# Itron, Inc.

**TEST REPORT FOR**

**ORRNC**
**Model: RN-EGM**

**Tested to The Following Standards:**

**FCC Part 15 Subpart C Section(s)**

**15.207 & 15.247**
**(DTS 902-928MHz)**

**Report No.: 104631-4**

**Date of issue: February 10, 2021**

**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 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.**

**Test Certificate # 803.01**

## TABLE OF CONTENTS

# ADMINISTRATIVE INFORMATION

## Test Report Information

**REPORT PREPARED FOR:**

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

Representative: Jay Holcomb
Customer Reference Number: 224127

**REPORT PREPARED BY:**

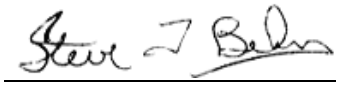
Kim Romero
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 104631

**DATE OF EQUIPMENT RECEIPT:** January 5, 2021
**DATE(S) OF TESTING:** January 5 – 8 and 18, 2021

## Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, 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.
Canyon Park
22116 23rd Drive S.E., Suite A
Bothell, WA 98021

# Software Versions

| CKC Laboratories Proprietary Software | Version |
|---|---|
| EMITest Emissions | 5.03.19 |

# Site Registration & Accreditation Information

| Location | *NIST CB # | FCC | Canada | Japan |
|---|---|---|---|---|
| Canyon Park, Bothell, WA | US0103 | US1024 | 3082C | A-0136 |
| Brea, CA | US0103 | US1024 | 3082D | A-0136 |
| Fremont, CA | US0103 | US1024 | 3082B | A-0136 |
| Mariposa, CA | US0103 | US1024 | 3082A | A-0136 |

*CKC's list of NIST designated countries can be found at: https://standards.gov/cabs/designations.html

# SUMMARY OF RESULTS

## Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS 902-928MHz)

| Test Procedure | Description | Modifications | Results |
|---|---|---|---|
| 15.247(a)(2) | 6dB Bandwidth | NA | Pass |
| 15.247(b)(3) | Output Power | NA | Pass |
| 15.247(e) | Power Spectral Density | NA | Pass |
| 15.247(d) | RF Conducted Emissions & Band Edge | NA | Pass |
| 15.247(d) | Radiated Emissions & Band Edge | NA | Pass |
| 15.207 | AC Conducted Emissions | NA | Pass |

NA = Not Applicable

| ISO/IEC 17025 Decision Rule |
|---|
| The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing. |
| |

# 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 1

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| ORRNC | Itron | RN-EGM | 335579339 |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Antenna | PCTEL | BOA9022NM-ITR | 181489 |
| Laptop | Dell | Latitude E6400 | DQ8W1M1 |

## General Product Information:

| Product Information | Manufacturer-Provided Details |
|---|---|
| Equipment Type: | Stand-Alone Equipment |
| Type of Wideband System: | DTS |
| Operating Frequency Range: | 903.2-926 MHz |
| Modulation Type(s): | OFDM |
| Maximum Duty Cycle: | Assume 100% as worst case |
| Number of TX Chains: | 1 |
| Antenna Type(s) and Gain: | Omnidirectional / 2.6dBi |
| Beamforming Type: | NA |
| Antenna Connection Type: | External Connector (Professional Installation) |
| Nominal Input Voltage: | 115VAC Nominal (85-264VAC supported) |
| Firmware / Software used for Test: | BrtLoader v4.8.5.4<br>Certification GUI vUpdate2<br>Test FW11.0.51.1 GEN5EGM_REL1_BETA |

## EUT and Accessory Photo(s)

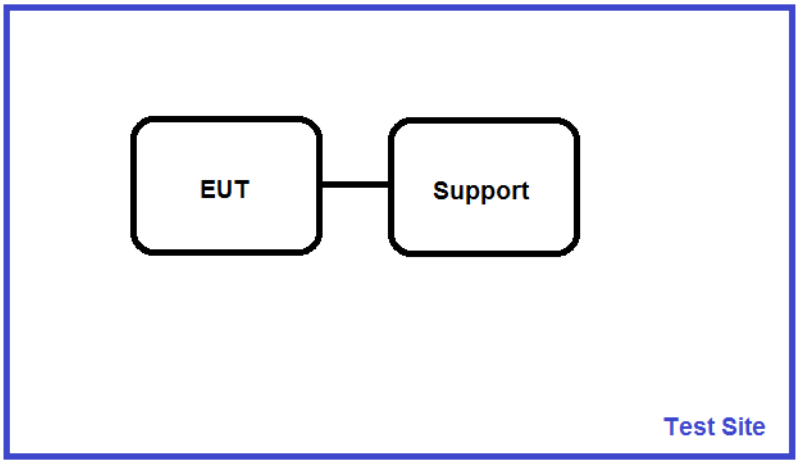

EUT


Accessory

## Support Equipment Photo(s)

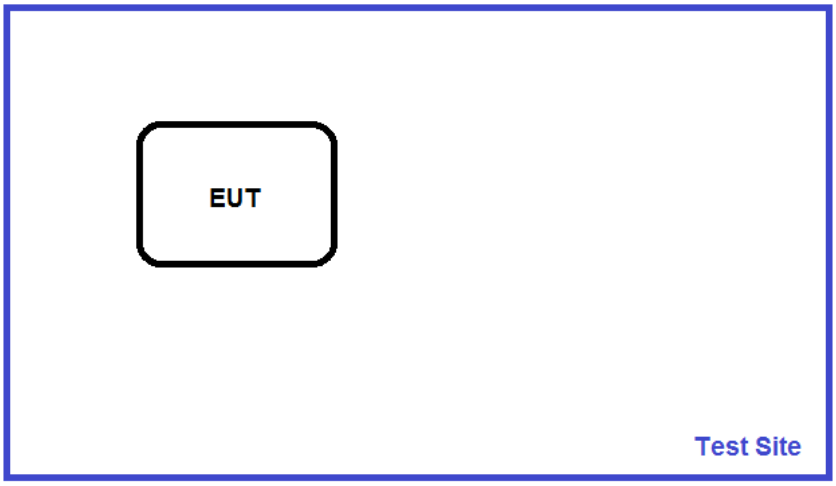
## Block Diagram of Test Setup(s)

### Test Setup Block Diagram




Conducted

### Test Setup Block Diagram




Radiated

# FCC Part 15 Subpart C

## 15.247(a)(2) 6dB Bandwidth

| Test Setup/Conditions | | | |
|---|---|---|---|
| Test Location: | Bothell Lab Bench | Test Engineer: | M. Harrison |
| Test Method: | ANSI C63.10 (2013), KDB 558074 v05r02:04/02/2019 | Test Date(s): | 1/5/2021 |
| Configuration: | 1 | | |
| Test Setup: | The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting at its rated output power. | | |

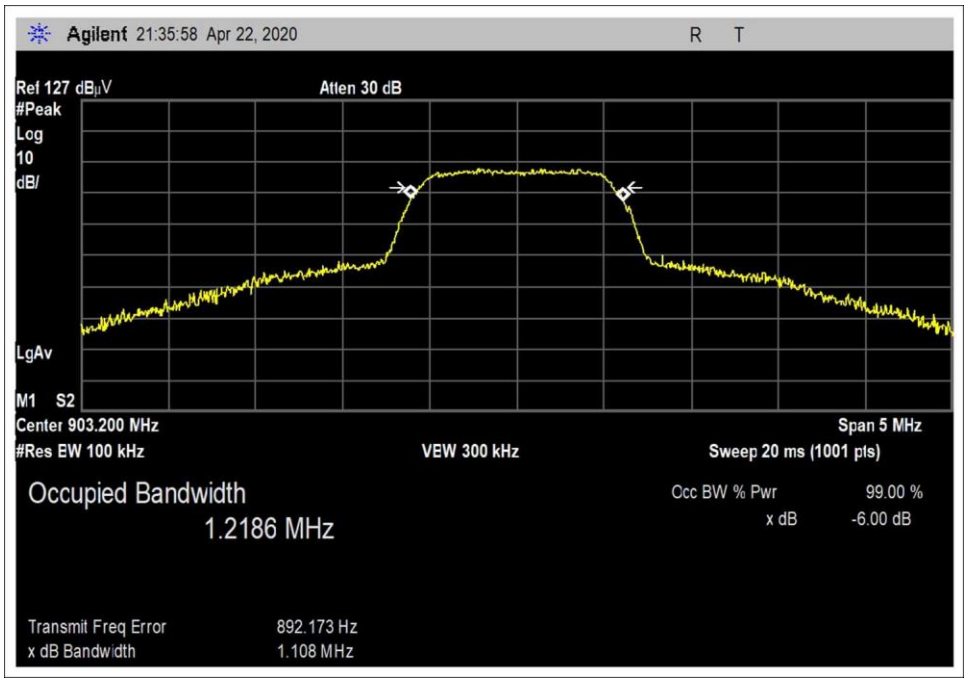
| Environmental Conditions | | | |
|---|---|---|---|
| Temperature (ºC) | 22 | Relative Humidity (%): | 41 |

| Test Equipment | | | | | |
|---|---|---|---|---|---|
| **Asset#** | **Description** | **Manufacturer** | **Model** | **Cal Date** | **Cal Due** |
| 02872 | Spectrum Analyzer | Agilent | E4440A | 11/18/2019 | 11/18/2021 |
| P05748 | Attenuator | Pasternack | PE7004-20 | 3/4/2020 | 3/4/2022 |

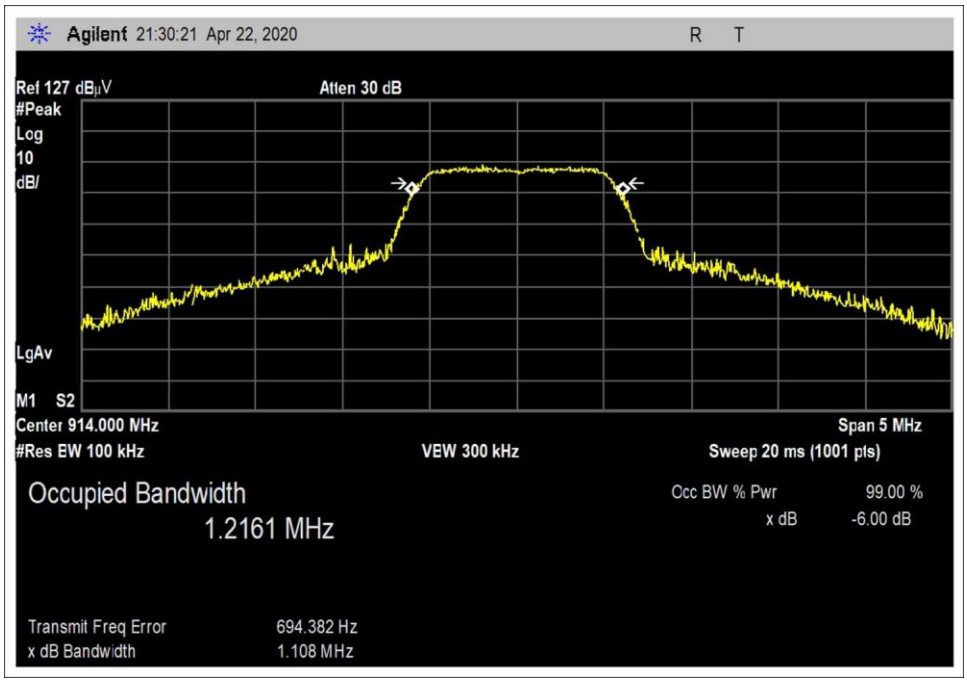
| Test Data Summary | | | | | |
|---|---|---|---|---|---|
| **Frequency (MHz)** | **Antenna Port** | **Modulation** | **Measured (kHz)** | **Limit (kHz)** | **Results** |
| 903.2 | 1 | OFDM 1200kbps | 1108 | ≥500 | Pass |
| 914 | 1 | OFDM 1200kbps | 1108 | ≥500 | Pass |
| 926 | 1 | OFDM 1200kbps | 1118 | ≥500 | Pass |
| 903.2 | 1 | OFDM 2400kbps | 1104 | ≥500 | Pass |
| 914 | 1 | OFDM 2400kbps | 1113 | ≥500 | Pass |
| 926 | 1 | OFDM 2400kbps | 1110 | ≥500 | Pass |

## Plot(s)

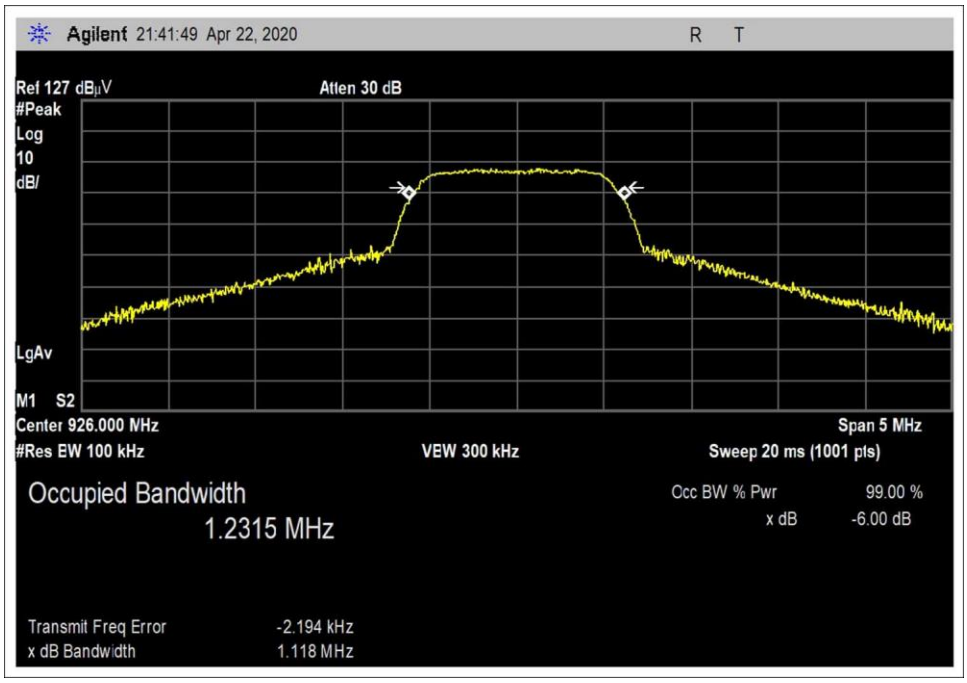
**Note:** At the time of testing, the date stamp on the plots below was set on a default setting and should read 1/5/2021.



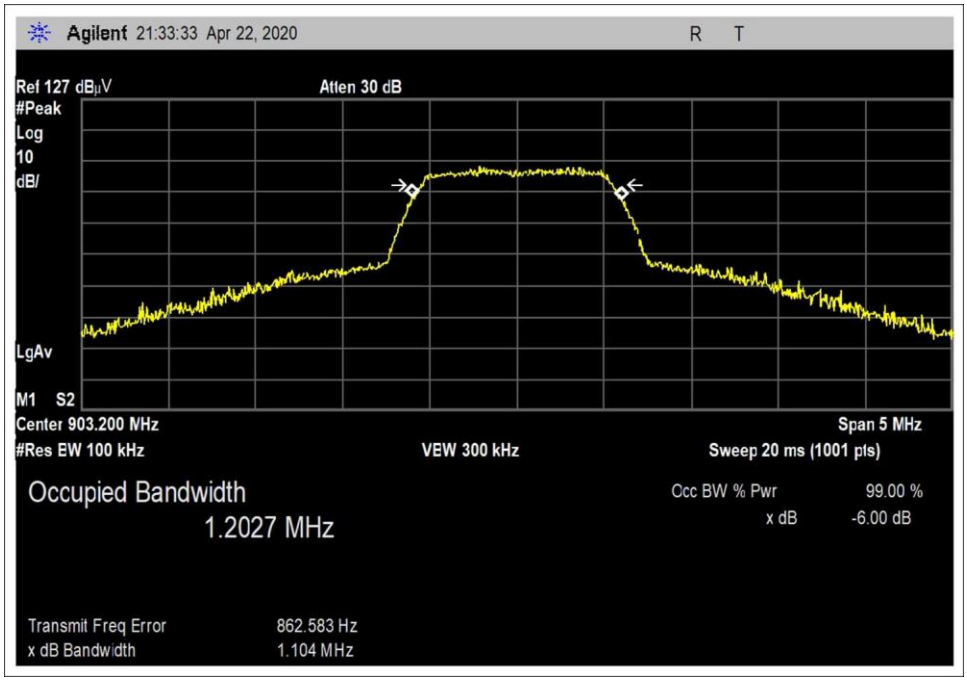

1200kbps, Low Channel



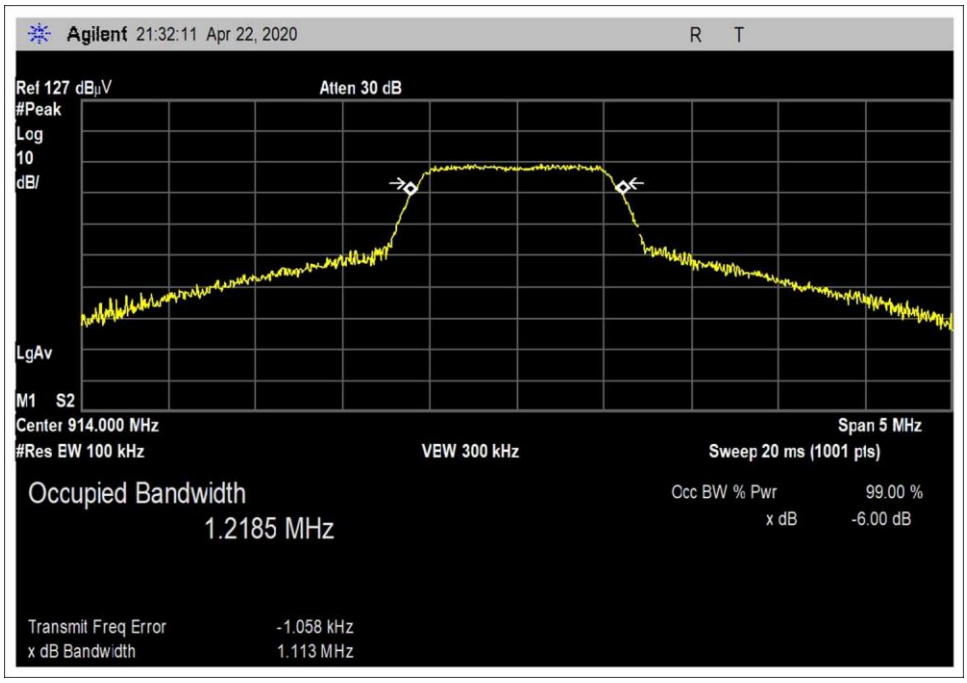

1200kbps, Middle Channel



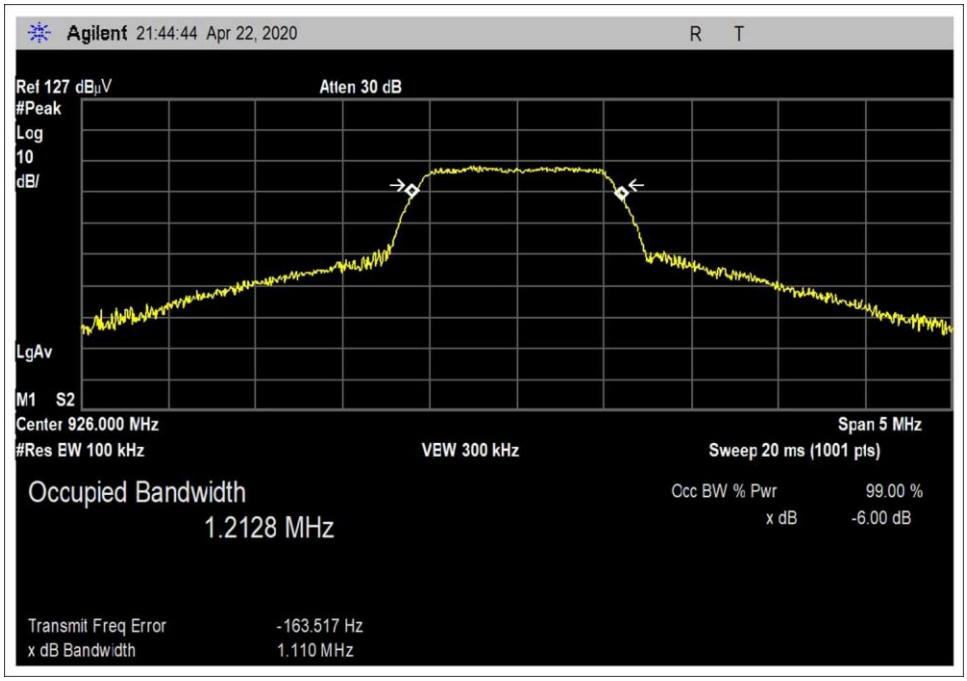

1200kbps, High Channel




2400kbps, Low Channel




2400kbps, Middle Channel




2400kbps, High Channel

## Test Setup Photo(s)

# 15.247(b)(3) Output Power

| Test Setup/Conditions | | | |
|---|---|---|---|
| Test Location: | Bothell Lab Bench | Test Engineer: | M. Harrison |
| Test Method: | ANSI C63.10 (2013), KDB 558074 v05r02:04/02/2019 | Test Date(s): | 1/5/2021 |
| Configuration: | 1 | | |
| Test Setup: | The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting at its rated output power. | | |

| Environmental Conditions | | | |
|---|---|---|---|
| Temperature (ºC) | 22 | Relative Humidity (%): | 41 |

| Test Equipment | | | | | |
|---|---|---|---|---|---|
| **Asset#** | **Description** | **Manufacturer** | **Model** | **Cal Date** | **Cal Due** |
| 02872 | Spectrum Analyzer | Agilent | E4440A | 11/18/2019 | 11/18/2021 |
| P05748 | Attenuator | Pasternack | PE7004-20 | 3/4/2020 | 3/4/2022 |

| Test Data Summary - Voltage Variations | | | | | |
|---|---|---|---|---|---|
| **Frequency (MHz)** | **Modulation / Ant Port** | **$V_{Minimum}$ (dBm)** | **$V_{Nominal}$ (dBm)** | **$V_{Maximum}$ (dBm)** | **Max Deviation from $V_{Nominal}$ (dB)** |
| 903.2 | OFDM / 1 | 28.7 | 28.8 | 28.8 | 0.1 |
| 914 | OFDM / 1 | 28.4 | 28.4 | 28.4 | 0.1 |
| 926 | OFDM / 1 | 27.5 | 27.5 | 27.5 | 0 |

Note: Test performed using operational mode with the highest output power, representing worst case.

***Parameter Definitions:***

Measurements performed at input voltage Vnominal ± 15%.

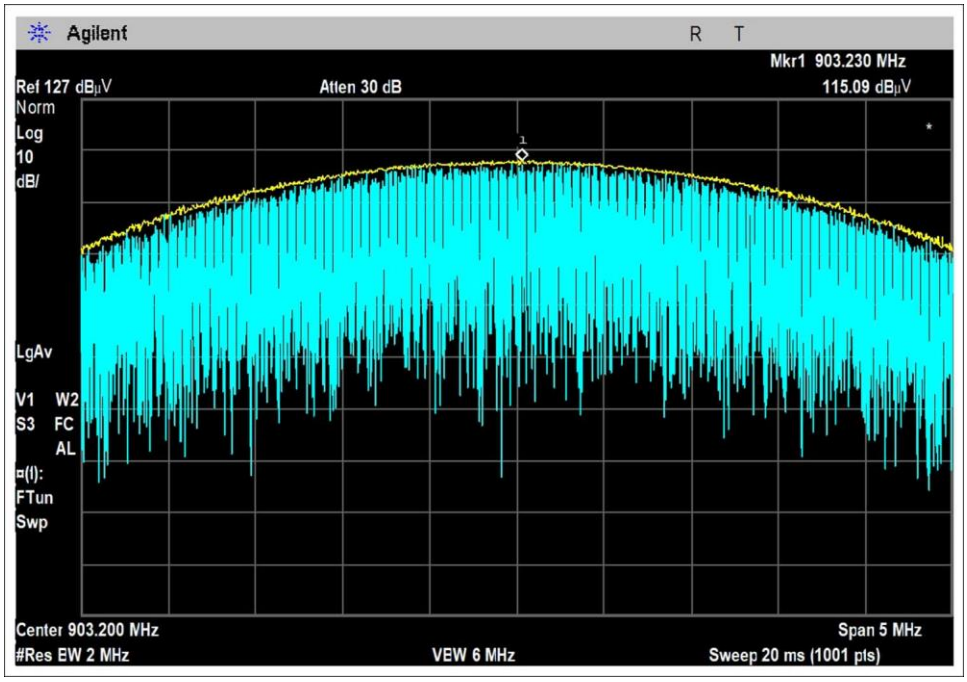
| Parameter | Value |
|---|---|
| $V_{Nominal}$: | 115 |
| $V_{Minimum}$: | 98 |
| $V_{Maximum}$: | 132 |

| Test Data Summary - RF Conducted Measurement | | | | | |
|---|---|---|---|---|---|
| Measurement Option: RBW > DTS Bandwidth | | | | | |
| **Frequency (MHz)** | **Modulation** | **Ant. Type / Gain (dBi)** | **Measured (dBm)** | **Limit (dBm)** | **Results** |
| 903.2 | OFDM | Omnidirectional / 2.6dBi | 28.8 | ≤ 30 | Pass |
| 914 | OFDM | Omnidirectional / 2.6dBi | 28.4 | ≤ 30 | Pass |
| 926 | OFDM | Omnidirectional / 2.6dBi | 27.5 | ≤ 30 | Pass |

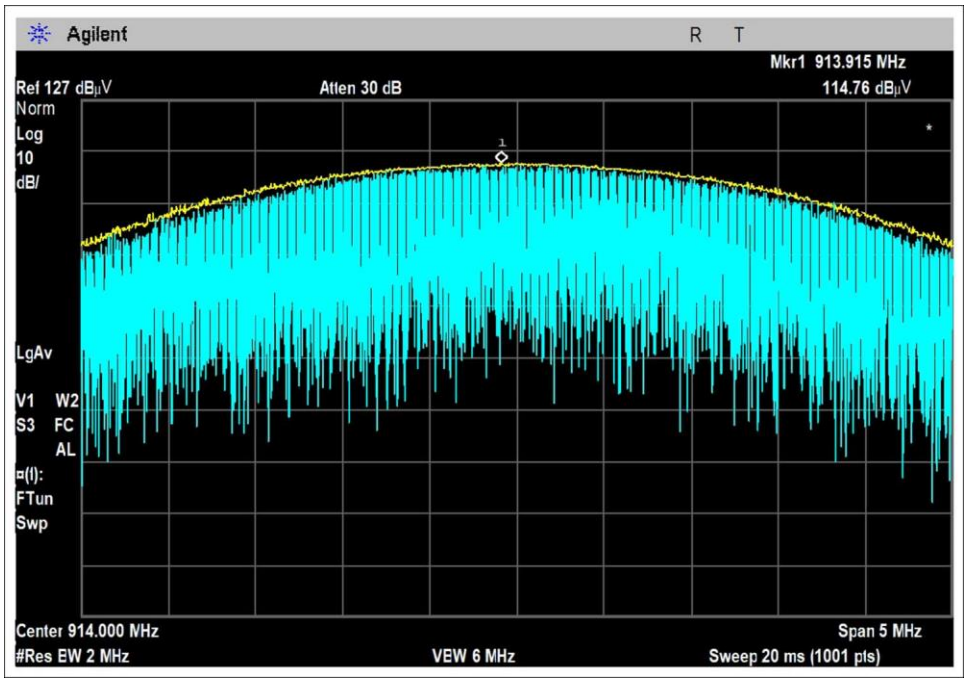
For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

$Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$

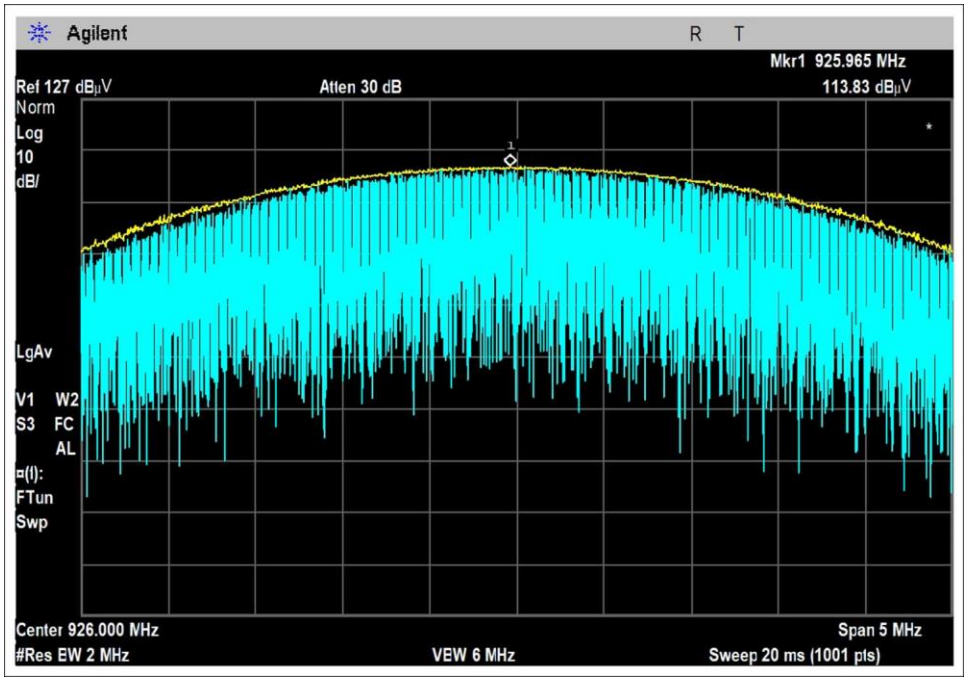
## Plot(s)



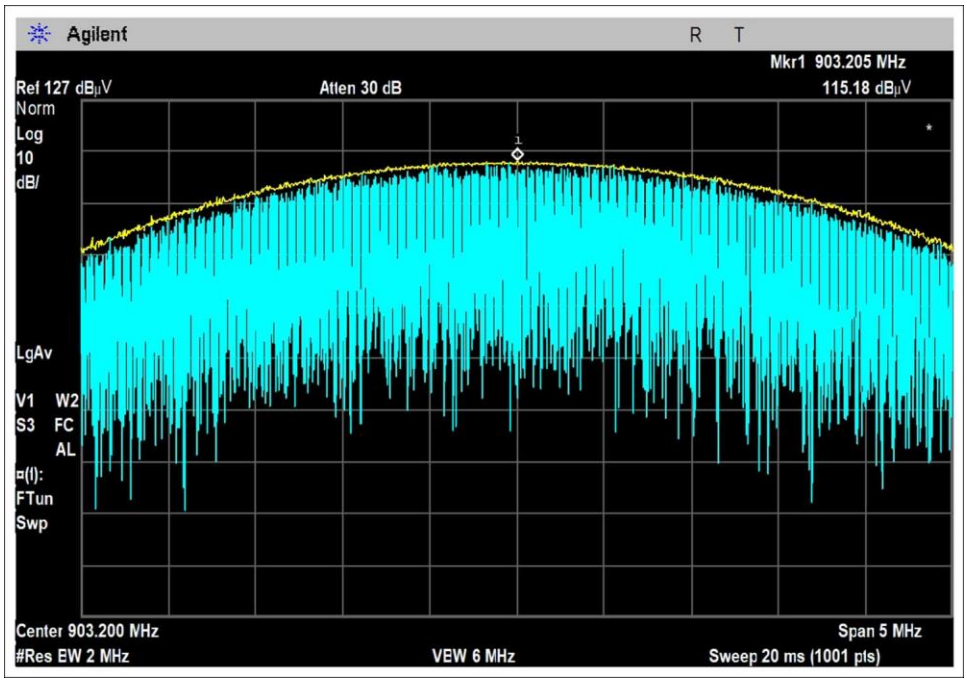

1.2MHz, Low Channel



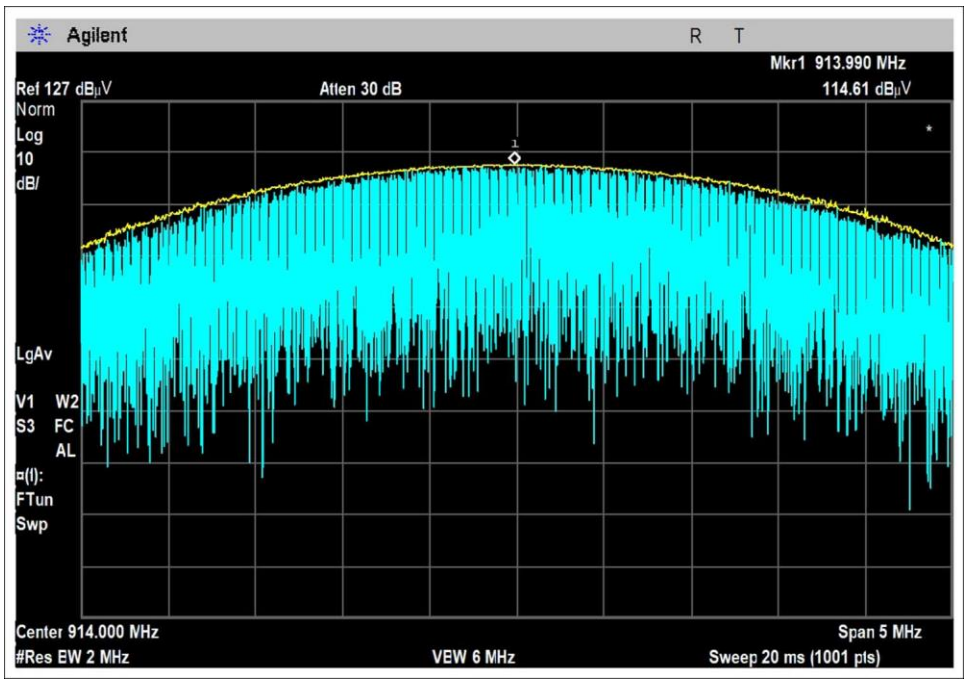

1.2MHz, Middle Channel



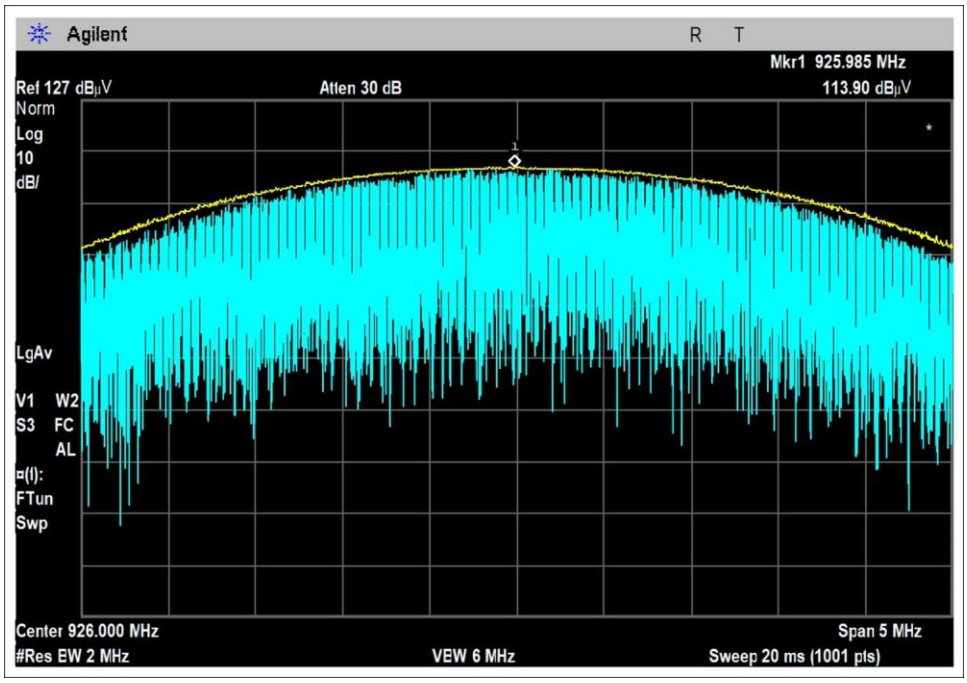

1.2MHz, High Channel




2.4MHz, Low Channel




2.4MHz, Middle Channel




2.4MHz, High Channel

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.247(b) Power Output (902-928 MHz DTS)** | | |
| Work Order #: | **104631** | Date: | 1/18/2021 |
| Test Type: | **Conducted Emissions** | Time: | 13:24:23 |
| Tested By: | Matt Harrison | Sequence#: | 10 |
| Software: | EMITest 5.03.19 | | 120V 60Hz |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

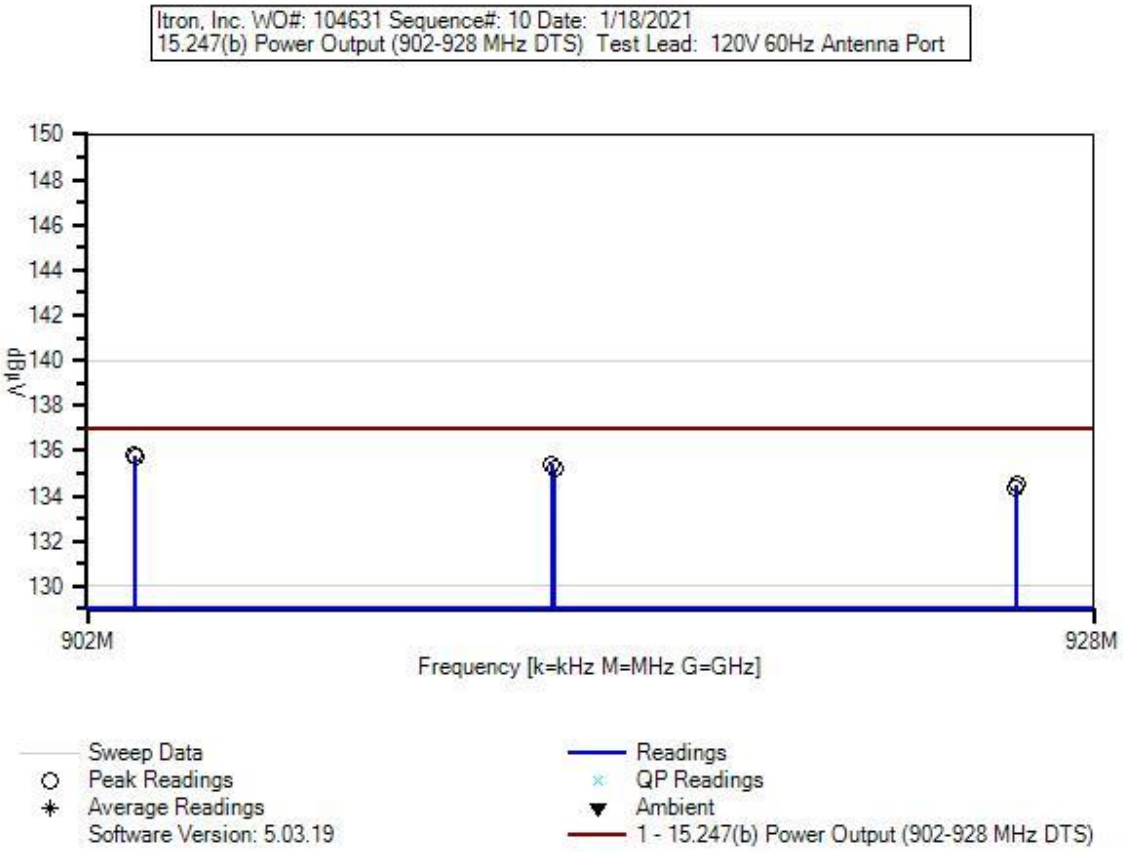
***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 902-928MHz

Test Setup:
The equipment under test (EUT) is setup for direct antenna port measurements. The EUT is transmitting continuous wave at its rated output power.




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP06007 | Cable | Heliax | 1/20/2020 | 1/20/2022 |
| T2 | ANP07229 | Attenuator | PE7004-20 | 10/2/2019 | 10/2/2021 |
| T3 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |

***Measurement Data:*** Reading listed by margin. Test Lead: Antenna Port

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | dB | Dist Table | Corr dBµV | Spec dBµV | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 903.205M | 115.2 | +0.5 | +20.1 | +0.0 | | +0.0 | 135.8 | 137.0 2.4M | -1.2 | Anten |
| 2 | 903.230M | 115.1 | +0.5 | +20.1 | +0.0 | | +0.0 | 135.7 | 137.0 1.2M | -1.3 | Anten |
| 3 | 913.915M | 114.8 | +0.5 | +20.1 | +0.0 | | +0.0 | 135.4 | 137.0 1.2M | -1.6 | Anten |
| 4 | 913.990M | 114.6 | +0.5 | +20.1 | +0.0 | | +0.0 | 135.2 | 137.0 2.4M | -1.8 | Anten |
| 5 | 925.985M | 113.9 | +0.5 | +20.1 | +0.0 | | +0.0 | 134.5 | 137.0 2.4M | -2.5 | Anten |
| 6 | 925.965M | 113.8 | +0.5 | +20.1 | +0.0 | | +0.0 | 134.4 | 137.0 1.2M | -2.6 | Anten |

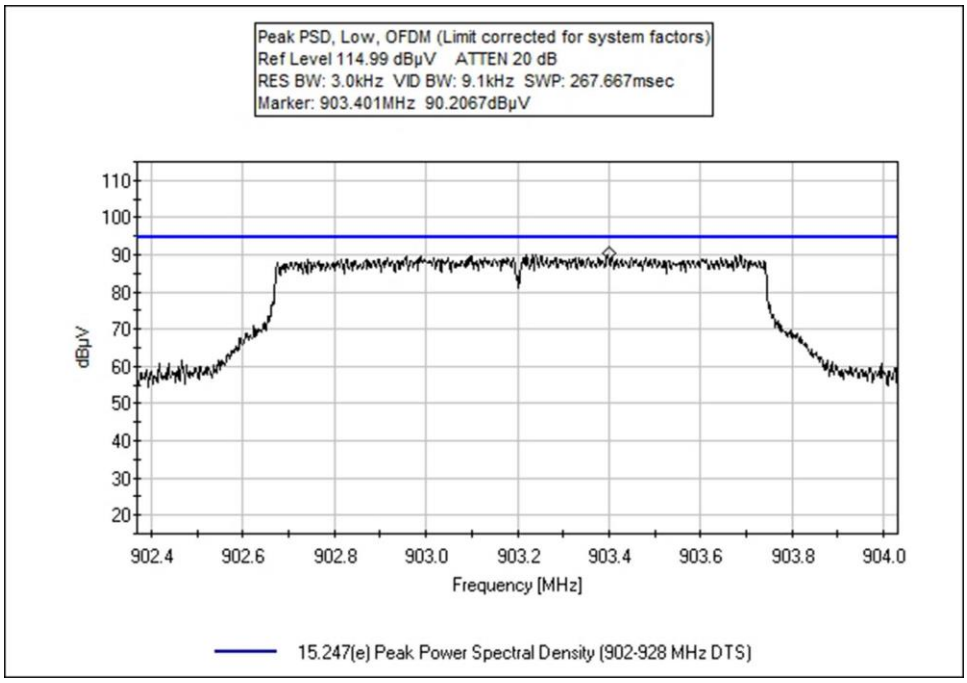
## Test Setup Photo(s)

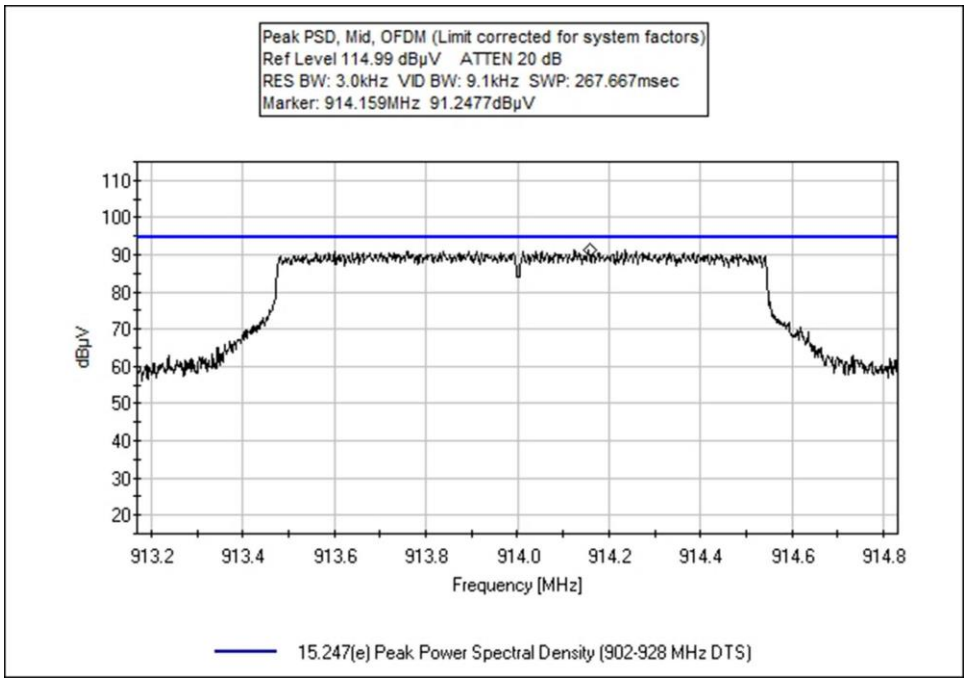
# 15.247(e) Power Spectral Density

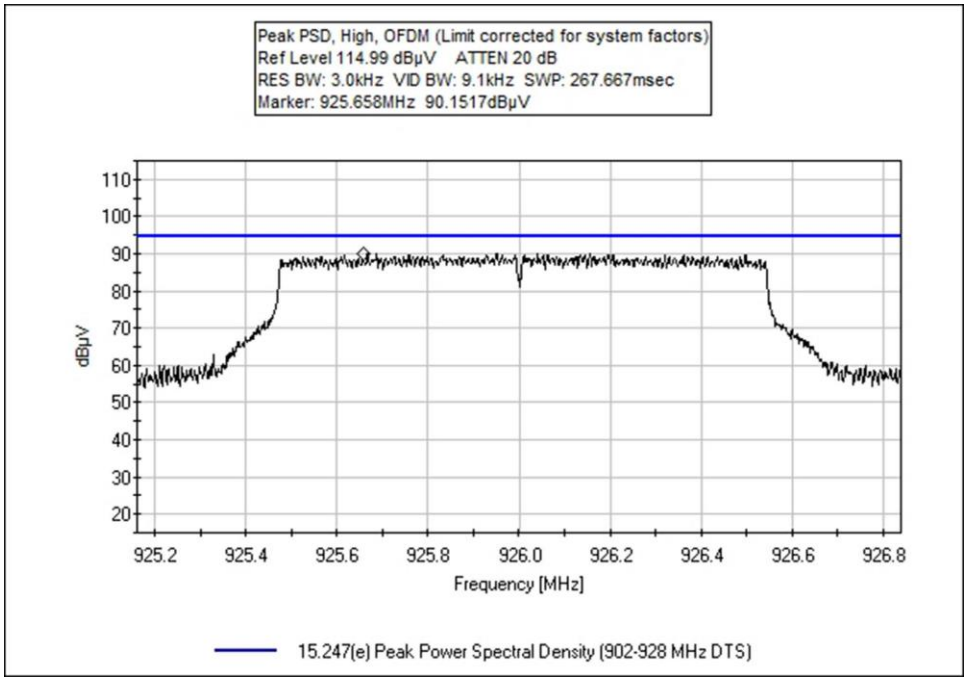
| Test Data Summary - RF Conducted Measurement | | | | |
|---|---|---|---|---|
| Measurement Method: PKPSD | | | | |
| **Frequency (MHz)** | **Modulation** | **Measured (dBm/3kHz)** | **Limit (dBm/3kHz)** | **Results** |
| 903.2 | OFDM | 3.7 | ≤8 | Pass |
| 914 | OFDM | 4.7 | ≤8 | Pass |
| 926 | OFDM | 3.7 | ≤8 | Pass |

Note: Worst case presented.

## Plot(s)




Peak PSD, Mid, OFDM (Limit corrected for system factors)
Ref Level 114.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 267.667msec
Marker: 914.159MHz 91.2477dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
913.2
913.4
913.6
913.8
914.0
914.2
914.4
914.6
914.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)


Peak PSD, High, OFDM (Limit corrected for system factors)
Ref Level 114.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 267.667msec
Marker: 925.658MHz 90.1517dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
925.2
925.4
925.6
925.8
926.0
926.2
926.4
926.6
926.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.247(e) Peak Power Spectral Density (902-928 MHz DTS)** | | |
| Work Order #: | **104631** | Date: | 1/8/2021 |
| Test Type: | **Conducted Emissions** | Time: | 09:21:45 |
| Tested By: | Matt Harrison | Sequence#: | 21 |
| Software: | EMITest 5.03.19 | | 120V 60Hz |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

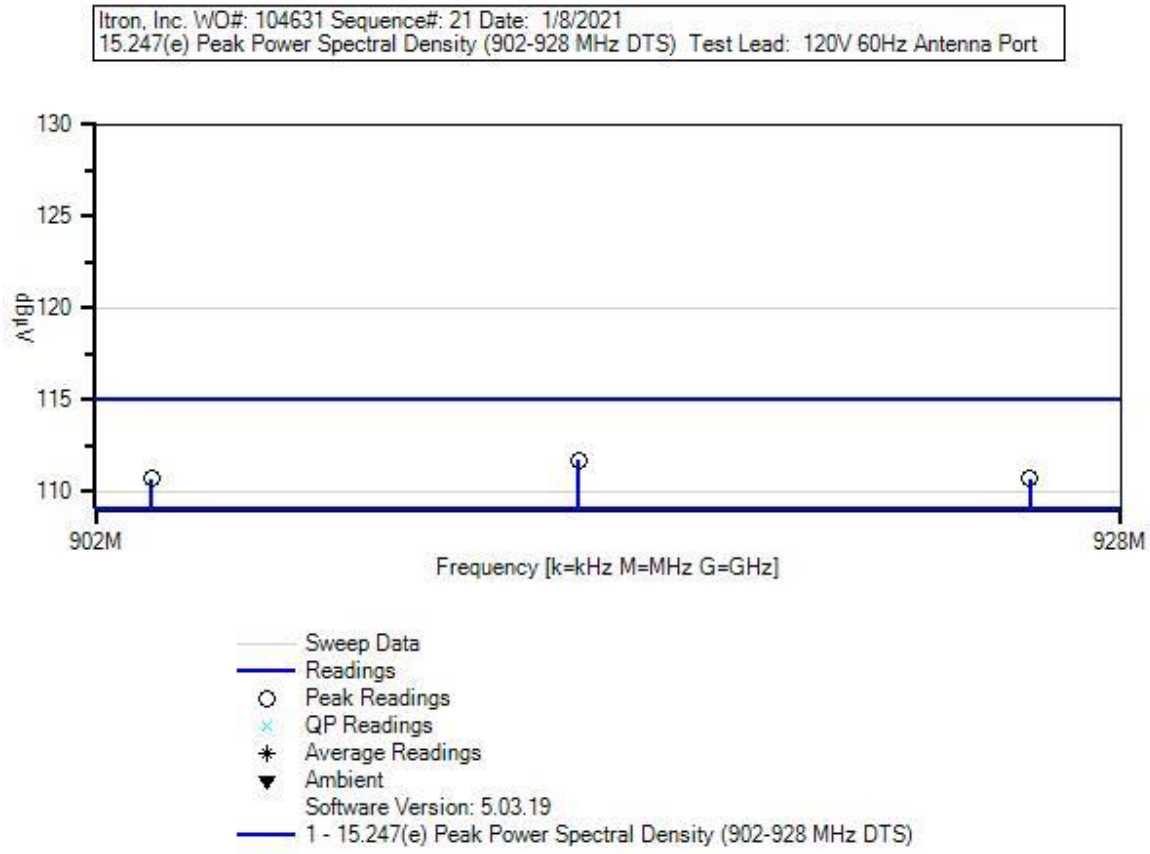
***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

Test Method: ANSI C63.10 (2013) KDB 558074 v05r02:04/02/2019

Frequency Range:902-928MHz

Test Setup:
The equipment under test (EUT) is setup for direct antenna port measurements. The EUT is transmitting continuous wave at its rated output power.




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP05748 | Attenuator | PE7004-20 | 3/4/2020 | 3/4/2022 |
| T2 | ANP06007 | Cable | Heliax | 1/20/2020 | 1/20/2022 |
| | AN02872 | Spectrum Analyzer | E4440A | 11/18/2019 | 11/18/2021 |

***Measurement Data:*** Reading listed by margin. Test Lead: Antenna Port

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | dB | dB | Dist Table | Corr dBµV | Spec dBµV | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 914.159M | 91.2 | +20.0 | +0.5 | | | +0.0 | 111.7 | 115.0 | -3.3 | Anten |
| 2 | 925.658M | 90.2 | +20.0 | +0.5 | | | +0.0 | 110.7 | 115.0 | -4.3 | Anten |
| 3 | 903.401M | 90.2 | +20.0 | +0.5 | | | +0.0 | 110.7 | 115.0 | -4.3 | Anten |

## Test Setup Photo(s)

# 15.247(d) RF Conducted Emissions & Band Edge

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.247(d) Conducted Spurious Emissions** | | |
| Work Order #: | **104631** | Date: | 1/8/2021 |
| Test Type: | **Conducted Emissions** | Time: | 14:41:44 |
| Tested By: | Matt Harrison | Sequence#: | 25 |
| Software: | EMITest 5.03.19 | | 120V 60Hz |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

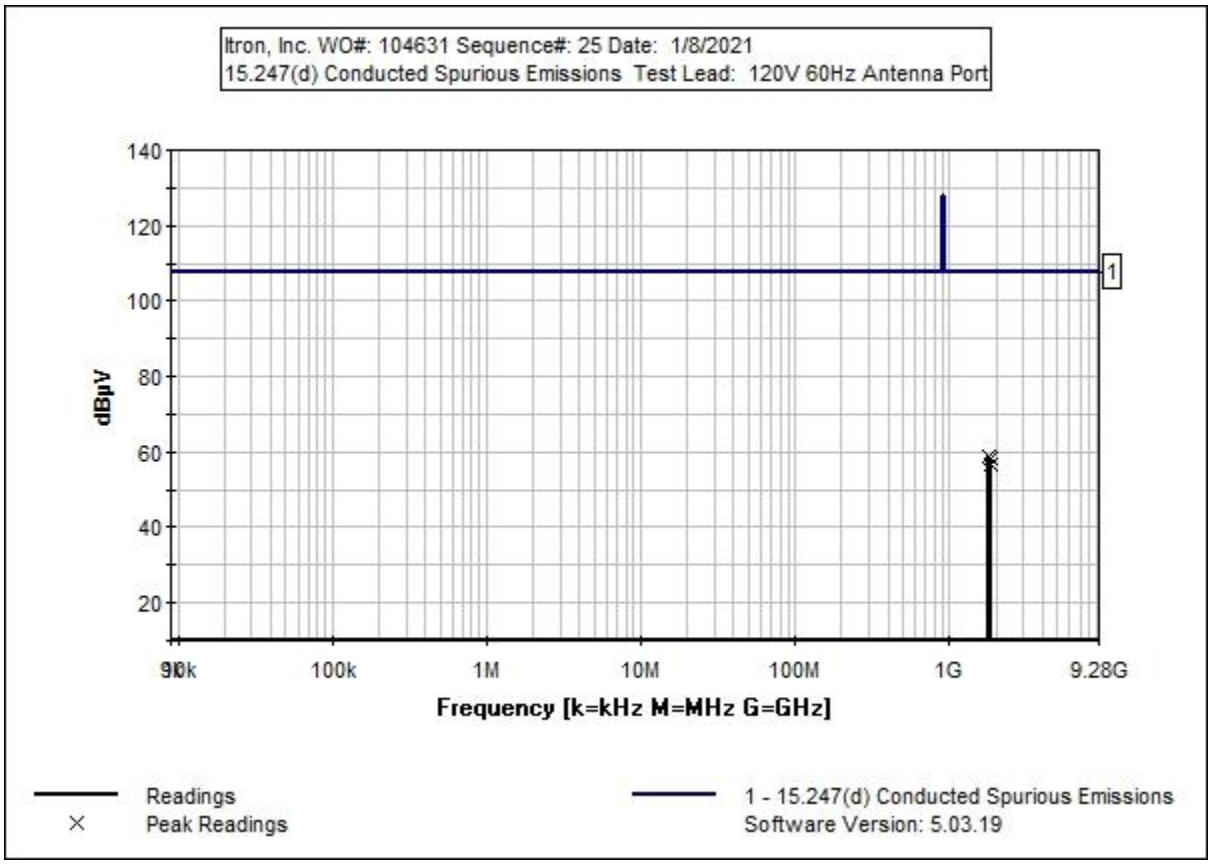
Test Method: ANSI C63.10 (2013) KDB 558074 v05r02:04/02/2019

Frequency Range:902-928MHz

Test Setup:
The equipment under test (EUT) is setup for direct antenna port measurements. The EUT is transmitting continuous wave at its rated output power.

Note: All modulations and baud rates were checked, worst case provided.

OFDM Modulation




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP05748 | Attenuator | PE7004-20 | 3/4/2020 | 3/4/2022 |
| T2 | ANP06007 | Cable | Heliax | 1/20/2020 | 1/20/2022 |
| | AN02872 | Spectrum Analyzer | E4440A | 11/18/2019 | 11/18/2021 |

***Measurement Data:*** Reading listed by margin. Test Lead: Antenna Port

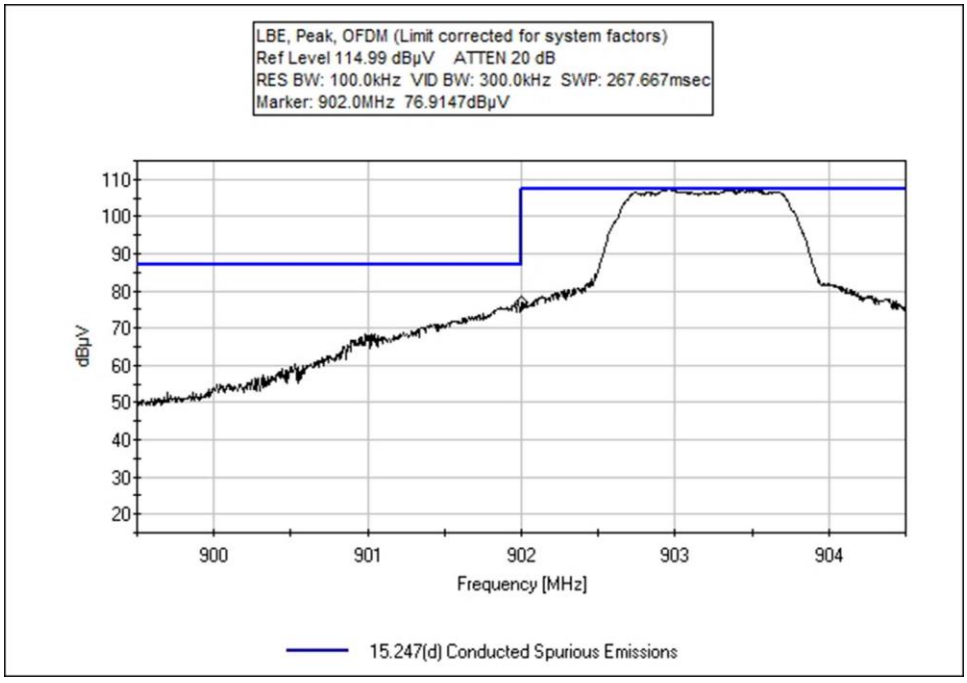
| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | dB | dB | Dist Table | Corr dBµV | Spec dBµV | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1805.000M | 38.4 | +20.0 | +0.6 | | | +0.0 | 59.0 | 107.7 | -48.7 | Anten |
| 2 | 1825.000M | 37.8 | +20.0 | +0.6 | | | +0.0 | 58.4 | 107.7 | -49.3 | Anten |
| 3 | 1855.000M | 36.2 | +20.0 | +0.7 | | | +0.0 | 56.9 | 107.7 | -50.8 | Anten |

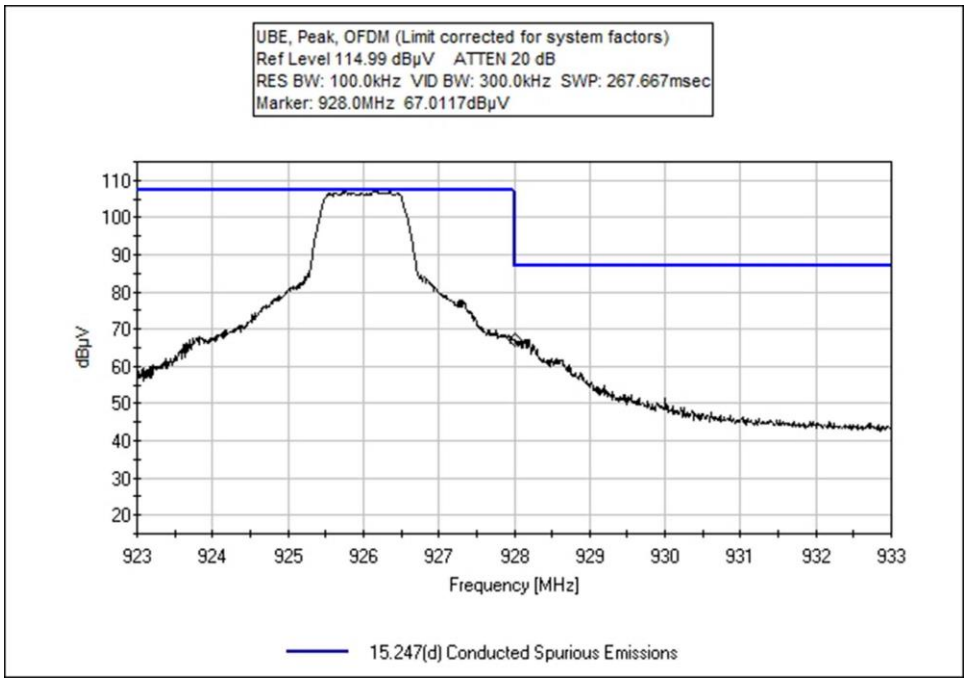
## Band Edge

| Band Edge Summary | | | | |
|---|---|---|---|---|
| Limit applied: Max Power/100kHz - 20dB. | | | | |
| **Frequency (MHz)** | **Modulation** | **Measured (dBµV)** | **Limit (dBµV)** | **Results** |
| 902 | OFDM | 97.4 | < 107.7 | Pass |
| 928 | OFDM | 87.5 | < 107.7 | Pass |

Note: All modulations and baud rates were checked, worst case provided.

## Band Edge Plots




UBE, Peak, OFDM (Limit corrected for system factors)
Ref Level 114.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 267.667msec
Marker: 928.0MHz 67.0117dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
923
924
925
926
927
928
929
930
931
932
933
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.247(d) Conducted Spurious Emissions** | | |
| Work Order #: | **104631** | Date: | 1/8/2021 |
| Test Type: | **Conducted Emissions** | Time: | 08:58:42 |
| Tested By: | Matt Harrison | Sequence#: | 20 |
| Software: | EMITest 5.03.19 | | 120V 60Hz |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

Test Method: ANSI C63.10 (2013) KDB 558074 v05r02:04/02/2019

Frequency Range:902-928MHz

Test Setup:
The equipment under test (EUT) is setup for direct antenna port measurements. The EUT is transmitting continuous wave at its rated output power.

Note: All modulations and baud rates were checked, worst case provided

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP05748 | Attenuator | PE7004-20 | 3/4/2020 | 3/4/2022 |
| T2 | ANP06007 | Cable | Heliax | 1/20/2020 | 1/20/2022 |
| | AN02872 | Spectrum Analyzer | E4440A | 11/18/2019 | 11/18/2021 |

***Measurement Data:*** Reading listed by margin. Test Lead: Antenna Port

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | dB | dB | Dist Table | Corr dBµV | Spec dBµV | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 902.965M | 107.2 | +20.0 | +0.5 | | | +0.0 | 127.7 | 127.7 | +0.0 | Anten |
| 2 | 902.000M | 76.9 | +20.0 | +0.5 | | | +0.0 | 97.4 | 107.7 | -10.3 | Anten |
| 3 | 928.000M | 67.0 | +20.0 | +0.5 | | | +0.0 | 87.5 | 107.7 | -20.2 | Anten |

## Test Setup Photo(s)

# 15.247(d) Radiated Emissions & Band Edge

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.247(d) / 15.209 Radiated Spurious Emissions** | | |
| Work Order #: | **104631** | Date: | 1/7/2021 |
| Test Type: | **Radiated Scan** | Time: | 14:32:49 |
| Tested By: | Matt Harrison | Sequence#: | 4 |
| Software: | EMITest 5.03.19 | | |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

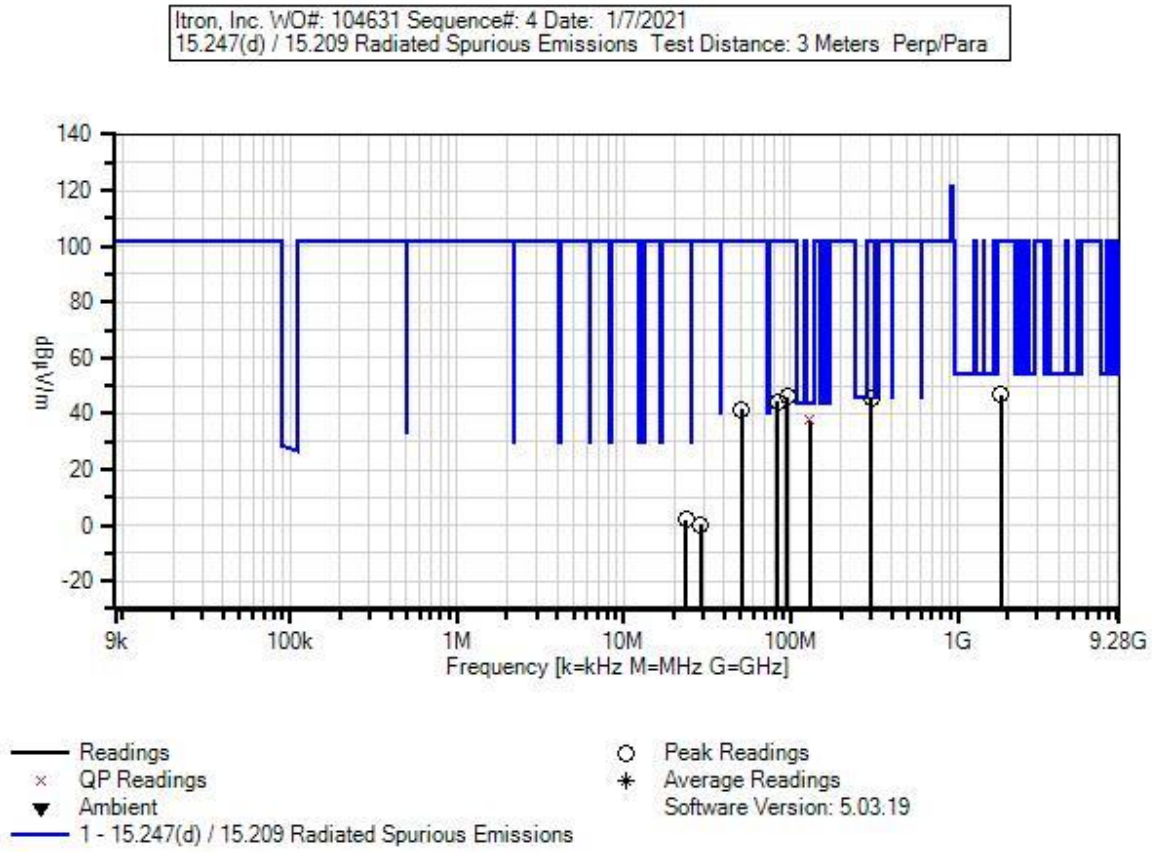
Test Method: ANSI C63.10 (2013) KDB 558074 v05r02:04/02/2019

Frequency Range: 9kHz-9.28GHz

Test Setup:
The equipment under test (EUT) is placed on the tabletop. The EUT is transmitting continuous wave at its rated output power. Low, Mid, High channels investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 x orthogonal axes investigated below 30MHz, worst case reported.

Note: All modulations and baud rates were checked, worst case provided.

OFDM Modulation




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T1 | AN03540 | Preamp | 83017A | 5/13/2019 | 5/13/2021 |
| T2 | AN01467 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 7/5/2019 | 7/5/2021 |
| T3 | ANP06243 | Attenuator | 54A-10 | 1/27/2020 | 1/27/2022 |
| T4 | ANP06515 | Cable | Heliax | 7/1/2020 | 7/1/2022 |
| T5 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T6 | ANP07505 | Cable | CLU40-KMKM-02.00F | 1/17/2019 | 1/17/2021 |
| T7 | AN03170 | High Pass Filter | HM1155-11SS | 10/23/2019 | 10/23/2021 |
| T8 | AN03628 | Biconilog Antenna | 3142E | 6/11/2019 | 6/11/2021 |
| T9 | ANP06123 | Attenuator | 18N-6 | 4/5/2019 | 4/5/2021 |
| T10 | ANP05305 | Cable | ETSI-50T | 9/6/2019 | 9/6/2021 |
| T11 | ANP05360 | Cable | RG214 | 2/3/2020 | 2/3/2022 |
| T12 | AN00052 | Loop Antenna | 6502 | 5/4/2020 | 5/4/2022 |

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

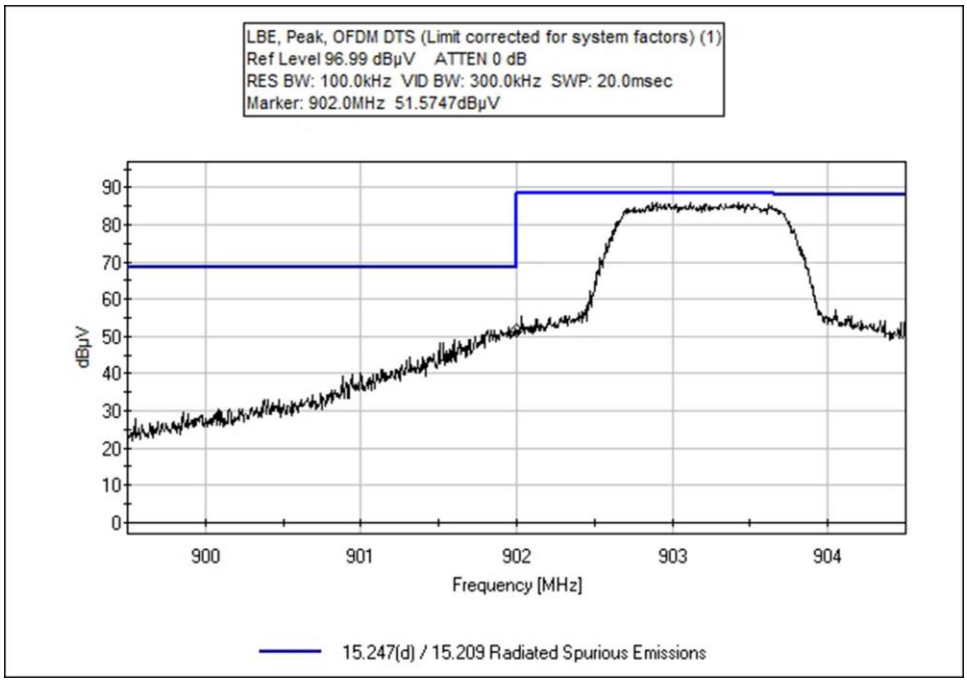
| # | Freq | Rdng | T1<br>T5<br>T9 | T2<br>T6<br>T10 | T3<br>T7<br>T11 | T4<br>T8<br>T12 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 129.813M | 22.7 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 37.8 | 43.5 | -5.7 | Vert/ |
| | QP | | +0.1 | +0.0 | +0.0 | +8.0 | | | | | |
| | | | +5.8 | +0.5 | +0.7 | +0.0 | | | | | |
| ^ | 129.813M | 26.1 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 41.2 | 43.5 | -2.3 | Vert/ |
| | | | +0.1 | +0.0 | +0.0 | +8.0 | | | | | |
| | | | +5.8 | +0.5 | +0.7 | +0.0 | | | | | |
| 3 | 1802.380M | 42.1 | -34.8 | +26.0 | +10.0 | +2.3 | +0.0 | 46.8 | 101.8 | -55.0 | Vert/ |
| | | | +0.5 | +0.2 | +0.5 | +0.0 | | | | | |
| | | | +0.0 | +0.0 | +0.0 | +0.0 | | | | | |
| 4 | 96.000M | 31.5 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 46.2 | 101.8 | -55.6 | Vert/ |
| | | | +0.1 | +0.0 | +0.0 | +7.7 | | | | | |
| | | | +5.8 | +0.5 | +0.6 | +0.0 | | | | | |
| 5 | 302.600M | 24.6 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 45.8 | 101.8 | -56.0 | Vert/ |
| | | | +0.2 | +0.0 | +0.0 | +13.2 | | | | | |
| | | | +5.8 | +0.9 | +1.1 | +0.0 | | | | | |
| 6 | 83.400M | 30.7 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 44.3 | 101.8 | -57.5 | Vert/ |
| | | | +0.1 | +0.0 | +0.0 | +6.8 | | | | | |
| | | | +5.8 | +0.4 | +0.5 | +0.0 | | | | | |
| 7 | 50.400M | 27.6 | +0.0 | +0.0 | +0.0 | +0.0 | +0.0 | 41.6 | 101.8 | -60.2 | Vert/ |
| | | | +0.1 | +0.0 | +0.0 | +7.3 | | | | | |
| | | | +5.8 | +0.4 | +0.4 | +0.0 | | | | | |
| 8 | 98.535k | 36.8 | +0.0 | +0.0 | +0.0 | +0.0 | -80.0 | -33.6 | 27.7 | -61.3 | Perp/ |
| | | | +0.0 | +0.0 | +0.0 | +0.0 | | | | | |
| | | | +0.0 | +0.0 | +0.0 | +9.6 | | | | | |
| 9 | 23.433M | 15.1 | +0.0 | +0.0 | +0.0 | +0.2 | -20.0 | 2.1 | 101.8 | -99.7 | Perp/ |
| | | | +0.1 | +0.0 | +0.0 | +0.0 | | | | | |
| | | | +0.0 | +0.0 | +0.0 | +6.7 | | | | | |
| 10 | 28.806M | 15.2 | +0.0 | +0.0 | +0.0 | +0.3 | -20.0 | 0.3 | 101.8 | -101.5 | Perp/ |
| | | | +0.1 | +0.0 | +0.0 | +0.0 | | | | | |
| | | | +0.0 | +0.0 | +0.0 | +4.7 | | | | | |

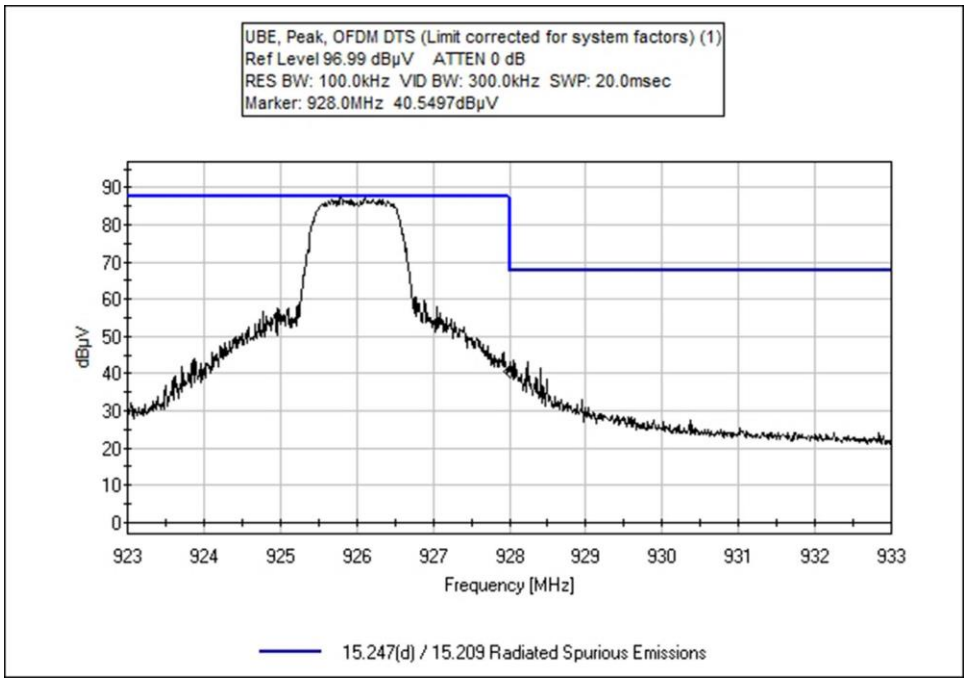
## Band Edge

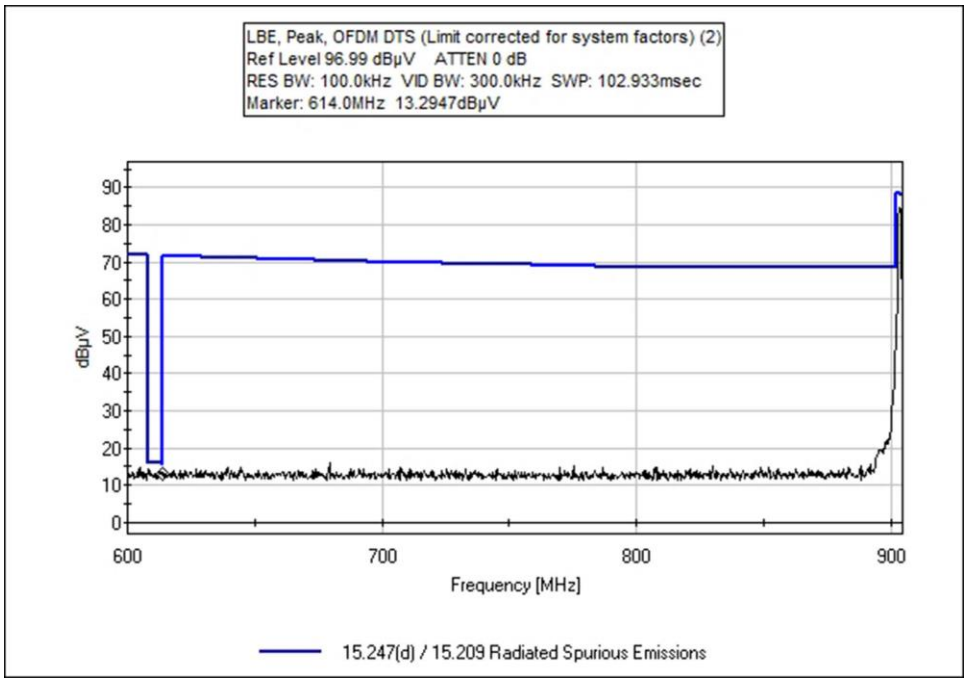
| Band Edge Summary | | | | | |
|---|---|---|---|---|---|
| **Frequency (MHz)** | **Modulation** | **Ant. Type** | **Field Strength (dBuV/m @3m)** | **Limit (dBuV/m @3m)** | **Results** |
| 614 | OFDM | Omnidirectional / 2.6dBi | 39.7 | <46 | Pass |
| 902 | OFDM | Omnidirectional / 2.6dBi | 85 | < 101.8 | Pass |
| 928 | OFDM | Omnidirectional / 2.6dBi | 74.6 | < 101.8 | Pass |
| 960 | OFDM | Omnidirectional / 2.6dBi | 47.3 | <54 | Pass |

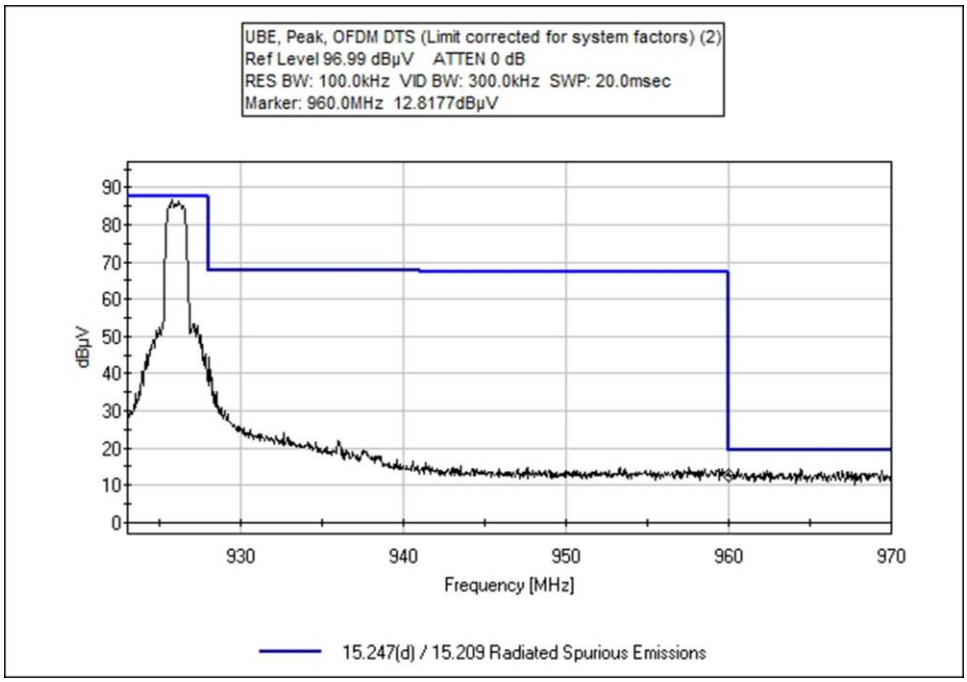
Note: All modulations and baud rates were checked, worst case provided.

## Band Edge Plots




LBE, Peak, OFDM DTS (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 102.933msec
Marker: 614.0MHz 13.2947dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


UBE, Peak, OFDM DTS (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 12.8177dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.247(d) / 15.209 Radiated Spurious Emissions** | | |
| Work Order #: | **104631** | Date: | 1/7/2021 |
| Test Type: | **Radiated Scan** | Time: | 11:29:59 |
| Tested By: | Matt Harrison | Sequence#: | 5 |
| Software: | EMITest 5.03.19 | | |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

Test Method: ANSI C63.10 (2013) KDB 558074 v05r02:04/02/2019

Frequency Range: 600-970MHz

Test Setup:
The equipment under test (EUT) is placed on the tabletop. The EUT is transmitting continuous wave at its rated output power. Low, Mid, High channels investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 x orthogonal axes investigated below 30MHz, worst case reported.

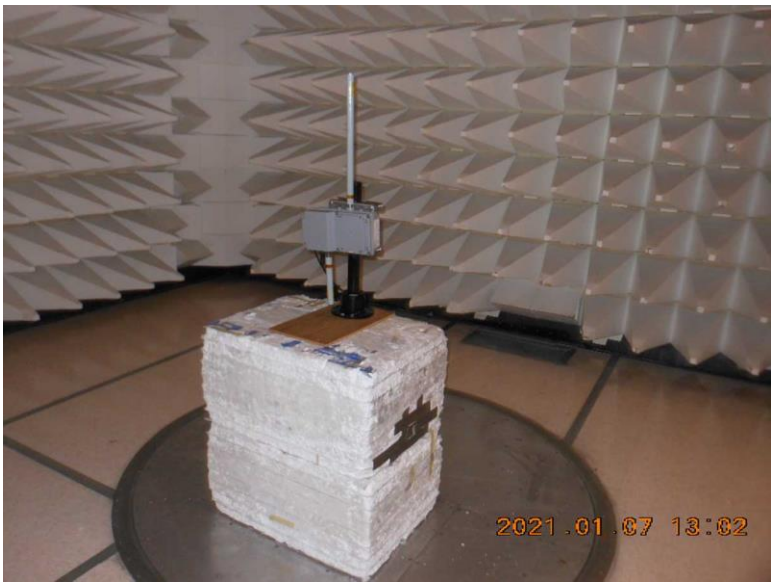
***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN03628 | Biconilog Antenna | 3142E | 6/11/2019 | 6/11/2021 |
| T2 | ANP06123 | Attenuator | 18N-6 | 4/5/2019 | 4/5/2021 |
| T3 | ANP05305 | Cable | ETSI-50T | 9/6/2019 | 9/6/2021 |
| T4 | ANP05360 | Cable | RG214 | 2/3/2020 | 2/3/2022 |
| T5 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T6 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

| # | Freq | Rdng | T1<br>T5 | T2<br>T6 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 925.780M | 87.8 | +24.1<br>+0.4 | +5.8<br>+0.0 | +1.5 | +2.2 | +0.0 | 121.8 | 121.8<br>SC | +0.0 | Vert/ |
| 2 | 614.000M<br>QP | 9.5 | +21.2<br>+0.3 | +5.8<br>+0.0 | +1.2 | +1.7 | +0.0 | 39.7 | 46.0<br>SC | -6.3 | Vert/ |
| ^ | 614.000M | 13.3 | +21.2<br>+0.3 | +5.8<br>+0.0 | +1.2 | +1.7 | +0.0 | 43.5 | 46.0<br>SC | -2.5 | Vert/ |
| 4 | 960.000M | 12.8 | +24.6<br>+0.4 | +5.8<br>+0.0 | +1.5 | +2.2 | +0.0 | 47.3 | 54.0<br>SC | -6.7 | Vert/ |
| 5 | 902.000M | 51.6 | +23.8<br>+0.3 | +5.8<br>+0.0 | +1.4 | +2.1 | +0.0 | 85.0 | 101.8<br>SC | -16.8 | Vert/ |
| 6 | 928.000M | 40.5 | +24.2<br>+0.4 | +5.8<br>+0.0 | +1.5 | +2.2 | +0.0 | 74.6 | 101.8 | -27.2 | Vert/ |

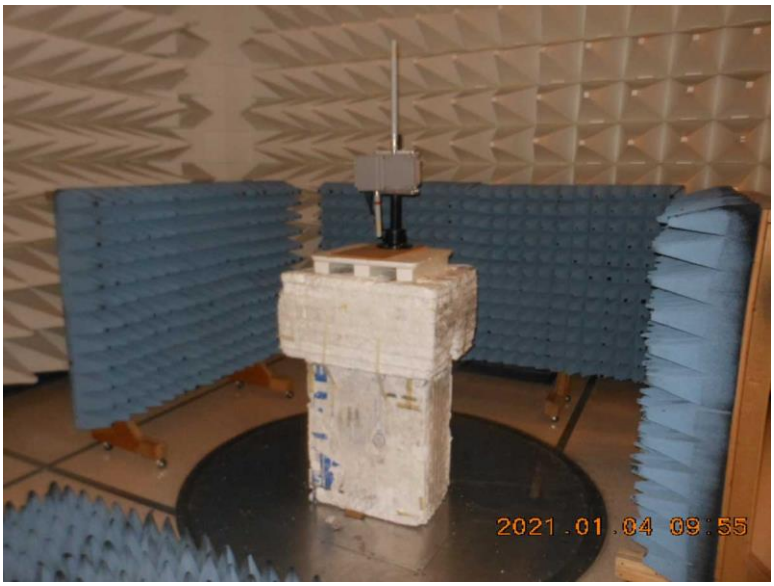
## Test Setup Photo(s)




Below 1GHz


Below 1GHz


Above 1GHz




Above 1GHz

# 15.207 AC Conducted Emissions

## Test Setup / Conditions / Data

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.207 AC Mains - Average** | | |
| Work Order #: | **104631** | Date: | 1/7/2021 |
| Test Type: | **Conducted Emissions** | Time: | 16:10:42 |
| Tested By: | Matt Harrison | Sequence#: | 18 |
| Software: | EMITest 5.03.19 | | 120V 60Hz |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

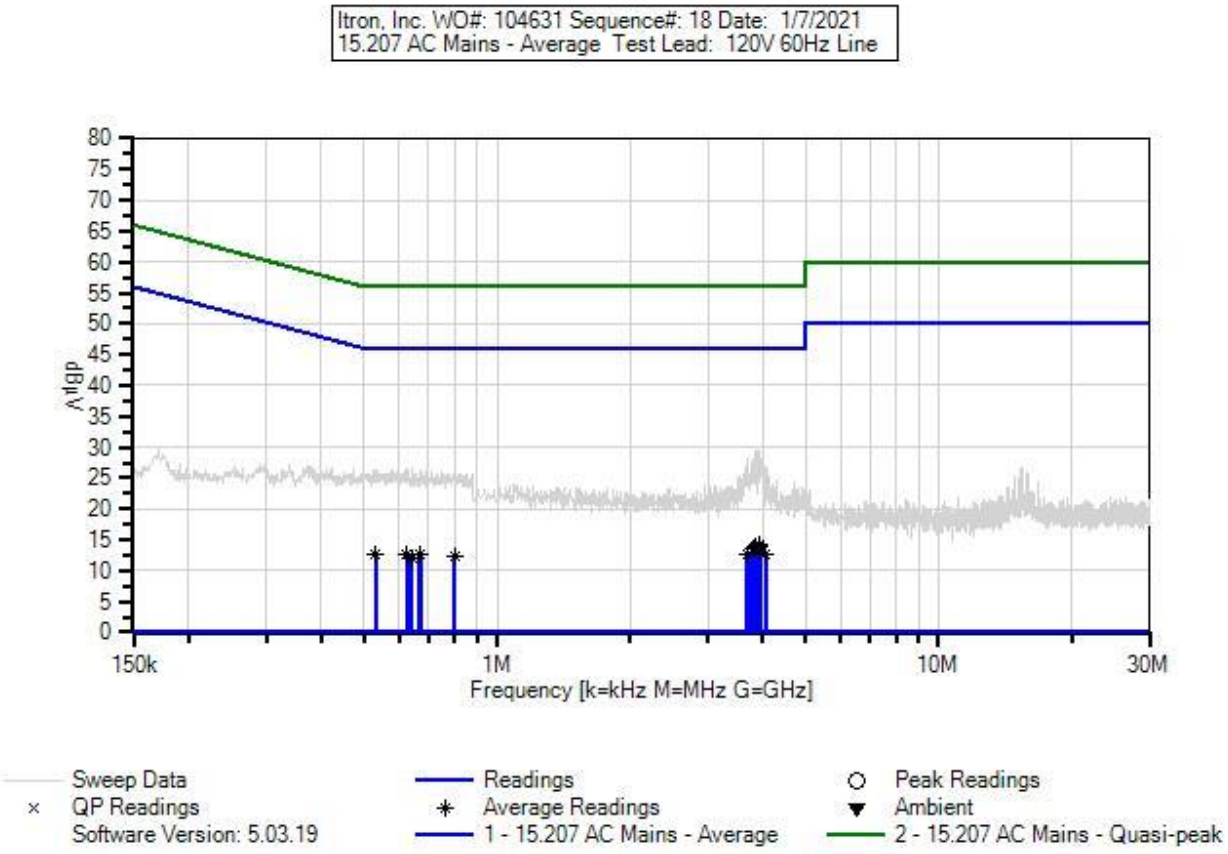
***Test Conditions / Notes:***

Test Environment Conditions:
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 600-970MHz

Test Setup:
The equipment under test (EUT) is placed on the tabletop. The EUT is transmitting continuous wave at its rated output power. Low, Mid, High channels investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 x orthogonal axes investigated below 30MHz, worst case reported.




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP06219 | Attenuator | 768-10 | 4/7/2020 | 4/7/2022 |
| T2 | ANP06515 | Cable | Heliax | 7/1/2020 | 7/1/2022 |
| T3 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T4 | AN01311 | 50uH LISN-Line1 (L) | 3816/2 | 2/24/2020 | 2/24/2022 |
| | AN01311 | 50uH LISN-Line2 (N) | 3816/2 | 2/24/2020 | 2/24/2022 |
| | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T5 | AN02611 | High Pass Filter | HE9615-150K-50-720B | 1/10/2020 | 1/10/2022 |

***Measurement Data:*** Reading listed by margin. Test Lead: Line

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV | dBµV | dB | Ant |
| 1 | 3.935M | 5.1 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 14.1 | 46.0 | -31.9 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.935M | 19.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 28.6 | 46.0 | -17.4 | Line |
| | | | +0.1 | | | | | | | | |
| 3 | 3.909M | 5.0 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 14.0 | 46.0 | -32.0 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.909M | 20.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 29.6 | 46.0 | -16.4 | Line |
| | | | +0.1 | | | | | | | | |
| 5 | 3.858M | 4.9 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.9 | 46.0 | -32.1 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.858M | 20.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 29.6 | 46.0 | -16.4 | Line |
| | | | +0.1 | | | | | | | | |
| 7 | 3.841M | 4.8 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.8 | 46.0 | -32.2 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.841M | 18.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 27.6 | 46.0 | -18.4 | Line |
| | | | +0.1 | | | | | | | | |
| 9 | 3.803M | 4.7 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.7 | 46.0 | -32.3 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.803M | 19.2 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 28.2 | 46.0 | -17.8 | Line |
| | | | +0.1 | | | | | | | | |
| 11 | 3.790M | 4.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.6 | 46.0 | -32.4 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.790M | 18.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 27.6 | 46.0 | -18.4 | Line |
| | | | +0.1 | | | | | | | | |
| 13 | 531.782k | 3.8 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 12.8 | 46.0 | -33.2 | Line |
| | Ave | | +0.3 | | | | | | | | |
| ^ | 531.782k | 17.5 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 26.5 | 46.0 | -19.5 | Line |
| | | | +0.3 | | | | | | | | |
| 15 | 4.058M | 3.9 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 12.8 | 46.0 | -33.2 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 4.058M | 18.1 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 27.0 | 46.0 | -19.0 | Line |
| | | | +0.1 | | | | | | | | |
| 17 | 623.410k | 3.7 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 12.7 | 46.0 | -33.3 | Line |
| | Ave | | +0.3 | | | | | | | | |
| ^ | 623.410k | 17.6 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 26.6 | 46.0 | -19.4 | Line |
| | | | +0.3 | | | | | | | | |
| 19 | 3.697M | 3.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 12.6 | 46.0 | -33.4 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.697M | 17.7 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 26.7 | 46.0 | -19.3 | Line |
| | | | +0.1 | | | | | | | | |
| 21 | 666.315k | 3.5 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 12.5 | 46.0 | -33.5 | Line |
| | Ave | | +0.3 | | | | | | | | |
| 22 | 669.951k | 3.5 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 12.5 | 46.0 | -33.5 | Line |
| | Ave | | +0.3 | | | | | | | | |
| ^ | 666.315k | 17.4 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 26.4 | 46.0 | -19.6 | Line |
| | | | +0.3 | | | | | | | | |
| ^ | 669.951k | 17.4 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 26.4 | 46.0 | -19.6 | Line |
| | | | +0.3 | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 3.684M | 3.5 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 12.5 | 46.0 | -33.5 | Line |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.684M | 19.3 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 28.3 | 46.0 | -17.7 | Line |
| | | | +0.1 | | | | | | | | |
| 27 | 800.121k | 3.4 | +9.1 | +0.0 | +0.0 | -0.3 | +0.0 | 12.4 | 46.0 | -33.6 | Line |
| | Ave | | +0.2 | | | | | | | | |
| ^ | 800.121k | 17.4 | +9.1 | +0.0 | +0.0 | -0.3 | +0.0 | 26.4 | 46.0 | -19.6 | Line |
| | | | +0.2 | | | | | | | | |
| 29 | 641.590k | 3.1 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 12.1 | 46.0 | -33.9 | Line |
| | Ave | | +0.3 | | | | | | | | |
| ^ | 641.590k | 17.7 | +9.1 | +0.0 | +0.0 | -0.4 | +0.0 | 26.7 | 46.0 | -19.3 | Line |
| | | | +0.3 | | | | | | | | |

| | | | |
|---|---|---|---|
| Test Location: | CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362) | | |
| Customer: | **Itron, Inc.** | | |
| Specification: | **15.207 AC Mains - Average** | | |
| Work Order #: | **104631** | Date: | 1/7/2021 |
| Test Type: | **Conducted Emissions** | Time: | 16:22:51 |
| Tested By: | Matt Harrison | Sequence#: | 19 |
| Software: | EMITest 5.03.19 | | 120V 60Hz |

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Configuration 1 | | | |

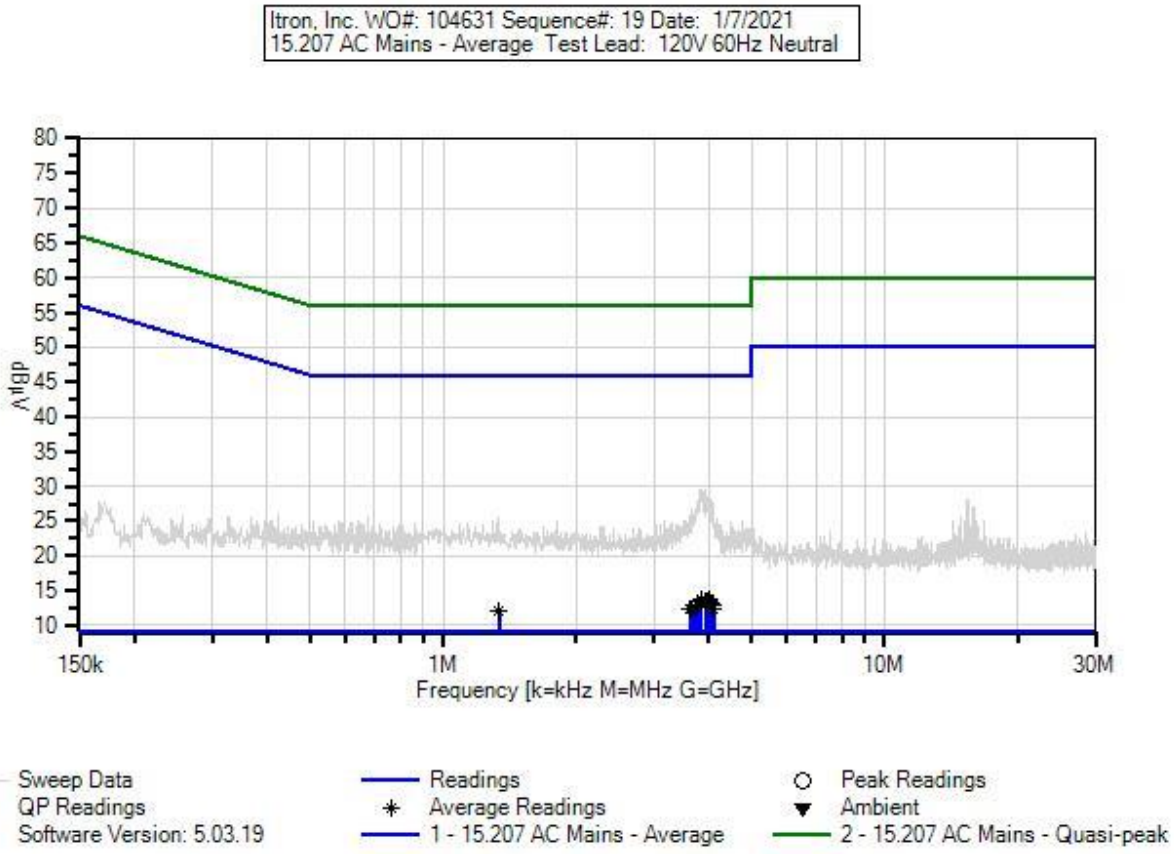
***Test Conditions / Notes:***

Test Environment Conditions;
Temperature: 23°C
Relative Humidity: 41%
Pressure: 101.6kPa

Test Method: ANSI C63.10 (2013)

Frequency Range: 600-970MHz

Test Setup:
The equipment under test (EUT) is placed on the tabletop. The EUT is transmitting continuous wave at its rated output power. Low, Mid, High channels investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 x orthogonal axes investigated below 30MHz, worst case reported.




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | ANP06219 | Attenuator | 768-10 | 4/7/2020 | 4/7/2022 |
| T2 | ANP06515 | Cable | Heliax | 7/1/2020 | 7/1/2022 |
| T3 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| | AN01311 | 50uH LISN-Line1 (L) | 3816/2 | 2/24/2020 | 2/24/2022 |
| T4 | AN01311 | 50uH LISN-Line2 (N) | 3816/2 | 2/24/2020 | 2/24/2022 |
| | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T5 | AN02611 | High Pass Filter | HE9615-150K-50-720B | 1/10/2020 | 1/10/2022 |

***Measurement Data:*** Reading listed by margin. Test Lead: Neutral

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV | dBµV | dB | Ant |
| 1 | 3.829M | 4.9 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.9 | 46.0 | -32.1 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.829M | 20.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 29.6 | 46.0 | -16.4 | Neutr |
| | | | +0.1 | | | | | | | | |
| 3 | 4.007M | 4.7 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.7 | 46.0 | -32.3 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 4.007M | 20.2 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 29.2 | 46.0 | -16.8 | Neutr |
| | | | +0.1 | | | | | | | | |
| 5 | 3.977M | 4.7 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 13.6 | 46.0 | -32.4 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.977M | 19.7 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 28.6 | 46.0 | -17.4 | Neutr |
| | | | +0.1 | | | | | | | | |
| 7 | 3.939M | 4.5 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 13.4 | 46.0 | -32.6 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.939M | 20.6 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 29.5 | 46.0 | -16.5 | Neutr |
| | | | +0.1 | | | | | | | | |
| 9 | 4.045M | 4.4 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 13.3 | 46.0 | -32.7 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| 10 | 4.054M | 4.3 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 13.2 | 46.0 | -32.8 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 4.054M | 19.3 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 28.2 | 46.0 | -17.8 | Neutr |
| | | | +0.1 | | | | | | | | |
| ^ | 4.045M | 18.8 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 27.7 | 46.0 | -18.3 | Neutr |
| | | | +0.1 | | | | | | | | |
| 13 | 3.752M | 4.0 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 13.0 | 46.0 | -33.0 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.752M | 18.9 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 27.9 | 46.0 | -18.1 | Neutr |
| | | | +0.1 | | | | | | | | |
| 15 | 4.067M | 4.0 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 12.9 | 46.0 | -33.1 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 4.067M | 18.1 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 27.0 | 46.0 | -19.0 | Neutr |
| | | | +0.1 | | | | | | | | |
| 17 | 4.080M | 3.9 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 12.8 | 46.0 | -33.2 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 4.080M | 17.8 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 26.7 | 46.0 | -19.3 | Neutr |
| | | | +0.1 | | | | | | | | |
| 19 | 3.714M | 3.6 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 12.6 | 46.0 | -33.4 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.714M | 17.7 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 26.7 | 46.0 | -19.3 | Neutr |
| | | | +0.1 | | | | | | | | |
| 21 | 3.658M | 3.4 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 12.4 | 46.0 | -33.6 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 3.658M | 17.8 | +9.1 | +0.1 | +0.0 | -0.3 | +0.0 | 26.8 | 46.0 | -19.2 | Neutr |
| | | | +0.1 | | | | | | | | |
| 23 | 4.097M | 3.5 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 12.4 | 46.0 | -33.6 | Neutr |
| | Ave | | +0.1 | | | | | | | | |
| ^ | 4.097M | 18.8 | +9.1 | +0.1 | +0.0 | -0.4 | +0.0 | 27.7 | 46.0 | -18.3 | Neutr |
| | | | +0.1 | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 Ave | 3.620M | 3.3 | +9.1 +0.1 | +0.1 | +0.0 | -0.3 | +0.0 | 12.3 | 46.0 | -33.7 | Neutr |
| ^ | 3.620M | 17.0 | +9.1 +0.1 | +0.1 | +0.0 | -0.3 | +0.0 | 26.0 | 46.0 | -20.0 | Neutr |
| 27 Ave | 3.646M | 3.3 | +9.1 +0.1 | +0.1 | +0.0 | -0.3 | +0.0 | 12.3 | 46.0 | -33.7 | Neutr |
| ^ | 3.646M | 16.7 | +9.1 +0.1 | +0.1 | +0.0 | -0.3 | +0.0 | 25.7 | 46.0 | -20.3 | Neutr |
| 29 Ave | 1.336M | 3.1 | +9.1 +0.2 | +0.0 | +0.0 | -0.3 | +0.0 | 12.1 | 46.0 | -33.9 | Neutr |
| ^ | 1.336M | 16.5 | +9.1 +0.2 | +0.0 | +0.0 | -0.3 | +0.0 | 25.5 | 46.0 | -20.5 | Neutr |

## 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 |

Uncertainties reported are worst case for all CKC Laboratories' sites and 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.

| MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE | | | |
|---|---|---|---|
| TEST | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| 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.