

Ittron, Inc.

REVISED TEST REPORT TO 102206-6

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.: 102206-6A

Date of issue: May 30, 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:

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

Representative: Jay Holcomb
Customer Reference Number: 170692

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: 102206

February 5, 2019

February 5-11, 2019

Revision History

Original: Testing of the AMR Transceiver Device For Communicating With Utility Meters, Model: IMRB to FCC Part 15 Subpart C Section(s) 15.207 & 15.231a (PERIODIC OPERATION >70MHZ).

Revision A: To correct the header to 15.231(a) for Periodic Operation Requirements.

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 that reads "Steve Behm". The signature is written in a cursive style with a horizontal line underneath.

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 - 15.231a

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

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):	OOK
Maximum Duty Cycle:	100% tested as worst case
Antenna Type(s) and Gain:	External Monopole Vehicle Mounted, 5dBi gain and External Monopole Attached, 3dBi gain
Antenna Connection Type:	External Connector
Operational Trigger Type:	Manually Activated Trigger
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

15.231(c) Occupied Bandwidth (20dB BW)

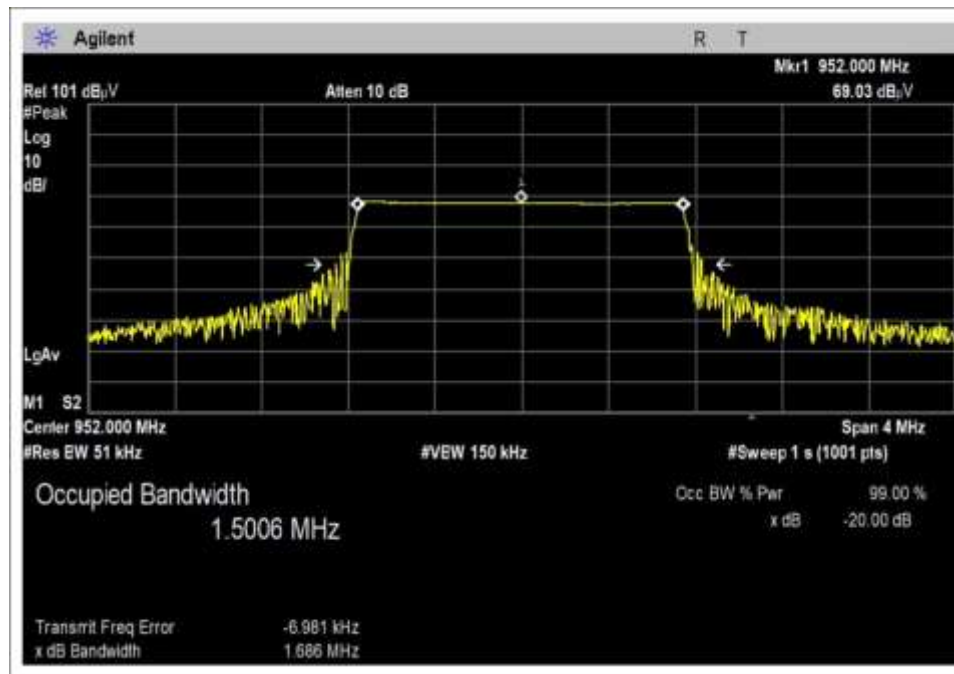
Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	2/11/2019
Configuration:	2		
Test Setup:	Firmware power setting: Max Power Protocol /MCS/Modulation: OOK Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting Test 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

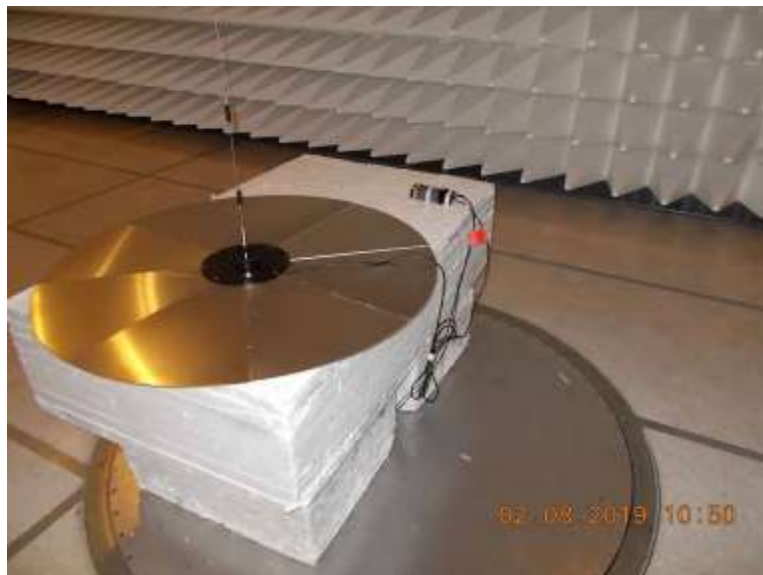
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/3/2017	11/3/2019
P06540	Cable	Andrews	Heliast	10/30/2017	10/30/2019
P05305	Cable	Andrews	ETSI-50T	10/24/2017	10/24/2019
02307	Preamplifier	HP	8447D	1/15/2018	1/15/2020
P05360	Cable	Belden	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					
$Limit = \begin{cases} 0.25\% f_c & 70 \text{ MHz} < f_c < 900 \text{ MHz} \\ 0.5\% f_c & f_c > 900 \text{ MHz} \end{cases}$					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
952	1	OOK	1686	≤4760	Pass

Plot(s)



Test Setup Photo(s)



15.231(b) 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
952	OOK	5dBi external monopole (vehicle)	78.8	≤81.9	Pass
952	OOK	3dBi external attached monopole (rubber duck)	78.7	≤81.9	Pass

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 (5dBi antenna)	78.8	78.8	78.8	0.0
952	OOK (3dBi antenna)	78.7	78.7	78.7	0.0

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.

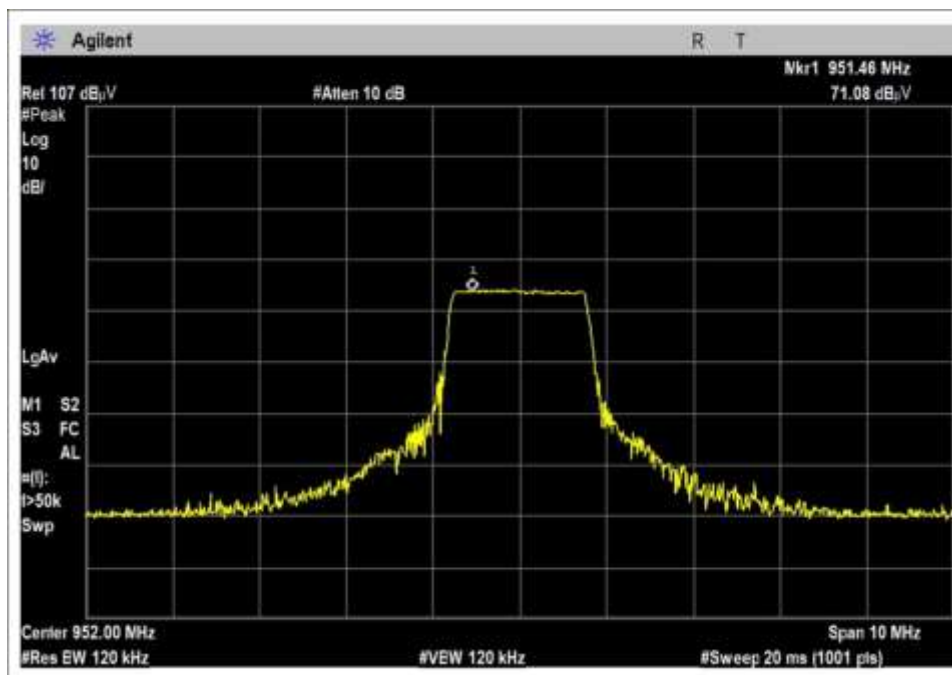
Parameter Definitions:

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

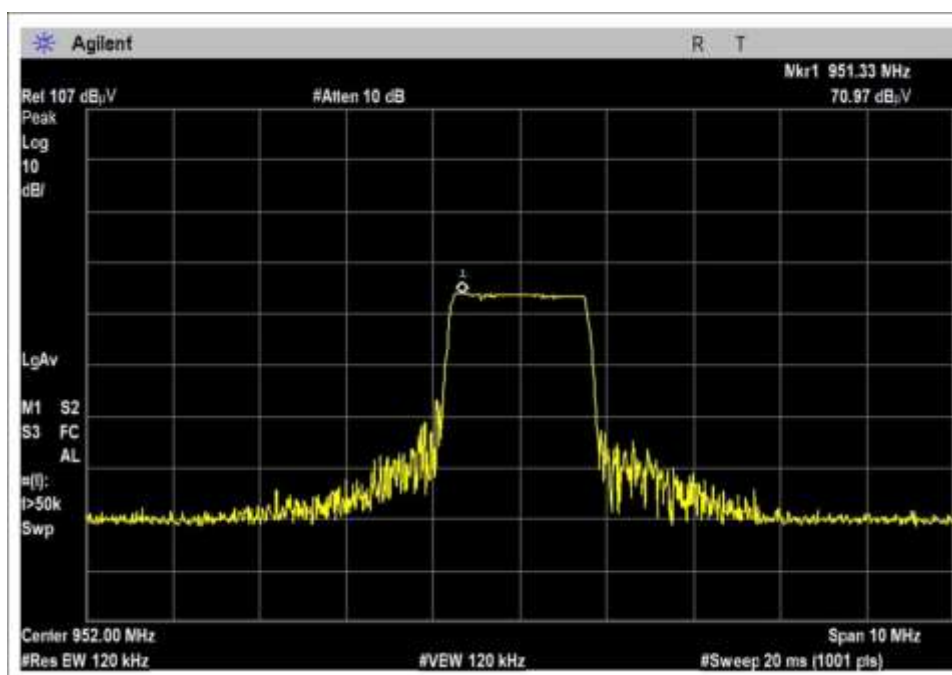
Measurements performed at input voltage according to manufacturer specification. (DC Input)

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

Plots



Configuration 2



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: **15.231(b) Fundamental Field Strength**
 Work Order #: **102206** Date: 2/11/2019
 Test Type: **Maximized Emissions** Time: 14:16:45
 Tested By: Michael Atkinson Sequence#: 14
 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			

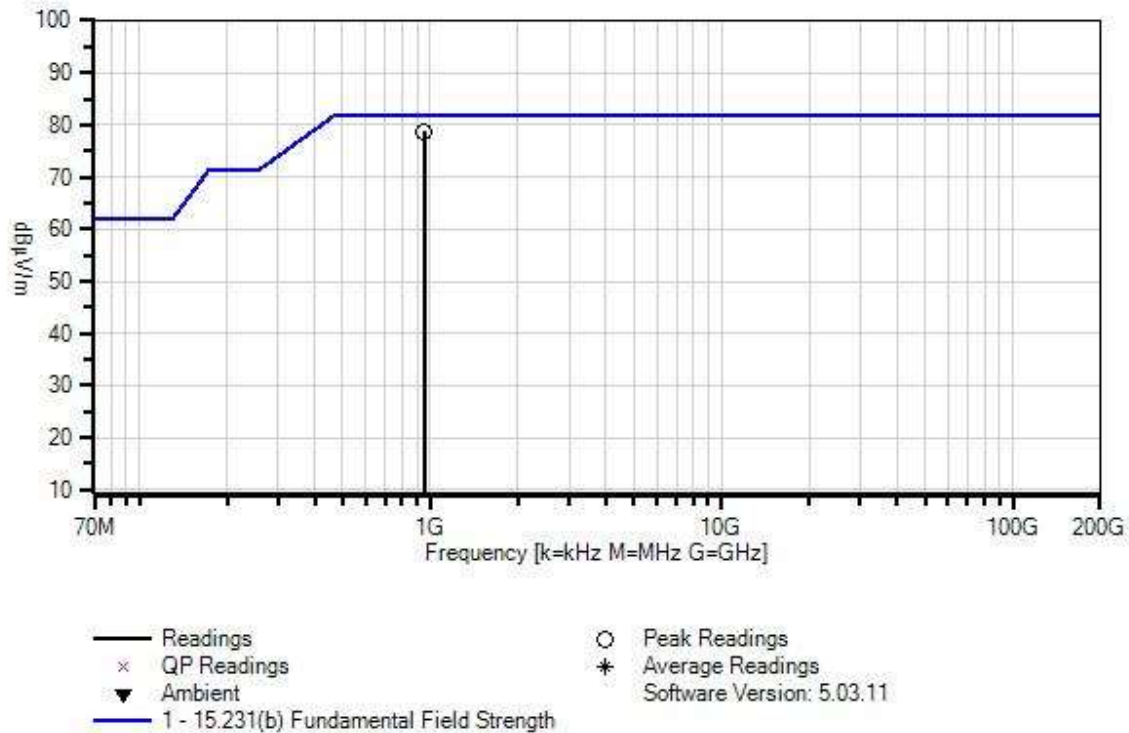
Test Conditions / Notes:

Frequency Range: 952-953MHz
 Frequency tested: Fundamental
 Firmware power setting: Max Power
 Protocol/MCS/Modulation: OOK

 Duty Cycle: 100% (Test Mode)
 Test Location: Bothell Lab C3
 Temperature (°C) 20-22
 Relative Humidity (%): 20-30
 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, worst case reported.
Antenna: 5dBi and 3dBi antennas investigated

Ittron, Inc WD#: 102014 Sequence#: 14 Date: 2/11/2019
15.231(b) Fundamental Field Strength 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	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T3	ANP05305	Cable	ETSI-50T	10/24/2017	10/24/2019
T4	AN02307	Preamp	8447D	1/15/2018	1/15/2020
T5	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T6	ANP06123	Attenuator	18N-6	5/5/2017	5/5/2019
T7	AN03628	Biconilog Antenna	3142E	6/7/2017	6/7/2019

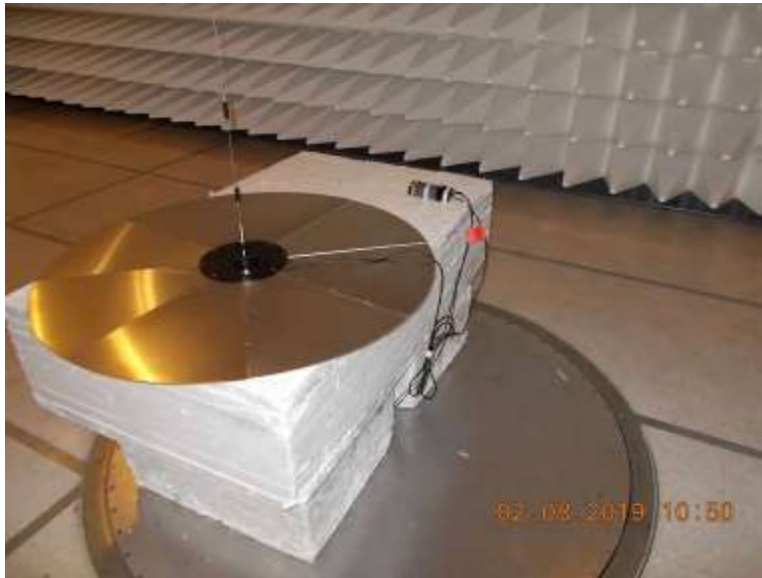
Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6	T7						
			dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	951.460M	71.1	+0.4	+0.0	+1.6	-27.2	+0.0	78.8	81.9	-3.1	Vert
			+2.0	+5.9	+25.0				5dBi vehicle antenna		
2	951.330M	71.0	+0.4	+0.0	+1.6	-27.2	+0.0	78.7	81.9	-3.2	Vert
			+2.0	+5.9	+25.0				3dBi rubber ducky (Z axis)		

Test Setup Photo(s)



Configuration 2



Configuration 3



X Axis



Y Axis



Z Axis

15.231(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):	2/11/2019
Configuration:	2		
Test Setup:	Firmware power setting: Max Power Protocol /MCS/Modulation: OOK 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.		

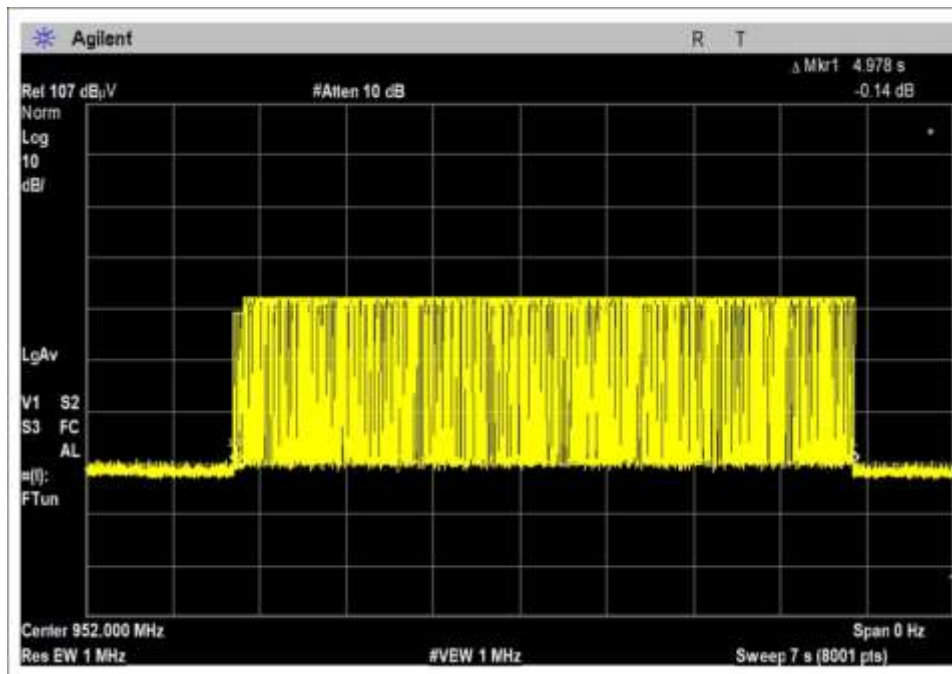
Environmental Conditions			
Temperature (°C)	20-23	Relative Humidity (%):	20-30

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/3/2017	11/3/2019
P06540	Cable	Andrews	Helix	10/30/2017	10/30/2019
P05305	Cable	Andrews	ETSI-50T	10/24/2017	10/24/2019
02307	Preamplifier	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

15.231(a)(1) Manual Triggered Deactivation Time

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (s)	Limit (s)	Results
952	1	OOK	4.978	≤5	Pass

Plot(s)



Time On

Test Setup Photo(s)



15.231(a)(2) Automatic Triggered Deactivation Time

NA = The EUT cannot be activated automatically.

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

NA = The EUT has no polling or supervision transmission mode.

15.231(a)(4) Alarm Condition Transmission Duration

NA = The EUT has no alarm condition transmission mode.

15.231(a)(5) Setup Transmission Duration

NA = 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
 Customer: **Itron, Inc.**
 Specification: **15.231(e) Spurious Field Strength (>470 MHz Transmitter)**
 Work Order #: **102206** Date: 2/11/2019
 Test Type: **Maximized Emissions** Time: 15:13:03
 Tested By: Michael Atkinson Sequence#: 8
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

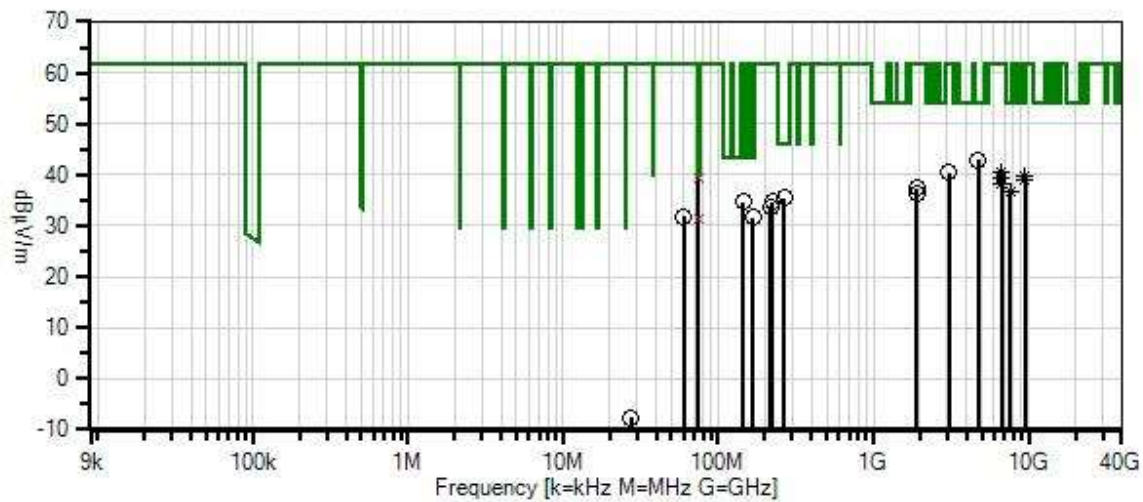
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Temperature: 20-23°C Humidity: 25-35% Pressure: 100.5-102.0 kPa Frequency Range: 952-953MHz Frequency tested: 952MHz Firmware power setting: Max Power Protocol /MCS/Modulation: OOK Duty Cycle: 100% (Test Mode) Test Location: Bothell Lab C3 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 mount antenna
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Itron, Inc W/O#: 102014 Sequence#: 8 Date: 2/11/2019
15.231(b) Spurious Field Strength (>470 MHz Transmitter) Test Distance: 3 Meters Vert



- Readings
- Peak Readings
- × QP Readings
- * Average Readings
- ▼ Ambient
- Software Version: 5.03.12
- 1 - 15.231(b) Spurious Field Strength (>470 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Helix	10/30/2017	10/30/2019
T2	ANP06515	Cable	Helix	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 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	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	74.600M	45.4	+0.1	+0.0	+0.0	+0.0	+0.0	31.5	40.0	-8.5	Horiz
	QP		+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.8	+0.5	+5.9					
			+6.9								
^	74.600M	47.6	+0.1	+0.0	+0.0	+0.0	+0.0	33.7	40.0	-6.3	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.5	-27.8	+0.5	+5.9					
			+6.9								
3	266.700M	41.3	+0.2	+0.0	+0.0	+0.0	+0.0	35.5	46.0	-10.5	Horiz
			+0.0	+0.0	+0.0	+0.0					
			+0.8	-27.0	+0.9	+5.9					
			+13.4								
4	4759.810M	37.0	+0.5	+4.1	-33.2	+1.5	+0.0	42.9	54.0	-11.1	Horiz
			+32.3	+0.7	+0.0	+0.0			Y		
			+0.0	+0.0	+0.0	+0.0					
			+0.0								

5	166.800M	42.5	+0.2 +0.0 +0.6 +9.3	+0.0 +0.0 -27.5 +0.7	+0.0 +0.0 +0.7 +5.9	+0.0 +0.0 +0.0 +0.0	+0.0	31.7	43.5	-11.8	Horiz
6	7616.640M Ave	24.9	+1.2 +36.9 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-34.6 +0.0 +0.0 +0.0	+2.2 +0.0 +0.0 +0.0	+0.0	36.6	54.0 X	-17.4	Vert
^	7616.640M	39.6	+1.2 +36.9 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-34.6 +0.0 +0.0 +0.0	+2.2 +0.0 +0.0 +0.0	+0.0	51.3	54.0 X	-2.7	Vert
8	6664.050M Ave	30.1	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	40.5	61.9 Y	-21.4	Horiz
9	3057.500M	39.2	+0.6 +29.6 +0.0 +0.0	+3.0 +0.6 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+1.1 +0.0 +0.0 +0.0	+0.0	40.4	61.9	-21.5	Horiz
10	9520.760M Ave	25.3	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	39.6	61.9 Y	-22.3	Vert
^	9520.760M	39.4	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	53.7	61.9 Y	-8.2	Vert
12	74.601M QP	53.3	+0.1 +0.0 +0.5 +6.9	+0.0 +0.0 -27.8 +0.5	+0.0 +0.0 +0.5 +5.9	+0.0 +0.0 +0.0 +0.0	+0.0	39.4	61.9	-22.5	Vert
^	74.660M	53.6	+0.1 +0.0 +0.5 +6.9	+0.0 +0.0 -27.8 +0.5	+0.0 +0.0 +0.5 +5.9	+0.0 +0.0 +0.0 +0.0	+0.0	39.7	61.9	-22.2	Vert
14	6664.040M Ave	29.0	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	39.4	61.9 X	-22.5	Vert
^	6664.040M	43.4	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	53.8	61.9 X	-8.1	Vert
16	9519.640M Ave	24.6	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	38.9	61.9 Y	-23.0	Horiz
^	9519.640M	36.2	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	50.5	61.9 Y	-11.4	Horiz

18	9520.540M Ave	24.6	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	38.9 X	61.9	-23.0	Vert
^	9520.540M	37.0	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	51.3 X	61.9	-10.6	Vert
20	6664.000M Ave	28.0	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	38.4 Z	61.9	-23.5	Horiz
^	6664.050M	43.6	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	54.0 Y	61.9	-7.9	Horiz
^	6664.050M	42.2	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	52.6 Z	61.9	-9.3	Horiz
^	6664.030M	40.6	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	51.0	61.9	-10.9	Horiz
24	1903.930M	40.4	+0.4 +27.3 +0.0 +0.0	+2.3 +0.6 +0.0 +0.0	-34.4 +0.0 +0.0 +0.0	+0.8 +0.0 +0.0 +0.0	+0.0	37.4 Y	61.9	-24.5	Horiz
25	1904.350M	40.4	+0.4 +27.3 +0.0 +0.0	+2.3 +0.6 +0.0 +0.0	-34.4 +0.0 +0.0 +0.0	+0.8 +0.0 +0.0 +0.0	+0.0	37.4 Y	61.9	-24.5	Vert
26	1903.660M	39.4	+0.4 +27.3 +0.0 +0.0	+2.3 +0.6 +0.0 +0.0	-34.4 +0.0 +0.0 +0.0	+0.8 +0.0 +0.0 +0.0	+0.0	36.4 X	61.9	-25.5	Vert
27	222.500M	43.3	+0.2 +0.0 +0.7 +10.9	+0.0 +0.0 -27.1 +0.8	+0.0 +0.0 +0.8 +5.9	+0.0 +0.0 +0.0 +5.9	+0.0	34.7	61.9	-27.2	Vert
28	143.960M	46.6	+0.2 +0.0 +0.6 +8.2	+0.0 +0.0 -27.6 +0.7	+0.0 +0.0 +0.7 +5.9	+0.0 +0.0 +0.0 +5.9	+0.0	34.6	61.9	-27.3	Vert
29	217.200M	42.7	+0.2 +0.0 +0.7 +10.7	+0.0 +0.0 -27.2 +0.8	+0.0 +0.0 +0.8 +5.9	+0.0 +0.0 +0.0 +5.9	+0.0	33.8	61.9	-28.1	Horiz
30	60.030M	46.2	+0.1 +0.0 +0.4 +6.7	+0.0 +0.0 -27.9 +0.4	+0.0 +0.0 +0.4 +5.9	+0.0 +0.0 +0.0 +5.9	+0.0	31.8	61.9	-30.1	Vert

31	27.331M	25.6	+0.1	+0.3	+0.0	+0.0	-40.0	-7.7	61.9	-69.6	Para
			+0.0	+0.0	+0.0	+6.3					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
32	8.736M	19.8	+0.0	+0.2	+0.0	+0.0	-40.0	-10.7	61.9	-72.6	Perp
			+0.0	+0.0	+0.0	+9.3					
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
33	18.873M	20.7	+0.0	+0.2	+0.0	+0.0	-40.0	-10.9	61.9	-72.8	Para
			+0.0	+0.0	+0.0	+8.2					
			+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: **15.231(e) Spurious Field Strength (>470 MHz Transmitter)**
 Work Order #: **102206** Date: 2/11/2019
 Test Type: **Maximized Emissions** Time: 15:00:42
 Tested By: Michael Atkinson Sequence#: 7
 Software: EMITest 5.03.11

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

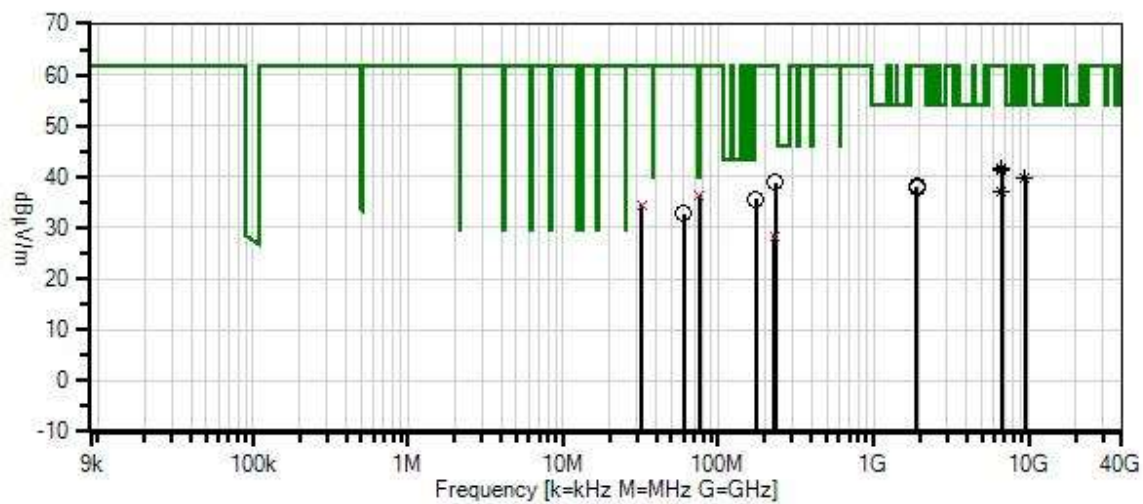
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Temperature: 20-23°C Humidity: 25-35% Pressure: 100.5-102.0 kPa Frequency Range: 952-953MHz Frequency tested: 952MHz Firmware power setting: Max Power Protocol /MCS/Modulation: OOK Duty Cycle: 100% (Test Mode) Test Location: Bothell Lab C3 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 Type 44 material ferrite with 2 passes each on AC power cord and USB cord underneath ground plane outside of test volume (NOT a modification to the EUT)

Itron, Inc W/O#: 102014 Sequence#: 7 Date: 2/11/2019
 15.231(b) Spurious Field Strength (>470 MHz Transmitter) Test Distance: 3 Meters Horiz



— Readings
 ○ Peak Readings
 × QP Readings
 * Average Readings
 ▼ Ambient
 Software Version: 5.03.12
 — 1 - 15.231(b) Spurious Field Strength (>470 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06540	Cable	Heliac	10/30/2017	10/30/2019
T2	ANP06515	Cable	Heliac	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 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	75.008M	50.3	+0.1 +0.0 +0.5 +6.9	+0.0 +0.0 -27.8	+0.0 +0.0 +0.5	+0.0 +0.0 +5.9	+0.0	36.4	40.0	-3.6	Vert
^	75.008M	51.5	+0.1 +0.0 +0.5 +6.9	+0.0 +0.0 -27.8	+0.0 +0.0 +0.5	+0.0 +0.0 +5.9	+0.0	37.6	40.0	-2.4	Vert
3	6664.090M	31.1	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0	-33.7 +0.0 +0.0	+2.0 +0.0 +0.0	+0.0	41.5	61.9 Y	-20.4	Horiz
^	6664.090M	43.6	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0	-33.7 +0.0 +0.0	+2.0 +0.0 +0.0	+0.0	54.0	61.9 Y	-7.9	Horiz
^	6664.090M	42.9	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0	-33.7 +0.0 +0.0	+2.0 +0.0 +0.0	+0.0	53.3	61.9	-8.6	Horiz

6	6664.000M Ave	30.7	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	41.1 Z	61.9	-20.8	Vert
^	6664.037M	43.2	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	53.6 X	61.9	-8.3	Vert
^	6664.090M	44.3	+0.6 +0.0 +0.0 +0.0	+5.5 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0 +0.0 +0.0 +0.0	+0.0	50.4 Z	61.9	-11.5	Vert
9	9520.000M Ave	25.3	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	39.6 Z	61.9	-22.3	Vert
^	9520.030M	38.6	+0.9 +37.4 +0.0 +0.0	+6.2 +0.7 +0.0 +0.0	-33.5 +0.0 +0.0 +0.0	+2.6 +0.0 +0.0 +0.0	+0.0	52.9 Z	61.9	-9.0	Vert
11	234.920M	46.1	+0.2 +0.0 +0.8 +12.0	+0.0 +0.0 -27.1 +0.9	+0.0 +0.0 +0.9 +5.9	+0.0 +0.0 +0.0 +5.9	+0.0	38.8	61.9	-23.1	Vert
12	1903.580M	41.1	+0.4 +27.3 +0.0 +0.0	+2.3 +0.6 +0.0 +0.0	-34.4 +0.0 +0.0 +0.0	+0.8 +0.0 +0.0 +0.0	+0.0	38.1 X	61.9	-23.8	Vert
13	1903.963M	40.8	+0.4 +27.3 +0.0 +0.0	+2.3 +0.6 +0.0 +0.0	-34.4 +0.0 +0.0 +0.0	+0.8 +0.0 +0.0 +0.0	+0.0	37.8 Y	61.9	-24.1	Vert
14	6667.960M Ave	26.5	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	36.9 Z	61.9	-25.0	Horiz
^	6667.960M	42.6	+0.6 +35.5 +0.0 +0.0	+5.5 +0.5 +0.0 +0.0	-33.7 +0.0 +0.0 +0.0	+2.0 +0.0 +0.0 +0.0	+0.0	53.0 Z	61.9	-8.9	Horiz
16	173.820M	45.8	+0.2 +0.0 +0.6 +9.8	+0.0 +0.0 -27.4 +0.7	+0.0 +0.0 +0.7 +5.9	+0.0 +0.0 +0.0 +5.9	+0.0	35.6	61.9	-26.3	Vert
17	32.390M QP	41.2	+0.1 +0.0 +0.3 +14.6	+0.0 +0.0 -28.0 +0.3	+0.0 +0.0 +0.3 +5.9	+0.0 +0.0 +0.3 +5.9	+0.0	34.4	61.9	-27.5	Vert
^	32.350M	43.3	+0.1 +0.0 +0.3 +14.6	+0.0 +0.0 -28.0 +0.3	+0.0 +0.0 +0.3 +5.9	+0.0 +0.0 +0.3 +5.9	+0.0	36.5	61.9	-25.4	Vert

19	59.610M	47.1	+0.1 +0.0 +0.4 +6.7	+0.0 +0.0 -27.9	+0.0 +0.0 +0.4	+0.0 +0.0 +5.9	+0.0	32.7	61.9	-29.2	Vert
20	231.002M QP	36.2	+0.2 +0.0 +0.7 +11.5	+0.0 +0.0 -27.1	+0.0 +0.0 +0.9	+0.0 +0.0 +5.9	+0.0	28.3	61.9	-33.6	Horiz
^	231.000M	42.4	+0.2 +0.0 +0.7 +11.5	+0.0 +0.0 -27.1	+0.0 +0.0 +0.9	+0.0 +0.0 +5.9	+0.0	34.5	61.9	-27.4	Horiz
22	18.573M	18.3	+0.0 +0.0 +0.0 +0.0	+0.2 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +8.3 +0.0	-40.0	-13.2	61.9	-75.1	Perp
23	27.391M	18.7	+0.1 +0.0 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +6.3 +0.0	-40.0	-14.6	61.9	-76.5	Para

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: 16:22:03
 Tested By: Michael Atkinson Sequence#: 14
 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:

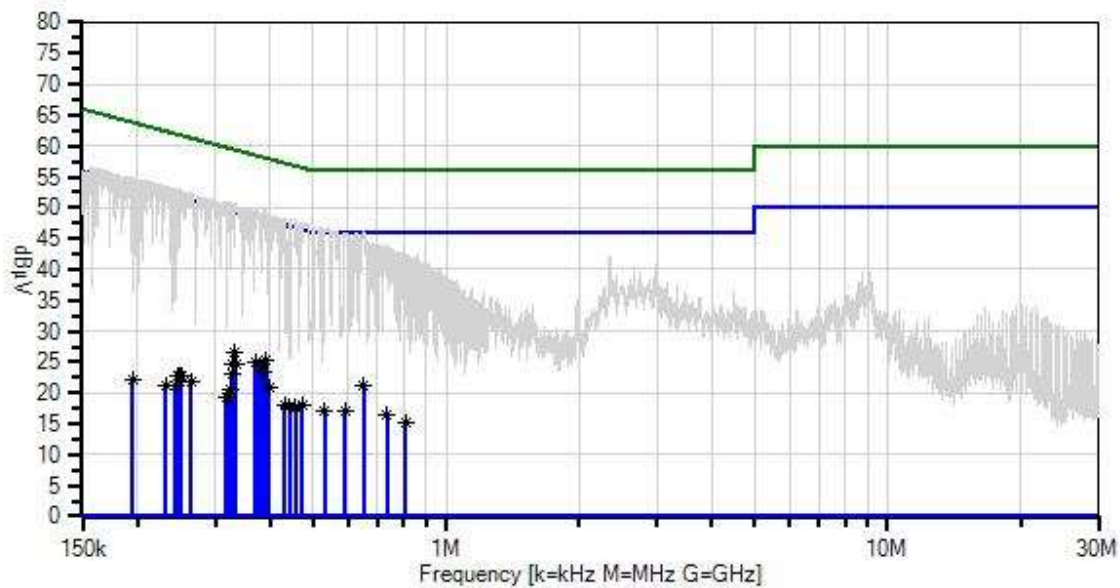
Temperature: 20-23°C
 Humidity: 20-30%
 Pressure: 102-103kPa

 Frequency Range: 952MHz
 Frequency tested: 0.15-30MHz
 Firmware power setting: Max Power
 Protocol /MCS/Modulation: OOK

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

 Test Method: ANSI C63.10 (2013)
 Test Mode: Continuously transmitting
 Test Setup: EUT is transmitting through to attached antenna. Investigated multiple Low, Middle, High channels, mid channel data that is representative of worst case reported. Investigated attached and vehicle mounted antenna, attached antenna data that is representative of worst case reported.

Itron, Inc W/O#: 102014 Sequence#: 14 Date: 2/5/2019
15.207 AC Mains - Average Test Lead: 115VAC 60Hz Line



— 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
	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	Helix	10/30/2017	10/30/2019
T3	ANP06515	Cable	Helix	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 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	391.868k	15.6	+0.1	+0.0	+0.0	+9.1	+0.0	25.3	48.0	-22.7	Line
	Ave		+0.5								
^	391.867k	40.0	+0.1	+0.0	+0.0	+9.1	+0.0	49.7	48.0	+1.7	Line
			+0.5								
3	330.809k	16.9	+0.1	+0.0	+0.0	+9.1	+0.0	26.7	49.4	-22.7	Line
	Ave		+0.6								
4	370.684k	15.1	+0.1	+0.0	+0.0	+9.1	+0.0	24.9	48.5	-23.6	Line
	Ave		+0.6								
^	370.684k	40.2	+0.1	+0.0	+0.0	+9.1	+0.0	50.0	48.5	+1.5	Line
			+0.6								
6	378.100k	14.8	+0.1	+0.0	+0.0	+9.1	+0.0	24.5	48.3	-23.8	Line
	Ave		+0.5								
^	378.100k	39.3	+0.1	+0.0	+0.0	+9.1	+0.0	49.0	48.3	+0.7	Line
			+0.5								
8	334.725k	14.9	+0.1	+0.0	+0.0	+9.1	+0.0	24.7	49.3	-24.6	Line
	Ave		+0.6								
^	334.725k	40.7	+0.1	+0.0	+0.0	+9.1	+0.0	50.5	49.3	+1.2	Line
			+0.6								
10	328.673k	15.0	+0.1	+0.0	+0.0	+9.1	+0.0	24.8	49.5	-24.7	Line
	Ave		+0.6								
11	384.925k	13.7	+0.1	+0.0	+0.0	+9.1	+0.0	23.4	48.2	-24.8	Line
	Ave		+0.5								
^	384.925k	40.3	+0.1	+0.0	+0.0	+9.1	+0.0	50.0	48.2	+1.8	Line
			+0.5								
13	650.600k	11.4	+0.2	+0.0	+0.0	+9.1	+0.0	21.1	46.0	-24.9	Line
	Ave		+0.4								
^	650.600k	35.6	+0.2	+0.0	+0.0	+9.1	+0.0	45.3	46.0	-0.7	Line
			+0.4								

15	327.427k Ave	13.2	+0.1 +0.6	+0.0	+0.0	+9.1	+0.0	23.0	49.5	-26.5	Line
^	330.808k	40.8	+0.1 +0.6	+0.0	+0.0	+9.1	+0.0	50.6	49.4	+1.2	Line
17	397.030k Ave	11.2	+0.1 +0.5	+0.0	+0.0	+9.1	+0.0	20.9	47.9	-27.0	Line
^	397.030k	40.6	+0.1 +0.5	+0.0	+0.0	+9.1	+0.0	50.3	47.9	+2.4	Line
19	471.817k Ave	8.2	+0.2 +0.5	+0.0	+0.1	+9.1	+0.0	18.1	46.5	-28.4	Line
^	471.817k	37.8	+0.2 +0.5	+0.0	+0.1	+9.1	+0.0	47.7	46.5	+1.2	Line
21	251.130k Ave	12.6	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	22.8	51.7	-28.9	Line
22	590.890k Ave	7.4	+0.2 +0.4	+0.0	+0.0	+9.1	+0.0	17.1	46.0	-28.9	Line
^	590.890k	35.6	+0.2 +0.4	+0.0	+0.0	+9.1	+0.0	45.3	46.0	-0.7	Line
24	247.400k Ave	12.7	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	22.9	51.8	-28.9	Line
25	249.349k Ave	12.7	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	22.9	51.8	-28.9	Line
^	249.348k	42.8	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	53.0	51.8	+1.2	Line
^	251.130k	42.7	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	52.9	51.7	+1.2	Line
28	530.400k Ave	7.3	+0.2 +0.4	+0.0	+0.0	+9.1	+0.0	17.0	46.0	-29.0	Line
^	530.400k	37.0	+0.2 +0.4	+0.0	+0.0	+9.1	+0.0	46.7	46.0	+0.7	Line
30	455.791k Ave	7.9	+0.1 +0.5	+0.0	+0.1	+9.1	+0.0	17.7	46.8	-29.1	Line
^	455.791k	38.3	+0.1 +0.5	+0.0	+0.1	+9.1	+0.0	48.1	46.8	+1.3	Line
32	430.319k Ave	8.2	+0.2 +0.5	+0.0	+0.1	+9.1	+0.0	18.1	47.2	-29.1	Line
^	430.318k	38.5	+0.2 +0.5	+0.0	+0.1	+9.1	+0.0	48.4	47.2	+1.2	Line
34	325.647k Ave	10.6	+0.1 +0.6	+0.0	+0.0	+9.1	+0.0	20.4	49.6	-29.2	Line
^	325.646k	41.1	+0.1 +0.6	+0.0	+0.0	+9.1	+0.0	50.9	49.6	+1.3	Line
^	328.672k	41.0	+0.1 +0.6	+0.0	+0.0	+9.1	+0.0	50.8	49.5	+1.3	Line
^	327.426k	41.0	+0.1 +0.6	+0.0	+0.0	+9.1	+0.0	50.8	49.5	+1.3	Line

38	442.789k Ave	7.9	+0.2 +0.5	+0.0	+0.1	+9.1	+0.0	17.8	47.0	-29.2	Line
^	442.788k	38.3	+0.2 +0.5	+0.0	+0.1	+9.1	+0.0	48.2	47.0	+1.2	Line
40	263.876k Ave	11.7	+0.2 +0.8	+0.0	+0.0	+9.1	+0.0	21.8	51.3	-29.5	Line
^	263.875k	42.5	+0.2 +0.8	+0.0	+0.0	+9.1	+0.0	52.6	51.3	+1.3	Line
42	734.400k Ave	6.8	+0.2 +0.3	+0.0	+0.0	+9.1	+0.0	16.4	46.0	-29.6	Line
^	734.400k	34.0	+0.2 +0.3	+0.0	+0.0	+9.1	+0.0	43.6	46.0	-2.4	Line
44	317.280k Ave	9.5	+0.1 +0.7	+0.0	+0.0	+9.1	+0.0	19.4	49.8	-30.4	Line
45	320.128k Ave	9.3	+0.1 +0.7	+0.0	+0.0	+9.1	+0.0	19.2	49.7	-30.5	Line
^	320.128k	41.1	+0.1 +0.7	+0.0	+0.0	+9.1	+0.0	51.0	49.7	+1.3	Line
^	317.279k	41.2	+0.1 +0.7	+0.0	+0.0	+9.1	+0.0	51.1	49.8	+1.3	Line
48	243.899k Ave	11.1	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	21.3	52.0	-30.7	Line
^	243.899k	43.0	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	53.2	52.0	+1.2	Line
^	247.400k	42.7	+0.2 +0.9	+0.0	+0.0	+9.1	+0.0	52.9	51.8	+1.1	Line
51	810.300k Ave	5.6	+0.2 +0.3	+0.0	+0.0	+9.1	+0.0	15.2	46.0	-30.8	Line
^	810.300k	32.7	+0.2 +0.3	+0.0	+0.0	+9.1	+0.0	42.3	46.0	-3.7	Line
53	231.323k Ave	11.0	+0.2 +1.0	+0.0	+0.0	+9.1	+0.0	21.3	52.4	-31.1	Line
^	231.323k	43.3	+0.2 +1.0	+0.0	+0.0	+9.1	+0.0	53.6	52.4	+1.2	Line
55	195.000k Ave	11.7	+0.2 +1.2	+0.0	+0.0	+9.1	+0.0	22.2	53.8	-31.6	Line
^	195.000k	44.2	+0.2 +1.2	+0.0	+0.0	+9.1	+0.0	54.7	53.8	+0.9	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 - Average**
 Work Order #: **102206** Date: 2/5/2019
 Test Type: **Conducted Emissions** Time: 16:52:18
 Tested By: Michael Atkinson Sequence#: 15
 Software: EMITest 5.03.11 115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

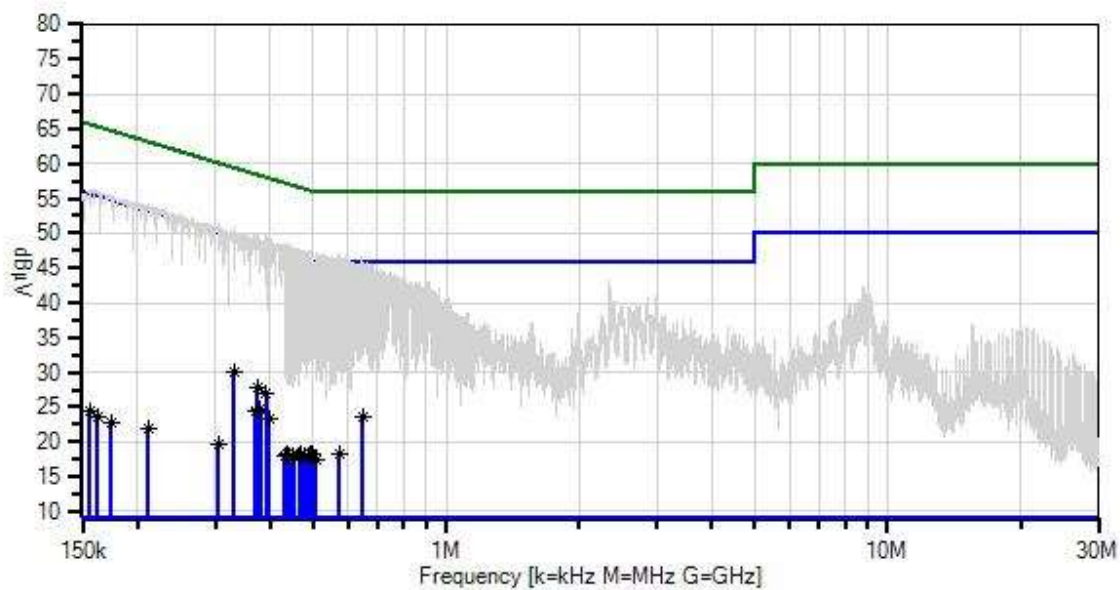
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Temperature: 20-23°C Humidity: 20-30% Pressure: 102-103kPa Frequency Range: 952MHz Frequency tested: 0.15-30MHz Firmware power setting: Max Power Protocol /MCS/Modulation: OOK Duty Cycle: 100% (Test Mode) Test Location: Bothell Lab C3 Test Method: ANSI C63.10 (2013) Test Mode: Continuously transmitting Test Setup: EUT is transmitting through to attached antenna. Investigated multiple Low, Middle, High channels, mid channel data that is representative of worst case reported. Investigated attached and vehicle mounted antenna, attached antenna data that is representative of worst case reported.

Ittron, Inc W/O#: 102014 Sequence#: 15 Date: 2/5/2019
15.207 AC Mains - Average Test Lead: 115VAC 60Hz Return



— 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
	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	Helix	10/30/2017	10/30/2019
T3	ANP06515	Cable	Helix	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 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV	dBμV	dB	Ant
1	331.521k	20.3	+0.1	+0.0	+0.0	+9.1	+0.0	30.1	49.4	-19.3	Retur
	Ave		+0.6								
^	331.521k	41.1	+0.1	+0.0	+0.0	+9.1	+0.0	50.9	49.4	+1.5	Retur
			+0.6								
3	373.532k	18.2	+0.1	+0.0	+0.0	+9.1	+0.0	27.9	48.4	-20.5	Retur
	Ave		+0.5								
4	390.800k	17.3	+0.1	+0.0	+0.0	+9.1	+0.0	27.0	48.0	-21.0	Retur
	Ave		+0.5								
^	390.799k	40.3	+0.1	+0.0	+0.0	+9.1	+0.0	50.0	48.0	+2.0	Retur
			+0.5								
6	648.700k	13.9	+0.2	+0.0	+0.0	+9.1	+0.0	23.6	46.0	-22.4	Retur
	Ave		+0.4								
^	648.700k	36.4	+0.2	+0.0	+0.0	+9.1	+0.0	46.1	46.0	+0.1	Retur
			+0.4								
8	380.119k	15.1	+0.1	+0.0	+0.0	+9.1	+0.0	24.8	48.3	-23.5	Retur
	Ave		+0.5								
^	380.118k	39.7	+0.1	+0.0	+0.0	+9.1	+0.0	49.4	48.3	+1.1	Retur
			+0.5								
10	369.082k	14.7	+0.1	+0.0	+0.0	+9.1	+0.0	24.4	48.5	-24.1	Retur
	Ave		+0.5								
^	369.081k	40.3	+0.1	+0.0	+0.0	+9.1	+0.0	50.0	48.5	+1.5	Retur
			+0.5								
^	373.532k	40.2	+0.1	+0.0	+0.0	+9.1	+0.0	49.9	48.4	+1.5	Retur
			+0.5								
13	398.098k	13.6	+0.1	+0.0	+0.0	+9.1	+0.0	23.3	47.9	-24.6	Retur
	Ave		+0.5								
^	398.098k	39.8	+0.1	+0.0	+0.0	+9.1	+0.0	49.5	47.9	+1.6	Retur
			+0.5								

15	499.636k	8.7	+0.2	+0.0	+0.0	+9.1	+0.0	18.4	46.0	-27.6	Retur
^	499.636k	37.7	+0.2	+0.0	+0.0	+9.1	+0.0	47.4	46.0	+1.4	Retur
17	571.603k	8.6	+0.2	+0.0	+0.0	+9.1	+0.0	18.3	46.0	-27.7	Retur
^	571.603k	37.4	+0.2	+0.0	+0.0	+9.1	+0.0	47.1	46.0	+1.1	Retur
19	492.984k	8.5	+0.2	+0.0	+0.0	+9.1	+0.0	18.2	46.1	-27.9	Retur
^	492.984k	37.8	+0.2	+0.0	+0.0	+9.1	+0.0	47.5	46.1	+1.4	Retur
21	478.470k	8.4	+0.2	+0.0	+0.0	+9.1	+0.0	18.1	46.4	-28.3	Retur
^	478.469k	37.8	+0.2	+0.0	+0.0	+9.1	+0.0	47.5	46.4	+1.1	Retur
23	470.910k	8.4	+0.2	+0.0	+0.1	+9.1	+0.0	18.2	46.5	-28.3	Retur
^	470.910k	37.9	+0.2	+0.0	+0.1	+9.1	+0.0	47.7	46.5	+1.2	Retur
25	486.029k	8.2	+0.2	+0.0	+0.0	+9.1	+0.0	17.9	46.2	-28.3	Retur
^	486.029k	37.9	+0.2	+0.0	+0.0	+9.1	+0.0	47.6	46.2	+1.4	Retur
27	506.591k	7.8	+0.2	+0.0	+0.0	+9.1	+0.0	17.5	46.0	-28.5	Retur
^	506.591k	37.5	+0.2	+0.0	+0.0	+9.1	+0.0	47.2	46.0	+1.2	Retur
29	464.862k	8.2	+0.1	+0.0	+0.1	+9.1	+0.0	17.9	46.6	-28.7	Retur
^	464.862k	38.0	+0.1	+0.0	+0.1	+9.1	+0.0	47.7	46.6	+1.1	Retur
31	435.531k	8.5	+0.2	+0.0	+0.1	+9.1	+0.0	18.4	47.1	-28.7	Retur
^	435.531k	38.6	+0.2	+0.0	+0.1	+9.1	+0.0	48.5	47.1	+1.4	Retur
33	442.789k	8.2	+0.2	+0.0	+0.1	+9.1	+0.0	18.1	47.0	-28.9	Retur
^	442.788k	38.4	+0.2	+0.0	+0.1	+9.1	+0.0	48.3	47.0	+1.3	Retur
35	450.046k	8.1	+0.1	+0.0	+0.1	+9.1	+0.0	17.9	46.9	-29.0	Retur
^	450.045k	38.2	+0.1	+0.0	+0.1	+9.1	+0.0	48.0	46.9	+1.1	Retur
37	430.497k	8.1	+0.2	+0.0	+0.1	+9.1	+0.0	18.0	47.2	-29.2	Retur
^	430.496k	38.4	+0.2	+0.0	+0.1	+9.1	+0.0	48.3	47.2	+1.1	Retur
39	304.997k	9.9	+0.1	+0.0	+0.0	+9.1	+0.0	19.8	50.1	-30.3	Retur
^	304.996k	41.5	+0.1	+0.0	+0.0	+9.1	+0.0	51.4	50.1	+1.3	Retur

41	211.831k	11.6	+0.2	+0.0	+0.0	+9.1	+0.0	22.0	53.1	-31.1	Retur
	Ave		+1.1								
^	211.830k	43.8	+0.2	+0.0	+0.0	+9.1	+0.0	54.2	53.1	+1.1	Retur
			+1.1								
43	155.880k	12.7	+0.8	+0.0	+0.0	+9.1	+0.0	24.3	55.7	-31.4	Retur
	Ave		+1.7								
^	155.880k	44.2	+0.8	+0.0	+0.0	+9.1	+0.0	55.8	55.7	+0.1	Retur
			+1.7								
45	162.040k	12.2	+0.6	+0.0	+0.0	+9.1	+0.0	23.5	55.4	-31.9	Retur
	Ave		+1.6								
^	162.040k	44.8	+0.6	+0.0	+0.0	+9.1	+0.0	56.1	55.4	+0.7	Retur
			+1.6								
47	173.900k	11.9	+0.4	+0.0	+0.0	+9.1	+0.0	22.8	54.8	-32.0	Retur
	Ave		+1.4								
^	173.900k	44.7	+0.4	+0.0	+0.0	+9.1	+0.0	55.6	54.8	+0.8	Retur
			+1.4								

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.