



Engineering and Testing for EMC and Safety Compliance

CLASS II PERMISSIVE CHANGE APPLICATION
FCC PART 15

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FCC ID:	BV8MTT-A025	FRN:	0006-633-010
PLAT FORM:	N/A	RTL WO NUMBER:	2004100
MODEL(S):	OpenSky SkyLink ISM Radio	RTL QUOTE NUMBER:	QRTL04-195
TEST REPORT DATE:	July 20, 2004		
FCC Classification:	DTS – Digital Transmission System		
FCC Rule Part(s):	Part 15.247: Operation in the bands 902-928 MHz, 2400-2483.5 MHz, and 5725 and 5850 MHz		
Frequency Range (MHz)	Power (W)	Frequency Tolerance	Emission Designator
2412-2462	0.26	N/A	N/A
2412-2462	0.042	N/A	N/A

We, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards.

Furthermore, there was no deviation from, additions to or exclusions from the FCC Part 2, FCC Part 15, ANSI C63.4.

Signature: 

Date: July 20, 2004

Typed/Printed Name: Desmond A. Fraser

Position: President

Signature: 

Date: July 20, 2004

Typed/Printed Name: Daniel W. Baltzell

Position: EMC Test Engineer

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1 GENERAL INFORMATION

1.1 SCOPE

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

A direct sequence (DS) system is a spread spectrum (SS) system in which the carrier has been modulated by a high speed spreading code and an information data stream. The high-speed code sequence dominates the “modulating function” and is the direct cause of the wide spreading of the transmitted signal.

1.2 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 2003).

1.3 RELATED SUBMITAL(S)/GRANT(S)

This is a permissive change application for the original certification for FCC ID: BV8MTT-A025.

1.4 DESCRIPTION OF CHANGE IN DEVICE

Three antenna options have been added, which are responsible for the radiated power. No changes were made to the modulation circuitry. The three antennas are a 24.5 dBi Grid Parabolic Dish Antenna, a 21.3 dBi Parabolic Antenna, and a 13.5 dBi Omni Patch Antenna.

2 EQUIPMENT INFORMATION

2.1 JUSTIFICATION

The power was measured as a conducted measurement with a power meter, and reflects the worst case data. The frequencies investigated were 2412, 2442, and 2462 MHz.

2.2 EXERCISING THE EUT

The OpenSky SkyLink ISM Radio network is a point-to-multi-point communication link between tower sites and cell sites, which transmits at a frequency within the range 2412-2462 MHz. The following frequencies were tested: 2412, 2442, and 2462 MHz, in three orthogonal planes, with the receiving antenna in both horizontal and vertical polarities, from 1 meter to 4 meters in height. The worst case data is submitted.

2.3 TEST SYSTEM DETAILS

The test sample was received on June 23, 2004. The FCC Identifiers for all equipment, plus descriptions of all cables used in the tested system are:

TABLE 2-1: EQUIPMENT UNDER TEST (EUT)

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BARCODE
24.5 dBi 2.4 GHz Grid Parabolic Antenna	Radio Waves, Inc.	G3-2.4	N/A	N/A	N/A	016031
Parabolic Dish	M/A Com	N/A	N/A	N/A	N/A	016032
21.3 dBi 2.4 GHz Parabolic Antenna	Radio Waves, Inc.	SP2-2.4	N/A	N/A	N/A	016027
Parabolic Dish	M/A Com	N/A	N/A	N/A	N/A	016030
13.5 dBi Omni Patch Antenna	Winncom Technologies Corp.	WRO2400- 135H	N/A	N/A	N/A	016026
ISM Tower Top	M/A Com	Opensky	A400F0101092	BV8MTT- A025	1m unshielded I/O; 1m unshielded power	016024
Mini Mount	M/A Com	N/A	N/A	N/A	N/A	016023
Mini Mount	M/A Com	N/A	N/A	N/A	N/A	016022
Cable	M/A Com	L4A- PNMNF6- USA	35337	N/A	1.8m Shielded	016020

2.4 CONFIGURATION OF TESTED SYSTEM

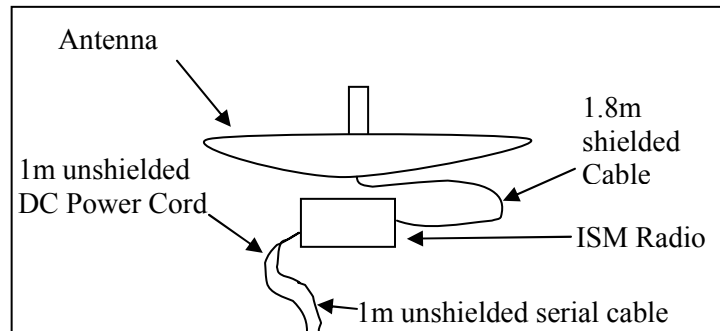


FIGURE 1: CONFIGURATION OF TESTED SYSTEM

3 FCC PART 2 §2.1046 (A): RF POWER OUTPUT: CONDUCTED

3.1 RF POWER OUTPUT: CONDUCTED TEST PROCEDURE

ANSI C63.4 1992: The EUT was connected to a coaxial attenuator having a 50 Ω load impedance.

15.247 (b)(4)(i): Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.2 RF POWER OUTPUT: CONDUCTED TEST DATA

The following channels (in MHz) were tested: 2412 MHz, 2442 MHz, and 2462 MHz. The worst case output power (highest) levels are shown.

TABLE 3-1: CARRIER OUTPUT POWER FOR ANTENNAS UNDER 21.3 dBI GAIN

Channel	Frequency (MHz)	Level (dBm)	Level (W)
1	2412	24.2	0.26
7	2442	24.5	0.28
11	2462	23.7	0.23

*Measurement accuracy: +/- 3%

TABLE 3-2: CARRIER OUTPUT POWER FOR OVER 21.3 dBI DIRECTIONAL ANTENNA

Channel	Frequency (MHz)	Level (dBm)	Level (W)
1	2412	16.2	0.042
7	2442	16.4	0.043
11	2462	15.7	0.037

*Measurement accuracy: +/- 3%

TABLE 3-3: RATED POWER

Rated Power (W)	
High Power	Low Power (for high gain antennas)
0.26	0.042

Antenna	Power Reduction	Power Measured (dBm)	Limit (dBm)	Margin (dB)
24.5 dBi 2.4 GHz Parabolic Grid Antenna	$24.5 - 6 = 18.5$ $18.5 / 3 = 6.2$ dB reduction	16.4	23.8	-7.4
21.3 dBi 2.4GHz Parabolic Antenna	$21.3 - 6 = 15.3$ $15.3 / 3 = 5.1$ dB reduction	16.4	24.9	-8.5
13.5 dBi Omni HP Antenna	$13.5 - 6 = 7.5$ $7.5 / 3 = 2.5$ dB reduction	24.5	27.5	-3.0

TEST PERSONNEL:

DANIEL BALTZELL
TEST ENGINEER



SIGNATURE

JUNE 23, 2004
DATE OF TEST

3.3 TEST EQUIPMENT

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901184	Agilent Technologies	E4416A	EPM-P Power Meter, single channel	GB41050573	7/30/04
901186	Agilent Technologies	E9323A (50 MHz-6 GHz)	Peak & Average Power Sensor	US40410380	7/30/04

4 FCC RULES AND REGULATIONS PART 2 §2.1051: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

4.1 RADIATED SPURIOUS EMISSION LIMITS TEST PROCEDURE

Radiated Spurious Emissions applies to harmonics and spurious emissions that fall in the restricted and non-restricted bands. The restricted bands are listed in Part 15.205. The maximum permitted average field strength for the restricted band is listed in Part 15.209. The EUT was tested in the 3 orthogonal planes

4.2 TEST DATA

The following channels were investigated: 2412, 2442, and 2462 MHz. The worst case unwanted emissions channels are shown. The magnitude of emissions attenuated more than 20 dB below the FCC limit need not be recorded.

TABLE 4-1: CONDUCTED SPURIOUS EMISSIONS CHANNEL 1 – 2412 MHZ SP2 ANTENNA (21.3 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2386.500	34	23.0	26.5	49.5	54.0	-4.5
2386.792	33.2	23.0	26.5	49.5	54.0	-4.5
2390.000	20.8	16.3	26.4	42.7	54.0	-11.3
2412.000	92.3	82.8	26.3	109.1		
4824.000	34.2	29.2	13.9	43.1	54.0	-10.9
7236.000	26.2	16.8	13.3	30.1	89.1	-59.0
9648.000	29.3	18.7	15.5	34.2	89.1	-54.9
12060.000	26.7	16.8	19.9	36.7	54.0	-17.3
14472.000	27.7	17.2	24.7	41.9	54.0	-12.1
16884.000	28.8	18.2	22.7	40.9	89.1	-48.2
19296.000	24.8	15.2	23.5	38.7	54.0	-15.3
21708.000	23.8	14.0	27.6	41.6	89.1	-47.5
24120.000	30.3	18.7	28.5	47.2	89.1	-41.9

TABLE 4-2: CONDUCTED SPURIOUS EMISSIONS CHANNEL 7 – 2442 MHZ SP2 ANTENNA (21.3 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2442.000	91.7	82.3	26.4	108.7		
4884.000	32.7	24.8	14.2	39.0	54.0	-15.0
7326.000	28.0	17.8	13.1	30.9	54.0	-23.1
9768.000	29.5	18.8	14.9	33.7	88.7	-55.0
12210.000	27.7	17.5	23.9	41.4	54.0	-12.6
14652.000	28.2	17.8	26.2	44.0	88.7	-44.7
17094.000	28.2	16.8	22.5	39.3	88.7	-49.4
19536.000	26.7	14.3	24.4	38.7	54.0	-15.3
21978.000	23.7	14.3	27.7	42.0	88.7	-46.7
24420.000	28.0	19.0	28.6	47.6	88.7	-41.1

TABLE 4-3: CONDUCTED SPURIOUS EMISSIONS CHANNEL 11– 2462 MHZ SP2 ANTENNA (21.3 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2462.000	91.0	80.5	26.6	107.1		
2470.976	67.5	55.8	26.5	82.3	87.1	-4.8
2483.500	28.3	24.2	26.7	50.9	54.0	-3.1
4924.000	33.5	25.5	14.0	39.5	54.0	-14.5
7386.000	27.5	17.5	14.0	31.5	54.0	-22.5
9848.000	29.8	19.0	16.1	35.1	87.1	-52.0
12310.000	27.2	17.5	22.8	40.3	54.0	-13.7
14772.000	28.8	17.5	26.6	44.1	87.1	-43.0
17234.000	26.2	17.0	22.4	39.4	87.1	-47.7
19696.000	23.3	14.3	23.2	37.5	54.0	-16.5
22158.000	24.5	14.7	27.8	42.5	54.0	-11.5
24620.000	30.8	19.0	28.7	47.7	87.1	-39.4

TABLE 4-4: CONDUCTED SPURIOUS EMISSIONS CHANNEL 1 – 2412 MHZ GRID ANTENNA (24.5 dBi)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2385.233	21.0	10.7	26.5	37.2	54.0	-16.8
2386.500	20.9	11.0	26.5	37.5	54.0	-16.5
2399.993	51.2	41.0	26.5	67.5	76.0	-8.5
2412.000	79.5	69.7	26.3	96.0		
4824.000	28.7	19.4	13.9	33.3	54.0	-20.7
7236.000	28.5	16.7	13.3	30.0	76.0	-46.0
9648.000	26.7	16.4	15.5	31.9	76.0	-44.1
12060.000	27.5	16.9	19.9	36.8	54.0	-17.2
14472.000	28.2	17.4	24.7	42.1	54.0	-11.9
16884.000	29.0	16.7	22.7	39.4	76.0	-36.6
19296.000	27.0	17.0	23.5	40.5	54.0	-13.5
21708.000	26.2	15.7	27.6	43.3	76.0	-32.7
24120.000	31.4	20.7	28.5	49.2	76.0	-26.8

TABLE 4-5: CONDUCTED SPURIOUS EMISSIONS CHANNEL 7 – 2442 MHZ GRID ANTENNA (24.5 dBi)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2442.000	79.8	69.8	26.4	96.2		
4884.000	31.3	20.0	14.2	34.2	54.0	-19.8
7326.000	18.8	9.2	13.1	22.3	54.0	-31.7
9768.000	28.8	18.3	14.9	33.2	76.2	-43.0
12210.000	27.2	17.7	23.9	41.6	54.0	-12.4
14652.000	28.5	18.0	26.2	44.2	76.2	-32.0
17094.000	26.3	17.0	22.5	39.5	76.2	-36.7
19536.000	25.7	14.2	24.4	38.6	54.0	-15.4
21978.000	25.0	14.3	27.7	42.0	76.2	-34.2
24420.000	28.8	19.0	28.6	47.6	76.2	-28.6

TABLE 4-6: CONDUCTED SPURIOUS EMISSIONS CHANNEL 11– 2462 MHZ GRID ANTENNA (24.5 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2462.000	79.2	69.8	26.6	96.4		
2471.000	56.2	47.2	26.5	73.7	76.4	-2.7
2483.500	21.0	10.2	26.7	36.9	54.0	-17.1
4924.000	32.2	22.7	14.0	36.7	54.0	-17.3
7386.000	18.3	9.0	14.0	23.0	54.0	-31.0
9848.000	30.0	19.2	16.1	35.3	76.4	-41.1
12310.000	28.2	17.7	22.8	40.5	54.0	-13.5
14772.000	29.2	18.0	26.6	44.6	76.4	-31.8
17234.000	27.2	17.2	22.4	39.6	76.4	-36.8
19696.000	24.8	14.3	23.2	37.5	54.0	-16.5
22158.000	24.2	14.8	27.8	42.6	54.0	-11.4
24620.000	28.5	18.8	28.7	47.5	76.4	-28.9

TABLE 4-7: CONDUCTED SPURIOUS EMISSIONS CHANNEL 1 – 2412 MHZ OMNI ANTENNA (13.5 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2383.033	38.9	26.1	26.6	52.7	54.0	-1.3
2386.183	34.9	26.8	26.5	53.3	54.0	-0.7
2390.000	29.8	22.4	26.4	48.8	54.0	-5.2
2412.000	88.8	79.8	26.3	106.1		
4824.000	33.6	29.2	13.9	43.1	54.0	-10.9
7236.000	29.2	18.0	13.3	31.3	86.1	-54.8
9648.000	28.2	18.5	15.5	34.0	86.1	-52.1
12060.000	27.7	17.2	19.9	37.1	54.0	-16.9
14472.000	27.7	18.0	24.7	42.7	54.0	-11.3
16884.000	28.3	18.0	22.7	40.7	86.1	-45.4
19296.000	29.2	17.2	23.5	40.7	54.0	-13.3
21708.000	27.2	17.0	27.6	44.6	86.1	-41.5
24120.000	28.5	20.0	28.5	48.5	86.1	-37.6

TABLE 4-8: CONDUCTED SPURIOUS EMISSIONS CHANNEL 7 – 2442 MHZ OMNI ANTENNA (13.5 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2442.000	89.3	80.7	26.4	107.1		
4884.000	32.3	22.3	14.2	36.5	54.0	-17.5
7326.000	31.2	20.0	13.1	33.1	54.0	-20.9
9768.000	28.5	19.8	14.9	34.7	87.1	-52.4
12210.000	27.2	16.7	23.9	40.6	54.0	-13.4
14652.000	28.0	18.3	26.2	44.5	87.1	-42.6
17094.000	27.8	18.2	22.5	40.7	87.1	-46.4
19536.000	29.2	18.8	24.4	43.2	54.0	-10.8
21978.000	26.7	16.7	27.7	44.4	87.1	-42.7
24420.000	28.5	19.3	28.6	47.9	87.1	-39.2

TABLE 4-9: CONDUCTED SPURIOUS EMISSIONS CHANNEL 11– 2462 MHZ OMNI ANTENNA (13.5 dBI)

Frequency (MHz)	Peak Spectrum Analyzer Level (dBuV)	Average Spectrum Analyzer Level (dBuV)	Site Correction Factor (dB/m)	Corrected Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2462.000	88.8	78.7	26.6	105.3		
2483.500	34.8	22.8	26.7	49.5	54.0	-4.5
2487.820	35.7	25.3	26.9	52.2	54.0	-1.8
2488.243	36.5	25.3	26.9	52.2	54.0	-1.8
4924.000	33.0	25.3	14.0	39.3	54.0	-14.7
7386.000	27.2	16.8	14.0	30.8	54.0	-23.2
9848.000	30.0	19.7	16.1	35.8	105.3	-69.5
12310.000	26.3	17.8	22.8	40.6	54.0	-13.4
14772.000	28.0	17.7	26.6	44.3	105.3	-61.0
17234.000	27.0	17.2	22.4	39.6	105.3	-65.7
19696.000	28.5	18.5	23.2	41.7	54.0	-12.3
22158.000	27.3	17.0	27.8	44.8	54.0	-9.2
24620.000	29.0	19.8	28.7	48.5	105.3	-56.8

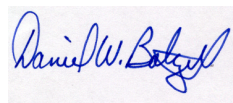
4.3 TEST EQUIPMENT

TABLE 4-10: TEST EQUIPMENT: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

RTL ASSET #	MANUFACTURER	MODEL	PART TYPE	SERIAL NUMBER	CALIBRATION DUE DATE
900772	EMCO	3161-02	Horn Antenna (2 - 4 GHz)	9804-1044	5/20/07
900323	EMCO	3160-7	Horn Antenna (8.2 - 12.4 GHz)	9605-1054	5/20/07
900356	EMCO	3160-08	Horn Antenna (12.4 - 18 GHz)	9607-1044	5/20/07
900321	EMCO	3161-03	Horn Antenna (4.0 - 8.2 GHz)	9508-1020	5/20/07
900325	EMCO	3160-9	Horn Antennas (18 - 26.5 GHz)	9605-1051	5/20/07
901053	Schaffner & Chase	CBL6112B	Bilog Antenna (20 MHz - 2 GHz)	2648	7/3/04
900932	Hewlett Packard	8449B	Microwave Preamplifier (1 - 26.5 GHz)	3008A00505	5/5/05
901020	Hewlett Packard	8564E	Portable Spectrum Analyzer (9 kHz - 40 GHz)	3943A01719	7/15/04
901232	IW Microwave Products	KPW-1503-2400-KPS	High Frequency RF Cables	240"	1/30/05
901235	IW Microwave Products	KPS-1503-360-KPS	High Frequency RF Cables	36"	1/30/05

TEST PERSONNEL:

DANIEL BALTZELL
 TEST ENGINEER



SIGNATURE

JUNE 25, 2004
 DATE OF TEST

5 CONCLUSION

The data in this Class II change report shows that the OpenSky SkyLink ISM Radio Network with the additional antenna options, FCC ID: BV8MTT-A025, complies with all the requirements of Parts 2 and 15 of the FCC Rules.