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Report Number: R11CA14739-Outdoor Repeater

Project Number: 11CA14739

File Number: MC16660

Date: March 28, 2011
(Revised April 18, 2011)

Model: Outdoor Repeater
(FCC ID: X9INCS04010910)

# Electromagnetic Compatibility Test Report

# For

# Elliott Tech LLC

**Raleigh, NC**

# Test Report Details

| | |
|---|---|
| Tests Performed By: | **Underwriters Laboratories Inc.<br>12 Laboratory Dr.<br>Research Triangle Park, NC 27709** |
| Tests Performed For: | **Elliott Tech, LLC<br>346 Raleigh Street<br>Holly Springs, NC 27540** |
| Applicant Contact:<br>Title: | **Krista L. Larrison<br>Project Administrator** |
| Phone:<br>Fax:<br>E-mail: | **+1 (919) 342-6899<br>+1 (888) 631-1795<br>k.larrison@elliotttech.com** |
| Test Report Date: | **March 28, 2010** |
| Product Type: | **Unlicensed Transmitter** |
| Product standards | **FCC Part 15, Subpart C, 15.247** |
| Model Number: | **Outdoor Repeater** |
| Sample Serial Number: | **Unserialized, pre-production sample** |
| EUT Category: | **Low Power Transmitter 902-928 MHz** |
| Testing Start Date: | **March 7, 2011** |
| Date Testing Complete: | **March 11, 2011** |
| **Overall Results:** | **Compliant** |

# Report Directory

Report Revision History

| Revision Date | Description | Revised By | Revision Reviewed By |
|---|---|---|---|
| 4-18-2011 | Revised to include transmissions description during test | J. Marley | M. Nolting |

# 1.0 G E N E R A L - Product Description

## 1.1 Equipment Description

This family of devices operates as a personal alert system operating on the 902-928 MHz ISM band. The system consists of four different products.

(1) Hub – serves as the center of the system. It receives an alert and communicates to security personnel.
(2) PAS – a body-worn or hand-held transceiver that, when a button is depressed, initiates an alert.
(3) Outdoor Repeater – relays signals between the PAS and Hub. Intended to be mounted outdoors.
(4) Indoor Repeater – same as the outdoor repeater, but without a weatherproof enclosure.

All four devices contain an identical transceiver section operating with identical output power, modulation, and duty cycle.

This report documents measurements performed for the Outdoor Repeater.

This device contains a detachable antenna. Device is professionally installed. Maximum gain is 6.0 dBi for monopole antenna.

## 1.2 Device Configuration During Test

### 1.2.1 Equipment Used During Test:

| Use | Product Type | Manufacturer | Model | Comments |
|---|---|---|---|---|
| **EUT** | Transceiver | Elliott Technologies | Outdoor Repeater | 902-928 MHz Transceiver |
| Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test) | | | | |

### 1.2.2 Input/Output Ports:

| Port # | Name | Type* | Cable Max. >3m (Y/N) | Cable Shielded (Y/N) | Comments |
|---|---|---|---|---|---|
| 0 | Enclosure | N/E | — | — | |
| 1 | DC Power | DC | N | N | This unit is DC powered (12V). |
| 2 | Antenna | N/E | N | - | Antenna is permanently attached |

Note:
AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

### 1.2.3 EUT Internal Operating Frequencies:

| Frequency (MHz) | Description |
|---|---|
| 32 | Highest Digital (unintentional) operating frequency |
| 902-928 | Transmit Frequency Band |

### 1.2.4 Power Interface:

| Mode # /Rated | Voltage (V) | Frequency (DC/AC-Hz) | Phases (#) | Comments |
|---|---|---|---|---|
| 1 | 12V | DC | - | |

### 1.3 Block Diagram:

A block diagram is provided as a separate exhibit for FCC Certification.

### 1.4 EUT Configurations

| Mode # | Description |
|---|---|
| 1 | Device is positioned as described in each test section. Each of three orthogonal axes (Flat, Upright, and side) are examined to determine worst-case radiated spurious emissions. |

### 1.5 EUT Operation Modes

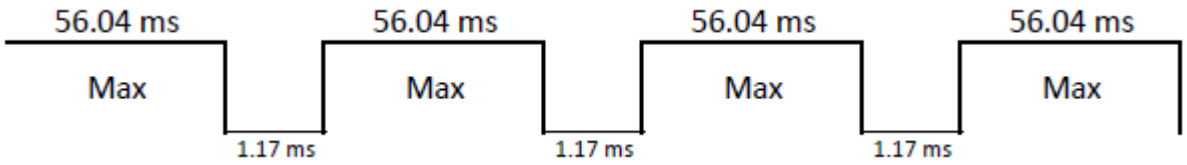
| Mode # | Description |
|---|---|
| 1 | The device is tested at highest output power on low, middle, or high channel as noted in each test section. Device is set to transmit frames continuously for measurement in most tests. Normal On/Off cycle is enabled for duty cycle measurement. A description of operation during test is shown below: |

### 1.6 Detailed Description of Operation during Test

Continuous Transmission of Frames:

The Outdoor Repeater (along with Hub, PAS, and Indoor Repeater) operates using a fixed Gaussian Frequency Shift Keying (GFSK) encoding pattern. Unless otherwise documented within this report, the transmitter is set to continuously broadcast packets with a minimal delay between packets. In normal use the transmissions are brief and difficult to measure with a spectrum analyzer while sweeping. Similarly, channel hopping is turned off so that low, middle, and high channels may be measured.

A timing diagram showing of the transmission, including a brief pause between frames, is shown below.




Duty Cycle:

Normal on/off duty cycle is enabled for the Duty Cycle measurement. Only a maximum of 100 ms of the repeating pattern is considered.

Hopping:

Frequency Hopping is enabled for the frequency hopping measurements (duration, number of channels, channel spacing).

### 1.7 Test Setup Photos

Setup Photos are provided as a separate exhibit for FCC Certification.

# 2.0 Summary

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by Underwriters Laboratories Inc. in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed were applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

## 2.1 Deviations from standard test methods

None

## 2.2 Device Modifications Necessary for Compliance

None

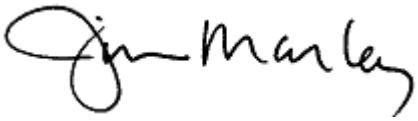
## 2.3 Reference Standards

| Standard Number | Standard Name | Standard Date |
|---|---|---|
| FCC Part 15, Subpart C, 15.247 | Code of Federal Regulations, Part 15, Radio Frequency Devices | 2010 |
| ANSI C63.4 | 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 | 2003 |

## 2.4 Results Summary

| Requirement – Test | Result (Compliant / Non-Compliant)* |
|---|---|
| Radiated Spurious Emissions | Compliant |
| Conducted Spurious Emissions | Compliant |
| Band Edge Compliance | Compliant |
| Frequency Hopping | Compliant |
| Maximum Output Power | Compliant |
| Occupied Bandwidth | Compliant |
| Duty Cycle | Pass/Fail Not Applicable |
| Maximum Permissible Exposure | Compliant |

Test Engineer:



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## 3.0 Calibration of Equipment Used for Measurement

All test equipment and test accessories are calibrated on a regular basis. The maximum time between calibrations is one year or the manufacturers' recommendation, whichever is less.

All test equipment calibrations are traceable to the National Institute of Standards and Technology (NIST); therefore, all test data recorded in this report is traceable to NIST.

## 4.0 EMISSIONS TEST RESULTS

The emissions tests were performed according to following regulations:

---------- United States ----------

| | |
|---|---|
| Code of Federal Regulations Title 47 | Part 15, Subpart C, Section 15.247 |

Unless specified otherwise in the individual Methods, the tests shall be conducted under the following ambient conditions. Confirmation of these conditions shall be verified at the time the test is conducted.

| | | | | | |
|---|---|---|---|---|---|
| Ambient Temperature, °C | 22.5 ± 2.5 | Relative Humidity, % | 45 ± 15 | Barometric Pressure, mBar | 950 ± 150 |

**Measurement Uncertainty**

| Test | Uncertainty |
|---|---|
| Conducted Emissions | ± 2.5 |
| Radiated Emissions | ± 3.4 |

**Sample Calculations**

Radiated Emissions data contained within this report is calculated as follows:

- Field Strength (dBuV/m) = Receiver Reading (dBuV) + Antenna Factor (dB/m) – Amp Gain (dB) + Cable/Filter Losses (dB)

Conducted Emissions data contained within this report is calculated as follows:

- Conducted Voltage (dBuV) = Receiver Reading (dBuV) + Cable/Attenuator Losses (dB) + LISN Correction Factor (dB)

## 4.1 Test Conditions and Results – RADIATED SPURIOUS EMISSIONS

| | |
|---|---|
| Test Description | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section15.205(c)). |

| Basic Standard | 47 CFR Part 15.209/15.247(d), ANSI C63.4:2003<br>RSS-210, A8.5<br>RSS-Gen 7.2.1 and 7.2.3 | |
|---|---|---|
| | Frequency range | Measurement Point |
| Fully configured sample scanned over the following frequency range | 30 MHz – 9.3 GHz | 3 meter distance |

**Limits (Radiated – Restricted Bands Only)**

| Frequency (MHz) | Limit (dBµV/m) | |
|---|---|---|
| | Quasi-Peak | Average |
| | General Emissions | Spurious |
| 30 – 88 | 29.54 | - |
| 88 – 216 | 33.06 | - |
| 216 – 960 | 35.56 | - |
| 960 – 1000 | 43.52 | - |
| 1,000 – 9280 | - | 54 |

Supplementary information:

Below 1GHz, spectrum was checked. All emissions related to the transmitter below 1GHz are not in the restricted band therefore only antenna conducted limits apply (20 dB below the peak level of the fundamental).

Radiated Spurious emissions was performed in three orthogonal axes on the middle channel. The worst-case axis was noted. The low and high channels were measured in this position.

**Figure 1 RADIATED SPURIOUS EMISSIONS EUT Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| Supplementary information: None | | |

**Figure 2 RADIATED SPURIOUS EMISSIONS Test Equipment**

| Equip. ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| | **30-1000 MHz Range** | | | | |
| AT0025 | Biconical Antenna, 30 to 300 MHz | Schaffner, EMC | VBA6106A | 2010-8-28 | 2011-8-31 |
| AT0030 | Log-periodic Antenna, 200 MHz to 1000 MHz | Chase | UPA6109 | 2010-8-28 | 2011-8-31 |
| | **1-10 GHz** | | | | |
| AT0032 | Horn Antenna 1 to 18 GHz | EMC Test Systems | 3115 | 2010-10-28 | 2011-10-31 |
| | **Gain-Loss Chains** | | | | |
| SAC_C (Biconical 3m location) | (1) ATA084: Attenuator<br>(2) ATA124: Amplifier<br>(3) ATA167: Cable<br>(4) ATA132: Cable<br>(5) ATA229: DC Bias Tee<br>(6) ATA199: Cable | (1) Pasternack<br>(2) Miteq<br>(3) Eupen<br>(4) UL<br>(5) Miteq<br>(6) Micro-Coax | (1) PE7002-6<br>(2) AM-3A-000110-N<br>(3) CMS/RG 214<br>(4) UFA210A-0-6000-50U-50U<br>(5) BT2000-C<br>(6) UFB293C-0-0720-5GU50U) | 2010-8-16 | 2011-8-31 |
| SAC_D (Log-Periodic 3m location) | (1) ATA085: Attenuator<br>(2) ATA125: Amplifier<br>(3) ATA225: Cable<br>(4) ATA189: Cable<br>(5) ATA115: DC Bias Tee<br>(6) ATA198: Cable | (1) Pasternack<br>(2) Miteq<br>(3) EUPEN<br>(4) EUPE<br>(5) Miteq<br>(6) Micro-Coax | (1) PE7002-6<br>(2) AM-3A-000110-N<br>(3) CMS/RG 214<br>(4) CMS/RG 214<br>(5) AM-1523-7687<br>(6) UFB293C-0-0720-5GU50U | 2010-8-16 | 2011-8-31 |
| SAC_E_HORN (Horn 3m location) | (1) ATA144: Amplifier<br>(2) ATA207: Cable<br>(3) ATA096: Cable<br>(4) ATA199: Cable | (1) Miteq<br>(2) Micro-Coax<br>(3) Micro-Coax<br>(4) Micro-Coax | (1) AFS42-00101800-25-N-42MF<br>(2) UFB293C-1-3360-50U50U<br>(3) UTiFLEX<br>(4) UFB293C-0-0720-5GU50U | 2010-8-16 | 2011-8-31 |
| | **Receiver & Software** | | | | |
| SAR004 | Spectrum Analyzer / Receiver | Hewlett-Packard | 8572A | 2010-2-25 | 2011-2-28 |
| SOFTEMI | EMI Software | UL | Version 9.5 | NA | NA |
| | **Additional Equipment used** | | | | |
| HPF003 | High-Pass Filter | Mini-Circuits | HPF-1810 | 2011-3-3 | 2012-3-31 |

**Table 3 RADIATED SPURIOUS EMISSIONS Results (Summary)**

| Transmit Channel (L/M/H) | EUT Orient. | Freq. (MHz) | Detect. Type (P/A/Q) | Receiver Reading (dBuV) | Cable /Amp Factor (dB) | Anten. Factor (dB/m) | Field Strength (dBuV/m) | Duty Cycle Avg (dB) | Field Strength (dBuV/m) | 15.209 Limit (dBuV/m) | Margin (dB) | Anten. Polar. (V/H) | Anten. Height (cm) | Ttable Angle (deg) | Com-ments (#) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mid | Upright | 1830 | P | 58.6 | -27.6 | 27.0 | 58.0 | - | 58.0 | - | - | V | 150.0 | rot | |
| Mid | Upright | 1829.99 | A | 57.6 | -27.6 | 27.0 | 57.0 | -8.4 | 48.6 | - | - | V | 113.0 | 346.0 | 2 |
| Mid | Upright | 2744 | P | 51.2 | -28.6 | 29.0 | 51.6 | - | 51.6 | 74.0 | -22.4 | V | 100.0 | rot | |
| Mid | Upright | 2744 | A | 51.2 | -28.6 | 29.0 | 51.6 | -8.4 | 43.2 | 54.0 | -10.8 | V | 100.0 | rot | 1 |
| Mid | Upright | 3660 | P | 52.7 | -27.8 | 31.9 | 56.8 | - | 56.8 | 74.0 | -17.2 | V | 100.0 | rot | |
| Mid | Upright | 3659.97 | A | 50.2 | -27.8 | 31.9 | 54.3 | -8.4 | 45.9 | 54.0 | -8.1 | V | 102.0 | 333.0 | 2 |
| Mid | Upright | 4572 | P | 55.4 | -25.2 | 32.4 | 62.6 | - | 62.6 | 74.0 | -11.4 | V | 100.0 | rot | |
| Mid | Upright | 4574.94 | A | 53.3 | -25.2 | 32.4 | 60.5 | -8.4 | 52.1 | 54.0 | -1.9 | V | 102.0 | 189.0 | 2 |
| Mid | Upright | 5484 | P | 48.7 | -25.2 | 32.4 | 55.9 | - | 55.9 | 74.0 | -18.1 | V | 100.0 | rot | |
| Mid | Upright | 5489.95 | A | 47.0 | -25.2 | 32.4 | 54.2 | -8.4 | 45.8 | 54.0 | -8.2 | V | 104.0 | 74.0 | 2 |
| Mid | Side | 1830 | P | 58.1 | -27.6 | 27.0 | 57.5 | - | 57.5 | - | - | H | 151.0 | rot | |
| Mid | Side | 1830.01 | A | 58.1 | -27.6 | 27.0 | 57.5 | -8.4 | 49.1 | - | - | H | 113.0 | 122.0 | 2 |
| Mid | Side | 2744 | P | 49.5 | -28.6 | 29.0 | 49.9 | - | 49.9 | 74.0 | -24.1 | H | 100.0 | rot | |
| Mid | Side | 2744 | A | 49.5 | -28.6 | 29.0 | 49.9 | -8.4 | 41.5 | 54.0 | -12.5 | H | 100.0 | rot | 1 |
| Mid | Side | 3660 | P | 52.3 | -27.8 | 31.9 | 56.4 | - | 56.4 | 74.0 | -17.6 | H | 100.0 | rot | |
| Mid | Side | 3659.97 | A | 51.5 | -27.8 | 31.9 | 55.6 | -8.4 | 47.2 | 54.0 | -6.9 | H | 102.0 | 243.0 | 2 |
| Mid | Side | 4575 | P | 53.5 | -25.2 | 32.4 | 60.7 | - | 60.7 | 74.0 | -13.3 | H | 150.0 | rot | |
| Mid | Side | 4574.94 | A | 53.1 | -25.2 | 32.4 | 60.3 | -8.4 | 51.9 | 54.0 | -2.1 | H | 122.0 | 0.0 | 2 |
| Mid | Side | 5484 | P | 46.7 | -22.0 | 34.3 | 59.0 | - | 59.0 | 74.0 | -15.0 | H | 100.0 | rot | |
| Mid | Side | 5484 | A | 45.5 | -22.0 | 34.3 | 57.8 | -8.4 | 49.4 | 54.0 | -4.6 | H | 123.0 | 37.0 | 2 |
| Mid | Flat | 1830 | P | 57.1 | -27.6 | 27.0 | 56.5 | - | 56.5 | - | - | V | 100.0 | rot | |
| Mid | Flat | 1829.98 | A | 56.0 | -27.6 | 27.0 | 55.4 | -8.4 | 47.0 | - | - | V | 102.0 | 183.0 | 2 |
| Mid | Flat | 2744 | P | 49.7 | -28.6 | 29.0 | 50.1 | - | 50.1 | 74.0 | -23.9 | V | 100.0 | rot | |
| Mid | Flat | 2744 | A | 49.7 | -28.6 | 29.0 | 50.1 | -8.4 | 41.7 | 54.0 | -12.3 | V | 100.0 | rot | 1 |
| Mid | Flat | 3660 | P | 52.9 | -27.8 | 31.9 | 57.0 | - | 57.0 | 74.0 | -17.0 | V | 100.0 | rot | |
| Mid | Flat | 3659.96 | A | 52.8 | -27.8 | 31.9 | 56.9 | -8.4 | 48.5 | 54.0 | -5.5 | V | 143.0 | 20.0 | 2 |
| Mid | Flat | 4575 | P | 49.7 | -25.2 | 32.4 | 56.9 | - | 56.9 | 74.0 | -17.1 | V | 100.0 | rot | |
| Mid | Flat | 4574.92 | A | 47.0 | -25.2 | 32.4 | 54.2 | -8.4 | 45.8 | 54.0 | -8.2 | V | 100.0 | 231.0 | 2 |
| Mid | Flat | 5484 | P | 47.3 | -22.0 | 34.3 | 59.6 | - | 59.6 | 74.0 | -14.4 | V | 100.0 | rot | |
| Mid | Flat | 5489.93 | A | 46.6 | -22.0 | 34.3 | 58.9 | -8.4 | 50.5 | 54.0 | -3.5 | V | 142.0 | 44.0 | 2 |
| Low | Upright (worst) | 1806 | P | 57.5 | -27.2 | 26.9 | 57.2 | - | 57.2 | - | - | V | 150.0 | rot | |
| Low | Upright | 1804.98 | A | 56.1 | -27.2 | 26.9 | 55.8 | -8.4 | 47.4 | - | - | V | 123.0 | 304.0 | 2 |
| Low | Upright | 2706 | P | 50.2 | -28.7 | 29.0 | 50.5 | - | 50.5 | 74.0 | -23.5 | V | 100.0 | rot | |
| Low | Upright | 2707 | A | 50.2 | -28.7 | 29.0 | 50.5 | -8.4 | 42.1 | 54.0 | -11.9 | V | 100.0 | rot | 1 |

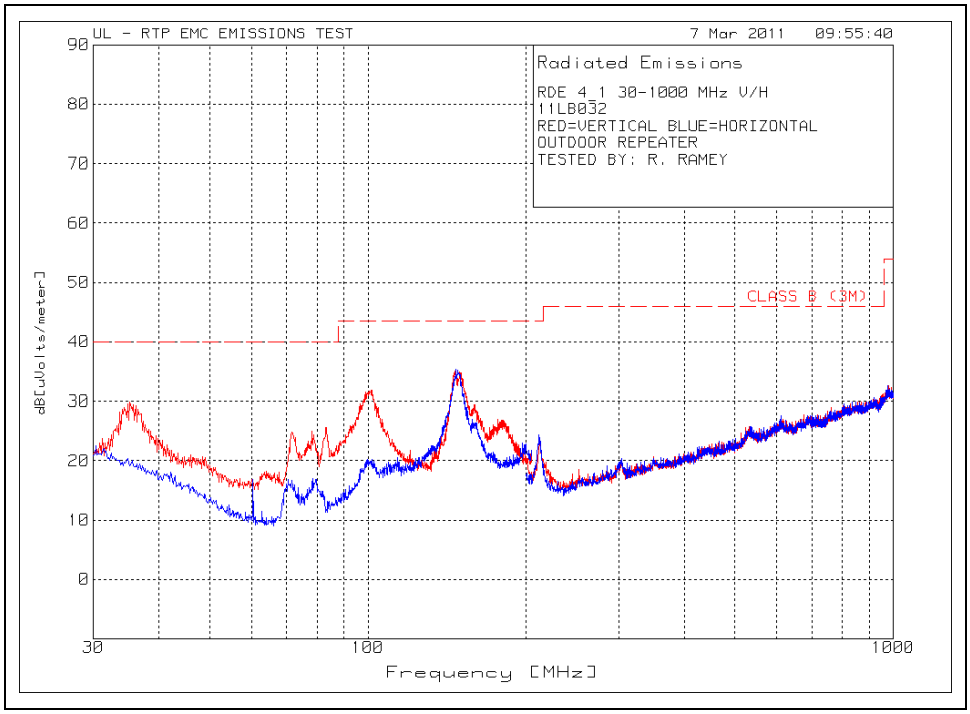
| Transmit Channel (L/M/H) | EUT Orient. | Freq. (MHz) | Detect. Type (P/A/Q) | Receiver Reading (dBuV) | Cable /Amp Factor (dB) | Anten. Factor (dB/m) | Field Strength (dBuV/m) | Duty Cycle Avg (dB) | Field Strength (dBuV/m) | 15.209 Limit (dBuV/m) | Margin (dB) | Anten. Polar. (V/H) | Anten. Height (cm) | Ttable Angle (deg) | Com-ments (#) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Low | Upright | 3610 | P | 52.1 | -27.7 | 31.6 | 56.0 | - | 56.0 | 74.0 | -18.0 | H | 100.0 | rot | |
| Low | Upright | 3609.98 | A | 47.8 | -27.7 | 31.6 | 51.7 | -8.4 | 43.3 | 54.0 | -10.8 | H | 102.0 | 116.0 | 2 |
| Low | Upright | 4512 | P | 54.0 | -26.0 | 32.3 | 60.3 | - | 60.3 | 74.0 | -13.7 | V | 151.0 | rot | |
| Low | Upright | 4512.45 | A | 51.1 | -25.9 | 32.3 | 57.5 | -8.4 | 49.1 | 54.0 | -4.9 | V | 122.0 | 189.0 | 2 |
| Low | Upright | 5412 | P | 47.3 | -22.3 | 34.2 | 59.2 | - | 59.2 | 74.0 | -14.8 | H | 151.0 | rot | |
| Low | Upright | 5414.91 | A | 40.0 | -22.3 | 34.2 | 51.9 | -8.4 | 43.5 | 54.0 | -10.5 | H | 143.0 | 1.0 | 2 |
| High | Upright (worst) | 1856 | P | 59.5 | -28.0 | 27.1 | 58.6 | - | 58.6 | - | - | V | 150.0 | rot | |
| High | Upright | 1854.99 | A | 58.2 | -28.0 | 27.1 | 57.3 | -8.4 | 48.9 | - | - | V | 112.0 | 304.0 | 2 |
| High | Upright | 2782 | P | 53.0 | -28.5 | 29.0 | 53.5 | - | 53.5 | 74.0 | -20.5 | H | 151.0 | rot | |
| High | Upright | 2782.46 | A | 53.6 | -28.5 | 29.0 | 54.1 | -8.4 | 45.7 | 54.0 | -8.3 | H | 133.0 | 85.0 | 2 |
| High | Upright | 3710 | P | 54.6 | -27.4 | 32.3 | 59.5 | - | 59.5 | 74.0 | -14.5 | V | 151.0 | rot | |
| High | Upright | 3710 | A | 54.6 | -27.4 | 32.3 | 59.5 | -8.4 | 51.1 | 54.0 | -2.9 | V | 151.0 | rot | 1 |
| High | Upright | 4636 | P | 56.8 | -25.2 | 32.5 | 64.1 | - | 64.1 | 74.0 | -9.9 | V | 100.0 | rot | |
| High | Upright | 4636 | A | 54.2 | -25.2 | 32.5 | 61.5 | -8.4 | 53.1 | 54.0 | -0.9 | V | 102.0 | 189.0 | 2 |
| High | Upright | 5564 | P | 50.6 | -21.8 | 34.2 | 63.0 | - | 63.0 | 74.0 | -11.0 | V | 100.0 | rot | |
| High | Upright | 5564 | A | 46.8 | -21.8 | 34.2 | 59.2 | -8.4 | 50.8 | 54.0 | -3.2 | V | 112.0 | 73.0 | 2 |

Notes:

1 Duty cycle factor is applied to peak measurements where that is sufficient to show compliance.

2 Duty cycle factor is applied to Average Measurement. Device is tested continuously transmitting with normal modulation - on/off cycling is disabled.

**Figure 4 Radiated Spurious Emissions below 1GHz - Middle Channel**




Note: No significant spurious emissions are observed below 1 GHz. Low and High channels are similar. Transmit signal is blocked by notch filter.

**Figure 9A Radiated Spurious Emissions, Middle Channel (Flat-Orientation)**

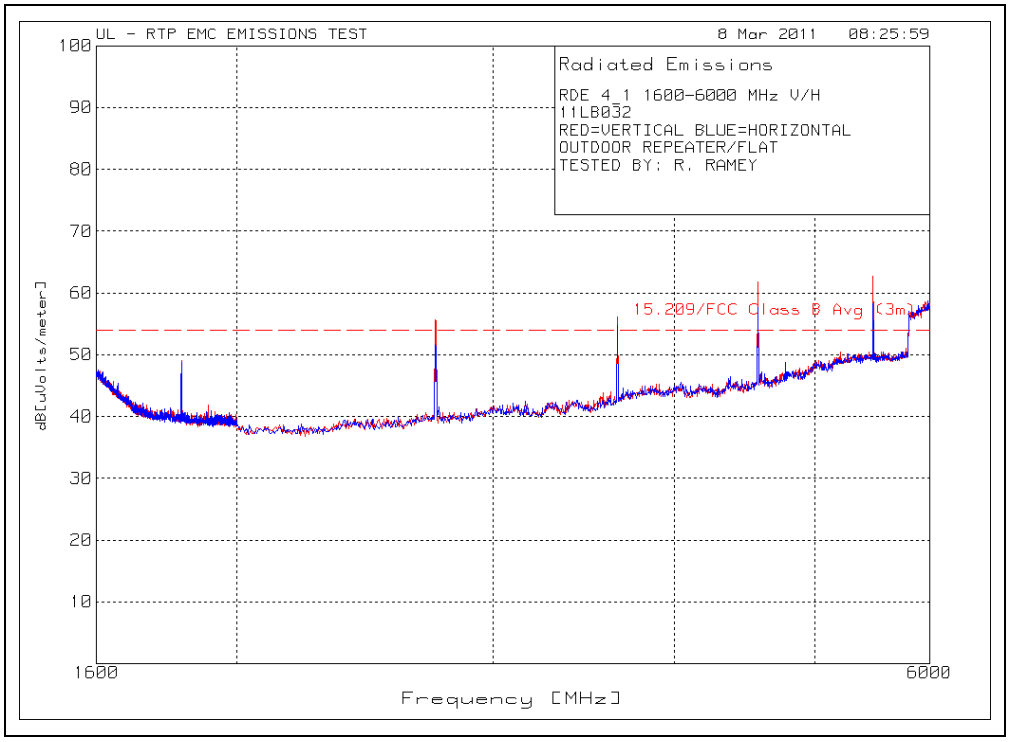



**Figure 9B Radiated Spurious Emissions, Middle Channel (Flat-Orientation)**

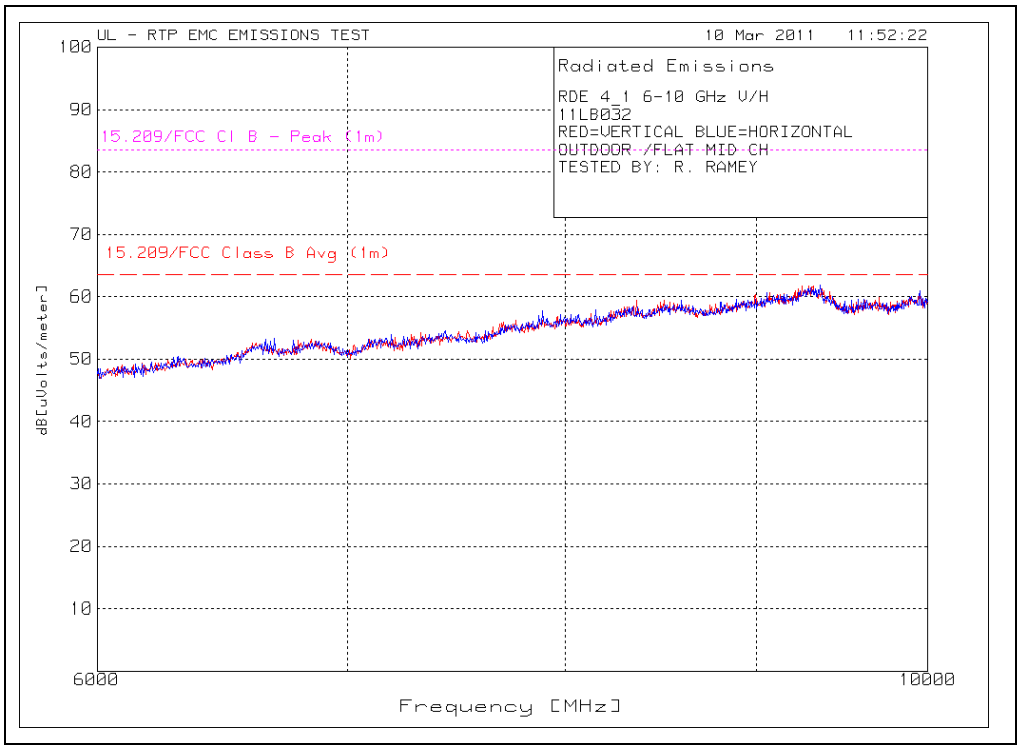


**Figure 10A Radiated Spurious Emissions, Middle Channel (Side-Orientation)**

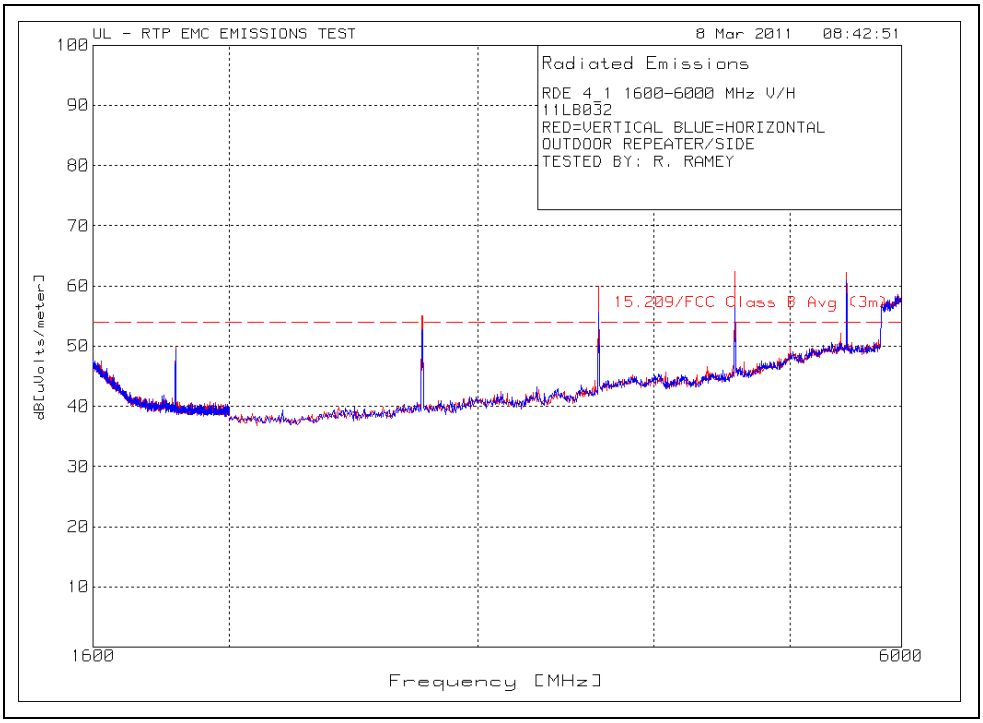



**Figure 10B Radiated Spurious Emissions, Middle Channel (Side-Orientation)**

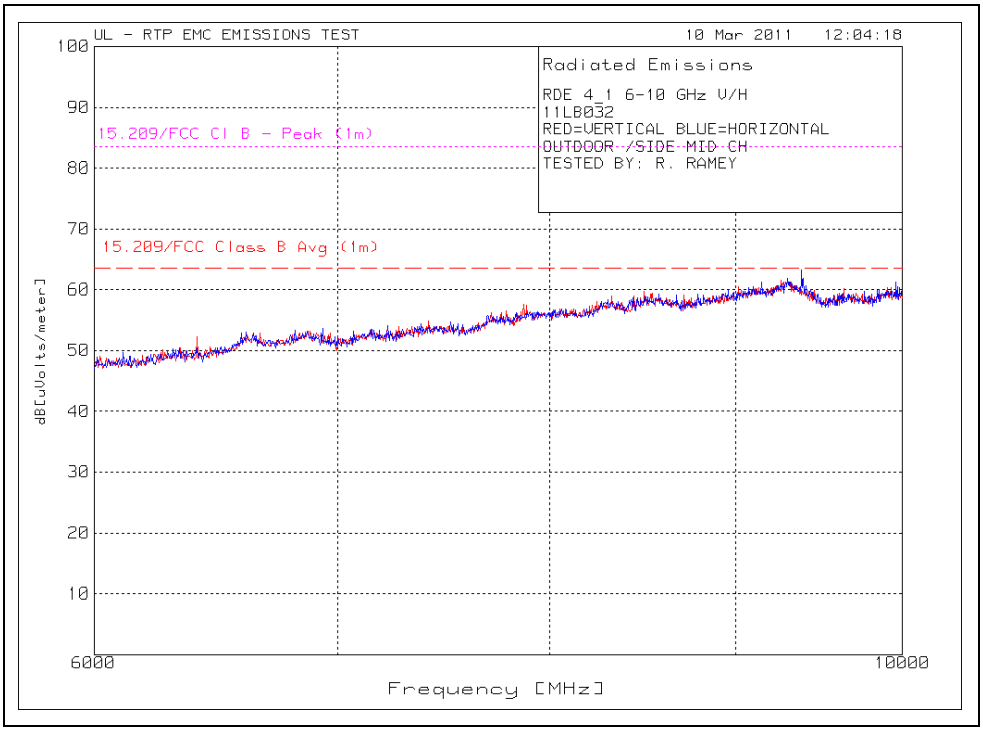


**Figure 11A Radiated Spurious Emissions, Middle Channel (Upright-Orientation)**

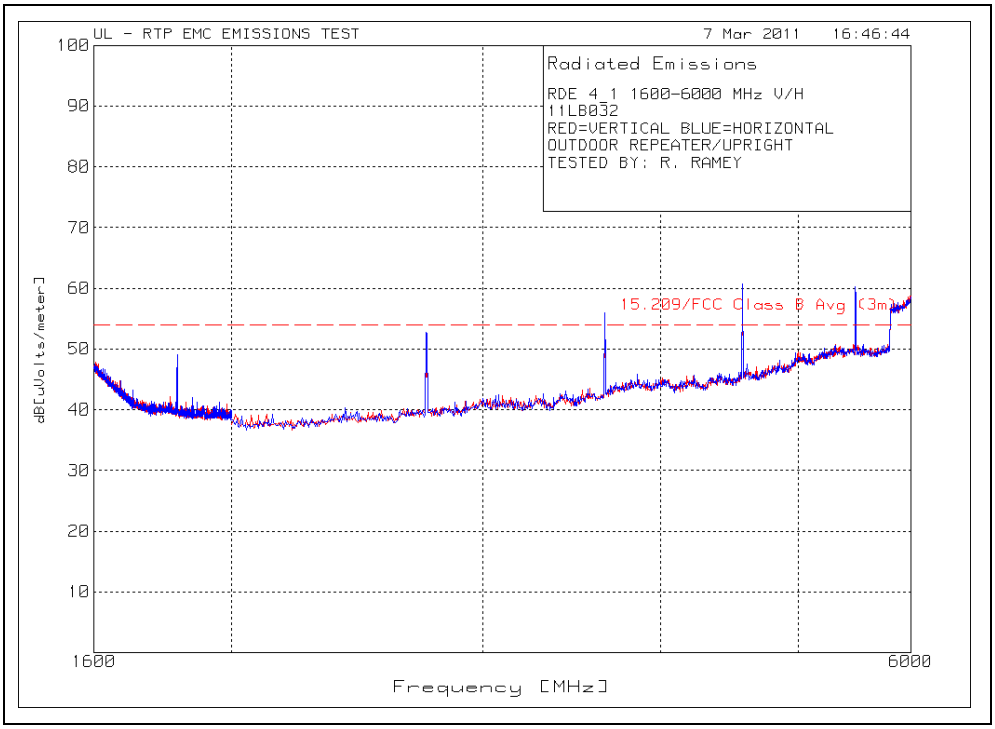



**Figure 11B Radiated Spurious Emissions, Middle Channel (Upright-Orientation)**

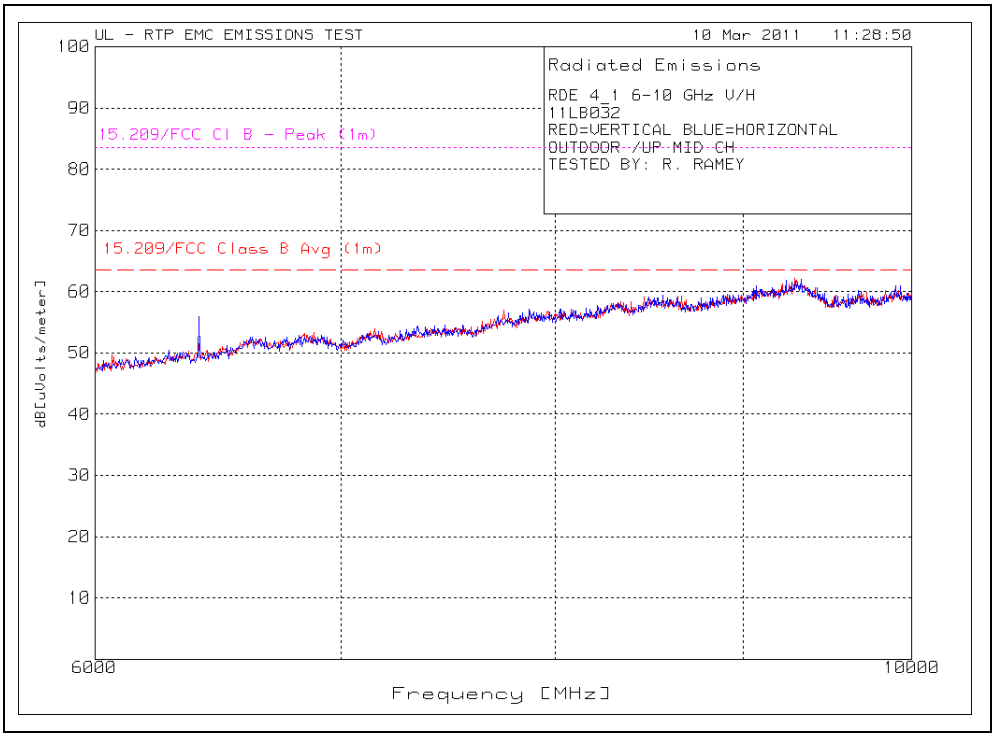


**Figure 12A Radiated Spurious Emissions, Low Channel (Worst-case Orientation)**

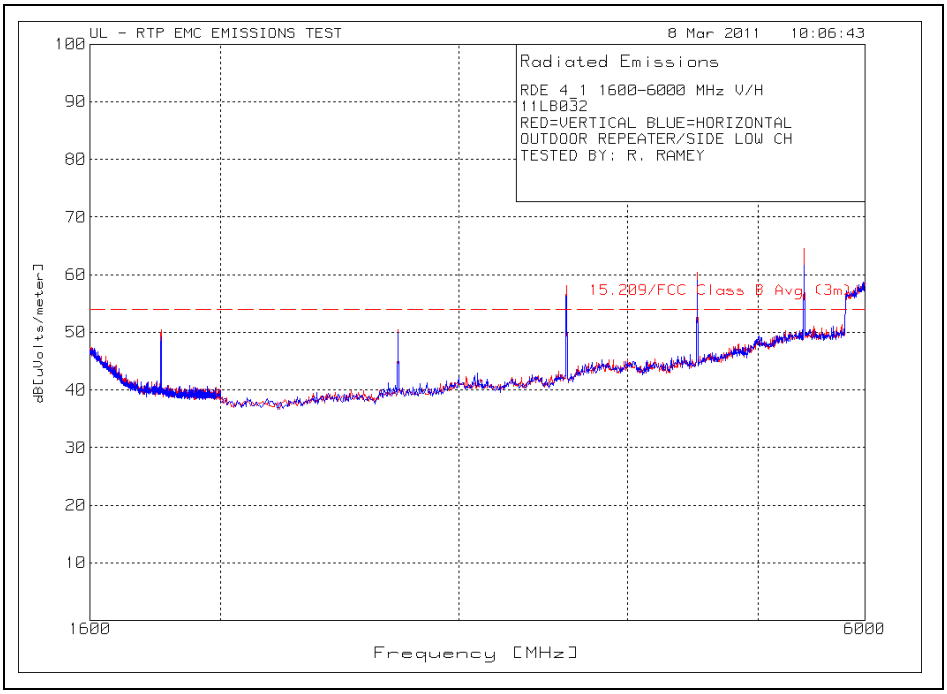



**Figure 12B Radiated Spurious Emissions, Low Channel (Worst-Case Orientation)**

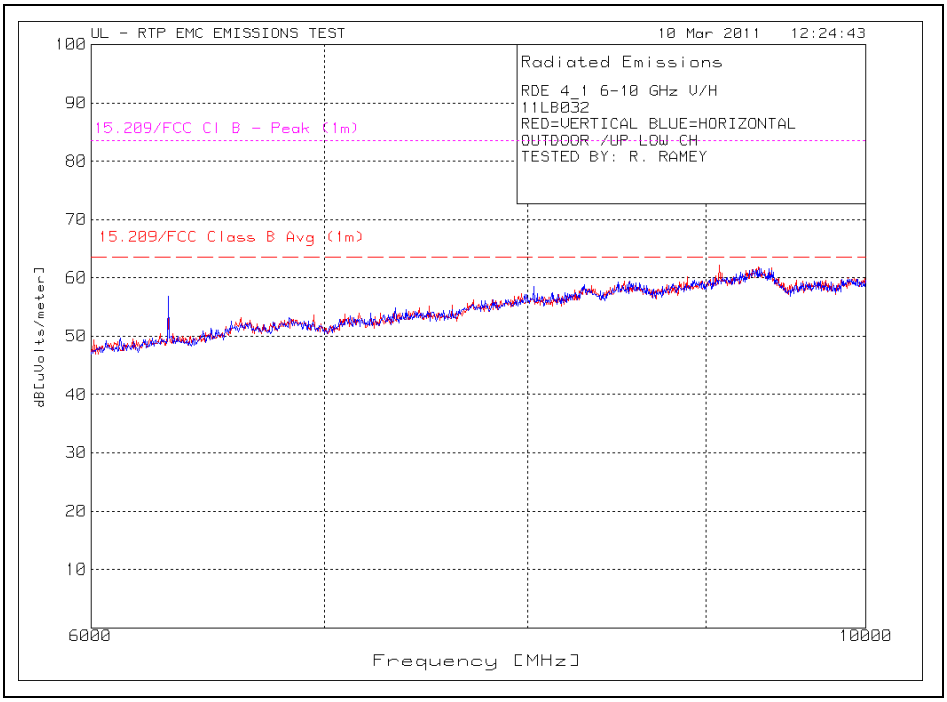


**Figure 13A Radiated Spurious Emissions, High Channel (Worst-case Orientation)**

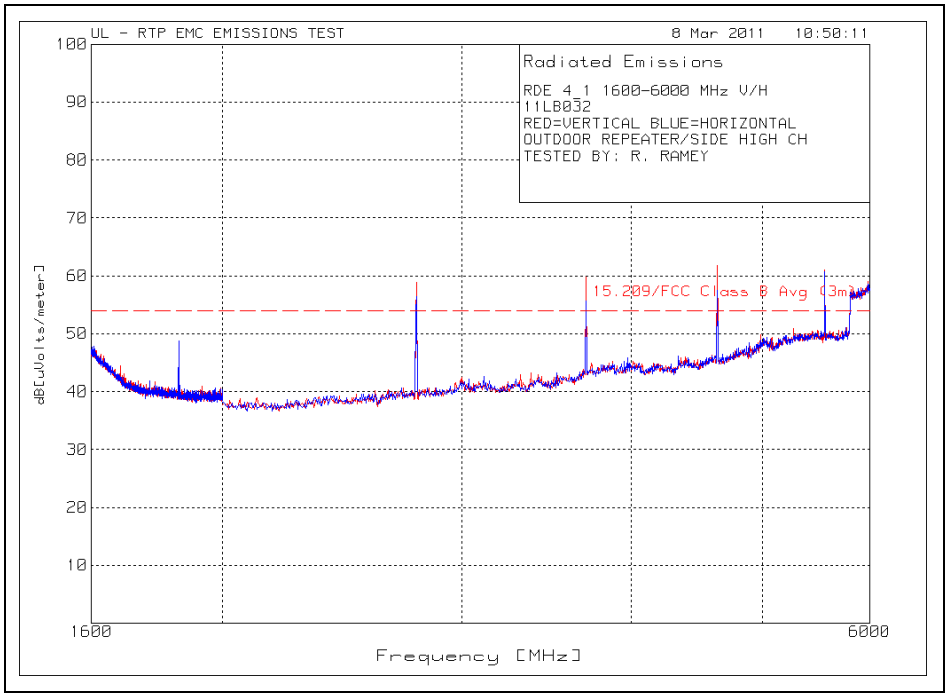
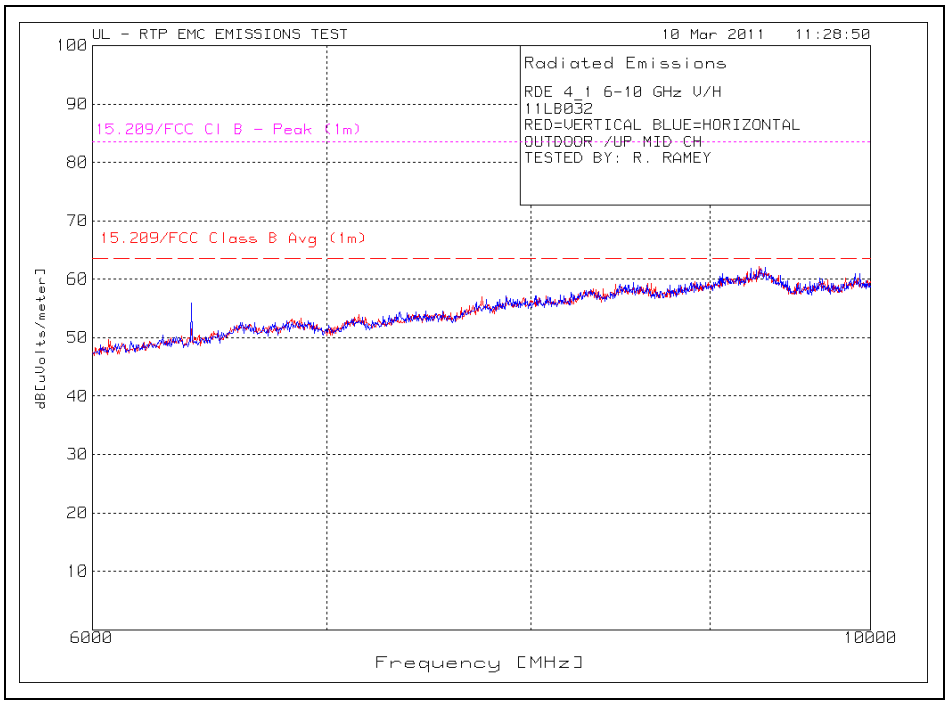



**Figure 13B Radiated Spurious Emissions, High Channel (Worst-Case Orientation)**



## 4.2 Test Conditions and Results – CONDUCTED SPURIOUS EMISSIONS

| | | |
|---|---|---|
| Test Description | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section15.205(c)). | |
| Basic Standard | 47 CFR Part 15.247(d), ANSI C63.4:2003<br>RSS-210, A8.5<br>RSS-Gen 7.2.1 and 7.2.3 | |
| | Frequency range | Measurement Point |
| Fully configured sample scanned over the following frequency range | 30 MHz – 9.3 GHz | Antenna port |
| **Limits (Antenna Conducted)** | | |
| All emissions must be 20dB below the level of the fundamental frequency, as peak method is used. | | |
| Supplementary information:<br>None. | | |

**Figure 5 CONDUCTED SPURIOUS EMISSIONS EUT Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| Supplementary information: None | | |

**Figure 6 CONDUCTED SPURIOUS EMISSIONS Test Equipment**

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| SAR003 | Spectrum Analyzer / Receiver | Hewlett-Packard | 8572 | 2011-2-2 | 2012-2-29 |
| - | Coaxial Cable | Pasternack | N-Male to SMA | N/A* | N/A |
| - | Attenuators (3x10dB) | - | N-Male to N-Female | N/A* | N/A |

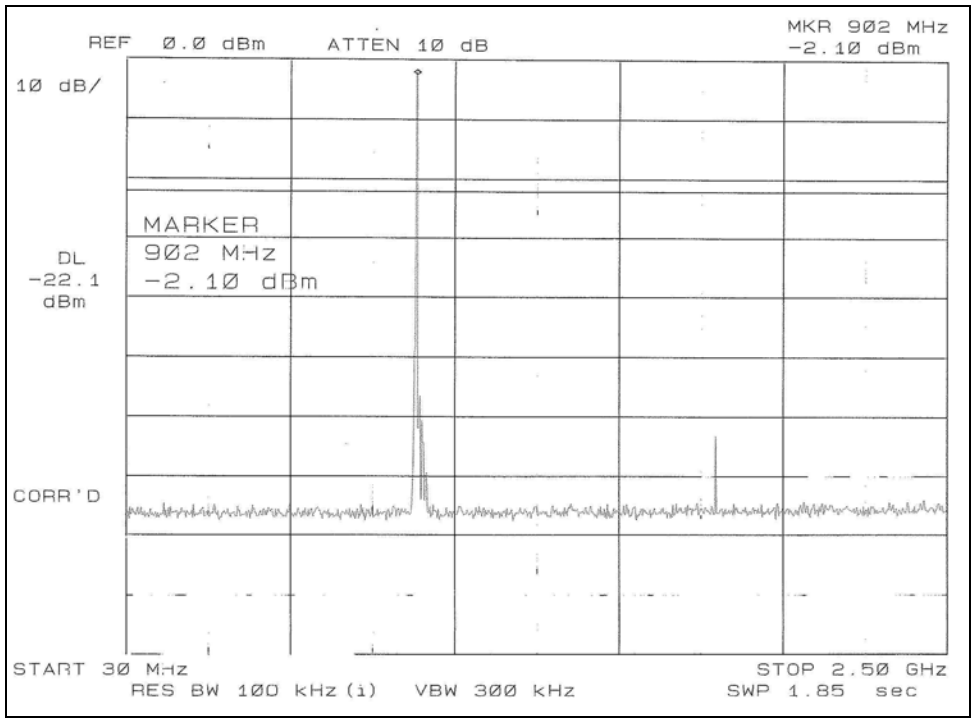
*Insertion loss verified prior to test

**Figure 7 Test Results Table – Conducted Spurious Emissions (Summary)**

| Transmit Channel (L/M/H) | Frequency (MHz) | Detect. Type (P/A/Q) | Receiver Reading (dBuV) | Cable Factor (dB) | Attenuator Factor (dB) | Adjusted Power (dBm) | -20 dBc Limit (dBuV/m) | Margin (dB) | Comments (#) |
|---|---|---|---|---|---|---|---|---|---|
| Low | 902.5 | P | -2.8 | 0.4 | 30 | 27.6 | - | - | Transmit Power |
| Low | 1805 | P | | 0.4 | 30 | | 7.6 | | Spurious (2nd harmonic) |
| Mid | 914.5 | P | -3.3 | 0.4 | 30 | 27.1 | - | - | Transmit Power |
| Mid | 1829 | P | | 0.4 | 30 | | 7.1 | | Spurious (2nd harmonic) |
| High | 927.5 | P | -2.5 | 0.4 | 30 | 27.9 | - | - | Transmit Power |
| High | 1855 | P | | 0.4 | 30 | | 7.9 | | Spurious (2nd harmonic) |

*Note: Only the 2nd harmonic was visible above the measurement noise floor. All other harmonics are more than 50 dB below the transmit power.

**Figure 8 Low-Channel 30 MHz – 10 GHz**



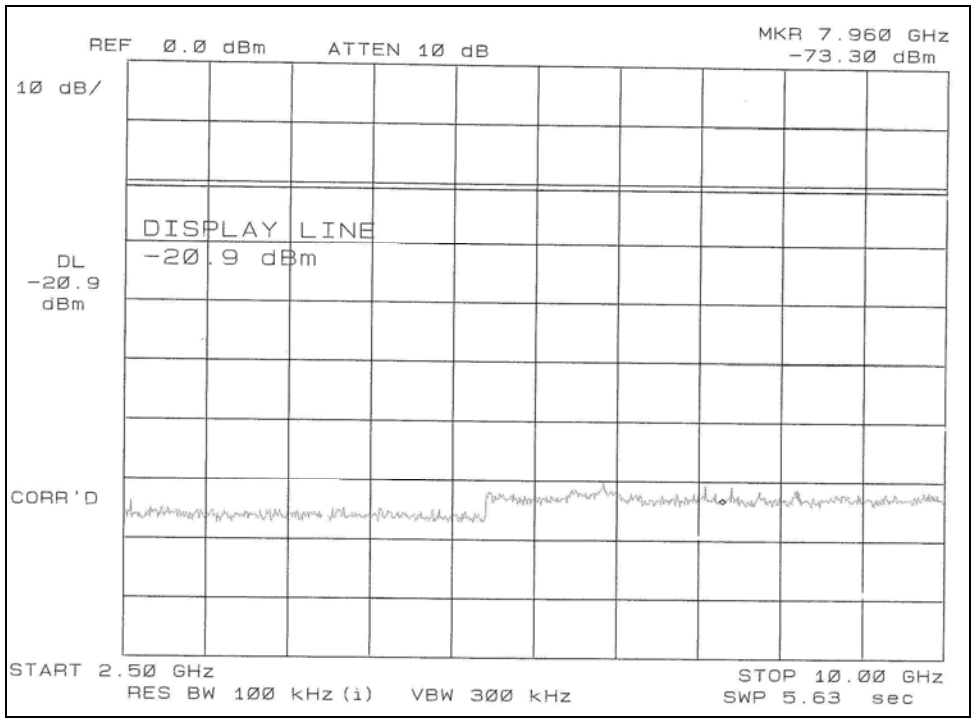
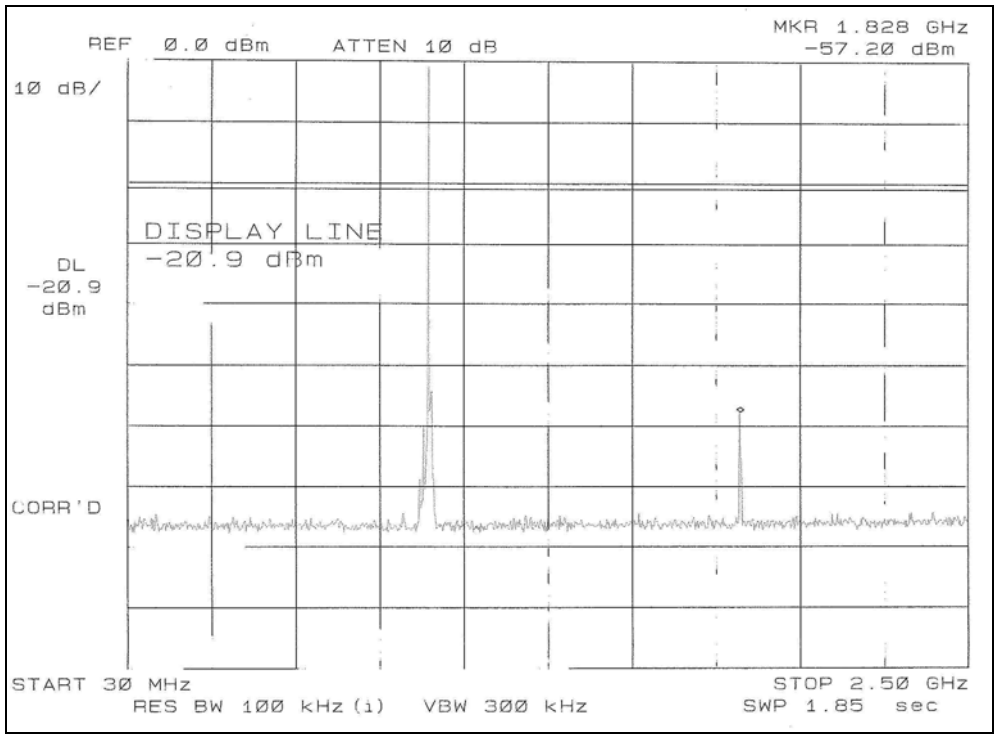



**Figure 9 Mid-Channel 30 MHz – 10 GHz**



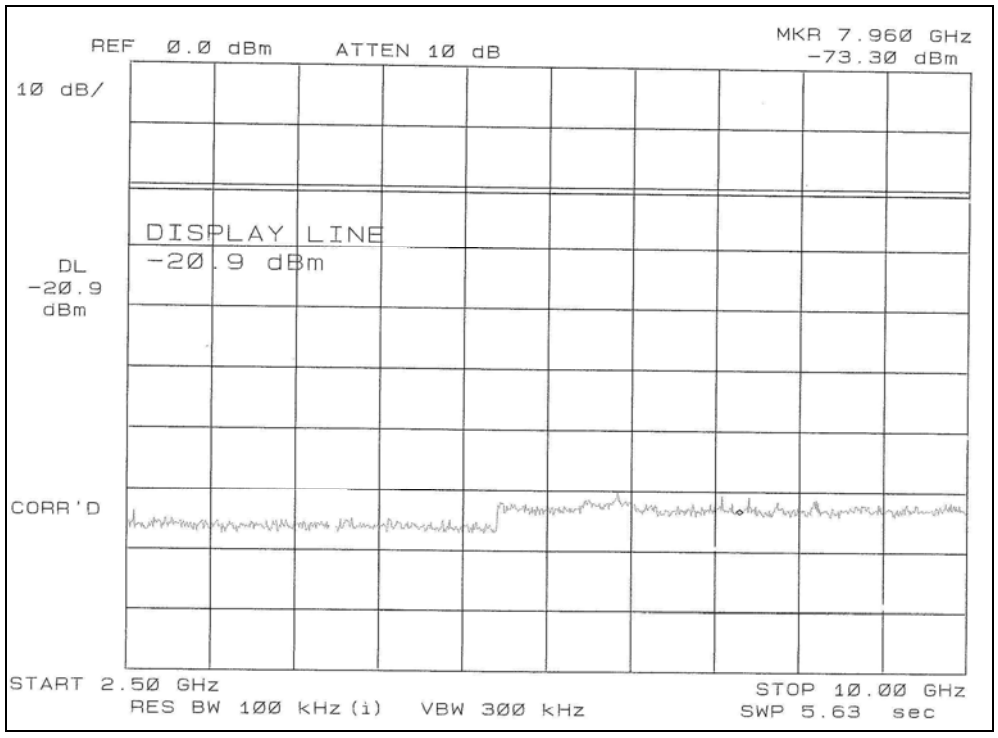
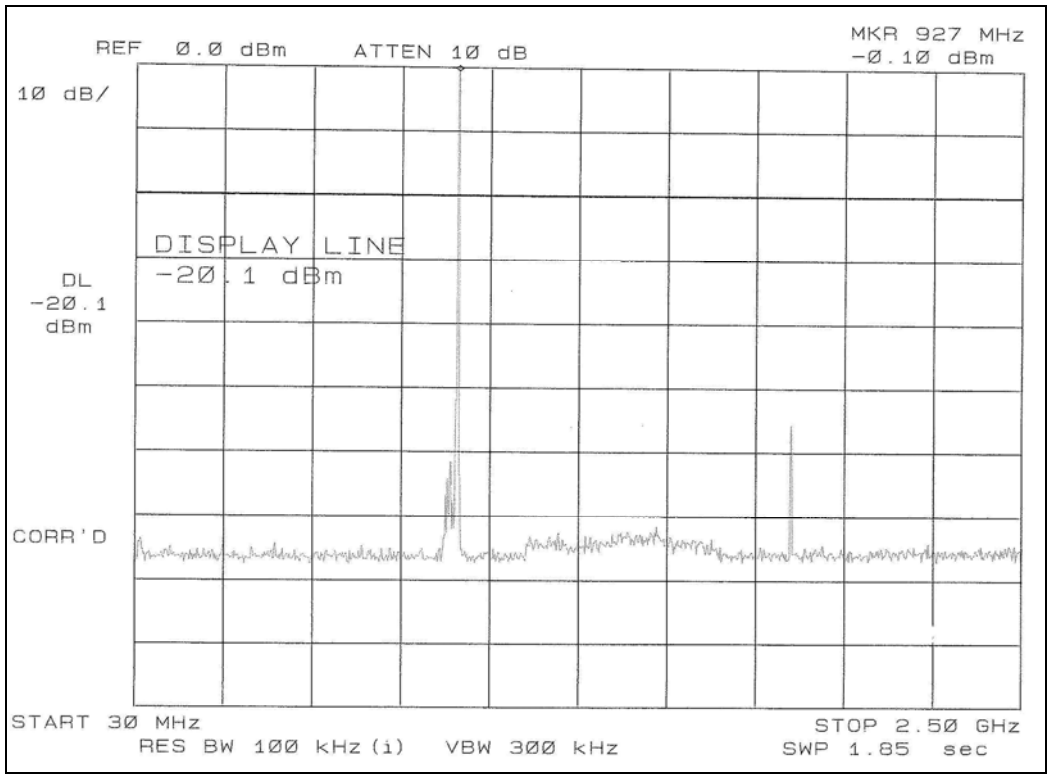
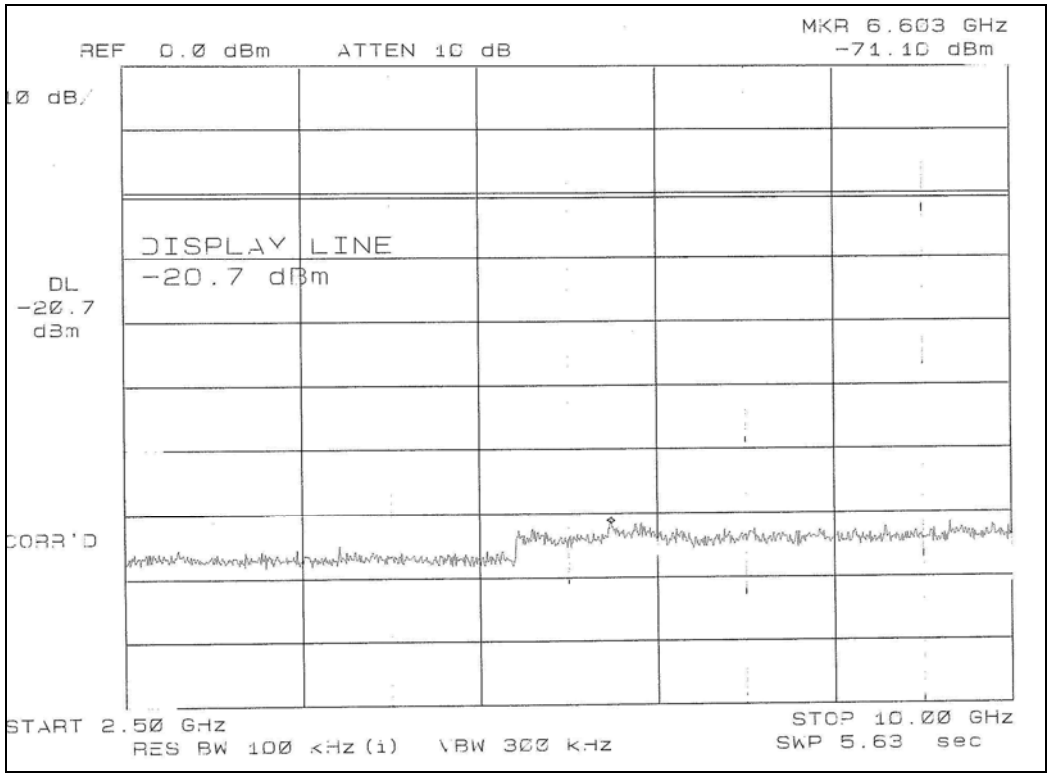



**Figure 10 High-Channel 30 MHz – 10 GHz**



## 4.3 Test Conditions and Results – BAND EDGE

| | |
|---|---|
| Test Description | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section15.205(c)). |

| Basic Standard | 47 CFR Part 15.247(d), ANSI C63.4:2003<br>RSS-210, A8.5 | |
|---|---|---|
| | Frequency range | Measurement Point |
| Fully configured sample scanned over the following frequency range | 902 MHz – 928 MHz | Antenna Conducted |

| **Limits** | |
|---|---|
| Measurement Type | |
| Conducted | Antenna Conducted – 20dB below the fundamental |
| Radiated | Radiated only required if emissions are in the restricted band |
| Supplementary information: Only antenna conducted is required. Peak power method is used. -20 dBc is shown to be within the 902-928 MHz band. | |

**Figure 11 Band Edge Compliance EUT Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| Supplementary information: None | | |

**Figure 12 Band Edge Compliance Test Equipment**

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| SAR003 | Spectrum Analyzer / Receiver | Hewlett-Packard | 8572 | 2011-2-2 | 2012-2-29 |
| - | Coaxial Cable | Pasternack | N-Male to SMA | N/A* | N/A |
| - | Attenuators (3x10dB) | - | N-Male to N-Female | N/A* | N/A |

*Insertion loss verified prior to test

**Figure 13 Band Edge Compliance Data Points (Summary)**

| Transmit Channel (L/M/H) | Channel Frequency (MHz) | Detect. Type (P/A/Q) | -20dBC Frequency (MHz) | Band Edge (MHz) | Inside Band? (Y/N) | Comments (#) |
|---|---|---|---|---|---|---|
| Low | 902.5 | P | 902.343 | 902.000 | Y | Lower Band Edge |
| High | 927.5 | P | 927.614 | 928.000 | Y | Upper Band Edge |

**Figure 14 Conducted Band Edge Compliance Graph – Low Channel**

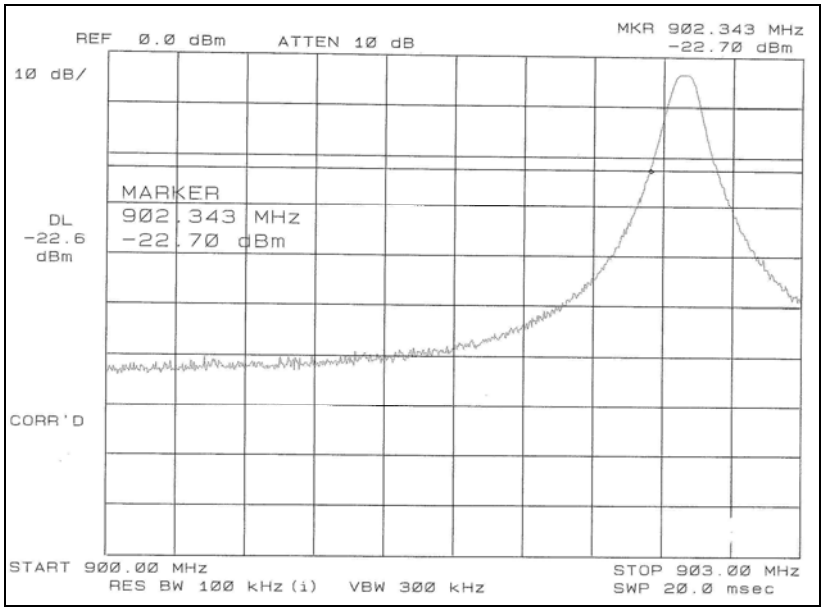
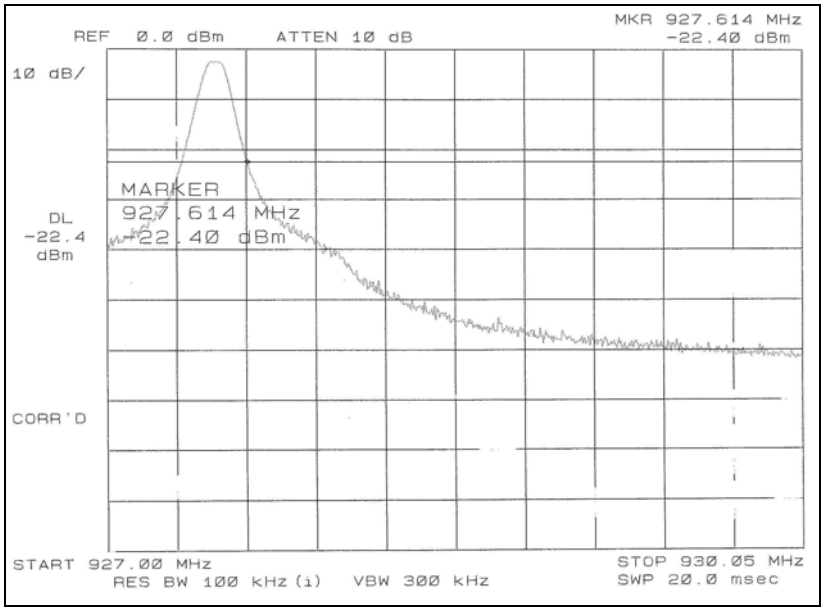



**Figure 15 Conducted Band Edge Compliance Graph – High Channel**



## 4.4 Test Conditions and Results – FREQUENCY HOPPING

| | | |
|---|---|---|
| Test Description | Number of Channels, Dwell on each channel, and pseudo-random hopping sequence is shown. | |
| Basic Standard | 47 CFR Part 15.247<br>RSS-210, A8.1 | |
| | Frequency range | Measurement Point |
| Fully configured sample scanned over the following frequency range | 902 MHz – 928 MHz | Antenna Conducted |

| **Limits** | |
|---|---|
| Measurement Type | Requirements |
| Minimum Number of Channels | 50 |
| Channel Spacing | 250 kHz |
| Hopping Method | Pseudo-random sequence |
| Supplementary information: None | |

**Figure 16 Spectral Density Compliance EUT Configuration Settings**

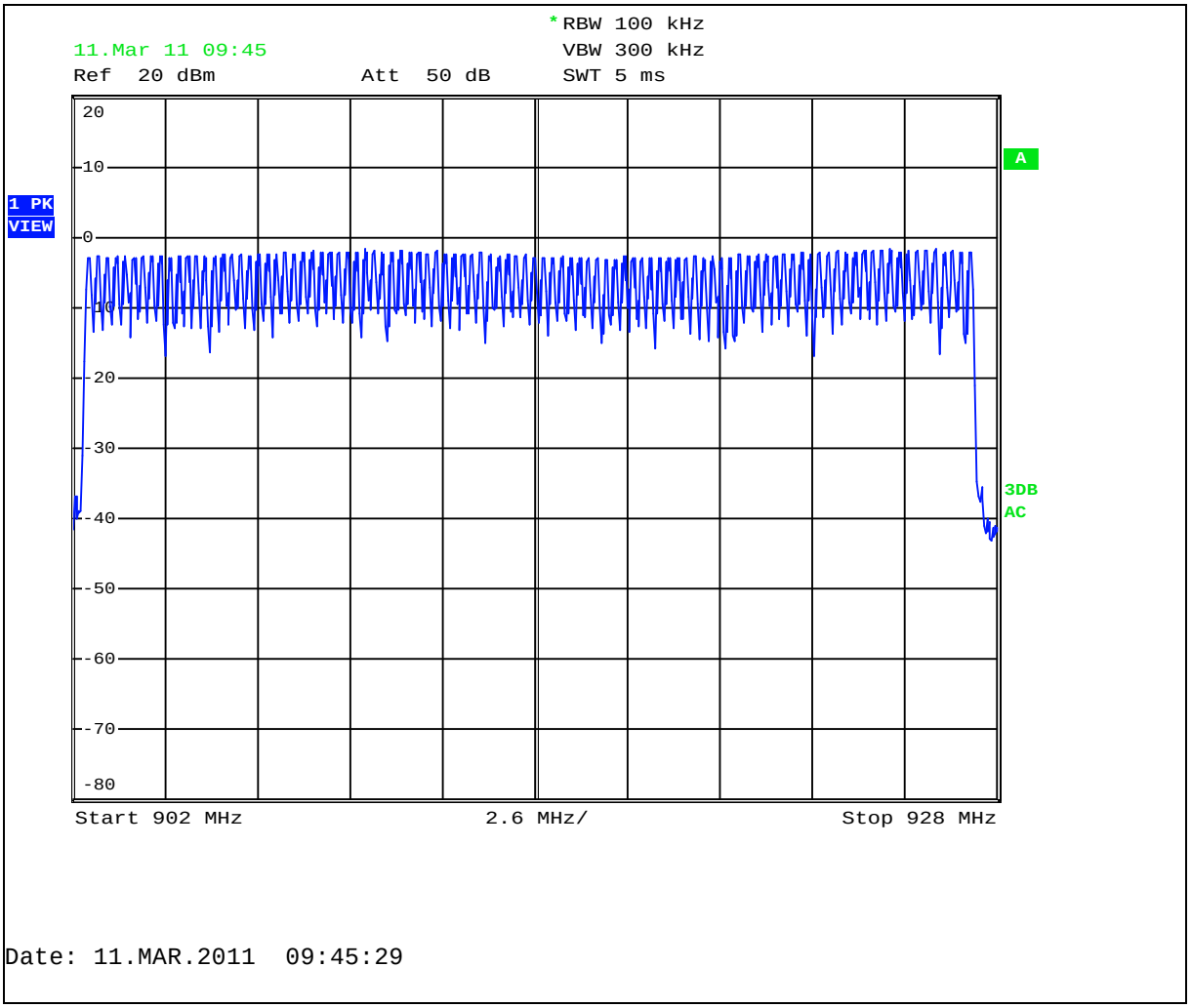
| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| Supplementary information: None | | |

**Figure 17 Frequency Hopping Compliance Test Equipment**

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| SA0015 | Spectrum Analyzer / Receiver | Rohde & Schwarz | ESCI7 | 2011-1-25 | 2012-1-31 |
| - | Coaxial Cable | Pasternack | N-Male to SMA | N/A* | N/A |
| - | Attenuators (3x10dB) | - | N-Male to N-Female | N/A* | N/A |

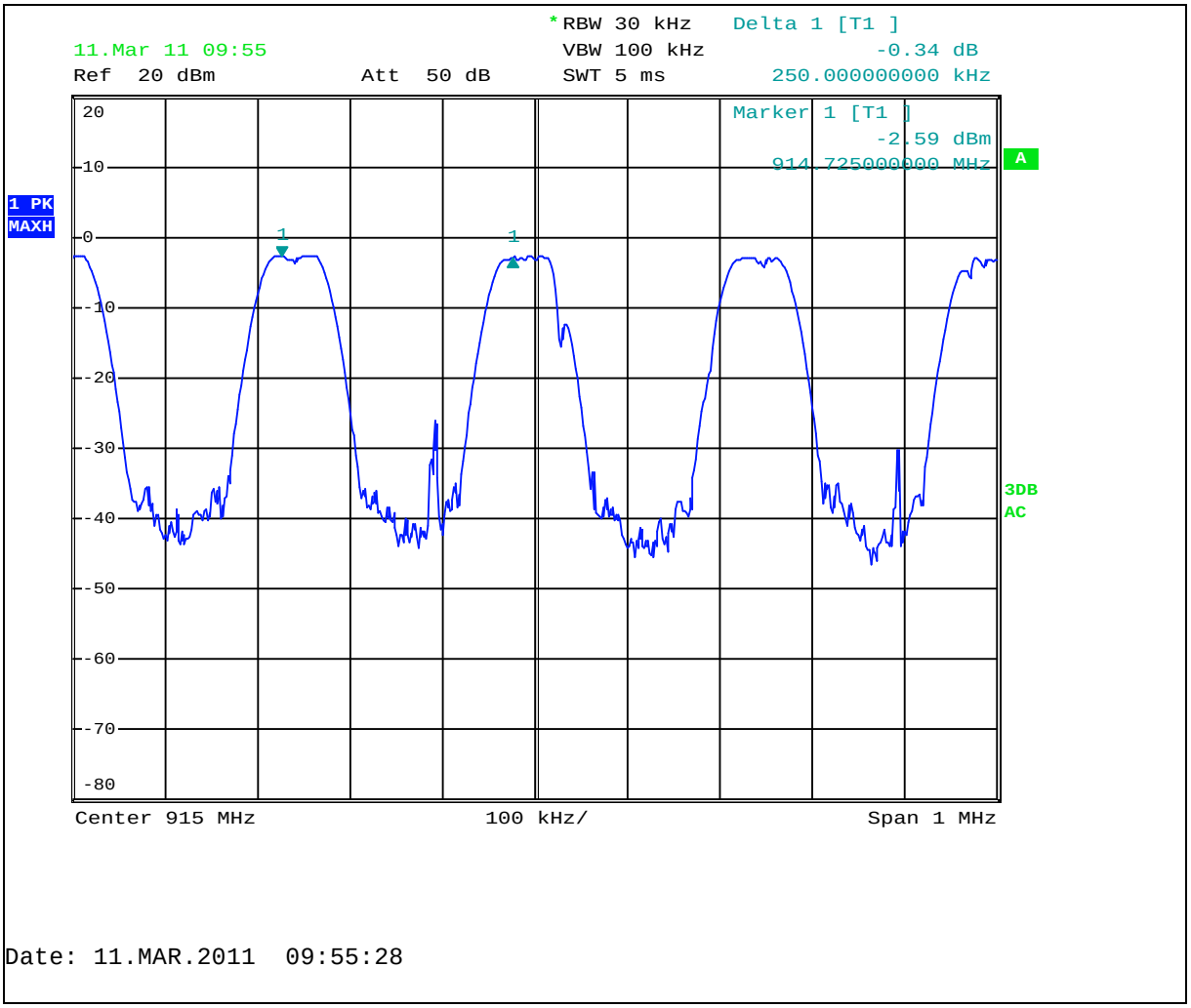
*Insertion loss verified prior to test

**Figure 18 Number of Channels**




A total of 101 channels are shown.

**Figure 19 Channel Spacing**



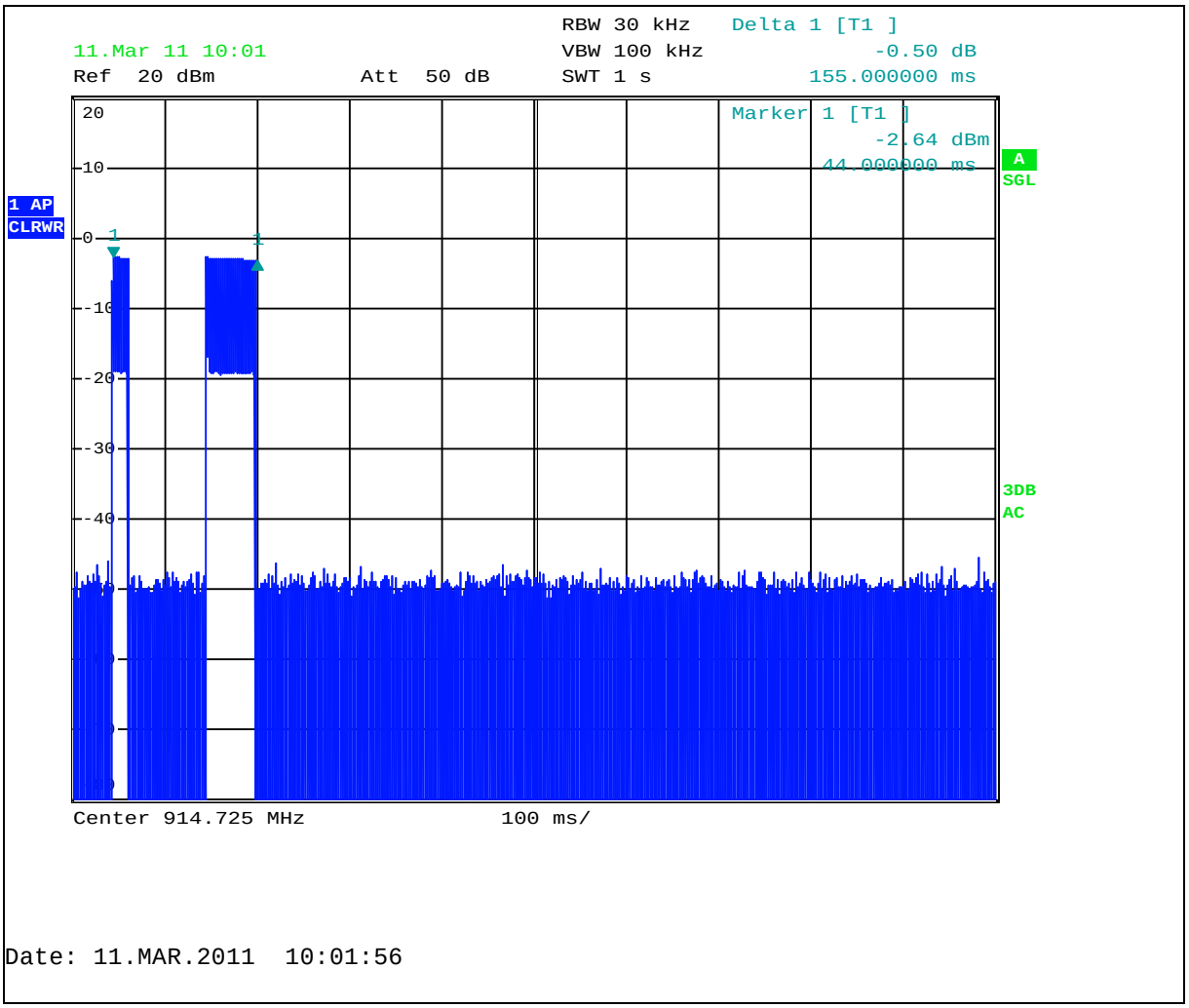

Channel Spacing is shown to be 250 kHz.

**Figure 20 Pseudo-random Sequence (from Manufacturer's Literature)**

Broadcast: 903, 911.25, 920.75, 925, 921.25, 922.5, 904.25, 904, 923, 910.25, 912.25, 922.25, 921.5, 904.5, 913.5, 922, 914.5, 914.75, 908.5, 903.5, 917.5, 919, 908.75, 920, 925.5, 924.5, 926.25, 905.5, 903.25, 909.75, 918.75, 926.75, 906.5, 924, 918.5, 907.25, 906.25, 902.75, 914.25, 923.5, 924.25, 908, 911.75, 915.75, 926, 927.25, 919.5, 919.25, 924.75, 917.75

Backbone: 912, 922.75, 910.5, 904.75, 912.5, 915.5, 917.25, 906, 912.75, 907.5, 923.25, 921.75, 906.75, 905, 911.5, 907, 913, 914, 905.75, 927, 926.5, 920.25, 917, 916.25, 909.25, 902.5, 925.75, 911, 903.75, 916, 905.25, 916.75, 918.25, 913.25, 921, 913.75, 915, 925.25, 918, 908.25, 916.5, 910.75, 920.5, 910, 909.5, 919.75, 915.25, 907.75, 923.75, 909

**Figure 21 Dwell time per channel**




Dwell time on each channel is shown to be 155 ms.

## 4.5 Test Conditions and Results – PEAK OUTPUT POWER

| | | |
|---|---|---|
| Test Description | For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section. | |
| Basic Standard | 47 CFR Part 15.247(b)(2), ANSI C63.4:2003<br>RSS-210, A8.4(1) | |
| | Frequency range | Measurement Point |
| Fully configured sample scanned over the following frequency range | 902MHz – 928MHz | Antenna Conducted |

| **Limits** | |
|---|---|
| Frequency (MHz) | Limit mW |
| | Peak |
| 902 - 928 | 1000 (30dBm) |

Supplementary information:

(1) Conducted Power measurement was performed on the hub device. The transmitter section of all devices within this family are identical, therefore these measurements are representative of the entire family.

(2) Resolution Bandwidth is set to 1 MHz, Video Bandwidth is set to 3 MHz. Both setting are larger than occupied BW,

(3) Transmitter is set to transmit continuously on the channel shown with normal modulation. See section 1.6 for modulation description during test.

**Figure 22 Spectral Density Compliance EUT Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| Supplementary information: None | | |

**Figure 23 Maximum Peak Output Power Test Equipment**

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| SAR003 | Spectrum Analyzer / Receiver | Hewlett-Packard | 8572A | 2011-2-2 | 2012-2-29 |
| - | Coaxial Cable | Pasternack | N-Male to SMA | N/A* | N/A |
| - | Attenuators (3x10dB) | - | N-Male to N-Female | N/A* | N/A |

*Insertion Loss verified prior to test

**Figure 24 Maximum Peak Output Power Graph – Low Channel**

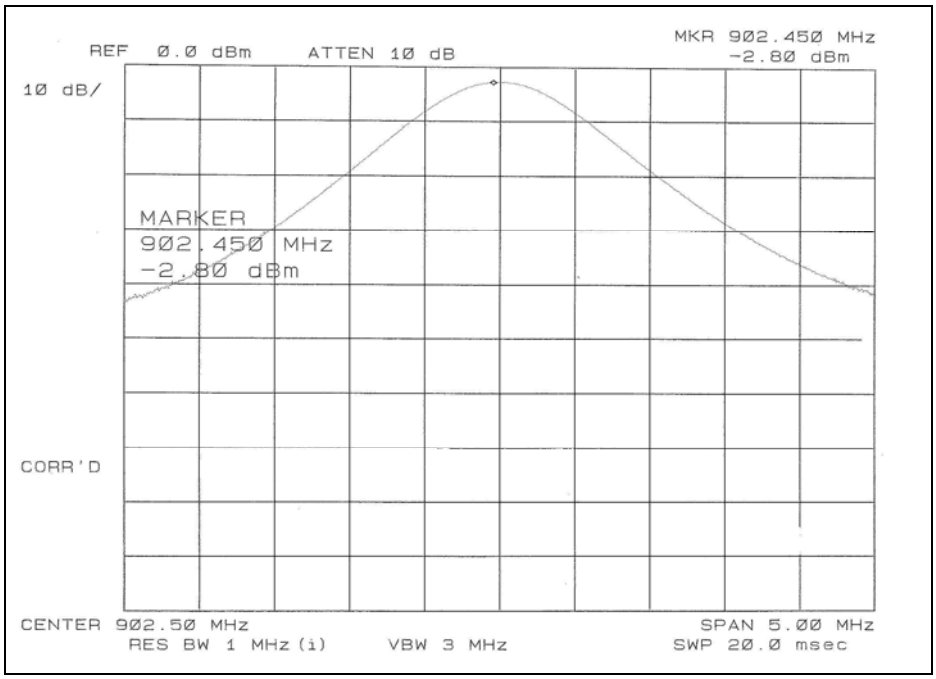



**Figure 25 Maximum Peak Output Power Graph – Middle Channel**

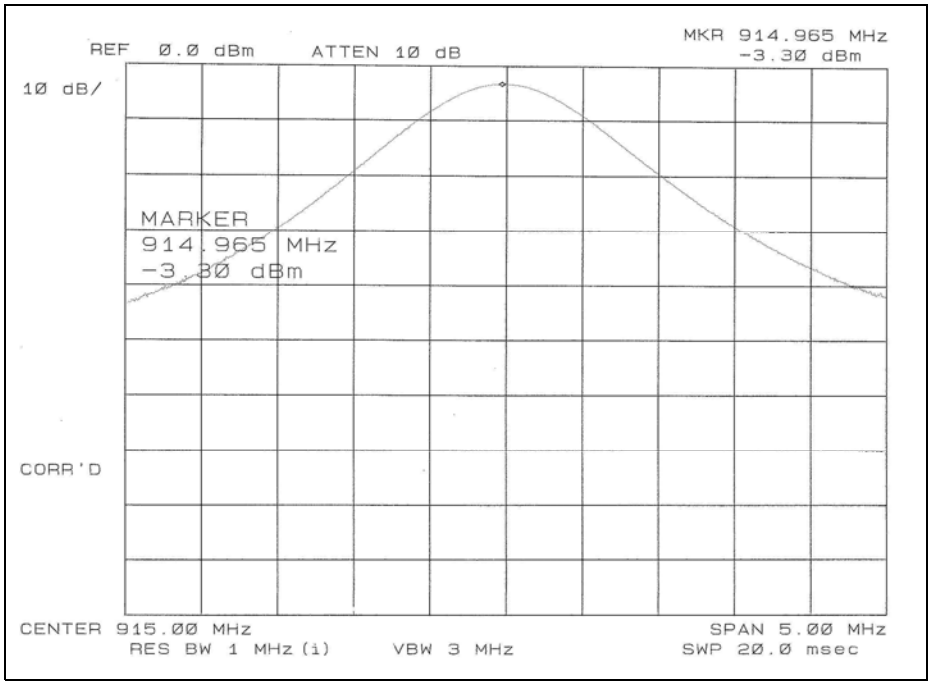


**Figure 26 Maximum Peak Output Power Graph – High Channel**

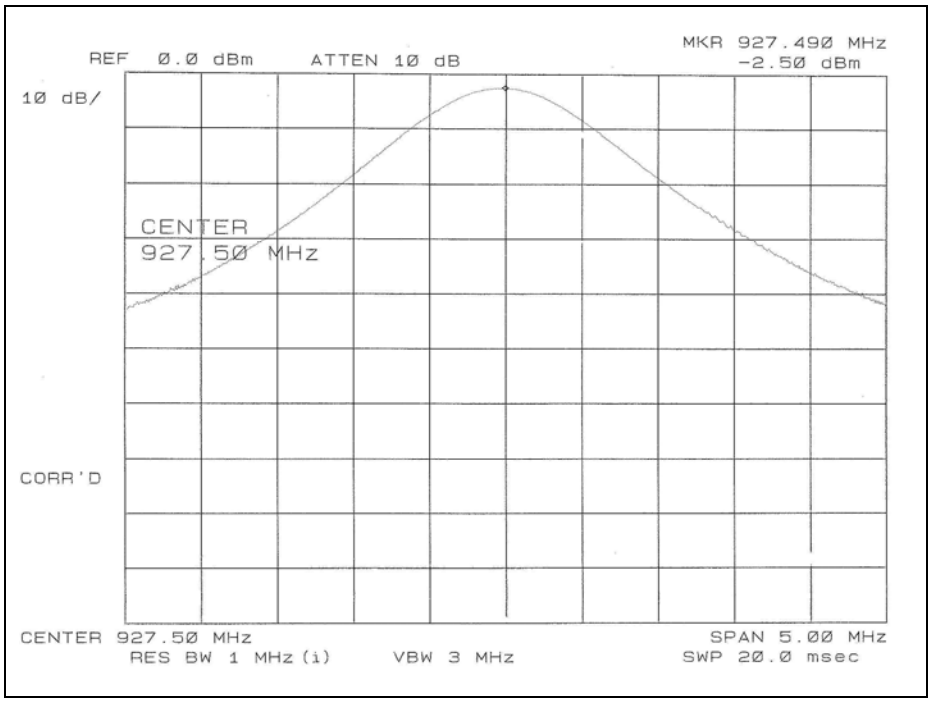



**Figure 27 Maximum Peak Output Power Results**

| Channel | Measured (dBm) | Attenuator Loss (dB) | Cable Loss (dB) | Peak Power (dBm) | Power Limit (dBm) | Comments |
|---|---|---|---|---|---|---|
| Low Channel | -2.8 | 30.0 | 0.4 | 27.6 | 30.0 | 575 mW |
| Middle Channel | -3.3 | 30.0 | 0.4 | 27.1 | 30.0 | 513 mW |
| High Channel | -2.5 | 30.0 | 0.4 | 27.9 | 30.0 | 617 mW |

### 4.6 Test Conditions and Results – OCCUPIED BANDWIDTH

| | |
|---|---|
| Test Description | Measurement is performed by the following method. Frequency span is set to include entire emission. Left and Right 20dB points are marked and recorded. For 99% Power measurement the receiver 99% power function is used. |
| Basic Standard | 47 CFR Part 15.247(a)(1)(i), ANSI C63.4:2003<br>RSS-210, A8.1(c) |

| Span (MHz) | Measurement Objective | Resolution Bandwidth (MHz) |
|---|---|---|
| 200 kHz | -20 dBc BW | 10kHz RBW, 30kHz VBW<br>(ANSI C63.4:2003) |
| | 99% Power | 3kHz RBW, 10kHz VBW<br>(1% to 3% of Span) |
| Supplementary information: None | | |

**Figure 28 Occupied Bandwidth Configuration Settings**

| Power Interface Mode # | EUT Configurations Mode # | EUT Operation Mode # |
|---|---|---|
| 1 | 1 | 1 |
| Supplementary information: Note 99% OBW measurement is not required. Canadian certification is not requested at this time. | | |

**Figure 29 Occupied Bandwidth Test Equipment**

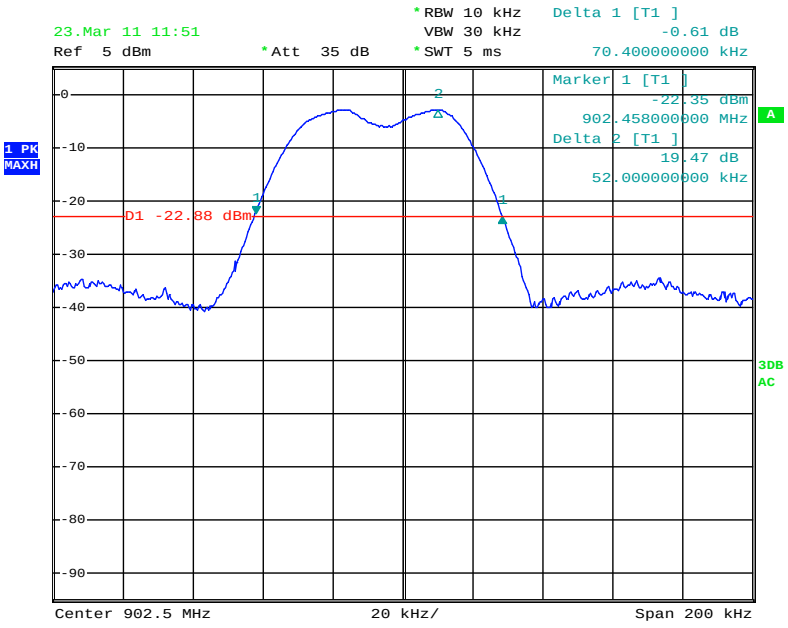
| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| SA0015 | Spectrum Analyzer / Receiver | Rohde & Schwarz | ESCI7 | 2011-1-25 | 2012-1-31 |
| - | Coaxial Cable | Pasternack | N-Male to SMA | N/A* | N/A |
| - | Attenuators (3x10dB) | - | N-Male to N-Female | N/A* | N/A |

*Insertion loss verified prior to test

**Figure 30 Occupied Bandwidth Results**

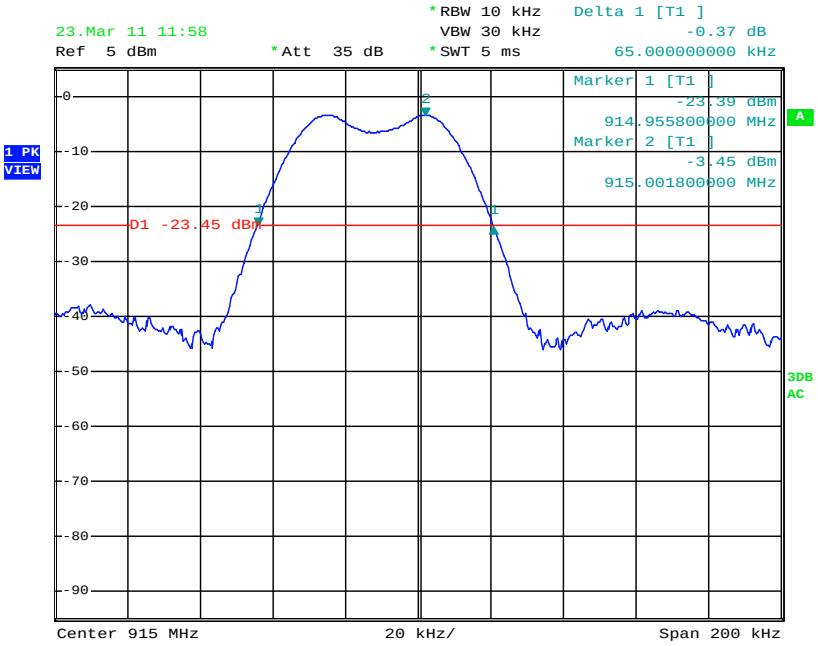
| Mode | -20dBc Occupied Bandwidth Measured | -99% Occupied Bandwidth Limit | Comments |
|---|---|---|---|
| Low Channel | 70.4 | 48.84 | |
| Middle Channel | 65.0 | 49.60 | |
| High Channel | 64.8 | 47.80 | |

**20dB Bandwidth – Low Channel**



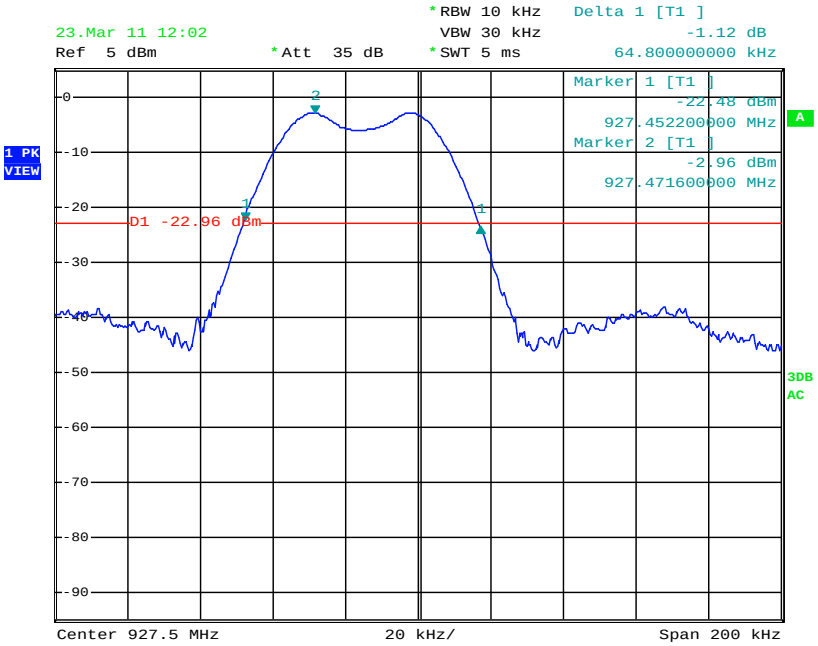

Date: 23.MAR.2011 11:51:14

## 20 dB Bandwidth – Mid Channel



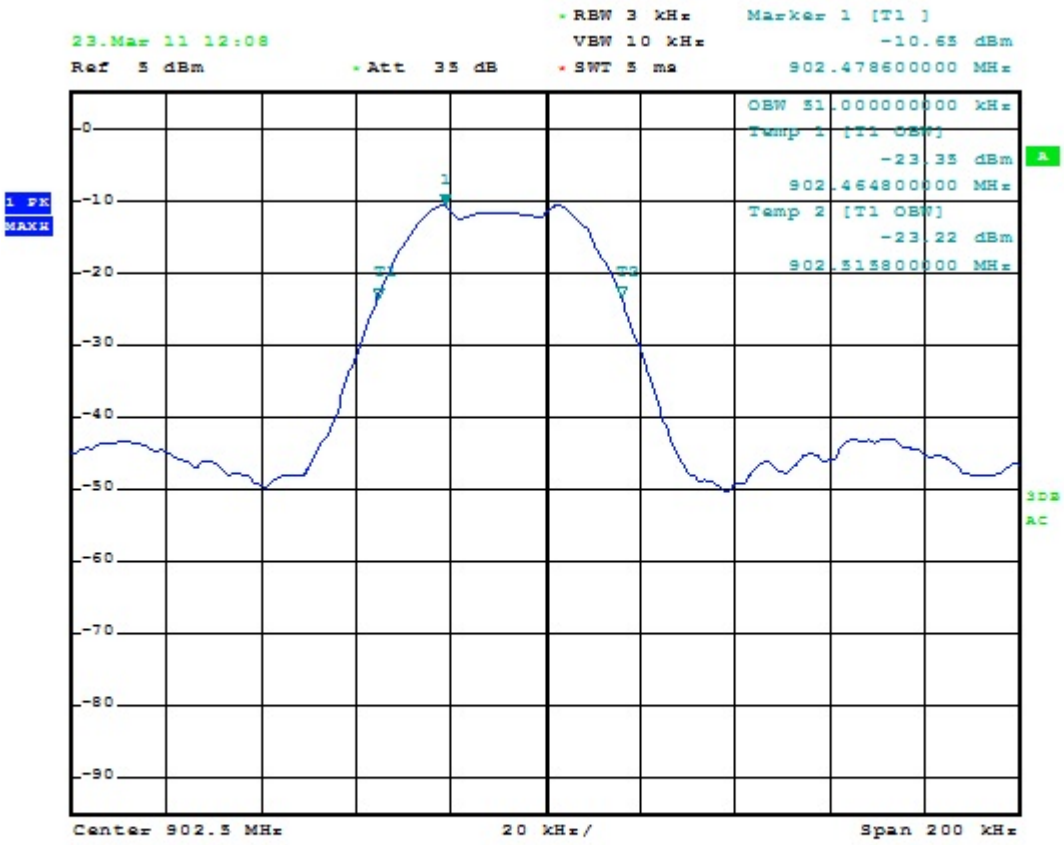

Date: 23.MAR.2011 11:58:51

## 20 dB Bandwidth – High Channel



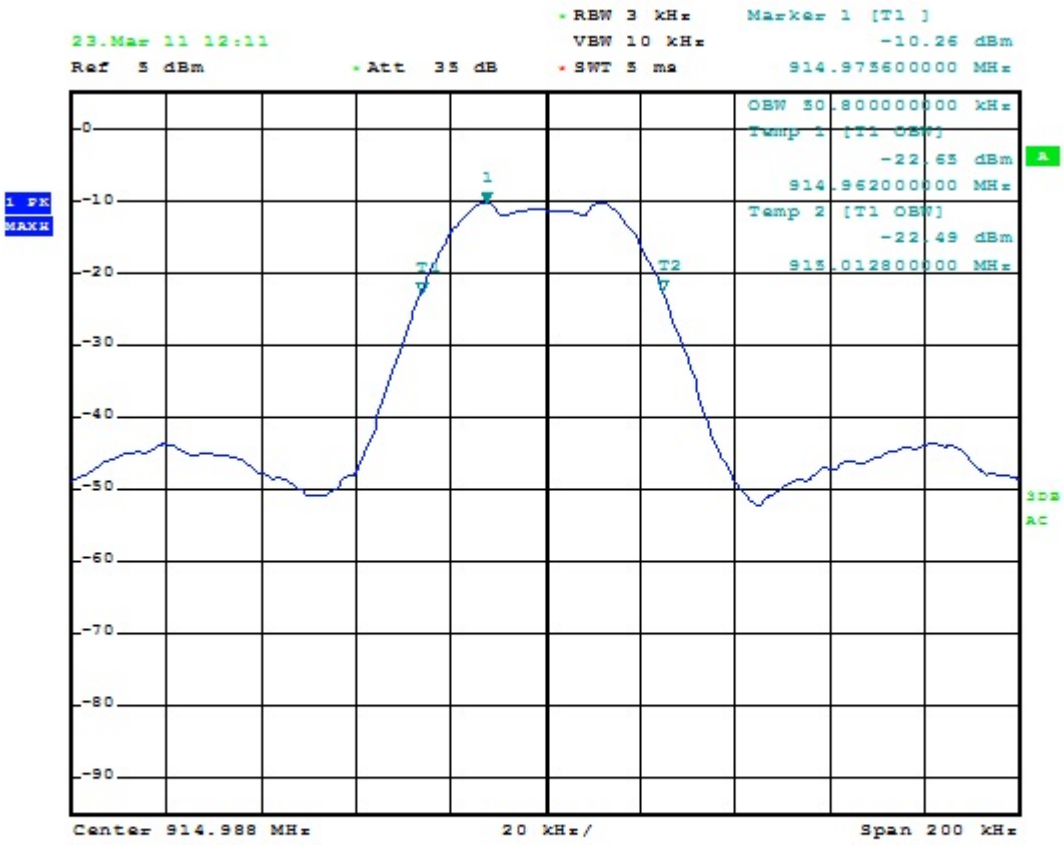

Date: 23.MAR.2011 12:02:05

**99% Power Bandwidth – Low Channel**



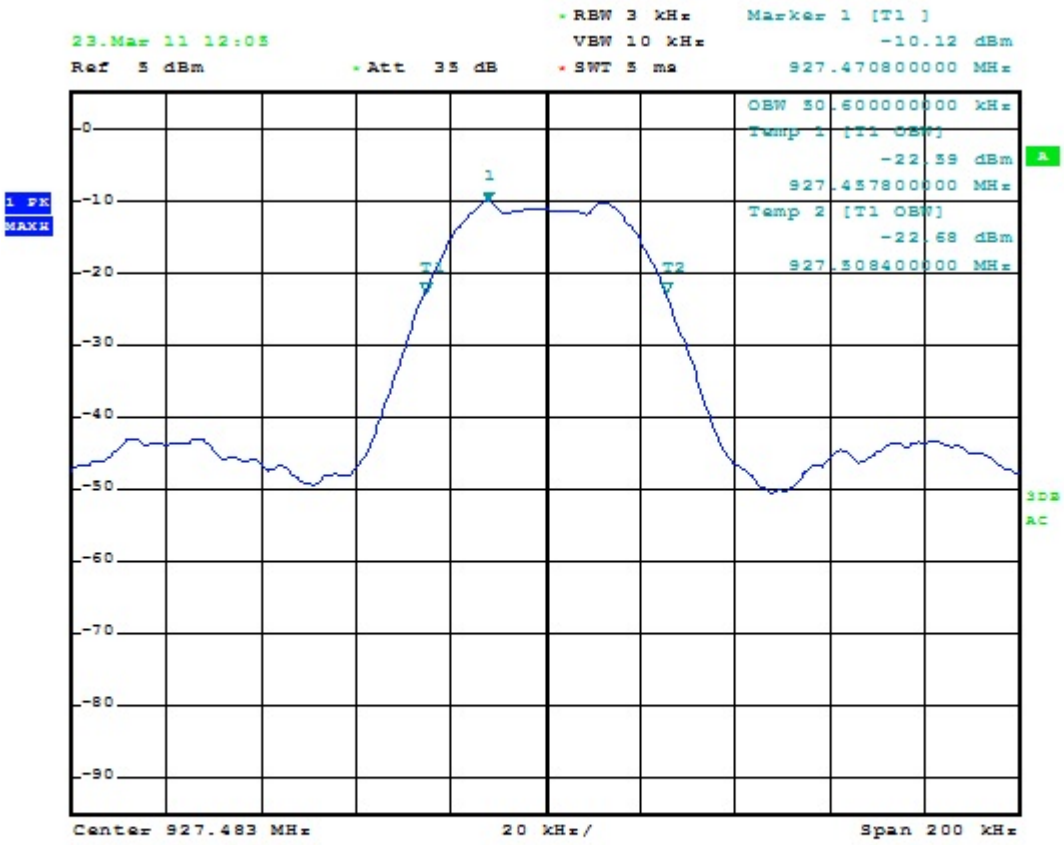

Date: 23.MAR.2011 12:08:26

**99% Power Bandwidth – Mid Channel**




Date: 23.MAR.2011 12:11:25

**99% Power Bandwidth – High Channel**




Date: 23.MAR.2011 12:05:45

## 4.7 Test Conditions and Results – DUTY CYCLE

| | |
|---|---|
| Test Description | Duty Cycle is measured to determine Duty Cycle Correction Factor, if applicable, to apply to average measurements. Note that only 100 ms of cycle may be considered for this measurement. |
| Basic Standard | Not Applicable. |

**Figure 31 Duty Cycle Correction Factor (100 ms)**

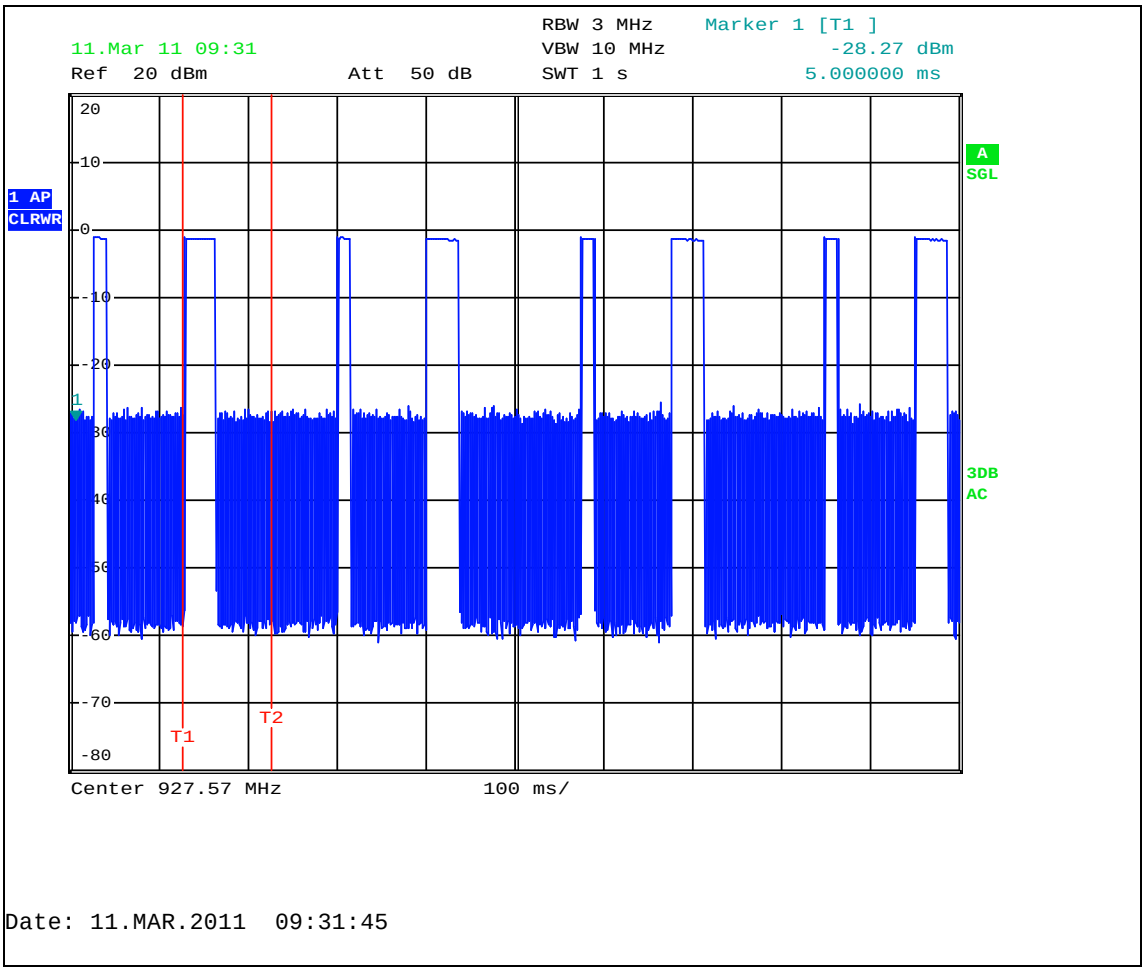
| Mode | Number of TX in 100mS | TX Duration in 100mS | Duty Cycle Correction (dB) $20 \times \log(\frac{TX\,(ms)}{100\,ms})$ |
|---|---|---|---|
| Hopping turned off, Normal duty cycle on | 1 | 38 (longest transmission) | – 8.4 dB |

**Figure 32 Duty Cycle Test Equipment**

| Equipment ID | Description | Manufacturer | Model Number | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| SA0015 | Spectrum Analyzer / Receiver | Rohde & Schwarz | ESCI7 | 2011-1-25 | 2012-1-31 |
| - | Coaxial Cable | Pasternack | N-Male to SMA | N/A* | N/A |
| - | Attenuators (3x10dB) | - | N-Male to N-Female | N/A* | N/A |

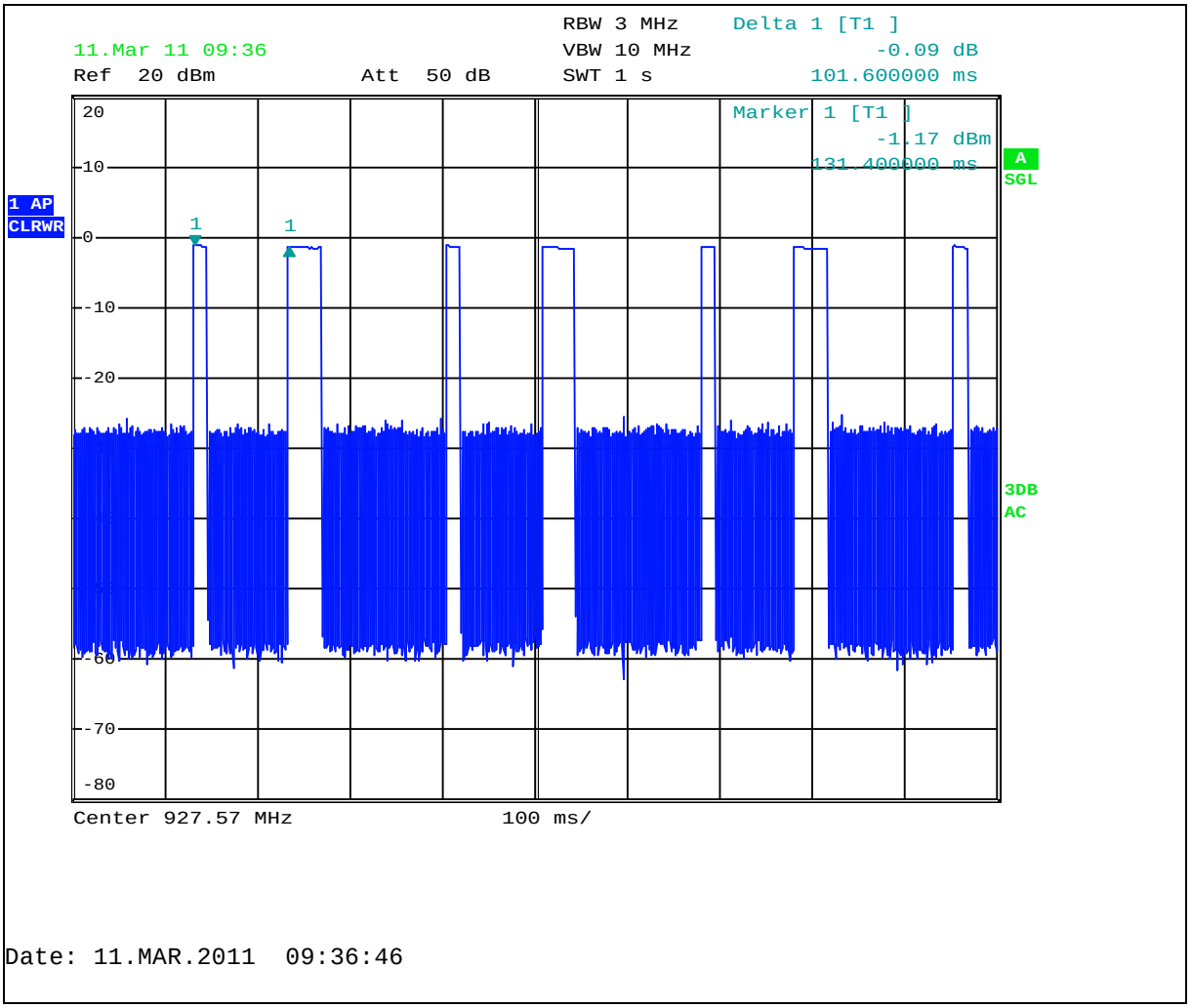
*Insertion loss verified prior to test

**Figure 33 Dwell Time Graph – 1 second sweep**



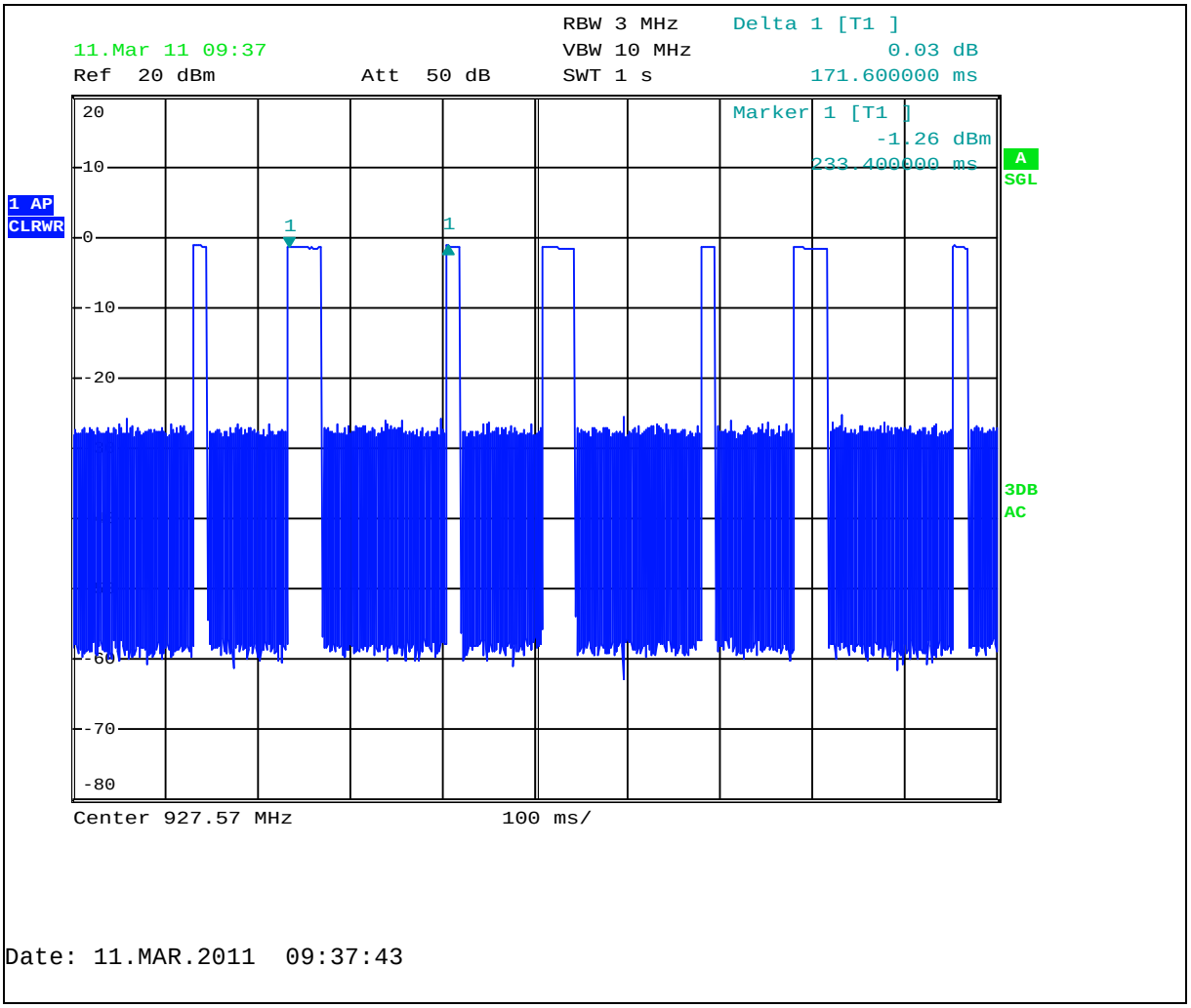

Note: A 1-second sweep shows the repeating pattern of long and short transmissions. As shown in the following measurements, there is not more than one transmission in each 100 ms window.

**Figure 34 Dwell Time Graph – Short Transmission Cycle**



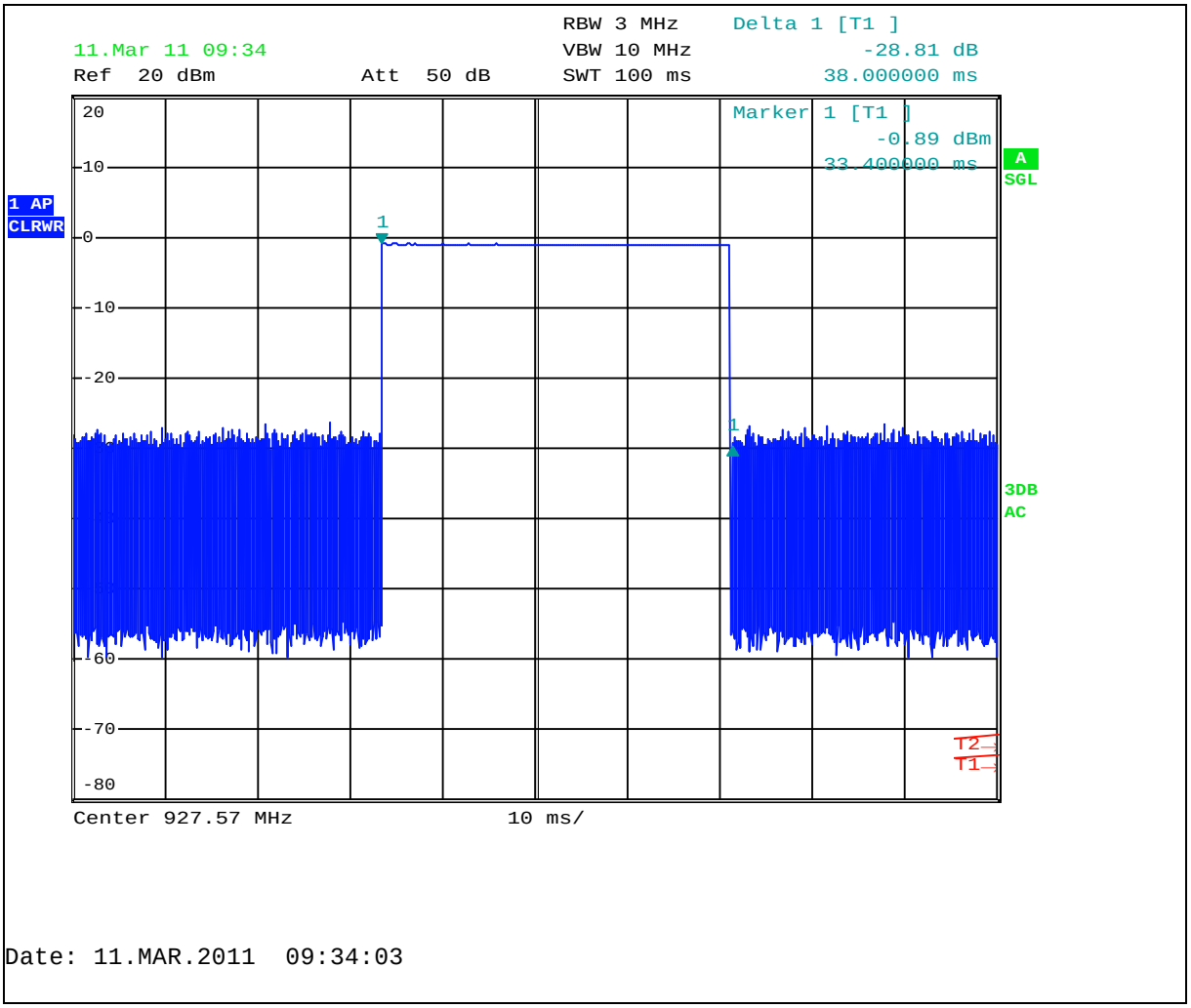

Measurement of start of short transmission plug off duration. This cycle is 101.6ms. It is shown that only one transmission exists within this 100 ms period.

**Figure 35 Dwell Time Graph – Long Transmission Cycle**




Measurement of start of long transmission plus off duration. This cycle is 171.6 ms. It is shown that only one transmission exists within this 100 ms period.

**Figure 36 Dwell Time Graph – 100 ms sweep to measure long pulse**




Duration of long pulse is 38 ms.

## 4.8 Test Conditions and Results – MAXIMUM PERMISSIBLE EXPOSURE

| Test Description | Maximum Permissible Exposure calculation is performed to ensure that this device meets RF exposure limits for its intended environment. This device is required to meet the General Population/Uncontrolled exposure limits. | | | |
|---|---|---|---|---|
| Basic Standard | 47 CFR Part 1.1307<br>Industry Canada IC Safety Code 6 | | | |
| FCC Limits for Occupational/Controlled Exposure | | | | |
| Frequency Range (MHZ) | Electric Field Strength (E) (V/M) | Magnetic Field Strength (H) (A/M) | Power Density (S) ($MW/CM^2$) | Averaging Time $\|E^2\|$, $\|H^2\|$. or S (MINUTES) |
| 0.3 – 3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0 - 30 | 1824/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 | - | - | 5.0 | 6 |
| FCC Limits for General Population/Uncontrolled Exposure | | | | |
| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) ($mw/cm^2$) | Averaging Time $\|E^2\|$, $\|H^2\|$. or S (minutes) |
| 0.3 - 1.34 | 614 | 1.63 | (100)* | 30 |
| 1.34 - 30 | 824/F | 2.19/F | ($180/F^2$)* | 30 |
| 30 - 300 | 27.5 | 0.073 | 0.2 | 30 |
| 300 – 1500 | - | - | F/1500 | 30 |
| 1500 – 100,000 | - | - | 1.0 | 30 |

**Figure 37 MPE - EUT Configuration Settings**

Calculation is performed from conducted power and antenna gain measurements documented within this report.

**Background:** Per the following guidance from OET Bulletin 65 Supplement C required minimum spacings are provided to the professional installer.

| Transmitter or Device Type[18] | Output[19] | Applicable Methods to Ensure Compliance[20] |
|---|---|---|
| Transmitters using indoor antennas that operate at 20 cm or more from nearby persons | >2.5 W at 915 MHz | If the MPE distance is greater than that required for normal operation of the device, operating instructions, warning instructions and/or warning labels may be used to ensure compliance by indicating the minimal separation distance to comply with MPE limits.<br>If the antennas are professionally installed to ensure compliance, warning instructions and warning labels are not necessary. |
| | =< 2.5 W at 915 MHz or =< 4 W at 2450 MHz | Transmitters operating at 2.5 W EIRP (1.5 W ERP) or less at 915 MHz, or at 4 W EIRP (2.4 W ERP) or less at 2450 MHz, generally are not expected to exceed MPE limits when nearby persons are 20 cm or more from most antennas. Therefore, special instructions and warnings are normally not necessary to ensure compliance. |

**Figure 38 Duty Cycle Correction Factor (100 ms)**

| Mode | ON Duration (ms) | Total Duration (ms) | Duty Cycle Correction (dB) $20 \times \log(\frac{TX\,(ms)}{100\,ms})$ | Comments |
|---|---|---|---|---|
| Short Pulse | 14 | 101.4 | | |
| Long Transmission | 38 | 171.6 | | |
| Total | 52 | 273.0 | -14.4 dB | 52ms / 273ms = 19.0% |

**Figure 39 MPE - Calculation**

**MPE Calculation with highest EIRP:**

The highest conducted power was observed to be 617 mW and this measurement is used for the calculation. Limit is calculated at low channel (902.5 MHz) as exposure limit increases slightly with frequency in the operating band. Duty cycle is 14.4%.

$S = EIRP / (4 * Pi * R^2)$,

| |
|---|
| Power Density = EIRP / (4 * Pi * $R^2$), |
| where EIRP = Output Power * Antenna Gain |

**Uncontrolled/General Exposure**
**0.617 Watt, 0.00 dBi antenna (Unity Gain), 20 cm spacing**

| | | | |
|---|---|---|---|
| Operating Frequency | 902.5 MHz | | |
| Output Power (Peak) | **0.617** Watts | | |
| Antenna Gain | **6.0** dB | or (linear) | 3.981 (unitless) |
| Separation Distance | **0.2** m | -or- | 7.874 inches |

| | | | |
|---|---|---|---|
| Peak Power Density | 4.887 $W/m^2$ | - or - | 0.4887 $mW/cm^2$ |
| Exposure % (over 6 min timespan for uncontrolled) | 100% | | |
| Transmit Duty Cycle (Peak-to-Average Ratio) | 14.4% | | |
| Average Power Density | **0.7037** $W/m^2$ | - or - | **0.07037** $mW/cm^2$ |
| Limit for **Uncontrolled** Exposure at Operating Frequency | **6.01667** $W/m^2$ | - or - | **0.60167** $mW/cm^2$ |

The product was found to comply with this requirement.

# Appendix A

**Accreditations and Authorizations**

NVLAP Lab code: 200246-0

NVLAP: The National Institute of Standards and Technology (NIST) administers the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP is comprised of laboratory accreditation programs (LAPs) which are established on the basis of requests and demonstrated need. Each LAP includes specific calibration and/or test standards and related methods and protocols assembled to satisfy the unique needs for accreditation in a field of testing or calibration. NVLAP accredits public and private laboratories based on evaluation of their technical qualifications and competence to carry out specific calibrations or tests. Accreditation criteria are established in accordance with the U.S. Code of Federal Regulations (CFR, Title 15, Part 285), NVLAP Procedures and General Requirements, and encompass the requirements of ISO/IEC 17025. For a full scope listing see http://ts.nist.gov/Standards/scopes/2002460.htm

FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland (Ref. No. 91039).

Industry Canada Industrie Canada

Industry of Canada: Accredited by Industry Canada for performance of radiated measurements. Our test site complies with RSP 100, Issue 7, Section 3.3. File #: IC 2180C

VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.:

- Test Station 5 (Location A) R-722, G-246
- Test Station 1 (Location D) C-742, T-1484
- Test Station 4 (Location E) C-743, T-1485

ICASA: ICASA (Independent Communications Authority of South Africa) has appointed UL as a Designated Test Laboratory to test Telecommunications equipment for type approval in compliance with CISPR 22 to assist in fulfilling its mandate under section 54(1) of the Telecommunications Act, 1996 (Act 103 of 1996).

NIST/CAB: Validated by the European Commission as a U.S. Conformity Assessment Body (CAB) of the U.S.-EU Mutual Recognition Agreement (MRA) for the Electromagnetic Compatibility - Council Directive 2004/108/EC, Annex III. Also validated for the Telecommunication Equipment-Council Directive 99/5/EC, Annex III and IV, Identification Number: 0983.
NIST/CAB: Provisioned to act as a U.S. Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the Asia Pacific Economic Cooperation (APEC) MRA between the American Institute in Taiwan (AIT) and the United States. Our laboratory is considered qualified to test equipment subject to the applicable EMC regulations of the Chinese Taipei Bureau of Standards, Metrology and Inspection (BSMI) which require testing to CNS 13438 (CISPR 22).
NIST/CAB: Recognized by the Infocomm Development Authority of Singapore (IDA) under the Asia Pacific Economic Cooperation Mutual Recognition Agreement (APEC MRA). Our laboratory is provisionally designated to act as a Conformity Assessment Body (CAB) under Appendix B, Phase I Procedures, of the APEC MRA. Our scope of designation includes IDA TS EMC (CISPR 22).