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RADIO CERTIFICATION REPORT

In accordance with:

CFR47 FCC Part 15, Subpart C

Inner Range Pty Ltd

994726

SIFER Keypad Mobile Access

FCC ID: 2ASIN-994726

REPORT: E2101-1380B-4
DATE: September, 2021

WORLD RECOGNISED ACCREDITATION

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

Certificate of Compliance

EMC Bayswater Test Report: E2101-1380B-4
Issue Date: September, 2021

Test Sample(s):	SIFER Keypad Mobile Access
Model No:	SIFER Keypad Mobile Access
Serial No:	None stated
Part No:	994726
FCC ID:	2ASIN-994726

Client Details:

Mr Sean Regan
Inner Range Pty Ltd
1 Millennium Court
Knoxfield, Victoria, 3180, Australia

Phone No: 03 9780 4300
e-mail: Sean.regan@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 13.410-13.553 MHz and 13.567-13.710 MHz	***Complied***
15.225 (c) - Field Strength within the bands 13.110-13.410 MHz 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): 13th of January, 2021 to 24th of February, 2021

Test House (Issued By):

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

FCC Accredited Test Firm Registration number: 527798
FCC Accredited Test Firm Designation number: AU0004

Phone No: +61 3 9761 5888 e-mail: sales@emcbayswater.com.au
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This is to certify that the necessary measurements were made by EMC Bayswater Pty Ltd, and that the Inner Range Pty Ltd, 994726, SIFER Keypad Mobile Access, has been tested in accordance with requirements contained in the appropriate commission regulations.

Prepared & tested by:	Approved by:	
		30/09/2021 10:44
Adnan Zaman (EMC Test Engineer)	Neville Liyanapatabendige (Manager)	Date

Radio Certification Report
for
Inner Range Pty Ltd

Contents

1. Introduction

Radio tests were performed on an Inner Range Pty Ltd, 994726, SIFER Keypad Mobile Access in accordance with the requirements of Title 47 of the standard CFR47 FCC Part 15, Subpart C.

2. Test Report Revision History

None

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 45.2dB
15.225 (b)	Field Strength within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	Complied by 27.4dB
15.225 (c)	Field Strength within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	Complied by 21.5dB
15.225 (d), 15.209	Field Strength outside the band 13.110-14.010 MHz	Complied by 12.9dB
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

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:	SIFER Keypad Mobile Access	
Model No:	SIFER Keypad Mobile Access	
Part No:	994726	
Serial No:	None stated	
Variant:	None stated	
Firmware:	V1.18b22	
Software:	None Stated	
Dimensions:	10(L) x 6(W) x 2.5(D) (cm)	
Weight:	<250g	
Power Specifications:	13.75V DC	
Orientation:	The EUT is typically used in one orientation only	
RFID Transceiver:	Description:	Integrated RFID
	Type:	13.56MHz RFID Transceiver
	Modulation:	None Stated
	Channels:	Single Channel
	Max power:	<25mW
	Antenna Type:	Internal, Integrated into PCB
	Antenna Gain:	None stated
	FCC ID:	2ASIN-994726
Bluetooth Transmitter details: **PRE APPROVED MODULE**	Manufacturer:	Silicon Laboratories Finland oy
	Description:	Bluetooth
	Type:	Bluetooth
	Modulation:	GFSK
	Channels:	Minimum 15
	Max power:	Max power <500mW
	Antenna:	Integrated into PCB
	FCC ID:	QOQBGM12LMA
	IC:	5123A-BGM12LMA
	CE mark:	Yes

(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:

“13.56MHz SIFER RFID 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 2.4GHz.

(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 199733

5.4. Product operating modes

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

Mode 1: RFID Idle: Normal operation waiting for RFID, tag not presented, Bluetooth Idle (not paired) polling

Mode 2: RFID Active: On Continuous TX/RX, tag present, Bluetooth Idle (Not Paired)

(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 1: RFID Idle: Normal operation waiting for RFID, tag not presented, Bluetooth Idle (not paired) polling

Mode 2: RFID Active: On Continuous TX/RX, tag present, Bluetooth Idle (Not Paired)

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.

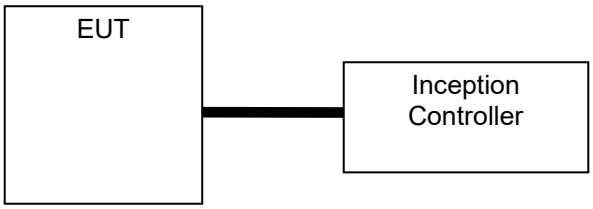


Figure 1: Block diagram of EUT test configuration without Tag

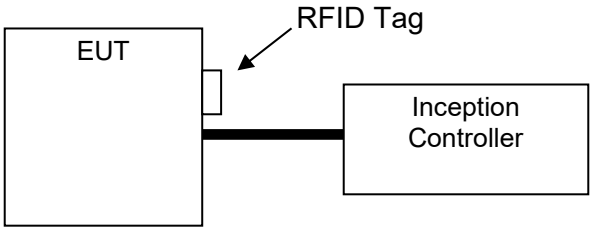


Figure 2: Block diagram of EUT test configuration with Tag

Port	Cable Type	Cable Brand	Cable Model	Length (m)	Termination
RS-485 LAN	4 Core Un-shielded Twisted Pair cable	Altronics	0420	15m	Inception Controller Reader LAN Port

Table 2: List of ports, loads and cable lengths used for testing

5.7. 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.

EMC Bayswater Pty Ltd's FCC Test Firm Designation number is AU0004.

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
Inner Range Pty Ltd
EMC Testing Schedule SIFERPass Reader and Keypad with Bluetooth
Version: Rev3
Date: 03/09/2021

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 and 10 to 15 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 (dB□V/m)	Limit at 3m *Note 1* (dB□V/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 3: 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 (dB□V/m)	Limit at 3m (dB□V/m)	Delta limit (dB)
15.225 (a)	13.553 to 13.567	13.561	78.8	124.0	-45.2
15.225 (b)	13.410 to 13.553	13.544	57.3	90.5	-33.2
	13.567 to 13.710	13.572	63.0	90.5	**-27.5***
15.225 (c)	13.110 to 13.410	13.267	45.1	80.5	-35.4
	13.710 to 14.010	13.770	46.4	80.5	-34.1

**Worst-case emissions*

Table 4: Field Strength within the 13.110MHz to 14.010MHz bands – Mode 1 (Without Tag)

FCC Par 15 Section	Frequency Band (MHz)	Frequency (MHz)	Measured Field Strength at 3m Peak (dB□V/m)	Limit at 3m (dB□V/m)	Delta limit (dB)
15.225 (a)	13.553 to 13.567	13.561	78.4	124.0	-45.6
15.225 (b)	13.410 to 13.553	13.455	63.0	90.5	-27.5
	13.567 to 13.710	13.667	63.1	90.5	-27.4
15.225 (c)	13.110 to 13.410	13.349	59.0	80.5	**-21.5***
	13.710 to 14.010	13.773	58.4	80.5	-22.1

**Worst-case emissions*

Table 5: Field Strength within the 13.110MHz to 14.010MHz bands – Mode 2 (With Tag)

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:	22 to 24□C
Humidity:	43 to 47%
Atmospheric pressure:	1008.9 to 1013.7hPa

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 1GHz) 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.

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.

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 8 and 10 to 17 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 (dBV/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.

(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	62.4	96.6	-34.2
	0.987	50.7	67.7	-17.0
	1.317	49.6	65.2	**-15.6***
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 – Mode 1 (Without Tag)

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	0.354	62.3	96.6	-34.3
	0.988	51.1	67.7	-16.6
	1.316	50.4	65.2	**-14.8***
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 9: Radiated Spurious Emissions – 9kHz to 30MHz – Mode 2 (With Tag)

Antenna polarisation	Frequency (MHz)	Result Quasi-peak (dB□V/m)	Limit Quasi-peak (dB□V/m)	Delta limit (dB)
Horizontal	216.968	26.6	46.0	-19.4
	257.659	26.2	46.0	-19.8
	853.094	31.6	46.0	**-14.4***
Vertical	40.670	27.1	40.0	**-12.9***
	216.968	31.5	46.0	-14.5
	919.830	32.3	46.0	-13.7

**Worst-case emissions*

Table 10: Radiated Spurious Emissions – 30MHz to 1GHz – Mode 1 (Without Tag)

Antenna polarisation	Frequency (MHz)	Result Quasi-peak (dB□V/m)	Limit Quasi-peak (dB□V/m)	Delta limit (dB)
Horizontal	203.388	27.4	43.5	-16.1
	216.968	28.6	46.0	-17.4
	899.363	31.9	46.0	**-14.1***
Vertical	40.670	26.8	40.0	**-13.2***
	216.968	30.2	46.0	-15.8
	731.650	30.1	46.0	-15.9

**Worst-case emissions*

Table 11: Radiated Spurious Emissions – 30MHz to 1GHz – Mode 2 (With Tag)

The measurement uncertainty was calculated as follows:

Measurement frequency range	Calculated measurement uncertainty
0.009MHz to 30MHz	±4.3dB
30MHz to 1GHz	±4.65dB

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:	22 to 24□C
Humidity:	43 to 47%
Atmospheric pressure:	1008.9 to 1013.7hPa

Table 12: 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 dB□V/m
$V_{QP/PK/AV}$	=	Measured Voltage (Quasi Peak, Peak or Average) in dB□V
AF	=	Antenna Factor in dB(/m)
L_C	=	Cable and attenuator Loss in dB
G_{Amp}	=	Pre Amplifier Voltage Gain in dB

Example calculation:

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

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 13: Frequency tolerance of the carrier signal – Voltage variation

(Refer to photographs 9 & 18 in Annex C 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): 13.561020 MHz

Reference Frequency (MHz)	0.01% Bandwidth (MHz)	Lower Frequency Limit (MHz)	Upper Frequency Limit (MHz)
13.560960	0.001356	13.559604	13.562316

Table 14: Frequency tolerance of the carrier signal – Limits – Mode 1 (Without Tag)

Reference Frequency (MHz)	0.01% Bandwidth (MHz)	Lower Frequency Limit (MHz)	Upper Frequency Limit (MHz)
13.560960	0.001356	13.559604	13.562316

Table 15: Frequency tolerance of the carrier signal – Limits – Mode 2 (With Tag)

12.3. Test Results

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

Reference Frequency: 13.560960MHz, 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	13.560960	13.560940	13.560940	13.560940	0.0000	-0.0001	-0.0001	-0.0001	Complied
+40	13.560940	13.560940	13.560940	13.560940	-0.0001	-0.0001	-0.0001	-0.0001	Complied
+30	13.560960	13.560960	13.560960	13.560960	0.0000	0.0000	0.0000	0.0000	Complied
+20	13.560960	13.560960	13.560980	13.560980	0.0000	0.0000	0.0001	0.0001	Complied
+10	13.560980	13.560980	13.560980	13.560980	0.0001	0.0001	0.0001	0.0001	Complied
0	13.560980	13.560980	13.560980	13.560980	0.0001	0.0001	0.0001	0.0001	Complied
-10	13.560960	13.560960	13.560960	13.560960	0.0000	0.0000	0.0000	0.0000	Complied
-20	13.560900	13.560900	13.560900	13.560900	-0.0004	-0.0004	-0.0004	-0.0004	Complied

Table 16: Frequency tolerance of the carrier signal – Temperature variation at nominal voltage – Mode 1 (Without Tag)

Reference Frequency: 13.560960MHz, 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)	13.560960	13.560960	13.056096	13.560960	Reference				
11.68 VDC	13.560960	13.560960	13.560960	13.560960	0.0000	0.0000	0.0000	0.0000	Complied
15.81 VDC	13.560960	13.560960	13.560960	13.560960	0.0000	0.0000	0.0000	0.0000	Complied

Table 17: Frequency tolerance of the carrier signal – Voltage variation at +20°C – Mode 1 (Without Tag)

Reference Frequency: 13.560960MHz, 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	13.560960	13.560940	13.560940	13.560940	0.0000	-0.0001	-0.0001	-0.0001	Complied
+40	13.560940	13.560940	13.560940	13.560940	-0.0001	-0.0001	-0.0001	-0.0001	Complied
+30	13.560940	13.560940	13.560940	13.560940	-0.0001	-0.0001	-0.0001	-0.0001	Complied
+20	13.560960	13.560960	13.560960	13.560960	0.0000	0.0000	0.0000	0.0000	Complied
+10	13.560980	13.560980	13.560980	13.560980	0.0001	0.0001	0.0001	0.0001	Complied
0	13.561000	13.561000	13.560980	13.560980	0.0003	0.0003	0.0001	0.0001	Complied
-10	13.560980	13.560980	13.560980	13.560980	0.0001	0.0001	0.0001	0.0001	Complied
-20	13.560980	13.560980	13.560980	13.560980	0.0001	0.0001	0.0001	0.0001	Complied

Table 18: Frequency tolerance of the carrier signal – Temperature variation at nominal voltage – Mode 2 (With Tag)

Reference Frequency: 13.560960MHz, 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)	13.560960	13.560960	13.056096	13.560960	Reference				
11.68 VDC	13.560960	13.560960	13.560960	13.560960	0.0000	0.0000	0.0000	0.0000	Complied
15.81 VDC	13.560960	13.560960	13.560940	13.560940	0.0000	0.0000	-0.0001	-0.0001	Complied

Table 19: Frequency tolerance of the carrier signal – Voltage variation at +20°C – Mode 2 (With Tag)

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:	23□C
Humidity:	46%
Atmospheric pressure:	1012.0hPa

Table 20: Climatic conditions

Calculations: Frequency Tolerance (%) = $((F_{measaued} - F_{reference})/ F_{reference}) \times 100$

$F_{measaued}$ = 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 photographs 1 to 6 and 10 to 15 in Annex C 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	13.350	13.773	13.110 to 14.010	Complied

Table 21: Results for 20dB Bandwidth – Mode 1 (Without Tag)

Transmit operating frequency (MHz)	Measured 20dB Bandwidth Lower Frequency (MHz)	Measured 20dB Bandwidth Upper Frequency (MHz)	Designated Operating Band (MHz)	Comment
13.560	13.346	13.775	13.110 to 14.010	Complied

Table 22: Results for 20dB Bandwidth – Mode 2 (With Tag)

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:	22□C
Humidity:	43%
Atmospheric pressure:	1008.9hPa

Table 23: Climatic conditions

Notes: The 20 dB 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, 994726, SIFER Keypad Mobile Access 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		
					Interval	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	1 year	May-22	E
0932	CONTROLLER, Position	Sunol Sciences	SC104V-3	081006-1	N/A	N/A	V
0933	TURNTABLE	Sunol Sciences	SM46C	081006-2	N/A	N/A	V
0024	ANTENNA, Active Loop	EMCO	6502	2620	2 years	Aug-23	I
1143	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84287041	SN MY058/4PA	1 year	Jan-22	I
1145	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84279564	SN MY056/4PA	1 year	Jan-22	I
1248	HYGROMETER, Temp, Humidity	Thomas Scientific	6066N53	181037404	2 years	Feb-22	I
0666	ENCLOSURE, Semi-Anechoic, No 1	RFI Industries	S800 iOATS	1229	2 years	Jan-22	I
SW007	EMC Measurement Software	Rohde & Schwarz	EMC 32	Version 8.53.0	N/A	N/A	N/A
	15.225 (d) Field strength (Radiated Emissions) 30MHz to 1GHz						
1217	ANALYSER, EMI Receiver	Rohde & Schwarz	ESU40	100182	1 year	May-22	E
0932	CONTROLLER, Position	Sunol Sciences	SC104V-3	081006-1	N/A	N/A	V
0933	TURNTABLE	Sunol Sciences	SM46C	081006-2	N/A	N/A	V
0934	MAST, Antenna	Sunol Sciences	TLT2	081006-5	N/A	N/A	V
0935	ANTENNA, Biconilog	Sunol Sciences	JB5	A071106	2 years	Feb-23	E
0718	ATTENUATOR, 6dB	JFW	50FPE-006	-	2 years	Jan-22	I
1143	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84287041	SN MY058/4PA	1 year	Jan-22	I
1145	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84279564	SN MY056/4PA	1 year	Jan-22	I
1248	HYGROMETER, Temp, Humidity	Thomas Scientific	6066N53	181037404	2 years	Feb-22	I
0666	ENCLOSURE, Semi-Anechoic, No 1	RFI Industries	S800 iOATS	1229	2 years	Jan-22	I
SW007	EMC Measurement Software	Rohde & Schwarz	EMC 32	Version 8.53.0	N/A	N/A	N/A
	Frequency tolerance of the carrier signal (Frequency Stability)						
0954	ANALYSER, EMI Receiver	Rohde+Schwarz	ESCI 3	100196	1 year	Aug-22	E
0697	PROBE, Near-field, E&H, set	ETS Lindgren	7405	4747	N/A	N/A	V
0843	ATTENUATOR, 10dB	JFW	50HF-010N	-	3 years	Nov-21	V
1237	CABLE, Coax, Sucoflex 126 E	Huber + Suhner	85072830	SN MY953/26EA	1 year	Jan-22	I
0950	CHAMBER, Environmental	Thermal Product Solutions - Tenney	TJR	0702000083	2 years	Jul-23	I
1148	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84287047	SN MY059/4PA	1 year	Jan-22	I
1181	Programmable DC Power supply	BK Precision	9115-AT	60218601071771 0003	N/A	N/A	V
1154	HYGROMETER, Temp, Humidity	DigiTech	QM7312	-	2 years	Jul-23	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	AE – Inception Controller
A	5	
A	6	AE – Connector Board
A	7	AE – RFID tag
B	1	EUT – Internal views
B	2	
B	3	
B	4	
B	5	
B	6	
C	1	Radiated measurements – EUT X Orientation – Mode 1
C	2	Radiated measurements – EUT Y Orientation – Mode 1
C	3	Radiated measurements – EUT Z Orientation – Mode 1
C	4	Radiated measurements – 9kHz to 30MHz – X Antenna orientation – Mode 1
C	5	Radiated measurements – 9kHz to 30MHz – Y Antenna orientation – Mode 1
C	6	Radiated measurements – 9kHz to 30MHz – Z Antenna orientation – Mode 1
C	7	Radiated measurements – 30MHz to 1000MHz – Mode 1
C	8	
C	9	Frequency Tolerance of Carrier Signal – Test configuration – Mode 1
C	10	Radiated measurements – EUT X Orientation – Mode 2
C	11	Radiated measurements – EUT Y Orientation – Mode 2
C	12	Radiated measurements – EUT Z Orientation – Mode 2
C	13	Radiated measurements – 9kHz to 30MHz – X Antenna orientation – Mode 2
C	14	Radiated measurements – 9kHz to 30MHz – Y Antenna orientation – Mode 2
C	15	Radiated measurements – 9kHz to 30MHz – Z Antenna orientation – Mode 2
C	16	Radiated measurements – 30MHz to 1000MHz – Mode 2
C	17	
C	18	Frequency Tolerance of Carrier Signal – Test configuration – Mode 2

EUT External Photographs	-	EMC Bayswater Test Report E2101-1380B-4 Annex A
EUT Internal Photographs	-	EMC Bayswater Test Report E2101-1380B-4 Annex B
EUT Orientations & Test Configurations Photographs	-	EMC Bayswater Test Report E2101-1380B-4 Annex C

Appendix C – Measurement Graphs

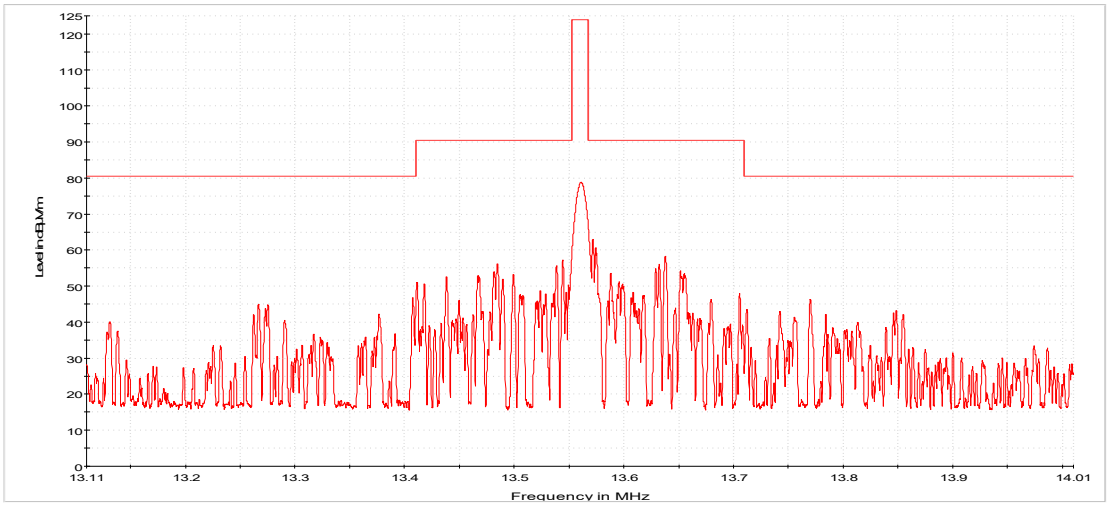
Appendix C.1 – 15.225 (a), (b) and (c) Field Strength

No.	Test	Graph Description
1	Field Strength – Mode 1	X measurement antenna polarisation
2		Y measurement antenna polarisation
3		Z measurement antenna polarisation
4	Field Strength – Mode 2	X measurement antenna polarisation
5		Y measurement antenna polarisation
6		Z measurement antenna polarisation

EMC Bayswater Pty. Ltd.

Field Strength - FCC Part 15.225 (a), (b) and (c)
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – X measurement antenna polarisation

Job Number: E2101-1380B-4
Test Engineer: AZ

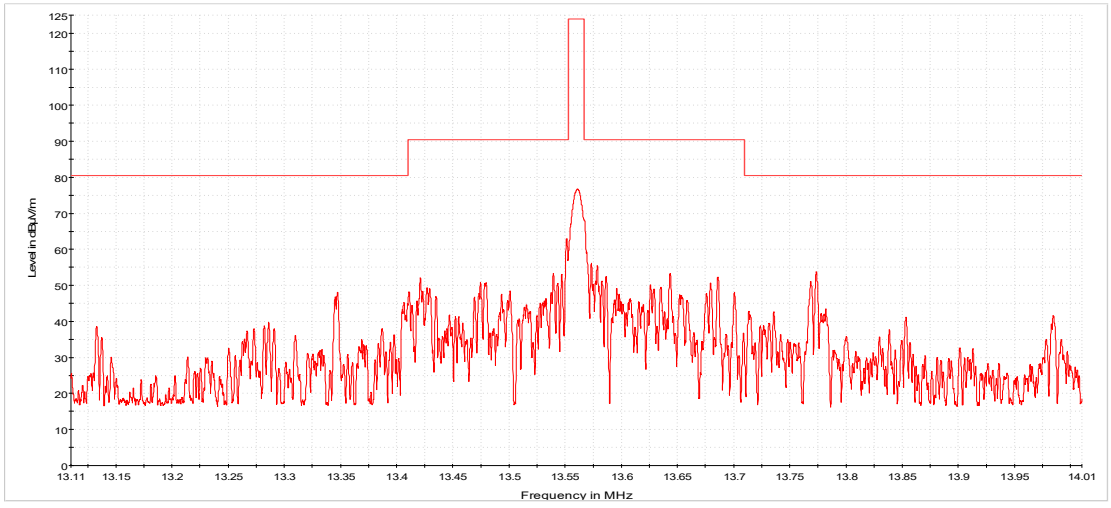


Graph 1

EMC Bayswater Pty. Ltd.

Field Strength - FCC Part 15.225 (a), (b) and (c)
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – Y measurement antenna polarisation

Job Number: E2101-1380B-4
Test Engineer: AZ

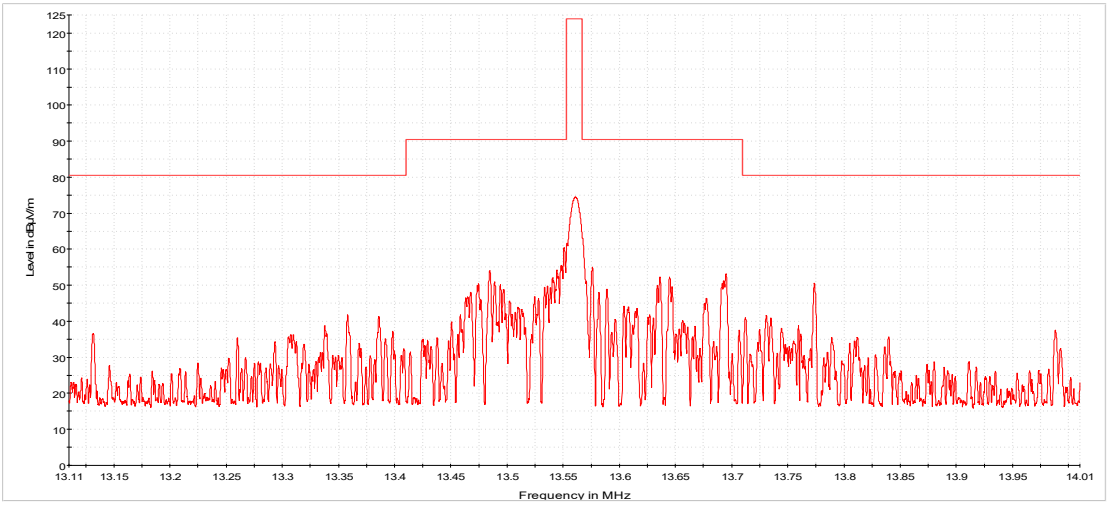


Graph 2

EMC Bayswater Pty. Ltd.

Field Strength - FCC Part 15.225 (a), (b) and (c)
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – Z measurement antenna polarisation

Job Number: E2101-1380B-4
Test Engineer: AZ

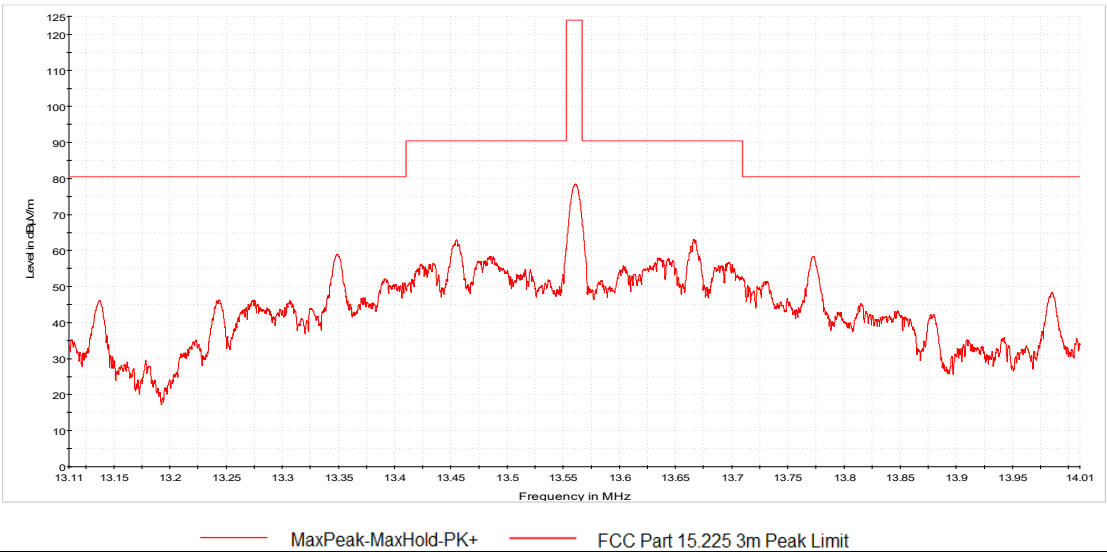


Graph 3

EMC Bayswater Pty. Ltd.

Field Strength - FCC Part 15.225 (a), (b) and (c)
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – X measurement antenna polarisation

Job Number: E2101-1380B-4
Test Engineer: AZ

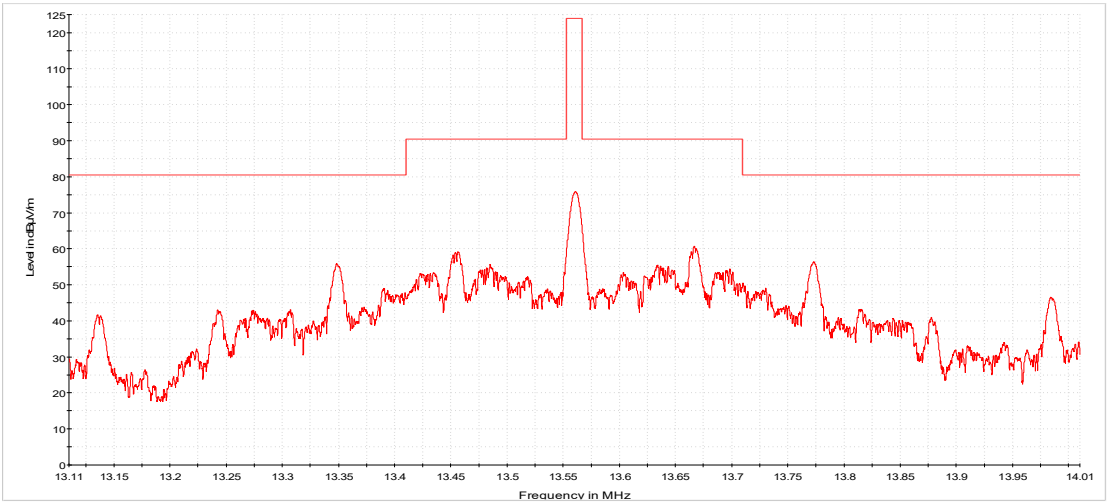


Graph 4

EMC Bayswater Pty. Ltd.

Field Strength - FCC Part 15.225 (a), (b) and (c)
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – Y measurement antenna polarisation

Job Number: E2101-1380B-4
Test Engineer: AZ

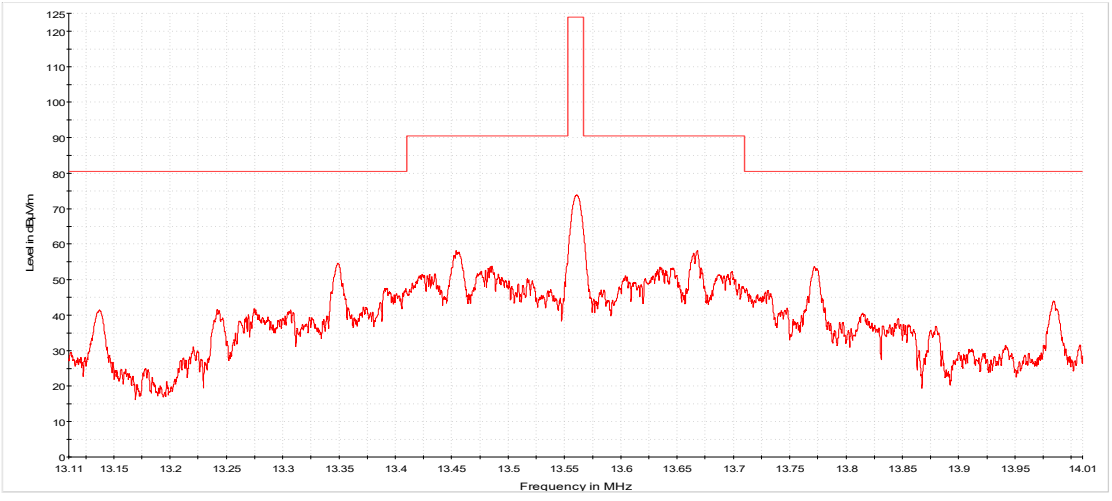


Graph 5

EMC Bayswater Pty. Ltd.

Field Strength - FCC Part 15.225 (a), (b) and (c)
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – Z measurement antenna polarisation

Job Number: E2101-1380B-4
Test Engineer: AZ



Graph 6

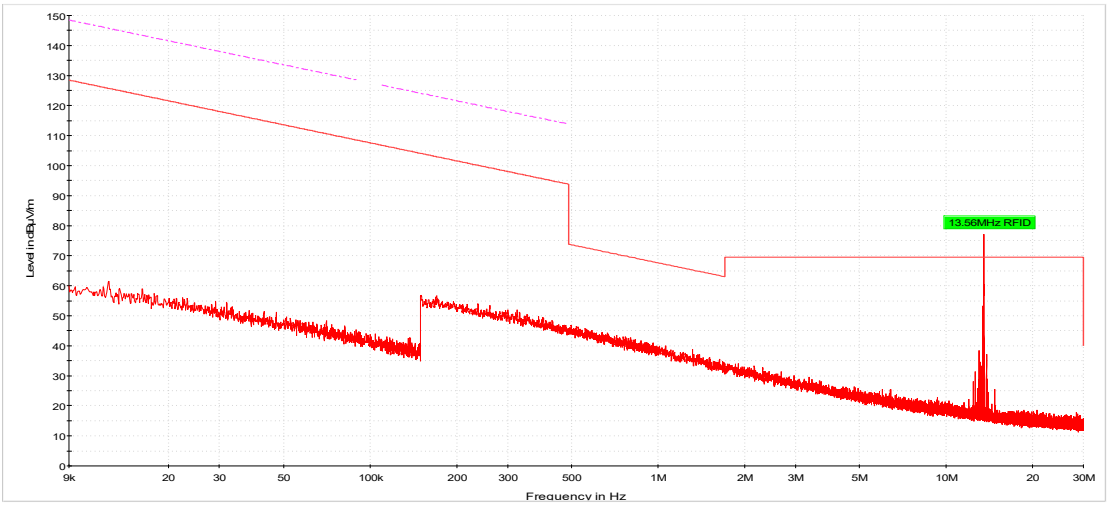
Appendix C.2 – Field Strength outside the band 13.110-14.010 MHz (Spurious Emissions)

No.	Test	Graph Description
7	Radiated Spurious Emissions – Mode 1	X measurement antenna polarisation – 9kHz to 30MHz
8		Y measurement antenna polarisation – 9kHz to 30MHz
9		Z measurement antenna polarisation – 9kHz to 30MHz
10		Horizontal measurement antenna polarisation – 30MHz to 1GHz
11		Vertical measurement antenna polarisation – 30MHz to 1GHz
12	Radiated Spurious Emissions – Mode 2	X measurement antenna polarisation – 9kHz to 30MHz
13		Y measurement antenna polarisation – 9kHz to 30MHz
14		Z measurement antenna polarisation – 9kHz to 30MHz
15		Horizontal measurement antenna polarisation – 30MHz to 1GHz
16		Vertical measurement antenna polarisation – 30MHz to 1GHz

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – X measurement antenna polarisation – 9kHz to 30MHz

Job Number: E2101-1380B-4
Test Engineer: AZ



Graph 7

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – Y measurement antenna polarisation – 9kHz to 30MHz

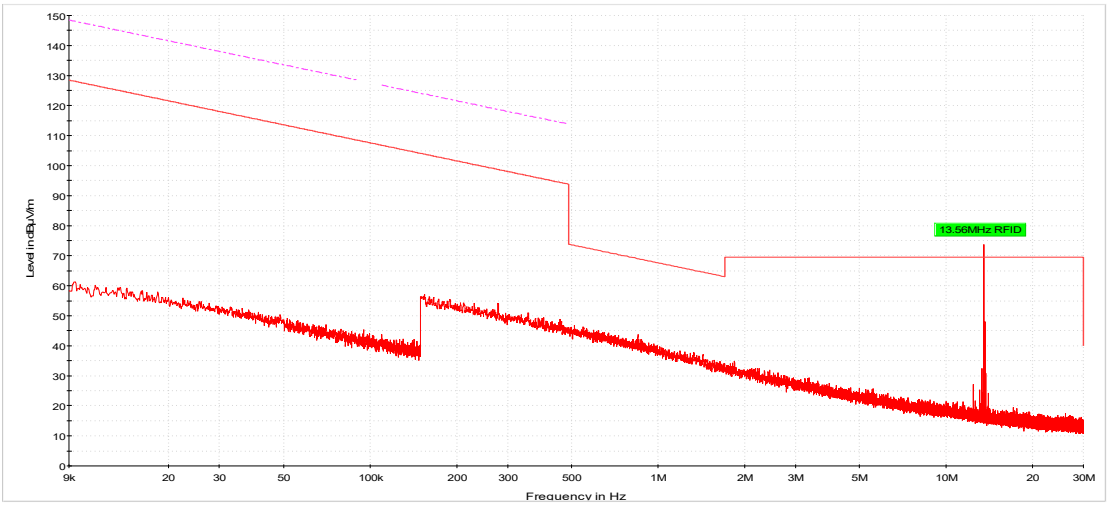
Job Number: E2101-1380B-4
Test Engineer: AZ

Graph 8

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – Z measurement antenna polarisation – 9kHz to 30MHz

Job Number: E2101-1380B-4
Test Engineer: AZ

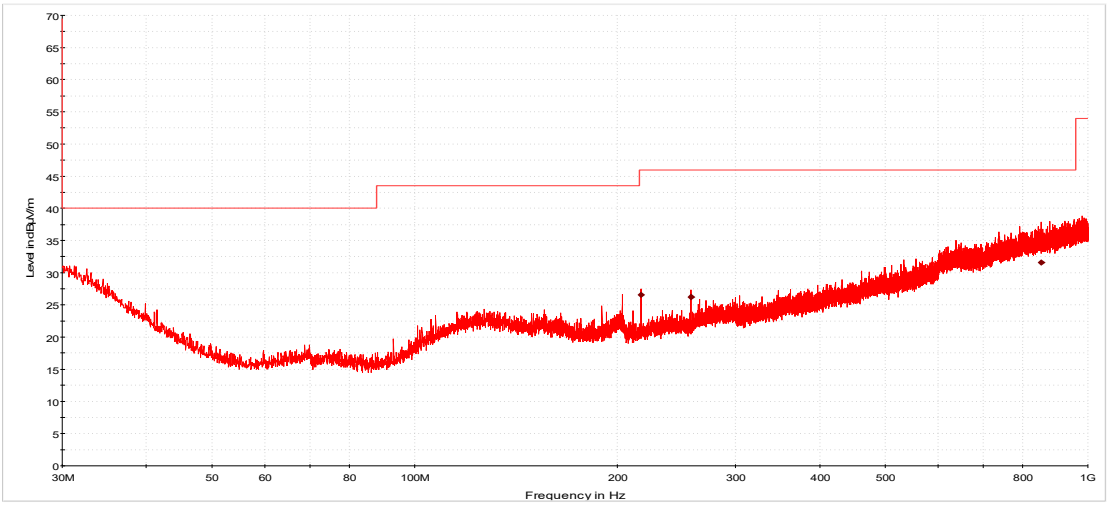


Graph 9

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – Horizontal antenna polarisation – 30MHz to 1GHz

Job Number: E2101-1380B-4
Test Engineer: AZ

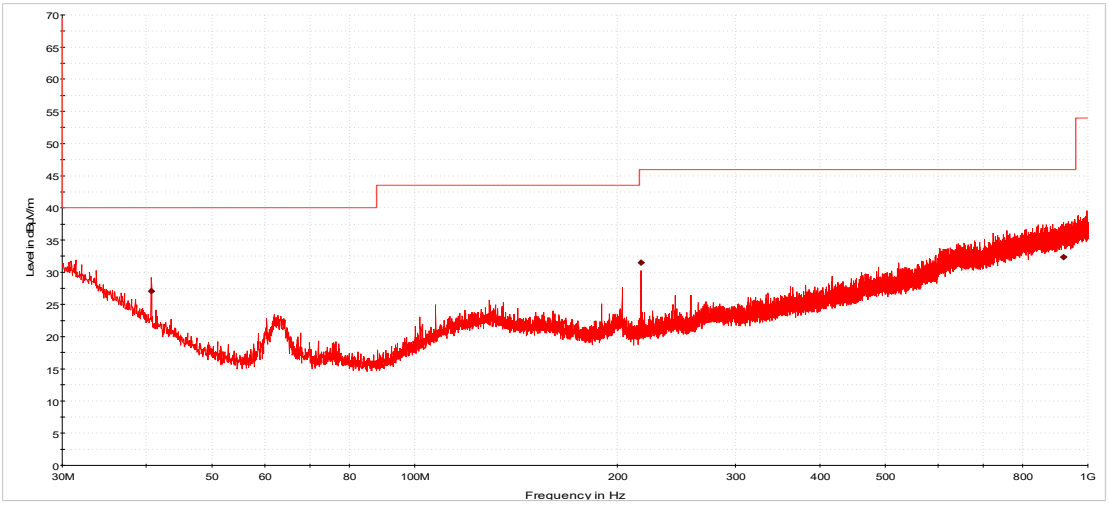


Graph 10

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 1 – Vertical antenna polarisation – 30MHz to 1GHz

Job Number: E2101-1380B-4
Test Engineer: AZ

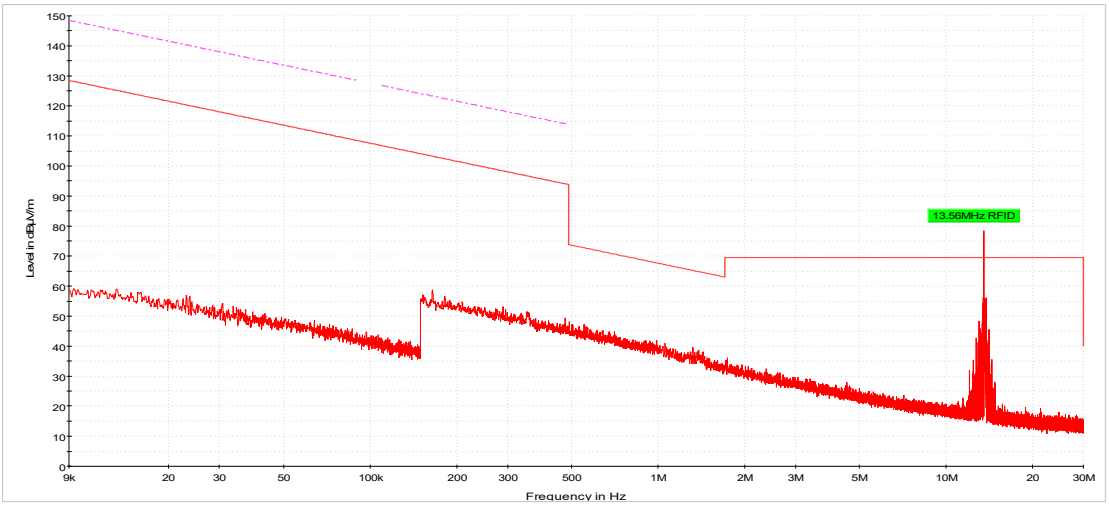


Graph 11

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – X measurement antenna polarisation – 9kHz to 30MHz

Job Number: E2101-1380B-4
Test Engineer: AZ



Graph 12

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – Y measurement antenna polarisation – 9kHz to 30MHz

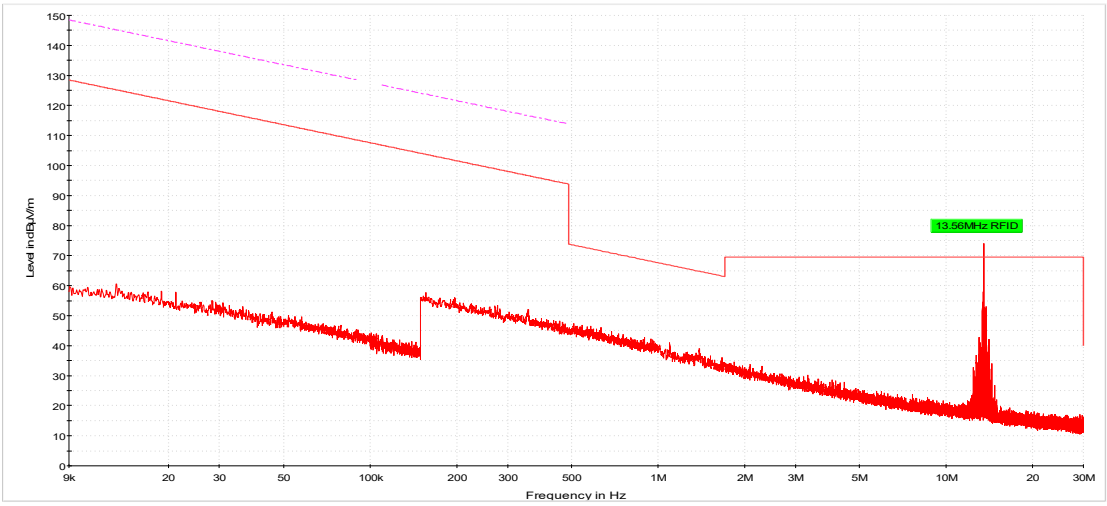
Job Number: E2101-1380B-4
Test Engineer: AZ

Graph 13

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – Z measurement antenna polarisation – 9kHz to 30MHz

Job Number: E2101-1380B-4
Test Engineer: AZ

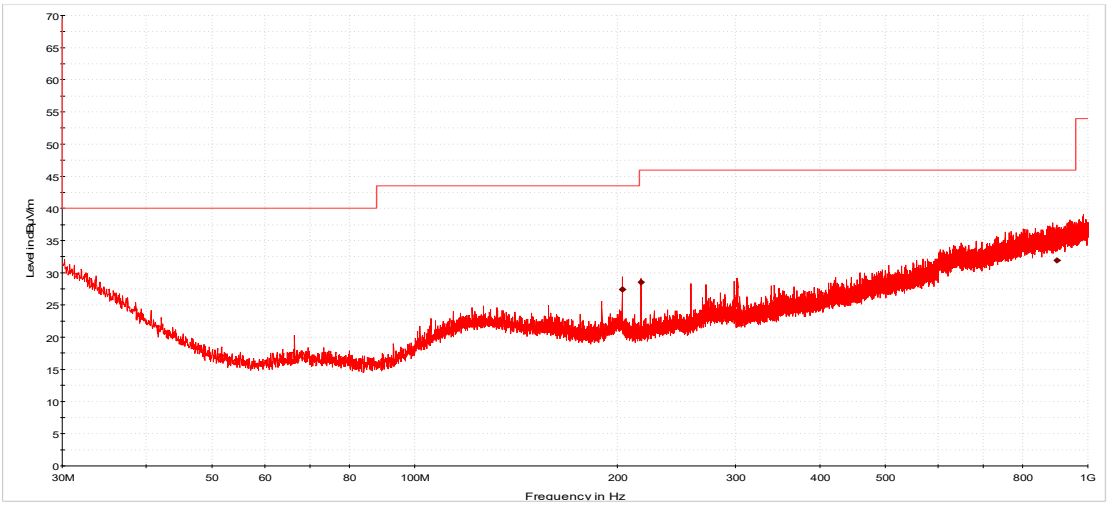


Graph 14

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – Horizontal antenna polarisation – 30MHz to 1GHz

Job Number: E2101-1380B-4
Test Engineer: AZ

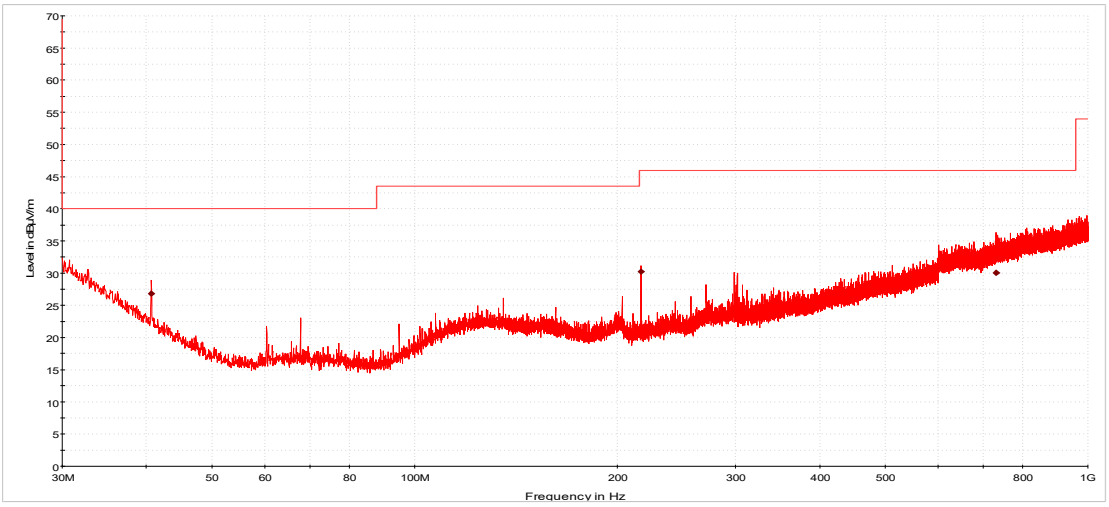


Graph 15

EMC Bayswater Pty. Ltd.

Radiated Spurious Emission - FCC Part 15.209
Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access
Mode 2 – Vertical antenna polarisation – 30MHz to 1GHz

Job Number: E2101-1380B-4
Test Engineer: AZ



Graph 16

Appendix C.3 – 20dB Emission Bandwidth

No.	Test	Graph Description
17	Mode 1 – 20dB Emission Bandwidth	Normal test conditions
18	Mode 2 – 20dB Emission Bandwidth	Normal test conditions

EMC Bayswater Pty. Ltd.

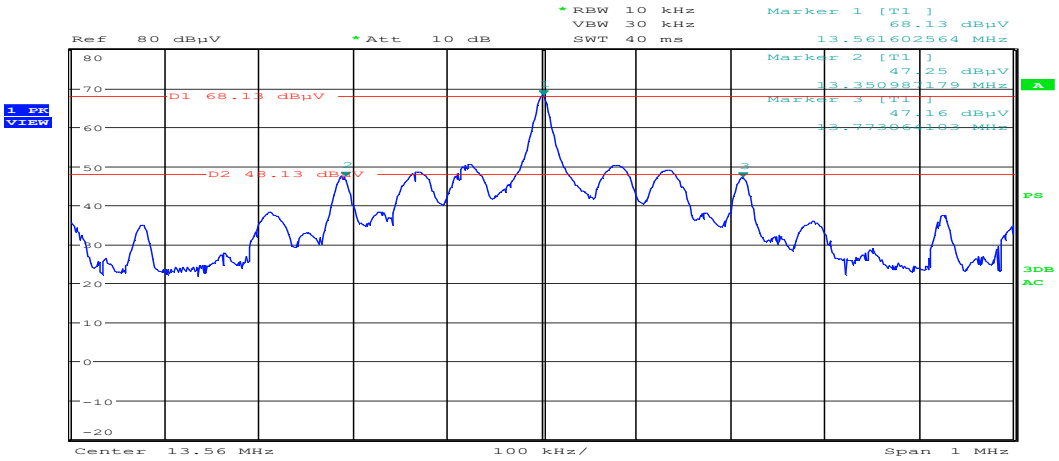
CFR47 FCC Part 15, Subpart C – 15.215 (c) 20dB Emission Bandwidth

Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access

Mode 1 – Normal voltage (13.75V) and Room Temperature (20ºC)

Job Number: E2101-1380B-4

Test Engineer: NL/AZ



Graph 17

EMC Bayswater Pty. Ltd.

CFR47 FCC Part 15, Subpart C – 15.215 (c) 20dB Emission Bandwidth

Inner Range Pty Ltd - 994726 - SIFER Keypad Mobile Access

Mode 2 – Normal voltage (13.75V) and Room Temperature (20ºC)

Job Number: E2101-1380B-4

Test Engineer: NL/AZ

Graph 18

Appendix D – Exposure of Humans to RF fields (Radio Frequency Hazard) information

SAR and RF Exposure exception evaluation

SAR exception evaluation

As per Appendix C of KDB 447498 D01 General RF Exposure Guidance v06

***SAR Test Exclusion Thresholds* for < 100 MHz and < 200 mm**

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in 4.3.1 must be applied to determine SAR test exclusion.

MHz	< 50	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	237	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	
50	308	617	625	634	643	651	660	669	677	686	695	703	712	721	729	738	
10	474	948	961	975	988	1001	1015	1028	1041	1055	1068	1081	1095	1108	1121	1135	
1	711	1422	1442	1462	1482	1502	1522	1542	1562	1582	1602	1622	1642	1662	1682	1702	mW
0.1	948	1896	1923	1949	1976	2003	2029	2056	2083	2109	2136	2163	2189	2216	2243	2269	
0.05	1019	2039	2067	2096	2125	2153	2182	2211	2239	2268	2297	2325	2354	2383	2411	2440	
0.01	1185	2370	2403	2437	2470	2503	2537	2570	2603	2637	2670	2703	2737	2770	2803	2837	

SAR test exclusion threshold for 13.56MHz transmitter is 459.2mW for less than 50mm distance.

The Measured EIRP is 0.023mW (Worst-case).

Calculation Example

Measured maximum ,Electric field at 3m distance = 78.8 dBµV/m

Therefore Maximum e.i.r.p calculated from following equation

*Maximum e.i.r.p = (Field Strength(V/m) * Distance(m))^2/30*

Therefore Maximum e.i.r.p = 0.023mW

RF Exposure Evaluation

As per section 1.1310 of CFR 47 following Maximum Permissible Exposure (MPE) limits are applicable.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	$*900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	$*180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

Limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields for 13.56MHz as per Table 1 of Section 15.1310 is 0.978 mW/cm^2 (General Population/Un-controlled).

Using equation

$$S = PG / 4\pi R^2$$

where: S = Power density
P = Power input to the antenna
G = Antenna gain
R = Distance to the center of radiation of the antenna

Prediction Worst case:

Maximum EIRP: 0.023mW (Worst-case, Without Tag)
Distance: 20cm
Calculated Power Density= 0.000004575 mW/cm^2
MPE limit for General Population/Un-controlled exposure: 0.978 mW/cm^2

Result: The measured EIRP is below the SAR exception threshold and the calculated power density level at a distance of 20cm are below the maximum levels allowed by regulations.