
REPORT ON

FCC Part 15 Testing of a WWC107C Wearable Wrist Computer
FCC ID: H9PWWC107C

Report No OR610739/2 Issue 2

February 2003



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Computer

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PREPARED FOR

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DATED

26 February 2003

DISTRIBUTION

Symbol Technologies

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Note: This report is re-issued to correct a typographical error on page 7

Total No of Pages 25



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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	Wearable Wrist Computer
APPLICANT	Symbol Technologies Inc One Symbol Plaza Holtsville
MANUFACTURERS MODEL NUMBER	WWC107C
SERIAL NUMBER	MXA16552
TEST SPECIFICATION NUMBER	FCC Part 15 Subpart C
REGISTRATION NUMBER	OR610739
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR610739
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
ORDER NUMBER DATE	EMEA 12600 29 January 2003
START OF TEST FINISH OF TEST	10 February 2003 13 February 2003
TEST ENGINEERS	A R Hubbard A Blagg
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 incorporates a PCMCIA radio card Model AIR-LMC352, manufactured by Cisco Systems Inc. FCC ID: LDK102040.

Testing was carried out in accordance with the customer's requirements.

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



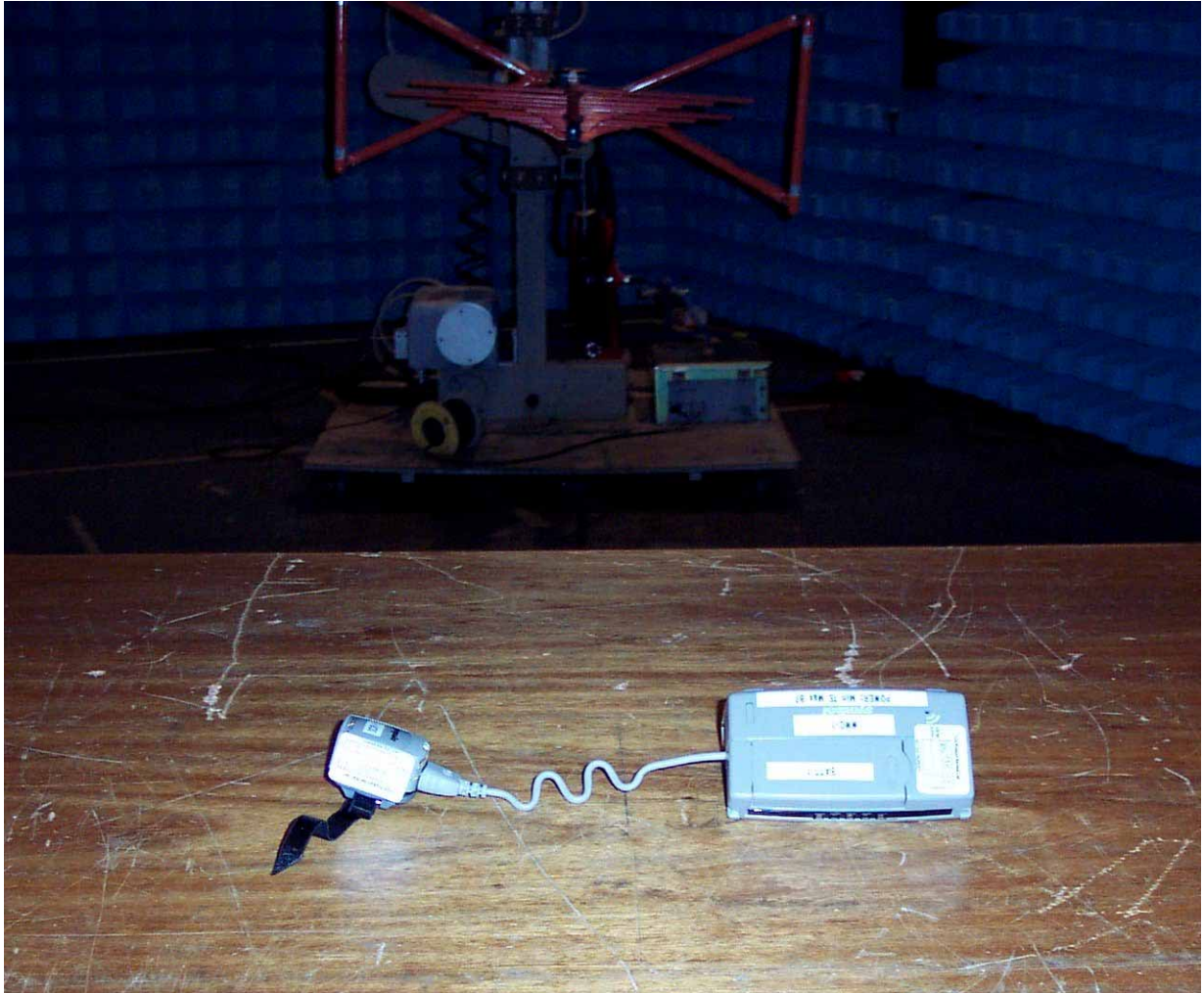
SYSTEM CONFIGURATION DURING EMC TESTING

The WWC107C was set-up simulating a typical user installation on the Alternative Open Field Test Site identified on page 23, 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 from its integral battery, which was replaced with a freshly charged battery as required during the testing.

TEST SETUP PHOTOGRAPH

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





EQUIPMENT INFORMATION

Equipment under Test (EUT):

Equipment: Wrist Worn Computer
Manufacturer: Symbol Technologies
Type No: WWC107C
Serial No: MXA16552
Build Status: Rev 2
Software Status: NBASNGAA, Rev A

Instrumentation used for Emission Testing:

Instrument	Manufacturer	Type No	EMC No	Cal to
EMI Receiver	Hewlett Packard	8542E	2286	13 Dec 03
Bilog Antenna	Chase	CBL6143	2860	11 Apr 03
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	Hewlett Packard	8562A	1427	10 Jan 04
Horn	EMCO	3115	2397	29 Jun 03
Signal Generator	Rohde & Schwarz	SMR40	2768	23 Feb 03
Low Noise Amplifier (8-18GHz)	Avantek	AWT 18036	1081	TU
Low Noise Amplifier (18-26GHz)	Avantek	AMT-26177-33	2072	TU
Horn	FMI	2024/20	1396	TU
Waveguide to Coax Adaptor	FMI	2093SF40	S/N 595	TU
4GHz High Pass Filter	RLC Electronics	F-100-4000-5-R	INV 04468	TU

Instrumentation used for Maximum Power measurements

Spectrum Analyzer	Rohde and Shwarz	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

TEST PROCEDURE

Testing was carried out 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 23.

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 25 GHz. 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 CISPR Quasi-peak detector in the frequency range 30MHz to 1GHz and a peak and average detector in the frequency range 1GHz to 25GHz.

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 measurements up to 1GHZ were made using a a Hewlett Packard 8542E EMI Receiver and measurements from 1GHZ to 25GHZ were made using a Hewlett Packard 8562A 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.

No EUT emissions were detected above the system noise floor.

Procedure Test Performed in accordance with ANSI C63.4.

Performed by: A R Hubbard, EMC Engineer.

Date: 10 February 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 – POWER SETTING SET ON WWC-107C TO B7

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

Frequency (MHz)	Raw Result (dBm)	Substitution Level (dBm)	Cable Loss (dB)	Substitution Antenna Gain (dB)	Result ERP (dBm)	Result ERP (mW)
2412	-17.80	14.24	4.79	9.2	18.65	73.28
2437	-19.19	12.88	4.57	9.2	17.51	56.36
2462	-20.00	12.04	4.65	9.2	16.59	45.60

Table 1

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

Performed by: A Blagg, EMC Engineer.

Date: 24 February 2003

PHOTOGRAPHS OF EQUIPMENT



Photograph 2
Front view WWC107C

PHOTOGRAPHS OF EQUIPMENT



Photograph 3
Rear view of WWC107C

PHOTOGRAPHS OF EQUIPMENT



Photograph 4
View of WCC107C, battery removed

PHOTOGRAPHS OF EQUIPMENT



Photograph 5
WCC107C, internal view

PHOTOGRAPHS OF EQUIPMENT



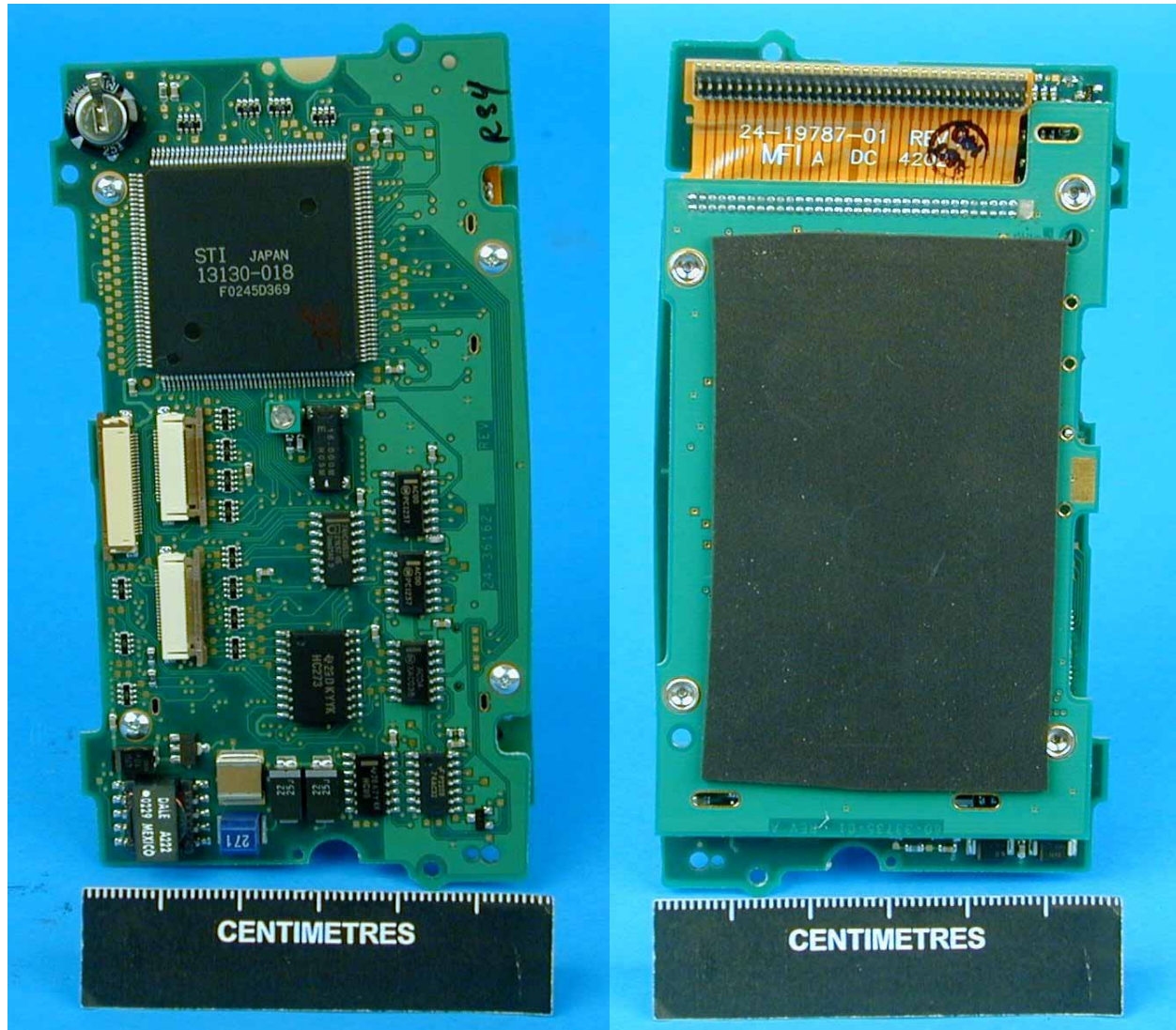
Photograph 6
View of radio card

PHOTOGRAPHS OF EQUIPMENT



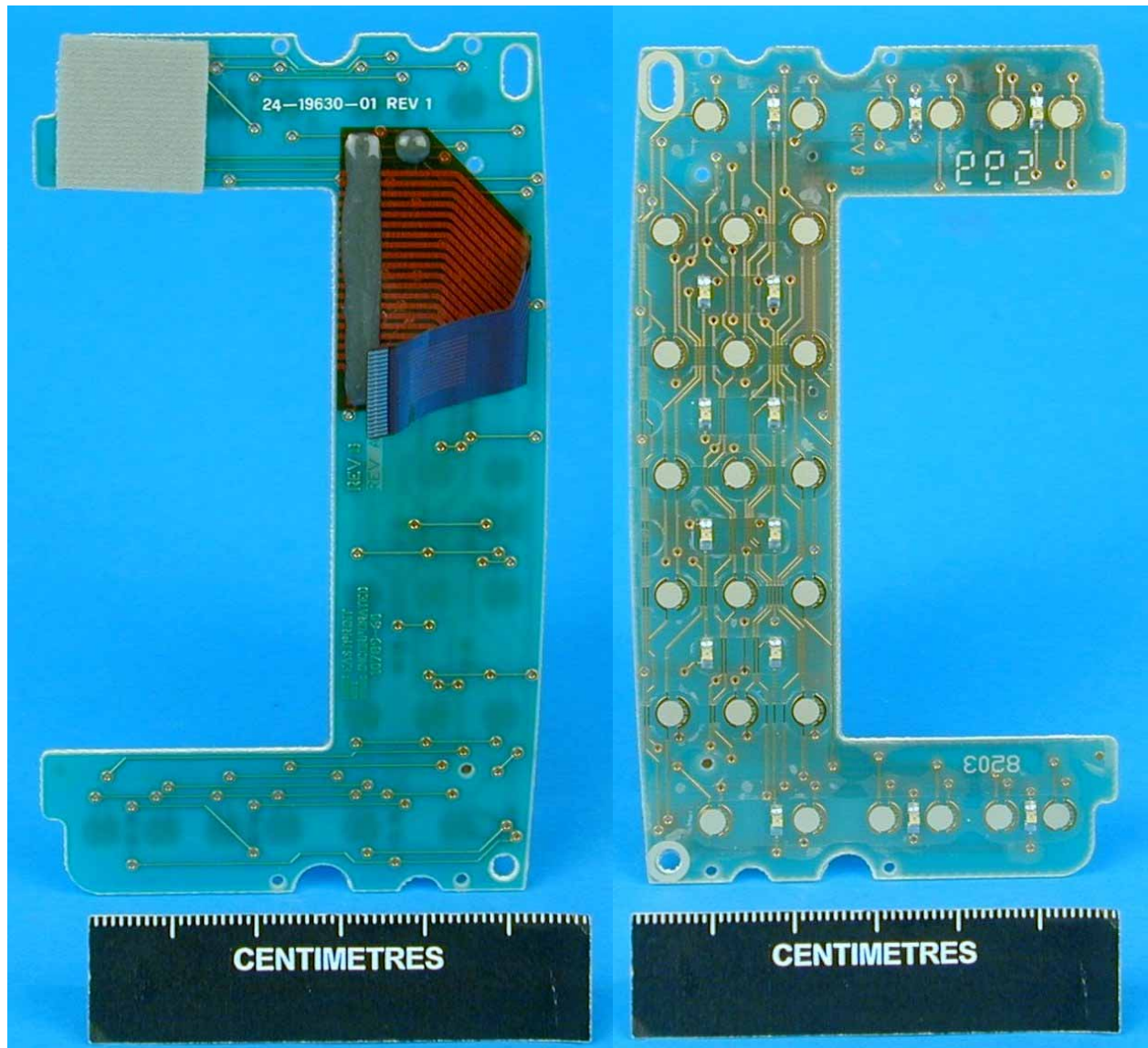
Photograph 7
Reverse side of radio card

PHOTOGRAPHS OF EQUIPMENT



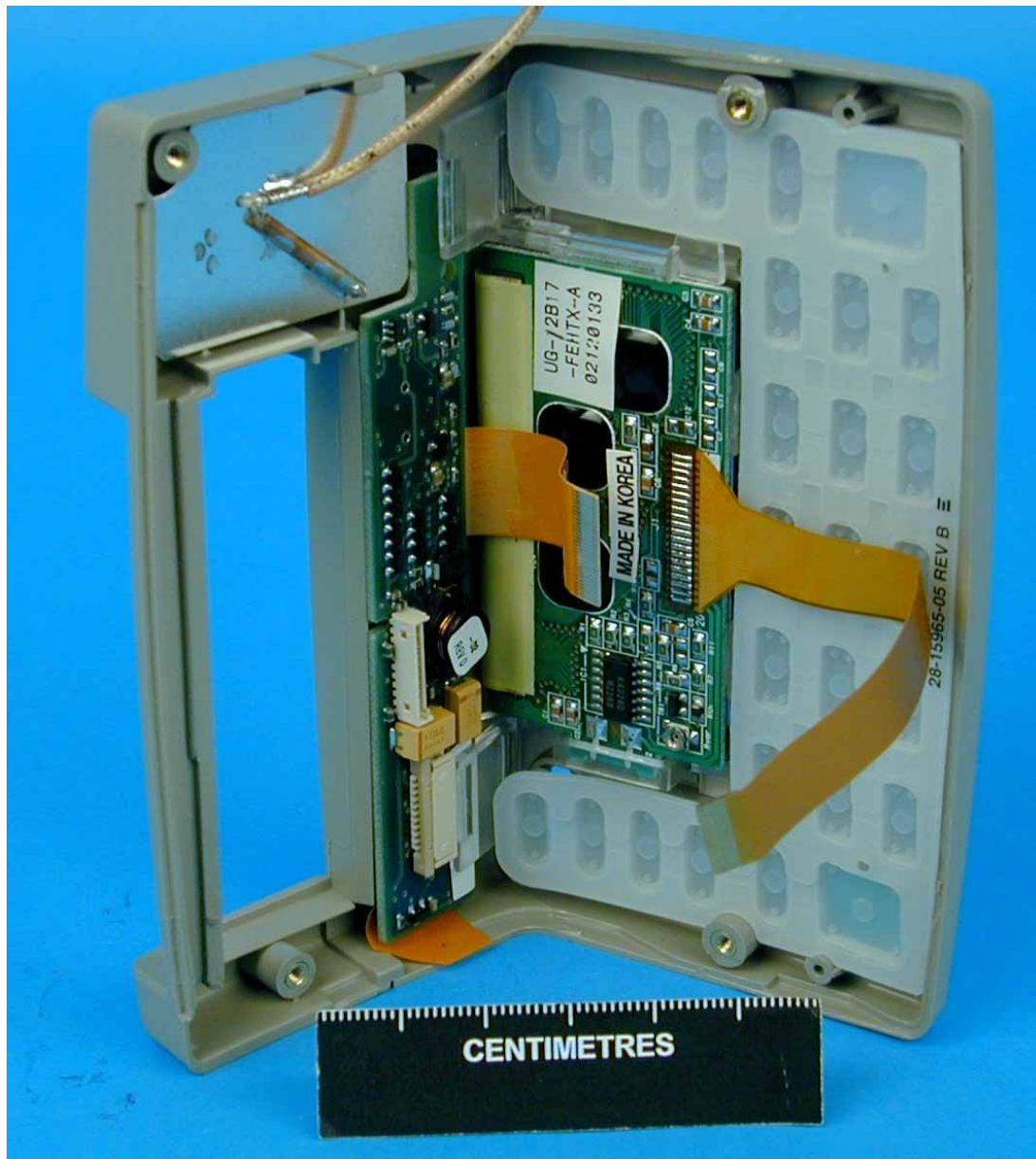
Photograph 8
Views of pcb

PHOTOGRAPHS OF EQUIPMENT



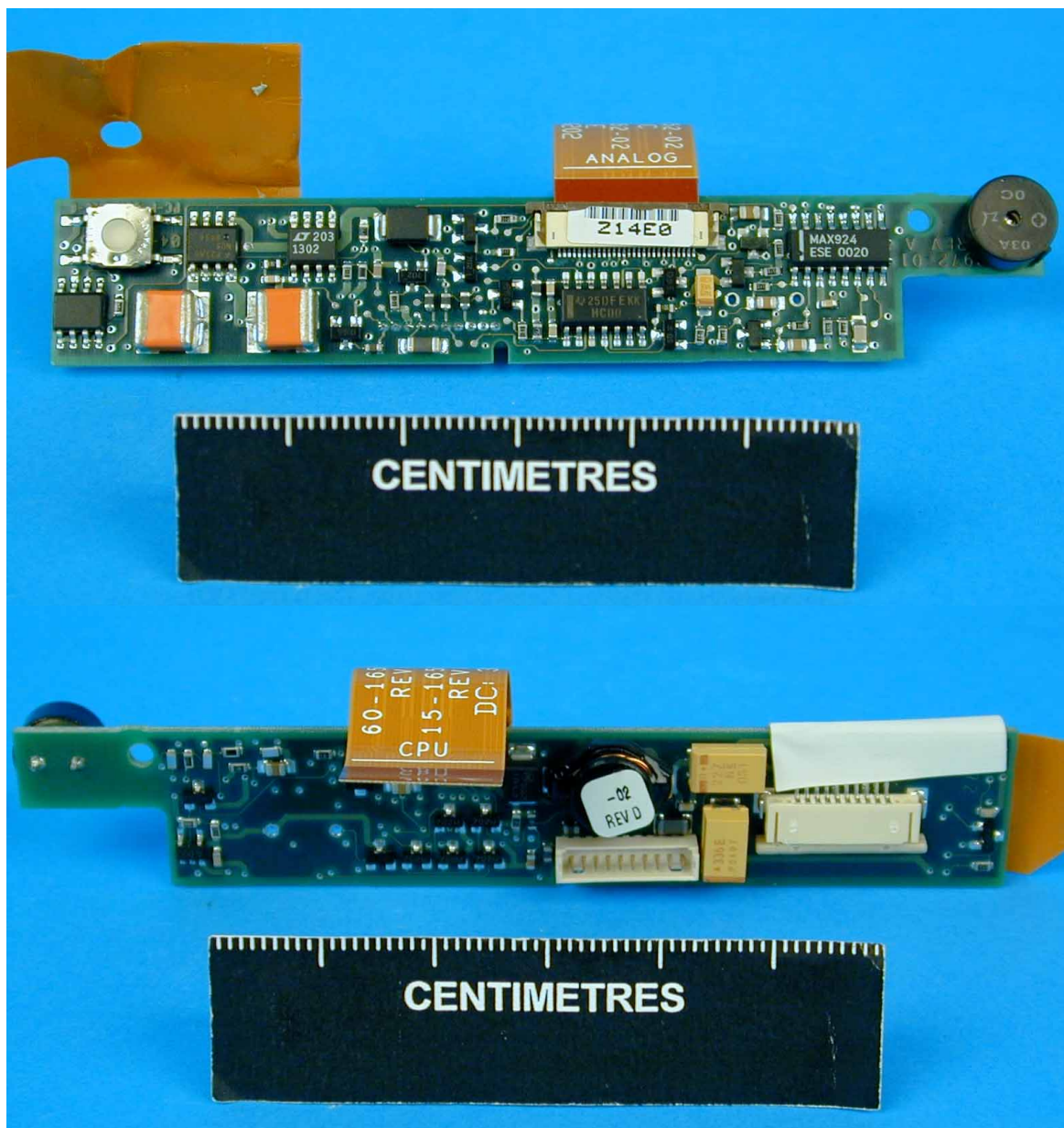
Photograph 9
Views of pcb

PHOTOGRAPHS OF EQUIPMENT



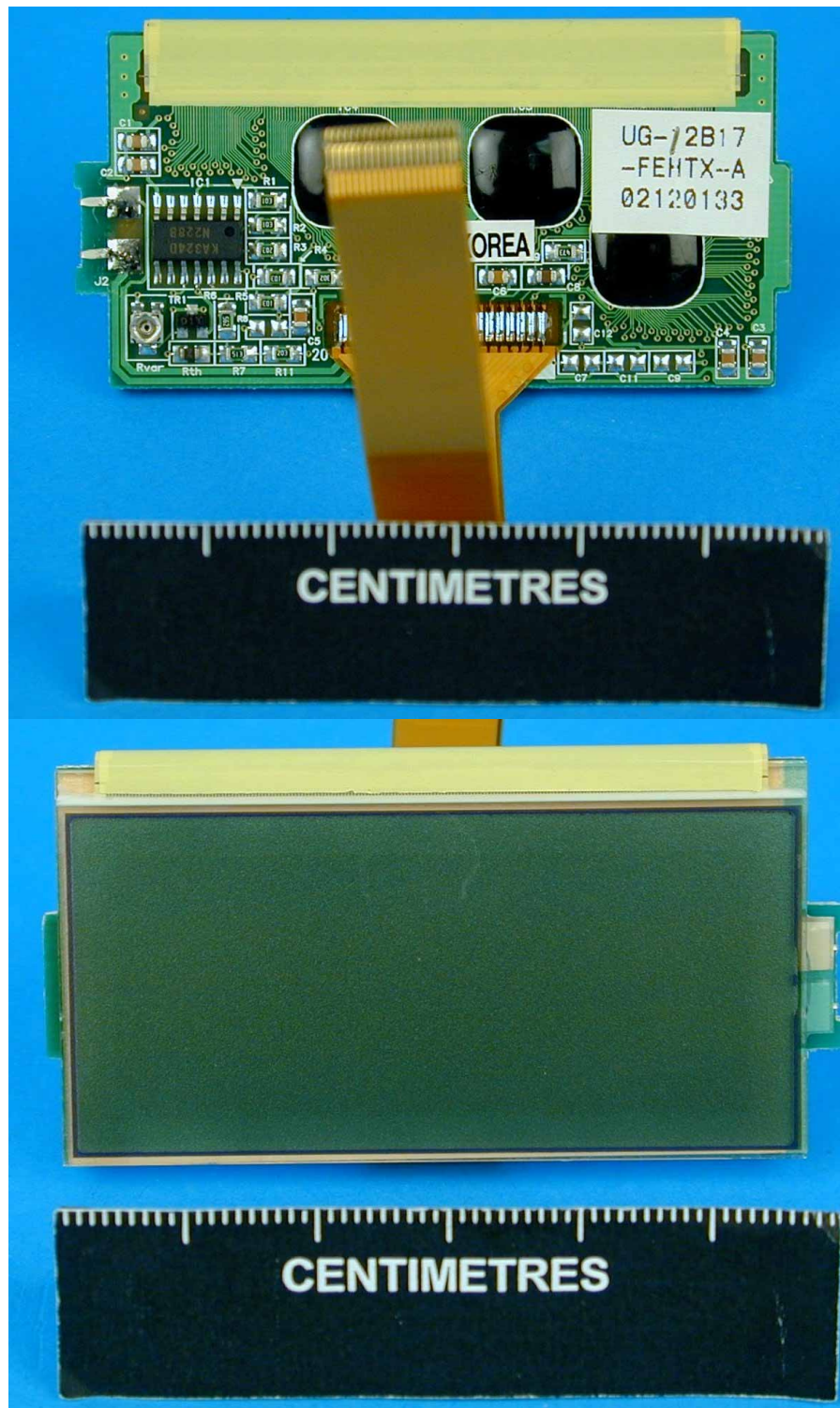
Photograph 10
Internal view of WWC107C

PHOTOGRAPHS OF EQUIPMENT



Photograph 11
Views of pcb

PHOTOGRAPHS OF EQUIPMENT



Photograph 12
Views of display and pcb



MANUFACTURER'S LABEL DRAWING

FCC ID: H9PWWC107C IC: 1549D-WWC107C THIS DEVICE CONTAINS AN APPROVED RLAN MODULE TYPE: LMC352 FREQ: 2.400 - 2.4835 GHz 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.		 
P/N: WXX107C-XXXX-WW		
<div>BAR CODE</div>		
(S)S/N A000004		
MADE IN XXXXXX		XXXX
SYMBOL TECHNOLOGIES, INC HOLTSVILLE N.Y. 11742		

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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Results of tests not yet included in our UKAS Accreditation Schedule are marked NUA
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