

# Ittron, Inc.

## TEST REPORT FOR

**Gas Endpoint  
Model: 500GR**

**Tested To The Following Standards:**

**FCC Part 15 Subpart C Section(s)**

**15.249**

**Report No.: 99808-7**

**Date of issue: April 17, 2017**



This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of EMC testing for CKC Laboratories, Inc.

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

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## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

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

REPRESENTATIVE: Jay Holcomb  
Customer Reference Number: 119366

**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: 99808

April 4, 2017

April 4-5 and 20, 2017

### Report Authorization

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

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

## Test Facility Information



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

TEST LOCATION(S):  
CKC Laboratories, Inc.  
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, CA	US0060	SL2-IN-E-1146R	3082D-2	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	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 2

#### *Equipment Tested:*

Device	Manufacturer	Model #	S/N
Gas Endpoint	Itron, Inc.	500GR	0100002767

#### *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:	Power level 0 for OOK is 56.1%
Antenna Type(s) and Gain:	PC board antenna
Antenna Connection Type:	Integral
Nominal Input Voltage:	6.3Vdc
Firmware / Software used for Test:	STM32 1.18.3.0 MSP 0.15.4.0

## FCC Part 15 Subpart C

### 15.215(c) Occupied Bandwidth (20dB BW)

Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	4/20/2017
Configuration:	2		
Test Setup:	<p>The EUT is placed on 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.</p> <p>Operating frequency: 908MHz Modulation: OOK Firmware power: power level 0</p> <p>Frequency range of measurement = 908MHz RBW=5.1 kHz, VBW=15 kHz</p>		

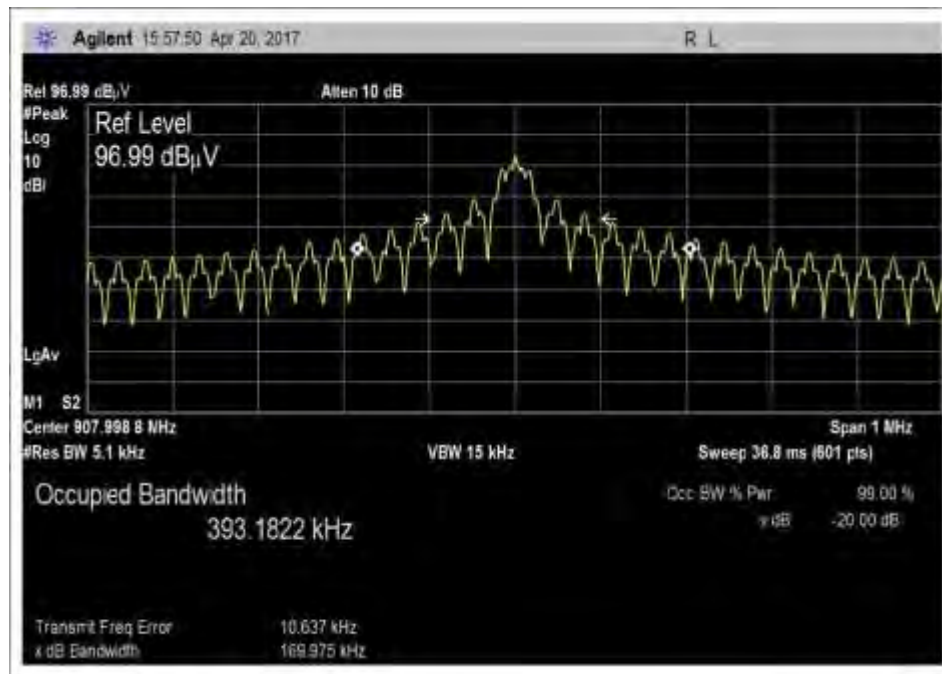
Environmental Conditions			
Temperature (°C)	24	Relative Humidity (%):	42

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
00010	Preamplifier	HP	8447D	3/14/2016	3/14/2018
P05283	Attenuator	Midwest Microwave	ATT-0218-06-NNN-02	5/5/2016	5/5/2018
P04382	Cable	Andrew	LDF-50	6/6/2016	6/6/2018
P05555	Cable	Pasternack	RG223/U	4/5/2016	4/5/2018
P05569	Cable	Pasternack	RG-214/U	12/7/2016	12/7/2018
02672	Spectrum Analyzer	Agilent	E4446A	3/2/2017	3/2/2019
01994	Biconilog Antenna	Chase	CBL6111C	3/11/2016	3/11/2018

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
908	NA*	OOK	169.975	None	NA

\*Radiated measurement

## Plot



## Test Setup Photo





## 15.249(a) Field Strength of Fundamental

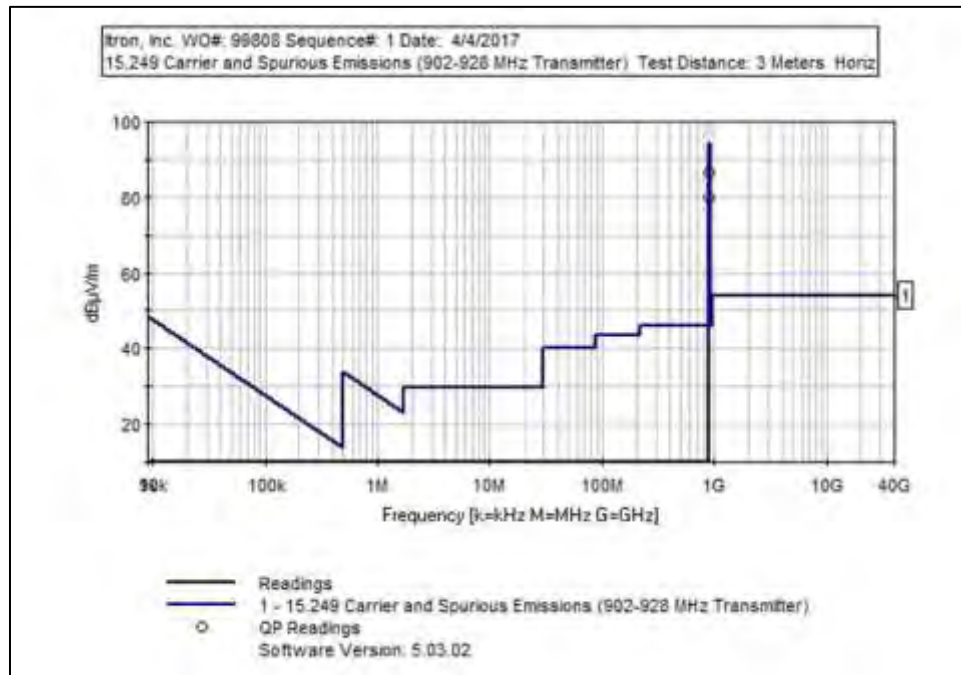
### Test Data Summary - Voltage Variations

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 (PC board)	88.4	≤94	Pass

### Plot



## 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 #: **99808** Date: 4/4/2017  
 Test Type: **Maximized Emissions** Time: 13:17:56  
 Tested By: Don Nguyen Sequence#: 1  
 Software: EMITest 5.03.02

### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

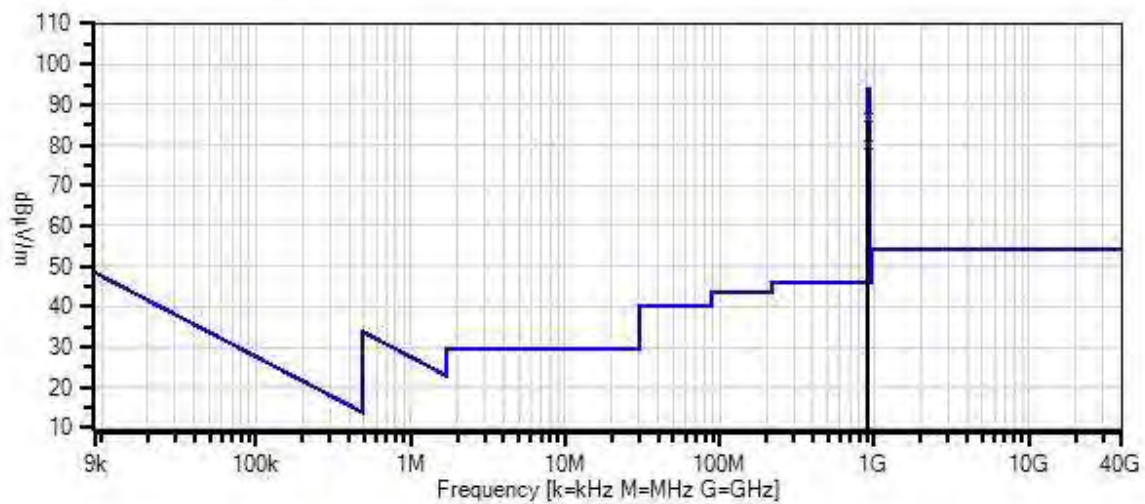
### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

### Test Conditions / Notes:

The EUT is placed on 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**  
 Firmware power: power level 0  
  
 Frequency range of measurement = 908MHz  
 RBW=120 kHz, VBW=360 kHz  
  
 Temperature: 19°C, Humidity: 57%, Pressure: 100.1kPa.  
 Site D.  
 Test Method: ANSI C63.10 (2013)

Ittron, Inc. WD#: 99808 Sequence#: 1 Date: 4/4/2017  
 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: 5.03.02  
 — 1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00010	Preamp	8447D	3/14/2016	3/14/2018
T2	ANP05283	Attenuator	ATT-0218-06- NNN-02	5/5/2016	5/5/2018
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-Amplitude +15C to +45C (dB)	RG-214/U	12/7/2016	12/7/2018
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T6	AN01994	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	907.998M	77.0	-27.6	+5.9	+3.3	+0.5	+0.0	86.8	94.0	-7.2	Horiz
	QP		+3.5	+24.2							
^	907.998M	78.6	-27.6	+5.9	+3.3	+0.5	+0.0	88.4	94.0	-5.6	Horiz
			+3.5	+24.2							
3	907.998M	70.2	-27.6	+5.9	+3.3	+0.5	+0.0	80.0	94.0	-14.0	Vert
	QP		+3.5	+24.2							
^	907.998M	72.0	-27.6	+5.9	+3.3	+0.5	+0.0	81.8	94.0	-12.2	Vert
			+3.5	+24.2							

Test Setup Photos



## 15.249(a) Radiated Emissions and Band Edge

### 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 #: **99808** Date: 4/4/2017  
 Test Type: **Maximized Emissions** Time: 13:55:33  
 Tested By: Don Nguyen Sequence#: 3  
 Software: EMITest 5.03.02

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

#### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

#### Test Conditions / Notes:

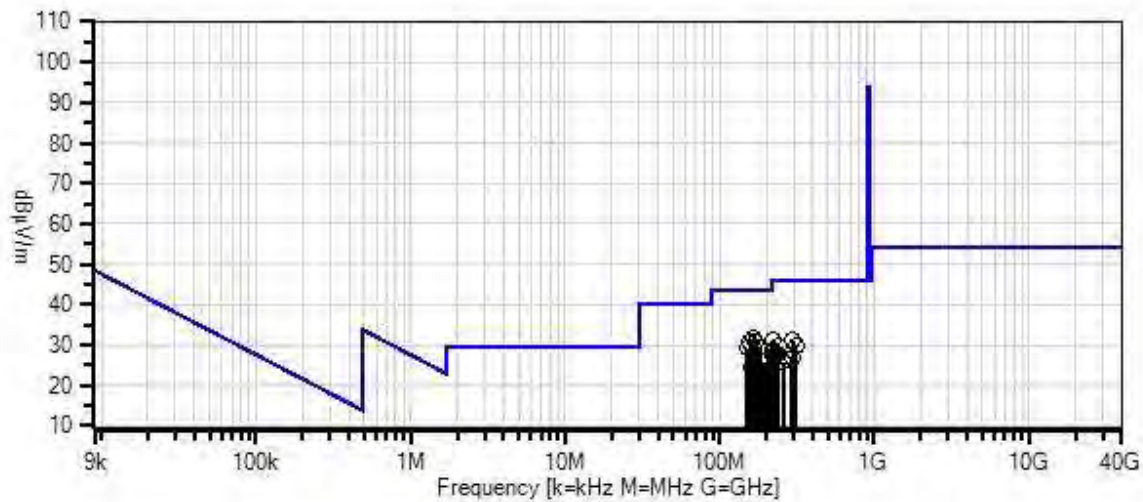
The EUT is placed on Styrofoam platform at 0.8m in height for measurement below 1GHz and 1.5m in height for measurement above 1GHz. The EUT is turned on and set in transmitting mode.  
 The EUT has fresh battery installed. Nominal input voltage is 6.3Vdc.  
 The EUT is tested in preferred orientation declared by the manufacturer.

Operating frequency: 908MHz  
**Modulation: OOK**  
 Firmware power: power level 0

Frequency range of measurement = 9kHz-1GHz  
 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=360 kHz

Temperature: 19°C, Humidity: 57%, Pressure: 100.1kPa.  
 Site D.  
 Test Method: ANSI C63.10 (2013)

Ittron, Inc. WO#: 99808 Sequence#: 3 Date: 4/4/2017  
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert



- 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	AN00010	Preamp	8447D	3/14/2016	3/14/2018
T2	ANP05283	Attenuator	ATT-0218-06- NNN-02	5/5/2016	5/5/2018
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-Amplitude +15C to +45C (dB)	RG-214/U	12/7/2016	12/7/2018
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T6	AN01994	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018
	AN00314	Loop Antenna	6502	5/20/2016	5/20/2018

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	167.050M	40.1	-26.9 +1.3	+5.8 +10.0	+1.3	+0.2	+0.0	31.8	43.5	-11.7	Vert
2	164.550M	39.7	-26.9 +1.3	+5.8 +10.2	+1.3	+0.2	+0.0	31.6	43.5	-11.9	Vert
3	156.050M	38.1	-26.9 +1.3	+5.8 +11.0	+1.3	+0.2	+0.0	30.8	43.5	-12.7	Vert
4	171.300M	39.2	-26.9 +1.3	+5.8 +9.6	+1.4	+0.2	+0.0	30.6	43.5	-12.9	Vert
5	180.800M	38.2	-26.9 +1.3	+5.8 +9.4	+1.4	+0.2	+0.0	29.4	43.5	-14.1	Vert
6	149.800M	35.8	-26.9 +1.3	+5.8 +11.6	+1.3	+0.2	+0.0	29.1	43.5	-14.4	Vert
7	222.250M	37.3	-26.7 +1.5	+5.8 +11.6	+1.5	+0.2	+0.0	31.2	46.0	-14.8	Horiz
8	295.300M	33.8	-26.6 +1.8	+5.8 +14.2	+1.8	+0.2	+0.0	31.0	46.0	-15.0	Vert
9	310.250M	32.6	-26.7 +1.8	+5.8 +14.5	+1.8	+0.2	+0.0	30.0	46.0	-16.0	Horiz
10	237.550M	34.3	-26.6 +1.6	+5.8 +12.9	+1.6	+0.2	+0.0	29.8	46.0	-16.2	Vert
11	219.750M	35.2	-26.7 +1.5	+5.8 +11.4	+1.5	+0.2	+0.0	28.9	46.0	-17.1	Horiz
12	205.250M	34.0	-26.7 +1.4	+5.8 +10.2	+1.5	+0.2	+0.0	26.4	43.5	-17.1	Horiz
13	223.800M	34.7	-26.7 +1.5	+5.8 +11.8	+1.6	+0.2	+0.0	28.9	46.0	-17.1	Vert



14	193.300M	34.1	-26.8 +1.4	+5.8 +9.6	+1.5	+0.2	+0.0	25.8	43.5	-17.7	Vert
15	234.800M	32.8	-26.7 +1.5	+5.8 +12.6	+1.6	+0.2	+0.0	27.8	46.0	-18.2	Vert
16	219.300M	33.7	-26.7 +1.5	+5.8 +11.4	+1.5	+0.2	+0.0	27.4	46.0	-18.6	Vert
17	170.000M	33.2	-26.9 +1.3	+5.8 +9.7	+1.4	+0.2	+0.0	24.7	43.5	-18.8	Horiz
18	292.750M	30.0	-26.6 +1.8	+5.8 +14.1	+1.8	+0.2	+0.0	27.1	46.0	-18.9	Horiz
19	227.250M	32.5	-26.7 +1.5	+5.8 +12.0	+1.6	+0.2	+0.0	26.9	46.0	-19.1	Horiz
20	159.000M	31.8	-26.9 +1.3	+5.8 +10.8	+1.3	+0.2	+0.0	24.3	43.5	-19.2	Horiz
21	256.550M	29.4	-26.6 +1.6	+5.8 +13.9	+1.6	+0.2	+0.0	25.9	46.0	-20.1	Vert



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 #: **99808** Date: 4/5/2017  
Test Type: **Maximized Emissions** Time: 13:43:55  
Tested By: S. Yamamoto Sequence#: 2  
Software: EMITest 5.03.02

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

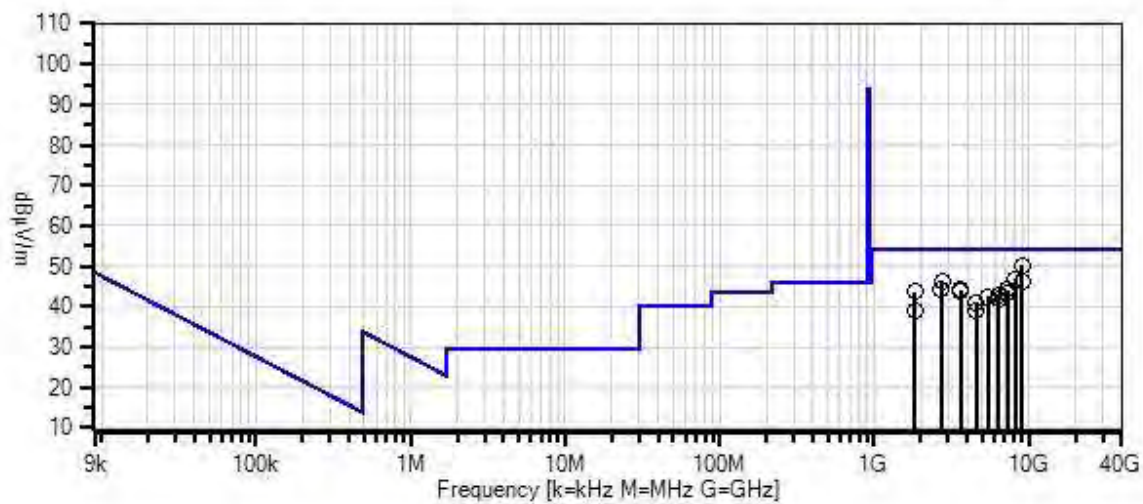
***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

The equipment under test (EUT) is stand alone on the table top. The EUT is turned on and set in transmit mode. The EUT has new batteries installed. Nominal input voltage is 6.3Vdc. The EUT is tested in the single orientation as requested by the manufacturer. The interface cable is unterminated. Operating frequency: 908MHz. <b>Modulation: OOK.</b> Firmware power: power level 0dBm  Frequency range of measurement, 1GHz to 9.10GHz. RBW=1 MHz, VBW=3 MHz  Temperature: 23°C, Humidity: 46%, Pressure: 100.1kPa. Site D. Test Method: ANSI C63.10 (2013)
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Ittron, Inc. WO#: 99808 Sequence#: 2 Date: 4/5/2017  
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Vert



- 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
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T1	ANP04382	Cable	LDF-50	6/6/2016	6/6/2018
T2	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
T3	AN00787	Preamplifier	83017A	6/10/2015	6/10/2017
T4	ANP06554	Cable	32022-29094K-29094K-24TC	12/30/2015	12/30/2017
T5	AN03169	High Pass Filter	HM1155-11SS	6/24/2015	6/24/2017
T6	AN01646	Horn Antenna	3115	3/4/2016	3/4/2018

**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	9079.840M	33.0	+12.9 +0.1	+6.2 +36.2	-39.5	+1.2	+0.0	50.1	54.0	-3.9	Vert
2	8171.872M	33.0	+12.0 +0.2	+6.1 +34.3	-40.0	+1.2	+0.0	46.8	54.0	-7.2	Vert
3	8171.077M	32.9	+12.0 +0.2	+6.1 +34.3	-40.0	+1.2	+0.0	46.7	54.0	-7.3	Horiz
4	2724.048M	49.4	+6.4 +0.2	+3.2 +26.3	-40.0	+0.6	+0.0	46.1	54.0	-7.9	Vert
5	9079.997M	28.9	+12.9 +0.1	+6.2 +36.2	-39.5	+1.2	+0.0	46.0	54.0	-8.0	Horiz
6	2723.850M	47.6	+6.4 +0.2	+3.2 +26.3	-40.0	+0.6	+0.0	44.3	54.0	-9.7	Horiz
7	7264.398M	34.2	+10.9 +0.2	+5.5 +32.6	-40.3	+1.1	+0.0	44.2	54.0	-9.8	Vert
8	3632.042M	44.8	+7.3 +0.1	+3.8 +27.8	-40.4	+0.7	+0.0	44.1	54.0	-9.9	Horiz
9	1816.025M	50.9	+5.1 +0.3	+2.5 +23.8	-39.4	+0.5	+0.0	43.7	54.0	-10.3	Vert
10	3632.102M	44.3	+7.3 +0.1	+3.8 +27.8	-40.4	+0.7	+0.0	43.6	54.0	-10.4	Vert
11	7264.308M	33.2	+10.9 +0.2	+5.5 +32.6	-40.3	+1.1	+0.0	43.2	54.0	-10.8	Horiz
12	6355.915M	35.3	+10.0 +0.3	+5.0 +31.2	-39.9	+1.0	+0.0	42.9	54.0	-11.1	Vert

13	5447.925M	36.0	+9.5 +0.2	+4.6 +31.4	-40.1	+0.9	+0.0	42.5	54.0	-11.5	Horiz
14	5448.030M	36.0	+9.5 +0.2	+4.6 +31.4	-40.1	+0.9	+0.0	42.5	54.0	-11.5	Vert
15	6355.858M	34.2	+10.0 +0.3	+5.0 +31.2	-39.9	+1.0	+0.0	41.8	54.0	-12.2	Horiz
16	4540.012M	37.7	+8.5 +0.1	+4.1 +29.9	-40.2	+0.8	+0.0	40.9	54.0	-13.1	Vert
17	1816.133M	46.1	+5.1 +0.3	+2.5 +23.8	-39.4	+0.5	+0.0	38.9	54.0	-15.1	Horiz
18	4539.792M	35.7	+8.5 +0.1	+4.1 +29.9	-40.2	+0.8	+0.0	38.9	54.0	-15.1	Horiz

## Band Edge

### Band Edge Summary

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	OOK	Integral (PC board)	35.9	<46	Pass
928	OOK	Integral (PC board)	35.5	<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 #: **99808** Date: 4/4/2017  
 Test Type: **Maximized Emissions** Time: 13:24:55  
 Tested By: Don Nguyen Sequence#: 2  
 Software: EMITest 5.03.02

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

#### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

#### Test Conditions / Notes:

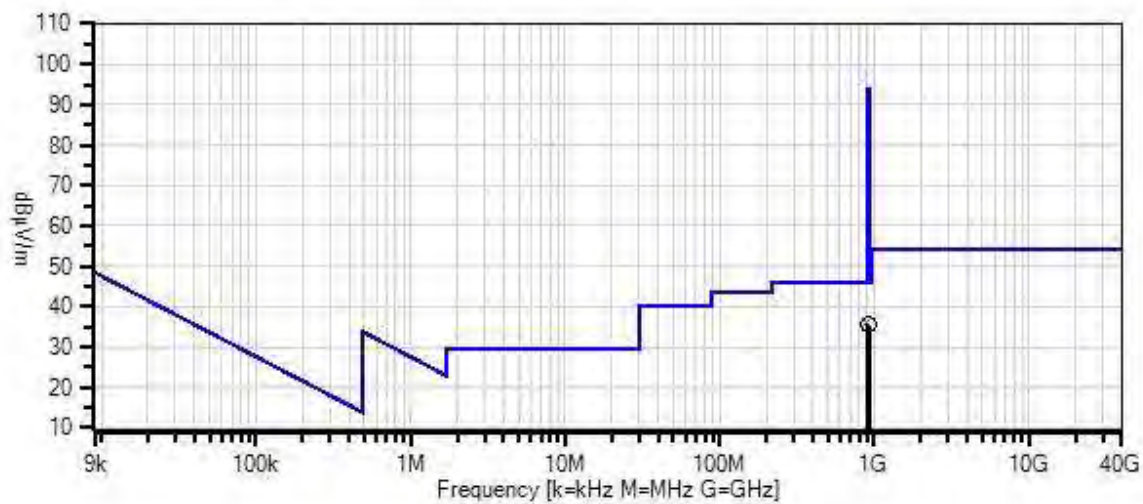
The EUT is placed on Styrofoam platform at 0.8m in height for measurement below 1GHz and 1.5m in height for measurement above 1GHz. The EUT is turned on and set in transmitting mode.  
 The EUT has fresh battery installed. Nominal input voltage is 6.3Vdc.  
 The EUT is tested in preferred orientation declared by the manufacturer.

Operating frequency: 908MHz  
**Modulation: OOK**  
 Firmware power: power level 0

Frequency range of measurement = 902-928MHz  
 RBW=120 kHz, VBW=360 kHz

Temperature: 19°C, Humidity: 57%, Pressure: 100.1kPa.  
 Site D.  
 Test Method: ANSI C63.10 (2013)

Ittron, Inc. WD#: 99808 Sequence#: 2 Date: 4/4/2017  
 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: 5.03.02
- 1 - 15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN00010	Preamp	8447D	3/14/2016	3/14/2018
T2	ANP05283	Attenuator	ATT-0218-06- NNN-02	5/5/2016	5/5/2018
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-Amplitude +15C to +45C (dB)	RG-214/U	12/7/2016	12/7/2018
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T6	AN01994	Biconilog Antenna	CBL6111C	3/11/2016	3/11/2018

**Measurement Data:**

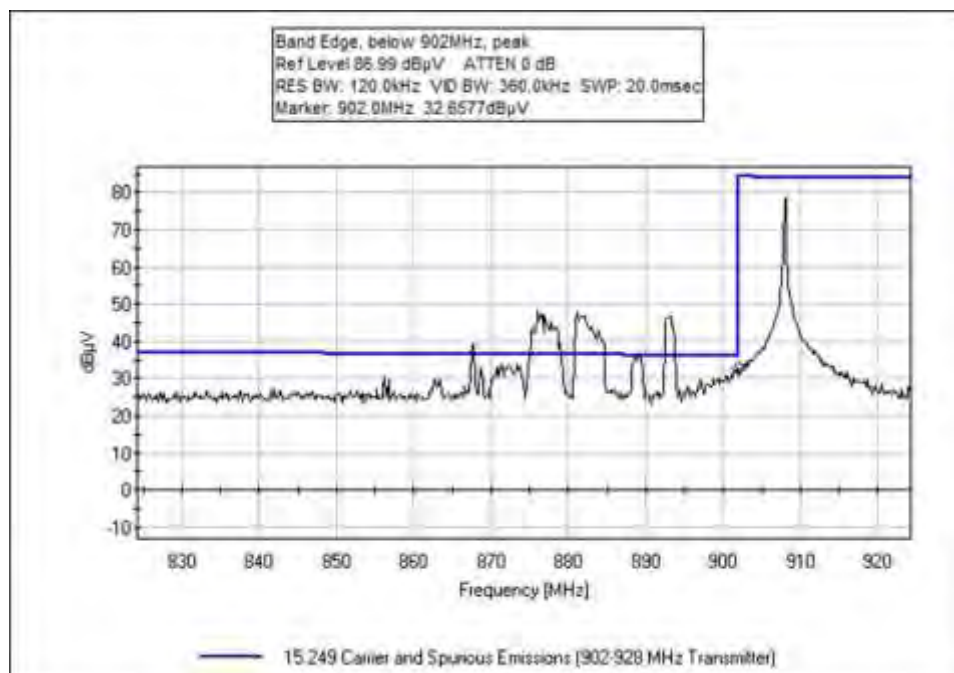
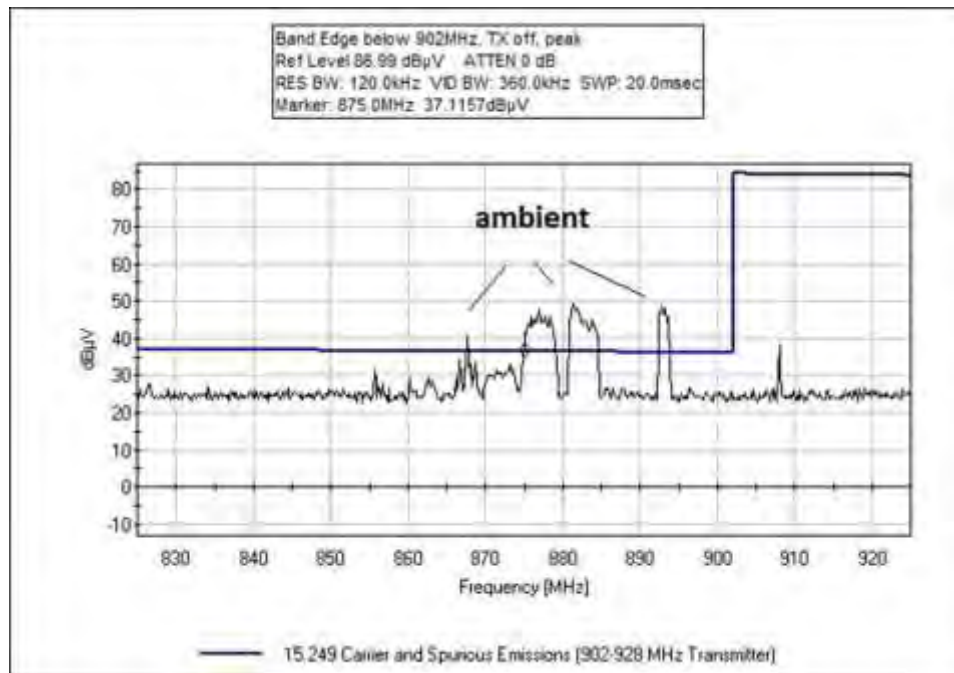
Reading listed by margin.

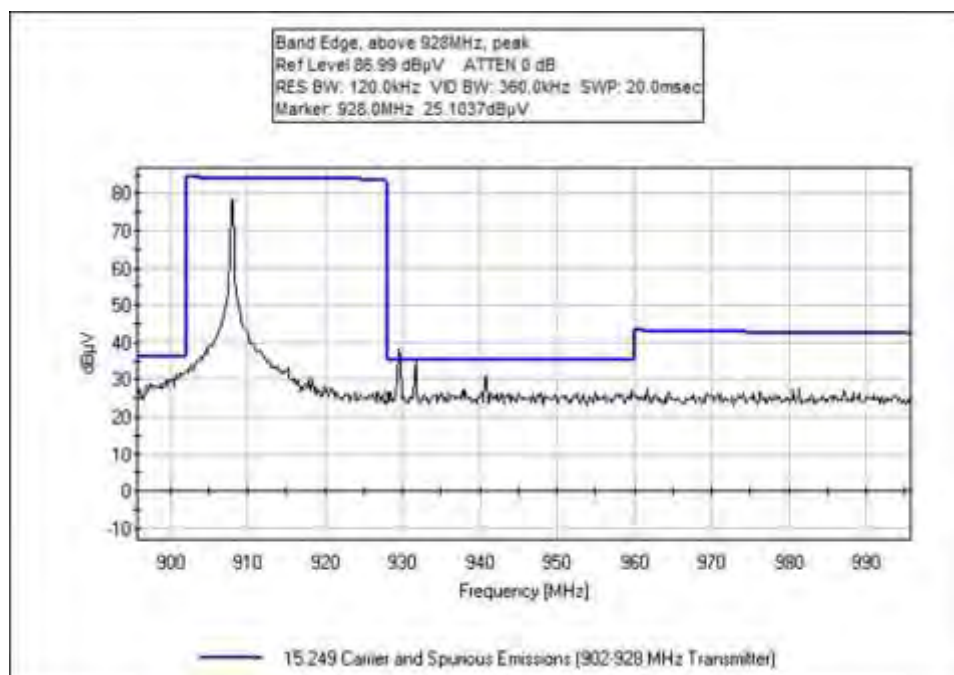
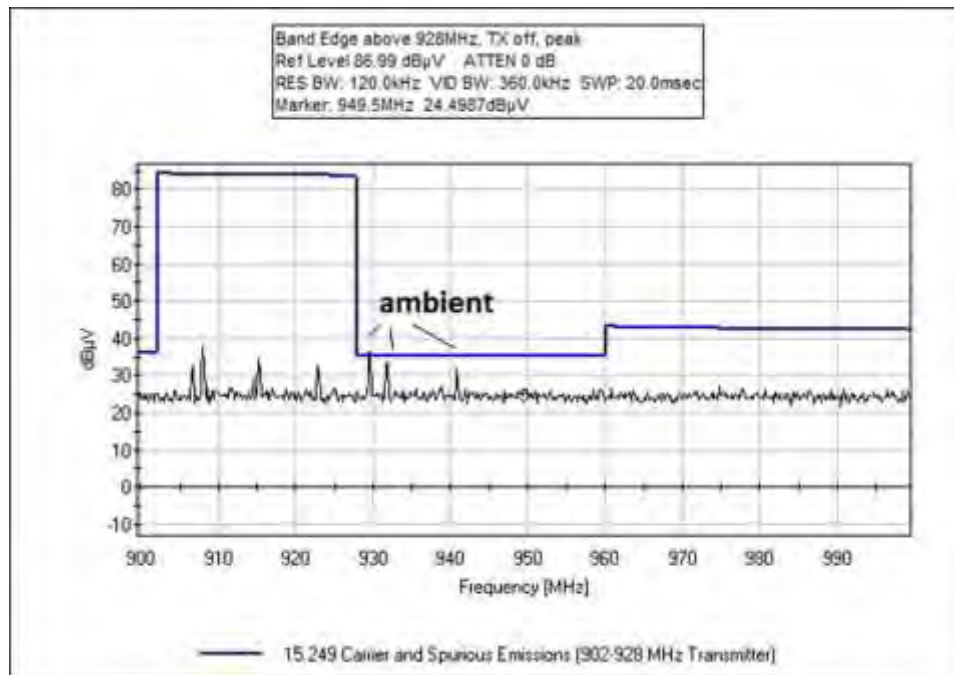
Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	902.000M	26.2	-27.6	+5.9	+3.3	+0.5	+0.0	35.9	46.0	-10.1	Horiz
	QP		+3.5	+24.1							
^	902.000M	32.9	-27.6	+5.9	+3.3	+0.5	+0.0	42.6	46.0	-3.4	Horiz
			+3.5	+24.1							
^	902.000M	32.6	-27.6	+5.9	+3.3	+0.5	+0.0	42.3	46.0	-3.7	Horiz
			+3.5	+24.1							
^	902.000M	32.5	-27.6	+5.9	+3.3	+0.5	+0.0	42.2	46.0	-3.8	Horiz
			+3.5	+24.1							
5	928.000M	25.1	-27.5	+5.9	+3.4	+0.6	+0.0	35.5	46.0	-10.5	Horiz
			+3.6	+24.4							



## Band Edge Plots





**Test Setup Photos**



Below 1GHz



Below 1GHz



Above 1GHz



Above 1GHz

## 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	( $\text{dB}/\text{m}$ )
+	Cable Loss	( $\text{dB}$ )
-	Distance Correction	( $\text{dB}$ )
-	Preamplifier Gain	( $\text{dB}$ )
=	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.