



EMC Test Data

For The

Sierra Wireless Inc.

Model

AirCard 400

Chief EMC Engineer: Paul Slavens

Signature Paul Slavens

Date 11 SEPTEMBER 2000



Client: Sierra Wireless
Model: AirCard 400
Contact: Ying Wang
Emissions Spec: FCC

Work Order# 2505hr
Chief Eng: Paul Slavens

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Test Summary

Date	Test Performed	Level	Results	Margin
Sep 1, 2000	RE, Preliminary Scan, 30-1000MHz	FCC B	Pass	-2 dB @ 240.508 MHz
Sep 1, 2000	RE, Maximized Emissions, 30-1000MHz	FCC B	Pass	-3.0dB @ 240.508 MHz
Sep 1, 2000	CE, AC Power 120V/60Hz	FCC	Pass	-8.9dB @ 18.29 MHz
Sep 11, 2000	RE, 1-10GHz Spurious Emissions in Restricted Bands	FCC Part 15.209/15.247	Pass	-2.4 dB @ 2772.19 MHz
Sep 11, 2000	RE, 1-10GHz Spurious Emissions in Restricted Bands	FCC Part 15.209/15.247	Pass	-5.4 dB @ 3608.55 MHz

Abbreviation Used: RE-Radiated Emissions, CE-Conducted Emissions



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EUT Information

General Description

The EUT is a wireless FHSS transceiver operating in the 902-928 MHz which is designed to transmit and receive data. Normally the EUT would be placed in a laptop computer during operation. The EUT was, therefore, placed in this position during emission testing to simulate the end user environment. The electrical rating of the EUT is 5VDC.

Equipment Under Test

Manufacturer	Model	Descriptions	Serial Number	FCC ID
Sierra Wireless	AirCard 400	Wireless PCMCIA Card	Pre-Production Model(s)	O6UACRD400

Other EUT Details

Digital clock is 20MHz. Two antennas were tested with the EUT, a monopole and a sleeve dipole.

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 5.5cm wide by 8.5cm deep by 0.5cm high.

Modification History

Mode.#	Test	Date	Modification
1			
2			
3			



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Test Configuration Information

EUT Peripherals for Emissions Testing

Device	Manufacturer	Model Number	FCC ID	Serial Number
Laptop Computer	IBM	ThinkPad 2600	HLZ315	2600-50U AS 00DV8
Printer (Parallel Port)	Hewlett Packard	C2642A	B94C2642X	MY68L1D0JK
IR Adapter (Serial Port)	Extended Systems	JetEye PC	None	9828

EUT Operation During Emissions Testing

The EUT was in receive only mode during Class B testing. The EUT was set to transmit continuously on either the low, mid or high channels during transmitter testing.

EUT Interface Cables

Host Computer Port	Connected To	Cable(s)		
		Description	Shielded/Unshielded	Length(m)
Parallel Port	Printer	Multiconductor	Shielded	1
Serial Port	IR Adapter	Multiconductor	Shielded	1.6
DC Power In	External AC Adapter	Multiconductor	Shielded	1.5



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Conducted Emissions

Date of Test: Sep 1, 2000
Test Location: Acme Site #1
Tested by: Dan Staton

General Test Configuration

For tabletop equipment, the host system was located on a wooden table, 40 cm from a vertical coupling plane. The LISN was located 80 cm from the host system.

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power 120V/60Hz	FCC	Pass	-8.9dB at 18.29MHz

Modification Made During Testing:

None

AC Power Port Conducted Emissions, 0.45-30 MHz 120V, 60Hz

The radio was transmitting during testing

Frequency MHz	Level dBuV	Power Lead	FCC		Detector QP/Ave
			Limit	Margin	
0.4693	36.3	Neutral	48.0	11.7	QP
0.5458	36.1	Neutral	48.0	11.9	QP
0.6268	36.8	Neutral	48.0	11.2	QP
5.282	35.9	Neutral	48.0	12.1	QP
14.4	35.5	Neutral	48.0	12.5	QP
18.29	39.1	Neutral	48.0	8.9	QP
0.4713	37.2	Line	48.0	10.8	QP
0.5181	36.6	Line	48.0	11.4	QP
0.6268	37.4	Line	48.0	10.6	QP
5.349	35.5	Line	48.0	12.5	QP
15.01	35.9	Line	48.0	12.1	QP
18.36	39.1	Line	48.0	8.9	QP



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Class B Digital Emissions

Date of Test: Sep 1, 2000
Test Location: Acme Site #1
Tested by: Dan Staton

Test Configuration:

The EUT and all local support equipment were located on the turntable for radiated emissions testing. The measurement antennas were located at 3 meters distance from the EUT.

Summary of Results:

Run#	Test Performed	Limit	Result	Margin
1	RE, Preliminary Scan 30-1000MHz	FCC B	Pass	-2 dB @ 240.508MHz
2	RE, 30-1000MHz, Maximized Emissions	FCC B	Pass	-3.0dB @ 240.508MHz

Modifications Made During Testing:

None



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Run#1: Preliminary radiated emissions, 30-1000MHz

FREQ MHz	BND	PEAK		POL V/H	Height cm	Azimuth degrees	Comment
		MARGIN	ABS				
85.19	6	-15	25.3	H	190	340	
95.21	8	-11	32.2	H	190	340	
110.23	11	-8	35.7	V	100	0	
115.26	11	-7	36.6	V	100	0	
120.247	12	-1	42.2	V	100	345	
125.29	12	-7	36.7	V	100	330	
130.258	12	-4	39.5	V	100	305	
135.281	13	-3	40.3	V	100	325	
140.312	14	-10	33.8	V	100	345	
145.297	15	-12	31.7	V	100	345	
150.325	16	-12	31.1	H	310	110	
155.365	16	-14	29.7	H	310	110	
160.36	17	-11	32.5	H	310	110	
165.42	17	-9	34.6	H	310	110	
170.45	17	-11	32.3	H	310	110	
175.25	18	-12	31.8	H	220	295	
180.31	18	-10	33.1	H	220	295	
185.37	18	-12	31.7	H	220	295	
190.48	18	-11	33.0	H	220	295	
195.51	18	-9	34.2	H	220	295	
199.79	18	-13	30.4	H	220	295	
200.41	19	-9	34.7	H	100	100	
210.49	19	-8	35.6	H	100	100	
215.454	19	-4	39.1	H	100	90	
220.47	20	-7	39.1	H	100	60	
225.473	20	-5	41.3	H	100	40	
230.485	20	-2	43.7	H	100	65	
235.498	20	-4	42.5	H	100	60	
240.508	21	-2	43.9	H	100	60	
245.43	21	-8	37.7	H	100	100	
250.49	21	-10	36.0	H	100	100	
255.47	21	-9	37.4	H	100	100	
260.63	21	-11	35.1	H	100	100	
305.95	21	-12	34.3	H	100	195	
321.06	21	-12	34.1	H	100	195	
332.74	22	-12	34.1	H	100	220	
335.75	22	-9	36.6	H	100	20	
345.85	22	-13	33.3	H	100	220	
350.8	23	-13	33.2	H	100	5	
355.7	23	-12	33.7	H	100	5	
365.7	23	-10	35.5	H	100	5	
370.8	23	-9	37.4	H	100	5	
379.93	23	-6	39.9	H	100	235	



ACME TESTING

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FREQ MHz	BND	PEAK		POL V/H	Height Cm	Azimuth degrees	Comment
		MARGIN	ABS				
385.9	23	-12	33.9	H	100	5	
401.1	23	-13	32.6	H	100	5	
465.95	25	-15	30.9	H	100	240	
532.8	26	-15	31.4	H	100	240	
566.1	26	-16	30.3	H	100	240	
615.4	27	-15	31.0	H	100	270	
643.2	27	-14	32.5	H	100	10	
664.7	27	-14	32.0	H	100	10	
689.5	27	-13	32.8	H	100	10	
698.7	28	-13	32.7	H	100	300	
710.7	28	-10	35.8	H	100	30	
713.6	28	-14	32.3	H	100	30	
738.4	28	-11	35.2	H	100	300	
744.6	28	-13	33.5	H	100	300	
749.0	28	-12	33.7	H	100	300	
798.6	28	-12	33.6	H	100	300	
913.6	30	-11	35.2	H	100	359	
936.0	30	-9	36.7	H	100	359	
947.5	30	-7	38.7	H	100	359	
959.9	30	-8	37.8	H	100	359	

Run#2: Maximized readings from Run#1

Frequency MHz	Level dBuV/m	Class B		Detector Pk/QP/Avg	Azimuth degrees	Height cm	Pol H/V
		Limit	Margin				
120.247	39.2	43.5	-4.3	QP	345	100	V
130.258	36.7	43.5	-6.8	QP	305	100	V
135.284	39.0	43.5	-4.5	QP	325	100	V
215.454	37.4	43.5	-6.1	QP	90	100	H
225.473	39.5	46.0	-6.5	QP	40	100	H
230.485	40.2	46.0	-5.8	QP	65	100	H
235.498	41.1	46.0	-4.9	QP	60	100	H
240.508	43.0	46.0	-3.0	QP	60	100	H
379.930	38.7	46.0	-7.3	QP	235	100	H



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Radiated Emissions in Restricted Bands

Date of Test: Sep 11, 2000
Test Location: Acme Site #1
Tested by: Dan Staton

Test Configuration:

The EUT and all local support equipment were located on the turntable for radiated emissions testing. The measurement antenna was located at 3 meters distance from the EUT. Unless stated otherwise the EUT was operating such that it continuously transmit on either the low, mid or high channels.

Summary of Results:

Run#	Test Performed	Limit	Result	Margin
1	RE, 1-10GHz Spurious Emissions in Restricted Bands	FCC Part 15.209/15.247(c)	Pass	-2.4 dB @ 2772.19 MHz
2	RE, 1-10GHz Spurious Emissions in Restricted Bands	FCC Part 15.209/15.247(c)	Pass	-5.4 dB @ 3608.55 MHz

Modification Made During Testing:

None



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EUT with monopole antenna. $P_{out}=29.7$ dBm.

Run #1a: Radiated Spurious Emissions, 1-10GHz. Low Channel @ 902.16MHz

Frequency	Level	Part15.209/15.247		Detector	Azimuth	Height	Pol	Correction Factor
MHz	dBuV/m	Limit	Margin	Pk/QP/Avg	degrees	cm	H/V	dB
2706.47	51.5	54.0	-2.5	AVG	250	150	V	0.5
2706.48	53.0	74.0	-21.0	PK	250	150	V	0.5
3608.62	49.3	54.0	-4.7	AVG	245	160	V	1.0
3608.67	51.8	74.0	-22.2	PK	245	160	V	1.0
4510.79	41.2	74.0	-32.8	PK	245	160	V	3.7
4510.80	31.7	54.0	-22.3	AVG	245	160	V	3.7

Run #1b: Radiated Spurious Emissions, 1-10GHz. Mid Channel @ 914.16MHz

Frequency	Level	Part15.209/15.247		Detector	Azimuth	Height	Pol	Correction Factor
MHz	dBuV/m	Limit	Margin	Pk/QP/Avg	degrees	cm	H/V	dB
2742.48	52.1	74.0	-21.9	PK	245	170	V	0.6
2742.53	50.4	54.0	-3.6	AVG	245	170	V	0.6
3656.64	46.6	54.0	-7.4	AVG	240	160	V	3.9
3656.68	48.8	74.0	-25.2	PK	240	160	V	3.9
4570.75	39.6	54.0	-14.4	AVG	255	160	V	3.9
4570.82	45.7	74.0	-28.3	PK	255	160	V	3.9

Run #1c: Radiated Spurious Emissions, 1-10GHz. High Channel @ 924.08MHz

Frequency	Level	Part15.209/15.247		Detector	Azimuth	Height	Pol	Correction Factor
MHz	dBuV/m	Limit	Margin	Pk/QP/Avg	degrees	cm	H/V	dB
2772.19	51.6	54.0	-2.4	AVG	250	140	V	0.8
2772.22	52.7	74.0	-21.3	PK	250	140	V	0.8
3696.31	45.8	54.0	-8.3	AVG	245	160	V	3.9
3696.40	48.7	74.0	-25.3	PK	245	160	V	3.9
4620.38	41.2	54.0	-12.8	AVG	255	155	V	4.1
4620.45	45.9	74.0	-28.1	PK	255	155	V	4.1



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EUT with sleeve dipole antenna. $P_{out}=29.7$ dBm.

Run #2a: Radiated Spurious Emissions, 1-10GHz. Low Channel @ 902.16MHz

Frequency	Level	Part15.209/15.247		Detector	Azimuth	Height	Pol	Correction Factor
MHz	dBuV/m	Limit	Margin	Pk/QP/Avg	degrees	cm	H/V	dB
2706.47	47.7	54.0	-6.3	AVG	240	140	V	0.5
2706.48	49.6	74.0	-24.4	PK	240	140	V	0.5
3608.55	48.6	54.0	-5.4	AVG	245	170	V	1.0
3608.67	50.9	74.0	-23.1	PK	245	170	V	1.0
4510.78	33.7	54.0	-20.3	AVG	230	170	V	3.7
4510.79	42.5	74.0	-31.5	PK	230	170	V	3.7

Run #2b: Radiated Spurious Emissions, 1-10GHz. Mid Channel @ 914.16MHz

Frequency	Level	Part15.209/15.247		Detector	Azimuth	Height	Pol	Correction Factor
MHz	dBuV/m	Limit	Margin	Pk/QP/Avg	degrees	cm	H/V	dB
2742.48	48.9	74.0	-25.1	PK	250	140	V	0.6
2742.49	46.8	54.0	-7.2	AVG	250	140	V	0.6
3656.59	46.7	54.0	-7.3	AVG	240	185	V	3.9
3656.68	49.6	74.0	-24.4	PK	240	185	V	3.9
4570.82	42.7	74.0	-31.3	PK	240	140	V	3.9
4570.86	35.4	54.0	-18.6	AVG	240	140	V	3.9

Run #2c: Radiated Spurious Emissions, 1-10GHz. High Channel @ 924.08MHz

Frequency	Level	Part15.209/15.247		Detector	Azimuth	Height	Pol	Correction Factor
MHz	dBuV/m	Limit	Margin	Pk/QP/Avg	degrees	cm	H/V	dB
2772.23	48.3	74.0	-25.7	PK	250	140	V	0.8
2772.23	45.7	54.0	-8.3	AVG	250	140	V	0.8
3696.28	48.7	54.0	-5.4	AVG	245	160	V	3.9
3696.38	50.3	74.0	-23.8	PK	245	160	V	3.9
4620.32	39.7	54.0	-14.3	AVG	255	155	V	4.1
4620.54	46.0	74.0	-28.0	PK	255	155	V	4.1



Test Equipment

The following test equipment was used to perform the testing at Acme Testing Inc.:

- Spectrum Analyzer (blue): Hewlett-Packard 8567A, Serial Number 2410A00168, Calibrated: 17 March 2000, Calibration due Date: 17 March 2001
- RF Preselector (blue): Hewlett-Packard 85685A, Serial Number 2648A-00519, Calibrated: 17 March 2000, Calibration due Date: 17 March 2001
- Quasi Peak Adapter (blue): Hewlett-Packard 85650A, Serial Number 2043A00327, Calibrated: 17 March 2000, Calibration due Date: 17 March 2001
- Line Impedance Stabilization Network: EMCO 3825/2, Serial Number 9002-1601, Calibrated: 17 August 2000, Calibration due Date: 17 August 2001
- Broadband Biconical Antenna (blue) (20 MHz to 200 MHz): EMCO 3110, Serial Number 1180, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000
- Broadband Log Periodic Antenna (blue) (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2852, Calibrated: 10 October 1999, Calibration due Date: 10 October 2000
- EUT Turntable Position Controller: Rothenbuhler Engineering, Custom, No Calibration Required
- Antenna Mast: Compliance Design, model M100/200, No Calibration Required
- Double Ridge Guide Horn Antenna: EMCO 3115, Serial Number 9807-5534, Calibrated: 30 December 1999, Calibration due Date: 30 December 2000
- 2 GHz to 10 GHz Low Noise Preamplifier: Milliwave 593-2898, Serial Number 2494, No Calibration Required
- 2 GHz High Pass Filter: Microphase Corporation, Part Number CR220HIB, Serial Number 1119, No Calibration Required