
REPORT ON

Simultaneous Transmitters: Limited FCC Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC9060 Terminal

FCC ID: H9PMC9060B

Report No OR612324/01 Issue 1

April 2004

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DATED

15-04-04

DISTRIBUTION

Symbol Technologies

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ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Part 15. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineers;


M Larkin


G Lawler





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SECTION 1

REPORT SUMMARY

Simultaneous Transmitters: Limited FCC Testing in support of an
Application for Grant of Equipment Authorisation
of a Symbol MC9060 Terminal



1.1 STATUS

EQUIPMENT UNDER TEST OBJECTIVE	MC9060 Terminal To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
NAME AND ADDRESS OF CLIENT	Symbol Technologies Inc One Symbol Plaza Holtsville 11742-1300, New York United States of America
TYPE NUMBER	MC9060
PART NUMBER	MC9060-SK0H9AEA7WW
SERIAL NUMBER	ALP76725
HARDWARE VERSION	Rev 6 (To be released as Rev A)
DECLARED VARIANTS	None
TEST SPECIFICATION/ISSUE/DATE	FCC CFR 47: Part 15, Subpart C, August 2002
NUMBER OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Commercial In Confidence
INCOMING RELEASE DATE	Declaration of Build Status 22 nd March 2004
DISPOSAL REFERENCE NUMBER DATE	Held pending disposal Not Applicable Not Applicable
START OF TEST	22 nd March 2004
FINISH OF TEST	25 th March 2004
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.



1.2 INTRODUCTION

The information contained within this report is intended to show limited verification of compliance of the Symbol Technologies Inc MC9060 Terminal to the requirements of FCC Specification Parts 15 C for Simultaneous Transmission of Co-Located Transmitters.

Testing was carried out in support of an application for Grant of Equipment Authorisation Type 2 Permissive Change in the name of Symbol Technologies Inc.

The purpose of this Test Report is to show compliance for Simultaneous Radio Operation of RLAN and Bluetooth.

Testing of the MC9060 Terminal for 802.11B RLAN and Bluetooth connectivity can be found in BABT Report Number OR611522/02.



1.2.1 DECLARATION OF BUILD STATUS

MAIN EUT		
MANUFACTURING DESCRIPTION	Mobile Computer	
MANUFACTURER	Symbol Technologies Inc	
TYPE	MC9060	
PART NUMBER	MC9060-SK0H9AEA7WW	
SERIAL NUMBER	ALP76725, ALP76726,	
HARDWARE VERSION	Rev 6 (To be released as Rev A)	
COUNTRY OF ORIGIN	United States of America	
FCC ID	H9PMC9060B	
INDUSTRY CANADA ID	1549D-MC9060B	
TECHNICAL DESCRIPTION	The unit supplied for testing is a Symbol MC9060 Mobile Computer, which offers 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity with the following options: Imager; Colour (touch) display; 128/64 memory option; 28 Key Keyboard; PPC2003; Audio; Bluetooth	
BATTERY/POWER SUPPLY		
MANUFACTURING DESCRIPTION	Lithium Battery	
MANUFACTURER	Symbol Technologies Inc.	
TYPE	N/A	
PART NUMBER	21-62960-01	
VOLTAGE	7.2V	
COUNTRY OF ORIGIN	USA	
MODULES		
MANUFACTURING DESCRIPTION	Main Terminal Module with Embedded RLAN Radio	Bluetooth Module
MANUFACTURER	Symbol Technologies Inc	Symbol Technologies Inc
COUNTRY OF ORIGIN	USA	USA
TYPE	21-64436	21-64381
POWER	7 - 16V	3.3V
TRANSMITTER OPERATING RANGE	2400 – 2483.5MHz	2400 – 2483.5MHz
TRANSMITTER POWER	100mW (+20dBm)	100mW (+20dBm)
RECEIVER OPERATING RANGE	2400 – 2483.5MHz	2400 – 2483.5MHz
INTERMEDIATE FREQUENCIES	374MHz	Direct Conversion
EMISSION DESIGNATOR	11M0F1D	1M00F1D
DHSS/FHSS/COMBINED	DSSS	FHSS
FCC ID	H9P2164436	H9P2164381
INDUSTRY CANADA ID	1549D-2164436	1549D-2164381
ANCILLARIES		
MANUFACTURING DESCRIPTION	Headset	
MANUFACTURER	VXI Corporation	
TYPE	VXI 61-SYB	
PART NUMBER	50-11300-050	
SERIAL NUMBER	Not Serialised	
HARDWARE VERSION	Rev A	
COUNTRY OF ORIGIN	USA	

Signature

Date

22 March 2004

D of B S Serial No

OR612324

BABT formally certifies that the manufacturer's declaration as reproduced in this report, is a true and accurate record of the original received from the applicant.



1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

Test	Spec Clause	Test Description	Result	Levels/Comments
2.1	15.247(c)	Spurious Radiated Emissions	Pass	

1.4 OPINIONS AND INTERPRETATIONS

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.



1.5 PRODUCT INFORMATION

1.5.1 Technical Description

The unit supplied for testing is a Symbol MC9060 Mobile Computer, which offers 2.4GHz 802.11b Wireless LAN and Bluetooth connectivity with the following options: Imager; Colour (touch) display; 128/64 memory option; 28 Key Keyboard; PPC2003; Audio; Bluetooth

The terminal utilizes the approved Symbol 21-64436 Main Terminal Module with embedded RLAN Radio and the approved Symbol 21-64381 Bluetooth Module. FCC ID numbers are detailed in Section 1.2.1 "Declaration of Build Status".

1.5.2 Modes of Operation

Applicable testing was carried out with the EUT transmitting at maximum power as detailed in Section 1.5.3 "Test Configuration".

The Client has declared that the Symbol 21-64436 and the Symbol 21-64381 Modules are Co-Located and are capable of Simultaneously Transmitting.

Testing of the MC9060 Terminal for individual transmitter modes, 802.11B RLAN and Bluetooth connectivity can be found in BABT Report Number OR611522/02.

1.5.3 Test Configuration

Test Mode: RLAN and Bluetooth Transmitting Simultaneously on the following frequencies;

RLAN	Bluetooth
2412MHz	2480MHz
2462MHz	2402MHz

1.6 TEST CONDITIONS

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

For all tests, the Symbol MC9060 Terminal was powered by its own internal battery and fitted with a headset.

1.7 DEVIATIONS FROM THE STANDARD

Not Applicable

1.8 MODIFICATION RECORD

Not Applicable



SECTION 2

TEST DETAILS

Simultaneous Transmitters: Limited FCC Testing in support of an
Application for Grant of Equipment Authorisation
Of a Symbol MC9060 Terminal



2.1 SPURIOUS RADIATED EMISSIONS

2.1.1 Test Standard

FCC CFR 47: Part 15 Subpart C, Section 15.247(c)

2.1.2 Equipment Under Test

MC9060 Terminal

2.1.3 Date of Test

22nd March 2004

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.1” within the Test Equipment Used table shown in Section 3.1.

2.1.5 Test Procedure

Test Performed in accordance with ANSI C63.4.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. 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. The list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 26GHz were then formally measured using Peak and Average Detectors, as appropriate.

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



2.1 SPURIOUS RADIATED EMISSIONS - continued

2.1.5 Test Procedure - continued

The limits for Spurious Emissions have been calculated, as shown in the table below using the following formula:

Field Strength of Carrier -(20dB)

Where:

Field Strength is measured in dBμV/m

Test Mode	Carrier Frequency MHz	Carrier Field Strength dBμV/m	Limit for Spurious Emissions dBμV/m
Bluetooth	2480	111.5	91.5*
Bluetooth	2402	109.3	89.3*

*In accordance with FCC guidelines, these are the least stringent results and therefore these are the limits that will be used for any emissions that are found outside the restricted bands.

In accordance with FCC Public Notice DA 00-705, Released 30th March 2000, Section 15.247(c) Spurious Radiated Emissions "If the dwell time per channel of the hopping signal is less than 100ms, then the reading obtained with the 10Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100\text{ms})$, in an effort to demonstrate compliance with the 15.209 limit the following adjustment has been calculated for use with Average Measurements only;

Dwell Time = 5.81ms this is derived from;

Total slot time per time slot for DH5 packet $625\mu\text{s} \times 5 = 3.125\text{ms}$

Actual transmit time during this time slot is 2.905ms and the reply time slot after each DH5 packet is 625μs.

Total time slot length per channel $3.125 + 0.625 = 3.75\text{ms}$.

Multiply Total time slot length per channel by 32 channels per hop sequence $32 \times 3.75 = 120\text{ms}$

It is therefore possible to have a maximum of two hop sequences in any given 100ms period, a single channel could occur twice within any 100ms time window. $2 \times 2.905 = 5.81\text{ms}$

Therefore; the Bluetooth Duty Cycle Correction Factor for the EUT is $20 \log (5.81/100) = -24.7\text{dB}$



2.1 SPURIOUS RADIATED EMISSIONS - continued

2.1.6 Test Results

30MHz - 1GHz Frequency Range

Equipment Designation: Intentional Radiator.

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

EUT Tx on RLAN: 2412MHz and BLUETOOTH: 2480MHz

Frequency	Antenna		Turntable	Field Strength at 3m	Specification Limit
	Pol	Height	Azimuth		
MHz	H/V	cm	Deg	dBµV/m	dBµV/m
208.4	V	100	169	20.3	91.5
497.6	V	102	343	27.3	91.5
579.5	V	100	000	25.8	91.5
527.1	V	100	331	32.1	91.5
581.3	V	102	032	25.3	91.5
748.0	H	100	217	36.6	91.5

EUT Tx on RLAN: 2462MHz and BLUETOOTH: 2402MHz

Frequency	Antenna		Turntable	Field Strength at 3m	Specification Limit
	Pol	Height	Azimuth		
MHz	H/V	cm	deg	dBµV/m	dBµV/m
208.3	V	100	162	19.5	89.3
497.6	V	100	000	27.2	89.3
519.2	V	100	338	26.4	89.3
527.3	V	100	326	32.0	89.3
581.3	V	100	027	25.3	89.3
748.0	H	100	213	36.1	89.3

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree



2.1 SPURIOUS RADIATED EMISSIONS - continued

2.1.6 Test Results - continued

1GHz - 26GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c) for Radiated Emissions (1GHz – 26GHz).

EUT Tx on RLAN: 2412MHz and BLUETOOTH: 2480MHz

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBμV/m	dBμV/m	dBμV/m	dBμV/m
2.04	V	100	192	44.2	91.5	N/A	N/A
2.45	V	100	093	56.4	91.5	N/A	N/A
2.54	V	117	084	66.5	91.5	N/A	N/A
4.08	V	100	308	53.8	74.0	44.8	54.0
4.82	V	108	216	52.8	74.0	44.0	54.0
4.96	V	100	223	52.7	74.0	43.4	54.0
7.44	V	100	193	55.1	74.0	47.4	54.0

Note: The Measurements in the above table marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205) and hence Average Measurements are not required.



2.1 SPURIOUS RADIATED EMISSIONS - continued

2.1.6 Test Results - continued

1GHz - 26GHz Frequency Range

Equipment Designation: Intentional Radiator.

The EUT met the requirements of FCC CFR 47: Part 15 Subpart C, Section 15.247(c) for Radiated Emissions (1GHz – 26GHz).

EUT Tx on RLAN: 2462MHz and BLUETOOTH: 2402MHz

Frequency	Antenna		Turntable	Peak Field Strength	Peak Limit	Average Field Strength	Average Limit
	Pol	Height	Azimuth				
GHz	H/V	cm	deg	dBµV/m	dBµV/m	dBµV/m	dBµV/m
2.34	V	100	085	51.6	74.0	33.8	54.0
2.41	V	100	095	46.9	89.3	N/A	N/A
2.50	V	100	053	48.9	74.0	41.8	54.0
2.56	V	100	068	45.2	89.3	N/A	N/A
4.18	V	100	262	52.8	74.0	35.2	54.0
4.76	V	100	184	50.6	74.0	47.8	54.0
4.80	V	103	157	51.8	74.0	39.5	54.0
7.21	V	117	181	56.3	89.3	N/A	N/A

Note: The Measurements in the above table marked N/A are Not Applicable because the frequency does not fall within the Restricted Band (15.205) and hence Average Measurements are not required.

ABBREVIATIONS FOR ABOVE TABLES

H Horizontal Polarisation
Pol Polarisation

V Vertical Polarisation
deg degree



2.1 SPURIOUS RADIATED EMISSIONS - continued

2.1.7 Set Up Photograph



Spurious Radiated Emissions Set Up Photograph



SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

Item	Instrument	Manufacturer	Type No	Serial No	EMC / INV No	Cal. Due
Section 2.1						
1	Spectrum Analyser	HEW	8542E	3617A00165_00154	2286	09/12/2004
2	Bilog Antenna	SCH	CBL6143	-	2860	11/04/2004
3	Turntable Controller	H-D	HD 050	050/396	2528	TU
4	Screened Room 5	SIE	EAC54300	NA	2533	18/09/1999
5	Low Noise Amplifier	MIQ	AMF-3d-001080-18-13P	UNK	2457	TU
6	Double Ridge Guide Antenna	EMC	3115	97015079	2397	04/07/2004
7	Signal Generator	HEW	8673B	2147A00423	954	14/06/2004
8	Test Receiver	ROH	ESIB40	100181	2972	08/11/2004
9	Solid State Amplifier	AVA	AWT-18036	F13365 8452	1081	26/06/2004
10	Signal Amplifier	AVA	AMT-26177-33	6669	2072	26/06/2004
11	Horn Antenna	EMCO	3115	-	502	04/07/2004
12	Antenna Mast	EMCO	2070	-	-	TU
13	Antenna Mast Controller	EMCO	2090	-	-	TU
14	High Pass Filter	RLC	F-100-4000-5-R	-	4468	TU

Key To Manufacturers

AVA	Avantek
EMC	Emco
FLA	Flann
H-D	HD GmbH
HEW	Hewlett Packard
MIQ	Miteq Corp
RLC	RLC Electronics
ROH	Rohde & Schwarz
SCH	Schaffner
SIE	Siemens



3.2 MEASUREMENT UNCERTAINTY

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

IN THE FREQUENCY RANGE 30MHz TO 1000MHz		
TEST	FREQUENCY	AMPLITUDE
For Radiated Emissions, Quasi-Peak Measurements taken in Zero Span using the Hewlett Packard EMI Receiver and Bilog Antenna	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$	5.15dB calculated in accordance with CISPR 16-4
IN THE FREQUENCY RANGE 1GHz TO 26GHz		
TEST	FREQUENCY	AMPLITUDE
For Spurious Radiated Emissions measurements	$\pm 2 \times 10^{-7} \times \text{Centre Frequency}$	$\pm 3.4\text{dB}$



SECTION 4

EUT PHOTOGRAPH



4.1 EUT PHOTOGRAPH



Front View



SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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APPENDIX A

TITCHFIELD 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