Itron, Inc.

ADDENDUM TEST REPORT TO 99315-5

Gas Endpoint
Model: 500GA

Tested To The Following Standard:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 99315-5A

Date of issue: March 27, 2017

ACCREDITED
Testing Certificates:
803.01, 803.02, 803.05, 803.06

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.

This report contains a total of 20 pages and may be reproduced in full only. Partial reproduction may only be done with the written consent of CKC Laboratories, Inc.

Testing the Future
CKC LABORATORIES, INC.

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 110651

REPORT PREPARED BY:

Joyce Walker
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 99315

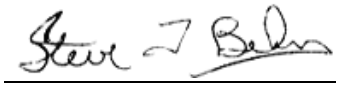
DATE OF EQUIPMENT RECEIPT: December 7, 2016
DATE(S) OF TESTING: December 7-16, 2016

Revision History

Original: Testing of the Gas Endpoint, Model: 500GA to FCC Part 15 Subpart C Section(s) 15.249.
Addendum A: To correct antenna gain numbers throughout the report.

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 - 15.249

Test Procedure	Description	Modifications	Results
15.215(c)	Occupied Bandwidth	NA	NP
15.249(a)	Field Strength of Fundamental	NA	Pass
15.249(a)	Radiated Emissions and Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NP

NA = Not Applicable
NP = CKC Laboratories was not contracted to perform test.

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 5

Equipment Tested:

Device	Manufacturer	Model #	S/N
Gas Endpoint	Itron, Inc.	500GA	0100001730

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	OOK
Maximum Duty Cycle:	See supplemental report
Antenna Type(s) and Gain:	See supplemental report
Antenna Connection Type:	Integral
Nominal Input Voltage:	Battery
Firmware / Software used for Test:	See supplemental report

FCC Part 15 Subpart C

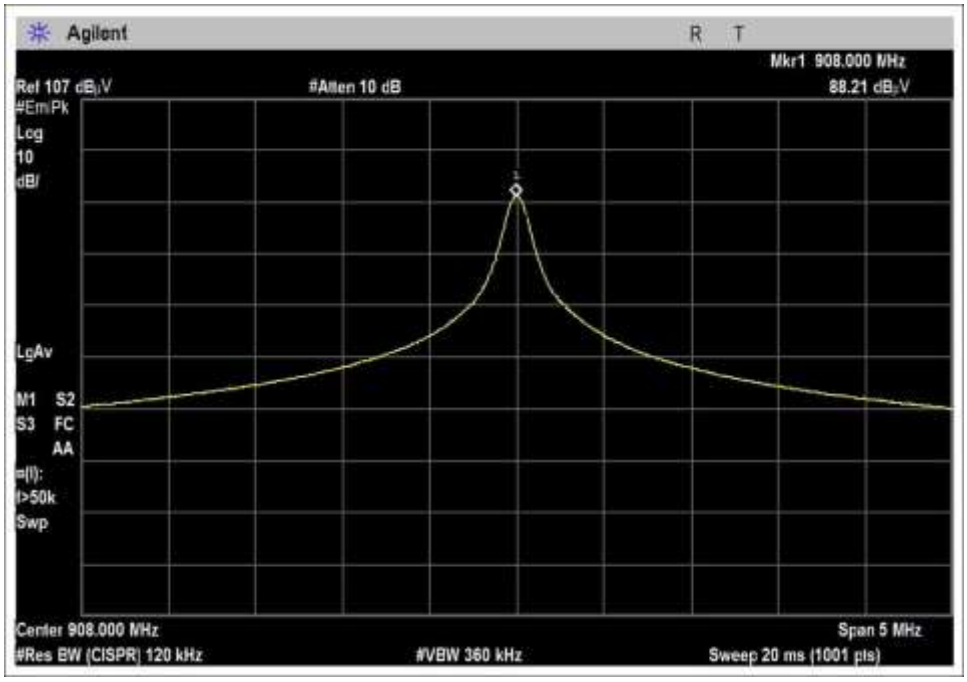
15.249(a) Field Strength of Fundamental

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

Test Data Summary – Radiated Field Strength Measurement					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Measured (dBuV/m @ 3m)**	**Limit (dBuV/m @ 3m)**	**Results**
908	OOK	Integral	93.8 (QP)	≤94	Pass

Plot



Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE Suite A • Bothell, WA 98021 • 800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**		
Work Order #:	**99315**	Date:	12/7/2016
Test Type:	**Maximized Emissions**	Time:	15:17:00
Tested By:	Steven Pittsford	Sequence#:	2
Software:	EMITest 5.03.02		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

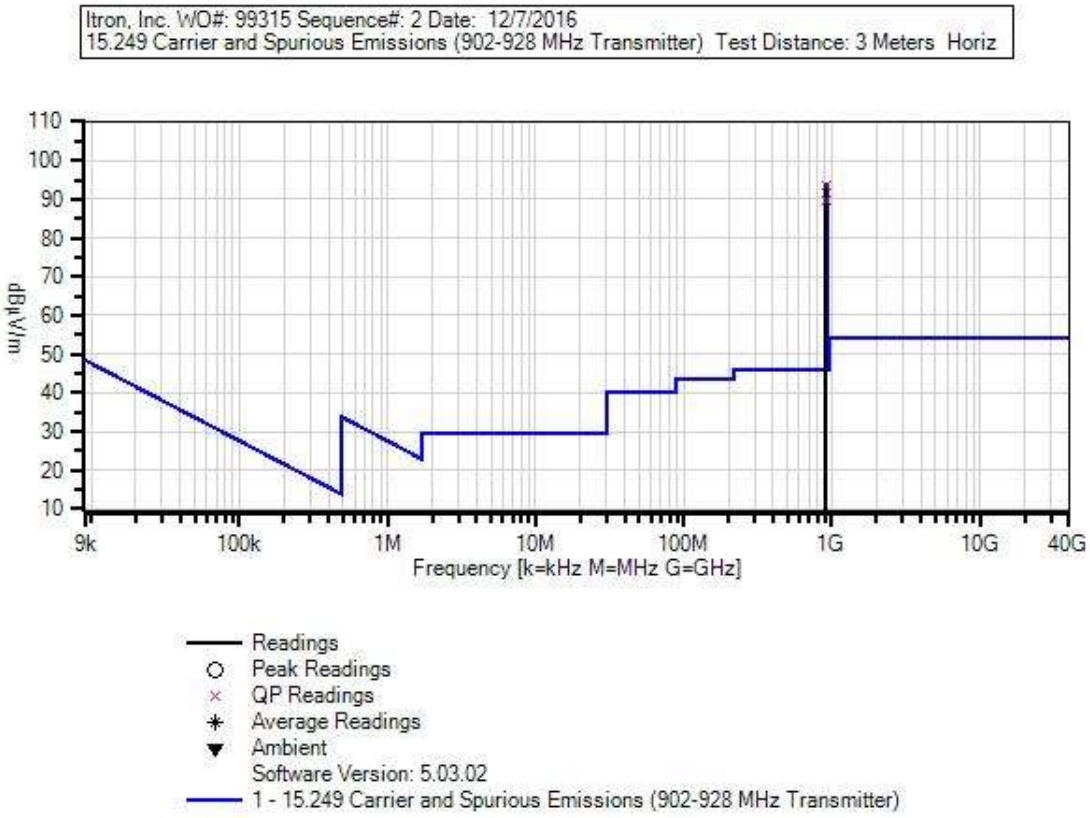
Test Conditions / Notes:

Temperature: 22ºC
Relative Humidity: 21%

Frequency range investigated: Fundamental
Transmitter Frequency: 908MHz
Modulation: OOK
Firmware Power Level: 0
EUT Firmware: App Version: 1.18.3.0, CSL Version: 2.22.1.0
Antenna Type: Internal Trace
Antenna Gain: 7.19 dBi
Duty Cycle: Max

Test Method: ANSI C63.10 (2013)

The EUT is a transmitter operating at 908MHz. The EUT is battery operated, fresh batteries installed.
The EUT has no IO ports.
The EUT orientation selected as worst case based on X, Y, Z investigation as well as previous engineering data.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01991	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
T2	ANP05657	Attenuator	PE7004-6	12/22/2015	12/22/2017
T3	ANP05360	Cable	RG214	11/30/2016	11/30/2018
T4	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
T5	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
T6	AN02673	Spectrum Analyzer	E4446A	10/12/2015	10/12/2017
T7	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
			T5	T6	T7						
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	908.000M	85.4	+25.0	+6.0	+2.1	+2.4	+0.0	93.8	94.0	-0.2	Horiz
	QP		+0.3	+0.0	-27.4						
^	907.998M	88.2	+25.0	+6.0	+2.1	+2.4	+0.0	96.6	94.0	+2.6	Horiz
			+0.3	+0.0	-27.4						
3	908.000M	81.1	+25.0	+6.0	+2.1	+2.4	+0.0	89.5	94.0	-4.5	Vert
	QP		+0.3	+0.0	-27.4						
^	908.005M	83.8	+25.0	+6.0	+2.1	+2.4	+0.0	92.2	94.0	-1.8	Vert
			+0.3	+0.0	-27.4						

Test Setup Photo

15.249(a) Radiated Emissions and Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE Suite A • Bothell, WA 98021 • 800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**		
Work Order #:	**99315**	Date:	12/16/2016
Test Type:	**Maximized Emissions**	Time:	19:49:39
Tested By:	Michael Atkinson	Sequence#:	13
Software:	EMITest 5.03.02		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

Test Conditions / Notes:

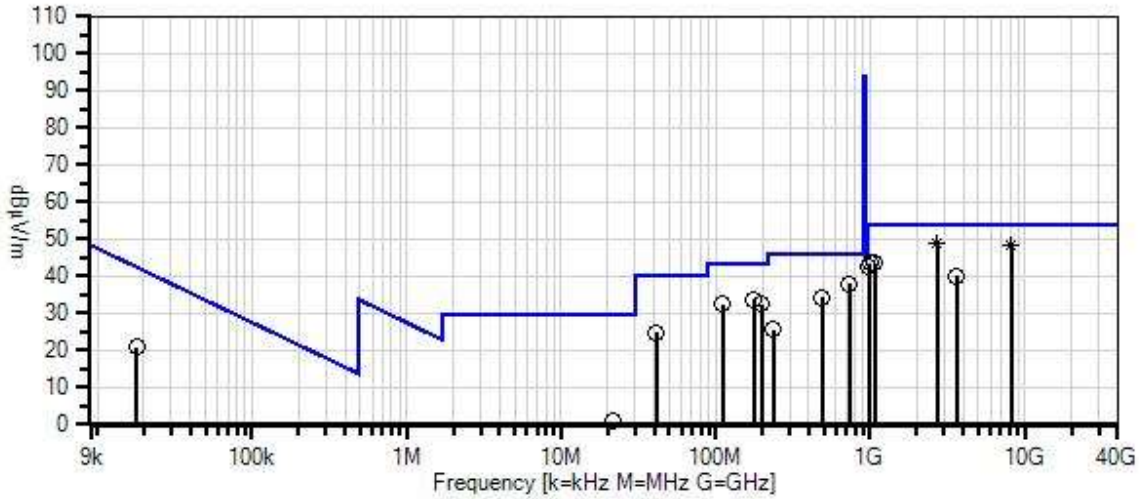
Temperature: 20-22ºC
Relative Humidity: 21-35%

Frequency range investigated: 9kHz-10GHz
Transmitter Frequency: 908MHz
Modulation: OOK
Firmware Power Level: 0
EUT Firmware: App Version: 1.18.3.0, CSL Version: 2.22.1.0
Antenna Type: Internal Trace
Antenna Gain: 7.19 dBi
Duty Cycle: Max

Test Method: ANSI C63.10 (2013)

The EUT is a transmitter operating at 908MHz. The EUT is battery operated, fresh batteries installed.
The EUT has no IO ports. Parallel, Perpendicular, Ground parallel antenna polarities investigated below 30MHz, Horizontal and Vertical antenna polarities investigated above 30MHz, only worst case reported.
The EUT orientation selected as worst case based on X, Y, Z investigation as well as previous engineering data.

Itron, Inc. WO#: 99315 Sequence#: 13 Date: 12/16/2016
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Perp



Readings
Peak Readings
QP Readings
Average Readings
Ambient
Software Version: 5.03.02
1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	10/12/2015	10/12/2017
T2	AN03170	High Pass Filter	HM1155-11SS	12/17/2015	12/17/2017
T3	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
T4	ANP05305	Cable	ETSI-50T	2/15/2016	2/15/2018
T5	AN03540	Preamp	83017A	4/30/2015	4/30/2017
T6	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	8/12/2015	8/12/2017
T7	ANP06935	Cable	32026-29801-29801-18	3/11/2016	3/11/2018
	AN02871	Spectrum Analyzer	E4440A	8/25/2015	8/25/2017
T8	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
T9	ANP05360	Cable	RG214	11/30/2016	11/30/2018
T10	AN01816	Log Periodic Antenna-ANSI 63.5	3146	1/8/2016	1/8/2018
T11	AN02372	Bicon Antenna-ANSI 63.5	3104C	5/27/2015	5/27/2017
T12	AN00052	Loop Antenna	6502	4/8/2016	4/8/2018

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	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	2724.008M	50.4	+0.0	+0.5	+0.7	+3.0	+0.0	49.2	54.0	-4.8	Horiz
	Ave		-34.5	+28.7	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
^	2724.008M	50.3	+0.0	+0.5	+0.7	+3.0	+0.0	49.1	54.0	-4.9	Horiz
			-34.5	+28.7	+0.4	+0.0					
			+0.0	+0.0	+0.0	+0.0					
3	8172.066M	39.1	+0.0	+0.3	+1.3	+5.3	+0.0	48.3	54.0	-5.7	Horiz
	Ave		-35.1	+36.7	+0.7	+0.0					
			+0.0	+0.0	+0.0	+0.0					
^	8172.066M	40.0	+0.0	+0.3	+1.3	+5.3	+0.0	49.2	54.0	-4.8	Horiz
			-35.1	+36.7	+0.7	+0.0					
			+0.0	+0.0	+0.0	+0.0					
5	732.700M	13.0	+0.0	+0.0	+0.3	+0.0	+0.0	38.1	46.0	-7.9	Horiz
			+0.0	+0.0	+0.0	+2.2					
			+1.8	+20.8	+0.0	+0.0					
6	177.390M	15.0	+0.0	+0.0	+0.2	+0.0	+0.0	33.9	43.5	-9.6	Horiz
			+0.0	+0.0	+0.0	+1.4					
			+0.8	+0.0	+16.5	+0.0					
7	1072.000M	45.2	+0.0	+8.9	+0.4	+1.9	+0.0	43.6	54.0	-10.4	Horiz
			-37.2	+24.2	+0.2	+0.0					
			+0.0	+0.0	+0.0	+0.0					
8	995.800M	13.8	+0.0	+0.0	+0.4	+0.0	+0.0	43.6	54.0	-10.4	Horiz
			+0.0	+0.0	+0.0	+2.5					
			+2.3	+24.6	+0.0	+0.0					

9	111.090M	16.0	+0.0	+0.0	+0.1	+0.0	+0.0	32.5	43.5	-11.0	Horiz
			+0.0	+0.0	+0.0	+1.2					
			+0.6	+0.0	+14.6	+0.0					
10	197.620M	13.8	+0.0	+0.0	+0.2	+0.0	+0.0	32.4	43.5	-11.1	Vert
			+0.0	+0.0	+0.0	+1.4					
			+0.8	+0.0	+16.2	+0.0					
11	972.400M	13.8	+0.0	+0.0	+0.4	+0.0	+0.0	42.5	54.0	-11.5	Horiz
			+0.0	+0.0	+0.0	+2.5					
			+2.2	+23.6	+0.0	+0.0					
12	487.000M	13.9	+0.0	+0.0	+0.3	+0.0	+0.0	34.4	46.0	-11.6	Horiz
			+0.0	+0.0	+0.0	+1.9					
			+1.4	+16.9	+0.0	+0.0					
13	3628.000M	39.3	+0.0	+0.4	+0.7	+3.7	+0.0	40.2	54.0	-13.8	Horiz
			-34.2	+29.8	+0.5	+0.0					
			+0.0	+0.0	+0.0	+0.0					
14	41.560M	12.6	+0.0	+0.0	+0.1	+0.0	+0.0	24.9	40.0	-15.1	Horiz
			+0.0	+0.0	+0.0	+0.5					
			+0.4	+0.0	+11.3	+0.0					
15	236.400M	12.3	+0.0	+0.0	+0.2	+0.0	+0.0	25.7	46.0	-20.3	Horiz
			+0.0	+0.0	+0.0	+1.5					
			+0.9	+10.8	+0.0	+0.0					
16	18.030k	46.5	+0.0	+0.0	+0.0	+0.0	-40.0	20.8	42.5	-21.7	Perp
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+14.3					
17	21.603M	12.7	+0.0	+0.0	+0.0	+0.3	-20.0	0.8	29.5	-28.7	Perp
			+0.0	+0.0	+0.0	+0.0					
			+0.0	+0.0	+0.0	+7.8					

Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	OOK	Integral	43.9 (QP)	<46	Pass
928	OOK	Integral	35.9 (QP)	<46	Pass

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE Suite A • Bothell, WA 98021 • 800-500-4EMC (4362)
Customer: **Itron, Inc.**
Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
Work Order #: **99315** Date: 12/7/2016
Test Type: **Maximized Emissions** Time: 14:53:37
Tested By: Steven Pittsford Sequence#: 2
Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

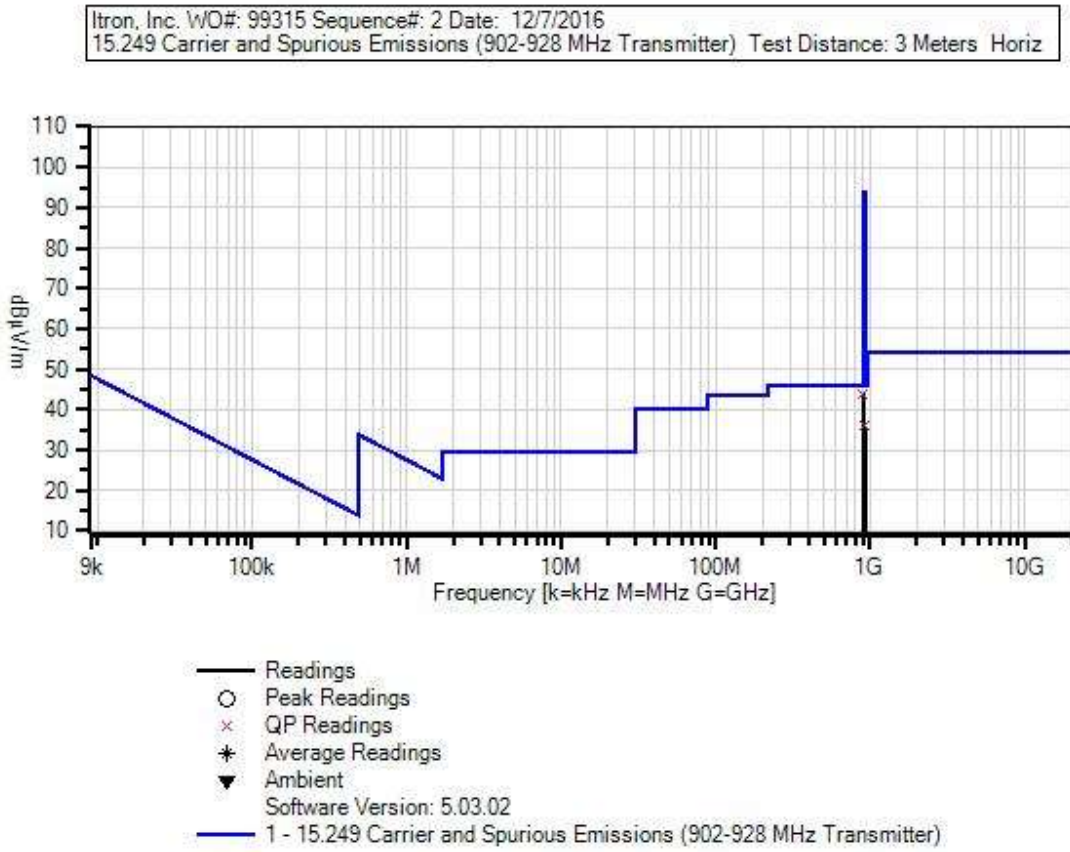
Test Conditions / Notes:

Temperature: 20-22ºC
Relative Humidity: 21-35%

Frequency range investigated: Band Edge
Transmitter Frequency: 908MHz
Modulation: OOK
Firmware Power Level: 0
EUT Firmware: App Version: 1.18.3.0, CSL Version: 2.22.1.0
Antenna Type: Internal Trace
Antenna Gain: 7.19 dBi
Duty Cycle: Max

Test Method: ANSI C63.10 (2013)

The EUT is a transmitter operating at 908MHz. The EUT is battery operated, fresh batteries installed.
The EUT has no IO ports.
The EUT orientation selected as worst case based on X, Y, Z investigation as well as previous engineering data.



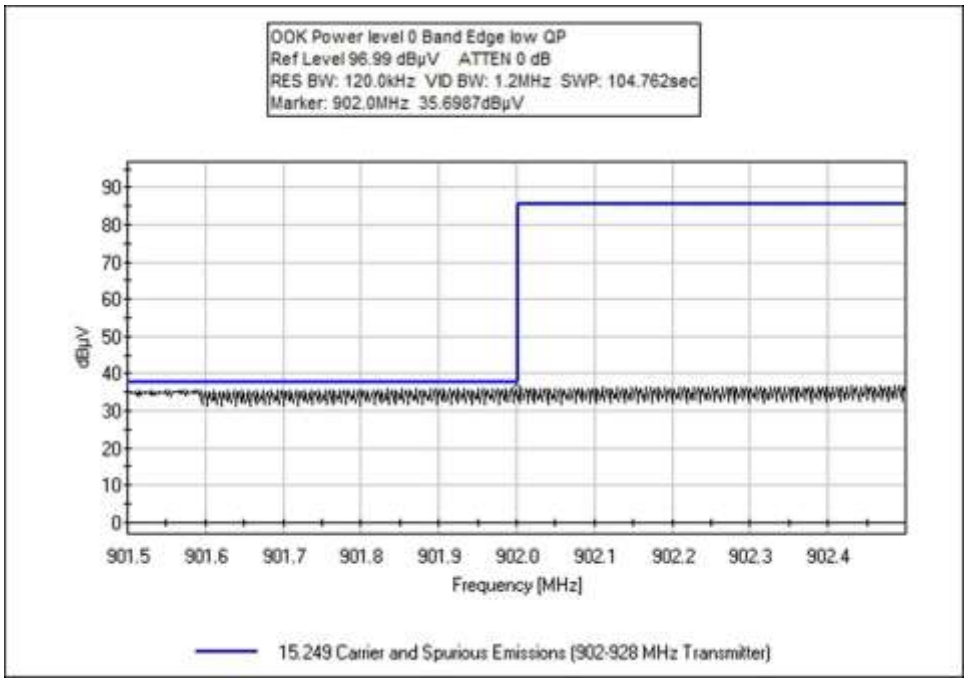
Test Equipment:

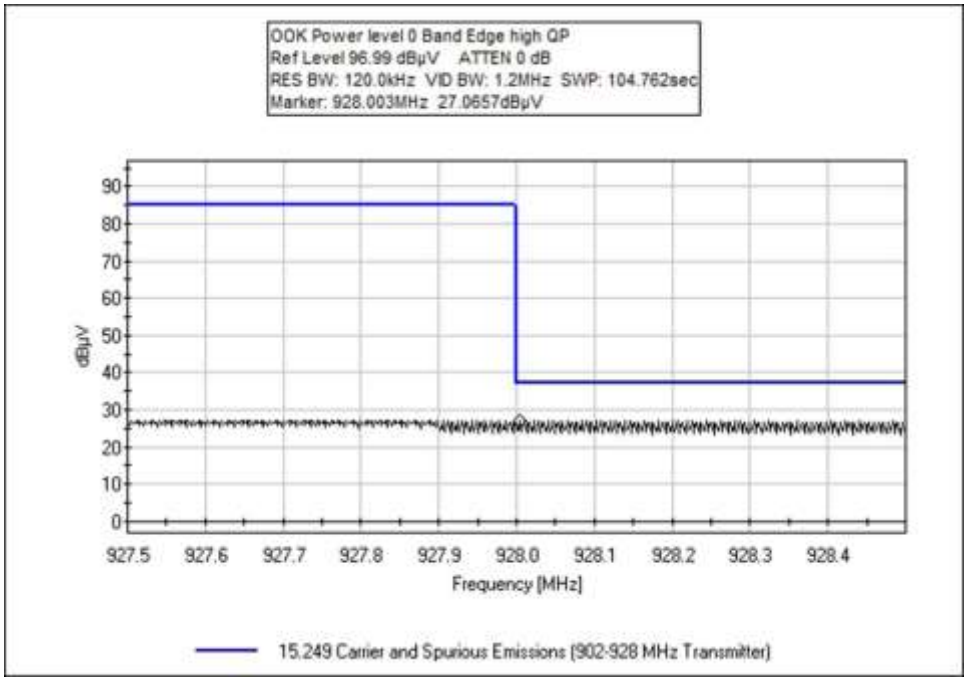
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01991	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
T2	ANP05657	Attenuator	PE7004-6	12/22/2015	12/22/2017
T3	ANP05360	Cable	RG214	11/30/2016	11/30/2018
T4	ANP05963	Cable	RG-214	2/15/2016	2/15/2018
T5	ANP06540	Cable	Heliax	10/29/2015	10/29/2017
	AN02673	Spectrum Analyzer	E4446A	10/12/2015	10/12/2017
T6	AN02307	Preamp	8447D	2/15/2016	2/15/2018

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	902.000M	35.6	+24.9	+6.0	+2.1	+2.4	+0.0	43.9	46.0	-2.1	Horiz
	QP		+0.3	-27.4					Band Edge		
2	928.000M	27.1	+25.1	+6.1	+2.1	+2.4	+0.0	35.9	46.0	-10.1	Horiz
	QP		+0.4	-27.3					Band Edge		

Band Edge Plots





Test Setup Photos

Below 1GHz

Above 1 GHz

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

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