


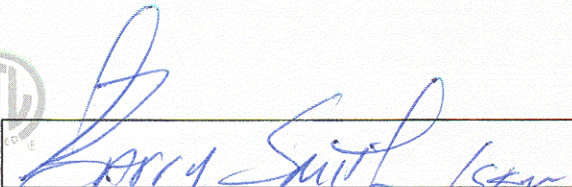


FCC Part 15, Class B (DoC) Emissions Test Report
 for
Symbol Technologies
 on the
Spectrum Wireless LAN
Model: LA-4111

Test Report #: J99022686f
 Date of Report: September 30, 1999

Job #: J99022686
 Date of Test: September 24-27, 1999

Total No. of Pages Contained in this Report: 19 + data pages



 	Barry Smith, Test Engineer
 	David Chernomordik, Ph.D., EMC Site Manager

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Part 15 Class B (DoC) and ANSI C63.4-1992, Rev. 8/99



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VERIFICATION OF COMPLIANCE
Report No. J99022686f

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:	Spectrum Wireless LAN
Trade Name:	Symbol Technologies
Model No.:	LA-4111
Serial No.:	Not Labeled
Applicant:	Symbol Technologies
Contact:	Mr.Norm Nelson
Address:	2145 Hamilton Ave. San Jose CA 95125 USA
Tel. number:	408/369-2649
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 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	September 24-27, 1999



We attest to the accuracy of this report:



Barry Smith
Barry Smith
Test Engineer

David Chernomordik
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 Spectrum Wireless LAN is a radio in PCMCIA format that allows a laptop to remotely hook up to a LAN.

A pre-production version of the sample was received on September 24, 1999 in good condition.

3.0 Test Summary

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

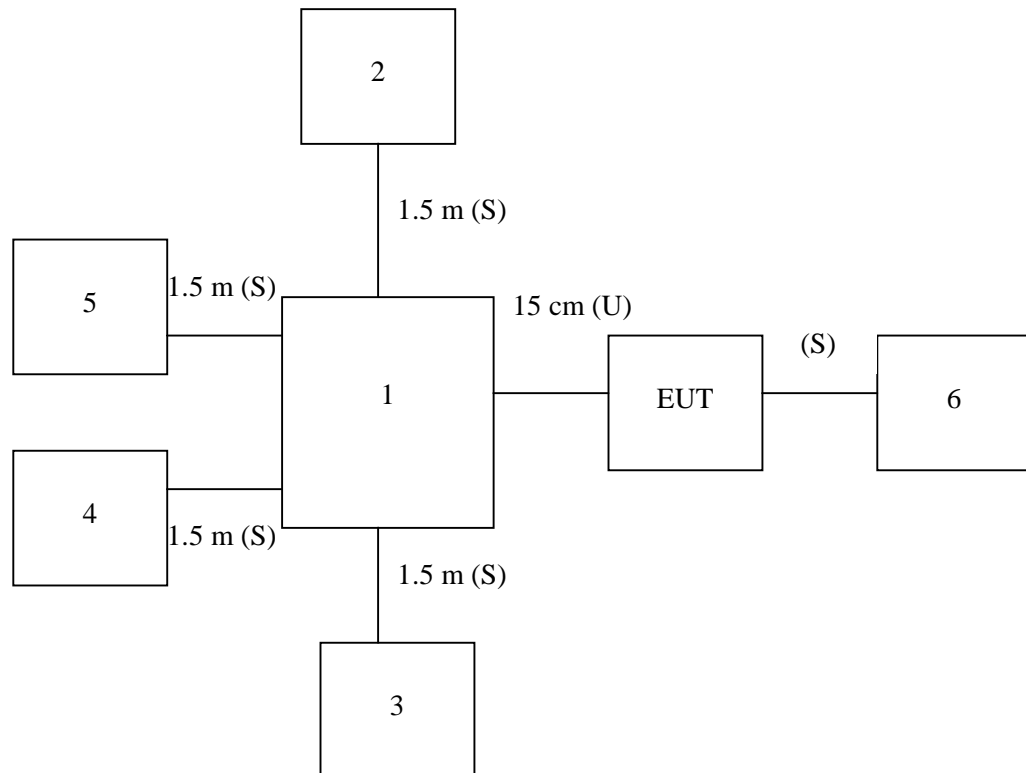
FCC Part 15 Subpart B Summary of Test Results			
Test Condition	Description	Class	Compliance Status
Conducted Emission (AC main)	0.45 MHz - 30 MHz	B	Pass
Radiated Emission	30 MHz - 1000 MHz	B	Pass

4.0 System Test Configuration

4.1 Support Equipment

Item #	Description	Model No.	Serial No.	FCC ID
1	Compaq Computer	Contura 400CX	2800A	CNT75MB2CA
2	ViewSonic Monitor	7034T	3732285769	FV17034T
3	Compaq Mouse	M-S28	ID768AN56891	DZL210472
4	HP Printer	2225C+	2921S45711	DSI6XU2225
5	Datronics Modem	1200CK	017-247336	E2050V1200CK
6	Antennas	-	-	-

4.2 Block Diagram of Test Setup



* = EUT	S = Shielded;	F = With Ferrite
** = No ferrites on video cable	U = Unshielded	

4.3 Justification

The EUT was configured as a customer would normally use it.

4.4 Software Exercise Program

The software provided by Symbol was used to exercise the EUT.

4.5 Mode of Operation During Test

The EUT was set to continuously transmit.

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 installed by Intertek Testing Services.

4.7 Additions, deviations and exclusions from standards

No additions, exclusions, or deviations were made to the 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 $\mu\text{V/m}$	Class B at 3m $\text{dB}(\mu\text{V/m})$
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, $\text{dB}(\mu\text{V})$, and microvolts (μV). To convert between them, use the following formulas: $20 \text{ LOG}_{10}(\mu\text{V}) = \text{dB}(\mu\text{V})$, $\text{dB}(m) = \text{dB}(\mu\text{V}) - 107$.



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(μV/m)

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

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(μV/m)

RR = RA - AG in dB(μV)

LF = CF + AF in dB/m

Assume a receiver reading of 52.0 dB(μV) is obtained. The antenna factor of 7.4 dB/m and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 23 dB(μV). This value in dBμV/m was converted to its corresponding level in μV/m.

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

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

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

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

$$FS = RR + LF$$

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

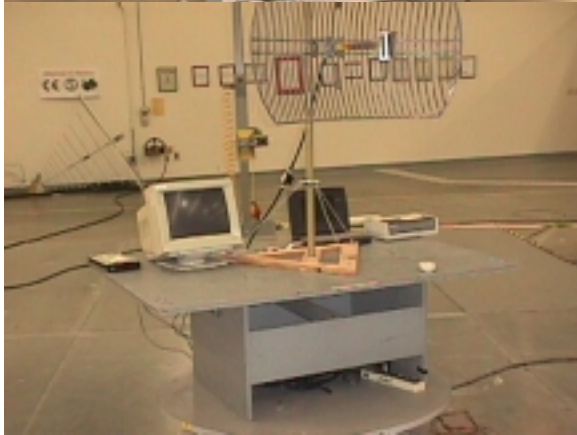
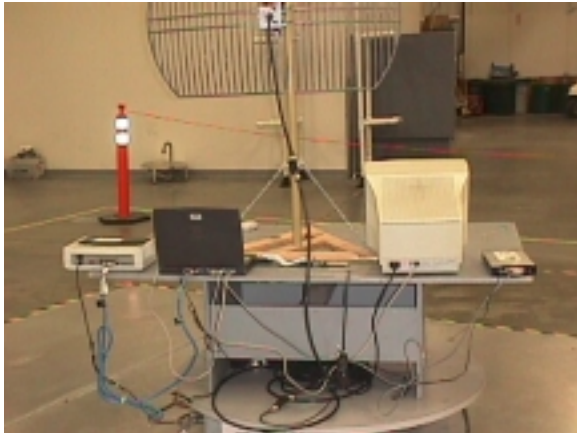
$$RR = 23.0 \text{ dB}(\mu\text{V})$$

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

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

5.3 Configuration Photographs

Worst-Case Radiated Emission at 110 MHz



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 3.6 dB at 110 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



Radiated Emissions Test Data

Company: Symbol		Model #: H9PLA4111	Standard_	FCC § 15B
EUT: Trilogy Direct Sequence Radio		S/N #:	Limits	2
Project #: J99020337		Test Date: Sept 14, 1999	Test Distance_	3 meters
Test Mode: TX/RX		Engineer: Barry Smith	Duty Relaxation	0 dB

	Antenna Used			Pre-Amp Used			Cable Used			Transducer Used
Number:	1	2	22	1	2	5	1	0	0	0
Model:	EMCO 3143	EMCO 3143	3160-10	HP 8447D	HP 8447D	CDI_P950	Site 1	None	None	None

Frequency	Reading	Detector	Ant	Amp.	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/A/Q	#	#	H/V	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
88	50.2	Peak	1	1	H	8.1	26.0	0.8	0.0	33.1	43.5	-10.4
110	57.7	Peak	1	1	H	6.9	25.6	0.9	0.0	39.9	43.5	-3.6
132	52.9	Peak	1	1	H	7.9	24.8	1.0	0.0	37.0	43.5	-6.5
176	49.8	QP	2	2	H	9.1	21.8	1.2	0.0	38.3	43.5	-5.2
220	48.3	Peak	2	2	H	11.4	22.3	1.3	0.0	38.7	46.0	-7.3
264	43.6	Peak	2	2	H	12.7	22.0	1.6	0.0	35.9	46.0	-10.1
286	49.1	Peak	2	2	H	13.0	22.5	1.6	0.0	41.2	46.0	-4.8
308	45.4	Peak	2	2	H	13.7	22.6	1.7	0.0	38.2	46.0	-7.8
440	41.5	Peak	2	2	H	17.3	22.6	2.1	0.0	38.3	46.0	-7.7

Notes:	a) D.C.F.:Distance Correction Factor
	b) Insert. Loss (dB) = Cable A + Cable B + Cable C .
	c) Net (dE) = Reading + Antenna Factor - Pre-amp + Insert. Loss. - Transducer Loss - Duty Relaxation (transmitter only).
	d) Negative signs (-) in Margin column signify levels below the limits.
	e) All other emissions not reported are below the equipment noise floor which is at least 20 dB below the limits.

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 μV	Class B $\text{dB}(\mu\text{V})$
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, $\text{dB}(\mu\text{V})$, and microvolts (μV). To convert between them, use the following formulas: $20 \text{ LOG}_{10}(\mu\text{V}) = \text{dB}(\mu\text{V})$, $\text{dB}(m) = \text{dB}(\mu\text{V}) - 107$.

6.2 Configuration Photographs

Worst-Case Line-Conducted Emission at 25.2 MHz

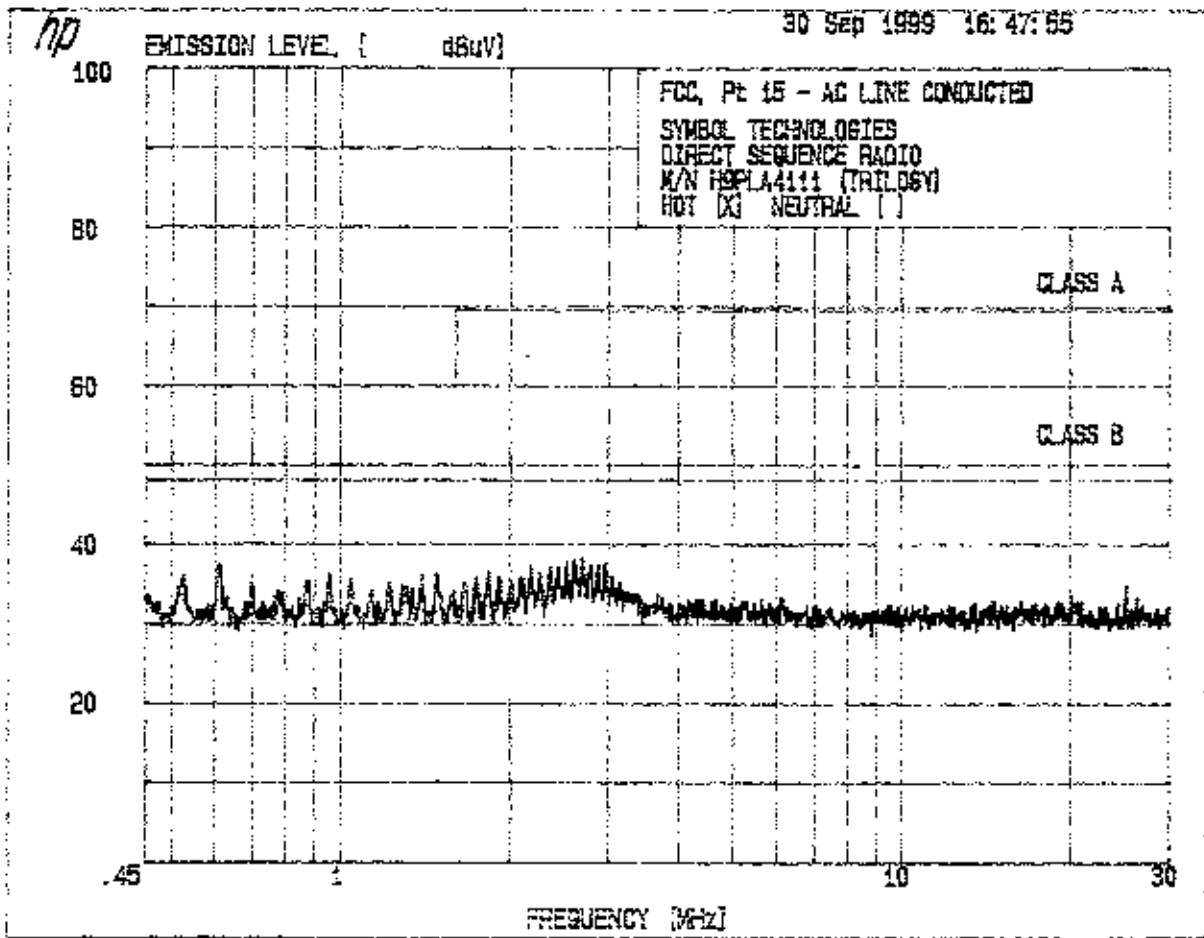
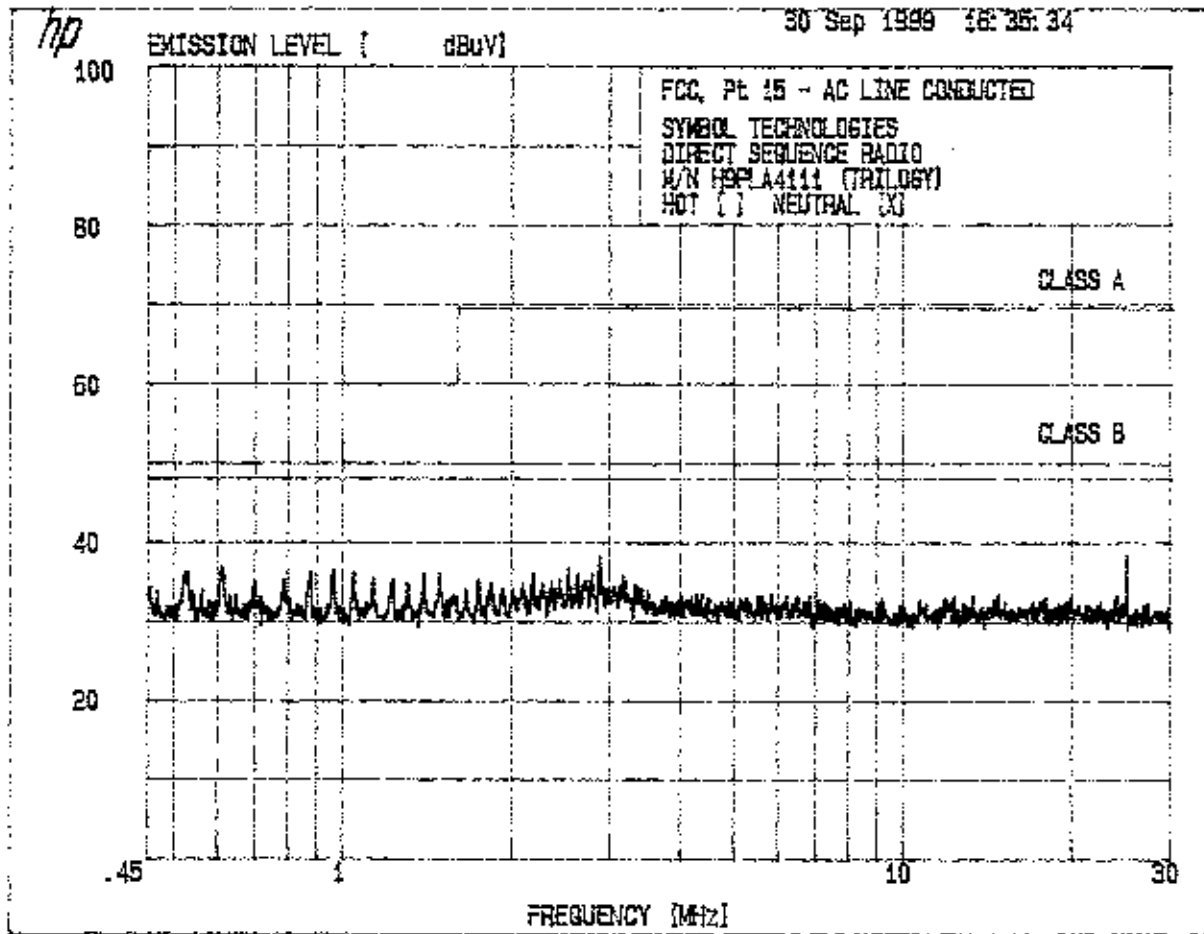


6.3 Test Data

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

Results: Passed by 9.5 dB at 25.2 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



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30 Sep 1999 16:35:34

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3. FCC CFR 47, Pt 15
3.1 FCC, Pt 15 - AC LINE CONDUCTED

=====

SYMBOL TECHNOLOGIES
DIRECT SEQUENCE RADIO
M/N H9PLA4111 (TRILOGY)
HOT [] NEUTRAL [X]

PEAKS FOUND ABOVE 36 dBuV

PEAK#	FREQ (MHz)	AMPL(dBuV)
1	.5300	36.2
2	.6138	36.8
3	.8842	36.0
4	.9697	36.4
5	1.055	36.2
6	1.403	36.1
7	1.494	36.1
8	2.198	36.0
9	2.545	36.9
10	2.643	36.0
11	2.803	36.0
12	2.887	38.2
13	25.15	38.5

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30 Sep 1999 16:47:55

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3. FCC CFR 47, Pt 15
3.1 FCC, Pt 15 - AC LINE CONDUCTED

=====

SYMBOL TECHNOLOGIES
DIRECT SEQUENCE RADIO
M/N H9PLA4111 (TRILOGY)
HOT [X] NEUTRAL []

PEAKS FOUND ABOVE 36 dBuV

PEAK#	FREQ (MHz)	AMPL(dBuV)
1	.5138	37.3
2	.9616	36.1
3	1.403	36.0
4	1.488	36.1
5	1.843	36.4
6	2.188	37.2
7	2.273	36.2
8	2.370	37.0
9	2.451	37.0
10	2.535	37.7
11	2.621	38.0
12	2.711	38.1
13	2.803	37.2
14	2.887	37.2



Symbol Technologies, LA-4111

Date of Test: September 24-27, 1999

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	Hewlett Packard	8447D	2648A04700	12	12/4/99	X
Spectrum Analyzer w/85650 QP Adaptor	Hewlett Packard	8566B	2416A00317 2043A00251	12	12/30/99	X
Spectrum Analyzer w/85650 QP Adaptor	Hewlett Packard	8568B	1912A00553 2521A01021	12	2/12/00	X
LISN	Solar Electronics	8028-50-TS-24	ETL344	12	12/7/99	X
LISN	Solar Electronics	8028-50-TS-24	ETL343	12	12/7/99	X
Pulse limiter	Hewlett Packard	11947A	2820A00184	12	6/28/00	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.

A

1365 Adams Court, Menlo Park, CA 94025

Symbol Technologies, LA-4111

Date of Test: September 24-27, 1999

8.0 Miscellaneous Information or Other Comments

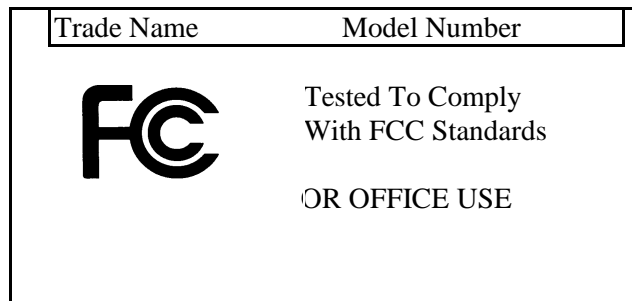
None.

8.1 Labeling - USA

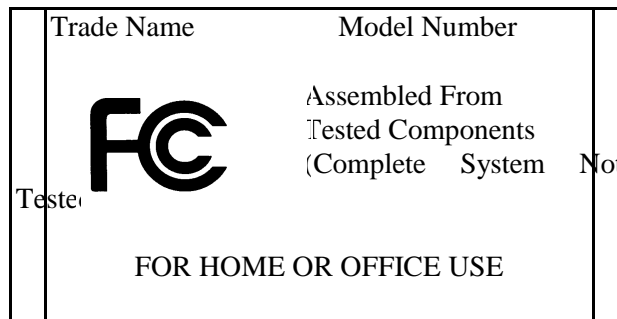
Products subject to Declaration of Conformity (DoC) shall be labeled as shown below. The label shall be located in a conspicuous location on the device and shall contain the unique identification described in FCC Section 2.1074.

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:



8.2 Labeling - Canada

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.

- (c) 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.

Symbol Technologies, LA-4111

Date of Test: September 24-27, 1999

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 Drive

San Jose, CA 95119-1208

Telephone Number: 408-528-2600

Equipment Information

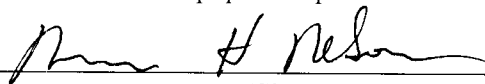
Type of Equipment: 2.4 GHz Part 15 Spread Spectrum Transceiver

Trade Name: Spectrum 24© WLAN PC CARD

Model Number: LA4111

Test Report Reference: Report No. J99022686f

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



(Signature)

Norman H. Nelson, Sr. EMC Engineer

(Name & Title)

November 22, 1999

(Date)



9.0 Document History

Revision/Job Number	Date	Change
1.0 /		Original document