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RADIO TEST REPORT

REPORT NUMBER: M181213-5

TEST STANDARD: FCC PART 15 SUBPART C
(SECTION §15.207 & § 15.209)

CLIENT: BLUECHIIP LIMITED

DEVICE: HANDHELD READER

MODEL: BLU-668

FCC ID: 2ATNO-BRHRBB001

DATE OF ISSUE: 12 AUGUST 2022

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CONTENTS

1	Test Summary	5
2	Test Facility	5
2.1	General	5
2.2	NATA Accreditation	5
3	Test Equipment Calibration	6
4	Measurement Uncertainty	6
5	Device Details.....	7
5.1	EUT (Transmitter) Details.....	7
5.2	EUT (Host) Details.....	7
5.3	Test Configuration	7
5.4	Modifications	7
6	Results.....	8
6.1	§15.203 Antenna Requirement.....	8
6.2	§15.205 Restricted Bands of Operation	8
6.3	§15.207 Conducted Limits.....	8
6.3.1	Test Procedure	8
6.3.2	Limits.....	8
6.3.3	Results	8
6.4	§15.215 Operating Frequency Range	11
6.4.1	Test procedure.....	11
6.4.2	Limits.....	11
6.4.3	Results	11
6.5	§15.209 Radiated emission limits; general requirements.....	12
6.5.1	Test procedure.....	12
6.5.2	Limits.....	12
6.5.3	Results: Frequency Band: 9 kHz – 30 MHz.....	13
6.5.4	Results: Frequency Band: 30 – 450 MHz.....	14

GRAPHS

Graph 6-1: Active Line (0.15 MHz to 30 MHz)	9
Graph 6-2: Neutral Line (0.15 MHz to 30 MHz).....	10
Graph 6-3: Operating Frequency Range	11
Graph 6-4: Spurious Emissions, 9 kHz – 30 MHz, Front Antenna	13
Graph 6-5: Spurious Emissions, 9 kHz – 30 MHz, Rear Antenna.....	13
Graph 6-6: Spurious Emissions, 30 – 450 MHz, Vertical, Front Antenna	14
Graph 6-7: Spurious Emissions, 30 – 450 MHz, Horizontal, Front Antenna	15
Graph 6-8: Spurious Emissions, 30 – 450 MHz, Vertical, Rear Antenna.....	16
Graph 6-9: Spurious Emissions, 30 – 450 MHz, Horizontal, Rear Antenna.....	17

TABLES

Table 6-1: Active Line (0.15 MHz to 30 MHz)	9
Table 6-2: Neutral Line (0.15 MHz to 30 MHz).....	10
Table 6-3: Operating Frequency Range	11
Table 6-4: Spurious Emissions, 30 – 450 MHz, Vertical, Front Antenna	14
Table 6-5: Spurious Emissions, 30 – 450 MHz, Horizontal, Front Antenna	15
Table 6-6: Spurious Emissions, 30 – 450 MHz, Vertical, Rear Antenna.....	16
Table 6-7: Spurious Emissions, 30 – 450 MHz, Horizontal, Rear Antenna.....	17

TEST CERTIFICATE

Device: Handheld Reader
Model Number: BLU-668

FCC ID: 2ATNO-BRHRBB001

Manufacturer: Bluechiip Limited

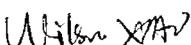
Tested for: Bluechiip Limited
Address: 1 Dalmore Drive, Scoresby, Vic, 3179
Phone Number: +61 (0) 3 97639763
Contact: Scott Turner
Email: Scott.turner@bluechiip.com

Standard: FCC Part 15 – Radio Frequency Devices
Subpart C – Intentional Radiators
Section §15.207 Conducted Limits
Section §15.209 Radiated emission limits; general requirements

Result: The Test Sample complied with applicable requirements of FCC 47 CFR Part 15 Part C.
Refer to Report M181213-5 for full details

Test Date(s): 29 March and 1 April 2019

Issue Date: 12 August 2022

Test Engineer(s): 

Wilson Xiao

Attestation: *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.*

Authorised Signatory: Shabbir Ahmed, PhD
Technical Director
EMC Technologies Pty Ltd

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RADIO TEST REPORT

1 TEST SUMMARY

Section	Clause	Result(s)
6.1	§15.203 Antenna Requirement	Complied
6.2	§15.205 Restricted Bands of Operation	Complied*
6.3	§15.207 Conducted Limits	Complied
6.4	§15.215 Operating Frequency Range	Complied
6.5	§15.209 (a) Radiated emission limits; general requirements	Complied

*FCC Waiver ID: DA 11-461 (Allows Bluechip tracking system to transmit in the three restricted bands within the 1.5-4.2 MHz band: 2.1735-2.1095 MHz, 4.125-4.128 MHz and 4.17725-4.17775 MHz)

2 TEST FACILITY

2.1 General

EMC Technologies Pty Ltd is accredited by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies Pty Ltd has also been designated as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 and 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001**.

EMC Technologies Pty Ltd is also an ISED Canada recognized testing laboratory – **ISED company number: 9626A** and **CAB identifier number: AU0001**.

2.2 NATA Accreditation

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI) and an internal quality system similar to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A²LA).

All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation to ISO 17025 for both testing and calibration and ISO 17020 for Inspection – **Accreditation Number 5292**.

The current full scope of accreditation can be found on the NATA website: www.nata.com.au

3 TEST EQUIPMENT CALIBRATION

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Agilent Technologies (Australia) Pty Ltd or the National Measurement Institute (NMI) or in-house. All equipment calibration is traceable to Australian national standards at the National Measurements Institute.

Equipment Type	Make/Model/Serial Number	Last Cal. dd/mm/yyyy	Due Date dd/mm/yyyy	Cal. Interval
Chamber	Frankonia SAC-3-2 (R-144)	17/07/2017	17/07/2020	3 Year ^{*1}
EMI Receiver	R&S ESW26 Sn: 101306 (R-143)	22/05/2018	22/05/2019	1 Year ^{*2}
Antennas	SUNOL JB1 Sn. A061917 (A-425)	21/07/2017	21/07/2019	2 Year ^{*2}
	EMCO 6502 Active Loop Antenna Sn. 9311-2801 (A-231)	16/11/2018	15/07/2021	3 Year ^{*1}
Cables ^{*4}	Huber & Suhner Sucoflex 104A Sn: 503055 (C-457)	21/01/2019	21/01/2020	1 Year ^{*1}
	Huber & Suhner Sucoflex 104A Sn: 507099 (C-479)	21/01/2019	21/01/2020	1 Year ^{*1}
	Huber & Suhner Sucoflex 104A Sn: 503061 (C-463)	21/01/2019	21/01/2020	1 Year ^{*1}

Note *1. Internal NATA calibration.

Note *2. External NATA / A2LA calibration.

Note *3. Calibration date was valid during the time of testing.

Note *4. Cables are verified before measurements are taken.

4 MEASUREMENT UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainties for emissions tests shown within this report are as follows:

Conducted Emissions: 9 kHz to 30 MHz ±3.2 dB

Radiated Emissions: 9 kHz to 30 MHz ±4.1 dB
30 MHz to 300 MHz ±5.1 dB
300 MHz to 1000 MHz ±4.7 dB
1 GHz to 18 GHz ±4.6 dB

Peak Output Power: ±1.5 dB

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

5 DEVICE DETAILS

(Information supplied by the Client)

The Handheld Reader scans Bluechip-enabled Cryovials, CryoTags, and 1D and 2D barcodes.

5.1 EUT (Transmitter) Details

Radio:	RFID Transmitter
Operating Band:	1.3 – 4.5 MHz
No. of Channels:	80
Channel Bandwidth:	Approx. 30 kHz
Front Antenna (Top):	Air coil antenna 4uH
Rear Antenna (Bottom):	Air coil antenna 2uH
FCC Waiver ID:	DA 11-461 (Allows Bluechip tracking system to transmit in the three restricted bands within the 1.5-4.2 MHz band: 2.1735-2.1095 MHz, 4.125-4.128 MHz and 4.17725-4.17775 MHz)

5.2 EUT (Host) Details

Device under Test:	Handheld Reader
Model Number:	BLU-668
Power requirements:	Internal battery 7.2V (2xNCR18650B Li-Ion battery) Plug pack
Plug pack details:	Input: 100-240V AC, 50/60 Hz, 0.8A Output: 12V DC, 2.5A

5.3 Test Configuration

Testing was performed with the EUT set to transmit continuously at 10 times per second.

Note: The EUT transmitter could not be configured to transmit separately on the Low, Mid and High channels. The interrogator steps through 80 sub-bands of approximately 30 kHz each over the 1.3-4.5 MHz band.

Front and rear antennas were exercised separately.

5.4 Modifications

No modification was required to achieve compliance.

6 RESULTS

6.1 §15.203 Antenna Requirement

Both Front and Rear RFID antennas are placed internally within the Bluechiip Handheld Reader. The below antennas will only be installed by the manufacturer. Said installation will preclude any unauthorised switching of antennas.

The RFID module incorporates the following antennas:

Front Antenna (Top): Air coil antenna 4uH

Antenna port to antenna connection: N/A. Antenna is soldered on PCB.

Rear Antenna (Bottom): Air coil antenna 2uH

Antenna port to antenna connection: N/A. Antenna is soldered on PCB.

6.2 §15.205 Restricted Bands of Operation

Provisions of the §15.205 restricted bands of operation have been met.

Bluechiip has an FCC Waiver (ID: DA 11-461) that allows Bluechiip tracking system to transmit in the three restricted bands within the 1.5-4.2 MHz band: 2.1735-2.1095 MHz, 4.125-4.128 MHz and 4.17725-4.17775 MHz)

6.3 §15.207 Conducted Limits

The Bluechiip Hand-Held Reader is powered by a plug pack as detailed below.

Plug pack:	I.T.E Power Supply
Model:	HK-AB-120A250-CP6
Input supply:	100-240V AC, 50/60 Hz, 0.8A
Output supply:	12V DC, 2.5A

6.3.1 Test Procedure

The arrangement specified in ANSI C63.10: 2013 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2: 2009 was used to perform the measurements.

The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

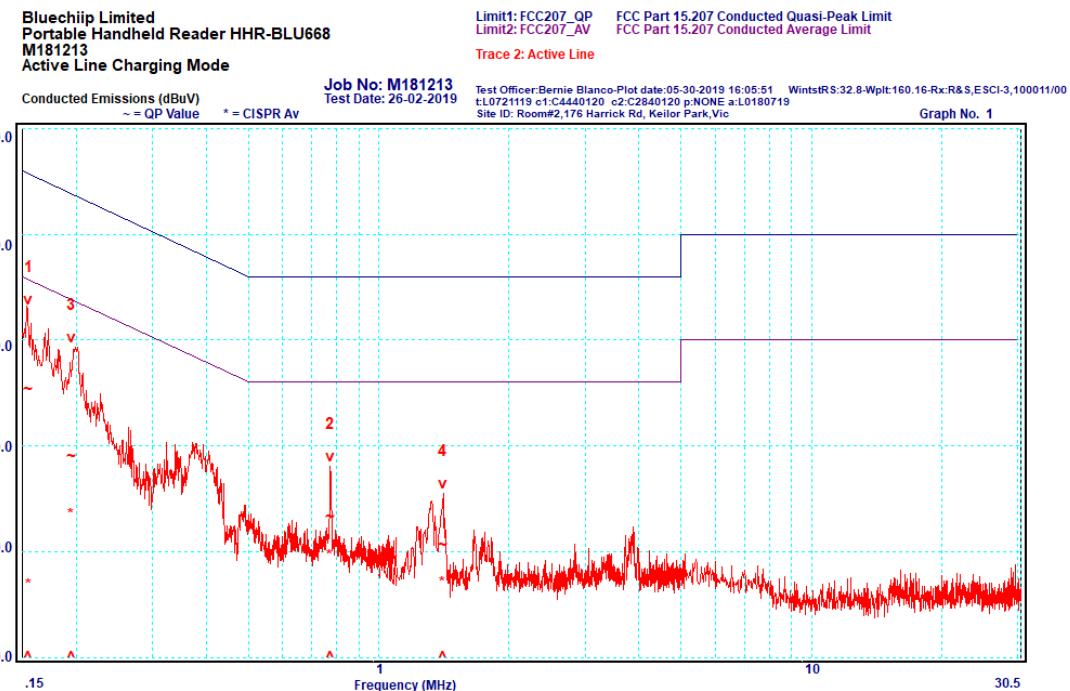
6.3.2 Limits

The limit applied was in accordance to the conducted limits defined in §15.207.

6.3.3 Results

The sample complied with the conducted emission limits of §15.207.

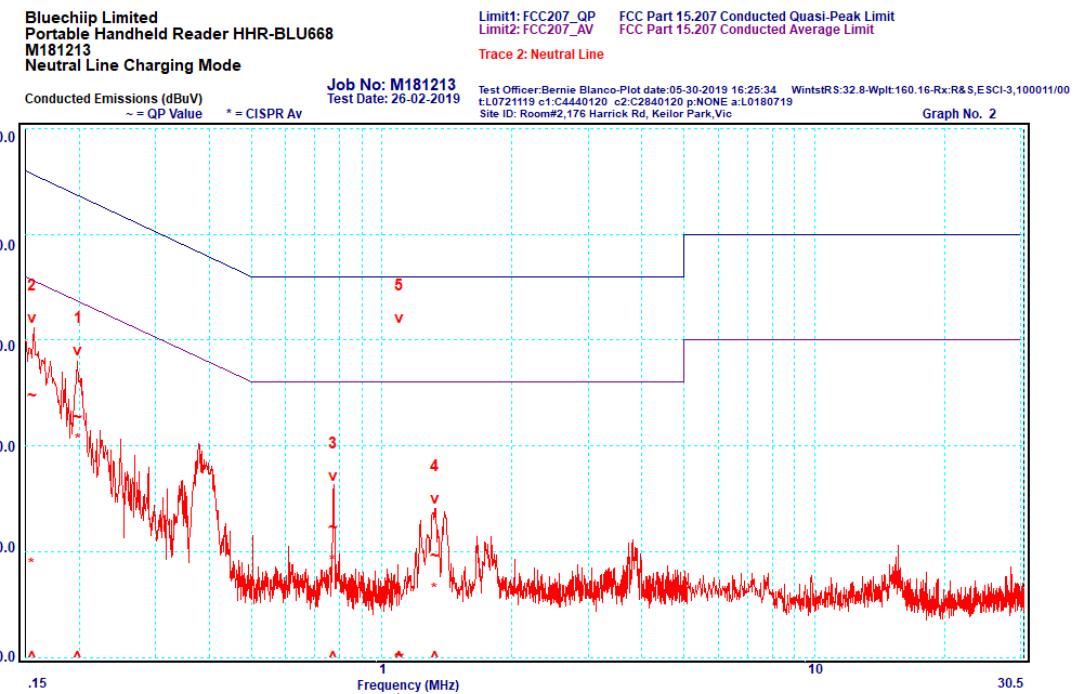
Testing was performed over the frequency range of 150 kHz to 30 MHz at a voltage of 110V AC, 60 Hz.



Graph 6-1: Active Line (0.15 MHz to 30 MHz)

Table 6-1: Active Line (0.15 MHz to 30 MHz)

Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dB μ V]	Limit [dB μ V]	Margin [dB]	Level [dB μ V]	Limit [dB μ V]	Margin [dB]
1	0.155	Active	45.4	65.7	-20.3	26.8	55.7	-28.9
2	0.773	Active	33.2	56.0	-22.8	29.6	46.0	-16.4
3	0.195	Active	38.9	63.8	-24.9	33.5	53.8	-20.3
4	1.407	Active	30.6	56.0	-25.4	27.0	46.0	-19.0



Graph 6-2: Neutral Line (0.15 MHz to 30 MHz)

Table 6-2: Neutral Line (0.15 MHz to 30 MHz)

Peak	Frequency [MHz]	Line	Quasi-Peak			Average		
			Level [dB μ V]	Limit [dB μ V]	Margin [dB]	Level [dB μ V]	Limit [dB μ V]	Margin [dB]
1	0.199	Neutral	42.6	63.6	-21.0	40.5	53.6	-13.1
2	0.156	Neutral	44.7	65.7	-21.0	28.8	55.7	-26.9
3	0.773	Neutral	32.3	56.0	-23.7	29.1	46.0	-16.9
4	1.329	Neutral	29.5	56.0	-26.5	26.4	46.0	-19.6
5	1.100	Neutral	20.1	56.0	-35.9	16.0	46.0	-30.0

6.4 §15.215 Operating Frequency Range

6.4.1 Test procedure

A near-field passive probe was used to measure the operating frequency range. The RFID reader was allowed to sweep across its band of operation with the EMI receiver set at Max-Hold until the trace stabilised. The frequencies of the upper and lower edges that were 20 dB below the peak were recorded.

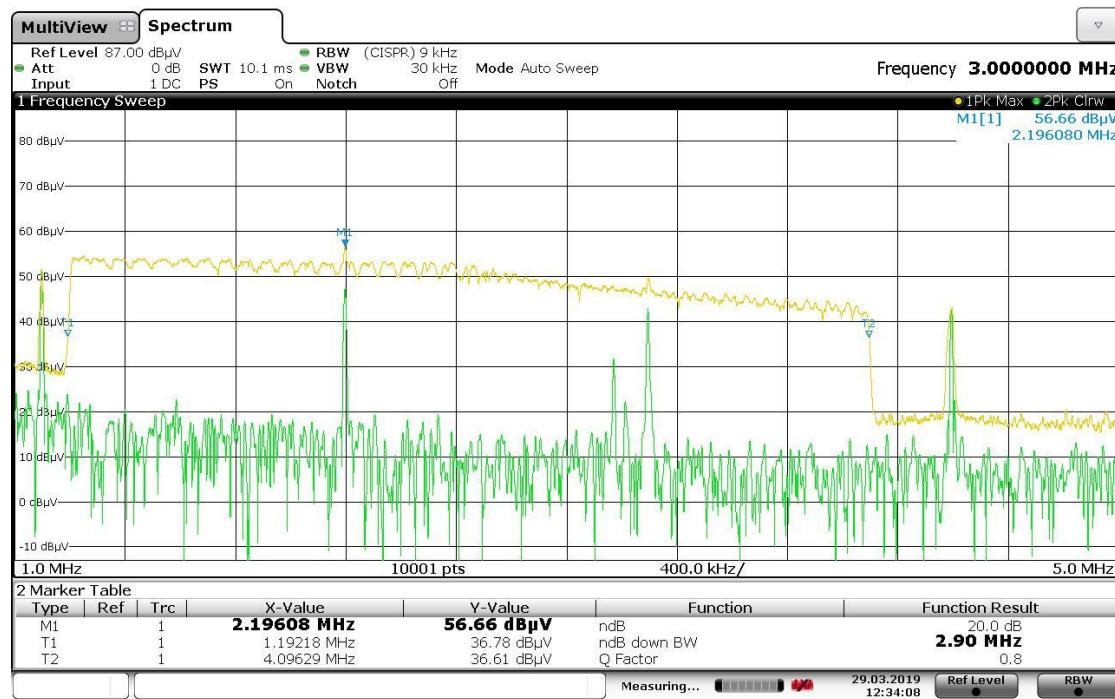
6.4.2 Limits

No set limits.

6.4.3 Results

Table 6-3: Operating Frequency Range

	Low Frequency [MHz]	High Frequency [MHz]
20 dB below the peak	1.19	4.09



Graph 6-3: Operating Frequency Range

6.5 §15.209 Radiated emission limits; general requirements

6.5.1 Test procedure

Radiated emissions measurements were performed in a semi-anechoic chamber compliant with ANSI C63.4: 2014.

The test frequency range was sub-divided into smaller bands with the defined resolution bandwidths to permit reliable display and identification of emissions.

Frequency range [MHz]	Measurement Bandwidth [kHz]	Measurement Distance [m]	Antenna
0.009 to 0.150	0.2	3	
0.150 to 30	9	3	0.6 metre loop antenna
30 to 1000	120	3	Biconilog hybrid
1000 to 18 000	1000	3	Standard gain or broadband horn
18 000 to 40 000	1000	1	

EUT was set at 0.8 m for measurements below 1000 MHz and set at 1.5 m at measurements above 1000 MHz.

The sample was slowly rotated with the spectrum analyser set to Max-Hold. This was performed for at least two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable and by varying the antenna height. For below 1000 MHz the emissions were measured with a Quasi-Peak detector, and for above 1000 MHz the emissions were measured with Peak and Average detectors.

The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical polarisations of the measurement antenna.

6.5.2 Limits

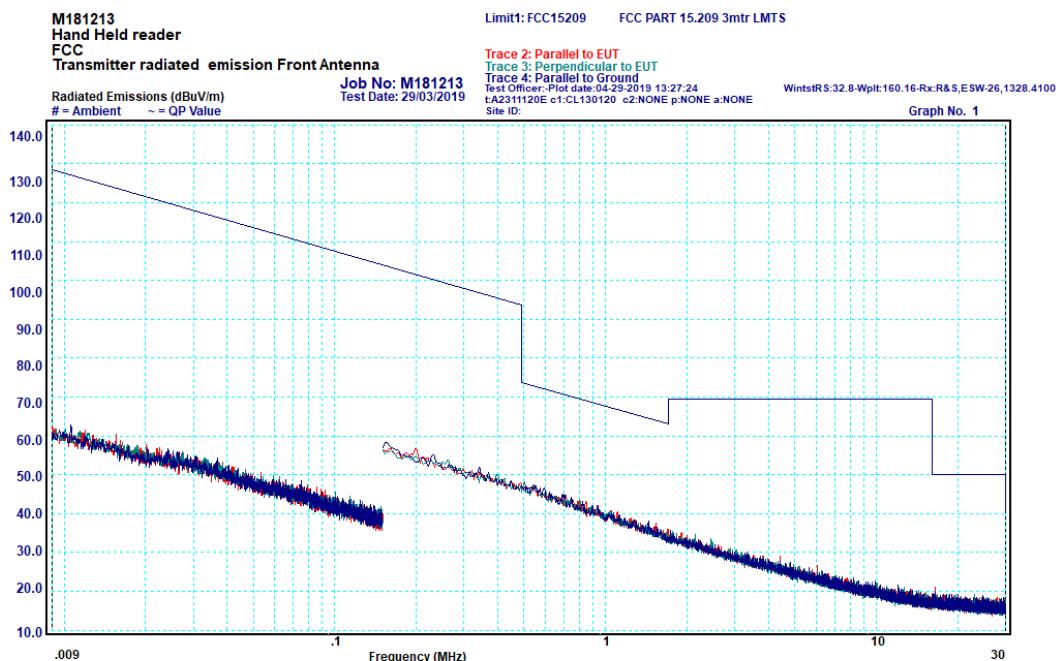
The limit applied is in accordance to the radiated emission limits defined in §15.209.

6.5.3 Results: Frequency Band: 9 kHz – 30 MHz

All spurious emissions measured in the frequency band 9 kHz – 30 MHz complied with the requirements of §15.209. The emissions were more than 10 dB below the limit.

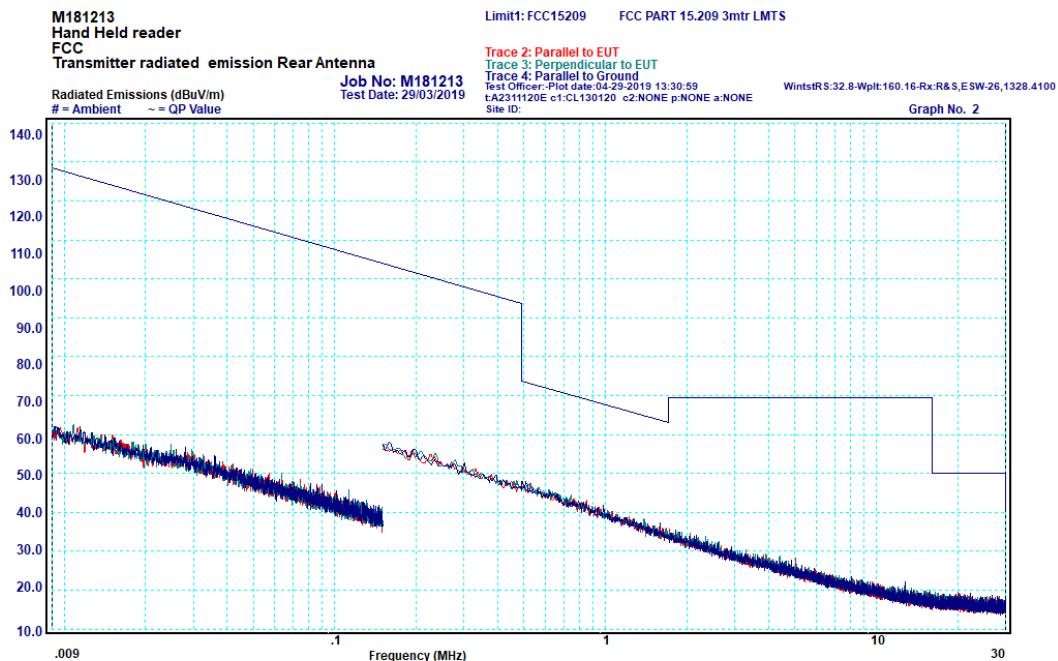
Note: At a measurement distance of 3 metres, all Bluechip fundamental transmissions were below the noise floor of the EMI receiver.

Front Antenna:



Graph 6-4: Spurious Emissions, 9 kHz – 30 MHz, Front Antenna

Rear Antenna:

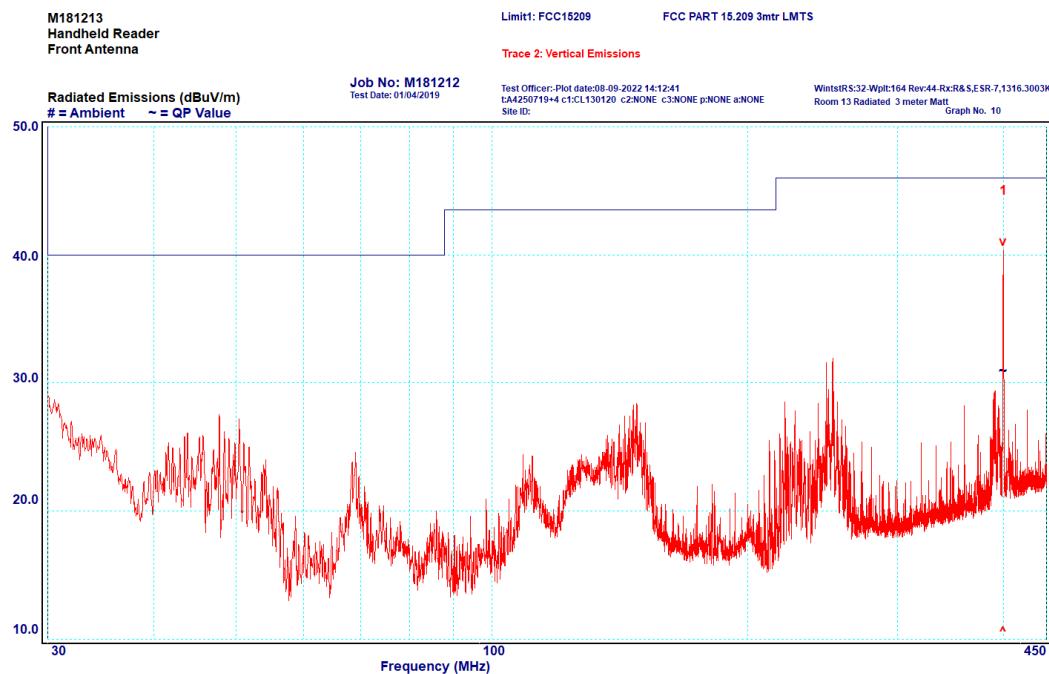


Graph 6-5: Spurious Emissions, 9 kHz – 30 MHz, Rear Antenna

6.5.4 Results: Frequency Band: 30 – 450 MHz

All spurious emissions measured in the frequency band 30 MHz to 450 MHz complied with the requirements of §15.209 (a).

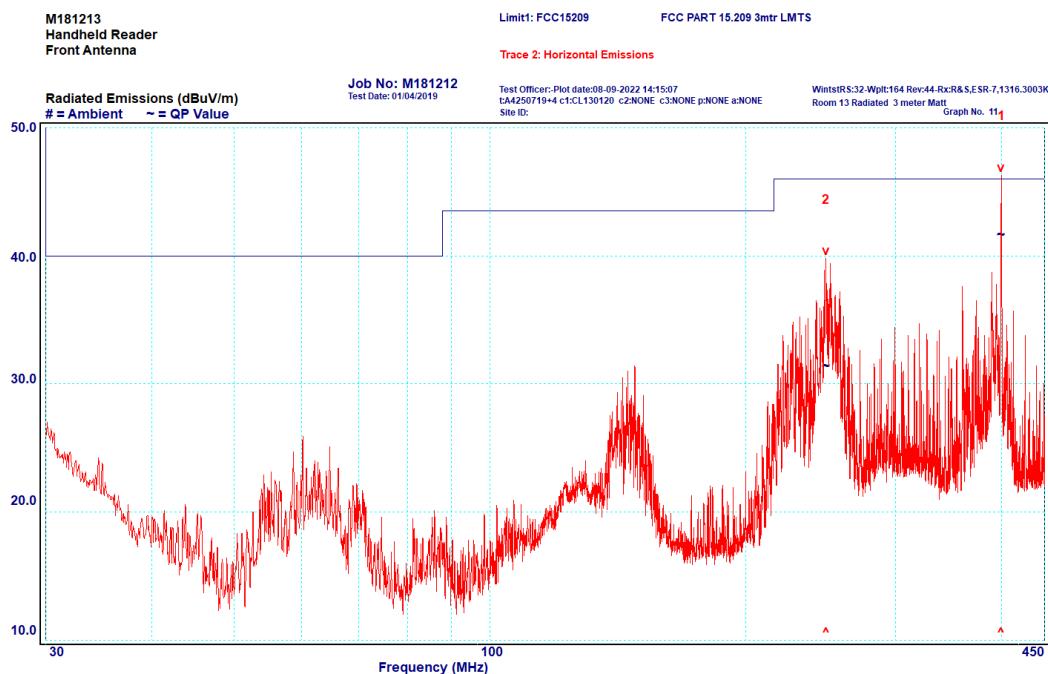
Front Antenna:



Graph 6-6: Spurious Emissions, 30 – 450 MHz, Vertical, Front Antenna

Table 6-4: Spurious Emissions, 30 – 450 MHz, Vertical, Front Antenna

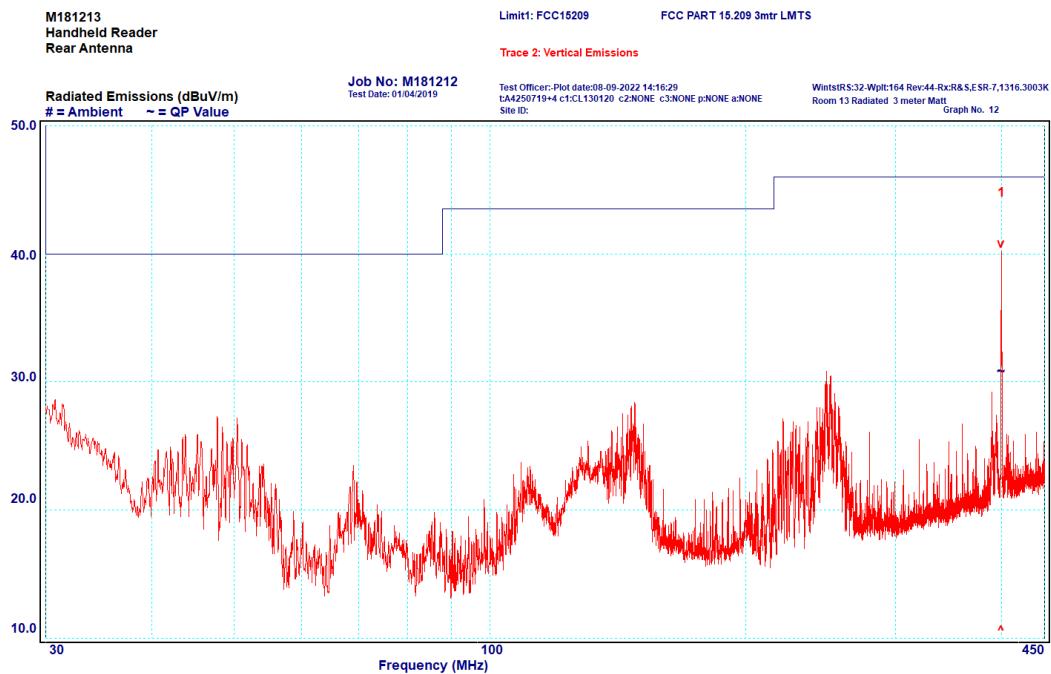
Peak	Polarisation	Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1	400.05	Vertical	31.4	46.0	-14.6



Graph 6-7: Spurious Emissions, 30 – 450 MHz, Horizontal, Front Antenna

Table 6-5: Spurious Emissions, 30 – 450 MHz, Horizontal, Front Antenna

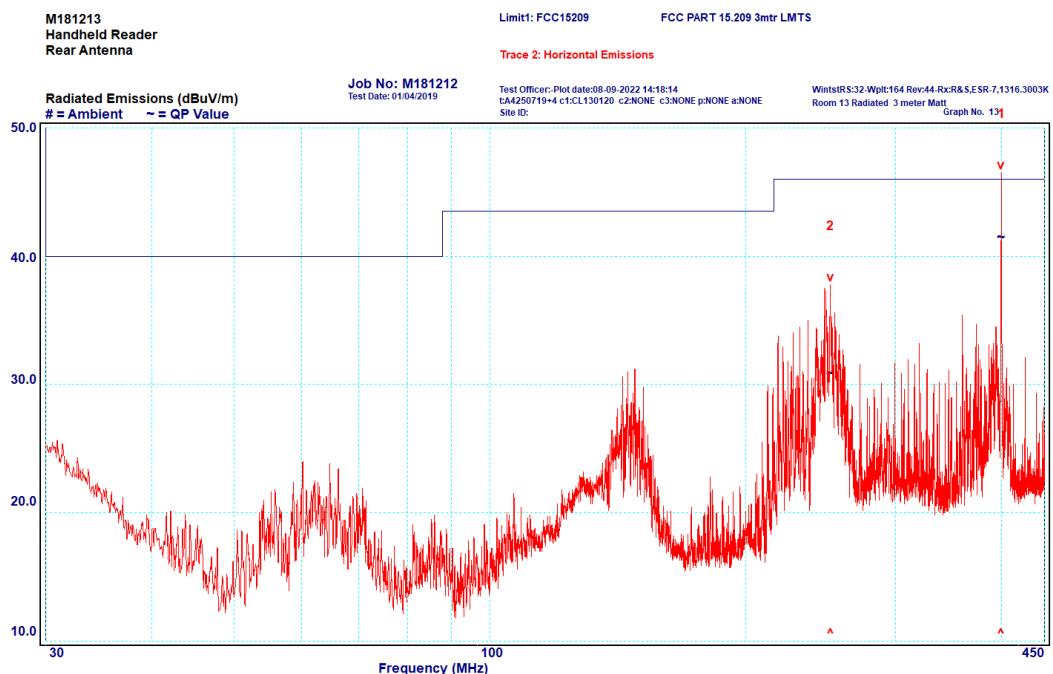
Peak	Polarisation	Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1	400.15	Horizontal	42.1	46.0	-3.9
2	248.67	Horizontal	31.9	46.0	-14.1

Rear Antenna:

Graph 6-8: Spurious Emissions, 30 – 450 MHz, Vertical, Rear Antenna

Table 6-6: Spurious Emissions, 30 – 450 MHz, Vertical, Rear Antenna

Peak	Polarisation	Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1	Vertical	400.14	31.3	46.0	-14.7



Graph 6-9: Spurious Emissions, 30 – 450 MHz, Horizontal, Rear Antenna

Table 6-7: Spurious Emissions, 30 – 450 MHz, Horizontal, Rear Antenna

Peak	Polarisation	Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Delta Limit (dB)
1	400.14	Horizontal	41.9	46.0	-4.1
2	251.78	Horizontal	31.4	46.0	-14.6

END OF REPORT