

# Itron, Inc.

## TEST REPORT FOR

### OpenWay Riva Gas Remote Disconnect Model: OWRGRD

#### Tested to The Following Standards:

#### FCC Part 15 Subpart C Section(s)

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

**Report No.: 103184-2**

Date of issue: November 25, 2019



Test Certificate # 803.01

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

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

Representative: Jay Holcomb  
Customer Reference Number: 191323

**DATE OF EQUIPMENT RECEIPT:**

**DATE(S) OF TESTING:**

**REPORT PREPARED BY:**

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

Project Number: 103184

October 3, 2019

October 3-28, 2019

### 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 23<sup>rd</sup> 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 (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	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
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 = Not applicable because the EUT is battery powered.

NP = CKC Laboratories was not contracted to perform test. See Manufacturer Declaration in Average Time of Occupancy section.

#### 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
OpenWay Riva Gas Remote Disconnect	Itron, Inc.	OWRGRD	103184-cond

*Support Equipment:*

Device	Manufacturer	Model #	S/N
Laptop	Dell	E6410	3XG40P1
AC/DC Adapter (for Laptop)	Dell	DA130PE1-00	NA
USB Interface Board	Itron, Inc.	PCB-TEMP-0007 Rev3	NA

### Configuration 2

*Equipment Tested:*

Device	Manufacturer	Model #	S/N
OpenWay Riva Gas Remote Disconnect	Itron, Inc.	OWRGRD	103184-rad

*Support Equipment:*

Device	Manufacturer	Model #	S/N
Flood Sensor	Itron, Inc.	TEL-7103-008	NA

## General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Operating Frequency Range:	902.2 - 927.75MHz (GFSK 25kbps) 902.2 – 927.8MHz (GFSK 50 kbps)
Number of Hopping Channels:	512 channels (GFSK 25 kbps, previously tested channel plan) 129 channels (GFSK 50 kbps, new channel plan)
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):	GFSK 25kbps and 50kbps
Maximum Duty Cycle:	100%
Number of TX Chains:	1 (there are 2 internal antennas but does not support simultaneous transmission)
Antenna Type(s) and Gain:	Integral Antenna 1: H port: -0.4dBi (PCB Trace) Integral Antenna 2: V port: 3.67dBi (Stamped Metal)
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	6.0VDC battery
Firmware / Software used for Test:	Command Line Interface (CLI) Tool (dated Feb 21, 2019) App Version 5.04.0, CSL Version: 16.0.5.0

## FCC Part 15 Subpart C

### 15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.10 (2013)	Test Date(s):	10/3/2019 to 10/20/2019
Configuration:	1		
Test Setup:	<p>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 max power.                      Measurements were performed with a fresh battery installed.</p>		

Environmental Conditions			
Temperature (°C)	19-23	Relative Humidity (%):	30-50

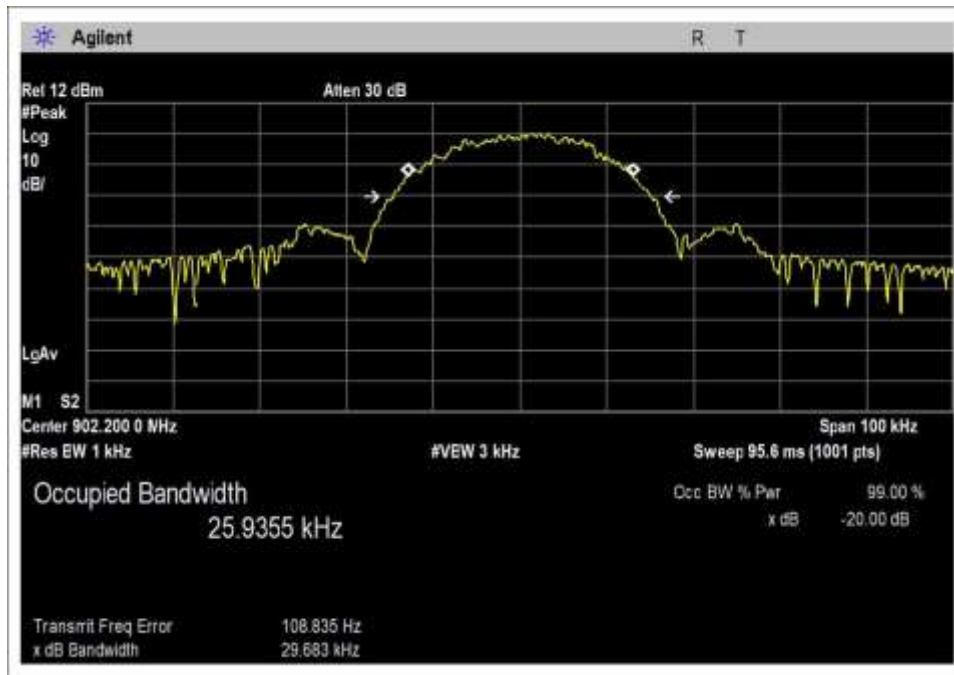
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	11/3/2017	11/3/2019
P05748	Attenuator	Pasternack	PE7004-20	4/24/2018	4/24/2020
P05959	Cable	Andrews	Heliac	4/11/2018	4/11/2020



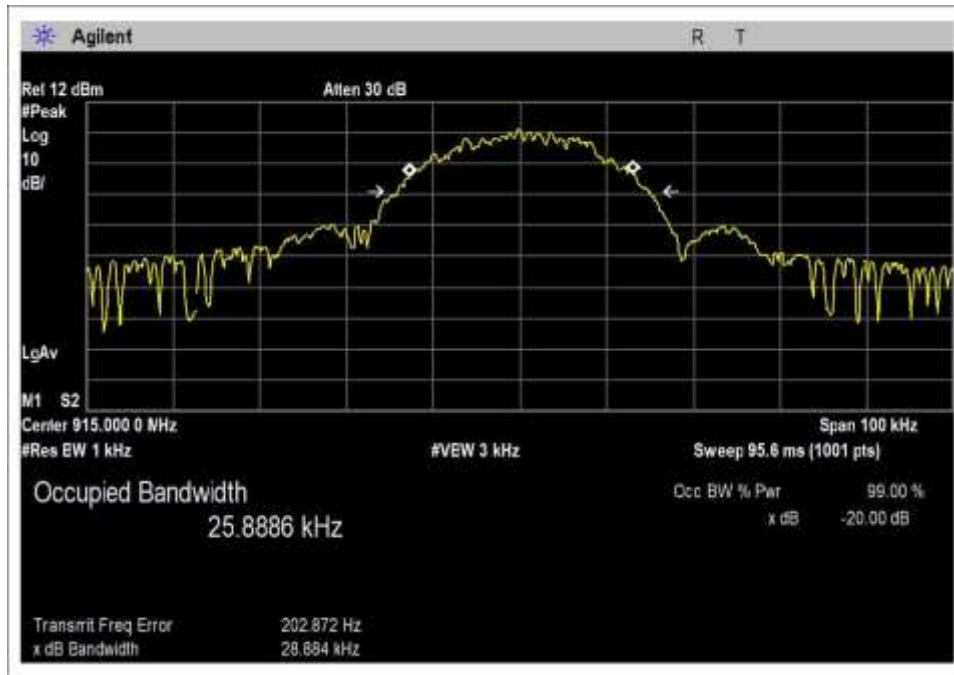
### 15.247(a)(1)(i) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
902.2	V	GFSK 25kbps	29.683	≤500	Pass
915	V	GFSK 25kbps	28.884	≤500	Pass
927.75	V	GFSK 25kbps	29.829	≤500	Pass
902.2	V	GFSK 50 kbps	101.668	≤500	Pass
915	V	GFSK 50 kbps	100.720	≤500	Pass
927.8	V	GFSK 50 kbps	86.861	≤500	Pass
902.2	H	GFSK 25kbps	29.969	≤500	Pass
915	H	GFSK 25kbps	28.398	≤500	Pass
927.75	H	GFSK 25kbps	29.638	≤500	Pass
902.2	H	GFSK 50 kbps	102.425	≤500	Pass
915	H	GFSK 50 kbps	96.730	≤500	Pass
927.8	H	GFSK 50 kbps	92.790	≤500	Pass

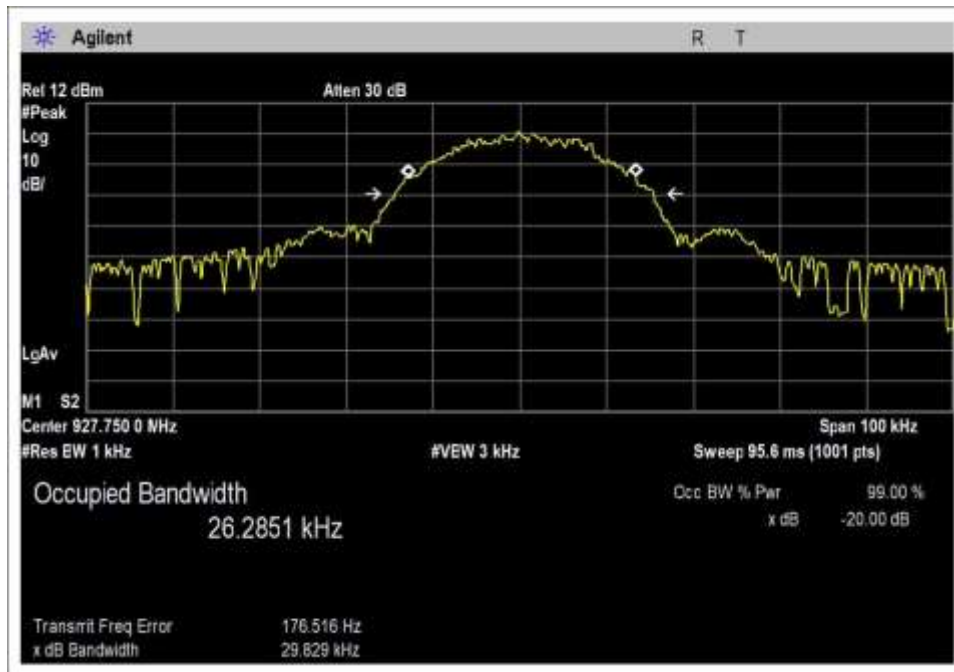
### Plot(s)



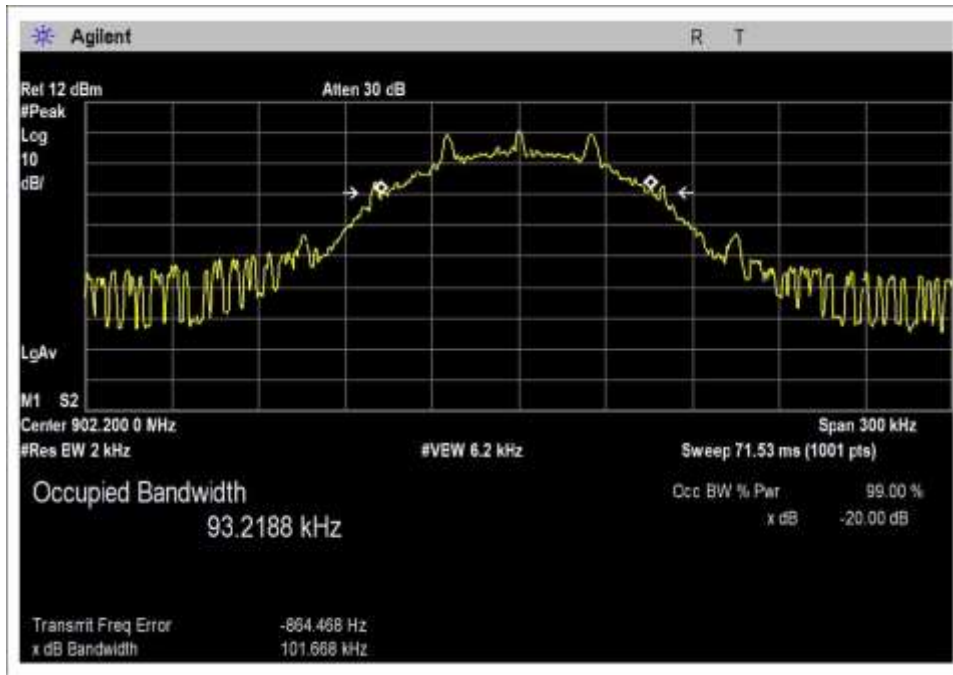
GFSK 25kbps Port V (Low)



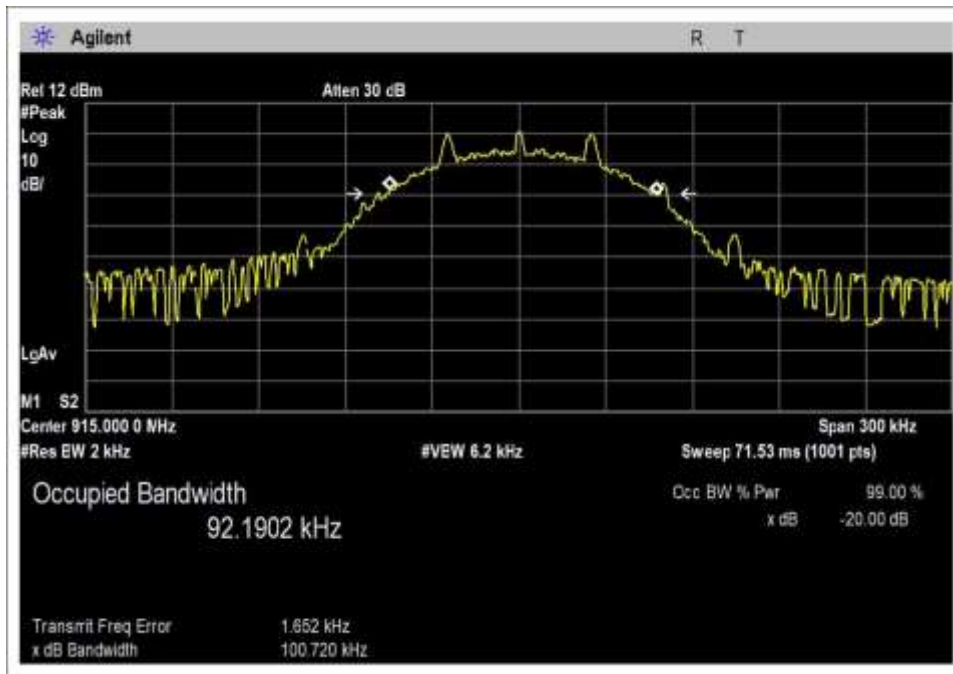
GFSK 25kbps Port V (Mid)



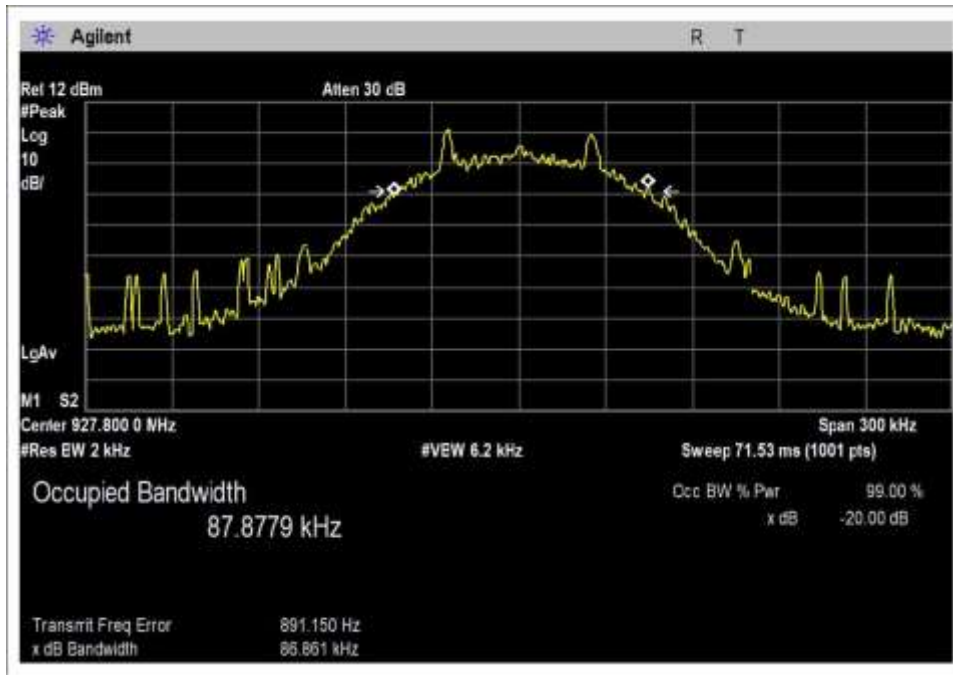
GFSK 25kbps Port V (High)



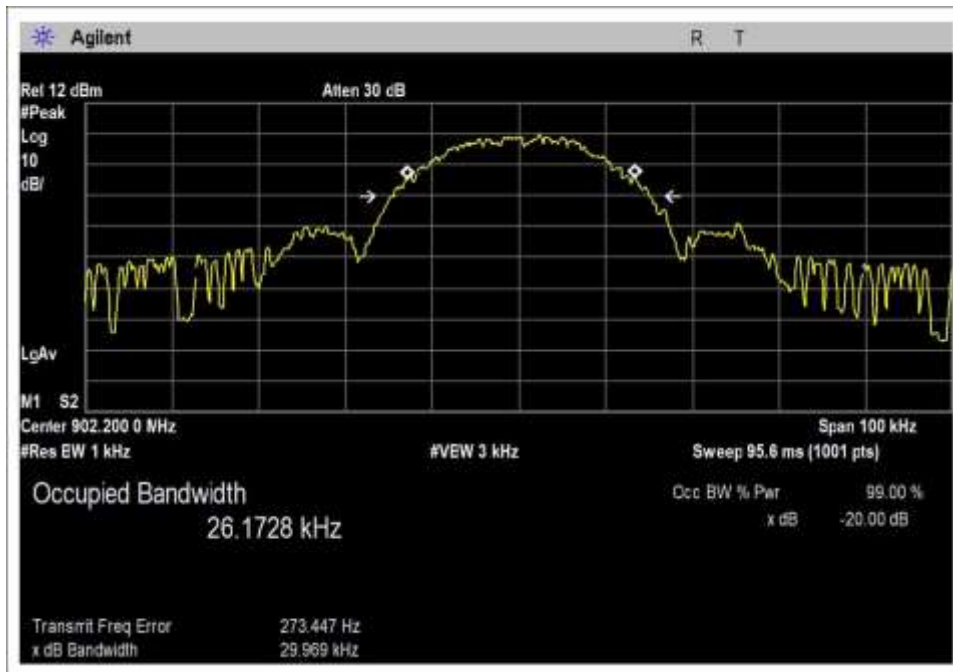
GFSK 50kbps Port V (Low)



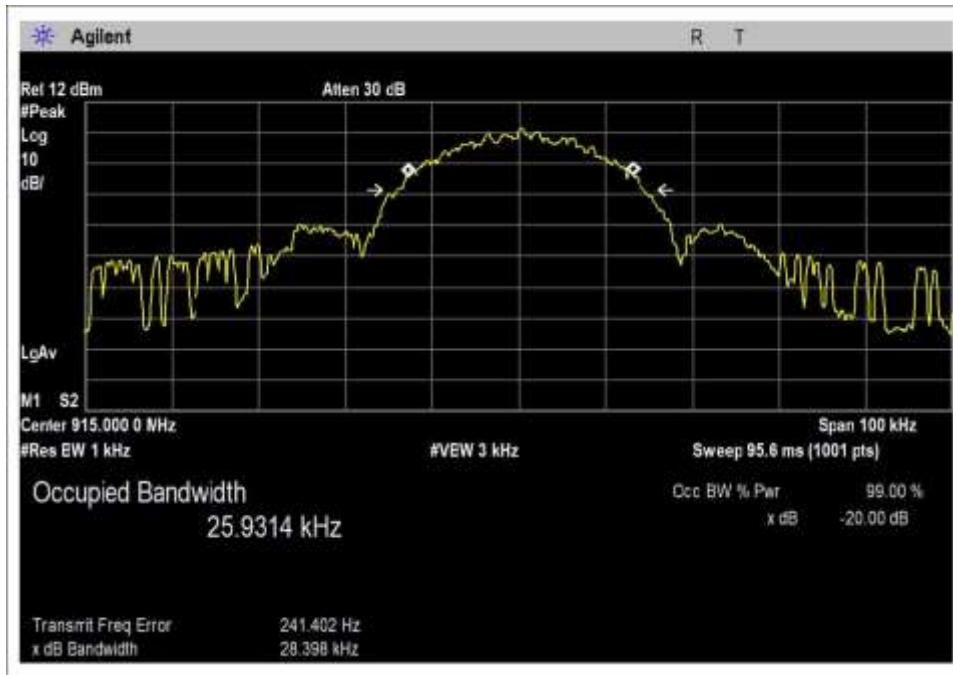
OBW GFSK 50kbps Port V (Mid)



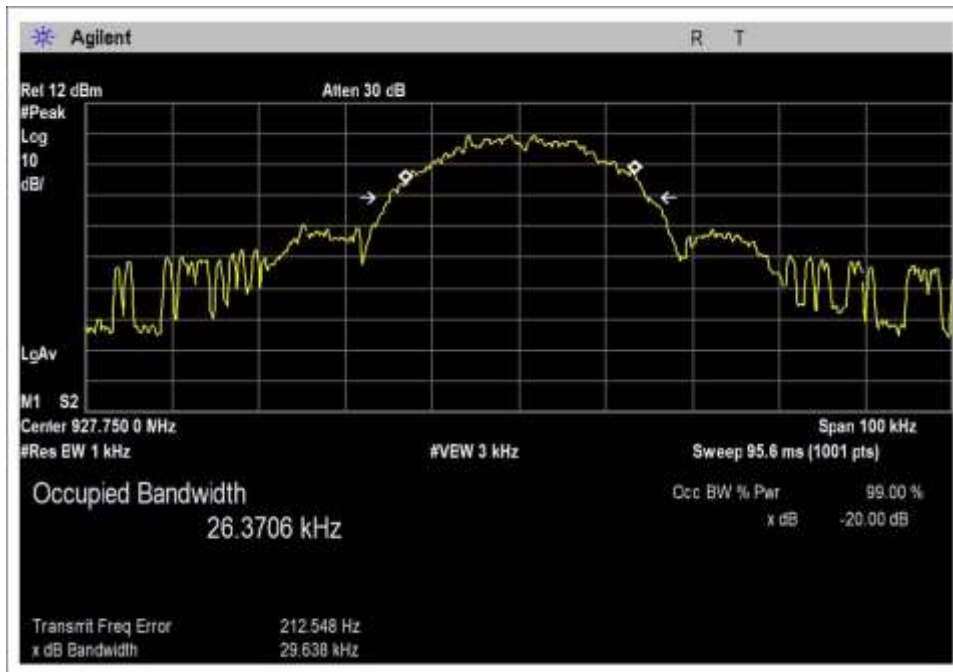
GFSK 50kbps Port V (High)



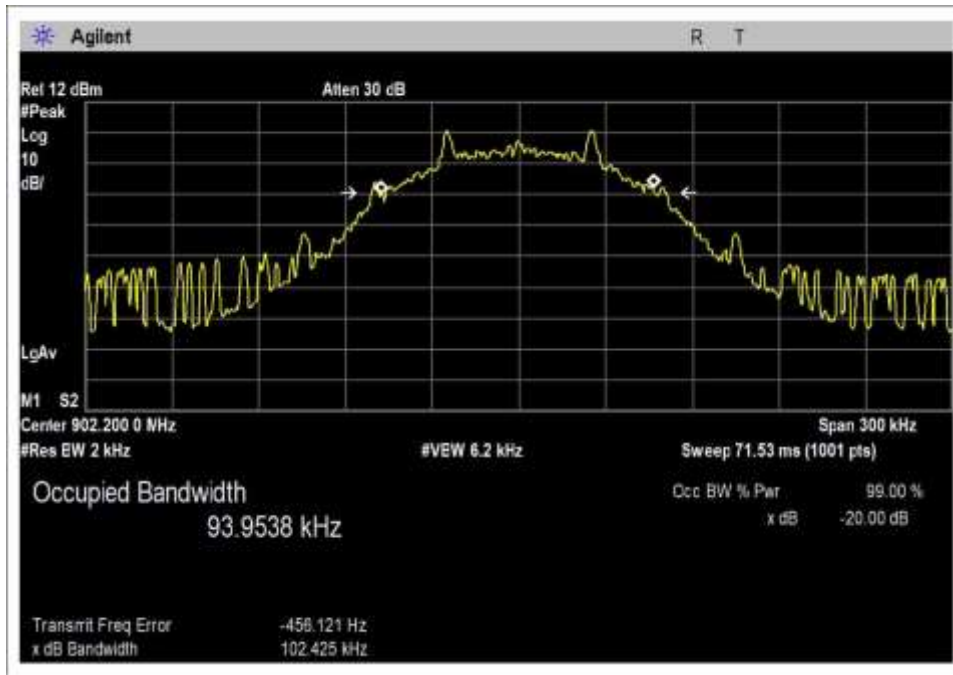
GFSK 25kbps Port H (Low)



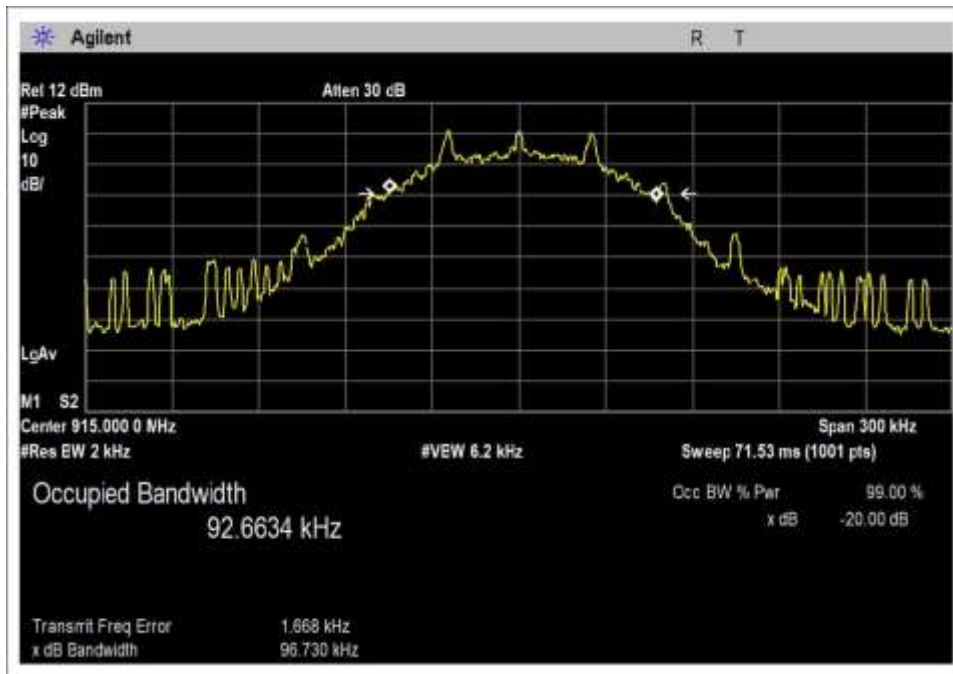
GFSK 25kbps Port H (Mid)



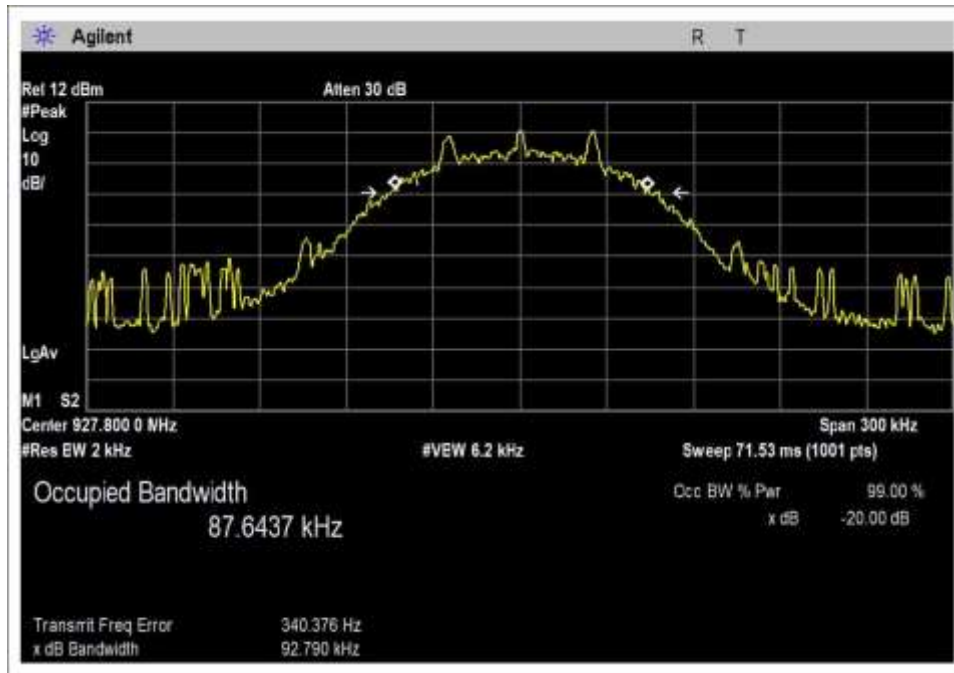
GFSK 25kbps Port H (High)



GFSK 50kbps Port H (Low)



GFSK 50kbps Port H (Mid)



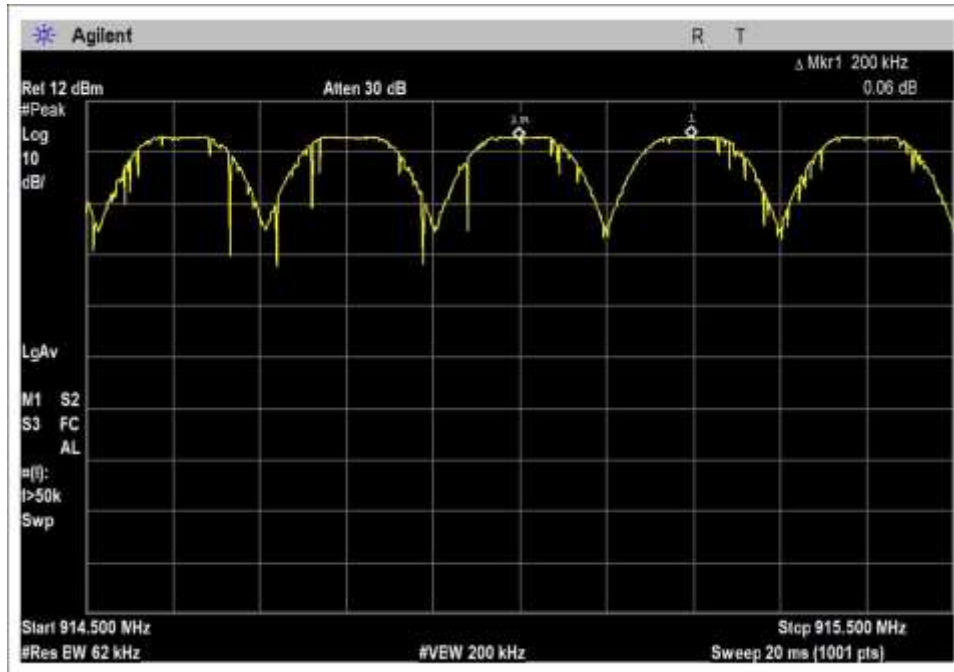
GFSK 50kbps Port H (High)



### 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
V	GFSK 50 kbps , Continually Hopping Channels	200.0	≥102.425	Pass

### Plot(s)

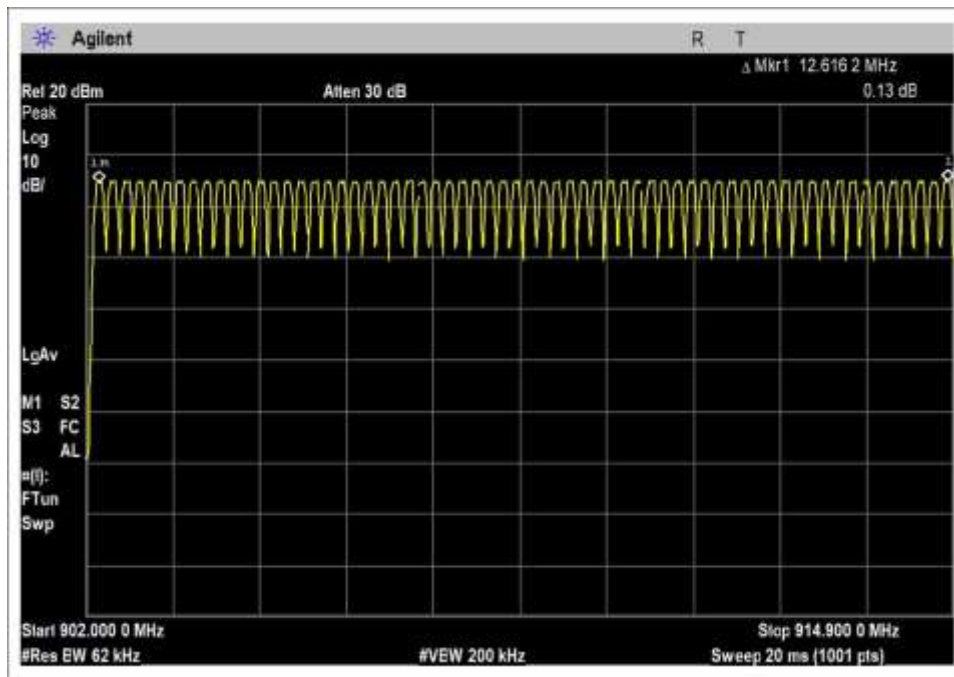




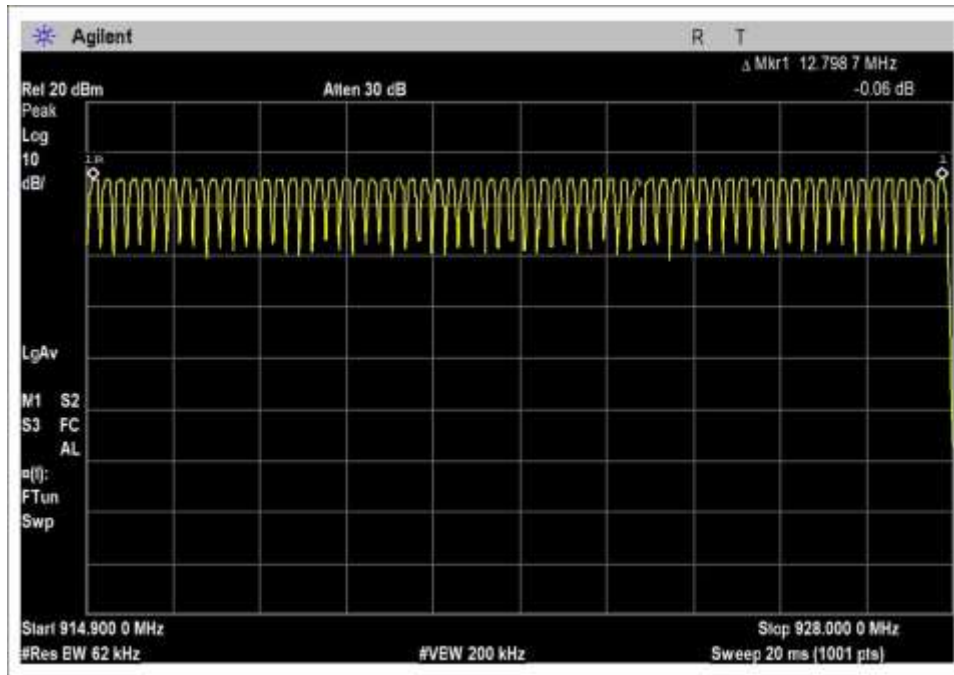
### 15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50 \text{ Channels} &   20 \text{ dB BW} < 250\text{kHz} \\ 25 \text{ Channels} &   20 \text{ dB BW} \geq 250\text{kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (Channels)	Limit (Channels)	Results
V	GFSK 50 kbps , Continually Hopping Channels	129	≥50	Pass

### Plot(s)



Channels 1-64



Channels 65-129

**Test Setup Photo(s)**



Port V



Port H

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

CKC laboratories was not contracted to perform the testing 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 multiple modulations, modes and hop tables, the mode with the worst-case Time of Occupancy to demonstrate 400mS compliance is 399.9 mS in 20 seconds, since this modulation is less than 250kHz Occupied Band Width. Each session of multiple short transmissions takes place on channels out of a minimum of 50 channels in a pseudorandom sequence. The algorithm that determines the pseudo-random hop sequence ensures all active channels are used equally on the average.

Itron, Inc. employs hopping patterns based on pseudo-random sequence generators or pseudo-random hop tables.

The firmware uses the channels in the prescribed pseudo random order, therefore it maintains equal channel usage.

The system has receiver channel 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.

When the transmitter needs to send a continuous or long data stream, total time of the packet transmissions is monitored to comply with dwell time requirement of 400ms in the appropriate 10s or 20s window depending on the modulation/mode enabled.

This device does not employ any hopping avoidance techniques.

## 15.247(b)(1) Output Power

### Test Data Summary - Voltage Variations

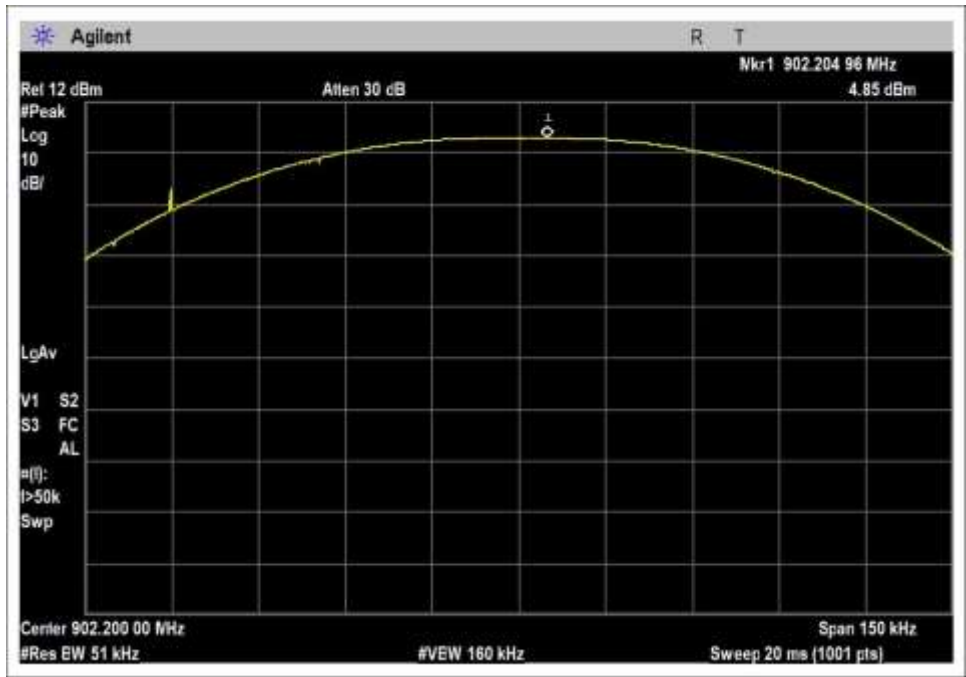
This equipment is battery powered. Power output tests were performed using a fresh battery.

### Test Data Summary - RF Conducted Measurement

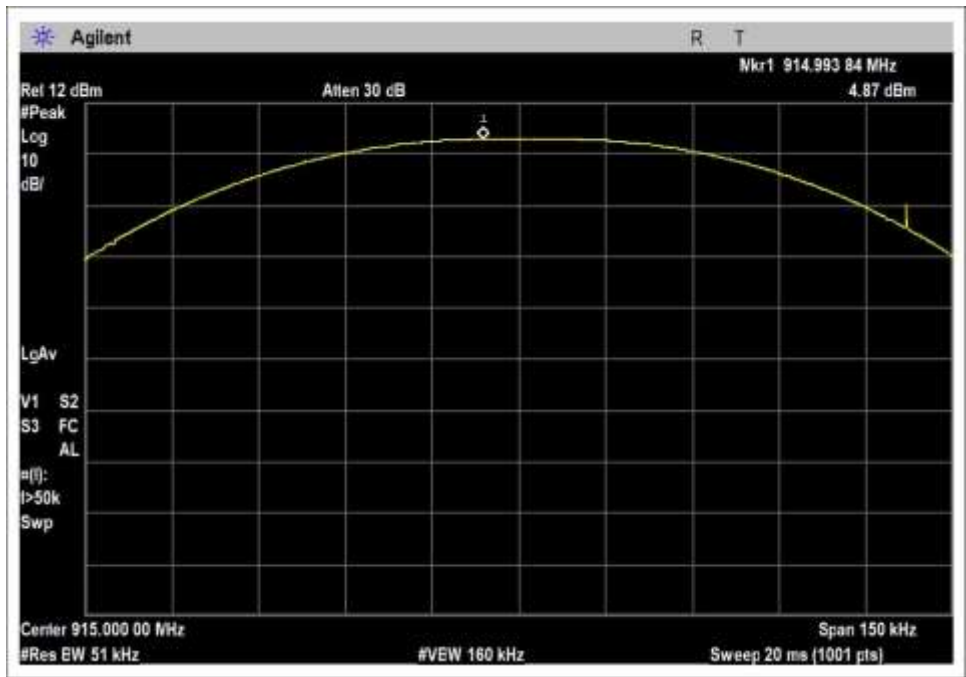
$$Limit = \begin{cases} 30dBm \text{ Conducted}/36dBm \text{ EIRP} & | \geq 50 \text{ Channels} \\ 24dBm \text{ Conducted}/30dBm \text{ EIRP} & | < 50 \text{ Channels (min 25)} \end{cases}$$

Frequency (MHz)	Port	Modulation	Gain (dBi)	Measured (dBm)	Conducted Limit (dBm)	Results
902.2	V	GFSK 25kbps	3.67	25.5	≤30	Pass
915	V	GFSK 25kbps	3.67	25.5	≤30	Pass
927.75	V	GFSK 25kbps	3.67	25.4	≤30	Pass
902.2	V	GFSK 50 kbps	3.67	25.4	≤30	Pass
915	V	GFSK 50 kbps	3.67	25.5	≤30	Pass
927.8	V	GFSK 50 kbps	3.67	25.4	≤30	Pass
902.2	H	GFSK 25kbps	-0.4	25.5	≤30	Pass
915	H	GFSK 25kbps	-0.4	25.5	≤30	Pass
927.75	H	GFSK 25kbps	-0.4	25.5	≤30	Pass
902.2	H	GFSK 50 kbps	-0.4	25.5	≤30	Pass
915	H	GFSK 50 kbps	-0.4	25.5	≤30	Pass
927.8	H	GFSK 50 kbps	-0.4	25.5	≤30	Pass

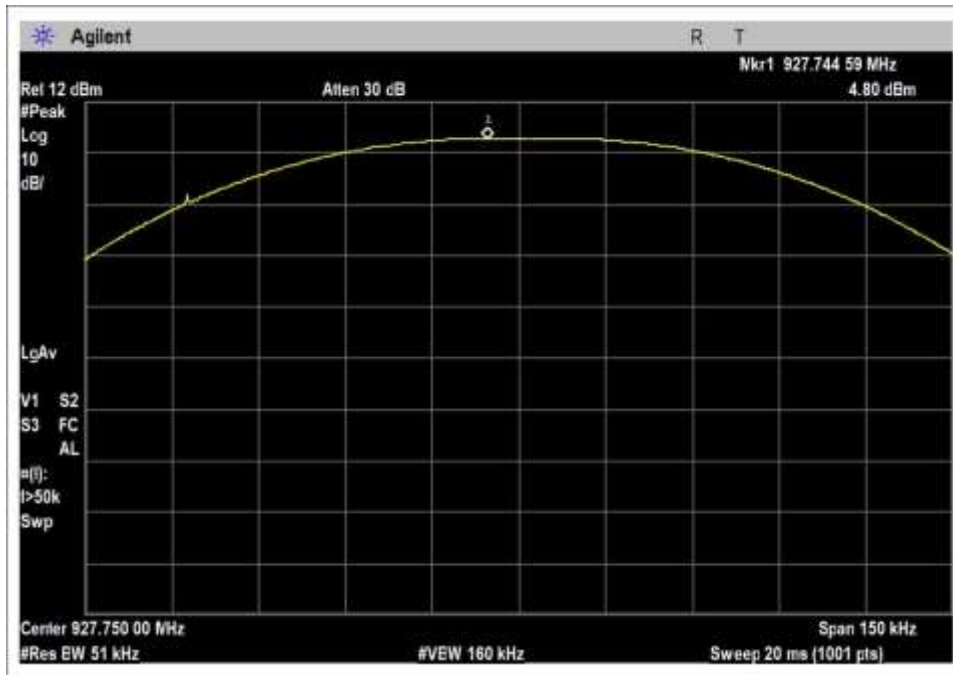
Plots



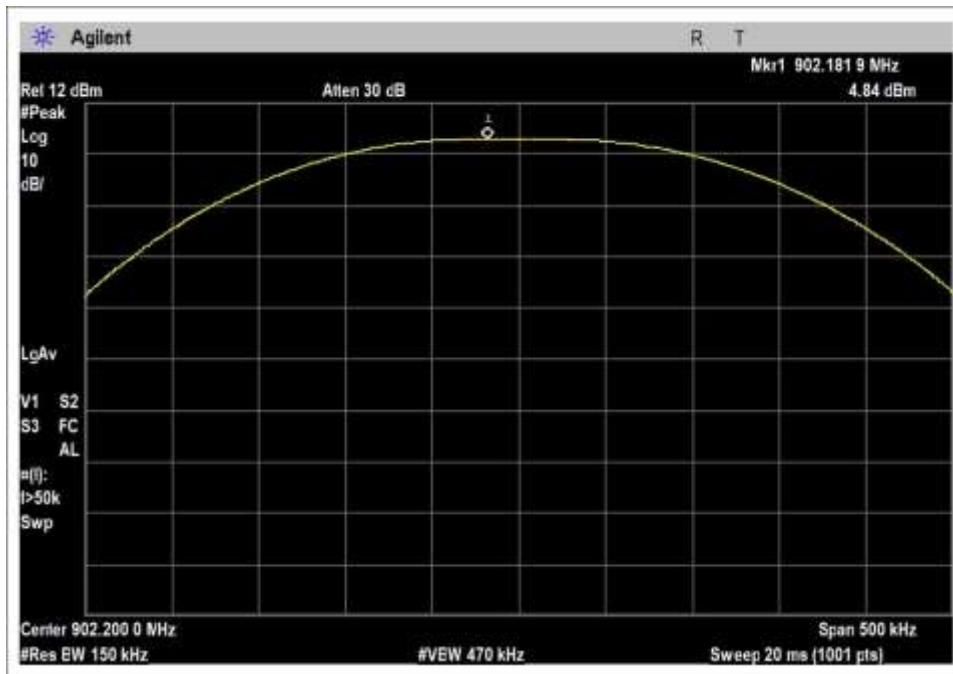
GFSK 25kbps Port V (Low)



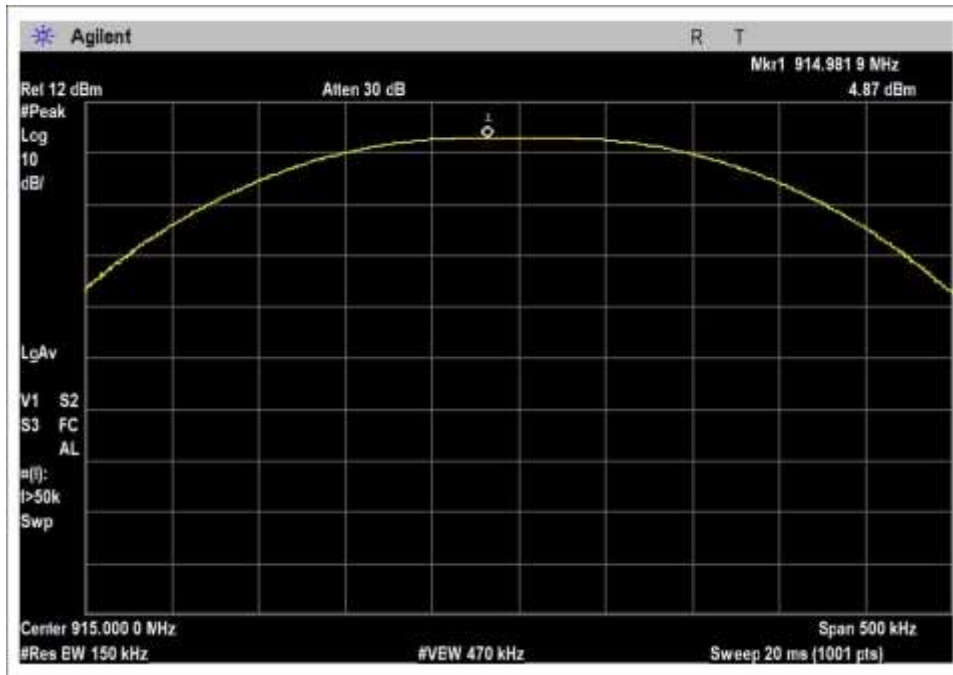
GFSK 25kbps Port V (Mid)



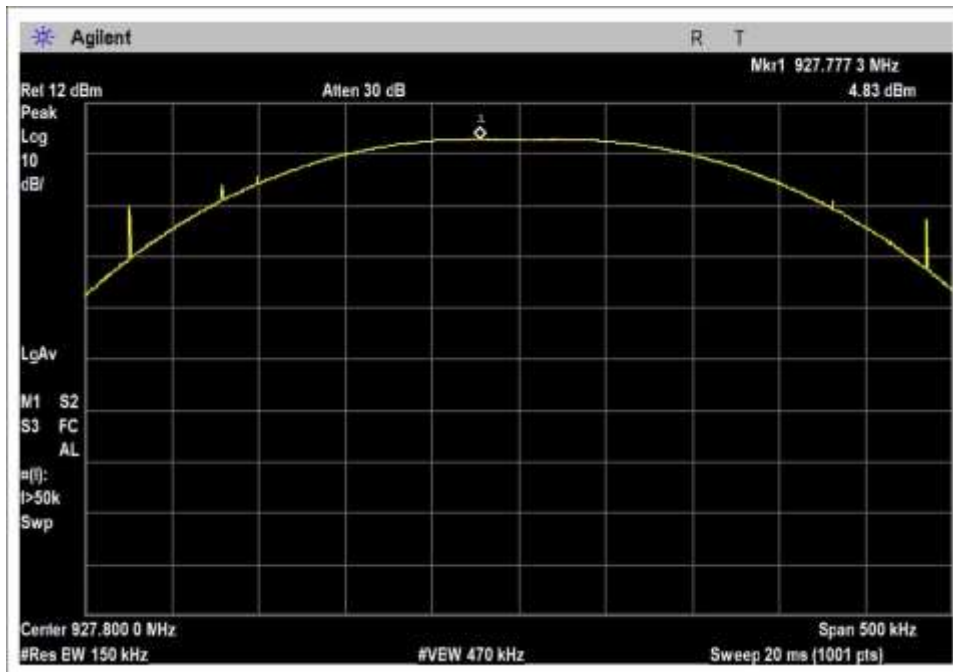
GFSK 25kbps Port V (High)



GFSK 50kbps Port V (Low)

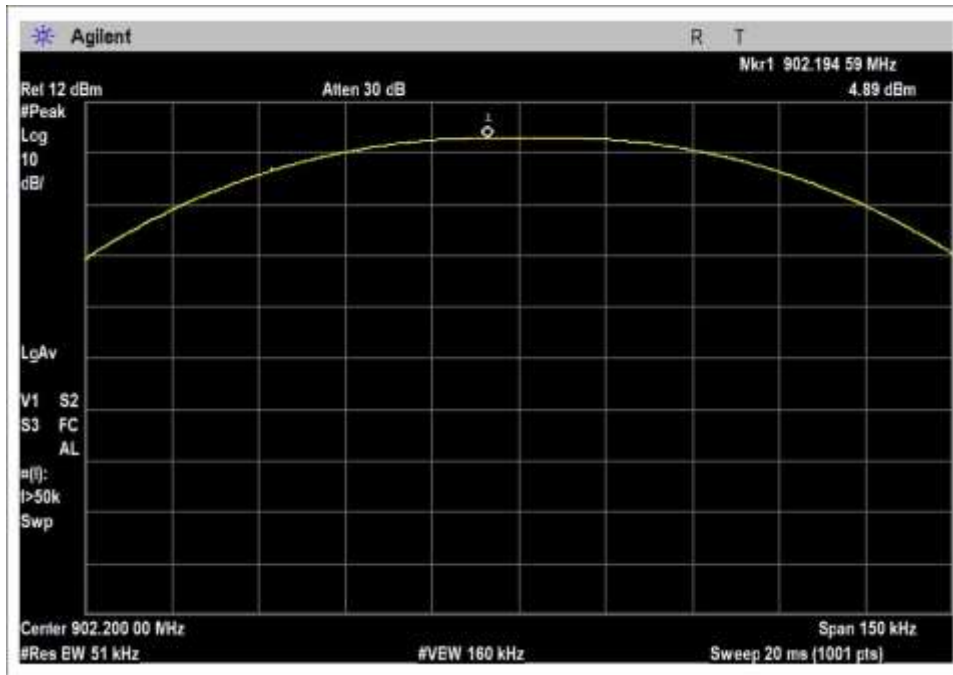


GFSK 50kbps Port V (Mid)

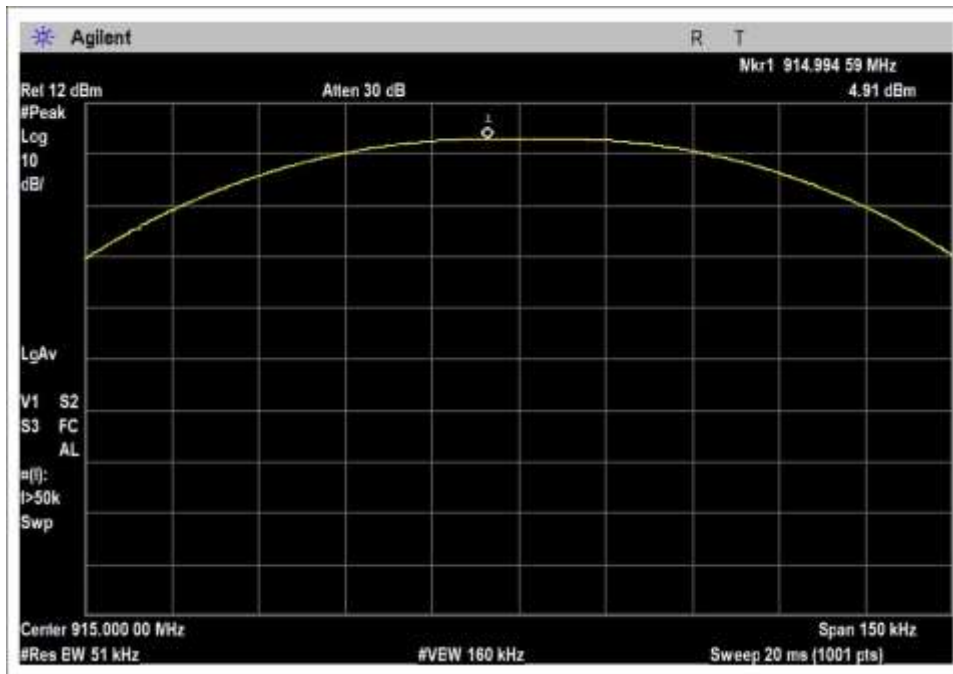


GFSK 50kbps Port V (High)

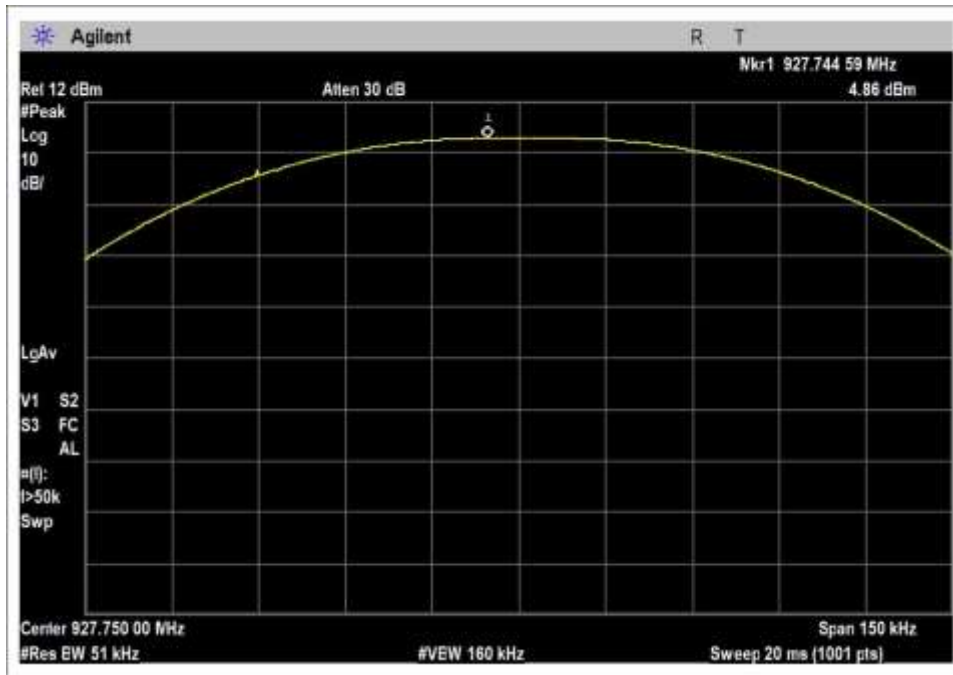




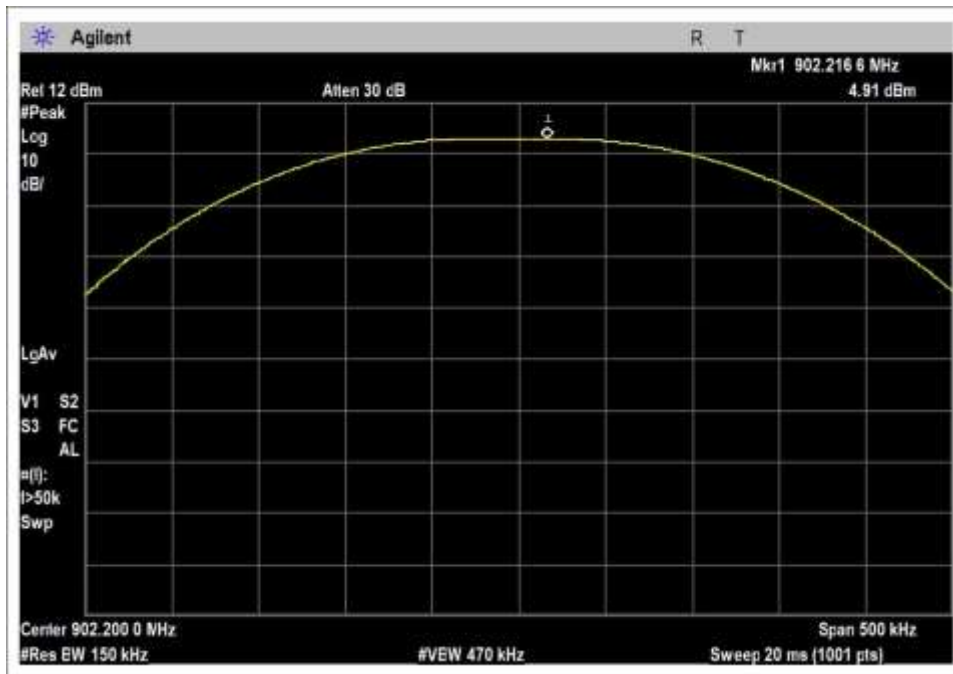
GFSK 25kbps Port H (Low)



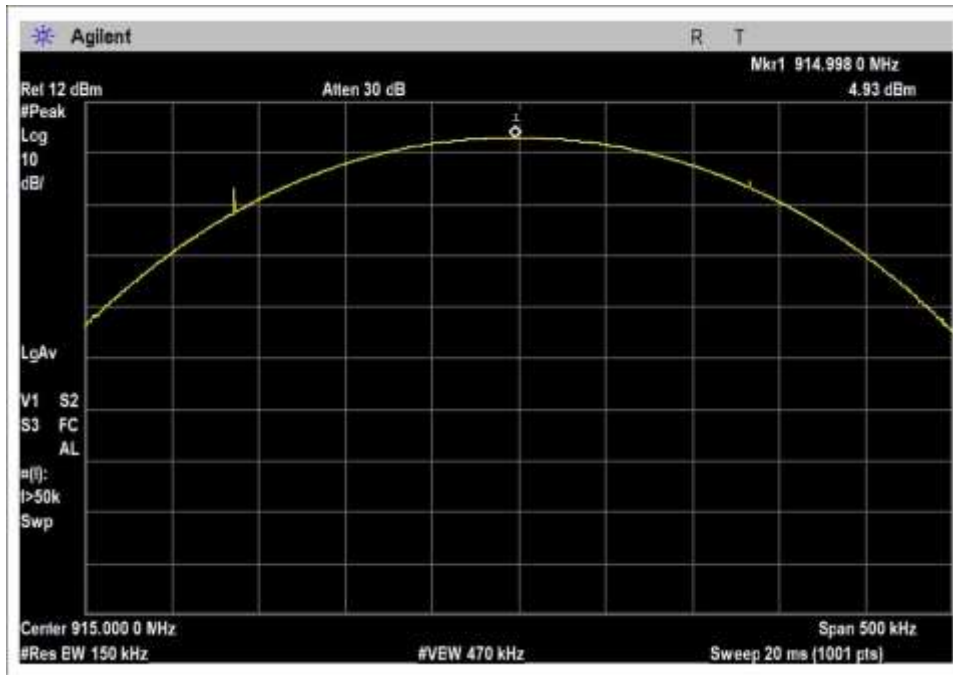
GFSK 25kbps Port H (Mid)



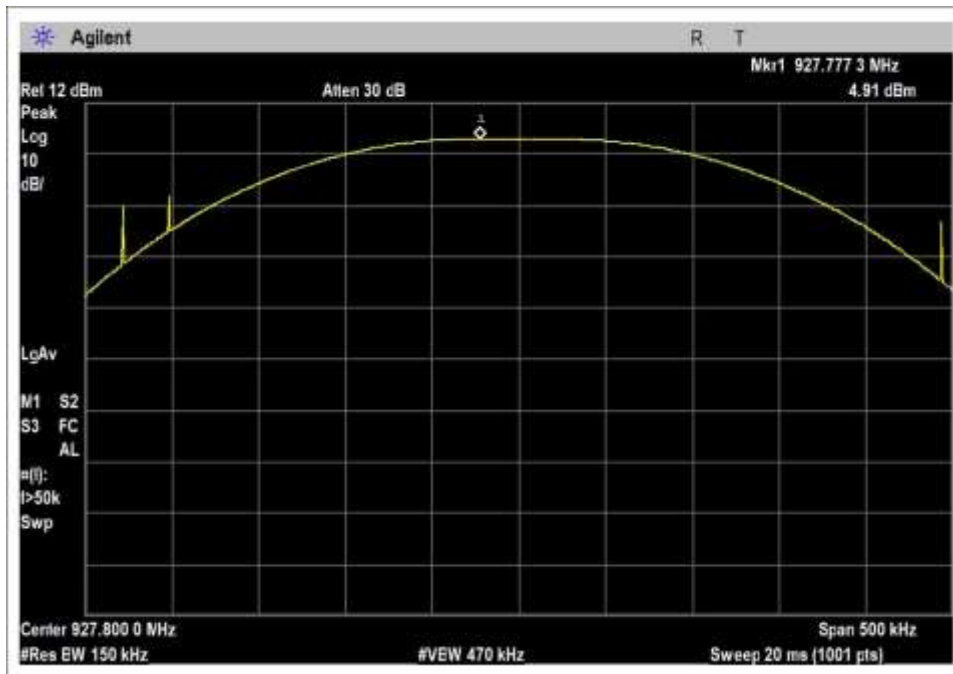
GFSK 25kbps Port H (High)



GFSK 50kbps Port H (Low)



GFSK 50kbps Port H (Mid)



GFSK 50kbps Port H (High)

**Test Setup / Conditions / Data**

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(b) Power Output (902-928 MHz FHSS >50 Channels)**  
 Work Order #: **103184** Date: 10/3/2019  
 Test Type: **Conducted Emissions** Time: 15:08:38  
 Tested By: Michael Atkinson Sequence#: 1  
 Software: EMITest 5.03.12 Battery

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

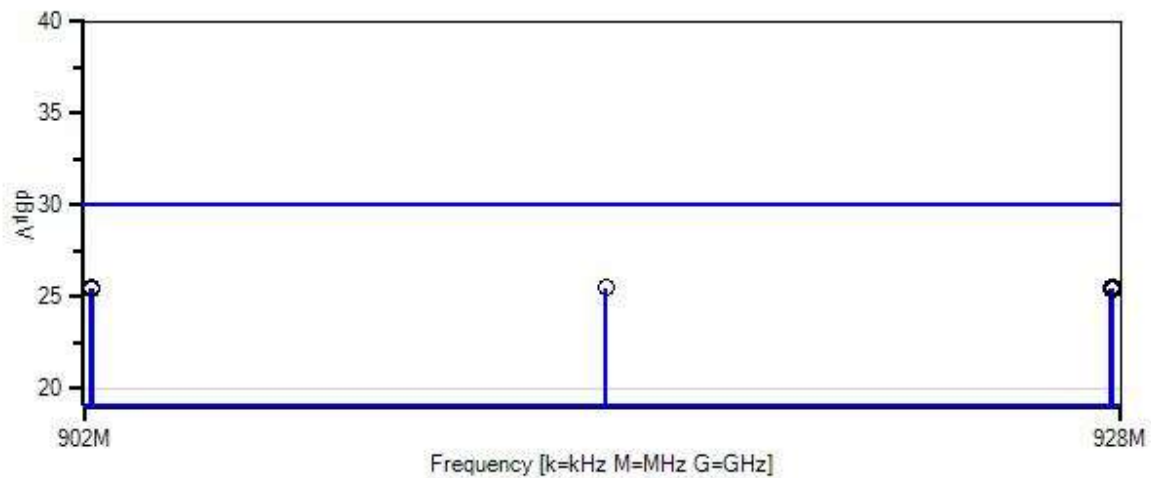
Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

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 max power.  
 Measurements were performed with a fresh battery installed.

Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

Itron, Inc. WO#: 103184 Sequence#: 1 Date: 10/3/2019  
15.247(b) Power Output (902-928 MHz FHSS >50 Channels) Test Lead: Battery RF Port (H and V)



- Sweep Data
  - Readings
  - Peak Readings
  - × QP Readings
  - \* Average Readings
  - ▼ Ambient
- Software Version: 5.03.12
- 1 - 15.247(b) Power Output (902-928 MHz FHSS >50 Channels)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T2	ANP05748	Attenuator	PE7004-20	4/24/2018	4/24/2020
T3	ANP05959	Cable	Heliac	4/11/2018	4/11/2020

**Measurement Data:**

Reading listed by margin.

Test Lead: RF Port (H and V)

#	Freq MHz	Rdng dBm	T1 dB	T2 dB	T3 dB	Dist Table	Corr dBm	Spec dBm	Margin dB	Polar Ant
1	902.205M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 25kbps		
2	902.195M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 25 kbps		
3	914.994M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 25kbps		
4	914.982M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 50kbps		
5	914.995M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 25 kbps		
6	914.998M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 50kbps		
7	927.777M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 50kbps		
8	927.745M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 25 kbps		
9	902.217M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	30.0	-4.5	RF Po
								GFSK 50kbps		
10	927.777M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	30.0	-4.6	RF Po
								GFSK 50kbps		
11	902.182M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	30.0	-4.6	RF Po
								GFSK 50kbps		
12	927.745M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	30.0	-4.6	RF Po
								GFSK 25kbps		

**Test Setup Photo(s)**



Port V



Port H

## 15.247(d) RF Conducted Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **103184** Date: 10/24/2019  
 Test Type: **Conducted Emissions** Time: 11:53:47  
 Tested By: Michael Atkinson Sequence#: 3  
 Software: EMITest 5.03.12 Battery

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 1			

***Test Conditions / Notes:***

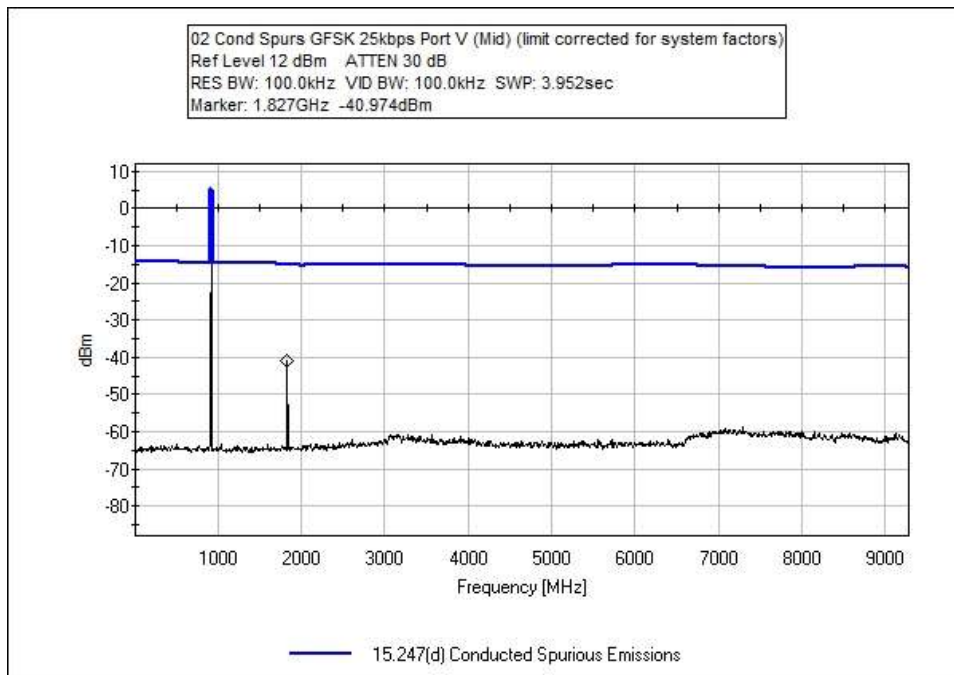
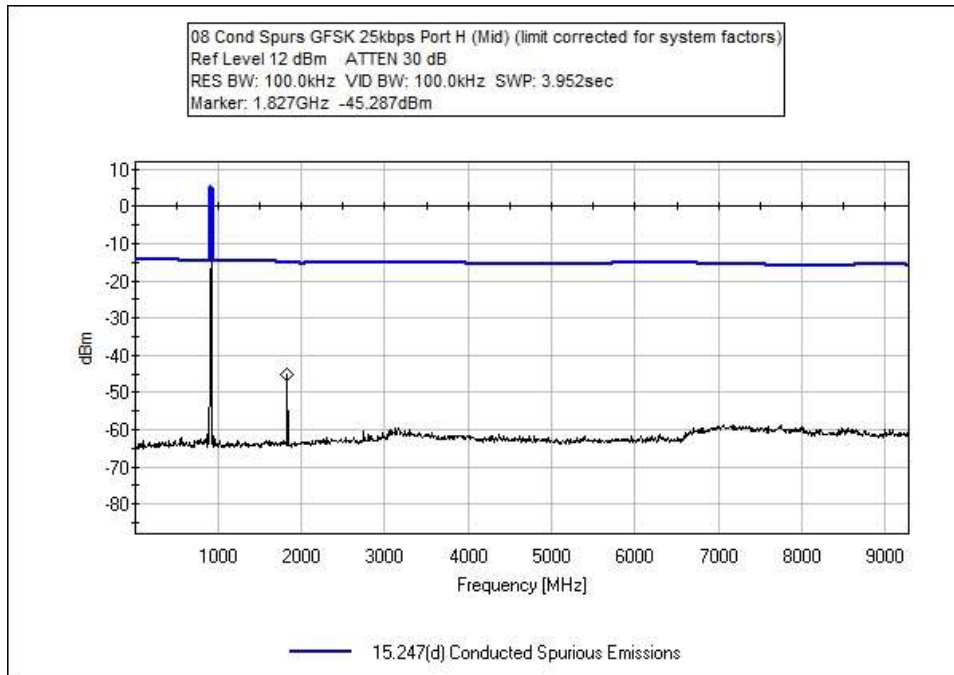
Frequency: 9kHz-9280MHz.

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 max power.  
 Measurements were performed with a fresh battery installed. L, M, H channels investigated.  
 25k and 50k data rates investigated.  
 H and V EUT ports investigated.

Worst case reported.

Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)





**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T2	ANP05748	Attenuator	PE7004-20	4/24/2018	4/24/2020
T3	ANP05959	Cable	Heliac	4/11/2018	4/11/2020

**Measurement Data:**

Reading listed by margin.

Test Lead: RF Port V

#	Freq MHz	Rdng dBm	T1 dB	T2 dB	T3 dB	Dist Table	Corr dBm	Spec dBm	Margin dB	Polar Ant
1	1855.500M	-40.2	+0.0	+20.0	+1.1	+0.0	-19.1	6.0	-25.1	RF Po
								25kbps GFSK		
2	1855.600M	-40.4	+0.0	+20.0	+1.1	+0.0	-19.3	6.0	-25.3	RF Po
								50kbps GFSK		
3	1830.000M	-40.9	+0.0	+20.0	+1.1	+0.0	-19.8	6.0	-25.8	RF Po
								50kbps GFSK		
4	1830.000M	-41.0	+0.0	+20.0	+1.1	+0.0	-19.9	6.0	-25.9	RF Po
								25kbps GFSK		
5	1804.400M	-41.4	+0.0	+20.0	+1.1	+0.0	-20.3	6.0	-26.3	RF Po
								25kbps GFSK		
6	1804.400M	-41.6	+0.0	+20.0	+1.1	+0.0	-20.5	6.0	-26.5	RF Po
								50kbps GFSK		
7	1855.600M	-42.5	+0.0	+20.0	+1.1	+0.0	-21.4	6.0	-27.4	RF Po
								50kbps GFSK		
8	1830.000M	-45.3	+0.0	+20.0	+1.1	+0.0	-24.2	6.0	-30.2	RF Po
								25kbps GFSK		
9	1855.500M	-45.3	+0.0	+20.0	+1.1	+0.0	-24.2	6.0	-30.2	RF Po
								25kbps GFSK		
10	1804.400M	-45.4	+0.0	+20.0	+1.1	+0.0	-24.3	6.0	-30.3	RF Po
								25kbps GFSK		
11	1804.400M	-45.6	+0.0	+20.0	+1.1	+0.0	-24.5	6.0	-30.5	RF Po
								50kbps GFSK		
12	1830.000M	-45.7	+0.0	+20.0	+1.1	+0.0	-24.6	6.0	-30.6	RF Po
								50kbps GFSK		

### Band Edge

#### Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.

Operating Mode: H port, Single Channel (Low and High)

Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	GFSK 25kbps	-23.0	<6.0	Pass
928	GFSK 25kbps	-24.5	<6.0	Pass

#### Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.

Operating Mode: H Port, Single Channel (Low and High)

Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	GFSK 50kbps	-22.6	<6.0	Pass
928	GFSK 50kbps	-30.8	<6.0	Pass

#### Band Edge Summary

Limit applied: Max Power/100kHz - 20dB. (Using Marker Delta Method)

Operating Mode: H port, Hopping

Freq (MHz)	Modulation	100kHz Band Edge Measurement (dBm)	100kHz Fundamental Measurement (dBm)	30kHz Band Edge Measurement (dBm)	30kHz Fundamental Measurement (dBm)	Band Edge Limit (30kHz) (dBm)	Results
902	Hopping GFSK 25k	7.7	25.4	<b><u>-3.5</u></b>	25.4	<6.0	Pass
928	Hopping GFSK 25k	5.0	25.6	<b><u>-6.0</u></b>	25.6	<6.0	Pass
902	Hopping GFSK 50k	8.3	25.4	<b><u>-2.8</u></b>	25.4	<6.0	Pass
928	Hopping GFSK 50k	6.8	25.5	<b><u>-4.5</u></b>	25.6	<6.0	Pass

Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement, underlined and bold in the table above.

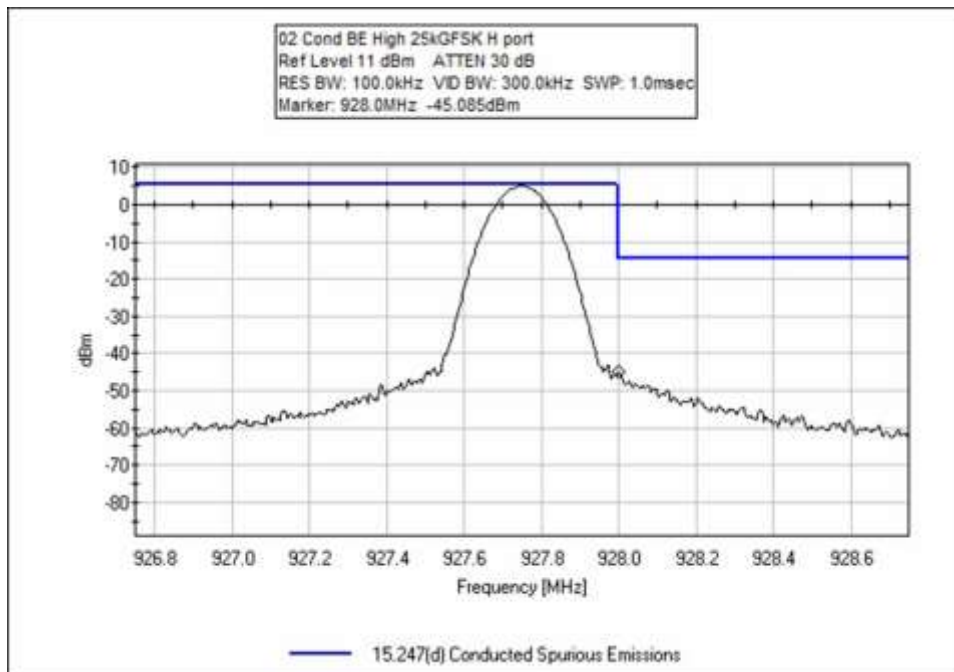
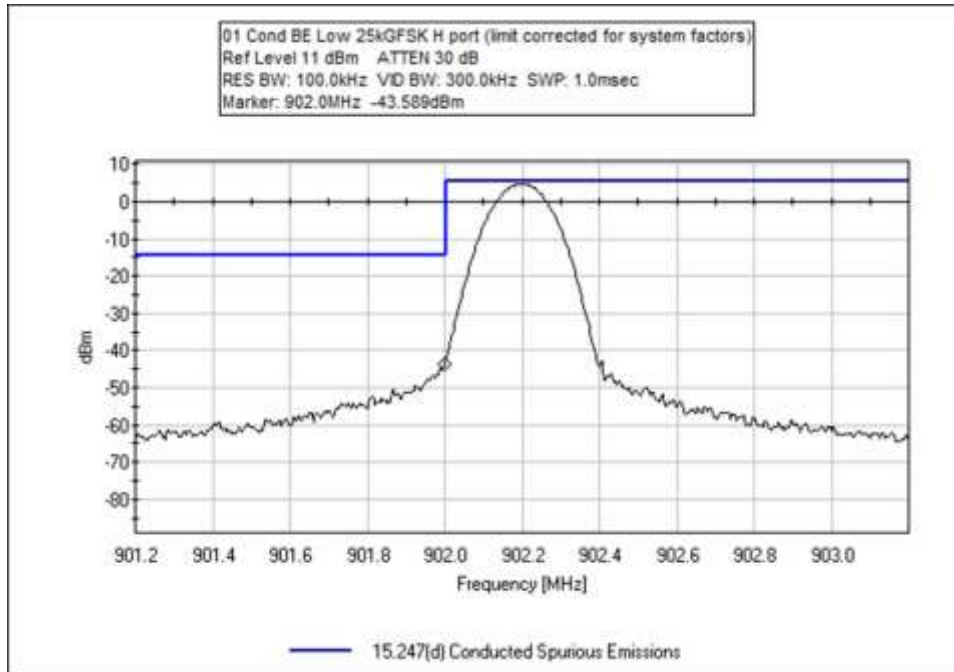
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Operating Mode: V port, Single Channel (Low and High)				
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	GFSK 25kbps	-22.6	<6.0	Pass
928	GFSK 25kbps	-26.6	<6.0	Pass

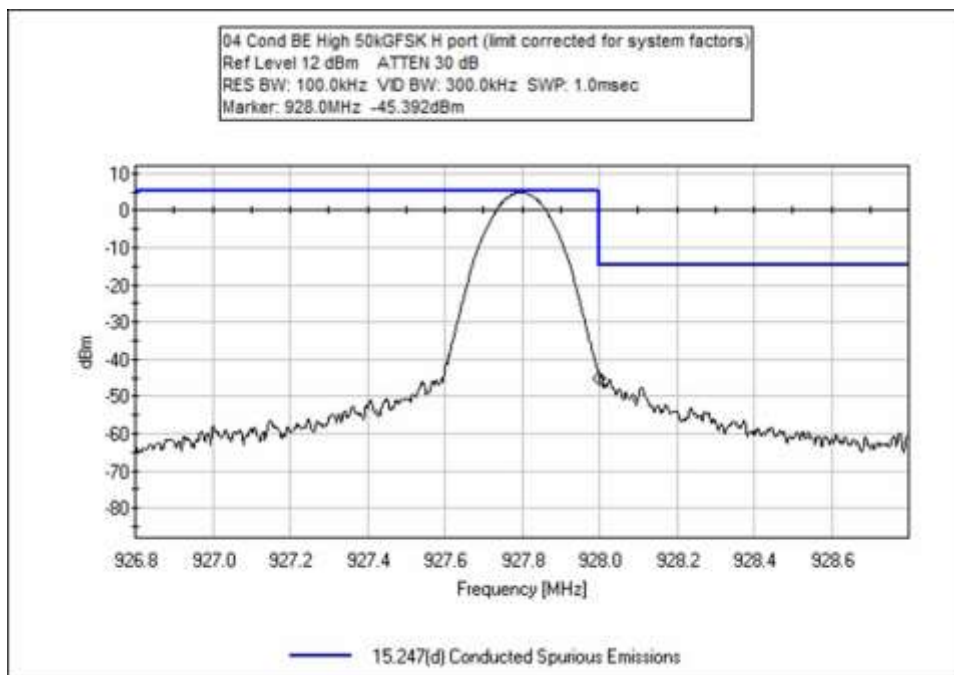
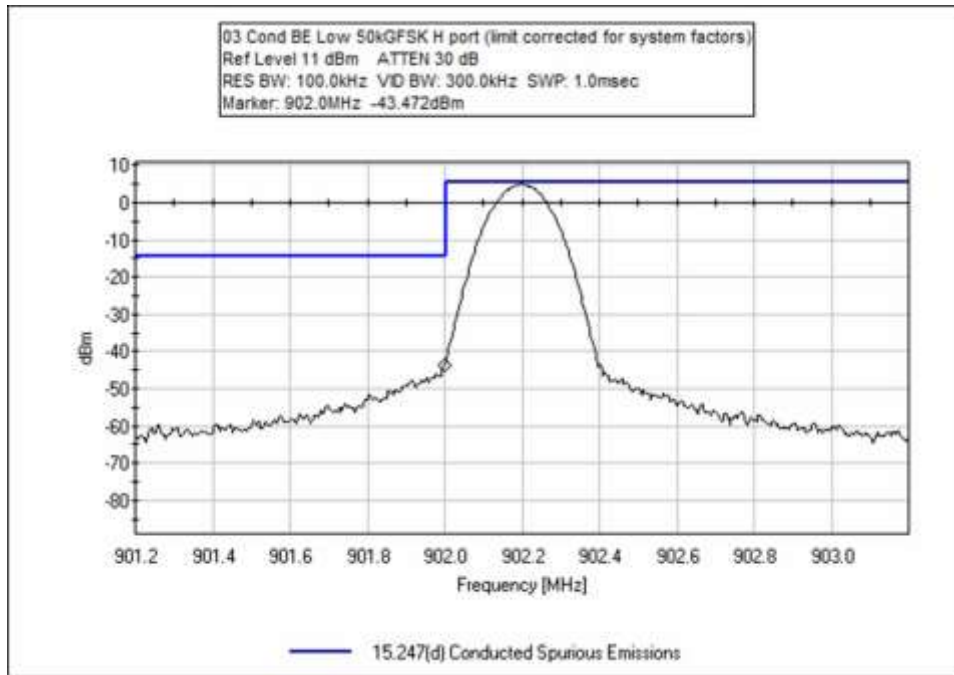
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Operating Mode: V Port, Single Channel (Low and High)				
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	GFSK 50kbps	-21.0	<6.0	Pass
928	GFSK 50kbps	-23.3	<6.0	Pass

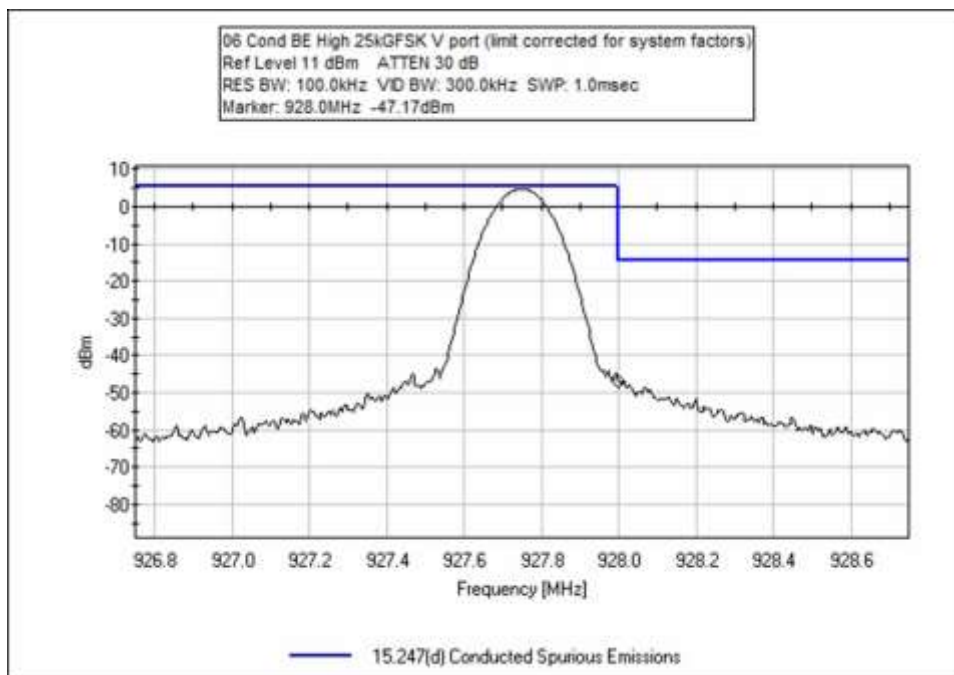
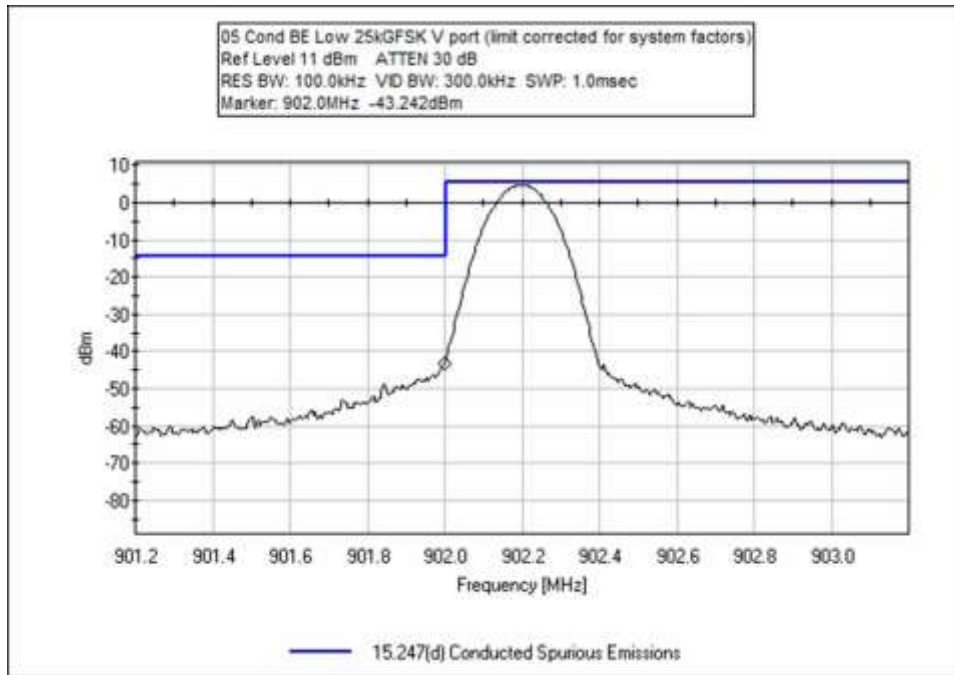
Band Edge Summary							
Limit applied: Max Power/100kHz - 20dB. (Using Marker Delta Method)							
Operating Mode: V port, Hopping							
Freq (MHz)	Modulation	100kHz Band Edge Measurement (dBm)	100kHz Fundamental Measurement (dBm)	30kHz Band Edge Measurement (dBm)	30kHz Fundamental Measurement (dBm)	Band Edge Limit (30kHz) (dBm)	Results
902	Hopping GFSK 25k	7.6	25.4	<b><u>-3.5</u></b>	25.4	<6.0	Pass
928	Hopping GFSK 25k	4.6	25.5	<b><u>-6.0</u></b>	25.5	<6.0	Pass
902	Hopping GFSK 50k	8.5	25.4	<b><u>-2.8</u></b>	25.4	<6.0	Pass
928	Hopping GFSK 50k	6.5	25.5	<b><u>-4.5</u></b>	25.5	<6.0	Pass

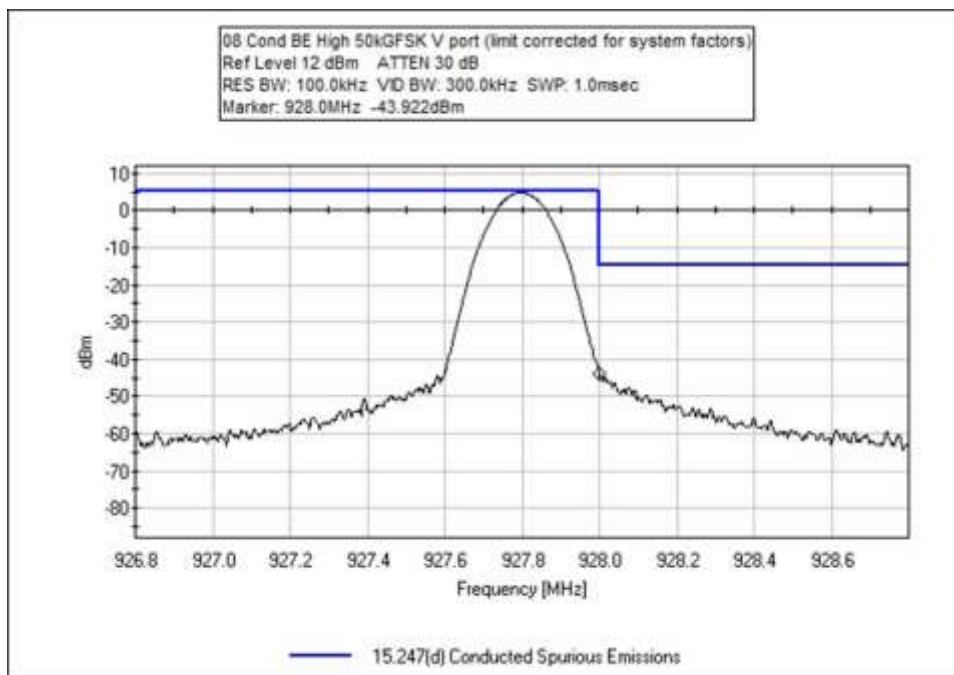
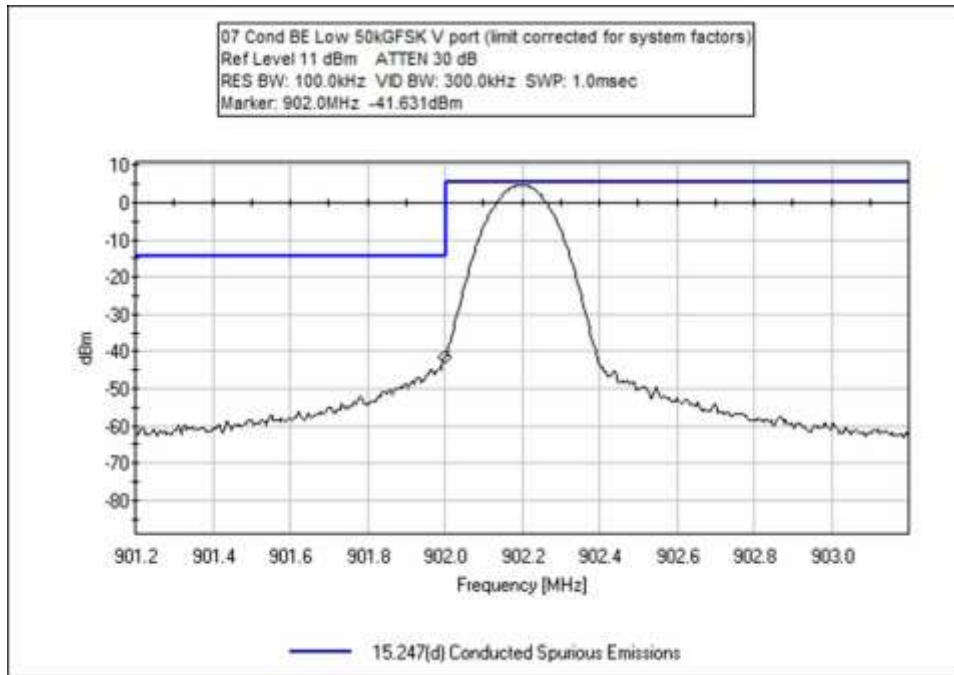
Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement, underlined and bold in the table above.

## Band Edge Plots



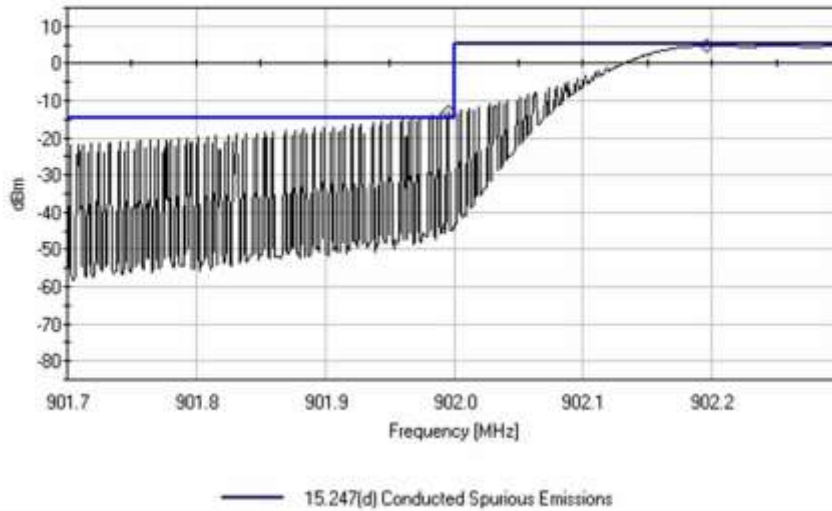




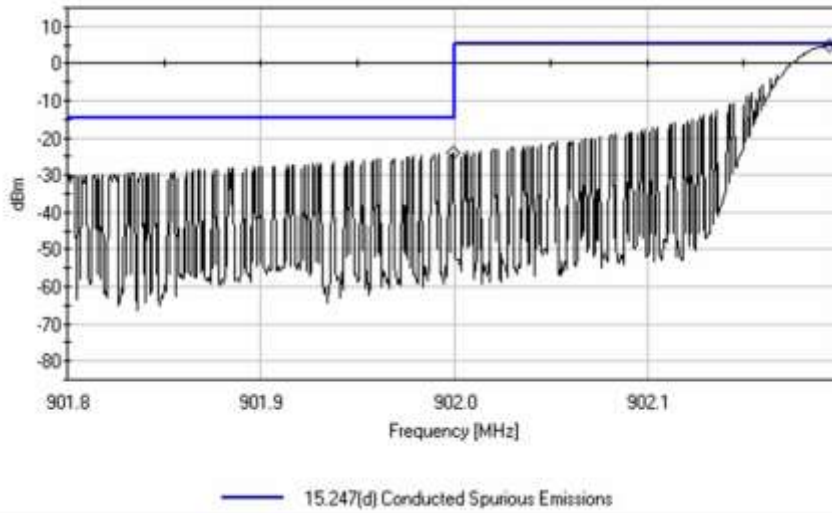


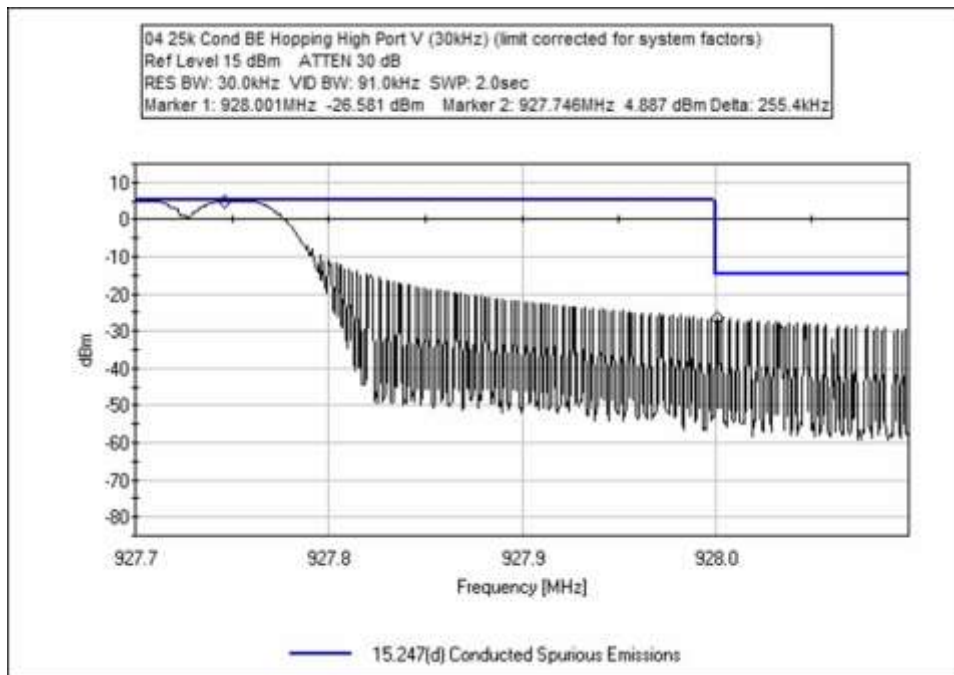
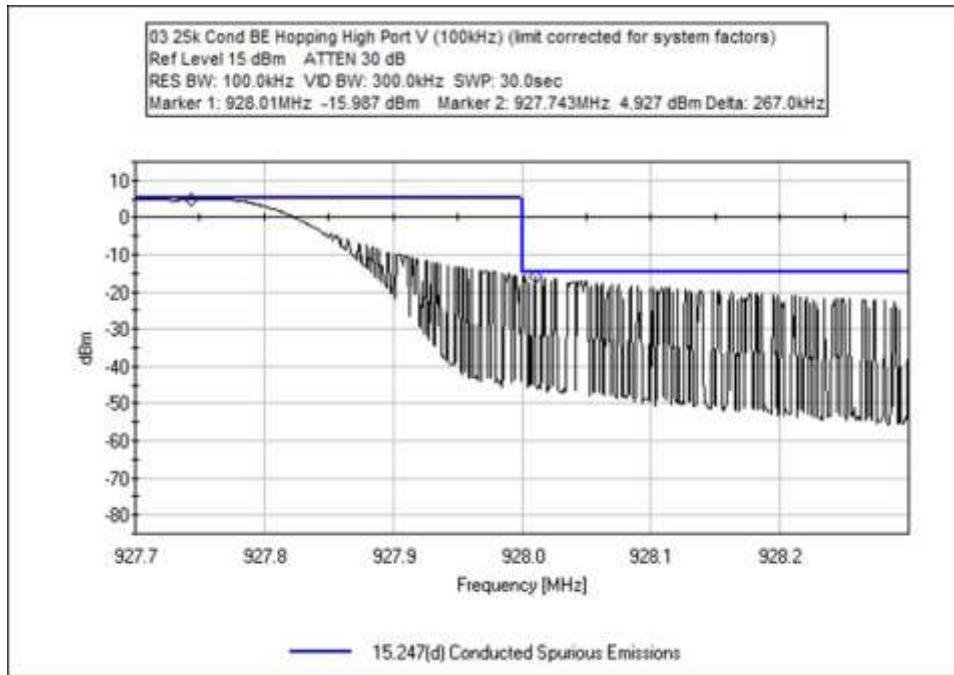


01 25k Cond BE Hopping Low Port V (100kHz) (limit corrected for system factors) See other plots for 30kHz Marker Delta  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec  
 Marker 1: 901.996MHz -13.052 dBm Marker 2: 902.196MHz 4.768 dBm Delta: 200.0kHz

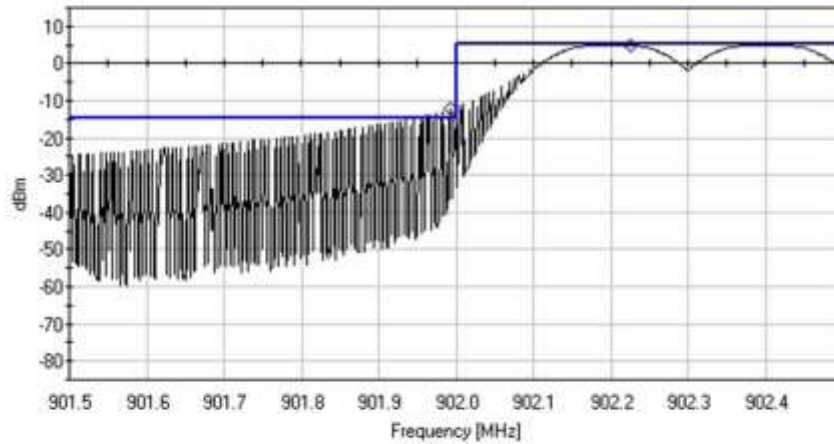


02 25k Cond BE Hopping Low Port V (30kHz) (limit corrected for system factors)  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 30.0kHz VID BW: 91.0kHz SWP: 43.855sec  
 Marker 1: 901.999MHz -24.137 dBm Marker 2: 902.194MHz 4.768 dBm Delta: 194.7kHz



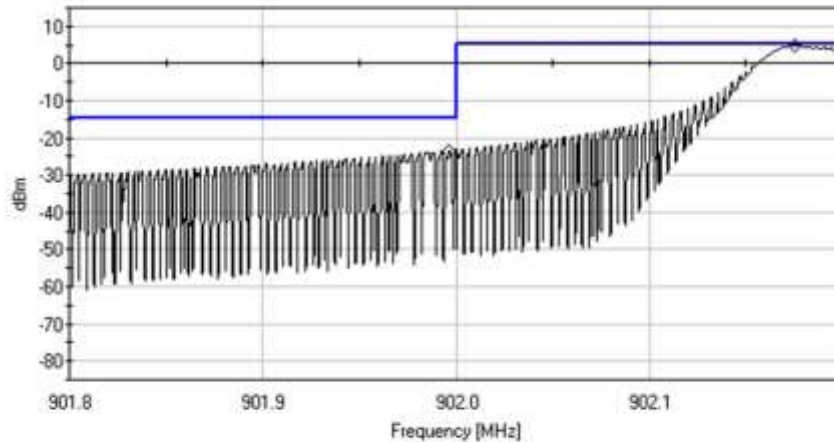


05 50k Cond BE Hopping Low Port V (100kHz) (limit corrected for system factors) See other plots for 30kHz Marker Delta  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec  
 Marker 1: 901.993MHz -12.104 dBm Marker 2: 902.226MHz 4.779 dBm Delta: 233.1kHz

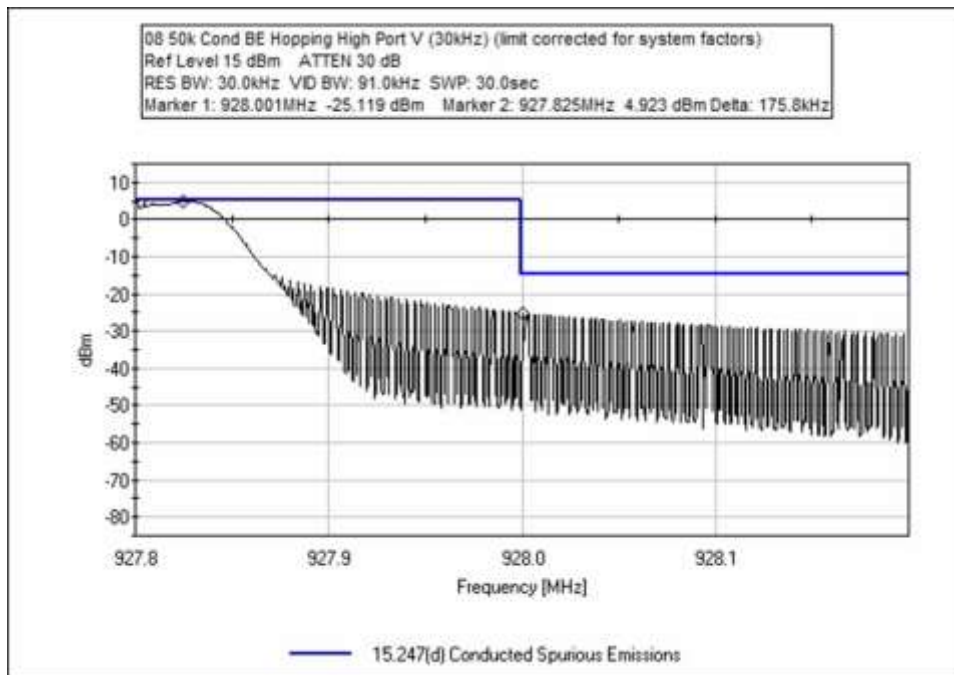
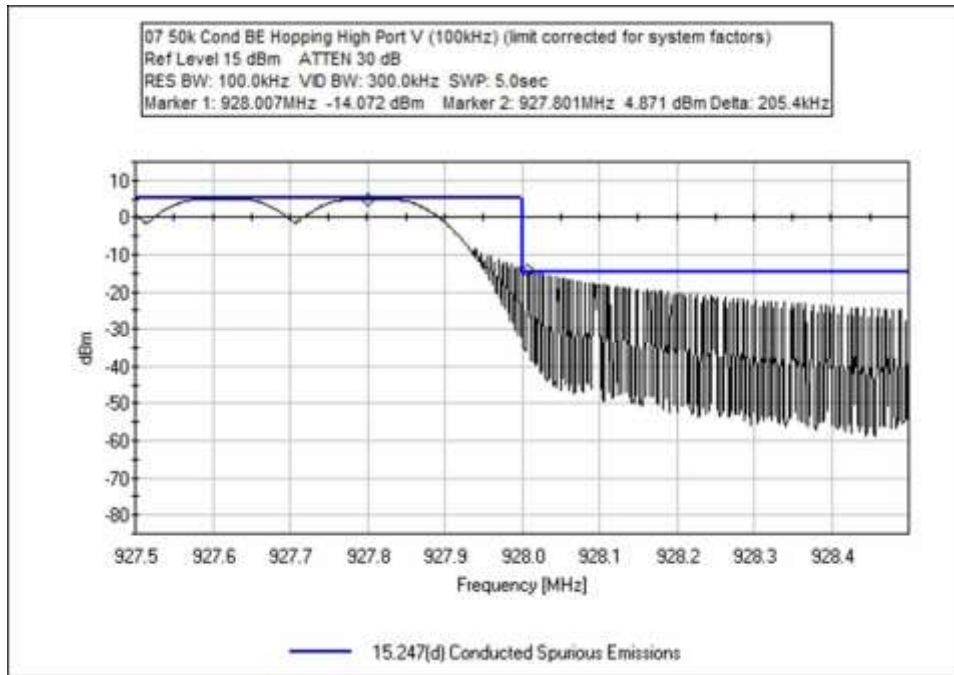


15.247(d) Conducted Spurious Emissions

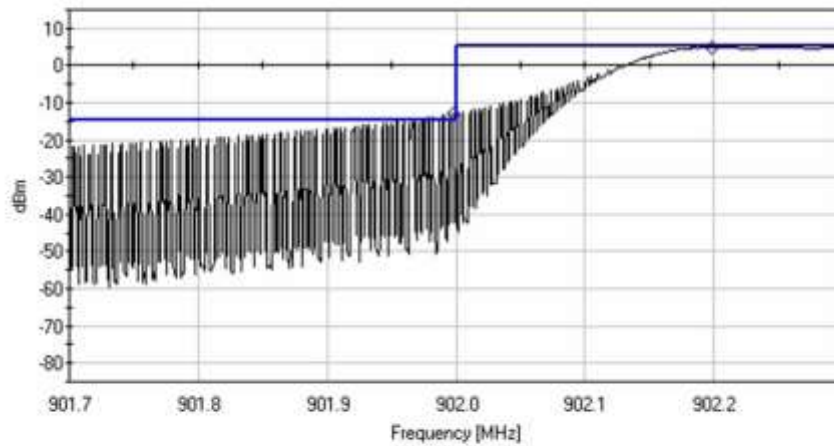
06 50k Cond BE Hopping Low Port V (30kHz) (limit corrected for system factors)  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec  
 Marker 1: 901.996MHz -23.404 dBm Marker 2: 902.175MHz 4.772 dBm Delta: 179.4kHz



15.247(d) Conducted Spurious Emissions

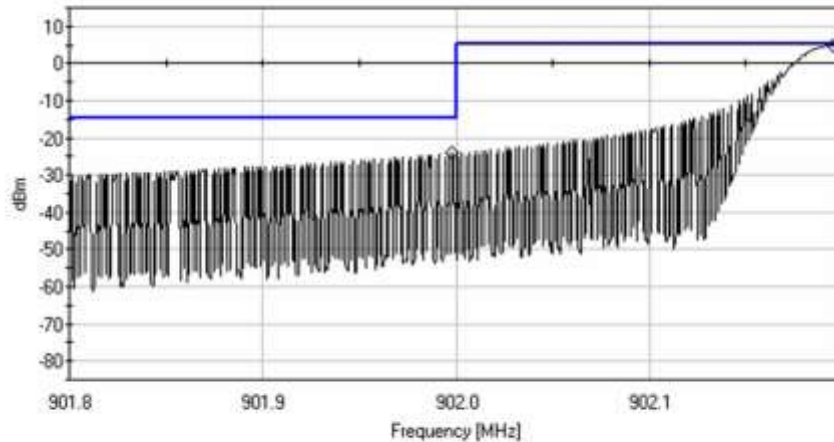


09 25k Cond BE Hopping Low Port H (100kHz) (limit corrected for system factors) See other plots for 30kHz Marker Delta  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec  
 Marker 1: 901.998MHz -12.872 dBm Marker 2: 902.199MHz 4.821 dBm Delta: 201.0kHz

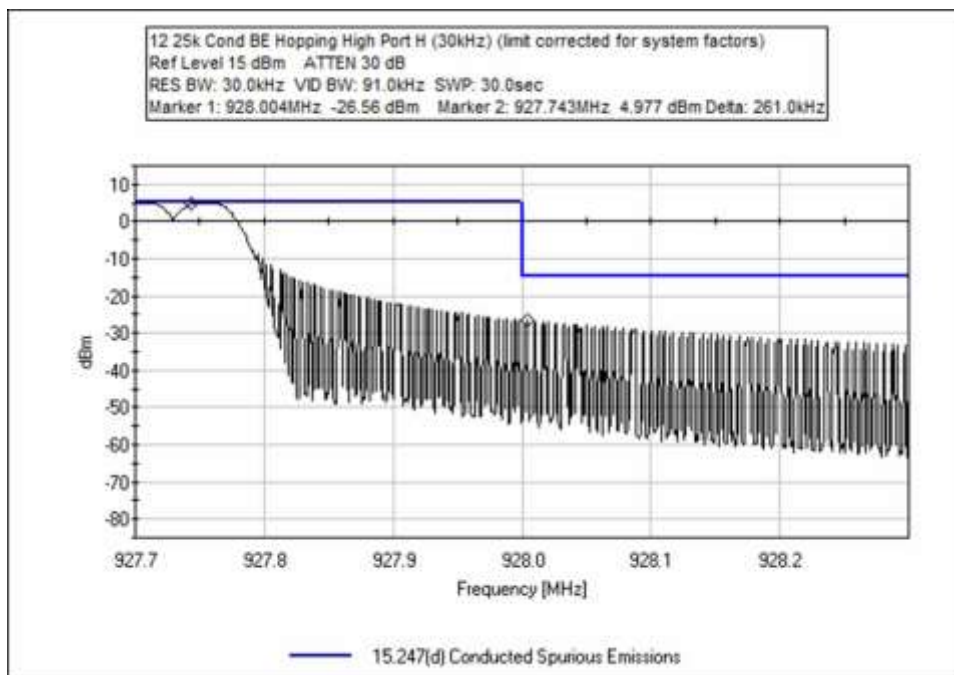
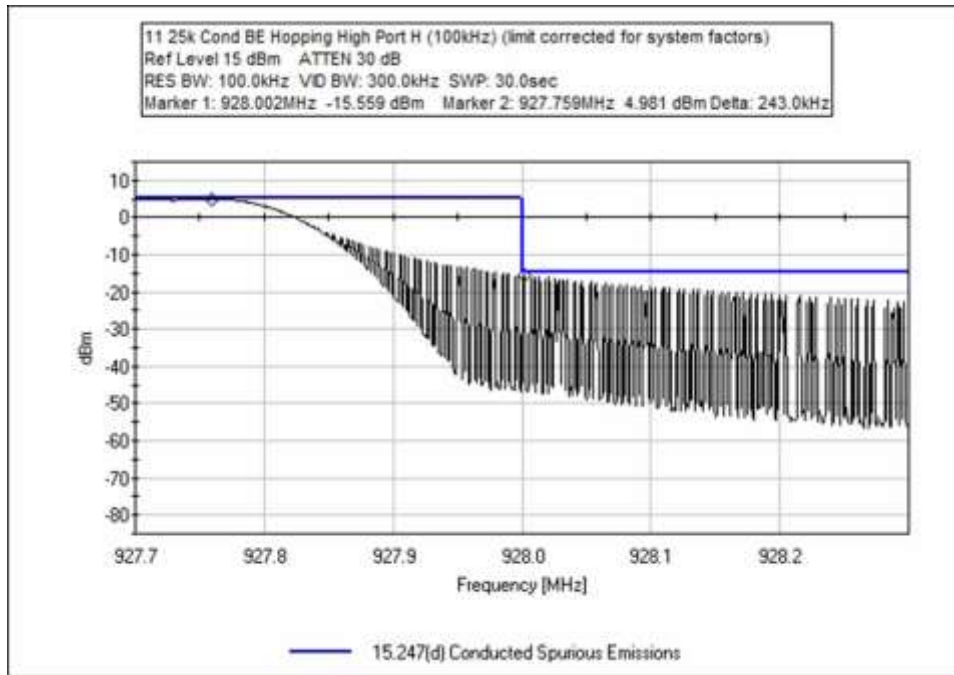


15.247(d) Conducted Spurious Emissions

10 25k Cond BE Hopping Low Port H (30kHz) (limit corrected for system factors)  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec  
 Marker 1: 901.998MHz -24.103 dBm Marker 2: 902.195MHz 4.817 dBm Delta: 196.7kHz

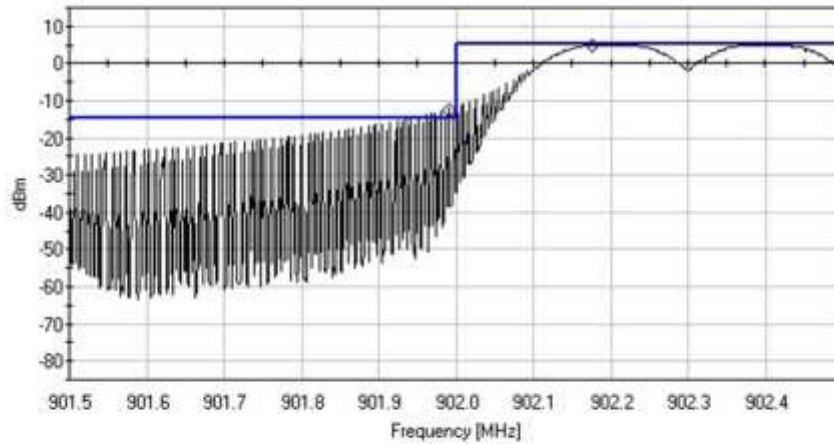


15.247(d) Conducted Spurious Emissions



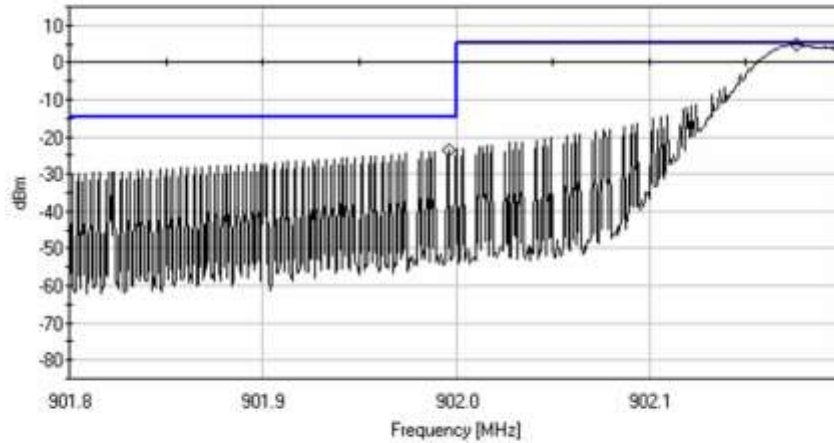


13 50k Cond BE Hopping Low Port H (100kHz) (limit corrected for system factors) See other plots for 30kHz Marker Delta  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 100.0kHz VID BW: 300.0kHz SWP: 30.0sec  
 Marker 1: 901.99MHz -12.334 dBm Marker 2: 902.176MHz 4.826 dBm Delta: 186.4kHz

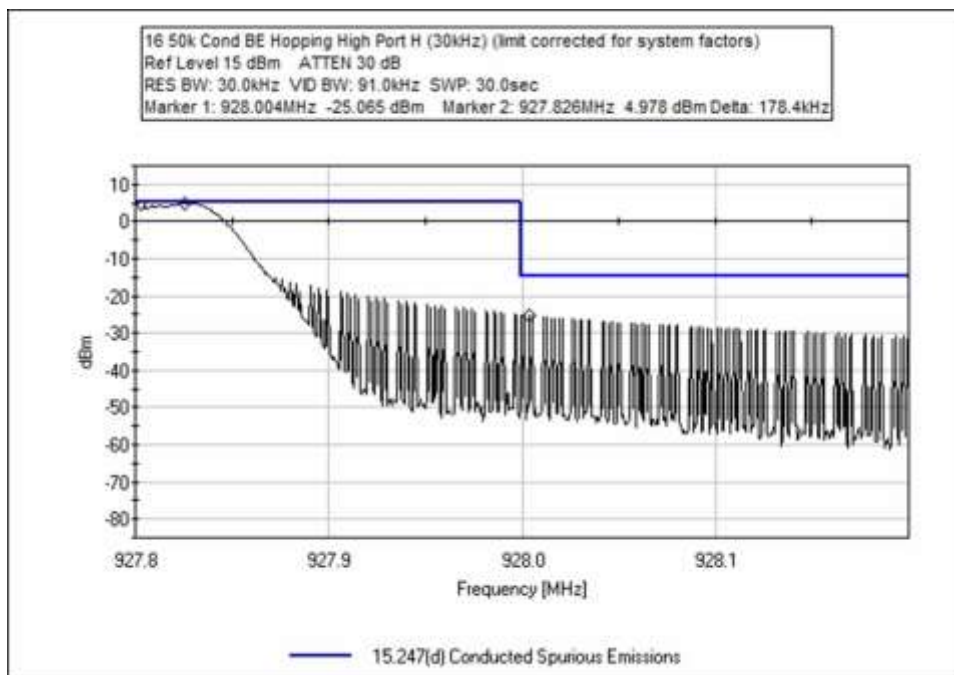
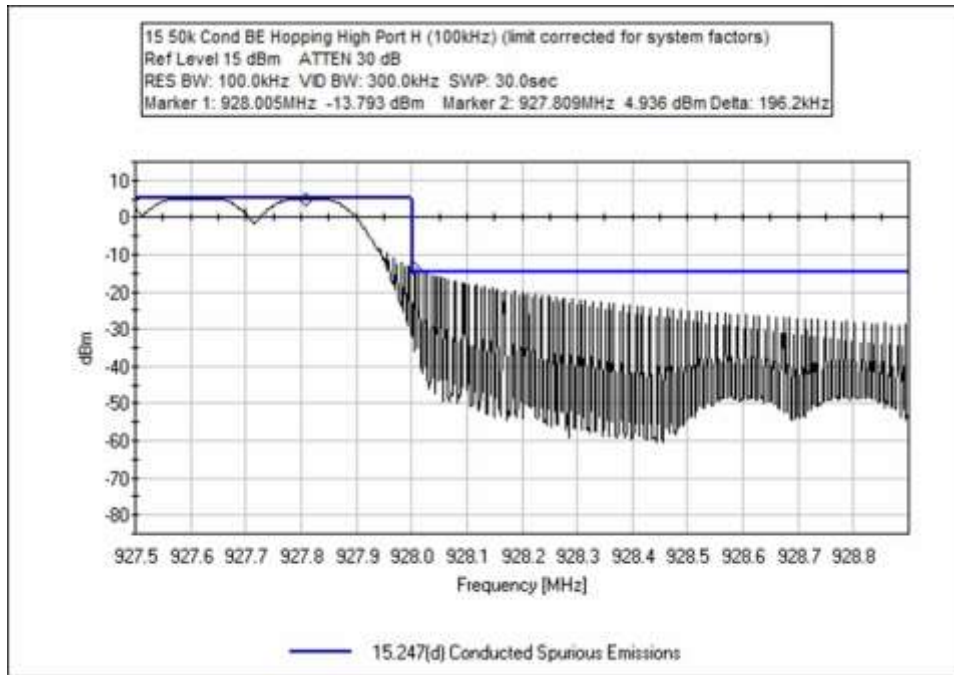


15.247(d) Conducted Spurious Emissions

14 50k Cond BE Hopping Low Port H (30kHz) (limit corrected for system factors)  
 Ref Level 15 dBm ATTN 30 dB  
 RES BW: 30.0kHz VID BW: 91.0kHz SWP: 30.0sec  
 Marker 1: 901.997MHz -23.414 dBm Marker 2: 902.176MHz 4.814 dBm Delta: 179.4kHz



15.247(d) Conducted Spurious Emissions





**Test Setup / Conditions / Data**

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **103184** Date: 10/16/2019  
 Test Type: **Conducted Emissions** Time: 15:33:12  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.12 Battery

***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 connected to the spectrum analyzer using a coaxial cable and attenuator.  
 The EUT is transmitting at max power..  
 Measurements were performed with a fresh battery installed. L and H channels investigated.  
 25k and 50k data rates investigated.  
 H and V EUT ports investigated. Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T2	ANP05748	Attenuator	PE7004-20	4/24/2018	4/24/2020
T3	ANP05959	Cable	Heliac	4/11/2018	4/11/2020

**Measurement Data:**

Reading listed by margin.

Test Lead: RF Port V + H

#	Freq MHz	Rdng dBm	T1 dB	T2 dB	T3 dB	Dist dB	Table	Corr dBm	Spec dBm	Margin dB	Polar Ant
1	902.000M	-41.6	+0.0	+20.0	+0.6	+0.0		-21.0	6.0 50k GFSK	-27.0	RF Po
2	902.000M	-43.2	+0.0	+20.0	+0.6	+0.0		-22.6	6.0 50k GFSK	-28.6	RF Po
3	902.000M	-43.2	+0.0	+20.0	+0.6	+0.0		-22.6	6.0 25k GFSK	-28.6	RF Po
4	902.000M	-43.6	+0.0	+20.0	+0.6	+0.0		-23.0	6.0 25k GFSK	-29.0	RF Po
5	928.000M	-43.9	+0.0	+20.0	+0.6	+0.0		-23.3	6.0 50k GFSK	-29.3	RF Po
6	928.000M	-45.1	+0.0	+20.0	+0.6	+0.0		-24.5	6.0 25k GFSK	-30.5	RF Po
7	928.000M	-45.4	+0.0	+20.0	+0.6	+0.0		-24.8	6.0 50k GFSK	-30.8	RF Po
8	928.000M	-47.2	+0.0	+20.0	+0.6	+0.0		-26.6	6.0 25k GFSK	-32.6	RF Po



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **103184** Date: 10/24/2019  
 Test Type: **Conducted Emissions** Time: 19:31:36  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.12 Battery

***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 transmitter through the selected internal antenna.  
 The EUT is transmitting at max power.  
 Measurements were performed with a fresh battery installed. Hopping mode investigated.  
 25k and 50k data rates investigated.  
  
 Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T1	ANP05748	Attenuator	PE7004-20	4/24/2018	4/24/2020
T2	ANP05959	Cable	Heliac	4/11/2018	4/11/2020

**Measurement Data:**

Reading listed by margin.

Test Lead: RF Port H

#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB		Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	927.759M	5.0	+20.0	+0.6		+0.0	25.6	26.0 25k High	-0.4	RF Po
2	927.826M	5.0	+20.0	+0.6		+0.0	25.6	26.0 50k High	-0.4	RF Po
3	927.743M	5.0	+20.0	+0.6		+0.0	25.6	26.0 25k High	-0.4	RF Po
4	927.809M	4.9	+20.0	+0.6		+0.0	25.5	26.0 50k High	-0.5	RF Po
5	902.176M	4.8	+20.0	+0.6		+0.0	25.4	26.0 50k Low	-0.6	RF Po
6	902.199M	4.8	+20.0	+0.6		+0.0	25.4	26.0 25k Low	-0.6	RF Po
7	902.195M	4.8	+20.0	+0.6		+0.0	25.4	26.0 25k Low	-0.6	RF Po
8	902.176M	4.8	+20.0	+0.6		+0.0	25.4	26.0 50k Low	-0.6	RF Po
9	901.997M	-23.4	+20.0	+0.6		+0.0	-2.8	6.0 50k Low	-8.8	RF Po
10	901.998M	-24.1	+20.0	+0.6		+0.0	-3.5	6.0 25k Low	-9.5	RF Po
11	928.004M	-25.1	+20.0	+0.6		+0.0	-4.5	6.0 50k High	-10.5	RF Po
12	928.004M	-26.6	+20.0	+0.6		+0.0	-6.0	6.0 25k High	-12.0	RF Po



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) Conducted Spurious Emissions**  
 Work Order #: **103184** Date: 10/24/2019  
 Test Type: **Conducted Emissions** Time: 18:44:50  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.12 Battery

***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 transmitter through the selected internal antenna.  
 The EUT is transmitting at max power.  
 Measurements were performed with a fresh battery installed. Hopping mode investigated.  
 25k and 50k data rates investigated.  
  
 Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02872	Spectrum Analyzer	E4440A	11/3/2017	11/3/2019
T2	ANP05748	Attenuator	PE7004-20	4/24/2018	4/24/2020
T3	ANP05959	Cable	Heliac	4/11/2018	4/11/2020

**Measurement Data:**

Reading listed by margin.

Test Lead: RF Port V

#	Freq MHz	Rdng dB $\mu$ V	T1 dB	T2 dB	T3 dB	Dist Table	Corr dB $\mu$ V	Spec dB $\mu$ V	Margin dB	Polar Ant
1	927.746M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	26.0 25k High	-0.5	RF Po
2	927.743M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	26.0 25k High	-0.5	RF Po
3	927.801M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	26.0 50k High	-0.5	RF Po
4	927.825M	4.9	+0.0	+20.0	+0.6	+0.0	25.5	26.0 50k High	-0.5	RF Po
5	902.196M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	26.0 25k Low	-0.6	RF Po
6	902.194M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	26.0 25k Low	-0.6	RF Po
7	902.226M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	26.0 50k Low	-0.6	RF Po
8	902.175M	4.8	+0.0	+20.0	+0.6	+0.0	25.4	26.0 50k Low	-0.6	RF Po
9	901.996M	-23.4	+0.0	+20.0	+0.6	+0.0	-2.8	6.0 50k Low	-8.8	RF Po
10	901.999M	-24.1	+0.0	+20.0	+0.6	+0.0	-3.5	6.0 25k Low	-9.5	RF Po
11	928.001M	-25.1	+0.0	+20.0	+0.6	+0.0	-4.5	6.0 50k High	-10.5	RF Po
12	928.001M	-26.6	+0.0	+20.0	+0.6	+0.0	-6.0	6.0 25k High	-12.0	RF Po

Test Setup Photo(s)



Port V



Port H

## 15.247(d) Radiated Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.209 Radiated Emissions**  
 Work Order #: **103183** Date: 10/23/2019  
 Test Type: **Maximized Emissions** Time: 09:21:26  
 Tested By: Michael Atkinson Sequence#: 3  
 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:

Frequency Range: 9kHz-30MHz  
  
 Test Mode: Continuously transmitting  
  
 Test Setup: EUT is continuously transmitting through integral antenna.  
 Low, Mid, High channels investigated, worst case reported.  
 25kbps and 50kbps modulations investigated, worst case reported.  
 X, Y, Z EUT axes investigated, worst case reported.  
 3 orthogonal antenna orientations investigated below 30MHz, worst case reported.  
**H and V EUT antenna ports investigated**, worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)







Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.209 Radiated Emissions**  
 Work Order #: **103183** Date: 10/25/2019  
 Test Type: **Maximized Emissions** Time: 16:45:38  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.12

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

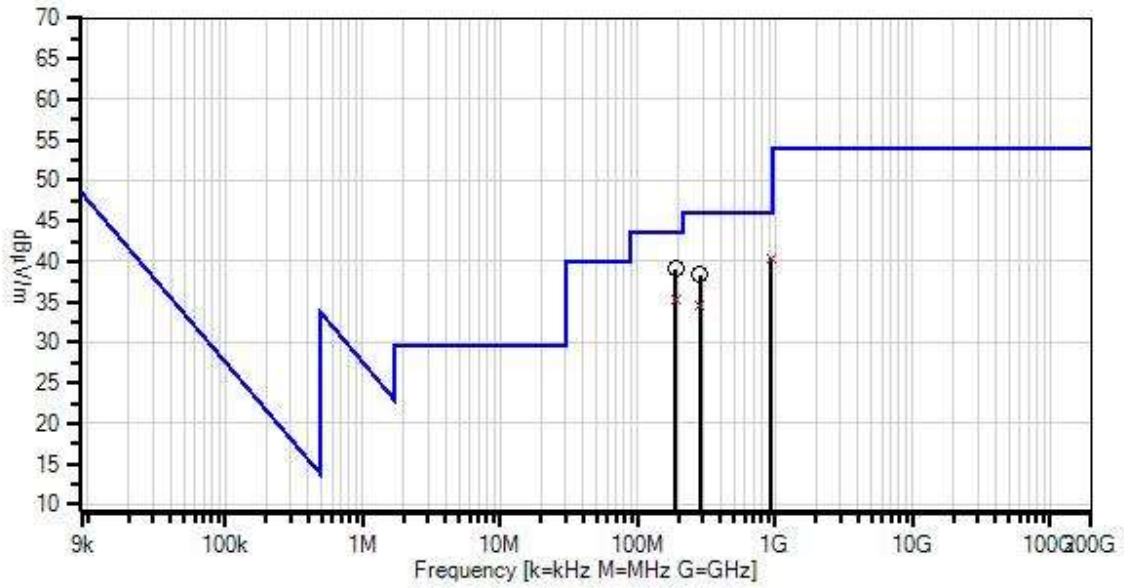
***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Frequency Range: 30-1000MHz  
 Test Mode: Continuously transmitting, **Port H**  
 Test Setup: EUT is continuously transmitting through integral antenna.  
 25 and 50kbps data rate investigated.  
 Low, Mid, High channels as well as hopping mode investigated, worst case reported.  
 X, Y, Z EUT axes investigated, worst case reported.  
 Horizontal and Vertical measurement antenna polarities investigated, worst case reported.  
 Test Location: Bothell Lab Bench Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

Itron, Inc. W/O#: 103183 Sequence#: 4 Date: 10/25/2019  
 15.209 Radiated Emissions Test Distance: 3 Meters Vert



— Readings  
 \* Average Readings  
 — 1 - 15.209 Radiated Emissions  
 ○ Peak Readings  
 ▼ Ambient  
 × QP Readings  
 Software Version: 5.03.12

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T2	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T3	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
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	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V/m	dB $\mu$ V/m	dB	Ant
1	188.100M	21.7	+0.0 +5.8	+0.2 +9.9	+0.7	+0.8	+0.0	39.1	43.5	-4.4	Horiz
2	939.900M QP	6.4	+0.0 +5.8	+0.4 +24.3	+1.5	+2.0	+0.0	40.4	46.0	-5.6	Vert
^	939.900M	23.5	+0.0 +5.8	+0.4 +24.3	+1.5	+2.0	+0.0	57.5	46.0	+11.5	Vert
4	283.200M	17.8	+0.0 +5.8	+0.2 +12.8	+0.8	+1.0	+0.0	38.4	46.0	-7.6	Horiz
5	187.866M QP	18.0	+0.0 +5.8	+0.2 +9.9	+0.7	+0.8	+0.0	35.4	43.5	-8.1	Horiz
6	282.977M QP	14.0	+0.0 +5.8	+0.2 +12.8	+0.8	+1.0	+0.0	34.6	46.0	-11.4	Horiz



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.209 Radiated Emissions**  
 Work Order #: **103183** Date: 10/25/2019  
 Test Type: **Maximized Emissions** Time: 16:41:21  
 Tested By: Michael Atkinson Sequence#: 3  
 Software: EMITest 5.03.12

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

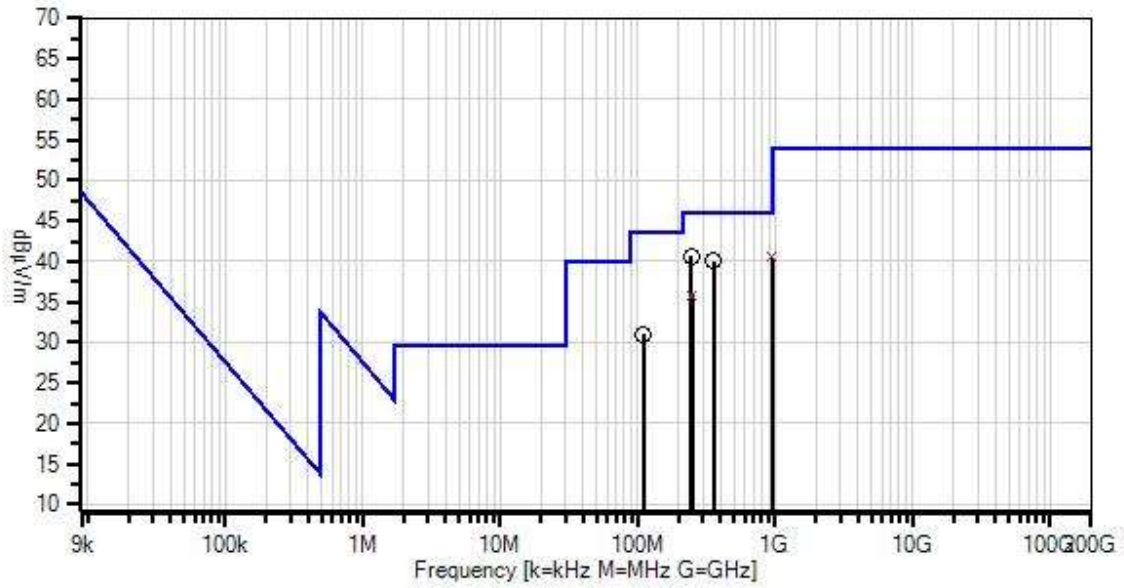
***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Frequency Range: 30-1000MHz  
 Test Mode: Continuously transmitting, **Port V**  
 Test Setup: EUT is continuously transmitting through integral antenna.  
 25 and 50kbps data rate investigated.  
 Low, Mid, High channels as well as hopping mode investigated, worst case reported.  
 X, Y, Z EUT axes investigated, worst case reported.  
 Horizontal and Vertical measurement antenna polarities investigated, worst case reported.  
 Test Location: Bothell Lab Bench Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

Itron, Inc. WO#: 103183 Sequence#: 3 Date: 10/25/2019  
 15.209 Radiated Emissions Test Distance: 3 Meters Horiz



— Readings  
 \* Average Readings  
 — 1 - 15.209 Radiated Emissions  
 ○ Peak Readings  
 ▼ Ambient  
 × QP Readings  
 Software Version: 5.03.12

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T2	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T3	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
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 MHz	Rdng dB $\mu$ V	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	247.300M	20.8	+0.0 +5.8	+0.2 +12.1	+0.8	+0.9	+0.0	40.6	46.0	-5.4	Horiz
2	950.500M QP	6.3	+0.0 +5.8	+0.4 +24.5	+1.5	+2.0	+0.0	40.5	46.0	-5.5	Vert
^	950.500M	22.0	+0.0 +5.8	+0.4 +24.5	+1.5	+2.0	+0.0	56.2	46.0	+10.2	Vert
4	357.900M	16.2	+0.0 +5.8	+0.2 +15.8	+0.9	+1.1	+0.0	40.0	46.0	-6.0	Vert
5	247.632M QP	16.0	+0.0 +5.8	+0.2 +12.1	+0.8	+0.9	+0.0	35.8	46.0	-10.2	Horiz
6	109.500M	15.9	+0.0 +5.8	+0.1 +8.1	+0.5	+0.6	+0.0	31.0	43.5	-12.5	Vert



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103183** Date: 10/20/2019  
 Test Type: **Maximized Emissions** Time: 10:11:54  
 Tested By: Michael Atkinson Sequence#: 5  
 Software: EMITest 5.03.12

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Support Equipment:***

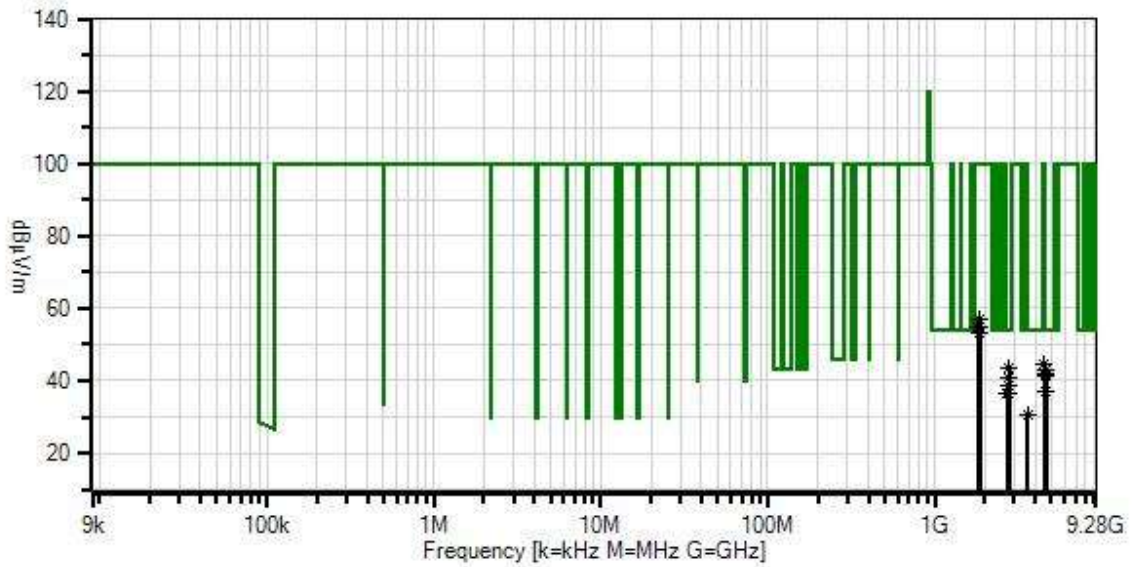
Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Frequency Range: 1-10GHz  
 Test Mode: Continuously transmitting, Port H  
 Test Setup: EUT is continuously transmitting through integral antenna, **EUT H port investigated.**  
 25kbps and 50kbps data rate investigated.  
 Low, Mid, High channels as well as hopping mode investigated, worst case reported.  
 X, Y, Z EUT axes investigated, worst case reported.  
 Horizontal and Vertical measurement antenna polarities investigated, worst case reported.  
 Test Location: Bothell Lab Bench Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)



Itron, Inc. W/O#: 103183 Sequence#: 5 Date: 10/20/2019  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



- Readings
  - × QP Readings
  - ▼ Ambient
  - 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
  - Peak Readings
  - \* Average Readings
- Software Version: 5.03.12

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T2	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T3	AN03170	High Pass Filter	HM1155-11SS	11/27/2017	11/27/2019
T4	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T6	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020
T7	ANP06515	Cable	Heliac	6/29/2018	6/29/2020

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	Reading listed by margin.			T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
			T1 dB	T2 dB	T3 dB						
1	4511.085M Ave	39.4	+0.0 +31.8	+0.9 +1.5	+0.8 +3.9	-33.7	+0.0	44.6	54.0 Y	-9.4	Horiz
2	2783.320M Ave	44.3	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	43.7	54.0 X	-10.3	Horiz
^	2783.320M	51.7	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	51.1	54.0 X	-2.9	Horiz
4	4575.020M Ave	37.6	+0.0 +31.9	+0.9 +1.5	+0.8 +4.0	-33.7	+0.0	43.0	54.0 Y	-11.0	Horiz
^	4575.020M	47.9	+0.0 +31.9	+0.9 +1.5	+0.8 +4.0	-33.7	+0.0	53.3	54.0 Y	-0.7	Horiz
6	4638.740M Ave	36.2	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	41.9	54.0 Y	-12.1	Horiz
^	4638.750M	48.1	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	53.8	54.0 Y	-0.2	Horiz
8	4637.980M Ave	35.6	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	41.3	54.0 Y, 50k GFSK	-12.7	Horiz
^	4637.980M	46.6	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	52.3	54.0 Y, 50k GFSK	-1.7	Horiz
10	2783.420M Ave	41.4	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	40.8	54.0 X, 50k GFSK	-13.2	Horiz
^	2783.400M	50.3	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	49.7	54.0 X, 50k GFSK	-4.3	Horiz
12	2744.980M Ave	39.3	+0.0 +28.4	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	38.6	54.0 X	-15.4	Horiz
^	2745.010M	49.0	+0.0 +28.4	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	48.3	54.0 X	-5.7	Horiz
14	4639.090M Ave	31.5	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	37.2	54.0 Y, 50k GFSK	-16.8	Horiz
^	4639.020M	41.8	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	47.5	54.0 Y, 50k GFSK	-6.5	Horiz
16	2706.520M Ave	37.5	+0.0 +28.3	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	36.7	54.0 X	-17.3	Horiz
^	2706.520M	48.5	+0.0 +28.3	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	47.7	54.0 X	-6.3	Horiz

18	2782.830M Ave	37.2	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	36.6	54.0 X, 50k GFSK	-17.4	Horiz
^	2782.830M	47.4	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	46.8	54.0 X, 50k GFSK	-7.2	Horiz
20	3608.720M Ave	27.8	+0.0 +30.3	+0.8 +1.3	+0.8 +3.6	-33.8	+0.0	30.8	54.0 X	-23.2	Horiz
^	3608.720M	41.4	+0.0 +30.3	+0.8 +1.3	+0.8 +3.6	-33.8	+0.0	44.4	54.0 X	-9.6	Horiz
22	1855.500M Ave	61.1	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	57.2	100.0 X	-42.8	Horiz
^	1855.490M	69.7	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	65.8	100.0 X	-34.2	Horiz
24	1855.180M Ave	59.0	+0.0 +26.5	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	55.0	100.0 X, 50k GFSK	-45.0	Horiz
^	1855.090M	67.8	+0.0 +26.5	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	63.8	100.0 X, 50k GFSK	-36.2	Horiz
26	1804.360M Ave	59.7	+0.0 +26.0	+0.5 +0.7	+0.7 +2.2	-34.8	+0.0	55.0	100.0 X	-45.0	Horiz
^	1804.360M	69.0	+0.0 +26.0	+0.5 +0.7	+0.7 +2.2	-34.8	+0.0	64.3	100.0 X	-35.7	Horiz
28	1855.600M Ave	58.6	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	54.7	100.0 X, 50k GFSK	-45.3	Horiz
^	1855.600M	68.0	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	64.1	100.0 X, 50k GFSK	-35.9	Horiz
30	1830.010M Ave	57.6	+0.0 +26.3	+0.5 +0.7	+0.7 +2.3	-34.8	+0.0	53.3	100.0 X	-46.7	Horiz
^	1830.010M	67.0	+0.0 +26.3	+0.5 +0.7	+0.7 +2.3	-34.8	+0.0	62.7	100.0 X	-37.3	Horiz



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103183** Date: 10/20/2019  
 Test Type: **Maximized Emissions** Time: 09:59:58  
 Tested By: Michael Atkinson Sequence#: 4  
 Software: EMITest 5.03.12

***Equipment Tested:***

Device	Manufacturer	Model #	S/N
Configuration 2			

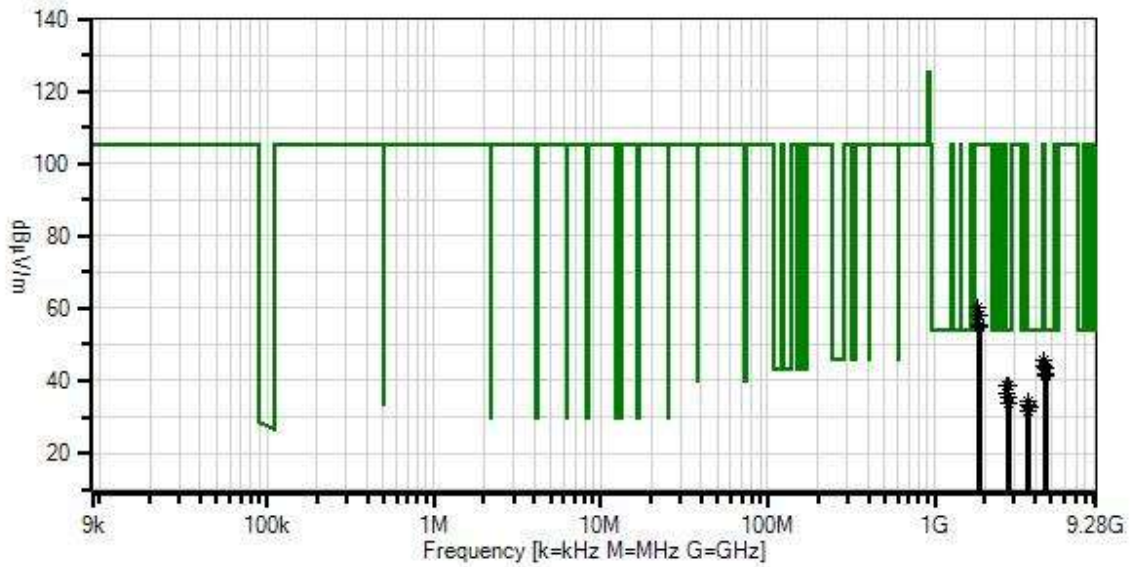
***Support Equipment:***

Device	Manufacturer	Model #	S/N
Configuration 2			

***Test Conditions / Notes:***

Frequency Range: 1-10GHz  
 Test Mode: Continuously transmitting  
 Test Setup: EUT is continuously transmitting through integral antenna, **EUT V port investigated.**  
 25kbps and 50kbps data rate investigated.  
 Low, Mid, High channels as well as hopping mode investigated, worst case reported.  
 X, Y, Z EUT axes investigated, worst case reported.  
 Horizontal and Vertical measurement antenna polarities investigated, worst case reported.  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

Itron, Inc. W/O#: 103183 Sequence#: 4 Date: 10/20/2019  
 15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



- Readings
  - × QP Readings
  - ▼ Ambient
  - 1 - 15.247(d) / 15.209 Radiated Spurious Emissions
  - Peak Readings
  - \* Average Readings
- Software Version: 5.03.12

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T2	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T3	AN03170	High Pass Filter	HM1155-11SS	11/27/2017	11/27/2019
T4	AN03540	Preamp	83017A	5/13/2019	5/13/2021
T5	AN01467	Horn Antenna-ANSI C63.5 Calibration	3115	7/5/2019	7/5/2021
T6	ANP06503	Cable	32026-29801- 29801-36	3/13/2018	3/13/2020
T7	ANP06515	Cable	Heliac	6/29/2018	6/29/2020

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	Reading listed by margin.			T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
			T1 dB	T2 dB	T3 dB						
1	4511.009M Ave	40.5	+0.0 +31.8	+0.9 +1.5	+0.8 +3.9	-33.7	+0.0	45.7	54.0 Y	-8.3	Horiz
2	4511.050M Ave	39.1	+0.0 +31.8	+0.9 +1.5	+0.8 +3.9	-33.7	+0.0	44.3	54.0 Y, 50k GFSK	-9.7	Horiz
^	4511.050M	50.1	+0.0 +31.8	+0.9 +1.5	+0.8 +3.9	-33.7	+0.0	55.3	54.0 Y	+1.3	Horiz
^	4511.050M	49.1	+0.0 +31.8	+0.9 +1.5	+0.8 +3.9	-33.7	+0.0	54.3	54.0 Y, 50k GFSK	+0.3	Horiz
5	4575.040M Ave	38.3	+0.0 +31.9	+0.9 +1.5	+0.8 +4.0	-33.7	+0.0	43.7	54.0 Y	-10.3	Horiz
^	4575.040M	47.5	+0.0 +31.9	+0.9 +1.5	+0.8 +4.0	-33.7	+0.0	52.9	54.0 Y	-1.1	Horiz
7	4638.730M Ave	36.4	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	42.1	54.0 Y	-11.9	Horiz
^	4638.660M	47.0	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	52.7	54.0 Y	-1.3	Horiz
9	4639.000M Ave	35.9	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	41.6	54.0 Y, 50k GFSK	-12.4	Horiz
^	4639.000M	46.1	+0.0 +32.1	+0.9 +1.5	+0.8 +4.0	-33.6	+0.0	51.8	54.0 Y, 50k GFSK	-2.2	Horiz
11	2706.620M Ave	39.5	+0.0 +28.3	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	38.7	54.0 X	-15.3	Horiz
12	2744.880M Ave	39.2	+0.0 +28.4	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	38.5	54.0 X	-15.5	Horiz
^	2744.880M	49.7	+0.0 +28.4	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	49.0	54.0 X	-5.0	Horiz
14	2706.560M Ave	37.4	+0.0 +28.3	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	36.6	54.0 X, 50k GFSK	-17.4	Horiz
^	2706.530M	49.9	+0.0 +28.3	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	49.1	54.0 X	-4.9	Horiz
^	2706.560M	48.2	+0.0 +28.3	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	47.4	54.0 X, 50k GFSK	-6.6	Horiz

17	2783.190M Ave	36.0	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	35.4	54.0 X	-18.6	Horiz
^	2783.190M	46.4	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	45.8	54.0 X	-8.2	Horiz
^	2783.150M	45.6	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	45.0	54.0 X, 50k GFSK	-9.0	Horiz
20	3608.869M Ave	31.1	+0.0 +30.3	+0.8 +1.3	+0.8 +3.6	-33.8	+0.0	34.1	54.0 X	-19.9	Horiz
21	2783.530M Ave	34.2	+0.0 +28.5	+0.7 +1.1	+0.6 +2.6	-34.1	+0.0	33.6	54.0 X, 50k GFSK	-20.4	Horiz
22	3660.070M Ave	29.6	+0.0 +30.5	+0.9 +1.3	+0.9 +3.7	-33.7	+0.0	33.2	54.0 X	-20.8	Horiz
^	3660.070M	43.5	+0.0 +30.5	+0.9 +1.3	+0.9 +3.7	-33.7	+0.0	47.1	54.0 X	-6.9	Horiz
24	3710.940M Ave	29.1	+0.0 +30.6	+0.9 +1.3	+0.9 +3.8	-33.7	+0.0	32.9	54.0 X	-21.1	Horiz
^	3710.940M	40.4	+0.0 +30.6	+0.9 +1.3	+0.9 +3.8	-33.7	+0.0	44.2	54.0 X	-9.8	Horiz
26	3608.780M Ave	28.7	+0.0 +30.3	+0.8 +1.3	+0.8 +3.6	-33.8	+0.0	31.7	54.0 X, 50k GFSK	-22.3	Horiz
^	3608.840M	42.7	+0.0 +30.3	+0.8 +1.3	+0.8 +3.6	-33.8	+0.0	45.7	54.0 X	-8.3	Horiz
^	3608.780M	41.0	+0.0 +30.3	+0.8 +1.3	+0.8 +3.6	-33.8	+0.0	44.0	54.0 X, 50k GFSK	-10.0	Horiz
29	1804.399M Ave	64.7	+0.0 +26.1	+0.5 +0.7	+0.7 +2.2	-34.8	+0.0	60.1	105.0 Z	-44.9	Vert
30	1804.350M Ave	62.8	+0.0 +26.0	+0.5 +0.7	+0.7 +2.2	-34.8	+0.0	58.1	105.0 Z, 50k GFSK	-46.9	Vert
^	1804.370M	73.8	+0.0 +26.0	+0.5 +0.7	+0.7 +2.2	-34.8	+0.0	69.1	105.0 Z	-35.9	Vert
^	1804.350M	72.3	+0.0 +26.0	+0.5 +0.7	+0.7 +2.2	-34.8	+0.0	67.6	105.0 Z, 50k GFSK	-37.4	Vert
33	1829.980M Ave	62.1	+0.0 +26.3	+0.5 +0.7	+0.7 +2.3	-34.8	+0.0	57.8	105.0 Z	-47.2	Vert
^	1829.980M	72.0	+0.0 +26.3	+0.5 +0.7	+0.7 +2.3	-34.8	+0.0	67.7	105.0 Z	-37.3	Vert
35	1855.540M Ave	59.4	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	55.5	105.0 Z	-49.5	Vert
36	1855.550M Ave	58.9	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	55.0	105.0 Z, 50 GFSK	-50.0	Vert
^	1855.470M	68.9	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	65.0	105.0 Z	-40.0	Vert
^	1855.550M	68.4	+0.0 +26.6	+0.5 +0.7	+0.7 +2.3	-34.7	+0.0	64.5	105.0 Z, 50 GFSK	-40.5	Vert

## Band Edge

### Band Edge Summary

Operating Mode: Single Channel (Low and High) V Port (3.67dBi)				
Frequency (MHz)	Modulation	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK 25kbps	39.4	46.0	Pass
902	GFSK 25kbps	78.0	105.0	Pass
928	GFSK 25kbps	75.3	105.0	Pass
960	GFSK 25kbps	43.8	54.0	Pass

### Band Edge Summary

Operating Mode: Single Channel (Low and High) V Port (3.67dBi)				
Frequency (MHz)	Modulation	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK 50kbps	39.4	46.0	Pass
902	GFSK 50kbps	76.7	105.0	Pass
928	GFSK 50kbps	76.2	105.0	Pass
960	GFSK 50kbps	43.9	54.0	Pass

### Band Edge Summary

Operating Mode: Single Channel (Low and High) V Port (3.67dBi)							
Freq (MHz)	Modulation	100kHz Band Edge Measurement (dBuV/m @3m)	100kHz Fundamental Field Strength (dBuV/m @3m)	30kHz Band Edge Measurement (dBuV/m @3m)	30kHz Fundamental Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	GFSK 25kbps	106.2	123.8	<b><u>94.8</u></b>	123.8	105.0	Pass
928	GFSK 25kbps	101.7	122.4	<b><u>90.8</u></b>	122.4	105.0	Pass
902	GFSK 50kbps	108.1	124.6	<b><u>96.6</u></b>	124.6	105.0	Pass
928	GFSK 50kbps	105.0	123.6	<b><u>93.0</u></b>	123.6	105.0	Pass

Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement, underlined and bold in the table above.

Note: Single channel data at 614MHz and 960MHz is representative of data collected in hopping mode.



Band Edge Summary				
Operating Mode: Single Channel (Low and High)				
H Port (-0.4dBi)				
Frequency (MHz)	Modulation	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK 25kbps	39.4	46.0	Pass
902	GFSK 25kbps	71.1	100.0	Pass
928	GFSK 25kbps	69.4	100.0	Pass
960	GFSK 25kbps	43.8	54.0	Pass

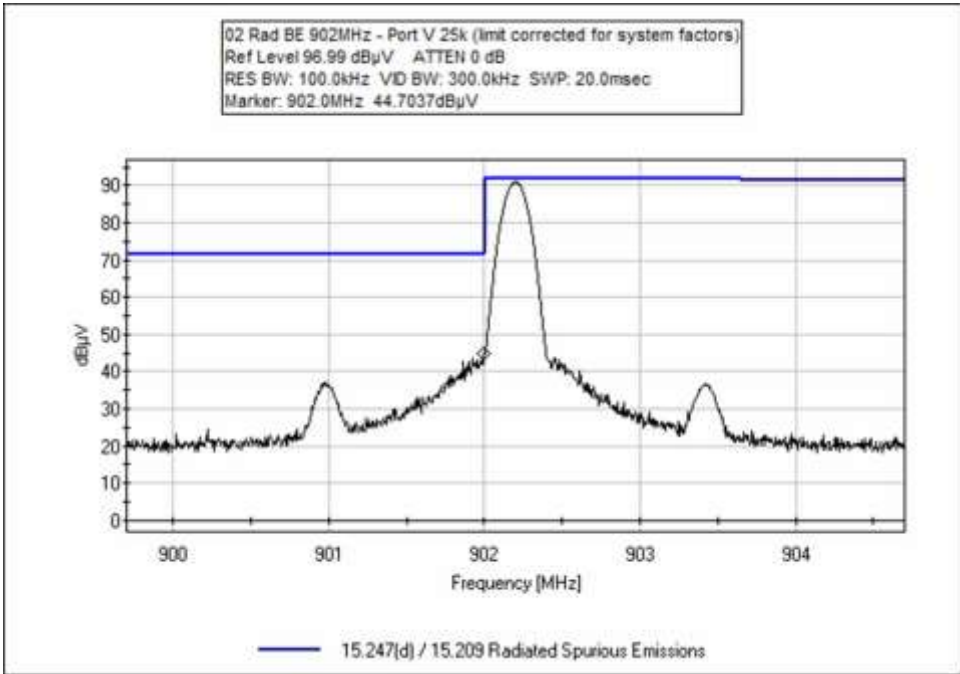
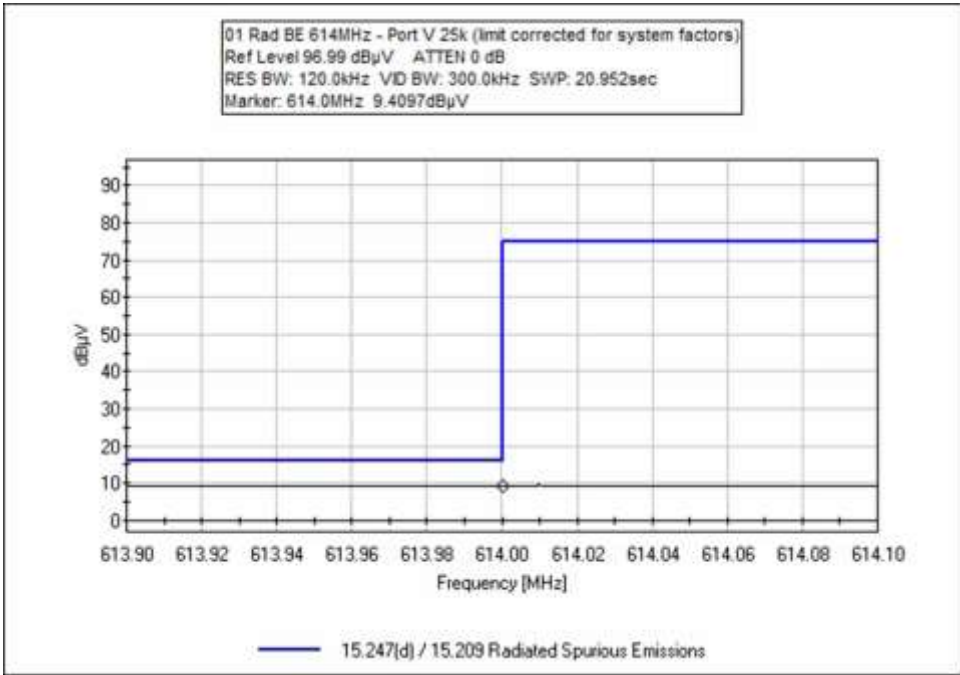
Band Edge Summary				
Operating Mode: Single Channel (Low and High)				
H Port (-0.4dBi)				
Frequency (MHz)	Modulation	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK 50kbps	39.3	46.0	Pass
902	GFSK 50kbps	71.7	100.0	Pass
928	GFSK 50kbps	72.1	100.0	Pass
960	GFSK 50kbps	43.8	54.0	Pass

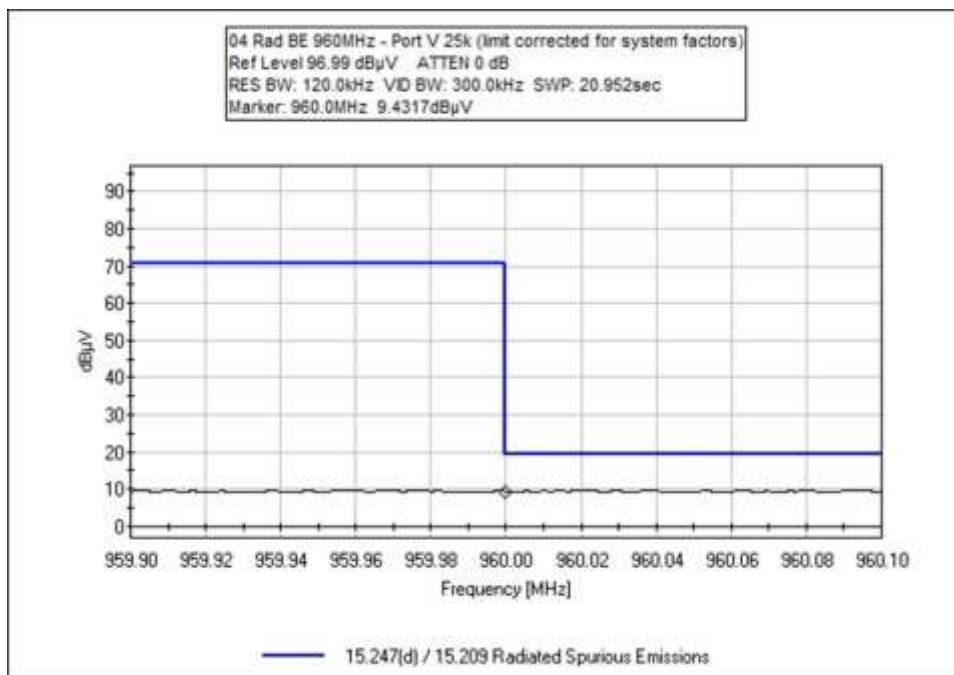
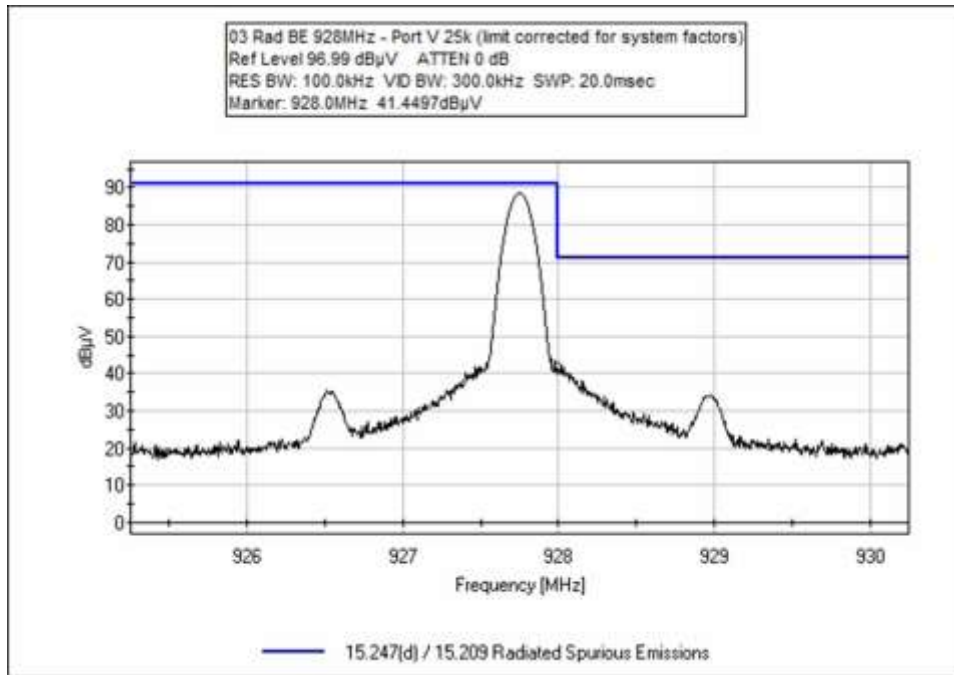
Band Edge Summary							
Operating Mode: Single Channel (Low and High)							
H Port (-0.4dBi)							
Freq (MHz)	Modulation	100kHz Band Edge Measurement (dBuV/m @3m)	100kHz Fundamental Field Strength (dBuV/m @3m)	30kHz Band Edge Measurement (dBuV/m @3m)	30kHz Fundamental Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
902	GFSK 25kbps	101.6	119.6	<b><u>90.3</u></b>	119.6	100.0	Pass
928	GFSK 25kbps	99.3	119.9	<b><u>88.5</u></b>	119.9	100.0	Pass
902	GFSK 50kbps	102.0	118.9	<b><u>90.2</u></b>	118.5	100.0	Pass
928	GFSK 50kbps	100.5	119.6	<b><u>89.0</u></b>	119.5	100.0	Pass

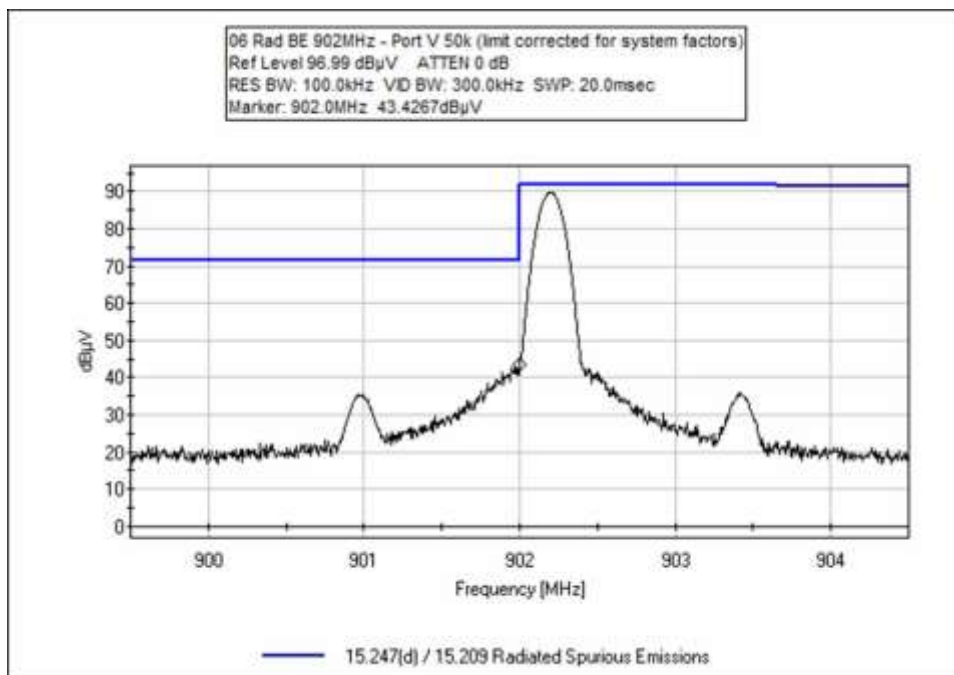
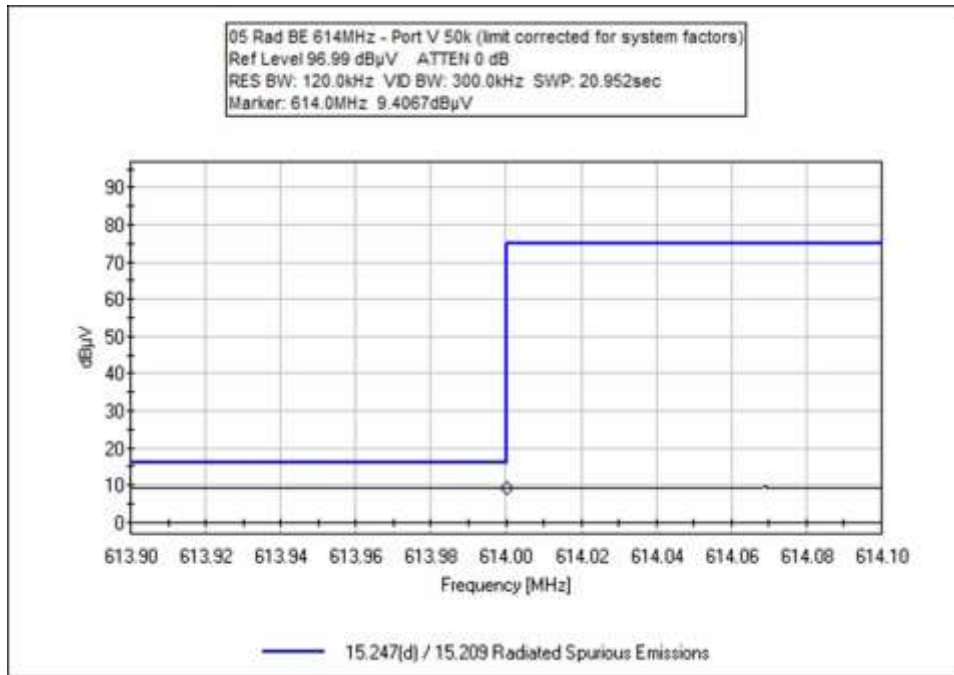
Note: Marker delta limit was applied per ANSI C63.10 (2013) section 6.10.6.2. The final value to consider against the limit is the worst case 30kHz Band Edge measurement, underlined and bold in the table above.

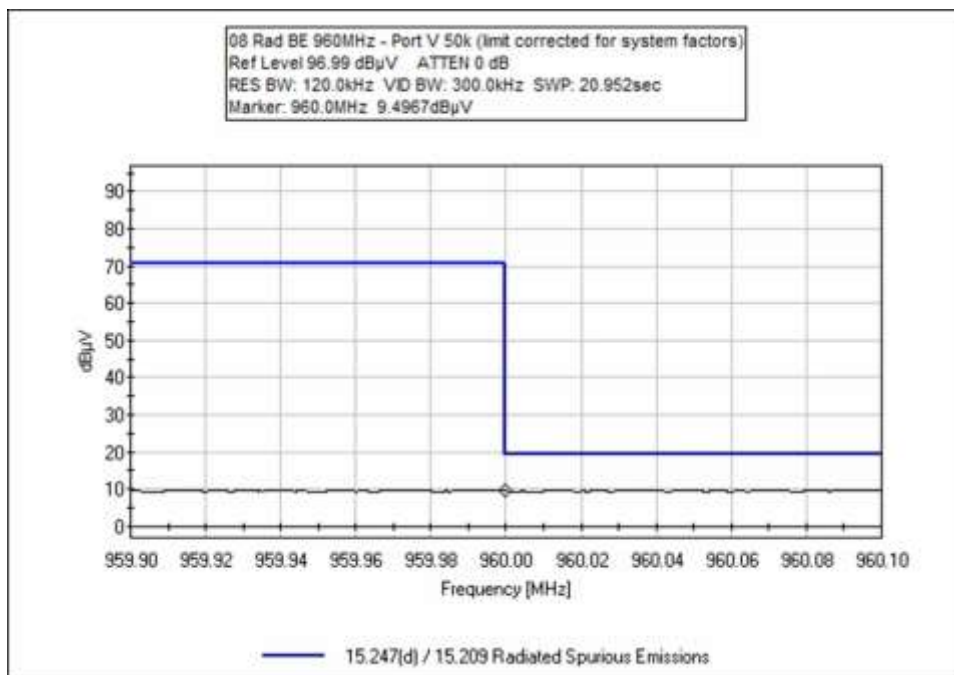
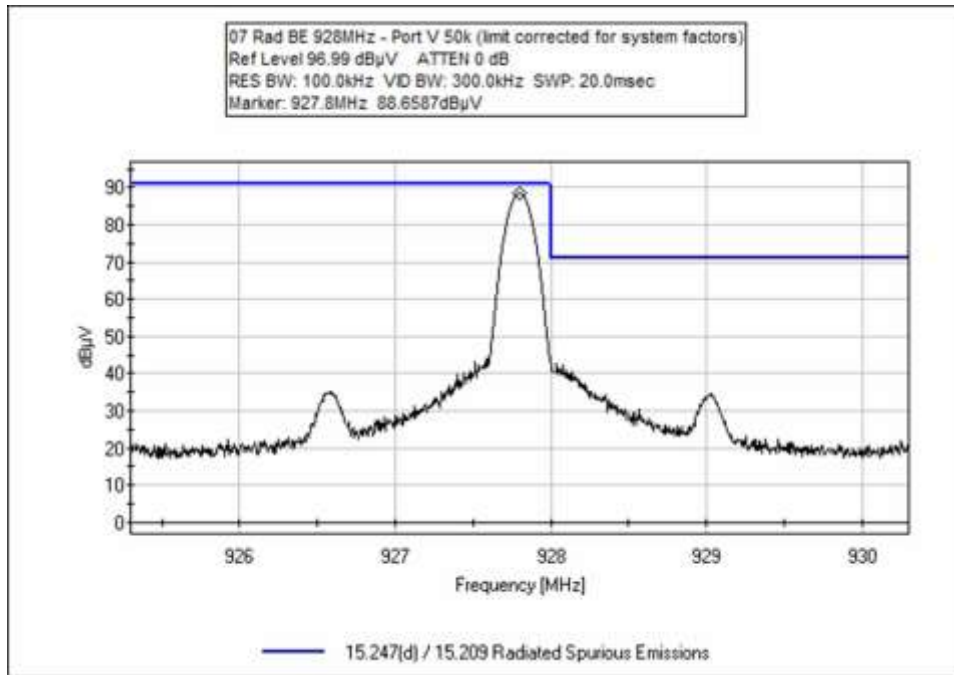
Note: Single channel data at 614MHz and 960MHz is representative of data collected in hopping mode.

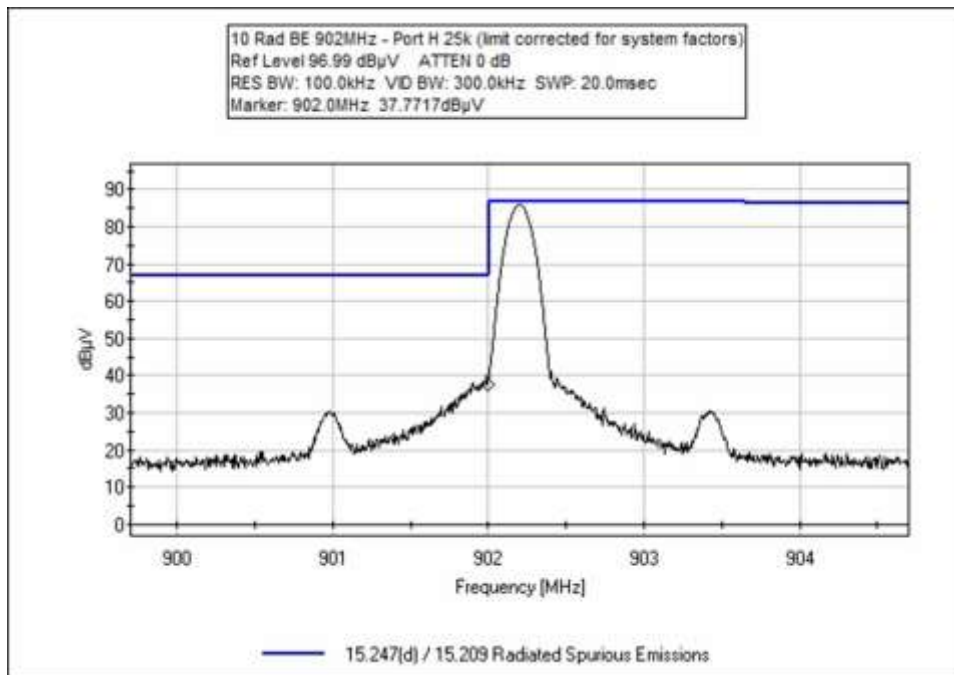
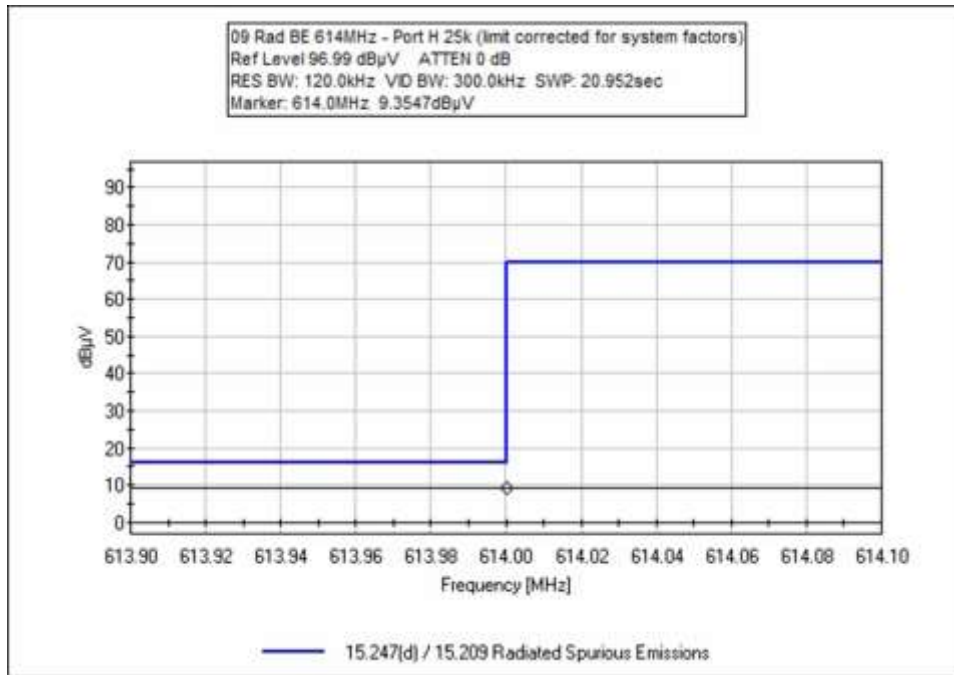
## Band Edge Plots

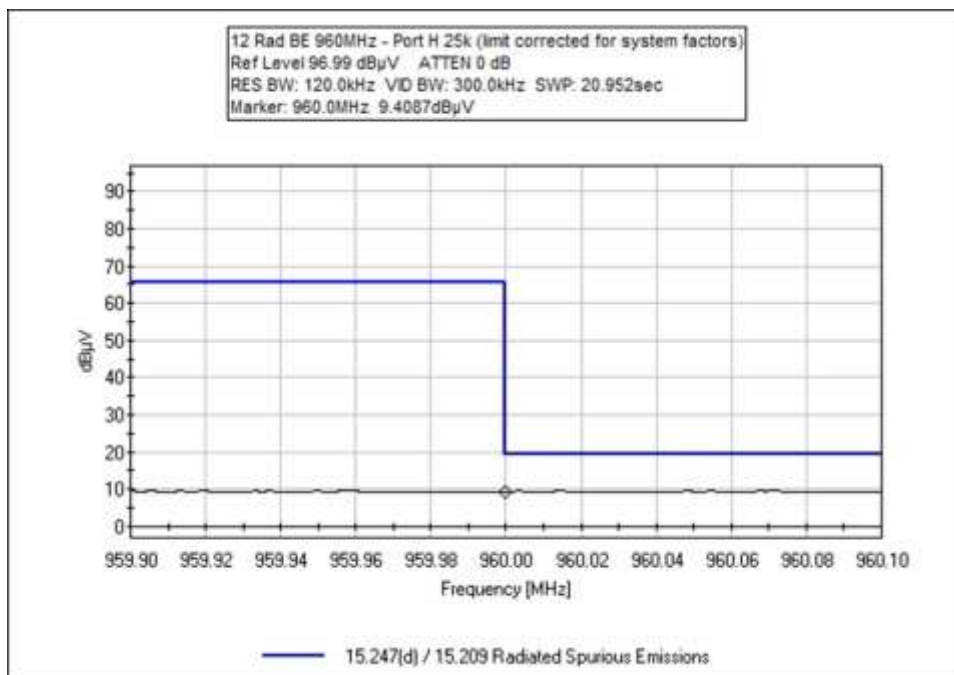
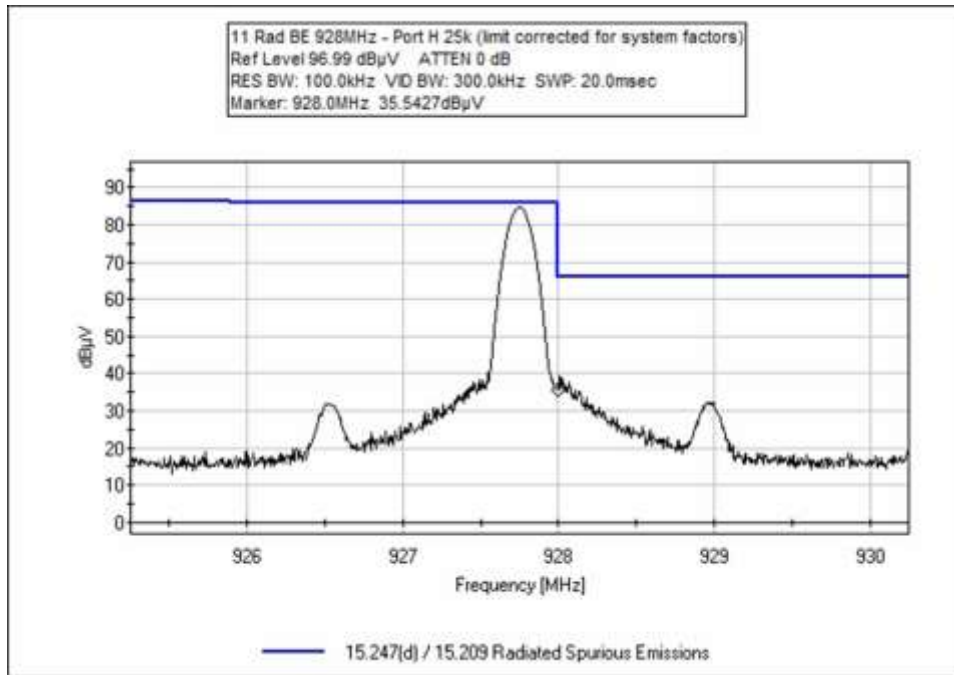


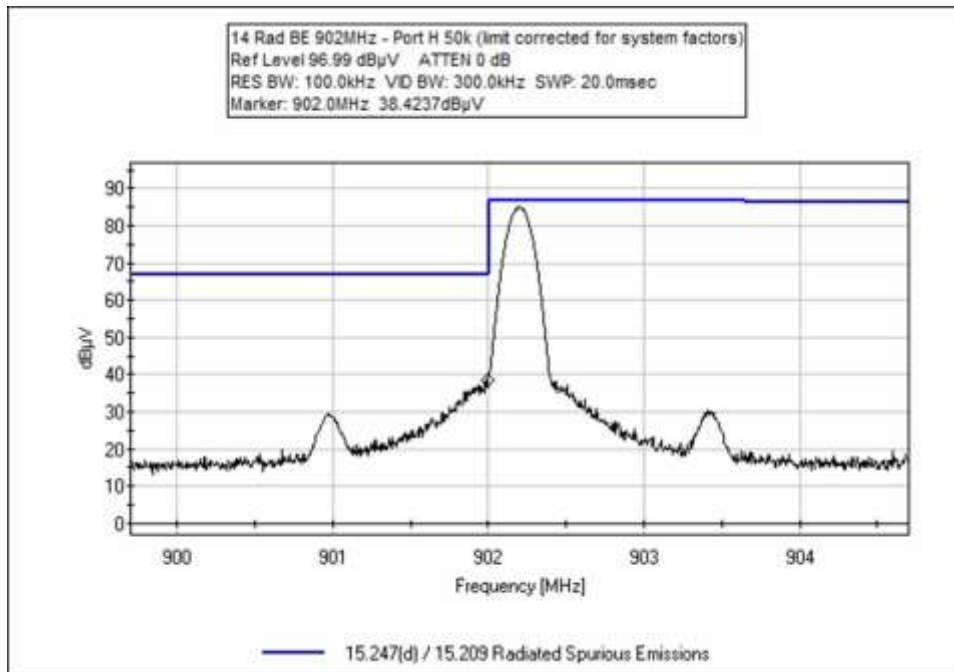
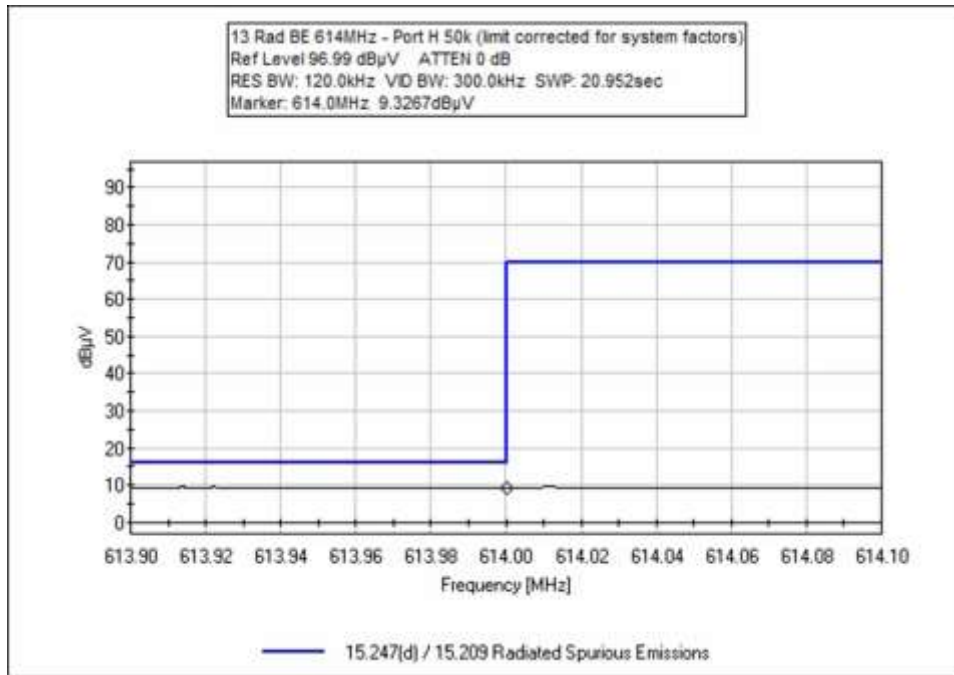




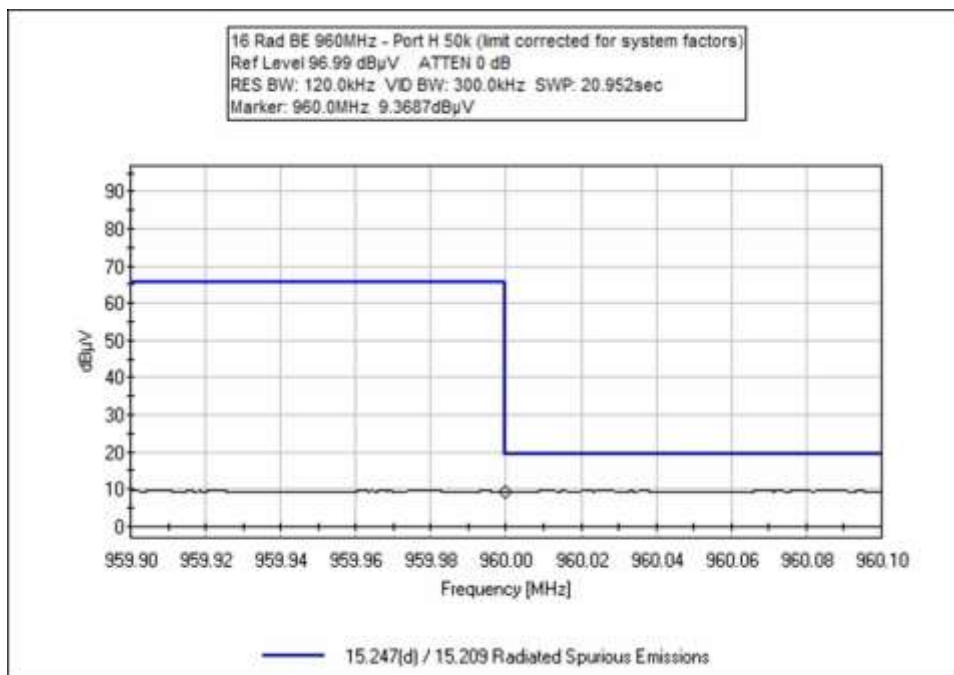
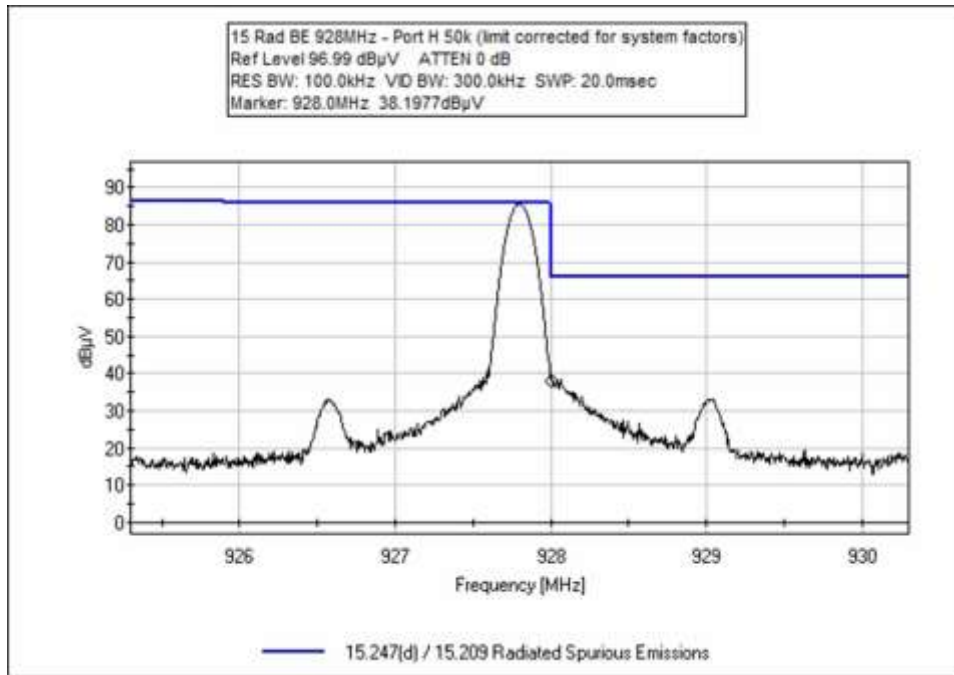


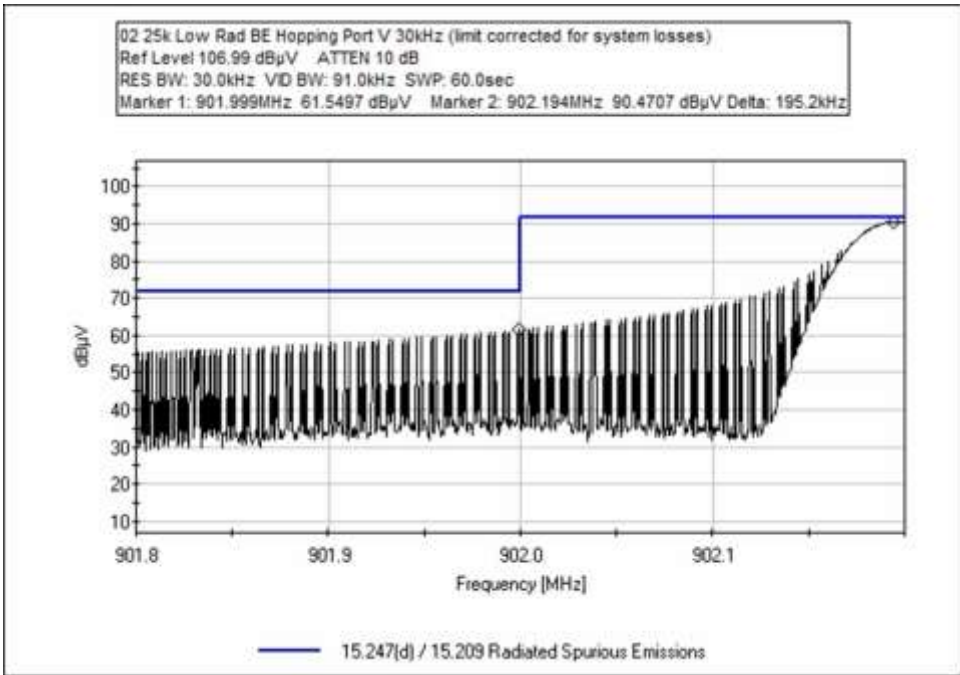
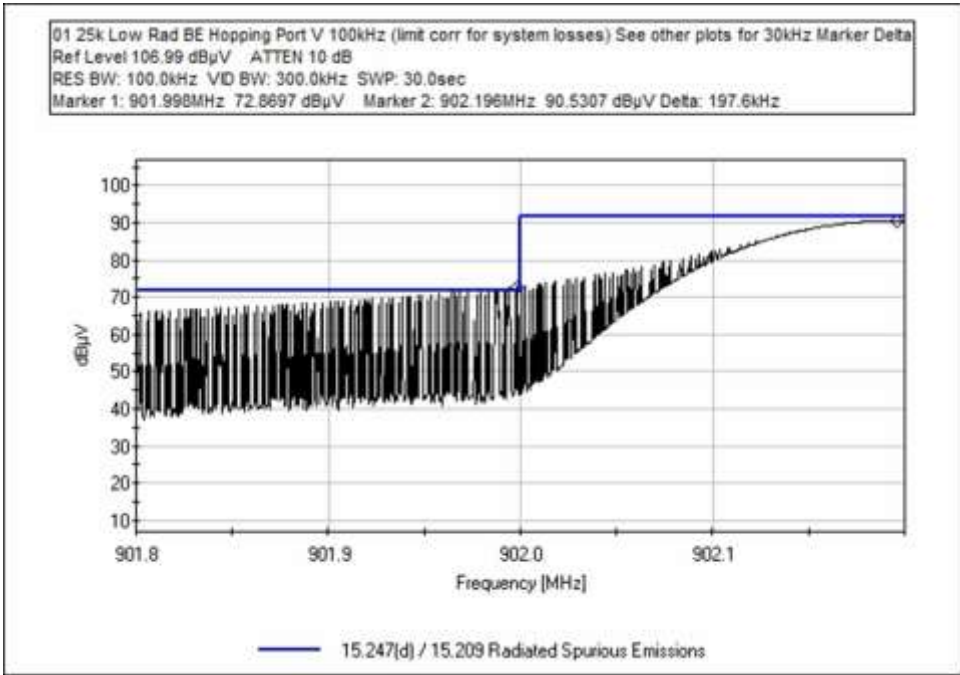


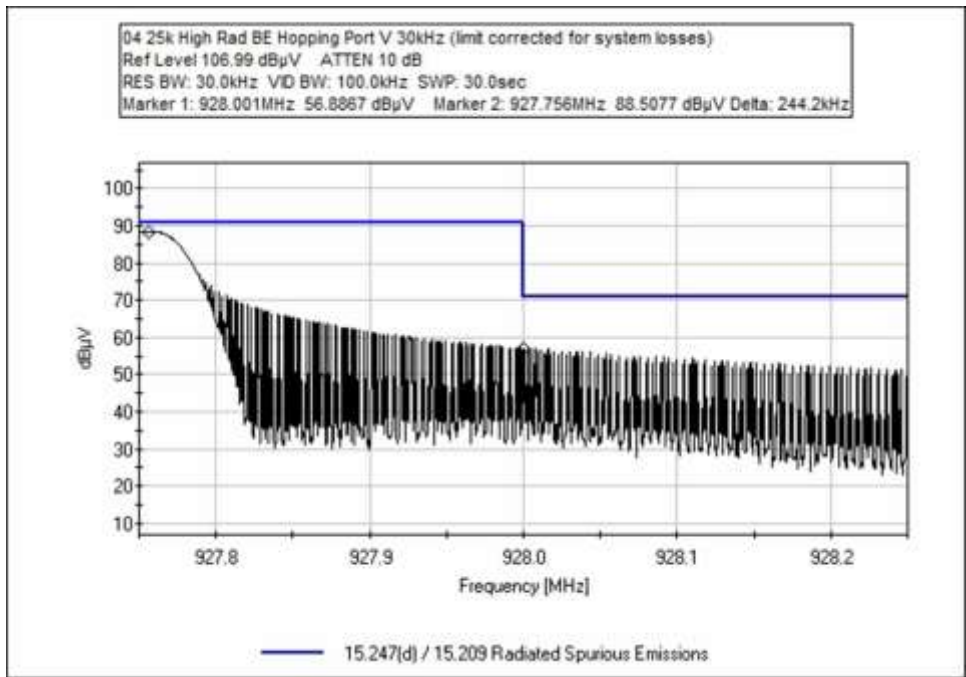
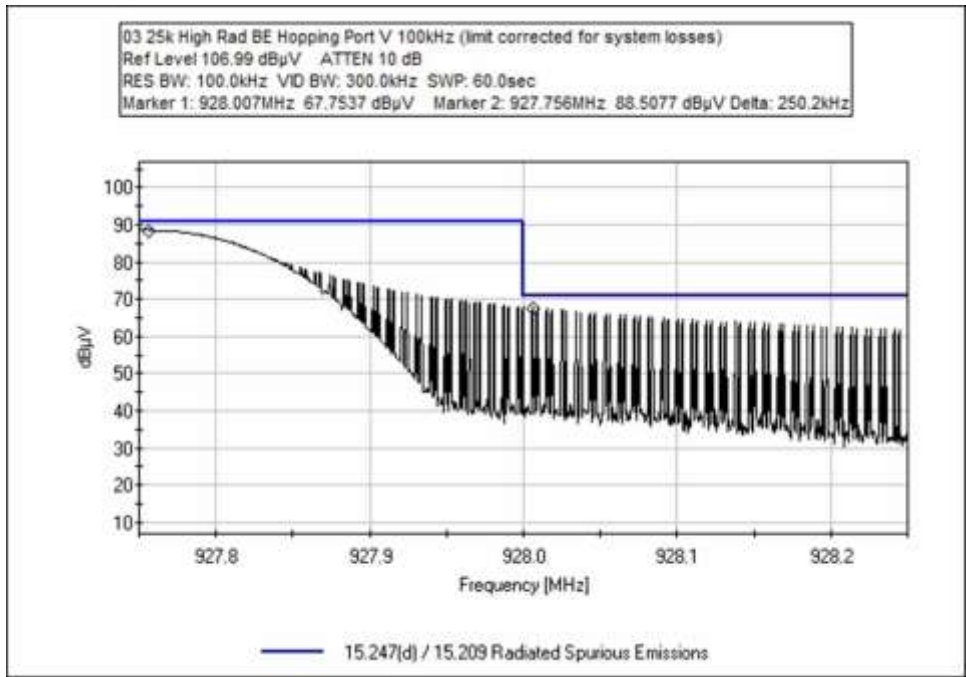


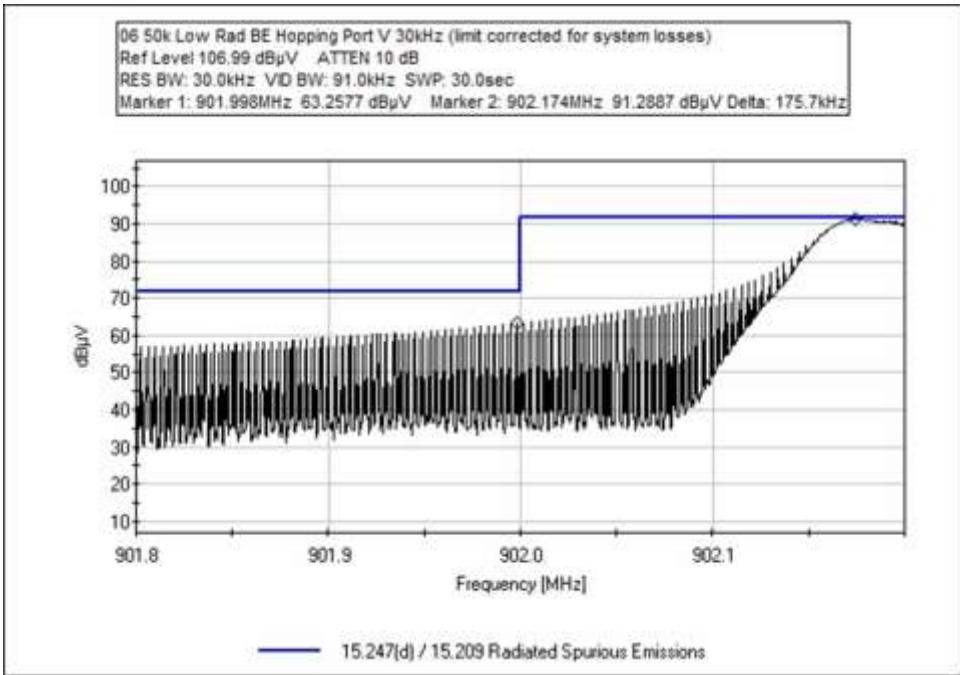
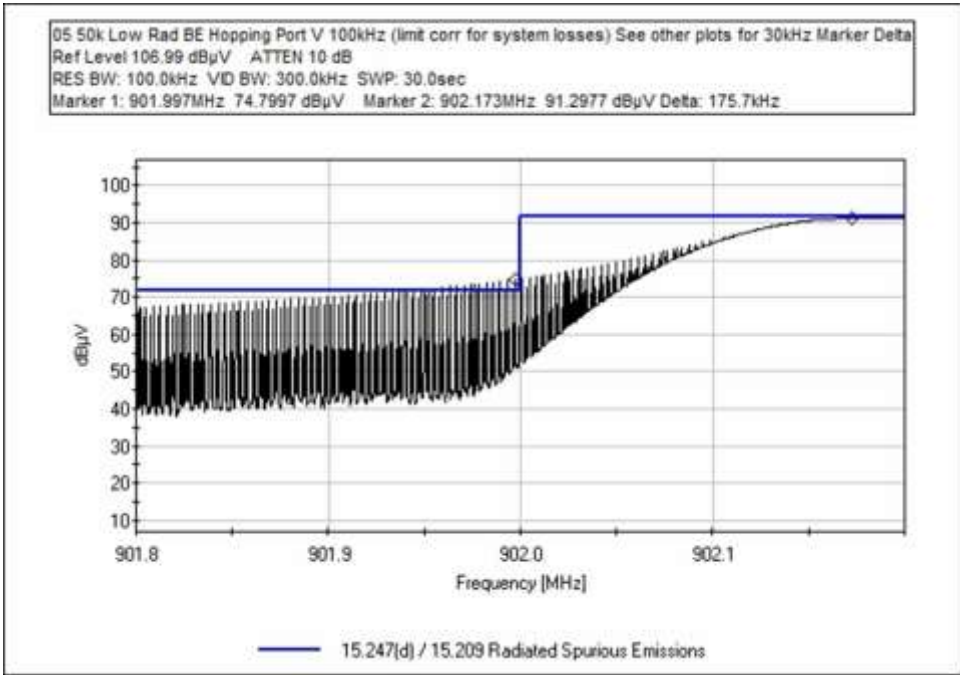


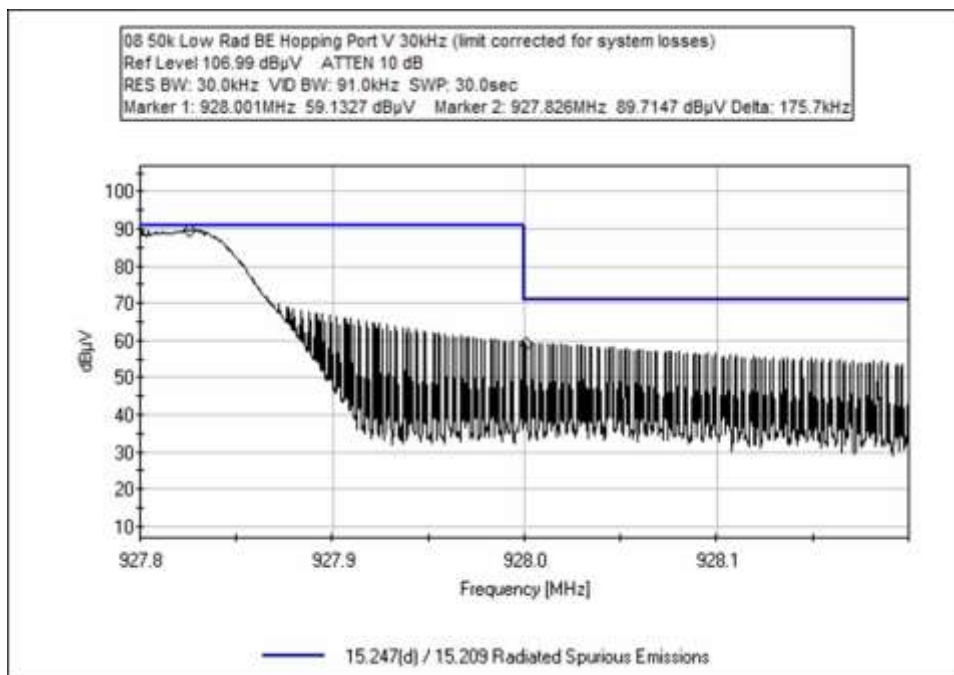
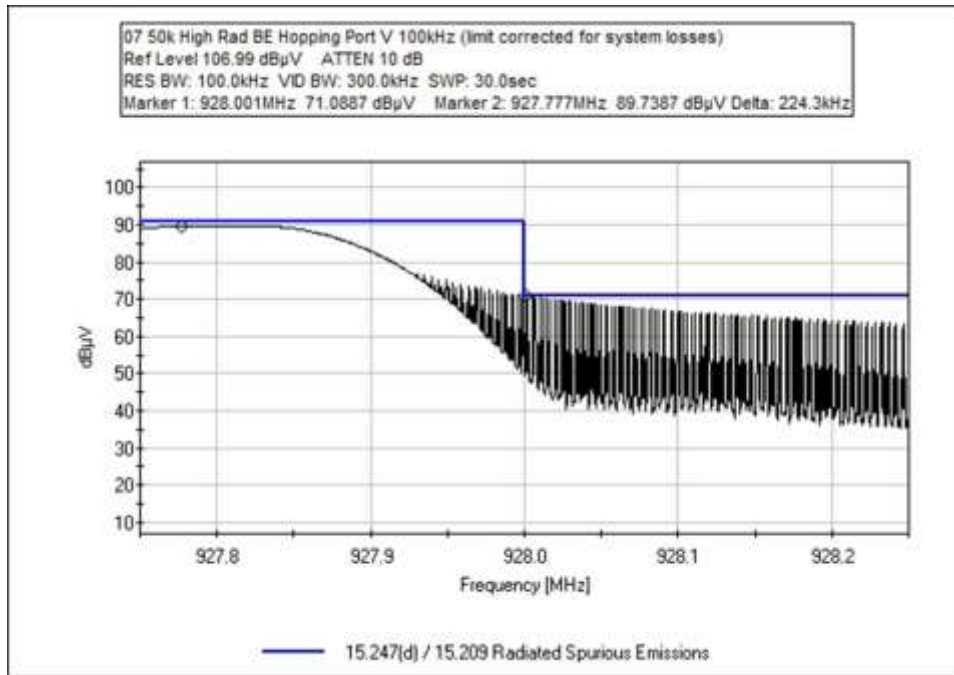


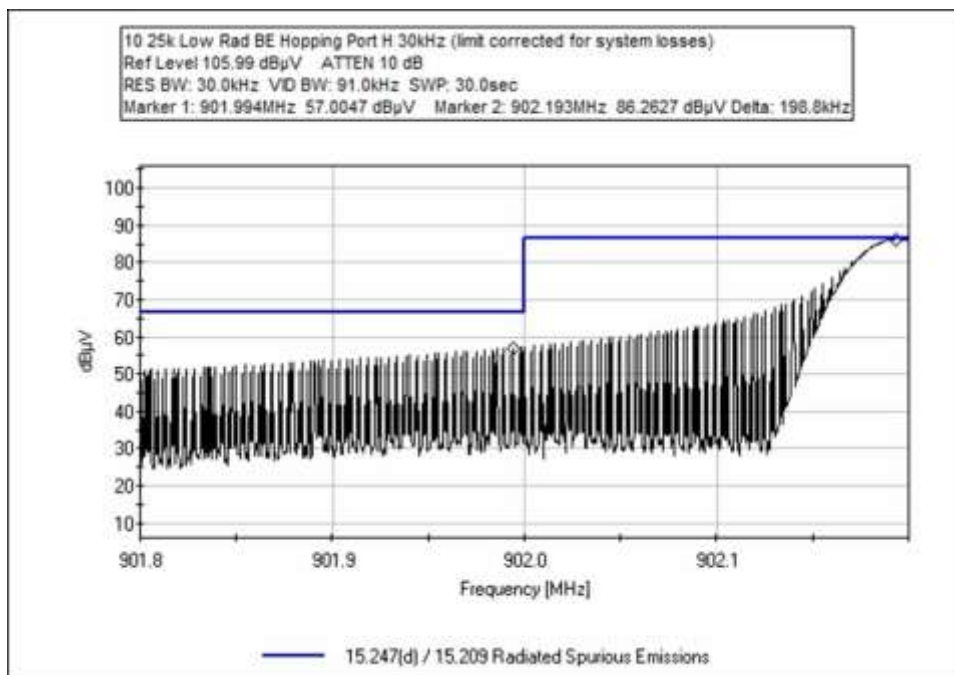
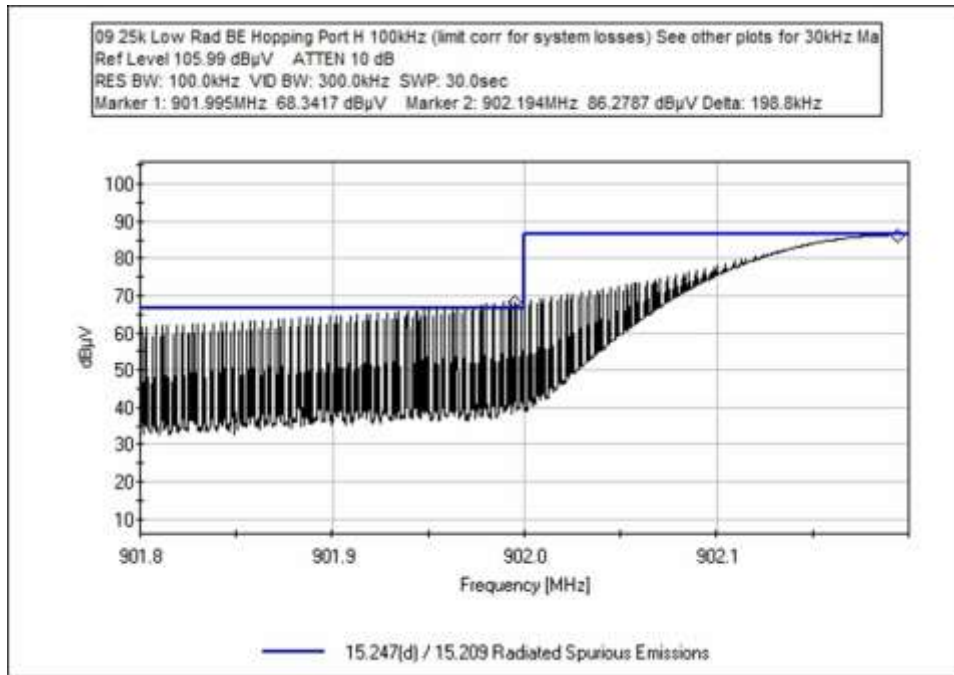


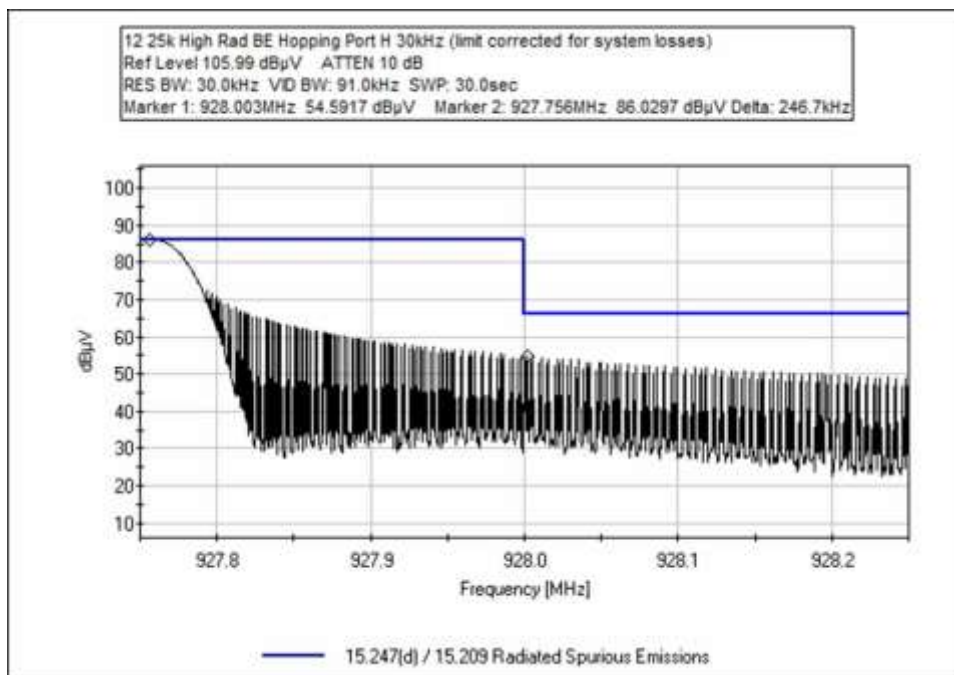
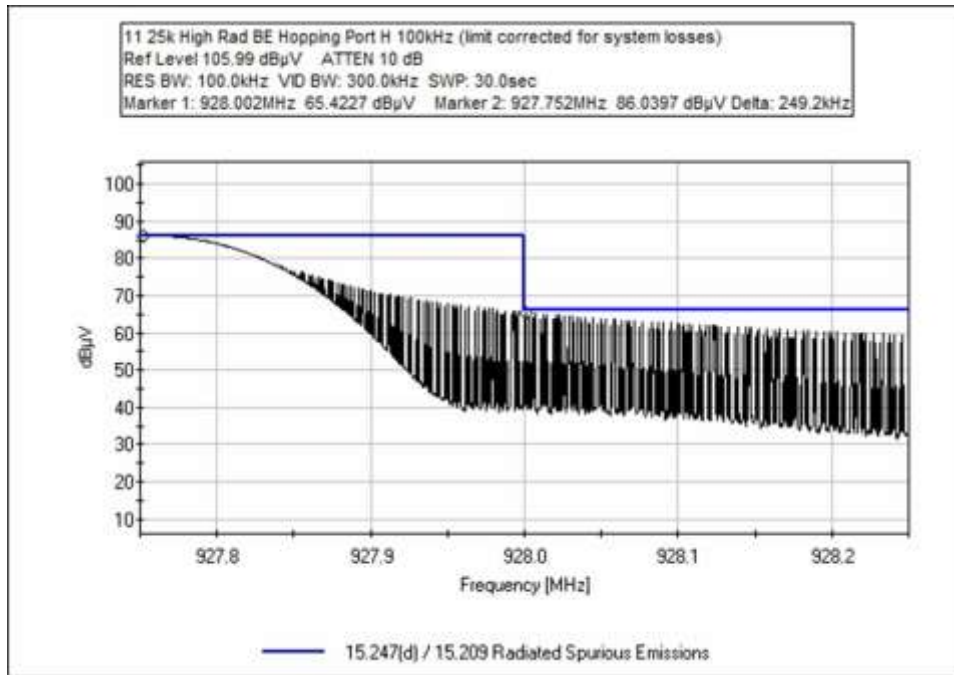




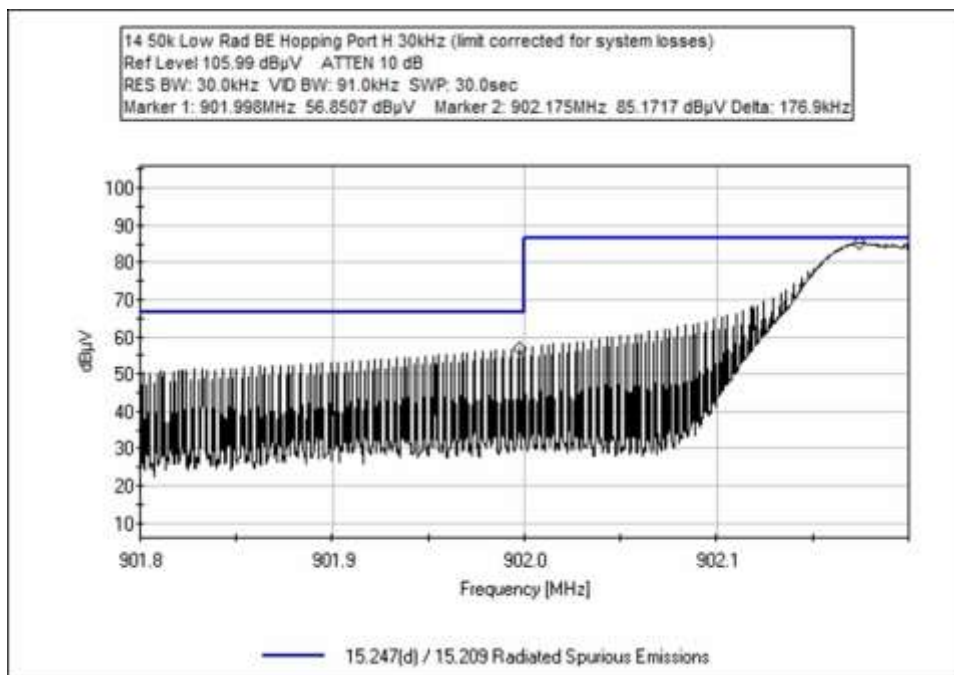
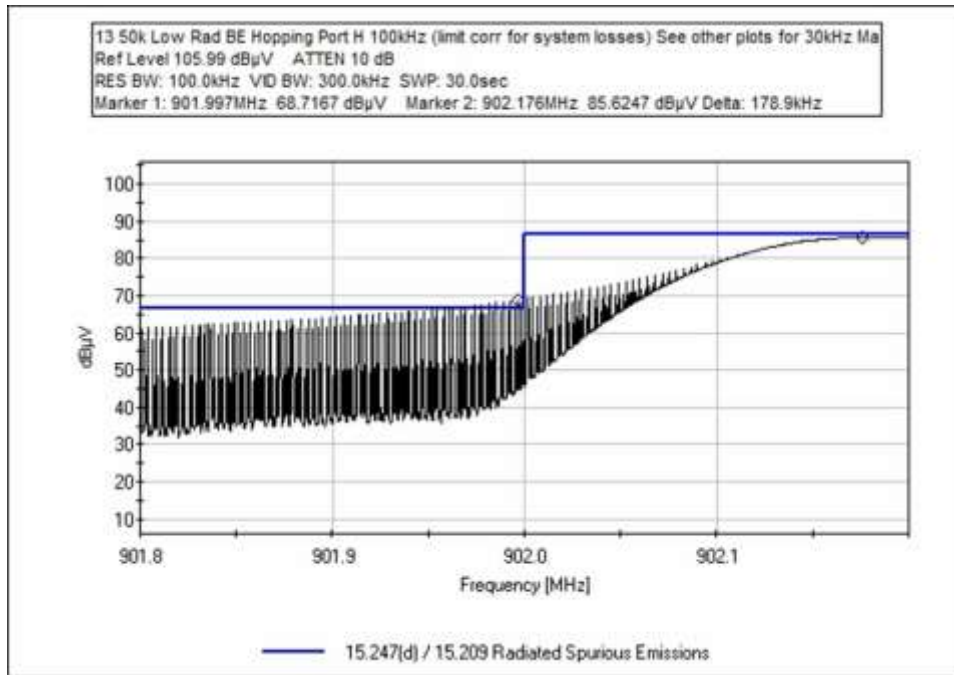




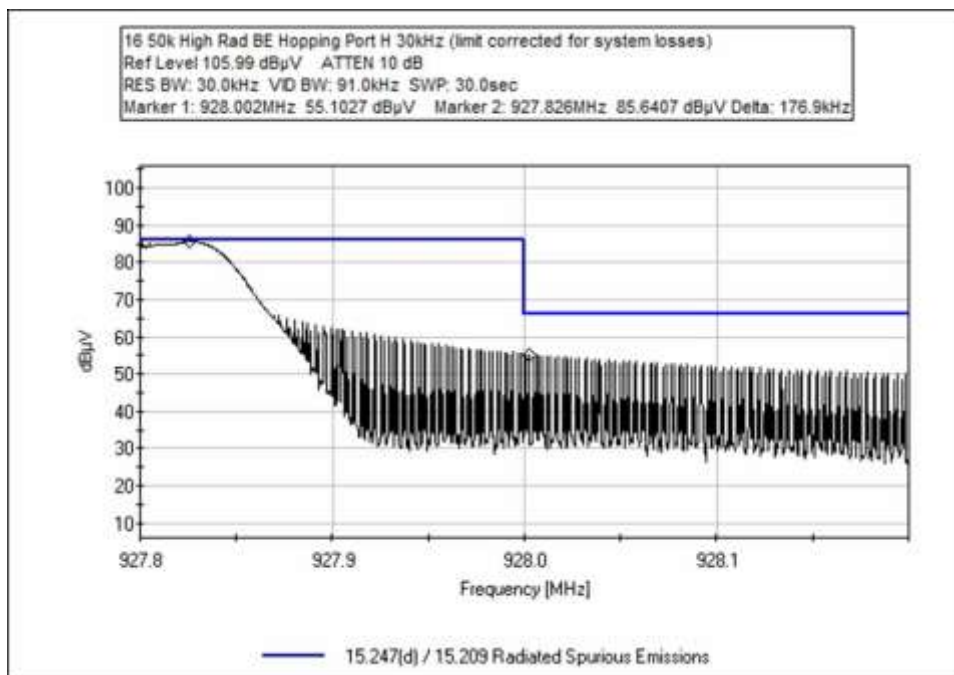
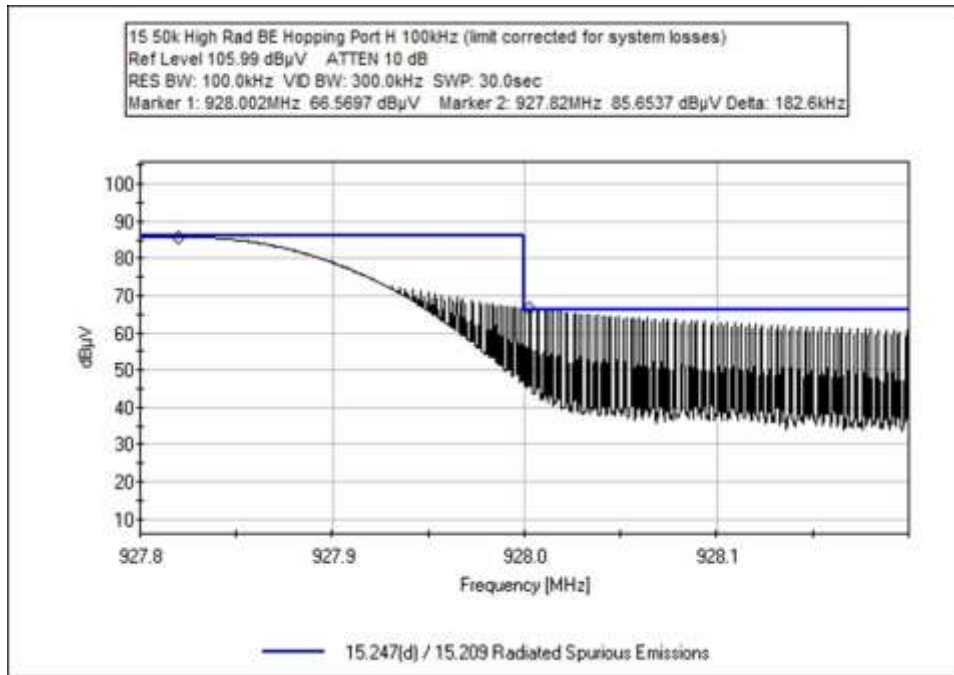












**Test Setup / Conditions / Data**

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103183** Date: 10/23/2019  
 Test Type: **Maximized Emissions** Time: 12:27:08  
 Tested By: Michael Atkinson Sequence#: 6  
 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:***

Frequency: Band Edge  
  
 Setup: The equipment under test (EUT) is placed on the tabletop.  
 The output of the EUT is transmitter through the selected internal antenna.  
 The EUT is transmitting at max power.  
 Measurements were performed with a fresh battery installed.  
 L and H channels investigated.  
 25k and 50k data rates investigated.  
  
 Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T2	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T3	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T4	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T5	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB $\mu$ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	614.000M QP	9.4	+0.3 +21.2	+1.2	+1.5	+5.8	+0.0	39.4	46.0 25K	-6.6	Vert
2	614.000M QP	9.3	+0.3 +21.2	+1.2	+1.5	+5.8	+0.0	39.3	46.0	-6.7	Vert
3	960.000M QP	9.4	+0.4 +24.6	+1.5	+2.1	+5.8	+0.0	43.8	54.0	-10.2	Vert
4	960.000M QP	9.4	+0.4 +24.6	+1.5	+2.1	+5.8	+0.0	43.8	54.0 25K	-10.2	Vert
5	928.000M	38.2	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	72.1	100.0	-27.9	Vert
6	902.000M	38.4	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	71.7	100.0	-28.3	Vert
7	902.000M	37.8	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	71.1	100.0 25K	-28.9	Vert
8	928.000M	35.5	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	69.4	100.0 25K	-30.6	Vert



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103183** Date: 10/23/2019  
 Test Type: **Maximized Emissions** Time: 11:21:37  
 Tested By: Michael Atkinson Sequence#: 5  
 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:***

Frequency: Band Edge  
  
 Setup: The equipment under test (EUT) is placed on the tabletop.  
 The output of the EUT is transmitter through the selected internal antenna.  
 The EUT is transmitting at max power.  
 Measurements were performed with a fresh battery installed. L and H channels investigated.  
 25k and 50k data rates investigated.  
  
 Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T2	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T3	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T4	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T5	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dB $\mu$ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	614.000M QP	9.4	+0.3 +21.2	+1.2	+1.5	+5.8	+0.0	39.4	46.0 50k	-6.6	Vert
2	614.000M QP	9.4	+0.3 +21.2	+1.2	+1.5	+5.8	+0.0	39.4	46.0 25k	-6.6	Vert
3	960.000M QP	9.5	+0.4 +24.6	+1.5	+2.1	+5.8	+0.0	43.9	54.0 50k	-10.1	Vert
4	960.000M QP	9.4	+0.4 +24.6	+1.5	+2.1	+5.8	+0.0	43.8	54.0 25k	-10.2	Vert
5	902.000M	44.7	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	78.0	105.0 25k	-27.0	Vert
6	902.000M	43.4	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	76.7	105.0 50k	-28.3	Vert
7	928.000M	42.3	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	76.2	105.0 50k	-28.8	Vert
8	928.000M	41.4	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	75.3	105.0 25k	-29.7	Vert



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103183** Date: 10/28/2019  
 Test Type: **Maximized Emissions** Time: 09:14:57  
 Tested By: Michael Atkinson Sequence#: 7  
 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:***

Frequency: Band Edge  
  
 Setup: The equipment under test (EUT) is placed on the tabletop.  
 The output of the EUT is transmitter through the selected internal antenna.  
 The EUT is transmitting at max power.  
 Measurements were performed with a fresh battery installed. Hopping channels investigated.  
 25k and 50k data rates investigated.  
  
 Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)

**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T2	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T3	ANP05360	Cable	RG214	1/31/2018	1/31/2020
T4	ANP06123	Attenuator	18N-6	4/5/2019	4/5/2021
T5	AN03628	Biconilog Antenna	3142E	6/11/2019	6/11/2021

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

#	Freq MHz	Rdng dB $\mu$ V	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	927.752M	86.0	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	119.9	120.0 High 25k	-0.1	Vert
2	927.756M	86.0	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	119.9	120.0 High 25k	-0.1	Vert
3	902.194M	86.3	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	119.6	120.0 Low 25k	-0.4	Vert
4	902.193M	86.3	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	119.6	120.0 Low 25k	-0.4	Vert
5	927.820M	85.7	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	119.6	120.0 50k High	-0.4	Vert
6	927.826M	85.6	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	119.5	120.0 50k High	-0.5	Vert
7	902.176M	85.6	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	118.9	120.0 50k Low	-1.1	Vert
8	902.175M	85.2	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	118.5	120.0 50k Low	-1.5	Vert
9	901.994M	57.0	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	90.3	100.0 Low 25k	-9.7	Vert
10	901.998M	56.9	+0.3 +23.8	+1.4	+2.0	+5.8	+0.0	90.2	100.0 50k Low	-9.8	Vert
11	928.002M	55.1	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	89.0	100.0 50k High	-11.0	Vert
12	928.003M	54.6	+0.4 +24.2	+1.5	+2.0	+5.8	+0.0	88.5	100.0 High 25k	-11.5	Vert



Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103183** Date: 10/25/2019  
 Test Type: **Maximized Emissions** Time: 16:32:56  
 Tested By: Michael Atkinson Sequence#: 6  
 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:***

Frequency: Band Edge  
  
 Setup: The equipment under test (EUT) is placed on the tabletop.  
 The output of the EUT is transmitter through the selected internal antenna.  
 The EUT is transmitting at max power.  
 Measurements were performed with a fresh battery installed. Hopping channels investigated.  
 25k and 50k data rates investigated.  
  
 Worst case reported.  
  
 Test Location: Bothell Lab Bench  
 Temperature (°C): 19-23  
 Relative Humidity (%): 30-50  
 Test Method: ANSI C63.10 (2013)



**Test Equipment:**

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T2	ANP06540	Cable	Heliac	8/23/2019	8/23/2021
T3	ANP05305	Cable	ETSI-50T	9/6/2019	9/6/2021
T4	ANP05360	Cable	RG214	1/31/2018	1/31/2020
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 MHz	Rdng dB $\mu$ V	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dB $\mu$ V/m	Spec dB $\mu$ V/m	Margin dB	Polar Ant
1	902.174M	91.3	+0.0 +5.8	+0.3 +23.8	+1.4	+2.0	+0.0	124.6	125.0 50k Low	-0.4	Vert
2	902.173M	91.3	+0.0 +5.8	+0.3 +23.8	+1.4	+2.0	+0.0	124.6	125.0 50k Low	-0.4	Vert
3	902.196M	90.5	+0.0 +5.8	+0.3 +23.8	+1.4	+2.0	+0.0	123.8	125.0 25k Low	-1.2	Vert
4	902.194M	90.5	+0.0 +5.8	+0.3 +23.8	+1.4	+2.0	+0.0	123.8	125.0 25k Low	-1.2	Vert
5	927.826M	89.7	+0.0 +5.8	+0.4 +24.2	+1.5	+2.0	+0.0	123.6	125.0 50k High	-1.4	Vert
6	927.777M	89.7	+0.0 +5.8	+0.4 +24.2	+1.5	+2.0	+0.0	123.6	125.0 50k High	-1.4	Vert
7	927.748M	88.5	+0.0 +5.8	+0.4 +24.2	+1.5	+2.0	+0.0	122.4	125.0 25k High	-2.6	Vert
8	927.756M	88.5	+0.0 +5.8	+0.4 +24.2	+1.5	+2.0	+0.0	122.4	125.0 25k High	-2.6	Vert
9	901.998M	63.3	+0.0 +5.8	+0.3 +23.8	+1.4	+2.0	+0.0	96.6	105.0 50k Low	-8.4	Vert
10	901.999M	61.5	+0.0 +5.8	+0.3 +23.8	+1.4	+2.0	+0.0	94.8	105.0 25k Low	-10.2	Vert
11	928.001M	59.1	+0.0 +5.8	+0.4 +24.2	+1.5	+2.0	+0.0	93.0	105.0 50k High	-12.0	Vert
12	928.001M	56.9	+0.0 +5.8	+0.4 +24.2	+1.5	+2.0	+0.0	90.8	105.0 25k High	-14.2	Vert

**Test Setup Photo(s)**



Below 1GHz



Above 1GHz



X Axis



Y Axis



Z Axis

# 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.

<b>MEASURING EQUIPMENT BANDWIDTH SETTINGS PER FREQUENCY RANGE</b>			
<b>TEST</b>	<b>BEGINNING FREQUENCY</b>	<b>ENDING FREQUENCY</b>	<b>BANDWIDTH SETTING</b>
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.