

EMC Technologies (NZ) Ltd

Test Report No 40629.1

Report date: 25th June 2004

TEST REPORT

Salcom 12-85 UHF Desktop POCSAG Paging Transmitter

tested for compliance with the

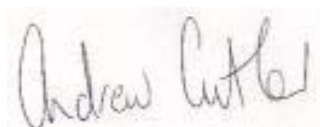
Code of Federal Regulations (CFR) 47

Part 90 –Private Land Mobile Services

for

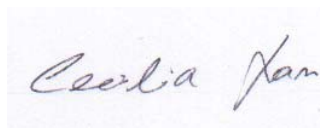
Sea Air and Land Communications Ltd

Test Report issued by:



Andrew Cutler - General Manager

Test Report prepared by:



Cecilia Lam – Office Administrator



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Page 1 of 18

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th June 2004

Table of Contents

1. CLIENT INFORMATION	3
2. DESCRIPTION OF TEST SAMPLE	3
3. COMPLIANCE STATEMENT & SUMMARY OF TEST RESULTS	4
4. ARTICLES SUBMITTED	4
5. TEST SAMPLE DESCRIPTION	5
6. TEST CONDITIONS	6
7. ATTESTATION	7
8. TRANSMITTER TEST RESULTS	8
9. TEST EQUIPMENT USED	15
10. ACCREDITATIONS	15
11. PHOTOGRAPH(S)	16

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th June 2004

1. CLIENT INFORMATION

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

2. DESCRIPTION OF TEST SAMPLE

Brand Name	Salcom
Model Number	12-85-0000
Product	UHF Desktop POCSAG Paging Transmitter
Manufacturer	Sea Air and Land Communications Ltd
Country of Origin	New Zealand
Serial Number	00001, 00002
FCC ID	O871285

NB: This report replaces the reports issued in the 40122 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 **40629.1**

Report date: 25th June 2004

3. COMPLIANCE STATEMENT AND SUMMARY OF TEST RESULTS

The Salcom 12-85 UHF Desktop POCSAG 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 12-85 UHF Pocket Paging Transmitter.

User manual.

The transmitter has requires an external antenna that is supplied by the client.

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th June 2004

5. TEST SAMPLE DESCRIPTION

The sample tested is a UHF Desktop POCSAG paging transmitter with the following specifications:

Rated Transmitter Output Power

120 mW (stated as 21 dBm but is actually 20.8 dBm)

Test frequency

470.0 MHz

Channel spacing

12.5 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

External Controls

This device has no external controls.

Power Supply

12 Vdc external power supply

Antenna

External antenna.

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Page 5 of 18

EMC Technologies (NZ) Ltd

Test Report No 40629.1

Report date: 25th 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 external power supply.

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

The nominal supply voltage is 12.0 Vdc.

The equipment manual specifies a range of 11.5 – 14.0 Vdc.

Testing has therefore been carried out over the range:

85% = 10.2 Vdc

117% = 14.0 Vdc

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th June 2004

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 **40629.1**

Report date: 25th 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 120 mW

Conducted power measurements have been carried out which show a power level of 110 mW (20.4 dBm) at 470 MHz when using either 2.25 or 4.50 kHz deviation.

This measurement falls within the manufacturers specification of 20.8 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

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Test Report No **40629.1**

Report date: 25th June 2004

RF Radiated Power Output

Measurements were not applicable as this transmitter typically operates using an external antenna that would be supplied by the client.

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.

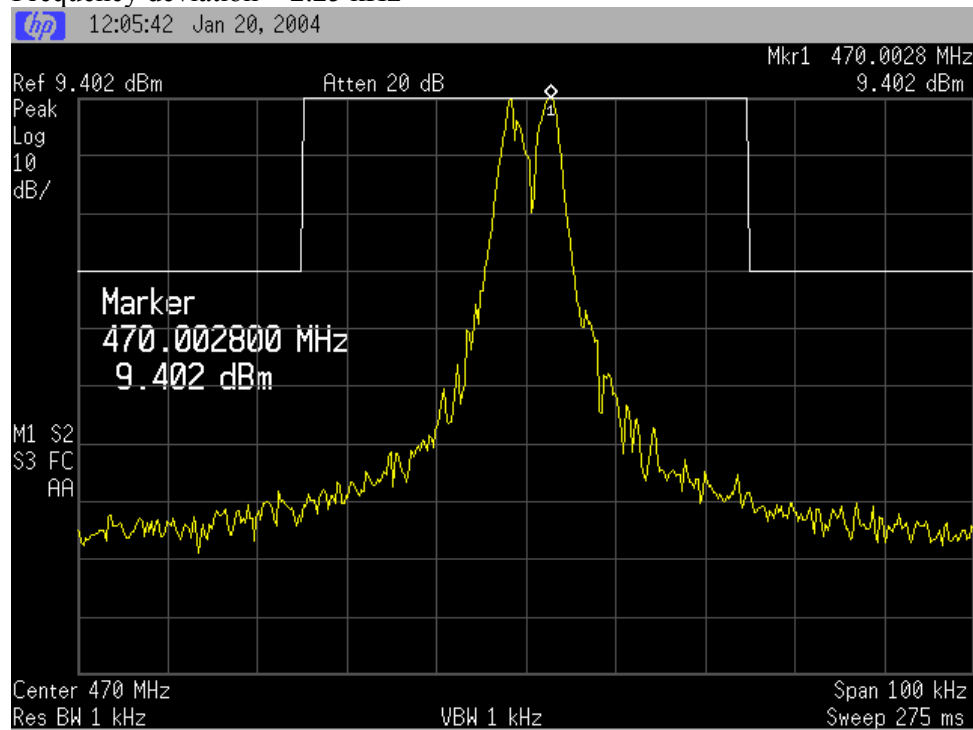
The 12.5 kHz channelling mask has been applied to both frequency deviations.

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

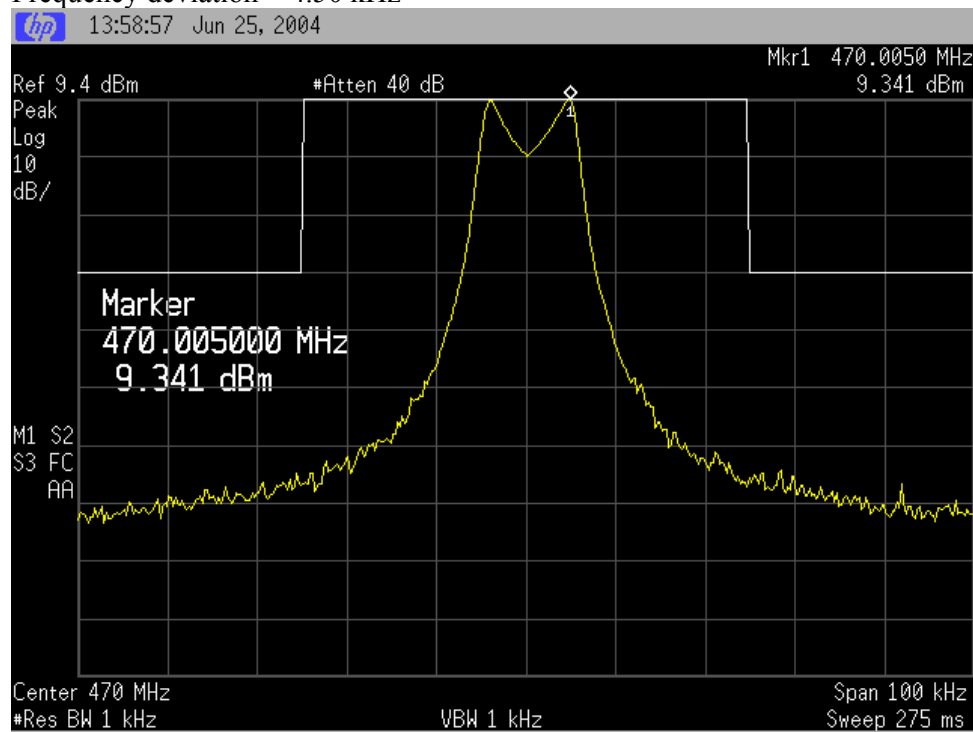
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Test Report No **40629.1**
Report date: 25th June 2004

Frequency deviation = 2.25 kHz



Frequency deviation = 4.50 kHz



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Page 10 of 18

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th June 2004

Conducted measurements made away from the carrier as detailed:

Frequency: 470.000 MHz

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)
940.000	-48.9	-10.4	-38.5
1410.000	-51.4	-10.4	-41.0
1880.000	-52.8	-10.4	-42.4
2350.000	-45.6	-10.4	-35.2
2820.000	-51.1	-10.4	-40.7
3290.000	-38.1	-10.4	-27.7
3760.000	-63.5	-10.4	-53.1
4230.000	-46.5	-10.4	-36.1
4700.000	-54.5	-10.4	-44.1

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.

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 20.4dBm.

All emissions are therefore required to be below -10.4dBm.

Result: Complies.

Measurement Uncertainty: ± 1.2 dB

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th 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	76.4	-25.0	-20.0	Horizontal	-5.0
940.0	71.5	-27.0	-20.0	Vertical	-7.0
1410.0	66.1	-31.0	-20.0	Horizontal	-11.0
1410.0	57.4	-40.0	-20.0	Vertical	-20.0
1880.0	72.2	-26.0	-20.0	Horizontal	-6.0
1880.0	70.1	-29.0	-20.0	Vertical	-9.0
2350.0	70.3	-28.0	-20.0	Horizontal	-8.0
2350.0	68.6	-29.0	-20.0	Vertical	-9.0
2820.0	-	-	-20.0	Horizontal	-
2820.0	-	-	-20.0	Vertical	-
3290.0	-	-	-20.0	Horizontal	-
3290.0	-	-	-20.0	Vertical	-
3760.0	-	-	-20.0	Horizontal	-
3760.0	-	-	-20.0	Vertical	-
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 (receiving / 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 12th, 2003.

The transmitter was tested while transmitting continuously, using either 2.25 or 4.5 kHz deviation, with a dummy load 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 12 of 18

EMC Technologies (NZ) Ltd

Test Report No 40629.1

Report date: 25th 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 120 mW gives a limit of -20 dBm.

No measurements were made above the 10th harmonic.

Result:

Measurement Uncertainty: $\pm 4.1 \text{ dB}$

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th 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 117 and 85% of the nominal supply voltage (12.0 Vdc).

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

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

Nominal frequency: 470.00225 MHz

Voltage Temp.	Frequency Error (Hz)		
	10.2 Vdc	12.0 Vdc	14.0 Vdc
+50°C	+310.0	+310.0	+315.0
+40°C	+130.0	+120.0	+125.0
+30°C	-25.0	-20.0	-30.0
+20°C	-30.0	-40.0	-30.0
+10°C	-10.0	-10.0	-15.0
0°C	-80.0	-80.0	-90.0
-10°C	-60.0	-60.0	-60.0
-20°C	-150.0	-140.0	-130.0
-30°C	-760.0	-750.0	-750.0

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 for devices operating 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

EMC Technologies (NZ) Ltd

Test Report No 40629.1

Report date: 25th June 2004

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 3rd 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 15 of 18

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Test Report No 40629.1

Report date: 25th June 2004

11. PHOTOGRAPH(S)

FCC Label



External Photographs



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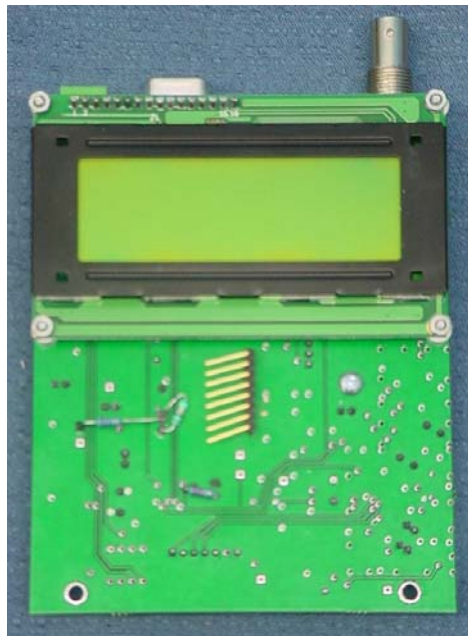
Page 16 of 18

EMC Technologies (NZ) Ltd

Test Report No **40629.1**

Report date: 25th June 2004

Internal Photographs



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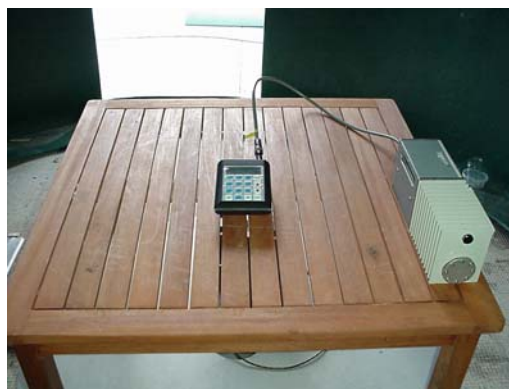
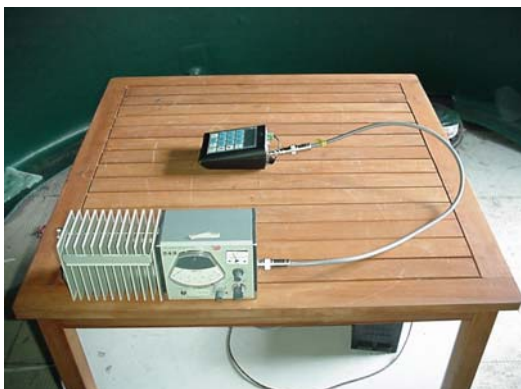
Page 17 of 18

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Test Report No **40629.1**

Report date: 25th June 2004

Radiated emissions test set up



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Page 18 of 18