

ltron, 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



Test Certificate # 803.01

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.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 191352

DATE OF EQUIPMENT RECEIPT:

DATE(S) OF TESTING:

REPORT PREPARED BY:

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

Project Number: 103183

October 4, 2019

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:

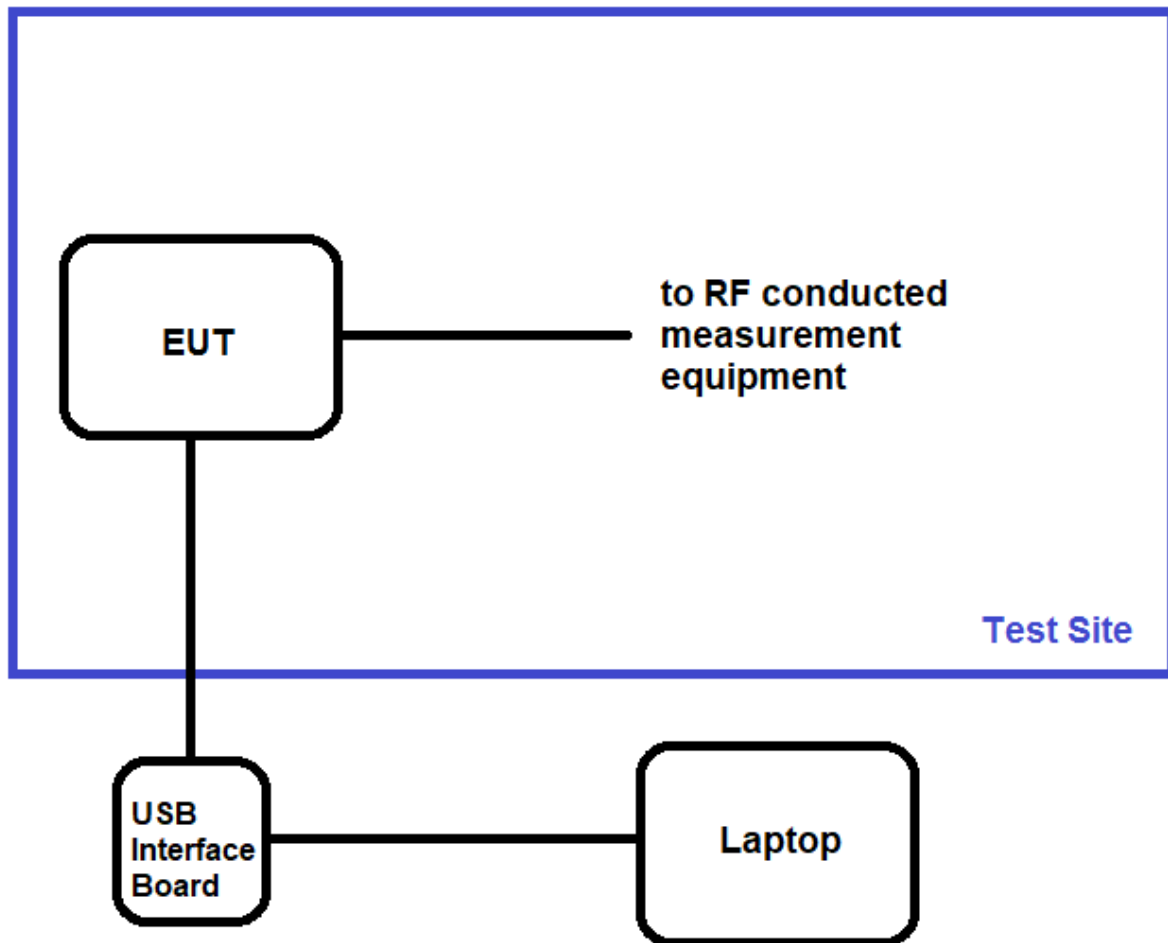
Device	Manufacturer	Model #	S/N
None			

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: 902.2 - 927.75MHz (GFSK 25kbps) 902.2 - 927.8MHz (GFSK 50 kbps)
Number of Hopping Channels:	512 channels (GFSK 25 kbps, previously tested channel plan) 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) App Version 5.04.0, CSL Version: 16.0.5.0

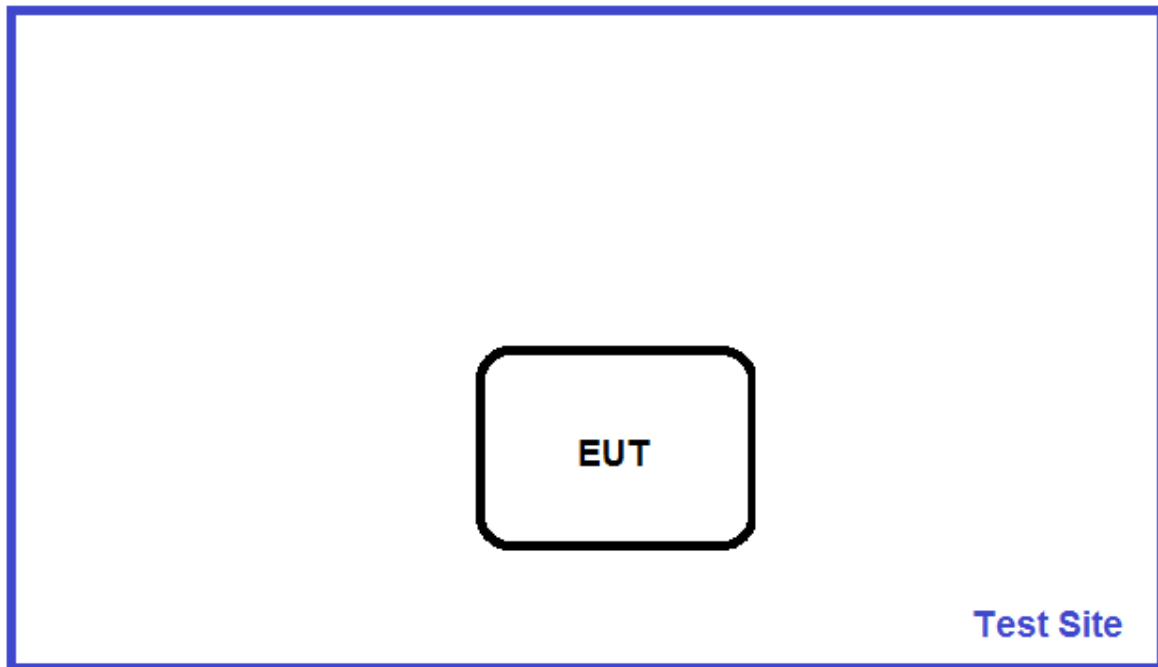
Block Diagram of Test Setup(s)

Test Setup Block Diagram



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. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. 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.		

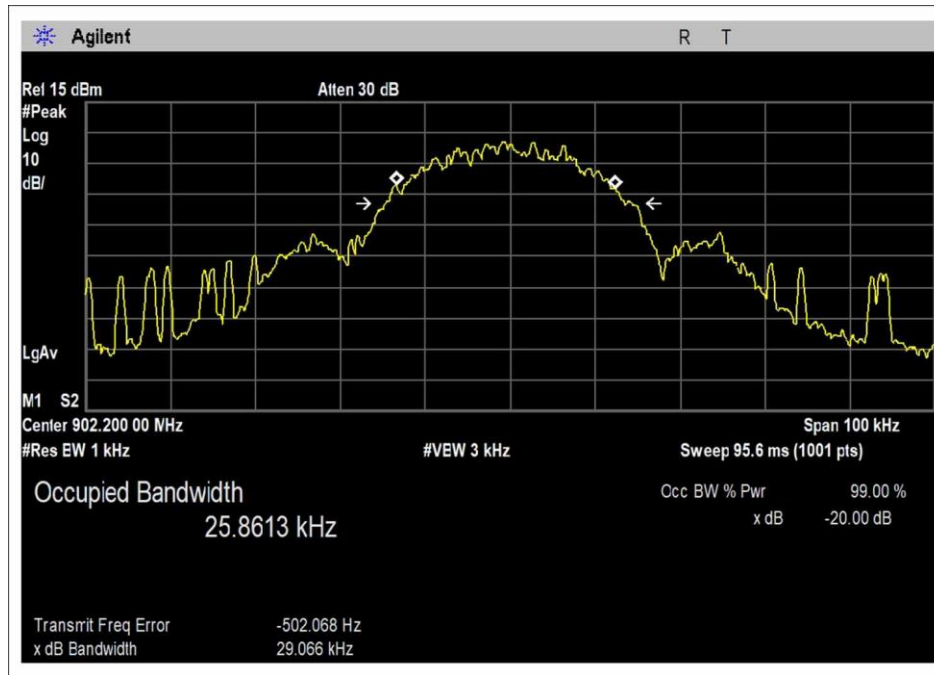
Environmental Conditions			
Temperature (°C)	19-23	Relative Humidity (%):	30-50

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	Heliac	4/11/2018	4/11/2020
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021

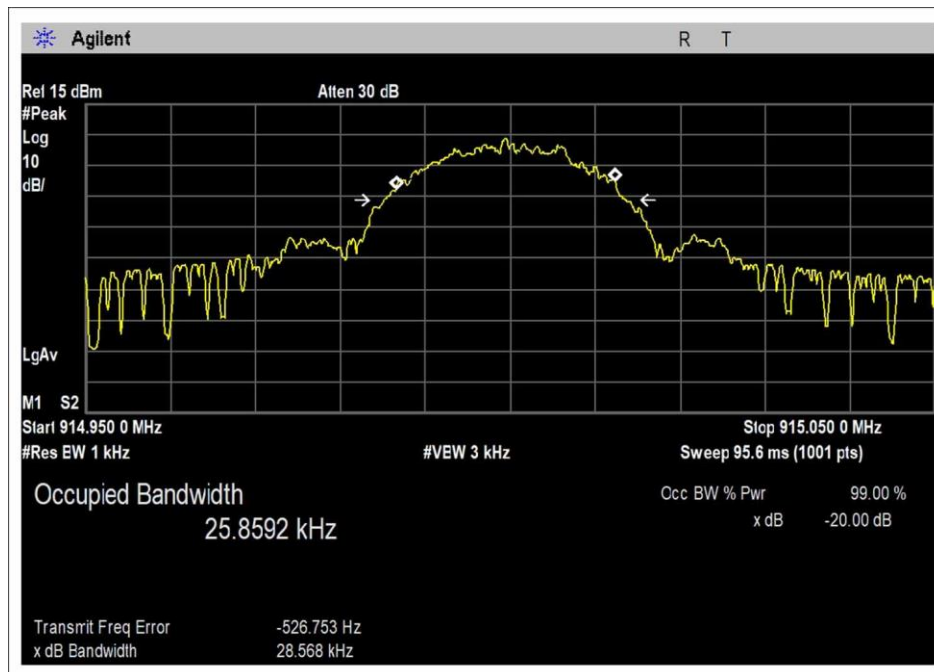
15.247(a)(1) 20 dB Bandwidth

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

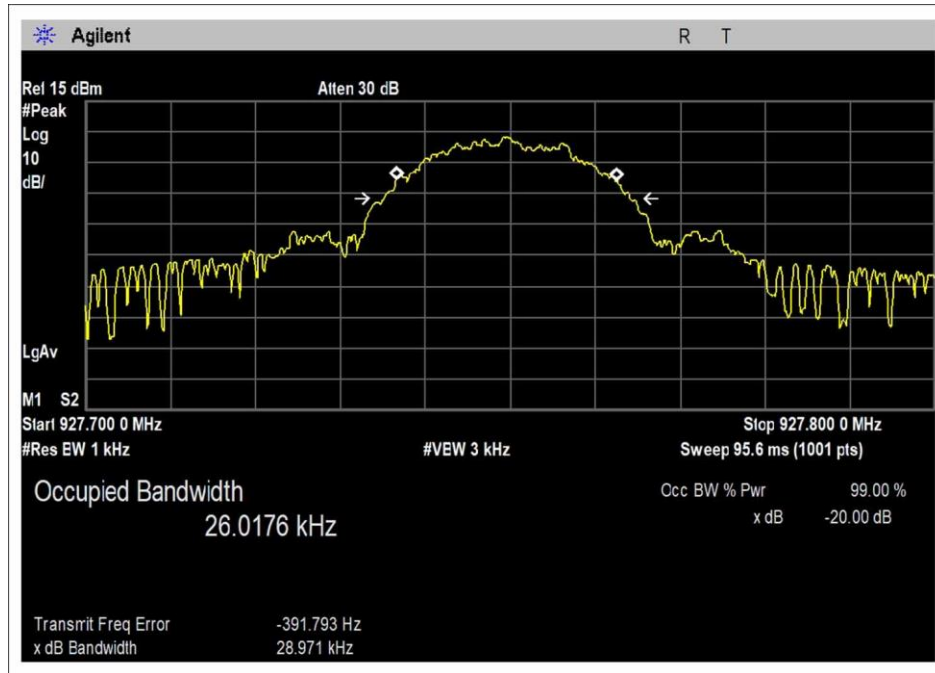
Plot(s)



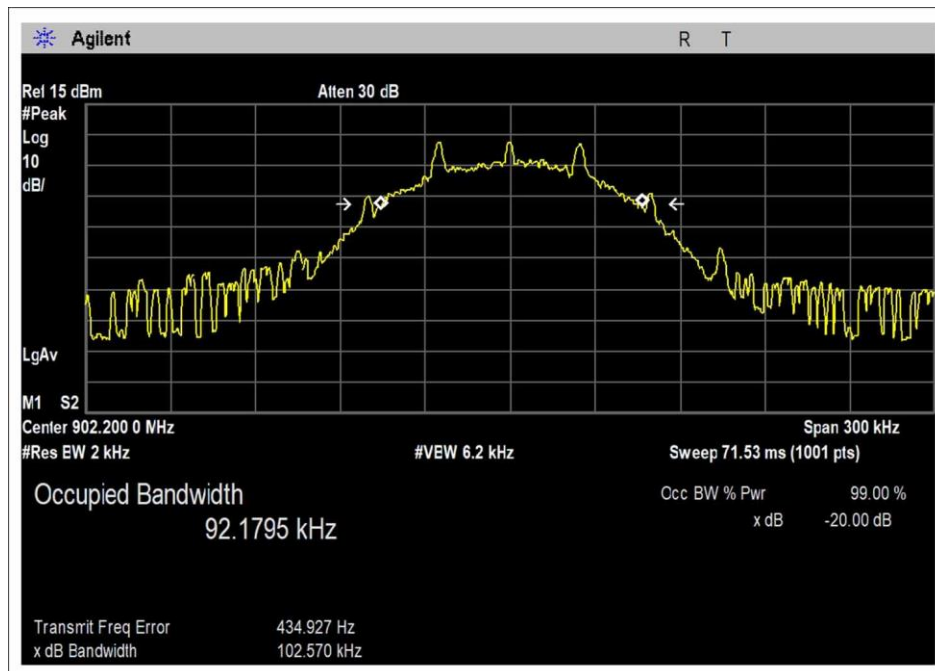
25kbps Low Channel



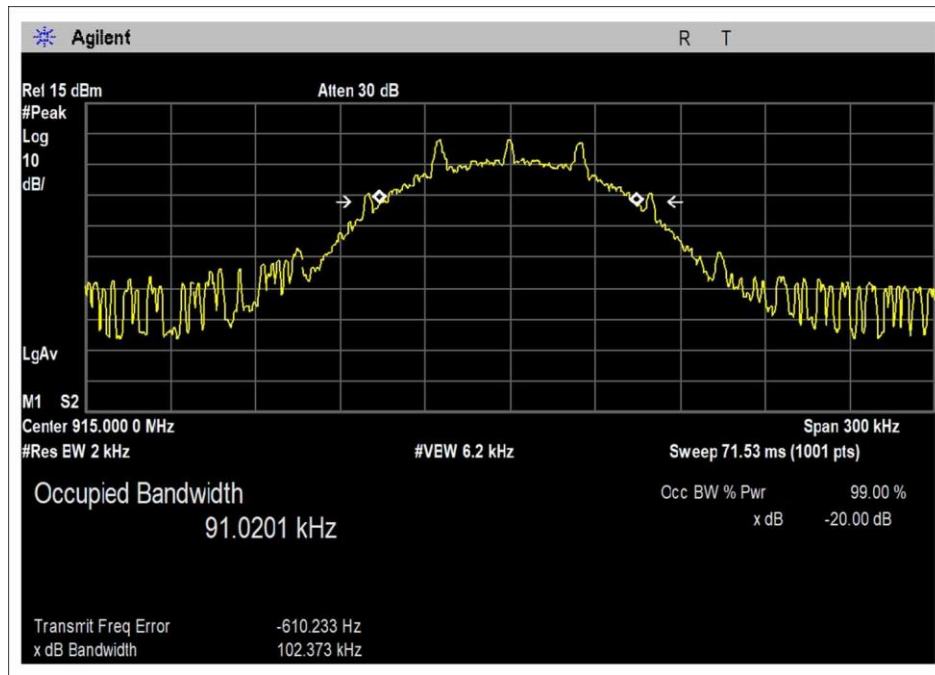
25kbps Middle Channel



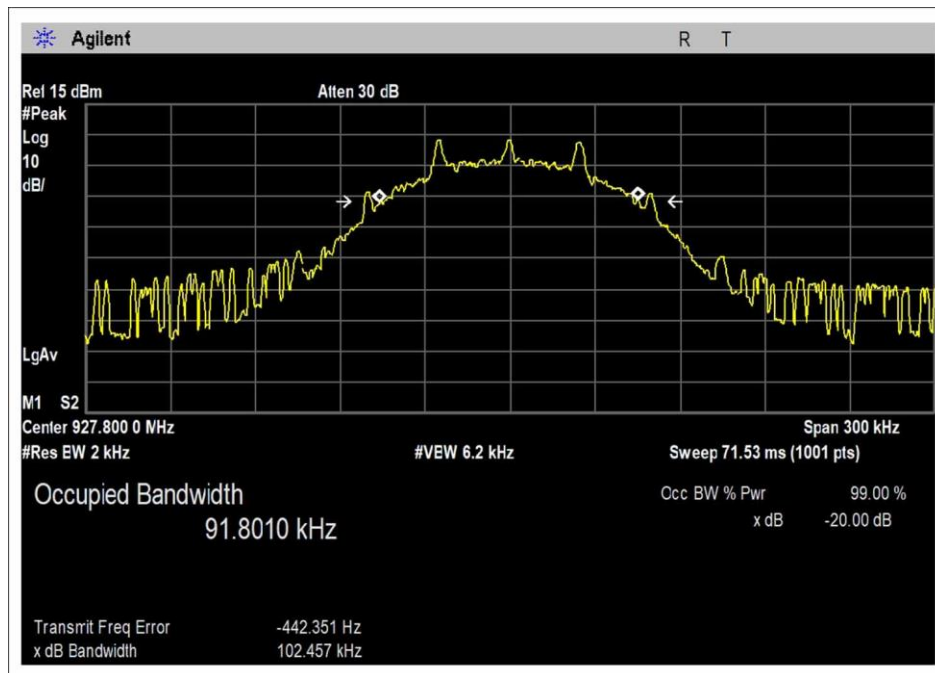
25kbps High Channel



50kbps Low Channel



50kbps Middle Channel

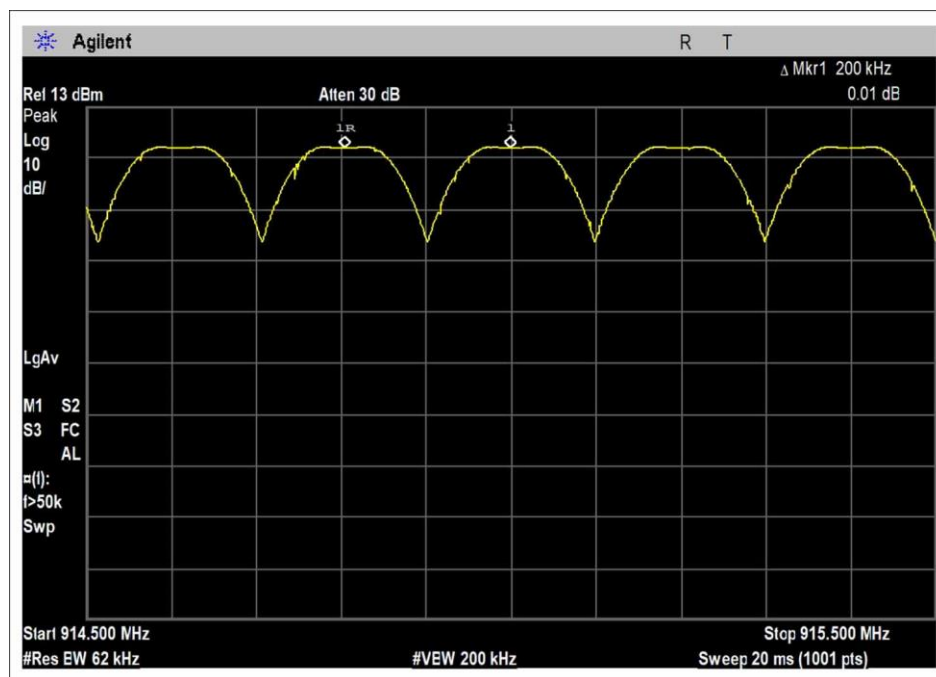


50kbps High Channel

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)

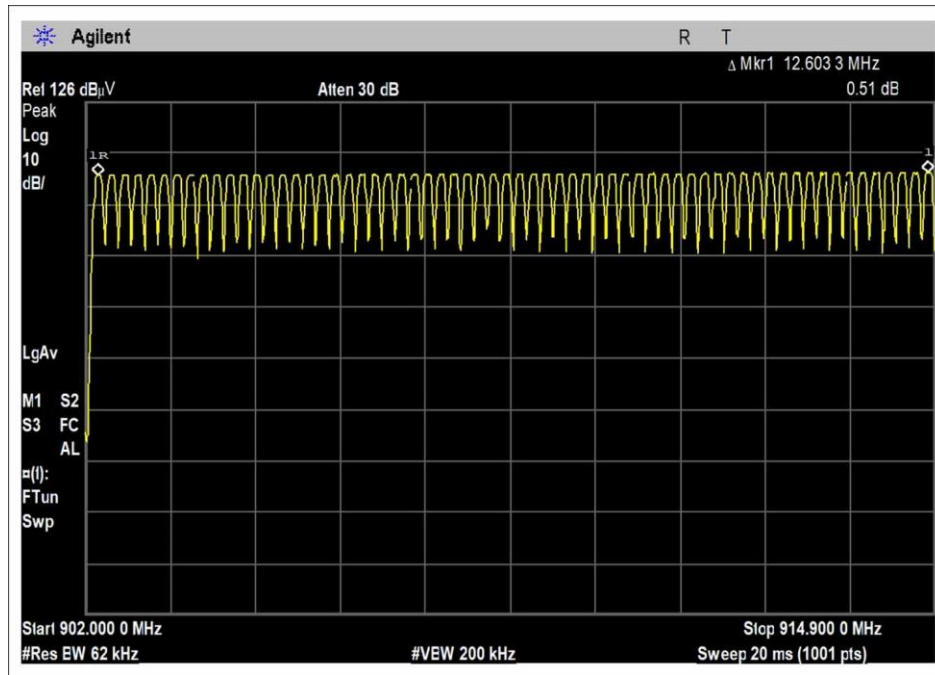


Channel Separation

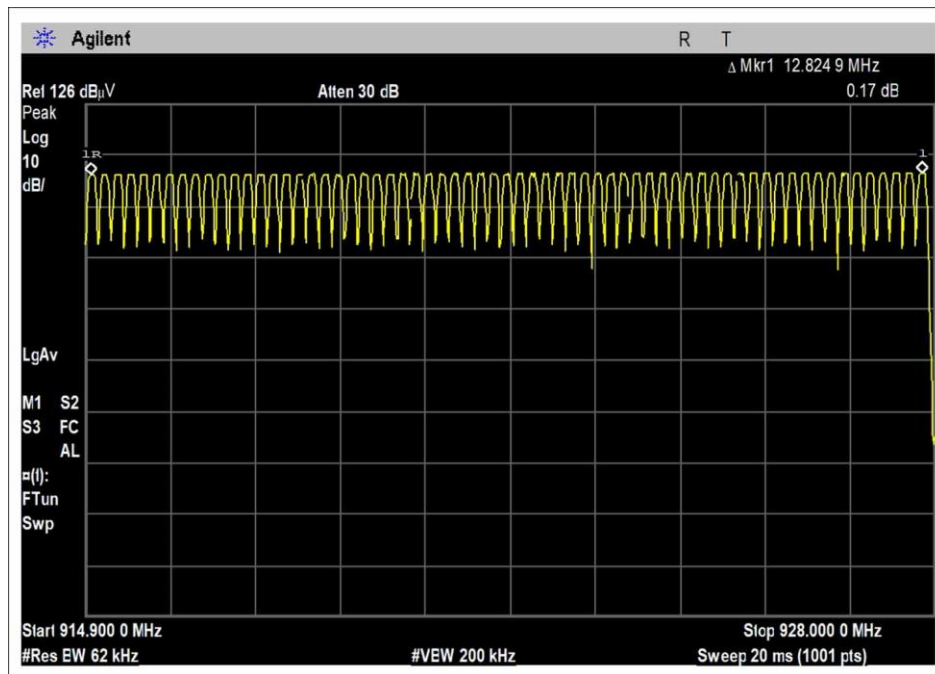
15.247(a)(1)(iii) Number of Hopping Channels

Test Data Summary				
$\text{Limit} = \begin{cases} 50 \text{ Channels} & 20 \text{ dB BW} < 250\text{kHz} \\ 25 \text{ Channels} & 20 \text{ dB BW} \geq 250\text{kHz} \end{cases}$				
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

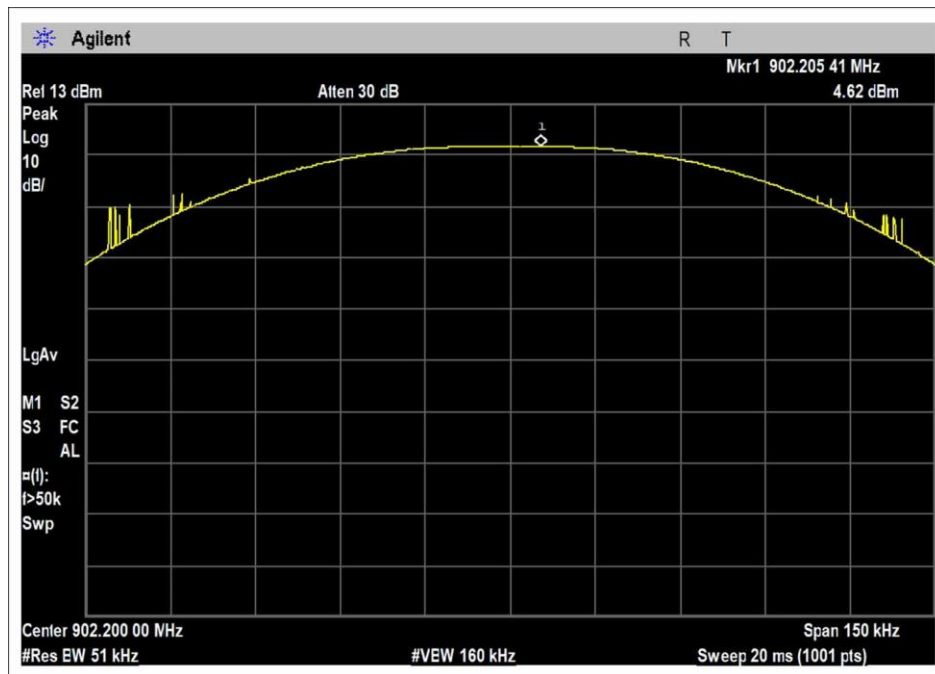
Test Data Summary - Voltage Variations

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

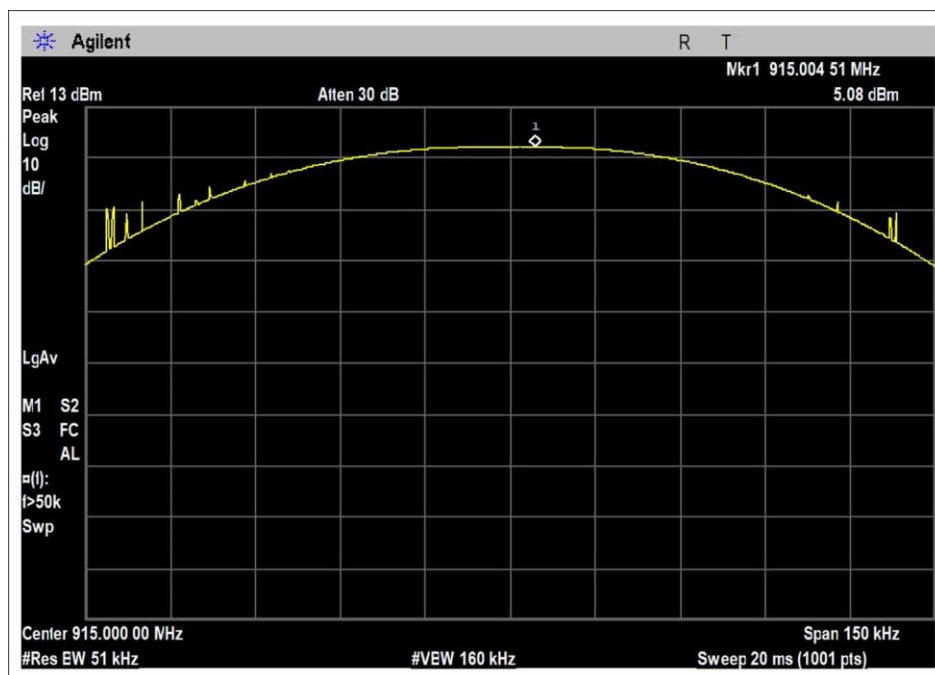
Test Data Summary - RF Conducted Measurement

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

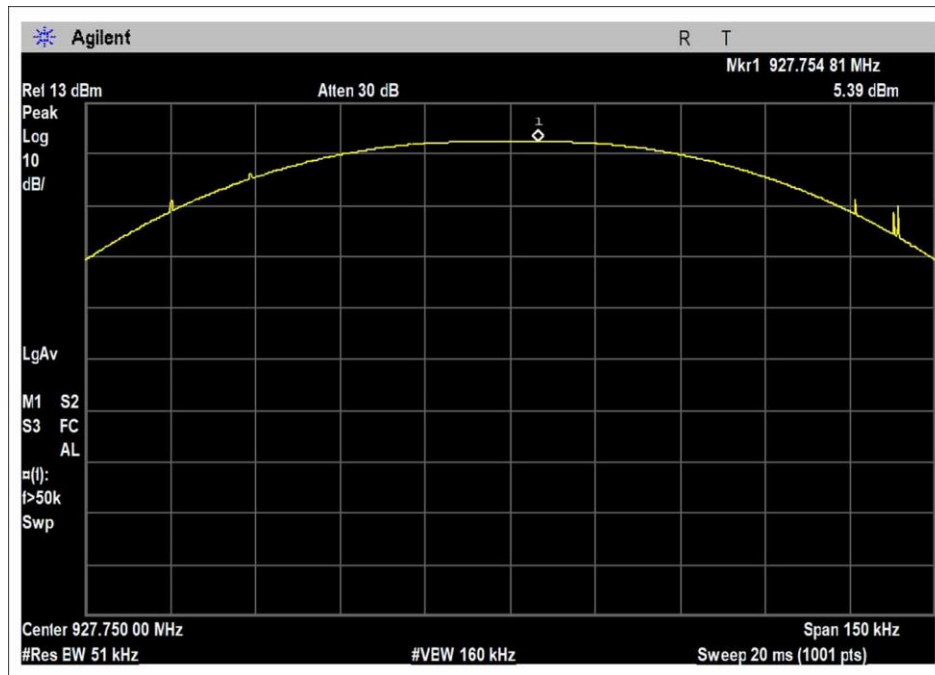
Plots



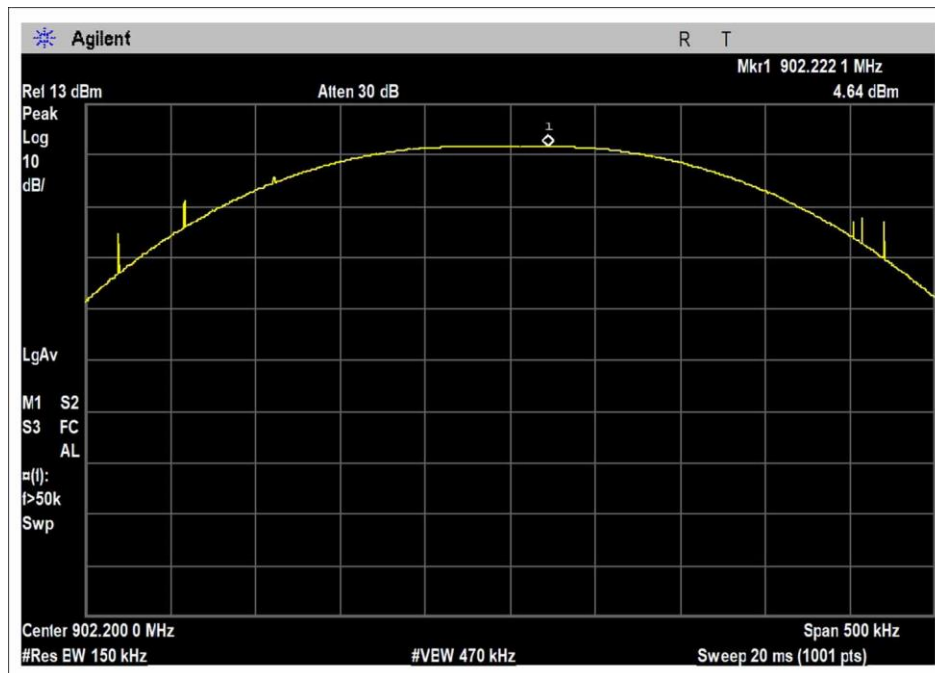
25kbps Low Channel



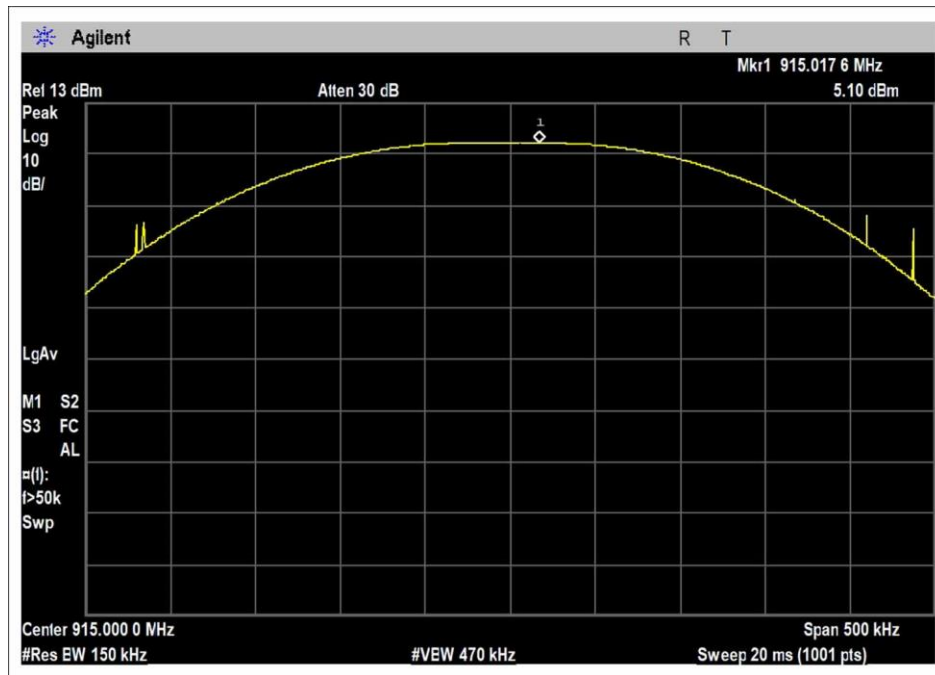
25kbps Middle Channel



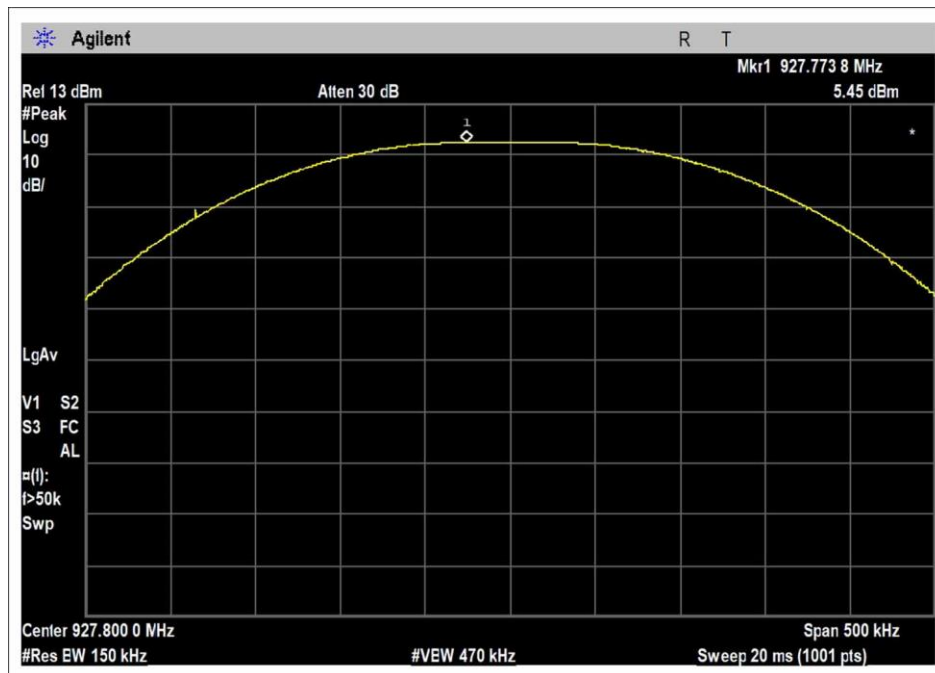
25kbps High Channel



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:

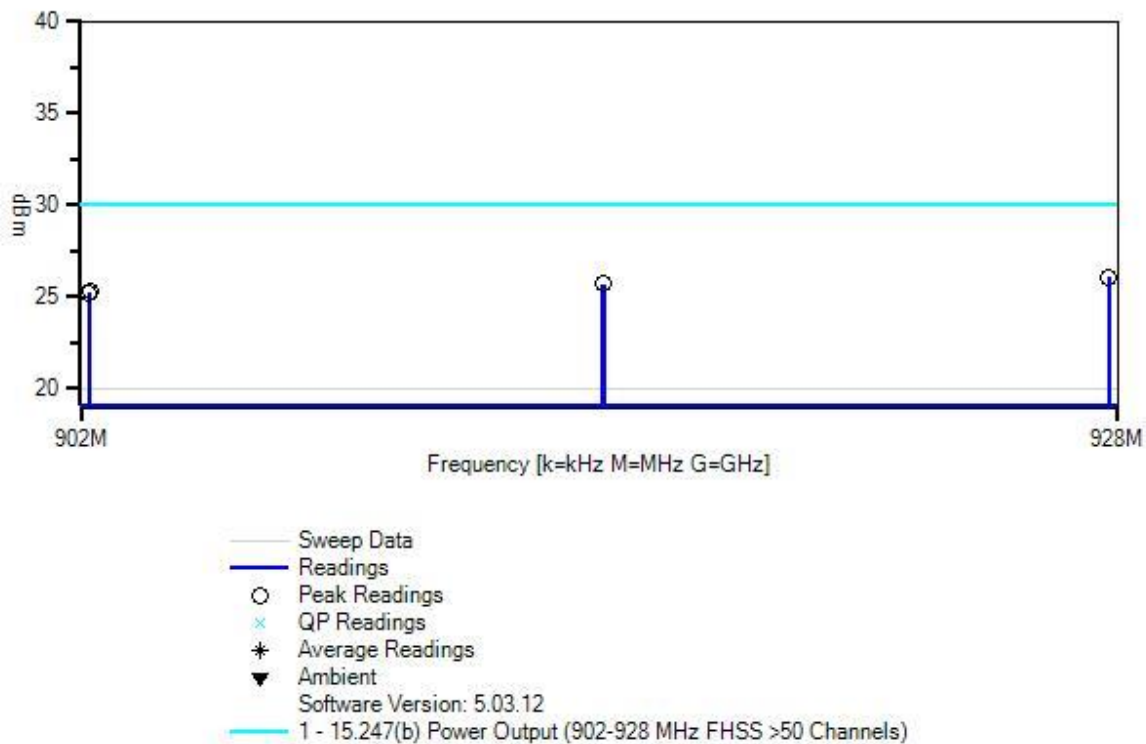
Device	Manufacturer	Model #	S/N
Configuration 1			

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 (°C): 19-23
 Relative Humidity (%): 30-50

Itron, Inc. W/O#: 103184 Sequence#: 2 Date: 10/29/2019
15.247(b) Power Output (902-928 MHz FHSS >50 Channels) Test Lead: Battery RF Port



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	Helix	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.

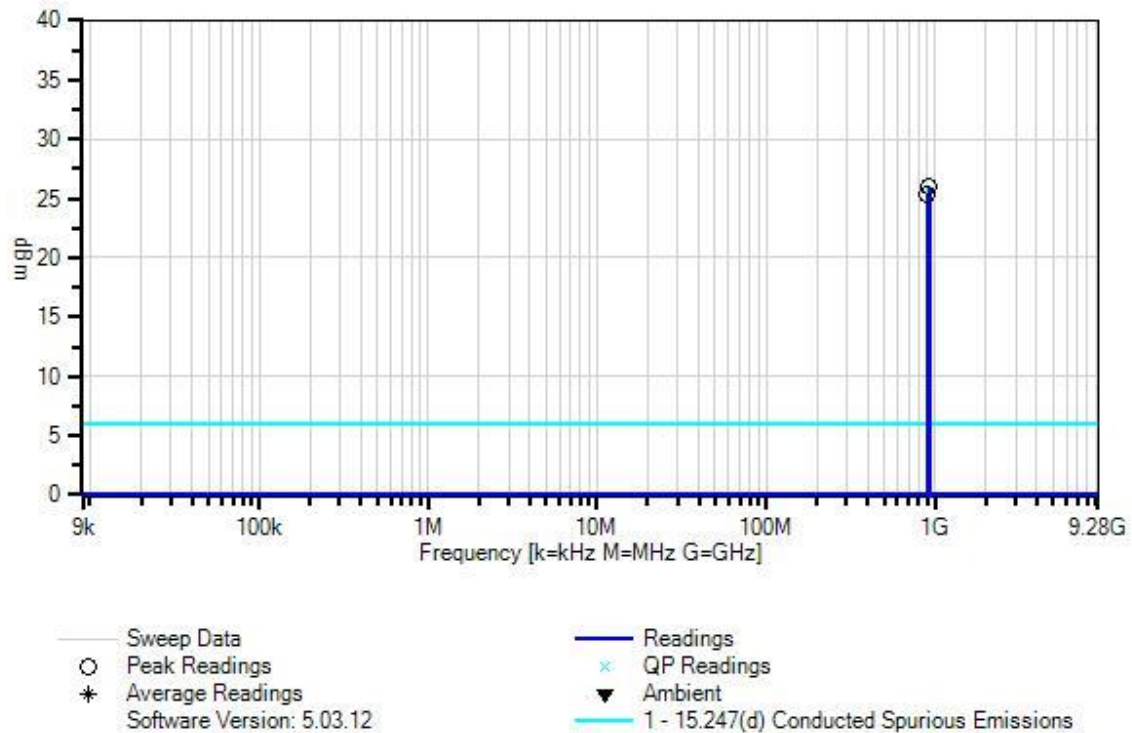
Test Location: Brea Lab Bench

Test Method: ANSI C63.10 (2013)

Temperature (°C): 19-23

Relative Humidity (%): 30-50

Itron, Inc. WO#: 103184 Sequence#: 5 Date: 10/29/2019
15.247(d) Conducted Spurious Emissions Test Lead: Battery RF Port



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	Helix	4/11/2018	4/11/2020

Measurement Data:

Reading listed by margin.

Test Lead: RF Port

Measurement Data		Reading listed by margin					Test Result at 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	-25.5	RF Po
									50k		
2	1804.410M	-40.6	+0.0	+20.0	+1.1		+0.0	-19.5	6.0	-25.5	RF Po
									25k		
3	1830.005M	-41.0	+0.0	+20.0	+1.1		+0.0	-19.9	6.0	-25.9	RF Po
									25k		
4	1855.548M	-41.0	+0.0	+20.0	+1.1		+0.0	-19.9	6.0	-25.9	RF Po
									50k		
5	1855.500M	-41.1	+0.0	+20.0	+1.1		+0.0	-20.0	6.0	-26.0	RF Po
									25k		
6	1830.001M	-41.1	+0.0	+20.0	+1.1		+0.0	-20.0	6.0	-26.0	RF Po
									50k		

Band Edge

Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.

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.

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

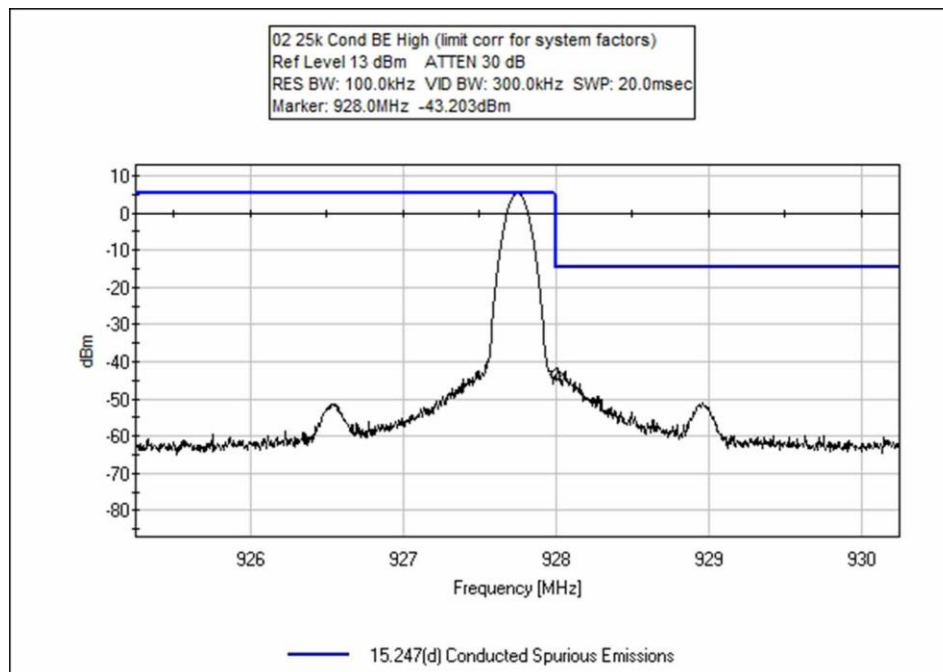
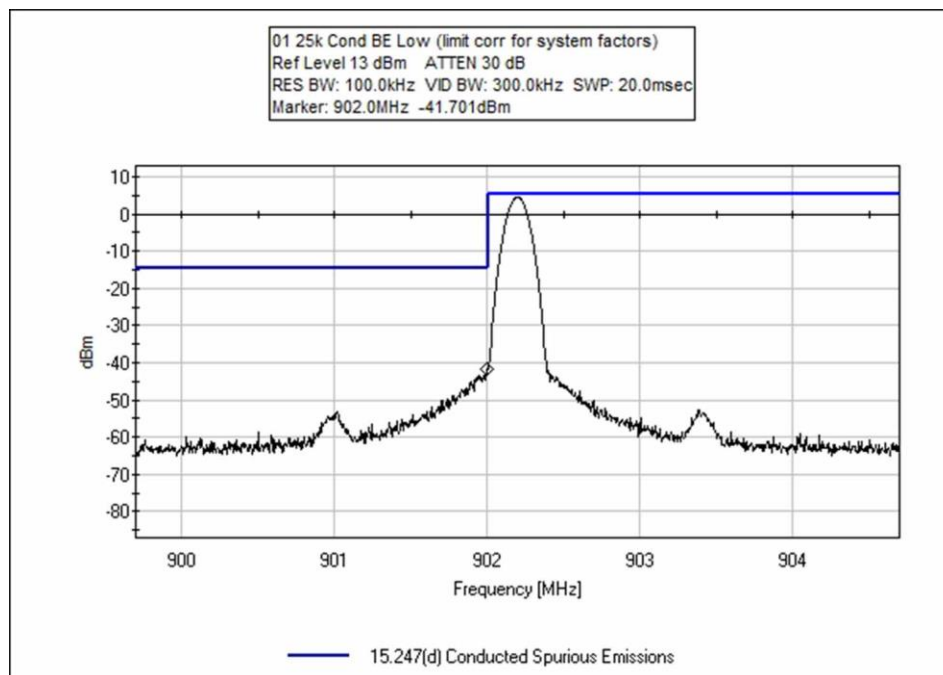
Limit applied: Max Power/100kHz - 20dB. (Using Marker Delta Method)

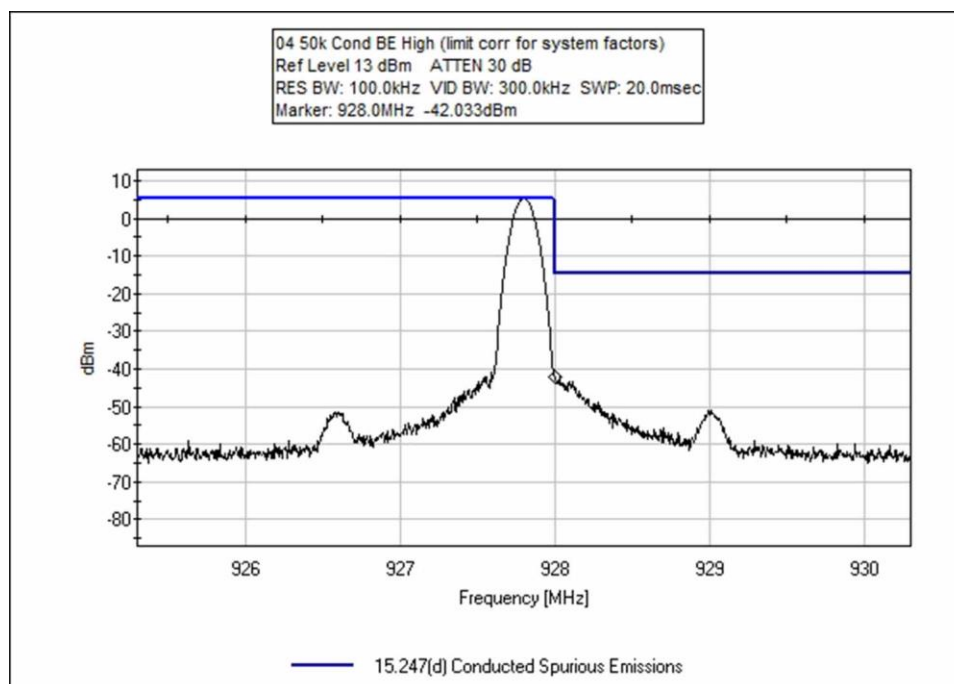
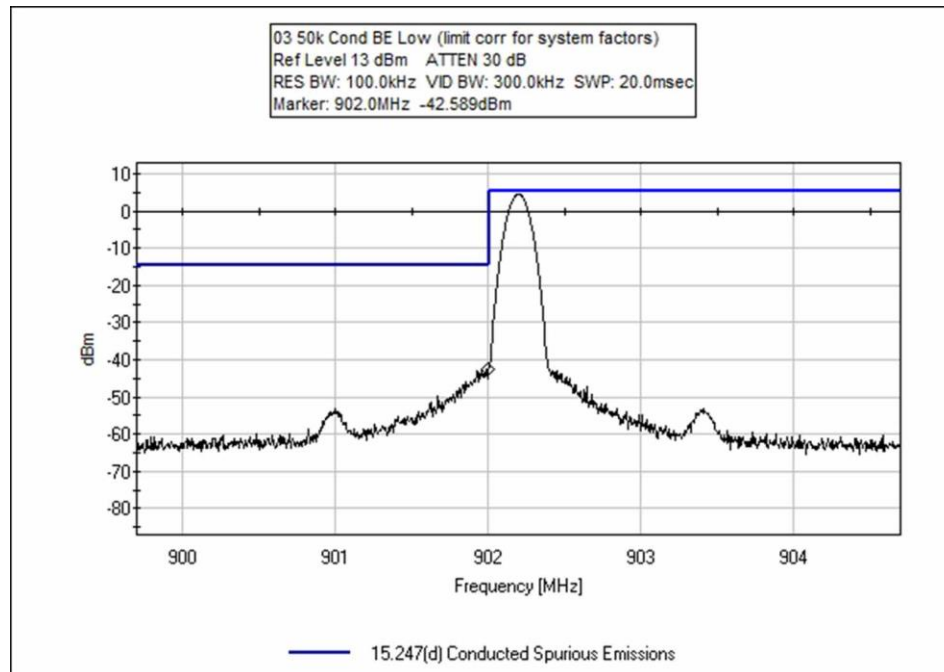
Operating Mode: Hopping

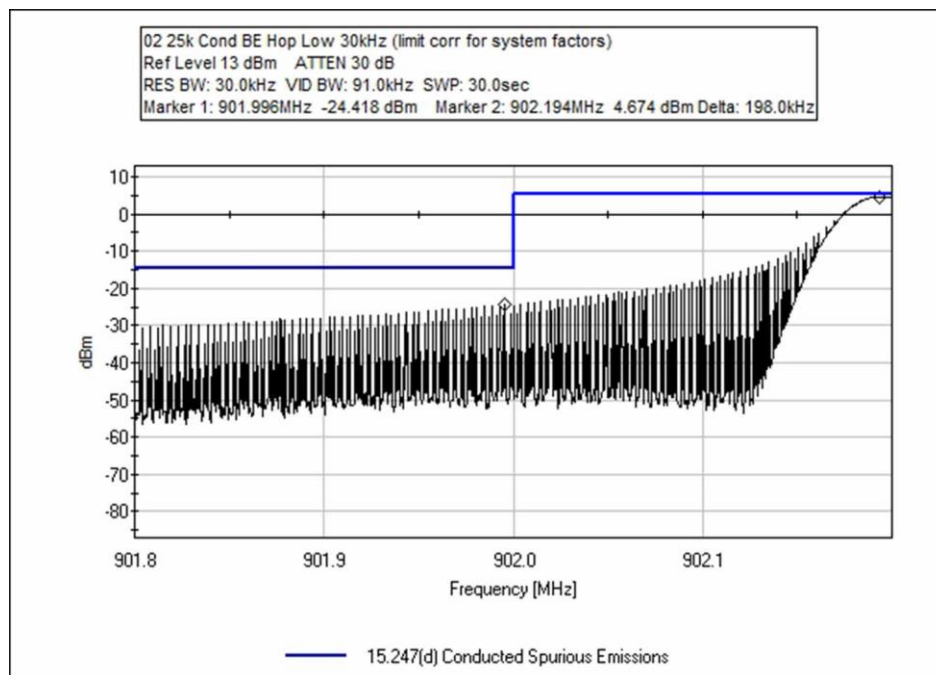
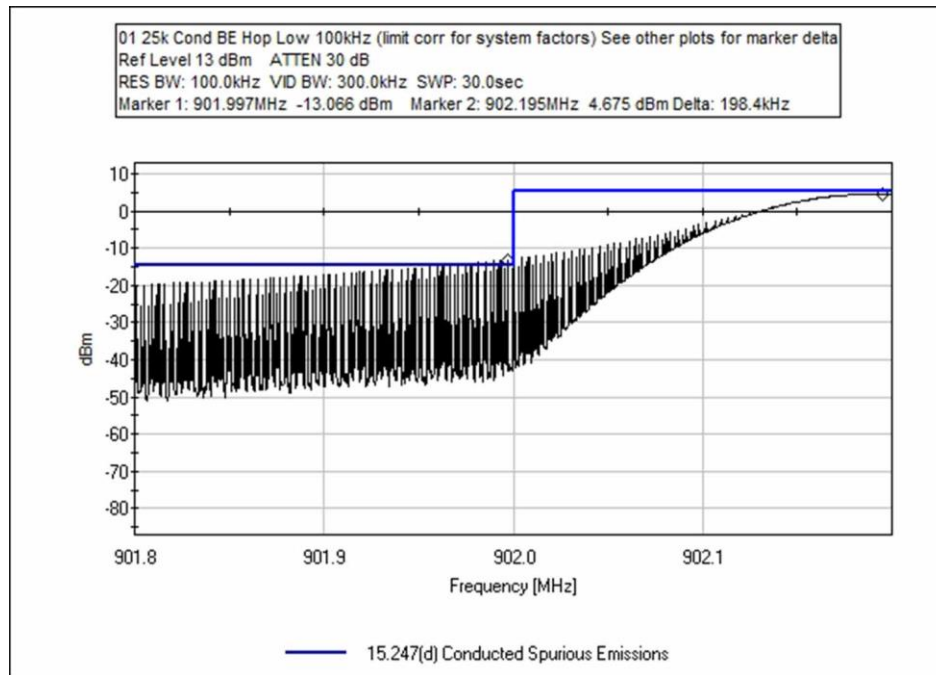
Freq (MHz)	Modulation	100kHz Band Edge Measurement (dBm)	100kHz Fundamental Measurement (dBm)	30kHz Band Edge Measurement (dBm)	30kHz Fundamental Measurement (dBm)	Band Edge Limit (30kHz) (dBm)	Results
902	Hopping GSFK 25k	7.5	25.3	-3.8	25.3	<6.0	Pass
928	Hopping GSFK 25k	5.3	26.0	-5.4	26.0	<6.0	Pass
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

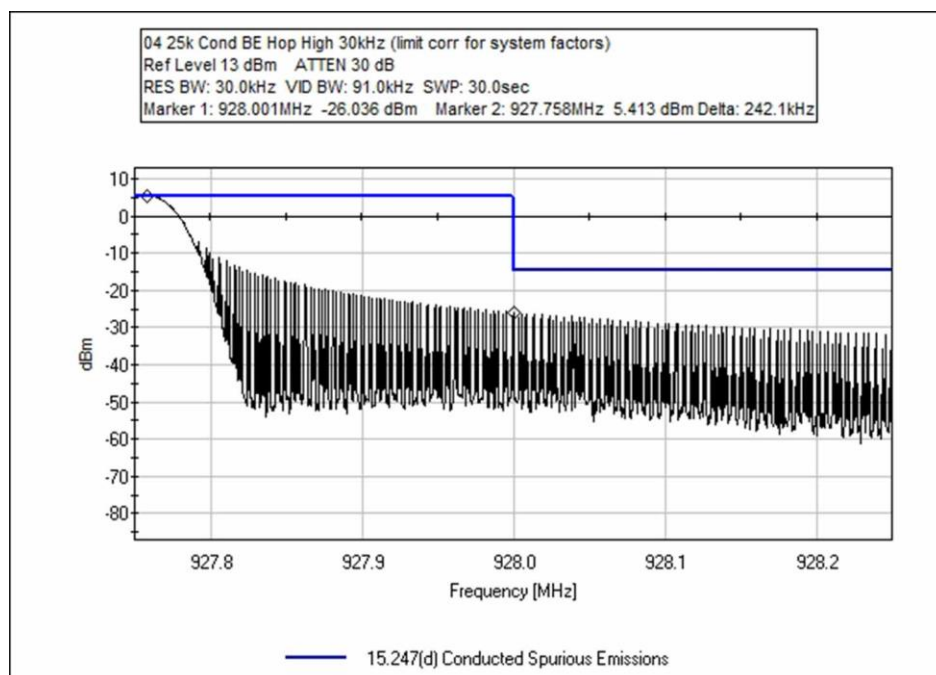
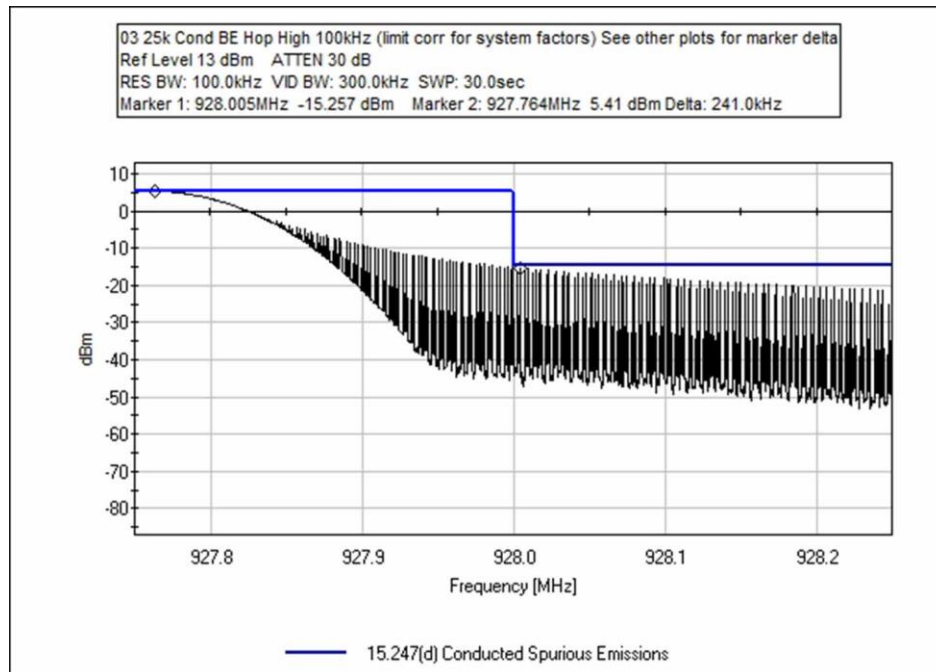
Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement.

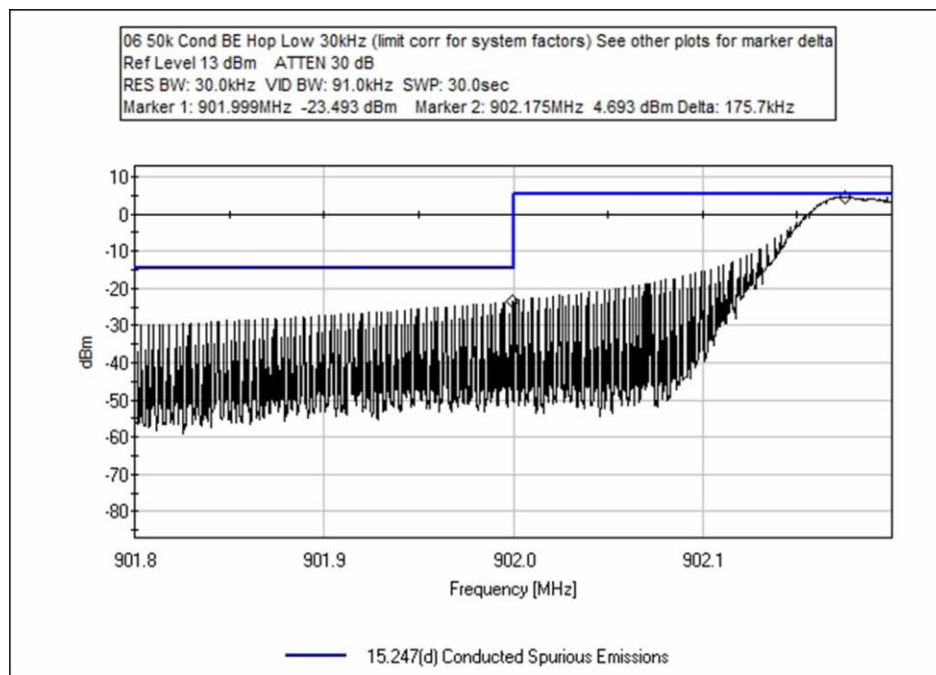
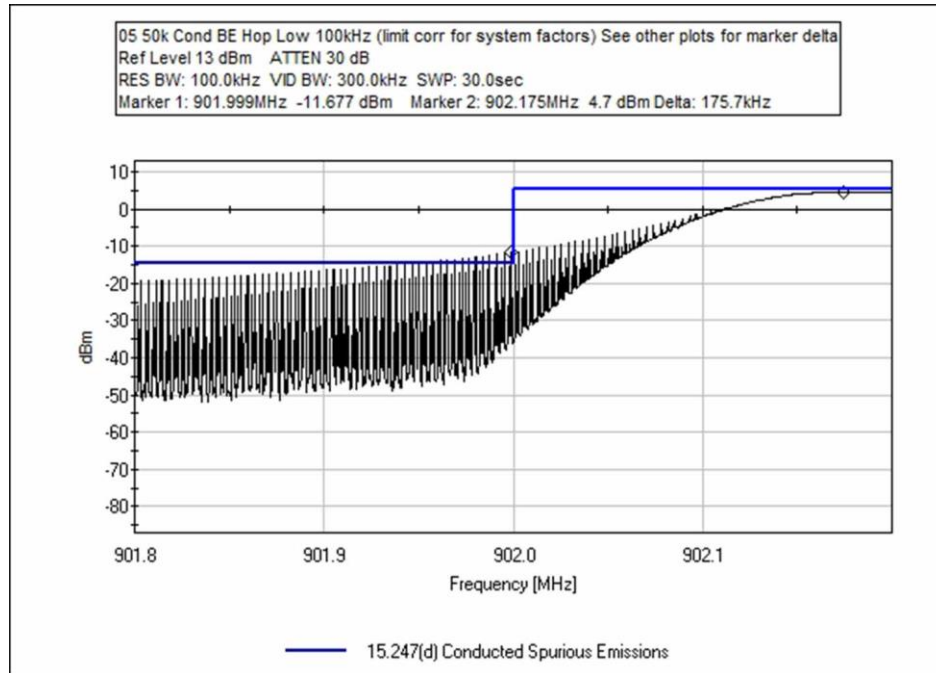
Band Edge Plots

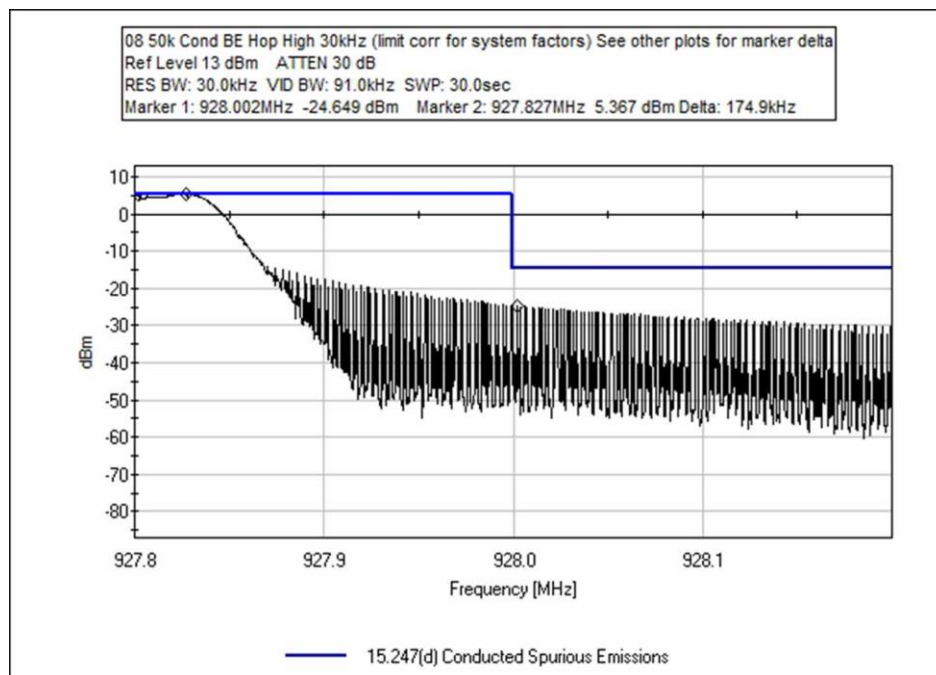
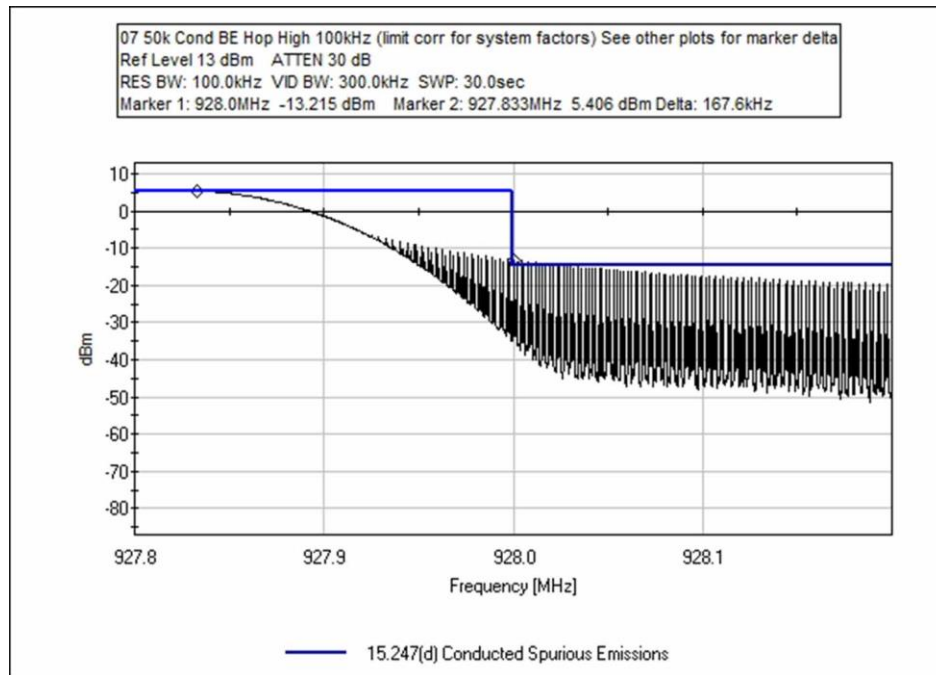












Test Setup / Conditions / Data

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	Helix	4/11/2018	4/11/2020

Measurement Data:

Reading listed by margin.

Test Lead: RF Port

#	Freq MHz	Rdng dBm	T1 dB	T2 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	+0.0	RF Po
									25k High		
2	927.764M	5.4	+20.0	+0.6			+0.0	26.0	26.0	+0.0	RF Po
									25k High		
3	927.833M	5.4	+20.0	+0.6			+0.0	26.0	26.0	+0.0	RF Po
									50k High		
4	927.827M	5.4	+20.0	+0.6			+0.0	26.0	26.0	+0.0	RF Po
									50k High		
5	902.195M	4.7	+20.0	+0.6			+0.0	25.3	26.0	-0.7	RF Po
									25k Low		

6	902.194M	4.7	+20.0	+0.6	+0.0	25.3	26.0 25k Low	-0.7	RF Po
7	902.175M	4.7	+20.0	+0.6	+0.0	25.3	26.0 50k Low	-0.7	RF Po
8	902.175M	4.7	+20.0	+0.6	+0.0	25.3	26.0 50k Low	-0.7	RF Po
9	901.999M	-23.5	+20.0	+0.6	+0.0	-2.9	6.0 50k Low	-8.9	RF Po
10	901.996M	-24.4	+20.0	+0.6	+0.0	-3.8	6.0 25k Low	-9.8	RF Po
11	928.002M	-24.6	+20.0	+0.6	+0.0	-4.0	6.0 50k High	-10.0	RF Po
12	928.001M	-26.0	+20.0	+0.6	+0.0	-5.4	6.0 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	Heliac	4/11/2018	4/11/2020

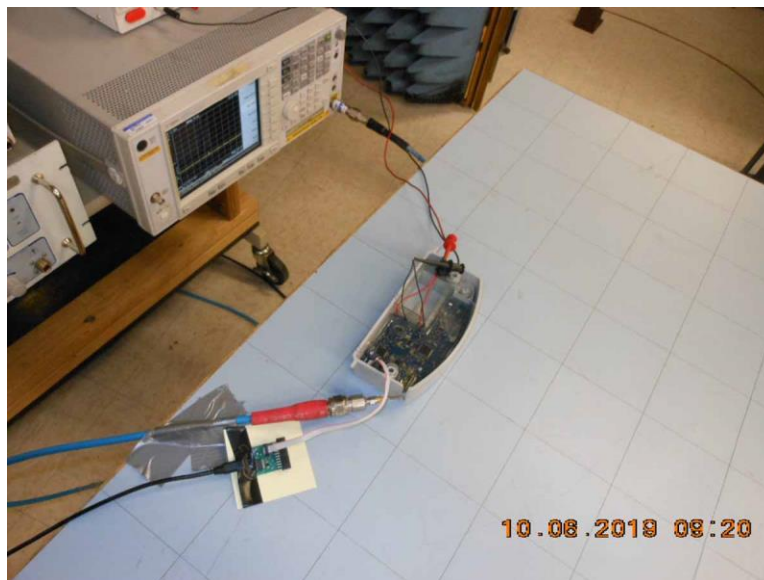
Measurement Data:

Reading listed by margin.

Test Lead: RF Port

#	Freq MHz	Rdng dBm	T1 dB	T2 dB		Dist dB	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			

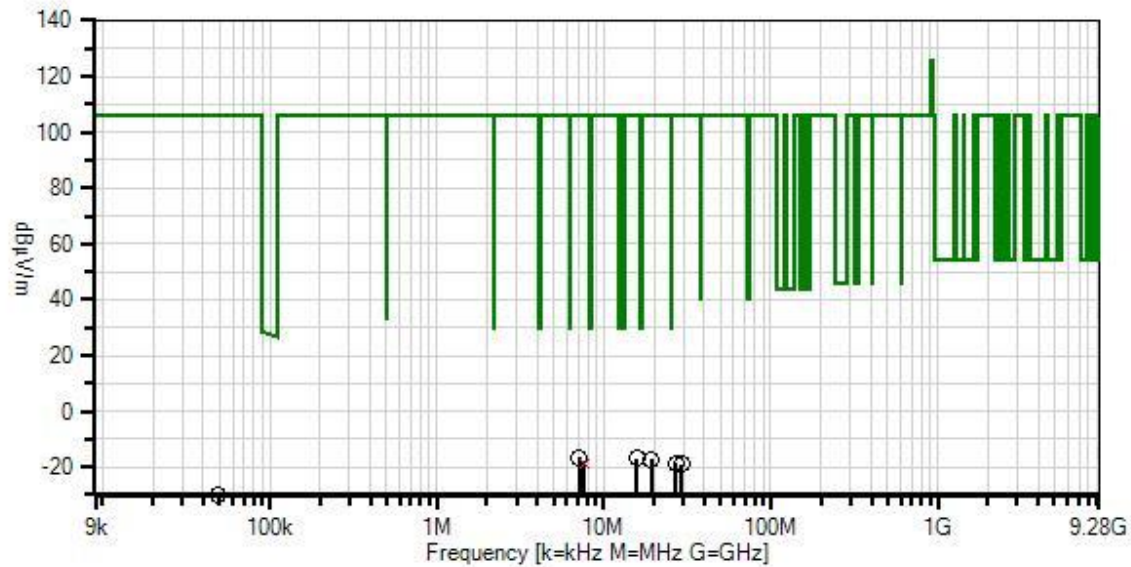
Support Equipment:

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 (°C): 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



— Readings
 × QP Readings
 ▼ Ambient
 ○ Peak Readings
 * Average Readings
 Software Version: 5.03.12
 1 - 15.247(d) / 15.209 Radiated Spurious Emissions

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	Heliac	8/23/2019	8/23/2021
T3	ANP06515	Cable	Heliac	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	11.9	+0.0	+0.0	+0.1	+9.4	-40.0	-18.6	106.0	-124.6	Para
QP											
^	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			

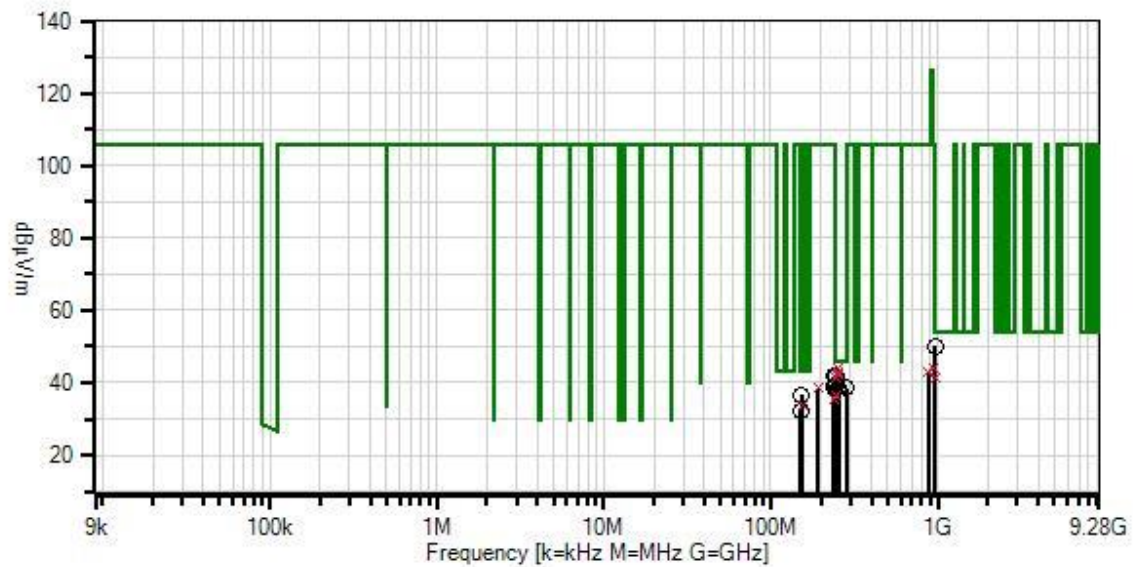
Support Equipment:

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 (°C): 19-23 Relative Humidity (%): 30-50

Itron, Inc. WD#: 103183 Sequence#: 2 Date: 10/6/2019
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters H+V



— 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	Helix	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 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	250.059M QP	24.0	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	43.9	46.0	-2.1	Horiz
^	250.059M	28.1	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	48.0	46.0	+2.0	Horiz
3	251.210M QP	23.1	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	43.0	46.0	-3.0	Horiz
4	254.934M QP	22.7	+0.0 +5.8	+0.2 +12.3	+0.8	+0.9	+0.0	42.7	46.0	-3.3	Horiz
5	964.100M	15.6	+0.0 +5.9	+0.4 +24.6	+1.5	+2.1	+0.0	50.1	54.0	-3.9	Horiz
6	249.200M	21.7	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	41.6	46.0	-4.4	Vert
7	247.531M QP	21.5	+0.0 +5.8	+0.2 +12.1	+0.8	+0.9	+0.0	41.3	46.0	-4.7	Horiz
8	242.400M	19.8	+0.0 +5.8	+0.2 +11.9	+0.8	+0.9	+0.0	39.4	46.0	-6.6	Vert
9	249.200M	19.4	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	39.3	46.0	-6.7	Vert
10	241.500M	19.4	+0.0 +5.8	+0.2 +11.8	+0.8	+0.9	+0.0	38.9	46.0	-7.1	Horiz
11	282.200M	17.8	+0.0 +5.8	+0.2 +12.8	+0.8	+1.0	+0.0	38.4	46.0	-7.6	Horiz
12	252.100M	18.5	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	38.4	46.0	-7.6	Vert
13	248.866M QP	16.5	+0.0 +5.8	+0.2 +12.2	+0.8	+0.9	+0.0	36.4	46.0	-9.6	Vert
14	241.563M QP	15.7	+0.0 +5.8	+0.2 +11.8	+0.8	+0.9	+0.0	35.2	46.0	-10.8	Vert
^	241.500M	19.0	+0.0 +5.8	+0.2 +11.8	+0.8	+0.9	+0.0	38.5	46.0	-7.5	Vert
16	964.100M QP	6.8	+0.0 +5.9	+0.4 +24.6	+1.5	+2.1	+0.0	41.3	54.0	-12.7	Vert
17	953.400M QP	9.5	+0.0 +5.8	+0.4 +24.5	+1.5	+2.1	+0.0	43.8	106.0	-62.2	Horiz
^	953.400M	18.9	+0.0 +5.8	+0.4 +24.5	+1.5	+2.1	+0.0	53.2	106.0	-52.8	Horiz

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			

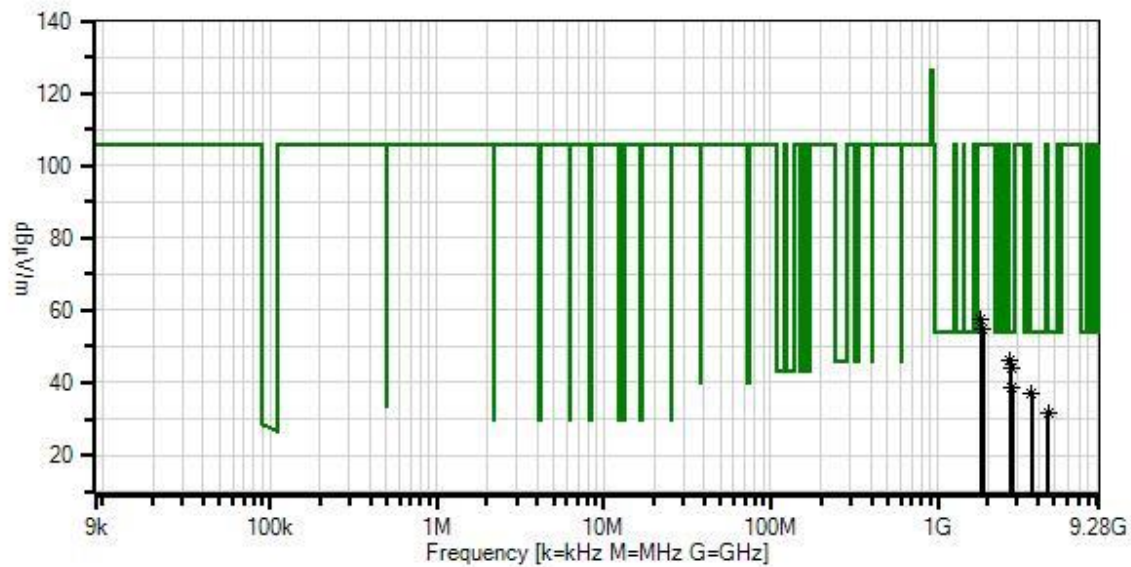
Support Equipment:

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 (°C): 19-23 Relative Humidity (%): 30-50
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Itron, Inc. WD#: 103183 Sequence#: 3 Date: 10/18/2019
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters H+V



— 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	Heliac	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	Heliac	6/29/2018	6/29/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5 dB	T6 dB	T7 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)
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)
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

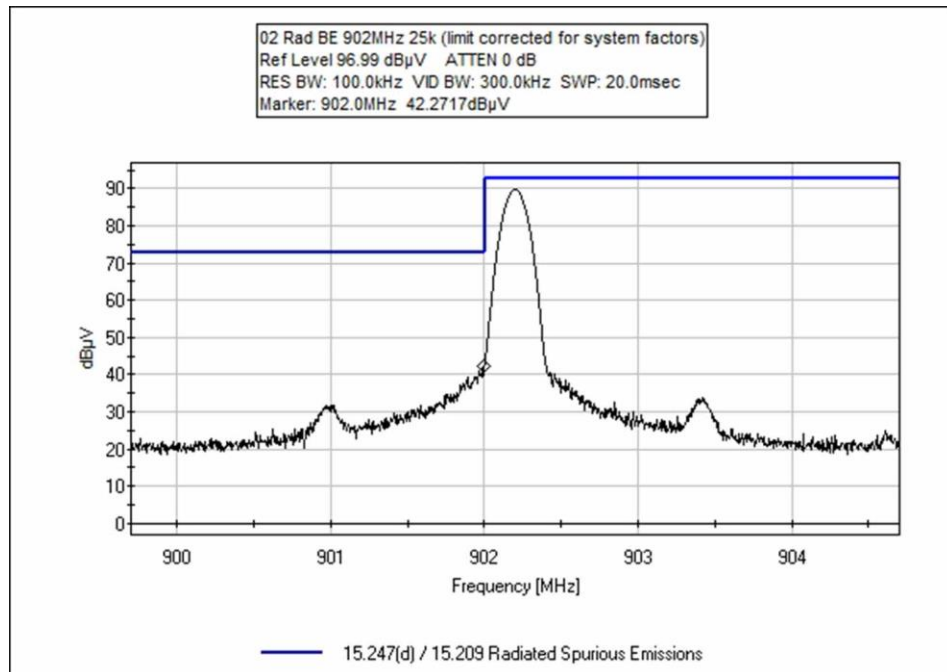
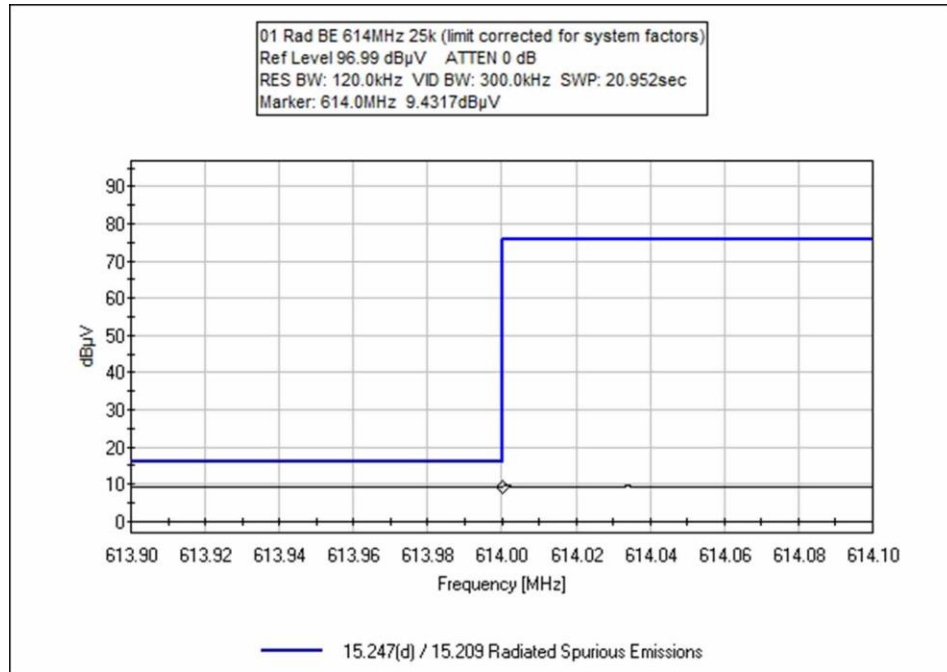
Operating Mode: Single Channel (Low and High)
Integral Antenna 4.8dBi

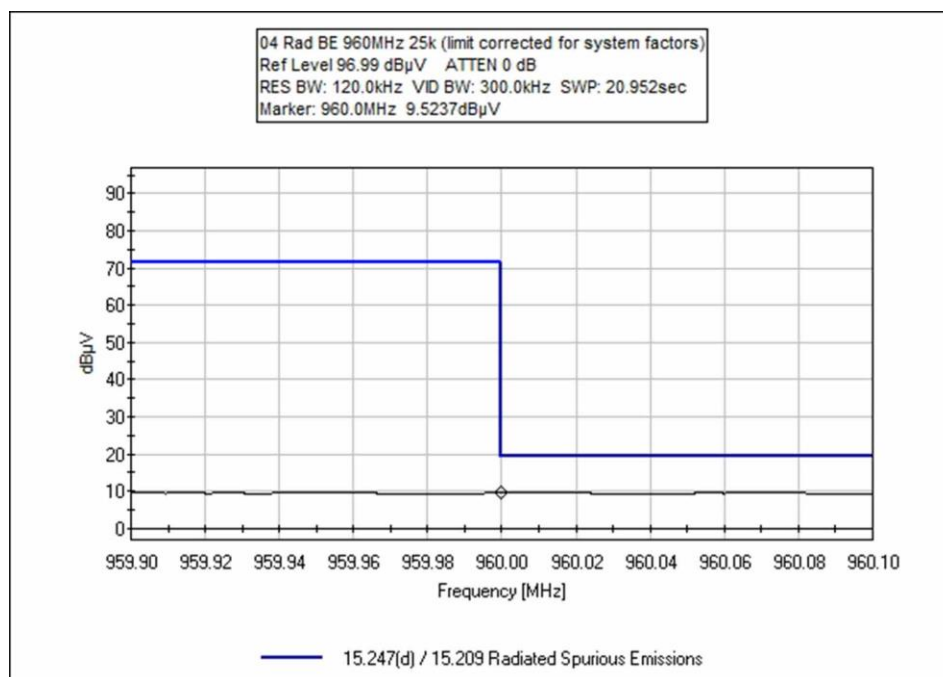
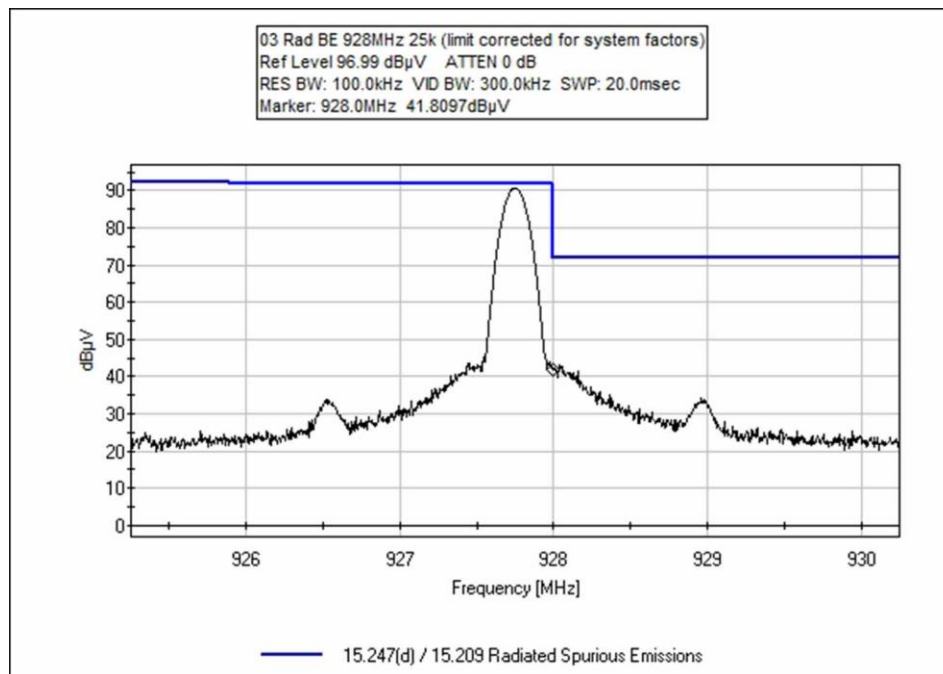
Freq (MHz)	Modulation	100kHz Band Edge Measurement (dBuV/m @3m)	100kHz Fundamental Field Strength (dBuV/m @3m)	30kHz Band Edge Measurement (dBuV/m @3m)	30kHz Fundamental Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	GFSK 25kbps	105.7	123.3	94.3	123.3	106.0	Pass
928	GFSK 25kbps	102.6	123.4	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

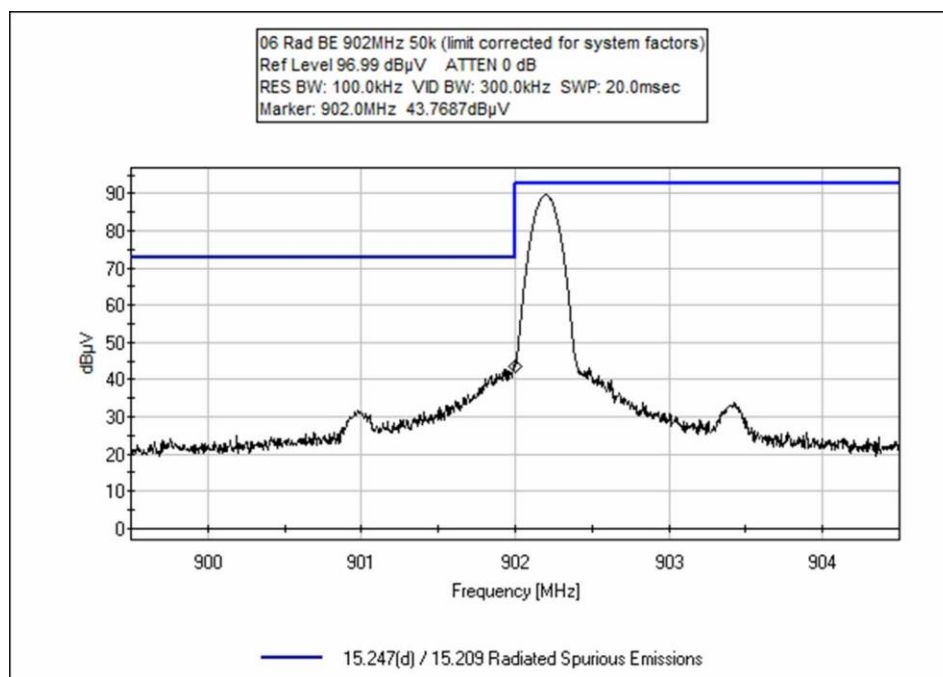
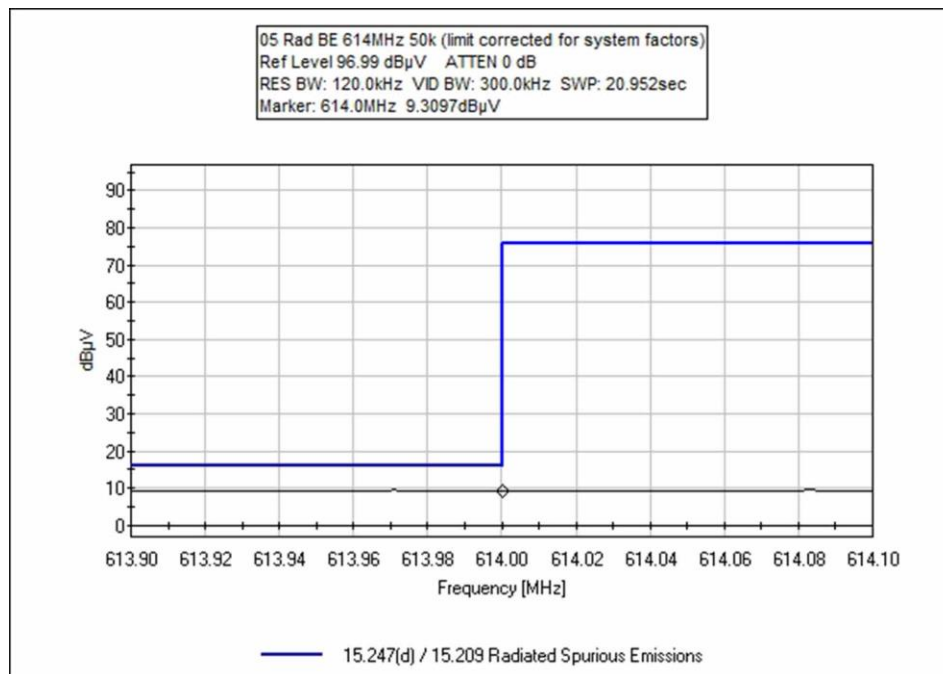
Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement, underlined and bold in the table above.

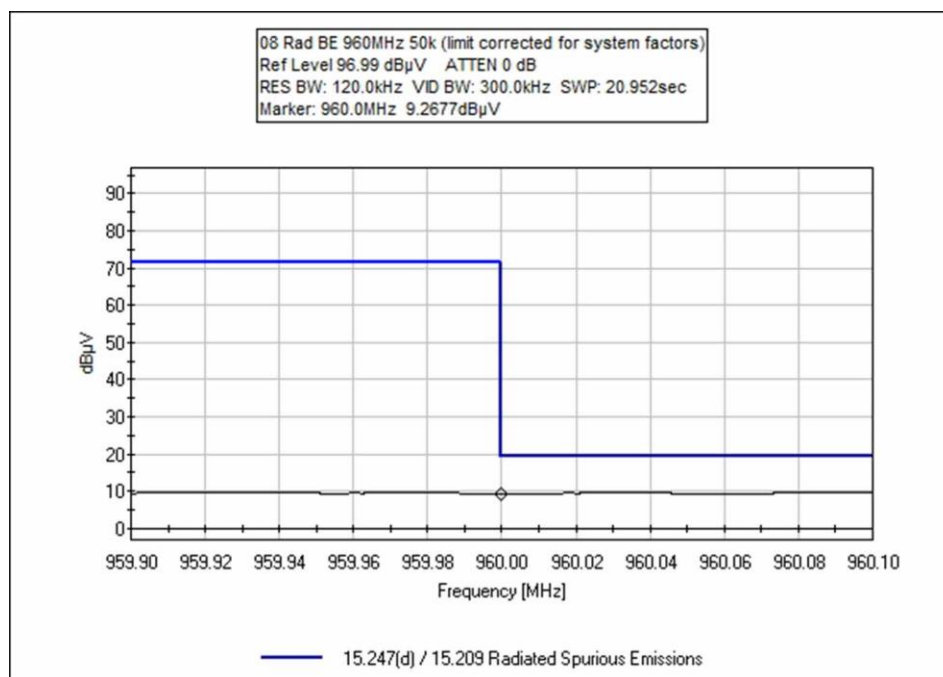
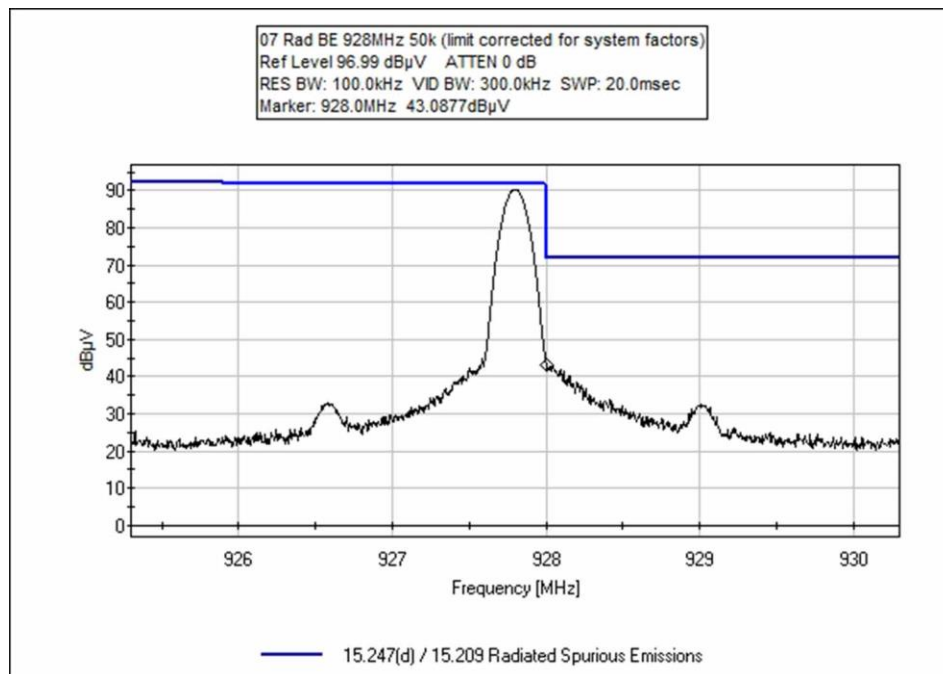
Note: Single channel data at 614MHz and 960MHz is representative of data collected in hopping mode.

Band Edge Plots

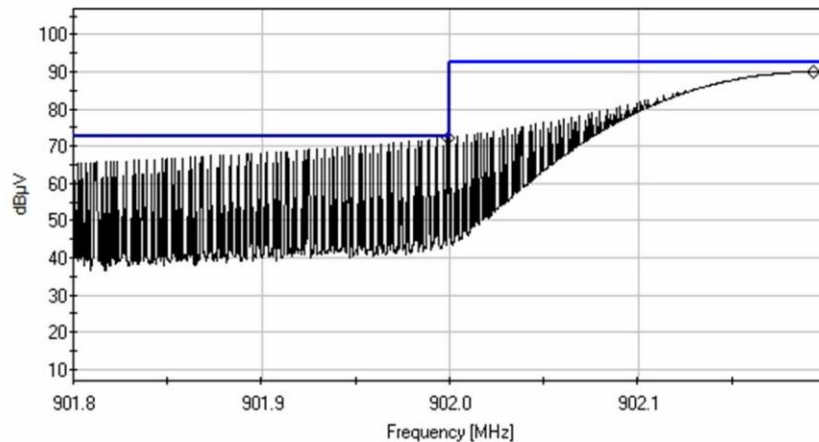






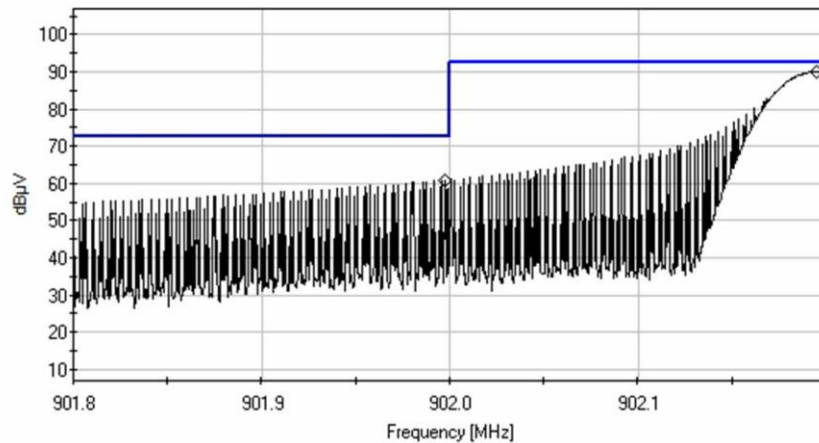


01 25k Rad BE Low Hopping 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 106.99 dBμV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 901.999MHz 72.4167 dBμV Marker 2: 902.193MHz 90.0177 dBμV Delta: 194.0kHz

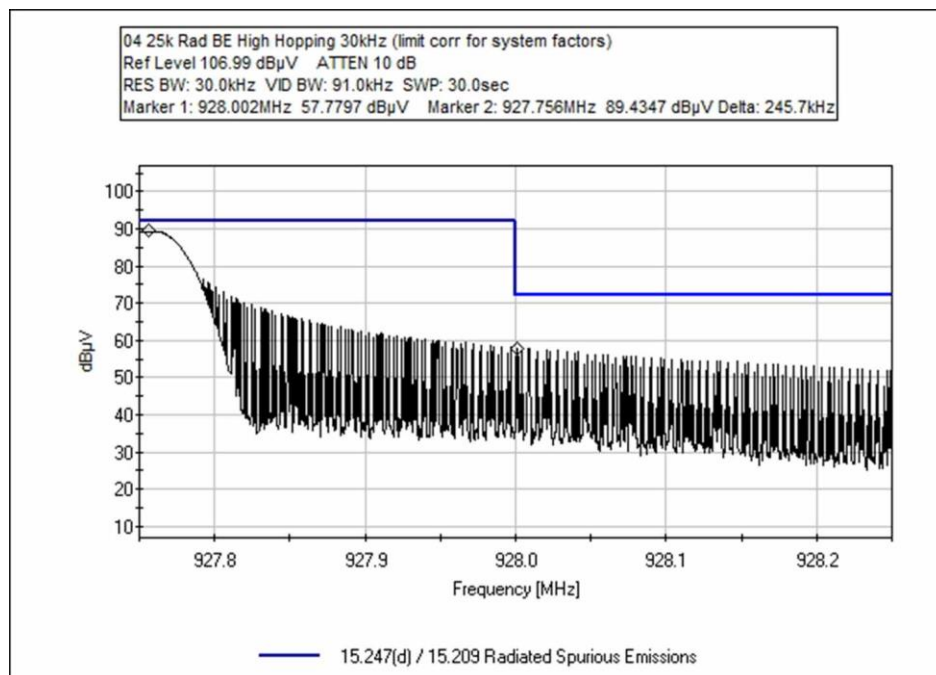
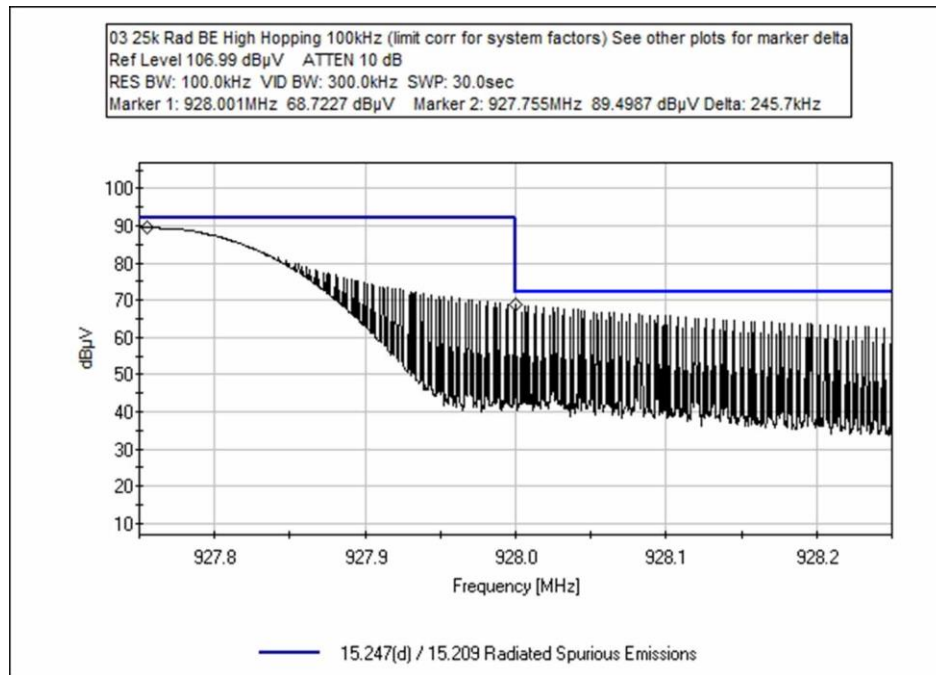


15.247(d) / 15.209 Radiated Spurious Emissions

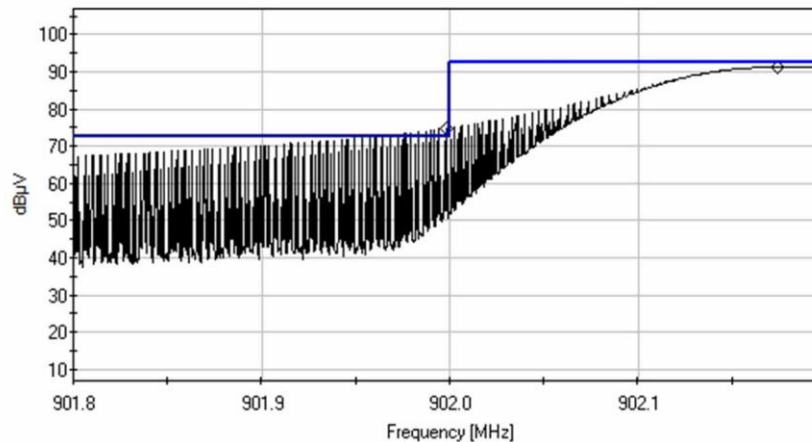
02 25k Rad BE Low Hopping 30kHz (limit corr for system factors)
Ref Level 106.99 dBμV ATTEN 10 dB
RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec
Marker 1: 901.998MHz 60.9857 dBμV Marker 2: 902.195MHz 89.9947 dBμV Delta: 197.6kHz



15.247(d) / 15.209 Radiated Spurious Emissions

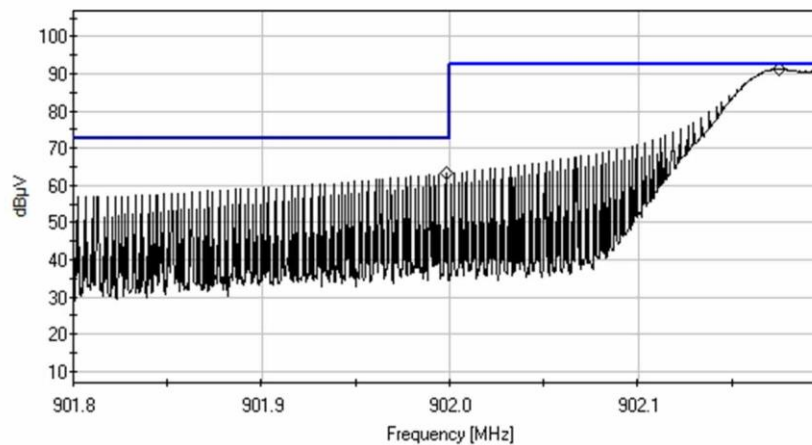


05 50k Rad BE Low Hopping 100kHz (limit corr for system factors) See other plots for marker delta
Ref Level 106.99 dBμV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec
Marker 1: 901.998MHz 74.8427 dBμV Marker 2: 902.174MHz 91.3807 dBμV Delta: 175.7kHz



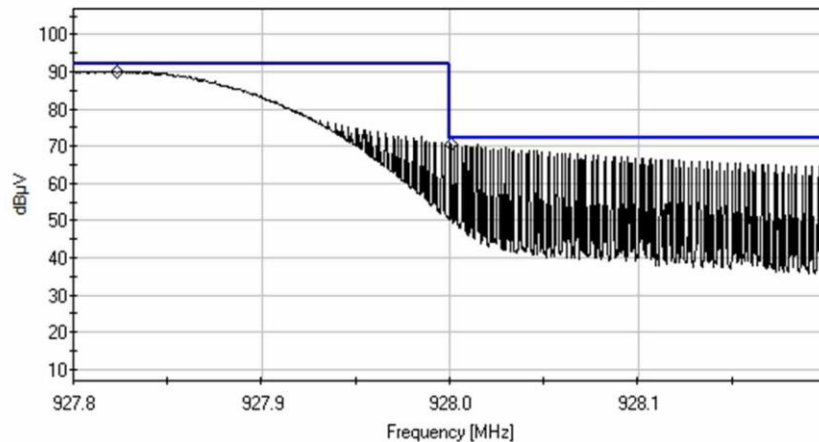
15.247(d) / 15.209 Radiated Spurious Emissions

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



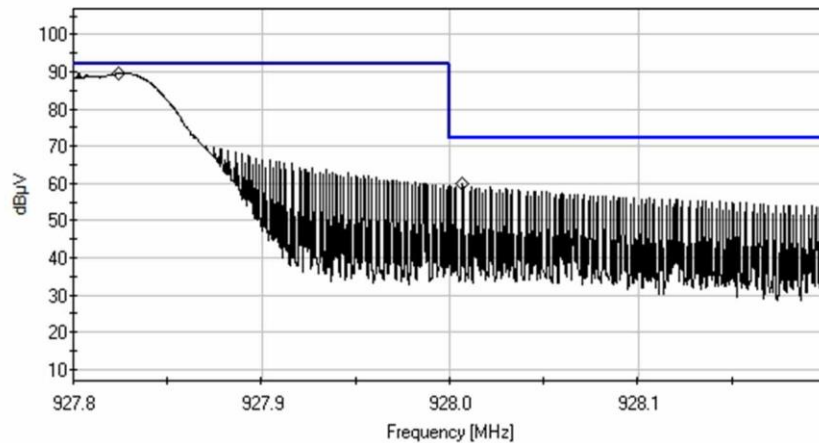
15.247(d) / 15.209 Radiated Spurious Emissions

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



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



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	Heliac	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 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 +23.8	+1.4	+2.0	+5.8	+0.0	124.7	126.0 50k	-1.3	Horiz
2	902.175M	91.4	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	124.7	126.0 50k	-1.3	Horiz
3	927.823M	90.2	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	124.1	126.0 50k	-1.9	Horiz
4	927.824M	89.7	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	123.6	126.0 50k	-2.4	Horiz
5	927.755M	89.5	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	123.4	126.0 25k	-2.6	Horiz
6	902.193M	90.0	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	123.3	126.0 25k	-2.7	Horiz
7	902.195M	90.0	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	123.3	126.0 25k	-2.7	Horiz
8	927.756M	89.4	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	123.3	126.0 25k	-2.7	Horiz
9	901.998M	63.2	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	96.5	106.0 50k	-9.5	Horiz
10	901.998M	61.0	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	94.3	106.0 25k	-11.7	Horiz
11	928.006M	60.0	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	93.9	106.0 50k	-12.1	Horiz
12	928.002M	57.8	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	91.7	106.0 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	Heliac	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 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 QP	9.4	+0.3 +21.2	+1.2	+1.5	+5.8	+0.0	39.4	46.0 25k	-6.6	Horiz
2	614.000M QP	9.3	+0.3 +21.2	+1.2	+1.5	+5.8	+0.0	39.3	46.0 50k	-6.7	Horiz
3	960.000M QP	9.5	+0.4 +24.6	+1.5	+2.1	+5.8	+0.0	43.9	54.0 25k	-10.1	Horiz
4	960.000M QP	9.3	+0.4 +24.6	+1.5	+2.1	+5.8	+0.0	43.7	54.0 50k	-10.3	Horiz
5	902.000M	43.8	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	77.1	106.0 50k	-28.9	Horiz
6	928.000M	43.1	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	77.0	106.0 50k	-29.0	Horiz
7	928.000M	41.8	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	75.7	106.0 25k	-30.3	Horiz
8	902.000M	42.3	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	75.6	106.0 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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ 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	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

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.