

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 & 15.231a
(PERIODIC OPERATION >70MHZ)

Report No.: 102014-6

Date of issue: March 8, 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 11, 2018

December 11-17, 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 positioned above 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 - 15.231a

Test Procedure	Description	Modifications	Results
15.231(c)	Occupied Bandwidth	NA	Pass
15.231(b)	Field Strength of Fundamental	NA	Pass
15.231(a)	Periodic Operation Requirements	NA	Pass
15.231(b)	Field Strength of Spurious Emissions	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	NA
AC Adapter	DVE	DV-51AR	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	OOK
Maximum Duty Cycle:	100%
Antenna Type(s) and Gain:	Internal PIFA 2.0dBi
Antenna Connection Type:	Integral
Operational Trigger Type:	Manually Activated Trigger
Nominal Input Voltage:	120VAC, 60Hz
Firmware / Software used for Test:	DPS Firmware 5.71 / MC3 Test v4.0.3.4

FCC Part 15 Subpart C

15.231(c) Occupied Bandwidth (20dB BW)

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison / S. Pittsford
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/13/2018
Configuration:	1		
Test Setup:	Frequency Range: 952-953MHz Frequency tested: 952MHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 2.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting sitting on foam table. Modifications Added: None		

Environmental Conditions			
Temperature (°C)	20-22	Relative Humidity (%):	30-40

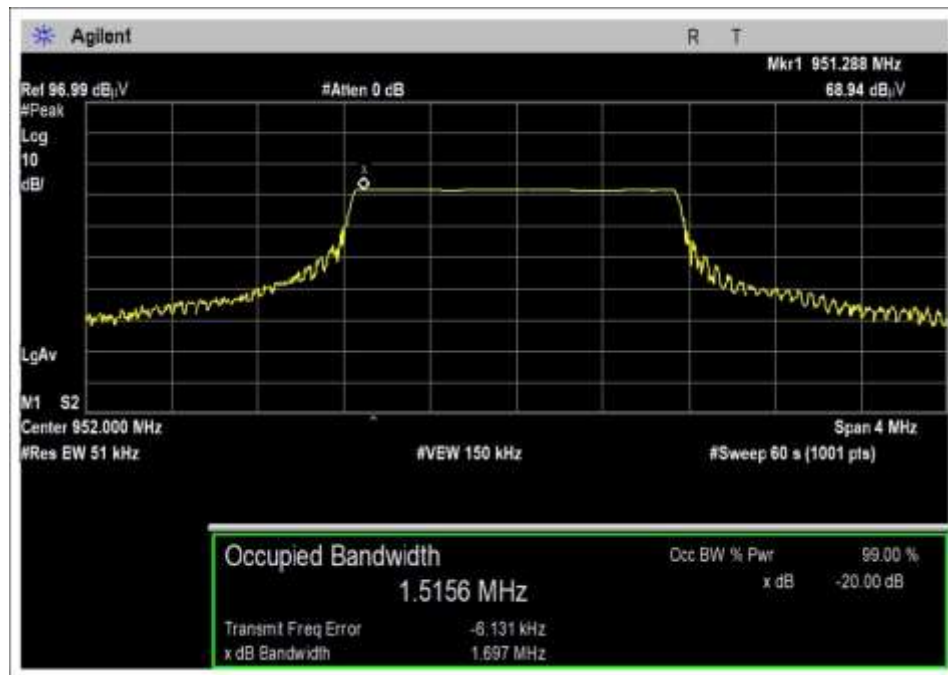
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02307	Preamp	HP	8447D	1/15/2018	1/15/2020
P05305	Cable	Andrews	ETSI-50T	10/24/2017	10/24/2019
P05360	Cable	Belden	RG214	1/31/2018	1/31/2020
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2017	2/3/2019
P06123	Attenuator	Aeroflex	18N-6	5/5/2017	5/5/2019
P06540	Cable	Andrews	Heliac	10/30/2017	10/30/2019
03628	Biconilog Antenna	ETS	3142E	6/7/2017	6/7/2019

Test Data Summary

$$Limit = \begin{cases} 0.25\% f_c & | 70 \text{ MHz} < f_c < 900 \text{ MHz} \\ 0.5\% f_c & | f_c > 900 \text{ MHz} \end{cases}$$

Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
952	1	OOK	1697	≤4760	Pass

Plot(s)



Test Setup Photo(s)



15.231(b) Field Strength of Fundamental

Test Data Summary - Voltage Variations

Frequency (MHz)	Modulation / Ant Port	V _{Minimum} (dBuV/m@3m)	V _{Nominal} (dBuV/m@3m)	V _{Maximum} (dBuV/m@3m)	Max Deviation from V _{Nominal} (dB)
952	OOK	77.1	77.1	77.1	0.0

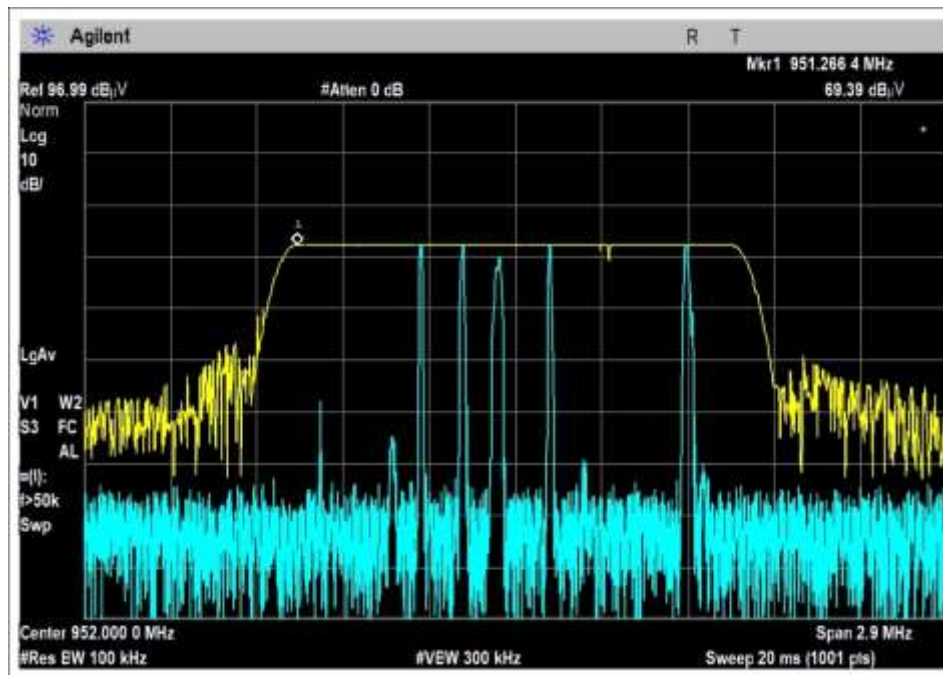
Test performed using operational mode with the highest output power, representing worst case.

Parameter Definitions:

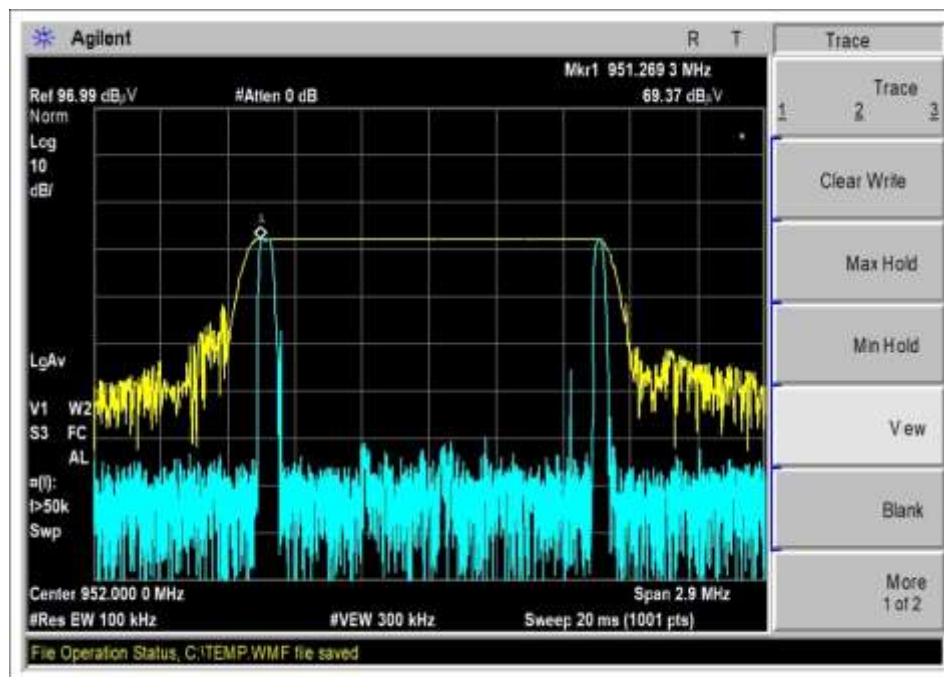
Measurements performed at input voltage V_{Nominal} ± 15%.

Parameter	Value
V _{Nominal} :	120 VAC
V _{Minimum} :	102.00 VAC
V _{Maximum} :	138.00 VAC

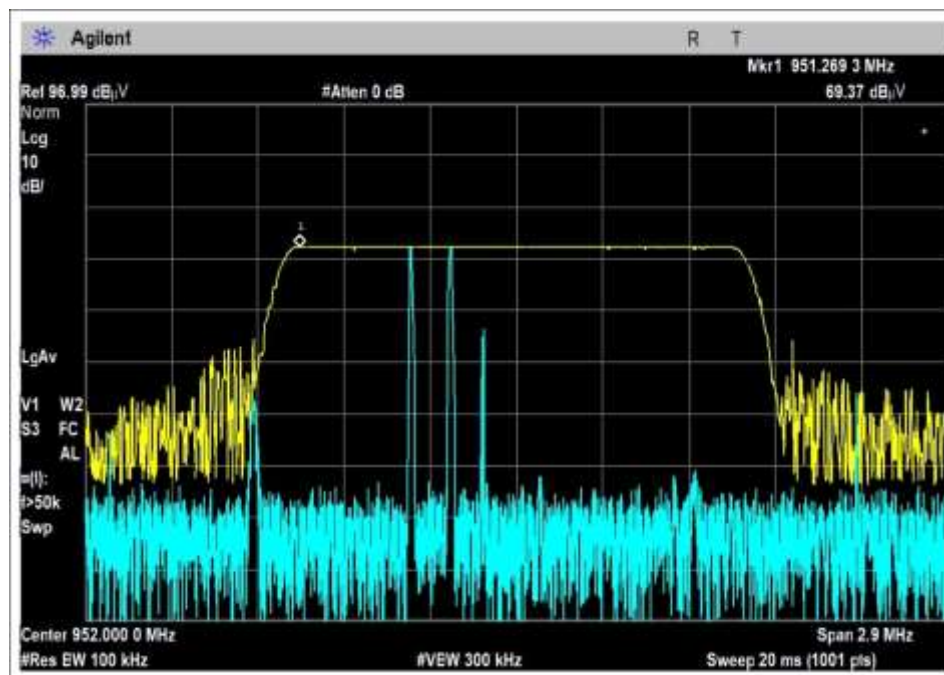
Plot(s)



Z Axis, V_{nom}



Z Axis, Vmin



Z Axis, Vmax

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: **15.231(b) Fundamental Field Strength**
 Work Order #: **102014** Date: 12/13/2018
 Test Type: **Maximized Emissions** Time: 14:29:59
 Tested By: Matthew Harrison / Steven Pittsford Sequence#: 20
 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: 23°C
 Humidity: 33%
 Pressure: 100.8-102.7kPa

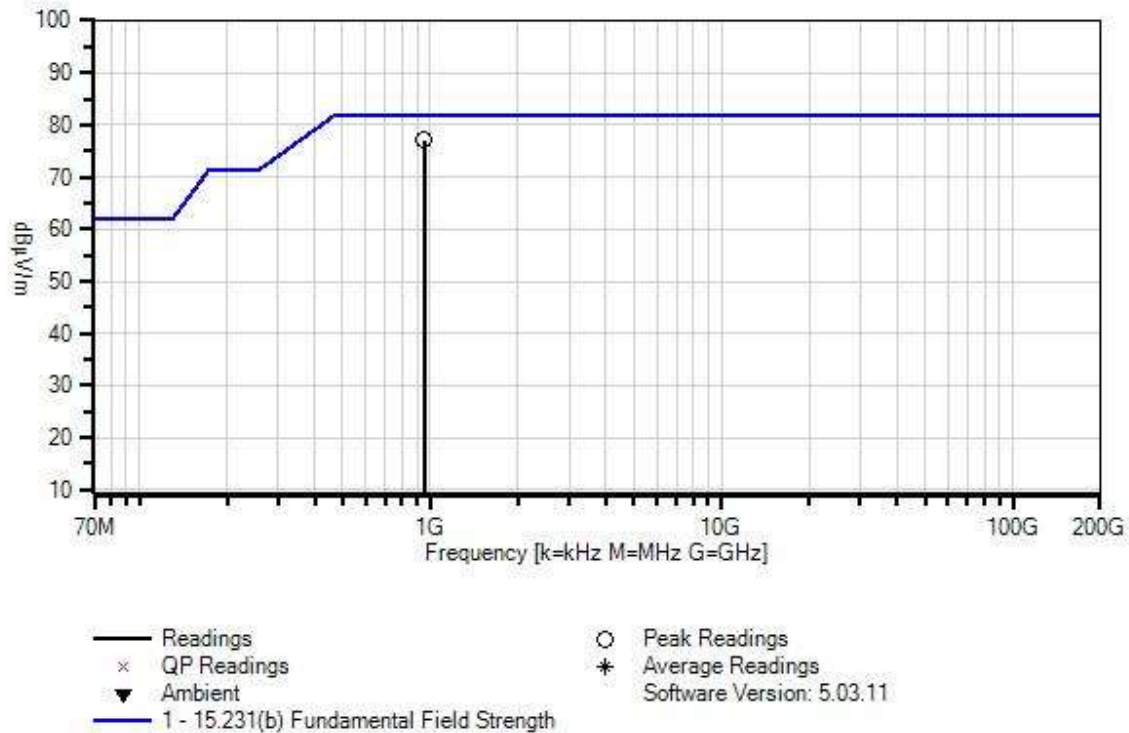
 Frequency Range: 9kHz to 10GHz
 Frequency tested: 952MHz
 Firmware power setting: Low Power

 Protocol /MCS/Modulation: Continuous OOK

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting OOK on single channel, 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)
 Plots are uncorrected/raw data

Ittron, Inc WD#: 102014 Sequence#: 20 Date: 12/13/2018
15.231(b) Fundamental Field Strength Test Distance: 3 Meters Vert



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	AN02307	Preamplifier	8447D	1/15/2018	1/15/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7						
			dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	951.266M	69.4	+25.0	+5.9	+1.6	+2.0	+0.0	77.1	81.9	-4.8	Vert
			+0.4	+0.0	-27.2		360		Z-Axis, Vnom		102
2	951.269M	69.4	+25.0	+5.9	+1.6	+2.0	+0.0	77.1	81.9	-4.8	Vert
			+0.4	+0.0	-27.2		360		Z-Axis, Vmax		102
3	951.269M	69.4	+25.0	+5.9	+1.6	+2.0	+0.0	77.1	81.9	-4.8	Vert
			+0.4	+0.0	-27.2		360		Z-Axis, Vmin		102

Test Setup Photo(s)



Below 1GHz



X Axis



Y Axis



Z Axis

15.231(a) Periodic Operation Requirements

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison / S. Pittsford
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/13/2018
Configuration:	1		
Test Setup:	Frequency Range: 952-953MHz Frequency tested: 952MHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK Antenna type: Internal PIFA Antenna Gain: 2.0 dBi Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test Setup: EUT is transmitting sitting on foam table. Modifications Added: None		

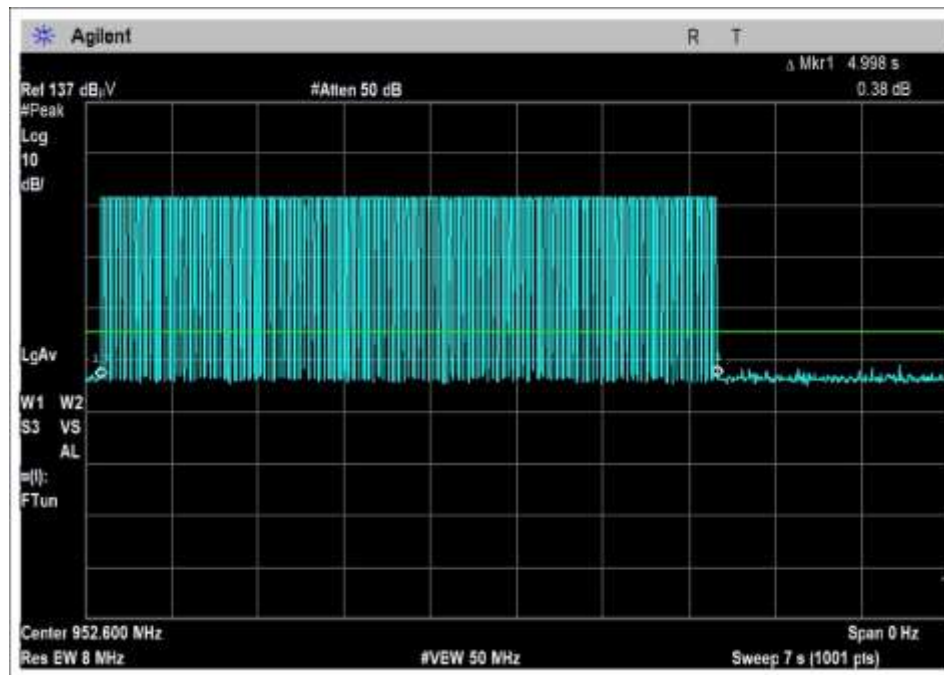
Environmental Conditions			
Temperature (°C)	20-22	Relative Humidity (%):	30-40

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02307	Preamp	HP	8447D	1/15/2018	1/15/2020
P05305	Cable	Andrews	ETSI-50T	10/24/2017	10/24/2019
P05360	Cable	Belden	RG214	1/31/2018	1/31/2020
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2017	2/3/2019
P06123	Attenuator	Aeroflex	18N-6	5/5/2017	5/5/2019
P06540	Cable	Andrews	Heliac	10/30/2017	10/30/2019
03628	Biconilog Antenna	ETS	3142E	6/7/2017	6/7/2019

15.231(a)(1) Manual Triggered Deactivation Time

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (s)	Limit (s)	Results
952	1	OOK	4.998	≤5	Pass

Plot(s)



Test Setup Photo(s)



15.231(a)(2) Automatic Triggered Deactivation Time

NA = Not applicable because the EUT cannot be activated automatically

15.231(a)(3) Polling or Supervision Transmission Duration

NA = Not applicable because the EUT has no polling or supervision transmission mode.

15.231(a)(4) Alarm Condition Transmission Duration

NA = Not applicable because the EUT has no alarm condition transmission mode.

15.231(a)(5) Setup Transmission Duration

NA = Not applicable because the EUT has no setup transmission duration

15.231(b) Radiated Emissions

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)
 Customer: **Itron, Inc.**
 Specification: **15.231(b) Spurious Field Strength (>470 MHz Transmitter)**
 Work Order #: **102014** Date: 12/17/2018
 Test Type: **Maximized Emissions** Time: 07:30:08
 Tested By: Matthew Harrison / Steven Pittsford Sequence#: 21
 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: 20-23°C
 Humidity: 33-37%
 Pressure: 100.8-102.7kPa

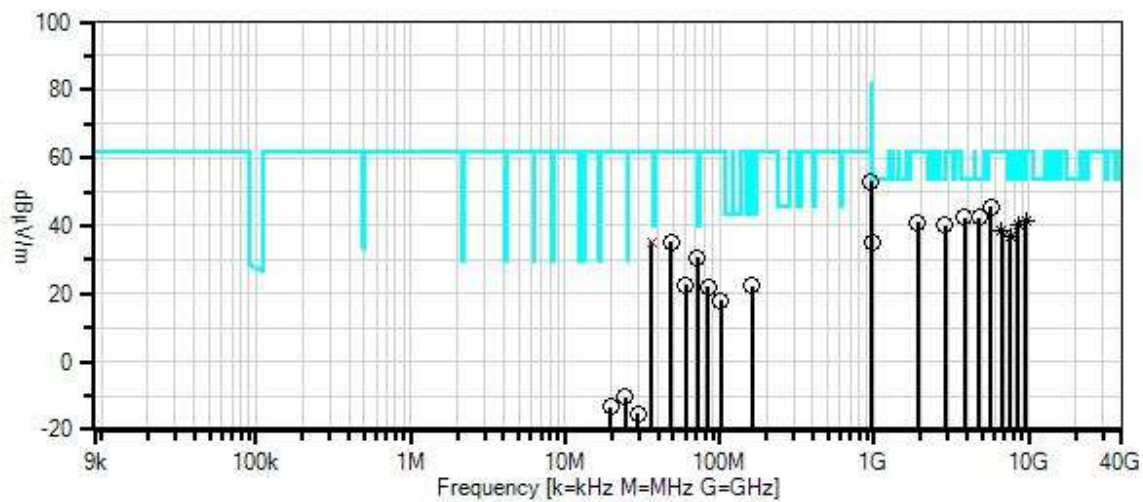
 Frequency Range: 9kHz to 10GHz
 Frequency tested: 952MHz
 Firmware power setting: Low Power

 Protocol /MCS/Modulation: Continuous OOK

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting OOK on single channel, 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)

Ittron, Inc W/O#: 102014 Sequence#: 21 Date: 12/17/2018
15.231(b) Spurious Field Strength (>470 MHz Transmitter) Test Distance: 3 Meters Vert



— Readings
○ Peak Readings
× QP Readings
* Average Readings
▼ Ambient
Software Version: 5.03.11
1 - 15.231(b) Spurious Field Strength (>470 MHz Transmitter)

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	HeliAx	10/30/2017	10/30/2019
T6	AN02673	Spectrum Analyzer	E4446A	2/3/2017	2/3/2019
T7	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T8	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020
T9	ANP06515	Cable	HeliAx	6/29/2018	6/29/2020
T10	AN03540	Preamp	83017A	5/2/2017	5/2/2019
T11	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/21/2017	7/21/2019
T12	ANP06503	Cable	32026-29801-29801-36	3/13/2018	3/13/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

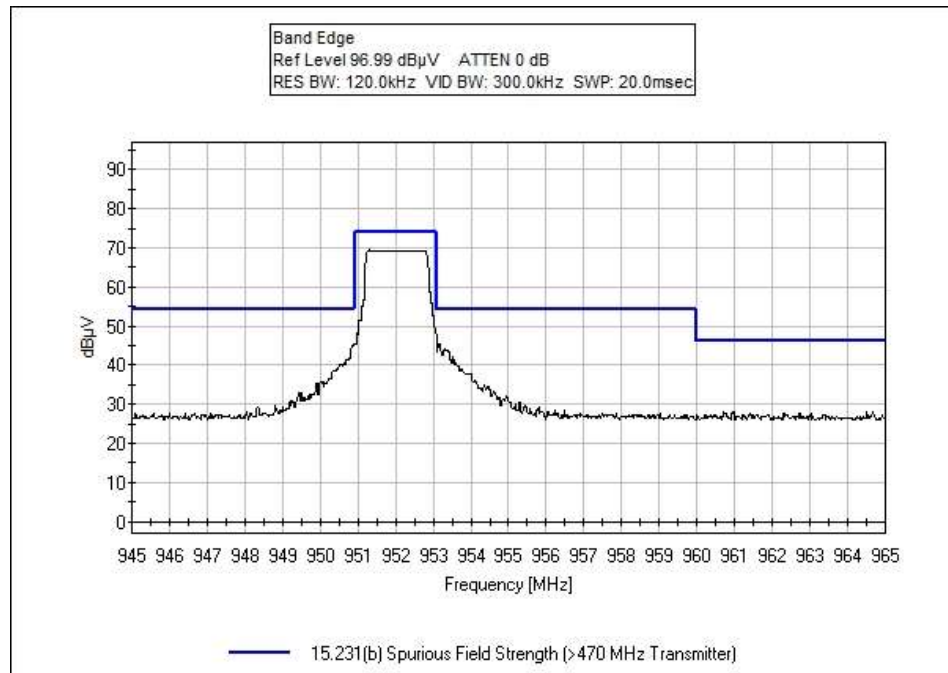
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7	T8					
			T9	T10	T11	T12	Table	dBμV/m	dBμV/m	dB	Ant
1	950.900M	45.3	+25.0	+5.9	+1.6	+2.0	+0.0	53.0	61.9	-8.9	Vert
			+0.4	+0.0	-27.2	+0.0	360				102
			+0.0	+0.0	+0.0	+0.0					
2	953.100M	45.3	+25.0	+5.9	+1.6	+2.0	+0.0	53.0	61.9	-8.9	Vert
			+0.4	+0.0	-27.2	+0.0	360				102
			+0.0	+0.0	+0.0	+0.0					
3	4758.883M	37.3	+0.0	+0.0	+0.0	+0.0	+0.0	42.5	54.0	-11.5	Vert
			+0.5	+0.0	+0.0	+0.0					154
			+4.1	-33.2	+32.3	+1.5					
4	3807.983M	39.3	+0.0	+0.0	+0.0	+0.0	+0.0	42.4	54.0	-11.6	Vert
			+0.4	+0.0	+0.0	+0.0	332				154
			+3.8	-33.4	+31.0	+1.3					
5	2854.117M	40.6	+0.0	+0.0	+0.0	+0.0	+0.0	40.2	54.0	-13.8	Horiz
			+0.5	+0.0	+0.0	+0.0					154
			+2.7	-33.8	+29.1	+1.1					
6	5712.875M	37.6	+0.0	+0.0	+0.0	+0.0	+0.0	45.7	61.9	-16.2	Horiz
			+0.7	+0.0	+0.0	+0.0	166				154
			+4.5	-33.4	+34.5	+1.8					
7	7614.420M	25.4	+0.0	+0.0	+0.0	+0.0	+0.0	36.6	54.0	-17.4	Vert
	Ave		+1.2	+0.0	+0.0	+0.0	267				142
			+5.5	-34.6	+36.9	+2.2					
^	7614.420M	39.6	+0.0	+0.0	+0.0	+0.0	+0.0	50.8	54.0	-3.2	Vert
			+1.2	+0.0	+0.0	+0.0	360				168
			+5.5	-34.6	+36.9	+2.2					

9	9519.465M Ave	28.0	+0.0 +0.9 +6.2	+0.0 +0.0 -33.5	+0.0 +0.0 +37.4	+0.0 +0.0 +2.6	+0.0 360	41.6	61.9	-20.3	Vert 136
^	9519.465M	39.2	+0.0 +0.9 +6.2	+0.0 +0.0 -33.5	+0.0 +0.0 +37.4	+0.0 +0.0 +2.6	+0.0	52.8	61.9	-9.1	Vert 155
11	1904.433M	44.5	+0.0 +0.4 +2.3	+0.0 +0.0 -34.4	+0.0 +0.0 +27.3	+0.0 +0.0 +0.8	+0.0 147	40.9 Y	61.9	-21.0	Vert 112
12	162.550M	32.6	+9.7 +0.2 +0.0	+5.9 +0.0 +0.0	+0.6 -27.5 +0.0	+0.7 +0.0 +0.0	+0.0	22.2	43.5	-21.3	Vert 103
13	8565.605M Ave	28.2	+0.0 +0.9 +5.9	+0.0 +0.0 -34.1	+0.0 +0.0 +37.2	+0.0 +0.0 +2.3	+0.0	40.4	61.9	-21.5	Vert 142
^	8565.605M	38.2	+0.0 +0.9 +5.9	+0.0 +0.0 -34.1	+0.0 +0.0 +37.2	+0.0 +0.0 +2.3	+0.0 136	50.4	61.9	-11.5	Vert 159
15	6663.500M Ave	28.4	+0.0 +0.6 +5.5	+0.0 +0.0 -33.7	+0.0 +0.0 +35.5	+0.0 +0.0 +2.0	+0.0	38.3	61.9	-23.6	Vert 161
^	6663.500M	39.4	+0.0 +0.6 +5.5	+0.0 +0.0 -33.7	+0.0 +0.0 +35.5	+0.0 +0.0 +2.0	+0.0 360	49.3	61.9	-12.6	Vert 181
17	48.110M	49.2	+7.2 +0.1 +0.0	+5.9 +0.0 +0.0	+0.4 -27.9 +0.0	+0.4 +0.0 +0.0	+0.0 326	35.3	61.9	-26.6	Vert 103
18	35.970M QP	44.0	+12.6 +0.1 +0.0	+5.9 +0.0 +0.0	+0.3 -28.0 +0.0	+0.3 +0.0 +0.0	+0.0	35.2	61.9	-26.7	Vert 103
^	35.970M	46.4	+12.6 +0.1 +0.0	+5.9 +0.0 +0.0	+0.3 -28.0 +0.0	+0.3 +0.0 +0.0	+0.0 360	37.6	61.9	-24.3	Vert 103
20	958.900M	27.4	+24.9 +0.4 +0.0	+5.9 +0.0 +0.0	+1.6 -27.2 +0.0	+2.1 +0.0 +0.0	+0.0 360	35.1	61.9	-26.8	Vert 102
21	72.121M	44.8	+7.0 +0.1 +0.0	+5.9 +0.0 +0.0	+0.4 -27.9 +0.0	+0.5 +0.0 +0.0	+0.0	30.8	61.9	-31.1	Vert 109
22	60.340M	37.0	+6.7 +0.1 +0.0	+5.9 +0.0 +0.0	+0.4 -27.9 +0.0	+0.4 +0.0 +0.0	+0.0	22.6	61.9	-39.3	Vert 103

23	84.290M	36.3	+6.6 +0.1 +0.0	+5.9 +0.0 +0.0	+0.5 -27.8 +0.0	+0.5 +0.0 +0.0	+0.0	22.1	61.9	-39.8	Vert 103
24	101.880M	30.6	+8.1 +0.1 +0.0	+5.9 +0.0 +0.0	+0.5 -27.7 +0.0	+0.6 +0.0 +0.0	+0.0	18.1	61.9	-43.8	Vert 103
25	24.448M	22.2	+0.0 +0.1 +0.3	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +7.1 +0.0	-40.0 360	-10.3	61.9	-72.2	Perpe 99
26	19.552M	18.4	+0.0 +0.0 +0.2	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +8.1 +0.0	-40.0 360	-13.3	61.9	-75.2	Perpe 99
27	29.493M	18.6	+0.0 +0.1 +0.3	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +5.7 +0.0	-40.0 360	-15.3	61.9	-77.2	Perpe 99
28	18.165k	46.1	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +12.2 +0.0	-80.0 121	-21.7	61.9	-83.6	Paral 99

Band Edge

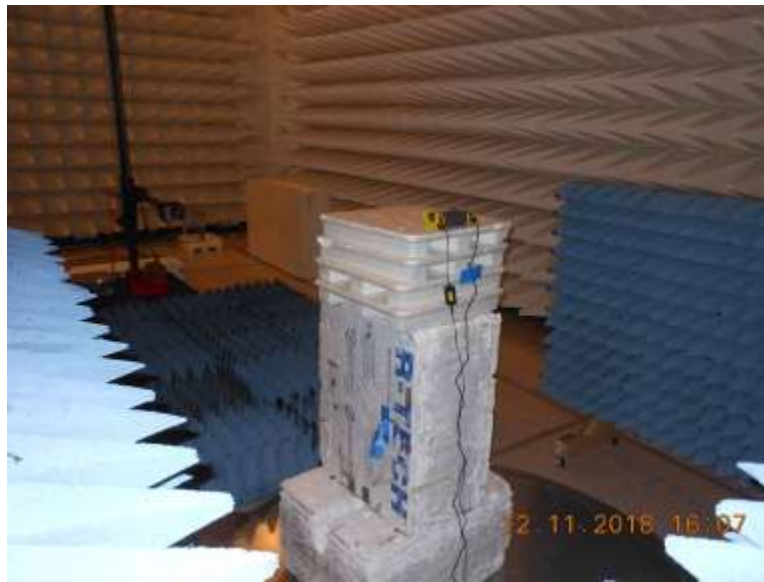
Plot



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 - Average**
 Work Order #: **102014** Date: 12/11/2018
 Test Type: **Conducted Emissions** Time: 11:59:50
 Tested By: Steven Pittsford Sequence#: 12
 Software: EMITest 5.03.11 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 22°C
 Humidity: 33%
 Pressure: 101.4kPa

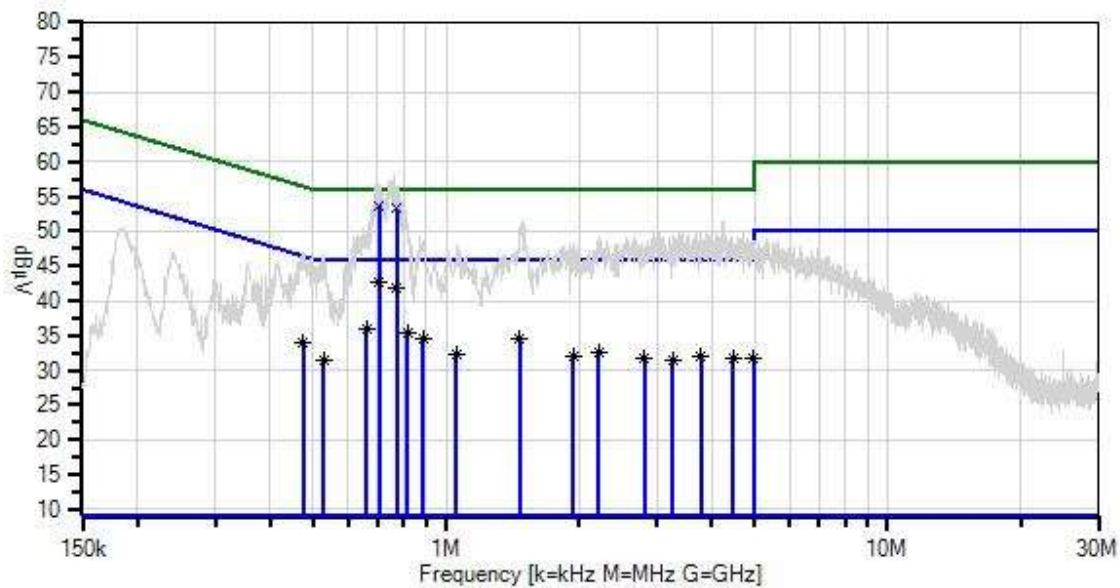
 Frequency Range: 0.15-30MHz

 Frequency tested: 952MHz
 Firmware power setting: Low Power
 Protocol /MCS/Modulation: OOK

 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#: 12 Date: 12/11/2018
15.207 AC Mains - Average Test Lead: 115VAC 60Hz Line



— Sweep Data	— Readings	○ Peak Readings
x QP Readings	* Average Readings	▼ Ambient
Software Version: 5.03.11	— 1 - 15.207 AC Mains - Average	— 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
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	707.100k QP	44.1	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	53.7	56.0	-2.3	Line
2	772.300k QP	43.6	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	53.2	56.0	-2.8	Line
3	707.100k Ave	33.1	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	42.7	46.0	-3.3	Line
^	707.100k	47.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	56.8	46.0	+10.8	Line
5	772.300k Ave	32.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	41.8	46.0	-4.2	Line
^	772.300k	48.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	57.6	46.0	+11.6	Line
7	661.800k Ave	26.1	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	35.8	46.0	-10.2	Line
^	661.800k	42.9	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	52.6	46.0	+6.6	Line
9	819.000k Ave	25.9	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	35.5	46.0	-10.5	Line
^	819.000k	41.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.8	46.0	+4.8	Line
11	885.500k Ave	24.9	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	34.5	46.0	-11.5	Line
^	885.500k	40.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	49.9	46.0	+3.9	Line
13	1.468M Ave	24.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	34.4	46.0	-11.6	Line
^	1.468M	42.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	51.9	46.0	+5.9	Line

15	474.800k Ave	24.2	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	33.9	46.4	-12.5	Line
^	474.800k	36.6	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	46.3	46.4	-0.1	Line
17	2.210M Ave	23.0	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.6	46.0	-13.4	Line
^	2.210M	41.0	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.6	46.0	+4.6	Line
19	1.056M Ave	22.7	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	32.3	46.0	-13.7	Line
^	1.056M	39.4	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	49.0	46.0	+3.0	Line
21	3.779M Ave	22.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	32.1	46.0	-13.9	Line
^	3.779M	40.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.1	46.0	+4.1	Line
23	1.942M Ave	22.3	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.9	46.0	-14.1	Line
^	1.942M	39.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.8	46.0	+2.8	Line
25	2.810M Ave	22.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.8	46.0	-14.2	Line
^	2.810M	40.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.0	46.0	+4.0	Line
27	4.967M Ave	22.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.7	46.0	-14.3	Line
^	4.967M	38.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.4	46.0	+2.4	Line
29	4.463M Ave	22.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.7	46.0	-14.3	Line
^	4.463M	40.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.1	46.0	+4.1	Line
31	528.900k Ave	21.9	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	31.6	46.0	-14.4	Line
^	528.900k	37.0	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	46.7	46.0	+0.7	Line
33	3.254M Ave	21.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	31.4	46.0	-14.6	Line
^	3.254M	40.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.0	46.0	+4.0	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: 11:45:39
 Tested By: Steven Pittsford Sequence#: 11
 Software: EMITest 5.03.11 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

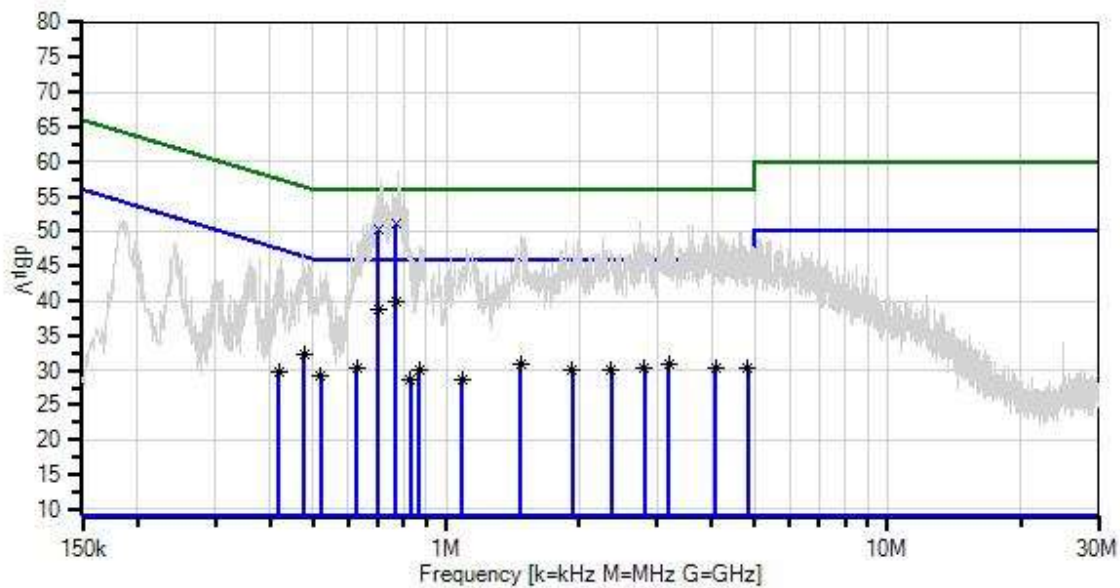
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 22°C Humidity: 33% Pressure: 101.4kPa Frequency Range: 0.15-30MHz Frequency tested: 952MHz Firmware power setting: Low Power Protocol /MCS/Modulation: OOK 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)
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Itron, Inc W/O#: 102014 Sequence#: 11 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	770.600k	41.5	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	51.1	56.0	-4.9	Neutr
2	703.700k	40.6	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	50.2	56.0	-5.8	Neutr
3	770.600k	30.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	39.9	46.0	-6.1	Neutr
^	770.600k	48.3	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	57.9	46.0	+11.9	Neutr
5	703.700k	29.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	38.8	46.0	-7.2	Neutr
^	703.700k	48.9	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	58.5	46.0	+12.5	Neutr
7	476.400k	22.6	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	32.3	46.4	-14.1	Neutr
^	476.400k	37.2	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	46.9	46.4	+0.5	Neutr
9	3.191M	21.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.8	46.0	-15.2	Neutr
^	3.191M	38.6	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.2	46.0	+2.2	Neutr
11	1.477M	21.2	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.8	46.0	-15.2	Neutr
^	1.477M	39.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.0	46.0	+3.0	Neutr
13	4.076M	20.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.4	46.0	-15.6	Neutr
^	4.076M	40.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.7	46.0	+3.7	Neutr

15	2.807M	20.8	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.4	46.0	-15.6	Neutr
^	2.807M	40.0	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	49.6	46.0	+3.6	Neutr
17	4.829M	20.7	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.3	46.0	-15.7	Neutr
^	4.829M	40.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.1	46.0	+4.1	Neutr
19	626.600k	20.5	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	30.2	46.0	-15.8	Neutr
^	626.600k	40.2	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	49.9	46.0	+3.9	Neutr
21	1.931M	20.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.1	46.0	-15.9	Neutr
^	1.931M	39.1	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	48.7	46.0	+2.7	Neutr
23	870.500k	20.5	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	30.1	46.0	-15.9	Neutr
^	870.500k	39.8	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	49.4	46.0	+3.4	Neutr
25	2.369M	20.4	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	30.0	46.0	-16.0	Neutr
^	2.369M	40.5	+9.1 +0.1	+0.1	+0.0	+0.3	+0.0	50.1	46.0	+4.1	Neutr
27	520.400k	19.5	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	29.2	46.0	-16.8	Neutr
^	520.400k	35.0	+9.1 +0.2	+0.0	+0.0	+0.4	+0.0	44.7	46.0	-1.3	Neutr
29	1.089M	19.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	28.6	46.0	-17.4	Neutr
^	1.089M	39.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	48.8	46.0	+2.8	Neutr
31	832.300k	19.0	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	28.6	46.0	-17.4	Neutr
^	832.300k	38.2	+9.1 +0.2	+0.0	+0.0	+0.3	+0.0	47.8	46.0	+1.8	Neutr
33	417.100k	19.9	+9.1 +0.1	+0.0	+0.0	+0.5	+0.0	29.6	47.5	-17.9	Neutr
^	417.100k	36.0	+9.1 +0.1	+0.0	+0.0	+0.5	+0.0	45.7	47.5	-1.8	Neutr

Test Setup Photo(s)



SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

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

Emissions Test Details

TESTING PARAMETERS

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

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

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

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in $\text{dB}\mu\text{V}/\text{m}$, 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.