Itron, Inc.

EMC TEST REPORT FOR

Mobile Collection Device, MC3
Model: DCU5310C

Tested to The Following Standards:

FCC Part 101 Subpart C – Fixed Microwave Services

Report No.: 104623-14

Date of issue: January 21, 2021

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

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: Jay Holcomb
Customer Reference Number: 226650

REPORT PREPARED BY:

Kim Romero
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 104623

DATE OF EQUIPMENT RECEIPT: December 4, 2020
DATE(S) OF TESTING: December 4, 7, 14, and 16, 2020 and January 20, 2021

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.
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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.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.19
EMITest Immunity	5.03.10

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 101

Description	Test Procedure/Method	Results
Technical requirements specifications	**Sub clause**	
Frequency tolerance	FCC Part 101.107(a)	NP
Bandwidth	FCC Part 101.109(c)	NP
Emission limitations.	FCC Part 101.111(a)(5)	PASS
Transmitter power limitations.	FCC Part 101.113(a)	PASS

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 (MC4Max+tablet)

Equipment Tested:

Device	Manufacturer	Model #	S/N
Receiver Antenna	PCTEL	SUB-0275-001/H	S15180005
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
Tablet	Panasonic	FZ-G1	NA
5dBi Antenna	PCTEL	Generic	NA
Mobile Collection Device, MC3	Itron, Inc.	DCU5310C	74007940

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Extech Instruments	382225	P99250026

Configuration 2 (MC4Max+laptop)

Equipment Tested:

Device	Manufacturer	Model #	S/N
Receiver Antenna	PCTEL	SUB-0275-001/H	S15180005
Power Supply	Panasonic	CF-AA5713A M3	5713AM314Z14641A
Laptop	Panasonic	CF-VEK33	T1126Z
5dBi Antenna	PCTEL	Generic	NA
Mobile Collection Device, MC3	Itron, Inc.	DCU5310C	74007940

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Extech Instruments	382225	P99250026

Configuration 3 (MC3Lite+tablet)

Device	Manufacturer	Model #	S/N
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
Tablet	Panasonic	FZ-G1	NA
5dBi Antenna	PCTEL	Generic	NA
Mobile Collection Device, MC3	Itron, Inc.	DCU5310C	74007956

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Extech Instruments	382225	P99250026

EQUIPMENT UNDER TEST (EUT) CONTINUED

Configuration 4 (MC3Lite+laptop)

Device	Manufacturer	Model #	S/N
Power Supply	Panasonic	CF-AA5713A M3	5713AM314Z14641A
Laptop	Panasonic	CF-VEK33	T1126Z
5dBi Antenna	PCTEL	Generic	NA
Mobile Collection Device, MC3	Itron, Inc.	DCU5310C	74007956

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Extech Instruments	382225	P99250026

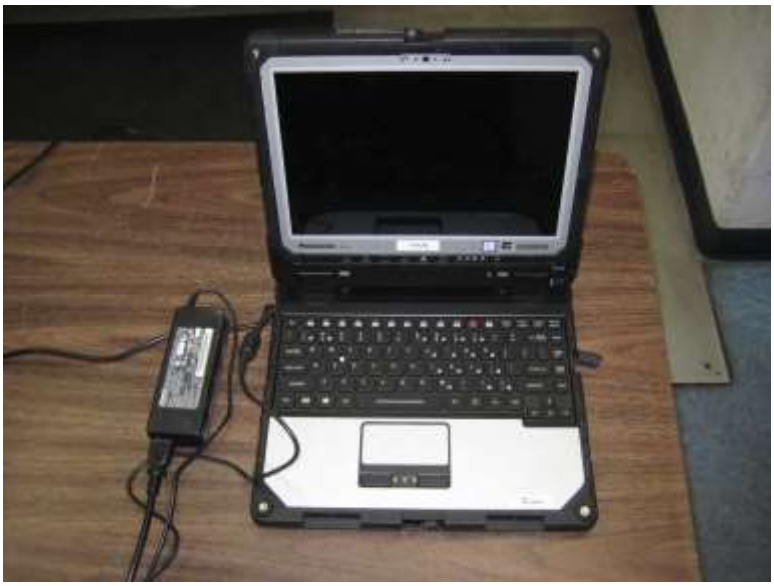
General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Land-Mobile Transmitter and Receiver (27.41-960 MHz) (MAS transmitter)
Operating Frequency Range:	952.0-959.85MHz
Number of Hopping Channels:	NA
Modulation Type(s):	24.76-57.78Hz AM
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Gain:	5dbi
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	13.8Vdc from car battery
Firmware / Software used for Test:	Arm Version: 7.66.00.01 DSP Version: 5.70.00.00 FPGA Version: 3.02 PSoC Version: 3.01 MC3 SuperRaptor Test ver.4.0.3.5

EUT and Accessory Photo(s)

MC3Lite

MC4Max



Laptop & Power Adapter

Tablet

Tablet Power Adapter

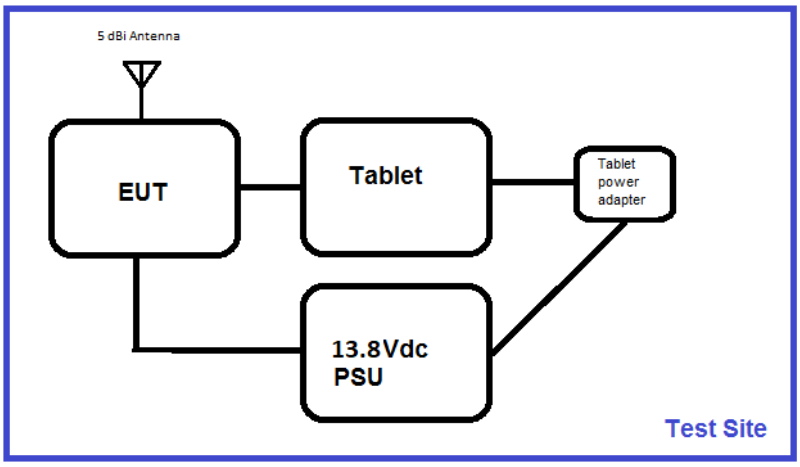
Antennas

Support Equipment Photo(s)

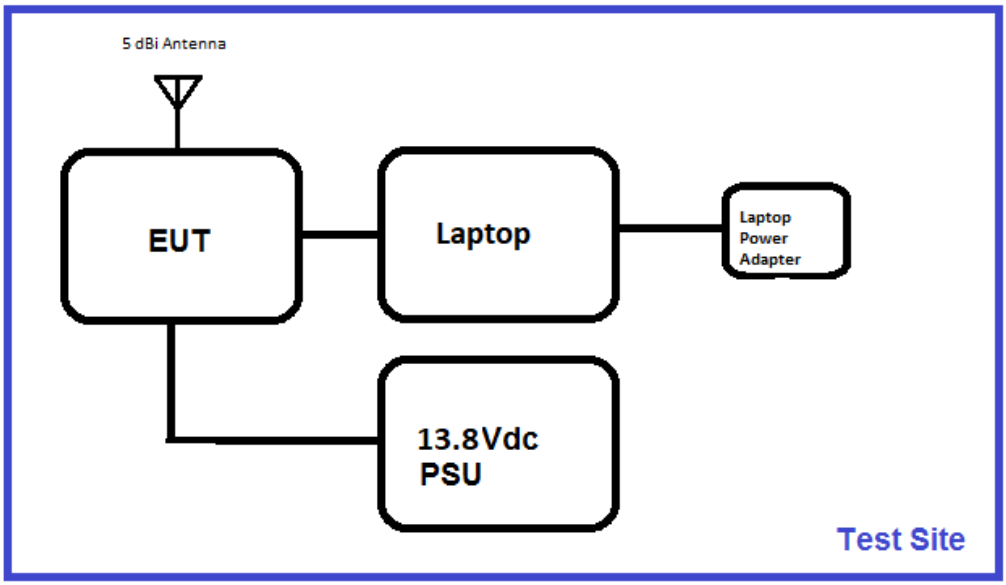
12V PSU

Block Diagram(s) of Test Setup

Test Setup Block Diagram



Test Setup Block Diagram



FCC PART 101

101.111(a)(5) Emission Limitations - Radiated Emission

Test Conditions / Setup

Test Location:	CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**FCC Part 101.111(a)(5) Emission Limitations- Radiated Emission**		
Work Order #:	**104623**	Date:	12/4/2020
Test Type:	**Maximized Emissions**	Time:	12:06:49
Tested By:	Don Nguyen	Sequence#:	1
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

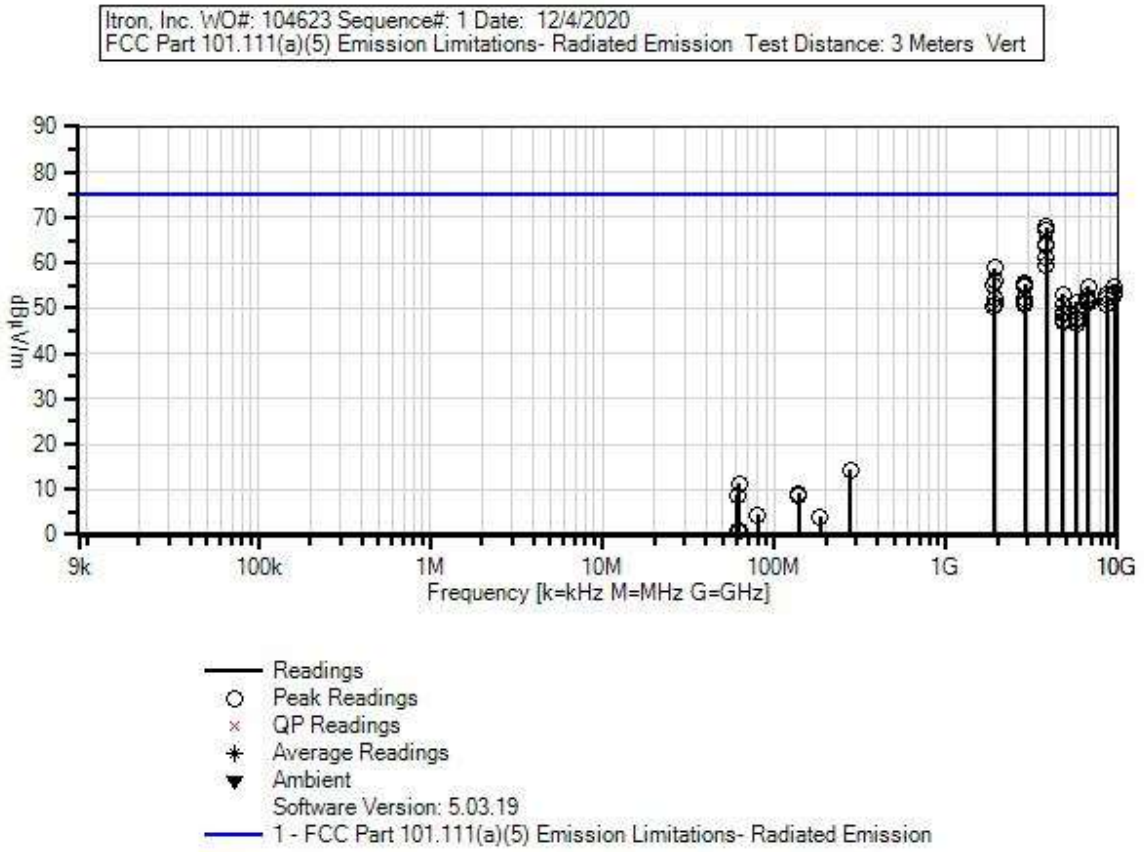
Test Conditions / Notes:

The EUT is placed on turn table. Input voltage is 13.8Vdc from external power supply. GPS, L/R receiver ports are connected to external antennas. Main antenna port is terminated with 50ohm load. USB port is connected to a touchscreen computer. The computer is sending command to the EUT using software MC3 SuperRaptor Test ver.4.0.3.5 The EUT is set into continuous transmitting mode. The EUT is rotated in three orthogonal orientations. Data represents the worst case orientation. The antenna of the EUT is mounted to a 52" diameter aluminum plate to represent a vehicle roof. The aluminum plate is supported by foam blocks. The EUT is directly below the plate, on the test table.

Power Setting: 4W

Operating Frequency: 952-959.85MHz
Tested Frequencies: 952, 956, 959.85MHz
Frequency Range of Measurement = 9kHz-10GHz
RBW=100kHz, VBW=300kHz (outside of +/-15kHz of authorized bandwidth, 9kHz-1000MHz)
RBW=1MHz, VBW=3MHz (1-10GHz)

Test Environment Conditions:
Temperature: 24°C
Relative Humidity: 22%
Site A



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
T1	AN00309	Preamp	8447D	12/24/2019	12/24/2021
T2	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
T3	ANP01911	Cable-Amplitude +15C to +45C (dB)	RG214/U	1/2/2020	1/2/2022
T4	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
T5	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
	AN03643	Spectrum Analyzer	E4440A	5/20/2020	5/20/2022
T6	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T7	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T8	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T9	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T10	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021

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

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	3807.983M	68.5	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0 +4.0	+0.0	67.9	75.2	-7.3	Vert
2	3824.000M	67.7	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0 +4.0	+0.0	67.1	75.2	-8.1	Vert
3	3839.400M	64.9	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0 +4.0	+0.0	64.3	75.2	-10.9	Vert
4	3807.983M	64.5	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0 +4.0	+0.0	63.9	75.2	-11.3	Horiz
5	3824.000M	61.8	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0 +4.0	+0.0	61.2	75.2	-14.0	Horiz
6	3839.400M	60.1	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0 +4.0	+0.0	59.5	75.2	-15.7	Horiz
7	1919.700M	66.7	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.4	+0.0 +2.9	+0.0	58.9	75.2	-16.3	Vert
8	1912.000M	63.7	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0 +2.9	+0.0	55.8	75.2	-19.4	Vert
9	2856.033M	59.7	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0 +3.6	+0.0	55.4	75.2	-19.8	Vert
10	2868.000M	59.6	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0 +3.6	+0.0	55.3	75.2	-19.9	Vert
11	1904.033M	63.0	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0 +2.9	+0.0	55.1	75.2	-20.1	Vert
12	6718.967M	50.3	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0 +5.9	+0.0	54.8	75.2	-20.4	Vert
13	9520.033M	44.0	+0.0 +0.0 +1.1	+0.0 -36.2 +0.4	+0.0 +38.2	+0.0 +7.2	+0.0	54.7	75.2	-20.5	Horiz
14	2879.550M	58.7	+0.0 +0.0 +0.5	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0 +3.6	+0.0	54.5	75.2	-20.7	Vert
15	9598.517M	42.4	+0.0 +0.0 +1.1	+0.0 -36.1 +0.4	+0.0 +38.2	+0.0 +7.3	+0.0	53.3	75.2	-21.9	Vert

16	4760.083M	52.4	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +32.9	+0.0 +4.5	+0.0	53.1	75.2	-22.1	Vert
17	9520.083M	42.2	+0.0 +0.0 +1.1	+0.0 -36.2 +0.4	+0.0 +38.2	+0.0 +7.2	+0.0	52.9	75.2	-22.3	Vert
18	8638.667M	44.3	+0.0 +0.0 +0.9	+0.0 -36.8 +0.3	+0.0 +37.4	+0.0 +6.7	+0.0	52.8	75.2	-22.4	Vert
19	6664.083M	48.1	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.7	+0.0 +5.9	+0.0	52.5	75.2	-22.7	Vert
20	8568.083M	43.5	+0.0 +0.0 +1.0	+0.0 -36.9 +0.4	+0.0 +37.4	+0.0 +6.6	+0.0	52.0	75.2	-23.2	Vert
21	2879.550M	56.1	+0.0 +0.0 +0.5	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0 +3.6	+0.0	51.9	75.2	-23.3	Horiz
22	1912.000M	59.8	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0 +2.9	+0.0	51.9	75.2	-23.3	Horiz
23	8604.000M	43.5	+0.0 +0.0 +1.0	+0.0 -36.9 +0.3	+0.0 +37.4	+0.0 +6.6	+0.0	51.9	75.2	-23.3	Vert
24	6664.033M	47.4	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.7	+0.0 +5.9	+0.0	51.8	75.2	-23.4	Horiz
25	6718.950M	47.2	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0 +5.9	+0.0	51.7	75.2	-23.5	Horiz
26	6692.000M	47.1	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0 +5.9	+0.0	51.6	75.2	-23.6	Vert
27	5736.000M	48.7	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0 +5.2	+0.0	51.4	75.2	-23.8	Vert
28	6692.000M	46.8	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0 +5.9	+0.0	51.3	75.2	-23.9	Horiz
29	2856.033M	55.5	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0 +3.6	+0.0	51.2	75.2	-24.0	Horiz
30	1919.700M	58.8	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.4	+0.0 +2.9	+0.0	51.0	75.2	-24.2	Horiz
31	2868.000M	55.3	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0 +3.6	+0.0	51.0	75.2	-24.2	Horiz
32	8638.650M	42.2	+0.0 +0.0 +0.9	+0.0 -36.8 +0.3	+0.0 +37.4	+0.0 +6.7	+0.0	50.7	75.2	-24.5	Horiz

33	4780.000M	49.8	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0 +4.5	+0.0	50.6	75.2	-24.6	Vert
34	1903.983M	58.2	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0 +2.9	+0.0	50.3	75.2	-24.9	Horiz
35	5759.200M	46.4	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0 +5.2	+0.0	49.1	75.2	-26.1	Vert
36	4759.983M	48.3	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +32.9	+0.0 +4.5	+0.0	49.0	75.2	-26.2	Horiz
37	4799.250M	47.7	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0 +4.5	+0.0	48.5	75.2	-26.7	Vert
38	5712.083M	45.0	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0 +5.2	+0.0	47.7	75.2	-27.5	Vert
39	5712.033M	44.7	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0 +5.2	+0.0	47.4	75.2	-27.8	Horiz
40	4799.250M	46.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0 +4.5	+0.0	47.3	75.2	-27.9	Horiz
41	4780.000M	46.0	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0 +4.5	+0.0	46.8	75.2	-28.4	Horiz
42	5759.100M	44.0	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0 +5.2	+0.0	46.7	75.2	-28.5	Horiz
43	278.460M	21.4	-27.9 +12.9 +0.0	+5.9 +0.0 +0.0	+1.6 +0.0	+0.3 +0.0	+0.0	14.2	75.2	-61.0	Horiz
44	62.800M	26.5	-28.1 +6.3 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0	+0.1 +0.0	+0.0	11.4	75.2	-63.8	Vert
45	138.900M	18.6	-28.0 +11.4 +0.0	+5.9 +0.0 +0.0	+1.1 +0.0	+0.2 +0.0	+0.0	9.2	75.2	-66.0	Vert
46	60.950M	23.9	-28.1 +6.2 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0	+0.1 +0.0	+0.0	8.7	75.2	-66.5	Vert

47	138.965M	17.9	-28.0 +11.4 +0.0	+5.9 +0.0 +0.0	+1.1 +0.0	+0.2 +0.0	+0.0	8.5	75.2	-66.7	Horiz
48	80.420M	18.2	-28.1 +7.5 +0.0	+5.9 +0.0 +0.0	+0.8 +0.0	+0.1 +0.0	+0.0	4.4	75.2	-70.8	Horiz
49	185.075M	15.6	-28.0 +9.0 +0.0	+5.9 +0.0 +0.0	+1.2 +0.0	+0.2 +0.0	+0.0	3.9	75.2	-71.3	Vert
50	62.345M	16.1	-28.1 +6.3 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0	+0.1 +0.0	+0.0	1.0	75.2	-74.2	Horiz
51	60.875M	16.1	-28.1 +6.2 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0	+0.1 +0.0	+0.0	0.9	75.2	-74.3	Horiz

Test Location:	CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**FCC Part 101.111(a)(5) Emission Limitations- Radiated Emission**		
Work Order #:	**104623**	Date:	12/14/2020
Test Type:	**Maximized Emissions**	Time:	10:24:58
Tested By:	Don Nguyen	Sequence#:	2
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

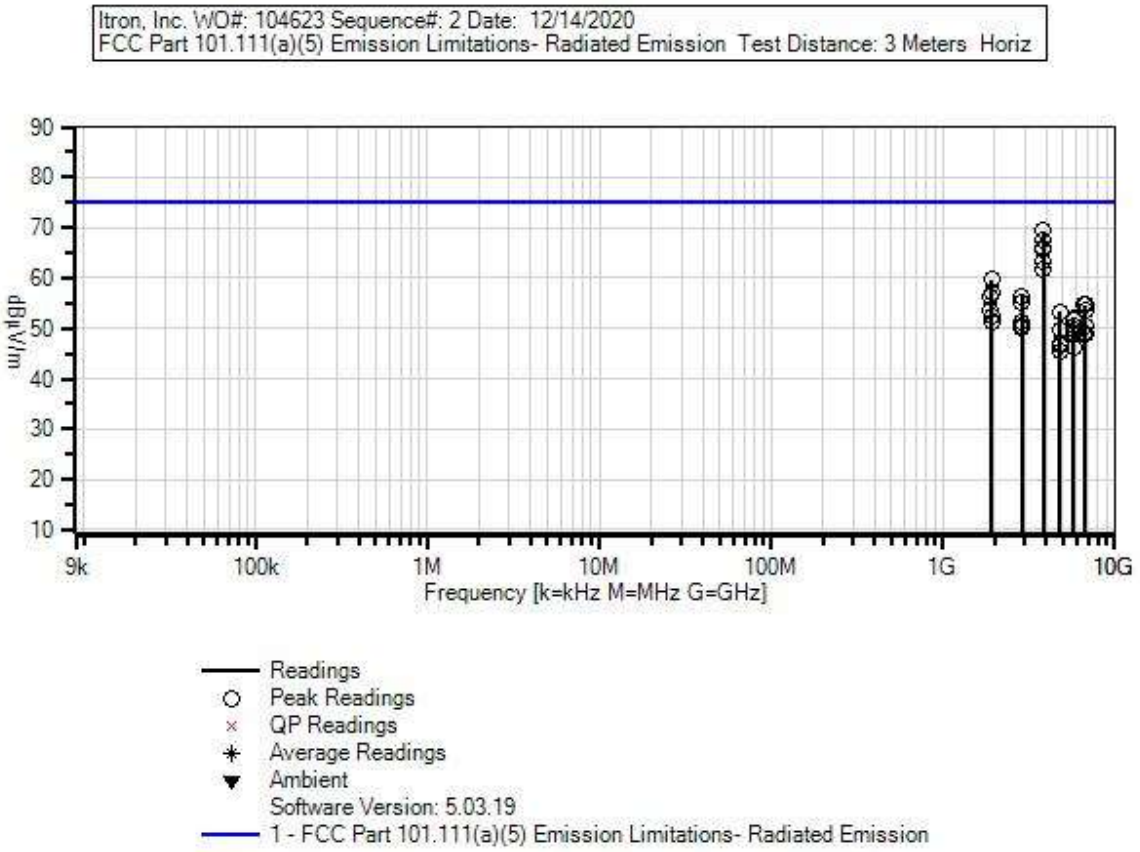
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on turn table. Input voltage is 13.8Vdc from external power supply. GPS, L/R receiver ports are connected to external antennas. Main antenna port is terminated with 50ohm load. USB port is connected to a touchscreen computer. The computer is sending command to the EUT using software MC3 SuperRaptor Test ver.4.0.3.5 The EUT is set into continuous transmitting mode. The EUT is rotated in three orthogonal orientations. Data represents the worst case orientation.
The antenna of the EUT is mounted to a 52" diameter aluminum plate to represent a vehicle roof. The aluminum plate is supported by foam blocks. The EUT is directly below the plate, on the test table.
Power setting: 4W
Operating Frequency: 952-959.85MHz
Tested Frequencies: 952, 956, 959.85MHz
Frequency Range of Measurement = 9kHz-10GHz
RBW=100kHz, VBW=300kHz (outside of +/-15kHz of authorized bandwidth, 9kHz-1000MHz)
RBW=1MHz, VBW=3MHz (1-10GHz)

Test Environment Conditions:
Temperature: 24°C
Relative Humidity: 22%
Site A



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00309	Preamp	8447D	12/24/2019	12/24/2021
	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
	ANP01911	Cable-Amplitude +15C to +45C (dB)	RG214/U	1/2/2020	1/2/2022
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
T1	AN03643	Spectrum Analyzer	E4440A	5/20/2020	5/20/2022
T2	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T3	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T4	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T5	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T6	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	3807.983M	69.9	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	69.3	75.2	-5.9	Vert
2	3823.983M	68.1	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	67.5	75.2	-7.7	Vert
3	3839.383M	66.6	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	66.0	75.2	-9.2	Vert
4	3807.983M	66.3	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	65.7	75.2	-9.5	Horiz
5	3823.983M	64.0	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	63.4	75.2	-11.8	Horiz
6	3839.383M	62.4	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	61.8	75.2	-13.4	Horiz
7	1919.683M	67.4	+0.0 +0.4	-38.7 +0.2	+27.4	+2.9	+0.0	59.6	75.2	-15.6	Vert
8	1911.983M	65.0	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	57.1	75.2	-18.1	Vert
9	2855.983M	60.7	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	56.4	75.2	-18.8	Vert
10	1904.000M	64.1	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	56.2	75.2	-19.0	Vert
11	2867.983M	60.4	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	56.1	75.2	-19.1	Vert
12	2879.533M	59.4	+0.0 +0.5	-38.4 +0.2	+29.9	+3.6	+0.0	55.2	75.2	-20.0	Vert
13	6663.983M	50.2	+0.0 +0.8	-37.2 +0.2	+34.7	+5.9	+0.0	54.6	75.2	-20.6	Vert
14	6691.983M	50.1	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	54.6	75.2	-20.6	Vert
15	6718.933M	49.2	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	53.7	75.2	-21.5	Vert
16	1903.983M	61.3	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	53.4	75.2	-21.8	Horiz
17	4759.983M	52.6	+0.0 +0.7	-37.6 +0.2	+32.9	+4.5	+0.0	53.3	75.2	-21.9	Vert
18	1919.683M	60.3	+0.0 +0.4	-38.7 +0.2	+27.4	+2.9	+0.0	52.5	75.2	-22.7	Horiz
19	5735.983M	49.3	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	52.0	75.2	-23.2	Horiz
20	5759.083M	48.9	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	51.6	75.2	-23.6	Horiz
21	1911.983M	59.2	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	51.3	75.2	-23.9	Horiz
22	2879.533M	55.5	+0.0 +0.5	-38.4 +0.2	+29.9	+3.6	+0.0	51.3	75.2	-23.9	Horiz
23	5711.983M	47.8	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	50.5	75.2	-24.7	Horiz
24	6691.983M	46.0	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	50.5	75.2	-24.7	Horiz

25	2867.983M	54.7	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	50.4	75.2	-24.8	Horiz
26	2855.983M	54.4	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	50.1	75.2	-25.1	Horiz
27	4779.983M	49.0	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	49.8	75.2	-25.4	Vert
28	5711.983M	47.0	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	49.7	75.2	-25.5	Vert
29	4799.233M	48.8	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	49.6	75.2	-25.6	Vert
30	6663.983M	44.7	+0.0 +0.8	-37.2 +0.2	+34.7	+5.9	+0.0	49.1	75.2	-26.1	Horiz
31	5759.083M	46.1	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	48.8	75.2	-26.4	Vert
32	6718.933M	44.3	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	48.8	75.2	-26.4	Horiz
33	4759.983M	46.1	+0.0 +0.7	-37.6 +0.2	+32.9	+4.5	+0.0	46.8	75.2	-28.4	Horiz
34	4779.983M	45.9	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	46.7	75.2	-28.5	Horiz
35	5735.983M	43.6	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	46.3	75.2	-28.9	Vert
36	4799.233M	44.8	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	45.6	75.2	-29.6	Horiz

Test Location:	CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**FCC Part 101.111(a)(5) Emission Limitations- Radiated Emission**		
Work Order #:	**104623**	Date:	12/7/2020
Test Type:	**Maximized Emissions**	Time:	11:22:55
Tested By:	Don Nguyen	Sequence#:	2
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

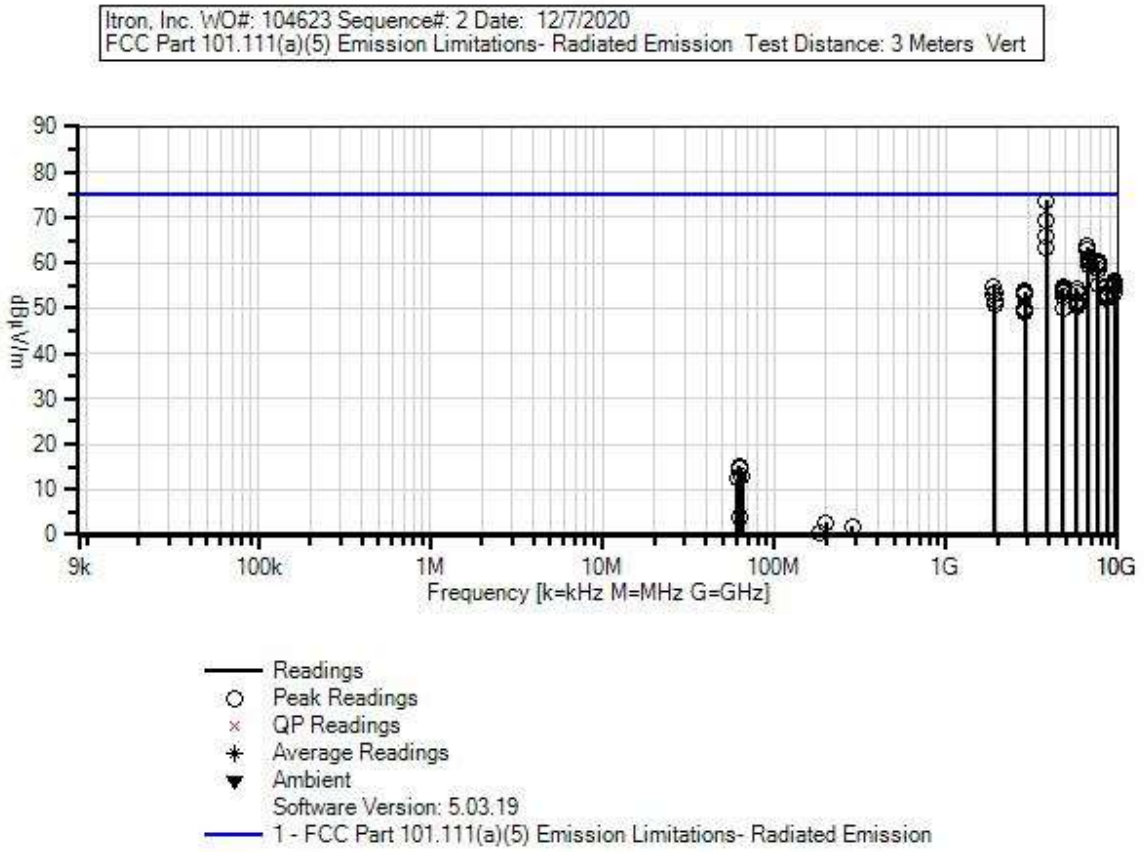
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

The EUT is placed on turn table. Input voltage is 13.8Vdc from external power supply. GPS port is connected to external antennas. Main antenna port is terminated with 50ohm load. USB port is connected to a touchscreen computer. The computer is sending command to the EUT using software MC3 SuperRaptor Test ver.4.0.3.5 The EUT is set into continuous transmitting mode. The EUT is rotated in three orthogonal orientation. Data represents the worst case orientation.
The antenna of the EUT is mounted to a 52" diameter aluminum plate to represent a vehicle roof. The aluminum plate is supported by foam blocks. The EUT is directly below the plate, on the test table.
Power setting: 4W
Operating Frequency: 952-959.85MHz
Frequency Range of Measurement = 9kHz-10GHz
RBW=100kHz, VBW=300kHz (outside of +/-15kHz of authorized bandwidth, 9kHz-1000MHz)
RBW=1MHz, VBW=3MHz (1-10GHz)

Test Environment Conditions:
Temperature: 24°C
Relative Humidity: 22%
Site A



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
T1	AN00309	Preamp	8447D	12/24/2019	12/24/2021
T2	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
T3	ANP01911	Cable-Amplitude +15C to +45C (dB)	RG214/U	1/2/2020	1/2/2022
T4	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
T5	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
T6	AN03643	Spectrum Analyzer	E4440A	5/20/2020	5/20/2022
T7	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T8	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T9	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T10	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T11	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021

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	3839.430M	74.3	+0.0 +0.0 +4.0	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0	73.7	75.2	-1.5	Vert
2	3824.000M	74.2	+0.0 +0.0 +4.0	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0	73.6	75.2	-1.6	Vert
3	3807.970M	70.1	+0.0 +0.0 +4.0	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0	69.5	75.2	-5.7	Vert
4	3823.970M	66.7	+0.0 +0.0 +4.0	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0	66.1	75.2	-9.1	Horiz
5	3807.930M	66.6	+0.0 +0.0 +4.0	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0	66.0	75.2	-9.2	Horiz
6	6664.100M	59.3	+0.0 +0.0 +5.9	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.7	+0.0	63.7	75.2	-11.5	Horiz
7	3839.400M	64.0	+0.0 +0.0 +4.0	+0.0 +0.0 +0.7	+0.0 -37.9 +0.2	+0.0 +32.4	+0.0	63.4	75.2	-11.8	Horiz
8	6664.100M	58.6	+0.0 +0.0 +5.9	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.7	+0.0	63.0	75.2	-12.2	Vert
9	6692.030M	56.6	+0.0 +0.0 +5.9	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0	61.1	75.2	-14.1	Horiz
10	6692.030M	56.3	+0.0 +0.0 +5.9	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0	60.8	75.2	-14.4	Vert
11	6719.050M	56.0	+0.0 +0.0 +5.9	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0	60.5	75.2	-14.7	Vert
12	7678.700M	53.5	+0.0 +0.0 +6.2	+0.0 +0.0 +1.0	+0.0 -37.0 +0.2	+0.0 +36.6	+0.0	60.5	75.2	-14.7	Vert
13	7678.830M	52.8	+0.0 +0.0 +6.2	+0.0 +0.0 +1.0	+0.0 -37.0 +0.2	+0.0 +36.6	+0.0	59.8	75.2	-15.4	Horiz
14	7616.000M	53.0	+0.0 +0.0 +6.1	+0.0 +0.0 +0.9	+0.0 -37.1 +0.2	+0.0 +36.6	+0.0	59.7	75.2	-15.5	Horiz
15	6718.980M	55.1	+0.0 +0.0 +5.9	+0.0 +0.0 +0.8	+0.0 -37.2 +0.2	+0.0 +34.8	+0.0	59.6	75.2	-15.6	Horiz

16	7615.970M	52.7	+0.0 +0.0 +6.1	+0.0 +0.0 +0.9	+0.0 -37.1 +0.2	+0.0 +36.6	+0.0	59.4	75.2	-15.8	Vert
17	7648.030M	51.8	+0.0 +0.0 +6.2	+0.0 +0.0 +1.0	+0.0 -37.1 +0.2	+0.0 +36.6	+0.0	58.7	75.2	-16.5	Vert
18	9560.030M	45.3	+0.0 +0.0 +7.2	+0.0 +0.0 +1.1	+0.0 -36.2 +0.4	+0.0 +38.2	+0.0	56.0	75.2	-19.2	Vert
19	9520.000M	45.0	+0.0 +0.0 +7.2	+0.0 +0.0 +1.1	+0.0 -36.2 +0.4	+0.0 +38.2	+0.0	55.7	75.2	-19.5	Horiz
20	7648.030M	48.4	+0.0 +0.0 +6.2	+0.0 +0.0 +1.0	+0.0 -37.1 +0.2	+0.0 +36.6	+0.0	55.3	75.2	-19.9	Horiz
21	9560.030M	44.4	+0.0 +0.0 +7.2	+0.0 +0.0 +1.1	+0.0 -36.2 +0.4	+0.0 +38.2	+0.0	55.1	75.2	-20.1	Horiz
22	8567.930M	46.4	+0.0 +0.0 +6.6	+0.0 +0.0 +1.0	+0.0 -36.9 +0.4	+0.0 +37.4	+0.0	54.9	75.2	-20.3	Vert
23	9519.930M	44.2	+0.0 +0.0 +7.2	+0.0 +0.0 +1.1	+0.0 -36.2 +0.4	+0.0 +38.2	+0.0	54.9	75.2	-20.3	Vert
24	4799.250M	53.8	+0.0 +0.0 +4.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0	54.6	75.2	-20.6	Horiz
25	1904.000M	62.5	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0	54.6	75.2	-20.6	Vert
26	9598.530M	43.6	+0.0 +0.0 +7.3	+0.0 +0.0 +1.1	+0.0 -36.1 +0.4	+0.0 +38.2	+0.0	54.5	75.2	-20.7	Horiz
27	4799.280M	53.6	+0.0 +0.0 +4.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0	54.4	75.2	-20.8	Vert
28	5736.030M	51.6	+0.0 +0.0 +5.2	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0	54.3	75.2	-20.9	Vert
29	2856.000M	58.1	+0.0 +0.0 +3.6	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0	53.8	75.2	-21.4	Vert
30	4759.870M	53.1	+0.0 +0.0 +4.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +32.9	+0.0	53.8	75.2	-21.4	Vert
31	9598.400M	42.7	+0.0 +0.0 +7.3	+0.0 +0.0 +1.1	+0.0 -36.1 +0.4	+0.0 +38.2	+0.0	53.6	75.2	-21.6	Vert
32	2868.030M	57.8	+0.0 +0.0 +3.6	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0	53.5	75.2	-21.7	Vert

33	8638.550M	45.0	+0.0 +0.0 +6.7	+0.0 +0.0 +0.9	+0.0 -36.8 +0.3	+0.0 +37.4	+0.0	53.5	75.2	-21.7	Vert
34	5712.000M	50.7	+0.0 +0.0 +5.2	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0	53.4	75.2	-21.8	Vert
35	1912.030M	61.3	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0	53.4	75.2	-21.8	Vert
36	4780.030M	52.6	+0.0 +0.0 +4.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0	53.4	75.2	-21.8	Vert
37	8568.000M	44.8	+0.0 +0.0 +6.6	+0.0 +0.0 +1.0	+0.0 -36.9 +0.4	+0.0 +37.4	+0.0	53.3	75.2	-21.9	Horiz
38	1904.058M	61.0	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0	53.1	75.2	-22.1	Horiz
39	2879.580M	57.1	+0.0 +0.0 +3.6	+0.0 +0.0 +0.5	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0	52.9	75.2	-22.3	Vert
40	8604.030M	44.5	+0.0 +0.0 +6.6	+0.0 +0.0 +1.0	+0.0 -36.9 +0.3	+0.0 +37.4	+0.0	52.9	75.2	-22.3	Vert
41	4779.970M	51.8	+0.0 +0.0 +4.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +33.0	+0.0	52.6	75.2	-22.6	Horiz
42	8638.680M	44.1	+0.0 +0.0 +6.7	+0.0 +0.0 +0.9	+0.0 -36.8 +0.3	+0.0 +37.4	+0.0	52.6	75.2	-22.6	Horiz
43	8604.030M	43.9	+0.0 +0.0 +6.6	+0.0 +0.0 +1.0	+0.0 -36.9 +0.3	+0.0 +37.4	+0.0	52.3	75.2	-22.9	Horiz
44	1919.730M	59.5	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.4	+0.0	51.7	75.2	-23.5	Vert
45	5735.970M	48.9	+0.0 +0.0 +5.2	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0	51.6	75.2	-23.6	Horiz
46	1912.030M	59.4	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.3	+0.0	51.5	75.2	-23.7	Horiz
47	5759.100M	48.7	+0.0 +0.0 +5.2	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0	51.4	75.2	-23.8	Horiz
48	1919.700M	58.7	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.4	+0.0	50.9	75.2	-24.3	Horiz
49	5712.030M	47.9	+0.0 +0.0 +5.2	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0	50.6	75.2	-24.6	Horiz

50	1919.700M	58.4	+0.0 +0.0 +2.9	+0.0 +0.0 +0.4	+0.0 -38.7 +0.2	+0.0 +27.4	+0.0	50.6	75.2	-24.6	Horiz
51	5759.200M	47.6	+0.0 +0.0 +5.2	+0.0 +0.0 +0.7	+0.0 -37.4 +0.2	+0.0 +34.0	+0.0	50.3	75.2	-24.9	Vert
52	4760.030M	49.3	+0.0 +0.0 +4.5	+0.0 +0.0 +0.7	+0.0 -37.6 +0.2	+0.0 +32.9	+0.0	50.0	75.2	-25.2	Horiz
53	2868.030M	54.3	+0.0 +0.0 +3.6	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0	50.0	75.2	-25.2	Horiz
54	2856.030M	53.8	+0.0 +0.0 +3.6	+0.0 +0.0 +0.4	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0	49.5	75.2	-25.7	Horiz
55	2879.550M	53.2	+0.0 +0.0 +3.6	+0.0 +0.0 +0.5	+0.0 -38.4 +0.2	+0.0 +29.9	+0.0	49.0	75.2	-26.2	Horiz
56	62.917M	30.3	-28.1 +6.3 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	15.2	75.2	-60.0	Vert
57	63.667M	29.8	-28.1 +6.3 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	14.7	75.2	-60.5	Vert
58	64.817M	27.9	-28.1 +6.4 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	12.9	75.2	-62.3	Vert
59	61.067M	27.5	-28.1 +6.2 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	12.3	75.2	-62.9	Vert
60	63.317M	19.2	-28.1 +6.3 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	4.1	75.2	-71.1	Horiz
61	199.680M	14.5	-28.0 +8.9 +0.0	+5.9 +0.0 +0.0	+1.3 +0.0 +0.0	+0.2 +0.0	+0.0	2.8	75.2	-72.4	Vert
62	286.430M	9.0	-27.9 +13.0 +0.0	+5.9 +0.0 +0.0	+1.6 +0.0 +0.0	+0.3 +0.0	+0.0	1.9	75.2	-73.3	Horiz
63	182.680M	12.0	-28.0 +9.1 +0.0	+5.9 +0.0 +0.0	+1.2 +0.0 +0.0	+0.2 +0.0	+0.0	0.4	75.2	-74.8	Horiz
64	65.567M	14.9	-28.1 +6.4 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	-0.1	75.2	-75.3	Horiz
65	192.980M	10.6	-28.0 +9.0 +0.0	+5.9 +0.0 +0.0	+1.3 +0.0 +0.0	+0.2 +0.0	+0.0	-1.0	75.2	-76.2	Vert
66	60.017M	11.4	-28.1 +6.2 +0.0	+5.9 +0.0 +0.0	+0.7 +0.0 +0.0	+0.1 +0.0	+0.0	-3.8	75.2	-79.0	Horiz

Test Location:	CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**FCC Part 101.111(a)(5) Emission Limitations- Radiated Emission**		
Work Order #:	**104623**	Date:	12/16/2020
Test Type:	**Maximized Emissions**	Time:	09:26:55
Tested By:	Don Nguyen	Sequence#:	3
Software:	EMITest 5.03.19		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

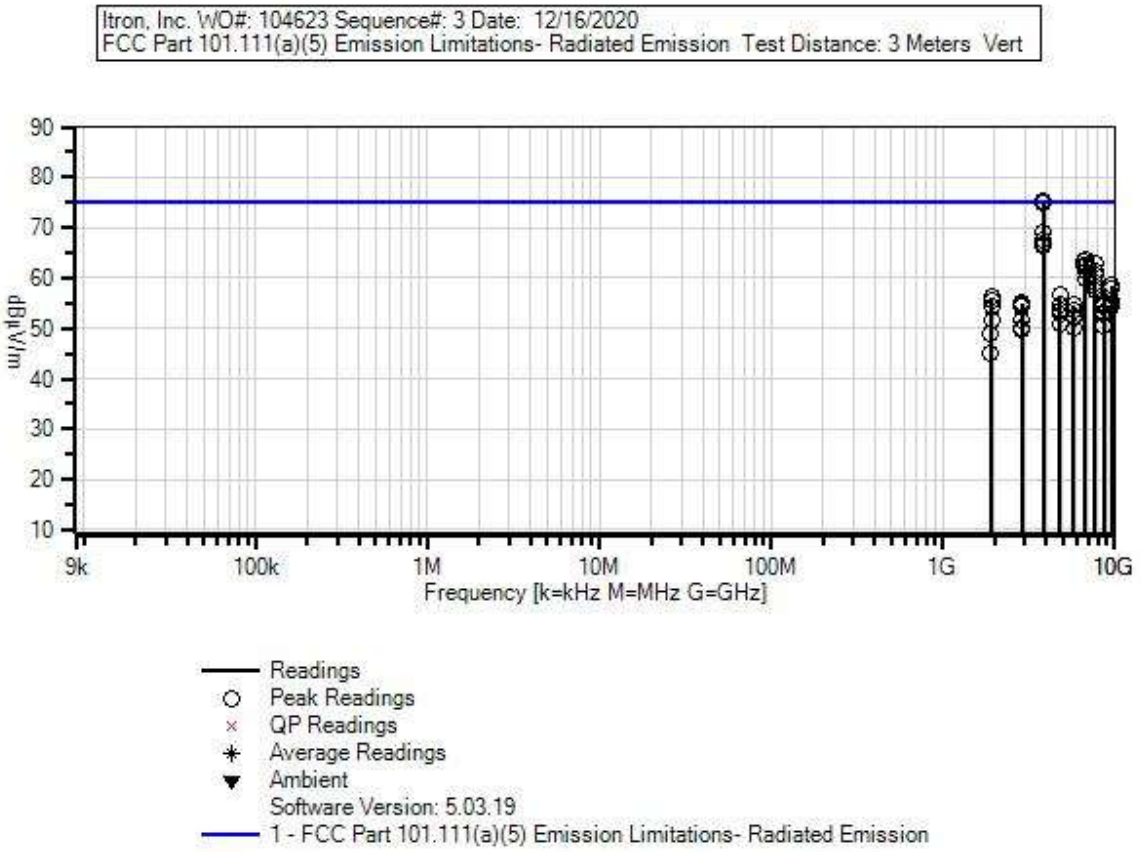
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

The EUT is placed on turn table. Input voltage is 13.8Vdc from external power supply. GPS port is connected to external antennas. Main antenna port is terminated with 50ohm load. USB port is connected to a touchscreen computer. The computer is sending command to the EUT using software MC3 SuperRaptor Test ver.4.0.3.5 The EUT is set into continuous transmitting mode. The EUT is rotated in three orthogonal orientations. Data represents the worst case orientation.
The antenna of the EUT is mounted to a 52" diameter aluminum plate to represent a vehicle roof. The aluminum plate is supported by foam blocks. The EUT is directly below the plate, on the test table.
Power setting: 4W
Operating Frequency: 952-959.85MHz
Frequency Range of Measurement = 9kHz-10GHz
RBW=100kHz, VBW=300kHz (outside of +/-15kHz of authorized bandwidth, 9kHz-1000MHz)
RBW=1MHz, VBW=3MHz (1-10GHz)

Test Environment Conditions:
Temperature:24°C
Relative Humidity: 22%
Site A



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	AN00309	Preamp	8447D	12/24/2019	12/24/2021
	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
	ANP01911	Cable-Amplitude +15C to +45C (dB)	RG214/U	1/2/2020	1/2/2022
	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
T1	AN03643	Spectrum Analyzer	E4440A	5/20/2020	5/20/2022
T2	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T3	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T4	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T5	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T6	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	3824.000M	75.7	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	75.1	75.2	-0.1	Vert
2	3839.400M	75.6	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	75.0	75.2	-0.2	Vert
3	3808.000M	69.6	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	69.0	75.2	-6.2	Vert
4	3808.000M	68.2	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	67.6	75.2	-7.6	Horiz
5	3824.000M	67.2	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	66.6	75.2	-8.6	Horiz
6	3839.400M	67.1	+0.0 +0.7	-37.9 +0.2	+32.4	+4.0	+0.0	66.5	75.2	-8.7	Horiz
7	6692.000M	59.3	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	63.8	75.2	-11.4	Vert
8	6664.000M	58.8	+0.0 +0.8	-37.2 +0.2	+34.7	+5.9	+0.0	63.2	75.2	-12.0	Horiz
9	7678.800M	55.8	+0.0 +1.0	-37.0 +0.2	+36.6	+6.2	+0.0	62.8	75.2	-12.4	Vert
10	6664.000M	58.1	+0.0 +0.8	-37.2 +0.2	+34.7	+5.9	+0.0	62.5	75.2	-12.7	Vert
11	6718.950M	58.0	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	62.5	75.2	-12.7	Vert
12	6692.000M	56.9	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	61.4	75.2	-13.8	Horiz
13	7616.000M	54.5	+0.0 +0.9	-37.1 +0.2	+36.6	+6.1	+0.0	61.2	75.2	-14.0	Vert
14	7648.000M	53.6	+0.0 +1.0	-37.1 +0.2	+36.6	+6.2	+0.0	60.5	75.2	-14.7	Vert
15	6718.950M	55.1	+0.0 +0.8	-37.2 +0.2	+34.8	+5.9	+0.0	59.6	75.2	-15.6	Horiz
16	7616.000M	52.3	+0.0 +0.9	-37.1 +0.2	+36.6	+6.1	+0.0	59.0	75.2	-16.2	Horiz
17	9560.000M	47.9	+0.0 +1.1	-36.2 +0.4	+38.2	+7.2	+0.0	58.6	75.2	-16.6	Vert
18	7678.800M	51.4	+0.0 +1.0	-37.0 +0.2	+36.6	+6.2	+0.0	58.4	75.2	-16.8	Horiz
19	9598.500M	47.0	+0.0 +1.1	-36.1 +0.4	+38.2	+7.3	+0.0	57.9	75.2	-17.3	Vert
20	7648.000M	50.7	+0.0 +1.0	-37.1 +0.2	+36.6	+6.2	+0.0	57.6	75.2	-17.6	Horiz
21	4799.250M	55.7	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	56.5	75.2	-18.7	Horiz
22	1912.000M	64.1	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	56.2	75.2	-19.0	Vert
23	1919.700M	63.5	+0.0 +0.4	-38.7 +0.2	+27.4	+2.9	+0.0	55.7	75.2	-19.5	Vert
24	9560.000M	44.8	+0.0 +1.1	-36.2 +0.4	+38.2	+7.2	+0.0	55.5	75.2	-19.7	Horiz

25	8568.000M	46.5	+0.0 +1.0	-36.9 +0.4	+37.4	+6.6	+0.0	55.0	75.2	-20.2	Vert
26	2868.000M	59.3	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	55.0	75.2	-20.2	Vert
27	4799.250M	54.1	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	54.9	75.2	-20.3	Vert
28	2879.550M	59.1	+0.0 +0.5	-38.4 +0.2	+29.9	+3.6	+0.0	54.9	75.2	-20.3	Vert
29	9520.000M	44.1	+0.0 +1.1	-36.2 +0.4	+38.2	+7.2	+0.0	54.8	75.2	-20.4	Vert
30	4780.000M	53.9	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	54.7	75.2	-20.5	Horiz
31	8638.650M	46.2	+0.0 +0.9	-36.8 +0.3	+37.4	+6.7	+0.0	54.7	75.2	-20.5	Vert
32	5759.100M	51.9	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	54.6	75.2	-20.6	Horiz
33	8604.000M	46.1	+0.0 +1.0	-36.9 +0.3	+37.4	+6.6	+0.0	54.5	75.2	-20.7	Vert
34	2856.000M	58.5	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	54.2	75.2	-21.0	Vert
35	1912.000M	62.1	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	54.2	75.2	-21.0	Horiz
36	9598.500M	43.3	+0.0 +1.1	-36.1 +0.4	+38.2	+7.3	+0.0	54.2	75.2	-21.0	Horiz
37	4780.000M	52.9	+0.0 +0.7	-37.6 +0.2	+33.0	+4.5	+0.0	53.7	75.2	-21.5	Vert
38	5736.000M	50.9	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	53.6	75.2	-21.6	Vert
39	8604.000M	44.7	+0.0 +1.0	-36.9 +0.3	+37.4	+6.6	+0.0	53.1	75.2	-22.1	Horiz
40	8568.000M	44.3	+0.0 +1.0	-36.9 +0.4	+37.4	+6.6	+0.0	52.8	75.2	-22.4	Horiz
41	4760.000M	52.0	+0.0 +0.7	-37.6 +0.2	+32.9	+4.5	+0.0	52.7	75.2	-22.5	Vert
42	5712.000M	49.7	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	52.4	75.2	-22.8	Vert
43	5759.100M	49.4	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	52.1	75.2	-23.1	Vert
44	5736.000M	49.4	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	52.1	75.2	-23.1	Horiz
45	2868.000M	56.0	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	51.7	75.2	-23.5	Horiz
46	1919.700M	59.3	+0.0 +0.4	-38.7 +0.2	+27.4	+2.9	+0.0	51.5	75.2	-23.7	Horiz
47	4760.000M	50.1	+0.0 +0.7	-37.6 +0.2	+32.9	+4.5	+0.0	50.8	75.2	-24.4	Horiz
48	8638.650M	41.8	+0.0 +0.9	-36.8 +0.3	+37.4	+6.7	+0.0	50.3	75.2	-24.9	Horiz

49	2879.550M	54.3	+0.0 +0.5	-38.4 +0.2	+29.9	+3.6	+0.0	50.1	75.2	-25.1	Horiz
50	5712.000M	47.2	+0.0 +0.7	-37.4 +0.2	+34.0	+5.2	+0.0	49.9	75.2	-25.3	Horiz
51	2856.000M	53.8	+0.0 +0.4	-38.4 +0.2	+29.9	+3.6	+0.0	49.5	75.2	-25.7	Horiz
52	1904.000M	56.7	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	48.8	75.2	-26.4	Horiz
53	1904.000M	53.1	+0.0 +0.4	-38.7 +0.2	+27.3	+2.9	+0.0	45.2	75.2	-30.0	Vert

Limit Line For Spurious Conducted Emission

Required Attenuation = 50+10 Log P db

Limit line (dBuV) = V_{dBuv} - Attenuation

$$V_{dBuV} = 20 \text{ Log } \frac{V}{1 \text{ x } 10^{-6}}$$
$$= 20 \left(\text{Log } V - \text{Log } 1 \text{ x } 10^{-6} \right)$$
$$= 20 \text{ Log } V - 20 \text{ Log} 1 \text{ x } 10^{-6}$$
$$= 20 \text{ Log } V - 20 \left(-6 \right)$$
$$= 20 \text{ Log } V + 120$$

$$\text{Attenuation} = 50 + 10 \text{ Log } P$$
$$= 50 + 10 \text{ Log } \frac{V^2}{R}$$
$$= 50 + 10 \left(\text{Log } V^2 \text{ - Log } R \right)$$
$$= 50 + 10 \left(2 \text{ Log } V \text{ - Log } R \right)$$
$$= 50 + 20 \text{ Log } V \text{ -10 Log } R$$

Limit line = V_{dBuv} - Attenuation
= 20 Log V + 120 – (55 + 20 Log V – 10Log R)
= 20 Log V + 120 – 55 – 20 Log V + 10Log R
= 20 Log V + 120 – 55 – 20 Log V + 10Log R
= 120 – 50 + 10 Log 50 Note : R = 50 Ω
= 120 –50 + 16.897
= 87 dBuV (-20dBm) at any power level

Limit line for Spurious Radiated Emission

Conversion to EIRP limit
E(dBuV/m)=P(dBm)-20log(3)+104.77=-20-20log(3)+104.77=75.2dbuV/m

Test Setup Photo(s)

Below 1GHz; Configuration 1

Below 1GHz; Configuration 1

Below 1GHz; Configuration 2

Below 1GHz; Configuration 2

Below 1GHz; Configuration 3

Below 1GHz; Configuration 4

Below 1GHz; Configuration 4

Above 1GHz; Configuration 1

Above 1GHz; Configuration 1

Above 1GHz; Configuration 2

Above 1GHz; Configuration 2

Above 1GHz; Configuration 3

Above 1GHz; Configuration 4

Above 1GHz; Configuration 4

X Axis; Configuration 1 & 2

Y Axis; Configuration 1 & 2

Z Axis; Configuration 1 & 2

X Axis; Configuration 3 & 4

Y Axis; Configuration 3 & 4

Z Axis; Configuration 3 & 4

101.113(a) Transmitter Power Limitations

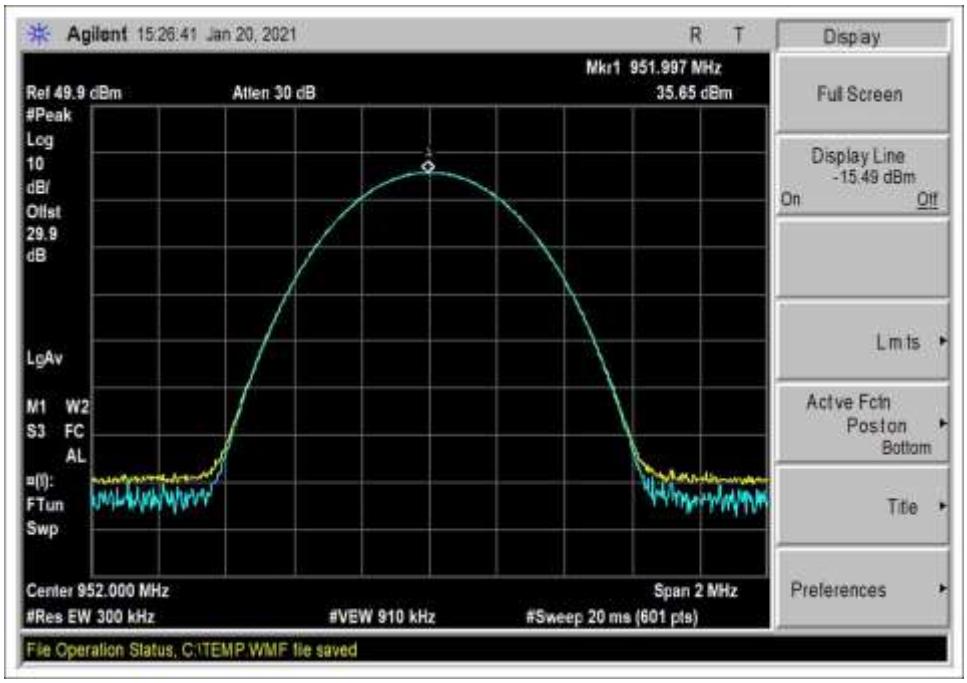
Test Setup/Conditions			
Test Location:	Brea Lab D	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.26 (2015), section 5.2	Test Date(s):	1/20/2021
Configuration:	1		
Test Setup:	The EUT is placed on test bench. Input voltage is 13.8Vdc from external power supply. USB port is connected to a touchscreen tablet. The computer is sending command to the EUT using software MC3 SuperRaptor Test ver.4.0.3.5 The EUT is set to continuously transmit. Power setting: 4W Operating frequency: 952 to 959.85MHz Frequency of measurement: 952 to 959.85MHz RBW=300kHz VBW=910kHz Note: There are two EUTs with the same transmitter. The difference between them is the optional receivers in one of them. The EUT used for this test is the one with optional receivers as it is the worst-case configuration.		

Environmental Conditions			
Temperature (ºC)	23.6	Relative Humidity (%):	28

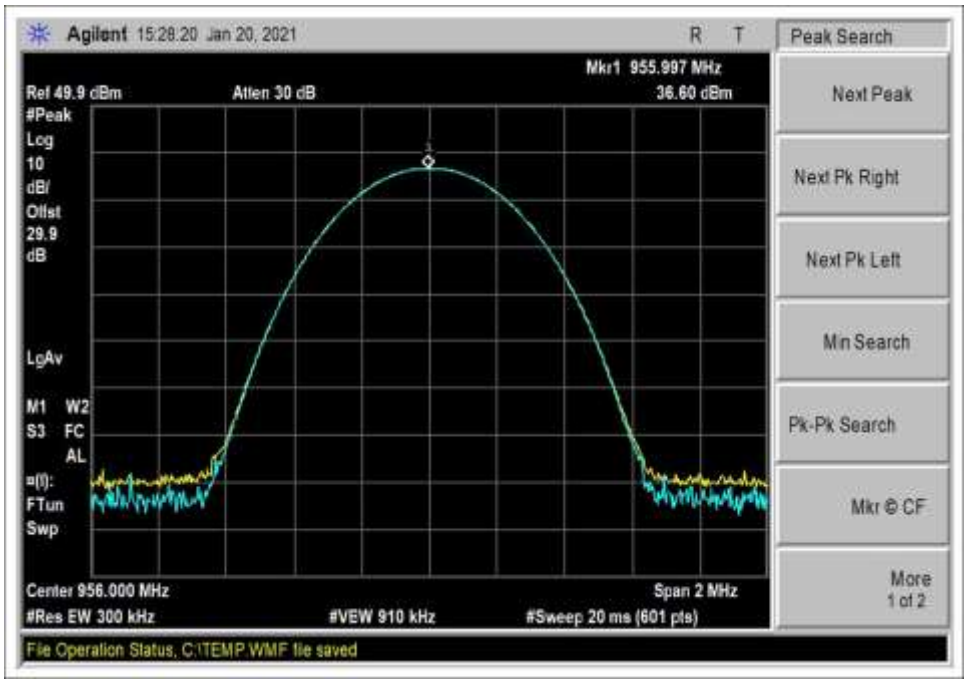
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	8/3/2020	8/3/2021
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07243	Cable	H&S	32022-29094K-29094K-24TC	5/29/2020	5/29/2022

Test Data Summary - RF Conducted Measurement							
Frequency (MHz)	**Modulation**	**Ant. Gain (dBi)**	**Measured (dBm)**	**EIRP (dBm)**	**Limit (dBm)**	**Limit (dBW)**	**Results**
952.0	24.76 Hz AM	5	35.65	40.65	≤44	≤14	Pass
956.0	24.76 Hz AM	5	36.60	41.60	≤44	≤14	Pass
959.85	24.76 Hz AM	5	35.78	40.78	≤44	≤14	Pass
952.0	57.78 Hz AM	5	35.61	40.61	≤44	≤14	Pass
956.0	57.78 Hz AM	5	36.56	41.56	≤44	≤14	Pass
959.85	57.78 Hz AM	5	35.75	40.75	≤44	≤14	Pass

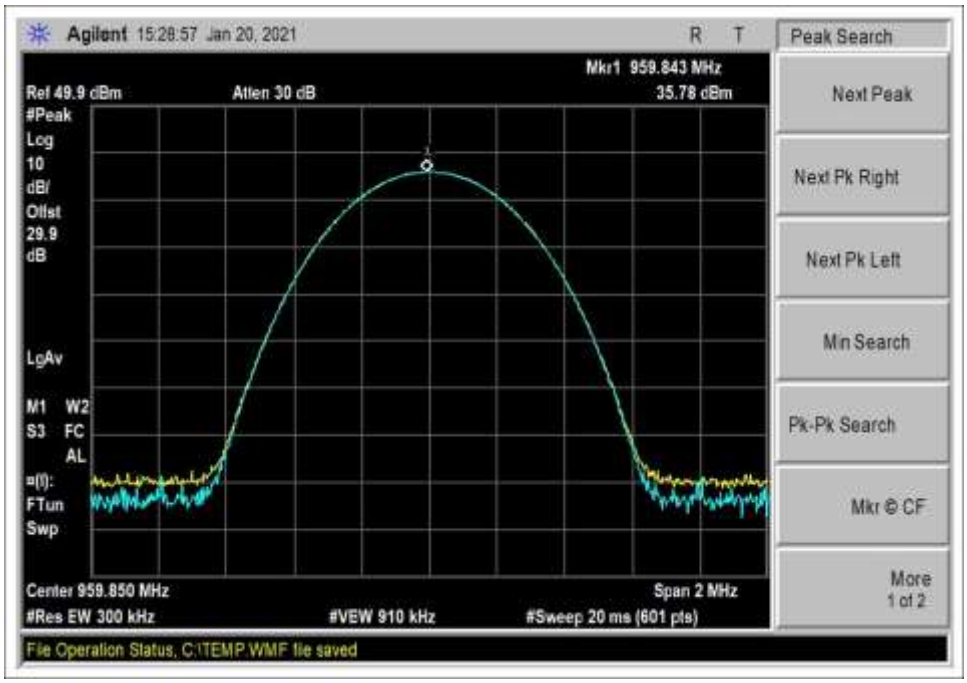
Test Data



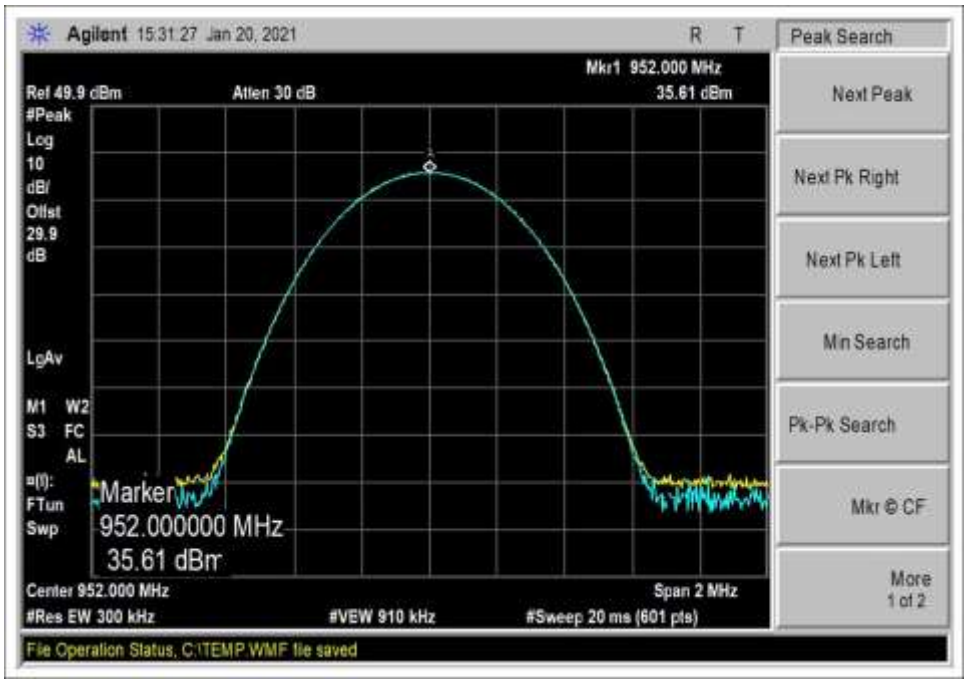
24Hz Low Channel



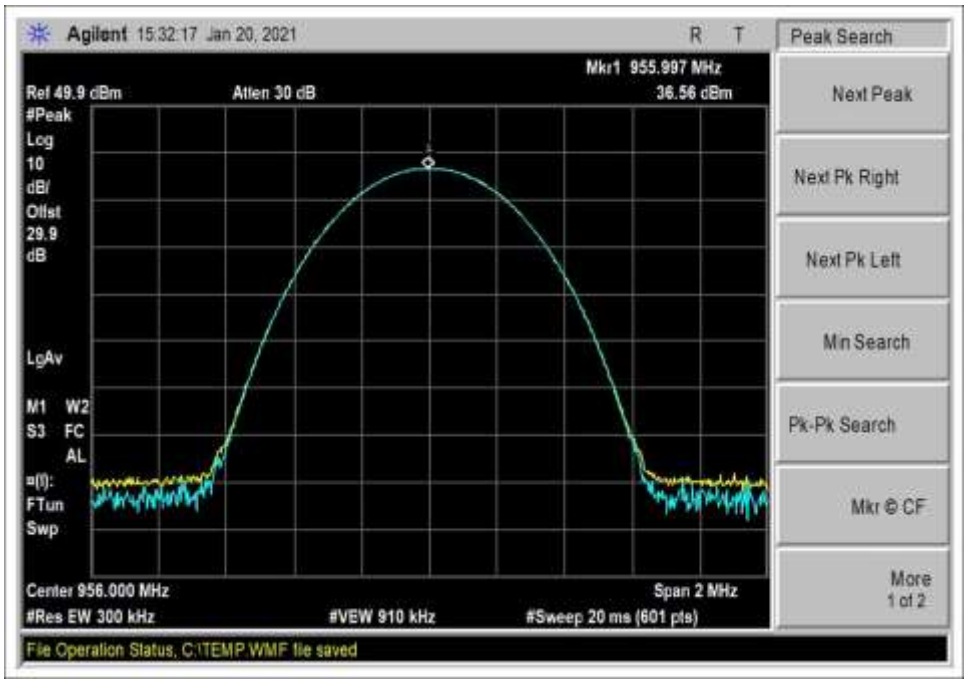
24Hz Middle Channel



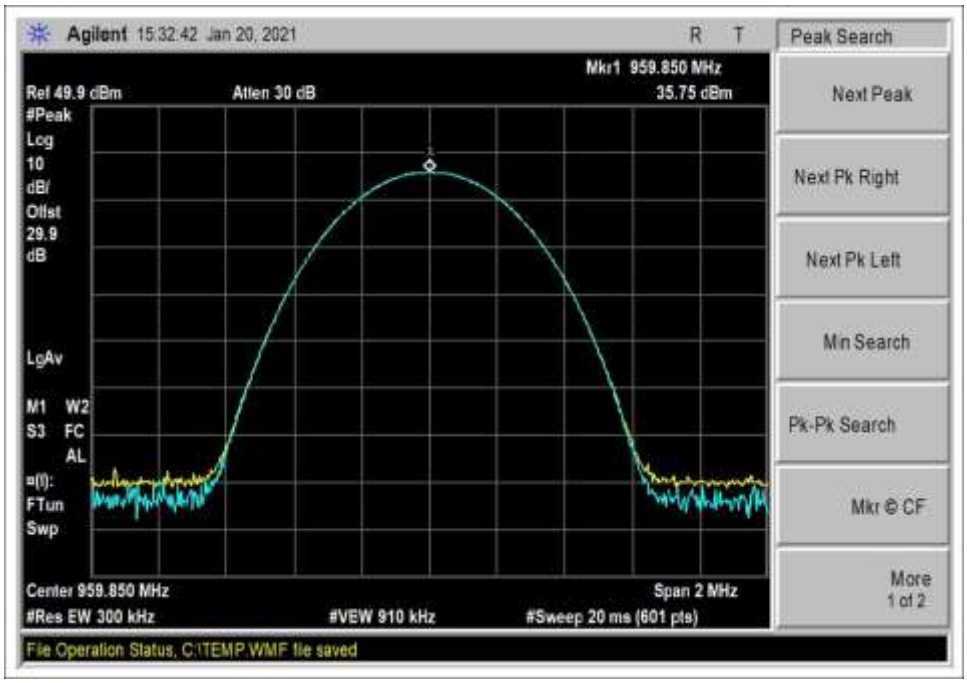
24Hz High Channel



57Hz Low Channel



57Hz Middle Channel



57Hz High Channel

Test Setup Photo(s)

SUPPLEMENTAL INFORMATION

Measurement Uncertainty

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

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

Emissions Test Details

TESTING PARAMETERS

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

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

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

CORRECTION FACTORS

The basic spectrum analyzer reading was converted using correction factors as shown in the highest emissions readings in the tables. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula. This reading was then compared to the applicable specification limit. Individual measurements were compared with the displayed limit value in the margin column. The margin was calculated based on subtracting the limit value from the corrected measurement value; a positive margin represents a measurement exceeding the limit, while a negative margin represents a measurement less than the limit.

SAMPLE CALCULATIONS		
	Meter reading	(dBµV)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	(dBµV/m)

TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed were used to collect the emissions data. A spectrum analyzer or receiver was used for all measurements. Unless otherwise specified, the following table shows the measuring equipment bandwidth settings that were used in designated frequency bands. For testing emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used.

MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
CONDUCTED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	>1 GHz	1 MHz

SPECTRUM ANALYZER/RECEIVER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in the emissions tables indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "positive peak" detector mode. Whenever a "quasi-peak" or "average" reading was recorded, the measurement was annotated with a "QP" or an "Ave" on the appropriate rows of the data sheets. In cases where quasi-peak or average limits were employed and data exists for multiple measurement types for the same frequency then the peak measurement was retained in the report for reference, however the numbering for the affected row was removed and an arrow or caret ("^") was placed in the far left-hand column indicating that the row above takes precedence for comparison to the limit. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data.

Peak

In this mode, the spectrum analyzer or receiver recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature called "peak hold," the measurement device had the ability to measure intermittent or low duty cycle transient emission peak levels. In this mode the measuring device made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

Quasi-Peak

Quasi-peak measurements were taken using the quasi-peak detector when the true peak values exceeded or were within 2 dB of a quasi-peak specification limit. Additional QP measurements may have been taken at the discretion of the operator.

Average

Average measurements were taken using the average detector when the true peak values exceeded or were within 2 dB of an average specification limit. Additional average measurements may have been taken at the discretion of the operator. If the specification or test procedure requires trace averaging, then the averaging was performed using 100 samples or as required by the specification. All other average measurements are performed using video bandwidth averaging. To make these measurements, the test engineer reduces the video bandwidth on the measuring device until the modulation of the signal is filtered out. At this point, the measuring device is set into the linear mode and the scan time is reduced.