part 15, Subpart C and in subpart E of CFR47 FCC Part 15, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated.

Designated Operating Frequency Band: 13.110MHz to 14.010MHz

## 13.3. Test Results

20dB Bandwidth measurements are tabulated below:

*(Refer to graphs in Appendix C.3)*

| Transmit operating frequency (MHz) | Measured 20dB Bandwidth Lower Frequency (MHz) | Measured 20dB Bandwidth Upper Frequency (MHz) | Designated Operating Band (MHz) | Comment |
|---|---|---|---|---|
| 13.560 | 13.448 | 13.778 | 13.110 to 14.010 | Complied |

Table 17: Results for 20dB Bandwidth

The measurement uncertainty was calculated as follows:

| Measurement Parameter | Calculated measurement uncertainty |
|---|---|
| Operating Frequency | ±10.5kHz |
| Bandwidth | ±14.96kHz |

The reported uncertainty is an expanded uncertainty calculated using a coverage factor of *k*=2 which gives a level of confidence of approximately 95%. The referenced uncertainty standard specifies that determination of compliance shall be based on measurements without taking into account measurement uncertainty. However, the measurement uncertainty shall appear in the test report.

| Climatic Conditions | |
|---|---|
| Temperature: | 20°C |
| Humidity: | 38% |
| Atmospheric pressure: | 1017.6hPa |

Table 18: Climatic conditions

**Notes:** The 20dB bandwidth of the emission was contained within the designated operating frequency band (13.110 MHz to 14.010 MHz).

**Assessment:** The EUT complied with the 20dB Emission Bandwidth requirements of CFR47 FCC Part 15, Subpart C section 15.215 (c).

## 14. Conclusion

The Inner Range Pty Ltd, 994725, SiferPad, NFC Reader with Keypad complied with the applicable requirements of CFR47 FCC Part 15, Subpart C sections 15.209, 15.225, 15.203 and 15.215(c).

# Appendix A – Test Equipment

| Inv. | Equipment | Make | Model No. | Serial No. | Calibration | |
|---|---|---|---|---|---|---|
| | | | | | Due | Type |
| **15.225 (a), (b), (c) and (d) Field strength (Radiated Emissions) - 9kHz to 30MHz and 20dB Bandwidth** | | | | | | |
| 1217 | ANALYSER, EMI Receiver | Rohde & Schwarz | ESU40 | 100182 | Apr-19 | E |
| 0024 | Loop Antenna | EMCO | 6502 | 2620 | Aug-19 | I |
| 1143 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84287041 | SN MY058/4PA | Jan-20 | I |
| 1145 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84279564 | SN MY056/4PA | Jan-20 | I |
| 0932 | CONTROLLER, Position | Sunol Sciences | SC104V-3 | 081006-1 | N/A | V |
| 0933 | TURNTABLE | Sunol Sciences | SM46C | 081006-2 | N/A | V |
| 0666 | ENCLOSURE, Semi-Anechoic, No 1 | RFI Industries | S800 iOATS | 1229 | Jul-19 | I |
| 1248 | HYGROMETER, Temp, Humidity | Thomas Scientific | 6066N53 | 181037404 | Mar-20 | E |
| SW007 | EMC Measurement Software | Rohde & Schwarz | EMC 32 | Version 8.53.0 | N/A | N/A |
| **15.225 (d) Field strength (Radiated Emissions) 30MHz to 1GHz** | | | | | | |
| 1217 | ANALYSER, EMI Receiver | Rohde & Schwarz | ESU40 | 100182 | Apr-19 | E |
| 0932 | CONTROLLER, Position | Sunol Sciences | SC104V-3 | 081006-1 | N/A | V |
| 0933 | TURNTABLE | Sunol Sciences | SM46C | 081006-2 | N/A | V |
| 0934 | MAST, Antenna | Sunol Sciences | TLT2 | 081006-5 | N/A | V |
| 0935 | ANTENNA, Biconilog | Sunol Sciences | JB5 | A071106 | Feb-21 | E |
| 0718 | ATTENUATOR, 6dB | JFW | 50FPE-006 | - | Jan-20 | I |
| 1143 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84287041 | SN MY058/4PA | Jan-20 | I |
| 1145 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84279564 | SN MY056/4PA | Jan-20 | I |
| 1248 | HYGROMETER, Temp, Humidity | Thomas Scientific | 6066N53 | 181037404 | Mar-20 | E |
| 0666 | ENCLOSURE, Semi-Anechoic, No 1 | RFI Industries | S800 iOATS | 1229 | Jul-19 | I |
| SW007 | EMC Measurement Software | Rohde & Schwarz | EMC 32 | Version 8.53.0 | N/A | N/A |
| **15.225 (d) Field strength (Radiated Emissions) 1GHz to 2GHz** | | | | | | |
| 1217 | ANALYSER, EMI Receiver | Rohde & Schwarz | ESU40 | 100182 | Apr-19 | E |
| 0932 | CONTROLLER, Position | Sunol Sciences | SC104V-3 | 081006-1 | N/A | V |
| 0933 | TURNTABLE | Sunol Sciences | SM46C | 081006-2 | N/A | V |
| 0934 | MAST, Antenna | Sunol Sciences | TLT2 | 081006-5 | N/A | V |
| 0633 | ANTENNA, Double Ridge Horn | EMCO | 3115 | 9712-5369 | Aug-21 | I |
| 0559 | PRE-AMP, Microwave, 18GHz | Miteq | AFS8 | 605305 | Nov-19 | I |
| 1143 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84287041 | MY058/4PA | Jan-20 | I |
| 1145 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84279564 | MY056/4PA | Jan-20 | I |
| 1238 | CABLE, Coax, Sucoflex 126 E | Huber + Suhner | 10422876 | 8000495/126E | Jan-20 | I |
| 1248 | HYGROMETER, Temp, Humidity | Thomas Scientific | 6066N53 | 181037404 | Mar-20 | E |
| 0666 | ENCLOSURE, Semi-Anechoic, No 1 | RFI Industries | S800 iOATS | 1229 | Jul-19 | I |
| SW007 | EMC Measurement Software | Rohde & Schwarz | EMC 32 | Version 8.53.0 | N/A | N/A |

| Inv | Equipment | Make | Model No | Serial No | Calibration | |
|---|---|---|---|---|---|---|
| | | | | | Due | Type |
| **Frequency tolerance of the carrier signal (Frequency Stability)** | | | | | | |
| 0954 | ANALYSER, EMI Receiver | Rohde+Schwarz | ESCI 3 | 100196 | Jun-19 | E |
| 0697 | PROBE, Near-field, E&H, set | ETS Lindgren | 7405 | 4747 | N/A | V |
| 0950 | CHAMBER, Environmental | Thermal Product Solutions - Tenney | TJR | 0702000083 | Mar-19 | I |
| 1148 | CABLE, Coax, Sucoflex 104PA | Huber + Suhner | 84287047 | SN MY059/4PA | Jan-20 | I |
| 1181 | Programmable DC Power supply | BK Precision | 9115-AT | 602186010717710003 | N/A | V |
| 0340 | METER, DMM | Fluke | 6648 | 63610440 | N/A | V |
| 1154 | HYGROMETER, Temp, Humidity | DigiTech | QM7312 | - | Jun-19 | I |

*V: Verification of operation against an internal reference*
*I: Internal calibration against a traceable standard*
*E: External calibration by a NATA or MRA equivalent endorsed facility*
*N/A: Not Applicable*

# Appendix B – Photographs

| Annex | Number | Photograph Description |
|---|---|---|
| A | 1 | EUT – External views |
| A | 2 | |
| A | 3 | |
| A | 4 | |
| A | 5 | |
| A | 6 | AE – Inception Controller |
| A | 7 | |
| A | 8 | AE – RFID tag |
| A | 9 | |
| B | 1 | EUT – Internal views |
| B | 2 | |
| B | 3 | |
| B | 4 | |
| B | 5 | |
| B | 6 | |
| C | 1 | Radiated measurements – EUT X Orientation |
| C | 2 | Radiated measurements – EUT Y Orientation |
| C | 3 | Radiated measurements – EUT Z Orientation |
| C | 4 | Radiated measurements – 9kHz to 30MHz – X Antenna orientation |
| C | 5 | Radiated measurements – 9kHz to 30MHz – Y Antenna orientation |
| C | 6 | Radiated measurements – 9kHz to 30MHz – Z Antenna orientation |
| C | 7 | Radiated measurements – 30MHz to 1000MHz – Horizontal orientation |
| C | 8 | Radiated measurements – 30MHz to 1000MHz – Vertical orientation |
| C | 9 | Radiated measurements – 1GHz to 2GHz – Horizontal orientation |
| C | 10 | Radiated measurements – 1GHz to 2GHz – Vertical orientation |
| C | 11 | Frequency Tolerance of Carrier Signal – Test configuration |
| C | 12 | |

| | | |
|---|---|---|
| EUT External Photographs | - | EMC Bayswater Test Report E1902-1136C-2 Annex A |
| EUT Internal Photographs | - | EMC Bayswater Test Report E1902-1136C-2 Annex B |
| EUT Orientations & Test Configurations Photographs | - | EMC Bayswater Test Report E1902-1136C-2 Annex C |

# Appendix C – Measurement Graphs

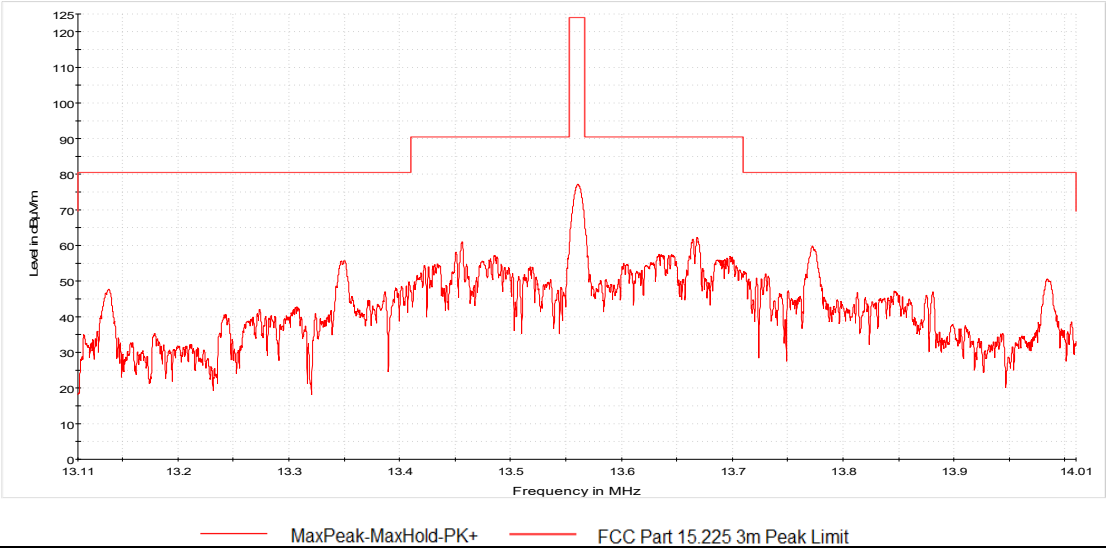
## Appendix C.1 – 15.225 (a), (b) and (c) Field Strength

| No. | Test | Graph Description |
|---|---|---|
| 1 | Field Strength | X measurement antenna polarisation |
| 2 | | Y measurement antenna polarisation |
| 3 | | Z measurement antenna polarisation |

## EMC Bayswater Pty. Ltd.

**Field Strength - FCC Part 15.225 (a), (b) and (c)**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**X measurement antenna polarisation**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL



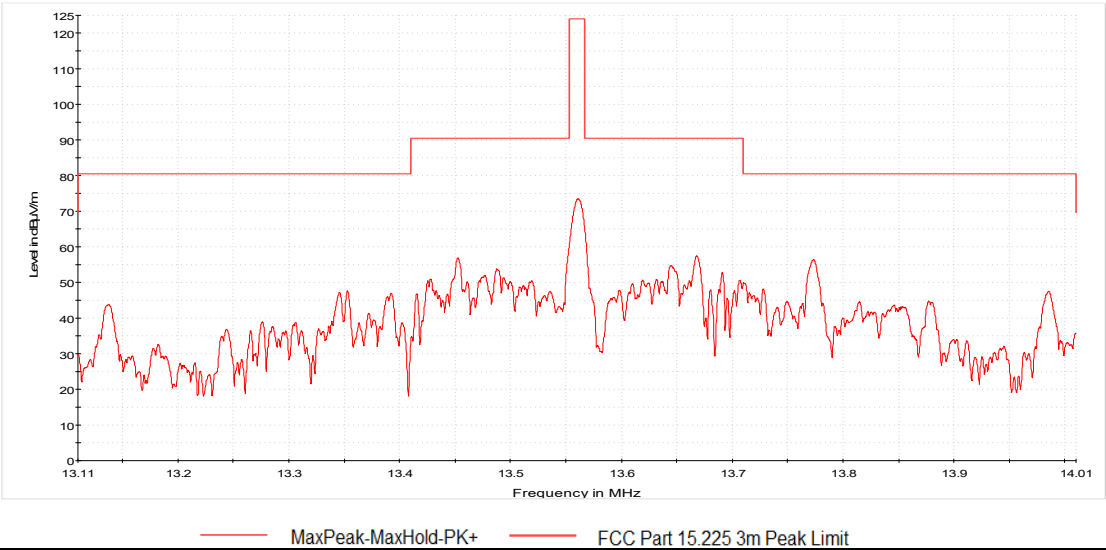



Graph 1

## EMC Bayswater Pty. Ltd.

**Field Strength - FCC Part 15.225 (a), (b) and (c)**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Y measurement antenna polarisation**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL



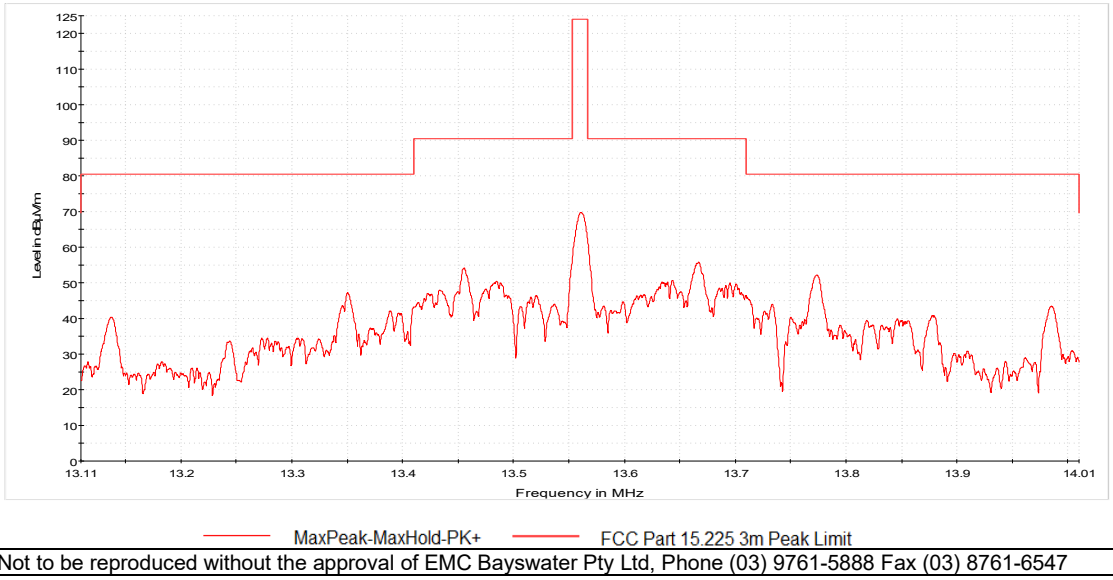



Graph 2

## EMC Bayswater Pty. Ltd.

**Field Strength - FCC Part 15.225 (a), (b) and (c)**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Z measurement antenna polarisation**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL






Graph 3

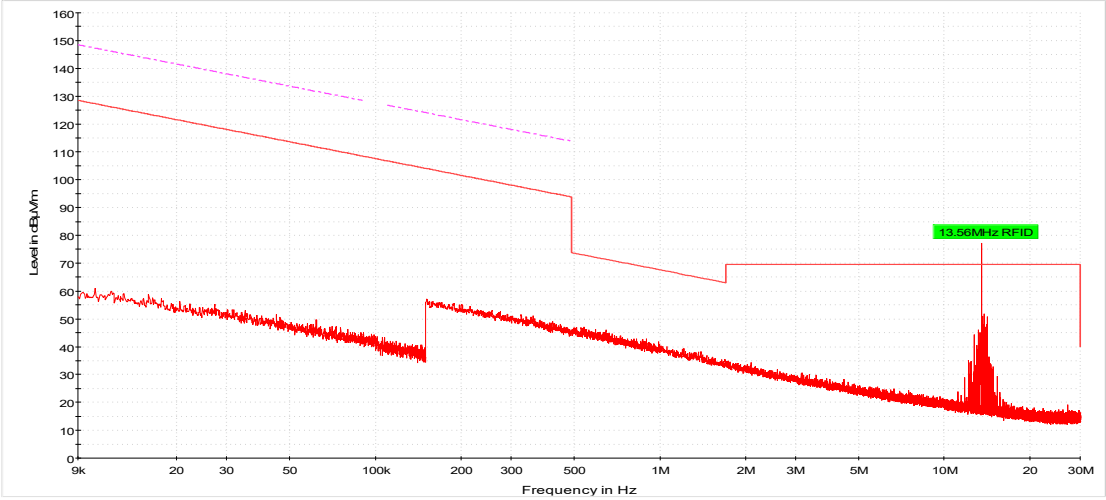
## Appendix C.2 – Field Strength outside the band 13.110-14.010 MHz (Spurious Emissions)

| No. | Test | Graph Description |
|---|---|---|
| 4 | Radiated Spurious Emissions | X measurement antenna polarisation – 9kHz to 30MHz |
| 5 | | Y measurement antenna polarisation – 9kHz to 30MHz |
| 6 | | Z measurement antenna polarisation – 9kHz to 30MHz |
| 7 | | Horizontal measurement antenna polarisation – 30MHz to 1GHz |
| 8 | | Horizontal measurement antenna polarisation – 1GHz to 2GHz |
| 9 | | Vertical measurement antenna polarisation – 30MHz to 1GHz |
| 10 | | Vertical measurement antenna polarisation – 1GHz to 2GHz |

## EMC Bayswater Pty. Ltd.

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**X measurement antenna polarisation – 9kHz to 30MHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL



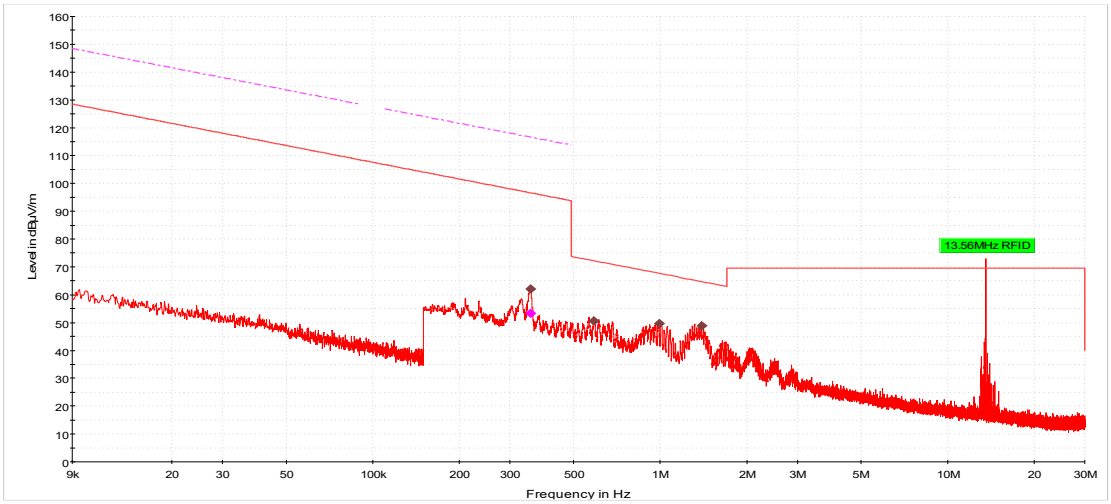



Graph 4

## EMC Bayswater Pty. Ltd.

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Y measurement antenna polarisation – 9kHz to 30MHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL



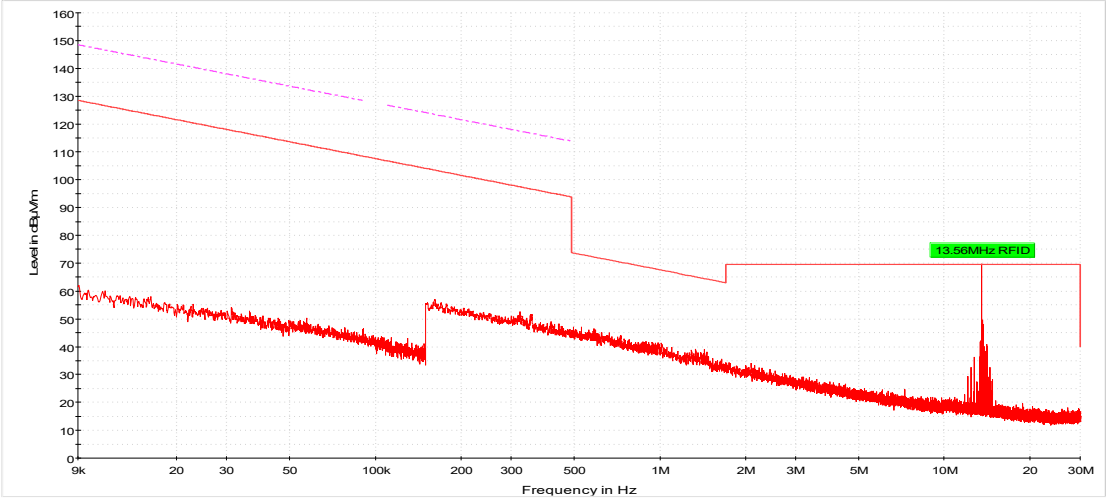



Graph 5

## EMC Bayswater Pty. Ltd.

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Z measurement antenna polarisation – 9kHz to 30MHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL



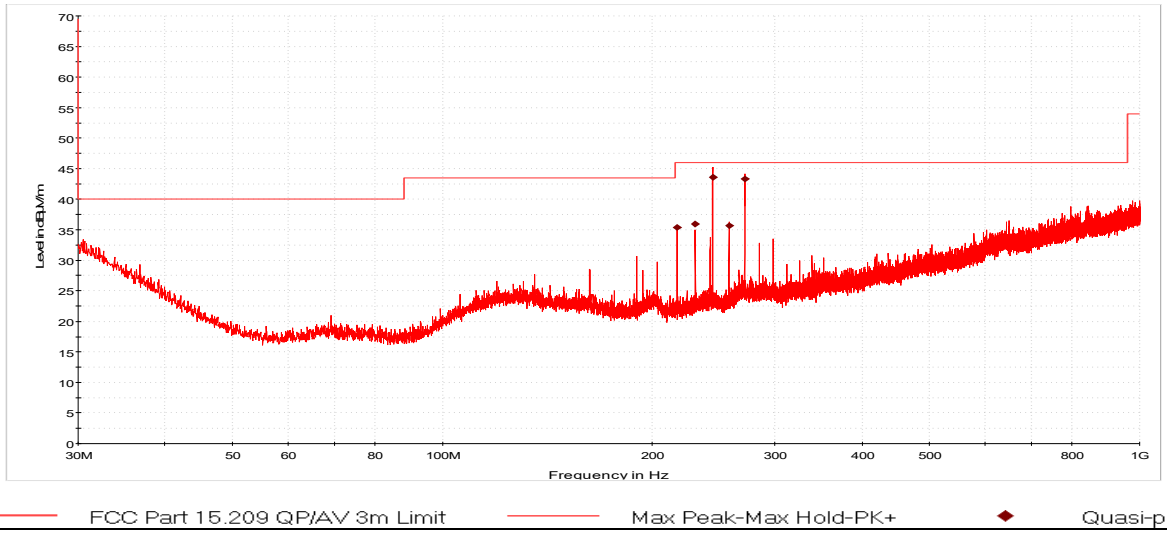



Graph 6

## EMC Bayswater Pty. Ltd.

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Horizontal antenna polarisation – 30MHz to 1GHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: FD



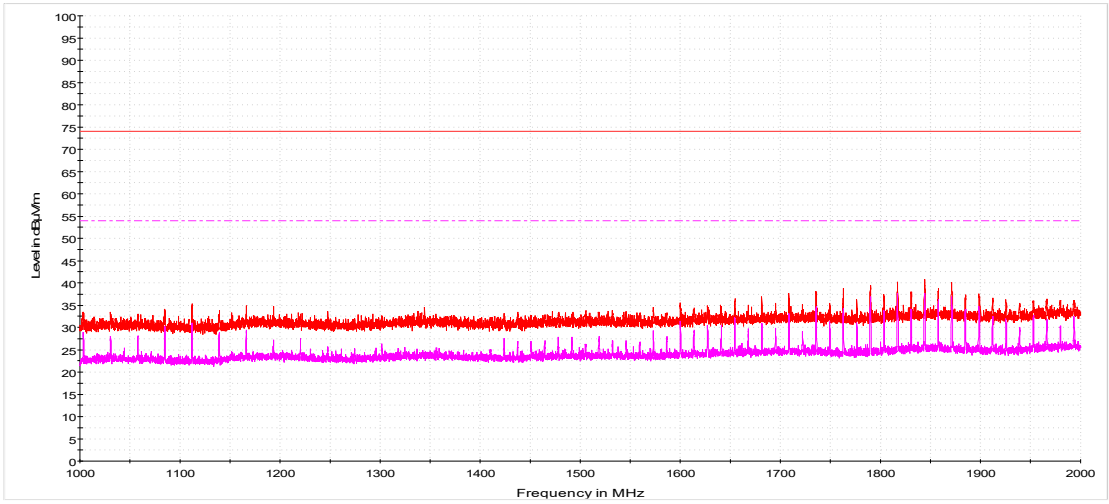



Graph 7

## EMC Bayswater Pty. Ltd.

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Horizontal antenna polarisation – 1GHz to 2GHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: FD



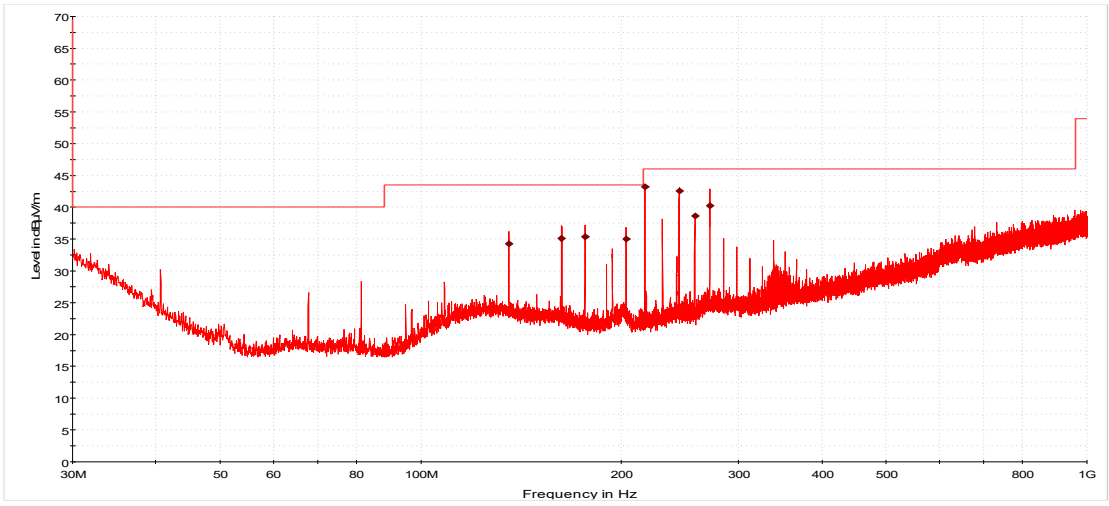



Graph 8

## EMC Bayswater Pty. Ltd.

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Vertical antenna polarisation – 30MHz to 1GHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: FD



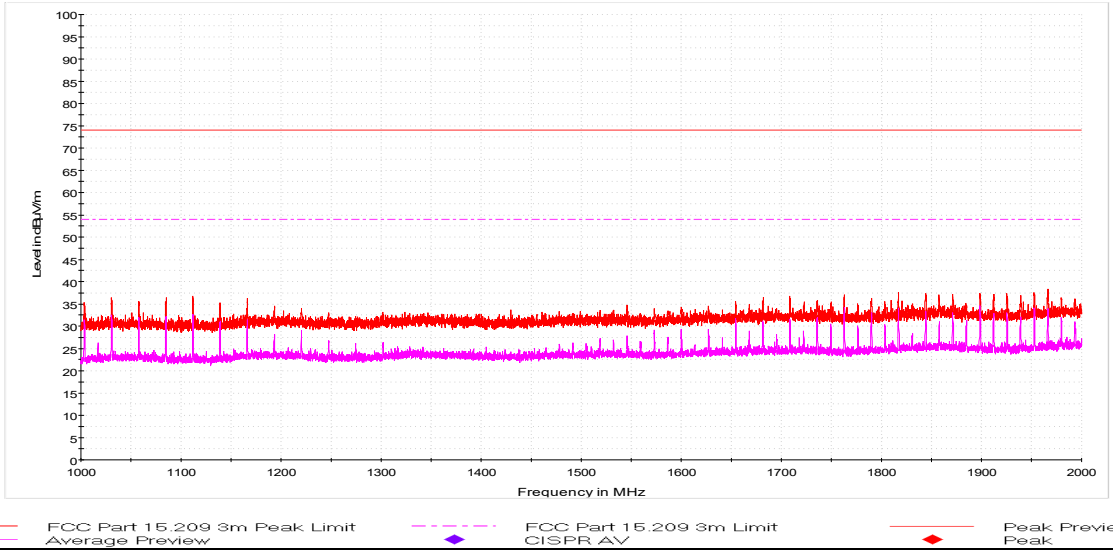



Graph 9

**EMC Bayswater Pty. Ltd.**

**Radiated Spurious Emission - FCC Part 15.209**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Vertical antenna polarisation – 1GHz to 2GHz**

Job Number: E1902-1136C-2 Rev1
Test Engineer: FD






Graph 10

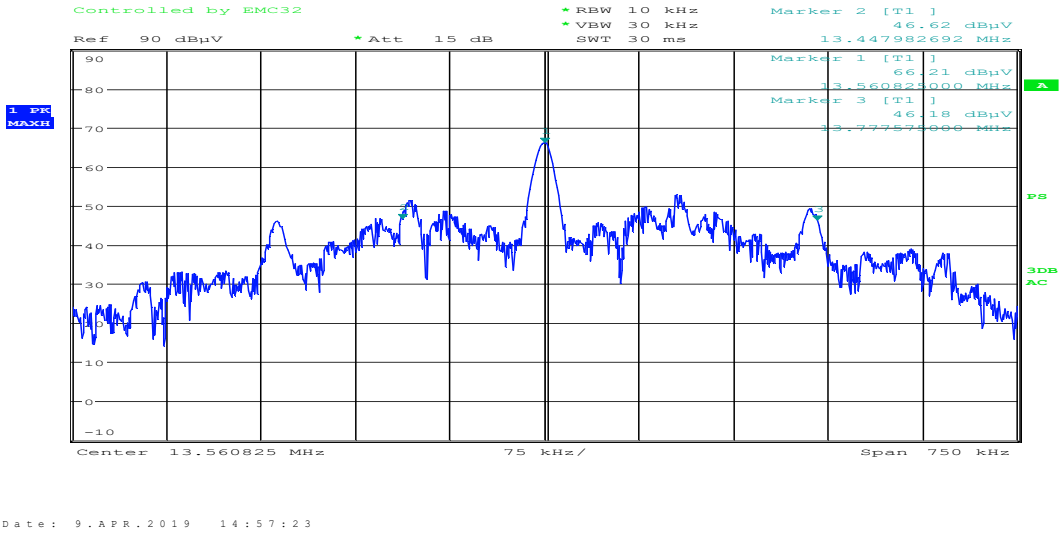
## Appendix C.3 – 20dB Emission Bandwidth

| No. | Test | Graph Description |
|---|---|---|
| 11 | 20dB Emission Bandwidth | Normal test conditions |

## EMC Bayswater Pty. Ltd.

**CFR47 FCC Part 15, Subpart C – 15.215 (c) 20dB Emission Bandwidth**
**Inner Range Pty Ltd - 994725 - SiferPad, NFC Reader with Keypad**
**Normal voltage (13.75V) and Room Temperature (20ºC)**

Job Number: E1902-1136C-2 Rev1
Test Engineer: NL






Graph 11