Itron, Inc.

REVISED TEST REPORT FOR 107148-5

Itron Cellular 500G Module
Model: 500GDC

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(DTS 2400-2483.5 MHz)

Report No.: 107148-5A

Date of issue: December 23, 2022

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.

Test Certificate # 803.01

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Johann Dejager
Customer Reference Number: 263856

REPORT PREPARED BY:

Viviana Prado
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107148

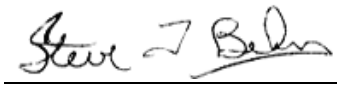
DATE OF EQUIPMENT RECEIPT: August 15, 2022
DATE(S) OF TESTING: August 15 - 22, 2022

Revision History

Original: Testing of the Itron Cellular 500G Module, Model: 500GDC to FCC Part 15.247
Revision A: Provided appropriate notes to indicate 15.207 AC Conducted Emissions were not applicable.

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.
Canyon Park
22116 23rd Drive S.E., Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

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	NA1
15.247(d)	Radiated Emissions & Band Edge	Mod. #1	Pass
15.247(e)	Power Spectral Density	NA	Pass
15.207	AC Conducted Emissions	NA	NA2

NA = Not Applicable
NA1 = Not applicable because the EUT does not have a permanent external antenna port.
NA2 = Not applicable because the EUT is battery powered.

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
Modification #1: For the band edge test only, the fundamental setting was reduced by 1dB on the high channel to meet the upper band edge. All other tests were done at the original max power setting as worst case at time of test. The manufacturer will reduce the fundamental on the high channel and possibly all channels by 1dB for the final production setting.

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
Itron Cellular 500G Module	Itron, Inc.	500GDC	107148-cond

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	NA
AC Adapter (for Laptop)	HP	L25296-002	NA
USB Hub	Insignia	NS-PCH5420	NA
USB Interface Board	Itron, Inc.	PCB-TEMP-0007 Rev3	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Itron Cellular 500G Module	Itron, Inc.	500GDC	107148-rad

Support Equipment:

Device	Manufacturer	Model #	S/N
USB Interface Board	Itron, Inc.	PCB-TEMP-0007 Rev3	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	802.15.1
Operating Frequency Range:	2402-2480
Modulation Type(s):	GFSK
Maximum Duty Cycle:	Assume 100% as worst case
Number of TX Chains:	1
Antenna Type(s) and Gain:	Wide band PCB dipole antenna, 2.1dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	3.68V Battery
Firmware / Software used for Test:	Support Laptop CLI Tool (Version 2.0.1.24) EUT App Version 10.0.48.8 EUT CSL Version 19.0.12.1
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

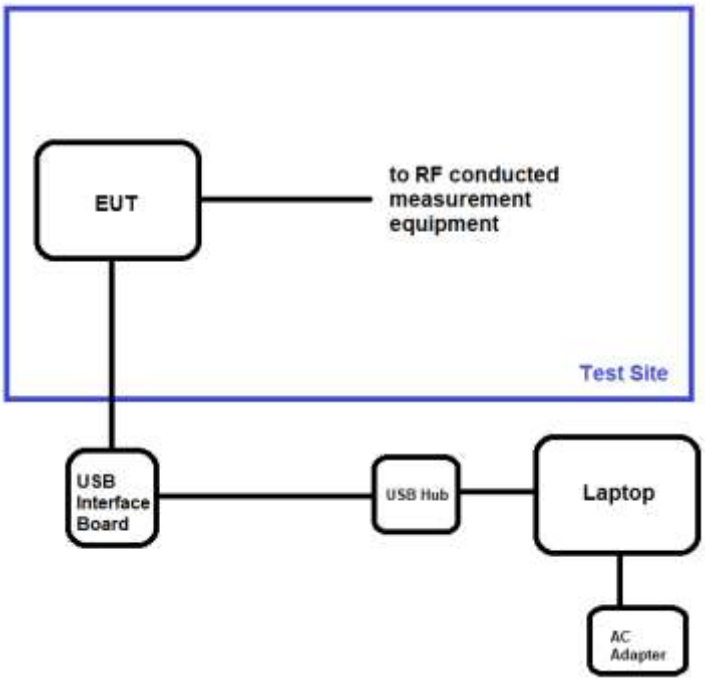
EUT and Accessory Photo(s)

Support Equipment Photo(s)

Block Diagram of Test Setup(s)

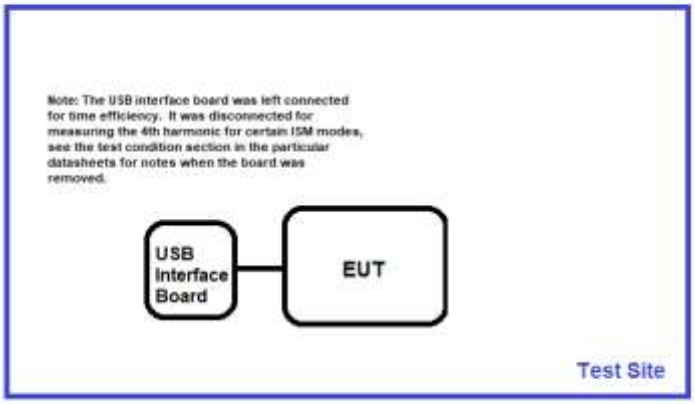
Configuration 1

Test Setup Block Diagram



Configuration 2

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a)(2) 6dB Bandwidth

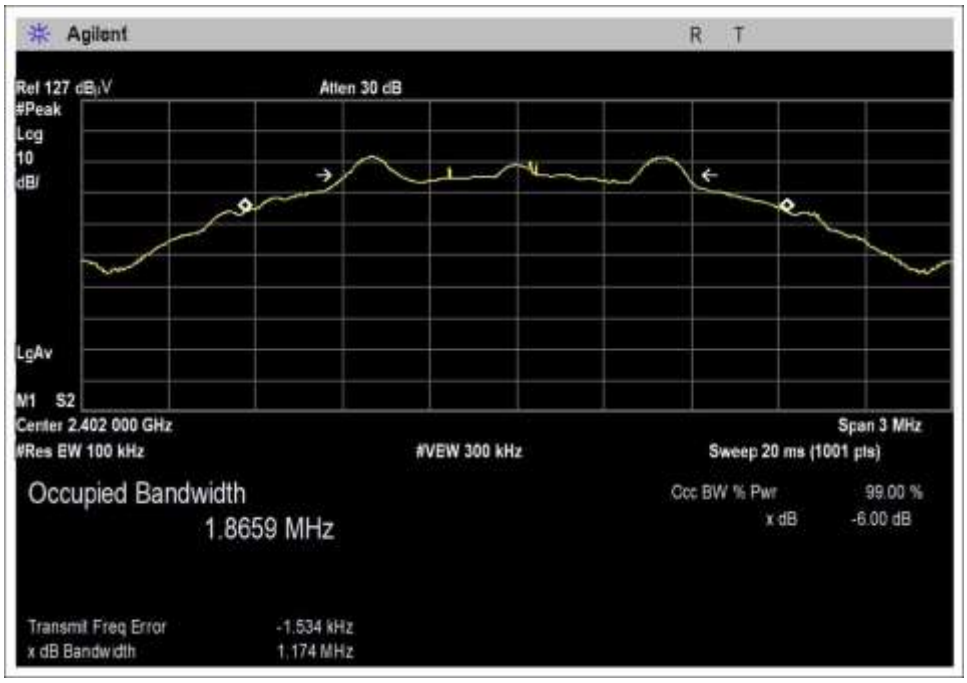
Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013), KDB 558074 (April 2, 2019)	Test Date(s):	8/15/2022
Configuration:	1		
Test Setup:	EUT has temporary antenna connector attached. EUT directly connected to spectrum analyzer through appropriate cables and attenuators. EUT is transmitting with modulation.		

Environmental Conditions			
Temperature (ºC)	21	Relative Humidity (%):	40

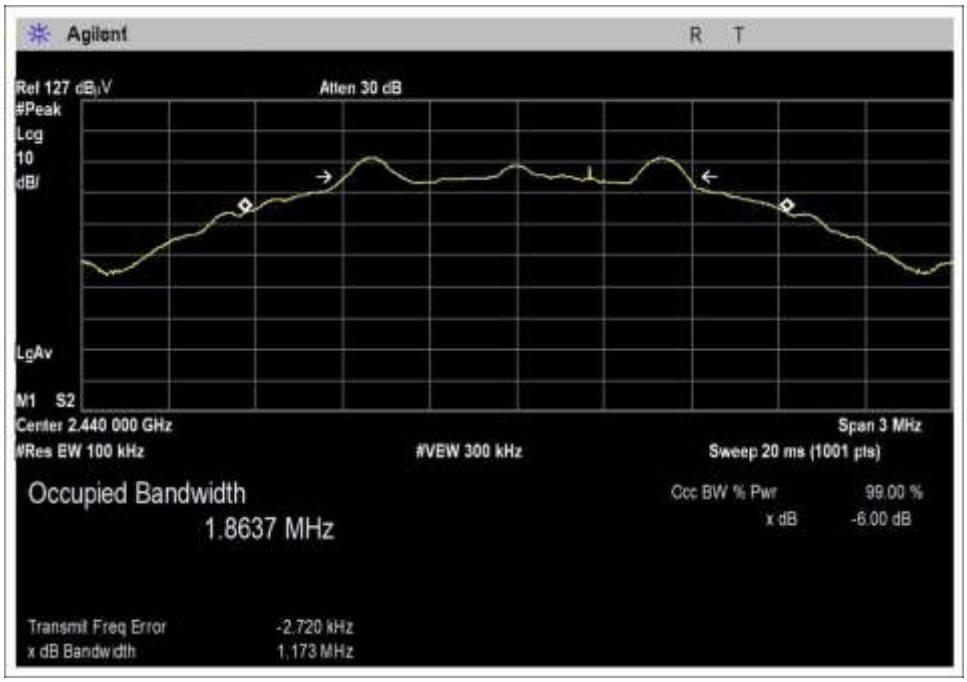
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02872	Spectrum Analyzer	Agilent	E4440A	11/29/2021	11/29/2023
P06452	Cable	Andrews	Heliax	1/17/2022	1/17/2024
P05503	Attenuator	Narda	766-10	6/8/2021	6/8/2023

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
2402	1	GFSK	1174	≥500	Pass
2440	1	GFSK	1173	≥500	Pass
2480	1	GFSK	1174	≥500	Pass

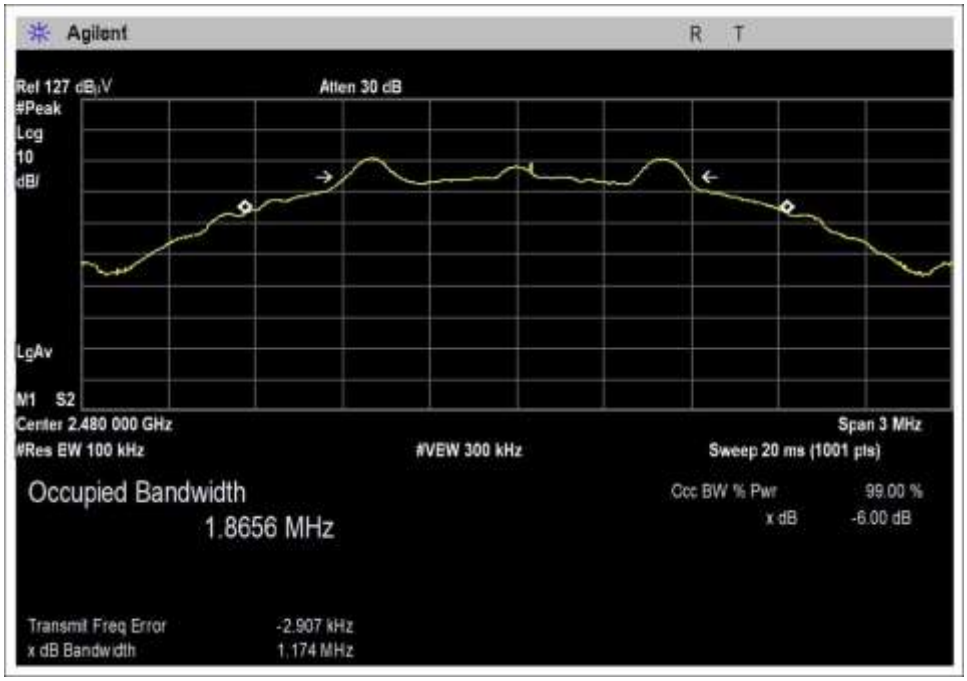
Plot(s)



Low Channel



Middle Channel



High Channel

Test Setup Photo(s)

15.247(b)(3) Output Power

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using a fresh battery.

Power Output 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	PCB/2.1dBi	14.0	≤30	Pass
2440	GFSK	PCB/2.1dBi	13.8	≤30	Pass
2480	GFSK	PCB/2.1dBi	13.2	≤30	Pass

For fixed point-to-point antennas, the limit is calculated in accordance with 15.247(c)(1):

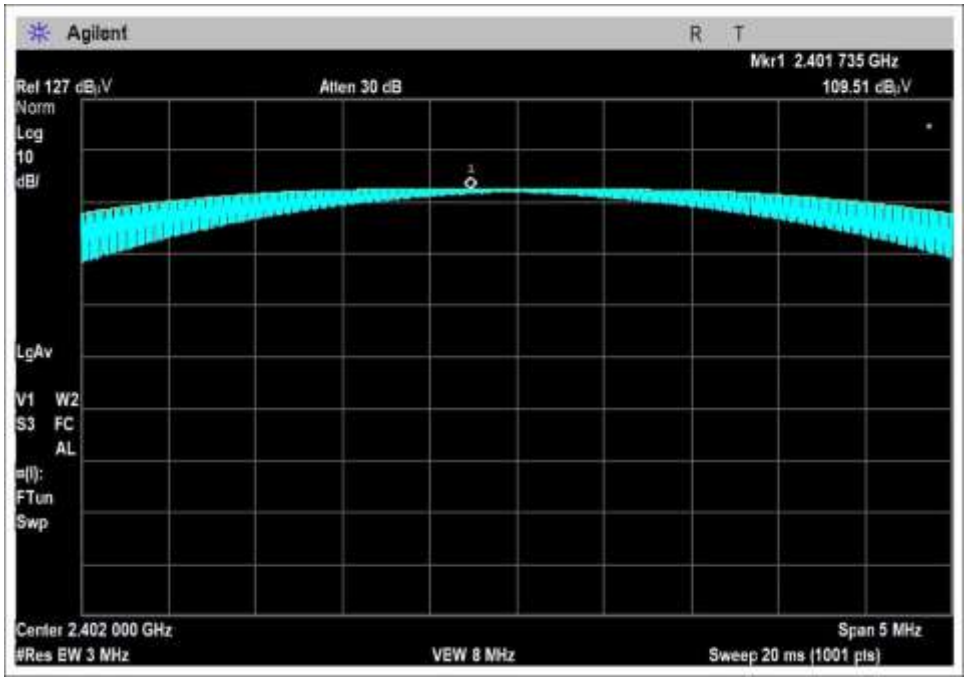
$$Limit = 30 - Roundup\left(\frac{G-6}{3}\right)$$

For directional beamforming antennas, the limit is calculated in accordance with 15.247(c)(2) and KDB 662911.

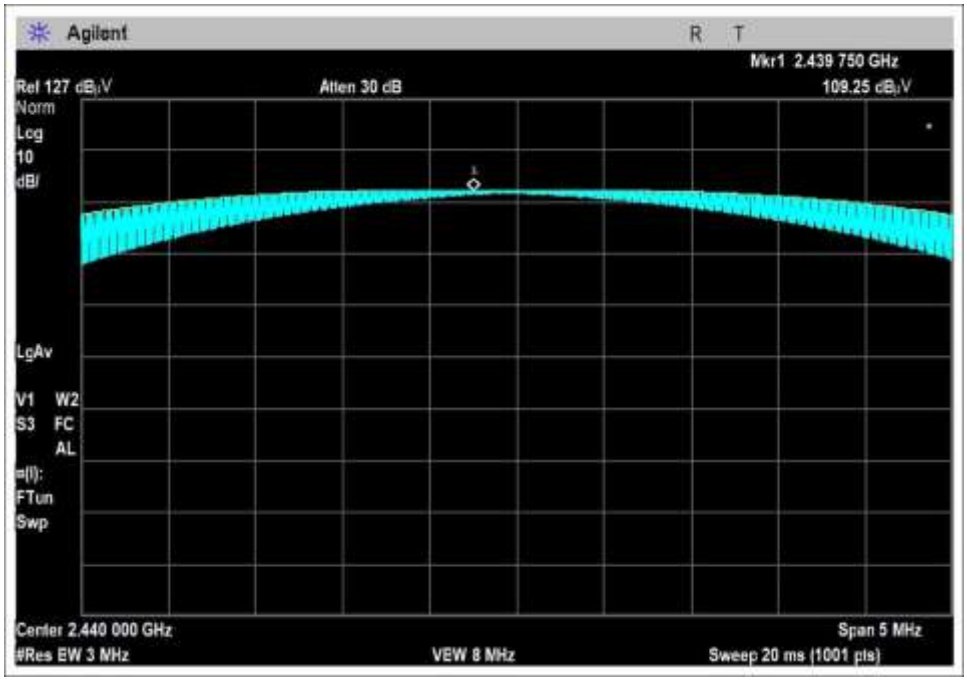
For all other antennas, the limit is calculated according to a maximum of 1W (30 dBm) conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b)

$$Limit = 30 - Roundup(G - 6)$$

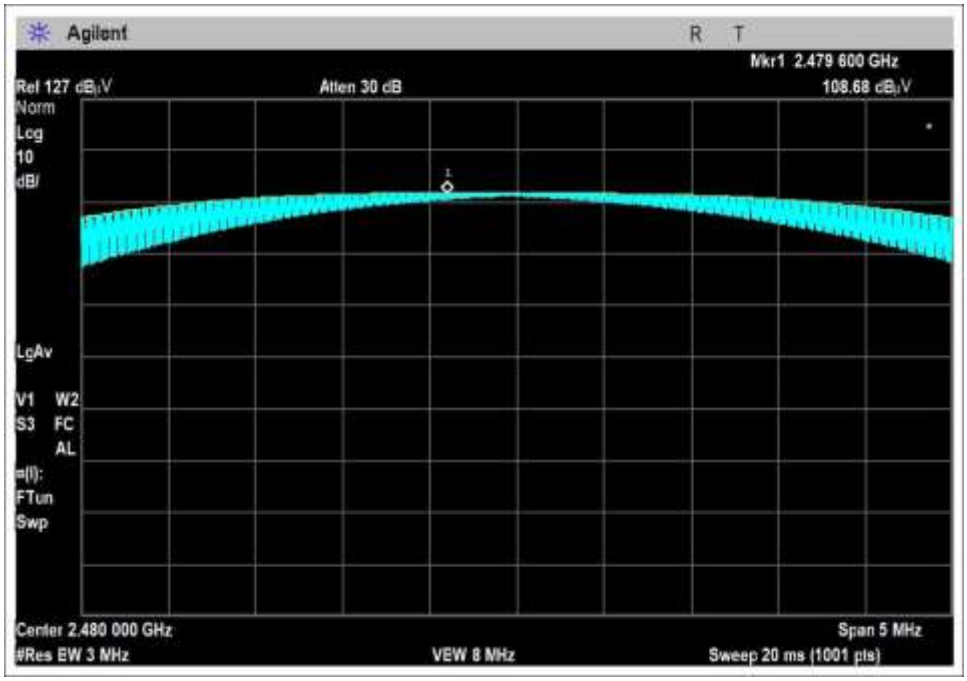
Plots



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(b) Power Output (2400-2483.5 MHz DTS)**		
Work Order #:	**107148**	Date:	8/16/2022
Test Type:	**Conducted Emissions**	Time:	07:21:58
Tested By:	Matt Harrison	Sequence#:	5
Software:	EMITest 5.03.20		3.67VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

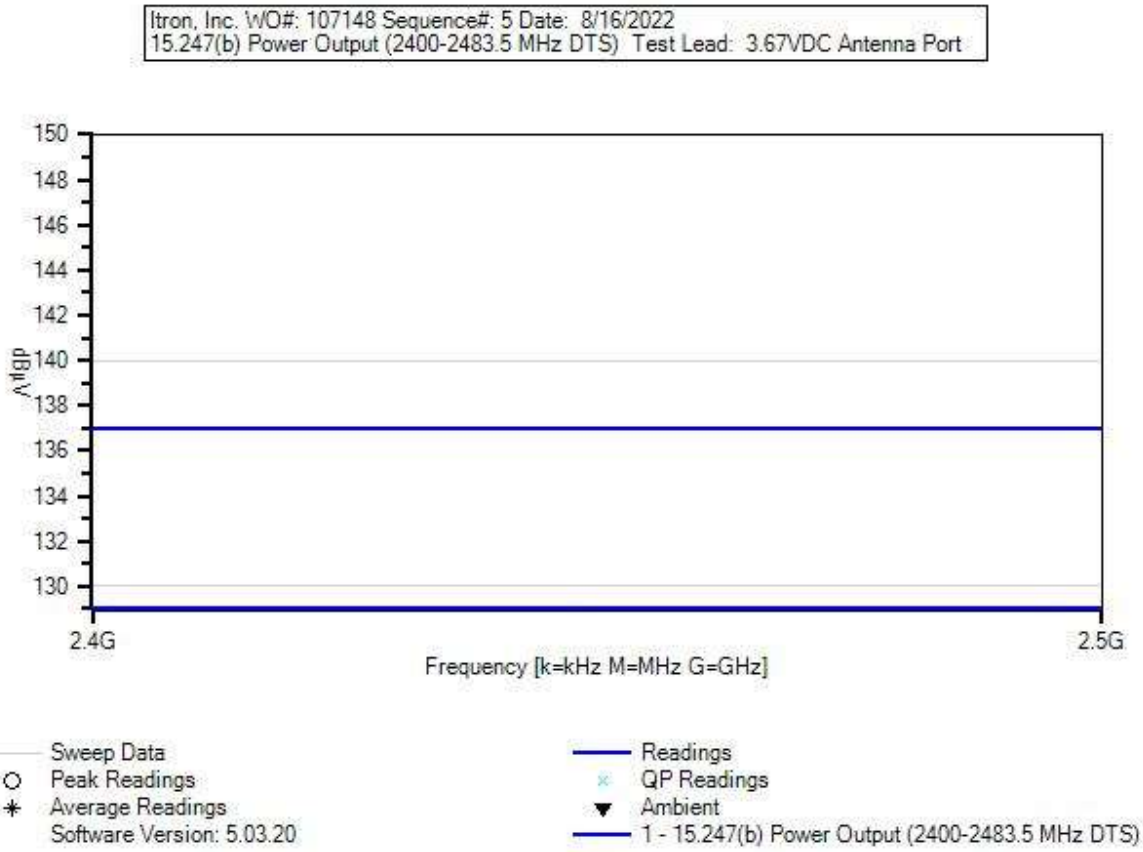
Test Conditions / Notes:

Environmental Conditions:
Temperature: 21°C
Humidity: 40%
Pressure: 102.5kPa

Method: ANSI C63.10 (2013)

Frequency: Fundamental

Setup:
EUT is setup for Conducted Measurements.
It is connected directly to the spectrum analyzer via cable and attenuator.



Test Equipment:

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	6/8/2021	6/8/2023
T2	ANP06452	Cable	Heliax	1/17/2022	1/17/2024
T3	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023

Measurement Data: Reading listed by margin. Test Lead: Antenna Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2401.675M	109.5	+10.2	+1.3	+0.0		+0.0	121.0	137.0	-16.0	Anten
2	2439.750M	109.3	+10.2	+1.3	+0.0		+0.0	120.8	137.0	-16.2	Anten
3	2479.600M	108.7	+10.2	+1.3	+0.0		+0.0	120.2	137.0	-16.8	Anten

Test Setup Photo(s)

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107148**	Date:	8/19/2022
Test Type:	**Maximized Emissions**	Time:	18:05:08
Tested By:	Matt Harrison/Mike Atkinson	Sequence#:	17
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 24°C
Humidity: 46%
Pressure: 101.4kPa

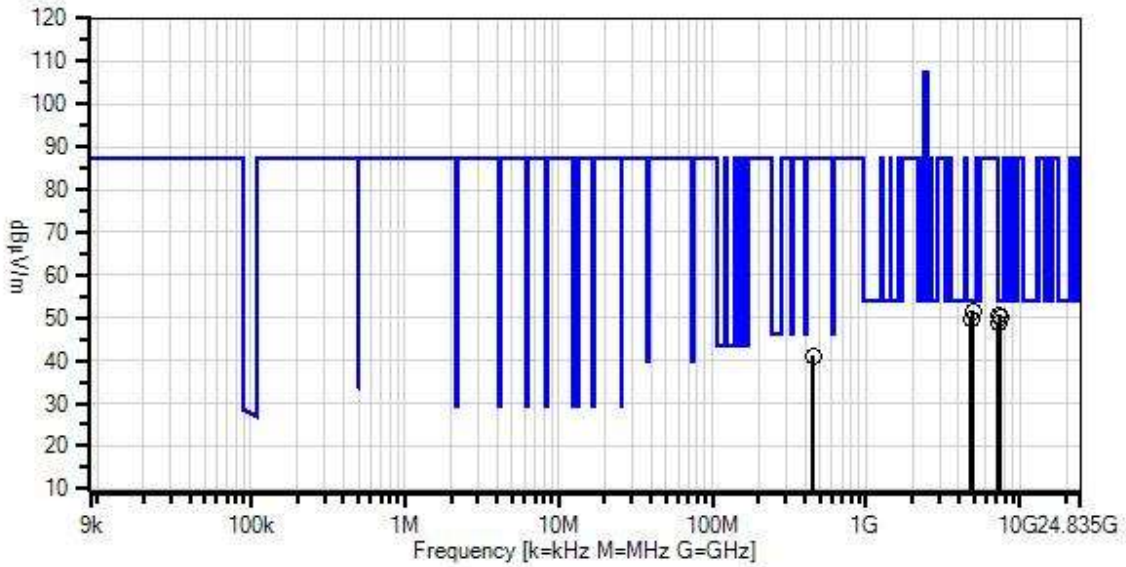
Method: ANSI C63.10 (2013)

Frequency: 9kHz-25GHz

Setup:
EUT is on foam table.
EUT is transmitting with modulation.
2 orientations investigated per manufacturer installed use case, worst case reported.
Horizontal and vertical antenna polarities investigated, worst case reported.

Notes:
No Emissions found within 20dB of the limit below 30MHz or above 10GHz.

Itron, Inc. WO#: 107148 Sequence#: 17 Date: 8/19/2022
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: 5.03.20

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP06515	Cable	Heliax	5/23/2022	5/23/2024
	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T4	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T5	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
	ANP07226	Attenuator	PE7004-6	8/9/2021	8/9/2023
	ANP07929	Attenuator	PE7004-6	3/7/2022	3/7/2024
T7	AN03116	High Pass Filter	11SH10-00313	2/11/2021	2/11/2023
	AN02741	Active Horn Antenna	AMFW-5F-12001800-20-10P	5/13/2021	5/13/2023
	AN02742	Active Horn Antenna	AMFW-5F-18002650-20-10P	11/11/2020	11/11/2022
	ANP07900	Cable	CLU40-KMKM-10.00F	3/18/2022	3/18/2024
	ANP07901	Cable	CLU40-KMKM-10.00F	3/18/2022	3/18/2024
	AN02763-69	Waveguide	Multiple	3/11/2022	3/11/2024

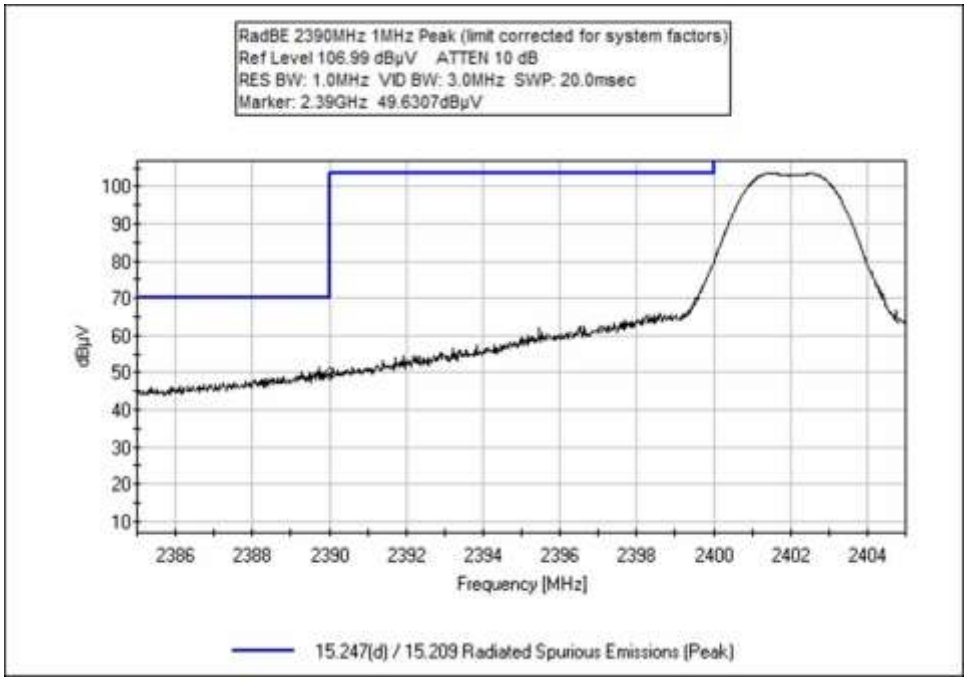
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

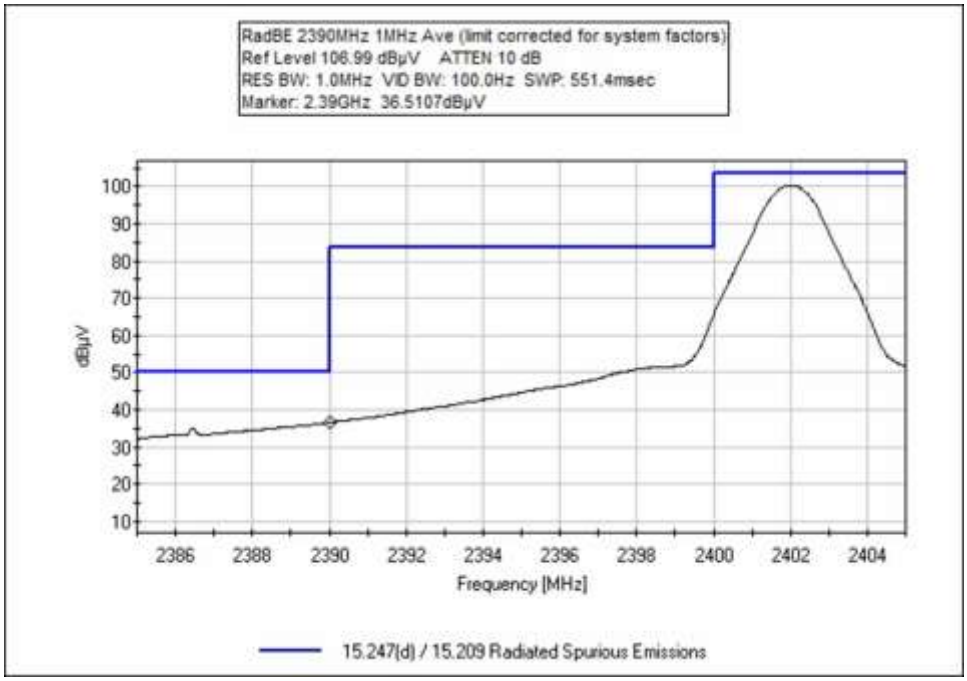
#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4958.930M	44.2	+0.0 +33.8	+0.7 +0.7	+4.4 +0.9	-33.4	+0.0	51.3	54.0	-2.7	Horiz
2	7318.590M	40.0	+0.0 +37.5	+1.3 +0.7	+4.8 +1.2	-34.9	+0.0	50.6	54.0	-3.4	Horiz
3	7441.540M	39.4	+0.0 +37.5	+1.4 +0.7	+5.0 +0.9	-34.8	+0.0	50.1	54.0	-3.9	Horiz
4	4805.180M	44.2	+0.0 +33.2	+0.6 +0.5	+4.0 +0.8	-33.6	+0.0	49.7	54.0	-4.3	Horiz
5	4881.090M	42.9	+0.0 +33.6	+0.7 +0.6	+4.2 +0.9	-33.5	+0.0	49.4	54.0	-4.6	Horiz
6	7206.000M	38.9	+0.0 +36.9	+1.2 +0.7	+4.7 +1.1	-34.9	+0.0	48.6	87.5	-38.9	Horiz
7	449.000M	15.1	+0.0 +0.0	+0.2 +0.0	+1.1 +0.0	+0.0	+0.0	41.0	87.5	-46.5	Vert/

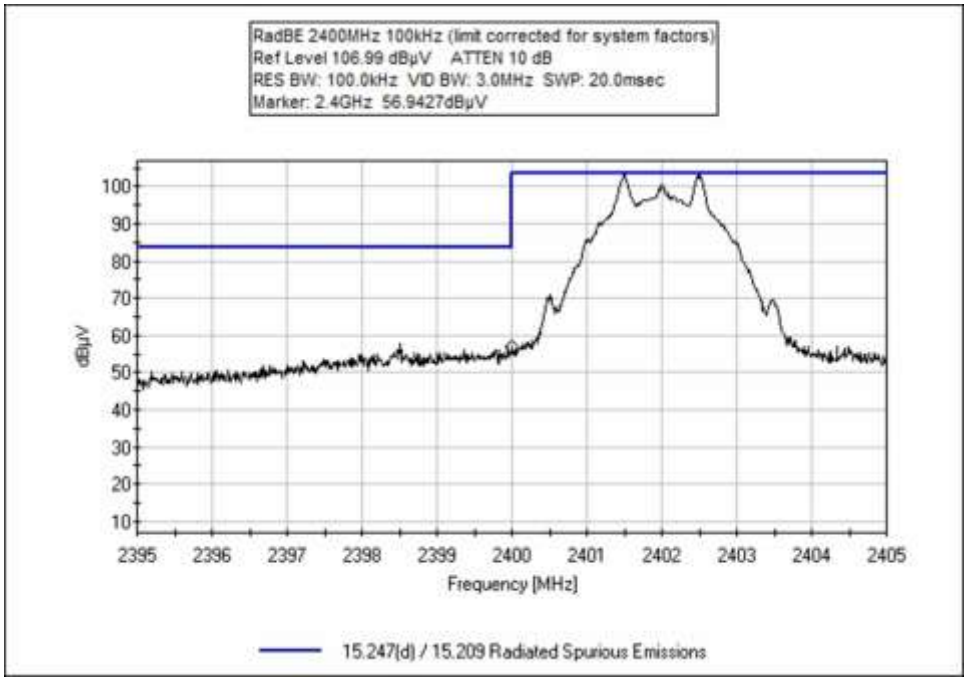
Band Edge

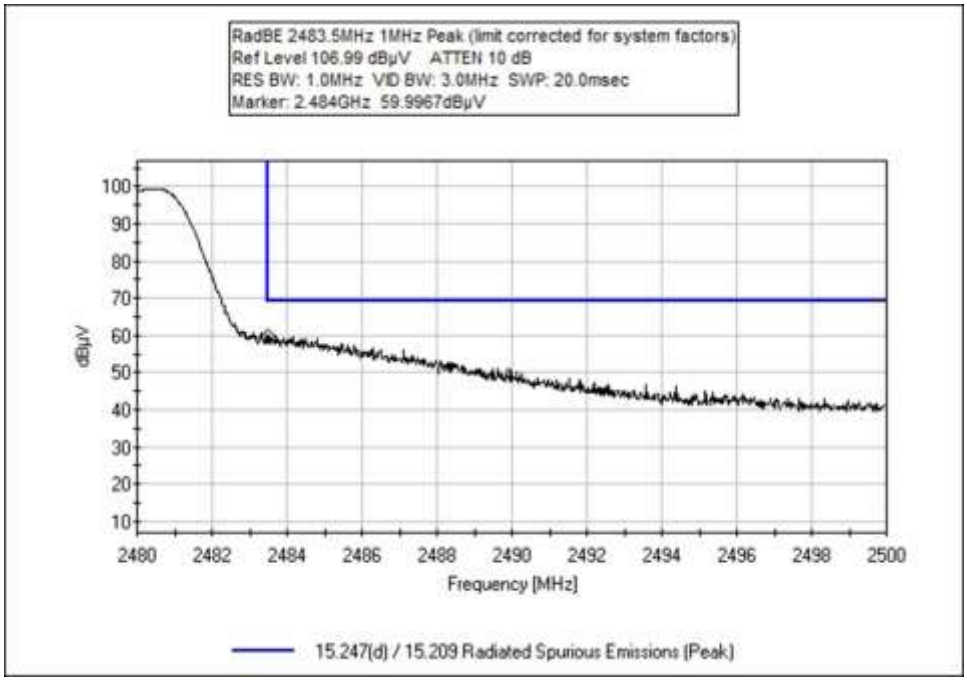
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
2390.0 (1MHz Peak)	GFSK	Int PCB	53.4	<74	Pass
2390.0 (1MHz Ave)	GFSK	Int PCB	40.3	<54	Pass
2400.0 (100kHz Peak)	GFSK	Int PCB	60.8	<87.5	Pass
2483.5 (1MHz Peak)	GFSK	Int PCB	64.7	<74	Pass
2483.5 (1MHz Ave)	GFSK	Int PCB	53.3	<54	Pass

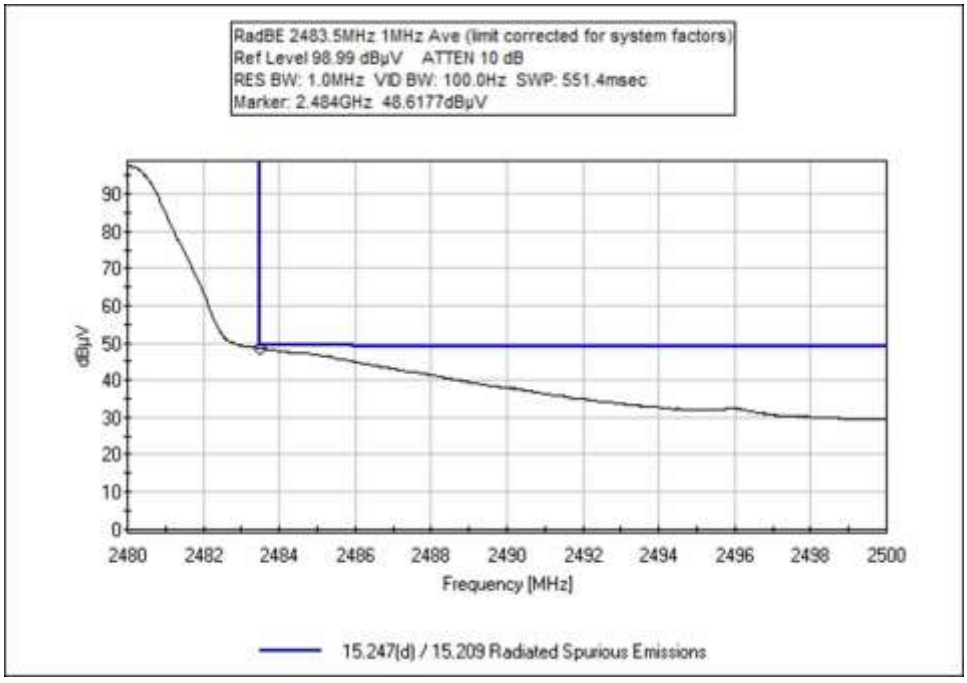
Band Edge Plots

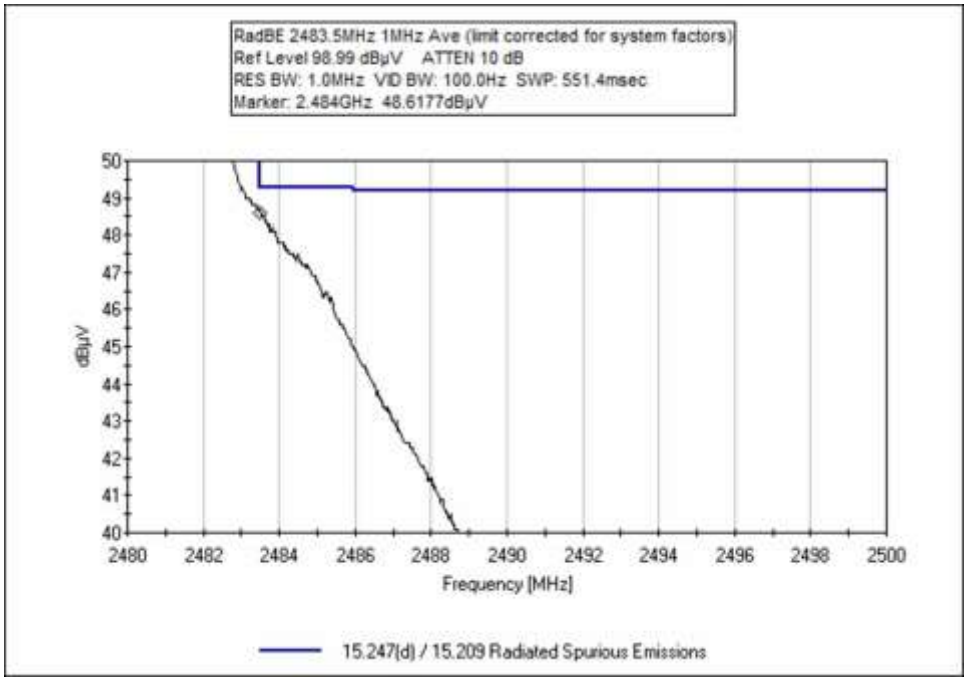





RadBE 2400MHz 100kHz (limit corrected for system factors)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 2.4GHz 56.9427dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


RadBE 2483.5MHz 1MHz Peak (limit corrected for system factors)
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 3.0MHz SWP: 20.0msec
Marker: 2.484GHz 59.9967dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions (Peak)


RadBE 2483.5MHz 1MHz Ave (limit corrected for system factors)
Ref Level 98.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 100.0Hz SWP: 551.4msec
Marker: 2.484GHz 48.6177dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


RadBE 2483.5MHz 1MHz Ave (limit corrected for system factors)
Ref Level 98.99 dBµV ATTEN 10 dB
RES BW: 1.0MHz VID BW: 100.0Hz SWP: 551.4msec
Marker: 2.484GHz 48.6177dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107148**	Date:	8/22/2022
Test Type:	**Maximized Emissions**	Time:	16:44:03
Tested By:	Michael Atkinson	Sequence#:	22
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Environmental Conditions:
Temperature: 24°C
Humidity: 46%
Pressure: 101.4kPa

Method: ANSI C63.4 (2014)

Frequency: Fund

Setup:
EUT is on foam table.
EUT is in standby/receive mode..
2 orientations investigated per manufacturer installed use case, worst case reported.
Horizontal and vertical antenna polarities investigated, worst case reported.
Max EUT frequency used is less than 2.5GHz.

Modification #1 was in place during testing.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP06515	Cable	Heliax	5/23/2022	5/23/2024
T4	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T5	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T7	ANP07226	Attenuator	PE7004-6	8/9/2021	8/9/2023

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

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2483.500M	48.6	+0.0	+0.5	+2.8	+29.4	+0.0	53.3	54.0	-0.7	Vert
	Ave		-34.2	+0.3	+5.9						
^	2483.500M	60.0	+0.0	+0.5	+2.8	+29.4	+0.0	64.7	74.0	-9.3	Vert
			-34.2	+0.3	+5.9						
3	2390.000M	36.5	+0.0	+0.5	+2.7	+28.7	+0.0	40.3	54.0	-13.7	Vert
	Ave		-34.3	+0.3	+5.9						
^	2390.000M	49.6	+0.0	+0.5	+2.7	+28.7	+0.0	53.4	74.0	-20.6	Vert
			-34.3	+0.3	+5.9						
5	2400.000M	56.9	+0.0	+0.5	+2.7	+28.8	+0.0	60.8	87.5	-26.7	Vert
			-34.3	+0.3	+5.9				100kHz Peak		

Test Setup Photo(s)

Orientation 1

Orientation 2

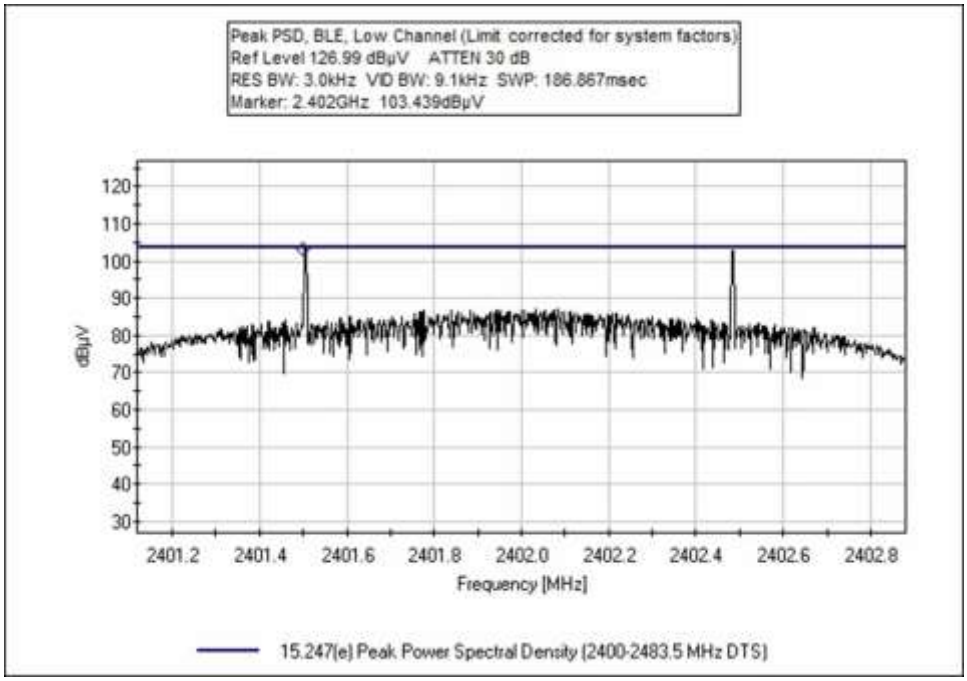
Below 1GHz

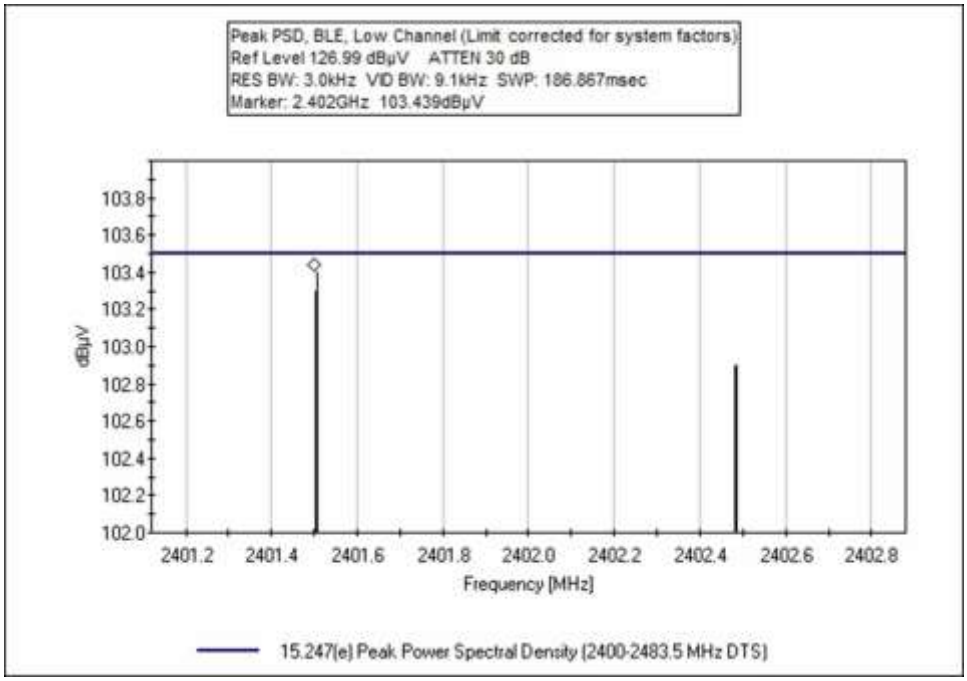
Above 1GHz

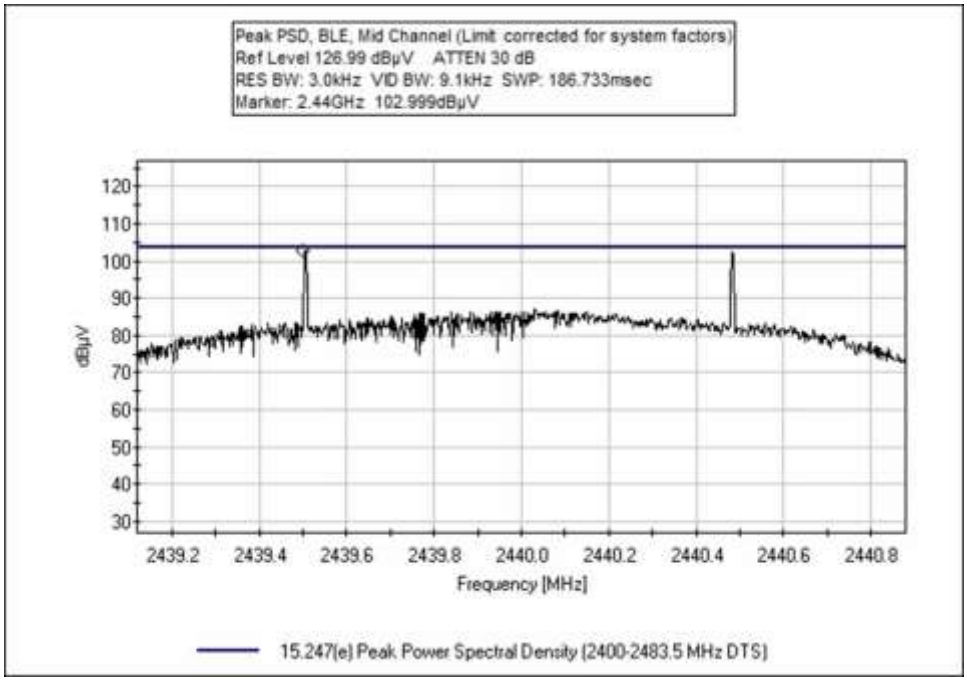
15.247(e) Power Spectral Density

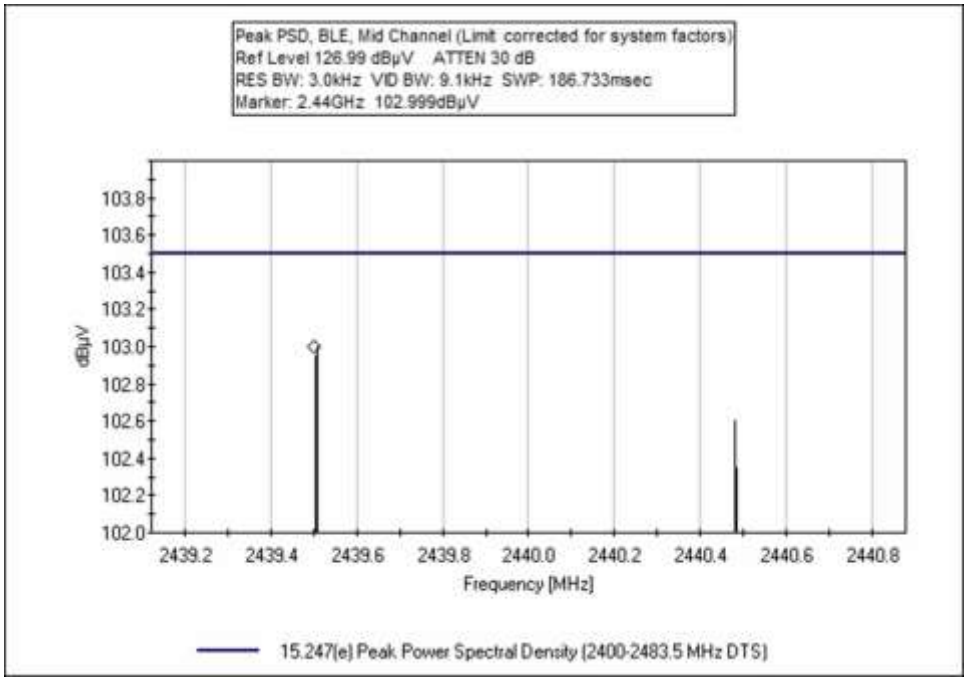
PSD Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	**Modulation**	**Measured (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
2402	GFSK	7.9	≤8	Pass
2440	GFSK	7.5	≤8	Pass
2480	GFSK	6.9	≤8	Pass

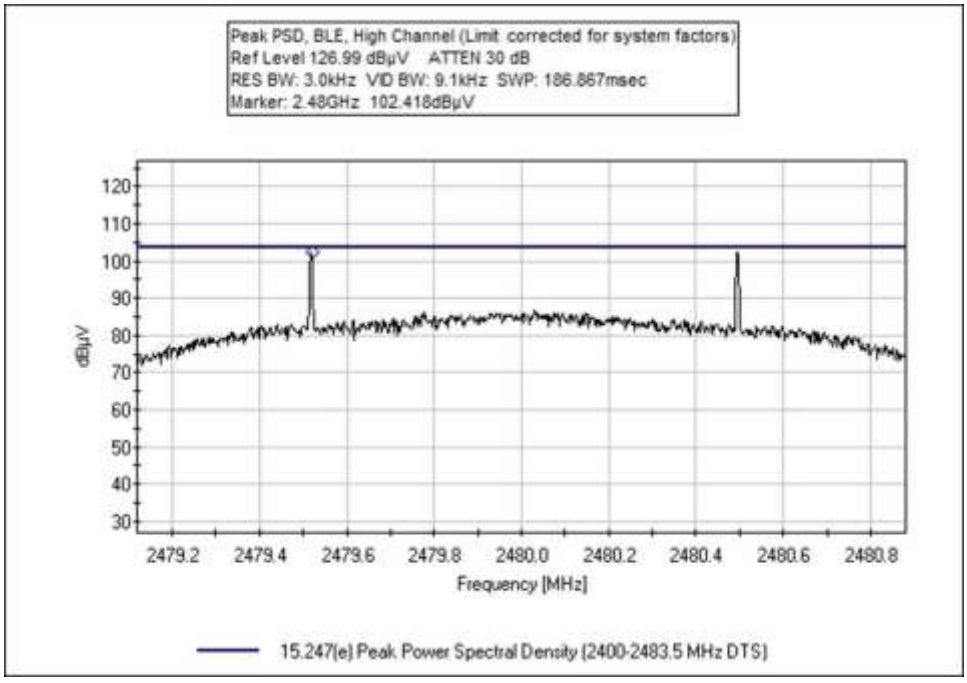
Plots

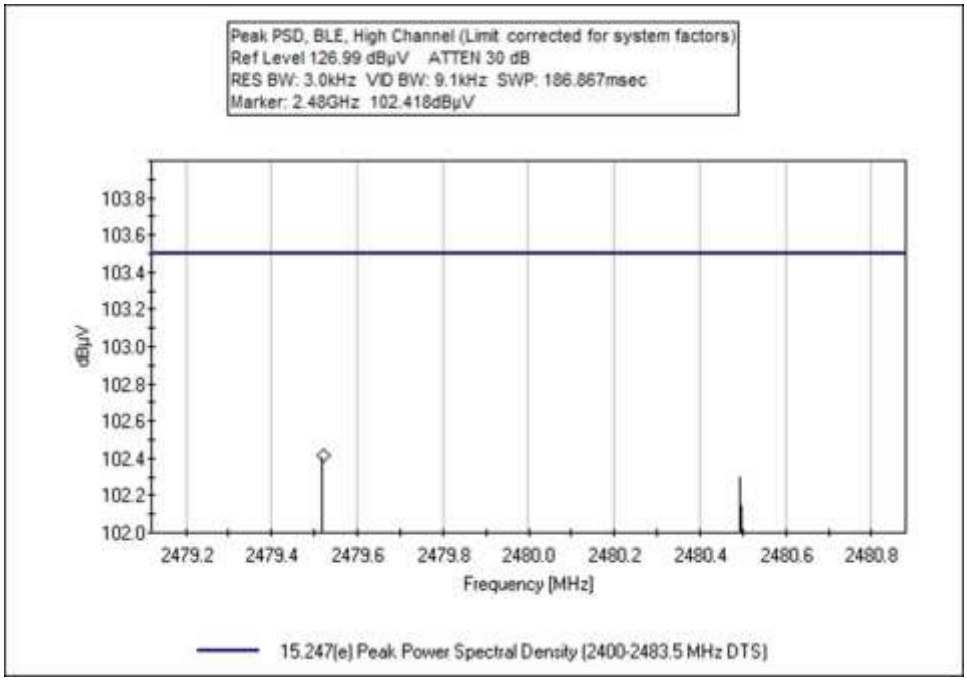

Peak PSD, BLE, Low Channel (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 186.867msec
Marker: 2.402GHz 103.439dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
2401.2
2401.4
2401.6
2401.8
2402.0
2402.2
2402.4
2402.6
2402.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)


Peak PSD, BLE, Low Channel (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 186.867msec
Marker: 2.402GHz 103.439dBµV
dBµV
103.8
103.6
103.4
103.2
103.0
102.8
102.6
102.4
102.2
102.0
2401.2
2401.4
2401.6
2401.8
2402.0
2402.2
2402.4
2402.6
2402.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)


Peak PSD, BLE, Mid Channel (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 186.733msec
Marker: 2.44GHz 102.999dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
2439.2
2439.4
2439.6
2439.8
2440.0
2440.2
2440.4
2440.6
2440.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)


Peak PSD, BLE, Mid Channel (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 186.733msec
Marker: 2.44GHz 102.999dBµV
dBµV
103.8
103.6
103.4
103.2
103.0
102.8
102.6
102.4
102.2
102.0
2439.2
2439.4
2439.6
2439.8
2440.0
2440.2
2440.4
2440.6
2440.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)


Peak PSD, BLE, High Channel (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 186.867msec
Marker: 2.48GHz 102.418dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
2479.2
2479.4
2479.6
2479.8
2480.0
2480.2
2480.4
2480.6
2480.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)


Peak PSD, BLE, High Channel (Limit corrected for system factors)
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 186.867msec
Marker: 2.48GHz 102.418dBµV
dBµV
103.8
103.6
103.4
103.2
103.0
102.8
102.6
102.4
102.2
102.0
2479.2
2479.4
2479.6
2479.8
2480.0
2480.2
2480.4
2480.6
2480.8
Frequency [MHz]
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**		
Work Order #:	**107148**	Date:	8/16/2022
Test Type:	**Conducted Emissions**	Time:	07:49:08
Tested By:	Matt Harrison	Sequence#:	10
Software:	EMITest 5.03.20		3.67VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

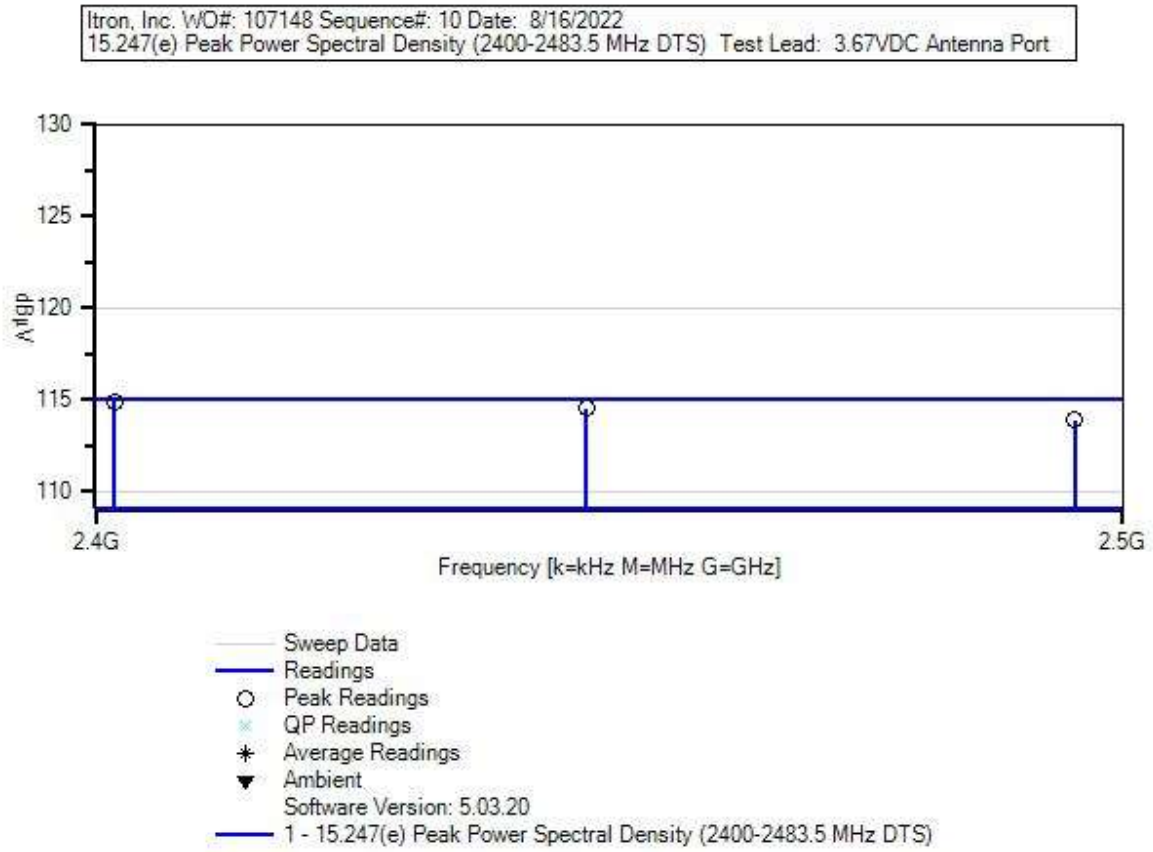
Test Conditions / Notes:

Environmental Conditions:
Temperature: 21°C
Humidity: 40%
Pressure: 102.5kPa

Method: ANSI C63.10 (2013)

Frequency: Fundamental

Setup:
EUT is setup for Conducted Measurements.
It is connected directly to the spectrum analyzer via cable and attenuator.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	6/8/2021	6/8/2023
T2	ANP06452	Cable	Heliax	1/17/2022	1/17/2024
T3	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023

Measurement Data: Reading listed by margin. Test Lead: Antenna Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2401.500M	103.4	+10.2	+1.3	+0.0		+0.0	114.9	115.0	-0.1	Anten
2	2439.500M	103.0	+10.2	+1.3	+0.0		+0.0	114.5	115.0	-0.5	Anten
3	2479.521M	102.4	+10.2	+1.3	+0.0		+0.0	113.9	115.0	-1.1	Anten

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.