EMC Technologies (NZ) Ltd

Test Report No **50315.1a**
Report date: 21 May 2005

TEST REPORT

Kruse CFAP 1.1 REV.E GPS Commentary System

tested to

47 Code of Federal Regulations

Part 15 - Radio Frequency Devices

Subpart C – Intentional Radiators

for

Kruse – ITS Limited

This Test Report is issued with the authority of:

Andrew Cutler - General Manager

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

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1. STATEMENT OF COMPLIANCE

The **Kruse CFAP 1.1 REV.E GPS Commentary** 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 is integral to the device.
15.204	External PA and antenna modifications	Not applicable. No external devices.
15.205	Restricted bands of operation	Complies. Device transmits on either 106.7, 106.9, 107.1, 107.3, 107.5, 107.7 or 107.9 MHz.
15.207	Conducted limits	Not applicable. Device to be operated in a vehicle from a battery supply.
15.209	Radiated emission limits	Noted. See 15.239(c)
15.215	Additional provisions	–20 dB bandwidth requirement noted.
15.239(a)	Operation in the band 88 – 108 MHz: Modulation	Complies.
15.239(b)	Field strength of fundamental	Complies with a 0.9 dB margin when measured using an average detector.
15.239(c)	Field strength of spurious emissions.	Complies with an 8.6 dB margin at 160.000 MHz (Vertical).
15.239(d)	Telemetry intentional radiator	Not applicable

3. INTRODUCTION

This report describes the tests and measurements performed on the **Kruse CFAP 1.1 REV.E GPS Commentary System** 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.

4. CLIENT INFORMATION

Company Name	Kruse – ITS Limited
Address	PO Box 26367 Epsom
City	Auckland
Country	New Zealand
Contact	Mr Jonathan Kruse
FCC Grantee Code	S7K
FRN #	0013284476

5. DESCRIPTION OF TEST SAMPLE

Brand Name	Kruse
Model Number	CFAP 1.1 REV.E
Product	GPS Commentary System
Manufacturer	-
Country of Origin	New Zealand
Serial Number	0158

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 this device does not has an antenna connector with the antenna being integral to the device (length of wire heat shrunk onto the dc supply cable).

Result: Complies.

Section 15.204: External radio frequency power amplifiers and antenna modifications

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

Section 15.205: Restricted bands of operation

Not applicable

Section 15.207: Conducted limits

Not applicable.

Device will be used in a motor vehicle and will only ever be powered from a DC battery supply.

Section 15.209: Radiated emission limits, general requirements

Radiated emissions 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:

Level (dBμV/m) = Receiver Reading(dBμV) + Antenna Factor(dB) + Coax Loss(dB)

Section 15.239: Operation in the band 88 – 108 MHz

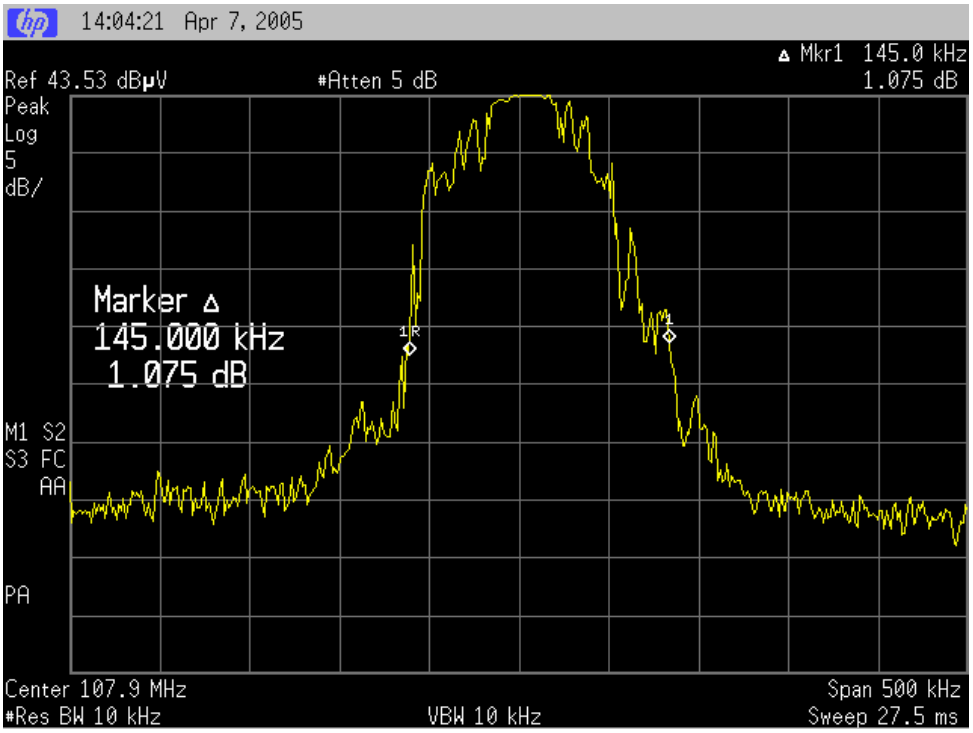
(a) Modulation requirements

Emissions shall be confined within a band 200 kHz wide centred on the operating frequency. The 200 kHz band shall lie wholly within the frequency band of 88 – 108 MHz.

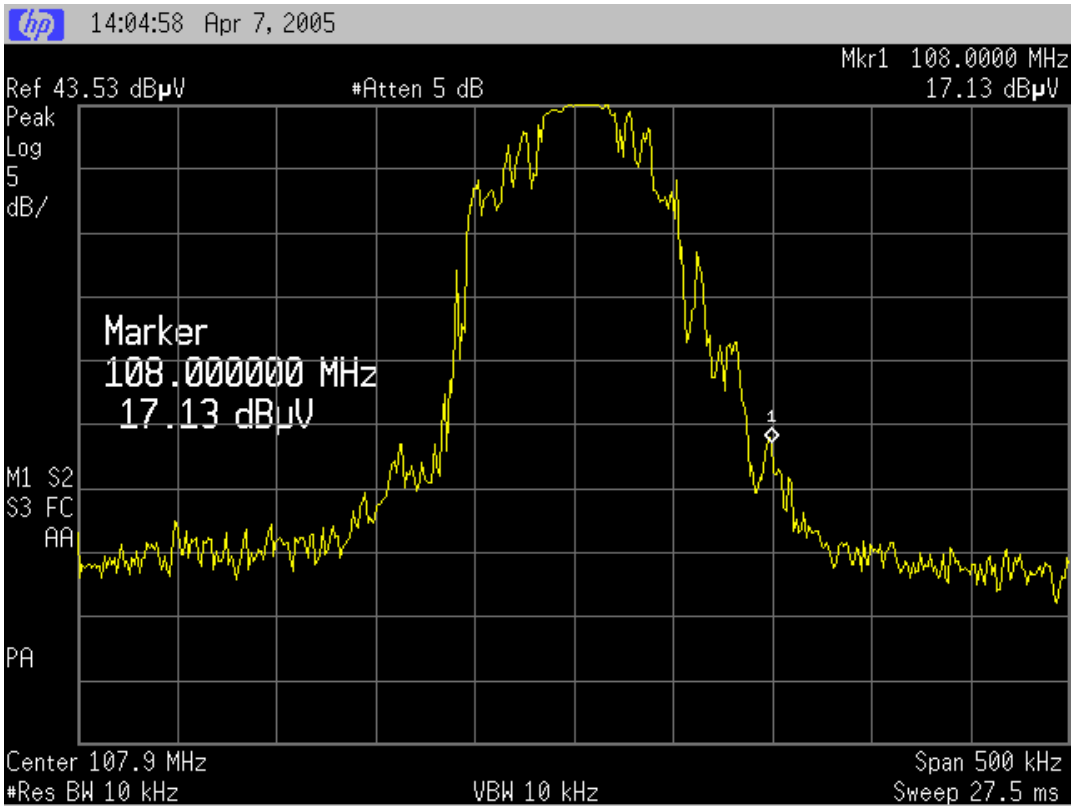
This device can be configured to operate on the following frequencies: 106.7, 106.9, 107.1, 107.3, 107.5, 107.7 and 107.9 MHz.

Testing has been carried out on 107.9 MHz to determine whether the 200 kHz band remains within the 88 – 108 MHz band.

Testing was carried out using a spectrum analyser in peak hold mode while the transmitter was being modulated by various forms of modulation



The 20 dB bandwidth can be seen to be less than 200 kHz



At the band edge the emission level is more than 20 dB down on the carrier peak.

Result: Complies.

(b) Fundamental emission field strength:

The field strength of the fundamental emission within the 200 kHz band shall not exceed 250 uV/m (48 dBuV/m) at 3 metres when an average detector has been used.

The provisions of section 15.35 for limiting peak emissions have also been applied.

Measurements were made using a measurement receiver with an average detector and a 120 kHz bandwidth.

Peak measurements were also made using this receiver using a peak detector and a 120 kHz bandwidth.

Measurements were made while the device was being powered using a 12 Vdc battery and an external power supply in order to vary the supply voltage between 10.2 Vdc and 13.8 Vdc (85% and 115%).

Frequency	Level		Recheck	Limit	Margin	Result	Worst Case Antenna
	Vertical	Hort					
MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB		
Average							
107.9000	47.1	36.5	47.1	48.0	0.9	Pass	Vertical
Peak							
107.9000	47.2	36.9		68.0	20.8	Pass	Vertical

Variation in the supply voltage did not vary the observed field strength.

Result: Complies with a 0.9 dB margin when measured using an Average detector.

Measurement uncertainty with a confidence interval of 95% is:
- Free radiation tests (30 - 1000 MHz) ± 4.1 dB

Section 15.209: Spurious Emissions

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 12 Vdc lead acid battery.

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

No transmitter spurious emissions were observed up to 1000 MHz as per section 15.33(b).

Measurements were not carried out on the GPS receiver as this device operates above 960 MHz and therefore measurements are not required as per Section 15.111.

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
960.0 – 1000.0 MHz	500 uV/m	54.0 dBuV/m

Result: Complies with an 8.6 dB margin at 160.000 MHz (Vertical).

Measurement uncertainty with a confidence interval of 95% is:

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

Spurious Emissions

Frequency	Level		Limit	Margin	Result	Worst Case
	Vertical	Hort				Antenna
MHz	dBuV/m	dBuV/m	dBuV/m	dB		
32.000	26.1	20.0	40.0	13.9	Pass	Vertical
36.000	26.4		40.0	13.6	Pass	Vertical
63.000	20.4		40.0	19.6	Pass	Vertical
69.000	20.0		40.0	20.0	Pass	Vertical
70.000	22.0		40.0	18.0	Pass	Vertical
71.000	28.0		40.0	12.0	Pass	Vertical
72.000	30.0		40.0	10.0	Pass	Vertical
73.000	25.3		40.0	14.7	Pass	Vertical
74.000	22.7		40.0	17.3	Pass	Vertical
75.000	24.3		40.0	15.7	Pass	Vertical
76.000	21.0		40.0	19.0	Pass	Vertical
79.000	22.6		40.0	17.4	Pass	Vertical
80.000	26.0		40.0	14.0	Pass	Vertical
128.000	23.0		43.5	20.5	Pass	Vertical
135.000	23.4		43.5	20.1	Pass	Vertical
136.000	28.0		43.5	15.5	Pass	Vertical
144.000	29.2		43.5	14.3	Pass	Vertical
160.000	34.9	22.0	43.5	8.6	Pass	Vertical
168.000	28.3		43.5	15.2	Pass	Vertical
173.000	25.0		43.5	18.5	Pass	Vertical
176.000	32.5		43.5	11.0	Pass	Vertical
184.000	28.7		43.5	14.8	Pass	Vertical
192.000	33.2	22.5	43.5	10.3	Pass	Vertical
224.000	26.4		43.5	17.1	Pass	Vertical

No transmitter spurious emissions detected.

All other emissions observed have a margin to the limit of greater than 20 dB.

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	VUSLP 9111	9111-228	3785
Measurement Receiver	Rohde & Schwarz	ESCS 30	847124/020	E1595
Spectrum Analyser	Hewlett Packard	E7405A	US39150142	3776
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 February 17th, 2004.

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.

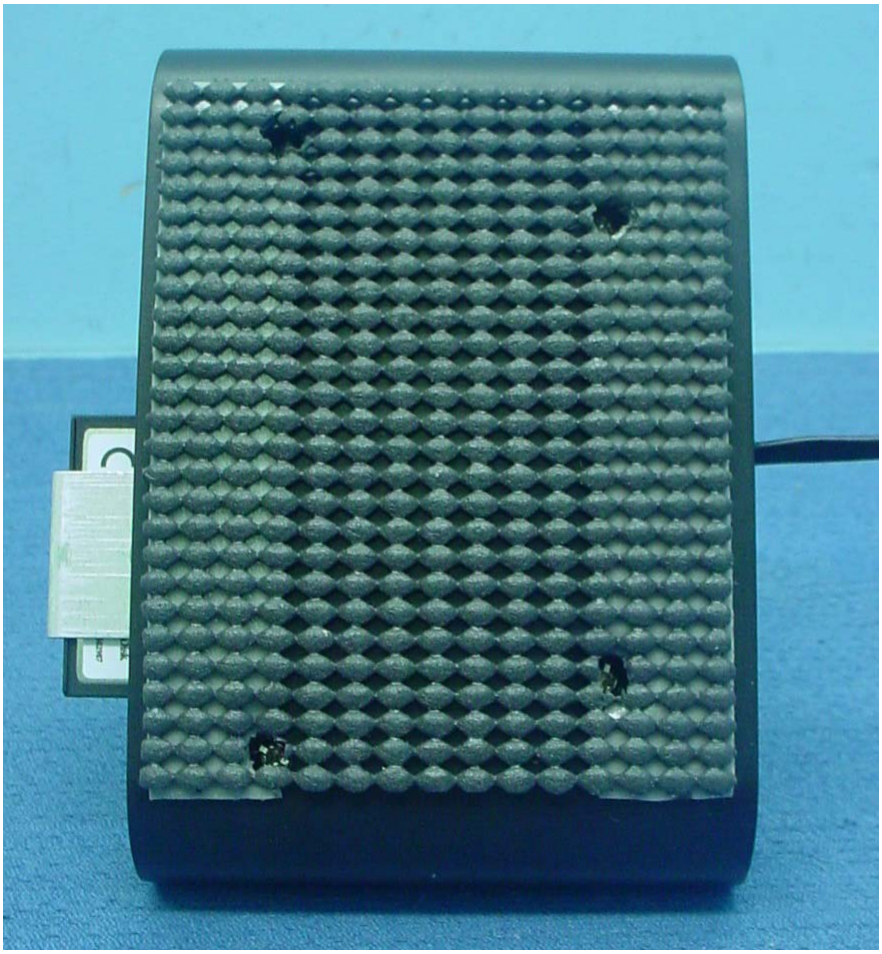
All measurement equipment has been calibrated in accordance with the terms of the EMC Technologies (NZ) Ltd International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025.1999.

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.

9. PHOTOGRAPH (S)

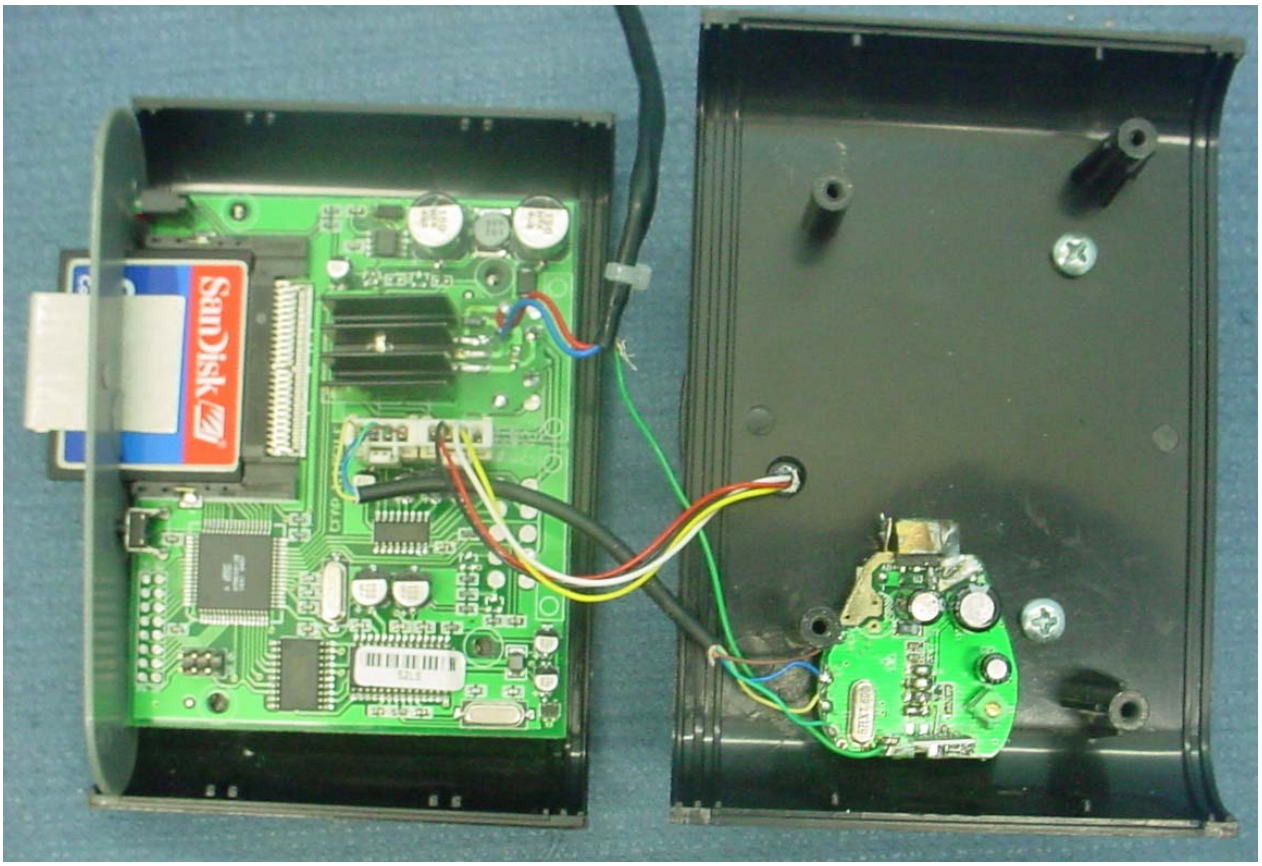
External Views

GARMIN
9 b/h
0158

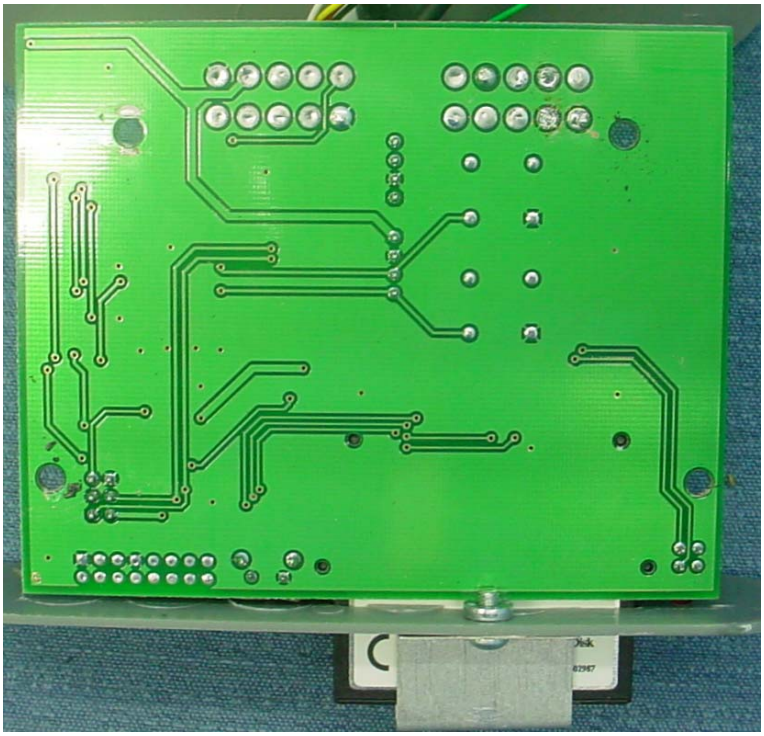


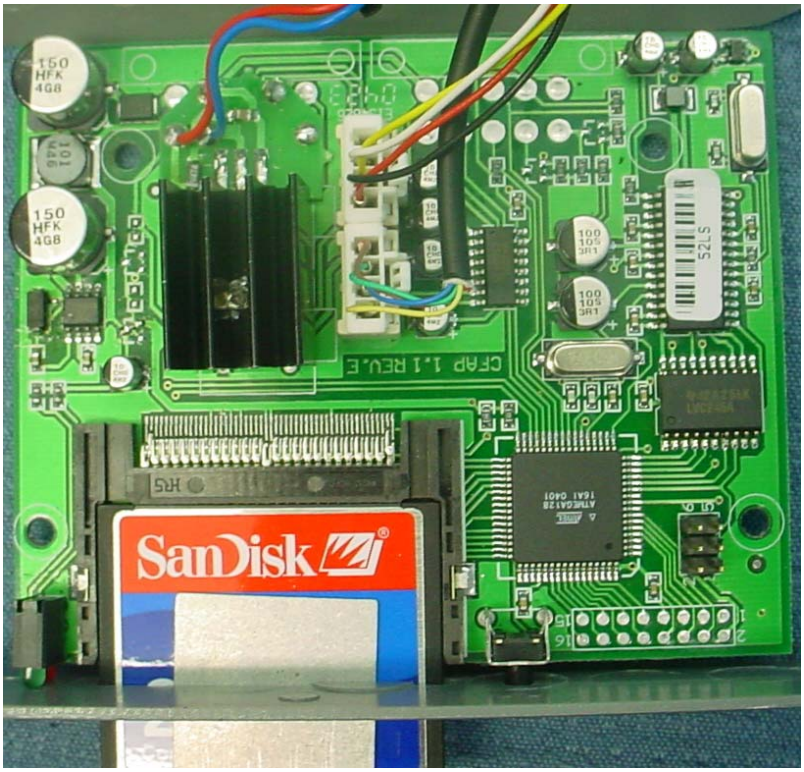
GPS Antenna Details

Internal Photographs

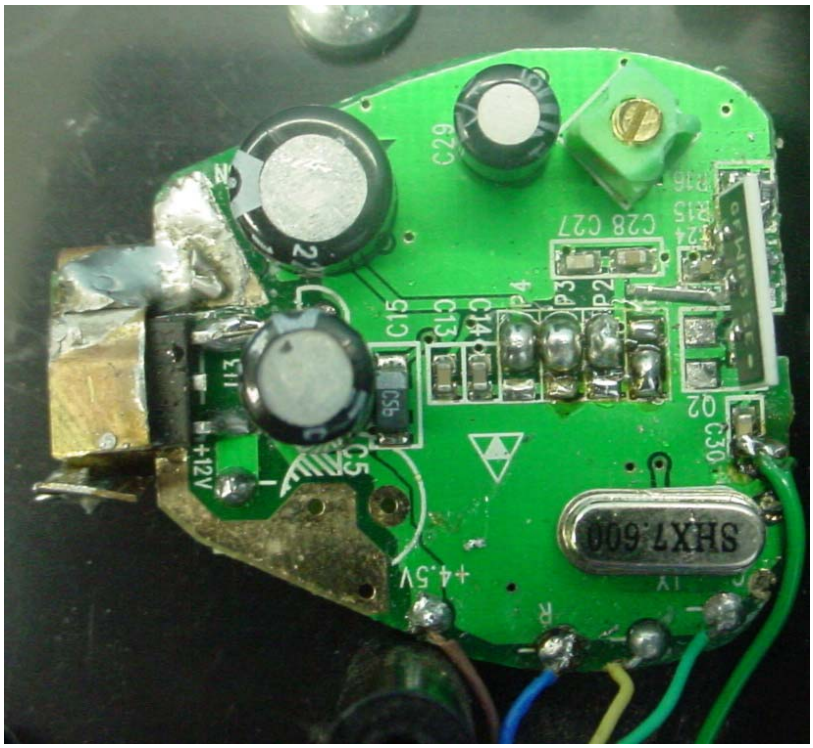


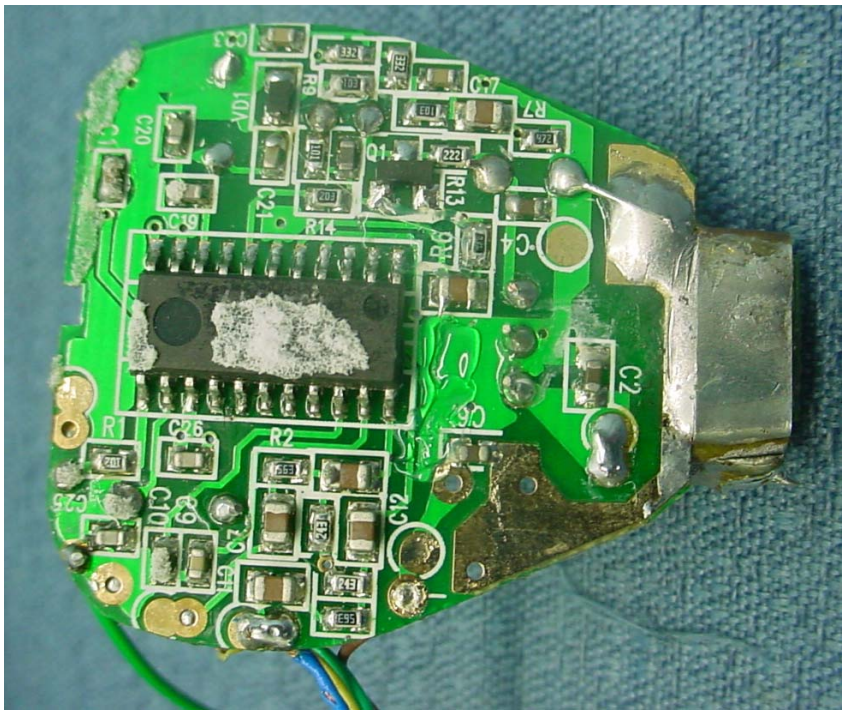
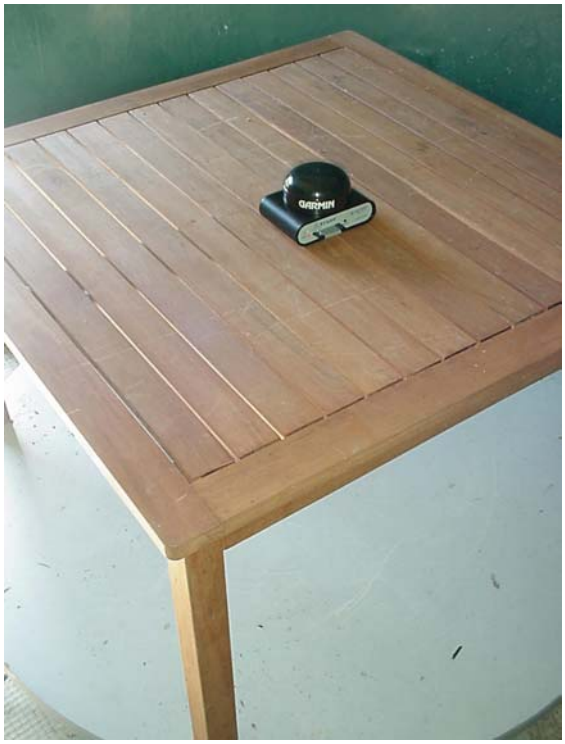
The antenna is the green wire coming off the transmitter board that is then heat shrunk on to the DC supply cable.




SanDisk

Transmitter Board





Radiated Emissions Test Set Up