EMC Bayswater Pty Ltd

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EMC COMPLIANCE REPORT
FCC Certification Test Report
In accordance with:
CFR47 FCC Part 15, Subpart B (Class A)

CR Mining

T1340

Receiver

FCC ID: 2A9FA-07-0026-915-A

REPORT: E2211-1609C
DATE: April, 2023

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

Certificate of Compliance
Certification EMC Compliance Report
EMC Bayswater Test Report: E2211-1609C
Issue Date: April, 2023

Product(s):	Receiver
Model No:	T1340
Serial No:	2022-010
Variant:	None stated
FCC ID:	2A9FA-07-0026-915-A

Customer Details:	Mr Julien Lopez CR Mining 3/271 Treasure Road North Welshpool WA 6106 Australia Phone No: +61 (08) 6253 3913 e-mail: Julien.Lopez@crmining.com
Test Specification:	CFR47 FCC Part 15, Subpart B (Class A)
Results Summary:	Radiated Emissions – CFR47 FCC Part 15, section 15.109 ***Complied (Class A)*** Conducted Emissions – CFR47 FCC Part 15, section 15.107 ***N/A**** **The EUT is a battery powered device and does not connect to an AC mains supply*
Test Date(s):	22nd of November, 2022
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 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 CR Mining, T1340, Receiver (Serial No: 2022-010), has been tested in accordance with requirements contained in the appropriate commission regulations.

Prepared & tested by:	Approved by:	
Adnan Zaman (EMC Test Engineer)	Neville Liyanapatabendige (Manager)	21/04/2023 11:28 Date

FCC Certification Test Report
for
CR Mining

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1. Introduction

Electromagnetic Compatibility (EMC) tests were performed on a CR Mining, T1340 Receiver in accordance with the requirements of Title 47 of the standard CFR47 FCC Part 15, Subpart B (Class A).

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 the CFR47 FCC Part 15, Subpart B, Class A, Radiated Emissions (section 15.109) requirements. Worst-case emissions are tabled as follows:

Test	Result
Radiated Emissions (Horizontal Antenna Polarisation)	Complied with quasi-peak limit by 7.3dB
	Complied with peak limit by >20dB
	Complied with average limit by >20dB
Radiated Emissions (Vertical Antenna Polarisation)	Complied with quasi-peak limit by 13.7dB
	Complied with peak limit by >20dB
	Complied with average limit by >20dB

Table 1: Summary of test results

5. Product Sample, Configuration & Modifications

5.1. Product Sample Details

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

Product:	Receiver
Model No:	T1340
Variant:	None stated
Serial No:	2022-010
Firmware:	Not supplied
FCC ID:	2A9FA-07-0026-915-A
Power Specifications:	12-32VDC power input
Dimensions:	132 x 208 x 53 (mm) (Length x Width x Height)
Weight:	1.1kg
EUT Type:	Tested as table top.

(Customer supplied product information)

5.2. Product description

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

"The receiver is used to collect the data from the Ground Engaging Tool IoT sensors and acts as an interface with the rest of the system. Using a 12-32VDC supply, the device used GSFK modulation to receive the data in the 915MHz ISM band."

(Customer supplied product description information)

The highest frequency generated or used in the device or on which the device operates or tunes as specified by the customer is 927MHz.

The customer declared that the device is strictly used as a receiver only.

The EUT has been identified as class A digital device or peripheral by the customer. The following or similar warning shall be included in the instructions for use:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

5.3. Support Equipment

Support Equipment: 1	Description:	Cabinet
	Manufacturer:	CR Mining
	Model:	Not supplied
	Serial number:	Not supplied

5.4. Product operating modes

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

"Receiver only."

(Customer supplied product operating mode information)

5.5. Product operating mode for testing

Receiver only.

5.6. EUT Configuration

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

The EUT was powered from the customer provided support equipment.

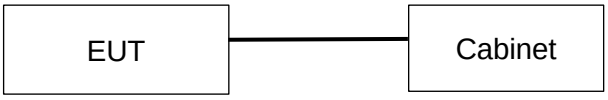


Figure 1: Block diagram of EUT test configuration

Port	Cable type	Length (m)	Cable Brand	Cable Model	Termination
DC IN	2 cores unshielded	2m	Not Stated	Not Stated	Cabinet
IO	Un-shielded multi-core	2m	Not Stated	Not Stated	Cabinet
LAN1 (RF) INT	CAT6 unshielded	2m	Not Stated	Not Stated	Cabinet
LAN2 (Main) EXT	CAT6 unshielded	2m	Not Stated	Not Stated	Cabinet
RF1	1 core, shielded co-axial	2m	Not Stated	Not Stated	Cabinet
RF2	1 core, shielded co-axial	2m	Not Stated	Not Stated	Cabinet
RF3	1 core, shielded co-axial	2m	Not Stated	Not Stated	Cabinet
RF4	1 core, shielded co-axial	2m	Not Stated	Not Stated	Cabinet
GPS	1 core, shielded co-axial	2m	Not Stated	Not Stated	Cabinet
BAT	Unterminated				
USB	Unterminated				
CAN	Unterminated				

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 Emissions 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.

EMC Bayswater Pty Ltd's FCC Accredited Test Firm Registration number: 527798.
EMC Bayswater Pty Ltd's FCC Accredited Test Firm Designation number: AU0004

6.2. Test Equipment

Refer to Appendix A for the measurement instrument list.

7. Referenced Standards

CFR47 FCC Part 15, Subpart B

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

None.

9. Radiated Emissions

9.1. Test Procedure

Radiated Emissions were 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 EUT was placed on a non-conductive table, at a height of 0.8m above the ground plane.

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 120 kHz and a video bandwidth of 300 kHz. 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 120 kHz.

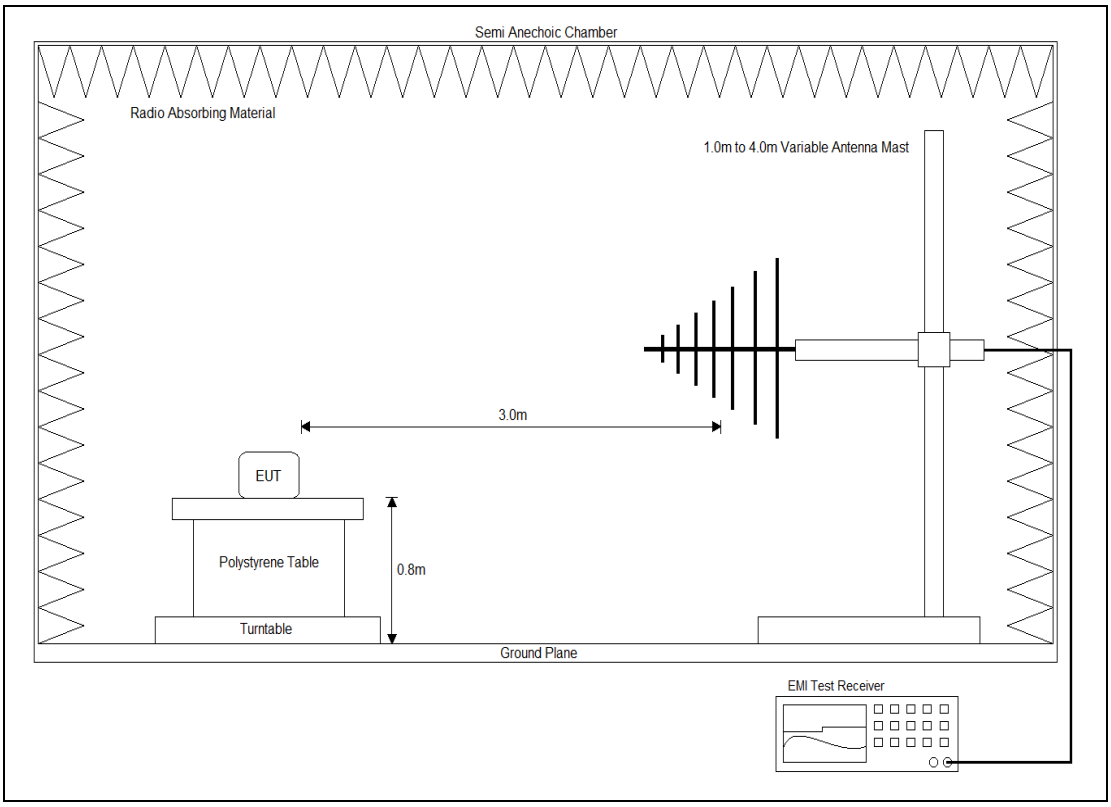


Figure 2: Test setup – 30MHz to 1GHz

In the frequency range 1GHz to 5GHz 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 1 MHz and a video bandwidth of 3 MHz. 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 no less than 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 1 MHz. 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.

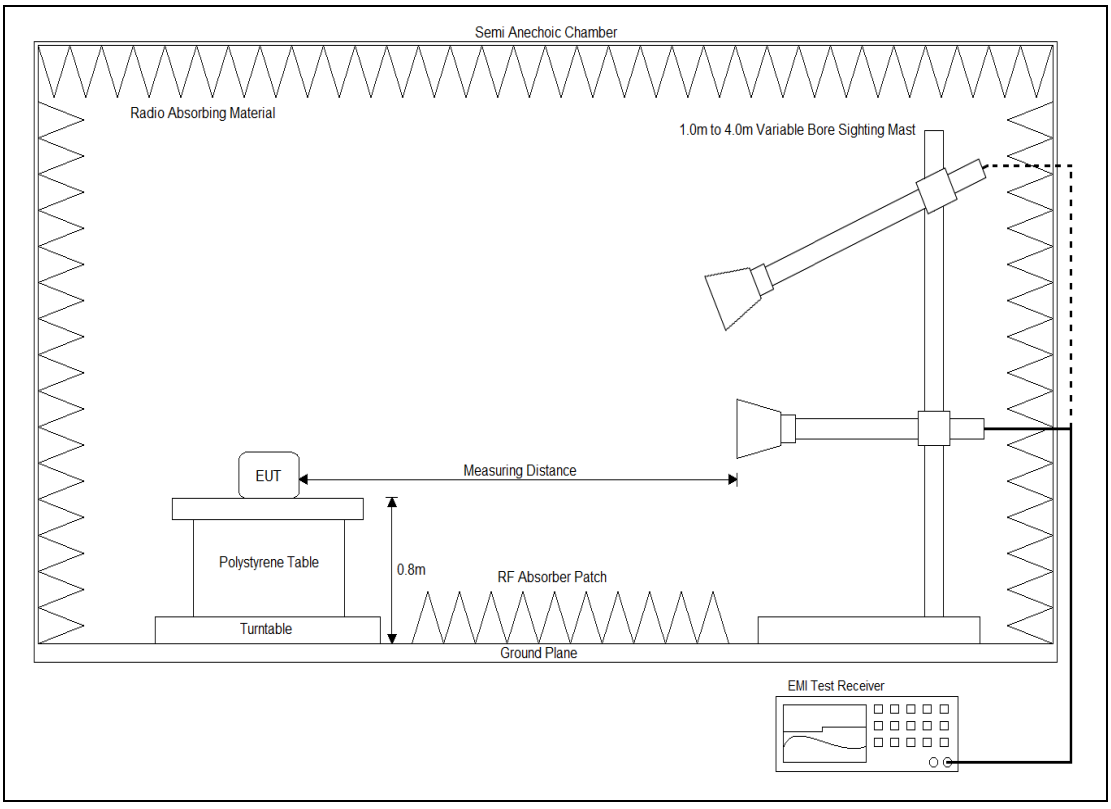


Figure 3: Test setup – above 1GHz

Horn	Frequency	Degrees	Measuring	Illumination	Measuring	Illumination
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	5.8 to 8.2	30.00	3	1.61	1	0.54
AH SAS-585	8.2 to 12.4	30.00	3	1.61	1	0.54
AH SAS-586	12.4 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 3: 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 5 in Appendix B for views of the test configuration)

9.2. Limits

The EUT shall meet the limits in the following table:

Frequency Range (MHz)	Measuring distance	Limits (dBµV/m)	
		Quasi-Peak	
30 to 88	3m	49.5	
88 to 216	3m	54.0	
216 to 960	3m	56.9	
960 to 1000	3m	60.0	
Frequency Range (GHz)	**Measuring distance**	**Limits (dBµV/m)**	
		Average	**Peak**
1.0 to 26.5	3m	60.0	80.0
26.5 to 40.0	1m	69.5	89.5
NOTE The lower limit shall apply at the transition frequency.			

Table 4: Limits for Radiated Emissions of Class A equipment

9.3. 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 1 to 4 in Appendix C)

Frequency (MHz)	Result Quasi-peak (dBµV/m)	Limit Quasi-peak (dBµV/m)	Delta limit (dB)
30.825	25.8	49.5	-23.7
101.829	25.0	54.0	-29.0
138.446	26.5	54.0	-27.5
211.293	24.5	54.0	-29.5
217.889	22.8	56.9	-34.1
1000.000	52.7	60.0	**-7.3***

**Worst-case emission*

Table 5: Radiated Emissions – Horizontal Antenna Polarisation (30MHz to 1GHz)

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)
Peak emissions were not above the measurements system noise floor or at least 20dB below the limit				1057.980	28.7	60.0	-31.3
				1124.800	39.4	60.0	**-20.6***
				2460.160	25.5	60.0	-34.5

**Worst-case emissions*

Table 6: Radiated Emissions – Horizontal Antenna Polarisation (1GHz to 5GHz)

Frequency (MHz)	Result Quasi-peak (dBµV/m)	Limit Quasi-peak (dBµV/m)	Delta limit (dB)
36.160	35.8	49.5	**-13.7***
37.372	35.2	49.5	-14.3
38.924	32.3	49.5	-17.2
101.877	37.8	54.0	-16.2
227.153	28.0	56.9	-28.9
1000.000	45.8	60.0	-14.2

**Worst-case emission*

Table 7: Radiated Emissions – Vertical Antenna Polarisation (30MHz to 1GHz)

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)
Peak emissions were not above the measurements system noise floor or at least 20dB below the limit				1047.320	25.1	60.0	-34.9
				1124.800	34.3	60.0	**-25.7***
				2459.380	25.8	60.0	-34.2

**Worst-case emissions*

Table 8: Radiated Emissions – Vertical Antenna Polarisation (1GHz to 5GHz)

The measurement uncertainty was calculated as follows:

Measurement frequency range	Calculated measurement uncertainty
30MHz to 1GHz	±4.65dB
1GHz to 6GHz	±4.83dB

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:	16.3 to 16.6°C
Humidity:	47 to 49%
Atmospheric pressure:	1013.2 to 1013.5hPa

Table 9: 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:

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

Notes: All Radiated Emissions measured were below the Class A limits.

If the highest frequency generated or used within the device or on which the device operates or tunes is between 500MHz and 1000MHz, the upper frequency of measurement range should be 5000MHz.

The highest frequency of the EUT as specified by the customer is 927MHz as such measurements up to 5GHz were taken.

Assessment: The EUT complied with the Radiated Emissions requirements of CFR47 FCC Part 15, Subpart B (Class A) section 15.109.

10. Conclusion

The CR Mining, T1340, Receiver (Serial No: 2022-010) complied with the requirements of CFR47 FCC Part 15, Subpart B (Class A)**,** sections 15.109.

Appendix A – Test Equipment

Inv.	Equipment	Make	Model No.	Serial No.	Calibration	
					Due	Type
Radiated Disturbance (Radiated Emissions) - 30MHz to 1000MHz						
1217	ANALYSER, EMI Receiver	Rohde & Schwarz	ESU40	100182	Jun-23	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-23	E
0718	ATTENUATOR, 6dB	JFW	50FPE-006	-	Jan-24	I
1145	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84279564	SN MY056/4PA	Jan-24	I
0989	CABLE, Coax, Sucoflex 104A	Huber+Suhner	44454/4A	C357	Jan-24	I
1155	HYGROMETER, Temp, Humidity	DigiTech	QM7312	-	Jul-23	I
0666	ENCLOSURE, Semi-Anechoic, No 1	RFI Industries	S800 iOATS	1229	Aug-25	I
SW007	EMC Measurement Software	Rohde & Schwarz	EMC 32	Version 8.53.0	N/A	N/A
Radiated Disturbance (Radiated Emissions) - 1000MHz to 5000MHz						
1217	ANALYSER, EMI Receiver	Rohde & Schwarz	ESU40	100182	Jun-23	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-24	I
0559	PRE-AMP, Microwave, 18GHz	Miteq	AFS8	605305	Apr-23	I
1145	CABLE, Coax, Sucoflex 104PA	Huber + Suhner	84279564	SN MY056/4PA	Jan-24	I
1238	CABLE, Coax, Sucoflex 126 E	Huber + Suhner	10422876	SN 8000495/126E	Jan-24	I
0989	CABLE, Coax, Sucoflex 104A	Huber+Suhner	44454/4A	C357	Jan-24	I
1155	HYGROMETER, Temp, Humidity	DigiTech	QM7312	-	Jul-23	I
0666	ENCLOSURE, Semi-Anechoic, No 1	RFI Industries	S800 iOATS	1229	Aug-25	I
SW007	EMC Measurement Software	Rohde & Schwarz	EMC 32	Version 8.53.0	N/A	N/A

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	
A	7	Support Equipment - Cabinet
A	8	
A	9	
A	10	
A	11	
A	12	
A	13	
B	1	EUT – Internal Views
B	2	
B	3	
C	1	Radiated Emissions – Test Configuration
C	2	
C	3	
C	4	
C	5	

EUT External Photographs	EMC Bayswater Test Report E2211-1609C Annex A
EUT Internal Photographs	EMC Bayswater Test Report E2211-1609C Annex B
EUT Test Configurations Photographs	EMC Bayswater Test Report E2211-1609C Annex C

Appendix C – Measurement Graphs

No.	Test	Graph Description
1	Radiated Emissions	Horizontal Antenna Polarisation – 30MHz to 1000MHz
2		Horizontal Antenna Polarisation – 1GHz to 5GHz
3		Vertical Antenna Polarisation – 30MHz to 1000MHz
4		Vertical Antenna Polarisation – 1GHz to 5GHz

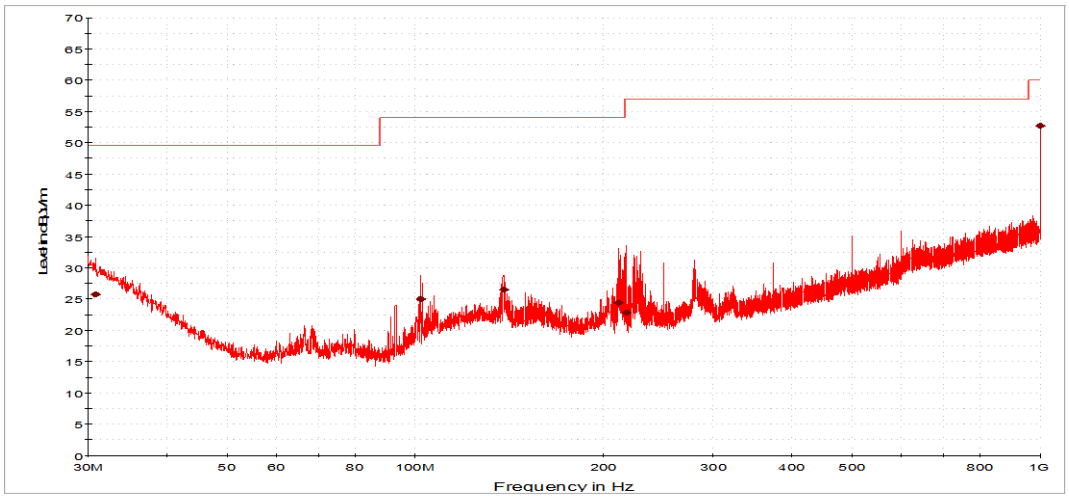
EMC Bayswater Pty. Ltd.

CFR47 FCC Part 15, Subpart B (Class A) - Radiated Emissions

CR Mining - T1340 - Receiver

Horizontal Antenna Polarisation – 30MHz to 1000MHz

Job Number: E2211-1609C
Test Engineer: AZ



Graph 1

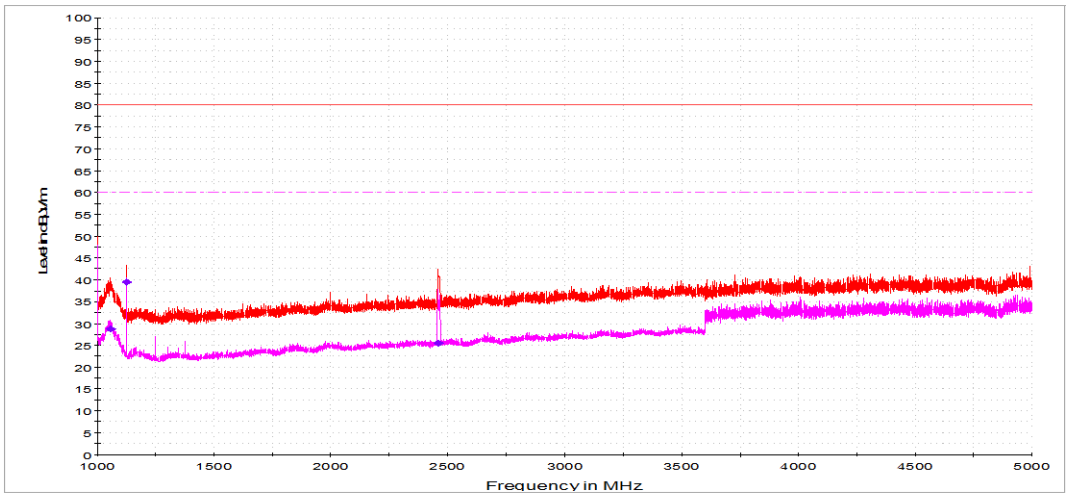
EMC Bayswater Pty. Ltd.

CFR47 FCC Part 15, Subpart B (Class A) - Radiated Emissions

CR Mining - T1340 - Receiver

Horizontal Antenna Polarisation – 1GHz to 5GHz

Job Number: E2211-1609C
Test Engineer: AZ



Graph 2

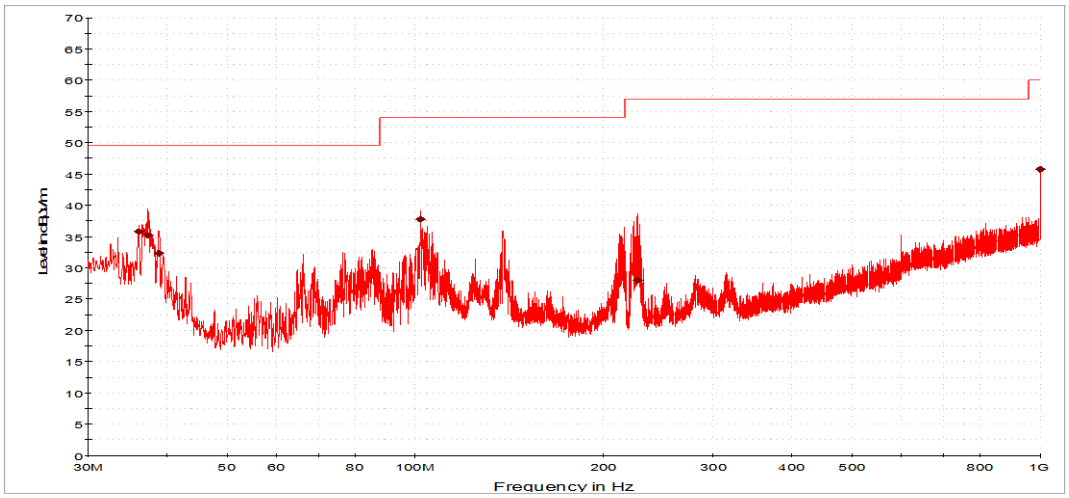
EMC Bayswater Pty. Ltd.

CFR47 FCC Part 15, Subpart B (Class A) - Radiated Emissions

CR Mining - T1340 - Receiver

Vertical Antenna Polarisation – 30MHz to 1000MHz

Job Number: E2211-1609C
Test Engineer: AZ



Graph 3

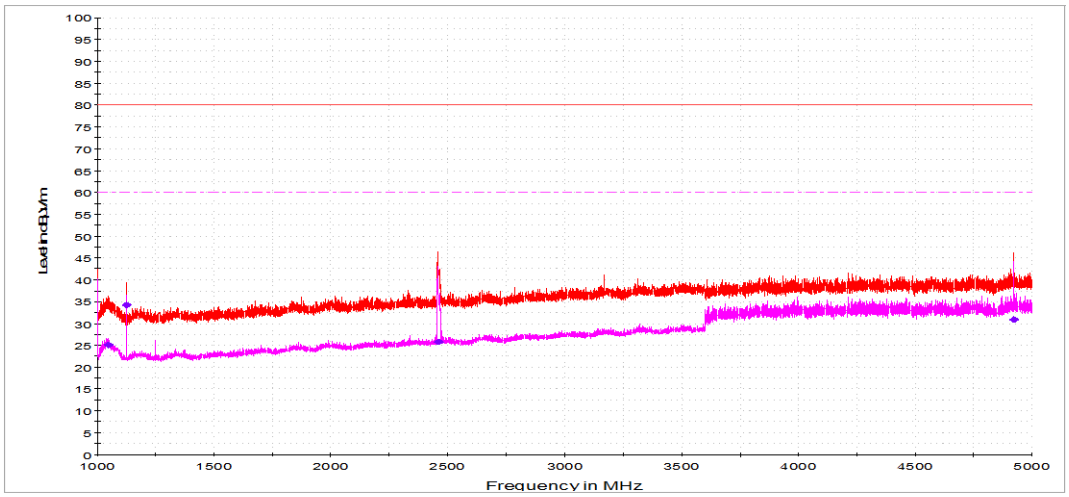
EMC Bayswater Pty. Ltd.

CFR47 FCC Part 15, Subpart B (Class A) - Radiated Emissions

CR Mining - T1340 - Receiver

Vertical Antenna Polarisation – 1GHz to 5GHz

Job Number: E2211-1609C
Test Engineer: AZ



Graph 4

Appendix D – Customer Declaration of Responsible Party

MINING BY NUMBERS

CR Mining
3/271 Treasure Road North
Welshpool WA 6106 Australia
T +61 (08)6253 3913
crmining.com
ABN: 11010402990

Date: 15/03/23

Declaration of Responsible party

We (Responsible party) CR Mining
of 3/271 Treasure Rd N, Welshpool WA 6106 Australia

hereby declare as per FCC KDB 896810 D01 SDoC v01 that:

Julien Francois Joel Lopez

is acting as the representative of the responsible party with the authority to act on behalf of the responsible party.

Signed by: … .....
Name: Julien Lopez
Position: Production Engineer (Electronics)
Date signed: 15/03/2023