

# Itron, Inc.

REVISED TEST REPORT TO 105379-14

**Itron Cellular 500G Module  
Model: 500GAC**

**Tested to The Following Standards:**

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

**15.247  
(DTS 2400-2483.5MHz)**

**Report No.: 105379-14A**

**Date of issue: August 18, 2021**



**Test Certificate # 803.01**

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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**TABLE OF CONTENTS**

Administrative Information ..... 3

    Test Report Information .....3

    Revision History .....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 ..... 9

    15.247(a)(2) 6dB Bandwidth.....9

    15.247(b)(3) Output Power .....13

    15.247(d) RF Conducted Emissions & Band Edge .....18

    15.247(d) Radiated Emissions & Band Edge .....25

    15.247(e) Power Spectral Density .....36

Supplemental Information..... 41

    Measurement Uncertainty .....41

    Emissions Test Details.....41

## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

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

Representative: Jay Holcomb  
Customer Reference Number: 236177

**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: 105379

May 11, 2021

May 11, 13, 14, 25, and 26, 2021

### Revision History

**Original:** Testing of the Itron Cellular 500G Module, Model: 500GAC to FCC Part 15 Subpart C Section(s) 15.247 (DTS 2400-2483.5MHz).

**Revision A:** Added statement to the Conditions During Test table to clarify the orientation of the EUT during testing.

### 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.



**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	5.03.19

## Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

\*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 - 15.247 (DTS)

Test Procedure	Description	Modifications	Results
15.247(a)(2)	6dB Bandwidth	NA	PASS
15.247(b)(3)	Output Power	NA	PASS
15.247(e)	Power Spectral Density	NA	PASS
15.247(d)	RF Conducted Emissions & Band Edge	NA	PASS
15.247(d)	Radiated Emissions & Band Edge	NA	PASS
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 = Not applicable because the manufacturer declares the EUT is battery operated.

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 manufacturer declares the equipment is only installed in one orientation and was tested in that orientation.

## 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
Itron Cellular 500G Module	Itron, Inc.	500GAC	CON1

#### Support Equipment:

Device	Manufacturer	Model #	S/N
USB to Serial Interface	Itron, Inc.	NA	NA
Laptop Computer	Dell	Latitude E6410	46TXXNI

### Configuration 2

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Itron Cellular 500G Module	Itron, Inc.	500GAC	005

#### Support Equipment:

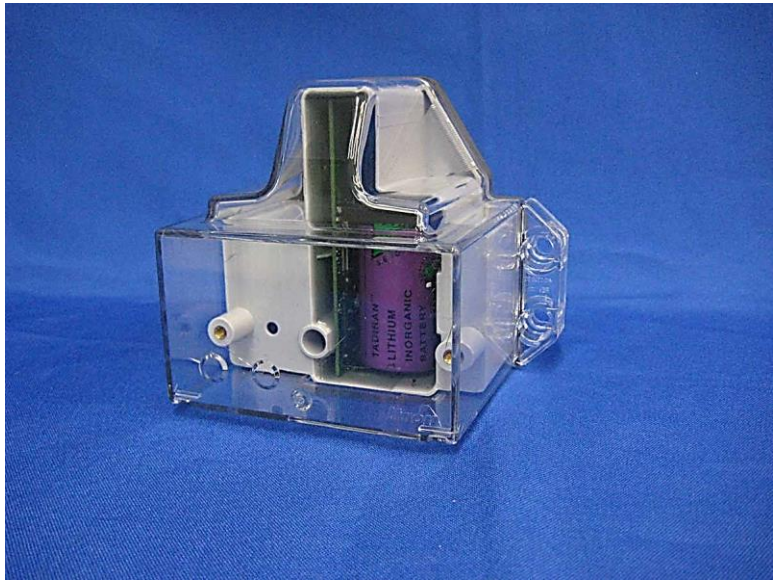
Device	Manufacturer	Model #	S/N
USB to Serial Interface	Itron, Inc.	NA	NA
Laptop Computer	Dell	Latitude E6410	46TXXNI

## General Product Information:

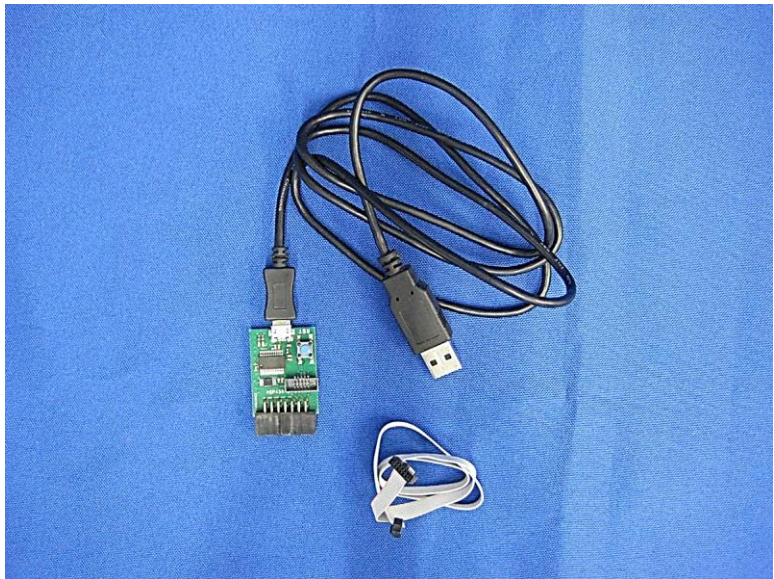
Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	BLE
Operating Frequency Range:	2402MHz to 2480MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	12.5%
Number of TX Chains:	1
Antenna Type(s) and Gain:	PCB Trace/ -0.5 dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral
Nominal Input Voltage:	3.6V Battery
Firmware / Software used for Test:	App Version: 0.0.33.0 CSL version: 8.1.17.0 Hardware Rev: 4



**EUT Photo(s)**



**Support Equipment Photo(s)**



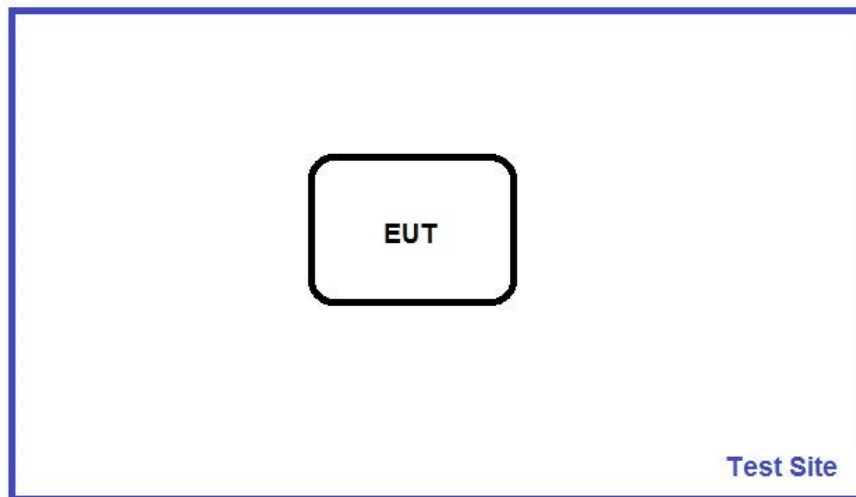
USB to Serial Interface



Laptop and Power Supply

**Block Diagram of Test Setup(s)**

**Test Setup Block Diagram**





# FCC Part 15 Subpart C

## 15.247(a)(2) 6dB Bandwidth

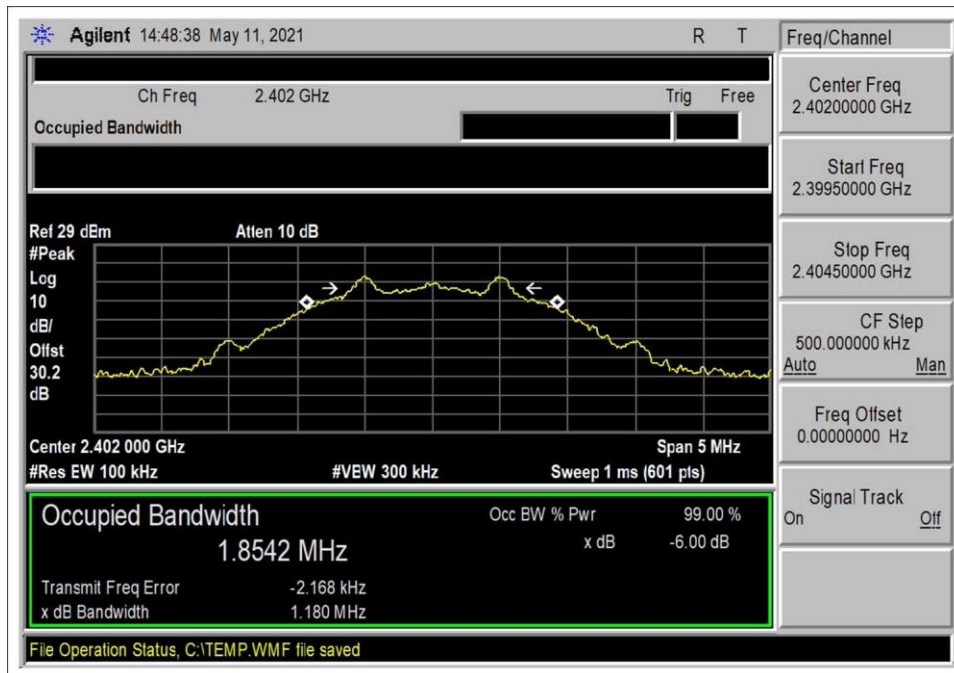
Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	S. Yamamoto
Test Method:	ANSI C63.10 (2013), KDB 558074	Test Date(s):	5/11/2021
Configuration:	1		
Test Setup:	<p>The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.</p> <p>The RF output has been configured to a coaxial cable output with sma connector. The output is connected to the spectrum analyzer using a coaxial cable and power attenuator.</p> <p>Frequency range of test: 24202MHz to 2480MHz.</p> <p>BLE GFSK Power Level 3            Low channel 2402MHz            Middle channel 2442MHz            High channel 2480MHz</p> <p>Temperature: 21°C            Humidity: 50%            Pressure: 99kPa</p> <p>Site D</p> <p>Reference 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013</p>		

Environmental Conditions			
Temperature (°C)	21	Relative Humidity (%):	50

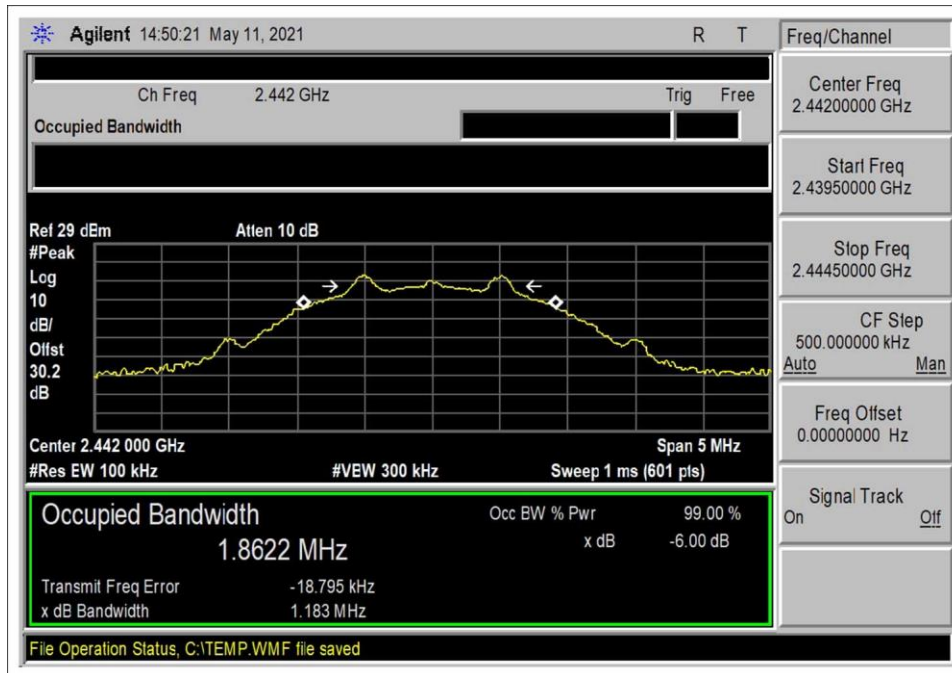
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02869	Spectrum Analyzer	Agilent	E4440A	8/3/2020	8/3/2021
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07656	Cable	Astrolab, Inc.	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	1	GFSK (PL3)	1180	≥500	Pass
2442	1	GFSK (PL3)	1183	≥500	Pass
2480	1	GFSK (PL3)	1183	≥500	Pass

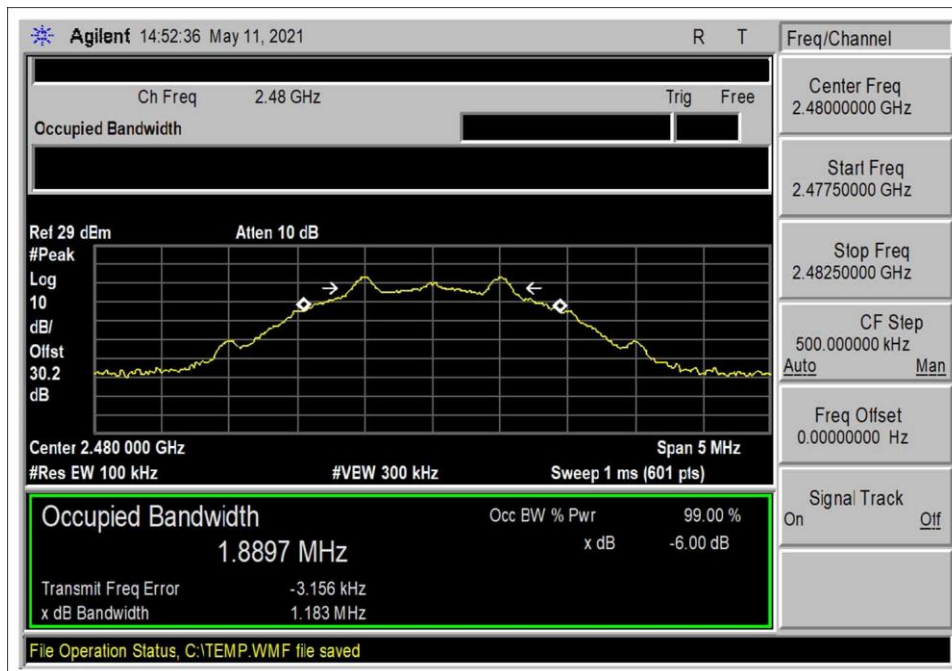
**Plot(s)**



Low Channel

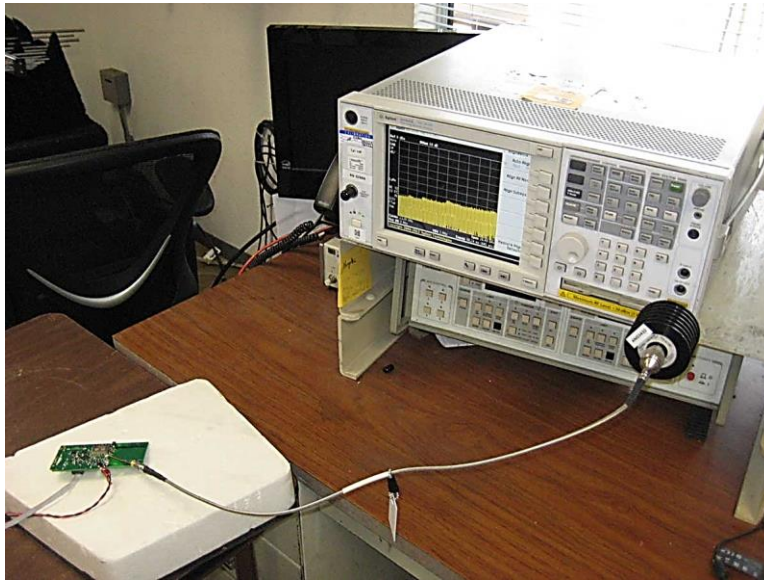


Middle Channel



High Channel

**Test Setup Photo(s)**



## 15.247(b)(3) Output Power

### Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112  
 Customer: **Itron, Inc.**  
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**  
 Work Order #: **105379** Date: 5/11/2021  
 Test Type: **Conducted Emissions** Time: 12:24:39  
 Tested By: S. Yamamoto Sequence#: 5  
 Software: EMITest 5.03.19 3.6Vdc

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Test Conditions / Notes:

The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.

The RF output has been configured to a coaxial cable output with sma connector. The output is connected to the spectrum analyzer using a coaxial cable and power attenuator.

Frequency range of test: 2402MHz to 2480MHz.

Low Channel 2402MHz

Middle Channel 2442MHz

High Channel 2480MHz

RBW=1.5MHz, VBW=5MHz

Output level 3 BLE

Test Environment Conditions:

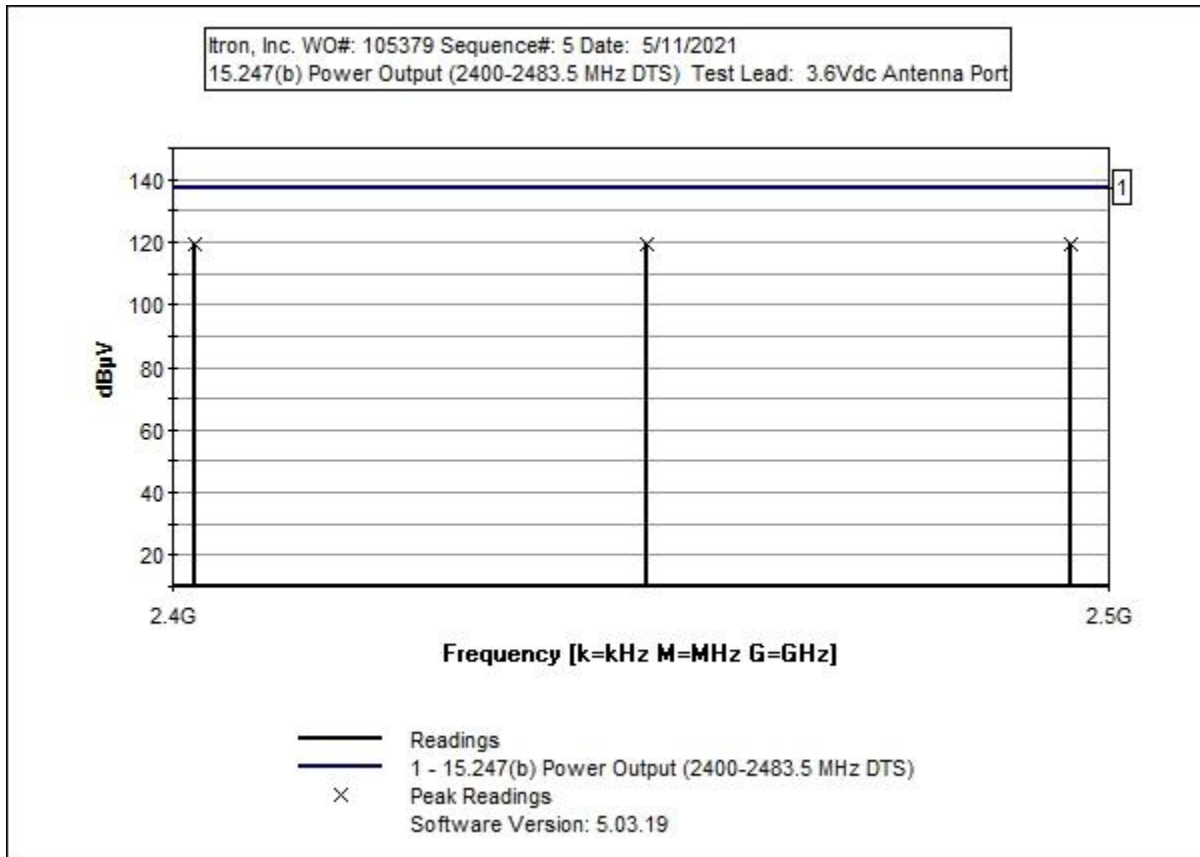
Temperature: 21°C

Humidity: 50%

Pressure: 99kPa

Site D

Reference 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013



**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T3	ANP07656	Cable	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022

**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	Dist dB	Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2442.000M	89.4	+0.0	+29.7	+0.5	+0.0		119.6	137.0	-17.4	Anten
2	2480.000M	89.4	+0.0	+29.7	+0.5	+0.0		119.6	137.0	-17.4	Anten
3	2402.000M	89.2	+0.0	+29.7	+0.5	+0.0		119.4	137.0	-17.6	Anten



**Parameter Definitions:**

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V <sub>Nominal</sub> :	3.6Vdc
V <sub>Minimum</sub> :	NA
V <sub>Maximum</sub> :	NA

**Test Data Summary - Voltage Variations**

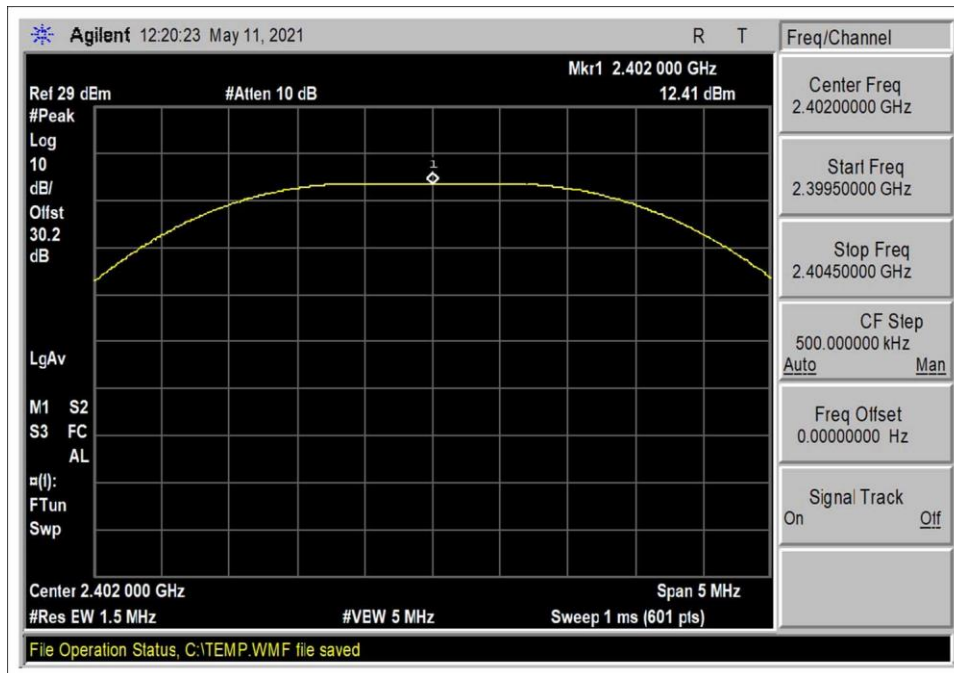
This equipment is battery powered. Power output tests were performed using a power supply simulating a brand new battery.

**Test Data Summary - RF Conducted Measurement**

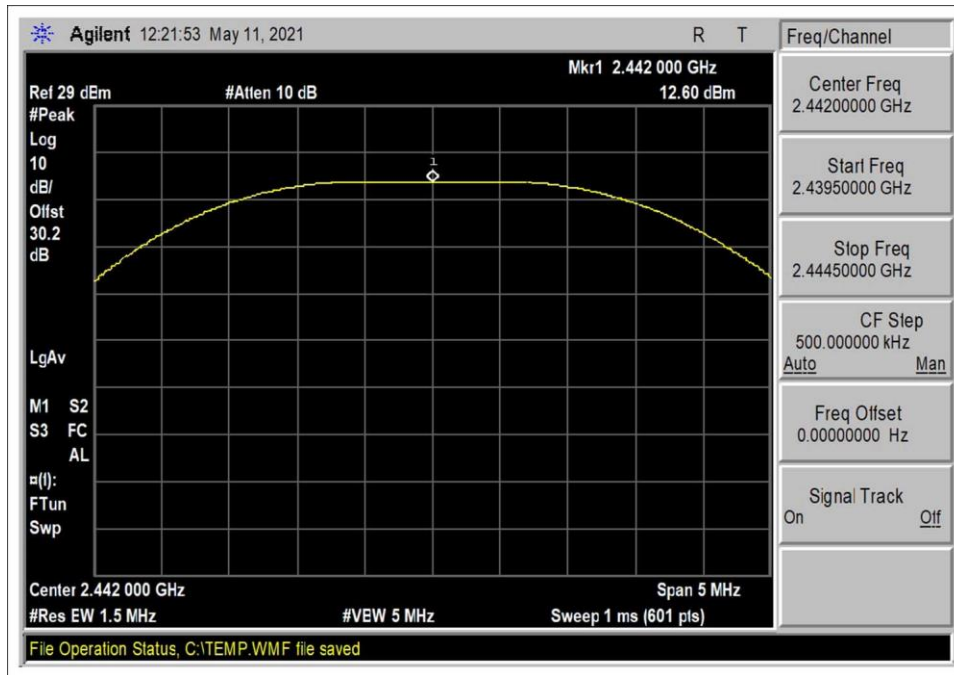
Measurement Option: RBW > DTS Bandwidth

Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2402	GFSK (PL3)	PCB Trace/ -0.5	12.41	≤ 30	Pass
2442	GFSK (PL3)	PCB Trace/ -0.5	12.60	≤ 30	Pass
2480	GFSK (PL3)	PCB Trace/ -0.5	12.62	≤ 30	Pass

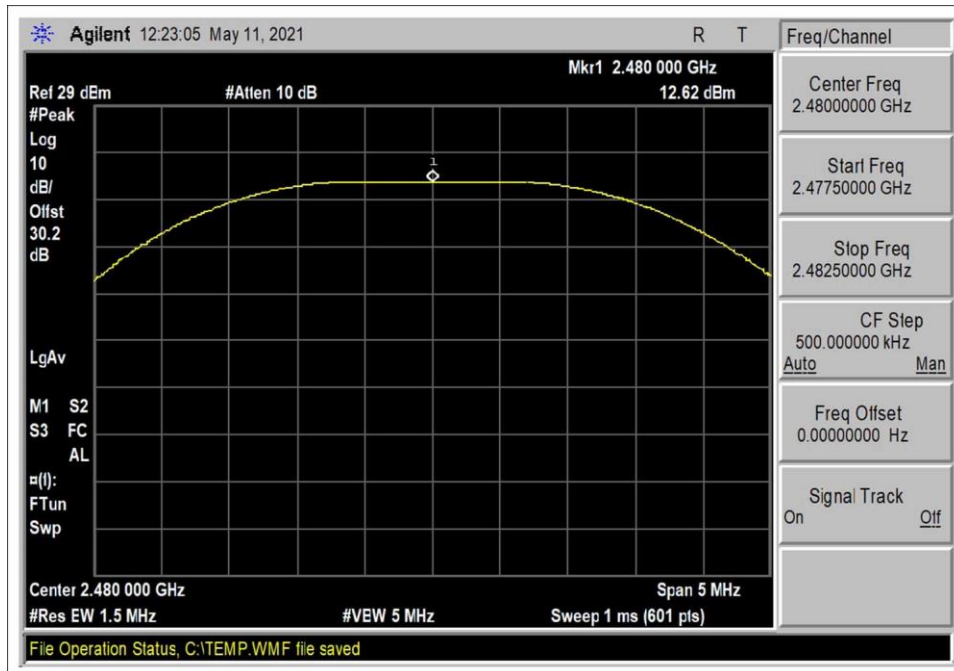
**Plots**



Low Channel

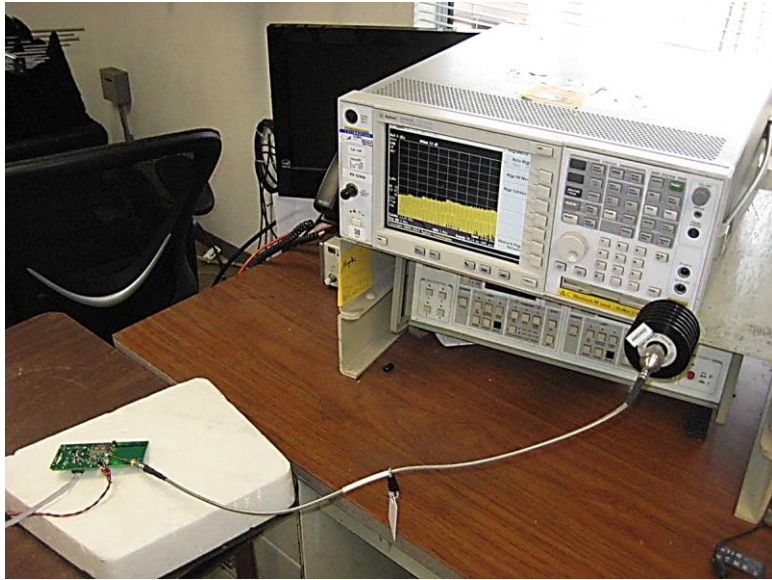


Middle Channel



High Channel

**Test Setup Photo(s)**



## 15.247(d) RF Conducted Emissions & 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: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **105379** Date: 5/14/2021  
 Test Type: **Conducted Emissions** Time: 09:10:24  
 Tested By: S. Yamamoto Sequence#: 15  
 Software: EMITest 5.03.19 3.6Vdc

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.

The RF output has been configured to a coaxial cable output with sma connector. The output is connected to the spectrum analyzer using a coaxial cable and power attenuator.

Frequency range of test: 9kHz to 24.80GHz.

Test Channels  
 Low Channel 2402MHz  
 Middle Channel 2442MHz  
 High Channel 2480MHz

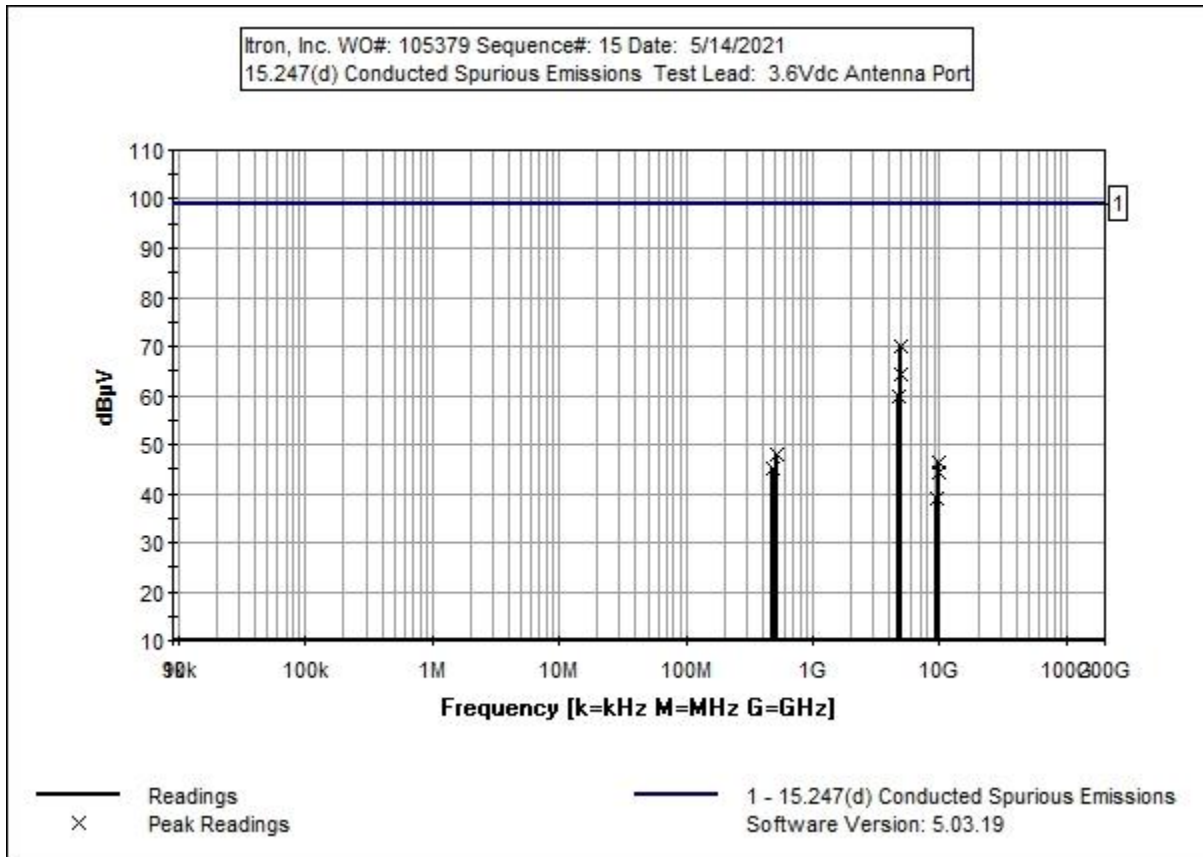
RBW=100kHz, VBW=300kHz

Output level 3 BLE

Test Environment Conditions:  
 Temperature: 20°C  
 Humidity: 53%  
 Pressure: 99kPa

Site D

Reference 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013



**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T1	ANP07656	Cable	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022
T2	AN03430	Attenuator	75A-10-12	12/20/2019	12/20/2021

**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB		Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	4961.017M	59.3	+0.7	+10.1		+0.0	70.1	99.0	-28.9	Anten
2	4885.000M	53.4	+0.7	+10.1		+0.0	64.2	99.0	-34.8	Anten
3	4803.000M	48.9	+0.7	+10.2		+0.0	59.8	99.0	-39.2	Anten
4	519.800M	37.9	+0.2	+10.0		+0.0	48.1	99.0	-50.9	Anten
5	9922.033M	35.8	+0.8	+9.8		+0.0	46.4	99.0	-52.6	Anten
6	480.783M	35.1	+0.2	+10.0		+0.0	45.3	99.0	-53.7	Anten
7	9766.000M	33.6	+0.8	+9.8		+0.0	44.2	99.0	-54.8	Anten
8	9605.900M	28.5	+0.8	+9.7		+0.0	39.0	99.0	-60.0	Anten



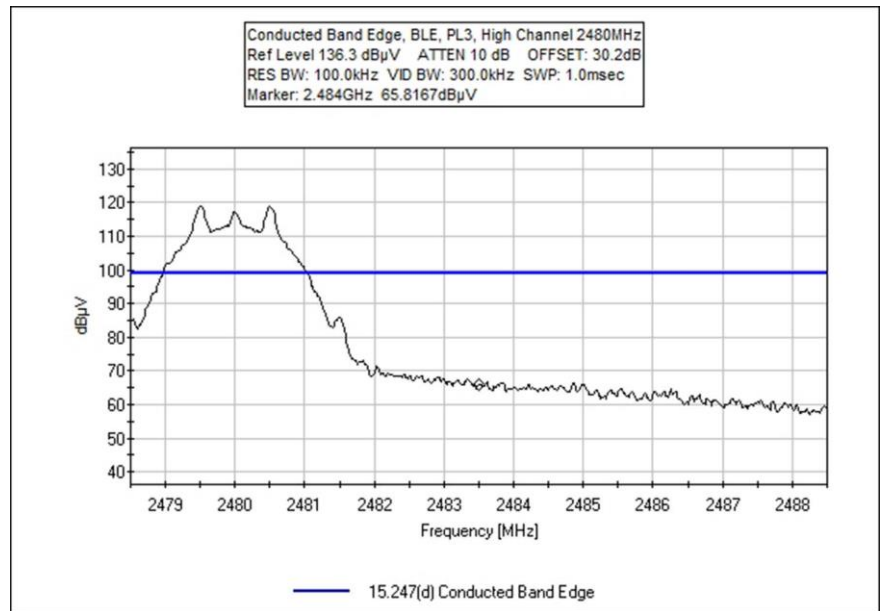
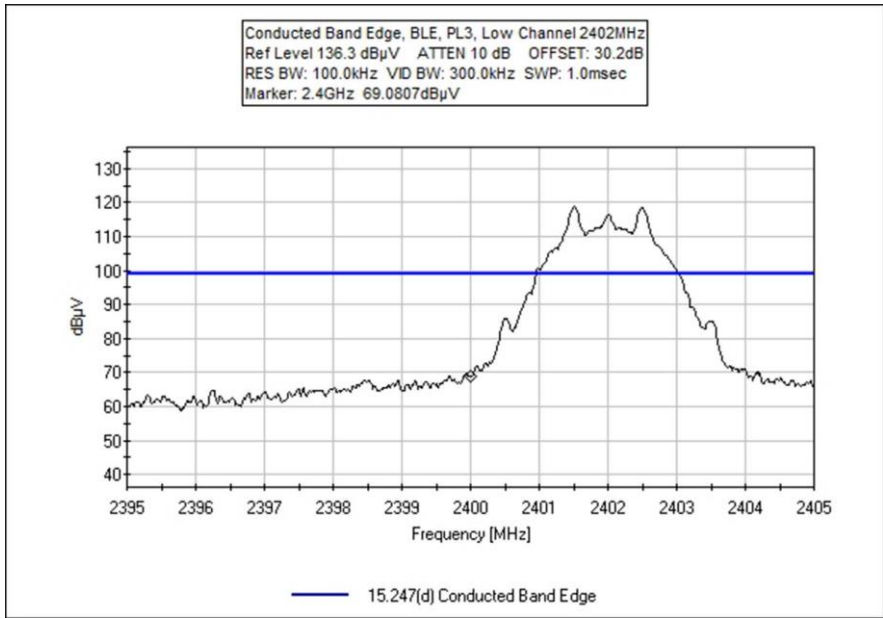
## Band Edge

### Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.

Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
2400.0	GFSK (PL3)	-37.28	< -7.38	Pass
2483.5	GFSK (PL3)	-40.48	< -7.38	Pass

### Band Edge Plots



**Test Setup / Conditions / Data**

Test Location: CKC Laboratories Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) Conducted Band Edge**  
 Work Order #: **105379** Date: 5/13/2021  
 Test Type: **Conducted Emissions** Time: 10:51:17  
 Tested By: S. Yamamoto Sequence#: 10  
 Software: EMITest 5.03.19 3.6Vdc

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Test Conditions / Notes:**

The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.

The RF output has been configured to a coaxial cable output with sma connector. The output is connected to the spectrum analyzer using a coaxial cable and power attenuator.

Frequency range of test: 2395MHz to 2488.5MHz.  
 Low Channel 2402MHz  
 High Channel 2480MHz

RBW=100kHz, VBW=300kHz

Output level 3 BLE

Test Environment Conditions:  
 Temperature: 20°C  
 Humidity: 53%  
 Pressure: 99kPa

Site D

Reference 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013

**Test Equipment:**

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T3	ANP07656	Cable	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022

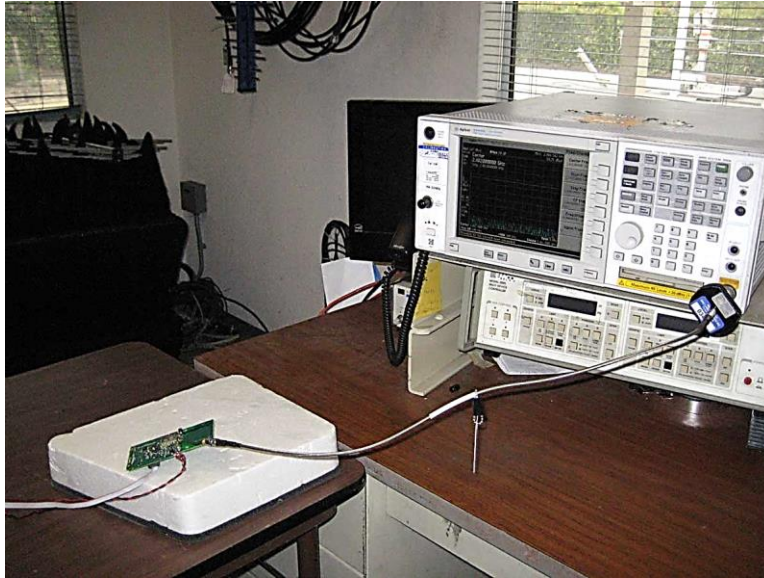
**Measurement Data:**

Reading listed by margin.

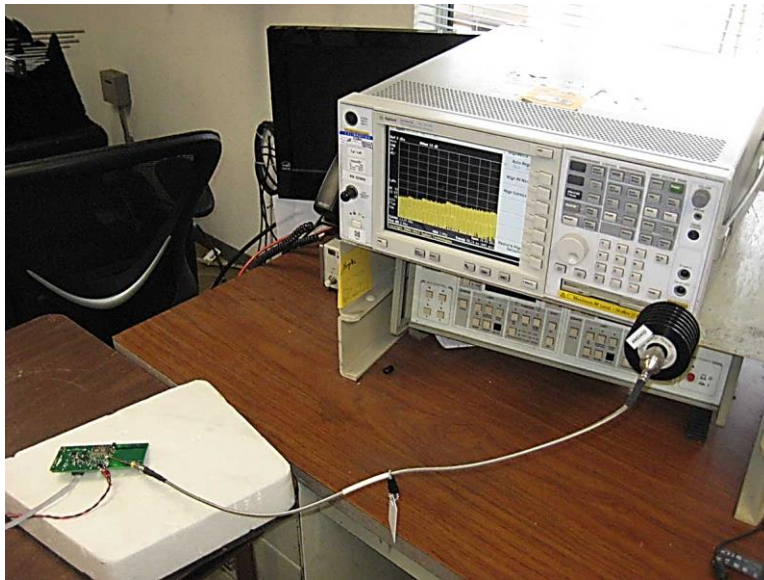
Test Lead: Antenna Port

#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	Dist dB	Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	2400.000M	38.9	+0.0	+29.7	+0.5		+0.0	69.1	99.0	-29.9	Anten
2	2483.500M	35.6	+0.0	+29.7	+0.5		+0.0	65.8	99.0	-33.2	Anten

**Test Setup Photo(s)**



Conducted Spurious Emissions



Band Edge

## 15.247(d) Radiated Emissions & 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: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **105379** Date: 5/25/2021  
 Test Type: **Maximized Emissions** Time: 16:34:07  
 Tested By: S. Yamamoto Sequence#: 22  
 Software: EMITest 5.03.19

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Test Conditions / Notes:

The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.

Once the parameters have been set, the support equipment is removed from the EUT.

Frequency range of test: 9kHz to 24.835GHz.

#### Test Channels:

Low channel 2402MHz

Middle channel 2442MHz

High channel 2480MHz

RBW=1MHz, VBW=3MHz

Output level 3 BLE

The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. The duty cycle correction factor is  $20 \log(12.5/100) = -18.06\text{dB}$ . The average reading in the restricted bands is calculated from the peak reading with the duty cycle correction factor.

#### Test Environment Conditions:

Temperature: 23°C

Relative Humidity: 43%

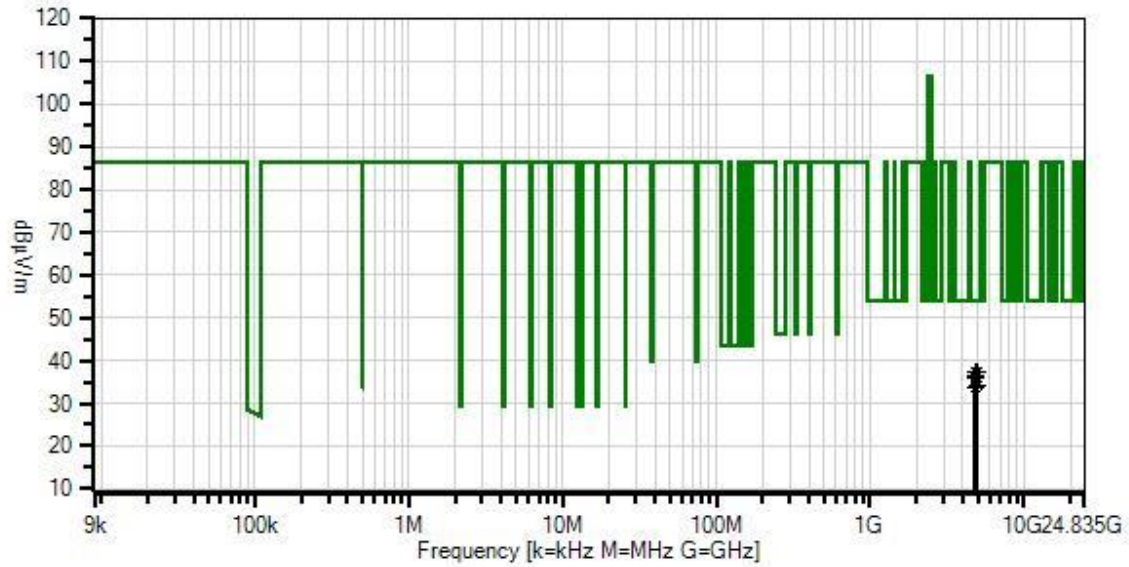
Pressure: 99kPa

Site D

The EUT is powered from a new 3.6V lithium battery

Test Method: ANSI C63.10-2013

Itron, Inc. WO#: 105379 Sequence#: 22 Date: 5/25/2021  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



- Readings
  - × QP Readings
  - ▼ Ambient
  - 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
  - Peak Readings
  - \* Average Readings
- Software Version: 5.03.19



**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	ANP04382	Cable	LDF-50	5/15/2020	5/15/2022
T3	ANP07138	Cable	ANDL1- PNMNM-60	3/30/2021	3/30/2023
T4	AN00787	Preamp	83017A	5/31/2019	5/31/2021
T5	ANP07657	Cable	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022
T6	AN01646	Horn Antenna	3115	3/17/2020	3/17/2022
T7	AN03385	High Pass Filter	11SH10- 3000/T10000- O/O	5/17/2021	5/17/2023
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	AN00010	Preamp	8447D	1/2/2020	1/2/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01994	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05283	Attenuator	ATT-0218-06- NNN-02	3/26/2020	3/26/2022
	ANP05569	Cable-Amplitude +15C to +45C (dB)	RG-214/U	12/14/2020	12/14/2022
	ANP06978	Cable	Sucoflex 104A	3/26/2020	3/26/2022

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

#	Freq MHz	Rdng dB $\mu$ V	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	4958.955M	27.9	+0.0	+8.6	+5.9	-39.9	+0.0	37.3	54.0	-16.7	Horiz
	Ave		+0.7	+33.8	+0.3						
^	4958.955M	46.0	+0.0	+8.6	+5.9	-39.9	+0.0	55.4	54.0	+1.4	Horiz
			+0.7	+33.8	+0.3						
3	4882.850M	28.0	+0.0	+8.6	+5.8	-39.9	+0.0	37.2	54.0	-16.8	Horiz
	Ave		+0.7	+33.7	+0.3						
^	4882.850M	46.1	+0.0	+8.6	+5.8	-39.9	+0.0	55.3	54.0	+1.3	Horiz
			+0.7	+33.7	+0.3						
5	4803.048M	27.9	+0.0	+8.5	+5.7	-40.0	+0.0	36.6	54.0	-17.4	Horiz
	Ave		+0.7	+33.5	+0.3						
^	4803.048M	46.0	+0.0	+8.5	+5.7	-40.0	+0.0	54.7	54.0	+0.7	Horiz
			+0.7	+33.5	+0.3						
7	4882.900M	26.7	+0.0	+8.6	+5.8	-39.9	+0.0	35.9	54.0	-18.1	Vert
	Ave		+0.7	+33.7	+0.3						
^	4882.900M	44.8	+0.0	+8.6	+5.8	-39.9	+0.0	54.0	54.0	+0.0	Vert
			+0.7	+33.7	+0.3						
9	4959.090M	24.5	+0.0	+8.6	+5.9	-39.9	+0.0	33.9	54.0	-20.1	Vert
	Ave		+0.7	+33.8	+0.3						
^	4959.090M	42.6	+0.0	+8.6	+5.9	-39.9	+0.0	52.0	54.0	-2.0	Vert
			+0.7	+33.8	+0.3						
11	4802.965M	25.0	+0.0	+8.5	+5.7	-40.0	+0.0	33.7	54.0	-20.3	Vert
	Ave		+0.7	+33.5	+0.3						
^	4802.965M	43.1	+0.0	+8.5	+5.7	-40.0	+0.0	51.8	54.0	-2.2	Vert
			+0.7	+33.5	+0.3						

**Band Edge**

<b>Band Edge Summary</b>					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK (PL3)	PCB trace	49.4 pk	<54 avg	Pass
2400.0	GFSK (PL3)	PCB trace	56.7 pk	<85.8 pk	Pass
2483.5	GFSK (PL3)	PCB trace	62.3 pk	<72.06 avg *	Pass

\*Limit is calculated using DCCF.

Duty Cycle Correction Factor (DCCF) is calculated in accordance with ANSI C63.10:

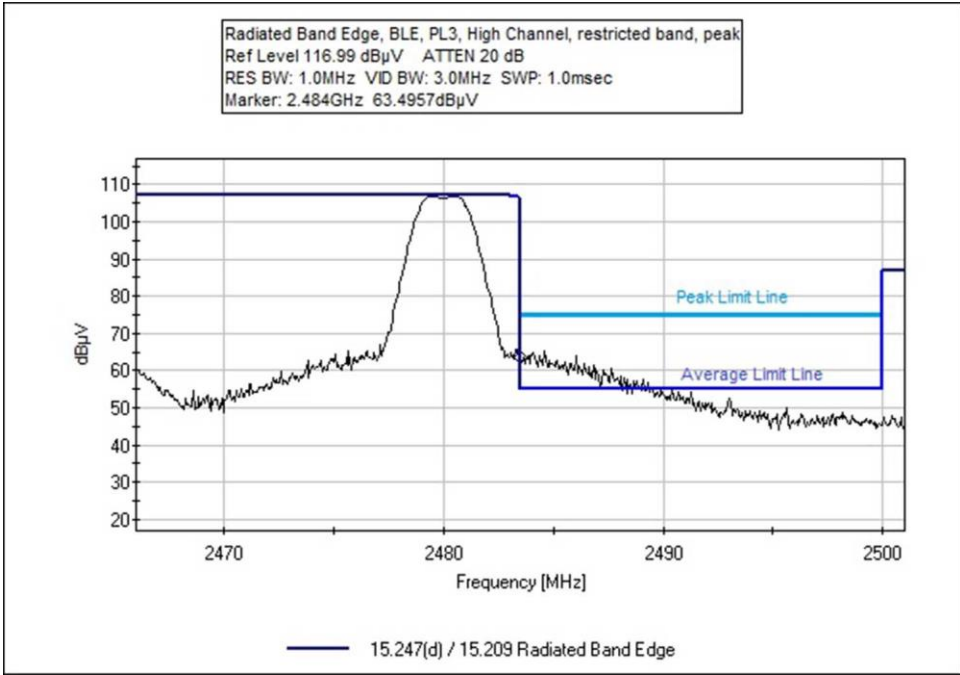
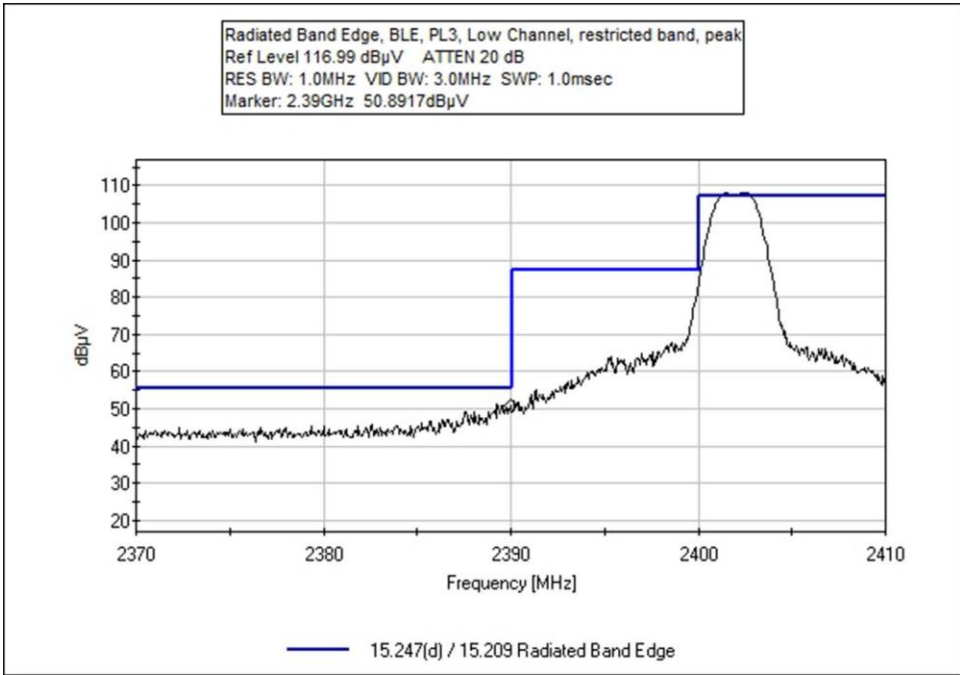
$$DCCF = 20 \cdot \text{Log} \left( \frac{\text{On Time}}{P_{obs}} \right)$$

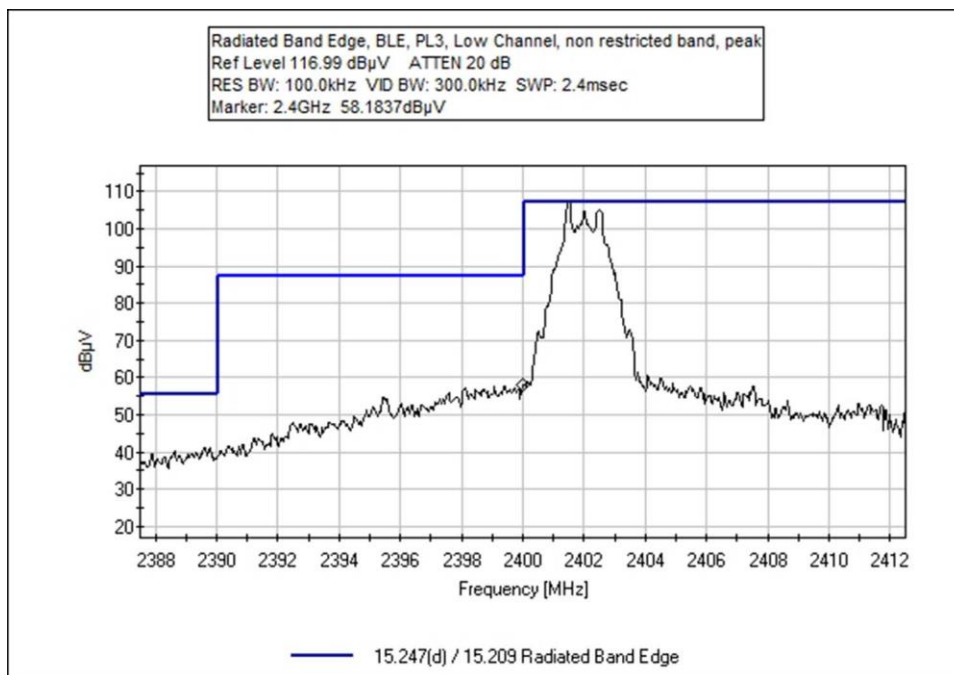
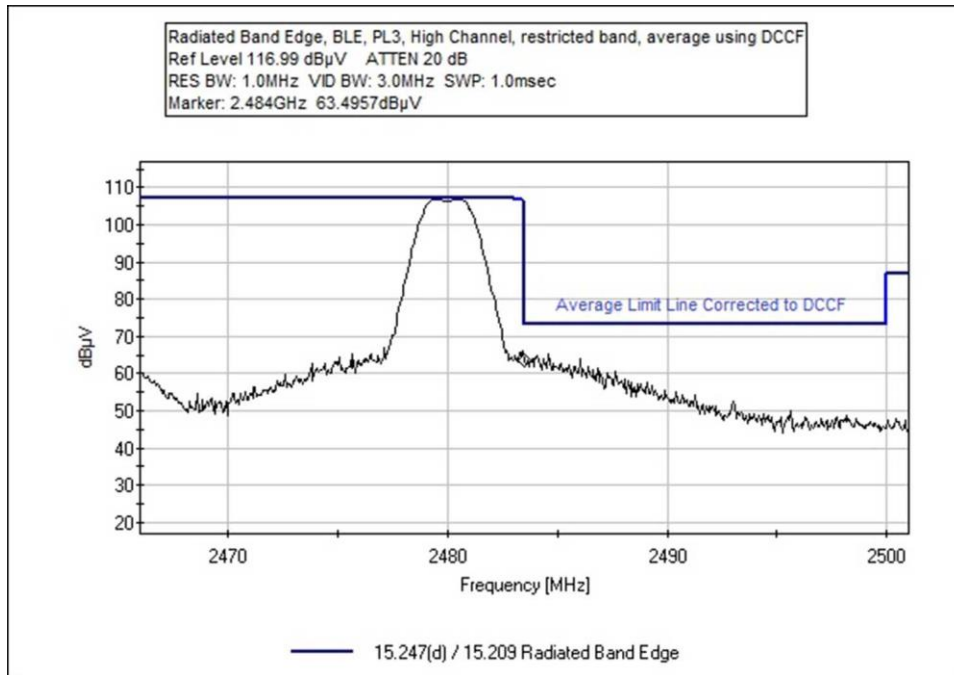
where  $P_{obs} = 100\text{ms}$ ,  $\text{On Time} = 12.5\text{ms}$  (Manufacturer declaration)

$$DCCF = 20 \cdot \text{Log} \left( \frac{12.5}{100} \right) = -18.06$$

Note: The duty cycle of the test sample transmission was not measured however the Manufacturer declares it to be 12.5%.

## Band Edge Plots





**Test Setup / Conditions / Data**

Test Location: CKC Laboratories Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Band Edge**  
 Work Order #: **105379** Date: 5/26/2021  
 Test Type: **Maximized Emissions** Time: 09:47:02  
 Tested By: S. Yamamoto Sequence#: 23  
 Software: EMITest 5.03.19

**Equipment Tested:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Support Equipment:**

Device	Manufacturer	Model #	S/N
Configuration 1			

**Test Conditions / Notes:**

The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.

Once the parameters have been set, the support equipment is removed from the EUT.

Frequency range of test: 2370MHz to 2501MHz.

Test Channels  
 Low Channel 2402MHz  
 High Channel 2480MHz

RBW=1MHz, VBW=3MHz

Output level 3 BLE

Test Environment Conditions:  
 Temperature: 20°C  
 Humidity: 49%  
 Pressure: 99kPa

Site D

The EUT is powered from a new 3.6V lithium battery

Test Method: ANSI C63.10-2013

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	ANP04382	Cable	LDF-50	5/15/2020	5/15/2022
T3	ANP07138	Cable	ANDL1- PNMNM-60	3/30/2021	3/30/2023
T4	AN00787	Preamp	83017A	5/31/2019	5/31/2021
T5	ANP07657	Cable	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022
T6	AN01646	Horn Antenna	3115	3/17/2020	3/17/2022

**Measurement Data:**

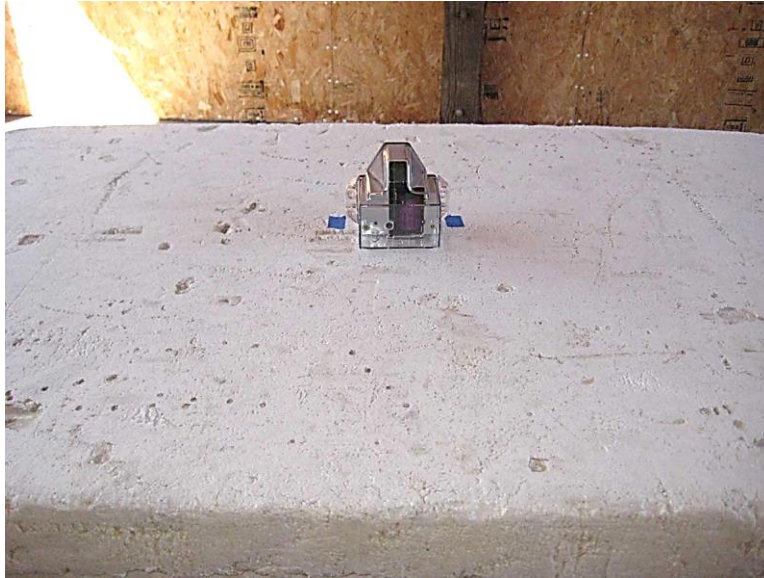
Reading listed by margin.

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	2390.000M	50.9	+0.0 +0.4	+5.6 +28.3	+4.0	-39.8	+0.0	49.4	54.0	-4.6	Vert
2	2483.500M Ave	63.5	+0.0 +0.5	+5.7 +28.2	+4.3	-39.9	+0.0	62.3	72.1	-9.8	Vert
3	2400.000M	58.2	+0.0 +0.4	+5.6 +28.3	+4.0	-39.8	+0.0	56.7	85.8	-29.1	Vert



**Test Setup Photo(s)**



Below 1GHz, Front View



Below 1GHz, Back View



Above 1GHz

## 15.247(e) Power Spectral Density

### Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 110 N Olinda Pl • Brea CA 92823 • 714-993-6112  
 Customer: **Itron, Inc.**  
 Specification: **15.247(e) Power Spectral Density**  
 Work Order #: **105379** Date: 5/13/2021  
 Test Type: **Conducted Emissions** Time: 10:12:55  
 Tested By: S. Yamamoto Sequence#: 10  
 Software: EMITest 5.03.19 3.6Vdc

#### Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

#### Test Conditions / Notes:

The equipment under test (EUT) is connected to a laptop computer via USB to serial interface board. The laptop is running Command Line Interface (CLI) Tool. This software is used to run the scripts for setting the EUT parameters.

The RF output has been configured to a coaxial cable output with sma connector. The output is connected to the spectrum analyzer using a coaxial cable and power attenuator.

Frequency range of test: 2402MHz to 2480MHz.

Low Channel 2402MHz

Middle Channel 2442MHz

High Channel 2480MHz

RBW=3kHz, VBW=10kHz

Output level 3 BLE

Test Environment Conditions:

Temperature: 20°C

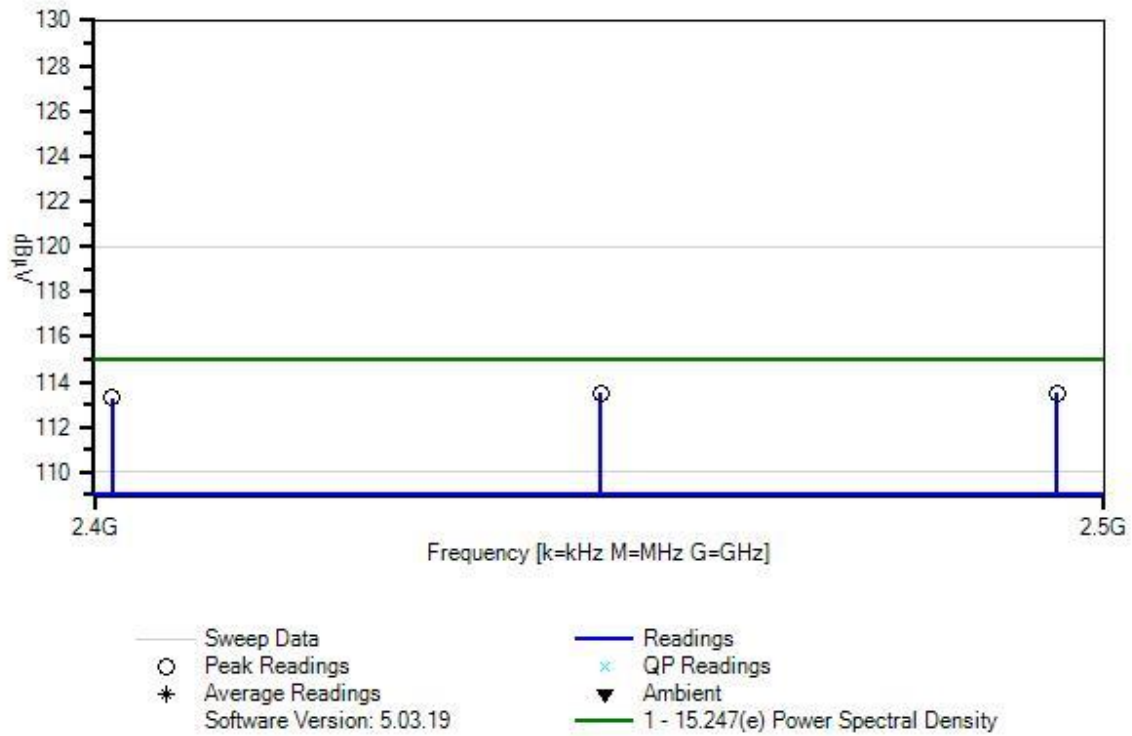
Humidity: 53%

Pressure: 99kPa

Site D

Reference 558074 D01 15.247 Meas Guidance v05r02 and ANSI C63.10-2013

ltron, Inc. W/O#: 105379 Sequence#: 10 Date: 5/13/2021  
 15.247(e) Power Spectral Density Test Lead: 3.6Vdc Antenna Port



**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T2	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T3	ANP07656	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

**Measurement Data:**

Reading listed by margin.

Test Lead: Antenna Port

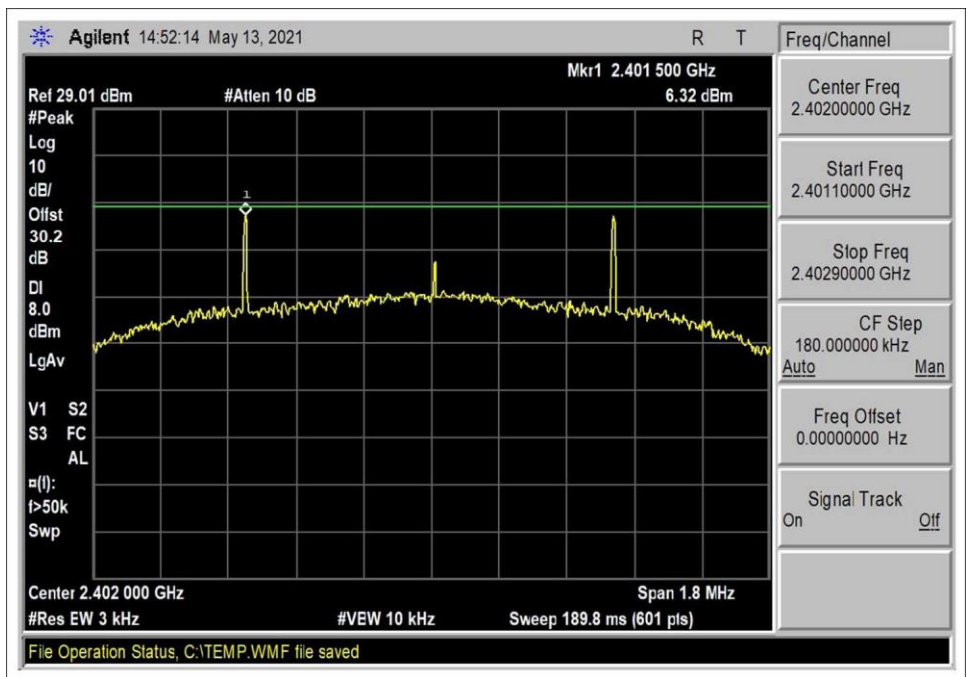
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	Dist dB	Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	2479.501M	83.3	+0.0	+29.7	+0.5	+0.0		113.5	115.0	-1.5	Anten
2	2441.500M	83.3	+0.0	+29.7	+0.5	+0.0		113.5	115.0	-1.5	Anten
3	2401.500M	83.1	+0.0	+29.7	+0.5	+0.0		113.3	115.0	-1.7	Anten

**Test Data Summary - RF Conducted Measurement**

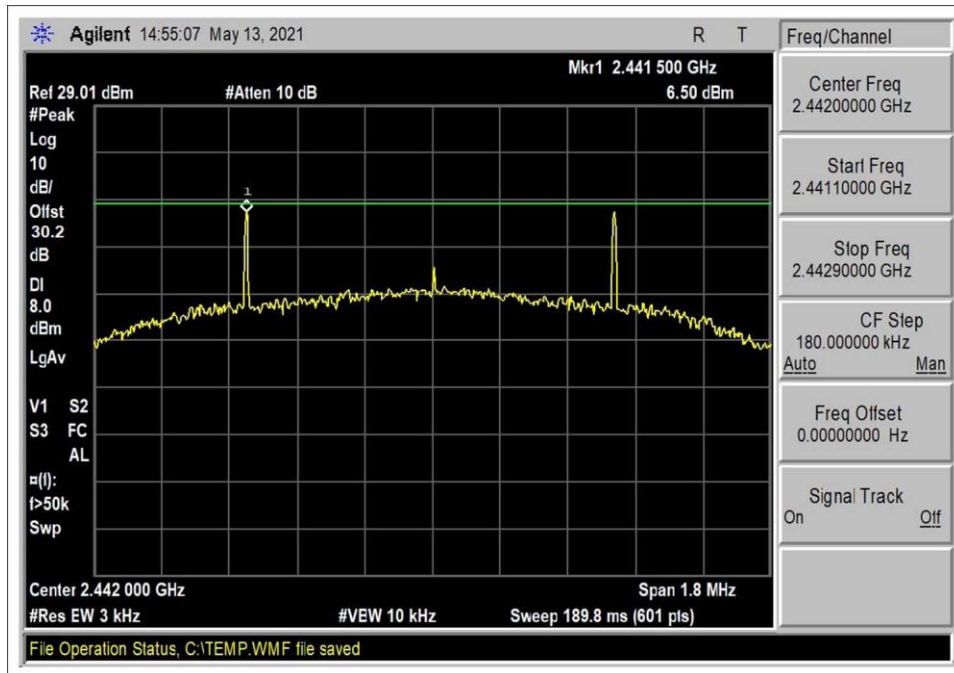
Measurement Method: PKPSD

Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
2401.5	GFSK (PL3)	6.32	≤8	Pass
2441.5	GFSK (PL3)	6.50	≤8	Pass
2479.501	GFSK (PL3)	6.46	≤8	Pass

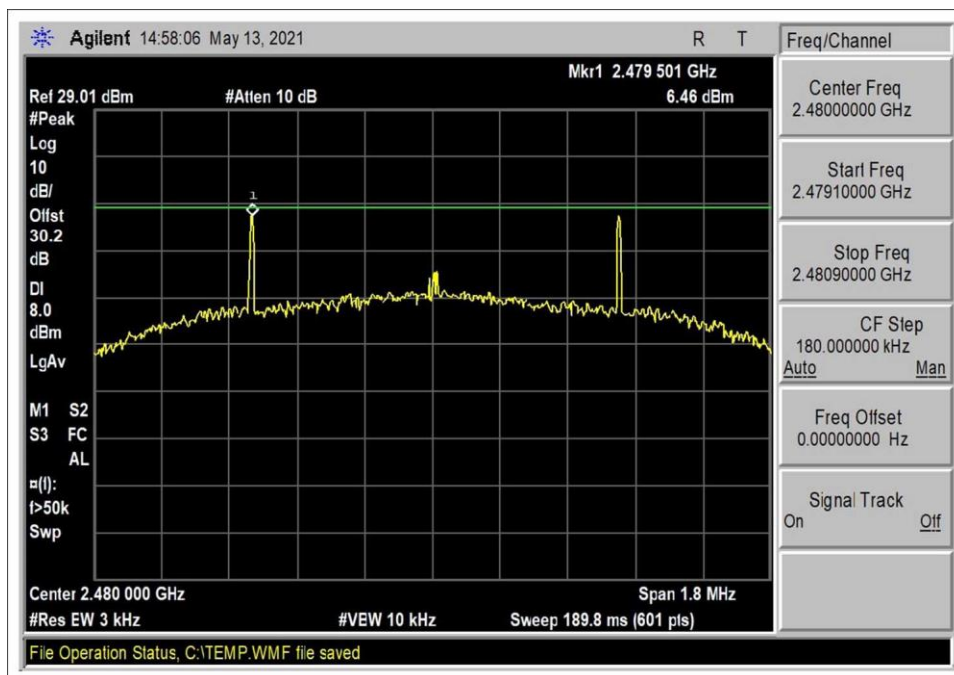
**Plots**



Low Channel



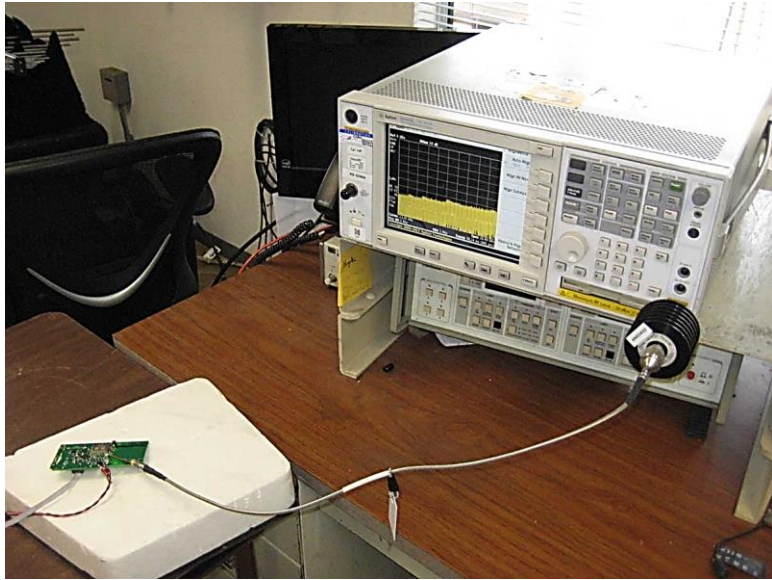
Middle Channel



High Channel



**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 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.