

Itron, Inc.

TEST REPORT FOR

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

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.249

Report No.: 107148-2

Date of issue: October 4, 2022



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: Johann Dejager
Customer Reference Number: 263856

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

Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107148

August 15, 2022

August 15 - 22, 2022

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, reading "Steve Behm", is written over a horizontal line.

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 - 15.249

Test Procedure	Description	Modifications	Results
15.215(c)	Occupied Bandwidth	NA	Pass
15.249(a)	Field Strength of Fundamental	NA	Pass
15.249(a)	Radiated Spurious Emissions and Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 - Not applicable because the device is battery powered only.

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

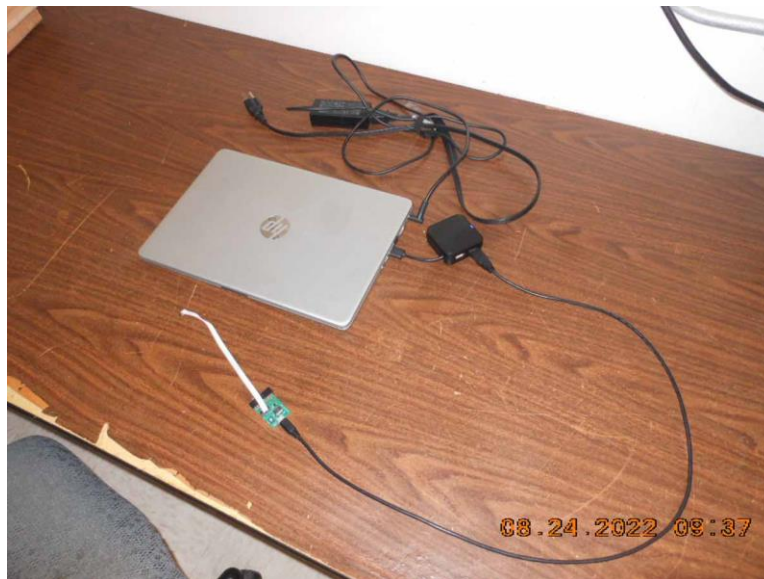
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Modulation Type(s):	OOK (Power Level 0)
Maximum Duty Cycle:	Assume 100% as worst case
Antenna Type(s) and Gain:	Wide band PCB dipole antenna, -0.4dBi
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)



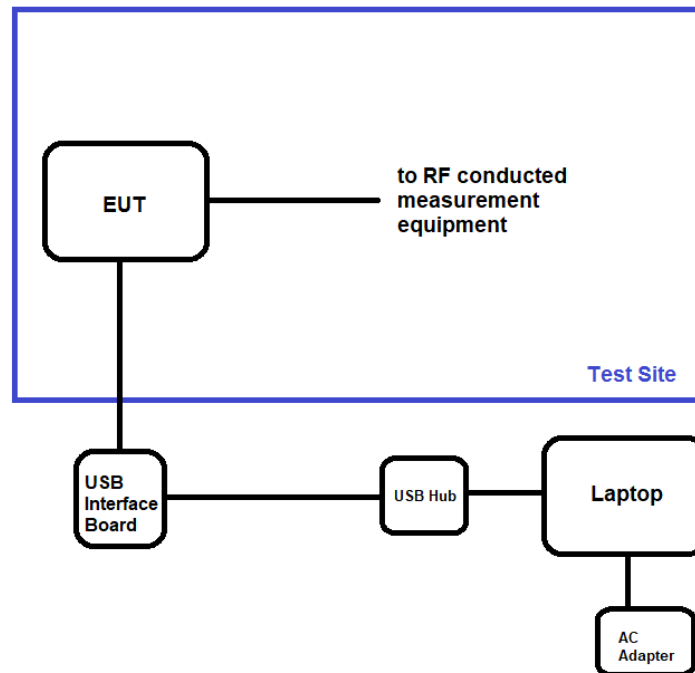
Support Equipment Photo(s)



Block Diagram of Test Setup(s)

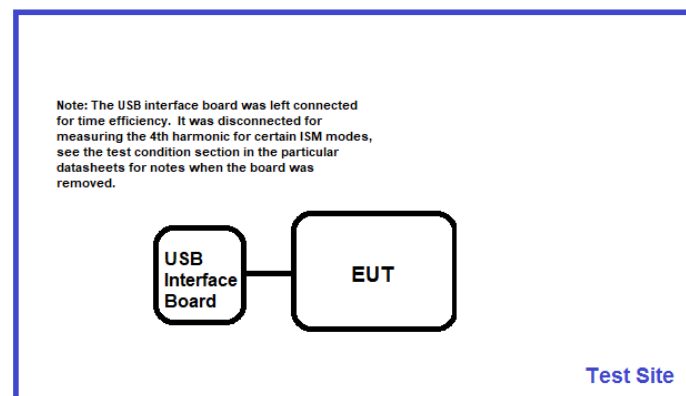
Configuration 1

Test Setup Block Diagram



Configuration 2

Test Setup Block Diagram



FCC Part 15 Subpart C

15.215(c) Occupied Bandwidth (20dB BW)

Test Setup/Conditions			
Test Location:	Canyon Park Lab Bench	Test Engineer:	M. Harrison/M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	8/15/2022, 9/30/2022
Configuration:	1		
	EUT has temporary antenna connector attached. EUT directly connected to spectrum analyzer through appropriate cables and attenuators. EUT is transmitting with modulation.		

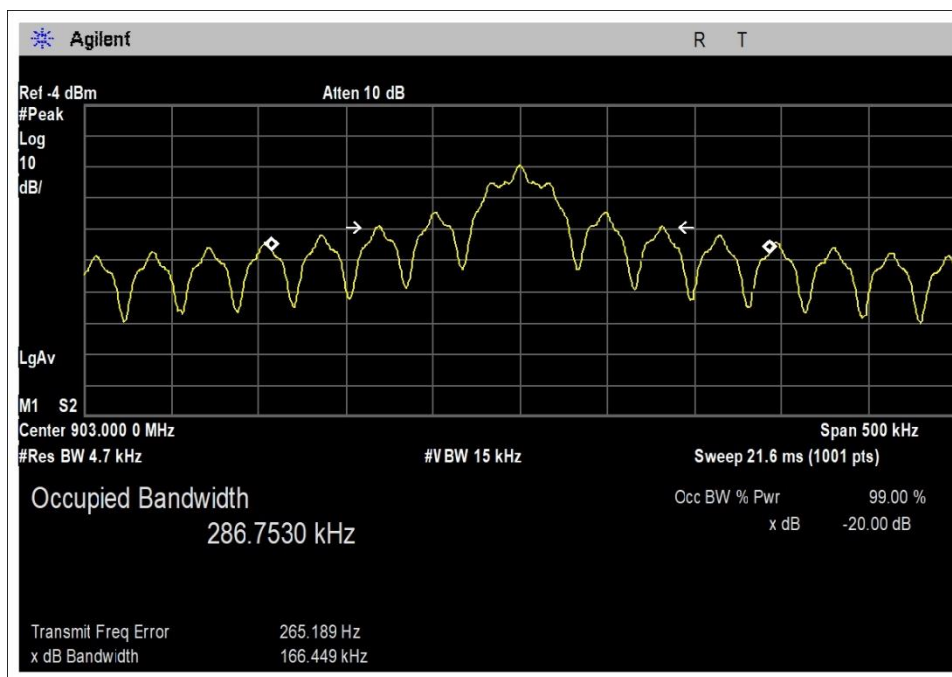
Environmental Conditions			
Temperature (°C)	21-24	Relative Humidity (%):	40-50

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/29/2021	11/29/2023
P06452	Cable	Andrews	Heliac	1/17/2022	1/17/2024
P05503	Attenuator	Narda	766-10	6/8/2021	6/8/2023
02673	Spectrum Analyzer	Agilent	E4446A	2/3/2021	2/3/2023

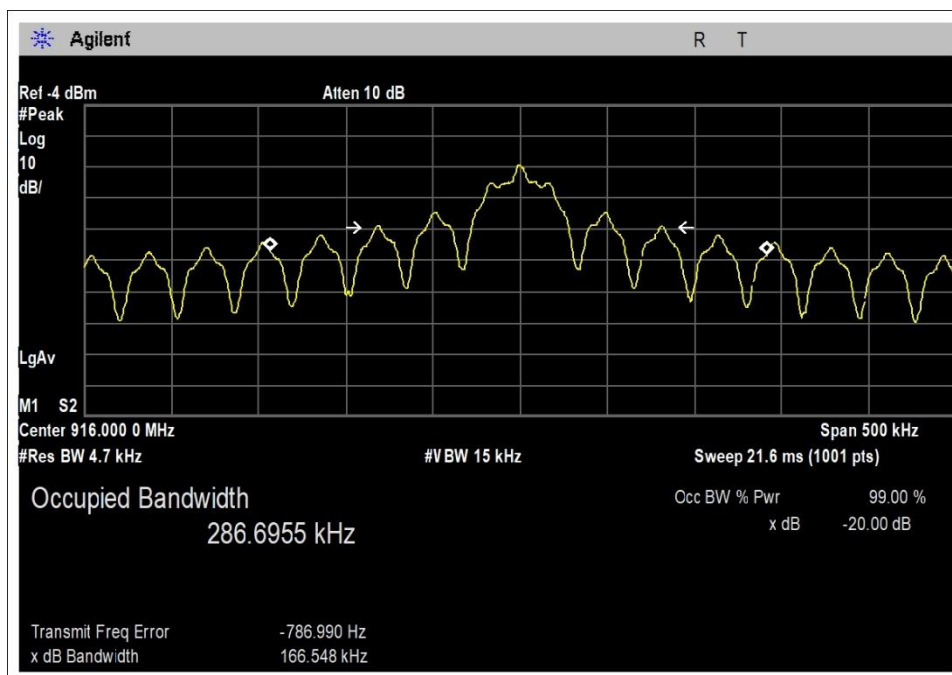
Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
903	1	OOK (Power Level 0)	166.449	None	NA
916	1	OOK (Power Level 0)	166.548	None	NA
923.8	1	OOK (Power Level 0)	166.538	None	NA

NA = Not applicable, because FCC 15.215 does not give any limits so there is no criteria for pass or fail.

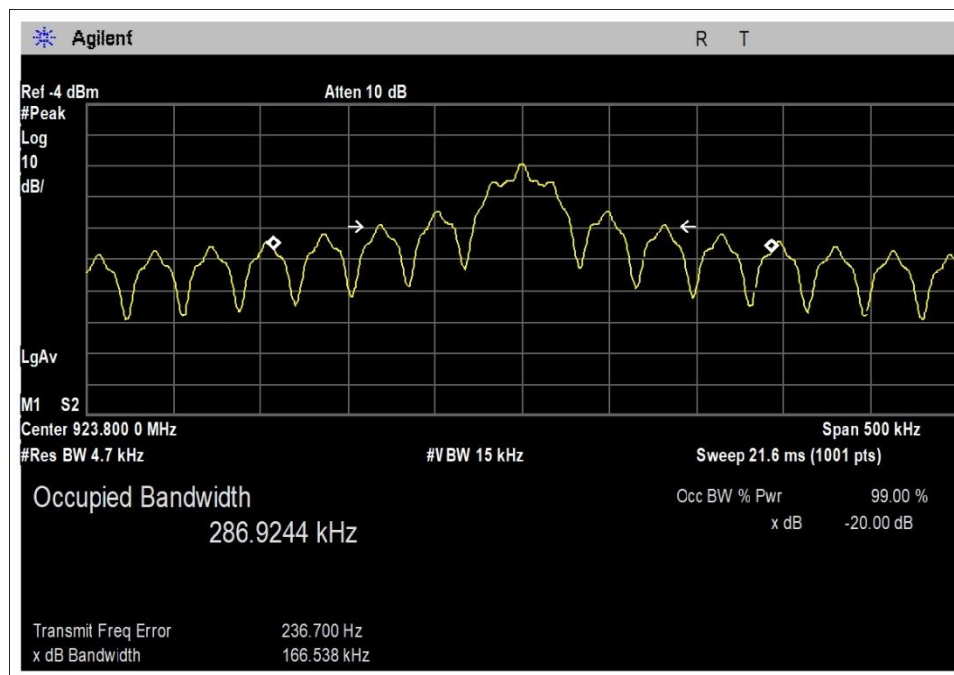
Plot(s)



Low Channel

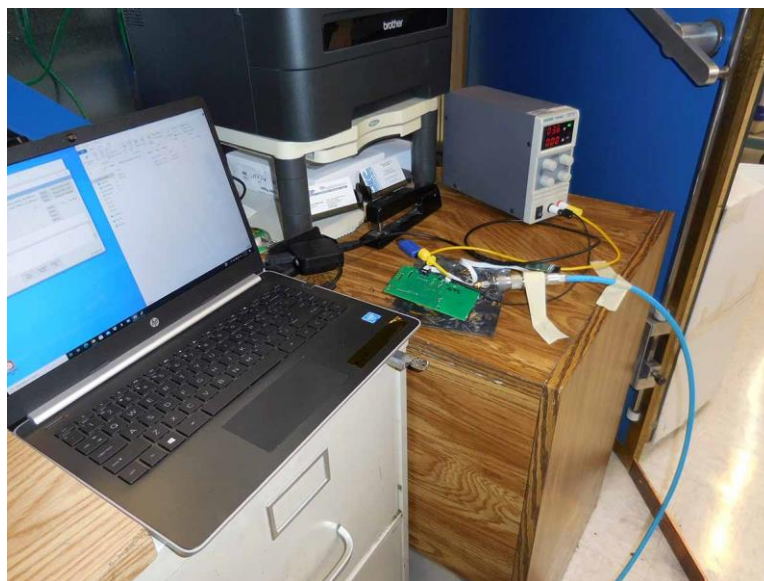


Middle Channel



High Channel

Test Setup Photo(s)



15.249(a) Field Strength of Fundamental

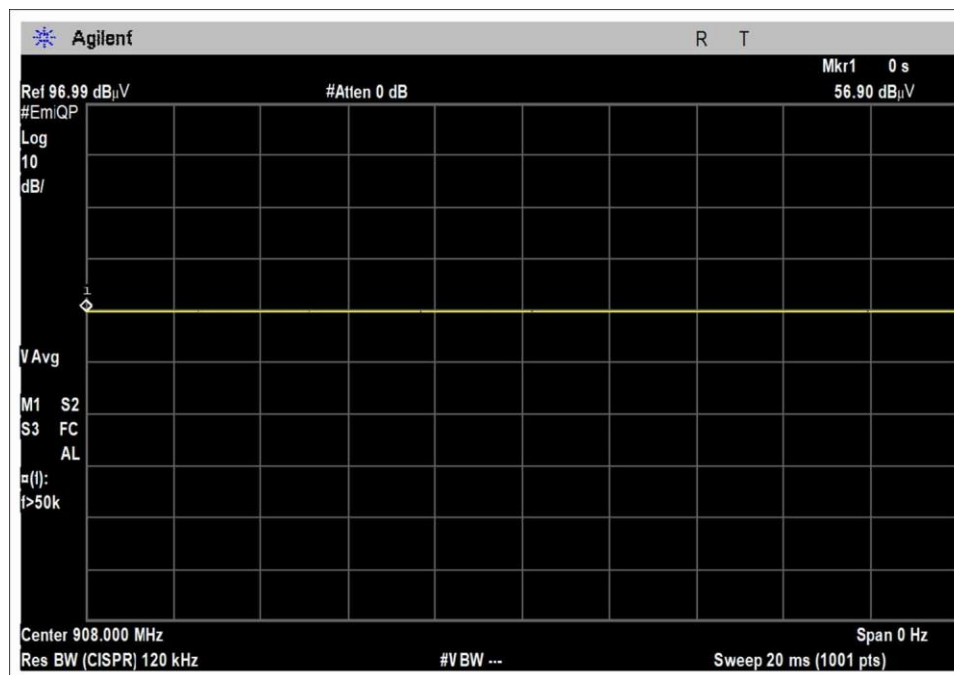
Test Data Summary - Voltage Variations

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

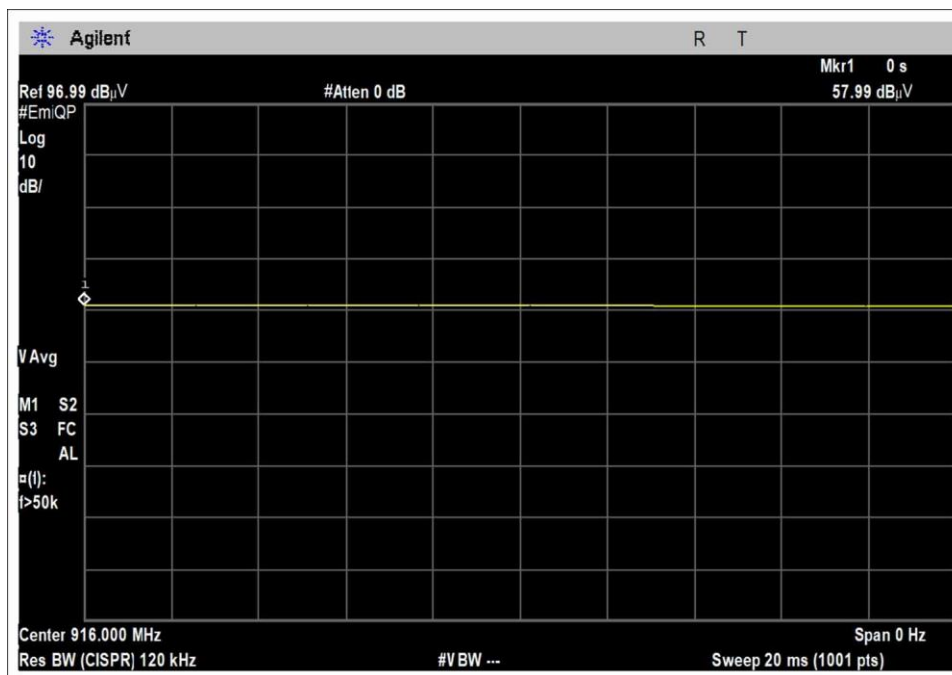
Test Data Summary – Radiated Field Strength Measurement

Frequency (MHz)	Modulation	Ant. Type	Measured (dBuV/m @ 3m)	Limit (dBuV/m @ 3m)	Results
903	OOK (Power Level 0)	Integral PCB	91.0	≤94	Pass
916	OOK (Power Level 0)	Integral PCB	92.2	≤94	Pass
923.8	OOK (Power Level 0)	Integral PCB	92.3	≤94	Pass

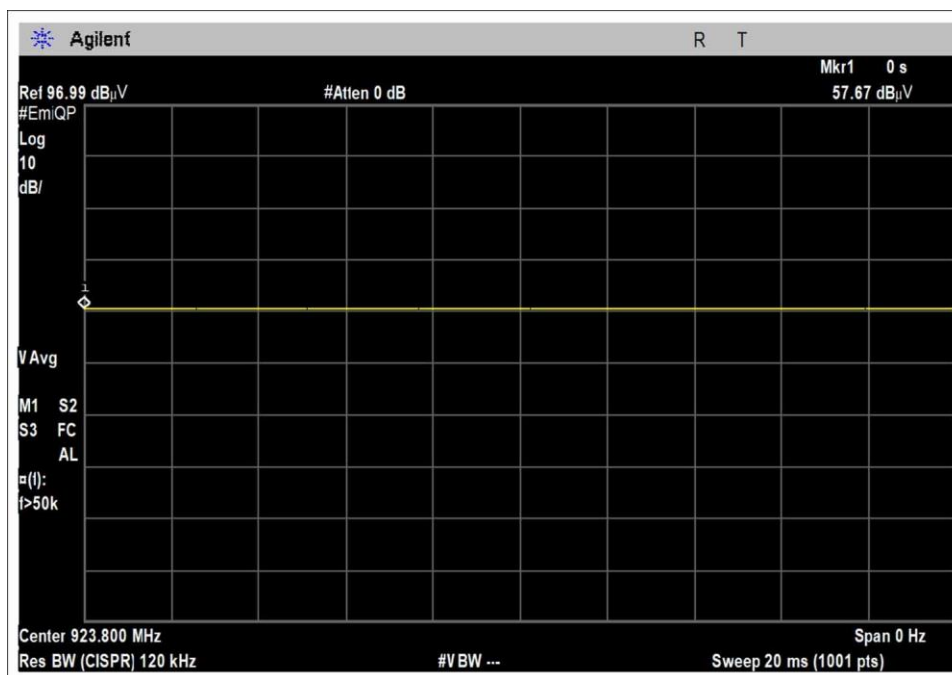
Plot(s)



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: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **107148** Date: 8/15/2022
 Test Type: **Maximized Emissions** Time: 15:15:42
 Tested By: Michael Atkinson Sequence#: 6
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

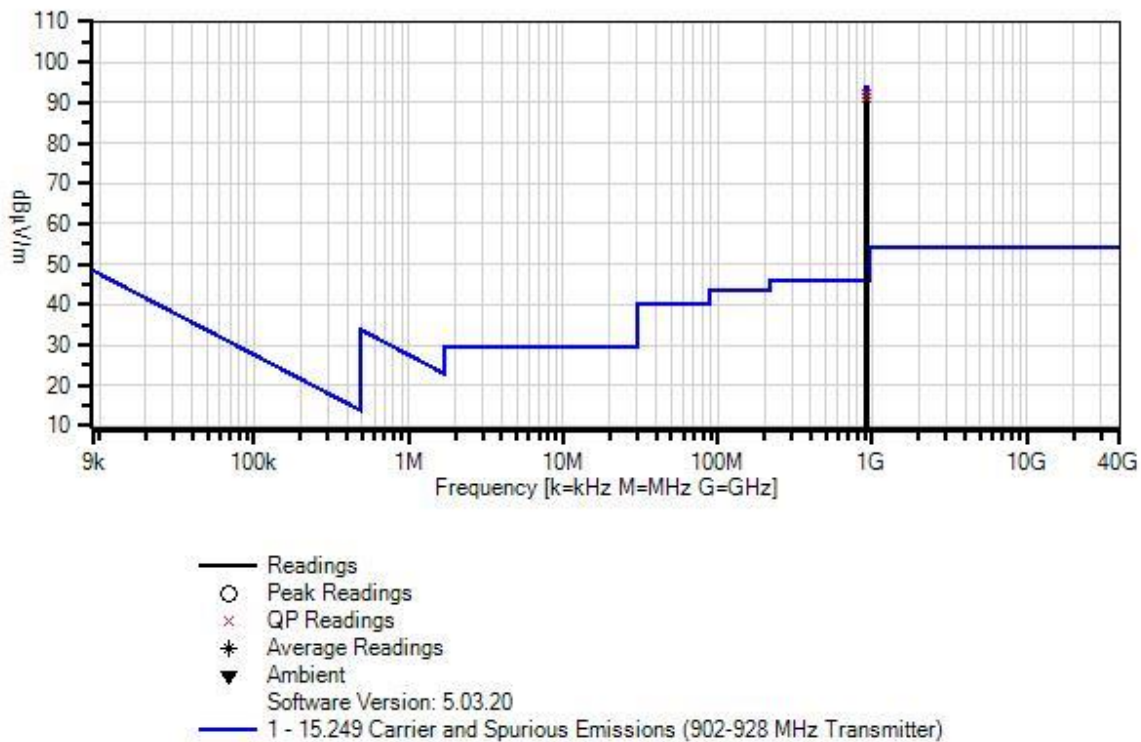
Support Equipment:

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, worst case reported. Fresh battery installed.
--

Ittron, Inc. WO#: 107148 Sequence#: 6 Date: 8/15/2022
15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter) Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T1	ANP06540	Cable	Helix	1/17/2022	1/17/2024
T2	ANP06515	Cable	Helix	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

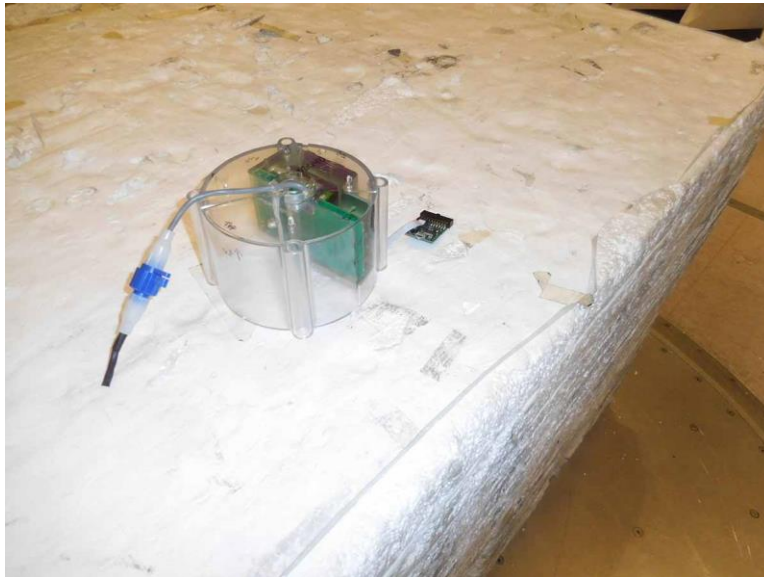
Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	923.800M	57.7	+0.3	+1.6	+2.4	+30.3	+0.0	92.3	94.0	-1.7	Horiz
QP											
2	916.000M	58.0	+0.3	+1.6	+2.4	+29.9	+0.0	92.2	94.0	-1.8	Horiz
QP											
3	908.000M	56.9	+0.3	+1.6	+2.4	+29.8	+0.0	91.0	94.0	-3.0	Horiz
QP											

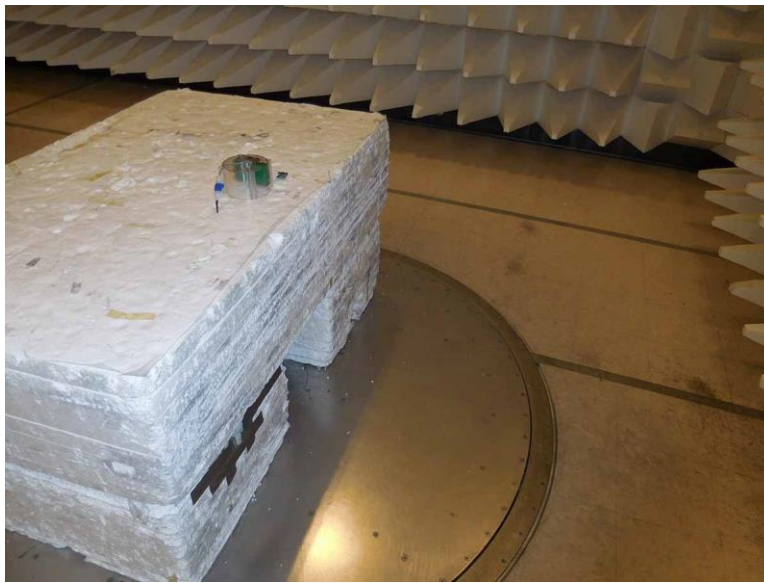
Test Setup Photo(s)



Orientation 1



Orientation 2



Below 1GHz

15.249(a) Radiated Spurious Emissions and 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: 19:10:10
 Tested By: Matt Harrison/Mike Atkinson Sequence#: 14
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

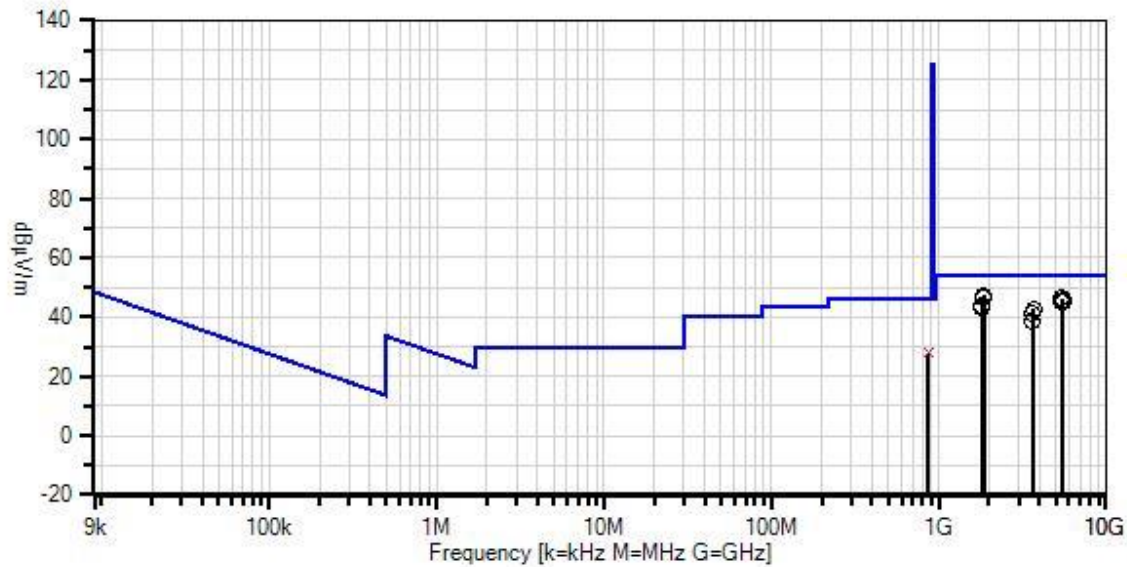
Support Equipment:

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-10GHz 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.

Itron, Inc. WO#: 107148 Sequence#: 14 Date: 8/22/2022
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



— Readings
× QP Readings
▼ Ambient
○ Peak Readings
* Average Readings
Software Version: 5.03.20
1 - 15.247(d) / 15.209 Radiated Spurious Emissions

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	Heliac	1/17/2022	1/17/2024
T3	ANP06515	Cable	Heliac	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
T6	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T7	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T8	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T9	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
T10	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T11	AN02307	Preamp	8447D	1/6/2022	1/6/2024

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

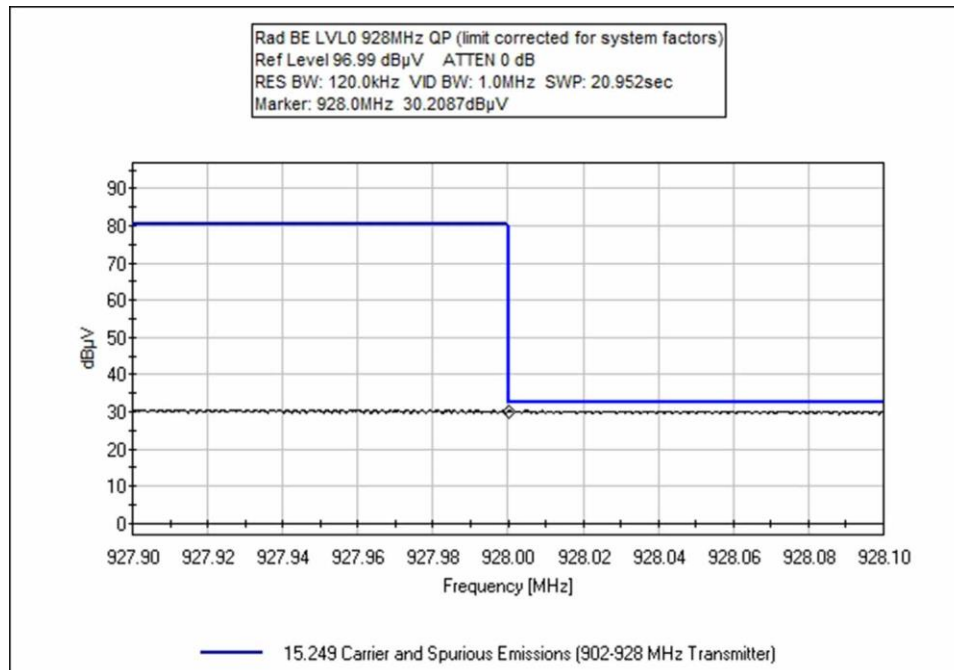
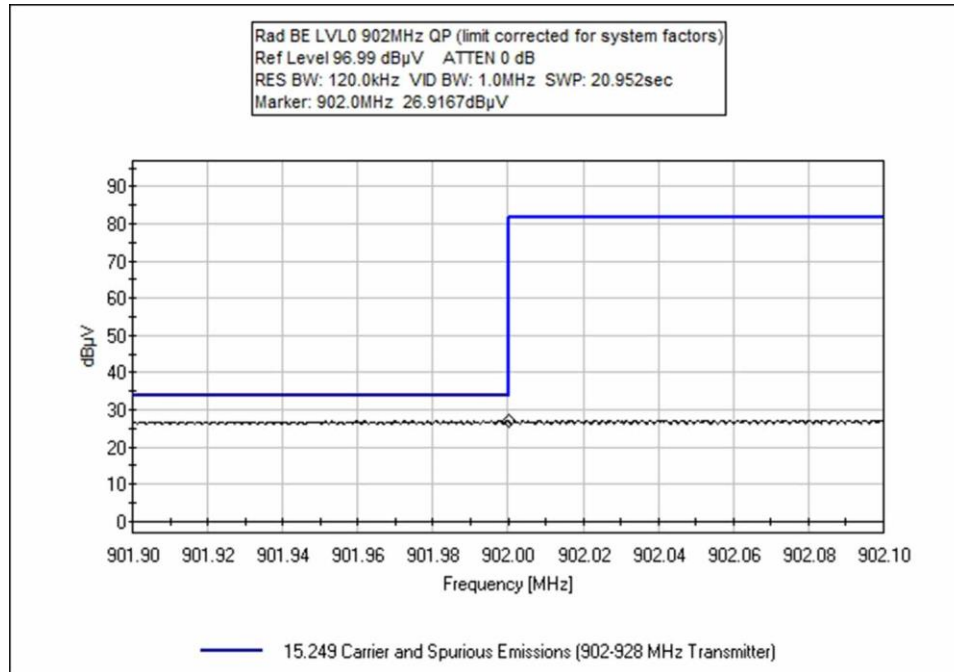
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	1847.600M	50.9	+0.0 +0.0 +0.3	+0.4 +0.0 +0.6	+2.3 -34.7 +0.0	+0.0 +27.6	+0.0	47.4	54.0	-6.6	Horiz
2	5448.040M	39.0	+0.0 +0.0 +0.5	+0.8 +0.0 +0.4	+4.6 -33.6 +0.0	+0.0 +34.7	+0.0	46.4	54.0	-7.6	Horiz
3	1831.960M	49.8	+0.0 +0.0 +0.3	+0.4 +0.0 +0.6	+2.3 -34.7 +0.0	+0.0 +27.5	+0.0	46.2	54.0	-7.8	Horiz
4	5542.800M	38.6	+0.0 +0.0 +0.5	+0.8 +0.0 +0.5	+4.7 -33.6 +0.0	+0.0 +34.6	+0.0	46.1	54.0	-7.9	Horiz
5	5448.040M	38.1	+0.0 +0.0 +0.5	+0.8 +0.0 +0.4	+4.6 -33.6 +0.0	+0.0 +34.7	+0.0	45.5	54.0	-8.5	Vert
6	5496.020M	37.8	+0.0 +0.0 +0.5	+0.8 +0.0 +0.4	+4.8 -33.6 +0.0	+0.0 +34.7	+0.0	45.4	54.0	-8.6	Horiz
7	1816.030M	47.6	+0.0 +0.0 +0.3	+0.4 +0.0 +0.6	+2.3 -34.7 +0.0	+0.0 +27.4	+0.0	43.9	54.0	-10.1	Horiz
8	1816.030M	47.1	+0.0 +0.0 +0.3	+0.4 +0.0 +0.6	+2.3 -34.7 +0.0	+0.0 +27.4	+0.0	43.4	54.0	-10.6	Vert
9	3663.960M	40.5	+0.0 +0.0 +0.4	+0.6 +0.0 +0.2	+3.2 -33.8 +0.0	+0.0 +31.7	+0.0	42.8	54.0	-11.2	Horiz
10	3695.360M	40.1	+0.0 +0.0 +0.3	+0.6 +0.0 +0.2	+3.2 -33.8 +0.0	+0.0 +31.9	+0.0	42.5	54.0	-11.5	Horiz
11	3631.940M	38.8	+0.0 +0.0 +0.4	+0.6 +0.0 +0.3	+3.2 -33.8 +0.0	+0.0 +31.7	+0.0	41.2	54.0	-12.8	Horiz
12	3631.940M	36.4	+0.0 +0.0 +0.4	+0.6 +0.0 +0.3	+3.2 -33.8 +0.0	+0.0 +31.7	+0.0	38.8	54.0	-15.2	Vert
13	862.300M QP	22.5	+0.0 +28.9 +0.0	+0.3 +0.0 +0.0	+1.5 +0.0 -27.5	+2.3 +0.0	+0.0	28.0	46.0	-18.0	Horiz
^	862.300M	31.0	+0.0 +28.9 +0.0	+0.3 +0.0 +0.0	+1.5 +0.0 -27.5	+2.3 +0.0	+0.0	36.5	46.0	-9.5	Horiz
15	16.921M	10.8	+0.0 +0.0 +0.0	+0.0 +7.6 +0.0	+0.2 +0.0 +0.0	+0.0 +0.0	-40.0	-21.4	29.5	-50.9	Groun

Band Edge

Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	OOK (Power Level 0)	Integral PCB	39.1	<46	Pass
928	OOK (Power Level 0)	Integral PCB	43.6	<46	Pass

Test performed using operational mode with the highest output power, representing worst case

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: **15.249 Carrier and Spurious Emissions (902-928 MHz Transmitter)**
 Work Order #: **107148** Date: 8/15/2022
 Test Type: **Maximized Emissions** Time: 16:13:48
 Tested By: Michael Atkinson Sequence#: 7
 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:

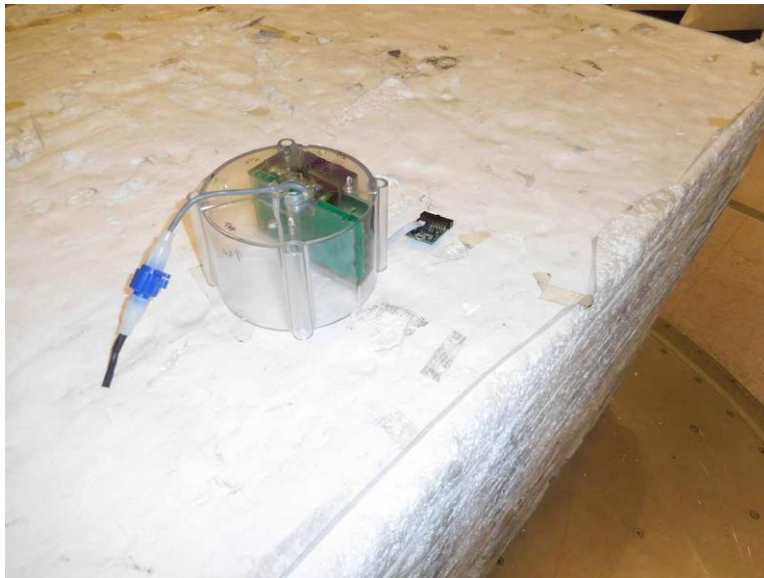
Environmental Conditions:
Temperature: 24°C
Humidity: 46%
Pressure: 101.4kPa
Method: ANSI C63.10 (2013)
Frequency: Band Edge
Setup:
EUT is on foam table.
EUT is transmitting with modulation.
2 orientations investigated per manufacturer installed use case, worst case reported.
Horizontal and vertical 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	Helix	1/17/2022	1/17/2024
T2	ANP06515	Cable	Helix	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
T5	AN02307	Preamp	8447D	1/6/2022	1/6/2024
T6	ANP07929	Attenuator	PE7004-6	3/7/2022	3/7/2024

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	928.000M	30.2	+0.3	+1.6	+2.4	+30.6	+0.0	43.6	46.0	-2.4	Horiz
	QP		-27.3	+5.8							
2	902.000M	26.9	+0.3	+1.6	+2.3	+29.6	+0.0	39.1	46.0	-6.9	Horiz
	QP		-27.4	+5.8							

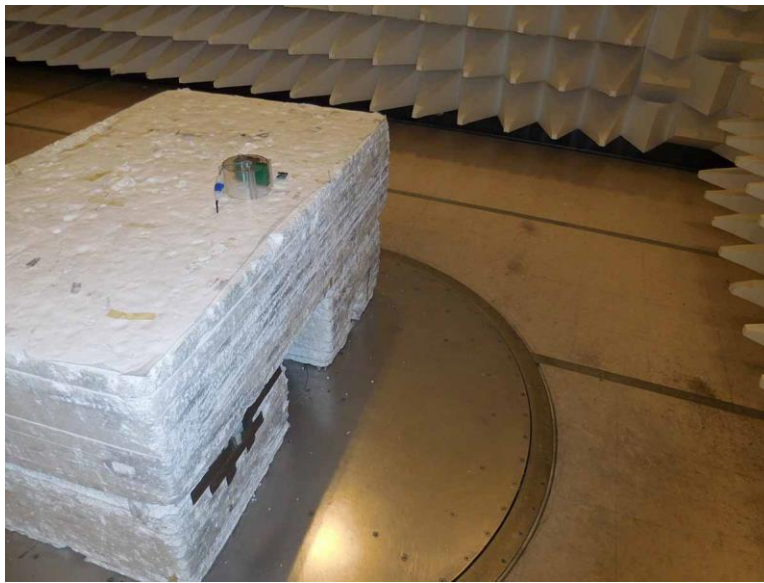
Test Setup Photo(s)



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