



FCC Certification Report for the  
**LA3021-100** WLAN PC Card  
Class II Permissive Change

EXHIBIT 2

**TEST REPORT**




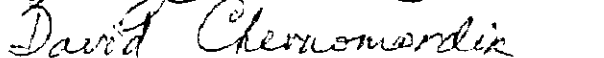
**FCC Part 15.247 (c) Radiated Emissions  
in Restricted Bands Test Report**  
for  
**Symbol Technologies**  
on the  
**Spread Spectrum Transmitter**  
**Model: LA3021**

Test Report #: J20000670d  
Date of Report: January 28, 2000

Job #: J20000670-A  
Date of Test: January 24-27, 2000

Total No. of Pages Contained in this Report: 13 + data pages



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

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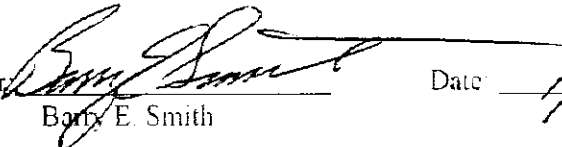
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1.0 Summary of Tests

**Symbol Technologies Inc. - Model No.: LA3021**

TEST	REFERENCE	RESULTS
Radiated Emission in Restricted Bands	15.247(c)	Pass

Test Engineer:  Date: 1/28/00  
Barry E. Smith

EMC Site Mgr.:  Date: 01/28/00  
David Chernomordik

**2.0 General Description**

## 2.1 Product Description

The Symbol Technologies model LA3021 is 2.4 GHz Spread Spectrum radio in the form of a PCMCIA card that is used for wireless communication from a computer to a LAN.

**Overview of the EUT**

Trade Name & Model No.	Symbol Technologies, Model No. LA3021-100
Frequency Range (MHz)	2402 - 2480
Antenna(s)	5 antennas
Manufacturer name & address	Symbol Technologies 2145 Hamilton Avenue San Jose, CA 95125

### 2.3 Test Methodology

Radiated emissions measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Data Sheet**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

### 2.4 Test Facility

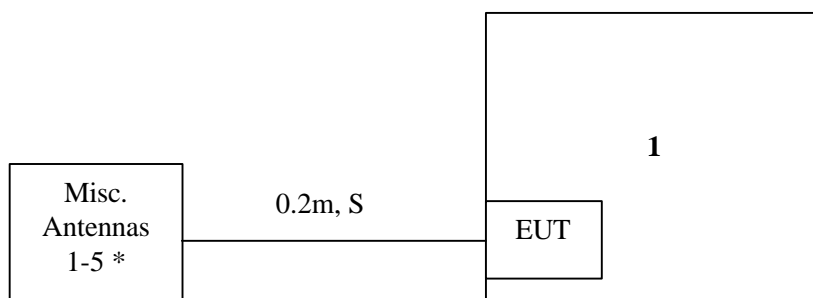
The open area test site facility used to collect the radiated data is located at 1365 Adams Court, Menlo Park, CA 94025. This test facility and site measurement data have been fully placed on file with the FCC.

**3.0 System Test Configuration**

## 3.1 Support Equipment

Item #	Description	Model No.	Serial No.	FCC ID
1	Compaq Notebook Computer	2860A	7448HJJ53R518	CNT75MB2CA

## 3.2 Block Diagram of Test Setup



- \*:  
Antenna #1 = Model XP  
Antenna #2 = Model 2742  
Antenna #3 = Model Vocollect MMCX  
Antenna #4 = Model 7242  
Antenna #5 = Model Toko

m: Length in meters

S: Shielded

### 3.3 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For radiated emission measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

### 3.4 Software Exercise Program

The EUT exercise program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

### 3.5 Mode of Operation During Test

For emissions testing, the units were setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

### 3.6 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 Inc. prior to compliance testing):

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



#### 4.0 Measurement Results

##### 4.1 Transmitter Radiated Emissions in Restricted Bands, *FCC Ref: 15.247(c)*

Radiated emission measurements were performed from 30 MHz to 25000 MHz. Analyzer resolution is 100 kHz or greater for frequencies from 30 MHz to 1000 MHz and 1 MHz for frequencies above 1000 MHz.

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included. All measurements were performed with peak detection and average detection (above 1 GHz) unless otherwise specified.

On the following pages, the emissions on the harmonics frequencies, the limits, and the margin of compliance are presented. These tests were made when the transmitter is in full radiated power.

The additional test was performed to show compliance with the requirement at the band-edge frequency 2483.5 MHz and up to 2500 MHz.

The transmitter was setup to transmit at the highest channel. The spectrum analyzer with resolution bandwidth 1 MHz was connected to the antenna terminal of the transmitter. The antenna conducted emissions in the band 2400 - 2483.5 MHz were measured and plotted. The difference (delta) between the levels on fundamental frequency and on the frequency 2483.5 MHz was determined. Then the field strength ( $E_0$  in dBuV/m) of radiated emission at the fundamental frequency at 3 m was measured.

The radiated emission ( $E_1$  in dBuV/m) at 2483.5 MHz was calculated as follows:

$$E_1 = E_0 - \text{delta.}$$

The same procedure was used to measure the radiated emissions at the frequency 2390 MHz and down to 2310 MHz.

For the test results, refer to the attached radiated emission measurements and the antenna conducted emission plots from the original application.

For transmitters with hopping channel ON times < 100 msec, DUTY CYCLE CORRECTION is permitted for emissions above 1000 MHz: Duty Cycle of 0 dB was used.

4.2 Radiated Emission Configuration Photograph



4.2 Radiated Emission Configuration Photograph



4.2 Radiated Emission Configuration Photograph



4.2 Radiated Emission Configuration Photograph



4.2 Radiated Emission Configuration Photograph



**Radiated Emissions  
Test Data**

Company: Symbol		Model #: LA3021-10		Standard		FCC § 15.247 (R.B.)						
EUT: Direct Sequence Radio		S/N #:		Limits		11						
Project #: J20000670		Test Date: Jan 26, 2000		Test Distance		3 meters						
Test Mode: Xmit with antenna TOCO		Engineer: Barry Smith		Duty Relaxation		0 dB						
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/O	#	#	UV	dB(1/m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
2402												
4804	33.1	Peak	14	8	V	33.9	28.1	3.2	0.0	42.1	74.0	-31.9
4804	23.0	Ave.	14	8	V	33.9	28.1	3.2	0.0	32.0	54.0	-22.0
12010	41.2	Peak	14	10	V	42.3	39.1	5.9	0.0	50.3	74.0	-23.8
12010	30.1	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.2	54.0	-14.9
19216	41.9	Peak	21	13	V	40.2	23.3	7.7	-9.5	57.0	74.0	-17.0
19216	30.8	Ave.	21	13	V	40.2	23.3	7.7	-9.5	45.9	54.0	-8.1
2440												
4880	40.4	Peak	14	8	V	33.9	28.1	3.2	0.0	49.4	74.0	-24.6
4880	37.2	Ave.	14	8	V	33.9	28.1	3.2	0.0	46.2	54.0	-7.8
7320	39.3	Peak	14	8	V	38.0	28.0	4.3	0.0	53.6	74.0	-20.4
7320	32.6	Ave.	14	8	V	38.0	28.0	4.3	0.0	46.9	54.0	-7.1
12220	39.9	Peak	14	10	V	42.3	39.1	5.9	0.0	49.0	74.0	-25.1
12220	30.3	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.4	54.0	-14.7
19520	42.4	Peak	21	13	V	40.3	23.3	7.7	-9.5	57.6	74.0	-16.4
19520	31.5	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.7	54.0	-7.3
2480												
4960	36.1	Peak	14	8	V	33.9	28.1	4.9	0.0	46.8	74.0	-27.2
4960	30.6	Ave.	14	8	V	33.9	28.1	4.9	0.0	41.3	54.0	-12.7
7440	35.7	Peak	14	8	V	38.0	28.0	6.3	0.0	52.0	74.0	-22.0
7440	25.4	Ave.	14	8	V	38.0	28.0	6.3	0.0	41.7	54.0	-12.3
12400	40.0	Peak	14	10	V	42.3	39.1	8.8	0.0	52.0	74.0	-22.0
12400	29.4	Ave.	14	10	V	42.3	39.1	8.8	0.0	41.4	54.0	-12.6
22320	46.6	Peak	21	13	V	40.3	23.3	0.0	-9.5	54.1	74.0	-19.9
22320	35.0	Ave.	21	13	V	40.3	23.3	0.0	-9.5	42.5	54.0	-11.5

Readings with DCF (distance correction factor) -9.5 dB were taken at 1 meter with RBW = 300kHz

**Radiated Emissions  
Test Data**

Company: Symbol						Model #: LA3021-10			Standard		FCC § 15.247 (R.B.)	
EUT: Direct Sequence Radio						S/N #:			Limits		11	
Project #: J2000670						Test Date: Jan 26, 2000			Test Distance		3 meters	
Test Mode: Xmit with antenna 2740						Engineer: Barry Smith			Duty Relaxation		0 dB	
Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D.C. F.	Net	Limit @3m	Margin
MHz	dB(µV)	P/AVG	#	#	H/V	dB(1m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
2402												
4804	39.6	Peak	14	8	V	33.9	28.1	3.2	0.0	48.6	74.0	-25.4
4804	34.6	Ave.	14	8	V	33.9	28.1	3.2	0.0	43.6	54.0	-10.4
12010	39.3	Peak	14	10	V	42.3	39.1	5.9	0.0	48.4	74.0	-25.7
12010	29.0	Ave.	14	10	V	42.3	39.1	5.9	0.0	38.1	54.0	-16.0
19216	41.1	Peak	21	13	V	40.2	23.3	7.7	-9.5	56.1	74.0	-17.9
19216	31.2	Ave.	21	13	V	40.2	23.3	7.7	-9.5	46.3	54.0	-7.7
2440												
4880	34.0	Peak	14	8	V	33.9	28.1	3.2	0.0	43.0	74.0	-31.0
4880	25.6	Ave.	14	8	V	33.9	28.1	3.2	0.0	34.6	54.0	-19.4
7320	38.2	Peak	14	8	V	38.0	28.0	4.3	0.0	52.5	74.0	-21.5
7320	26.6	Ave.	14	8	V	38.0	28.0	4.3	0.0	40.9	54.0	-13.1
12220	40.2	Peak	14	10	V	42.3	39.1	5.9	0.0	49.3	74.0	-24.8
12220	29.9	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.0	54.0	-15.1
19520	41.4	Peak	21	13	V	40.3	23.3	7.7	-9.5	56.6	74.0	-17.4
19520	31.8	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.9	54.0	-7.1
2480												
4960	33.0	Peak	14	8	V	33.9	28.1	4.9	0.0	43.7	74.0	-30.3
4960	23.0	Ave.	14	8	V	33.9	28.1	4.9	0.0	33.7	54.0	-20.3
7440	37.2	Peak	14	8	V	38.0	28.0	6.3	0.0	53.5	74.0	-20.5
7440	27.0	Ave.	14	8	V	38.0	28.0	6.3	0.0	43.3	54.0	-10.7
12400	40.5	Peak	14	10	V	42.3	39.1	8.8	0.0	52.5	74.0	-21.5
12400	29.9	Ave.	14	10	V	42.3	39.1	8.8	0.0	41.9	54.0	-12.1
22320	45.7	Peak	21	13	V	40.3	23.3	0.0	-9.5	53.2	74.0	-20.8
22320	34.9	Ave.	21	13	V	40.3	23.3	0.0	-9.5	42.4	54.0	-11.6

Readings with DCF (distance correction factor) -9.5 dB were taken at 1 meter with RBW = 300kHz



**Radiated Emissions  
Test Data**

Company:		Symbol:		Model #:		LA3021-10		Standard:		FCC 5 15.247 (R.B.)		
EUT:		Direct Sequence Radio		S/N #:				Limits:		11		
Project #:		J20000670-B		Test Date:		Jan 26, 2000		Test Distance:		3 meters		
Test Mode:		Xmit with antenna Vocollect		Engineer:		Barry Smith		Duty Relaxation:		0 dB		
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
2402												
4804	38.2	Peak	14	8	V	33.9	28.1	3.2	0.0	47.2	74.0	-26.8
4804	35.4	Ave.	14	8	V	33.9	28.1	3.2	0.0	44.4	54.0	-9.6
12010	41.2	Peak	14	10	V	42.3	39.1	5.9	0.0	50.3	74.0	-23.8
12010	30.2	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.3	54.0	-14.8
19216	41.9	Peak	21	13	V	40.2	23.3	7.7	-9.5	57.0	74.0	-17.0
19216	30.7	Ave.	21	13	V	40.2	23.3	7.7	-9.5	45.8	54.0	-8.2
2440												
4880	33.7	Peak	14	8	V	33.9	28.1	3.2	0.0	42.7	74.0	-31.3
4880	24.9	Ave.	14	8	V	33.9	28.1	3.2	0.0	33.9	54.0	-20.1
7320	36.7	Peak	14	8	V	38.0	28.0	4.3	0.0	51.0	74.0	-23.0
7320	26.3	Ave.	14	8	V	38.0	28.0	4.3	0.0	40.6	54.0	-13.4
12220	41.1	Peak	14	10	V	42.3	39.1	5.9	0.0	50.2	74.0	-23.9
12220	31.6	Ave.	14	10	V	42.3	39.1	5.9	0.0	40.7	54.0	-13.4
19520	42.0	Peak	21	13	V	40.3	23.3	7.7	-9.5	57.2	74.0	-16.8
19520	31.5	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.7	54.0	-7.3
2480												
4960	33.7	Peak	14	8	V	33.9	28.1	4.9	0.0	44.4	74.0	-29.6
4960	22.7	Ave.	14	8	V	33.9	28.1	4.9	0.0	33.4	54.0	-20.6
7440	37.7	Peak	14	8	V	38.0	28.0	6.3	0.0	54.0	74.0	-20.0
7440	27.4	Ave.	14	8	V	38.0	28.0	6.3	0.0	43.7	54.0	-10.3
12400	40.3	Peak	14	10	V	42.3	39.1	8.8	0.0	52.3	74.0	-21.7
12400	30.2	Ave.	14	10	V	42.3	39.1	8.8	0.0	42.2	54.0	-11.8
22320	44.3	Peak	21	13	V	40.3	23.3	0.0	-9.5	51.8	74.0	-22.2
22320	31.5	Ave.	21	13	V	40.3	23.3	0.0	-9.5	39.0	54.0	-15.0

Readings with DCF (distance correction factor) -9.5 dB were taken at 1 meter with RBW = 300kHz

**Radiated Emissions  
Test Data**

Company: Symbol						Model #: LA3021-10		Standard		FCC § 15.247 (R.B.)		
EUT: Direct Sequence Radio						S/N #:		Limits		11		
Project #: J20000670						Test Date: Jan 26, 2000		Test Distance		3 meters		
Test Mode: Xmit with antenna 7420						Engineer: Barry Smith		Duty Relaxation		0 dB		
Frequency	Reading	Detector	Ant #	Amp #	Ant. Pol.	Ant. Factor	Pre-Amp	Insert. Loss	D. C. F.	Net	Limit @3m	Margin
Mhz	dB(μV)	P/Avg	#	#	H/V	dB(1m)	dB	dB	dB	dB(μV/m)	dB(μV/m)	dB
2402												
4804	32.8	Peak	14	8	V	33.9	28.1	3.2	0.0	41.8	74.0	-32.2
4804	22.6	Ave.	14	8	V	33.9	28.1	3.2	0.0	31.6	54.0	-22.4
12010	41.5	Peak	14	10	V	42.3	39.1	5.9	0.0	50.6	74.0	-23.5
12010	29.3	Ave.	14	10	V	42.3	39.1	5.9	0.0	38.4	54.0	-15.7
19216	43.5	Peak	21	13	V	40.2	23.3	7.7	-9.5	58.6	74.0	-15.4
19216	30.8	Ave.	21	13	V	40.2	23.3	7.7	-9.5	45.9	54.0	-8.1
2440												
4880	34.5	Peak	14	8	V	33.9	28.1	3.2	0.0	43.5	74.0	-30.5
4880	25.8	Ave.	14	8	V	33.9	28.1	3.2	0.0	34.8	54.0	-19.2
7320	39.5	Peak	14	8	V	38.0	28.0	4.3	0.0	53.8	74.0	-20.2
7320	32.6	Ave.	14	8	V	38.0	28.0	4.3	0.0	46.9	54.0	-7.1
12220	40.6	Peak	14	10	V	42.3	39.1	5.9	0.0	49.7	74.0	-24.4
12220	30.0	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.1	54.0	-15.0
19520	41.8	Peak	21	13	V	40.3	23.3	7.7	-9.5	57.0	74.0	-17.0
19520	31.4	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.6	54.0	-7.4
2480												
4960	34.8	Peak	14	8	V	33.9	28.1	4.9	0.0	45.5	74.0	-28.5
4960	27.7	Ave.	14	8	V	33.9	28.1	4.9	0.0	38.4	54.0	-15.6
7440	38.5	Peak	14	8	V	38.0	28.0	6.3	0.0	54.8	74.0	-19.2
7440	27.2	Ave.	14	8	V	38.0	28.0	6.3	0.0	43.5	54.0	-10.5
12400	40.5	Peak	14	10	V	42.3	39.1	8.8	0.0	52.5	74.0	-21.5
12400	29.8	Ave.	14	10	V	42.3	39.1	8.8	0.0	41.8	54.0	-12.2
22320	45.9	Peak	21	13	V	40.3	23.3	0.0	-9.5	53.4	74.0	-20.6
22320	35.0	Ave.	21	10	V	40.3	36.1	0.0	-9.5	29.7	54.0	-24.3

Readings with DCF (distance correction factor) -9.5 dB were taken at 1 meter with RBW = 300kHz

**Radiated Emissions  
Test Data**

Company:		Symbol		Model #:		LA3021-10		Standard		FCC 5.15.247 (R.B.)		
EUT:		Direct Sequence Radio		S/N #:				Limits		11		
Project #:		J2000670		Test Date:		Jan 26, 2000		Test Distance		3 meters		
Test Mode:		Xmit with antenna XP		Engineer:		Barry Smith		Duty Relaxation		0 dB		
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(1m)	dB	dB	dB	dB(µV/m)	dB(µV/m)	dB
2402							0.0	2.3	0.0			—
4804	35.5	Peak	14	8	V	33.9	28.1	3.2	0.0	44.5	74.0	-29.5
4804	27.3	Ave.	14	8	V	33.9	28.1	3.2	0.0	36.3	54.0	-17.7
12010	35.3	Peak	14	10	V	42.3	39.1	5.9	0.0	44.4	74.0	-29.7
12010	30.2	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.3	54.0	-14.8
19216	41.4	Peak	21	13	V	40.2	23.3	7.7	-9.5	56.5	74.0	-17.5
19216	30.7	Ave.	21	13	V	40.2	23.3	7.7	-9.5	45.8	54.0	-8.2
2440												
4880	35.6	Peak	14	8	V	33.9	28.1	3.2	0.0	44.6	74.0	-29.4
4880	29.0	Ave.	14	8	V	33.9	28.1	3.2	0.0	38.0	54.0	-16.0
7320	39.4	Peak	14	8	V	38.0	28.0	4.3	0.0	53.7	74.0	-20.3
7320	31.1	Ave.	14	8	V	38.0	28.0	4.3	0.0	45.4	54.0	-8.6
12220	40.3	Peak	14	10	V	42.3	39.1	5.9	0.0	49.4	74.0	-24.7
12220	29.9	Ave.	14	10	V	42.3	39.1	5.9	0.0	39.0	54.0	-15.1
19520	42.3	Peak	21	13	V	40.3	23.3	7.7	-9.5	57.5	74.0	-16.5
19520	31.7	Ave.	21	13	V	40.3	23.3	7.7	-9.5	46.9	54.0	-7.1
2480												
4960	36.4	Peak	14	8	V	33.9	28.1	4.9	0.0	47.1	74.0	-26.9
4960	30.5	Ave.	14	8	V	33.9	28.1	4.9	0.0	41.2	54.0	-12.8
7440	36.9	Peak	14	8	V	38.0	28.0	6.3	0.0	53.2	74.0	-20.8
7440	26.6	Ave.	14	8	V	38.0	28.0	6.3	0.0	42.9	54.0	-11.1
12400	40.6	Peak	14	10	V	42.3	39.1	8.8	0.0	52.6	74.0	-21.4
12400	29.7	Ave.	14	10	V	42.3	39.1	8.8	0.0	41.7	54.0	-12.3
22320	45.9	Peak	21	13	V	40.3	23.3	0.0	-9.5	53.4	74.0	-20.6
22320	35.0	Ave.	21	13	V	40.3	23.3	0.0	-9.5	42.5	54.0	-11.5

Readings with DCF (distance correction factor) -9.5 dB were taken at 1 meter with RBW = 300kHz

**5.0 Document History**

<b>Revision/Job Number</b>	<b>Date</b>	<b>Change</b>
1.0 / J20000670	January 28, 2000	Original document