Itron, Inc.

TEST REPORT FOR

AMR Transceiver Device For Communicating With Utility Meters
Models: IMRC-INT and IMRC-EXT

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(FHSS 902-928 MHz)

Report No.: 103955-26

Date of issue: August 5, 2020

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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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 208224

REPORT PREPARED BY:

Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 103955

DATE OF EQUIPMENT RECEIPT: June 10, 2020
DATE(S) OF TESTING: June 10-12, and 25, 2020

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.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.12

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Japan
Canyon Park, Bothell, WA	US0081	US1022	A-0136
Brea, CA	US0060	US1025	A-0136
Fremont, CA	US0082	US1023	A-0136
Mariposa, CA	US0103	US1024	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	Pass
15.247(a)(1)	Carrier Separation	NA	Pass
15.247(a)(1)(i)	Number of Hopping Channels	NA	Pass
15.247(a)(1)(i)	Average Time of Occupancy	NA	Pass
15.247(b)(2)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable

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
The EUT with internal antenna and the EUT with external antenna use the same modulation and channel configuration. The only difference between them is the power output. Hence, the data measured on the internal antenna unit can be used for both except RF conducted power and spurious emissions.

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.	IMRC-INT	66034285
10" Tablet	Panasonic	FZ-G1	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
Power Distribution Box	Itron, Inc.	Generic	NA
12Vdc AC Adapter	Husky	FW 1288	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
10" Tablet	Panasonic	FZ-G1	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
Power Distribution Box	Itron, Inc.	Generic	NA
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-EXT	66034368

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 3

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-INT	66034283
10" Tablet	Panasonic	FZ-G1	NA
5Vdc AC Adapter	zip	SG-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

Configuration 4

Equipment Tested:

Device	Manufacturer	Model #	S/N
10" Tablet	Panasonic	FZ-G1	NA
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-EXT	66034368
3dBi Rubber Duck Antenna	Generic	NA	NA
12Vdc AC Adapter	Husky	FW 1288	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

Configuration 5

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-INT	66034283
Power Distribution Box	Itron, Inc.	Generic	NA
10" Tablet	Panasonic	FZ-G1	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
5Vdc AC Adapter	zip	SG-511	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 6

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-EXT	66034368
3dBi Rubber Duck Antenna	Generic	NA	NA
Power Distribution Box	Itron, Inc.	Generic	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
10" Tablet	Panasonic	FZ-G1	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 7

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-EXT	66034368
Power Distribution Box	Itron, Inc.	Generic	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
10" Tablet	Panasonic	FZ-G1	NA
5dBi Antenna	PCTEL	Generic	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 8

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-INT	66034283
Power Distribution Box	Itron, Inc.	Generic	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
5Vdc AC Adapter	zip	SG-511	NA
7" Tablet	Panasonic	FZ-M1	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 9

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-EXT	66034368
3dBi Rubber Duck Antenna	Generic	NA	NA
Power Distribution Box	Itron, Inc.	Generic	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
7" Tablet	Panasonic	FZ-M1	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

Configuration 10

Equipment Tested:

Device	Manufacturer	Model #	S/N
AMR transceiver device for communicating with utility meters	Itron, Inc.	IMRC-EXT	66034368
Power Distribution Box	Itron, Inc.	Generic	NA
Automobile Adapter	Lind Electronics, Inc.	PA1555-2155 FB	NA
5dBi Antenna	PCTEL	Generic	NA
7" Tablet	Panasonic	FZ-M1	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Topward	6306D	988614

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Operating Frequency Range:	908-924MHz
Number of Hopping Channels:	81
Receiver Bandwidth and Synchronization:	The manufacturer declares the receiver input bandwidth matches the transmit channel bandwidth and shifts frequencies in synchronization with the transmitter.
Modulation Type(s):	FSK
Maximum Duty Cycle:	45%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Internal, directional 1.2dBi External, Vehicular mount 5dBi monopole, 3dBi Rubber Duck
Beamforming Type:	NA
Antenna Connection Type:	Integral/External Connector
Nominal Input Voltage:	Internal antenna unit: 5VDC Adapter External antenna unit: 13.8VDC (7 to 18VDC)
Firmware / Software used for Test:	Arm Version: 7.73.00.01 DSP Version: 5.76.00.07 FPGA Version: 3.02 MC3 SuperRaptor Test ver.4.0.3.5
Tablets FCC ID:	7” tablet – Panasonic FZ-M1 FCC ID: ACJ9TGWL15B IC: 216A-CFWL15B contains: FCC ID: ACJ9TGWW13B3 IC: 216A-CFWW13B 10” tablet – Panasonic FZ-G1 FCC ID: ACJ9TGWL15A IC: 216A-CFWL15A contains: FCC ID: ACJ9TGWW13B1 IC: 216A-CFWW13B

EUT Photo and Accessory Photos(s)

IMRC-INT for Conducted

IMRC-INT

IMRC-EXT

3dBi Antenna

5dBi Antenna

5VDC Adapter

12VDC Adapter

Power Distribution

Tablet Power Adapter

Tablet #1

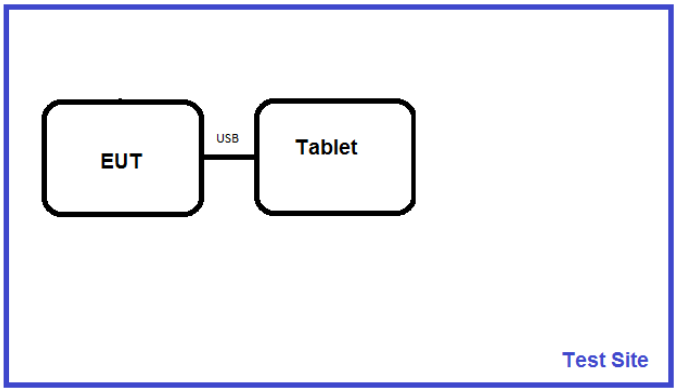
Tablet #2

Support Equipment Photo(s)

12VDC Power Supply

Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	6/10/2020
Configuration:	1		
Test Setup:	EUT is placed on test bench and connected to an external DC power supply. The EUT is set to continuous transmit. Frequency Range: 908-924MHz Frequency tested: 908, 916, 924MHz Firmware power setting: High Power Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting		

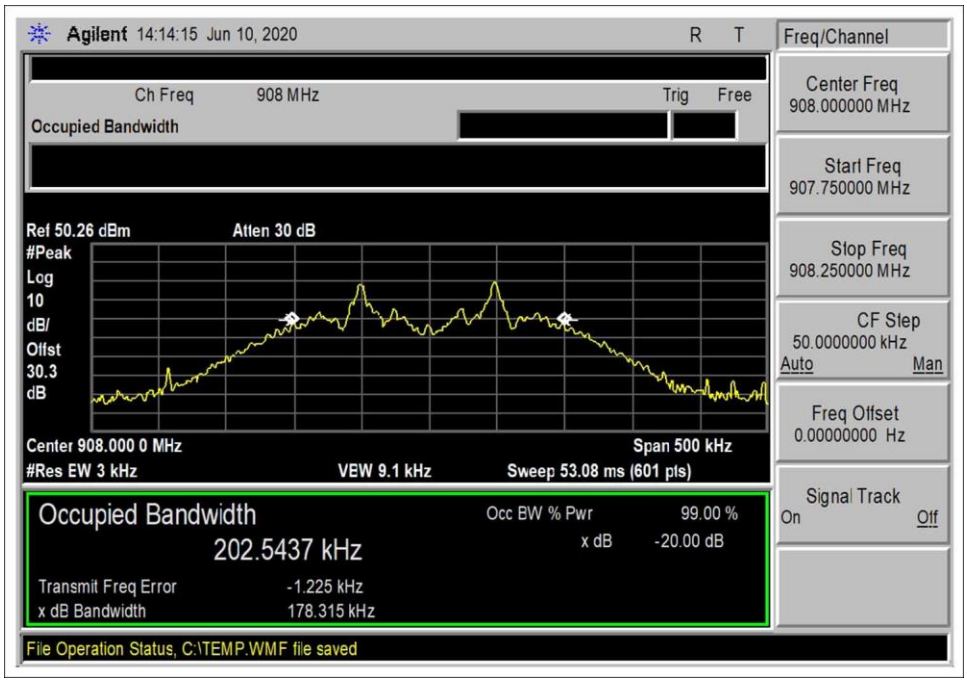
Environmental Conditions			
Temperature (ºC)	25.4	Relative Humidity (%):	25

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02869	Spectrum Analyzer	Agilent	E4440A	7/25/2019	7/25/2020
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07243	Cable	H&S	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

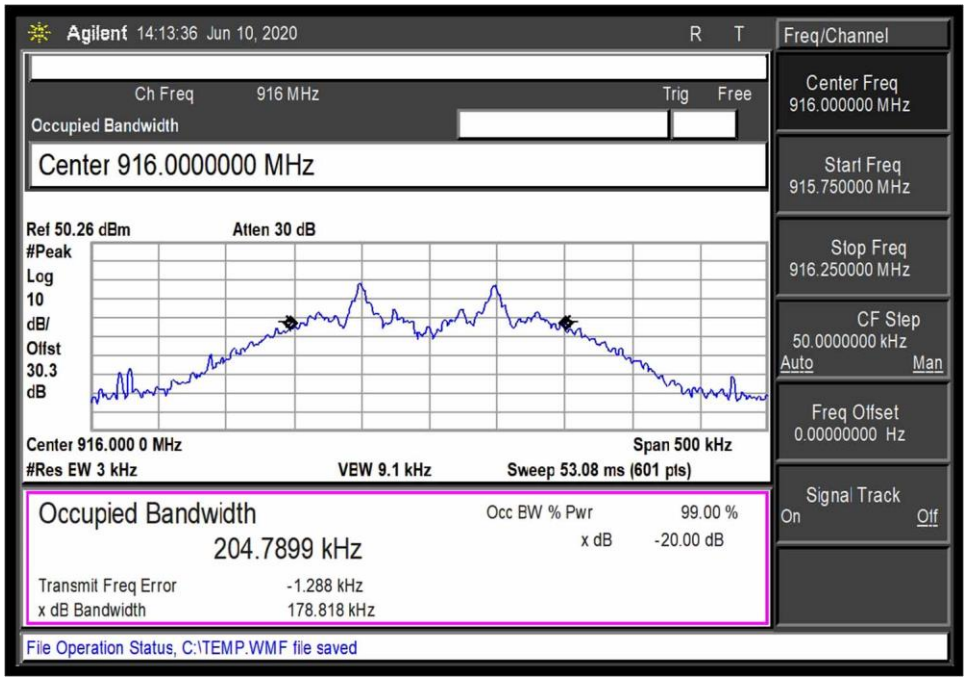
15.247(a)(1)(i) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
908	1	FSK	178.315	≤500	Pass
916	1	FSK	178.818	≤500	Pass
924	1	FSK	195.464	≤500	Pass

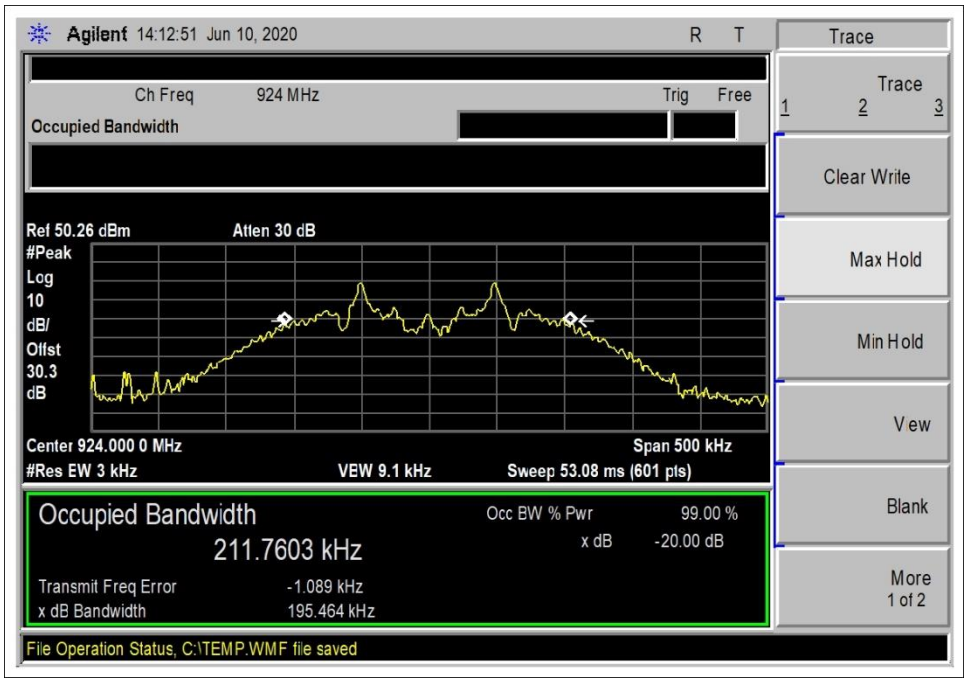
Plot(s)



Low Channel



Middle Channel

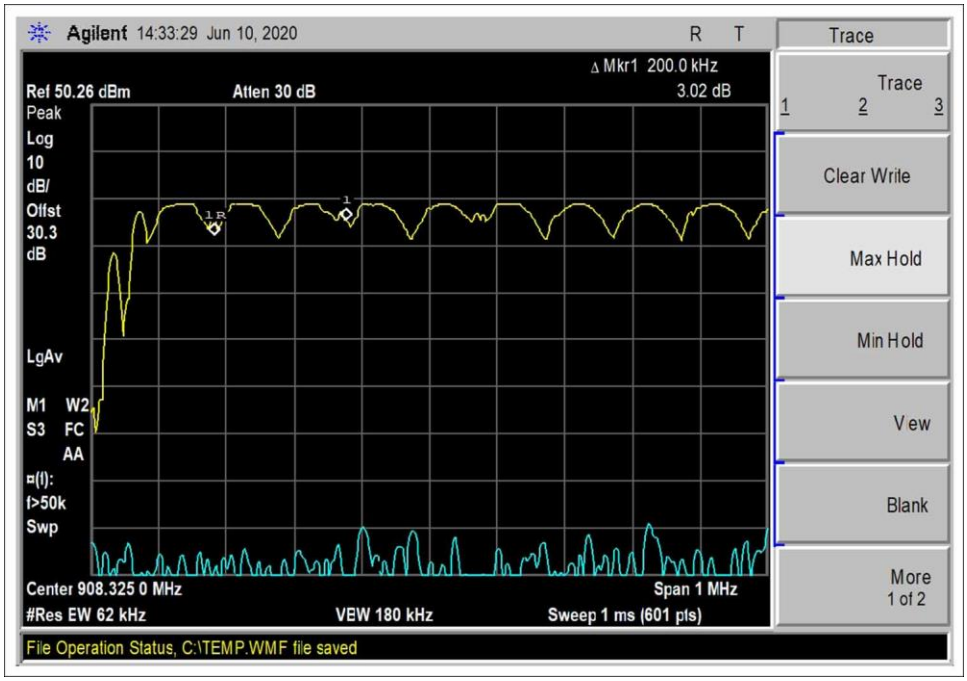


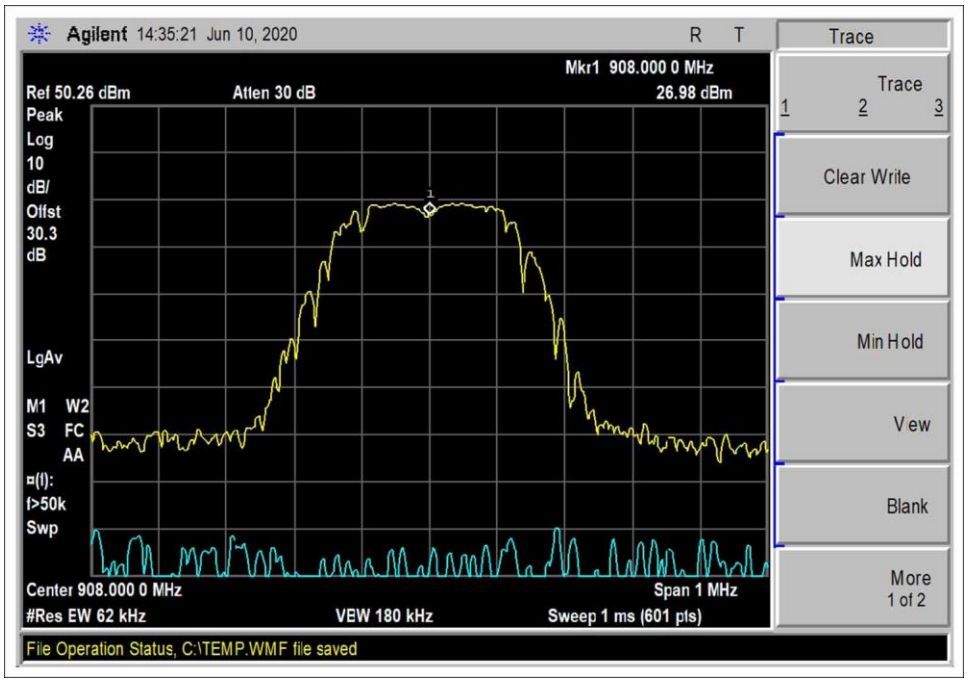
High Channel

15.247(a)(1) Carrier Separation

Test Data Summary				
Limit applied: 20dB bandwidth of the hopping channel.				
Antenna Port	**Operational Mode**	**Measured (kHz)**	**Limit (kHz)**	**Results**
1	Hopping	200	>195.464	Pass

Plot(s)



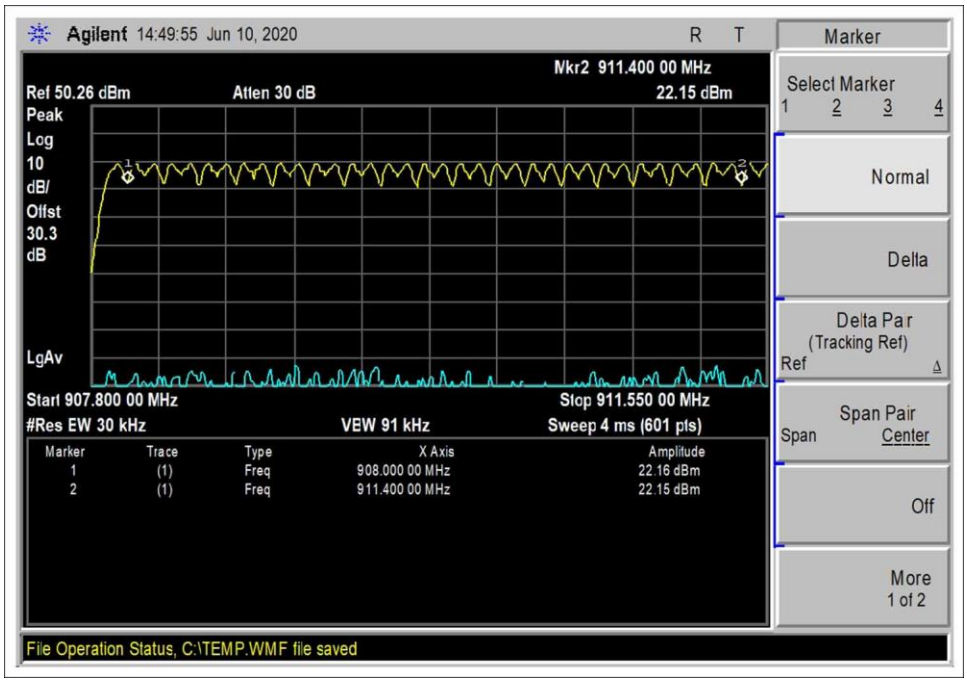


Single Channel

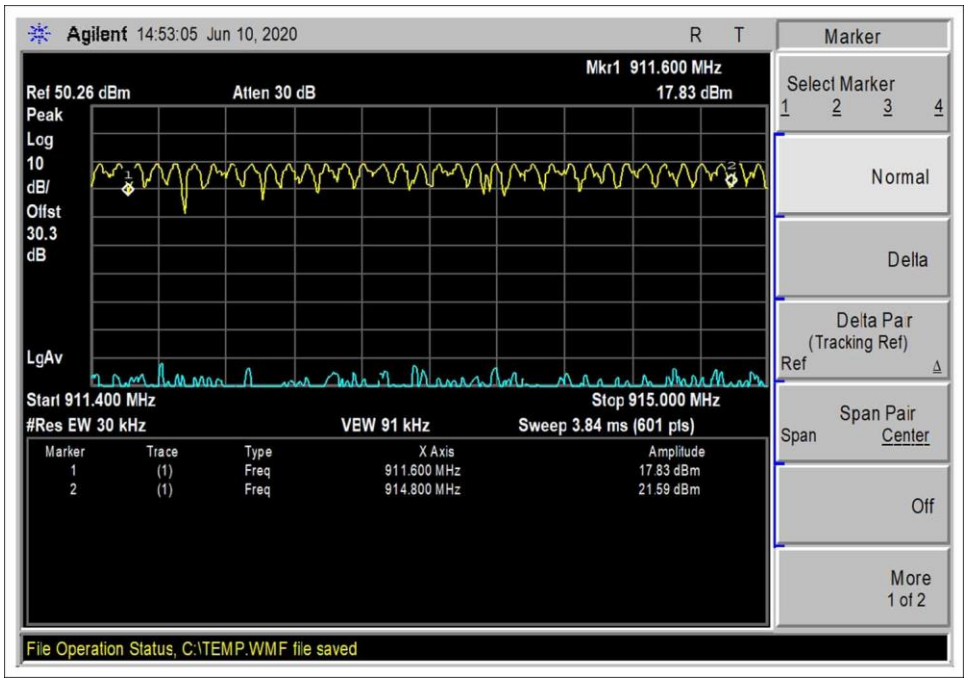
15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50\ Channels \mid 20\ dB\ BW < 250kHz \\ 25\ Channels \mid 20\ dB\ BW \geq 250kHz \end{cases}$				
Antenna Port	**Operational Mode**	**Measured (Channels)**	**Limit (Channels)**	**Results**
1	Hopping	81	≥50	Pass

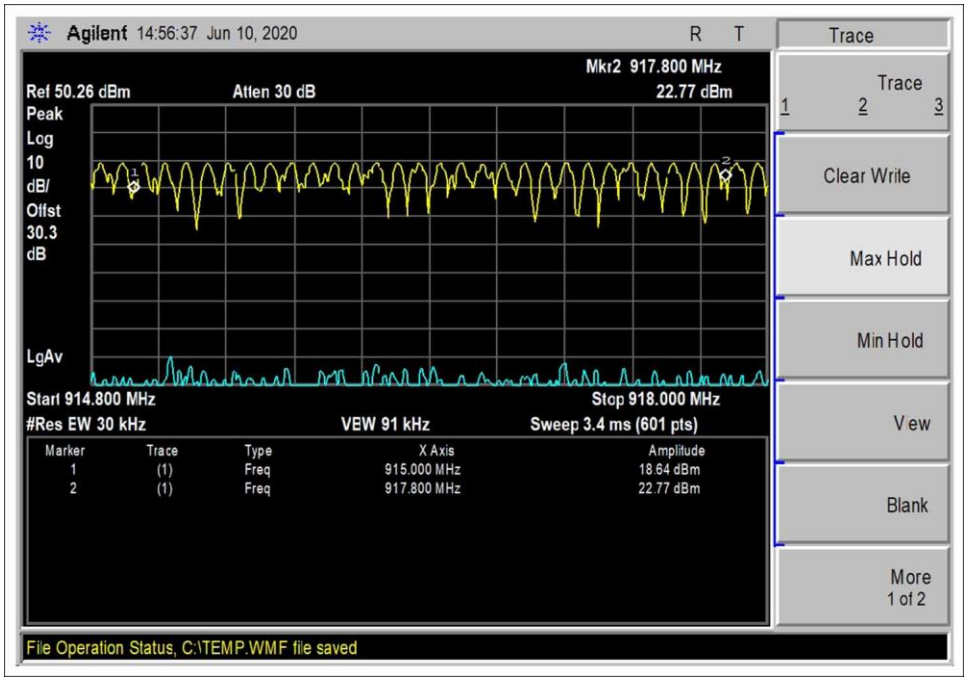
Plot(s)



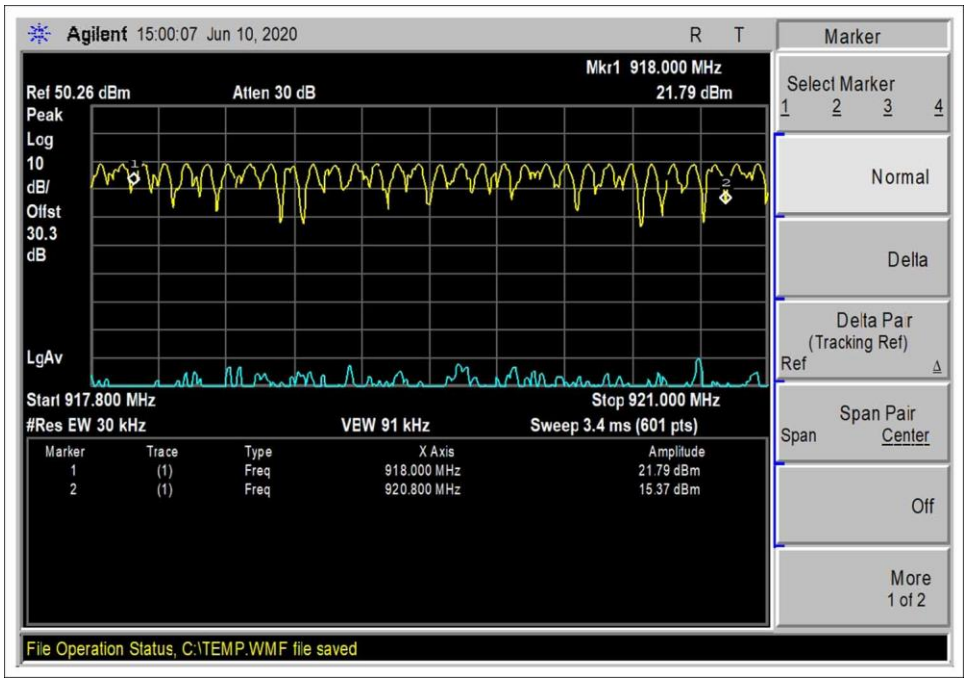
18 Channel



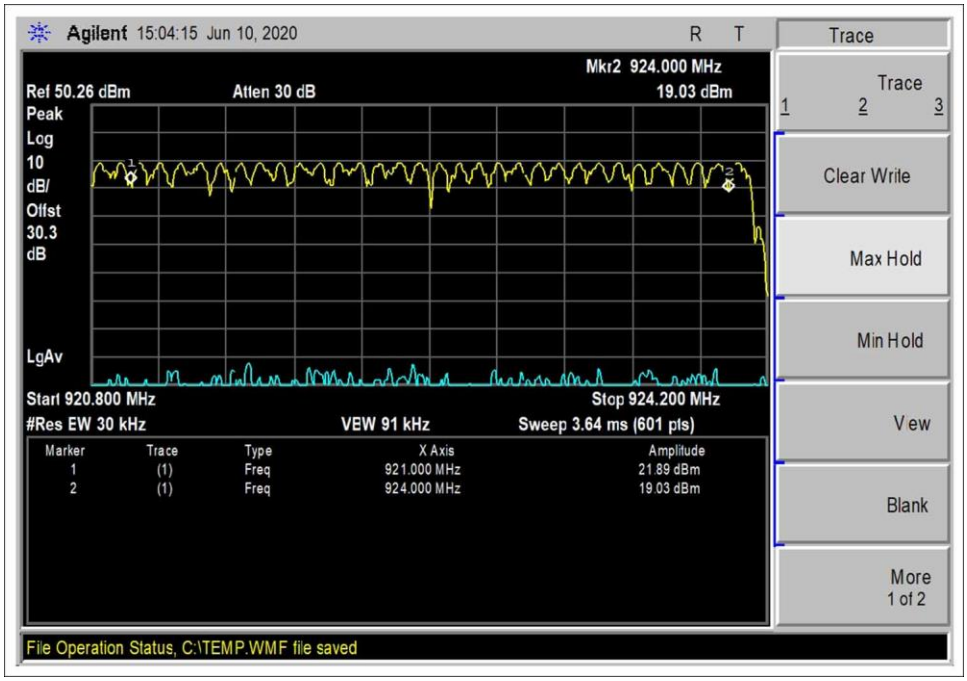
17 Channel



15 Channel



15 Channel



16 Channel

15.247(a)(1)(i) Time of Occupancy

Test Data Summary				
Observation Period, P_{obs} is derived from the following: $P_{Obs} = \begin{cases} 20\ Seconds & 20\ dB\ BW < 250kHz \\ 10\ Seconds & 20\ dB\ BW \geq 250kHz \end{cases}$				
Antenna Port	**Operational Mode**	**Measured (ms)**	**Limit (ms/P_{obs})**	**Results**
1	Hopping	356	≤400	Pass

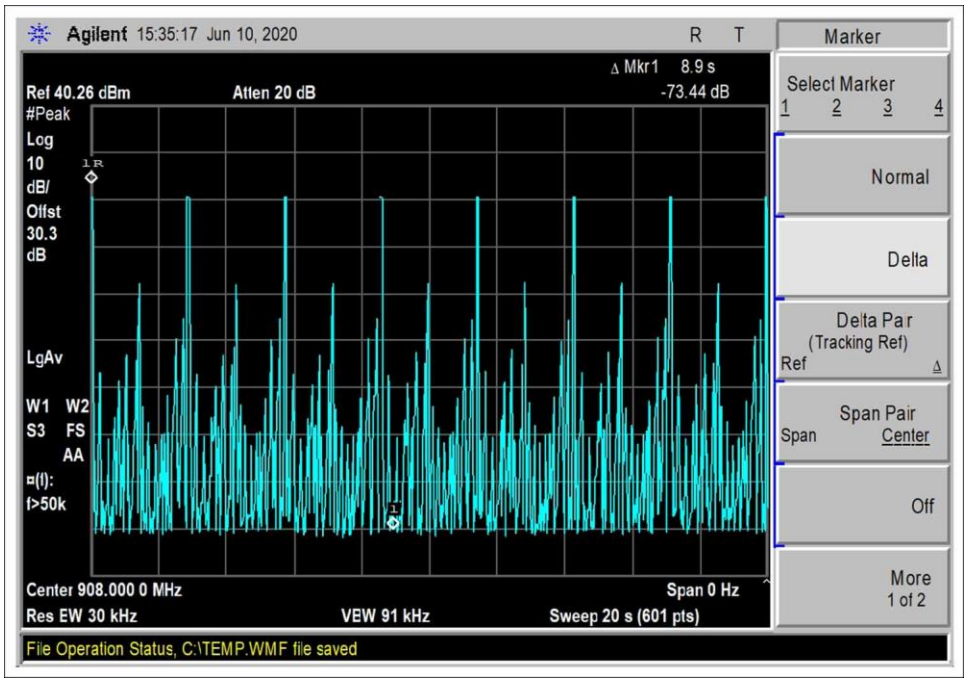
Measured results are calculated as follows:

$$Dwell\ time = \left(\sum_{Bursts} RF\ Burst\ On\ Time + \sum_{Control} Control\ Signal\ On\ time \right)\Big|_{P_{obs}}$$

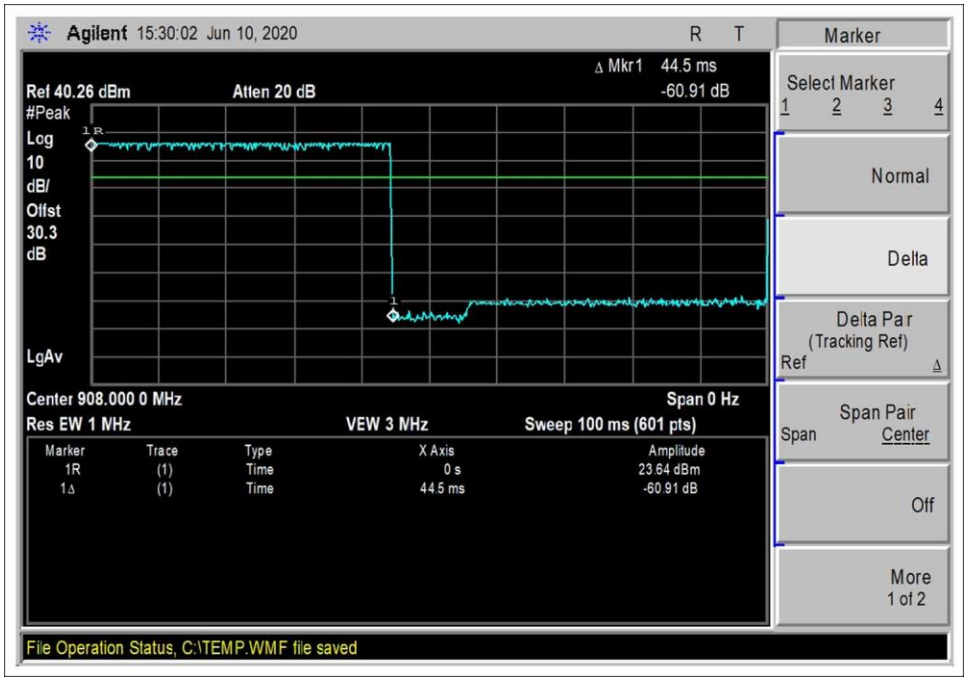
Actual Calculated Values:

Parameter	Value
Observation Period (P_{obs}):	20 second
Number of RF Bursts / P_{obs}:	8
On time of RF Burst:	44.5 ms
Number of Control or other signals / P_{obs}:	0
On time of Control or other Signals:	0
Total Measured On Time:	356 ms

Plot(s)

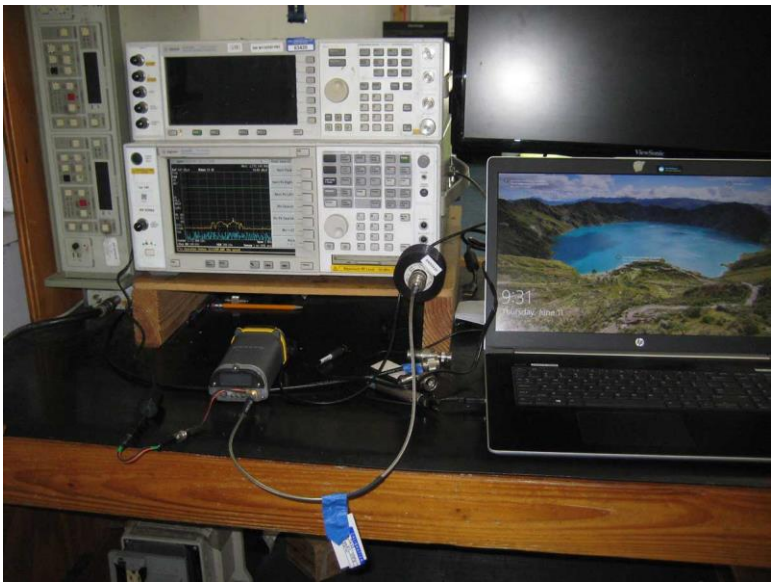


8 Transmissions in 20s



Single Transmission

Test Setup Photo(s)



IMRC-INT

IMRC-EXT

15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	6/10/2020
Configuration:	1 and 2		
Test Setup:	EUT is placed on test bench and connected to an external DC power supply. The EUT is set to continuous transmit. Frequency Range: 908-924MHz Frequency tested: 908, 916, 924MHz Firmware power setting: High Power Duty Cycle: 100% (Test Mode) Test Mode: Continuously transmitting		

Environmental Conditions			
Temperature (ºC)	25.4	Relative Humidity (%):	25

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02869	Spectrum Analyzer	Agilent	E4440A	7/25/2019	7/25/2020
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07243	Cable	H&S	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

Test Data Summary – Voltage Variations					
Configuration 1					
Frequency (MHz)	**Modulation**	**$V_{Minimum}$ (dBm)**	**$V_{Nominal}$ (dBm)**	**$V_{Maximum}$ (dBm)**	**Max Deviation from $V_{Nominal}$ (dB)**
908	FSK	29.27	29.29	29.29	0.02
916	FSK	29.23	29.23	29.21	0.02
924	FSK	29.17	29.17	29.16	0.01

Note: Offset includes 0.46dB internal cable loss in internal antenna unit.

Parameter Definitions:

Measurements performed at input voltage Vnominal ± 15%. (AC and DC Input)

Parameter	Value
$V_{Nominal}$:	115VAC / 5VDC
$V_{Minimum}$:	97VAC / 4.25VDC
$V_{Maximum}$:	133VAC / 5.75VDC

Test Data Summary – Voltage Variations					
Configuration 2					
Frequency (MHz)	**Modulation**	**$V_{Minimum}$ (dBm)**	**$V_{Nominal}$ (dBm)**	**$V_{Maximum}$ (dBm)**	**Max Deviation from $V_{Nominal}$ (dB)**
908	FSK	27.00	26.99	27.00	0.01
916	FSK	26.94	26.94	26.95	0.01
924	FSK	26.77	26.78	26.76	0.02

Investigated minimum and maximum voltage for both AC and DC input, worst case reported.

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification. (DC Input)

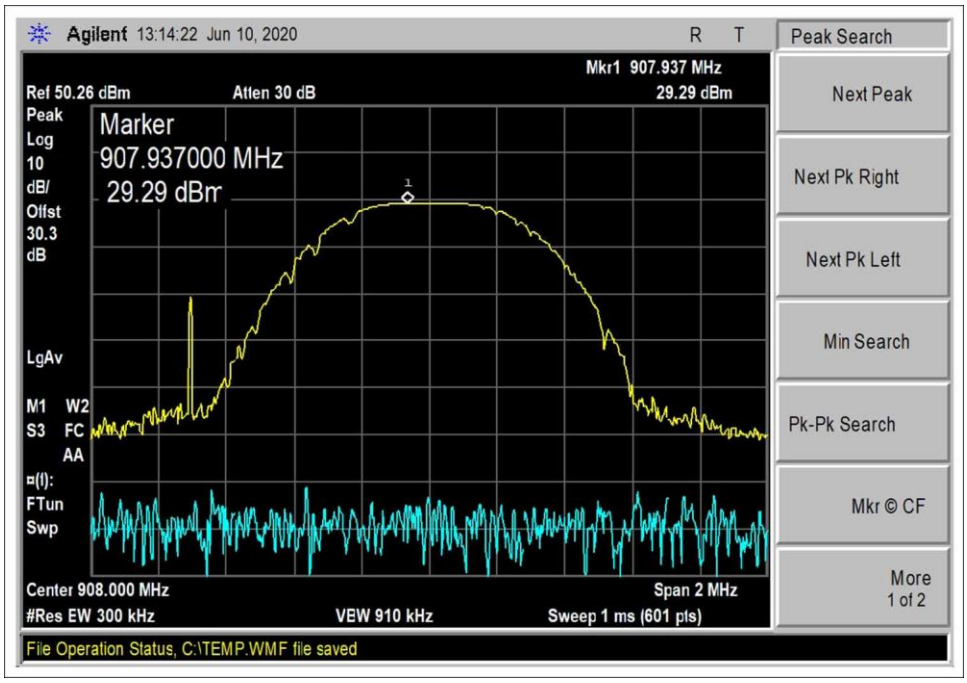
Parameter	Value
$V_{Nominal}$:	13.8VDC
$V_{Minimum}$:	7VDC
$V_{Maximum}$:	18VDC

Test Data Summary - RF Conducted Measurement					
$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$					
Configuration 1					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
908	FSK	Internal/1.2	29.29	≤30	Pass
916	FSK	Internal/1.2	29.23	≤30	Pass
924	FSK	Internal/1.2	29.17	≤30	Pass

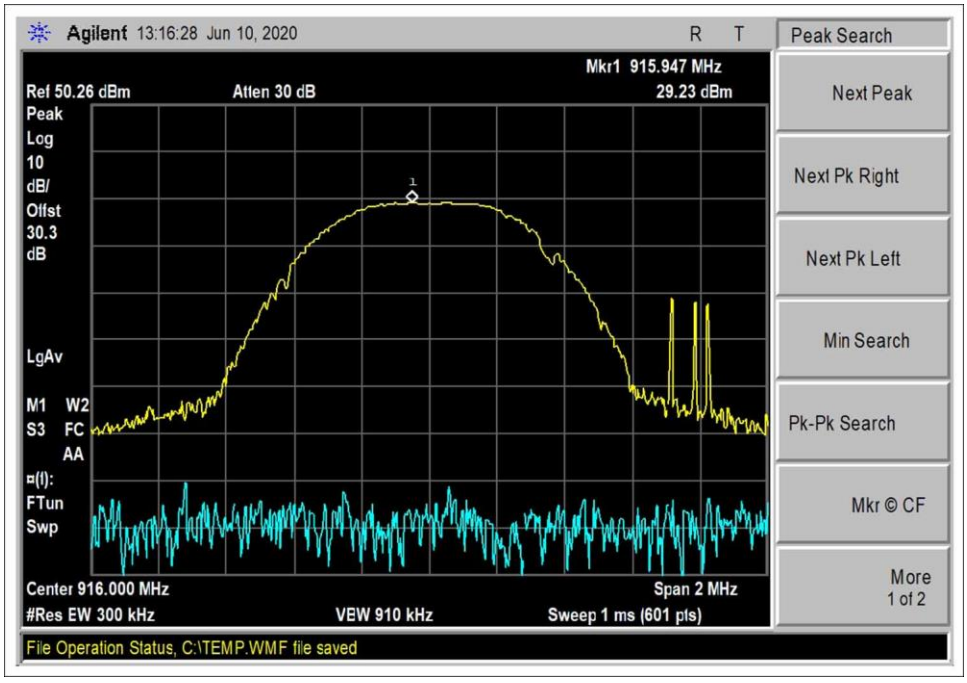
Note: offset includes 0.46dB internal cable loss in internal antenna unit.

Test Data Summary - RF Conducted Measurement					
$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$					
Configuration 2					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
908	FSK	External Monopole/5 External Rubber Duck/3	27.00	≤30	Pass
916	FSK	External Monopole/5 External Rubber Duck/3	26.95	≤30	Pass
924	FSK	External Monopole/5 External Rubber Duck/3	26.78	≤30	Pass

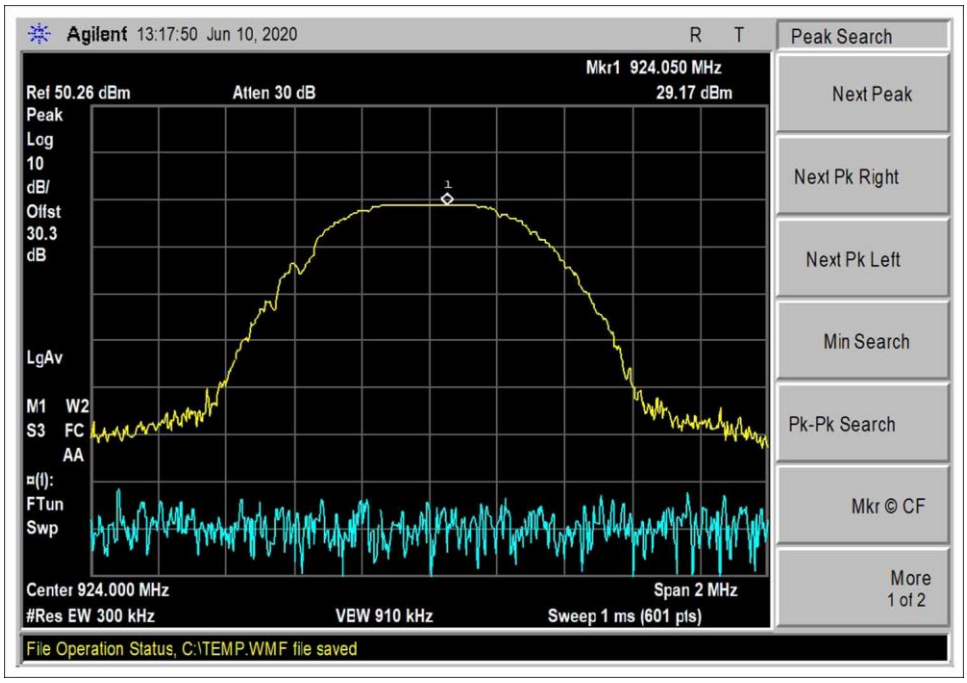
Plots



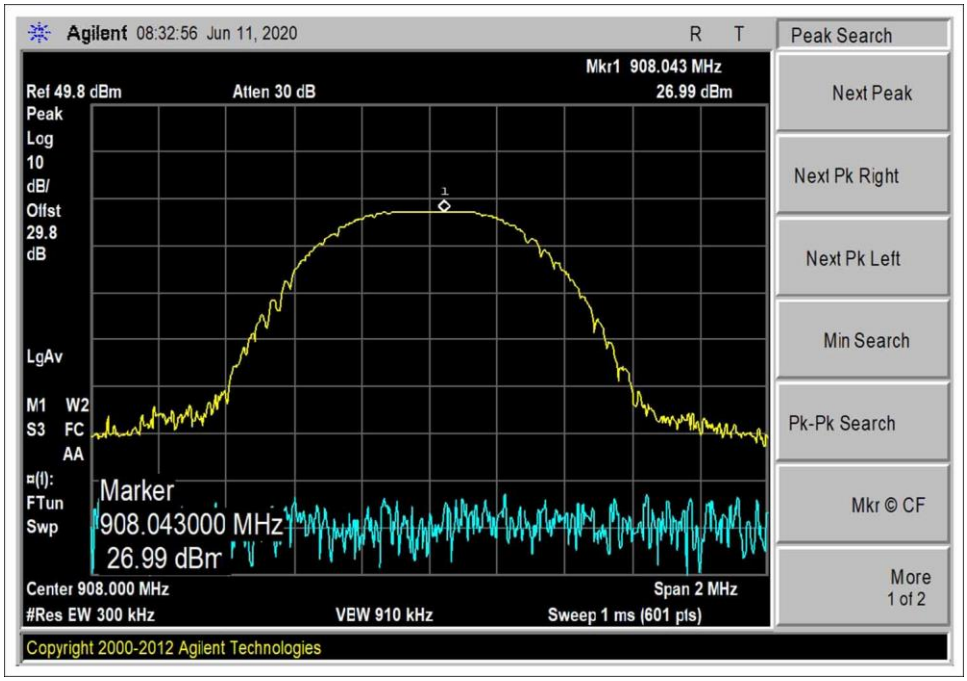
Configuration 1, Low Channel



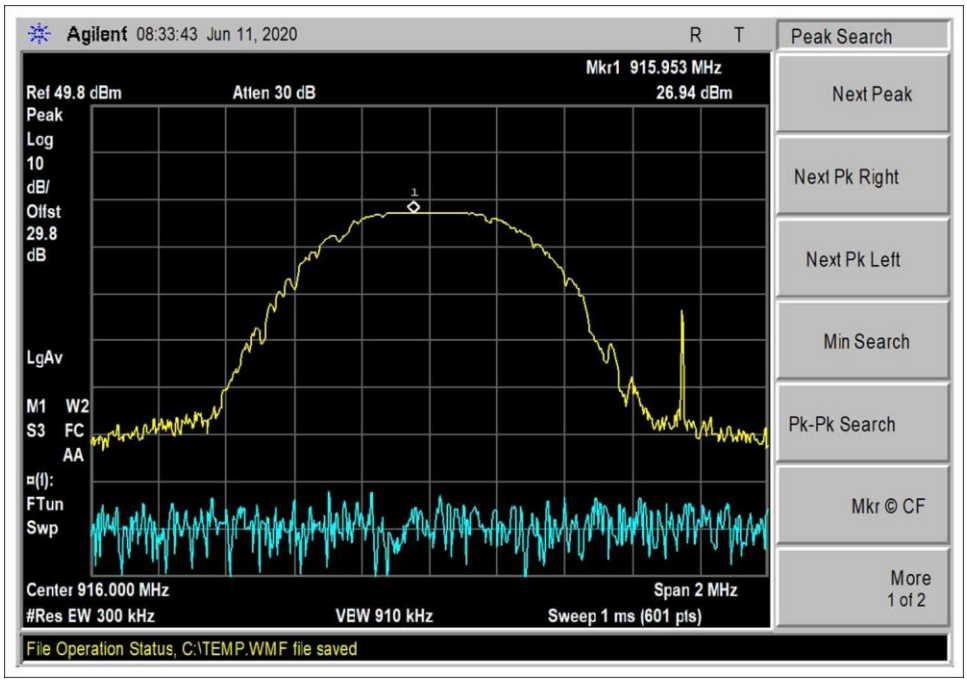
Configuration 1, Middle Channel



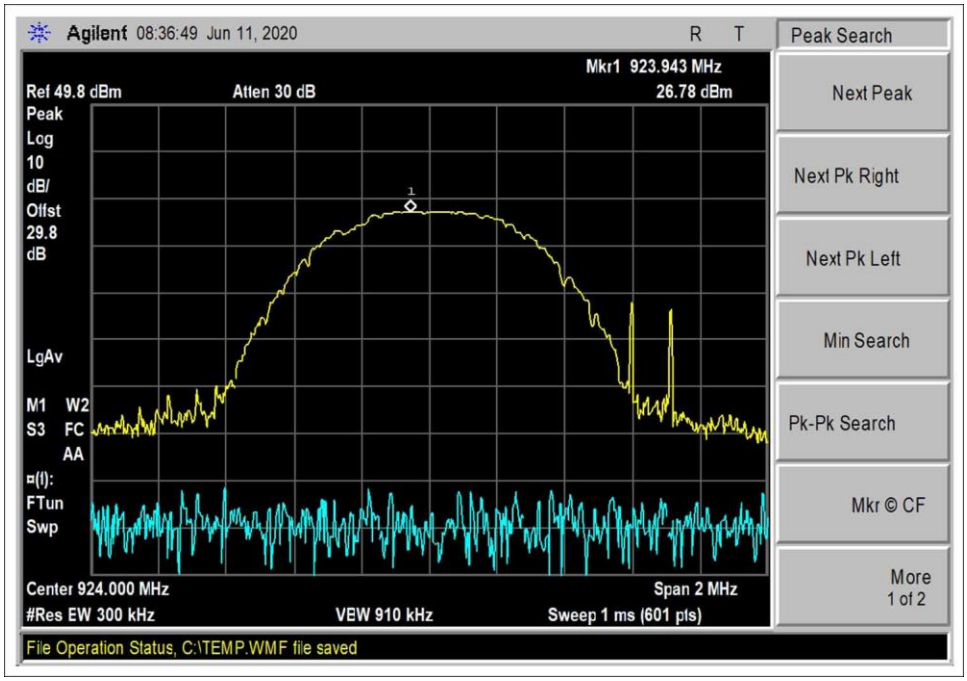
Configuration 1, High Channel



Configuration 2, Low Channel

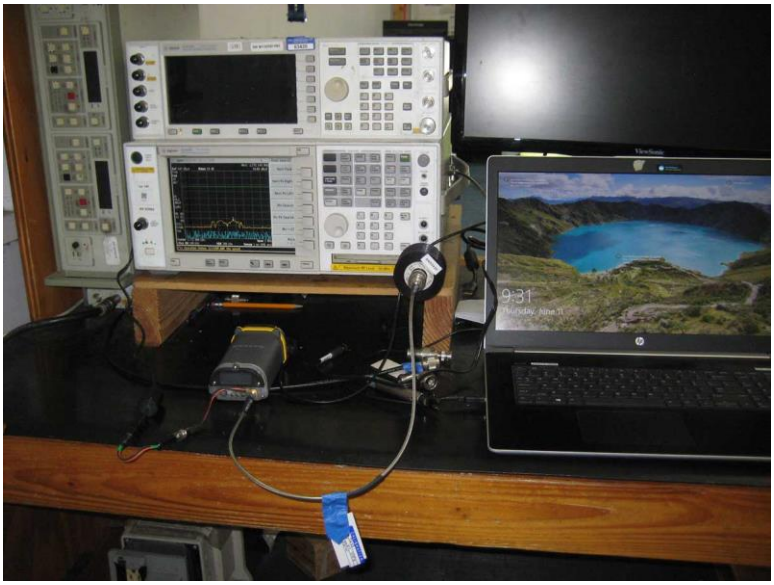


Configuration 2, Middle Channel



Configuration 2, High Channel

Test Setup Photo(s)



Configuration 1

Configuration 2

15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**103955**	Date:	6/11/2020
Test Type:	**Conducted Emissions**	Time:	09:42:55
Tested By:	Don Nguyen	Sequence#:	1
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

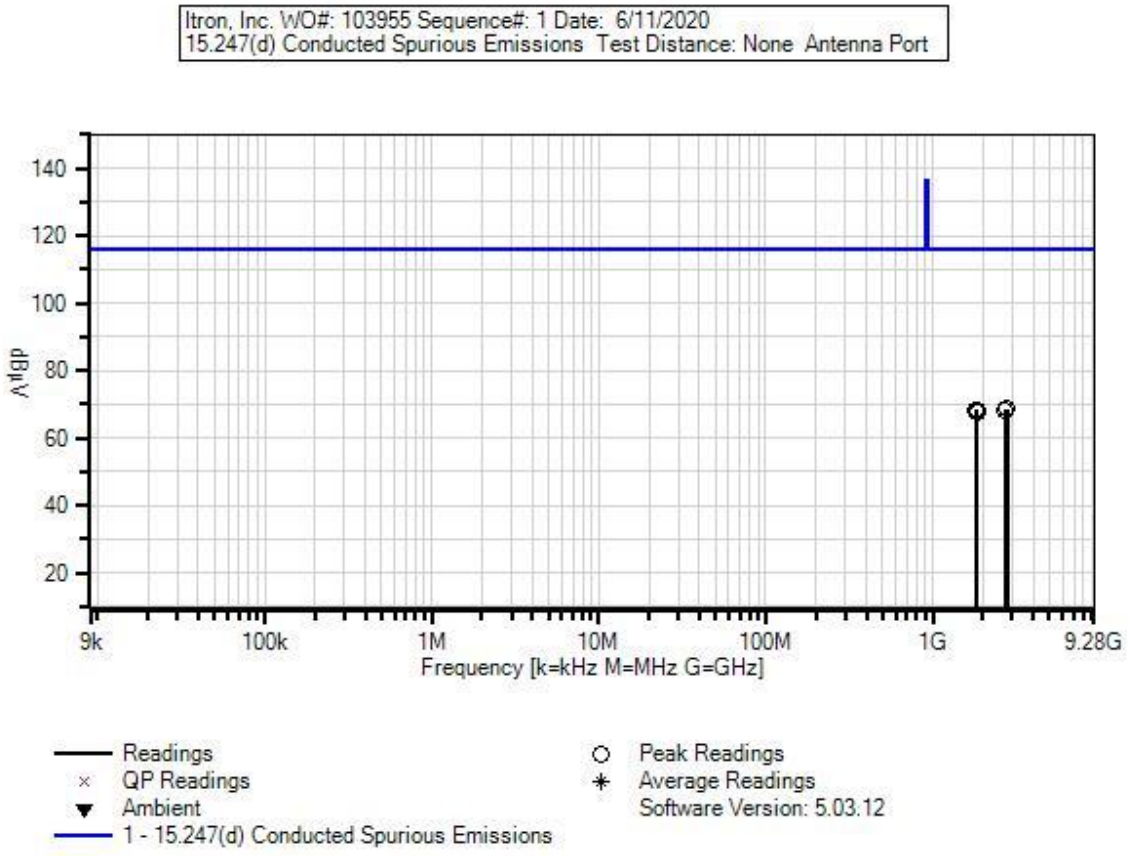
Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is placed on test bench. 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.

Operating frequency: 908MHz, 916MHz, 924MHz
Frequency of measurement: 9kHz-9.28GHz
RBW=100kHz, VBW=300kHz

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 24.9
Relative Humidity (%): 33



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	7/25/2019	7/25/2020
T1	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T2	ANP07243	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

Measurement Data: Reading listed by margin. Test Distance: None

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2771.842M	38.7	+29.7	+0.3			+0.0	68.7	116.3	-47.6	Anten
2	2748.140M	38.5	+29.7	+0.3			+0.0	68.5	116.3	-47.8	Anten
3	2724.133M	38.4	+29.7	+0.3			+0.0	68.4	116.3	-47.9	Anten
4	1815.893M	38.6	+29.6	+0.2			+0.0	68.4	116.3	-47.9	Anten
5	1847.882M	38.2	+29.6	+0.2			+0.0	68.0	116.3	-48.3	Anten
6	1832.103M	38.0	+29.6	+0.2			+0.0	67.8	116.3	-48.5	Anten

Test Location:	CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**103955**	Date:	6/11/2020
Test Type:	**Conducted Emissions**	Time:	09:12:44
Tested By:	Don Nguyen	Sequence#:	0
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

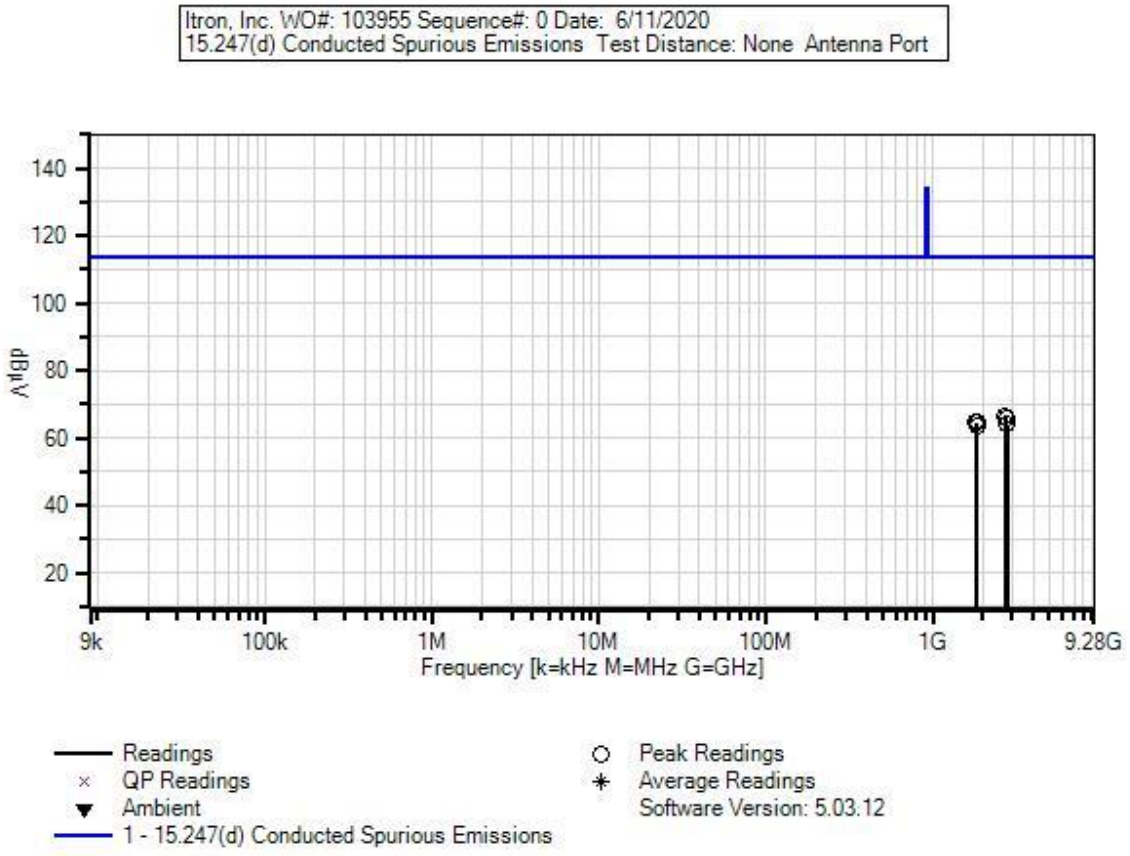
Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on test bench. 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.

Operating frequency: 908MHz, 916MHz, 924MHz
Frequency of measurement: 9kHz-9.28GHz
RBW=100kHz, VBW=300kHz

Test Method: ANSI C63.10 (2013)
Temperature (ºC): 24.9
Relative Humidity (%): 33



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02869	Spectrum Analyzer	E4440A	7/25/2019	7/25/2020
T1	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T2	ANP07243	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

Measurement Data: Reading listed by margin. Test Distance: None

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	2723.849M	36.3	+29.7	+0.3			+0.0	66.3	114.0	-47.7	Anten
2	2747.833M	35.8	+29.7	+0.3			+0.0	65.8	114.0	-48.2	Anten
3	1816.101M	34.8	+29.6	+0.2			+0.0	64.6	114.0	-49.4	Anten
4	1831.897M	34.7	+29.6	+0.2			+0.0	64.5	114.0	-49.5	Anten
5	2772.143M	34.0	+29.7	+0.3			+0.0	64.0	114.0	-50.0	Anten
6	1847.887M	33.8	+29.6	+0.2			+0.0	63.6	114.0	-50.4	Anten

Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB. Operating Mode: Single Channel (Low and High) **Configuration 1**				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	FSK	-43.31	<9.3	Pass
928	FSK	-40.90	<9.3	Pass

Note: offset includes 0.46dB internal cable loss in internal antenna unit.

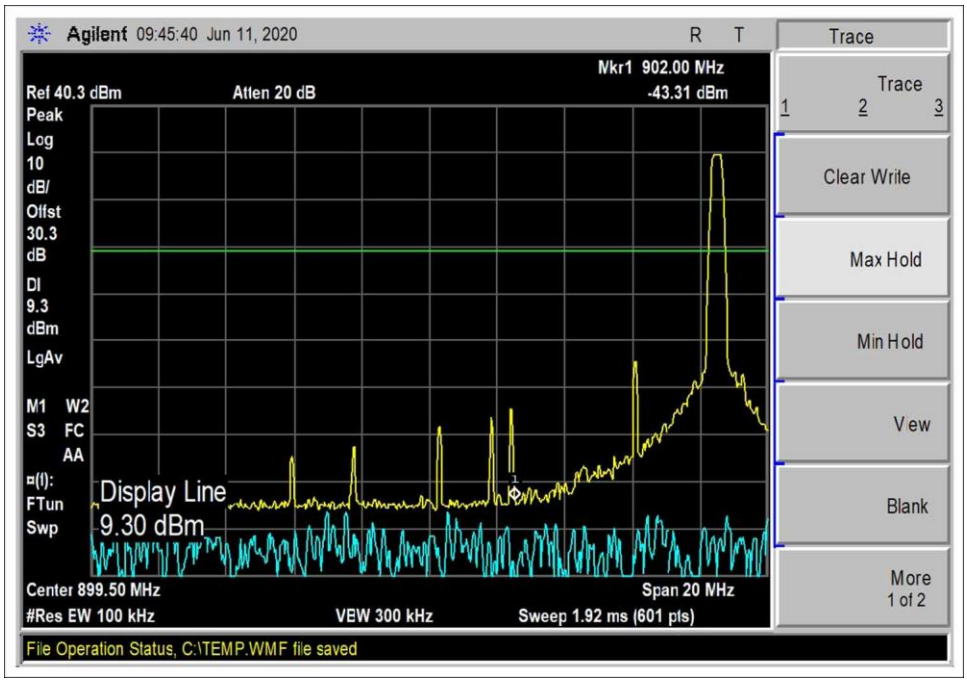
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB. Operating Mode: Hopping **Configuration 1**				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	FSK	-43.19	<9.3	Pass
928	FSK	-42.98	<9.3	Pass

Note: offset includes 0.46dB internal cable loss in internal antenna unit.

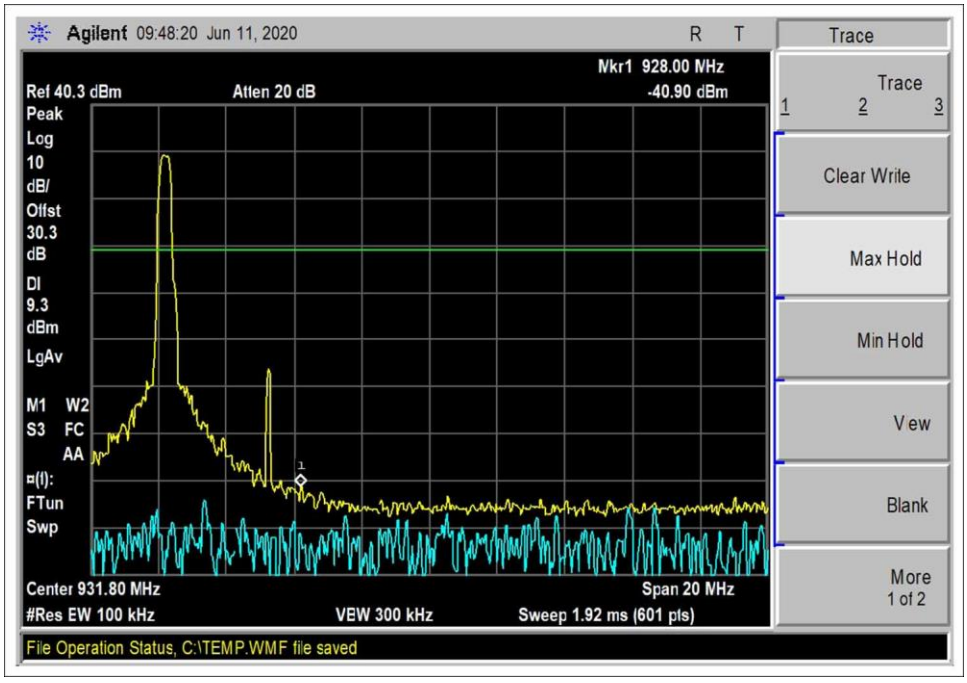
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB. Operating Mode: Single Channel (Low and High) **Configuration 2**				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	FSK	-35.05	<7.4	Pass
928	FSK	-36.28	<7.4	Pass

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB. Operating Mode: Hopping **Configuration 2**				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	FSK	-36.11	<7.4	Pass
928	FSK	-36.00	<7.4	Pass

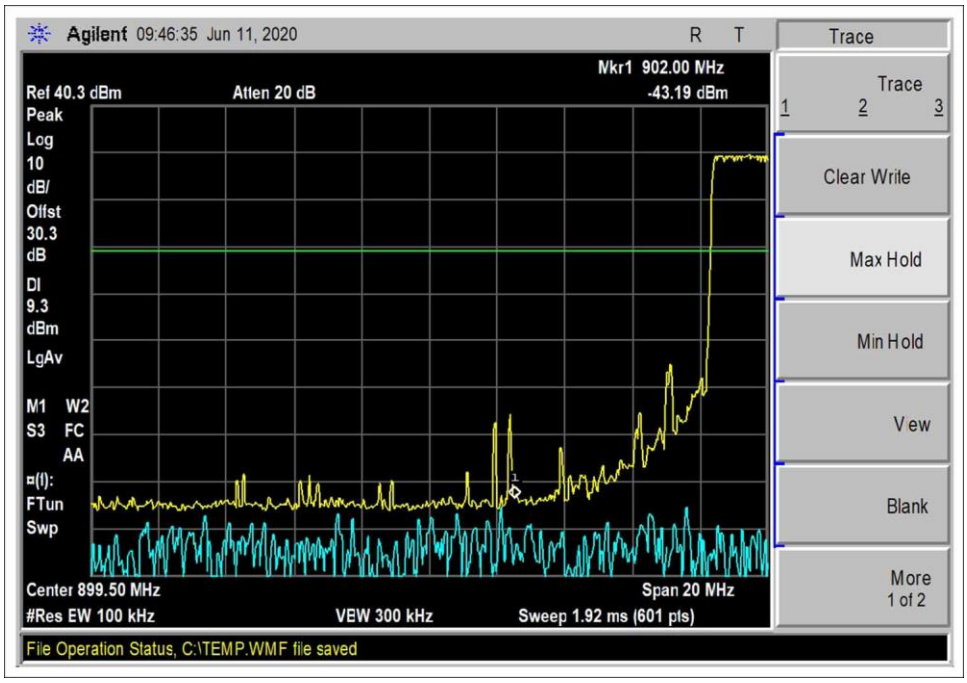
Band Edge Plots



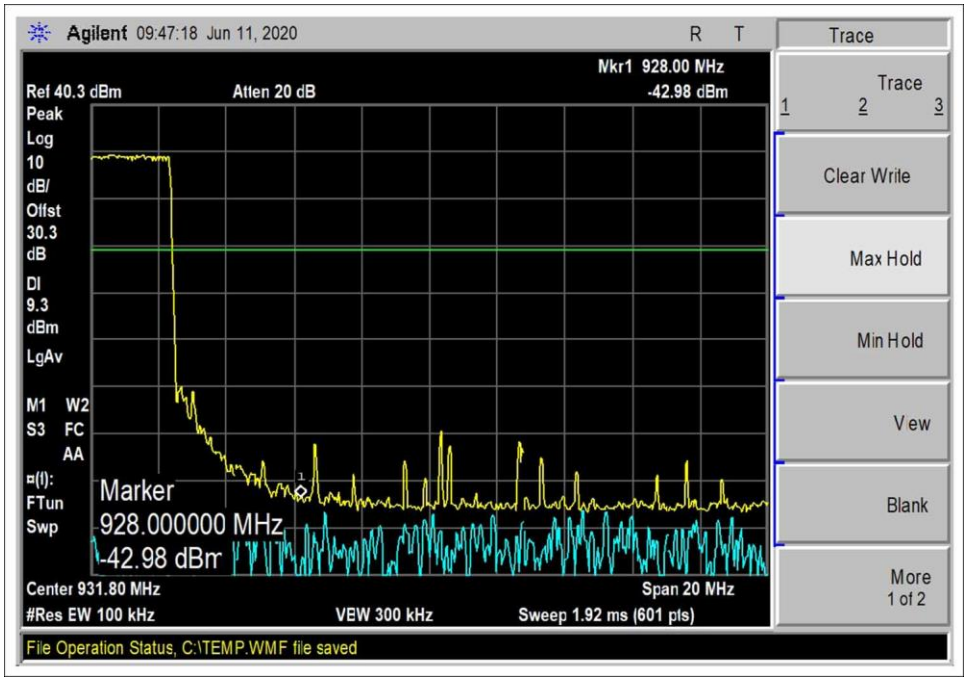
Configuration 1, Low Channel



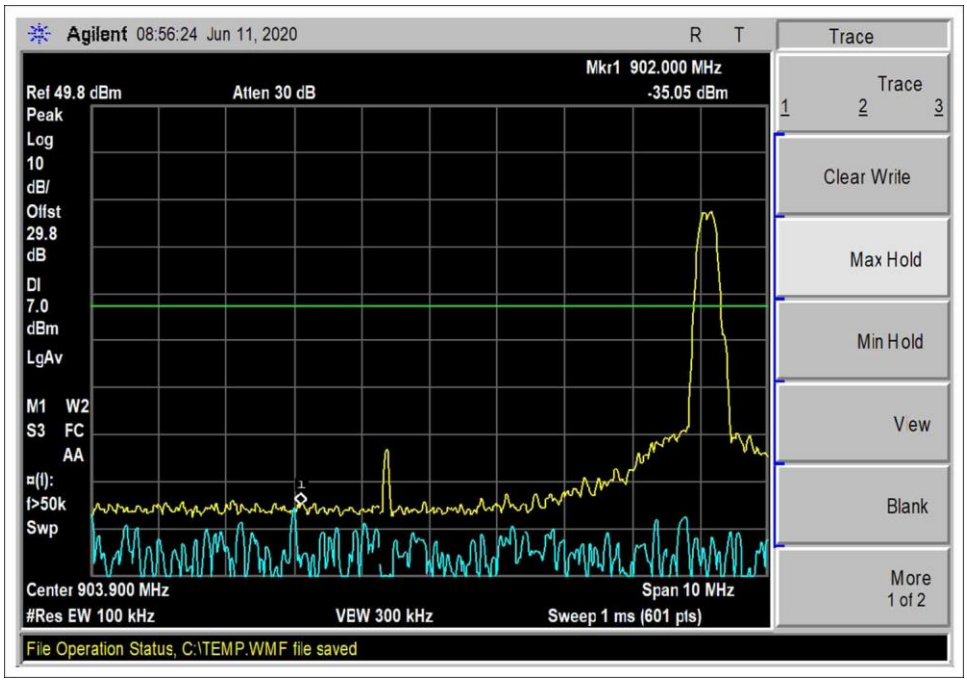
Configuration 1, High Channel



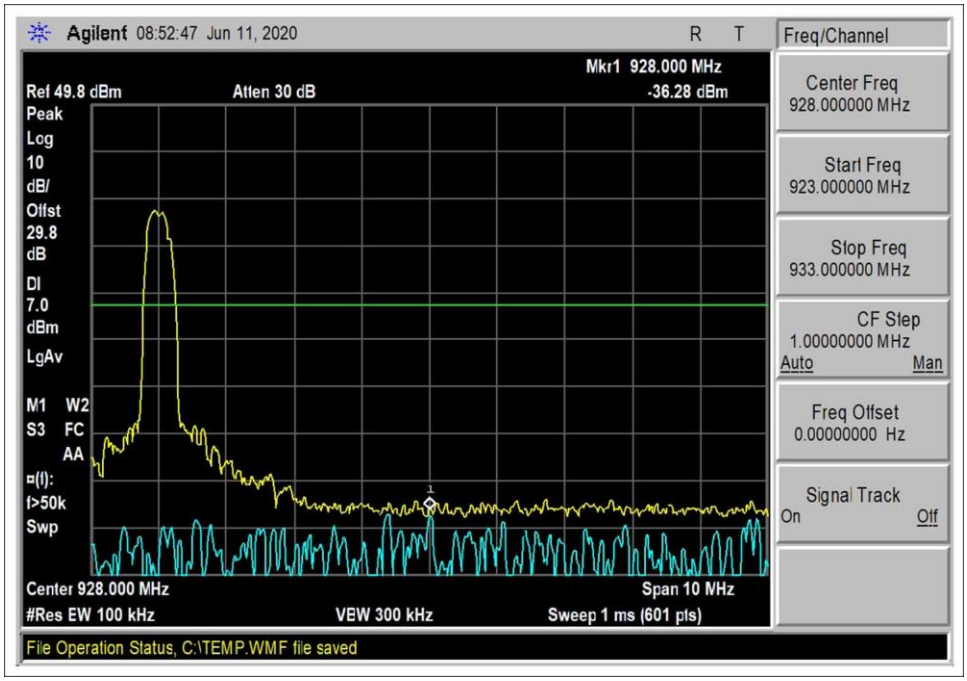
Configuration 1, Low Channel – Hopping



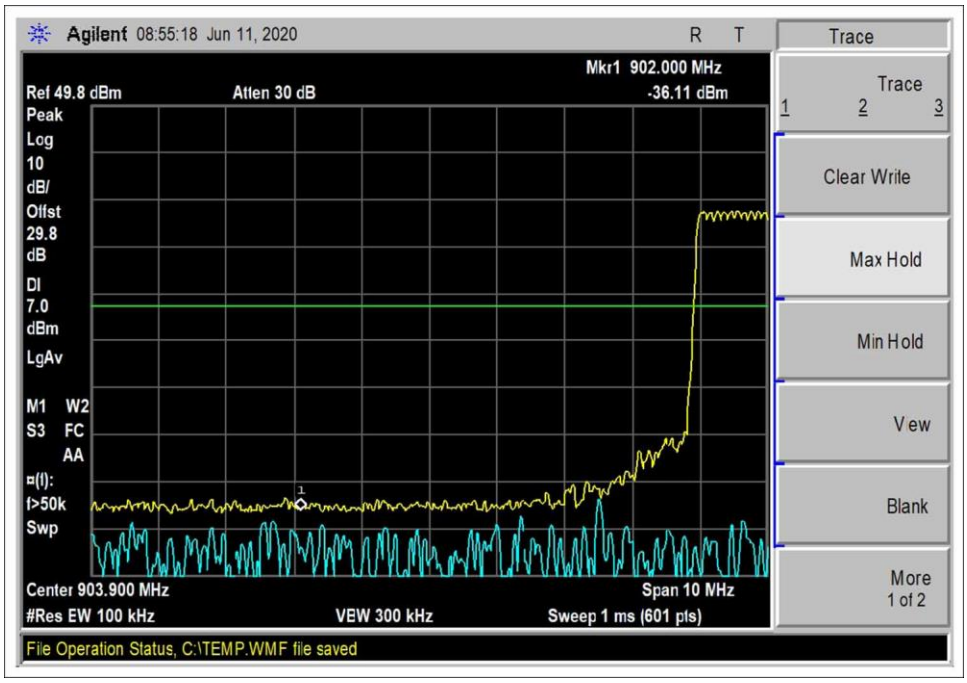
Configuration 1, High Channel – Hopping



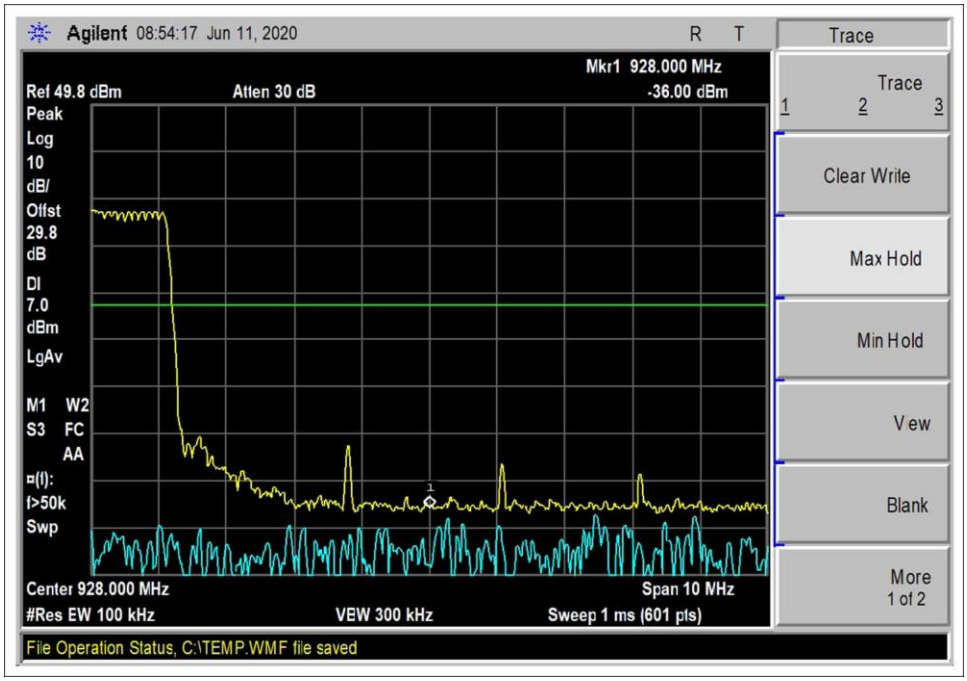
Configuration 2, Low Channel



Configuration 2, High Channel

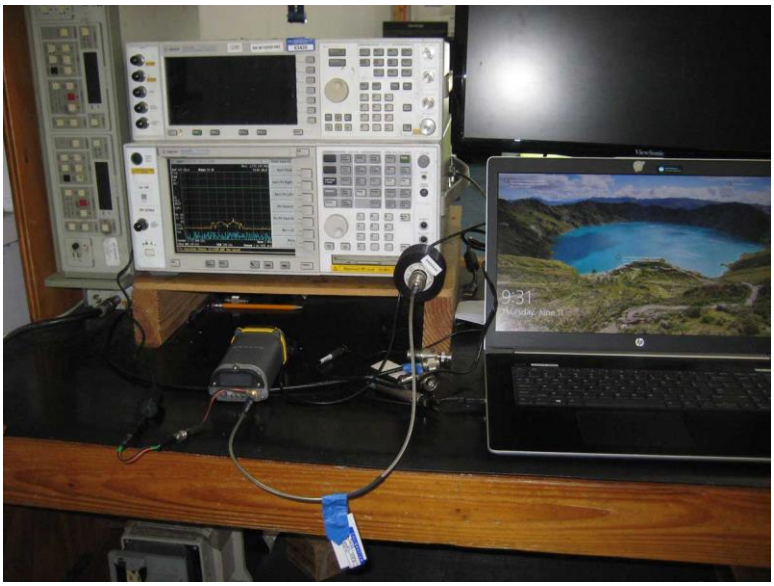


Configuration 2, Low Channel – Hopping



Configuration 2, High Channel - Hopping

Test Setup Photo(s)



Configuration 1

Configuration 2

15.247(d) Radiated Emissions & Band Edge

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	6/25/2020
Configuration:	5, 6, 7, 8, 9, 10		
Setup	The EUT is placed on Styrofoam platform and connected to DC 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. Operating frequency: 908MHz, 916MHz, 924MHz Frequency of measurement: 9kHz-9.28GHz 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz. 150kHz to 30MHz RBW=9kHz, VBW=27kHz. 30-1000MHz, RBW=120kHz, VBW=360kHz 1000-9280MHz, RBW=1MHz, VBW=3MHz RBW=100kHz, VBW=300kHz (-20dB limit) Note: The EUT is rotated in three orthogonal axis. Data represents the worst-case configuration. For band edge measurement, data was measured with 10” tablet. Measurement was verified again with 7” tablet and no change was observed.		

Environmental Conditions			
Temperature (ºC)	24.9	Relative Humidity (%):	54

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 100 North Olinda Place • Brea CA 92823• 714 993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103955**	Date:	6/24/2020
Test Type:	**Maximized Emissions**	Time:	13:54:45
Tested By:	Don Nguyen	Sequence#:	5
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 5			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 5			

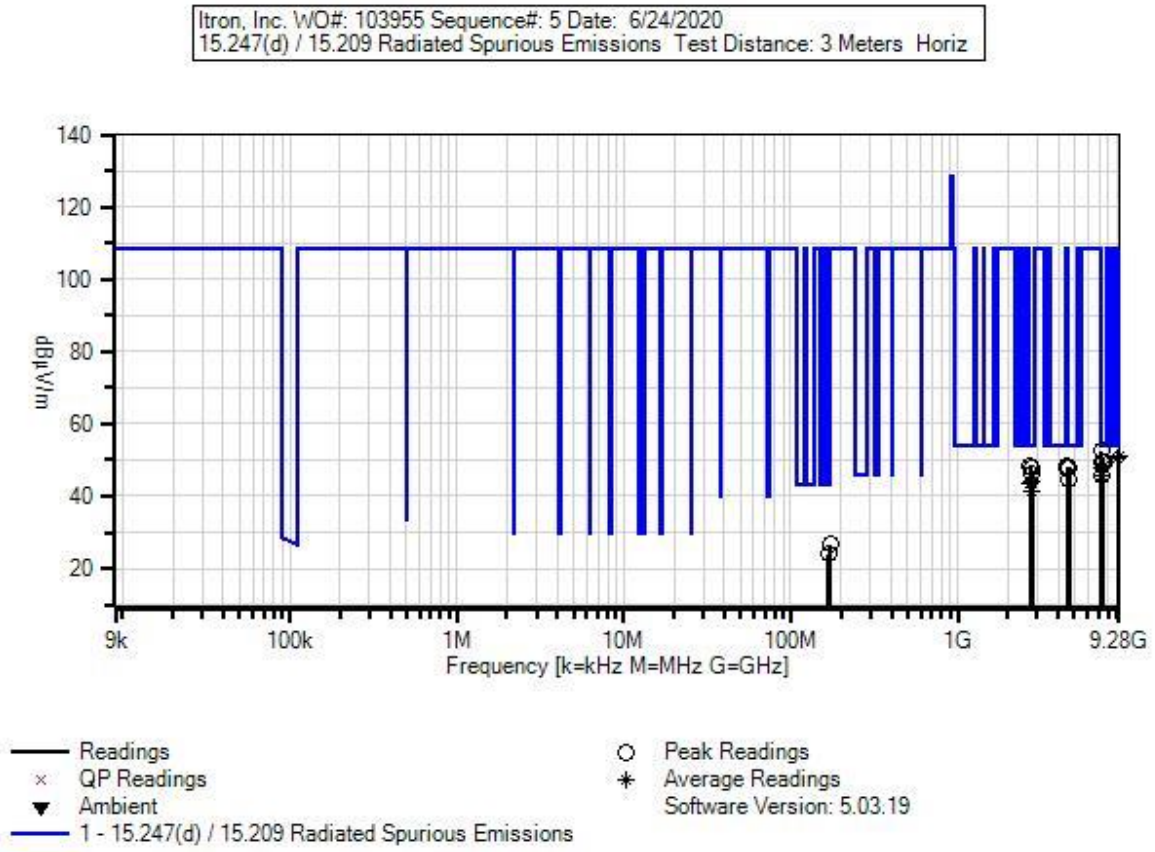
Test Conditions / Notes:

The EUT is placed on Styrofoam platform and connected to DC 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.

Operating frequency: 908MHz, 916MHz, 924MHz
Frequency of measurement: 9kHz-9.28GHz
9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz.
150kHz to 30MHz RBW=9kHz, VBW=27kHz.
30-1000MHz, RBW=120kHz, VBW=360kHz
1000-9280MHz, RBW=1MHz, VBW=3MHz
RBW=100kHz, VBW=300kHz (-20dB limit)
Duty cycle correction is 20Log(.0445/.1)=-7.0dB

The worst case emission were verified with power supply on and off the table. No change in emission level was observed.



Test Equipment:

ID	Asset #	Description	Model	Cal Date	Cal Due Date
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
T1	AN02869	Spectrum Analyzer	E4440A	7/25/2019	7/25/2020
T2	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/4/2018	12/4/2020
T3	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
T4	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
T5	AN00309	Preamp	8447D	12/24/2019	12/24/2021
T6	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
T7	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T8	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T9	ANP07243	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T10	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021
T11	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022

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

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7	T8					
			T9	T10	T11						
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	7263.790M	46.5	+0.0	+0.0	+0.0	+0.0	+0.0	52.4	54.0	-1.6	Horiz
			+0.0	+0.0	+6.1	-37.2					
			+0.8	+0.2	+36.0						
2	9159.557M	41.6	+0.0	+0.0	+0.0	+0.0	+0.0	50.9	54.0	-3.1	Vert
	Ave		+0.0	+0.0	+6.9	-36.6					
			+0.9	+0.2	+37.9						
^	9159.557M	48.6	+0.0	+0.0	+0.0	+0.0	+0.0	57.9	54.0	+3.9	Vert
			+0.0	+0.0	+6.9	-36.6					
			+0.9	+0.2	+37.9						
4	9079.503M	41.6	+0.0	+0.0	+0.0	+0.0	+0.0	50.7	54.0	-3.3	Vert
	Ave		+0.0	+0.0	+6.8	-36.7					
			+1.0	+0.1	+37.9						
^	9079.503M	48.6	+0.0	+0.0	+0.0	+0.0	+0.0	57.7	54.0	+3.7	Vert
			+0.0	+0.0	+6.8	-36.7					
			+1.0	+0.1	+37.9						
6	7327.743M	43.4	+0.0	+0.0	+0.0	+0.0	+0.0	49.4	54.0	-4.6	Horiz
			+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.2						
7	7392.307M	43.2	+0.0	+0.0	+0.0	+0.0	+0.0	49.3	54.0	-4.7	Horiz
			+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.3						
8	7391.980M	43.2	+0.0	+0.0	+0.0	+0.0	+0.0	49.3	54.0	-4.7	Horiz
			+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.3						
9	2723.977M	53.1	+0.0	+0.0	+0.0	+0.0	+0.0	48.3	54.0	-5.7	Horiz
			+0.0	+0.0	+3.4	-38.5					
			+0.5	+0.2	+29.6						
10	4540.130M	47.7	+0.0	+0.0	+0.0	+0.0	+0.0	48.3	54.0	-5.7	Horiz
			+0.0	+0.0	+4.5	-37.4					
			+0.7	+0.2	+32.6						
11	7392.290M	42.0	+0.0	+0.0	+0.0	+0.0	+0.0	48.1	54.0	-5.9	Vert
	Ave		+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.3						
^	7392.290M	49.0	+0.0	+0.0	+0.0	+0.0	+0.0	55.1	54.0	+1.1	Vert
			+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.3						
13	2747.693M	52.7	+0.0	+0.0	+0.0	+0.0	+0.0	48.0	54.0	-6.0	Horiz
			+0.0	+0.0	+3.4	-38.5					
			+0.5	+0.2	+29.7						
14	4620.517M	47.3	+0.0	+0.0	+0.0	+0.0	+0.0	48.0	54.0	-6.0	Horiz
			+0.0	+0.0	+4.5	-37.4					
			+0.7	+0.2	+32.7						
15	4619.637M	47.3	+0.0	+0.0	+0.0	+0.0	+0.0	48.0	54.0	-6.0	Vert
			+0.0	+0.0	+4.5	-37.4					
			+0.7	+0.2	+32.7						

16	4540.113M	47.3	+0.0	+0.0	+0.0	+0.0	+0.0	47.9	54.0	-6.1	Vert
			+0.0	+0.0	+4.5	-37.4					
			+0.7	+0.2	+32.6						
17	7263.633M	41.8	+0.0	+0.0	+0.0	+0.0	+0.0	47.7	54.0	-6.3	Vert
	Ave		+0.0	+0.0	+6.1	-37.2					
			+0.8	+0.2	+36.0						
^	7263.633M	48.8	+0.0	+0.0	+0.0	+0.0	+0.0	54.7	54.0	+0.7	Vert
			+0.0	+0.0	+6.1	-37.2					
			+0.8	+0.2	+36.0						
19	2772.050M	50.8	+0.0	+0.0	+0.0	+0.0	+0.0	46.2	54.0	-7.8	Horiz
			+0.0	+0.0	+3.5	-38.5					
			+0.5	+0.2	+29.7						
20	7328.140M	39.5	+0.0	+0.0	+0.0	+0.0	+0.0	45.5	54.0	-8.5	Vert
	Ave		+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.2						
^	7328.140M	46.5	+0.0	+0.0	+0.0	+0.0	+0.0	52.5	54.0	-1.5	Vert
			+0.0	+0.0	+6.1	-37.3					
			+0.8	+0.2	+36.2						
22	7263.790M	39.5	+0.0	+0.0	+0.0	+0.0	+0.0	45.4	54.0	-8.6	Horiz
			+0.0	+0.0	+6.1	-37.2					
			+0.8	+0.2	+36.0						
23	4580.290M	44.2	+0.0	+0.0	+0.0	+0.0	+0.0	44.8	54.0	-9.2	Vert
			+0.0	+0.0	+4.5	-37.4					
			+0.7	+0.2	+32.6						
24	2772.103M	48.5	+0.0	+0.0	+0.0	+0.0	+0.0	43.9	54.0	-10.1	Vert
	Ave		+0.0	+0.0	+3.5	-38.5					
			+0.5	+0.2	+29.7						
^	2772.103M	55.5	+0.0	+0.0	+0.0	+0.0	+0.0	50.9	54.0	-3.1	Vert
			+0.0	+0.0	+3.5	-38.5					
			+0.5	+0.2	+29.7						
26	2724.303M	48.1	+0.0	+0.0	+0.0	+0.0	+0.0	43.3	54.0	-10.7	Vert
	Ave		+0.0	+0.0	+3.4	-38.5					
			+0.5	+0.2	+29.6						
^	2724.303M	55.1	+0.0	+0.0	+0.0	+0.0	+0.0	50.3	54.0	-3.7	Vert
			+0.0	+0.0	+3.4	-38.5					
			+0.5	+0.2	+29.6						
28	2748.123M	46.1	+0.0	+0.0	+0.0	+0.0	+0.0	41.4	54.0	-12.6	Vert
	Ave		+0.0	+0.0	+3.4	-38.5					
			+0.5	+0.2	+29.7						
^	2748.123M	53.1	+0.0	+0.0	+0.0	+0.0	+0.0	48.4	54.0	-5.6	Vert
			+0.0	+0.0	+3.4	-38.5					
			+0.5	+0.2	+29.7						
30	173.100M	36.6	+0.0	+2.4	+5.9	+9.5	+0.0	26.6	43.5	-16.9	Vert
			-28.0	+0.2	+0.0	+0.0					
			+0.0	+0.0	+0.0						
31	167.900M	33.4	+0.0	+2.4	+5.9	+10.0	+0.0	23.9	43.5	-19.6	Horiz
			-28.0	+0.2	+0.0	+0.0					
			+0.0	+0.0	+0.0						

Test Location:	CKC Laboratories • 100 North Olinda Place • Brea CA 92823• 714 993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103955**	Date:	6/24/2020
Test Type:	**Maximized Emissions**	Time:	17:36:28
Tested By:	Don Nguyen	Sequence#:	4
Software:	EMITest 5.03.12		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 6			

Support Equipment:

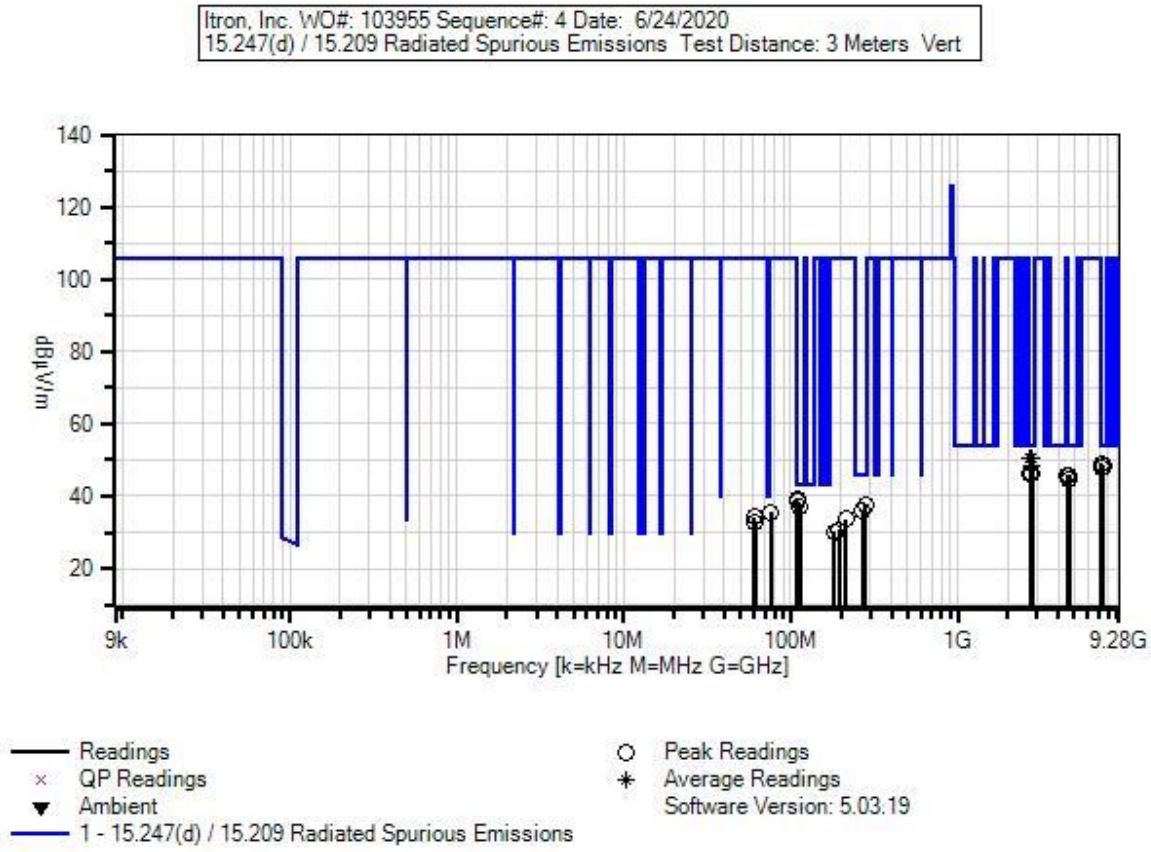
Device	Manufacturer	Model #	S/N
Configuration 6			

Test Conditions / Notes:

The EUT is placed on Styrofoam platform and connected to DC 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.

Operating frequency: 908MHz, 916MHz, 924MHz
Frequency of measurement: 9kHz-9.28GHz
9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz.
150kHz to 30MHz RBW=9kHz, VBW=27kHz.
30-1000MHz, RBW=120kHz, VBW=360kHz
1000-9280MHz, RBW=1MHz, VBW=3MHz
RBW=100kHz, VBW=300kHz (-20dB limit)
Duty cycle correction is 20Log(.0445/.1)=-7.0dB



Test Equipment:

ID	Asset #	Description	Model	Cal Date	Cal Due Date
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
T1	AN02672	Spectrum Analyzer	E4446A	3/13/2019	3/13/2021
T2	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/4/2018	12/4/2020
T3	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
T4	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
	AN00309	Preamp	8447D	12/24/2019	12/24/2021
	ANP05050	Cable	RG223/U	12/24/2018	12/24/2020
T5	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T6	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T7	ANP07243	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
T8	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021
T9	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022