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EMI TEST REPORT
for
CERTIFICATION to
FCC PART 15.245

Test Sample: EVR25 Wireless Vacuum Sensor and VPR100 COM Card

Tested for: Creative Product Design

Report Number: M030430_Cert_Tx

Issue Date: 20th August 2004

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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NATA Accredited Laboratory Number: 5292

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to
FCC Part 15.245

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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15.245

Report Number: **M030430_Cert_Tx**

Test Sample: EVR25 Wireless Vacuum Sensor and VPR100 COM Card

Manufacturer: InnovAg Pty Ltd
Address: 82 Victoria Street, Sandringham, VIC 3191, Australia
Phone: + 61 3 9521 9383
Fax: + 61 3 9521 8009
Contact: Braham Basser

Equipment Type: Intentional Radiator

Tested For: Creative Product Design
Address: 82 Victoria Street, Sandringham, VIC 3191, Australia
Phone: + 61 3 9521 9383
Fax: + 61 3 9521 8009
Responsible Party: Braham Basser

Test Standards: FCC Part 15, Subpart C – Intentional Radiators
FCC Part 15.245: Operation within the bands 902 - 928 MHz, 2435 – 2465 MHz, 5785 – 5815 MHz, 10500 – 10550 MHz and 24075 – 24175 MHz.
ANSI C63.4 – 1992
OET Bulletin No. 63

Test Dates: 23rd April to 20th June 2003

Test Officers:

Chieu Huynh **B.Eng (Hons) Electronics**
Jorge Lara

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:

Chris Zombolas
Technical Director
EMC Technologies Pty Ltd

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EMI TEST REPORT FOR CERTIFICATION
to
FCC PART 15.245

1.0 INTRODUCTION

This report details the results of EMI tests and measurements performed on the EVR25 Wireless Vacuum Sensor and VPR100 COM Card.

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 15.245)
Section 15.245:	FCC Part 15.245: Operation within the bands 902 - 928 MHz, 2435 – 2465 MHz, 5785 – 5815 MHz, 10500 – 10550 MHz and 24075 – 24175 MHz.
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 15.245: Operation within the band 902 - 928 MHz.

1.1 Summary of Results

FCC Part 15, Subpart C Clauses	Test Performed	Result
15.203	Antenna Requirement	**Not Applicable**
15.205	Operation in Restricted Band	**Complies**
15.207	Conducted Emissions	**Complies**
15.209	Radiated Emissions	**Complies**
15.245	Operation within the band 902 - 928 MHz	**Complies**

The measurement procedure used was in accordance with ANSI C63.4-1992 and OET Bulletin No. 96-43. The instrumentation conformed to the requirements of ANSI C63.2-1987.

1.2 Modifications by EMC Technologies

No modifications were required.

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2.0 GENERAL INFORMATION

(Information supplied by the Client)

2.1 Product Details

Test Sample:	EVR25 Wireless Vacuum Sensor and VPR100 COM Card.
Microprocessor:	EVR25: HD64F38024
	VPR100: HD64F2339
	RF Interface (used in both sides): nRF903
Crystal Frequencies:	EVR25: 9.8304 MHz
	VPR100: 24.576 MHz
	RF Interface (nRF903 - used in both sides): 11.0592 MHz
Real Time Clock:	EVR25: n/a
	VPR100: 32.768 kHz
Input Supply:	EVR25: 2 x AA Batts
	VPR100: internal batteries
Equipment Type:	Intentional Radiator

2.2 Test Sample Description

EVR25: Vacuum Sensor with wireless interface to VPR100 Test Instrument.
VPR100 COM Card: Add on card to provide wireless interface to VPR100.

The EVR25 start kit is an accessory to the DeLaval performance tester VRP100. It consists of a wireless sensor and a transceiver module. With the module fitted inside the VPR100 unit and the sensor connected to a measuring point it is possible to take vacuum measures via the sensor while standing elsewhere in the bam. This is useful both when testing vacuum and airflow.

2.3 Test Sample Configuration

Set up VPR100 for wireless operation, register EVR25. Apply vacuum to EVR25 and check for reading on VPR100.

Testing was performed with new batteries fitted and rotated around 3 orthogonal planes. The EUT was transmitting continuously during the tests. The worst-case results are reported.

2.4 Test Procedure

Emissions measurements were performed in accordance with the procedures of ANSI C63.4-1992. Radiated emissions tests were performed at a distance of 3 metres from the EUT. OET Bulletin 63 dated October 1993 was used for reference.

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2.5 Test Facility

2.5.1 General

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. Bandwidth measurements were performed at EMC Technologies' laboratory in Tullamarine, (Melbourne) Victoria Australia.

The above sites have been fully described in a report submitted to the FCC office, and accepted in a letter dated June 14, 2002, **FCC Registration Number 90560**.

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), cable locating equipment (15.213) and unlicensed national information infrastructure devices (Sub part E)."

The current full scope of accreditation can be found on the NATA website: www.nata.asn.au
It also includes a large number of emission, 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 Laboratory (NML) 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 Units of Measurements

Radiated Emissions
Measurements are reported in units of dB relative to one microvolt per metre (dBμV/m).

2.7 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 Laboratory (NML). All equipment calibration is traceable to Australia national standards at the National Measurements Laboratory. The reference antenna calibration was performed by NML and the working antennas (loop, biconical and log-periodic) calibrated by the NATA approved procedures. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A.

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2.8 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.

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4.0 RADIATED EMISSION MEASUREMENTS

4.1 Test Procedure

The EUT was transmitting continuously on 916.88 MHz. Testing was performed in accordance with the requirements of FCC Part 15.245.

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 Biconical antenna was used for measurements between 30 MHz to 232 MHz, a calibrated Logperiodic antenna used for measurements between 230 MHz to 1000 MHz. Calibrated EMCO 3115 Horn antenna was used for measurements between 1 to 9.2 GHz.

The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.

The measurement of emissions above 1000 MHz was made using an average detector with the resolution bandwidth of 1.0 MHz.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. Each significant peak was then investigated and maximised with the Quasi-Peak detector. The measurement data for each frequency range was automatically corrected by the software for cable losses, antenna factors and preamplifier gain and all data was then stored on disk in sequential data files. This process was performed for both parallel and perpendicular 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.

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4.3 Calculation of Peak and Average Field Strength

The peak 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 Peak 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 insertion loss in dB. (stored as a data array of Insertion Loss versus frequency)

- **Example Peak 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 carried out in accordance with the requirements of FCC Part 15.245(b), 15.205(a) and 15.209(a).

4.4.1 30 – 1000 MHz

The measurements were made at the open area test site at a distance of 3 metres.

EVR25 Wireless Vacuum Sensor

Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
916.88	Horizontal	87.6	114	-26.4
916.88	Vertical	87.4	114	-26.6

VPR100 Test Instrument with COM Card

Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
916.88	Horizontal	84.8	114	-29.2
916.88	Vertical	82.0	114	-32.0

The worst case radiated EMI occurred at 916.88 MHz and complied with the Class B quasi peak limit by a margin of 26.4 dB. The measurement uncertainty for radiated emissions was ±3.7 dB. Refer to Appendix C, graphs 1 & 2 (EVR25 Wireless Vacuum Sensor) and 3 & 4 (VPR100 Test Instrument with COM Card).

Conclusion: Complies.

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4.4.3 1 – 9.2 GHz

The measurements were made at the open area test site at a distance of 3 metres.

EVR25 Wireless Vacuum Sensor and VPR100 COM Card

Frequency MHz	Polarisation	AV Measured dBμV/m	AV Limit dBμV/m	ΔQP ± dB
1833.7	Horizontal	56.8	64.1	-7.3
1833.7	Vertical	49.6	64.1	-14.5
2750.6	Vertical	49.1	54.0	-4.9
2750.6	Horizontal	48.6	54.0	-5.4
3667.5	Horizontal	50.5	64.1	-13.6
3667.5	Vertical	46.4	64.1	-17.7
4584.4	Horizontal	38.6	54.0	-15.4
4584.4	Vertical	38.1	54.0	-15.9
5501.3	Horizontal	37.7	64.1	-26.4
5501.3	Vertical	37.6	64.1	-26.5
6418.2	Vertical	38.1	64.1	-26.0
6418.2	Horizontal	37.8	64.1	-26.3
7335.0	Vertical	41.4	54.0	-12.6
7335.0	Horizontal	41.4	54.0	-12.6
8251.9	Vertical	45.1	54.0	-8.9
8251.9	Horizontal	45.0	54.0	-9.0
9168.8	Horizontal	48.2	54.0	-5.8
9168.8	Vertical	48.1	54.0	-5.9

The worst case radiated EMI occurred at 2750.6 MHz and complied with the Class B quasi peak limit by a margin of 4.9 dB. The measurement uncertainty for radiated emissions was ±4.1 dB.

Conclusion: Complies.

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 EVR25 Wireless Vacuum Sensor and VPR100 COM Card, tested on behalf of Creative Product Design, **complies** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.245: Operation within the bands 902 - 928 MHz, 2435 – 2465 MHz, 5785 – 5815 MHz, 10500 – 10550 MHz and 24075 – 24175 MHz.

Results were as follows:

FCC Part 15, Subpart C Clauses	Test Performed	Result
15.203	Antenna Requirement	**Not Applicable**
15.205	Operation in Restricted Band	**Complies**
15.207	Conducted Emissions	**Complies**
15.209	Radiated Emissions	**Complies**
15.245	Operation within the band 902 - 928 MHz	**Complies**

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APPENDIX A
MEASUREMENT INSTRUMENTATION DETAILS

EQUIPMENT TYPE	MAKE/MODEL SERIAL NUMBER	LAST CAL. DD/MM/YY	DUE DATE DD/MM/YY	CAL. INTERVAL
EMI RECEIVER	HP 8574B System Components	26/09/03	26/09/04	1 YEAR *2
EMI RECEIVER	HP 8546A, Sn: 3549A00290	13/02/04	13/02/05	1 YEAR *2
EMI RECEIVER	Rohde & Schwarz, Model ESIB40 SN 1088 7490, 20 Hz – 40 GHz	20/07/04	20/07/05	1 YEAR *3
ANTENNAS	EMCO 93110B BICONICAL	20/08/03	20/08/04	1 YEAR *1
	20 - 300 MHz Sn. 9804-3092			
	EMCO 93146A LOG PERIODIC	11/07/03	11/07/04	1 YEAR *1
	200 -1000MHz Sn. 5033			
	EMCO 3115 DOUBLE RIDGED HORN 1 - 18 GHz Sn: 8908-3282	29/01/03	29/01/06	3 YEAR *1

Note *1. In-house calibration. Refer to Quality Manual.
Note *2. NATA calibration by Agilent Technologies (Aust) Pty Ltd
Note *3. NATA calibration by Rohde & Schwarz

TEST SITES

Shielded Room Test Laboratory	**Melbourne**			
	11m x 8m x 4m Chamber-semi-anechoic	Feb 04	Feb 05	1 Year *1
	8.8m x 5.8m x 3.1m Test Chamber	N/A	N/A	N/A
	3.4m x 6.1m x 2.5m Test Chamber	N/A	N/A	N/A
	3.4m x 7.3m x 7.5m Test Chamber	N/A	N/A	N/A
Open Area Test Site	**Melbourne**			
	3/10 Metre site. 1-4 metre antenna mast. 1.2 metre/400 kg Turntable. (Situated at Lerderderg Gorge, near Bacchus Marsh, Victoria)	11/02/04	11/02/05	1 Year *1

Note *1. In-house calibration. Refer to Quality Manual.

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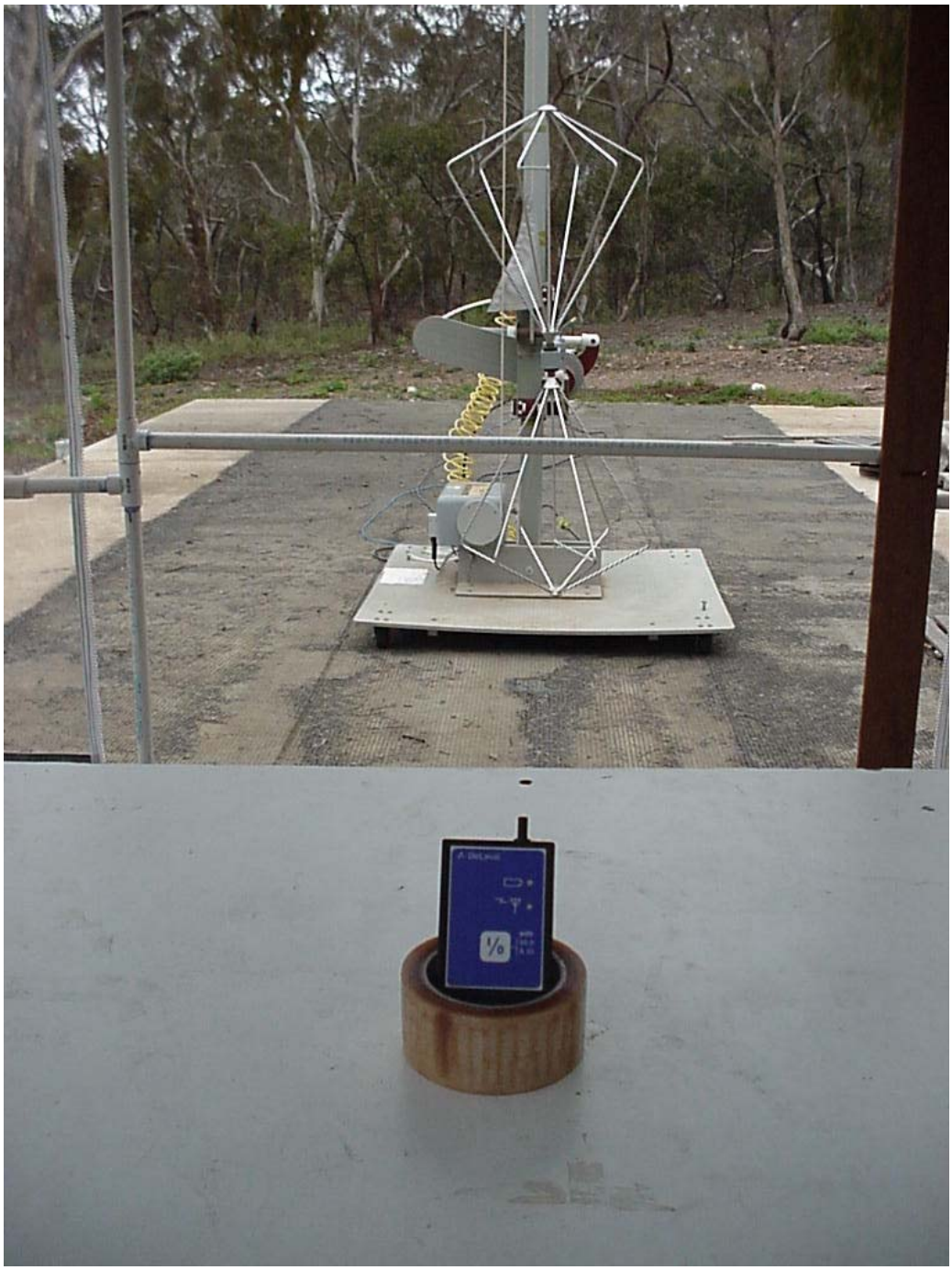
APPENDIX B1
Test Setup Photographs

Radiated Emissions – EVR25 Wireless Vacuum Sensor



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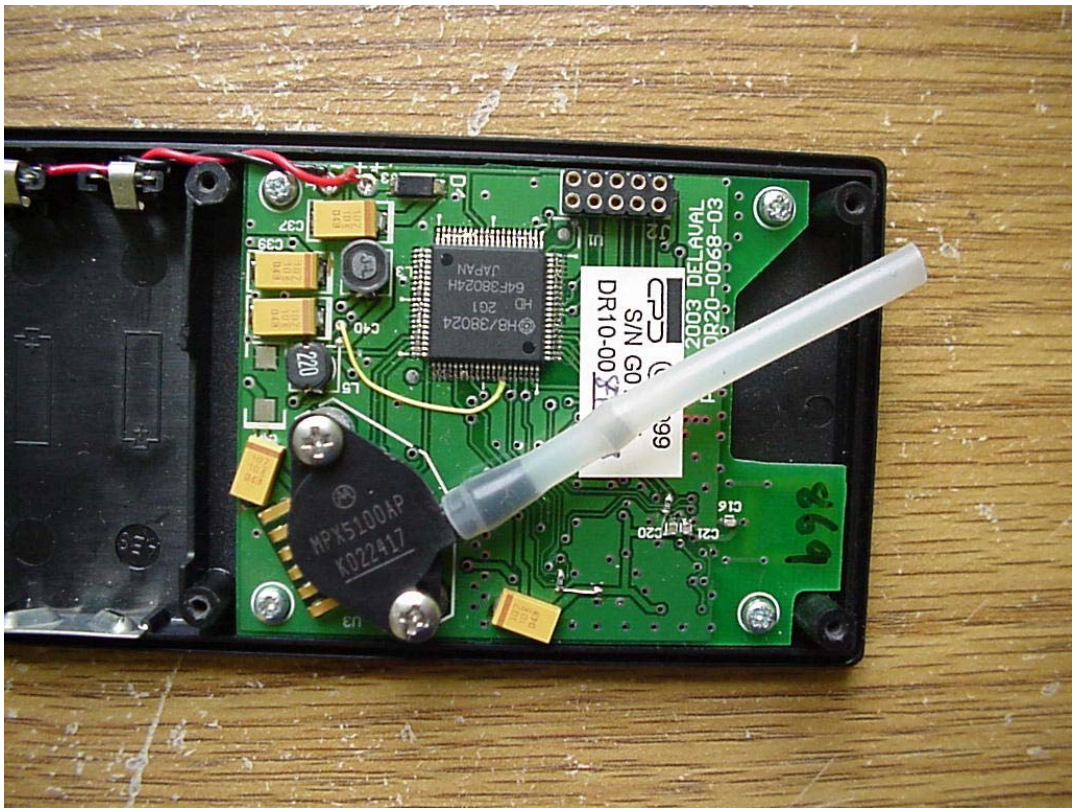
APPENDIX B2
Test Setup Photographs

EVR25 Wireless Vacuum Sensor



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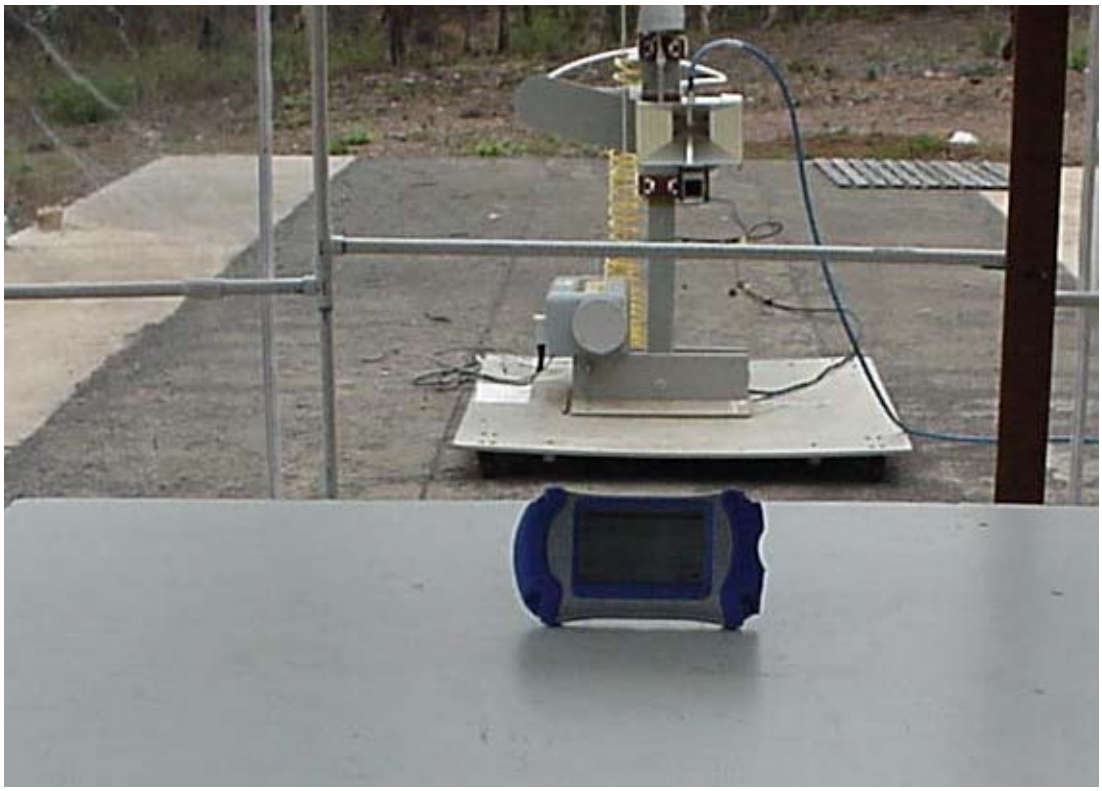
APPENDIX B3
Test Setup Photographs

Radiated Emissions – VPR100 Test Instrument with COM Card



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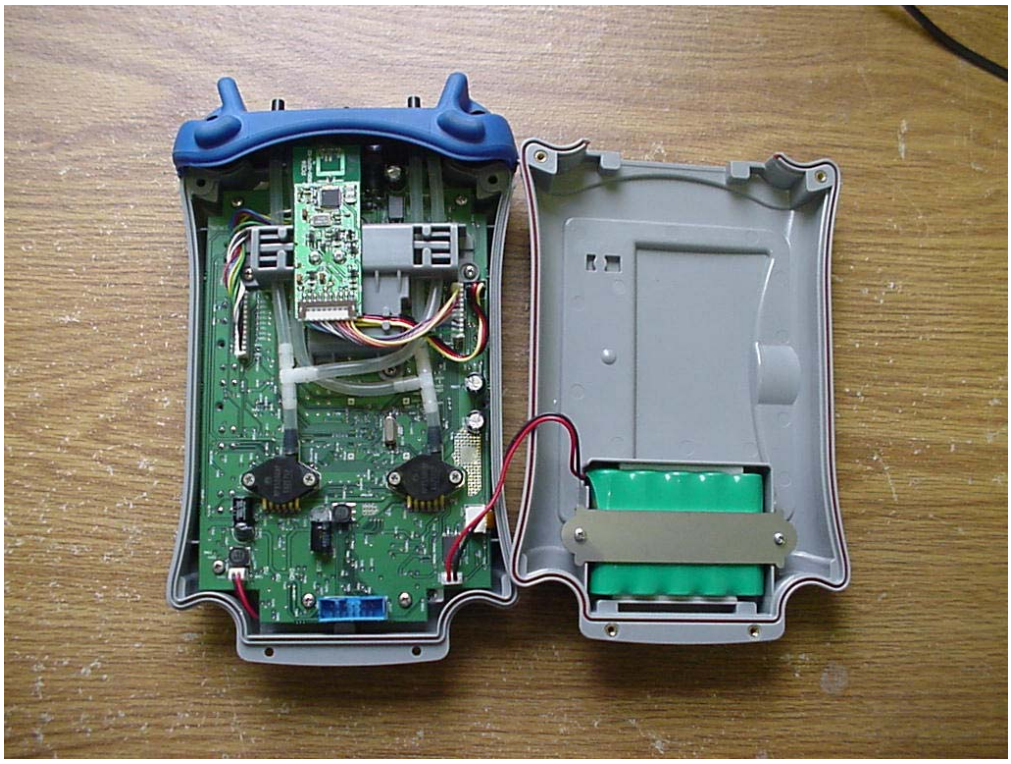
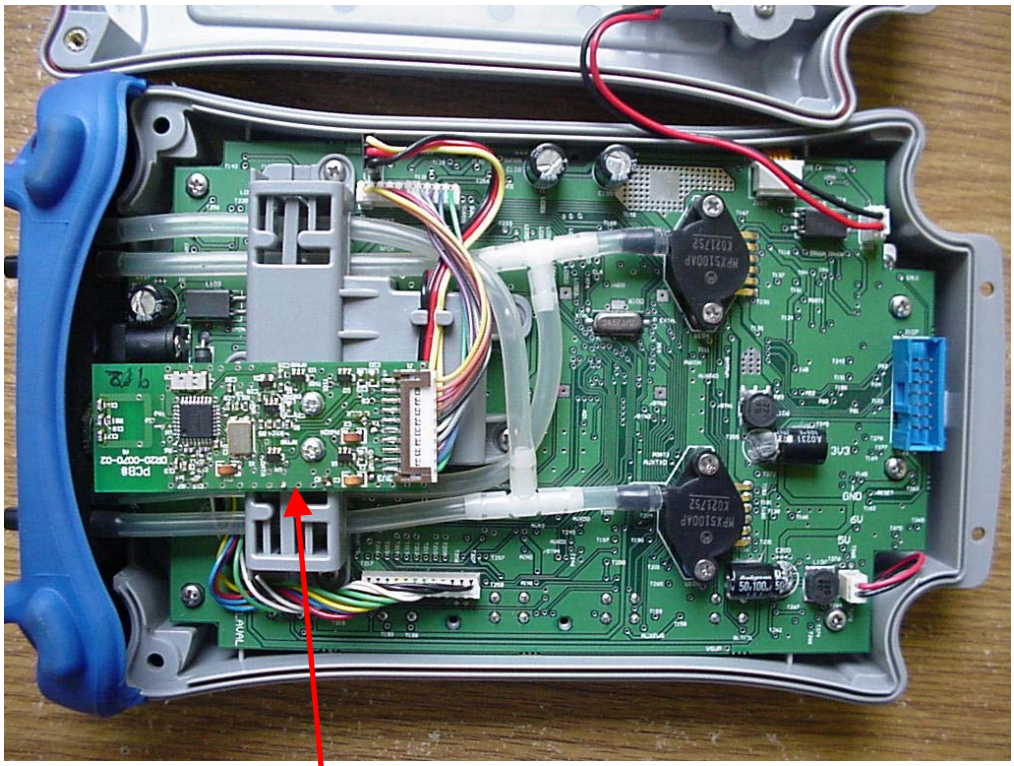
APPENDIX B4
Test Setup Photographs

VPR100 Test Instrument with COM Card





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APPENDIX C

Graphs of EMI Measurements

RADIATED EMI

EVR25 Wireless Vacuum Sensor

Graph 1:	Vertical Polarisation	30 MHz - 1000 MHz
Graph 2:	Horizontal Polarisation	30 MHz - 1000 MHz

VPR100 Test Instrument with COM Card

Graph 3:	Vertical Polarisation	30 MHz - 1000 MHz
Graph 4:	Horizontal Polarisation	30 MHz - 1000 MHz

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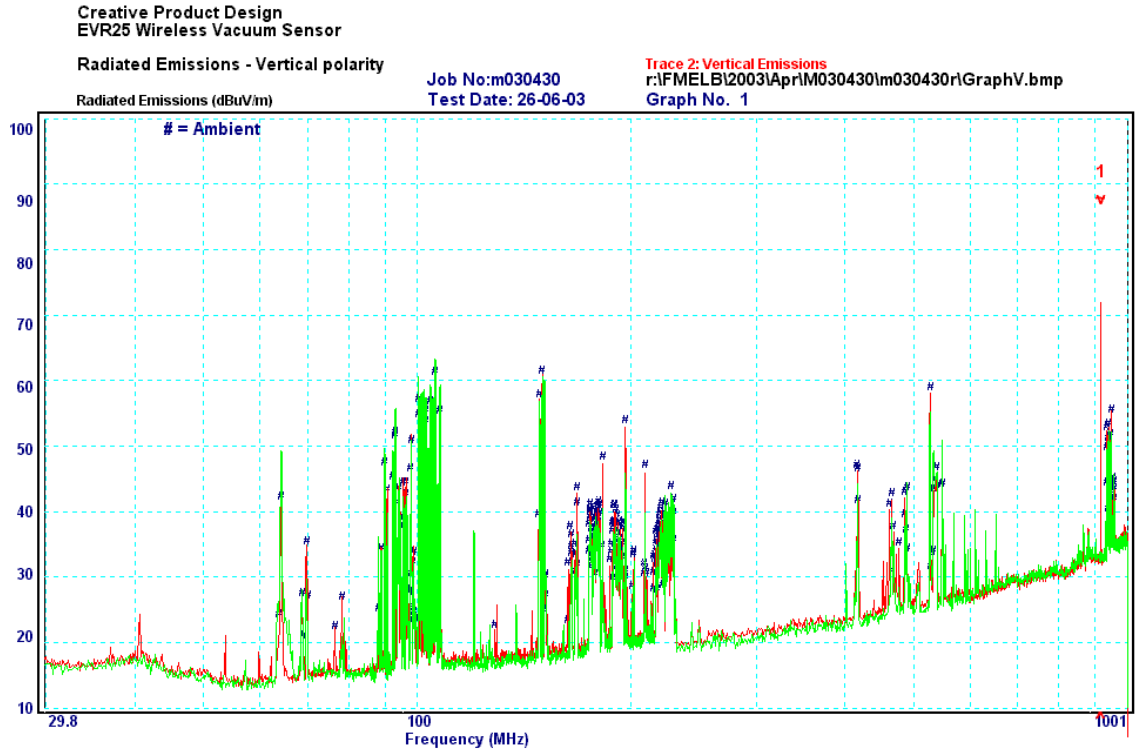
RADIATED EMI

Graph 1: Vertical Polarisation 30 MHz - 1000 MHz



Peak	Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
1	916.88	Vertical	87.4	114	-26.6

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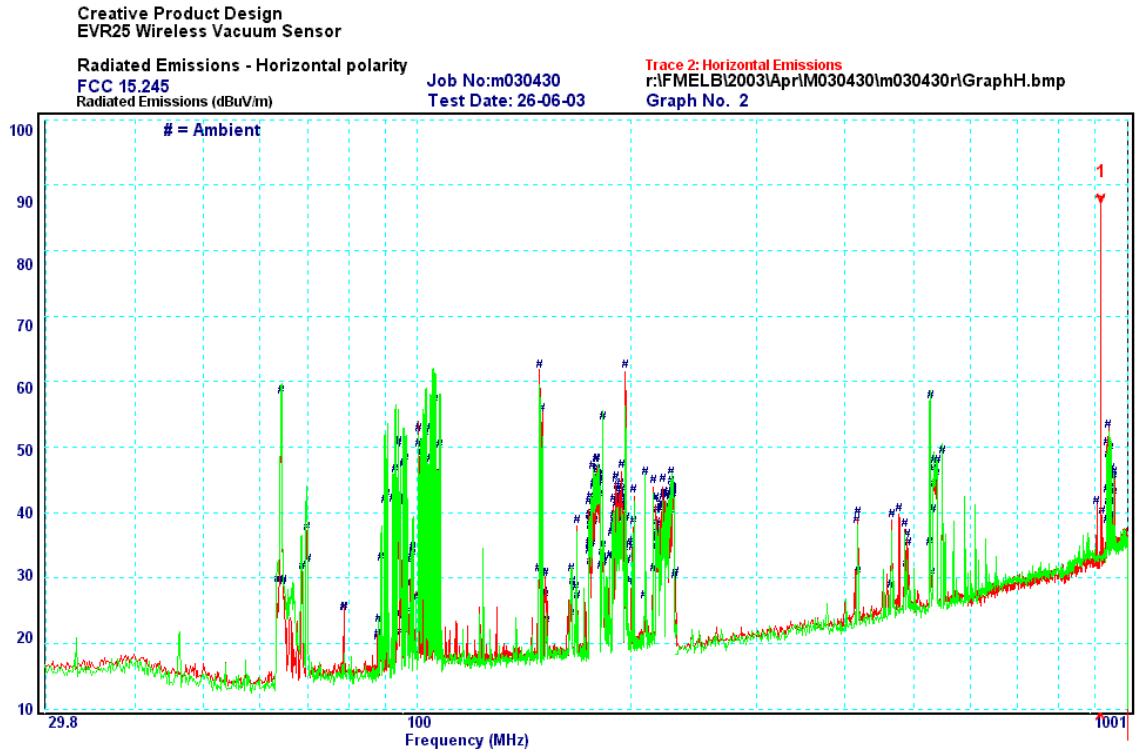
RADIATED EMI

Graph 2: Horizontal Polarisation 30 MHz - 1000 MHz



Peak	Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
1	916.88	Horizontal	87.6	114	-26.4

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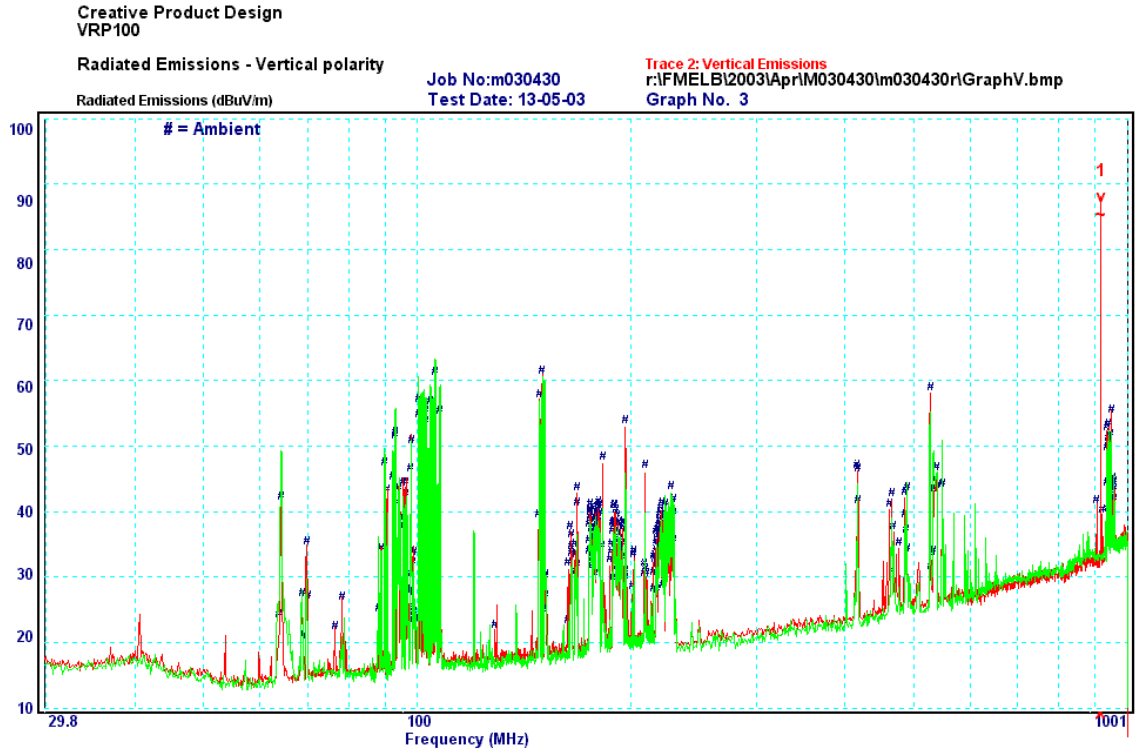
RADIATED EMI

Graph 3: Vertical Polarisation 30 MHz - 1000 MHz



Peak	Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
1	916.88	Vertical	84.8	114	-29.2

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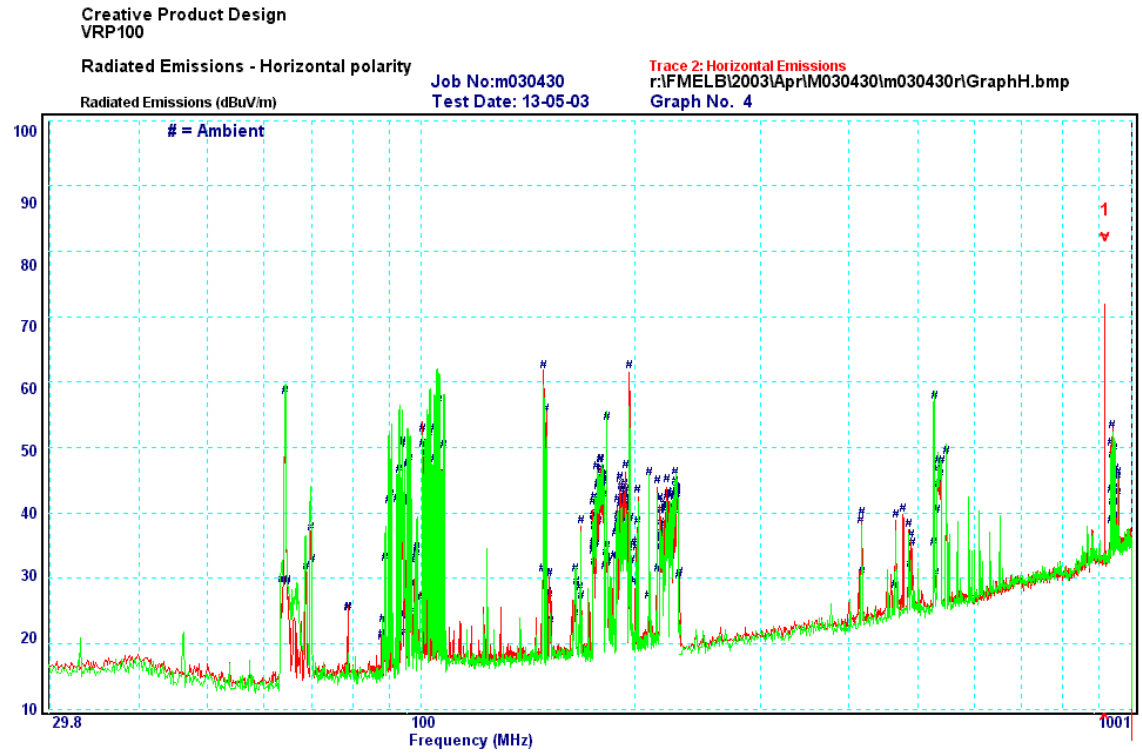
RADIATED EMI

Graph 4: Horizontal Polarisation 30 MHz - 1000 MHz



Peak	Frequency MHz	Polarisation	QP Measured dBμV/m	QP Limit dBμV/m	ΔQP ± dB
1	916.88	Horizontal	82.0	114	-32.0

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