

Itron, Inc.

TEST REPORT FOR

500C

Models: WPITC0, WRMTC0 and GRMTC0

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

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

Report No.: 104621-15

Date of issue: February 9, 2021



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: 223674

DATE OF EQUIPMENT RECEIPT:

DATE(S) OF TESTING:

REPORT PREPARED BY:

Dianne Dudley
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 104621

December 7, 2020

December 7, 18-30, 31, 2020

January 21, 22, 25, 2021

Report Authorization

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



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

Test Facility Information



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

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

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.19

Site Registration & Accreditation Information

Location	*NIST CB #	FCC	Canada	Japan
Canyon Park, Bothell, WA	US0103	US1024	3082C	A-0136
Brea, CA	US0103	US1024	3082D	A-0136
Fremont, CA	US0103	US1024	3082B	A-0136
Mariposa, CA	US0103	US1024	3082A	A-0136

*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

SUMMARY OF RESULTS

Standard / Specification: FCC Part 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	MOD 1	PASS
15.247(d)	RF Conducted Emissions & Band Edge	MOD 1	PASS
15.247(d)	Radiated Emissions & Band Edge	MOD 1	PASS
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable

NA1 = Not applicable; the manufacturer declares the EUT is battery operated.

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

MOD 1 = Power setting changed from 0x00C00D7 to 0x00C0070 for OOK LV3 and to 0x00C0040 for GFSK LV3.

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 (GAS REMOTE)

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	GRMTC0	RAD1

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	None

Configuration 2 (WATER REMOTE)

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	WRMTC0	RAD1

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	None

Configuration 3 (PIT)

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	WPITC0	RAD1

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	None

Configuration 4 (WPITC0-Conducted)

Equipment Tested:

Device	Manufacturer	Model #	S/N
500C	Itron, Inc.	WPITC0	CON1

Support Equipment:

Device	Manufacturer	Model #	S/N
Power Supply	Extech Instruments	382225	P99250026
Laptop	Dell	Latitude E6420	8P954R1
Laptop Power Supply	Dell	ADP-65JB	None

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Proprietary Low power and FHSS
Operating Frequency Range:	903 – 926.8MHz, 200kHz steps, 120 channels, 16384 OOK LV1 903 – 926.8MHz, 200kHz steps, 120 channels, 16384 OOK LV3 902.4 – 927.6MHz, 400kHz steps, 64 channels, 300kbps GFSK LV3
Number of Hopping Channels:	120 (OOK) and 64 (GFSK)
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):	16384 OOK and 300kbps GFSK
Maximum Duty Cycle:	GFSK: 45% OOK: 28.05%
Number of TX Chains:	1
Antenna Type(s) and Gain:	PCB Trace/ 1.1dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	3.6Vdc battery
Firmware / Software used for Test:	App Version: 0.0.25.0, CSL version: 8.1.3.0 Hardware Rev: 9

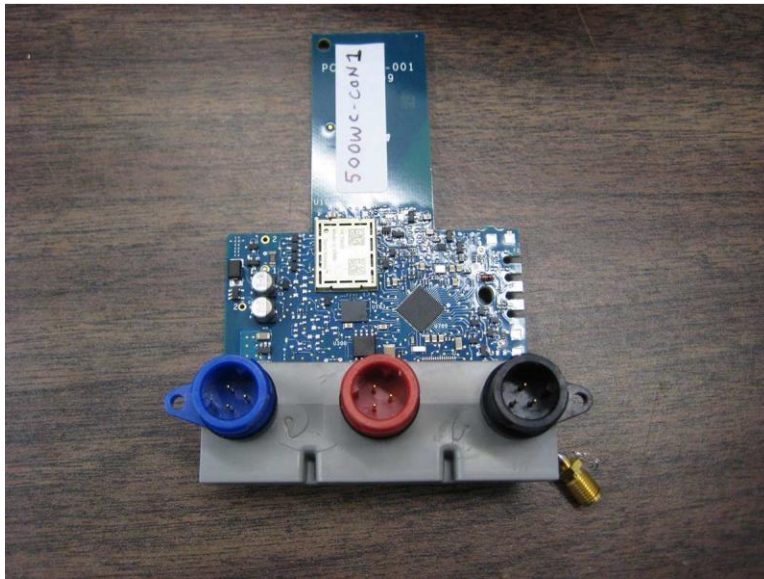
EUT and Accessory Photo(s)



GRMTC0



WPITCO



WPITCO - Conducted



WRMTC0

Support Equipment Photo(s)



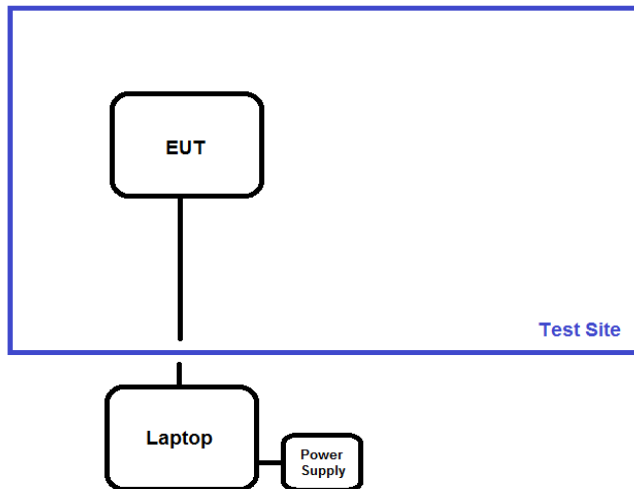
12V PSU



Laptop and Laptop PSU

Block Diagram of Test Setup(s)

Test Setup Block Diagram



FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/18/2020
Configuration:	4		
Test Setup:	The EUT is placed on test bench and powered from 3.6Vdc power supply (to simulate fresh battery). The EUT is connected to a support laptop running CLI Tool ver.2.0.1.24. Operating frequency range/ modes 903 – 926.8MHz, 200kHz steps, 120 channels, 16384 OOK LV1 903 – 926.8MHz, 200kHz steps, 120 channels, 16384 OOK LV3 902.4 – 927.6MHz, 400kHz steps, 64 channels, 300kbps GFSK LV3 Tested frequency range: 902.4-927.6MHz		

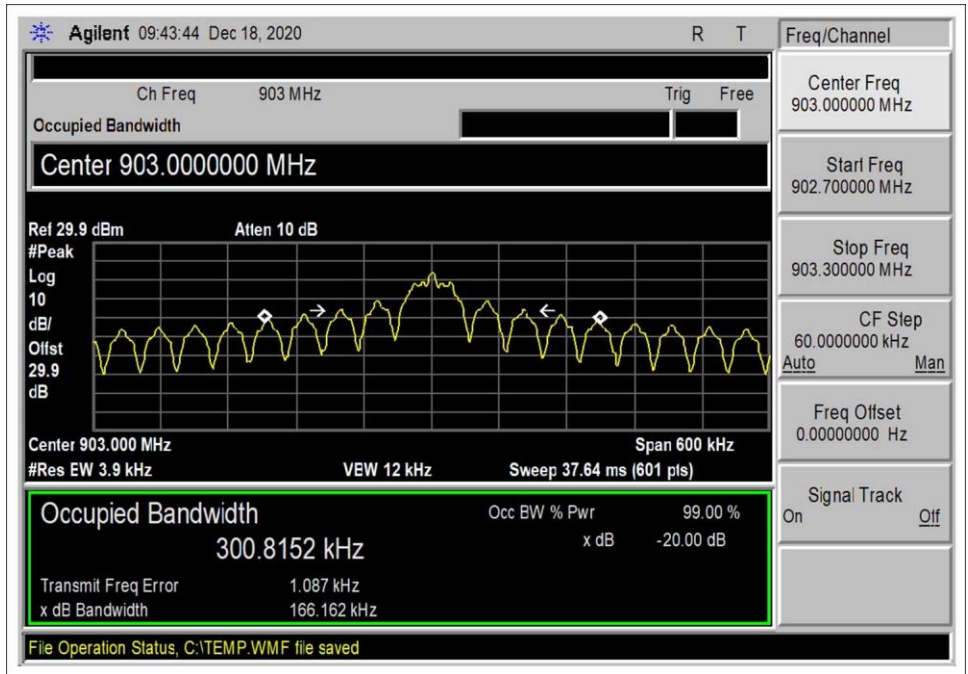
Environmental Conditions			
Temperature (°C)	18.6	Relative Humidity (%):	45

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03643	Spectrum Analyzer	Agilent	E4440A	5/20/2020	5/20/2022
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07246	Cable	H&S	32022-29094K-29094K-24TC	5/29/2020	5/29/2022

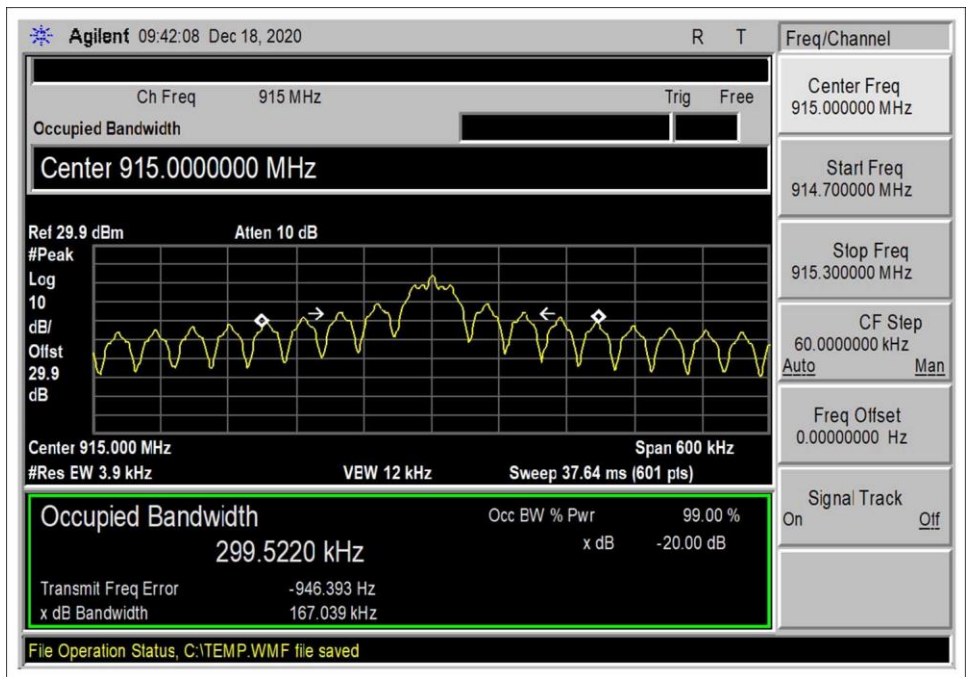
15.247(a)(1) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
903.0	1	16384 OOK LV3	166.162	≤500	Pass
915.0	1	16384 OOK LV3	167.039	≤500	Pass
926.8	1	16384 OOK LV3	167.322	≤500	Pass
902.4	1	300k GFSK LV3	361.307	≤500	Pass
915.2	1	300k GFSK LV3	363.069	≤500	Pass
927.6	1	300k GFSK LV3	365.474	≤500	Pass

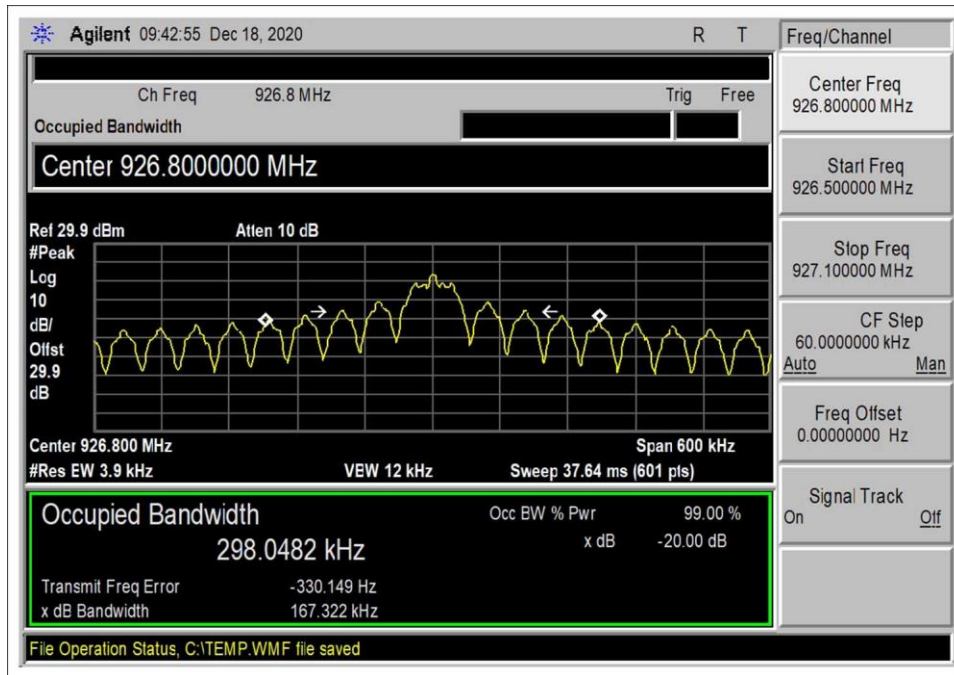
Plot(s)



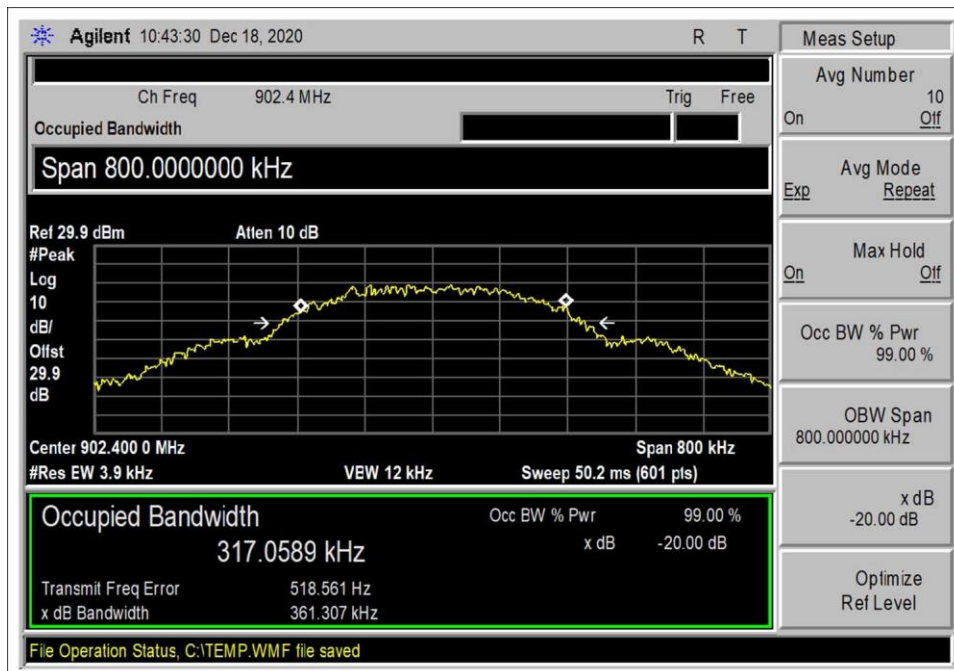
OOK Low Channel



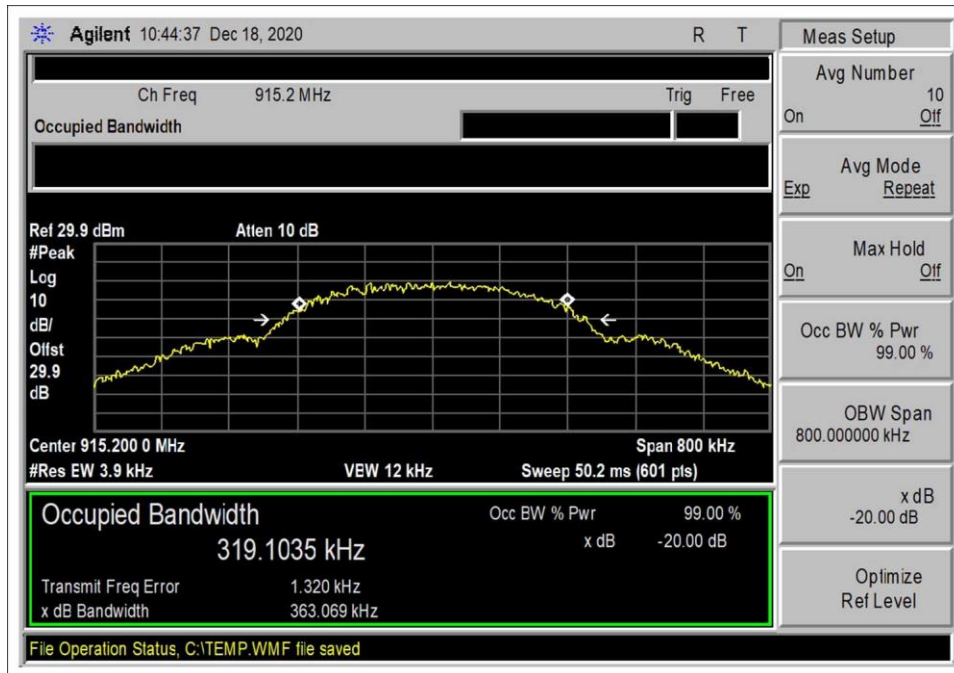
OOK Middle Channel



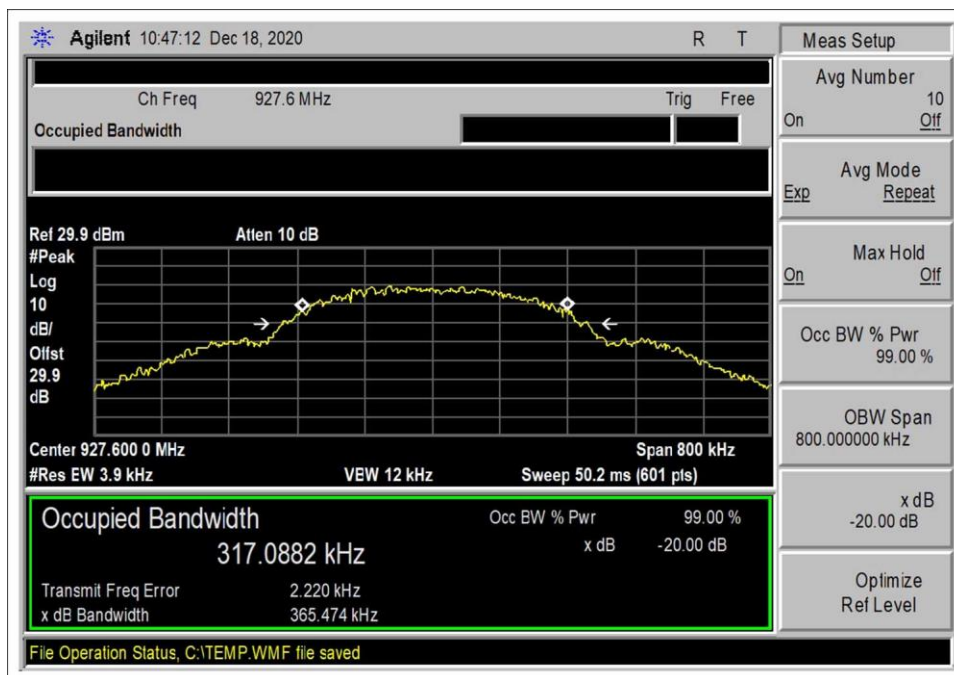
OOK High Channel



GFSK Low Channel



GFSK Middle Channel

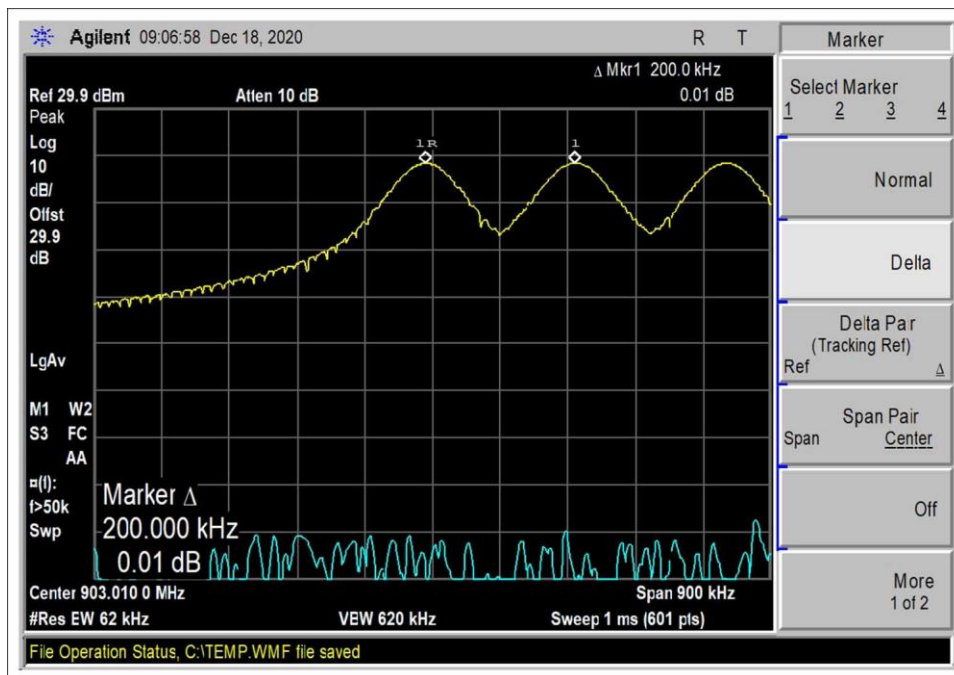


GFSK High Channel

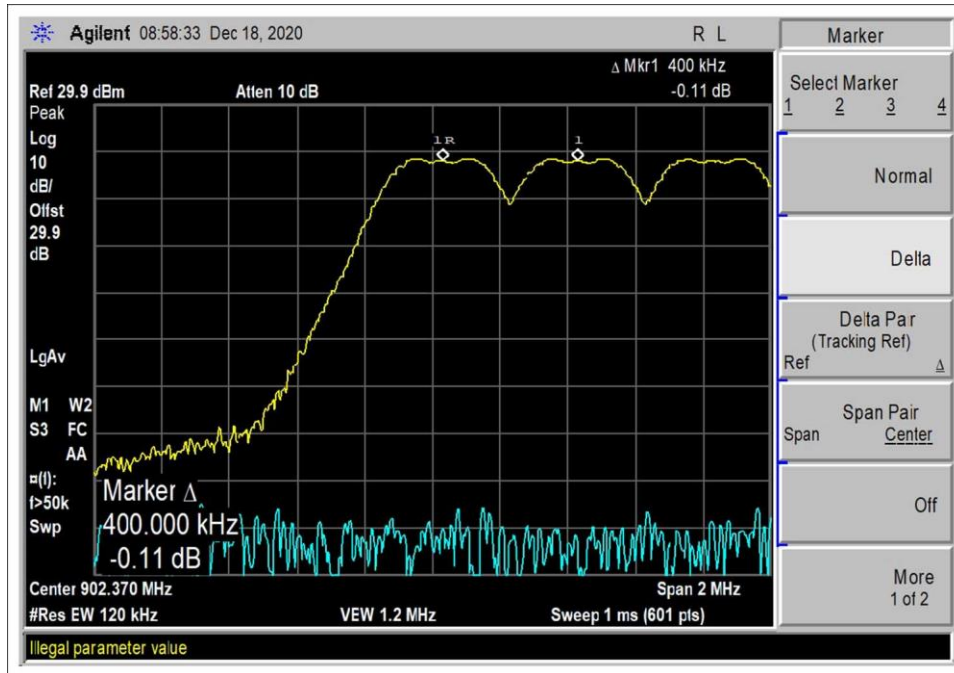
15.247(a)(1) Carrier Separation

Test Data Summary				
Limit applied: 20dB bandwidth of the hopping channel.				
Antenna Port	Operational Mode	Measured (kHz)	Limit (kHz)	Results
1	16384 OOK LV3	200	>167.322	Pass
1	300k GFSK LV3	400	>365.474	Pass

Plot(s)



OOK

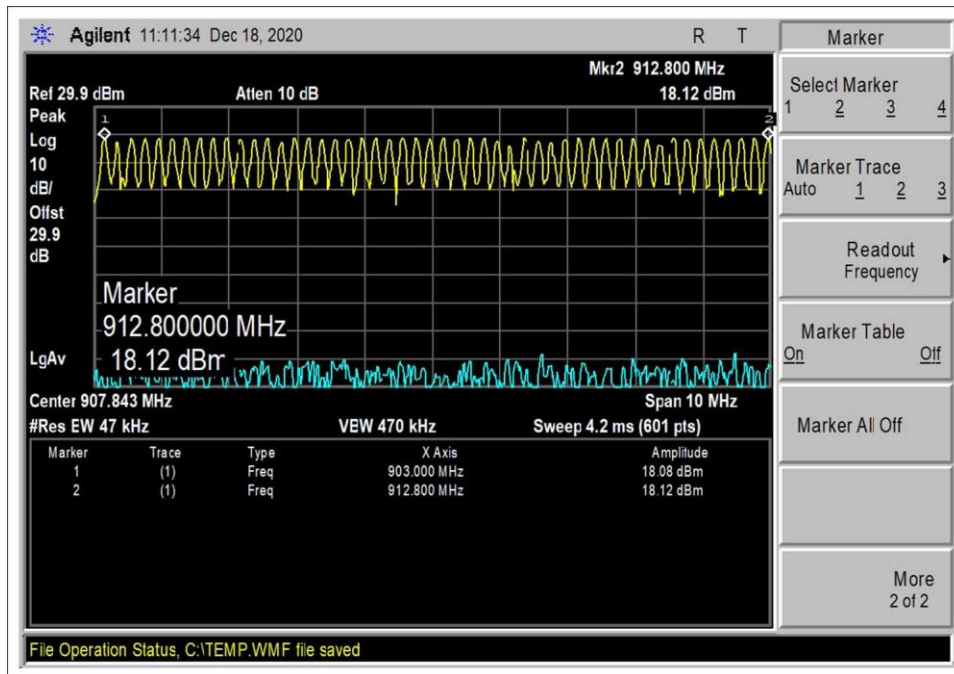


GFSK

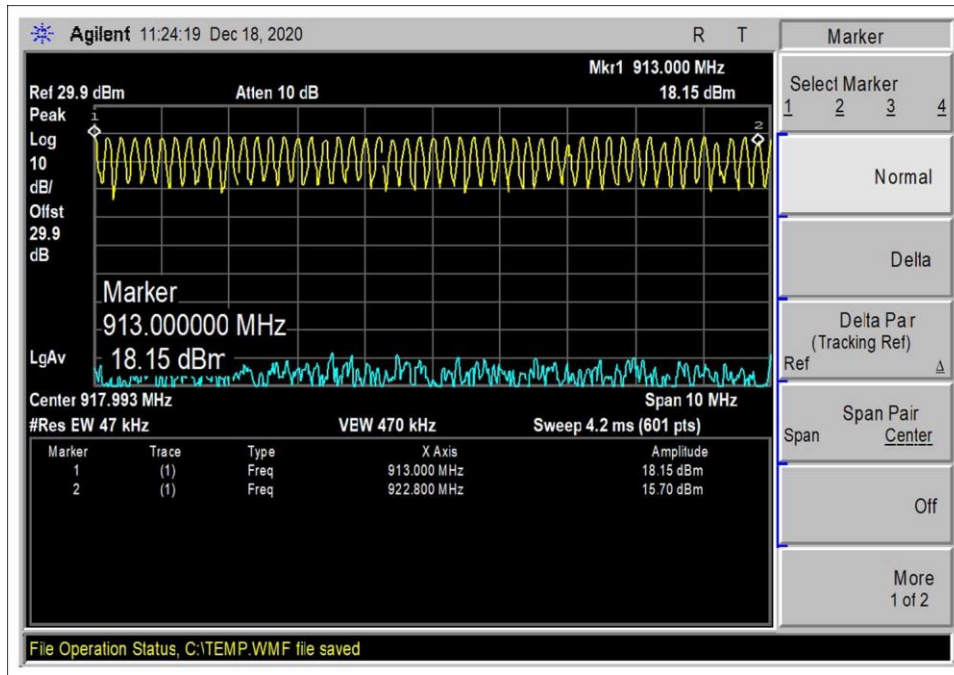
15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
Limit applied: { 50 Channels 20 dB BW < 250kHz 25 Channels 20 dB BW ≥ 250kHz				
Antenna Port	Operational Mode	Measured (Channels)	Limit (Channels)	Results
1	16384 OOK LV3	120	≥50	Pass
1	300k GFSK LV3	64	≥25	Pass

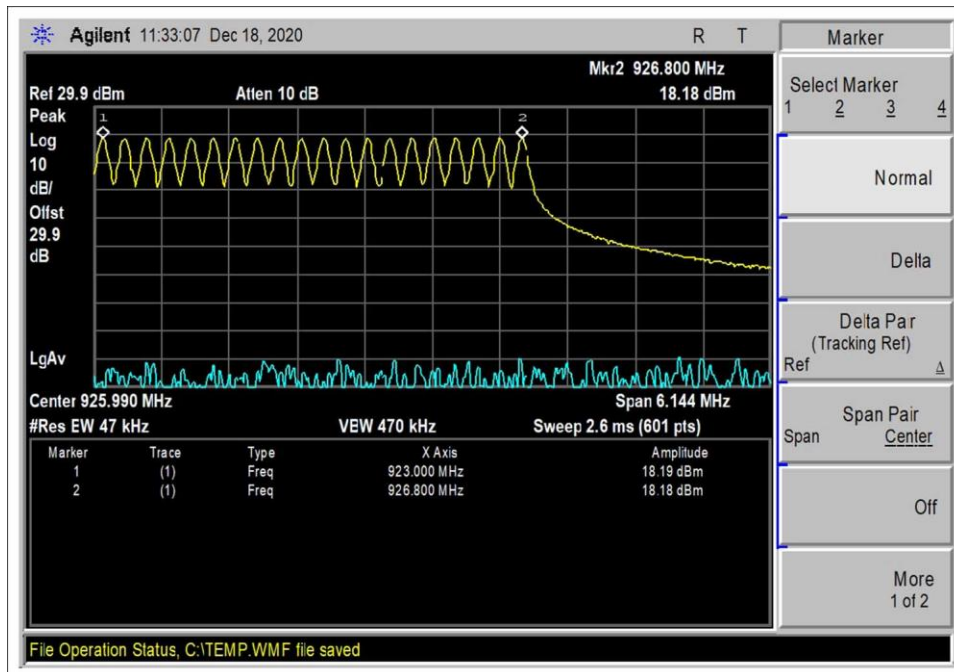
Plot(s)



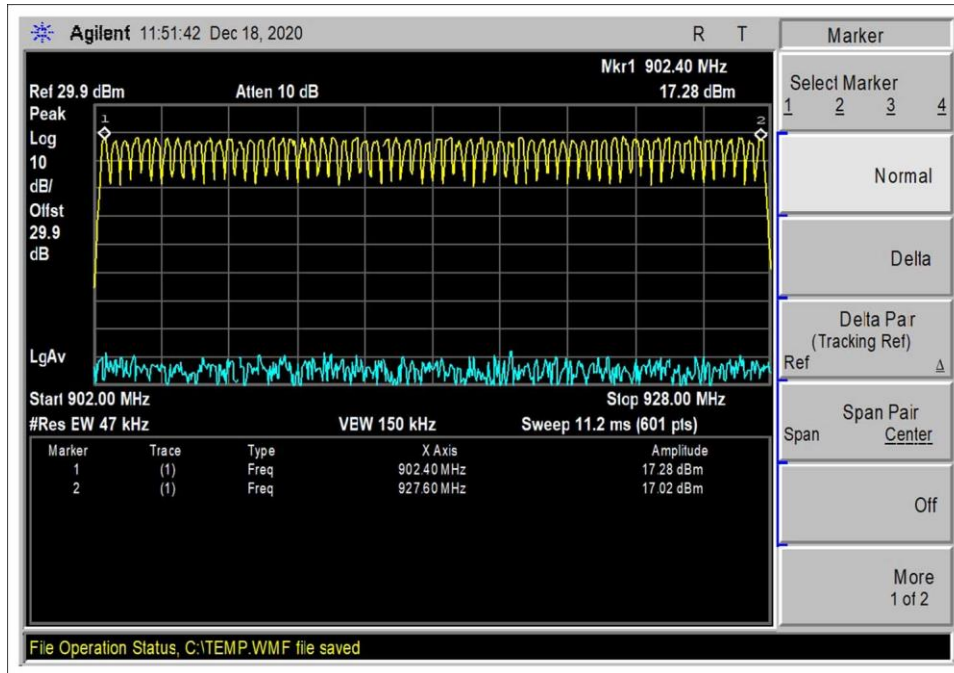
OOK 903-912.8M_50CH



OOK 913-922.8M_50CH



OOK 923-926.8M_20CH



GFSK 902.4-927.6M_64CH

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 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.

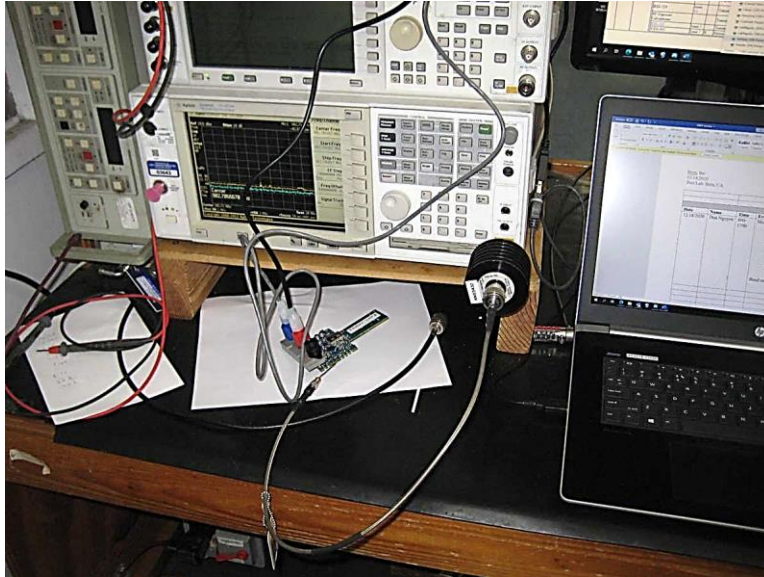
The system has receiver channel bandwidths that match the transmitter's modulation bandwidth that is enabled.

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(s)



15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	Don Nguyen
Test Method:	ANSI C63.10 (2013)	Test Date(s):	2/1/2021
Configuration:	4		
Test Setup:	<p>The EUT is placed on test bench and powered from 3.6Vdc power supply (to simulate fresh battery). The EUT is connected to a support laptop running CLI Tool ver.2.0.1.24.</p> <p>Operating frequency range/ modes:</p> <p>903 – 926.8MHz, 200kHz steps, 120 channels, 16384 OOK LV1</p> <p>903 – 926.8MHz, 200kHz steps, 120 channels, 16384 OOK LV3</p> <p>902.4 – 927.6MHz, 400kHz steps, 64 channels, 300kbps GFSK LV3</p> <p>Tested frequency range: 902.4-927.6MHz</p> <p>RBW=1MHz, VBW=3MHz</p> <p>Modification 1 was in place during testing.</p>		

Environmental Conditions			
Temperature (°C)	24	Relative Humidity (%):	34

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03643	Spectrum Analyzer	Agilent	E4440A	5/20/2020	5/20/2022
03432	Attenuator	Aeroflex/Weinschel	90-30-34	10/22/2019	10/22/2021
P07246	Cable	H&S	32022-29094K-29094K-24TC	5/29/2020	5/29/2022

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V _{Nominal} :	3.6Vdc
V _{Minimum} :	3.6Vdc
V _{Maximum} :	3.6Vdc

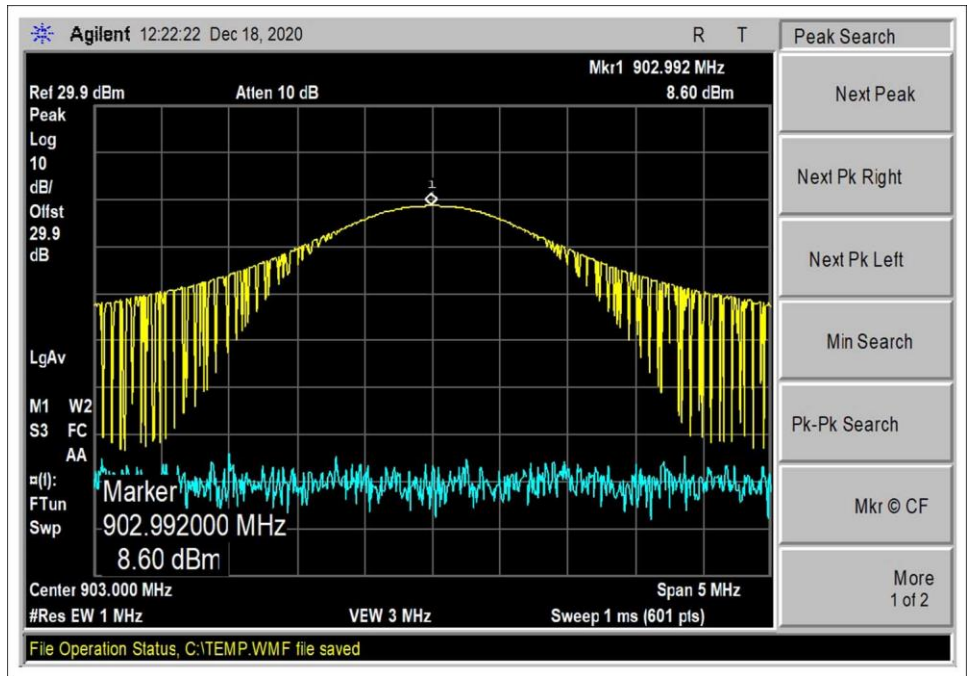
Test Data Summary - Voltage Variations

This equipment is battery powered. Power output tests were performed using an external power supply simulating fresh battery.

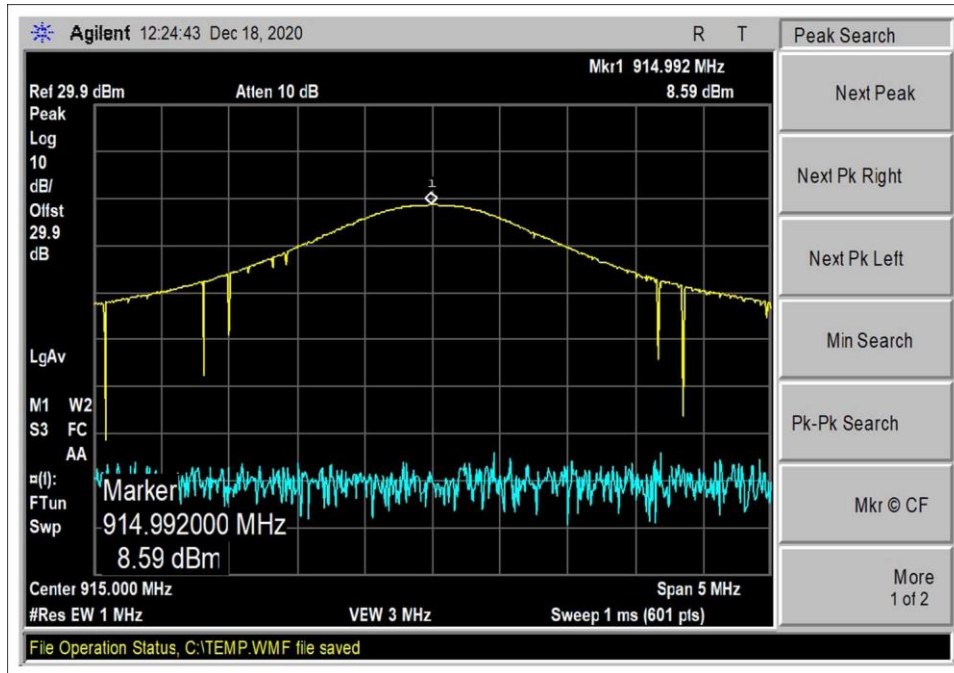
Test Data Summary - RF Conducted Measurement

Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
$Limit = \begin{cases} 30dBm \text{ Conducted} / 36dBm \text{ EIRP} & \geq 50 \text{ Channels} \\ 24dBm \text{ Conducted} / 30dBm \text{ EIRP} & < 50 \text{ Channels (min 25)} \end{cases}$					
903.0	16384 OOK LV1	PCB Trace/ 1.1	8.60	≤30	Pass
915.0	16384 OOK LV1	PCB Trace/ 1.1	8.59	≤30	Pass
926.8	16384 OOK LV1	PCB Trace/ 1.1	8.55	≤30	Pass
903.0	16384 OOK LV3	PCB Trace/ 1.1	12.76	≤30	Pass
915.0	16384 OOK LV3	PCB Trace/ 1.1	12.73	≤30	Pass
926.8	16384 OOK LV3	PCB Trace/ 1.1	12.71	≤30	Pass
902.4	300k GFSK LV3	PCB Trace/ 1.1	8.02	≤30	Pass
915.2	300k GFSK LV3	PCB Trace/ 1.1	7.99	≤30	Pass
927.6	300k GFSK LV3	PCB Trace/ 1.1	7.96	≤30	Pass

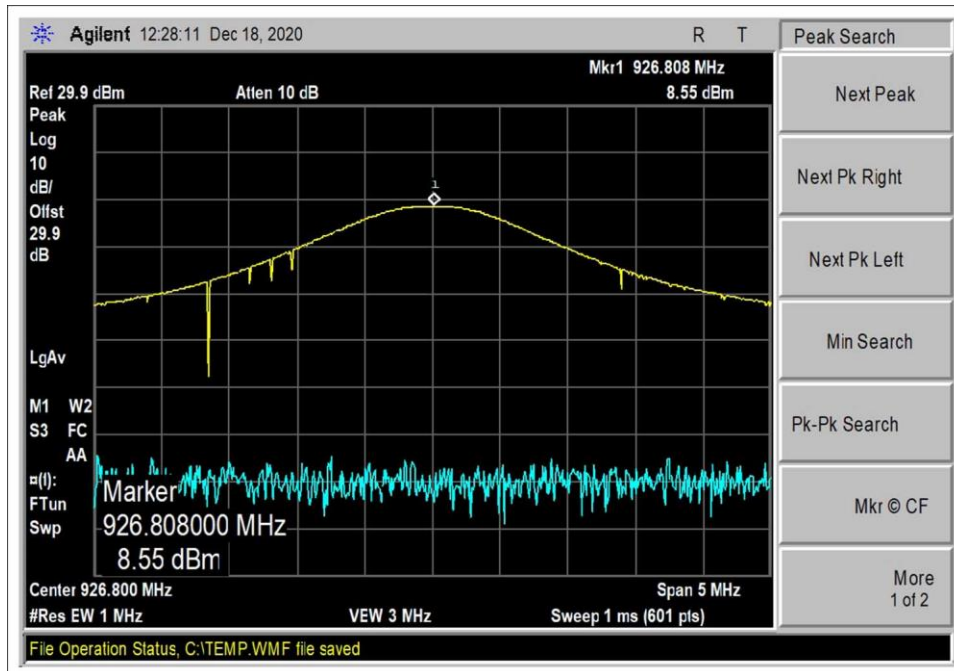
Plot(s)



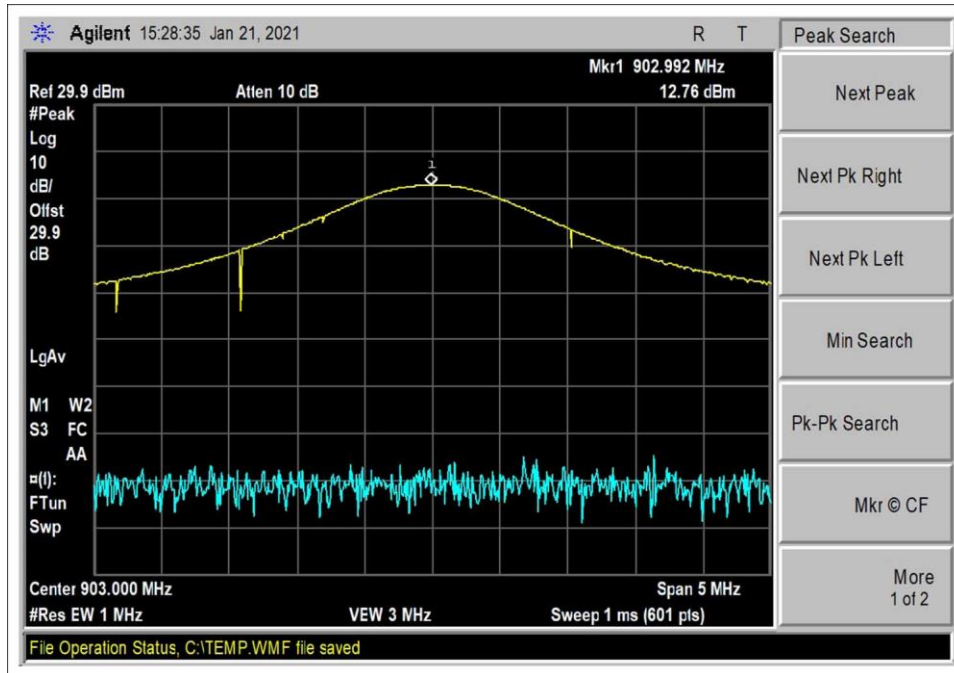
OOK LV1 Low Channel



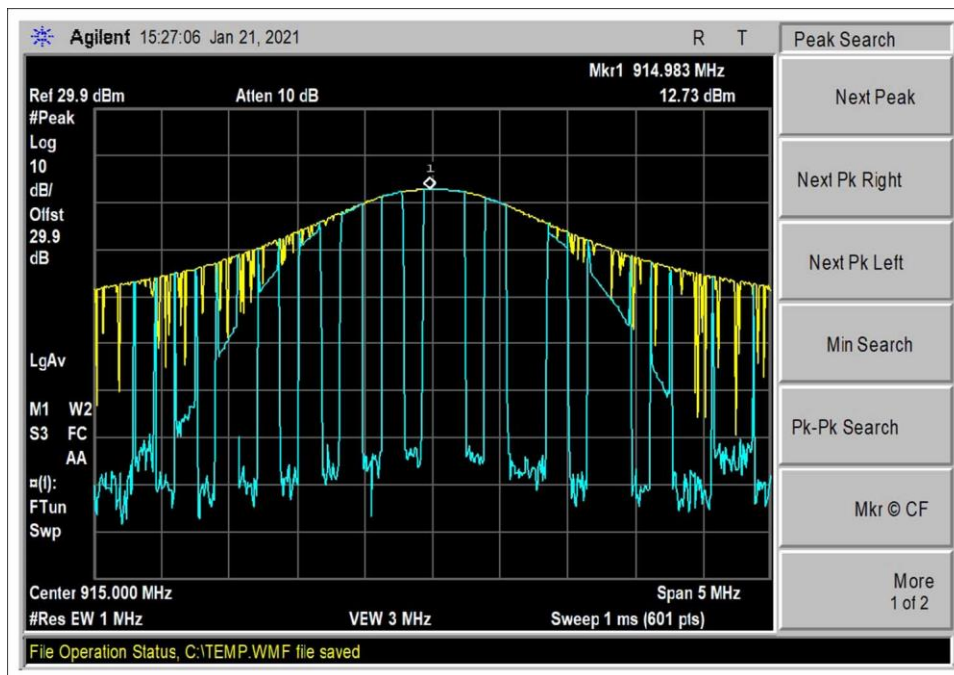
OOK LV1 Middle Channel



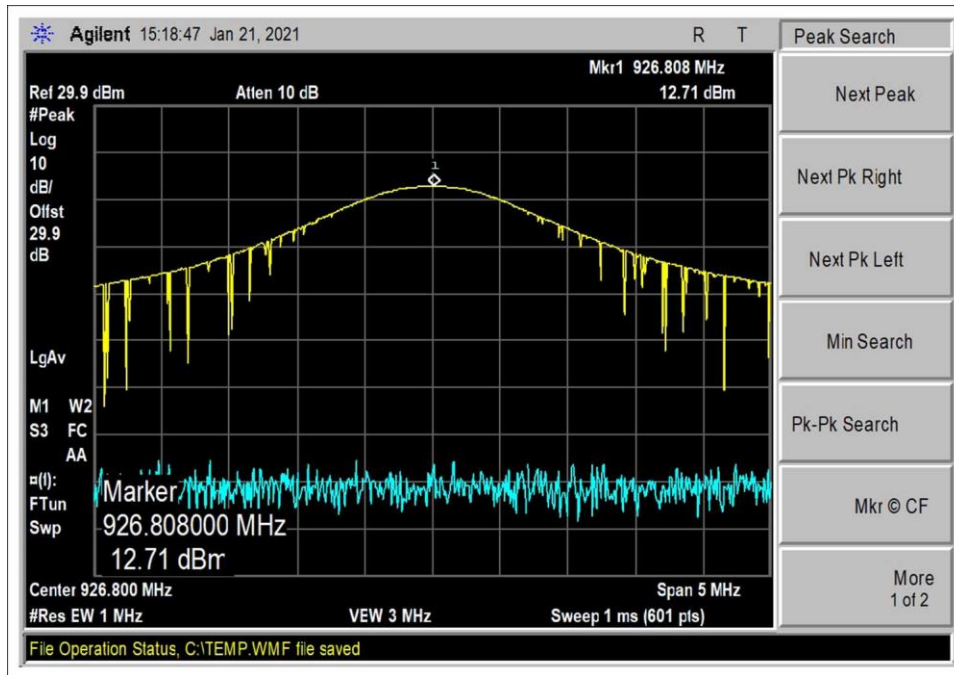
OOK LV1 High Channel



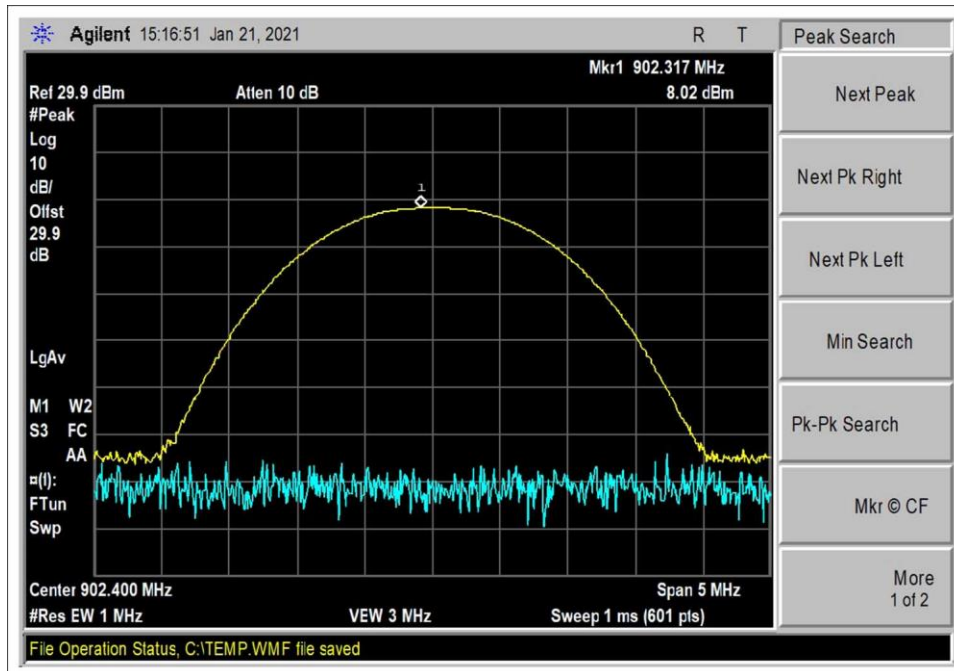
OOK LV3 Low Channel



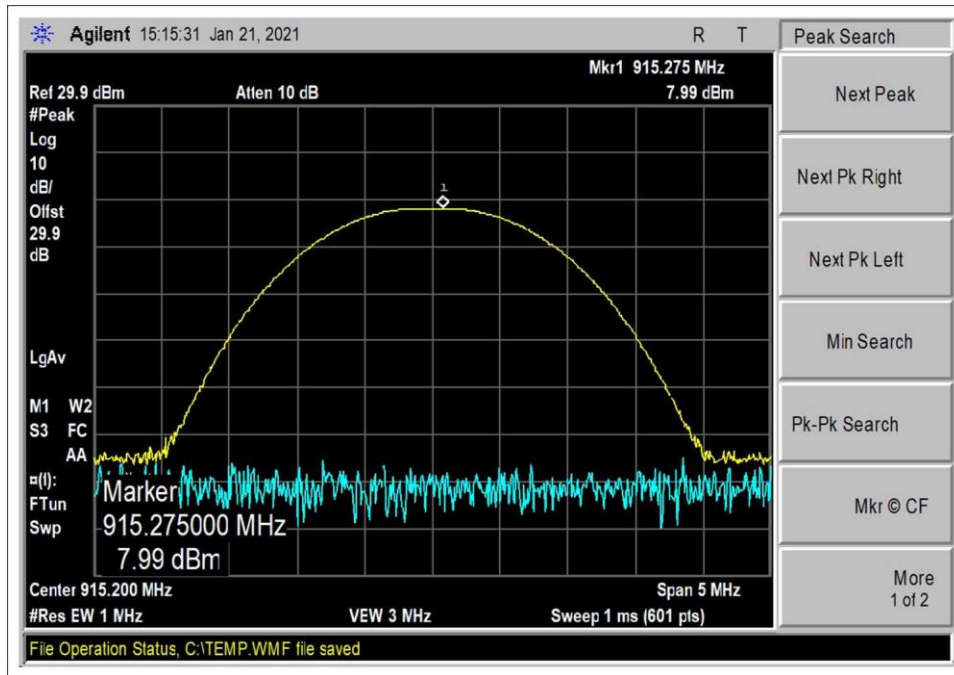
OOK LV3 Middle Channel



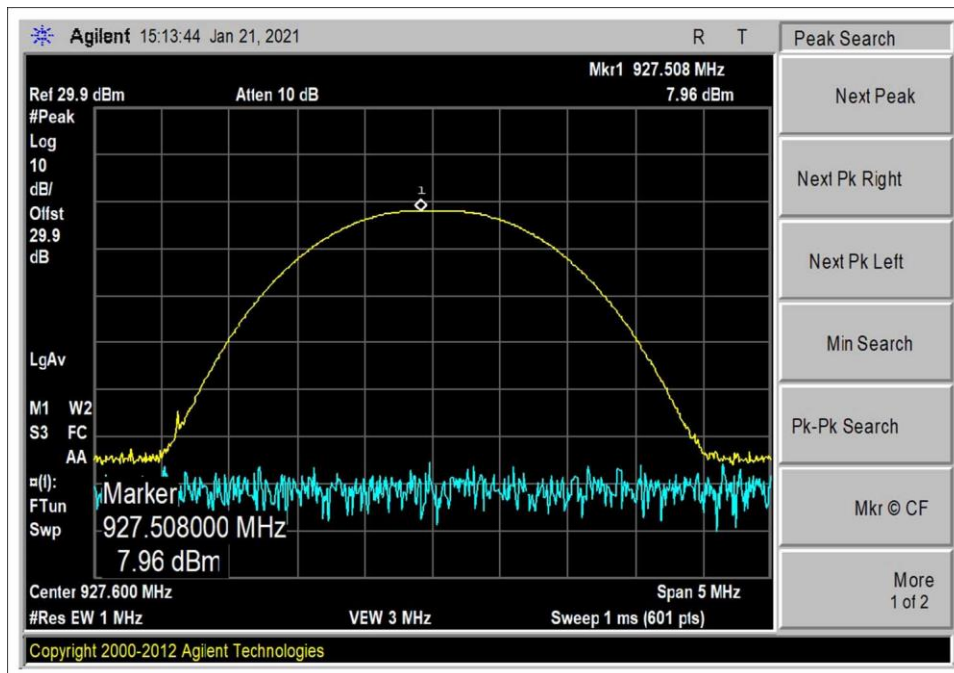
OOK LV3 High Channel



GFSK LV2_3 Low Channel

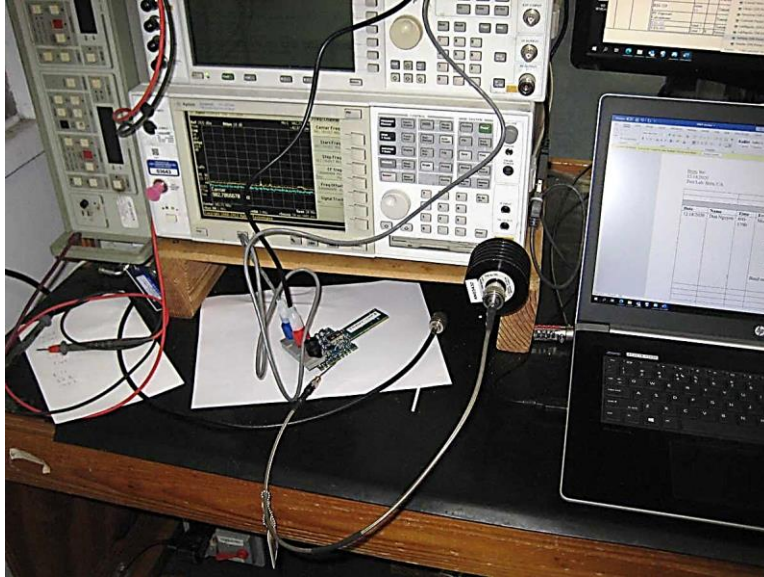


GFSK LV2_3 Middle Channel



GFSK LV2_3 High Channel

Test Setup Photo(s)



15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **104621** Date: 1/22/2021
 Test Type: **Conducted Emissions** Time: 08:11:45
 Tested By: Don Nguyen Sequence#: 3
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

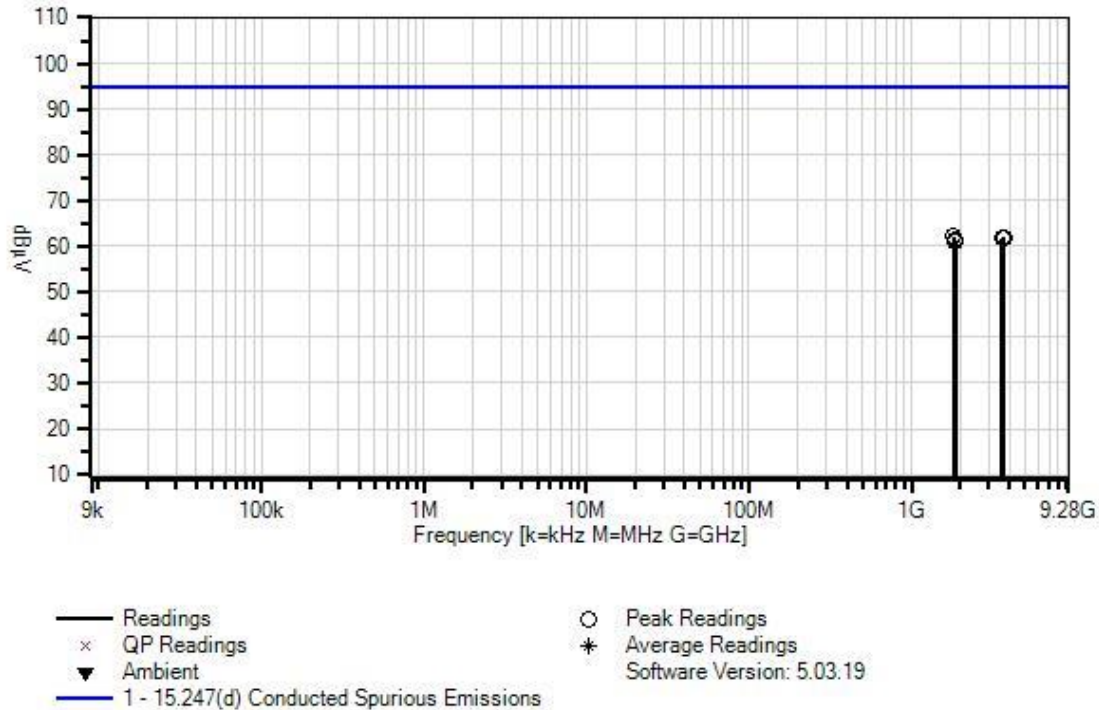
Test Conditions / Notes:

The EUT is placed on test bench and powered from 3.6Vdc power supply (to simulate fresh battery). The EUT is connected to a support laptop running CLI Tool ver.2.0.1.24.
 Operating frequency range/ modes
 902.4 - 927.6MHz, 400kHz steps, 64 channels, 300kbps **GFSK LV2/LV3**
 Frequency of measurement: 9kHz-9.28GHz
 RBW=100kHz, VBW=300kHz

 Test Method: ANSI C63.10 (2013)
 Temperature (°C): 24
 Relative Humidity (%): 34

 Modification 1 was in place during testing.

Itron, Inc. WD#: 104621 Sequence#: 3 Date: 1/22/2021
 15.247(d) Conducted Spurious Emissions Test Distance: None Antenna Port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T2	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021

Measurement Data:

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1804.644M	32.2	+29.6	+0.4			+0.0	62.2	95.0	-32.8	Anten
2	3710.100M	31.4	+29.8	+0.7			+0.0	61.9	95.0	-33.1	Anten
3	3609.913M	31.4	+29.7	+0.6			+0.0	61.7	95.0	-33.3	Anten
4	3661.113M	31.1	+29.8	+0.7			+0.0	61.6	95.0	-33.4	Anten
5	1830.553M	31.4	+29.6	+0.4			+0.0	61.4	95.0	-33.6	Anten
6	1855.053M	31.0	+29.6	+0.4			+0.0	61.0	95.0	-34.0	Anten

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **104621** Date: 12/21/2020
 Test Type: **Conducted Emissions** Time: 08:26:48
 Tested By: Don Nguyen Sequence#: 0
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

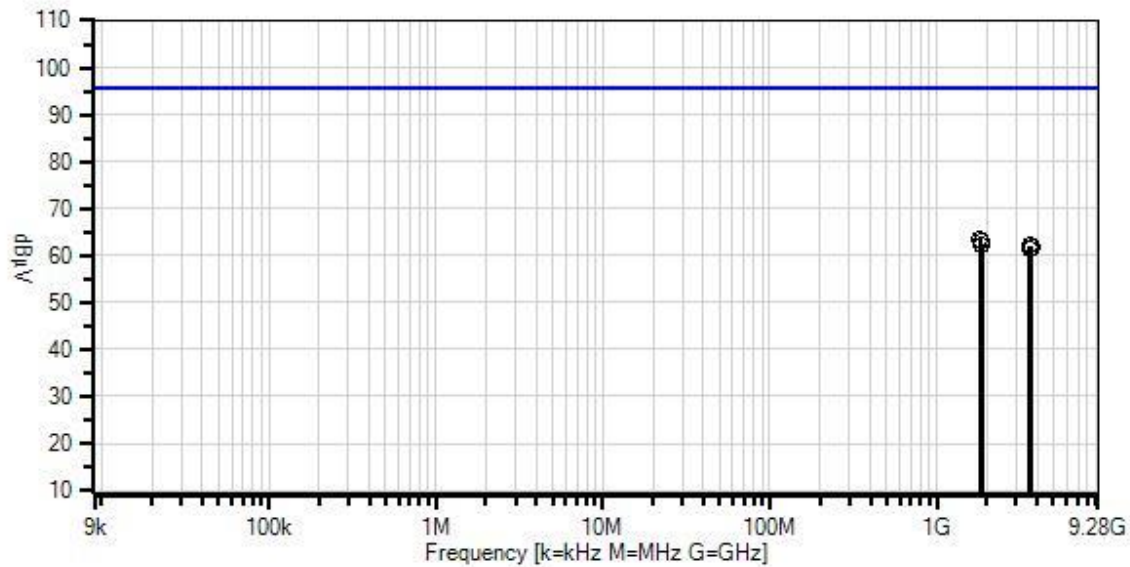
Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

The EUT is placed on test bench and powered from 3.6Vdc power supply (to simulate fresh battery). The EUT is connected to a support laptop running CLI Tool ver.2.0.1.24.
 Operating frequency range/ modes
 903 - 926.8MHz, 200kHz steps, 120 channels, 16384 **OOK LV1**
 Frequency of measurement: 9kHz-9.28GHz
 RBW=100kHz, VBW=300kHz

 Test Method: ANSI C63.10 (2013)
 Temperature (°C): 24
 Relative Humidity (%): 34
 Modification 1 was in place during testing.

Ittron, Inc. W/O#: 104621 Sequence#: 0 Date: 12/21/2020
 15.247(d) Conducted Spurious Emissions Test Distance: None Antenna Port



— Readings
 × QP Readings
 ▼ Ambient
 — 1 - 15.247(d) Conducted Spurious Emissions
 ○ Peak Readings
 * Average Readings
 Software Version: 5.03.19

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T2	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
	AN03643	Spectrum Analyzer	E4440A	5/20/2020	5/20/2022

Measurement Data:

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1805.982M	33.6	+29.6	+0.4			+0.0	63.6	95.6	-32.0	Anten
2	1829.977M	33.0	+29.6	+0.4			+0.0	63.0	95.6	-32.6	Anten
3	1853.610M	32.4	+29.6	+0.4			+0.0	62.4	95.6	-33.2	Anten
4	3612.000M	31.7	+29.7	+0.6			+0.0	62.0	95.6	-33.6	Anten
5	3707.177M	31.3	+29.8	+0.7			+0.0	61.8	95.6	-33.8	Anten
6	3660.027M	30.9	+29.8	+0.7			+0.0	61.4	95.6	-34.2	Anten

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **104621** Date: 1/22/2021
 Test Type: **Conducted Emissions** Time: 08:18:09
 Tested By: Don Nguyen Sequence#: 2
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

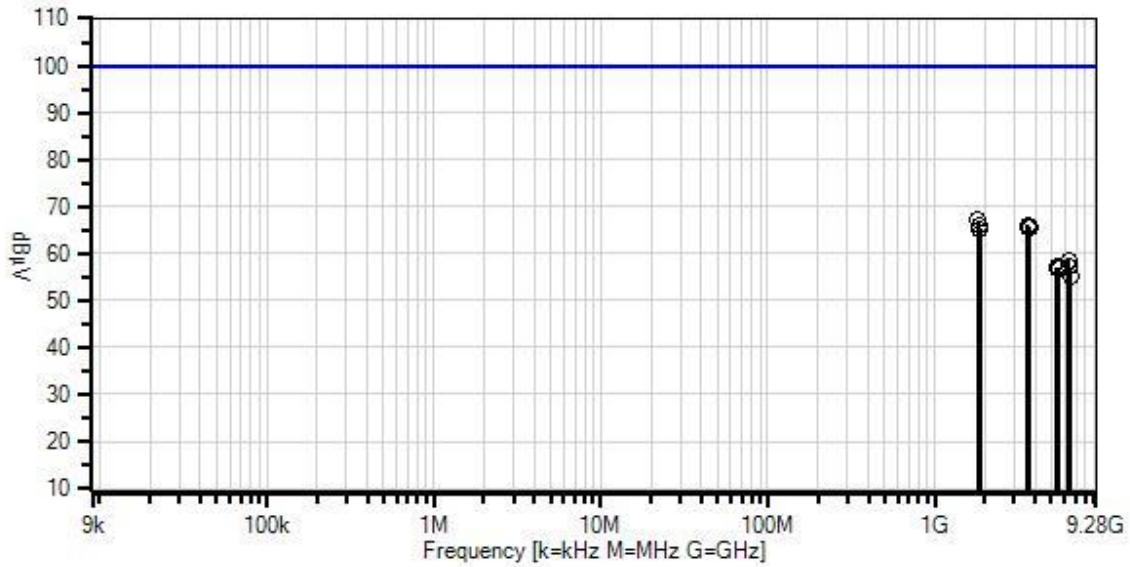
Test Conditions / Notes:

The EUT is placed on test bench and powered from 3.6Vdc power supply (to simulate fresh battery). The EUT is connected to a support laptop running CLI Tool ver.2.0.1.24.
 Operating frequency range/ modes
 903 - 926.8MHz, 200kHz steps, 120 channels, 16384 **OOK LV3**
 Frequency of measurement: 9kHz-9.28GHz
 RBW=100kHz, VBW=300kHz

Test Method: ANSI C63.10 (2013)
 Temperature (°C): 24
 Relative Humidity (%): 34

Modification 1 was in place during testing.

Ittron, Inc. W/O#: 104621 Sequence#: 2 Date: 1/22/2021
15.247(d) Conducted Spurious Emissions Test Distance: None Antenna Port



— Readings
 × QP Readings
 ▼ Ambient
 — 1 - 15.247(d) Conducted Spurious Emissions
 ○ Peak Readings
 * Average Readings
 Software Version: 5.03.19

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03432	Attenuator	90-30-34	10/22/2019	10/22/2021
T2	ANP07246	Cable	32022-29094K-29094K-24TC	5/29/2020	5/29/2022
	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021

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

#	Freq MHz	Rdng dB μ V	T1 dB	T2 dB			Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
1	1806.003M	37.0	+29.6	+0.4			+0.0	67.0	99.8	-32.8	Anten
2	3611.987M	35.7	+29.7	+0.6			+0.0	66.0	99.8	-33.8	Anten
3	1829.990M	35.8	+29.6	+0.4			+0.0	65.8	99.8	-34.0	Anten
4	3659.997M	35.1	+29.8	+0.7			+0.0	65.6	99.8	-34.2	Anten
5	3707.180M	35.1	+29.8	+0.7			+0.0	65.6	99.8	-34.2	Anten
6	1853.597M	35.3	+29.6	+0.4			+0.0	65.3	99.8	-34.5	Anten
7	6321.017M	28.1	+29.6	+0.8			+0.0	58.5	99.8	-41.3	Anten
8	5418.040M	26.6	+29.9	+0.7			+0.0	57.2	99.8	-42.6	Anten
9	6405.033M	26.9	+29.5	+0.7			+0.0	57.1	99.8	-42.7	Anten
10	5489.983M	26.4	+29.9	+0.7			+0.0	57.0	99.8	-42.8	Anten
11	5560.780M	26.0	+29.9	+0.7			+0.0	56.6	99.8	-43.2	Anten
12	6487.627M	25.0	+29.4	+0.7			+0.0	55.1	99.8	-44.7	Anten

Band Edge

Band Edge Summary

Limit applied: Max Power/100kHz - 20dB.
 Operating Mode: Single Channel (Low and High)

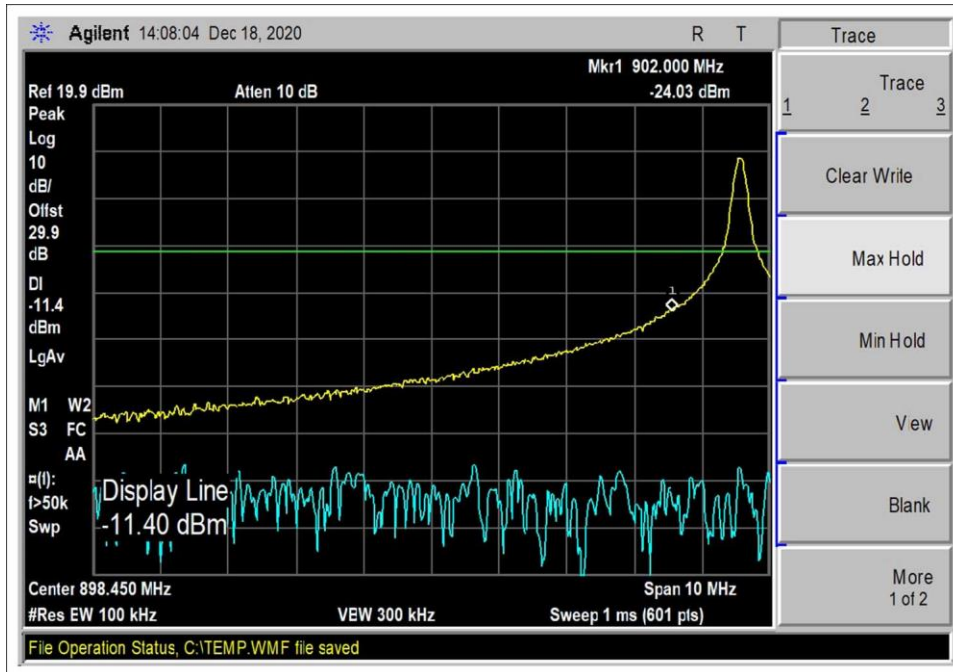
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	16384 OOK LV1	-24.03	<-11.40	Pass
928	16384 OOK LV1	-25.67	<-11.40	Pass
902	16384 OOK LV3	-20.22	<-7.24	Pass
928	16384 OOK LV3	-21.86	<-7.24	Pass
902	300k GFSK LV3	-32.68	<-11.98	Pass
928	300k GFSK LV3	-35.66	<-11.98	Pass

Band Edge Summary

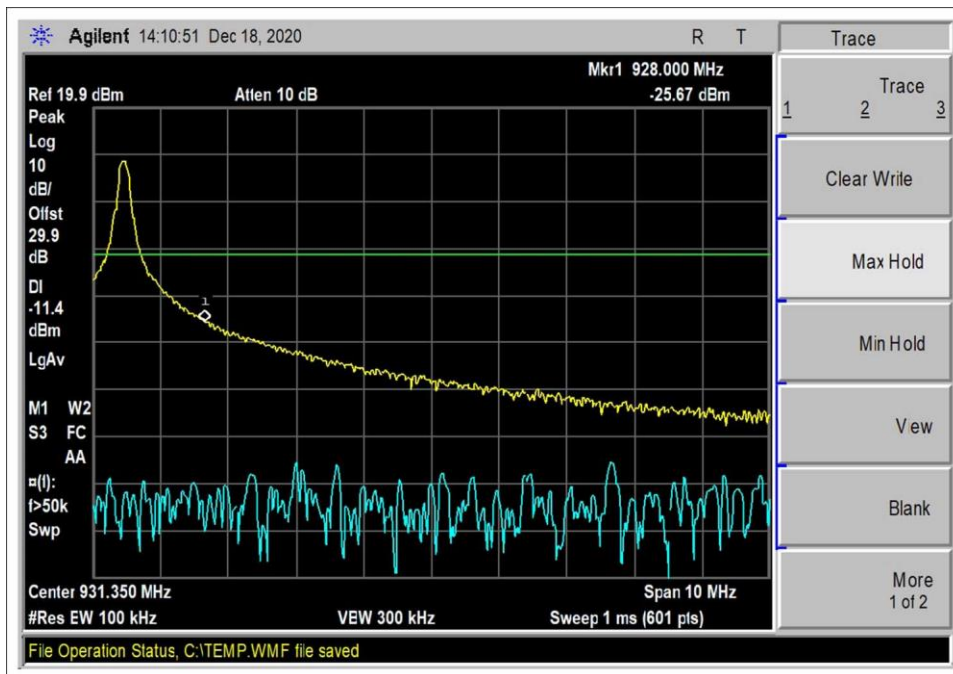
Limit applied: Max Power/100kHz - 20dB.
 Operating Mode: Hopping

Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	16384 OOK LV1	-24.34	<-11.40	Pass
928	16384 OOK LV1	-25.56	<-11.40	Pass
902	16384 OOK LV3	-19.91	<-7.24	Pass
928	16384 OOK LV3	-22.17	<-7.24	Pass
902	300k GFSK LV3	-32.76	<-11.98	Pass
928	300k GFSK LV3	-34.92	<-11.98	Pass

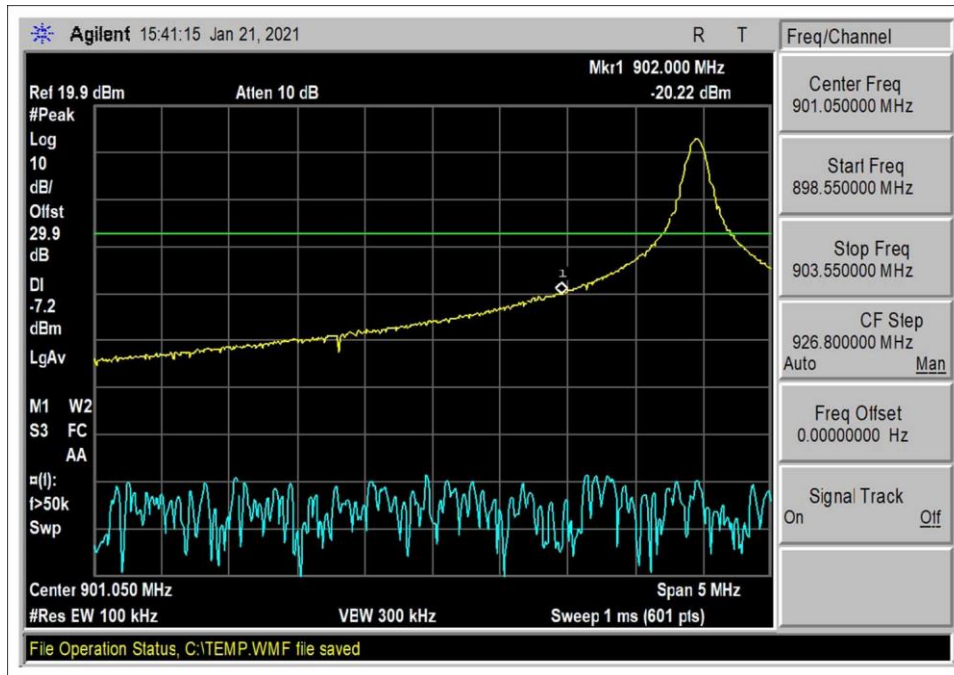
Band Edge Plots Single Channel



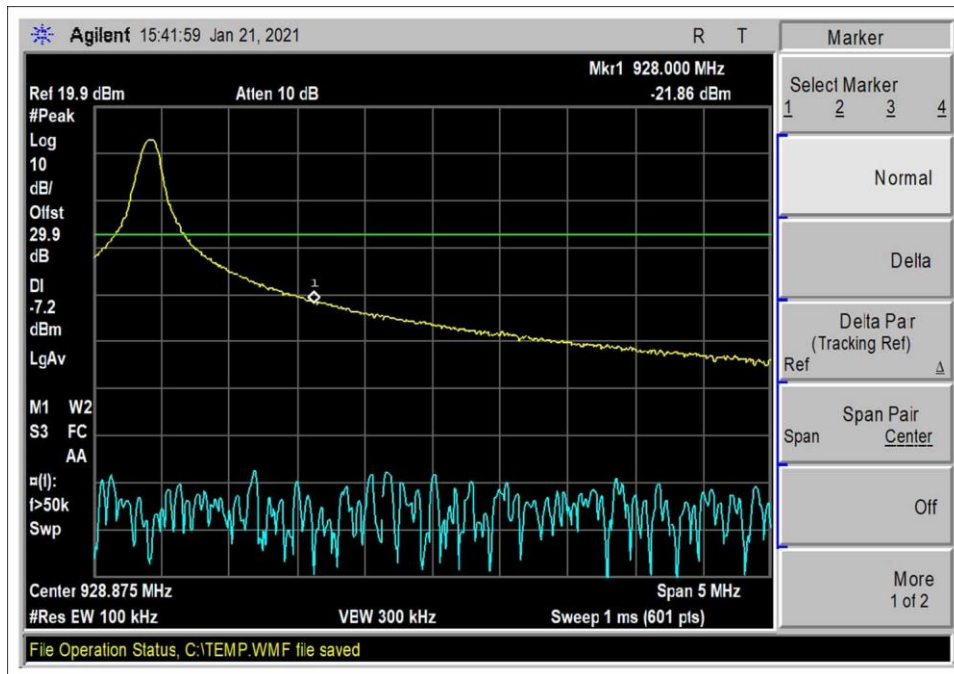
OOK LV1 Low Channel



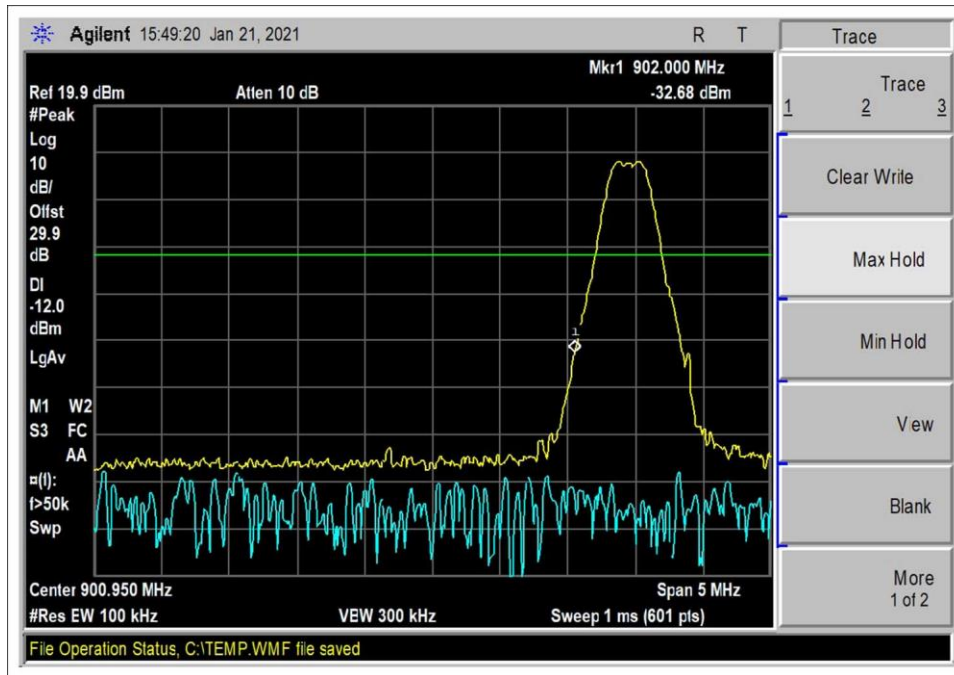
OOK LV1 High Channel



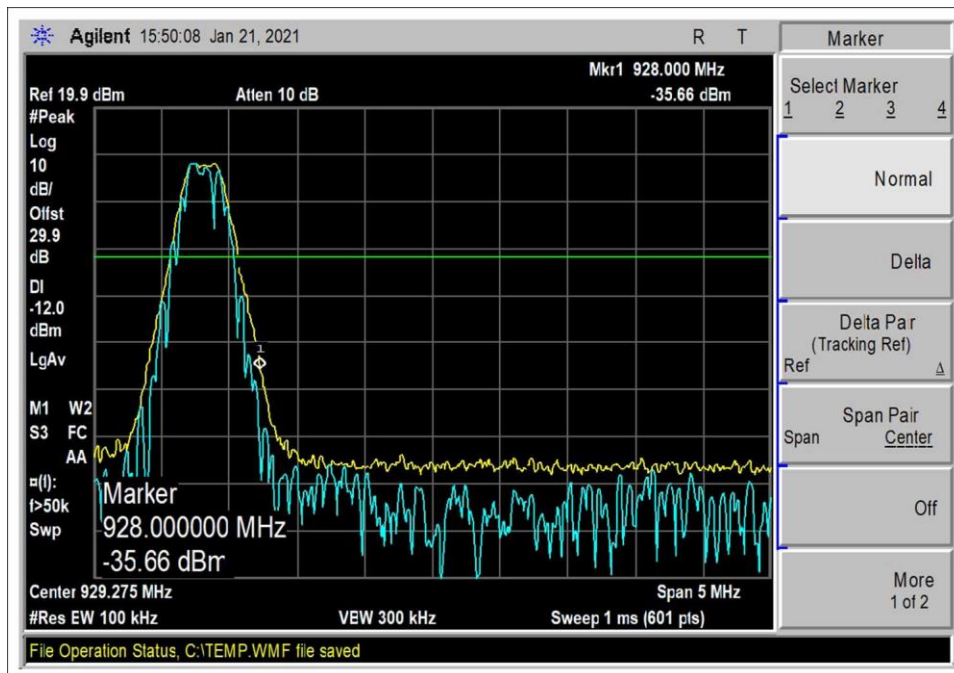
OOK LV3 Low Channel



OOK LV3 High Channel

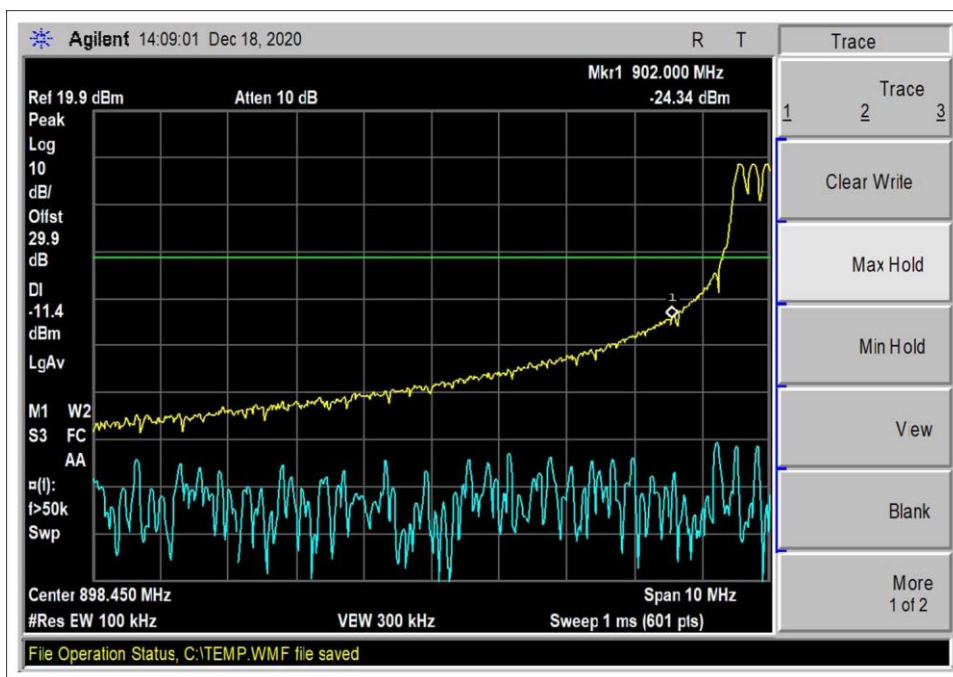


GFSK LV2_3 Low Channel

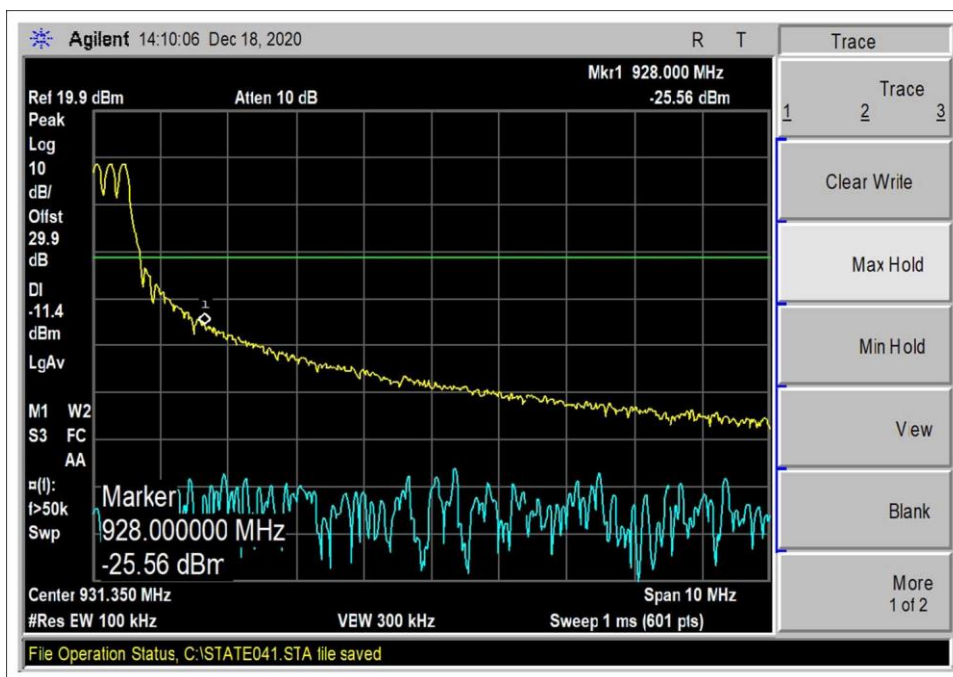


GFSK LV2_3 High Channel

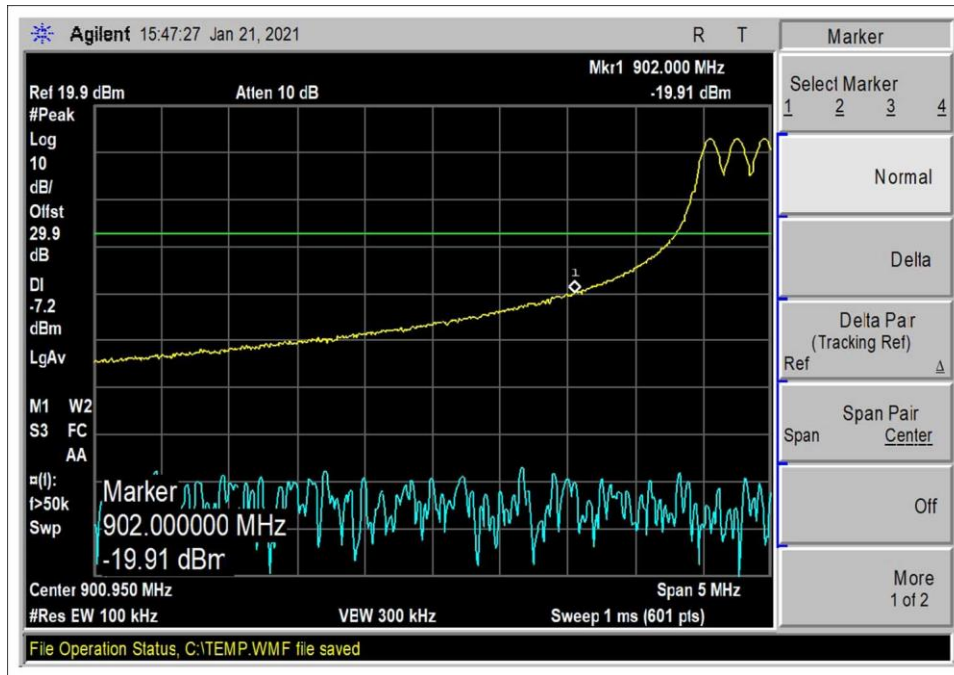
Band Edge Plots - Hopping



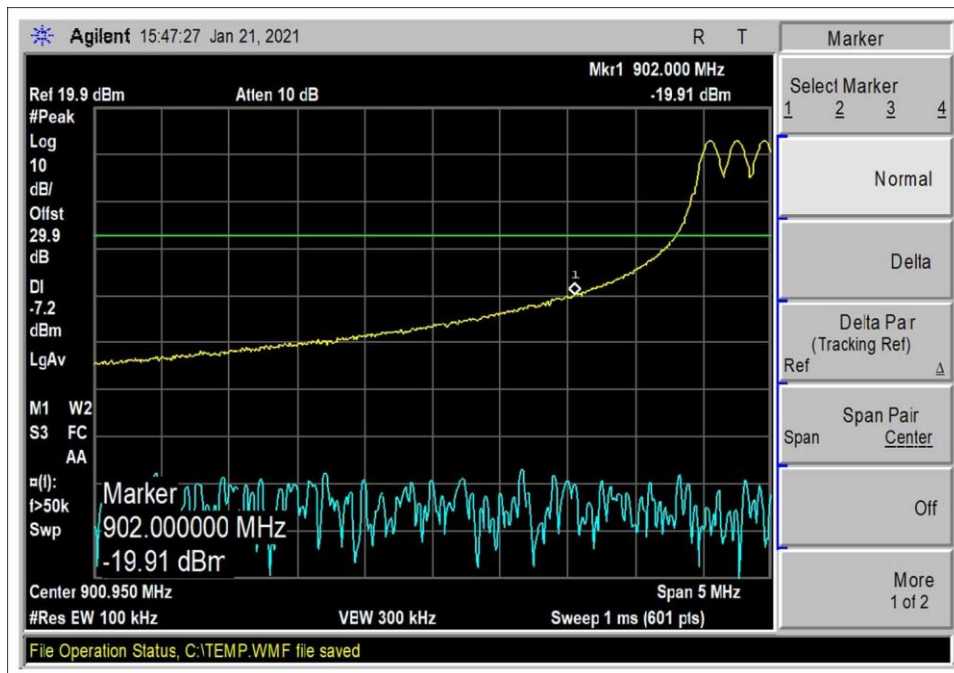
OOK LV1 hopping Low Channel



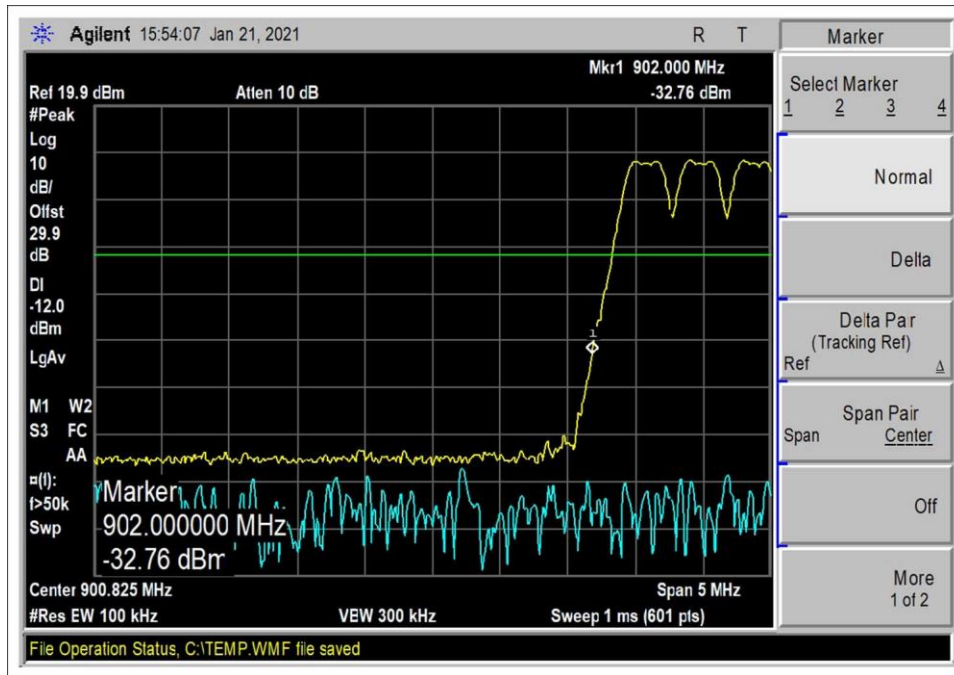
OOK LV1 hopping High Channel



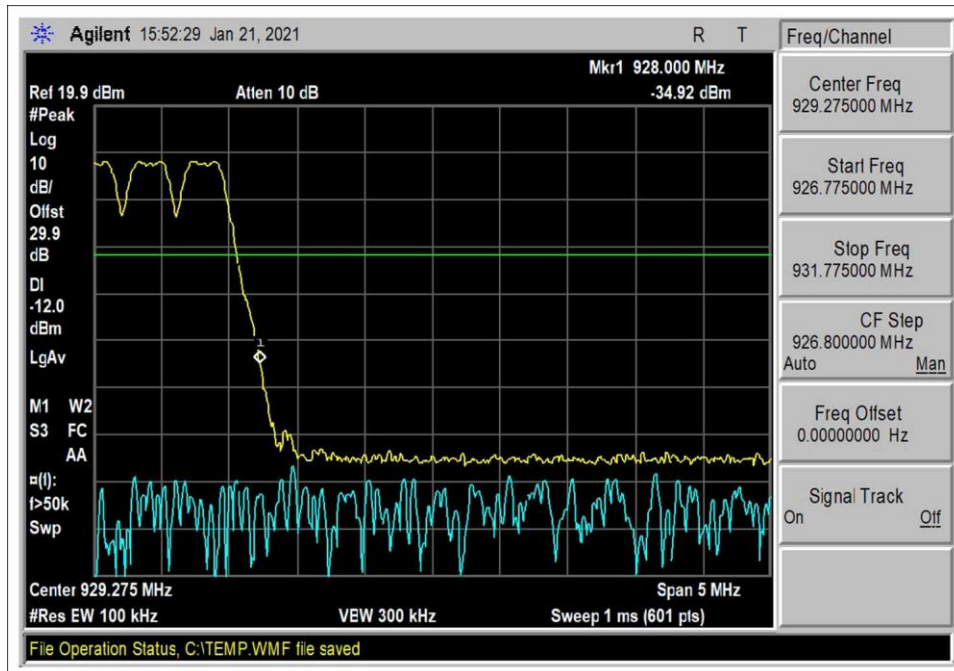
OOK LV3 hopping Low Channel



OOK LV3 hopping High Channel

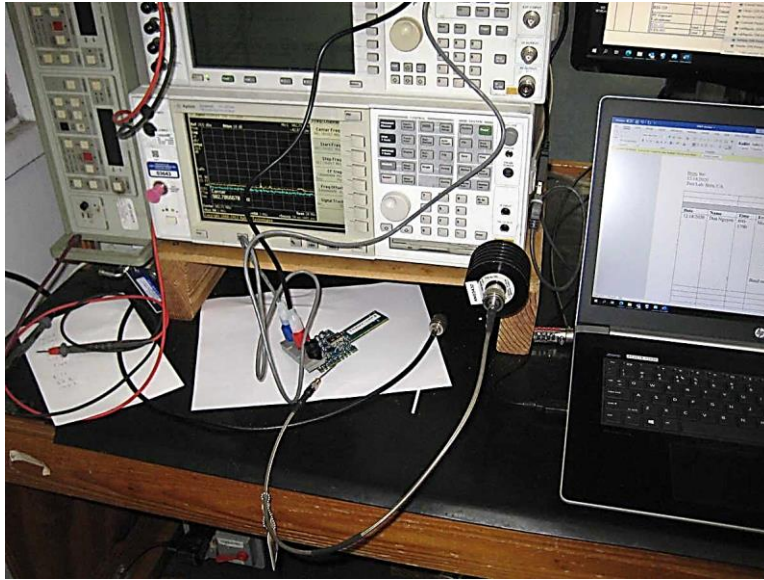


GFSK LV2_3 hopping Low Channel



GFSK LV2_3 hopping High Channel

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **104621** Date: 1/22/2021
 Test Type: **Radiated Emissions** Time: 12:45:05
 Tested By: Don Nguyen Sequence#: 15
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

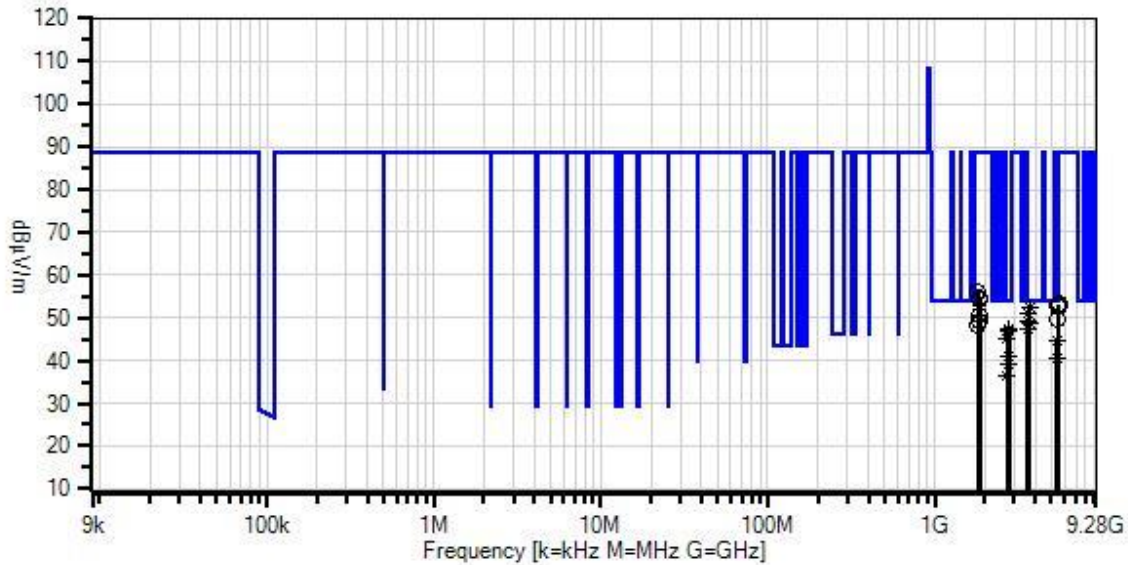
Test Conditions / Notes:

The EUT is placed on Styrofoam platform and powered from 3.6V fresh battery. The EUT is connected to a remote located laptop running CLI Tool ver.2.0.1.24.
 EUT has fixed orientation per manufacture's specification.
 Operating frequency range/ mode
 902.4 - 927.6MHz, 400kHz steps, 64 channels, 300k **GFSK LV2/LV3**
 Frequency of measurement: 9k-9280MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-9280MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 45ms per 100ms. Duty cycle correction factor=
 $20\log(45\text{ms}/100\text{ms}) = -6.9\text{dB}$. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

Test Method: ANSI C63.10 (2013)
 Temperature (°C): 24
 Relative Humidity (%): 30
 Modification 1 was in place during testing.

Itron, Inc. WO#: 104621 Sequence#: 15 Date: 1/22/2021
 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: 5.03.19

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN00314	Loop Antenna	6502	4/13/2020	4/13/2022
	ANP01911	Cable-Amplitude +15C to +45C (dB)	RG214/U	1/2/2020	1/2/2022
	ANP05281	Attenuator	1B	4/7/2020	4/7/2022
	AN01993	Biconilog Antenna	CBL6111C	6/11/2019	6/11/2021
T1	AN00786	Preamp	83017A	5/20/2020	5/20/2022
T2	AN00849	Horn Antenna	3115	3/17/2020	3/17/2022
T3	ANP06360	Cable	L1-PNMNM-48	8/8/2019	8/8/2021
T4	ANP07246	Cable	32022-29094K- 29094K-24TC	5/29/2020	5/29/2022
T5	AN03169	High Pass Filter	HM1155-11SS	5/8/2019	5/8/2021
T6	AN02869	Spectrum Analyzer	E4440A	8/3/2020	8/3/2021
T7	ANDCCF	Duty Cycle Correction Factor		1/1/2021	1/1/2025

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

#	Freq MHz	Rdng dB μ V	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 dB	Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	3710.592M Ave	60.3	-38.1 +0.2	+32.2 +0.0	+4.0 -7.0	+0.7	+0.0	52.3	54.0	-1.7	Vert
^	3710.592M	60.3	-38.1 +0.2	+32.2 +0.0	+4.0 +0.0	+0.7	+0.0	59.3	54.0	+5.3	Vert
3	3661.092M Ave	59.3	-38.1 +0.2	+32.0 +0.0	+4.0 -7.0	+0.7	+0.0	51.1	54.0	-2.9	Vert
^	3661.092M	59.3	-38.1 +0.2	+32.0 +0.0	+4.0 +0.0	+0.7	+0.0	58.1	54.0	+4.1	Vert
5	3660.567M Ave	57.3	-38.1 +0.2	+32.0 +0.0	+4.0 -7.0	+0.7	+0.0	49.1	54.0	-4.9	Horiz
^	3660.567M	57.3	-38.1 +0.2	+32.0 +0.0	+4.0 +0.0	+0.7	+0.0	56.1	54.0	+2.1	Horiz
7	3609.558M Ave	57.7	-38.1 +0.1	+31.8 +0.0	+4.0 -7.0	+0.6	+0.0	49.1	54.0	-4.9	Vert
^	3609.558M	57.7	-38.1 +0.1	+31.8 +0.0	+4.0 +0.0	+0.6	+0.0	56.1	54.0	+2.1	Vert
9	3710.183M Ave	56.9	-38.1 +0.2	+32.2 +0.0	+4.0 -7.0	+0.7	+0.0	48.9	54.0	-5.1	Horiz
^	3710.183M	56.9	-38.1 +0.2	+32.2 +0.0	+4.0 +0.0	+0.7	+0.0	55.9	54.0	+1.9	Horiz
11	2783.100M Ave	59.1	-38.5 +0.2	+29.8 +0.0	+3.5 -7.0	+0.4	+0.0	47.5	54.0	-6.5	Vert
^	2783.100M	59.1	-38.5 +0.2	+29.8 +0.0	+3.5 +0.0	+0.4	+0.0	54.5	54.0	+0.5	Vert
13	3609.883M Ave	56.1	-38.1 +0.1	+31.8 +0.0	+4.0 -7.0	+0.6	+0.0	47.5	54.0	-6.5	Horiz
^	3609.883M	56.1	-38.1 +0.1	+31.8 +0.0	+4.0 +0.0	+0.6	+0.0	54.5	54.0	+0.5	Horiz
15	2745.317M Ave	58.7	-38.5 +0.2	+29.7 +0.0	+3.4 -7.0	+0.4	+0.0	46.9	54.0	-7.1	Vert
^	2745.317M	58.7	-38.5 +0.2	+29.7 +0.0	+3.4 +0.0	+0.4	+0.0	53.9	54.0	-0.1	Vert
17	2707.192M Ave	57.1	-38.5 +0.2	+29.5 +0.0	+3.4 -7.0	+0.4	+0.0	45.1	54.0	-8.9	Vert
^	2707.192M	57.1	-38.5 +0.2	+29.5 +0.0	+3.4 +0.0	+0.4	+0.0	52.1	54.0	-1.9	Vert
19	5414.750M Ave	48.7	-37.2 +0.2	+34.0 +0.0	+5.1 -7.0	+0.7	+0.0	44.5	54.0	-9.5	Horiz
^	5414.750M	48.7	-37.2 +0.2	+34.0 +0.0	+5.1 +0.0	+0.7	+0.0	51.5	54.0	-2.5	Horiz
21	2782.442M Ave	52.4	-38.5 +0.2	+29.8 +0.0	+3.5 -7.0	+0.4	+0.0	40.8	54.0	-13.2	Horiz
^	2782.442M	52.4	-38.5 +0.2	+29.8 +0.0	+3.5 +0.0	+0.4	+0.0	47.8	54.0	-6.2	Horiz

23	5414.500M Ave	44.9	-37.2 +0.2	+34.0 +0.0	+5.1 -7.0	+0.7	+0.0	40.7	54.0	-13.3	Vert
^	5414.500M	44.9	-37.2 +0.2	+34.0 +0.0	+5.1 +0.0	+0.7	+0.0	47.7	54.0	-6.3	Vert
25	2745.992M Ave	50.9	-38.5 +0.2	+29.7 +0.0	+3.4 -7.0	+0.4	+0.0	39.1	54.0	-14.9	Horiz
^	2745.992M	50.9	-38.5 +0.2	+29.7 +0.0	+3.4 +0.0	+0.4	+0.0	46.1	54.0	-7.9	Horiz
27	2707.400M Ave	48.4	-38.5 +0.2	+29.5 +0.0	+3.4 -7.0	+0.4	+0.0	36.4	54.0	-17.6	Horiz
^	2707.400M	48.4	-38.5 +0.2	+29.5 +0.0	+3.4 +0.0	+0.4	+0.0	43.4	54.0	-10.6	Horiz
29	1804.983M	65.0	-38.8 +0.2	+26.7 +0.0	+2.8 +0.0	+0.4	+0.0	56.3	88.5	-32.2	Vert
30	1830.417M	63.2	-38.8 +0.2	+26.9 +0.0	+2.8 +0.0	+0.4	+0.0	54.7	88.5	-33.8	Vert
31	1855.175M	62.6	-38.8 +0.2	+27.0 +0.0	+2.9 +0.0	+0.4	+0.0	54.3	88.5	-34.2	Vert
32	5565.850M	50.5	-37.3 +0.2	+34.1 +0.0	+5.1 +0.0	+0.7	+0.0	53.3	88.5	-35.2	Horiz
33	5565.858M	50.0	-37.3 +0.2	+34.1 +0.0	+5.1 +0.0	+0.7	+0.0	52.8	88.5	-35.7	Vert
34	5490.900M	49.8	-37.2 +0.2	+34.1 +0.0	+5.1 +0.0	+0.7	+0.0	52.7	88.5	-35.8	Horiz
35	1854.942M	58.7	-38.8 +0.2	+27.0 +0.0	+2.9 +0.0	+0.4	+0.0	50.4	88.5	-38.1	Horiz
36	5491.083M	46.7	-37.2 +0.2	+34.1 +0.0	+5.1 +0.0	+0.7	+0.0	49.6	88.5	-38.9	Vert
37	1830.308M	57.9	-38.8 +0.2	+26.9 +0.0	+2.8 +0.0	+0.4	+0.0	49.4	88.5	-39.1	Horiz
38	1804.917M	57.0	-38.8 +0.2	+26.7 +0.0	+2.8 +0.0	+0.4	+0.0	48.3	88.5	-40.2	Horiz

Test Location: CKC Laboratories Inc. • 110 N. Olinda Pl. • Brea, CA 92823 • 714-993-6112
 Customer: **Itron, Inc.**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **104621** Date: 1/7/2021
 Test Type: **Radiated Emissions** Time: 11:22:01
 Tested By: Don Nguyen Sequence#: 16
 Software: EMITest 5.03.19

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

The EUT is placed on Styrofoam platform and powered from 3.6V fresh battery. The EUT is connected to a remote located laptop running CLI Tool ver.2.0.1.24.
 EUT has fixed orientation per manufacture's specification.
 Operating frequency range/ mode
 903 - 926.8MHz, 200kHz steps, 120 channels, 16384 **OOK LV1**
 Frequency of measurement: 9k-9280MHz
 9kHz to 150kHz RBW=0.2kHz, VBW=0.6kHz
 150kHz to 30MHz RBW=9kHz, VBW=27kHz
 30-1000MHz, RBW=120kHz, VBW=360kHz
 1000-9280MHz, RBW=1MHz, VBW=3MHz
 -20dBc limit, RBW=100kHz, VBW=300kHz

Note: The manufacturer declares the worst case duty cycle is 28.05ms per 100ms. Duty cycle correction factor= $20\log(28.05\text{ms}/100\text{ms}) = -11.04\text{dB}$. Average readings in restricted band are calculated from peak readings with duty cycle correction factor.

Test Method: ANSI C63.10 (2013)
 Temperature (°C): 24
 Relative Humidity (%): 30

Modification 1 was in place during testing.