# Certification Test Report

## FCC ID: SK9WF111

## FCC Rule Part: 15.247

## Report Number: AT72135742-2P2

Manufacturer: Itron, Inc.
Model: WF111

Test Begin Date: April 09, 2018
Test End Date: April 18, 2018

Report Issue Date: May 18, 2018

FOR THE SCOPE OF ACCREDITATION UNDER Certificate Number: AT-2021

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, NIST, or any agency of the Federal Government.


**Prepared by:**

**Jeremy Pickens**
**Senior Wireless Engineer**
**TÜV SÜD America Inc.**

**Reviewed by:**

**Ryan McGann**
**Senior Engineer**
**TÜV SÜD America Inc.**




**This report contains 16 pages**

# TABLE OF CONTENTS


**1 GENERAL ..... 3**

1.1 PURPOSE ..... 3
1.2 PRODUCT DESCRIPTION ..... 3
1.3 TEST METHODOLOGY AND CONSIDERATIONS ..... 4

**2 TEST FACILITIES ..... 5**

2.1 LOCATION ..... 5
2.2 LABORATORY ACCREDITATIONS/RECOGNITIONS/CERTIFICATIONS ..... 5
2.3 RADIATED EMISSIONS TEST SITE DESCRIPTION ..... 6
*2.3.1 Semi-Anechoic Chamber Test Site ..... 6*
*2.3.2 Open Area Tests Site (OATS) ..... 7*
2.4 CONDUCTED EMISSIONS TEST SITE DESCRIPTION ..... 8

**3 APPLICABLE STANDARD REFERENCES ..... 8**

**4 LIST OF TEST EQUIPMENT ..... 9**

**5 SUPPORT EQUIPMENT ..... 10**

**6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM ..... 10**

**7 SUMMARY OF TESTS ..... 11**

7.1 ANTENNA REQUIREMENT – FCC: SECTION 15.203 ..... 11
7.2 POWER LINE CONDUCTED EMISSIONS – FCC: SECTION 15.207; ISED CANADA: RSS-GEN 8.8 ..... 11
*7.2.1 Measurement Procedure ..... 11*
*7.2.2 Measurement Results ..... 11*
7.3 RADIATED SPURIOUS EMISSIONS – FCC: SECTIONS 15.205, 15.209; ISED CANADA: RSS-GEN 8.9/8.10 ..... 13
*7.3.1 Measurement Procedure ..... 13*
*7.3.2 Measurement Results ..... 13*
*7.3.3 Sample Calculation: ..... 15*

**8 ESTIMATION OF MEASUREMENT UNCERTAINTY ..... 16**

**9 CONCLUSION ..... 16**

# 1 GENERAL

## 1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart C of the FCC's Code of Federal Regulations for a Class II Permissive Change.

The purpose of this Class II Permissive Change is to add a new antenna and host combination.

## 1.2 Product description

The Itron WF111 is a communications module which includes an 802.11b/g/n(HT20) transmitter operating in the 2400-2483.5MHz band. The module operates on DC voltage which is supplied by the host device.

This Class II Permissive Change addresses the WF111 (FCC ID: SK9F111) integrated into the Itron, Inc. Socket Based Router (SBR) with new monopole antenna configuration.

This test report documents the compliance of the 2.4 GHz transceiver.

Technical Details:

| Detail | Description |
|---|---|
| Frequency Range | 2412 – 2462MHz |
| Number of Channels | 11 |
| Modulation Format | 802.11 b/g/n(HT20) |
| Data Rates (kbps) | 802.11b: 1,2,5.5,11 Mbps<br>802.11g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps<br>802.11n: 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65.5, 72.2 Mbps |
| Operating Voltage | 3.3Vdc (Supplied by host) |
| Antenna Type(s) / Gain(s) | WF121-N: 2.14 dBi<br>Taoglas GW26.0112 Monopole (new): 1.8 dBi |

Manufacturer Information:
Itron, Inc.
313 N Hwy 11
West Union, SC 29696

EUT Serial Numbers: FCC2 (Host S/N)

Test Sample Condition: The test samples were provided in good working order with no visible defects.

### 1.3 Test Methodology and Considerations

All modes of operation, including all available data rates, were evaluated for each mode. The data presented in this report represents the worst case where applicable.

The purpose of this Class II Permissive Change is to add a new antenna and host to the originally certified module, therefore this evaluation is limited to Radiated Emissions testing and AC Power Line Conducted Emissions testing only

For radiated emissions, the EUT was evaluated in the Socket Based Router (SBR). The data rates evaluated were 802.11b 1Mbps, 802.11g 6Mbps, and 802.11n MCS0 (7.2Mbps).

For AC power line conducted emissions the EUT was evaluated installed in the Socket Based Router (SBR) powered from 240Vac, 60Hz.

Radiated inter-modulation testing was performed for all combinations of simultaneous transmission and found to comply.

# 2 TEST FACILITIES

## 2.1 Location

The radiated and conducted emissions test sites are located at the following address:

TÜV SÜD America, Inc.
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

## 2.2 Laboratory Accreditations/Recognitions/Certifications

TÜV SÜD America, Inc. is accredited to ISO/IEC 17025 by the ANSI-ASQ National Accreditation Board/ANAB accreditation program, and has been issued certificate number AT-2021 in recognition of this accreditation. Unless otherwise specified, all tests methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Innovation, Science, and Economic Development Canada and the Japanese Voluntary Control Council for Interference by information technology equipment.

FCC Registration Number: 391271
Innovation, Science, and Economic Development Canada Lab Code: 23597
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

## 2.3 Radiated Emissions Test Site Description

### 2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 – 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 – 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

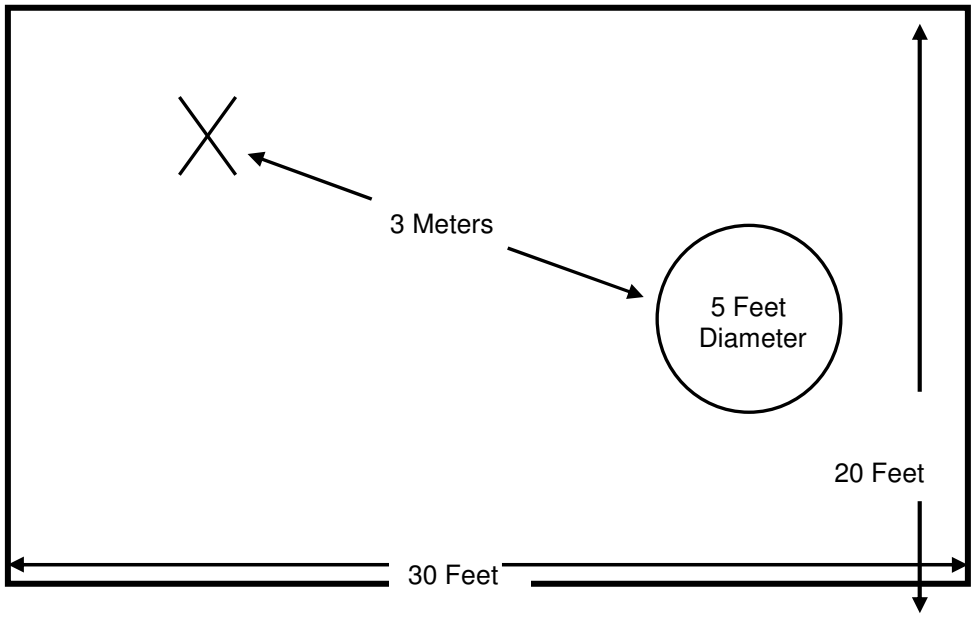


**Figure 2.3-1: Semi-Anechoic Chamber Test Site**

### 2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 – 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 – 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse referenced in ANSI C63.10.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

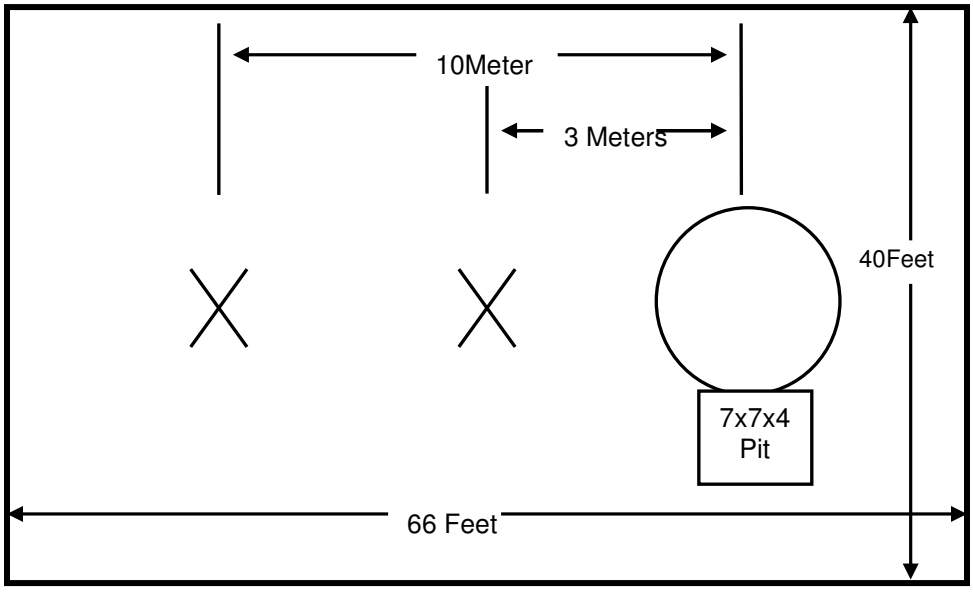


**Figure 2.3-2: Open Area Test Site**

### 2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is located in the main EMC lab. It consists of an 8' x 8' solid aluminum horizontal ground reference plane (GRP) bonded every 3" to an 8' X 8' vertical ground plane.

The site is of sufficient size to test table top and floor standing equipment in accordance with ANSI C63.10.

A diagram of the room is shown below in figure 2.4-1:

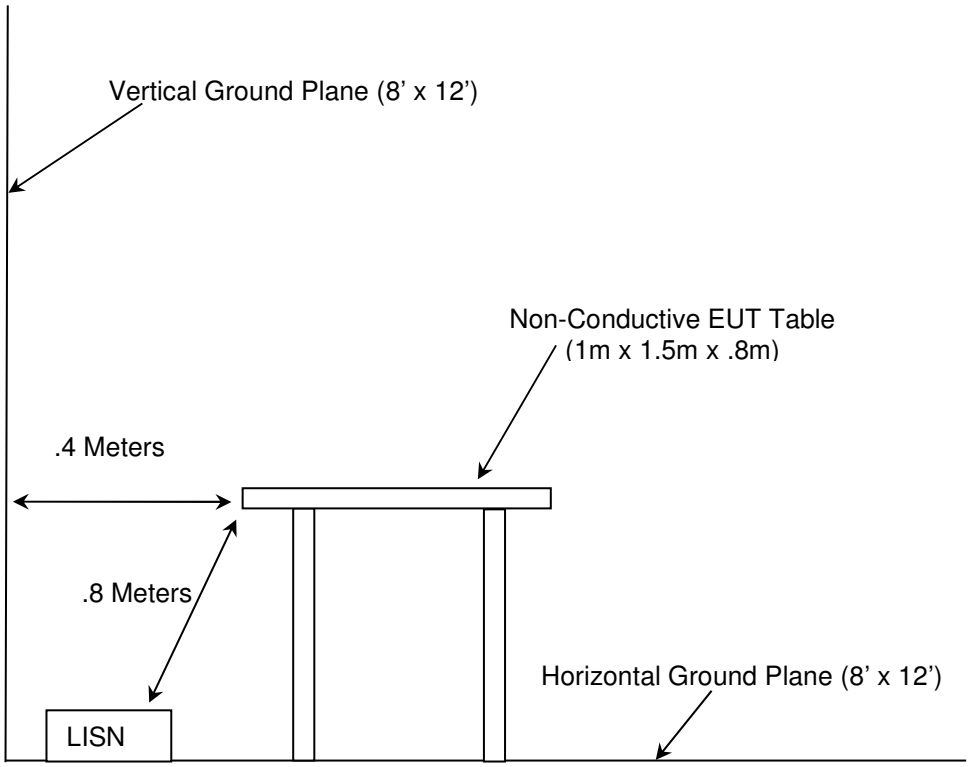


**Figure 2.4-1: AC Mains Conducted EMI Site**

## 3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2018
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators, 2018
- ISED Canada Radio Standards Specification: RSS-247 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices, Issue 2, Feb 2017
- ISED Canada Radio Standards Specification: RSS-GEN – General Requirements and Information for the Certification of Radiocommunication Equipment, Issue 4, Nov 2014.

## 4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

**Table 4-1: Test Equipment**

| AssetID | Manufacturer | Model # | Equipment Type | Serial # | Last Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|---|
| 30 | Spectrum Technologies | DRH-0118 | 1-18GHz Horn Antenna | 970102 | 05/09/2017 | 05/09/2019 |
| 40 | EMCO | 3104 | Bicon Antenna | 3211 | 06/08/2016 | 06/08/2018 |
| 167 | ACS | Chamber EMI Cable Set | Consisits of cables 485, 242, 204 and 10 | 167 | 09/29/2017 | 09/29/2018 |
| 168 | Hewlett Packard | 11947A | Transient Pulse Limiter | 44829 | 01/22/2018 | 01/22/2019 |
| 213 | TEC | PA 102 | Amplifier | 44927 | 07/24/2017 | 07/24/2018 |
| 324 | ACS | Belden | Conducted EMI Cable | 8214 | 04/05/2018 | 04/05/2019 |
| 334 | Rohde&Schwarz | 3160-09 | HF Antenna - 18-26.5GHz | 45576 | 10/07/2017 | 10/07/2018 |
| 335 | Suhner | SF-102A | Cable (40GHZ) | 882/2A | 07/11/2017 | 07/11/2018 |
| 338 | Hewlett Packard | 8449B | High Frequency Pre-Amp | 3008A01111 | 07/11/2017 | 07/11/2019 |
| 345 | Suhner Sucoflex | 102A | Cable 42(GHZ) | 1077/2A | 07/10/2017 | 07/10/2018 |
| 412 | Electro Metrics | LPA-25 | Log Periodic Antenna | 1241 | 08/08/2016 | 08/08/2018 |
| 422 | Florida RF | SMS-200AW-72.0-SMR | Cable | 805 | 11/27/2017 | 11/27/2018 |
| 432 | Microwave Circuits | H3G020G4 | Highpass Filter | 264066 | 05/13/2017 | 05/13/2018 |
| 616 | Florida RF Cables | SMRE-200W-12.0-SMRE | High Frequency Cable | N/A | 10/07/2017 | 10/07/2018 |
| 676 | Florida RF Labs | SMS-290AW-480.0-SMS | Cable | MFR2Y194 | 01/08/2018 | 01/08/2019 |
| 813 | PMM | 9010 | EMI Receiver; RF Input 50ohm; 10Hz-50MHz; 10Hz-30MHz | 697WW30606 | 02/12/2018 | 02/12/2019 |
| 819 | Rohde & Schwarz USA, Inc. | ESR26 | EMI Test Receiver | 101345 | 10/31/2017 | 10/31/2018 |
| 3010 | Rohde & Schwarz | ENV216 | Two-Line V-Network | 3010 | 07/11/2017 | 07/11/2018 |

**NCR = No Calibration Required**
**NOTE: All test equipment was used only during active calibration cycles.**

## 5 SUPPORT EQUIPMENT

**Table 5-1: Support Equipment – Radiated Emissions**

| Item | Equipment Type | Manufacturer | Model/Part Number | Serial Number |
|---|---|---|---|---|
| 1 | Host Device | Itron, Inc. | SBR | FCC2 |

**Table 5-2: Cable Description – Radiated Emissions**

| Cable | Cable Type | Length | Shield | Termination |
|---|---|---|---|---|
| A | AC Power Cable | 1.75 m | No | Host Device to AC Mains |

## 6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

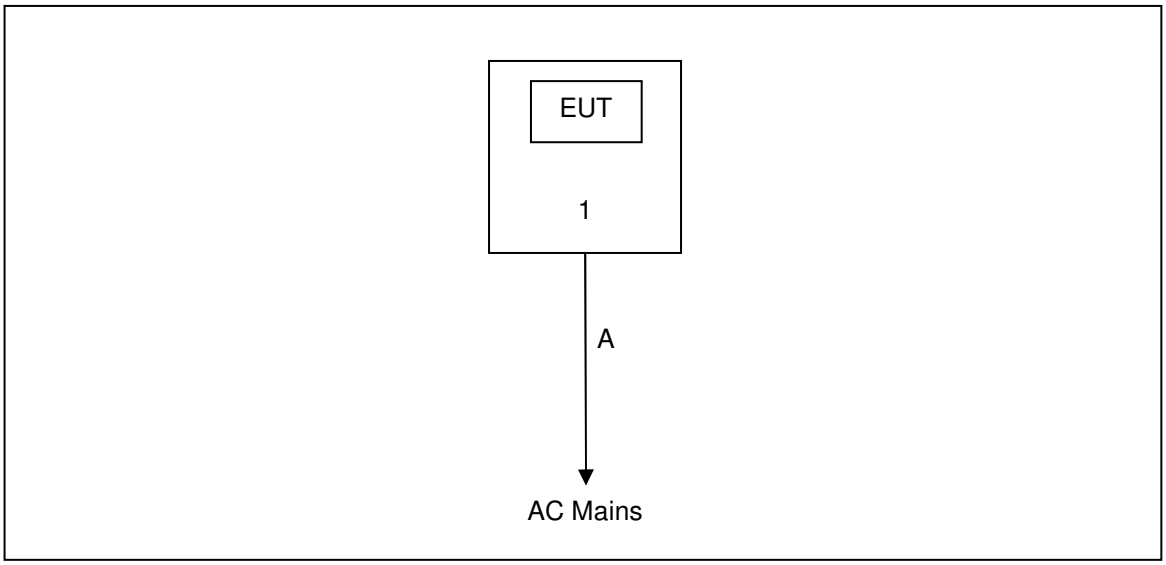


**Figure 6-1: Test Setup Block Diagram**

# 7 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

## 7.1 Antenna Requirement – FCC: Section 15.203

When installed in the Itron, Inc. Socket Based Router (SBR) the EUT utilizes an internal Taoglas monopole antenna with a peak gain of 1.8dBi in the 2.4GHz ISM band. The antenna employs a reverse polarity SMA connector. The EUT and host device require professional installation, therefore meeting the requirements of Section 15.203.

## 7.2 Power Line Conducted Emissions – FCC: Section 15.207; ISED Canada: RSS-Gen 8.8

### 7.2.1 Measurement Procedure

Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

**Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss**
**Margin = Corrected Reading - Applicable Limit**

### 7.2.2 Measurement Results

Performed by: Arthur Sumner

**Table 7.2.2-1: Conducted EMI Results – Line 1**

| Frequency (MHz) | Corrected Reading | | Limit | | Margin | | |
|---|---|---|---|---|---|---|---|
| | Quasi-Peak (dBuV) | Average (dBuV) | Quasi-Peak (dBuV) | Average (dBuV) | Quasi-Peak (dB) | Average (dB) | Correction (dB) |
| 0.162 | 45.04 | 34.56 | 65.36 | 55.36 | -20.32 | -20.8 | 9.58 |
| 0.226 | 43.39 | 33.84 | 62.6 | 52.6 | -19.21 | -18.76 | 9.58 |
| 0.394 | 41.49 | 25.76 | 57.98 | 47.98 | -16.49 | -22.22 | 9.59 |
| 0.41 | 51.01 | 46.83 | 57.65 | 47.65 | -6.64 | -0.82 | 9.59 |
| 0.418 | 50.56 | 40.2 | 57.49 | 47.49 | -6.93 | -7.29 | 9.59 |
| 0.43 | 47.49 | 31.53 | 57.25 | 47.25 | -9.76 | -15.72 | 9.59 |
| 0.694 | 48.13 | 40.5 | 56 | 46 | -7.87 | -5.5 | 9.59 |
| 1.286 | 47.74 | 38.06 | 56 | 46 | -8.26 | -7.94 | 9.6 |
| 1.678 | 45.97 | 38.12 | 56 | 46 | -10.03 | -7.88 | 9.61 |
| 18.358 | 45.89 | 42.93 | 60 | 50 | -14.11 | -7.07 | 9.83 |

**Table 7.2.2-2: Conducted EMI Results – Line 2**

| Frequency (MHz) | Corrected Reading | | Limit | | Margin | | |
|---|---|---|---|---|---|---|---|
| | Quasi-Peak (dBuV) | Average (dBuV) | Quasi-Peak (dBuV) | Average (dBuV) | Quasi-Peak (dB) | Average (dB) | Correction (dB) |
| 0.158 | 47.55 | 25.89 | 65.57 | 55.57 | -18.02 | -29.68 | 9.58 |
| 0.17 | 46.78 | 22.78 | 64.96 | 54.96 | -18.18 | -32.18 | 9.58 |
| 0.182 | 45.09 | 31.8 | 64.39 | 54.39 | -19.3 | -22.59 | 9.58 |
| 0.198 | 43.76 | 27.43 | 63.69 | 53.69 | -19.93 | -26.26 | 9.58 |
| 0.23 | 43.57 | 36.2 | 62.45 | 52.45 | -18.88 | -16.25 | 9.58 |
| 0.282 | 41.1 | 35.86 | 60.76 | 50.76 | -19.66 | -14.9 | 9.59 |
| 0.402 | 46.91 | 35.46 | 57.81 | 47.81 | -10.9 | -12.35 | 9.59 |
| 0.434 | 45.47 | 30.58 | 57.18 | 47.18 | -11.71 | -16.6 | 9.59 |
| 0.454 | 49.12 | 42.73 | 56.8 | 46.8 | -7.68 | -4.07 | 9.59 |
| 18.51 | 44.58 | 41.59 | 60 | 50 | -15.42 | -8.41 | 9.86 |

## 7.3 Radiated Spurious Emissions – FCC: Sections 15.205, 15.209; ISED Canada: RSS-Gen 8.9/8.10

### 7.3.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 30 MHz to 25 GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1 meter to 4 meters so that the maximum radiated emissions level would be detected. For frequencies below 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. For frequencies above 1000 MHz, peak and average measurements were made with RBW and VBW of 1 MHz and 3 MHz respectively.

The EUT was caused to generate a continuous modulated carrier at each of the low, middle, and high channels.

Each emission found to be in a restricted band was compared to the applicable radiated emission limits.

### 7.3.2 Measurement Results

Performed by: Tyler Leeson, Arthur Sumner

**Table 7.3.2-1: Radiated Spurious Emissions Tabulated Data – 802.11b**

| Frequency (MHz) | Level (dBuV) | | Antenna Polarity | Correction Factors | Corrected Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **Low Channel** | | | | | | | | | | |
| **2390** | 72.37 | 43.81 | H | -4.58 | 67.79 | 39.23 | 74.0 | 54.0 | 6.2 | 14.8 |
| **2390** | 71.43 | 43.07 | V | -4.58 | 66.85 | 38.49 | 74.0 | 54.0 | 7.1 | 15.5 |
| **4824** | 47.64 | 34.52 | H | 3.64 | 51.28 | 38.16 | 74.0 | 54.0 | 22.7 | 15.8 |
| **4824** | 48.30 | 36.21 | V | 3.64 | 51.94 | 39.85 | 74.0 | 54.0 | 22.1 | 14.2 |
| **Middle Channel** | | | | | | | | | | |
| **4874** | 47.96 | 36.04 | H | 3.82 | 51.78 | 39.86 | 74.0 | 54.0 | 22.2 | 14.1 |
| **4874** | 47.72 | 35.46 | V | 3.82 | 51.54 | 39.28 | 74.0 | 54.0 | 22.5 | 14.7 |
| **High Channel** | | | | | | | | | | |
| **2483.5** | 70.14 | 41.46 | H | -4.15 | 65.99 | 37.31 | 74.0 | 54.0 | 8.0 | 16.7 |
| **2483.5** | 68.35 | 40.13 | V | -4.15 | 64.20 | 35.98 | 74.0 | 54.0 | 9.8 | 18.0 |
| **4924** | 47.83 | 35.55 | H | 4.00 | 51.83 | 39.55 | 74.0 | 54.0 | 22.2 | 14.4 |
| **4924** | 48.07 | 35.72 | V | 4.00 | 52.07 | 39.72 | 74.0 | 54.0 | 21.9 | 14.3 |

**Table 7.3.2-2: Radiated Spurious Emissions Tabulated Data – 802.11g**

| Frequency (MHz) | Level (dBuV) | | Antenna Polarity | Correction Factors | Corrected Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **Low Channel** | | | | | | | | | | |
| **2390** | 68.52 | 49.86 | H | -4.58 | 63.94 | 45.28 | 74.0 | 54.0 | 10.1 | 8.7 |
| **2390** | 73.42 | 51.76 | V | -4.58 | 68.84 | 47.18 | 74.0 | 54.0 | 5.2 | 6.8 |
| **4824** | 47.64 | 34.52 | H | 3.64 | 51.28 | 38.16 | 74.0 | 54.0 | 22.7 | 15.8 |
| **4824** | 48.30 | 36.21 | V | 3.64 | 51.94 | 39.85 | 74.0 | 54.0 | 22.1 | 14.2 |
| **Middle Channel** | | | | | | | | | | |
| **4874** | 46.10 | 32.30 | H | 3.82 | 49.92 | 36.12 | 74.0 | 54.0 | 24.1 | 17.9 |
| **4874** | 45.30 | 32.20 | V | 3.82 | 49.12 | 36.02 | 74.0 | 54.0 | 24.9 | 18.0 |
| **12185** | 47.60 | 33.90 | H | 16.60 | 64.20 | 50.50 | 83.5 | 63.5 | 19.3 | 13.0 |
| **12185** | 46.90 | 33.90 | V | 16.60 | 63.50 | 50.50 | 83.5 | 63.5 | 20.0 | 13.0 |
| **High Channel** | | | | | | | | | | |
| **2483.5** | 61.10 | 43.40 | H | -4.15 | 56.95 | 39.25 | 74.0 | 54.0 | 17.1 | 14.8 |
| **2483.5** | 61.30 | 42.80 | V | -4.15 | 57.15 | 38.65 | 74.0 | 54.0 | 16.9 | 15.4 |
| **4924** | 46.10 | 32.70 | H | 4.00 | 50.10 | 36.70 | 74.0 | 54.0 | 23.9 | 17.3 |
| **4924** | 46.40 | 32.70 | V | 4.00 | 50.40 | 36.70 | 74.0 | 54.0 | 23.6 | 17.3 |
| **7386** | 46.90 | 32.60 | H | 8.96 | 55.86 | 41.56 | 74.0 | 54.0 | 18.1 | 12.4 |
| **7386** | 45.90 | 32.60 | V | 8.96 | 54.86 | 41.56 | 74.0 | 54.0 | 19.1 | 12.4 |
| **12310** | 47.50 | 34.20 | H | 17.51 | 65.01 | 51.71 | 83.5 | 63.5 | 18.5 | 11.8 |
| **12310** | 47.30 | 34.20 | V | 17.51 | 64.81 | 51.71 | 83.5 | 63.5 | 18.7 | 11.8 |

**Table 7.3.2-3: Radiated Spurious Emissions Tabulated Data – 802.11n**

| Frequency (MHz) | Level (dBuV) | | Antenna Polarity | Correction Factors | Corrected Level (dBuV/m) | | Limit (dBuV/m) | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | pk | Qpk/Avg | (H/V) | (dB) | pk | Qpk/Avg | pk | Qpk/Avg | pk | Qpk/Avg |
| **Low Channel** | | | | | | | | | | |
| **2390** | 68.60 | 49.80 | H | -4.58 | 64.02 | 45.22 | 74.0 | 54.0 | 10.0 | 8.8 |
| **2390** | 65.50 | 47.70 | V | -4.58 | 60.92 | 43.12 | 74.0 | 54.0 | 13.1 | 10.9 |
| **4824** | 45.60 | 32.40 | H | 3.64 | 49.24 | 36.04 | 74.0 | 54.0 | 24.8 | 18.0 |
| **4824** | 46.10 | 32.40 | V | 3.64 | 49.74 | 36.04 | 74.0 | 54.0 | 24.3 | 18.0 |
| **12060** | 47.30 | 33.90 | H | 15.69 | 62.99 | 49.59 | 83.5 | 63.5 | 20.5 | 14.0 |
| **12060** | 46.70 | 33.90 | V | 15.69 | 62.39 | 49.59 | 83.5 | 63.5 | 21.1 | 14.0 |
| **14472** | 46.60 | 33.30 | H | 19.28 | 65.88 | 52.58 | 83.5 | 63.5 | 17.6 | 11.0 |
| **14472** | 47.00 | 33.30 | V | 19.28 | 66.28 | 52.58 | 83.5 | 63.5 | 17.2 | 11.0 |
| **Middle Channel** | | | | | | | | | | |
| **4874** | 45.30 | 32.10 | H | 3.82 | 49.12 | 35.92 | 74.0 | 54.0 | 24.9 | 18.1 |
| **4874** | 45.00 | 32.20 | V | 3.82 | 48.82 | 36.02 | 74.0 | 54.0 | 25.2 | 18.0 |
| **7311** | 46.90 | 32.50 | H | 8.94 | 55.84 | 41.44 | 74.0 | 54.0 | 18.2 | 12.6 |
| **7311** | 45.50 | 32.40 | V | 8.94 | 54.44 | 41.34 | 74.0 | 54.0 | 19.6 | 12.7 |
| **12185** | 47.80 | 33.90 | H | 16.60 | 64.40 | 50.50 | 83.5 | 63.5 | 19.1 | 13.0 |
| **12185** | 46.80 | 33.80 | V | 16.60 | 63.40 | 50.40 | 83.5 | 63.5 | 20.1 | 13.1 |
| **High Channel** | | | | | | | | | | |
| **2483.5** | 64.30 | 44.10 | H | -4.15 | 60.15 | 39.95 | 74.0 | 54.0 | 13.9 | 14.1 |
| **2483.5** | 62.20 | 43.10 | V | -4.15 | 58.05 | 38.95 | 74.0 | 54.0 | 16.0 | 15.1 |
| **4924** | 44.90 | 32.00 | H | 4.00 | 48.90 | 36.00 | 74.0 | 54.0 | 25.1 | 18.0 |
| **4924** | 45.80 | 32.10 | V | 4.00 | 49.80 | 36.10 | 74.0 | 54.0 | 24.2 | 17.9 |
| **7386** | 45.90 | 32.40 | H | 8.96 | 54.86 | 41.36 | 74.0 | 54.0 | 19.1 | 12.6 |
| **7386** | 45.30 | 32.40 | V | 8.96 | 54.26 | 41.36 | 74.0 | 54.0 | 19.7 | 12.6 |
| **12310** | 46.60 | 33.70 | H | 17.51 | 64.11 | 51.21 | 83.5 | 63.5 | 19.4 | 12.3 |
| **12310** | 46.90 | 33.70 | V | 17.51 | 64.41 | 51.21 | 83.5 | 63.5 | 19.1 | 12.3 |
| **19696** | 48.80 | 34.40 | H | 14.17 | 62.97 | 48.57 | 83.5 | 63.5 | 20.5 | 15.0 |
| **19696** | 48.20 | 34.30 | V | 14.17 | 62.37 | 48.47 | 83.5 | 63.5 | 21.1 | 15.1 |

### 7.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

| | | |
|---|---|---|
| $CF_T$ | = | Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only) |
| $R_U$ | = | Uncorrected Reading |
| $R_C$ | = | Corrected Level |
| AF | = | Antenna Factor |
| CA | = | Cable Attenuation |
| AG | = | Amplifier Gain |
| DC | = | Duty Cycle Correction Factor |

**Example Calculation: Peak – 802.11b**

Corrected Level: 72.37 + -4.58 = 67.79dBuV/m
Margin: 74dBuV/m – 67.79dBuV/m = 6.2dB

**Example Calculation: Average – 802.11b**

Corrected Level: 43.81 + -4.58 + 0 = 39.23dBuV
Margin: 54dBuV – 39.23dBuV = 14.8dB

## 8 ESTIMATION OF MEASUREMENT UNCERTAINTY

The expanded laboratory measurement uncertainty figures ($U_{Lab}$) provided below correspond to an expansion factor (coverage factor) k = 1.96 which provide confidence levels of 95%.

| Parameter | $U_{lab}$ |
|---|---|
| Occupied Channel Bandwidth | ± 0.009 % |
| RF Conducted Output Power | ± 0.349 dB |
| Power Spectral Density | ± 0.372 dB |
| Antenna Port Conducted Emissions | ± 1.264 dB |
| Radiated Emissions ≤ 1 GHz | ± 5.814 dB |
| Radiated Emissions > 1 GHz | ± 4.318 dB |
| Temperature | ± 0.860 °C |
| Radio Frequency | ± 2.832 x $10^{-8}$ |
| AC Power Line Conducted Emissions | ± 3.360 dB |

## 9 CONCLUSION

In the opinion of TÜV SÜD America, Inc. the WF111, implemented by Itron, Inc. meets the requirements of FCC Part 15 subpart C for the tests documented in this test report.

# END REPORT