

EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER

I. GENERAL INFORMATION

Requirement: FCC, Industry Canada
Test Requirements: FCC: Part 2, Part 15 IC: RSS-Gen, RSS-210,
Applicant: Silver Spring Networks
575 Broadway Street
Redwood City, CA 94063
FCC ID: OWS-IMU518
IC: 5975A-IMU518
Model No.: 222-040001 rev 01

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Silver Spring Networks (SSN) IMU518 is a battery-operated radio module for gas meter communications use. The board incorporates a 900 MHz FHSS radio.

III. TEST DATES AND TEST LOCATION

Antenna port conducted were performed at Silver Spring Networks on 23 March 2011.

Radiated emissions tests above 1 GHz were performed 12 October and 7 November 2011 at BACL in Sunnyvale, CA



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

5 January 2012

15.203 Antenna connector requirement

The EUT uses a custom permanently attached integral antenna,

| Antenna description | Mfr. | Model No. | Gain |
|----------------------|------|-----------|-----------------|
| Built-in sheet metal | SSN | n/a | 1dBi at 915 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-Gen, Issue 3: General Requirements and Information for the Certification of Radio Apparatus (December 2010)

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.

Tests were performed at three frequencies:

Channel 0 (LOW) – 902.3 MHz

Channel 43 (MID) -915.2 MHz

Channel 82 (HIGH) – 926.9 MHz

Test Equipment

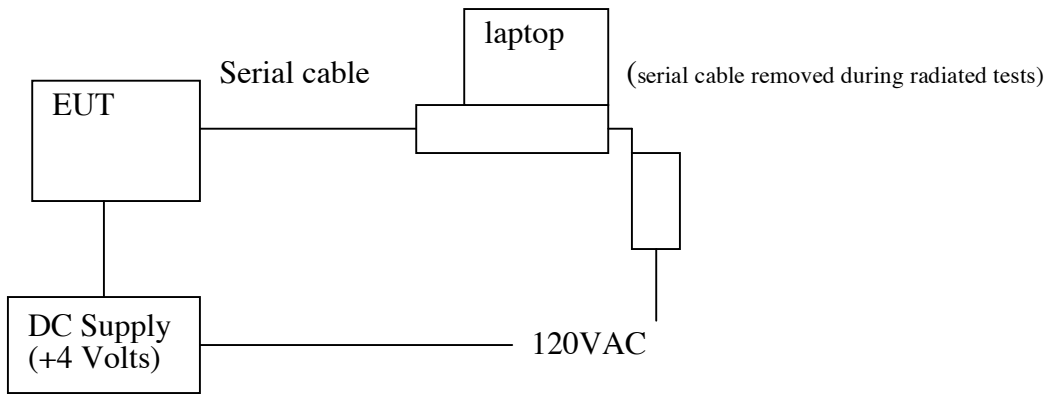
Silver Spring Networks:

| Equipment | Mfr | Model | Serial No. | Cal Due |
|-------------------|---------|--------|------------|----------|
| Spectrum analyzer | Agilent | E44053 | MY45113391 | 10/19/11 |
| Spectrum analyzer | Agilent | EXA | MY48030147 | 10/19/11 |

BACL

| DESC. | Model | Freq. Range | Mfr | Serial No. | Last Cal | Cal Due |
|---------------------|-----------|---------------|----------------|------------|------------|------------|
| Antenna, Biconi-Log | JB3 | 30 - 3000MHz | Sunol Sciences | A020106-2 | 2011-08-10 | 2012-08-10 |
| Amplifier | ZVA-183-S | 1-18 GHz | Mini-Circuits | 570400946 | 2011-05-09 | 2012-05-09 |
| Amplifier, Pre | 8447D | 0.1-1300 MHz | HP | 2944A06639 | 2011-06-09 | 2012-06-09 |
| Antenna, Horn | 3115 | 1-18 GHz | EMCO | 9511-4627 | 2011-10-03 | 2012-10-03 |
| Analyzer, Spectrum | E4440A | 3Hz - 26.5GHz | Agilent | MY44303352 | 2011-05-10 | 2012-05-10 |

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 |

FREQUENCY HOPPING SPREAD SPECTRUM RADIO EMISSIONS

TEST RESULTS

Radiated Test Set-up, 30 MHz-9.3 GHz

FCC: 15.109, 15.205, 15.209

IC: RSS-Gen, Sec. 6.1, 7.7.2

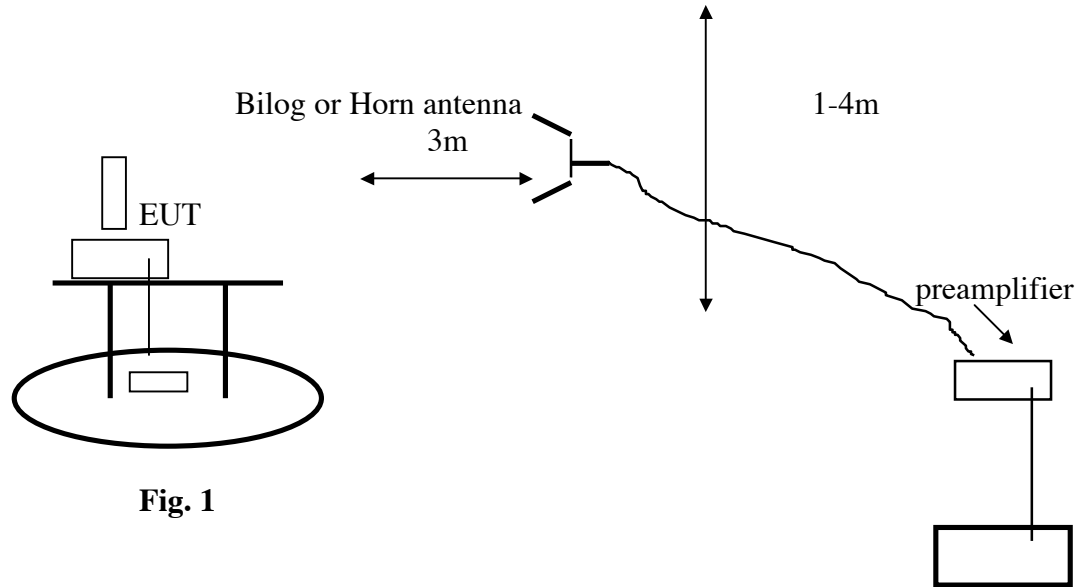


Fig. 1

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 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. 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 |
| 12.51875 - 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 |

Transmitter Radiated Emissions Above 1 GHz



Company: Silver Spring Network
 Project number: T1109233
 Frequency range: 902.3-926.9 MHz
 measurement: Spurious Emission above 1GHz
 Date: 10-12-2011
 Tester: Quinn Jiang

Rockwell: MAC: 00135002000B9EAC

LC 902.3 MHz

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | Part 15C | | Comments |
|-----------------|---------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| 1017.56 | 48.5 | 202 | 100 | H | 23.79 | 1.78 | 27.21 | 46.86 | 74 | -27.14 | Peak |
| 1017.56 | 44.56 | 241 | 100 | V | 23.98 | 1.78 | 27.21 | 43.11 | 74 | -30.89 | Peak |
| 1017.56 | 37.03 | 202 | 100 | H | 23.79 | 1.78 | 27.21 | 35.39 | 54 | -18.61 | Avg |
| 1017.56 | 32.86 | 241 | 100 | V | 23.98 | 1.78 | 27.21 | 31.41 | 54 | -22.59 | Avg |
| 4511.43 | 43.22 | 339 | 100 | H | 31.965 | 5.36 | 27.35 | 53.20 | 74 | -20.8036 | Peak |
| 4511.37 | 40.36 | 0 | 100 | V | 31.965 | 5.36 | 27.35 | 50.34 | 74 | -23.6636 | Peak |
| 4511.43 | 38.08 | 339 | 100 | H | 31.965 | 5.36 | 27.35 | 48.06 | 54 | -5.9436 | Avg |
| 4511.37 | 31.77 | 0 | 100 | V | 31.965 | 5.36 | 27.35 | 41.75 | 54 | -12.2536 | Avg |
| 2706.97 | 42.47 | 100 | 155 | H | 28.574 | 3.97 | 27.57 | 47.444 | 74 | -26.556 | Peak |
| 2707 | 40.51 | 260 | 100 | V | 28.395 | 3.97 | 27.57 | 45.305 | 74 | -28.695 | Peak |
| 2707 | 35.69 | 100 | 155 | H | 28.574 | 3.97 | 27.57 | 40.664 | 54 | -13.336 | Avg |
| 2707 | 30.57 | 260 | 100 | V | 28.395 | 3.97 | 27.57 | 35.365 | 54 | -18.635 | Avg |

MC 915.2 MHz

| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | Part 15C | | Comments |
|-----------------|---------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| 1830 | 48.7 | 198 | 187 | H | 26.72 | 2.49 | 27.6 | 50.31 | 74 | -23.69 | Peak |
| 1830 | 53.53 | 268 | 100 | V | 26.56 | 2.49 | 27.6 | 54.98 | 74 | -19.02 | Peak |
| 1830 | 46.74 | 198 | 187 | H | 26.72 | 2.49 | 27.6 | 48.35 | 54 | -5.65 | Avg |
| 1830 | 52.36 | 268 | 100 | V | 26.56 | 2.49 | 27.6 | 53.81 | 54 | -0.19 | Avg |
| 3660 | 43.8 | 84 | 160 | H | 30.862 | 4.6 | 26.93 | 52.33 | 74 | -21.668 | Peak |
| 3660 | 42.43 | 159 | 100 | V | 30.955 | 4.6 | 26.93 | 51.06 | 74 | -22.945 | Peak |
| 3660 | 38.6 | 84 | 160 | H | 30.862 | 4.6 | 26.93 | 47.13 | 54 | -6.868 | Avg |
| 3660 | 35.71 | 159 | 100 | V | 30.955 | 4.6 | 26.93 | 44.34 | 54 | -9.665 | Avg |
| 4576 | 44.57 | 326 | 100 | H | 32.025 | 5.33 | 27.24 | 54.355 | 74 | -19.645 | Peak |
| 4576 | 40.6 | 0 | 100 | V | 31.927 | 5.33 | 27.24 | 50.287 | 74 | -23.713 | Peak |
| 4576 | 39.68 | 326 | 100 | H | 32.025 | 5.33 | 27.24 | 49.465 | 54 | -4.535 | Avg |
| 4576 | 33.42 | 0 | 100 | V | 32.025 | 5.33 | 27.24 | 43.205 | 54 | -10.795 | Avg |

HC 926.9 MHz

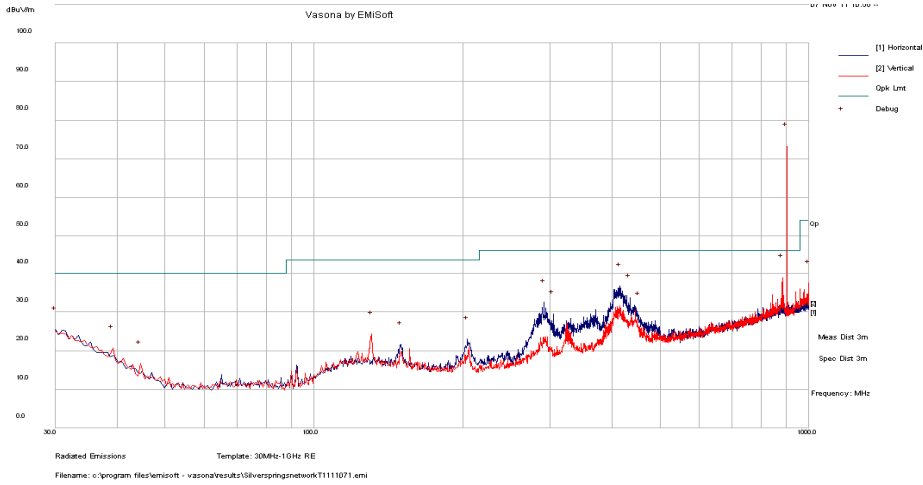
| Frequency (MHz) | S.A. Reading (dBµV) | Turntable Azimuth (degrees) | Test Antenna | | | Cable Loss (dB) | Pre-Amp. (dB) | Cord. Reading (dBµV/m) | Part 15C | | Comments |
|-----------------|-------------------------|-----------------------------|--------------|----------------|---------------|-----------------|---------------|------------------------|----------------|-------------|----------|
| | | | Height (cm) | Polarity (H/V) | Factor (dB/m) | | | | Limit (dBµV/m) | Margin (dB) | |
| 3707 | below noise floor level | | | H | 31.481 | 4.79 | 27.19 | #VALUE! | 74 | #VALUE! | Peak |
| 3707 | below noise floor level | | | V | 31.427 | 4.79 | 27.19 | #VALUE! | 74 | #VALUE! | Peak |
| 3707 | below noise floor level | | | H | 31.481 | 4.79 | 27.19 | #VALUE! | 54 | #VALUE! | Avg |
| 3707 | below noise floor level | | | V | 31.427 | 4.79 | 27.19 | #VALUE! | 54 | #VALUE! | Avg |
| 4634 | 39.94 | 336 | 100 | H | 32.025 | 5.35 | 27.33 | 49.985 | 74 | -24.015 | Peak |
| 4634 | 38.02 | 331 | 100 | V | 31.927 | 5.35 | 27.33 | 47.967 | 74 | -26.033 | Peak |
| 4634 | 31.05 | 336 | 100 | H | 32.025 | 5.35 | 27.33 | 41.095 | 54 | -12.905 | Avg |
| 4634 | 26.93 | 331 | 100 | V | 31.927 | 5.35 | 27.33 | 36.877 | 54 | -17.123 | Avg |
| 1853.6 | 41.57 | 196 | 182 | H | 27.16 | 2.57 | 27.56 | 43.97 | 74 | -30.03 | Peak |
| 1853.7 | 46.27 | 270 | 100 | V | 27.03 | 2.57 | 27.56 | 48.54 | 74 | -25.46 | Peak |
| 1853.6 | 34.71 | 196 | 182 | H | 27.16 | 2.57 | 27.56 | 37.11 | 54 | -16.89 | Avg |
| 1853.7 | 43 | 270 | 100 | V | 27.03 | 2.57 | 27.56 | 45.27 | 54 | -8.73 | Avg |

TX Radiated Emissions Below 1 GHZ

Worst case: Low channel

30MHz-1GHz Scan

LC 902.3 MHz



Vasona Data : List of Debug Frequencies

| No | Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement | Pol | Limit dBuV/m | Margin dB |
|----|---------------|----------|------------|--------|--------------|-------------|-----|--------------|-----------|
| 1 | 902.515 | 61.7 | 13.47 | -1.88 | 73.28 | Peak [Scan] | V | 46 | 27.28 |
| 2 | 883.6 | 28.09 | 13.35 | -2.52 | 38.92 | Peak [Scan] | V | 46 | -7.08 |
| 3 | 415.09 | 33.28 | 12.05 | -8.62 | 36.71 | Peak [Scan] | H | 46 | -9.29 |
| 4 | 434.975 | 29.9 | 12.08 | -8.22 | 33.76 | Peak [Scan] | H | 46 | -12.24 |
| 5 | 291.415 | 32.25 | 11.56 | -11.31 | 32.5 | Peak [Scan] | H | 46 | -13.5 |
| 6 | 30 | 18.5 | 10.02 | -3.04 | 25.48 | Peak [Scan] | H | 40 | -14.52 |
| 7 | 304.025 | 29.05 | 11.63 | -11.08 | 29.6 | Peak [Scan] | H | 46 | -16.4 |
| 8 | 998.545 | 24.97 | 13.83 | -1.28 | 37.52 | Peak [Scan] | V | 54 | -16.48 |
| 9 | 453.405 | 25.26 | 12.09 | -8.13 | 29.22 | Peak [Scan] | H | 46 | -16.78 |
| 10 | 130.88 | 24.61 | 10.74 | -11.04 | 24.31 | Peak [Scan] | V | 43.5 | -19.19 |
| 11 | 39.215 | 20.94 | 10.09 | -10.37 | 20.66 | Peak [Scan] | V | 40 | -19.34 |
| 12 | 204.115 | 24.77 | 11.13 | -12.98 | 22.92 | Peak [Scan] | H | 43.5 | -20.58 |
| 13 | 149.795 | 22.9 | 10.86 | -12.16 | 21.6 | Peak [Scan] | H | 43.5 | -21.9 |
| 14 | 44.55 | 20.56 | 10.13 | -14.07 | 16.62 | Peak [Scan] | V | 40 | -23.38 |

Receiver Radiated Emissions

All emissions 30 MHz - 9.3 GHz more than 20 dB below limits

20 dB Bandwidth and 99% Occupied Bandwidth

FCC: 15.247(a) 1(i)

IC: RSS-210 A8.1, RSS-Gen 4.6.1

LIMIT

500 kHz maximum

99% Bandwidth

RSS-210, RSS-Gen

LIMIT

None, for reporting purposes only

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The analyzer OCC BW function was activated to measure and display both the -20 dB and the 99% Occupied Bandwidth.

RESULTS

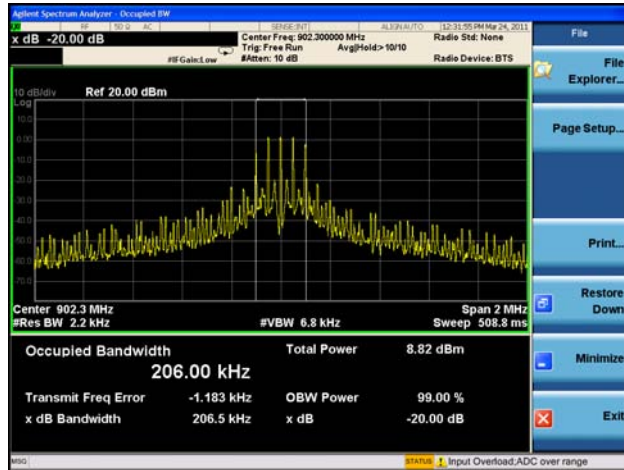
No non-compliance noted:

| Channel | Frequency (MHz) | 20 dB Bandwidth (kHz) |
|----------------|------------------------|------------------------------|
| Low | 902.3 | 206.5 |
| Middle | 915.2 | 206.3 |
| High | 926.9 | 205.9 |

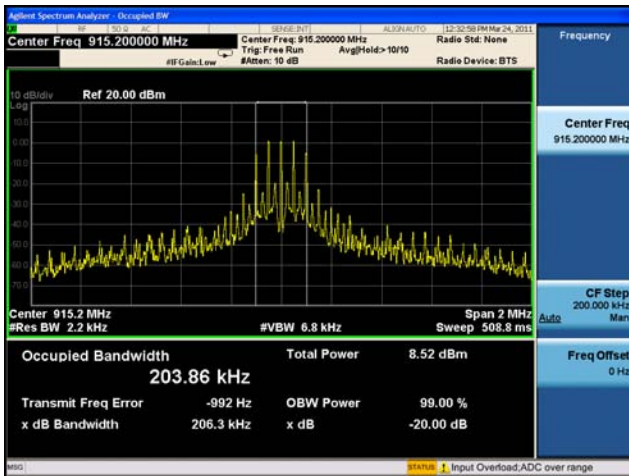
| Channel | Frequency (MHz) | 99% Occ BW (kHz) |
|----------------|------------------------|-------------------------|
| Low | 902.3 | 206 |
| Middle | 915.2 | 203.86 |
| High | 926.9 | 203.71 |

Emission Designator: 206KF1D

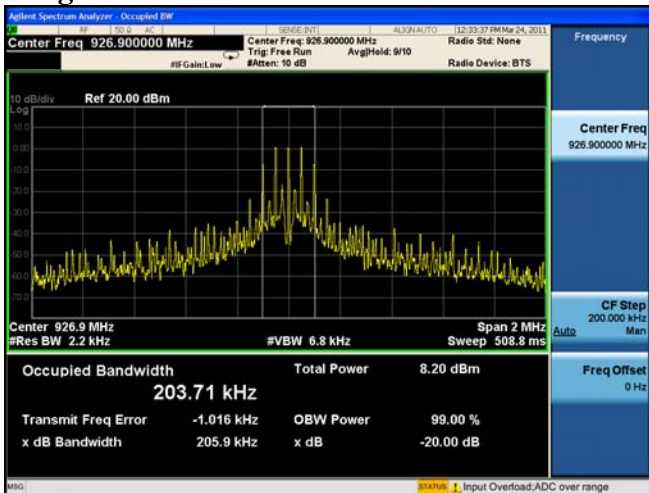
Low Channel 99% and -20 dBc Occ. BW



Mid Channel 99% Occ BW and -20 dBc Occ. BW



High Channel 99% Occ BW and -20 dBc Occ. BW



Emission designator: 206KF1D

HOPPING FREQUENCY SEPARATION

FCC: 15.247(a) 1

IC: RSS-210 A8.1 (a)

LIMIT

§15.247 (a) (1) 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.

TEST PROCEDURE

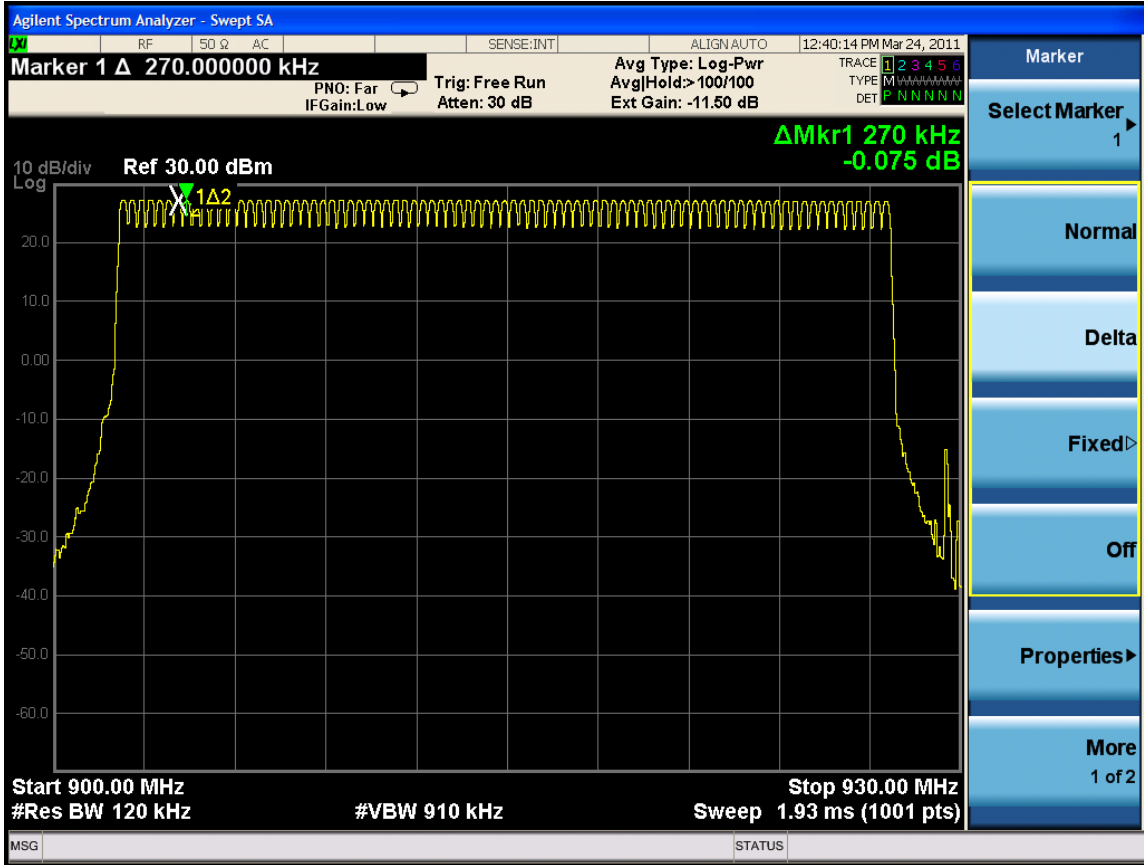
The transmitter output is connected to a spectrum analyzer. The RBW is set to 120 kHz and the VBW is set to 910 kHz. The sweep time is coupled.

RESULTS

No non-compliance noted:

The separation is 270 kHz.

HOPPING FREQUENCY SEPARATION



NUMBER OF HOPPING CHANNELS

FCC: 15.247 (a) 1(i)

IC: RSS 210 A8.1 (b)

LIMIT

§15.247 (a) (1) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST PROCEDURE

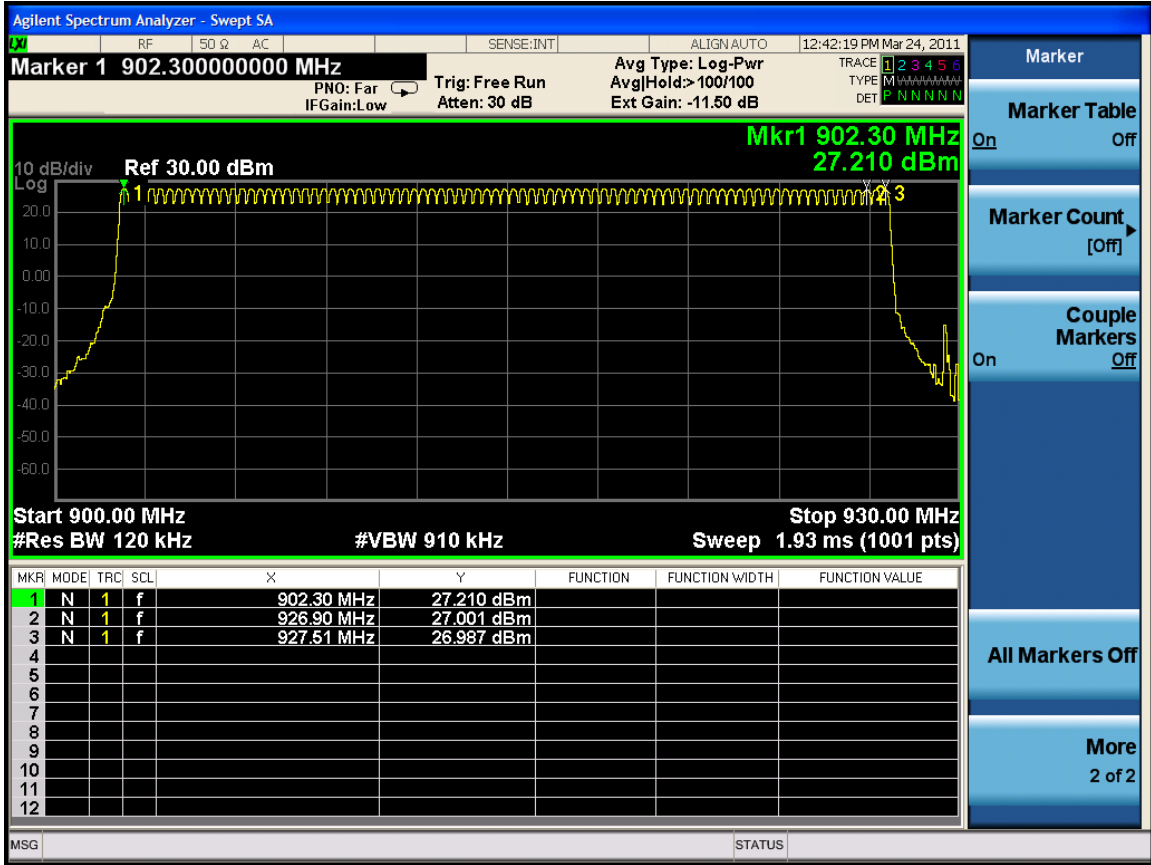
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 30 kHz. The analyzer is set to Max Hold.

RESULTS

No non-compliance noted:

86 channels total, channels 0-82 are US channels (902.3 – 926.9 MHz). Channels 43 – 86 are frequencies authorized for use in Australia.

NUMBER OF HOPPING CHANNELS



AVERAGE TIME OF OCCUPANCY

FCC: 15.247(a) 1(i)

IC: RSS 210 A8.1(c)

LIMIT

§15.247 (a) (1) (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 20 second scan, to enable resolution of each occurrence.

RESULTS

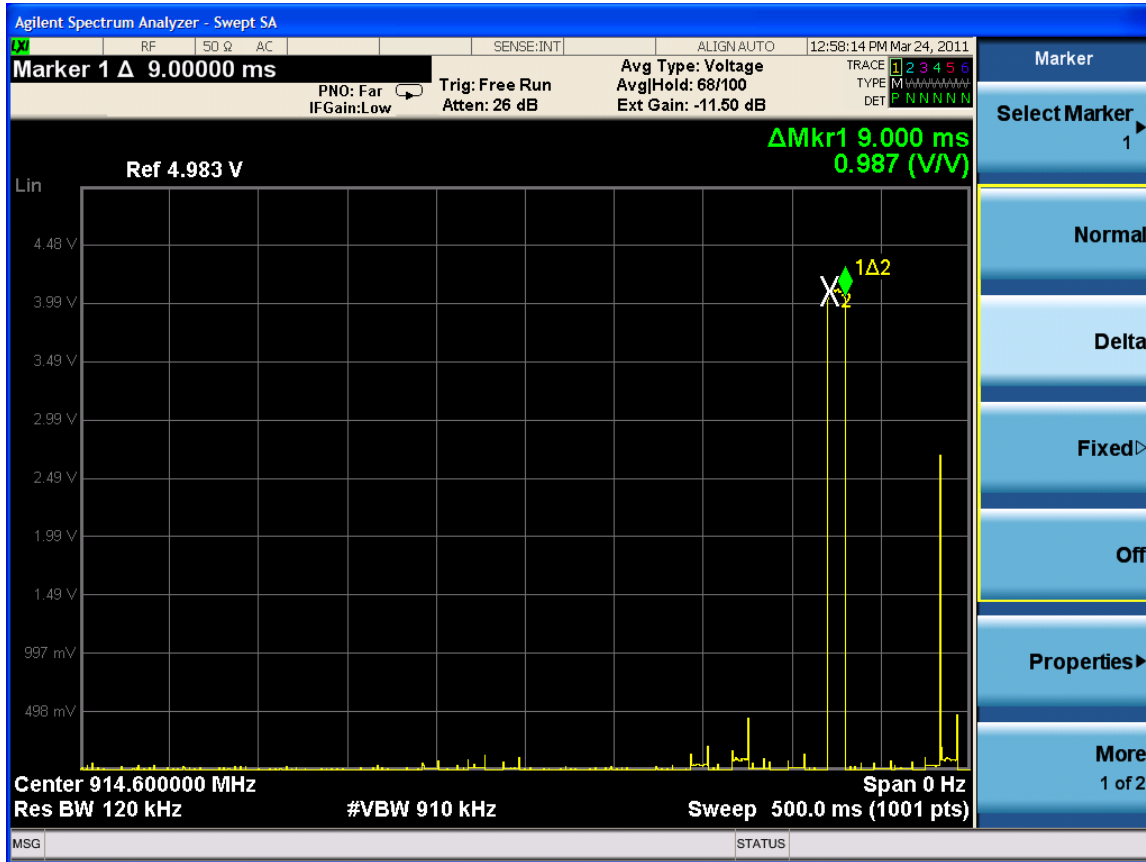
No non-compliance noted:

There are 2 pulse2 within the 20-second period. The on time for each pulse is 19 msec.

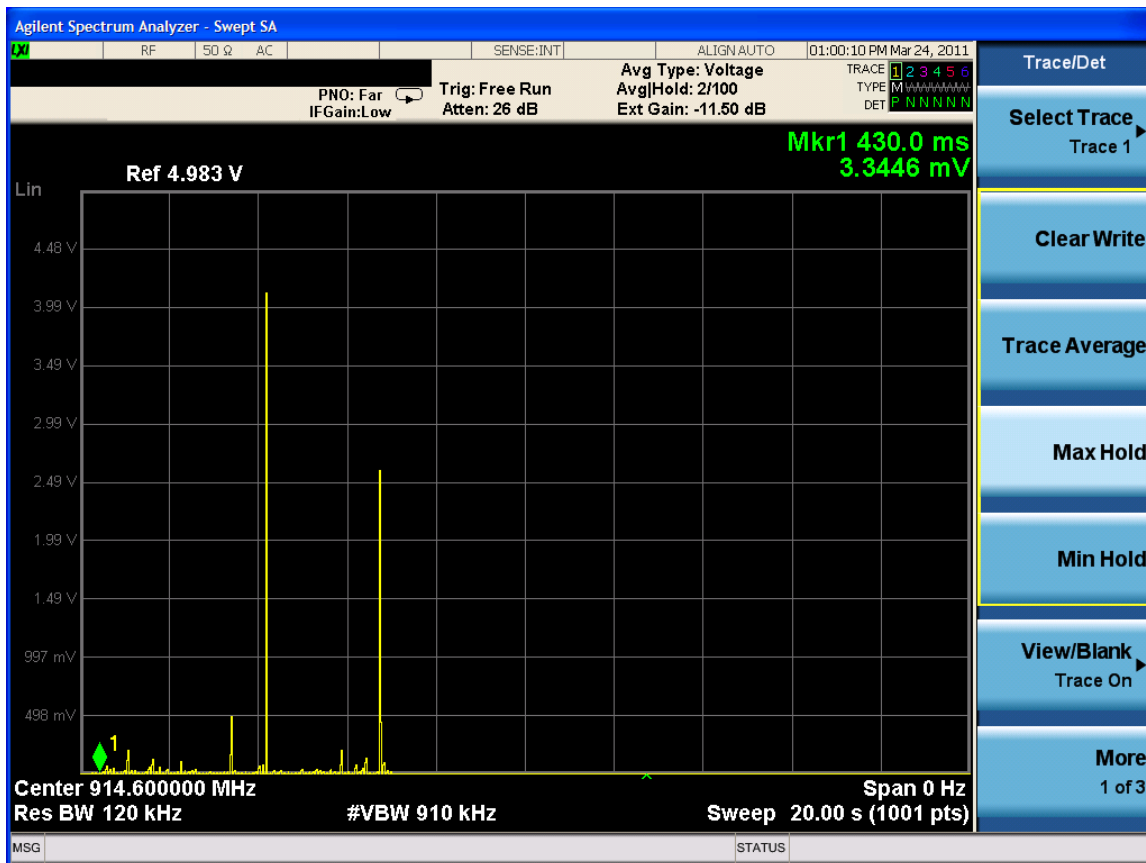
Therefore, the average time of occupancy in the specified 20-second period is 38 msec.

Limit: 400 msec

PULSE WIDTH



NUMBER OF PULSES IN 20 SECOND OBSERVATION PERIOD



PEAK OUTPUT POWER

FCC: 15.247(b) 2

RSS-210 A8.4 (1)

The maximum antenna gain is 1 dBi, the number of hopping channels is over 50, therefore the power limit is 30 dBm.

TEST PROCEDURE

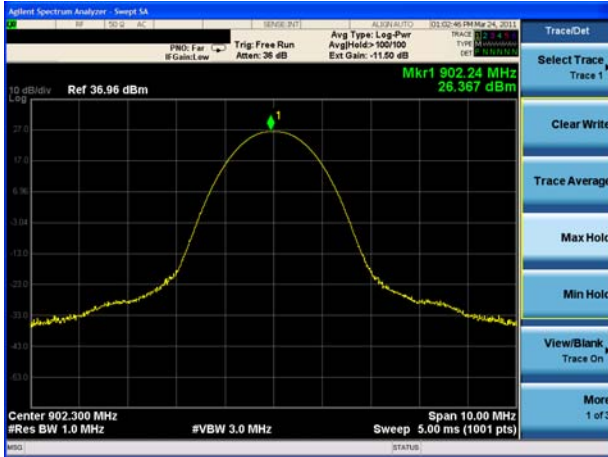
The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

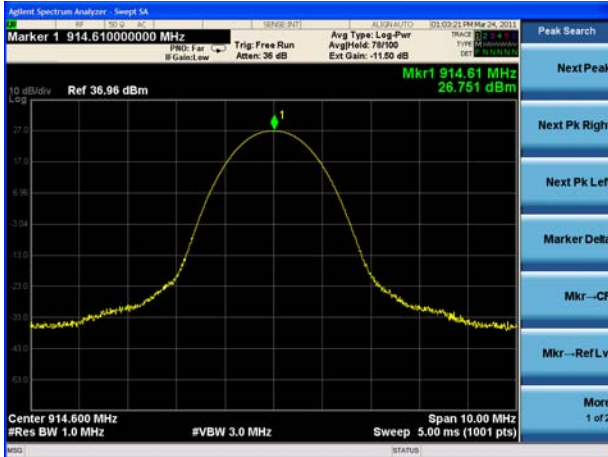
No non-compliance noted:

| Channel | Frequency | P out, dBm | Pout, watts |
|----------------|------------------|-------------------|--------------------|
| Low | 902.3 | 26.37 | 0.434 |
| Mid | 915.2 | 26.75 | 0.473 |
| High | 926.9 | 26.65 | 0.462 |

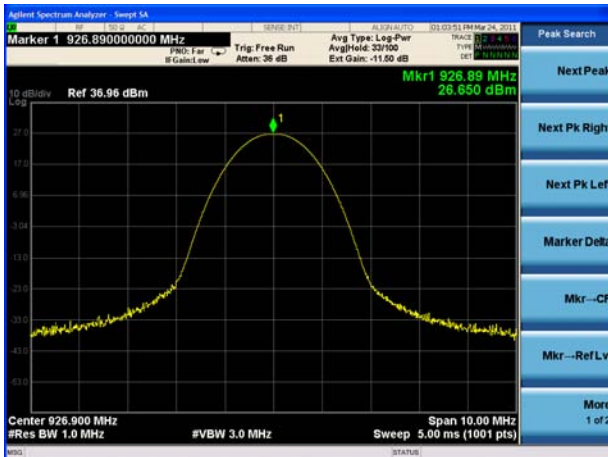
OUTPUT POWER LOW CHANNEL



OUTPUT POWER MID CHANNEL



OUTPUT POWER HIGH CHANNEL



MAXIMUM PERMISSIBLE EXPOSURE

FCC: 1.1310

IC: RSS-102

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/cm²) | Output Power (dBm) | Antenna Gain (dBi) | S, mW/cm² at 20cm |
|--|-----------------------------------|-----------------------------------|---|
| 0.6 | 26.75 | 1.00 | 0.12 |

MPE Distance: 8.89 cm

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

FCC: 15.247 (c)

IC: RSS 210 A8.5

TEST PROCEDURE

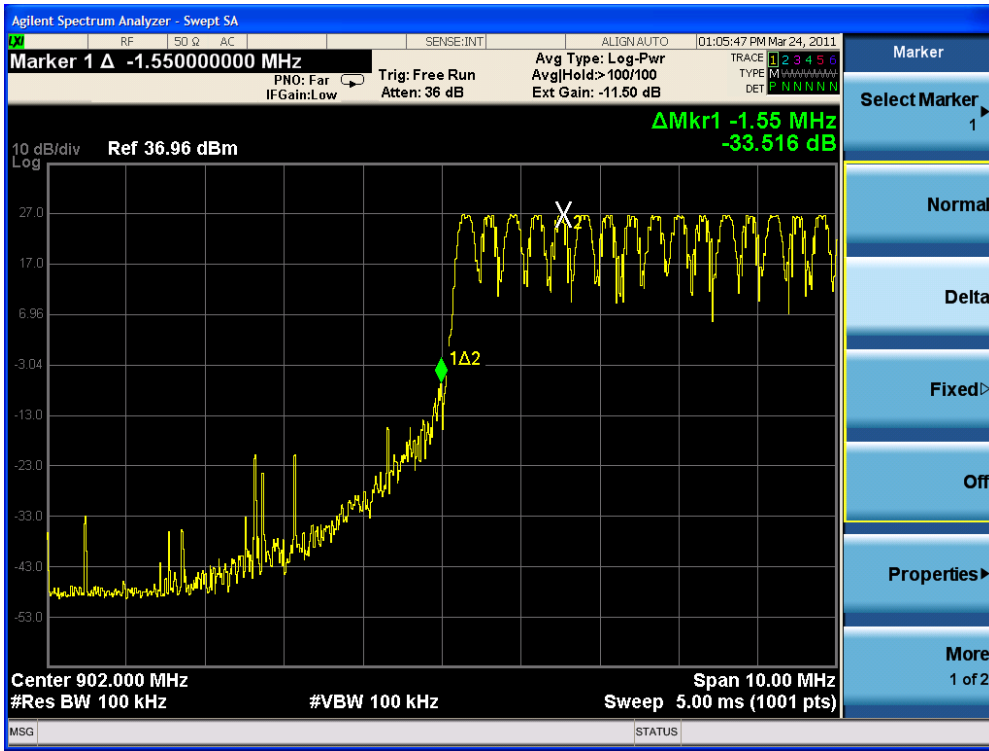
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

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

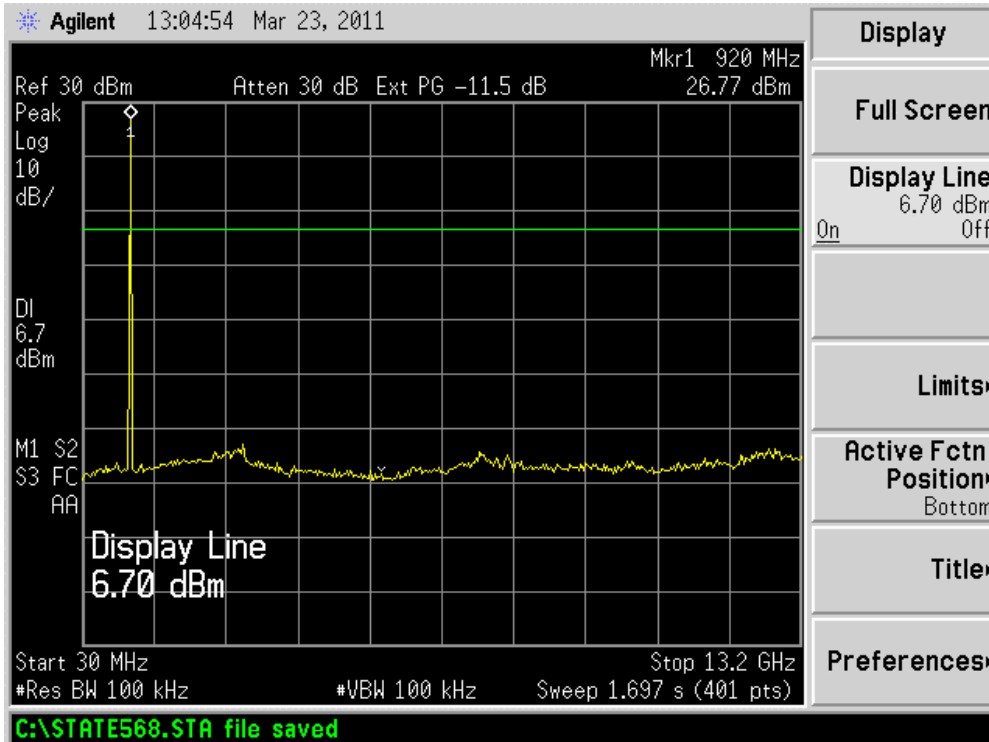
RESULTS

No non-compliance noted:

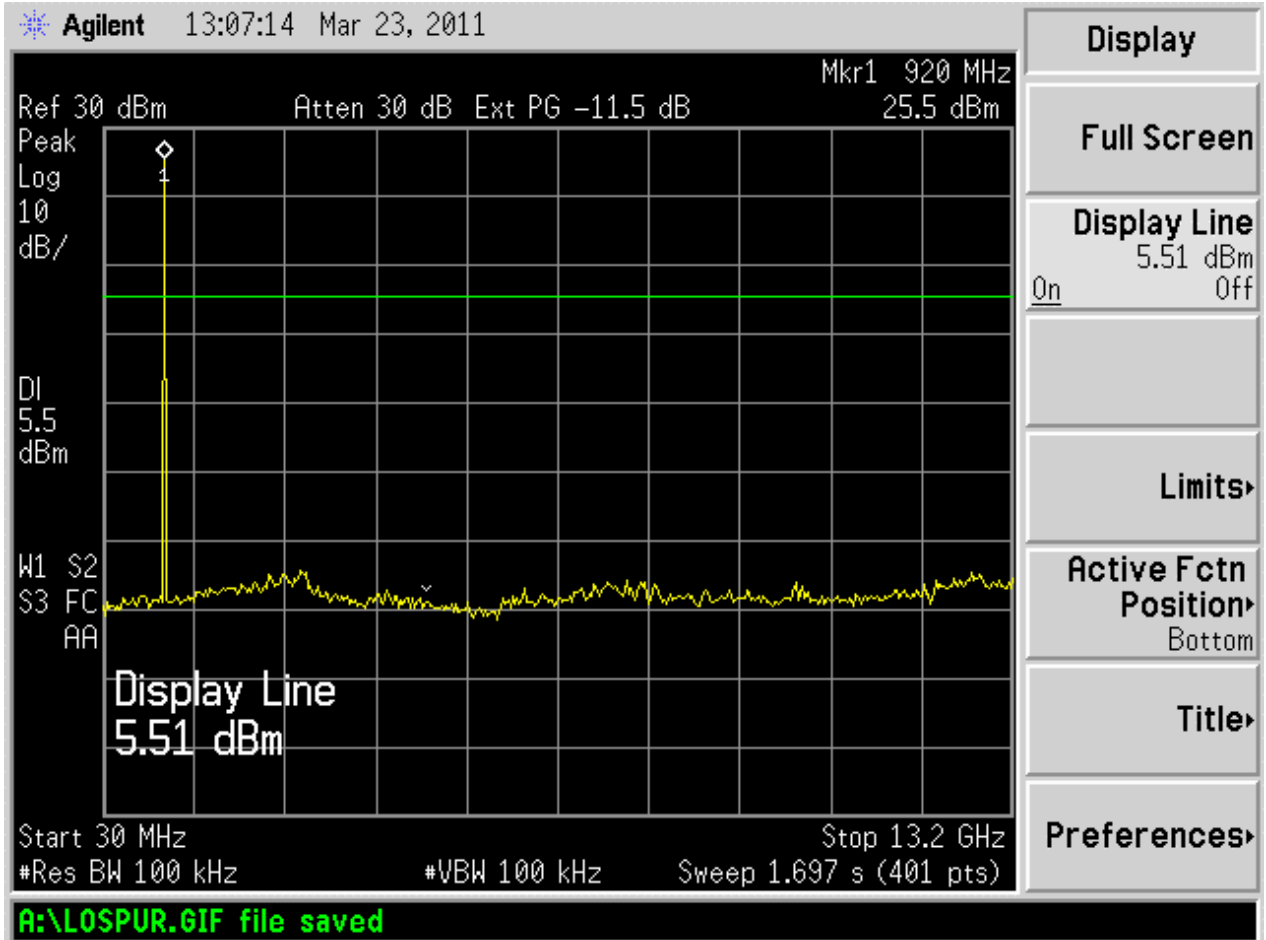
SPURIOUS EMISSIONS, LOW CHANNEL, HOPPING



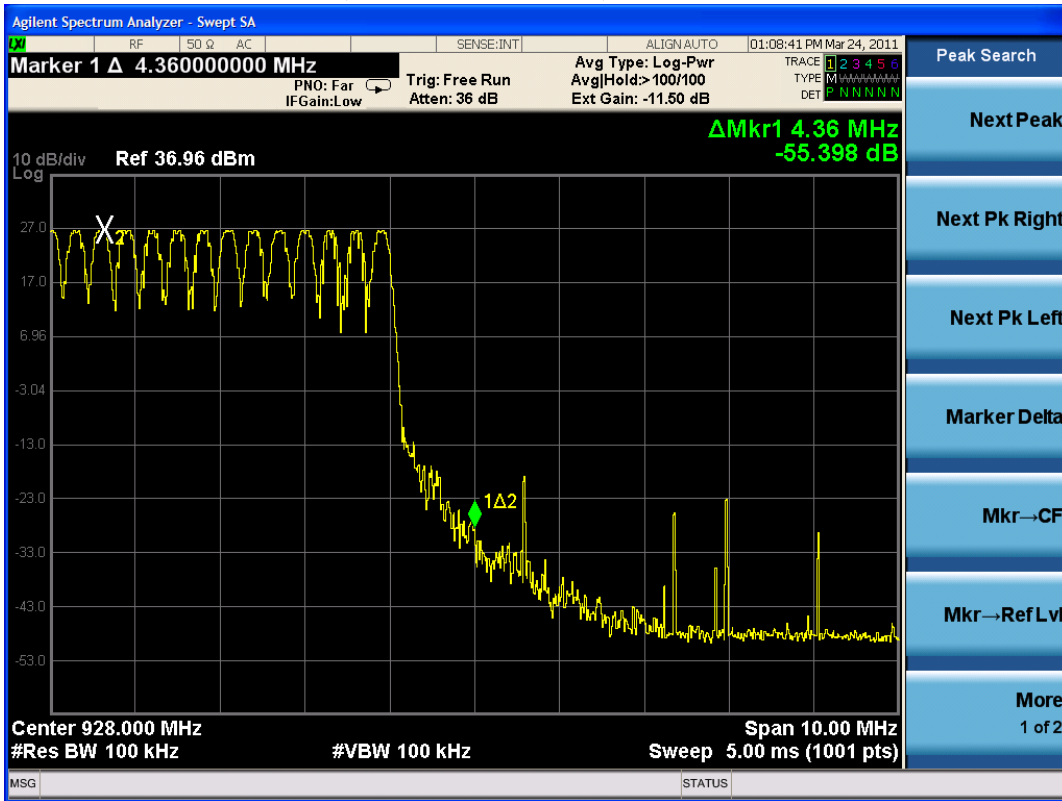
SPURIOUS EMISSIONS, LOW CHANNEL



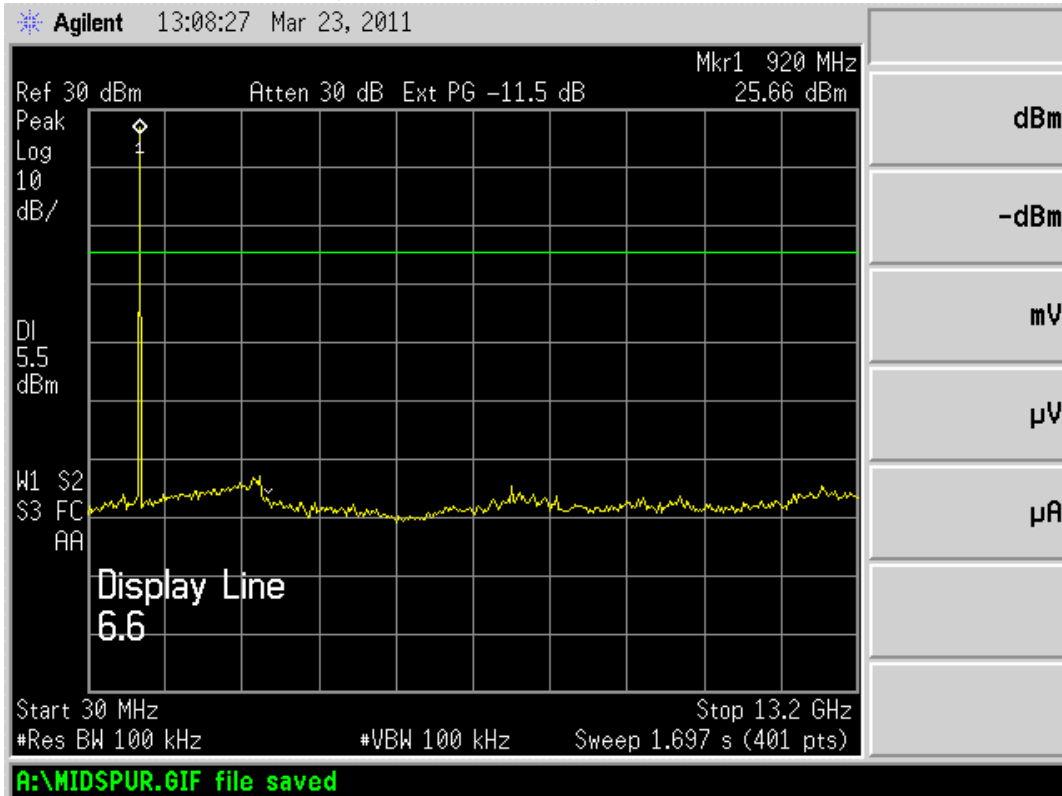
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL, BANDEDGE



SPURIOUS EMISSIONS, HIGH CHANNEL, HOPPING



4.4 POWERLINE CONDUCTED EMISSIONS

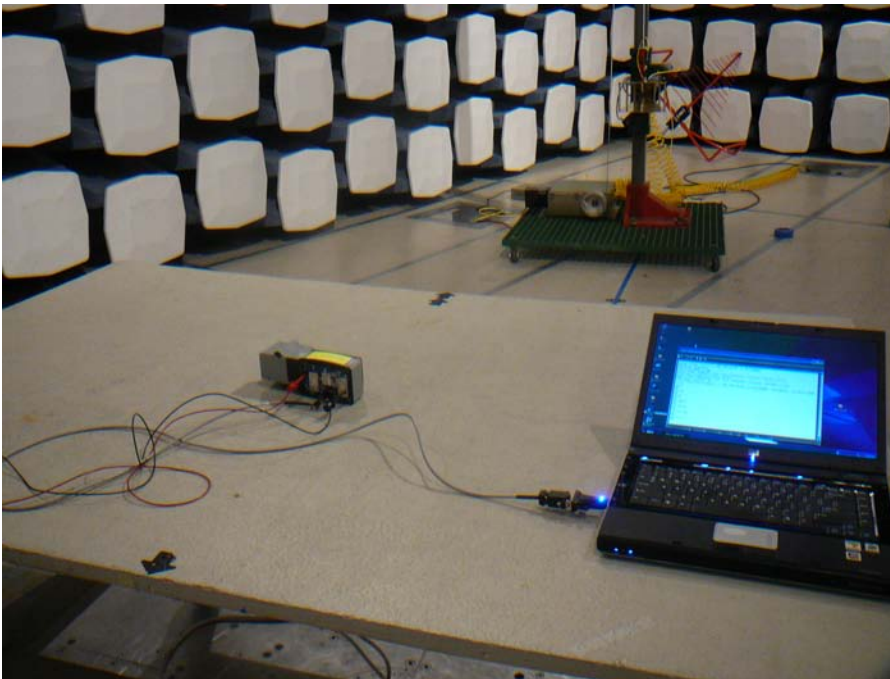
LIMIT

FCC: 15.207

IC: RSS-Gen Sec. 7.2.4

TEST NOT REQUIRED. EUT is battery powered only.

SETUP PHOTOS



NOTE: Laptop and serial cable were removed after EUT parameters were set and the EUT was transmitting continuously at the desired channel and power.

END OF REPORT

Report Revision History

| Revision No. | Revision Description | Pages Revised | Revised by | Date |
|--------------|----------------------|---------------|-------------|----------|
| - | Initial release | | T. Cokenias | 1/5/2012 |