

Ittron, Inc.

TEST REPORT FOR

AMR Transceiver Device For Communicating With Utility Meters Model: IMRA

Tested To The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.231a
(PERIODIC OPERATION >70MHZ)

Report No.: 99513-8

Date of issue: June 1, 2017



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 EMC testing for CKC Laboratories, Inc.

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

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

REPRESENTATIVE: Jay Holcomb
Customer Reference Number: 114073

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: 99513

April 11, 2017

April 11 – May 3, 2017

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment 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	5.03.02

Site Registration & Accreditation Information

Location	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)	Radiated Emissions and Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable

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.	IMRA	66030023

Support Equipment:

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

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRA	66030023

Support Equipment:

Device	Manufacturer	Model #	S/N
AC Adapter	Itron, Inc.	GUSB05	N/A

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)

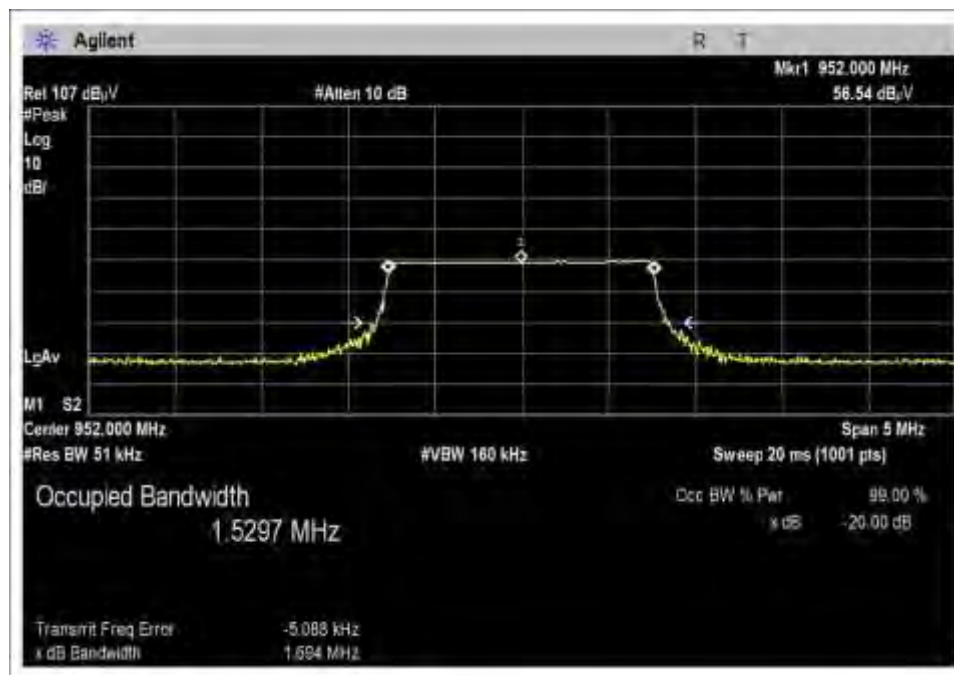
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	4/20/2017
Configuration:	1		
Test Setup:	Frequency Range: 952MHz Frequency tested: 952MHz Firmware power setting: Max Power EUT Firmware: 5.71 Protocol /MCS/Modulation: OOK 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
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2015	11/18/2017
P06540	Cable	Andrews	Heliast	10/29/2015	10/29/2017
P05963	Cable	Belden	RG-214	2/15/2016	2/15/2018
P05360	Cable	Belden	RG214	11/30/2016	11/30/2018
01991	Biconilog Antenna	Chase	CBL6111C	3/11/2016	3/11/2018
P05657	Attenuator	Paternack	PE7004-6	12/22/2015	12/22/2017
02307	Preamp	HP	8447D	2/15/2016	2/15/2018

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	1694	≤4760	Pass

Plot



Test Setup Photo



Below 1GHz

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	78.2	78.1	77.9	0.2

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

Parameter Definitions:

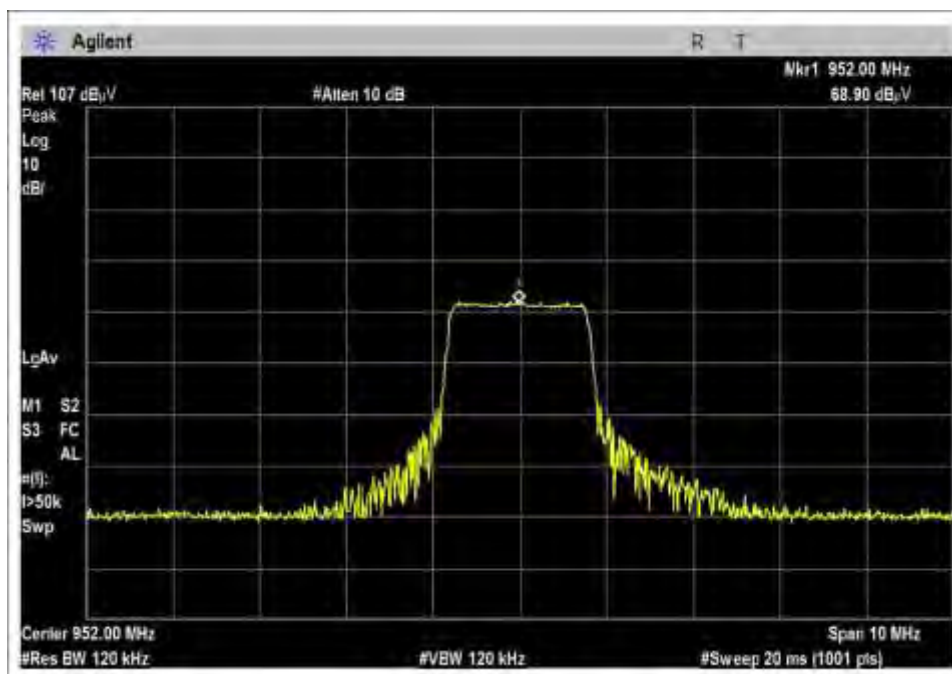
Measurements performed at input voltage V_{Nominal} ± 15%.

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

Test Data Summary – Radiated Field Strength Measurement

Frequency (MHz)	Modulation	Ant. Type	Measured (dBuV/m @ 3m)	Limit (dBuV/m @ 3m)	Results
952	OOK	Internal PIFA 2.0dBi	78.1	≤81.9	Pass

Plot



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 #: **99513** Date: 4/30/2017
 Test Type: **Maximized Emissions** Time: 08:24:19
 Tested By: Michael Atkinson Sequence#: 6
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency Range: 952MHz
 Frequency tested: 952MHz
 Firmware power setting: Max Power
 EUT Firmware: 5.71
 Protocol /MCS/Modulation: OOK

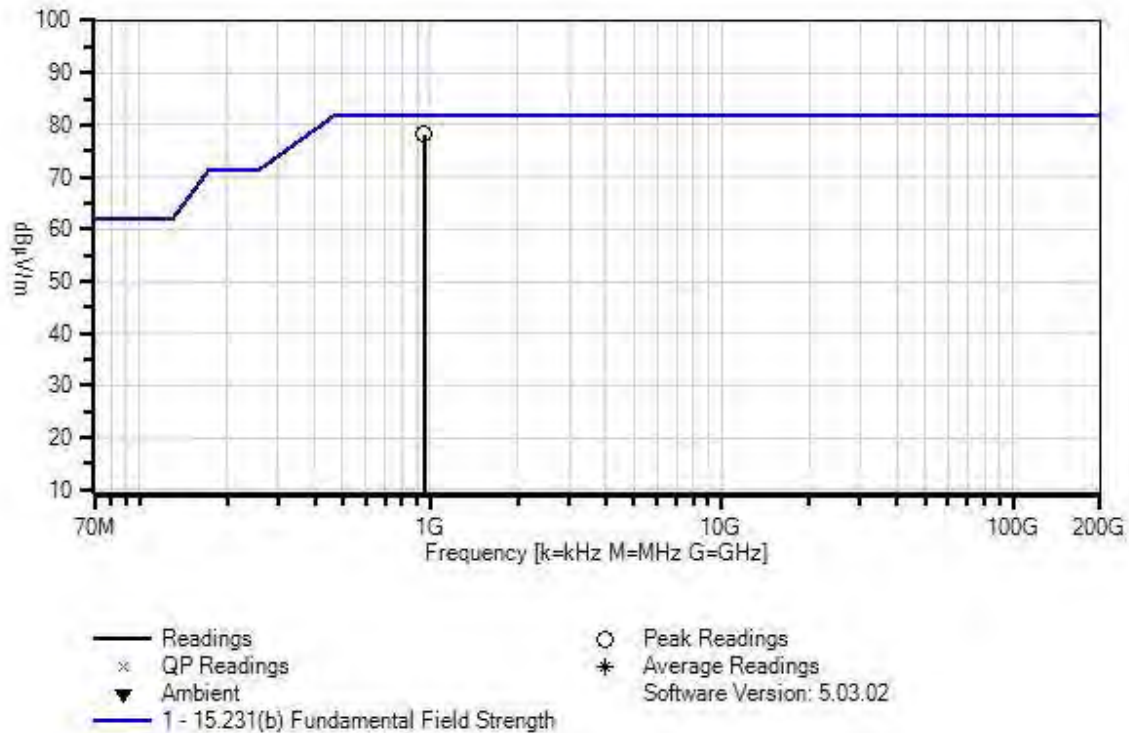
 Antenna type: Internal PIFA
 Antenna Gain: 2.0 dBi.

 Temperature: 20-26°C
 Relative Humidity: 36-41%
 Bothell Lab C3

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting
 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 W/O#: 99513 Sequence#: 6 Date: 4/30/2017
15.231(b) Fundamental Field Strength Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T1	ANP06540	Cable	Helix	10/29/2015	10/29/2017
T2	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
T3	ANP05360	Cable	RG214	11/30/2016	11/30/2018
T4	AN01991	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
T5	ANP05657	Attenuator	PE7004-6	12/22/2015	12/22/2017
T6	AN02307	Preamp	8447D	2/15/2016	2/15/2018

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							
			dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	952.000M	68.9	+0.4	+2.4	+2.2	+25.3	+0.0	78.1	81.9	-3.8	Horiz
			+6.1	-27.2							

Test Photos



Below 1 GHz



X Axis



Y Axis



Z Axis

15.225(a) Periodic Operation Requirements

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	4/20/2017
Configuration:	1		
Test Setup:	Frequency Range: 952 Frequency tested: 952 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 through a temporary antenna connector and is attached directly to the spectrum analyzer. Various modulation tones were investigated, only worst case reported. Modifications Added: None		

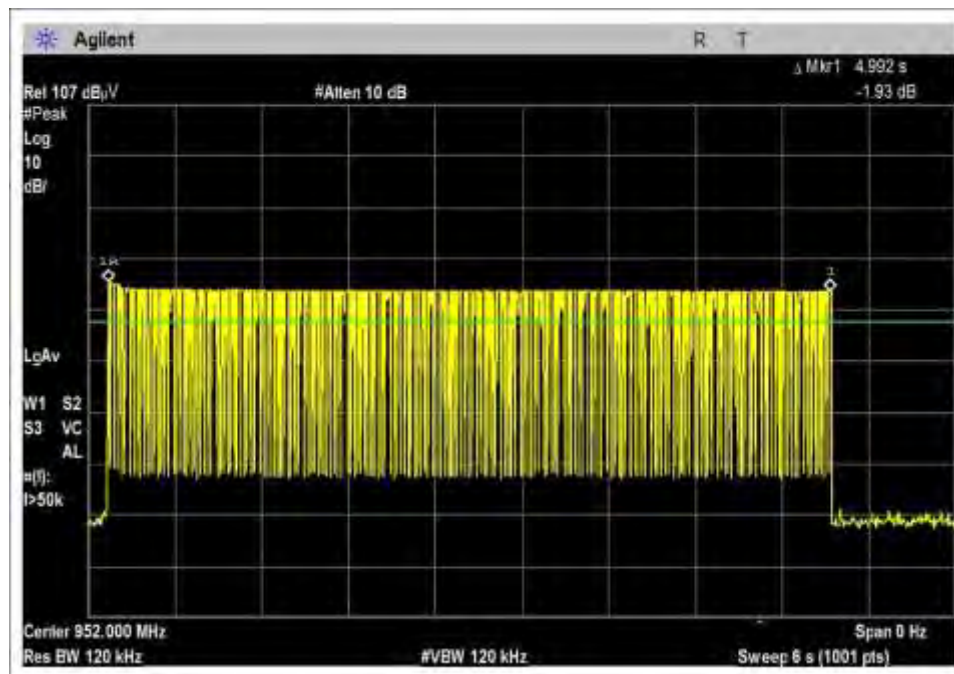
Environmental Conditions			
Temperature (°C)	20-22	Relative Humidity (%):	30-40

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2015	11/18/2017
P06540	Cable	Andrews	Helix	10/29/2015	10/29/2017
P05963	Cable	Belden	RG-214	2/15/2016	2/15/2018
P05360	Cable	Belden	RG214	11/30/2016	11/30/2018
01991	Biconilog Antenna	Chase	CBL6111C	3/11/2016	3/11/2018
P05657	Attenuator	Paternack	PE7004-6	12/22/2015	12/22/2017
02307	Preamplifier	HP	8447D	2/15/2016	2/15/2018

15.231(a)(1) Manual Triggered Deactivation Time

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (s)	Limit (s)	Results
952	1	OOK	4.992	≤5	Pass

Plot



Test Setup Photo



15.231(a)(2) Automatic Triggered Deactivation Time

Test Summary
NA = Not applicable because the EUT cannot be activated automatically.

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

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

15.231(a)(4) Alarm Condition Transmission Duration

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

15.231(a)(5) Setup Transmission Duration

Test Summary
NA = Not applicable because the EUT does not have a setup transmission mode.

15.231(b) 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: **15.231(b) Spurious Field Strength (>470 MHz Transmitter)**
 Work Order #: **99513** Date: 5/3/2017
 Test Type: **Maximized Emissions** Time: 15:57:15
 Tested By: Michael Atkinson Sequence#: 5
 Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Temperature: 20 to 26°C
 Humidity: 31 to 41%
 Pressure: 99.3 to 102.5kPa
 Bothell Lab C3

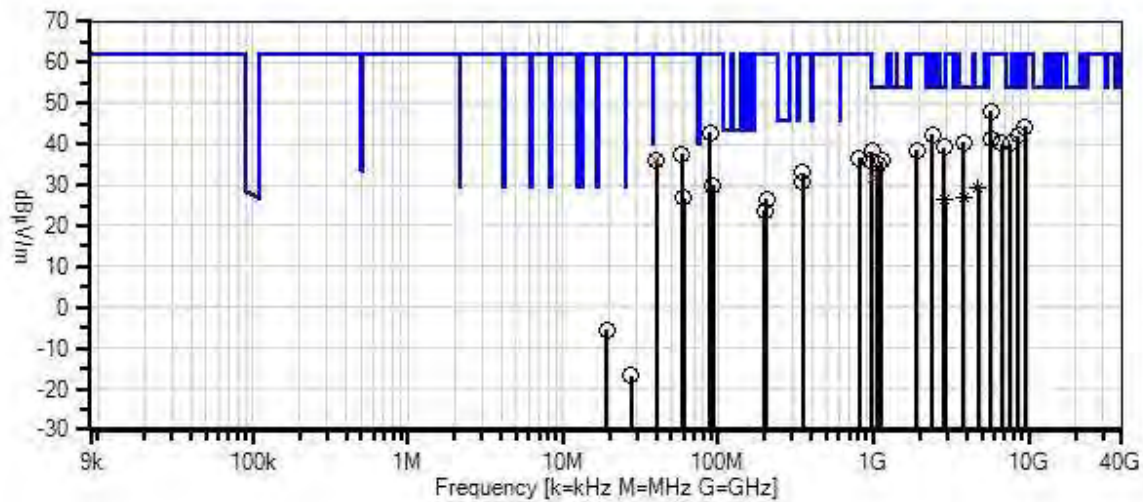
 Frequency Range: 9kHz-9.28GHz
 Frequency tested: 952MHz
 Firmware power setting: Max Power
 EUT Firmware: 5.71
 Protocol /MCS/Modulation: OOK

 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: 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#: 99513 Sequence#: 5 Date: 5/3/2017
15.231(b) Spurious Field Strength (>470 MHz Transmitter) Test Distance: 3 Meters Vert



- Readings
- Peak Readings
- × QP Readings
- * Average Readings
- ▼ Ambient
- Software Version: 5.03.02
- 1 - 15.231(b) Spurious Field Strength (>470 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	10/12/2015	10/12/2017
T1	ANP06540	Cable	Helix	10/29/2015	10/29/2017
T2	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T3	AN01467	Horn Antenna- ANSI C63.5 Calibration	3115	8/12/2015	8/12/2017
T4	ANP06935	Cable	32026-29801- 29801-18	3/11/2016	3/11/2018
	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T5	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
T6	ANP05360	Cable	RG214	11/30/2016	11/30/2018
T7	AN02307	Preamp	8447D	2/15/2016	2/15/2018
T8	AN01991	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
T9	ANP05657	Attenuator	PE7004-6	12/22/2015	12/22/2017
T10	AN00052	Loop Antenna	6502	4/8/2016	4/8/2018
T11	AN03540	Preamp	83017A	5/2/2017	5/2/2019

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

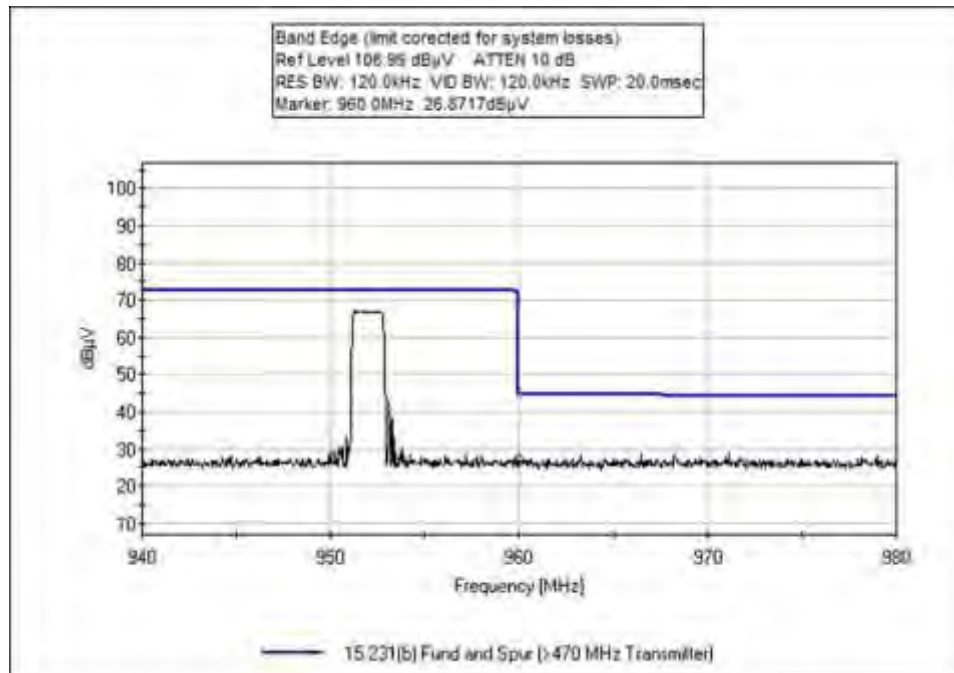
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	3807.980M	38.6	+0.7 +0.0 +0.0	+3.8 +0.0 +0.0	+30.4 +0.0 -33.4	+0.5 +0.0	+0.0	40.6	54.0	-13.4	Horiz
2	5734.000M	41.4	+1.1 +0.0 +0.0	+4.4 +0.0 +0.0	+34.2 +0.0 -33.4	+0.5 +0.0	+0.0	48.2	61.9	-13.7	Vert
3	7615.932M	31.1	+1.3 +0.0 +0.0	+5.0 +0.0 +0.0	+36.8 +0.0 -34.6	+0.6 +0.0	+0.0	40.2	54.0	-13.8	Horiz
4	2855.980M	39.8	+0.7 +0.0 +0.0	+3.1 +0.0 +0.0	+29.2 +0.0 -33.8	+0.4 +0.0	+0.0	39.4	54.0	-14.6	Horiz
5	980.600M	28.5	+0.4 +2.5 +6.1	+0.0 +2.2 +0.0	+0.0 -27.1 +0.0	+0.0 +25.6	+0.0	38.2	54.0	-15.8	Horiz
6	9519.829M	31.9	+1.6 +0.0 +0.0	+6.1 +0.0 +0.0	+37.4 +0.0 -33.5	+0.8 +0.0	+0.0	44.3	61.9	-17.6	Horiz
7	960.000M	26.7	+0.4 +2.5 +6.1	+0.0 +2.2 +0.0	+0.0 -27.1 +0.0	+0.0 +25.4	+0.0	36.2	54.0	-17.8	Vert
8	1126.000M	45.1	+0.4 +0.0 +0.0	+2.0 +0.0 +0.0	+24.2 +0.0 -36.2	+0.3 +0.0	+0.0	35.8	54.0	-18.2	Horiz
9	1072.000M	44.7	+0.4 +0.0 +0.0	+1.9 +0.0 +0.0	+24.2 +0.0 -36.5	+0.2 +0.0	+0.0	34.9	54.0	-19.1	Horiz

10	88.200M	54.6	+0.1 +0.9 +6.0	+0.0 +0.5 +0.0	+0.0 -27.8 +0.0	+0.0 +8.5	+0.0	42.8	61.9	-19.1	Vert
11	2413.000M	44.8	+0.6 +0.0 +0.0	+2.8 +0.0 +0.0	+27.7 +0.0 -34.0	+0.4 +0.0	+0.0	42.3	61.9	-19.6	Vert
12	8567.829M	31.5	+1.7 +0.0 +0.0	+5.6 +0.0 +0.0	+36.8 +0.0 -34.1	+0.7 +0.0	+0.0	42.2	61.9	-19.7	Horiz
13	5711.932M	34.4	+1.1 +0.0 +0.0	+4.4 +0.0 +0.0	+34.1 +0.0 -33.4	+0.5 +0.0	+0.0	41.1	61.9	-20.8	Horiz
14	6663.932M	33.0	+1.2 +0.0 +0.0	+4.5 +0.0 +0.0	+34.6 +0.0 -33.7	+0.6 +0.0	+0.0	40.2	61.9	-21.7	Horiz
15	974.800M QP	22.3	+0.4 +2.5 +6.1	+0.0 +2.2 +0.0	+0.0 -27.1 +0.0	+0.0 +25.5	+0.0	31.9	54.0	-22.1	Vert
^	974.800M	28.9	+0.4 +2.5 +6.1	+0.0 +2.2 +0.0	+0.0 -27.1 +0.0	+0.0 +25.5	+0.0	38.5	54.0	-15.5	Vert
17	1903.980M	42.1	+0.6 +0.0 +0.0	+2.6 +0.0 +0.0	+27.3 +0.0 -34.4	+0.3 +0.0	+0.0	38.5	61.9	-23.4	Horiz
18	1903.240M	41.8	+0.6 +0.0 +0.0	+2.6 +0.0 +0.0	+27.3 +0.0 -34.4	+0.3 +0.0	+0.0	38.2	61.9	-23.7	Vert
19	58.100M	52.0	+0.1 +0.7 +6.0	+0.0 +0.4 +0.0	+0.0 -27.8 +0.0	+0.0 +6.3	+0.0	37.7	61.9	-24.2	Vert
20	4763.240M Ave	24.2	+0.9 +0.0 +0.0	+4.3 +0.0 +0.0	+32.7 +0.0 -33.2	+0.5 +0.0	+0.0	29.4	54.0	-24.6	Vert
^	4763.240M	38.1	+0.9 +0.0 +0.0	+4.3 +0.0 +0.0	+32.7 +0.0 -33.2	+0.5 +0.0	+0.0	43.3	54.0	-10.7	Vert
22	4759.932M Ave	24.1	+0.9 +0.0 +0.0	+4.3 +0.0 +0.0	+32.7 +0.0 -33.2	+0.5 +0.0	+0.0	29.3	54.0	-24.7	Horiz
^	4759.932M	36.0	+0.9 +0.0 +0.0	+4.3 +0.0 +0.0	+32.7 +0.0 -33.2	+0.5 +0.0	+0.0	41.2	54.0	-12.8	Horiz
24	814.700M	29.3	+0.3 +2.3 +6.0	+0.0 +1.9 +0.0	+0.0 -27.7 +0.0	+0.0 +24.5	+0.0	36.6	61.9	-25.3	Horiz

25	39.700M	42.5	+0.1 +0.5 +6.0	+0.0 +0.3 +0.0	+0.0 -27.9 +0.0	+0.0 +14.7	+0.0	36.2	61.9	-25.7	Horiz
26	39.700M QP	42.5	+0.1 +0.5 +6.0	+0.0 +0.3 +0.0	+0.0 -27.9 +0.0	+0.0 +14.7	+0.0	36.2	61.9	-25.7	Vert
^	39.700M	48.1	+0.1 +0.5 +6.0	+0.0 +0.3 +0.0	+0.0 -27.9 +0.0	+0.0 +14.7	+0.0	41.8	61.9	-20.1	Vert
28	3810.040M Ave	25.1	+0.7 +0.0 +0.0	+3.8 +0.0 +0.0	+30.4 +0.0 -33.4	+0.5 +0.0	+0.0	27.1	54.0	-26.9	Vert
^	3810.040M	39.2	+0.7 +0.0 +0.0	+3.8 +0.0 +0.0	+30.4 +0.0 -33.4	+0.5 +0.0	+0.0	41.2	54.0	-12.8	Vert
30	2881.000M Ave	26.8	+0.7 +0.0 +0.0	+3.1 +0.0 +0.0	+29.3 +0.0 -33.7	+0.4 +0.0	+0.0	26.6	54.0	-27.4	Vert
^	2881.000M	41.2	+0.7 +0.0 +0.0	+3.1 +0.0 +0.0	+29.3 +0.0 -33.7	+0.4 +0.0	+0.0	41.0	54.0	-13.0	Vert
32	349.100M	36.4	+0.2 +1.7 +6.0	+0.0 +1.2 +0.0	+0.0 -27.3 +0.0	+0.0 +14.8	+0.0	33.0	61.9	-28.9	Vert
33	348.200M	34.1	+0.2 +1.7 +6.0	+0.0 +1.2 +0.0	+0.0 -27.3 +0.0	+0.0 +14.8	+0.0	30.7	61.9	-31.2	Horiz
34	92.100M	40.9	+0.1 +1.0 +6.0	+0.0 +0.5 +0.0	+0.0 -27.7 +0.0	+0.0 +9.1	+0.0	29.9	61.9	-32.0	Horiz
35	60.100M	41.6	+0.1 +0.7 +6.0	+0.0 +0.4 +0.0	+0.0 -27.8 +0.0	+0.0 +5.8	+0.0	26.8	61.9	-35.1	Horiz
36	203.600M	36.0	+0.2 +1.4 +6.0	+0.0 +0.9 +0.0	+0.0 -27.2 +0.0	+0.0 +9.2	+0.0	26.5	61.9	-35.4	Vert
37	198.800M	33.6	+0.2 +1.4 +6.0	+0.0 +0.8 +0.0	+0.0 -27.2 +0.0	+0.0 +8.9	+0.0	23.7	61.9	-38.2	Horiz
38	19.203M	25.9	+0.0 +0.0 +0.0	+0.3 +0.0 +8.3	+0.0 +0.0 +0.0	+0.0 +0.0	-40.0	-5.5	61.9	-67.4	Groun
39	27.571M	16.6	+0.0 +0.0 +0.0	+0.3 +0.0 +6.3	+0.0 +0.0 +0.0	+0.0 +0.0	-40.0	-16.8	61.9	-78.7	Groun
40	459.000k	39.1	+0.0 +0.0 +0.0	+0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0	-80.0	-31.2	61.9	-93.1	Groun

Band Edge

Band Edge Plot



Test Setup Photos



Below 1GHz



Above 1GHz



X Axis



Y Axis



Z Axis

15.207 AC Conducted Emissions

Test 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 #: **99513** Date: 4/11/2017
 Test Type: **Conducted Emissions** Time: 12:38:20
 Tested By: Michael Atkinson Sequence#: 14
 Software: EMITest 5.03.02 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Temperature: 22°C
 Humidity: 30%
 Pressure: 102.2kPa
 Bothell Lab C3

 Frequency Range: 0.15-30MHz

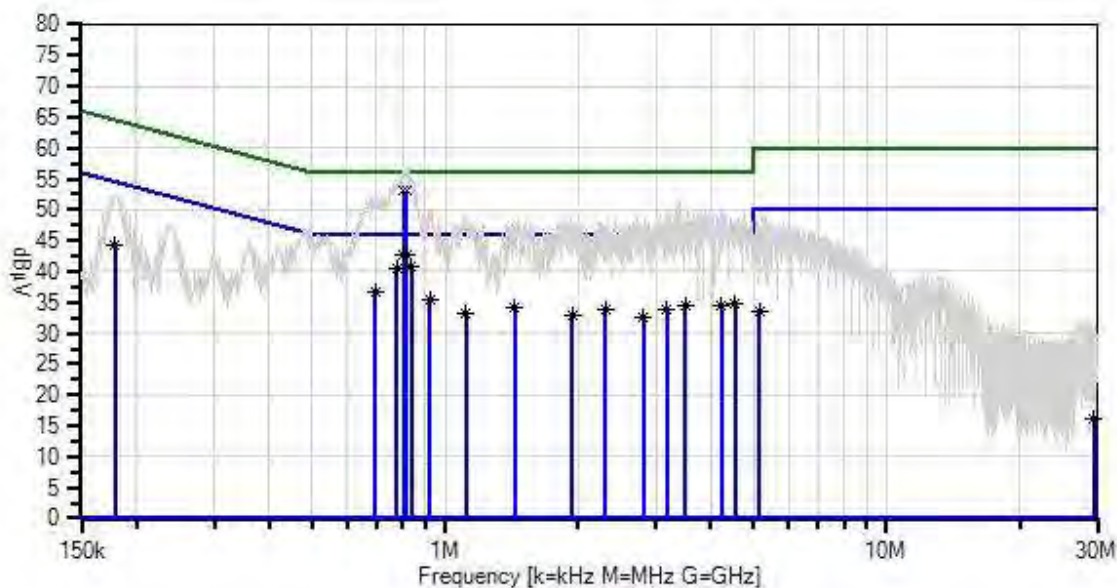
 Frequency tested: 952MHz
 Firmware power setting: Max Power
 EUT Firmware: 5.71
 Protocol /MCS/Modulation: OOK

 Antenna type: Internal PIFA
 Antenna Gain : 2.0 dBi

 Duty Cycle: 100% (Test Mode)

 Test Mode: Continuously transmitting
 Test Setup: EUT 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#: 99513 Sequence#: 14 Date: 4/11/2017
 15.207 AC Mains - Quasi-peak Test Lead: 115VAC 60Hz Line



— Sweep Data
 x QP Readings
 Software Version: 5.03.02

— 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
	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T1	ANP06540	Cable	Helix	10/29/2015	10/29/2017
T2	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T3	AN02611	High Pass Filter	HE9615-150K-50-720B	2/18/2016	2/18/2018
T4	ANP06219	Attenuator	768-10	4/12/2016	4/12/2018
T5	AN01492	50uH LISN-Line	3816/2NM	8/5/2015	8/5/2017
	AN01492	50uH LISN-Neutral	3816/2NM	8/5/2015	8/5/2017

Measurement Data:

Reading listed by margin.

Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V	dB μ V	dB	Ant
1	805.046k	43.3	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	53.1	56.0	-2.9	Line
	QP										
2	818.914k	43.3	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	53.1	56.0	-2.9	Line
	QP										
3	818.914k	33.0	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	42.8	46.0	-3.2	Line
	Ave										
^	818.914k	47.2	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	57.0	56.0	+1.0	Line
5	805.046k	33.0	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	42.8	46.0	-3.2	Line
	Ave										
^	805.046k	47.0	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	56.8	56.0	+0.8	Line
7	838.433k	30.9	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	40.7	46.0	-5.3	Line
	Ave										
^	838.432k	45.9	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	55.7	56.0	-0.3	Line
9	777.309k	30.7	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	40.5	46.0	-5.5	Line
	Ave										
^	777.309k	45.2	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	55.0	56.0	-1.0	Line
11	693.600k	26.9	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	36.7	46.0	-9.3	Line
	Ave										
^	693.600k	42.3	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	52.1	56.0	-3.9	Line
13	179.110k	33.5	+0.0 +1.5	+0.0	+0.3	+9.1	+0.0	44.4	54.5	-10.1	Line
	Ave										
^	179.110k	41.4	+0.0 +1.5	+0.0	+0.3	+9.1	+0.0	52.3	64.5	-12.2	Line
15	921.400k	25.6	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	35.4	46.0	-10.6	Line
	Ave										
^	921.400k	40.8	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	50.6	56.0	-5.4	Line
17	4.544M	25.0	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	34.7	46.0	-11.3	Line
	Ave										
^	4.544M	40.4	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	50.1	56.0	-5.9	Line

19	4.228M	24.9	+0.0	+0.1	+0.1	+9.1	+0.0	34.6	46.0	-11.4	Line
^	4.228M	40.5	+0.0	+0.1	+0.1	+9.1	+0.0	50.2	56.0	-5.8	Line
			+0.4								
21	3.492M	24.7	+0.0	+0.1	+0.1	+9.1	+0.0	34.4	46.0	-11.6	Line
^	3.492M	40.9	+0.0	+0.1	+0.1	+9.1	+0.0	50.6	56.0	-5.4	Line
			+0.4								
23	1.440M	24.2	+0.0	+0.1	+0.2	+9.1	+0.0	34.0	46.0	-12.0	Line
^	1.440M	39.5	+0.0	+0.1	+0.2	+9.1	+0.0	49.3	56.0	-6.7	Line
			+0.4								
25	3.180M	24.2	+0.0	+0.1	+0.1	+9.1	+0.0	33.9	46.0	-12.1	Line
^	3.180M	41.0	+0.0	+0.1	+0.1	+9.1	+0.0	50.7	56.0	-5.3	Line
			+0.4								
27	2.304M	24.2	+0.0	+0.1	+0.1	+9.1	+0.0	33.9	46.0	-12.1	Line
^	2.304M	40.3	+0.0	+0.1	+0.1	+9.1	+0.0	50.0	56.0	-6.0	Line
			+0.4								
29	1.116M	23.3	+0.0	+0.1	+0.2	+9.1	+0.0	33.1	46.0	-12.9	Line
^	1.116M	39.6	+0.0	+0.1	+0.2	+9.1	+0.0	49.4	56.0	-6.6	Line
			+0.4								
31	1.936M	23.1	+0.0	+0.1	+0.2	+9.1	+0.0	32.9	46.0	-13.1	Line
^	1.936M	39.8	+0.0	+0.1	+0.2	+9.1	+0.0	49.6	56.0	-6.4	Line
			+0.4								
33	2.820M	23.0	+0.0	+0.1	+0.1	+9.1	+0.0	32.7	46.0	-13.3	Line
^	2.820M	40.6	+0.0	+0.1	+0.1	+9.1	+0.0	50.3	56.0	-5.7	Line
			+0.4								
35	5.140M	23.6	+0.0	+0.1	+0.1	+9.1	+0.0	33.4	50.0	-16.6	Line
^	5.140M	38.9	+0.0	+0.1	+0.1	+9.1	+0.0	48.7	60.0	-11.3	Line
			+0.5								
37	29.410M	5.9	+0.0	+0.3	+0.2	+9.1	+0.0	16.0	50.0	-34.0	Line
^	29.410M	21.3	+0.0	+0.3	+0.2	+9.1	+0.0	31.4	60.0	-28.6	Line
			+0.5								



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 #: **99513** Date: 4/11/2017
 Test Type: **Conducted Emissions** Time: 12:51:31
 Tested By: Michael Atkinson Sequence#: 15
 Software: EMITest 5.03.02 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

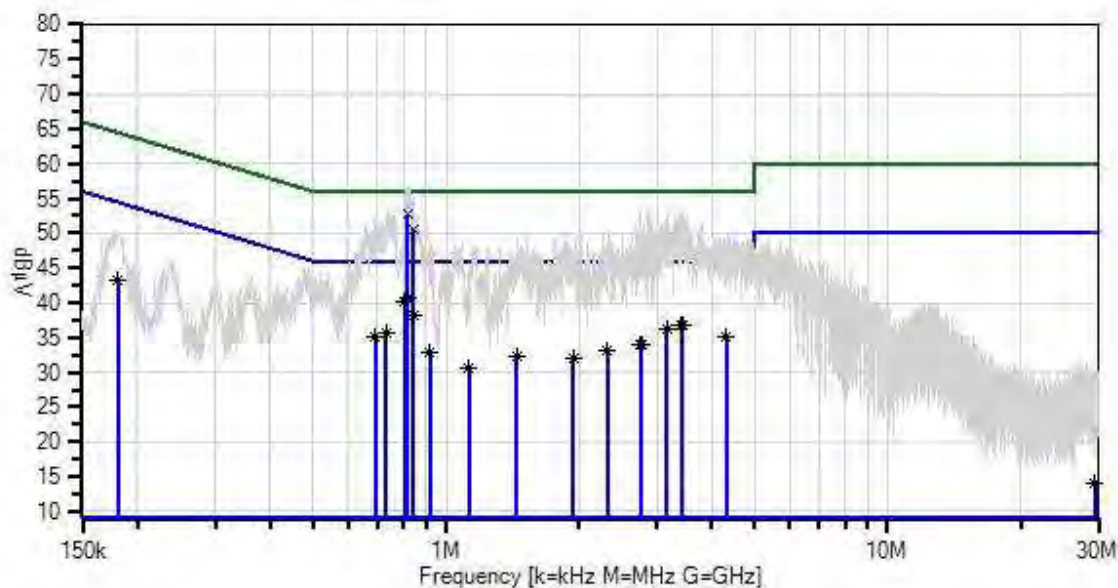
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Temperature: 22°C Humidity: 30% Pressure: 102.2kPa Bothell Lab C3 Frequency Range: 0.15-30MHz 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 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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Ittron, Inc W/O#: 99513 Sequence#: 15 Date: 4/11/2017
15.207 AC Mains - Quasi-peak Test Lead: 115VAC 60Hz Return



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2015	11/18/2017
T1	ANP06540	Cable	Heliac	10/29/2015	10/29/2017
T2	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T3	AN02611	High Pass Filter	HE9615-150K-50-720B	2/18/2016	2/18/2018
T4	ANP06219	Attenuator	768-10	4/12/2016	4/12/2018
	AN01492	50uH LISN-Line	3816/2NM	8/5/2015	8/5/2017
T5	AN01492	50uH LISN-Neutral	3816/2NM	8/5/2015	8/5/2017

Measurement Data:

Reading listed by margin.

Test Lead: Return

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	816.860k	42.9	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	52.7	56.0	-3.3	Retur
	QP										
2	816.860k	30.9	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	40.7	46.0	-5.3	Retur
	Ave										
^	816.859k	46.6	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	56.4	56.0	+0.4	Retur
4	841.514k	40.8	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	50.6	56.0	-5.4	Retur
	QP										
5	805.046k	30.4	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	40.2	46.0	-5.8	Retur
	Ave										
^	805.046k	44.4	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	54.2	56.0	-1.8	Retur
7	841.514k	28.4	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	38.2	46.0	-7.8	Retur
	Ave										
^	841.514k	45.6	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	55.4	56.0	-0.6	Retur
9	3.430M	27.0	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	36.7	46.0	-9.3	Retur
	Ave										
^	3.430M	43.8	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	53.5	56.0	-2.5	Retur
11	3.420M	27.0	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	36.7	46.0	-9.3	Retur
	Ave										
^	3.420M	43.4	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	53.1	56.0	-2.9	Retur
13	3.160M	26.4	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	36.1	46.0	-9.9	Retur
	Ave										
^	3.160M	43.5	+0.0 +0.4	+0.1	+0.1	+9.1	+0.0	53.2	56.0	-2.8	Retur
15	731.000k	26.0	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	35.8	46.0	-10.2	Retur
	Ave										
^	731.000k	42.9	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	52.7	56.0	-3.3	Retur
17	691.500k	25.3	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	35.1	46.0	-10.9	Retur
	Ave										
^	691.500k	42.1	+0.0 +0.4	+0.1	+0.2	+9.1	+0.0	51.9	56.0	-4.1	Retur

19	4.311M	25.4	+0.0	+0.1	+0.1	+9.1	+0.0	35.1	46.0	-10.9	Retur
	Ave		+0.4								
^	4.311M	39.7	+0.0	+0.1	+0.1	+9.1	+0.0	49.4	56.0	-6.6	Retur
			+0.4								
21	180.610k	32.2	+0.0	+0.0	+0.3	+9.1	+0.0	43.1	54.5	-11.4	Retur
	Ave		+1.5								
^	180.610k	39.0	+0.0	+0.0	+0.3	+9.1	+0.0	49.9	64.5	-14.6	Retur
			+1.5								
23	2.760M	24.3	+0.0	+0.1	+0.1	+9.1	+0.0	34.0	46.0	-12.0	Retur
	Ave		+0.4								
^	2.760M	43.6	+0.0	+0.1	+0.1	+9.1	+0.0	53.3	56.0	-2.7	Retur
			+0.4								
25	2.774M	24.3	+0.0	+0.1	+0.1	+9.1	+0.0	34.0	46.0	-12.0	Retur
	Ave		+0.4								
^	2.774M	44.6	+0.0	+0.1	+0.1	+9.1	+0.0	54.3	56.0	-1.7	Retur
			+0.4								
27	2.314M	23.3	+0.0	+0.1	+0.1	+9.1	+0.0	33.0	46.0	-13.0	Retur
	Ave		+0.4								
^	2.314M	41.4	+0.0	+0.1	+0.1	+9.1	+0.0	51.1	56.0	-4.9	Retur
			+0.4								
29	920.000k	23.0	+0.0	+0.1	+0.2	+9.1	+0.0	32.8	46.0	-13.2	Retur
	Ave		+0.4								
^	920.000k	38.4	+0.0	+0.1	+0.2	+9.1	+0.0	48.2	56.0	-7.8	Retur
			+0.4								
31	1.445M	22.6	+0.0	+0.1	+0.2	+9.1	+0.0	32.4	46.0	-13.6	Retur
	Ave		+0.4								
^	1.445M	41.6	+0.0	+0.1	+0.2	+9.1	+0.0	51.4	56.0	-4.6	Retur
			+0.4								
33	1.941M	22.3	+0.0	+0.1	+0.2	+9.1	+0.0	32.1	46.0	-13.9	Retur
	Ave		+0.4								
^	1.941M	41.5	+0.0	+0.1	+0.2	+9.1	+0.0	51.3	56.0	-4.7	Retur
			+0.4								
35	1.126M	20.7	+0.0	+0.1	+0.2	+9.1	+0.0	30.5	46.0	-15.5	Retur
	Ave		+0.4								
^	1.126M	39.2	+0.0	+0.1	+0.2	+9.1	+0.0	49.0	56.0	-7.0	Retur
			+0.4								
37	29.430M	4.0	+0.0	+0.3	+0.2	+9.1	+0.0	14.0	50.0	-36.0	Retur
	Ave		+0.4								
^	29.430M	19.8	+0.0	+0.3	+0.2	+9.1	+0.0	29.8	60.0	-30.2	Retur
			+0.4								

Test Setup Photo



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.