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**REPORT ON**

FCC Part 15 Testing in support of an Application for a Class 2 Permissive Change for  
a Symbol Gemini MC9010 Mobile Computer  
FCC ID: HP9LA3021-100

Report No OR611452-2 Issue 2

August 2003

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**REPORT ON**

FCC Part 15C Testing in support of an Application for a Class 2  
Permissive Change for a Symbol Gemini MC9010 Mobile  
Computer

FCC ID: HP9LA3021-100

Report No OR611296-2 Issue 2

August 2003

**PREPARED FOR**

Symbol Technologies Inc  
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Holtsville  
NY 11742-1300  
New York  
United States of America

**APPROVED BY**



**C H GOULD**  
Chief Engineer

**DATED**

21-08-03

**DISTRIBUTION**

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## **STATUS**

OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
MANUFACTURING DESCRIPTION	Mobile Computer
APPLICANT	Symbol Technologies Inc One Symbol Plaza Holtsville NY 11742-1300 New York United States of America
TYPE NUMBER	MC9010
MANUFACTURERS MODEL NUMBER	MC9010-GF0JAEB00FB
SERIAL NUMBER	ALP68867
HARDWARE VERSION	Rev 1
TEST SPECIFICATION NUMBER	FCC Part 15 Subpart C
REGISTRATION NUMBER	OR611452/03
QUANTITY OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE SERIAL NUMBER DATE	Declaration of Build Status OR611452 30 <sup>th</sup> June 2003
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal N/A N/A
START OF TEST FINISH OF TEST	7 <sup>th</sup> July 2003 17 <sup>th</sup> July 2003
TEST ENGINEERS	G Lawler 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. FCC Public Notice document (DA 00-705 released 30 March 2000)



## **TEST RATIONALE**

This report has been re-issued because of some typing errors in the original report OR611452-2. This report should be read in place of the original.

The information contained within this report is intended to show verification of compliance of the Symbol Technologies Inc MC9010 Mobile Computer to the requirements of FCC Specification Part 15.

FCC ID HP9LA3021-100

The unit supplied for testing was a MC9010 Mobile Computer, which offers 2.4GHz 802.11 Frequency Hopping Spread Spectrum (FHSS) Wireless LAN connectivity.

The terminal utilizes the approved LA-3021 Symbol 802.11 radio card. FCC ID number is detailed below:

Type:	Description	Approval	FCCID	Date
LA3021	802.11 FHSS Radio Card	FCC Part15	H9PLA3021-100	15/03/2000

This report details testing carried out in accordance with:

- FCC: Part 15.247(c), Radiated Emission Measurement at the Band Edge (Marker Delta method)
- FCC: Part 15.247(c), Radiated 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 42, and tested in accordance with the specification.

The test software in the EUT enabled the Test Engineer to select full power and continuous transmit on the following channels;

Bottom Channel:	2402MHz
Middle Channel:	2441MHz
Top Channel:	2480MHz

### TEST SETUP PHOTOGRAPH

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



Photograph 1



## EQUIPMENT INFORMATION

### Equipment under Test (EUT):

<b>Equipment:</b>	Mobile Computer
<b>Manufacturer:</b>	Symbol Technologies Inc
<b>Type No:</b>	MC9010
<b>Model No.</b>	MC9010-GF0JAEB00FB
<b>Serial No:</b>	ALP68867
<b>Drawing Revision:</b>	Rev 1

### Instrumentation used for Emission Testing:

<b>Instrument</b>	<b>Manufacturer</b>	<b>Type No</b>	<b>EMC No</b>	<b>Cal to</b>
Screened Enclosure	Siemens	EAC 54300	2533	TU
Turntable & Controller	HD GmbH	HD 050	2528	TU
Antenna Mast	Emco	2070		TU
Antenna Mast Controller	Emco	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 July 04
18-40GHz Horn	Advanced Microtek	AM180 HA-K-TU2	2945	15 Apr 04
8-18GHz Low Noise Amplifier	Avantek	AWT-18036	1081	26 Jun 04
18-40GHz Low Noise Amplifier	Narda	DB02-0447	2936	23 Apr 04
18-26GHz Low Noise Amplifier	Avantek	AMT-26177-33	2072	TU
Barometer	diplex	-	1938	TU
Hygrometer	Rotronic	A1	INV4066	28 Nov 03

### Instrumentation used for Maximum Power measurements

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	06 July 04
Substitution DRG Antenna	EMCO	3115	INV3777	20 Jan 04
Amplifier			INV4863	21 Feb 04
Cable	Reynolds Industries	269-0088-3000	CS0535	TU
Cable	Rosenberger	FA210B-1-070M	CS0567	TU
Hygrometer	Rotronic	A1	INV4198	07 Apr 04

TU - Traceability Unscheduled





## **RADIATED EMISSIONS**

### **MEASUREMENT AT THE BAND EDGE (Marker Delta Method)**

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.

Performed in accordance with ANSI C63.4

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 $\mu$ V/m	dB $\mu$ V/m
2.402	H	100	121	110.4	109.9

#### **Step 2**

Determine Marker delta amplitude between 2.402GHz fundamental and 2.390GHz the Band Edge under investigation.

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

2.402GHz Peak using above instrument settings = 79.4dB $\mu$ V (uncorrected)

2.390GHz Peak using above instrument settings = 21.8dB $\mu$ V (uncorrected)

Therefore Marker Delta Amplitude (79.4dB $\mu$ V – 21.8dB $\mu$ V) = 57.6dB

#### **Step 3**

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

Peak of 110.4dB $\mu$ V/m – 57.6dB (Delta) = 52.8dB $\mu$ V/m (Limit is 74.0dB $\mu$ V/m = Pass)

Average of 109.9dB $\mu$ V/m – 57.6dB (Delta) = 52.3dB $\mu$ V/m (Limit is 54.0dB $\mu$ V/m = Pass)



**RADIATED EMISSIONS**

**MEASUREMENT AT THE BAND EDGE (Marker Delta Method) Continued**

**Step 1**

Top Channel Fundamental Field Strength Measurement.

Performed in accordance with ANSI C63.4

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	dBµV/m	dBµV/m
2.480	V	129	70	115.5	114.0

**Step 2**

Determine Marker delta amplitude between 2.480GHz fundamental and 2.4835GHz the Band Edge under investigation.

Using a span of 30MHz with Resolution Bandwidth and Video Bandwidth of 300kHz.

2.480GHz Peak using above instrument settings = 83.2dBµV (uncorrected)

2.485GHz Peak using above instrument settings = 20.6dBµV (uncorrected)

Therefore Marker Delta Amplitude (83.2dBµV – 20.6dBµV) = 62.6dB

**Step 3**

Subtracting the Marker Delta obtained from Step 2 from the 2.480GHz Field Strength measurement from Step 1, gives following Result

Peak of 115.5dBµV/m – 62.6dB (Delta) =52.9dBµV/m (Limit is 74.0dBµV/m = Pass)

Average of 114.0dBµV/m – 62.6dB (Delta) = 51.4dBµV/m (Limit is 54.0dBµV/m = Pass)

EUT meets the measurement at the Band Edge requirements for the Top and Bottom Channel.

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

Performed by: A Guy, EMC Engineer.

Signature: 

Date: 17<sup>th</sup> July 2003



## **RADIATED EMISSIONS**

### **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 27.

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 using a CISPR Quasi-Peak detector. 1GHz – 25GHz emissions levels were then formally measured using 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.

Bottom Channel:	2402MHz
Middle Channel:	2441MHz
Top Channel:	2480MHz

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 Part 15.247(c) for Radiated Emissions (30MHz – 1GHz).

**EUT Tx on Bottom Channel (2.402GHz)**

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azim	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m		Specification Limit	
							MHz	H/V	cm	deg
400.0	V	128	172	15.8	2.9	16.0	34.7	54.3	46.0	200
420.0	V	106	173	14.2	3.0	16.2	33.4	46.8	46.0	200
440.0	V	118	153	15.1	3.1	16.5	34.7	54.3	46.0	200
480.0	V	100	159	16.4	3.2	16.9	36.5	66.8	46.0	200
500.0	V	100	148	10.8	3.3	17.2	31.3	36.7	46.0	200
520.0	V	100	161	15.1	3.4	17.4	35.9	62.4	46.0	200

Table of Results for Radiated Emissions

**EUT Tx on Middle Channel (2.441GHz)**

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the six highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azim	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m		Specification Limit	
							MHz	H/V	cm	deg
400.0	V	127	170	15.6	2.9	16.0	34.5	53.1	46.0	200
420.0	V	117	173	13.2	3.0	16.2	32.4	41.7	46.0	200
440.0	V	122	162	14.5	3.1	16.5	34.1	50.7	46.0	200
480.0	V	100	160	16.5	3.2	16.9	36.6	67.6	46.0	200
500.0	V	102	156	10.9	3.3	17.2	31.4	37.2	46.0	200
520.0	V	100	162	15.0	3.4	17.4	35.8	61.7	46.0	200

Table of Results for Radiated Emissions



**RADIATED EMISSIONS TEST RESULTS: EUT in RLAN Mode (cont'd)**

**30MHz - 1GHz Frequency Range**

**EUT Tx on Top Channel (2.480GHz)**

30MHz – 1GHz Alternative Open Area Test Site Results: The levels of the highest emissions measured in accordance with the specification are presented below: -

Emission Frequency	Pol	Hgt	Azm	Level at 3m	Cable Loss	Antenna Factor	Field Strength at 3m		Specification Limit	
							dBµV/m	µV/m	dBµV/m	µV/m
MHz	H/V	cm	deg	dBµV	dB	dB	dBµV/m	µV/m	dBµV/m	µV/m
400.0	V	134	176	15.4	2.9	16.0	34.3	51.9	46.0	200
420.0	V	120	166	13.3	3.0	16.2	32.5	42.2	46.0	200
440.0	V	108	165	15.2	3.1	16.5	34.8	55.0	46.0	200
480.0	V	100	149	16.8	3.2	16.9	36.9	70.0	46.0	200
500.0	V	100	150	11.2	3.3	17.2	31.7	38.5	46.0	200
520.0	V	100	159	14.6	3.4	17.4	35.4	58.9	46.0	200

Table of Results for Radiated Emissions

**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: G Lawler, EMC Engineer.

Signature: 

Date: 7<sup>th</sup> July 2003



## RADIATED EMISSIONS TEST RESULTS (cont'd)

### 1GHz - 25GHz Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC Part 15.247(c) for Radiated Emissions (1GHz – 25GHz).

### **EUT Tx on Bottom Channel (2.402GHz)**

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	Deg	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m
4.062	V	100	88	44.5	89.8	-	-
4.804	V	100	84	44.2	74.0	-	-

Table of Results for Radiated Emissions

### **EUT Tx on Middle Channel (2.441GHz)**

Frequency	Antenna			Field Strength (Peak) at 3m	Limit (Peak)	Field Strength (Average) at 3m	Limit (Average)
	Polarisation	Height	Azimuth				
GHz	H/V	cm	Deg	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m
4.882	H	100	226	51.8	74.0	45.6	54.0

Table of Results for Radiated Emissions



**RADIATED EMISSIONS TEST RESULTS: EUT in RLAN Mode (cont'd)**

**1GHz - 25GHz Range**

**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	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m
4.959	H	100	216	52.7	74.0	47.7	54.0

Table of Results for Radiated Emissions

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

Performed by: A Guy, EMC Engineer.

Signature:  \_\_\_\_\_

Date: 17<sup>th</sup> July 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:

Bottom Channel: 2402MHz  
Middle Channel: 2441MHz  
Top Channel: 2480MHz

### 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)
2402	-31.64	9.00	-4.68	7.73	12.05	16.03
2441	-30.65	10.00	-5.00	7.95	12.95	19.72
2480	-28.94	11.90	-4.79	8.17	15.28	33.73

Table 1

Performed by: Ryan Henley, Radio Engineer.

Signature: 

Date: 15<sup>th</sup> June 2003





## PHOTOGRAPHS OF THE MC9010

PHOTOGRAPHS OF EQUIPMENT



Photograph 2  
MC9010 Front view

PHOTOGRAPHS OF EQUIPMENT



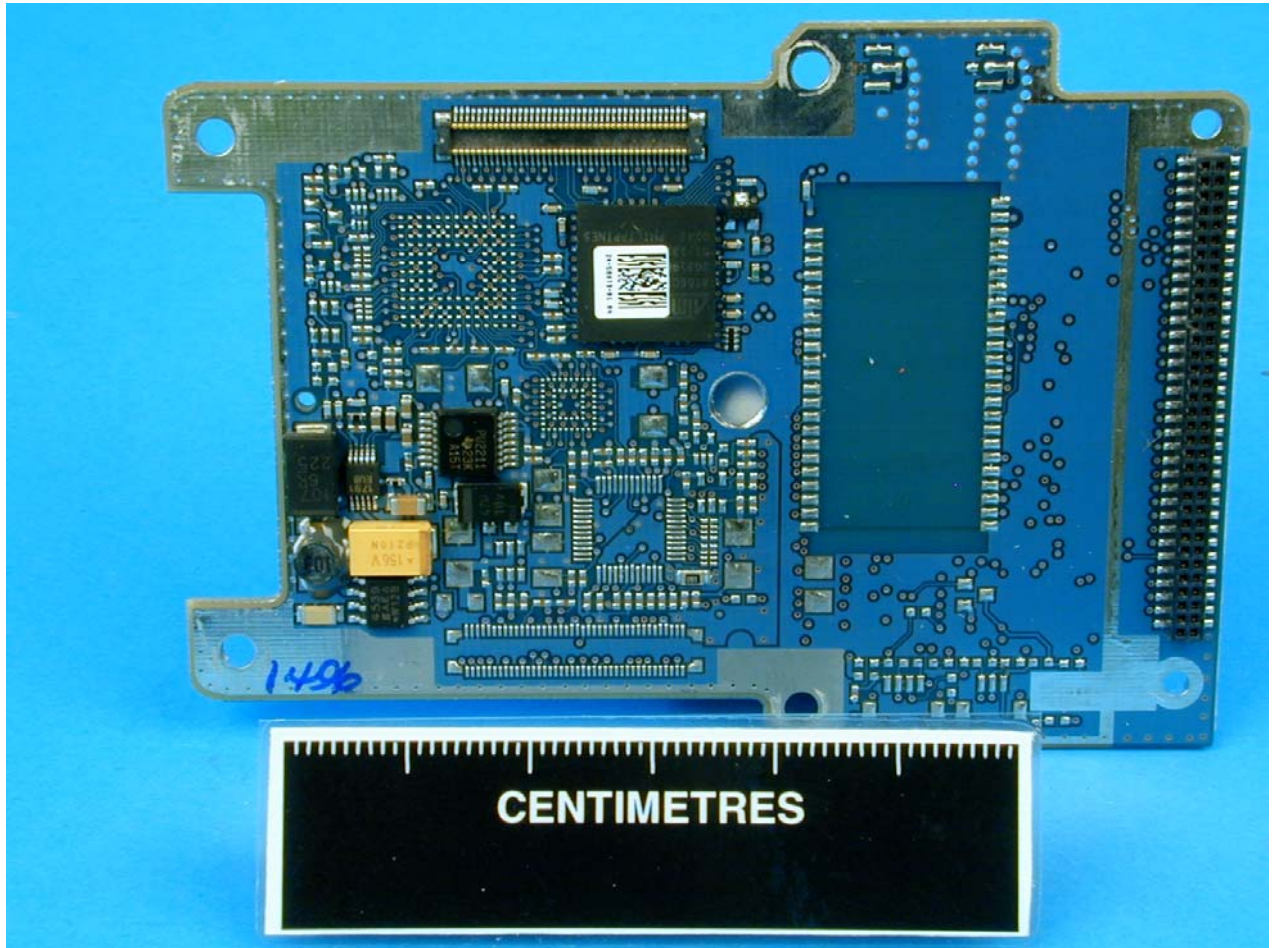
Photograph 3  
MC9010 Rear View

PHOTOGRAPHS OF EQUIPMENT



Photograph 4  
MC9010 Internal view

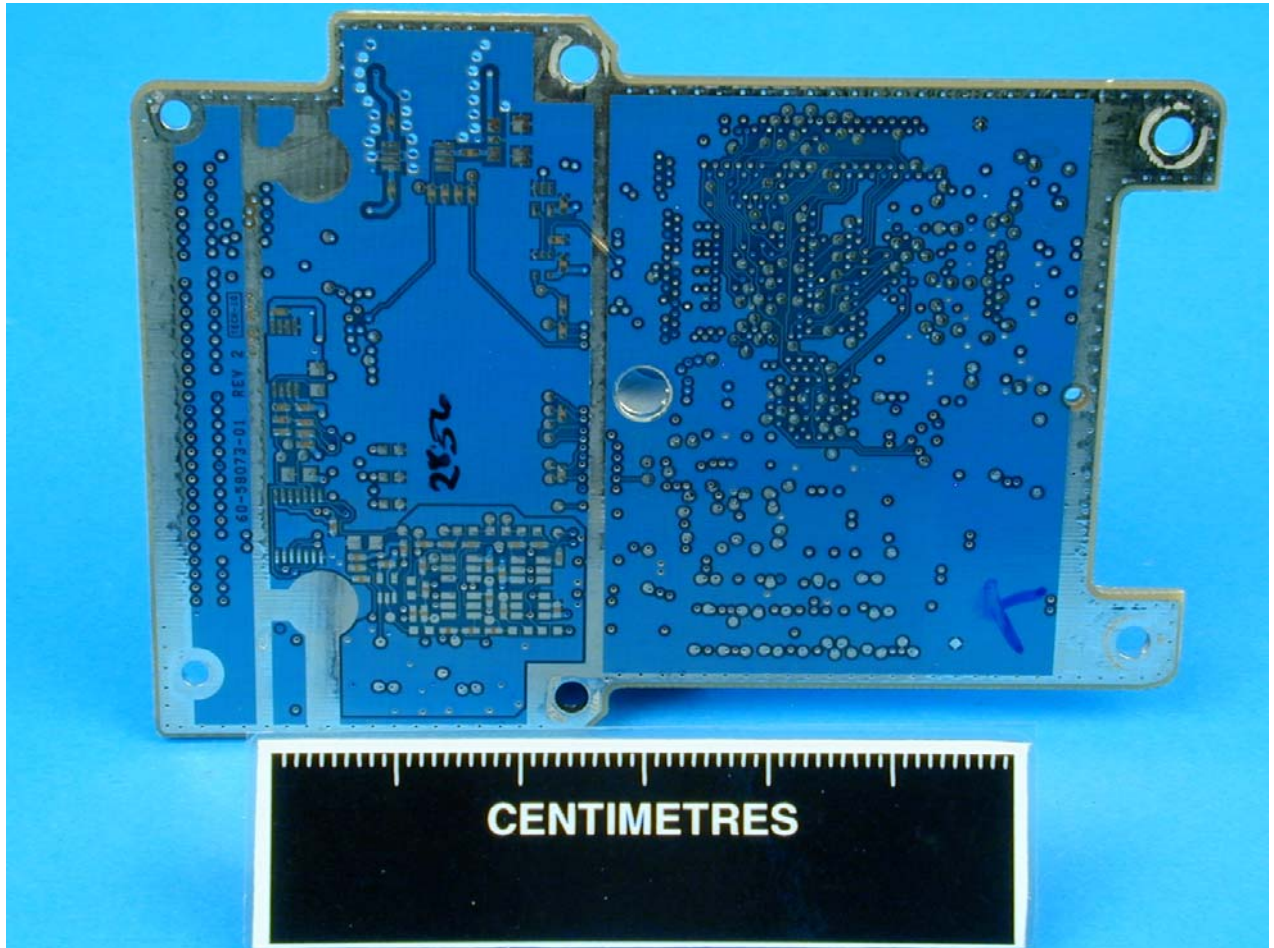
PHOTOGRAPHS OF EQUIPMENT



Photograph 5  
MC9010 Internal View

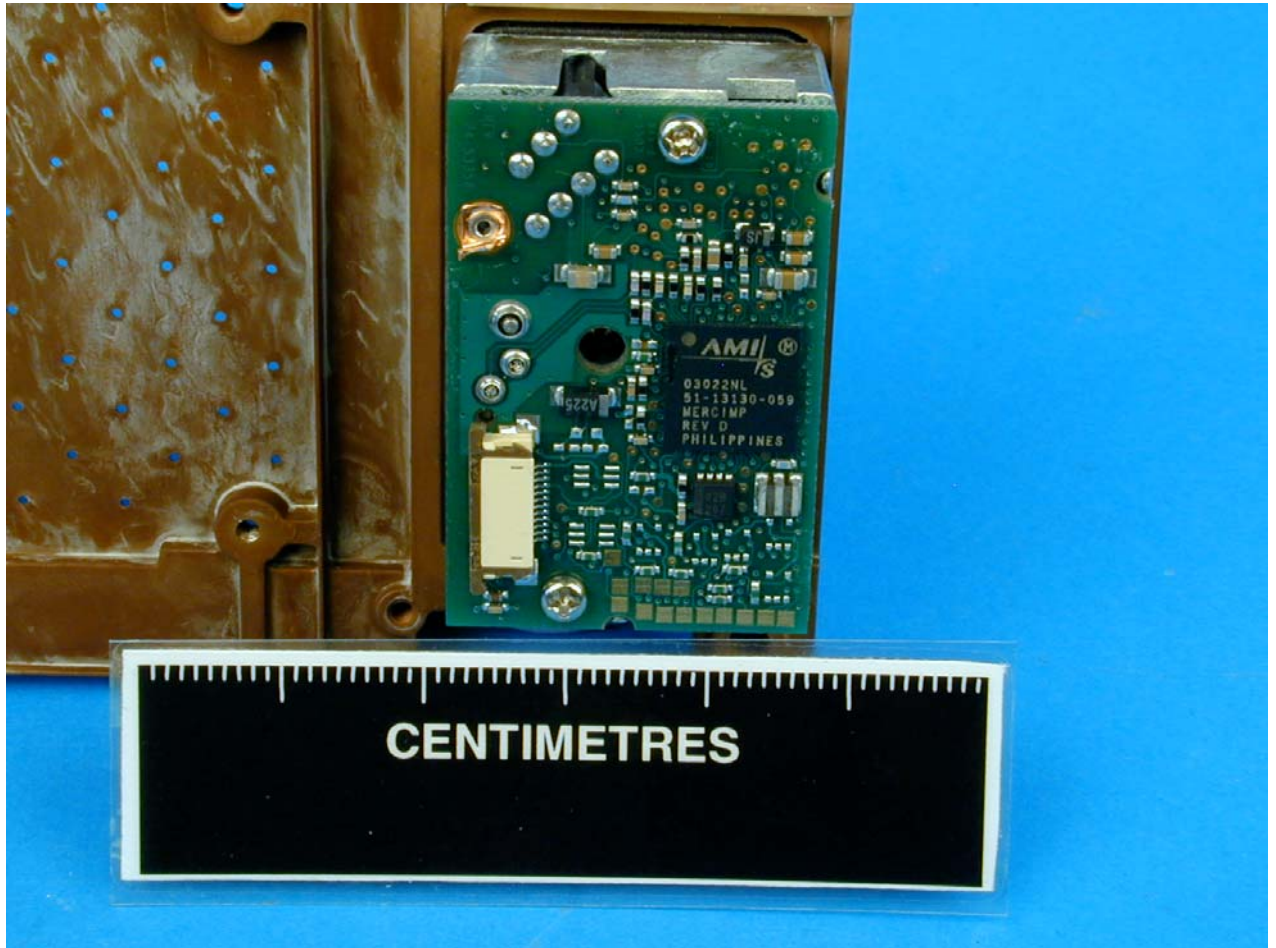


PHOTOGRAPHS OF EQUIPMENT



Photograph 6  
MC9010 Internal view

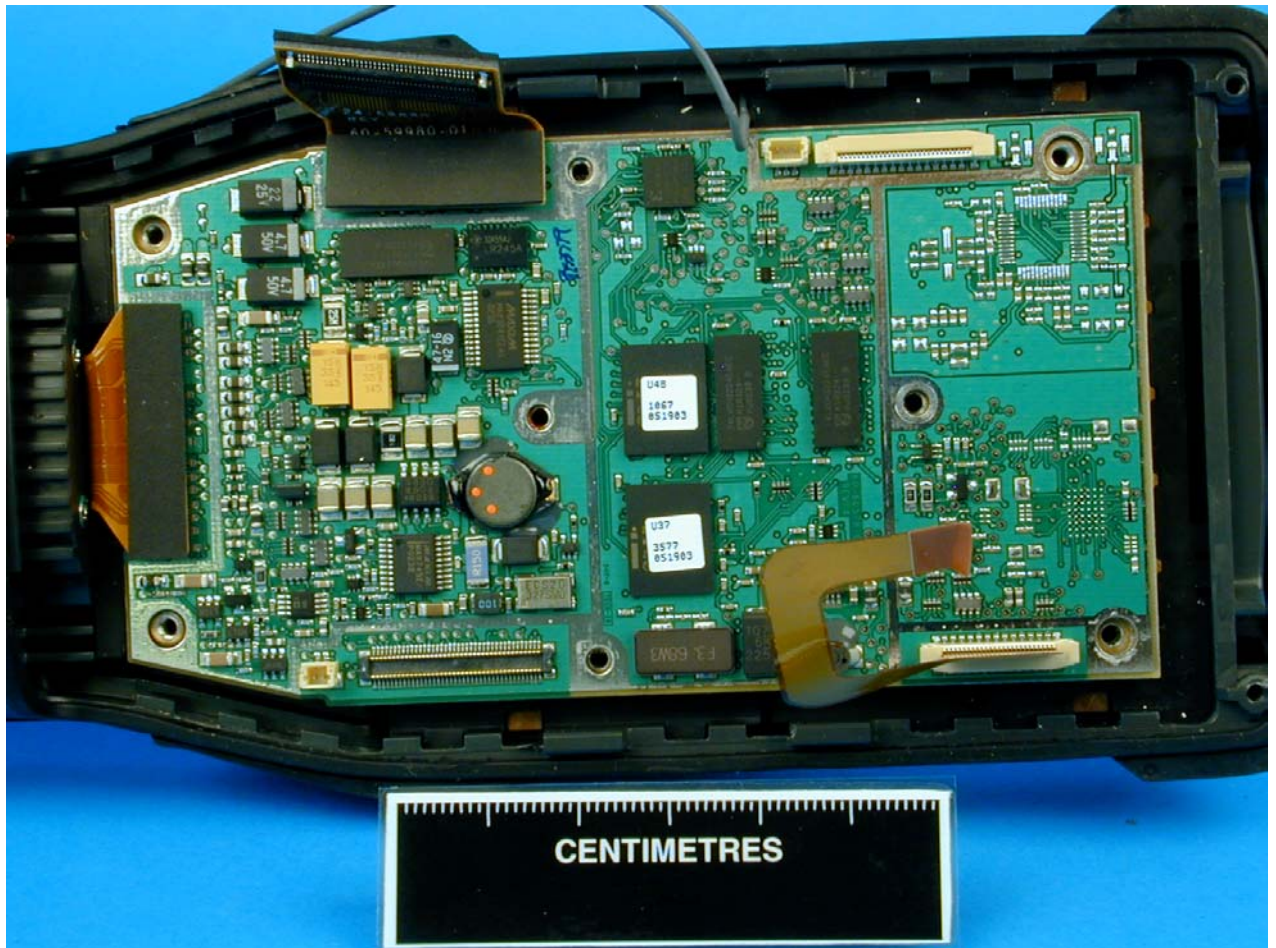
PHOTOGRAPHS OF EQUIPMENT



Photograph 7  
MC9010 Internal View



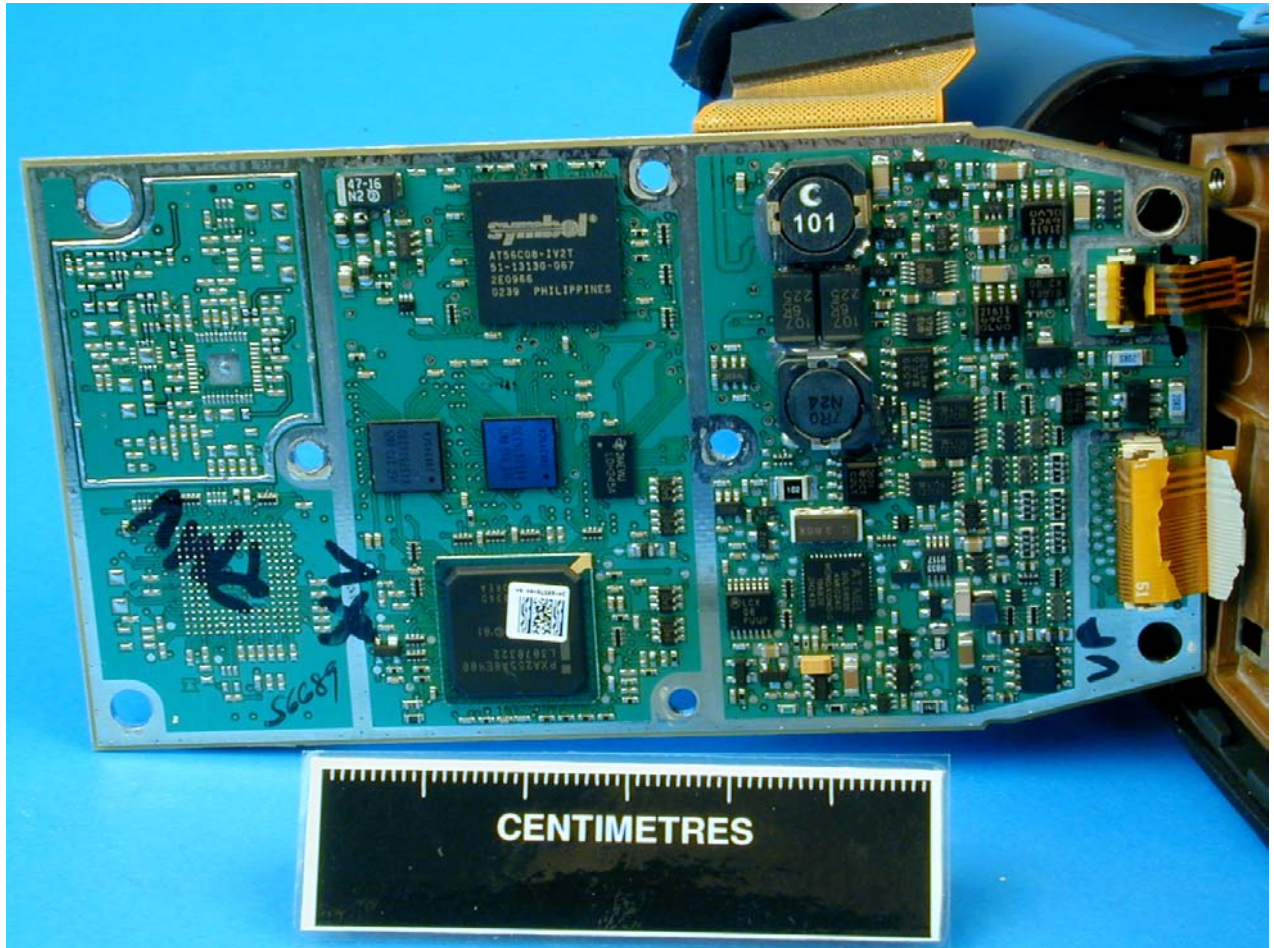
PHOTOGRAPHS OF EQUIPMENT



Photograph 8  
MC9010 Internal View



PHOTOGRAPHS OF EQUIPMENT



Photograph 9  
MC9010 Internal View

PHOTOGRAPHS OF EQUIPMENT




Photograph 10  
MC9010 View of Symbol LA-3021 Radio Card



**MANUFACTURERS LABEL DIAGRAM**

LASERLICHT - NICHT IN DEN STRAHL BLICKEN.  
LASER KLASSE 2  
LUMIÈRE LASER -NE PAS REGARDER DANS  
LE FAISCEAU APPAREIL À LASER DE CLASSE 2.  
CAUTION-LASER LIGHT. DO NOT STARE INTO BEAM.  
CLASS 2 LASER PRODUCT 630-680 nM, 1 mW







**SYMBOL TECHNOLOGIES INC., HOLTSVILLE, N.Y.**

**P/N: MC9010XXXXX                      MADE IN XXXXXXX**

**MFD: XXXXXXXXX,XXXX                      XXXX**

(S)S/N: BAR CODE  
**XXXXXXXXXXXX**

**THIS DEVICE CONTAINS AN APPROVED RF MODULE  
TYPE: LA3021  
FCC ID: H9PLA3021-100  
IC: 15491021685A                      11-16V  /2A**

  **0168** 

MC9010 Label View



**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](http://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	$\pm 2 \times 10^{-7}$ x 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	$\pm 2 \times 10^{-7}$ x Centre Frequency
Amplitude	$\pm 3.4$ dB

For Effective Radiated Power (ERP) measurements: -

Amplitude	$\pm 1.45$ 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 (Not UKAS Accredited).

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