

Itron, Inc.

TEST REPORT FOR

**Smart Network Interface Card, Model: SNIC1
ORRNA, Model: RN-EGS**

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

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

Report No.: 104265-2

Date of issue: July 31, 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:

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

Representative: Jay Holcomb
Customer Reference Number: 215017

DATE OF EQUIPMENT RECEIPT:

DATE(S) OF TESTING:

REPORT PREPARED BY:

Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 104265

July 1, 2020

July 1-16, 2020

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	5.03.19

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	Pass

NA = Not Applicable

NP= CKC Laboratories was not contracted to perform test. See Manufacturer Declaration in Average Time of Occupancy section.

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

The permissive change testing performed in this report was for adding a new baudrate to an already approved modulation type in an already approved module. However, the testing on this new baudrate was performed on this specific host, therefore, for this permissive change to the module, it will only be valid for this specific host only. This module has already had Co-Location and RFX testing performed in this host, and the new baudrate added follows the same channel plan as a previously tested baudrate, so no new RFX or Co-Location was performed.

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
ORRNA	Itron, Inc.	RN-EGS	334915638 (HOST)
Smart Network Interface Card	Itron, Inc.	SNIC1	9230011615 (MODULE)

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	5CD941CCWS
AC Adapter (for Laptop)	HP	L25296-002	NA
Antenna (used for different radio inside host)	PCTEL	BOA9025NM-ITR	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
ORRNA	Itron, Inc.	RN-EGS	334915638 (HOST)
Smart Network Interface Card	Itron, Inc.	SNIC1	9230011615 (MODULE)

Support Equipment:

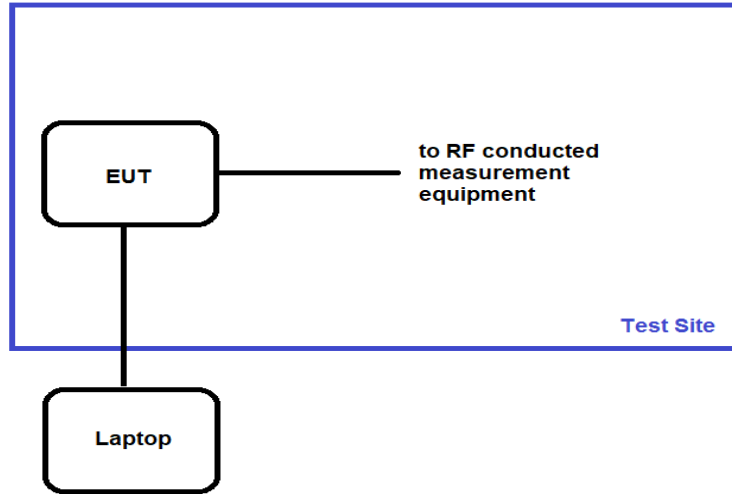
Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	5CD941CCWS
AC Adapter (for Laptop)	HP	L25296-002	NA
Antenna	PCTEL	BOA9022NM-ITR	NA
Antenna (used for different radio inside host)	PCTEL	BOA9025NM-ITR	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Host Specific Testing on Update to Integrated Module
Type of Wideband System:	Proprietary FHSS
Operating Frequency Range:	902.2 – 927.8MHz
Number of Hopping Channels:	513
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):	25kbps FSK
Maximum Duty Cycle:	Assume 100% as worst case
Number of TX Chains:	1
Antenna Type(s) and Gain:	Omnidirectional, 2.6dBi
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	85 to 265VAC (Host Device)
Firmware / Software used for Test:	RF_FW_NBFSK25_UART_f2ff12 (for the RF DSP) wifi_certificate_image_itron_secure Ver 1.5 build 24 rev. 632619 (for the Linux kernel) NGC_GUI_FSK_NB_0502 (Support Laptop Software)

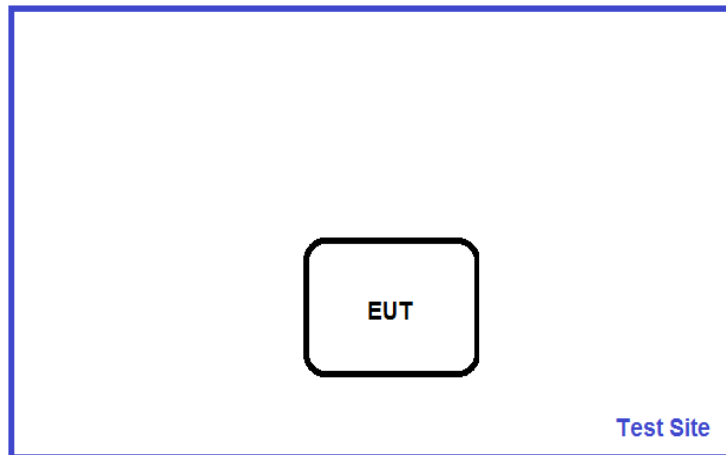
Block Diagram of Test Setup(s)

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 C3	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	7/1-2/2020
Configuration:	1		
Test Setup:	The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting at its rated output power.		

Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	49

Test Equipment

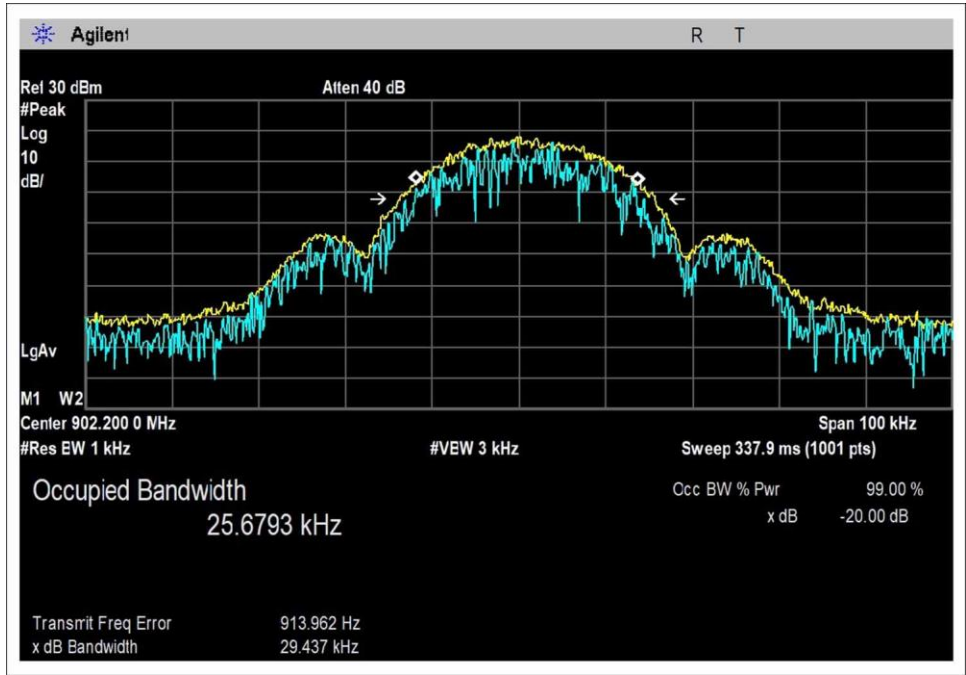
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
P05959	Cable	Andrews	Heliac	1/20/2020	1/20/2022
P07227	Attenuator	Pasternack	PE7004-6	10/2/2019	10/2/2021

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

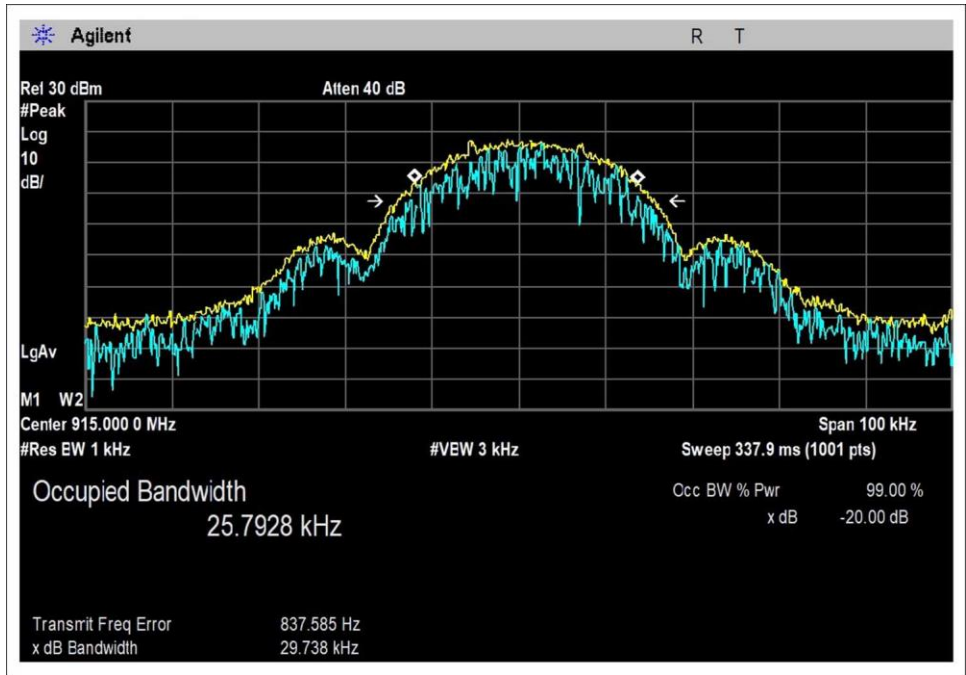
Test Data Summary

Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
902.2	1	FSK 25kbps	29.437	≤500	Pass
915.0	1	FSK 25kbps	29.738	≤500	Pass
927.8	1	FSK 25kbps	29.279	≤500	Pass

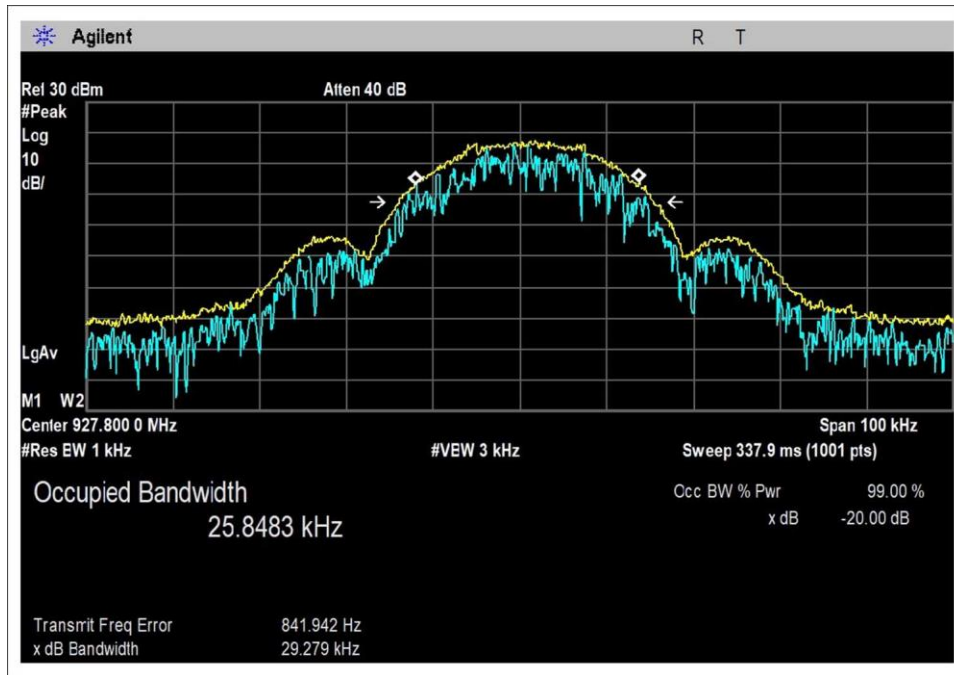
Plot(s)



Low Channel



Middle Channel

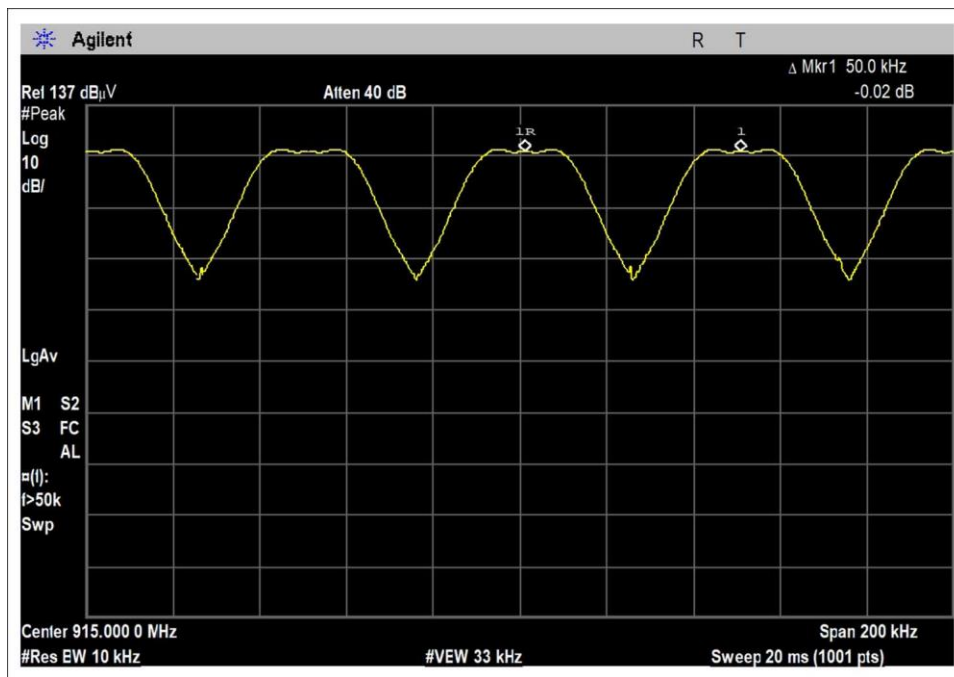


High Channel

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	Hopping FSK 25kbps	50.0	>29.738	Pass

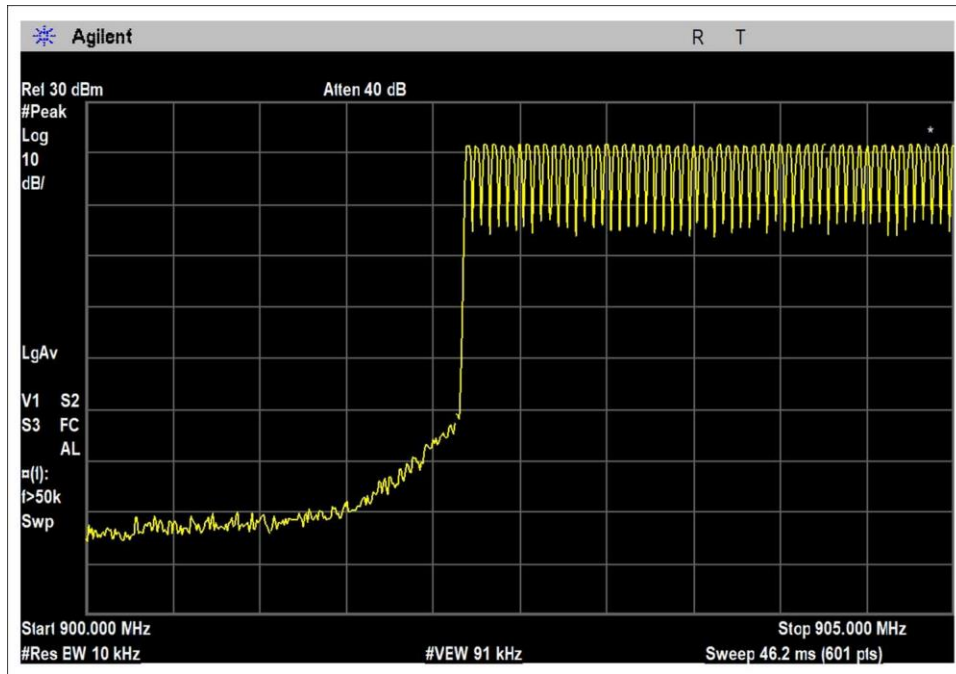
Plot(s)



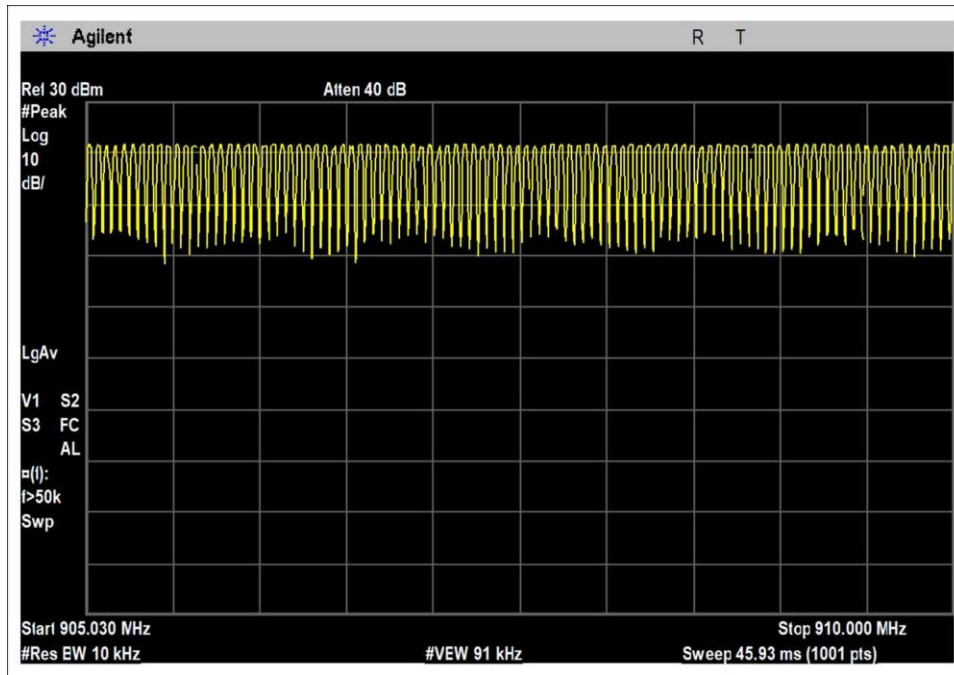
15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50 \text{ Channels} & 20 \text{ dB BW} < 250\text{kHz} \\ 25 \text{ Channels} & 20 \text{ dB BW} \geq 250\text{kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (Channels)	Limit (Channels)	Results
1	Hopping FSK 25kbps	513	≥ 50	Pass

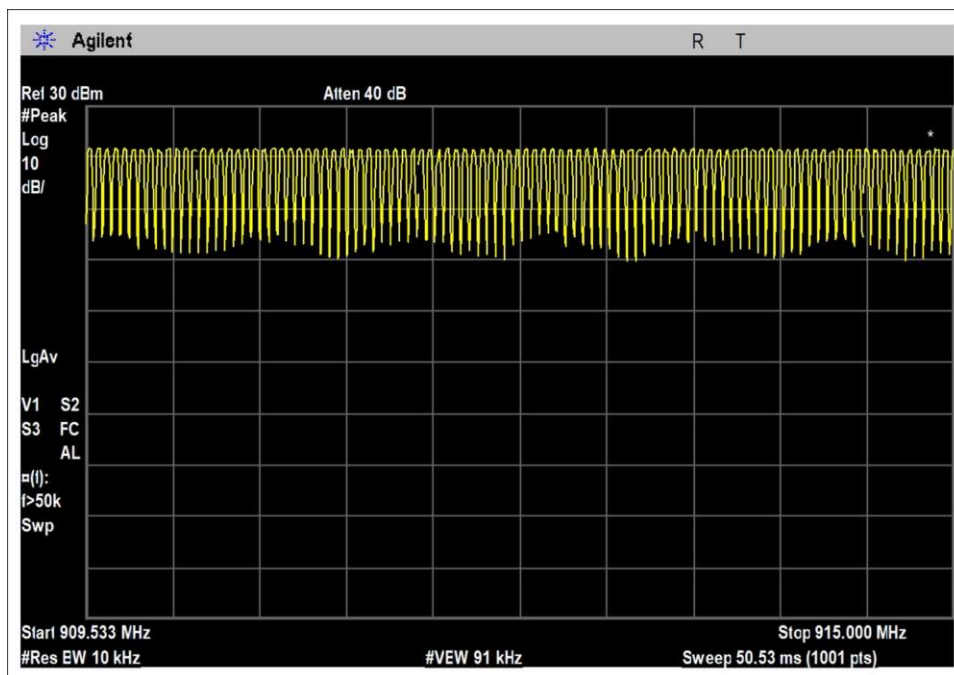
Plot(s)



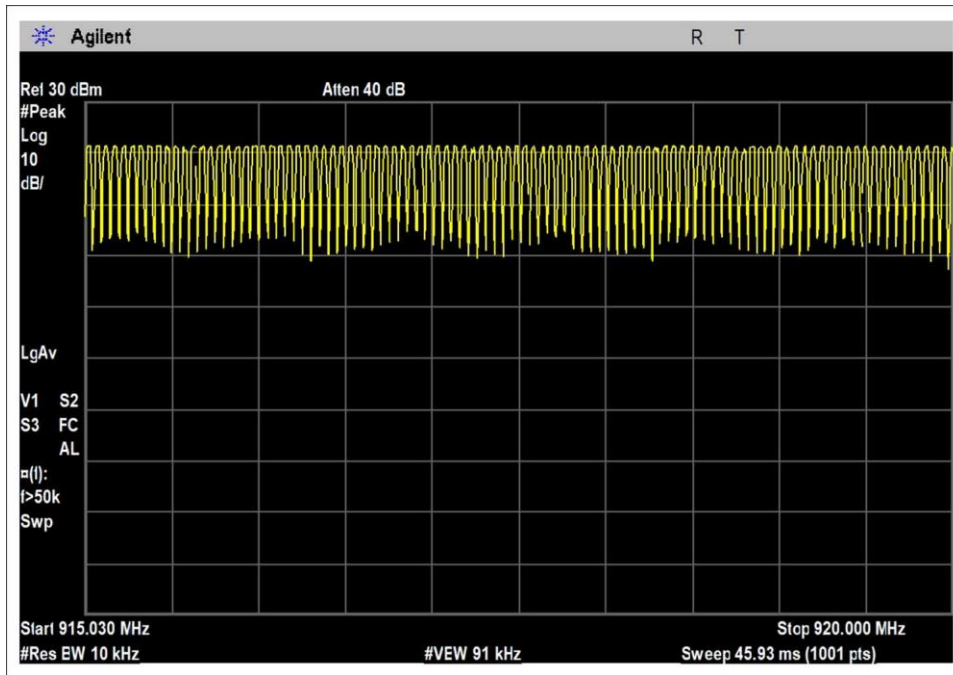
57 Channel



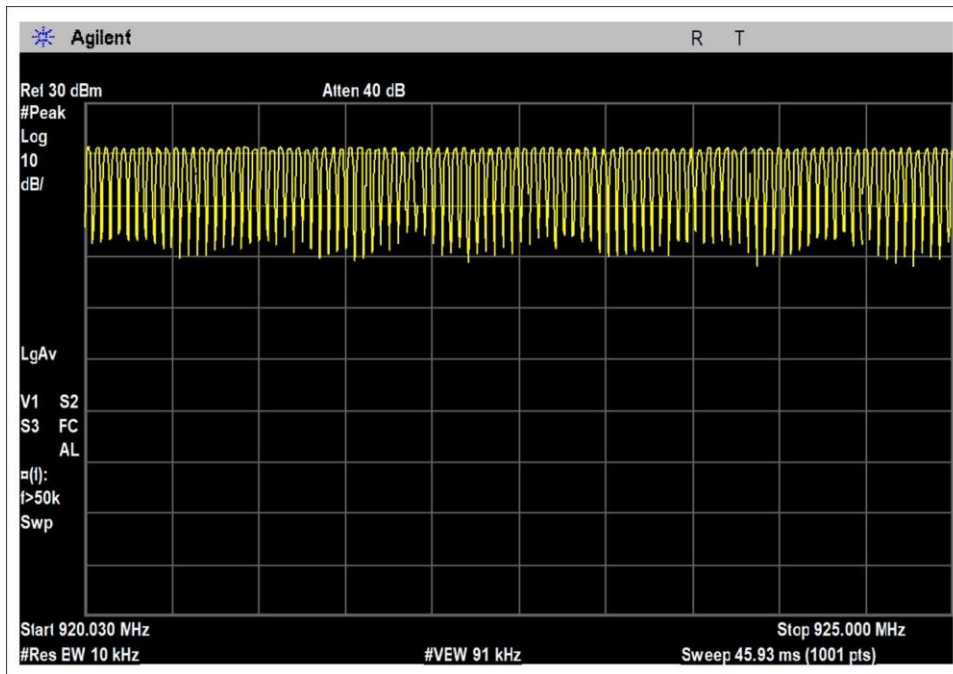
100 Channel



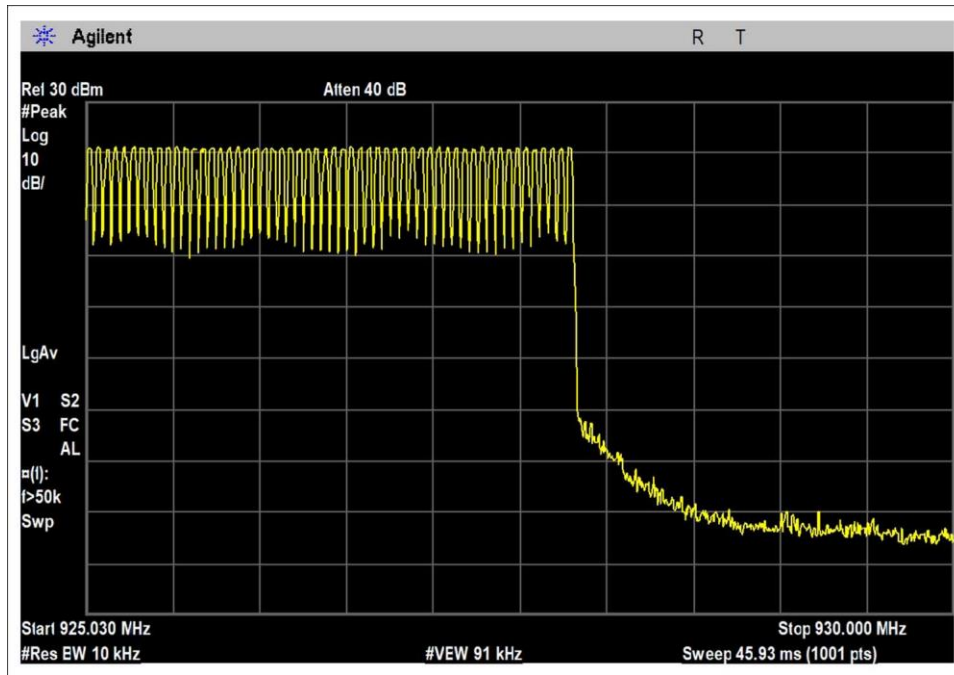
100 Channel



100 Channel

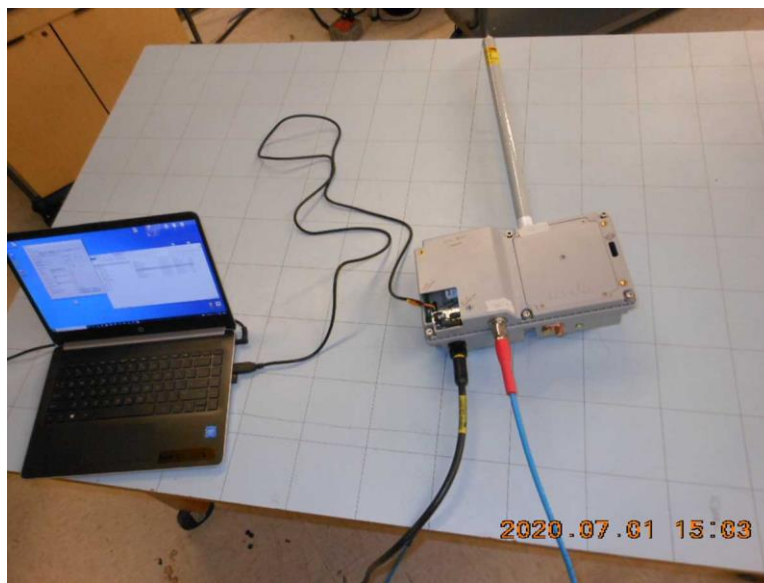


100 Channel



56 Channel

Test Setup Photo(s)



15.247(a)(1)(i) Time of Occupancy

CKC was not contracted to perform the testing due to the required equipment and firmware to exercise the EUT's multiple pseudo-random hopping sequences was not available and that the complexity of the different modulations and modes depend on the device to be in a fully operating network environment. Therefore, the manufacturer declares the following:

For this permissive change, the modulation/mode has a worst-case Time of Occupancy demonstrating 400mS compliance of 395.4mS in 20 seconds, with < 250kHz OBW. Each session of multiple short transmissions takes place on one of 513 different channels in a pseudorandom sequence. The algorithm that determines the pseudo-random hop sequence ensures all channels are used equally on the average.

Itron Inc. (the manufacturer) employs hopping patterns based on a pseudo-random sequence generated by an algorithm. The algorithm can have multiple components generated, that each has its own pseudo-random sequence.

The firmware ensures the channels are used in the prescribed pseudo random order, therefore, it maintains equal channel usage.

The system has single channel receiver bandwidths that match the transmitter's modulation bandwidth that is enabled.

With the transmitter and receiver in synchronization within the network, transmitters switch frequencies in synchronization with the receiver.

When the transmitter needs to send a continuous or long data stream, total time of the packet transmissions is monitored to comply with dwell time requirement of 400ms in the appropriate 20s window if this modulation/mode is enabled.

This device does not employ any hopping avoidance techniques.

15.247(b)(1) Output Power

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03514	Multimeter	Fluke	87	12/7/2018	12/7/2020
01505B	AC Power Supply	PPS	345AMXT-UPC32	5/28/2019	5/28/2021

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBm)	V _{Nominal} (dBm)	V _{Maximum} (dBm)	Max Deviation from V _{Nominal} (dB)
902.2	FSK 25kbps	29.4	29.3	29.4	0.1
915.0	FSK 25kbps	29.4	29.3	29.3	0.1
927.8	FSK 25kbps	29.0	28.9	29.0	0.1

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

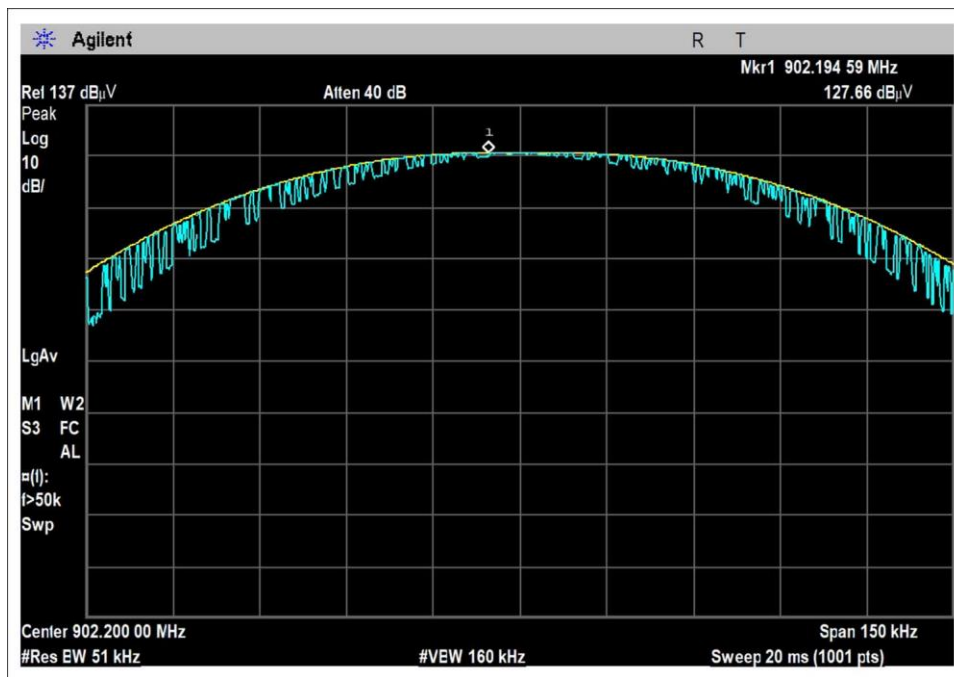
Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

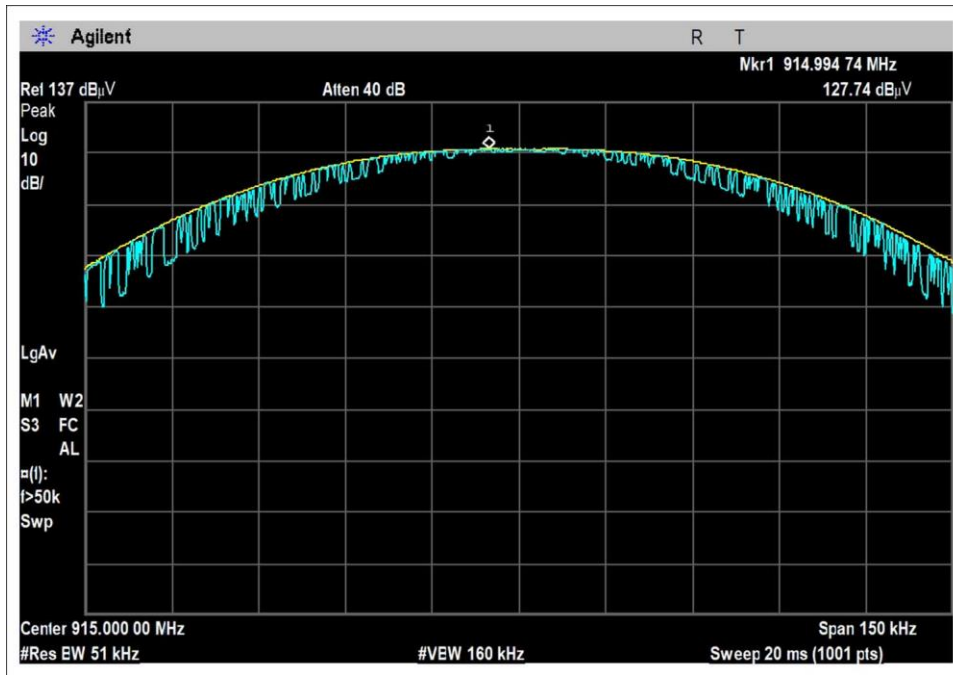
Parameter	Value
V _{Nominal} :	120VAC
V _{Minimum} :	85VAC
V _{Maximum} :	265VAC

Test Data Summary - RF Conducted Measurement					
$Limit = \begin{cases} 30dBm \text{ Conducted} / 36dBm \text{ EIRP} & \geq 50 \text{ Channels} \\ 24dBm \text{ Conducted} / 30dBm \text{ EIRP} & < 50 \text{ Channels (min 25)} \end{cases}$					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
902.2	FSK 25kbps	Omnidirectional / 2.6dBi	29.3	≤ 30	Pass
915.0	FSK 25kbps	Omnidirectional / 2.6dBi	29.3	≤ 30	Pass
927.8	FSK 25kbps	Omnidirectional / 2.6dBi	28.9	≤ 30	Pass

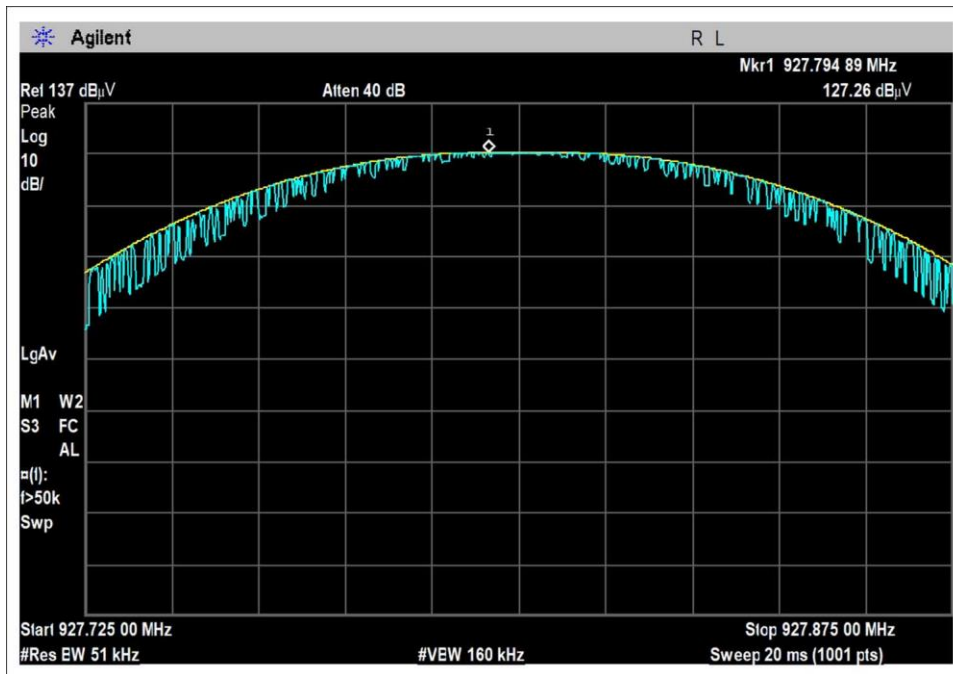
Plots



Low Channel



Middle Channel



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 #: **104265** Date: 7/1/2020
 Test Type: **Conducted Emissions** Time: 15:46:55
 Tested By: Michael Atkinson Sequence#: 2
 Software: EMITest 5.03.19 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 22-24 °C
 Humidity: 40-49 %
 Pressure: 101.8kPa

 Method: ANSI C63.10 (2013)

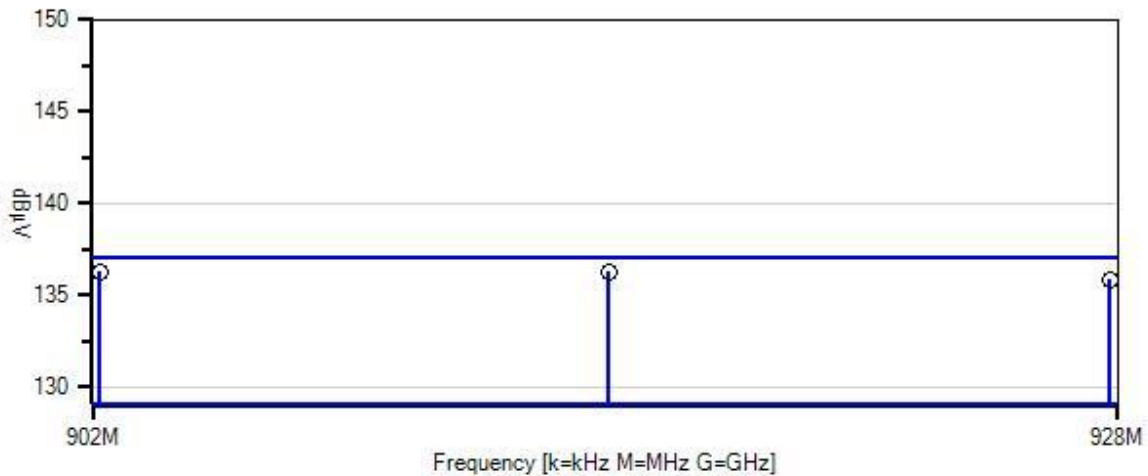
Test Setup:
 The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting at its rated output power.

The internal insertion loss of the EUT's adapters to the internal module being tested are characterized under CKC asset C00157, this accounts for both the RF Switch Board (UFL to SMA) as well as the SMA to N type cable internal to the EUT. This is to calculate the output power at the module itself for this host specific module testing.

*ANC00157 insertion loss factor not characterized until 7/10/2020. After this equipment was characterized, these factors were applied to the final measurement.

A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT.

Itron, Inc. WO#: 104265 Sequence#: 2 Date: 7/1/2020
 15.247(b) Power Output (902-928 MHz FHSS >50 Channels) Test Lead: 115VAC 60Hz RF Port



- Sweep Data
 - Readings
 - Peak Readings
 - × QP Readings
 - * Average Readings
 - ▼ Ambient
- Software Version: 5.03.19
 1 - 15.247(b) Power Output (902-928 MHz FHSS >50 Channels)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T2	ANP07227	Attenuator	PE7004-6	10/2/2019	10/2/2021
T3	ANP05959	Cable	Heliac	1/20/2020	1/20/2022
T4	ANC00157*	Site Equipment		7/10/2020	7/10/2022

* See Test Conditions Notes for details.

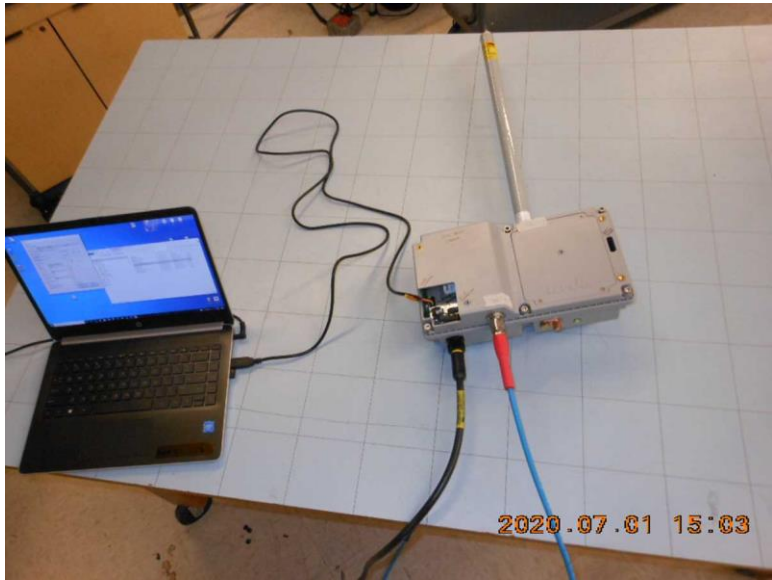
Measurement Data:

Reading listed by margin.

Test Lead: RF Port

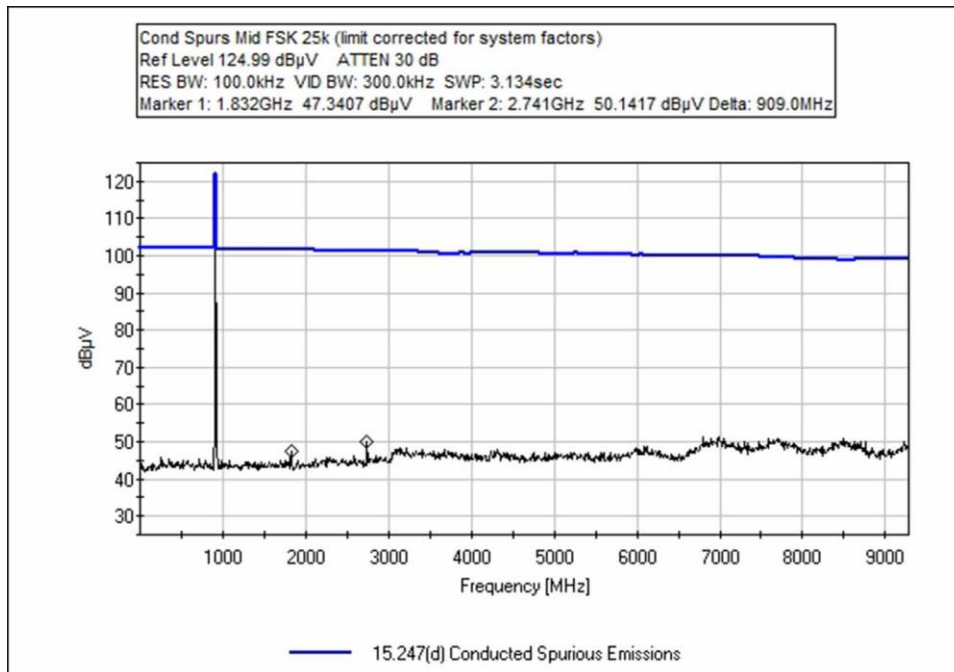
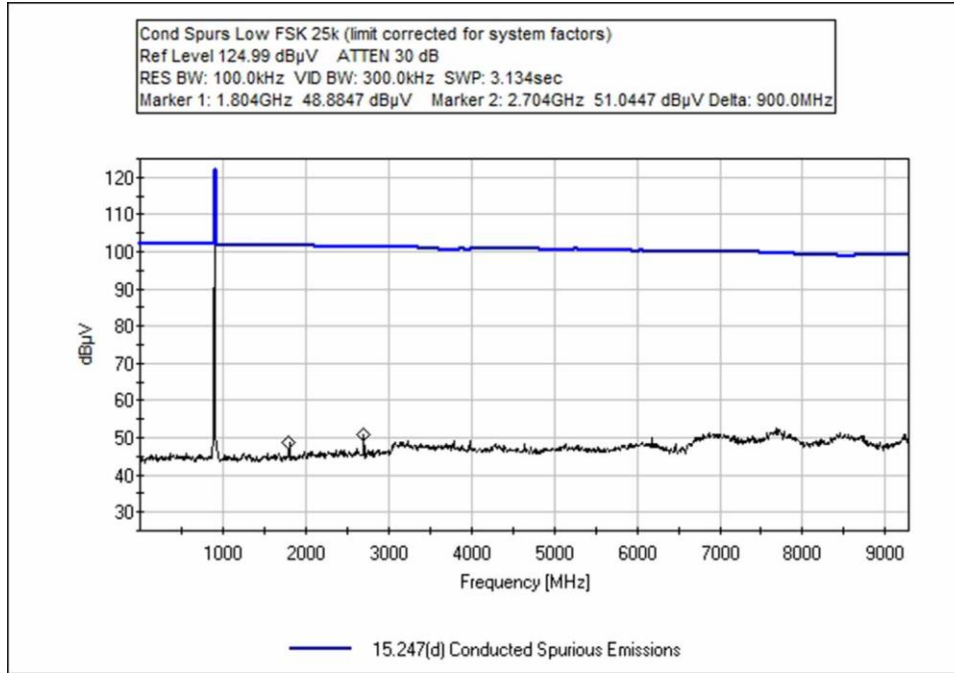
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	914.995M	127.7	+0.0	+5.9	+0.4	+2.3	+0.0	136.3	137.0	-0.7	RF Po
2	902.195M	127.7	+0.0	+5.9	+0.4	+2.3	+0.0	136.3	137.0	-0.7	RF Po
3	927.795M	127.3	+0.0	+5.9	+0.4	+2.3	+0.0	135.9	137.0	-1.1	RF Po

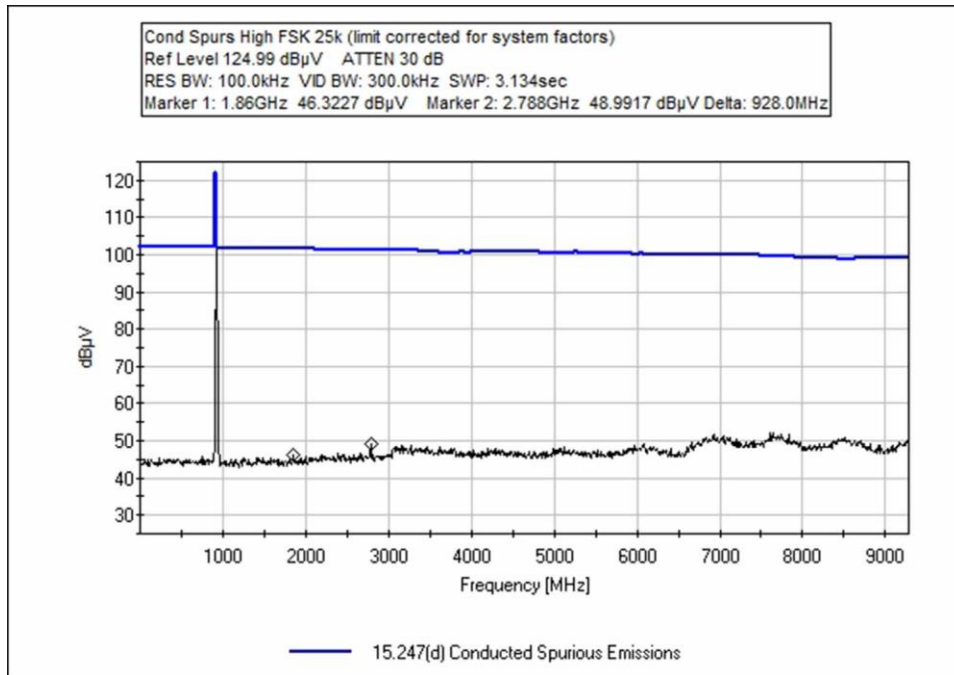
Test Setup Photo(s)



15.247(d) RF Conducted Emissions & 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 #: **104265** Date: 7/15/2020
 Test Type: **Conducted Emissions** Time: 11:25:45
 Tested By: Michael Atkinson Sequence#: 3
 Software: EMITest 5.03.19 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24 °C
 Humidity: 40 %
 Pressure: 101.8 kPa

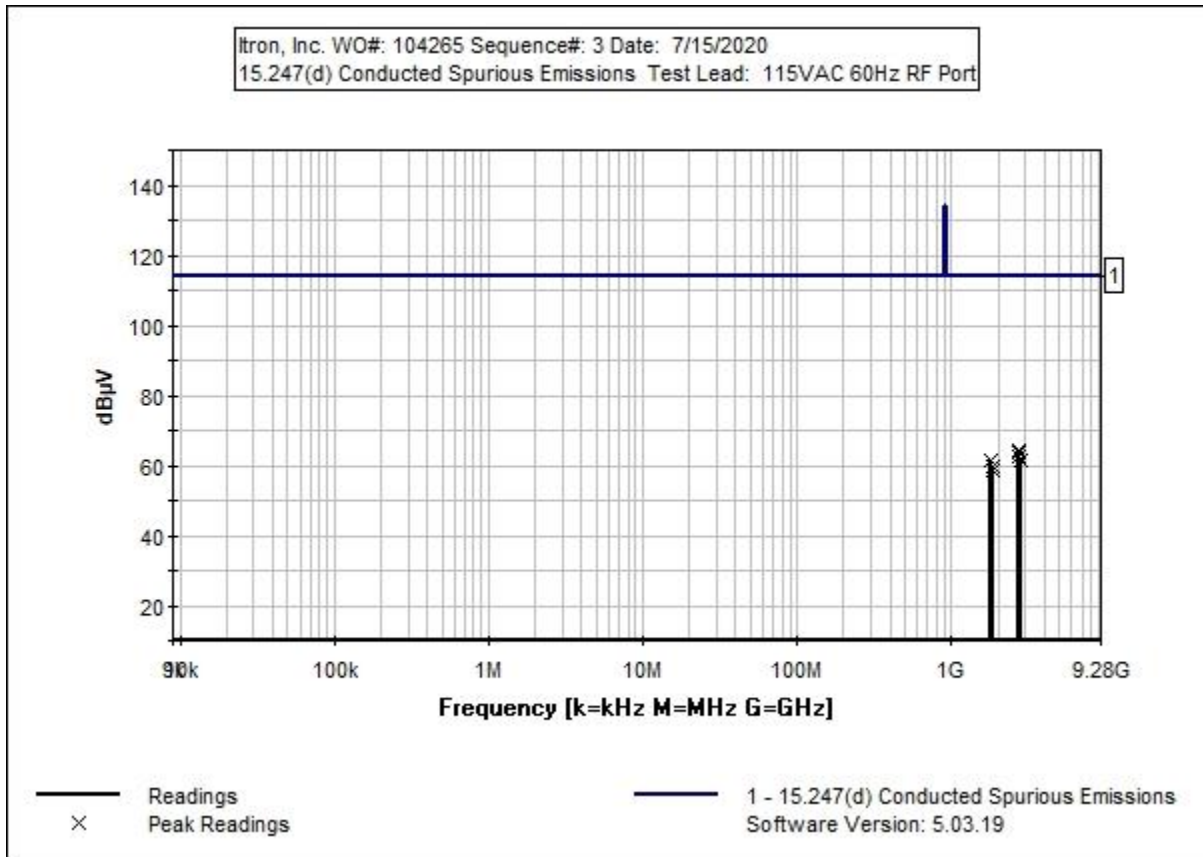
 Method: ANSI C63.10 (2013)

 Frequency: 9kHz-9.28GHz

 Test Setup:
 The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting continuously with modulation at its rated output power. Low, Mid, and High channels as well as hopping mode investigated, worst case reported.

 For this specific host modular testing the Conducted Emissions are measured directly at the N port of the EUT, there is no additional correction for the loss to the internal module for Conducted Emissions or Band Edge. The limit based on the worst case 100kHz fundamental will also be measured directly at the N port of the EUT without any additional correction for the loss to the internal module.

 A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T2	ANP07227	Attenuator	PE7004-6	10/2/2019	10/2/2021
T3	ANP05959	Cable	Heliac	1/20/2020	1/20/2022
T4	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021

Measurement Data:

Reading listed by margin.

Test Lead: RF Port

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	2739.000M	51.4	+0.0	+5.9	+0.9	+5.9	+0.0	64.1	114.0	-49.9	RF Po
										worst case hopping	
2	2704.000M	51.0	+0.0	+5.9	+0.9	+5.9	+0.0	63.7	114.0	-50.3	RF Po
3	2741.000M	50.1	+0.0	+5.9	+0.9	+5.9	+0.0	62.8	114.0	-51.2	RF Po
4	2788.000M	49.0	+0.0	+5.9	+0.9	+5.9	+0.0	61.7	114.0	-52.3	RF Po
5	1812.000M	49.0	+0.0	+5.9	+0.7	+5.9	+0.0	61.5	114.0	-52.5	RF Po
										worst case hopping	
6	1804.000M	48.9	+0.0	+5.9	+0.7	+5.9	+0.0	61.4	114.0	-52.6	RF Po
7	1832.000M	47.3	+0.0	+5.9	+0.7	+5.9	+0.0	59.8	114.0	-54.2	RF Po
8	1860.000M	46.3	+0.0	+5.9	+0.7	+5.9	+0.0	58.8	114.0	-55.2	RF Po

Band Edge

Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.
Operating Mode: Single Channel (Low and High)

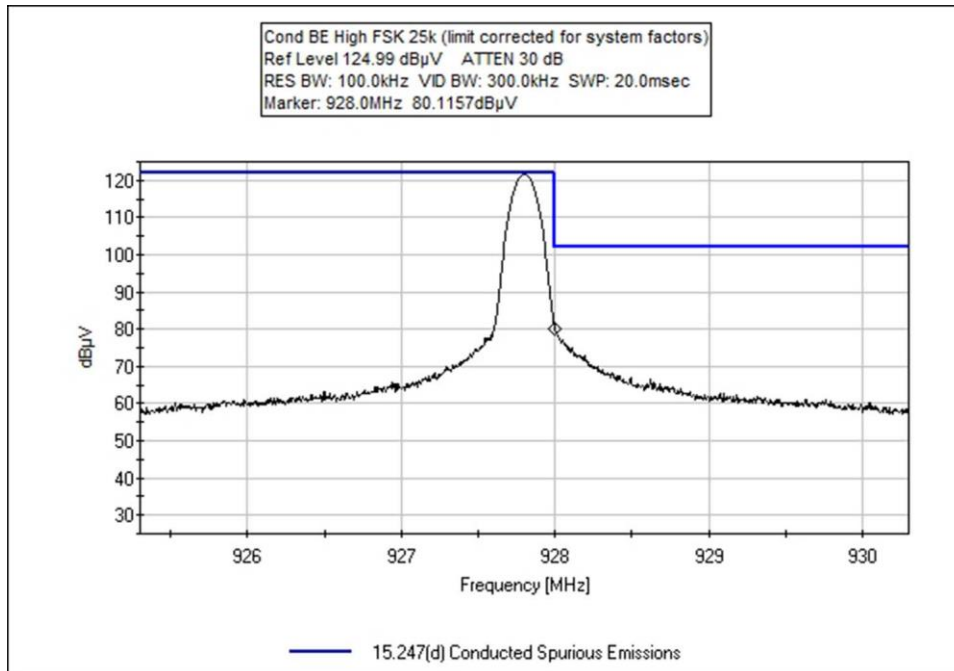
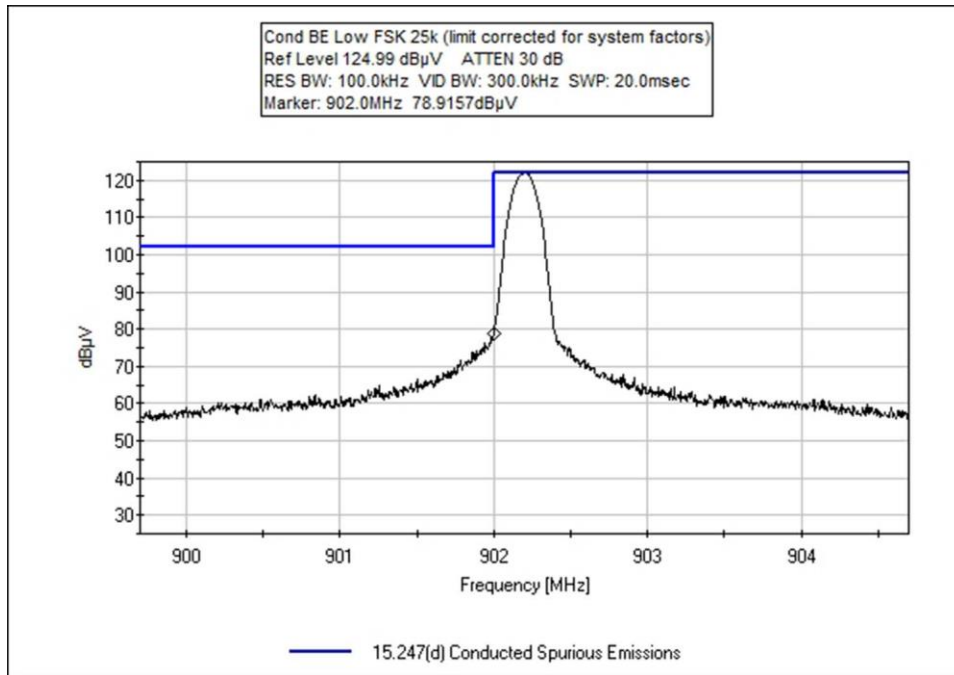
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	FSK 25kbps	-16.0	< 7.0	Pass
928	FSK 25kbps	-14.8	< 7.0	Pass

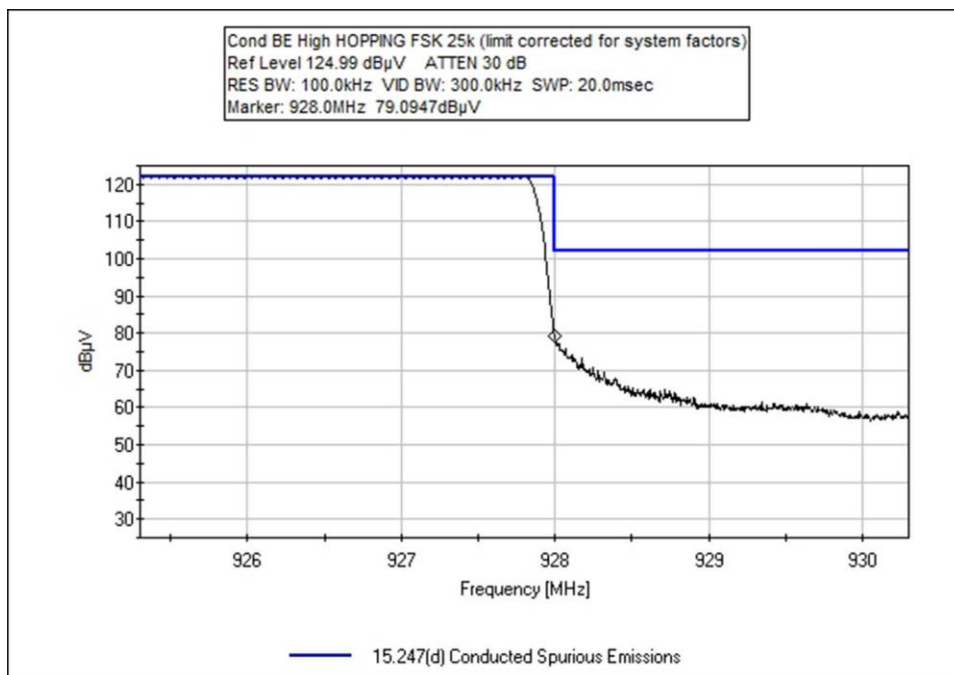
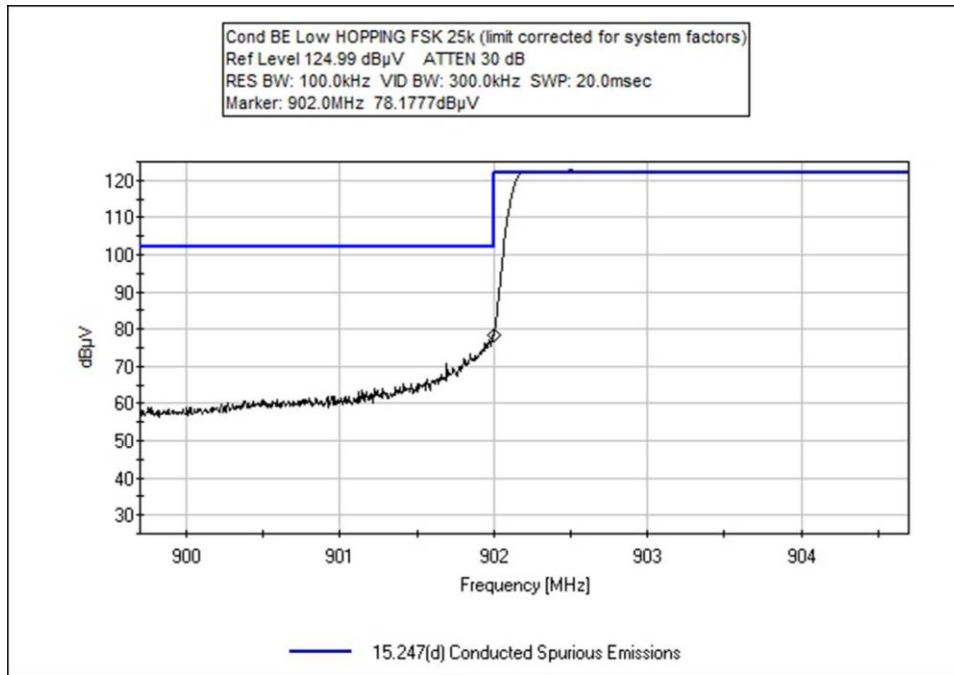
Band Edge Summary

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

Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	Hopping - FSK 25kbps	-16.7	< 7.0	Pass
928	Hopping - FSK 25kbps	-15.8	< 7.0	Pass

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 #: **104265** Date: 7/15/2020
 Test Type: **Conducted Emissions** Time: 11:11:39
 Tested By: Michael Atkinson Sequence#: 4
 Software: EMITest 5.03.19 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 24 °C
 Humidity: 40 %
 Pressure: 101.8 kPa

 Method: ANSI C63.10 (2013)

 Frequency: Band Edge

 Test Setup:
 The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting continuously with modulation at its rated output power. Low and High channels investigated for Band Edge, as well as hopping mode.

 For this specific host modular testing the Conducted Emissions are measured directly at the N port of the EUT, there is no additional correction for the loss to the internal module for Conducted Emissions or Band Edge. The limit based on the worst case 100kHz fundamental will also be measured directly at the N port of the EUT without any additional correction for the loss to the internal module.

 A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT.

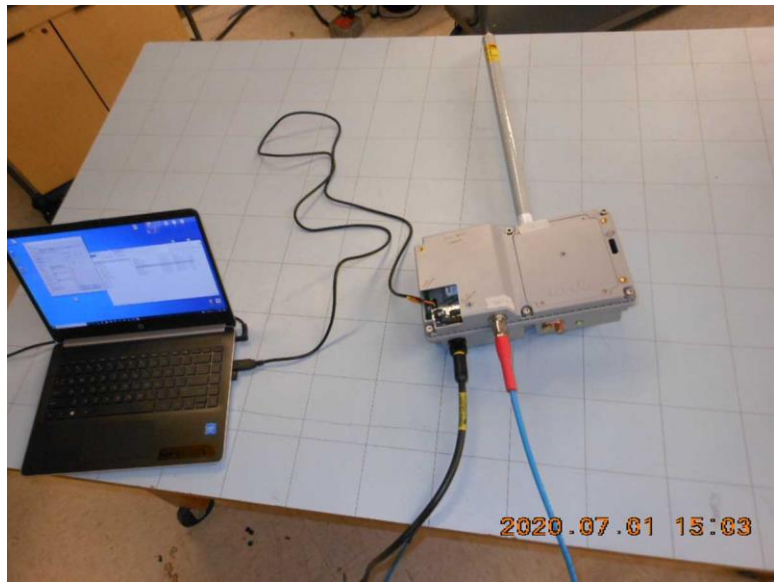
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T2	ANP07227	Attenuator	PE7004-6	10/2/2019	10/2/2021
T3	ANP05959	Cable	Helix	1/20/2020	1/20/2022
T4	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021

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

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	928.000M	80.1	+0.0	+5.9	+0.4	+5.8	+0.0	92.2	114.0	-21.8	RF Po
2	928.000M	79.1	+0.0	+5.9	+0.4	+5.8	+0.0	91.2	114.0 Hopping	-22.8	RF Po
3	902.000M	78.9	+0.0	+5.9	+0.4	+5.8	+0.0	91.0	114.0	-23.0	RF Po
4	902.000M	78.2	+0.0	+5.9	+0.4	+5.8	+0.0	90.3	114.0 Hopping	-23.7	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 #: **104265** Date: 7/16/2020
 Test Type: **Radiated Scan** Time: 13:05:39
 Tested By: Michael Atkinson Sequence#: 6
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

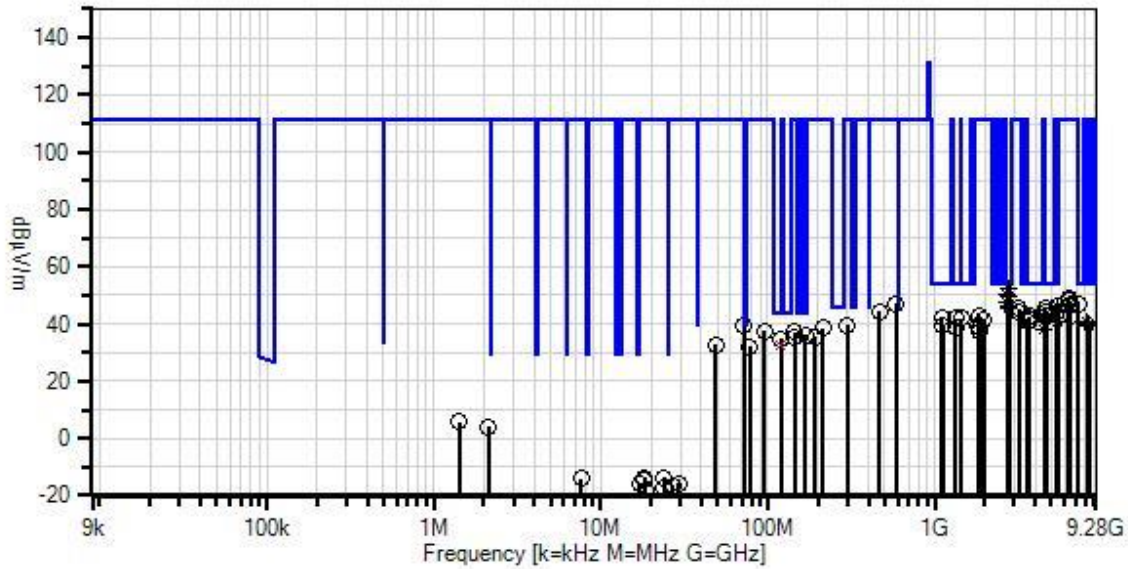
Temperature: 23 °C
 Humidity: 41 %
 Pressure: 101.6 kPa

 Method: ANSI C63.10 (2013)

 Frequency: 9kHz-9.28GHz

 Test Setup:
 The equipment under test (EUT) is placed on the tabletop. A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT. The EUT host output port is connected to the externally attached antenna. The EUT is transmitting continuously with modulation at its rated output power. Low, Mid, High channels as well as hopping mode investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 x orthogonal axes investigated below 30MHz, worst case reported.

ltron, Inc. WO#: 104265 Sequence#: 6 Date: 7/16/2020
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Ground Para



— Readings
 × QP Readings
 ▼ Ambient
 — 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
 ○ Peak Readings
 * Average Readings
 Software Version: 5.03.19

Test Equipment:

ID	Asset #	Description	Model	Cal 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	7/1/2020	7/1/2022
T4	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T6	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T7	AN03170	High Pass Filter	HM1155-11SS	10/23/2019	10/23/2021
T8	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T9	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T10	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T11	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T12	AN00052	Loop Antenna	6502	5/4/2020	5/4/2022

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

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
	MHz	dB μ V	T9	T10	T11	T12	Table	dB μ V/m	dB μ V/m	dB	Ant
1	2783.400M Ave	53.7	+0.0 +28.5 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	52.3	54.0 High	-1.7	Vert
^	2783.410M	56.5	+0.0 +28.5 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	55.1	54.0 High	+1.1	Vert
3	2706.620M Ave	51.7	+0.0 +28.3 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	50.1	54.0 Low	-3.9	Vert
^	2706.650M	53.2	+0.0 +28.3 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	51.6	54.0 Low	-2.4	Vert
5	2745.025M Ave	51.4	+0.0 +28.4 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	49.9	54.0 Mid	-4.1	Vert
^	2745.060M	54.1	+0.0 +28.4 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	52.6	54.0 Mid	-1.4	Vert
7	2706.620M Ave	49.3	+0.0 +28.3 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	47.7	54.0 Low	-6.3	Horiz
^	2706.590M	49.9	+0.0 +28.3 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	48.3	54.0 Low	-5.7	Horiz
9	5413.250M Ave	40.7	+0.0 +33.4 +0.0	+1.0 -33.7 +0.0	+4.3 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	46.5	54.0 Low	-7.5	Horiz
^	5413.240M	43.2	+0.0 +33.4 +0.0	+1.0 -33.7 +0.0	+4.3 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	49.0	54.0 Low	-5.0	Horiz
11	2783.430M Ave	47.5	+0.0 +28.5 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	46.1	54.0 High	-7.9	Horiz
^	2783.400M	49.5	+0.0 +28.5 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	48.1	54.0 High	-5.9	Horiz
13	4575.000M	41.3	+0.0 +31.9 +0.0	+0.9 -33.7 +0.0	+3.8 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	45.5	54.0 Mid	-8.5	Vert
14	120.200M	19.9	+0.0 +0.0 +0.6	+0.1 +0.0 +5.8	+0.0 +0.0 +8.0	+0.0 +0.5 +0.0	+0.0	34.9	43.5	-8.6	Vert

15	2745.080M Ave	46.8	+0.0 +28.4 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	45.3	54.0 Mid	-8.7	Horiz
^	2745.030M	48.6	+0.0 +28.4 +0.0	+0.7 -34.1 +0.0	+2.9 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	47.1	54.0 Mid	-6.9	Horiz
17	4639.090M	40.1	+0.0 +32.1 +0.0	+0.9 -33.6 +0.0	+3.8 +0.6 +0.0	+0.6 +0.0 +0.0	+0.0	44.5	54.0 High	-9.5	Horiz
18	120.029M QP	17.9	+0.0 +0.0 +0.6	+0.1 +0.0 +5.8	+0.0 +0.0 +8.0	+0.0 +0.5 +0.0	+0.0	32.9	43.5	-10.6	Vert
19	4639.008M	38.3	+0.0 +32.1 +0.0	+0.9 -33.6 +0.0	+3.8 +0.6 +0.0	+0.6 +0.0 +0.0	+0.0	42.7	54.0 High	-11.3	Vert
20	3711.032M	40.3	+0.0 +30.6 +0.0	+0.9 -33.7 +0.0	+3.5 +0.5 +0.0	+0.5 +0.0 +0.0	+0.0	42.6	54.0 High	-11.4	Vert
21	1104.000M	48.3	+0.0 +24.7 +0.0	+0.4 -36.7 +0.0	+1.8 +3.6 +0.0	+0.1 +0.0 +0.0	+0.0	42.2	54.0	-11.8	Horiz
22	3608.830M	40.2	+0.0 +30.3 +0.0	+0.8 -33.8 +0.0	+3.4 +0.5 +0.0	+0.6 +0.0 +0.0	+0.0	42.0	54.0 Low	-12.0	Horiz
23	1327.000M	49.3	+0.0 +25.2 +0.0	+0.4 -35.8 +0.0	+2.0 +0.8 +0.0	+0.1 +0.0 +0.0	+0.0	42.0	54.0	-12.0	Horiz
24	1442.000M	48.9	+0.0 +25.1 +0.0	+0.5 -35.5 +0.0	+2.1 +0.7 +0.0	+0.2 +0.0 +0.0	+0.0	42.0	54.0	-12.0	Vert
25	3711.150M	39.3	+0.0 +30.6 +0.0	+0.9 -33.7 +0.0	+3.5 +0.5 +0.0	+0.5 +0.0 +0.0	+0.0	41.6	54.0 High	-12.4	Horiz
26	4575.000M Ave	37.3	+0.0 +31.9 +0.0	+0.9 -33.7 +0.0	+3.8 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	41.5	54.0 Mid	-12.5	Horiz
^	4574.975M	43.1	+0.0 +31.9 +0.0	+0.9 -33.7 +0.0	+3.8 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	47.3	54.0 Mid	-6.7	Horiz
28	3660.000M	38.8	+0.0 +30.5 +0.0	+0.9 -33.7 +0.0	+3.4 +0.5 +0.0	+0.5 +0.0 +0.0	+0.0	40.9	54.0 Mid	-13.1	Vert
29	8119.800M Ave	30.9	+0.0 +37.0 +0.0	+1.3 -35.0 +0.0	+5.3 +0.8 +0.0	+0.6 +0.0 +0.0	+0.0	40.9	54.0 Low	-13.1	Horiz
^	8119.800M	40.0	+0.0 +37.0 +0.0	+1.3 -35.0 +0.0	+5.3 +0.8 +0.0	+0.6 +0.0 +0.0	+0.0	50.0	54.0 Low	-4.0	Horiz
31	3660.000M	38.5	+0.0 +30.5 +0.0	+0.9 -33.7 +0.0	+3.4 +0.5 +0.0	+0.5 +0.0 +0.0	+0.0	40.6	54.0 Mid	-13.4	Horiz

32	5413.235M Ave	34.7	+0.0 +33.4 +0.0	+1.0 -33.7 +0.0	+4.3 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	40.5	54.0 Low	-13.5	Vert
^	5413.235M	41.7	+0.0 +33.4 +0.0	+1.0 -33.7 +0.0	+4.3 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	47.5	54.0 Low	-6.5	Vert
34	8235.010M Ave	29.8	+0.0 +37.0 +0.0	+1.7 -35.0 +0.0	+5.3 +0.9 +0.0	+0.5 +0.0 +0.0	+0.0	40.2	54.0 Mid	-13.8	Horiz
^	8234.965M	37.4	+0.0 +37.0 +0.0	+1.7 -35.0 +0.0	+5.3 +0.9 +0.0	+0.5 +0.0 +0.0	+0.0	47.8	54.0 Mid	-6.2	Horiz
36	8350.260M Ave	29.2	+0.0 +37.0 +0.0	+1.7 -34.9 +0.0	+5.3 +0.8 +0.0	+0.5 +0.0 +0.0	+0.0	39.6	54.0 High	-14.4	Horiz
^	8350.290M	37.1	+0.0 +37.0 +0.0	+1.7 -34.9 +0.0	+5.3 +0.8 +0.0	+0.5 +0.0 +0.0	+0.0	47.5	54.0 High	-6.5	Horiz
38	1116.000M	46.9	+0.0 +24.7 +0.0	+0.4 -36.6 +0.0	+1.8 +2.3 +0.0	+0.1 +0.0 +0.0	+0.0	39.6	54.0	-14.4	Vert
39	1331.000M	46.1	+0.0 +25.2 +0.0	+0.4 -35.8 +0.0	+2.0 +0.8 +0.0	+0.1 +0.0 +0.0	+0.0	38.8	54.0	-15.2	Vert
40	4511.010M Ave	34.2	+0.0 +31.8 +0.0	+0.9 -33.7 +0.0	+3.7 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	38.2	54.0 Low	-15.8	Horiz
^	4511.090M	42.3	+0.0 +31.8 +0.0	+0.9 -33.7 +0.0	+3.7 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	46.3	54.0 Low	-7.7	Horiz
42	4511.085M Ave	34.0	+0.0 +31.8 +0.0	+0.9 -33.7 +0.0	+3.7 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	38.0	54.0 Low	-16.0	Vert
^	4511.040M	41.8	+0.0 +31.8 +0.0	+0.9 -33.7 +0.0	+3.7 +0.6 +0.0	+0.7 +0.0 +0.0	+0.0	45.8	54.0 Low	-8.2	Vert
44	6315.435M	41.1	+0.0 +34.6 +0.0	+1.0 -34.1 +0.0	+5.1 +0.5 +0.0	+0.5 +0.0 +0.0	+0.0	48.7	111.5 Low	-62.8	Vert
45	6405.060M	40.1	+0.0 +34.6 +0.0	+1.1 -34.2 +0.0	+5.3 +0.5 +0.0	+0.6 +0.0 +0.0	+0.0	48.0	111.5 Mid	-63.5	Vert
46	583.900M	17.5	+0.0 +0.0 +1.6	+0.3 +0.0 +5.8	+0.0 +0.0 +20.5	+0.0 +1.2 +0.0	+0.0	46.9	111.5	-64.6	Vert
47	6494.616M	38.7	+0.0 +34.5 +0.0	+1.2 -34.2 +0.0	+5.4 +0.5 +0.0	+0.6 +0.0 +0.0	+0.0	46.7	111.5 High	-64.8	Vert
48	7217.680M	37.5	+0.0 +36.5 +0.0	+1.1 -34.5 +0.0	+5.1 +0.4 +0.0	+0.5 +0.0 +0.0	+0.0	46.6	111.5 Low	-64.9	Horiz

49	6404.965M	38.5	+0.0 +34.6 +0.0	+1.1 -34.2 +0.0	+5.3 +0.5 +0.0	+0.6 +0.0 +0.0	+0.0	46.4	111.5 Mid	-65.1	Horiz
50	5490.140M	40.1	+0.0 +33.5 +0.0	+1.0 -33.7 +0.0	+4.4 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	46.1	111.5 Mid	-65.4	Vert
51	5490.000M	39.9	+0.0 +33.5 +0.0	+1.0 -33.7 +0.0	+4.4 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	45.9	111.5 Mid	-65.6	Horiz
52	3187.000M	44.9	+0.0 +29.5 +0.0	+0.8 -34.0 +0.0	+3.2 +0.3 +0.0	+0.5 +0.0 +0.0	+0.0	45.2	111.5	-66.3	Vert
53	464.600M	17.6	+0.0 +0.0 +1.4	+0.3 +0.0 +5.8	+0.0 +0.0 +18.2	+0.0 +1.1 +0.0	+0.0	44.4	111.5	-67.1	Horiz
54	3201.200M	44.1	+0.0 +29.5 +0.0	+0.8 -34.0 +0.0	+3.2 +0.3 +0.0	+0.5 +0.0 +0.0	+0.0	44.4	111.5	-67.1	Horiz
55	3186.640M	43.8	+0.0 +29.5 +0.0	+0.8 -34.0 +0.0	+3.2 +0.3 +0.0	+0.5 +0.0 +0.0	+0.0	44.1	111.5	-67.4	Vert
56	6494.690M	35.1	+0.0 +34.5 +0.0	+1.2 -34.2 +0.0	+5.4 +0.5 +0.0	+0.6 +0.0 +0.0	+0.0	43.1	111.5 High	-68.4	Horiz
57	5566.800M	36.7	+0.0 +33.7 +0.0	+1.0 -33.7 +0.0	+4.4 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	42.9	111.5 High	-68.6	Vert
58	1830.060M	47.9	+0.0 +26.3 +0.0	+0.5 -34.8 +0.0	+2.4 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	42.9	111.5 Mid	-68.6	Vert
59	5566.890M	36.6	+0.0 +33.7 +0.0	+1.0 -33.7 +0.0	+4.4 +0.4 +0.0	+0.4 +0.0 +0.0	+0.0	42.8	111.5 High	-68.7	Horiz
60	1855.675M	47.3	+0.0 +26.6 +0.0	+0.5 -34.7 +0.0	+2.4 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	42.7	111.5 High	-68.8	Vert
61	1959.000M	44.7	+0.0 +27.5 +0.0	+0.6 -34.6 +0.0	+2.5 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	41.3	111.5 Low	-70.2	Horiz
62	299.700M	18.5	+0.0 +0.0 +1.1	+0.2 +0.0 +5.8	+0.0 +0.0 +13.1	+0.0 +0.9 +0.0	+0.0	39.6	111.5	-71.9	Horiz
63	1804.490M	44.7	+0.0 +26.1 +0.0	+0.5 -34.8 +0.0	+2.3 +0.5 +0.0	+0.2 +0.0 +0.0	+0.0	39.5	111.5 Low	-72.0	Horiz
64	1804.435M	44.5	+0.0 +26.1 +0.0	+0.5 -34.8 +0.0	+2.3 +0.5 +0.0	+0.2 +0.0 +0.0	+0.0	39.3	111.5 Low	-72.2	Vert
65	71.700M	25.0	+0.0 +0.0 +0.5	+0.1 +0.0 +5.8	+0.0 +0.0 +7.3	+0.0 +0.4 +0.0	+0.0	39.1	111.5	-72.4	Vert

66	1830.050M	43.7	+0.0 +26.3 +0.0	+0.5 -34.8 +0.0	+2.4 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	38.7	111.5 Mid	-72.8	Horiz
67	214.300M	20.5	+0.0 +0.0 +0.9	+0.2 +0.0 +5.8	+0.0 +0.0 +10.5	+0.0 +0.7 +0.0	+0.0	38.6	111.5	-72.9	Horiz
68	96.000M	22.8	+0.0 +0.0 +0.6	+0.1 +0.0 +5.8	+0.0 +0.0 +7.7	+0.0 +0.5 +0.0	+0.0	37.5	111.5	-74.0	Vert
69	1855.600M	41.8	+0.0 +26.6 +0.0	+0.5 -34.7 +0.0	+2.4 +0.4 +0.0	+0.2 +0.0 +0.0	+0.0	37.2	111.5 High	-74.3	Horiz
70	144.500M	21.3	+0.0 +0.0 +0.7	+0.1 +0.0 +5.8	+0.0 +0.0 +8.7	+0.0 +0.5 +0.0	+0.0	37.1	111.5	-74.4	Vert
71	167.700M	19.0	+0.0 +0.0 +0.8	+0.2 +0.0 +5.8	+0.0 +0.0 +9.9	+0.0 +0.6 +0.0	+0.0	36.3	111.5	-75.2	Vert
72	167.700M	18.9	+0.0 +0.0 +0.8	+0.2 +0.0 +5.8	+0.0 +0.0 +9.9	+0.0 +0.6 +0.0	+0.0	36.2	111.5	-75.3	Horiz
73	192.000M	18.1	+0.0 +0.0 +0.8	+0.2 +0.0 +5.8	+0.0 +0.0 +9.9	+0.0 +0.7 +0.0	+0.0	35.5	111.5	-76.0	Vert
74	144.500M	19.2	+0.0 +0.0 +0.7	+0.1 +0.0 +5.8	+0.0 +0.0 +8.7	+0.0 +0.5 +0.0	+0.0	35.0	111.5	-76.5	Horiz
75	48.400M	18.1	+0.0 +0.0 +0.4	+0.1 +0.0 +5.8	+0.0 +0.0 +8.0	+0.0 +0.4 +0.0	+0.0	32.8	111.5	-78.7	Vert
76	77.500M	18.2	+0.0 +0.0 +0.5	+0.1 +0.0 +5.8	+0.0 +0.0 +6.9	+0.0 +0.4 +0.0	+0.0	31.9	111.5	-79.6	Horiz
77	1.419M	36.1	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +9.6	+0.0 +0.0 +0.0	-40.0	5.7	111.5	-105.8	Para
78	2.138M	34.5	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.1 +0.0 +9.5	+0.0 +0.0 +0.0	-40.0	4.1	111.5	-107.4	Para
79	24.002M	19.3	+0.0 +0.0 +0.0	+0.1 +0.0 +0.0	+0.3 +0.0 +6.6	+0.0 +0.0 +0.0	-40.0	-13.7	111.5	-125.2	Perp
80	7.597M	16.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.1 +0.0 +9.2	+0.0 +0.0 +0.0	-40.0	-14.0	111.5	-125.5	Para
81	18.334M	17.7	+0.0 +0.0 +0.0	+0.1 +0.0 +0.0	+0.2 +0.0 +7.9	+0.0 +0.0 +0.0	-40.0	-14.1	111.5	-125.6	Perp
82	18.274M	17.6	+0.0 +0.0 +0.0	+0.1 +0.0 +0.0	+0.2 +0.0 +7.9	+0.0 +0.0 +0.0	-40.0	-14.2	111.5	-125.7	Groun

83	29.190M	19.5	+0.0	+0.1	+0.3	+0.0	-40.0	-15.6	111.5	-127.1	Perp
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+4.5					
84	17.014M	15.2	+0.0	+0.1	+0.2	+0.0	-40.0	-16.1	111.5	-127.6	Perp
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+8.4					
85	26.971M	17.8	+0.0	+0.1	+0.3	+0.0	-40.0	-16.3	111.5	-127.8	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+5.5					
86	24.002M	15.8	+0.0	+0.1	+0.3	+0.0	-40.0	-17.2	111.5	-128.7	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+6.6					
87	18.603M	14.3	+0.0	+0.1	+0.2	+0.0	-40.0	-17.6	111.5	-129.1	Para
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+7.8					

Band Edge

Band Edge Summary

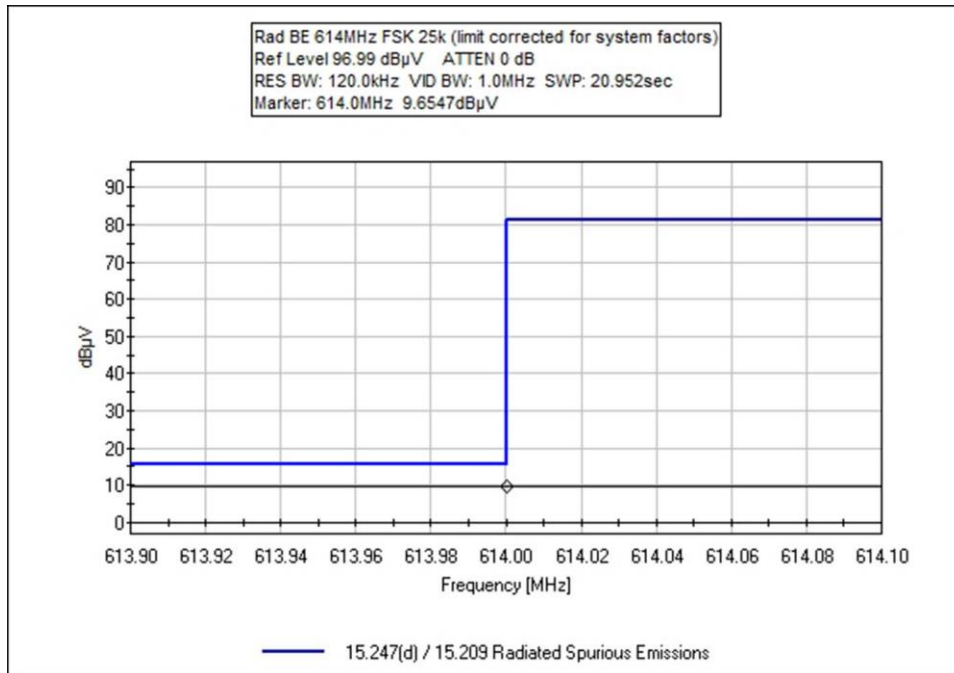
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	FSK 25kbps	Omnidirectional / 2.6dBi	39.9	<46	Pass
902	FSK 25kbps	Omnidirectional / 2.6dBi	88.3	<111.5	Pass
928	FSK 25kbps	Omnidirectional / 2.6dBi	88.0	< 111.5	Pass
960	FSK 25kbps	Omnidirectional / 2.6dBi	47.2	<54	Pass

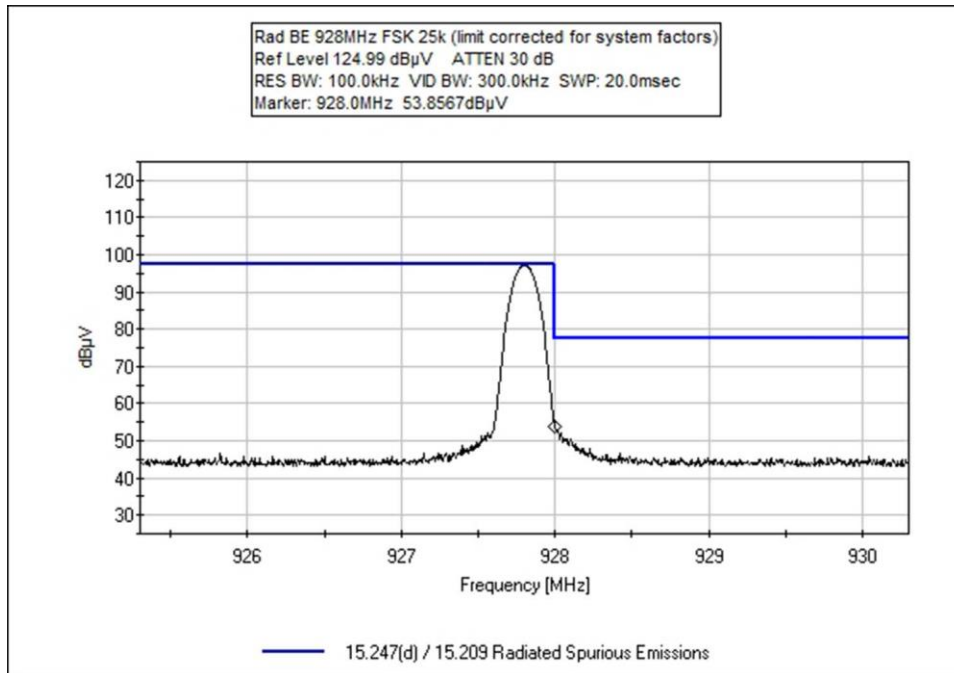
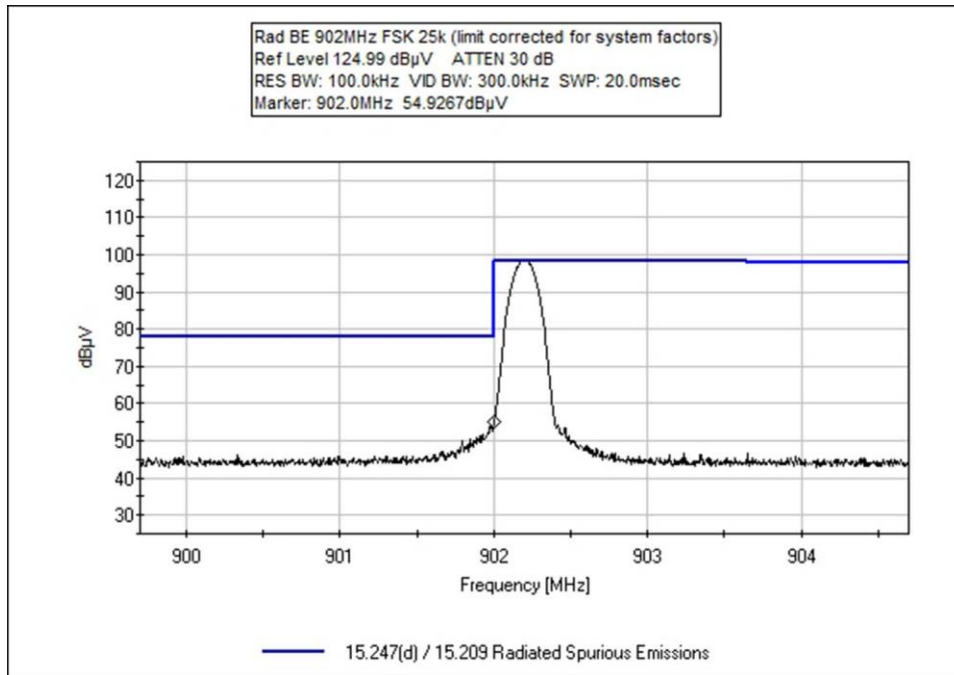
Band Edge Summary

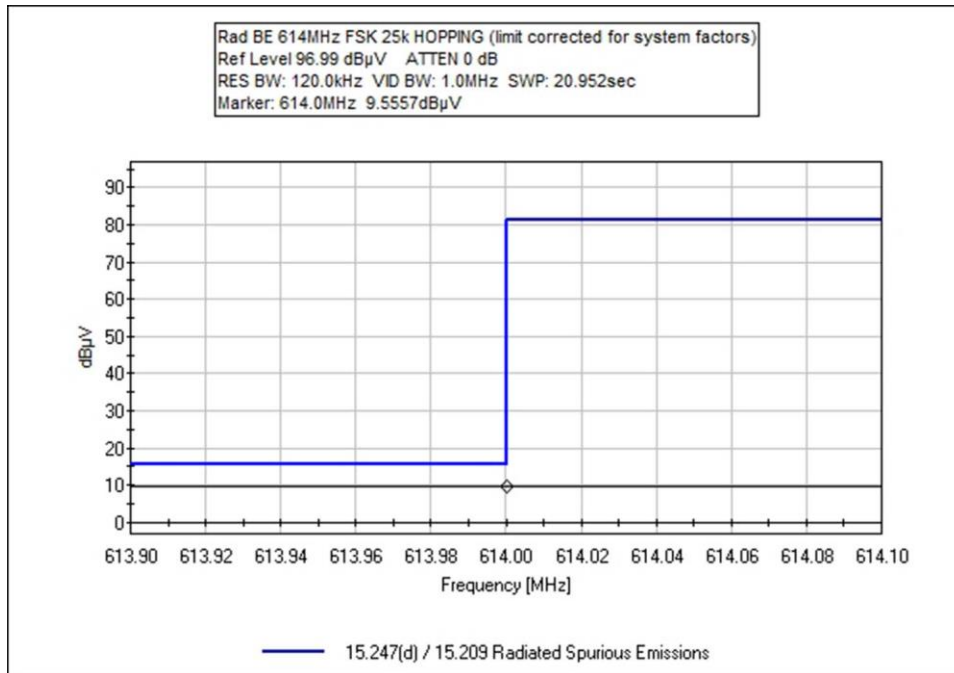
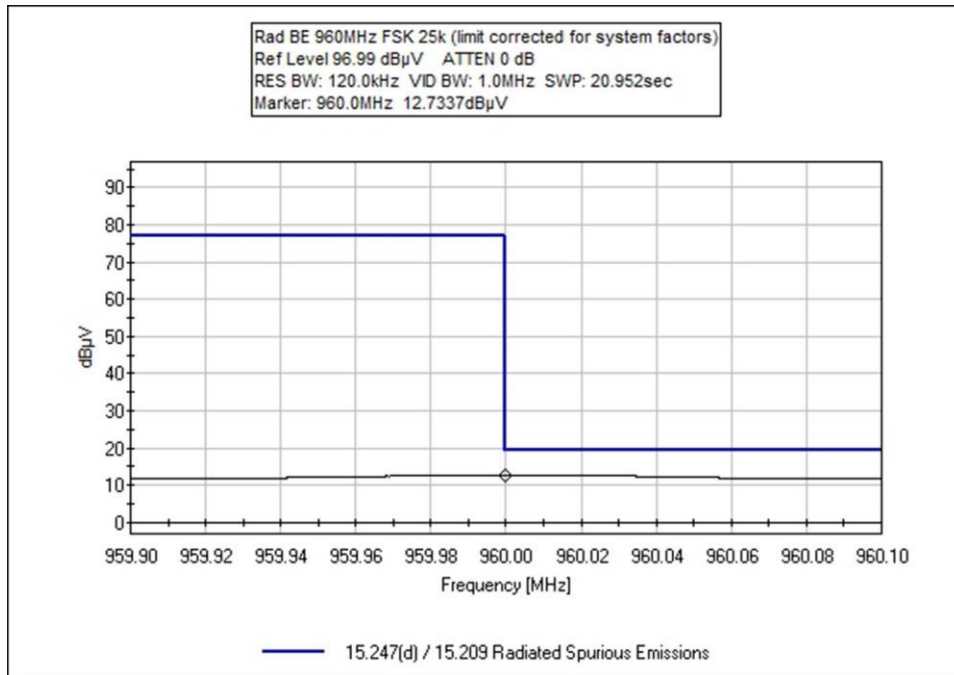
Operating Mode: Hopping

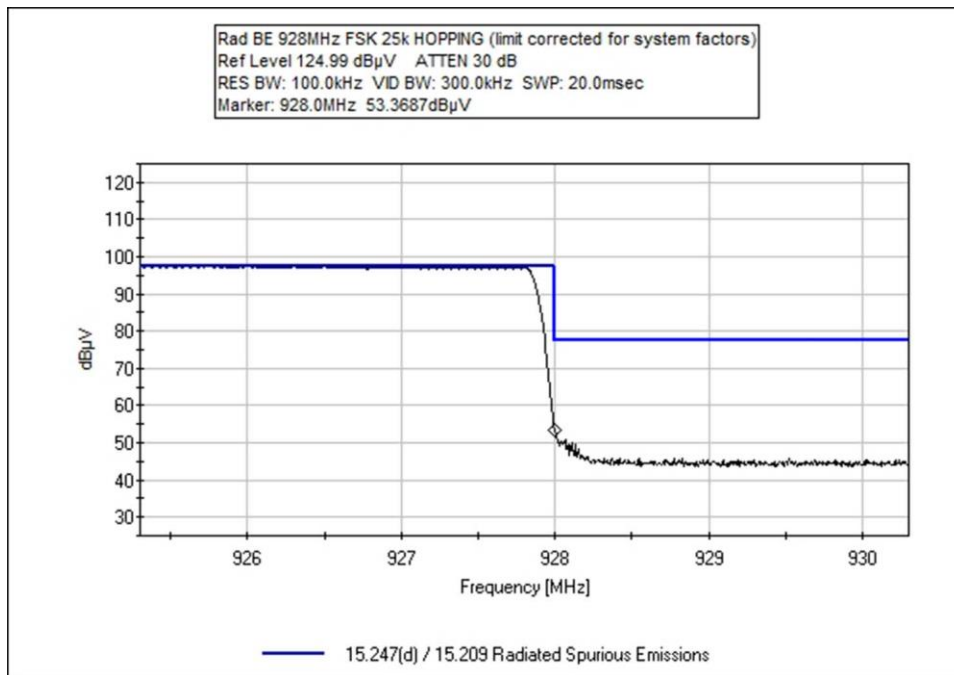
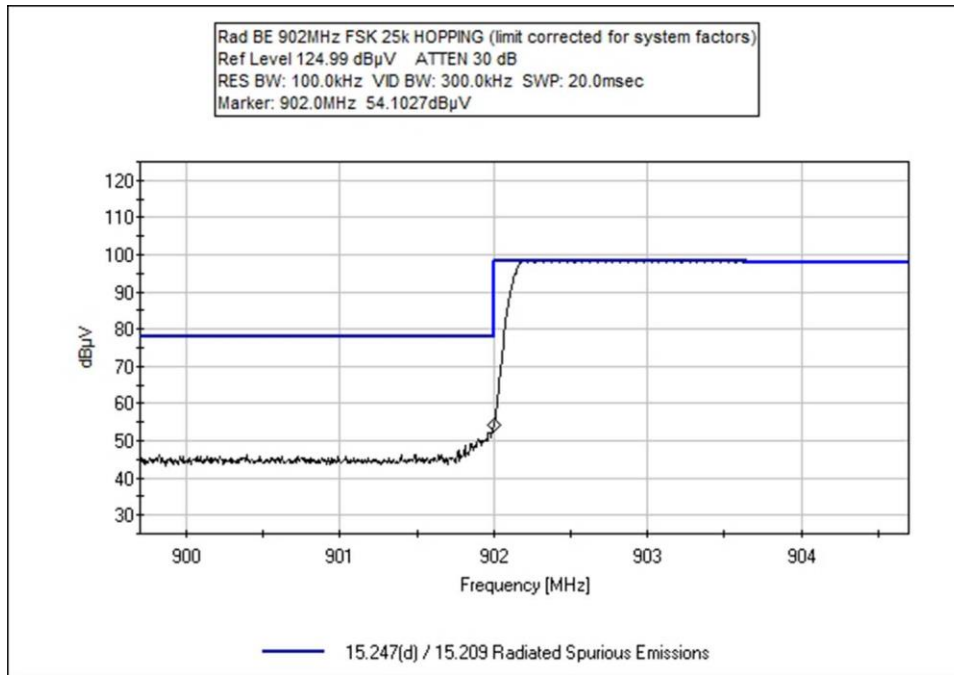
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	Hopping, FSK 25kbps	Omnidirectional / 2.6dBi	39.8	<46	Pass
902	Hopping, FSK 25kbps	Omnidirectional / 2.6dBi	87.5	<111.5	Pass
928	Hopping, FSK 25kbps	Omnidirectional / 2.6dBi	87.5	< 111.5	Pass
960	Hopping, FSK 25kbps	Omnidirectional / 2.6dBi	45.0	<54	Pass

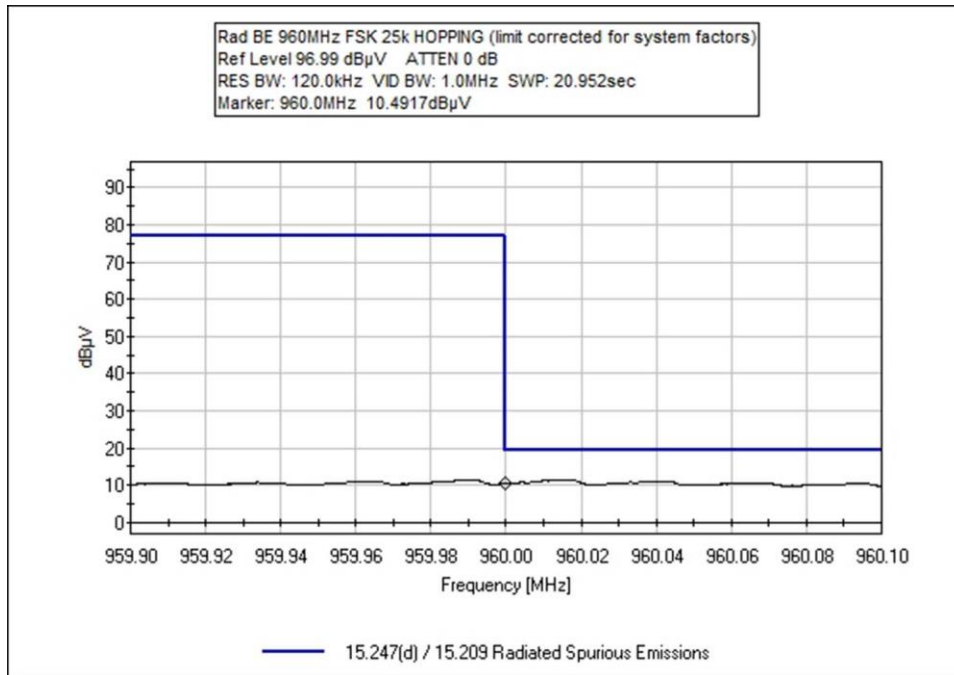
Band Edge Plots











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) / 15.209 Radiated Spurious Emissions**
 Work Order #: **104265** Date: 7/15/2020
 Test Type: **Radiated Scan** Time: 15:02:58
 Tested By: Michael Atkinson Sequence#: 5
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Temperature: 24 °C
 Humidity: 40 %
 Pressure: 101.8 kPa

 Method: ANSI C63.10 (2013)

 Frequency: Band Edge

 Test Setup:
 The equipment under test (EUT) is placed on the tabletop. A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT. The EUT host output port is connected to the externally attached antenna. The EUT is transmitting continuously with modulation at its rated output power. Low and High channels as well as hopping mode investigated, worst case reported. Horizontal and Vertical antenna polarities 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	2/3/2020	2/3/2022
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.

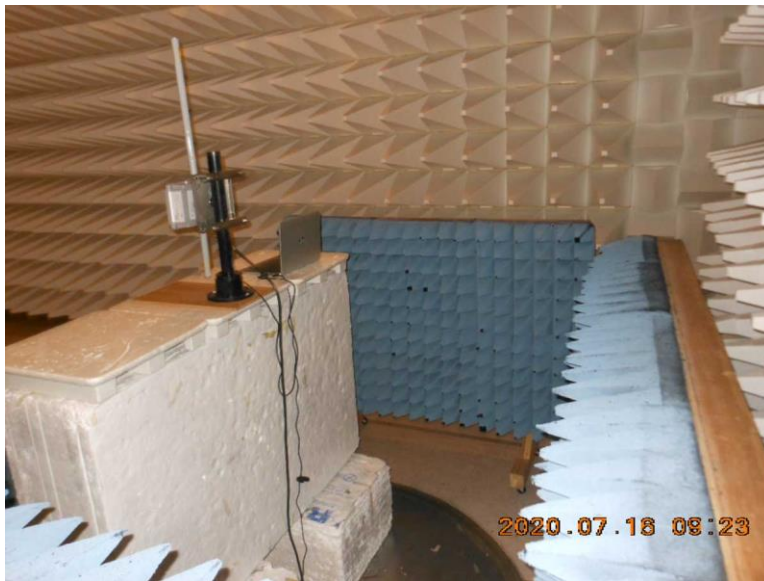
Test Distance: 3 Meters

#	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	9.7	+0.3 +21.2	+1.2	+1.7	+5.8	+0.0	39.9	46.0	-6.1	Vert
2	614.000M QP	9.6	+0.3 +21.2	+1.2	+1.7	+5.8	+0.0	39.8	46.0 Hopping	-6.2	Vert
3	960.000M QP	12.7	+0.4 +24.6	+1.5	+2.2	+5.8	+0.0	47.2	54.0	-6.8	Vert
4	960.000M QP	10.5	+0.4 +24.6	+1.5	+2.2	+5.8	+0.0	45.0	54.0 Hopping	-9.0	Vert
5	902.000M	54.9	+0.3 +23.8	+1.4	+2.1	+5.8	+0.0	88.3	111.5	-23.2	Vert
6	928.000M	53.9	+0.4 +24.2	+1.5	+2.2	+5.8	+0.0	88.0	111.5	-23.5	Vert
7	928.000M	53.4	+0.4 +24.2	+1.5	+2.2	+5.8	+0.0	87.5	111.5 Hopping	-24.0	Vert
8	902.000M	54.1	+0.3 +23.8	+1.4	+2.1	+5.8	+0.0	87.5	111.5 Hopping	-24.0	Vert

Test Setup Photo(s)



Below 1GHz



Above 1GHz

15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Itron, Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **104265** Date: 7/16/2020
 Test Type: **Conducted Emissions** Time: 14:43:28
 Tested By: Michael Atkinson Sequence#: 7
 Software: EMITest 5.03.19 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

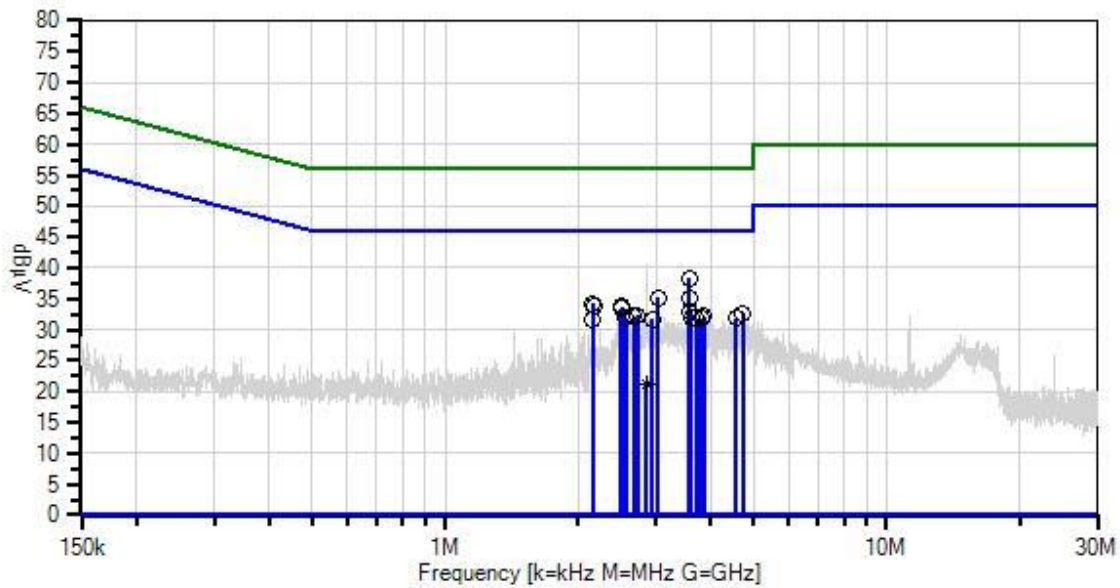
Temperature: 23 °C
 Humidity: 41 %
 Pressure: 101.6 kPa

 Method: ANSI C63.10 (2013)

 Frequency: 0.15-30MHz

 Test Setup:
 The equipment under test (EUT) is placed on the tabletop. AC power for EUT is connected via measurement LISN. A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT. Support Laptop Power supply is connected to AC mains via LISN with termination. The EUT host output port is connected to the externally attached antenna. The EUT is transmitting continuously with modulation at its rated output power. Low, Mid, High channels as well as hopping mode investigated, worst case reported.

Itron, Inc. WD#: 104265 Sequence#: 7 Date: 7/16/2020
 15.207 AC Mains - Average Test Lead: 115VAC 60Hz Line



— Sweep Data
 × QP Readings
 Software Version: 5.03.19
 — Readings
 * Average Readings
 — 1 - 15.207 AC Mains - Average
 ○ Peak Readings
 ▼ Ambient
 — 2 - 15.207 AC Mains - Quasi-peak

Test Equipment:

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

<i>Measurement Data:</i>		Reading listed by margin.						Test Lead: Line				
#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar	
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V	dB μ V	dB	Ant	
1	3.568M	29.4	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	38.4	46.0	-7.6	Line	
2	3.043M	26.1	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	35.1	46.0	-10.9	Line	
3	3.581M	26.0	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	35.0	46.0	-11.0	Line	
4	2.163M	25.1	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	34.2	46.0	-11.8	Line	
5	2.175M	24.7	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	33.8	46.0	-12.2	Line	
6	2.513M	24.7	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	33.7	46.0	-12.3	Line	
7	2.498M	24.4	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	33.4	46.0	-12.6	Line	
8	3.592M	23.9	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	32.9	46.0	-13.1	Line	
9	4.726M	23.8	+0.1 -0.4	+0.0	+0.1	+9.1	+0.0	32.7	46.0	-13.3	Line	
10	2.732M	23.3	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	32.3	46.0	-13.7	Line	
11	2.676M	23.1	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	32.1	46.0	-13.9	Line	
12	3.865M	23.1	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	32.1	46.0	-13.9	Line	
13	3.600M	23.0	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	32.0	46.0	-14.0	Line	
14	2.561M	22.9	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	31.9	46.0	-14.1	Line	
15	3.697M	22.8	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	31.8	46.0	-14.2	Line	
16	3.797M	22.8	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	31.8	46.0	-14.2	Line	
17	4.563M	22.9	+0.1 -0.4	+0.0	+0.1	+9.1	+0.0	31.8	46.0	-14.2	Line	
18	2.158M	22.6	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	31.7	46.0	-14.3	Line	
19	2.939M	22.7	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	31.7	46.0	-14.3	Line	
20	2.858M	12.3	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	21.3	46.0	-24.7	Line	
^	Ave 2.858M	31.4	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	40.4	46.0	-5.6	Line	

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)
 Customer: **Itron, Inc.**
 Specification: **15.207 AC Mains - Average**
 Work Order #: **104265** Date: 7/16/2020
 Test Type: **Conducted Emissions** Time: 14:58:00
 Tested By: Michael Atkinson Sequence#: 8
 Software: EMITest 5.03.19 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

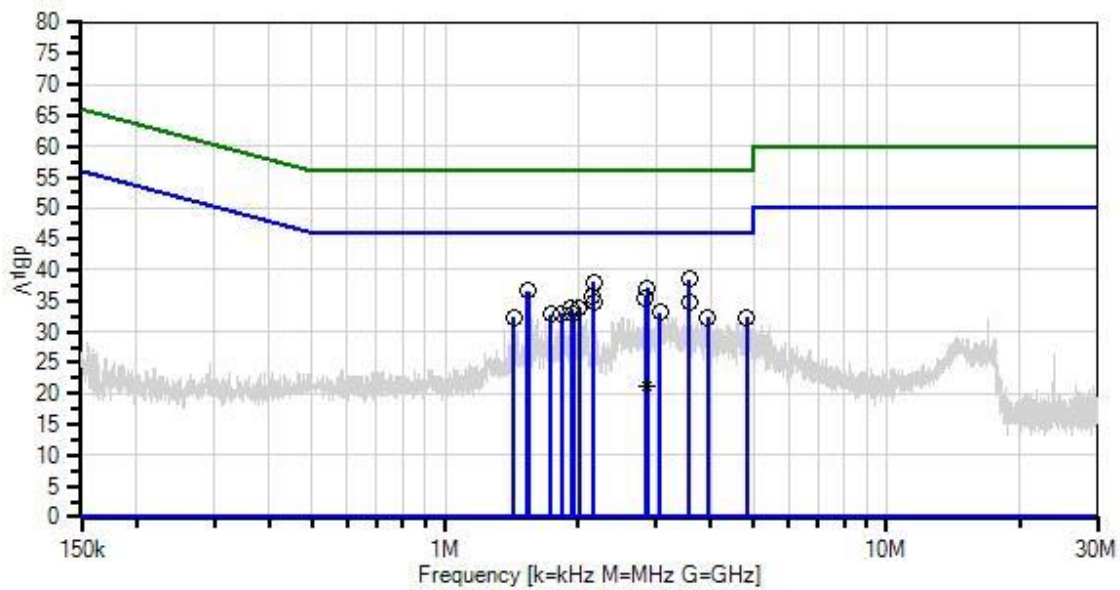
Temperature: 23 °C
 Humidity: 41 %
 Pressure: 101.6 kPa

 Method: ANSI C63.10 (2013)

 Frequency: 0.15-30MHz

 Test Setup:
 The equipment under test (EUT) is placed on the tabletop. AC power for EUT is connected via measurement LISN. A support laptop is connected to the EUT via USB to Serial cable to configure the settings in the EUT. Support Laptop Power supply is connected to AC mains via LISN with termination. The EUT host output port is connected to the externally attached antenna. The EUT is transmitting continuously with modulation at its rated output power. Low, Mid, High channels as well as hopping mode investigated, worst case reported.

Itron, Inc. WO#: 104265 Sequence#: 8 Date: 7/16/2020
 15.207 AC Mains - Average Test Lead: 115VAC 60Hz Neutral



— Sweep Data
 × QP Readings
 Software Version: 5.03.19

— Readings
 * Average Readings
 — 1 - 15.207 AC Mains - Average

○ Peak Readings
 ▼ Ambient
 — 2 - 15.207 AC Mains - Quasi-peak

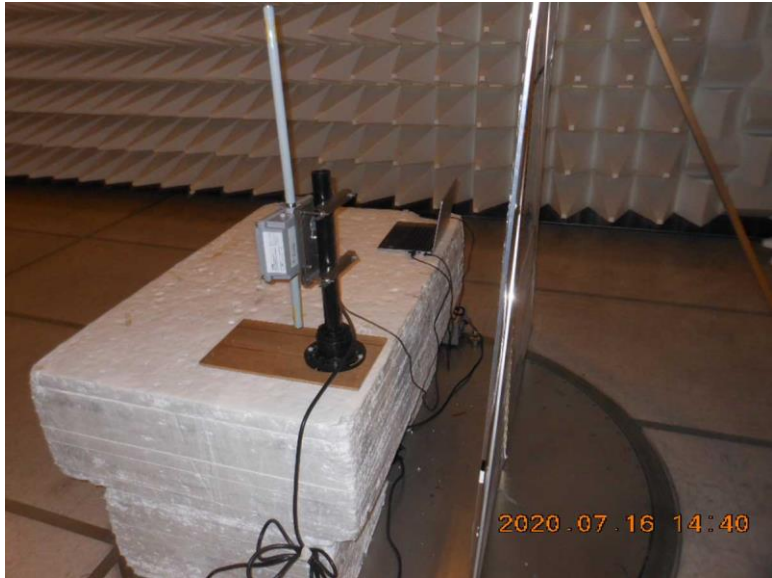
Test Equipment:

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

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

#	Freq MHz	Rdng dB μ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	3.571M	29.5	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	38.5	46.0	-7.5	Neutr
2	2.169M	29.0	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	38.1	46.0	-7.9	Neutr
3	2.876M	28.0	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	37.0	46.0	-9.0	Neutr
4	1.535M	27.5	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	36.6	46.0	-9.4	Neutr
5	1.544M	27.5	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	36.6	46.0	-9.4	Neutr
6	2.164M	26.5	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	35.6	46.0	-10.4	Neutr
7	2.843M	26.5	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	35.5	46.0	-10.5	Neutr
8	3.575M	25.9	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	34.9	46.0	-11.1	Neutr
9	2.173M	25.8	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	34.9	46.0	-11.1	Neutr
10	2.013M	24.8	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	33.9	46.0	-12.1	Neutr
11	1.935M	24.6	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	33.7	46.0	-12.3	Neutr
12	3.061M	24.2	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	33.2	46.0	-12.8	Neutr
13	1.834M	23.9	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	33.0	46.0	-13.0	Neutr
14	1.953M	23.8	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	32.9	46.0	-13.1	Neutr
15	1.739M	23.7	+0.2 -0.3	+0.0	+0.1	+9.1	+0.0	32.8	46.0	-13.2	Neutr
16	1.433M	23.4	+0.2 -0.3	+0.0	+0.0	+9.1	+0.0	32.4	46.0	-13.6	Neutr
17	3.928M	23.5	+0.1 -0.4	+0.0	+0.1	+9.1	+0.0	32.4	46.0	-13.6	Neutr
18	4.827M	23.5	+0.1 -0.4	+0.0	+0.1	+9.1	+0.0	32.4	46.0	-13.6	Neutr
19	2.855M	12.1	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	21.1	46.0	-24.9	Neutr
Ave											
^	2.855M	30.2	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	39.2	46.0	-6.8	Neutr
^	2.859M	29.2	+0.1 -0.3	+0.0	+0.1	+9.1	+0.0	38.2	46.0	-7.8	Neutr

Test Setup Photo(s)



SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

Uncertainties reported are worst case for all CKC Laboratories’ sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

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

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

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

CORRECTION FACTORS

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

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

TEST INSTRUMENTATION AND ANALYZER SETTINGS

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

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

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

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

Peak

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

Quasi-Peak

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

Average

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