

EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement: FCC
Test Requirements: FCC Part 15

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

FCC ID: OWS-NIC714
IC: 5975A-NIC714
Model No.: NIC414
Application type: Class 2 permissive change

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Silver Spring Networks (SSN) model NIC414 is a radio module for electric power meter communications use. The module incorporates a 900 MHz frequency hopping spread spectrum mesh network radio and a 2.4 GHz DTS radio.

This report is for a Class 2 permissive change for the 900 MHz portion of the product. The internal antenna gain has changed, and the front end has been replaced with a new RFMD front end module (FEM) that is pin compatible with the original front end.

III. TEST DATES AND TEST LOCATION

Testing was performed on various dates between May and July 2013.

Radiated emissions:
BACL Laboratories
1274 Anvilwood Ave.
Sunnyvale, CA 94089

Antenna port conducted tests were performed at Silver Spring Networks.



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

5 August 2013

15.203 Antenna connector requirement

The EUT uses a custom permanently attached integral antenna, a special sheet metal antenna manufactured by Silver Spring Networks for electric meters. There is also an optional external antenna that can be used with this radio.

| Antenna description | Mfr. | Model No. | Gain |
|-------------------------------------|------|-----------|--|
| Built-in sheet metal electric meter | SSN | n/a | 1.2 dBi at 915 MHz 5.6 dBi at 2.4 GHz |
| External monopole antenna (omni) | SSN | | 3 dBi at 915 MHz 3.6 dBi at 2.4 GHz |

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 8: Low power license exempt radio frequency devices (December 2010)

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.

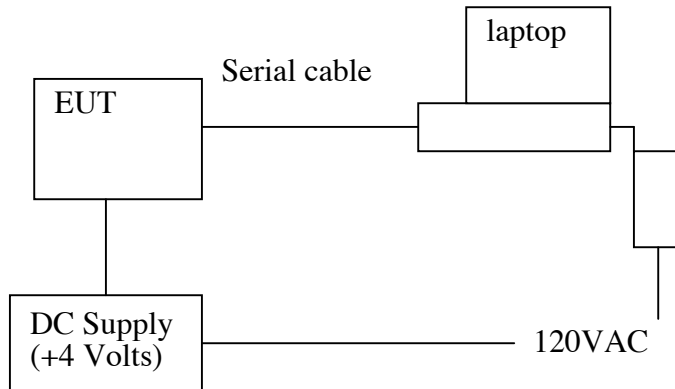
Test Equipment

Silver Spring Networks:

| Equipment | Mfr | Model | Serial No. | Cal Due |
|-------------------|---------|--------|------------|----------|
| Spectrum analyzer | Agilent | E4405B | MY45113391 | 01/23/14 |
| Spectrum analyzer | Agilent | N9030A | MY48030147 | 01/23/14 |

| Manufacturer | Description | Model No. | Serial No. | Calibration Due |
|--------------------|---------------------|-------------------|------------|-----------------|
| Rohde & Schwarz | EMI Test Receiver | ESCI 1166.5950K03 | 100337 | 2014-03-22 |
| Agilent | Spectrum Analyzer | E4446A | US44300386 | 2013-09-29 |
| Sunol Science Corp | System Controller | SC99V | 122303-1 | N/R |
| Sunol Science Corp | Combination Antenna | JB3 | A0020106-3 | 2013-06-18 |
| EMCO | Horn antenna | 3115 | 9511-4627 | 2013-10-03 |
| Hewlett Packard | Pre amplifier | 8447D | 2944A06639 | 2013-06-09 |
| Mini-Circuits | Pre Amplifier | ZVA-183-S | 570400946 | 2014-01-29 |

Test Set-up Diagram



Support Equipment

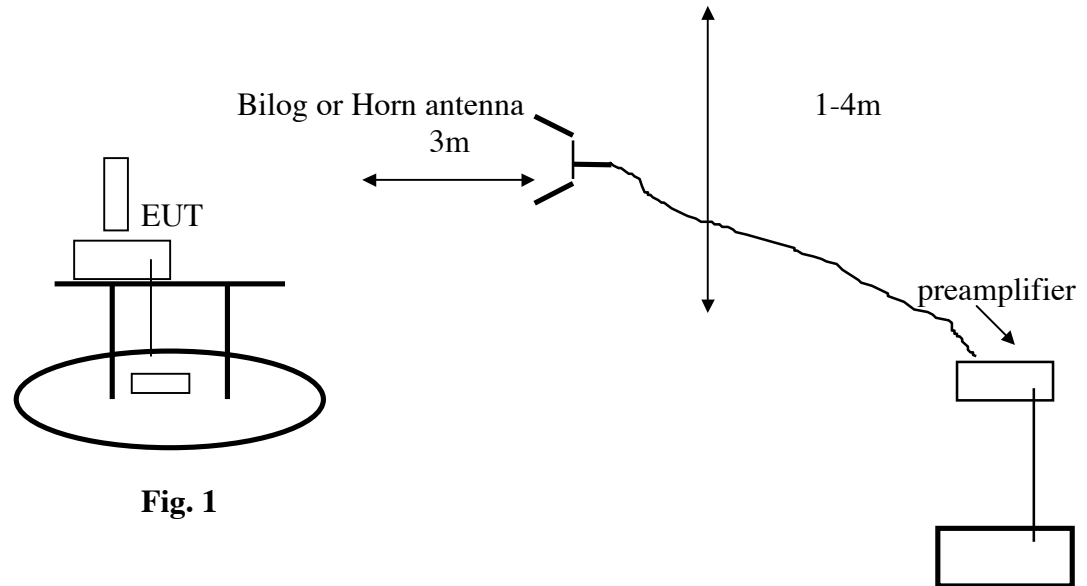
| Equipment | Mfr | Model | Asset No. |
|-----------------|----------|------------|------------------------|
| DC Power Supply | Agilent | E3610A | 2844 |
| Laptop PC | Dell | PP01L | TW-0791UH1280-OC9-6558 |
| AC/DC adapter | CUI Inc. | DSA-60W-20 | 2607HB |

900 MHz FREQUENCY HOPPING SPREAD SPECTRUM RADIO EMISSIONS

The 900 MHz FHSS radiated spurious emissions were measured for both internal and external antenna operation. Worst-case radiated emissions were for 300 kbps setting and are reported here.

TEST RESULTS

Radiated Test Set-up, 30 MHz-9.3 GHz



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 10th 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 (300 kbps data rate). 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).

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 |



Horn antenna: DRH118
 Amplifier: mini circuit 570400946, HP 8447D SN:2944a06039
 Spectrum Analyzer: MY44303352
 cable: SPS-2303-3840-SPS 32 feet, chamber 3 below 1 Ghz cable, RF cable SN:10

Company Name: Silver Spring Networks
 Product Type: Board
 Project Number: T1305022
 Tester: Wei Sun
 Date: 2013-05-02

FCC 15 C in 5 M Chamber 3 at 3 meters distance

| Frequency (MHz) | S.A. Reading (dBµV) | Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC 15.247 | | Comments |
|---|---------------------|-------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low channel 902.4 MHz measured at 3 meters GFSK Modulation External Antenna. 300 kbps data rate MAC: 0013500200A6FF3E Part Number: 174-0396 REV 07 | | | | | | | | | | | |
| 1804.8 | 57.56 | 301 | 100 | V | 25.92 | 3.41 | 27.67 | 59.22 | | 59.22 | Peak |
| 1804.8 | 56.87 | 301 | 100 | V | 25.92 | 3.41 | 27.67 | 58.53 | | 58.53 | Ave |
| 1804.8 | 53.55 | 91 | 100 | H | 25.92 | 3.41 | 27.67 | 55.21 | | 55.21 | Peak |
| 1804.8 | 52.58 | 91 | 100 | H | 25.92 | 3.41 | 27.67 | 54.24 | | 54.24 | Ave |
| 2707.2 | 43.43 | 314 | 100 | V | 29.56 | 4.15 | 27.85 | 49.29 | 74 | -24.71 | Peak |
| 2707.2 | 39.77 | 314 | 100 | V | 29.56 | 4.15 | 27.85 | 45.63 | 54 | -8.37 | Ave |
| 2707.2 | 44.3 | 253 | 100 | H | 29.56 | 4.15 | 27.85 | 50.16 | 74 | -23.84 | Peak |
| 2707.2 | 40.91 | 253 | 100 | H | 29.56 | 4.15 | 27.85 | 46.77 | 54 | -7.23 | Ave |
| 3609.6 | 39.88 | 51 | 100 | V | 30.97 | 4.84 | 27.96 | 47.73 | 74 | -26.27 | Peak |
| 3609.6 | 34.37 | 51 | 100 | V | 30.97 | 4.84 | 27.96 | 42.22 | 54 | -11.78 | Ave |
| 3609.6 | 38.64 | 66 | 100 | H | 30.97 | 4.84 | 27.96 | 46.49 | 74 | -27.51 | Peak |
| 3609.6 | 31.06 | 66 | 100 | H | 30.97 | 4.84 | 27.96 | 38.91 | 54 | -15.09 | Ave |
| 4512 | 36.09 | 74 | 100 | V | 31.79 | 5.56 | 27.88 | 45.56 | 74 | -28.44 | Peak |
| 4512 | 29.01 | 74 | 100 | V | 31.79 | 5.56 | 27.88 | 38.48 | 54 | -15.52 | Ave |
| 4512 | 34.07 | 291 | 100 | H | 31.79 | 5.56 | 27.88 | 43.54 | 74 | -30.46 | Peak |
| 4512 | 23.11 | 291 | 100 | H | 31.79 | 5.56 | 27.88 | 32.58 | 54 | -21.42 | Ave |
| 5414.4 | 30 | 0 | 100 | V | 34.39 | 6.03 | 27.62 | 42.8 | 74 | -31.2 | Peak |
| 5414.4 | 20 | 0 | 100 | V | 34.39 | 6.03 | 27.62 | 32.8 | 54 | -21.2 | Ave |
| 5414.4 | 30 | 0 | 100 | H | 34.39 | 6.03 | 27.62 | 42.8 | 74 | -31.2 | Peak |
| 5414.4 | 20 | 0 | 100 | H | 34.39 | 6.03 | 27.62 | 32.8 | 54 | -21.2 | Ave |

| | | | | | | | | | | | |
|--|--------|-----|-----|---|-------|------|-------|--------|----|--------|------|
| Middle channel 915.2 MHz measured at 3 meters GFSK Modulation External Antenna. 300 kbps data rate MAC: 0013500200A6FF3E Part Number: 174-0396 REV 07 | | | | | | | | | | | |
| 1830.4 | 52.38 | 312 | 100 | V | 25.92 | 3.4 | 27.68 | 54.02 | | 54.02 | Peak |
| 1830.4 | 51.31 | 312 | 100 | V | 25.92 | 3.4 | 27.68 | 52.95 | | 52.95 | Ave |
| 1830.4 | 48.52 | 2 | 100 | H | 25.92 | 3.4 | 27.68 | 50.16 | | 50.16 | Peak |
| 1830.4 | 46.97 | 2 | 100 | H | 25.92 | 3.4 | 27.68 | 48.61 | | 48.61 | Ave |
| 2745.6 | 39.69 | 355 | 100 | V | 29.56 | 4.15 | 27.84 | 45.56 | 74 | -28.44 | Peak |
| 2745.6 | 31.69 | 355 | 100 | V | 29.56 | 4.15 | 27.84 | 37.56 | 54 | -16.44 | Ave |
| 2745.6 | 40.12 | 251 | 100 | H | 29.56 | 4.15 | 27.84 | 45.99 | 74 | -28.01 | Peak |
| 2745.6 | 32.94 | 251 | 100 | H | 29.56 | 4.15 | 27.84 | 38.81 | 54 | -15.19 | Ave |
| 3660.8 | 41.76 | 54 | 100 | V | 30.92 | 4.83 | 27.96 | 49.55 | 74 | -24.45 | Peak |
| 3660.8 | 36.45 | 54 | 100 | V | 30.92 | 4.83 | 27.96 | 44.24 | 54 | -9.76 | Ave |
| 3660.8 | 40.09 | 67 | 100 | H | 30.92 | 4.83 | 27.96 | 47.88 | 74 | -26.12 | Peak |
| 3660.8 | 34.07 | 67 | 100 | H | 30.92 | 4.83 | 27.96 | 41.86 | 54 | -12.14 | Ave |
| 4576 | 35.63 | 78 | 100 | V | 31.82 | 5.54 | 27.84 | 45.15 | 74 | -28.85 | Peak |
| 4576 | 27.57 | 78 | 100 | V | 31.82 | 5.54 | 27.84 | 37.09 | 54 | -16.91 | Ave |
| 4576 | 33.47 | 177 | 100 | H | 31.82 | 5.54 | 27.84 | 42.99 | 74 | -31.01 | Peak |
| 4576 | 22.69 | 177 | 100 | H | 31.82 | 5.54 | 27.84 | 32.21 | 54 | -21.79 | Ave |
| 5491.2 | 30 | 0 | 100 | V | 34.34 | 6.08 | 27.6 | 42.82 | | 42.82 | Peak |
| 5491.2 | 20 | 0 | 100 | V | 34.34 | 6.08 | 27.6 | 32.82 | | 32.82 | Ave |
| 5491.2 | 30 | 0 | 100 | H | 34.34 | 6.08 | 27.6 | 42.82 | | 42.82 | Peak |
| 5491.2 | 20 | 0 | 100 | H | 34.34 | 6.08 | 27.6 | 32.82 | | 32.82 | Ave |
| 915.2 | 102.21 | 90 | 100 | V | 22.09 | 1.87 | 0 | 126.17 | | 126.17 | Peak |

| | | | | | | | | | | | |
|--|-------|-----|-----|---|-------|------|-------|-------|----|--------|------|
| High channel 927.6 MHz measured at 3 meters GFSK Modulation External Antenna. 300 kbps data rate MAC: 0013500200A6FF3E Part Number: 174-0396 REV 07 | | | | | | | | | | | |
| 1855.2 | 51.66 | 339 | 100 | V | 26.64 | 3.4 | 27.73 | 53.97 | | 53.97 | Peak |
| 1855.2 | 50.21 | 339 | 100 | V | 26.64 | 3.4 | 27.73 | 52.52 | | 52.52 | Ave |
| 1855.2 | 47.48 | 1 | 100 | H | 26.64 | 3.4 | 27.73 | 49.79 | | 49.79 | Peak |
| 1855.2 | 45.47 | 1 | 100 | H | 26.64 | 3.4 | 27.73 | 47.78 | | 47.78 | Ave |
| 2782.8 | 30 | 0 | 100 | V | 29.44 | 4.26 | 27.81 | 35.89 | 74 | -38.11 | Peak |
| 2782.8 | 20 | 0 | 100 | V | 29.44 | 4.26 | 27.81 | 25.89 | 54 | -28.11 | Ave |
| 2782.8 | 30 | 0 | 100 | H | 29.44 | 4.26 | 27.81 | 35.89 | 74 | -38.11 | Peak |
| 2782.8 | 20 | 0 | 100 | H | 29.44 | 4.26 | 27.81 | 25.89 | 54 | -28.11 | Ave |
| 3710.4 | 44.75 | 52 | 100 | V | 30.92 | 4.98 | 27.96 | 52.69 | 74 | -21.31 | Peak |
| 3710.4 | 41.68 | 52 | 100 | V | 30.92 | 4.98 | 27.96 | 49.62 | 54 | -4.38 | Ave |
| 3710.4 | 41.99 | 55 | 100 | H | 30.92 | 4.98 | 27.96 | 49.93 | 74 | -24.07 | Peak |
| 3710.4 | 37.92 | 55 | 100 | H | 30.92 | 4.98 | 27.96 | 45.86 | 54 | -8.14 | Ave |
| 4638 | 34.67 | 144 | 100 | V | 31.82 | 5.57 | 27.79 | 44.27 | 74 | -29.73 | Peak |
| 4638 | 23.05 | 144 | 100 | V | 31.82 | 5.57 | 27.79 | 32.65 | 54 | -21.35 | Ave |
| 4638 | 30 | 0 | 100 | H | 31.82 | 5.57 | 27.79 | 39.6 | 74 | -34.4 | Peak |
| 4638 | 20 | 0 | 100 | H | 31.82 | 5.57 | 27.79 | 29.6 | 54 | -24.4 | Ave |
| 5565.6 | 38.62 | 311 | 100 | V | 34.1 | 6.09 | 27.56 | 51.25 | | 51.25 | Peak |
| 5565.6 | 32.5 | 311 | 100 | V | 34.1 | 6.09 | 27.56 | 45.13 | | 45.13 | Ave |
| 5565.6 | 35.71 | 33 | 100 | H | 34.1 | 6.09 | 27.56 | 48.34 | | 48.34 | Peak |



Horn antenna: 3115
 Amplifier: mini circuit 570400946, HP 8447D SN:2944a06039
 Spectrum Analyzer: MY44303352
 cable: SPS-2303-3840-SPS 32 feet, chamber 3 below 1 Ghz cable, RF cable SN:10

Company Name: Silver Spring Networks
 Product Type: Board
 Project Number: T1305161
 Tester: Wei Sun
 Date: 2013-05-16

FCC 15 C in 5 M Chamber 3 at 3 meters distance

| Frequency (MHz) | S.A. Reading (dBµV) | Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | FCC 15.247 | | Comments |
|--|---------------------|-------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| Low channel 902.4 MHz measured at 3 meters GFSK Modulation Internal Antenna. 300 kbps data rate MAC: 0013500200A6FF3E Part Number: 174-0396 REV 07 | | | | | | | | | | | |
| 1804.8 | 51.81 | 81 | 100 | V | 27.2 | 3.41 | 27.67 | 54.75 | | 54.75 | Peak |
| 1804.8 | 50.55 | 81 | 100 | V | 27.2 | 3.41 | 27.67 | 53.49 | | 53.49 | Ave |
| 1804.8 | 51.16 | 121 | 100 | H | 27.2 | 3.41 | 27.67 | 54.1 | | 54.1 | Peak |
| 1804.8 | 49.75 | 121 | 100 | H | 27.2 | 3.41 | 27.67 | 52.69 | | 52.69 | Ave |
| 2707.2 | 44.12 | 216 | 100 | V | 29.21 | 4.15 | 27.85 | 49.63 | 74 | -24.37 | Peak |
| 2707.2 | 38.755 | 216 | 100 | V | 29.21 | 4.15 | 27.85 | 44.265 | 54 | -9.735 | Ave |
| 2707.2 | 50.42 | 122 | 100 | H | 29.21 | 4.15 | 27.85 | 55.93 | 74 | -18.07 | Peak |
| 2707.2 | 48.24 | 122 | 100 | H | 29.21 | 4.15 | 27.85 | 53.75 | 54 | -0.25 | Ave |
| 3609.6 | 36.42 | 224 | 100 | V | 31.54 | 4.84 | 27.96 | 44.84 | 74 | -29.16 | Peak |
| 3609.6 | 26.73 | 224 | 100 | V | 31.54 | 4.84 | 27.96 | 35.15 | 54 | -18.85 | Ave |
| 3609.6 | 35.96 | 62 | 100 | H | 31.54 | 4.84 | 27.96 | 44.38 | 74 | -29.62 | Peak |
| 3609.6 | 23.78 | 62 | 100 | H | 31.54 | 4.84 | 27.96 | 32.2 | 54 | -21.8 | Ave |
| 4512 | 34.88 | 229 | 100 | V | 32.47 | 5.56 | 27.88 | 45.03 | 74 | -28.97 | Peak |
| 4512 | 25.17 | 229 | 100 | V | 32.47 | 5.56 | 27.88 | 35.32 | 54 | -18.68 | Ave |
| 4512 | 34.22 | 111 | 100 | H | 32.47 | 5.56 | 27.88 | 44.37 | 74 | -29.63 | Peak |
| 4512 | 23.69 | 111 | 100 | H | 32.47 | 5.56 | 27.88 | 33.84 | 54 | -20.16 | Ave |
| 5414.4 | 30 | 0 | 100 | V | 34.44 | 6.03 | 27.62 | 42.85 | 74 | -31.15 | Peak |
| 5414.4 | 20 | 0 | 100 | V | 34.44 | 6.03 | 27.62 | 32.85 | 54 | -21.15 | Ave |
| 5414.4 | 30 | 0 | 100 | H | 34.44 | 6.03 | 27.62 | 42.85 | 74 | -31.15 | Peak |
| 5414.4 | 20 | 0 | 100 | H | 34.44 | 6.03 | 27.62 | 32.85 | 54 | -21.15 | Ave |
| Middle channel 915.2 MHz measured at 3 meters GFSK Modulation Internal Antenna. 300 kbps data rate MAC: 0013500200A6FF3E Part Number: 174-0396 REV 07 | | | | | | | | | | | |
| 1830.4 | 50.84 | 59 | 100 | V | 27.2 | 3.4 | 27.68 | 53.76 | | 53.76 | Peak |
| 1830.4 | 49.49 | 59 | 100 | V | 27.2 | 3.4 | 27.68 | 52.41 | | 52.41 | Ave |
| 1830.4 | 51.41 | 121 | 100 | H | 27.2 | 3.4 | 27.68 | 54.33 | | 54.33 | Peak |
| 1830.4 | 50.24 | 121 | 100 | H | 27.2 | 3.4 | 27.68 | 53.16 | | 53.16 | Ave |
| 2745.6 | 44.81 | 159 | 100 | V | 29.21 | 4.15 | 27.84 | 50.33 | 74 | -23.67 | Peak |
| 2745.6 | 41.02 | 159 | 100 | V | 29.21 | 4.15 | 27.84 | 46.54 | 54 | -7.46 | Ave |
| 2745.6 | 41.39 | 120 | 100 | H | 29.21 | 4.15 | 27.84 | 46.91 | 74 | -27.09 | Peak |
| 2745.6 | 45.01 | 120 | 100 | H | 29.21 | 4.15 | 27.84 | 50.53 | 54 | -3.47 | Ave |
| 3660.8 | 37.97 | 321 | 100 | V | 32.07 | 4.83 | 27.96 | 46.91 | 74 | -27.09 | Peak |
| 3660.8 | 27.57 | 321 | 100 | V | 32.07 | 4.83 | 27.96 | 36.51 | 54 | -17.49 | Ave |
| 3660.8 | 37.33 | 119 | 100 | H | 32.07 | 4.83 | 27.96 | 46.27 | 74 | -27.73 | Peak |
| 3660.8 | 26.6 | 119 | 100 | H | 32.07 | 4.83 | 27.96 | 35.54 | 54 | -18.46 | Ave |
| 4576 | 35.67 | 93 | 100 | V | 32.47 | 5.54 | 27.84 | 45.84 | 74 | -28.16 | Peak |
| 4576 | 24.91 | 93 | 100 | V | 32.47 | 5.54 | 27.84 | 35.08 | 54 | -18.92 | Ave |
| 4576 | 33.7 | 252 | 100 | H | 32.47 | 5.54 | 27.84 | 43.87 | 74 | -30.13 | Peak |
| 4576 | 23.28 | 252 | 100 | H | 32.47 | 5.54 | 27.84 | 33.45 | 54 | -20.55 | Ave |
| 5491.2 | 30 | 0 | 100 | V | 34.4 | 6.08 | 27.6 | 42.88 | | 42.88 | Peak |
| 5491.2 | 20 | 0 | 100 | V | 34.4 | 6.08 | 27.6 | 32.88 | | 32.88 | Ave |
| 5491.2 | 30 | 0 | 100 | H | 34.4 | 6.08 | 27.6 | 42.88 | | 42.88 | Peak |
| 5491.2 | 20 | 0 | 100 | H | 34.4 | 6.08 | 27.6 | 32.88 | | 32.88 | Ave |
| High channel 927.6 MHz measured at 3 meters GFSK Modulation Internal Antenna. 300 kbps data rate MAC: 0013500200A6FF3E Part Number: 174-0396 REV 07 | | | | | | | | | | | |
| 1855.2 | 51.94 | 62 | 100 | V | 27.77 | 3.4 | 27.73 | 55.38 | | 55.38 | Peak |
| 1855.2 | 50.58 | 62 | 100 | V | 27.77 | 3.4 | 27.73 | 54.02 | | 54.02 | Ave |
| 1855.2 | 52.06 | 123 | 100 | H | 27.77 | 3.4 | 27.73 | 55.5 | | 55.5 | Peak |
| 1855.2 | 50.47 | 123 | 100 | H | 27.77 | 3.4 | 27.73 | 53.91 | | 53.91 | Ave |
| 2782.8 | 30 | 0 | 100 | V | 29.26 | 4.26 | 27.81 | 35.71 | 74 | -38.29 | Peak |
| 2782.8 | 20 | 0 | 100 | V | 29.26 | 4.26 | 27.81 | 25.71 | 54 | -28.29 | Ave |
| 2782.8 | 30 | 0 | 100 | H | 29.26 | 4.26 | 27.81 | 35.71 | 74 | -38.29 | Peak |
| 2782.8 | 20 | 0 | 100 | H | 29.26 | 4.26 | 27.81 | 25.71 | 54 | -28.29 | Ave |
| 3710.4 | 39.62 | 306 | 100 | V | 32.07 | 4.98 | 27.96 | 48.71 | 74 | -25.29 | Peak |
| 3710.4 | 33.53 | 306 | 100 | V | 32.07 | 4.98 | 27.96 | 42.62 | 54 | -11.38 | Ave |
| 3710.4 | 38.86 | 243 | 100 | H | 32.07 | 4.98 | 27.96 | 47.95 | 74 | -26.05 | Peak |
| 3710.4 | 31.93 | 243 | 100 | H | 32.07 | 4.98 | 27.96 | 41.02 | 54 | -12.98 | Ave |
| 4638 | 34.15 | 122 | 100 | V | 32.47 | 5.57 | 27.79 | 44.4 | 74 | -29.6 | Peak |
| 4638 | 22.88 | 122 | 100 | V | 32.47 | 5.57 | 27.79 | 33.13 | 54 | -20.87 | Ave |
| 4638 | 33.26 | 131 | 100 | H | 32.47 | 5.57 | 27.79 | 43.51 | 74 | -30.49 | Peak |
| 4638 | 21.79 | 131 | 100 | H | 32.47 | 5.57 | 27.79 | 32.04 | 54 | -21.96 | Ave |
| 5565.6 | 30 | 0 | 100 | V | 34.29 | 6.09 | 27.56 | 42.82 | | 42.82 | Peak |
| 5565.6 | 20 | 0 | 100 | V | 34.29 | 6.09 | 27.56 | 32.82 | | 32.82 | Ave |
| 5565.6 | 30 | 0 | 100 | H | 34.29 | 6.09 | 27.56 | 42.82 | | 42.82 | Peak |
| 5565.6 | 20 | 0 | 100 | H | 34.29 | 6.09 | 27.56 | 32.82 | | 32.82 | Ave |

Radiated Emissions Below 1 GHZ

All TX emissions more than 20 dB below limits

PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (2) For frequency hopping systems operating in the 902-928 MHz band, employing at least 50 hopping channels: 1 watt; and employing less than 50 hopping channels, but at least 25 hopping channels: 0.25 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 3 dBi, therefore the power limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

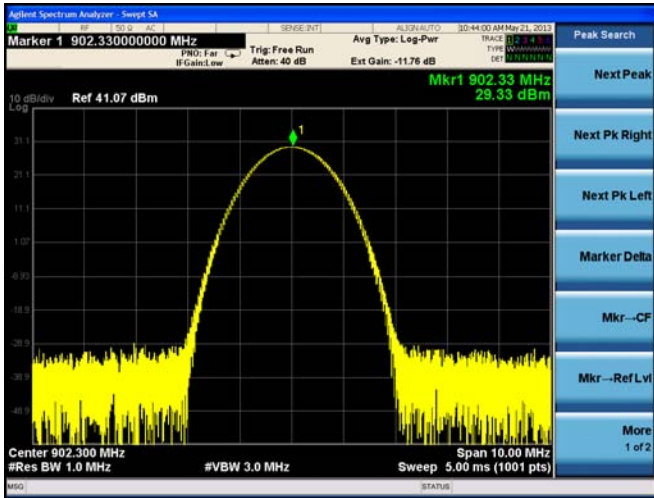
RESULTS

No non-compliance noted:

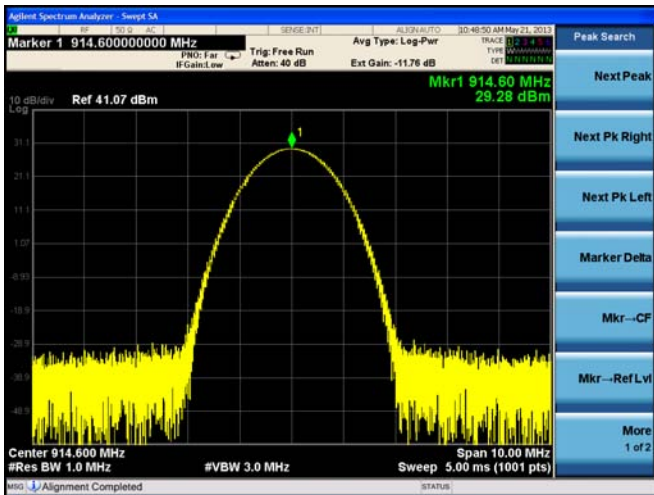
| Channel | Frequency | P out |
|----------------|------------------|--------------|
| Low | 902.3 | 29.33 |
| Mid | 914.9 | 29.28 |
| High | 926.9 | 29.92 |

Note: Power output equal for all hopping channel separation modes. Data presented for 300 kHz channel separation mode as most typical worst case.

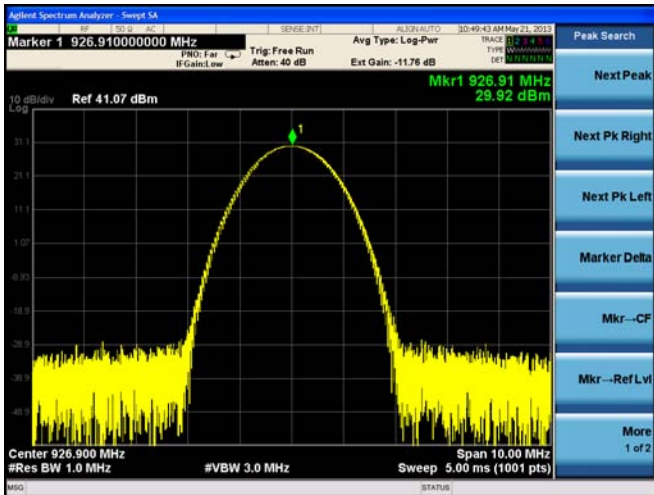
OUTPUT POWER LOW CHANNEL



OUTPUT POWER MID CHANNEL



OUTPUT POWER HIGH CHANNEL



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 (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm ²) | Averaging time (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 ²) | 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 ²) | 30 |

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

| Frequency range (MHz) | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm ²) | Averaging time (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/cm²

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/cm²

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

LIMITS

From §1.1310 Table 1 (B), $S = 0.6 \text{ mW/cm}^2$

RESULTS

No non-compliance noted:

| Power Density Limit (mW/cm^2) | Output power (dBm) | Antenna gain (dBi) | s, mW/cm^2 at 20cm | MPE Distance cm |
|---|-----------------------|-----------------------|--------------------------------|--------------------|
| 0.6 | 29.92 | 3 | 0.390 | 16.1 |

Maximum MPE calculated for external antenna (maximum eirp from EUT)

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.

CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

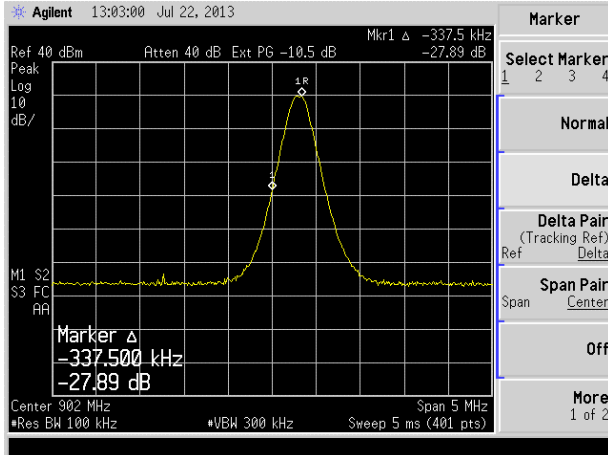
The spectrum from 30 MHz to 10 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

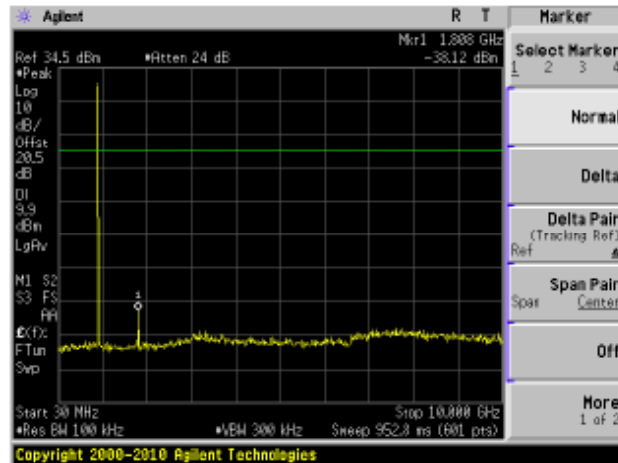
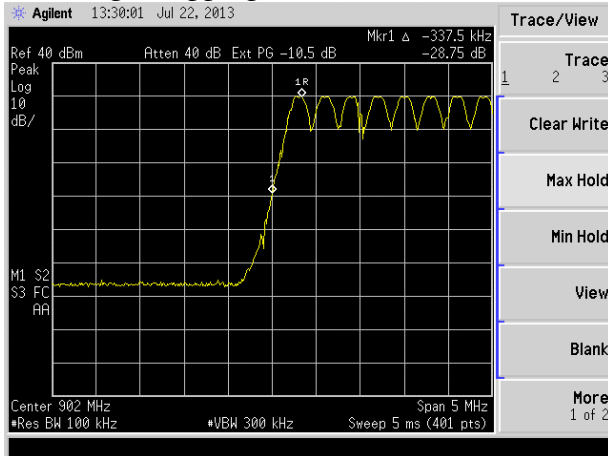
No non-compliance noted:

SPURIOUS EMISSIONS, LOW CHANNEL

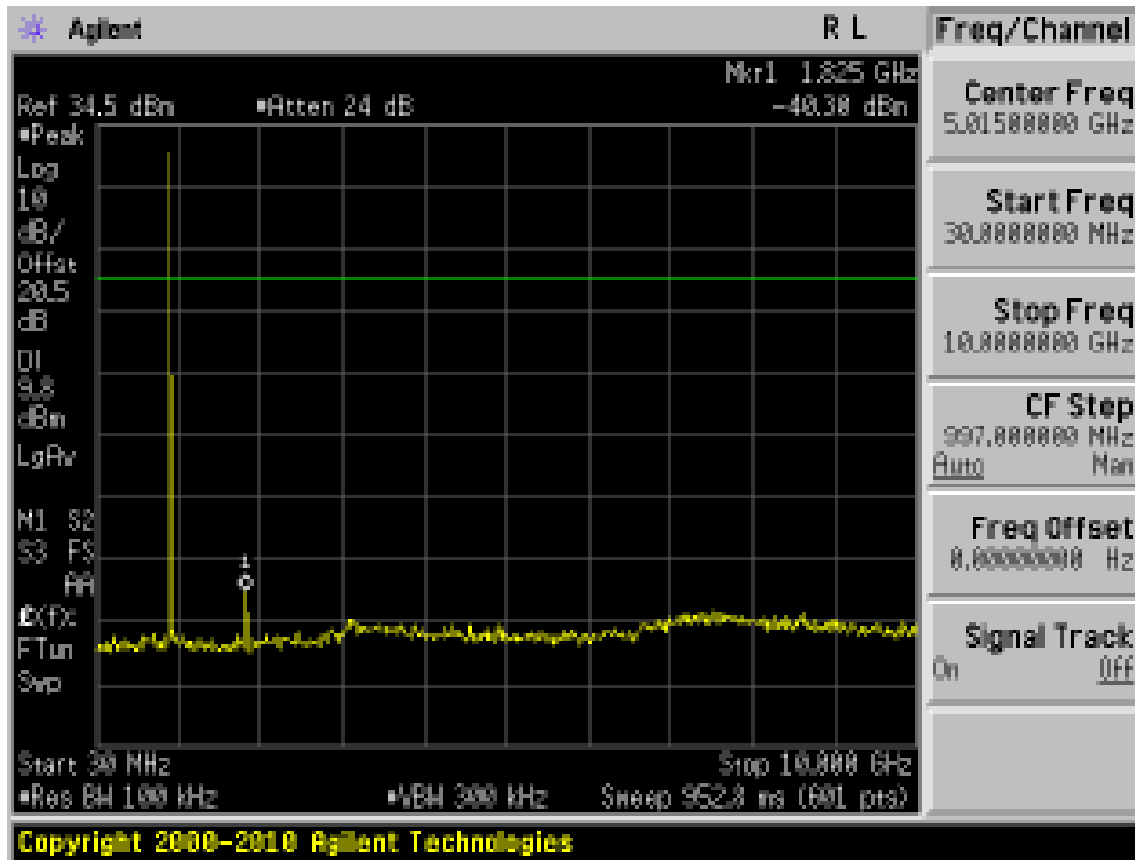
Band edge, non-hopping



Band edge, hopping function activated

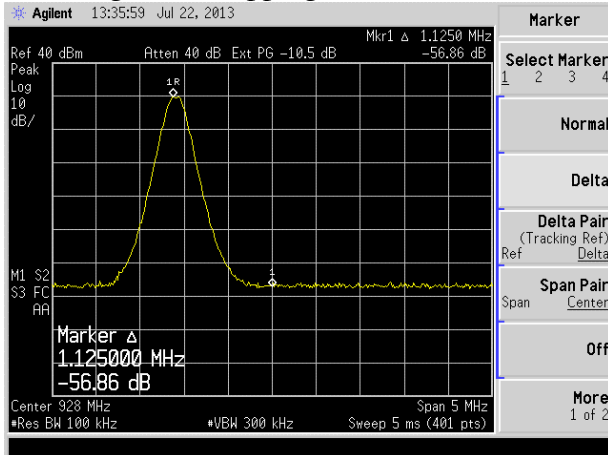


SPURIOUS EMISSIONS, MID CHANNEL

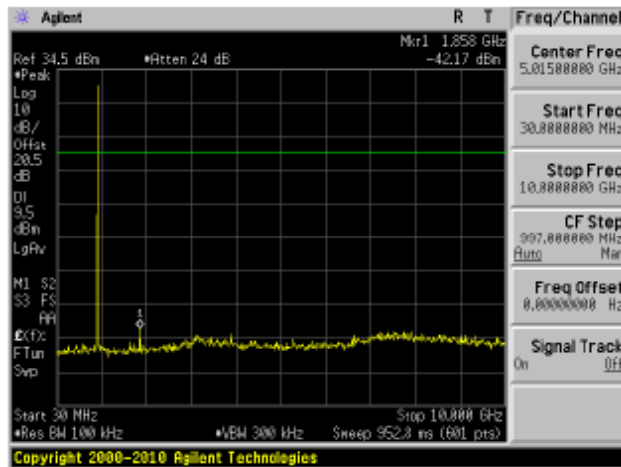
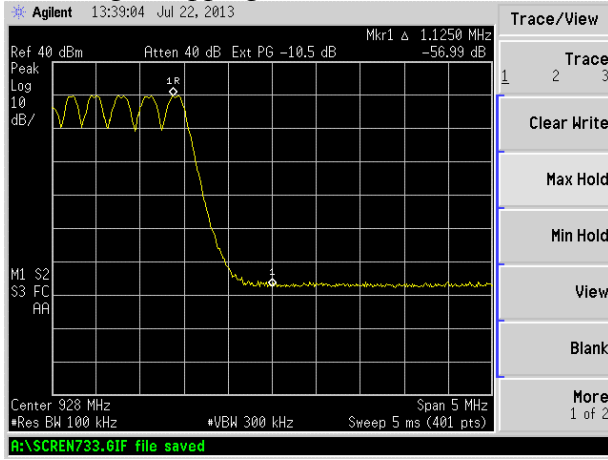


SPURIOUS EMISSIONS, HIGH CHANNEL

Band edge, non-hopping



Band edge, hopping function activated



END OF REPORT

Report Revision History

| Revision No. | Revision Description | Pages Revised | Revised by | Date |
|--------------|---|---------------|----------------|------------|
| - | Original | | T. Cokenias | 07/13/2013 |
| 1 | Correct model number in header Correction to antenna factors Remove typo- wrong antenna factor Add band edge plots for hopping and non-hopping operation Add Annex A model number differences | 1,2,14,16 | T. Cokenias | 08/05/2013 |

Model Number Difference Description

Descriptions of model numbers sold using this identifier are listed below. In the United States the FCC does not track model numbers for certification purposes, however, there are other regulatory domains that accept FCC certification reports and that do track model numbers, so the model number descriptions are listed here for reference.

| | |
|---------------|---|
| NIC 411-0301: | 900 MHz FHSS NAN1, 2.4 GHz HAN, INT ANT |
| NIC 411-0302: | 900 MHz FHSS NAN1, 2.4 GHz HAN, EXT ANT |
| NIC 411-0303: | 900 MHz FHSS NAN1, 2.4 GHz HAN, INT/EXT ANT |
| NAN1: | 900 MHz FHSS |
| HAN: | 2.4 GHz DSSS (Zigbee) |