Itron, Inc.

TEST REPORT FOR

Gas Endpoint
Model: 500GB

Tested to The Following Standard:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 98971-6

Date of issue: September 6, 2016

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.

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Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

REPRESENTATIVE: Jay Holcomb
Customer Reference Number: 104538

REPORT PREPARED BY:

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

Project Number: 98971

DATE OF EQUIPMENT RECEIPT: August 23, 2016
DATE(S) OF TESTING: August 23 - 25, 2016

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.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.02

Site Registration & Accreditation Information

Location	CB #	TAIWAN	CANADA	FCC	JAPAN
Brea D	US0060	SL2-IN-E-1146R	3082D-2	100638	A-0147

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)	Field Strength of Spurious Emissions	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = Not applicable because the EUT only operates on battery power.
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 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
Gas Endpoint	Itron, Inc.	500GB	NA

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, 6.3Vdc
Firmware / Software used for Test:	App Version: 1.9.13.174 CSL Version: 2.9.1.1

FCC Part 15 Subpart C

15.249(a) Field Strength of Fundamental

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation	$V_{Minimum}$ (dBuV/m)	$V_{Nominal}$ (dBuV/m)	$V_{Maximum}$ (dBuV/m)	Max Deviation from $V_{Nominal}$ (dB)
908	OOK	NA	88.1	NA	NA

Test performed using operational mode with the highest output power, representing worst case.
NA = Not Applicable, tests were performed using a fresh battery.

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
$V_{Nominal}$:	6.3VDC battery
$V_{Minimum}$:	NA
$V_{Maximum}$:	NA

NA = Not Applicable, tests were performed using a fresh battery.

Test Data Summary - Voltage Variations

This equipment is battery powered and manufacturer declares the equipment cannot operate while charging.
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	88.1	≤94	Pass

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**		
Work Order #:	**98971**	Date:	8/23/2016
Test Type:	**Maximized Emissions**	Time:	13:55:52
Tested By:	Don Nguyen	Sequence#:	0
Software:	EMITest 5.03.02		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

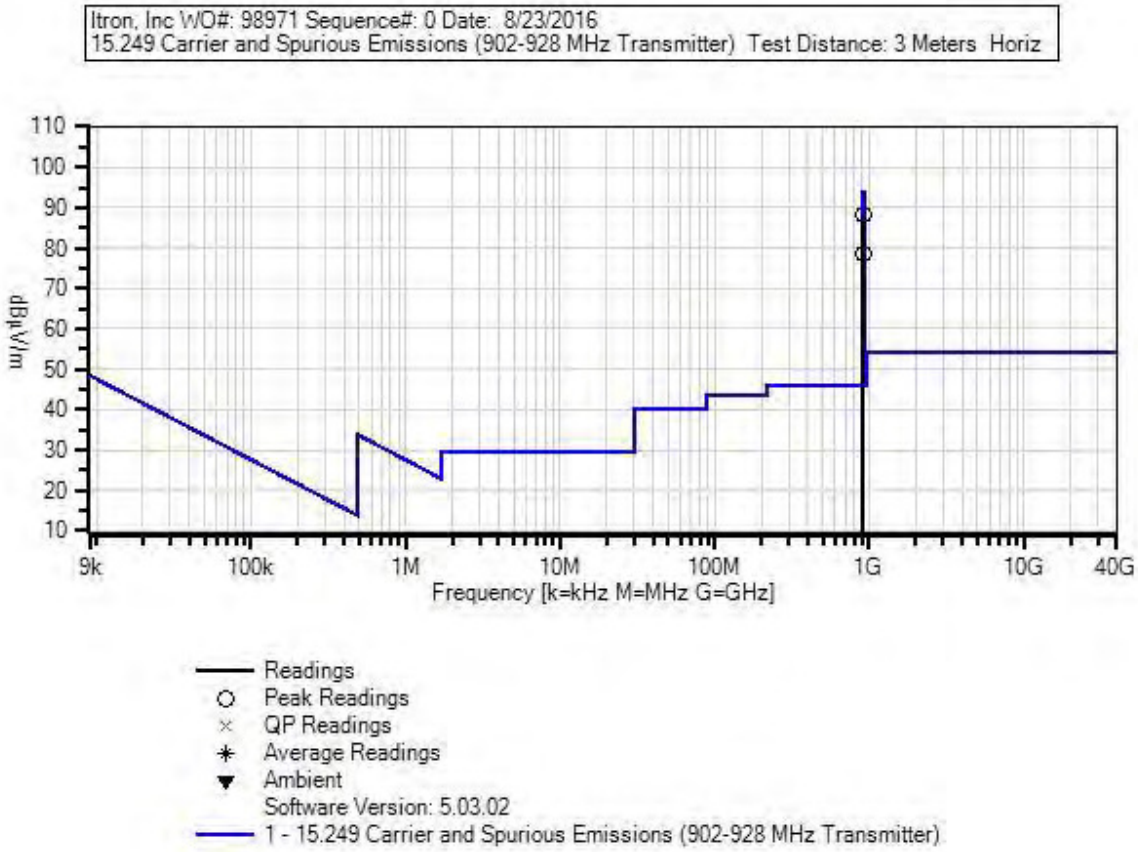
Test Conditions / Notes:

The EUT is placed on a Styrofoam platform at 0.8m in height for measurement below 1GHz and 1.5m in height for measurement above 1GHz. The EUT is turned on and set in transmitting mode.
The EUT has fresh battery installed. Nominal input voltage is 6.3Vdc.
The EUT is tested in preferred orientation declared by the manufacturer.
Operating frequency: 908MHz
Modulation: OOK
Rated power output: +0dBm

Frequency range of measurement = fundamental
RBW=120 kHz, VBW=300 kHz (peak detector)
RBW=120 kHz, VBW=1MHz (QP detector)

Test environment conditions:
Temperature: 27°C
Relative Humidity: 41%
Pressure: 100kPa

Site D
Test Method: ANSI C63.10 (2013)



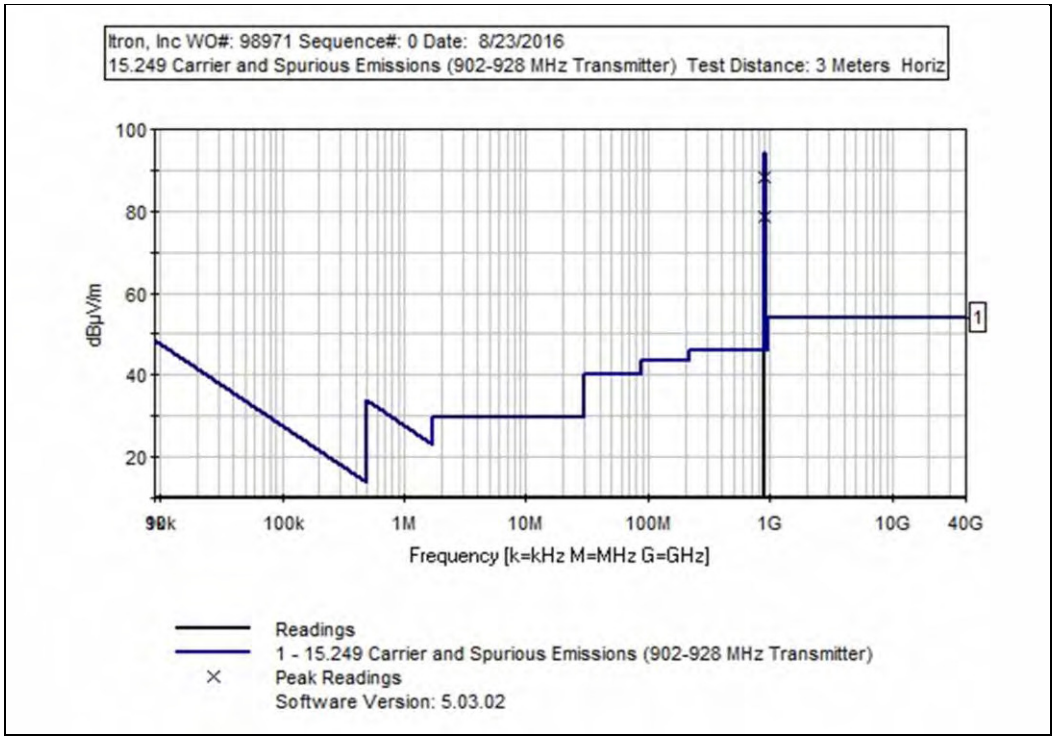
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00010	Preamp	8447D	3/14/2016	3/14/2018
T2	AN01992	Biconilog Antenna	CBL6111C	12/4/2014	12/4/2016
T3	ANP04382	Cable	LDF-50	6/6/2016	6/6/2018
T4	ANP05555	Cable	RG223/U	4/5/2016	4/5/2018
T5	ANP05569	Cable	RG-214/U	4/4/2016	4/4/2018
T6	AN02467	Spectrum Analyzer	E7405A	5/10/2016	5/10/2017
T7	ANP05283	Attenuator	ATT-0218-06-NNN-02	5/5/2016	5/5/2018

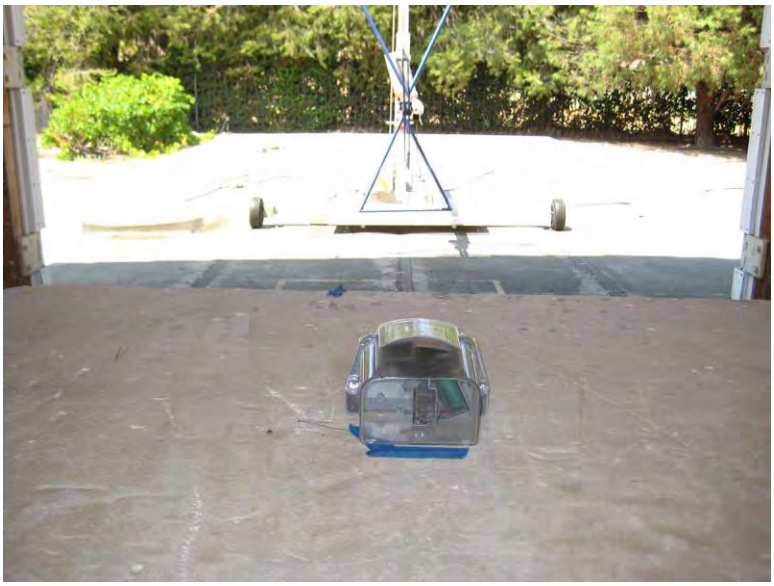
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	908.000M	79.7	-27.6 +3.6	+22.7 +0.0	+3.3 +5.9	+0.5	+0.0	88.1	94.0	-5.9	Vert
2	908.000M	70.3	-27.6 +3.6	+22.7 +0.0	+3.3 +5.9	+0.5	+0.0	78.7	94.0	-15.3	Horiz

Plot


Itron, Inc WO#: 98971 Sequence#: 0 Date: 8/23/2016
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Horiz
100
80
60
40
20
dBµV/m
1
90k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
Readings
1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)
Peak Readings
Software Version: 5.03.02

Test Setup Photos



15.249(a) Radiated Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**		
Work Order #:	**98971**	Date:	8/25/2016
Test Type:	**Maximized Emissions**	Time:	11:34:07
Tested By:	Don Nguyen	Sequence#:	1
Software:	EMITest 5.03.02		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

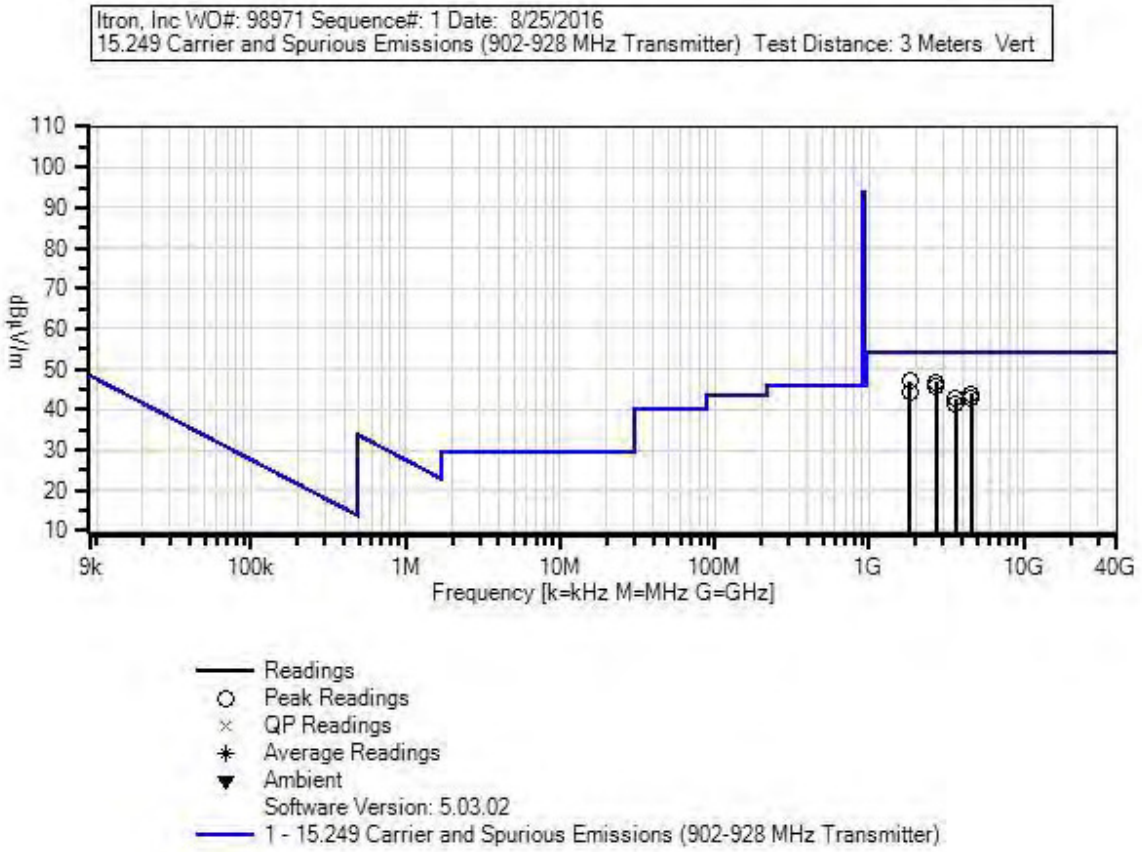
Test Conditions / Notes:

The EUT is placed on a Styrofoam platform at 0.8m in height for measurement below 1GHz and 1.5m in height for measurement above 1GHz. The EUT is turned on and set in transmitting mode.
The EUT has fresh battery installed. Nominal input voltage is 6.3Vdc.
The EUT is tested in preferred orientation declared by the manufacturer.
Operating frequency: 908MHz
Modulation: OOK
Rated power output: +0dBm

Frequency range of measurement = 9kHz-9.28GHz
9 kHz - 150 kHz, RBW=200 Hz, VBW=600 Hz
150 kHz -30 MHz, RBW=9 kHz, VBW=27 kHz
30 MHz - 1000MHz, RBW=120 kHz, VBW=300 kHz (peak detector), RBW=120 kHz, VBW=1MHz (QP detector)
1000 MHz - 9280MHz, RBW=1 MHz, VBW=3 MHz

Test environment conditions:
Temperature: 27°C
Relative Humidity: 41%
Pressure: 100kPa

Site D
Test Method: ANSI C63.10 (2013)


Itron, Inc WO#: 98971 Sequence#: 1 Date: 8/25/2016
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert
110
100
90
80
70
60
50
40
30
20
10
dBµV/m
9k
100k
1M
10M
100M
1G
10G
40G
Frequency [k=kHz M=MHz G=GHz]
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
	AN00314	Loop Antenna	6502	5/20/2016	5/20/2018
	AN00010	Preamp	8447D	3/14/2016	3/14/2018
	AN01992	Biconilog Antenna	CBL6111C	12/4/2014	12/4/2016
	ANP05555	Cable	RG223/U	4/5/2016	4/5/2018
	ANP05569	Cable	RG-214/U	4/4/2016	4/4/2018
	ANP05283	Attenuator	ATT-0218-06-NNN-02	5/5/2016	5/5/2018
	AN02467	Spectrum Analyzer	E7405A	5/10/2016	5/10/2017
T1	ANP04382	Cable	LDF-50	6/6/2016	6/6/2018
T2	AN00787	Preamp	83017A	6/10/2015	6/10/2017
T3	AN01646	Horn Antenna	3115	3/4/2016	3/4/2018
T4	ANP05563	Cable	ANDL-1-PNMN-48	6/6/2016	6/6/2018
T5	ANP06977	Cable	PHASEFLEX EJR01N01036.0	4/5/2016	4/5/2018
T6	AN03169	High Pass Filter	HM1155-11SS	6/24/2015	6/24/2017

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

#	Freq MHz	Rdng dBµV	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	1815.992M	54.6	+5.1 +0.5	-39.4 +0.3	+23.8	+2.2	+0.0	47.1	54.0	-6.9	Horiz
2	2723.992M	50.9	+6.4 +0.4	-40.0 +0.2	+26.3	+2.6	+0.0	46.8	54.0	-7.2	Horiz
3	2723.992M	49.7	+6.4 +0.4	-40.0 +0.2	+26.3	+2.6	+0.0	45.6	54.0	-8.4	Vert
4	1815.992M	51.5	+5.1 +0.5	-39.4 +0.3	+23.8	+2.2	+0.0	44.0	54.0	-10.0	Vert
5	4539.992M	41.8	+8.5 +0.5	-40.2 +0.1	+29.9	+3.2	+0.0	43.8	54.0	-10.2	Horiz
6	3631.992M	44.4	+7.3 +0.6	-40.4 +0.1	+27.8	+3.0	+0.0	42.8	54.0	-11.2	Vert
7	4539.992M	40.6	+8.5 +0.5	-40.2 +0.1	+29.9	+3.2	+0.0	42.6	54.0	-11.4	Vert
8	3631.992M	43.0	+7.3 +0.6	-40.4 +0.1	+27.8	+3.0	+0.0	41.4	54.0	-12.6	Horiz

Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	OOK	Integral	35.7	<46	Pass
928	OOK	Integral	37.0	<46	Pass

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112
Customer: **Itron, Inc.**
Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
Work Order #: **98971** Date: 8/24/2016
Test Type: **Maximized Emissions** Time: 09:10:17
Tested By: Don Nguyen Sequence#: 3
Software: EMITest 5.03.02

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

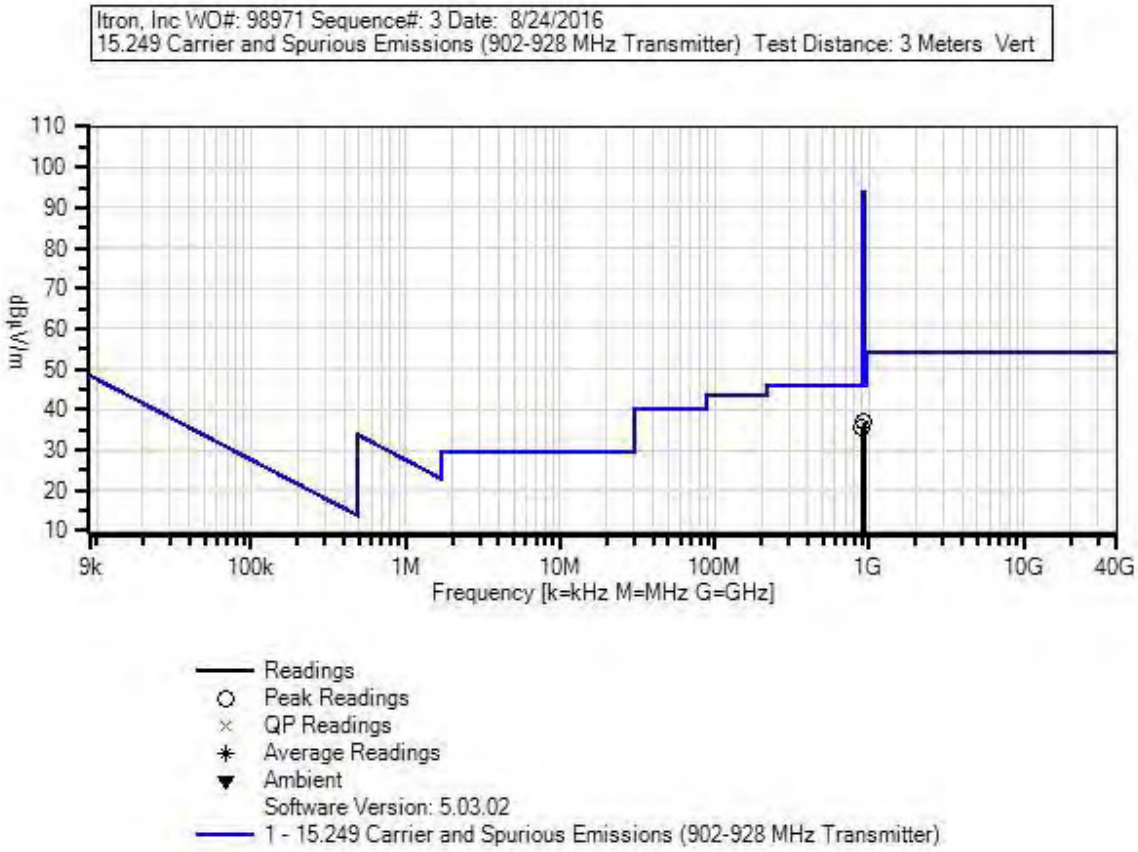
Test Conditions / Notes:

The EUT is placed on a Styrofoam platform at 0.8m in height for measurement below 1GHz and 1.5m in height for measurement above 1GHz. The EUT is turned on and set in transmitting mode.
The EUT has fresh battery installed. Nominal input voltage is 6.3Vdc.
The EUT is tested in preferred orientation declared by the manufacturer.
Operating frequency: 908MHz
Modulation: OOK
Rated power output: +0dBm

Frequency range of measurement = 9kHz-9.28GHz
9 kHz - 150 kHz, RBW=200 Hz, VBW=600 Hz
150 kHz -30 MHz, RBW=9 kHz, VBW=27 kHz
30 MHz - 1000MHz, RBW=120 kHz, VBW=1MHz
1000 MHz - 9280MHz, RBW=1 MHz, VBW=3 MHz

Test environment conditions:
Temperature: 27°C
Relative Humidity: 41%
Pressure: 100kPa

Site D
Test Method: ANSI C63.10 (2013)



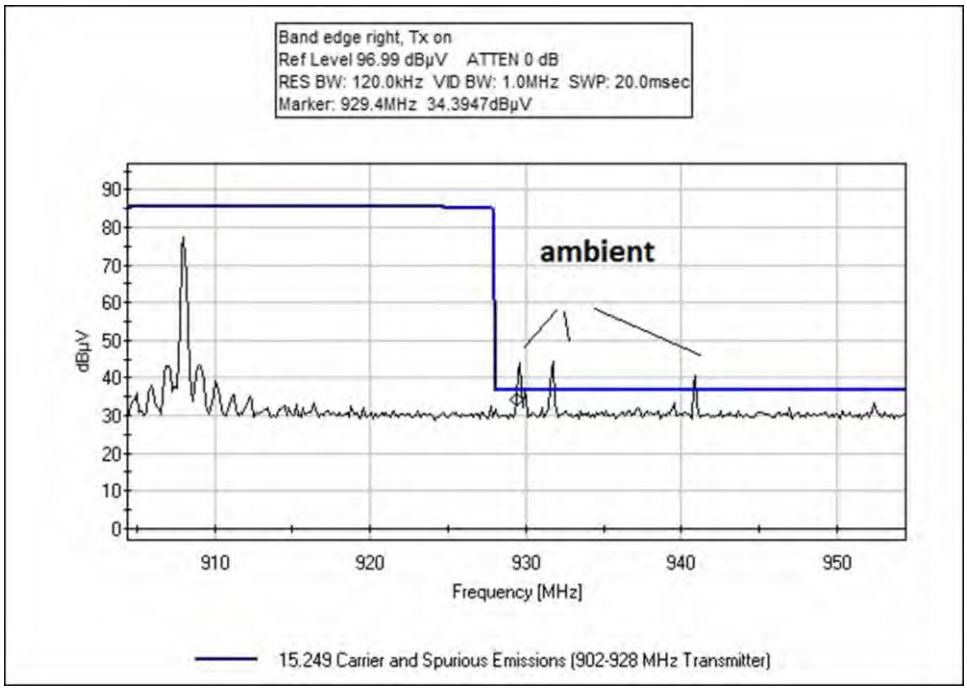
Test Equipment:

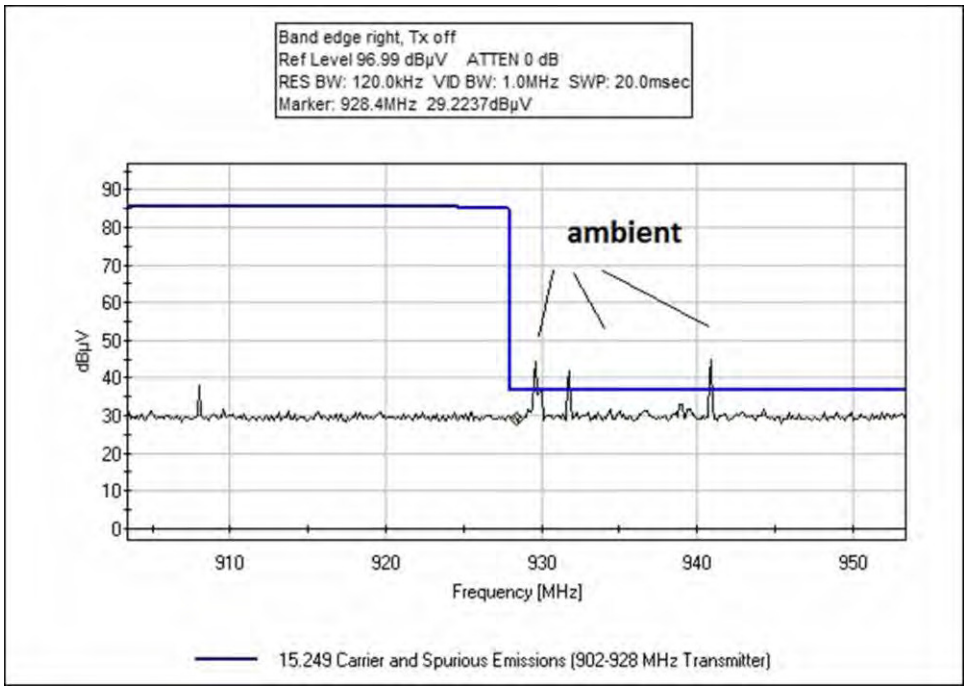
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00010	Preamp	8447D	3/14/2016	3/14/2018
T2	AN01992	Biconilog Antenna	CBL6111C	12/4/2014	12/4/2016
T3	ANP04382	Cable	LDF-50	6/6/2016	6/6/2018
T4	ANP05555	Cable	RG223/U	4/5/2016	4/5/2018
T5	ANP05569	Cable	RG-214/U	4/4/2016	4/4/2018
	AN02467	Spectrum Analyzer	E7405A	5/10/2016	5/10/2017
T6	ANP05283	Attenuator	ATT-0218-06-NNN-02	5/5/2016	5/5/2018

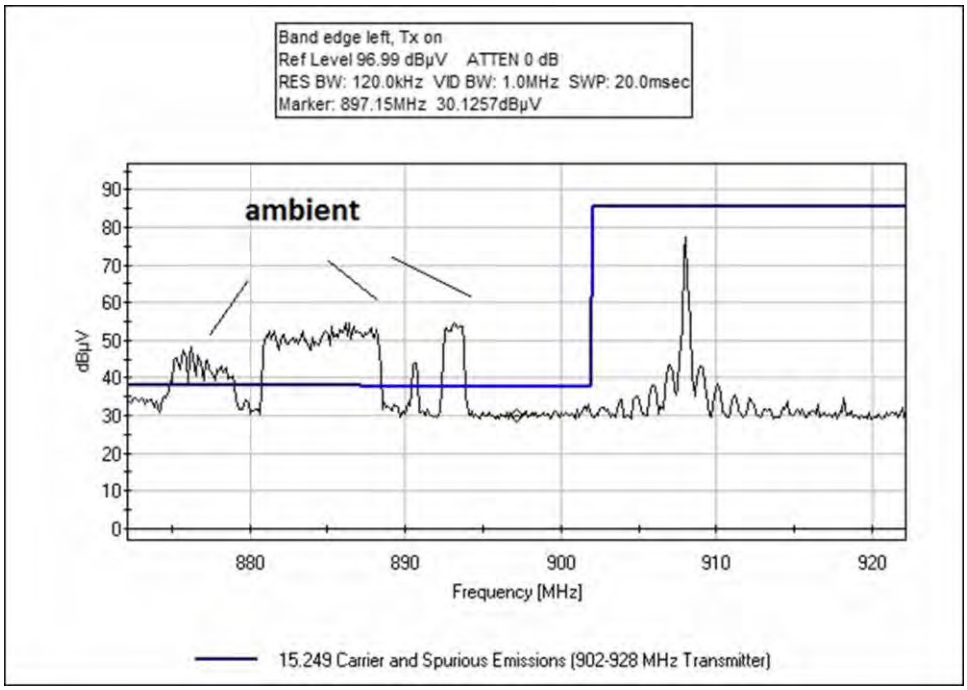
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

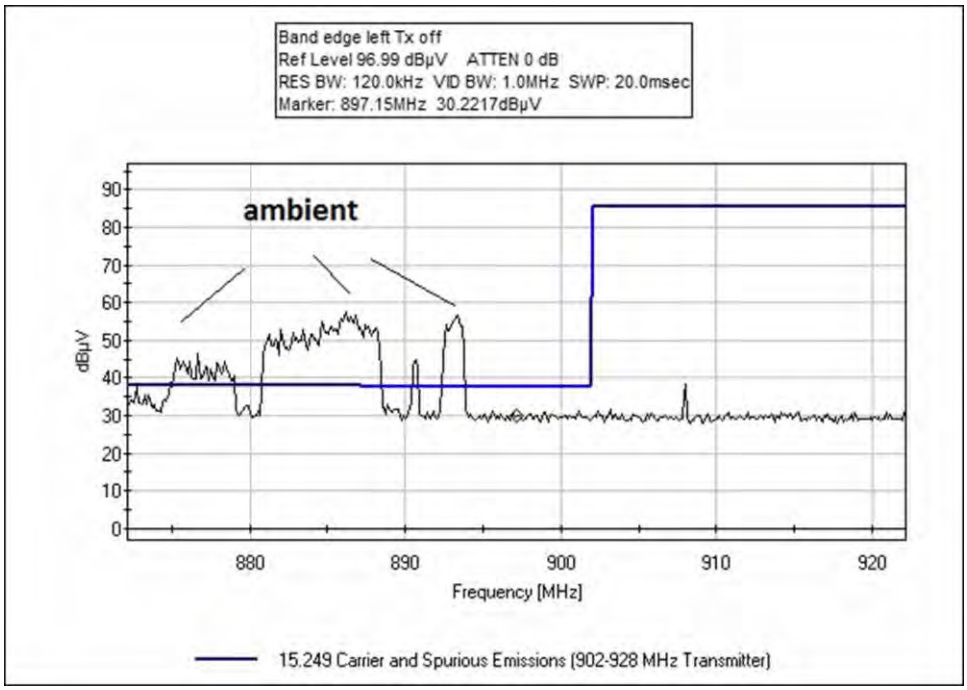
#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	928.000M	28.0	-27.5 +3.7	+22.9 +5.9	+3.4	+0.6	+0.0	37.0	46.0	-9.0	Vert
2	902.000M	27.4	-27.6 +3.6	+22.6 +5.9	+3.3	+0.5	+0.0	35.7	46.0	-10.3	Vert

Band Edge Plots

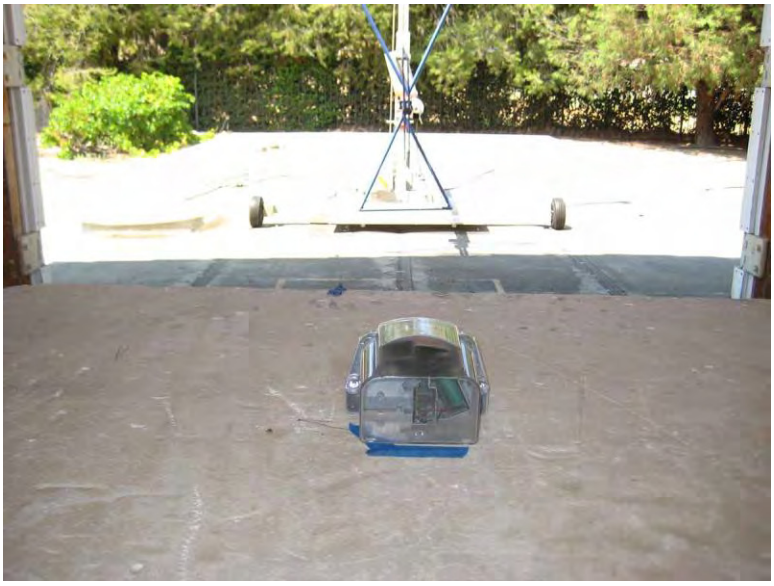





Band edge left, Tx on
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 897.15MHz 30.1257dBµV
ambient
dBµV
Frequency [MHz]
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)


Band edge left Tx off
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 897.15MHz 30.2217dBµV
ambient
dBµV
Frequency [MHz]
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

Test Setup Photos



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.