Itron, Inc.

TEST REPORT FOR

Gas Endpoint
Model: 500GB

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(FHSS AND HYBRID 902-928 MHz)

Report No.: 99317-18

Date of issue: December 24, 2018

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 # 803.02

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Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 163065

REPORT PREPARED BY:

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

Project Number: 99317

DATE OF EQUIPMENT RECEIPT: October 25, 2018
DATE(S) OF TESTING: October 25-30, 2018 and December 4-7, 2018

Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.

Steve Behm
Director of Quality Assurance & Engineering Services
CKC Laboratories, Inc.

Test Facility Information

Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):
CKC Laboratories, Inc.
110 Olinda Place
Brea, CA 92823

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.11

Site Registration & Accreditation Information

Location	NIST CB #	TAIWAN	CANADA	FCC	JAPAN
Brea A, CA	US0060	SL2-IN-E-1146R	3082D-1	US1025	A-0147

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)/15.247(f)	Average Time of Occupancy	NA	NP
15.247(f)	Hybrid Systems	NA	Pass
15.247(f)	Power Spectral Density	NA	Pass
15.247(b)(2)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = Not applicable because EUT operates on battery power.
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
Gas Endpoint	Itron, Inc.	500GB	99317-cond4

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6410	NA
Laptop AC/DC Adapter	Dell	LA65NS0-00	NA
USB to Serial Adapter	Itron, Inc.	PCB-TEMP-0007	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Gas Endpoint	Itron, Inc.	500GB	28 0100696429

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6410	NA
Laptop AC/DC Adapter	Dell	LA65NS0-00	NA
USB to Serial Adapter	Itron, Inc.	PCB-TEMP-0007	NA

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Proprietary FHSS
Operating Frequency Range:	902.3 to 926.9MHz (100kbps FSK power level 3) 902.4 to 927.6 MHz (300kbps power level 2-Hybrid) 902.4 to 927.6 MHz (300kbps power level 3)
Number of Hopping Channels:	83 (100kbps FSK power level 3) 64 (300kbps power level 2-Hybrid) 64 (300kbps power level 3)
Modulation Type(s):	100kbps FSK 300kbsp GFSK 300kbps GFSK Hybrid
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Gain:	3.6 dBi Integral Omni power level 2 4.1 dBi integral Omni power level 3
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	6.0Vdc
Firmware / Software used for Test:	FW 4.1.6.0/ Command Line Interface (CLI) Tool 2.0.0.11

FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/5/2018
Configuration:	1		
Test Setup:	The EUT is placed on test bench. The serial port is connected to a support laptop via serial to USB adapter. The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle. The EUT is powered from fresh battery 6.0Vdc. Frequency of measurement: 902.3 to 927.6MHz RBW=2kHz and 3.9kHz, VBW=6.2kHz and 12kHz		

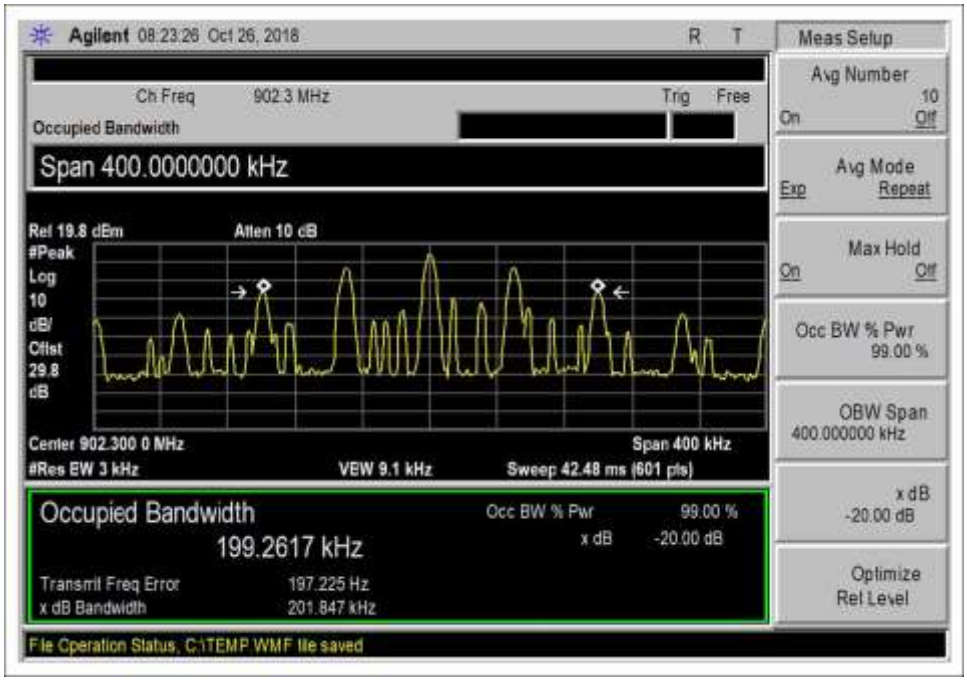
Environmental Conditions			
Temperature (ºC)	21.5	Relative Humidity (%):	35.0

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02672	Spectrum Analyzer	Agilent	E4446A	3/2/2017	3/2/2019
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/27/2017	10/27/2019
P07244	Cable	H&S	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

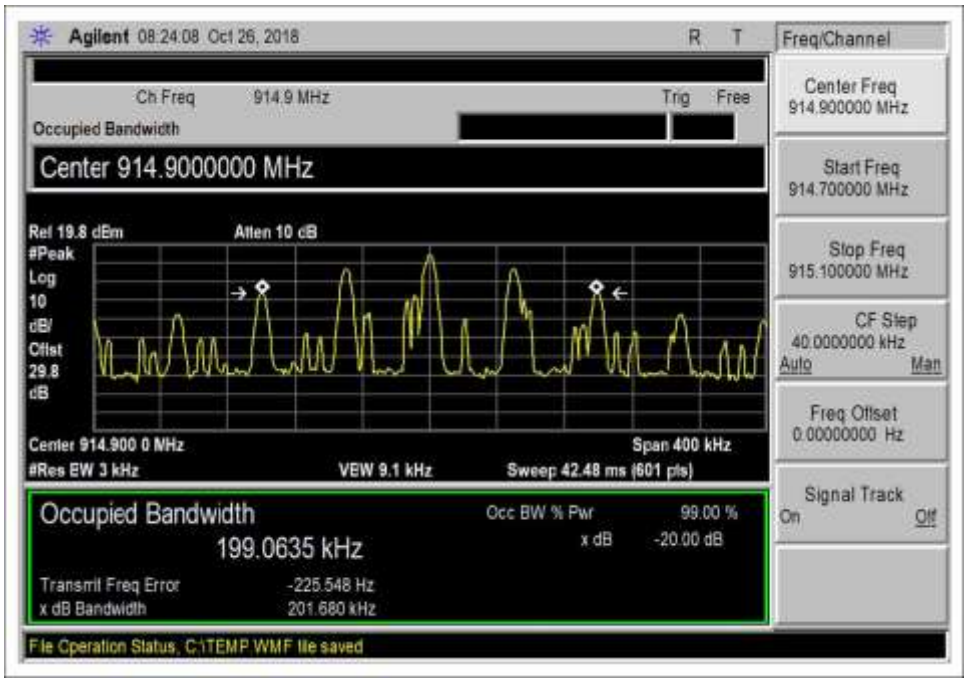
15.247(a)(1) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
902.3	1	100kbps FSK lv3	201.847	≤500	Pass
914.9	1	100kbps FSK lv3	201.680	≤500	Pass
926.9	1	100kbps FSK lv3	201.701	≤500	Pass
902.4	1	300kbps GFSK lv2	363.298	≤500	Pass
914.8	1	300kbps GFSK lv2	362.436	≤500	Pass
927.6	1	300kbps GFSK lv2	358.512	≤500	Pass
902.4	1	300kbps GFSK lv3	363.532	≤500	Pass
914.8	1	300kbps GFSK lv3	355.226	≤500	Pass
927.6	1	300kbps GFSK lv3	355.094	≤500	Pass

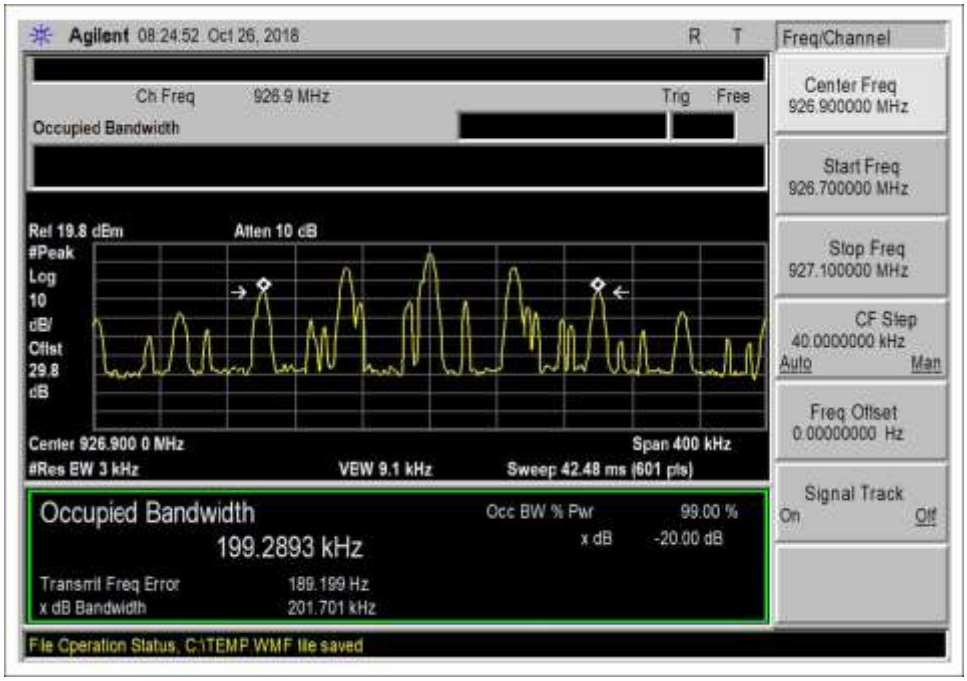
Plots



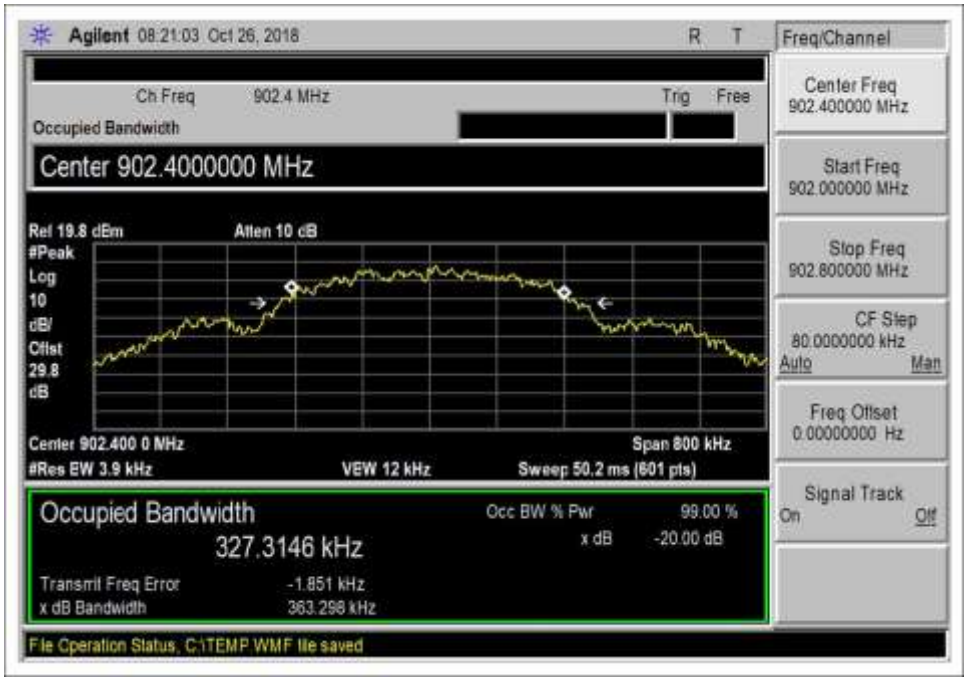
Low Channel, 100kbps, Power level 3



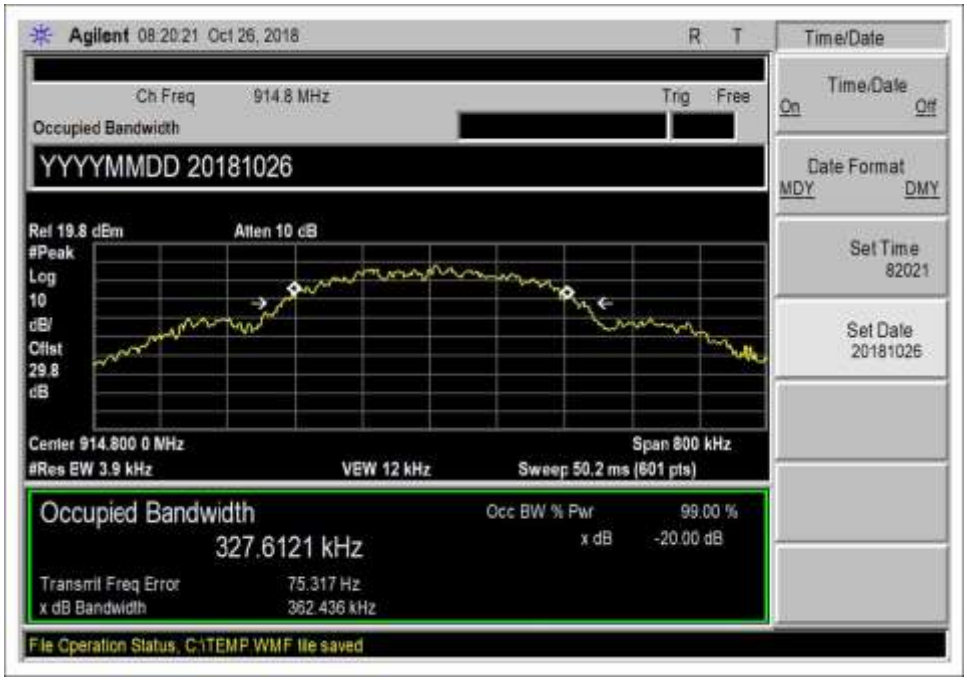
Middle Channel, 100kbps, Power level 3



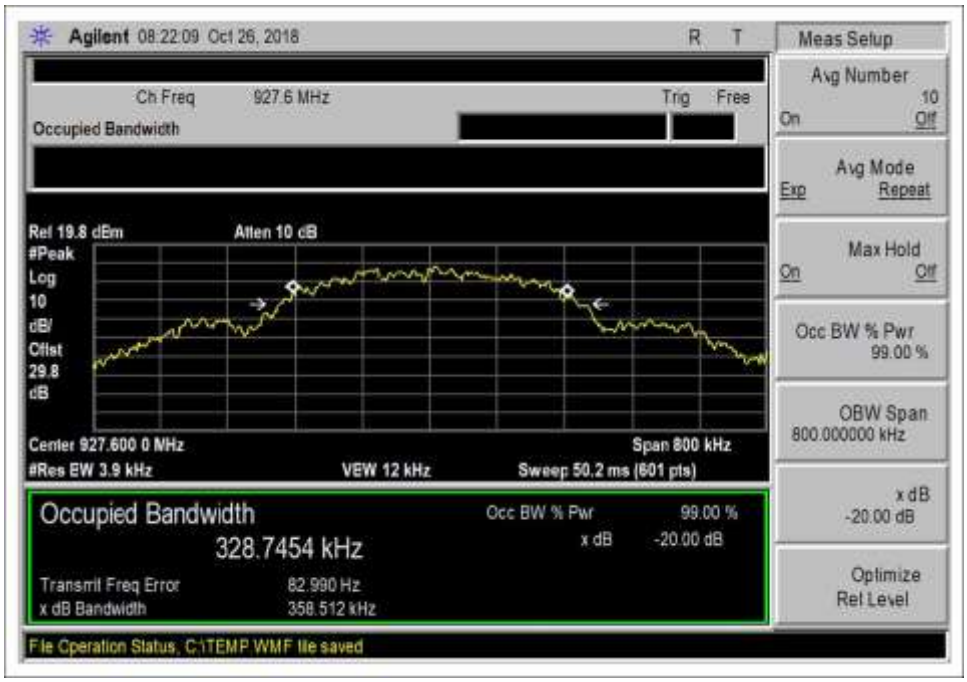
High Channel, 100kbps, Power level 3



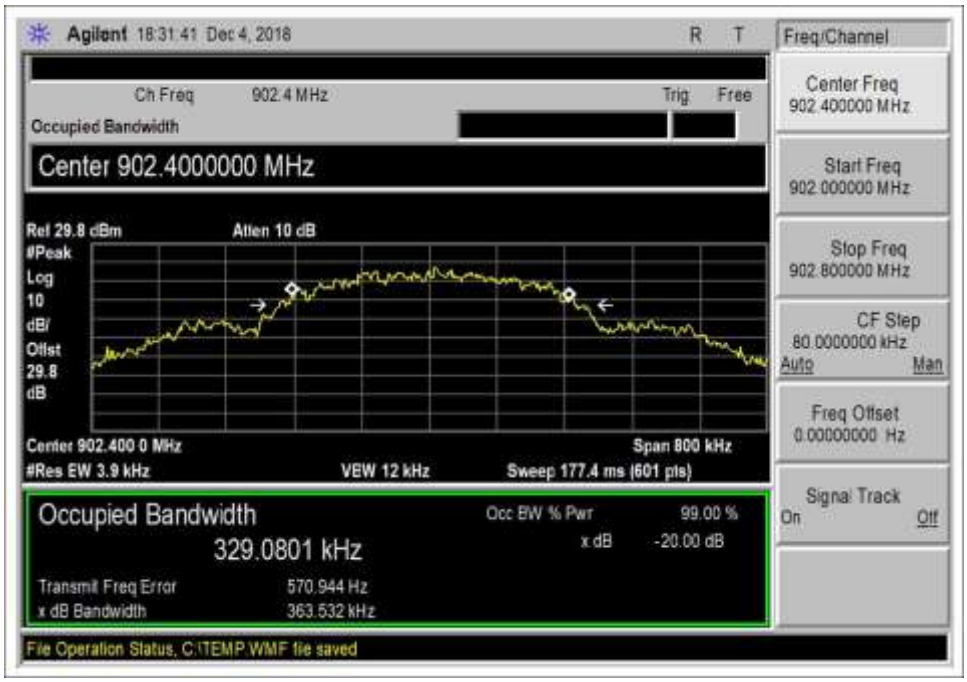
Low Channel, 300kbps, Power level 2



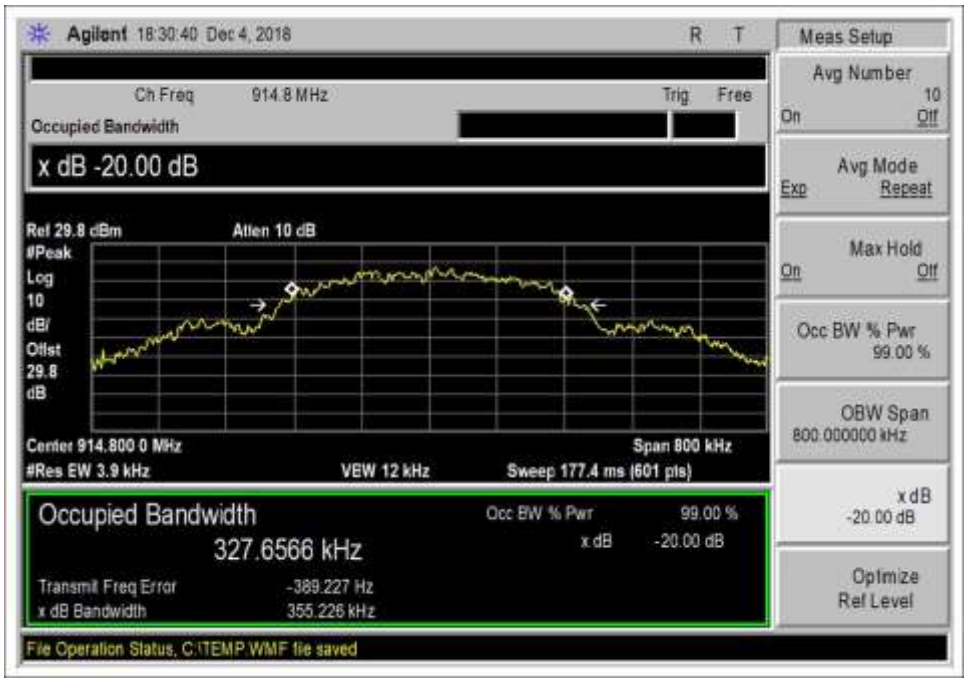
Middle Channel, 300kbps, Power level 2



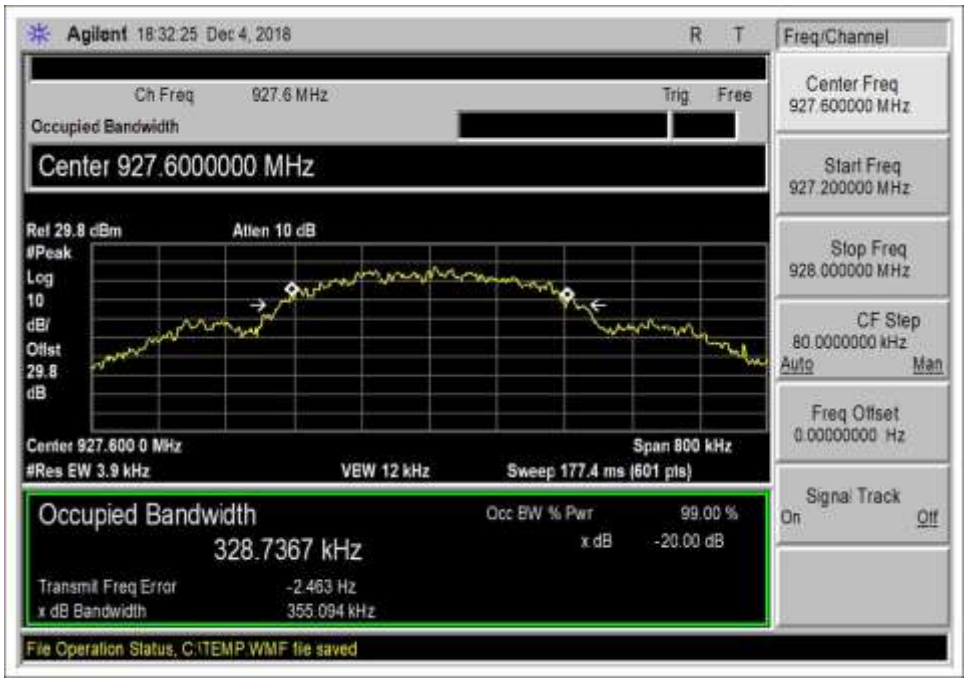
High Channel, 300kbps, Power level 2



Low Channel, 300kbps, Power level 3



Middle Channel, 300kbps, Power level 3

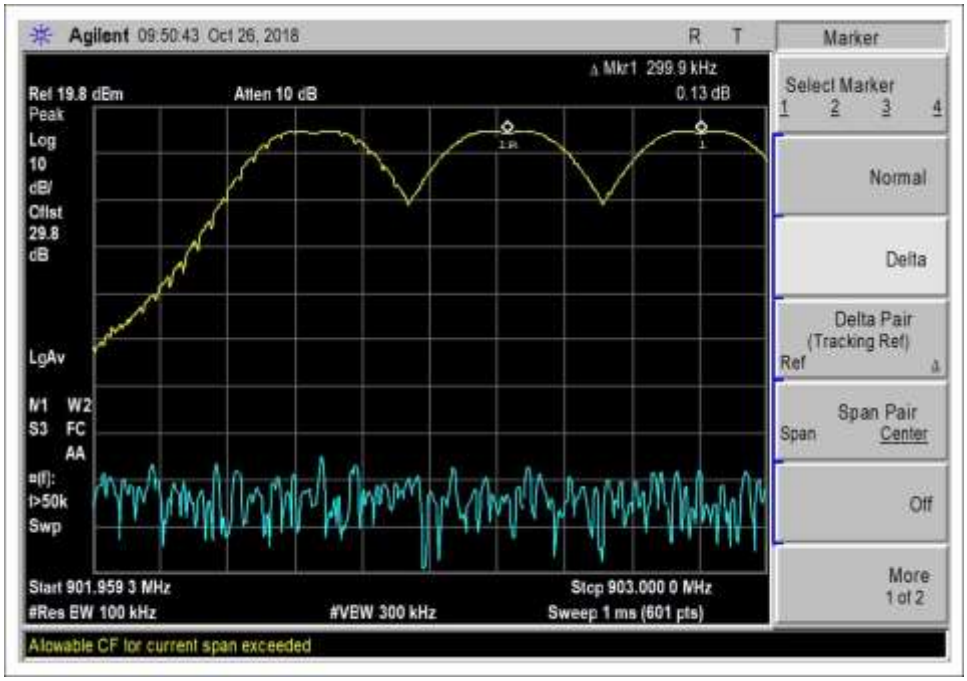


High Channel, 300kbps, Power level 3

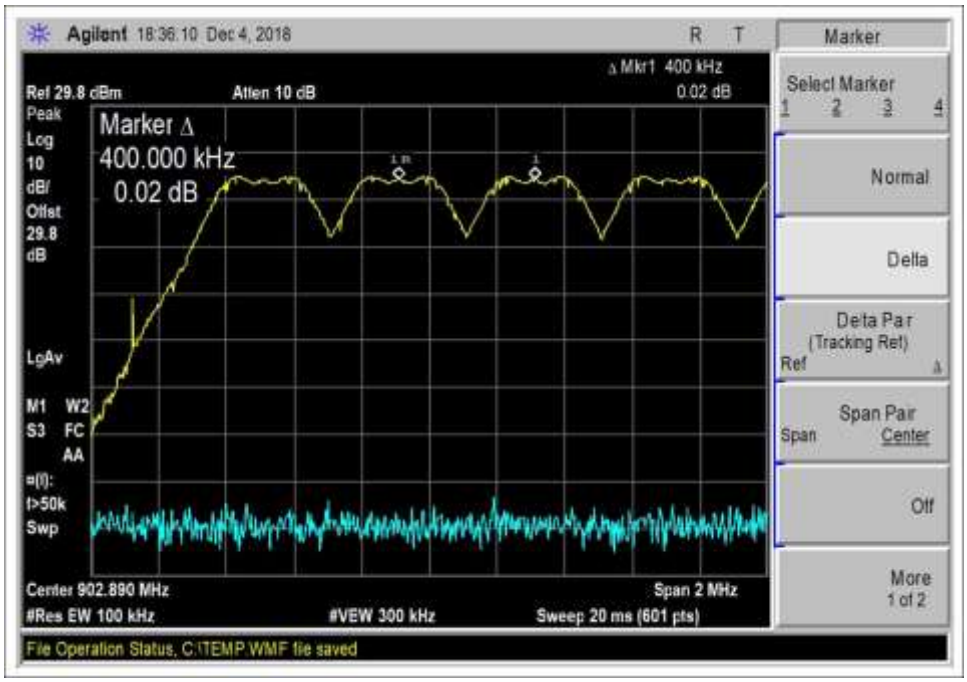
15.247(a)(1) Carrier Separation

Test Data Summary				
Limit applied: 20dB bandwidth of the hopping channel.				
Antenna Port	**Operational Mode**	**Measured (kHz)**	**Limit (kHz)**	**Results**
1	100kbps FSK lv3	300	> 201.847	Pass
1	300kbps GFSK lv2	400	> 363.298	Pass
1	300kbps GFSK lv3	400	> 363.532	

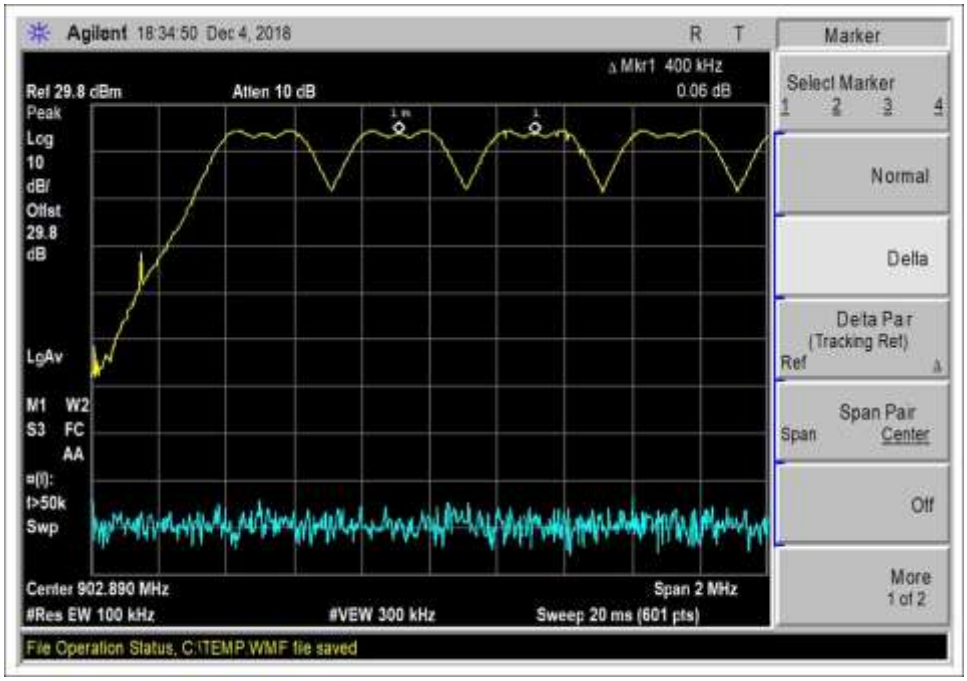
Plots



100kbps, Power level 3



300kbps, Power level 2

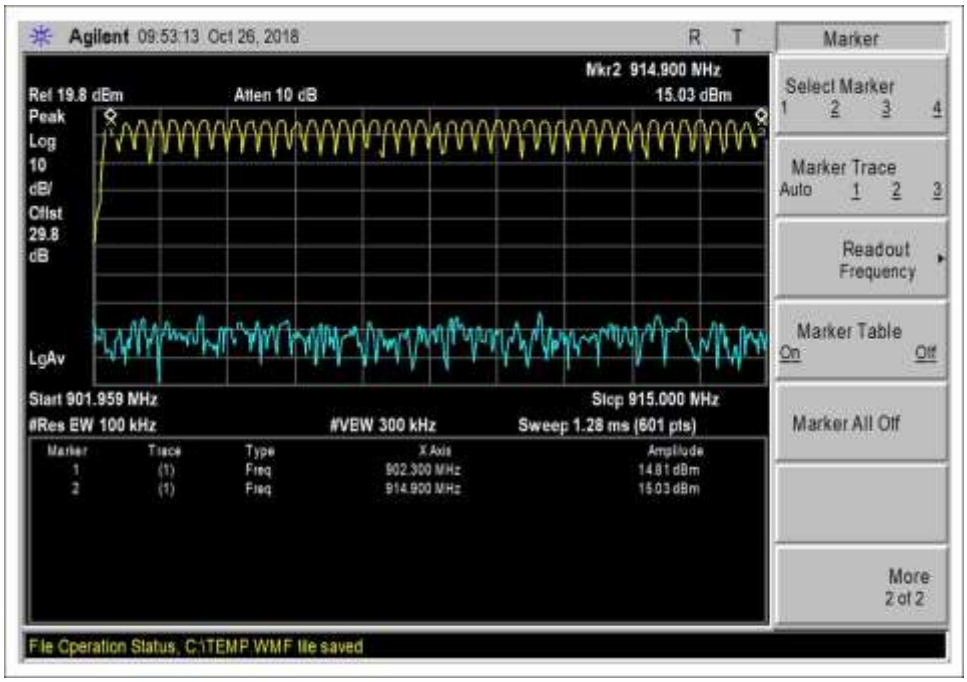


300kbps, Power level 3

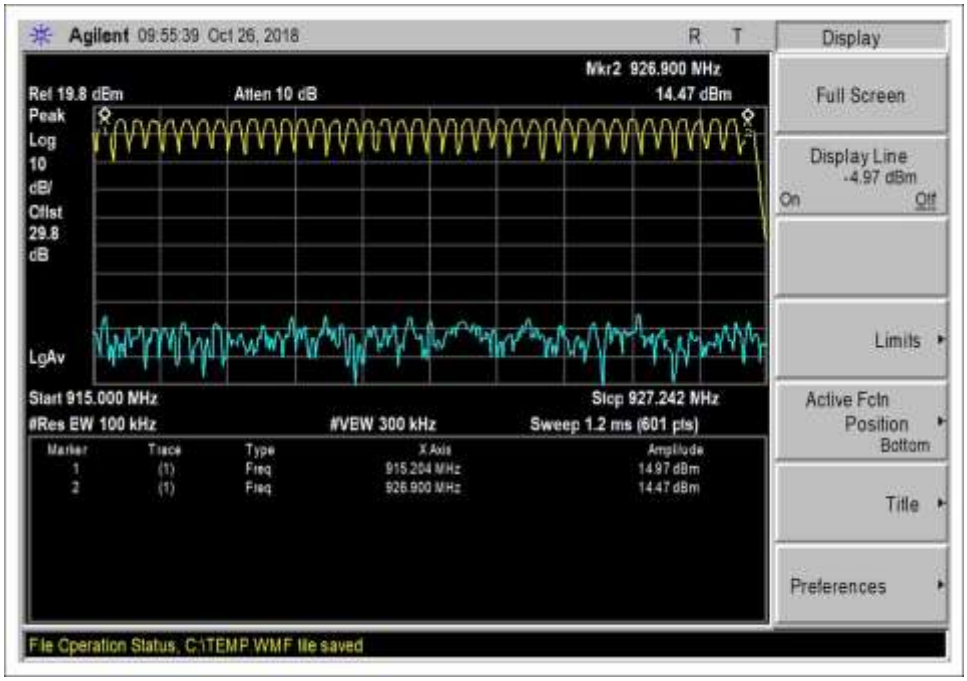
15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50\ Channels\ \vert 20\ dB\ BW < 250kHz \\ 25\ Channels\ \vert 20\ dB\ BW \geq 250kHz \end{cases}$				
Antenna Port	**Operational Mode**	**Measured (Channels)**	**Limit (Channels)**	**Results**
1	100kbps FSK lv3	83	≥ 50	Pass
1	300kbps GFSK lv2	64	≥ 25	Pass
1	300kbps GFSK lv3	64	≥ 25	Pass

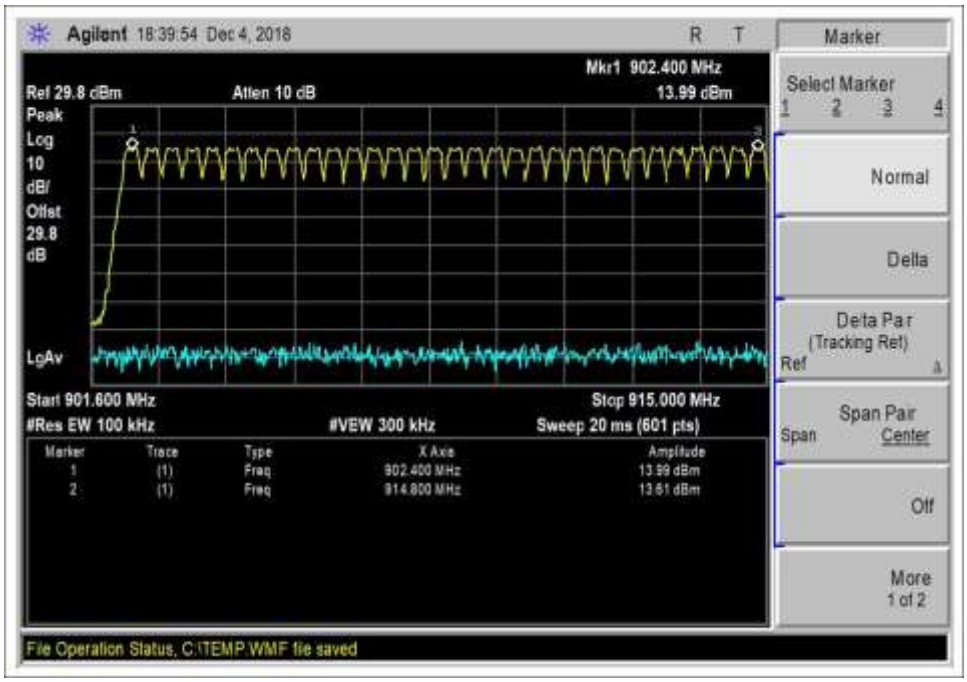
Plots



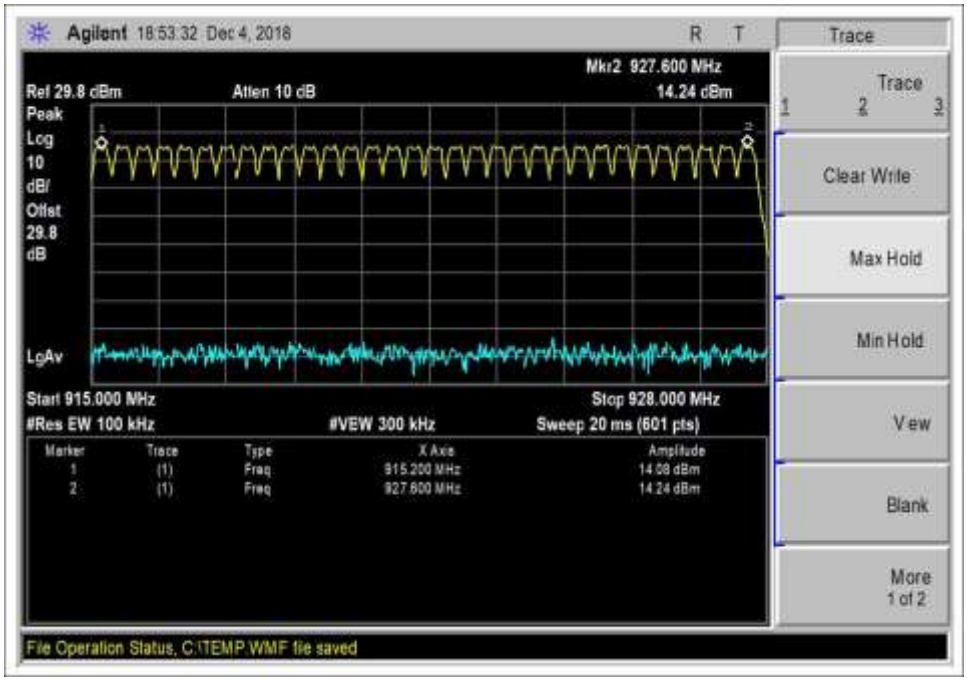
100kbps, Power level 3, #1



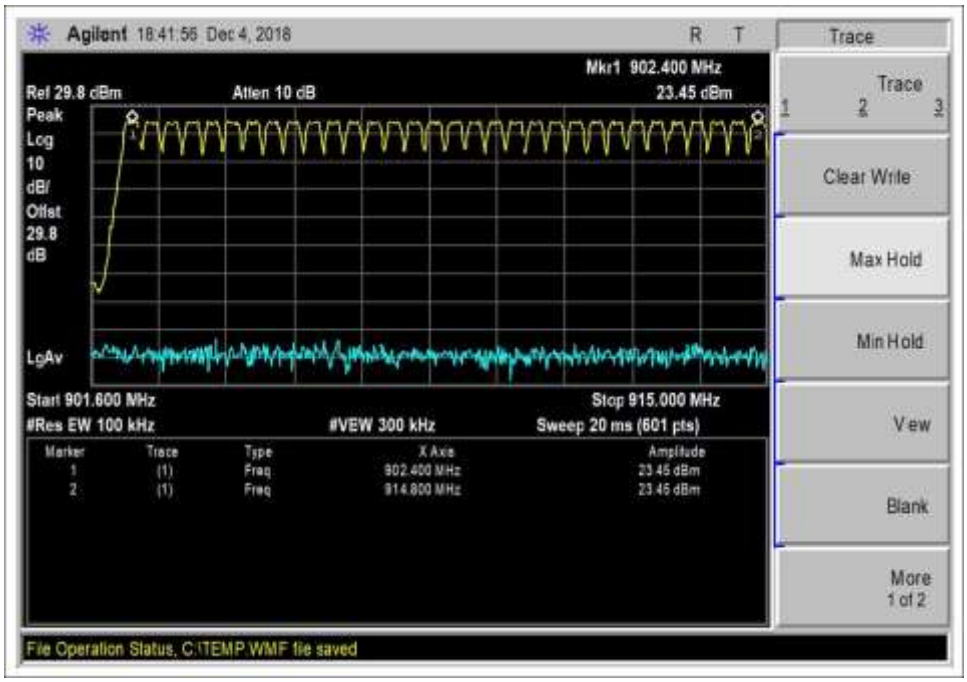
100kbps, Power level 3, #2



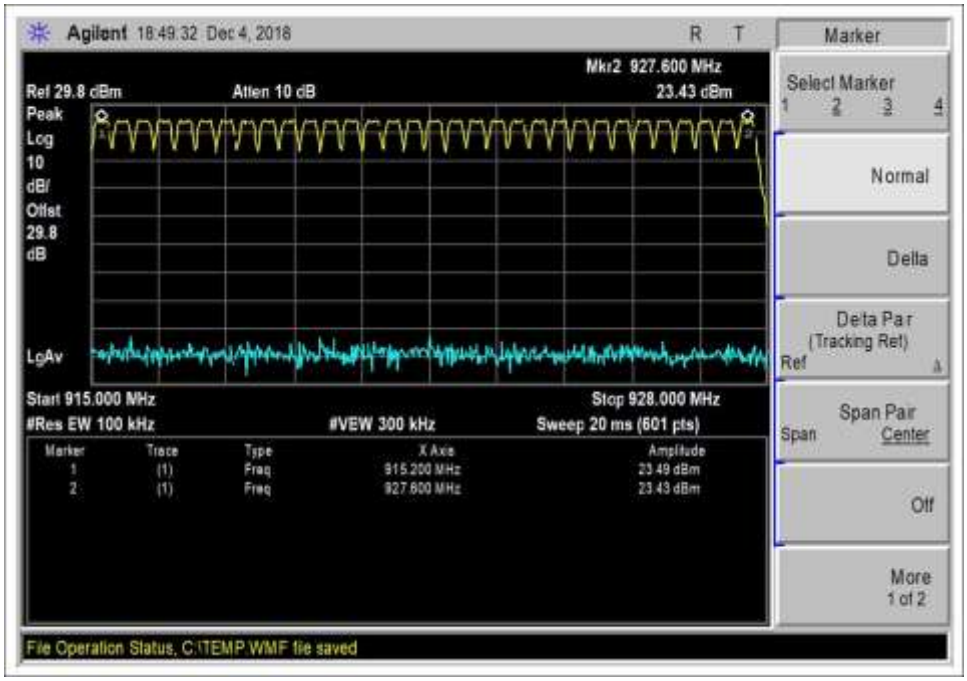
300kbps, Power level 2, #1



300kbps, Power level 2, #2



300kbps, Power level 3, #1



300kbps, Power level 3, #2

15.247(a)(1)(i)/15.247(f) Average 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 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.

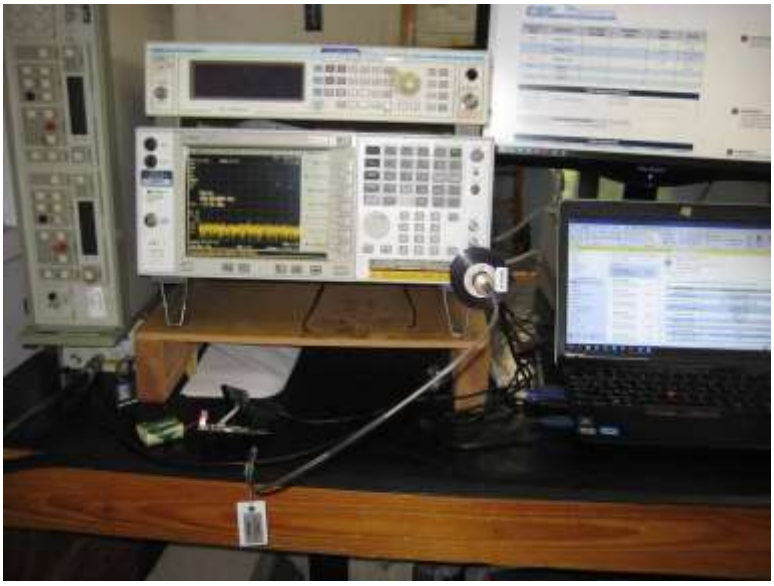
The system has receiver channel bandwidths that match the transmitter's modulation bandwidth that is enabled.

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.

Test Setup Photo



15.247(f) Hybrid Systems

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	10/25/2018
Configuration:	1		
Test Setup:	The EUT is placed on test bench. The serial port is connected to a support laptop via serial to USB adapter. The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle. The EUT is powered from fresh battery 6.0Vdc. Frequency of measurement: 902.4 to 927.6MHz RBW=3kHz, VBW=9kHz		

Environmental Conditions			
Temperature (ºC)	22.9	Relative Humidity (%):	54.4

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02672	Spectrum Analyzer	Agilent	E4446A	3/2/2017	3/2/2019
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/27/2017	10/27/2019
P07244	Cable	H&S	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

15.247(f) Power Spectral Density

Power Spectral Density

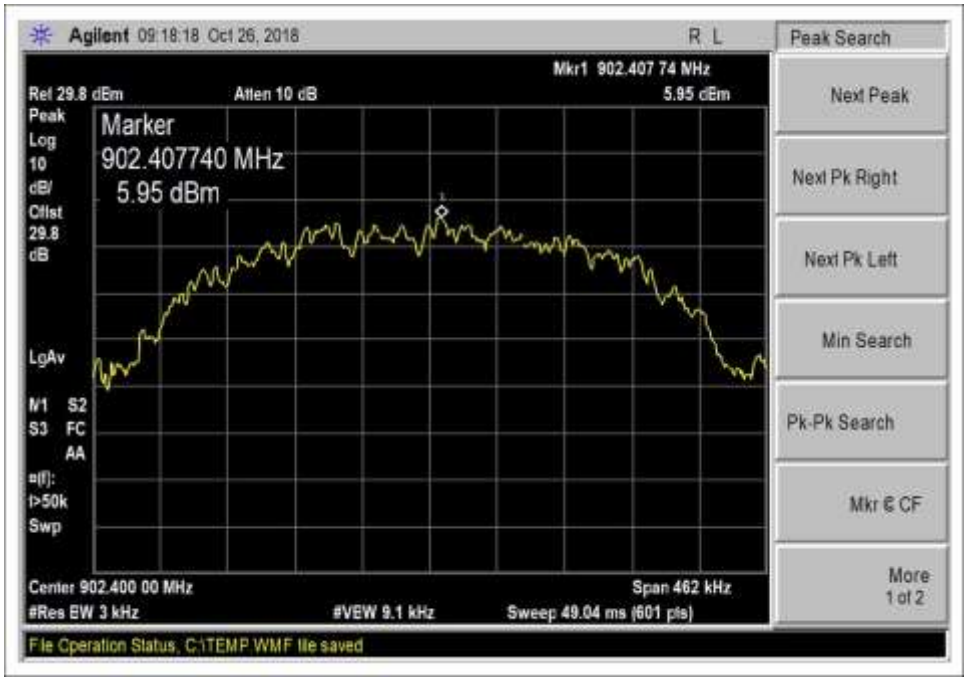
Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	**Modulation**	**Measured (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
902.4	300kbps GFSK lv2 Hybrid	5.95	≤8	Pass
914.8	300kbps GFSK lv2 Hybrid	6.20	≤8	Pass
927.6	300kbps GFSK lv2 Hybrid	6.26	≤8	Pass

6dB Occupied Bandwidth (required for PSD measurement)

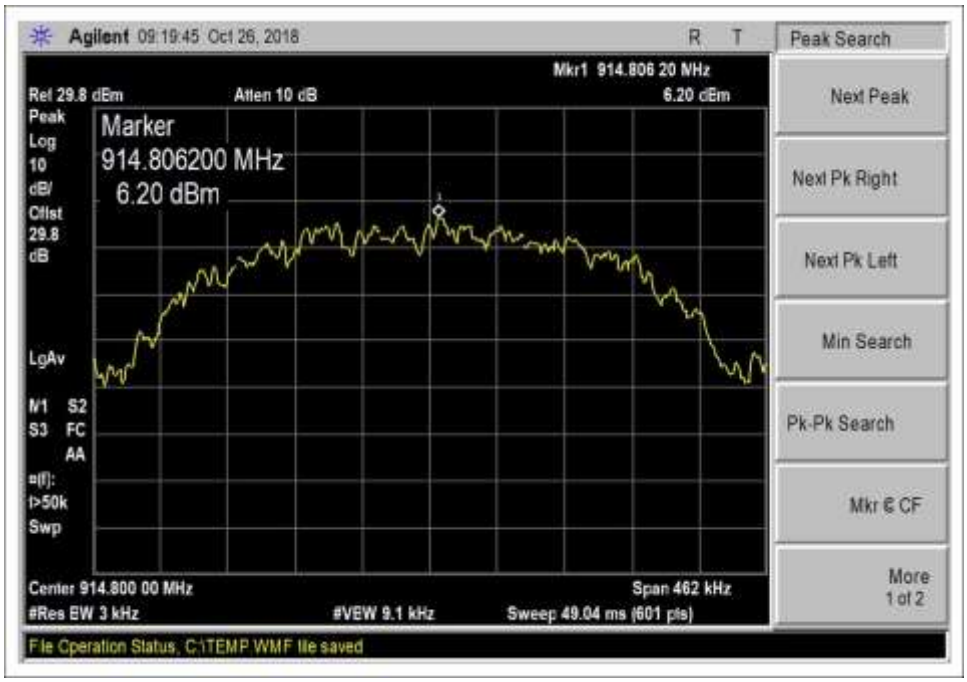
Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
902.4	1	300kbps GFSK lv2 Hybrid	307.545	None	Pass
914.8	1	300kbps GFSK lv2 Hybrid	307.819		
927.6	1	300kbps GFSK lv2 Hybrid	310.093		

Plots

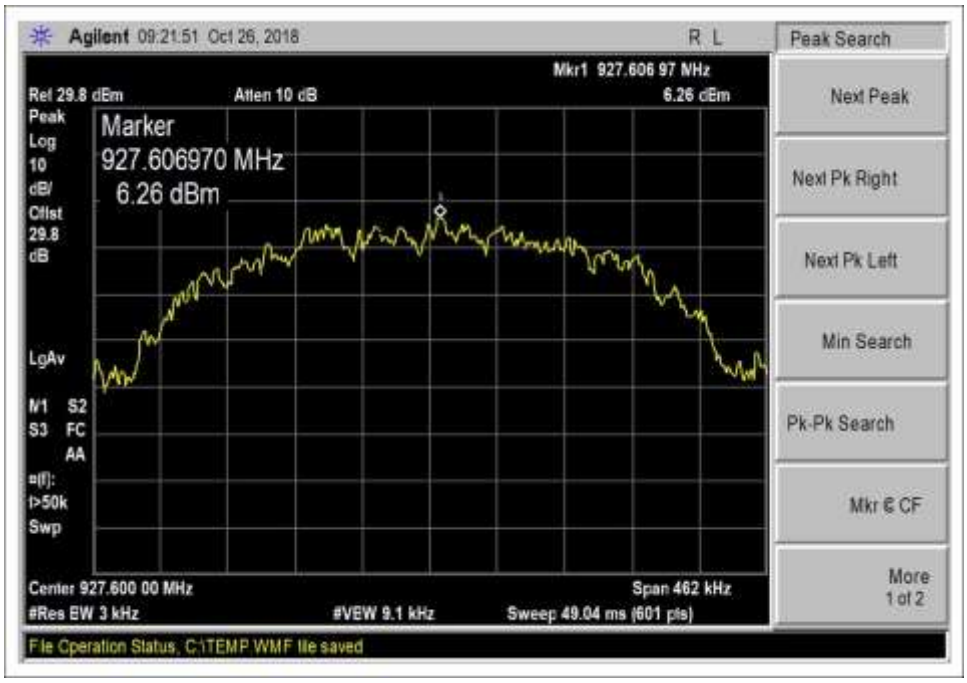
Power Spectral Density



Low Channel

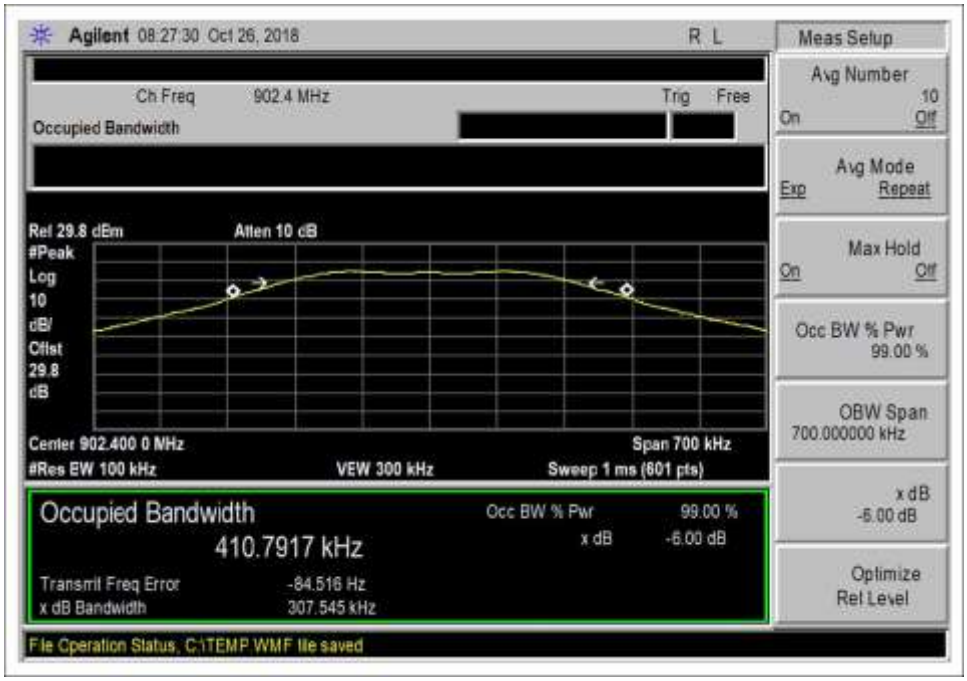


Middle Channel

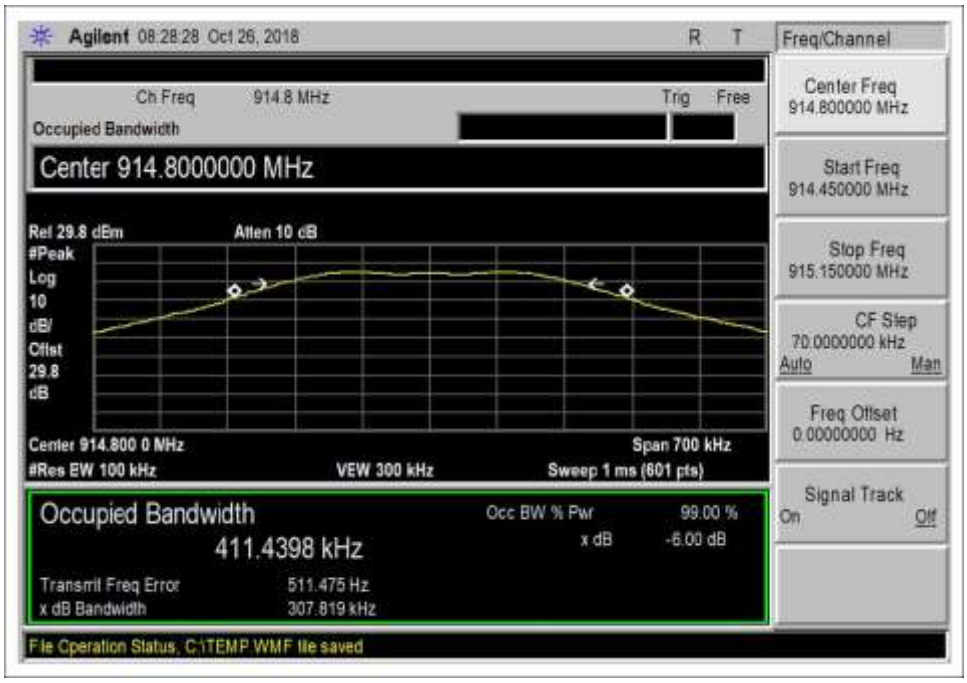


High Channel

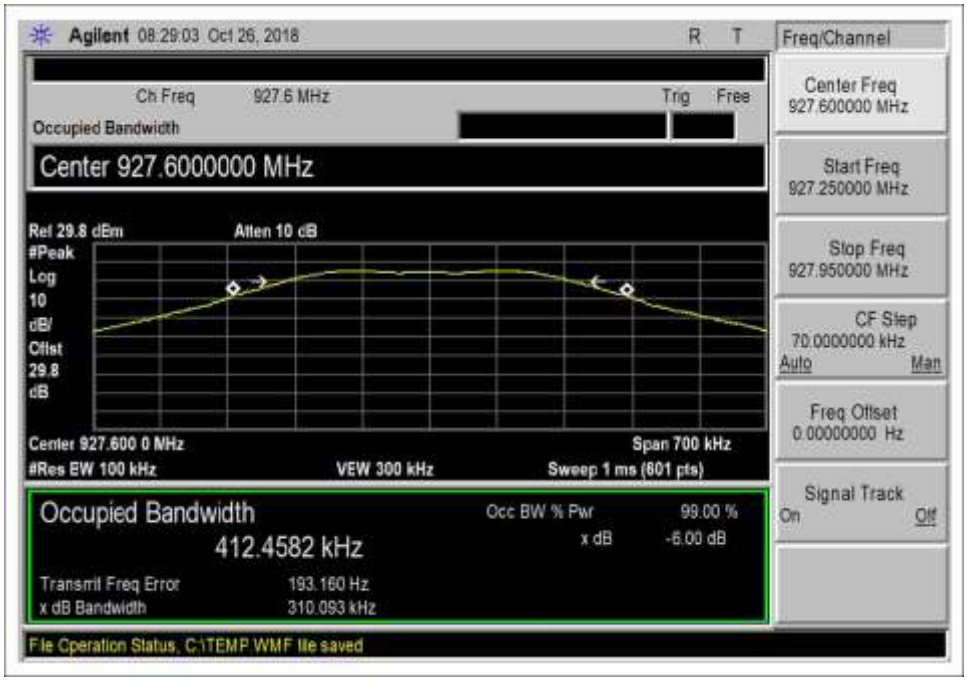
6dB Occupied Bandwidth



Low Channel

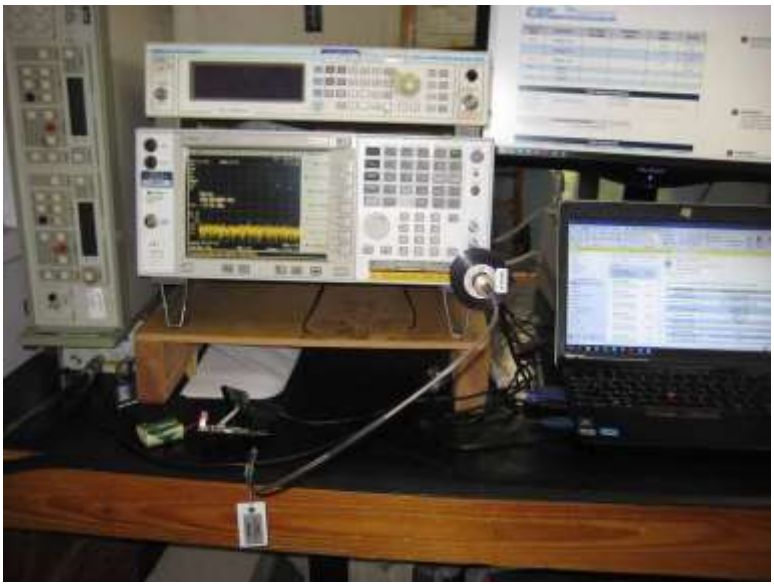


Middle Channel



High Channel

Test Setup Photo



15.247(b)(1) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/5/2018
Configuration:	1		
Test Setup:	The EUT is placed on test bench. The serial port is connected to a support laptop via serial to USB adapter. The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle. The EUT is powered from fresh battery 6.0Vdc. Frequency of measurement: 902.3 to 927.6MHz RBW=2MHz, VBW=6MHz		

Environmental Conditions			
Temperature (ºC)	21.5	Relative Humidity (%):	35.0

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02672	Spectrum Analyzer	Agilent	E4446A	3/2/2017	3/2/2019
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/27/2017	10/27/2019
P07244	Cable	H&S	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

Test Data Summary - Voltage Variations

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

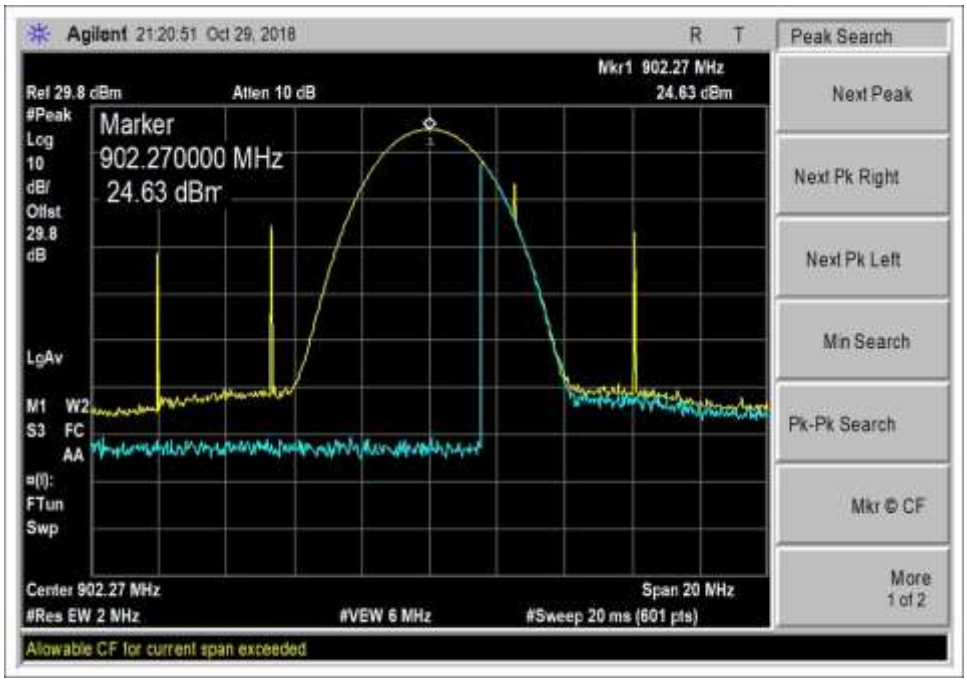
Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

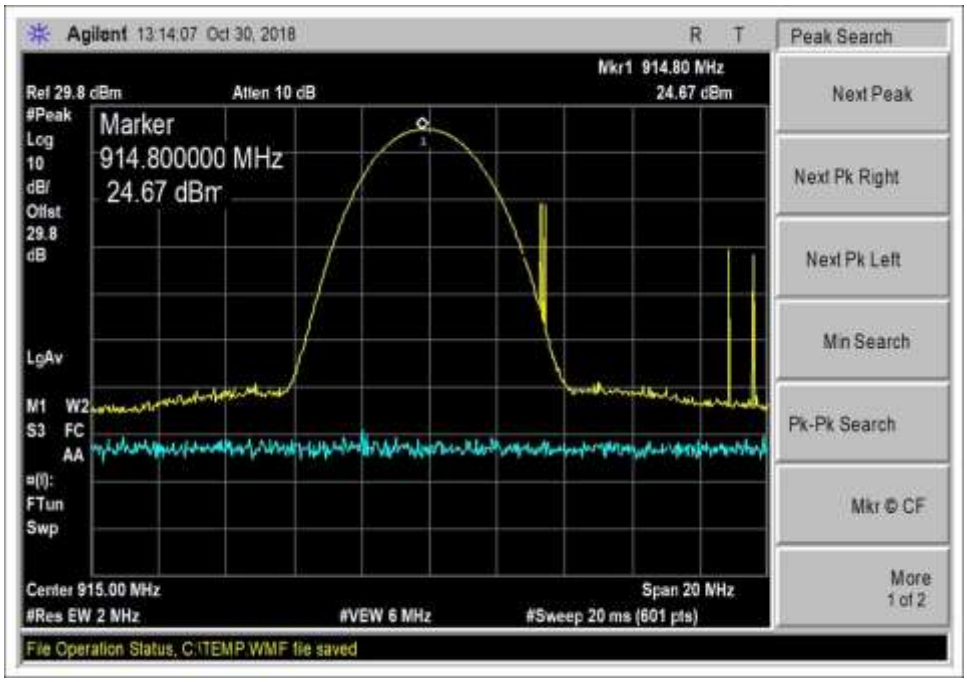
Parameter	Value
$V_{Nominal}$:	6.0Vdc
$V_{Minimum}$:	6.0Vdc
$V_{Maximum}$:	6.0Vdc

Test Data Summary - RF Conducted Measurement					
$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$					
Frequency (MHz)	**Modulation**	**Ant. Type / Gain (dBi)**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902.3	100kbps FSK lv3	Integral/4.1	24.63	≤ 30	Pass
914.9	100kbps FSK lv3	Integral/4.1	24.67	≤ 30	Pass
926.9	100kbps FSK	Integral/4.1	24.69	≤ 30	Pass
902.4	300kbps GFSK lv2	Integral/3.6	15.16	≤ 30	Pass
914.8	300kbps GFSK lv2	Integral/3.6	15.29	≤ 30	Pass
927.6	300kbps GFSK lv2	Integral/3.6	15.46	≤ 30	Pass
902.4	300kbps GFSK lv3	Integral/4.1	24.10	≤ 30	Pass
914.8	300kbps GFSK lv3	Integral/4.1	24.16	≤ 30	Pass
927.6	300kbps GFSK lv3	Integral/4.1	24.12	≤ 30	Pass

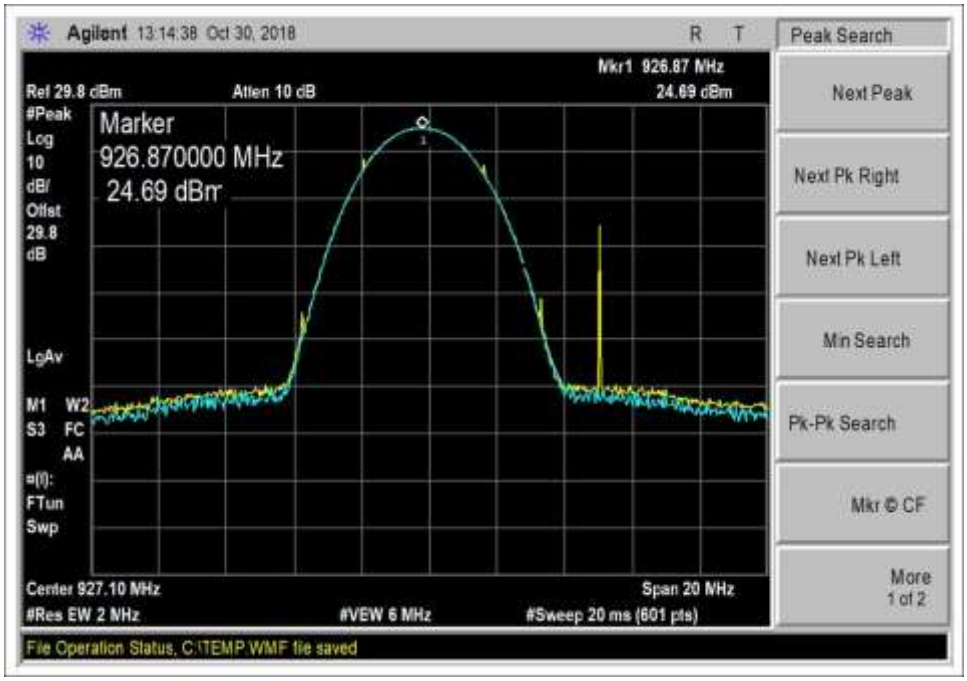
Plots



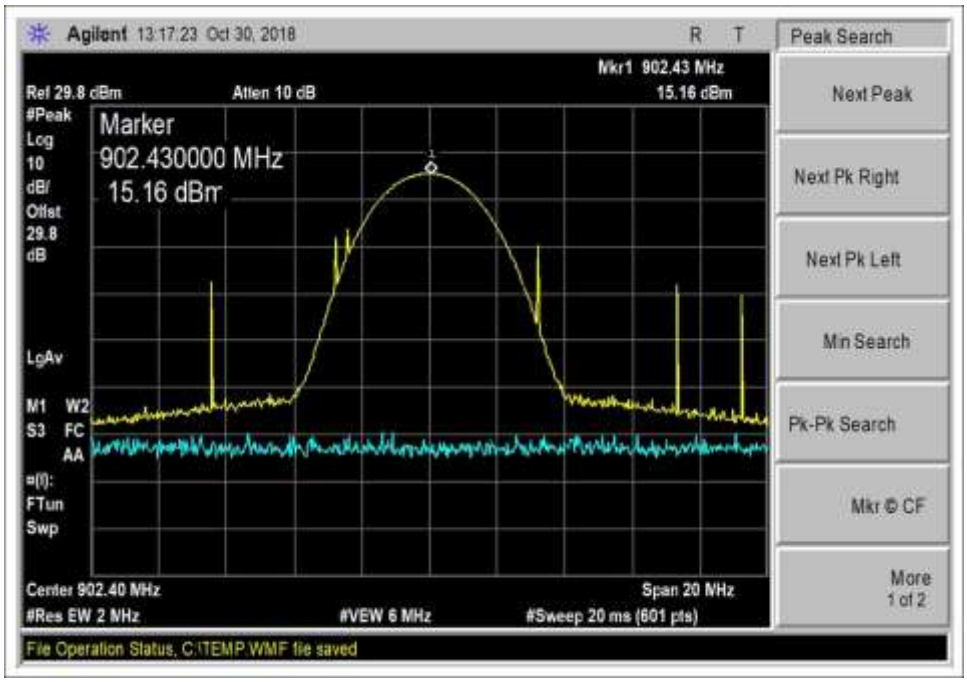
Low Channel, 100kbps, Power level 3



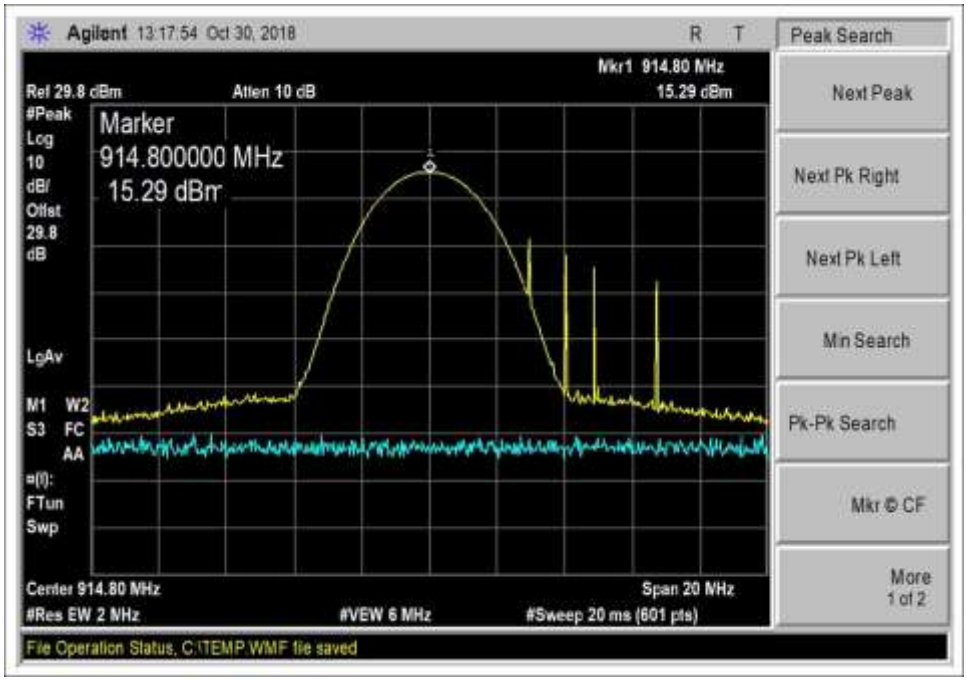
Middle Channel, 100kbps, Power level 3



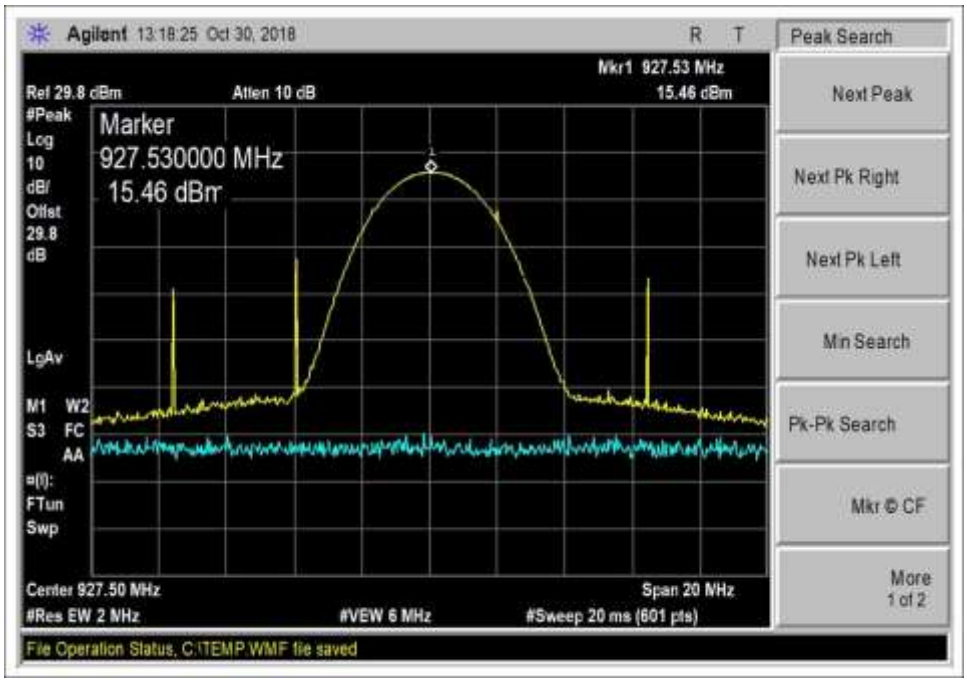
High Channel, 100kbps, Power level 3



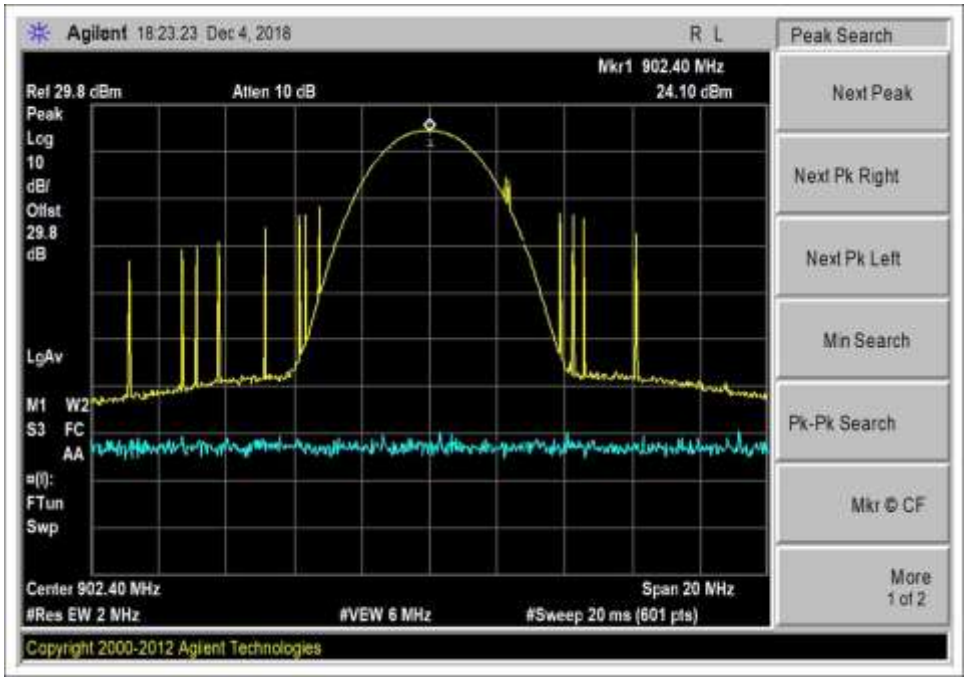
Low Channel, 300kbps, Power level 2



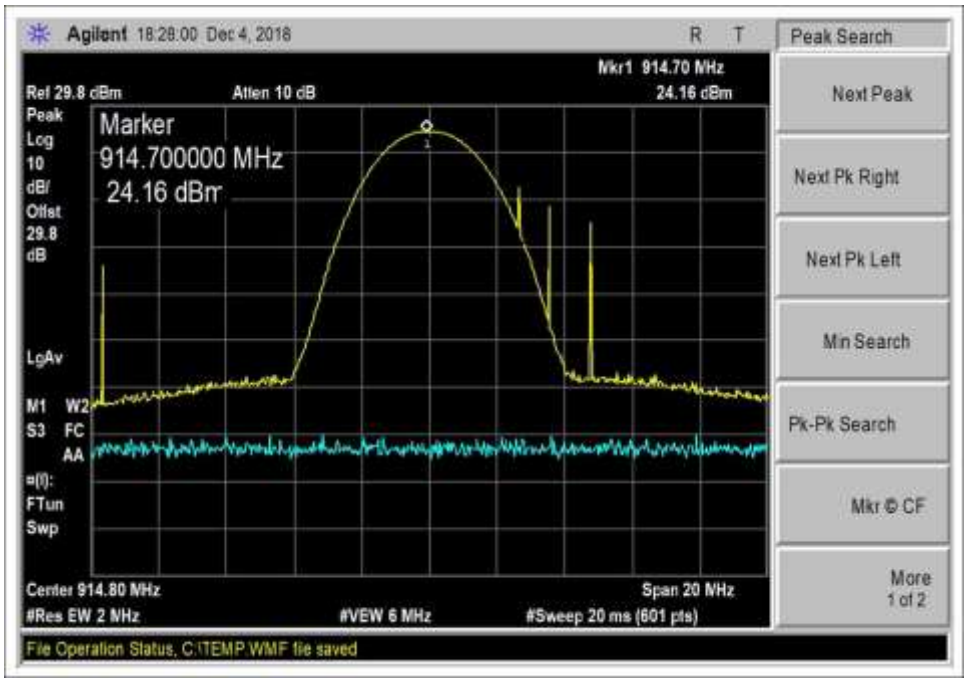
Middle Channel, 300kbps, Power level 2



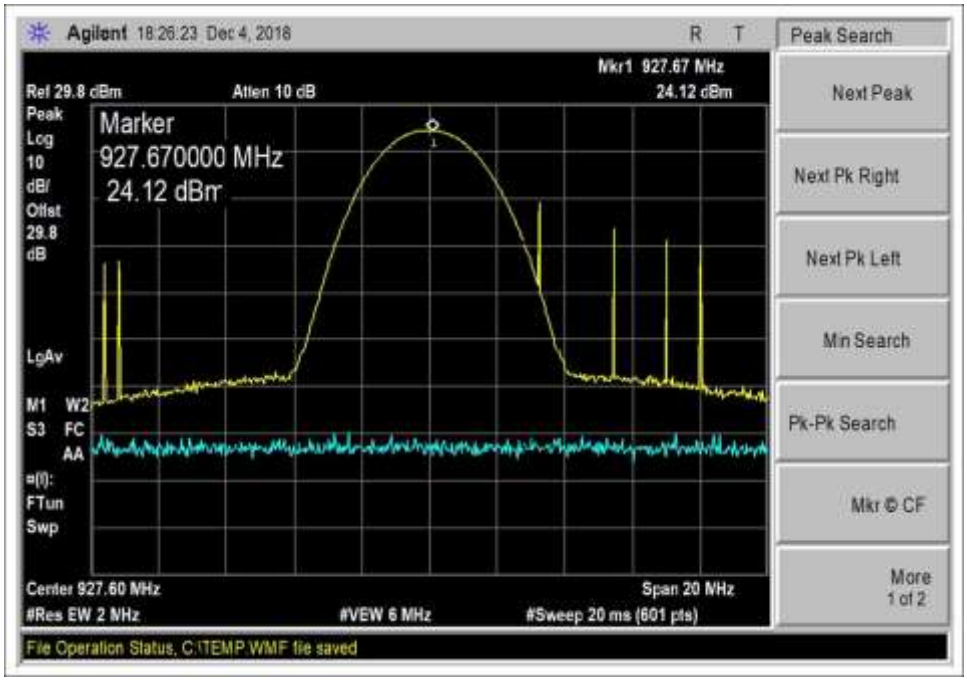
High Channel, 300kbps, Power level 2



Low Channel, 300kbps, Power level 3

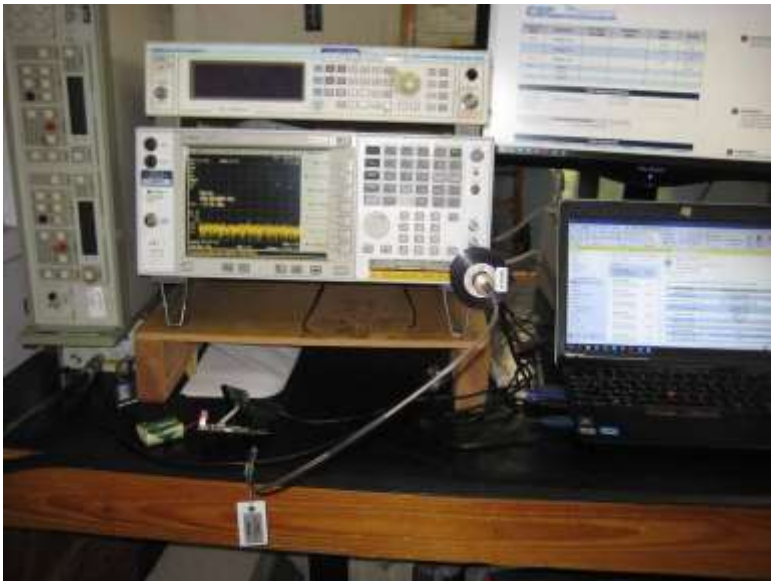


Middle Channel, 300kbps, Power level 3



High Channel, 300kbps, Power level 3

Test Setup Photo



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**99317**	Date:	12/5/2018
Test Type:	**Conducted Emissions**	Time:	09:31:51
Tested By:	Don Nguyen	Sequence#:	0
Software:	EMITest 5.03.11		6.0Vdc

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

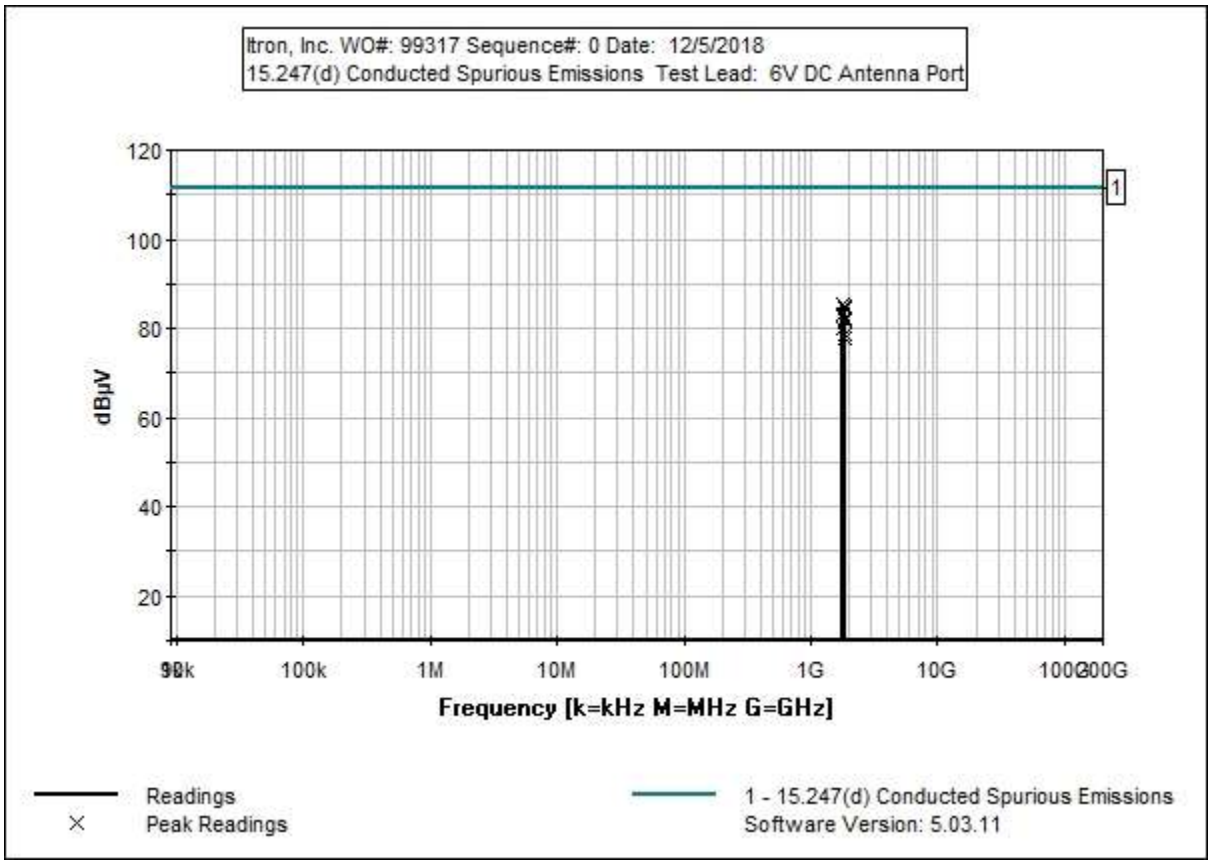
Test Conditions / Notes:

The EUT is placed on test bench. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc

Modulation: 100kbps FSK, 300kbps GFSK power level 2, 300kbps GFSK power level 3

Frequency of measurement: 9kHz-9280MHz
RBW=100kHz, VBW=300kHz
Test Method: ANSI C63.10 (2013)

Data represent worst case emissions.


Itron, Inc. WO#: 99317 Sequence#: 0 Date: 12/5/2018
15.247(d) Conducted Spurious Emissions Test Lead: 6V DC Antenna Port
120
100
80
60
40
20
dBµV
1
100k
1M
10M
100M
1G
10G
Frequency [k=kHz M=MHz G=GHz]
Readings
Peak Readings
1 - 15.247(d) Conducted Spurious Emissions
Software Version: 5.03.11

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03432	Attenuator	90-30-34	10/27/2017	10/27/2019
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	ANP07244	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020

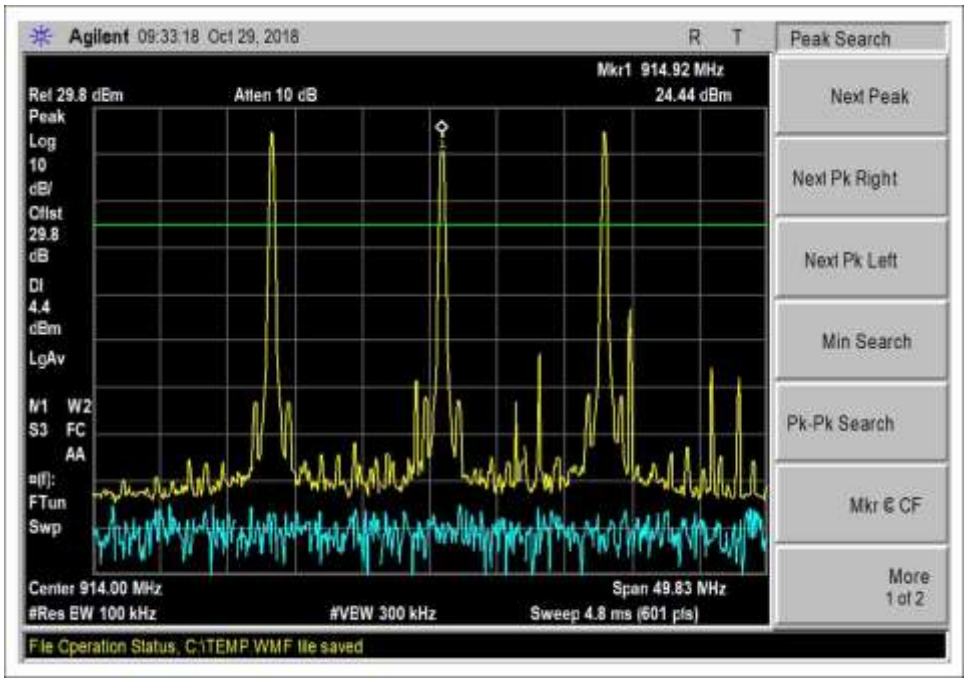
Measurement Data: Reading listed by margin. Test Lead: Antenna Port

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1804.647M	50.3	+29.7	+0.2			+0.0	80.2	102.0	-21.8	Anten
									GFSK 300k lv2		
2	1829.450M	49.0	+29.7	+0.2			+0.0	78.9	102.0	-23.1	Anten
									GFSK 300k lv2		
3	1855.050M	48.1	+29.7	+0.2			+0.0	78.0	102.0	-24.0	Anten
									GFSK 300k lv2		
4	1804.644M	55.7	+29.7	+0.2			+0.0	85.6	111.4	-25.8	Anten
									GFSK 300k lv3		
5	1829.453M	55.1	+29.7	+0.2			+0.0	85.0	111.4	-26.4	Anten
									GFSK 300k lv3		
6	1855.043M	54.7	+29.7	+0.2			+0.0	84.6	111.4	-26.8	Anten
									GFSK 300k lv3		
7	1804.805M	53.4	+29.7	+0.2			+0.0	83.3	111.4	-28.1	Anten
									FSK 100k lv3		
8	1829.600M	52.5	+29.7	+0.2			+0.0	82.4	111.4	-29.0	Anten
									FSK 100k lv3		
9	1855.200M	51.9	+29.7	+0.2			+0.0	81.8	111.4	-29.6	Anten
									FSK 100k lv3		

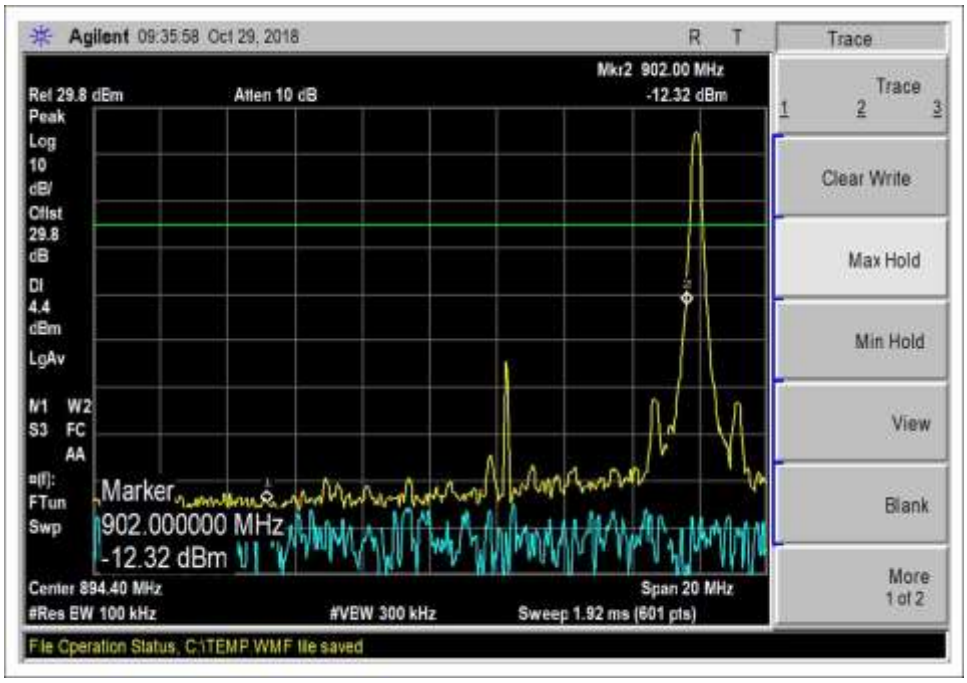
Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	100kbps FSK lv3	-12.32	<4.4	Pass
928	100kbps FSK lv3	-36.75	<4.4	Pass
902	100kbps FSK lv3 hopping	-11.29	<4.4	Pass
928	100kbps FSK lv3 hopping	-36.26	<4.4	Pass
902	300kbps GFSK lv2	-22.08	<-5.0	Pass
928	300kbps GFSK lv2	-21.57	<-5.0	Pass
902	300kbps GFSK lv2 hopping	-20.43	<-5.0	Pass
928	300kbps GFSK lv2 hopping	-26.81	<-5.0	Pass
902	300kbps GFSK lv3	-9.47	<4.2	Pass
928	300kbps GFSK lv3	-11.01	<4.2	Pass
902	300kbps GFSK lv3 hopping	-10.82	<4.2	Pass
928	300kbps GFSK lv3 hopping	-9.76	<4.2	Pass

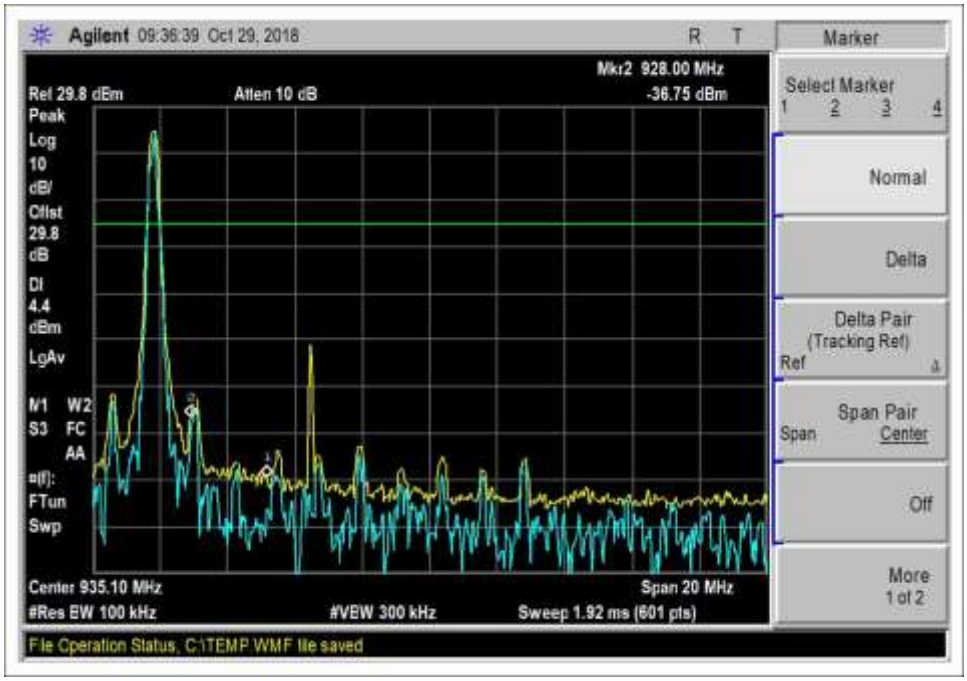
Band Edge Plots



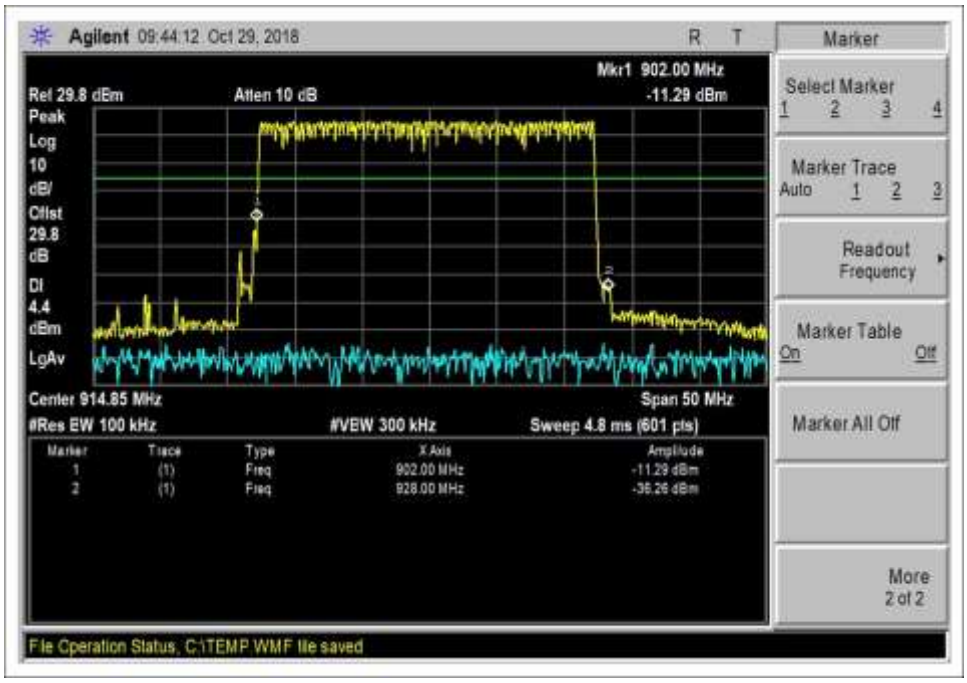
Peak, 100kbps, Power level 3



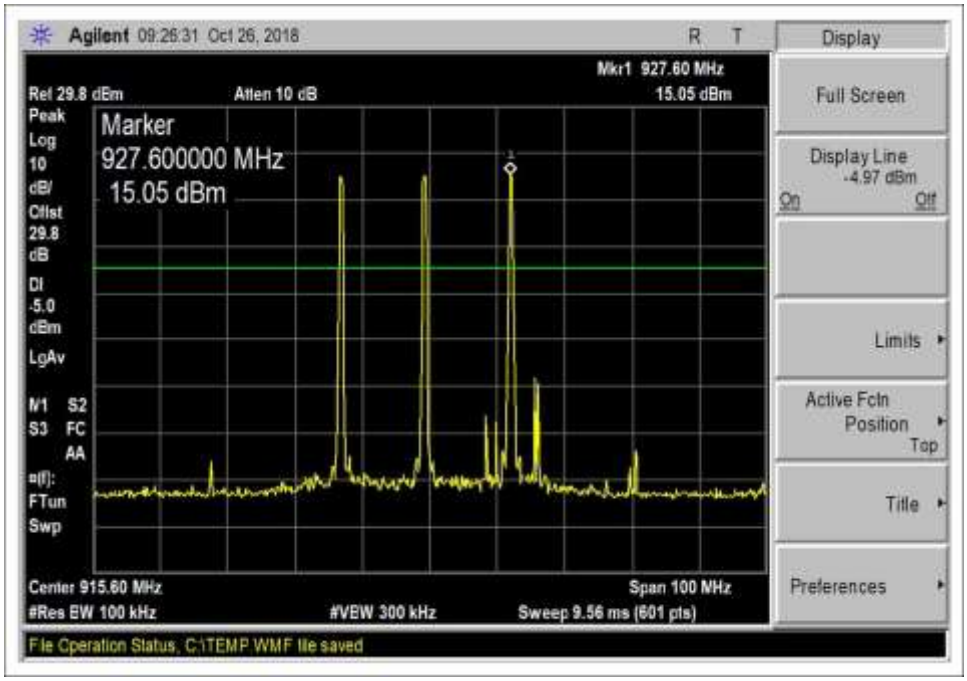
Low Channel, 100kbps, Power level 3



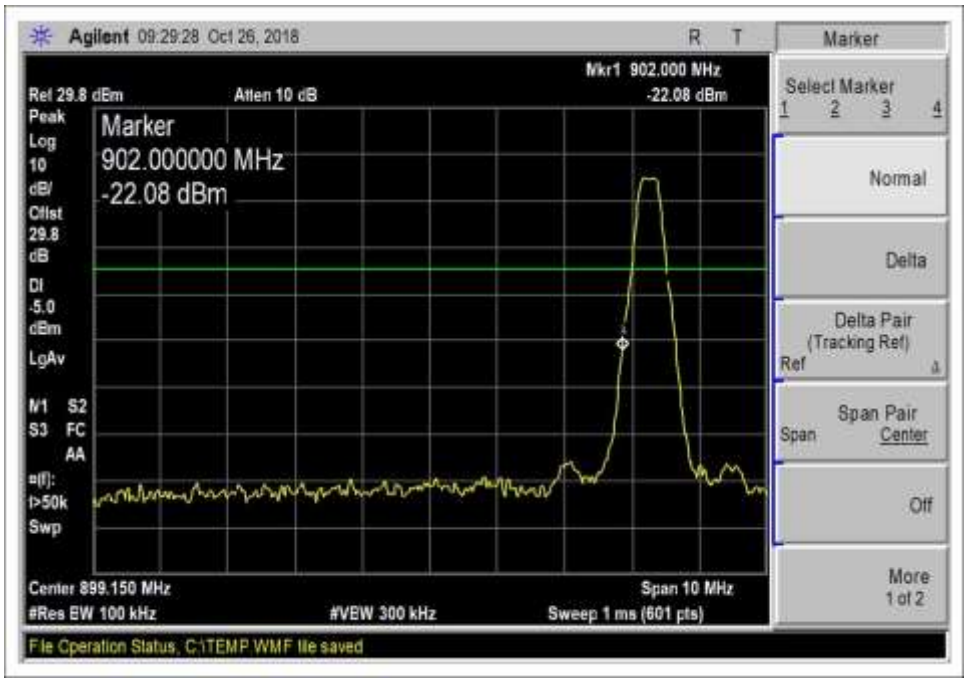
High Channel, 100kbps, Power level 3



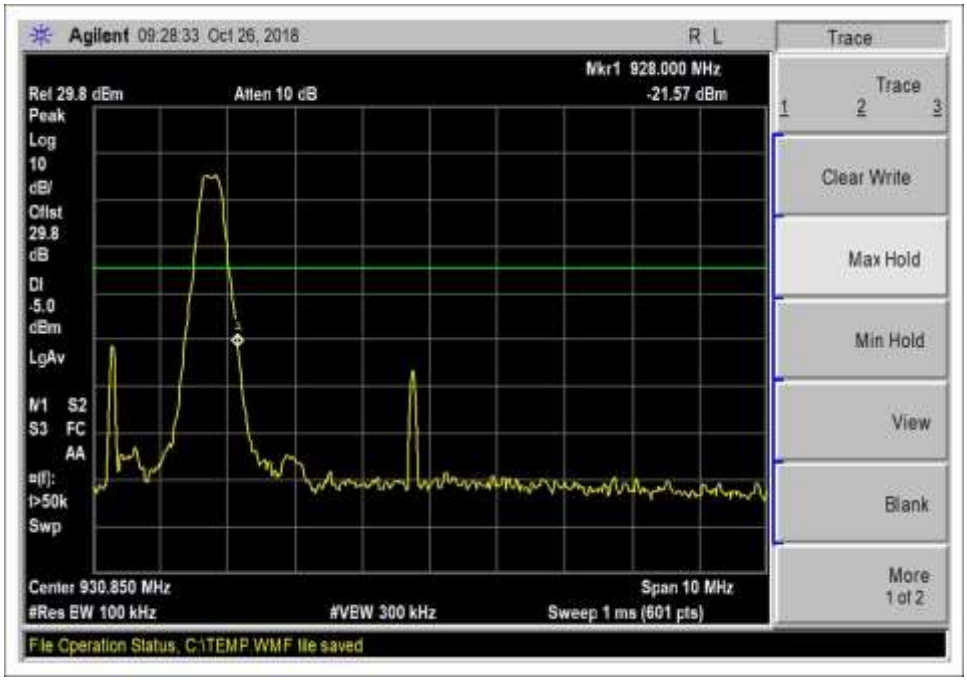
Hopping, 100kbps, Power level 3



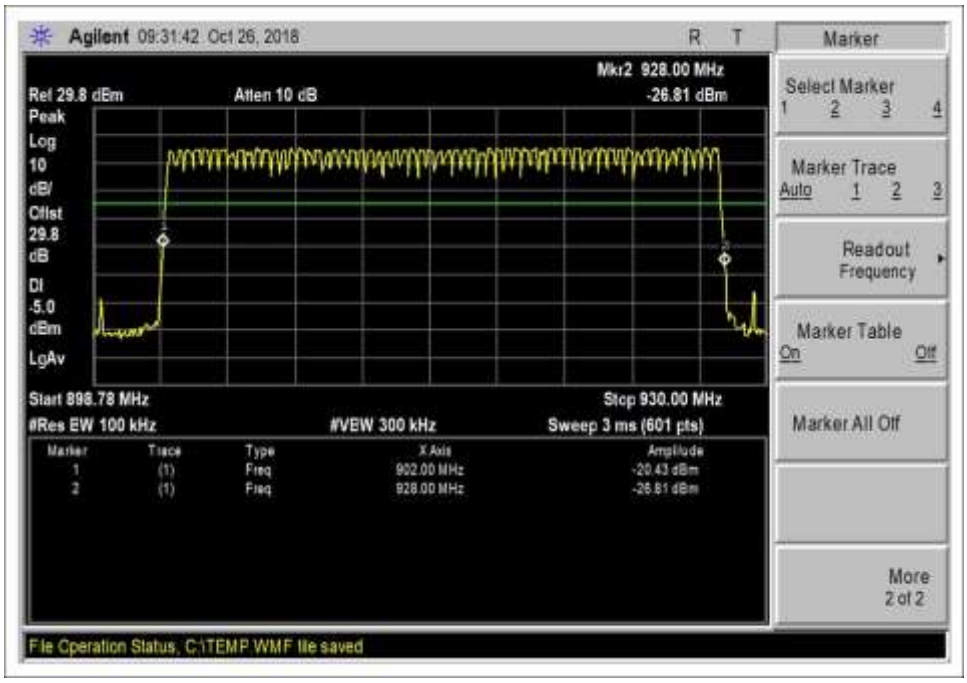
Peak, 300kbps, Power level 2



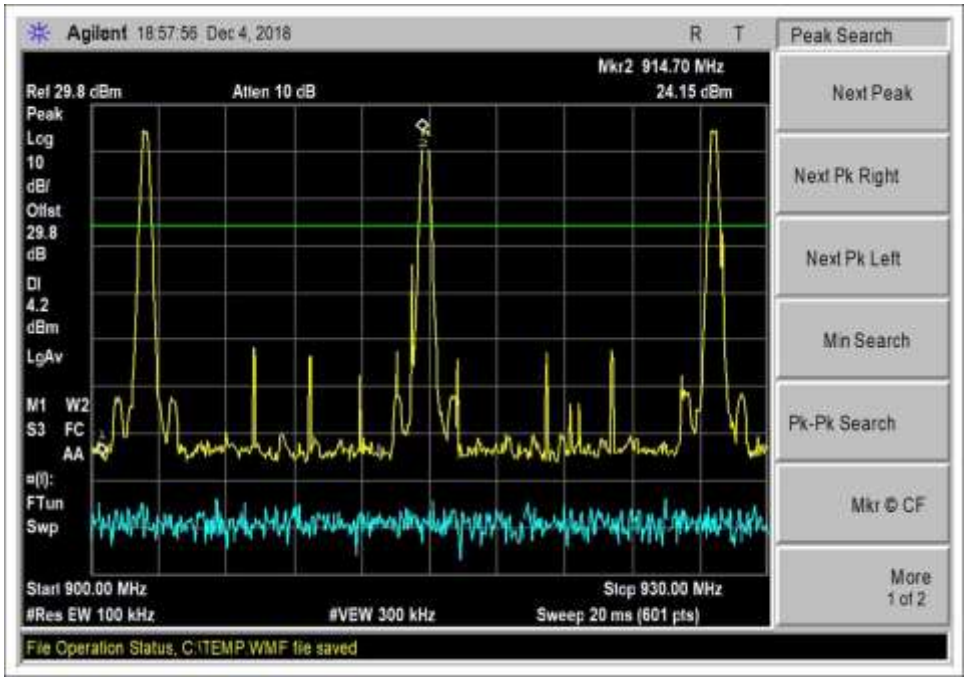
Low Channel, 300kbps, Power level 2



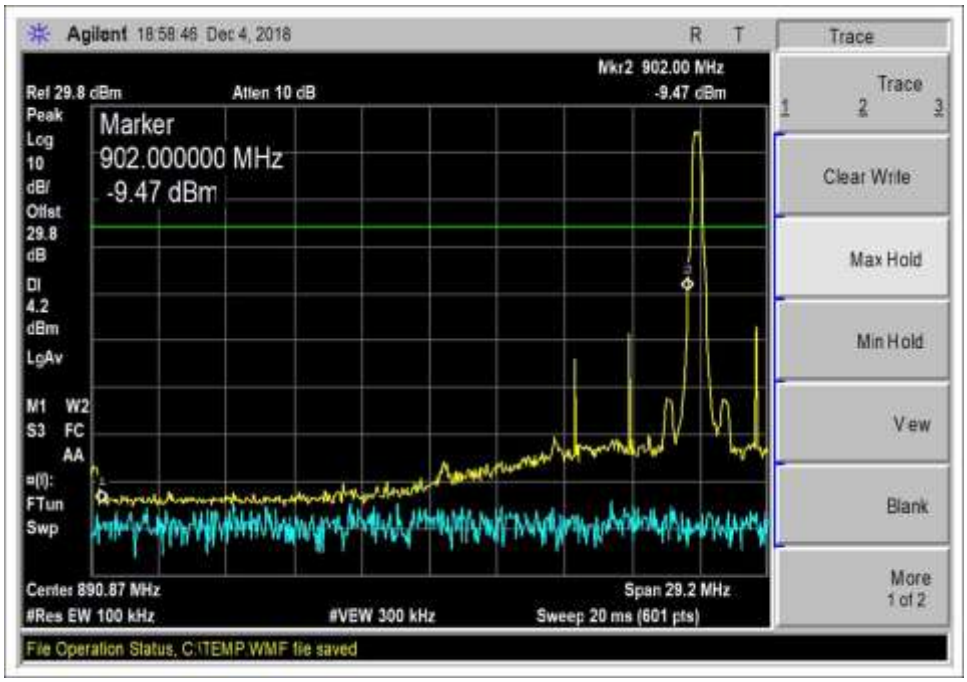
High Channel, 300kbps, Power level 2



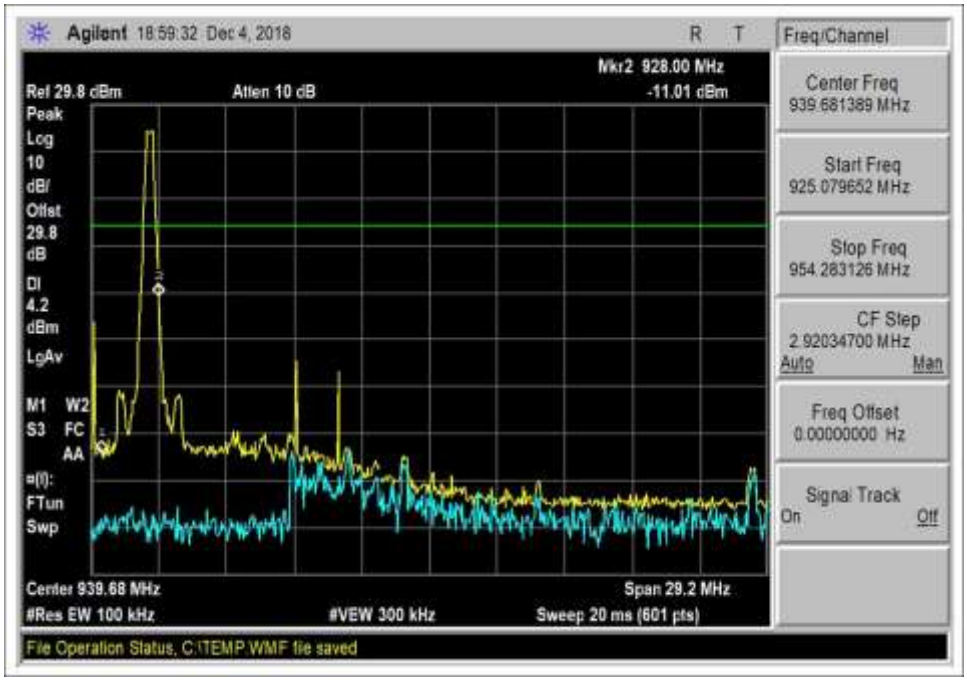
Hopping, 300kbps, Power level 2



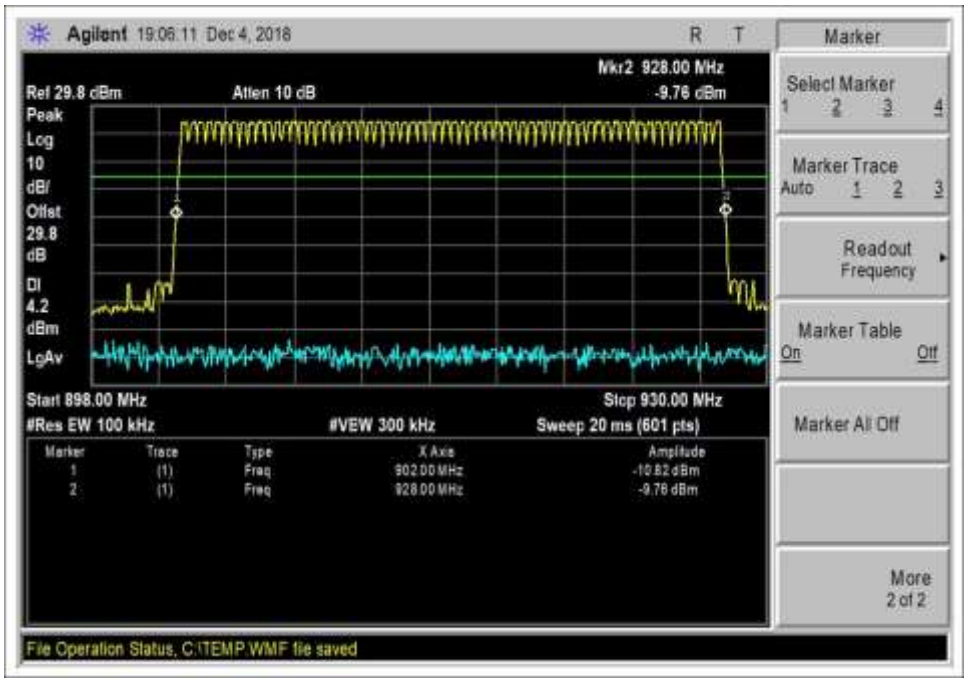
Peak, 300kbps, Power level 3



Low Channel, 300kbps, Power level 3

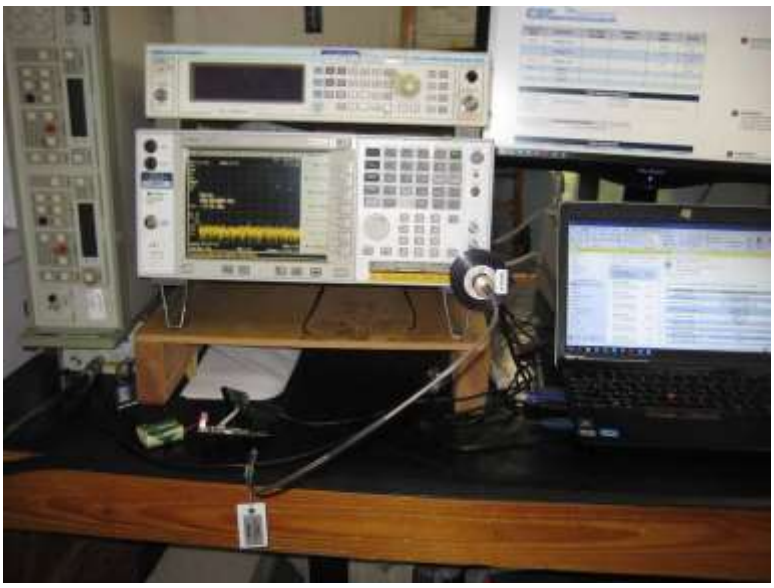


High Channel, 300kbps, Power level 3



Hopping, 300kbps, Power level 3

Test Setup Photo



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99317**	Date:	10/30/2018
Test Type:	**Maximized Emissions**	Time:	12:18:03
Tested By:	Don Nguyen	Sequence#:	5
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

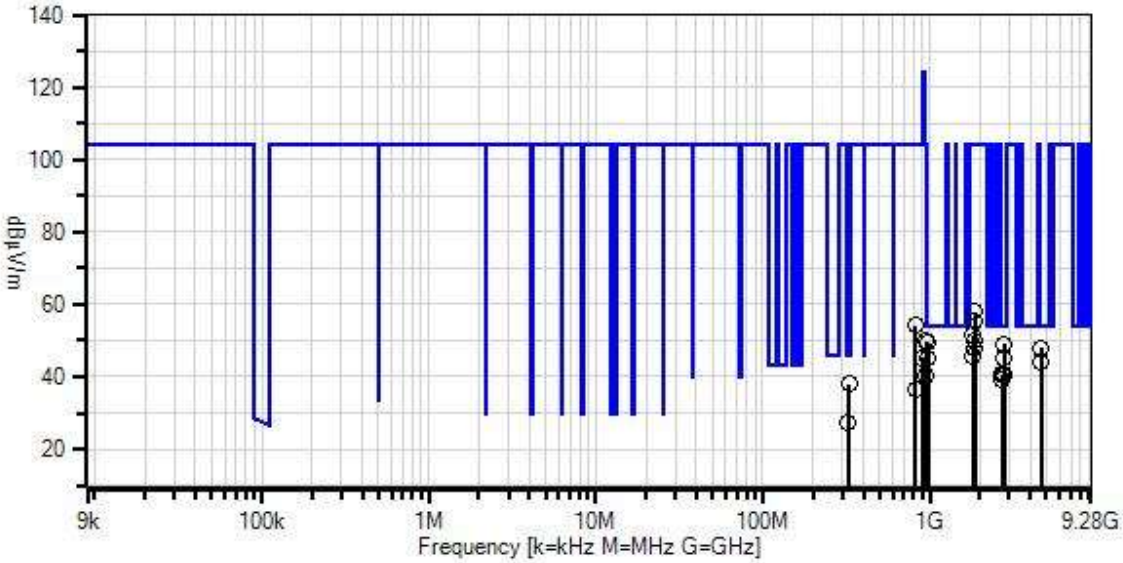
The EUT is placed on table top. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc. Support equipment is removed during test.

Modulation: 100kbps FSK power level 3.

Frequency of measurement: 9k-9280MHz
9 kH -150 kHz;RBW=200 Hz,VBW=600 Hz;
150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;
30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,
1000 MHz-9280MHz;RBW=1 MHz,VBW=3 MHz.
RBW=100kHz, VBW=300kHz (-20dbc limit)

Test Method: ANSI C63.10 (2013)
Site A
Temperature: 22.1°C
Relative Humidity: 52.6%

Itron, Inc. WO#: 99317 Sequence#: 5 Date: 10/30/2018
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: 5.03.11

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020
T1	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	AN00309	Preamp	8447D	2/19/2018	2/19/2020
T6	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T7	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T8	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T9	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
T10	ANP07244	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020
T11	AN03169	High Pass Filter	HM1155-11SS	6/15/2017	6/15/2019

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

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	978.860M	39.9	+24.0 -27.4 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0 +0.0	+6.2 +0.0	+0.0	49.3	54.0	-4.7	Vert
2	2780.750M	54.1	+0.0 +0.0 +3.3	+0.0 +0.0 +0.4	+0.0 -38.6 +0.2	+0.0 +29.5	+0.0	48.9	54.0	-5.1	Vert
3	4634.600M	47.9	+0.0 +0.0 +4.2	+0.0 +0.0 +0.6	+0.0 -37.7 +0.2	+0.0 +32.8	+0.0	48.0	54.0	-6.0	Vert
4	327.900M	42.4	+14.1 -27.9 +0.0	+6.0 +0.0 +0.0	+0.2 +0.0 +0.0	+3.3 +0.0	+0.0	38.1	46.0	-7.9	Horiz
5	966.260M	35.9	+23.8 -27.3 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0 +0.0	+6.2 +0.0	+0.0	45.2	54.0	-8.8	Vert
6	2780.700M	50.3	+0.0 +0.0 +3.3	+0.0 +0.0 +0.4	+0.0 -38.6 +0.2	+0.0 +29.5	+0.0	45.1	54.0	-8.9	Horiz
7	4634.500M	43.9	+0.0 +0.0 +4.2	+0.0 +0.0 +0.6	+0.0 -37.7 +0.2	+0.0 +32.8	+0.0	44.0	54.0	-10.0	Horiz
8	2706.900M	46.4	+0.0 +0.0 +3.2	+0.0 +0.0 +0.4	+0.0 -38.6 +0.2	+0.0 +29.1	+0.0	40.7	54.0	-13.3	Horiz
9	2744.700M	46.1	+0.0 +0.0 +3.2	+0.0 +0.0 +0.4	+0.0 -38.6 +0.2	+0.0 +29.4	+0.0	40.7	54.0	-13.3	Vert

10	2744.700M	45.7	+0.0 +0.0 +3.2	+0.0 +0.0 +0.4	+0.0 -38.6 +0.2	+0.0 +29.4	+0.0	40.3	54.0	-13.7	Horiz
11	2706.900M	45.1	+0.0 +0.0 +3.2	+0.0 +0.0 +0.4	+0.0 -38.6 +0.2	+0.0 +29.1	+0.0	39.4	54.0	-14.6	Vert
12	325.190M	31.6	+14.0 -27.9 +0.0	+6.0 +0.0 +0.0	+0.2 +0.0 +0.0	+3.3 +0.0	+0.0	27.2	46.0	-18.8	Vert
13	1853.800M	66.5	+0.0 +0.0 +2.6	+0.0 +0.0 +0.2	+0.0 -38.9 +0.3	+0.0 +27.2	+0.0	57.9	104.0	-46.1	Vert
14	1853.800M	63.9	+0.0 +0.0 +2.6	+0.0 +0.0 +0.2	+0.0 -38.9 +0.3	+0.0 +27.2	+0.0	55.3	104.0	-48.7	Horiz
15	820.587M	47.3	+22.1 -27.2 +0.0	+6.0 +0.0 +0.0	+0.4 +0.0 +0.0	+5.6 +0.0	+0.0	54.2	104.0	-49.8	Vert
16	1804.600M	60.3	+0.0 +0.0 +2.5	+0.0 +0.0 +0.2	+0.0 -38.9 +0.3	+0.0 +27.0	+0.0	51.4	104.0	-52.6	Vert
17	1829.800M	59.0	+0.0 +0.0 +2.5	+0.0 +0.0 +0.2	+0.0 -38.9 +0.3	+0.0 +27.1	+0.0	50.2	104.0	-53.8	Vert
18	952.860M	40.8	+23.6 -27.3 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0 +0.0	+6.1 +0.0	+0.0	49.8	104.0	-54.2	Vert
19	1829.800M	56.4	+0.0 +0.0 +2.5	+0.0 +0.0 +0.2	+0.0 -38.9 +0.3	+0.0 +27.1	+0.0	47.6	104.0	-56.4	Horiz
20	1804.600M	54.5	+0.0 +0.0 +2.5	+0.0 +0.0 +0.2	+0.0 -38.9 +0.3	+0.0 +27.0	+0.0	45.6	104.0	-58.4	Horiz
21	900.860M	37.2	+22.8 -27.2 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0 +0.0	+5.9 +0.0	+0.0	45.3	104.0	-58.7	Vert
22	952.925M	31.2	+23.6 -27.3 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0 +0.0	+6.1 +0.0	+0.0	40.2	104.0	-63.8	Horiz
23	820.000M	29.5	+22.1 -27.2 +0.0	+6.0 +0.0 +0.0	+0.4 +0.0 +0.0	+5.6 +0.0	+0.0	36.4	104.0	-67.6	Horiz

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99317**	Date:	10/30/2018
Test Type:	**Maximized Emissions**	Time:	10:55:34
Tested By:	Don Nguyen	Sequence#:	6
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

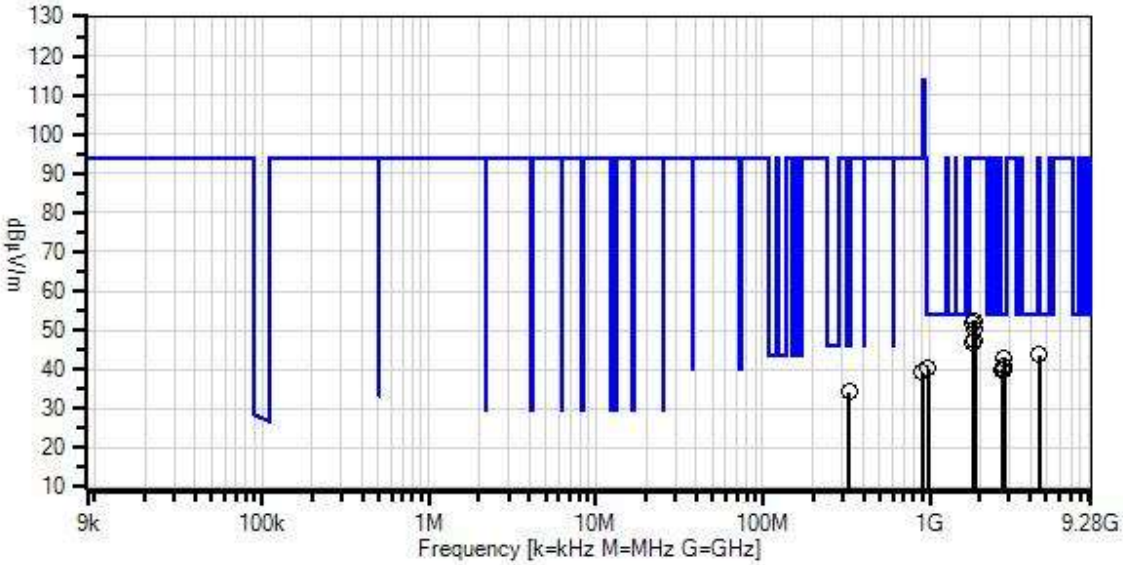
The EUT is placed on table top. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc. Support equipment is removed during test.

Modulation: 300kbps GFSK power level 2

Frequency of measurement: 9k-9280MHz
9 kH -150 kHz;RBW=200 Hz,VBW=600 Hz;
150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;
30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,
1000 MHz-9280MHz;RBW=1 MHz,VBW=3 MHz.
RBW=100kHz, VBW=300kHz (-20dbc limit)

Test Method: ANSI C63.10 (2013)
Site A
Temperature: 22.1°C
Relative Humidity: 52.6%

Itron, Inc. WO#: 99317 Sequence#: 6 Date: 10/30/2018
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert



Readings
QP Readings
Ambient
1 - 15.247(d) / 15.209 Radiated Spurious Emissions
Peak Readings
Average Readings
Software Version: 5.03.11

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020
T1	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	AN00309	Preamp	8447D	2/19/2018	2/19/2020
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T6	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T7	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T8	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
T9	ANP07244	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020
T10	AN03169	High Pass Filter	HM1155-11SS	6/15/2017	6/15/2019

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

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4512.008M	43.8	+0.0 +0.0 +0.1	+0.0 -37.8 +4.1	+0.0 +32.9	+0.0 +0.7	+0.0	43.8	54.0	-10.2	Vert
2	2782.800M	48.1	+0.0 +0.0 +0.2	+0.0 -38.6 +3.3	+0.0 +29.5	+0.0 +0.4	+0.0	42.9	54.0	-11.1	Vert
3	326.800M	38.5	+14.1 -27.9 +0.0	+6.0 +0.0 +0.0	+0.2 +0.0	+3.3 +0.0	+0.0	34.2	46.0	-11.8	Horiz
4	2782.800M	46.2	+0.0 +0.0 +0.2	+0.0 -38.6 +3.3	+0.0 +29.5	+0.0 +0.4	+0.0	41.0	54.0	-13.0	Horiz
5	979.600M	30.9	+24.0 -27.4 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0	+6.2 +0.0	+0.0	40.3	54.0	-13.7	Vert
6	2707.208M	45.7	+0.0 +0.0 +0.2	+0.0 -38.6 +3.2	+0.0 +29.1	+0.0 +0.4	+0.0	40.0	54.0	-14.0	Horiz
7	2707.208M	45.6	+0.0 +0.0 +0.2	+0.0 -38.6 +3.2	+0.0 +29.1	+0.0 +0.4	+0.0	39.9	54.0	-14.1	Vert
8	2744.400M	45.2	+0.0 +0.0 +0.2	+0.0 -38.6 +3.2	+0.0 +29.4	+0.0 +0.4	+0.0	39.8	54.0	-14.2	Horiz
9	1855.200M	61.0	+0.0 +0.0 +0.3	+0.0 -38.9 +2.6	+0.0 +27.3	+0.0 +0.2	+0.0	52.5	94.0	-41.5	Vert

10	1804.808M	60.7	+0.0 +0.0 +0.3	+0.0 -38.9 +2.5	+0.0 +27.0	+0.0 +0.2	+0.0	51.8	94.0	-42.2	Vert
11	1855.200M	58.9	+0.0 +0.0 +0.3	+0.0 -38.9 +2.6	+0.0 +27.3	+0.0 +0.2	+0.0	50.4	94.0	-43.6	Horiz
12	1829.600M	59.1	+0.0 +0.0 +0.3	+0.0 -38.9 +2.5	+0.0 +27.1	+0.0 +0.2	+0.0	50.3	94.0	-43.7	Vert
13	1829.600M	56.1	+0.0 +0.0 +0.3	+0.0 -38.9 +2.5	+0.0 +27.1	+0.0 +0.2	+0.0	47.3	94.0	-46.7	Horiz
14	1804.808M	55.5	+0.0 +0.0 +0.3	+0.0 -38.9 +2.5	+0.0 +27.0	+0.0 +0.2	+0.0	46.6	94.0	-47.4	Horiz
15	901.600M	31.2	+22.8 -27.2 +0.0	+6.1 +0.0 +0.0	+0.5 +0.0	+5.9 +0.0	+0.0	39.3	94.0	-54.7	Vert

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99317**	Date:	12/7/2018
Test Type:	**Maximized Emissions**	Time:	10:35:13
Tested By:	Don Nguyen	Sequence#:	6
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

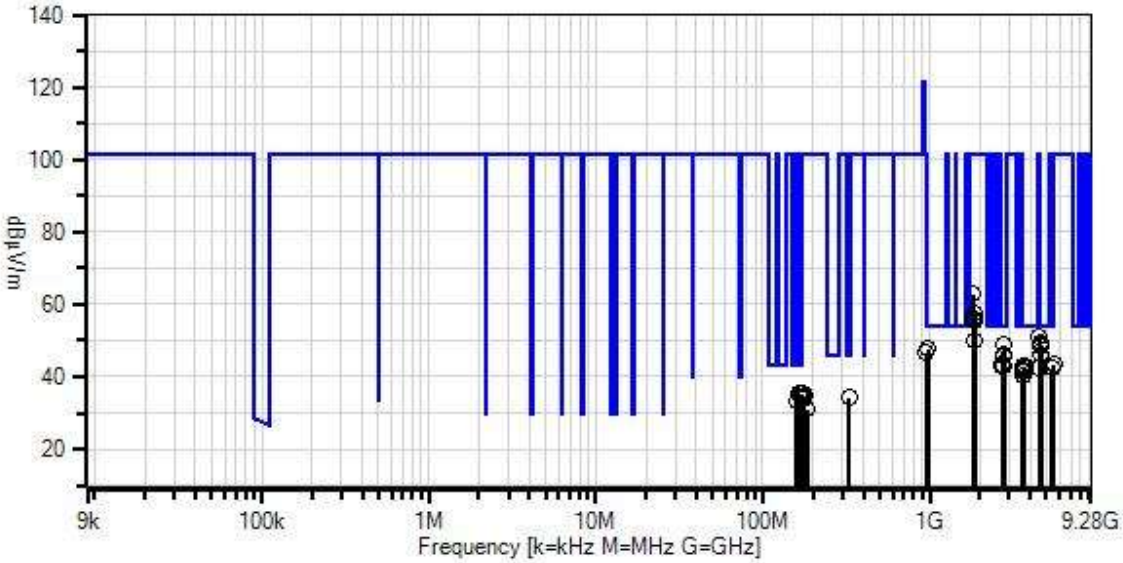
The EUT is placed on table top. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc. Support equipment is removed during test.

Modulation: 300kbps GFSK power level 3.

Frequency of measurement: 9k-9280MHz
9 kH -150 kHz;RBW=200 Hz,VBW=600 Hz;
150 kHz-30 MHz;RBW=9 kHz,VBW=27 kHz;
30 MHz-1000 MHz;RBW=120 kHz,VBW=360 kHz,
1000 MHz-9280MHz;RBW=1 MHz,VBW=3 MHz.
RBW=100kHz, VBW=300kHz (-20dbc limit)

Test Method: ANSI C63.10 (2013)
Site A
Temperature: 22.9°C
Relative Humidity: 21.1%

Itron, Inc. WO#: 99317 Sequence#: 6 Date: 12/7/2018
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: 5.03.11

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020
T1	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
	AN00309	Preamp	8447D	2/19/2018	2/19/2020
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T5	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T6	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T7	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
T8	ANP07244	Cable	32022-29094K-29094K-24TC	7/5/2018	7/5/2020
T9	AN03169	High Pass Filter	HM1155-11SS	6/15/2017	6/15/2019

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

#	Freq	Rdng	T1 T5 T9	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	4512.000M	51.1	+0.0 -37.8 +0.1	+0.0 +32.9	+0.0 +4.1	+0.0 +0.7	+0.0	51.1	54.0	-2.9	Horiz
2	4574.000M	49.2	+0.0 -37.8 +0.1	+0.0 +32.9	+0.0 +4.1	+0.0 +0.7	+0.0	49.2	54.0	-4.8	Horiz
3	2782.800M	53.9	+0.0 -38.6 +0.2	+0.0 +29.5	+0.0 +3.3	+0.0 +0.4	+0.0	48.7	54.0	-5.3	Vert
4	4638.000M	48.6	+0.0 -37.7 +0.2	+0.0 +32.8	+0.0 +4.2	+0.0 +0.6	+0.0	48.7	54.0	-5.3	Horiz
5	4574.000M	48.3	+0.0 -37.8 +0.1	+0.0 +32.9	+0.0 +4.1	+0.0 +0.7	+0.0	48.3	54.0	-5.7	Vert
6	979.600M	10.8	+24.0 +0.0 +0.0	+6.1 +0.0	+0.5 +0.0	+6.2 +0.0	+0.0	47.6	54.0	-6.4	Vert
7	2744.400M	51.8	+0.0 -38.6 +0.2	+0.0 +29.4	+0.0 +3.2	+0.0 +0.4	+0.0	46.4	54.0	-7.6	Vert
8	4638.000M	46.2	+0.0 -37.7 +0.2	+0.0 +32.8	+0.0 +4.2	+0.0 +0.6	+0.0	46.3	54.0	-7.7	Vert
9	172.750M	17.3	+9.7 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.3 +0.0	+0.0	35.4	43.5	-8.1	Horiz

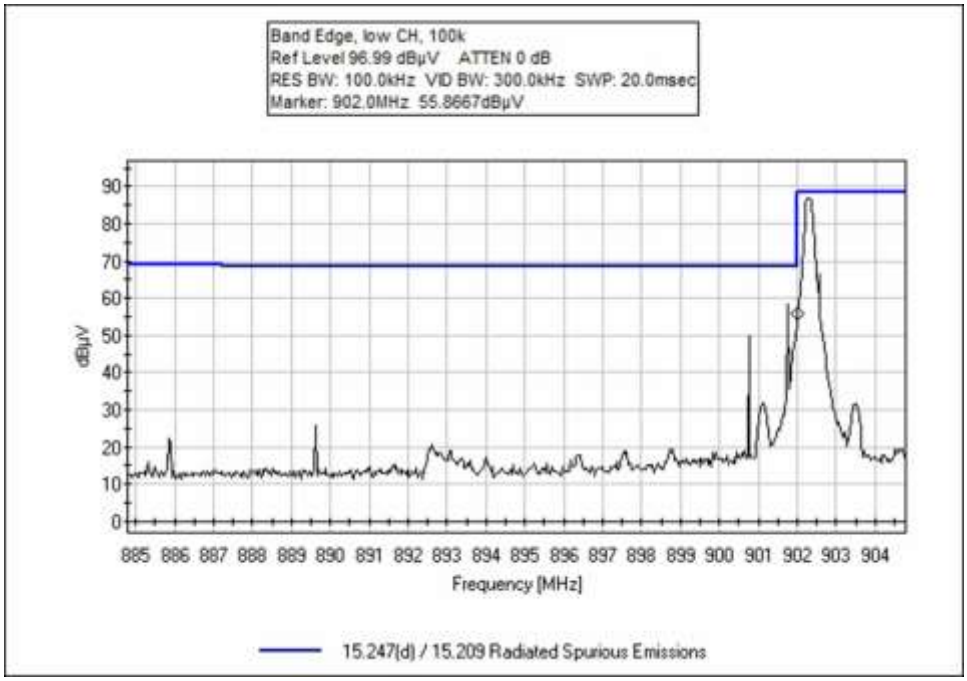
10	170.450M	17.1	+9.9 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.2 +0.0	+0.0	35.3	43.5	-8.2	Horiz
11	164.500M	16.6	+10.3 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.2 +0.0	+0.0	35.2	43.5	-8.3	Vert
12	2782.800M	50.9	+0.0 -38.6 +0.2	+0.0 +29.5	+0.0 +3.3	+0.0 +0.4	+0.0	45.7	54.0	-8.3	Horiz
13	170.400M	16.0	+9.9 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.2 +0.0	+0.0	34.2	43.5	-9.3	Vert
14	172.800M	15.8	+9.7 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.3 +0.0	+0.0	33.9	43.5	-9.6	Vert
15	2707.200M	49.0	+0.0 -38.6 +0.2	+0.0 +29.1	+0.0 +3.2	+0.0 +0.4	+0.0	43.3	54.0	-10.7	Vert
16	2707.200M	48.6	+0.0 -38.6 +0.2	+0.0 +29.1	+0.0 +3.2	+0.0 +0.4	+0.0	42.9	54.0	-11.1	Horiz
17	3710.400M	44.7	+0.0 -38.3 +0.2	+0.0 +31.9	+0.0 +3.8	+0.0 +0.5	+0.0	42.8	54.0	-11.2	Horiz
18	2744.400M	48.2	+0.0 -38.6 +0.2	+0.0 +29.4	+0.0 +3.2	+0.0 +0.4	+0.0	42.8	54.0	-11.2	Horiz
19	3659.200M	44.9	+0.0 -38.3 +0.2	+0.0 +31.6	+0.0 +3.8	+0.0 +0.5	+0.0	42.7	54.0	-11.3	Vert
20	4512.000M	42.5	+0.0 -37.8 +0.1	+0.0 +32.9	+0.0 +4.1	+0.0 +0.7	+0.0	42.5	54.0	-11.5	Vert
21	3710.400M	44.2	+0.0 -38.3 +0.2	+0.0 +31.9	+0.0 +3.8	+0.0 +0.5	+0.0	42.3	54.0	-11.7	Vert
22	5414.400M	40.7	+0.0 -37.5 +0.1	+0.0 +33.9	+0.0 +4.6	+0.0 +0.4	+0.0	42.2	54.0	-11.8	Horiz
23	327.700M	10.5	+14.1 +0.0 +0.0	+6.0 +0.0	+0.2 +0.0	+3.3 +0.0	+0.0	34.1	46.0	-11.9	Horiz
24	3659.200M	44.2	+0.0 -38.3 +0.2	+0.0 +31.6	+0.0 +3.8	+0.0 +0.5	+0.0	42.0	54.0	-12.0	Horiz
25	3609.600M	44.1	+0.0 -38.4 +0.2	+0.0 +31.1	+0.0 +3.8	+0.0 +0.6	+0.0	41.4	54.0	-12.6	Horiz
26	3609.600M	43.0	+0.0 -38.4 +0.2	+0.0 +31.1	+0.0 +3.8	+0.0 +0.6	+0.0	40.3	54.0	-13.7	Vert

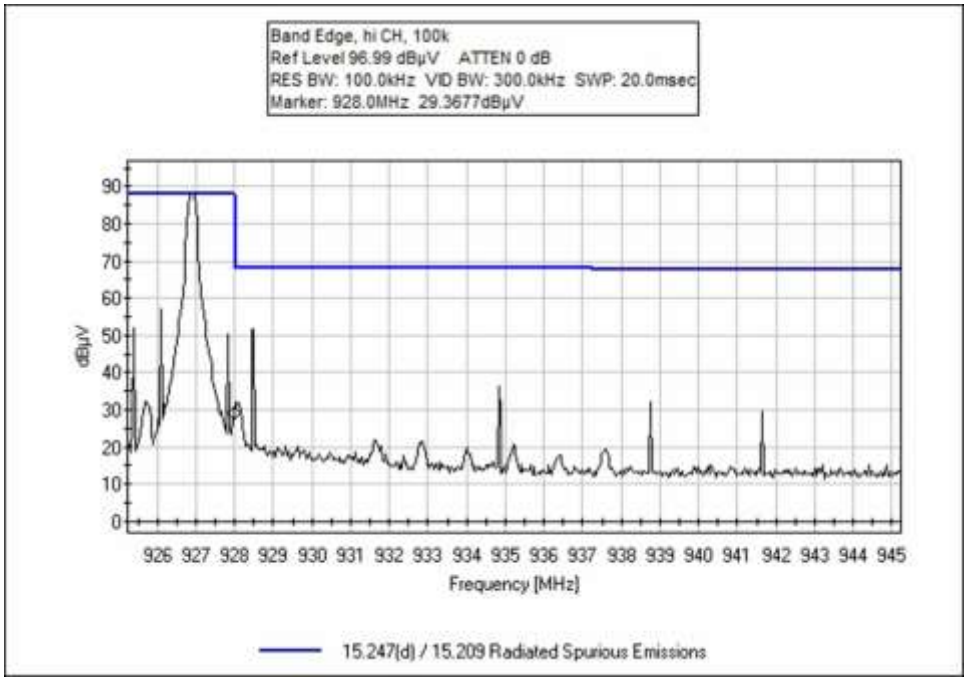
27	1804.800M	71.8	+0.0 -38.9 +0.3	+0.0 +27.0	+0.0 +2.5	+0.0 +0.2	+0.0	62.9	101.4	-38.5	Vert
28	1855.200M	65.8	+0.0 -38.9 +0.3	+0.0 +27.3	+0.0 +2.6	+0.0 +0.2	+0.0	57.3	101.4	-44.1	Vert
29	1804.800M	64.8	+0.0 -38.9 +0.3	+0.0 +27.0	+0.0 +2.5	+0.0 +0.2	+0.0	55.9	101.4	-45.5	Horiz
30	1855.200M	64.2	+0.0 -38.9 +0.3	+0.0 +27.3	+0.0 +2.6	+0.0 +0.2	+0.0	55.7	101.4	-45.7	Horiz
31	1829.600M	64.0	+0.0 -38.9 +0.3	+0.0 +27.1	+0.0 +2.5	+0.0 +0.2	+0.0	55.2	101.4	-46.2	Vert
32	1829.600M	59.0	+0.0 -38.9 +0.3	+0.0 +27.1	+0.0 +2.5	+0.0 +0.2	+0.0	50.2	101.4	-51.2	Horiz
33	953.600M	10.4	+23.6 +0.0 +0.0	+6.1 +0.0	+0.5 +0.0	+6.1 +0.0	+0.0	46.7	101.4	-54.7	Vert
34	5565.600M	41.7	+0.0 -37.4 +0.1	+0.0 +33.9	+0.0 +4.6	+0.0 +0.4	+0.0	43.3	101.4	-58.1	Vert
35	177.550M	16.9	+9.3 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.3 +0.0	+0.0	34.6	101.4	-66.8	Horiz
36	158.600M	14.1	+10.8 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.1 +0.0	+0.0	33.1	101.4	-68.3	Vert
37	183.450M	13.6	+9.1 +0.0 +0.0	+6.0 +0.0	+0.1 +0.0	+2.3 +0.0	+0.0	31.1	101.4	-70.3	Horiz

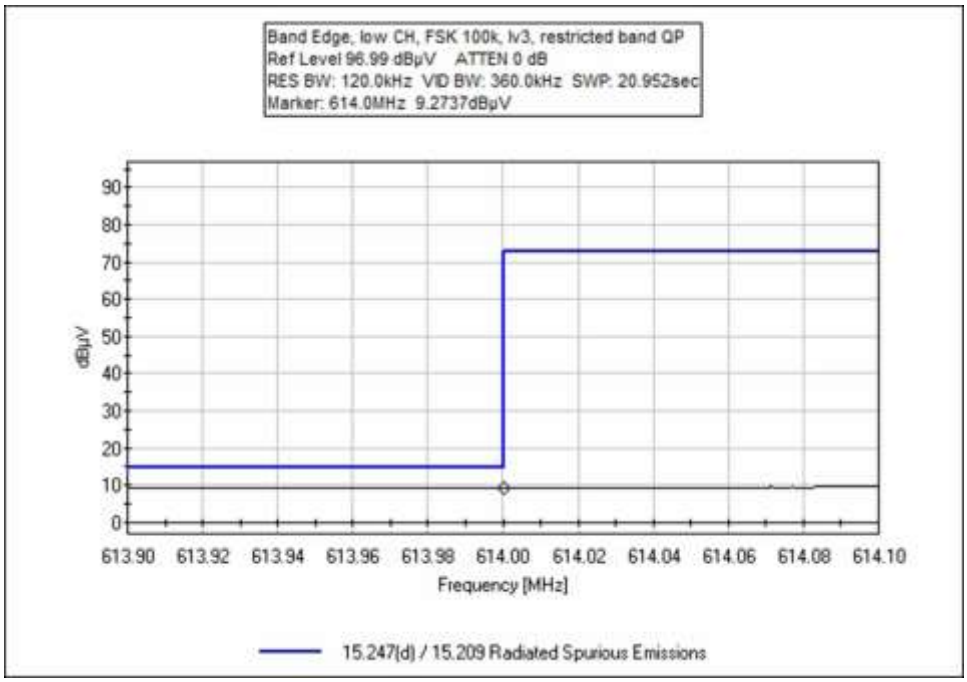
Band Edge

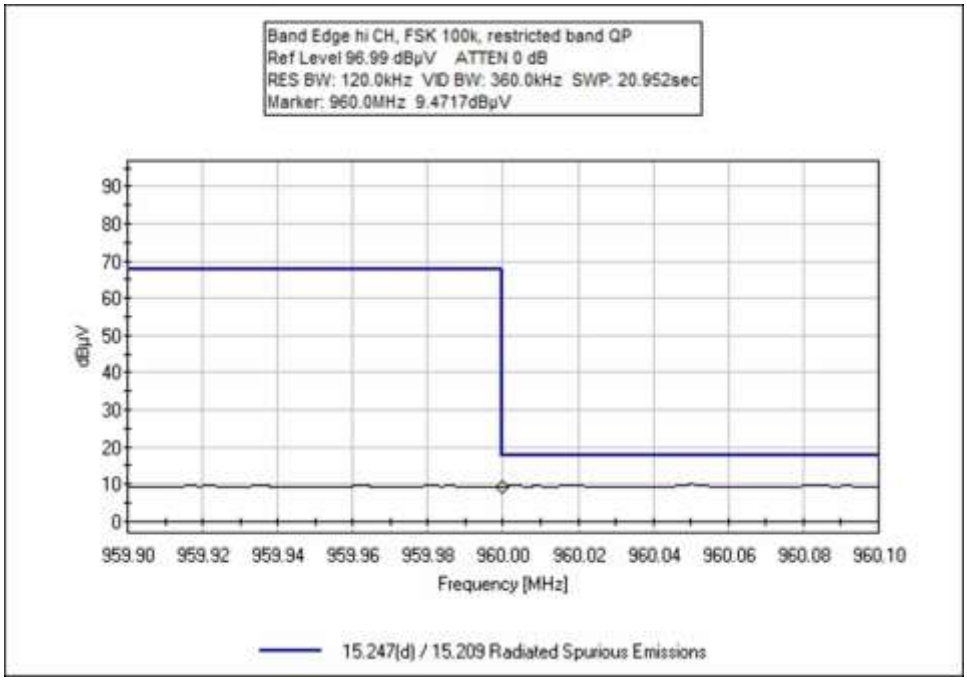
Band Edge Summary					
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	100kbps FSK lv3	Integral	40.4	<46	Pass
902	100kbps FSK lv3	Integral	91.2	<104	Pass
928	100kbps FSK lv3	Integral	65.2	<104	Pass
960	100kbps FSK lv3	Integral	45.9	<54	Pass
902	100kbps FSK lv3 Hopping	Integral	91.5	<104	Pass
928	100kbps FSK lv3 Hopping	Integral	64.1	<104	Pass
614	300kbps GFSK lv2	Integral	40.3	<46	Pass
902	300kbps GFSK lv2	Integral	78.9	<94	Pass
928	300kbps GFSK lv2	Integral	77.4	<94	Pass
960	300kbps GFSK lv2	Integral	45.8	<54	Pass
902	300kbps GFSK lv2 Hopping	Integral	77.8	<94	Pass
928	300kbps GFSK lv2 Hopping	Integral	76.7	<94	Pass
614	300kbps GFSK lv3	Integral	40.3	<46	Pass
902	300kbps GFSK lv3	Integral	87.9	<101.4	Pass
928	300kbps GFSK lv3	Integral	86.4	<101.4	Pass
960	300kbps GFSK lv3	Integral	45.7	<54	Pass
902	300kbps GFSK lv3 Hopping	Integral	87.0	<101.4	Pass
928	300kbps GFSK lv3 Hopping	Integral	86.6	<101.4	Pass

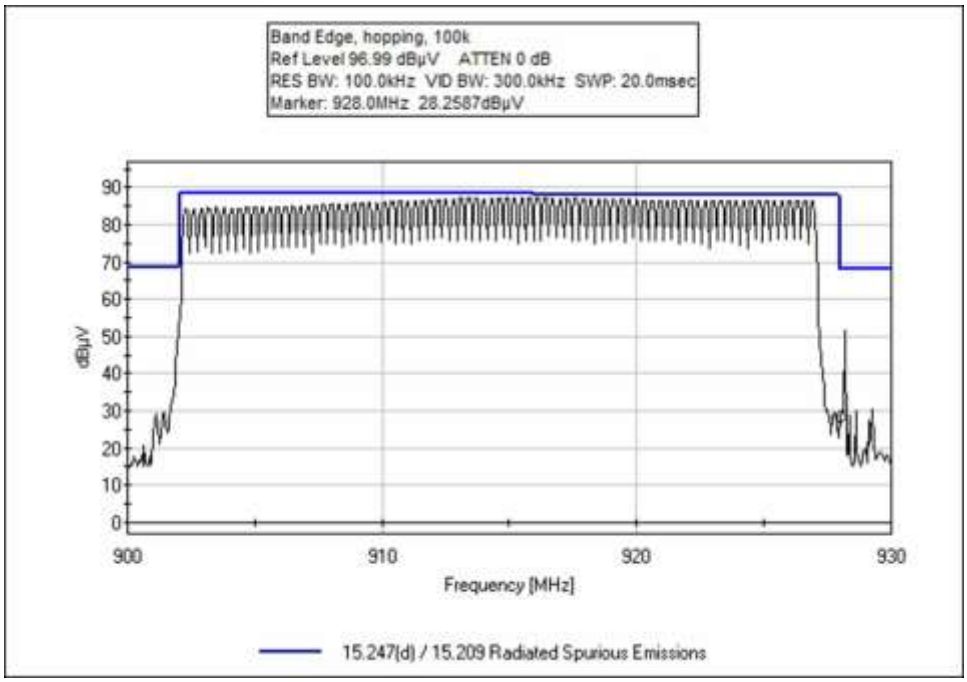
Band Edge Plots

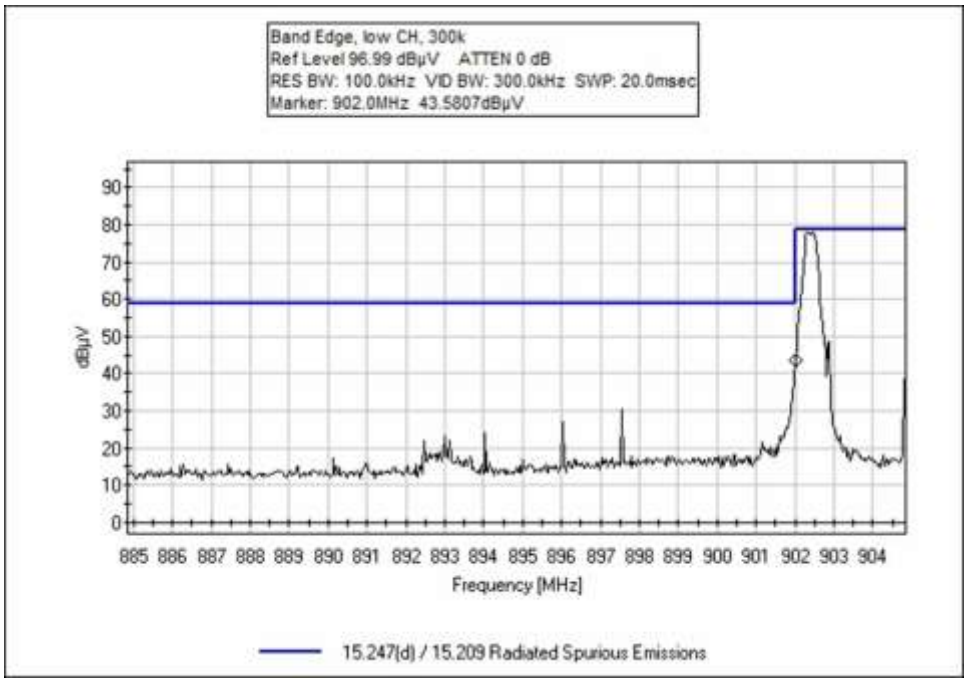


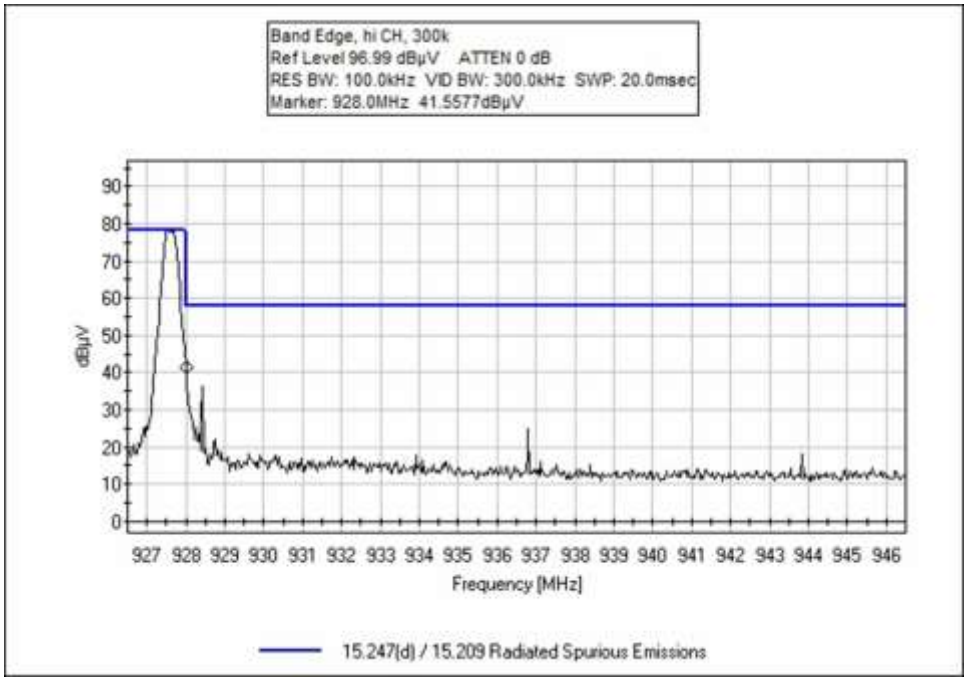


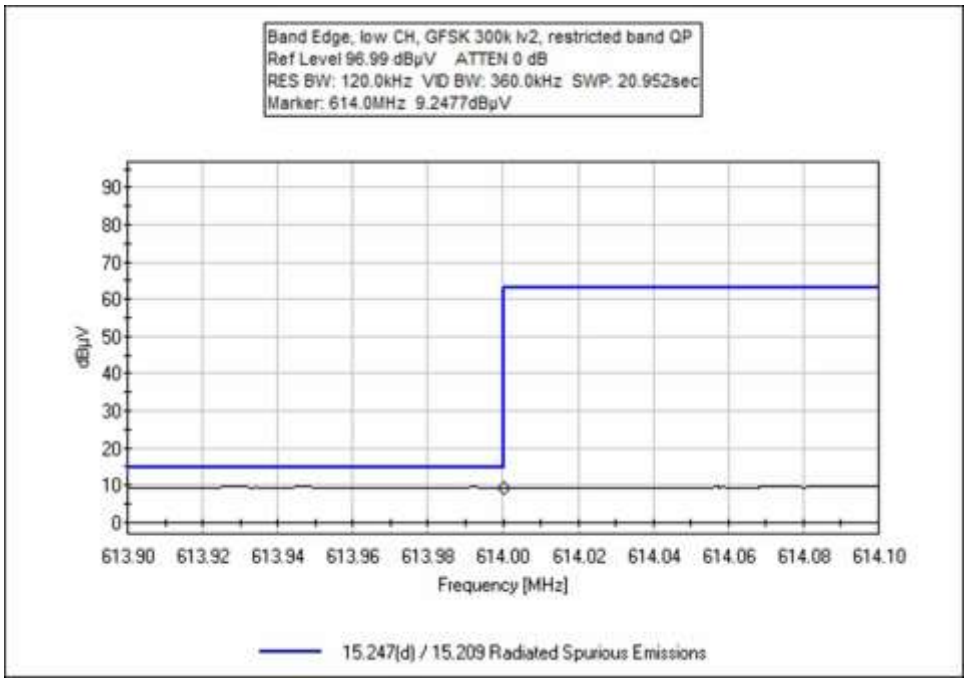

Band Edge, low CH, FSK 100k, lv3, restricted band QP
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 614.0MHz 9.2737dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.90 613.92 613.94 613.96 613.98 614.00 614.02 614.04 614.06 614.08 614.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

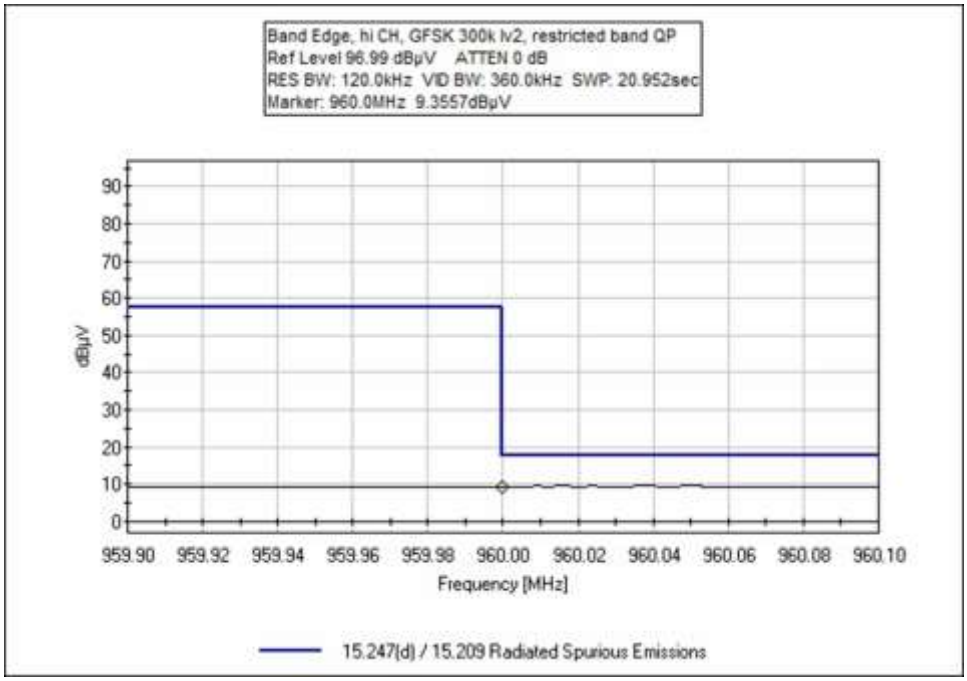

Band Edge hi CH, FSK 100k, restricted band QP
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 960.0MHz 9.4717dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.90 959.92 959.94 959.96 959.98 960.00 960.02 960.04 960.06 960.08 960.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

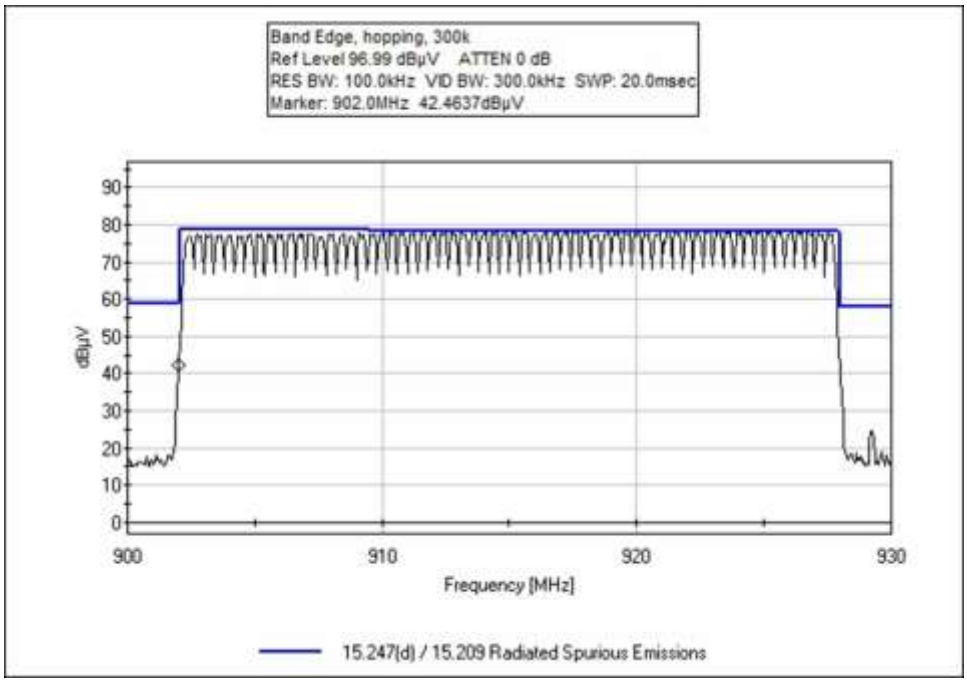

Band Edge, hopping, 100k
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 28.2587dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
900
910
920
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

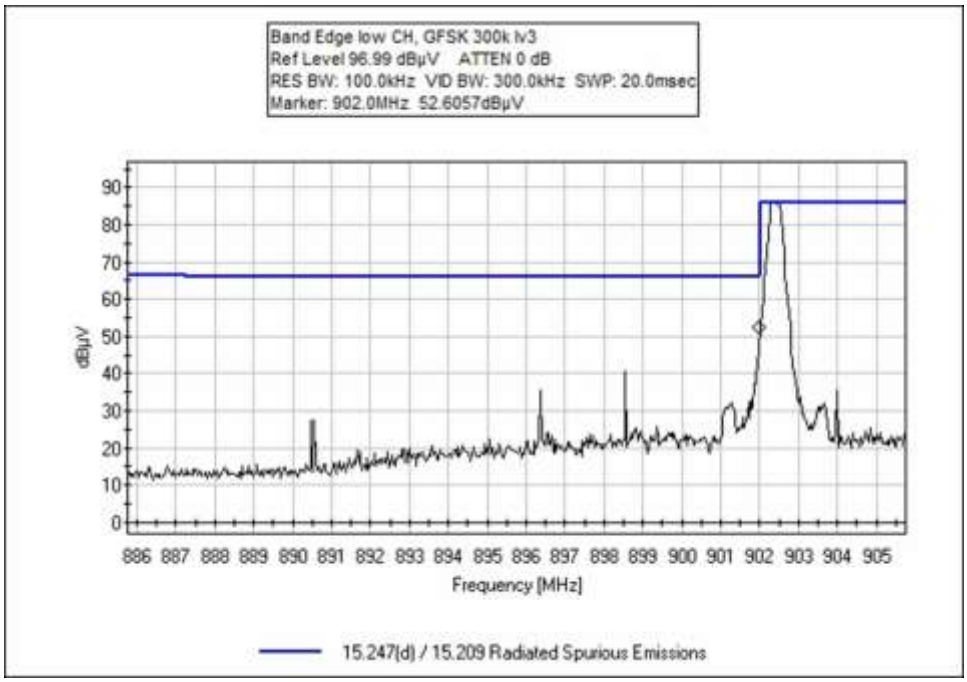

Band Edge, low CH, 300k
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 43.5807dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

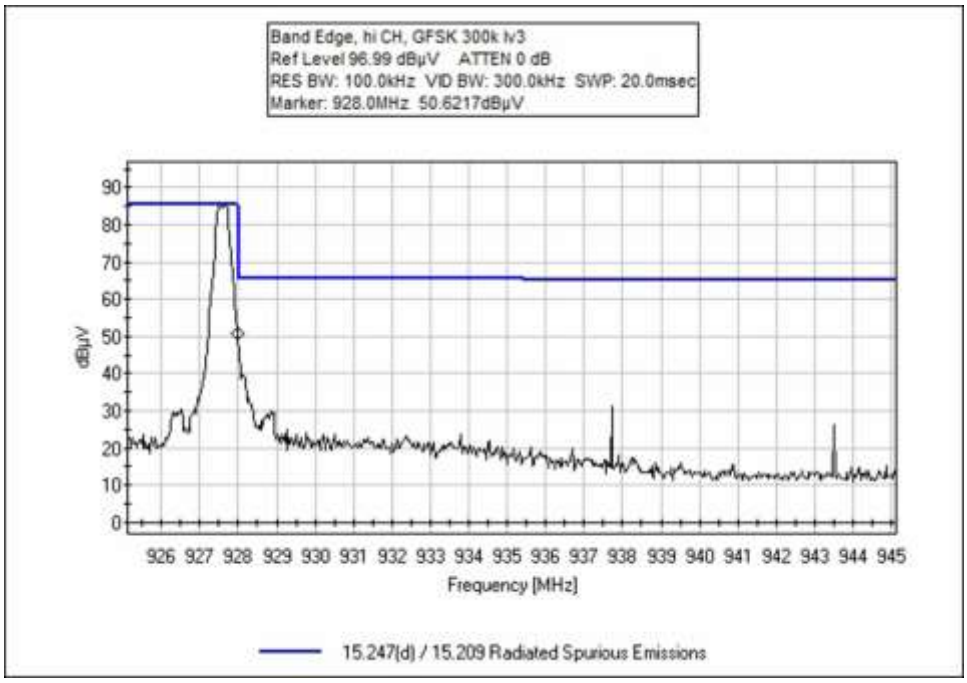

Band Edge, hi CH, 300k
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 41.5577dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

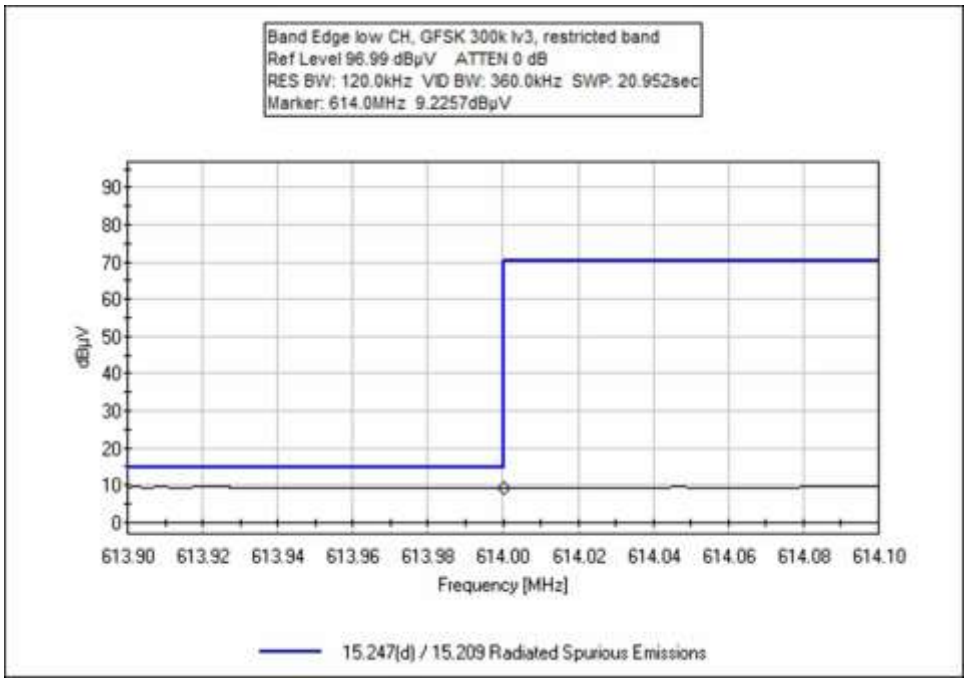

Band Edge, low CH, GFSK 300k lv2, restricted band QP
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 614.0MHz 9.2477dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.90 613.92 613.94 613.96 613.98 614.00 614.02 614.04 614.06 614.08 614.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

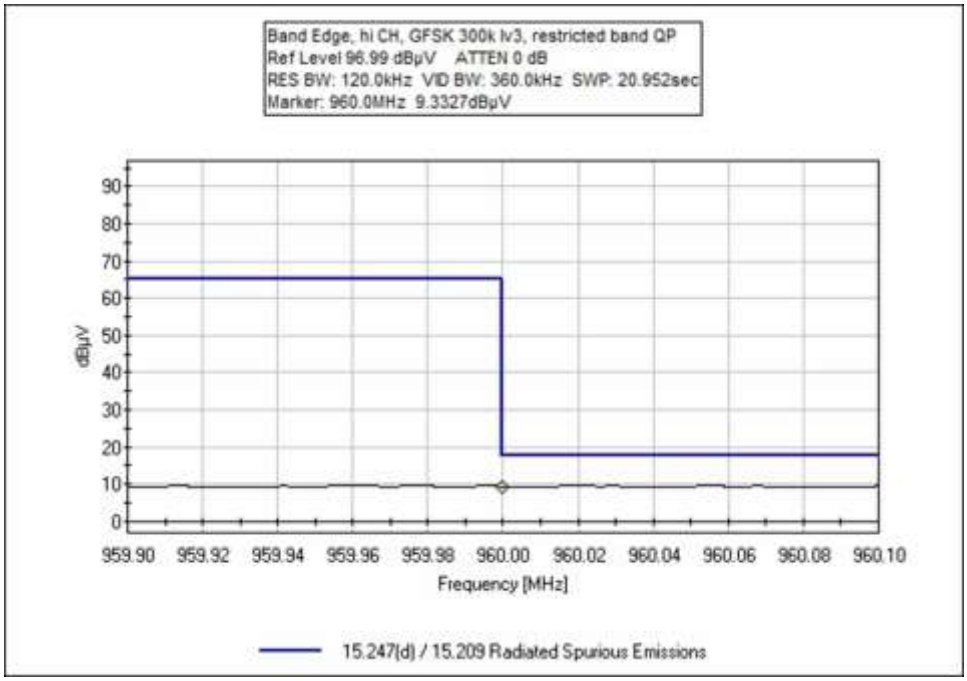

Band Edge, hi CH, GFSK 300k lv2, restricted band QP
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 960.0MHz 9.3557dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.90 959.92 959.94 959.96 959.98 960.00 960.02 960.04 960.06 960.08 960.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

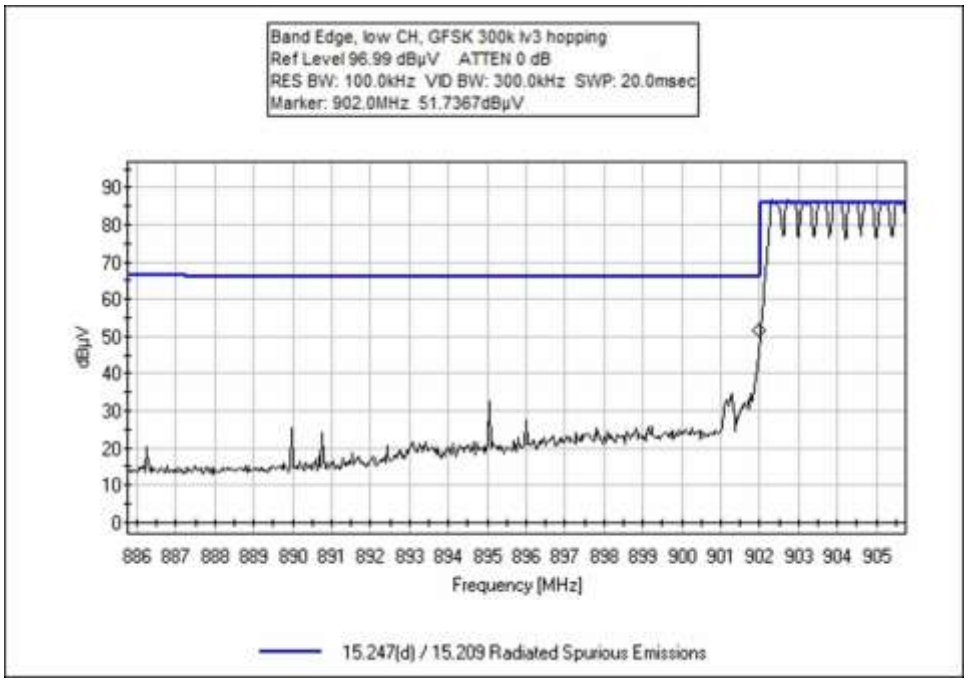

Band Edge, hopping, 300k
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 42.4637dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
900
910
920
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

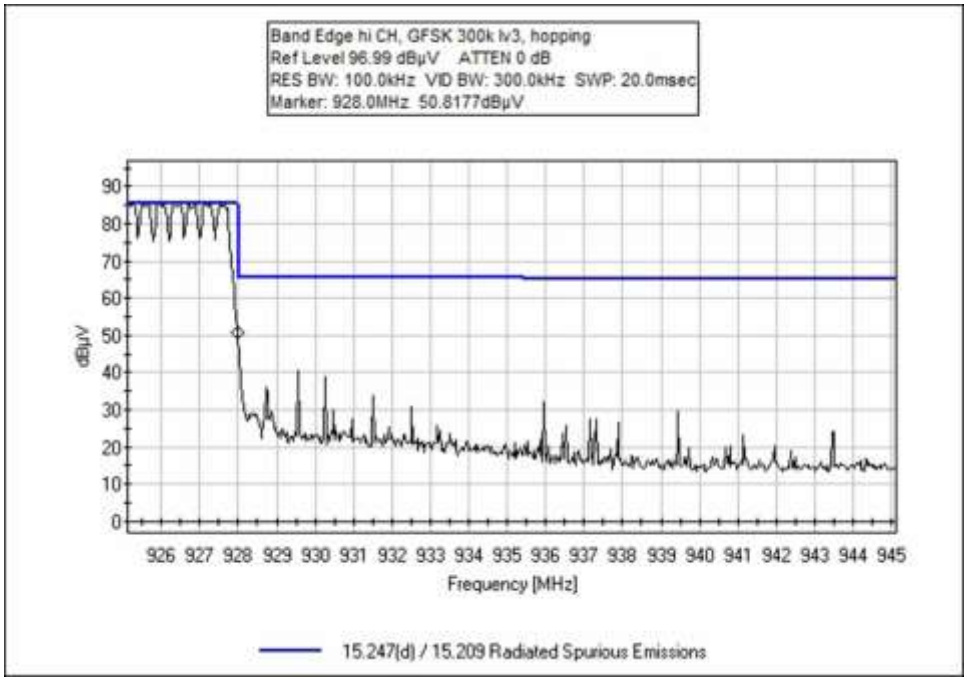

Band Edge low CH, GFSK 300k lv3
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 52.6057dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge, hi CH, GFSK 300k lv3
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 50.6217dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge low CH, GFSK 300k lv3, restricted band
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 614.0MHz 9.2257dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
613.90 613.92 613.94 613.96 613.98 614.00 614.02 614.04 614.06 614.08 614.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge, hi CH, GFSK 300k lv3, restricted band QP
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 20.952sec
Marker: 960.0MHz 9.3327dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.90 959.92 959.94 959.96 959.98 960.00 960.02 960.04 960.06 960.08 960.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge, low CH, GFSK 300k lv3 hopping
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 51.7367dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge hi CH, GFSK 300k lv3, hopping
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 50.8177dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99317**	Date:	12/4/2018
Test Type:	**Maximized Emissions**	Time:	13:23:54
Tested By:	Don Nguyen	Sequence#:	4
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on table top. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc. Support equipment is removed during test.

Modulation: 100kbps FSK power level 3.

Frequency of measurement: 902-928MHz
RBW=100kHz, VBW=300kHz (-20dBc limit)
RBW=120kHz, VBW=360kHz (restricted band limit)

Site A
Temperature: 22.1°C
Relative Humidity: 52.6%

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	614.000M QP	9.3	+20.0 +0.0	+6.0	+0.4	+4.7	+0.0	40.4	46.0	-5.6	Vert
2	960.000M QP	9.5	+23.7 +0.0	+6.1	+0.5	+6.1	+0.0	45.9	54.0	-8.1	Vert
3	902.000M	56.2	+22.8 +0.0	+6.1	+0.5	+5.9	+0.0	91.5	104.0 hopping	-12.5	Vert
4	902.000M	55.9	+22.8 +0.0	+6.1	+0.5	+5.9	+0.0	91.2	104.0	-12.8	Vert
5	928.000M	29.4	+23.2 +0.0	+6.1	+0.5	+6.0	+0.0	65.2	104.0	-38.8	Vert
6	928.000M	28.3	+23.2 +0.0	+6.1	+0.5	+6.0	+0.0	64.1	104.0 hopping	-39.9	Vert

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99317**	Date:	12/4/2018
Test Type:	**Maximized Emissions**	Time:	13:21:10
Tested By:	Don Nguyen	Sequence#:	5
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on table top. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc. Support equipment is removed during test.

Modulation: 300kbps GFSK power level 2.

Frequency of measurement: 902-928MHz
RBW=100kHz, VBW=300kHz (-20dBc limit)
RBW=120kHz, VBW=360kHz (restricted band limit)
Site A
Temperature: 22.1°C
Relative Humidity: 52.6%

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	614.000M QP	9.2	+20.0 +0.0	+6.0	+0.4	+4.7	+0.0	40.3	46.0	-5.7	Vert
2	960.000M QP	9.4	+23.7 +0.0	+6.1	+0.5	+6.1	+0.0	45.8	54.0	-8.2	Vert
3	902.000M	43.6	+22.8 +0.0	+6.1	+0.5	+5.9	+0.0	78.9	94.0	-15.1	Vert
4	902.000M	42.5	+22.8 +0.0	+6.1	+0.5	+5.9	+0.0	77.8	94.0 hopping	-16.2	Vert
5	928.000M	41.6	+23.2 +0.0	+6.1	+0.5	+6.0	+0.0	77.4	94.0	-16.6	Vert
6	928.000M	40.9	+23.2 +0.0	+6.1	+0.5	+6.0	+0.0	76.7	94.0 hopping	-17.3	Vert

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92823 • 714-993-6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**99317**	Date:	12/4/2018
Test Type:	**Maximized Emissions**	Time:	13:22:40
Tested By:	Don Nguyen	Sequence#:	5
Software:	EMITest 5.03.11		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

The EUT is placed on table top. The serial port is connected to a support laptop via serial to USB adapter.
The laptop is running software Command Line Interface Tool to turn on TX at 100% duty cycle.
The EUT is powered from fresh battery 6.0Vdc. Support equipment is removed during test.

Modulation: 300kbps GFSK power level 3.

Frequency of measurement: 902-928MHz
RBW=100kHz, VBW=300kHz (-20dBc limit)
RBW=120kHz, VBW=360kHz (restricted band limit)

Site A
Temperature: 22.1°C
Relative Humidity: 52.6%

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	614.000M QP	9.2	+20.0 +0.0	+6.0	+0.4	+4.7	+0.0	40.3	46.0	-5.7	Vert
2	960.000M QP	9.3	+23.7 +0.0	+6.1	+0.5	+6.1	+0.0	45.7	54.0	-8.3	Vert
3	902.000M	52.6	+22.8 +0.0	+6.1	+0.5	+5.9	+0.0	87.9	101.4	-13.5	Vert
4	902.000M	51.7	+22.8 +0.0	+6.1	+0.5	+5.9	+0.0	87.0	101.4 hopping	-14.4	Vert
5	928.000M	50.8	+23.2 +0.0	+6.1	+0.5	+6.0	+0.0	86.6	101.4 hopping	-14.8	Vert
6	928.000M	50.6	+23.2 +0.0	+6.1	+0.5	+6.0	+0.0	86.4	101.4	-15.0	Vert

Test Setup Photos

Below 1GHz

Below 1GHz

Above 1GHz, Cone placement

Above 1GHz, Cone placement

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.