
REPORT ON

FCC CFR 47:Part 15C Testing in support of an Application
for a Class 2 Permissive Change for a PS3050 Terminal
FCC ID: H9PLA4137

Report No OR611509/02/Issue 2

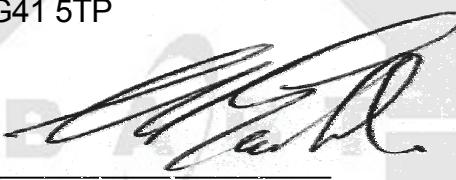
October 2003

REPORT ONFCC CFR 47: Part 15C Testing in support of an Application for
a Class 2 Permissive Change for a PS3050 Terminal

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Chief Engineer**APPROVED BY****DATED**

08-10-03

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STATUS

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	Personal Shopping Terminal
APPLICANT	Symbol Technologies Symbol Place Winnersh Triangle Berkshire RG41 5TP
MANUFACTURERS TYPE NUMBER	PS3050
MANUFACTURERS PART NUMBER	PS3050-0P0A1K100WW
SERIAL NUMBER	242SAMPLE3 (AUG/03)
HARDWARE VERSION	Rev 2
DECLARED VARIANTS	None
TEST SPECIFICATION NUMBER	FCC CFR 47:Part 15 Subpart C, 2002-08
REGISTRATION NUMBER	OR611509
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR611509 12 th September 2003
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	16 th September 2003 26 th September 2003
TEST ENGINEERS	A Guy P J Harrison
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. FCC Public Notice document (DA 00-705 released 30 March 2000)



TEST RATIONALE

This report has been re-issued as Issue 2 to cover some minor typographical errors and also include some test clause references that were omitted from the original report. This report is intended to replace the original report OR611509-02 Issued in October 2003.

The PS3050 Terminal is a hand held terminal for use with the Symbol Portable Shopping System™. The terminal allows shoppers to scan and tally purchases as they select goods from the shelves. On completion, the shopper proceeds to a dedicated Checkout, thus eliminating the need to unpack and repack the shopping trolley to pay for the goods.

Based on Symbol's Spectrum24 High Rate Direct Sequence Spread Spectrum (DSSS) wireless LAN technology, the CST3046 complies with the IEEE 802.11b standard.

Testing was carried out in support of an Application for a Class 2 Permissive Change for a PS3050 Terminal in the name of Symbol Technologies Inc.

Testing was carried out in accordance with:

- FCC: Part 15.205, Radiated Emission Measurement at the Band Edge (Marker Delta method)
- FCC: Part 15.247(c), Radiated Emissions
- FCC: Part 15.247(b), Maximum Radiated Peak Output Power (EIRP)



SYSTEM CONFIGURATION DURING EMC TESTING

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

The EUT was set to transmit continuously on maximum output power during all testing.

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):

Manufacturer: Symbol Technologies Inc

Equipment: Personal Shopping Terminal

Type No: PS3050

Model No. PS3050-0P0A1K100WW

Serial No: 242SAMPLE3 (AUG/03)

Drawing Revision: Rev 2

Instrumentation used for Emission Testing:

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	04 Jul 04
Horn (1 - 18GHz)	EMCO	3115	2297	04 Jul 04
Horn (18GHz - 40GHz)	Advanced Microtek	AM180HA-K-TU2	2945	20 May 04
Signal Generator	Hewlett Packard	8673B	953	05 Jun 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
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

TU - Traceability Unscheduled



RADIATED EMISSIONS

MEASUREMENT AT THE BAND EDGE (Marker Delta Method)

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.205, for Restricted Bands of Operation was carried out on the Measurement Test Facility detailed in Annex A. The following Test Results were obtained using the FCC Public Notice document (DA 00-705 released 30 March 2000) for making measurements at the Band Edge, incorporating the 'Marker Delta Method'.

Step 1

Bottom Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz. Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

Freq	Ant Pol	Hgt	Azi	Peak Field Strength	Average Field Strength
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m
2.412	V	153	190	109.1	100.0

Step 2

Determine Marker delta amplitude between 2.412GHz fundamental and 2.390GHz the Band Edge under investigation.

Using a span of 50MHz with Resolution Bandwidth and Video Bandwidth of 500kHz.

2.412GHz Peak using above instrument settings = 75.6 dB μ V (uncorrected)
2.390GHz Peak using above instrument settings = 27.2dB μ V (uncorrected)

Therefore Marker Delta Amplitude (75.6 – 27.2) = 48.4dB

Step 3

By subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Peak of 109.1dB μ V/m – 48.4dB (Delta) = **60.7dB μ V/m** (Limit is 74.0dB μ V/m = Pass)

Average of 100.0dB μ V/m – 48.4dB (Delta) = **51.2dB μ V/m** (Limit is 54.0dB μ V/m = Pass)



RADIATED EMISSIONS

MEASUREMENT AT THE BAND EDGE (Marker Delta Method) Continued

Step 1

Top Channel Fundamental Field Strength Measurement.

Peak measurements performed utilising a Resolution Bandwidth and Video Bandwidth of 1MHz.
Average measurements performed utilising a Resolution Bandwidth of 1MHz and Video Bandwidth of 10Hz.

Freq	Ant Pol	Hgt	Azi	Peak FS	Average FS
GHz	H/V	cm	Deg	dB μ V/m	dB μ V/m
2.462	V	119	168	109.7	100.1

Step 2

Determine Marker delta amplitude between 2.462GHz fundamental and 2.4835GHz the Band Edge under investigation.

Using a span of 50MHz with Resolution Bandwidth and Video Bandwidth of 500kHz.

2.462GHz Peak using above instrument settings = 75.8dB μ V (uncorrected)
2.4835GHz Peak using above instrument settings = 22.7dB μ V (uncorrected)

Therefore Marker Delta Amplitude (75.8 – 22.7) = 53.1dB

Step 3

By subtracting the Marker Delta obtained from Step 2 from the 2.412GHz Field Strength measurement from Step 1, gives following Result

Peak of 109.7dB μ V/m – 53.1dB (Delta) = **56.6dB μ V/m** (Limit is 74.0dB μ V/m = Pass)

Average of 100.1dB μ V/m – 53.1dB (Delta) = **43.5dB μ V/m** (Limit is 54.0dB μ V/m = Pass)

Procedure: Test Performed in accordance with FCC Public Notice document (DA 00-705 released 30 March 2000)

Performed by: A Guy, EMC Engineer.

Date: 24th September 2003



RADIATED EMISSIONS

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c), for Radiated Electric Field Emissions was carried out on the Measurement Test Facility detailed in Annex A. Section 15.247(c) requires Rule parts 15.205 and 15.209 to be applied.

A preliminary profile of the Radiated 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.

30MHz - 1GHz emissions levels were then formally measured utilising a CISPR Quasi-Peak detector. 1GHz - 25GHz emissions levels were then formally measured utilising Peak and Average detectors. (Note: Peak measurements performed using a Resolution and Video Bandwidth of 1MHz, Average measurements performed using a Resolution Bandwidth of 1MHz and a Video Bandwidth of 10Hz)

The EUT was operating off its internal battery; the battery was replaced at regular intervals to ensure optimum performance of the EUT.

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

Channel 1: 2412MHz

Channel 6: 2437MHz

Channel 11: 2462MHz

Radiated Emissions from 30MHz to 1GHz were made using a HP 8542E Test Receiver.

Radiated Emissions from 1GHz to 25GHz were made using a Rhode and Schwarz ESIB 40 Test Receiver.

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

The measurements were performed at a 3m distance unless otherwise stated.



RADIATED EMISSIONS TEST RESULTS (cont'd)

30MHz - 1GHz Frequency Range

Equipment Designation : Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (30MHz – 1GHz).

EUT Tx on Bottom Channel (2.412GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: No emissions attributable to the EUT were detected at levels higher than the measuring system noise floor. The levels of the system noise floor (Peak measurements) are presented below: -

Emission Frequency	Pol	Hgt	Azm	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m		Specification Limit	
							dB μ V	dB	dB μ V/m	μ V/m
MHz	H/V	cm	deg							
100.00	V	100	0	5.6	1.4	9.9	16.9	7.0	43.5	150.0
200.00	V	100	0	6.0	1.9	10.6	18.5	8.4	43.5	150.0
400.00	V	100	0	6.6	2.9	16.0	25.5	18.8	46.0	200.0
600.00	V	100	0	6.1	3.6	18.5	28.2	25.7	46.0	200.0
700.00	V	100	0	6.5	4.0	19.0	29.5	29.9	46.0	200.0
900.00	V	100	0	6.8	4.1	20.5	31.4	37.2	46.0	200.0

EUT Tx on Middle Channel (2.437GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: No emissions attributable to the EUT were detected at levels higher than the measuring system noise floor. The levels of the system noise floor (Peak measurements) are presented below: -

Emission Frequency	Pol	Hgt	Azm	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m		Specification Limit	
							dB μ V	dB	dB μ V/m	μ V/m
MHz	H/V	cm	deg							
100.00	V	100	0	5.6	1.4	9.9	16.9	7.0	43.5	150.0
200.00	V	100	0	6.0	1.9	10.6	18.5	8.4	43.5	150.0
400.00	V	100	0	6.6	2.9	16.0	25.5	18.8	46.0	200.0
600.00	V	100	0	6.1	3.6	18.5	28.2	25.7	46.0	200.0
700.00	V	100	0	6.5	4.0	19.0	29.5	29.9	46.0	200.0
900.00	V	100	0	6.8	4.1	20.5	31.4	37.2	46.0	200.0



RADIATED EMISSIONS TEST RESULTS (cont'd)

30MHz - 1GHz Frequency Range

EUT Tx on Top Channel (2.462GHz)

30MHz – 1GHz Alternative Open Area Test Site Results: No emissions attributable to the EUT were detected at levels higher than the measuring system noise floor. The levels of the system noise floor (Peak measurements) are presented below: -

Emission Frequency	Pol	Hgt	Azm	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m		Specification Limit	
							dB μ V	dB	dB μ V/m	μ V/m
100.00	V	100	0	5.6	1.4	9.9	16.9	7.0	43.5	150.0
200.00	V	100	0	6.0	1.9	10.6	18.5	8.4	43.5	150.0
400.00	V	100	0	6.6	2.9	16.0	25.5	18.8	46.0	200.0
600.00	V	100	0	6.1	3.6	18.5	28.2	25.7	46.0	200.0
700.00	V	100	0	6.5	4.0	19.0	29.5	29.9	46.0	200.0
900.00	V	100	0	6.8	4.1	20.5	31.4	37.2	46.0	200.0

ABBREVIATIONS FOR ABOVE TABLES

H	Horizontal Polarisation	V	Vertical Polarisation
Pol	Polarisation	Hgt	Height
deg	degree	Azm	Azimuth

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

Performed by: P J Harrison, EMC Engineers.

Date: 16th September 2003



RADIATED EMISSIONS TEST RESULTS (cont'd)

1GHz - 25GHz Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15.247(c), 15.205 and 15.209 for Radiated Emissions (1GHz – 25GHz).

EUT Tx on Bottom Channel (2.412GHz)

Note: measurement of the carrier frequency (2.412GHz) produced a Field Strength of 102.3dB μ V/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 82.3dB μ V/m (carrier level minus 20dB)

1 – 25GHz Alternative Open Area Test Site Results: The level of the only emission detected, measured in accordance with the specification is presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height					
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m	dB μ V/m	dB μ V/m
4.075	H	135	187	51.7	74.0	48.3	54.0

EUT Tx on Middle Channel (2.437GHz)

Note: measurement of the carrier frequency (2.412GHz) produced a Field Strength of 105.1dB μ V/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 85.1dB μ V/m (carrier level minus 20dB)

1 – 25GHz Alternative Open Area Test Site Results: The level of the only emission detected, measured in accordance with the specification is presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height					
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m	dB μ V/m	dB μ V/m
4.125	H	131	352	51.6	74.0	48.1	54.0



RADIATED EMISSIONS TEST RESULTS (cont'd)

1GHz - 25GHz Range

EUT Tx on Top Channel (2.462GHz)

Note: measurement of the carrier frequency (2.412GHz) produced a Field Strength of 102.1dB μ V/m. Therefore the specification limit for any spurious emissions found outside of the Restricted Band table (Section 15.205) is 82.1dB μ V/m (carrier level minus 20dB)

1 – 25GHz Alternative Open Area Test Site Results: The levels of the only two emissions detected, measured in accordance with the specification are presented below: -

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Polarisation	Height	Azimuth				
GHz	H/V	cm	deg	dB μ V/m	dB μ V/m	dB μ V/m	dB μ V/m
2.352	V	130	198	63.2	74.0	51.4	54.0
4.176	H	102	0	55.6	74.0	52.4	54.0

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

Performed by: A Guy Engineer.

Date: 24th September 2003



MAXIMUM RADIATED OUTPUT POWER

TEST PROCEDURE

Testing to the requirements of FCC CFR 47: 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: 2437MHz
Channel 11: 2462MHz

The EUT was then substituted with a 3115 DRG Horn Antenna connected to a Signal Generator. The generator's frequency was adjusted to that of the EUT and the amplitude increased to give the same level as measured from the EUT. The level was read from the Signal Generator and gave the maximum output power, allowing for the Isotropic Gain of the DRG Horn and Cable loss.

The measurements were performed using a Rohde and Schwarz ESIB 40 Test Receiver.

Results

Frequency (MHz)	Output Power EIRP (dBm)	Result (mW)
2412.0	19.7	93.33
2437.0	19.3	85.11
2462.0	19.8	95.50

Limit	<4W or <+36dBm
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EUT complies with CFR 47 15.247(b)(1). The EUT does not exceed 4W or +36dBm at the measured frequencies.

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

Performed by: A Guy, EMC Engineer.

Date: 25th September 2003



PHOTOGRAPHS OF EQUIPMENT



Photograph 2
Front View



PHOTOGRAPHS OF EQUIPMENT



Photograph 3
Rear view



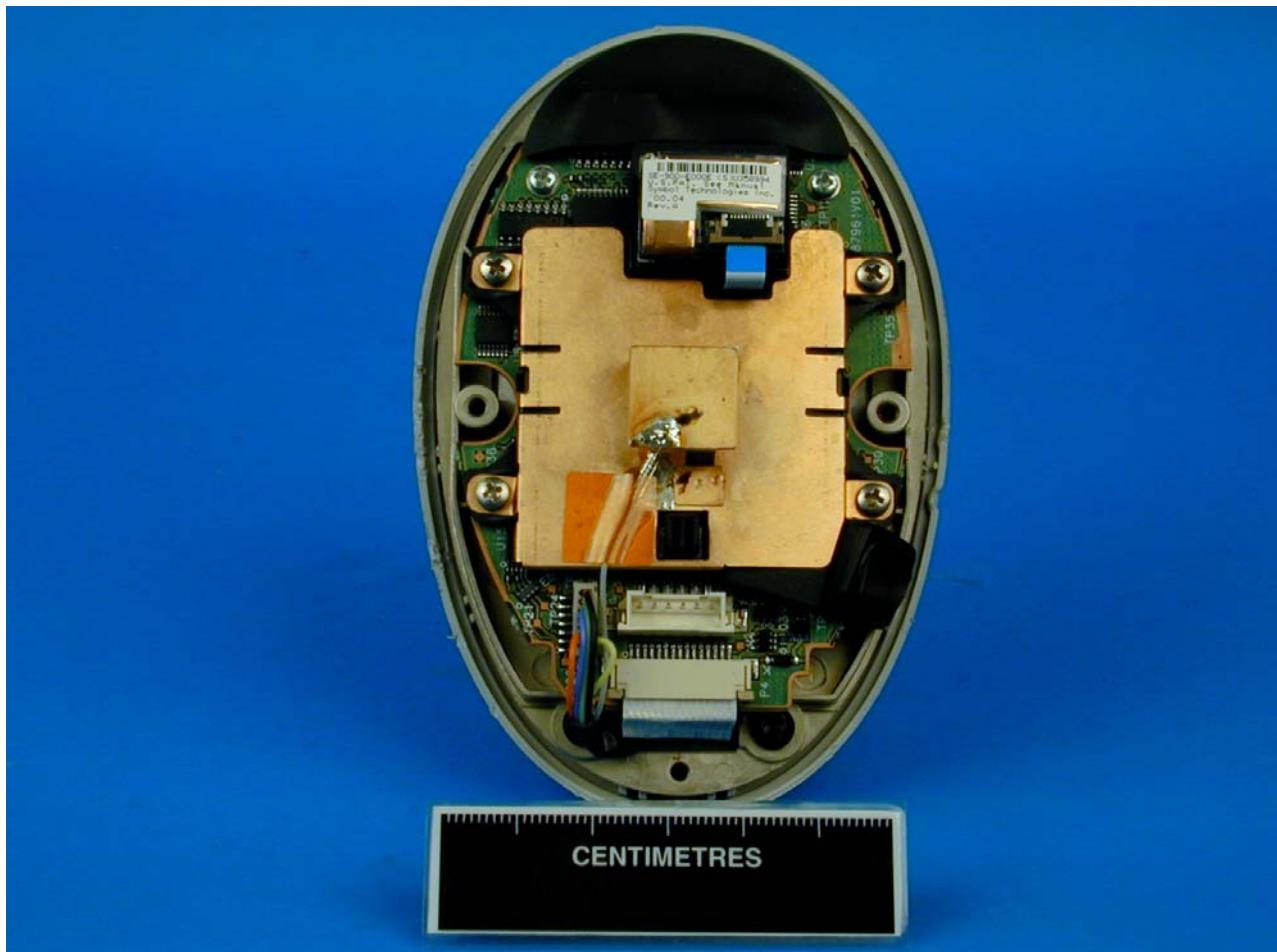
PHOTOGRAPHS OF EQUIPMENT



Photograph 4
Battery Label View



PHOTOGRAPHS OF EQUIPMENT



Photograph 5
Internal View 1



PHOTOGRAPHS OF EQUIPMENT



Photograph 6
Internal View 2



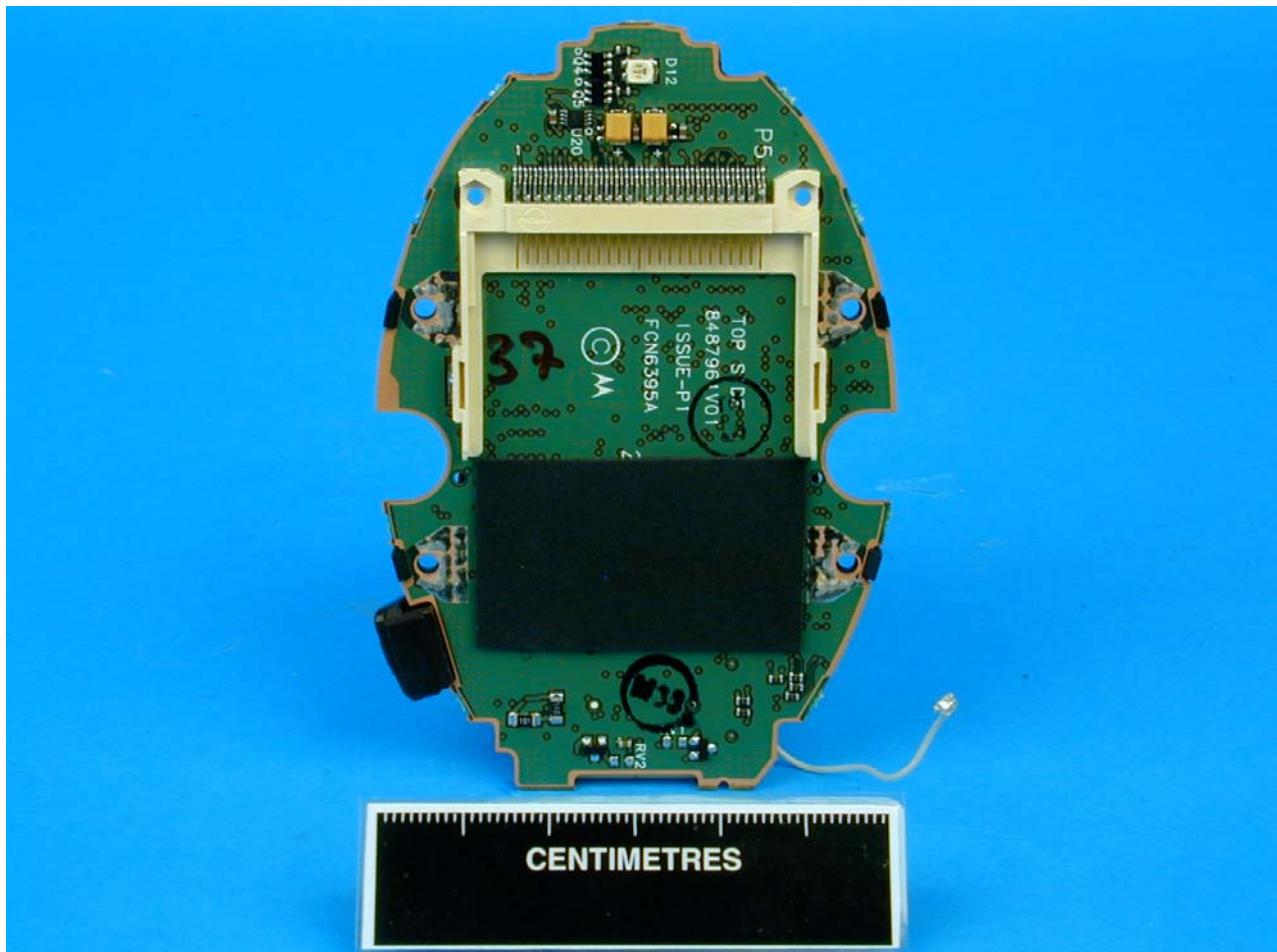
PHOTOGRAPHS OF EQUIPMENT



Photograph 7
Internal View 3



PHOTOGRAPHS OF EQUIPMENT



Photograph 8
Internal View 4



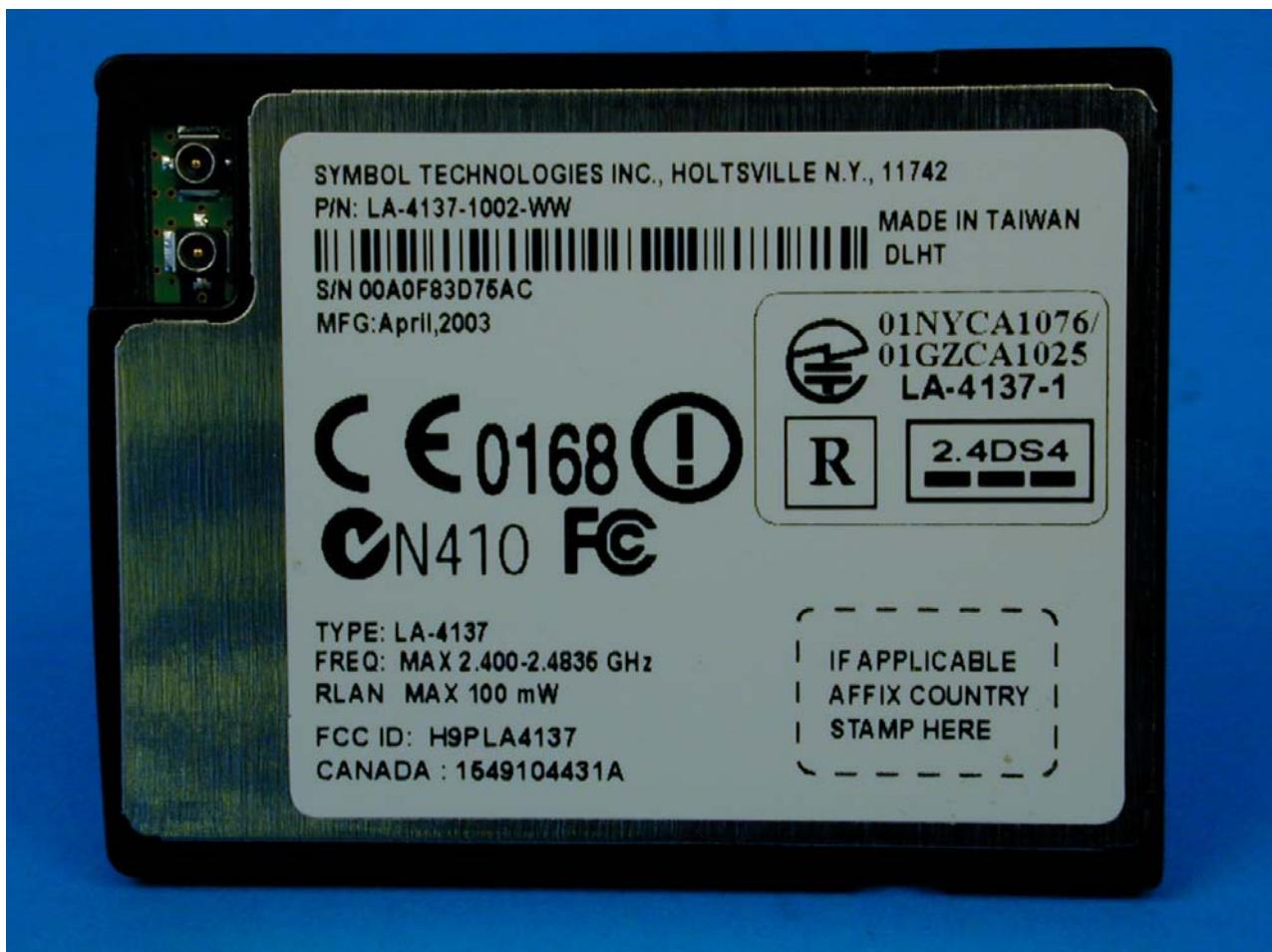
PHOTOGRAPHS OF EQUIPMENT



Photograph 8
LA-4137 RLAN Radio Card Rear Label View



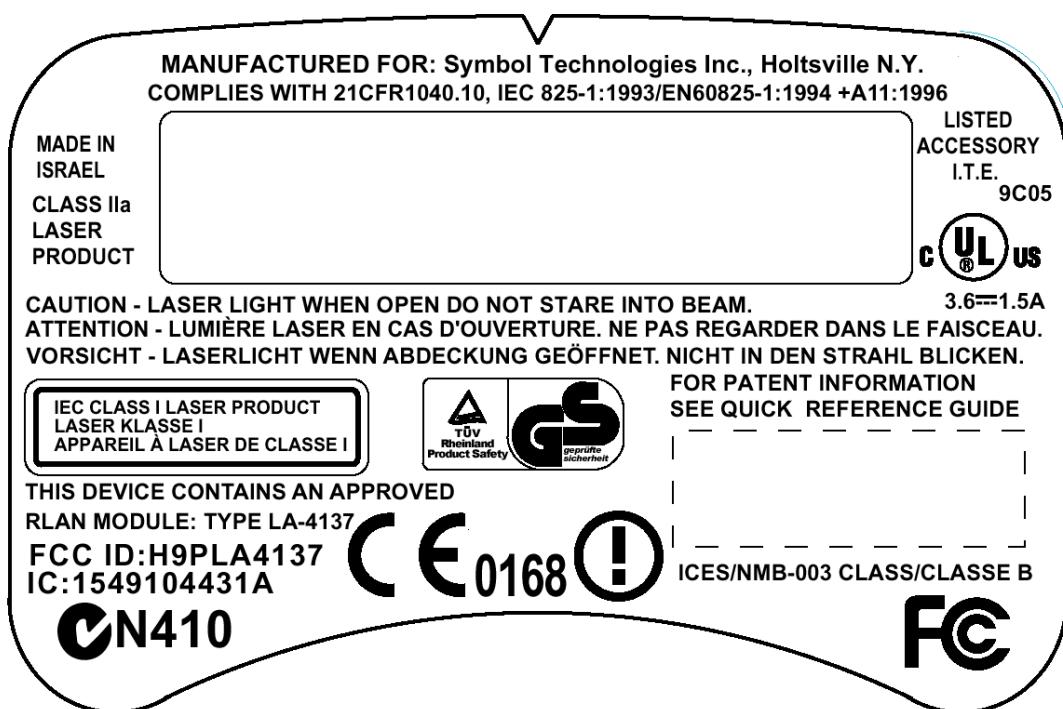
PHOTOGRAPHS OF EQUIPMENT



Photograph 9
LA-4137 RLAN Radio Card Front Label View



MANUFACTURERS LABEL DIAGRAM



Not to Scale



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	$\pm 2 \times 10^{-7} \times$ 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	$\pm 2 \times 10^{-7} \times$ Centre Frequency
Amplitude	± 3.4 dB

For Effective Isotropic Radiated Power (EIRP) measurements: -

Amplitude	± 1.45 dBm
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This report relates only to the actual item/items tested.

UKAS Accreditation's 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
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ANNEX A
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,

A handwritten signature in black ink that appears to read "Thomas W. Phillips".

Thomas W Phillips
Electronics Engineer