

## **EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER**

### **CLASS 2 PERMISSIVE CHANGE: ADD NEW ANTENNA TYPE**

#### **I. GENERAL INFORMATION**

Requirement: FCC  
Test Requirements: FCC Part 15

Applicant: Silver Spring Networks  
575 Broadway Street  
Redwood City, CA 94063

**FCC ID:** OWS-NIC505  
**IC:** 5975A-NIC505

**Model Nos.:** 210-040102 (Relay 1.0)  
210-040112 (Relay 1.5)

#### **II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)**

The Silver Spring Networks (SSN) NIC505 is a 902-928 MHz frequency hopping spread spectrum radio for use by electric utilities.

The radio was tested with a Mobile Mark model SM925 low profile antenna. Tests were performed on both versions of the EUT, the original configuration (Relay 1.0) granted 10/23/ 2007 and the configuration with the updated digital board (Relay 1.5) granted under class 2 permissive change on 07/06/2009.

#### **III. TEST DATES AND TEST LOCATION**

Testing was performed on 10 February 2010. Tests were performed at

Compliance Certification Services  
47173 Benicia Street  
Fremont, CA 94538



T.N. Cokenias  
EMC Consultant/Agent for Silver Spring Networks

17 February 2010

### 15.203 Antenna connector requirement

The radio is professionally installed. The antenna connector is a standard N-connector.

| Antenna description | Mfr.        | Model No. | Effective Gain |
|---------------------|-------------|-----------|----------------|
| Low profile         | Mobile Mark | SM925     | -1.4 dBi       |

Effective gain = Antenna gain, dBi – Cable loss dB

The antenna will be supplied with a 10ft length of RG-58 cable.

Antenna gain = 0 dBi

Cable loss = 1.4 dB at 902 MHz

### TEST PROCEDURES

All tests were performed in accordance with the applicable procedures called out in the following documents, unless otherwise noted:

FCC 47CFR15

RSS-210 Issue 7: Low power license exempt radio frequency devices (July 2007)

RSS-212: Test Facilities and Test Methods for Radio Equipment

ANSI C63.4 – 2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

Tests were performed at three frequencies:

900 MHz FHSS

Channel 0 (LOW) – 902.3 MHz

Channel 43 (MID) -915.2 MHz

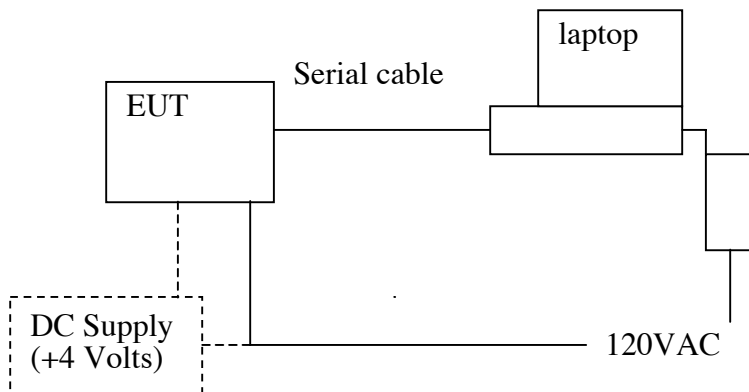
Channel 82 (HIFH) – 926.9 MHz

## Test Equipment

### Compliance Certification Services:

| Equipment         | Mfr            | Model    | Asset No. | Cal Due  |
|-------------------|----------------|----------|-----------|----------|
| Spectrum analyzer | Agilent        | E4440A   | T198      | 08/21/10 |
| Bilog antenna     | Sunol Sciences | JBI      | T185      | 07/14/10 |
| Pre-amplifier     | Agilent        | HP8447D  | T15       | 07/06/10 |
| Horn antenna      | EMCO           | 3115     | T60       | 07/29/10 |
| Pre-amplifier     | Agilent        | HP 8449B | T34       | 06/06/10 |

## Test Set-up Diagram



NOTE: Relay 1.0 was powered directly by 120 VAC. Relay 1.5 was tested with DC directly to radio board because EUT AC power supply was faulty and would not power the radio properly.

## Support Equipment

| Equipment       | Mfr      | Model      | Asset No.              |
|-----------------|----------|------------|------------------------|
| DC Power Supply | Agilent  | E3610A     | 2844                   |
| Laptop PC       | Dell     | PP01L      | TW-0791UH1280-OC9-6558 |
| AC/DC adapter   | CUI Inc. | DSA-60W-20 | 2607HB                 |

# FREQUENCY HOPPING SPREAD SPECTRUM RADIO EMISSIONS

## TEST RESULTS

### Radiated Test Set-up, 30 MHz-9.3 GHz

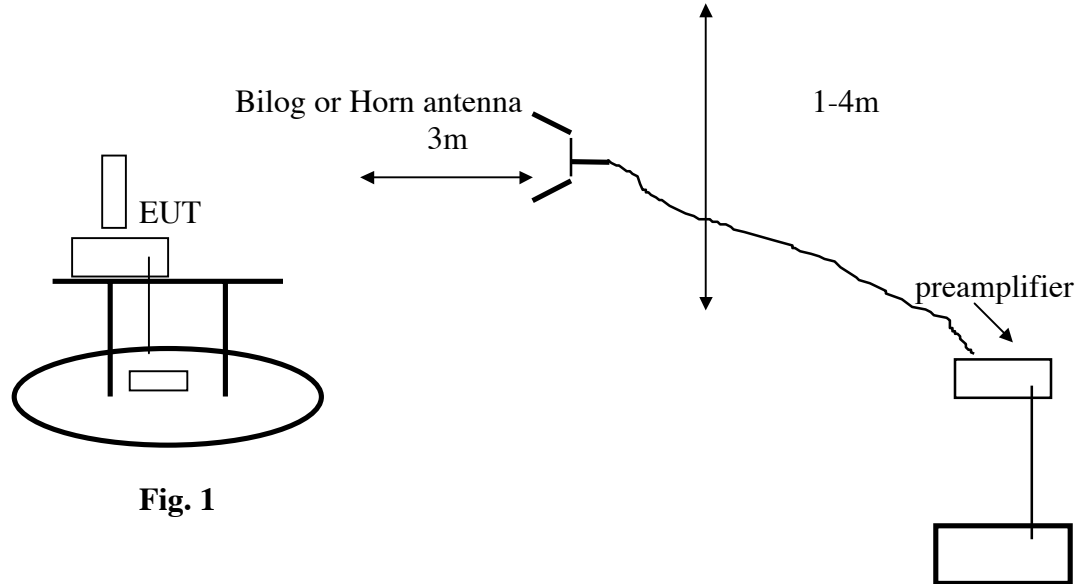


Fig. 1

### Test Procedures

Radiated emissions generated by the transmitter portion of the EUT were measured.

1. The EUT was placed on a wooden table resting on a turntable on the test site. The search antenna was placed 3m from the EUT. The EUT antenna was mounted in the with the EUT TX antenna pointed directly to the search antenna.
2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.
3. Emissions were investigated to the 10<sup>th</sup> harmonic of the fundamental.
4. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

**Test Results:** Worst-case results are presented. Refer to data sheets below. Restricted band emissions meet 54 dBuV/m. Other undesired emissions from the transmitter meet the -20 dBc requirement in 15.247(d).

Tests were performed at the LOW, MID, and HIGH operating channels.

| Channel | Frequency , MHz | Output power, dBm |
|---------|-----------------|-------------------|
| 0       | 902.3           | 29.8              |
| 43      | 915.2           | 29.88             |
| 82      | 926.9           | 29.9              |

**15.205 Restricted Frequency Bands**

| MHz                 | MHz                 | MHz             | GHz           |
|---------------------|---------------------|-----------------|---------------|
| 0.090 - 0.110       | 16.42 - 16.423      | 399.9 - 410     | 4.5 - 5.15    |
| 0.495 - 0.505 (1)   | 16.69475 - 16.69525 | 608 - 614       | 5.35 - 5.46   |
| 2.1735 - 2.1905     | 16.80425 - 16.80475 | 960 - 1240      | 7.25 - 7.75   |
| 4.125 - 4.128       | 25.5 - 25.67        | 1300 - 1427     | 8.025 - 8.5   |
| 4.17725 - 4.17775   | 37.5 - 38.25        | 1435 - 1626.5   | 9.0 - 9.2     |
| 4.20725 - 4.20775   | 73 - 74.6           | 1645.5 - 1646.5 | 9.3 - 9.5     |
| 6.215 - 6.218       | 74.8 - 75.2         | 1660 - 1710     | 10.6 - 12.7   |
| 6.26775 - 6.26825   | 108 - 121.94        | 1718.8 - 1722.2 | 13.25 - 13.4  |
| 6.31175 - 6.31225   | 123 - 138           | 2200 - 2300     | 14.47 - 14.5  |
| 8.291 - 8.294       | 149.9 - 150.05      | 2310 - 2390     | 15.35 - 16.2  |
| 8.362 - 8.366       | 156.52475 -         | 2483.5 - 2500   | 17.7 - 21.4   |
| 8.37625 - 8.38675   | 156.52525           | 2655 - 2900     | 22.01 - 23.12 |
| 8.41425 - 8.41475   | 156.7 - 156.9       | 3260 - 3267     | 23.6 - 24.0   |
| 12.29 - 12.293      | 162.0125 - 167.17   | 3332 - 3339     | 31.2 - 31.8   |
| 12.51975 - 12.52025 | 167.72 - 173.2      | 3345.8 - 3358   | 36.43 - 36.5  |
| 12.57675 - 12.57725 | 240 - 285           | 3600 - 4400     |               |
| 13.36 - 13.41       | 322 - 335.4         |                 |               |

**15.209 General Field Strength Limits**

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-----------------|-----------------------------------|-------------------------------|
| 0.009 - 0.490   | 2400/F (kHz)                      | 300                           |
| 0.490 - 1.705   | 24000/F (kHz)                     | 30                            |
| 1.705 - 30.0    | 30                                | 30                            |
| 30 - 88         | 100 **                            | 3                             |
| 88 - 216        | 150 **                            | 3                             |
| 216 - 960       | 200 **                            | 3                             |
| Above 960       | 500                               | 3                             |

## Radiated Emissions Above 1 GHz, Relay 1.0

| High Frequency Measurement                                |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
|---|-----------------------|------------------------|-----------------------|---------|-------|------------------------|--------------------------------|----------|--------------|------------|---------------|----------------|------------------------------|------------|---|--|
| Compliance Certification Services, Fremont 5m Chamber     |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Company:  |                       | Silver Spring Networks |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Project #:  |                       | 10U13066               |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Date:   |                       | 02/10/10               |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Test Engineer:  |                       | Thanh Nguyen           |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Configuration:  |                       | EUT AP 1.0, Laptop     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Mode:   |                       | Transmit               |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Test Equipment:   |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Horn 1-18GHz  |                       |                        | Pre-amplifier 1-26GHz |         |       | Pre-amplifier 26-40GHz |                                |          | Horn > 18GHz |            |               |                |                              |            |   |  |
| T60; S/N: 2238 @3m  |                       |                        | T34 HP 8449B          |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Hi Frequency Cables                                       |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| 3' cable 22807700   |                       |                        | 12' cable 22807600    |         |       | 20' cable 22807500     |                                |          | HPF          |            |               | Reject Filter  |                              |            | Peak Measurements<br>RBW=VBW=1MHz           |  |
| 3' cable 22807700   |                       |                        | 12' cable 22807600    |         |       | 20' cable 22807500     |                                |          |              |            |               | R_001          |                              |            | Average Measurements<br>RBW=1MHz ; VBW=10Hz |  |
| f GHz   | Dist (m)              | Read Pk dBuV           | Read Avg dBuV         | AF dB/m | CL dB | Amp dB                 | D Corr dB                      | Filtr dB | Peak dBuV/m  | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB                    | Avg Mar dB | Notes (V/H)                                 |  |
| <b>Ch 0, 902.30MHz</b>                                    |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| 1.804   | 3.0                   | 49.7                   |                       | 27.1    | 3.3   | -37.1                  | 0.0                            | 0.0      | 43.0         | -6.7       | 74            | 54             | -31.0                        | -60.7      | V   |  |
| 2.707   | 3.0                   | 54.3                   | 52.5                  | 28.9    | 4.1   | -36.1                  | 0.0                            | 0.0      | 51.2         | 49.4       | 74            | 54             | -22.8                        | -4.6       | V   |  |
| 3.609   | 3.0                   | 43.4                   | 41.8                  | 31.1    | 4.8   | -35.3                  | 0.0                            | 0.0      | 44.1         | 42.4       | 74            | 54             | -29.9                        | -11.6      | V   |  |
| 4.512   | 3.0                   | 50.4                   | 48.7                  | 32.4    | 5.6   | -34.9                  | 0.0                            | 0.0      | 53.5         | 51.8       | 74            | 54             | -20.5                        | -2.2       | V   |  |
| 5.414   | 3.0                   | 49.8                   | 47.5                  | 33.4    | 6.2   | -34.7                  | 0.0                            | 0.0      | 54.7         | 52.4       | 74            | 54             | -19.3                        | -1.6       | V   |  |
| 6.316   | 3.0                   | 40.6                   | 46.1                  | 34.2    | 6.7   | -34.5                  | 0.0                            | 0.0      | 47.0         | 52.5       | 74            | 54             | -27.0                        | -1.5       | V   |  |
| 7.219   | 3.0                   | 35.4                   | 26.5                  | 35.4    | 7.2   | -34.1                  | 0.0                            | 0.0      | 43.9         | 34.9       | 74            | 54             | -30.1                        | -19.1      | V   |  |
| 8.121   | 3.0                   | 36.0                   | 26.0                  | 36.4    | 7.7   | -34.0                  | 0.0                            | 0.0      | 46.1         | 36.1       | 74            | 54             | -27.9                        | -17.9      | V   |  |
| 9.023   | 3.0                   | 31.8                   | 20.2                  | 37.4    | 8.2   | -35.2                  | 0.0                            | 0.0      | 42.2         | 30.6       | 74            | 54             | -31.8                        | -23.4      | Noise floor                                 |  |
| 1.804   | 3.0                   | 42.0                   |                       | 27.1    | 3.3   | -37.1                  | 0.0                            | 0.0      | 35.3         | -6.7       | 74            | 54             | -38.7                        | -60.7      | H   |  |
| 2.707   | 3.0                   | 45.6                   | 43.7                  | 28.9    | 4.1   | -36.1                  | 0.0                            | 0.0      | 42.5         | 40.6       | 74            | 54             | -31.5                        | -13.4      | H   |  |
| 3.609   | 3.0                   | 39.9                   | 34.9                  | 31.1    | 4.8   | -35.3                  | 0.0                            | 0.0      | 40.6         | 35.5       | 74            | 54             | -33.4                        | -18.5      | H   |  |
| 4.512   | 3.0                   | 46.9                   | 45.1                  | 32.4    | 5.6   | -34.9                  | 0.0                            | 0.0      | 50.0         | 48.2       | 74            | 54             | -24.0                        | -5.8       | H   |  |
| 5.414   | 3.0                   | 45.4                   | 43.6                  | 33.4    | 6.2   | -34.7                  | 0.0                            | 0.0      | 50.4         | 48.5       | 74            | 54             | -23.6                        | -5.5       | H   |  |
| 6.316   | 3.0                   | 43.2                   | 40.0                  | 34.2    | 6.7   | -34.5                  | 0.0                            | 0.0      | 49.6         | 46.3       | 74            | 54             | -24.4                        | -7.7       | H   |  |
| 7.219   | 3.0                   | 34.7                   | 21.3                  | 35.4    | 7.2   | -34.1                  | 0.0                            | 0.0      | 43.1         | 29.8       | 74            | 54             | -30.9                        | -24.2      | H   |  |
| 8.121   | 3.0                   | 30.9                   | 20.7                  | 36.4    | 7.7   | -34.0                  | 0.0                            | 0.0      | 40.9         | 30.7       | 74            | 54             | -33.1                        | -23.3      | Noise floor                                 |  |
| <b>Ch 43, 915.20MHz</b>                                   |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| 1.830   | 3.0                   | 42.4                   |                       | 27.2    | 3.3   | -37.1                  | 0.0                            | 0.0      | 35.9         | -6.6       | 74            | 54             | -38.1                        | -60.6      | V   |  |
| 2.746   | 3.0                   | 44.6                   | 40.3                  | 29.0    | 4.1   | -36.1                  | 0.0                            | 0.0      | 41.6         | 37.4       | 74            | 54             | -32.4                        | -16.6      | V   |  |
| 3.661   | 3.0                   | 34.8                   | 23.3                  | 31.2    | 4.9   | -35.3                  | 0.0                            | 0.0      | 35.6         | 24.1       | 74            | 54             | -38.4                        | -29.9      | V   |  |
| 4.576   | 3.0                   | 37.9                   | 33.0                  | 32.5    | 5.6   | -34.9                  | 0.0                            | 0.0      | 41.1         | 36.2       | 74            | 54             | -32.9                        | -17.8      | V   |  |
| 5.491   | 3.0                   | 37.2                   | 29.3                  | 33.6    | 6.2   | -34.8                  | 0.0                            | 0.0      | 42.2         | 34.3       | 74            | 54             | -31.8                        | -19.7      | V   |  |
| 6.406   | 3.0                   | 47.4                   | 46.1                  | 34.3    | 6.8   | -34.5                  | 0.0                            | 0.0      | 54.0         | 52.7       | 74            | 54             | -20.0                        | -1.3       | V   |  |
| 7.321   | 3.0                   | 40.1                   | 35.6                  | 35.5    | 7.3   | -34.1                  | 0.0                            | 0.0      | 48.8         | 44.2       | 74            | 54             | -25.2                        | -9.8       | V   |  |
| 8.237   | 3.0                   | 34.5                   | 24.7                  | 36.5    | 7.8   | -34.2                  | 0.0                            | 0.0      | 44.5         | 34.8       | 74            | 54             | -29.5                        | -19.2      | V   |  |
| 9.152   | 3.0                   | 31.6                   | 20.2                  | 37.4    | 8.3   | -34.9                  | 0.0                            | 0.0      | 42.4         | 31.1       | 74            | 54             | -31.6                        | -22.9      | Noise floor                                 |  |
| 1.830   | 3.0                   | 36.8                   |                       | 27.2    | 3.3   | -37.1                  | 0.0                            | 0.0      | 30.2         | -6.6       | 74            | 54             | -43.8                        | -60.6      | H   |  |
| 2.746   | 3.0                   | 43.2                   | 38.5                  | 29.0    | 4.1   | -36.1                  | 0.0                            | 0.0      | 40.3         | 35.6       | 74            | 54             | -33.7                        | -18.4      | H   |  |
| 3.661   | 3.0                   | 34.8                   | 22.4                  | 31.2    | 4.9   | -35.3                  | 0.0                            | 0.0      | 35.6         | 23.3       | 74            | 54             | -38.4                        | -30.7      | H   |  |
| 4.576   | 3.0                   | 33.1                   | 20.6                  | 32.5    | 5.6   | -34.9                  | 0.0                            | 0.0      | 36.3         | 23.8       | 74            | 54             | -37.7                        | -30.2      | H   |  |
| 5.491   | 3.0                   | 32.7                   | 20.5                  | 33.6    | 6.2   | -34.8                  | 0.0                            | 0.0      | 37.7         | 25.5       | 74            | 54             | -36.3                        | -28.5      | H   |  |
| 6.406   | 3.0                   | 48.9                   | 47.1                  | 34.3    | 6.8   | -34.5                  | 0.0                            | 0.0      | 55.5         | 53.7       | 74            | 54             | -18.5                        | -0.3       | H   |  |
| 7.321   | 3.0                   | 31.8                   | 22.3                  | 35.5    | 7.3   | -34.1                  | 0.0                            | 0.0      | 40.4         | 31.0       | 74            | 54             | -33.6                        | -23.0      | H   |  |
| 8.237   | 3.0                   | 37.6                   | 31.9                  | 36.5    | 7.8   | -34.2                  | 0.0                            | 0.0      | 47.6         | 42.0       | 74            | 54             | -26.4                        | -12.0      | H   |  |
| 9.152   | 3.0                   | 32.6                   | 21.3                  | 37.4    | 8.3   | -34.9                  | 0.0                            | 0.0      | 43.4         | 32.1       | 74            | 54             | -30.6                        | -21.9      | Noise floor                                 |  |
| <b>Ch 82, 926.90MHz</b>                                   |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| 1.854   | 3.0                   | 42.2                   |                       | 27.3    | 3.3   | -37.1                  | 0.0                            | 0.0      | 35.8         | -6.5       | 74            | 54             | -38.2                        | -60.5      | V   |  |
| 2.787   | 3.0                   | 38.3                   | 25.6                  | 29.1    | 4.2   | -36.0                  | 0.0                            | 0.0      | 35.5         | 22.8       | 74            | 54             | -38.5                        | -31.2      | V   |  |
| 3.707   | 3.0                   | 32.6                   | 22.0                  | 31.4    | 4.9   | -35.2                  | 0.0                            | 0.0      | 33.6         | 23.0       | 74            | 54             | -40.4                        | -31.0      | V   |  |
| 4.635   | 3.0                   | 33.3                   | 20.7                  | 32.5    | 5.7   | -34.9                  | 0.0                            | 0.0      | 36.6         | 24.0       | 74            | 54             | -37.4                        | -30.0      | V   |  |
| 5.561   | 3.0                   | 35.3                   | 30.0                  | 33.6    | 6.3   | -34.8                  | 0.0                            | 0.0      | 40.3         | 35.0       | 74            | 54             | -33.7                        | -19.0      | V   |  |
| 6.488   | 3.0                   | 44.1                   | 42.1                  | 34.4    | 6.8   | -34.4                  | 0.0                            | 0.0      | 50.9         | 48.9       | 74            | 54             | -23.1                        | -5.1       | V   |  |
| 7.415   | 3.0                   | 34.1                   | 24.4                  | 35.6    | 7.3   | -34.1                  | 0.0                            | 0.0      | 43.0         | 33.2       | 74            | 54             | -31.0                        | -20.8      | V   |  |
| 8.342   | 3.0                   | 33.7                   | 23.6                  | 36.6    | 7.8   | -34.3                  | 0.0                            | 0.0      | 43.8         | 33.7       | 74            | 54             | -30.2                        | -20.3      | V   |  |
| 9.269   | 3.0                   | 31.5                   | 21.2                  | 37.5    | 8.3   | -34.6                  | 0.0                            | 0.0      | 42.7         | 32.4       | 74            | 54             | -31.3                        | -21.6      | Noise floor                                 |  |
| 1.854   | 3.0                   | 42.0                   |                       | 27.3    | 3.3   | -37.1                  | 0.0                            | 0.0      | 35.5         | -6.5       | 74            | 54             | -38.5                        | -60.5      | H   |  |
| 2.787   | 3.0                   | 38.8                   | 28.7                  | 29.1    | 4.2   | -36.0                  | 0.0                            | 0.0      | 36.0         | 25.9       | 74            | 54             | -38.0                        | -28.1      | H   |  |
| 3.707   | 3.0                   | 34.1                   | 22.2                  | 31.4    | 4.9   | -35.2                  | 0.0                            | 0.0      | 35.1         | 23.2       | 74            | 54             | -38.9                        | -30.8      | H   |  |
| 4.635   | 3.0                   | 32.0                   | 21.3                  | 32.5    | 5.7   | -34.9                  | 0.0                            | 0.0      | 35.3         | 24.6       | 74            | 54             | -38.7                        | -29.4      | H   |  |
| 5.561   | 3.0                   | 31.5                   | 20.5                  | 33.6    | 6.3   | -34.8                  | 0.0                            | 0.0      | 36.5         | 25.5       | 74            | 54             | -37.5                        | -28.5      | H   |  |
| 6.488   | 3.0                   | 40.0                   | 36.8                  | 34.4    | 6.8   | -34.4                  | 0.0                            | 0.0      | 46.8         | 43.6       | 74            | 54             | -27.2                        | -10.4      | H   |  |
| 7.415   | 3.0                   | 40.3                   | 37.1                  | 35.6    | 7.3   | -34.1                  | 0.0                            | 0.0      | 49.2         | 45.9       | 74            | 54             | -24.8                        | -8.1       | H   |  |
| 8.342   | 3.0                   | 32.5                   | 21.4                  | 36.6    | 7.8   | -34.3                  | 0.0                            | 0.0      | 42.6         | 31.5       | 74            | 54             | -31.4                        | -22.5      | Noise floor                                 |  |
| No other emissions were detected above system noise floor |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| Rev. 11.10.08   |                       |                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |   |  |
| f   | Measurement Frequency |                        |                       |         |       | Amp                    | Preamp Gain                    |          |              |            |               | Avg Lim        | Average Field Strength Limit |            |   |  |
| Dist  | Distance to Antenna   |                        |                       |         |       | D Corr                 | Distance Correct to 3 meters   |          |              |            |               | Pk Lim         | Peak Field Strength Limit    |            |   |  |
| Read  | Analyzer Reading      |                        |                       |         |       | Avg                    | Average Field Strength @ 3 m   |          |              |            |               | Avg Mar        | Margin vs. Average Limit     |            |   |  |
| AF  | Antenna Factor        |                        |                       |         |       | Peak                   | Calculated Peak Field Strength |          |              |            |               | Pk Mar         | Margin vs. Peak Limit        |            |   |  |
| CL  | Cable Loss            |                        |                       |         |       | HPF                    | High Pass Filter               |          |              |            |               |                |                              |            |   |  |

**Radiated Emissions Below 1 GHz, Relay 1.0**

All emissions more than 20 dB below limits.



### Radiated Emissions Above 1 GHz, Relay 1.5

| High Frequency Measurement                                |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
|---|-----------------------|-------------------------------------|-----------------------|---------|-------|------------------------|--------------------------------|----------|--------------|------------|---------------|----------------|------------------------------|------------|--|--|--|
| Compliance Certification Services, Fremont 5m Chamber     |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Company:  |                       | Silver Spring Networks              |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Project #:  |                       | 10U13066                            |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Date:   |                       | 02/10/10                            |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Test Engineer:  |                       | Thanh Nguyen                        |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Configuration:  |                       | EUT AP 1.5, DC Power Supply, Laptop |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Mode:   |                       | Transmit                            |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Test Equipment:   |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Horn 1-18GHz  |                       |                                     | Pre-amplifier 1-26GHz |         |       | Pre-amplifier 26-40GHz |                                |          | Horn > 18GHz |            |               |                |                              |            |  |  |  |
| T60; S/N: 2238 @3m  |                       |                                     | T34 HP 8449B          |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Hi Frequency Cables                                       |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| 3' cable 22807700   |                       |                                     | 12' cable 22807600    |         |       | 20' cable 22807500     |                                |          | HPF          |            |               | Reject Filter  |                              |            | Peak Measurements<br>RBW=VBW=1MHz<br>Average Measurements<br>RBW=1MHz ; VBW=10Hz |  |  |
| 3' cable 22807700   |                       |                                     | 12' cable 22807600    |         |       | 20' cable 22807500     |                                |          |              |            |               | R_001          |                              |            |  |  |  |
| f GHz   | Dist (m)              | Read Pk dBuV                        | Read Avg dBuV         | AF dB/m | CL dB | Amp dB                 | D Corr dB                      | Filtr dB | Peak dBuV/m  | Avg dBuV/m | Pk Lim dBuV/m | Avg Lim dBuV/m | Pk Mar dB                    | Avg Mar dB | Notes (V/H)  |  |  |
| <b>Ch 0, 902.325MHz</b>                                   |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| 1.804   | 3.0                   | 58.9                                |                       | 27.1    | 3.3   | -37.1                  | 0.0                            | 0.0      | 52.2         | -6.7       | 74            | 54             | -21.8                        | -60.7      | V  |  |  |
| 2.707   | 3.0                   | 50.6                                | 42.9                  | 28.9    | 4.1   | -36.1                  | 0.0                            | 0.0      | 47.5         | 39.7       | 74            | 54             | -26.5                        | -14.3      | V  |  |  |
| 3.609   | 3.0                   | 39.0                                | 33.1                  | 31.1    | 4.8   | -35.3                  | 0.0                            | 0.0      | 39.7         | 33.8       | 74            | 54             | -34.3                        | -20.2      | V  |  |  |
| 4.512   | 3.0                   | 46.8                                | 45.0                  | 32.4    | 5.6   | -34.9                  | 0.0                            | 0.0      | 49.9         | 48.1       | 74            | 54             | -24.1                        | -5.9       | V  |  |  |
| 5.414   | 3.0                   | 34.7                                | 30.1                  | 33.4    | 6.2   | -34.7                  | 0.0                            | 0.0      | 39.6         | 35.0       | 74            | 54             | -34.4                        | -19.0      | V  |  |  |
| 6.316   | 3.0                   | 40.6                                | 37.0                  | 34.2    | 6.7   | -34.5                  | 0.0                            | 0.0      | 47.0         | 43.3       | 74            | 54             | -27.0                        | -10.7      | V  |  |  |
| 7.219   | 3.0                   | 32.6                                | 21.3                  | 35.4    | 7.2   | -34.1                  | 0.0                            | 0.0      | 41.0         | 29.8       | 74            | 54             | -33.0                        | -24.2      | V  |  |  |
| 8.121   | 3.0                   | 33.7                                | 20.8                  | 36.4    | 7.7   | -34.0                  | 0.0                            | 0.0      | 43.8         | 30.9       | 74            | 54             | -30.2                        | -23.1      | Noise floor  |  |  |
| 1.804   | 3.0                   | 58.6                                |                       | 27.1    | 3.3   | -37.1                  | 0.0                            | 0.0      | 51.9         | -6.7       | 74            | 54             | -22.1                        | -60.7      | H  |  |  |
| 2.707   | 3.0                   | 45.3                                | 43.6                  | 28.9    | 4.1   | -36.1                  | 0.0                            | 0.0      | 42.1         | 40.4       | 74            | 54             | -31.9                        | -13.6      | H  |  |  |
| 3.609   | 3.0                   | 37.9                                | 33.2                  | 31.1    | 4.8   | -35.3                  | 0.0                            | 0.0      | 38.5         | 33.8       | 74            | 54             | -35.5                        | -20.2      | H  |  |  |
| 4.512   | 3.0                   | 51.5                                | 48.7                  | 32.4    | 5.6   | -34.9                  | 0.0                            | 0.0      | 54.6         | 51.9       | 74            | 54             | -19.4                        | -2.1       | H  |  |  |
| 5.414   | 3.0                   | 35.8                                | 27.9                  | 33.4    | 6.2   | -34.7                  | 0.0                            | 0.0      | 40.7         | 32.8       | 74            | 54             | -33.3                        | -21.2      | H  |  |  |
| 6.316   | 3.0                   | 36.3                                | 29.9                  | 34.2    | 6.7   | -34.5                  | 0.0                            | 0.0      | 42.6         | 36.3       | 74            | 54             | -31.4                        | -17.7      | H  |  |  |
| 7.219   | 3.0                   | 32.2                                | 21.9                  | 35.4    | 7.2   | -34.1                  | 0.0                            | 0.0      | 40.7         | 30.4       | 74            | 54             | -33.3                        | -23.6      | H  |  |  |
| 8.121   | 3.0                   | 30.9                                | 20.7                  | 36.4    | 7.7   | -34.0                  | 0.0                            | 0.0      | 40.9         | 30.7       | 74            | 54             | -33.1                        | -23.3      | Noise floor  |  |  |
| <b>Ch 43, 915.20MHz</b>                                   |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| 1.830   | 3.0                   | 53.0                                |                       | 27.2    | 3.3   | -37.1                  | 0.0                            | 0.0      | 46.4         | -6.6       | 74            | 54             | -27.6                        | -60.6      | V  |  |  |
| 2.746   | 3.0                   | 46.0                                | 42.5                  | 29.0    | 4.1   | -36.1                  | 0.0                            | 0.0      | 43.0         | 39.6       | 74            | 54             | -31.0                        | -14.4      | V  |  |  |
| 3.661   | 3.0                   | 41.4                                | 37.7                  | 31.2    | 4.9   | -35.3                  | 0.0                            | 0.0      | 42.3         | 38.6       | 74            | 54             | -31.7                        | -15.4      | V  |  |  |
| 4.576   | 3.0                   | 37.9                                | 33.0                  | 32.5    | 5.6   | -34.9                  | 0.0                            | 0.0      | 41.1         | 36.2       | 74            | 54             | -32.9                        | -17.8      | V  |  |  |
| 5.491   | 3.0                   | 36.6                                | 30.6                  | 33.6    | 6.2   | -34.8                  | 0.0                            | 0.0      | 41.6         | 35.7       | 74            | 54             | -32.4                        | -18.3      | V  |  |  |
| 6.406   | 3.0                   | 44.1                                | 40.8                  | 34.3    | 6.8   | -34.5                  | 0.0                            | 0.0      | 50.7         | 47.4       | 74            | 54             | -23.3                        | -6.6       | V  |  |  |
| 7.321   | 3.0                   | 34.9                                | 28.2                  | 35.5    | 7.3   | -34.1                  | 0.0                            | 0.0      | 43.6         | 36.9       | 74            | 54             | -30.4                        | -17.1      | V  |  |  |
| 8.237   | 3.0                   | 35.5                                | 25.6                  | 36.5    | 7.8   | -34.2                  | 0.0                            | 0.0      | 45.6         | 35.7       | 74            | 54             | -28.4                        | -18.3      | V  |  |  |
| 9.152   | 3.0                   | 32.9                                | 20.5                  | 37.4    | 8.3   | -34.9                  | 0.0                            | 0.0      | 43.7         | 31.3       | 74            | 54             | -30.3                        | -22.7      | Noise floor  |  |  |
| 1.830   | 3.0                   | 49.7                                |                       | 27.2    | 3.3   | -37.1                  | 0.0                            | 0.0      | 43.1         | -6.6       | 74            | 54             | -30.9                        | -60.6      | H  |  |  |
| 2.746   | 3.0                   | 41.3                                | 30.4                  | 29.0    | 4.1   | -36.1                  | 0.0                            | 0.0      | 38.3         | 27.5       | 74            | 54             | -35.7                        | -26.5      | H  |  |  |
| 3.661   | 3.0                   | 42.4                                | 38.8                  | 31.2    | 4.9   | -35.3                  | 0.0                            | 0.0      | 43.3         | 39.7       | 74            | 54             | -30.7                        | -14.3      | H  |  |  |
| 4.576   | 3.0                   | 35.6                                | 25.4                  | 32.5    | 5.6   | -34.9                  | 0.0                            | 0.0      | 38.8         | 28.7       | 74            | 54             | -35.2                        | -25.3      | H  |  |  |
| 5.491   | 3.0                   | 35.5                                | 30.2                  | 33.6    | 6.2   | -34.8                  | 0.0                            | 0.0      | 40.5         | 35.3       | 74            | 54             | -33.5                        | -18.7      | H  |  |  |
| 6.406   | 3.0                   | 39.2                                | 35.7                  | 34.3    | 6.8   | -34.5                  | 0.0                            | 0.0      | 45.8         | 42.3       | 74            | 54             | -28.2                        | -11.7      | H  |  |  |
| 7.321   | 3.0                   | 31.8                                | 22.3                  | 35.5    | 7.3   | -34.1                  | 0.0                            | 0.0      | 40.4         | 31.0       | 74            | 54             | -33.6                        | -23.0      | H  |  |  |
| 8.237   | 3.0                   | 35.5                                | 21.0                  | 36.5    | 7.8   | -34.2                  | 0.0                            | 0.0      | 45.6         | 31.1       | 74            | 54             | -28.4                        | -22.9      | Noise floor  |  |  |
| <b>Ch 82, 926.90MHz</b>                                   |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| 1.854   | 3.0                   | 49.1                                |                       | 27.3    | 3.3   | -37.1                  | 0.0                            | 0.0      | 42.6         | -6.5       | 74            | 54             | -31.4                        | -60.5      | V  |  |  |
| 2.787   | 3.0                   | 38.6                                | 31.7                  | 29.1    | 4.2   | -36.0                  | 0.0                            | 0.0      | 35.8         | 28.9       | 74            | 54             | -38.2                        | -25.1      | V  |  |  |
| 3.707   | 3.0                   | 36.2                                | 27.3                  | 31.4    | 4.9   | -35.2                  | 0.0                            | 0.0      | 37.2         | 28.3       | 74            | 54             | -36.8                        | -25.7      | V  |  |  |
| 4.635   | 3.0                   | 40.3                                | 37.6                  | 32.5    | 5.7   | -34.9                  | 0.0                            | 0.0      | 43.6         | 40.9       | 74            | 54             | -30.4                        | -13.1      | V  |  |  |
| 5.561   | 3.0                   | 36.3                                | 31.4                  | 33.6    | 6.3   | -34.8                  | 0.0                            | 0.0      | 41.3         | 36.4       | 74            | 54             | -32.7                        | -17.6      | V  |  |  |
| 6.488   | 3.0                   | 45.6                                | 43.9                  | 34.4    | 6.8   | -34.4                  | 0.0                            | 0.0      | 52.4         | 50.7       | 74            | 54             | -21.6                        | -3.3       | V  |  |  |
| 7.415   | 3.0                   | 34.1                                | 24.4                  | 35.6    | 7.3   | -34.1                  | 0.0                            | 0.0      | 43.0         | 33.2       | 74            | 54             | -31.0                        | -20.8      | V  |  |  |
| 8.342   | 3.0                   | 33.7                                | 23.6                  | 36.6    | 7.8   | -34.3                  | 0.0                            | 0.0      | 43.8         | 33.7       | 74            | 54             | -30.2                        | -20.3      | V  |  |  |
| 9.269   | 3.0                   | 31.5                                | 21.2                  | 37.5    | 8.3   | -34.6                  | 0.0                            | 0.0      | 42.7         | 32.4       | 74            | 54             | -31.3                        | -21.6      | Noise floor  |  |  |
| 1.854   | 3.0                   | 45.1                                |                       | 27.3    | 3.3   | -37.1                  | 0.0                            | 0.0      | 38.6         | -6.5       | 74            | 54             | -35.4                        | -60.5      | H  |  |  |
| 2.787   | 3.0                   | 39.0                                | 31.0                  | 29.1    | 4.2   | -36.0                  | 0.0                            | 0.0      | 36.2         | 28.2       | 74            | 54             | -37.8                        | -25.8      | H  |  |  |
| 3.707   | 3.0                   | 35.6                                | 26.4                  | 31.4    | 4.9   | -35.2                  | 0.0                            | 0.0      | 36.6         | 27.4       | 74            | 54             | -37.4                        | -26.6      | H  |  |  |
| 4.635   | 3.0                   | 34.5                                | 27.6                  | 32.5    | 5.7   | -34.9                  | 0.0                            | 0.0      | 37.8         | 30.9       | 74            | 54             | -36.2                        | -23.1      | H  |  |  |
| 5.561   | 3.0                   | 34.9                                | 24.6                  | 33.6    | 6.3   | -34.8                  | 0.0                            | 0.0      | 39.9         | 29.6       | 74            | 54             | -34.1                        | -24.4      | H  |  |  |
| 6.488   | 3.0                   | 40.4                                | 38.4                  | 34.4    | 6.8   | -34.4                  | 0.0                            | 0.0      | 47.1         | 45.2       | 74            | 54             | -26.9                        | -8.8       | H  |  |  |
| 7.415   | 3.0                   | 31.2                                | 20.3                  | 35.6    | 7.3   | -34.1                  | 0.0                            | 0.0      | 40.1         | 29.1       | 74            | 54             | -33.9                        | -24.9      | Noise floor  |  |  |
| No other emissions were detected above system noise floor |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| Rev. 11.10.08   |                       |                                     |                       |         |       |                        |                                |          |              |            |               |                |                              |            |  |  |  |
| f   | Measurement Frequency |                                     |                       |         |       | Amp                    | Preamp Gain                    |          |              |            |               | Avg Lim        | Average Field Strength Limit |            |  |  |  |
| Dist  | Distance to Antenna   |                                     |                       |         |       | D Corr                 | Distance Correct to 3 meters   |          |              |            |               | Pk Lim         | Peak Field Strength Limit    |            |  |  |  |
| Read  | Analyzer Reading      |                                     |                       |         |       | Avg                    | Average Field Strength @ 3 m   |          |              |            |               | Avg Mar        | Margin vs. Average Limit     |            |  |  |  |
| AF  | Antenna Factor        |                                     |                       |         |       | Peak                   | Calculated Peak Field Strength |          |              |            |               | Pk Mar         | Margin vs. Peak Limit        |            |  |  |  |
| CL  | Cable Loss            |                                     |                       |         |       | HPF                    | High Pass Filter               |          |              |            |               |                |                              |            |  |  |  |

### **Radiated Emissions Below 1 GHz, Relay 1.5**

All emissions more than 20 dB below limits.

## MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| Frequency range<br>(MHz)                                | Electric field<br>strength<br>(V/m) | Magnetic field<br>strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|---|-------------------------------------|-------------------------------------|--|-----------------------------|
| (A) Limits for Occupational/Controlled Exposures        |                                     |                                     |  |                             |
| 0.3–3.0 .....   | 614                                 | 1.63                                | *(100)                                 | 6                           |
| 3.0–30 .....  | 1842/f                              | 4.89/f                              | *(900/f <sup>2</sup> )                 | 6                           |
| 30–300 .....  | 61.4                                | 0.163                               | 1.0                                    | 6                           |
| 300–1500 .....  |                                     |                                     | f/300                                  | 6                           |
| 1500–100,000 .....                                      |                                     |                                     | 5                                      | 6                           |
| (B) Limits for General Population/Uncontrolled Exposure |                                     |                                     |  |                             |
| 0.3–1.34 .....  | 614                                 | 1.63                                | *(100)                                 | 30                          |
| 1.34–30 .....   | 824/f                               | 2.19/f                              | *(180/f <sup>2</sup> )                 | 30                          |

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

| Frequency range<br>(MHz) | Electric field<br>strength<br>(V/m) | Magnetic field<br>strength<br>(A/m) | Power density<br>(mW/cm <sup>2</sup> ) | Averaging time<br>(minutes) |
|--------------------------|-------------------------------------|-------------------------------------|--|-----------------------------|
| 30–300 .....             | 27.5                                | 0.073                               | 0.2                                    | 30                          |
| 300–1500 .....           |                                     |                                     | f/1500                                 | 30                          |
| 1500–100,000 .....       |                                     |                                     | 1.0                                    | 30                          |

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

## CALCULATIONS

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{((30 * P * G) / (3770 * S))}$$

Changing to units of Power to mW and Distance to cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = 100 * d \text{ (m)}$$

yields

$$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

S = Power Density in mW/cm<sup>2</sup>

Substituting the logarithmic form of power and gain using:

$$P \text{ (mW)} = 10^{(P \text{ (dBm)} / 10)} \text{ and}$$

$$G \text{ (numeric)} = 10^{(G \text{ (dBi)} / 10)}$$

yields

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S} \quad \text{Equation (1)}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

Equation (1) and the measured peak power is used to calculate the MPE distance.

**LIMITS**

From §1.1310 Table 1 (B), S = 0.6 mW/cm<sup>2</sup>

**RESULTS**

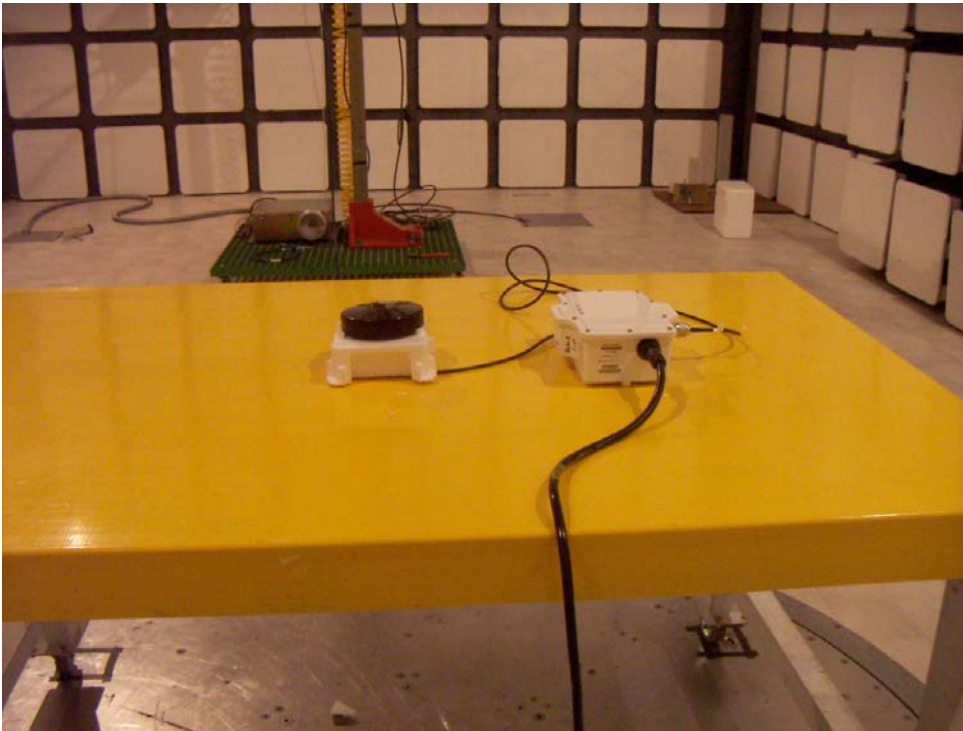
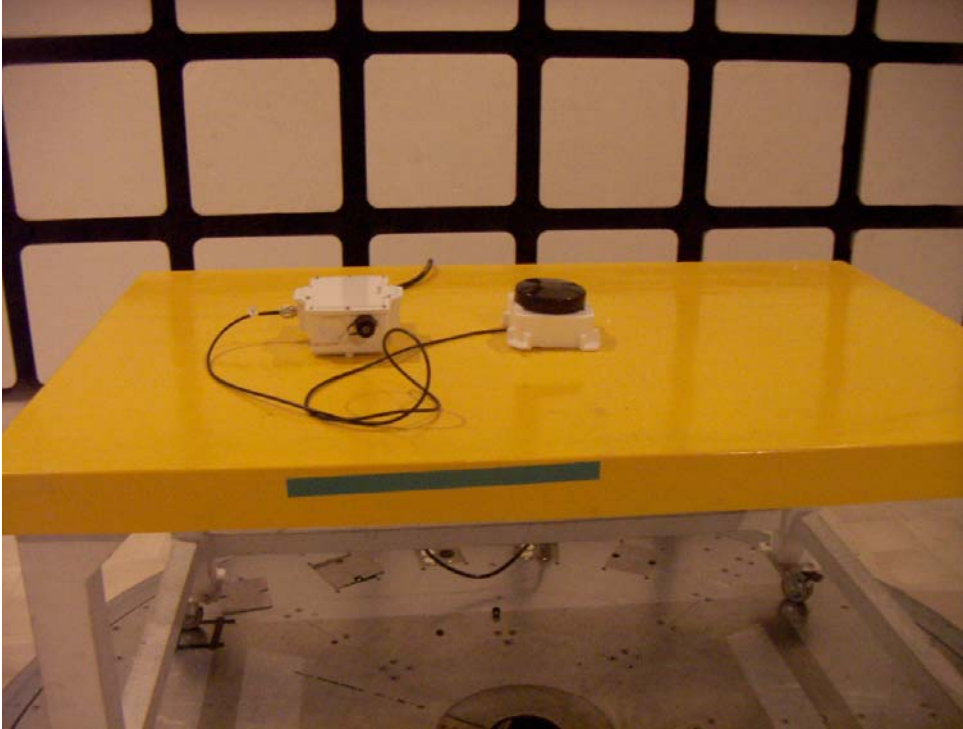
No non-compliance noted:

|  |            |              |                       |                |  |                |           |                  |              |
|--|------------|--------------|-----------------------|----------------|--|----------------|-----------|------------------|--------------|
| Silver Spring Networks   |            |              |                       |                |  |                |           |                  |              |
| FCC ID: OWS-NIC505   |            |              |                       |                |  |                |           |                  |              |
| 902-928 MHz FHSS Radio   |            |              |                       |                | Calculate mW/cm <sup>2</sup> here. Enter frequency in MHz: |                |           |                  |              |
| RF Hazard Distance Calculation   |            |              |                       |                | Calculation of Limits from 1.1310 Table 1                  |                |           |                  |              |
| mW/cm <sup>2</sup> from Table1:  |            | 0.60         |                       | F(MHz)         |  | Actual F, MHz  |           | Controlled       | Uncontrolled |
|  |            |              |                       | 0.3-3          |  | 0.5            |           | Ave 6 min        | Ave 30 min   |
| Max RF Power   | TX Antenna | MPE distance | S, mW/cm <sup>@</sup> | Comment        | 3.0 - 30.0   | 5              |           | 100.0            | 100.0        |
| P, dBm   | G, dBi     | cm           | at 20 cm              |                | 30.0-300   | 55             |           | 180.0            | 36.0         |
|  |            |              |                       |                | 300-1500   | 902            |           | 3.0              | 0.60         |
| 29.9   | -1.40      | 9.7          | 0.14                  | Effective gain | 1500-100000  | 5555           |           | 5.0              | 1.0          |
|  |            |              |                       |                | Enter P(mW)  | Equivalent dBm | Enter dBm | Equivalent Watts |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
| <b>Basis of Calculations:</b>  |            |              |                       |                | 963  | 29.84          | 29.84     | 963.8            |              |
| E <sup>2</sup> /3770 = S, mW/cm <sup>2</sup>   |            |              |                       |                |  |                |           |                  |              |
| E, V/m = (Pwatts*Ggain*30) <sup>.5</sup> /d, meters  |            |              |                       |                |  |                |           |                  |              |
| d = ((Pwatts*G*30)/3770*S) <sup>.5</sup>   |            |              |                       |                | Pwatts*Ggain = 10 <sup>^(PdBm-30+GdBi)/10</sup>            |                |           |                  |              |
| S@20cm = 20 log (MPE dist/20cm)  |            |              |                       |                |  |                |           |                  |              |
| <b>NOTE: For mobile or fixed location transmitters, minimum separation distance is for FCC compliance is 20 cm, even if calculations indicate MPE distance is less</b> |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |
|  |            |              |                       |                |  |                |           |                  |              |

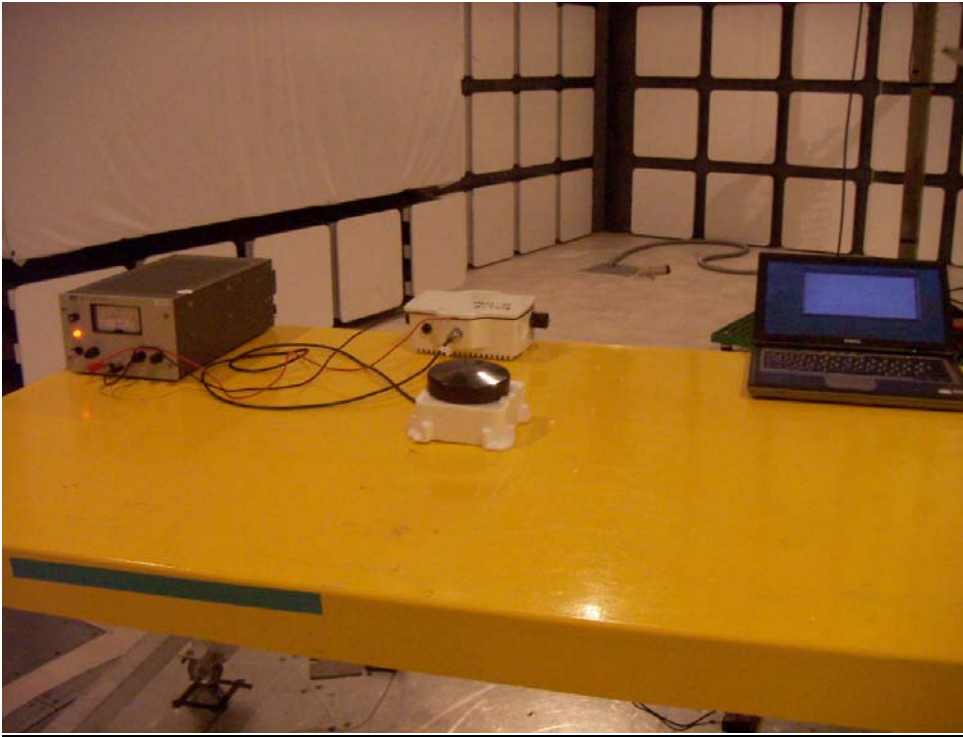
NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

## SETUP PHOTOS

### Relay 1.0 Radiated Emissions



**Relay 1.5 Radiated Emissions**



## END OF REPORT

### Report Revision History

| Revision No. | Revision Description | Pages Revised | Revised by  | Date      |
|--------------|----------------------|---------------|-------------|-----------|
| -            | Original Issue       |               | T. Cokenias | 2/17/2010 |