Itron, Inc.

TEST REPORT FOR

AMR transceiver device for communicating with utility meters
Models: IMRD-INT and IMRD-EXT

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(FHSS 902-928 MHz)

Report No.: 109895-15

Date of issue: August 28, 2024

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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Testing the Future
CKC LABORATORIES, INC.

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Administrative Information

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jack McPeck
Customer Reference Number: 298696

REPORT PREPARED BY:

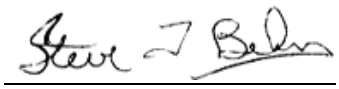
Viviana Prado
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 109895

DATE OF EQUIPMENT RECEIPT: July 23, 2024
DATE(S) OF TESTING: July 23 and 24, 2024

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.
22116 23rd Drive SE, 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 (FHSS 902-928MHz)

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

NA = Not Applicable
NP = CKC Laboratories was not contracted to perform test.

Partial testing for a PCI based on report 105444-4.

ISO/IEC 17025 Decision Rule
The equipment sample utilized for testing is selected by the manufacturer. The declaration of pass or fail herein is a binary statement for simple acceptance rule (ILAC G8) based upon assessment to the specification(s) listed above, without consideration 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
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRD-INT	66040505

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6410	3XG40P1
Tablet	Panasonic	FZ-G1	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRD-EXT	66043569

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6410	3XG40P1
Tablet	Panasonic	FZ-G1	NA
Attached Antenna	L-comm	3dBi Rubber Duck	NA

Configuration 4 (Conducted RF test unit)

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRD-INT	66040562

Support Equipment:

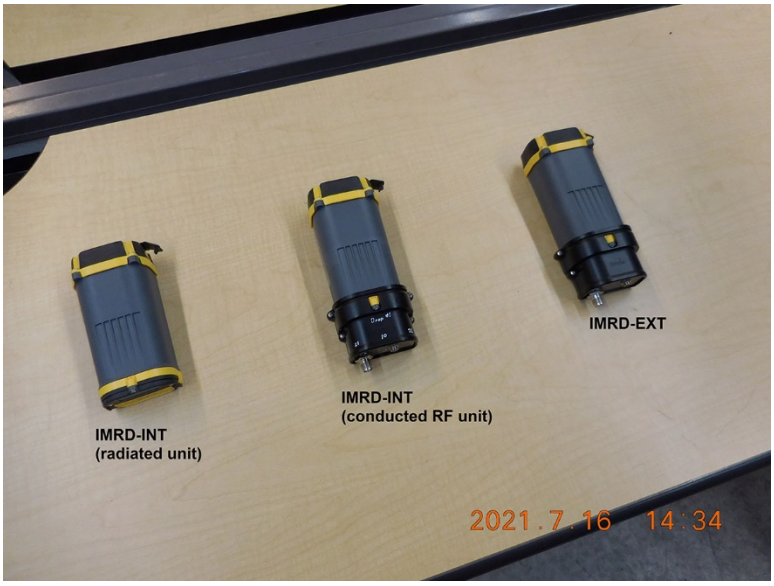
Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6410	3XG40P1

General Product Information:

Description of EUT
Wireless meter reader

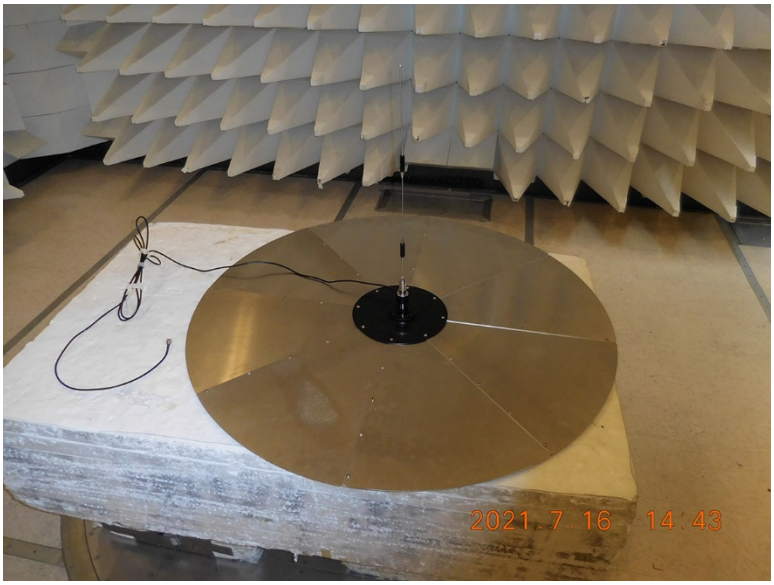
Product Information	Manufacturer-Provided Details
Operating Frequencies Tested:	908-924MHz
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Proprietary FHSS
Maximum Duty Cycle:	Tested 100% as worst case
Modulation Type(s):	FSK
Number of TX Chains:	1
Beamforming Type:	NA
Antenna Type(s) and Gain:	Internal PIFA 1.2dBi External Omni Attached 3dBi
Antenna Connection Type:	Integral and external variant
Nominal Input Voltage:	120VAC 60Hz to AC on Internal Unit 13.8 DC on External Unit
Firmware / Software Version(s):	MC3 superraptor Test version 4.2.0.0
Firmware / Software Description:	Test software for EUT
Firmware / Software Setting(s):	Internal power settings HighISMsetting=0x7D08 External power settings HighISMsetting=0x7D08
Tune-up or Adjustment(s):	Radio parameters highISMsetting adjusted
Receiver Bandwidth and Synchronization:	The manufacturer declares the receiver input bandwidth matches the transmit channel bandwidth and shifts frequencies in synchronization with the transmitter.
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)



EUTs

Attached Antenna with Adapter



External Antenna + Ground Plane

Support Equipment Photo(s)

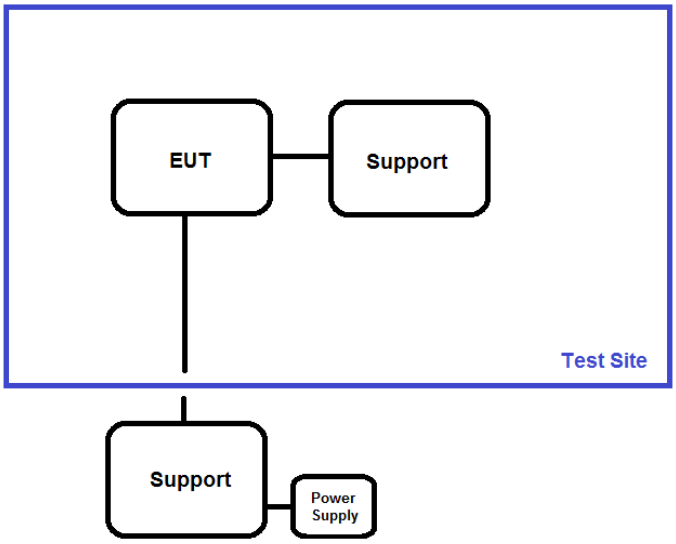
Laptop

Tablet

Block Diagram of Test Setup(s)

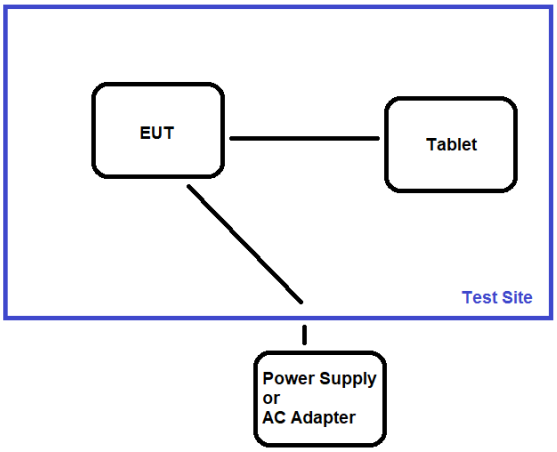
Config#	Setup Description of Block Diagram
1	EUT on a test bench connected to a support tablet.
2	EUT on a test bench connected to a support tablet.
4	EUT on a test bench

Test Setup Block Diagram



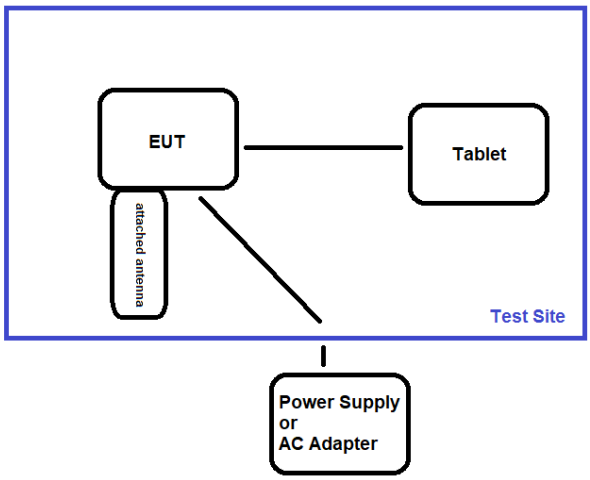
Configuration 1

Test Setup Block Diagram



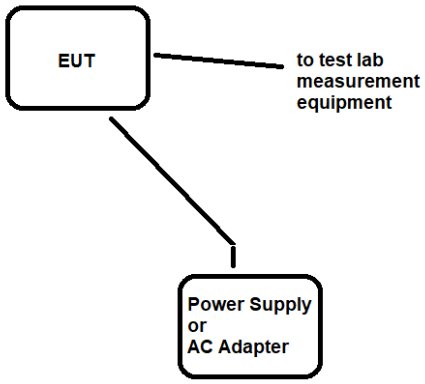
Configuration 2

Test Setup Block Diagram



Configuration 4

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	C. Plumadore/ S.Pittsford
Test Method:	ANSI C63.10 (2020)	Test Date(s):	7/23/2024
Configuration:	4 and 2		
Test Setup:	Partial testing for a PCI based on report 105444-4. Voltage variation not performed. EUT is connected to spectrum analyzer through a cable and attenuator.		

Environmental Conditions			
Temperature (ºC)	23.6	Relative Humidity (%):	42.2

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02673	Spectrum Analyzer	Agilent	E4446A	3/8/2024	3/8/2026
P07505	Cable	TMS	CLU40-KMKM-02.00F	1/19/2024	1/19/2026
P06242	Attenuator	Weinschel	54A-10	2/13/2023	2/13/2025

Test Data Summary - RF Conducted Measurement

$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$

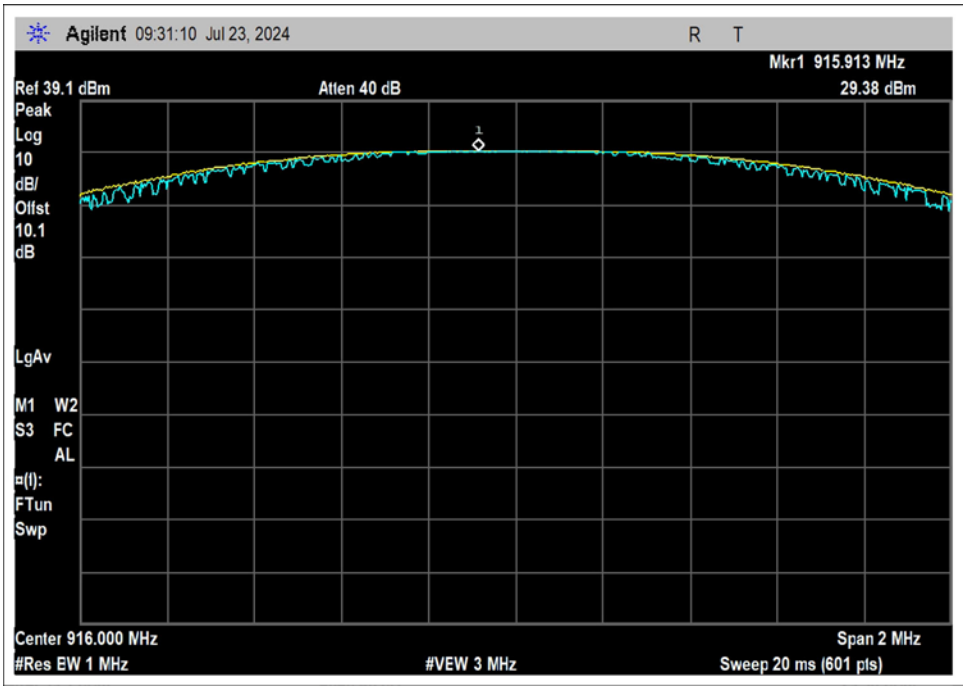
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	RF Conducted (dBm)		EIRP (dBm)		Results
			Measured	Limit	Calculated	Limit	
916	FSK	Internal - Configuration 4 1.2dBi	29.38	≤30	30.58	≤36	Pass
916	FSK	External - Configuration 2 5dBi	27.92	≤30	32.92	≤36	Pass

EIRP is calculated as RF conducted power (dBm) + antenna gain (dBi)

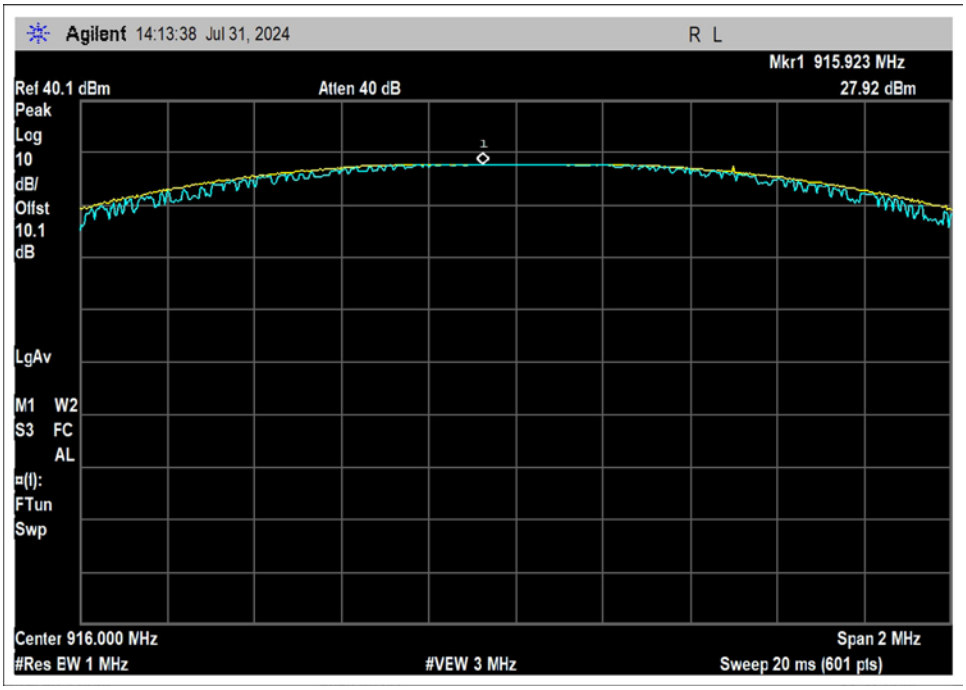
The RF conducted power limit is calculated according to the maximum allowed RF conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b):

$Limit = 30\ (or\ 24) - Roundup(G - 6)$

Plots

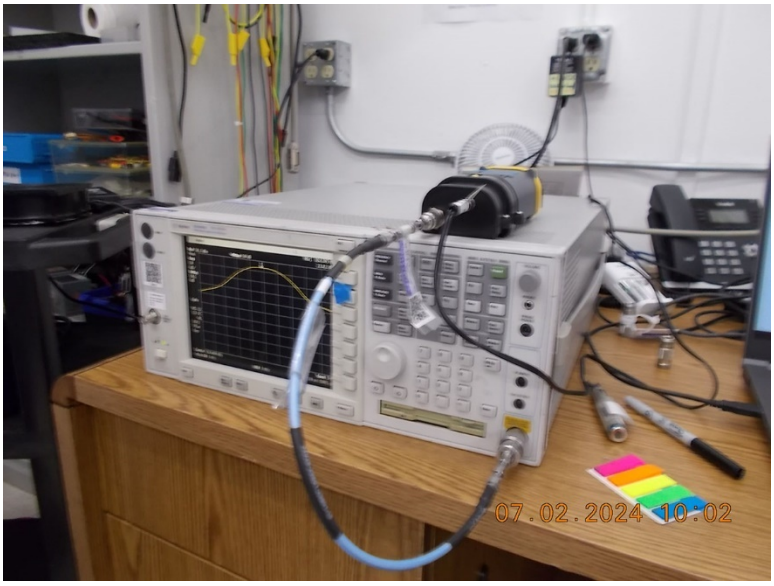


Internal



External

Test Setup Photo(s)



15.35(c) Duty Cycle Correction Factor

Test Data Summary			
Antenna Port	**Operational Mode**	**Measured On Time (mS / P_{obs})**	**Calculated DCCF (dB)**
1	Transmitting RF bursts	45/100	-6.9*

*Duty cycle data from report 105444-4 used.

15.247(d) Radiated Emissions & Band Edge

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	C. Plumadore/ S. Pittsford
Test Method:	ANSI C63.10 (2020)	Test Date(s):	7/23/2024
Configuration:	1 and 2		
Notes:	Partial testing for a PCI based on report 105444-4 band edge not performed.		

Environmental Conditions			
Temperature (ºC)	23.6	Relative Humidity (%):	42.2

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717
Customer: **Itron, Inc.**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **109895** Date: 7/23/2024
Test Type: **Radiated Scan** Time: 11:40:29
Tested By: C. Plumadore Sequence#: 1
Software: EMITest 5.03.21

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

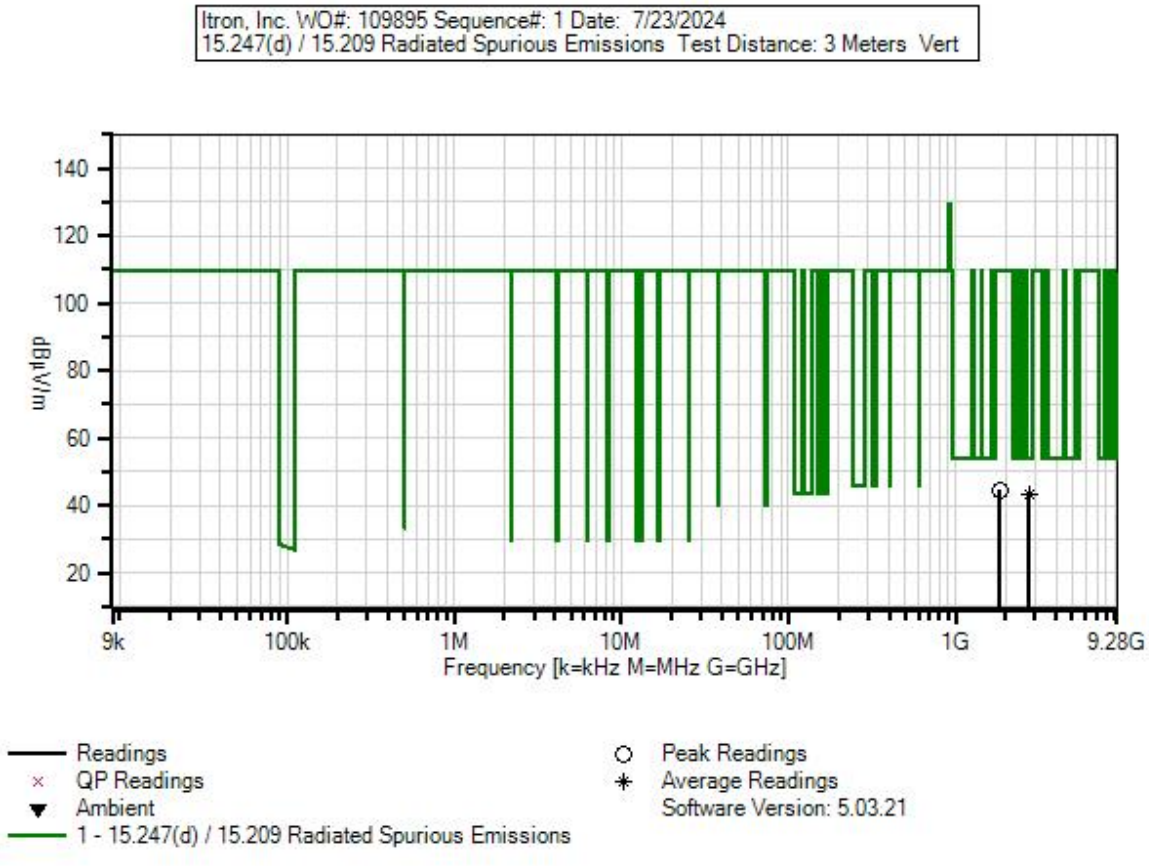
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 23.6°C
Humidity: 42.2%
Pressure: 102.0 kPa

Test Method: ANSI C63.10 (2020)

Frequency: 1-10GHz

FSK 12.5kbps



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T2	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T3	ANP06011	Cable	Heliax	11/16/2023	11/16/2025
T4	ANP06515	Cable	Heliax	2/28/2024	2/28/2026
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/19/2024	1/19/2026
	AN02673	Spectrum Analyzer	E4446A	3/8/2024	3/8/2026
T6	AN03170	High Pass Filter	HM1155-11SS	9/27/2023	9/27/2025
T7	ANP07929	Attenuator	PE7004-6	2/26/2024	2/26/2026
T8	AN45% DCCF	Test Data Adjustment		6/24/2021	6/24/3000

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

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2748.114M	45.0	-34.5	+29.3	+0.8	+2.8	+0.0	43.2	54.0	-10.8	Vert
	Ave		+0.5	+0.3	+5.9	-6.9					
^	2748.114M	51.0	-34.5	+29.3	+0.8	+2.8	+0.0	49.2	54.0	-4.8	Vert
			+0.5	+0.3	+5.9	-6.9					
3	1831.845M	49.3	-35.1	+27.6	+0.6	+2.3	+0.0	44.5	109.5	-65.0	Vert
			+0.4	+0.4	+5.9	-6.9					

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**109895**	Date:	7/24/2024
Test Type:	**Radiated Scan**	Time:	16:17:35
Tested By:	C. Plumadore	Sequence#:	7
Software:	EMITest 5.03.21		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

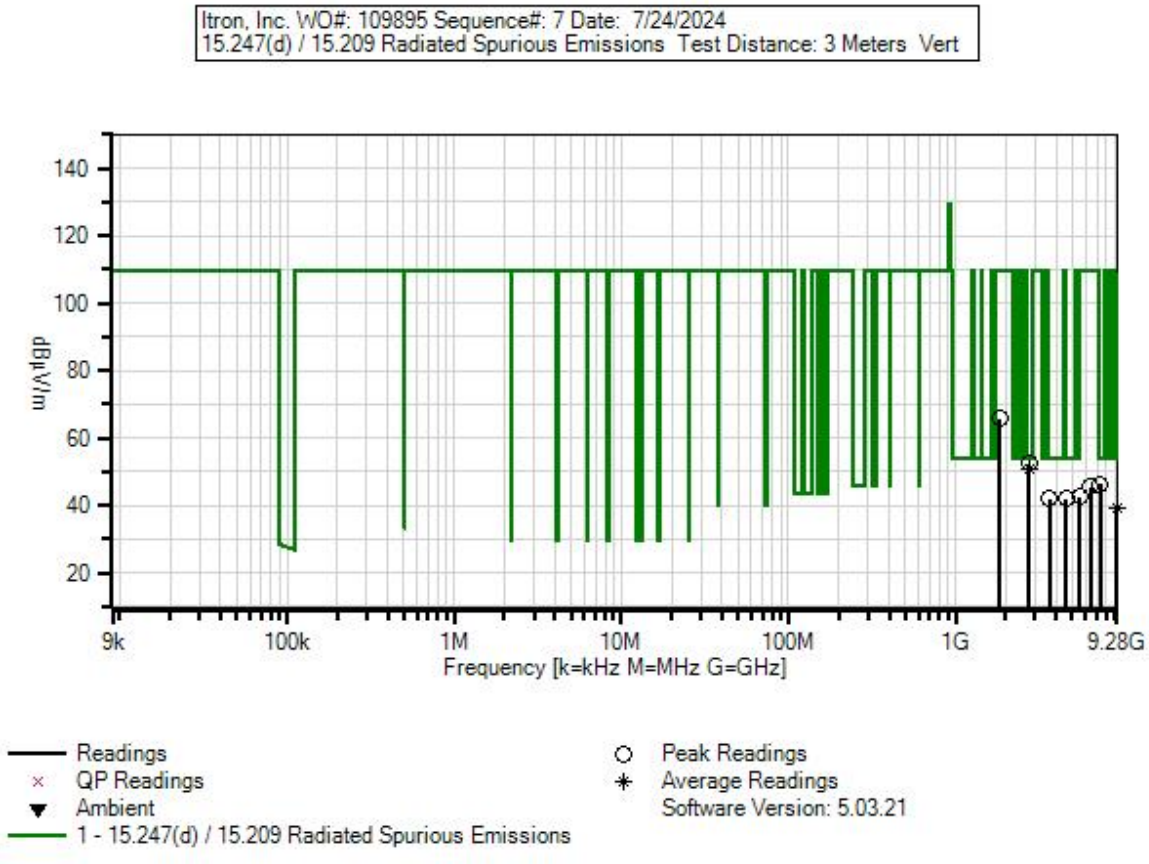
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 23.6°C
Humidity: 42.2%
Pressure: 102.0 kPa

Test Method: ANSI C63.10 (2020)

Frequency: 1-10GHz

power set to 7D
FSK 12.5kbps



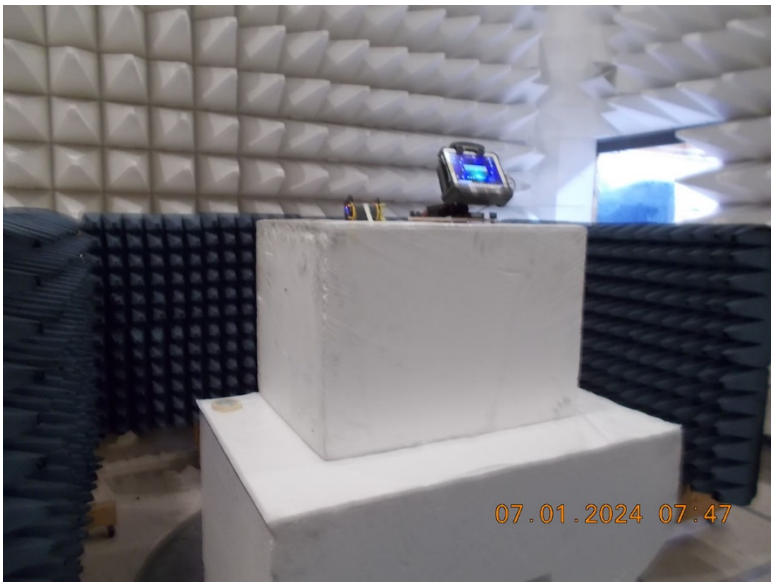
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T2	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T3	ANP06011	Cable	Heliax	11/16/2023	11/16/2025
T4	ANP06515	Cable	Heliax	2/28/2024	2/28/2026
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/19/2024	1/19/2026
	AN02673	Spectrum Analyzer	E4446A	3/8/2024	3/8/2026
T6	AN03170	High Pass Filter	HM1155-11SS	9/27/2023	9/27/2025
	ANP07929	Attenuator	PE7004-6	2/26/2024	2/26/2026
T7	AN45% DCCF	Test Data Adjustment		6/24/2021	6/24/3000

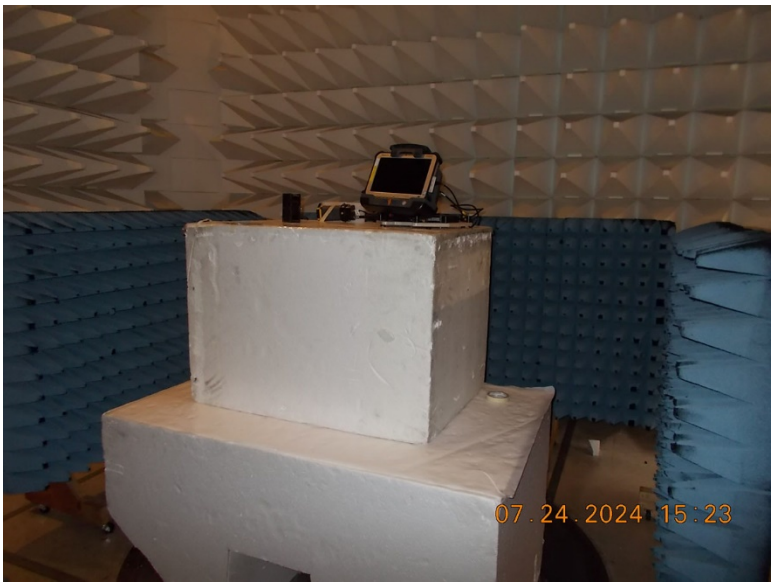
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	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	2747.865M	60.0	-34.5 +0.5	+29.3 +0.3	+0.8 -6.9	+2.8	+0.0	52.3	54.0	-1.7	Vert
2	2748.000M Ave	58.4	-34.5 +0.5	+29.3 +0.3	+0.8 -6.9	+2.8	+0.0	50.7	54.0	-3.3	Vert
3	7327.965M	43.5	-35.1 +0.6	+37.2 +0.5	+1.5 -6.9	+5.0	+0.0	46.3	54.0	-7.7	Vert
4	3663.920M	46.4	-34.0 +0.4	+31.4 +0.3	+0.9 -6.9	+3.4	+0.0	41.9	54.0	-12.1	Vert
5	4579.995M	44.3	-33.8 +0.6	+32.2 +0.4	+1.1 -6.9	+3.9	+0.0	41.8	54.0	-12.2	Vert
6	9159.350M Ave	33.7	-34.7 +0.9	+37.7 +0.9	+1.6 -6.9	+6.1	+0.0	39.3	54.0	-14.7	Vert
^	9159.350M	45.8	-34.7 +0.9	+37.7 +0.9	+1.6 -6.9	+6.1	+0.0	51.4	54.0	-2.6	Vert
8	1831.910M	76.4	-35.1 +0.4	+27.6 +0.4	+0.6 -6.9	+2.3	+0.0	65.7	109.5	-43.8	Vert
9	6411.880M	44.3	-34.3 +0.6	+34.7 +0.5	+1.3 -6.9	+5.1	+0.0	45.3	109.5	-64.2	Vert
10	5495.950M	42.5	-33.8 +0.4	+34.4 +0.5	+1.2 -6.9	+4.2	+0.0	42.5	109.5	-67.0	Vert

Test Setup Photo(s)



Configuration 1; Above 1GHz



Configuration 2; Above 1GHz

Supplemental Information

Measurement Uncertainty

Uncertainty Value	Parameter
5.77 dB	Radiated Emissions
0.673 dB	RF Conducted Measurements
5.77 x 10^{-10}	Frequency Deviation
0.00005 s	Time Deviation
3.18 dB	Mains Conducted Emissions

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.

End of Report