

Ittron, Inc.

TEST REPORT FOR

AMR Transceiver Device For Communicating With Utility Meters Model: IMRB

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(FHSS 902-928 MHz)

Report No.: 102014-4

Date of issue: February 15, 2019



Test Certificate # 803.05

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:

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

Representative: Jay Holcomb
Customer Reference Number: 165609

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: 102014

December 10, 2018

December 10-12, 2018

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.

A handwritten signature in black ink, reading "Steve Behm", is written over a horizontal line.

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	5.03.11

Site Registration & Accreditation Information

Location	NIST CB #	TAIWAN	CANADA	FCC	JAPAN
Canyon Park Bothell, WA	US0081	SL2-IN-E-1145R	3082C-1	US1022	A-0148

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	Pass
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

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
AMR Transceiver Device For Communicating With Utility Meters	Itron, Inc.	IMRB	IMR007894

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	E6410	46TXXN1
AC Adapter for Laptop	Dell	DA130PE1-00	N/A
AC Adapter	DVE	DV-51AR	N/A

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR Transceiver Device For Communicating With Utility Meters	Itron, Inc.	IMRB	IMR003024

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	E6410	46TXXN1
AC Adapter for Laptop	Dell	DA130PE1-00	N/A
AC Adapter	DVE	DV-51AR	N/A

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Proprietary FHSS
Operating Frequency Range:	908-923.8MHz
Number of Hopping Channels:	80
Modulation Type(s):	FSK
Maximum Duty Cycle:	45%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Internal PIFA 1.2dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	120VAC/60Hz
Firmware / Software used for Test:	DSP Version 85.75.00.02/FPGA Version 3.02 / MC3 Test v4.0.2.2

FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/10/2018
Configuration:	3		
Test Setup:	<p>Frequency Range: 908-923.8MHz Frequency tested: 908, 916, 923.8MHz Firmware power setting: Max Power Protocol /MCS/Modulation: FSK</p> <p>Duty Cycle: 100% (Test Mode)</p> <p>Test Mode: Continuously transmitting Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer. Modifications Added: None</p>		

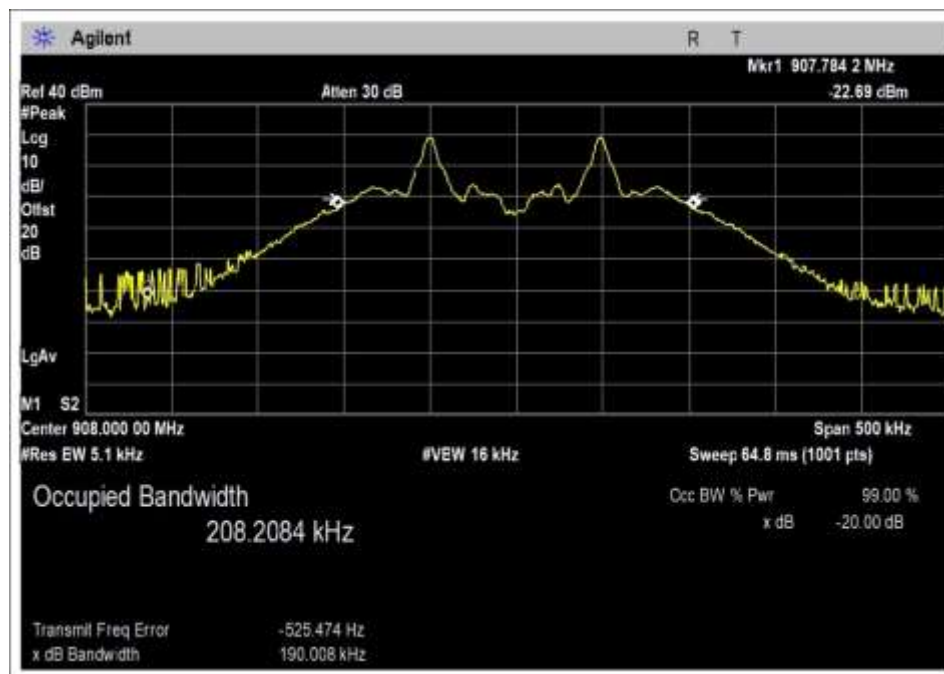
Environmental Conditions			
Temperature (°C)	20-21	Relative Humidity (%):	32-33

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2017	2/3/2019
P07228	Attenuator	Pasternack	PE7004-20	11/30/2017	11/30/2019

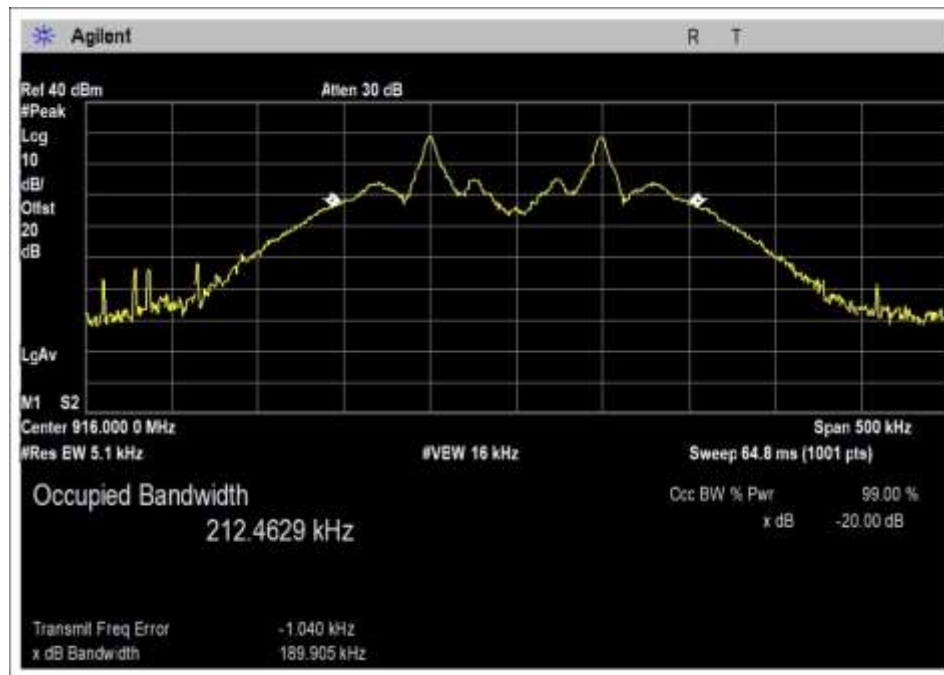
15.247(a)(1) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
908	1	FSK	190.0	≤500	Pass
916	1	FSK	189.9	≤500	Pass
923.8	1	FSK	195.5	≤500	Pass

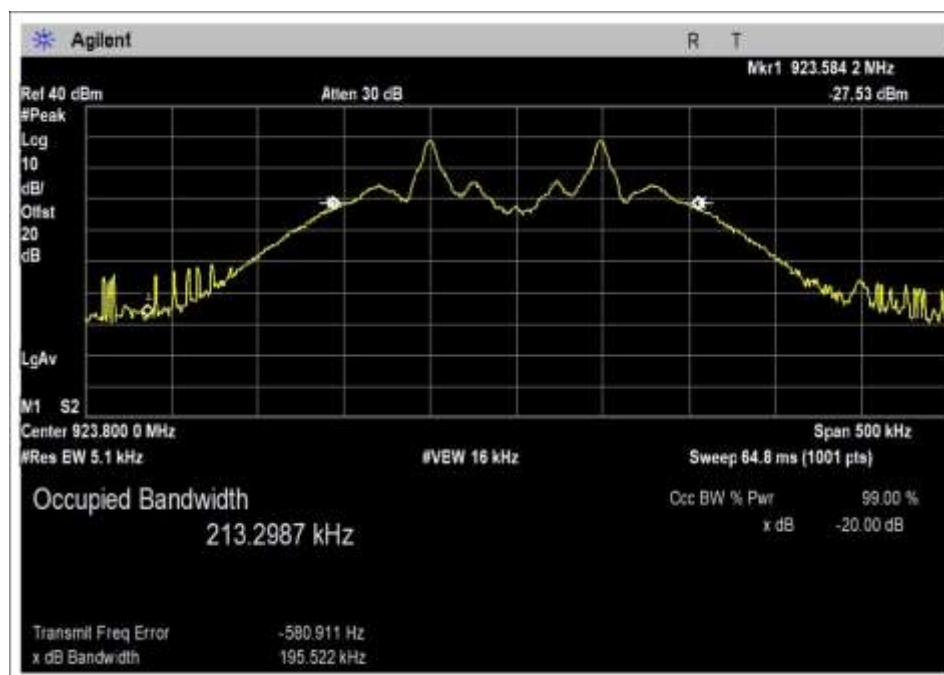
Plot(s)



Low Channel



Middle Channel



High Channel

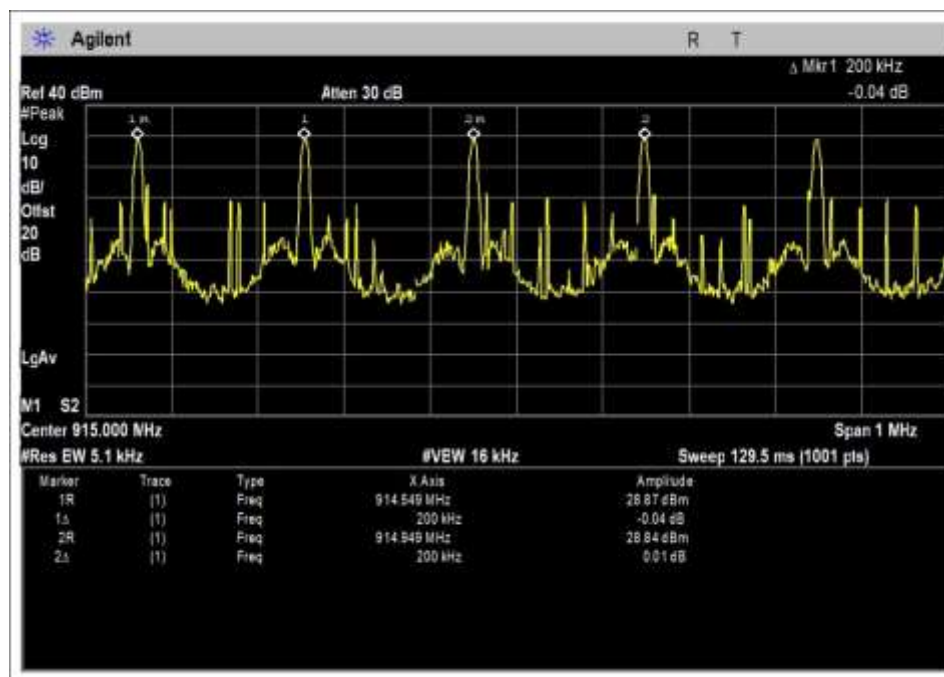
15.247(a)(1) Carrier Separation

Test Data Summary

Limit applied: 20dB bandwidth of the hopping channel.

Antenna Port	Operational Mode	Measured (kHz)	Limit (kHz)	Results
1	Normal Hopping	200	>195.5	Pass

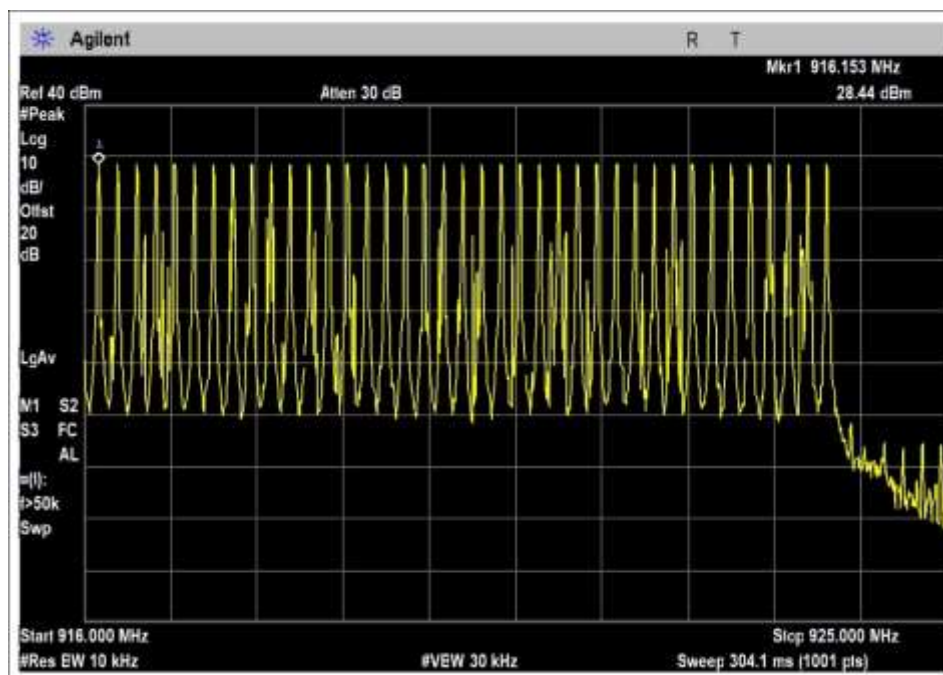
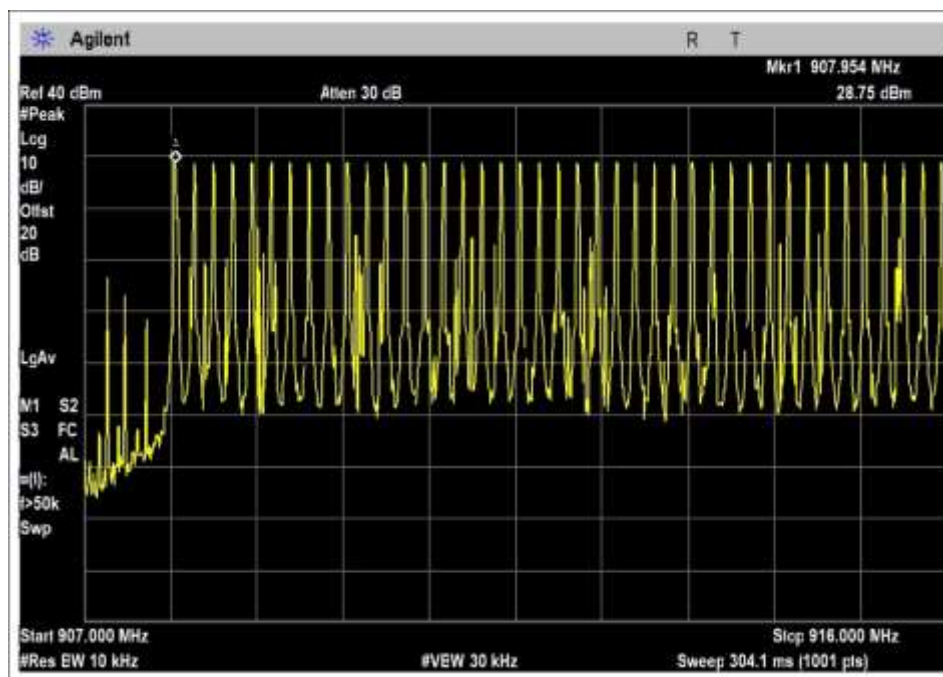
Plot(s)



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	Normal Hopping	80	≥ 50	Pass

Plot(s)



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

Test Data Summary				
Observation Period, P_{obs} is derived from the following:				
$P_{obs} = \begin{cases} 20 \text{ Seconds} & 20 \text{ dB BW} < 250\text{kHz} \\ 10 \text{ Seconds} & 20 \text{ dB BW} \geq 250\text{kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (ms)	Limit (ms/ P_{obs})	Results
1	Normal Hopping	357.6	≤ 400	Pass

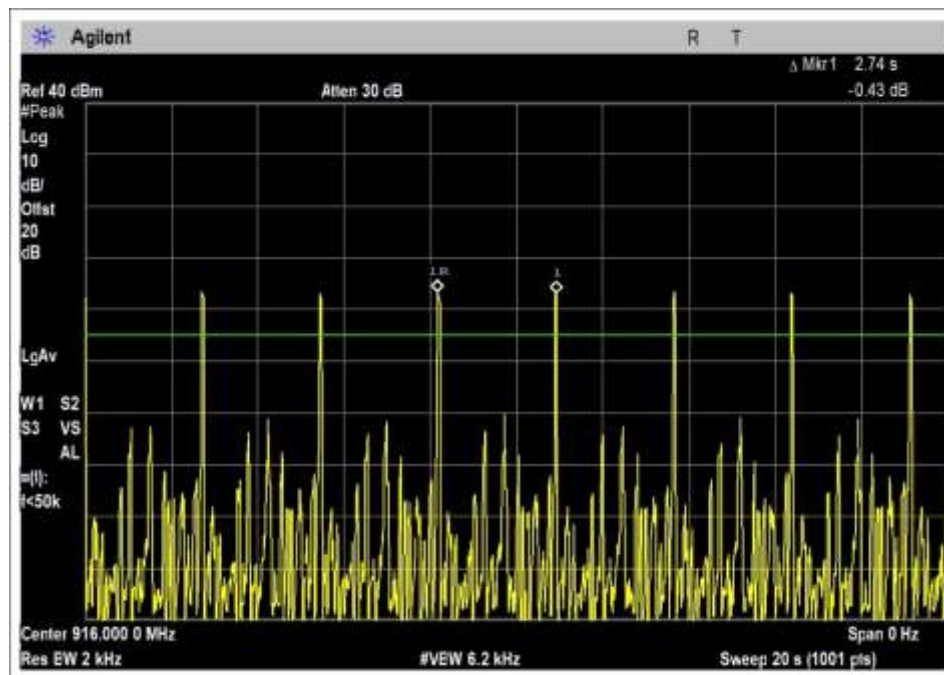
Measured results are calculated as follows:

$$Dwell \text{ time} = \left(\sum_{Bursts} RF \text{ Burst On Time} + \sum_{Control} Control \text{ Signal On time} \right) \Big|_{P_{obs}}$$

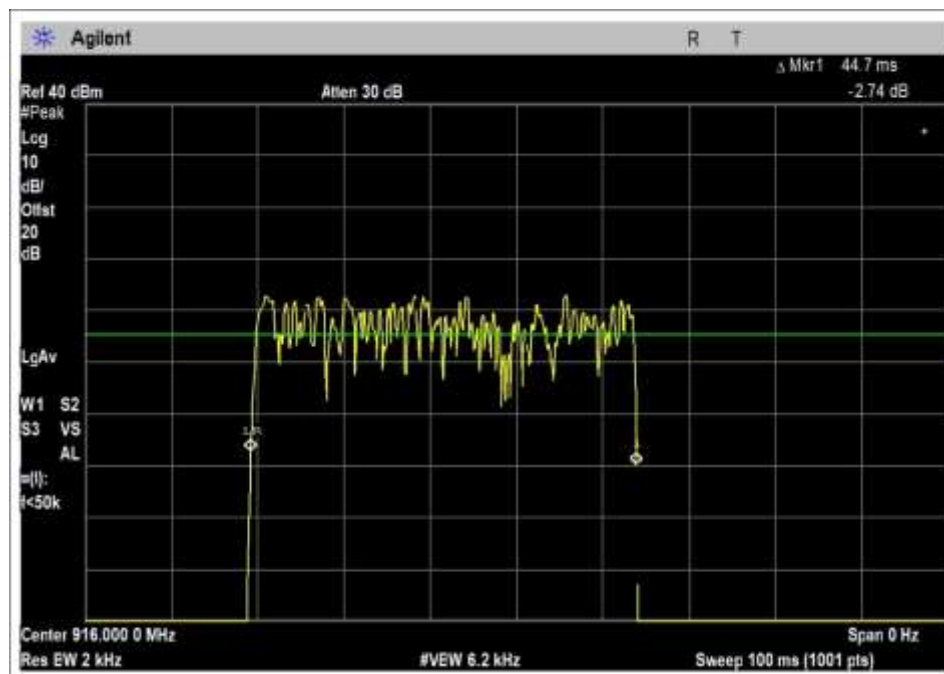
Actual Calculated Values:

Parameter	Value
Observation Period (P_{obs}):	20 sec
Number of RF Bursts / P_{obs} :	8
On time of RF Burst:	44.7ms
Number of Control or other signals / P_{obs} :	0
On time of Control or other Signals:	0
Total Measured On Time:	357.6

Plot(s)



20sec window



Single Burst

Test Setup Photo(s)



15.247(b)(1) Output Power

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/10/2018
Configuration:	3		
Test Setup:	<p>Frequency Range: 908-923.8MHz Frequency tested: 908, 916, 923.8MHz Firmware power setting: Max Power Protocol /MCS/Modulation: FSK</p> <p>Duty Cycle: 100% (Test Mode)</p> <p>Test Mode: Continuously transmitting Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer. Modifications Added: None</p>		

Environmental Conditions			
Temperature (°C)	20-21	Relative Humidity (%):	32-33

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2017	2/3/2019
P07228	Attenuator	Pasternack	PE7004-20	11/30/2017	11/30/2019

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)
908	FSK	29.1	29.1	29.1	0.0
916	FSK	29.0	29.0	29.0	0.0
923.8	FSK	28.9	28.9	28.9	0.0

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

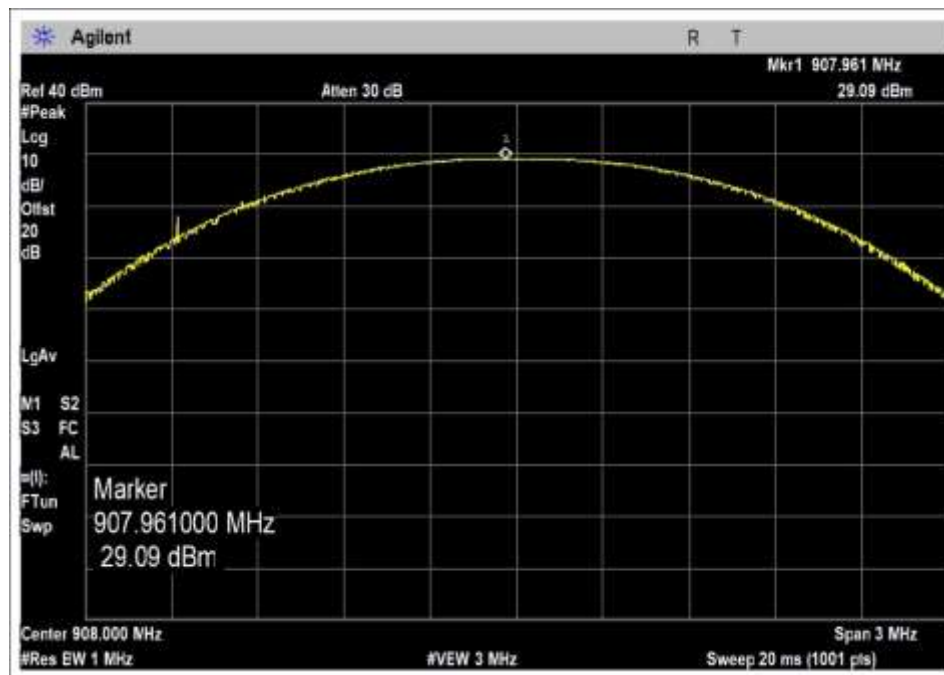
Parameter Definitions:

Measurements performed at input voltage V_{Nominal} ± 15%.

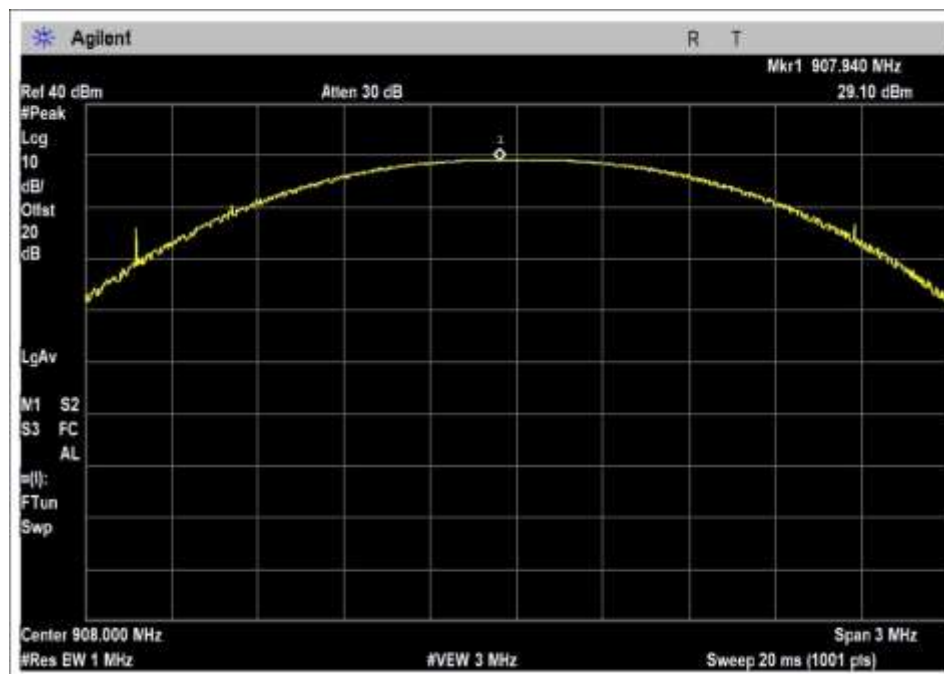
Parameter	Value
V _{Nominal} :	115VAC
V _{Minimum} :	97VAC
V _{Maximum} :	133VAC

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)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
908	FSK	Internal PIFA 1.2dBi	29.1	≤30	Pass
916	FSK	Internal PIFA 1.2dBi	29.0	≤30	Pass
923.8	FSK	Internal PIFA 1.2dBi	28.9	≤30	Pass

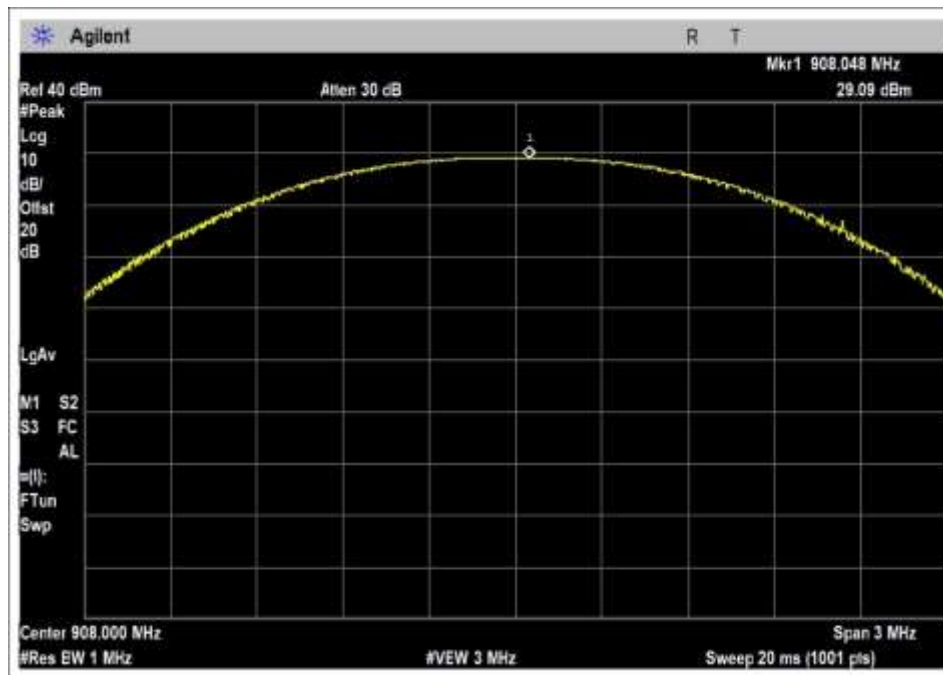
Plot(s)



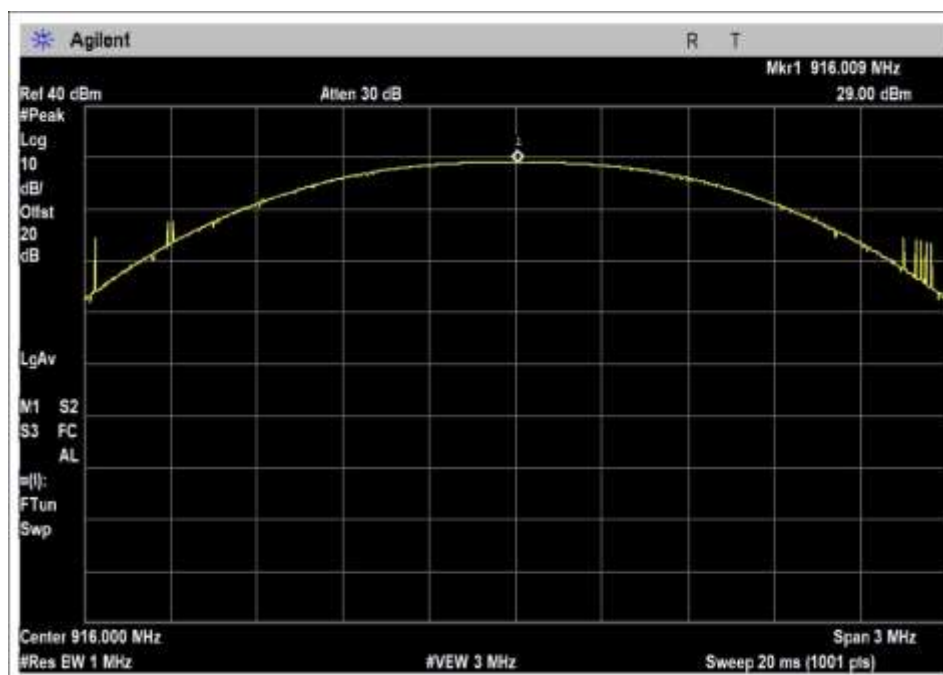
Low Channel Vnom



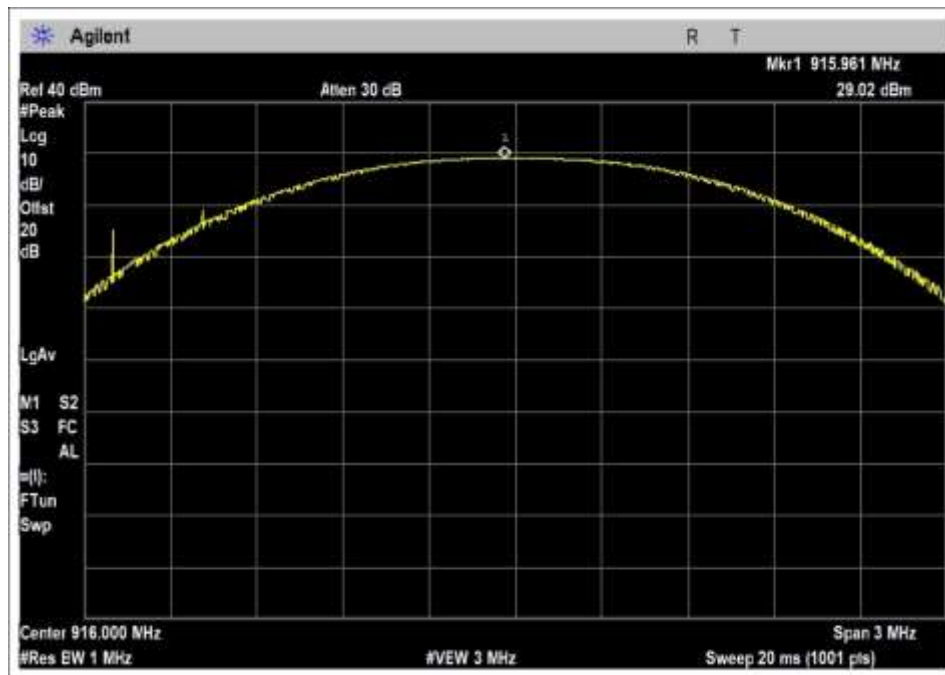
Low Channel Vlow



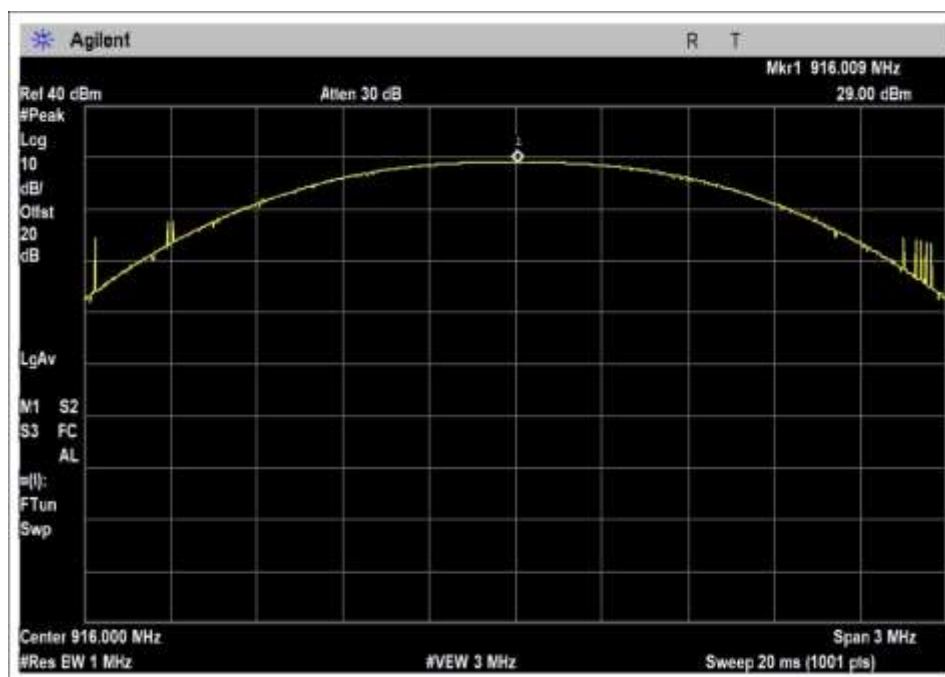
High Channel Vhigh



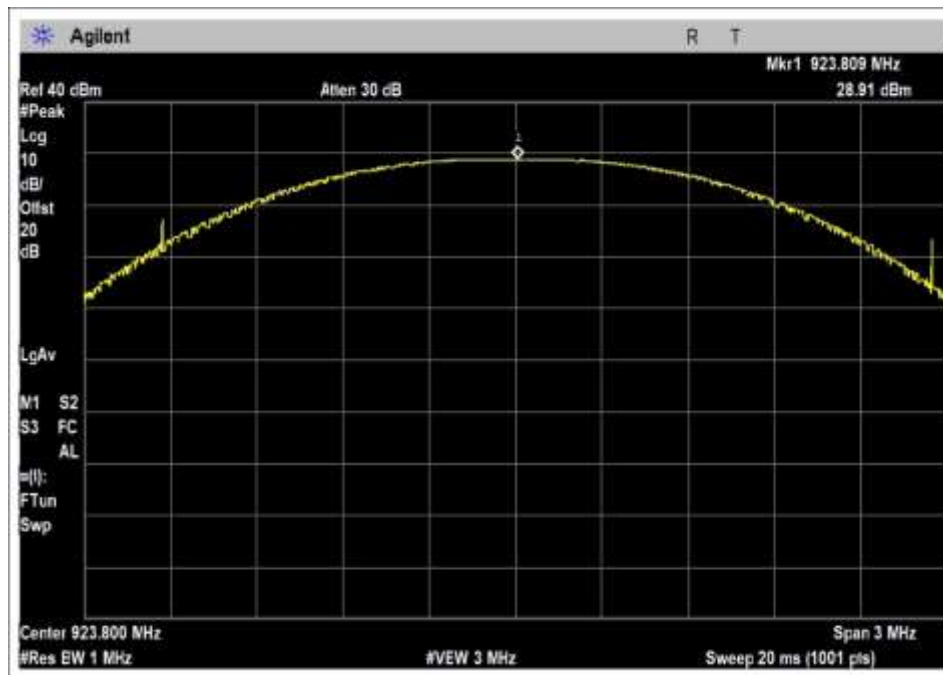
Middle Channel Vnom



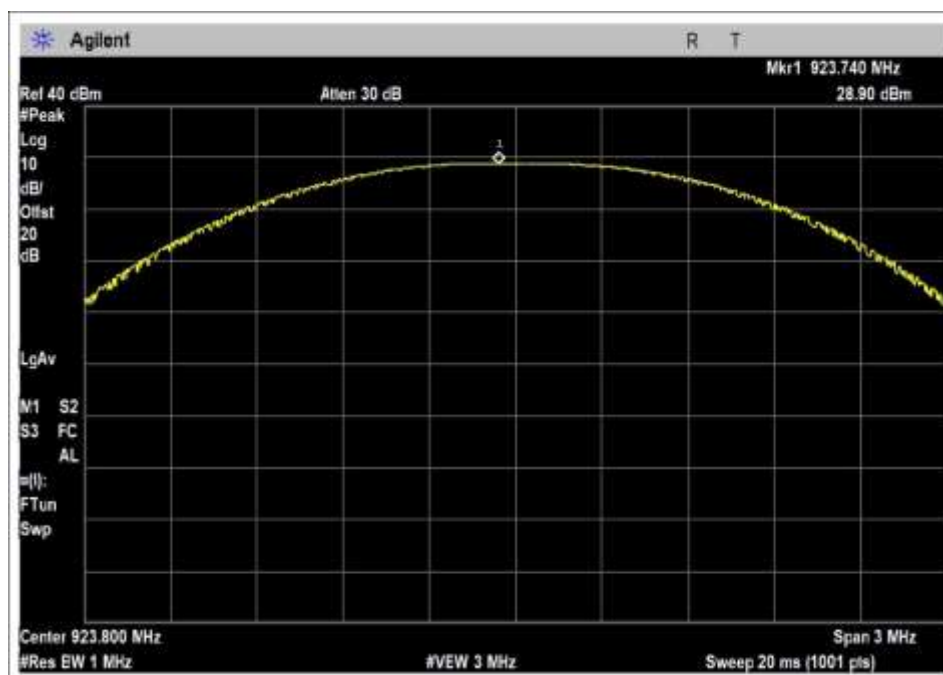
Middle Channel Vlow



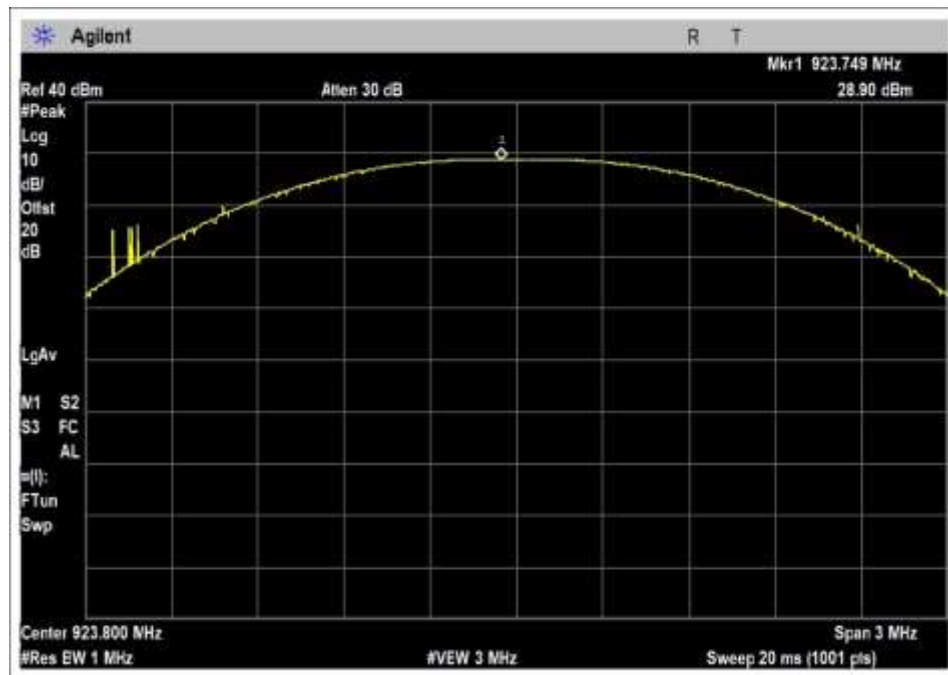
Middle Channel Vhigh



High Channel Vnom



High Channel Vlow



15.35(c) Duty Cycle Correction Factor

Test Data Summary			
Antenna Port	Operational Mode	Measured On Time (mS / P _{obs})	Calculated DCCF (dB)
1	Transmitting RF Bursts	45	-6.9

Observation Period, P_{obs} is the duration of the pulse train or maximum 100mS

Measured results are calculated as follows:

$$On\ Time = \left(\sum_{Bursts} RF\ Burst\ On\ Time + \sum_{Control} Control\ Signal\ On\ time \right) \Big|_{P_{obs} \ (max\ 100ms)}$$

Measured Values:

Parameter	Value
Observation Period (P _{obs}):	100ms
Number of RF Bursts / P _{obs} :	1
On time of RF Burst:	45ms
Number of Control or other signals / P _{obs} :	0
On time of Control or other Signals:	0
Total Measured On Time:	45mS

Duty Cycle Correction Factor (DCCF) is calculated in accordance with ANSI C63.10:

$$DCCF = 20 \cdot \log \left(\frac{On\ Time}{P_{obs}} \right)$$

Test Setup Photo(s)



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd DR SE • Bothell WA, 98021 • (425) 402-1717
 Customer: **Itron, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **102014** Date: 12/10/2018
 Test Type: **Conducted Emissions** Time: 12:00:05 PM
 Tested By: Steven Pittsford Sequence#: 1
 Software: EMITest 5.03.11 115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

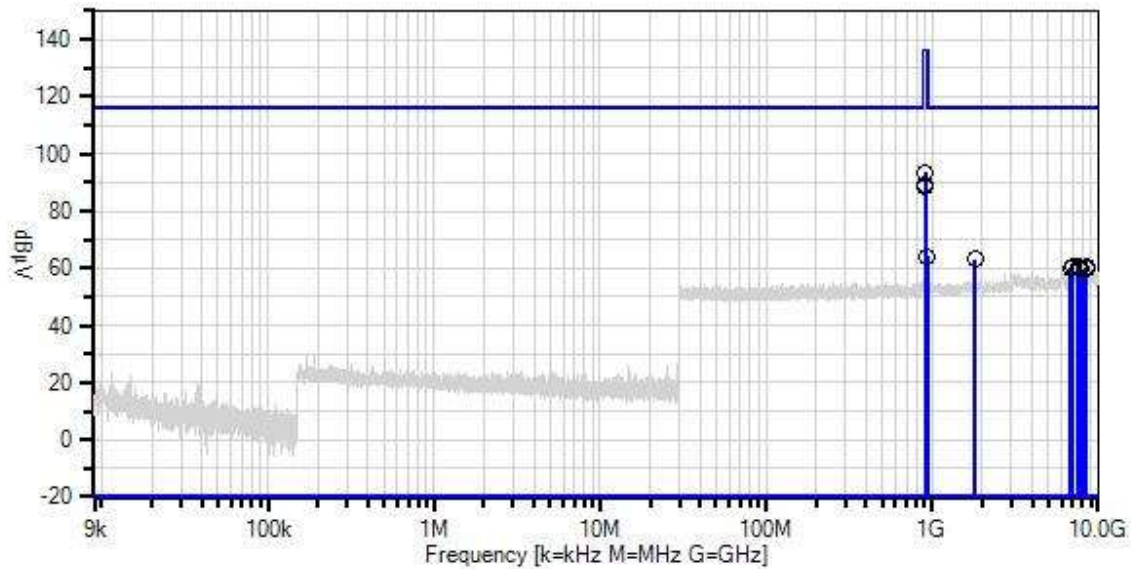
Test Conditions / Notes:

Frequency Range: 908-923.8MHz
 Frequency tested: 908MHz
 Firmware power setting: Max Power
 Protocol /MCS/Modulation: FSK

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting
 Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer.
 Modifications Added: None

Itron, Inc. WD#: 102014 Sequence#: 1 Date: 12/10/2018
15.247(d) Conducted Spurious Emissions Test Lead: 115V 60Hz Antenna Port



— Sweep Data
○ Peak Readings
* Average Readings
Software Version: 5.03.11

— Readings
× QP Readings
▼ Ambient
— 1 - 15.247(d) Conducted Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07228	Attenuator	PE7004-20	11/30/2017	11/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019

Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB				Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	910.001M	73.4	+20.0				+0.0	93.4	136.1	-42.7	Anten
2	906.737M	69.1	+20.0				+0.0	89.1	136.1	-47.0	Anten
3	909.185M	68.7	+20.0				+0.0	88.7	136.1	-47.4	Anten
4	935.575M	44.3	+20.0				+0.0	64.3	116.1	-51.8	Anten
5	1815.973M	43.2	+20.0				+0.0	63.2	116.1	-52.9	Anten
6	7628.904M	40.8	+20.1				+0.0	60.9	116.1	-55.2	Anten
7	7693.849M	40.6	+20.1				+0.0	60.7	116.1	-55.4	Anten
8	6954.625M	40.4	+20.1				+0.0	60.5	116.1	-55.6	Anten
9	8495.602M	40.3	+20.2				+0.0	60.5	116.1	-55.6	Anten
10	6820.915M	40.1	+20.1				+0.0	60.2	116.1	-55.9	Anten
11	7676.658M	40.1	+20.1				+0.0	60.2	116.1	-55.9	Anten
12	6824.736M	39.8	+20.1				+0.0	59.9	116.1	-56.2	Anten
13	7858.121M	39.7	+20.1				+0.0	59.8	116.1	-56.3	Anten
14	8478.482M	39.5	+20.2				+0.0	59.7	116.1	-56.4	Anten



Test Location: CKC Laboratories, Inc. • 22116 23rd DR SE • Bothell WA, 98021 • (425) 402-1717
Customer: **Itron, Inc.**
Specification: **15.247(d) Conducted Spurious Emissions**
Work Order #: **102014** Date: 12/10/2018
Test Type: **Conducted Emissions** Time: 12:03:52 PM
Tested By: Steven Pittsford Sequence#: 2
Software: EMITest 5.03.11 115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

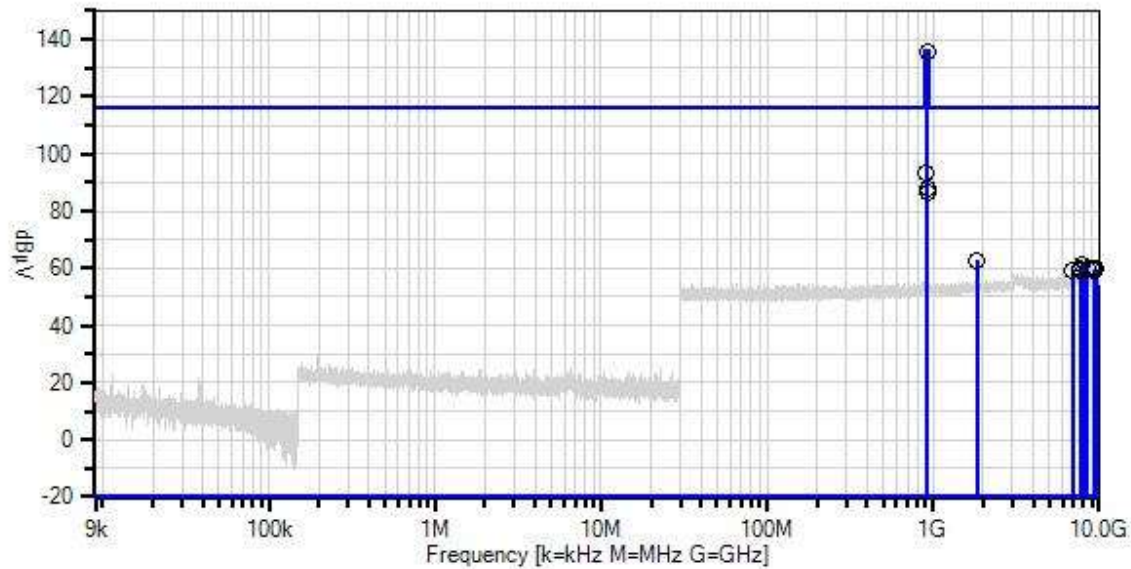
Test Conditions / Notes:

Frequency Range: 908-923.8MHz
Frequency tested: 916MHz
Firmware power setting: Max Power
Protocol /MCS/Modulation: FSK

Duty Cycle: 100% (Test Mode)

Test Mode: Continuously transmitting
Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer.
Modifications Added: None

Itron, Inc. WD#: 102014 Sequence#: 2 Date: 12/10/2018
15.247(d) Conducted Spurious Emissions Test Lead: 115V 60Hz Antenna Port



— Sweep Data
○ Peak Readings
* Average Readings
Software Version: 5.03.11

— Readings
x QP Readings
▼ Ambient
— 1 - 15.247(d) Conducted Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07228	Attenuator	PE7004-20	11/30/2017	11/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019

Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB				Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	915.987M	115.9	+20.0				+0.0	135.9	136.1	-0.2	Anten
2	914.082M	73.4	+20.0				+0.0	93.4	136.1	-42.7	Anten
3	917.075M	68.1	+20.0				+0.0	88.1	136.1	-48.0	Anten
4	914.898M	66.7	+20.0				+0.0	86.7	136.1	-49.4	Anten
5	1832.115M	42.7	+20.0				+0.0	62.7	116.1	-53.4	Anten
6	7872.871M	41.0	+20.1				+0.0	61.1	116.1	-55.0	Anten
7	7653.736M	40.1	+20.1				+0.0	60.2	116.1	-55.9	Anten
8	8493.462M	39.9	+20.2				+0.0	60.1	116.1	-56.0	Anten
9	7674.747M	40.0	+20.1				+0.0	60.1	116.1	-56.0	Anten
10	9574.146M	39.6	+20.2				+0.0	59.8	116.1	-56.3	Anten
11	7632.724M	39.5	+20.1				+0.0	59.6	116.1	-56.5	Anten
12	9274.550M	39.4	+20.2				+0.0	59.6	116.1	-56.5	Anten
13	6878.220M	39.4	+20.1				+0.0	59.5	116.1	-56.6	Anten
14	7720.591M	39.3	+20.1				+0.0	59.4	116.1	-56.7	Anten
15	9280.970M	39.2	+20.2				+0.0	59.4	116.1	-56.7	Anten



Test Location: CKC Laboratories, Inc. • 22116 23rd DR SE • Bothell WA, 98021 • (425) 402-1717
Customer: **Itron, Inc.**
Specification: **15.247(d) Conducted Spurious Emissions**
Work Order #: **102014** Date: 12/10/2018
Test Type: **Conducted Emissions** Time: 12:08:17 PM
Tested By: Steven Pittsford Sequence#: 3
Software: EMITest 5.03.11 115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

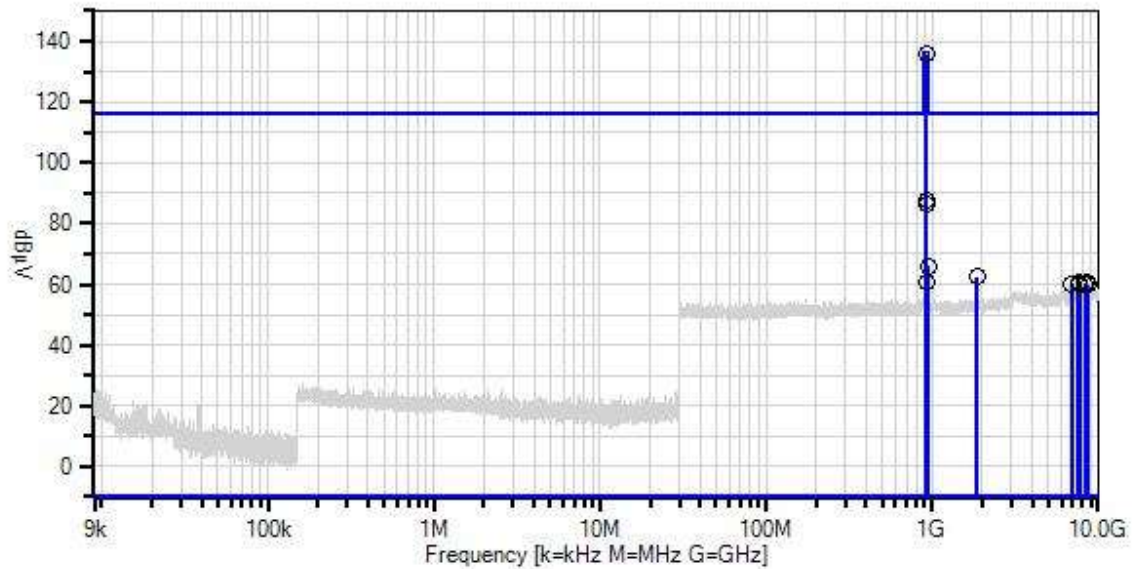
Test Conditions / Notes:

Frequency Range: 908-923.8MHz
Frequency tested: 923.8MHz
Firmware power setting: Max Power
Protocol /MCS/Modulation: FSK

Duty Cycle: 100% (Test Mode)

Test Mode: Continuously transmitting
Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer.
Modifications Added: None

Itron, Inc. WD#: 102014 Sequence#: 3 Date: 12/10/2018
15.247(d) Conducted Spurious Emissions Test Lead: 115V 60Hz Antenna Port



— Sweep Data
○ Peak Readings
* Average Readings
Software Version: 5.03.11

— Readings
× QP Readings
▼ Ambient
— 1 - 15.247(d) Conducted Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07228	Attenuator	PE7004-20	11/30/2017	11/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019

Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB				Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	923.876M	115.8	+20.0				+0.0	135.8	136.1	-0.3	Anten
2	924.965M	67.7	+20.0				+0.0	87.7	136.1	-48.4	Anten
3	922.516M	66.1	+20.0				+0.0	86.1	136.1	-50.0	Anten
4	950.538M	45.9	+20.0				+0.0	65.9	116.1	-50.2	Anten
5	1847.308M	42.6	+20.0				+0.0	62.6	116.1	-53.5	Anten
6	928.229M	40.9	+20.0				+0.0	60.9	116.1	-55.2	Anten
7	7697.669M	40.5	+20.1				+0.0	60.6	116.1	-55.5	Anten
8	7669.017M	40.5	+20.1				+0.0	60.6	116.1	-55.5	Anten
9	8465.642M	40.2	+20.2				+0.0	60.4	116.1	-55.7	Anten
10	6901.141M	40.1	+20.1				+0.0	60.2	116.1	-55.9	Anten
11	7605.982M	40.1	+20.1				+0.0	60.2	116.1	-55.9	Anten
12	7626.994M	40.1	+20.1				+0.0	60.2	116.1	-55.9	Anten
13	7590.701M	39.9	+20.1				+0.0	60.0	116.1	-56.1	Anten
14	8356.504M	39.8	+20.2				+0.0	60.0	116.1	-56.1	Anten
15	8632.560M	39.8	+20.2				+0.0	60.0	116.1	-56.1	Anten

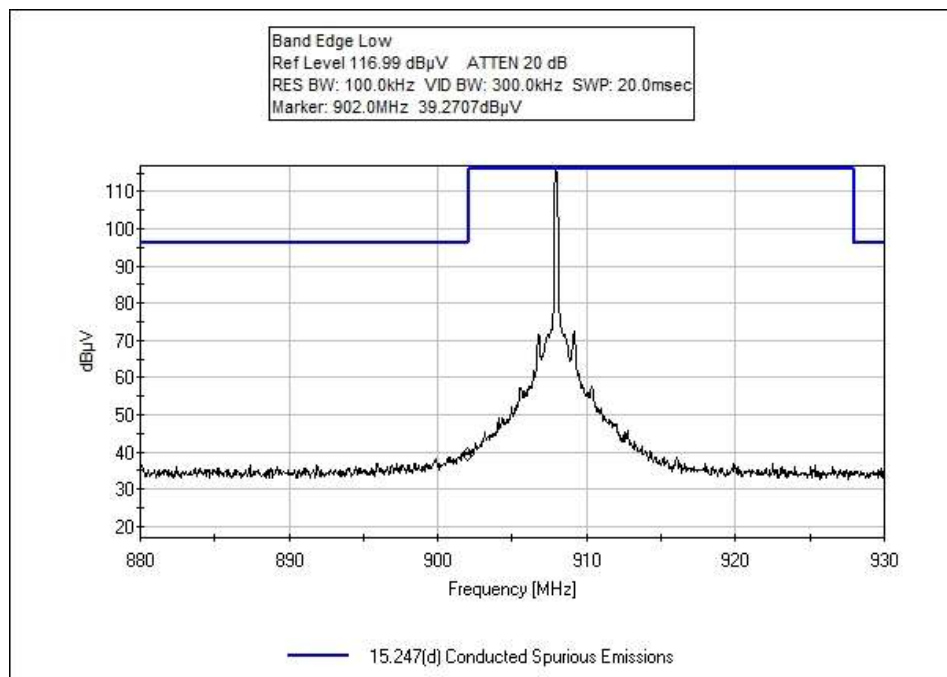
Band Edge

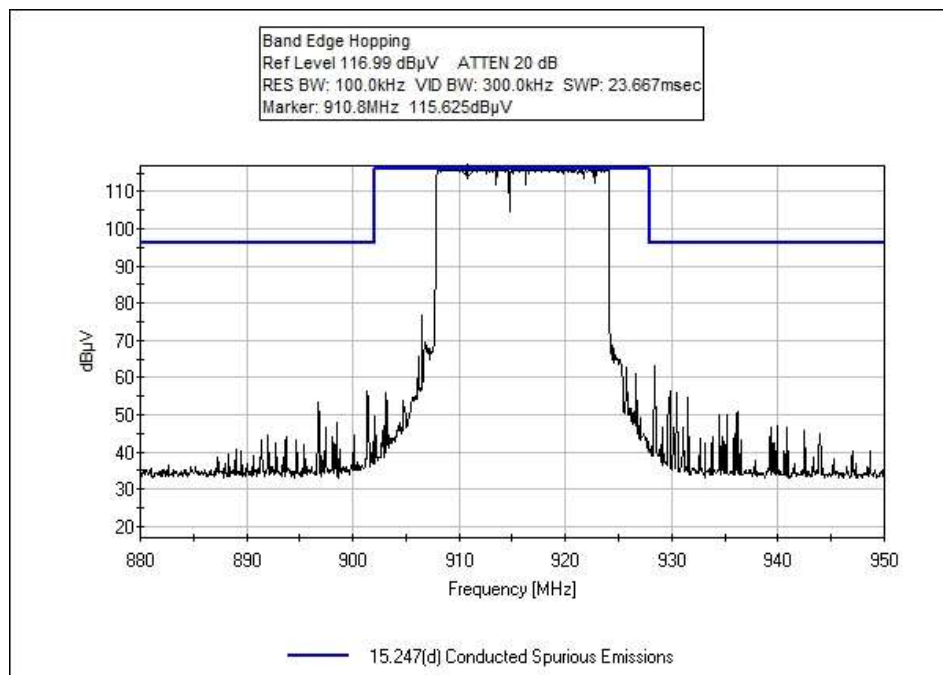
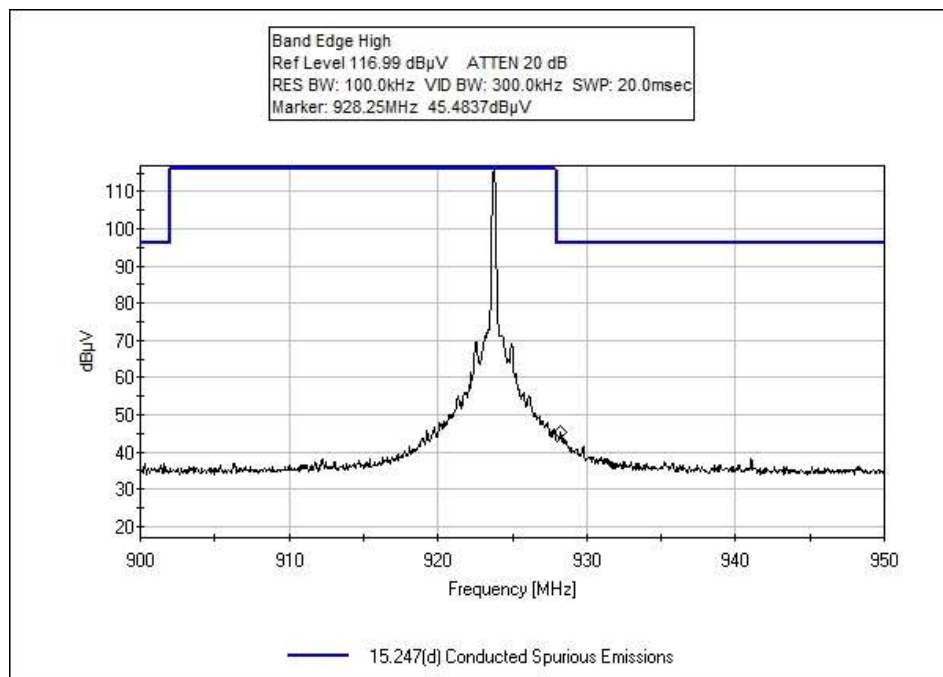
Band Edge Summary

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

Frequency (MHz)	Modulation	Measured (dBuV)	Limit (dBuV)	Results
902	Continuously Transmitting FSK	65.5	<116.1	Pass
928	Continuously Transmitting FSK	60.4	<116.1	Pass
902	Hopping FSK	78.6	<116.1	Pass
928	Hopping FSK	82.5	<116.1	Pass

Band Edge Plots





Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd DR SE • Bothell WA, 98021 • (425) 402-1717
 Customer: **Itron, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **102014** Date: 12/10/2018
 Test Type: **Conducted Emissions** Time: 12:25:05
 Tested By: Steven Pittsford Sequence#: 4
 Software: EMITest 5.03.11 115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Frequency Range: 908-923.8MHz
Frequency tested: 908, 923.8MHz & Hopping
Firmware power setting: Max Power
Protocol /MCS/Modulation: FSK
Duty Cycle: 100% (Test Mode)
Test Mode: Continuously transmitting
Test Setup: EUT is transmitting through a temporary antenna connector and is attached directly to the spectrum analyzer.
Modifications Added: None

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP07228	Attenuator	PE7004-20	11/30/2017	11/30/2019
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019

Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBμV	T1 dB	dB	dB	dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	928.390M	62.5	+20.0				+0.0	82.5	116.1	-33.6	Anten
2	900.670M	58.6	+20.0				+0.0	78.6	116.1	-37.5	Anten
3	928.250M	45.5	+20.0				+0.0	65.5	116.1	-50.6	Anten
4	902.000M	40.4	+20.0				+0.0	60.4	116.1	-55.7	Anten

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Itron, Inc.**
 Specification: **15.247(d) / Radiated Spurious Emissions**
 Work Order #: **102014** Date: 12/12/2018
 Test Type: **Maximized Emissions** Time: 07:47:04
 Tested By: Matthew Harrison / Steven Pittsford Sequence#: 16
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20-22°C
 Humidity: 33%
 Pressure: 100.8-102.7kPa

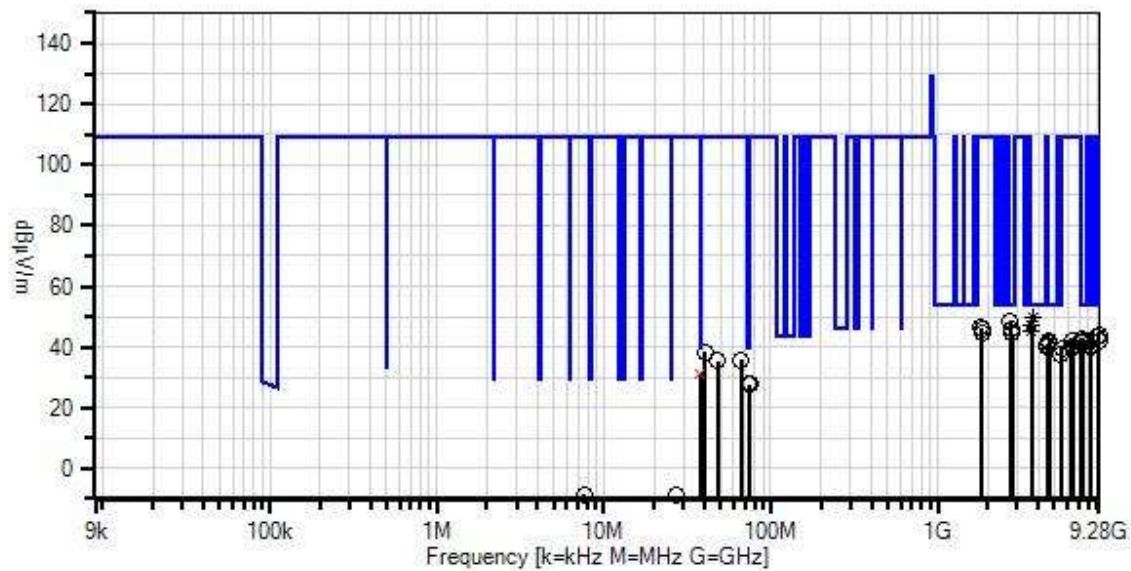
 Frequency Range: 9kHz to 10GHz
 Frequency tested: 908, 916, 923.8MHz
 Firmware power setting: Max Power

 Protocol /MCS/Modulation: Continuous FSK

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting GFSK on single channel and Hopping mode both investigated, worst case data reported.
 Test Setup: EUT is transmitting sitting on foam table. X, Y, Z axis investigated, both antenna polarities investigated, worst case data reported.
 Modifications Added: None
 Test Method: ANSI C63.10 (2013)

Itron, Inc WO#: 102014 Sequence#: 16 Date: 12/12/2018
 15.247(d) / Radiated Spurious Emissions Test Distance: 3 Meters Vert



— Readings
 × QP Readings
 ▼ Ambient
 — 1 - 15.247(d) / Radiated Spurious Emissions
 ○ Peak Readings
 * Average Readings
 Software Version: 5.03.11

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019
T2	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T3	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T5	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T6	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T7	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020
T8	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T9	AN03170	High Pass Filter	HM1155-11SS	11/27/2017	11/27/2019
T10	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T11	AN03540	Preamplifier	83017A	5/2/2017	5/2/2019
T12	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020
T13	AN45% DCCF	Test Data Adjustment		12/11/2018	12/11/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	3695.200M Ave	52.7	+0.0 +0.4 +0.9 -6.9	+0.0 +0.0 +30.8	+0.0 +0.0 -33.4	+0.0 +3.8 +1.3	+0.0 107	49.6 X	54.0	-4.4	Vert 162
^	3695.200M	54.8	+0.0 +0.4 +0.9 -6.9	+0.0 +0.0 +30.8	+0.0 +0.0 -33.4	+0.0 +3.8 +1.3	+0.0 107	51.7 X	54.0	-2.3	Vert 162
3	2724.015M	55.7	+0.0 +0.5 +0.6 -6.9	+0.0 +0.0 +28.8	+0.0 +0.0 -33.8	+0.0 +2.6 +1.1	+0.0 340	48.6 Y	54.0	-5.4	Horiz 149
4	3632.110M Ave	50.5	+0.0 +0.4 +0.9 -6.9	+0.0 +0.0 +30.8	+0.0 +0.0 -33.4	+0.0 +3.7 +1.3	+0.0 97	47.3 X	54.0	-6.7	Vert 170
^	3632.205M	53.3	+0.0 +0.4 +0.9 -6.9	+0.0 +0.0 +30.8	+0.0 +0.0 -33.4	+0.0 +3.7 +1.3	+0.0 91	50.1 X	54.0	-3.9	Vert 170
6	2748.010M	53.2	+0.0 +0.5 +0.6 -6.9	+0.0 +0.0 +28.8	+0.0 +0.0 -33.8	+0.0 +2.6 +1.1	+0.0 360	46.1 Y	54.0	-7.9	Horiz 163

7	3664.004M	48.7	+0.0	+0.0	+0.0	+0.0	+0.0	45.5	54.0	-8.5	Vert
	Ave		+0.4	+0.0	+0.0	+3.7	112		X		167
			+0.9	+30.8	-33.4	+1.3					
			-6.9								
^	3664.085M	52.1	+0.0	+0.0	+0.0	+0.0	+0.0	48.9	54.0	-5.1	Vert
			+0.4	+0.0	+0.0	+3.7	112		X		167
			+0.9	+30.8	-33.4	+1.3					
			-6.9								
9	37.760M	13.2	+11.6	+5.9	+0.3	+0.3	+0.0	31.4	40.0	-8.6	Vert
	QP		+0.1	+0.0	+0.0	+0.0					120
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	37.661M	18.6	+11.7	+5.9	+0.3	+0.3	+0.0	36.9	40.0	-3.1	Vert
			+0.1	+0.0	+0.0	+0.0	186				100
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
11	2771.140M	51.3	+0.0	+0.0	+0.0	+0.0	+0.0	44.3	54.0	-9.7	Horiz
			+0.5	+0.0	+0.0	+2.6	338		Y		177
			+0.6	+28.9	-33.8	+1.1					
			-6.9								
12	9161.015M	37.5	+0.0	+0.0	+0.0	+0.0	+0.0	43.9	54.0	-10.1	Vert
			+0.8	+0.0	+0.0	+6.2					157
			+0.6	+37.2	-33.9	+2.4					
			-6.9								
13	9078.545M	37.4	+0.0	+0.0	+0.0	+0.0	+0.0	43.6	54.0	-10.4	Vert
			+0.7	+0.0	+0.0	+6.2					152
			+0.6	+37.1	-33.9	+2.4					
			-6.9								
14	7263.815M	38.4	+0.0	+0.0	+0.0	+0.0	+0.0	42.9	54.0	-11.1	Vert
			+0.8	+0.0	+0.0	+5.4	360				152
			+0.6	+36.4	-33.9	+2.1					
			-6.9								
15	4619.080M	43.2	+0.0	+0.0	+0.0	+0.0	+0.0	42.1	54.0	-11.9	Vert
			+0.5	+0.0	+0.0	+4.0			X		162
			+0.8	+32.1	-33.1	+1.5					
			-6.9								
16	8244.865M	37.6	+0.0	+0.0	+0.0	+0.0	+0.0	42.0	54.0	-12.0	Vert
			+0.7	+0.0	+0.0	+5.7	96				142
			+0.5	+36.9	-34.8	+2.3					
			-6.9								
17	7391.385M	37.3	+0.0	+0.0	+0.0	+0.0	+0.0	41.9	54.0	-12.1	Vert
			+1.0	+0.0	+0.0	+5.4	218				161
			+0.5	+36.7	-34.3	+2.2					
			-6.9								
18	7327.005M	37.3	+0.0	+0.0	+0.0	+0.0	+0.0	41.7	54.0	-12.3	Vert
			+0.9	+0.0	+0.0	+5.4	265				139
			+0.5	+36.5	-34.1	+2.1					
			-6.9								
19	74.000M	13.8	+6.9	+5.9	+0.5	+0.5	+0.0	27.7	40.0	-12.3	Horiz
			+0.1	+0.0	+0.0	+0.0	360		Y		103
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

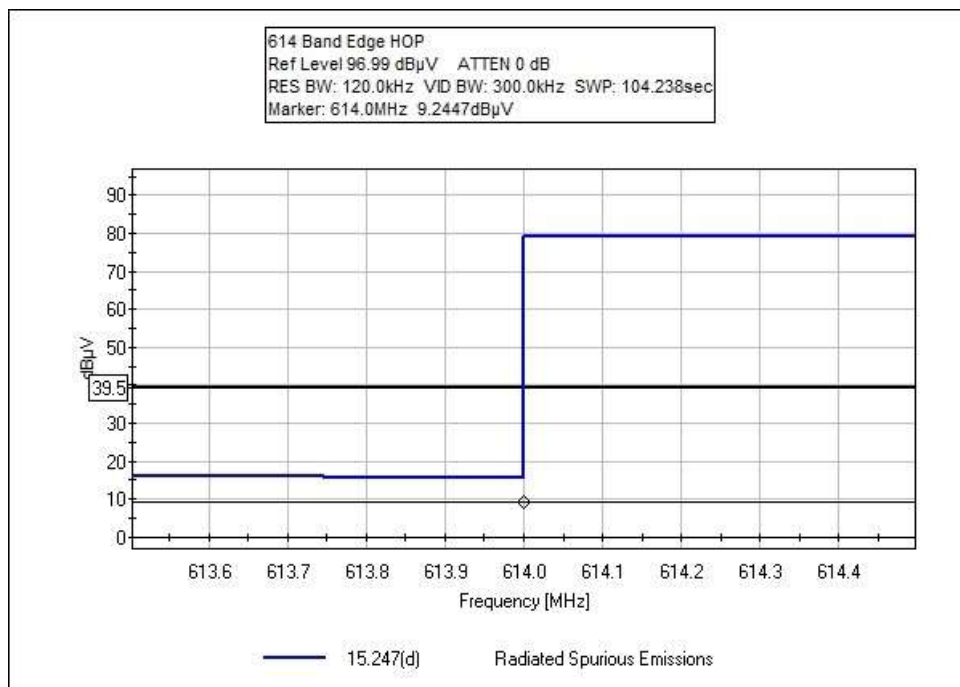
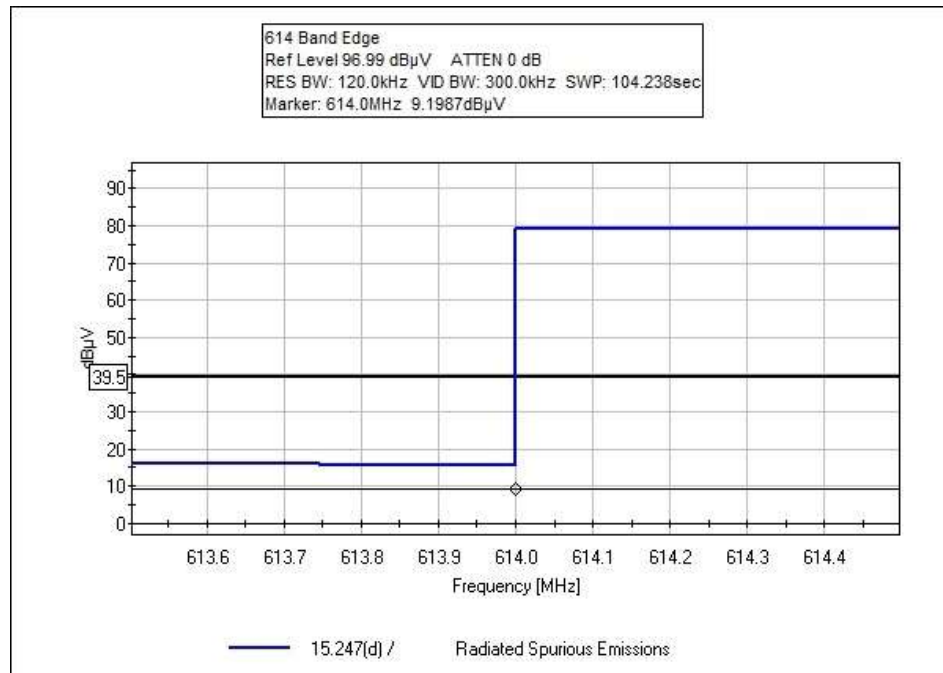
20	75.000M	13.8	+6.9 +0.1 +0.0 +0.0	+5.9 +0.0 +0.0 +0.0	+0.5 +0.0 +0.0 +0.0	+0.5 +0.0 +0.0 +0.0	27.7 360	40.0	-12.3	Vert 103
21	4579.700M	42.3	+0.0 +0.5 +0.8 -6.9	+0.0 +0.0 +32.0 -33.1	+0.0 +0.0 -33.1 +1.5	+0.0 +4.0 +1.5	41.1 239	54.0 X	-12.9	Vert 140
22	4539.755M	42.2	+0.0 +0.5 +0.8 -6.9	+0.0 +0.0 +32.0 -33.1	+0.0 +0.0 -33.1 +1.5	+0.0 +3.9 +1.5	40.9 43	54.0 X	-13.1	Vert 170
23	8313.955M	35.4	+0.0 +0.8 +0.5 -6.9	+0.0 +0.0 +37.0 -34.6	+0.0 +0.0 -34.6 +2.3	+0.0 +5.8 +2.3	40.3 133	54.0	-13.7	Vert 161
24	8171.815M	35.6	+0.0 +0.7 +0.5 -6.9	+0.0 +0.0 +36.9 -34.7	+0.0 +0.0 -34.7 +2.3	+0.0 +5.7 +2.3	40.1 360	54.0	-13.9	Vert 152
25	4539.970M	41.1	+0.0 +0.5 +0.8 -6.9	+0.0 +0.0 +32.0 -33.1	+0.0 +0.0 -33.1 +1.5	+0.0 +3.9 +1.5	39.8 116	54.0 Y	-14.2	Horiz 156
26	5447.755M	35.6	+0.0 +0.7 +1.0 -6.9	+0.0 +0.0 +34.0 -33.1	+0.0 +0.0 -33.1 +1.8	+0.0 +4.5 +1.8	37.6	54.0	-16.4	Vert 152
27	1816.060M	57.2	+0.0 +0.4 +0.7 -6.9	+0.0 +0.0 +26.5 -34.5	+0.0 +0.0 -34.5 +0.7	+0.0 +2.3 +0.7	46.4	109.3 Y	-62.9	Vert 195
28	1847.625M	56.6	+0.0 +0.4 +0.7 -6.9	+0.0 +0.0 +26.8 -34.5	+0.0 +0.0 -34.5 +0.7	+0.0 +2.3 +0.7	46.1 288	109.3 Y	-63.2	Vert 136
29	1832.085M	55.6	+0.0 +0.4 +0.7 -6.9	+0.0 +0.0 +26.6 -34.5	+0.0 +0.0 -34.5 +0.7	+0.0 +2.3 +0.7	44.9 15	109.3 Y	-64.4	Horiz 121
30	6355.945M	38.9	+0.0 +0.6 +0.5 -6.9	+0.0 +0.0 +35.3 -33.5	+0.0 +0.0 -33.5 +1.9	+0.0 +5.3 +1.9	42.1	109.3	-67.2	Vert 152
31	9238.285M	35.4	+0.0 +0.9 +0.6 -6.9	+0.0 +0.0 +37.2 -33.8	+0.0 +0.0 -33.8 +2.5	+0.0 +6.2 +2.5	42.1 42	109.3	-67.2	Vert 161
32	6466.015M	36.7	+0.0 +0.6 +0.6 -6.9	+0.0 +0.0 +35.5 -33.6	+0.0 +0.0 -33.6 +1.9	+0.0 +5.5 +1.9	40.3 360	109.3	-69.0	Vert 154

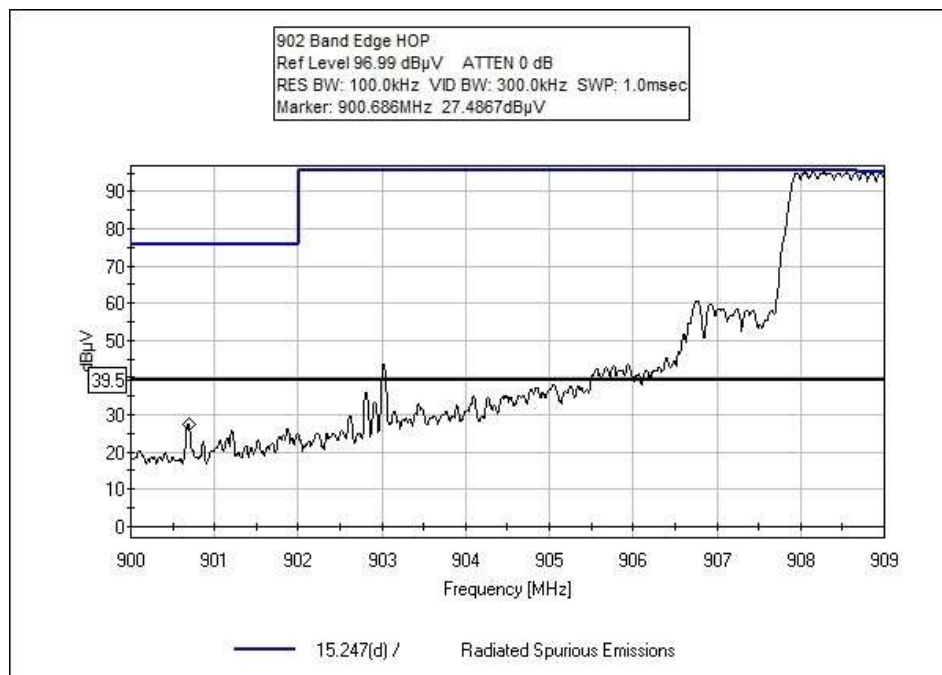
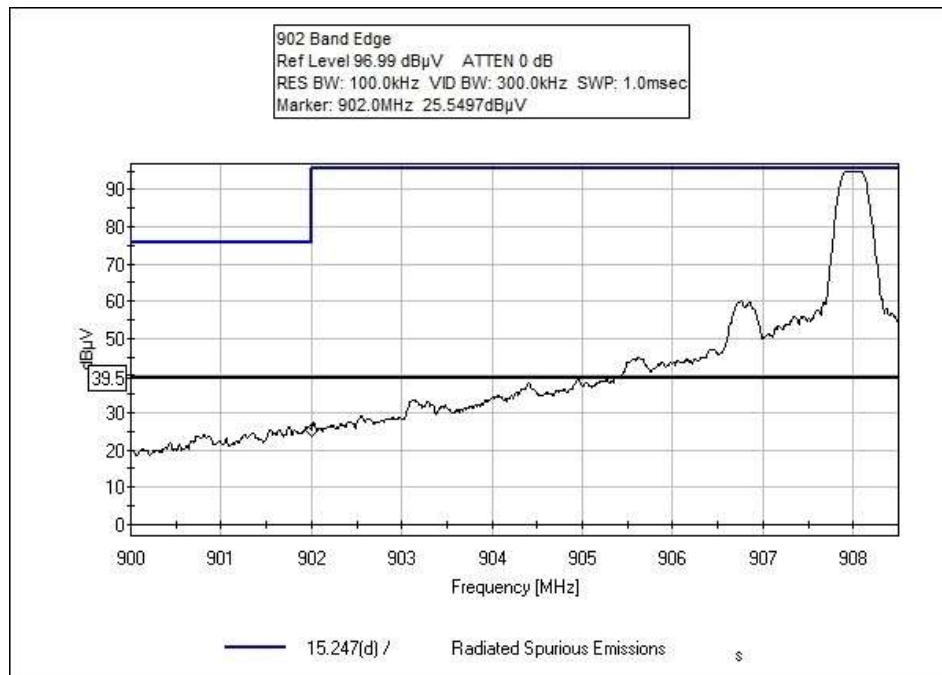
33	6412.075M	36.7	+0.0	+0.0	+0.0	+0.0	+0.0	40.0	109.3	-69.3	Vert
			+0.6	+0.0	+0.0	+5.4	338				139
			+0.5	+35.4	-33.6	+1.9					
			-6.9								
34	5542.650M	37.7	+0.0	+0.0	+0.0	+0.0	+0.0	39.7	109.3	-69.6	Vert
			+0.7	+0.0	+0.0	+4.5	227				162
			+0.8	+34.3	-33.2	+1.8					
			-6.9								
35	5494.395M	37.4	+0.0	+0.0	+0.0	+0.0	+0.0	39.5	109.3	-69.8	Vert
			+0.7	+0.0	+0.0	+4.5	360				140
			+0.9	+34.2	-33.1	+1.8					
			-6.9								
36	40.350M	21.5	+10.2	+5.9	+0.3	+0.3	+0.0	38.3	109.3	-71.0	Vert
			+0.1	+0.0	+0.0	+0.0	360				103
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
37	66.320M	21.8	+7.0	+5.9	+0.4	+0.4	+0.0	35.6	109.3	-73.7	Vert
			+0.1	+0.0	+0.0	+0.0	360				103
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
38	47.980M	21.3	+7.2	+5.9	+0.4	+0.4	+0.0	35.3	109.3	-74.0	Vert
			+0.1	+0.0	+0.0	+0.0	360				103
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
39	7.583M	22.1	+0.0	+0.0	+0.0	+0.0	-40.0	-8.4	109.3	-117.7	Para
			+0.0	+0.0	+9.4	+0.1					104
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
40	27.343M	24.3	+0.0	+0.0	+0.0	+0.0	-40.0	-9.0	109.3	-118.3	Perp
			+0.1	+0.0	+6.3	+0.3					104
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
41	23.970M	19.8	+0.0	+0.0	+0.0	+0.0	-40.0	-12.6	109.3	-121.9	Para
			+0.1	+0.0	+7.2	+0.3					104
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

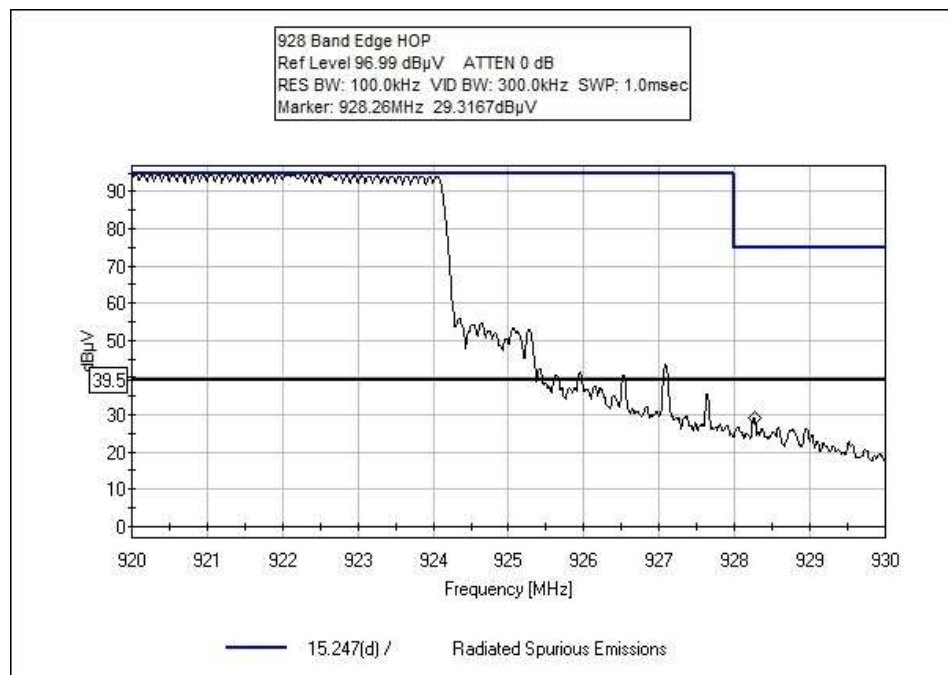
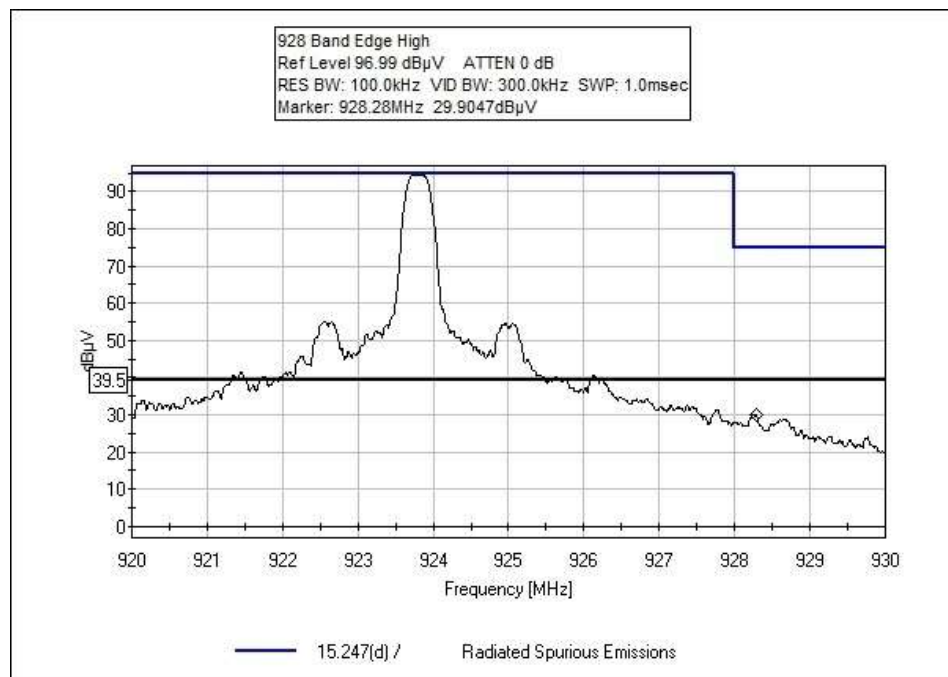
Band Edge

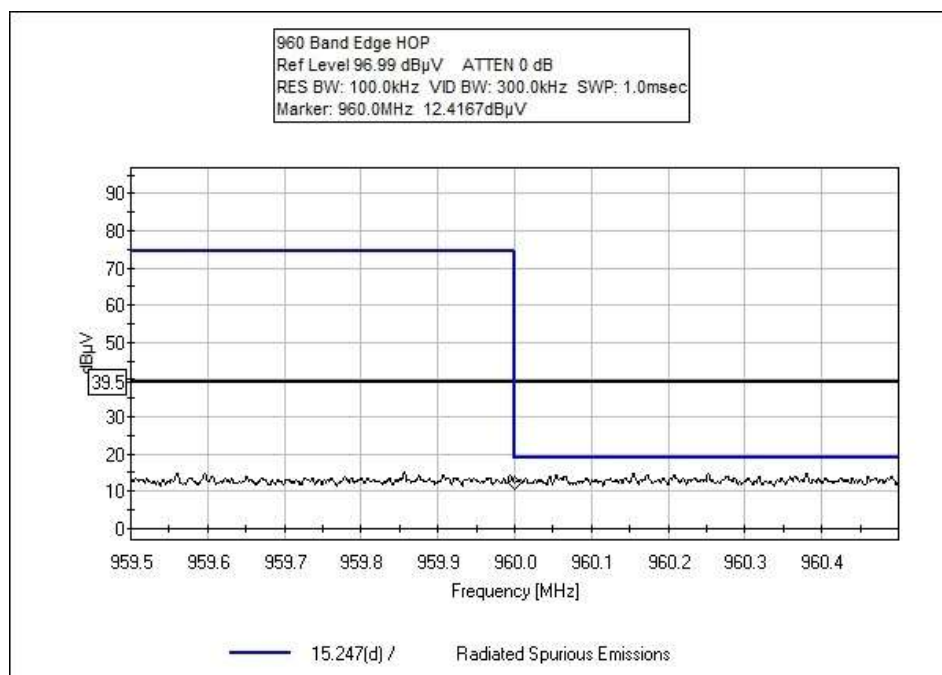
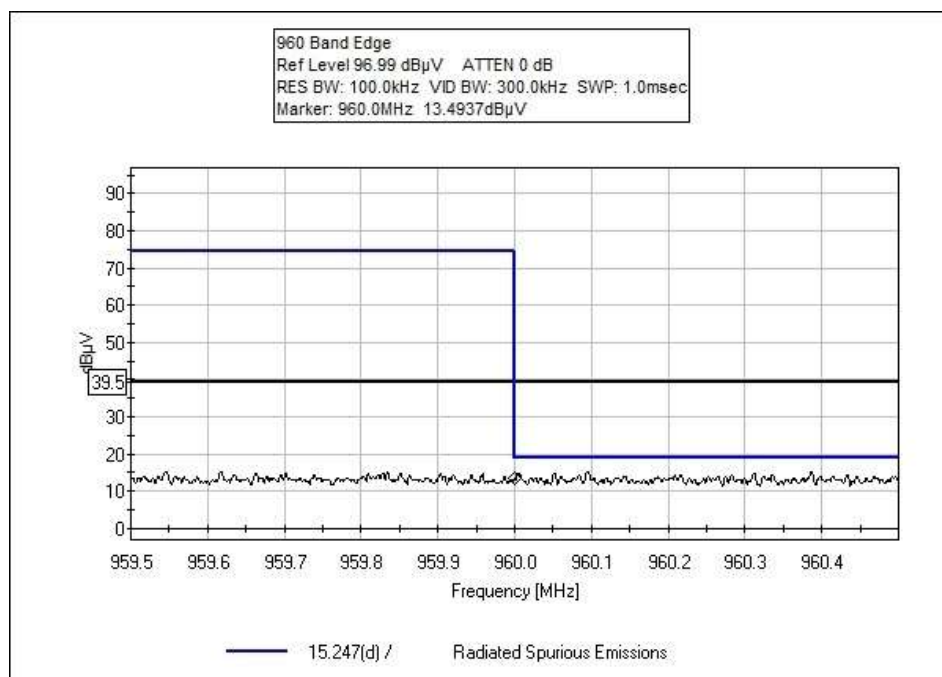
Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	Continuously Transmitting FSK	Integral	39.4	<46	Pass
902	Continuously Transmitting FSK	Integral	60.8	<109.3	Pass
928	Continuously Transmitting FSK	Integral	64.4	<109.3	Pass
960	Continuously Transmitting FSK	Integral	48.4	<54	Pass
614	Hopping FSK	Integral	39.4	<46	Pass
902	Hopping FSK	Integral	61	<109.3	Pass
928	Hopping FSK	Integral	63.8	<109.3	Pass
960	Hopping FSK	Integral	48.4	<54	Pass

Band Edge Plots









Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Itron, Inc.**
 Specification: **15.247(d) / Radiated Spurious Emissions**
 Work Order #: **102014** Date: 12/11/2018
 Test Type: **Maximized Emissions** Time: 14:25:13
 Tested By: Matthew Harrison / Steven Pittsford Sequence#: 15
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 22°C
 Humidity: 33%
 Pressure: 100.8kPa

 Frequency Range: Band Edge
 Frequency tested: 908, 923.8MHz
 Firmware power setting: Max Power

 Protocol /MCS/Modulation: Continuous FSK and Hopping FSK

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting GFSK on single channel and Hopping mode both investigated, worst case data reported.
 Test Setup: EUT is transmitting sitting on foam table 80cm high. X, Y, Z axis investigated, both antenna polarities investigated, worst case data reported.
 Modifications Added: None
 Test Method: ANSI C63.10 (2013)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019
T2	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T3	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T5	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T6	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019

Measurement Data:

Reading listed by margin.

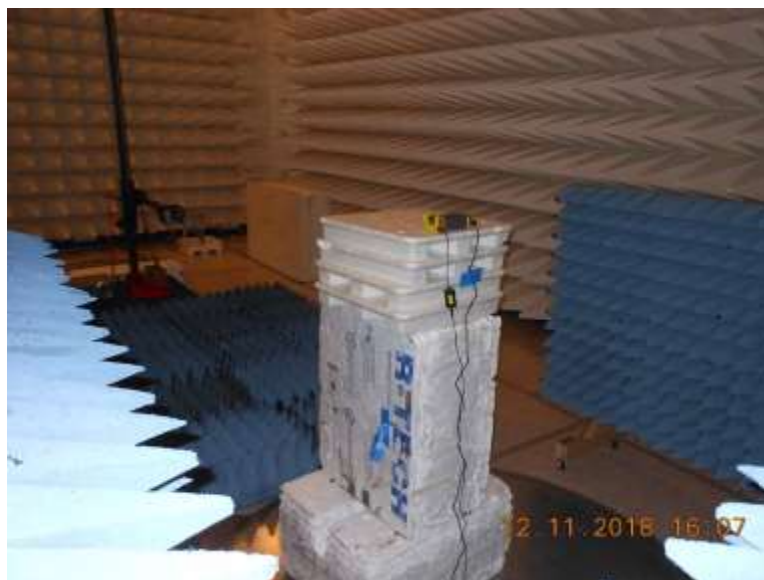
Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	960.000M	13.5	+24.9 +0.4	+5.9 +0.0	+1.6	+2.1	+0.0 339	48.4	54.0	-5.6	Vert 99
2	614.000M QP	9.2	+21.2 +0.3	+5.9 +0.0	+1.3	+1.5	+0.0 339	39.4	46.0 HOP	-6.6	Vert 99
3	614.000M QP	9.2	+21.2 +0.3	+5.9 +0.0	+1.3	+1.5	+0.0 339	39.4	46.0	-6.6	Vert 99
4	960.000M	12.4	+24.9 +0.4	+5.9 +0.0	+1.6	+2.1	+0.0 339	47.3	54.0 HOP	-6.7	Vert 99
5	928.280M	29.9	+24.6 +0.4	+5.9 +0.0	+1.6	+2.0	+0.0 339	64.4	109.3	-44.9	Vert 99
6	928.260M	29.3	+24.6 +0.4	+5.9 +0.0	+1.6	+2.0	+0.0 339	63.8	109.3 HOP	-45.5	Vert 99
7	900.686M	27.5	+23.8 +0.3	+5.9 +0.0	+1.5	+2.0	+0.0 339	61.0	109.3 HOP	-48.3	Vert 99
8	902.000M	27.3	+23.8 +0.3	+5.9 +0.0	+1.5	+2.0	+0.0 339	60.8	109.3	-48.5	Vert 99

Test Setup Photo(s)



Below 1GHz



Above 1GHz, Cone placement



X Axis



Y Axis



Z Axis

15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
 Customer: **Itron, Inc.**
 Specification: **15.207 AC Mains - Quasi-peak**
 Work Order #: **102014**
 Test Type: **Conducted Emissions**
 Tested By: Steven Pittsford
 Software: EMITest 5.03.11

Date: 12/11/2018
 Time: 08:40:05
 Sequence#: 5
 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20°C
 Humidity: 33%
 Pressure: 101.6kPa

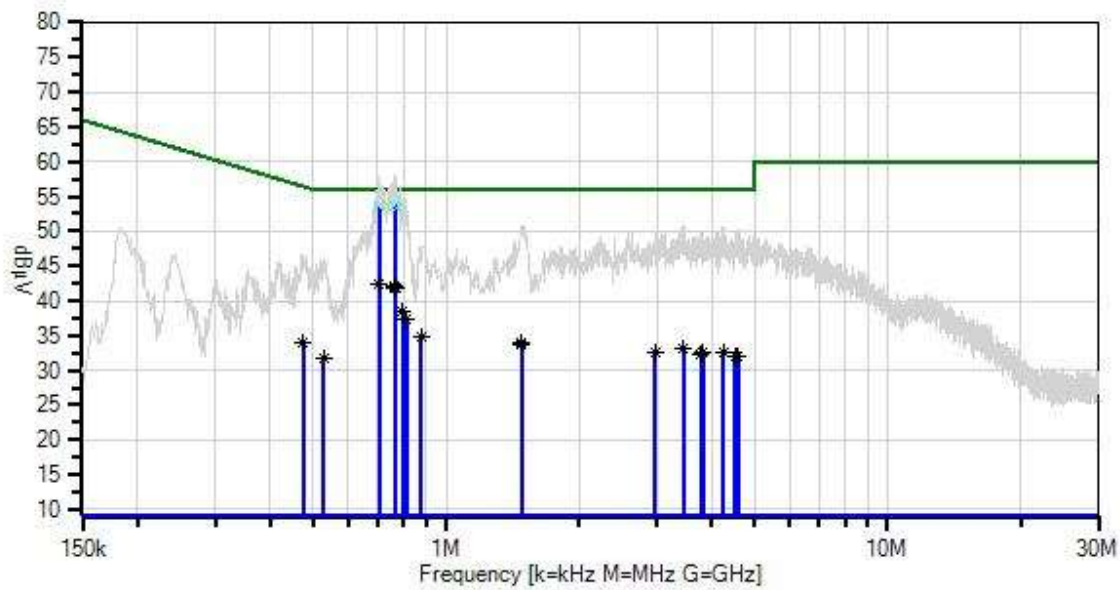
 Frequency Range: 0.15-30MHz

 Frequency tested: 916MHz
 Firmware power setting: Max User Allowed
 Protocol /MCS/Modulation: FSK

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting
 Test Setup: EUT connected to USB AC Adapter via USB cable. USB AC Adapter connected to AC mains through LISN.
 Modifications Added: None
 Test Method: ANSI C63.10 (2013)

Itron, Inc W/O#: 102014 Sequence#: 5 Date: 12/11/2018
15.207 AC Mains - Quasi-peak Test Lead: 115VAC 60Hz Line



— Sweep Data
× QP Readings
Software Version: 5.03.11
— Readings
* Average Readings
— 1 - 15.207 AC Mains - Quasi-peak
○ Peak Readings
▼ Ambient

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T2	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T4	AN01311	50uH LISN-Line1 (L)	3816/2	3/16/2018	3/16/2020
	AN01311	50uH LISN-Line2 (N)	3816/2	3/16/2018	3/16/2020
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/15/2018	1/15/2020

Measurement Data:

Reading listed by margin.

Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	765.943k	44.1	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	53.7	56.0	-2.3	Line
2	705.585k	43.9	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	53.5	56.0	-2.5	Line
3	771.034k	43.6	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	53.2	56.0	-2.8	Line
4	705.585k	32.8	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	42.4	46.0	-3.6	Line
^	705.585k	48.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	57.8	46.0	+11.8	Line
6	765.943k	32.6	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	42.2	46.0	-3.8	Line
7	765.943k	32.4	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	42.0	46.0	-4.0	Line
^	765.943k	48.7	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	58.3	46.0	+12.3	Line
9	771.034k	32.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	41.9	46.0	-4.1	Line
^	771.033k	48.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	57.8	46.0	+11.8	Line
11	795.759k	28.8	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	38.4	46.0	-7.6	Line
^	795.758k	44.8	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	54.4	46.0	+8.4	Line
13	812.485k	27.6	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	37.2	46.0	-8.8	Line
14	877.080k	25.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	34.8	46.0	-11.2	Line
^	877.080k	39.4	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	49.0	46.0	+3.0	Line

16	1.480M	24.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	33.9	46.0	-12.1	Line
17	1.485M	24.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	33.7	46.0	-12.3	Line
^	1.485M	41.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	51.0	46.0	+5.0	Line
^	1.480M	41.0	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.6	46.0	+4.6	Line
20	473.910k	24.3	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	34.0	46.4	-12.4	Line
^	473.910k	37.3	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	47.0	46.4	+0.6	Line
22	3.454M	23.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	33.0	46.0	-13.0	Line
^	3.454M	41.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	51.0	46.0	+5.0	Line
24	3.812M	23.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.7	46.0	-13.3	Line
^	3.812M	40.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.9	46.0	+3.9	Line
26	4.237M	22.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.5	46.0	-13.5	Line
^	4.237M	41.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.7	46.0	+4.7	Line
28	2.974M	22.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.5	46.0	-13.5	Line
^	2.974M	40.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.9	46.0	+3.9	Line
30	3.769M	22.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.4	46.0	-13.6	Line
^	3.769M	40.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.9	46.0	+3.9	Line
32	4.590M	22.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.1	46.0	-13.9	Line
^	4.590M	40.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.4	46.0	+4.4	Line
34	4.518M	22.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.9	46.0	-14.1	Line
^	4.518M	40.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.1	46.0	+4.1	Line
36	527.450k	22.0	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	31.7	46.0	-14.3	Line
^	527.450k	36.3	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	46.0	46.0	+0.0	Line



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC
Customer: **Itron, Inc.**
Specification: **15.207 AC Mains - Quasi-peak**
Work Order #: **102014** Date: 12/11/2018
Test Type: **Conducted Emissions** Time: 08:57:48
Tested By: Steven Pittsford Sequence#: 6
Software: EMITest 5.03.11 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Temperature: 20°C
Humidity: 33%
Pressure: 101.6kPa

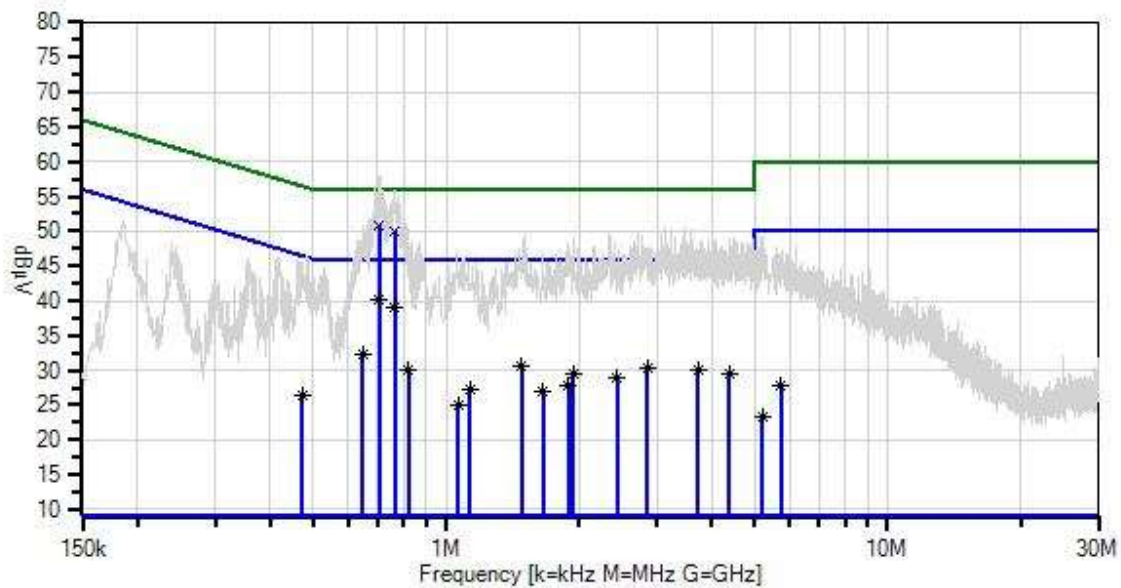
Frequency Range: 0.15-30MHz

Frequency tested: 916MHz
Firmware power setting: Max User Allowed
Protocol /MCS/Modulation: FSK

Duty Cycle: 100% (Test Mode)

Test Mode: Continuously transmitting
Test Setup: EUT connected to USB AC Adapter via USB cable. USB AC Adapter connected to AC mains through LISN.
Modifications Added: None
Test Method: ANSI C63.10 (2013)

Itron, Inc W/O#: 102014 Sequence#: 6 Date: 12/11/2018
15.207 AC Mains - Quasi-peak Test Lead: 115VAC 60Hz Neutral



— Sweep Data
x QP Readings
Software Version: 5.03.11

— 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
T1	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T2	ANP06515	Cable	Heliac	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
	AN01311	50uH LISN-Line1 (L)	3816/2	3/16/2018	3/16/2020
T4	AN01311	50uH LISN-Line2 (N)	3816/2	3/16/2018	3/16/2020
	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T5	AN02611	High Pass Filter	HE9615-150K-50-720B	1/15/2018	1/15/2020

Measurement Data:

Reading listed by margin.

Test Lead: Neutral

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	707.100k QP	41.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.8	56.0	-5.2	Neutr
2	707.100k Ave	30.5	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	40.1	46.0	-5.9	Neutr
^	707.100k	47.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	56.6	46.0	+10.6	Neutr
4	763.900k QP	40.4	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.0	56.0	-6.0	Neutr
5	763.900k Ave	29.5	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	39.1	46.0	-6.9	Neutr
^	763.900k	46.8	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	56.4	46.0	+10.4	Neutr
7	648.400k Ave	22.5	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	32.2	46.0	-13.8	Neutr
^	648.400k	41.5	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	51.2	46.0	+5.2	Neutr
9	1.486M Ave	20.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.5	46.0	-15.5	Neutr
^	1.486M	41.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.9	46.0	+4.9	Neutr
11	2.856M Ave	20.6	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.2	46.0	-15.8	Neutr
^	2.856M	38.9	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.5	46.0	+2.5	Neutr
13	822.300k Ave	20.5	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	30.1	46.0	-15.9	Neutr
^	822.300k	39.1	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	48.7	46.0	+2.7	Neutr

15	3.712M	20.5	+9.1	+0.1	+0.0	+0.3	+0.0	30.1	46.0	-15.9	Neutr
Ave			+0.1								
^	3.712M	40.3	+9.1	+0.1	+0.0	+0.3	+0.0	49.9	46.0	+3.9	Neutr
			+0.1								
17	4.384M	19.9	+9.1	+0.1	+0.0	+0.3	+0.0	29.5	46.0	-16.5	Neutr
Ave			+0.1								
^	4.384M	40.3	+9.1	+0.1	+0.0	+0.3	+0.0	49.9	46.0	+3.9	Neutr
			+0.1								
19	1.944M	19.8	+9.1	+0.1	+0.0	+0.3	+0.0	29.4	46.0	-16.6	Neutr
Ave			+0.1								
^	1.944M	40.6	+9.1	+0.1	+0.0	+0.3	+0.0	50.2	46.0	+4.2	Neutr
			+0.1								
21	2.444M	19.3	+9.1	+0.1	+0.0	+0.3	+0.0	28.9	46.0	-17.1	Neutr
Ave			+0.1								
^	2.444M	38.2	+9.1	+0.1	+0.0	+0.3	+0.0	47.8	46.0	+1.8	Neutr
			+0.1								
23	1.892M	18.1	+9.1	+0.1	+0.0	+0.3	+0.0	27.7	46.0	-18.3	Neutr
Ave			+0.1								
^	1.892M	39.3	+9.1	+0.1	+0.0	+0.3	+0.0	48.9	46.0	+2.9	Neutr
			+0.1								
25	1.130M	17.6	+9.1	+0.0	+0.0	+0.3	+0.0	27.2	46.0	-18.8	Neutr
Ave			+0.2								
^	1.130M	39.3	+9.1	+0.0	+0.0	+0.3	+0.0	48.9	46.0	+2.9	Neutr
			+0.2								
27	1.662M	17.5	+9.1	+0.1	+0.0	+0.3	+0.0	27.1	46.0	-18.9	Neutr
Ave			+0.1								
^	1.662M	38.5	+9.1	+0.1	+0.0	+0.3	+0.0	48.1	46.0	+2.1	Neutr
			+0.1								
29	471.400k	16.7	+9.1	+0.1	+0.0	+0.4	+0.0	26.5	46.5	-20.0	Neutr
Ave			+0.2								
^	471.400k	36.8	+9.1	+0.1	+0.0	+0.4	+0.0	46.6	46.5	+0.1	Neutr
			+0.2								
31	1.067M	15.4	+9.1	+0.0	+0.0	+0.3	+0.0	25.0	46.0	-21.0	Neutr
Ave			+0.2								
^	1.067M	39.0	+9.1	+0.0	+0.0	+0.3	+0.0	48.6	46.0	+2.6	Neutr
			+0.2								
33	5.736M	18.3	+9.1	+0.1	+0.0	+0.3	+0.0	27.9	50.0	-22.1	Neutr
Ave			+0.1								
^	5.736M	38.7	+9.1	+0.1	+0.0	+0.3	+0.0	48.3	50.0	-1.7	Neutr
			+0.1								
35	5.200M	13.8	+9.1	+0.1	+0.0	+0.3	+0.0	23.4	50.0	-26.6	Neutr
Ave			+0.1								
^	5.200M	38.5	+9.1	+0.1	+0.0	+0.3	+0.0	48.1	50.0	-1.9	Neutr
			+0.1								

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 $\text{dB}\mu\text{V}/\text{m}$, 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.