
REPORT ON

FCC Part 15 Testing in support of an Application for Grant of Equipment Authorisation
of the Symbol VRC697C Vehicle Radio Computer

FCC ID: H9PVRC697C

Report No OR611018/2

May 2003

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Equipment Authorisation of a Symbol VRC697C Vehicle Radio
Computer

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Report No OR611018/2

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PREPARED FOR

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DATED

7th May 2003

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Symbol Technologies

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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	Vehicle Radio Computer
APPLICANT	Symbol Technologies Incorporated One Symbol Plaza Holtsville NY11742 United States
MANUFACTURERS MODEL NUMBER	VRC697C
SERIAL NUMBER	M1E74A95H
TEST SPECIFICATION NUMBER	FCC Part 15 Subpart C
REGISTRATION NUMBER	OR611018
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR611018 2 nd May 2003
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	14 th April 2003 15 th April 2003
TEST ENGINEERS	G Lawler A Guy S Hartley
RELATED DOCUMENTS	ANSI C63.4 2001. Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.



TEST RATIONALE

The equipment comprises a Symbol VRC697C (containing a CISCO LM352 2.4GHz 11Mbps/sec Wireless LAN Module FCC ID LDK 102040) and Symbol LS 3000 Laser Scanner.

Section 3 of the report details testing carried out in accordance with:

- FCC: Part 15.247(c), Radiated Electric Field Emissions
- FCC: Part 15.247(b), Maximum Peak Output Power



SYSTEM CONFIGURATION DURING EMC TESTING

The EUT was set-up simulating a typical user installation on the Alternative Open Field Test Site identified on page 26, and tested in accordance with the specification.

The EUT was set to transmit continuously on maximum output power during all testing. The EUT was powered via a 12V power supply unit. An LS3000 scanner was also used to exercise the unit during test.

Testing was carried out with the EUT transmitting on the following channels.

Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

TEST SETUP PHOTOGRAPH

The photograph below shows the EUT configuration during Radiated Emission testing.



Photograph 1



EQUIPMENT INFORMATION

Equipment under Test (EUT):

Equipment:	VRC697C	LS 3000
Manufacturer:	Symbol Technologies Inc	Symbol Technologies Inc
Type No:	VRC697C	LS 3000
Serial No:	M1E74A95H	M71ED5
Drawing Revision:	Not Supplied	Not Supplied

Instrumentation used for Emission Testing:

Instrument	Manufacturer	Type No	EMC No	Cal to
Turntable & Controller	HD GmbH	HD 050	2528	TU
Antenna Mast	Emco	1051	2182	TU
Antenna Mast Controller	Emco	1050	2090	TU
Low Noise Amplifier (1-8GHz)	Miteq	AMF-3D-001080-18-13P	2457	TU
Spectrum Analyser	Rohde & Schwarz	ESIB40	2917	4 Feb 04
Horn	EMCO	3115	2397	29 Jun 03
Signal Generator	Hewlett Packard	8673B	2551	15 Jun 03
Low Noise Amplifier (8-18GHz)	Avantek	AWT 18036	1081	TU
Low Noise Amplifier (18-26GHz)	Avantek	AMT-26177-33	2072	TU

Instrumentation used for Maximum Power measurements

Spectrum Analyser	Rohde and Schwarz	FSEM	4034	16 Dec 03
Signal Generator	Hewlett Packard	ESG 4000A	3709	21 Jan 04
DRG Antenna	EMCO	3115	3549	29 Jun 03
Substitution DRG Antenna	EMCO	3115	3777	20 Jan 04
Cable	Reynolds Industries	269-0088-3000	CS0567	TU
Cable	Rosenberger	FA210B-1-070M	CS0535	TU

TU - Traceability Unscheduled



RADIATED ELECTRIC FIELD EMISSIONS (Transmitter Portion)

TEST PROCEDURE

Testing to the requirements of FCC Part 15 Subpart C, Section 15.247(c), for Radiated Electric Field Emissions was carried out on the Measurement Test Facility detailed on page 26.

A preliminary profile of the Radiated Electric Field Emissions was obtained by operating the Equipment Under Test (EUT) on a remotely controlled turntable within a semi-anechoic chamber; measurements were taken at a 3m distance unless otherwise stated. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, a search was made in the frequency range 30MHz to 25GHz. The list of worst case emissions was then confirmed or updated under Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. Emissions levels were then formally measured using a Quasi-Peak Detector which met the CISPR requirements in the frequency range 30MHz to 1000MHz and a peak detector in the frequency range 1GHz to 25GHz. The details of the worst case emissions were then recorded and are presented in Tables 1, 2 and 3.

The test was performed in accordance with ANSI C63.4.

Measurements were made with the EUT transmitting on the following channels.

Channel 1: 2412MHz
Channel 6: 2437MHz
Channel 11: 2462MHz

Radiated Emission from 1GHz to 25GHz were made using a Rohde & Schwarz ESIB40 Spectrum Analyser.



RADIATED ELECTRIC FIELD EMISSIONS (cont'd)

TEST RESULTS

Equipment Designation : Intentional Radiator.

The EUT met the requirements of FCC Part 15.247(c) for Radiated Electric Field Emissions.

The emissions were measured at 3m unless otherwise indicated.

EUT Tx on Bottom Channel (2.412GHz)

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	Deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
0.048	V	100	335	26.6*	40.0	-	-
0.336	H	100	101	31.5*	46.0	-	-
0.344	H	100	101	31.0*	46.0	-	-
2.530	V	100	0	49.0	74.0	45.6	54.0

Table 1

* Note, In accordance with the specification these measurements are Quasi-Peak.

EUT Tx on Middle Channel (2.437GHz)

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	Deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
0.048	V	100	340	27.5*	40.0	-	-
0.336	H	100	104	31.5*	46.0	-	-
0.344	H	100	104	31.5*	46.0	-	-
2.530	V	121	232	53.3	88.5	-	-

Table 2

* Note, In accordance with the specification these measurements are Quasi-Peak.



RADIATED ELECTRIC FIELD EMISSIONS

TEST RESULTS(cont'd)

EUT Tx on Top Channel (2.462GHz)

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	Deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
0.048	V	100	324	26.1*	40.0	-	-
0.336	H	100	106	30.5*	46.0	-	-
0.344	H	100	106	31.5*	46.0	-	-
2.530	V	100	308	58.8	86.4	-	-


Table 3

* Note, In accordance with the specification these measurements are Quasi-Peak.

Procedure: Test Performed in accordance with ANSI C63.4.

Performed by: A Guy, EMC Engineer.

Signatures:



Date: 4th April 2003



MAXIMUM PEAK OUTPUT POWER

TEST PROCEDURE

Testing to the requirements of FCC Part 15 Subpart C, Section 15.247(b)(1), for Maximum Peak Output Power was carried out.

The Spectrum Analyser was tuned to the test frequency. The device Output power setting was controlled via the 'Test Mode' on each handset being set to the conditions specified in the Summary on page 5 of this document. The device was then rotated through 360 degrees until the highest power level was observed in both planes of polarisation. The device was then replaced with a substitution antenna, the signal to the antenna was adjusted to equal the related level detected from the device.

Maximum Peak Output Power measurements were made with the EUT set to continuous transmit at maximum power on the following channels:

Channel 1: 2412MHz
Channel 6: 2347MHz
Channel 11: 2462MHz

TEST RESULTS

The EUT met the requirements of FCC Part 15.247(b)(1) for Maximum Peak Output Power, see Table 1.

MAXIMUM POWER

Frequency (MHz)	Raw Result (dBm)	Substitution Level (dBm)	Cable Loss (dB)	Substitution Antenna Gain (dB)	Result ERP (dBm)	Result ERP (mW)
2412	-26.0	15.5	14.0	6.96	8.5	7.08
2437	-25.6	19.0	13.2	7.00	12.8	19.05
2462	-24.8	20.0	13.2	7.00	13.8	23.98

Table 4

Calculations: The figures in Watts in the above table were calculated using the formula:

$$\text{EIRP in Watts} = \frac{10^{\left(\frac{\text{dBm}}{10}\right)}}{1000}$$

Performed by: A Guy, EMC Engineer.

Signature:

Date: 5th April 2003

PHOTOGRAPHS OF EQUIPMENT



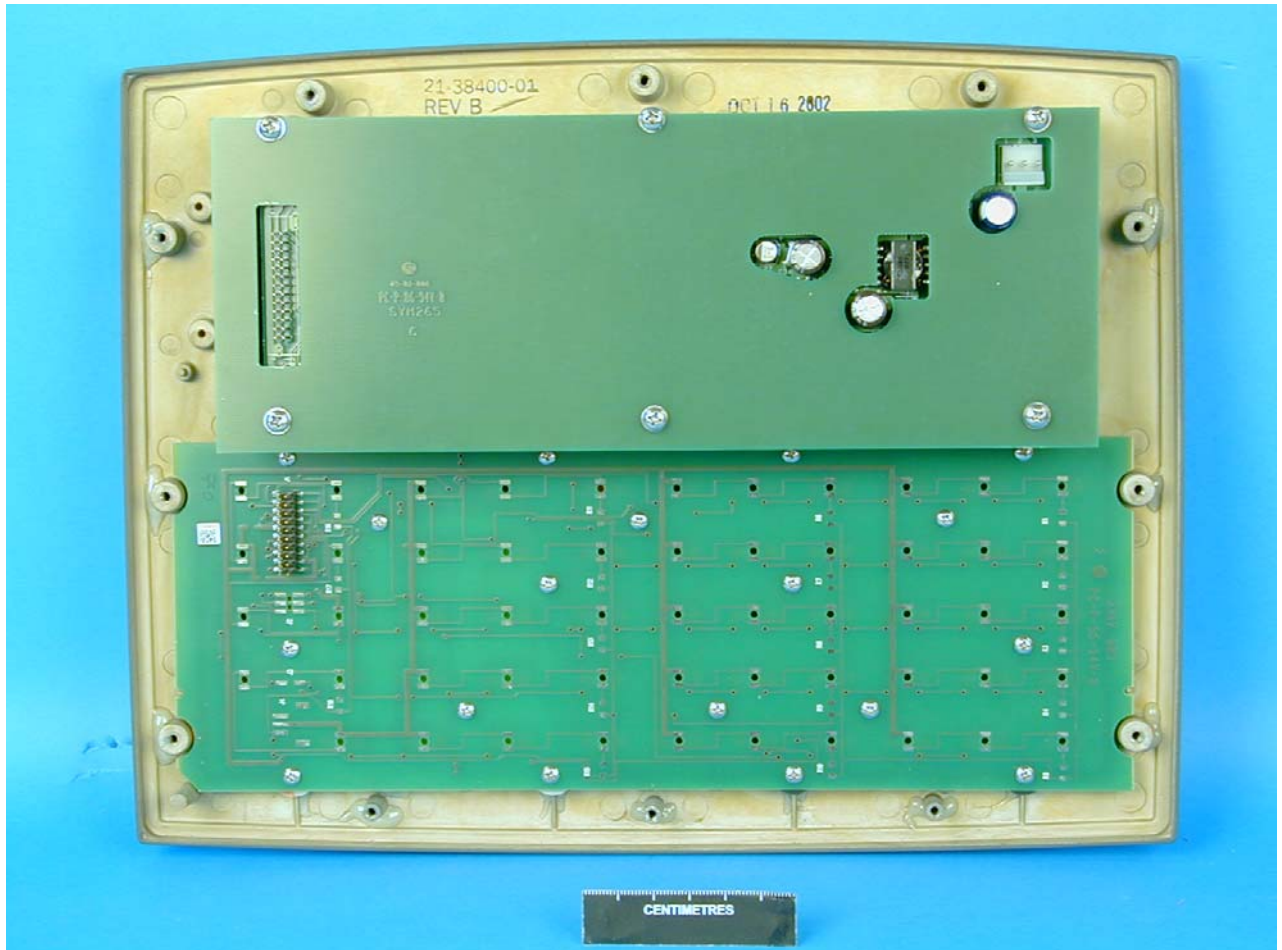
Photograph 2
Front View

PHOTOGRAPHS OF EQUIPMENT



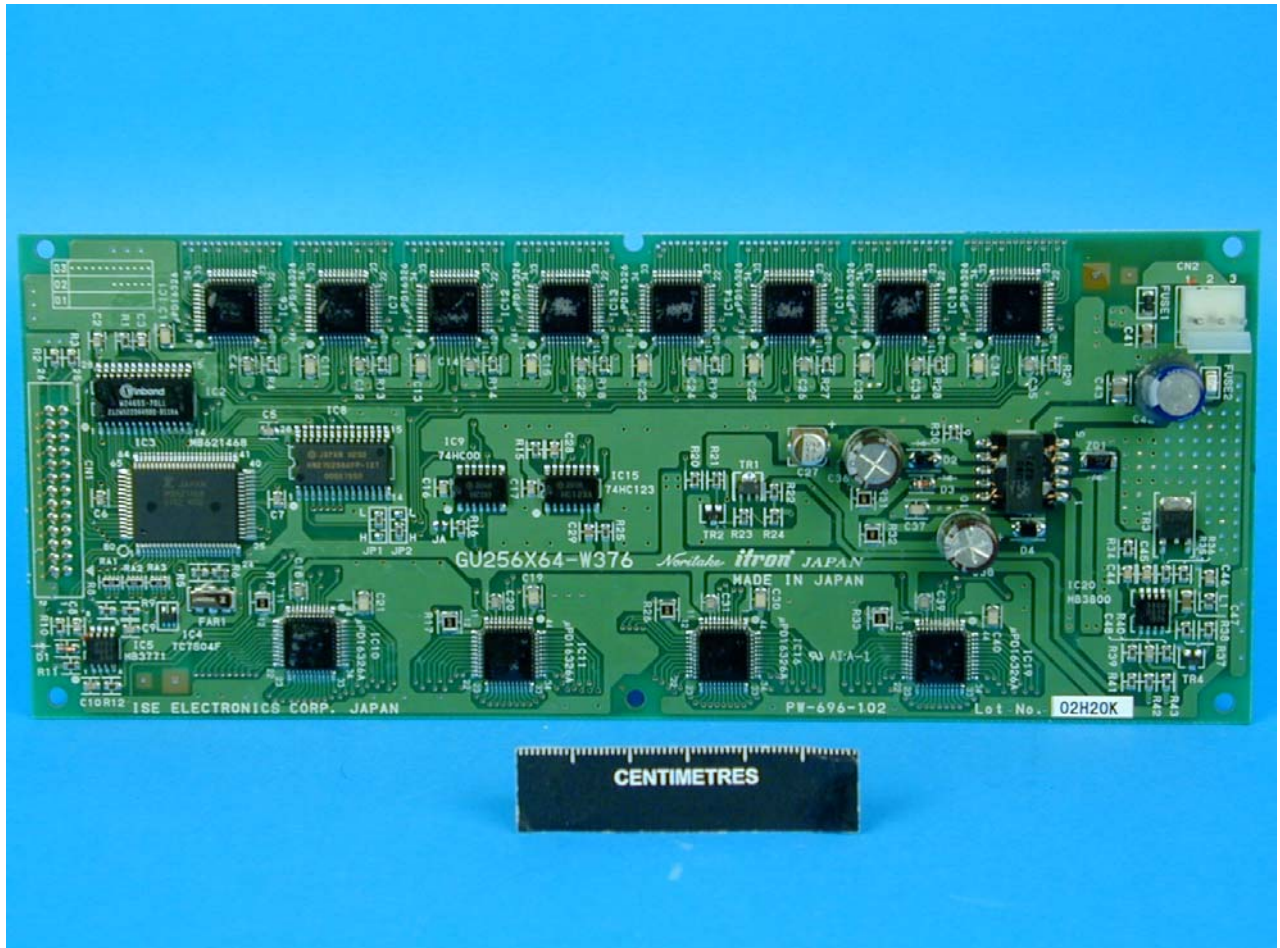
Photograph 3
Rear view

PHOTOGRAPHS OF EQUIPMENT



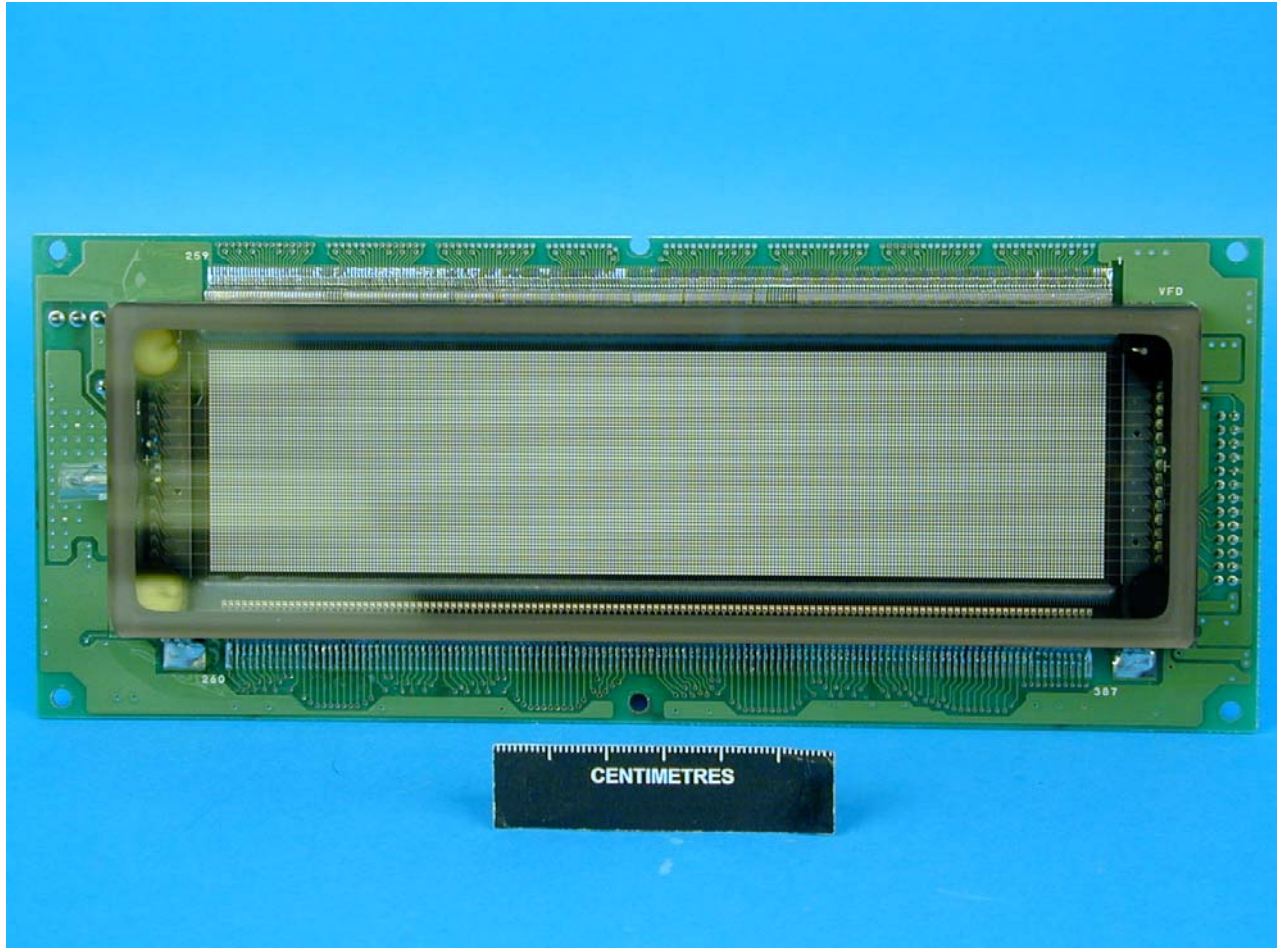
Photograph 4
Internal view

PHOTOGRAPHS OF EQUIPMENT



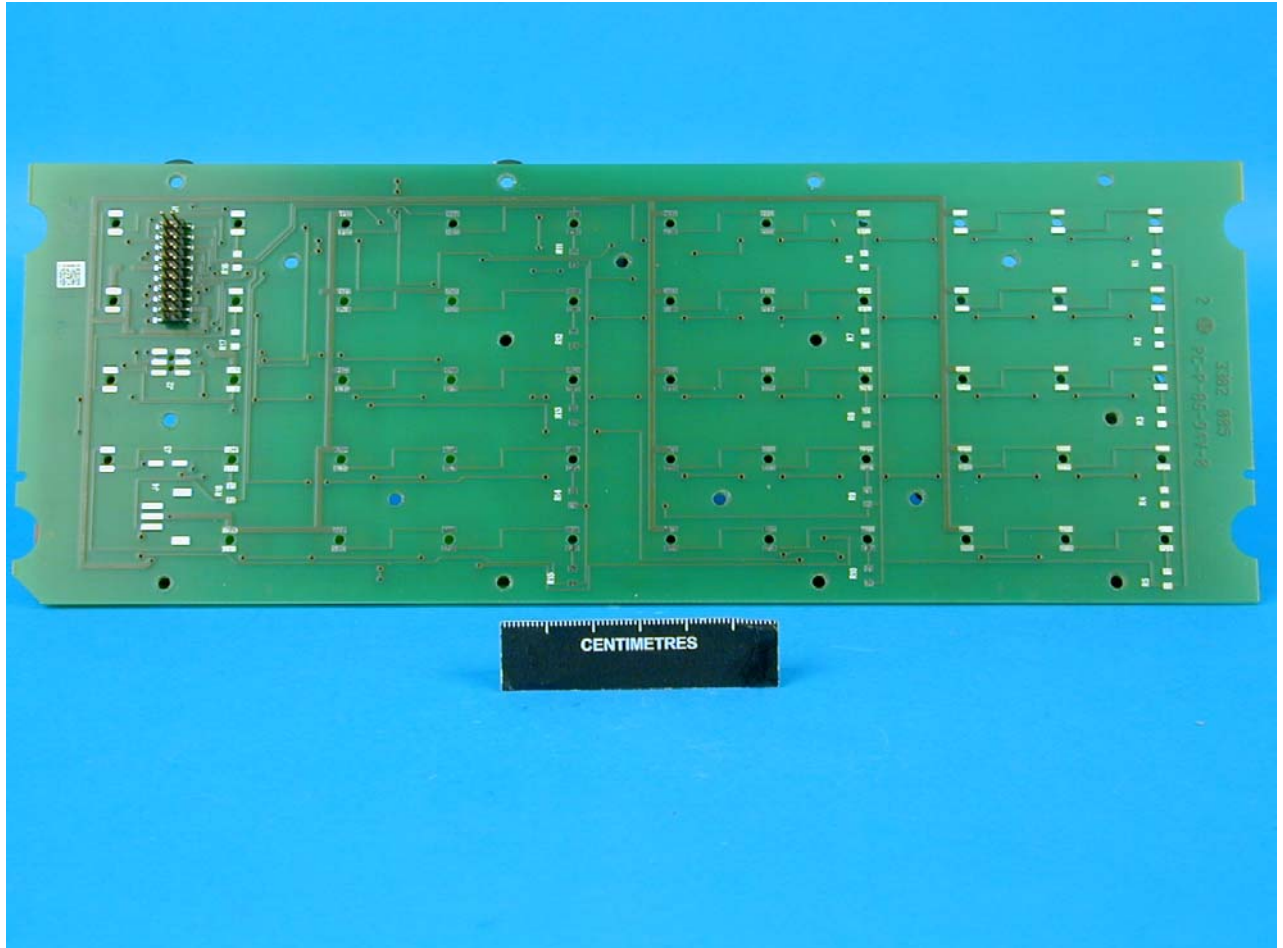
Photograph 5
Internal view

PHOTOGRAPHS OF EQUIPMENT



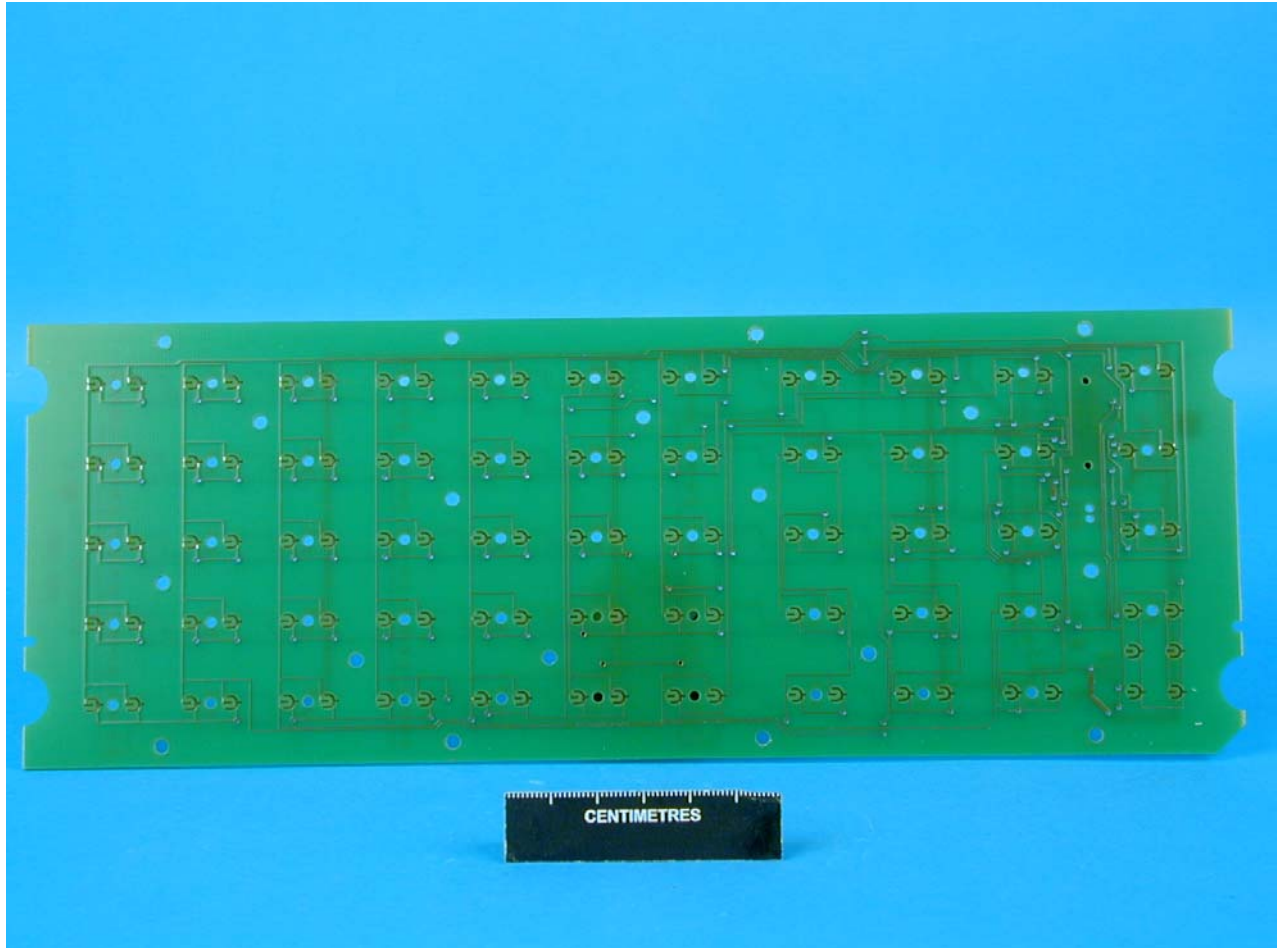
Photograph 6
Internal view

PHOTOGRAPHS OF EQUIPMENT



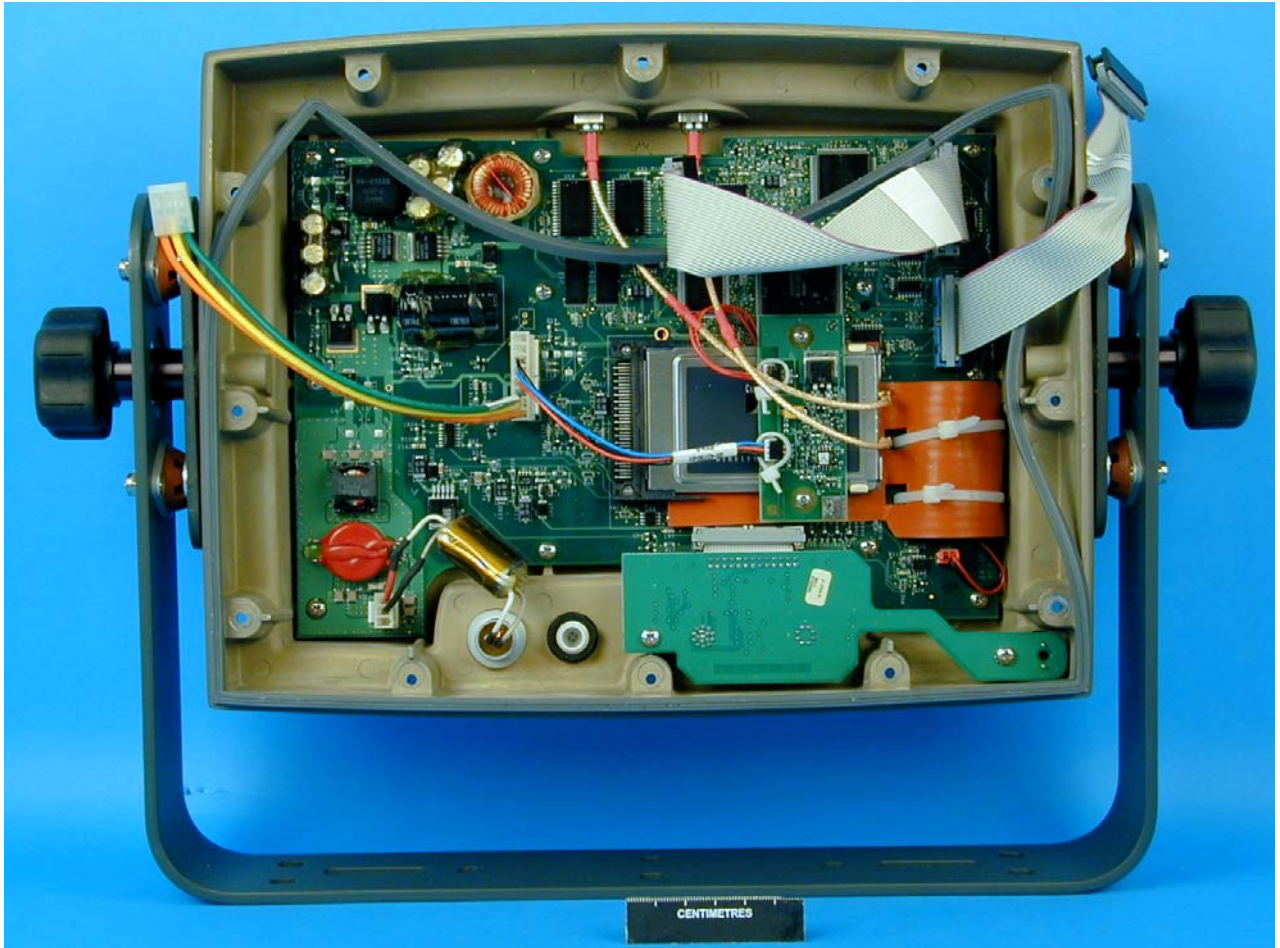
Photograph 7
Internal view

PHOTOGRAPHS OF EQUIPMENT



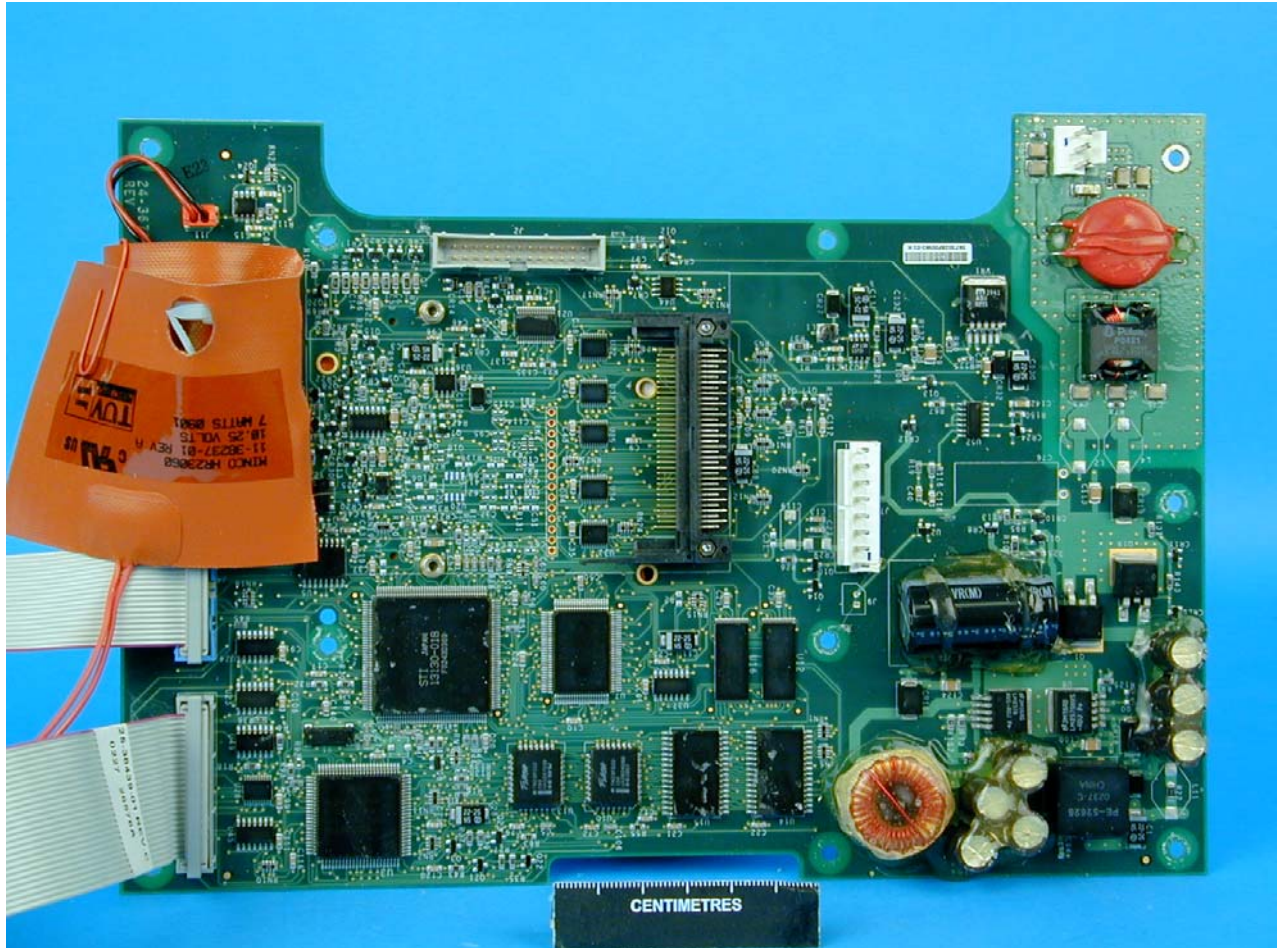
Photograph 8
Internal view

PHOTOGRAPHS OF EQUIPMENT



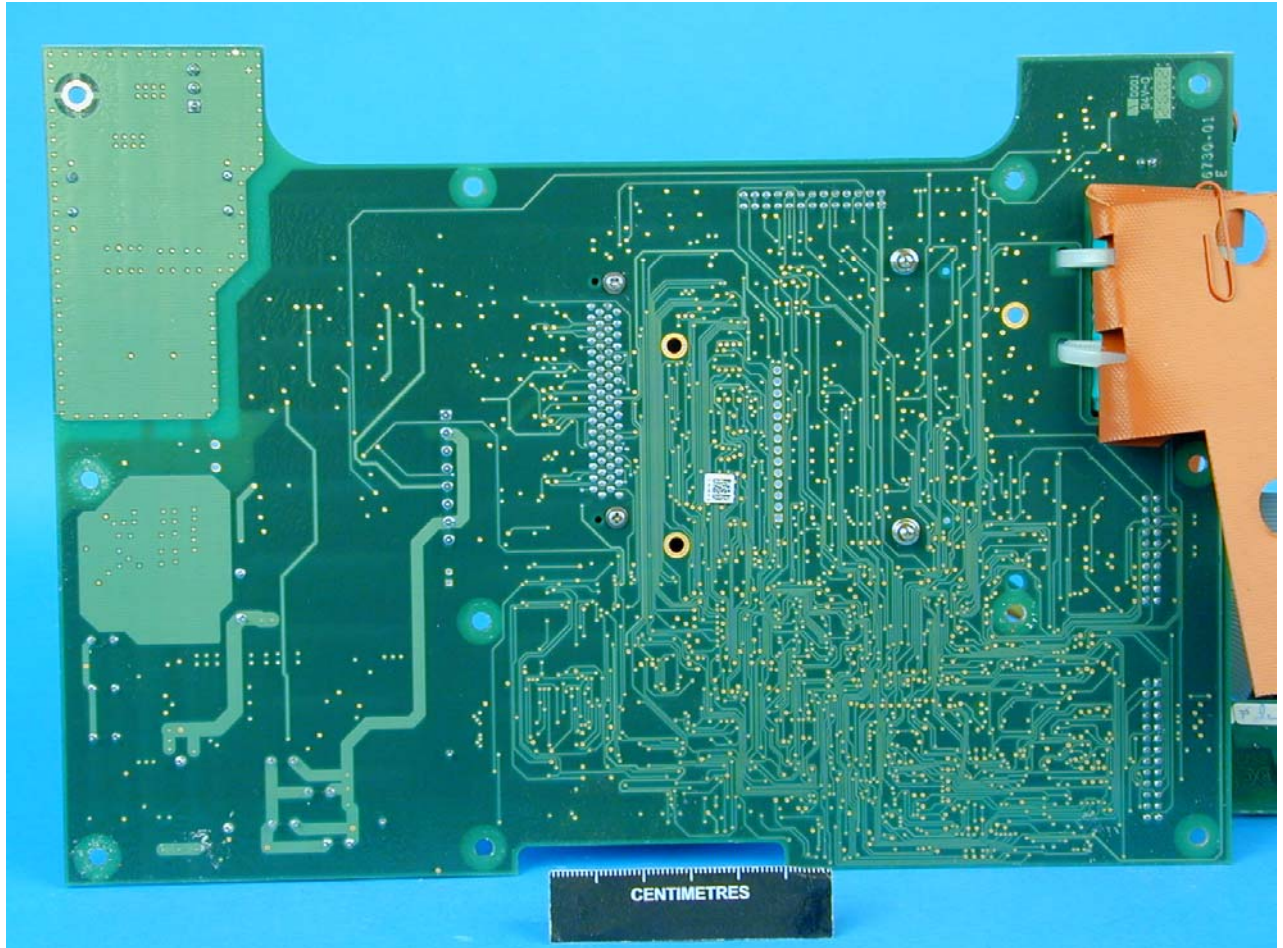
Photograph 9
Internal view

PHOTOGRAPHS OF EQUIPMENT



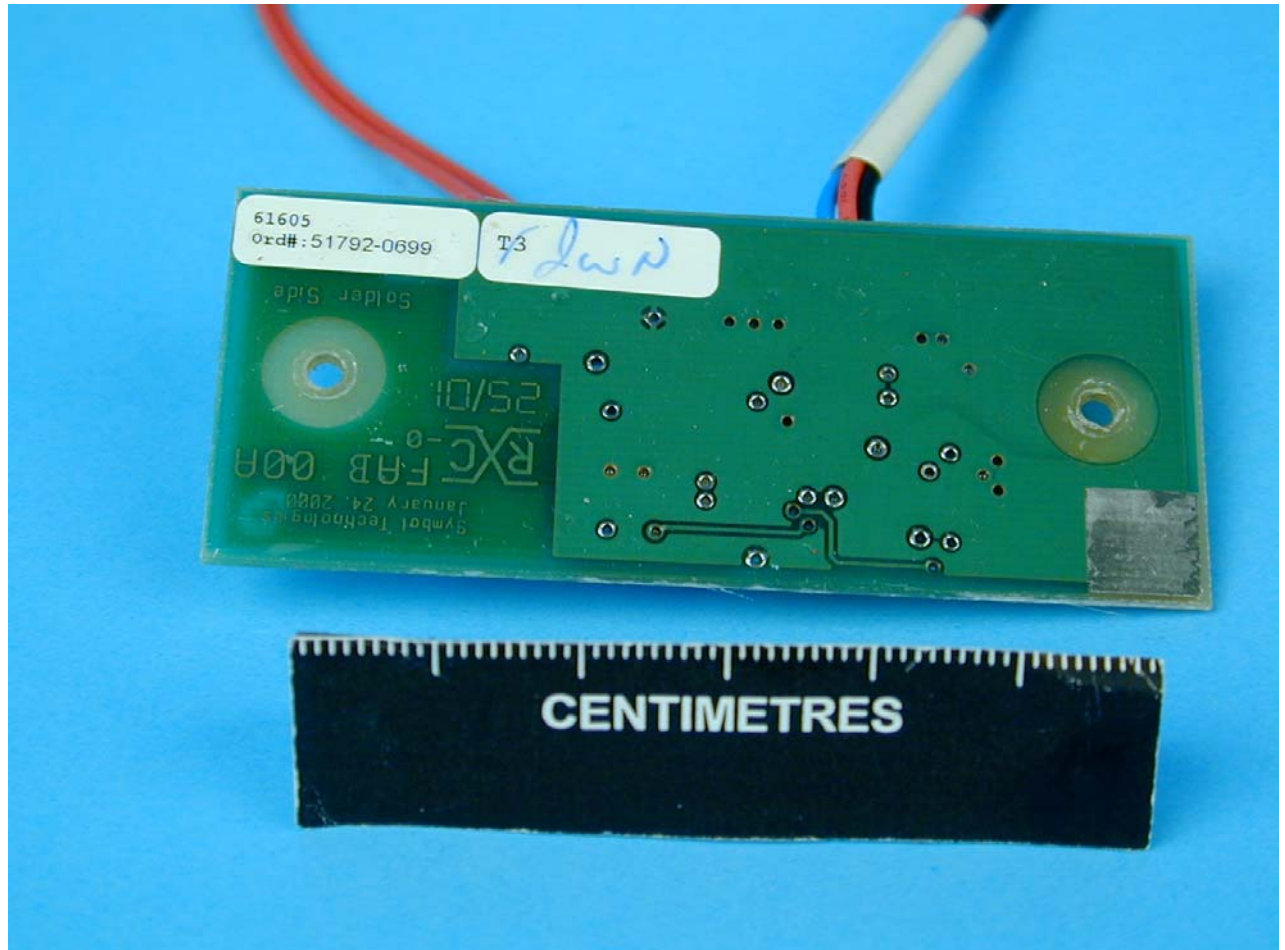
Photograph 10
Internal view

PHOTOGRAPHS OF EQUIPMENT



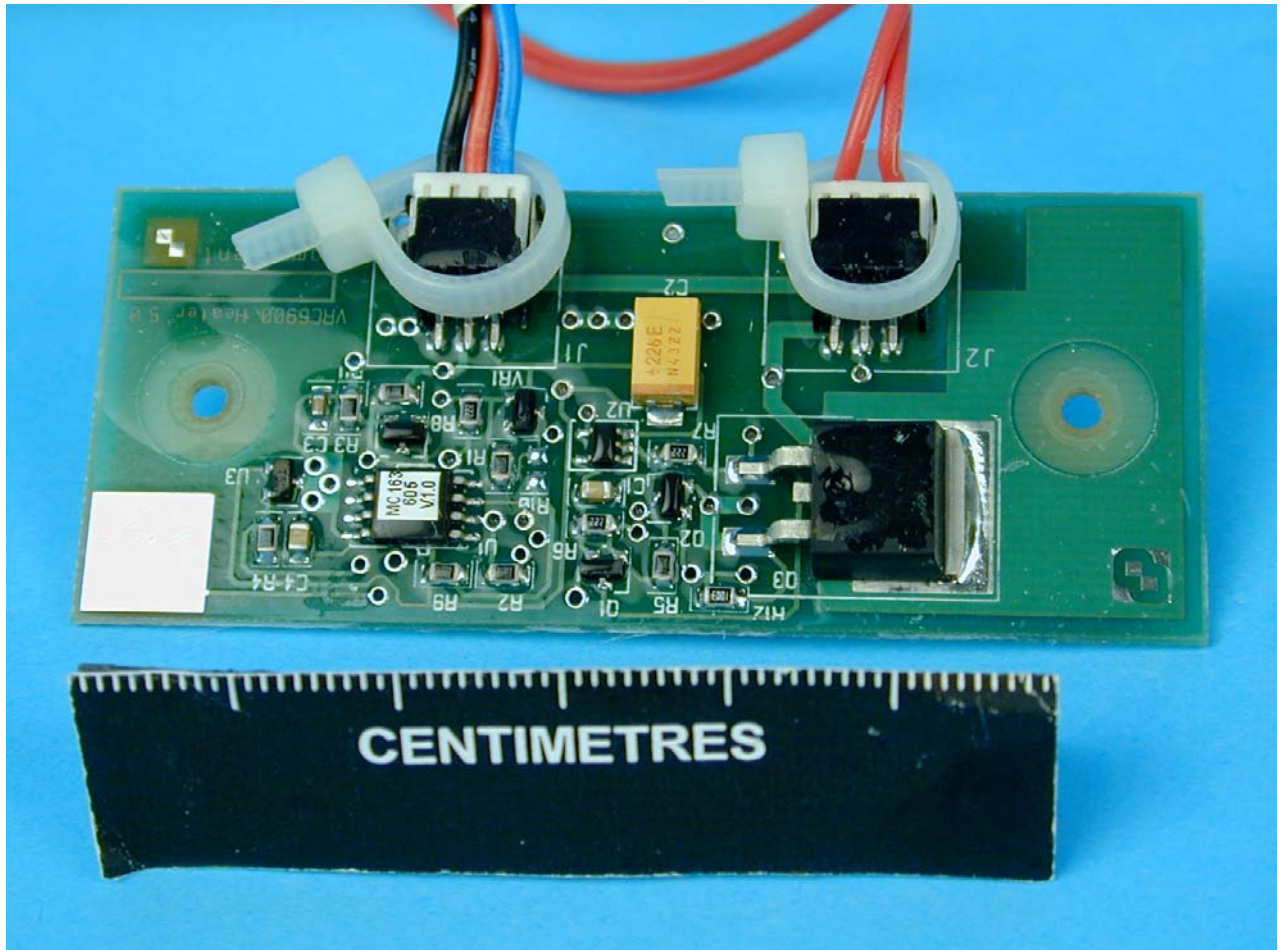
Photograph 11
Internal view

PHOTOGRAPHS OF EQUIPMENT



Photograph 12
Internal view

PHOTOGRAPHS OF EQUIPMENT



Photograph 13
Internal view

PHOTOGRAPHS OF EQUIPMENT



Photograph 14
Cisco Systems Inc 2.4GHz Wireless LAN Module Label view



MANUFACTURERS LABEL DRAWING

SYMBOL TECHNOLOGIES INC., HOLTSVILLE N.Y. 11742	
PN: VRC697C-XXXX- XX	MADE IN XXXXX
<div>BAR CODE</div>	XXXX
S/N: XXXXXXXXXXXX	
MFD: XXXXXXXXXXX,XXXX	
24-60V 1.3A LISTED ACCESSORY I.T.E.	9B97 N410

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES AND RSS-210 OF INDUSTRY CANADA. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION. THIS CLASS B DIGITAL APPARATUS COMPLIES WITH CANADIAN ICES-003. CET APPAREIL NUMÉRIQUE DE LA CLASSE B EST CONFORME À LA NORME NMB-003 DU CANADA

SEE QUICK REFERENCE GUIDE FOR PATENT INFORMATION
THIS DEVICE CONTAINS AN APPROVED RF MODULE
TYPE: LMC352
FCC ID: H9PVRC697C
CANADA: 1549D-VRC697C

0650

IF APPLICABLE
AFFIX COUNTRY
STAMP HERE

Not to Scale



FCC SITE COMPLIANCE LETTER

FEDERAL COMMUNICATIONS COMMISSION

**Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046**

October 18, 2002

Registration Number: 90987

**TUV Product Service Ltd
Segensworth Road
Titchfield
Fareham, Hampshire, PO15 5RH
United Kingdom
Attention: Kevan Adsetts**

**Re: Measurement facility located at Titchfield
Anechoic chamber (3 meters) and 3 & 10 meter OATS
Date of Listing: October 18, 2002**

Gentlemen:

Your request for registration of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC rules. The information has, therefore, been placed on file and the name of your organization added to the list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that the file must be updated for any changes made to the facility and the registration must be renewed at least every three years.

Measurement facilities that have indicated that they are available to the public to perform measurement services on a fee basis may be found on the FCC website www.fcc.gov under E-Filing, OET Equipment Authorization Electronic Filing, Test Firms.

Sincerely,

**Thomas W Phillips
Electronics Engineer**



MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems, are :-

In the frequency range 30MHz to 1000MHz

For Radiated Emissions, Quasi-Peak Measurements taken in Zero Span using the Hewlett Packard EMI Receiver:-

Frequency	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$
Amplitude	+4.45dB (30-200MHz; 3m Measurements) -4.42dB (30-200MHz; 3m Measurements) +4.80dB (200-1000MHz; 3m Measurements) -3.81dB (200-1000MHz; 3m Measurements)

In the frequency range 1GHz to 25GHz

For Radiated Emissions measurements:-

Frequency	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$
Amplitude	$\pm 3.0\text{dB}$ (1-25GHz; 3m Measurements)

For Effective Radiated Power (ERP) measurements:-

Amplitude	$\pm 1.45\text{dBm}$
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This report relates only to the actual item/items tested.

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Results of tests not yet included in our UKAS Accreditation Schedule are marked NUA
(Not UKAS Accredited).

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