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Global Product Certification
EMC-EMF Safety Approvals

EMI TEST REPORT for CERTIFICATION to FCC PART 15.209 & RSS-210 / RSS-Gen

FCC ID: **XBH-AABM001**
Industry Canada ID: **8425A-AABM001**

Test Sample: Biomark HPR Series RFID Reader

Tested for: Aleis Pty Ltd

Report Number: M120519_Cert_HPR

Issue Date: 10th July 2012

EMC Technologies Pty Ltd reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. EMC Technologies Pty Ltd shall have no liability for any deductions, inferences or generalisations drawn by the client or others from EMC Technologies Pty Ltd issued reports. This report shall not be used to claim, constitute or imply product endorsement by EMC Technologies Pty Ltd.

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Report No. M120519_Cert_HPR

Test Sample:	Biomark HPR Series RFID Reader
Model Number:	HPR
Part Number:	AABM001
Manufacturer:	Elexon Electronics
FCC ID:	XBH-AABM001
IC ID:	8425A-AABM001
Equipment Type:	Intentional Radiator
Tested for:	Aleis Pty Ltd
Address:	PO Box 63 Jandowae QLD 4410 Australia
Contact:	Brian Clayton
Responsible Party:	John Finlayson
Test Standards:	FCC Part 15 – Radio Frequency Devices (October 2009) FCC Part 15.209: Radiated Emission Limits, General Requirements. ANSI C63.4 – 2009 RSS-210 Issue 8 - Low Power Licence-Exempt RadioCommunication Devices (All Frequency Bands): Category I Equipment RSS-Gen Issue 3 - General Requirements and Information for the Certification of RadioCommunication Equipment
Test Dates:	26th June to 2nd July 2012
Test Engineers:	Chieu Huynh Matthew Grimwood
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: **Chieu Huynh**
EMC Technologies Pty Ltd

EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15.209 & RSS-210 / RSS-Gen

1.0 INTRODUCTION

EMI testing was performed on the Biomark HPR Series RFID Reader.

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

47 CFR, Part 15, Subpart C:	Rules for intentional radiators (particularly section 15.209)
Section 15.203:	Antenna requirements
Section 15.205:	Restricted bands of operation
Section 15.207:	Conducted Emission Limits
Section 15.209:	Radiated Emission Limits, General Requirements

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.209: Radiated Emission Limits, General Requirements.

The test sample also **complied** with the Industry Canada RSS-210 Issue 8 & RSS-Gen Issue 3.

1.1 Summary of Results

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 / RSS-Gen Clauses	Test Performed	Result
15.203	RSS-Gen (7.1.2)	Antenna Requirement	**Not Applicable**
15.205	RSS-Gen (7.2.2)	Operation in Restricted Band	**Complied**
15.207	RSS-Gen (7.2.4)	Conducted Emissions	**Complied**
15.209	RSS-Gen (7.2.5)	Radiated Emissions	**Complied**

The measurement procedure used was in accordance with ANSI C63.4-2009. The instrumentation conformed to the requirements of ANSI C63.2-1996.

1.2 EUT – Voltage Power Conditions

Power is provided via an AC/DC adaptor. Testing was performed at a voltage of 240VAC, 50Hz for radiated emissions and 120VAC, 60Hz for conducted emissions.

1.3 Modifications

Ferrite (loop) was fitted on antenna cable and power supply cable (DC end).

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	Biomark HPR Series RFID Reader.
Model Number:	HPR
Part Number:	AABM001
Transmit Frequency:	134 kHz
Microprocessor Type:	Freescale IMX ARM9 and NXP ARM7
Crystal Frequencies:	17 MHz and 24 MHz
Highest Operating Frequency:	454 MHz
Input Supply:	11 - 30 VDC, 20W Max
AC Adaptor:	100 – 240 VAC, 1A Max

2.2 Operational Description

The Biomark HPR Series Reader is a non-consumer device intended for reading RFID tagging of animals.

2.3 Test Configuration

The EUT was configured to read a RFID tag continuously. The unit shows the unique tag number on its LCD screen and also flashes a blue LED when it successfully reads the tag.

2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2009. Radiated emissions tests were performed at a distance of 3 and 10 metres from the EUT.

2.5 Test Facility

2.5.1 General

EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited 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 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada number 3569B.**

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia.

2.5.2 NATA Accreditation

EMC Technologies is accredited in Australia to test to the following standards by the National Association of Testing Authorities (NATA).

"FCC Part 15 unintentional and intentional emitters in the frequency range 9kHz to 18 GHz excluding TV receivers (15.117 and 15.119), TV interface devices (15.115), cable ready consumer electronic equipment (15.118) and cable locating equipment (15.213).

The current full scope of accreditation can be found on the NATA website: www.nata.asn.au
It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

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 to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation (A^2LA).

2.6 Test Equipment Calibration

All 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). All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NMI and the working antennas (active loop and biconilog) calibrated by the EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

3.0 CONDUCTED EMISSION MEASUREMENTS

3.1 Test Procedure

The arrangement specified in ANSI C63.4-2009 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 C63.2-1996 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. 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.

3.2 Peak Maximising Procedure

The various operating modes of the system were investigated. 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.

3.3 Calculation of Voltage Levels

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

$$\mathbf{VEMI} = \mathbf{VRx} + \mathbf{LBPF}$$

Where:
VEMI = the Measured EMI voltage in dBµV to be compared to the limit.
VRx = the Voltage in dBµV read directly at the EMI receiver.
LBPF = the insertion loss in dB of the cables and the Limiter and Pass Filter.

3.4 Plotting of Conducted Emission Measurement Data

The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

3.5 Results of Conducted Emission Measurement

All emissions complied with the FCC Class B, quasi peak and average limits by margins of 8.4dB and 2.0dB. Refer to Appendix H, Graphs 1 & 2.

4.0 RADIATED EMISSION MEASUREMENTS

4.1 Test Procedure

Testing was performed in accordance with the requirements of FCC Part 15.209.

Radiated emission measurements were performed to the limits as per section 15.209.

The EUT was set up on the table top (placed on turntable) of total height 80 cm above the ground plane, and operated as described in section 2 of this report. The EMI Receiver was operated under software control via the PC Controller through the IEEE.488 Interface Bus Card Adaptor. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated loop antenna was used for measurements between 0.009 MHz to 30 MHz. A calibrated Biconilog antenna was used for measurements between 30 MHz to 2000 MHz.

The following bandwidth settings were used:
RBW = 200 Hz and VBW = 1 kHz for frequency band 9 kHz – 150 kHz
RBW = 9 kHz and VBW = 30 kHz for frequency band 150 kHz – 30 MHz
RBW = 120 kHz and VBW = 300 kHz for frequency band 30 MHz – 1000 MHz
RBW = 200 Hz and VBW = 10 Hz for frequency bands 9 kHz – 90 kHz and 110 kHz – 490 kHz
RBW = 1000 kHz and VBW = 10 kHz for frequency band 1000 MHz – 2000 MHz

The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for 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. Each significant peak was investigated with the Peak/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 antenna polarisations.

4.2 Plotting of Measurement Data for Radiated Emissions

The stored measurement data was combined to form a single graph which comprised of all the frequency sub-ranges. The accumulated EMI (EUT ON) was plotted as the Red trace.

The highest recorded EMI signals are shown on the Peaks List on the bottom right side of the graph. For radiated EMI, each numbered peak is listed as a frequency, peak field strength, quasi-peak field strength and the margin relative to the limit in dB. A negative margin is the deviation of the recorded value below the limit.

At times, the quasi peak level may appear to be higher than the peak level. This happens because the individual peak is further maximised with the QP detector, after the peak trace is recorded. This will be apparent when the peaks list at the foot of the graphs shows the quasi peak level.

4.3 Calculation of field strength

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

E = V + AF - G + L Where:

E = Radiated Field Strength in dBµV/m.
V = EMI Receiver Voltage in dBµV. (measured value)
AF = Antenna Factor in dB(m^{-1}). (stored as a data array)
G = Preamplifier Gain in dB. (stored as a data array)
L = Cable loss in dB. (stored as a data array of Insertion Loss versus frequency)

- **Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dBµV is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

34.0 + 9.2 + 1.9 - 20 = 25.1 dBµV/m

4.4 Results

Testing was performed in accordance with the requirements of FCC Part 15.209 and RSS-210.

Measurements were performed in 3 orthogonal planes and worst case results presented.

4.4.1 Frequency Band: 0.009 - 30 MHz (Fundamental and Spurious)

The fundamental limit at 134 kHz is 25.1 dBµV at 300m.

Testing was performed at a distance of 10 and 3 metres.

To determine an extrapolation factor, measurements were performed at 20, 15, 2 and 1.5 metres. Extrapolation factors of 55.2dB/decade was recorded between 15 & 1.5 metres and 56.7dB/decade was recorded between 20 & 2 metres

Frequency MHz	Test Distance (m)	Measured Level dBµV/m	LIMIT dBµV/m	Δ ±dB
0.134	3	121.9		
	10	94.1		
	30	66.7 (calculated)*		
	100	38.9 (calculated)*		
	300	11.5 (calculated)*	25.0	-13.5

*Measurements at two different test distances can be used to calculate an extrapolation factor. From the above results, an extrapolation factor of 55.2 dB/decade was used to calculate the level at 30 m, 100 m and 300 m.

The field strength emission complied with FCC limits by a margin of 13.5 dB at 300 m distance. Refer to Appendix H, graph 3.

Harmonics and spurious emissions were found to comply with FCC limits by a margin of > 10 dB.

There was no significant difference in radiated emissions between the USA standard and 240VAC @ 50 Hz.

4.4.2 Frequency Band: 30 - 1000 MHz

Testing was performed at a distance of 3 metres.

Frequency MHz	Polarisation	Measured QP Level dBµV/m	QP LIMIT dBµV/m	ΔQP ±dB
113.36	Vertical	43.5	43.5	0
110.45	Vertical	43.4	43.5	-.1
161.01	Vertical	42.5	43.5	-1.0
165.20	Vertical	42.4	43.5	-1.1
140.16	Vertical	42.3	43.5	-1.2
135.71	Vertical	42.2	43.5	-1.3
158.92	Vertical	42.2	43.5	-1.3
169.39	Vertical	41.9	43.5	-1.6
138.32	Vertical	41.3	43.5	-2.2
155.94	Horizontal	40.5	43.5	-3.0
104.07	Vertical	39.4	43.5	-4.1
180.86	Horizontal	39.2	43.5	-4.3
101.97	Vertical	38.5	43.5	-5.0

The worst case radiated EMI occurred at 113.36 MHz and complied with the FCC 15.209 Class B quasi peak limit by a margin of 0 dB. Refer to Appendix H, graphs 4 and 5.

There was no significant difference in radiated emissions between the USA standard and 240VAC @ 50 Hz.

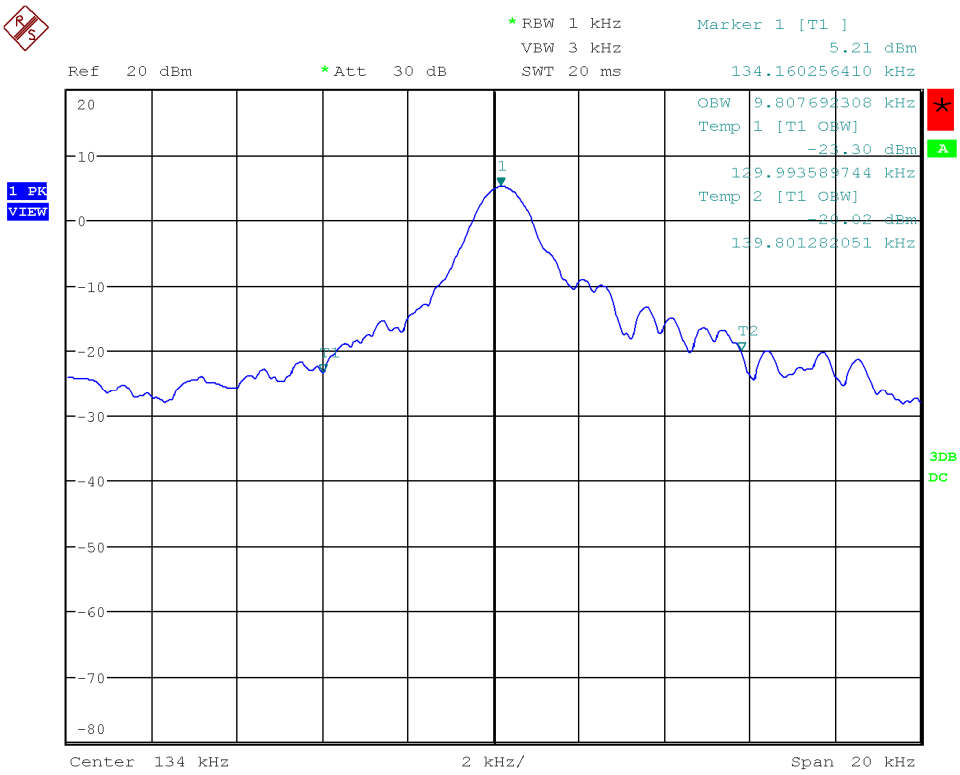
4.4.3 Frequency Band: 1000 - 2000 MHz

The worst case radiated EMI complied with the FCC 15.209 Class B average limit by a margin of > 10 dB. Refer to Appendix H, graphs 6 and 7.

There was no significant difference in radiated emissions between the USA standard and 240VAC @ 50 Hz.

4.4.4 Fundamental Bandwidth – 134 kHz

The 99% bandwidth is 9.807 kHz. Refer to below plot.



5. 0 ANTENNA REQUIREMENT

Testing to the requirements of FCC Part 15.203 was not applicable as this intentional radiator was designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

6.0 COMPLIANCE STATEMENT

The Biomark HPR Series RFID Reader, tested on behalf of Aleis Pty Ltd, **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.209: Radiated Emission Limits, General Requirements.

The test sample also **complied** with the Industry Canada RSS-210 Issue 8 & RSS-Gen Issue 3.

Results were as follows:

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 / RSS-Gen Clauses	Test Performed	Result
15.203	RSS-Gen (7.1.2)	Antenna Requirement	**Not Applicable**
15.205	RSS-Gen (7.2.2)	Operation in Restricted Band	**Complied**
15.207	RSS-Gen (7.2.4)	Conducted Emissions	**Complied**
15.209	RSS-Gen (7.2.5)	Radiated Emissions	**Complied**

7.0 UNCERTAINTIES

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

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%.

8.0 TEST REPORT APPENDICES

APPENDIX A: MEASUREMENT INSTRUMENT DETAILS
APPENDIX B: PHOTOGRAPHS
APPENDIX C: OPERATIONAL DESCRIPTION
APPENDIX D: BLOCK DIAGRAM
APPENDIX E: SCHEMATIC
APPENDIX F: LABELLING
APPENDIX G: USER MANUAL
APPENDIX H: GRAPHS of EMI MEASUREMENTS