

Itron, 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 & 15.249

Report No.: 102206-5

Date of issue: March 25, 2019



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.



We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

Test Certificate # 803.05

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TABLE OF CONTENTS

Administrative Information	3
Test Report Information	3
Report Authorization	3
Test Facility Information	4
Software Versions	4
Site Registration & Accreditation Information	4
Summary of Results	5
Modifications During Testing	5
Conditions During Testing	5
Equipment Under Test	6
General Product Information	6
FCC Part 15 Subpart C	7
15.215(c) Occupied Bandwidth (20dB BW)	7
15.249(a) Field Strength of Fundamental	11
15.249(a) Radiated Emissions and Band Edge	21
15.207 AC Conducted Emissions	39
Supplemental Information	46
Measurement Uncertainty	46
Emissions Test Details	46

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 170692

REPORT PREPARED BY:

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

Project Number: 102206

DATE OF EQUIPMENT RECEIPT:
DATE(S) OF TESTING:

February 5, 2019
February 5-24, 2019

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
22116 23rd Drive S.E., Suite A
Canyon Park, Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.11

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	JAPAN
Canyon Park, Bothell, WA	US0081	US1022	A-0148

*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 - 15.249

Test Procedure	Description	Modifications	Results
15.215(c)	Occupied Bandwidth	NA	Pass
15.249(a)	Field Strength of Fundamental	NA	Pass
15.249(a)	Radiated Emissions and 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

The device tested in this report is for the External Antenna version of model IMRB. The Internal Antenna version on the IMRB has been previously tested in a separate report.

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 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR Transceiver Device For Communicating With Utility Meters	Itron, Inc.	IMRB	66031570

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	E6410	3XG40P1
AC Adapter for Laptop	Dell	DA130PE1-00	NA
Power Supply	Triad	WDU12-1200	NA
External Monopole Vehicle Mounted Antenna – 5dBi	PCTel	Z3182	NA

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR Transceiver Device For Communicating With Utility Meters	Itron, Inc.	IMRB	66031570

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	E6410	3XG40P1
AC Adapter for Laptop	Dell	DA130PE1-00	NA
Power Supply	Triad	WDU12-1200	NA
External Monopole Attached Antenna – 3dBi	L-Com	HG903RD-RSP	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	FSK
Maximum Duty Cycle:	100%
Antenna Type(s) and Gain:	External Monopole Vehicle Mounted, 5dBi gain and External Monopole Attached, 3dBi gain
Antenna Connection Type:	External Connector
Nominal Input Voltage:	12VDC Nominal (7 to 18VDC), 120VAC 60Hz through AC Adapter
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

15.215(c) Occupied Bandwidth (20dB BW)

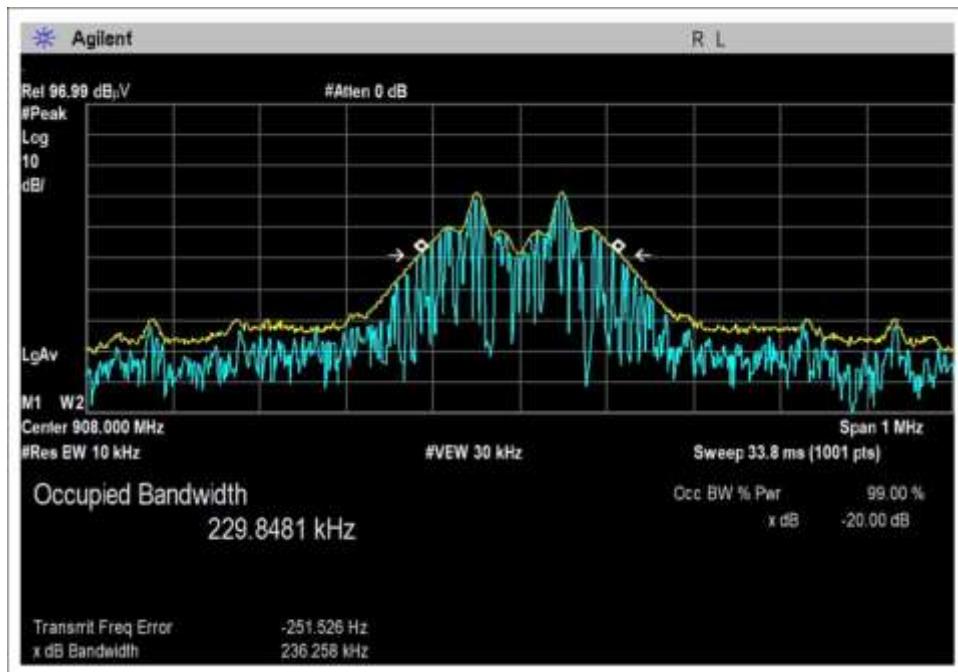
Test Setup/Conditions			
Test Location:	Canyon Park Lab C3	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	2/15/2019-2/24/2019
Configuration:	2		
Test Conditions:	Firmware power setting: Max Power Protocol /MCS/Modulation: FSK Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is on test table 80cm high. EUT is continuously transmitting through the vehicle mounted antenna.		

Environmental Conditions			
Temperature (°C)	20-22	Relative Humidity (%):	20-30

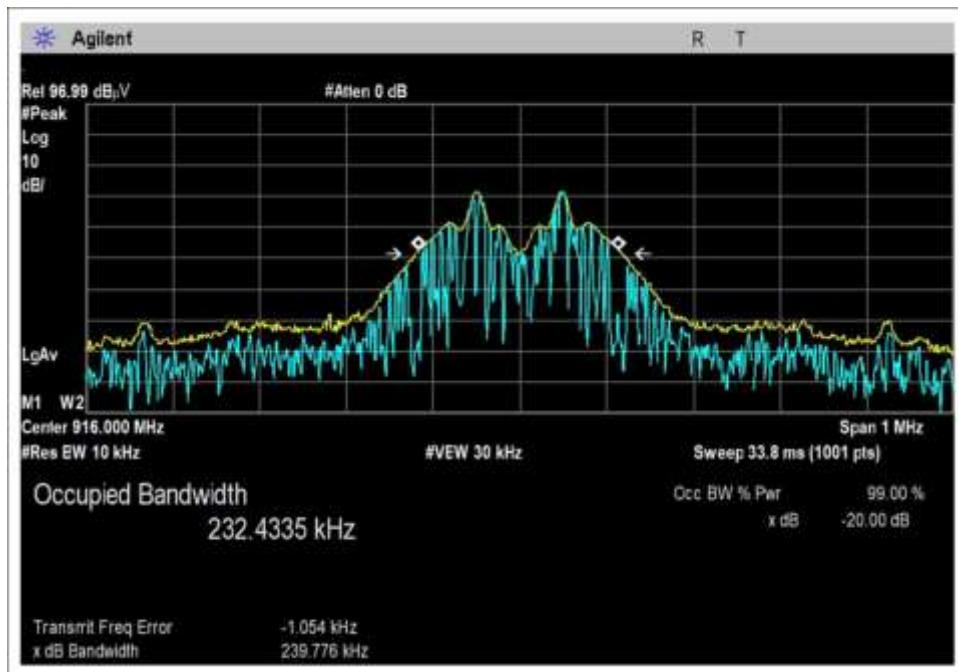
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/3/2017	11/3/2019
P06540	Cable	Andrews	Heliax	10/30/2017	10/30/2019
P05305	Cable	Andrews	ETSI-50T	10/24/2017	10/24/2019
02307	Preamp	HP	8447D	1/15/2018	1/15/2020
P05360	Cable	Belden	RG214	1/31/2018	1/31/2020
P06123	Attenuator	Aeroflex	18N-6	5/5/2017	5/5/2019
03628	Biconilog Antenna	ETS	3142E	6/7/2017	6/7/2019

Test Data Summary

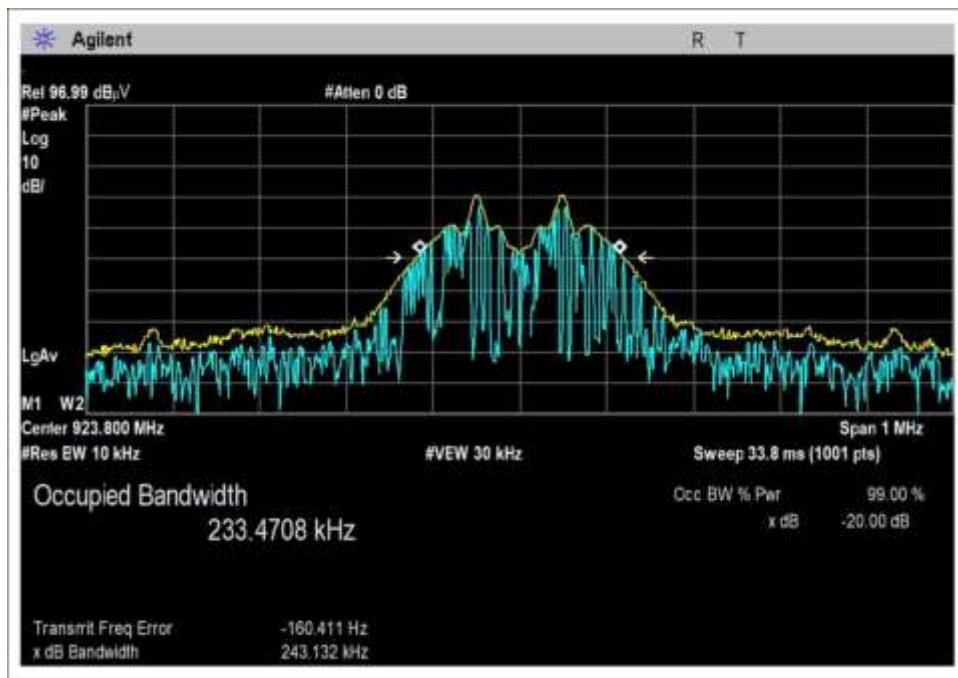
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
908	1	FSK	236.258	None	NA
916	1	FSK	239.776	None	NA
923.8	1	FSK	243.132	None	NA

Plot(s)


Low Channel

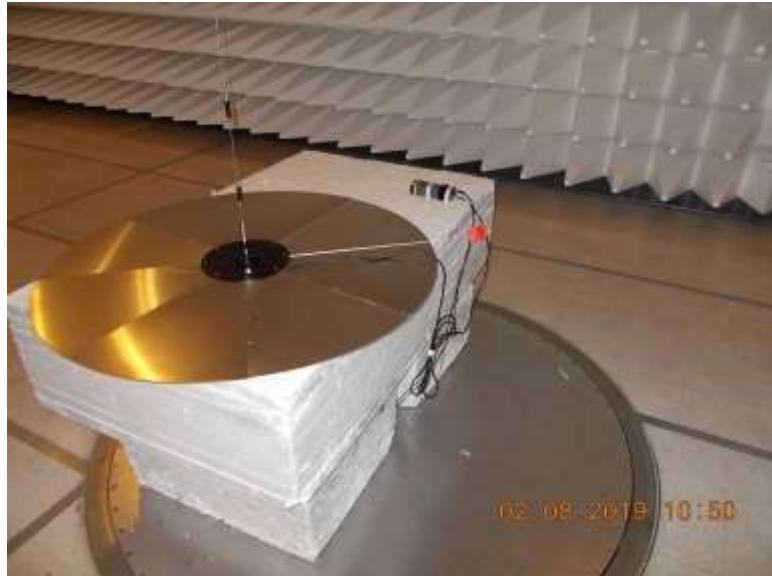


Middle Channel



High Channel

Test Setup Photo(s)



15.249(a) Field Strength of Fundamental

Test Data Summary – Radiated Field Strength Measurement					
Frequency (MHz)	Modulation	Ant. Type	Measured (dBuV/m @ 3m)	Limit (dBuV/m @ 3m)	Results
908	FSK	5dBi vehicle mounted	75.8	≤94	Pass
916	FSK	5dBi vehicle mounted	76.0	≤94	Pass
923.8	FSK	5dBi vehicle mounted	77.0	≤94	Pass
908	FSK	3dBi rubber duck	79.8	≤94	Pass
916	FSK	3dBi rubber duck	80.0	≤94	Pass
923.8	FSK	3dBi rubber duck	79.5	≤94	Pass

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBuV/m)	V _{Nominal} (dBuV/m)	V _{Maximum} (dBuV/m)	Max Deviation from V _{Nominal} (dB)
908	FSK (5dBi antenna)	75.9	75.8	75.9	0.1
916	FSK (5dBi antenna)	76.0	76.0	76.0	0.0
923.8	FSK (5dBi antenna)	77.3	77.0	77.3	0.3

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

Investigated minimum and maximum voltage for both AC and DC input, worst case reported.

Parameter Definitions:

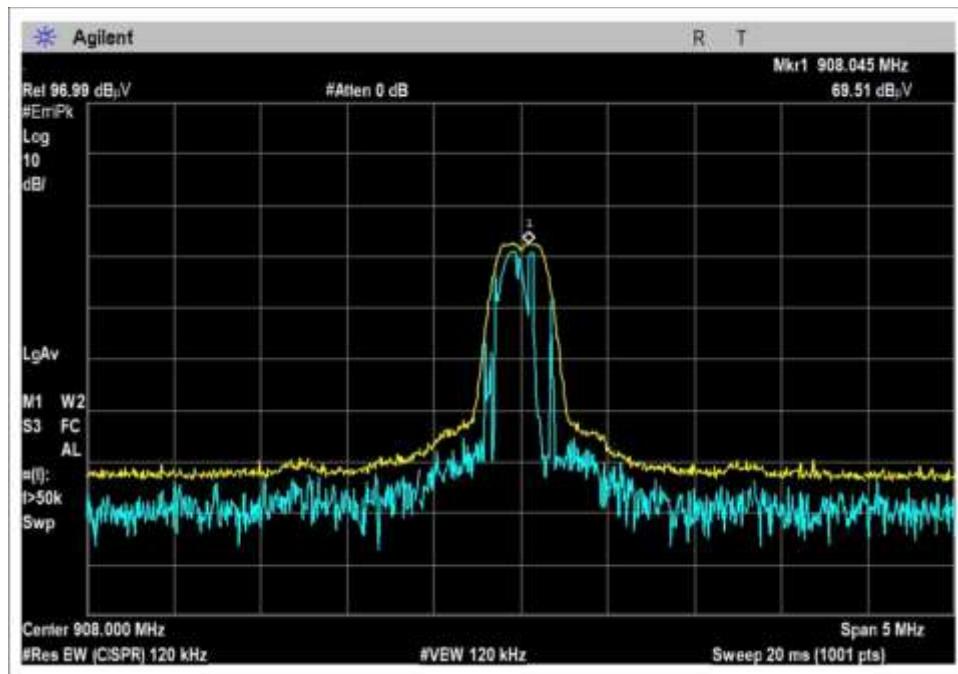
Measurements performed at input voltage $V_{Nominal} \pm 15\%$. (AC Input)

Measurements performed at input voltage according to manufacturer specification. (DC Input)

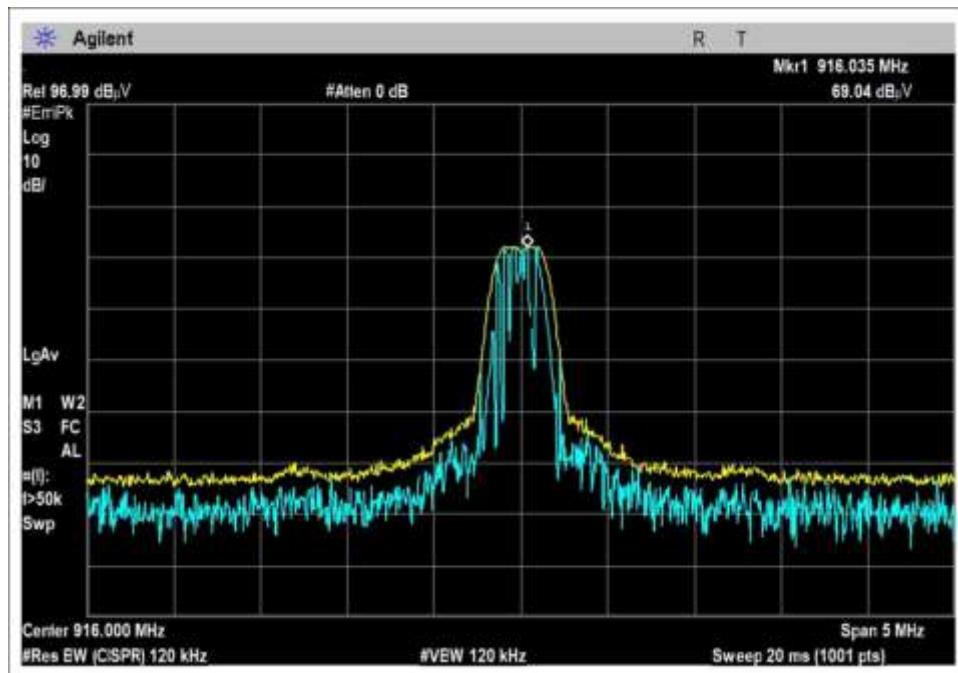
Parameter	Value
$V_{Nominal}$:	115VAC / 12VDC
$V_{Minimum}$:	97VAC / 7VDC
$V_{Maximum}$:	133VAC / 18VDC

Plot(s)

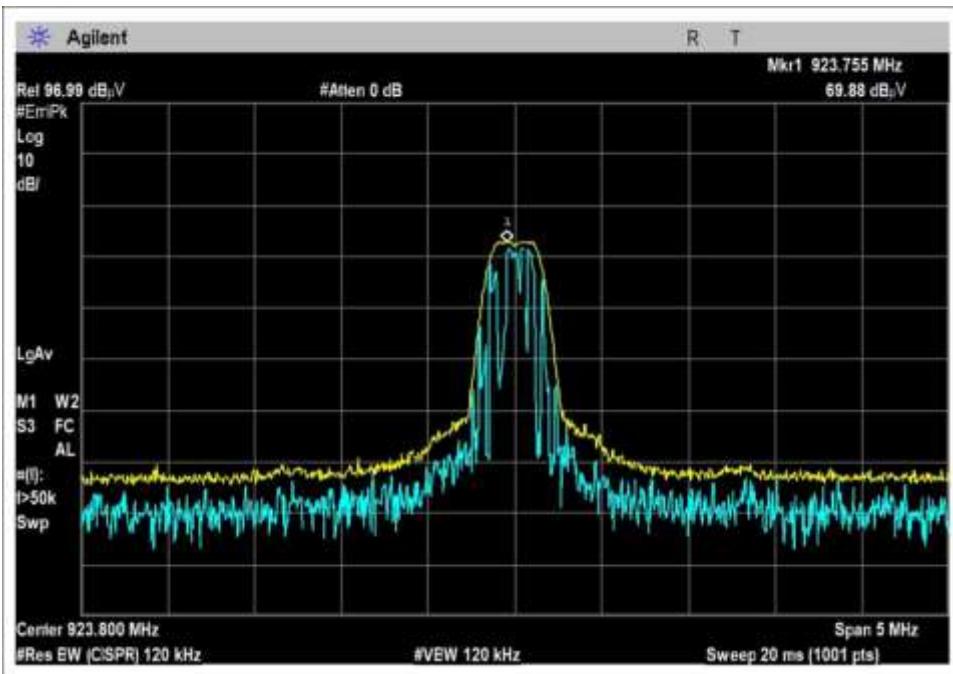
Configuration 2



Low Channel

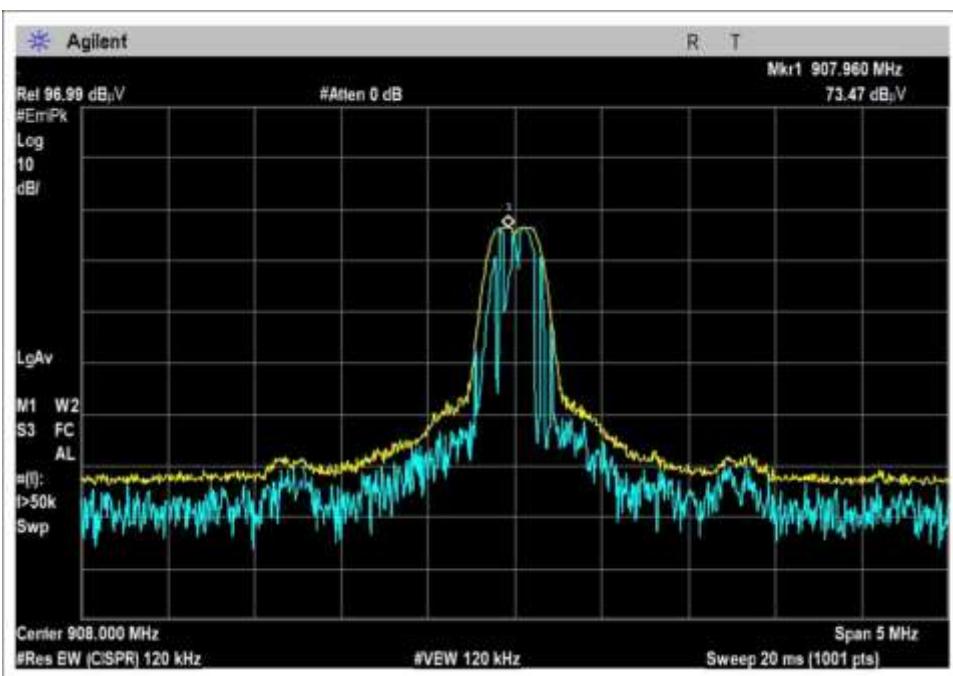


Middle Channel

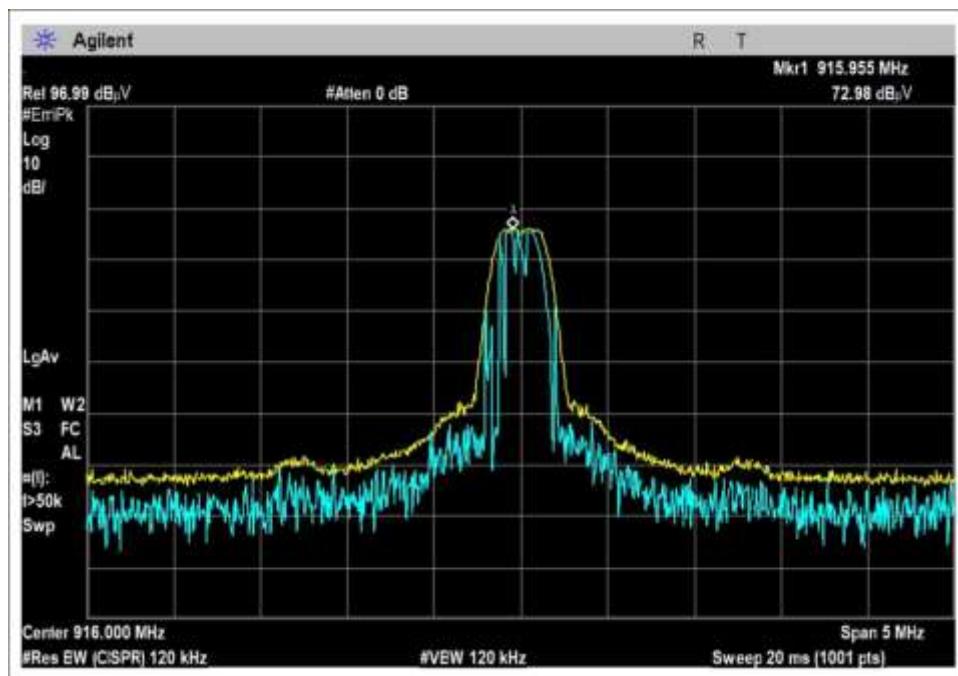


High Channel

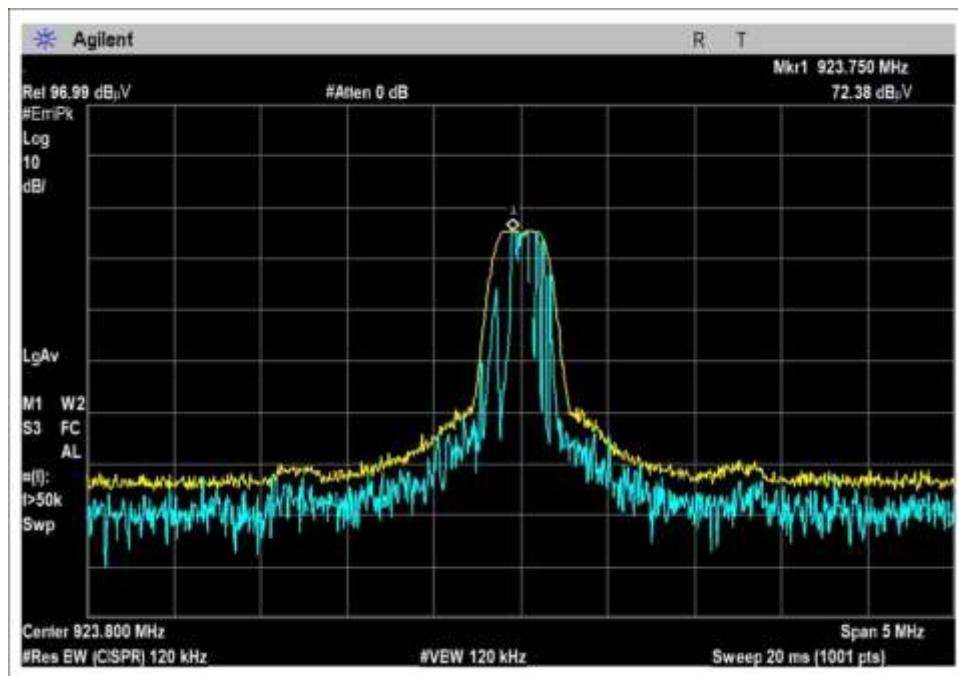
Configuration 3



Low Channel



Middle Channel



High Channel

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: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **102206** Date: 2/24/2019
 Test Type: **Maximized Emissions** Time: 13:41:29
 Tested By: Michael Atkinson Sequence#: 15
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2+3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2+3			

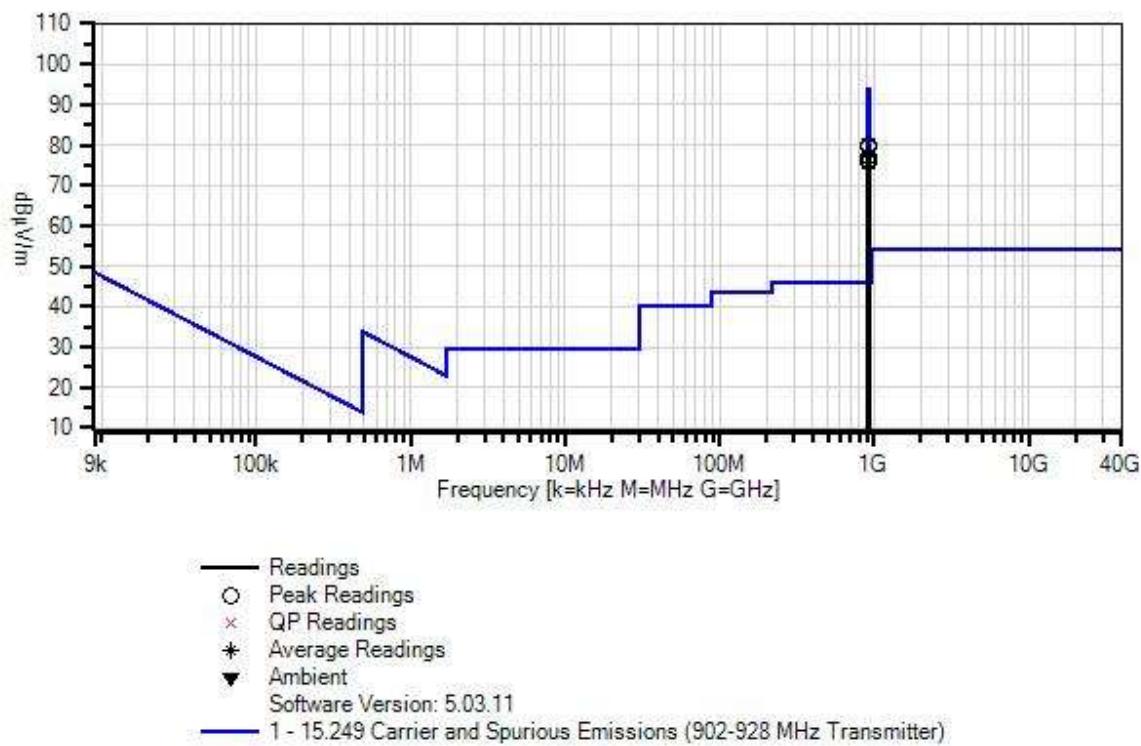
Test Conditions / Notes:

Firmware power setting: Max Power
 Protocol /MCS/Modulation: FSK

 Duty Cycle: 100% (Test Mode)
 Test Location: Canyon Park Lab C3
 Temperature (°C) 20-22
 Relative Humidity (%): 20-30
 Test Method: ANSI C63.10 (2013)
 Test Mode: Continuously transmitting
 Test Setup: EUT is on test table 80cm high. EUT is continuously transmitting through the external antenna.
 Horizontal and Vertical antenna polarities investigated, as well as XYZ EUT axes investigated, worst case reported.

Antenna: 5dBi and 3dBi antennas investigated.

Itron, Inc WO#: 102014 Sequence#: 15 Date: 2/24/2019
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters H+V



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T2	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T3	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T5	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T6	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019

Measurement Data:

Reading listed by margin.

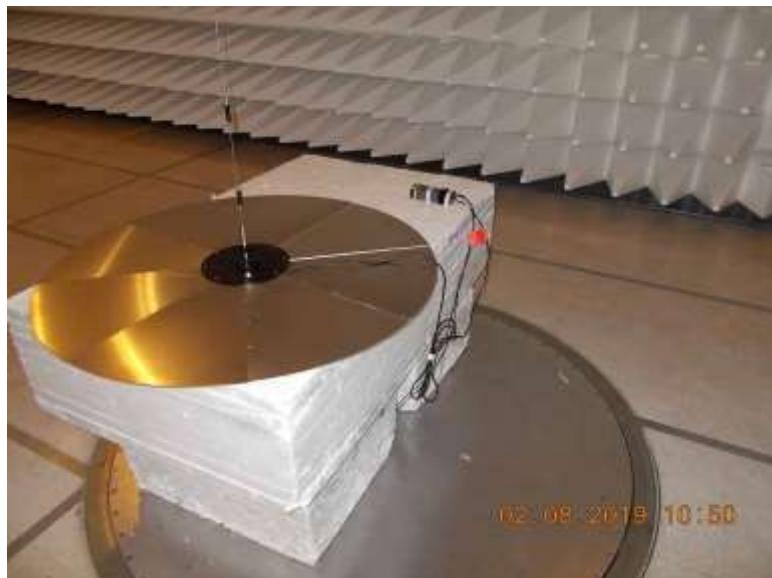
Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	915.955M	73.0	+0.4 +5.9	+1.6 +24.4	-27.3	+2.0	+0.0	80.0 3dBi	94.0	-14.0	Horiz
2	907.960M	73.5	+0.3 +5.9	+1.5 +24.0	-27.4	+2.0	+0.0	79.8 3dBi	94.0	-14.2	Horiz
3	923.750M	72.4	+0.4 +5.9	+1.6 +24.5	-27.3	+2.0	+0.0	79.5 3dBi	94.0	-14.5	Horiz
4	923.755M	69.9	+0.4 +5.9	+1.6 +24.5	-27.3	+2.0	+0.0	77.0 5dBi	94.0	-17.0	Vert
5	916.035M	69.0	+0.4 +5.9	+1.6 +24.4	-27.3	+2.0	+0.0	76.0 5dBi	94.0	-18.0	Vert
6	908.045M	69.5	+0.3 +5.9	+1.5 +24.0	-27.4	+2.0	+0.0	75.8 5dBi	94.0	-18.2	Vert

Test Setup Photo(s)



Configuration 2



Configuration 3



X Axis



Y Axis



Z Axis

15.249(a) Radiated Emissions and 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: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **102206** Date: **2/24/2019**
 Test Type: **Maximized Emissions** Time: **14:53:04**
 Tested By: Michael Atkinson Sequence#: **7**
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

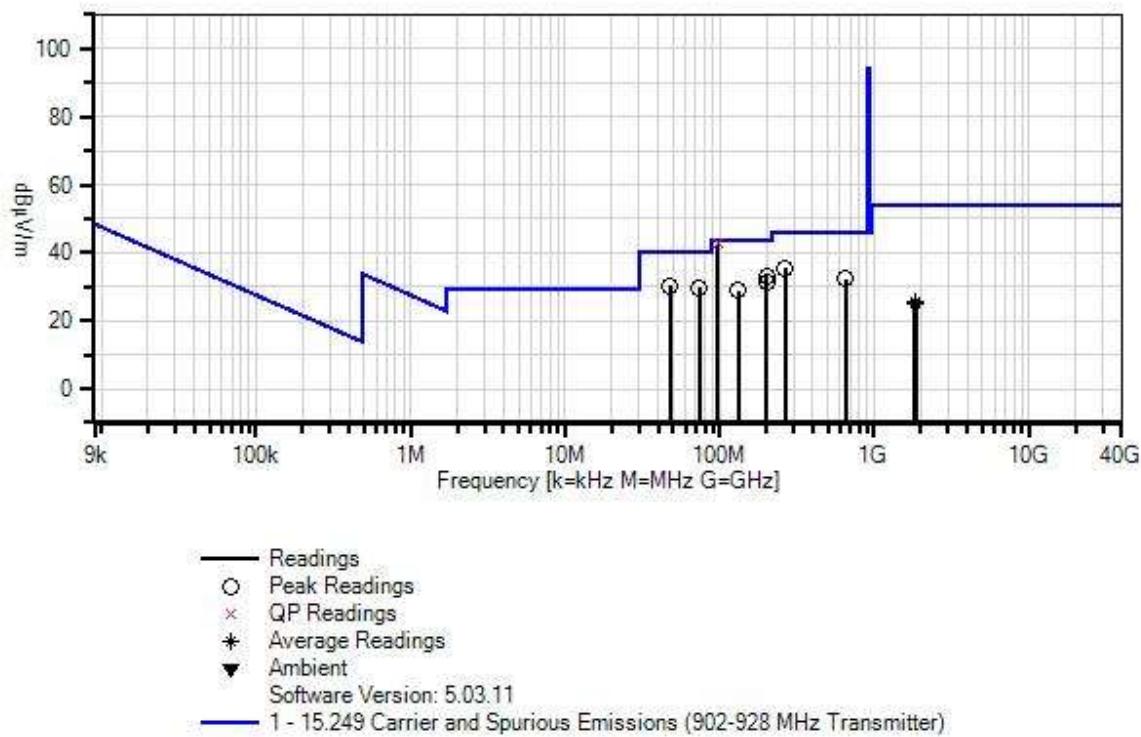
Frequency Range: 908, 916, 923.8MHz
 Frequency tested: 9kHz-9238MHz
 Firmware power setting: Max Power
 Protocol /MCS/Modulation: FSK

 Duty Cycle: 100% (Test Mode)
 Test Location: Canyon Park Lab C3
 Temperature (°C) 20-23
 Relative Humidity (%): 20-35
 Test Method: ANSI C63.10 (2013)
 Test Mode: Continuously transmitting
 Test Setup: EUT is continuously transmitting through antenna. X, Y, Z EUT axes investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 orthogonal antenna orientations investigated below 30MHz, worst case reported.

Antenna: 5dBi vehicle antenna

No emissions above 1GHz observed within 20dB of the limit.

Itron, Inc WO#: 102014 Sequence#: 7 Date: 2/24/2019
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Various



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T4	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	AN03170	High Pass Filter	HM1155-11SS	11/27/2017	11/27/2019
	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T7	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020
T8	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T9	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T10	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T11	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T12	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019

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					
			T9	T10	T11	T12					
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	97.277M	55.7	+0.1	+0.0	+0.0	+0.0	+0.0	42.7	43.5	-0.8	Vert
	QP		+0.0	+0.0	+0.0	+0.5					
			-27.7	+0.5	+5.9	+7.7					
^	97.277M	55.9	+0.1	+0.0	+0.0	+0.0	+0.0	42.9	43.5	-0.6	Vert
			+0.0	+0.0	+0.0	+0.5					
			-27.7	+0.5	+5.9	+7.7					
3	47.710M	44.1	+0.1	+0.0	+0.0	+0.0	+0.0	30.3	40.0	-9.7	Vert
			+0.0	+0.0	+0.0	+0.4					
			-27.9	+0.4	+5.9	+7.3					
4	73.890M	43.7	+0.1	+0.0	+0.0	+0.0	+0.0	29.8	40.0	-10.2	Vert
			+0.0	+0.0	+0.0	+0.5					
			-27.8	+0.5	+5.9	+6.9					
5	200.200M	42.8	+0.2	+0.0	+0.0	+0.0	+0.0	33.2	43.5	-10.3	Horiz
			+0.0	+0.0	+0.0	+0.7					
			-27.2	+0.8	+5.9	+10.0					
6	264.800M	41.3	+0.2	+0.0	+0.0	+0.0	+0.0	35.6	46.0	-10.4	Horiz
			+0.0	+0.0	+0.0	+0.8					
			-27.0	+0.9	+5.9	+13.5					
7	200.170M	40.8	+0.2	+0.0	+0.0	+0.0	+0.0	31.2	43.5	-12.3	Vert
			+0.0	+0.0	+0.0	+0.7					
			-27.2	+0.8	+5.9	+10.0					
8	652.200M	30.1	+0.3	+0.0	+0.0	+0.0	+0.0	32.4	46.0	-13.6	Horiz
			+0.0	+0.0	+0.0	+1.3					
			-28.2	+1.6	+5.9	+21.4					

9	132.410M	41.4	+0.2	+0.0	+0.0	+0.0	+0.0	28.9	43.5	-14.6	Vert
			+0.0	+0.0	+0.0	+0.6					
			-27.6	+0.6	+5.9	+7.8					
10	1847.590M	29.0	+0.4	+2.3	-34.5	+0.7	+0.0	25.4	54.0	-28.6	Vert
	Ave		+26.8	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
^	1847.590M	41.0	+0.4	+2.3	-34.5	+0.7	+0.0	37.4	54.0	-16.6	Vert
			+26.8	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
12	1832.050M	28.7	+0.4	+2.3	-34.5	+0.7	+0.0	24.9	54.0	-29.1	Vert
	Ave		+26.6	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
^	1832.050M	39.8	+0.4	+2.3	-34.5	+0.7	+0.0	36.0	54.0	-18.0	Vert
			+26.6	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
14	1815.700M	28.7	+0.4	+2.3	-34.5	+0.7	+0.0	24.8	54.0	-29.2	Vert
	Ave		+26.5	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
^	1815.700M	40.0	+0.4	+2.3	-34.5	+0.7	+0.0	36.1	54.0	-17.9	Vert
			+26.5	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
16	28.440M	22.7	+0.1	+0.3	+0.0	+0.0	-40.0	-10.9	29.5	-40.4	Perp
			+0.0	+0.0	+6.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
17	28.141M	22.5	+0.1	+0.3	+0.0	+0.0	-40.0	-11.0	29.5	-40.5	Para
			+0.0	+0.0	+6.1	+0.0					
			+0.0	+0.0	+0.0	+0.0					
18	18.543M	17.9	+0.0	+0.2	+0.0	+0.0	-40.0	-13.6	29.5	-43.1	Para
			+0.0	+0.0	+8.3	+0.0					
			+0.0	+0.0	+0.0	+0.0					



Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC
Customer: **Itron, Inc**
Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
Work Order #: **102206** Date: 2/24/2019
Test Type: **Maximized Emissions** Time: 14:45:18
Tested By: Michael Atkinson Sequence#: 6
Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

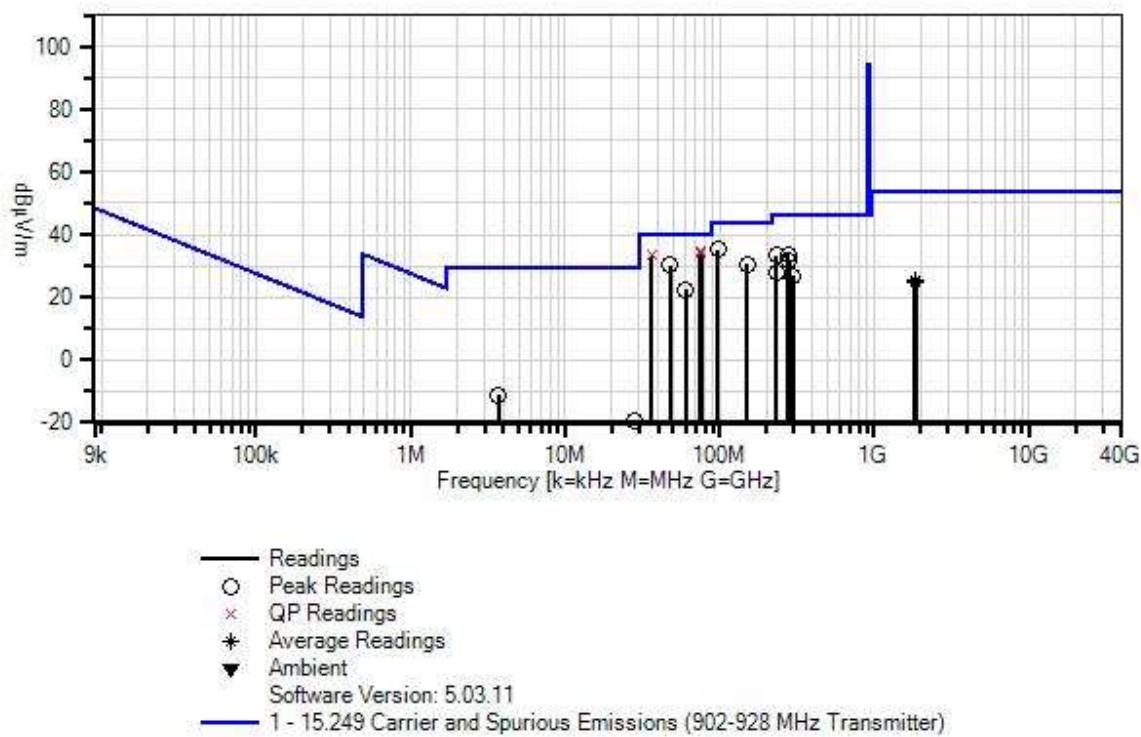
Frequency Range: 908, 916, 923.8MHz
Frequency tested: 9kHz-9238MHz
Firmware power setting: Max Power
Protocol /MCS/Modulation: FSK

Duty Cycle: 100% (Test Mode)
Test Location: Canyon Park Lab C3
Temperature (°C) 20-23
Relative Humidity (%): 20-35
Test Method: ANSI C63.10 (2013)
Test Mode: Continuously transmitting
Test Setup: EUT is continuously transmitting through antenna. X, Y, Z EUT axes investigated, worst case reported. Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported. 3 orthogonal antenna orientations investigated below 30MHz, worst case reported.

Antenna: 3dBi attached rubber duck antenna

No emissions above 1GHz observed within 20dB of the limit.

Itron, Inc WO#: 102014 Sequence#: 6 Date: 2/24/2019
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T4	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020
T5	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T6	AN03170	High Pass Filter	HM1155-11SS	11/27/2017	11/27/2019
T7	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T8	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020
T9	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T10	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T11	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T12	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T13	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019

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					
			T9	T10	T11	T12					
			T13								
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	75.365M	48.5	+0.1	+0.0	+0.0	+0.0	+0.0	34.6	40.0	-5.4	Vert
	QP		+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.8	+0.5	+5.9					
			+6.9								
2	75.459M	48.1	+0.1	+0.0	+0.0	+0.0	+0.0	34.2	40.0	-5.8	Vert
	QP		+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.8	+0.5	+5.9					
			+6.9								
^	75.430M	49.1	+0.1	+0.0	+0.0	+0.0	+0.0	35.2	40.0	-4.8	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.8	+0.5	+5.9					
			+6.9								
^	75.459M	49.0	+0.1	+0.0	+0.0	+0.0	+0.0	35.1	40.0	-4.9	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.8	+0.5	+5.9					
			+6.9								
5	35.962M	42.2	+0.1	+0.0	+0.0	+0.0	+0.0	33.4	40.0	-6.6	Vert
	QP		+0.0	+0.0	+0.0	+0.0					
			+0.3	-28.0	+0.3	+5.9					
			+12.6								
^	35.962M	44.7	+0.1	+0.0	+0.0	+0.0	+0.0	35.9	40.0	-4.1	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.3	-28.0	+0.3	+5.9					
			+12.6								

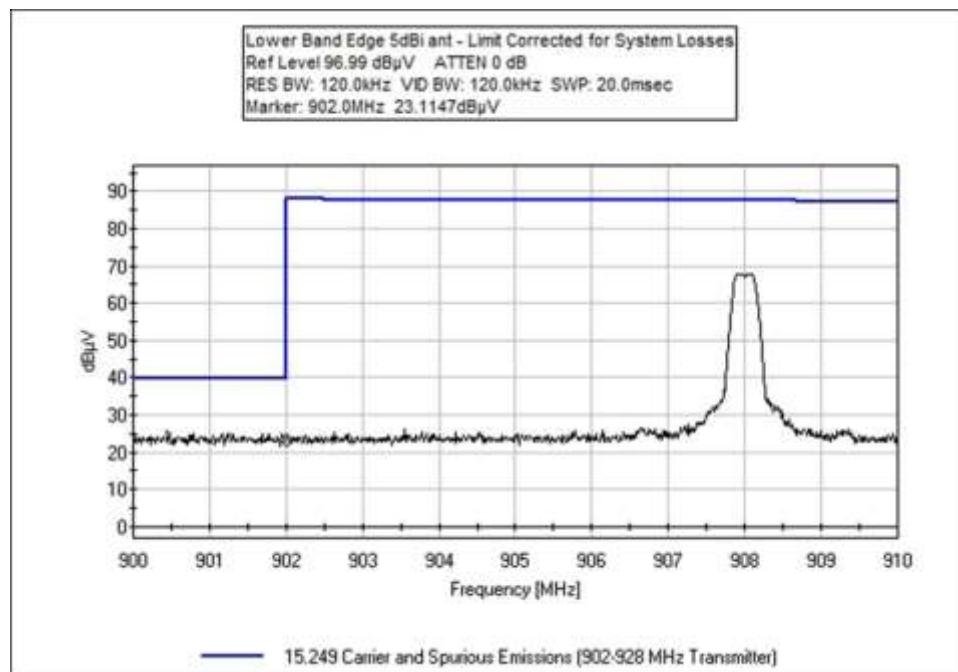
7	96.990M	48.2	+0.1	+0.0	+0.0	+0.0	+0.0	35.2	43.5	-8.3	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.7	+0.5	+5.9					
			+7.7								
8	47.710M	44.0	+0.1	+0.0	+0.0	+0.0	+0.0	30.2	40.0	-9.8	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.4	-27.9	+0.4	+5.9					
			+7.3								
9	276.400M	39.8	+0.2	+0.0	+0.0	+0.0	+0.0	33.5	46.0	-12.5	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.8	-27.0	+1.0	+5.9					
			+12.8								
10	234.000M	40.7	+0.2	+0.0	+0.0	+0.0	+0.0	33.3	46.0	-12.7	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.8	-27.1	+0.9	+5.9					
			+11.9								
11	149.350M	41.6	+0.2	+0.0	+0.0	+0.0	+0.0	30.6	43.5	-12.9	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.6	-27.5	+0.7	+5.9					
			+9.1								
12	278.700M	38.2	+0.2	+0.0	+0.0	+0.0	+0.0	31.7	46.0	-14.3	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.8	-27.0	+1.0	+5.9					
			+12.6								
13	60.000M	36.9	+0.1	+0.0	+0.0	+0.0	+0.0	22.5	40.0	-17.5	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.4	-27.9	+0.4	+5.9					
			+6.7								
14	231.000M	35.7	+0.2	+0.0	+0.0	+0.0	+0.0	27.8	46.0	-18.2	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.7	-27.1	+0.9	+5.9					
			+11.5								
15	298.730M	33.1	+0.2	+0.0	+0.0	+0.0	+0.0	26.8	46.0	-19.2	Vert
			+0.0	+0.0	+0.0	+0.0					
			+0.9	-27.1	+1.0	+5.9					
			+12.8								
16	1847.760M	29.0	+0.4	+2.3	-34.5	+0.7	+0.0	25.4	54.0	-28.6	Vert
Ave			+26.8	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	1847.760M	40.1	+0.4	+2.3	-34.5	+0.7	+0.0	36.5	54.0	-17.5	Vert
			+26.8	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
18	1831.650M	28.7	+0.4	+2.3	-34.5	+0.7	+0.0	24.9	54.0	-29.1	Vert
Ave			+26.6	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	1831.650M	38.7	+0.4	+2.3	-34.5	+0.7	+0.0	34.9	54.0	-19.1	Vert
			+26.6	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

20	1815.700M	28.8	+0.4	+2.3	-34.5	+0.7	+0.0	24.9	54.0	-29.1	Horiz
	Ave		+26.5	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
^	1815.700M	39.2	+0.4	+2.3	-34.5	+0.7	+0.0	35.3	54.0	-18.7	Horiz
			+26.5	+0.7	+0.0	+0.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
22	3.698M	19.3	+0.0	+0.1	+0.0	+0.0	-40.0	-11.0	29.5	-40.5	Perp
			+0.0	+0.0	+0.0	+9.6					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
23	28.470M	14.3	+0.1	+0.3	+0.0	+0.0	-40.0	-19.3	29.5	-48.8	Para
			+0.0	+0.0	+0.0	+6.0					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

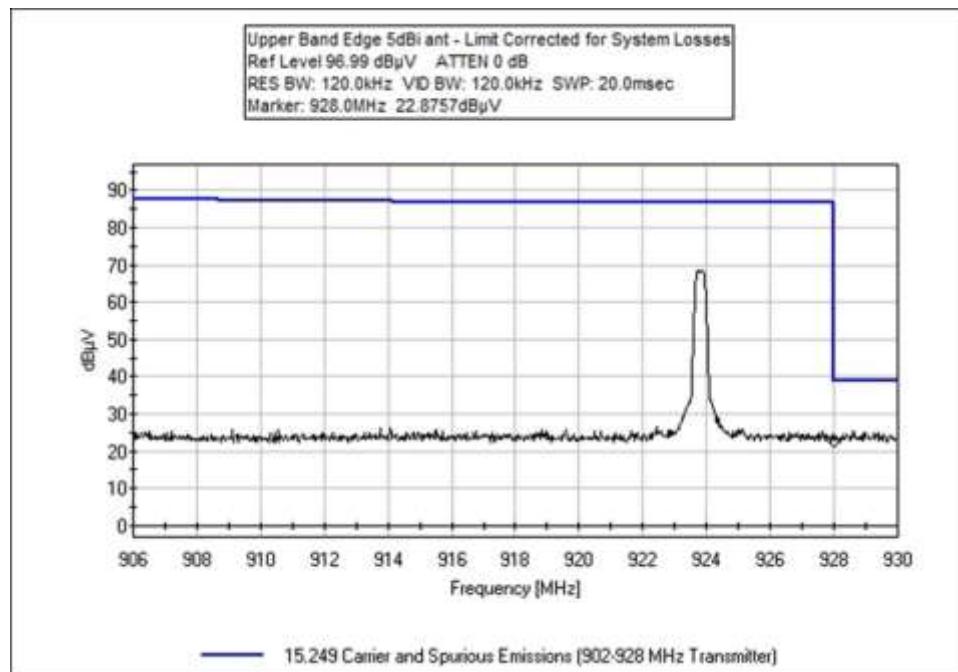
Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	FSK	5dBi vehicle antenna	29.0	<46	Pass
928	FSK	5dBi vehicle antenna	29.8	<46	Pass
902	FSK	3dBi rubber duck	30.3	<46	Pass
928	FSK	3dBi rubber duck	31.0	<46	Pass

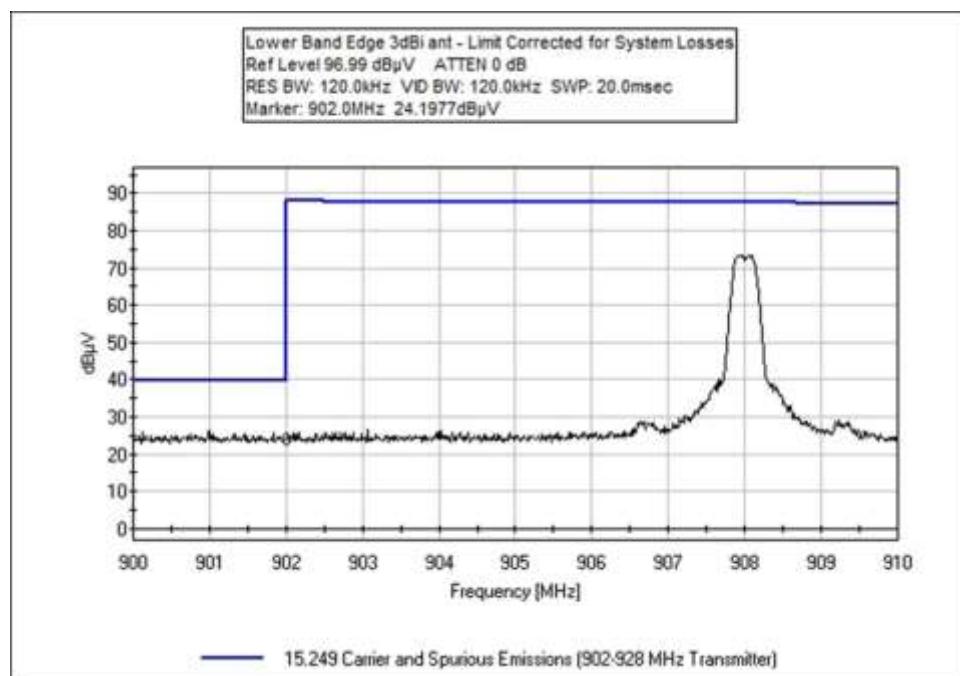
Band Edge Plots



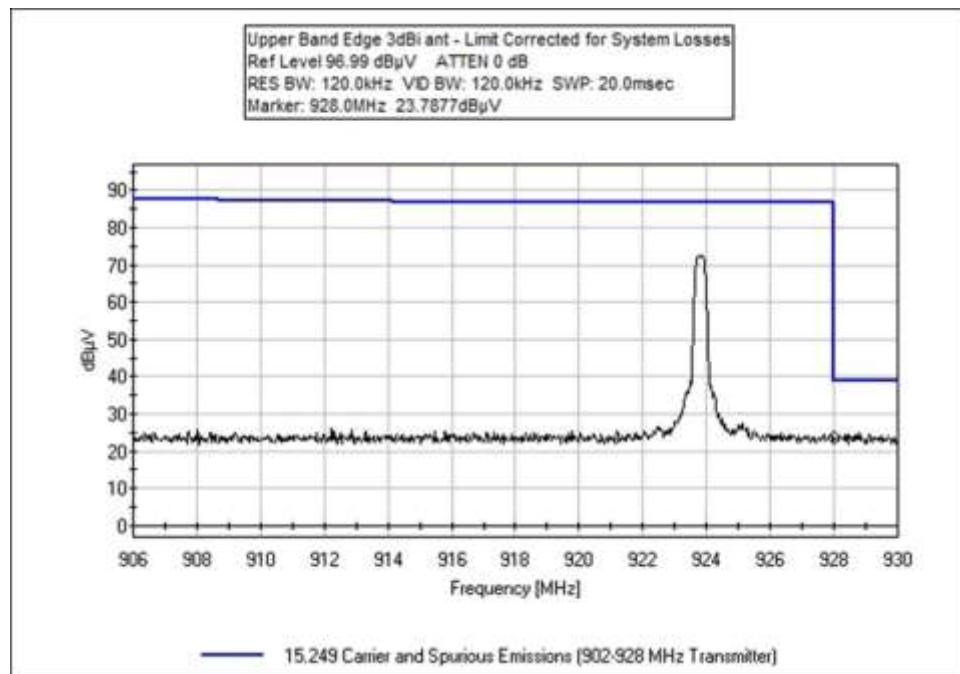
Configuration 2



Configuration 2



Configuration 3



Configuration 3

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: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **102206** Date: 2/24/2019
 Test Type: **Maximized Emissions** Time: 13:51:20
 Tested By: Michael Atkinson Sequence#: 16
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2+3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2+3			

Test Conditions / Notes:

Firmware power setting: Max Power
 Protocol /MCS/Modulation: FSK

Frequency Range: 908, 916, 923.8MHz
 Frequency Investigated: Band Edge

Duty Cycle: 100% (Test Mode)
 Test Location: Canyon Park Lab C3

Test Method: ANSI C63.10 (2013)
 Test Mode: Continuously transmitting
 Test Setup: EUT is on test table 80cm high. EUT is continuously transmitting through the external antenna.
 Horizontal and Vertical antenna polarities investigated, as well as XYZ EUT axes investigated, worst case reported.

Antenna: 5dBi and 3dBi antennas investigated.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T2	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T3	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T5	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T6	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019

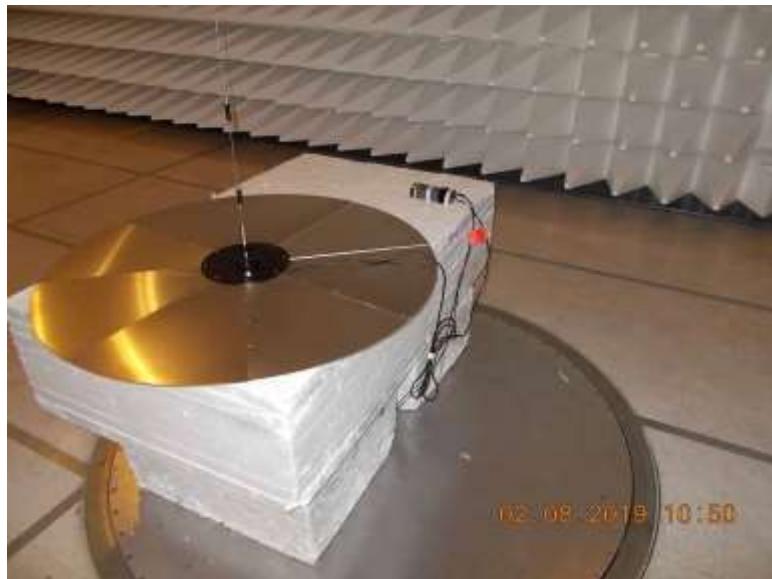
Measurement Data:

Reading listed by margin.

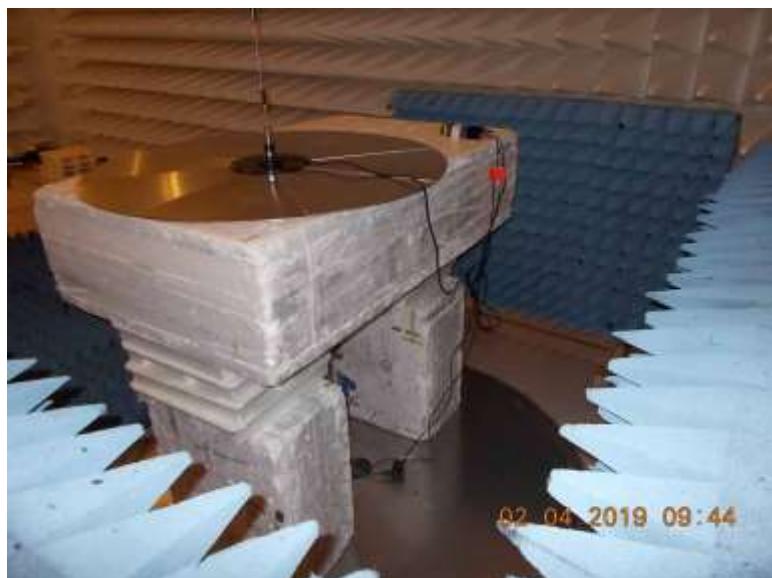
Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	928.000M	23.8	+0.4 +5.9	+1.6 +24.6	-27.3	+2.0	+0.0	31.0 3dBi	46.0	-15.0	Vert
2	902.000M	24.2	+0.3 +5.9	+1.5 +23.8	-27.4	+2.0	+0.0	30.3 3dBi	46.0	-15.7	Vert
3	928.000M	22.6	+0.4 +5.9	+1.6 +24.6	-27.3	+2.0	+0.0	29.8 5dBi	46.0	-16.2	Vert
4	902.000M	22.9	+0.3 +5.9	+1.5 +23.8	-27.4	+2.0	+0.0	29.0 5dBi	46.0	-17.0	Vert

Test Setup Photo(s)



Configuration 2, Below 1GHz



Configuration 2, Above 1GHz Cone placement



Configuration 3, Below 1GHz



Configuration 3, 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 - Average**
 Work Order #: **102206** Date: 2/5/2019
 Test Type: **Conducted Emissions** Time: 15:52:43
 Tested By: Michael Atkinson Sequence#: 13
 Software: EMITest 5.03.11 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Temperature: 20-23°C
 Humidity: 20-30%
 Pressure: 102-103kPa

Frequency Range: 908MHz
 Frequency tested: 0.15-30MHz
 Firmware power setting: Max Power
 Protocol /MCS/Modulation: FSK

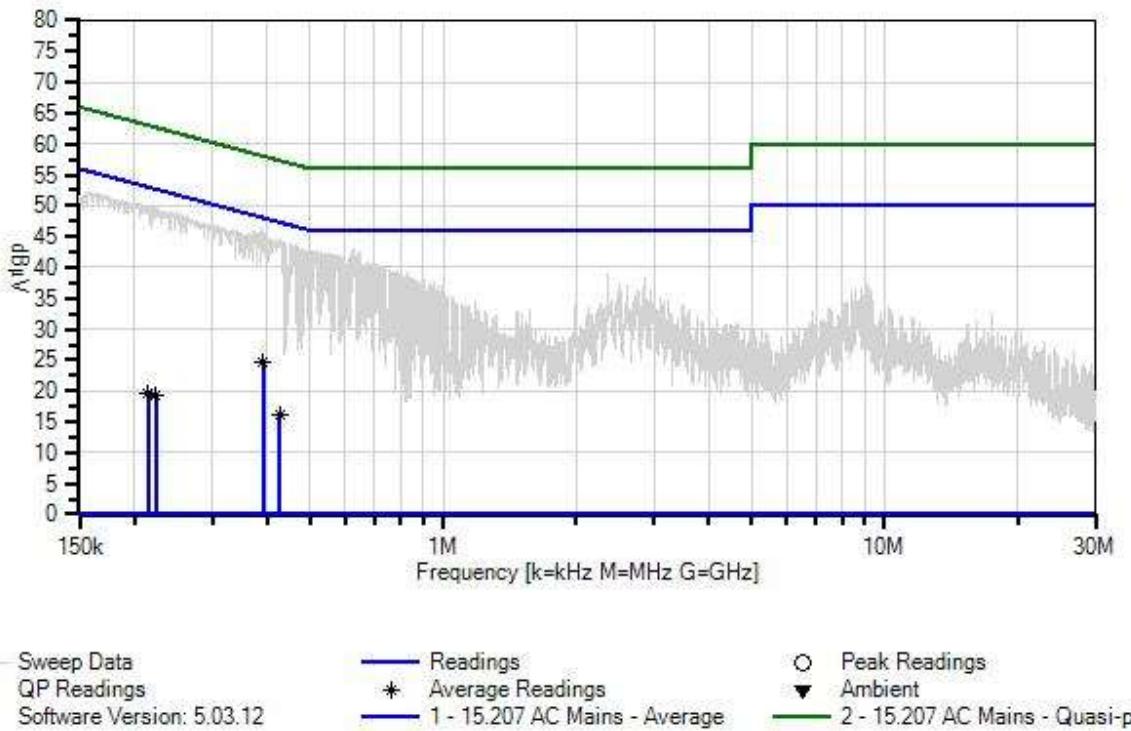
Test Location: Canyon Park Lab C3

Test Method: ANSI C63.10 (2013)
 Duty Cycle: 100% (Test Mode)

Test Mode: Continuously transmitting

Test Setup: EUT is transmitting through to attached antenna. Investigated attached and vehicle mounted antenna, attached antenna data that is representative of worst case reported.

Itron, Inc WO#: 102014 Sequence#: 13 Date: 2/5/2019
15.207 AC Mains - Average Test Lead: 115VAC 60Hz Line



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T1	AN02611	High Pass Filter	HE9615-150K-50-720B	1/15/2018	1/15/2020
T2	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T3	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T4	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
T5	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

Measurement Data:			Reading listed by margin.				Test Lead: Line				
#	Freq	Rdng	T1	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	391.512k	15.1	+0.1	+0.0	+0.0	+9.1	+0.0	24.8	48.0	-23.2	Line
	Ave		+0.5								
^	391.511k	36.6	+0.1	+0.0	+0.0	+9.1	+0.0	46.3	48.0	-1.7	Line
			+0.5								
3	426.759k	6.3	+0.1	+0.0	+0.1	+9.1	+0.0	16.1	47.3	-31.2	Line
	Ave		+0.5								
^	426.758k	34.8	+0.1	+0.0	+0.1	+9.1	+0.0	44.6	47.3	-2.7	Line
			+0.5								
5	214.660k	9.2	+0.2	+0.0	+0.0	+9.1	+0.0	19.6	53.0	-33.4	Line
	Ave		+1.1								
^	214.660k	39.8	+0.2	+0.0	+0.0	+9.1	+0.0	50.2	53.0	-2.8	Line
			+1.1								
7	224.092k	8.9	+0.2	+0.0	+0.0	+9.1	+0.0	19.2	52.7	-33.5	Line
	Ave		+1.0								
^	224.092k	39.7	+0.2	+0.0	+0.0	+9.1	+0.0	50.0	52.7	-2.7	Line
			+1.0								



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 - Average**
Work Order #: **102206** Date: 2/5/2019
Test Type: **Conducted Emissions** Time: 15:44:45
Tested By: Michael Atkinson Sequence#: 12
Software: EMITest 5.03.11 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Temperature: 20-23°C

Humidity: 20-30%

Pressure: 102-103kPa

Frequency Range: 908MHz

Frequency tested: 0.15-30MHz

Firmware power setting: Max Power

Protocol /MCS/Modulation: FSK

Test Location: Canyon Park Lab C3

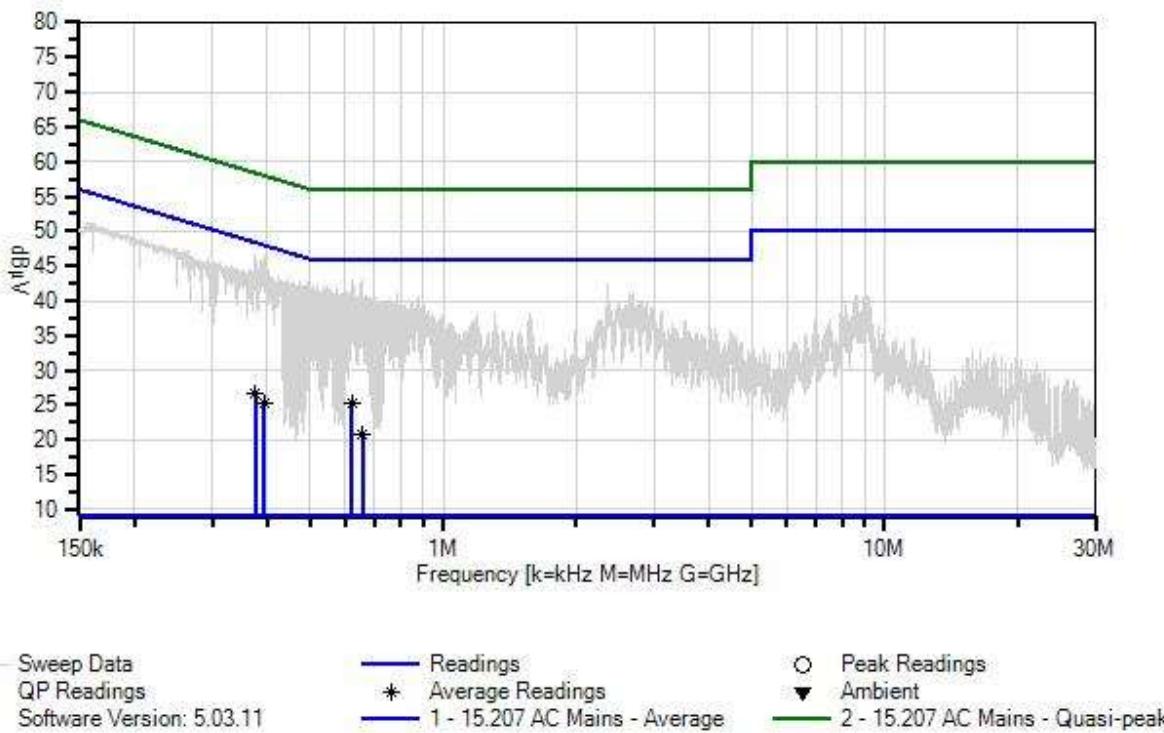
Test Method: ANSI C63.10 (2013)

Duty Cycle: 100% (Test Mode)

Test Mode: Continuously transmitting

Test Setup: EUT is transmitting through to attached antenna. Investigated attached and vehicle mounted antenna, attached antenna data that is representative of worst case reported.

Itron, Inc WO#: 102014 Sequence#: 12 Date: 2/5/2019
15.207 AC Mains - Average Test Lead: 115VAC 60Hz Return



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T1	AN02611	High Pass Filter	HE9615-150K-50-720B	1/15/2018	1/15/2020
T2	ANP06540	Cable	Heliax	10/30/2017	10/30/2019
T3	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T4	ANP06219	Attenuator	768-10	4/13/2018	4/13/2020
	AN01311	50uH LISN-Line1 (L)	3816/2	3/16/2018	3/16/2020
T5	AN01311	50uH LISN-Line2 (N)	3816/2	3/16/2018	3/16/2020

Measurement Data:

Reading listed by margin.

Test Lead: Return

#	Freq	Rdng	T1	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	622.404k	15.5	+0.2	+0.0	+0.0	+9.1	+0.0	25.2	46.0	-20.8	Retur
	Ave		+0.4								
^	622.403k	33.3	+0.2	+0.0	+0.0	+9.1	+0.0	43.0	46.0	-3.0	Retur
			+0.4								
3	375.490k	16.9	+0.1	+0.0	+0.0	+9.1	+0.0	26.6	48.4	-21.8	Retur
	Ave		+0.5								
^	375.490k	37.0	+0.1	+0.0	+0.0	+9.1	+0.0	46.7	48.4	-1.7	Retur
			+0.5								
5	393.470k	15.7	+0.1	+0.0	+0.0	+9.1	+0.0	25.4	48.0	-22.6	Retur
	Ave		+0.5								
^	393.469k	36.6	+0.1	+0.0	+0.0	+9.1	+0.0	46.3	48.0	-1.7	Retur
			+0.5								
7	657.480k	11.3	+0.2	+0.0	+0.0	+9.1	+0.0	20.9	46.0	-25.1	Retur
	Ave		+0.3								
^	657.479k	33.7	+0.2	+0.0	+0.0	+9.1	+0.0	43.3	46.0	-2.7	Retur
			+0.3								

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 dB μ V/m, the spectrum analyzer reading in dB μ 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	(dB μ V)
+ Antenna Factor	(dB/m)
+ Cable Loss	(dB)
- Distance Correction	(dB)
- Preamplifier Gain	(dB)
= Corrected Reading	(dB μ V/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.