# Itron, Inc.

**TEST REPORT FOR**

## Gas Endpoint
## Model: Intelis-Gas

**Tested to The Following Standards:**

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

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

**Report No.: 103183-2**

**Date of issue: January 10, 2020**

**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**



Testing the Future
CKC LABORATORIES, INC.

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# ADMINISTRATIVE INFORMATION

## Test Report Information

**REPORT PREPARED FOR:**

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

Representative: Jay Holcomb
Customer Reference Number: 191352

**REPORT PREPARED BY:**

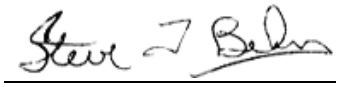
Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 103183

**DATE OF EQUIPMENT RECEIPT:** October 4, 2019
**DATE(S) OF TESTING:** October 4-29, 2019

## 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.
22116 23rd Drive S.E., Suite A
Canyon Park, Bothell, WA 98021

# Software Versions

| CKC Laboratories Proprietary Software | Version |
|---|---|
| EMITest Emissions | 5.03.12 |

# Site Registration & Accreditation Information

| Location | *NIST CB # | FCC | Japan |
|---|---|---|---|
| Canyon Park, Bothell, WA | US0081 | US1022 | A-0136 |
| Brea, CA | US0060 | US1025 | A-0136 |
| Fremont, CA | US0082 | US1023 | A-0136 |
| Mariposa, CA | US0103 | US1024 | 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 (FHSS 902-928MHz)

| Test Procedure | Description | Modifications | Results |
|---|---|---|---|
| 15.247(a)(1)(i) | Occupied Bandwidth | NA | Pass |
| 15.247(a)(1) | Carrier Separation | NA | Pass |
| 15.247(a)(1)(i) | Number of Hopping Channels | NA | Pass |
| 15.247(a)(1)(i) | Average Time of Occupancy | NA | NP |
| 15.247(b)(2) | Output Power | 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 | NA1 |

NA = Not Applicable
NA1 = Not applicable because the EUT is battery powered.
NP = CKC Laboratories was not contracted to perform test.

| 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

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Gas Endpoint | Itron, Inc. | Intelis-Gas | 103183-cond |

***Support Equipment:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Laptop | Dell | E6410 | 3XG40P1 |
| AC/DC Adapter (for Laptop) | Dell | DA130PE1-00 | NA |
| USB Interface Board | Itron, Inc. | PCB-TEMP-0007 Rev3 | NA |

## Configuration 2

***Equipment Tested:***

| Device | Manufacturer | Model # | S/N |
|---|---|---|---|
| Gas Endpoint | Itron, Inc. | Intelis-Gas | 103183-rad |

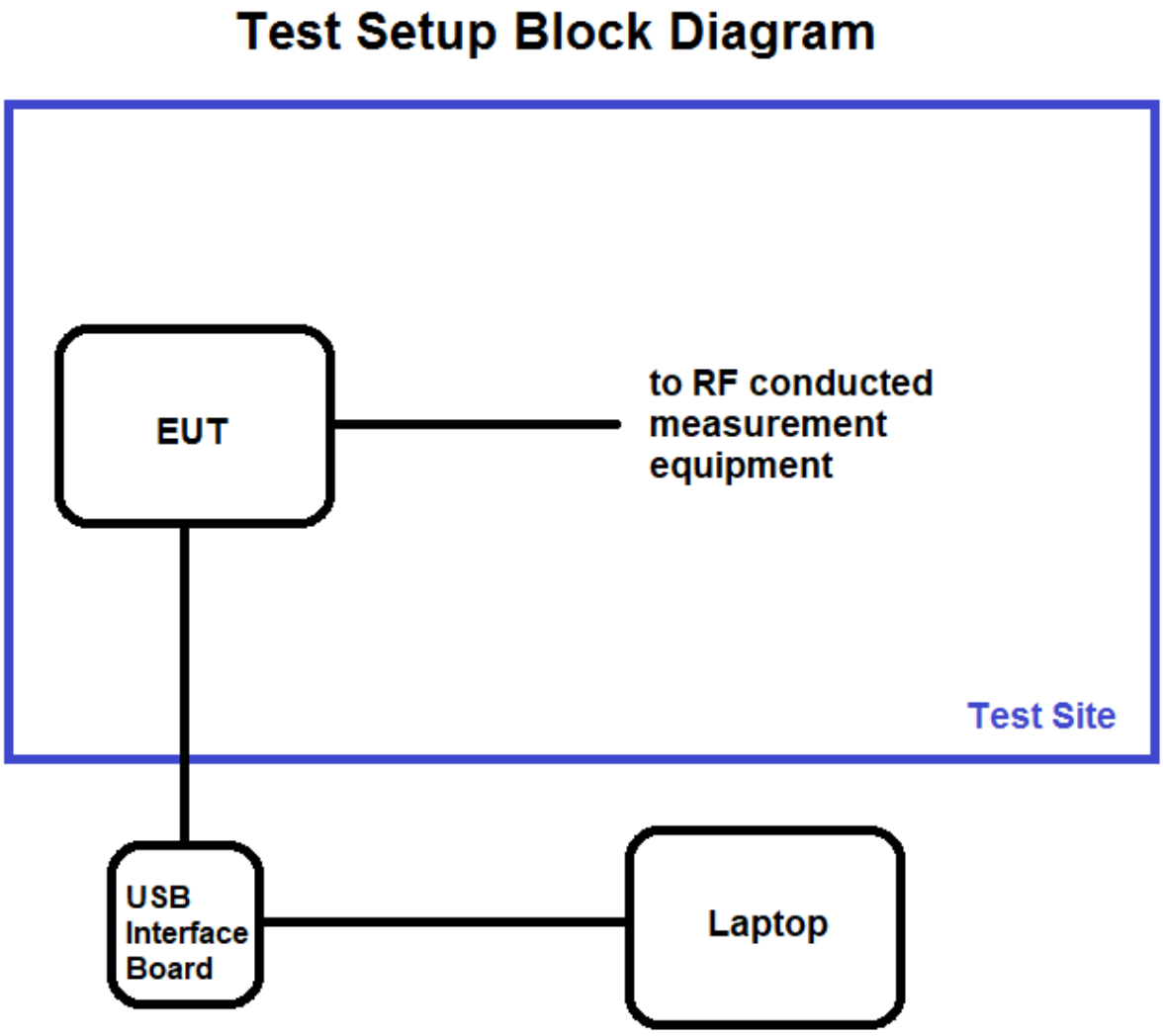
***Support Equipment:***

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

## General Product Information:

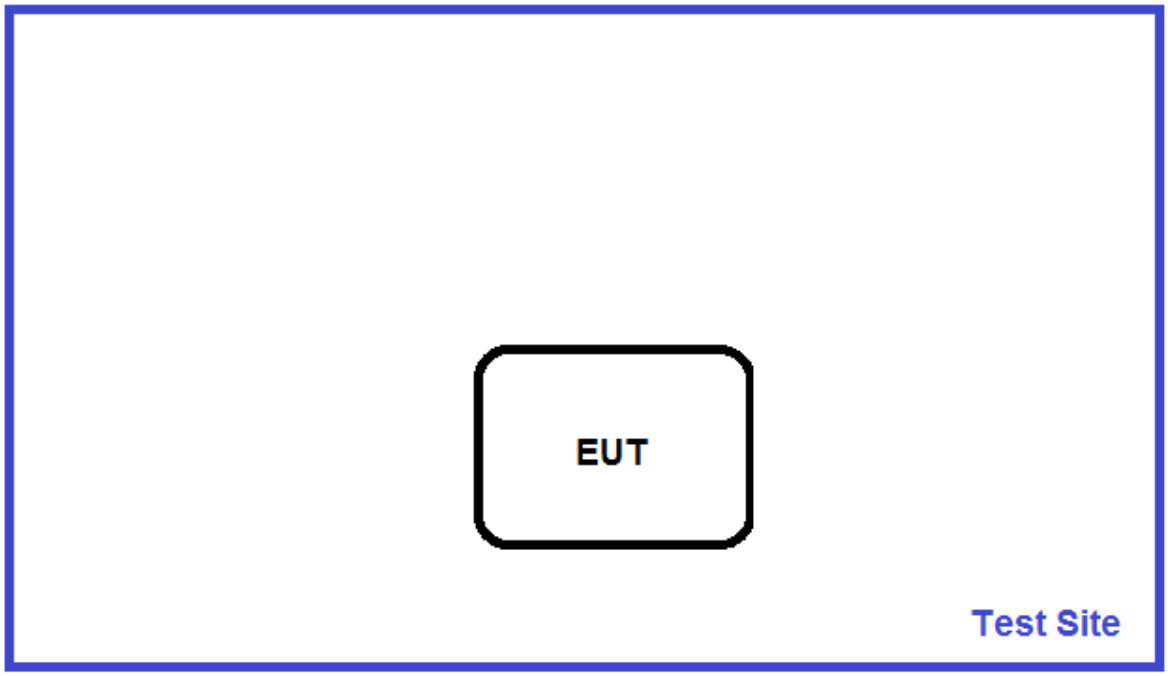
| Product Information | Manufacturer-Provided Details |
|---|---|
| Equipment Type: | Stand-Alone Equipment |
| Type of Wideband System: | FHSS |
| Operating Frequency Range: | New modulations added for this report:<br><br>902.2 - 927.75MHz (GFSK 25kbps)<br>902.2 - 927.8MHz (GFSK 50 kbps) |
| Number of Hopping Channels: | 512 channels (GFSK 25 kbps, previously tested channel plan)<br>129 channels (GFSK 50 kbps, new channel plan) |
| Receiver Bandwidth and Synchronization: | The manufacturer declares the receiver input bandwidth matches the transmit channel bandwidth and shifts frequencies in synchronization with the transmitter. |
| Modulation Type(s): | GFSK 25kbps and 50kbps |
| Maximum Duty Cycle: | 100% |
| Number of TX Chains: | 1 |
| Antenna Type(s) and Gain: | Internal Trace, 4.8dBi |
| Beamforming Type: | NA |
| Antenna Connection Type: | Integral (External connector provided to facilitate testing) |
| Nominal Input Voltage: | 6.0VDC Battery |
| Firmware / Software used for Test: | Command Line Interface (CLI) Tool (dated Feb 21, 2019)<br>App Version 5.04.0, CSL Version: 16.0.5.0 |

## Block Diagram of Test Setup(s)




Configuration 1

# Test Setup Block Diagram




Configuration 2

# FCC Part 15 Subpart C

## 15.247(a) Transmitter Characteristics

| Test Setup/Conditions | | | |
|---|---|---|---|
| Test Location: | Bothell Lab Bench | Test Engineer: | M. Atkinson |
| Test Method: | ANSI C63.10 (2013) | Test Date(s): | 10/4/19 to 10/29/19 |
| Configuration: | 1 | | |
| Test Setup: | The equipment under test (EUT) is placed on the tabletop.<br>The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator.<br>The EUT is transmitter at its rated output power.<br>Measurements were performed using a temporary connection to a power supply set to a voltage representative of a fresh battery installed. | | |

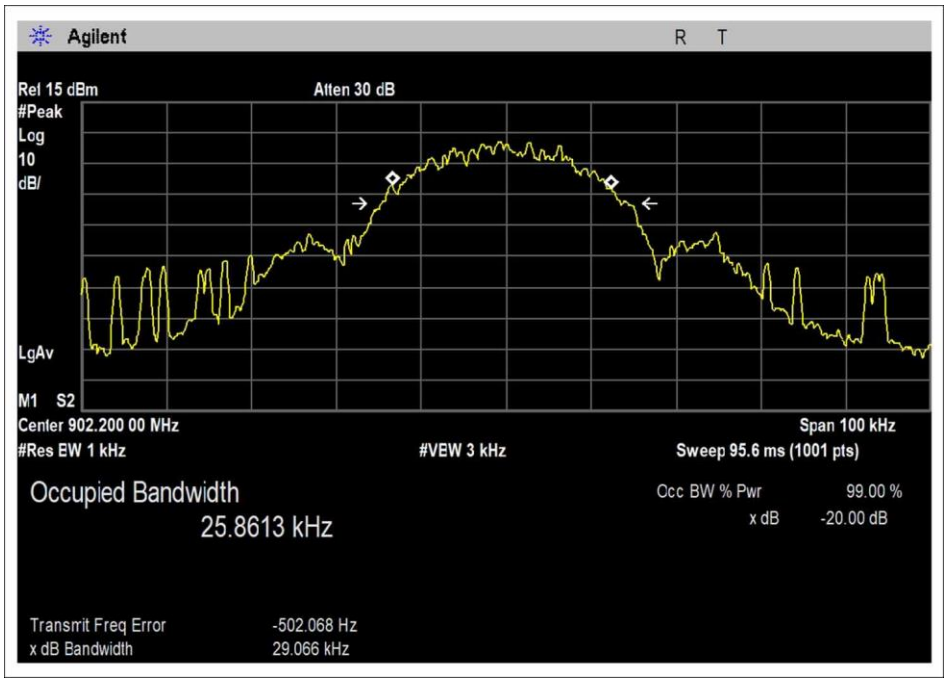
| Environmental Conditions | | | |
|---|---|---|---|
| Temperature (ºC) | 19-23 | Relative Humidity (%): | 30-50 |

| Test Equipment | | | | | |
|---|---|---|---|---|---|
| Asset# | Description | Manufacturer | Model | Cal Date | Cal Due |
| 02872 | Spectrum Analyzer | Agilent | E4440A | 11/3/2017 | 11/3/2019 |
| P05748 | Attenuator | Pasternack | PE7004-20 | 4/24/2018 | 4/24/2020 |
| P05959 | Cable | Andrews | Heliax | 4/11/2018 | 4/11/2020 |
| 02673 | Spectrum Analyzer | Agilent | E4446A | 2/22/2019 | 2/22/2021 |

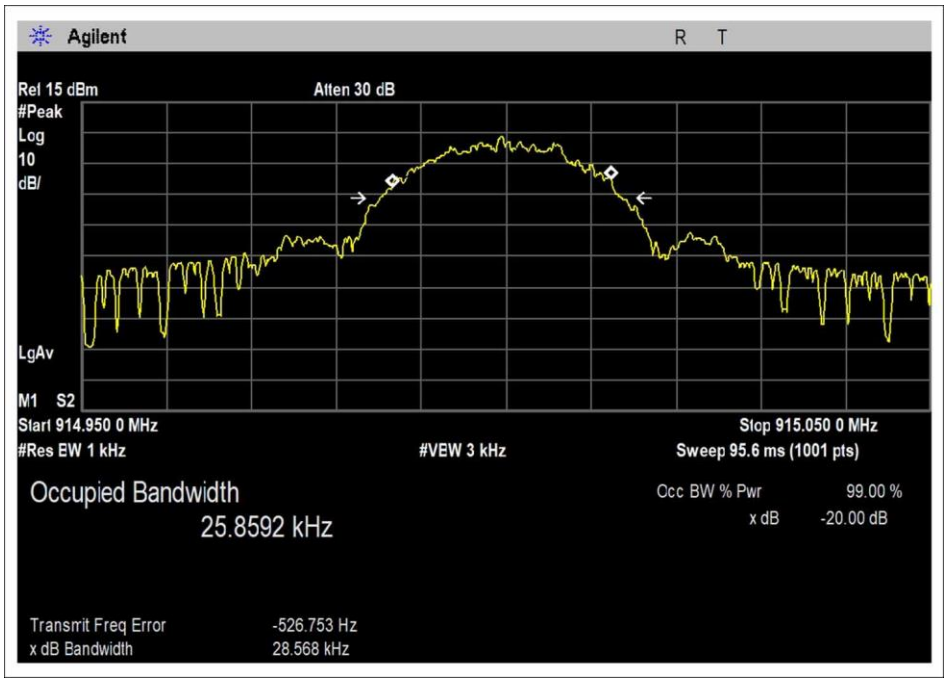
### 15.247(a)(1) 20 dB Bandwidth

| Test Data Summary | | | | | |
|---|---|---|---|---|---|
| Frequency (MHz) | Antenna Port | Modulation | Measured (kHz) | Limit (kHz) | Results |
| 902.2 | 1 | GFSK 25kbps | 29.066 | ≤500 | Pass |
| 915 | 1 | GFSK 25kbps | 28.568 | ≤500 | Pass |
| 927.75 | 1 | GFSK 25kbps | 28.971 | ≤500 | Pass |
| 902.2 | 1 | GFSK 50 kbps | 102.570 | ≤500 | Pass |
| 915 | 1 | GFSK 50 kbps | 102.373 | ≤500 | Pass |
| 927.8 | V | GFSK 50 kbps | 102.457 | ≤500 | Pass |

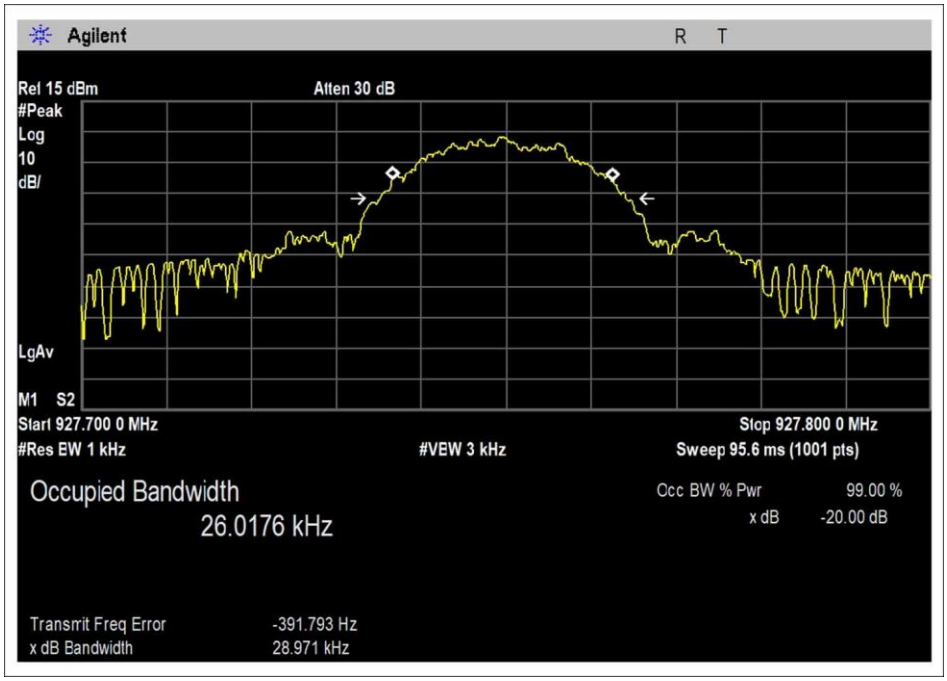
## Plot(s)



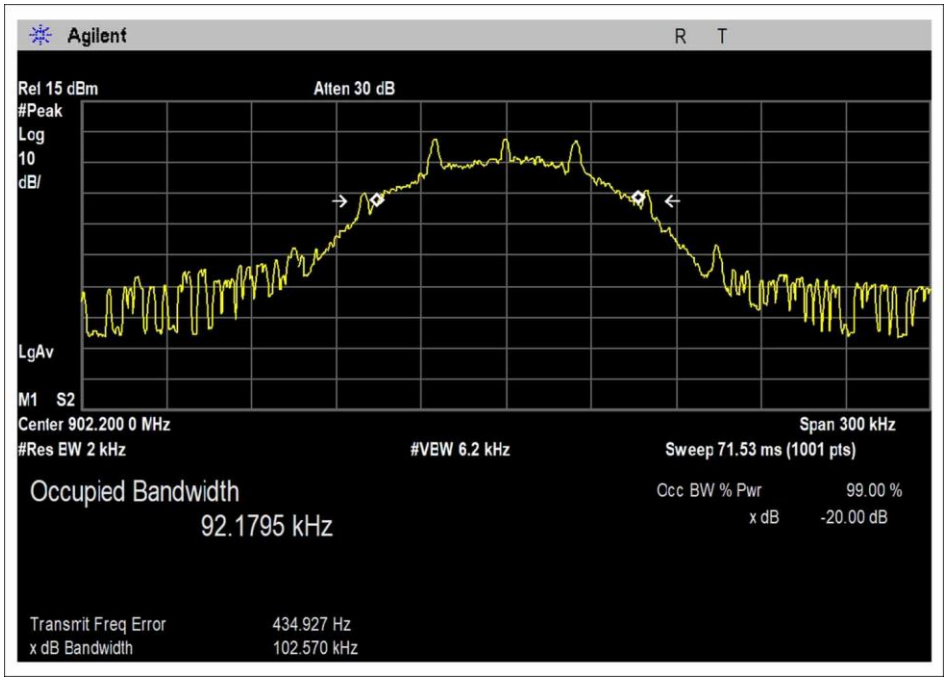

25kbps Low Channel



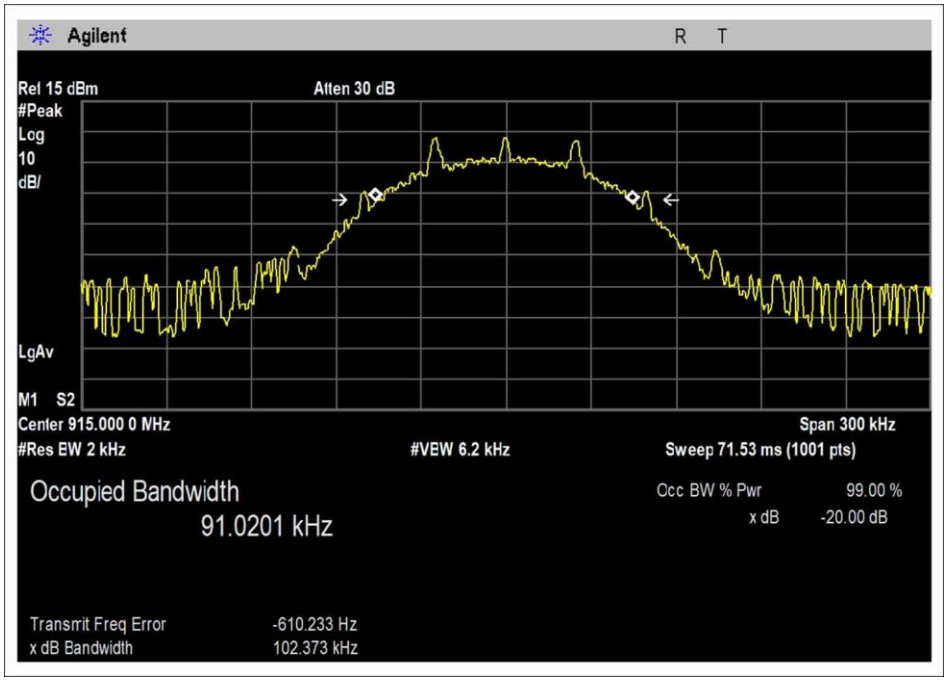

25kbps Middle Channel



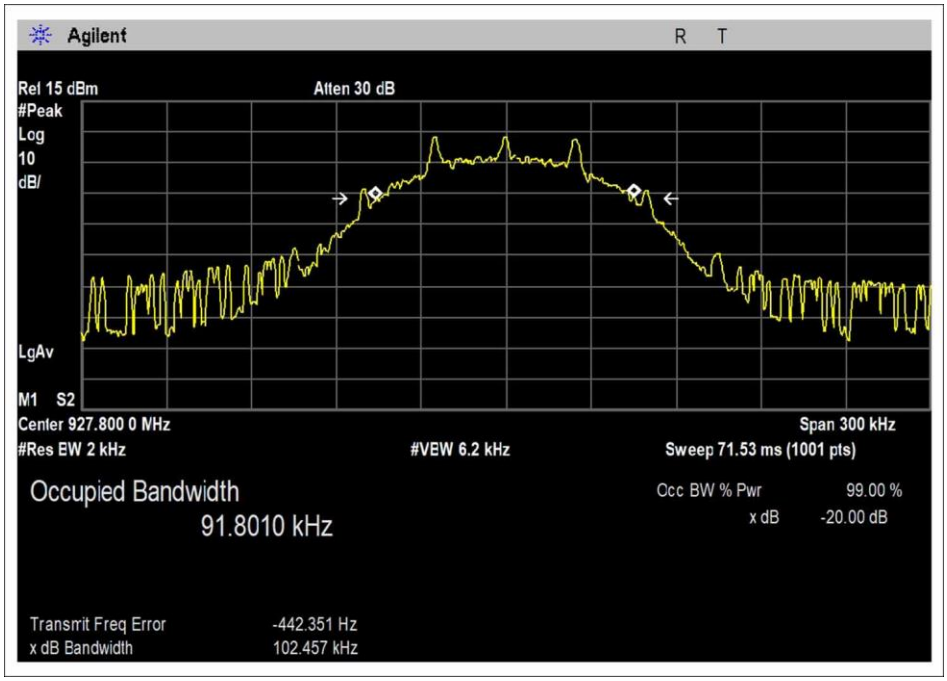

25kbps High Channel




50kbps Low Channel




50kbps Middle Channel

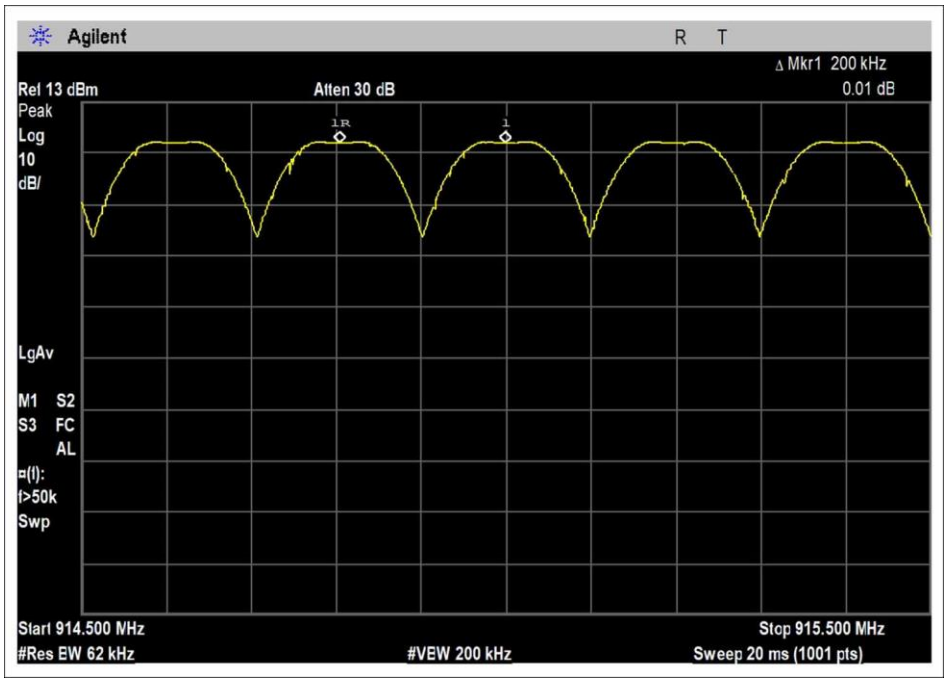



50kbps High Channel

# 15.247(a)(1) Carrier Separation

| Test Data Summary | | | | |
|---|---|---|---|---|
| Limit applied: 20dB bandwidth of the hopping channel. | | | | |
| **Antenna Port** | **Operational Mode** | **Measured (kHz)** | **Limit (kHz)** | **Results** |
| 1 | GFSK 50kbps | 200 | >102.570 | Pass |

## Plot(s)

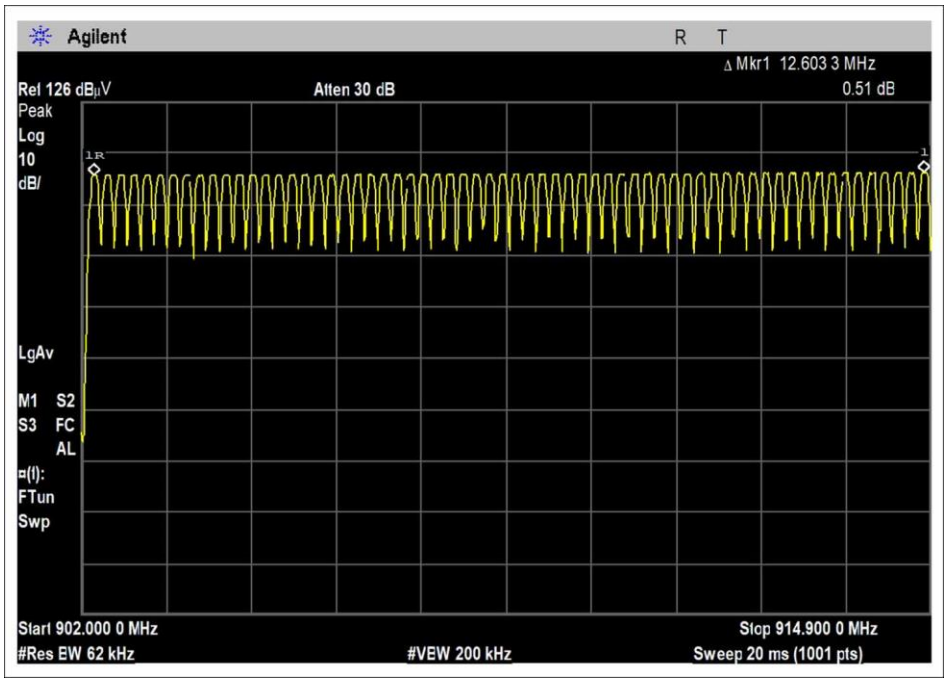



Channel Separation

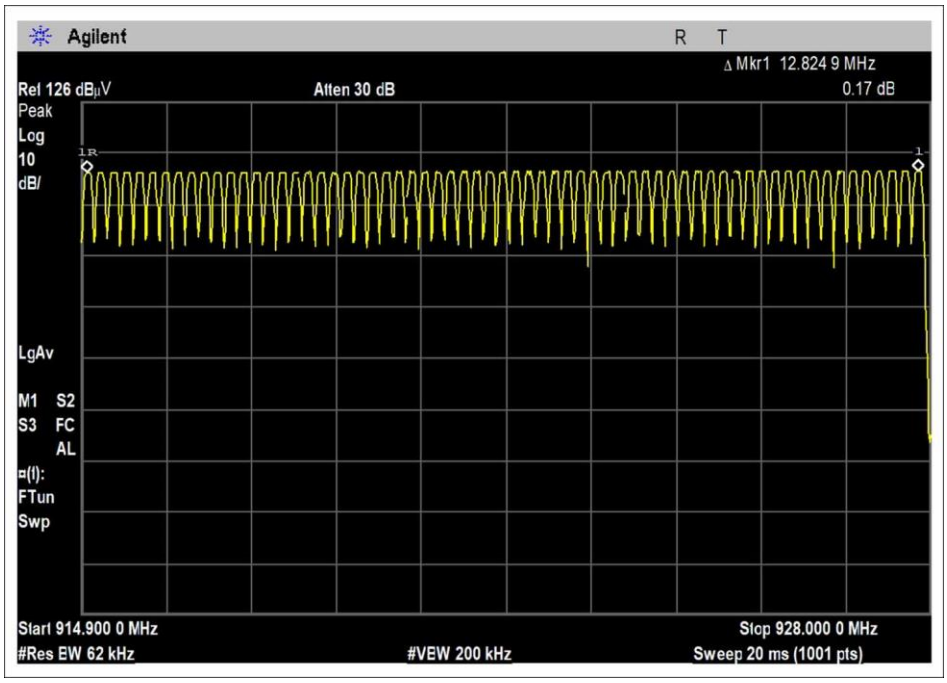
# 15.247(a)(1)(iii) Number of Hopping Channels

| Test Data Summary | | | | |
|---|---|---|---|---|
| $Limit = \begin{cases} 50\ Channels \mid 20\ dB\ BW < 250kHz \\ 25\ Channels \mid 20\ dB\ BW \geq 250kHz \end{cases}$ | | | | |
| **Antenna Port** | **Operational Mode** | **Measured (Channels)** | **Limit (Channels)** | **Results** |
| 1 | GFSK 50kbps | 129 | ≥50 | Pass |

## Plot(s)




Number of Channels (1 through 64)




Number of Channels (64 through 129)

## Test Setup Photo

# 15.247(b)(1) Output Power

## Test Data Summary - Voltage Variations

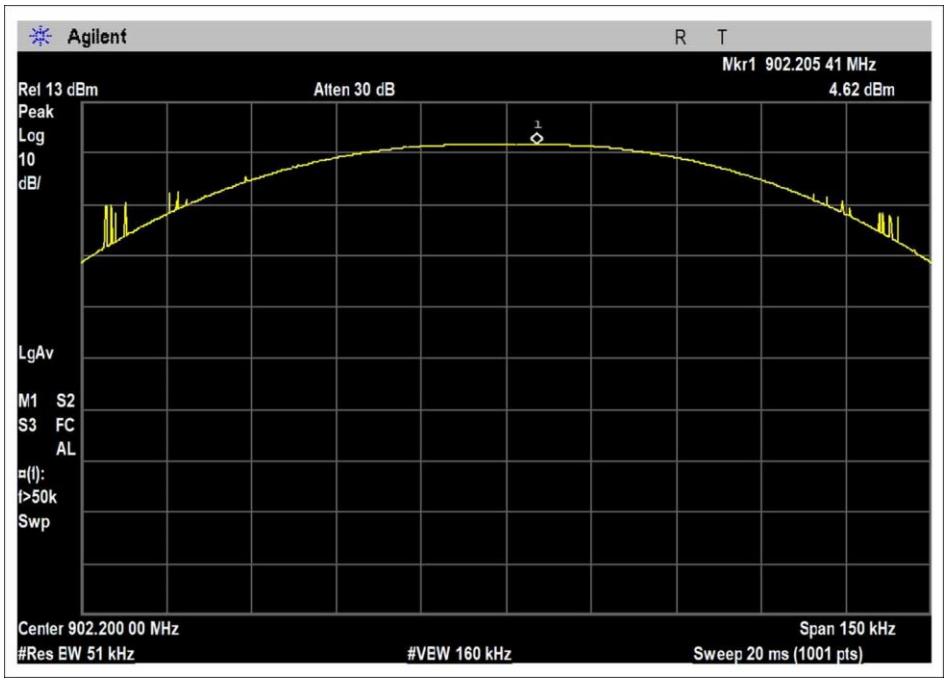
This equipment is battery powered. Power output tests were performed using a fresh battery.

## Test Data Summary - RF Conducted Measurement

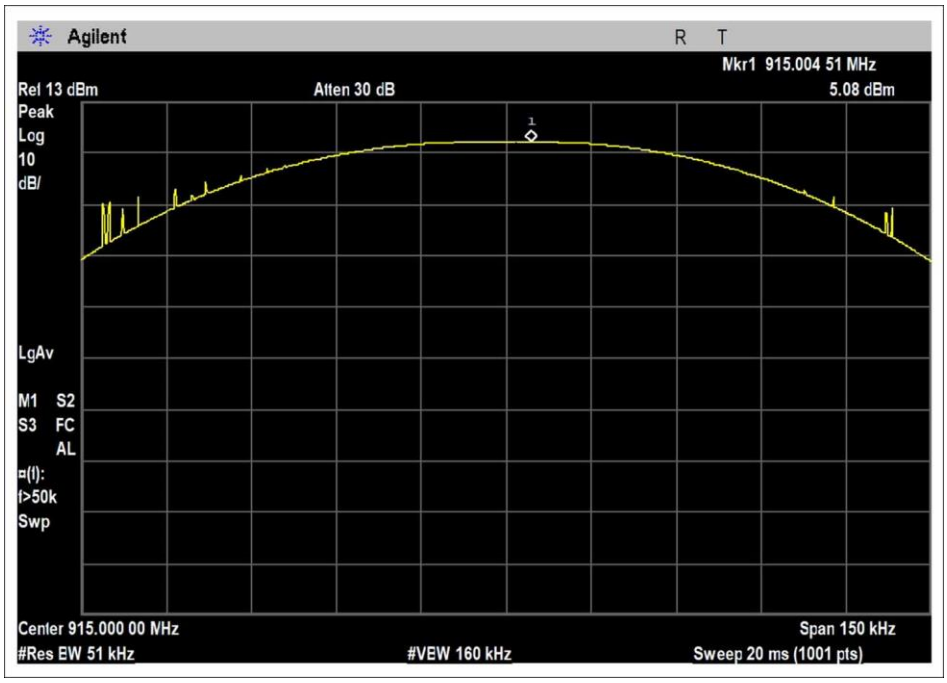
$$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$$

| Frequency (MHz) | Port | Modulation | Ant Gain (dBi) | Measured (dBm) | Conducted Limit (dBm) | Results |
|---|---|---|---|---|---|---|
| 902.2 | 1 | GFSK 25kbps | 4.8 | 25.2 | ≤30 | Pass |
| 915 | 1 | GFSK 25kbps | 4.8 | 25.7 | ≤30 | Pass |
| 927.75 | 1 | GFSK 25kbps | 4.8 | 26.0 | ≤30 | Pass |
| 902.2 | 1 | GFSK 50 kbps | 4.8 | 25.2 | ≤30 | Pass |
| 915 | 1 | GFSK 50 kbps | 4.8 | 25.7 | ≤30 | Pass |
| 927.8 | 1 | GFSK 50 kbps | 4.8 | 26.0 | ≤30 | Pass |

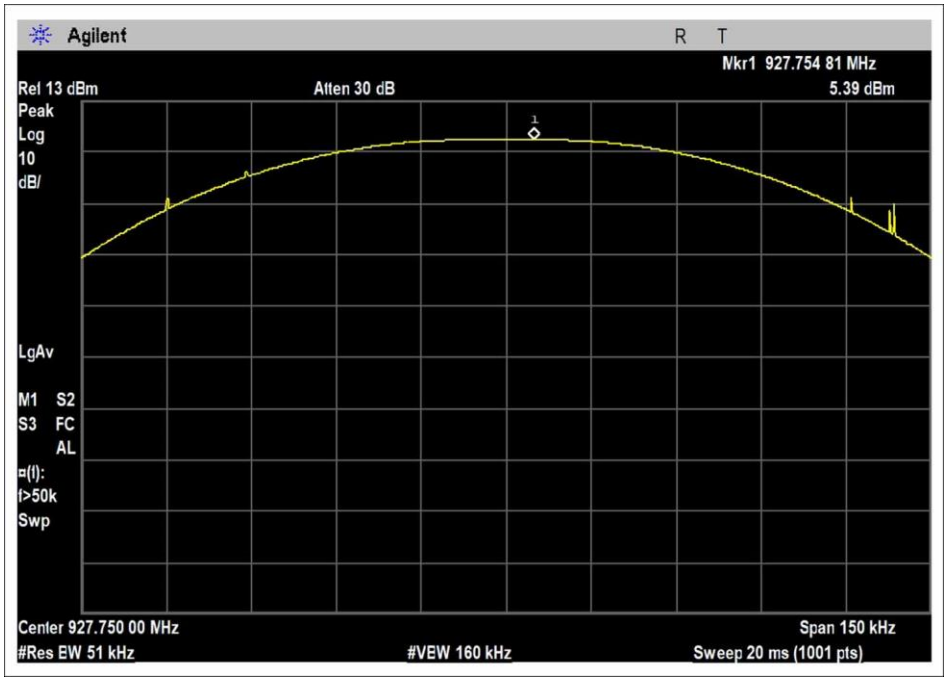
## Plots



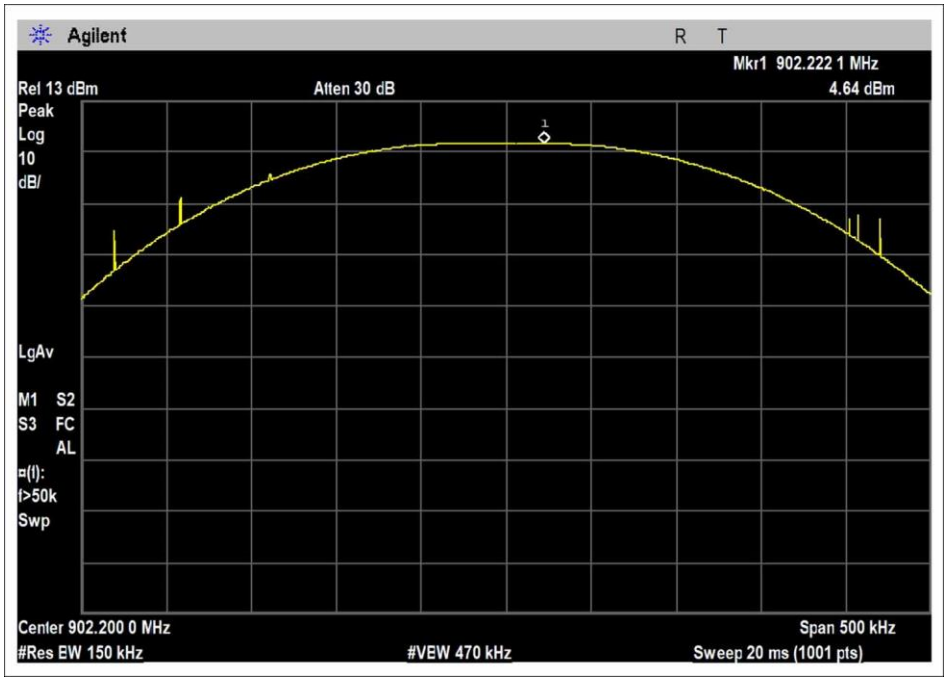

25kbps Low Channel



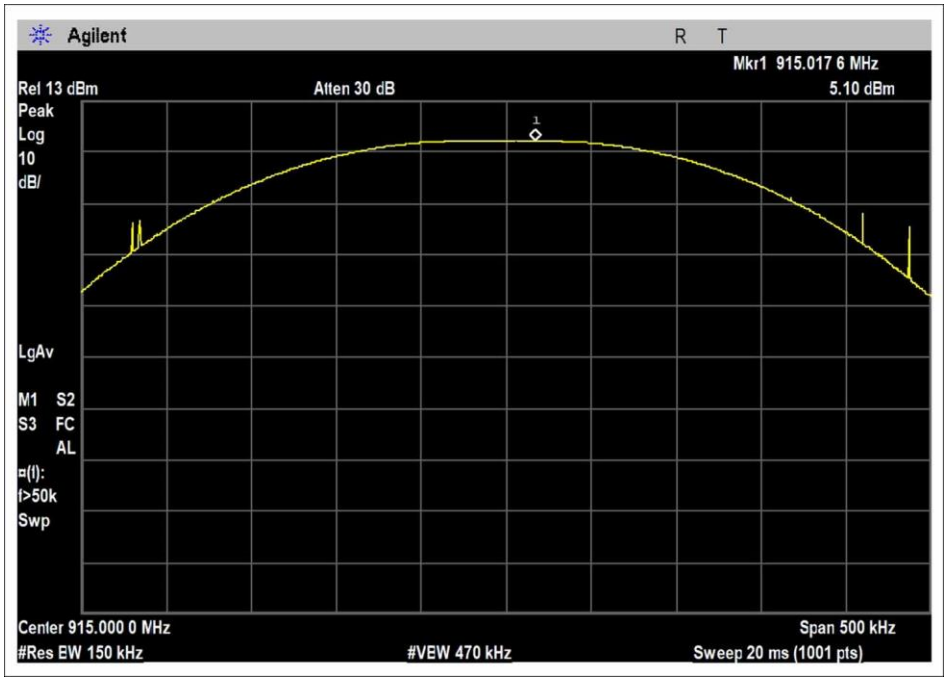

25kbps Middle Channel



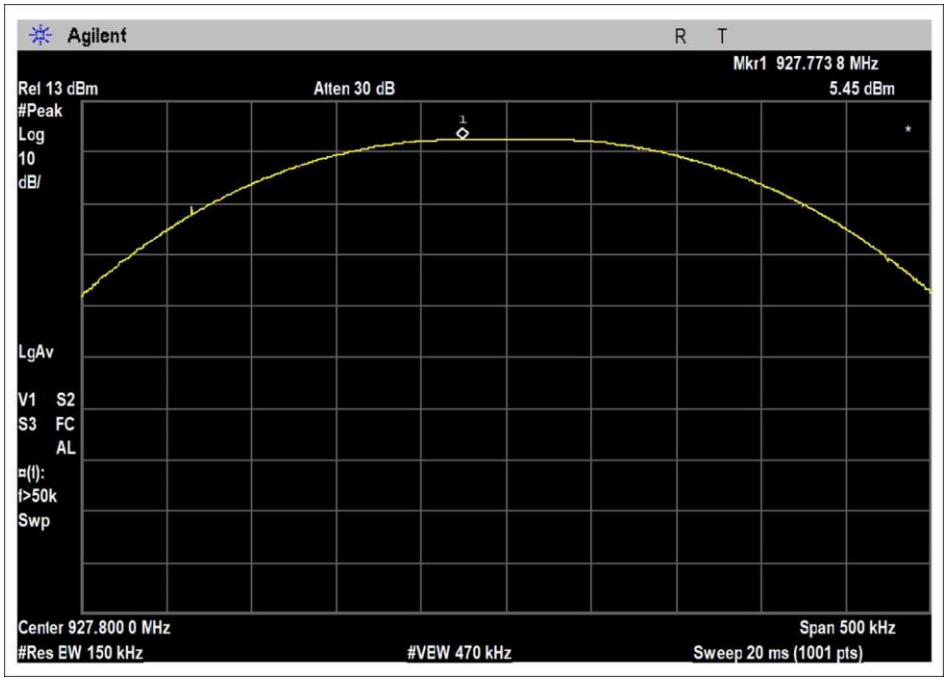

25kbps High Channel




50kbps Low Channel




50kbps Middle Channel




50kbps 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 FHSS >50 Channels)** | | |
| Work Order #: | **103184** | Date: | 10/29/2019 |
| Test Type: | **Conducted Emissions** | Time: | 11:43:03 |
| Tested By: | Michael Atkinson | Sequence#: | 2 |
| Software: | EMITest 5.03.12 | | Battery |

***Equipment Tested:***

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

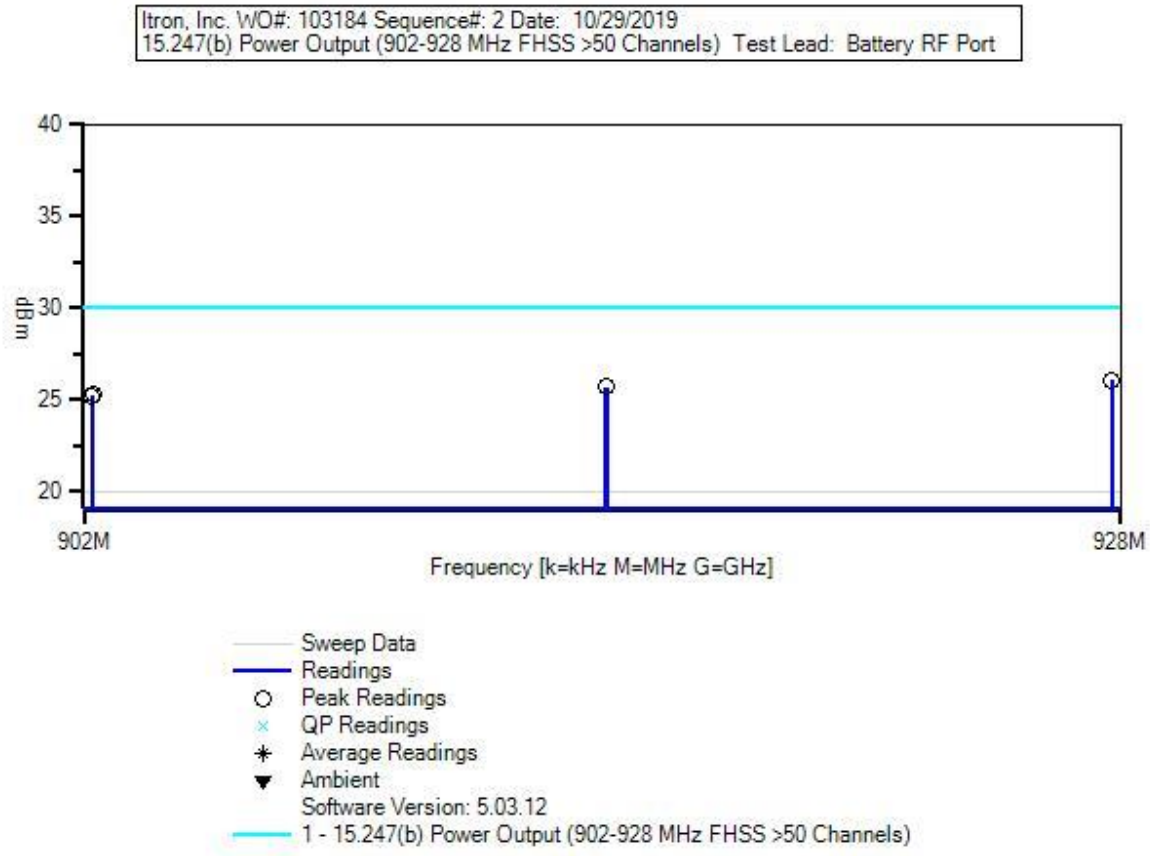
***Support Equipment:***

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

***Test Conditions / Notes:***

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 max power.
The EUT is transmitter at its rated output power.
Measurements were performed using a temporary connection to a power supply set to a voltage representative of a fresh battery installed.
Test Location: Bothell Lab Bench

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 19-23
Relative Humidity (%): 30-50




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN02872 | Spectrum Analyzer | E4440A | 11/3/2017 | 11/3/2019 |
| T1 | ANP05748 | Attenuator | PE7004-20 | 4/24/2018 | 4/24/2020 |
| T2 | ANP05959 | Cable | Heliax | 4/11/2018 | 4/11/2020 |

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

| # | Freq MHz | Rdng dBm | T1 dB | T2 dB | dB | dB | Dist Table | Corr dBm | Spec dBm | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 927.755M | 5.4 | +20.0 | +0.6 | | | +0.0 | 26.0 | 30.0 | -4.0 | RF Po |
| 2 | 927.774M | 5.4 | +20.0 | +0.6 | | | +0.0 | 26.0 | 30.0 | -4.0 | RF Po |
| 3 | 915.005M | 5.1 | +20.0 | +0.6 | | | +0.0 | 25.7 | 30.0 | -4.3 | RF Po |
| 4 | 915.018M | 5.1 | +20.0 | +0.6 | | | +0.0 | 25.7 | 30.0 | -4.3 | RF Po |
| 5 | 902.205M | 4.6 | +20.0 | +0.6 | | | +0.0 | 25.2 | 30.0 | -4.8 | RF Po |
| 6 | 902.222M | 4.6 | +20.0 | +0.6 | | | +0.0 | 25.2 | 30.0 | -4.8 | RF Po |

## Test Setup Photo

# 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 #: | **103184** | Date: | 10/29/2019 |
| Test Type: | **Conducted Emissions** | Time: | 13:26:32 |
| Tested By: | Michael Atkinson | Sequence#: | 4 |
| Software: | EMITest 5.03.12 | | Battery |

***Equipment Tested:***

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

***Support Equipment:***

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

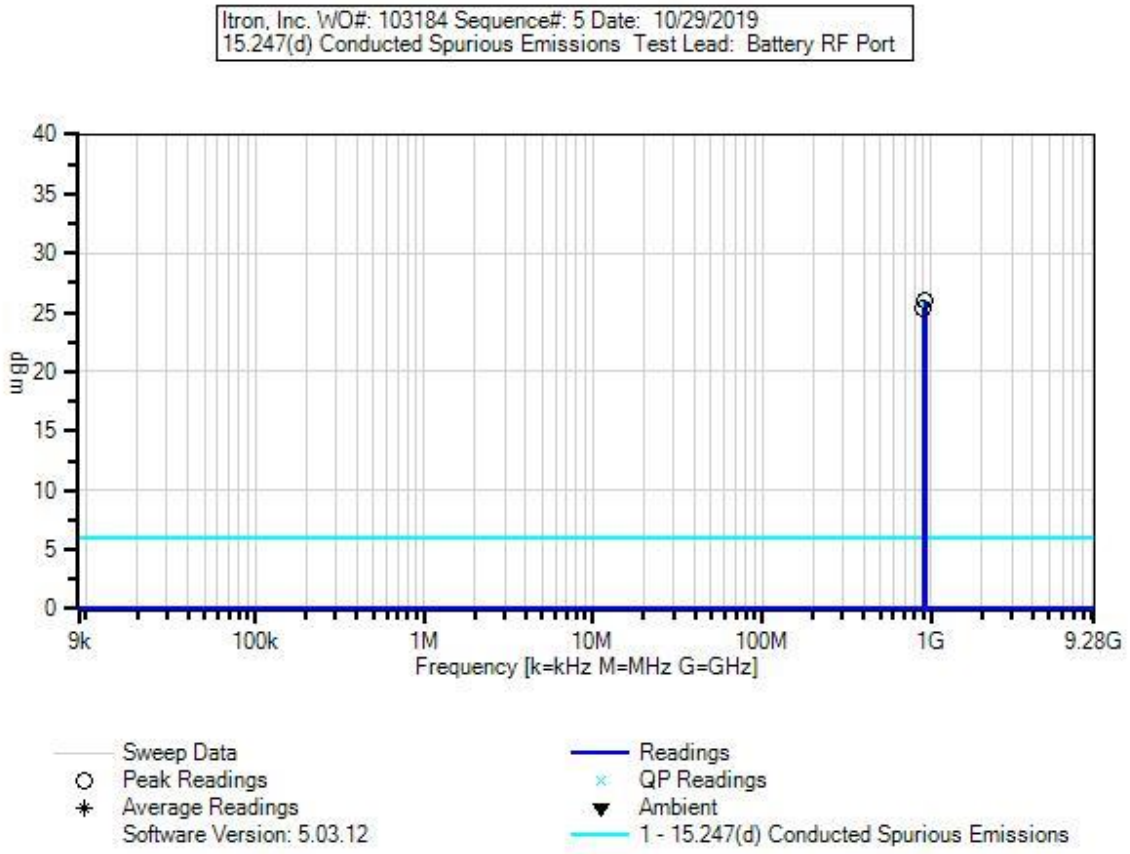
***Test Conditions / Notes:***

Frequency: 9kHz-9280MHz.

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 max power.
Measurements were performed with a fresh battery installed.
L, M, H channels investigated.
25k and 50k data rates investigated.
Worst case reported.

Test Location: Brea Lab Bench

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 19-23
Relative Humidity (%): 30-50




***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN02872 | Spectrum Analyzer | E4440A | 11/3/2017 | 11/3/2019 |
| T2 | ANP05748 | Attenuator | PE7004-20 | 4/24/2018 | 4/24/2020 |
| T3 | ANP05959 | Cable | Heliax | 4/11/2018 | 4/11/2020 |

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

| # | Freq MHz | Rdng dBm | T1 dB | T2 dB | T3 dB | dB | Dist Table | Corr dBm | Spec dBm | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1804.400M | -40.6 | +0.0 | +20.0 | +1.1 | | +0.0 | -19.5 | 6.0 50k | -25.5 | RF Po |
| 2 | 1804.410M | -40.6 | +0.0 | +20.0 | +1.1 | | +0.0 | -19.5 | 6.0 25k | -25.5 | RF Po |
| 3 | 1830.005M | -41.0 | +0.0 | +20.0 | +1.1 | | +0.0 | -19.9 | 6.0 25k | -25.9 | RF Po |
| 4 | 1855.548M | -41.0 | +0.0 | +20.0 | +1.1 | | +0.0 | -19.9 | 6.0 50k | -25.9 | RF Po |
| 5 | 1855.500M | -41.1 | +0.0 | +20.0 | +1.1 | | +0.0 | -20.0 | 6.0 25k | -26.0 | RF Po |
| 6 | 1830.001M | -41.1 | +0.0 | +20.0 | +1.1 | | +0.0 | -20.0 | 6.0 50k | -26.0 | RF Po |

## Band Edge

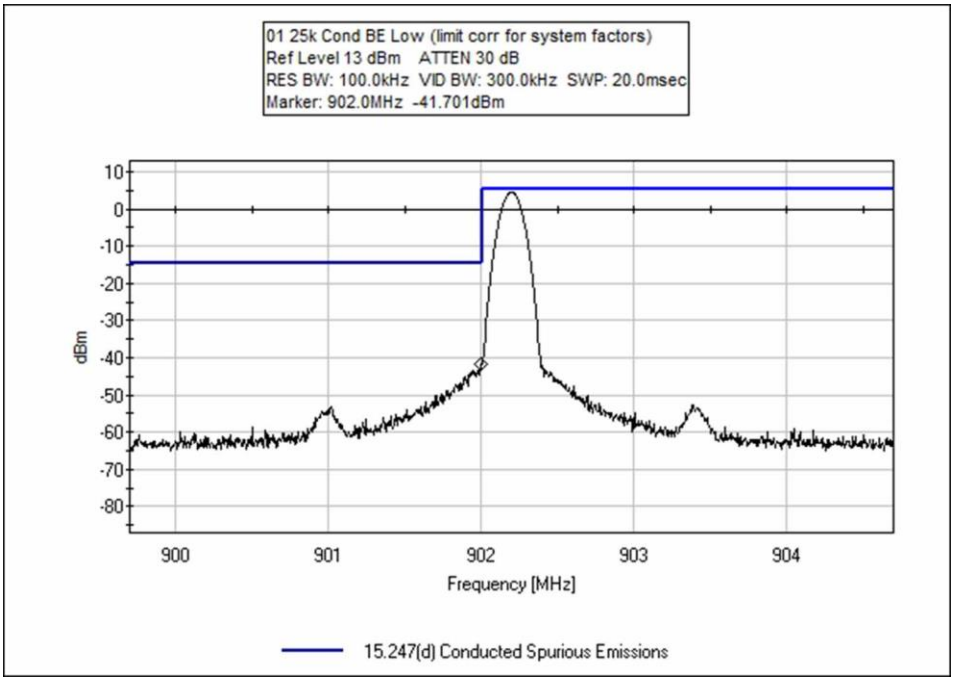
| Band Edge Summary | | | | |
|---|---|---|---|---|
| Limit applied: Max Power/100kHz - 20dB.<br>Operating Mode: Single Channel (Low and High) | | | | |
| **Frequency (MHz)** | **Modulation** | **Measured (dBm)** | **Limit (dBm)** | **Results** |
| 902 | GFSK 25kbps | -21.1 | <6.0 | Pass |
| 928 | GFSK 25kbps | -22.6 | <6.0 | Pass |

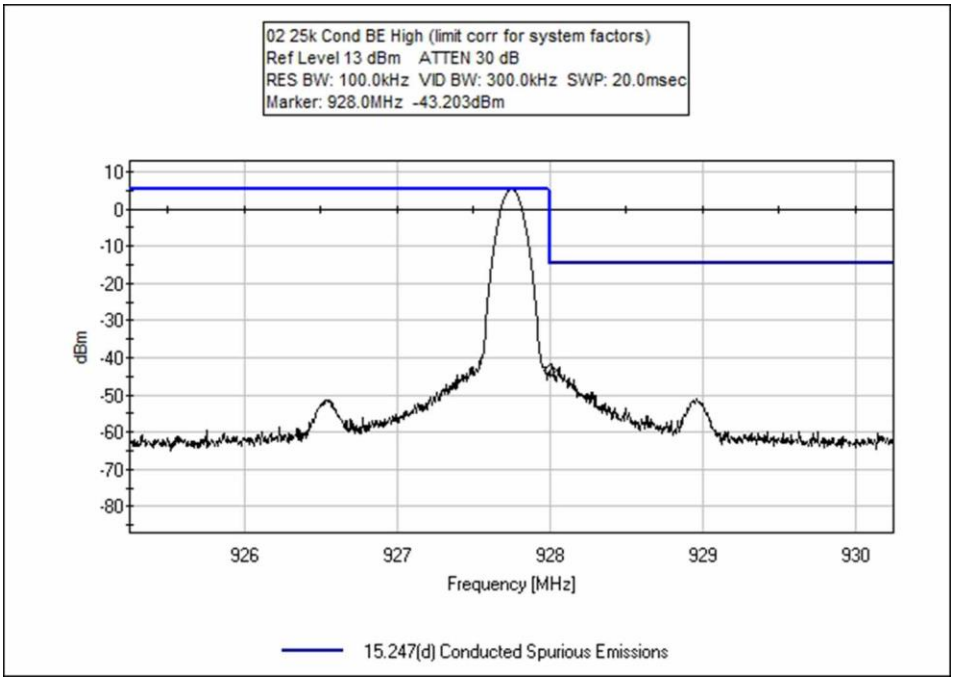
| Band Edge Summary | | | | |
|---|---|---|---|---|
| Limit applied: Max Power/100kHz - 20dB.<br>Operating Mode: Single Channel (Low and High) | | | | |
| **Frequency (MHz)** | **Modulation** | **Measured (dBm)** | **Limit (dBm)** | **Results** |
| 902 | GFSK 50kbps | -22.0 | <6.0 | Pass |
| 928 | GFSK 50kbps | -21.4 | <6.0 | Pass |

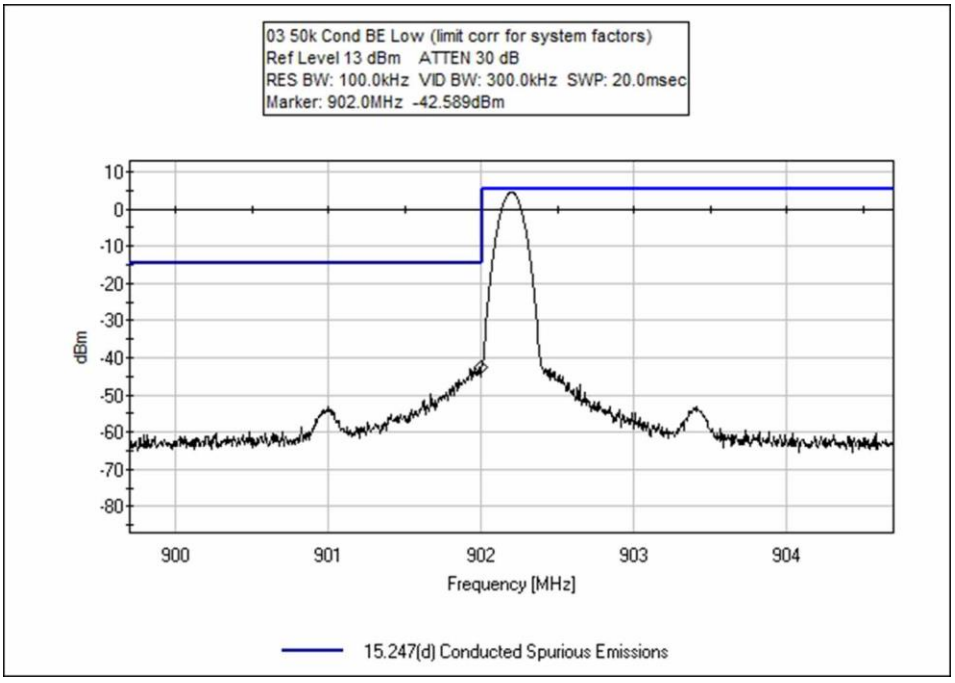
| Band Edge Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Limit applied: Max Power/100kHz - 20dB. (Using Marker Delta Method)<br>Operating Mode: Hopping | | | | | | | |
| **Freq (MHz)** | **Modulation** | **100kHz Band Edge Measurement (dBm)** | **100kHz Fundamental Measurement (dBm)** | **30kHz Band Edge Measurement (dBm)** | **30kHz Fundamental Measurement (dBm)** | **Band Edge Limit (30kHz) (dBm)** | **Results** |
| 902 | Hopping GSFK 25k | 7.5 | 25.3 | -3.8 | 25.3 | <6.0 | Pass |
| 928 | Hopping GSFK 25k | 5.3 | 26.0 | -5.4 | 26.0 | <6.0 | Pass |
| 902 | Hopping GSFK 50k | 8.9 | 25.3 | -2.9 | 25.3 | <6.0 | Pass |
| 928 | Hopping GSFK 50k | 7.4 | 26.0 | -4.0 | 26.0 | <6.0 | Pass |

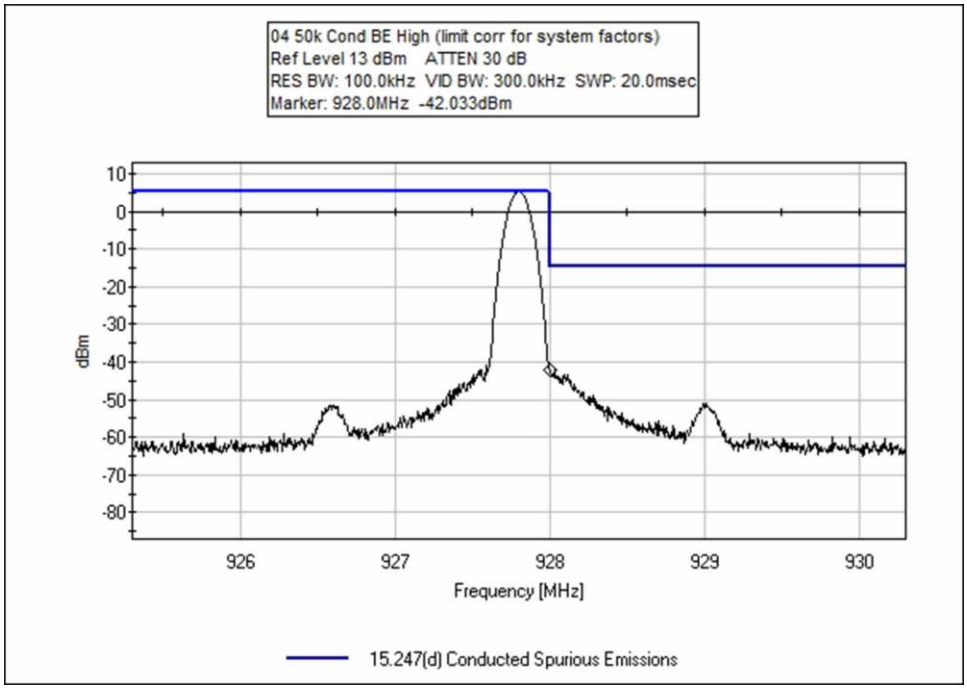
Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement.

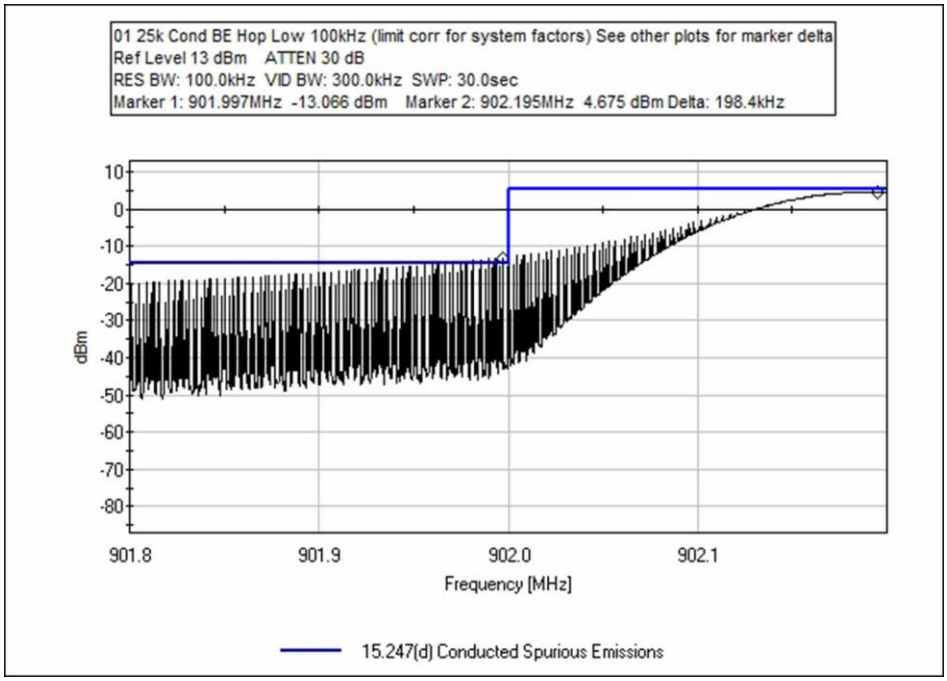
## Band Edge Plots

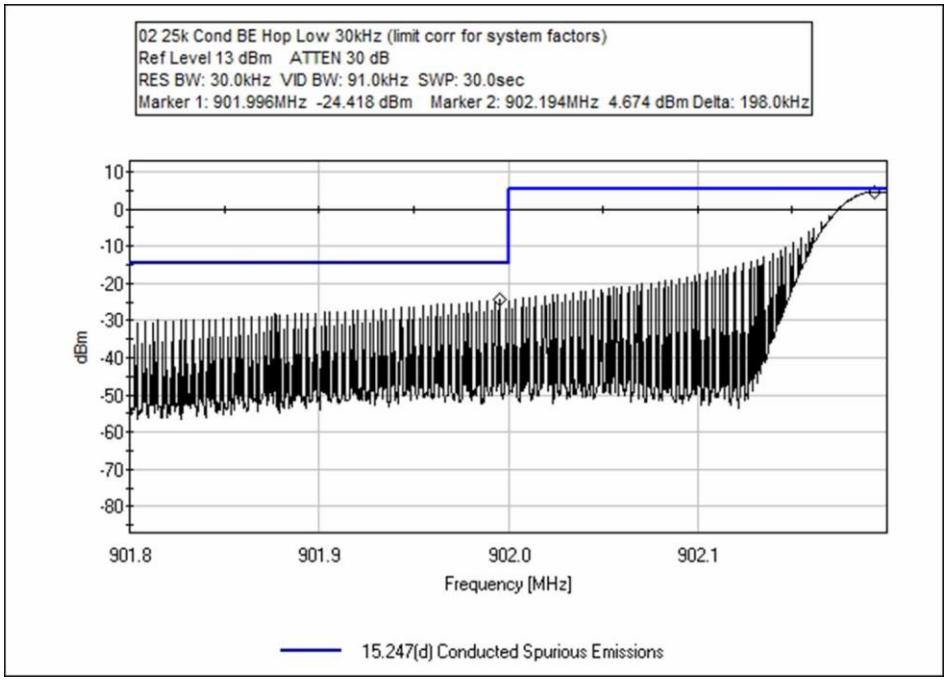


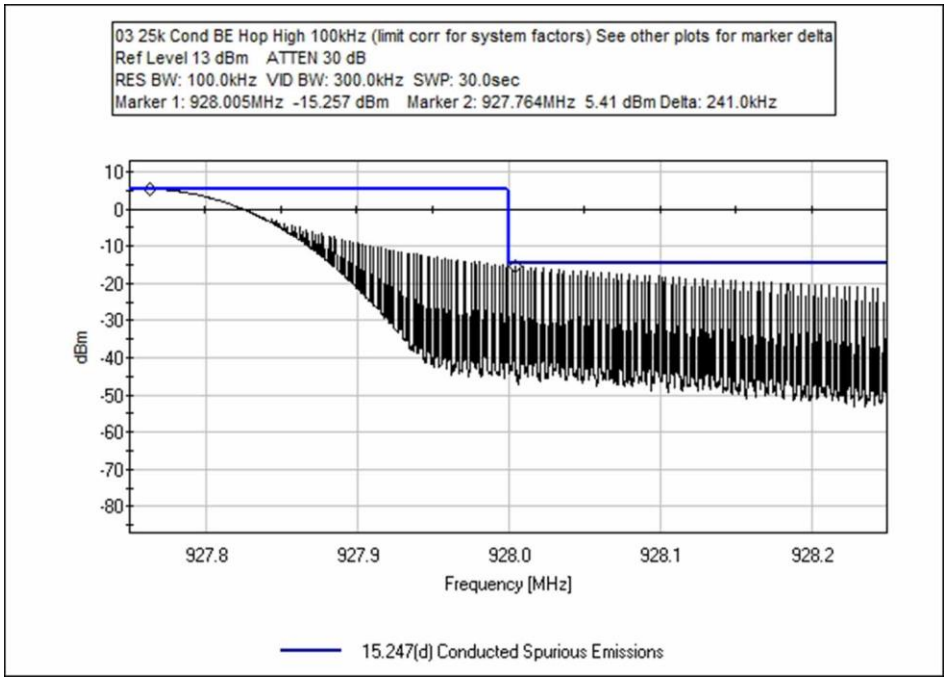



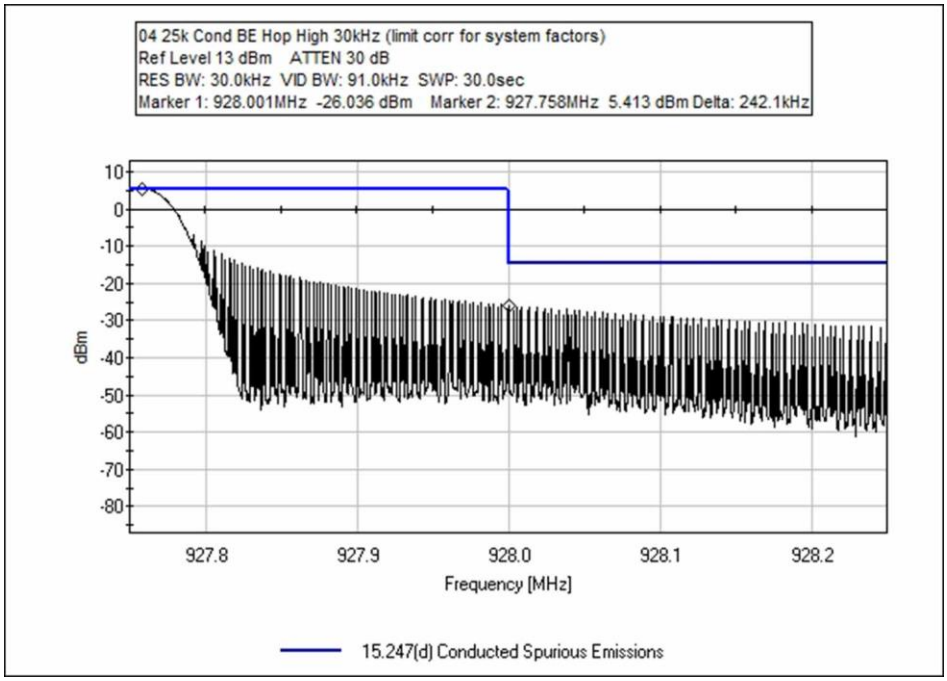

03 50k Cond BE Low (limit corr for system factors)
Ref Level 13 dBm ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz -42.589dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
900
901
902
903
904
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

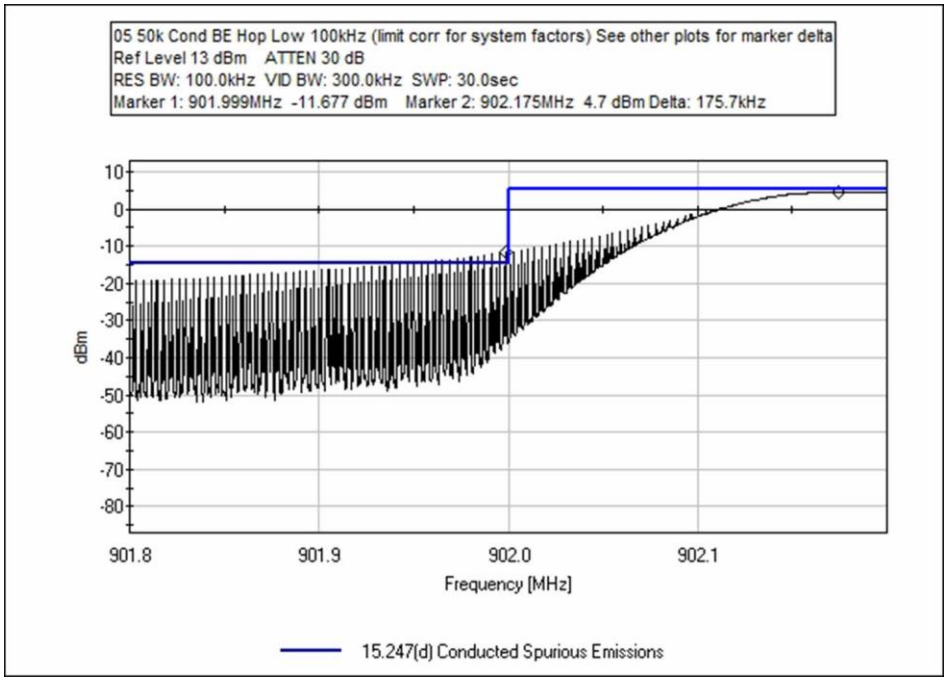

04 50k Cond BE High (limit corr for system factors)
Ref Level 13 dBm ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz -42.033dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
926
927
928
929
930
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

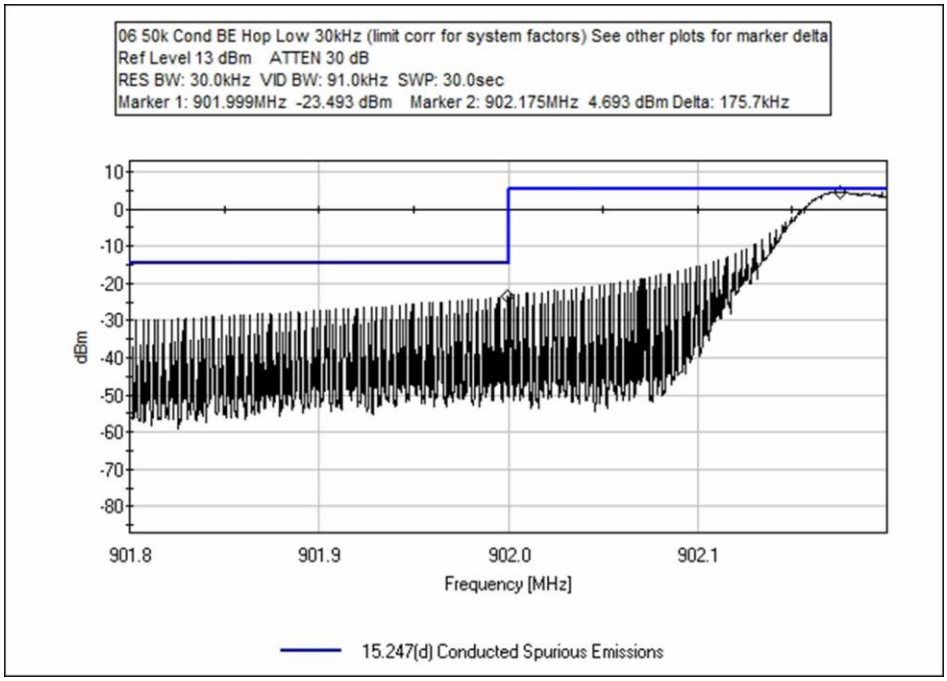

01 25k Cond BE Hop Low 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 13 dBm ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 901.997MHz -13.066 dBm Marker 2: 902.195MHz 4.675 dBm Delta: 198.4kHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

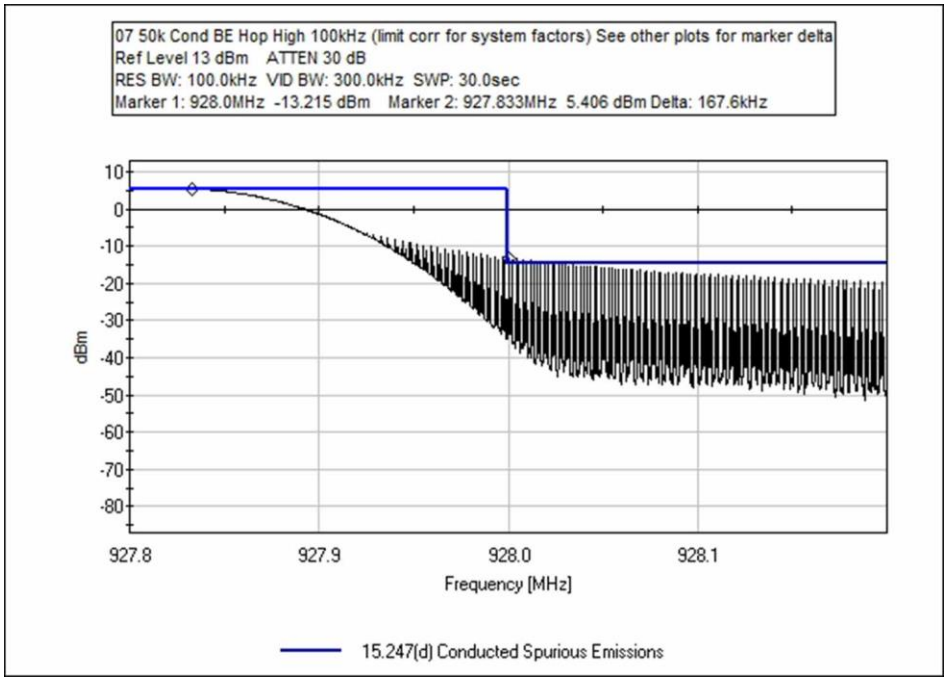

02 25k Cond BE Hop Low 30kHz (limit corr for system factors)
Ref Level 13 dBm ATTEN 30 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 901.996MHz -24.418 dBm Marker 2: 902.194MHz 4.674 dBm Delta: 198.0kHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

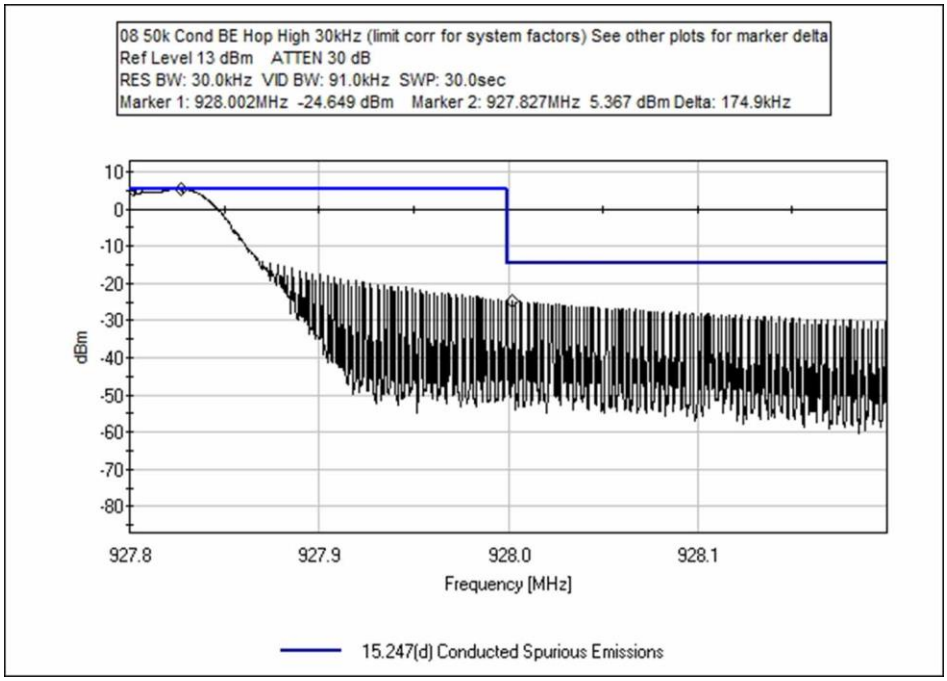

03 25k Cond BE Hop High 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 13 dBm ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 928.005MHz -15.257 dBm Marker 2: 927.764MHz 5.41 dBm Delta: 241.0kHz
dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
927.8
927.9
928.0
928.1
928.2
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


04 25k Cond BE Hop High 30kHz (limit corr for system factors)
Ref Level 13 dBm ATTEN 30 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 928.001MHz -26.036 dBm Marker 2: 927.758MHz 5.413 dBm Delta: 242.1kHz
dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
927.8
927.9
928.0
928.1
928.2
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


05 50k Cond BE Hop Low 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 13 dBm ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 901.999MHz -11.677 dBm Marker 2: 902.175MHz 4.7 dBm Delta: 175.7kHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


06 50k Cond BE Hop Low 30kHz (limit corr for system factors) See other plots for marker delta
Ref Level 13 dBm ATTEN 30 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 901.999MHz -23.493 dBm Marker 2: 902.175MHz 4.693 dBm Delta: 175.7kHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


07 50k Cond BE Hop High 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 13 dBm ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 928.0MHz -13.215 dBm Marker 2: 927.833MHz 5.406 dBm Delta: 167.6kHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
927.8
927.9
928.0
928.1
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


08 50k Cond BE Hop High 30kHz (limit corr for system factors) See other plots for marker delta
Ref Level 13 dBm ATTEN 30 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 928.002MHz -24.649 dBm Marker 2: 927.827MHz 5.367 dBm Delta: 174.9kHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
dBm
927.8
927.9
928.0
928.1
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 #: | **103184** | Date: | 10/29/2019 |
| Test Type: | **Conducted Emissions** | Time: | 13:14:54 |
| Tested By: | Michael Atkinson | Sequence#: | 5 |
| Software: | EMITest 5.03.12 | | Battery |

***Equipment Tested:***

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

***Support Equipment:***

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

***Test Conditions / Notes:***

Frequency: Band Edge

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 max power.
Measurements were performed with a fresh battery installed.
Hopping channels investigated.
25kbps and 50kbps data rates investigated.
Worst case reported.

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN02872 | Spectrum Analyzer | E4440A | 11/3/2017 | 11/3/2019 |
| T1 | ANP05748 | Attenuator | PE7004-20 | 4/24/2018 | 4/24/2020 |
| T2 | ANP05959 | Cable | Heliax | 4/11/2018 | 4/11/2020 |

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

| # | Freq MHz | Rdng dBm | T1 dB | T2 dB | dB | dB | Dist Table | Corr dBm | Spec dBm | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 927.758M | 5.4 | +20.0 | +0.6 | | | +0.0 | 26.0 | 26.0<br>25k High | +0.0 | RF Po |
| 2 | 927.764M | 5.4 | +20.0 | +0.6 | | | +0.0 | 26.0 | 26.0<br>25k High | +0.0 | RF Po |
| 3 | 927.833M | 5.4 | +20.0 | +0.6 | | | +0.0 | 26.0 | 26.0<br>50k High | +0.0 | RF Po |
| 4 | 927.827M | 5.4 | +20.0 | +0.6 | | | +0.0 | 26.0 | 26.0<br>50k High | +0.0 | RF Po |
| 5 | 902.195M | 4.7 | +20.0 | +0.6 | | | +0.0 | 25.3 | 26.0<br>25k Low | -0.7 | RF Po |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 902.194M | 4.7 | +20.0 | +0.6 | +0.0 | 25.3 | 26.0<br>25k Low | -0.7 | RF Po |
| 7 | 902.175M | 4.7 | +20.0 | +0.6 | +0.0 | 25.3 | 26.0<br>50k Low | -0.7 | RF Po |
| 8 | 902.175M | 4.7 | +20.0 | +0.6 | +0.0 | 25.3 | 26.0<br>50k Low | -0.7 | RF Po |
| 9 | 901.999M | -23.5 | +20.0 | +0.6 | +0.0 | -2.9 | 6.0<br>50k Low | -8.9 | RF Po |
| 10 | 901.996M | -24.4 | +20.0 | +0.6 | +0.0 | -3.8 | 6.0<br>25k Low | -9.8 | RF Po |
| 11 | 928.002M | -24.6 | +20.0 | +0.6 | +0.0 | -4.0 | 6.0<br>50k High | -10.0 | RF Po |
| 12 | 928.001M | -26.0 | +20.0 | +0.6 | +0.0 | -5.4 | 6.0<br>25k High | -11.4 | RF Po |

| | | | |
|---|---|---|---|
| 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 #: | **103184** | Date: | 10/29/2019 |
| Test Type: | **Conducted Emissions** | Time: | 12:40:35 |
| Tested By: | Michael Atkinson | Sequence#: | 5 |
| Software: | EMITest 5.03.12 | | 6VDC |

***Equipment Tested:***

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

***Support Equipment:***

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

***Test Conditions / Notes:***

Frequency: Band Edge

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 max power.
Measurements were performed with a fresh battery installed.
Low and High channels investigated.
25kbps and 50kbps data rates investigated.
Worst case reported.

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN02872 | Spectrum Analyzer | E4440A | 11/3/2017 | 11/3/2019 |
| T1 | ANP05748 | Attenuator | PE7004-20 | 4/24/2018 | 4/24/2020 |
| T2 | ANP05959 | Cable | Heliax | 4/11/2018 | 4/11/2020 |

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

| # | Freq MHz | Rdng dBm | T1 dB | T2 dB | dB | dB | Dist Table | Corr dBm | Spec dBm | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 902.000M | -41.7 | +20.0 | +0.6 | | | +0.0 | -21.1 | 6.0 25k | -27.1 | RF Po |
| 2 | 928.000M | -42.0 | +20.0 | +0.6 | | | +0.0 | -21.4 | 6.0 50k | -27.4 | RF Po |
| 3 | 902.000M | -42.6 | +20.0 | +0.6 | | | +0.0 | -22.0 | 6.0 50k | -28.0 | RF Po |
| 4 | 928.000M | -43.2 | +20.0 | +0.6 | | | +0.0 | -22.6 | 6.0 25k | -28.6 | RF Po |

## 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 #: | **103183** | Date: | 10/4/2019 |
| Test Type: | **Maximized Emissions** | Time: | 10:12:52 |
| Tested By: | Michael Atkinson | Sequence#: | 1 |
| Software: | EMITest 5.03.12 | | |

***Equipment Tested:***

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

***Support Equipment:***

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

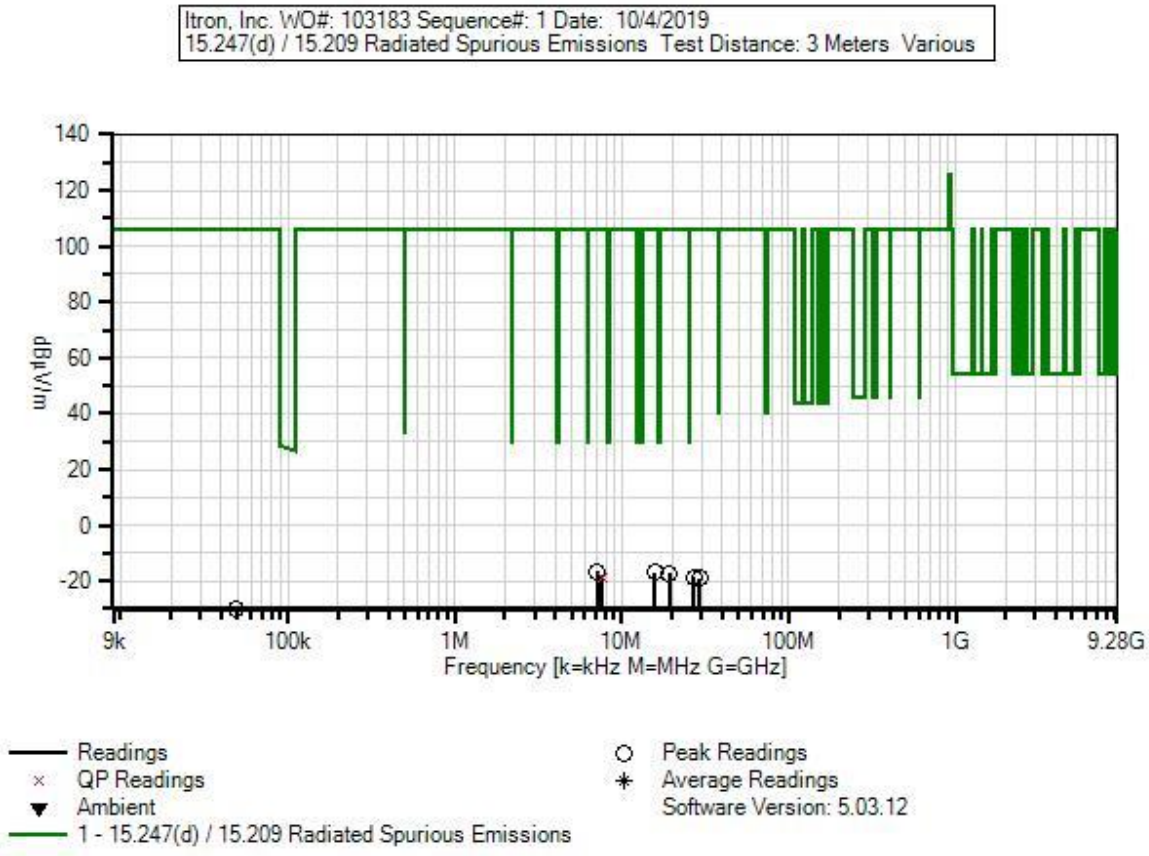
***Test Conditions / Notes:***

Frequency Range: 9kHz-30MHz

Test Setup:
EUT is continuously transmitting through integral antenna.
25kbps and 50kbps data rate investigated, worst case reported.
Low, Mid, High channels as well as hopping mode investigated, worst case reported.
Installed orientation of the X-axis was used.
3 x orthogonal measurement antenna polarities investigated, worst case reported.

Test Location: Bothell Lab C3

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 19-23
Relative Humidity (%): 30-50


Itron, Inc. WO#: 103183 Sequence#: 1 Date: 10/4/2019
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Various
140
120
100
80
60
40
20
0
-20
dBµV/m
9k
100k
1M
10M
100M
1G
9.28G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.12

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T2 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T3 | ANP06515 | Cable | Heliax | 6/29/2018 | 6/29/2020 |
| T4 | AN00052 | Loop Antenna | 6502 | 5/7/2018 | 5/7/2020 |

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

| # | Freq MHz | Rdng dBµV | T1 dB | T2 dB | T3 dB | T4 dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 101.100k | 36.6 | +0.0 | +0.0 | +0.0 | +9.7 | -80.0 | -33.7 | 27.5 | -61.2 | Para |
| 2 | 7.147M | 14.1 | +0.0 | +0.0 | +0.1 | +9.4 | -40.0 | -16.4 | 106.0 | -122.4 | Groun |
| 3 | 15.664M | 14.1 | +0.0 | +0.1 | +0.2 | +8.9 | -40.0 | -16.7 | 106.0 | -122.7 | Para |
| 4 | 19.383M | 14.2 | +0.0 | +0.1 | +0.2 | +8.1 | -40.0 | -17.4 | 106.0 | -123.4 | Para |
| 5 | 7.597M QP | 11.9 | +0.0 | +0.0 | +0.1 | +9.4 | -40.0 | -18.6 | 106.0 | -124.6 | Para |
| ^ | 7.597M | 16.4 | +0.0 | +0.0 | +0.1 | +9.4 | -40.0 | -14.1 | 106.0 | -120.1 | Para |
| 7 | 26.971M | 14.6 | +0.0 | +0.1 | +0.3 | +6.4 | -40.0 | -18.6 | 106.0 | -124.6 | Perp |
| 8 | 29.160M | 15.0 | +0.0 | +0.1 | +0.3 | +5.8 | -40.0 | -18.8 | 106.0 | -124.8 | Para |
| 9 | 48.399k | 39.8 | +0.0 | +0.0 | +0.0 | +10.2 | -80.0 | -30.0 | 106.0 | -136.0 | Para |

| | | | |
|---|---|---|---|
| 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 #: | **103183** | Date: | 10/6/2019 |
| Test Type: | **Maximized Emissions** | Time: | 14:11:36 |
| Tested By: | Michael Atkinson | Sequence#: | 2 |
| Software: | EMITest 5.03.12 | | |

***Equipment Tested:***

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

***Support Equipment:***

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

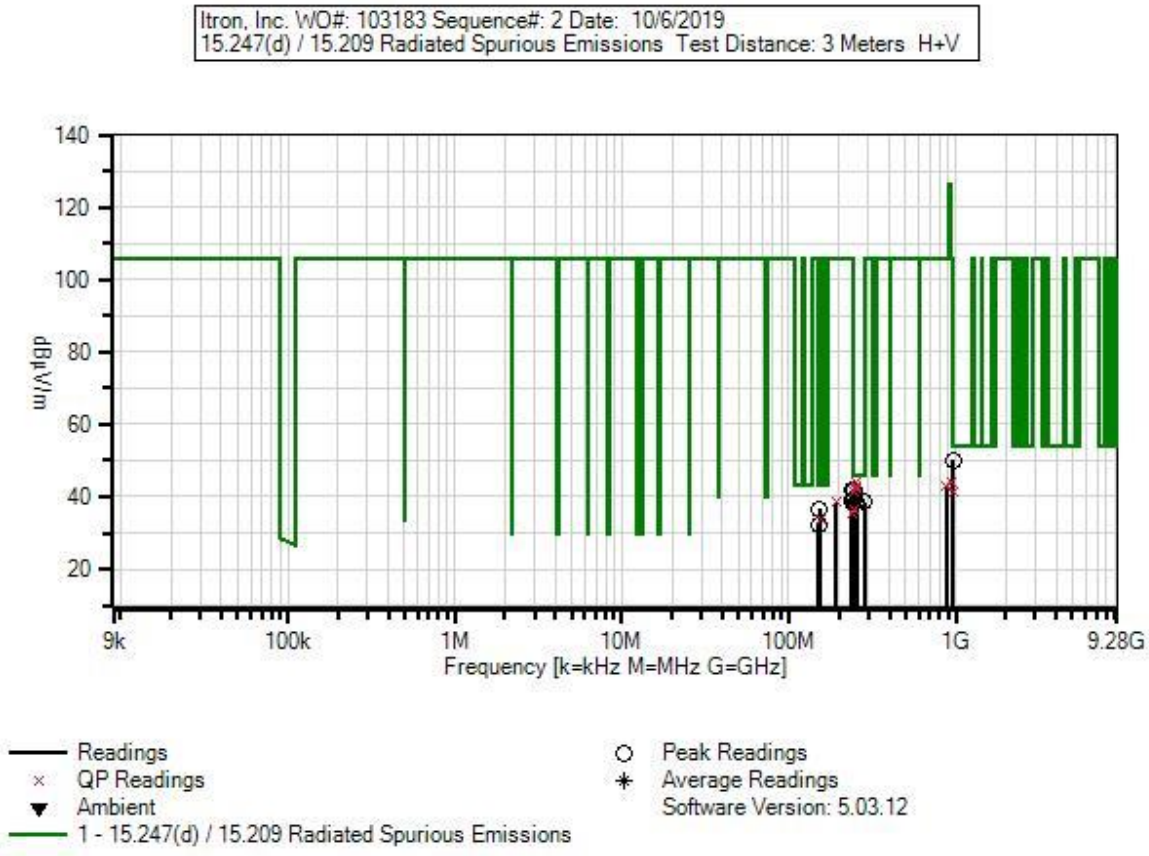
***Test Conditions / Notes:***

Frequency Range: 30-1000MHz

Test Setup:
EUT is continuously transmitting through integral antenna.
25kbps and 50kbps data rate investigated, worst case reported.
Low, Mid, High channels as well as hopping mode investigated, worst case reported.
Installed orientation of the X-axis was used.
Horizontal and Vertical measurement antenna polarities investigated, worst case reported.

Test Location: Bothell Lab C3

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 19-23
Relative Humidity (%): 30-50


Itron, Inc. WO#: 103183 Sequence#: 2 Date: 10/6/2019
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters H+V
140
120
100
80
60
40
20
dBµV/m
9k
100k
1M
10M
100M
1G
9.28G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.12

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T2 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T3 | ANP05305 | Cable | ETSI-50T | 9/6/2019 | 9/6/2021 |
| T4 | ANP05360 | Cable | RG214 | 1/31/2018 | 1/31/2020 |
| T5 | ANP06123 | Attenuator | 18N-6 | 4/5/2019 | 4/5/2021 |
| T6 | AN03628 | Biconilog Antenna | 3142E | 6/11/2019 | 6/11/2021 |

***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 | 250.059M | 24.0 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 43.9 | 46.0 | -2.1 | Horiz |
| | QP | | +5.8 | +12.2 | | | | | | | |
| ^ | 250.059M | 28.1 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 48.0 | 46.0 | +2.0 | Horiz |
| | | | +5.8 | +12.2 | | | | | | | |
| 3 | 251.210M | 23.1 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 43.0 | 46.0 | -3.0 | Horiz |
| | QP | | +5.8 | +12.2 | | | | | | | |
| 4 | 254.934M | 22.7 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 42.7 | 46.0 | -3.3 | Horiz |
| | QP | | +5.8 | +12.3 | | | | | | | |
| 5 | 964.100M | 15.6 | +0.0 | +0.4 | +1.5 | +2.1 | +0.0 | 50.1 | 54.0 | -3.9 | Horiz |
| | | | +5.9 | +24.6 | | | | | | | |
| 6 | 249.200M | 21.7 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 41.6 | 46.0 | -4.4 | Vert |
| | | | +5.8 | +12.2 | | | | | | | |
| 7 | 247.531M | 21.5 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 41.3 | 46.0 | -4.7 | Horiz |
| | QP | | +5.8 | +12.1 | | | | | | | |
| 8 | 242.400M | 19.8 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 39.4 | 46.0 | -6.6 | Vert |
| | | | +5.8 | +11.9 | | | | | | | |
| 9 | 249.200M | 19.4 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 39.3 | 46.0 | -6.7 | Vert |
| | | | +5.8 | +12.2 | | | | | | | |
| 10 | 241.500M | 19.4 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 38.9 | 46.0 | -7.1 | Horiz |
| | | | +5.8 | +11.8 | | | | | | | |
| 11 | 282.200M | 17.8 | +0.0 | +0.2 | +0.8 | +1.0 | +0.0 | 38.4 | 46.0 | -7.6 | Horiz |
| | | | +5.8 | +12.8 | | | | | | | |
| 12 | 252.100M | 18.5 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 38.4 | 46.0 | -7.6 | Vert |
| | | | +5.8 | +12.2 | | | | | | | |
| 13 | 248.866M | 16.5 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 36.4 | 46.0 | -9.6 | Vert |
| | QP | | +5.8 | +12.2 | | | | | | | |
| 14 | 241.563M | 15.7 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 35.2 | 46.0 | -10.8 | Vert |
| | QP | | +5.8 | +11.8 | | | | | | | |
| ^ | 241.500M | 19.0 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 38.5 | 46.0 | -7.5 | Vert |
| | | | +5.8 | +11.8 | | | | | | | |
| 16 | 964.100M | 6.8 | +0.0 | +0.4 | +1.5 | +2.1 | +0.0 | 41.3 | 54.0 | -12.7 | Vert |
| | QP | | +5.9 | +24.6 | | | | | | | |
| 17 | 953.400M | 9.5 | +0.0 | +0.4 | +1.5 | +2.1 | +0.0 | 43.8 | 106.0 | -62.2 | Horiz |
| | QP | | +5.8 | +24.5 | | | | | | | |
| ^ | 953.400M | 18.9 | +0.0 | +0.4 | +1.5 | +2.1 | +0.0 | 53.2 | 106.0 | -52.8 | Horiz |
| | | | +5.8 | +24.5 | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 880.700M | 9.7 | +0.0 | +0.3 | +1.4 | +1.9 | +0.0 | 42.9 | 106.0 | -63.1 | Horiz |
| | QP | | +5.8 | +23.8 | | | | | | | |
| | ^ 880.700M | 24.7 | +0.0 | +0.3 | +1.4 | +1.9 | +0.0 | 57.9 | 106.0 | -48.1 | Horiz |
| | | | +5.8 | +23.8 | | | | | | | |
| 21 | 882.600M | 9.6 | +0.0 | +0.3 | +1.4 | +1.9 | +0.0 | 42.8 | 106.0 | -63.2 | Vert |
| | QP | | +5.8 | +23.8 | | | | | | | |
| | ^ 882.600M | 26.0 | +0.0 | +0.3 | +1.4 | +1.9 | +0.0 | 59.2 | 106.0 | -46.8 | Vert |
| | | | +5.8 | +23.8 | | | | | | | |
| 23 | 238.500M | 22.3 | +0.0 | +0.2 | +0.8 | +0.9 | +0.0 | 41.7 | 106.0 | -64.3 | Horiz |
| | | | +5.8 | +11.7 | | | | | | | |
| 24 | 191.708M | 21.0 | +0.0 | +0.2 | +0.7 | +0.8 | +0.0 | 38.4 | 106.0 | -67.6 | Horiz |
| | QP | | +5.8 | +9.9 | | | | | | | |
| | ^ 191.708M | 24.2 | +0.0 | +0.2 | +0.7 | +0.8 | +0.0 | 41.6 | 106.0 | -64.4 | Horiz |
| | | | +5.8 | +9.9 | | | | | | | |
| 26 | 153.200M | 20.0 | +0.0 | +0.2 | +0.6 | +0.7 | +0.0 | 36.7 | 106.0 | -69.3 | Horiz |
| | | | +5.8 | +9.4 | | | | | | | |
| 27 | 154.190M | 16.9 | +0.0 | +0.2 | +0.6 | +0.7 | +0.0 | 33.7 | 106.0 | -72.3 | Horiz |
| | QP | | +5.8 | +9.5 | | | | | | | |
| | ^ 154.200M | 19.6 | +0.0 | +0.2 | +0.6 | +0.7 | +0.0 | 36.4 | 106.0 | -69.6 | Horiz |
| | | | +5.8 | +9.5 | | | | | | | |
| 29 | 150.300M | 16.1 | +0.0 | +0.2 | +0.6 | +0.7 | +0.0 | 32.4 | 106.0 | -73.6 | Vert |
| | | | +5.8 | +9.0 | | | | | | | |

| | | | |
|---|---|---|---|
| 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 #: | **103183** | Date: | 10/18/2019 |
| Test Type: | **Maximized Emissions** | Time: | 13:29:51 |
| Tested By: | Michael Atkinson | Sequence#: | 3 |
| Software: | EMITest 5.03.12 | | |

***Equipment Tested:***

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

***Support Equipment:***

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

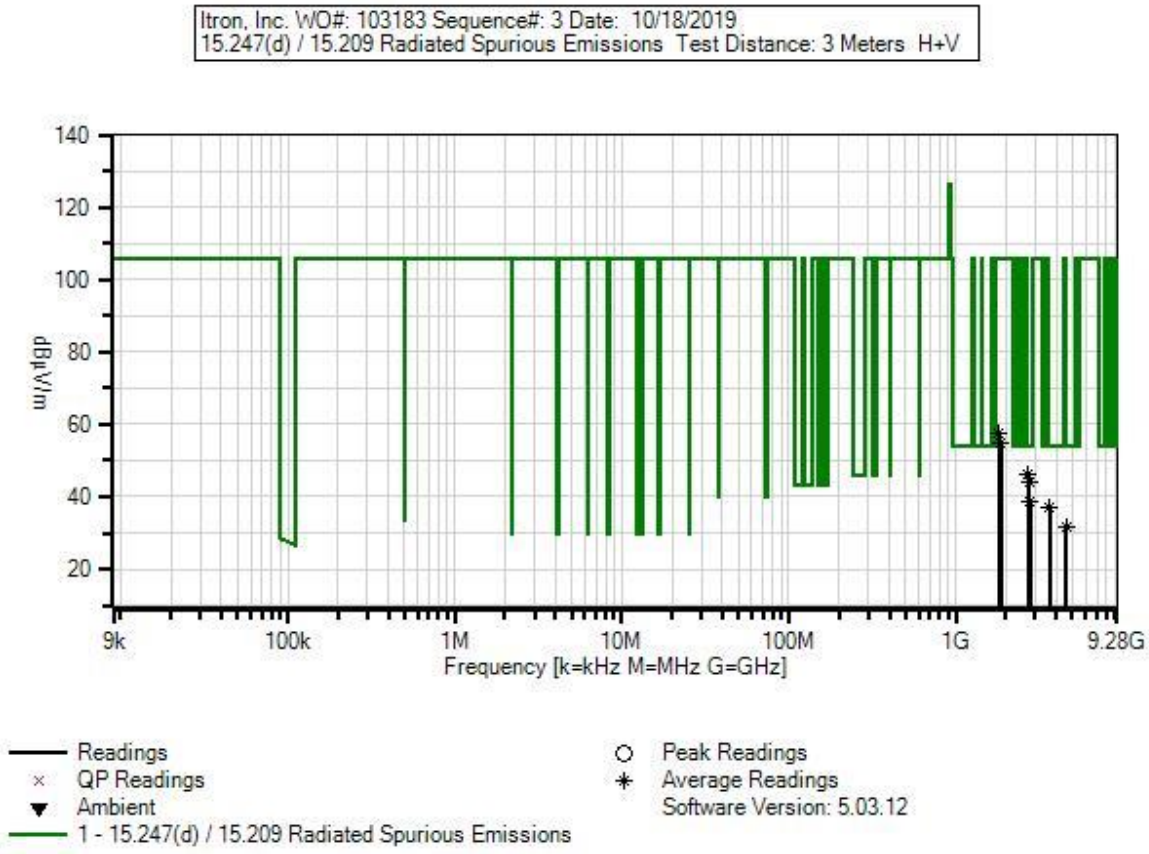
***Test Conditions / Notes:***

Frequency Range: 1-10GHz

Test Setup:
EUT is continuously transmitting through integral antenna.
25kbps and 50kbps data rate investigated, worst case reported.
Low, Mid, High channels as well as hopping mode investigated, worst case reported.
Installed orientation of the X-axis was used.
Horizontal and Vertical measurement antenna polarities investigated, worst case reported.

Test Location: Bothell Lab C3

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 19-23
Relative Humidity (%): 30-50


Itron, Inc. WO#: 103183 Sequence#: 3 Date: 10/18/2019
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters H+V
140
120
100
80
60
40
20
dBµV/m
9k
100k
1M
10M
100M
1G
9.28G
Frequency [k=kHz M=MHz G=GHz]
Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.12

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| T1 | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T2 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T3 | AN03170 | High Pass Filter | HM1155-11SS | 11/27/2017 | 11/27/2019 |
| T4 | AN03540 | Preamp | 83017A | 5/13/2019 | 5/13/2021 |
| T5 | AN01467 | Horn Antenna-ANSI C63.5 Calibration | 3115 | 7/5/2019 | 7/5/2021 |
| T6 | ANP06503 | Cable | 32026-29801-29801-36 | 3/13/2018 | 3/13/2020 |
| T7 | ANP06515 | Cable | Heliax | 6/29/2018 | 6/29/2020 |

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

| # | Freq | Rdng | T1<br>T5 | T2<br>T6 | T3<br>T7 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 2706.600M | 46.8 | +0.0 | +0.7 | +0.6 | -34.1 | +0.0 | 46.0 | 54.0 | -8.0 | Vert |
| | Ave | | +28.3 | +1.1 | +2.6 | | | | X-Axis | | |
| ^ | 2706.600M | 58.2 | +0.0 | +0.7 | +0.6 | -34.1 | +0.0 | 57.4 | 54.0 | +3.4 | Vert |
| | | | +28.3 | +1.1 | +2.6 | | | | X-Axis | | |
| 3 | 2745.000M | 44.8 | +0.0 | +0.7 | +0.6 | -34.1 | +0.0 | 44.1 | 54.0 | -9.9 | Vert |
| | Ave | | +28.4 | +1.1 | +2.6 | | | | X-Axis | | |
| ^ | 2745.000M | 58.3 | +0.0 | +0.7 | +0.6 | -34.1 | +0.0 | 57.6 | 54.0 | +3.6 | Vert |
| | | | +28.4 | +1.1 | +2.6 | | | | X-Axis | | |
| 5 | 2783.250M | 39.2 | +0.0 | +0.7 | +0.6 | -34.1 | +0.0 | 38.6 | 54.0 | -15.4 | Horiz |
| | Ave | | +28.5 | +1.1 | +2.6 | | | | X-Axis | | |
| ^ | 2783.250M | 52.3 | +0.0 | +0.7 | +0.6 | -34.1 | +0.0 | 51.7 | 54.0 | -2.3 | Horiz |
| | | | +28.5 | +1.1 | +2.6 | | | | X-Axis | | |
| 7 | 3660.000M | 33.7 | +0.0 | +0.9 | +0.9 | -33.7 | +0.0 | 37.3 | 54.0 | -16.7 | Vert |
| | Ave | | +30.5 | +1.3 | +3.7 | | | | X-Axis | | |
| ^ | 3660.000M | 43.8 | +0.0 | +0.9 | +0.9 | -33.7 | +0.0 | 47.4 | 54.0 | -6.6 | Vert |
| | | | +30.5 | +1.3 | +3.7 | | | | X-Axis | | |
| 9 | 4575.000M | 26.0 | +0.0 | +0.9 | +0.8 | -33.7 | +0.0 | 31.4 | 54.0 | -22.6 | Vert |
| | Ave | | +31.9 | +1.5 | +4.0 | | | | X-Axis | | |
| ^ | 4575.000M | 41.1 | +0.0 | +0.9 | +0.8 | -33.7 | +0.0 | 46.5 | 54.0 | -7.5 | Vert |
| | | | +31.9 | +1.5 | +4.0 | | | | X-Axis | | |
| 11 | 1804.400M | 62.1 | +0.0 | +0.5 | +0.7 | -34.8 | +0.0 | 57.5 | 106.0 | -48.5 | Vert |
| | Ave | | +26.1 | +0.7 | +2.2 | | | | X-Axis | | |
| ^ | 1804.400M | 71.0 | +0.0 | +0.5 | +0.7 | -34.8 | +0.0 | 66.4 | 106.0 | -39.6 | Vert |
| | | | +26.1 | +0.7 | +2.2 | | | | X-Axis | | |
| 13 | 1855.500M | 58.8 | +0.0 | +0.5 | +0.7 | -34.7 | +0.0 | 54.9 | 106.0 | -51.1 | Horiz |
| | Ave | | +26.6 | +0.7 | +2.3 | | | | X-Axis | | |
| ^ | 1855.500M | 68.7 | +0.0 | +0.5 | +0.7 | -34.7 | +0.0 | 64.8 | 106.0 | -41.2 | Horiz |
| | | | +26.6 | +0.7 | +2.3 | | | | X-Axis | | |

## Band Edge

| Band Edge Summary | | | | |
|---|---|---|---|---|
| Operating Mode: Single Channel (Low and High)<br>Integral Antenna 4.8dBi | | | | |
| **Frequency (MHz)** | **Modulation** | **Field Strength (dBuV/m @3m)** | **Limit (dBuV/m @3m)** | **Results** |
| 614 | GFSK 25kbps | 39.4 | 46.0 | Pass |
| 902 | GFSK 25kbps | 75.6 | 106.0 | Pass |
| 928 | GFSK 25kbps | 75.7 | 106.0 | Pass |
| 960 | GFSK 25kbps | 43.9 | 54.0 | Pass |

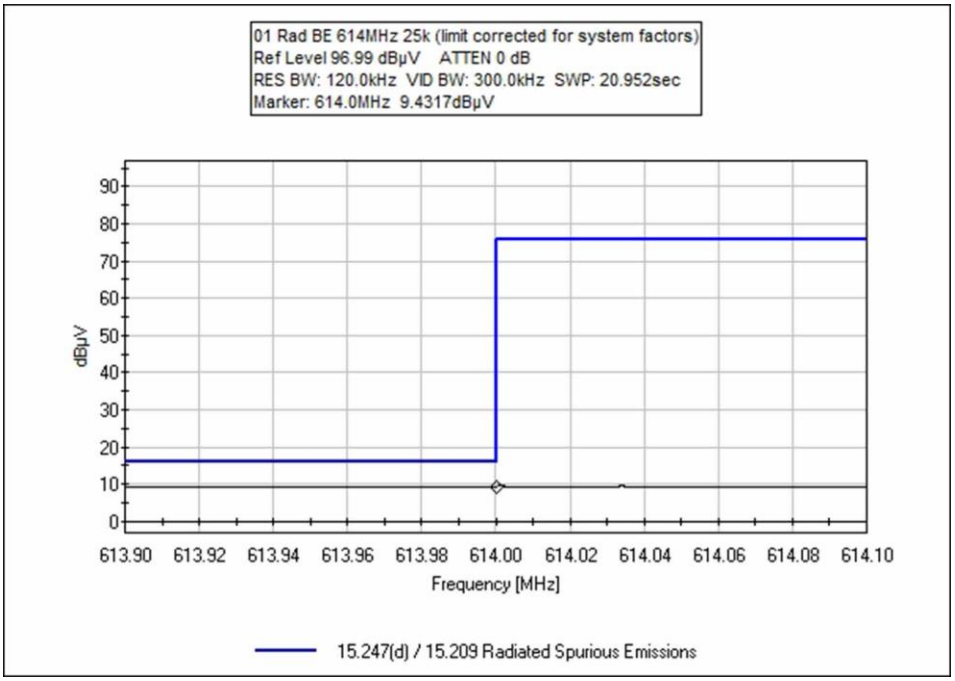
| Band Edge Summary | | | | |
|---|---|---|---|---|
| Operating Mode: Single Channel (Low and High)<br>Integral Antenna 4.8dBi | | | | |
| **Frequency (MHz)** | **Modulation** | **Field Strength (dBuV/m @3m)** | **Limit (dBuV/m @3m)** | **Results** |
| 614 | GFSK 50kbps | 39.3 | 46.0 | Pass |
| 902 | GFSK 50kbps | 77.1 | 106.0 | Pass |
| 928 | GFSK 50kbps | 77.0 | 106.0 | Pass |
| 960 | GFSK 50kbps | 43.7 | 54.0 | Pass |

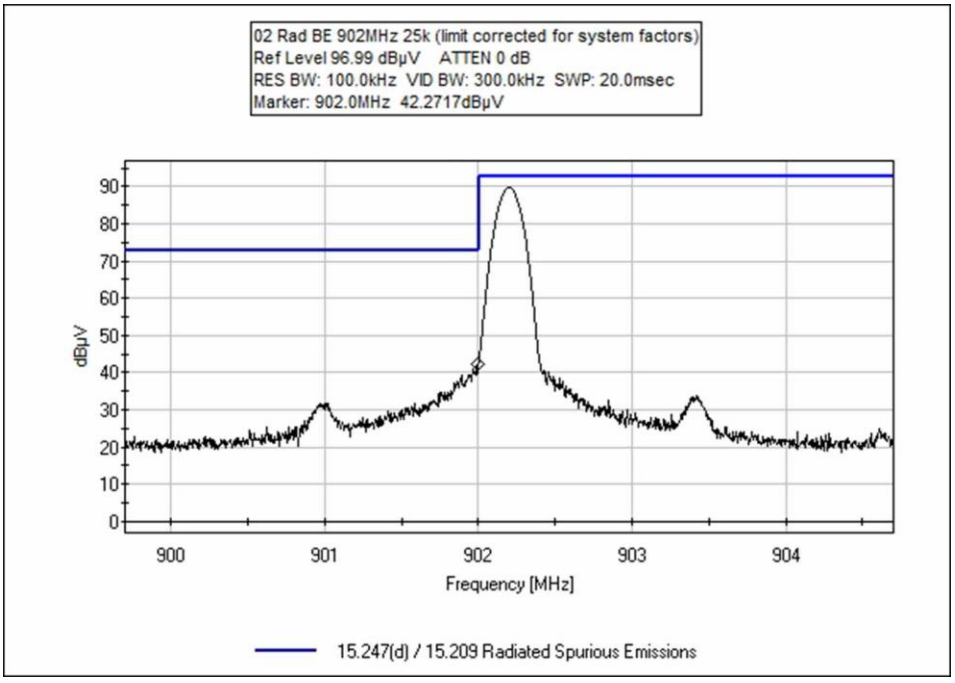
| Band Edge Summary | | | | | | | |
|---|---|---|---|---|---|---|---|
| Operating Mode: Single Channel (Low and High)<br>Integral Antenna 4.8dBi | | | | | | | |
| **Freq (MHz)** | **Modulation** | **100kHz Band Edge Measurement (dBuV/m @3m)** | **100kHz Fundamental Field Strength (dBuV/m @3m)** | **30kHz Band Edge Measurement (dBuV/m @3m)** | **30kHz Fundamental Field Strength (dBuV/m @3m)** | **Limit (dBuV/m @3m)** | **Results** |
| 902 | GFSK 25kbps | 105.7 | 123.3 | 94.3 | 123.3 | 106.0 | Pass |
| 928 | GFSK 25kbps | 102.6 | 123.4 | 91.7 | 123.3 | 106.0 | Pass |
| 902 | GFSK 50kbps | 108.1 | 124.7 | 96.5 | 124.7 | 106.0 | Pass |
| 928 | GFSK 50kbps | 104.3 | 124.1 | 93.9 | 123.6 | 106.0 | Pass |

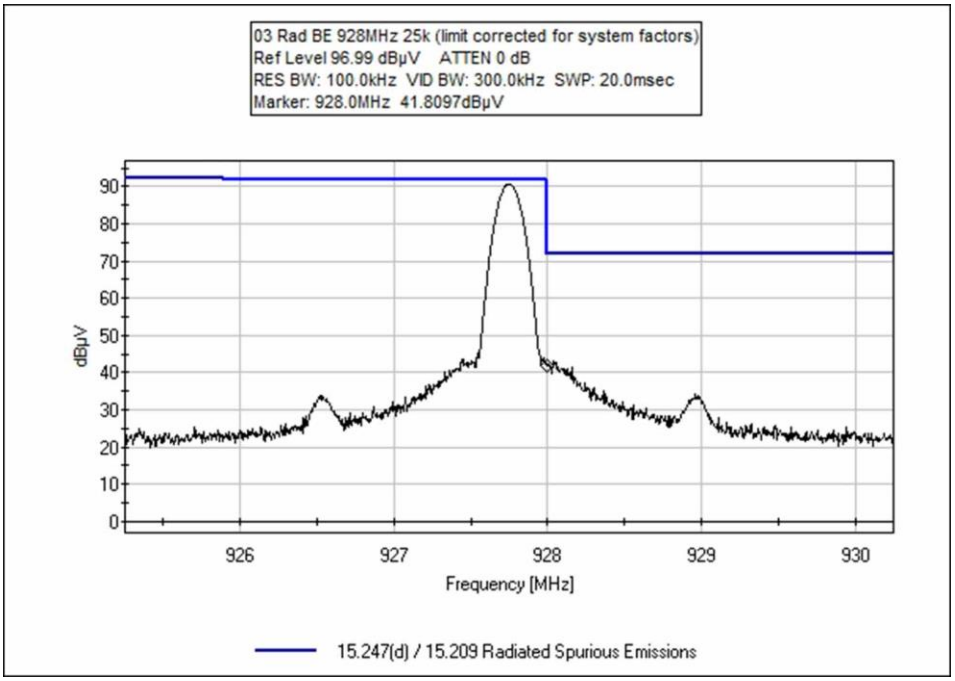
Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement, underlined and bold in the table above.

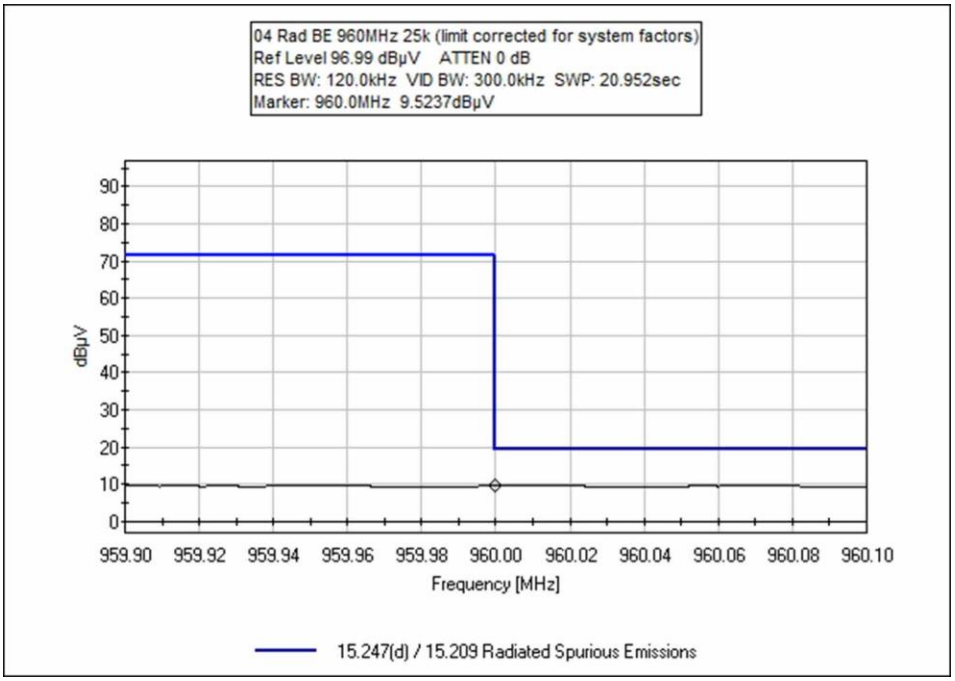
Note: Single channel data at 614MHz and 960MHz is representative of data collected in hopping mode.

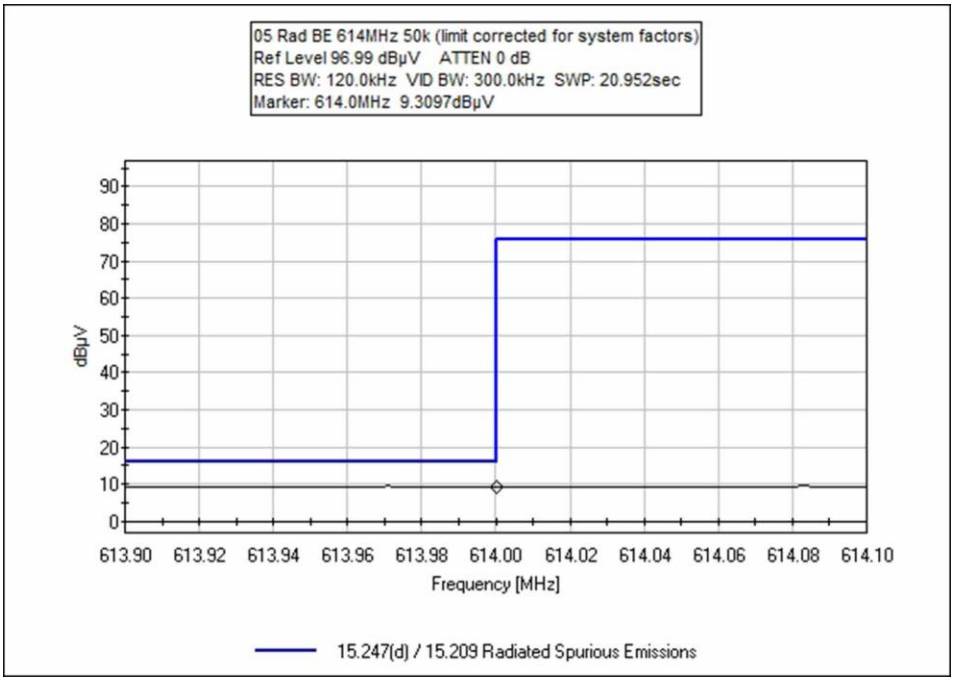
## Band Edge Plots

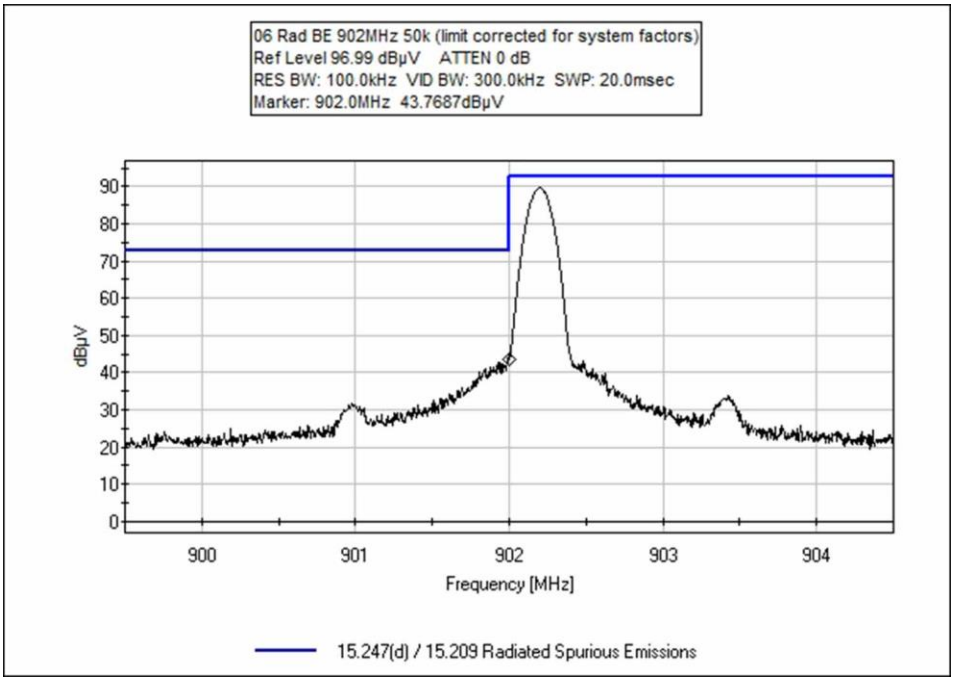


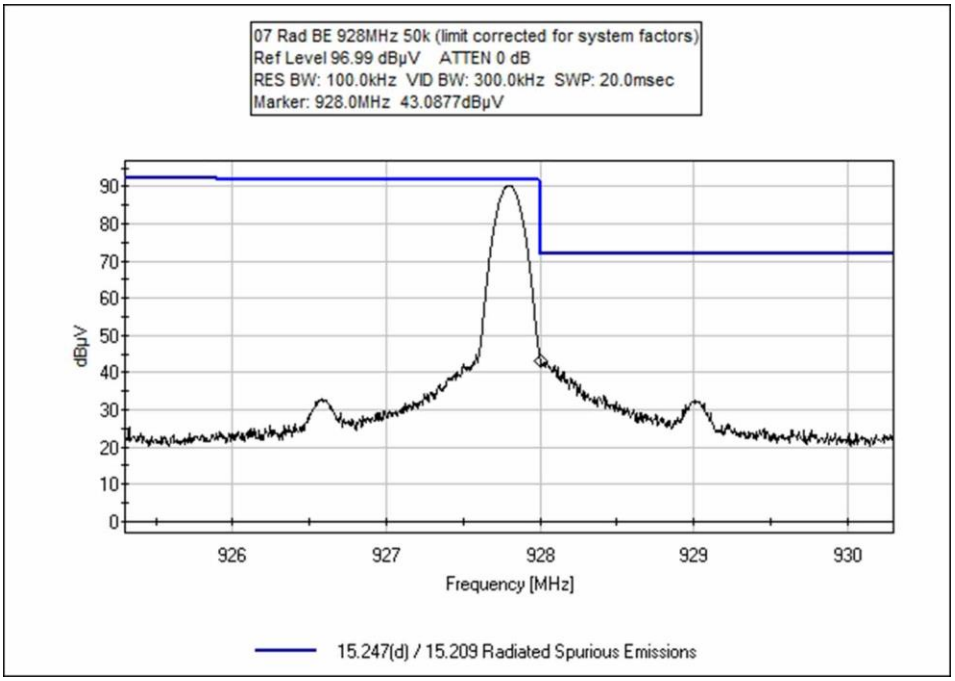



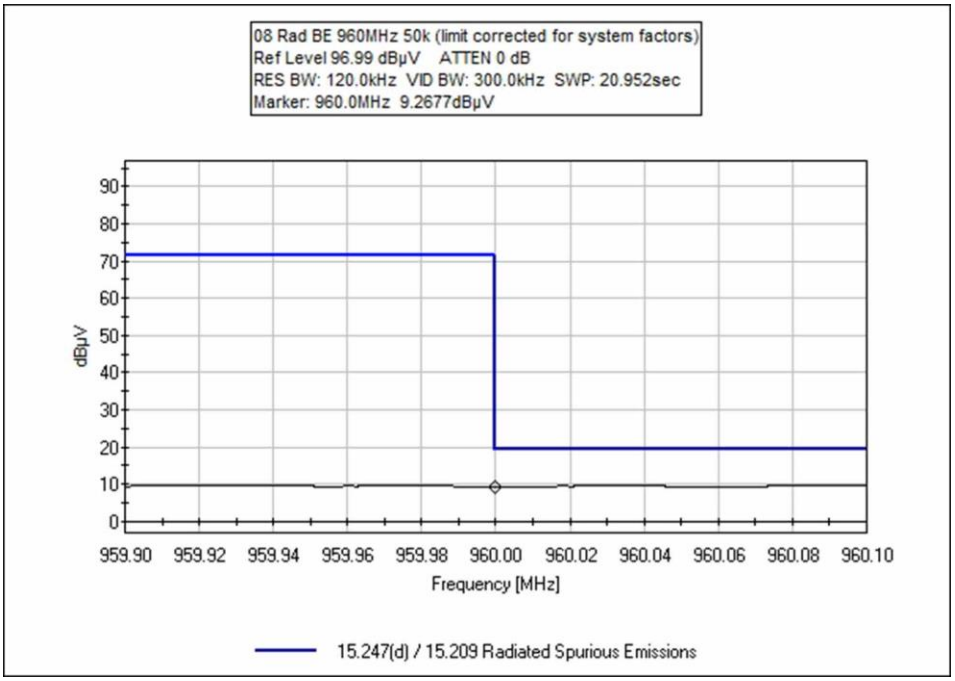

03 Rad BE 928MHz 25k (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 41.8097dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
929
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

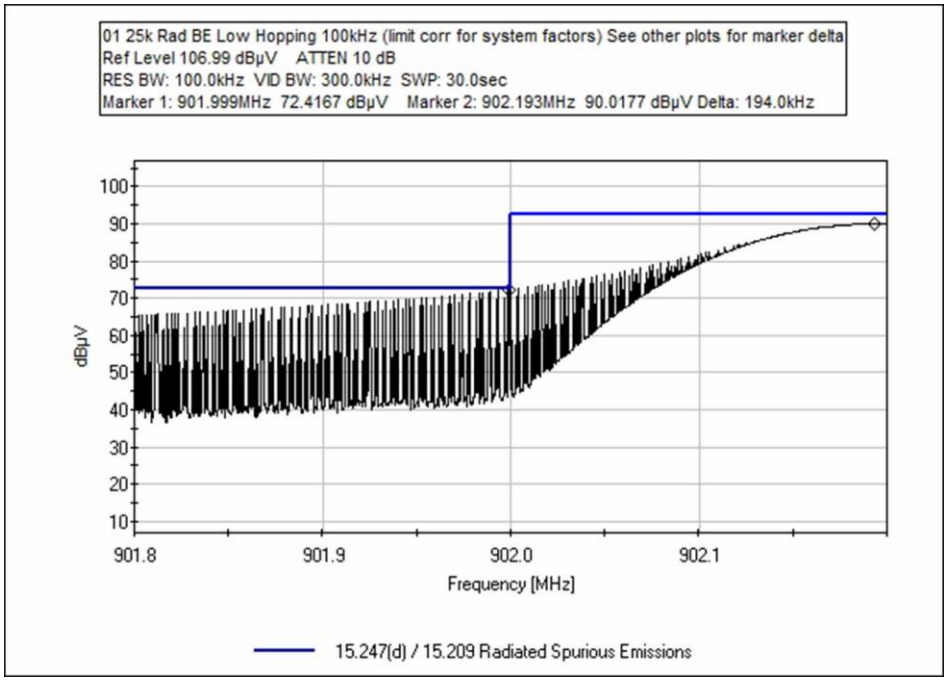

04 Rad BE 960MHz 25k (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 20.952sec
Marker: 960.0MHz 9.5237dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.90
959.92
959.94
959.96
959.98
960.00
960.02
960.04
960.06
960.08
960.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

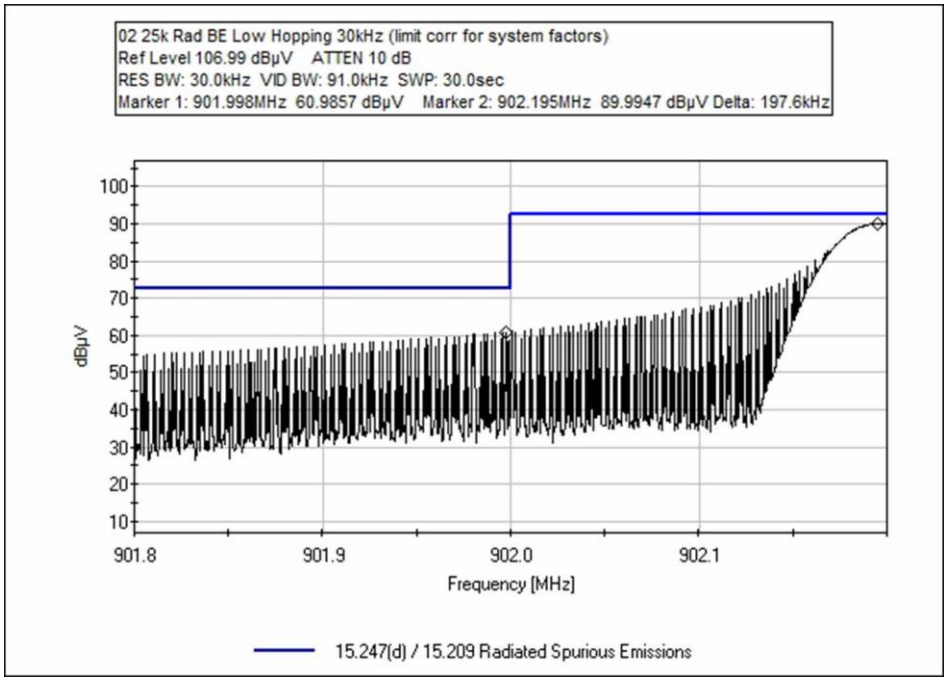

05 Rad BE 614MHz 50k (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 20.952sec
Marker: 614.0MHz 9.3097dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.90 613.92 613.94 613.96 613.98 614.00 614.02 614.04 614.06 614.08 614.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

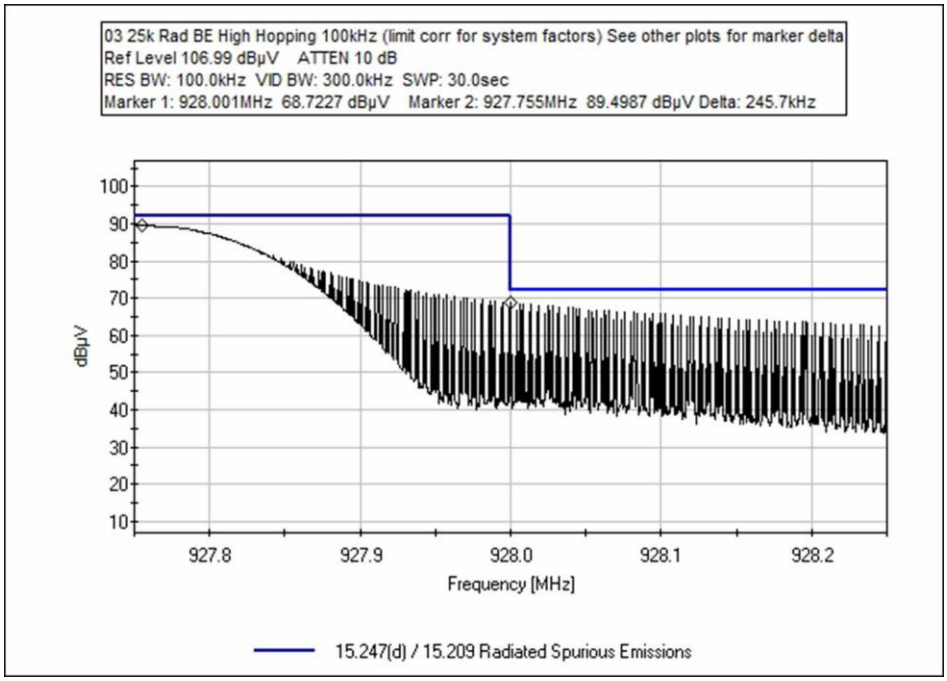

06 Rad BE 902MHz 50k (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 43.7687dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
900 901 902 903 904
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

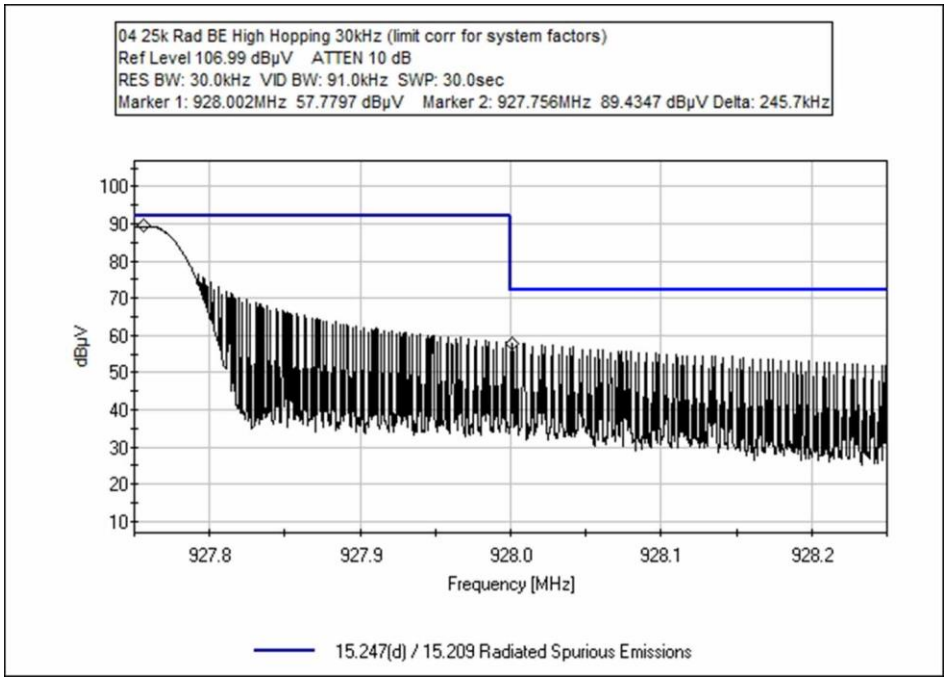

07 Rad BE 928MHz 50k (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 43.0877dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
929
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

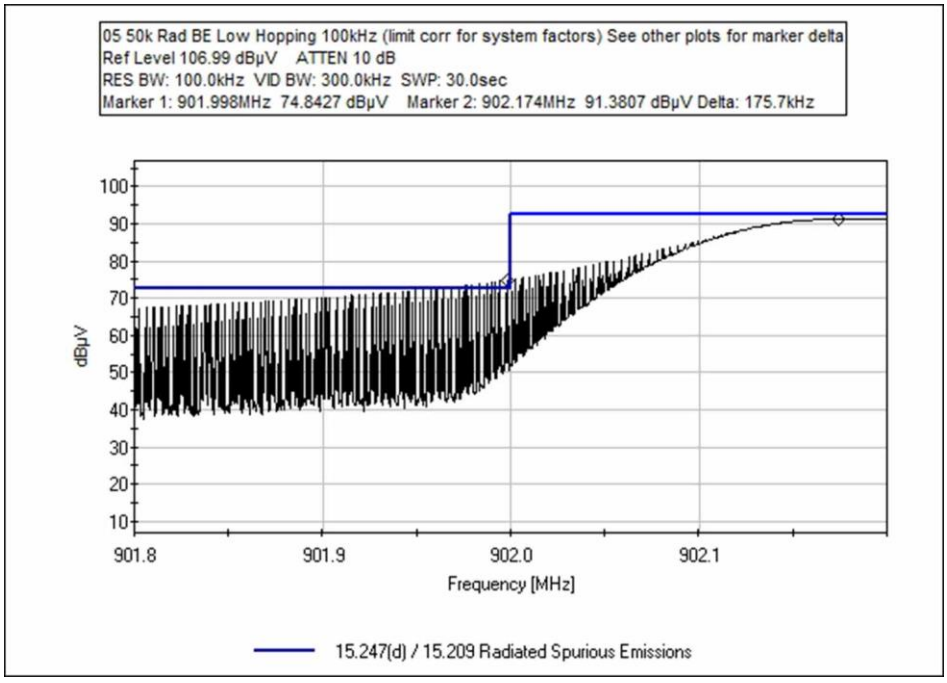

08 Rad BE 960MHz 50k (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 20.952sec
Marker: 960.0MHz 9.2677dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.90
959.92
959.94
959.96
959.98
960.00
960.02
960.04
960.06
960.08
960.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

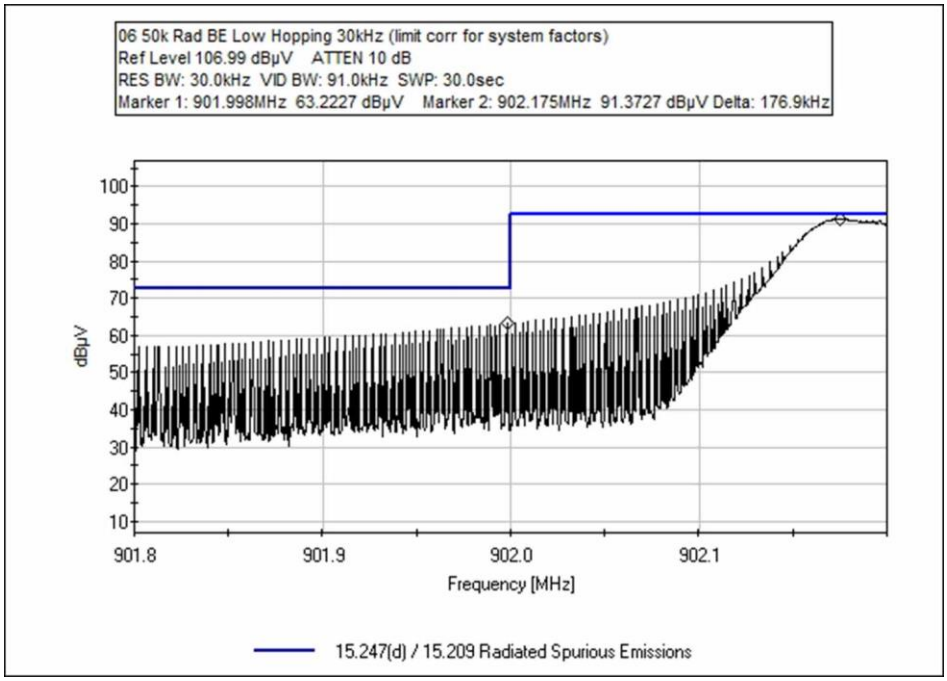

01 25k Rad BE Low Hopping 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 901.999MHz 72.4167 dBµV Marker 2: 902.193MHz 90.0177 dBµV Delta: 194.0kHz
dBµV
100
90
80
70
60
50
40
30
20
10
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

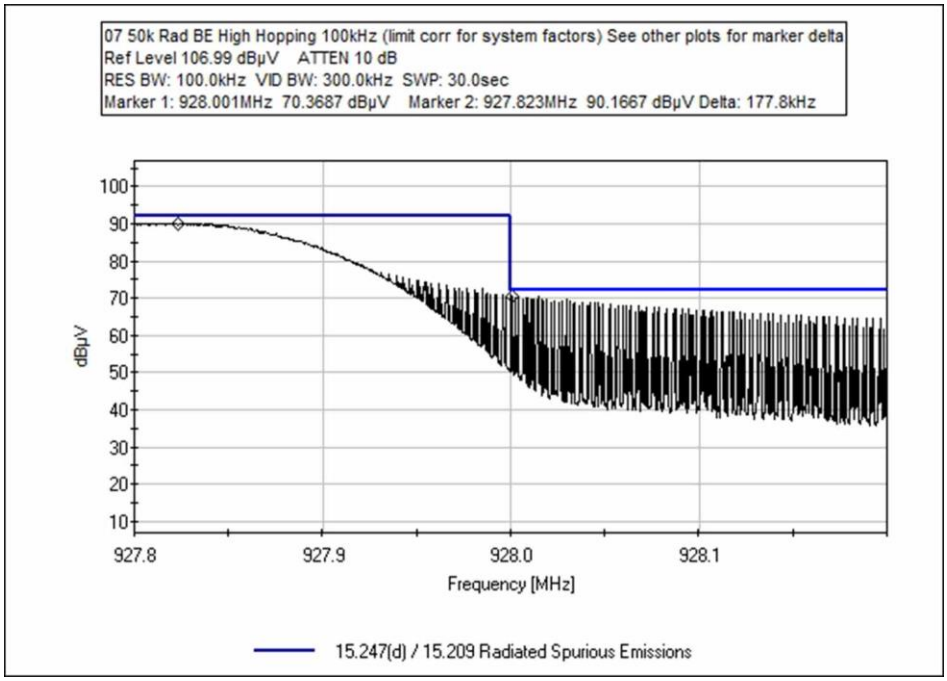

02 25k Rad BE Low Hopping 30kHz (limit corr for system factors)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 901.998MHz 60.9857 dBµV Marker 2: 902.195MHz 89.9947 dBµV Delta: 197.6kHz
dBµV
100
90
80
70
60
50
40
30
20
10
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

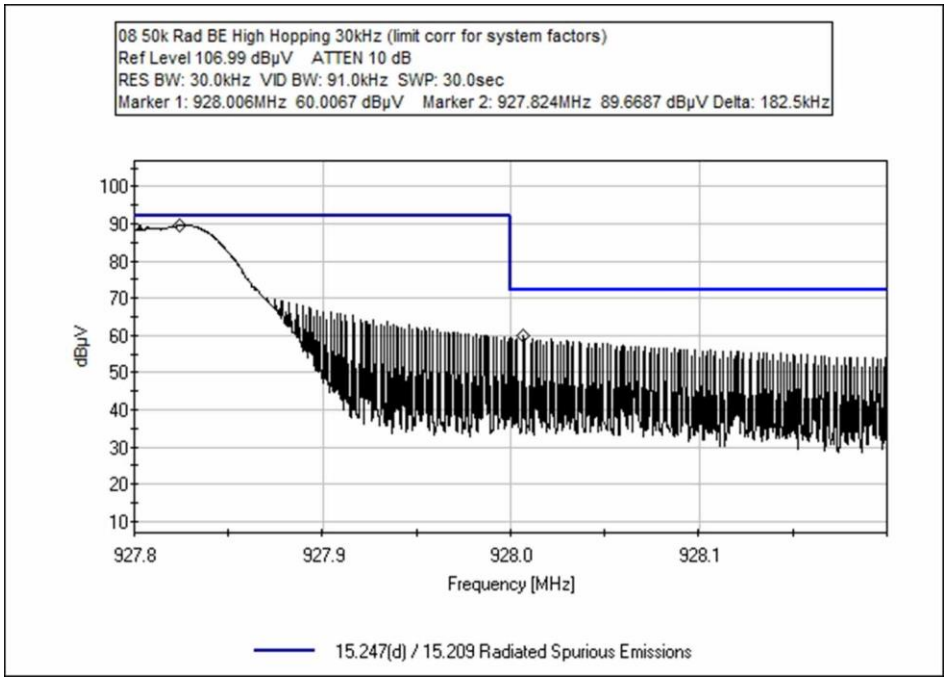

03 25k Rad BE High Hopping 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 928.001MHz 68.7227 dBµV Marker 2: 927.755MHz 89.4987 dBµV Delta: 245.7kHz
dBµV
100
90
80
70
60
50
40
30
20
10
927.8
927.9
928.0
928.1
928.2
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


04 25k Rad BE High Hopping 30kHz (limit corr for system factors)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 928.002MHz 57.7797 dBµV Marker 2: 927.756MHz 89.4347 dBµV Delta: 245.7kHz
dBµV
100
90
80
70
60
50
40
30
20
10
927.8
927.9
928.0
928.1
928.2
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


05 50k Rad BE Low Hopping 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 901.998MHz 74.8427 dBµV Marker 2: 902.174MHz 91.3807 dBµV Delta: 175.7kHz
dBµV
100
90
80
70
60
50
40
30
20
10
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


06 50k Rad BE Low Hopping 30kHz (limit corr for system factors)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 901.998MHz 63.2227 dBµV Marker 2: 902.175MHz 91.3727 dBµV Delta: 176.9kHz
dBµV
100
90
80
70
60
50
40
30
20
10
901.8
901.9
902.0
902.1
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


07 50k Rad BE High Hopping 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 928.001MHz 70.3687 dBµV Marker 2: 927.823MHz 90.1667 dBµV Delta: 177.8kHz
dBµV
100
90
80
70
60
50
40
30
20
10
927.8
927.9
928.0
928.1
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


08 50k Rad BE High Hopping 30kHz (limit corr for system factors)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 928.006MHz 60.0067 dBµV Marker 2: 927.824MHz 89.6687 dBµV Delta: 182.5kHz
dBµV
100
90
80
70
60
50
40
30
20
10
927.8
927.9
928.0
928.1
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 #: | **103183** | Date: | 10/29/2019 |
| Test Type: | **Maximized Emissions** | Time: | 08:49:17 |
| Tested By: | Michael Atkinson | Sequence#: | 6 |
| Software: | EMITest 5.03.12 | | |

***Equipment Tested:***

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

***Support Equipment:***

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

***Test Conditions / Notes:***

Frequency: Band Edge

Setup:
The equipment under test (EUT) is placed on the tabletop.
The output of the EUT is transmitter through the selected internal antenna.
The EUT is transmitting at max power.
Measurements were performed with a fresh battery installed.
Hopping channels investigated.
25kbps and 50kbps data rates investigated.
Worst case reported.

***Test Equipment:***

| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T1 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T2 | ANP05305 | Cable | ETSI-50T | 9/6/2019 | 9/6/2021 |
| T3 | ANP05360 | Cable | RG214 | 1/31/2018 | 1/31/2020 |
| T4 | ANP06123 | Attenuator | 18N-6 | 4/5/2019 | 4/5/2021 |
| T5 | AN03628 | Biconilog Antenna | 3142E | 6/11/2019 | 6/11/2021 |

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

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 902.174M | 91.4 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 124.7 | 126.0<br>50k | -1.3 | Horiz |
| 2 | 902.175M | 91.4 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 124.7 | 126.0<br>50k | -1.3 | Horiz |
| 3 | 927.823M | 90.2 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 124.1 | 126.0<br>50k | -1.9 | Horiz |
| 4 | 927.824M | 89.7 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 123.6 | 126.0<br>50k | -2.4 | Horiz |
| 5 | 927.755M | 89.5 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 123.4 | 126.0<br>25k | -2.6 | Horiz |
| 6 | 902.193M | 90.0 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 123.3 | 126.0<br>25k | -2.7 | Horiz |
| 7 | 902.195M | 90.0 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 123.3 | 126.0<br>25k | -2.7 | Horiz |
| 8 | 927.756M | 89.4 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 123.3 | 126.0<br>25k | -2.7 | Horiz |
| 9 | 901.998M | 63.2 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 96.5 | 106.0<br>50k | -9.5 | Horiz |
| 10 | 901.998M | 61.0 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 94.3 | 106.0<br>25k | -11.7 | Horiz |
| 11 | 928.006M | 60.0 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 93.9 | 106.0<br>50k | -12.1 | Horiz |
| 12 | 928.002M | 57.8 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 91.7 | 106.0<br>25k | -14.3 | Horiz |

| | | | |
|---|---|---|---|
| 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 #: | **103183** | Date: | 10/28/2019 |
| Test Type: | **Maximized Emissions** | Time: | 16:46:57 |
| Tested By: | Michael Atkinson | Sequence#: | 5 |
| Software: | EMITest 5.03.12 | | |

***Equipment Tested:***

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

***Support Equipment:***

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

***Test Conditions / Notes:***

Frequency: Band Edge

Setup:
The equipment under test (EUT) is placed on the tabletop.
The output of the EUT is transmitter through the selected internal antenna.
The EUT is transmitting at max power.
Measurements were performed with a fresh battery installed.
Low and High channels investigated.
25kbps and 50kbps data rates investigated.
Worst case reported.

***Test Equipment:***

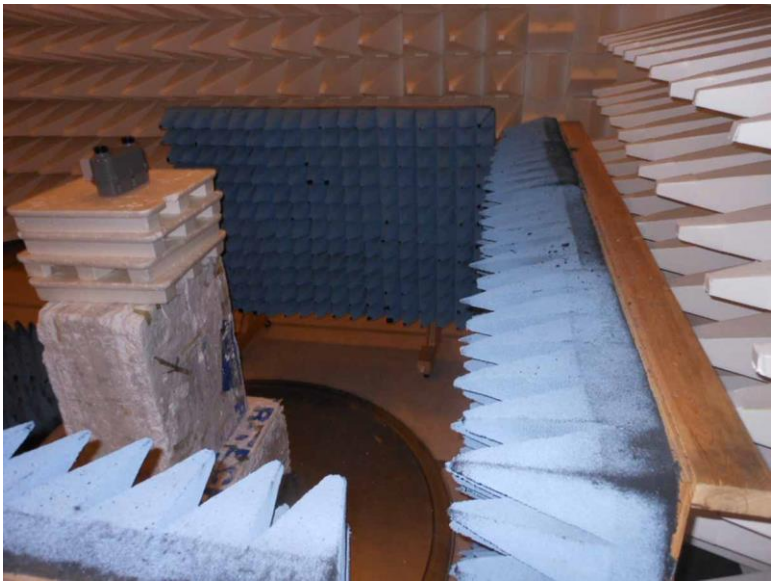
| ID | Asset # | Description | Model | Calibration Date | Cal Due Date |
|---|---|---|---|---|---|
| | AN02673 | Spectrum Analyzer | E4446A | 2/22/2019 | 2/22/2021 |
| T1 | ANP06540 | Cable | Heliax | 8/23/2019 | 8/23/2021 |
| T2 | ANP05305 | Cable | ETSI-50T | 9/6/2019 | 9/6/2021 |
| T3 | ANP05360 | Cable | RG214 | 1/31/2018 | 1/31/2020 |
| T4 | ANP06123 | Attenuator | 18N-6 | 4/5/2019 | 4/5/2021 |
| T5 | AN03628 | Biconilog Antenna | 3142E | 6/11/2019 | 6/11/2021 |

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

| # | Freq | Rdng | T1<br>T5 | T2 | T3 | T4 | Dist | Corr | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBµV | dB | dB | dB | dB | Table | dBµV/m | dBµV/m | dB | Ant |
| 1 | 614.000M<br>QP | 9.4 | +0.3<br>+21.2 | +1.2 | +1.5 | +5.8 | +0.0 | 39.4 | 46.0<br>25k | -6.6 | Horiz |
| 2 | 614.000M<br>QP | 9.3 | +0.3<br>+21.2 | +1.2 | +1.5 | +5.8 | +0.0 | 39.3 | 46.0<br>50k | -6.7 | Horiz |
| 3 | 960.000M<br>QP | 9.5 | +0.4<br>+24.6 | +1.5 | +2.1 | +5.8 | +0.0 | 43.9 | 54.0<br>25k | -10.1 | Horiz |
| 4 | 960.000M<br>QP | 9.3 | +0.4<br>+24.6 | +1.5 | +2.1 | +5.8 | +0.0 | 43.7 | 54.0<br>50k | -10.3 | Horiz |
| 5 | 902.000M | 43.8 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 77.1 | 106.0<br>50k | -28.9 | Horiz |
| 6 | 928.000M | 43.1 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 77.0 | 106.0<br>50k | -29.0 | Horiz |
| 7 | 928.000M | 41.8 | +0.4<br>+24.2 | +1.5 | +2.0 | +5.8 | +0.0 | 75.7 | 106.0<br>25k | -30.3 | Horiz |
| 8 | 902.000M | 42.3 | +0.3<br>+23.8 | +1.4 | +2.0 | +5.8 | +0.0 | 75.6 | 106.0<br>25k | -30.4 | Horiz |

## Test Setup Photo(s)


Below 1GHz



Above 1GHz

# 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.