

Itron, Inc.

REVISED TEST REPORT FOR 107148-4

Itron Cellular 500G Module Model: 500GDC

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(HYBRID 902-928 MHz)

Report No.: 107148-4A

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

This report contains a total of 39 pages and may be reproduced in full only. Partial reproduction may only be done with the written consent of CKC Laboratories, Inc.

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	7
FCC Part 15 Subpart C	10
15.247(a) Transmitter Characteristics	10
15.247(a)(1) 20 dB Bandwidth	10
15.247(a)(1) Carrier Separation	13
15.247 (f) Hybrid Systems Power Spectral Density	15
15.247 (f) Power Spectral Density	15
15.247(b)(1) Output Power	20
15.247(d) Radiated Emissions & Band Edge	25
Supplemental Information	38
Measurement Uncertainty	38
Emissions Test Details	38

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 (Hybrid 902-928MHz)

Test Procedure	Description	Modifications	Results
15.247(a)(1)(i)	Occupied Bandwidth	NA	Pass
15.247(a)(1)	Carrier Separation	NA	Pass
15.247(a)(1)(i)	Number of Hopping Channels	NA	NA1
15.247(a)(1)(i)	Average Time of Occupancy	NA	NA1
15.247 (f)	Hybrid Systems Time of Occupancy	NA	NP
15.247 (f)	Hybrid Systems Power Spectral Density	NA	Pass
15.247(b)(2)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	NA2
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA3

NA = Not Applicable

NA1 = This test is not applicable under Hybrid System requirements section 15.247 (f)

NA2 = Not applicable because the EUT does not have a permanent external antenna port.

NA3 = Not applicable because the EUT is battery powered.

NP = CKC Laboratories was not contracted to perform test.

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
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:	Proprietary Hybrid FHSS
Operating Frequency Range:	902.4-927.6MHz
Number of Hopping Channels:	Up to 64
Modulation Type(s):	GFSK (Power Level 2 for Hybrid)
Maximum Duty Cycle:	Assume 100% as worst case
Number of TX Chains:	1
Antenna Type(s) and Gain:	Wide band PCB dipole antenna, -0.4dBi
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)



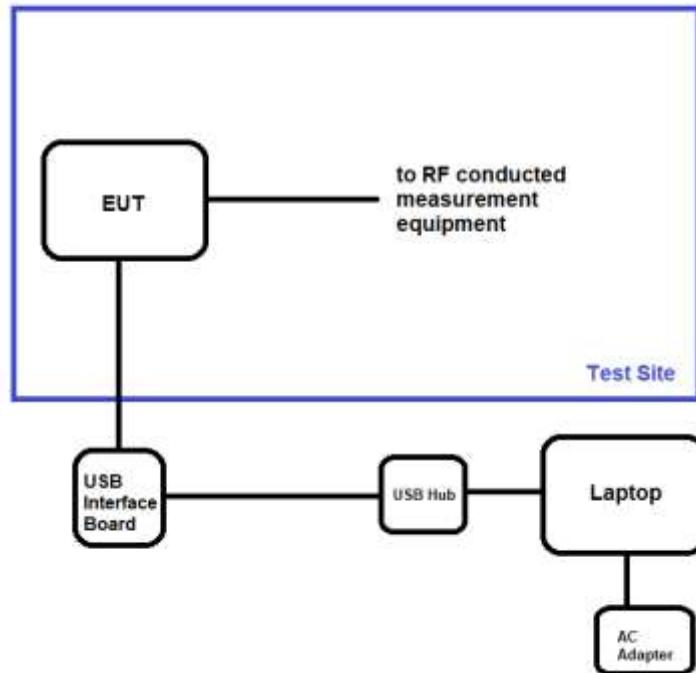
Support Equipment Photo(s)



Block Diagram of Test Setup(s)

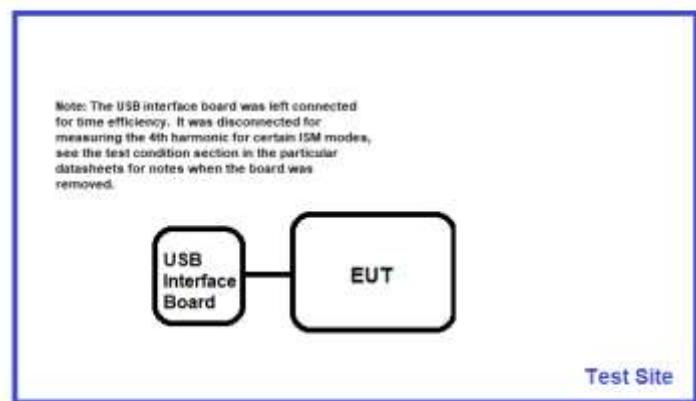
Configuration 1

Test Setup Block Diagram



Configuration 2

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	8/15/22 to 8/19/22
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 (°C)	21-24	Relative Humidity (%):	40-46

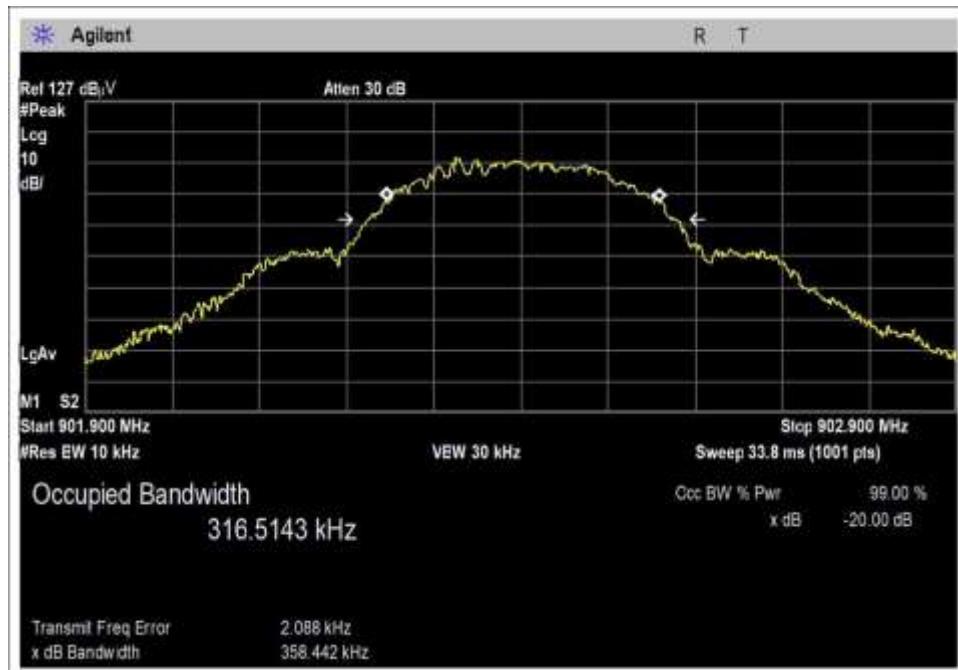
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/29/2021	11/29/2023
P06452	Cable	Andrews	Heliax	1/17/2022	1/17/2024
P05503	Attenuator	Narda	766-10	6/8/2021	6/8/2023

15.247(a)(1) 20 dB Bandwidth

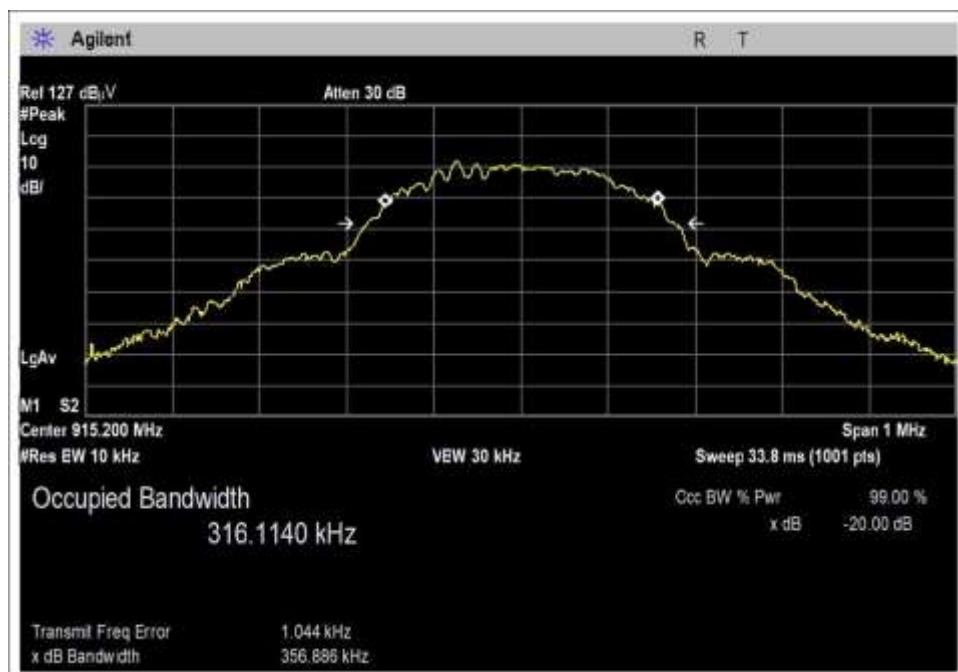
Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
902.4	1	GFSK	358.442		
915.2	1	GFSK	356.886		
927.6	1	GFSK	356.580		

*For this Hybrid mode there is no requirement to meet the FHSS or DTS bandwidth limits. See Supplemental Section of data in 15.247 (f) Hybrid Systems.

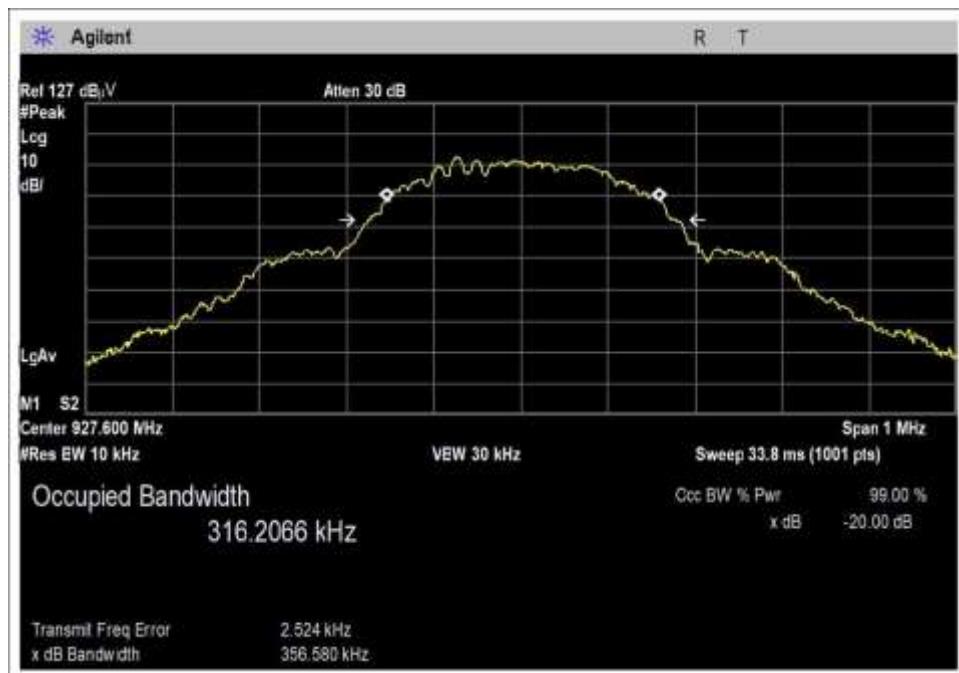
Plot(s)



Low Channel



Middle Channel



High Channel

15.247(a)(1) Carrier Separation

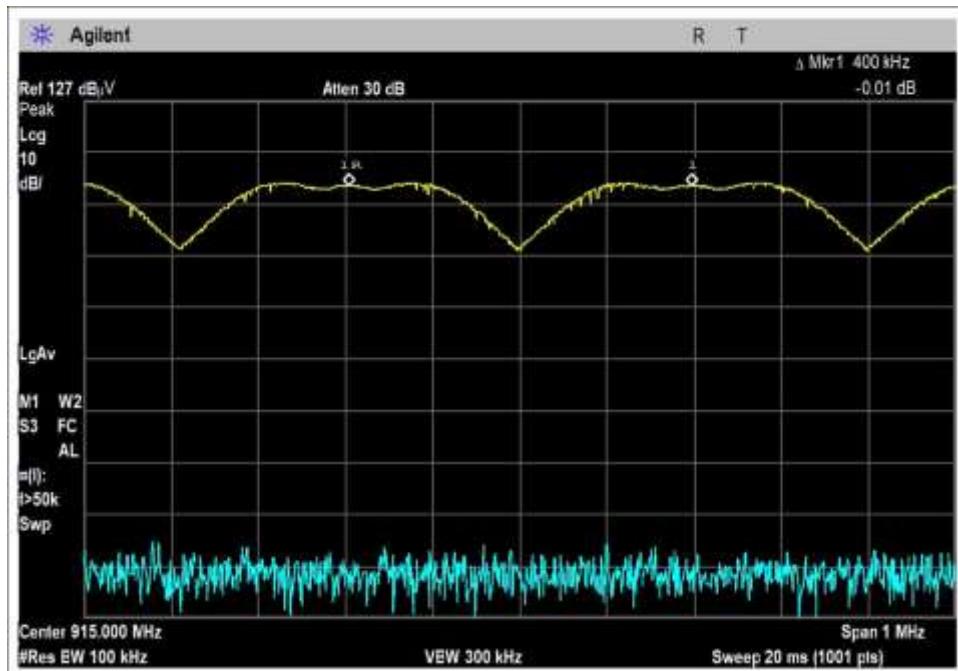
Test Data Summary

Limit applied: 20dB bandwidth of the hopping channel.

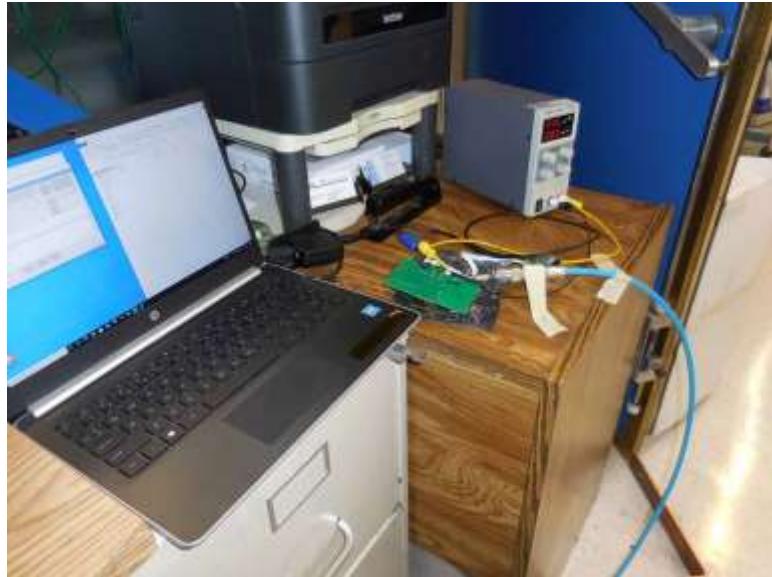
Antenna Port	Operational Mode	Measured (kHz)	Limit (kHz)	Results
1	GFSK	400.0	≥ 358.442	Pass

Note: Worst case channel plan with 64 channels tested

Plot(s)



Test Setup Photo(s)



15.247 (f) Hybrid Systems Power Spectral Density

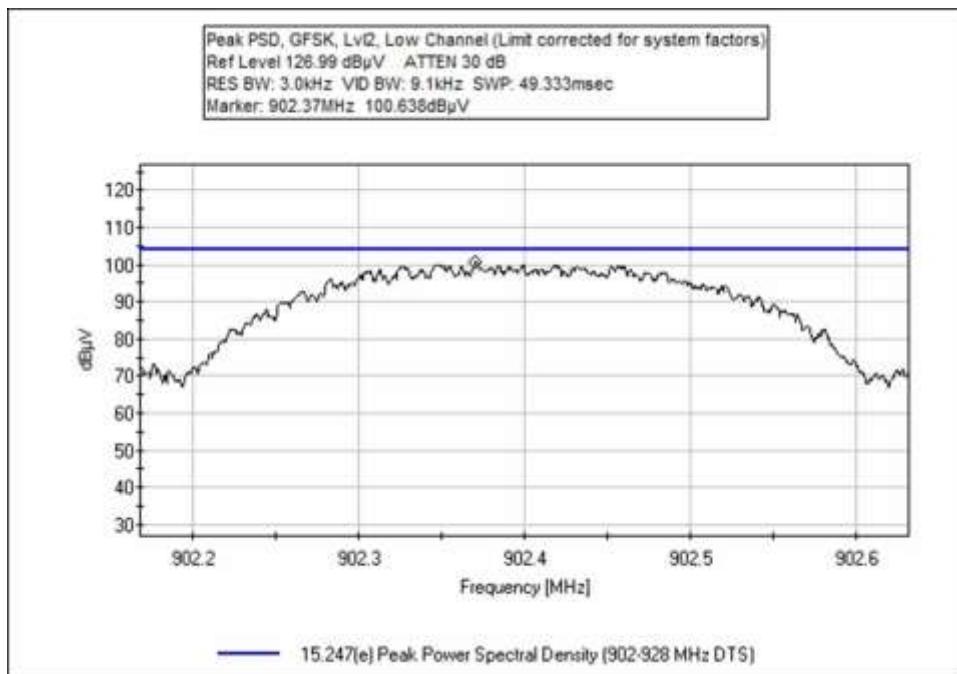
15.247 (f) Power Spectral Density

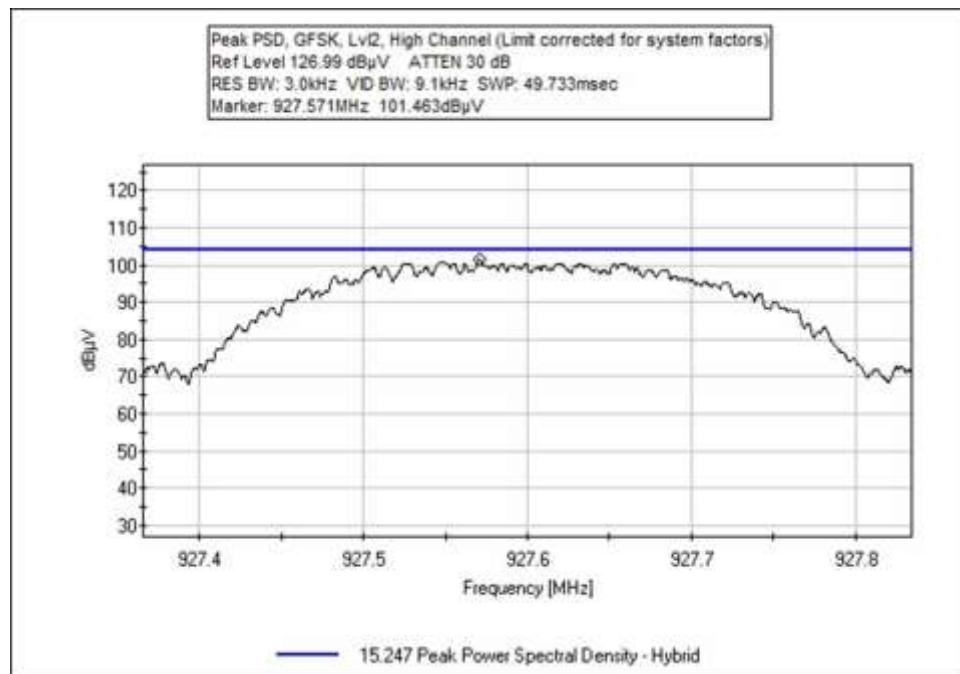
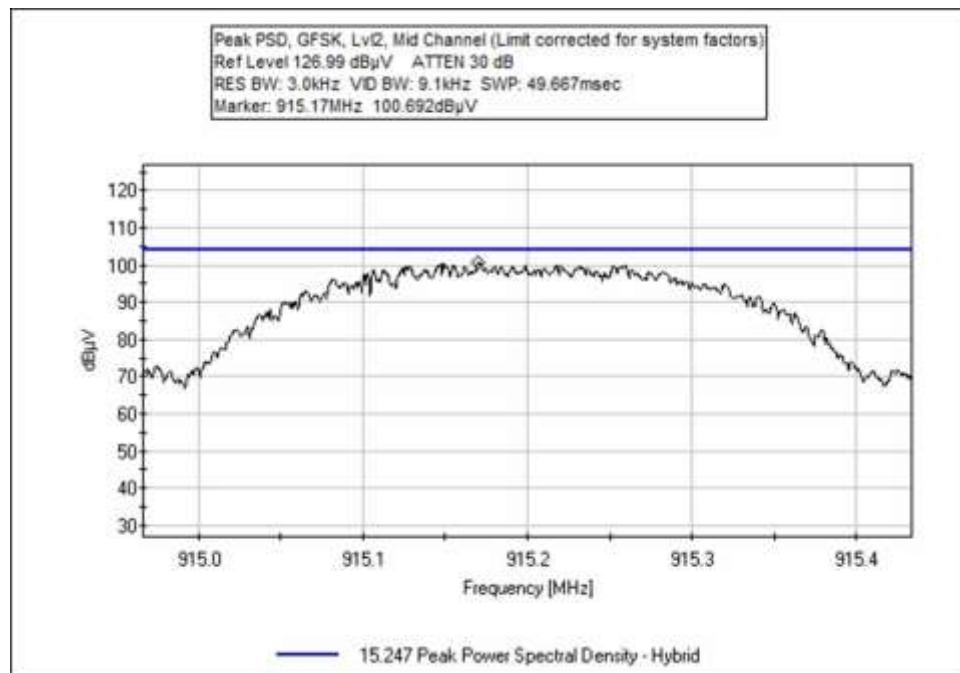
Test Data Summary - RF Conducted Measurement

Measurement Method: PKPSD

Frequency (MHz)	Modulation	Measured (dBm/3kHz)	Limit (dBm/3kHz)	Results
902.4	GFSK	4.4	≤8	Pass
915.2	GFSK	4.6	≤8	Pass
927.6	GFSK	5.4	≤8	Pass

Plot Data





Test 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 Peak Power Spectral Density - Hybrid**
 Work Order #: **107148** Date: 8/16/2022
 Test Type: **Conducted Emissions** Time: 09:05:43
 Tested By: Matt Harrison Sequence#: 11
 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

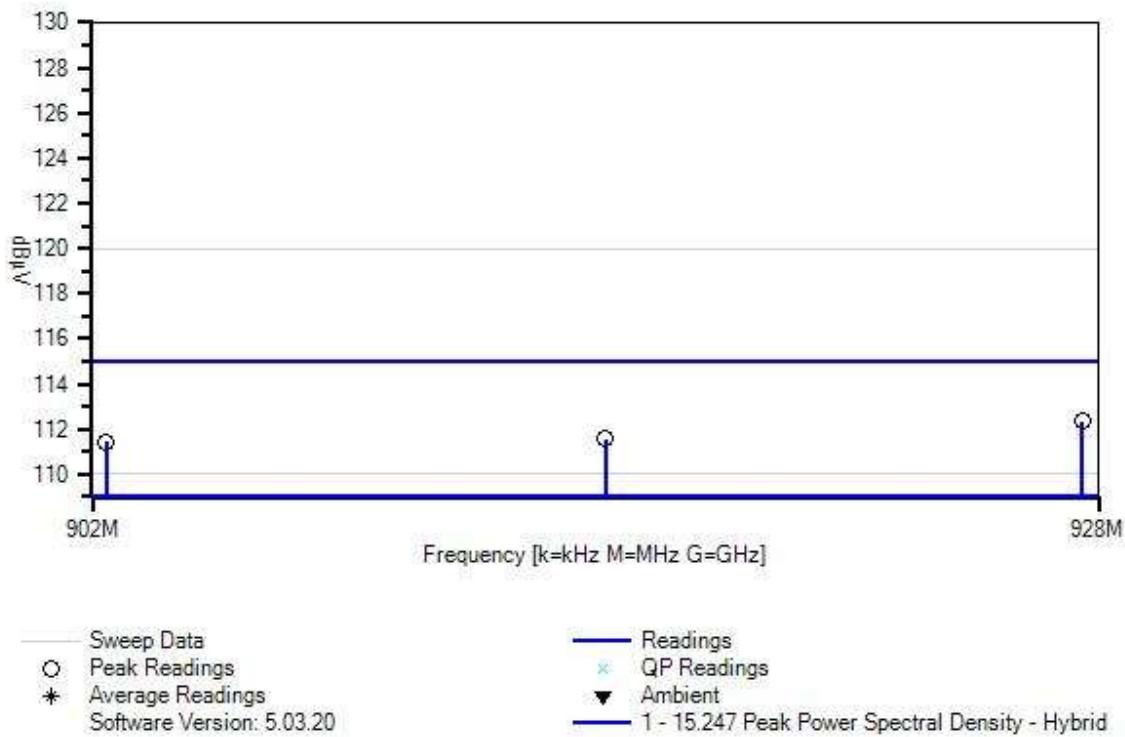
Method: ANSI C63.10 (2013)

Frequency: Fundamental

Setup:

EUT is setup for Conducted Measurements.

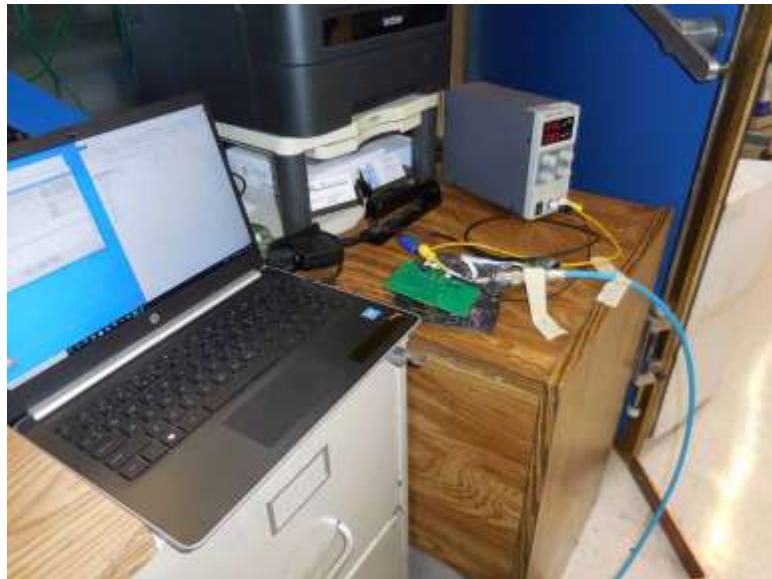
It is connected directly to the spectrum analyzer via cable and attenuator.

Itron, Inc. WO#: 107148 Sequence#: 11 Date: 8/16/2022
 15.247 Peak Power Spectral Density - Hybrid Test Lead: 3.67VDC Antenna Port

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
	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		dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar			
1	927.571M	101.5		+10.1	+0.8			+0.0	112.4	115.0	-2.6	Anten			
2	915.170M	100.7		+10.1	+0.8			+0.0	111.6	115.0	-3.4	Anten			
3	902.370M	100.6		+10.1	+0.7			+0.0	111.4	115.0	-3.6	Anten			

Test Setup Photo(s)



15.247(b)(1) Output Power

Test Data Summary - Voltage Variations

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

Test Data Summary - RF Conducted Measurement

Limit = 30dBm Conducted/36dBm EIRP

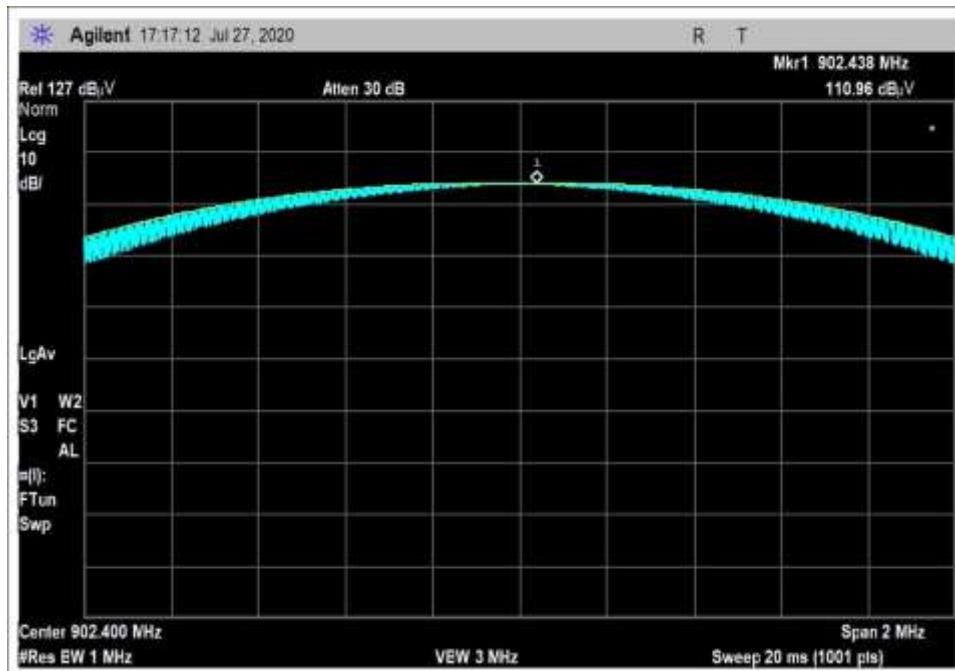
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
902.4	GSFK	PCB/-0.4dBi	14.8	≤30	Pass
915.2	GSFK	PCB/-0.4dBi	14.9	≤30	Pass
927.6	GSFK	PCB/-0.4dBi	15.6	≤30	Pass

*For this Hybrid Mode there is no minimum number of hopping channels required for the 1 Watt (30dBm) limit.

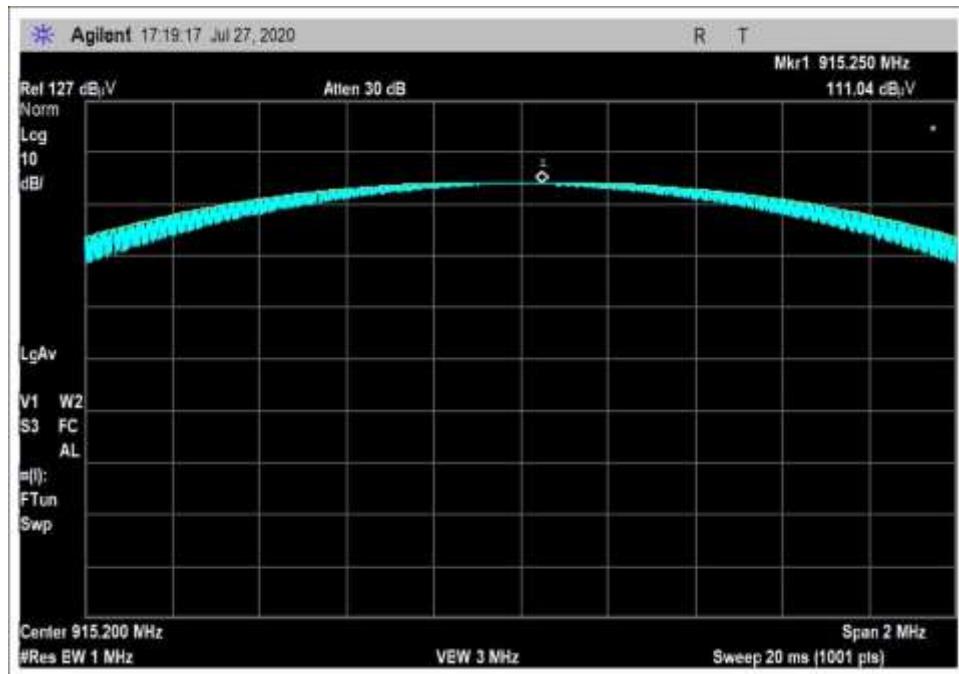
The limit is calculated according to a maximum of 1W (30 dBm) conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b)

$$\text{Limit} = 30 - \text{Roundup}(G - 6)$$

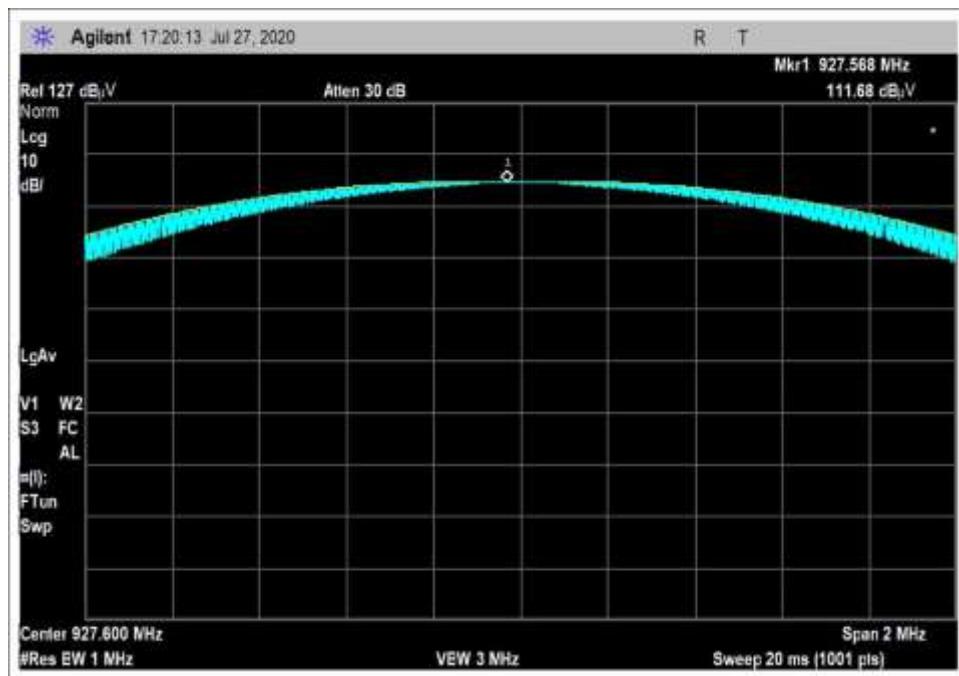
Plots



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 (902-928 MHz DTS)**
 Work Order #: **107148** Date: 8/15/2022
 Test Type: **Conducted Emissions** Time: 08:25:59
 Tested By: Matt Harrison Sequence#: 2
 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

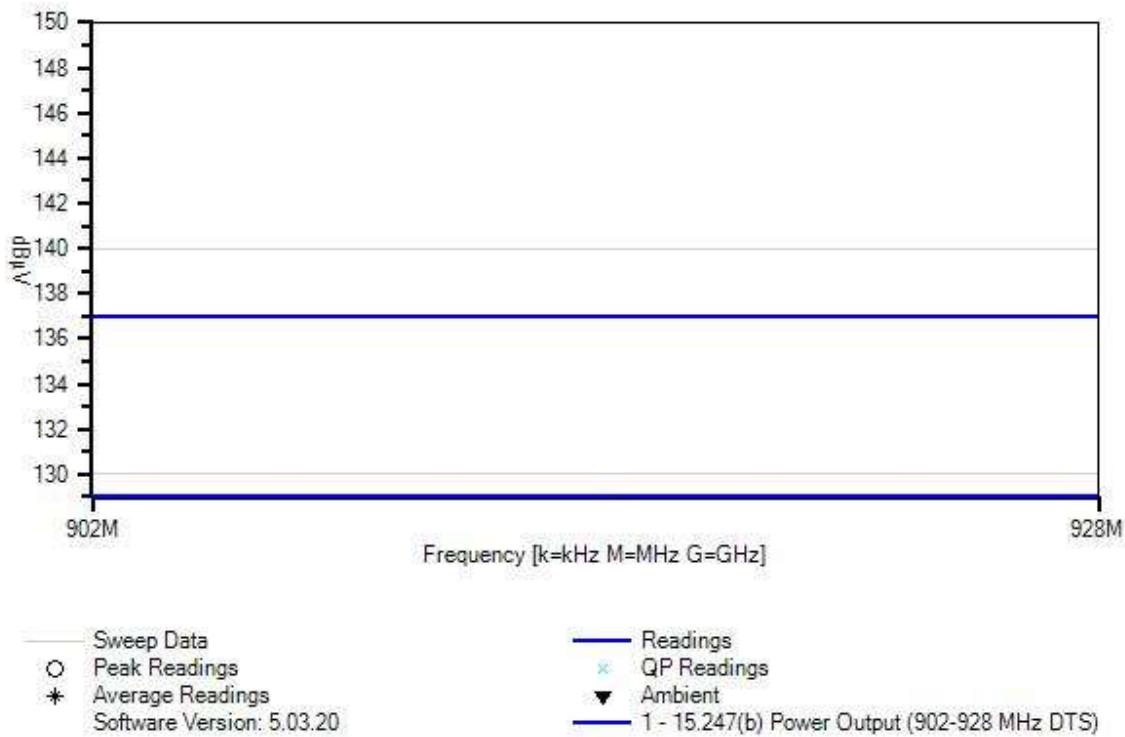
Method: ANSI C63.10 (2013)

Frequency: Fundamental

Setup:

EUT is setup for Conducted Measurements.

It is connected directly to the spectrum analyzer via cable and attenuator.

Itron, Inc. WO#: 107148 Sequence#: 2 Date: 8/15/2022
 15.247(b) Power Output (902-928 MHz DTS) Test Lead: 3.67VDC Antenna Port

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
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023

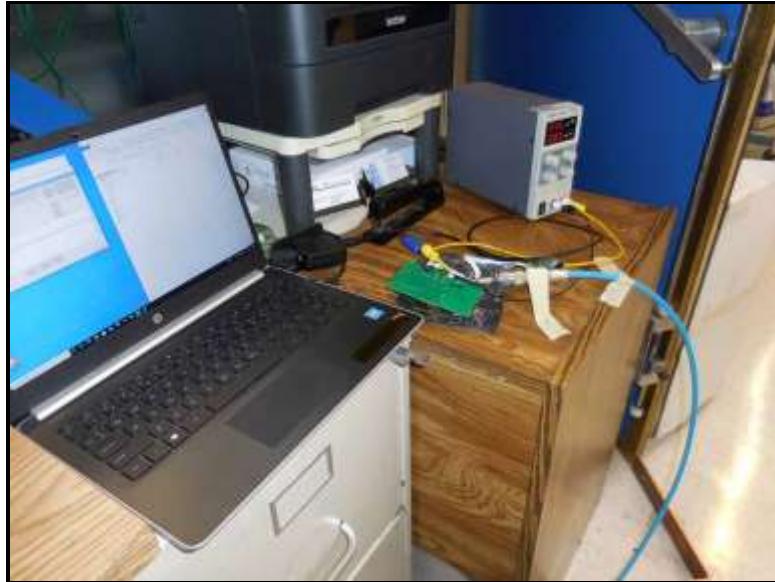
Measurement Data:

Reading listed by margin.

Test Lead: Antenna Port

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB	dB	Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	927.568M	111.7	+10.1	+0.8		+0.0	122.6	137.0	-14.4	Anten
2	915.250M	111.0	+10.1	+0.8		+0.0	121.9	137.0	-15.1	Anten
3	902.438M	111.0	+10.1	+0.7		+0.0	121.8	137.0	-15.2	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: 8/22/2022
 Test Type: **Maximized Emissions** Time: 17:17:44
 Tested By: Matt Harrison/Mike Atkinson Sequence#: 13
 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: Fundamental

Setup:

EUT is on foam table.

EUT is transmitting with modulation.

2 orientations investigated per manufacturer installed use case, worst case reported.

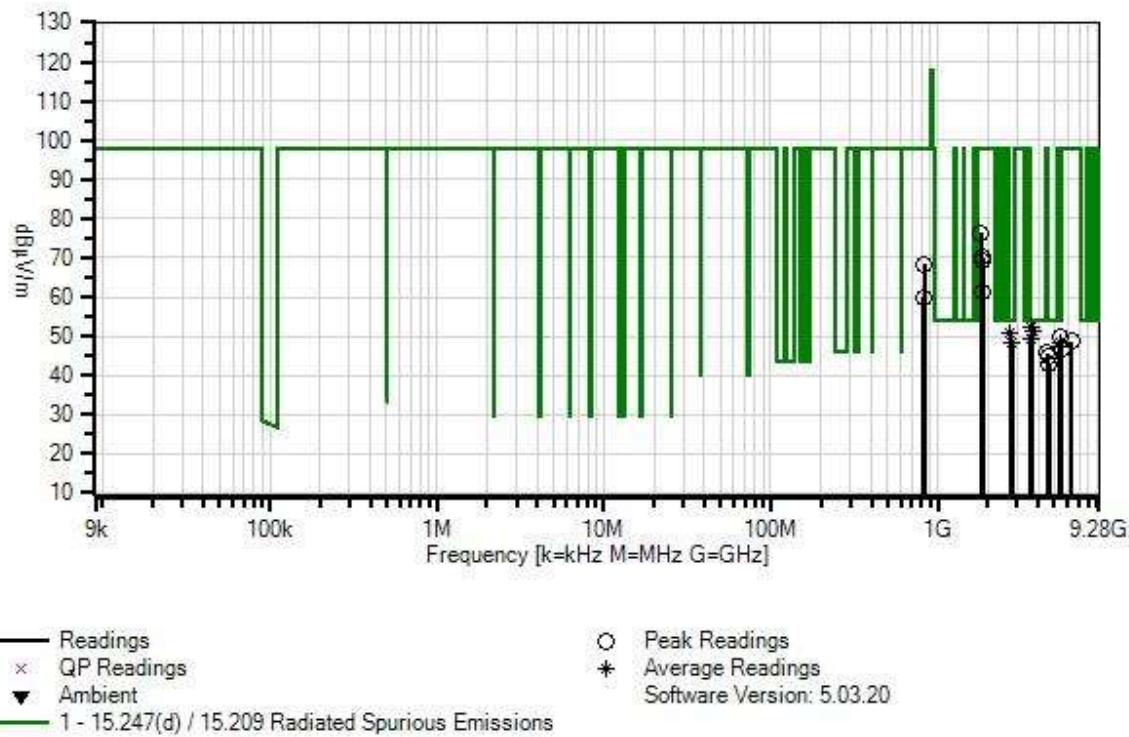
Horizontal and vertical antenna polarities investigated above 30MHz,

3 x orthogonal axes investigated below 30MHz, worst case reported.

Note:

Ribbon cable is connected for all measurements on this datasheet except the 4th harmonic where it was removed. This cable was present for ease of testing and representative of worst case, but it is not present on the actual use case.

No emissions observed within 20dB below 30MHz.

Itron, Inc. WO#: 107148 Sequence#: 13 Date: 8/22/2022
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Various

Test Equipment:

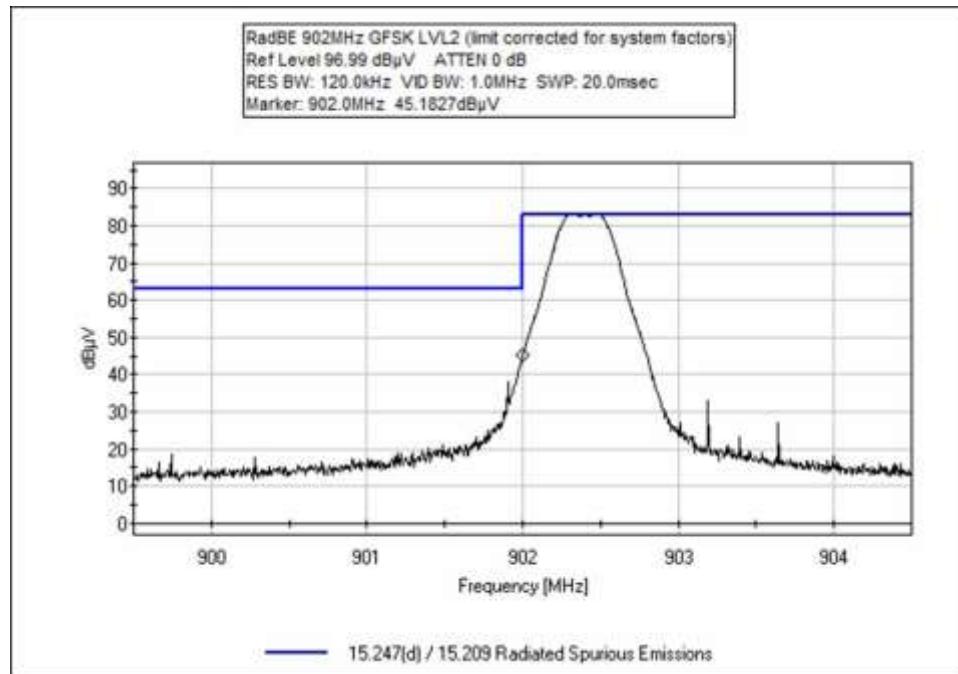
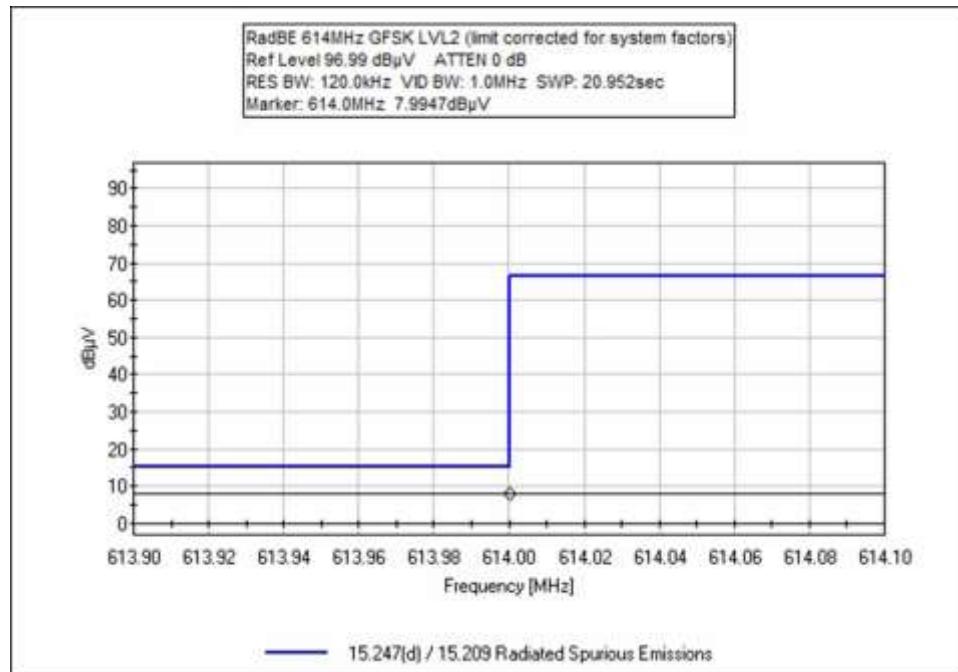
ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	ANP06515	Cable	Heliax	5/23/2022	5/23/2024
T4	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T5	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T6	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T7	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T8	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T9	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023

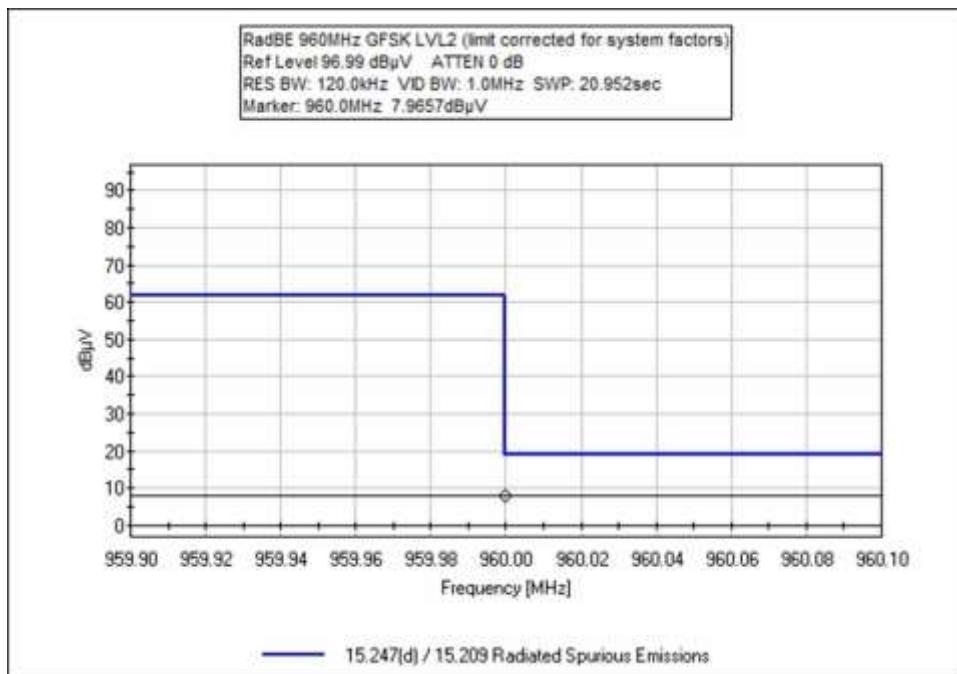
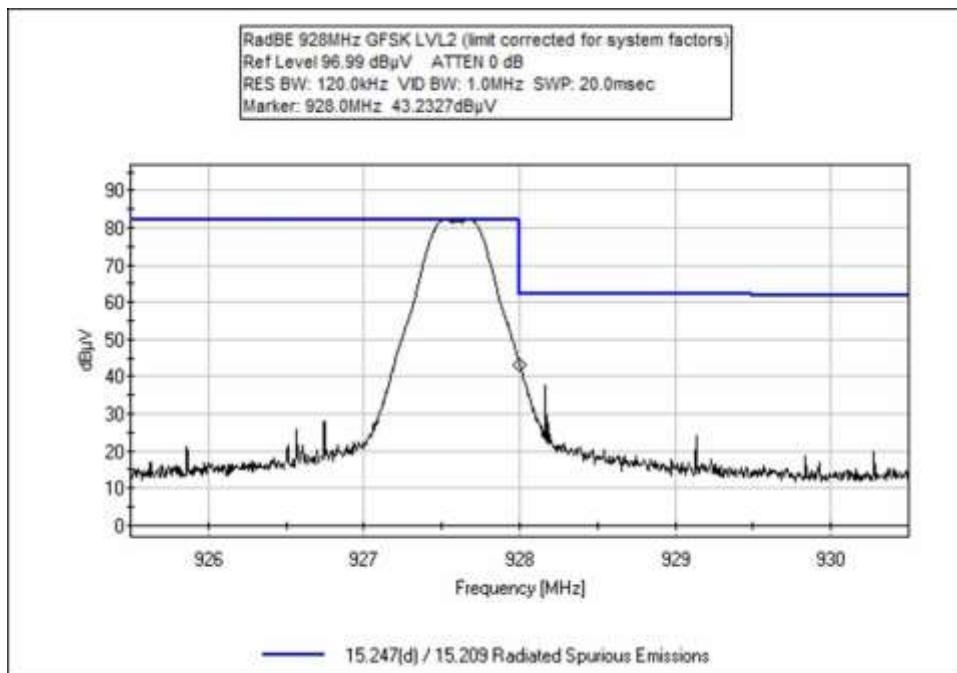
Measurement Data:			Reading listed by margin.				Test Distance: 3 Meters					
#	Freq	Rdng	T1 T5 T9	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar	
			MHz	dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	3660.800M	49.8	+0.0 +0.0 +0.2	+0.6 -33.8 +0.2	+3.2 +31.7	+0.0 +0.4	+0.0	+0.0	52.1	54.0	-1.9	Vert/
^	3660.800M	51.3	+0.0 +0.0 +0.2	+0.6 -33.8 +0.2	+3.2 +31.7	+0.0 +0.4	+0.0	+0.0	53.6	54.0	-0.4	Vert/
3	3710.400M	48.8	+0.0 +0.0 +0.2	+0.6 -33.8 +0.2	+3.1 +32.0	+0.0 +0.3	+0.0	+0.0	51.2	54.0	-2.8	Vert/
^	3710.430M	50.3	+0.0 +0.0 +0.2	+0.6 -33.8 +0.2	+3.1 +32.0	+0.0 +0.3	+0.0	+0.0	52.7	54.0	-1.3	Vert/
5	2707.200M	51.1	+0.0 +0.0 +0.2	+0.5 -34.1 +0.2	+2.9 +29.5	+0.0 +0.5	+0.0	+0.0	50.6	54.0	-3.4	Vert/
^	2707.200M	53.6	+0.0 +0.0 +0.2	+0.5 -34.1 +0.2	+2.9 +29.5	+0.0 +0.5	+0.0	+0.0	53.1	54.0	-0.9	Vert/
7	3609.600M	47.1	+0.0 +0.0 +0.3	+0.5 -33.8 +0.3	+3.3 +31.7	+0.0 +0.4	+0.0	+0.0	49.5	54.0	-4.5	Vert/
^	3609.600M	50.5	+0.0 +0.0 +0.3	+0.5 -33.8 +0.3	+3.3 +31.7	+0.0 +0.4	+0.0	+0.0	52.9	54.0	-1.1	Vert/
9	5414.400M	40.8	+0.0 +0.0 +0.4	+0.8 -33.6 +0.4	+4.5 +34.7	+0.0 +0.6	+0.0	+0.0	48.2	54.0	-5.8	Vert/
^	5414.400M	42.3	+0.0 +0.0 +0.4	+0.8 -33.6 +0.4	+4.5 +34.7	+0.0 +0.6	+0.0	+0.0	49.7	54.0	-4.3	Vert/
11	2745.600M	48.7	+0.0 +0.0 +0.3	+0.5 -34.1 +0.3	+2.9 +29.3	+0.0 +0.5	+0.0	+0.0	48.1	54.0	-5.9	Vert/
^	2745.600M	50.2	+0.0 +0.0 +0.3	+0.5 -34.1 +0.3	+2.9 +29.3	+0.0 +0.5	+0.0	+0.0	49.6	54.0	-4.4	Vert/
13	2783.290M	48.7	+0.0 +0.0 +0.3	+0.5 -34.1 +0.3	+2.9 +29.3	+0.0 +0.5	+0.0	+0.0	48.1	54.0	-5.9	Vert/
^	2783.290M	50.2	+0.0 +0.0 +0.3	+0.5 -34.1 +0.3	+2.9 +29.3	+0.0 +0.5	+0.0	+0.0	49.6	54.0	-4.4	Vert/
15	4511.890M	41.5	+0.0 +0.0 +0.5	+0.6 -33.6 +0.5	+4.2 +32.2	+0.0 +0.3	+0.0	+0.0	45.7	54.0	-8.3	Vert/

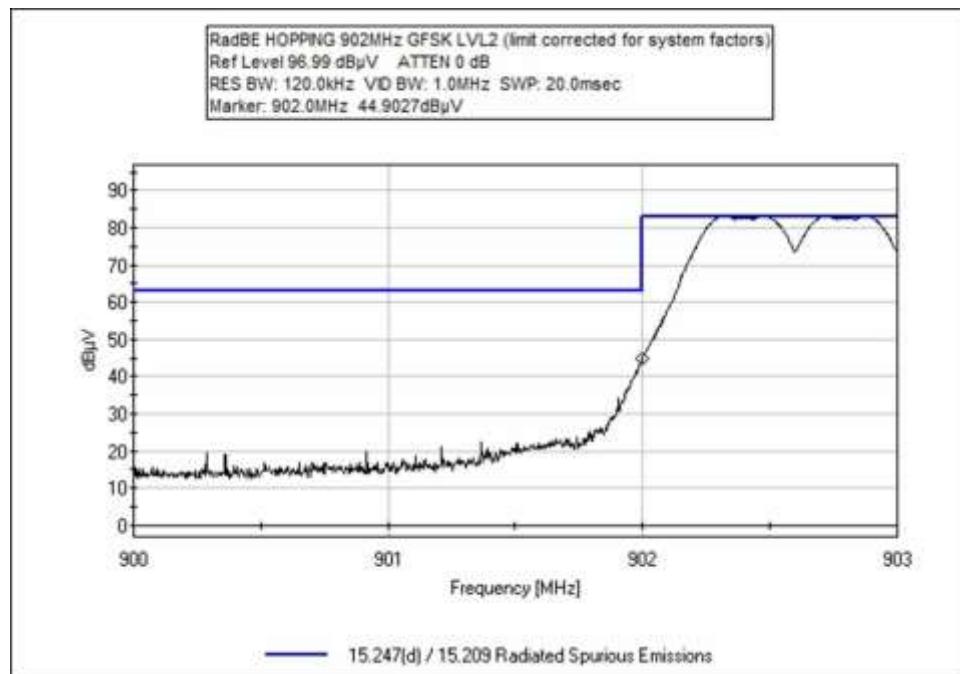
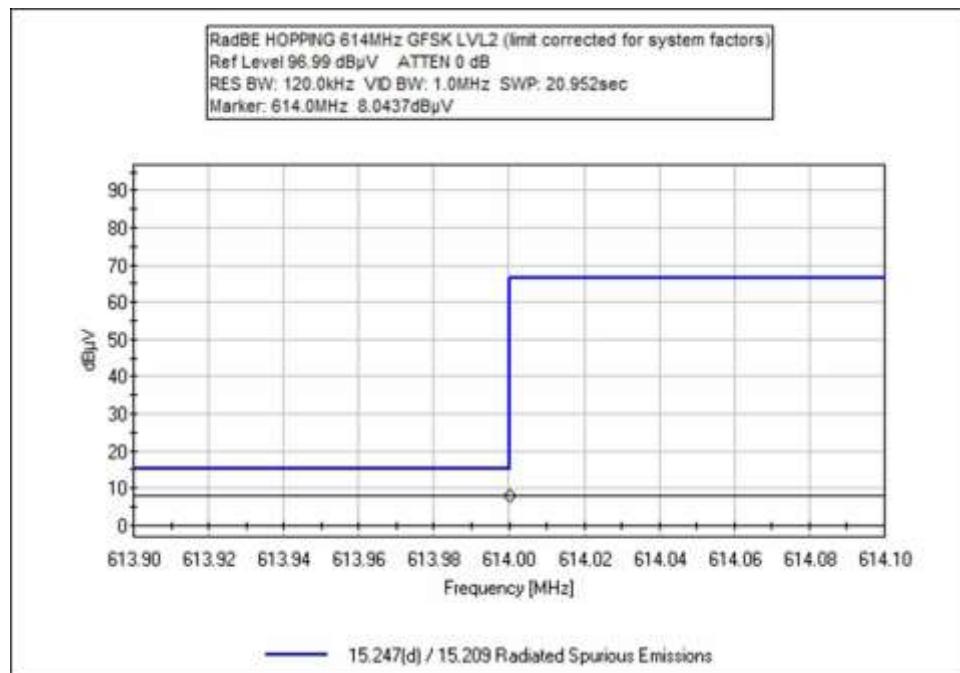
16	4576.050M	40.5	+0.0	+0.6	+4.1	+0.0	+0.0	44.7	54.0	-9.3	Vert/
			+0.0	-33.6	+32.2	+0.4					
			+0.5								
17	4638.060M	38.4	+0.0	+0.6	+4.0	+0.0	+0.0	42.7	54.0	-11.3	Vert/
			+0.0	-33.6	+32.5	+0.4					
			+0.4								
18	1804.680M	80.2	+0.0	+0.4	+2.3	+0.0	+0.0	76.4	98.0	-21.6	Vert/
			+0.0	-34.7	+27.3	+0.3					
			+0.6								
19	1855.310M	73.5	+0.0	+0.4	+2.3	+0.0	+0.0	70.1	98.0	-27.9	Vert/
			+0.0	-34.7	+27.7	+0.3					
			+0.6								
20	1830.225M	72.9	+0.0	+0.4	+2.3	+0.0	+0.0	69.3	98.0	-28.7	Vert/
			+0.0	-34.7	+27.5	+0.3					
			+0.6								
21	832.200M	34.7	+0.0	+0.3	+1.5	+2.2	+0.0	68.4	98.0	-29.6	Vert/
			+29.7	+0.0	+0.0	+0.0					
			+0.0								
22	1855.345M	64.7	+0.0	+0.4	+2.3	+0.0	+0.0	61.3	98.0	-36.7	Vert/
			+0.0	-34.7	+27.7	+0.3					
			+0.6								
23	824.400M	26.5	+0.0	+0.3	+1.5	+0.0	+0.0	59.9	98.0	-38.1	Vert/
			+0.0	+0.0	+0.0	+0.0					
			+0.0								
24	5490.920M	42.0	+0.0	+0.8	+4.8	+0.0	+0.0	49.6	98.0	-48.4	Vert/
			+0.0	-33.6	+34.7	+0.5					
			+0.4								
25	6317.145M	40.9	+0.0	+0.9	+4.7	+0.0	+0.0	48.7	98.0	-49.3	Vert/
			+0.0	-34.0	+35.2	+0.6					
			+0.4								
26	5565.550M	39.5	+0.0	+0.8	+4.7	+0.0	+0.0	46.9	98.0	-51.1	Vert/
			+0.0	-33.6	+34.5	+0.5					
			+0.5								

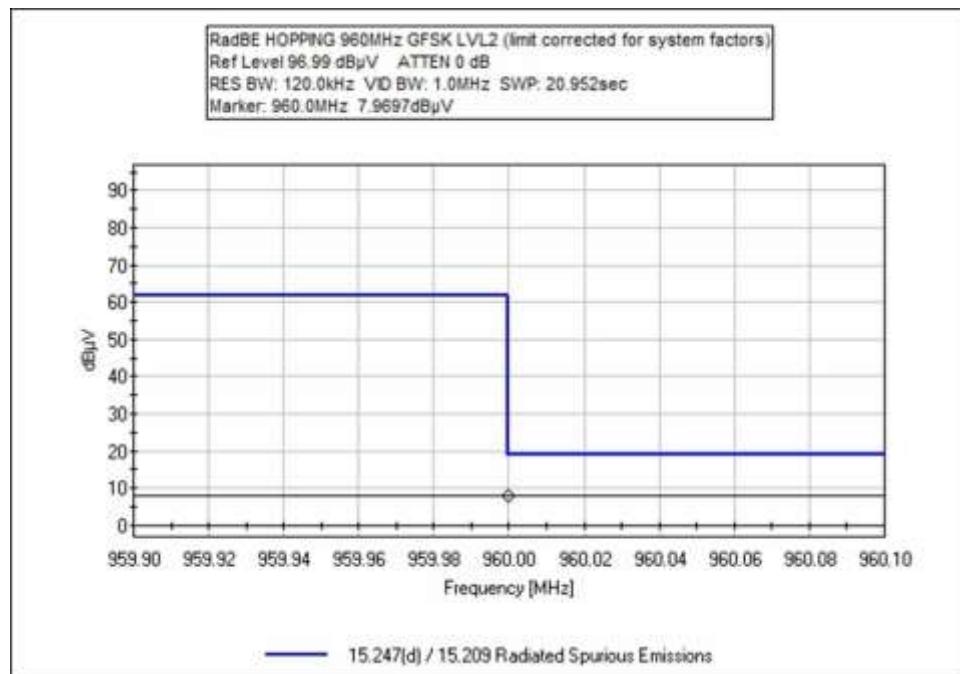
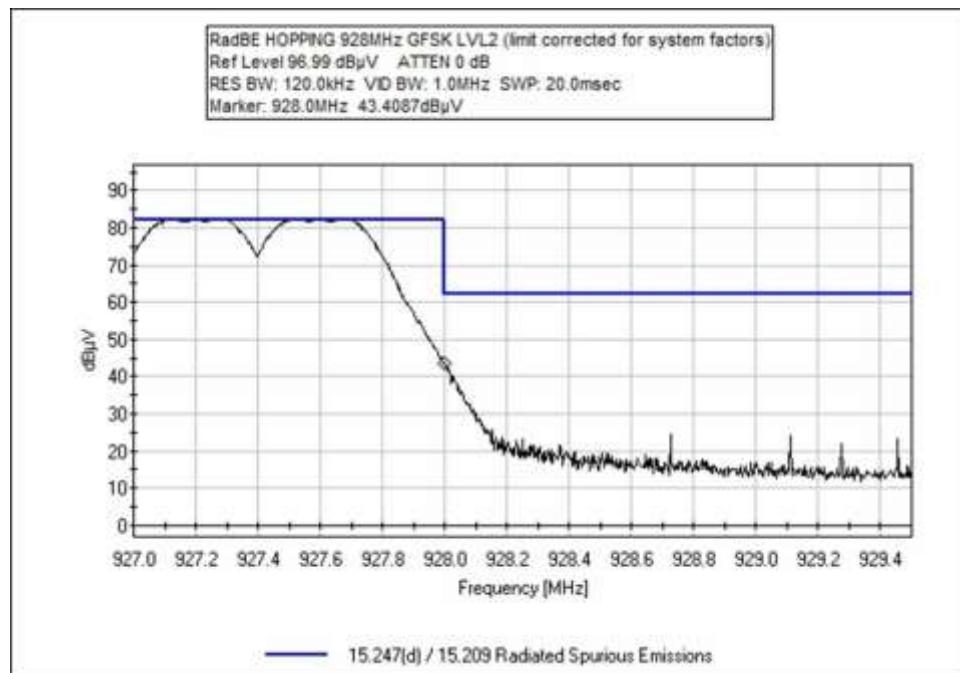
Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK Level 2 Hybrid (Single Channel)	PCB	38.7	<46.0	Pass
902			79.0	<97.0	Pass
928			78.1	<97.0	Pass
960			43.1	<54.0	Pass
614	GFSK Level 2 Hybrid (Hopping)	PCB	38.7	<46.0	Pass
902			78.7	<97.0	Pass
928			78.3	<97.0	Pass
960			43.1	<54.0	Pass

Band Edge Plots









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: 8/17/2022
 Test Type: **Maximized Emissions** Time: 18:54:03
 Tested By: Michael Atkinson Sequence#: 18
 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: Band Edge

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.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T2	ANP06515	Cable	Heliax	5/23/2022	5/23/2024
T3	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T4	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 MHz	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			dB μ V	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	614.000M	8.0	+0.0	+0.3	+1.3	+1.9	+0.0	38.7	46.0	-7.3	Horiz
	QP		+27.2						hopping		
2	614.000M	8.0	+0.0	+0.3	+1.3	+1.9	+0.0	38.7	46.0	-7.3	Horiz
	QP		+27.2						SC		
3	960.000M	8.0	+0.0	+0.3	+1.7	+2.4	+0.0	43.1	54.0	-10.9	Horiz
	QP		+30.7						SC		
4	960.000M	8.0	+0.0	+0.3	+1.7	+2.4	+0.0	43.1	54.0	-10.9	Horiz
	QP		+30.7						hopping		
5	902.000M	45.2	+0.0	+0.3	+1.6	+2.3	+0.0	79.0	97.0	-18.0	Horiz
			+29.6						SC		
6	902.000M	44.9	+0.0	+0.3	+1.6	+2.3	+0.0	78.7	97.0	-18.3	Horiz
			+29.6						hopping		
7	928.000M	43.4	+0.0	+0.3	+1.6	+2.4	+0.0	78.3	97.0	-18.7	Horiz
			+30.6						hopping		
8	928.000M	43.2	+0.0	+0.3	+1.6	+2.4	+0.0	78.1	97.0	-18.9	Horiz
			+30.6						SC		

Test Setup Photo(s)



Orientation 1



Orientation 2



Below 1GHz



Above 1GHz

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

Uncertainty Value	Parameter
4.73 dB	Radiated Emissions
3.34 dB	Mains Conducted Emissions
3.30 dB	Disturbance Power

Uncertainties reported are worst case for all CKC Laboratories' sites and represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2. Compliance is deemed to occur provided measurements are below the specified limits.

Emissions Test Details

TESTING PARAMETERS

Unless otherwise indicated, the following configuration parameters are used for equipment setup: The cables were routed consistent with the typical application by varying the configuration of the test sample. Interface cables were connected to the available ports of the test unit. The effect of varying the position of the cables was investigated to find the configuration that produced maximum emissions. Cables were of the type and length specified in the individual requirements. The length of cable that produced maximum emissions was selected.

The equipment under test (EUT) was set up in a manner that represented its normal use, as shown in the setup photographs. Any special conditions required for the EUT to operate normally are identified in the comments that accompany the emissions tables.

The emissions data was taken with a spectrum analyzer or receiver. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the table below. The corrected data was then compared to the applicable emission limits. Preliminary and final measurements were taken in order to ensure that all emissions from the EUT were found and maximized.

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dB μ V/m, the spectrum analyzer reading in dB μ 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	(dB μ V)
+ Antenna Factor	(dB/m)
+ Cable Loss	(dB)
- Distance Correction	(dB)
- Preamplifier Gain	(dB)
= Corrected Reading	(dB μ V/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.