



**Nemko Test Report:** 47117RUS1

**Applicant:** Overhead Door  
TREQ Center, Suite B  
2170 French Settlement Road  
Dallas, Texas 75212

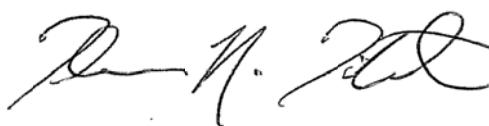
**Equipment Under Test:** Wireless Adapter  
**(E.U.T.)** Genie Model #37101R which is GN  
Overhead Door Model #37457R which is OA

**In Accordance With:** **CFR 47, Part 15, Subpart C, 15.247 &**  
**Industry Canada, RSS-210**  
Frequency Hopping Transmitters

**Tested By:** Nemko USA Inc.  
802 N. Kealy  
Lewisville, Texas 75057-3136

**TESTED BY:**   
\_\_\_\_\_  
David Light, Wireless Engineer

**DATE:** 03 June 2010

**APPROVED BY:**   
\_\_\_\_\_  
Tom Tidwell, Reviewer

**DATE:** 31 March 2011

**Total Number of Pages:** 36

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**Section 1. Summary of Test Results**

Manufacturer: Overhead Door

Model No.: Wireless Adapter

Variants: Genie Model #37101R which is GN  
Overhead Door Model #37457R which is OA

Products are identical except for logo.

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, Paragraph 15.247 and Industry Canada RSS-210, Issue 7 for Frequency Hopping Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and Industry Canada..

|                                     |                            |                                     |                     |
|-------------------------------------|----------------------------|-------------------------------------|---------------------|
| <input checked="" type="checkbox"/> | New Submission             | <input type="checkbox"/>            | Production Unit     |
| <input type="checkbox"/>            | Class II Permissive Change | <input checked="" type="checkbox"/> | Pre-Production Unit |
| <input checked="" type="checkbox"/> | Family Listing             |                                     |                     |

**THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.**

**THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.**  
See "Summary of Test Data".



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CFR 47, Part 15.247 and Industry Canada RSS-210

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* Wireless Adapter

PROJECT NO.: 47117RUS1

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*EQUIPMENT:* Wireless Adapter

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### **Summary of Test Data**

| NAME OF TEST                              | PARA. NO.                     | RESULT   |
|---|-------------------------------|----------|
| Powerline Conducted Emissions             | 15.207(a) / RSS-Gen 7.2.2     | Complies |
| Channel Separation                        | 15.247(a)(1) / RSS-210 8.1(b) | Complies |
| Time of Occupancy                         | 15.247(a)(1) / RSS-210 8.1(c) | Complies |
| 20 dB Occupied Bandwidth                  | 15.247(a)(1) / RSS-210 8.1(b) | Complies |
| Peak Power Output                         | 15.247(b) / RSS-210 8.4(1)    | Complies |
| Spurious Emissions<br>(Antenna Conducted) | 15.247(d) / RSS-210 8.5       | Complies |
| Spurious Emissions (Radiated)             | 15.247(d) / RSS-Gen 7.2.3     | Complies |
| Receiver Spurious Emissions               | RSS-Gen 7.2.3                 | Complies |

### **Footnotes:**

**Section 2. Equipment Under Test (E.U.T.)****General Equipment Information**

**Frequency Band:**  902 – 928 MHz  
 2400 – 2483.5 MHz  
 5725 – 5850 MHz

**Operating Frequency Range:** 903.94 to 925.60 MHz

**Input Power:** 120 Vac (input to drive head)

**Number of Channels:** 51

**20 dB Bandwidth:** 81.7 kHz

**Channel Spacing:** 380 kHz

**User Frequency Adjustment:** Software controlled

**Description of EUT**

Wireless adapter for Overhead Door NGX family of garage door openers.

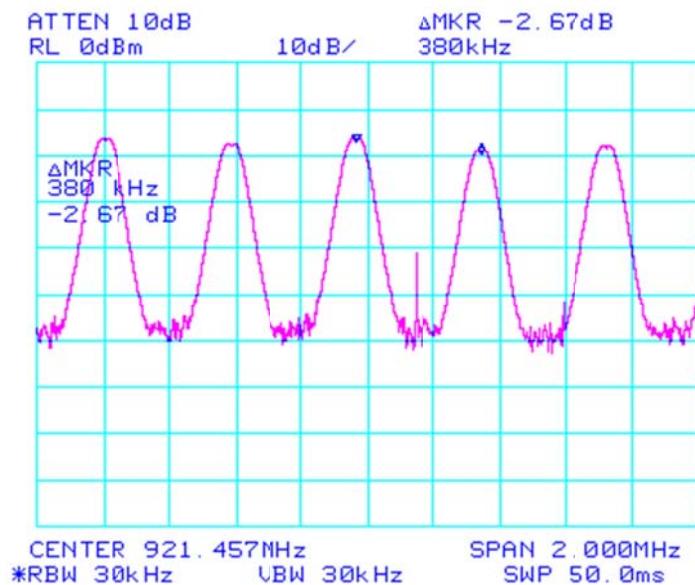
**Section 3. Channel Separation**

|                                  |   |
|----------------------------------|---|
| NAME OF TEST: Channel Separation | PARA. NO.: 15.247(a)(1)<br>RSS-210 8.1(b) |
| TESTED BY: David Light           | DATE: 02 June 2010                        |

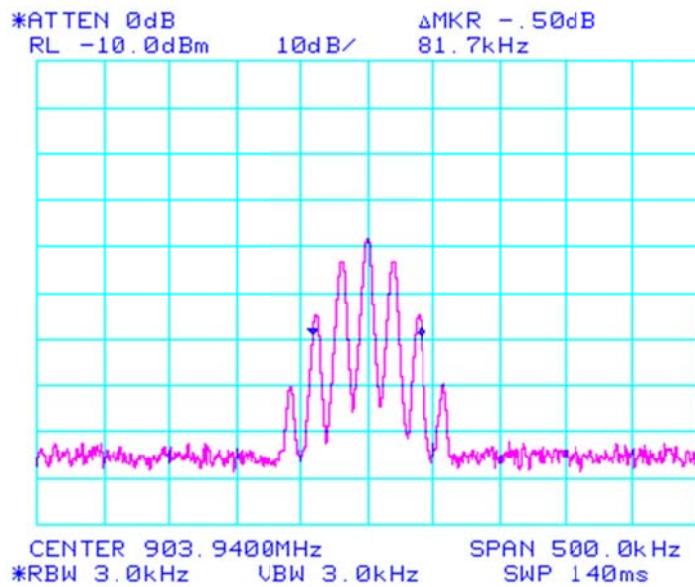
**Test Results:** Complies.**Measurement Data:** See 20 dB BW plot

Measured 20 dB bandwidth: 81.7 kHz  
Channel Separation: 380 kHz

**Equipment Used:** 1464-1082-1472**Measurement Uncertainty:** 1X10<sup>-7</sup>ppm**Temperature:** 22 °C**Relative Humidity:** 35 %

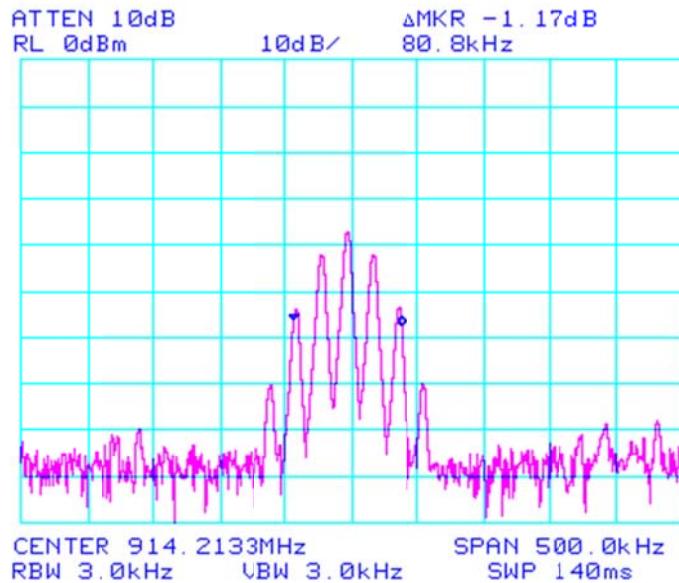
**Test Data – Channel Separation****Test Data – 20 dB Bandwidth**

## Low Channel

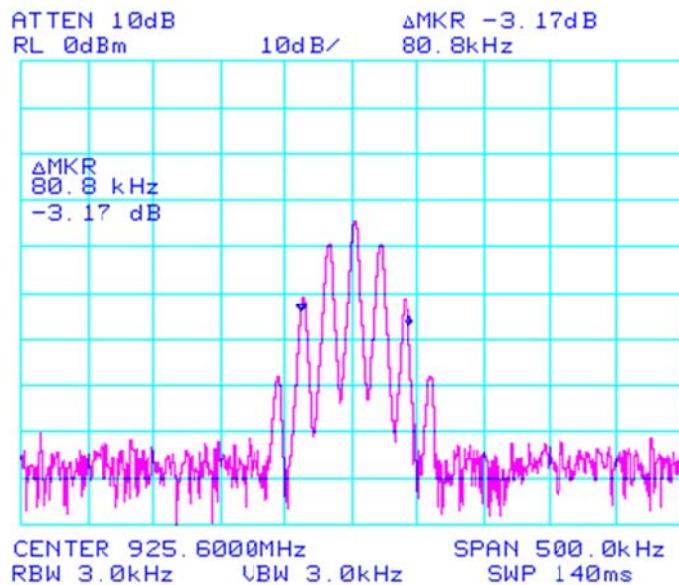


**Test Data – 20 dB Bandwidth**

Mid Channel



High Channel



**Section 4. Time of Occupancy**

|                                 |                                     |
|---------------------------------|-------------------------------------|
| NAME OF TEST: Time of Occupancy | PARA. NO.: 15.247(a)(1)             |
| TESTED BY: David Light          | RSS-210 8.1(c)<br>DATE:02 June 2010 |

**Test Results:** Complies.**Measurement Data:**

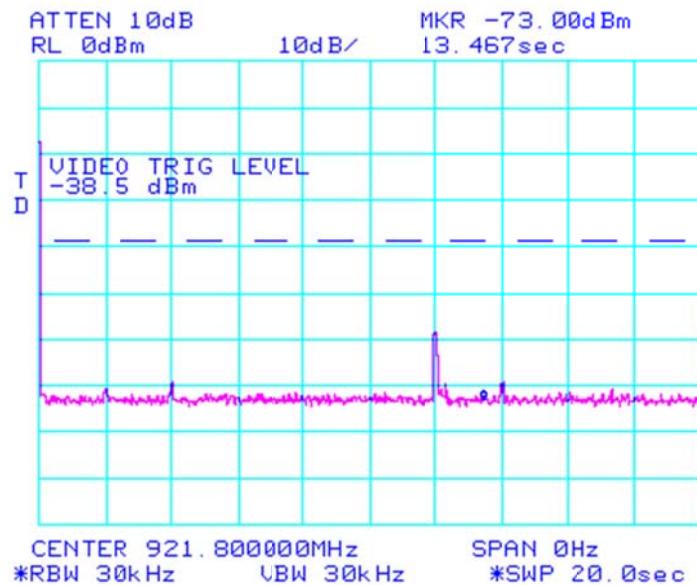
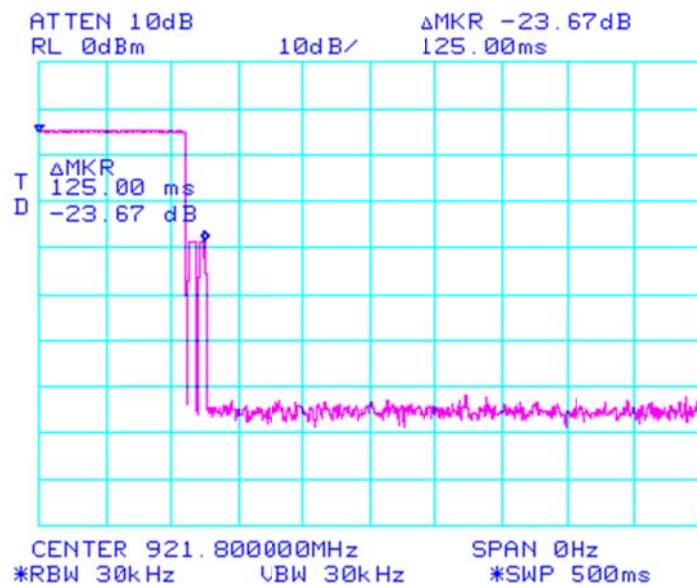
Maximum Dwell Time On Any Channel: 125 mS in 400 mS

**Equipment Used:** 1464-1082-1472**Measurement Uncertainty:** 1X10<sup>-7</sup> ppm**Temperature:** 22 °C**Relative Humidity:** 35 %

**Test Data – Time of Occupancy**

Pulse Width

125 mS



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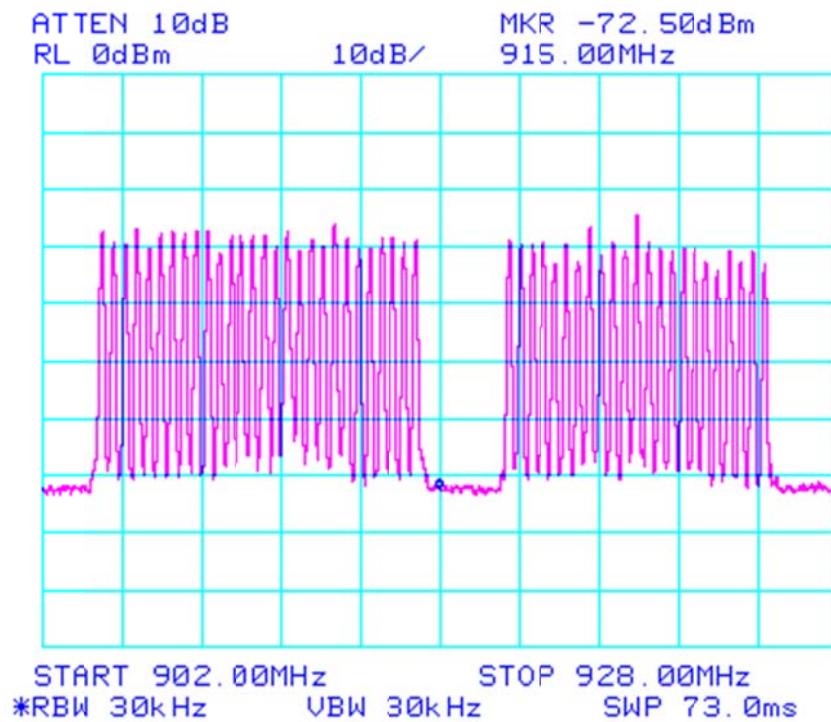
EQUIPMENT: Wireless Adapter

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**Test Data – Time of Occupancy**

Number of hopping channels = 51



**Section 5. Peak Power Output**

|                                 |   |
|---------------------------------|---|
| NAME OF TEST: Peak Power Output | PARA. NO.: 15.247 (b)<br>RSS-210 8.4(1) |
| TESTED BY: David Light          | DATE: 02 June 2010                      |

**Test Results:** Complies.**Measurement Data:** See attached plots.

Detachable antenna?  Yes  No  
If yes, state the type of non-standard connector used:

| Frequency (MHz) | Peak Power (dBm) | Peak Power (mW) | Antenna Type | Gain (dBi) | E.I.R.P. (dBm) | E.I.R.P. (mW) |
|-----------------|------------------|-----------------|--------------|------------|----------------|---------------|
| 903.94          | 10.5             | 11.2            | Dipole       | 2.1        | 12.6           | 18.2          |
| 914.26          | 10.2             | 10.5            | Dipole       | 2.1        | 12.3           | 17.0          |
| 925.60          | 9.7              | 9.3             | Dipole       | 2.1        | 11.8           | 15.1          |

Maximum EIRP (mW): 18.2

- This device was tested at +/- 15% input power per 15.31(e), with no variation in output power.
- For battery powered equipment, the device was tested with a fresh battery per 15.31(e).
- The device was tested on three channels per 15.31(l).

Spectrum analyzer settings: RBW=VBW=1MHz, Detector=Peak, Sweep=Auto, Span=5MHz

**Equipment Used:** 1464/1472/1082**Measurement Uncertainty:** 1.7 dB**Temperature:** 22 °C**Relative Humidity:** 35 %

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*EQUIPMENT:* Wireless Adapter

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## **Section 6. Spurious Emissions (Antenna Conducted)**

|  |                                     |
|--|-------------------------------------|
| NAME OF TEST: Spurious Emissions (Antenna Conducted) | PARA. NO.: 15.247(d)<br>RSS-210 8.5 |
| TESTED BY: David Light                               | DATE: 02 June 2010                  |

**Test Results:** Complies.

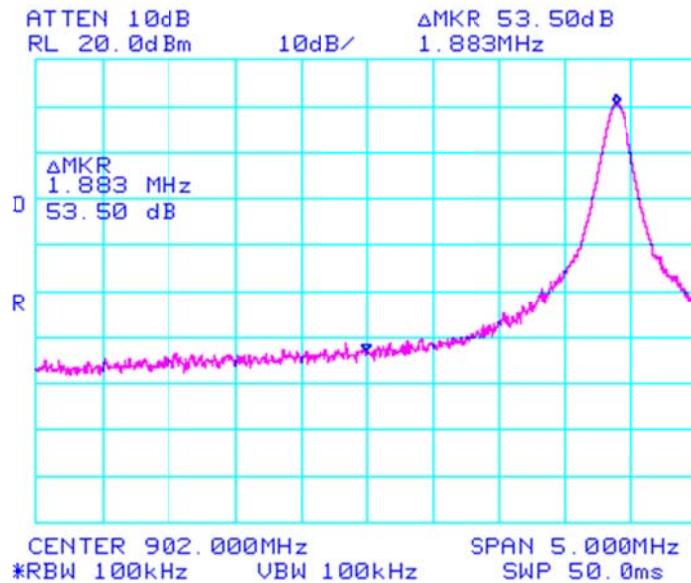
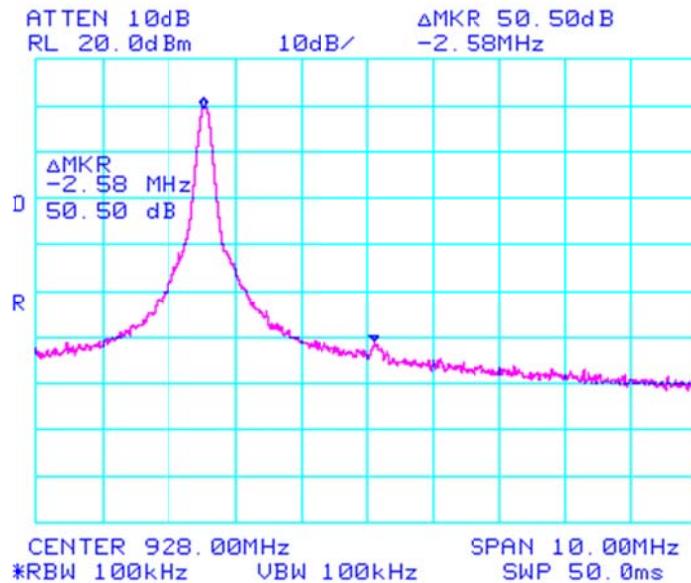
**Measurement Data:** See attached plots.

**Equipment Used:** 1464-1472-1082

**Measurement Uncertainty:** 1X10<sup>-7</sup> ppm

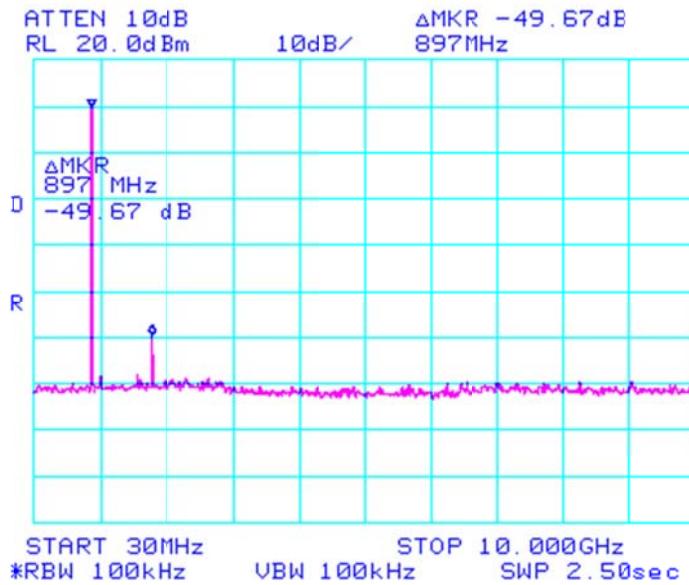
**Temperature:** 22 °C

**Relative Humidity:** 35 %

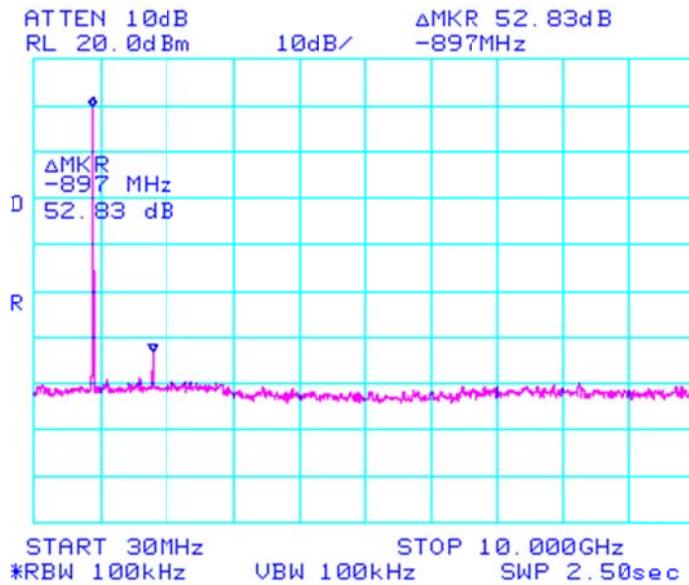
**Test Data – Spurious Emissions at Antenna Terminals****Lower Band Edge****Upper Band Edge**

**Test Data – Spurious Emissions at Antenna Terminals**

## Spurs – Low Channel

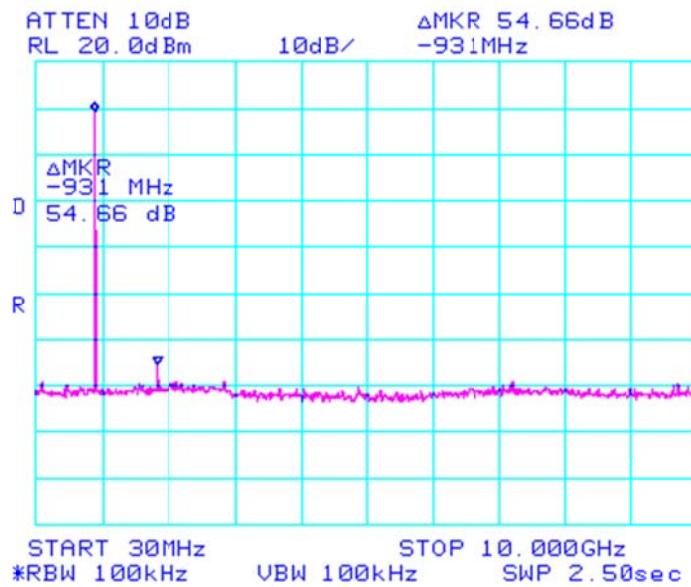


## Spurs – Mid Channel



**Test Data – Spurious Emissions at Antenna Terminals**

Spurs – High Channel



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*EQUIPMENT:* Wireless Adapter

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## **Section 7. Spurious Emissions (Radiated)**

|   |                      |
|---|----------------------|
| NAME OF TEST: Spurious Emissions (Radiated) | PARA. NO.: 15.247(d) |
| TESTED BY: David Light                      | RSS-Gen 7.2.3        |
|   | DATE: 02 June 2010   |

### **Test Results:**

Complies. The worst case emission was 53 dB $\mu$ V/m at 5485.3 MHz. This is 1 dB below the specification limit of 54 dB $\mu$ V/m.

**Measurement Data:** See attached table.

Notes:

- For handheld devices, the EUT was tested on three orthogonal axis'
- The device was tested from 30 MHz to the tenth harmonic of the highest fundamental frequency per 15.33. All readings within 20 dB of the specification limit are reported.
- The device was tested on three channels per 15.31(l).
- No emissions were detected within 20 dB of the specification limit therefore none are reported per 15.31(o). Band edge data is presented below.

**Equipment Used:** 1464-1484-1485-791-1480-1016-993

**Measurement Uncertainty:**  +/-3.6 dB

**Temperature:** \_\_\_\_\_ °C

**Relative Humidity:** \_\_\_\_\_ %

**Test Data - Radiated Emissions**

## Low Channel

| # | Freq<br>MHz    | Rdng<br>dB $\mu$ V | Cable | Cable | Pre-A | Horn  | Dist<br>Table | Corr<br>dB $\mu$ V/m | Spec<br>dB $\mu$ V/m | Margin<br>dB | Polar<br>Ant |
|---|----------------|--------------------|-------|-------|-------|-------|---------------|----------------------|----------------------|--------------|--------------|
|   |                |                    | dB    | dB    | dB    | dB    |               |                      |                      |              |              |
| 1 | 5423.60        | 47.8               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 54.3                 | 74.0                 | -19.7        | Horiz        |
| 2 | 5423.60<br>Ave | 44.0               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 50.5                 | 54.0                 | -3.5         | Horiz        |
| 3 | 5423.60        | 49.0               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 55.5                 | 74.0                 | -18.5        | Vert         |
| 4 | 5423.60<br>Ave | 45.5               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 52.0                 | 54.0                 | -2.0         | Vert         |

## Mid Channel

| # | Freq<br>MHz    | Rdng<br>dB $\mu$ V | Cable | Cable | Pre-A | Horn  | Dist<br>Table | Corr<br>dB $\mu$ V/m | Spec<br>dB $\mu$ V/m | Margin<br>dB | Polar<br>Ant |
|---|----------------|--------------------|-------|-------|-------|-------|---------------|----------------------|----------------------|--------------|--------------|
|   |                |                    | dB    | dB    | dB    | dB    |               |                      |                      |              |              |
| 1 | 5485.29        | 49.0               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 55.5                 | 74.0                 | -18.5        | Horiz        |
| 2 | 5485.29<br>Ave | 46.2               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 52.7                 | 54.0                 | -1.3         | Horiz        |
| 3 | 5485.29        | 49.5               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 56.0                 | 74.0                 | -18.0        | Vert         |
| 4 | 5485.29<br>Ave | 46.5               | +1.2  | +3.5  | -31.8 | +33.6 | +0.0          | 53.0                 | 54.0                 | -1.0         | Vert         |

## High Channel

| # | Freq<br>MHz    | Rdng<br>dB $\mu$ V | Cable | Cable | Pre-A | Horn  | Dist<br>Table | Corr<br>dB $\mu$ V/m | Spec<br>dB $\mu$ V/m | Margin<br>dB | Polar<br>Ant |
|---|----------------|--------------------|-------|-------|-------|-------|---------------|----------------------|----------------------|--------------|--------------|
|   |                |                    | dB    | dB    | dB    | dB    |               |                      |                      |              |              |
| 1 | 5553.66        | 48.5               | +1.2  | +3.5  | -31.9 | +33.7 | +0.0          | 55.0                 | 74.0                 | -19.0        | Vert         |
| 2 | 5553.66<br>Ave | 45.5               | +1.2  | +3.5  | -31.9 | +33.7 | +0.0          | 52.0                 | 54.0                 | -2.0         | Vert         |
| 3 | 5553.66        | 47.7               | +1.2  | +3.5  | -31.9 | +33.7 | +0.0          | 54.2                 | 74.0                 | -19.8        | Horiz        |
| 4 | 5553.66<br>Ave | 44.3               | +1.2  | +3.5  | -31.9 | +33.7 | +0.0          | 50.8                 | 54.0                 | -3.2         | Horiz        |

$$\text{Corr(dB $\mu$ V/m)} = \text{Rdng(dB $\mu$ V)} + \text{Cable(dB)} + \text{Pre amp(dB)} + \text{AF(dB)}$$

All measurements are peak unless otherwise indicated.

Analyzer Settings: Peak readings RBW=VBW=1 MHz Peak detector  
 Average readings RBW=1 MHz VBW=1kHz Peak detector

**Section 8. Powerline Conducted Emissions**

|   |                      |
|---|----------------------|
| NAME OF TEST: Powerline Conducted Emissions | PARA. NO.: 15.207(a) |
| TESTED BY: Art Ruvalcaba                    | RSS-Gen 7.2.2        |
|   | DATE: 06 May 2010    |

**Test Results:** Complies. The worst case emission was 55.81 dB $\mu$ V at 6.5 MHz. This is 4.19 dB below the quasi-peak specification limit of 60 dB $\mu$ V.

**Test Data:** Refer to attached table.

**Equipment Used:** 1258-1988-527-1284

**Measurement Uncertainty:** +/- 1.7 dB

**Temperature:** 22 °C

**Relative Humidity:** 35 %

**Test Data – Powerline Conducted Emissions**

Nemko

Line 1 Final QP/AVG

LINE 1

Operator: Art Model Number: 4 CE NGX DC Chain\_Belt unit

Company: OHD

02:41:35 PM, Thursday, May 06, 2010:

| Frequency | 22 B     | 22 B      | AVG    | AVG     | QP     | QP      |
|-----------|----------|-----------|--------|---------|--------|---------|
| MHz       | QP LIMIT | AVG LIMIT | Meas   | Margin  | Meas   | Margin  |
| 6.8004    | 60.000   | 50.000    | 39.525 | -10.475 | 52.340 | -7.660  |
| 6.8179    | 60.000   | 50.000    | 38.305 | -11.695 | 53.120 | -6.880  |
| 6.8974    | 60.000   | 50.000    | 37.070 | -12.930 | 46.990 | -13.010 |
| 6.9197    | 60.000   | 50.000    | 36.243 | -13.758 | 51.480 | -8.520  |
| 6.9923    | 60.000   | 50.000    | 38.863 | -11.137 | 50.790 | -9.210  |
| 7.2474    | 60.000   | 50.000    | 34.010 | -15.990 | 48.860 | -11.140 |
| 7.2928    | 60.000   | 50.000    | 33.328 | -16.672 | 49.360 | -10.640 |
| 7.4419    | 60.000   | 50.000    | 33.470 | -16.530 | 47.160 | -12.840 |
| 7.469     | 60.000   | 50.000    | 33.727 | -16.273 | 48.800 | -11.200 |
| 7.7875    | 60.000   | 50.000    | 27.818 | -22.182 | 51.311 | -8.689  |

Line 2 Final QP/Avg

Line 2

Operator: Art Model Number: 4 CE NGX DC Chain\_Belt unit

Company: OHD

02:28:53 PM, Thursday, May 06, 2010:

| Frequency | EN55022 B | EN55022 B | AVG    | AVG     | QP     | QP      |
|-----------|-----------|-----------|--------|---------|--------|---------|
| MHz       | QP Limit  | AVG Limit | Meas   | Margin  | Meas   | Margin  |
| 6.4678    | 60.000    | 50.000    | 38.140 | -11.860 | 51.530 | -8.470  |
| 6.4828    | 60.000    | 50.000    | 38.322 | -11.678 | 55.810 | -4.190  |
| 6.6186    | 60.000    | 50.000    | 40.438 | -9.563  | 53.940 | -6.060  |
| 6.6209    | 60.000    | 50.000    | 37.203 | -12.797 | 50.170 | -9.830  |
| 6.8335    | 60.000    | 50.000    | 39.250 | -10.750 | 55.050 | -4.950  |
| 6.8763    | 60.000    | 50.000    | 40.852 | -9.148  | 53.920 | -6.080  |
| 6.8935    | 60.000    | 50.000    | 35.868 | -14.133 | 53.730 | -6.270  |
| 8.5202    | 60.000    | 50.000    | 37.693 | -12.307 | 53.396 | -6.604  |
| 8.5356    | 60.000    | 50.000    | 37.666 | -12.334 | 53.796 | -6.204  |
| 12.7024   | 60.000    | 50.000    | 31.675 | -18.325 | 44.940 | -15.060 |

**Section 9.      Receiver Spurious Emissions**

|   |                          |
|---|--------------------------|
| NAME OF TEST: Receiver Spurious Emissions | PARA. NO.: RSS-Gen 7.2.3 |
| TESTED BY: David Light                    | DATE: 02 June 2010       |

**Test Results:** Complies. The worst case emission was -60.8 dBm at 877 MHz. This is 3.8 dB below the specification limit of -57 dBm.

**Test Data:** Refer to attached.

**Equipment Used:** 1464-1082

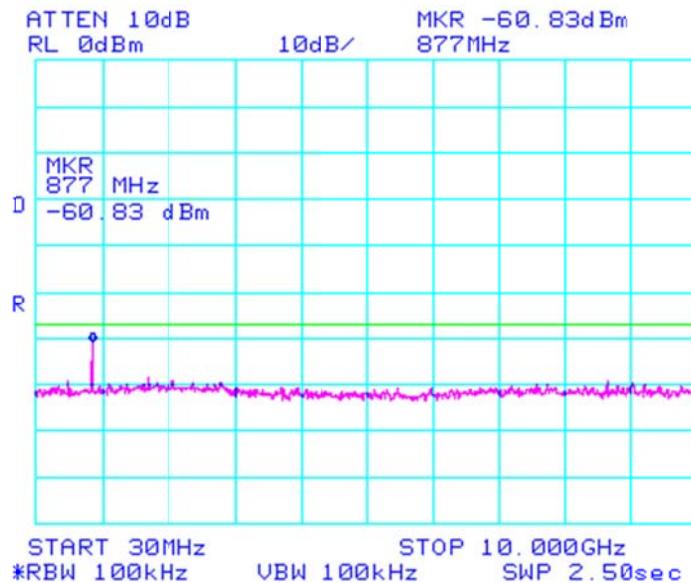
**Measurement Uncertainty:** +/- 1.7 dB

**Temperature:** 22 °C

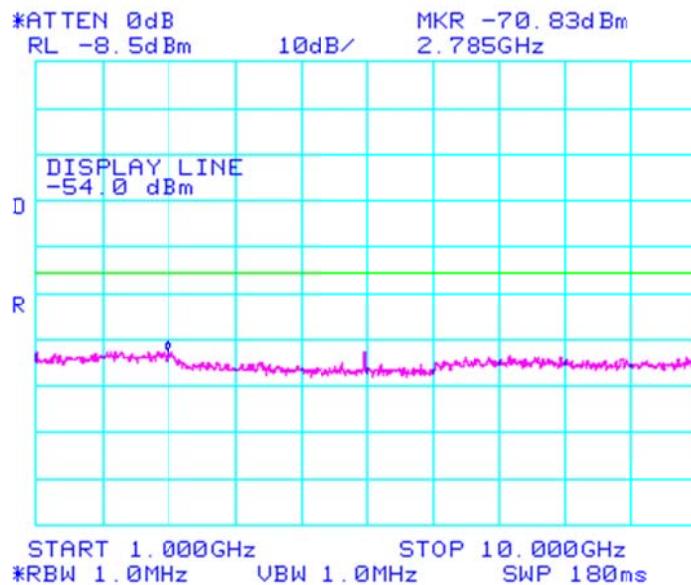
**Relative Humidity:** 35 %

**Test Data = Receiver Spurious Emissions**

Rx spurious



Rx Spurious



**Section 10. Test Equipment List**

| Asset Tag | Description                 | Manufacturer    | Model              | Serial #   | Last Cal    | Next Cal    |
|-----------|-----------------------------|-----------------|--------------------|------------|-------------|-------------|
| 993       | Antenna, Horn               | A.H. Systems    | SAS-200/571        | 162        | 09-Sep-2009 | 09-Sep-2011 |
| 1016      | Preamplifier                | Hewlett Packard | 8449A              | 2749A00159 | 23-Jun-2009 | 23-Jun-2010 |
| 1082      | Cable, 2m                   | Astrolab        | 32027-2-29094-72TC |            | N/R         |             |
| 1258      | LISN                        | EMCO            | 3825/2             | 1305       | 24-Sep-2009 | 24-Sep-2010 |
| 1284      | Quasi-Peak Adapter          | Hewlett Packard | 85650A             | 2521A00769 | 03-Jun-2009 | 03-Jun-2010 |
| 1464      | Spectrum Analyzer           | Hewlett Packard | 8563E              | 3551A04428 | 27-Feb-2009 | 27-Feb-2011 |
| 1472      | Attenuator, 20dB, DC 18 GHz | Omni Spectra    | 20600-20db         |            | N/R         |             |
| 1480      | Antenna, Bilog              | Schaffner-Chase | CBL6111C           | 2572       | 18-Jan-2010 | 18-Jan-2011 |
| 1484      | Cable                       | Storm           | PR90-010-072       |            | 23-Jun-2009 | 23-Jun-2010 |
| 1485      | Cable                       | Storm           | PR90-010-216       |            | 23-Jun-2009 | 23-Jun-2010 |
| 1988      | Cable, Coaxial              | Nemko USA, Inc. |                    |            | 29-Sep-2009 | 29-Sep-2010 |
| 791       | PreAmp                      | Nemko, USA      |                    |            | 03-Aug-2009 | 03-Aug-2010 |

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* Wireless Adapter

PROJECT NO.: 47117RUS1

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## **ANNEX A - TEST DETAILS**

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

**Minimum Standard:** §15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 mH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Conducted Emission (MHz) | Limit (dBmV) |           |
|---------------------------------------|--------------|-----------|
|                                       | Quasi-peak   | Average   |
| 0.15-0.5                              | 66 to 56*    | 56 to 46* |
| 0.5-5                                 | 56           | 46        |
| 5-30                                  | 60           | 50        |

\* Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 mV within the frequency band 535-1705 kHz, as measured using a 50 mH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as provided in §15.205 and §§15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

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CFR 47, Part 15.247 and Industry Canada RSS-210

FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* Wireless Adapter

PROJECT NO.: 47117RUS1

|                                  |                         |
|----------------------------------|-------------------------|
| NAME OF TEST: Channel Separation | PARA. NO.: 15.247(a)(1) |
|----------------------------------|-------------------------|

**Minimum Standard:**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

NAME OF TEST: Time of Occupancy

PARA. NO.: 15.247(a)(1)

**Minimum Standard:**

| Frequency Band (MHz) | 20 dB Bandwidth | No. of Hopping Channels | Average Time of Occupancy  |
|----------------------|-----------------|-------------------------|--|
| 902 - 928            | <250 kHz        | 50                      | =<0.4 sec. in 20 sec.  |
| 902 – 928            | =>250 kHz       | 25                      | =<0.4 sec. in 10 sec.  |
| 2400 – 2483.5        | -----           | 75                      | =<0.4 sec. in 0.4 seconds multiplied by the number of hopping channels employed. |
| 5725 – 5850          | -----           | 75                      | =<0.4 sec. in 30 sec.  |

**Method Of Measurement:**

The spectrum analyzer is set as follows:

RBW: 1 MHz

VBW: = RBW

Span: 0 Hz

LOG dB/div.: 10 dB

Sweep: Sufficient to see one hop time sequence.

Trigger: Video

The occupancy time of one hop is measured as above. The average time of occupancy is calculated over the appropriate period of time from above table

Avg. time of occupancy = (period from table/duration of one hop)/no. of channels multiplied by the duration of one hop.

For instance:

If a 2.4 GHz system has a measured hop duration time of 1 msec. and uses 75 channels, then the average time of occupancy would be:

$(30 \text{ sec.} / 0.001 \text{ sec.}) / 75 \text{ chan.} = 400 \times 1 \text{ msec.} = 400 \text{ msec. or } 0.4 \text{ sec. in 30 sec.}$

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FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* Wireless Adapter

PROJECT NO.: 47117RUS1

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 15.247(a)(1)

**Minimum Standard:**

| Frequency Band (MHz) | Maximum 20 dB Bandwidth |
|----------------------|-------------------------|
| 902 - 928            | 500 kHz                 |
| 2400 – 2483.5        | Not defined             |
| 5725 – 5850          | 1 MHz                   |

**Method Of Measurement:**

The spectrum analyzer is set as follows:

RBW: At least 1% of span/div.

VBW: >RBW

Span: Sufficient to display 20 dB bandwidth

LOG dB/div.: 10 dB

Sweep: Auto

**Number of channels tested:**

| Tuning range     | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less    | 1                         | middle                   |
| 1 to 10 MHz      | 2                         | top and bottom           |
| more than 10 MHz | 3                         | top, middle, bottom      |

NAME OF TEST: Peak Power Output

PARA. NO.: 15.247(b)

**Minimum Standard:**

| Frequency Band (MHz) | No. of Hopping Channels | Maximum Peak Power Output at Antenna Port |
|----------------------|-------------------------|---|
| 902 - 928            | at least 50             | 1 watt                                    |
| 902 – 928            | 25 - 49                 | 0.25 watts                                |
| 2400 – 2483.5        | 75                      | 1 watt                                    |
| 5725 – 5850          | 75                      | 1 watt                                    |

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

**Direct Measurement Method For Detachable Antennas:**

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

**Calculation Of EIRP For Integral Antenna:**

If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation  $GP/4\pi R^2 = E^2/120\pi$  and proceeding as follows:

$$P = \frac{E^2 R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts

E = the maximum measured field strength in V/m

R = the measurement range (3 meters)

G = the numeric gain of the transmit antenna in relation to an isotropic radiator

The RBW of the spectrum analyzer shall be set to a value greater than the measured 20 dB occupied bandwidth of the E.U.T.

Number of channels tested:

| Tuning range     | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less    | 1                         | middle                   |
| 1 to 10 MHz      | 2                         | top and bottom           |
| more than 10 MHz | 3                         | top, middle, bottom      |

|   |                      |
|---|----------------------|
| NAME OF TEST: Spurious Emissions at Antenna Terminals | PARA. NO.: 15.247(d) |
|---|----------------------|

**Minimum Standard:** In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

| Frequency (MHz) | Field Strength ( $\mu$ V/m @ 3m) | Field Strength (dB @ 3m) |
|-----------------|----------------------------------|--------------------------|
| 30 - 88         | 100                              | 40.0                     |
| 88 - 216        | 150                              | 43.5                     |
| 216 - 960       | 200                              | 46.0                     |
| Above 960       | 500                              | 54.0                     |

**THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC**

**Method Of Measurement:**

30 MHz - 10th harmonic plot

RBW: 100 kHz

VBW: 300 kHz

Sweep: Auto

Display line: -20 dBc

Lower Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge

RBW: At least 1% of span/div.

VBW: >RBW

Span: As necessary to display any spurious at band edge.

Sweep: Auto

Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz

Marker: Peak of fundamental emission

Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

| Tuning range     | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less    | 1                         | middle                   |
| 1 to 10 MHz      | 2                         | top and bottom           |
| more than 10 MHz | 3                         | top, middle, bottom      |

NAME OF TEST: Radiated Spurious Emissions

PARA. NO.: 15.247(d)

**Minimum Standard:** In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

**Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:**

| Frequency (MHz) | Field Strength ( $\mu$ V/m @ 3m) | Field Strength (dB @ 3m) |
|-----------------|----------------------------------|--------------------------|
| 30 - 88         | 100                              | 40.0                     |
| 88 - 216        | 150                              | 43.5                     |
| 216 - 960       | 200                              | 46.0                     |
| Above 960       | 500                              | 54.0                     |

**THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC**

#### 15.205 Restricted Bands

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.09-0.11         | 16.42-16.423        | 399.9-410     | 4.5-5.25    |
| 0.495-0.505       | 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     |
| 6.125-6.218       | 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       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2655-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | Above 38.6  |
| 13.36-13.41       | 1718                |               |             |

Number of channels tested:

| Tuning range     | Number of channels tested | Channel location in band |
|------------------|---------------------------|--------------------------|
| 1 MHz or less    | 1                         | middle                   |
| 1 to 10 MHz      | 2                         | top and bottom           |
| more than 10 MHz | 3                         | top, middle, bottom      |

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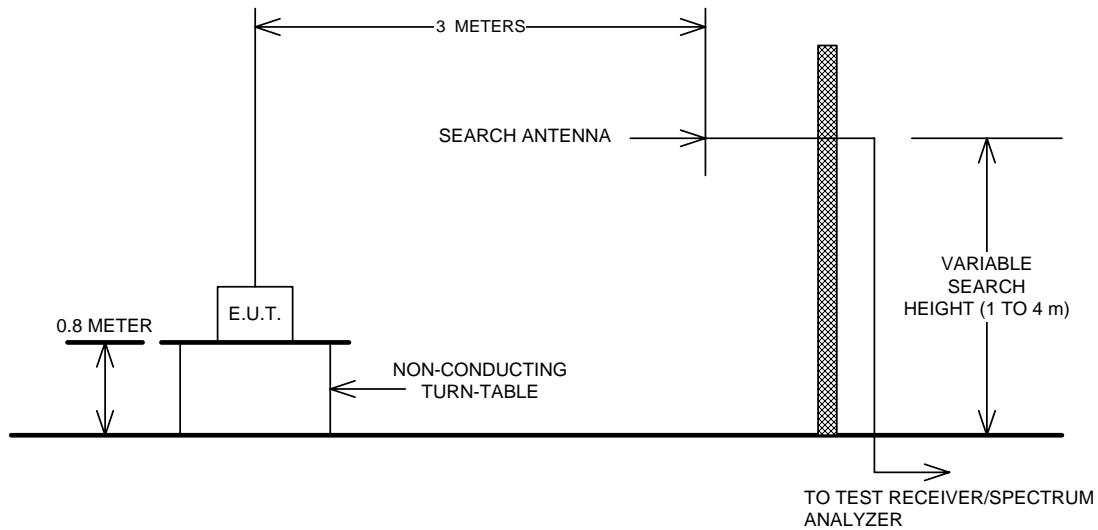
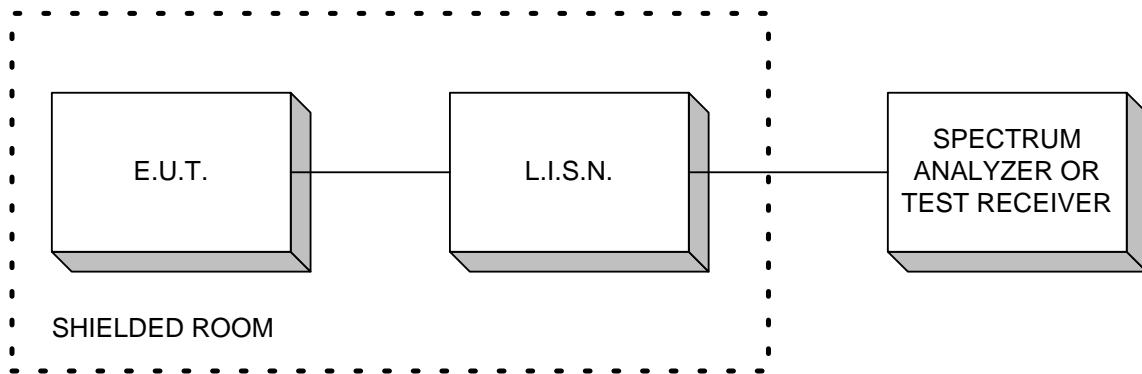
FREQUENCY HOPPING SPREAD SPECTRUM TRANSMITTER

*EQUIPMENT:* Wireless Adapter

PROJECT NO.: 47117RUS1

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## **ANNEX B - TEST DIAGRAMS**

**Test Site For Radiated Emissions****Conducted Emissions**

**Peak Power at Antenna Terminals**