

Ittron, Inc.

TEST REPORT FOR

500C

Models: WPITC, WRMTC, and GRMTC

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247

(DTS 2400-2483.5MHz)

Report No.: 105380-17

Date of issue: August 13, 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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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 240357

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

Kim Romero
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

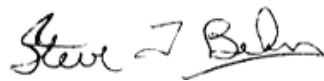
Project Number: 105380

June 8, 2021

June 8, 9, and 11, 2021

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 that reads "Steve Behm".

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(d)	RF Conducted Emissions & Band Edge	NA	PASS
15.247(d)	Radiated Emissions & Band Edge	NA	PASS
15.247(e)	Power Spectral Density	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

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
500C	Itron, Inc.	GRMTC	RAD2

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	NA
Power Supply	Extech Instruments	382225	P99250026

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	WRMTC	RAD2

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6420	8P954R1
Power Supply	Extech Instruments	382225	P99250026

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	WPITC	RAD2

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	NA
Power Supply	Extech Instruments	382225	P99250026

Configuration 4

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	WPITC	CON2

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Extech Instruments	382225	P99250026
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	NA
Power Supply	Extech Instruments	382225	P99250026

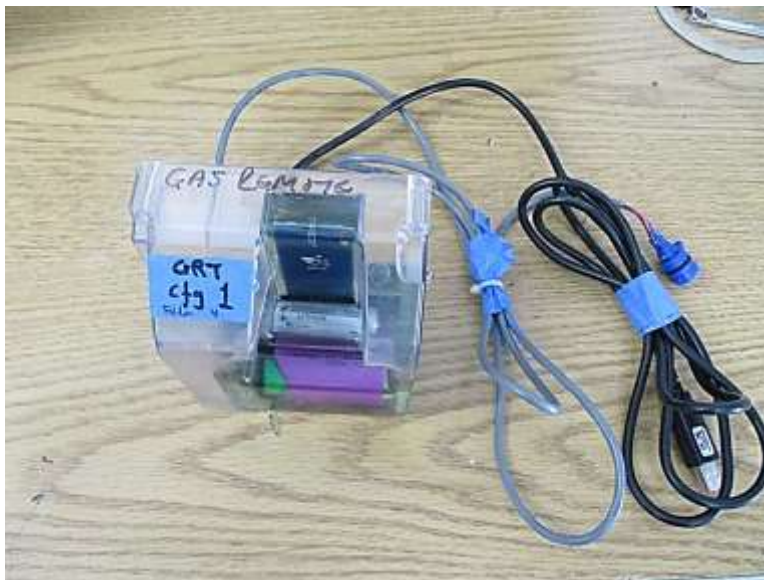
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	BLE
Operating Frequency Range:	2402-2480MHz
Modulation Type(s):	GFSK
Maximum Duty Cycle:	12.5%
Number of TX Chains:	1
Antenna Type(s) and Gain:	PCB trace/ 2.0 dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	3.6Vdc battery
Firmware / Software used for Test:	App Version: 0.0.25.0, CSL version: 8.1.3.0 Hardware Rev: 12
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT Photo(s)



Configuration 1; View 1



Configuration 1; View 2



Configuration 2; View 1



Configuration 2; View 2



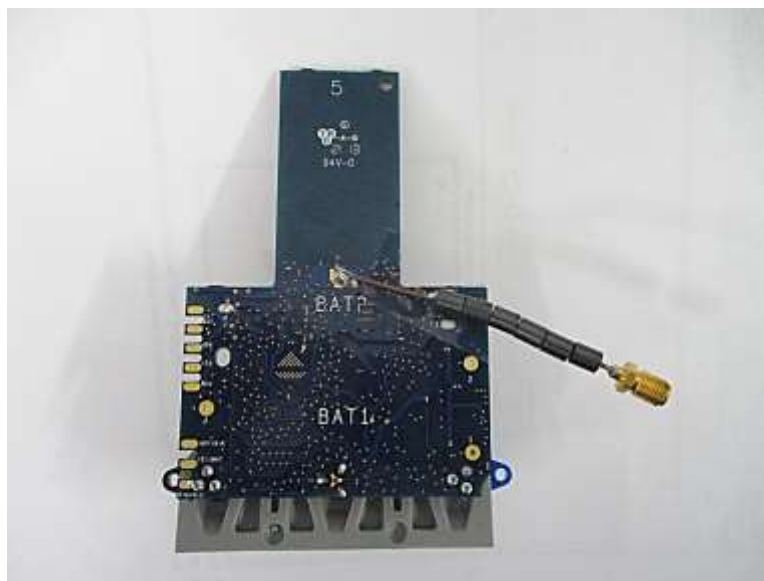
Configuration 3; View 1



Configuration 3, View 2



Configuration 4, View 1

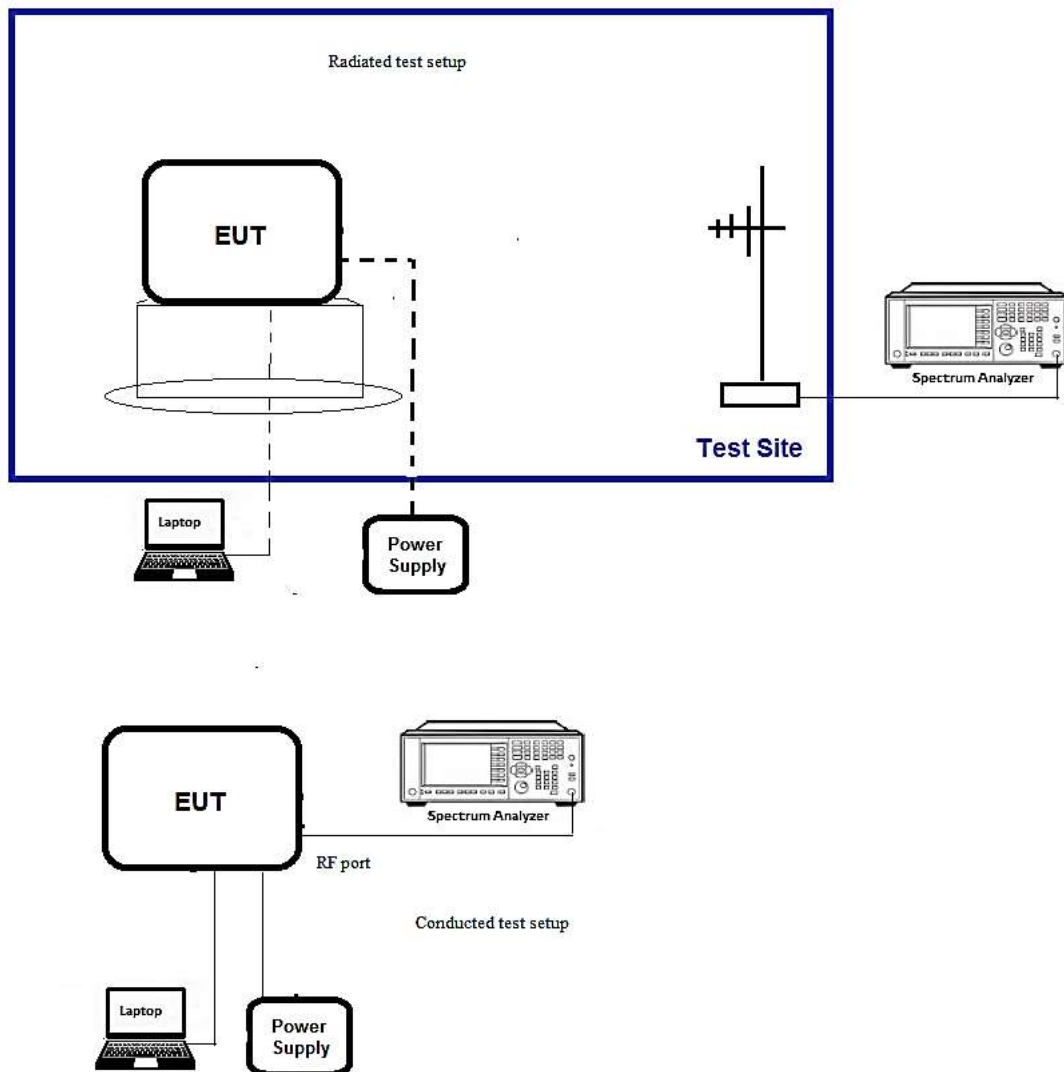


Configuration 4, View 2

Support Equipment Photo(s)



Block Diagram of Test Setup(s)



FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

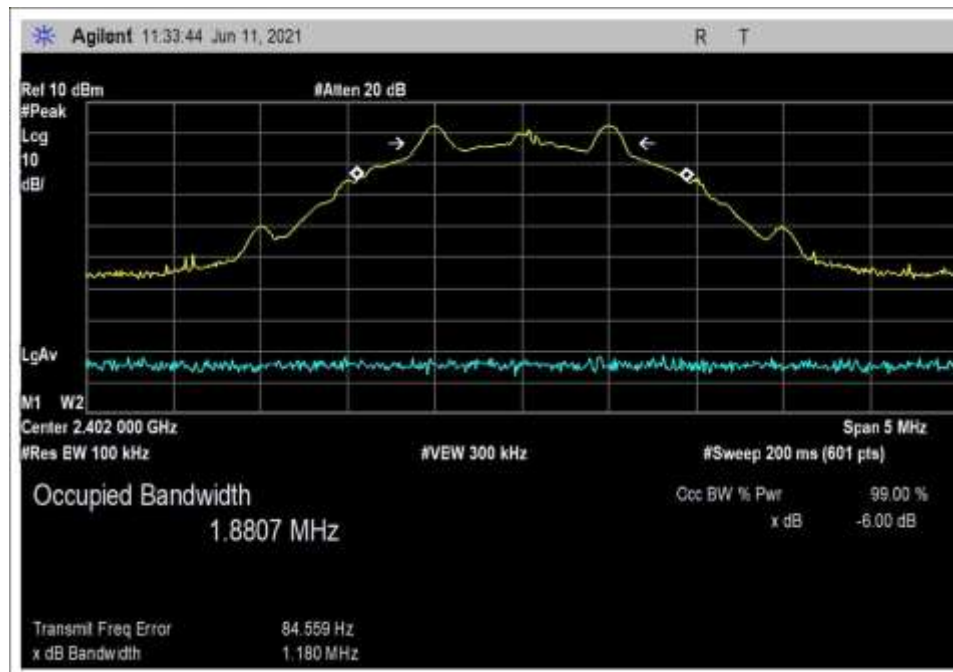
Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), KDB 55807415.247 Meas Guidance v05r02 April 2, 2019	Test Date(s):	6/11/2021
Configuration:	Configuration 4		
Test Setup:	The EUT is placed on test bench and the Blue port receives power from remotely located support power supply set 3.6Vdc to simulate a fresh battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes Note: Three EUTs have the same internal hardware. Conducted data measured on one EUT represents for all three EUTs.		

Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	38

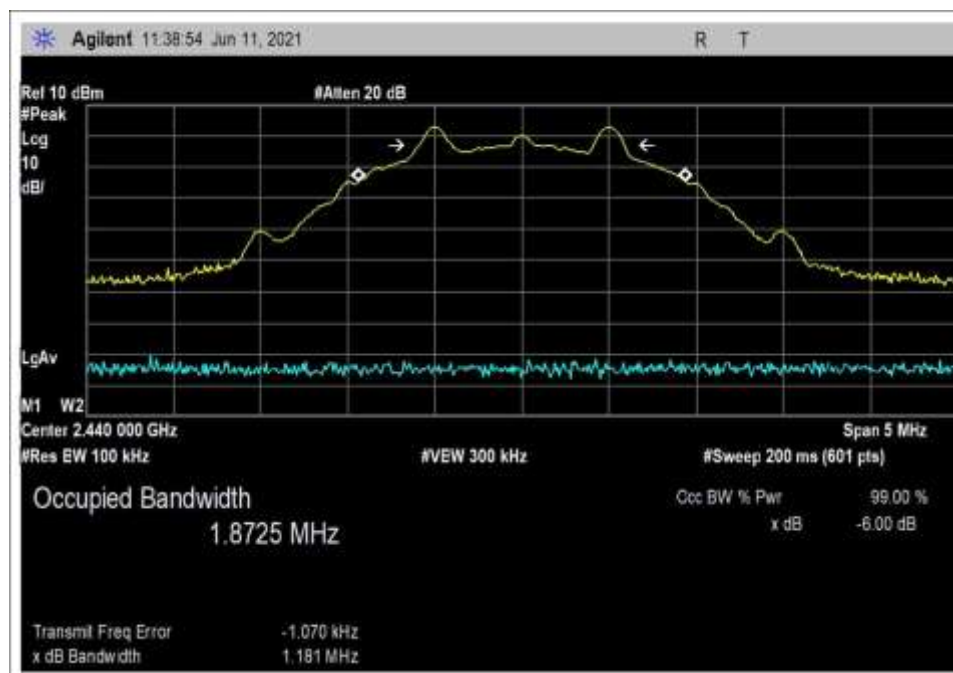
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/ Weinschel	75A-10-12	12/20/2019	12/20/2021
07659	Cable	Astrolab, Inc.	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
2402	1	GFSK	1180	≥500	Pass
2440	1	GFSK	1181	≥500	Pass
2480	1	GFSK	1181	≥500	Pass
Folder 3					

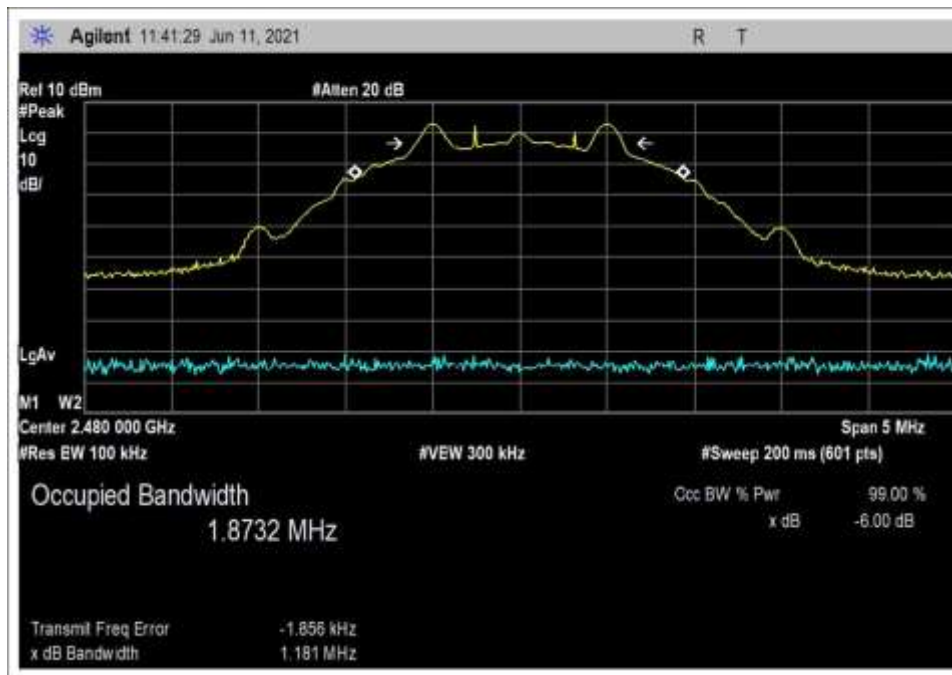
Plot(s)



Low Channel

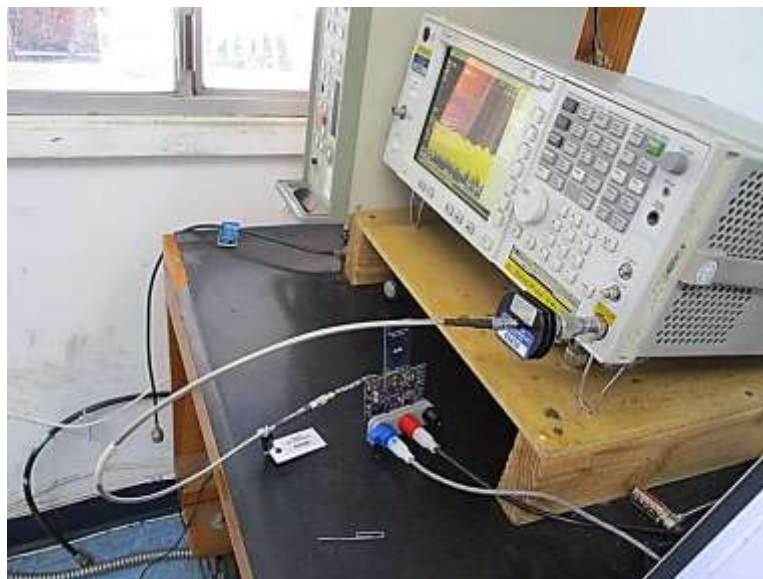


Middle Channel



High Channel

Test Setup Photo(s)



15.247(b)(3) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019	Test Date(s):	6/11/2021
Configuration:	Configuration 4		
Test Setup:	The EUT is placed on test bench and the Blue port receives power from remotely located support power supply set 3.6Vdc to simulate a fresh battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes. Note: Three EUTs have the same internal hardware. Conducted data measured on one EUT represents for all three EUTs. Correction factor is compensated for.		

Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	38

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/ Weinschel	75A-10-12	12/20/2019	12/20/2021
07659	Cable	Astrolab, Inc.	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery, simulated by a power supply a set at 3.6V DC

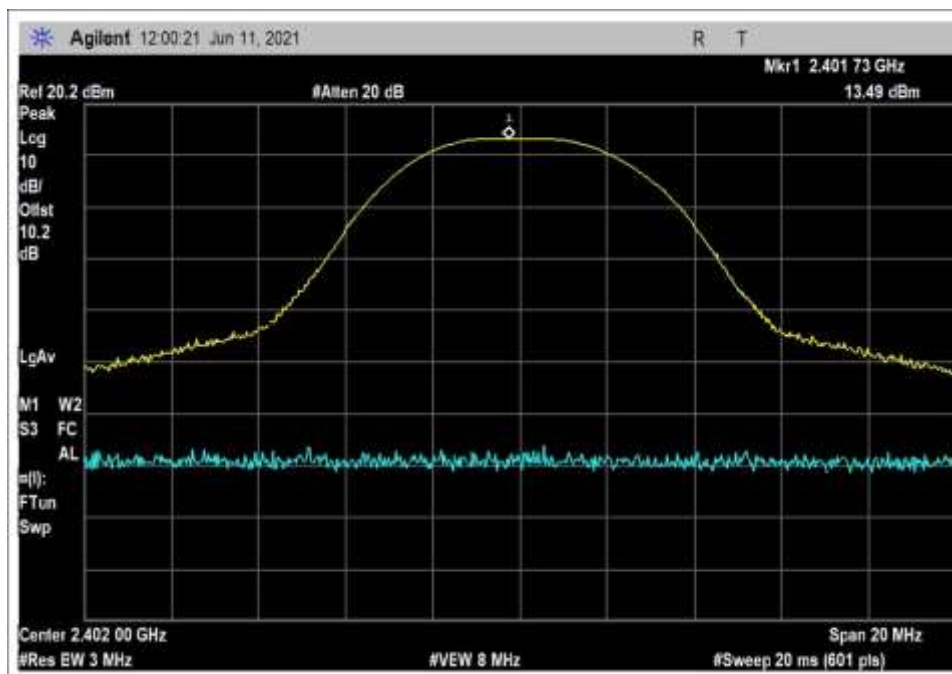
Test Data Summary - RF Conducted Measurement					
Measurement Option: RBW > DTS Bandwidth					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2402	GFSK /folder 3	PCB trace/ 2.0 dBi	13.49	≤ 30	Pass
2440	GFSK/folder 3	PCB trace/ 2.0 dBi	13.92	≤ 30	Pass
2480	GFSK/folder 3	PCB trace/ 2.0 dBi	13.87	≤ 30	Pass
Folder 3					

Test Data Summary - RF Conducted Measurement

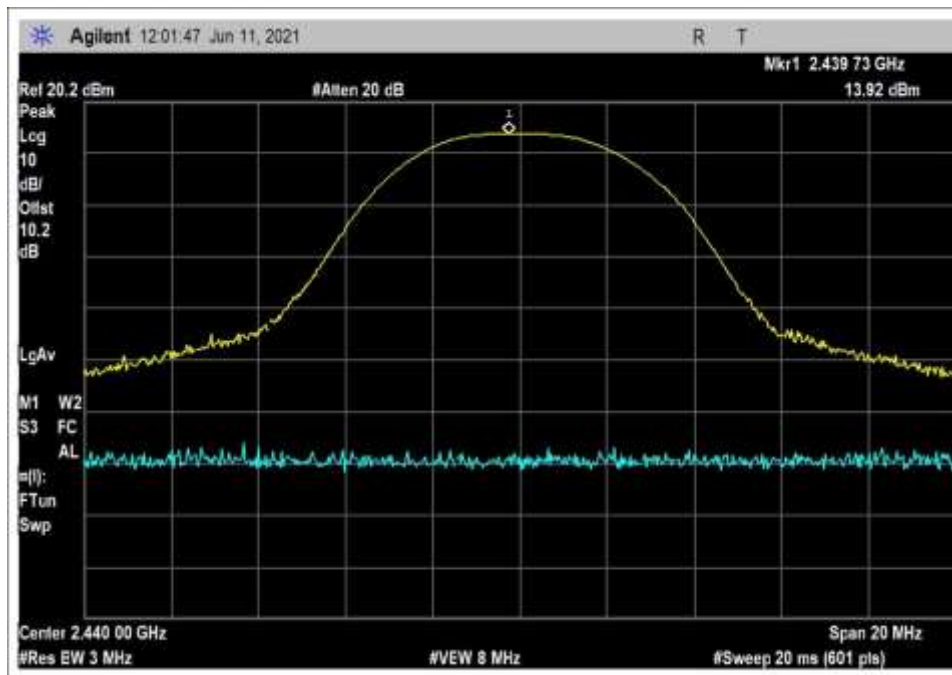
Measurement Option: RBW > DTS Bandwidth

Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
2402	GFSK/folder 4	PCB trace/ 2.0 dBi	13.48	≤ 30	Pass
2440	GFSK/folder 4	PCB trace/ 2.0 dBi	13.93	≤ 30	Pass
2480	GFSK/folder 4	PCB trace/ 2.0 dBi	13.88	≤ 30	Pass
Folder 4					

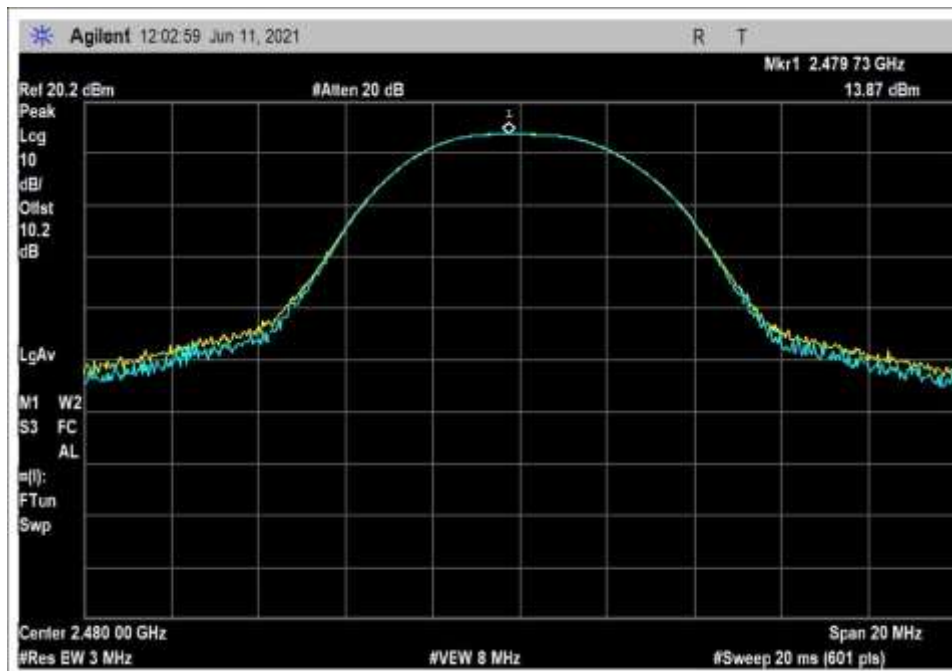
Plots – Folder 3



Low Channel

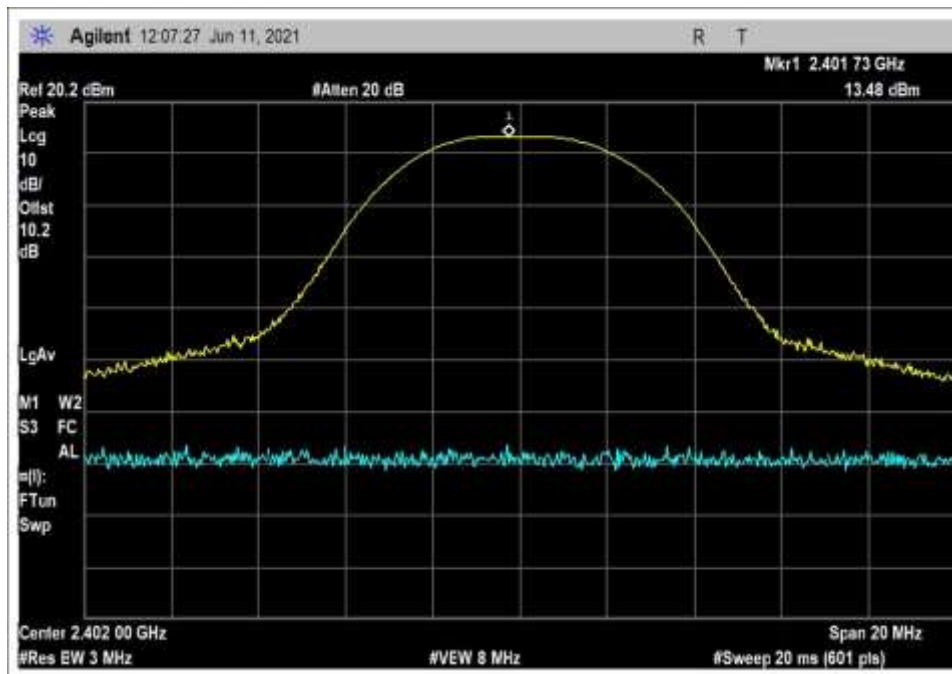


Middle Channel

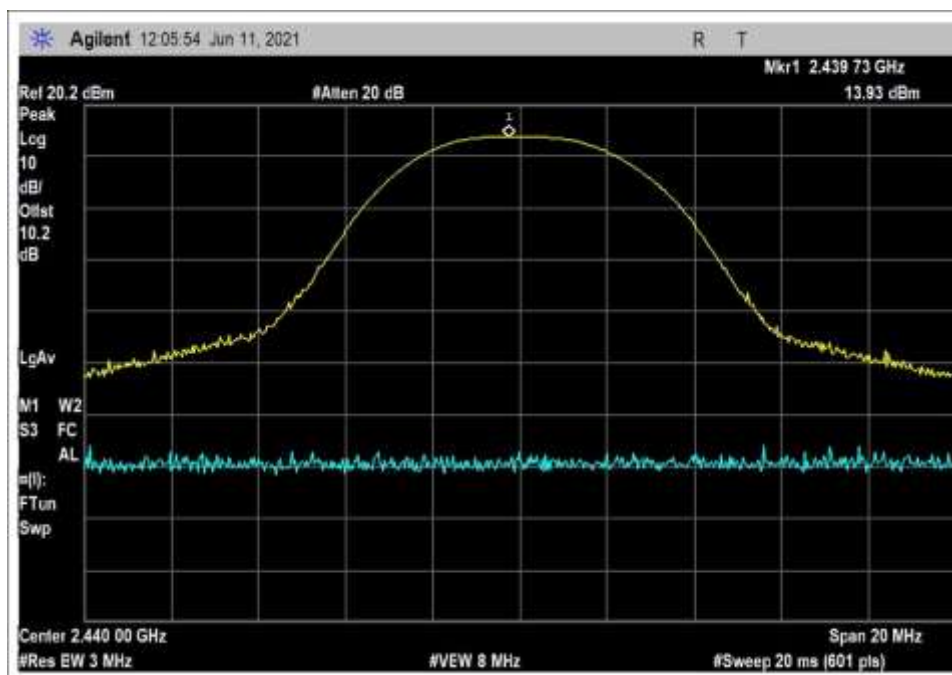


High Channel

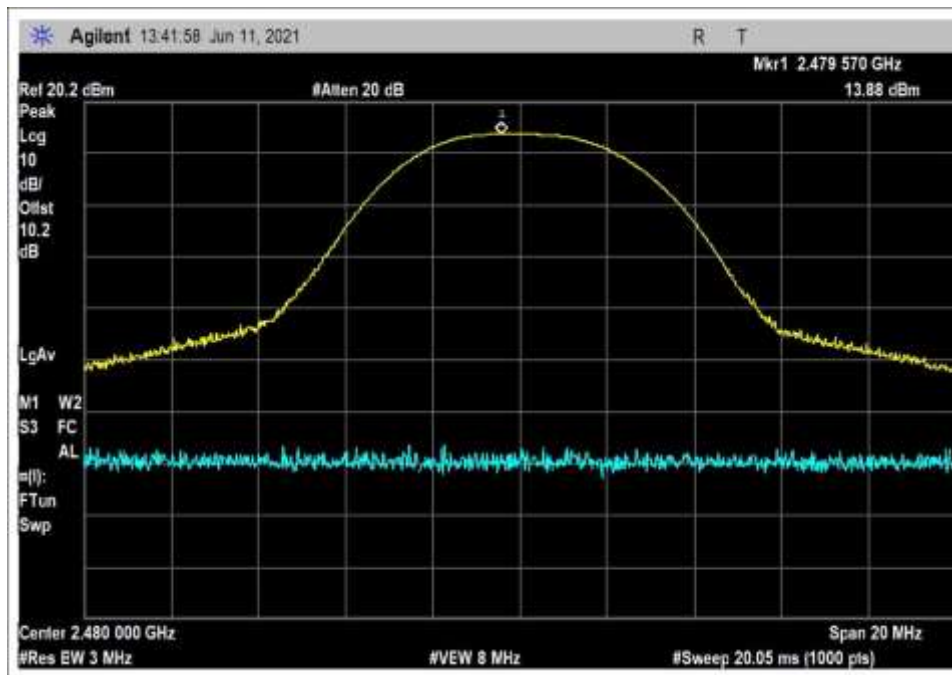
Plots – Folder 4



Low Channel

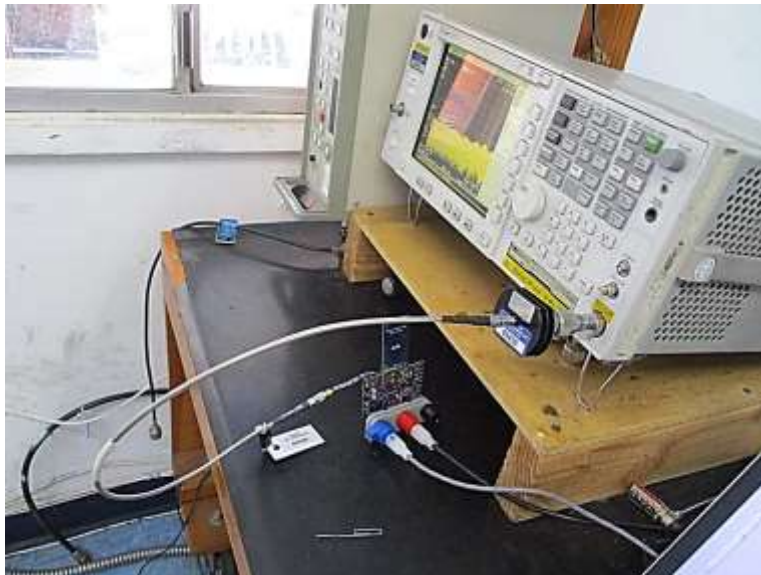


Middle Channel



High Channel

Test Setup Photo(s)



15.35(c) Duty Cycle Correction Factor

Summary

The manufacturer declares the worst-case duty cycle is 12.5ms per 100ms.
Duty cycle correction factor= $20\log(12.5/100) = -18.1$ dB.

The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.

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 #: **105380** Date: 6/11/2021
 Test Type: **Conducted Emissions** Time: 14:08:01
 Tested By: E. Wong Sequence#: 41
 Software: EMITest 5.03.19 3.6V DC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

The EUT is placed on test bench and the Blue port receives power from remotely located support power supply set 3.6Vdc to simulate a fresh battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Black port is connected to a section of unterminated cable. EUT has fixed orientation per manufacture's specification.

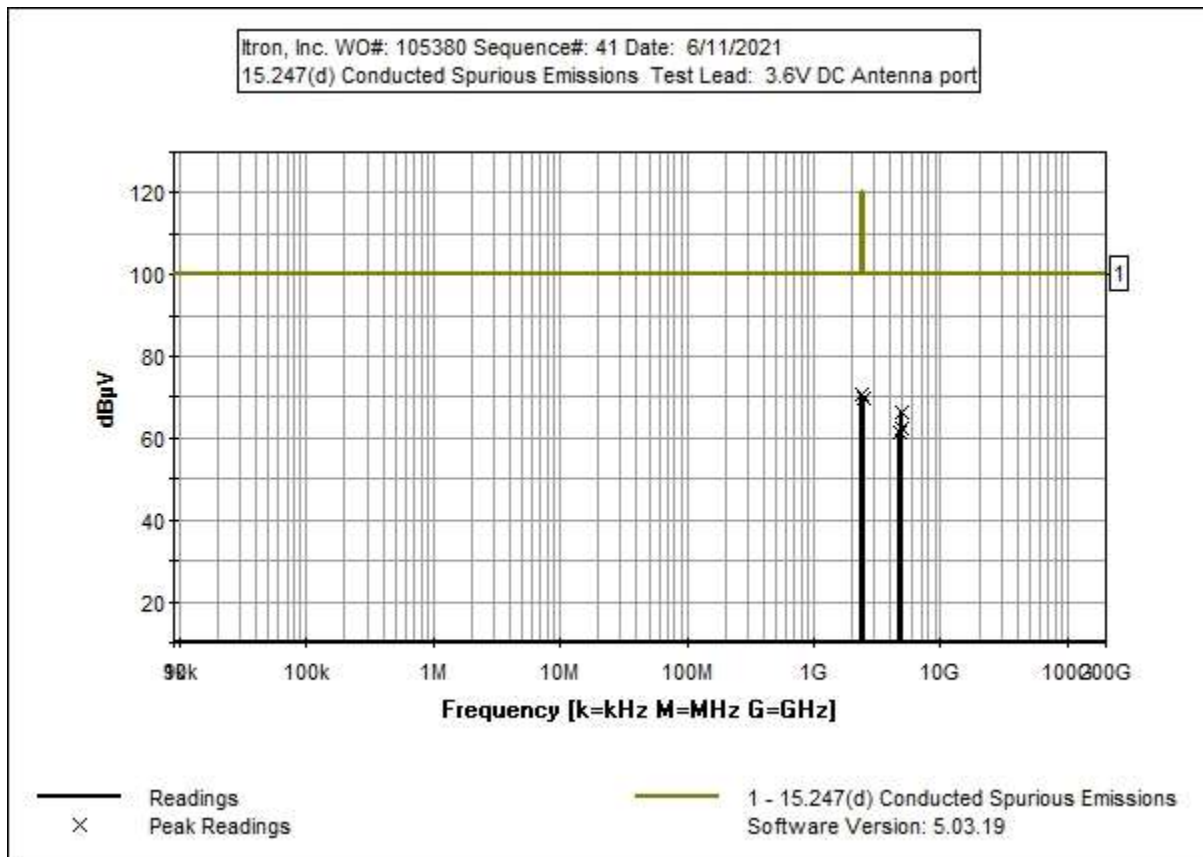
Operating Frequency / Mode:
 2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 3

Frequency of measurement: 9k-25000MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Test Environment Conditions:
 Temperature: 22°C
 Relative Humidity: 39%
 Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN03430	Attenuator	75A-10-12	12/20/2019	12/20/2021
T3	ANP07659	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	2400.000M	60.7	+0.0	+9.9	+0.3	+0.0		70.9	100.0	-29.1	Anten
									Bandedge L		
2	2483.500M	59.4	+0.0	+9.9	+0.3	+0.0		69.6	100.0	-30.4	Anten
									bandedge_H		
3	4879.000M	55.4	+0.0	+10.1	+0.7	+0.0		66.2	100.0	-33.8	Anten
									M		
4	4958.890M	51.8	+0.0	+10.1	+0.7	+0.0		62.6	100.0	-37.4	Anten
									H		
5	4803.600M	50.5	+0.0	+10.2	+0.6	+0.0		61.3	100.0	-38.7	Anten
									H		

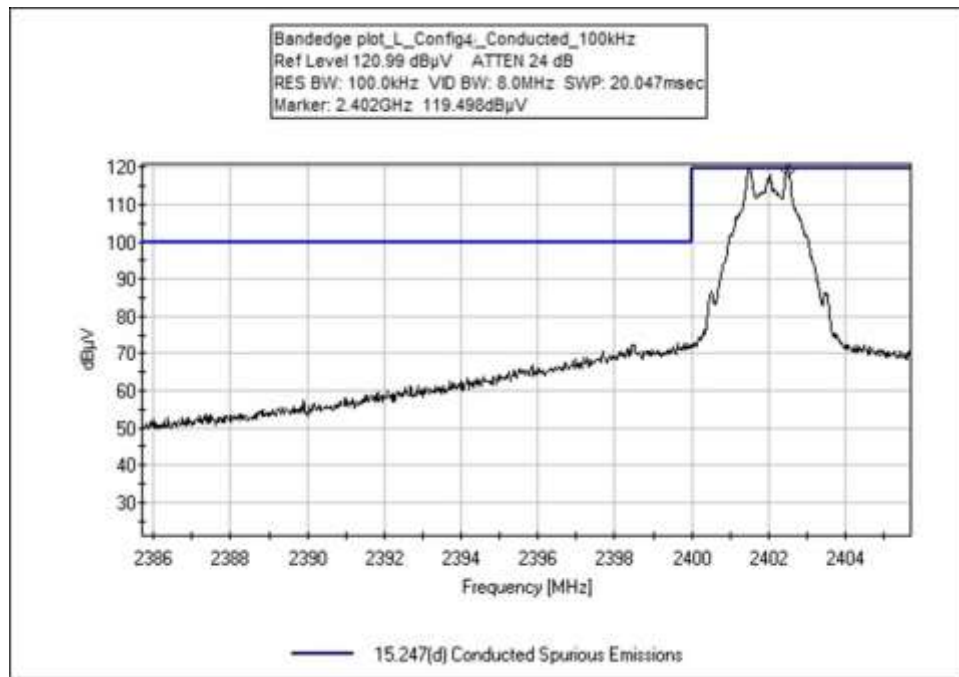
Band Edge

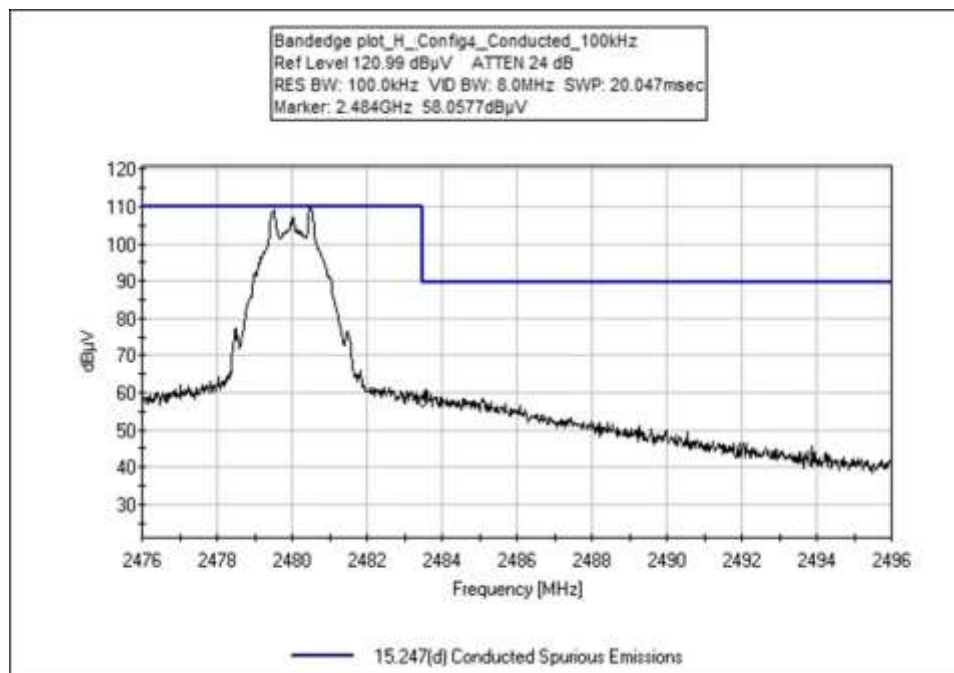
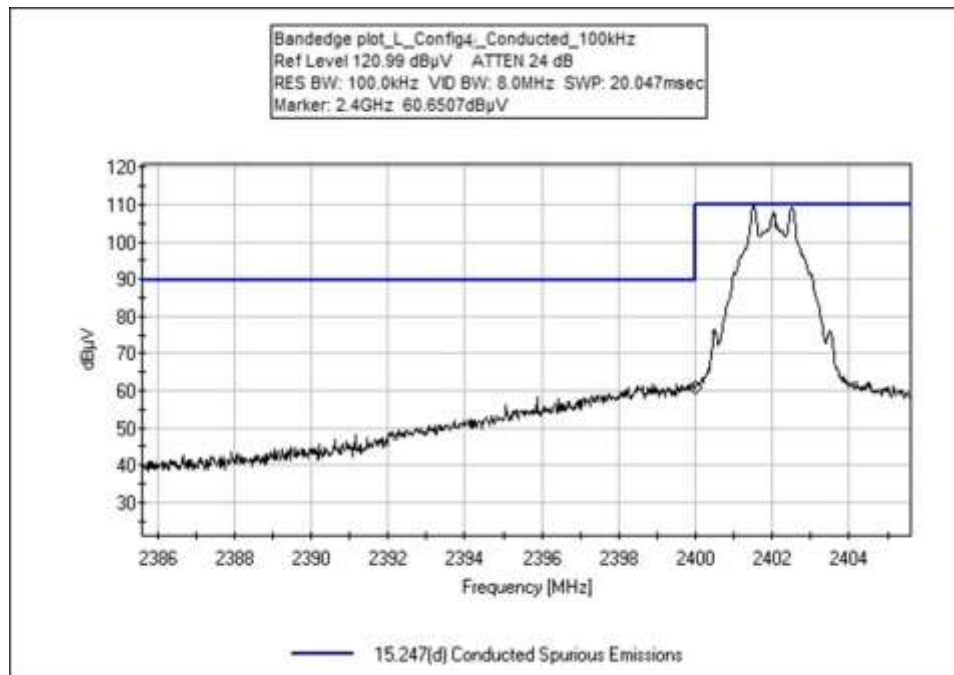
Band Edge Summary

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

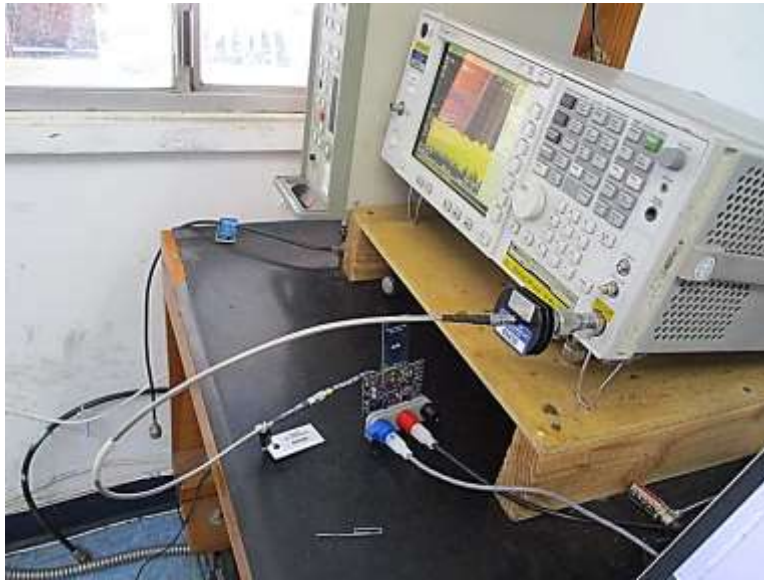
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
2400.0	GFSK	-36.1	< -7	Pass
2483.5	GFSK	-37.4	< -7	Pass

Band Edge Plots





Test Setup Photo(s)



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 #: **105380** Date: 6/8/2021
 Test Type: **Radiated Scan** Time: 16:21:43
 Tested By: E. Wong Sequence#: 17
 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 EUT is placed on Styrofoam platform and the Blue port is connected to a section of wire with a shorting tip to activate internal battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Fresh battery is used.

EUT has fixed orientation per manufacture's specification.

Operating Frequency / Mode
 2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 4

Frequency of Measurement: 9k-25000MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-25000MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. Duty cycle correction factor= $20\log(12.5/100) = -18.1$ dB. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

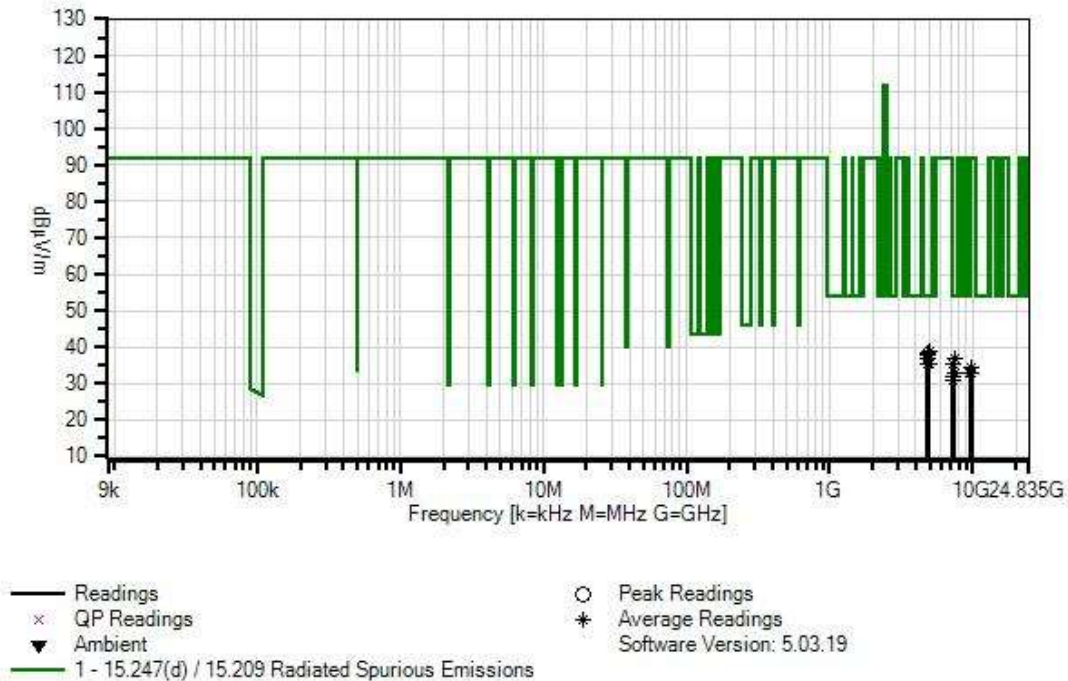
Test Environment Conditions:

Temperature: 22°C
 Relative Humidity: 39%
 Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

Itron, Inc. WO#: 105380 Sequence#: 17 Date: 6/8/2021
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07659	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T6	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
T7	ANDCCF	Duty Cycle Correction Factor		1/7/2021	1/7/2031
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
	AN00309	Preamp	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5 dB	T6 dB	T7 dB		Table	dBμV/m	dBμV/m	dB	Ant
1	4958.850M	55.8	+0.0	+33.4	+0.7	-37.6	+0.0	39.0	54.0	-15.0	Vert
	Ave		+4.5	+0.3	-18.1		95		H		104
^	4958.850M	55.8	+0.0	+33.4	+0.7	-37.6	+0.0	57.1	54.0	+3.1	Vert
			+4.5	+0.3	+0.0		95		H		104
3	4802.867M	55.6	+0.0	+33.0	+0.6	-37.6	+0.0	38.3	54.0	-15.7	Vert
	Ave		+4.5	+0.3	-18.1		115		L		126
^	4802.867M	55.6	+0.0	+33.0	+0.6	-37.6	+0.0	56.4	54.0	+2.4	Vert
			+4.5	+0.3	+0.0		115		L		126
5	4880.800M	55.0	+0.0	+33.2	+0.7	-37.6	+0.0	38.0	54.0	-16.0	Vert
	Ave		+4.5	+0.3	-18.1		154		M		156
^	4880.800M	55.0	+0.0	+33.2	+0.7	-37.6	+0.0	56.1	54.0	+2.1	Vert
			+4.5	+0.3	+0.0		154		M		156
7	4802.933M	54.2	+0.0	+33.0	+0.6	-37.6	+0.0	36.9	54.0	-17.1	Horiz
	Ave		+4.5	+0.3	-18.1		132		L		182
^	4802.933M	54.2	+0.0	+33.0	+0.6	-37.6	+0.0	55.0	54.0	+1.0	Horiz
			+4.5	+0.3	+0.0		132		L		182
9	7441.633M	48.6	+0.0	+36.5	+0.8	-37.2	+0.0	36.9	54.0	-17.1	Vert
	Ave		+6.1	+0.2	-18.1		110		H		108
^	7441.633M	48.6	+0.0	+36.5	+0.8	-37.2	+0.0	55.0	54.0	+1.0	Vert
			+6.1	+0.2	+0.0		110		H		108
11	7204.317M	47.8	+0.0	+35.9	+0.7	-37.1	+0.0	35.5	54.0	-18.5	Vert
	Ave		+6.1	+0.2	-18.1		261		L		123
^	7204.317M	47.8	+0.0	+35.9	+0.7	-37.1	+0.0	53.6	54.0	-0.4	Vert
			+6.1	+0.2	+0.0		261		L		123
13	4960.967M	52.2	+0.0	+33.4	+0.7	-37.6	+0.0	35.4	54.0	-18.6	Horiz
	Ave		+4.5	+0.3	-18.1		311		H		163
^	4960.967M	52.2	+0.0	+33.4	+0.7	-37.6	+0.0	53.5	54.0	-0.5	Horiz
			+4.5	+0.3	+0.0		311		H		163
15	4878.883M	52.2	+0.0	+33.2	+0.7	-37.6	+0.0	35.2	54.0	-18.8	Horiz
	Ave		+4.5	+0.3	-18.1		143		M		135
^	4878.883M	52.2	+0.0	+33.2	+0.7	-37.6	+0.0	53.3	54.0	-0.7	Horiz
			+4.5	+0.3	+0.0		143		M		135
17	9762.033M	41.8	+0.0	+38.3	+0.8	-36.1	+0.0	34.4	54.0	-19.6	Horiz
	Ave		+7.4	+0.3	-18.1		179		M		110
^	9762.033M	41.8	+0.0	+38.3	+0.8	-36.1	+0.0	52.5	54.0	-1.5	Horiz
			+7.4	+0.3	+0.0		179		M		110
19	9761.900M	40.5	+0.0	+38.3	+0.8	-36.1	+0.0	33.1	54.0	-20.9	Vert
	Ave		+7.4	+0.3	-18.1		173		M		141
^	9761.900M	40.5	+0.0	+38.3	+0.8	-36.1	+0.0	51.2	54.0	-2.8	Vert
			+7.4	+0.3	+0.0		173		M		141
21	9610.067M	40.6	+0.0	+38.2	+0.7	-36.1	+0.0	32.9	54.0	-21.1	Horiz
	Ave		+7.3	+0.3	+0.0		75		L		159
^	9610.067M	40.4	+0.0	+38.2	+0.7	-36.1	+0.0	50.8	54.0	-3.2	Horiz
			+7.3	+0.3	+0.0		75		L		159

23	7441.550M	44.5	+0.0	+36.5	+0.8	-37.2	+0.0	32.8	54.0	-21.2	Horiz
	Ave		+6.1	+0.2	-18.1		44		H		191
^	7441.550M	44.5	+0.0	+36.5	+0.8	-37.2	+0.0	50.9	54.0	-3.1	Horiz
			+6.1	+0.2	+0.0		44		H		191
25	9606.200M	40.5	+0.0	+38.2	+0.7	-36.1	+0.0	32.8	54.0	-21.2	Vert
	Ave		+7.3	+0.3	-18.1		36		L		127
^	9606.200M	40.5	+0.0	+38.2	+0.7	-36.1	+0.0	50.9	54.0	-3.1	Vert
			+7.3	+0.3	+0.0		149		L		127
27	7204.583M	44.4	+0.0	+35.9	+0.7	-37.1	+0.0	32.1	54.0	-21.9	Horiz
	Ave		+6.1	+0.2	-18.1		269		L		191
^	7204.583M	44.4	+0.0	+35.9	+0.7	-37.1	+0.0	50.2	54.0	-3.8	Horiz
			+6.1	+0.2	+0.0		269		L		191
29	7321.350M	43.0	+0.0	+36.2	+0.7	-37.3	+0.0	30.8	54.0	-23.2	Vert
	Ave		+6.1	+0.2	-18.1		23		M		166
^	7321.350M	43.0	+0.0	+36.2	+0.7	-37.3	+0.0	48.9	54.0	-5.1	Vert
			+6.1	+0.2	+0.0		23		M		166



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 #: **105380** Date: 6/9/2021
 Test Type: **Radiated Scan** Time: 13:09:47
 Tested By: E. Wong Sequence#: 25
 Software: EMITest 5.03.19

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 and the Blue port is connected to a section of wire with a shorting tip to activate internal battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Fresh battery is used.
 EUT has fixed orientation per manufacture's specification.

Operating Frequency / Mode:
 2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 4

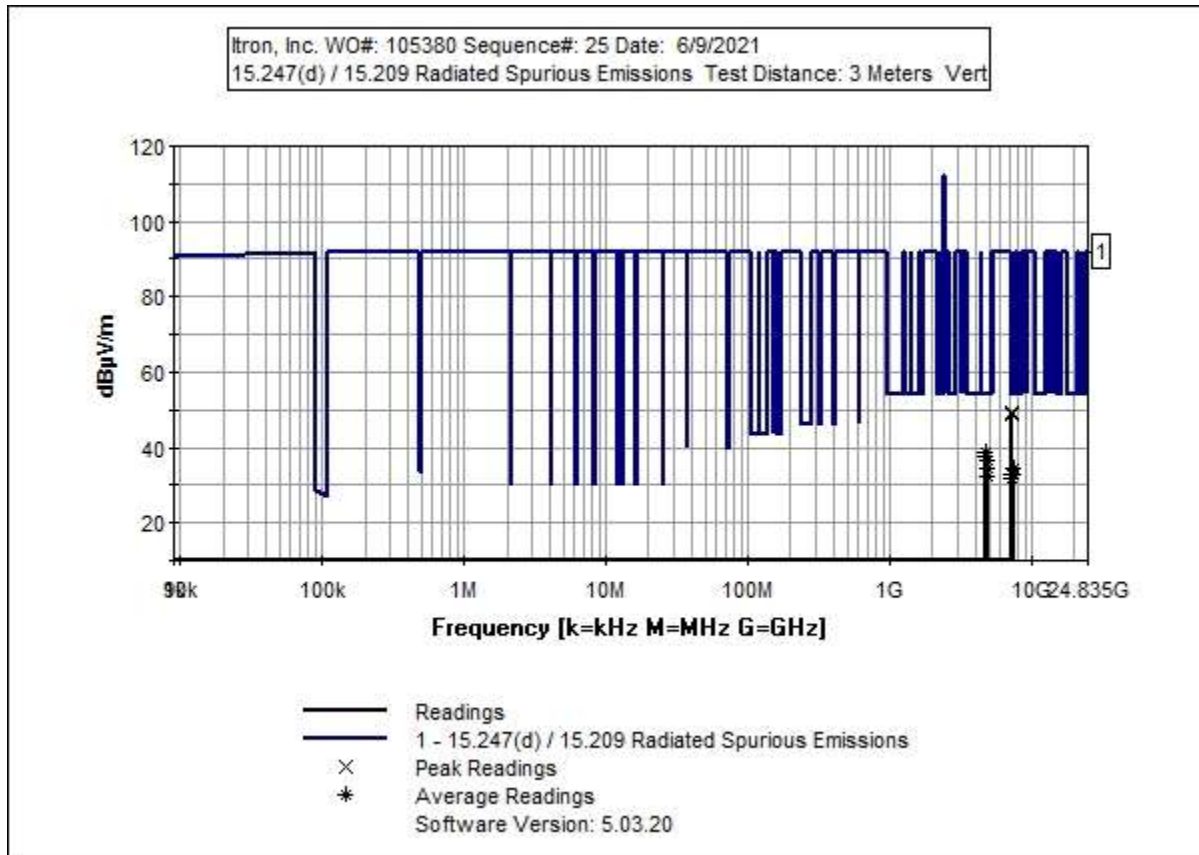
Frequency of Measurement: 9k-25000MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-25000MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. Duty cycle correction factor=20log (12.5/100) = -18.1 dB. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

Test Environment Conditions:
 Temperature: 22°C
 Relative Humidity: 39%
 Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07659	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMM-48	8/8/2019	8/8/2021
T6	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
T7	ANDCCF	Duty Cycle Correction Factor		1/7/2021	1/7/2031
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
	AN00309	Preamp	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar	
	MHz	dBμV	T5	T6	T7							
			dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant	
1	4805.070M	55.9	+0.0	+33.0	+0.6	-37.6	+0.0	38.6	54.0	-15.4	Horiz	
	Ave		+4.5	+0.3	-18.1		67		L		220	
^	4805.070M	55.9	+0.0	+33.0	+0.6	-37.6	+0.0	56.7	54.0	+2.7	Horiz	
			+4.5	+0.3	+0.0		67		L		220	
3	4803.000M	55.1	+0.0	+33.0	+0.6	-37.6	+0.0	37.8	54.0	-16.2	Vert	
	Ave		+4.5	+0.3	-18.1		109		L		123	
^	4803.000M	55.1	+0.0	+33.0	+0.6	-37.6	+0.0	55.9	54.0	+1.9	Vert	
			+4.5	+0.3	+0.0		109		L		123	
5	4878.900M	53.7	+0.0	+33.2	+0.7	-37.6	+0.0	36.7	54.0	-17.3	Vert	
	Ave		+4.5	+0.3	-18.1		109		M		132	
^	4878.900M	53.7	+0.0	+33.2	+0.7	-37.6	+0.0	54.8	54.0	+0.8	Vert	
			+4.5	+0.3	+0.0		109		M		132	
7	7441.500M	46.4	+0.0	+36.5	+0.8	-37.2	+0.0	34.7	54.0	-19.3	Vert	
	Ave		+6.1	+0.2	-18.1		114		H		115	
^	7441.500M	46.1	+0.0	+36.5	+0.8	-37.2	+0.0	52.5	54.0	-1.5	Vert	
			+6.1	+0.2	+0.0		114		H		115	
9	4878.970M	51.5	+0.0	+33.2	+0.7	-37.6	+0.0	34.5	54.0	-19.5	Horiz	
	Ave		+4.5	+0.3	-18.1		119		M		153	
^	4878.970M	51.5	+0.0	+33.2	+0.7	-37.6	+0.0	52.6	54.0	-1.4	Horiz	
			+4.5	+0.3	+0.0		119		M		153	
11	4961.000M	51.0	+0.0	+33.4	+0.7	-37.6	+0.0	34.2	54.0	-19.8	Vert	
	Ave		+4.5	+0.3	-18.1		119		H		117	
^	4961.000M	51.0	+0.0	+33.4	+0.7	-37.6	+0.0	52.3	54.0	-1.7	Vert	
			+4.5	+0.3	+0.0		119		H		117	
13	7318.570M	45.3	+0.0	+36.2	+0.7	-37.3	+0.0	33.1	54.0	-20.9	Vert	
	Ave		+6.1	+0.2	-18.1		266		M		177	
^	7318.570M	45.3	+0.0	+36.2	+0.7	-37.3	+0.0	51.2	54.0	-2.8	Vert	
			+6.1	+0.2	+0.0		266		M		177	
15	7441.500M	44.6	+0.0	+36.5	+0.8	-37.2	+0.0	32.9	54.0	-21.1	Horiz	
	Ave		+6.1	+0.2	-18.1		104		H		138	
^	7441.500M	44.6	+0.0	+36.5	+0.8	-37.2	+0.0	51.0	54.0	-3.0	Horiz	
			+6.1	+0.2	+0.0		104		H		138	
17	4961.000M	49.0	+0.0	+33.4	+0.7	-37.6	+0.0	32.2	54.0	-21.8	Horiz	
	Ave		+4.5	+0.3	-18.1		141		H		153	
^	4961.000M	49.0	+0.0	+33.4	+0.7	-37.6	+0.0	50.3	54.0	-3.7	Horiz	
			+4.5	+0.3	+0.0		141		H		153	
19	7318.300M	43.8	+0.0	+36.2	+0.7	-37.3	+0.0	31.6	54.0	-22.4	Horiz	
	Ave		+6.1	+0.2	-18.1		293		M		129	
^	7318.300M	43.2	+0.0	+36.2	+0.7	-37.3	+0.0	49.1	54.0	-4.9	Horiz	
			+6.1	+0.2	+0.0		293		M		129	
21	7207.330M	43.5	+0.0	+35.9	+0.7	-37.1	+0.0	49.3	90.5	-41.2	Horiz	
			+6.1	+0.2	+0.0		360		L		218	
22	7204.530M	43.0	+0.0	+35.9	+0.7	-37.1	+0.0	48.8	90.5	-41.7	Vert	
			+6.1	+0.2	+0.0		75		L		123	

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 #: **105380** Date: 6/8/2021
 Test Type: **Radiated Scan** Time: 16:27:12
 Tested By: E. Wong Sequence#: 16
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

The EUT is placed on Styrofoam platform and the Blue port receives power from remotely located support power supply set 3.6Vdc to simulate a fresh battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Black port is connected to a section of unterminated cable. EUT has fixed orientation per manufacture's specification.

Operating Frequency / Mode:
 2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 3

Frequency of Measurement: 9k-25000MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-25000MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. Duty cycle correction factor=20log (12.5/100) = -18.1 dB. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

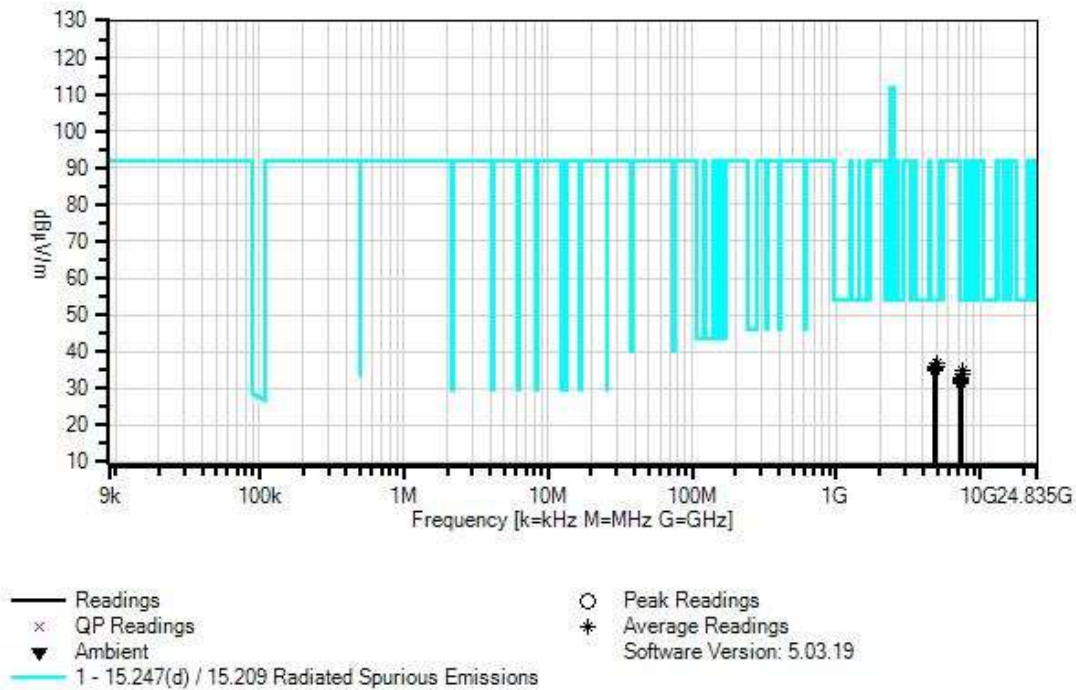
Test Environment Conditions:

Temperature: 22°C
 Relative Humidity: 39%
 Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

Itron, Inc. WO#: 105380 Sequence#: 16 Date: 6/8/2021
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07659	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMMN-48	8/8/2019	8/8/2021
T6	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
T7	ANDCCF	Duty Cycle Correction Factor		1/7/2021	1/7/2031
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
	AN00309	Preamp	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	T5 dB	T6 dB	T7 dB		Table	dBµV/m	dBµV/m	dB	Ant
1	4958.983M	53.8	+0.0	+33.4	+0.7	-37.6	+0.0	37.0	54.0	-17.0	Vert
	Ave		+4.5	+0.3	-18.1		63		H		182
^	4958.983M	53.8	+0.0	+33.4	+0.7	-37.6	+0.0	55.1	54.0	+1.1	Vert
			+4.5	+0.3	+0.0		63		H		182
3	4804.967M	53.3	+0.0	+33.0	+0.6	-37.6	+0.0	36.0	54.0	-18.0	Vert
	Ave		+4.5	+0.3	-18.1		261		L		133
^	4804.967M	53.3	+0.0	+33.0	+0.6	-37.6	+0.0	54.1	54.0	+0.1	Vert
			+4.5	+0.3	+0.0		261		L		133
5	4961.167M	52.6	+0.0	+33.4	+0.7	-37.6	+0.0	35.8	54.0	-18.2	Horiz
	Ave		+4.5	+0.3	-18.1		314		H		180
^	4961.167M	52.6	+0.0	+33.4	+0.7	-37.6	+0.0	53.9	54.0	-0.1	Horiz
			+4.5	+0.3	+0.0		314		H		180
7	4881.167M	52.4	+0.0	+33.2	+0.7	-37.6	+0.0	35.4	54.0	-18.6	Vert
	Ave		+4.5	+0.3	-18.1		94		M		125
^	4881.167M	52.4	+0.0	+33.2	+0.7	-37.6	+0.0	53.5	54.0	-0.5	Vert
			+4.5	+0.3	+0.0		94		M		125
9	4804.950M	52.5	+0.0	+33.0	+0.6	-37.6	+0.0	35.2	54.0	-18.8	Horiz
	Ave		+4.5	+0.3	-18.1		308		L		192
^	4804.950M	52.5	+0.0	+33.0	+0.6	-37.6	+0.0	53.3	54.0	-0.7	Horiz
			+4.5	+0.3	+0.0		308		L		192
11	4880.833M	51.9	+0.0	+33.2	+0.7	-37.6	+0.0	34.9	54.0	-19.1	Horiz
	Ave		+4.5	+0.3	-18.1		302		M		188
^	4880.833M	51.9	+0.0	+33.2	+0.7	-37.6	+0.0	53.0	54.0	-1.0	Horiz
			+4.5	+0.3	+0.0		302		M		188
13	7441.600M	46.4	+0.0	+36.5	+0.8	-37.2	+0.0	34.7	54.0	-19.3	Horiz
	Ave		+6.1	+0.2	-18.1		217		H		189
^	7441.600M	46.4	+0.0	+36.5	+0.8	-37.2	+0.0	52.8	54.0	-1.2	Horiz
			+6.1	+0.2	+0.0		217		H		189
15	7438.533M	45.6	+0.0	+36.5	+0.8	-37.2	+0.0	33.9	54.0	-20.1	Vert
	Ave		+6.1	+0.2	-18.1		300		H		170
^	7438.533M	45.6	+0.0	+36.5	+0.8	-37.2	+0.0	52.0	54.0	-2.0	Vert
			+6.1	+0.2	+0.0		300		H		170
17	7321.167M	44.2	+0.0	+36.2	+0.7	-37.3	+0.0	32.0	54.0	-22.0	Vert
	Ave		+6.1	+0.2	-18.1		285		M		163
^	7321.167M	44.2	+0.0	+36.2	+0.7	-37.3	+0.0	50.1	54.0	-3.9	Vert
			+6.1	+0.2	+0.0		285		M		163

19	7319.133M Ave	43.5	+0.0 +6.1	+36.2 +0.2	+0.7 -18.1	-37.3	+0.0 190	31.3	54.0 M	-22.7	Horiz 182
^	7319.133M	43.5	+0.0 +6.1	+36.2 +0.2	+0.7 +0.0	-37.3	+0.0 188	49.4	54.0 M	-4.6	Horiz 182
21	7207.467M Ave	45.4	+0.0 +6.1	+35.9 +0.2	+0.7 -18.1	-37.1	+0.0 273	33.1	92.0 L	-58.9	Vert 144
^	7207.467M	45.4	+0.0 +6.1	+35.9 +0.2	+0.7 +0.0	-37.1	+0.0 273	51.2	92.0 L	-40.8	Vert 144
23	7207.400M Ave	44.7	+0.0 +6.1	+35.9 +0.2	+0.7 -18.1	-37.1	+0.0 74	32.4	92.0 L	-59.6	Horiz 156
^	7207.400M	44.7	+0.0 +6.1	+35.9 +0.2	+0.7 +0.0	-37.1	+0.0 74	50.5	92.0 L	-41.5	Horiz 156

Band Edge

Band Edge Summary Configuration 1 GRT

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	PCB trace	56.9 Pk	<74	Pass
2390.0	GFSK	PCB trace	38.8 AV	<54	Pass
2400.0	GFSK	PCB trace	65.7 Pk	<92	Pass
2483.5	GFSK	PCB trace	69.5 Pk	<74	Pass
2483.5	GFSK	PCB trace	51.4Av	<54	Pass

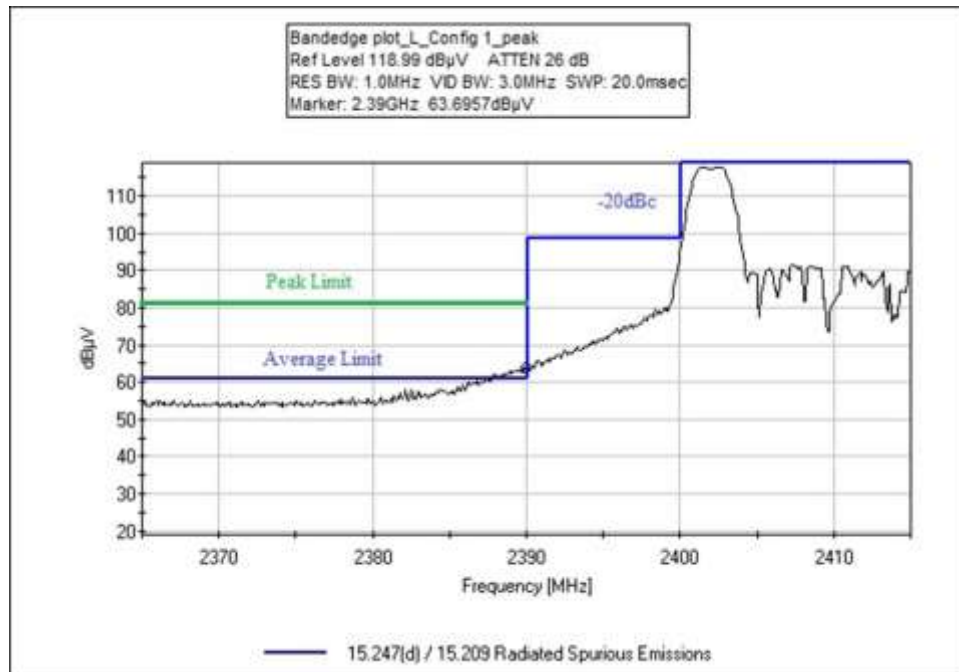
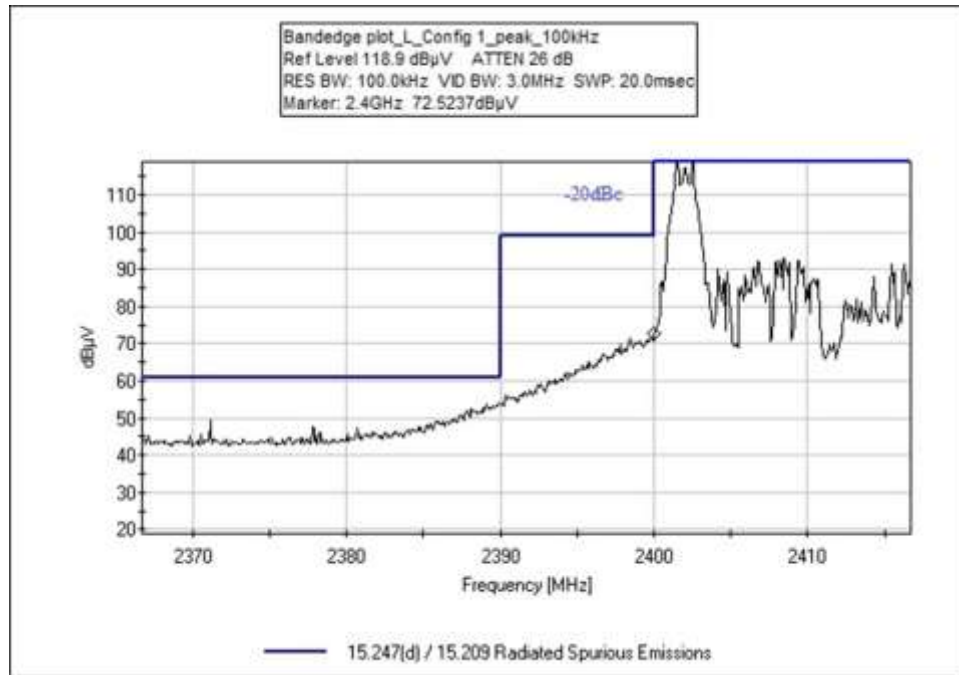
Band Edge Summary Configuration 2 WRT

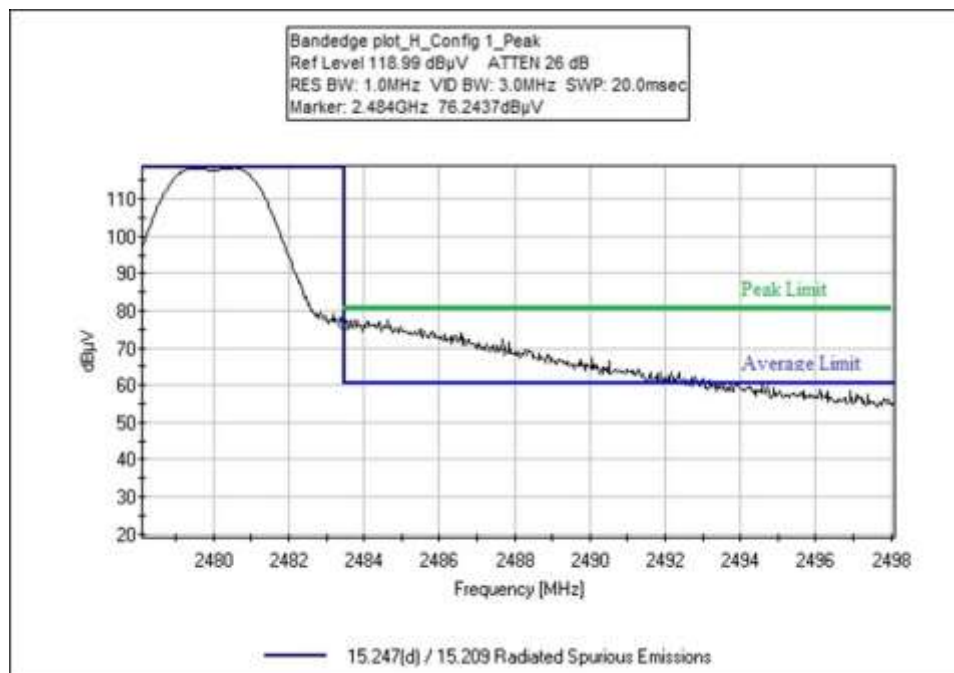
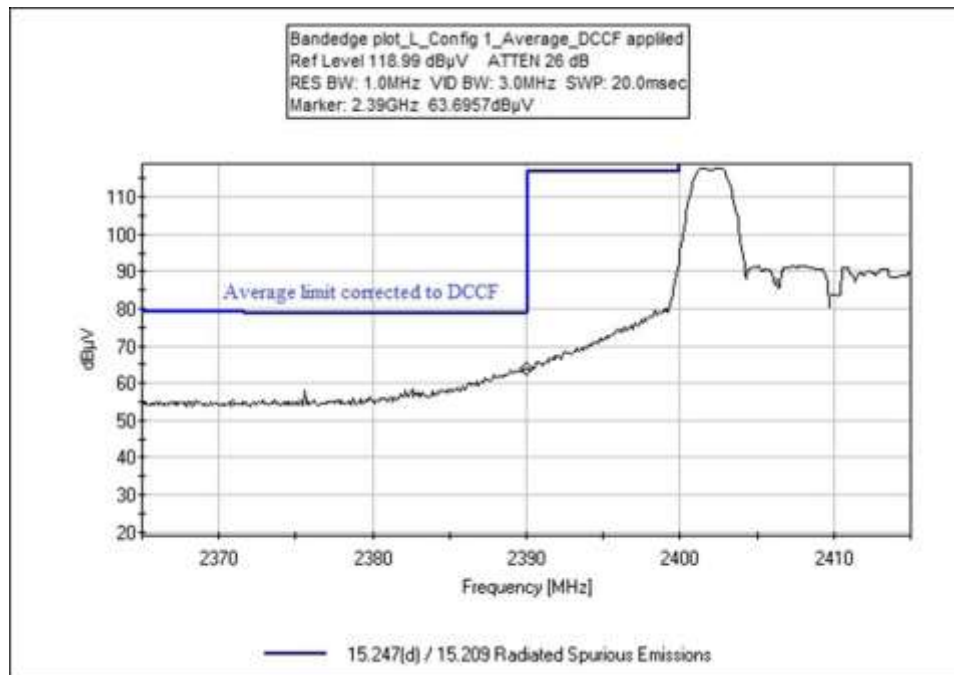
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	PCB trace	54.6 Pk	<74	Pass
2390.0	GFSK	PCB trace	36.5 ave	<54	Pass
2400.0	GFSK	PCB trace	66.3 pk	< 88	Pass
2483.5	GFSK	PCB trace	69.5pk	<74	Pass
2483.5	GFSK	PCB trace	51.4 av	<54	Pass

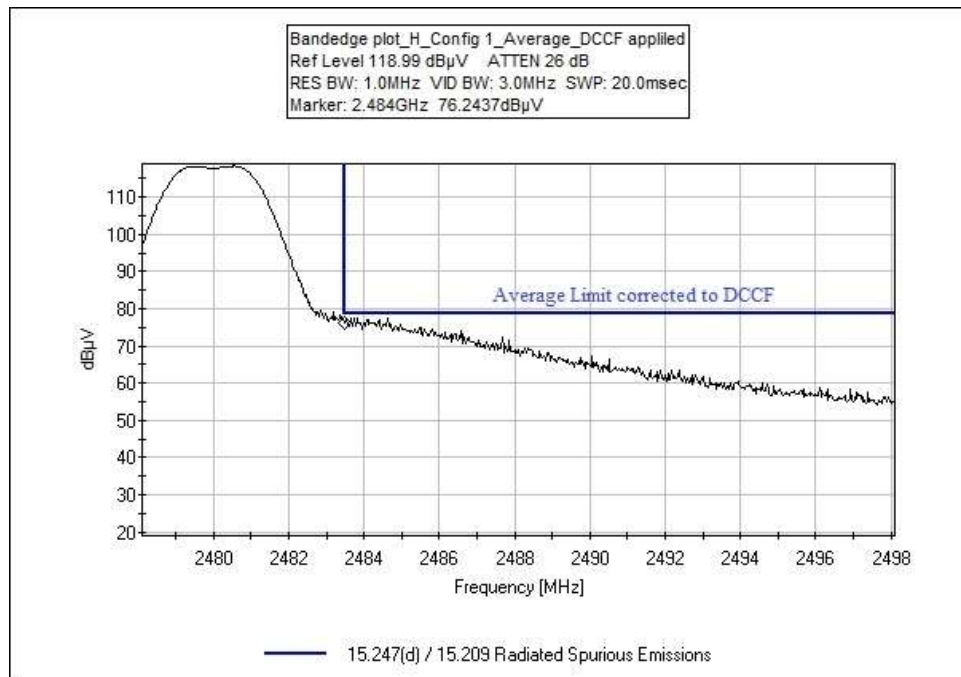
Band Edge Summary Configuration 3 PIT

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
2390.0	GFSK	PCB trace	55.7 Pk	<74	Pass
2390.0	GFSK	PCB trace	37.6 Av	<54	Pass
2400.0	GFSK	PCB trace	63.9 pk	< 90.5	Pass
2483.5	GFSK	PCB trace	67.5 Pk	<74	Pass
2483.5	GFSK	PCB trace	49.4 Av	<54	Pass

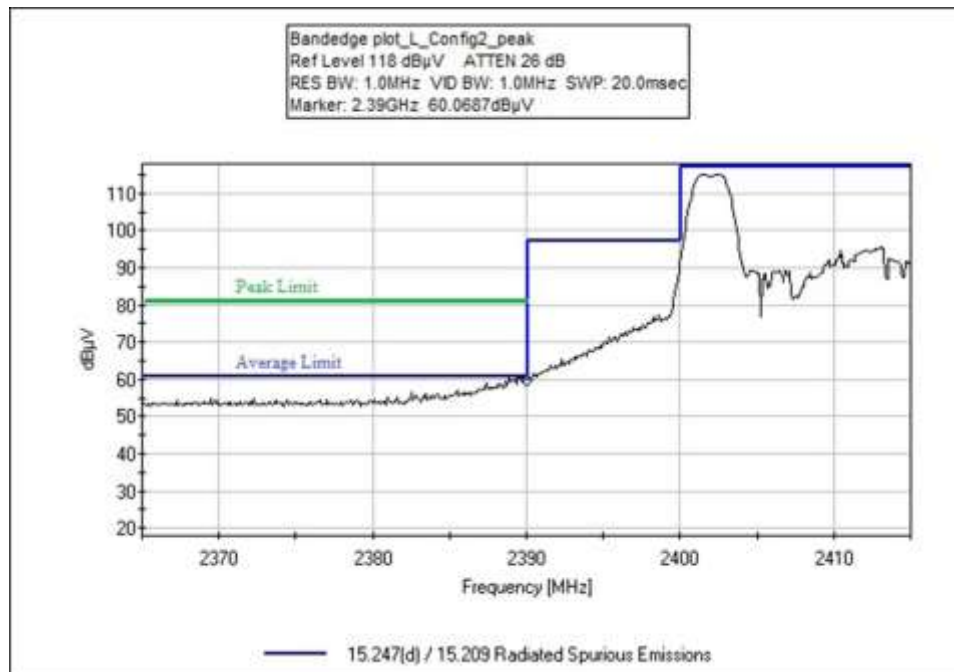
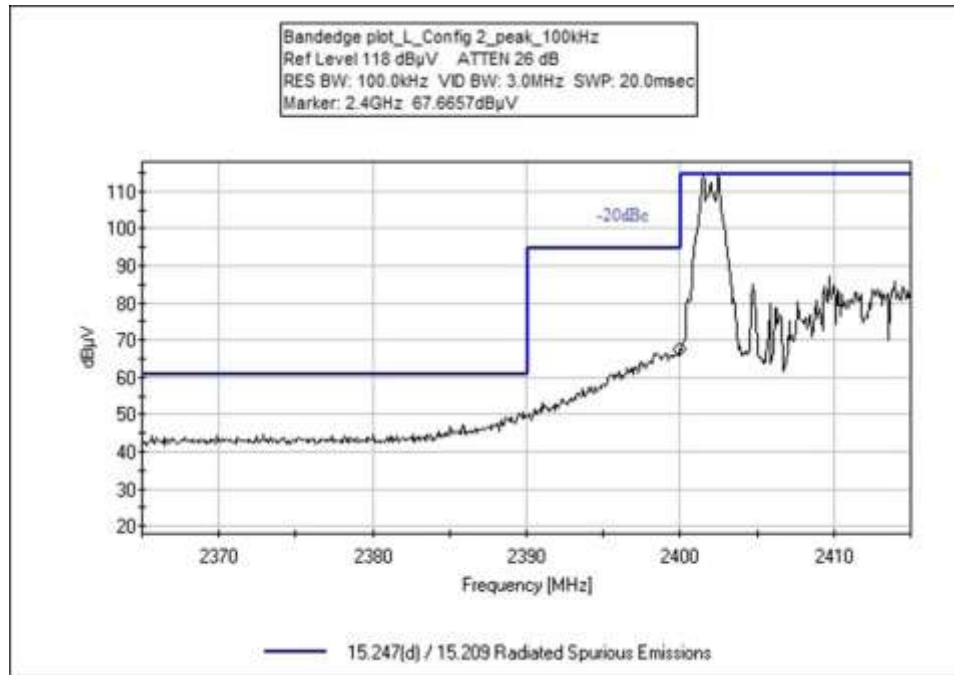
Configuration 1 Band Edge Plots

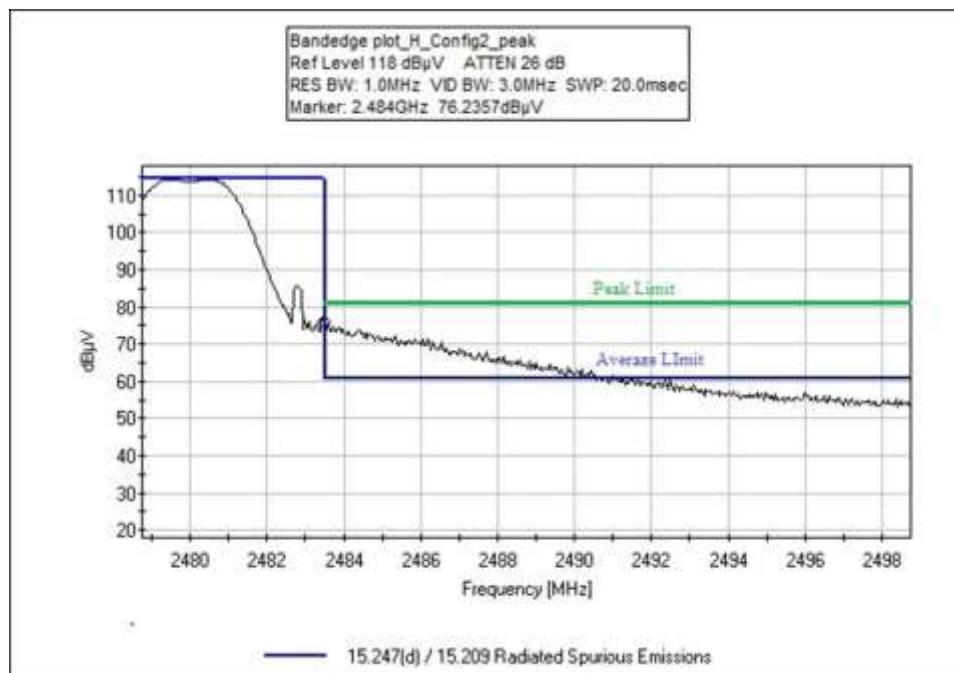
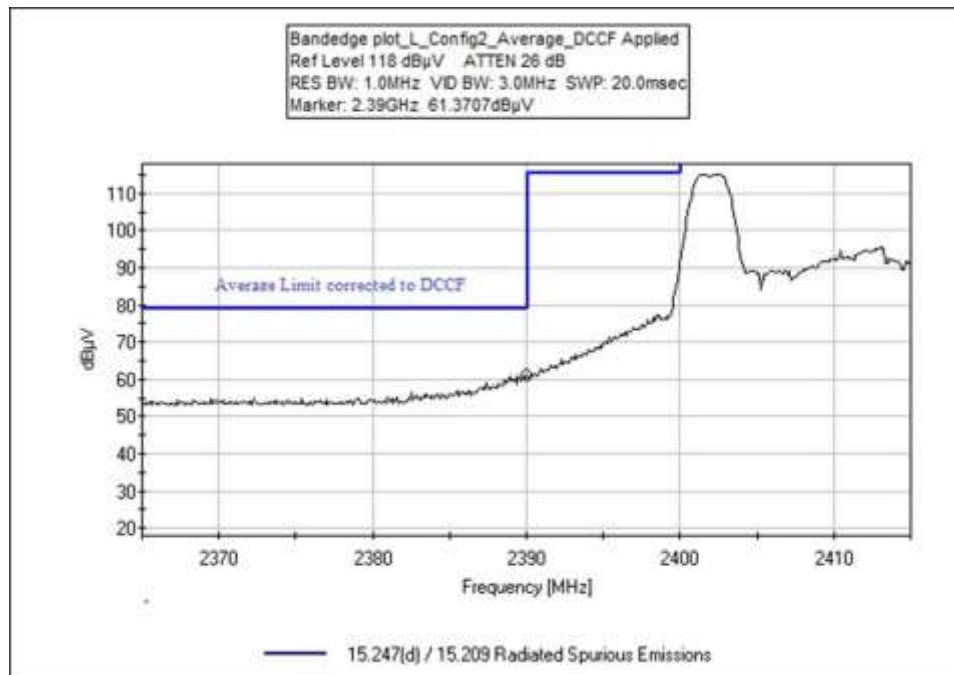


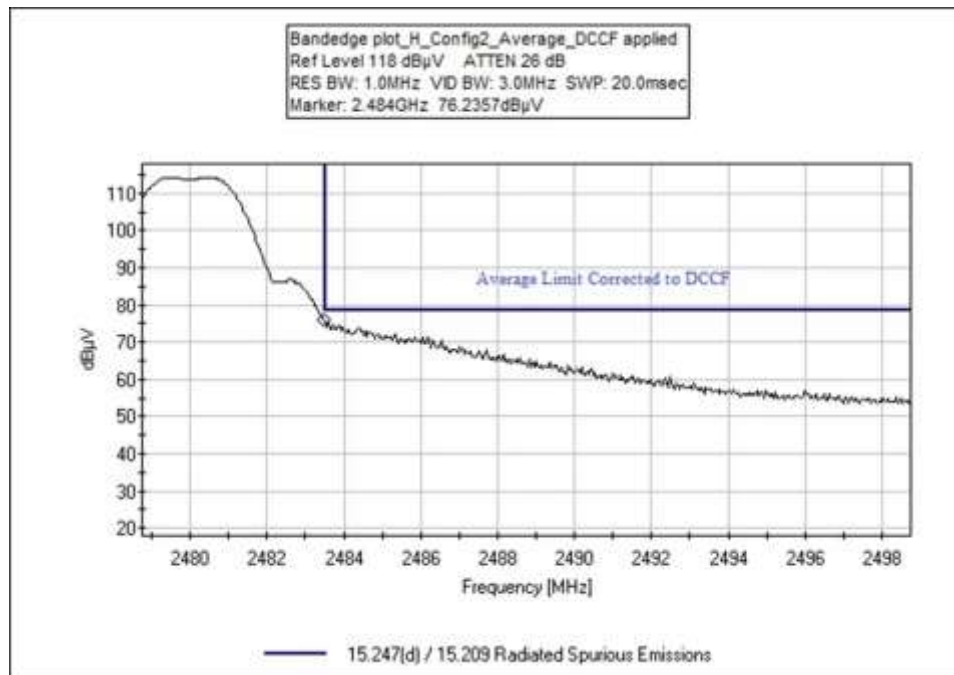




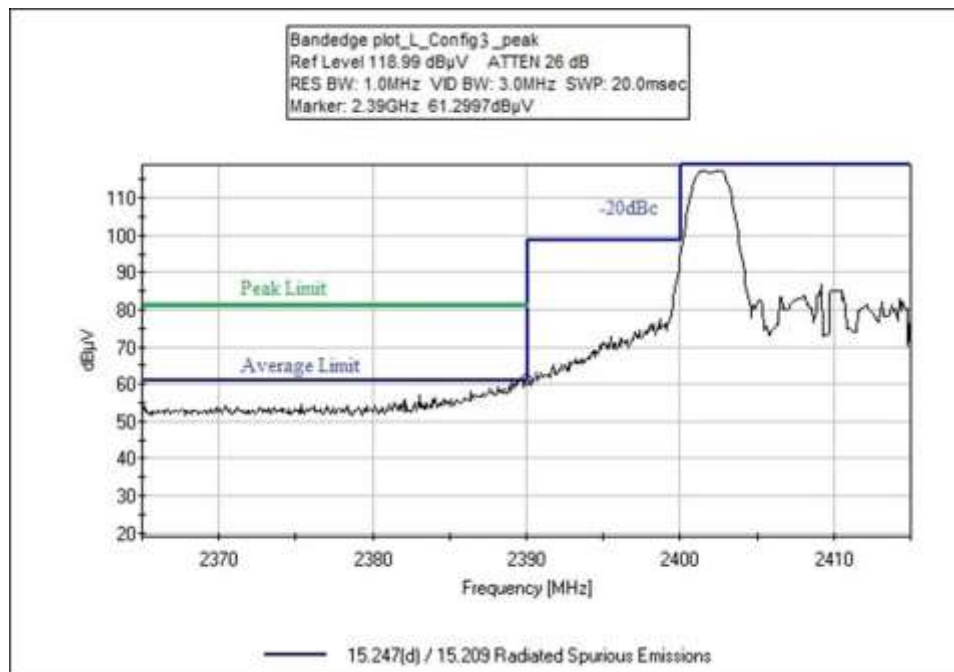
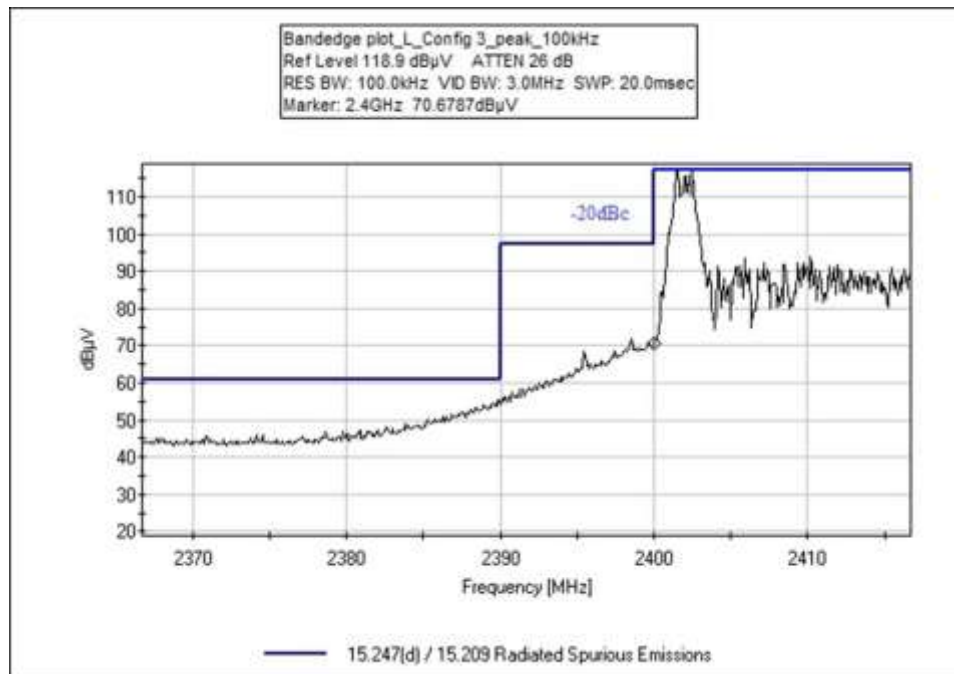
Configuration 2 Band Edge Plots

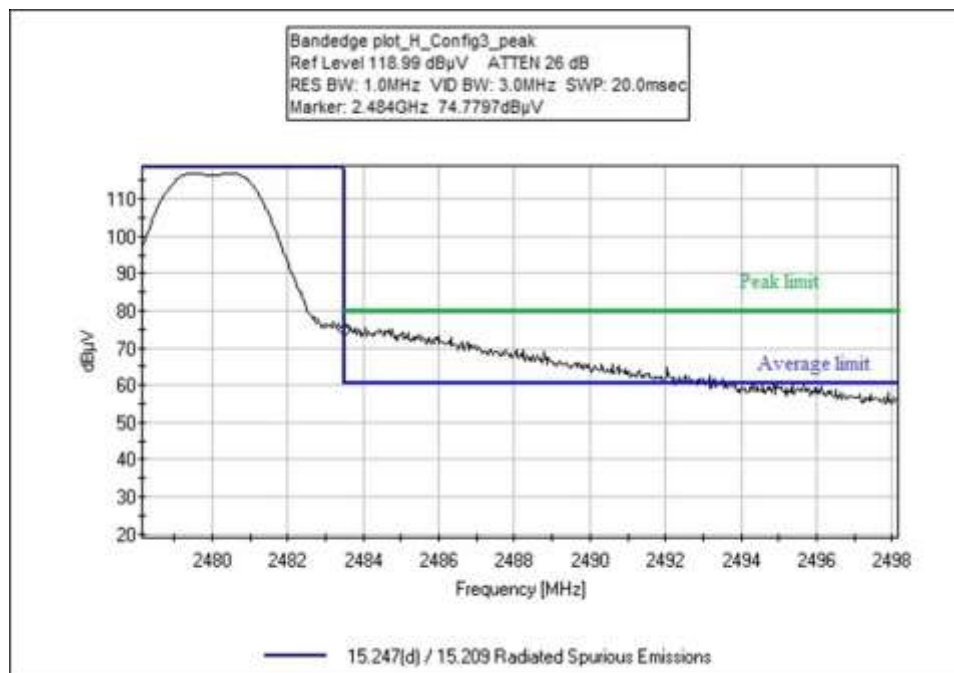
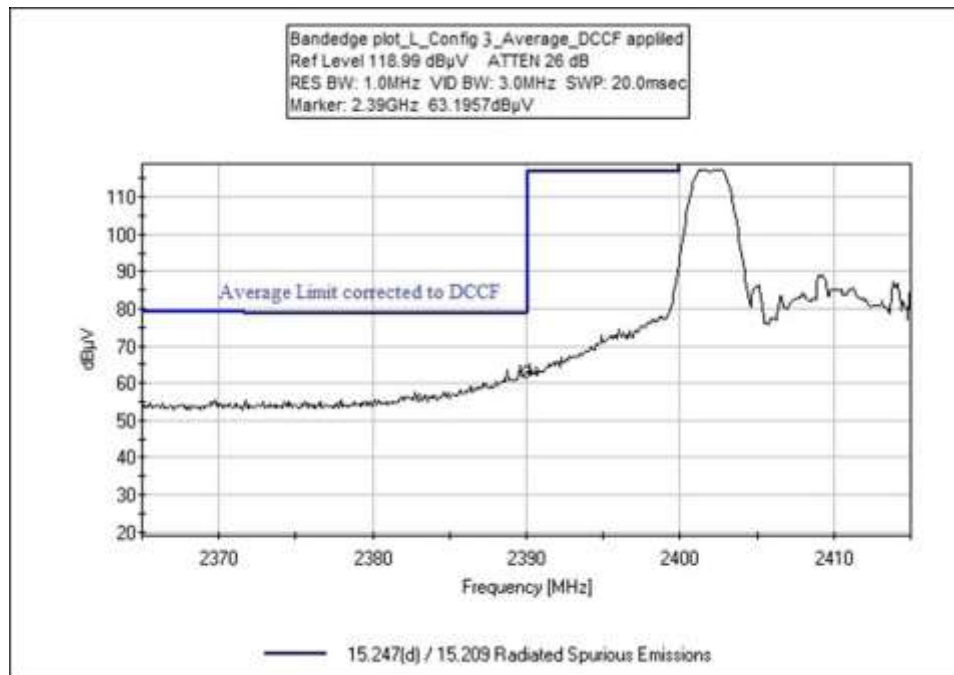


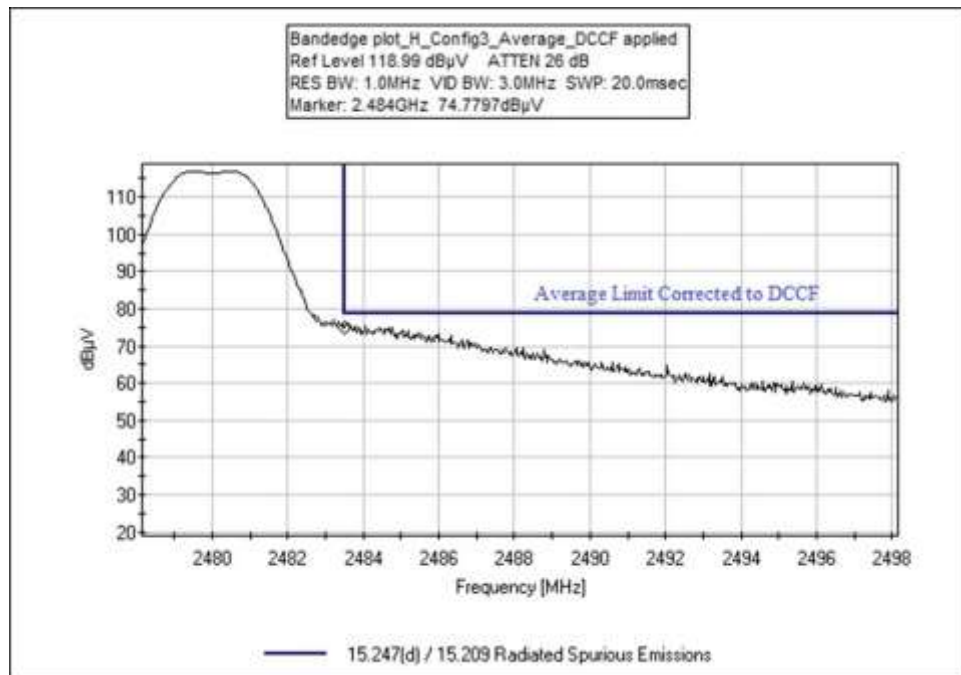




Configuration 3 Band Edge Plots







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 Spurious Emissions**
 Work Order #: **105380** Date: 6/8/2021
 Test Type: **Radiated Scan** Time: 16:21:43
 Tested By: E. Wong Sequence#: 17
 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 EUT is placed on Styrofoam platform and the Blue port is connected to a section of wire with a shorting tip to activate internal battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Fresh battery is used.

EUT has fixed orientation per manufacture's specification.

Operating Frequency / Mode:

2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 4

Frequency of Measurement: 9k-25000MHz

9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz

150kHz to 30MHz RBW=9kHz, VBW=27kHz

30-1000MHz, RBW=120kHz, VBW=360kHz

1000-25000MHz, RBW=1MHz, VBW=3MHz

-20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. Duty cycle correction factor= $20\log(12.5/100) = -18.1$ dB. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

Test Environment Conditions:

Temperature: 22°C

Relative Humidity: 39%

Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07659	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00786	Preamplifier	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMM-48	8/8/2019	8/8/2021
	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
T6	ANDCCF	Duty Cycle Correction Factor		1/7/2021	1/7/2031
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
	AN00309	Preamplifier	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6			Table	dBμV/m	dBμV/m	dB	Ant
1	2483.500M	76.2	+0.0	+28.3	+0.3	-38.6	+0.0	51.4	54.0	-2.6	Vert
	Ave		+3.3	-18.1			253		Bandedge H		212
^	2483.500M	76.2	+0.0	+28.3	+0.3	-38.6	+0.0	69.5	54.0	+15.5	Vert
			+3.3	+0.0			253		Bandedge H		212
3	2390.000M	63.7	+0.0	+28.3	+0.3	-38.6	+0.0	38.8	54.0	-15.2	Vert
	Ave		+3.2	-18.1			253		Bandedge L		205
^	2390.000M	63.7	+0.0	+28.3	+0.3	-38.6	+0.0	56.9	54.0	+2.9	Vert
			+3.2	+0.0			253		Bandedge L		205
5	2400.000M	72.5	+0.0	+28.3	+0.3	-38.6	+0.0	65.7	92.0	-26.3	Vert
			+3.2	+0.0			260		Bandedge L		198
									100kHz		



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 #: **105380** Date: 6/9/2021
 Test Type: **Radiated Scan** Time: 13:09:47
 Tested By: E. Wong Sequence#: 25
 Software: EMITest 5.03.19

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 and the Blue port is connected to a section of wire with a shorting tip to activate internal battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Fresh battery is used.
 EUT has fixed orientation per manufacture's specification.

Operating Frequency / Mode:
 2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 4

Frequency of Measurement: 9k-25000MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-25000MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. Duty cycle correction factor=20log (12.5/100) = -18.1 dB. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

Test Environment Conditions:
 Temperature: 22°C
 Relative Humidity: 39%
 Pressure:100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07659	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00786	Preamplifier	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMM-48	8/8/2019	8/8/2021
	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
T6	ANDCCF	Duty Cycle Correction Factor		1/7/2021	1/7/2031
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
	AN00309	Preamplifier	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6			Table	dBμV/m	dBμV/m	dB	Ant
1	2483.500M	76.2	+0.0	+28.3	+0.3	-38.6	+0.0	51.4	54.0	-2.6	Vert
	Ave		+3.3	-18.1			237		Bandedge_H		221
^	2483.500M	76.2	+0.0	+28.3	+0.3	-38.6	+0.0	69.5	54.0	+15.5	Vert
			+3.3	+0.0			237		Bandedge_H		221
3	2390.000M	61.4	+0.0	+28.3	+0.3	-38.6	+0.0	36.5	54.0	-17.5	Vert
	Ave		+3.2	-18.1			167		Bandedge_L		210
^	2390.000M	61.4	+0.0	+28.3	+0.3	-38.6	+0.0	54.6	54.0	+0.6	Vert
			+3.2	+0.0			167		Bandedge_L		210
5	2400.000M	67.7	+0.0	+28.3	+0.3	-38.6	+0.0	60.9	88.0	-27.1	Vert
			+3.2	+0.0			167		Bandedge_L_100k		210
									Hz		

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 #: **105380** Date: 6/8/2021
 Test Type: **Radiated Scan** Time: 16:27:12
 Tested By: E. Wong Sequence#: 16
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

The EUT is placed on Styrofoam platform and the Blue port receives power from remotely located support power supply set 3.6Vdc to simulate a fresh battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes, once configured, the laptop is removed from remote connection during course of testing. Black port is connected to a section of unterminated cable. EUT has fixed orientation per manufacture's specification.

Operating Frequency / Mode:
 2402MHz, 2440MHz, 2480MHz, BLE LV3 Folder 3

Frequency of Measurement: 9k-25000MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-25000MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 12.5ms per 100ms. Duty cycle correction factor=20log (12.5/100) = -18.1 dB. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

Test Environment Conditions:

Temperature: 22°C
 Relative Humidity: 39%
 Pressure: 100kPa

Site A

Test Method: ANSI C63.10-2013 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	4/29/2020	4/29/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP07659	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022
T4	AN00786	Preamplifier	83017A	5/20/2020	5/20/2022
T5	ANP06360	Cable	L1-PNMM-48	8/8/2019	8/8/2021
	AN03385	High Pass Filter	11SH10-3000/T10000-O/O	5/17/2021	5/17/2023
T6	ANDCCF	Duty Cycle Correction Factor		1/7/2021	1/7/2031
	AN03367	Horn Antenna	62-GH-62-25.	8/1/2019	8/1/2021
	AN00851	Biconilog Antenna	CBL6111C	4/14/2020	4/14/2022
	ANP05505	Attenuator	NAT-6	5/26/2021	5/26/2023
	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/21/2020	12/21/2022
	AN00309	Preamplifier	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2020	12/24/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN01413	Horn Antenna	84125-80008	10/19/2020	10/19/2022
	ANP07658	Cable	32022-29094K-29094K-24TC	7/30/2020	7/30/2022

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	T5	T6			Table	dBμV/m	dBμV/m	dB	Ant
1	2400.000M	95.0	+0.0	+28.3	+0.3	-38.6	+0.0	88.2	92.0	-3.8	Vert
			+3.2	+0.0			198		Bandedge L		196
2	2483.500M	74.2	+0.0	+28.3	+0.3	-38.6	+0.0	49.4	54.0	-4.6	Vert
	Ave		+3.3	-18.1			198		Bandedge H		196
^	2483.500M	74.2	+0.0	+28.3	+0.3	-38.6	+0.0	67.5	54.0	+13.5	Vert
			+3.3	+0.0			198		Bandedge H		196
4	2390.000M	62.5	+0.0	+28.3	+0.3	-38.6	+0.0	37.6	54.0	-16.4	Vert
	Ave		+3.2	-18.1			198		Bandedge L		196
^	2390.000M	62.5	+0.0	+28.3	+0.3	-38.6	+0.0	55.7	54.0	+1.7	Vert
			+3.2	+0.0			198		Bandedge L		196
6	2400.000M	70.7	+0.0	+28.3	+0.3	-38.6	+0.0	63.9	90.5	-26.6	Vert
			+3.2	+0.0			260		Bandedge L_100kHz		198

Test Setup Photo(s)



Configuration 1; Below 1GHz, View 1



Configuration 1; Below 1GHz, View 2



Configuration 1; Above 1GHz, View 1



Configuration 1; Above 1GHz, View 2



Configuration 2, Below 1GHz, View 1



Configuration 2, Below 1GHz, View 2



Configuration 2; Above 1GHz, View 1



Configuration 2; Above 1GHz, View 2



Configuration 3; Below 1GHz, View 1



Configuration 3; Below 1GHz, View 2



Configuration 3; Above 1GHz, View 1



Configuration 3; Above 1GHz, View 2



Above 1GHz; View 1



Above 1GHz; View 2

15.247(e) Power Spectral Density

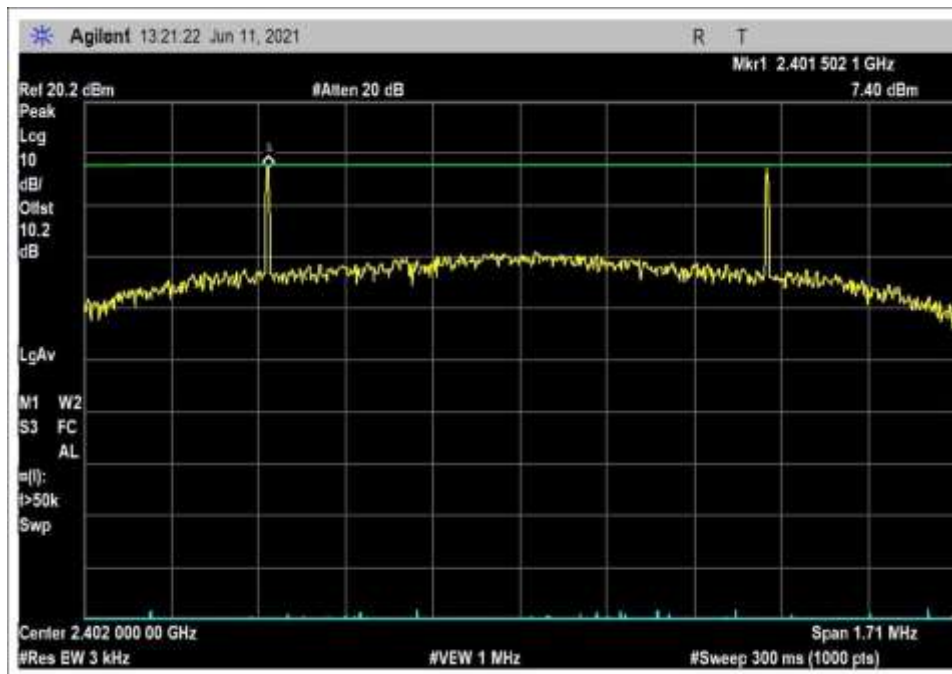
Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013), 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019	Test Date(s):	6/11/2021
Configuration:	4		
Test Setup:	The EUT is placed on test bench and the Blue port receives power from remotely located support power supply set 3.6Vdc to simulate a fresh battery. The EUT's data port is connected to a remote located laptop running CLI Tool ver.2.0.1.24 via USB cable for configuration purposes. Note: Three EUTs have the same internal hardware. Conducted data measured on one EUT represents for all three EUTs. Correction factor is compensated for.		

Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	38

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	4/29/2020	4/29/2022
03430	Attenuator	Aeroflex/ Weinschel	75A-10-12	12/20/2019	12/20/2021
07659	Cable	Astrolab, Inc.	32022-29094K- 29094K-24TC	7/30/2020	7/30/2022

Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
2402	GFSK /folder 3	7.4	≤8	Pass
2440	GFSK/folder 3	7.8	≤8	Pass
2480	GFSK/folder 3	7.8	≤8	Pass
2402	GFSK/folder 4	7.4	≤8	Pass
2440	GFSK/folder 4	7.9	≤8	Pass
2480	GFSK/folder 4	7.9	≤8	Pass

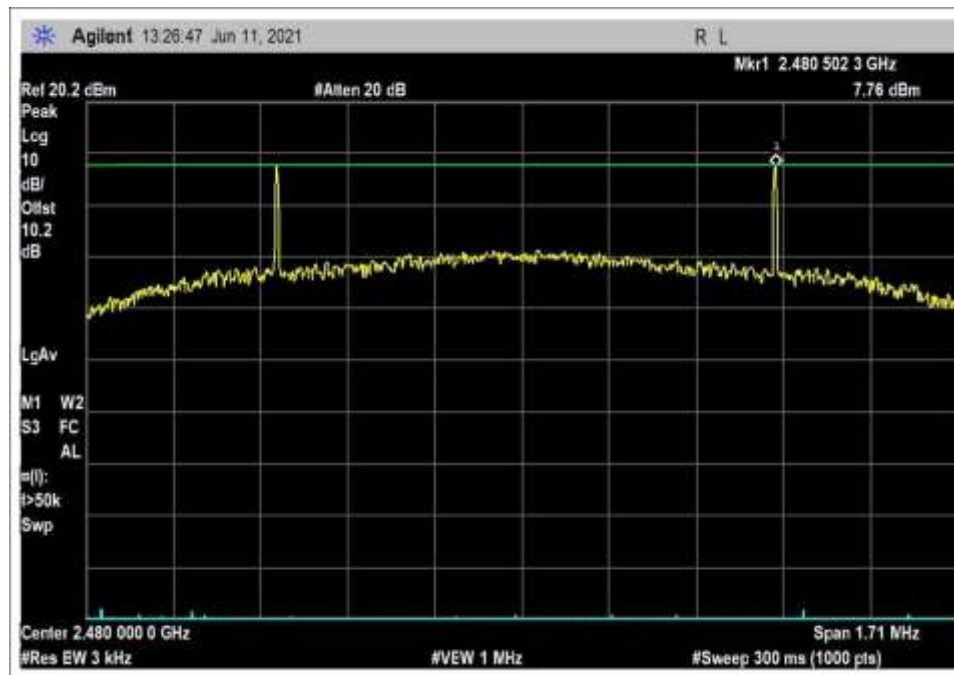
Plots – Folder 3



Low Channel

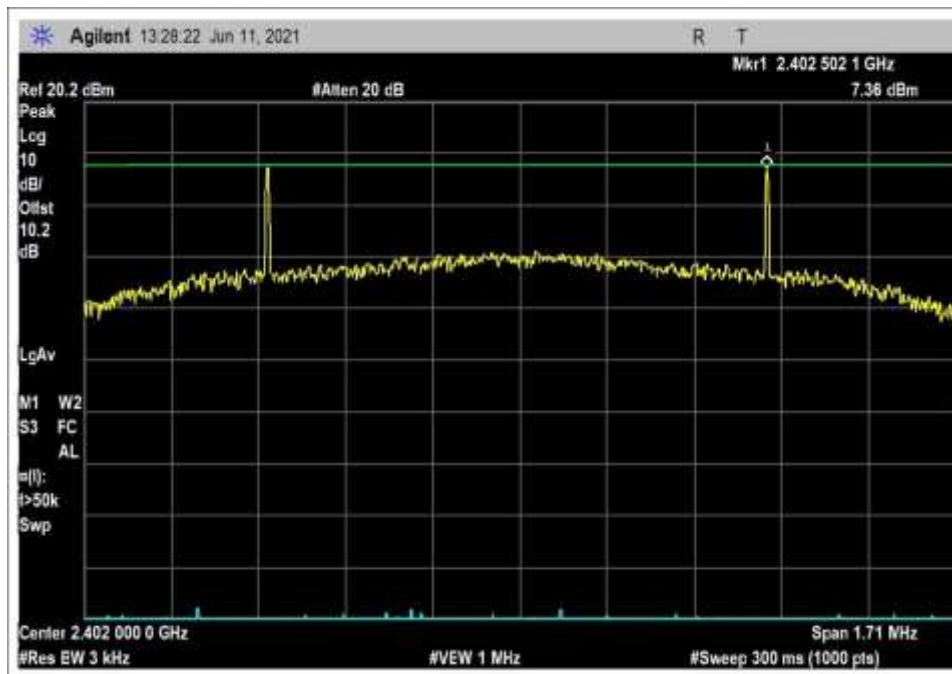


Middle Channel



High Channel

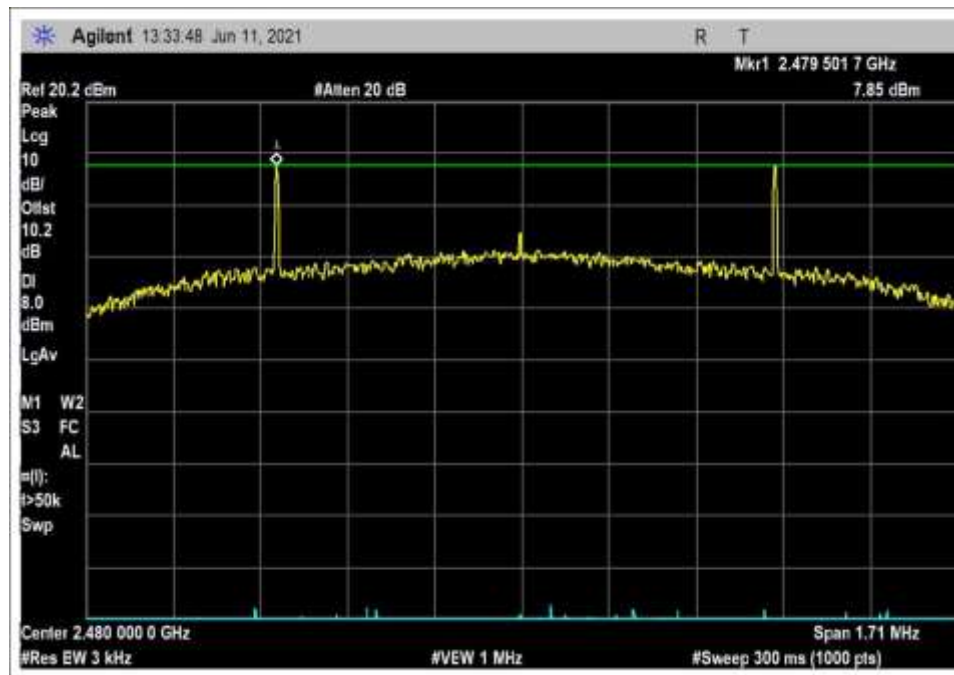
Plots – Folder 4



Low Channel

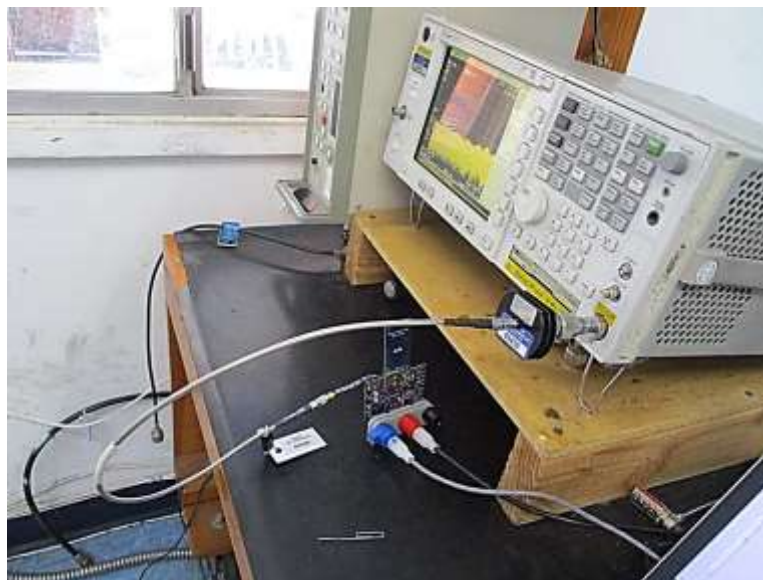


Middle Channel



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 $\text{dB}\mu\text{V}/\text{m}$, 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.