

EMC Technologies (NZ) Ltd

Test Report No 40126.1
Report date: 27 January 2004

TEST REPORT

Cardax 125 Encoder

tested to

47 Code of Federal Regulations

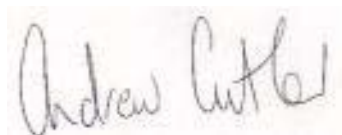
Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

for

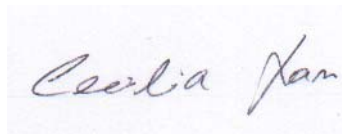
Gallagher Group Ltd

This Test Report is issued with the authority of:



Andrew Cutler - General Manager

Prepared By:



Cecilia Lam - Office Administrator



EMC Technologies (NZ) Ltd

STREET ADDRESS - 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand
POSTAL ADDRESS - PO Box 68 307, Newton, Auckland, New Zealand

Telephone: +64 9 360 0862 Fax: +64 9 360 0861

E-mail: aucklab@ihug.co.nz
Web Site: www.emctech.com.au

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1. STATEMENT OF COMPLIANCE

The **Cardax 125 Encoder** complies with FCC Part 15 Subpart C as an Intentional Radiator when the methods, as described in ANSI C63.4 - 1992, are applied.

2. RESULTS SUMMARY

Clause	Parameter	Result
15.201	Equipment authorisation requirement	Certification required.
15.203	Antenna requirement	Complies. Antenna connector unique.
15.204	External PA and antenna modifications	Not applicable. No external devices.
15.205	Restricted bands of operation	Complies. Device transmits on 125.0 kHz.
15.207	Conducted limits	Complies with a 19.68 dB margin at 25.485 MHz (Average).
15.209	Radiated emission limits - Fundamental	Complies with a 33.6 dB margin.
15.209	Radiated emission limits - Spurious emissions <30 MHz	Complies with a 12.2 dB margin at 1250 kHz.
15.209	Radiated emission limits – Spurious emissions >30 MHz	Complies with a 9.9 margin at 138.000 MHz.

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3. INTRODUCTION

This report describes the tests and measurements performed on the **Cardax 125 Encoder** for the purpose of determining compliance with the specification.

The client selected the test sample.

This report relates only to the sample tested.

This report contains no 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.

This report has been issued in addition to test report number 30326.3a and contains additional test results relating to tests carried out with 2 antennas attached.

4. CLIENT INFORMATION

Company Name	Gallagher Group Ltd
Address	Private Bag 3026
City	Hamilton
Country	New Zealand
Contact	Mr Dave Grant

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5. DESCRIPTION OF TEST SAMPLE

Brand Name	Cardax
Model Number	125
Product	Encoder
Manufacturer	Gallagher Group Ltd
Country of Origin	New Zealand
Serial Number	Not serialised

6. RESULTS

Standard

The sample was tested in accordance with 47 CFR Part 15 Subpart C.

Methods and Procedures

The measurement methods and procedures as described in ANSI C63.4 - 1992 were used.

Section 15.201: Equipment authorisation requirement

Certification as detailed in Subpart J of Part 2 is required for this device.

Section 15.203: Antenna requirement

As can be seen from the attached photographs the device has an internal unique antenna that cannot be easily accessed and therefore cannot be easily modified.

Result: Complies.

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Section 15.204: External radio frequency power amplifiers and antenna modifications

From the attached photographs it can be seen that it is not possible to attach an external power amplifier to this transmitter.

Result: Complies.

Section 15.205: Restricted bands of operation

The transmitter transmits on 125.0 kHz.

This falls between the restricted bands of 90 – 110 kHz and 495 – 505 kHz.

Result: Complies.

Section 15.207: Conducted limits

Conducted emission testing has been carried out as it is possible that this device could be powered using a 110 Vac to 12 Vdc power supply.

Conducted emissions testing was carried out over the frequency range of 150 kHz to 30 MHz at the Laboratory's MacKelvie Street premises in a 2.4 m x 2.4 m x 2.4 m screened room.

Measurements on both the phase and neutral lines were made using either a Quasi Peak or an Average detector with a 9 kHz bandwidth.

Result: Complies with a 19.68 dB margin at 25.485 MHz (Average).

Measurement uncertainty with a confidence interval of 95% is:

- Mains terminal tests (0.15 - 30 MHz) \pm 2.2 dB

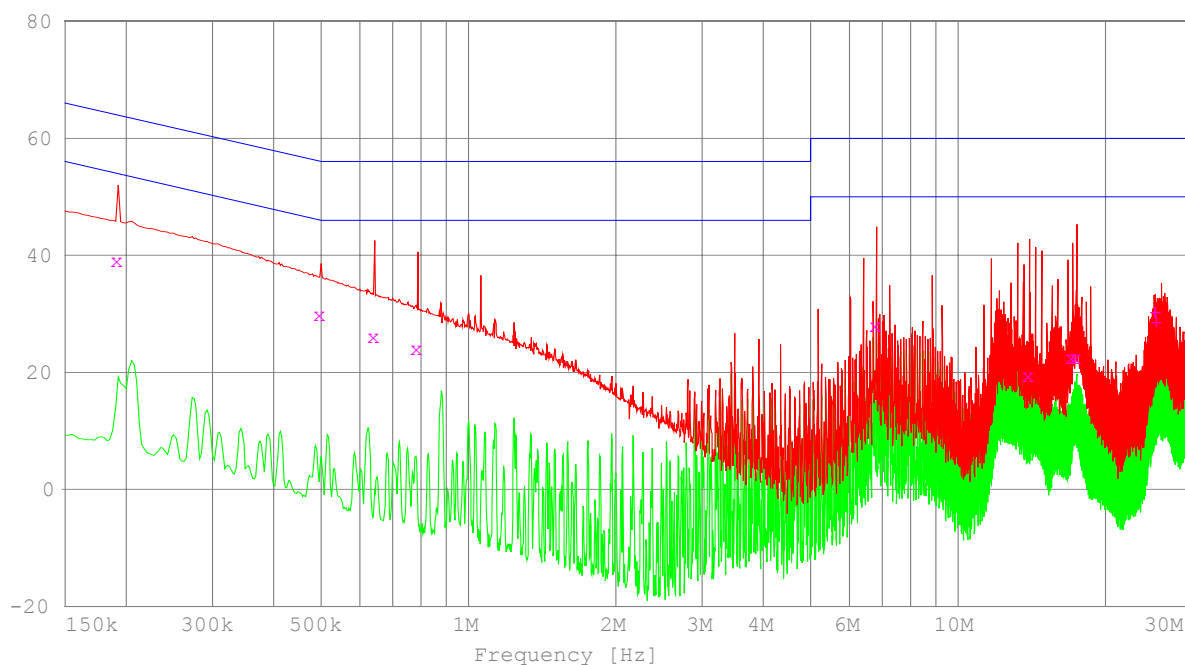
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Conducted Emissions

Comments:	Device tested when powered at 110 Vac transmitting continuously on 125 kHz with a laptop computer attached.
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Level [dB μ V]



Peak	Average	Quasi Peak	Average
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Quasi-Peak Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed	Phase	Rechecks dB μ V
0.192500	39.15	63.93	24.78		L1	
0.500000	29.84	56.00	26.16		L1	
0.642500	26.19	56.00	29.81		L1	
0.787500	24.10	56.00	31.90		L1	
6.820000	28.01	60.00	31.99		L1	
14.010000	19.58	60.00	40.42		N	
17.125000	22.56	60.00	37.44		L1	
17.515000	22.54	60.00	37.46		L1	

Average Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed	Phase	Rechecks dB μ V
25.425000	30.24	50.00	19.76		N	29.9
25.485000	30.32	50.00	19.68		N	29.6
25.545000	28.63	50.00	21.37		L1	28.6

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Section 15.209: Radiated emission limits, general requirements

Radiated emissions testing was carried out over the frequency range of 100 kHz to 1000 MHz.

Testing was carried out at the laboratory's open area test site - located at Driving Creek, Orere Point, Auckland, New Zealand.

This site conforms to the requirements of CISPR 16, Part 1, Clause 16, and ANSI C63.4 - 1992.

The device was placed on the test tabletop, which is a total of 0.8 m above the test site ground plane.

When an emission is located, it is positively identified and its maximum level is found by rotating the automated turntable, and by varying the antenna height, where appropriate, with an automated antenna tower.

The emission is measured in both vertical and horizontal antenna polarisations, where appropriate.

The emission level was determined in field strength by taking the following into consideration:

$$\text{Level (dB}\mu\text{V/m)} = \text{Receiver Reading (dB}\mu\text{V)} + \text{Antenna Factor (dB)} + \text{Coax Loss (dB)}$$

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Fundamental emission:

Measurements were made using a magnetic loop antenna and a receiver with an average detector and a 9 kHz bandwidth.

Measurements were made at a distance of 3 metres as no emissions could be detected when measurements were initially attempted at a distance of 10 metres.

The 300 metre limit at 125 kHz (2400/F(kHz) uV/m) has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

Measurements were made while the device was being powered using a 110 Vac power supply.

In addition measurements have been made while the 110 Vac supply was varied between 85% and 115%.

Only a small variation in level was observed.

Frequency (kHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Voltage
125.0	72.0	105.7	33.7	115%
125.0	72.1	105.7	33.6	110 Vac
125.0	72.0	105.7	33.7	85%

Result: Complies with a 33.7 dB margin

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

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Section 15.209: Spurious Emissions (below 30 MHz)

kHz	Level dBuV/m	Limit dBuV/m	Margin dB	Result
250.000	40.4	99.6	59.2	Pass
375.000	42.0	96.1	54.1	Pass
500.000	40.7	73.6	32.9	Pass
625.000	42.3	71.7	29.4	Pass
750.000	> 41.3	70.1	< 28.8	Pass
875.000	> 30.0	68.8	< 38.8	Pass
1000.000	28.0	67.6	39.6	Pass
1125.000	30.2	66.6	36.4	Pass
1250.000	> 53.5	65.7	< 12.2	Pass

No further emissions could be detected from the transmitter that were within 20 dB of the applicable limit.

Due to the presence of ambient signals on 750, 875 and 1250 kHz definitive measurements could not be made.

Magnetic loop measurements were made at a distance of 3 metres.

Measurements were made while the device was being powered using a 110 Vac power supply.

A receiver with an average detector and a 9 kHz bandwidth was used between 110 – 490 kHz and a quasi peak detector with a 9 kHz bandwidth was used between 490 kHz – 30.0 MHz.

The 300 metre limit between 125 – 490 kHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2) and the 30 metre limit between 490 – 1705 kHz has been scaled by a factor of 40 dB per decade, as per section 15.31 (f) (2).

The spurious emissions observed do not exceed the level of the fundament emission.

Result: Complies with a margin of 12.2 dB at 1250 kHz..

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (100 kHz – 30 MHz) ± 4.8 dB

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Section 15.209: Spurious Emissions (above 30 MHz)

Measurements between 30 – 1000 MHz have been made at a distance of 3 metres.

Measurements were made while the device was being powered using a 110 Vac power supply.

A receiver with a quasi peak detector with a 120 kHz bandwidth was used between 30 – 1000 MHz.

No transmitter spurious emissions were observed.

Measurements were carried out as the device contains a digital device.

The limits as described in Section 15.209 have been applied as follows:

30.0 – 88.0 MHz	100 uV/m	40 dBuV/m
88.0 – 216.0 MHz	150 uV/m	43.5 dBuV/m
216.9 – 960.0 MHz	200 uV/m	46.0 dBuV/m

Result: Complies with a 9.9 dB margin at 138.000 MHz.

Measurement uncertainty with a confidence interval of 95% is:

- Free radiation tests (30 – 1000 MHz) \pm 4.1 dB

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Spurious Emissions

Frequency MHz	Level		Recheck dBuV/m	Limit dBuV/m	Margin dB	Result	Worst Case Antenna
	Vertical dBuV/m	Hort dBuV/m					
48.677	28.3			40.0	11.7	Pass	Vertical
71.677	22.0			40.0	18.0	Pass	Vertical
80.000	26.0			40.0	14.0	Pass	Vertical
84.000	24.3			40.0	15.7	Pass	Vertical
88.000	29.4			43.5	14.1	Pass	Vertical
100.870	26.4			43.5	17.1	Pass	Vertical
110.000	29.9			43.5	13.6	Pass	Vertical
111.100	31.3			43.5	12.2	Pass	Vertical
112.000	25.4			43.5	18.1	Pass	Vertical
114.400		29.7		43.5	13.8	Pass	Horizontal
116.000	27.4			43.5	16.1	Pass	Vertical
132.000	30.5			43.5	13.0	Pass	Vertical
137.900		28.5		43.5	15.0	Pass	Horizontal
138.000	33.6			43.5	9.9	Pass	Vertical
142.000	31.6			43.5	11.9	Pass	Vertical
144.000	29.4			43.5	14.1	Pass	Vertical

No further emissions detected within 20 dB of the applicable limit.

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7. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial No	Asset Ref
Aerial Controller	EMCO	1090	9112-1062	RFS 3710
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612
Log Periodic Antenna	Schwarzbeck	UHALP 9107	-	RFS 3702
Measurement Receiver	Rohde & Schwarz	ESCS 30	847124/020	E1595
Measurement Receiver	Rohde & Schwarz	ESHS 10	828404/005	RFS 3728
Loop Antenna	Schwarzbeck	FMZ 1514	-	RFS 3602
Magnetic Loops	Schwarzbeck	FMZ 15141	-	RFS 3653
Magnetic Loops	Schwarzbeck	FMZ 15142	-	RFS 3654
Artificial Mains Network	Rohde & Schwarz	ESH2-Z5	881362/034	RFS 3628
Variac	General Radio	1592	-	RFS 3690
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709
VHF Balun Antenna	Schwarzbeck	VHA 9103		RFS 3603

8. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies Ltd registration with the Federal Communications Commission as a listed facility, registration number: 90838, which was last updated on May 12th, 2003.

All testing was carried out in accordance with the terms of EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.1999.

All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.1999.

International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with 46 accreditation bodies in 34 economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

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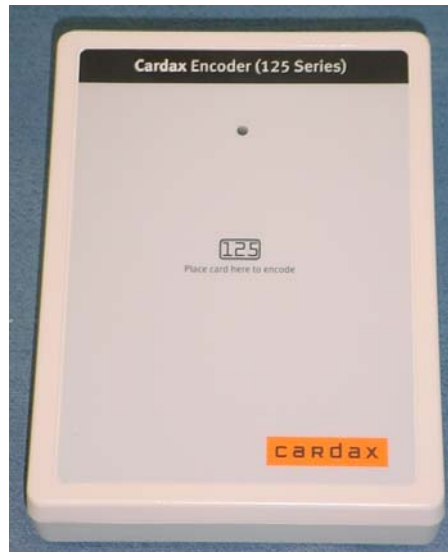
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9. PHOTOGRAPH (S)

External Views

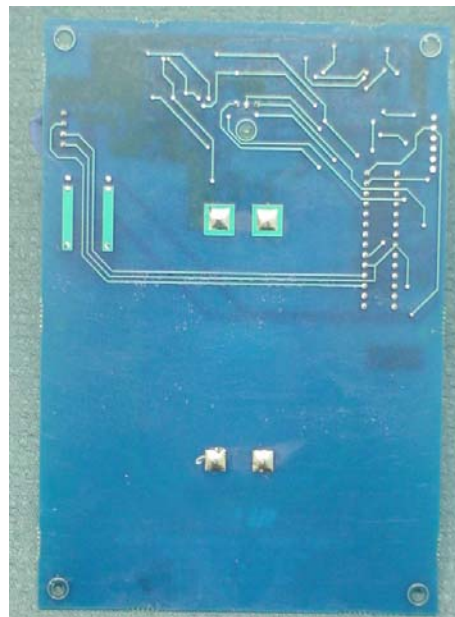


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Internal photographs including the antenna



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Conducted emission test set up



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POSTAL ADDRESS - PO Box 68 307, Newton, Auckland, New Zealand

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Telephone: +64 9 360 0862 Fax: +64 9 360 0861

E-mail: aucklab@ihug.co.nz

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Radiated emissions test set up



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