
TEST REPORT

FCC Part 24 Testing in support of the Application for Grant of Equipment Authorisation
of the Symbol 4111-GPRS Hand Held Data Terminal
FCC ID: H9P4111GPRS

Report Number OR610741-3 Issue 2

July 2003

Equipment: Symbol 4111-GPRS Hand Held Data Terminal

FCC ID: H9P4111GPRS

Specification: 47 CFR 2 & 47 CFR 24

Prepared for: Symbol Technologies Inc
One Symbol Plaza
Holtsville
NY 11742-1300
New York
United States of America

Manufacturer's Representative: Mr Marco Belli

Approved by:


C GOULD
UKAS EMC Signatory

Dated: 31-07-03

Start of Test: 10th June 2003

Completion of Test: 13th June 2003

Report Distribution: Symbol Technologies Inc Mr M Belli Copy No. 1
BABT Copy No's. 2 & 3
Copy No:

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the applicable limits. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 2, and Part 24 of the FCC Rules under normal use and maintenance.


A Guy
Test Engineer


R Henley
Test Engineer





Table of Contents	Page No
STATUS.....	3
INTRODUCTION	4
LOCATION OF TESTING.....	4
TEST EQUIPMENT AND ANCILLIARIES USED FOR TEST	4
DESCRIPTION OF EQUIPMENT UNDER TEST	6
RADIATED OUTPUT POWER	7
RADIATED EMISSIONS	8
TEST SETUP PHOTOGRAPH	11
PHOTOGRAPHS OF EQUIPMENT	12
MANUFACTURERS LABEL DIAGRAM.....	28
SYSTEM MEASUREMENT UNCERTAINTY.....	29
COPYRIGHT STATEMENT	30
FCC SITE COMPLIANCE LETTER.....	ANNEX A

**STATUS**

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	Hand Held Data Terminal
APPLICANT	Symbol Technologies Inc One Symbol Plaza Holtsville NY 11742-1300 New York United States of America
TYPE NUMBER	4111-GPRS
MANUFACTURERS MODEL NUMBER	4111-GPRS1
SERIAL NUMBER	ALP67837 (IMEI: 350030951706681)
HARDWARE VERSION	Rev 2
TEST SPECIFICATION NUMBER	FCC Part 24
REGISTRATION NUMBER	OR610741/05
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR610741
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	12 th June 2003 13 th June 2003
TEST ENGINEERS	A Guy R Henley
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. Public Notice DA 00-705, March 2000



INTRODUCTION

This report is Issue 2 and has been produced to cover a change in the Manufacturers Declared Power Level; this report supersedes the previous report OR610741-3.

The information contained within this report is intended to show verification of compliance of the Symbol Technologies Inc 4111-GPRS Hand Held Data Terminal to the requirements of FCC Specification Part 24.

4111-GPRS1 – FCC ID H9P4111GPRS

The unit supplied for testing was a 4111-GPRS hand held data terminal, which offers Tri Band GSM/GPRS, 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.

The terminal utilizes the Motorola G18 GSM/GPRS module to offer GSM GPRS data connectivity. Also included in the terminal is the approved LA-4137 Symbol Compact Flash 802.11b RLAN radio card and the 21-58466 Symbol Bluetooth module. FCC ID numbers are detailed below:

<u>Type:</u>	<u>Description</u>	<u>Approval</u>	<u>FCC ID</u>	<u>Date</u>
G18	Motorola GSM/GPRS module,	FCC Part 24	IHDT6AC1	8/01/2000.
LA4137	Symbol Compact Flash RLAN Radio	FCC Part15	H9PLA4137	21/03/2000
21-58466	Symbol Bluetooth Module	FCC Part15	H9PSNAPPER	10/11/2002

This report details testing carried out in accordance with:

- FCC: Part 24.238, Radiated Emissions
- FCC: Part 24.232, Maximum Peak Output Power

LOCATION OF TESTING

BABT Engineers, Anthony Guy and Ryan Henley, conducted all testing at the premises BABT, Segensworth Road, Fareham, Hampshire, PO15 5RH. Radiated Emissions measurements were performed in a 3 metre Anechoic Chamber. A complete site description is on file with the FCC Laboratory Division, Registration Number: 90987. See Annex A.

TEST EQUIPMENT AND ANCILLARIES USED FOR TEST

Instrument	Manufacturer	Type No	EMC No	Cal to
Screened Enclosure	Siemens	EAC 54300	2533	TU
Turntable & Controller	HD GmbH	HD 050	2528	TU
Antenna Mast	Emco	1051	2182	TU
Antenna Mast Controller	Emco	1050	2090	TU
Test Receiver	Hewlett Packard	8542E	2286	13 Dec 03
Bilog Antenna	Chase	CBL 6143	2860	11 Apr 04
Test Receiver	Rhode and Schwarz	ESIB 40	2917	04 Feb 04
Horn (1 - 18GHz)	EMCO	3115	2397	29 Jun 03
Horn (18GHz - 40GHz)	Advanced Microtek	AM180HA-K-TU2	2945	20 May 04
Signal Generator	Hewlett Packard	8672A	411	26 Feb 04
Low Noise Amplifier (1 - 8GHz)	Miteq	AMF-3D-001080-18-13P	2457	TU
Low Noise Amplifier (8 - 18GHz)	Avantek	AWT 18036	1081	TU
Low Noise Amplifier (18 - 26GHz)	Avantek	AMT-26177-33	2072	TU
Low Noise Amplifier (18 - 40GHz)	Narda	DB02-0447	2936	23 Apr 04
3GHz High Pass Filter	RLC Electronics	F-100-3000-5-R	INV 04467	TU
Barometer	diplex	-	1938	TU
Hygrometer	Rotronic	A1	INV4066	28 Nov 03
Spectrum Analyser	Rohde and Schwarz	FSEM	INV4034	16 Dec 03
Signal Generator	Hewlett Packard	ESG 4000A	INV3709	21 Jan 04
DRG Antenna	EMCO	3115	INV3549	29 Jun 03
Substitution DRG Antenna	EMCO	3115	INV3777	20 Jan 04
Log Periodic Antenna	Rohde and Schwarz	HUF-Z3	INV2207	06 July 03
Log Periodic Antenna	Rohde and Schwarz	-	2328	17 May 04
Cable	Reynolds Industries	269-0088-3000	CS0565	TU
Cable	Rosenberger	FA210B-1-070M	CS0567	TU

Table 1

**TEST EQUIPMENT AND ANCILLARIES USED FOR TEST** (Continued)**Note(s)**

- 1) All items are calibrated annually except where labelled T/U (Traceability Unscheduled). These items are calibrated within the test configurations using calibrated equipment.

INSTRUMENTATION USED FOR EXERCISING THE EUT

Instrument	Manufacturer	Type No	INV No
GSM Test Set	Hewlett Packard	8922M	3803
GSM Test Set	Rohde and Schwarz	CMU200	4858

Table 2

**DESCRIPTION OF EQUIPMENT UNDER TEST**

The Symbol 4111-GPRS is a hand held data terminal, which offers Tri Band GSM/GPRS, 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity.

The equipment under test is made up of the following component parts.

Module	Vendor	Type Number	Serial Number
Hand Held Data Terminal	Symbol Technologies Inc	4111-GPRS	ALP67838

Table 3

LIST OF PERFORMED MEASUREMENTS USING THE CONFIGURATION IN TABLE 3

- i) Power Output
- ii) Radiated Emissions



Test Case Radiated Output Power
 Test Date 12th June 2003
 Rule Parts 24.232

TEST PROCEDURE

Testing to the requirements of FCC Part 24, Section 24.232, Power and Antenna Height Limits, was carried out on the Measurement Test Facility detailed in Annex A.

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 512: 1850.2MHz
 Channel 661: 1880.0MHz
 Channel 810: 1909.6MHz

TEST RESULTS

The EUT met the requirements of FCC Part 24, Section 24.232, Power and Antenna Height Limits, 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)
1850.2	-8.06	22.4	4.61	6.47	24.26	266.7
1880.0	-9.35	21.8	4.61	6.42	23.61	229.6
1909.6	-10.75	20.6	4.61	6.36	22.35	171.8

Table of Results for Radiated Output Power

Performed by: Ryan Henley, Radio Engineer.

Signature:

Ryan Henley

Date: 10th June 2003



Test Case	Radiated Emissions
Test Date	12 th June 2003
Rule Parts	24.238

SYSTEM CONFIGURATION DURING EMC TESTING

The Symbol 4111-GPRS with GSM/GPRS Radio Module was powered by its own internal battery.

A communication link was established between the EUT and a Digital Radiocommunications Test Set.

TEST PROCEDURE

Testing to the requirements of FCC Part 24, Section 24.238, Emission Limits, was carried out on the Measurement Test Facility detailed in Annex A.

In order to determine the Radiated Emission Limits, measurements of transmitter power (P) were first carried out on the top, middle and bottom channels using a peak detector, and the results are shown in the following table.

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. 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 20GHz. The list of worst-case emissions was then confirmed or updated using the FCC listed semi-anechoic chamber. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth. Emissions levels were then formally measured using a peak detector. The details of the worst-case emissions were then recorded and are presented in the following tables.

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

All measurements made at 3m.



Test Case Radiated Emissions (continued)
 Test Date 12th June 2003
 Rule Parts 24.238

TEST RESULTS

The measurements of transmitter power, (P), on top, middle and bottom channels are detailed in Table 4 below.

Freq MHz	Res BW Hz	Vid BW Hz	Ant Pol V/H	Ant Hgt cm	EUT Azi Deg	Raw PEAK dBμV	Cable loss / Amp gain dB	Antenna Factor dB	Result Peak dBμV/m
Tx Channel 512									
1850.000	1M	1M	V	107	77	92.5	2.0	28.3	122.8
1850.400	1M	1M	H	100	180	98.5	2.0	28.3	128.8
Tx Channel 661									
1880.000	1M	1M	V	135	80	92.3	2.0	28.2	122.5
1880.000	1M	1M	H	124	183	97.0	2.0	28.2	127.2
Tx Channel 810									
1909.600	1M	1M	V	129	80	92.3	2.1	28.2	122.6
1909.570	1M	1M	H	124	193	95.9	2.1	28.2	126.2

Table of Results for Transmitter Power

The limit for spurious emissions in accordance with FCC 47CFR 24.238 is $43 + 10\log(P)$ down on the carrier where P is the power in Watts.

As the manufacturer's declared power is 270mW the spurious limit is $43 + 10\log(0.27) = 37.3\text{dB}$ down on the carrier.

Using the results obtained on the two channels the following limits were calculated:

Bottom channel 512: $128.8\text{dB}\mu\text{V/m} - 37.3\text{dB} = 91.5\text{dB}\mu\text{V/m}$

Middle channel 661: $127.2\text{dB}\mu\text{V/m} - 37.3\text{dB} = 89.9\text{dB}\mu\text{V/m}$

Top channel 810: $126.2\text{dB}\mu\text{V/m} - 37.3\text{dB} = 88.9\text{dB}\mu\text{V/m}$

These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following tables.



Test Case Radiated Emissions (continued)

Test Date 12th June 2003

Rule Parts 24.238

Tx Channel 512

Freq GHz	Res BW Hz	Vid BW Hz	Ant Pol V/H	Ant Hgt cm	EUT Azi Deg	Raw PEAK dBµV	Cable loss / Amp gain dB	Antenna Factor dB	Result Peak dBµV/m	Pass / Fail
5.5500	1M	3M	H	100	227	41.4	27.4	35.0	49.0	Pass
11.1010	1M	3M	H	139	158	47.4	29.2	38.7	56.9	Pass

Table of Results for Radiated Emissions

Tx Channel 661

Freq GHz	Res BW Hz	Vid BW Hz	Ant Pol V/H	Ant Hgt cm	EUT Azi Deg	Raw PEAK dBµV	Cable loss / Amp gain dB	Antenna Factor dB	Result Peak dBµV/m	Pass / Fail
5.640	1M	3M	H	106	203	41.6	26.5	35.2	50.3	Pass

Table of Results for Radiated Emissions

Tx Channel 810

Freq GHz	Res BW Hz	Vid BW Hz	Ant Pol V/H	Ant Hgt cm	EUT Azi Deg	Raw PEAK dBµV	Cable loss / Amp gain dB	Antenna Factor dB	Result Peak dBµV/m	Pass / Fail
5.729	1M	3M	H	100	48	42.5	26.8	35.2	50.9	Pass
11.458	1M	3M	V	100	182	49.6	28.0	39.1	60.7	Pass

Table of Results for Radiated Emissions

ABBREVIATIONS FOR ABOVE TABLE

ERP Effective Radiated Power
H Horizontal Polarisation

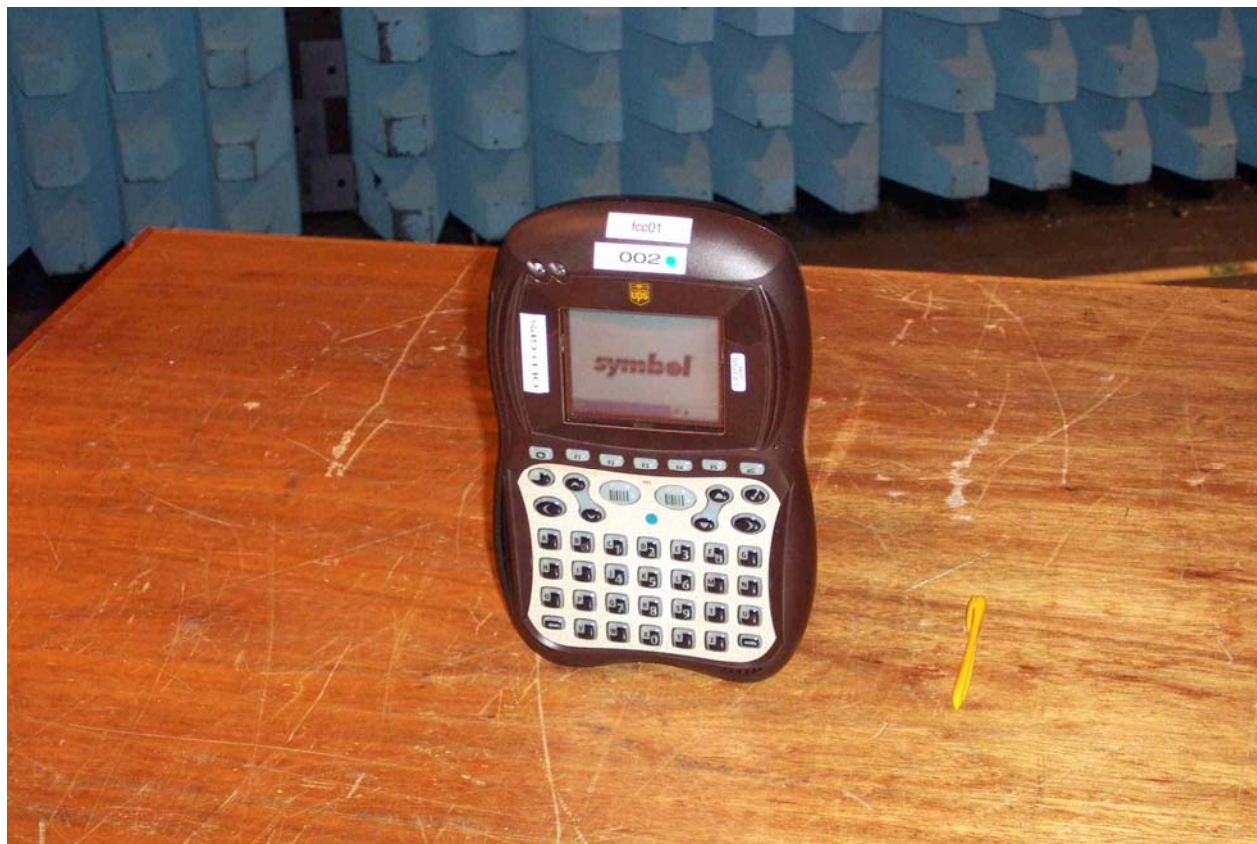
V Vertical Polarisation

Procedure Test Performed in accordance with ANSI C63.4.



TEST SETUP PHOTOGRAPH

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



Photograph 1
Radiated Emissions Set Up



PHOTOGRAPHS OF THE SYMBOL 4111-GPRS



PHOTOGRAPHS OF EQUIPMENT



Photograph 2
4111-GPRS Front view



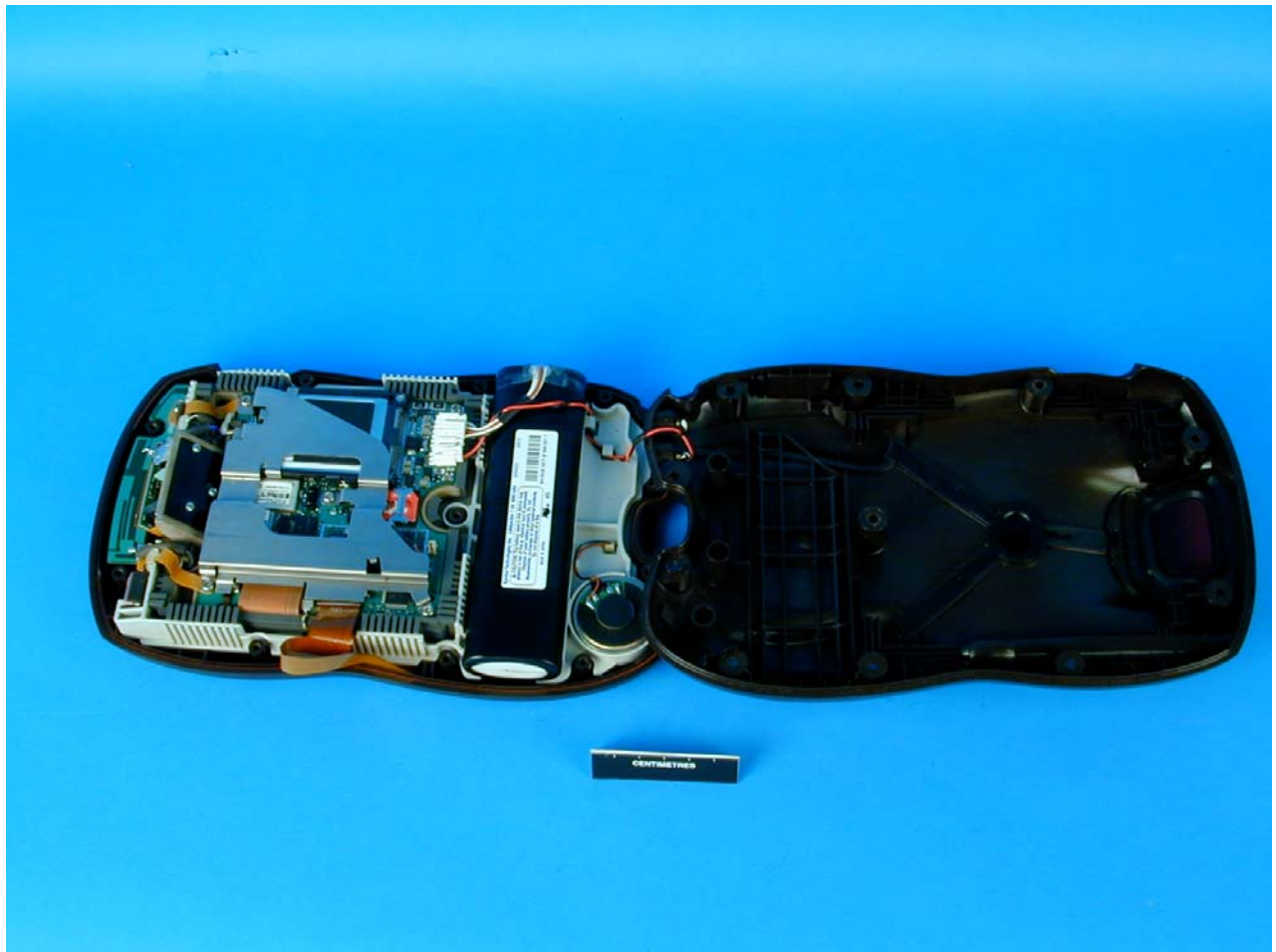
PHOTOGRAPHS OF EQUIPMENT



Photograph 3
4111-GPRS Rear View



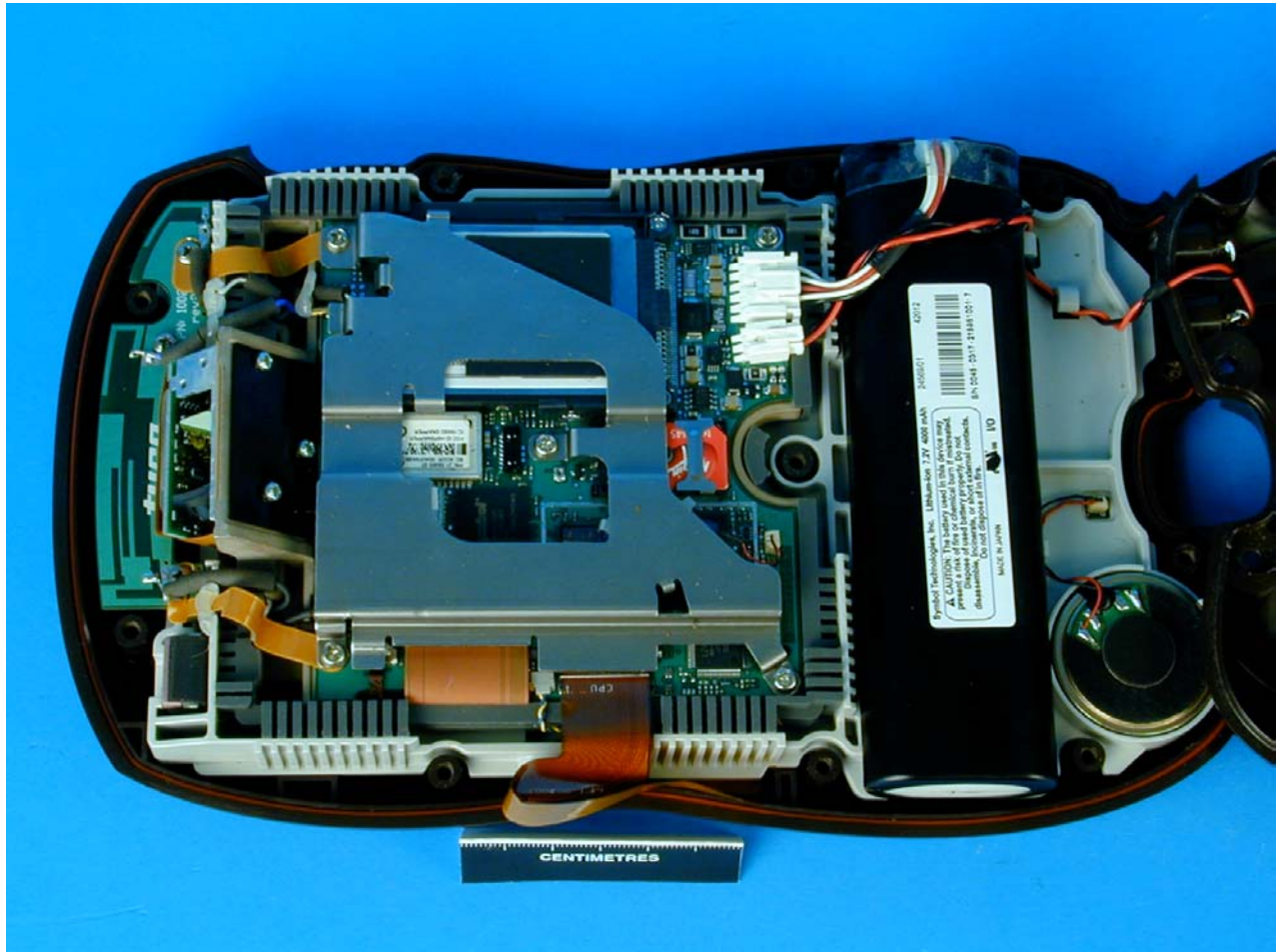
PHOTOGRAPHS OF EQUIPMENT



Photograph 4
4111-GPRS Internal view



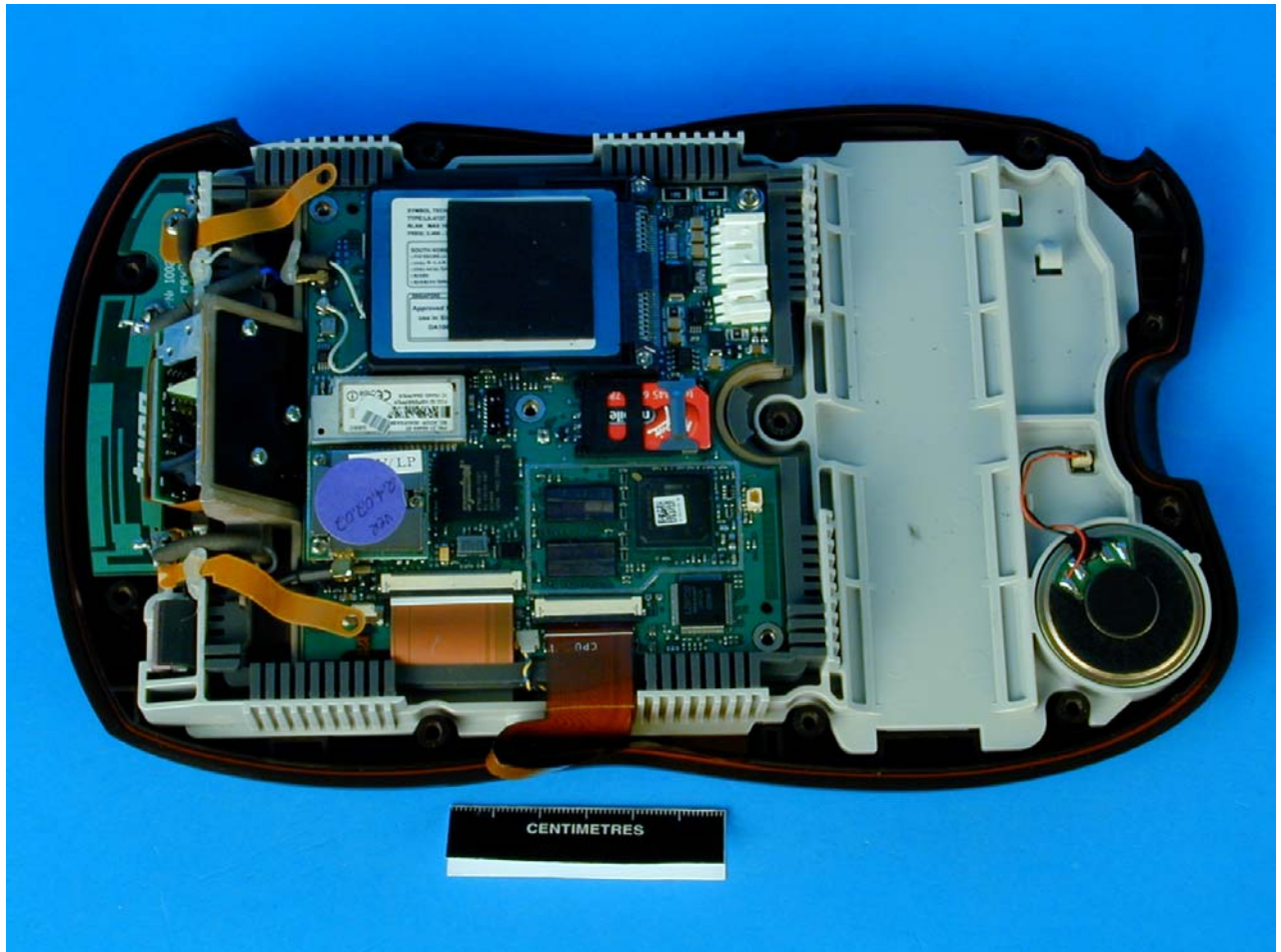
PHOTOGRAPHS OF EQUIPMENT



Photograph 5
4111 GPRS Internal view



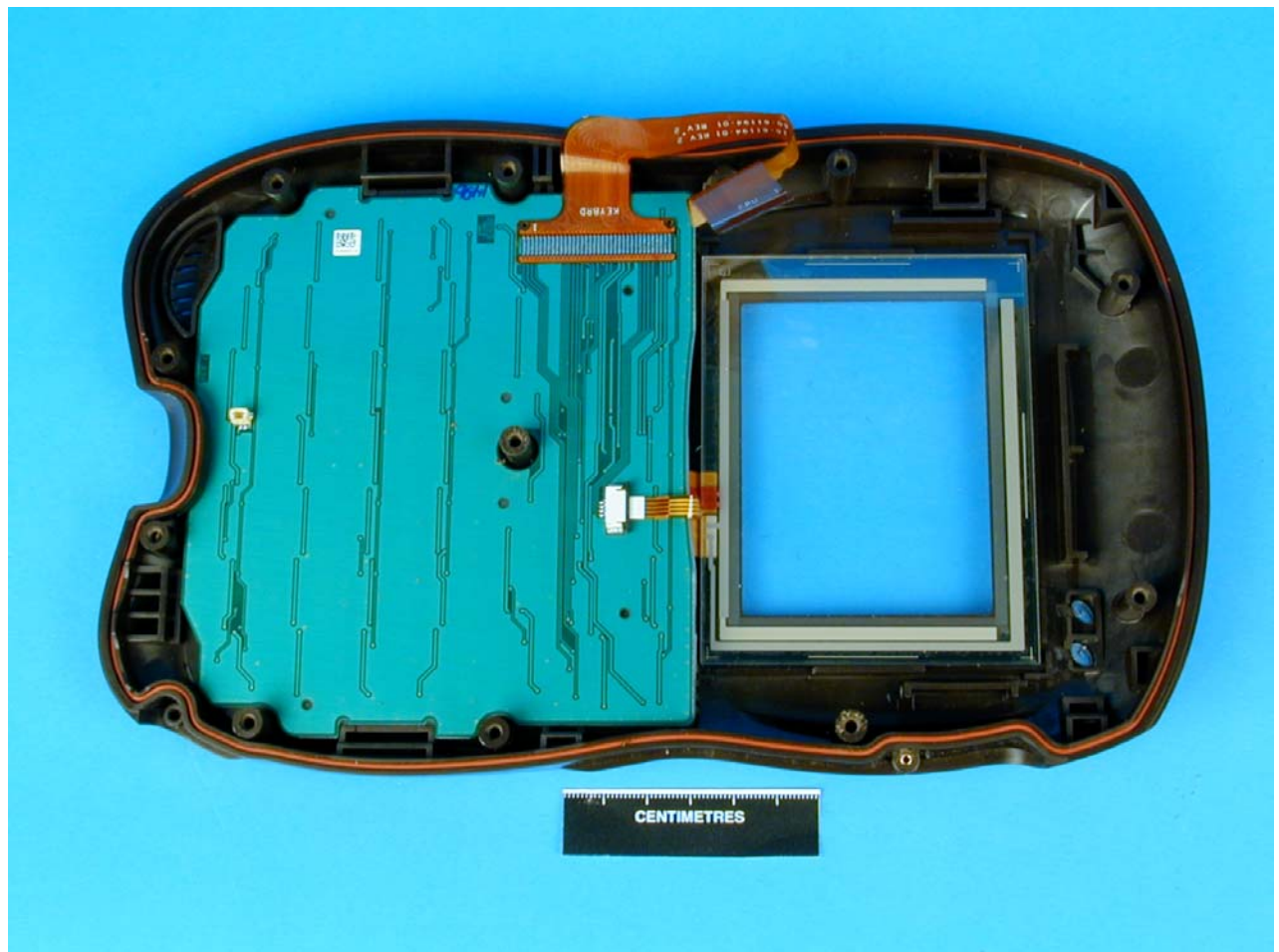
PHOTOGRAPHS OF EQUIPMENT



Photograph 6
4111-GPRS Internal View



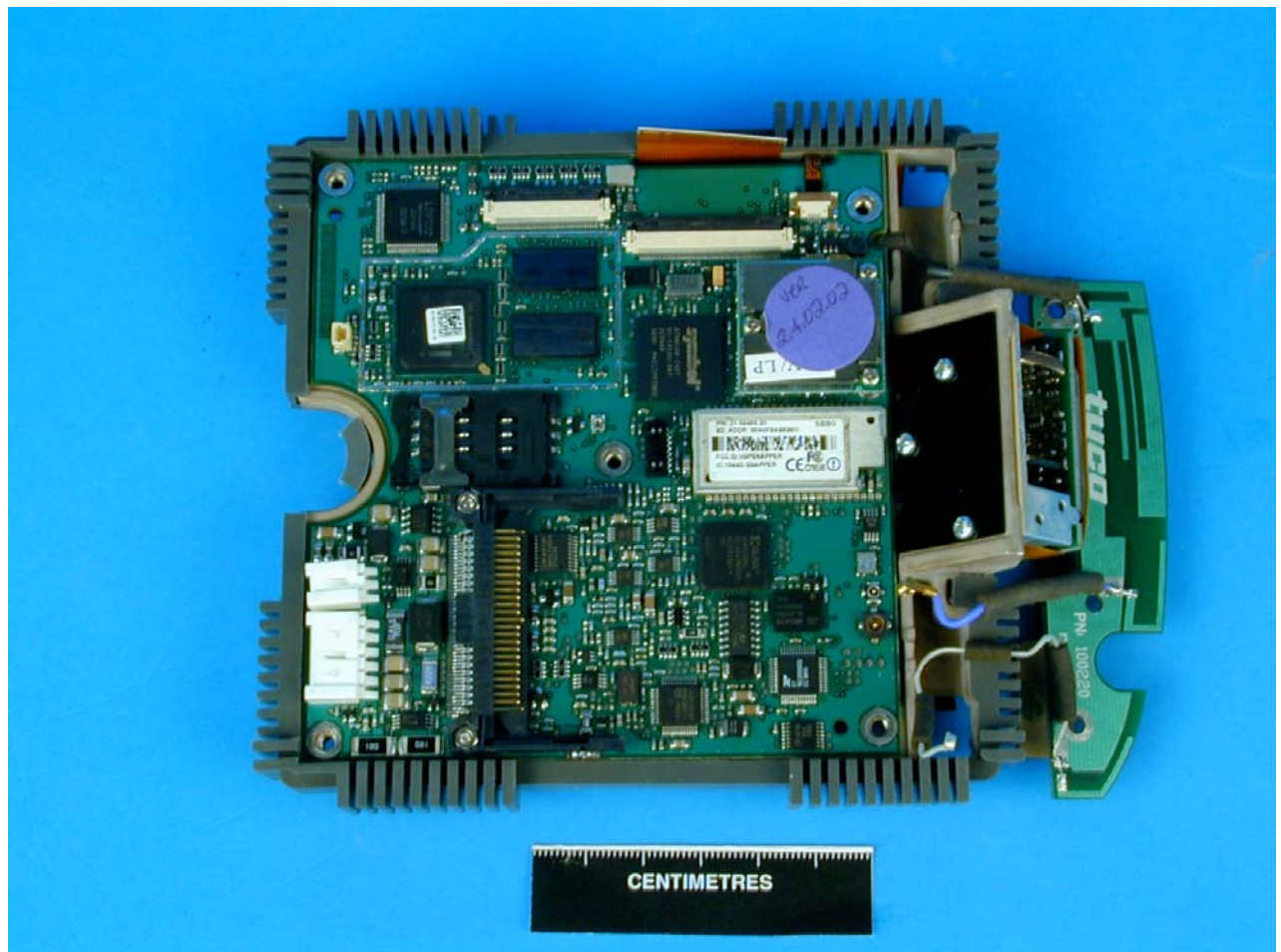
PHOTOGRAPHS OF EQUIPMENT



Photograph 7
4111-GPRS Internal view



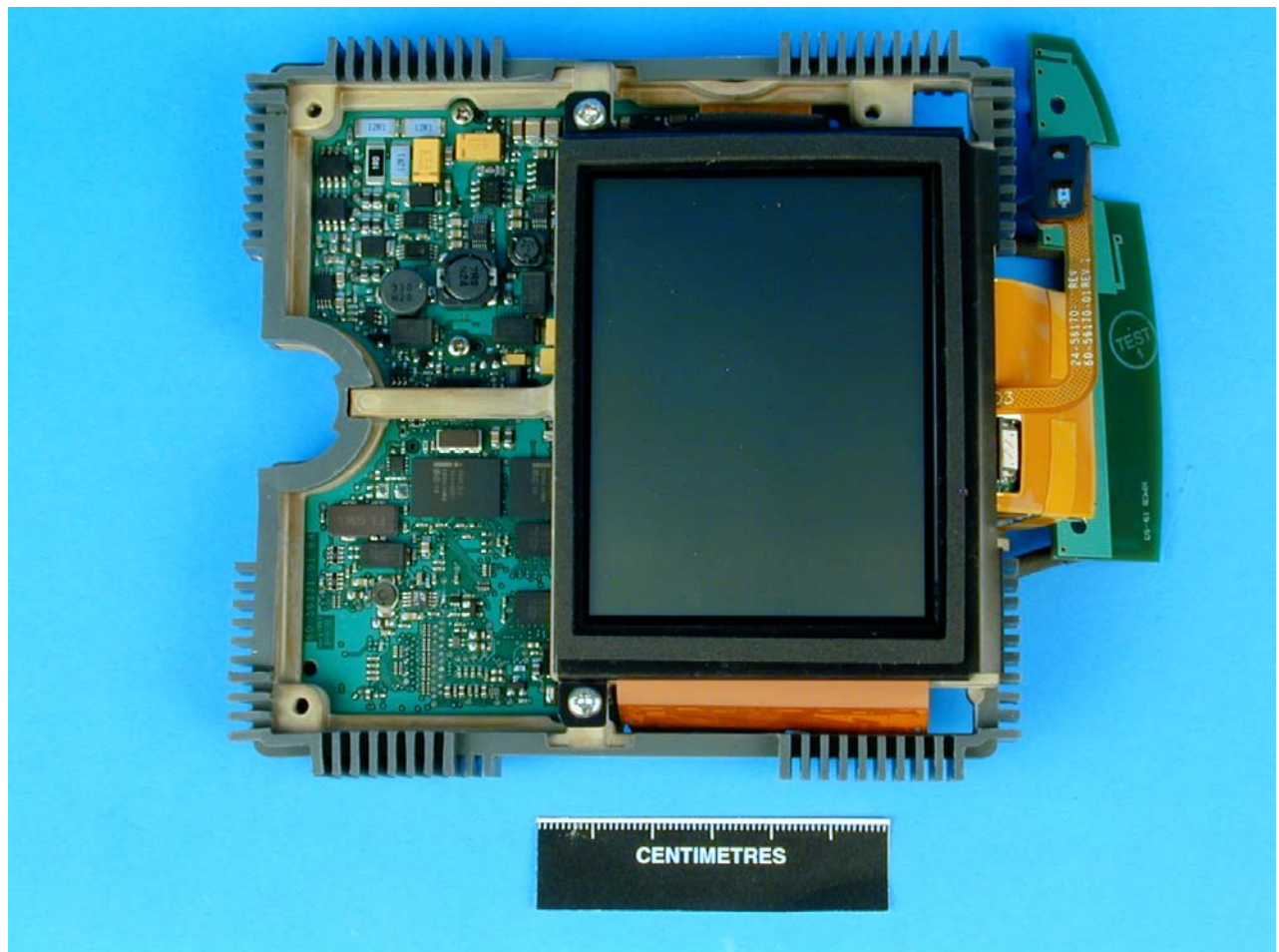
PHOTOGRAPHS OF EQUIPMENT



Photograph 8
4111-GPRS Internal View



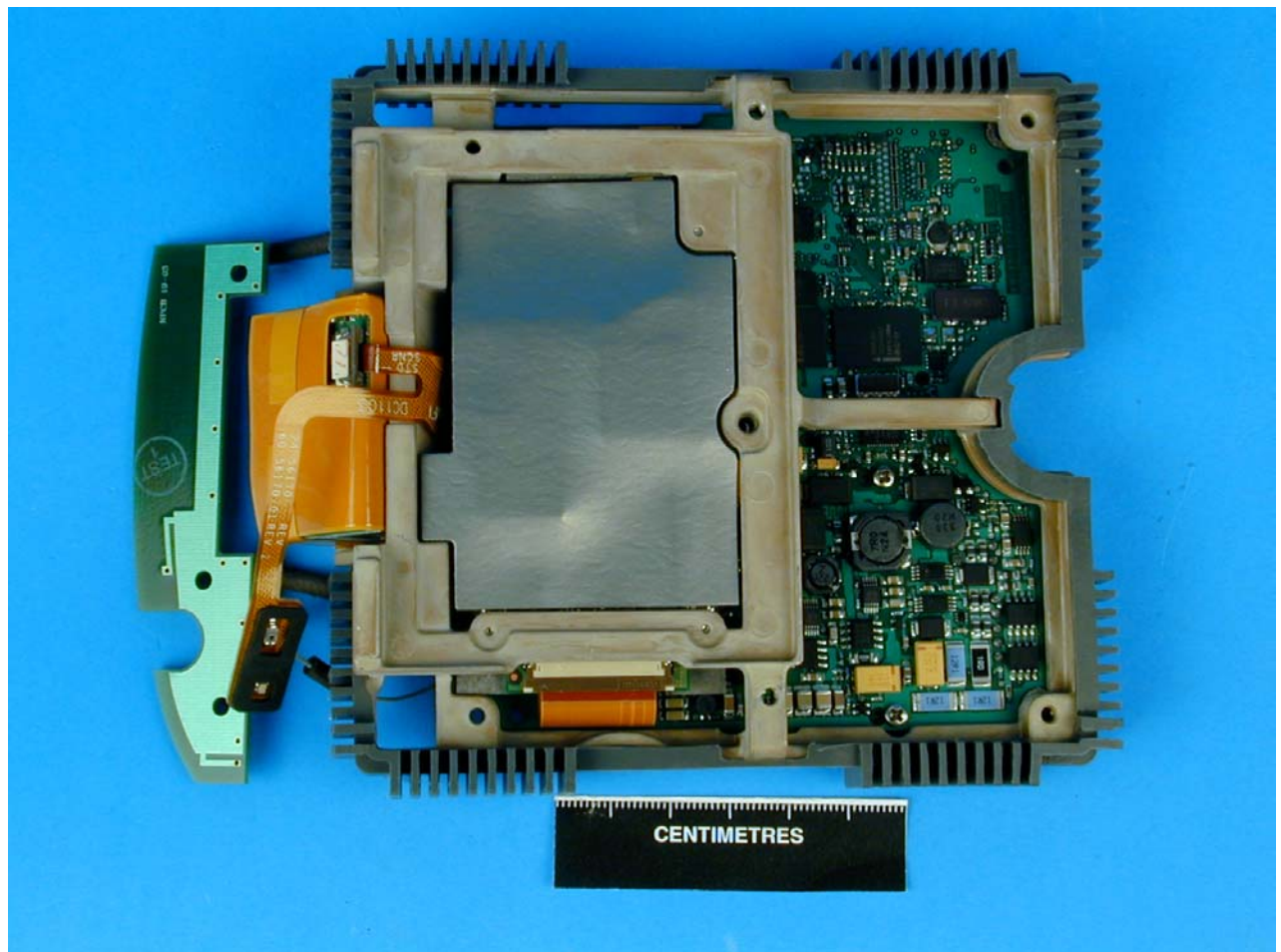
PHOTOGRAPHS OF EQUIPMENT



Photograph 9
4111-GPRS Internal View



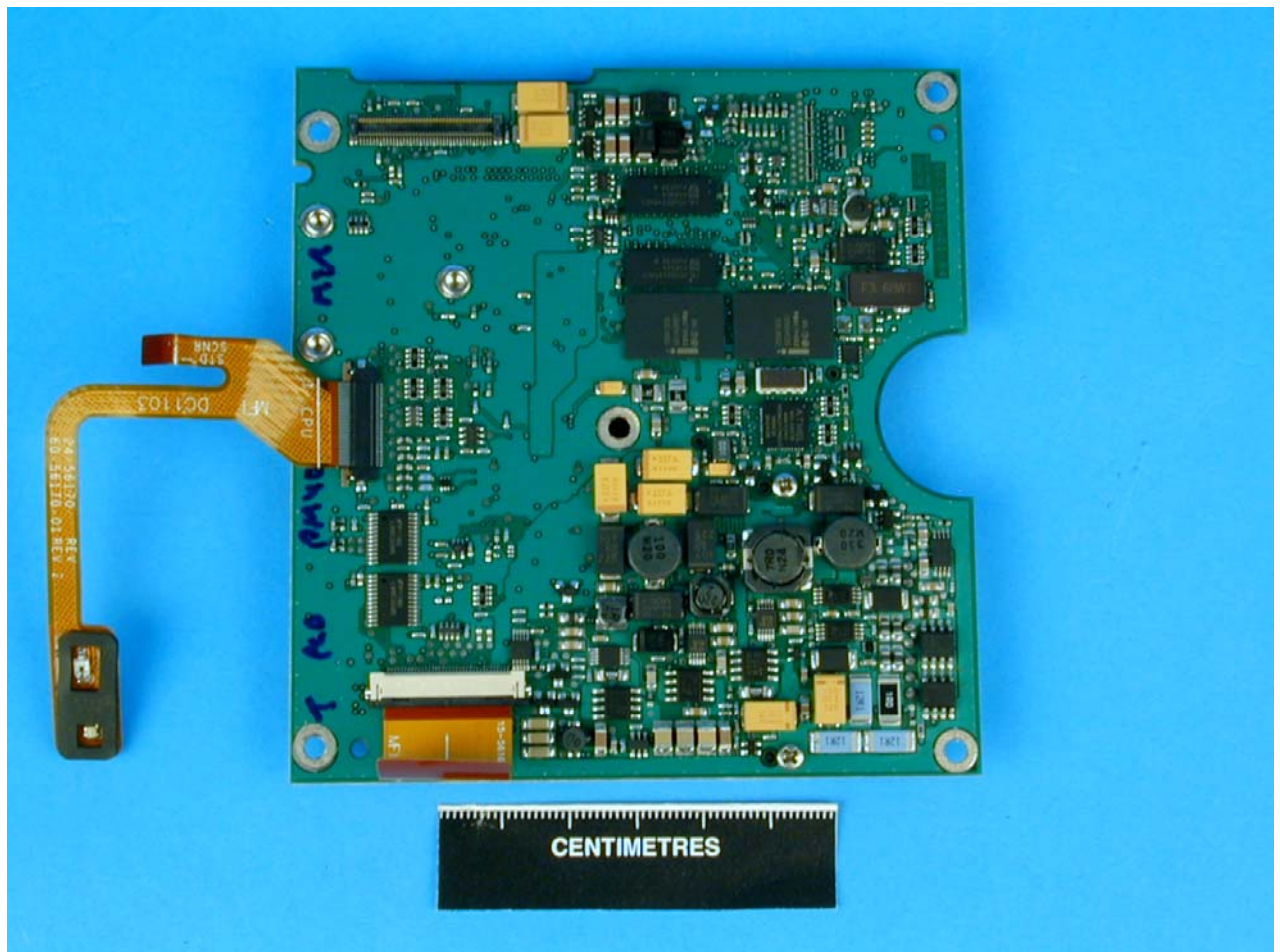
PHOTOGRAPHS OF EQUIPMENT



Photograph 10
4111-GPRS Internal View



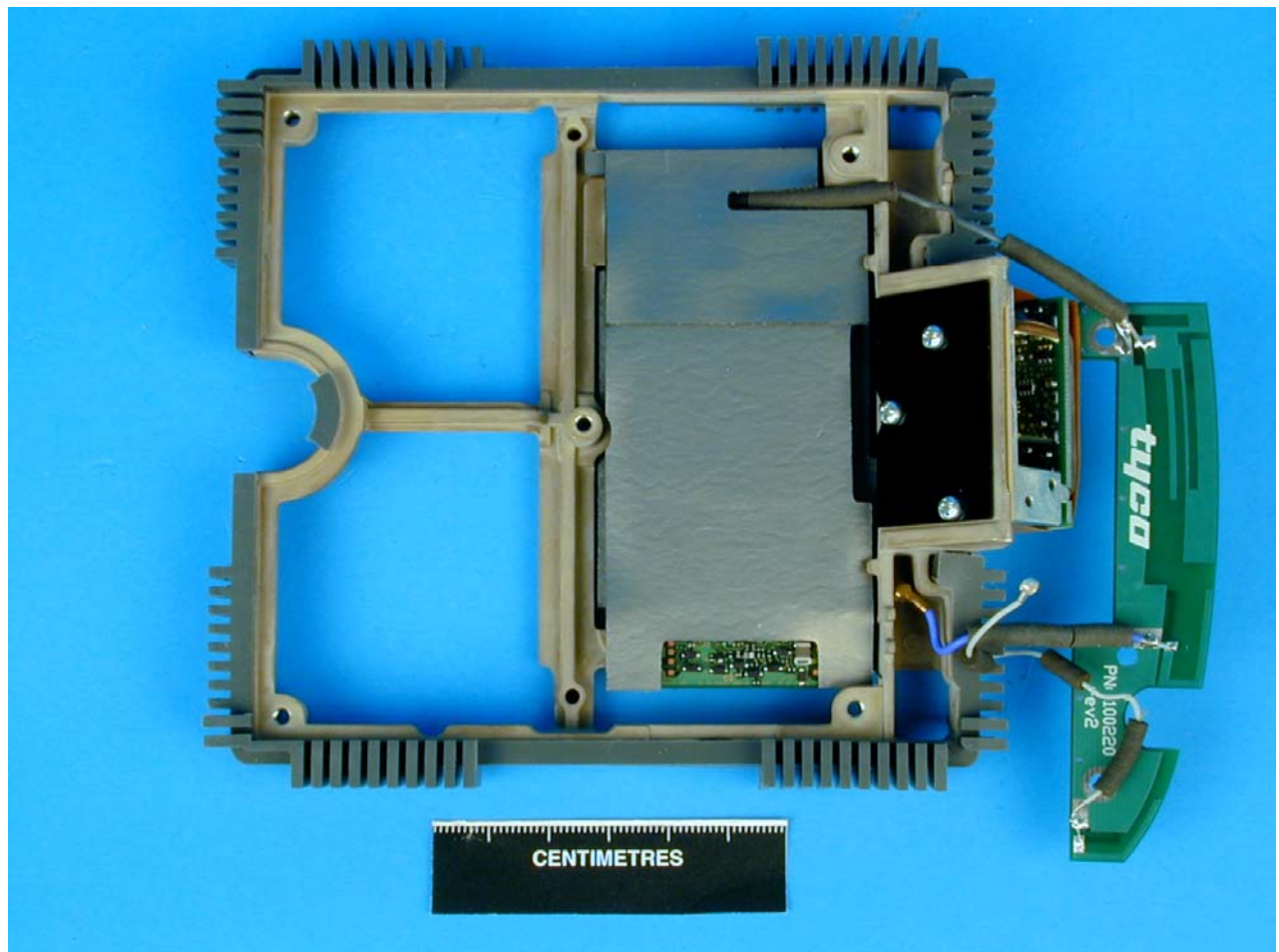
PHOTOGRAPHS OF EQUIPMENT



Photograph 11
4111-GPRS Internal View



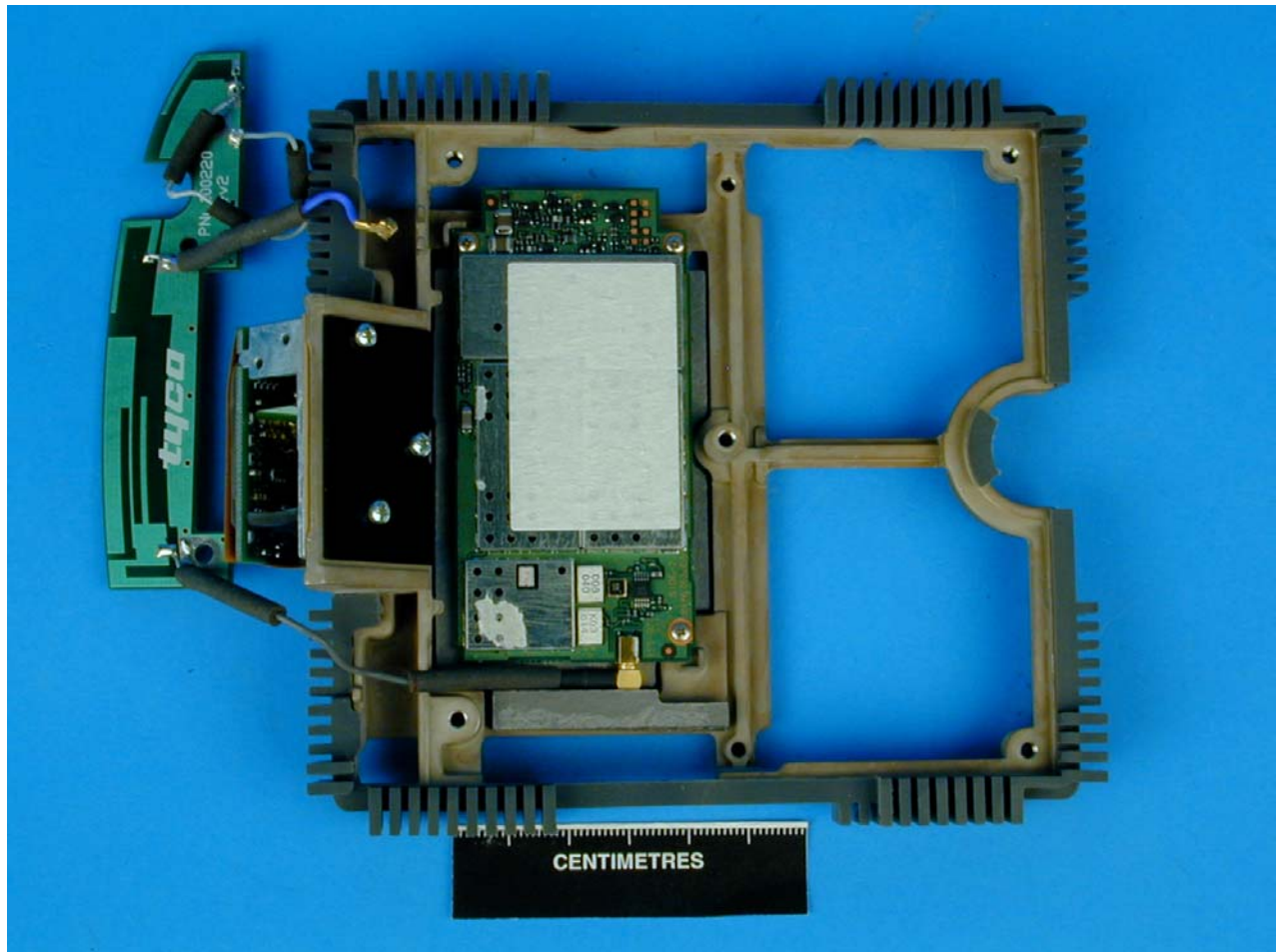
PHOTOGRAPHS OF EQUIPMENT



Photograph 12
4111-GPRS Internal view



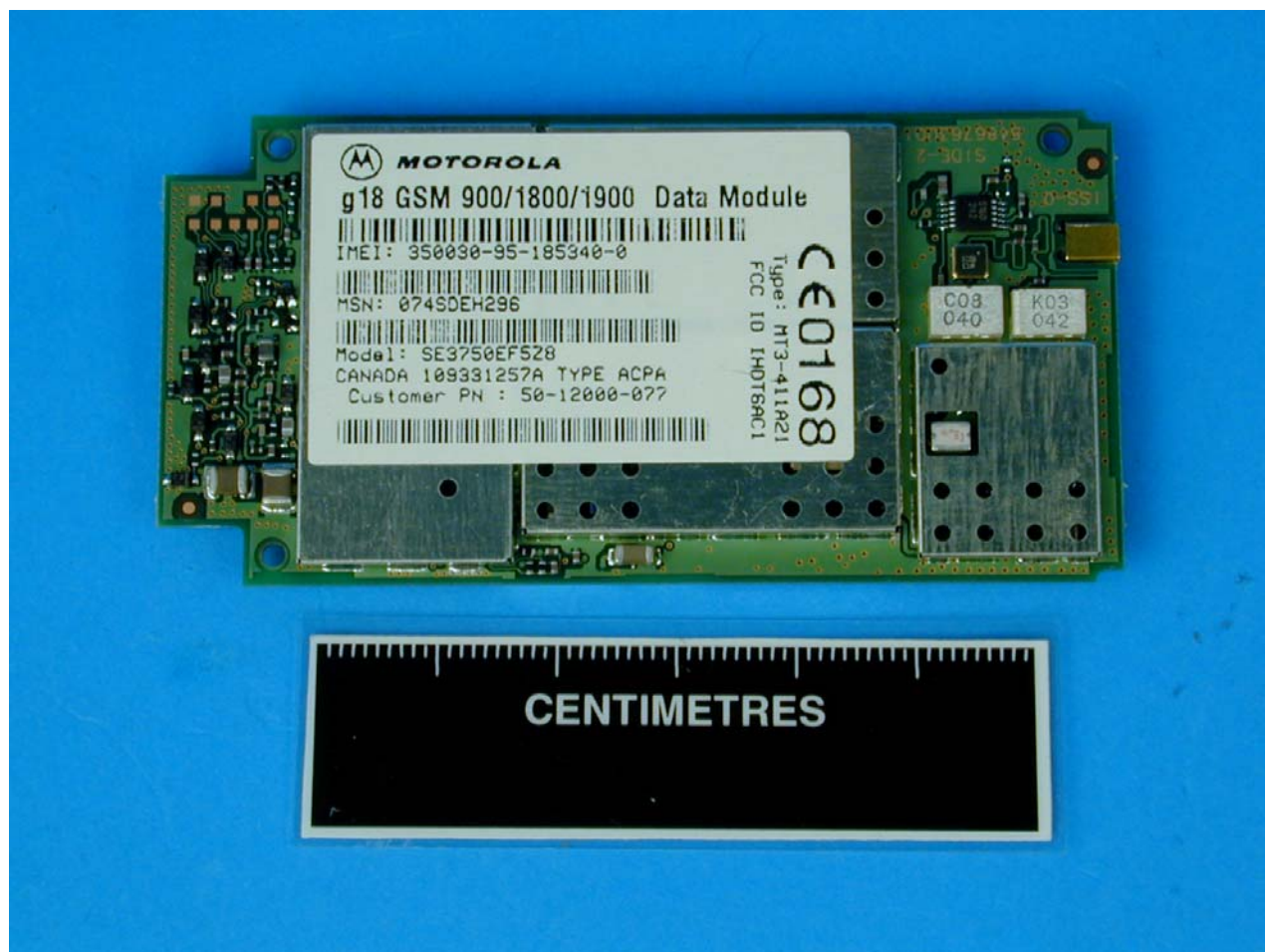
PHOTOGRAPHS OF EQUIPMENT



Photograph 13
4111-GPRS Internal view



PHOTOGRAPHS OF EQUIPMENT



Photograph 14
4111-GPRS Front view of G18 GSM/GPRS Module



PHOTOGRAPHS OF EQUIPMENT



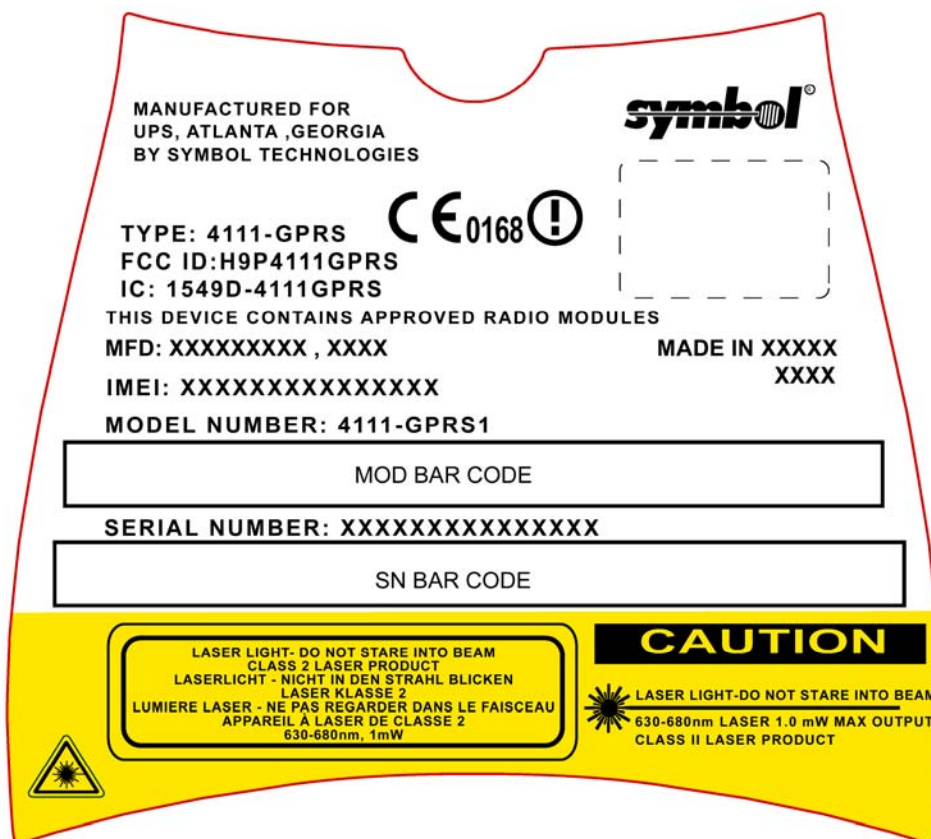
Photograph 15
4111-GPRS View of LA-4137 RLAN Card



PHOTOGRAPHS OF EQUIPMENT



Photograph 16
4111-GPRS Front View Symbol 21-58466 Bluetooth Module

**MANUFACTURERS LABEL DIAGRAM**4111-GPRS1 Label View

**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	$\pm 3.4\text{dB}$

For Effective Radiated Power (ERP) measurements: -

Amplitude	$\pm 1.45\text{dBm}$
-----------	----------------------



This report relates only to the actual item/items tested.

UKAS Accreditations do not cover opinions and interpretations and any expressed herein are outside the scope of any UKAS Accreditation.

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

This report must not be reproduced without the written permission of TUV Product Service Limited

© 2003 TUV Product Service Limited



Annex A

FCC Measurement Facility Compliance Letter

(Comprising of 1 page)



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