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Symbol Technologies

Emissions Testing
Performed on the
2.4 GHz 100mW Radio
Model: LA3021-100-US
FCC Part 15 Subpart B Class B (DoC)

Date of Test: May 19 - June 9, 1999

Job#: J99013298
Report#: J99013298a

Date of Report: June 23, 1999

Total No. of Pages Contained in this Report: 18 + Data Pages

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The results contained in this report were derived from measurements performed on the identified test samples. Any implied performance of other samples on this report is dependent on the representative of the samples tested.



Intertek Testing Services NA Inc.

1365 Adams Court, Menlo Park, CA 94025
Telephone 650-463-2900 FAX: (408) 528-2740 650-463-2910 Home Page www.worldlab.com

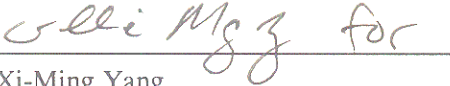


VERIFICATION OF COMPLIANCE
Report No. J99013298a

Verification is hereby issued to the named APPLICANT and is VALID ONLY for the equipment tested hereon for use under the rules and regulations listed below

Equipment Under Test:	2.4 GHz 100mW Radio
Trade Name:	Symbol Technologies
Model No.:	LA3021-100-US
Serial No.:	Not labeled
Applicant:	Symbol Technologies
Contact:	John Nagel
Address:	2145 Hamilton Avenue San Jose, CA 95121
Tel. number:	(408) 369-2677
Fax number:	(408) 369-2740
Applicable Regulation:	FCC Part 15, Subpart B, and Industry Canada ICES-003 issue 2
Equipment Class:	Class B
Test Site Location:	ITS - Site 2 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	May 19 - June 9, 1999

We attest to the accuracy of this report:


Xi-Ming Yang
Test Engineer


David Chernomordik, Ph.D.
EMC Site Manager

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1.0 Introduction

This report is designed to show compliance with the FCC Part 15, Subpart B Rules for an unintentional radiator. The test procedures, as described in American National Standards Institute C63.4-1992, were employed. A description of the product and operating configuration, the various provisions of the rules, the methods for determining compliance, and a detailed summary of the results are included within this test report.

2.0 Description of Equipment

The Symbol Technologies model LA3021-100-US is a 2.4 GHz 100mW Radio.

A preproduction version of the sample was received on May 19, 1999 in good condition.

3.0 Test Summary

Test results are given in full in section 5 and 6.

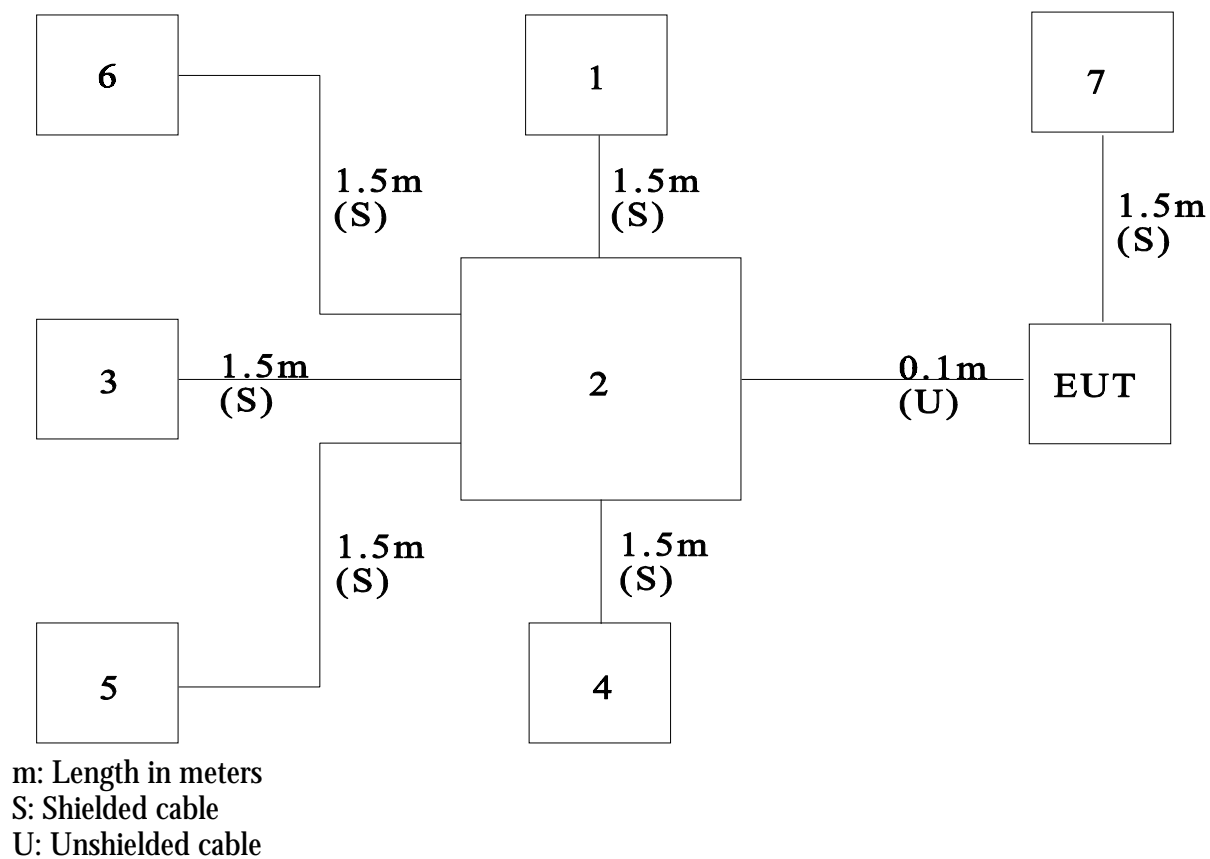
FCC Part 15 Subpart B Summary of Test Results			
Test Condition	Description	Class	Compliance Status
Conducted Emission (AC main)	0.45 MHz - 30 MHz	B	Pass
Radiated Emission	30 MHz - 1000 MHz	B	Pass

4.0 System Test Configuration

4.1 Support Equipment

Item #	Description	Model No.	Serial No.	FCC ID
1	CTX Monitor	CVP-5468A	N/A	DBLCVP-5468A
2	Dell Computer	POS3410-N500	F999999	DoC
3	Datatronics Modem	1200CK	07-317791	E2050V1200CK
4	H.P. Keyboard	SK0-2501K	M971019587	GYUR38SK
5	Microsoft Mouse	20A	03067960	C3K551
6	H.P. Printer	2225C	2809507863	DSI6XU2225
7	Cuschcraft Antenna	S2406B	N/A	N/A

4.2 Block Diagram of Test Setup



4.3 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C63.4 (1992).

4.4 Software Exercise Program

Software supplied by Symbol Technologies was used to exercise the EUT.

4.5 Mode of Operation During Test

The EUT was transmitting and receiving as in normal operating mode.

4.6 Modifications Required for Compliance

The following modifications were installed during compliance testing in order to bring the product into compliance (Please note that this list does not include changes made specifically by Symbol Technologies prior to compliance testing):

No modifications were made to the EUT by Intertek Testing Services.

4.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

5.0 Radiated Emissions

5.1 Radiated Emission Limits

The following radiated emission limits apply to Class B unintentional radiators:

Radiated Emissions Limits, Section 15.109(a)

Frequency MHz	Class B at 3m V/m	Class B at 3m dB(V/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Note: Three sets of units are commonly used for EMI measurement, decibels below one milliwatt (-dBm), decibels above a microvolt, dB(V), and microvolts (V). To convert between them, use the following formulas: $20 \text{ LOG}_{10} (V) = \text{dB}(V)$, $\text{dB}(m) = \text{dB}(V) - 107$.

5.2 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

where FS = Field Strength in dB(V/m)

RA = Receiver Amplitude (including preamplifier) in dB(V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB/m

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where FS = Field Strength in dB(V/m)

RR = RA - AG in dB(V)

LF = CF + AF in dB/m

Assume a receiver reading of 52.0 dB(V) is obtained. The antenna factor of 7.4 1/m and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB(V/m). This value in dB V/m was converted to its corresponding level in V/m.

$$RA = 52.0 \text{ dB(V)}$$

$$AF = 7.4 \text{ dB/m}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = RR + LF$$

$$FS = 23 + 9 = 32 \text{ dB(V/m)}$$

$$RR = 23.0 \text{ dB(V)}$$

$$LF = 9.0 \text{ dB}$$

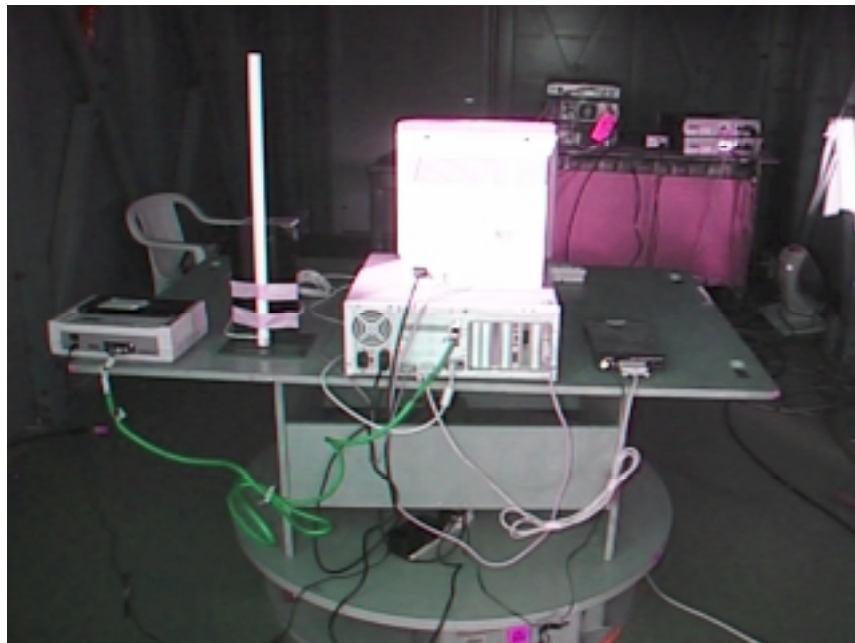
$$\text{Level in V/m} = \text{Common Antilogarithm } \{[32 \text{ dB(V/m)}]/20\} = 39.8 \text{ V/m}$$

5.3 Configuration Photographs - Radiated Emissions

Front



Back



5.4 Test Data

The results on the following page(s) were obtained when the device was tested in the condition described in section 4.

Results: Passed by 3.3 dB at 200.0 MHz

- Note:
- a) A complete scan from 30-1000 MHz was made with antenna oriented horizontally and vertically.
 - b) All emissions not reported are at least 20 dB below the limits
 - c) Analyzer setting: RBW \geq 100 kHz, VBW \geq 100 kHz
 Detector mode: Peak unless otherwise specified in the data page

ITS Intertek Testing Services

Company: Symbol Technologies
Project #: J99013298
Model: LA 3021-100-US
Engineer: Xi-Ming Yang
Date of test: June 9, 1999

FCC 15 Class B Radiated Emissions

Frequency	Antenna	Reading	Antenna	Cable	Pre-amp	Distance	Corrected	Limit	Margin
	Polarity		Factor	Loss		Factor	Reading		
MHz	H/V	dB(uV)	dB/m	dB	dB	dB	dB(uV/m)	dB(uV/m)	dB
60.0	H	31.1	4.7	0.0	0.0	0.0	35.8	40.0	-4.2
140.0	H	28.0	8.4	0.0	0.0	0.0	36.4	43.5	-7.1
160.0	H	31.1	8.8	0.0	0.0	0.0	39.9	43.5	-3.6
200.0	H	30.0	10.2	0.0	0.0	0.0	40.2	43.5	-3.3
240.0	H	31.0	11.0	0.0	0.0	0.0	42.0	46.0	-4.0
260.0	H	30.4	12.0	0.0	0.0	0.0	42.4	46.0	-3.6
280.0	H	30.0	12.1	0.0	0.0	0.0	42.1	46.0	-3.9
300.0	H	29.0	13.1	0.0	0.0	0.0	42.1	46.0	-3.9
380.0	H	25.0	15.0	0.0	0.0	0.0	40.0	46.0	-6.0
450.0	H	25.4	16.0	0.0	0.0	0.0	41.4	46.0	-4.6
720.0	H	11.0	20.4	0.0	0.0	0.0	31.4	46.0	-14.6

- Note:
1. All measurement were made at 3 meters
 2. Negative signs (-) in the margin column signify levels below the limit.

6.0 AC Mains Line-Conducted Emissions

6.1 Line Conducted Emission Limits

The following AC line conducted emission limits apply to Class B unintentional radiators:

Conducted Emissions Limits, Section 15.107(a)

Frequency MHz	Class B V	Class B dB(V)
0.45 - 1.705	250	48
1.705 to 30.000	250	48

Note: Three sets of units are commonly used for EMI measurement, decibels below one milliwatt (-dBm), decibels above a microvolt, dB(V), and microvolts (V). To convert between them, use the following formulas: $20 \text{ LOG}_{10} (V) = \text{dB}(V)$, $\text{dB}(m) = \text{dB}(V) - 107$.

6.2 Configuration Photographs - Line Conducted Emissions

Front



Back



6.3 Test Data

The results on the following page(s) were obtained when the device was tested in the condition described in section 4.

Results: Passed by 4.2 dB at 0.49 MHz

- Note: a) A complete scan from 0.45 - 30 MHz was made.
- b) Analyzer setting: RBW \geq 9 kHz, VBW \geq 9 kHz
Detector mode: Peak unless otherwise specified in the data page

hp

ITS Menlo Park
EMISSION LEVEL [dBuV]

9 Jun 1999 18:45:18

100

80

60

40

20

.45

1

10

30

FREQUENCY [MHz]

FCC, Pt 15 - AC LINE CONDUCTED
SYMBOL TECHNOLOGIES INC
M/N: LA3021-100-US
HOT [X] NEUTRAL []

CLASS A

CLASS B

hp

ITS Menlo Park
EMISSION LEVEL [dBuV]

9 Jun 1999 18:58:11

100

80

60

40

20

.45

1

10

30

FREQUENCY [MHz]

FCC, Pt 15 - AC LINE CONDUCTED
SYMBOL TECHNOLOGIES INC
M/N: LA3021-100-US
HOT [] NEUTRAL [X]

CLASS A

CLASS B

=====
ITS Menlo Park

9 Jun 1999 18:45:18
=====

3. FCC CFR 47, Pt 15

3.1 FCC, Pt 15 - AC LINE CONDUCTED
=====

SYMBOL TECHNOLOGIES INC

M/N: LA3021-100-US

HOT [X] NEUTRAL []

PEAKS FOUND ABOVE 37 dBuV

PEAK#	FREQ (MHz)	AMPL (dBuV)
1	.4935	43.8
2	.5390	42.0
3	.6268	38.2
4	.6732	39.7
5	.7169	37.6

=====
ITS Menlo Park

9 Jun 1999 18:58:11
=====

3. FCC CFR 47, Pt 15

3.1 FCC, Pt 15 - AC LINE CONDUCTED
=====

SYMBOL TECHNOLOGIES INC

M/N: LA3021-100-US

HOT [] NEUTRAL [X]

PEAKS FOUND ABOVE 38 dBuV

PEAK#	FREQ (MHz)	AMPL (dBuV)
1	.4914	43.4
2	.5367	41.8
3	.6704	39.3

7.0 Test Equipment

7.1 Equipment List

All test sites are FCC listed, IC accepted, and NVLAP accredited.

Industry Canada identifier number	IC 2059
NVLAP Lab Code	200201-0

Instruments used for emission compliance tests described in this report are listed below:

TEST EQUIPMENT FOR EMISSION TESTING						
EQUIPMENT	MFG.	MODEL	SERIAL NUMBER	CAL. INTERVAL (Months)	CAL. DUE DATE (m/d/y)	USED
Bi-Log Antenna	EMCO	3143	9509-1164	12	3/20/00	X
Pre-Amplifier	CDI	P950	N/A	12	1/10/00	X
LISN	Solar Electronics	8028-50-TS-24	ETL343	12	12/7/99	X
LISN	Solar Electronics	8028-50-TS-24	ETL433	12	12/7/99	X
Spectrum Analyzer	Hewlett Packard	8591EM	3801A01250	12	2/22/00	X
Spectrum Analyzer w/85650 QP Adaptor	Hewlett Packard	8568B	1912A00553 2521A01021	6	2/12/00	X

7.2 Measurement Uncertainty

7.2.1 Radiated Emission - 3m Open Site Test Distance

The uncertainty in the measured field strength is estimated as follows, for a minimum confidence probability of 95 %

Freq. Range	Detection Mode	Uncertainty
30 MHz to 200 MHz	Quasi-peak	± 4.4 dB
200 MHz to 1000 MHz	Quasi-peak	+ 5.0 / - 3.6 dB

7.2.2 Conducted Emission - AC Supply

The uncertainty in the measured voltage is estimated as follows, for a minimum confidence probability of 95 %

Freq. Range	Detection Mode	Uncertainty
9 kHz to 150 kHz	Average	± 2.1 dB
	Quasi-peak	± 2.5 dB
150 kHz to 30 MHz	Average	± 2.4 dB
	Quasi-peak	± 2.6 dB

7.3 Measurement Traceability

All measurements described in this report are traceable to National Institute of Standards and Technology (NIST) standards.

8.0 **Miscellaneous Information or Other Comments**

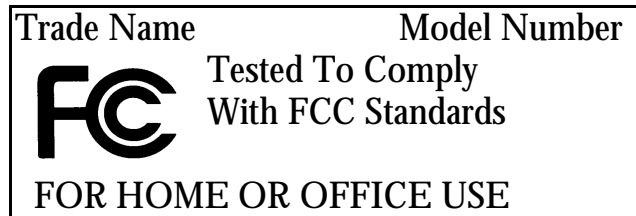
None.

8.1 Labeling - USA

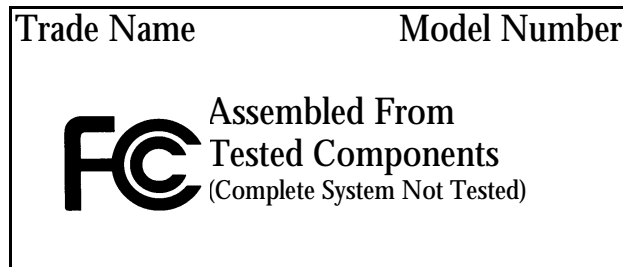
Products subject to Declaration of Conformity (DoC) shall be labeled as shown below. The label shall be located in a conspicuous location on the device and shall contain the unique identification described in FCC Section 2.1074.

The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase, as described in FCC Section 2.925(d). "Permanently affixed" means that the label is etched, engraved, stamped, silkscreened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting, or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable.

(I) If the product is authorized based on testing of the product or system



(ii) If the product is authorized based on assembly using separately authorized components and the resulting product is not separately tested:



Canadian Emissions and Labeling Requirements

The Canadian Government has announced an amendment of the radio act which will require computing equipment to comply with EMI Specifications in Canada. The effective date for products imported into Canada is January 31, 1989.

The intent of the amendment is to establish Canadian Regulations which are harmonized with the existing FCC Regulations. As such, no retesting is required and devices which have been tested and comply with the FCC Specifications (Class A or B) also comply with the Canadian Specification (Class A or B).

A record of the measurements and results shall be retained by the manufacturer or importer for a period of at least five years and made available for examination on the request of the Canadian Government.

A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other restrictions it is not feasible to affix a label to the apparatus, the notice may be in form of a statement included in the user's manual.

A suggested text for the notice, in English and French, is as follows:

This Class [*] digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe [*] respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

*Insert either "A" or "B" but not both as appropriate for the equipment requirements.

8.3 Compliance Information - USA

If a product must be tested and authorized under a Declaration of Conformity, a compliance information statement shall be supplied with the product at the time of marketing or importation, containing the following information:

- (a) Identification of the product, e.g., name and model number.
- (b) A statement that the product complies with Part 15 of the regulations:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

- © The identification, by name, address and telephone number, of the responsible party. The responsible party for a Declaration of Conformity must be located within the United States.

The compliance information statement shall be included in the user's manual or as a separate sheet.

The users manual or instruction manual shall also caution the user that:

Changes or modifications not expressly approved the party responsible for compliance could void the user's authority to operate this equipment.

8.4 Manufacturer's Certification

Declaration of Conformity

Standard to which conformity is declared: FCC Part 15 Subpart B Class B

Manufacturer/Importer's Information

Name: Symbol Technologies, Inc.

Address: 6480 Via Del Oro

San Jose, CA 95119-1208

Telephone Number: 408-528-2600

Equipment Information

Type of Equipment: 2.4 GHz Part 15 Spread Spectrum Transceiver

Trade Name: Spectrum 24© Wireless LAN Card

Model Number: LA3021-100

Test Report Reference: Report#: J99013298a

I, the undersigned, hereby declare that the equipment specified above conforms to Part 15 of the FCC Rules.

John Nagel
(Signature)

John Nagel Sr. EMC Engineer
(Name & Title)

October 14, 1999
(Date)