

Ittron, Inc.

TEST REPORT FOR

**Gas Endpoint
Model: Intelis-Gas**

Tested to The Following Standard:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 101080-7

Date of issue: May 30, 2018



Test Certificate # 803.02

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.

TABLE OF CONTENTS

Administrative Information	3
Test Report Information	3
Report Authorization	3
Test Facility Information	4
Software Versions	4
Site Registration & Accreditation Information	4
Summary of Results	5
Modifications During Testing	5
Conditions During Testing	5
Equipment Under Test	6
General Product Information	6
FCC Part 15 Subpart C	7
15.215(c) Occupied Bandwidth (20dB BW)	7
15.249(a) Field Strength of Fundamental	11
15.249(a) Radiated Emissions and Band Edge	16
Supplemental Information	26
Measurement Uncertainty	26
Emissions Test Details	26

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 148975

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: 101080

May 16, 2018

May 16-17, 2018

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

A handwritten signature in black ink, reading "Steve Behm", is positioned above a horizontal line.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.11

Site Registration & Accreditation Information

Location	NIST CB #	TAIWAN	CANADA	FCC	JAPAN
Brea A, CA	US0060	SL2-IN-E-1146R	3082D-1	US1025	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	Pass
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	NA1

NA = Not Applicable

NA1 = Not applicable because the EUT is battery powered.

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 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Gas Endpoint	Itron, Inc.	Intelis-Gas	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):	908 to 923.8MHz (OOK) (power level 0)
Maximum Duty Cycle:	100%
Antenna Type(s) and Gain:	PCB trace , 5.4dBi
Antenna Connection Type:	Integral
Nominal Input Voltage:	6.3V DC – battery
Firmware / Software used for Test:	App Version: 2.0.9.0, CSL Version: 3.0.18.9

FCC Part 15 Subpart C

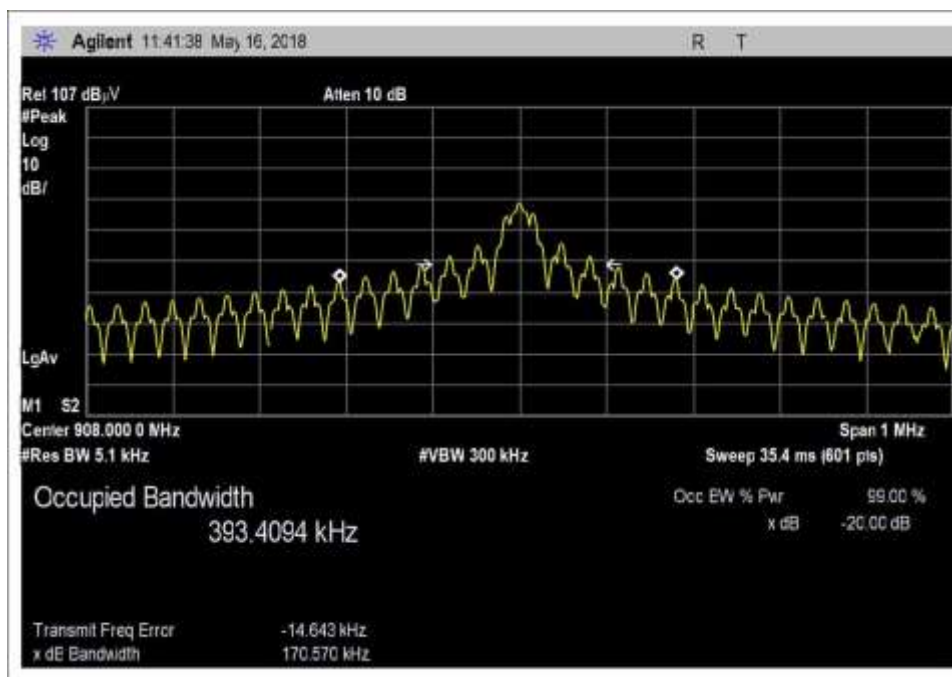
15.215(c) Occupied Bandwidth (20dB BW)

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013)	Test Date(s):	5/16/2018
Configuration:	2		
Test Setup:	The EUT is placed on a Styrofoam platform. The EUT is powered from fresh battery and programmed to transmit continuously. The gas meter is attached to the transmitter. Operation mode: OOK Power Level 0 Operating frequency: 908-923.8MHz Frequency range of measurement = Fundamental		

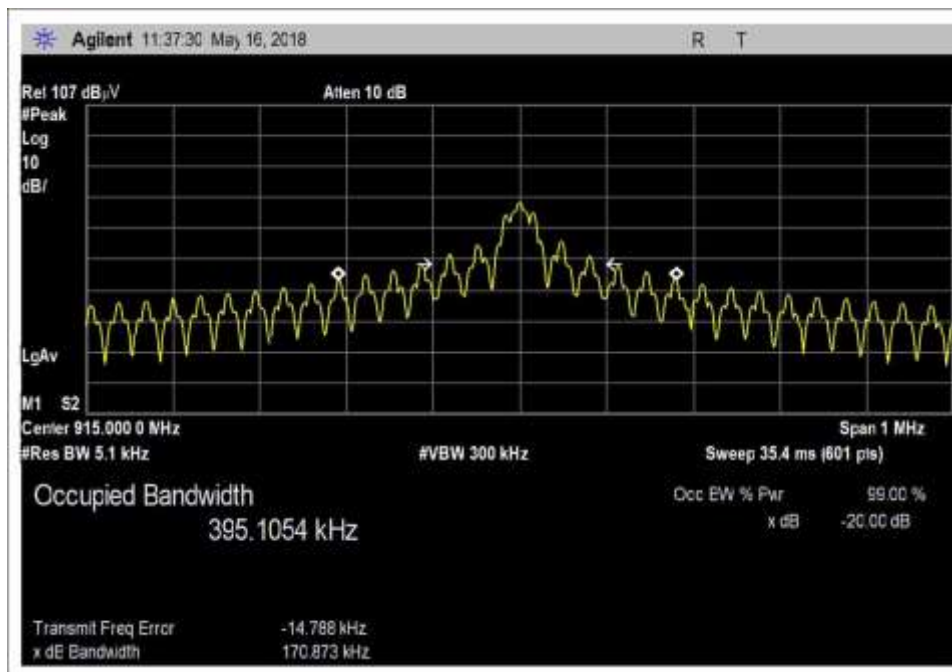
Environmental Conditions			
Temperature (°C)	20.4	Relative Humidity (%):	48.9

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P05198	Cable	Belden	8268	12/7/2016	12/7/2018
P05050	Cable	Pasternack	RG223/U	1/20/2017	1/20/2019
02672	Spectrum Analyzer	Agilent	E4446A	3/2/2017	3/2/2019
00309	Preamplifier	HP	8447D	2/19/2018	2/19/2020
01995	Biconilog Antenna	Chase	CBL6111C	4/23/2018	4/23/2020
05275	Attenuator	Weinschel	1W	4/5/2018	4/5/2020

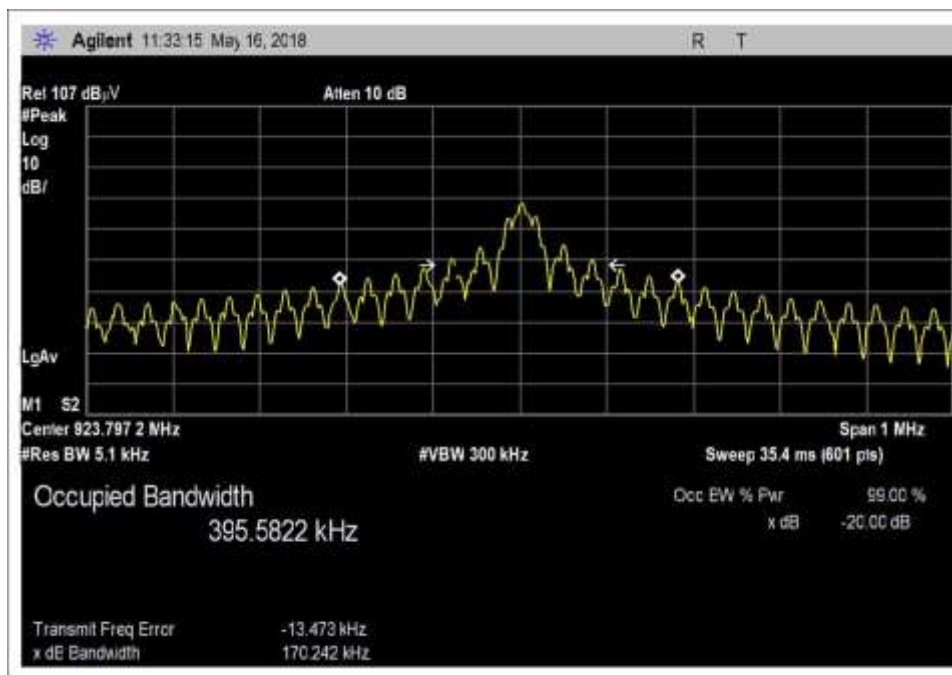
Plots



908MHz



915MHz



923MHz

Test Setup Photos



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 V	OOK, power level 0	Trace	89.4	≤94	Pass
908 H	OOK, power level 0	Trace	86.4	≤94	Pass
915 V	OOK, power level 0	Trace	89.7	≤94	Pass
915 H	OOK, power level 0	Trace	90.6	≤94	Pass
923.8 V	OOK, power level 0	Trace	90.4	≤94	Pass
923.8 H	OOK, power level 0	Trace	89.4	≤94	Pass

Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **101080** Date: 5/17/2018
 Test Type: **Maximized Emissions** Time: 11:29:17
 Tested By: E. Wong Sequence#: 1
 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:

The EUT is placed on a Styrofoam platform. The EUT is powered from fresh battery and programmed to transmit continuously. The gas meter is attached to the transmitter.

Operation mode: OOK Power Level 0

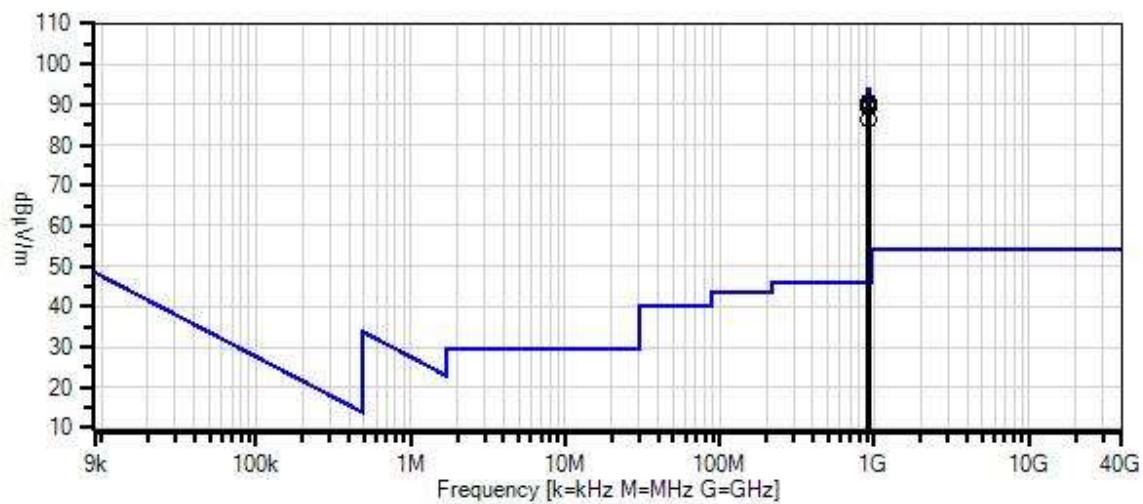
Operating frequency: 908-923.8MHz

Frequency range of measurement = Fundamental
 BW=VBW=120kHz

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

Temperature: 21.3°C
 Relative Humidity: 48.3%

Ittron, Inc. WO#: 101080 Sequence#: 1 Date: 5/17/2018
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Horiz



- Readings
 - Peak Readings
 - × QP Readings
 - * Average Readings
 - ▼ Ambient
- Software Version: 5.03.11
- 1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T3	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T6	AN00309	Preamp	8447D	2/19/2018	2/19/2020

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	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	915.000M	82.2	+0.0 +0.5	+23.0 -27.2	+6.1	+6.0	+0.0	90.6	94.0 Fundamental	-3.4	Horiz
2	923.800M	81.8	+0.0 +0.5	+23.2 -27.2	+6.1	+6.0	+0.0	90.4	94.0 Fundamental	-3.6	Vert
3	915.000M	81.3	+0.0 +0.5	+23.0 -27.2	+6.1	+6.0	+0.0	89.7	94.0 Fundamental	-4.3	Vert
4	908.000M	81.2	+0.0 +0.5	+22.9 -27.2	+6.1	+5.9	+0.0	89.4	94.0 Fundamental	-4.6	Vert
5	923.797M	80.8	+0.0 +0.5	+23.2 -27.2	+6.1	+6.0	+0.0	89.4	94.0 Fundamental	-4.6	Horiz
6	908.000M	78.2	+0.0 +0.5	+22.9 -27.2	+6.1	+5.9	+0.0	86.4	94.0 Fundamental	-7.6	Horiz

Test Setup Photos



15.249(a) Radiated Emissions and Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **101080** Date: 5/17/2018
 Test Type: **Maximized Emissions** Time: 11:29:17
 Tested By: E. Wong Sequence#: 1
 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:

The EUT is placed on a Styrofoam platform. The EUT is powered from fresh battery and programmed to transmit continuously. The gas meter is attached to the transmitter.

Operation mode: OOK Power Level 0

Operating frequency: 908-923.8MHz

Frequency range of measurement = 9 kHz- 10 GHz.

9 kHz -150 kHz;RBW=200 Hz,VBW=200 Hz;

150 kHz-30 MHz;RBW=9 kHz,VBW=9 kHz;

30 MHz-1000 MHz;RBW=120 kHz,VBW=120 kHz,

1000 MHz-10000 MHz;RBW=1 MHz,VBW=1 MHz.

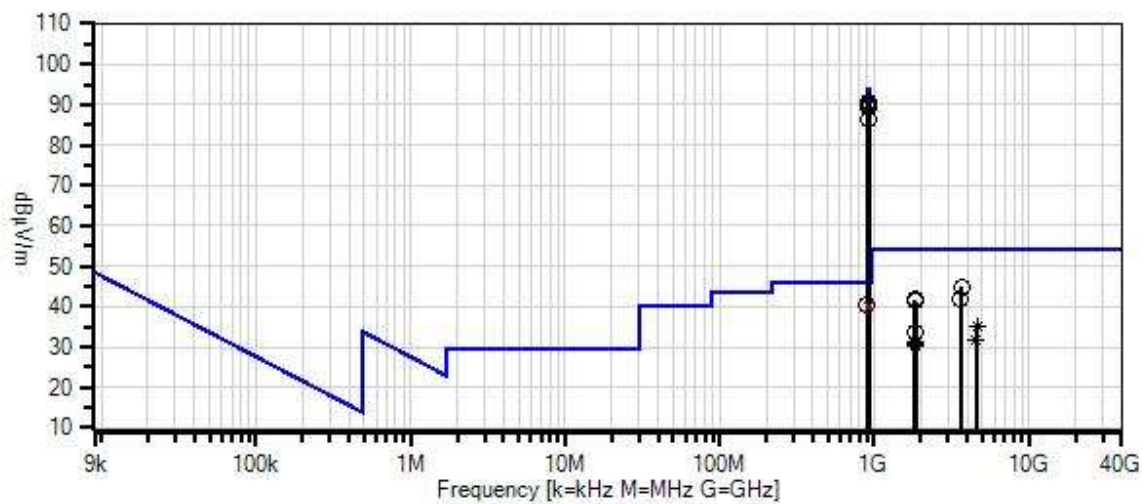
Site A

Test Method: ANSI C63.10 (2013)

Temperature: 21.3°C

Relative Humidity: 48.3%

Ittron, Inc. WO#: 101080 Sequence#: 1 Date: 5/17/2018
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Horiz



- Readings
 - Peak Readings
 - × QP Readings
 - * Average Readings
 - ▼ Ambient
- Software Version: 5.03.11
- 1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T3	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T6	AN00309	Preamp	8447D	2/19/2018	2/19/2020
T7	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T8	ANP06544	Cable	32026-29094K- 29094K-36TC	12/21/2017	12/21/2019
T9	ANP07139	Cable	ANDL1- PNMNM-48	3/1/2017	3/1/2019
T10	AN02749	High Pass Filter	9SH10- 1000/T10000- O/O	9/11/2017	9/11/2019
T11	AN00786	Preamp	83017A	5/12/2018	5/12/2020
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020

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	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	915.000M	82.2	+0.0 +0.5 +0.0	+23.0 -27.2 +0.0	+6.1 +0.0 +0.0	+6.0 +0.0	+0.0	90.6	94.0 Fundamental	-3.4	Horiz
2	923.800M	81.8	+0.0 +0.5 +0.0	+23.2 -27.2 +0.0	+6.1 +0.0 +0.0	+6.0 +0.0	+0.0	90.4	94.0 Fundamental	-3.6	Vert
3	915.000M	81.3	+0.0 +0.5 +0.0	+23.0 -27.2 +0.0	+6.1 +0.0 +0.0	+6.0 +0.0	+0.0	89.7	94.0 Fundamental	-4.3	Vert
4	908.000M	81.2	+0.0 +0.5 +0.0	+22.9 -27.2 +0.0	+6.1 +0.0 +0.0	+5.9 +0.0	+0.0	89.4	94.0 Fundamental	-4.6	Vert
5	923.797M	80.8	+0.0 +0.5 +0.0	+23.2 -27.2 +0.0	+6.1 +0.0 +0.0	+6.0 +0.0	+0.0	89.4	94.0 Fundamental	-4.6	Horiz
6	902.000M	32.2	+0.0 +0.5 +0.0	+22.8 -27.2 +0.0	+6.1 +0.0 +0.0	+5.9 +0.0	+0.0	40.3	46.0 bandedge L	-5.7	Vert
7	928.000M QP	31.5	+0.0 +0.5 +0.0	+23.2 -27.3 +0.0	+6.1 +0.0 +0.0	+6.0 +0.0	+0.0	40.0	46.0 bandedge H	-6.0	Vert
^	928.000M	37.7	+0.0 +0.5 +0.0	+23.2 -27.3 +0.0	+6.1 +0.0 +0.0	+6.0 +0.0	+0.0	46.2	46.0 bandedge H	+0.2	Vert

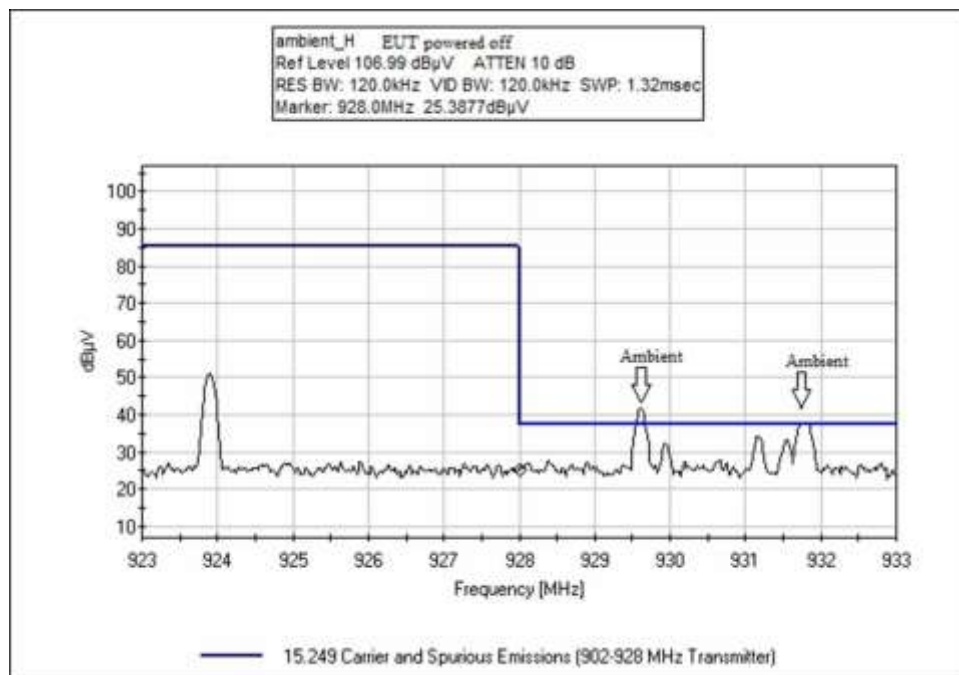
9	908.000M	78.2	+0.0 +0.5 +0.0	+22.9 -27.2 +0.0	+6.1 +0.0 +0.0	+5.9 +0.0	+0.0	86.4	94.0 Fundamental	-7.6	Horiz
10	3660.000M	46.1	+0.0 +0.0 +3.8	+0.0 +0.0 +0.5	+0.0 +31.6 -38.3	+0.0 +1.2	+0.0	44.9	54.0	-9.1	Horiz
11	3632.000M	43.7	+0.0 +0.0 +3.8	+0.0 +0.0 +0.4	+0.0 +31.3 -38.3	+0.0 +1.2	+0.0	42.1	54.0	-11.9	Horiz
12	1830.000M	50.0	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.1 -38.9	+0.0 +0.7	+0.0	41.8	54.0	-12.2	Horiz
13	1847.500M	49.4	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.2 -38.9	+0.0 +0.7	+0.0	41.3	54.0	-12.7	Horiz
14	4619.000M Ave	33.7	+0.0 +0.0 +4.1	+0.0 +0.0 +0.6	+0.0 +32.9 -37.7	+0.0 +1.6	+0.0	35.2	54.0	-18.8	Vert
^	4619.000M	48.5	+0.0 +0.0 +4.1	+0.0 +0.0 +0.6	+0.0 +32.9 -37.7	+0.0 +1.6	+0.0	50.0	54.0	-4.0	Vert
16	1816.000M	41.9	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.1 -38.9	+0.0 +0.7	+0.0	33.7	54.0	-20.3	Horiz
17	4575.000M Ave	30.4	+0.0 +0.0 +4.1	+0.0 +0.0 +0.6	+0.0 +33.0 -37.8	+0.0 +1.6	+0.0	31.9	54.0	-22.1	Horiz
^	4575.000M	46.5	+0.0 +0.0 +4.1	+0.0 +0.0 +0.6	+0.0 +33.0 -37.8	+0.0 +1.6	+0.0	48.0	54.0	-6.0	Horiz
19	1830.000M Ave	39.6	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.1 -38.9	+0.0 +0.7	+0.0	31.4	54.0	-22.6	Vert
^	1830.000M	51.8	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.1 -38.9	+0.0 +0.7	+0.0	43.6	54.0	-10.4	Vert
21	1816.000M Ave	39.0	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.1 -38.9	+0.0 +0.7	+0.0	30.8	54.0	-23.2	Vert
^	1816.000M	52.4	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.1 -38.9	+0.0 +0.7	+0.0	44.2	54.0	-9.8	Vert
23	1847.667M Ave	38.2	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.2 -38.9	+0.0 +0.7	+0.0	30.1	54.0	-23.9	Vert
^	1847.667M	52.3	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.2 -38.9	+0.0 +0.7	+0.0	44.2	54.0	-9.8	Vert

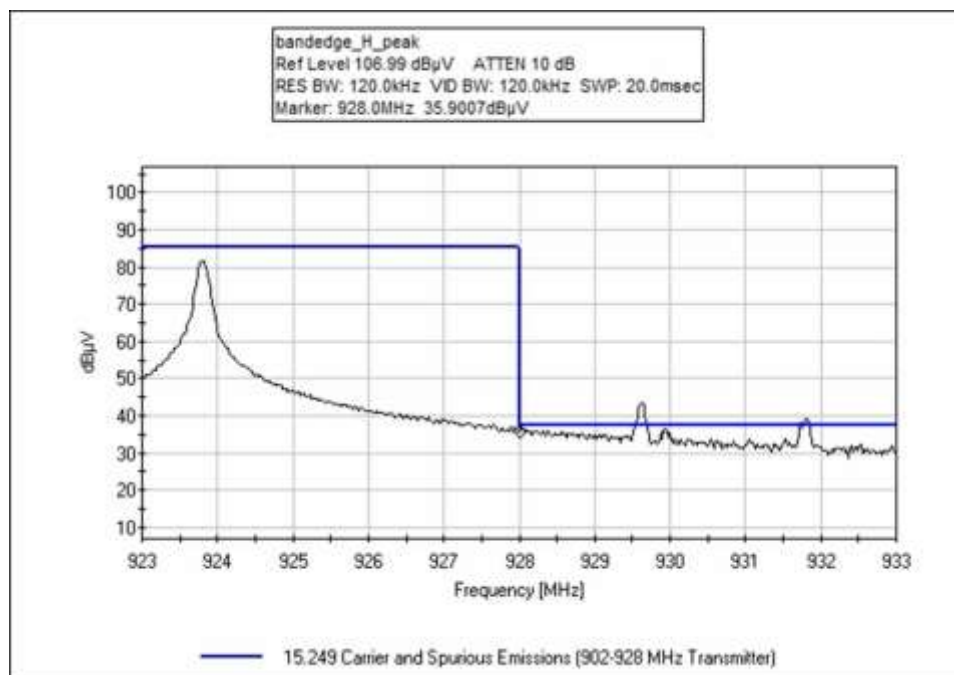
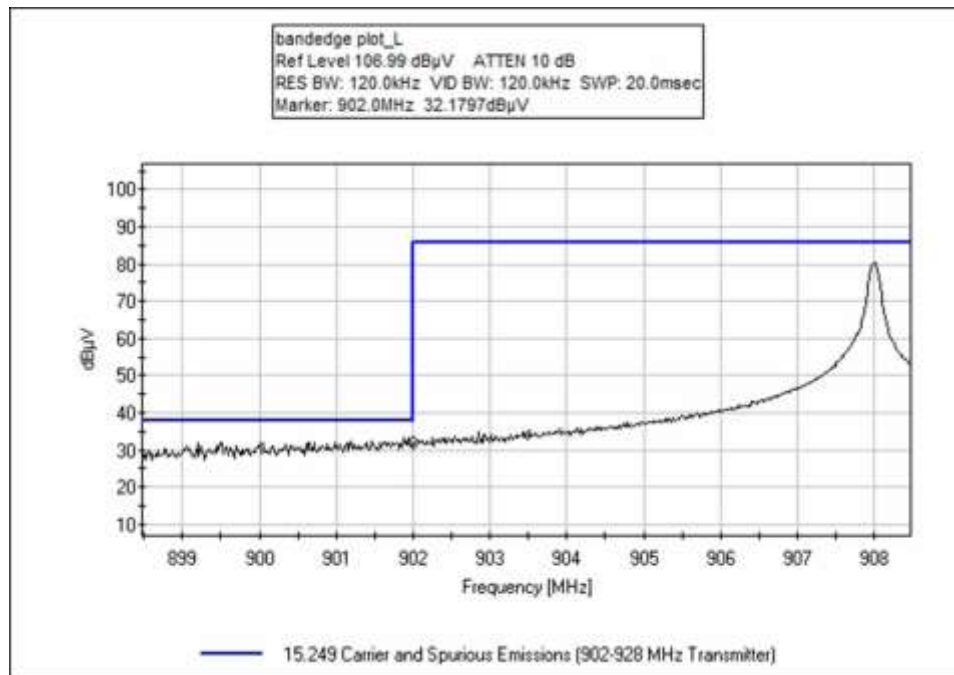
Band Edge

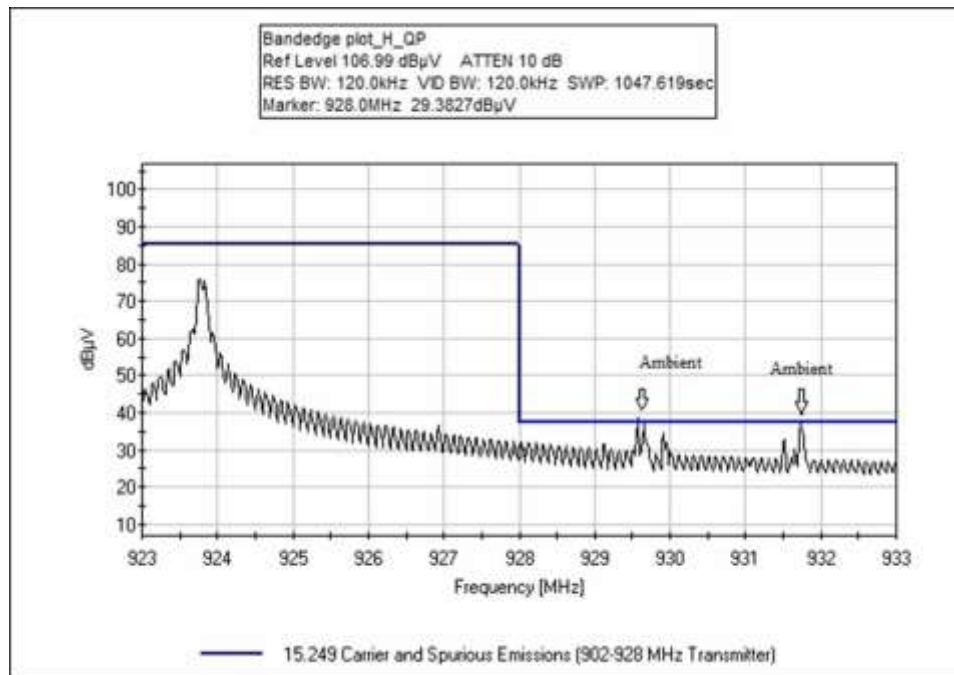
Band Edge Summary

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	OOK, power level 0	Trace	40.3	<54	Pass
928	OOK, power level 0	Trace	40.0 (QP)	<54	Pass

Band Edge Plots







Test Setup Photos



Below 1GHz



Below 1GHz



Above 1GHz



Above 1GHz



Above 1GHz Cone placement



Above 1GHz Cone placement

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.