

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**  
Report date: 25<sup>th</sup> June 2004

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## **TEST REPORT**

### **Salcom 11-85 UHF Pocket Paging Transmitter**

*tested for compliance with the*

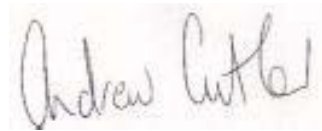
### **Code of Federal Regulations (CFR) 47**

### **Part 90 –Private Land Mobile Services**

*for*

### **Sea Air and Land Communications Ltd**

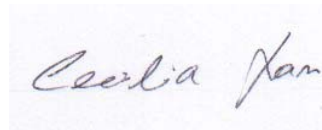
Test Report issued by:



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**Andrew Cutler - General Manager**

Test Report prepared by:



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**Cecilia Lam – Office Administrator**



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#### **EMC Technologies (NZ) Ltd**

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Page 1 of 19

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## **Table of Contents**

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>1. CLIENT INFORMATION</b>                                 | <b>3</b>  |
| <b>2. DESCRIPTION OF TEST SAMPLE</b>                         | <b>3</b>  |
| <b>3. COMPLIANCE STATEMENT &amp; SUMMARY OF TEST RESULTS</b> | <b>4</b>  |
| <b>4. ARTICLES SUBMITTED</b>                                 | <b>4</b>  |
| <b>5. TEST SAMPLE DESCRIPTION</b>                            | <b>5</b>  |
| <b>6. TEST CONDITIONS</b>                                    | <b>6</b>  |
| <b>7. ATTESTATION</b>                                        | <b>7</b>  |
| <b>8. TRANSMITTER TEST RESULTS</b>                           | <b>8</b>  |
| <b>9. TEST EQUIPMENT USED</b>                                | <b>16</b> |
| <b>10. ACCREDITATIONS</b>                                    | <b>16</b> |
| <b>11. PHOTOGRAPH(S)</b>                                     | <b>17</b> |

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## 1. CLIENT INFORMATION

|                     |                                     |
|---------------------|-------------------------------------|
| <b>Company Name</b> | Sea Air and Land Communications Ltd |
| <b>Address</b>      | PO Box 22-621                       |
| <b>City</b>         | Christchurch                        |
| <b>Country</b>      | New Zealand                         |
| <b>Contact</b>      | John Croft                          |

## 2. DESCRIPTION OF TEST SAMPLE

|                          |                                     |
|--------------------------|-------------------------------------|
| <b>Brand Name</b>        | Salcom                              |
| <b>Model Number</b>      | 11-85-0000                          |
| <b>Product</b>           | UHF Pocket Paging Transmitter       |
| <b>Manufacturer</b>      | Sea Air and Land Communications Ltd |
| <b>Country of Origin</b> | New Zealand                         |
| <b>Serial Number</b>     | 00001, 00002                        |
| <b>FCC ID</b>            | O871185                             |

**NB:** This report replaces the reports issued in the 40121 range to include a number of additional measurements required by the Telecommunications Certifications Body in order that certification for the product could be obtained.

This report includes measurements to show compliance when the frequency deviation is increased to 4 kHz.

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## 3. COMPLIANCE STATEMENT AND SUMMARY OF TEST RESULTS

The Salcom 11-85 UHF Pocket Paging Transmitter **complies with** 47 CFR Part 90, section 90.217.

Testing was carried out in accordance with the test methods defined in 47 CFR Part 2 and 90.

Listed below are the relevant Part 2 test methods and the Part 90 limits.

| <u>CLAUSE</u> | <u>TEST PERFORMED</u>                   | <u>RESULT</u> |
|---------------|-----------------------------------------|---------------|
| 2.1041        | Measurement procedures                  | Noted         |
| 2.1046        | RF power output                         | Complies      |
| 2.1049        | Occupied bandwidth                      | Noted         |
| 2.1051        | Spurious emissions at antenna terminals | Complies      |
| 2.1053        | Field strength of spurious radiation    | Complies      |
| 2.1055        | Frequency stability                     | Complies      |
| 2.1057        | Frequency spectrum to be investigated   | Noted         |
| 90.217        | Exemption from technical standards      | Complies      |

## 4. ARTICLES SUBMITTED

1 x Salcom 11-85 UHF Pocket Paging Transmitter.

User manual.

The transmitter has an integral antenna.

The sample supplied for testing was fitted with an external antenna connection in order to make testing easier.

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## 5. TEST SAMPLE DESCRIPTION

The sample tested has the following specifications:

### Rated Transmitter Output Power

20 dBm +/- 1 dB (100 mW)

### Test frequencies

470.000 MHz

### Channel spacing

12.5 kHz and 25 kHz

### FCC Frequency Range

450.0 – 470.0 MHz

### Emission Type

512 Baud Pocsag with Carrier FSK and NRZ data

### Emission Designation

12K5F1D

### Deviation

+/- 2.25 kHz and +/- 4.50 kHz

### Power Supply

9 Vdc from an internal DC battery

### External Controls

This device has no external controls.

### Antenna

Integral whip antenna.

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Page 5 of 19

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## 6. Test Conditions

### Standard Temperature and Humidity

Temperature: +25°C ± 4° maintained.

Relative Humidity: 60% ± 10% observed.

### Extreme Temperature

High Temperature: + 50°C maintained.

Low Temperature: - 30 °C maintained.

Tests were carried out at these extremes of temperature in increments of 10°C.

### Extreme Power Supply

This device is powered using an internal battery.

The user manual recommends Alkaline batteries.

Extreme power supply tests have been carried out at 85% and 115% of the nominal supply voltage.

The user manual advises that the device can be operated with an external power supply that should not exceed 10 Vdc.

Testing has also been carried out at:

85% = 7.6 Vdc

115% = 10.4 Vdc

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

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## 7. ATTESTATION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification with the following conditions:

**The test sample was selected by the client.**

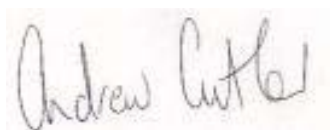
**The report relates only to the sample tested.**

**This report does not contain corrections or erasures.**

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations. To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler  
General Manager  
EMC Technologies NZ Ltd

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## 8. TRANSMITTER TEST RESULTS

### Introduction

This transmitter has been tested in accordance with the requirements of 47 CFR Section 90.217 – Exemption from technical standards.

- are exempt from the technical requirements set out in this subpart but must instead comply with the following.

In order for this section to apply the following needs to be demonstrated:

- The frequency of operation could be used at stations licensed below 800 MHz on any frequency listed in Subpart B and C of 47 CFR Part 90.

This transmitter can operate in the FCC band 450 – 470 MHz.

For testing purposes it has been configured to operate on 470.0 MHz.

### RF Conducted Power Output

Section 90.217 specifies the following:

- The output power of the transmitter should not exceed 120 mW (20.8 dBm).

The manufacturer's specification gives an output power of 100 mW

In order to test this device an antenna terminal has been provided.

Conducted power measurements have been carried out which show a power level of 81.3 mW (19.1 dBm) at 470 MHz when using either 2.25 or 4.5 kHz deviation.

This measurement falls within the manufacturers specification of 20.0 dBm +/- 1 dB and within the requirement of Section 90.217.

Measurements were made with an external 10 dB attenuator and a cable loss of 1.0 dB.

A spectrum plot of this measurement is attached over.

**Result:** Complies

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## **RF Radiated Power Output**

As the transmitter typically operates using an integral antenna radiated ERP/EiRP measurements were also made on this device.

| Frequency<br>(MHz) | Level<br>(dBuV/m) | Power<br>(dBm) | Limit<br>(dBm) | Polarity   | Margin<br>(dB) |
|--------------------|-------------------|----------------|----------------|------------|----------------|
| 470.000            | 113.0             | 12.9           | 20.8           | Horizontal | -7.9           |
| 470.000            | 118.2             | 20.8           | 20.8           | Vertical   | -0.0           |

Device was tested on an open area test site at a distance of 3 metres.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on May 12<sup>th</sup>, 2003.

The transmitter was tested while transmitting continuously, using either 2.25 or 4.5 kHz deviation, and an integral antenna.

The power level of each emission has been determined by replacing the transmitter with a dipole antenna that was connected to a signal generator.

The signal generator output level was then increased until the same field strength level was observed at each emission frequency.

The level recorded is the signal generator output level in dBm less any gains / losses due to the coax cable and the dipole antenna.

*Limit:* 120 mW or 20.8 dBm

**Result:** Complies

***Measurement Uncertainty:***  $\pm 4.1$  dB

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

## Conducted spurious emissions

The equipment is designed to operate in a band using 12.5 kHz channelling with a frequency deviation of +/- 2.25 kHz and 25 kHz channelling with a frequency deviation of +/- 4.50 kHz.

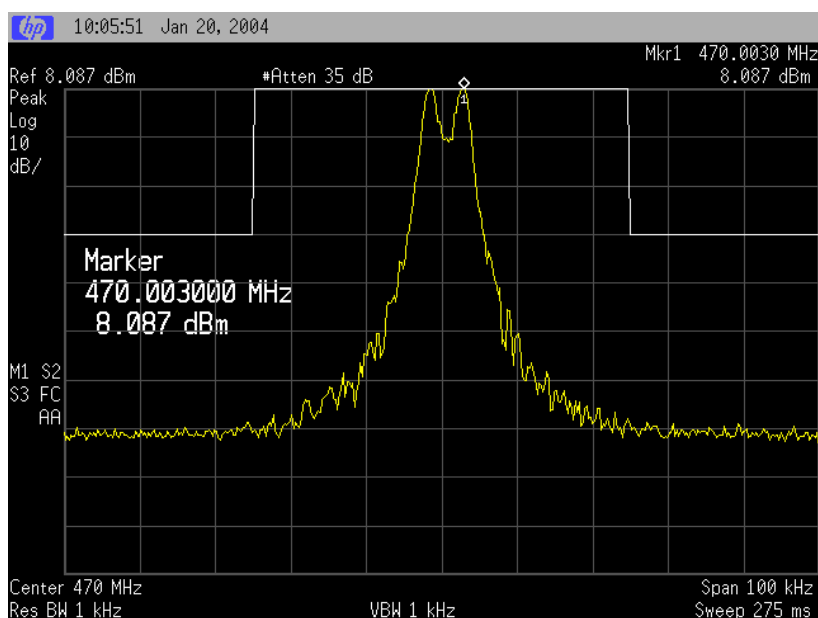
The transmitter cannot be operated with an un-modulated carrier so all measurements have been made with reference to the modulated carrier.

Measurements have been made in the laboratory using a spectrum analyser to observe emissions close to the carrier and also the transmitter power output. See the attached plots.

The 12.5 kHz channelling mask has been applied to both frequency deviations.

Please note that measurements have been made with an external 10 dB attenuator and a cable loss of 1.0 dB.

**Frequency deviation = +/- 2.25 kHz**



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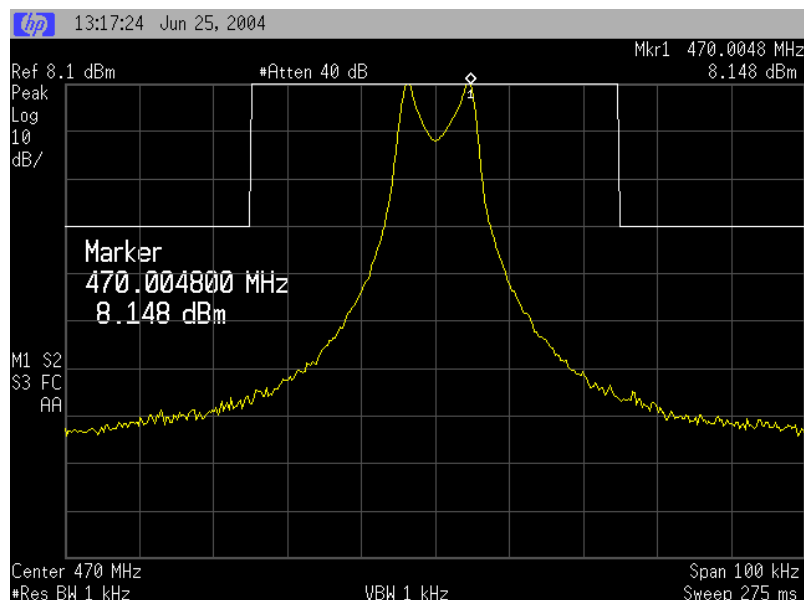
Page 10 of 19

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

**Frequency deviation = +/- 4.50 kHz**



Conducted measurements made away from the carrier as detailed:

**Frequency: 470.000 MHz**

| Frequency (MHz) | Level (dBm) | Limit (dBm) | Margin (dB) |
|-----------------|-------------|-------------|-------------|
| 940.000         | -40.5       | -10.0       | -30.5       |
| 1410.000        | -45.1       | -10.0       | -35.1       |
| 1880.000        | -56.4       | -10.0       | -46.4       |
| 2350.000        | -39.1       | -10.0       | -29.1       |
| 2820.000        | -53.0       | -10.0       | -43.0       |
| 3290.000        | -44.1       | -10.0       | -34.1       |
| 3760.000        | -44.9       | -10.0       | -34.9       |
| 4230.000        | -50.6       | -10.0       | -40.6       |
| 4700.000        | -45.2       | -10.0       | -35.2       |

Testing was carried out in the laboratory with the spectrum analyser with a resolution bandwidth of 100 kHz below 1 GHz and 1 MHz above 1 GHz with an appropriate frequency span at each frequency.

The level of spurious emissions observed was identical for either 2.25 or 4.5 kHz deviation.

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Page 11 of 19

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## *Limit*

- 90.217 (a) states that for equipment designed to operate with a 12.5 kHz channel bandwidth, any emission appearing on a frequency more than 25 kHz from the assigned frequency, shall be attenuated by at least 30 dB below the unmodulated carrier.

Modulated carrier maximum is 20.0 dBm.

All emissions are therefore required to be below -10.0 dBm.

**Result:** Complies.

**Measurement Uncertainty:**  $\pm 1.2$  dB

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

## Field strength of the transmitter spurious emissions

Frequency: 470.00 00 MHz

| Emission frequency (MHz) | Level (dBuV/m) | Power (dBm) | Limit (dBm) | Polarity   | Margin (dB) |
|--------------------------|----------------|-------------|-------------|------------|-------------|
| 940.0                    | 62.3           | -38.0       | -20.0       | Horizontal | -18.0       |
| 940.0                    | 64.7           | -36.0       | -20.0       | Vertical   | -16.0       |
| 1410.0                   | 65.1           | -37.0       | -20.0       | Horizontal | -17.0       |
| 1410.0                   | 64.5           | -38.0       | -20.0       | Vertical   | -18.0       |
| 1880.0                   | 69.7           | -33.0       | -20.0       | Horizontal | -13.0       |
| 1880.0                   | 66.3           | -36.0       | -20.0       | Vertical   | -16.0       |
| 2350.0                   | 69.3           | -33.0       | -20.0       | Horizontal | -13.0       |
| 2350.0                   | 66.4           | -36.0       | -20.0       | Vertical   | -16.0       |
| 2820.0                   | 58.0           | -44.0       | -20.0       | Horizontal | -24.0       |
| 2820.0                   | 57.5           | -45.0       | -20.0       | Vertical   | -25.0       |
| 3290.0                   | 59.7           | -43.0       | -20.0       | Horizontal | -23.0       |
| 3290.0                   | 57.7           | -45.0       | -20.0       | Vertical   | -25.0       |
| 3760.0                   | 61.1           | -42.0       | -20.0       | Horizontal | -22.0       |
| 3760.0                   | 59.2           | -43.0       | -20.0       | Vertical   | -23.0       |
| 4230.0                   | -              | -           | -20.0       | Horizontal | -           |
| 4230.0                   | -              | -           | -20.0       | Vertical   | -           |
| 4700.0                   | -              | -           | -20.0       | Horizontal | -           |
| 4700.0                   | -              | -           | -20.0       | Vertical   | -           |

No significant emissions were observed when the transmitter was being operated in stand by mode (not transmitting).

Device was tested on an open area test site at a distance of 3 metres.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on May 12<sup>th</sup>, 2003.

The transmitter was tested while transmitting continuously, using either 2.25 or 4.5 kHz deviation, with an integral antenna attached.

The power level of each emission has been determined by replacing the transmitter with a dipole antenna that was connected to a signal generator.

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Page 13 of 19

# EMC Technologies (NZ) Ltd

Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

---

The signal generator output level was then increased until the same field strength level was observed at each emission frequency.

The level recorded is the signal generator output level in dBm less any gains / losses due to the coax cable and the dipole antenna.

*Limit:*

All spurious emissions are to be attenuated by at least  $50 + 10 \log (P)$ .

The rated power of 100 mW gives a limit of -20 dBm.

No measurements were made above the 10<sup>th</sup> harmonic.

**Result:**

*Measurement Uncertainty:*  $\pm 4.1$  dB

# EMC Technologies (NZ) Ltd

Test Report No 40628.1

Report date: 25<sup>th</sup> June 2004

## Frequency Stability

Frequency stability measurements were between - 30 °C and + 50°C in 10°C increments.

At each temperature the transmitter was given a period of 30 minutes to stabilise. The transmitter was then turned on and the frequency error measured after a period of 1 minute.

Measurements were made with the supply varied between 115% and 85% of the nominal supply voltage (9.0 Vdc).

Testing was carried out using external software control with the upper 2.25 kHz carrier only being transmitted.

A similar frequency deviation was observed when comparison measurements were made using the upper 4.5 kHz carrier only being transmitter.

Nominal frequency: 470.00225 MHz

| Voltage<br>Temp. | Frequency Error (Hz) |         |          |
|------------------|----------------------|---------|----------|
|                  | 7.6 Vdc              | 9.0 Vdc | 10.4 Vdc |
| +50°C            | -960.0               | -950.0  | -990.0   |
| +40°C            | -560.0               | -590.0  | -600.0   |
| +30°C            | -300.0               | -250.0  | -250.0   |
| +20°C            | -140.0               | -10.0   | -10.0    |
| +10°C            | +10.0                | +50.0   | +90.0    |
| 0°C              | +150.0               | +160.0  | +120.0   |
| -10°C            | +200.0               | +210.0  | +180.0   |
| -20°C            | -80.0                | -85.0   | -90.0    |
| -30°C            | +10.0                | +10.0   | +0.0     |

### *Limit:*

In the absence of a specified limit the stability for mobile stations less than 2 watts operating in a 12.5 kHz band plan as per Part 90.213 has been applied where the frequency stability between 421 – 512 MHz is 2.5 ppm.

Testing was carried out on 470.000 MHz. 2.5 ppm = 2.5 x 470 MHz = 1175 Hz.

**Result:** Complies

***Measurement Uncertainty:*** ±30 Hz

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Test Report No **40628.1**

Report date: 25<sup>th</sup> June 2004

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## 9. TEST EQUIPMENT USED

| Instrument           | Manufacturer    | Model      | Serial #    | Asset    |
|----------------------|-----------------|------------|-------------|----------|
| Aerial Controller    | EMCO            | 1090       | 9112-1062   | RFS 3710 |
| Aerial Mast          | EMCO            | 1070-1     | 9203-1661   | RFS 3708 |
| Turntable            | EMCO            | 1080-1-2.1 | 9109-1578   | RFS 3709 |
| VHF Balun            | Schwarzbeck     | VHA 9103   | -           | RFS 3603 |
| Biconical Antenna    | Schwarzbeck     | BBA 9106   | -           | RFS 3612 |
| Log Periodic Antenna | Schwarzbeck     | VUSLP 9111 | 9111-228    | 3785     |
| UHF Dipole Antenna   | Schwarzbeck     | UHA 9107   | -           | RFS 3604 |
| Horn Antenna         | Electrometrics  | RGA-60     | 6234        | E1494    |
| Horn Antenna         | EMCO            | 3115       | 9511-4629   | E1526    |
| Measurement Receiver | Rohde & Schwarz | ESCS 30    | 847124/020  | E1595    |
| Spectrum Analyzer    | Hewlett Packard | E7405A     | US39150142  | 3776     |
| Modulation Analyzer  | Rohde & Schwarz | FMA        | 837807/020  | E1552    |
| Oscilloscope         | Tektronics      | 745A       | B010643     | 1569     |
| Signal Generator     | Rohde & Schwarz | SMHU.58    | 838923/028  | E1493    |
| Frequency Counter    | Hewlett Packard | HP 5342A   | 1916A01713  | E1224    |
| Attenuator 10 dB     | Hewlett Packard | HP8491A    | 24838       | E1329    |
| Attenuator 20 dB     | Weinschel       | 49-20-43   | GC-104      | E1308    |
| Power Supply         | Hewlett Packard | 6032A      | 2743A-02859 | E1069    |
| Rubidium Oscillator  | Ball Efratom    | FRS – C    | 4287        | E1053    |
| Thermal chamber      | Contherm        | M180F      | 86025       | E1129    |
| Thermometer          | DSIR            | RT200      | 035         | E1049    |
| Variac               | General Radio   | 1592       | -           | 3690     |

## 10. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd registration with the Federal Communications Commission as a listed facility, Registration Number: 90838, which was last up dated on May 3<sup>rd</sup>, 2003.

Testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.

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Page 16 of 19

# EMC Technologies (NZ) Ltd

Test Report No 40628.1

Report date: 25<sup>th</sup> June 2004

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## 11. PHOTOGRAPH(S)

### External and Internal Photographs



### FCC Label



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Page 17 of 19

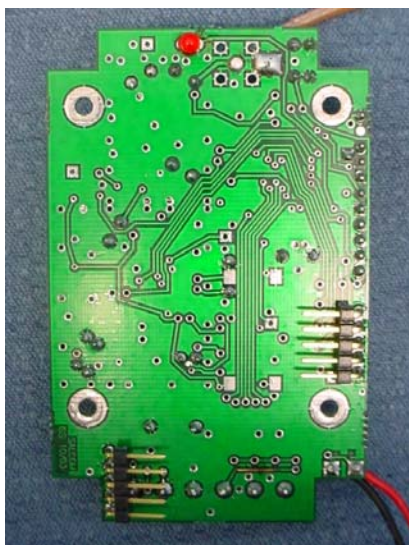
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## External and Internal Photographs



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Page 18 of 19

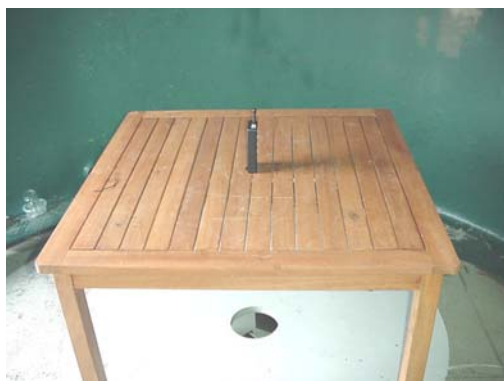
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## Radiated Emissions Test Set Up



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Page 19 of 19