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

FCC ID:	XBH-80309030
Industry Canada ID:	8425A-80309030
Test Sample:	ISO RFID Reader
Model:	ISO-9030BT
Tested for:	Aleis Pty Ltd
Report Number:	M090340_Cert_ISO-9030BT
Issue Date:	17th July 2009

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Test Sample:	ISO RFID Reader
Model:	ISO-9030BT
Manufacturer:	Aleis Pty Ltd
FCC ID:	XBH-80309030
IC:	8425A-80309030
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 (July 2008) FCC Part 15.209: Radiated Emission Limits, General Requirements. ANSI C63.4 – 2003 RSS-210 Issue 7 - Low Power Licence-Exempt RadioCommunication Devices (All Frequency Bands): Category I Equipment RSS-Gen Issue 2 - General Requirements and Information for the Certification of RadioCommunication Equipment
Test Dates:	7th to 9th April 2009
Test Engineer:	**Chieu Huynh** **Lee Hopkins**
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**

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1.0 INTRODUCTION

EMI testing was performed on the ISO RFID Reader, model number: ISO-9030BT.

The ISO-9030BT is one model of a series. The other three models listed below are variants:

ISO-8030	Standard Unit
ISO-8030BT	Standard Unit with Bluetooth (pre-approved module)
ISO-9030	With RFID Counter
ISO-9030BT	With RFID Counter and Bluetooth (pre-approved module)

All results for the ISO-9030BT are reported in this application (FCC ID: XBH-80309030). The other three models are exactly the same as the ISO-9030BT (the ISO-9030BT functions can cover the ISO-8030, ISO-8030BT and ISO-9030). Refer to Attachment 1 (model comparisons) for details. Therefore, the ISO-8030, ISO-8030BT and ISO-9030 are also included in this application.

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 7 & RSS-Gen Issue 2.

1.1 Summary of Results

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 / RSS-Gen Clauses	Test Performed	Result
15.203	7.1.4	Antenna Requirement	**Not Applicable**
15.205	2.2	Operation in Restricted Band	**Complies**
15.207	7.2.2	Conducted Emissions	**Not Applicable**
15.209	2.6 (tables 2 & 3)	Radiated Emissions	**Complies**

The measurement procedure used was in accordance with ANSI C63.4-2003. The instrumentation conformed to the requirements of ANSI C63.2-1996.

1.2 Modifications

No modifications were required.

2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	ISO RFID Reader
Model:	ISO-9030BT
Transmit Frequency:	134 kHz
Microprocessor Type:	NXP LPC2103 and Renesas H8S/2643
Crystal Frequencies:	17.1776 MHz and 14.7456 MHz
Highest Operating Frequency:	17.1776 MHz
Real Time Clock:	32.768 kHz
Input Supply:	9.6 VDC, 700mA Max

2.2 Operational Description

The 9030 Handheld ISO RFID Reader is used for detecting and recording RFIDs in Livestock and domestic Animals (pets).

2.3 Test Configuration

The EUT is operating in both HDX and FDX modes with Bluetooth (approved BT) on. Unit is continuously transmitting for the testing.

2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-2003. Radiated emissions tests were performed at a distance of 3, 10 and 30 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 open area test site (OATS) has also been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS 212, Issue 1 (Provisional) - **Industry Canada OATS number - IC 3569B-1.**

Radiated Emission measurements were performed at EMC Technologies open area test site (OATS) situated at Lerderderg Gorge, near the township of Bacchus Marsh in Victoria, Australia. Partial measurements were also performed at COLO site in Sydney (30m measurements).

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, biconical and log-periodic) 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

2.7 Ambients at OATS

The Open Area Test Site (OATS) is an area of low background ambient signals. No significant broadband ambients are present however commercial radio and TV signals exceed the limit in the FM radio, VHF and UHF television bands. Radiated prescan measurements were performed in the shielded enclosure to check for possible radiated emissions at the frequencies where the OATS ambient signals exceeded the test limit.

3.0 CONDUCTED EMISSION MEASUREMENTS

Not applicable, as EUT is battery powered.

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 measurements were made at the open area test site.

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 Biconical antenna was used for measurements between 30 MHz to 232 MHz and a calibrated Logperiodic antenna used for measurements between 230 MHz to 1000 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

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 over the range 0.009-30 MHz and 30-1000 MHz. The accumulated EMI (EUT ON) was plotted as the Red trace while the Ambient signals (AMBIENT) were plotted as Green trace. The worst case radiated EMI *peak* measurements as recorded using the Max-Hold data are presented as the upper or **RED** trace while the respective ambient signals are presented as the lower or **GREEN** trace. Occasionally, an intermittent ambient arose during the EUT ON measurement (RED trace) and could not be captured when the Ambient trace was being stored. The ambient peaks of significant amplitude with respect to the limit are tagged with the "#" symbol while EMI peaks are identified with a numeral. Ambient peaks that were present during the EUT ON measurement (RED trace) and not captured during the AMBIENT measurement were also tagged with the "#" symbol.

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.

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

Testing was performed at a distance of 3, 10 and 30 metres.

Frequency MHz	Test Distance (m)	Measured Level dBμV/m	LIMIT dBμV/m	Δ ±dB
0.134	10	96.8		
0.134	30	64.4	65.0	-0.6
0.134	100	32.0 (calculated)*	44.1	-12.1
0.134	300	-0.4 (calculated)*	25.0	-25.4
0.536	3	70.0	73.0	-3.0
0.403	3	79.4	95.2	-14.8
0.269	3	74.8	98.8	-24.8

*Measurements at two different test distances can be used to calculate a third distance. From the above results, an extrapolation factor of 32.4 dB was used to calculate the level at 100 m and then at 300 m.

Average and Quasi-Peak detectors were used in the frequency bands 9-90 kHz & 110-490 kHz. No significant differences in the field strength levels were measured.

The field strength emission complied with FCC limits by a margin of 0.6 dB at 30 m distance. Harmonics emissions were found to comply with FCC limits by a margin of 3.0 dB.
Refer to Appendix H, graphs 1 and 2.

4.4.2 Frequency Band: 30 - 1000 MHz

Testing was performed at a distance of 10 metres.

Frequency MHz	Polarisation	Measured QP Level dBμV/m	QP LIMIT dBμV/m	ΔQP ±dB
165.39	Horizontal	26.5	33.0	-6.5
274.86	Horizontal	28.3	35.5	-7.2
170.41	Horizontal	25.1	33.0	-7.9
78.98	Vertical	20.8	29.5	-8.7
368.68	Horizontal	25.9	35.5	-9.6

The worst case radiated EMI occurred at 165.39 MHz and complied with the FCC 15.209 Class B quasi peak limit by a margin of 6.5 dB. Refer to Appendix H, graphs 3 & 4.

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 ISO RFID Reader, model number: ISO-9030BT, 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 7 & RSS-Gen Issue 2.

Results were as follows:

FCC Part 15, Subpart C Clauses	Industry Canada RSS-210 / RSS-Gen Clauses	Test Performed	Result
15.203	7.1.4	Antenna Requirement	**Not Applicable**
15.205	2.2	Operation in Restricted Band	**Complies**
15.207	7.2.2	Conducted Emissions	**Not Applicable**
15.209	2.6 (tables 2 & 3)	Radiated Emissions	**Complies**

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:

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

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: FCC ID LABELLING
APPENDIX G: USER MANUAL
APPENDIX H: GRAPHS of EMI MEASUREMENTS
Attachment 1: Model Comparisons
Attachment 2: Bluetooth Letter
Attachment 3: Collocation Letter