Itron, Inc.

TEST REPORT FOR

ORRNC
Model: RN-EGM

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(HYBRID 902-928 MHz)

Report No.: 103786-3

Date of issue: June 25, 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

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: 205550

REPORT PREPARED BY:

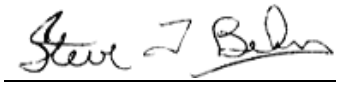
Darcy Thompson
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 103786

DATE OF EQUIPMENT RECEIPT: April 27, 2020
DATE(S) OF TESTING: April 27 – May 15, 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.
22116 23rd Drive S.E., Suite A
Canyon Park, Bothell, WA 98021

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 (Hybrid 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	NP
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
15.247 (f)	Hybrid Systems PSD Average Time of Occupancy	NA	Pass NP
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable

NP = CKC Laboratories was not contracted to perform the testing. Please see Section for manufacturer declaration.

ISO/IEC 17025 Decision Rule
The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
ORRNC	Itron, Inc.	RN-EGM	FCC-1

Support Equipment:

Device	Manufacturer	Model #	S/N
Antenna (Transceiver)	PCTEL	BOA9022NM-ITR	NA
Antenna (Receiver)	PCTEL	BOA9025NM-ITR	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
ORRNC	Itron, Inc.	RN-EGM	FCC-1

Support Equipment:

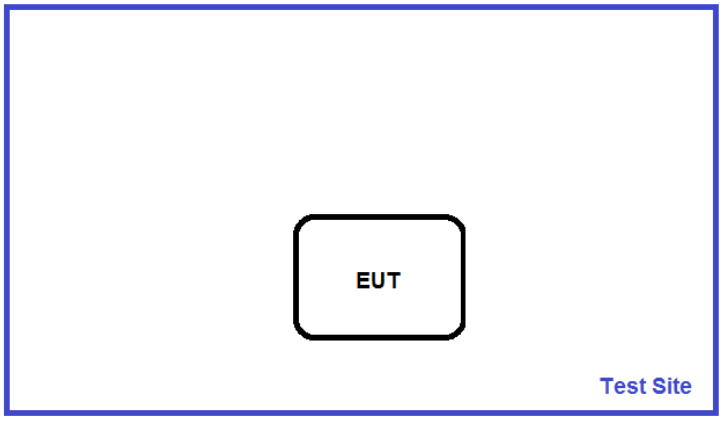
Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	NA
AC Adapter (For Laptop)	HP	L25296-002	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Proprietary Hybrid System
Operating Frequency Range:	902.8-926.8MHz
Number of Hopping Channels:	31
Modulation Type(s):	1.2M OFDM (Hybrid)
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Omnidirectional, 2.6dBI
Beamforming Type:	NA
Antenna Connection Type:	External Connector (Professional Installation)
Nominal Input Voltage:	115VAC Nominal (85-264VAC supported)
Firmware / Software used for Test:	BrtLoader v4.8.5.4 Certification GUI vUpdate2 Test FW 0.0.0.0 (current as of 4/27/2020)

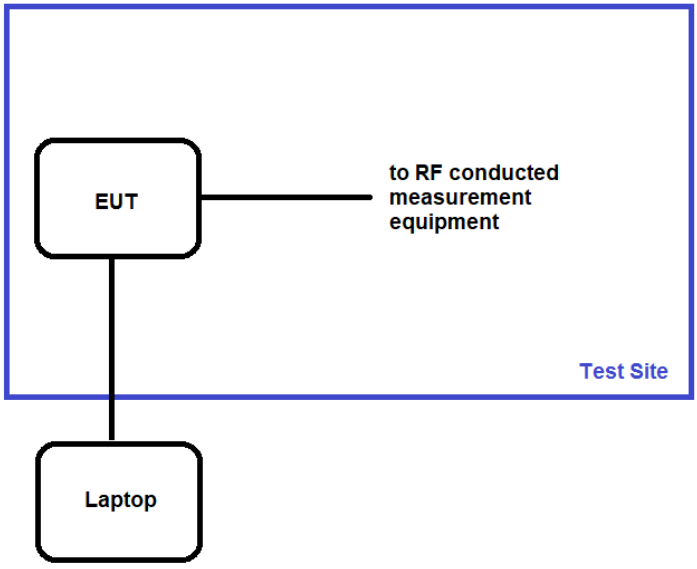
Block Diagram of Test Setup(s)

Test Setup Block Diagram



Configuration 1

Test Setup Block Diagram



Configuration 2

FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Brea Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	4/27/2020 to 4/28/2020
Configuration:	2		
Test Setup:	The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting at its rated output power.		

Environmental Conditions			
Temperature (ºC)	24	Relative Humidity (%):	39

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02872	Spectrum Analyzer	Agilent	E4440A	11/18/2019	11/18/2021
P05748	Attenuator	Pasternack	PE7004-20	3/4/2020	3/4/2022
P05546	Cable	Andrews	Heliax	8/24/2018	8/24/2020

15.247(a)(1) 20 dB Bandwidth

20dB Occupied Bandwidth

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
902.8	1	1.2M OFDM (Hybrid)	629.369	*See Note	NA
914.8	1	1.2M OFDM (Hybrid)	627.370		
926.8	1	1.2M OFDM (Hybrid)	622.434		

*Note: For this Hybrid mode, there is no requirement to meet the FHSS or DTS bandwidth limit. However, the system must pass the DTS PSD limit of 8dBm in any 3kHz band. Both 6dB and 20dB bandwidth measured for informational purposes. See Supplemental Section of data in 15.247 (f) Hybrid Systems.

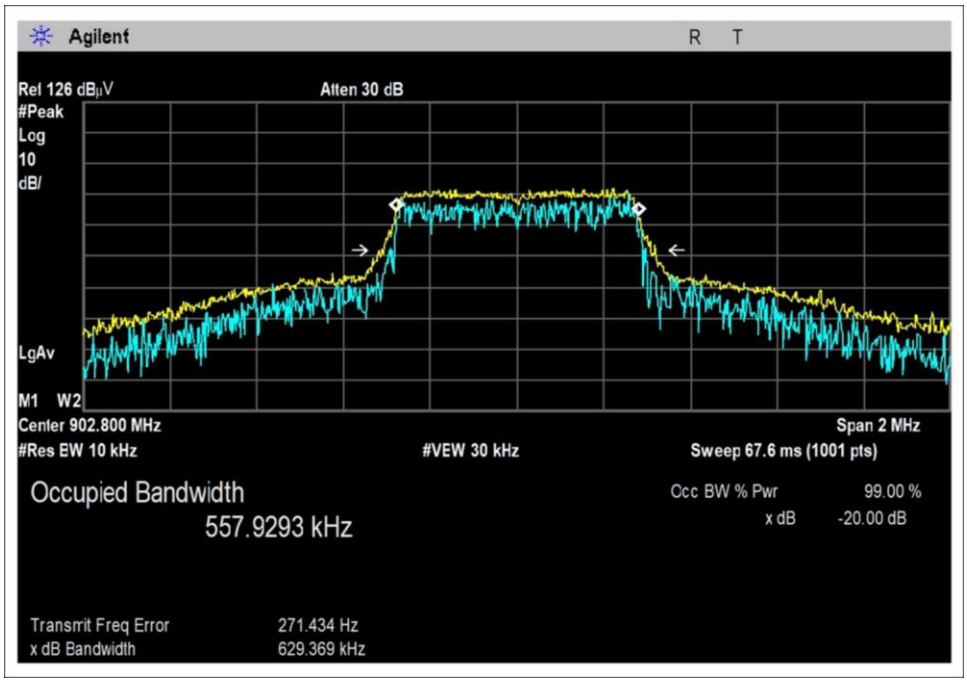
6dB Occupied Bandwidth (required for PSD measurement for Hybrid System)

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
902.8	1	1.2M OFDM (Hybrid)	579.631	*See Note	N/A
914.8	1	1.2M OFDM (Hybrid)	580.962		
926.8	1	1.2M OFDM (Hybrid)	578.796		

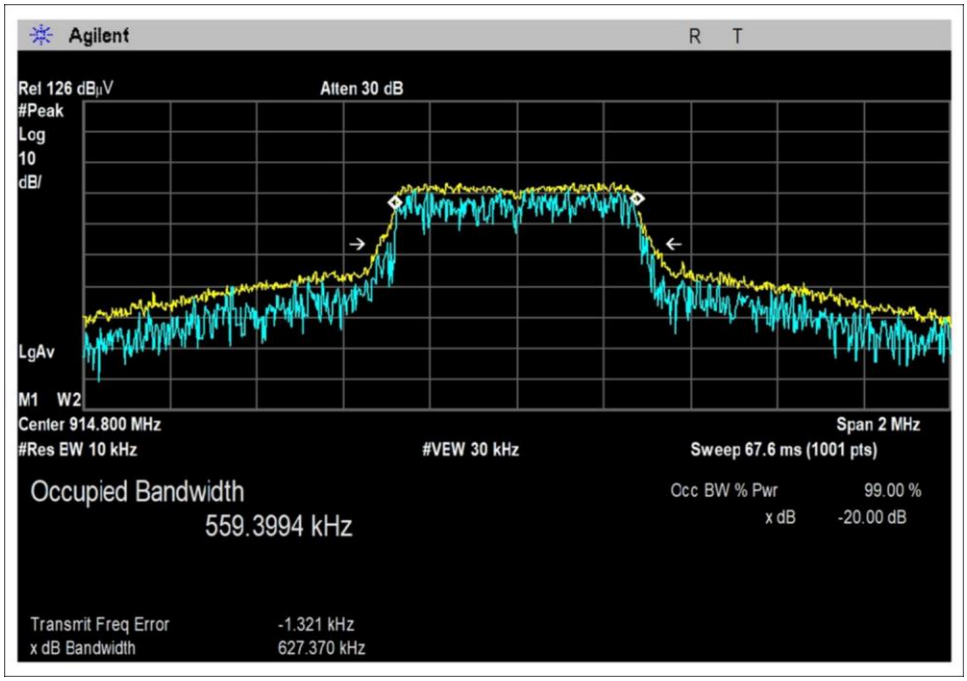
*Note: For this Hybrid mode, there is no requirement to meet the FHSS or DTS bandwidth limit. However, the system must pass the DTS PSD limit of 8dBm in any 3kHz band. Both 6dB and 20dB bandwidth measured for informational purposes. See Supplemental Section of data in 15.247 (f) Hybrid Systems.

Plot(s)

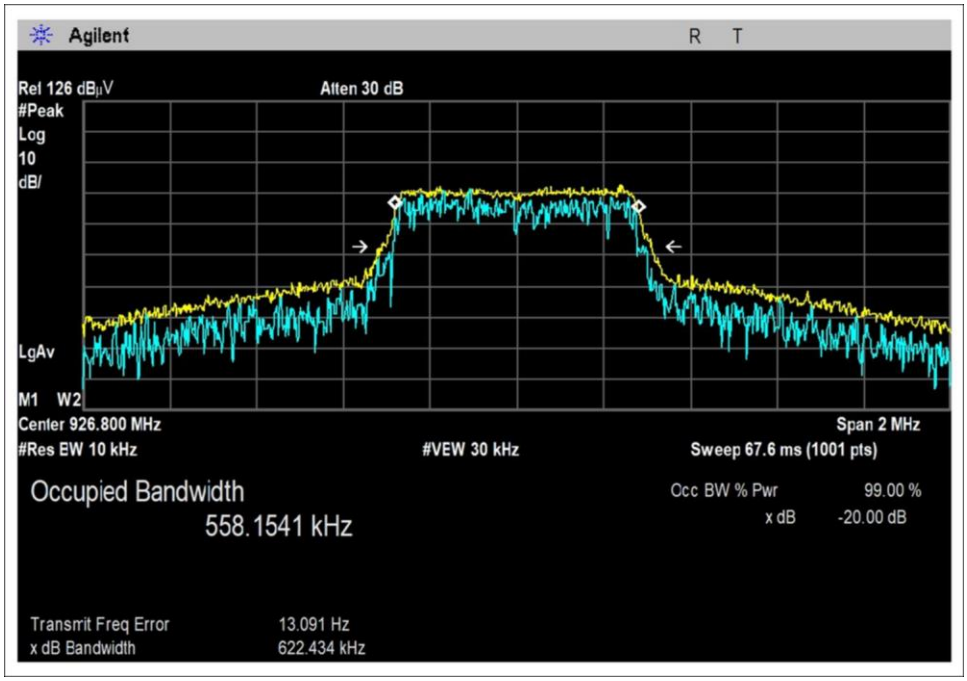
20dB Occupied Bandwidth



Low Channel

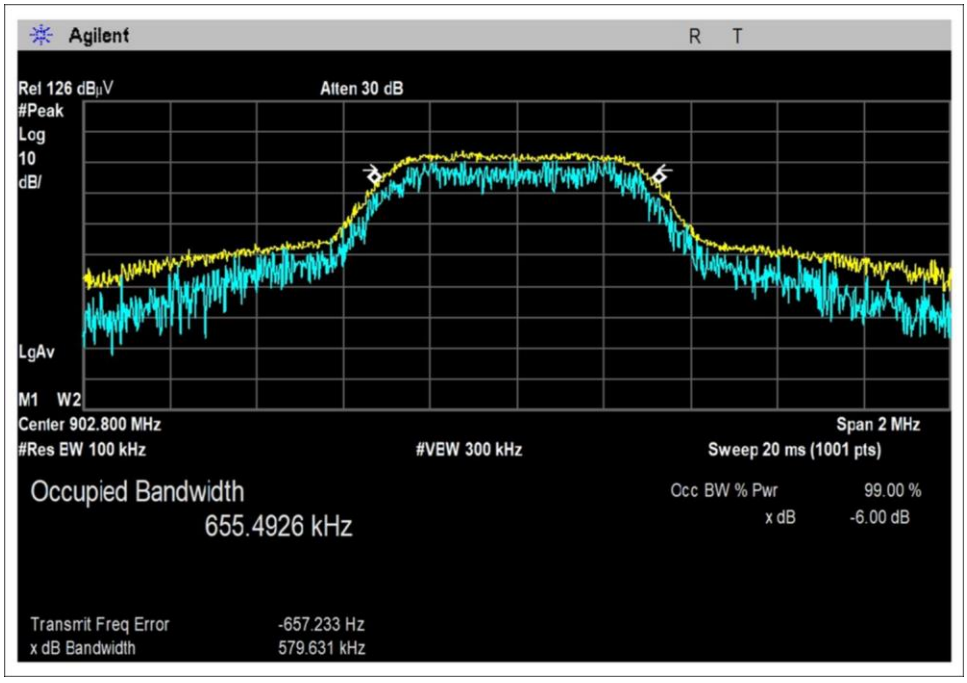


Middle Channel

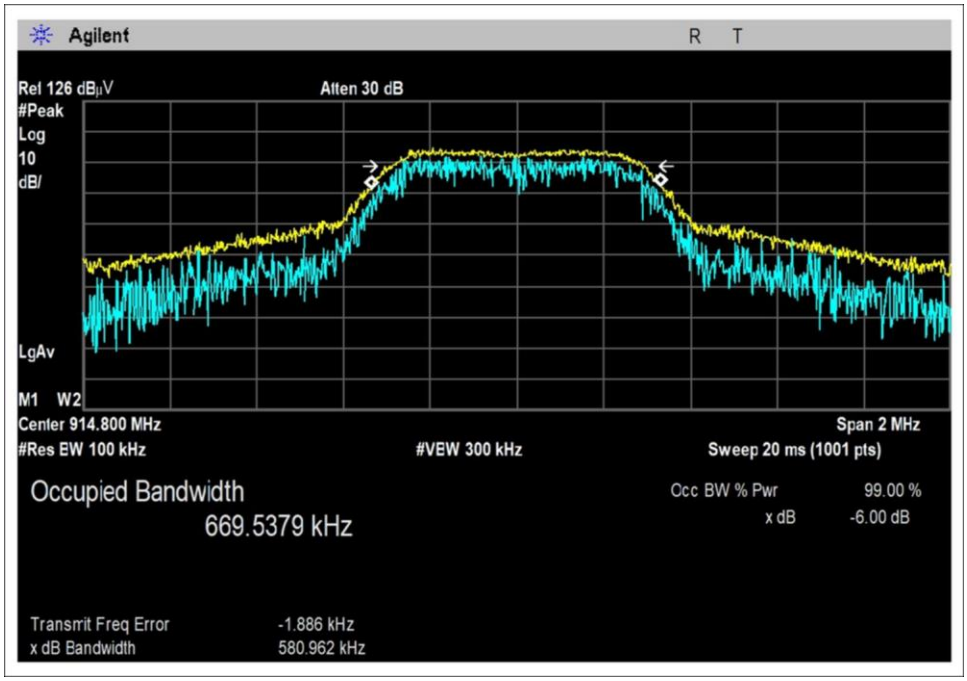


High Channel

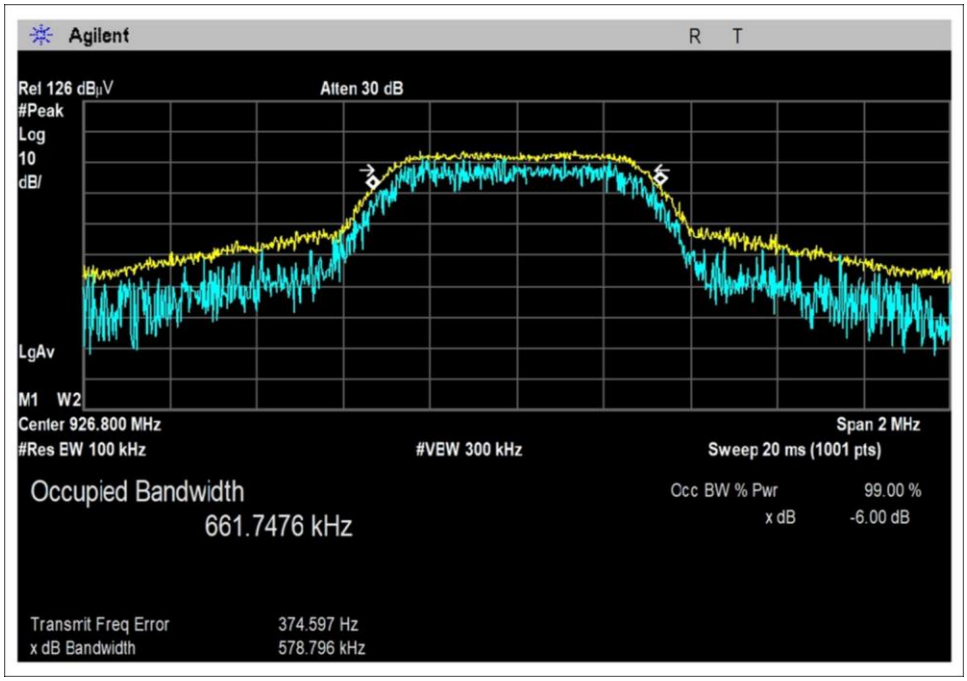
6dB Occupied Bandwidth



Low Channel



Middle Channel

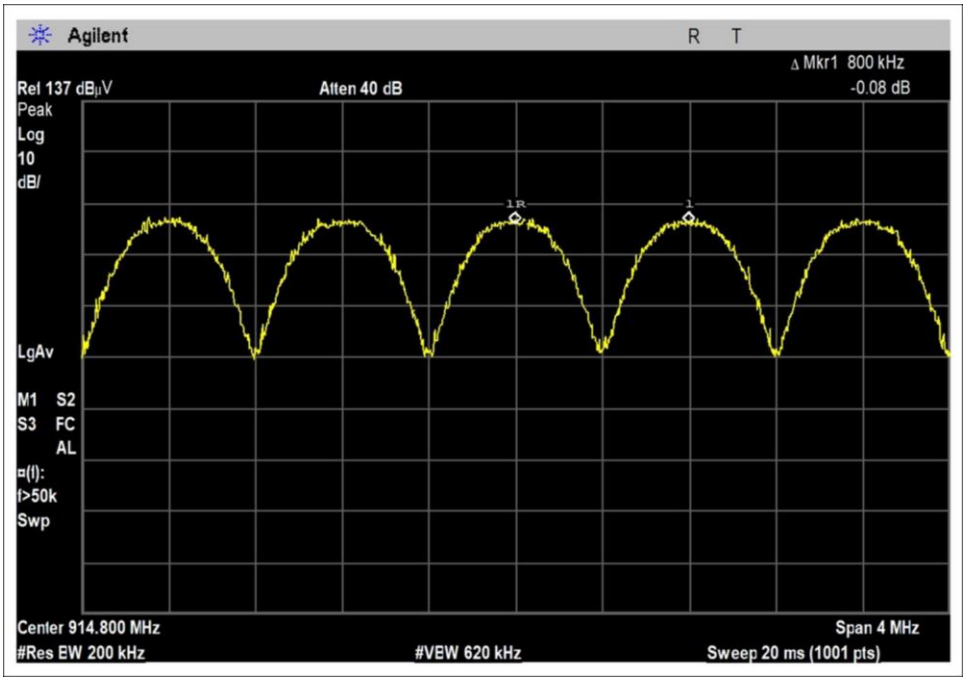


High Channel

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	800kHz Channel Plan (1.2M OFDM Hybrid Mode)	800	>629.369	Pass

Plot(s)

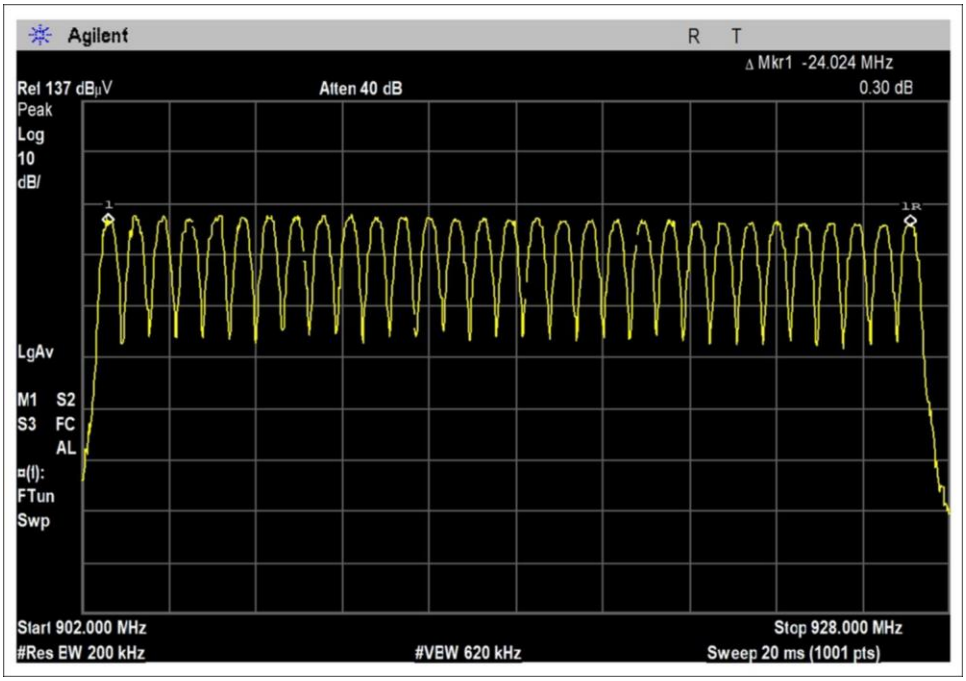


15.247(a)(1)(i) Number of Hopping Channels

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	800kHz Channel Plan (1.2M OFDM Hybrid Mode)	31	*See Note	Pass

*Note: For this Hybrid Mode there is no minimum number of hopping channels.

Plot(s)



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

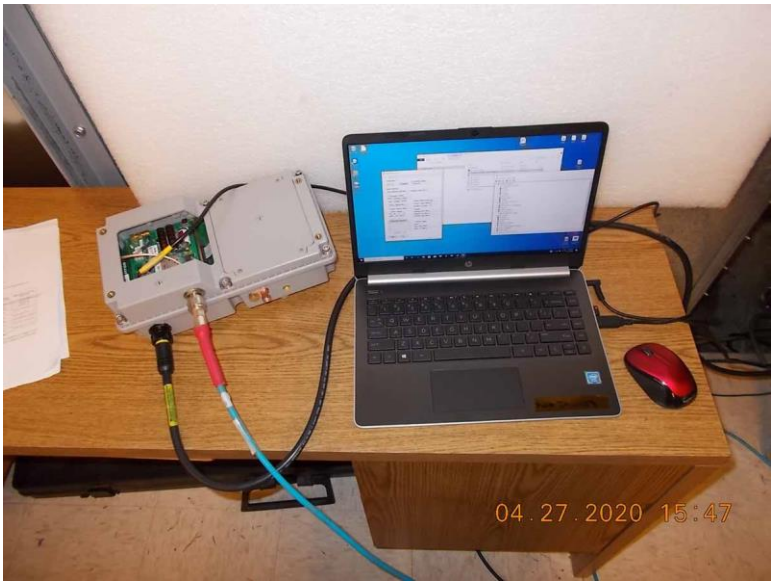
The manufacturer declares: Due to the required equipment and firmware to exercise the EUT's multiple pseudo-random hopping sequences was not available and that the complexity of the different modulations and modes depend on the device to be in a fully operating network environment. Therefore, the manufacturer declares the following:

With the 1.2Mbps modulation a hybrid blending both DTS and DSS and having a channel hopping table of 31 channels, the system complies with the Time of Occupancy requirement of 400ms with 399.6mS in 12.4 seconds (31 channels X 400mS = 12.4 seconds). Each session of multiple short transmissions takes place on one of 31 different channels in a pseudorandom sequence. The algorithm that determines the pseudo-random hop sequence ensures all channels are used equally on the average.

Itron employs hopping patterns based on a pseudo-random sequence generated by an algorithm. The algorithm can have multiple components generated, that each has its own pseudo-random sequence.

The firmware ensures the channels are used in the prescribed pseudo random order, therefore, it maintains equal channel usage.
The system has single channel receiver bandwidths that match the transmitter's modulation bandwidth that is enabled.
With the transmitter and receiver in synchronization within the network, transmitters switch frequencies in synchronization with the receiver.

Test Setup Photo(s)



15.247(b)(2) Output Power

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	$V_{Minimum}$ (dBm)	$V_{Nominal}$ (dBm)	$V_{Maximum}$ (dBm)	Max Deviation from $V_{Nominal}$ (dB)
902.8	1.2M OFDM (Hybrid)	28.6	28.6	28.6	0.0
914.8		28.1	28.1	28.2	0.1
926.8		27.3	27.3	27.3	0.0

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

Parameter Definitions:

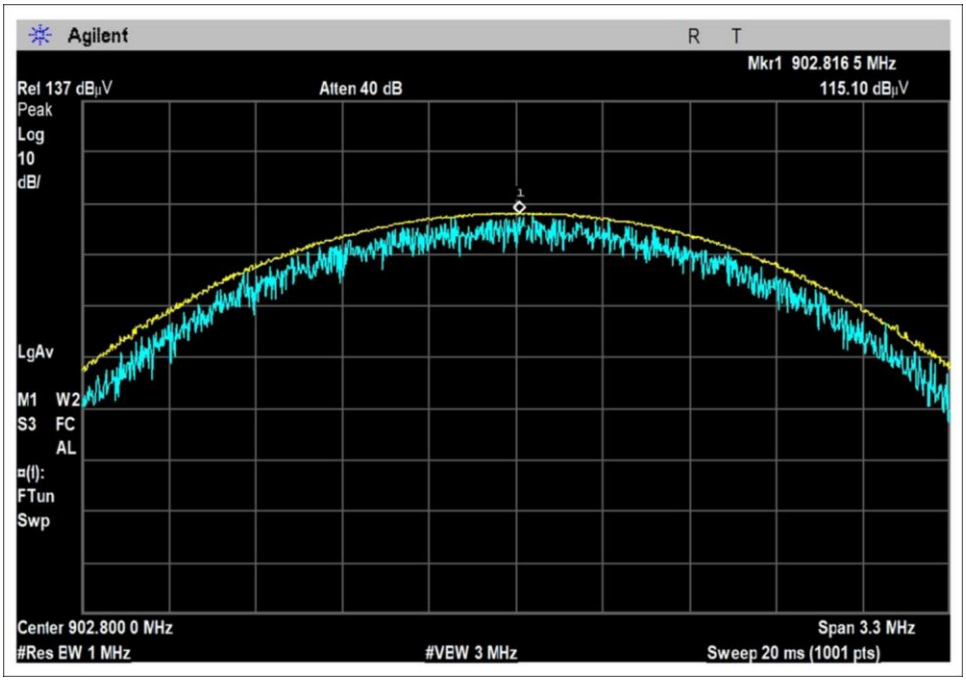
Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
$V_{Nominal}$:	115
$V_{Minimum}$:	85
$V_{Maximum}$:	264

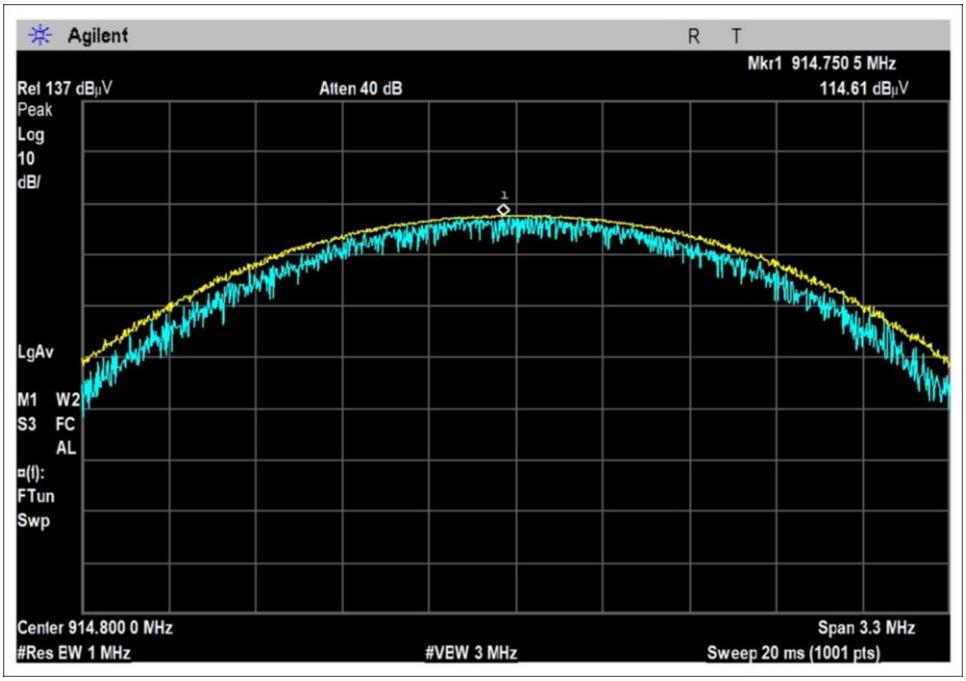
Test Data Summary - RF Conducted Measurement					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
902.8	1.2M OFDM (Hybrid)	Omnidirectional/2.6dBi	28.6	≤30	Pass
914.8			28.1		
926.8			27.3		

*For this Hybrid Mode there is no minimum number of hopping channels required for the 1 Watt (30dBm) limit.

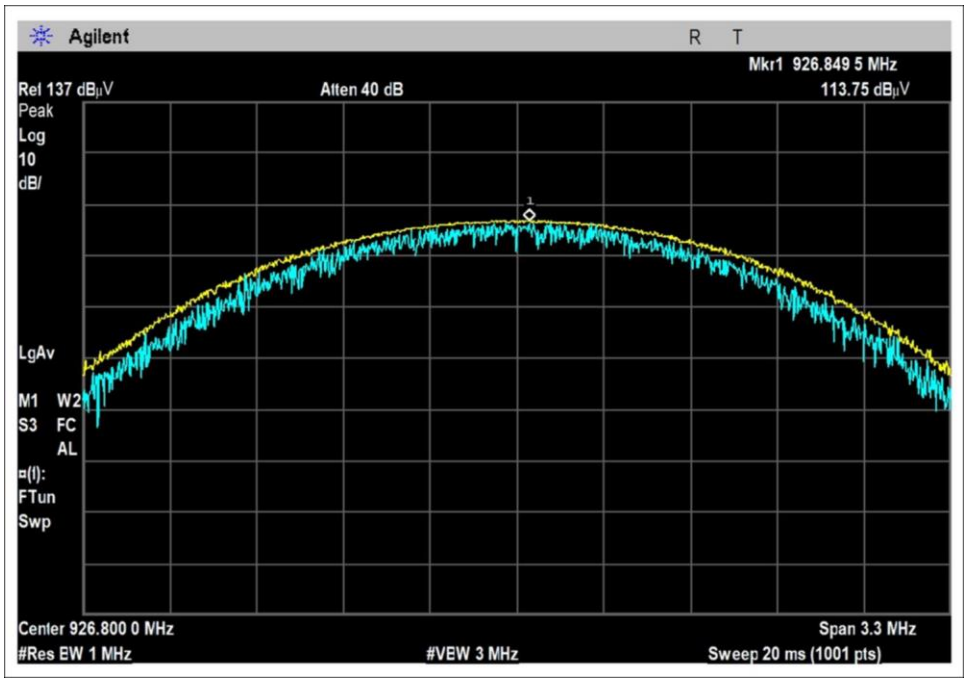
Plots



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(b) Power Output (902-928 MHz FHSS >50 Channels)**		
Work Order #:	**103786**	Date:	4/28/2020
Test Type:	**Conducted Emissions**	Time:	15:07:04
Tested By:	Michael Atkinson	Sequence#:	3
Software:	EMITest 5.03.12		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

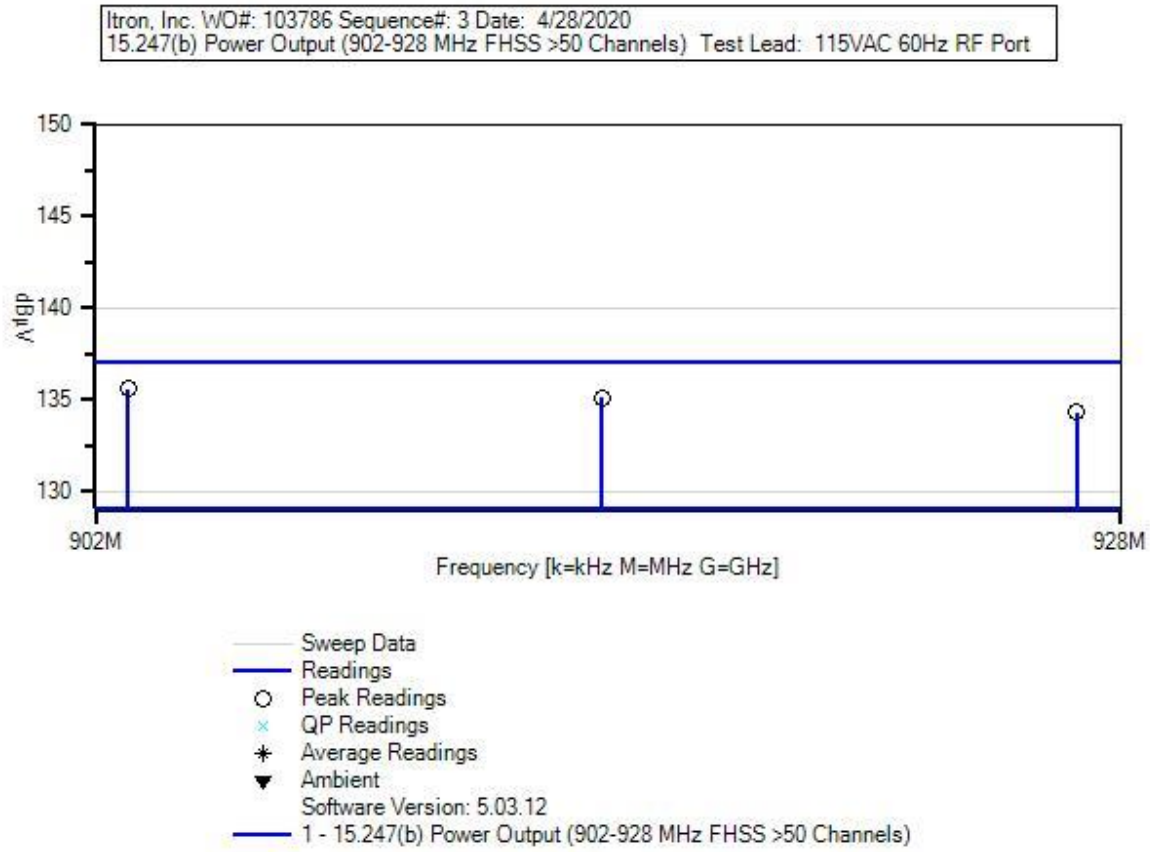
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The equipment under test (EUT) is placed on the tabletop. The output of the EUT is connected to the spectrum analyzer using a coaxial cable and attenuator. The EUT is transmitting at its rated output power.

Test Location: Bothell Lab Bench
Temperature (ºC): 22
Relative Humidity (%): 35
Test Method: ANSI C63.10 (2013)



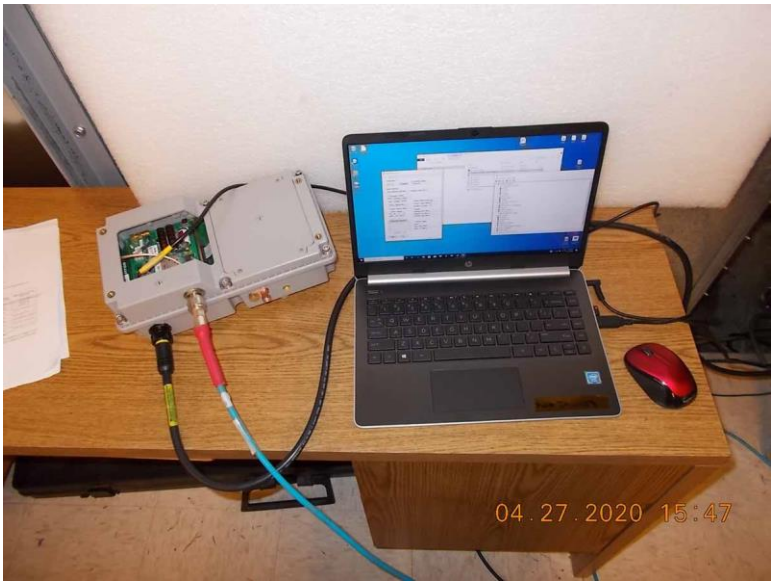
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T1	ANP05748	Attenuator	PE7004-20	3/4/2020	3/4/2022
T2	ANP05546	Cable	Heliax	8/24/2018	8/24/2020

Measurement Data: Reading listed by margin. Test Lead: RF Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	902.817M	115.1	+20.0	+0.5			+0.0	135.6	137.0	-1.4	RF Po
2	914.751M	114.6	+20.0	+0.5			+0.0	135.1	137.0	-1.9	RF Po
3	926.850M	113.8	+20.0	+0.5			+0.0	134.3	137.0	-2.7	RF Po

Test Setup Photo(s)



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**103786**	Date:	5/13/2020
Test Type:	**Conducted Emissions**	Time:	20:33:05
Tested By:	Michael Atkinson	Sequence#:	5
Software:	EMITest 5.03.12		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

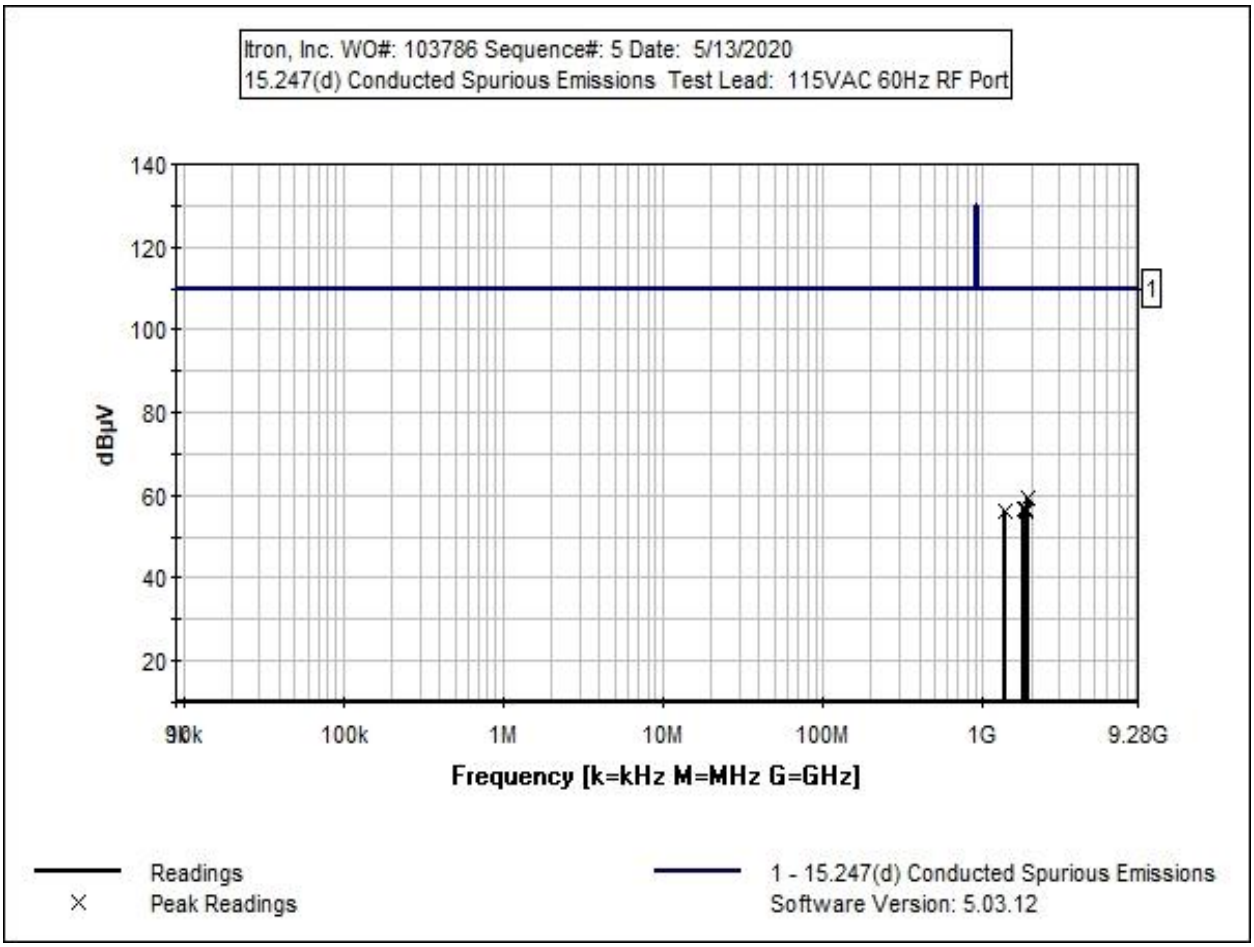
Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency: 9kHz-9.28GHz

EUT is continuously transmitting at max power.
EUT antenna port is connected to spectrum analyzer through cable/attenuator.

Low, Middle, and High channels investigated, as well as hopping mode, worst case reported.



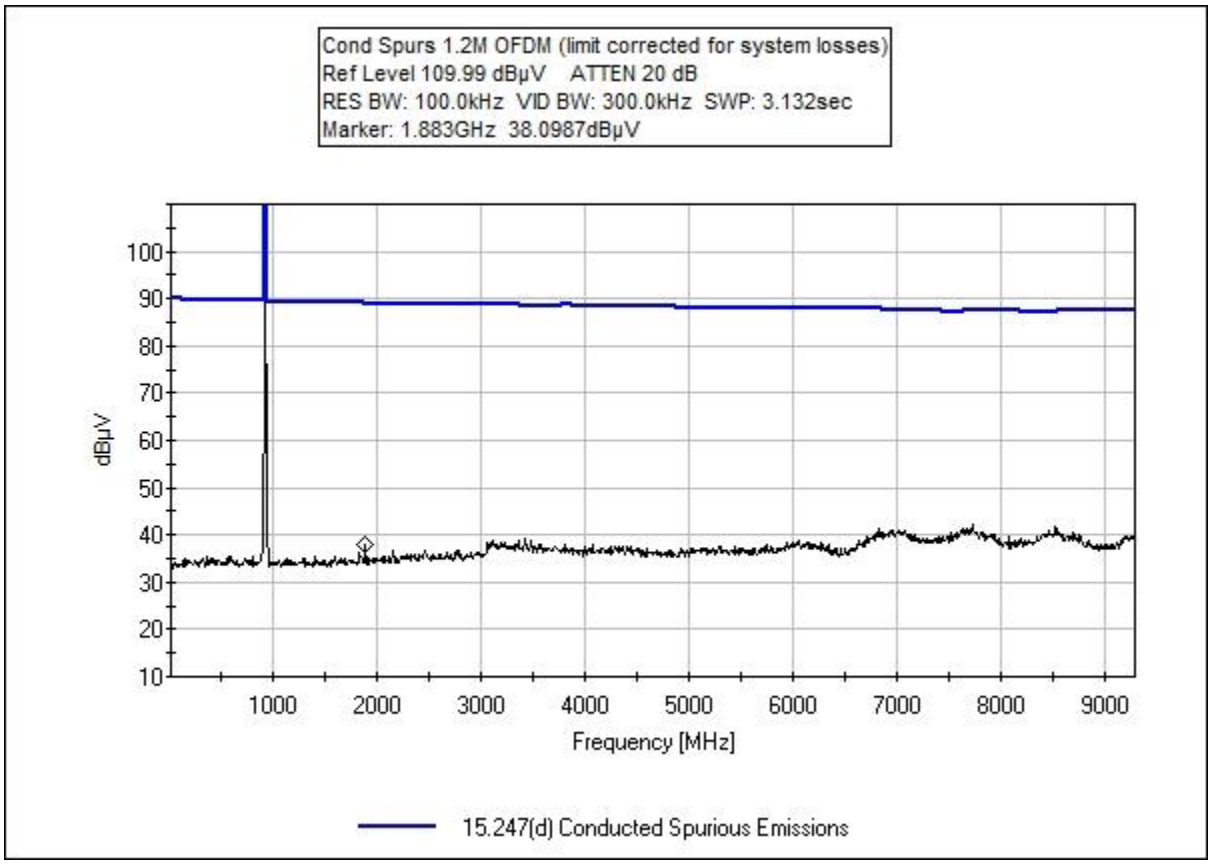
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05748	Attenuator	PE7004-20	3/4/2020	3/4/2022
T2	ANP05546	Cable	Heliax	8/24/2018	8/24/2020
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021

Measurement Data: Reading listed by margin. Test Lead: RF Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1882.540M	38.1	+20.0	+1.0			+0.0	59.1	110.0	-50.9	RF Po
2	1805.590M	35.9	+20.0	+0.9			+0.0	56.8	110.0	-53.2	RF Po
3	1829.560M	35.6	+20.0	+0.9			+0.0	56.5	110.0	-53.5	RF Po
4	1391.230M	35.5	+20.0	+0.8			+0.0	56.3	110.0	-53.7	RF Po
5	1853.560M	35.0	+20.0	+0.9			+0.0	55.9	110.0	-54.1	RF Po

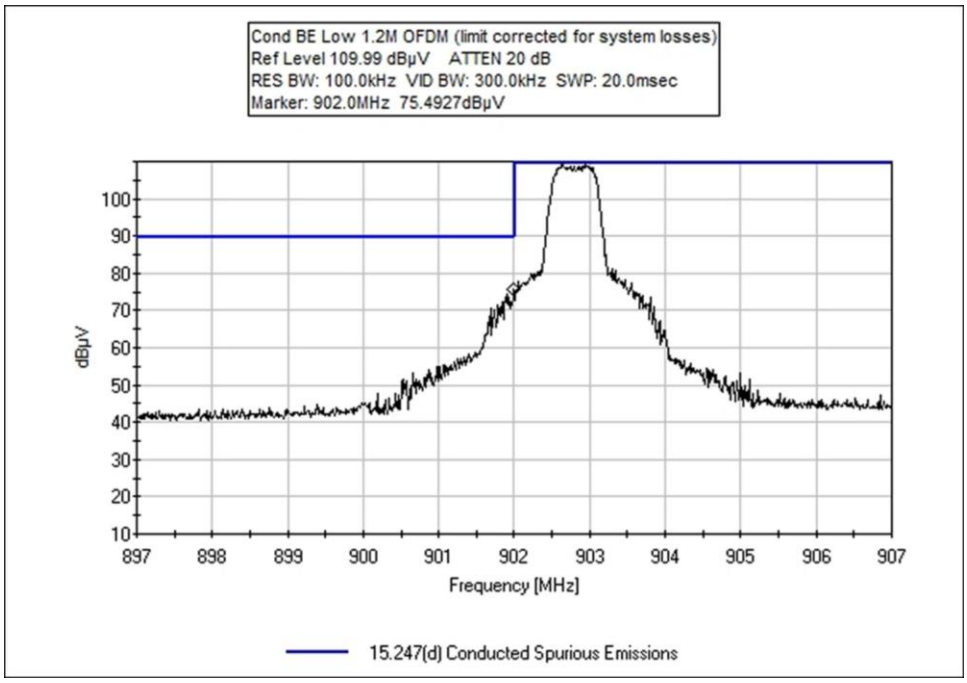
Plot

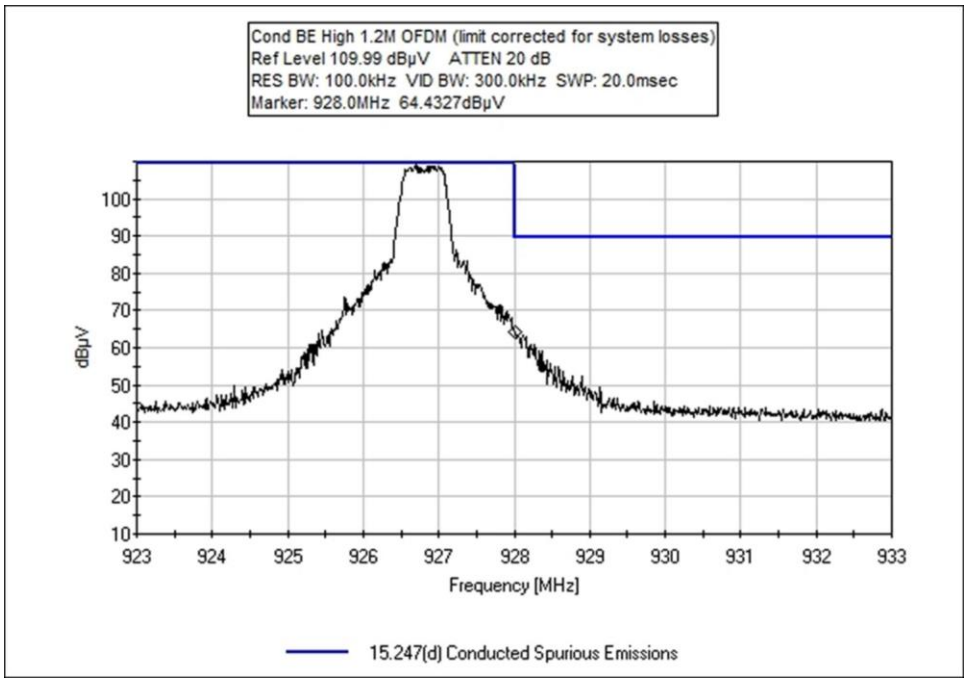

Cond Spurs 1.2M OFDM (limit corrected for system losses)
Ref Level 109.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.132sec
Marker: 1.883GHz 38.0987dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

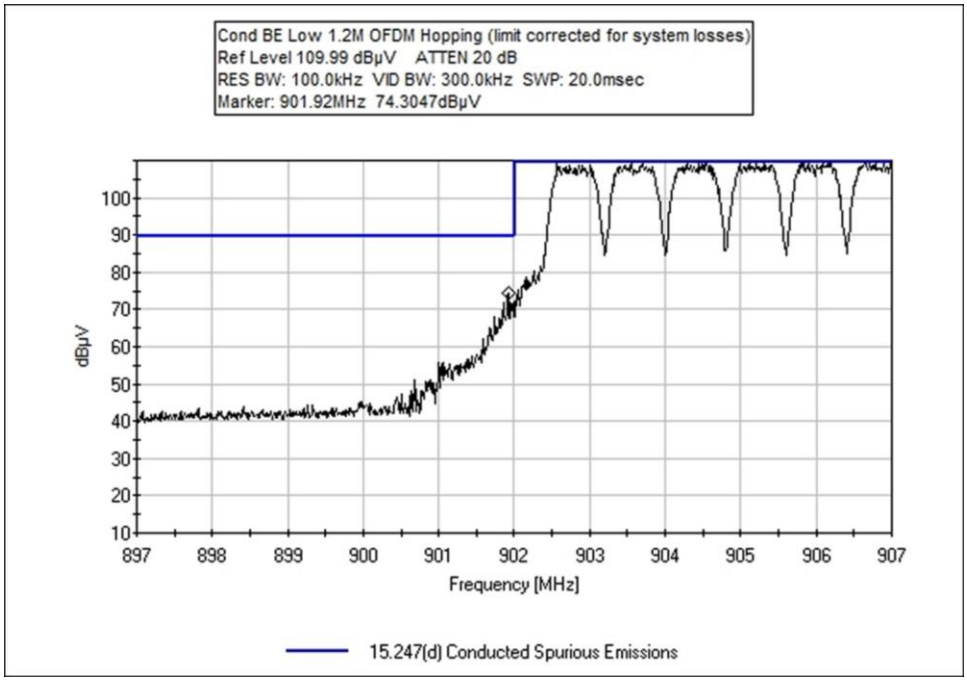
Band Edge

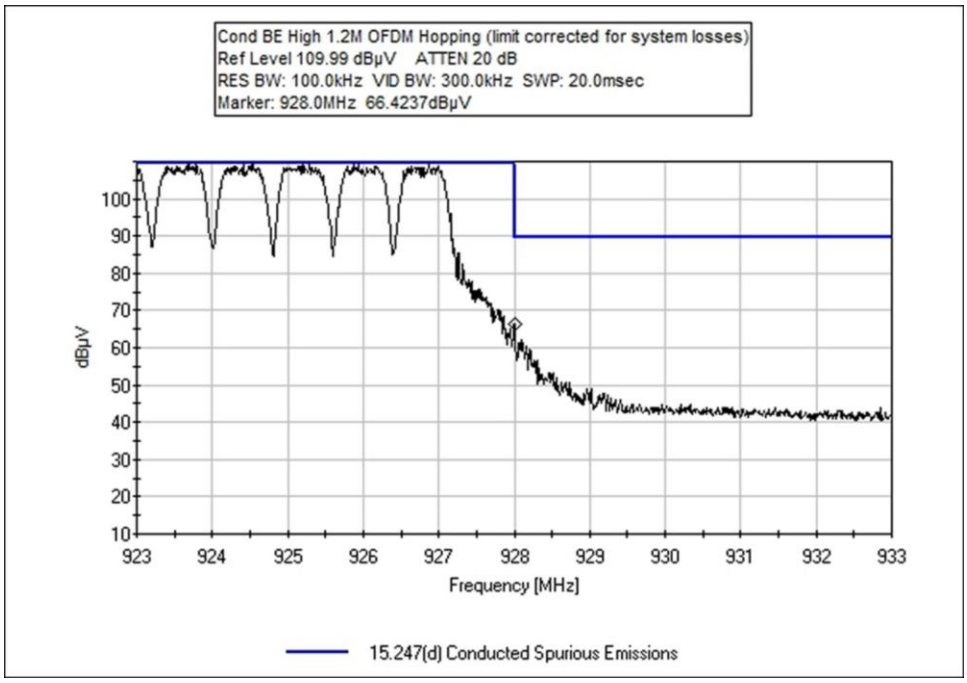
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	1.2M OFDM) (Hybrid)	-11.0	3	Pass
928	1.2M OFDM) (Hybrid)	-22.1	3	Pass
902	Hopping 1.2M OFDM (Hybrid)	-12.2	3	Pass
928	Hopping 1.2M OFDM (Hybrid)	-20.1	3	Pass

Band Edge Plots




Cond BE High 1.2M OFDM (limit corrected for system losses)
Ref Level 109.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 64.4327dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond BE Low 1.2M OFDM Hopping (limit corrected for system losses)
Ref Level 109.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 901.92MHz 74.3047dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond BE High 1.2M OFDM Hopping (limit corrected for system losses)
Ref Level 109.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 66.4237dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
923
924
925
926
927
928
929
930
931
932
933
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**103786**	Date:	5/13/2020
Test Type:	**Conducted Emissions**	Time:	20:45:26
Tested By:	Michael Atkinson	Sequence#:	6
Software:	EMITest 5.03.12		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency: Band Edge

EUT is continuously transmitting at max power.
EUT antenna port is connected to spectrum analyzer through cable/attenuator.

Low and High channels investigated, as well as hopping mode.

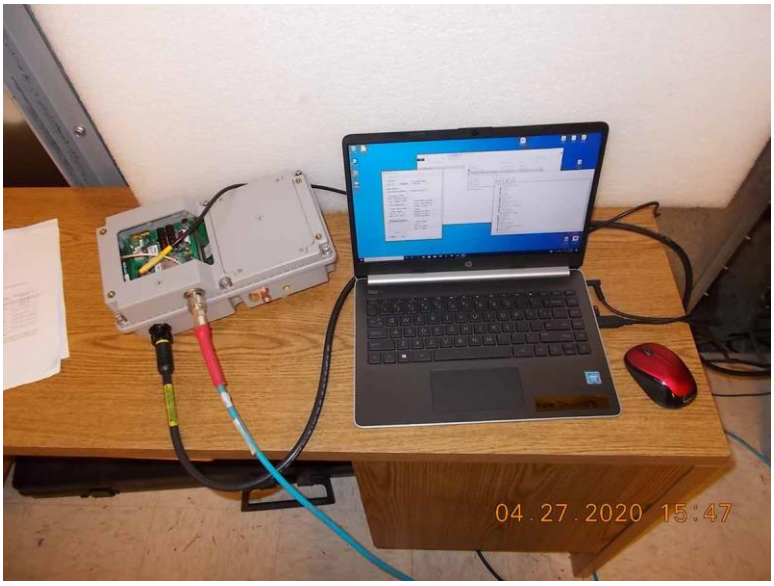
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05748	Attenuator	PE7004-20	3/4/2020	3/4/2022
T2	ANP05546	Cable	Heliax	8/24/2018	8/24/2020
T3	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021

Measurement Data: Reading listed by margin. Test Lead: RF Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	902.000M	75.5	+20.0	+0.5	+0.0		+0.0	96.0	110.0	-14.0	RF Po
2	901.920M	74.3	+20.0	+0.5	+0.0		+0.0	94.8	110.0 Hopping	-15.2	RF Po
3	928.000M	66.4	+20.0	+0.5	+0.0		+0.0	86.9	110.0 Hopping	-23.1	RF Po
4	928.000M	64.4	+20.0	+0.5	+0.0		+0.0	84.9	110.0	-25.1	RF Po

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103786**	Date:	5/5/2020
Test Type:	**Maximized Emissions**	Time:	19:41:14
Tested By:	Steven Pittsford	Sequence#:	6
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:

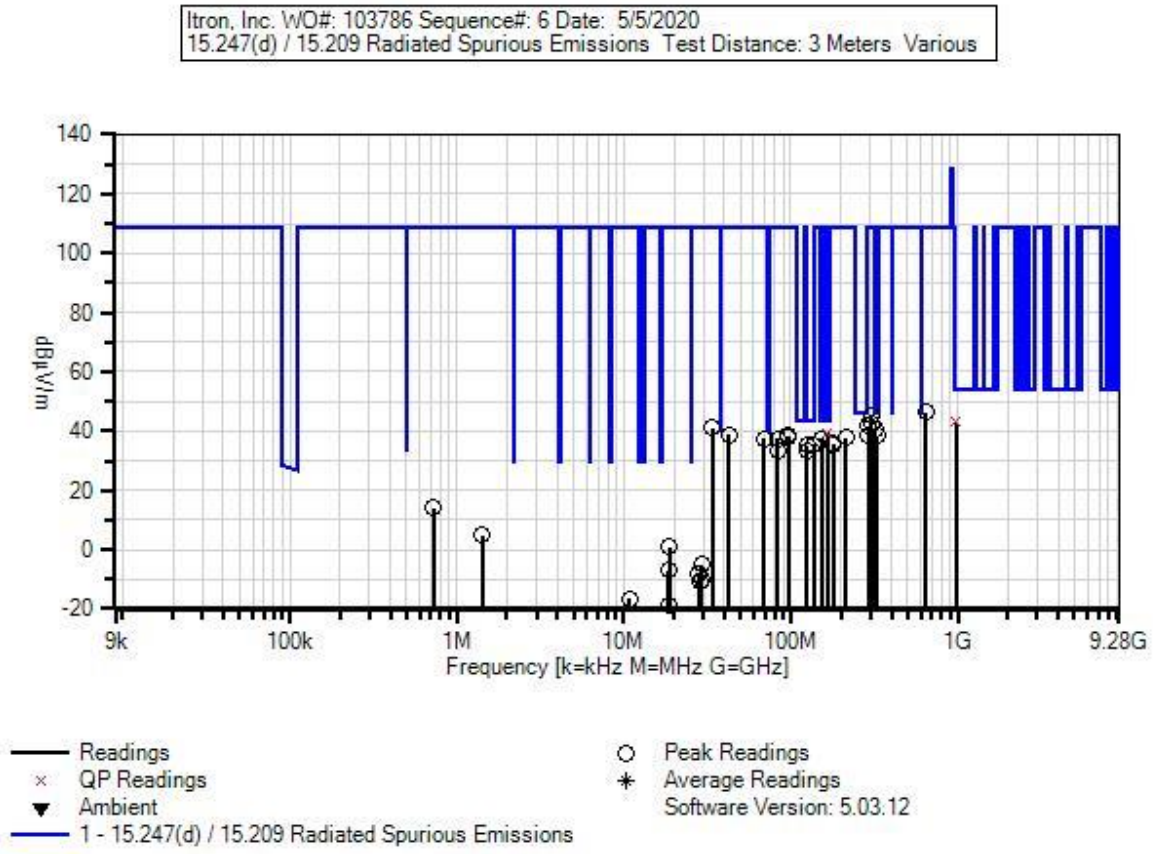
Test Method: ANSI 63.10 (2013)
Temperature (ºC): 24
Relative Humidity (%): 35
Set up:
Vertical and horizontal polarity investigated above 30MHz. 3 x orthogonal axes investigated below 30MHz.
Frequency: Below 1GHz

Worst case reported.

EUT is on the test bench mounted on a pole stand.

Transmitting continuously.
Low, Middle, and High channels investigated, as well as hopping mode investigated, worst case reported.

Modulation: 1.2M OFDM



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T1	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T2	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T3	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T4	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T5	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021
T6	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T7	AN00052	Loop Antenna	6502	5/7/2018	5/7/2020

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

#	Freq	Rdng	T1	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
			T5	T6	T7						
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	166.377M	22.0	+0.2	+0.6	+0.8	+5.8	+0.0	39.4	43.5	-4.1	Vert
	QP		+10.0	+0.0	+0.0						
^	166.300M	22.1	+0.2	+0.6	+0.8	+5.8	+0.0	39.5	43.5	-4.0	Vert
			+10.0	+0.0	+0.0						
3	328.450M	15.8	+0.2	+0.9	+1.2	+5.8	+0.0	38.4	46.0	-7.6	Vert
			+14.5	+0.0	+0.0						
4	124.940M	20.3	+0.1	+0.5	+0.7	+5.8	+0.0	35.2	43.5	-8.3	Vert
			+7.8	+0.0	+0.0						
5	137.630M	19.6	+0.1	+0.5	+0.7	+5.8	+0.0	35.1	43.5	-8.4	Vert
			+8.4	+0.0	+0.0						
6	124.940M	18.6	+0.1	+0.5	+0.7	+5.8	+0.0	33.5	43.5	-10.0	Horiz
			+7.8	+0.0	+0.0						
7	976.683M	8.1	+0.4	+1.5	+2.3	+5.9	+0.0	43.0	54.0	-11.0	Vert
	QP		+24.8	+0.0	+0.0						
8	640.500M	15.5	+0.3	+1.2	+1.7	+5.8	+0.0	46.2	108.5	-62.3	Horiz
			+21.7	+0.0	+0.0						
9	304.950M	23.6	+0.2	+0.9	+1.1	+5.8	+0.0	45.0	108.5	-63.5	Vert
			+13.4	+0.0	+0.0						
10	304.950M	21.4	+0.2	+0.9	+1.1	+5.8	+0.0	42.8	108.5	-65.7	Horiz
			+13.4	+0.0	+0.0						
11	291.320M	20.9	+0.2	+0.8	+1.1	+5.8	+0.0	41.8	108.5	-66.7	Vert
			+13.0	+0.0	+0.0						
12	33.900M	19.9	+0.1	+0.3	+0.3	+5.8	+0.0	41.2	108.5	-67.3	Vert
			+14.8	+0.0	+0.0						
13	318.580M	18.9	+0.2	+0.9	+1.1	+5.8	+0.0	40.9	108.5	-67.6	Horiz
			+14.0	+0.0	+0.0						
14	291.320M	17.9	+0.2	+0.8	+1.1	+5.8	+0.0	38.8	108.5	-69.7	Horiz
			+13.0	+0.0	+0.0						
15	42.690M	21.4	+0.1	+0.3	+0.3	+5.8	+0.0	38.7	108.5	-69.8	Vert
			+10.8	+0.0	+0.0						
16	97.210M	23.5	+0.1	+0.5	+0.6	+5.8	+0.0	38.3	108.5	-70.2	Horiz
			+7.8	+0.0	+0.0						
17	213.300M	19.8	+0.2	+0.7	+0.9	+5.8	+0.0	37.9	108.5	-70.6	Horiz
			+10.5	+0.0	+0.0						
18	97.210M	23.1	+0.1	+0.5	+0.6	+5.8	+0.0	37.9	108.5	-70.6	Vert
			+7.8	+0.0	+0.0						
19	152.670M	21.0	+0.2	+0.6	+0.7	+5.8	+0.0	37.6	108.5	-70.9	Vert
			+9.3	+0.0	+0.0						
20	69.480M	23.1	+0.1	+0.4	+0.5	+5.8	+0.0	37.3	108.5	-71.2	Vert
			+7.4	+0.0	+0.0						
21	83.110M	23.7	+0.1	+0.4	+0.5	+5.8	+0.0	37.3	108.5	-71.2	Vert
			+6.8	+0.0	+0.0						
22	180.400M	18.4	+0.2	+0.6	+0.8	+5.8	+0.0	35.8	108.5	-72.7	Vert
			+10.0	+0.0	+0.0						
23	180.400M	17.7	+0.2	+0.6	+0.8	+5.8	+0.0	35.1	108.5	-73.4	Horiz
			+10.0	+0.0	+0.0						
24	83.110M	20.0	+0.1	+0.4	+0.5	+5.8	+0.0	33.6	108.5	-74.9	Horiz
			+6.8	+0.0	+0.0						

25	729.000k	44.1	+0.0 +0.0	+0.0 +0.0	+0.0 +9.9	+0.0	-40.0	14.0	108.5	-94.5	Para
26	1.419M	35.0	+0.0 +0.0	+0.0 +0.1	+0.0 +9.8	+0.0	-40.0	4.9	108.5	-103.6	Para
27	18.723M	32.2	+0.1 +0.0	+0.0 +0.2	+0.0 +8.3	+0.0	-40.0	0.8	108.5	-107.7	Para
28	29.160M	28.9	+0.1 +0.0	+0.0 +0.3	+0.0 +5.8	+0.0	-40.0	-4.9	108.5	-113.4	Perp
29	18.393M	24.4	+0.1 +0.0	+0.0 +0.2	+0.0 +8.3	+0.0	-40.0	-7.0	108.5	-115.5	Groun
30	28.261M	25.4	+0.1 +0.0	+0.0 +0.3	+0.0 +6.1	+0.0	-40.0	-8.1	108.5	-116.6	Groun
31	29.430M	24.0	+0.1 +0.0	+0.0 +0.3	+0.0 +5.7	+0.0	-40.0	-9.9	108.5	-118.4	Para
32	28.440M	22.5	+0.1 +0.0	+0.0 +0.3	+0.0 +6.0	+0.0	-40.0	-11.1	108.5	-119.6	Para
33	10.746M	13.9	+0.0 +0.0	+0.0 +0.2	+0.0 +9.2	+0.0	-40.0	-16.7	108.5	-125.2	Groun
34	18.873M	13.0	+0.1 +0.0	+0.0 +0.2	+0.0 +8.2	+0.0	-40.0	-18.5	108.5	-127.0	Perp

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103786**	Date:	5/5/2020
Test Type:	**Maximized Emissions**	Time:	16:56:04
Tested By:	Steven Pittsford	Sequence#:	8
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:

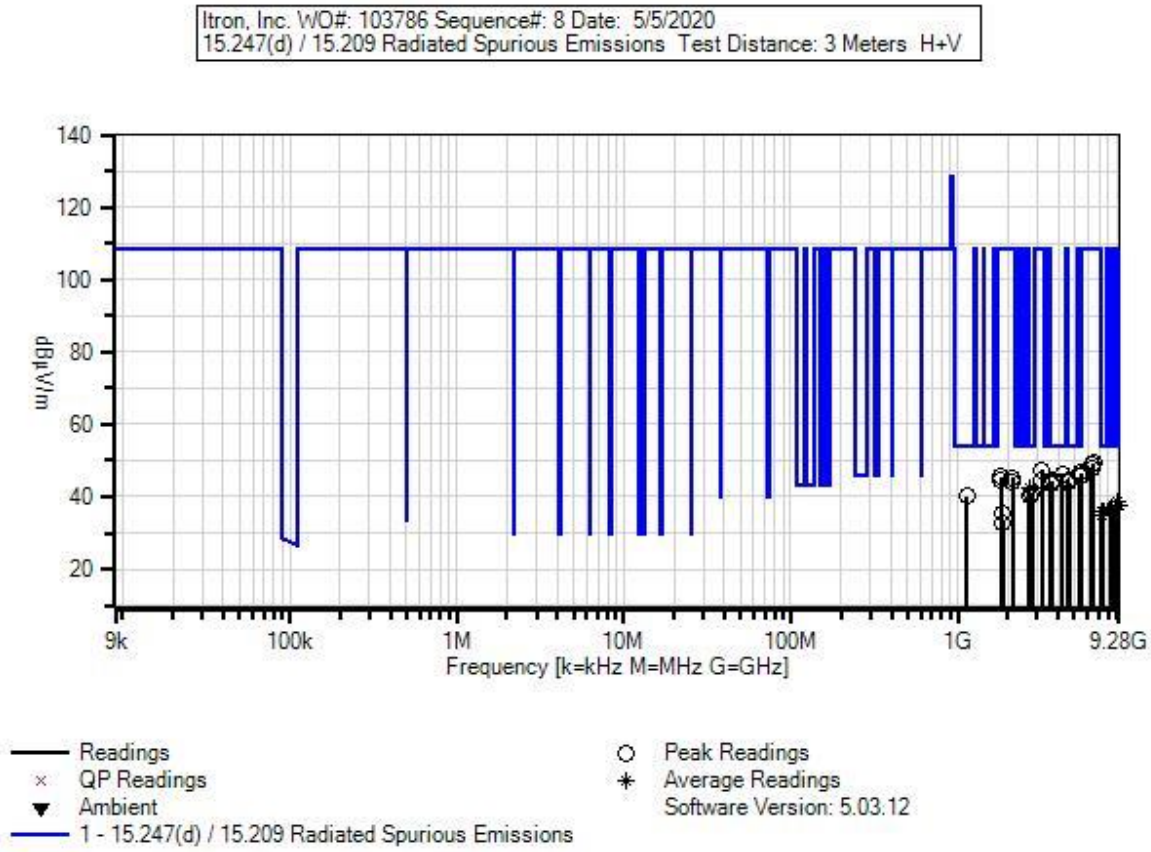
Frequency: 1-10GHz
Temperature (ºC): 24
Relative Humidity (%): 35
Test Method: ANSI 63.10 (2013)

Set up:
Vertical and horizontal polarity investigated.

EUT is on the test bench mounted on a pole stand.

Transmitting continuously.
Low, Middle, and High channels investigated, as well as hopping mode investigated, worst case reported.

Modulation: 1.2M OFDM



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T2	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T3	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T4	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/17/2019	1/17/2021
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T6	AN03170	High Pass Filter	HM1155-11SS	10/23/2019	10/23/2021

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

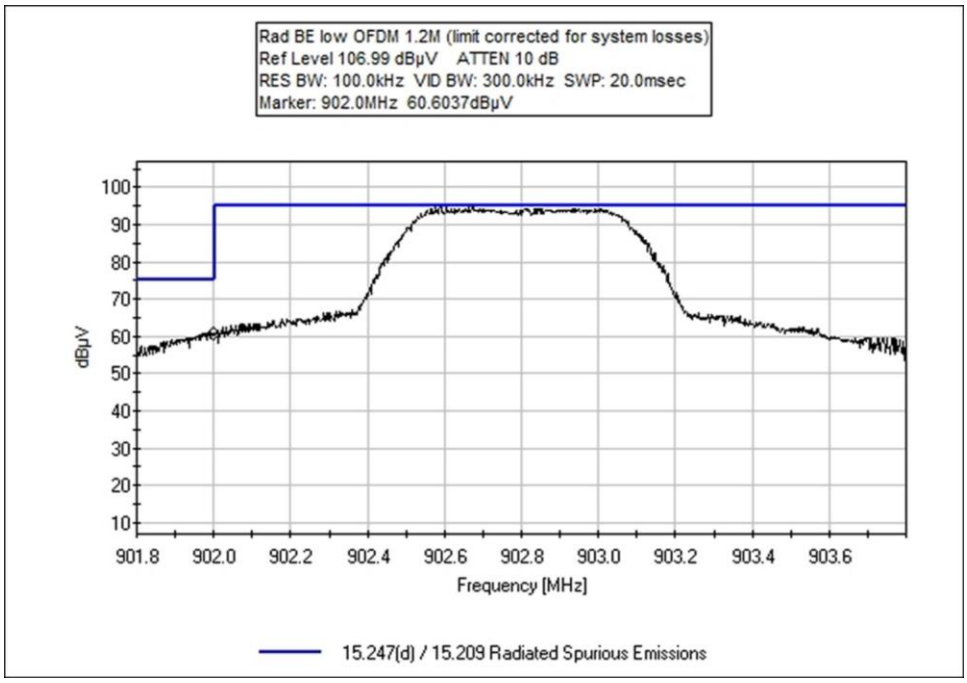
#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4246.000M	42.7	-33.7 +0.4	+31.6 +0.6	+3.8	+0.8	+0.0	46.2	54.0	-7.8	Vert
2	5416.799M	39.6	-33.7 +0.4	+33.4 +0.4	+4.5	+1.0	+0.0	45.6	54.0 1.2M OFDM	-8.4	Vert
3	4573.999M	40.4	-33.7 +0.7	+31.9 +0.6	+4.0	+0.9	+0.0	44.8	54.0 1.2M OFDM	-9.2	Vert
4	3707.202M	41.8	-33.7 +0.5	+30.6 +0.5	+3.8	+0.9	+0.0	44.4	54.0 1.2M OFDM	-9.6	Vert
5	3611.185M	42.2	-33.8 +0.6	+30.3 +0.5	+3.6	+0.8	+0.0	44.2	54.0 1.2M OFDM	-9.8	Vert
6	4513.996M	39.9	-33.7 +0.7	+31.8 +0.6	+3.9	+0.9	+0.0	44.1	54.0 1.2M OFDM	-9.9	Vert
7	4634.004M	39.4	-33.6 +0.6	+32.1 +0.6	+4.0	+0.9	+0.0	44.0	54.0 1.2M OFDM	-10.0	Vert
8	3659.199M	41.1	-33.7 +0.5	+30.5 +0.5	+3.7	+0.9	+0.0	43.5	54.0 1.2M OFDM	-10.5	Vert
9	2660.000M Ave	44.8	-34.2 +0.2	+28.1 +0.4	+2.6	+0.7	+0.0	42.6	54.0	-11.4	Vert
^	2660.000M	52.0	-34.2 +0.2	+28.1 +0.4	+2.6	+0.7	+0.0	49.8	54.0	-4.2	Vert
11	2780.434M	42.6	-34.1 +0.2	+28.5 +0.4	+2.6	+0.7	+0.0	40.9	54.0 1.2M OFDM	-13.1	Vert
12	2744.429M	42.4	-34.1 +0.2	+28.4 +0.4	+2.6	+0.7	+0.0	40.6	54.0 1.2M OFDM	-13.4	Vert
13	2708.394M	42.4	-34.1 +0.2	+28.3 +0.4	+2.6	+0.7	+0.0	40.5	54.0 1.2M OFDM	-13.5	Vert
14	1138.000M	48.1	-36.5 +0.1	+24.8 +1.3	+1.8	+0.4	+0.0	40.0	54.0	-14.0	Vert
15	9147.996M Ave	26.5	-34.2 +0.4	+37.5 +0.5	+6.2	+1.5	+0.0	38.4	54.0 1.2M OFDM	-15.6	Vert
^	9147.996M	40.5	-34.2 +0.4	+37.5 +0.5	+6.2	+1.5	+0.0	52.4	54.0 1.2M OFDM	-1.6	Vert
17	9028.002M Ave	26.0	-34.2 +0.3	+37.5 +0.5	+6.2	+1.4	+0.0	37.7	54.0 1.2M OFDM	-16.3	Vert
^	9028.002M	40.4	-34.2 +0.3	+37.5 +0.5	+6.2	+1.4	+0.0	52.1	54.0 1.2M OFDM	-1.9	Vert
19	8341.204M Ave	26.1	-34.9 +0.5	+37.0 +0.8	+5.8	+1.7	+0.0	37.0	54.0 1.2M OFDM	-17.0	Vert
^	8341.204M	41.4	-34.9 +0.5	+37.0 +0.8	+5.8	+1.7	+0.0	52.3	54.0 1.2M OFDM	-1.7	Vert
21	8233.191M Ave	25.8	-35.0 +0.5	+37.0 +0.9	+5.7	+1.7	+0.0	36.6	54.0 1.2M OFDM	-17.4	Vert
^	8233.191M	41.3	-35.0 +0.5	+37.0 +0.9	+5.7	+1.7	+0.0	52.1	54.0 1.2M OFDM	-1.9	Vert
23	8125.202M Ave	25.8	-35.0 +0.5	+37.0 +0.8	+5.7	+1.4	+0.0	36.2	54.0 1.2M OFDM	-17.8	Vert
^	8125.202M	40.9	-35.0 +0.5	+37.0 +0.8	+5.7	+1.4	+0.0	51.3	54.0 1.2M OFDM	-2.7	Vert

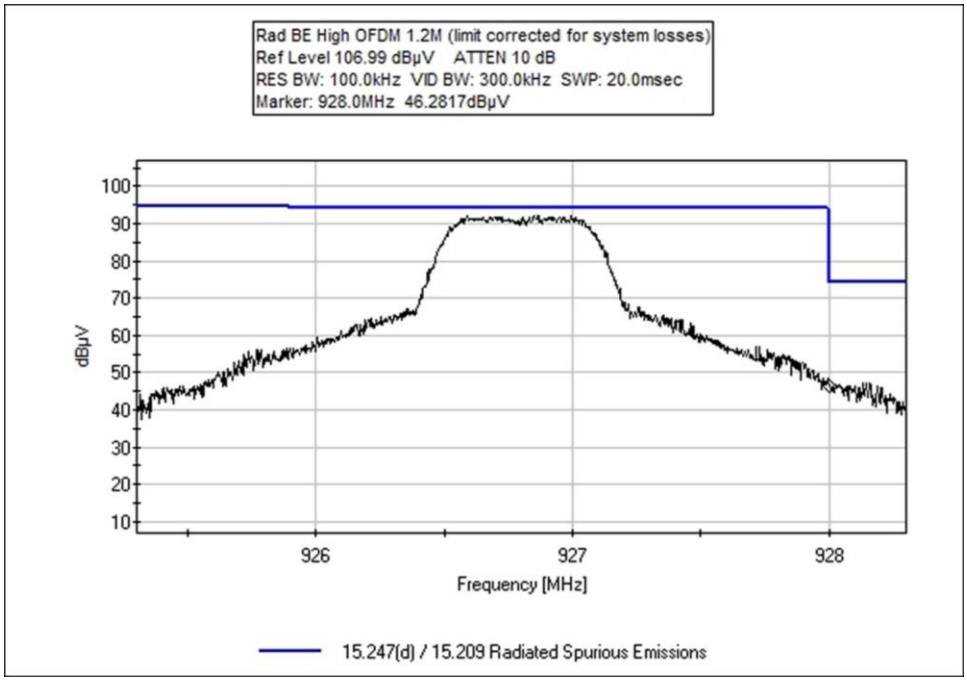
25	7414.400M Ave	25.7	-34.6 +0.4	+37.1 +0.6	+5.5	+1.5	+0.0	36.2	54.0 1.2M OFDM	-17.8	Vert
^	7414.400M	40.6	-34.6 +0.4	+37.1 +0.6	+5.5	+1.5	+0.0	51.1	54.0 1.2M OFDM	-2.9	Vert
27	7318.399M Ave	26.1	-34.6 +0.4	+36.8 +0.6	+5.4	+1.3	+0.0	36.0	54.0 1.2M OFDM	-18.0	Vert
^	7318.399M	40.1	-34.6 +0.4	+36.8 +0.6	+5.4	+1.3	+0.0	50.0	54.0 1.2M OFDM	-4.0	Vert
29	6487.603M	41.1	-34.2 +0.6	+34.5 +0.5	+5.6	+1.2	+0.0	49.3	108.5 1.2M OFDM	-59.2	Vert
30	6403.597M	41.1	-34.2 +0.6	+34.6 +0.5	+5.4	+1.1	+0.0	49.1	108.5 1.2M OFDM	-59.4	Vert
31	6319.603M	40.2	-34.1 +0.5	+34.6 +0.5	+5.2	+1.0	+0.0	47.9	108.5 1.2M OFDM	-60.6	Vert
32	3196.000M	47.1	-34.0 +0.5	+29.5 +0.3	+3.1	+0.8	+0.0	47.3	108.5	-61.2	Vert
33	5488.798M	40.6	-33.7 +0.4	+33.5 +0.4	+4.5	+1.0	+0.0	46.7	108.5 1.2M OFDM	-61.8	Vert
34	5560.800M	40.0	-33.7 +0.4	+33.7 +0.4	+4.5	+1.0	+0.0	46.3	108.5 1.2M OFDM	-62.2	Vert
35	1805.574M	50.7	-34.8 +0.2	+26.1 +0.5	+2.2	+0.5	+0.0	45.4	108.5 1.2M OFDM	-63.1	Vert
36	2128.000M	48.1	-34.4 +0.2	+27.8 +0.5	+2.4	+0.6	+0.0	45.2	108.5	-63.3	Vert
37	3189.000M	44.5	-34.0 +0.5	+29.5 +0.3	+3.1	+0.8	+0.0	44.7	108.5	-63.8	Horiz
38	1808.000M	50.0	-34.8 +0.2	+26.1 +0.4	+2.2	+0.5	+0.0	44.6	108.5	-63.9	Vert
39	2130.000M	46.9	-34.4 +0.2	+27.8 +0.5	+2.4	+0.6	+0.0	44.0	108.5	-64.5	Horiz
40	9268.001M Ave	25.7	-34.1 +0.4	+37.6 +0.5	+6.2	+1.5	+0.0	37.8	108.5 1.2M OFDM	-70.7	Vert
^	9268.001M	39.4	-34.1 +0.4	+37.6 +0.5	+6.2	+1.5	+0.0	51.5	108.5 1.2M OFDM	-57.0	Vert
42	1829.605M	40.5	-34.8 +0.2	+26.3 +0.4	+2.3	+0.5	+0.0	35.4	108.5 1.2M OFDM	-73.1	Vert
43	7222.397M Ave	25.8	-34.5 +0.5	+36.5 +0.4	+5.3	+1.1	+0.0	35.1	108.5 1.2M OFDM	-73.4	Vert
^	7222.397M	40.6	-34.5 +0.5	+36.5 +0.4	+5.3	+1.1	+0.0	49.9	108.5 1.2M OFDM	-58.6	Vert
45	1853.600M	37.6	-34.7 +0.2	+26.5 +0.4	+2.3	+0.5	+0.0	32.8	108.5 1.2M OFDM	-75.7	Vert

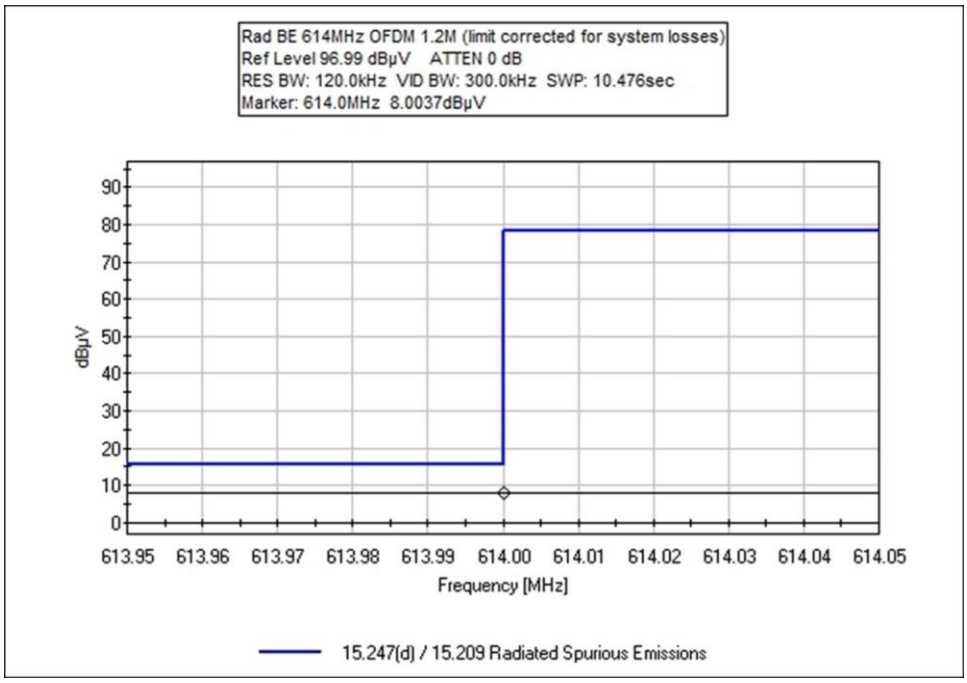
Band Edge

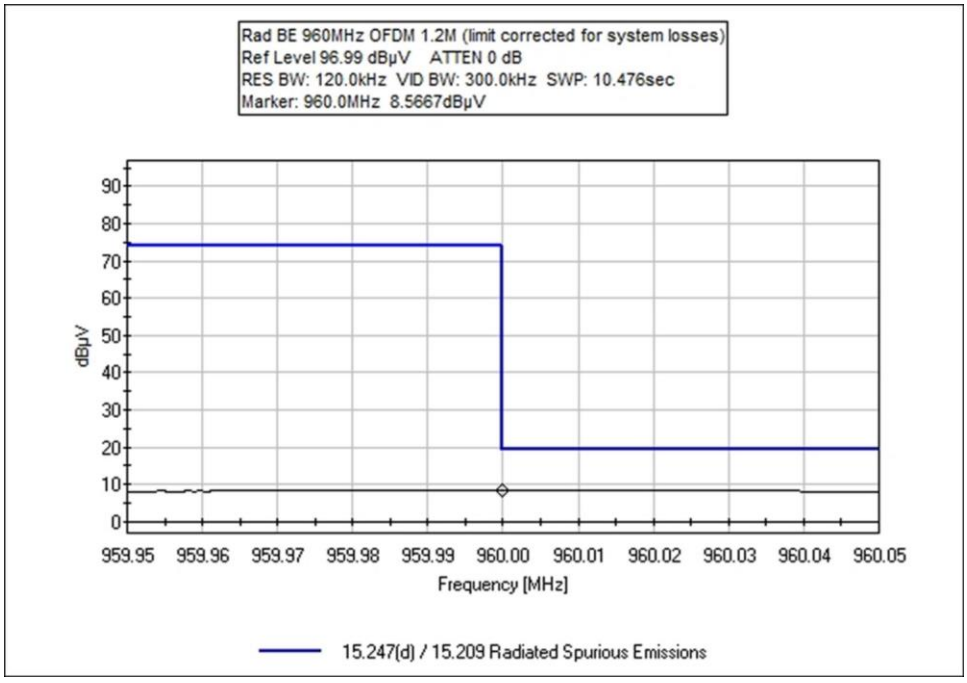
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614 (QP)	1.2M OFDM (Hybrid)	Omnidirectional	38.2	<46	Pass
902			94.0	<108.5	Pass
928			80.4	<108.5	Pass
960 (QP)			43.1	<54	Pass
614 (QP)	Hopping (1.2M OFDM) (Hybrid)	Omnidirectional	38.2	<46	Pass
902			91.2	<108.5	Pass
928			82.1	<108.5	Pass
960 (QP)			42.9	<54	Pass

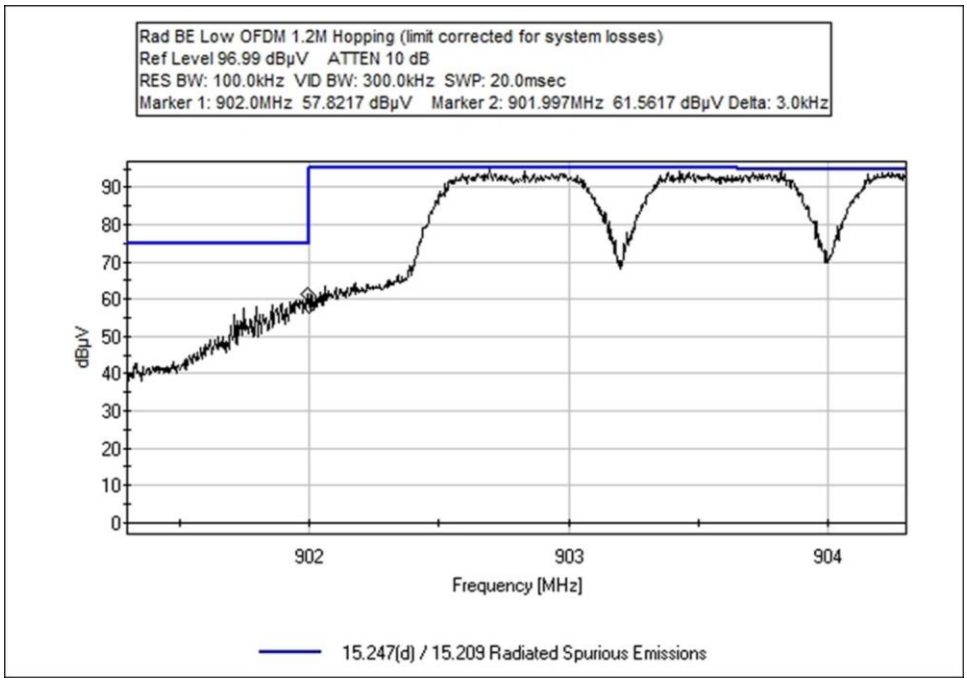
Band Edge Plots

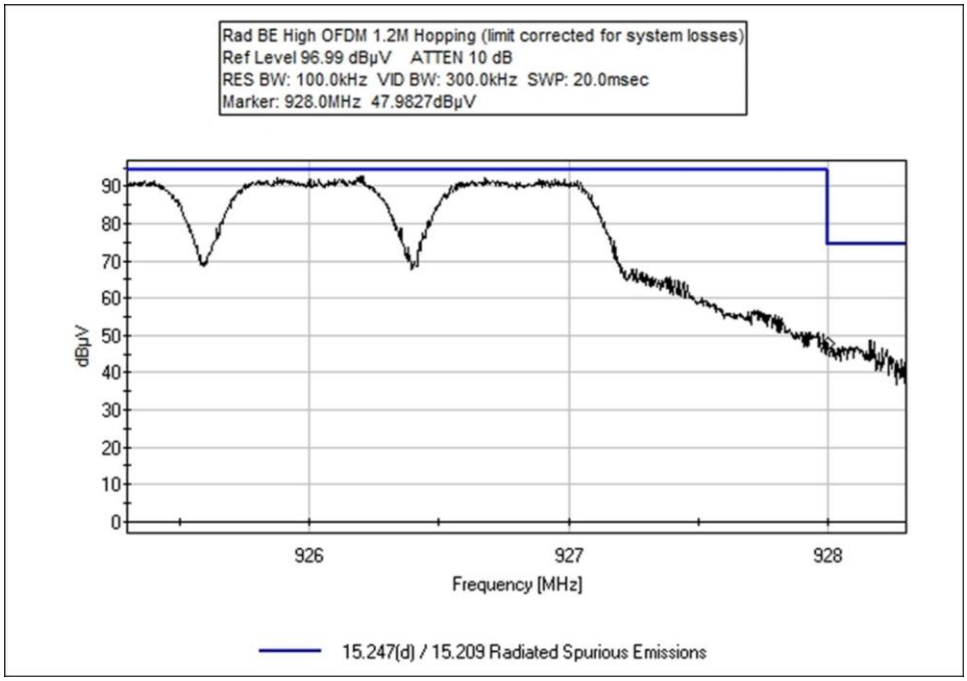


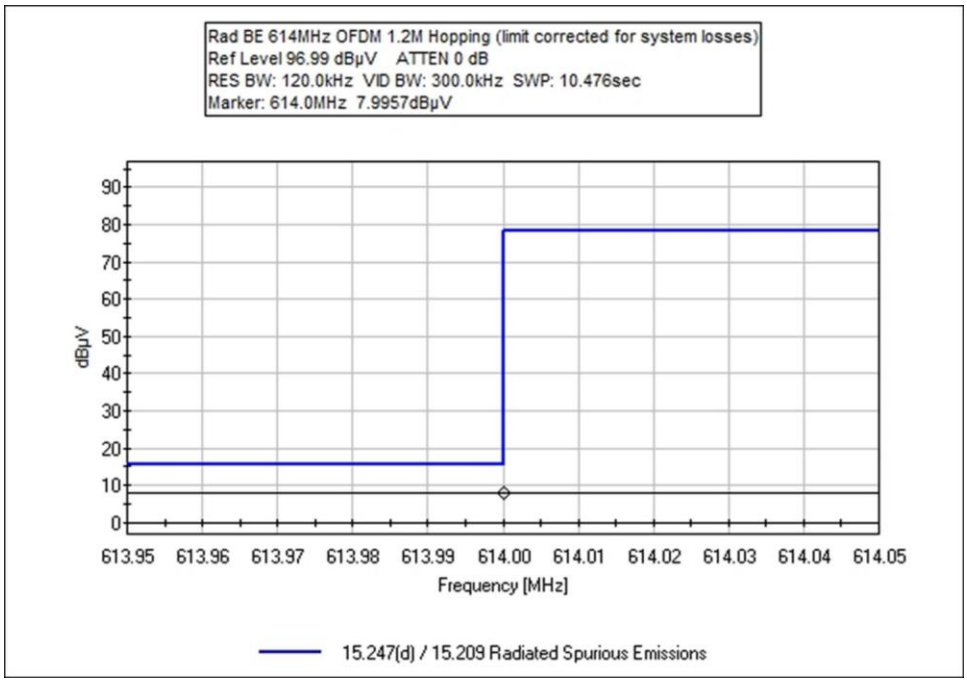


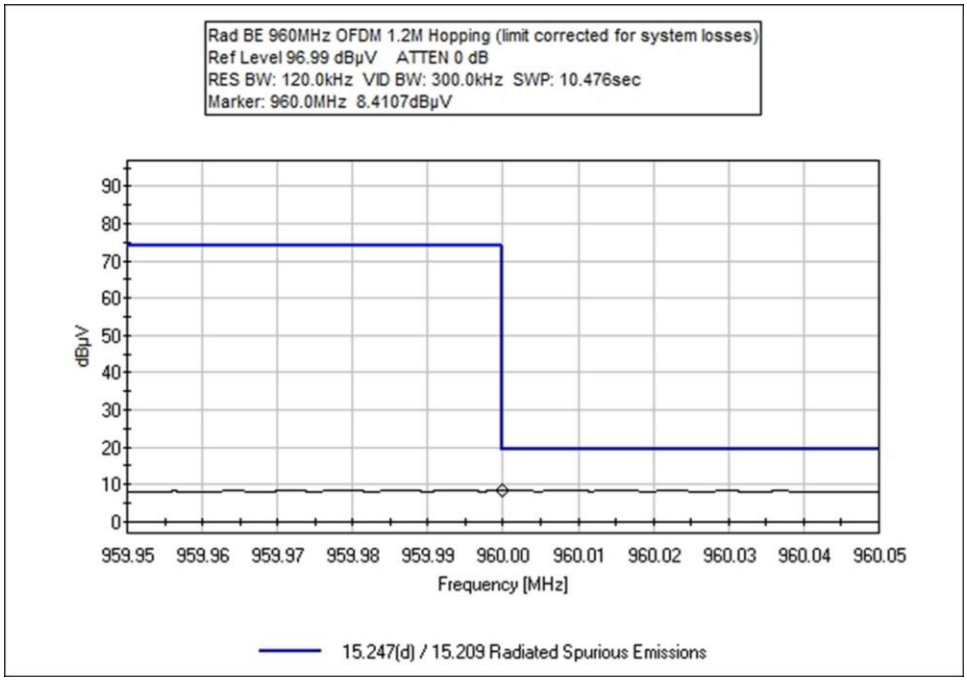

Rad BE 614MHz OFDM 1.2M (limit corrected for system losses)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 10.476sec
Marker: 614.0MHz 8.0037dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.95 613.96 613.97 613.98 613.99 614.00 614.01 614.02 614.03 614.04 614.05
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 960MHz OFDM 1.2M (limit corrected for system losses)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 10.476sec
Marker: 960.0MHz 8.5667dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.95 959.96 959.97 959.98 959.99 960.00 960.01 960.02 960.03 960.04 960.05
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE Low OFDM 1.2M Hopping (limit corrected for system losses)
Ref Level 96.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker 1: 902.0MHz 57.8217 dBµV Marker 2: 901.997MHz 61.5617 dBµV Delta: 3.0kHz
dBµV
90
80
70
60
50
40
30
20
10
0
902
903
904
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE High OFDM 1.2M Hopping (limit corrected for system losses)
Ref Level 96.99 dBµV ATTEN 10 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 47.9827dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 614MHz OFDM 1.2M Hopping (limit corrected for system losses)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 10.476sec
Marker: 614.0MHz 7.9957dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.95 613.96 613.97 613.98 613.99 614.00 614.01 614.02 614.03 614.04 614.05
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Rad BE 960MHz OFDM 1.2M Hopping (limit corrected for system losses)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 300.0kHz SWP: 10.476sec
Marker: 960.0MHz 8.4107dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.95 959.96 959.97 959.98 959.99 960.00 960.01 960.02 960.03 960.04 960.05
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**103786**	Date:	5/4/2020
Test Type:	**Maximized Emissions**	Time:	21:26:37
Tested By:	Michael Atkinson	Sequence#:	3
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:

Frequency: Band Edge

Setup:
The equipment under test (EUT) is placed on the tabletop.
The output of the EUT is continuously transmitting.
The EUT is transmitting at max power.
Fixed Low and High channels investigated, as well as Hopping mode investigated.
Horizontal and Vertical measurement antenna polarities investigated, worst case reported.

Modulation: 1.2M OFDM (Hybrid)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T2	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T3	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T4	ANP05360	Cable	RG214	2/3/2020	2/3/2022
T5	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T6	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021

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	614.000M	8.0	+0.0	+0.3	+1.2	+1.7	+0.0	38.2	46.0	-7.8	Vert
	QP		+5.8	+21.2					Hopping		
2	614.000M	8.0	+0.0	+0.3	+1.2	+1.7	+0.0	38.2	46.0	-7.8	Vert
	QP		+5.8	+21.2							
^	614.000M	10.7	+0.0	+0.3	+1.2	+1.7	+0.0	40.9	46.0	-5.1	Vert
			+5.8	+21.2					Hopping		
^	614.000M	10.1	+0.0	+0.3	+1.2	+1.7	+0.0	40.3	46.0	-5.7	Vert
			+5.8	+21.2							
5	960.000M	8.6	+0.0	+0.4	+1.5	+2.2	+0.0	43.1	54.0	-10.9	Vert
	QP		+5.8	+24.6							
6	960.000M	8.4	+0.0	+0.4	+1.5	+2.2	+0.0	42.9	54.0	-11.1	Vert
	QP		+5.8	+24.6					Hopping		
^	960.000M	11.9	+0.0	+0.4	+1.5	+2.2	+0.0	46.4	54.0	-7.6	Vert
			+5.8	+24.6							
^	960.000M	11.9	+0.0	+0.4	+1.5	+2.2	+0.0	46.4	54.0	-7.6	Vert
			+5.8	+24.6					Hopping		
9	901.997M	61.6	+0.0	+0.3	+1.4	+2.1	+0.0	95.0	108.5	-13.5	Vert
			+5.8	+23.8					Hopping		
10	902.000M	60.6	+0.0	+0.3	+1.4	+2.1	+0.0	94.0	108.5	-14.5	Vert
			+5.8	+23.8							
11	902.000M	57.8	+0.0	+0.3	+1.4	+2.1	+0.0	91.2	108.5	-17.3	Vert
			+5.8	+23.8					Hopping		
12	928.000M	48.0	+0.0	+0.4	+1.5	+2.2	+0.0	82.1	108.5	-26.4	Vert
			+5.8	+24.2					Hopping		
13	928.000M	46.3	+0.0	+0.4	+1.5	+2.2	+0.0	80.4	108.5	-28.1	Vert
			+5.8	+24.2							

Test Setup Photo(s)

Below 1GHz

Below 1GHz

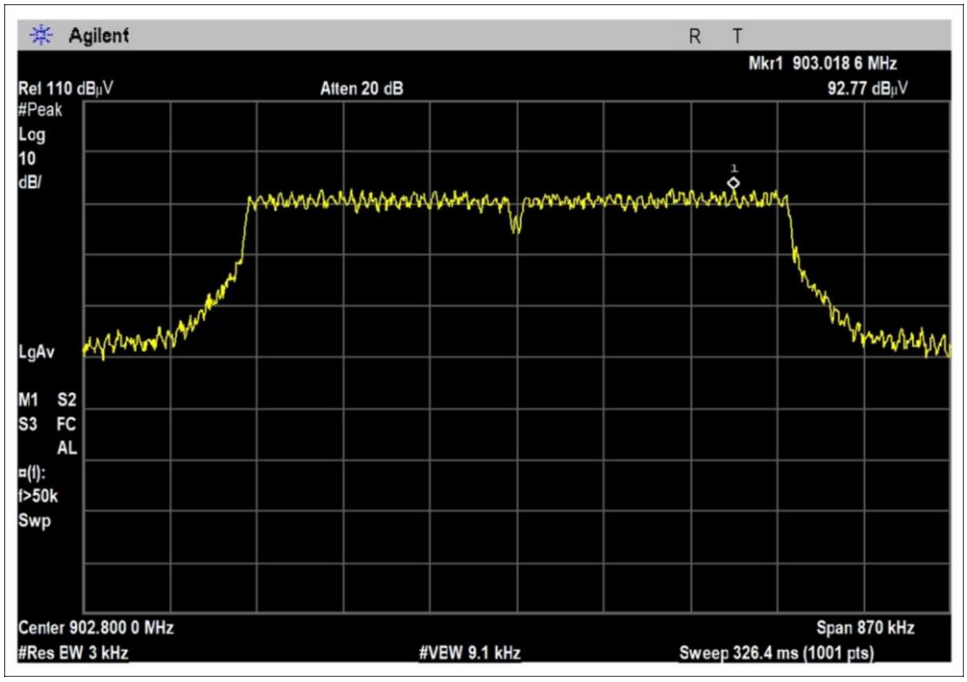
Above 1GHz

Above 1GHz

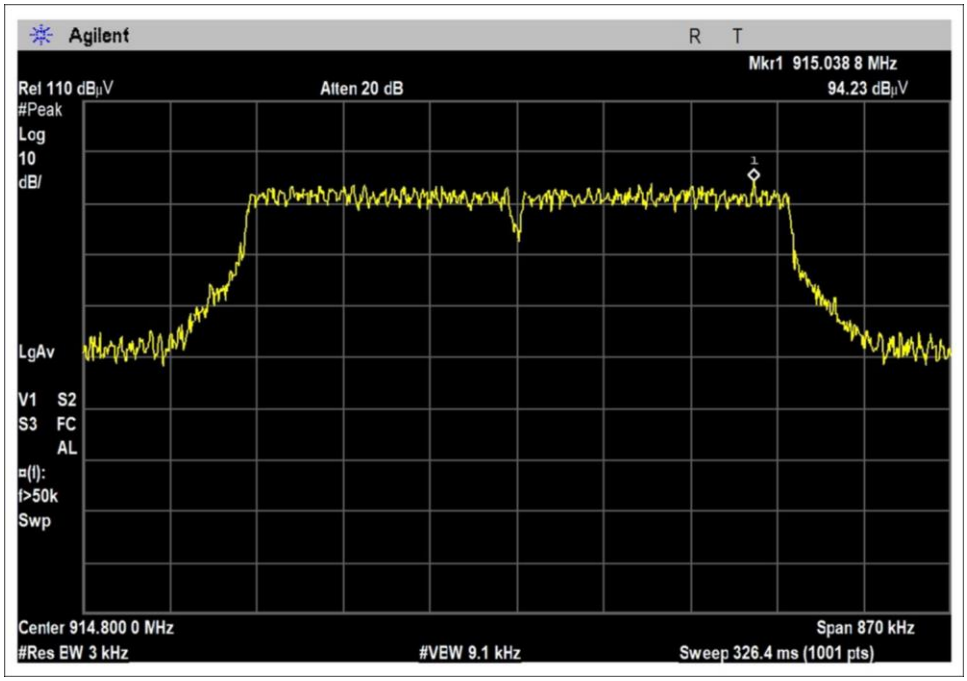
15.247(f) Hybrid Systems – Power Spectral Density

Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	**Modulation**	**Measured (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
902.8	1.2M OFDM (Hybrid)	6.3	≤8	Pass
914.8	1.2M OFDM (Hybrid)	7.7	≤8	Pass
926.8	1.2M OFDM (Hybrid)	6.7	≤8	Pass

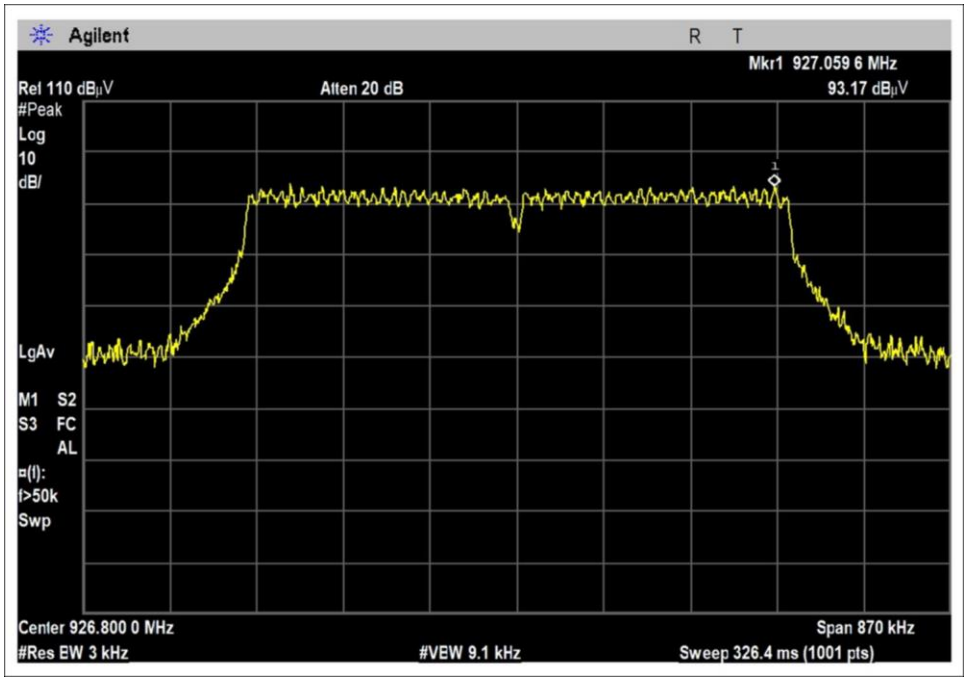
Plot(s)



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.247(f) Peak Power Spectral Density for Hybrid Systems (902-928 MHz DTS)**		
Work Order #:	**103786**	Date:	5/13/2020
Test Type:	**Conducted Emissions**	Time:	21:24:09
Tested By:	Michael Atkinson	Sequence#:	6
Software:	EMITest 5.03.12		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Frequency: Fundamental

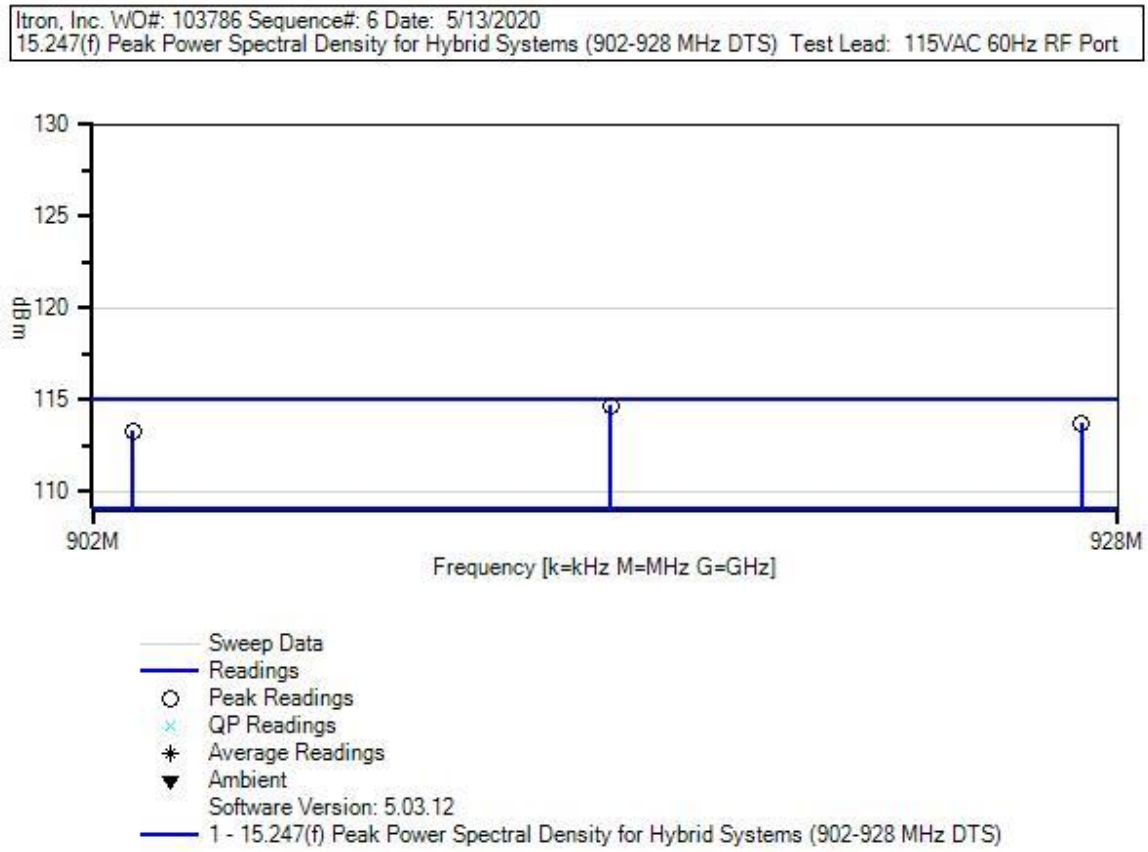
EUT is continuously transmitting at max power.
EUT antenna port is connected to spectrum analyzer through cable/attenuator.

Low, Middle, and High channels investigated.

Test Location: Bothell Lab Bench

Test Method: ANSI C63.10 (2013)

Temperature (ºC): 24
Relative Humidity (%): 35



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05748	Attenuator	PE7004-20	3/4/2020	3/4/2022
T2	ANP05546	Cable	Heliax	8/24/2018	8/24/2020
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021

Measurement Data: Reading listed by margin. Test Lead: RF Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBm	Spec dBm	Margin dB	Polar Ant
1	915.039M	94.2	+20.0	+0.5			+0.0	114.7	115.0	-0.3	RF Po
2	927.060M	93.2	+20.0	+0.5			+0.0	113.7	115.0	-1.3	RF Po
3	903.019M	92.8	+20.0	+0.5			+0.0	113.3	115.0	-1.7	RF Po

15.247 (f) Average Time of Occupancy

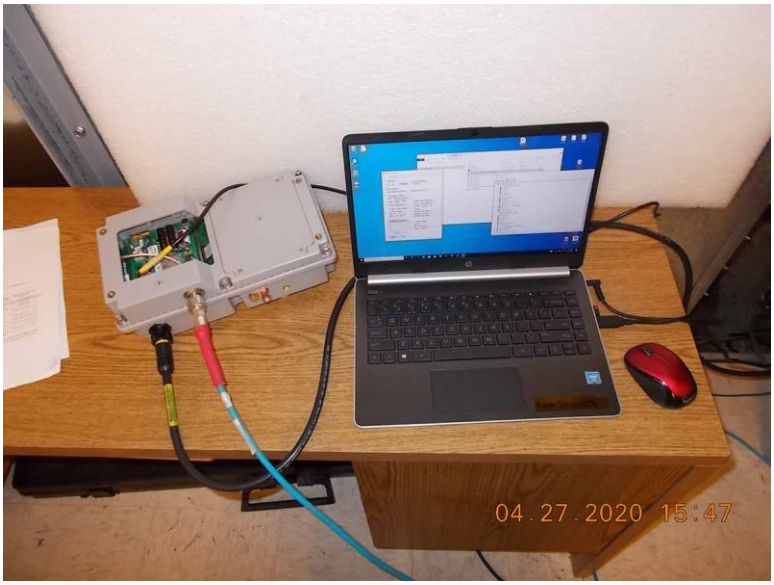
The manufacturer declares: Due to the required equipment and firmware to exercise the EUT's multiple pseudo-random hopping sequences was not available and that the complexity of the different modulations and modes depend on the device to be in a fully operating network environment. Therefore, the manufacturer declares the following:

With the 1.2Mbps modulation a hybrid blending both DTS and DSS and having a channel hopping table of 31 channels, the system complies with the Time of Occupancy requirement of 400ms with 399.6mS in 12.4 seconds (31 channels X 400mS = 12.4 seconds). Each session of multiple short transmissions takes place on one of 31 different channels in a pseudorandom sequence. The algorithm that determines the pseudo-random hop sequence ensures all channels are used equally on the average.

Itron employs hopping patterns based on a pseudo-random sequence generated by an algorithm. The algorithm can have multiple components generated, that each has its own pseudo-random sequence.

The firmware ensures the channels are used in the prescribed pseudo random order, therefore, it maintains equal channel usage.
The system has single channel receiver bandwidths that match the transmitter's modulation bandwidth that is enabled.
With the transmitter and receiver in synchronization within the network, transmitters switch frequencies in synchronization with the receiver.

Test Setup Photo(s)



15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**103786**	Date:	5/7/2020
Test Type:	**Conducted Emissions**	Time:	7:00:10 AM
Tested By:	Steven Pittsford	Sequence#:	7
Software:	EMITest 5.03.12		115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

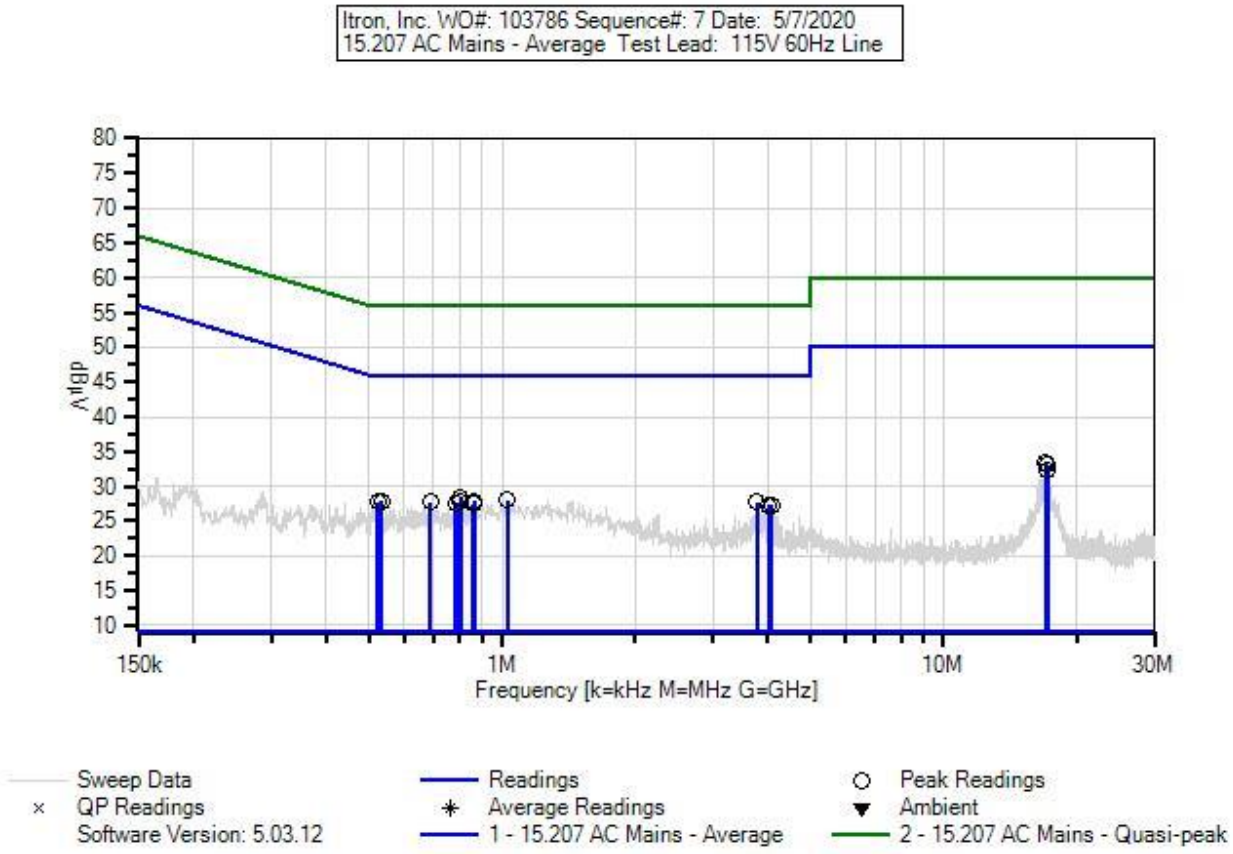
Test Conditions / Notes:

Temperature: 21°C
Pressure: 102.7kPa
Humidity: 33%

Frequency: 0.15-30MHz

Test Method: ANSI 63.10 (2013)

Set up:
EUT is on the test bench mounted on a pole stand.
Transmitting continuously at 915MHz & 2437MHz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/7/2020	4/7/2022
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T4	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022
T5	AN01492	50uH LISN-Line (L1)	3816/2NM	10/14/2019	10/14/2021
	AN01492	50uH LISN-Neutral (L2)	3816/2NM	10/14/2019	10/14/2021

Measurement Data: Reading listed by margin. Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	17.040M	23.2	+9.1 +0.5	+0.2	+0.1	+0.2	+0.0	33.3	50.0	-16.7	Line
2	17.202M	22.9	+9.1 +0.6	+0.2	+0.1	+0.2	+0.0	33.1	50.0	-16.9	Line
3	805.212k	18.5	+9.1 +0.5	+0.0	+0.0	+0.2	+0.0	28.3	46.0	-17.7	Line
4	17.076M	22.1	+9.1 +0.5	+0.2	+0.1	+0.2	+0.0	32.2	50.0	-17.8	Line
5	1.026M	18.3	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	28.0	46.0	-18.0	Line
6	533.237k	18.0	+9.1 +0.5	+0.0	+0.0	+0.3	+0.0	27.9	46.0	-18.1	Line
7	862.661k	18.2	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	27.9	46.0	-18.1	Line
8	523.783k	17.9	+9.1 +0.6	+0.0	+0.0	+0.2	+0.0	27.8	46.0	-18.2	Line
9	688.132k	17.8	+9.1 +0.5	+0.0	+0.0	+0.3	+0.0	27.7	46.0	-18.3	Line
10	803.030k	17.9	+9.1 +0.5	+0.0	+0.0	+0.2	+0.0	27.7	46.0	-18.3	Line
11	3.782M	18.0	+9.1 +0.4	+0.1	+0.0	+0.1	+0.0	27.7	46.0	-18.3	Line
12	787.032k	17.8	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	27.5	46.0	-18.5	Line
13	858.298k	17.7	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	27.4	46.0	-18.6	Line
14	4.020M	17.6	+9.1 +0.4	+0.1	+0.0	+0.1	+0.0	27.3	46.0	-18.7	Line
15	4.084M	17.5	+9.1 +0.5	+0.1	+0.0	+0.1	+0.0	27.3	46.0	-18.7	Line

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717		
Customer:	**Itron, Inc.**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**103786**	Date:	5/7/2020
Test Type:	**Conducted Emissions**	Time:	7:09:29 AM
Tested By:	Steven Pittsford	Sequence#:	6
Software:	EMITest 5.03.12		115V 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

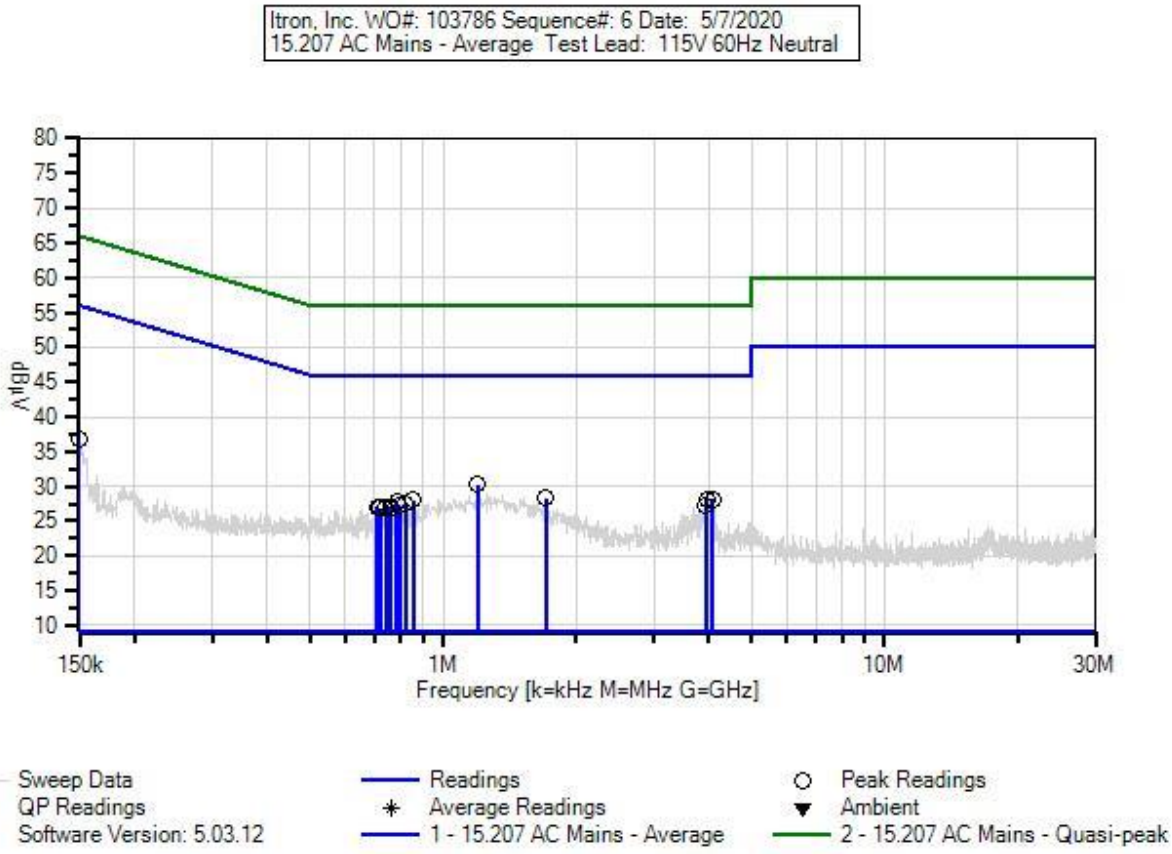
Test Conditions / Notes:

Temperature: 21°C
Pressure: 102.7kPa
Humidity: 33%

Frequency: 0.15-30MHz

Test Method: ANSI 63.10 (2013)

Set up:
EUT is on the test bench mounted on a pole stand.
Transmitting continuously at 915MHz & 2437MHz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06219	Attenuator	768-10	4/7/2020	4/7/2022
T2	ANP06515	Cable	Heliax	6/29/2018	6/29/2020
T3	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
	AN02872	Spectrum Analyzer	E4440A	11/18/2019	11/18/2021
T4	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022
	AN01492	50uH LISN-Line (L1)	3816/2NM	10/14/2019	10/14/2021
T5	AN01492	50uH LISN-Neutral (L2)	3816/2NM	10/14/2019	10/14/2021

Measurement Data: Reading listed by margin. Test Lead: Neutral

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	1.196M	20.5	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	30.2	46.0	-15.8	Neutr
2	1.706M	18.5	+9.1 +0.4	+0.1	+0.0	+0.2	+0.0	28.3	46.0	-17.7	Neutr
3	3.948M	18.3	+9.1 +0.5	+0.1	+0.0	+0.1	+0.0	28.1	46.0	-17.9	Neutr
4	4.071M	18.3	+9.1 +0.5	+0.1	+0.0	+0.1	+0.0	28.1	46.0	-17.9	Neutr
5	854.662k	18.3	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	28.0	46.0	-18.0	Neutr
6	787.032k	18.0	+9.1 +0.5	+0.0	+0.0	+0.2	+0.0	27.8	46.0	-18.2	Neutr
7	820.483k	17.7	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	27.4	46.0	-18.6	Neutr
8	3.939M	17.5	+9.1 +0.5	+0.1	+0.0	+0.1	+0.0	27.3	46.0	-18.7	Neutr
9	792.850k	17.5	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	27.2	46.0	-18.8	Neutr
10	797.940k	17.5	+9.1 +0.4	+0.0	+0.0	+0.2	+0.0	27.2	46.0	-18.8	Neutr
11	707.767k	17.1	+9.1 +0.5	+0.0	+0.0	+0.3	+0.0	27.0	46.0	-19.0	Neutr
12	761.580k	17.2	+9.1 +0.5	+0.0	+0.0	+0.2	+0.0	27.0	46.0	-19.0	Neutr
13	150.000k	23.3	+9.1 +2.0	+0.0	+0.0	+2.5	+0.0	36.9	56.0	-19.1	Neutr
14	721.583k	17.0	+9.1 +0.5	+0.0	+0.0	+0.3	+0.0	26.9	46.0	-19.1	Neutr
15	741.218k	17.1	+9.1 +0.5	+0.0	+0.0	+0.2	+0.0	26.9	46.0	-19.1	Neutr

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.