EMC Technologies Pty Ltd
ABN 82 057 105 549
Unit 3/87 Station Road
Seven Hills NSW 2147 Australia

Telephone +61 2 9624 2777
Facsimile +61 2 9838 4050
Email syd@emctech.com.au
www.emctech.com.au

Global Product Certification
EMC-EMF Safety Approvals

EMC TEST REPORT

This is a replacement report for Test Report No. B091002

Report No. B091002_R

Manufacturer:	Grcic Corp. Pty Ltd
Test Sample:	Referee (Electronic Gaming Equipment)
Model Number:	Referee
Serial Number:	R19CA (Tx) and R91IA (Rx)
Date of Issue:	23rd July 2013

Accreditation No. 5292

This document is issued in accordance with NATA's accreditation requirements. The results of tests, calibration and/or measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing and calibration reports.

ISO 7637, EN61000-3-2 and EN61000-3-3 are not covered by our NATA accreditation.

Certificate of Compliance
EMC Technologies Report No: B091002_R

Test Sample Name: Referee (Electronic Gaming Equipment)
Model Number: Referee
Serial Number: R19CA (Tx) and R91IA (Rx)
Part Number: Ref

Manufacturer: Grcic Corp. Pty Ltd

Tested For: Grcic Corp Pty Ltd
Address: 9-11 Evergreen Street
CLIFTON BEACH QLD 4879

Phone Number: (07) 4059 1197
Fax Number: (07) 4059 1197
Responsible Party: Ivy Grcic

Test Standard/s:
ETSI EN 300 220-1 v2.3.1 (2009-12)
Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25MHz to 1000MHz frequency range with power levels ranging up to 500mW; Part 1: Technical characteristics and test methods
ETSI EN 300 220-2 v2.1.2 (2007-06)
Electromagnetic compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 25MHz to 1000MHz frequency range with power levels ranging up to 500mW; Part 2: Harmonised EN covering essential requirements under article 3.2 of the R&TTE Directive.
ETSI EN 301 489-1 v1.8.1 (2008-04)
Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
ETSI EN 301 489-3 v1.4.1 (2002-08)
Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9kHz and 40GHz

Result of Test: Sample complied with the clauses tested of the above listed standards. Refer to Report B091002_R for full details.

Test Dates: 27/11/2009, 08/12/2009, 11/12/2009, 16/12/2009, 13/01/2009, 25/01/2009, 27/01/2010.

Testing Officers:

Andy Colak **Samuel Griffiths**

Authorised Signature:

Les Dickenson
Branch Manager
EMC Technologies Pty Ltd

Issued by EMC Technologies Pty Ltd, Unit 3, 87 Station Road, Seven Hills, NSW, 2147, Australia.
Phone: +61 2 9624 2777 Fax: +61 2 9838 4050 www.emctech.com.au

Part 1

EMC Tests on the Referee (Electronic Gaming Equipment), in accordance with ETSI EN 300 220-2, ETSI EN 300 220-1, ETSI EN 301 489-1 and ETSI EN 301 489-3

1. INTRODUCTION

Electromagnetic Compatibility (EMC) tests were performed on the Referee (Electronic Gaming Equipment), Model: Referee, in accordance with the clauses tested for the requirements of ETSI EN 300 220-2, ETSI EN 300 220-1, ETSI EN 301 489-1 and ETSI EN 301 489-3. The details of the Equipment Under Test (EUT) and the test results are provided.

2. SUMMARY of RESULTS

2.1 Emissions Test to ETSI EN 300 220-1 & 2

2.1.1 Transmitter Parameters

Frequency error or frequency drift	Complies
Carrier Power (conducted)	Not applicable
Effective Radiated Power	Complies
Spread Spectrum Modulation	Not applicable
Transient Power	Not applicable
Adjacent Channel Power	Not applicable
Modulation Bandwidth for wideband equipment	Complies
Spurious emissions	Complies with a margin of at least 1.8 dB*.
Frequency stability under low voltage conditions	Complies
Duty cycle	Complies
Principle for Listen Before Talk (LBT)	Not applicable

2.1.2 Receiver Parameters

Maximum usable sensitivity (conducted)	Not applicable
Receiver LBT threshold and transmitter max on-time	Not applicable
Adjacent channel selectivity	Not applicable
Blocking or desensitization	Not applicable
Intermodulation response rejection	Not applicable
Spurious response rejection	Not applicable
Receiver spurious radiation	Complies with a margin of greater than 10dB.

* This result falls within the laboratory's measurement uncertainty.

2.2 Emissions Test to ETSI EN 301 489-1 and ETSI EN 301 489-3

EN55022- Conducted EMI:	Not applicable
EN55022-Telecommunication:	Not applicable
EN55022 -Radiated EMI:	Complies
EN 61000-3-2	Not applicable
EN 61000-3-3	Not applicable

2.3 Immunity Tests to ETSI EN 301 489-1

EN61000-4-2:	Complies, with Criterion A
EN61000-4-3:	Complies, with Criterion A
EN61000-4-4:	Not applicable
EN61000-4-5:	Not applicable
EN61000-4-6:	Not applicable
ISO7637-1/2:	Not applicable
EN61000-4-11:	Not applicable

3. DESCRIPTION

3.1 Test Sample

The Equipment Under Test (EUT) was identified as follows:

Manufacturer	:	Grcic Corp. Pty Ltd
Test Sample	:	Referee (Electronic Gaming Equipment)
Model	:	Referee
Serial Number	:	R19CA (Tx) and R91IA (Rx)
Microprocessor	:	DSPIC 33F
Clock frequencies	:	8MHz

Transmitter Specifications:

RF frequency	:	433.299744 MHz
Channel width	:	199.951172 kHz
Deviation	:	31.738281 kHz
DataRate	:	76.766968 kBaud
Modulation	:	2-FSK
Duty Cycle	:	Maximum transmit time is 6.25 ms over a 2 second period.

3.2 Modifications

The power output was reduced to 8 dB by the manufacturer to comply with the radiated emissions requirement.

3.3 Test Set Up

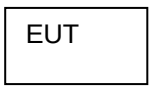
The EUT will be set up in accordance with the standard and the customer's requirements. Two samples are being tested together. For emissions testing one device (serial no: R19CA) was set up to transmit continually and the other (serial no: R91IA) was set up to be idle, ready to receive.

For immunity testing the Rx device was set up to fire infrared every 2 seconds. The Tx device registers a 'hit' and transmits RF. The Rx device receives the transmitted RF, increments a counter and plays a sound.

3.4 Description

The EUT is an infrared electronic gaming equipment used and designed for commercial indoor and outdoor live gaming venues.

3.5 Block Diagram



Part 2

EMC Emissions Tests on the Referee (Electronic Gaming Equipment), in accordance with ETSI EN 300 220-1 & 2

1 TEST REQUIREMENTS

1.1 ETSI EN 300 220-1 Requirements

Clause 1	Scope	Noted
Clause 2	References	Noted
Clause 3	Definitions and abbreviations	Noted
Clause 4	Technical requirements specifications	Noted
Clause 5	Test conditions, power sources and Ambient temperatures	Noted
Clause 6	General conditions	Noted
Clause 7	Transmitter requirements	Complied
Clause 8	Receiver requirement	Complied
Clause 9	Measurement uncertainty	Noted

1.2 ETSI EN 300 220-2 Requirements

Clause 1	Scope	Noted
Clause 2	References	Noted
Clause 3	Definitions and abbreviations	Noted
Clause 4	Technical requirements specifications	Noted
Clause 5	Test for compliance with technical Requirements	Noted
Clause 6	Interpretation of measurement results	Noted

1.3 ETSI EN 300 220-2/ETSI EN 300 220-1 Equipment Categorisation

The EUT was categorized as follows:

Category	Category Level
Power Class	7a
Receiver Class	1
Alignment range	AR0
Temperature Category	I
Duty Cycle Class	4

2. TRANSMITTER TEST RESULTS – ESTI EN 300 220-2

2.1 Transmitter Requirements ETSI EN 300 220-1

2.1.1 Frequency Error or Frequency Drift (Clause 7.1)

The frequency variation was less than 50 ppm over the operating temperature range of 0 °C to 35 °C.

2.1.2 Carrier Power (conducted) (Clause 7.2)

Not applicable as the EUT is supplied with a dedicated antenna.

2.1.3 Effective Radiated Power (Clause 7.3)

Effective Radiated Power measurements were taken at 10 metre antenna distance.

Frequency (MHz)	Antenna Polarisation	Peak Level (mW)	Limit (mW)	ΔResult (mW)
433.26	Vertical	0.681	5	4.319
433.25	Horizontal	0.127	5	4.873

The highest effective radiated power measurement was 4.319 mW below the limit at 433.26 MHz for Vertical Antenna Polarisation.
Refer to Appendix B, Graphs 5 to 6.

2.1.4 Spread Spectrum Modulation (Clause 7.4)

Not applicable as the EUT transmit frequency does not fall within the frequency range of the limits for spread spectrum modulation.

2.1.5 Transient Power (Clause 7.5)

Not applicable as the EUT does not employ digital modulation, nor does the EUT facilitate operating on multiple channels.

2.1.6 Adjacent Channel Power (Clause 7.6)

Not applicable as the EUT is not narrowband channel spacing equipment.

2.1.7 Modulation Bandwidth for Wideband Equipment (Clause 7.7)

Modulation bandwidth measurements were taken at the sub-band edge frequency (f_e) of 433.05 MHz with a centre frequency of 433. 27 MHz.

Frequency	RBW (kHz)	Peak Level (dBm)	Limit (dBm)	ΔResult (dB)
f_e	1	-32.6	-30	-2.6
f_e -200 kHz	1	-49.3	-36	-13.3
f_e -400 kHz	10	-46.5	-36	-10.5
f_e -1 MHz	100	-41.4	-36	-5.4

The EUT complied with the limit by a margin of 2.6 dB.

2.1.8 Spurious Emissions 25MHz to 5GHz (Clause 7.8)

Spurious emission measurements were taken at 10 metre antenna distance below 1GHz and at 3m above 1GHz.

Frequency (MHz)	Antenna Polarisation	Peak Level (dBµV/m)	Limit @ 10m (dBµV/m)	ΔResult (dB)
485.34	Vertical	29.0	30.8	-1.8
866.54	Vertical	45.4	48.8	-3.4
866.54	Horizontal	38.9	48.8	-9.9

The highest effective radiated power measurement was 1.8dB below the limit at 485.34MHz for Vertical Antenna Polarisation.
Refer to Appendix B, Graphs 1 to 4.

2.1.9 Frequency Stability Under Low Voltage Conditions (Clause 7.9)

The EUT was disconnected from its internal battery and connected to a test power source (DC power supply).
The voltage from the test power source was reduced below the lower extreme test voltage limit towards zero.

The result was that the carrier frequency remained stable up until the supply voltage fell to 3.6 V, at which point the carrier signal disappeared entirely.

2.1.10 Duty Cycle (Clause 7.10)

The manufacturer has declared that due to the time between transmissions by the devices, the duty cycle is less than 10 %.

2.1.11 Principle for Listen Before Talk (Clause 9.1)

Not applicable as the EUT does not use LBT

2.2 Receiver Requirement ETSI EN 300 220-1

2.2.1 Maximum Usable Sensitivity (conducted) (Clause 8.1)

Not applicable as the EUT does not transfer messages.

2.2.2 Receiver LBT threshold and transmitter max on-time (Clause 8.2)

Not applicable as the receiver does not facilitate an LBT protocol.

2.2.3 Adjacent Channel Selectivity (Clause 8.3)

Not applicable as no channel plan has been stated.

2.2.4 Blocking or Desensitization (Clause 8.4)

Not applicable for the following reason:

Section 9.4.2 of ETSI EN 300 220-1 states that “Signal Generator B is then switched on and adjusted until the wanted criteria (see clause 9.1.1) is just exceeded”.

The criteria of clause 9.1.1 are not relevant to the EUT because the EUT does not transfer messages.

For this reason, the blocking or desensitization test was not applied.

2.2.5 Intermodulation Response Rejection (Clause 8.5)

Not applicable as the EUT does not facilitate operating on multiple channels, and for the reason stated in section 2.2.4 of this report.

2.2.6 Spurious Response Rejection

Not applicable for the reason stated in section 2.2.4 of this report.

2.2.7 Receiver Spurious Radiation 25MHz to 4GHz (Clause 8.6)

This was tested to the requirements of ETSI EN 301 489-1 and ETSI EN 301 489-3.

2.3 CONCLUSION

The Referee (Electronic Gaming Equipment), Model: Referee, tested on behalf of Grcic Corp Pty Ltd, complied with the clauses tested for the requirements of ETSI EN 300 220-1 and ETSI EN 300 220-2.

2.4 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

9kHz to 30 MHz	±3.2 dB

Radiated Emissions

9kHz to 30MHz	±4.1 dB
30MHz to 300MHz	±5.1 dB
300MHz to 1000MHz	±4.7 dB
1GHz to 18GHz	±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%.

Part 3

EMC Tests on the Referee (Electronic Gaming Equipment), in accordance with ETSI EN 301 489-1 and ETSI EN 301 489-3

1. TEST REQUIREMENTS

1.1 ETSI EN 301 489-1 Requirements

Clause 1	Scope	Noted
Clause 2	References	Noted
Clause 3	Definitions and abbreviations	Noted
Clause 4	Test Conditions	Noted
Clause 5	Performance Assessment	Noted
Clause 6	Performance Criteria	Noted
Clause 7	Applicability overview table	
Clause 7.1	Emission	Noted
Clause 7.2	Immunity	Noted
Clause 8	Method of measurement and limits for EMC emissions	Noted
Clause 9	Test methods and levels for immunity tests	Noted
Clause 9.1	Test Configuration	Noted
Clause 9.2	Radio frequency electromagnetic field	Complies
Clause 9.3	Electrostatic Discharge	Complies
Clause 9.4	Fast transients common mode	Not applicable
Clause 9.5	Radio frequency common mode	Not applicable
Clause 9.6	Transients and surges, vehicular environment	Not applicable
Clause 9.7	Voltage dips and interruptions	Not applicable
Clause 9.8	Surges	Not applicable

1.2 ETSI EN 301 489-3 Requirements

Clause 1	Scope	Noted
Clause 2	References	Noted
Clause 3	Definitions and abbreviations	Noted
Clause 4	Test Conditions	Noted, EUT was classified as Type III as per Table 1
Clause 5	Performance Assessment	Noted
Clause 6	Performance Criteria	Noted, EUT was classified as Class 1 as per Table 3
Clause 7	Applicability overview	
Clause 7.1	Emission	Tested to requirements of Table 5
Clause 7.2	Immunity	Tested to requirement of Table 6

1.3 EN 55022 REQUIREMENTS

Clause 1:	Noted
Clause 2:	Noted
Clause 3:	Noted
Clause 4:	Class B ITE
Clause 5:	Not applicable
Clause 6.1:	Tested to the limits of Table 6 at a 10 m distance
Clause 6.2:	Tested to the limits of Table 9 at a 3 m distance
Clause 7:	Noted, only one sample tested
Clause 8:	Noted, all tests and equipment are in accordance with the requirements of the standard
Clause 9:	Noted, all tests and equipment are in accordance with the requirements of the standard
Clause 10:	Noted, all tests and equipment are in accordance with the requirements of the standard

2. EMISSIONS TEST RESULTS – EN55022

2.1 Conducted Disturbance Results

Not applicable for a battery operated device.

2.2 Radiated Disturbance Results

Radiated disturbance measurements were taken at a 10 metre antenna distance below 1GHz and at 3m above 1GHz.

The highest radiated disturbance measurement was greater than 10dB below the limit.

Refer to Appendix B, Graphs 7 to 10.

2.3 Current Harmonic Emissions

Not applicable for a battery operated device.

NATA does not provide accreditation for testing to EN61000-3-2

2.4 Voltage Fluctuations and Flicker

Not applicable for a battery operated device.

NATA does not provide accreditation for testing to EN61000-3-3

3. IMMUNITY TEST RESULTS

3.1 Performance Pass/Fail Criteria in accordance with ETSI EN 301 489-3

The following performance criteria was used to determine the pass/fail status for immunity tests in accordance with ETSI EN 301 489-3.

Class of SRD Equipment	Risk assessment of receiver performance
1	Highly reliable SRD communication media; e.g. serving human life inherent systems (may result in physical risk to a person).
2	Medium reliable SRD communication media; e.g. causing inconvenience to persons, which cannot simply be overcome by other means.
3	Standard reliable SRD communication media; e.g. inconvenience to persons, which can simply be overcome by other means(e.g. manual)

Class 1 SRD Equipment		
Criteria	**During test**	**After test**
A	Operate as intended. No loss of function. For equipment type II the minimum performance shall be 12dB SINAD. No unintentional responses.	Operate as intended. For equipment type II the communication link shall be maintained. No loss of function. No degradation of performance. No loss of stored data or user programmable functions.
B	May be loss of function (one or more). No unintentional responses	Operate as intended. Lost functions shall be self-recoverable. No degradation of performance. No loss of stored data or user programmable functions.
Class 2 SRD Equipment		
Criteria	**During test**	**After test**
A	Operate as intended. No loss of function. For equipment type II the minimum performance shall be 6dB SINAD. No unintentional responses	Operate as intended. For equipment type II the communication link shall be maintained. No loss of function. No degradation of performance. No loss of stored data or user programmable functions.
B	May be loss of function (one or more). No unintentional responses	Operate as intended. Lost functions shall be self-recoverable. No degradation of performance. No loss of stored data or user programmable functions.
Class 3 SRD Equipment		
Criteria	**During test**	**After test**
A & B	May be loss of function (one or more). No unintentional responses	Operate as intended. For equipment type II the communication link may be lost, but shall be recoverable by user. No degradation of performance. Lost functions shall be self-recoverable.

The EUT was classified as Class 3; equipment.

Equipment Type	Technical Nature of the Primary Function
I	Transfer of messages (digital or analogue signals)
II	Transfer of audio (speech or music)
III	Others

The EUT was classified as Type III equipment.

3.2 STANDARDS APPLIED

ETSI EN 301 489-1
Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.

ETSI EN 301 489-3
Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9kHz and 40GHz.

EN61000-4-2:2001
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques.
Section 2: Electrostatic Discharge immunity test.

EN61000-4-3:2006
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques.
Section 3: Radiated, radio-frequency, electromagnetic field immunity test.

EN61000-4-4:2004
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques.
Section 4: Electrical fast transient burst immunity test.

EN61000-4-5:2006
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques.
Section 5: Surge immunity test

EN61000-4-6:2007
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques.
Section 6: Immunity to conducted disturbances.

ISO7637-2:2004
Road vehicles - Electrical disturbances from conduction and coupling
Part 2: Electrical transient conduction along supply lines only

EN61000-4-11:2004
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques.
Section 11: Voltage dips, short interruptions and voltage variations immunity test.

3.3 PERFORMANCE CRITERIA

Criteria are from table 4, Class 3 SRD Equipment:

Performance criteria for continuous phenomena applied to Transmitters (CT)
For equipment of Type I or II, performance Criteria A applies.
For equipment of type II or III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence.
Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that unintentional transmission does not occur.

Performance criteria for Transient phenomena applied to Transmitters (TT)
For equipment of Type I or II, performance Criteria B applies, except for power interruptions exceeding a certain time (refer to Clause 7.2.2 of the standard).
For equipment of type II or III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence.
Where the EUT is a transmitter, tests shall be repeated with the EUT in standby mode to ensure that unintentional transmission does not occur.

Performance criteria for Continuous phenomena applied to Receivers (CR)
For equipment of Type I or II, performance Criteria A applies.
Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.
For equipment of type II or III that requires a communication link that is maintained during the test, it shall be verified by appropriate means supplied by the manufacturer that the communication link is maintained during each individual exposure in the test sequence.

Performance criteria for Transient phenomena applied to Receivers (TR)
For equipment of Type I or II, performance Criteria B applies, except for power interruptions exceeding a certain time (refer to Clause 7.2.2 of the standard). Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.
For equipment of type II or III that requires a communication link that is maintained during the test, this shall be verified by appropriate means supplied by the manufacturer during each individual exposure in the test sequence.

The product standard determined the following compliance criteria:

Test	EUT	Abbreviation	Pass Criteria
Electrostatic Discharge	Transmitters	TT	Criteria B
	Receiver	TR	Criteria B
Radiated RF Field	Transmitters	CT	Criteria A
	Receivers	CR	Criteria A
Electrical Fast Transient	Transmitter	TR	Criteria B
	Receivers	TR	Criteria B
Surge	Transmitters	TT	Criteria B
	Receivers	TR	Criteria B
Conducted Disturbances	Transmitters	CT	Criteria A
	Receivers	CR	Criteria A
Voltage Dips and Interruptions	Transmitters	TT	Criteria B
	Receivers	TR	Criteria B
Transient and Surges	Transmitters	TT	Criteria B
	Receivers	TR	Criteria B

4. TEST RESULTS

4.1 EN61000-4-2 Immunity to Electrostatic Discharge

4.1.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP 1000-4-2 and EN61000-4-2. A minimum of ten discharges were applied at each level. Both the Transmitter unit and the Receiver unit were tested.

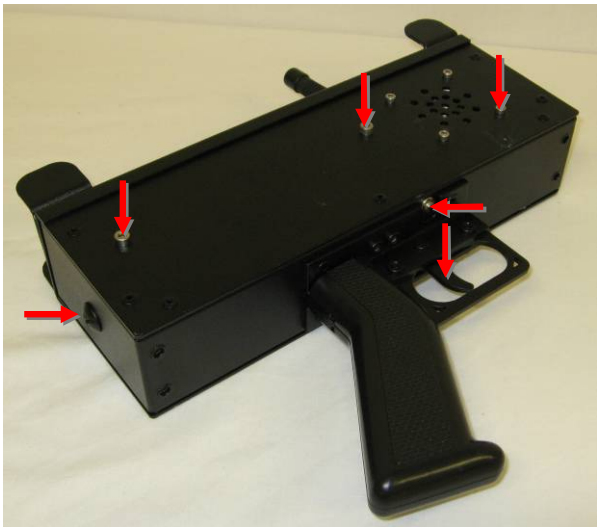
4.1.2 Test Climatic Conditions

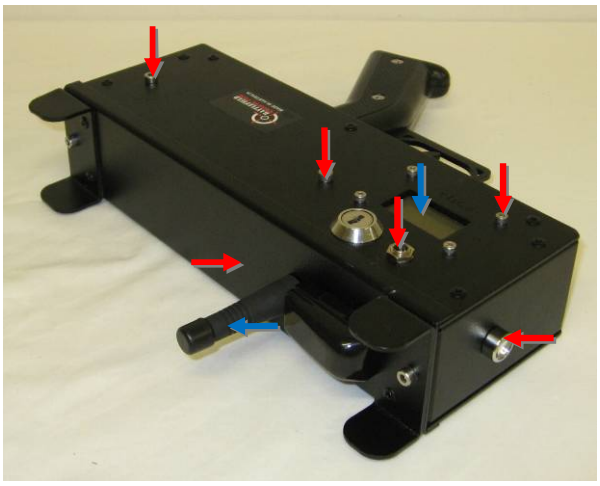
Shielded Room Temperature:	27°C
Relative Humidity:	49%

4.1.3 Discharge Points

Indirect contact discharges were applied to the horizontal coupling plane (HCP) at one point on each of the four sides of the EUT. Indirect contact discharges were applied to the vertical coupling plane (VCP) with the VCP placed along each of the four sides of the unit.

Direct contact discharges were applied to the following points in red and direct air discharges were applied to the following points in blue:





4.1.4 Air Discharge

Air Discharges	Level	Voltage	Result
Insulating Surfaces	1	± 2kV	No effect
Insulating Surfaces	2	± 4kV	No effect
Insulating Surfaces	3	± 8kV	No effect

Note: No discharge occurred.

Conclusion: No effect. The EUT complied with the Criterion A requirements of ETSI EN 301 489-1.

4.1.5 Contact Discharge

Contact Discharges	Level	Voltage	Result
Horizontal Coupling Plane	1	± 2kV	No effect
Horizontal Coupling Plane	2	± 4kV	No effect
Vertical Coupling Plane	1	± 2kV	No effect
Vertical Coupling Plane	2	± 4kV	No effect
Direct	1	± 2kV	Note
Direct	2	± 4kV	Note

Note: At +2kV and ±4kV the EUT in Transmit mode does not register a hit and therefore remains idle. The EUT automatically recovers after the test.

Conclusion: Effect noted. The EUT complied with the Criterion B requirements of ETSI EN 301 489-1.

4.2 EN61000-4-3 Immunity to Radiated Electromagnetic Fields

4.2.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP1000-4-3 and EN61000-4-3.

The radiating antenna was positioned at a distance of 3m from the EUT in vertical and horizontal antenna polarisation. Six sides of the EUT were irradiated. The dwell time at each frequency was 3 seconds with a step rate of 1% of the fundamental frequency. Both the Transmitter unit and the Receiver unit were tested. Testing was performed from 80 – 1000MHz. The transmitter and receiver performance was not monitored in the frequency range between 390 MHz and 476 MHz as stated in clause 4 of ETSI EN 301 489-3 for a Receiver Class 3. Radiated Immunity testing for the frequency range of 1000-2700MHz was performed by EMC Technologies Pty Ltd – Sydney. The results are attached in Appendix C.

4.2.2 Test Climatic Conditions

Shielded Room Temperature: 25°C
Relative Humidity: 61%

4.2.3 Results

Field Level	Modulation	Frequency Band	Result
3V/m	1 kHz 80% AM	80-1000 MHz	No effect

Conclusion: No effect, the EUT complied with the Criterion A requirements of ETSI EN 301 489-1.

4.3 EN61000-4-4 Immunity to Electrical Fast Transients

Not applicable as the EUT is battery powered with no cables exceeding a 3m length.

4.4 EN61000-4-5 Surge Immunity

Not applicable as the EUT is battery powered.

4.5 ISO7637-1 and ISO7637-2 Immunity to Transients & Surges

Not applicable as the device is not for vehicular use.

4.6 EN61000-4-6 Immunity to Conducted Disturbances

Not applicable as the EUT is battery powered with no cables exceeding a 3m length.

4.7 EN61000-4-11 Immunity to Voltage Dips and Interruptions

Not applicable as the EUT is battery powered.

5. CONCLUSION

The Referee (Electronic Gaming Equipment), Model: Referee, complied with the emission and immunity requirements of ETSI EN 300 489-1 and ETSI EN 300 220-1.

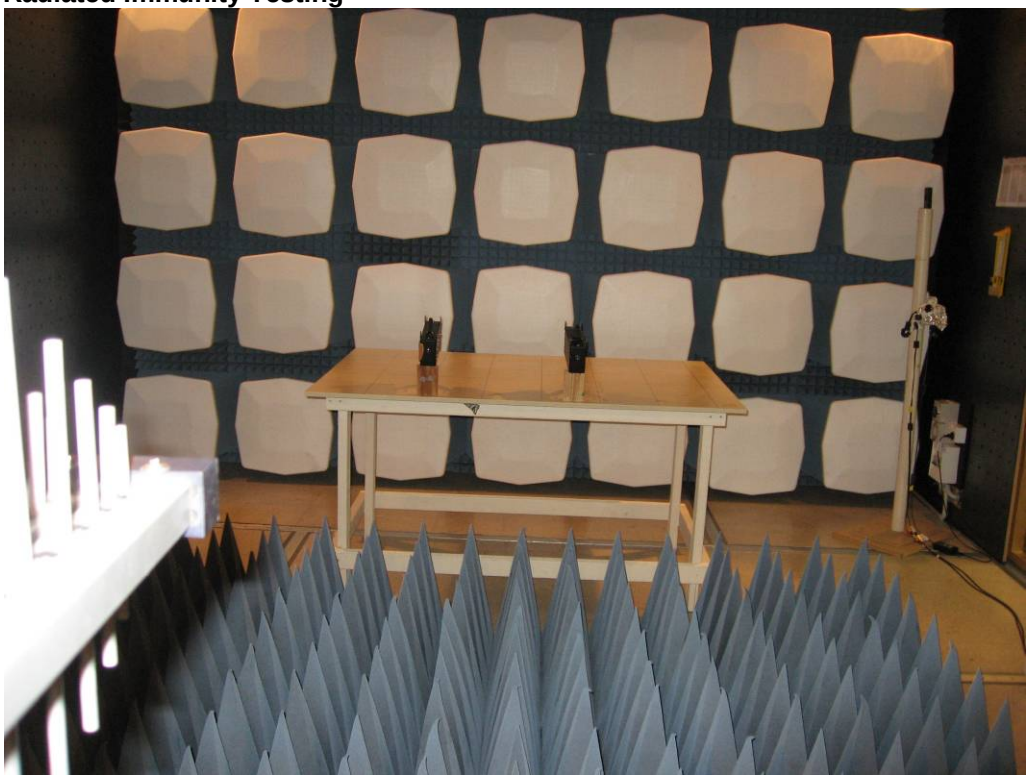
APPENDIX A1
Photographs – Test Setup

Radiated Emissions

APPENDIX A2
Photographs – Test Setup

Electrostatic Discharge

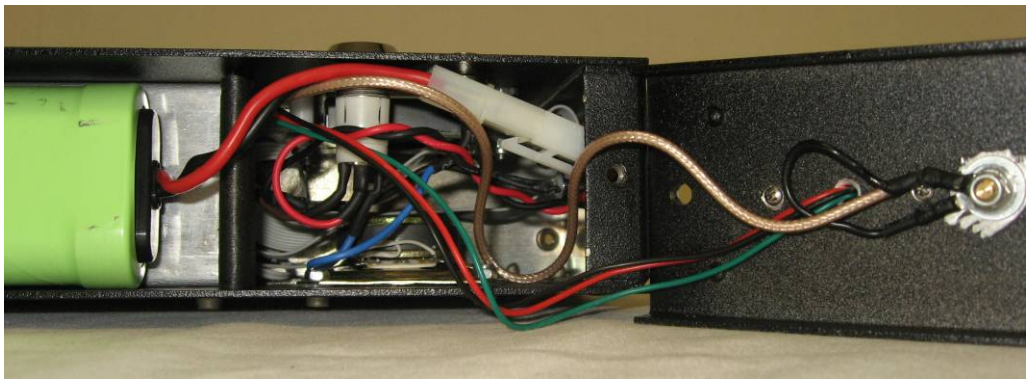
Radiated Immunity Testing

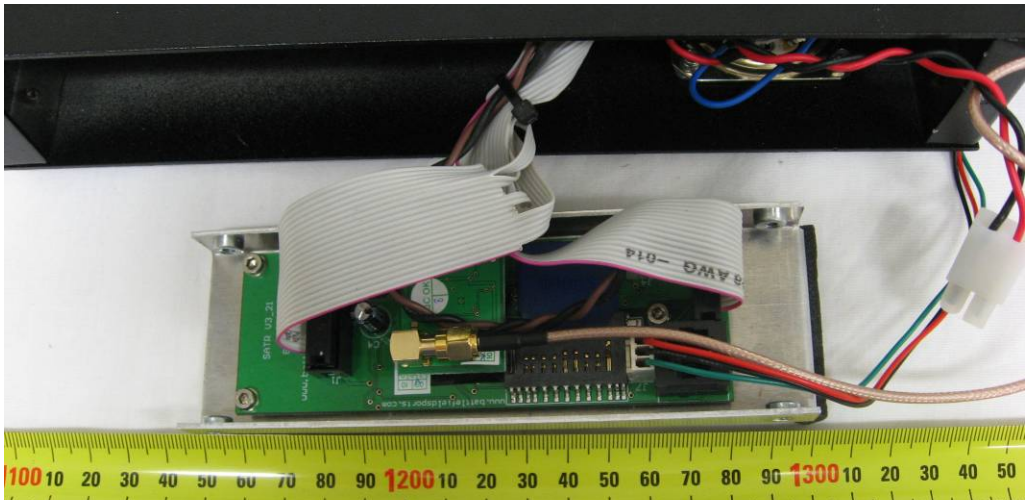


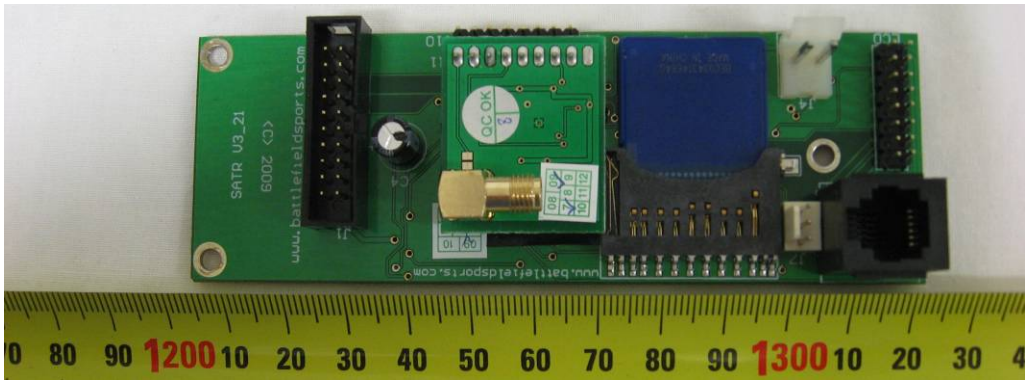
APPENDIX A3
Photographs – Identification

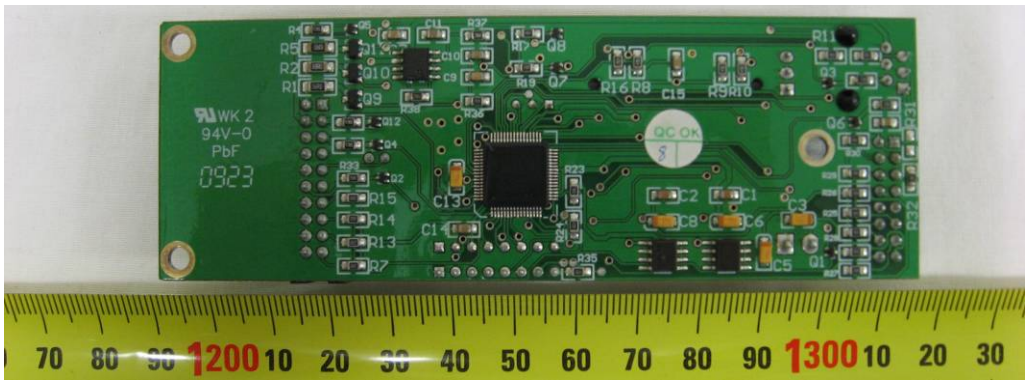
Rx Mode

APPENDIX A4
Photographs – Identification

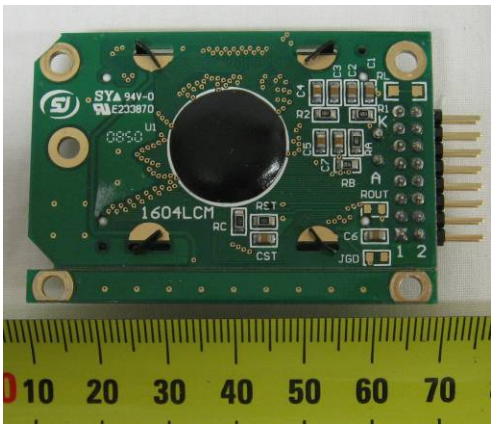


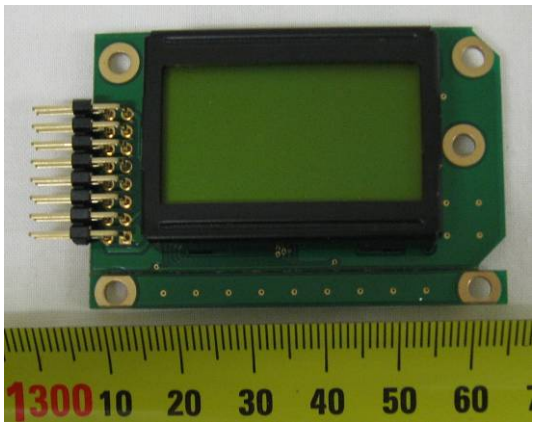


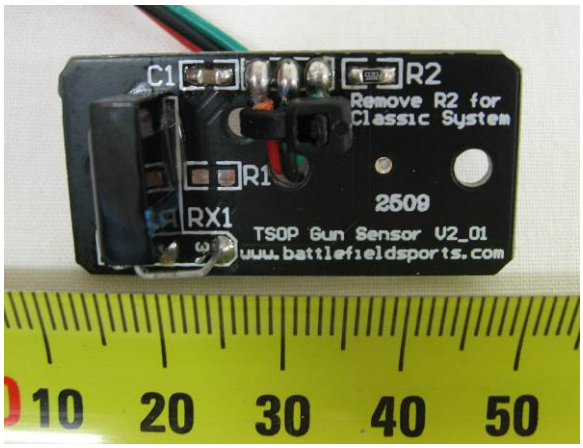


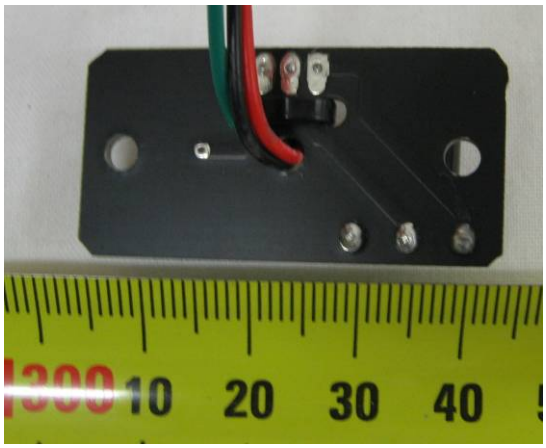


APPENDIX A5
Photographs – Identification



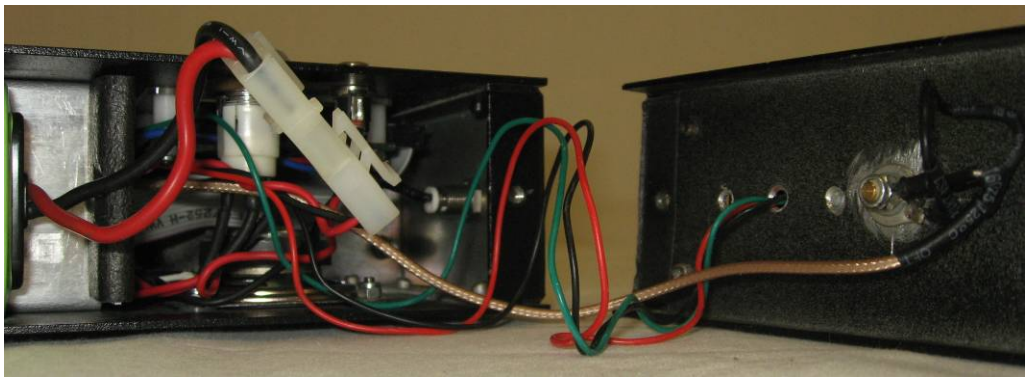


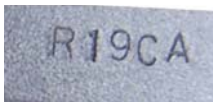


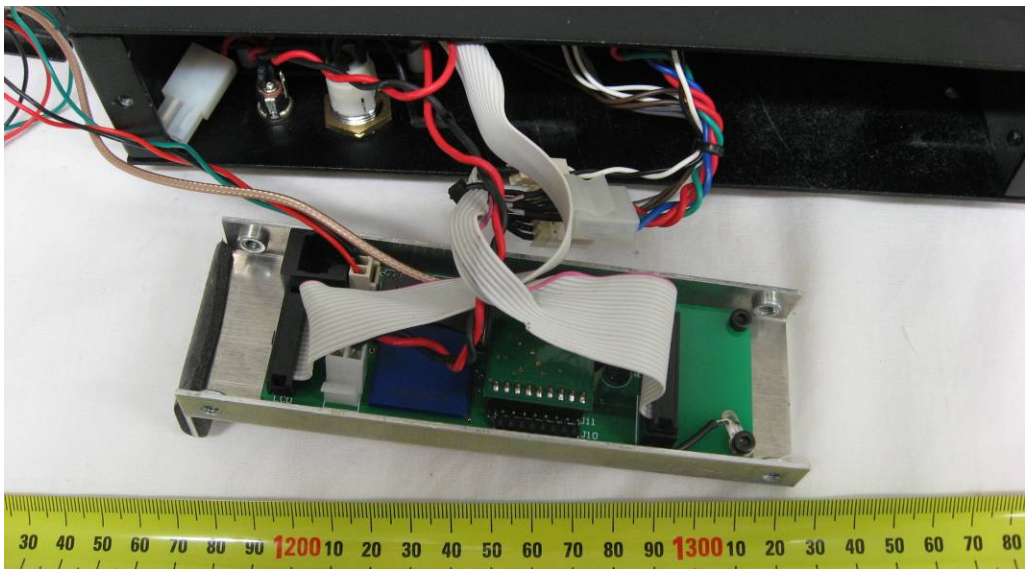


Tx Mode

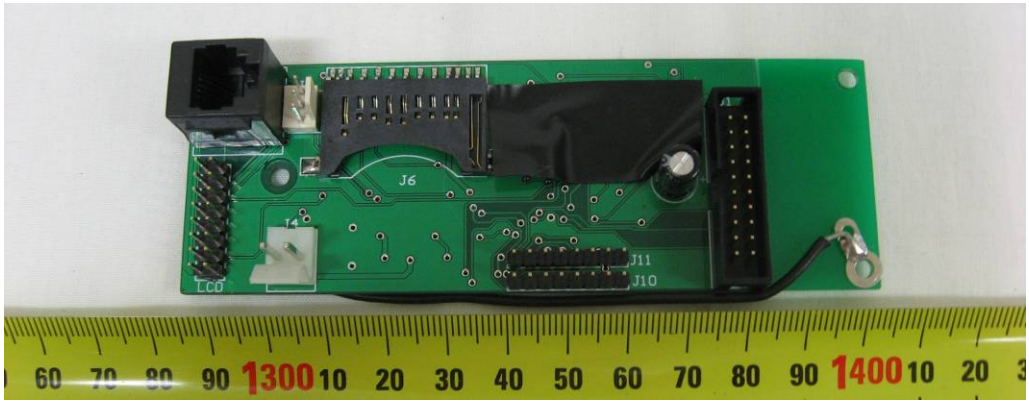
APPENDIX A6
Photographs – Identification

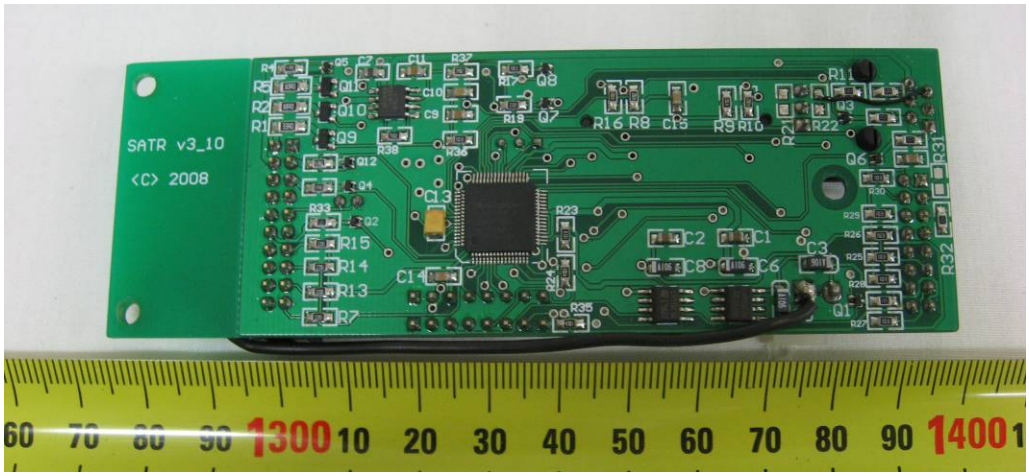




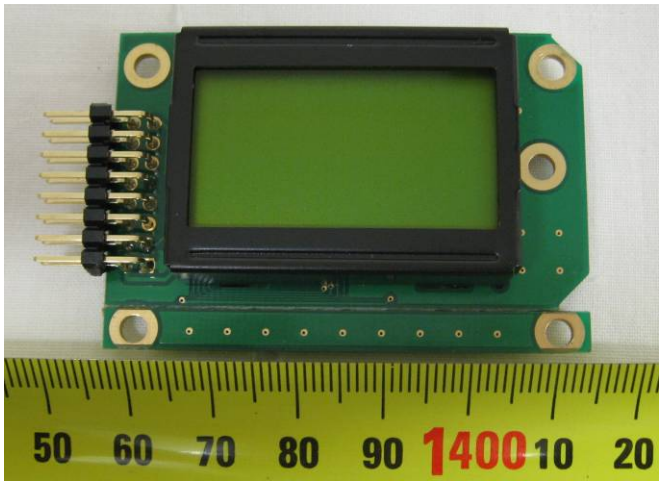


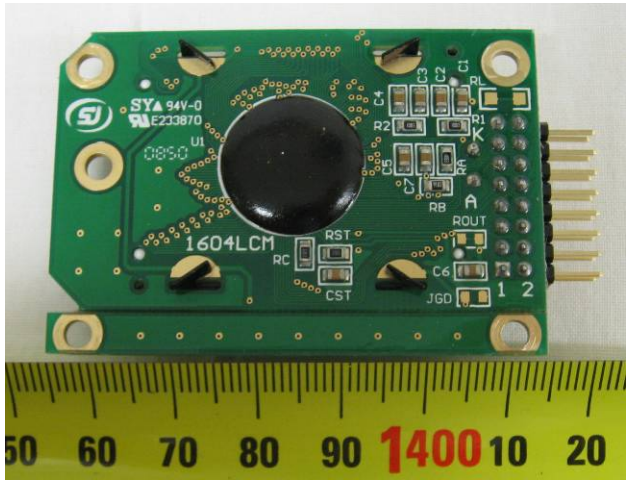
APPENDIX A7
Photographs – Identification

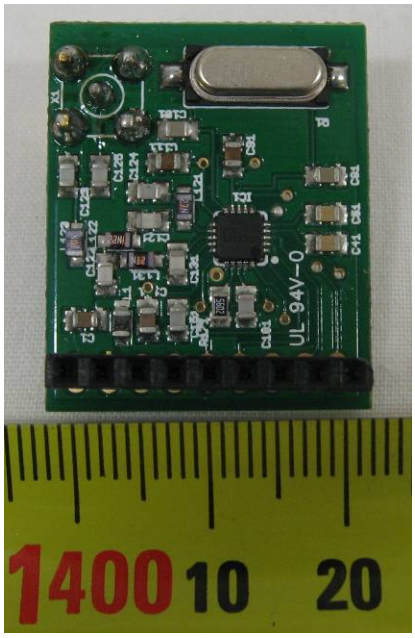


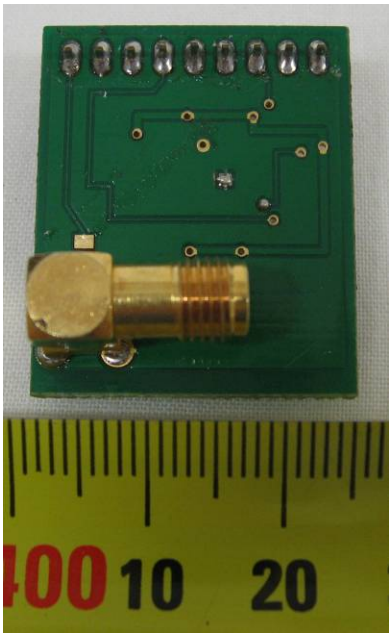


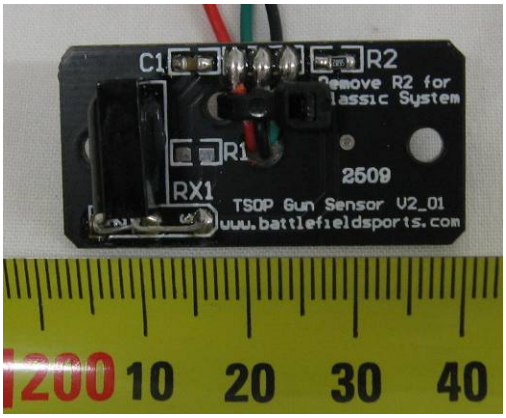
APPENDIX A8
Photographs – Identification

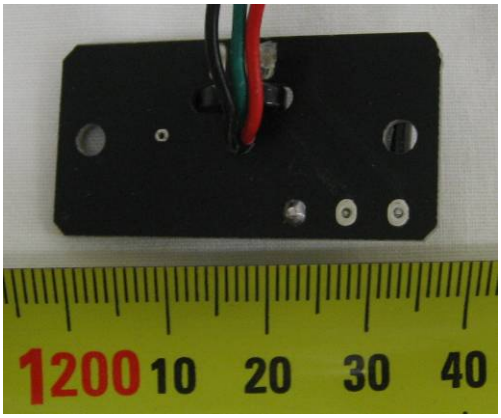












APPENDIX B

Graphs of EMI Measurements

Radiated Emissions

Transmitter – ETSI EN 300 220-1

Graph 1:	Vertical Antenna Polarisation	29 to 1005 MHz
Graph 2:	Horizontal Antenna Polarisation	29 to 1005 MHz
Graph 3:	Vertical Antenna Polarisation	1000 to 5005 MHz
Graph 4:	Horizontal Antenna Polarisation	1000 to 5005 MHz
Graph 5:	Vertical Antenna Polarisation	430 to 437 MHz
Graph 6:	Horizontal Antenna Polarisation	430 to 437 MHz

Receiver – ETSI EN 301 489-1 and ETSI EN 301 489-3

Graph 7:	Vertical Antenna Polarisation	29 to 1005 MHz
Graph 8:	Horizontal Antenna Polarisation	29 to 1005 MHz
Graph 9:	Vertical Antenna Polarisation	1000 to 5005 MHz
Graph 10:	Horizontal Antenna Polarisation	1000 to 5005 MHz

EMC Technologies Pty. Ltd. - Global Product Certification

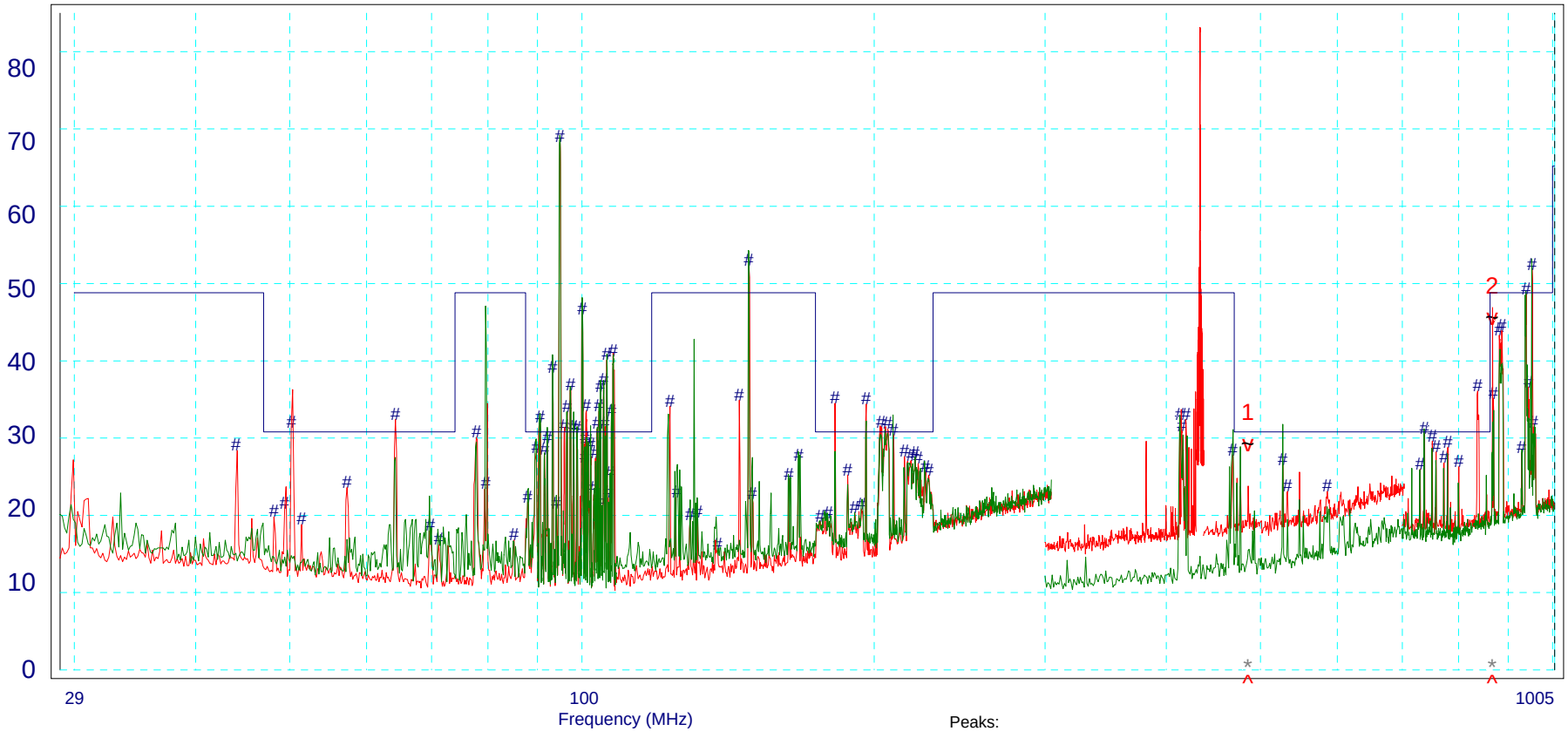
ETSI EN 300 220
Radiated Emissions (dBuV/m)
= Ambient

Job No:B091002

p:\PCF\091002tx_1.PCF

Test Date: 27/11/2009

GRAPH No. 1



Peaks:

No	Freq (MHz)	Peak (dBuV/m)	QP Val	300-220-S (dBuV/m)	dL1 (dB)
1	485.34	29.0	29.0	30.8	-1.8
2	866.54	45.4	45.4	48.8	-3.4

Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R19CA
Transmit Mode

Limits:
300-220-S EN 300 220-1 Spurious Emissions

Legend:
Vertical Ambients
Vertical Emissions

Ver 5.5 Build 158
Milbong OATS
t:A2230110 c1:COAT0310_10M c2:NONE p:A0510610 a:
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002R1 1 , 2 , 3 , 4 , 5 , 14 ,15
091002R3 23 ,24 ,25 ,26 ,27 ,12 ,13 ,11 ,10

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

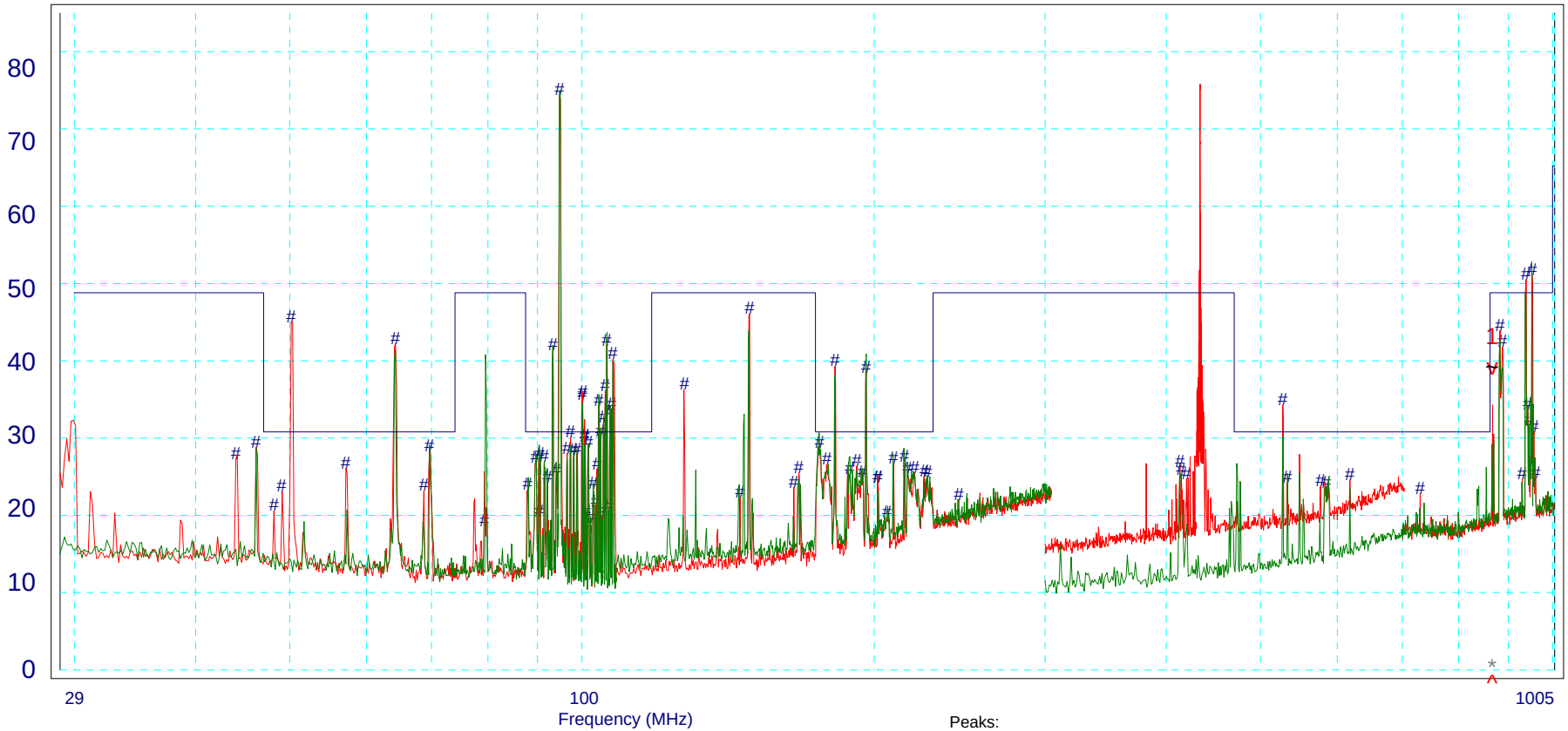
ETSI EN 300 220
Radiated Emissions (dBuV/m)
= Ambient

Job No:B091002

p:\PCF\091002tx_2.PCF

Test Date: 27/11/2009

GRAPH No. 2



Peaks:

No	Freq (MHz)	Peak (dBuV/m)	QP Val	300-220-S (dBuV/m)	dL1 (dB)
1	866.54	38.9	38.9	48.8	-9.9

Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R19CA
Transmit Mode

Limits:
300-220-S EN 300 220-1 Spurious Emissions

Legend:
Horizontal Ambients
Horizontal Emissions

Ver 5.5 Build 158
Milbong OATS
t:A2230110 c1:COAT0310_10M c2:NONE p:A0510610 a:
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002R1 6 , 7 , 8 , 9 , 10 ,11 ,12
091002R3 18 ,19 ,20 ,21 ,22 ,14 ,15 ,16 ,17

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

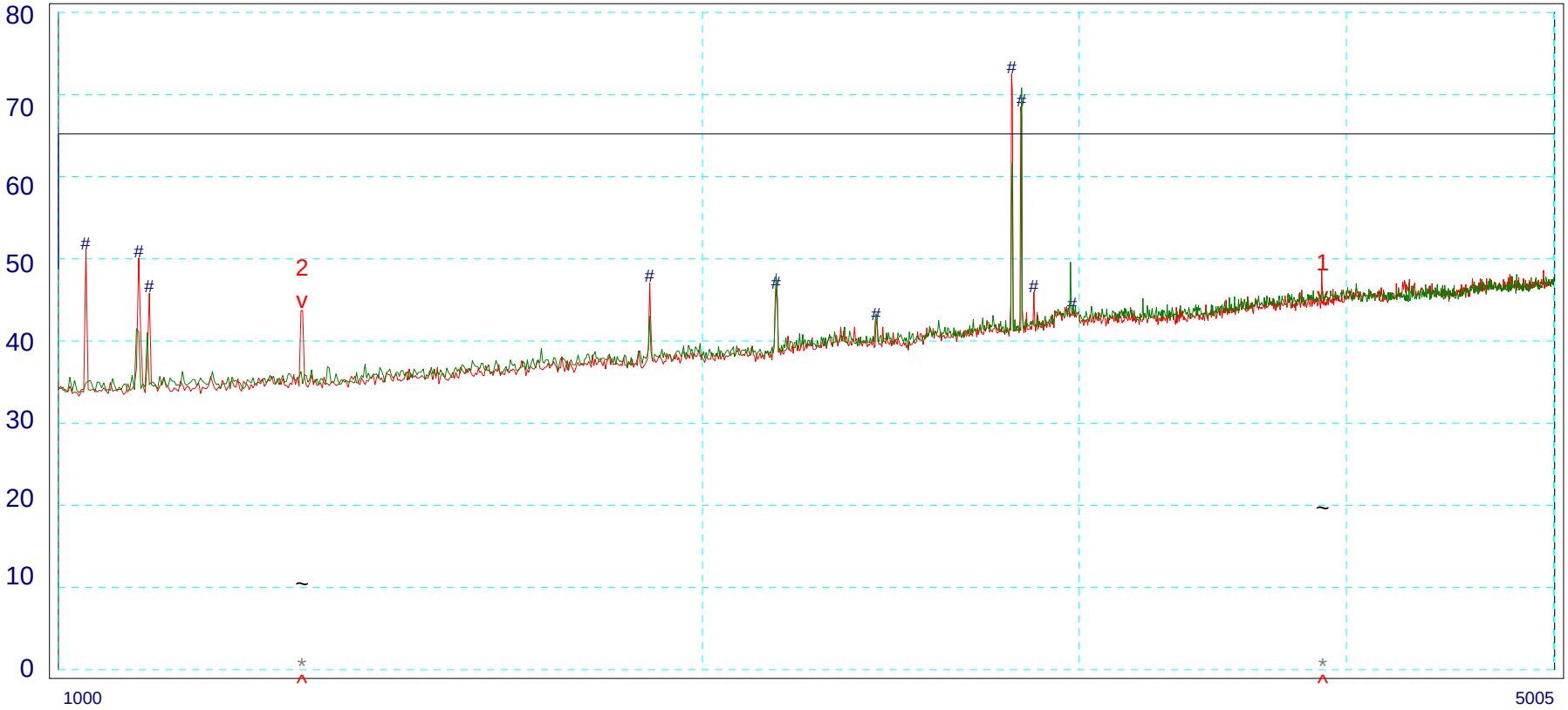
ETSI EN 300 220
Radiated Emissions (dBuV/m)
= Ambient

Job No:B091002

p:\PCF\091002tx_3.PCF

Test Date: 11/12/2009

GRAPH No. 3



Peaks:

No	Freq (MHz)	Peak (dBuV/m)	Av Val	300-220-S (dBuV/m)	dL1 (dB)
1	3899.65	45.1	19.3	65.2	-45.9
2	1299.97	44.5	10.1	65.2	-55.1

Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R19CA
Transmit Mode

Limits:
300-220-S EN 300 220-1 Spurious Emissions

Legend:
Vertical Ambients
Vertical Emissions

Ver 5.5 Build 158
Milbong OATS, Microwave Frequencies
t:A2250112 c1:C4111010 c2:C4121010 p:NONE a:NONE
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002G1 1 , 2 , 3 , 4
091002G1 11 ,12 ,13 ,14

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

ETSI EN 300 220

Radiated Emissions (dBuV/m)

= Ambient

Job No:B091002

p:\PCF\091002tx_4.PCF

Test Date: 11/12/2009

GRAPH No. 4

Peaks:

No	Freq (MHz)	Peak (dBuV/m)	Av Val	300-220-S (dBuV/m)	dL1 (dB)
1	1299.89	43.6	23.4	65.2	-41.8
2	1733.34	37.7	23.2	65.2	-42.0

Grcic Corp Pty Ltd

Referee

Model: Referee, Serial No: R19CA

Transmit Mode

Limits:

300-220-S EN 300 220-1 Spurious Emissions

Legend:

Horizontal Ambients

Horizontal Emissions

Ver 5.5 Build 158

Milbong OATS, Microwave Frequencies

t:A2250112 c1:C4111010 c2:C4121010 p:NONE a:NONE

Site ID: OATS, Milbong, Queensland

Test Officer:Andy Colak

Source:

091002G16 , 7 , 8 , 9

091002G115 ,16 ,17 ,18

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia

Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

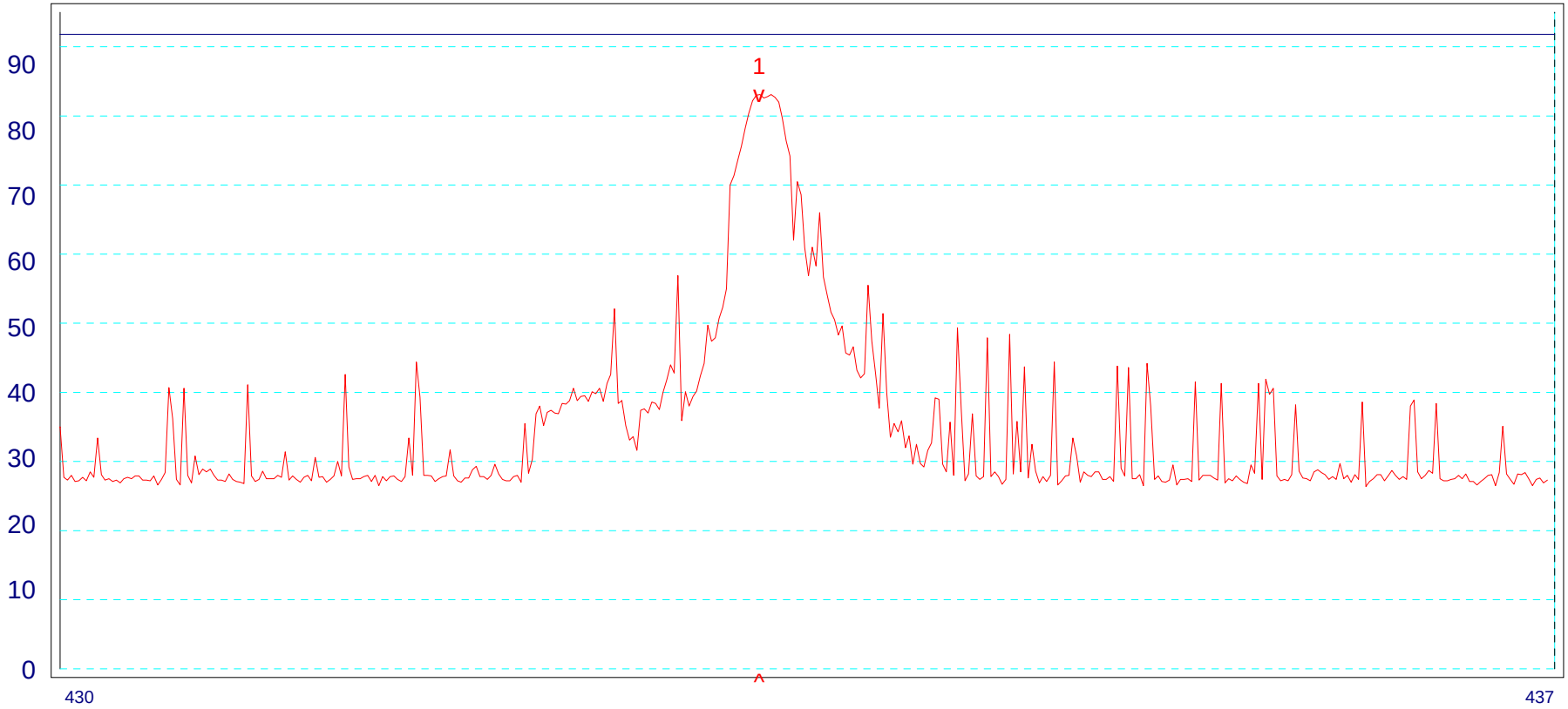
ETSI EN 300 220
Radiated Emissions (dBuV/m)
= Ambient

Job No:B091002

p:\PCF\091002tx_5.PCF

Test Date: 27/11/2009

GRAPH No. 5



Peaks:

No	Freq (MHz)	Peak (dBuV/m)	300-220-7a (dBuV/m)	dL1 (dB)
1	433.26	83.1	91.8	-8.7

Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R19CA
Transmit Mode

Limits:
300-220-7a EN 300 220-1 Effective Radiated Power Class 7a

Legend:
Vertical Emissions

Ver 5.5 Build 158
Milbong OATS
t:A2230110 c1:COAT0310_10M c2:NONE p:NONE a:
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002R3.13

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

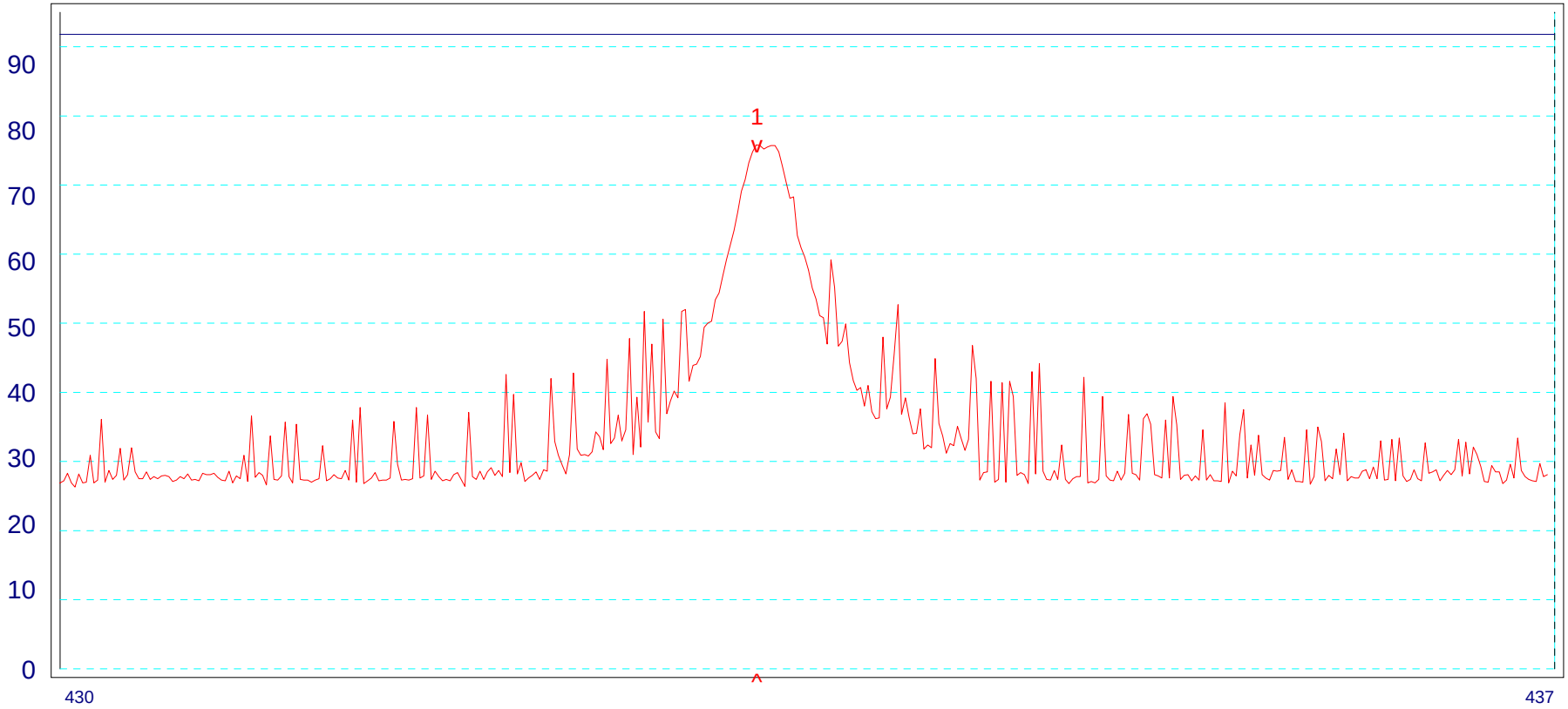
ETSI EN 300 220
Radiated Emissions (dBuV/m)
= Ambient

Job No:B091002

p:\PCF\091002tx_6.PCF

Test Date: 27/11/2009

GRAPH No. 6



Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R19CA
Transmit Mode

Limits:
300-220-7a EN 300 220-1 Effective Radiated Power Class 7a

Legend:
Horizontal Emissions

Ver 5.5 Build 158
Milbong OATS
t:A2230110 c1:COAT0310_10M c2:NONE p:NONE a:
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002R3.15

Peaks:

No	Freq (MHz)	Peak (dBuV/m)	300-220-7a (dBuV/m)	dL1 (dB)
1	433.25	75.8	91.8	-16.0

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

ETSI EN 301 489-1 & ETSI EN 301 489-3

Radiated Emissions (dBuV/m)

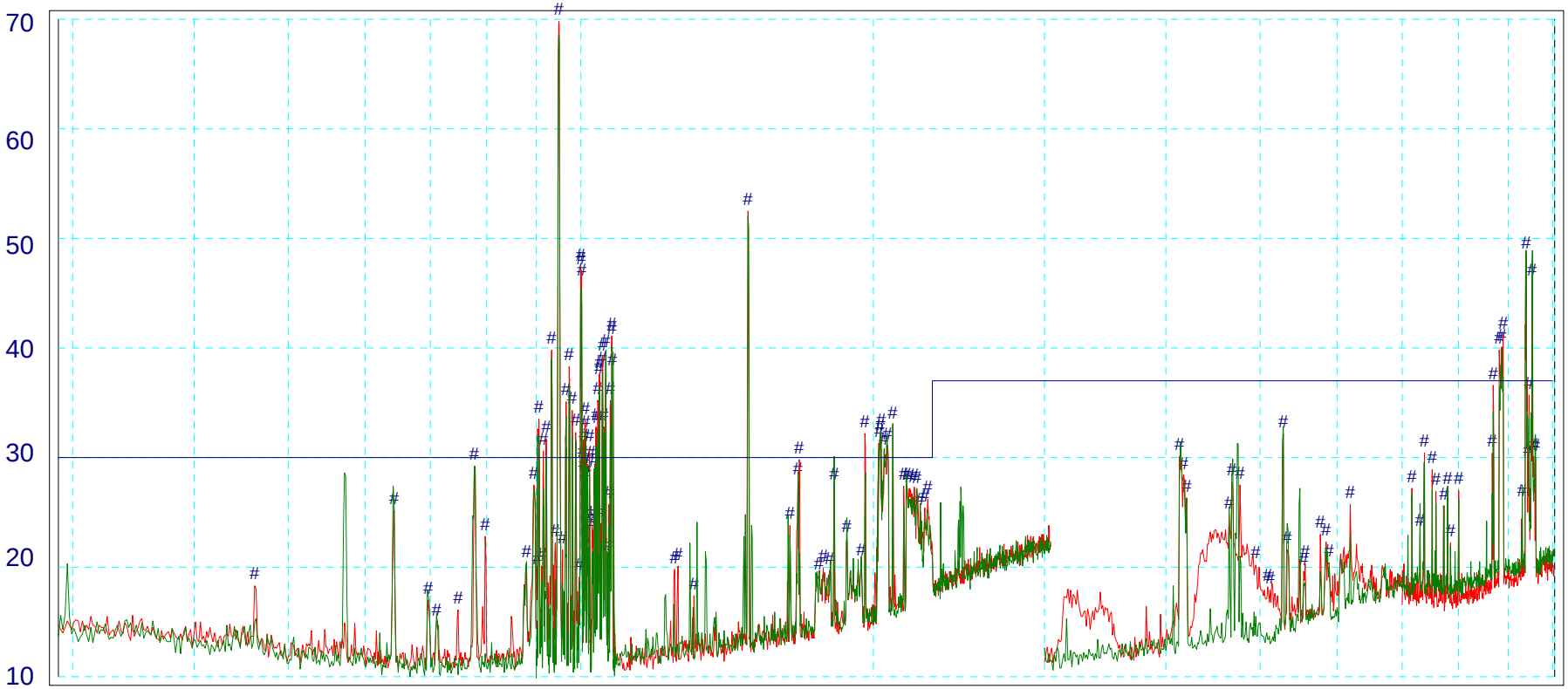
= Ambient

Job No:B091002

p:\PCF\091002rx_1.PCF

Test Date: 27/11/2009

GRAPH No. 7



Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R91IA
Receive Mode

Limits:
C22-B10 CISPR 22 CLASS B 10 metre QP LIMITS

Legend:
Vertical Ambients
Vertical Emissions

Ver 5.5 Build 158
Milbong OATS
t:A2230110 c1:COAT0310_10M c2:NONE p:A0510610 a:
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
100103R1 12 ,13 ,14 ,15 ,16 ,1 , 2
091002R4 11 ,5 , 6 , 13 ,7 , 3 , 1

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

ETSI EN 301 489-1 & ETSI EN 301 489-3

Radiated Emissions (dBuV/m)

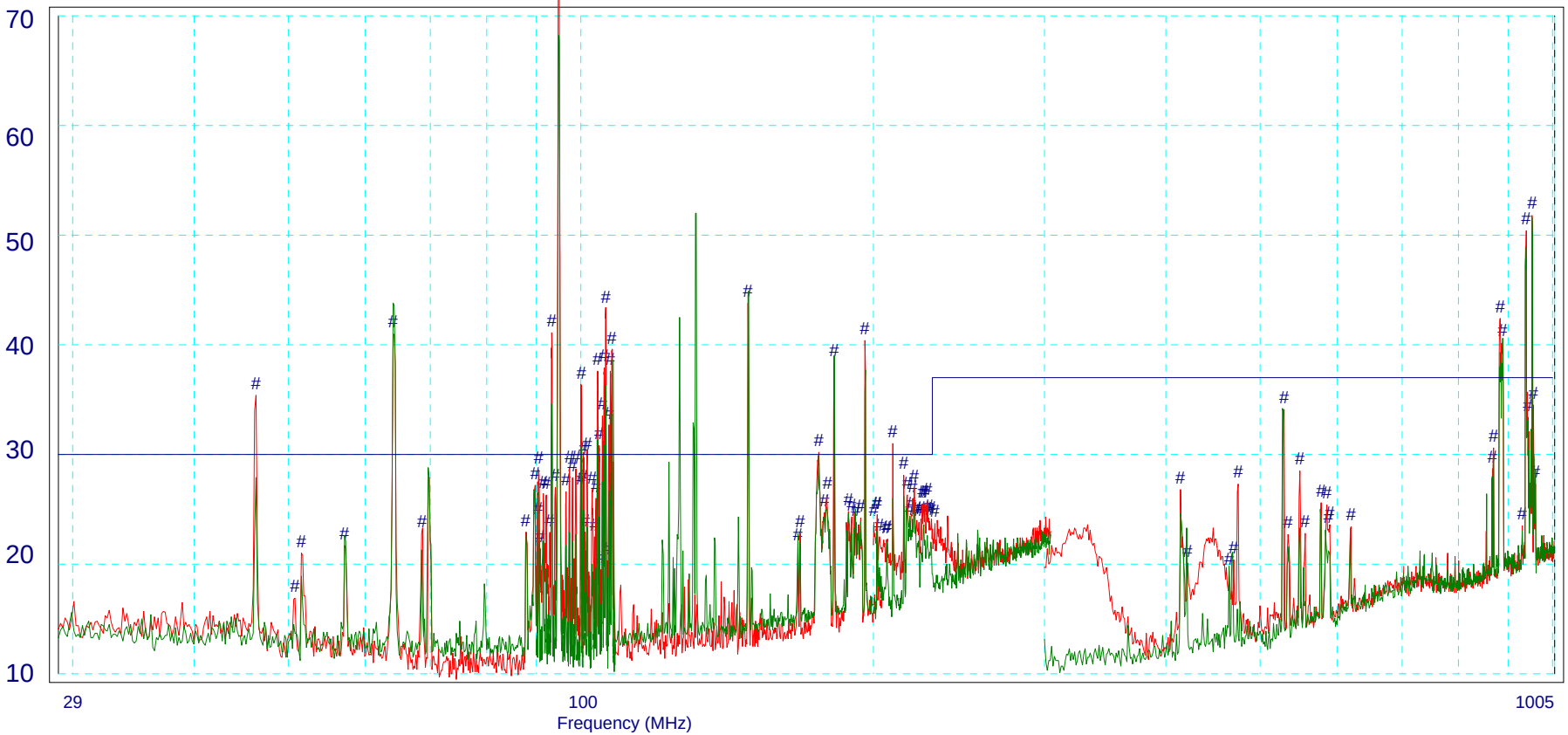
= Ambient

Job No:B091002

p:\PCF\091002rx_2.PCF

Test Date: 27/11/2009

GRAPH No. 8



Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R91IA
Receive Mode

Limits:
C22-B10 CISPR 22 CLASS B 10 metre QP LIMITS

Legend:
Horizontal Ambients
Horizontal Emissions

Ver 5.5 Build 158
Milbong OATS
t:A2230110 c1:COAT0310_10M c2:NONE p:A0510610 a:
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
100103R17 , 8 , 9 , 10 ,11 ,4 , 5
091002R415 ,8 , 9 , 14 ,10 ,4 , 2

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

ETSI EN 301 489-1 & ETSI EN 301 489-3

Radiated Emissions (dBuV/m)

= Ambient

Job No:B091002

p:\PCF\091002rx_3.PCF

Test Date: 11/12/2009

GRAPH No. 9

Peaks:

No	Freq (MHz)	Peak (dBuV/m)	Av Val	C22B-GHzAv (dBuV/m)	dL1 (dB)	C22B-GHzPk (dBuV/m)	dL2 (dB)
1	3899.65	45.1	19.3	54.0	-34.7	74.0	-54.7
2	1299.97	44.5	10.1	50.0	-39.9	70.0	-59.9

Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R91IA
Receive Mode

Limits:
C22B-GHzAv CISPR 22 1-6 GHz CLASS B 3mtr Av LIMITS
C22B-GHzPk CISPR 22 1-6 GHz CLASS B 3mtr Pk LIMITS

Legend:
Vertical Ambients
Vertical Emissions

Ver 5.5 Build 158
Milbong OATS, Microwave Frequencies
t:A2250112 c1:C4111010 c2:C4121010 p:NONE a:NONE
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002G11 , 2 , 3 , 4
091002G11 ,12 ,13 ,14

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

EMC Technologies Pty. Ltd. - Global Product Certification

ETSI EN 301 489-1 & ETSI EN 301 489-3

Radiated Emissions (dBuV/m)

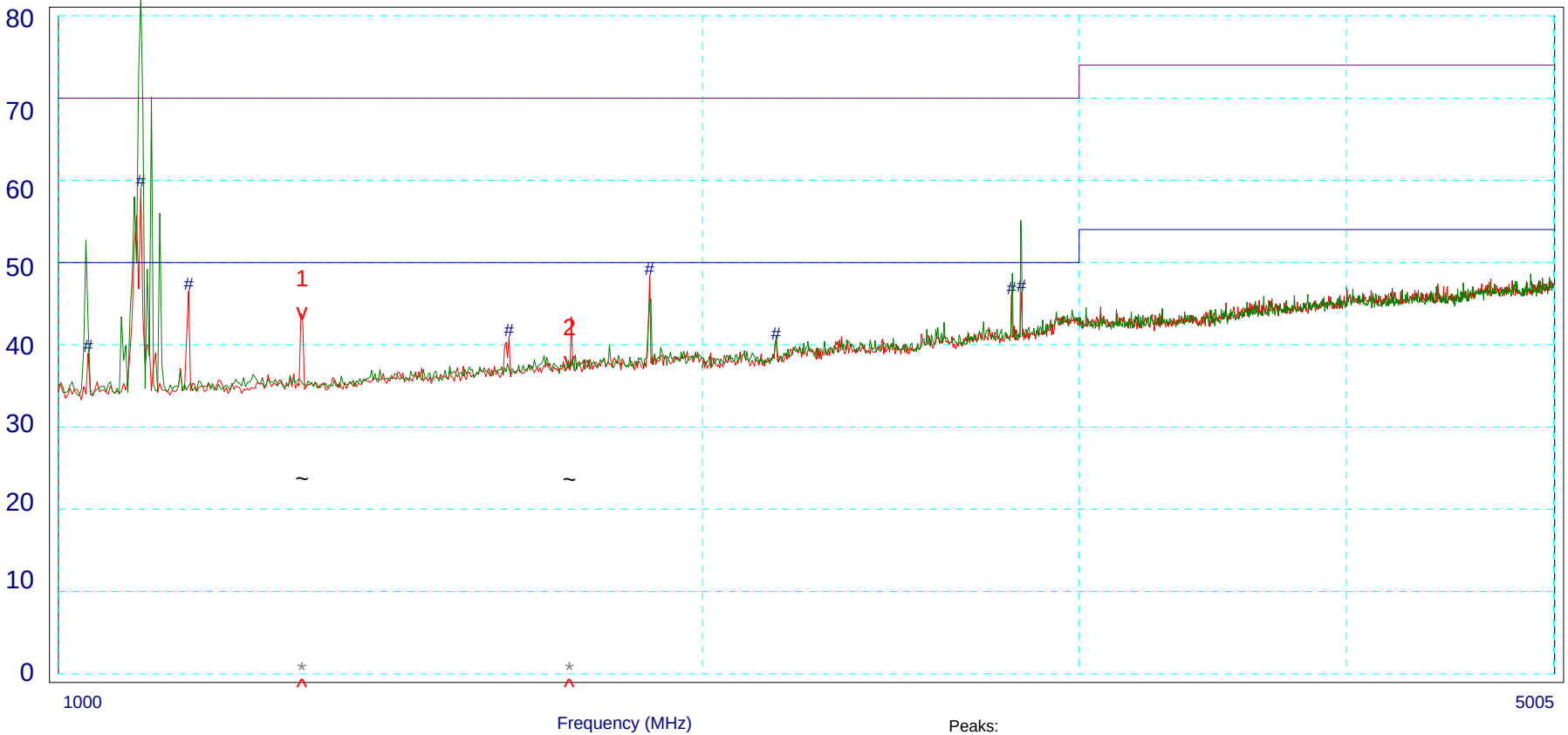
Job No:B091002

p:\PCF\091002rx_4.PCF

Test Date: 11/12/2009

GRAPH No. 10

= Ambient



Peaks:

No	Freq (MHz)	Peak (dBuV/m)	Av Val	C22B-GHzAv (dBuV/m)	dL1 (dB)	C22B-GHzPk (dBuV/m)	dL2 (dB)
1	1299.89	43.6	23.4	50.0	-26.6	70.0	-46.6
2	1733.34	37.7	23.2	50.0	-26.8	70.0	-46.8

Grcic Corp Pty Ltd
Referee
Model: Referee, Serial No: R91IA
Receive Mode

Limits:
C22B-GHzAv CISPR 22 1-6 GHz CLASS B 3mtr Av LIMITS
C22B-GHzPk CISPR 22 1-6 GHz CLASS B 3mtr Pk LIMITS

Legend:
Horizontal Ambients
Horizontal Emissions

Ver 5.5 Build 158
Milbong OATS, Microwave Frequencies
t:A2250112 c1:C4111010 c2:C4121010 p:NONE a:NONE
Site ID: OATS, Milbong, Queensland
Test Officer:Andy Colak

Source:
091002G16 , 7 , 8 , 9
091002G115 ,16 ,17 ,18

EMC Technologies (Brisbane) 1/15 Success St, Acacia Ridge,4110, QLD, Australia
Phone+(617) 3875 2455 Fax+(617) 3875 2466

APPENDIX C

EN61000-4-3

Radiated Immunity Test Results

EMC Technologies Pty Ltd
ABN 82 057 105 549
Unit 3/87 Station Road
Seven Hills NSW 2147 Australia

Telephone +61 2 9624 2777
Facsimile +61 2 9838 4050
Email syd@emctech.com.au
www.emctech.com.au

Global Product Certification
EMC-EMF Safety Approvals

EMC TEST REPORT

Report No. T100210

Manufacturer:	Grcic Corp Pty Ltd
Test Sample:	Referee (Electronic Gaming Equipment)
Model:	Referee
Serial Number:	R19CA (Tx) and R91IA (Rx)
Date of Issue:	9th February 2010

Accreditation No. 5292

This document is issued in accordance with NATA's accreditation requirements. The results of tests, calibration and/or measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing and calibration reports.

Certificate of Compliance

EMC Technologies Report No: T100210

Test Sample Name:	Referee (Electronic Gaming Equipment)
Model:	Referee
Serial Numbers:	R19CA (Tx) and R91IA (Rx)
Part Number:	Ref
Manufacturer:	Grcic Corp.Pty Ltd 2 Evergreen Street Clifton Beach QLD 4879
Tested For:	EMC Technologies Pty Ltd
Address:	1/15 Success Street Acacia Ridge QLD 4110
Phone Number:	(07) 3875 2455
Fax Number:	(07) 3875 2466
Responsible Party:	Mr Andy Colak
Test Standard:	**EN 61000-4-3:2006** *Section 3: Radiated, radio-frequency, electromagnetic immunity test.*
Result of Test:	The test sample complied with the requirements of EN61000-4-3 in the frequency range of 1000MHz to 2700MHz. Refer to Report T100210 for full details.
Test Dates:	05/02/2010, 08/02/2010

Testing Officer:

Jared Chircop

Authorised Signature:

Christian Kai
Facility Manager
EMC Technologies Pty Ltd

Issued by EMC Technologies Pty Ltd, Unit 3, 87 Station Road, Seven Hills, NSW, 2147, Australia.
Phone: +61 2 9624 2777 Fax: +61 2 9838 4050 www.emctech.com.au

EMC Tests on the Referee (Electronic Gaming Equipment), in accordance with EN 61000-4-3

1. INTRODUCTION

This report is intended to document the conformance of the Referee (Electronic Gaming Equipment) with Model: Referee, with the Electromagnetic Compatibility requirements of EN 61000-4-3 for the frequency range of 1000MHz to 2700MHz. Identification photographs are not included in this report as it is part of a full report.

2. SUMMARY of RESULTS

EN 61000-4-3	:	Complies for the frequency range of 1000MHz to 2700MHz

3. TEST SAMPLE

3.1 Description

The Equipment Under Test (EUT) was identified as follows:

Manufacturer	:	Grcic Corp Pty Ltd
Test Sample	:	Referee (Electronic Gaming Equipment)
Model	:	Referee
Serial Number	:	R19CA (Tx) and R91IA (Rx)
Part Number	:	Ref
Microprocessor	:	DSPIC 33F
Crystal Frequency	:	8MHz

3.2 Modifications

No modifications were performed in order for the EUT to comply with the standard.

3.3 Test Set Up

The EUT was set up in accordance with the standard. During the testing, the EUT was monitored for normal operation.

3.4 Block Diagram

Not required.

3.5 Product Description

The EUT is an infrared electronic gaming equipment used and designed for commercial indoor and outdoor live gaming venues.

4. REGULATIONS AND STANDARDS APPLIED

EN61000-4-3:2006
Electromagnetic Compatibility - Part 4: Testing and Measuring Techniques
Section 3: Radiated, radio-frequency, electromagnetic immunity test.

5. PERFORMANCE CRITERIA

Criterion A: During testing normal performance of the unit shall be maintained. No corruption of stored data is allowed. The analysis shall be within the normal bounds for the product.

Criterion B: During testing temporary degradation is permitted providing it is self recoverable without operator intervention.

Criterion C: Temporary loss of function is permitted provided that this is self-recoverable or can be restored by the operation of controls eg Normal operation resumes after a power down/power on cycle. No permanent damage is to be sustained.

6. TEST RESULTS

6.1 EN61000-4-3 Immunity to Radiated Electromagnetic Fields

6.1.1 Test Procedure

This test was performed as per EMC Technologies test procedure TP1000-4-3, EN61000-4-3.

The radiating antenna was positioned at a distance of 3m from the EUT. The dwell time at each frequency was 3 seconds with a step rate of 1% of the fundamental frequency. Six sides of the EUT were irradiated. The test was performed with both horizontal and vertical polarisation of the antenna. Testing was performed in the frequency range of 1000 – 2700MHz.

The RF had no effect on the EUT functioning. The Rx unit display was monitored during testing.

6.1.2 Test Climatic Conditions

Shielded Room Temperature: 21 - 23°C
Relative Humidity: 59 - 65%

6.1.3 Results

Field Level	Modulation	Frequency Band	Result
3V/m	1 kHz 80% AM	1000 - 2700 MHz	No effect

Conclusion: No effect. The EUT complied with the Criterion A requirements of EN 61000-4-3 in the frequency range of 1000 – 2700MHz.

7. CONCLUSION

The Referee (Electronic Gaming Equipment) with Model: Referee, complied with the requirements of EN 61000-4-3 in the frequency range of 1000MHz to 2700MHz.

8. UNCERTAINTIES

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

EMC Testing	Range	Value
Radiated, Radio-frequency Electromagnetic Field Immunity	80 MHz to 3.0 GHz	+6.3 dB -0.3 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%.

APPENDIX A1
Photographs – Test Setup

Radiated Immunity