# ENGINEERING TEST REPORT

## XBee Series 2 OEM RF Module
## Model No.: XBEE2

## FCC ID: OUR-XBEE2

*Applicant:*

**MaxStream, Inc.**
*355 South 520 West Suite 180*
*Lindon, UT 84042*

***In Accordance With***

**Federal Communications Commission (FCC)**
**Part 15, Subpart C, Section 15.247**
**Digital Modulation Systems (DTS) Operating in 2400 – 2483.5 MHz Band**

**UltraTech's File No.: DIGI-057F15C247C2PC**

This Test report is Issued under the Authority of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: November 10, 2011

| | |
|---|---|
| Report Prepared by: Dan Huynh | Tested by: Mr. Hung Trinh |
| Issued Date: November 10, 2011 | Test Dates: November 4 & 7, 2011 |

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*


**UltraTech**

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| FCC | VCCI | Industry Canada Approved Test Facility | NVLAP | BSMI | Korea KCC-RRL |
|---|---|---|---|---|---|
| 91038 | 1309 | 46390-2049 | NvLap Lab Code 200093-0 | SL2-IN-E-1119R | CA2049 |

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# EXHIBIT 1. INTRODUCTION

## 1.1. SCOPE

| | |
|---|---|
| **Reference:** | FCC Part 15, Subpart C, Section 15.247 |
| **Title:** | Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15 |
| **Purpose of Test:** | Class II Permissive Change application for equipment certification of Digital Modulation Systems (DTS) Transmitter Operating in the Frequency Band 2400-2483.5 MHz. |
| **Test Procedures:** | Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute 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. |
| **Environmental Classification:** | [ x ] Commercial, industrial or business environment<br>[ x ] Residential environment |

## 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

## 1.3. NORMATIVE REFERENCES

| Publication | Year | Title |
|---|---|---|
| 47 CFR Parts 0-19 | 2010 | Code of Federal Regulations (CFR), Title 47 – Telecommunication |
| ANSI C63.4 | 2009 | 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 |
| ANSI C63.10 | 2009 | American National Standard for Testing Unlicensed Wireless Devices |
| CISPR 22 &<br>EN 55022 | 2008-09,<br>Edition 6.0<br>2006 | Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement |
| CISPR 16-1-1<br>+A1<br>+A2 | 2006<br>2006<br>2007 | Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus |
| CISPR 16-1-2<br>+A1<br>+A2 | 2003<br>2004<br>2006 | Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances |

# EXHIBIT 2. PERFORMANCE ASSESSMENT

## 2.1. CLIENT INFORMATION

| APPLICANT | |
|---|---|
| **Name:** | MaxStream, Inc. |
| **Address:** | 355 South 520 West Suite 180<br>Lindon, UT 84042<br>USA |
| **Contact Person:** | Mr. Paul Dahl<br>Phone #: 801-765-9885<br>Fax #: 801-765-9895<br>Email Address: Paul.dahl@digi.com |

| MANUFACTURER | |
|---|---|
| **Name:** | Digi International Inc. |
| **Address:** | 11001 Bren Road East<br>Minnetonka, MN 55343<br>USA |
| **Contact Person:** | Mr. Paul Dahl<br>Phone #: 801-765-9885<br>Fax #: 801-765-9895<br>Email Address: Paul.dahl@digi.com |

## 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

| | |
|---|---|
| **Brand Name:** | MaxStream Inc. |
| **Product Name:** | XBee Series 2 OEM RF Module |
| **Model Name or Number:** | XBEE2 |
| **Serial Number:** | Test Sample |
| **Type of Equipment:** | Digital Modulation Transmitter |
| **Input Power Supply Type:** | External DC Power Supply |
| **Primary User Functions of EUT:** | Wireless modem |

## 2.3. EUT'S TECHNICAL SPECIFICATIONS

| TRANSMITTER | |
|---|---|
| **Equipment Type:** | • Mobile<br>• Base Station (fixed use) |
| **Intended Operating Environment:** | • Commercial, industrial or business<br>• Residential |
| **Power Supply Requirement:** | 2.8 – 3.4 Vdc |
| **RF Output Power Rating:** | 2.8 mW Peak |
| **Operating Frequency Range:** | 2405 – 2480 MHz |
| **RF Output Impedance:** | 50 Ohm |
| **Channel Spacing:** | 5 MHz |
| **Duty Cycle:** | 27% |
| **6 dB bandwidth:** | 1.611MHz |
| **Modulation Type:** | QPSK |
| **Oscillator Frequencies:** | 16 MHz |
| **Antenna Connector Type:** | • Integral<br>• Unique connector (RPSMA/U.FL/IPX) |

## 2.4. ASSOCIATED ANTENNA DESCRIPTION

1. Integrated PCB Antenna (Manufacturer: Digi, Part Number: 29000430, Gain: -0.5 dBi)

## 2.5. LIST OF EUT'S PORTS

| Port Number | EUT's Port Description | Number of Identical Ports | Connector Type | Cable Type (Shielded/Non-shielded) |
|---|---|---|---|---|
| 1 | RF IN/OUT Port | 1 | RPSMA/U.FL/IPX | Shielded |
| 2 | DC Supply & I/O Port | 1 | Pin Header | No cable, direct connection |

## 2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

| **Ancillary Equipment # 1** | |
|---|---|
| Description: | Test Jig Cable |
| Brand name: | MaxStream |
| Model Name or Number: | N/A |
| Serial Number: | N/A |
| Connected to EUT's Port: | Module pin signals |

# EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

## 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

| | |
|---|---|
| Temperature: | 21°C |
| Humidity: | 51% |
| Pressure: | 102 kPa |
| Power input source: | 2.8 – 3.4 Vdc |

## 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

| | |
|---|---|
| **Operating Modes:** | Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. |
| **Special Test Software:** | Special software and hardware by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing. |
| **Special Hardware Used:** | The RF Module could be tested outside of the enclosure using Test Jig connected to EUT. |
| **Transmitter Test Antenna:** | The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral / non-integral antenna equipment as described with the test results. |

| **Transmitter Test Signals** | |
|---|---|
| **Frequency Band(s):** | 2405 – 2480 MHz |
| **Frequency(ies) Tested:**<br>(Near lowest, near middle & near highest frequencies in the frequency range of operation.) | 2405 MHz, 2440 MHz and 2480 MHz |
| **RF Power Output:**<br>(measured maximum output power at antenna terminals) | 4.15 dBm (2.60 mW) Peak |
| **Normal Test Modulation:** | QPSK |
| **Modulating Signal Source:** | Internal |

# EXHIBIT 4. SUMMARY OF TEST RESULTS

## 4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

## 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

| FCC Section(s) | Test Requirements | Compliance (Yes/No) |
|---|---|---|
| 15.203 | Antenna requirements | See Note 1 |
| 15.207(a) | AC Power Line Conducted Emissions | See Note 2 |
| 15.247(a)(2) | 6 dB Bandwidth | See Note 2 |
| 15.247(b)(3) | Peak Conducted Output Power - DTS | Yes |
| 15.247(d) | Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal | See Note 2 |
| 15.247(d), 15.209 & 15.205 | Transmitter Spurious Radiated Emissions | Yes |
| 15.247(e) | Power Spectral Density | See Note 2 |
| 15.247(i) | RF Exposure | See Note 2 |

Note 1: The EUT complies with the requirement, it employs an integrated PCB antenna or unique (non-standard) antenna connector (RPSMA/U.FL/IPX), for all external antennas proposed for use with the EUT.
Note 2: Refer to original filing.

## 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

# EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

## 5.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.10.

## 5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.
Refer to Exhibit 7 for Measurement Uncertainties.

## 5.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

## 5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER

Wireless modem.

## 5.5. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

### 5.5.1. Limit(s)

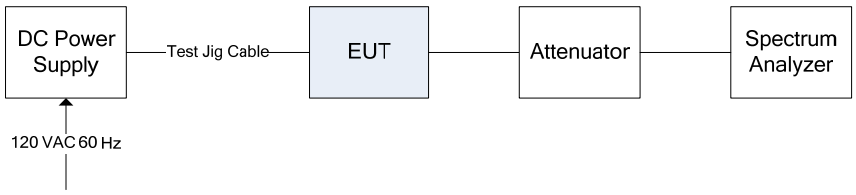
**§ 15.247(b)(3):** For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

**§15.247(b)(4):** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.5.2. Method of Measurements & Test Arrangement

ANSI C63.10, Section 6.10.2.

#### 5.5.2.1. Test Arrangement

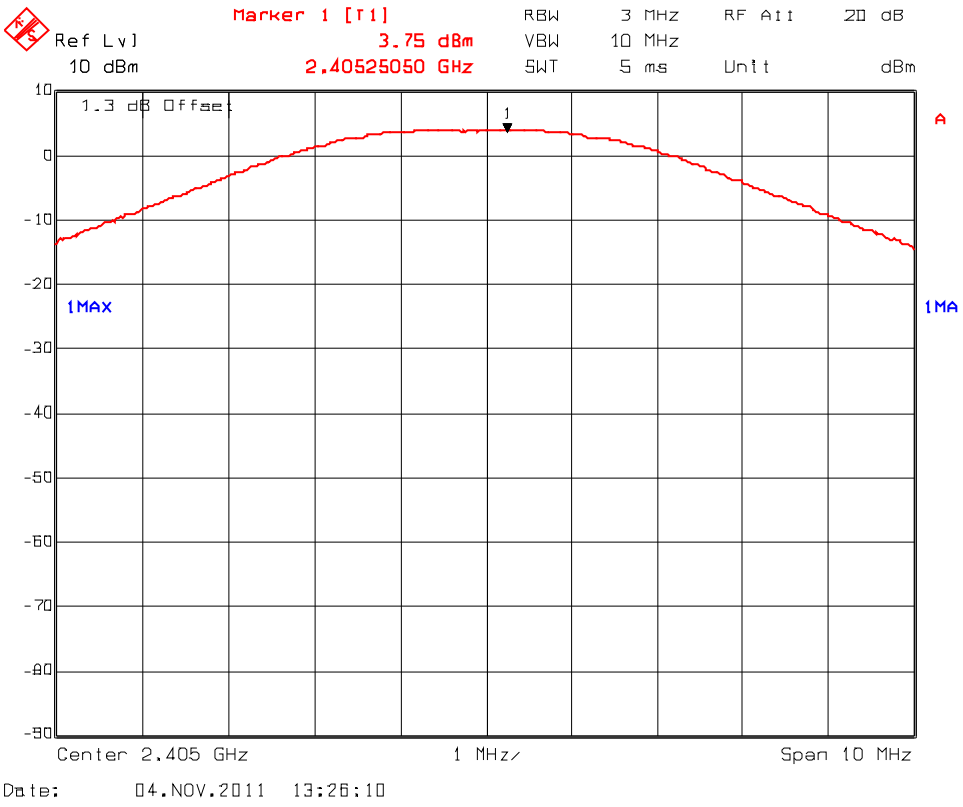



### 5.5.3. Test Data

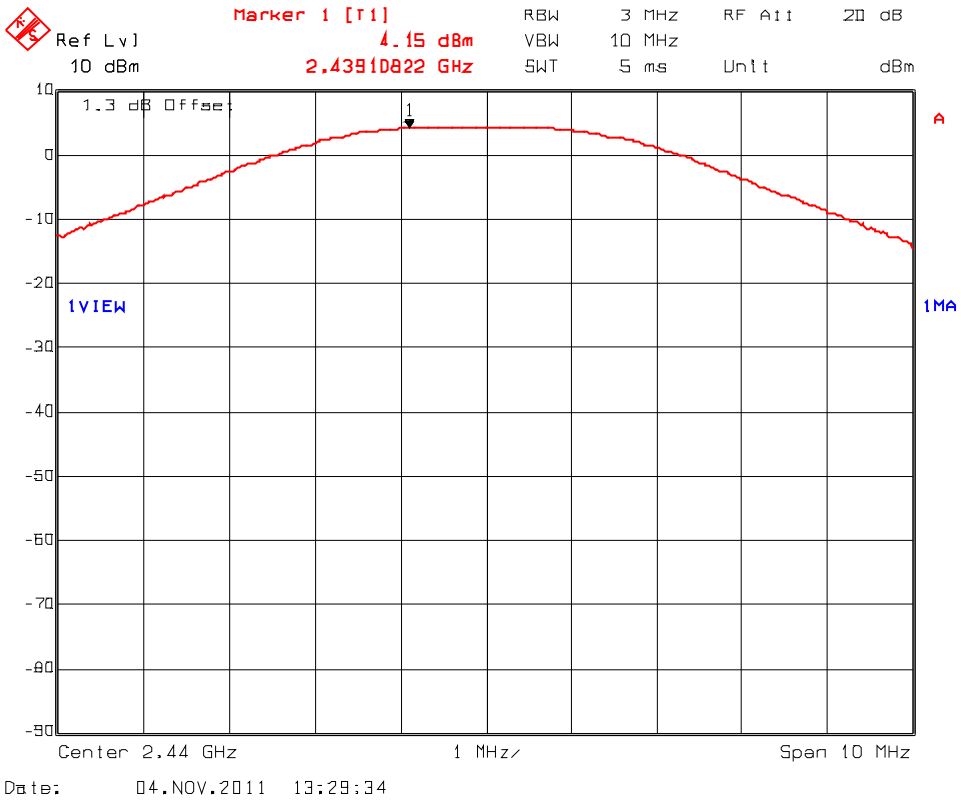
| Frequency (MHz) | Peak Conducted Power (dBm) | Peak EIRP* (dBm) | Peak Conducted Power Limit (dBm) | EIRP Limit (dBm) |
|---|---|---|---|---|
| 2405 | 3.75 | 3.25 | 30 | 36 |
| 2440 | 4.15 | 3.65 | 30 | 36 |
| 2480 | 3.95 | 3.45 | 30 | 36 |

* Peak EIRP calculation = Peak Conducted Power + Antenna Gain in dBi.

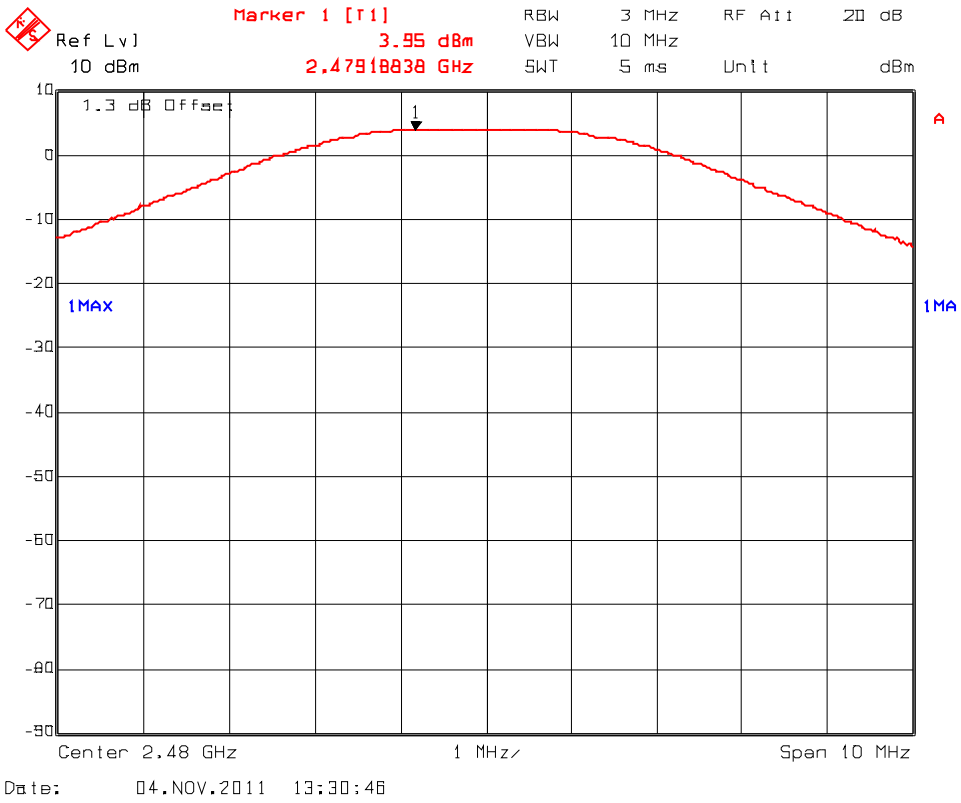
**Plot 5.5.3.1.** Peak Conducted Output Power
Test Frequency: 2405 MHz



**Plot 5.5.3.2.** Peak Conducted Output Power
Test Frequency: 2440 MHz



**Plot 5.5.3.3.** Peak Conducted Output Power
Test Frequency: 2480 MHz



## 5.6. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

### 5.6.1. Limit(s)

**§ 15.247 (d)** 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 § 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)).

**Section 15.205(a) - Restricted Bands of Operation**

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090–0.110 | 16.42–16.423 | 399.9–410 | 4.5–5.15 |
| [1] 0.495–0.505 | 16.69475–16.69525 | 608–614 | 5.35–5.46 |
| 2.1735–2.1905 | 16.80425–16.80475 | 960–1240 | 7.25–7.75 |
| 4.125–4.128 | 25.5–25.67 | 1300–1427 | 8.025–8.5 |
| 4.17725–4.17775 | 37.5–38.25 | 1435–1626.5 | 9.0–9.2 |
| 4.20725–4.20775 | 73–74.6 | 1645.5–1646.5 | 9.3–9.5 |
| 6.215–6.218 | 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 | 156.52475–156.52525 | 2483.5–2500 | 17.7–21.4 |
| 8.37625–8.38675 | 156.7–156.9 | 2655–2900 | 22.01–23.12 |
| 8.41425–8.41475 | 162.0125–167.17 | 3260–3267 | 23.6–24.0 |
| 12.29–12.293 | 167.72–173.2 | 3332–3339 | 31.2–31.8 |
| 12.51975–12.52025 | 240–285 | 3345.8–3358 | 36.43–36.5 |
| 12.57675–12.57725 | 322–335.4 | 3600–4400 | [2] |
| 13.36–13.41. | | | |

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

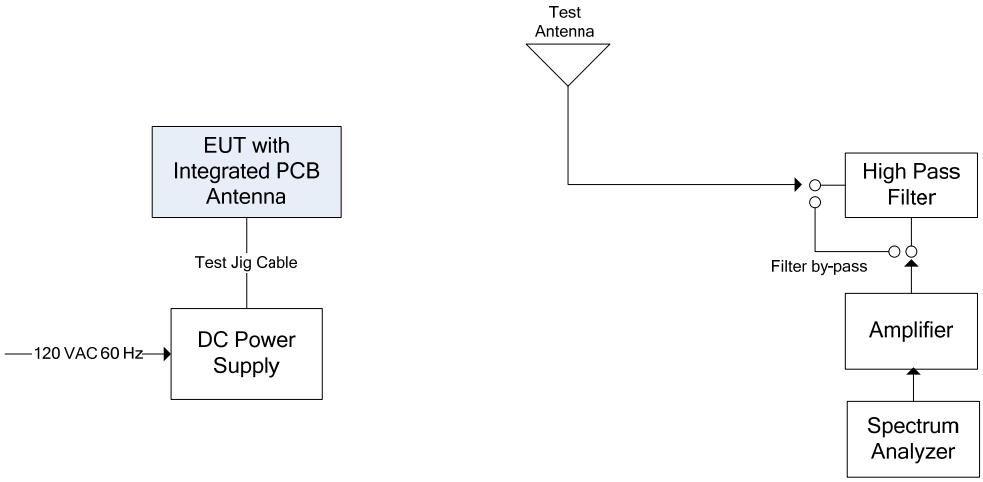
**Section 15.209(a)**
**-- Field Strength Limits within Restricted Frequency Bands --**

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 - 0.490 | 2,400 / F (kHz) | 300 |
| 0.490 - 1.705 | 24,000 / 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 |

### 5.6.2. Method of Measurements

ANSI C63.10, Section 6.9.2.

### 5.6.3. Test Arrangement




### 5.6.4. Test Data

**Remarks:**

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- The following test results are the worst-case measurements.

| Fundamental Frequency: | 2405 MHz | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Frequency Range: | 30 MHz – 25 GHz | | | | | | |
| **Frequency (MHz)** | **RF Peak Level (dBµV/m)** | **RF Avg Level (dBµV/m)** | **Antenna Plane (H/V)** | **Limit 15.209 (dBµV/m)** | **Limit 15.247 (dBµV/m)** | **Margin (dB)** | **Pass/ Fail** |
| 2405 | 104.00 | -- | V | -- | -- | -- | -- |
| 2405 | 102.30 | -- | H | -- | -- | -- | -- |
| 4810 | 52.81 | 42.80 | V | 54.0 | 84.0 | -11.2 | Pass* |
| 4810 | 49.42 | 37.37 | H | 54.0 | 84.0 | -16.6 | Pass* |
| 7215 | 52.37 | 39.52 | V | 54.0 | 84.0 | -14.5 | Pass* |
| 7215 | 52.19 | 38.51 | H | 54.0 | 84.0 | -15.5 | Pass* |

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

| Fundamental Frequency: | 2440 MHz | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Frequency Range: | 30 MHz – 25 GHz | | | | | | |
| **Frequency (MHz)** | **RF Peak Level (dBµV/m)** | **RF Avg Level (dBµV/m)** | **Antenna Plane (H/V)** | **Limit 15.209 (dBµV/m)** | **Limit 15.247 (dBµV/m)** | **Margin (dB)** | **Pass/ Fail** |
| 2440 | 104.78 | -- | V | -- | -- | -- | -- |
| 2440 | 103.01 | -- | H | -- | -- | -- | -- |
| 4880 | 51.00 | 39.99 | V | 54.0 | 84.8 | -14.0 | Pass* |
| 4880 | 49.91 | 38.42 | H | 54.0 | 84.8 | -15.6 | Pass* |
| 7320 | 52.88 | 40.35 | V | 54.0 | 84.8 | -13.7 | Pass* |
| 7320 | 51.52 | 39.17 | H | 54.0 | 84.8 | -14.8 | Pass* |

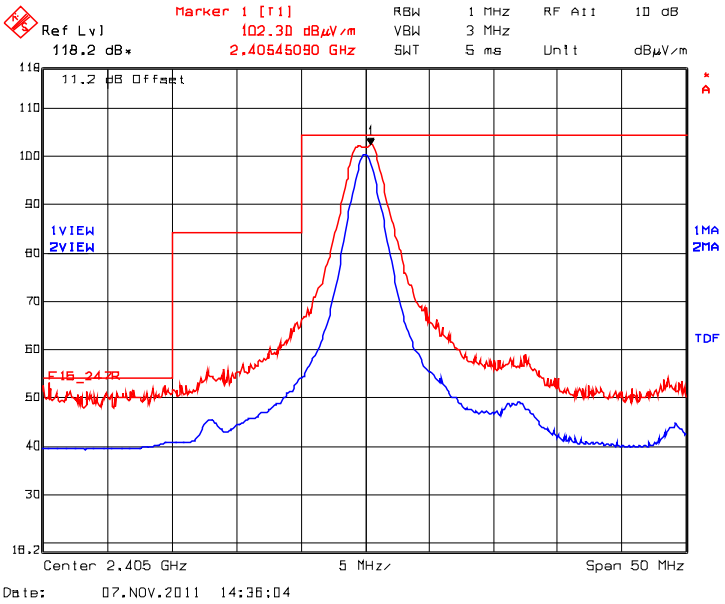
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

| Fundamental Frequency: | 2480 MHz | | | | | | |
|---|---|---|---|---|---|---|---|
| Test Frequency Range: | 30 MHz – 25 GHz | | | | | | |
| **Frequency (MHz)** | **RF Peak Level (dBµV/m)** | **RF Avg Level (dBµV/m)** | **Antenna Plane (H/V)** | **Limit 15.209 (dBµV/m)** | **Limit 15.247 (dBµV/m)** | **Margin (dB)** | **Pass/ Fail** |
| 2480 | 104.48 | -- | V | -- | -- | -- | -- |
| 2480 | 103.48 | -- | H | -- | -- | -- | -- |
| 4960 | 51.65 | 40.82 | V | 54.0 | 84.5 | -13.2 | Pass* |
| 4960 | 51.35 | 39.75 | H | 54.0 | 84.5 | -14.3 | Pass* |
| 7440 | 53.69 | 40.65 | V | 54.0 | 84.5 | -13.4 | Pass* |
| 7440 | 51.93 | 38.73 | H | 54.0 | 84.5 | -15.3 | Pass* |

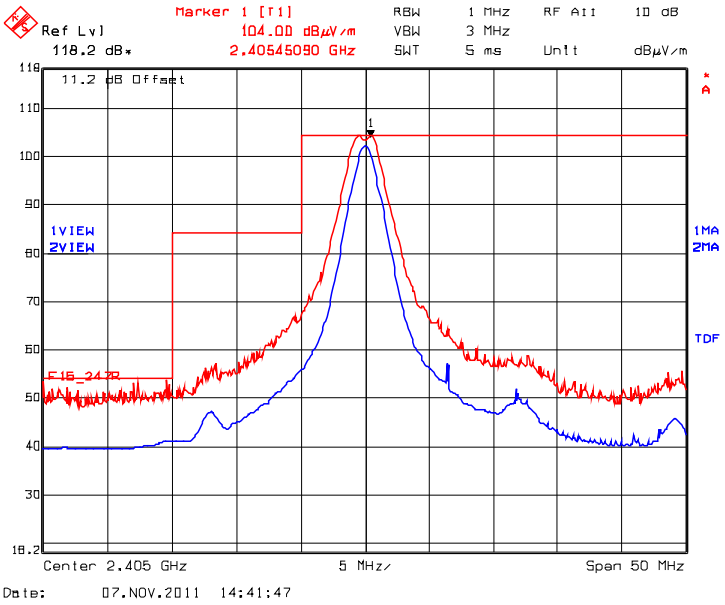
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

See the following test data plots for band-edge emissions.

**Plot 5.6.4.1.** Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band
Rx Antenna Orientation: Horizontal

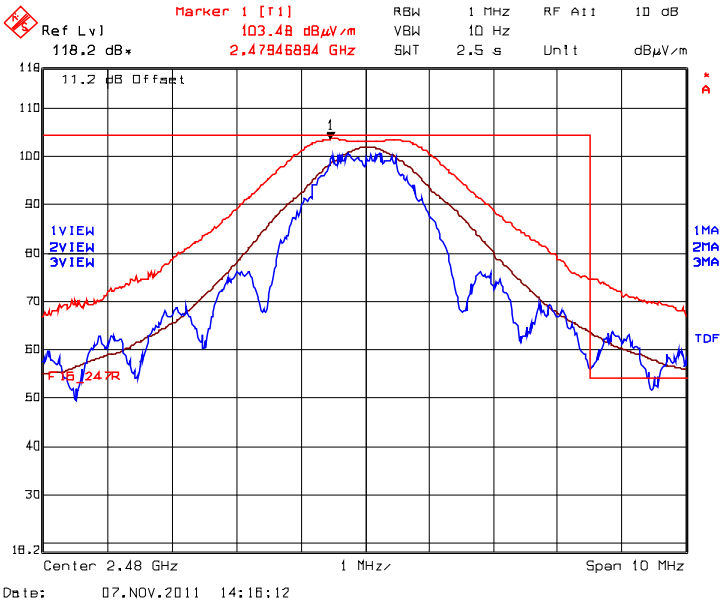



**Plot 5.6.4.2.** Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band
Rx Antenna Orientation: Vertical

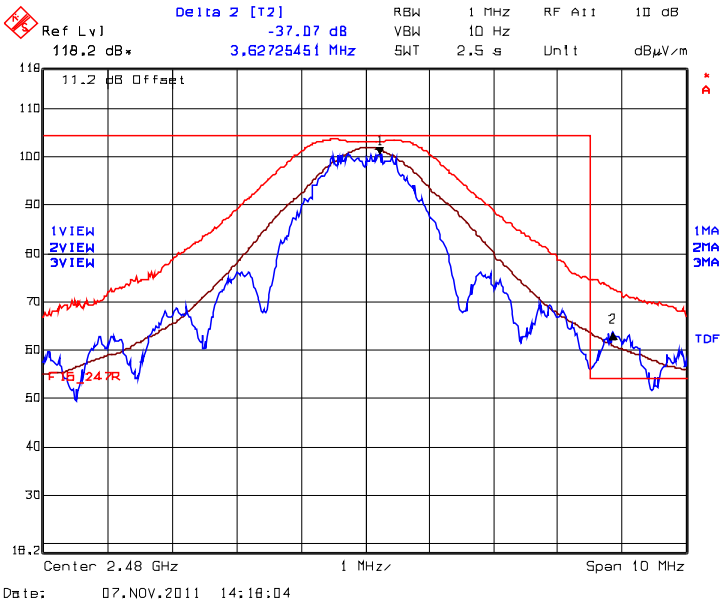



Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 1 MHz, VBW = 10 Hz

**Plot 5.6.4.3.** Band-Edge RF Radiated Emissions @ 3 m, High End of Frequency Band
Rx Antenna Orientation: Horizontal

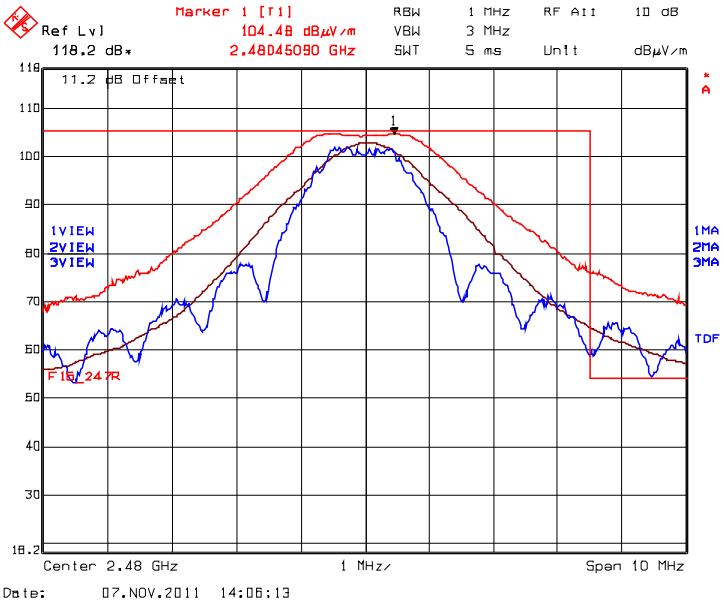



**Plot 5.6.4.4.** Band-Edge RF Radiated Emissions @ 3 m, High End of Frequency Band
Rx Antenna Orientation: Horizontal

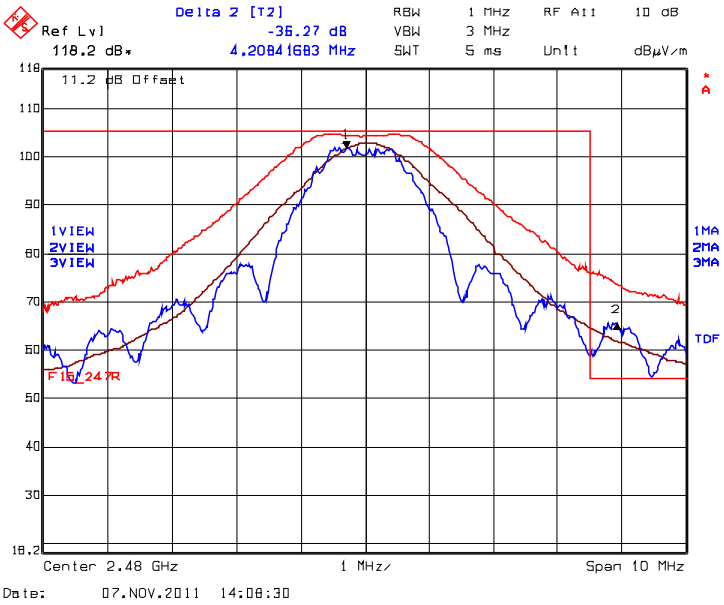



Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 37.07 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 103.48 dBµV/m – 37.07 dB = 66.41 dBµV/m
Average: 63.48 dBµV/m - 11.37dB = 52.11 dBµV/m

**Plot 5.6.4.5.** Band-Edge RF Radiated Emissions @ 3 m, High End of Frequency Band
Rx Antenna Orientation: Vertical




**Plot 5.6.4.6.** Band-Edge RF Radiated Emissions @ 3 m, High End of Frequency Band
Rx Antenna Orientation: Vertical




Trace 1: RBW = 1 MHz, VBW = 3 MHz
Trace 2: RBW = 100 kHz, VBW = 300 kHz, Delta (Peak to Band-Edge): 36.27 dB
Trace 3: RBW = 1 MHz, VBW = 10 Hz
Peak Band-Edge at 2483.5 MHz: Peak = 104.48 dBµV/m – 36.27 dB = 68.21 dBµV/m
Average: 64.52 dBµV/m - 11.37 dB = 53.15 dBµV/m

## EXHIBIT 6. TEST EQUIPMENT LIST

| Test Instruments | Manufacturer | Model No. | Serial No. | Frequency Range | Cal. Due Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSEK30 | 100077 | 20 Hz – 40 GHz | 27 Sep 2012 |
| Spectrum Analyzer | Rohde & Schwarz | ESU40 | 100037 | 20 Hz – 40 GHz | 15 Mar 2012 |
| RF Amplifier | Hewlett Packard | 84498 | 3008A00769 | 1 – 26.5 GHz | 17 Feb 2012 |
| RF Amplifier | AH System | PAM-0118 | 225 | 20 MHz – 18 GHz | 15 Mar 2012 |
| High Pass Filter | K & L | 11SH10-4000/T12000 | 4 | Cut off 2.4 GHz | Cal. on use |
| Horn Antenna | Emco | 3115 | 6570 | 1 – 18 GHz | 22 Feb 2012 |
| Biconi-Log Antenna | Emco | 3142C | 00034792 | 26 – 3000 MHz | 26 April 2012 |
| Signal Generator | Hewlett Packard | 8648C | 3443U00391 | 100 kHz – 3200 MHz | 16 Dec, 2011 |
| Attenuator | Narda | 4768-20 | - | DC – 40 GHz | Cal. on use |
| Horn Antenna | Emco | 3155 | 5061 | 1 – 18 GHz | 28 Nov 2011 |
| Horn Antenna | Emco | 3160-09 | 00118385 | 18 – 26.5 GHz | 30 May 2012 |

# EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

## 7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

| | **Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):** | **Measured** | **Limit** |
|---|---|---|---|
| $u_c$ | **Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$ | **± 1.57** | **± 1.8** |
| **U** | **Expanded uncertainty U:** $U = 2u_c(y)$ | **± 3.14** | **± 3.6** |

## 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

| | **Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):** | **Measured** | **Limit** |
|---|---|---|---|
| $u_c$ | **Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$ | **± 2.15** | **± 2.6** |
| **U** | **Expanded uncertainty U:** $U = 2u_c(y)$ | **± 4.30** | **± 5.2** |

| | **Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):** | **Measured** | **Limit** |
|---|---|---|---|
| $u_c$ | **Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$ | **± 2.39** | **± 2.6** |
| **U** | **Expanded uncertainty U:** $U = 2u_c(y)$ | **± 4.78** | **± 5.2** |

| | **Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):** | **Measured** | **Limit** |
|---|---|---|---|
| $u_c$ | **Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$ | **± 1.87** | Under consideration |
| **U** | **Expanded uncertainty U:** $U = 2u_c(y)$ | **± 3.75** | Under consideration |