

Ittron, Inc.

TEST REPORT FOR

MC4Max

Model: MC3C*

*(See Appendix A for Manufacturers Declaration)

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

**15.247
(FHSS 902-928 MHz)**

Report No.: 109570-6

Date of issue: April 30, 2024



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: Jack McPeck
Customer Reference Number: 294642

REPORT PREPARED BY:

Lisa Bevington
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 109570

DATE OF EQUIPMENT RECEIPT:

April 3, 2024

DATE(S) OF TESTING:

April 3 & 8, 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.

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.
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	NA1

NA = Not Applicable

NA1 = Not applicable because EUT is battery powered.

NP = CKC Laboratories, Inc. was not contracted to perform test.

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
MC4Max	Itron, Inc.	MC3C	74007940

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Panasonic	CF-VEK33	T1126Z
Laptop PSU	Panasonic	CF-AA5713A M3	5713AM317811923D
EUT Power Source	RadioShack	Switching Power Supply	10A08

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
MC4Max	Itron, Inc.	MC3C	74007940

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Panasonic	CF-VEK33	T1126Z
Laptop PSU	Panasonic	CF-AA5713A M3	5713AM317811923D
EUT Power Source	RadioShack	Switching Power Supply	10A08
5dBi Antenna	PCTEL	Generic	NA
Receiver Antenna	PCTEL	SUB-0275-001/H	S15180005

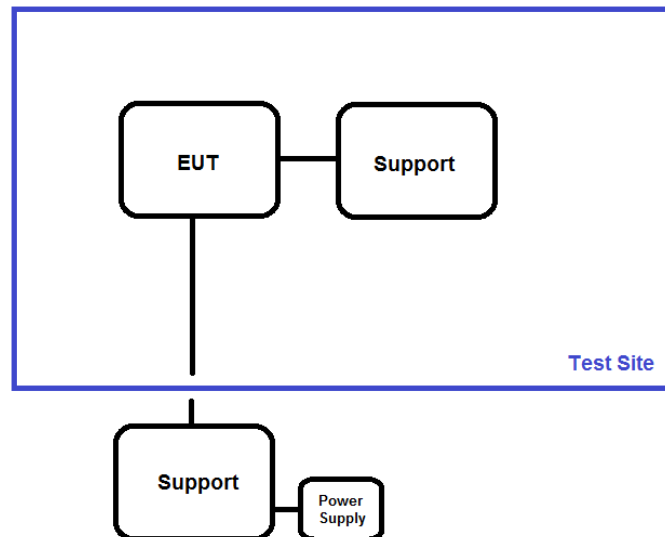
General Product Information:

Description of EUT	
Mobile Collection System	
Product Information	Manufacturer-Provided Details
Operating Frequencies Tested:	904.8-924.4 MHz
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Maximum Duty Cycle:	Tested at 100%
Modulation Type(s):	FSK 150kbps
Number of TX Chains:	1
Beamforming Type:	NA
Antenna Type(s) and Gain:	Omni / 5 dBi
Antenna Connection Type:	External Connector
Nominal Input Voltage:	Battery / 13.8VDC
Firmware / Software Version(s):	ARM version: 8.00.00.19 DSP version: 7.00.00.57 FPGA version: 3.08 TX version: 0.00 PSoC version: 0.00 MC3 SuperRaptor Test 4.2.0.0
Firmware / Software Description:	<ul style="list-style-type: none"> Radio Firmware consists of 3 separate files - <ul style="list-style-type: none"> ARM code for the ARM Cortex processor contained within the OMAP application processor. DSP code for the Digital Signal Processor contained within the OMAP application processor. FPGA code for the Field Programmable Gate Array Software for testing the EUT consists of MC3Test running on a PC. MC3Test is used to set the transmitter power, frequency, modulation, and data rate during testing. This software is not available to the end user and the end user has no control over transmitter settings.
Firmware / Software Setting(s):	TXDAC: 10 PA: 29
Tune-up or Adjustment(s):	None
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.	

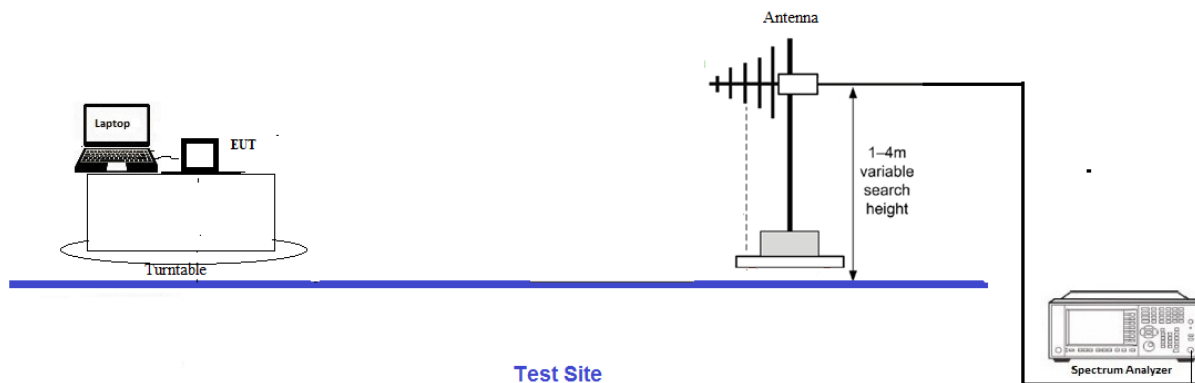
Block Diagram of Test Setup(s)

Config#	Setup Description of Block Diagram
1	EUT is setup for conducted measurements. The antenna port is directly connected to a spectrum analyzer via cable and attenuator.
2	EUT is setup for radiated measurements. Radio is connected to a laptop.

Test Setup Block Diagram



Radiated test setup



FCC Part 15 Subpart C

15.247(b)(2) Output Power

Test Setup/Conditions

Test Location:	Bothell Lab C3	Test Engineer:	Matt Harrison
Test Method:	ANSI C63.10 (2020)	Test Date(s):	4/8/2024
Configuration:	1		
Test Setup:	EUT is setup for conducted measurements. The antenna port is directly connected to a spectrum analyzer via cable and attenuator.		

Environmental Conditions

Temperature (°C)	21	Relative Humidity (%):	42
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Test Equipment

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02673	PSA Series Spectrum Analyzer	Agilent	E4446A	3/8/2024	3/8/2026
P05503	Attenuator	Narda	766-10	4/28/2023	4/28/2025
P06009	Cable	Andrew	Heliac	3/7/2024	3/7/2026

Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using an external power supply to simulate a fresh battery (13.8VDC).

Test Data Summary - RF Conducted Measurement

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

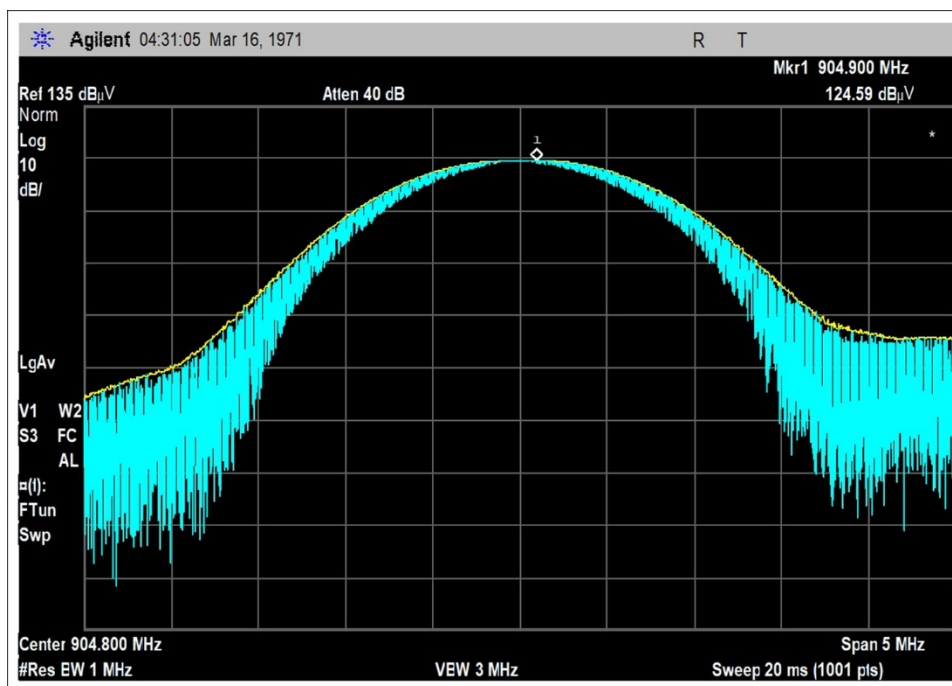
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	RF Conducted (dBm)		EIRP (dBm)		Results
			Measured	Limit	Calculated	Limit	
904.8	150kbps	Omni / 5 dBi	28.3	≤ 30	33.3	≤36	Pass
914	150kbps	Omni / 5 dBi	29.6	≤ 30	34.6	≤36	Pass
924.4	150kbps	Omni / 5 dBi	29.5	≤ 30	34.5	≤36	Pass

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

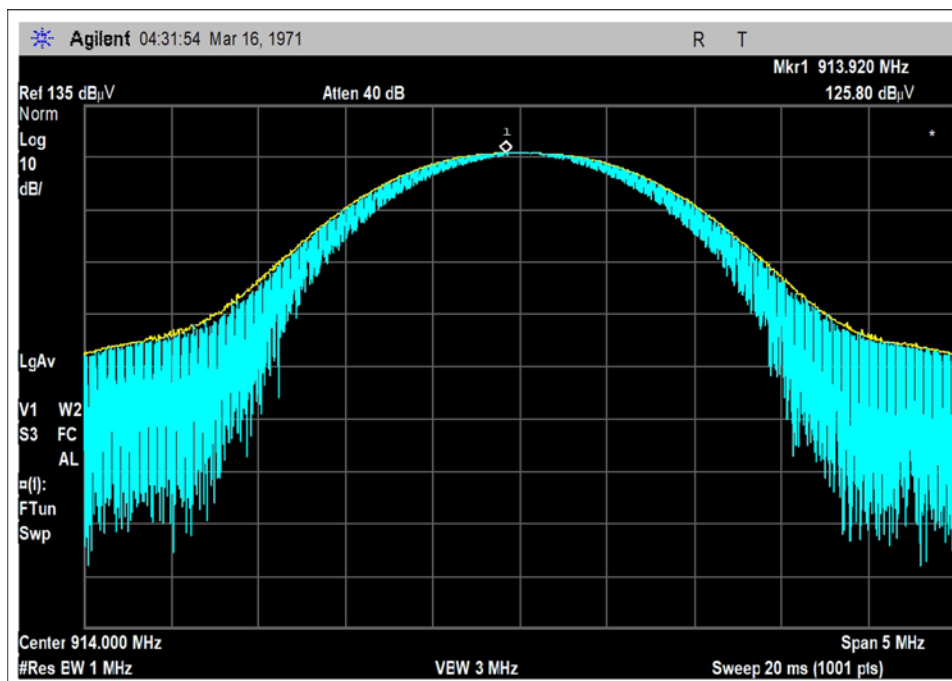
The RF conducted power limit is calculated according to the maximum allowed RF conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b):

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

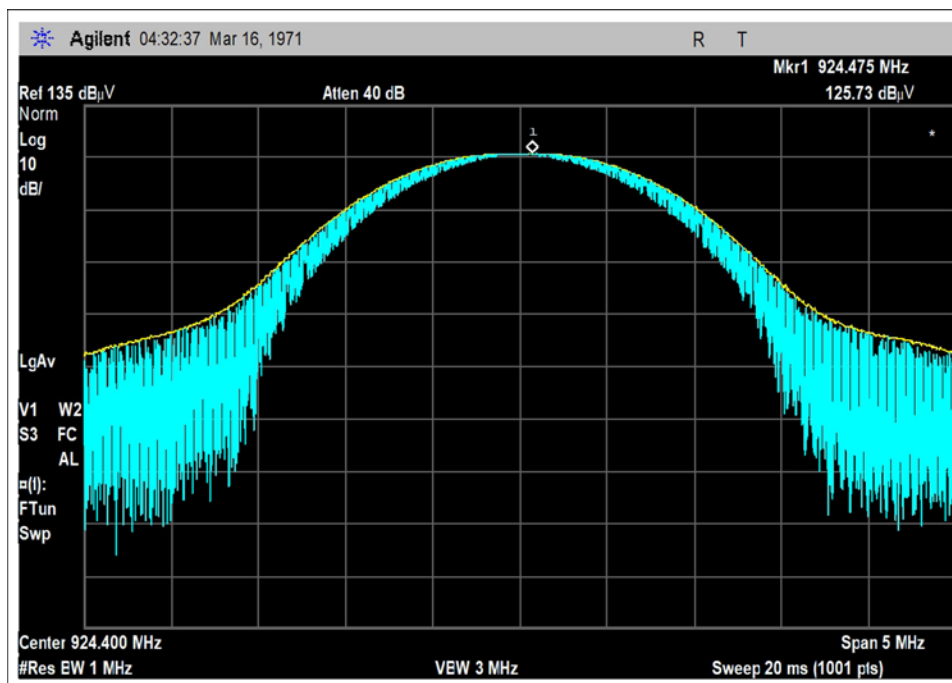
Plots



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 FHSS >50 Channels)**
 Work Order #: **109570** Date: 4/8/2024
 Test Type: **Conducted Emissions** Time: 08:39:43
 Tested By: Matt Harrison Sequence#: 3
 Software: EMITest 5.03.20 13.8VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

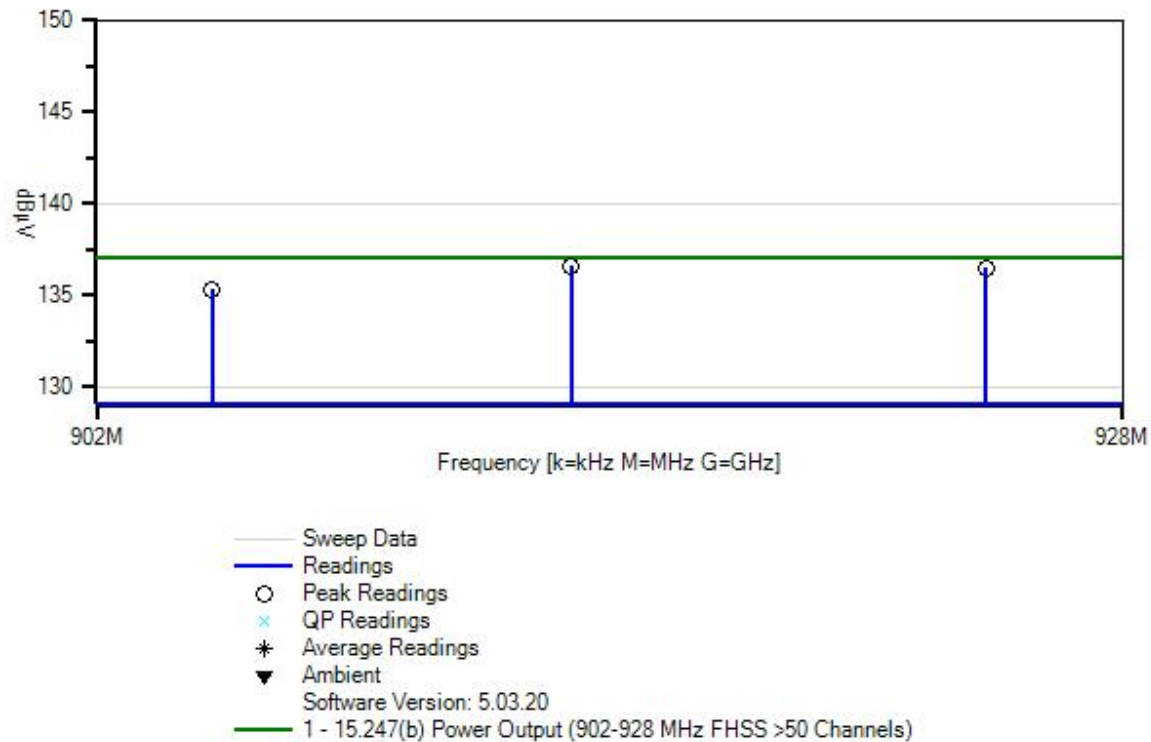
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

<p>Test Environment Conditions: Temperature: 20°C Humidity: 42% Pressure: 100.3kPa</p> <p>Test Method: ANSI C63.10 Test Mode: Modulated Tx Test Setup: EUT is setup for conducted measurements. The antenna port is directly connected to a spectrum analyzer via cable and attenuator.</p> <p>Band of operation: 902-928 MHz Frequency tested: 904.8, 914, 924.4 MHz Firmware power setting: 06 01 30 Protocol /MCS/Modulation: FSK 150kbps Duty Cycle: 100%</p> <p>Antenna type: External Omni Antenna Gain: 5 dBi. EUT Firmware: See Report Details Modifications: None</p>
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Ittron, Inc. WO#: 109570 Sequence#: 3 Date: 4/8/2024
15.247(b) Power Output (902-928 MHz FHSS >50 Channels) Test Lead: 13.8VDC RF Port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	4/28/2023	4/28/2025
T2	ANP06009	Cable	Heliac	3/7/2024	3/7/2026
	AN02673	Spectrum Analyzer	E4446A	3/8/2024	3/8/2026

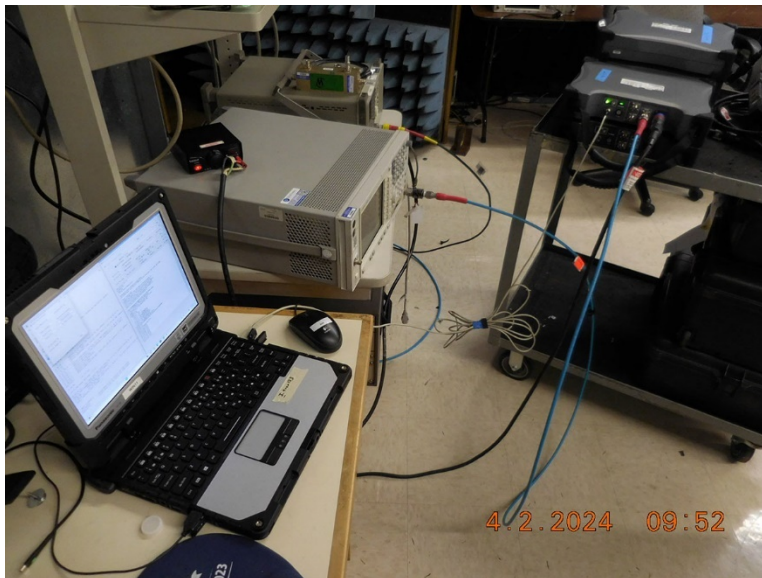
Measurement Data:

Reading listed by margin.

Test Lead: RF Port

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	Dist dB	Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	913.920M	125.8	+10.2	+0.6		+0.0	136.6	137.0	-0.4	RF Po
2	924.475M	125.7	+10.2	+0.6		+0.0	136.5	137.0	-0.5	RF Po
3	904.900M	124.6	+10.2	+0.5		+0.0	135.3	137.0	-1.7	RF Po

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 #: **109570** Date: 4/3/2024
 Test Type: **Radiated Scan** Time: 09:31:24
 Tested By: Matt Harrison Sequence#: 1
 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:

Test Environment Conditions:
 Temperature: 23°C
 Humidity: 41%
 Pressure: 102kPa

 Test Method: ANSI C63.10
 Test Mode: Modulated Tx
 Test Setup: EUT is setup in a tabletop configuration. It is connected to 2 RX antennas, 1Tx/GPS RX antenna, a Laptop, and a power supply. X, Y, Z and both polarities were explored, worst-case data provided.

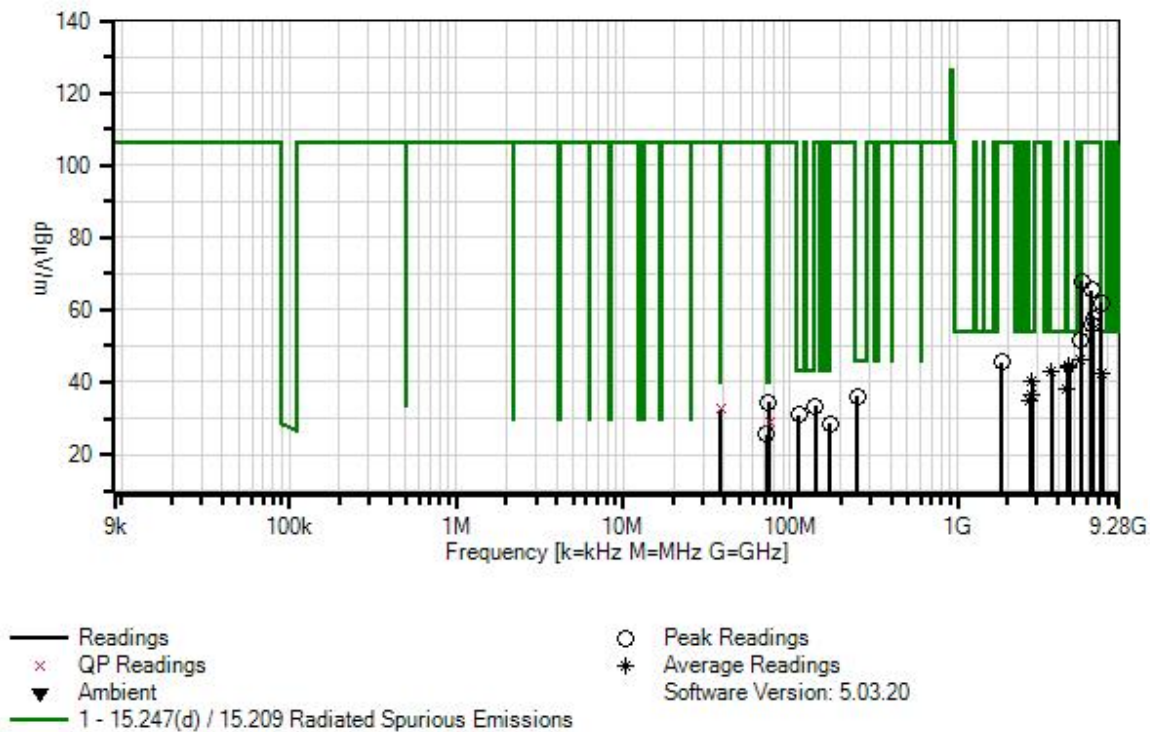
 Frequency Range: 9k-10GHz

 Band of operation: 902-928 MHz
 Frequency tested: 904.8, 914, 924.4 MHz
 Firmware power setting: 06 01 30
 Protocol /MCS/Modulation: FSK 150kbps
 Duty Cycle: 100%

 Antenna type: External Omni
 Antenna Gain: 5 dBi.
 EUT Firmware: See Report Details
 Modifications: None

 Notes: No EUT emissions found within 20dB of the limit below 30MHz.

Itron, Inc. W/O#: 109570 Sequence#: 1 Date: 4/3/2024
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	AN02673	Spectrum Analyzer	E4446A	3/8/2024	3/8/2026
T5	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025
T6	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T7	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T8	ANP07746	Attenuator	PE7004-6	2/16/2023	2/16/2025
T9	ANP06515	Cable	Heliac	2/28/2024	2/28/2026
T10	ANP07504	Cable	CLU40-KMKM-02.00F	1/19/2024	1/19/2026
T11	AN03170	High Pass Filter	HM1155-11SS	9/27/2023	9/27/2025
T12	ANP08072	Band Reject Filter	BRC50722	10/3/2023	10/3/2025
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T13	AN02307	Preamp	8447D	8/9/2023	8/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9 T13	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	73.512M	47.9	+0.1 +13.0 +0.0 -27.6	+0.4 +0.0 +0.0	+0.6 +0.0 +0.0	+0.0 +0.0 +0.1	+0.0	34.5	40.0	-5.5	Vert 188
2	38.057M QP	42.3	+0.0 +17.3 +0.0 -27.7	+0.3 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0 +0.0 +0.1	+0.0	32.7	40.0	-7.3	Vert 188
^	38.057M	44.5	+0.0 +17.3 +0.0 -27.7	+0.3 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0 +0.0 +0.1	+0.0	34.9	40.0	-5.1	Vert 188
4	5428.800M Ave	33.5	+1.2 +0.0 +4.2 +0.0	+0.0 -33.8 +0.5	+0.0 +34.4 +0.4	+0.0 +5.8 +0.0	+0.0	46.2	54.0 904.8	-7.8	Vert 188
^	5428.800M	42.9	+1.2 +0.0 +4.2 +0.0	+0.0 -33.8 +0.5	+0.0 +34.4 +0.4	+0.0 +5.8 +0.0	+0.0	55.6	54.0 904.8	+1.6	Vert 188
6	4622.000M Ave	34.0	+1.1 +0.0 +3.9 +0.0	+0.0 -33.8 +0.5	+0.0 +32.4 +0.5	+0.0 +5.9 +0.0	+0.0	44.5	54.0 924.4	-9.5	Vert 188
^	4622.000M	42.4	+1.1 +0.0 +3.9 +0.0	+0.0 -33.8 +0.5	+0.0 +32.4 +0.5	+0.0 +5.9 +0.0	+0.0	52.9	54.0 924.4	-1.1	Vert 188
8	251.730M	42.1	+0.2 +18.3 +0.0 -26.8	+0.8 +0.0 +0.0	+1.2 +0.0 +0.0	+0.0 +0.0 +0.2	+0.0	36.0	46.0	-10.0	Horiz 188
9	4570.000M Ave	33.5	+1.1 +0.0 +3.9 +0.0	+0.0 -33.8 +0.6	+0.0 +32.2 +0.4	+0.0 +5.9 +0.0	+0.0	43.8	54.0 914	-10.2	Vert 188
^	4570.000M	42.6	+1.1 +0.0 +3.9 +0.0	+0.0 -33.8 +0.6	+0.0 +32.2 +0.4	+0.0 +5.9 +0.0	+0.0	52.9	54.0 914	-1.1	Vert 188

11	74.975M	42.7	+0.1	+0.4	+0.6	+0.0	+0.0	29.2	40.0	-10.8	Vert
	QP		+12.9	+0.0	+0.0	+0.0					188
			+0.0	+0.0	+0.0	+0.1					
			-27.6								
^	74.975M	48.2	+0.1	+0.4	+0.6	+0.0	+0.0	34.7	40.0	-5.3	Vert
			+12.9	+0.0	+0.0	+0.0					188
			+0.0	+0.0	+0.0	+0.1					
			-27.6								
14	3656.000M	34.5	+0.9	+0.0	+0.0	+0.0	+0.0	42.8	54.0	-11.2	Vert
	Ave		+0.0	-34.0	+31.4	+5.9		914			188
			+3.4	+0.4	+0.3	+0.0					
			+0.0								
^	3656.000M	43.7	+0.9	+0.0	+0.0	+0.0	+0.0	52.0	54.0	-2.0	Vert
			+0.0	-34.0	+31.4	+5.9		914			188
			+3.4	+0.4	+0.3	+0.0					
			+0.0								
16	7312.000M	26.8	+1.5	+0.0	+0.0	+0.0	+0.0	42.4	54.0	-11.6	Vert
	Ave		+0.0	-35.0	+37.1	+5.9		914			188
			+5.0	+0.6	+0.5	+0.0					
			+0.0								
^	7312.000M	39.8	+1.5	+0.0	+0.0	+0.0	+0.0	55.4	54.0	+1.4	Vert
			+0.0	-35.0	+37.1	+5.9		914			188
			+5.0	+0.6	+0.5	+0.0					
			+0.0								
18	112.312M	43.3	+0.1	+0.5	+0.7	+0.0	+0.0	31.0	43.5	-12.5	Vert
			+13.8	+0.0	+0.0	+0.0					188
			+0.0	+0.0	+0.0	+0.1					
			-27.5								
19	2773.200M	35.4	+0.8	+0.0	+0.0	+0.0	+0.0	40.5	54.0	-13.5	Vert
	Ave		+0.0	-34.5	+29.3	+5.9		924.4			188
			+2.8	+0.5	+0.3	+0.0					
			+0.0								
^	2773.200M	44.1	+0.8	+0.0	+0.0	+0.0	+0.0	49.2	54.0	-4.8	Vert
			+0.0	-34.5	+29.3	+5.9		924.4			188
			+2.8	+0.5	+0.3	+0.0					
			+0.0								
21	171.602M	38.6	+0.1	+0.6	+0.9	+0.0	+0.0	28.5	43.5	-15.0	Vert
			+15.3	+0.0	+0.0	+0.0					188
			+0.0	+0.0	+0.0	+0.2					
			-27.2								
22	4524.000M	28.0	+1.0	+0.0	+0.0	+0.0	+0.0	38.1	54.0	-15.9	Vert
	Ave		+0.0	-33.8	+32.1	+5.9		904.8			188
			+3.8	+0.7	+0.4	+0.0					
			+0.0								
^	4524.000M	40.6	+1.0	+0.0	+0.0	+0.0	+0.0	50.7	54.0	-3.3	Vert
			+0.0	-33.8	+32.1	+5.9		904.8			188
			+3.8	+0.7	+0.4	+0.0					
			+0.0								

24	2742.000M	31.2	+0.8	+0.0	+0.0	+0.0	+0.0	36.3	54.0	-17.7	Vert
	Ave		+0.0	-34.5	+29.3	+5.9			914		188
			+2.8	+0.5	+0.3	+0.0					
			+0.0								
^	2742.000M	42.5	+0.8	+0.0	+0.0	+0.0	+0.0	47.6	54.0	-6.4	Vert
			+0.0	-34.5	+29.3	+5.9			914		188
			+2.8	+0.5	+0.3	+0.0					
			+0.0								
26	2714.400M	29.7	+0.8	+0.0	+0.0	+0.0	+0.0	34.8	54.0	-19.2	Vert
	Ave		+0.0	-34.5	+29.3	+5.9			904.8		188
			+2.8	+0.5	+0.3	+0.0					
			+0.0								
^	2714.400M	42.7	+0.8	+0.0	+0.0	+0.0	+0.0	47.8	54.0	-6.2	Vert
			+0.0	-34.5	+29.3	+5.9			904.8		188
			+2.8	+0.5	+0.3	+0.0					
			+0.0								
28	5546.800M	55.1	+1.2	+0.0	+0.0	+0.0	+0.0	67.8	106.4	-38.6	Vert
			+0.0	-33.8	+34.4	+5.8			924.4		188
			+4.2	+0.4	+0.5	+0.0					
			+0.0								
29	6334.020M	51.8	+1.2	+0.0	+0.0	+0.0	+0.0	65.5	106.4	-40.9	Vert
			+0.0	-34.2	+34.7	+5.9			904.8		188
			+5.0	+0.6	+0.5	+0.0					
			+0.0								
30	7238.180M	46.8	+1.4	+0.0	+0.0	+0.0	+0.0	61.9	106.4	-44.5	Vert
			+0.0	-35.0	+36.9	+5.9			904.8		188
			+4.9	+0.5	+0.5	+0.0					
			+0.0								
31	6471.060M	43.7	+1.3	+0.0	+0.0	+0.0	+0.0	57.6	106.4	-48.8	Vert
			+0.0	-34.3	+34.7	+5.9			924.4		188
			+5.2	+0.5	+0.6	+0.0					
			+0.0								
32	6398.540M	42.1	+1.3	+0.0	+0.0	+0.0	+0.0	56.0	106.4	-50.4	Vert
			+0.0	-34.2	+34.7	+5.9			914		188
			+5.1	+0.6	+0.5	+0.0					
			+0.0								
33	5484.120M	38.7	+1.2	+0.0	+0.0	+0.0	+0.0	51.4	106.4	-55.0	Vert
			+0.0	-33.8	+34.4	+5.8			914		188
			+4.2	+0.4	+0.5	+0.0					
			+0.0								
34	1848.530M	43.2	+0.6	+0.0	+0.0	+0.0	+0.0	45.5	106.4	-60.9	Vert
			+0.0	-35.0	+27.7	+5.9			924.4		188
			+2.3	+0.4	+0.4	+0.0					
			+0.0								
35	141.150M	45.3	+0.1	+0.5	+0.8	+0.0	+0.0	33.4	106.4	-73.0	Horiz
			+13.9	+0.0	+0.0	+0.0					188
			+0.0	+0.0	+0.0	+0.1					
			-27.3								
36	72.180M	39.0	+0.1	+0.4	+0.6	+0.0	+0.0	25.6	106.4	-80.8	Horiz
			+13.0	+0.0	+0.0	+0.0					188
			+0.0	+0.0	+0.0	+0.1					
			-27.6								

Band Edge

Band Edge Summary – Single Channel Mode Configuration 2

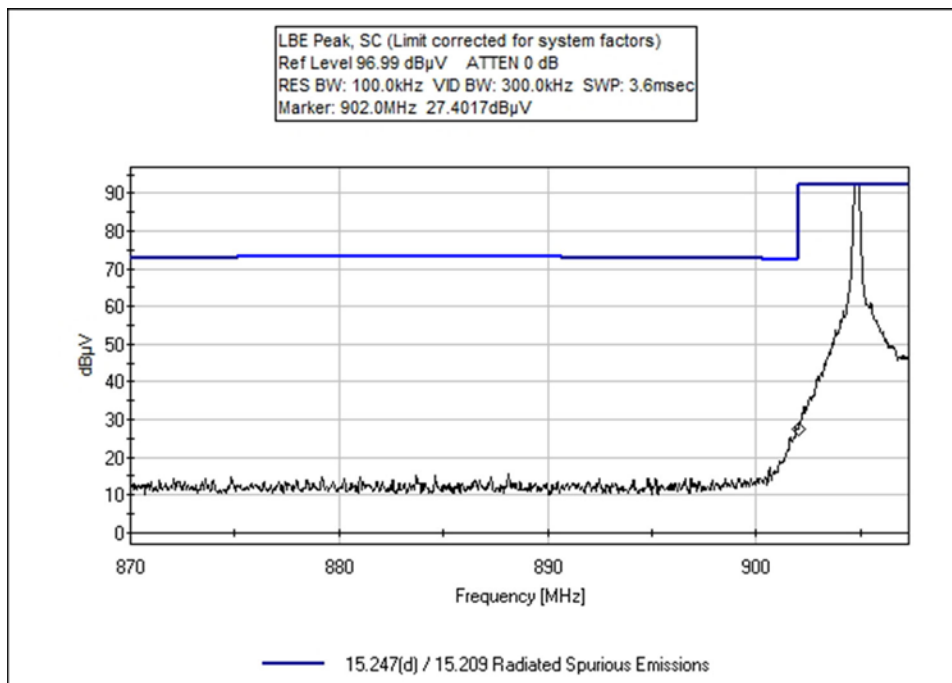
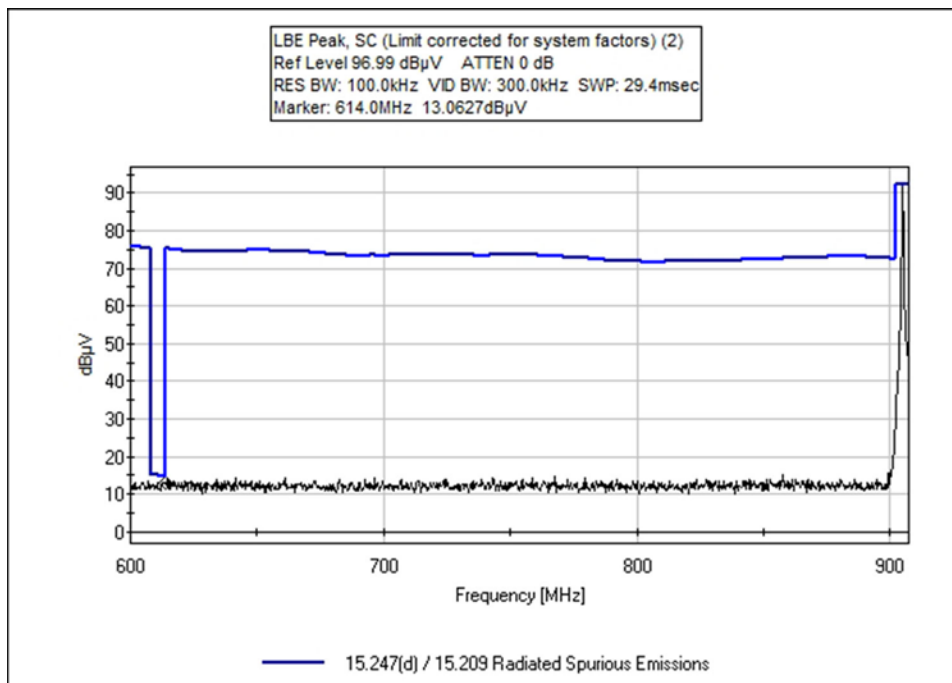
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	150kbps	Omni	40.4	<46	Pass
902			61.3	<106.4	Pass
928			70.2	<106.4	Pass
960			49.2	<54	Pass

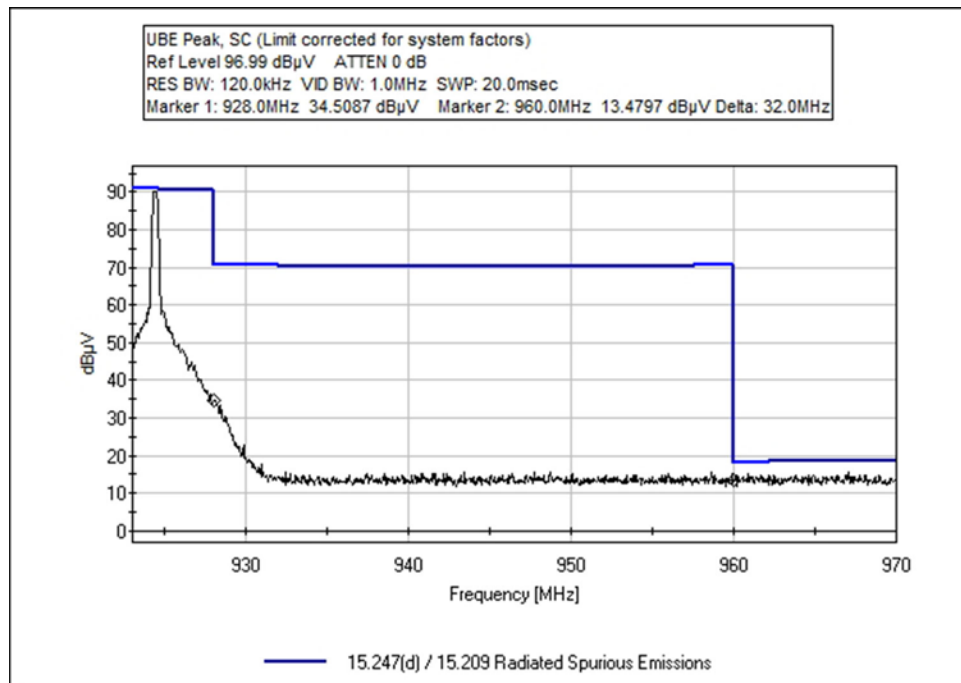
Band Edge Summary – Hopping Mode Configuration 2

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	150kbps	Omni	40.7	<46	Pass
902			61.5	<106.4	Pass
928			68.9	<106.4	Pass
960			49.1	<54	Pass

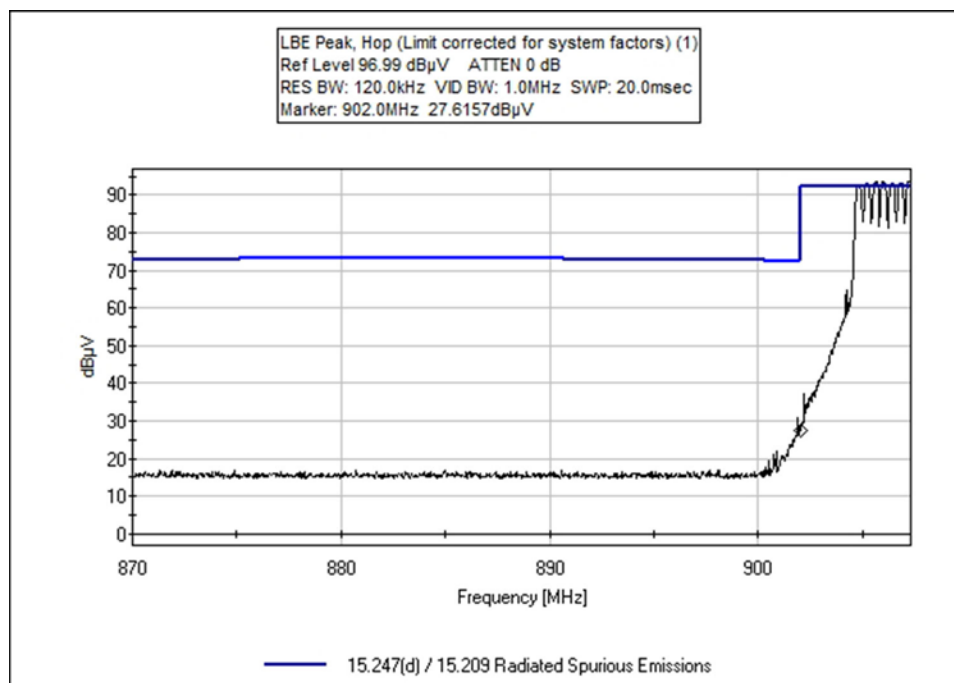
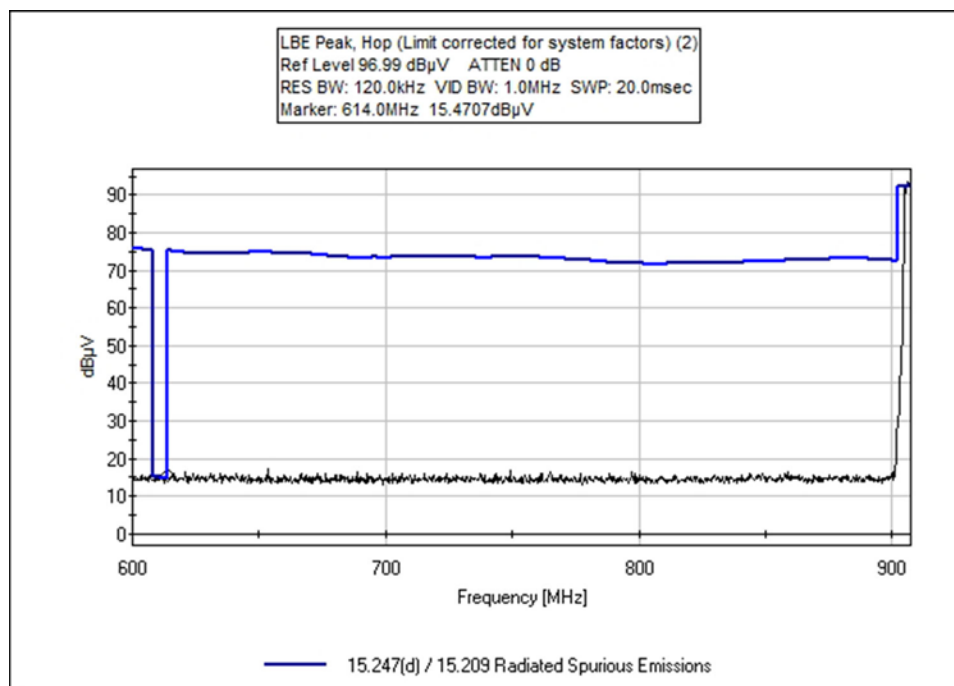
Band Edge Plots

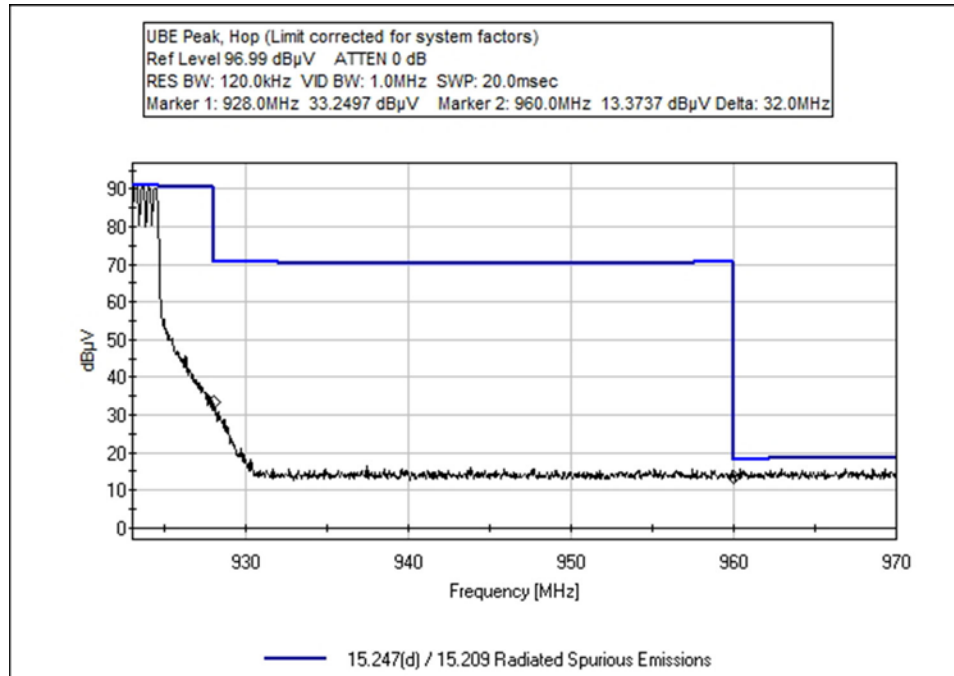
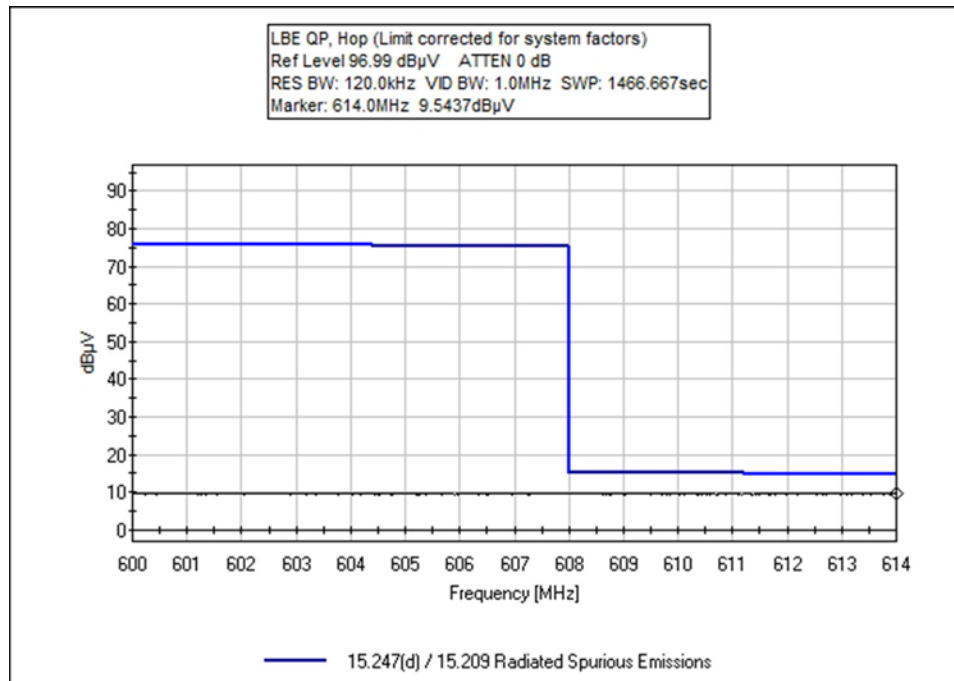
Configuration 2 Single Channel





Hopping





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 #: **109570** Date: 4/3/2024
 Test Type: **Radiated Scan** Time: 11:38:19
 Tested By: Matt Harrison Sequence#: 2
 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:

<p>Test Environment Conditions:</p> <p>Temperature: 23°C</p> <p>Humidity: 41%</p> <p>Pressure: 102kPa</p> <p>Test Method: ANSI C63.10</p> <p>Test Mode: Modulated Tx</p> <p>Test Setup: EUT is setup in a tabletop configuration. It is connected to 2 RX antennas, 1Tx/GPS RX antenna, a Laptop, and a power supply. X, Y, Z and both polarities were explored, worst-case data provided.</p> <p>Frequency Range: 9k-10GHz</p> <p>Band of operation: 902-928 MHz</p> <p>Frequency tested: 904.8, 914, 924.4 MHz</p> <p>Firmware power setting: 06 01 30</p> <p>Protocol /MCS/Modulation: FSK 150kbps</p> <p>Duty Cycle: 100%</p> <p>Antenna type: External Omni</p> <p>Antenna Gain: 5 dBi.</p> <p>EUT Firmware: See Report Details</p> <p>Modifications: None</p> <p>Notes: No EUT emissions found within 20dB of the limit below 30MHz.</p>
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Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	AN02673	Spectrum Analyzer	E4446A	3/8/2024	3/8/2026
T5	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	960.000M	13.5	+0.4 +31.1	+1.6	+2.6	+0.0	+0.0	49.2	54.0 SC	-4.8	Vert 188
2	960.000M	13.4	+0.4 +31.1	+1.6	+2.6	+0.0	+0.0	49.1	54.0 Hop	-4.9	Vert 188
3	614.000M QP	9.5	+0.3 +27.4	+1.2	+2.3	+0.0	+0.0	40.7	46.0 Hop	-5.3	Vert 188
4	614.000M QP	9.2	+0.3 +27.4	+1.2	+2.3	+0.0	+0.0	40.4	46.0 SC	-5.6	Vert 188
^	614.000M	15.5	+0.3 +27.4	+1.2	+2.3	+0.0	+0.0	46.7	46.0 Hop	+0.7	Vert 188
^	614.000M	13.1	+0.3 +27.4	+1.2	+2.3	+0.0	+0.0	44.3	46.0 SC	-1.7	Vert 188
7	928.000M	34.5	+0.4 +31.2	+1.5	+2.6	+0.0	+0.0	70.2	106.4 SC	-36.2	Vert 188
8	928.000M	33.2	+0.4 +31.2	+1.5	+2.6	+0.0	+0.0	68.9	106.4 Hop	-37.5	Vert 188
9	902.000M	27.6	+0.4 +29.5	+1.5	+2.5	+0.0	+0.0	61.5	106.4 Hop	-44.9	Vert 188
10	902.000M	27.4	+0.4 +29.5	+1.5	+2.5	+0.0	+0.0	61.3	106.4 SC	-45.1	Vert 188

Test Setup Photo(s)

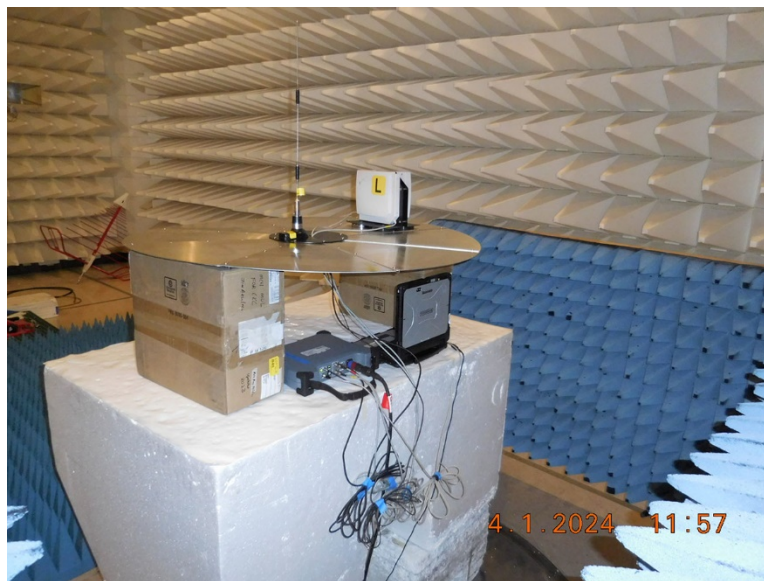
Configuration 2



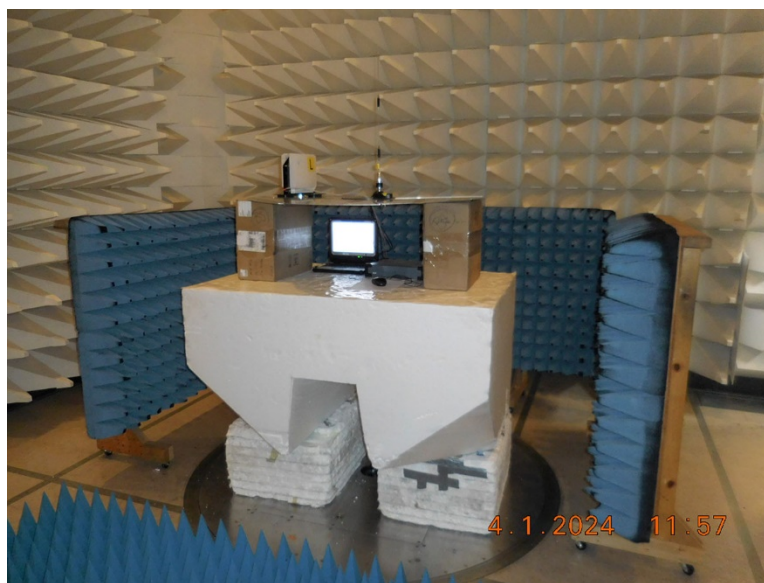
Below 1GHz; View 1



Below 1GHz; View 2



Above 1GHz; View 1



Above 1GHz; View 2

Appendix A: Manufacturer Declaration

The following models have been tested by CKC Laboratories:

Device: MC4Max

Model: MC3C

The manufacturer declares that the following additional models are identical electrically or any differences between them do not affect their EMC characteristics, and therefore meets the level of testing equivalent to the tested model:

Device: MC3

Model: MC3C

Device: MC3Lite

Model: MC3C1

Supplemental Information

Measurement Uncertainty

Uncertainty Value	Parameter
5.77 dB	Radiated Emissions
0.673 dB	RF Conducted Measurements
5.77×10^{-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 $\text{dB}\mu\text{V}/\text{m}$, 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.

End of Report