

# ITRON, Inc.

TEST REPORT FOR

**Water Endpoint  
Model: RIVAW**

Tested to The Following Standards:

FCC Part 15 Subpart C  
Section: 15.249

Report No.: 98804-15

Date of issue: August 31, 2016



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

## TABLE OF CONTENTS

|   |    |
|---|----|
| Administrative Information .....                    | 3  |
| Test Report Information .....                       | 3  |
| Report Authorization .....                          | 3  |
| Test Facility Information .....                     | 4  |
| Software Versions .....                             | 4  |
| Site Registration & Accreditation Information ..... | 4  |
| Summary of Results .....                            | 5  |
| Modifications During Testing .....                  | 5  |
| Conditions During Testing .....                     | 5  |
| Equipment Under Test .....                          | 6  |
| General Product Information .....                   | 7  |
| FCC Part 15 Subpart C .....                         | 8  |
| 15.249(a) Field Strength of Fundamental .....       | 8  |
| 15.249(a) Radiated Emissions .....                  | 13 |
| Supplemental Information .....                      | 22 |
| Measurement Uncertainty .....                       | 22 |
| Emissions Test Details .....                        | 22 |

## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

Itron, Inc.  
2111 N. Molter Road  
Liberty Lake, WA 99019

Representative: Jay Holcomb  
Customer Reference Number: 103450

**DATE OF EQUIPMENT RECEIPT:**

**DATE(S) OF TESTING:**

**REPORT PREPARED BY:**

Dianne Dudley  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 98804

August 19, 2016

August 19-20, 2016

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



**Steve Behm**  
*Director of Quality Assurance & Engineering Services*  
*CKC Laboratories, Inc.*

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
22116 23rd Drive S.E., Suite A  
Bothell, WA 98021-4413

## Software Versions

| CKC Laboratories Proprietary Software | Version |
|---------------------------------------|---------|
| EMITest Emissions                     | 5.03.02 |

## Site Registration & Accreditation Information

| Location | CB #   | TAIWAN         | CANADA  | FCC    | JAPAN  |
|----------|--------|----------------|---------|--------|--------|
| Bothell  | US0081 | SL2-IN-E-1145R | 3082C-1 | 318736 | A-0148 |

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 15 Subpart C - 15.249

| Test Procedure | Description                          | Modifications | Results |
|----------------|--------------------------------------|---------------|---------|
| 15.215(c)      | Occupied Bandwidth                   | NA            | NP      |
| 15.249(a)      | Field Strength of Fundamental        | NA            | Pass    |
| 15.249(a)      | Field Strength of Spurious Emissions | NA            | Pass    |
| 15.207         | AC Conducted Emissions               | NA            | NP      |

NA = Not Applicable

NP = CKC Laboratories was not contracted to perform test.

### Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

| Summary of Conditions                      |
|--|
| No modifications were made during testing. |
|  |

**Modifications listed above must be incorporated into all production units.**

### Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

| Summary of Conditions |
|-----------------------|
| None                  |
|                       |

## EQUIPMENT UNDER TEST (EUT)

During testing numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 2

***Equipment Tested:***

| Device         | Manufacturer | Model # | S/N |
|----------------|--------------|---------|-----|
| Water Endpoint | Ittron, Inc. | RIVAW   | 1   |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|--------|--------------|---------|-----|
| None   |              |         |     |

## General Product Information:

---

| Product Information                | Manufacturer-Provided Details                 |
|------------------------------------|---|
| Equipment Type:                    | Stand-Alone Equipment                         |
| Modulation Type(s):                | OOK   |
| Maximum Duty Cycle:                | See supplemental report.                      |
| Antenna Type(s) and Gain:          | See supplemental report.                      |
| Antenna Connection Type:           | Integral                                      |
| Nominal Input Voltage:             | Battery                                       |
| Firmware / Software used for Test: | CLITool.exe and manufacturer provided scripts |

## FCC Part 15 Subpart C

### 15.249(a) Field Strength of Fundamental

| Test Setup/Conditions |                    |                |              |
|-----------------------|--------------------|----------------|--------------|
| Test Location:        | Bothell Lab C3     | Test Engineer: | Randal Clark |
| Test Method:          | ANSI C63.10 (2013) | Test Date(s):  | 8/19/2016    |
| Configuration:        | 2                  |                |              |

| Environmental Conditions |    |                        |    |
|--------------------------|----|------------------------|----|
| Temperature (°C)         | 24 | Relative Humidity (%): | 36 |

See data sheets for test setup and test equipment.

### Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

| Test Data Summary – Radiated Field Strength Measurement |            |           |                        |                     |         |
|---|------------|-----------|------------------------|---------------------|---------|
| Frequency (MHz)   | Modulation | Ant. Type | Measured (dBuV/m @ 3m) | Limit (dBuV/m @ 3m) | Results |
| 908   | OOK        | Integral  | 90.9                   | ≤94                 | Pass    |



**Test Data**

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE Suite A • Bothell, WA 98021 • 800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**  
 Work Order #: **98804** Date: 8/20/2016  
 Test Type: **Maximized Emissions** Time: 00:33:12  
 Tested by: Randal Clark Sequence#: 34  
 Software: EMITest 5.03.02

***Equipment Tested:***

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

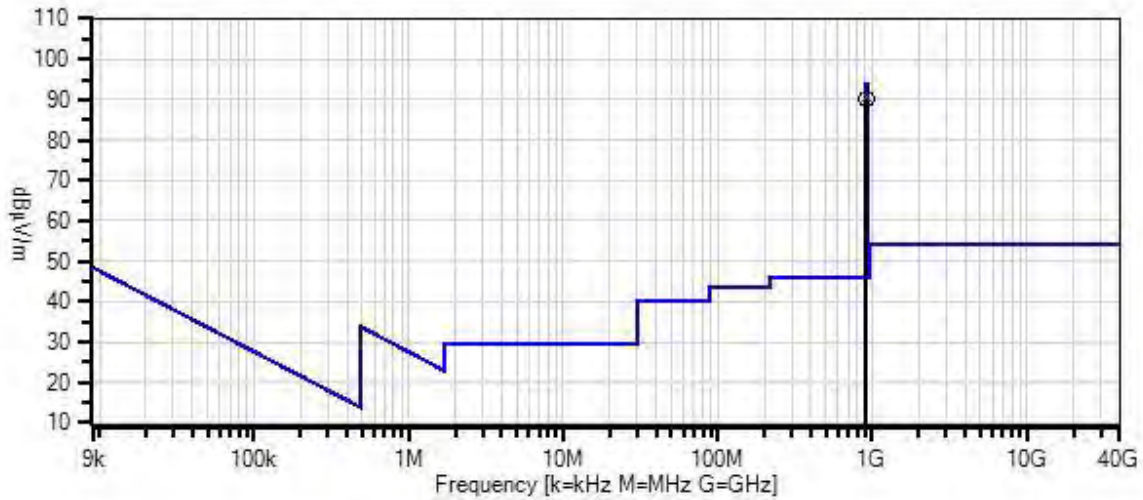
***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|--------|--------------|---------|-----|
|--------|--------------|---------|-----|

***Test Conditions / Notes:***

EUT is a transmitter operating on 908 MHz. EUT is battery operated, fresh batteries installed. EUT has IO ports with cables attached. Middle port is for remote antenna and must be left open for testing integral antenna. Equipment installed according to manufacturer specifications. Equipment is configured for low power operation on a single channel.  
 Test procedure: ANSI C63.10 (2013)  
 Frequency range investigated: 902-928 MHz  
 Transmitter Frequency: 908MHz  
 Temperature: 24°C  
 Relative Humidity: 36%

Itron, Inc. WO#: 98804 Sequence#: 34 Date: 8/20/2016  
 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert



- Readings
  - Peak Readings
  - × QP Readings
  - \* Average Readings
  - ▼ Ambient
- Software Version: 5.03.02
- 1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

**Test Equipment:**

| ID | Asset #  | Description       | Model    | Calibration Date | Cal Due Date |
|----|----------|-------------------|----------|------------------|--------------|
| T1 | AN02872  | Spectrum Analyzer | E4440A   | 11/18/2015       | 11/18/2017   |
| T2 | AN02307  | Preamp            | 8447D    | 2/15/2016        | 2/15/2018    |
| T3 | AN01994  | Biconilog Antenna | CBL6111C | 3/11/2016        | 3/11/2018    |
| T4 | ANP05505 | Attenuator        | NAT-6    | 3/31/2016        | 3/31/2018    |
| T5 | ANP05360 | Cable             | RG214    | 12/1/2014        | 12/1/2016    |
| T6 | ANP05963 | Cable             | RG-214   | 2/15/2016        | 2/15/2018    |
| T7 | ANP06540 | Cable             | Heliac   | 10/29/2015       | 10/29/2017   |

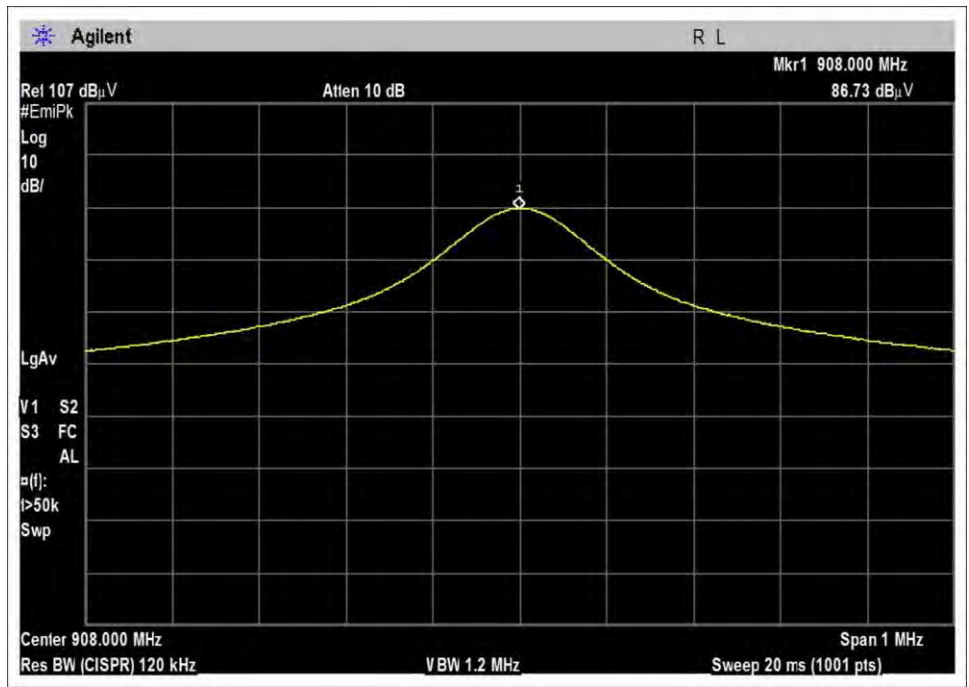
**Measurement Data:**

Reading listed by margin.

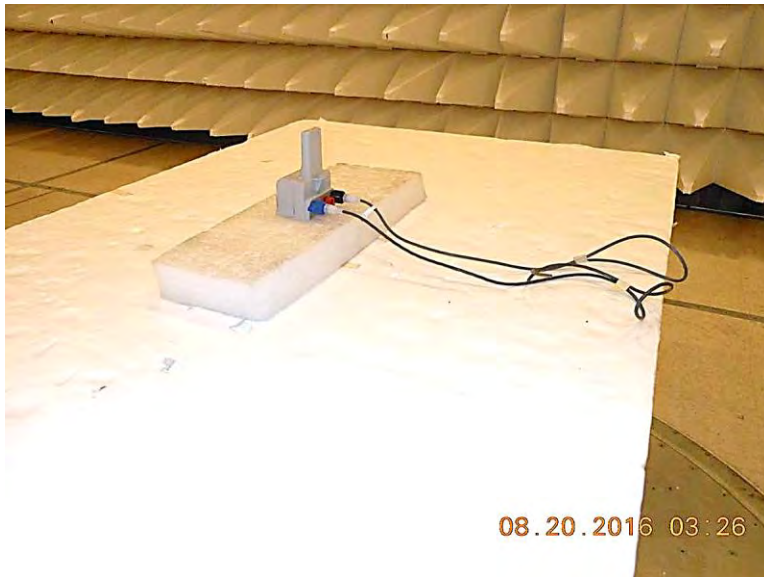
Test Distance: 3 Meters

| # | Freq     | Rdng       | T1   | T2    | T3    | T4   | Dist  | Corr         | Spec         | Margin | Polar |
|---|----------|------------|------|-------|-------|------|-------|--------------|--------------|--------|-------|
|   | MHz      | dB $\mu$ V | T5   | T6    | T7    |      | Table | dB $\mu$ V/m | dB $\mu$ V/m | dB     | Ant   |
| 1 | 908.000M | 83.2       | +0.0 | -27.4 | +24.2 | +6.2 | +0.0  | 90.9         | 94.0         | -3.1   | Vert  |
|   | QP       |            | +2.0 | +2.4  | +0.3  |      |       |              |              |        |       |
| ^ | 908.000M | 86.7       | +0.0 | -27.4 | +24.2 | +6.2 | +0.0  | 94.4         | 94.0         | +0.4   | Vert  |
|   |          |            | +2.0 | +2.4  | +0.3  |      |       |              |              |        |       |
| 3 | 908.000M | 82.5       | +0.0 | -27.4 | +24.2 | +6.2 | +0.0  | 90.2         | 94.0         | -3.8   | Horiz |
|   |          |            | +2.0 | +2.4  | +0.3  |      |       |              |              |        |       |

**Plot Data**



**Test Setup Photo(s)**



## 15.249(a) Radiated Emissions

### Test Setup/Conditions

|                |                    |                |              |
|----------------|--------------------|----------------|--------------|
| Test Location: | Bothell Lab C3     | Test Engineer: | Randal Clark |
| Test Method:   | ANSI C63.10 (2013) | Test Date(s):  | 8/19/2016    |
| Configuration: | 2                  |                |              |

### Environmental Conditions

|                  |    |                       |    |
|------------------|----|-----------------------|----|
| Temperature (°C) | 27 | Relative Humidity (%) | 33 |
| Temperature (°C) | 24 | Relative Humidity (%) | 36 |

See data sheets for test setup and test equipment.

### Test Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE Suite A • Bothell, WA 98021 • 800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**  
 Work Order #: **98804** Date: 8/20/2016  
 Test Type: **Maximized Emissions** Time: 00:46:44  
 Tested by: Randal Clark Sequence#: 36  
 Software: EMITest 5.03.02

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

#### Support Equipment:

| Device | Manufacturer | Model # | S/N |
|--------|--------------|---------|-----|
|--------|--------------|---------|-----|

#### Test Conditions / Notes:

EUT is a transmitter operating on 908 MHz. EUT is battery operated, fresh batteries installed. EUT has IO ports with cables attached. Middle port is for remote antenna and must be left open for testing integral antenna. Equipment installed according to manufacturer specifications. Equipment is configured for low power operation on a single channel.

Test procedure: ANSI C63.10 (2013)

Frequency range investigated: 9kHz - 10GHz

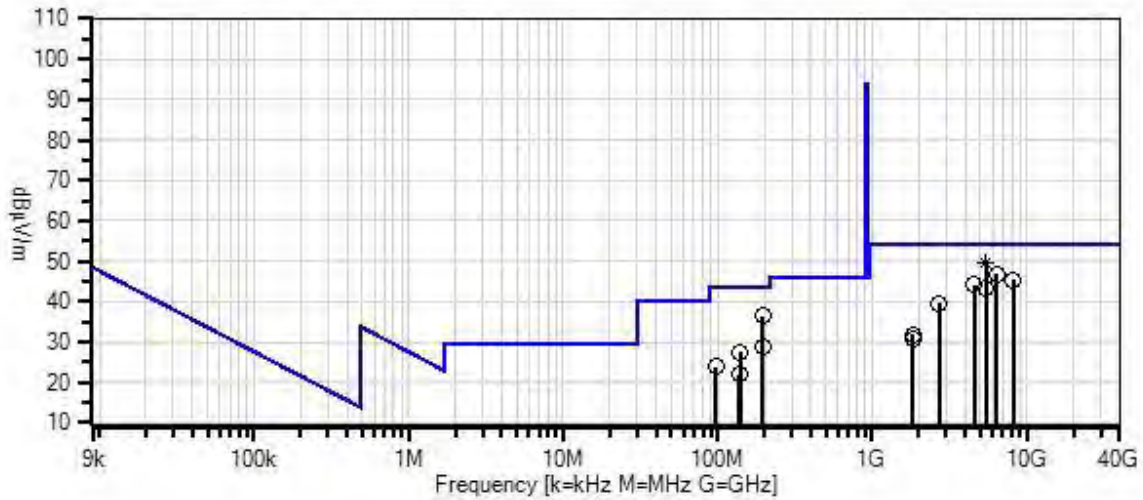
Transmitter Frequency: 908MHz

No emissions detected within 20dB of the limit at frequencies <80MHz. See band edge emissions data for emissions near transmit band.

Temperature: 27°C

Relative Humidity: 33%

Itron, Inc. WO#: 98804 Sequence#: 36 Date: 8/20/2016  
 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert





**Test Equipment:**

| ID  | Asset #  | Description                                | Model                    | Calibration Date | Cal Due Date |
|-----|----------|--|--------------------------|------------------|--------------|
| T1  | AN02872  | Spectrum Analyzer                          | E4440A                   | 11/18/2015       | 11/18/2017   |
| T2  | AN02307  | Preamp                                     | 8447D                    | 2/15/2016        | 2/15/2018    |
| T3  | AN03540  | Preamp                                     | 83017A                   | 4/30/2015        | 4/30/2017    |
| T4  | AN03170  | High Pass Filter                           | HM1155-11SS              | 12/17/2015       | 12/17/2017   |
| T5  | AN01467  | Horn Antenna-<br>ANSI C63.5<br>Calibration | 3115                     | 8/12/2015        | 8/12/2017    |
|     | AN00052  | Loop Antenna                               | 6502                     | 4/8/2016         | 4/8/2018     |
| T6  | AN01994  | Biconilog Antenna                          | CBL6111C                 | 3/11/2016        | 3/11/2018    |
| T7  | ANP05505 | Attenuator                                 | NAT-6                    | 3/31/2016        | 3/31/2018    |
| T8  | ANP05360 | Cable                                      | RG214                    | 12/1/2014        | 12/1/2016    |
| T9  | ANP05963 | Cable                                      | RG-214                   | 2/15/2016        | 2/15/2018    |
| T10 | ANP06540 | Cable                                      | Heliac                   | 10/29/2015       | 10/29/2017   |
| T11 | ANP05305 | Cable                                      | ETSI-50T                 | 2/15/2016        | 2/15/2018    |
| T12 | ANP06935 | Cable                                      | 32026-29801-<br>29801-18 | 3/11/2016        | 3/11/2018    |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq      | Rdng       | T1    | T2    | T3    | T4   | Dist  | Corr         | Spec         | Margin | Polar |
|---|-----------|------------|-------|-------|-------|------|-------|--------------|--------------|--------|-------|
|   | MHz       | dB $\mu$ V | T5    | T6    | T7    | T8   | Table | dB $\mu$ V/m | dB $\mu$ V/m | dB     | Ant   |
|   |           |            | T9    | T10   | T11   | T12  |       |              |              |        |       |
| 1 | 5448.000M | 44.5       | +0.0  | +0.0  | -34.2 | +0.3 | +0.0  | 49.8         | 54.0         | -4.2   | Horiz |
|   | Ave       |            | +33.1 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +1.0  | +4.5  | +0.6 |       |              |              |        |       |
| ^ | 5448.000M | 45.0       | +0.0  | +0.0  | -34.2 | +0.3 | +0.0  | 50.3         | 54.0         | -3.7   | Horiz |
|   |           |            | +33.1 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +1.0  | +4.5  | +0.6 |       |              |              |        |       |
| 3 | 195.580M  | 45.5       | +0.0  | -27.2 | +0.0  | +0.0 | +0.0  | 36.5         | 43.5         | -7.0   | Horiz |
|   |           |            | +0.0  | +9.6  | +6.2  | +0.8 |       |              |              |        |       |
|   |           |            | +1.4  | +0.2  | +0.0  | +0.0 |       |              |              |        |       |
| 4 | 6356.000M | 39.3       | +0.0  | +0.0  | -34.2 | +0.3 | +0.0  | 46.7         | 54.0         | -7.3   | Horiz |
|   |           |            | +34.7 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +1.3  | +4.7  | +0.6 |       |              |              |        |       |
| 5 | 8172.000M | 36.1       | +0.0  | +0.0  | -35.1 | +0.3 | +0.0  | 45.3         | 54.0         | -8.7   | Horiz |
|   |           |            | +36.7 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +1.3  | +5.3  | +0.7 |       |              |              |        |       |
| 6 | 4540.000M | 39.9       | +0.0  | +0.0  | -34.1 | +0.3 | +0.0  | 44.2         | 54.0         | -9.8   | Horiz |
|   |           |            | +32.5 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +0.9  | +4.2  | +0.5 |       |              |              |        |       |
| 7 | 5448.000M | 37.9       | +0.0  | +0.0  | -34.2 | +0.3 | +0.0  | 43.2         | 54.0         | -10.8  | Vert  |
|   |           |            | +33.1 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +1.0  | +4.5  | +0.6 |       |              |              |        |       |
| 8 | 2724.000M | 40.8       | +0.0  | +0.0  | -34.5 | +0.5 | +0.0  | 39.6         | 54.0         | -14.4  | Horiz |
|   |           |            | +28.7 | +0.0  | +0.0  | +0.0 |       |              |              |        |       |
|   |           |            | +0.0  | +0.7  | +3.0  | +0.4 |       |              |              |        |       |
| 9 | 195.580M  | 37.9       | +0.0  | -27.2 | +0.0  | +0.0 | +0.0  | 28.9         | 43.5         | -14.6  | Vert  |
|   |           |            | +0.0  | +9.6  | +6.2  | +0.8 |       |              |              |        |       |
|   |           |            | +1.4  | +0.2  | +0.0  | +0.0 |       |              |              |        |       |

|    |           |      |       |       |       |      |      |      |      |       |       |
|----|-----------|------|-------|-------|-------|------|------|------|------|-------|-------|
| 10 | 139.310M  | 34.8 | +0.0  | -27.5 | +0.0  | +0.0 | +0.0 | 27.4 | 43.5 | -16.1 | Horiz |
|    |           |      | +0.0  | +11.9 | +6.1  | +0.7 |      |      |      |       |       |
|    |           |      | +1.3  | +0.1  | +0.0  | +0.0 |      |      |      |       |       |
| 11 | 97.280M   | 33.8 | +0.0  | -27.7 | +0.0  | +0.0 | +0.0 | 23.9 | 43.5 | -19.6 | Horiz |
|    |           |      | +0.0  | +9.9  | +6.1  | +0.6 |      |      |      |       |       |
|    |           |      | +1.1  | +0.1  | +0.0  | +0.0 |      |      |      |       |       |
| 12 | 137.880M  | 29.2 | +0.0  | -27.5 | +0.0  | +0.0 | +0.0 | 21.8 | 43.5 | -21.7 | Vert  |
|    |           |      | +0.0  | +11.9 | +6.1  | +0.7 |      |      |      |       |       |
|    |           |      | +1.3  | +0.1  | +0.0  | +0.0 |      |      |      |       |       |
| 13 | 1816.000M | 36.3 | +0.0  | +0.0  | -35.1 | +0.4 | +0.0 | 31.8 | 54.0 | -22.2 | Horiz |
|    |           |      | +26.9 | +0.0  | +0.0  | +0.0 |      |      |      |       |       |
|    |           |      | +0.0  | +0.5  | +2.5  | +0.3 |      |      |      |       |       |
| 14 | 1816.000M | 35.5 | +0.0  | +0.0  | -35.1 | +0.4 | +0.0 | 31.0 | 54.0 | -23.0 | Vert  |
|    |           |      | +26.9 | +0.0  | +0.0  | +0.0 |      |      |      |       |       |
|    |           |      | +0.0  | +0.5  | +2.5  | +0.3 |      |      |      |       |       |



**Band Edge**

**Band Edge Summary**

| Frequency (MHz) | Modulation | Ant. Type | Field Strength (dBuV/m @3m) | Limit (dBuV/m @3m) | Results |
|-----------------|------------|-----------|-----------------------------|--------------------|---------|
| 902             | OOK        | Integral  | 40.8(QP)                    | <46                | Pass    |
| 928             | OOK        | Integral  | <36                         | <46                | Pass    |

**Test Data**

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE Suite A • Bothell, WA 98021 • 800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**  
 Work Order #: **98804** Date: 8/20/2016  
 Test Type: **Maximized Emissions** Time: 00:38:54  
 Tested by: Randal Clark Sequence#: 35  
 Software: EMITest 5.03.02

**Equipment Tested:**

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 2 |              |         |     |

**Support Equipment:**

| Device | Manufacturer | Model # | S/N |
|--------|--------------|---------|-----|
|--------|--------------|---------|-----|

**Test Conditions / Notes:**

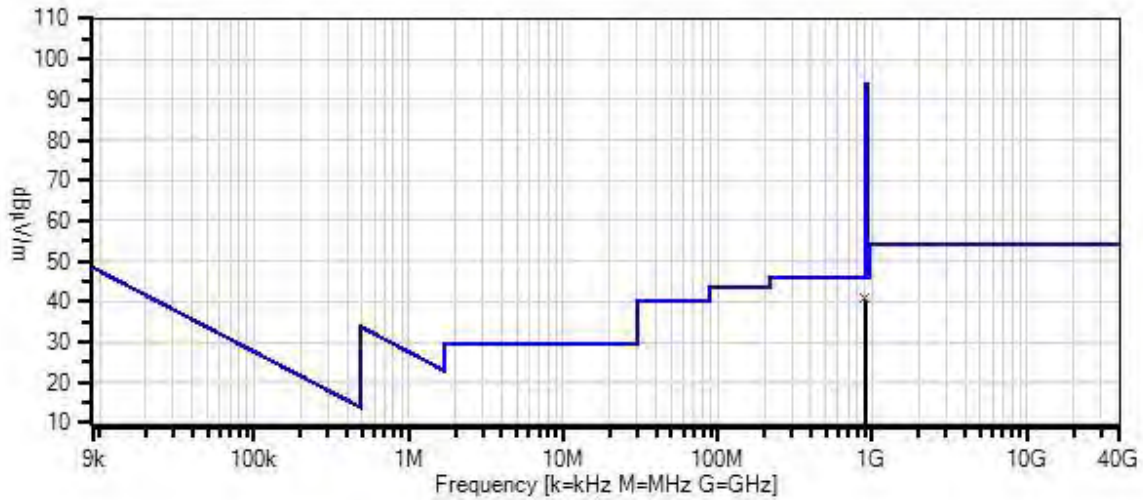
EUT is a transmitter operating on 908 MHz. EUT is battery operated, fresh batteries installed. EUT has IO ports with cables attached. Middle port is for remote antenna and must be left open for testing integral antenna. Equipment installed according to manufacturer specifications. Equipment is configured for low power operation on a single channel.

Test procedure: ANSI C63.10 (2013)

Frequency range investigated: 902-928 MHz  
 Transmitter Frequency: 908MHz

Temperature: 24°C  
 Relative Humidity: 36%

Itron, Inc. WO#: 98804 Sequence#: 35 Date: 8/20/2016  
 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert



**Test Equipment:**

| ID | Asset #  | Description       | Model    | Calibration Date | Cal Due Date |
|----|----------|-------------------|----------|------------------|--------------|
|    | AN02872  | Spectrum Analyzer | E4440A   | 11/18/2015       | 11/18/2017   |
| T1 | AN02307  | Preamp            | 8447D    | 2/15/2016        | 2/15/2018    |
| T2 | AN01994  | Biconilog Antenna | CBL6111C | 3/11/2016        | 3/11/2018    |
| T3 | ANP05505 | Attenuator        | NAT-6    | 3/31/2016        | 3/31/2018    |
| T4 | ANP05360 | Cable             | RG214    | 12/1/2014        | 12/1/2016    |
| T5 | ANP05963 | Cable             | RG-214   | 2/15/2016        | 2/15/2018    |
| T6 | ANP06540 | Cable             | Heliac   | 10/29/2015       | 10/29/2017   |

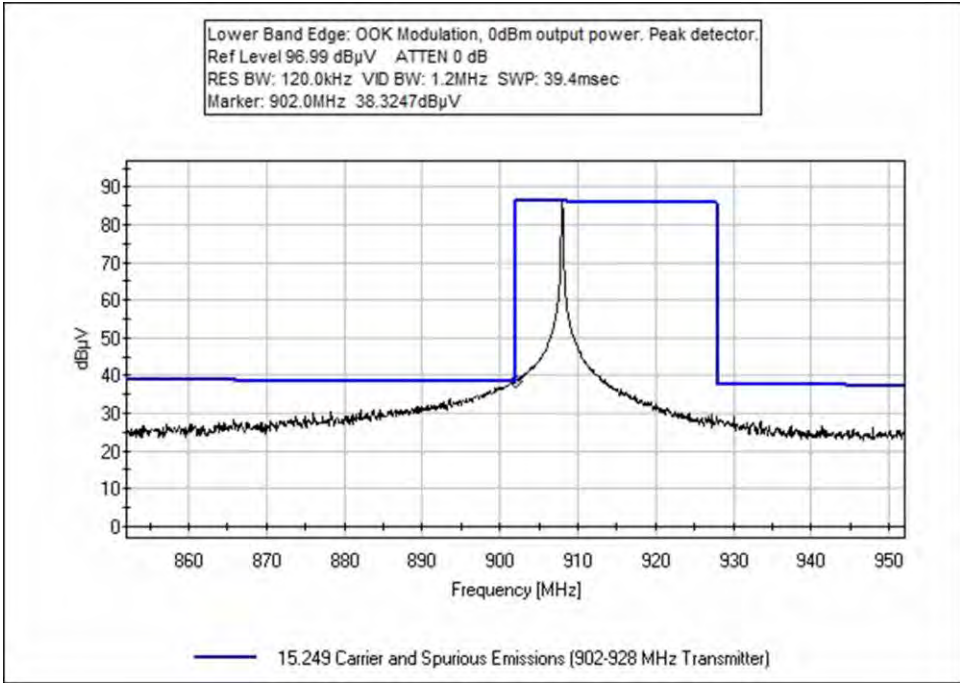
**Measurement Data:**

Reading listed by margin.

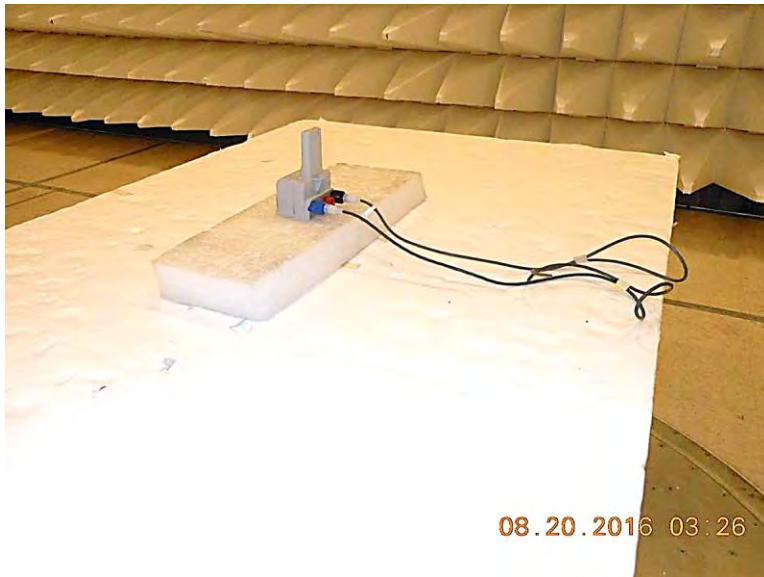
Test Distance: 3 Meters

| # | Freq     | Rdng       | T1       | T2       | T3   | T4   | Dist  | Corr         | Spec         | Margin | Polar |
|---|----------|------------|----------|----------|------|------|-------|--------------|--------------|--------|-------|
|   | MHz      | dB $\mu$ V | T5<br>dB | T6<br>dB | dB   | dB   | Table | dB $\mu$ V/m | dB $\mu$ V/m | dB     | Ant   |
| 1 | 902.000M | 33.2       | -27.4    | +24.1    | +6.2 | +2.0 | +0.0  | 40.8         | 46.0         | -5.2   | Vert  |
|   | QP       |            | +2.4     | +0.3     |      |      |       |              |              |        |       |
| ^ | 902.000M | 38.2       | -27.4    | +24.1    | +6.2 | +2.0 | +0.0  | 45.8         | 46.0         | -0.2   | Vert  |
|   |          |            | +2.4     | +0.3     |      |      |       |              |              |        |       |

**Band Edge Plots**



**Test Setup Photo(s)**



## SUPPLEMENTAL INFORMATION

### Measurement Uncertainty

| Uncertainty Value | Parameter                 |
|-------------------|---------------------------|
| 4.73 dB           | Radiated Emissions        |
| 3.34 dB           | Mains Conducted Emissions |
| 3.30 dB           | Disturbance Power         |

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

### Emissions Test Details

**TESTING PARAMETERS**

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

**CORRECTION FACTORS**

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBμV/m, the spectrum analyzer reading in dBμV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

| SAMPLE CALCULATIONS |                     |          |
|---------------------|---------------------|----------|
|                     | Meter reading       | (dBμV)   |
| +                   | Antenna Factor      | (dB/m)   |
| +                   | Cable Loss          | (dB)     |
| -                   | Distance Correction | (dB)     |
| -                   | Preamplifier Gain   | (dB)     |
| =                   | Corrected Reading   | (dBμV/m) |

**TEST INSTRUMENTATION AND ANALYZER SETTINGS**

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

| <b>MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE</b> |                            |                         |                          |
|---|----------------------------|-------------------------|--------------------------|
| <b>TEST</b>   | <b>BEGINNING FREQUENCY</b> | <b>ENDING FREQUENCY</b> | <b>BANDWIDTH SETTING</b> |
| CONDUCTED EMISSIONS   | 150 kHz                    | 30 MHz                  | 9 kHz                    |
| RADIATED EMISSIONS  | 9 kHz                      | 150 kHz                 | 200 Hz                   |
| RADIATED EMISSIONS  | 150 kHz                    | 30 MHz                  | 9 kHz                    |
| RADIATED EMISSIONS  | 30 MHz                     | 1000 MHz                | 120 kHz                  |
| RADIATED EMISSIONS  | 1000 MHz                   | >1 GHz                  | 1 MHz                    |

**SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS**

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

**Peak**

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

**Quasi-Peak**

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

**Average**

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point the measuring device is set into the linear mode and the scan time is reduced.