Itron, Inc.

TEST REPORT FOR

Gas Endpoint
Model: Intelis-Gas

Tested to The Following Standard:

FCC Part 15 Subpart C Section(s)

15.247
(FHSS 902-928 MHz)

Report No.: 101080-8

Date of issue: May 30, 2018

ACCREDITED

Test Certificate # 803.02

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 EMC 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.

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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

Representative: Jay Holcomb
Customer Reference Number: 148975

REPORT PREPARED BY:

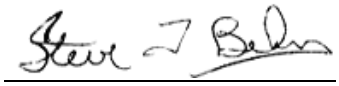
Terri Rayle
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 101080

DATE OF EQUIPMENT RECEIPT: May 16, 2018
DATE(S) OF TESTING: May 16-17, 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)(iii)	Number of Hopping Channels	NA	Pass
15.247(a)(1)(iii)	Average Time of Occupancy	NA	NP
15.247(b)(2)	Output Power	NA	Pass
15.247(d)	RF Conducted Emissions & Band Edge	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = Not applicable because the EUT is battery powered.
NP = CKC Laboratories was not contracted to perform test. See Appendix A for manufacturer declaration for time of occupancy calculation.

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.	Intelis-Gas	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	Dell	E6410	7VNWTM1

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
Gas Endpoint	Itron, Inc.	Intelis-Gas	NA

Support Equipment:

Device	Manufacturer	Model #	S/N
None			

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	Low Power, FHSS
Operating Frequency Range:	903 to 926.8MHz (OOK) (power level 1 and 3) 902.2 to 927.75MHz (GFSK) (power level 3) 902.4 to 927.6MHz (GFSK) (power level 3)
Number of Hopping Channels:	120 (903 to 926.8MHz (OOK)) 512 (902.2 to 927.75MHz (GFSK)) (10kbps) 64 (902.4 to 927.6MHz (GFSK)) (150kbps)
Modulation Type(s):	OOK and GFSK
Maximum Duty Cycle:	Power level 1 for OOK is 12.7% Power level 3 for OOK is 56.1% Power level 3 for both GFSKs is 100%
Number of TX Chains:	2
Antenna Type(s) and Gain:	PCB trace Power level 1: 2.3 dBi Power level 3: 2.0 dBi
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	6.3V DC – battery
Firmware / Software used for Test:	App Version: 2.0.9.0, CSL Version: 3.0.18.9

FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Brea Lab A	Test Engineer:	E. Wong
Test Method:	ANSI C63.10 (2013)	Test Date(s):	5/14/2018
Configuration:	1		
Test Setup:	The EUT is placed on the test bench. RF characteristic is evaluated at the temporarily antenna port. A support laptop configures the EUT in test mode. Transmit Freq pulse at 6.8% duty cycle, 56.33ms pulse Frequency: 902-928MHz OOK Power level 1, Tx frequency: 903-926.8MHz OOK Power level 3, Tx frequency: 903-926.8MHz GFSK 10kbps Power level 3 Tx frequency; 902.2 – 927.75MHz GFSK 150kbps Power level 3 Tx Frequency: 902.4-927.6MHz Fully charged battery is installed.		

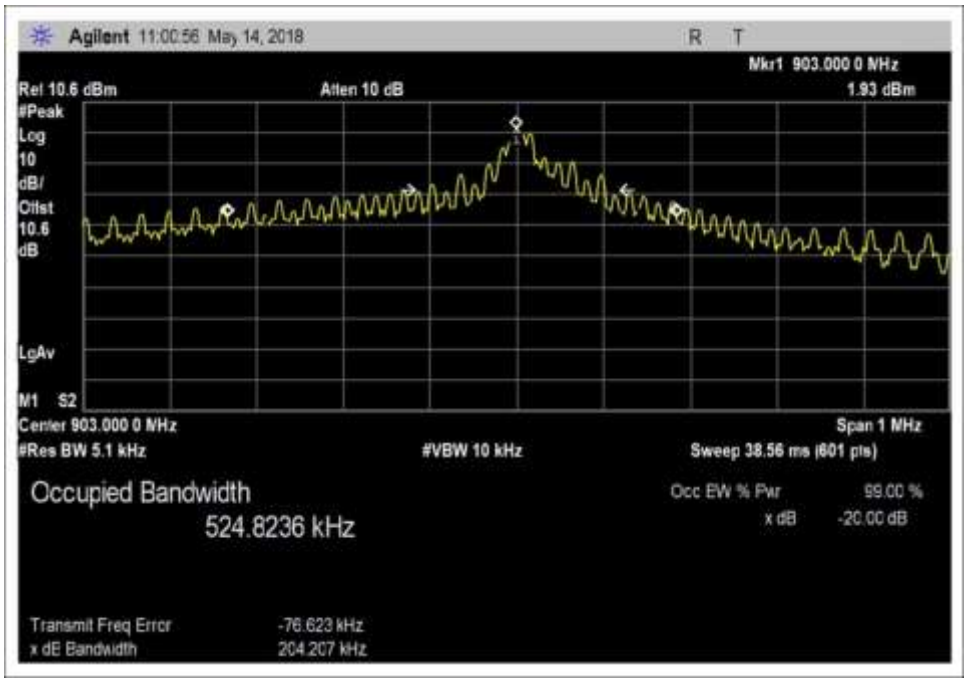
Environmental Conditions			
Temperature (ºC)	21	Relative Humidity (%):	51.3

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02672	Spectrum Analyzer	Agilent	E4446A	3/2/2017	3/2/2019
03430	Attenuator	Aeroflex/Weinschel	75A-10-12	12/19/2017	12/19/2019
P06544	Cable	Astro Steel	32026-29094K-29094K-36TC	12/21/2017	12/21/2019

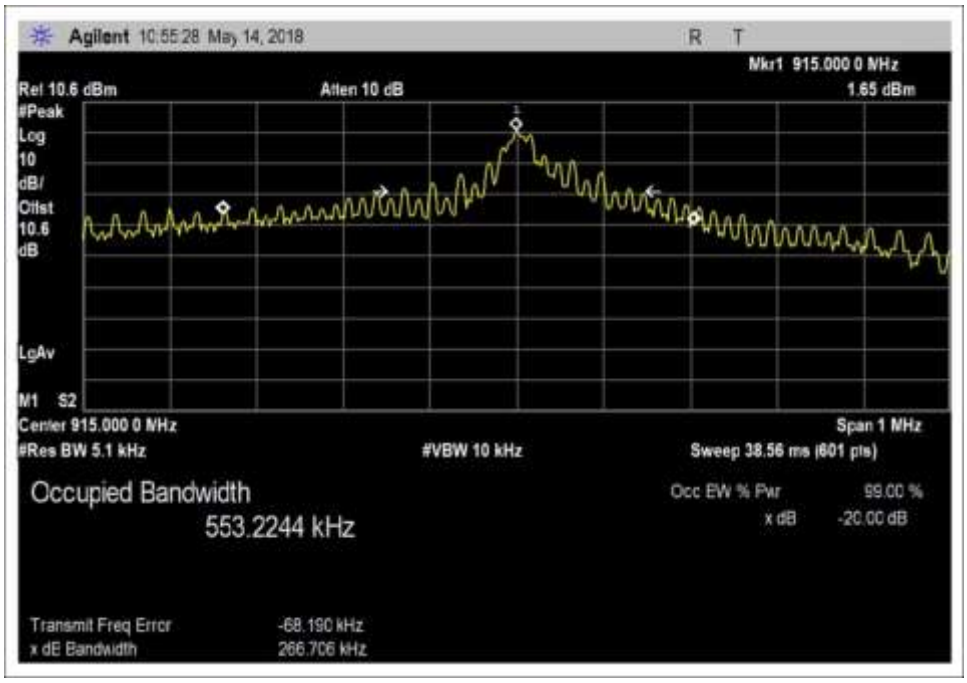
15.247(a)(1) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
903.0	1	OOK Power level 1	204.2	≤500	Pass
915.0	1	OOK Power level 1	266.7	≤500	Pass
926.8	1	OOK Power level 1	203.8	≤500	Pass
903.0	1	OOK Power level 3	170.1	≤500	Pass
915.0	1	OOK Power level 3	170.1	≤500	Pass
926.8	1	OOK Power level 3	170.3	≤500	Pass
902.2	1	GFSK power level 3 10kbps	20.6	≤500	Pass
915	1	GFSK power level 3 10kbps	20.0	≤500	Pass
927.75	1	GFSK power level 3 10kbps	19.9	≤500	Pass
902.4	1	GFSK power level 3 150kbps	151.2	≤500	Pass
915.6	1	GFSK power level 3 150kbps	151.3	≤500	Pass
927.6	1	GFSK power level 3 150kbps	151.7	≤500	Pass

Plots



OOK Power level 1, 903MHz



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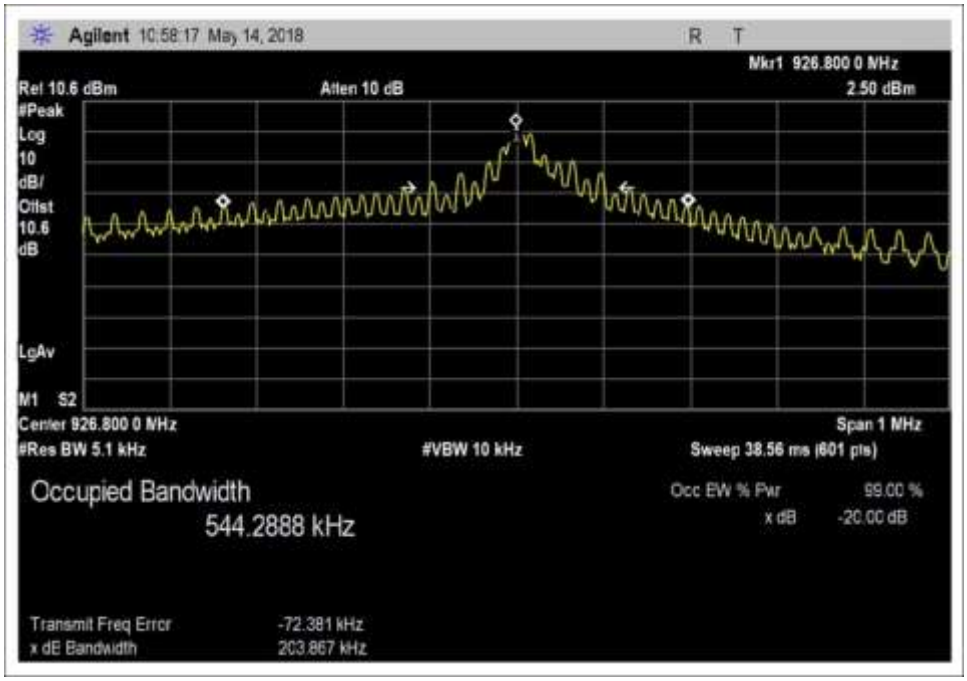
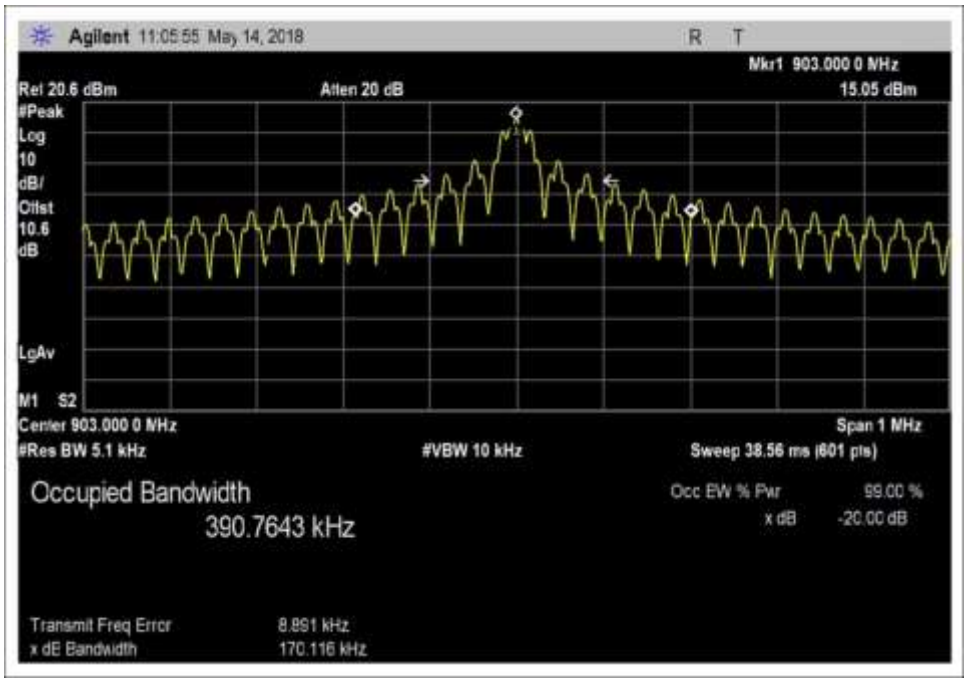
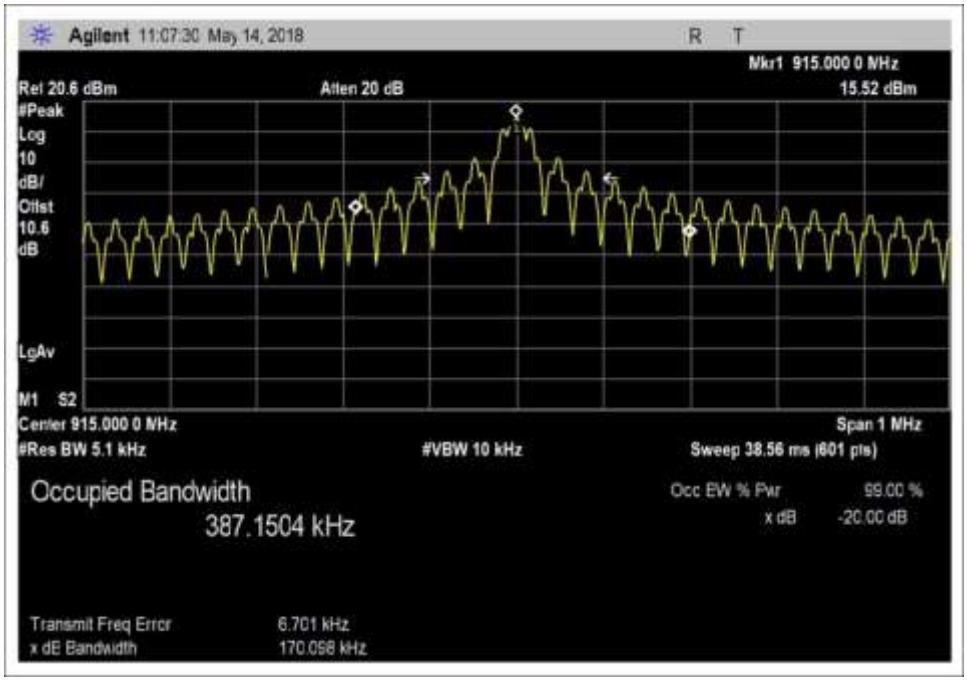


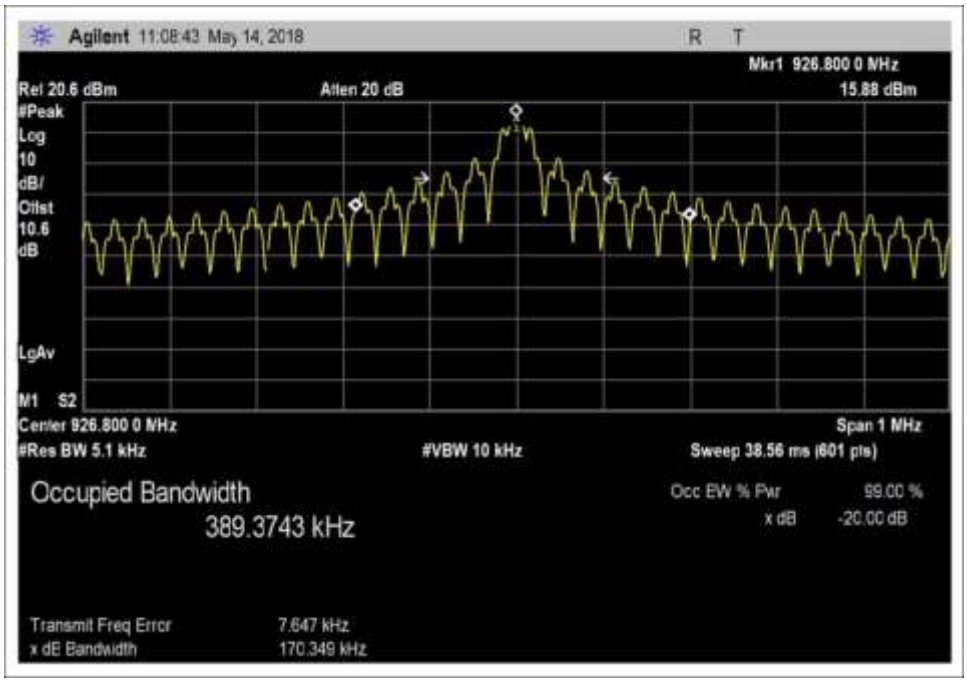
OOK Power level 1, 926MHz



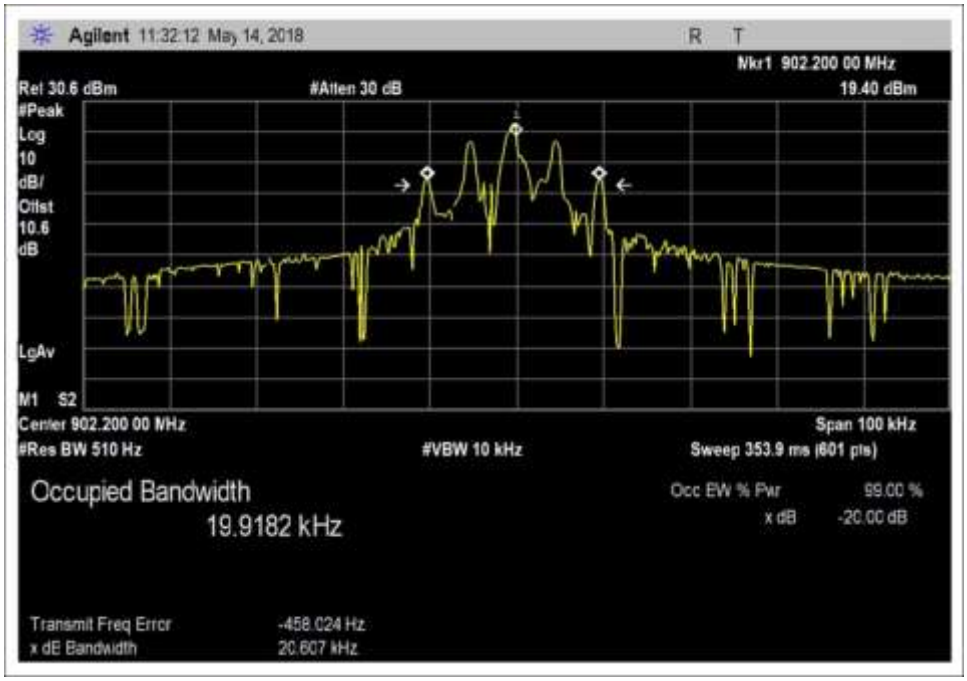
OOK Power level 3, 903MHz



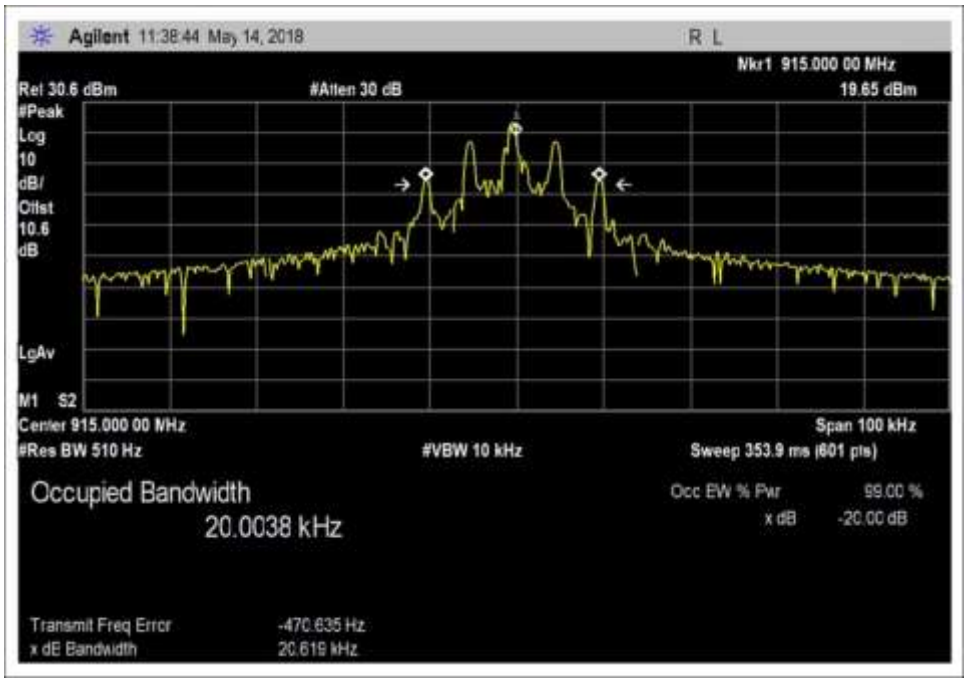
OOK Power level 3, 915MHZ



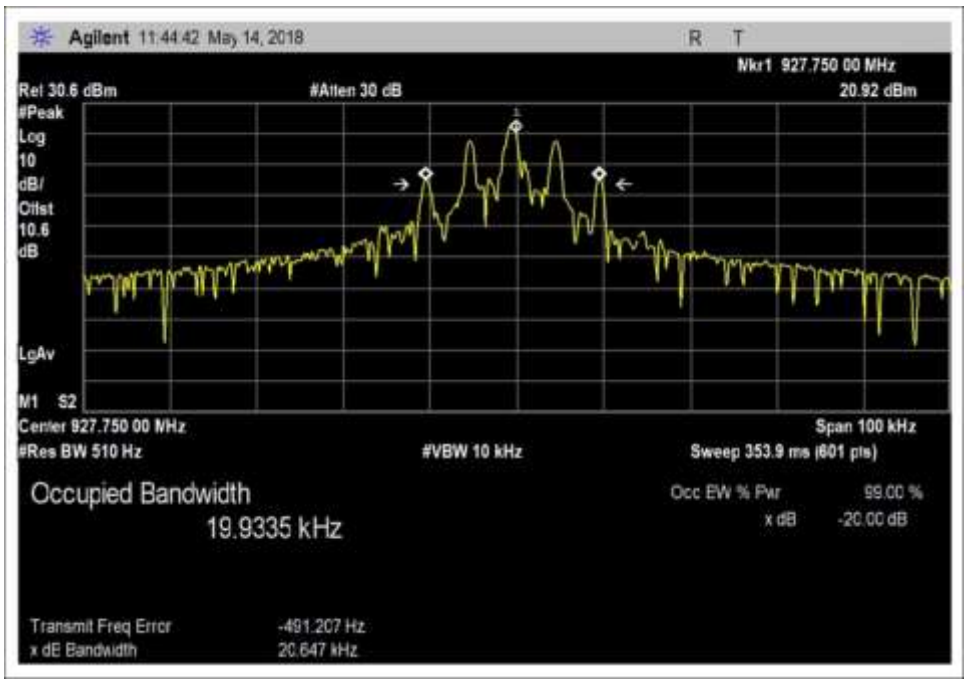
OOK Power level 3, 926MHz



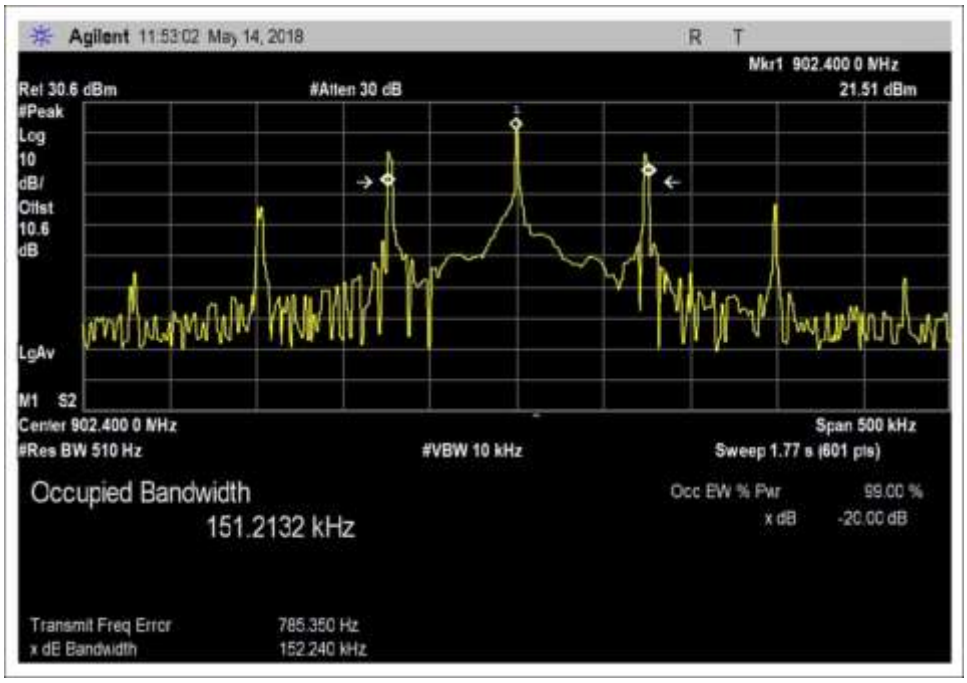
GFSK Power level 3, 10kbps, 902MHz



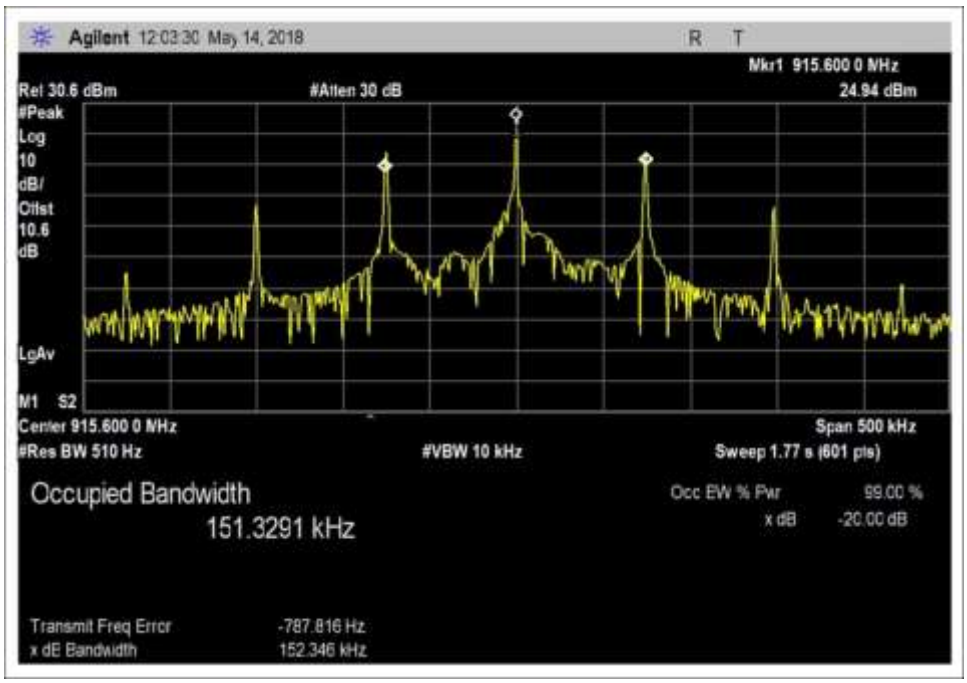
GFSK Power level 3, 10kbps, 915MHz



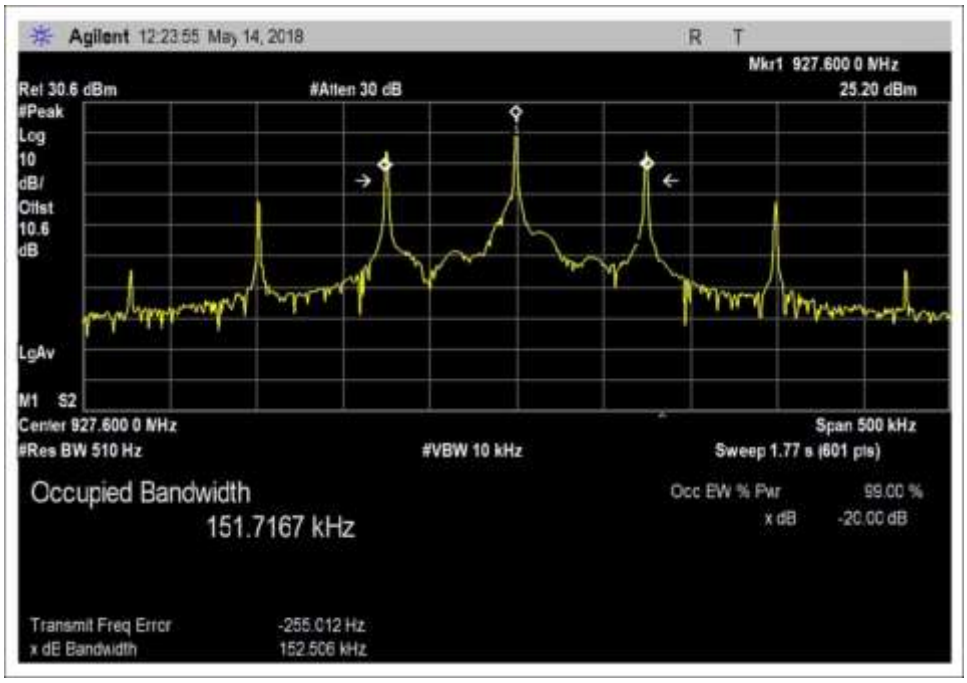
GFSK Power level 3, 10kbps, 927MHz



GFSK Power level 3, 150kbps, 902MHz



GFSK Power level 3, 150kbps, 915MHz

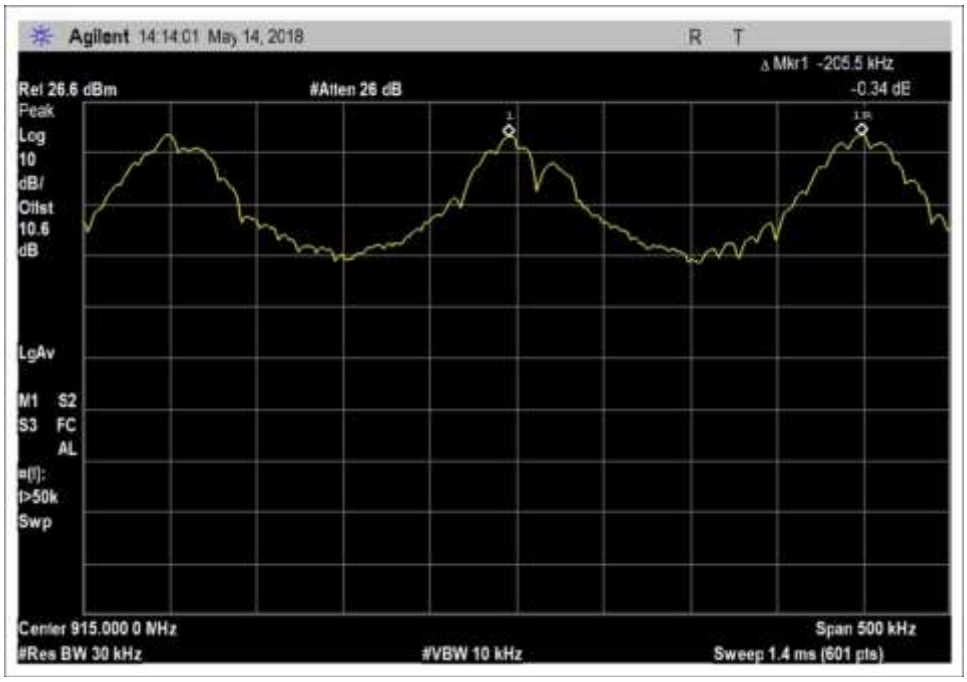


GFSK Power level 3, 150kbps, 927.6MHz

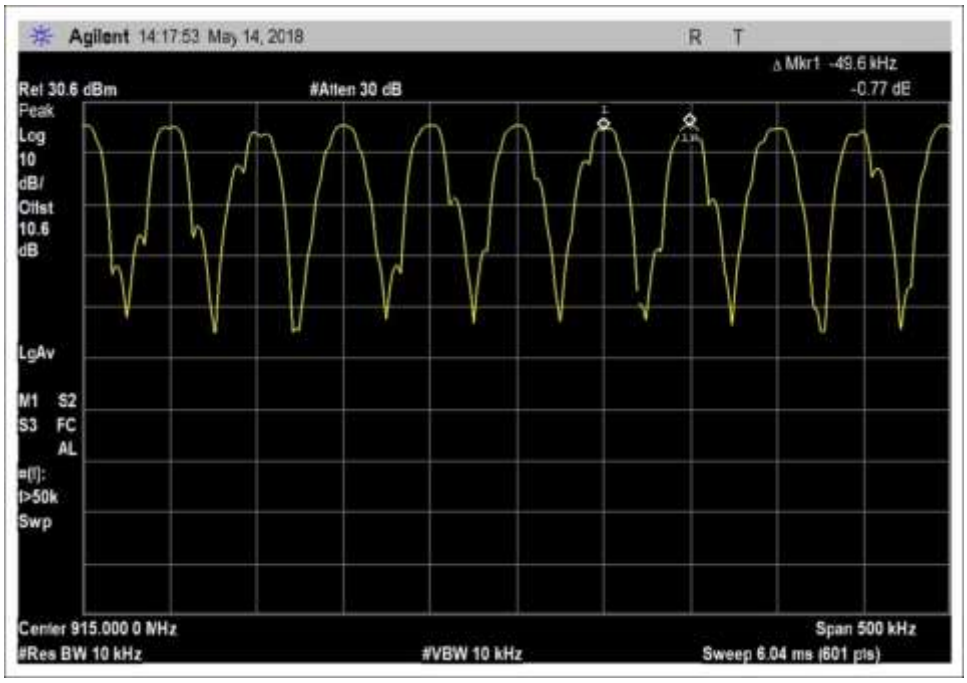
15.247(a)(1) Carrier Separation

Test Data Summary				
Limit applied: minimum 25kHz.				
Antenna Port	**Operational Mode**	**Measured (kHz)**	**Limit (kHz)**	**Results**
1	OOK Power level 3	205	25	Pass
1	GFSK power level 3 10kbps	49.6	25	Pass
1	GFSK power level 3 150kbps	400	25	Pass

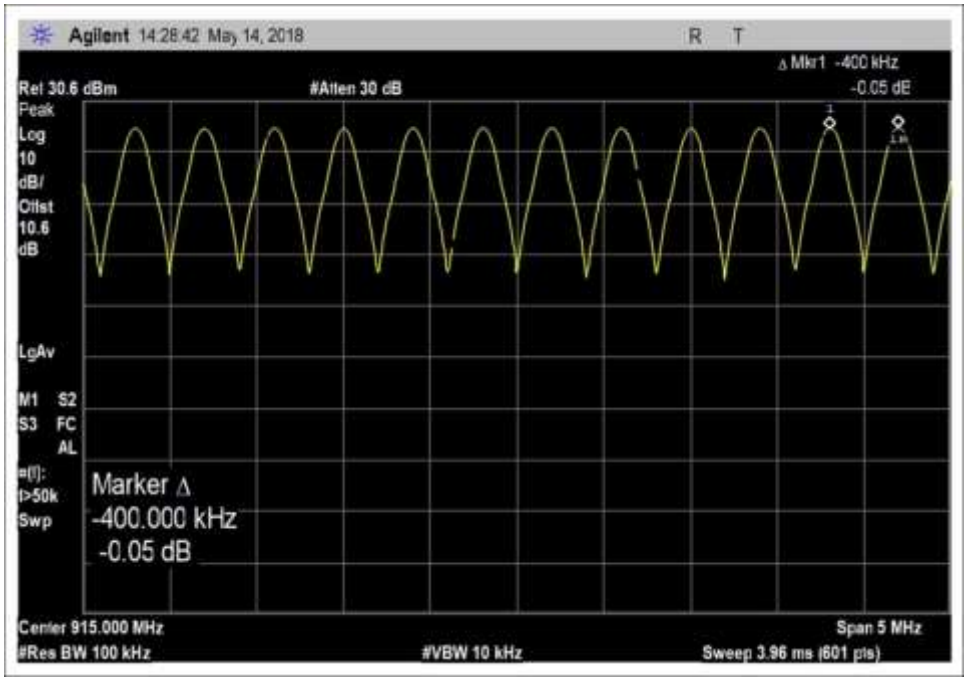
Plots



OOK Hopping



GFSK 10kbps Hopping

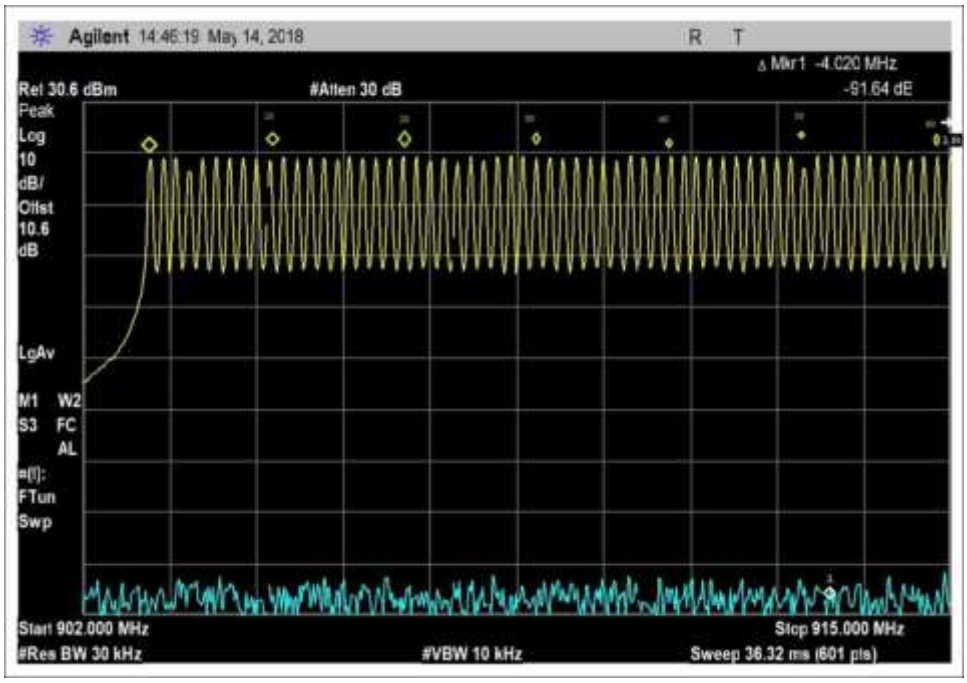


GFSK 150kbps Hopping

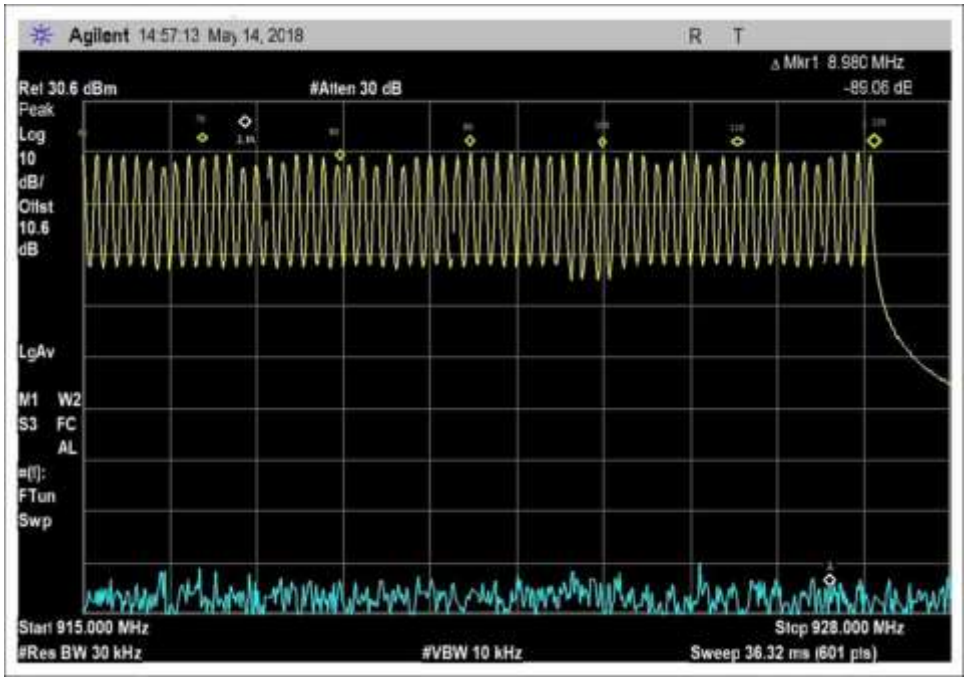
15.247(a)(1)(iii) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50\ Channels \mid 20\ dB\ BW < 250kHz \\ 25\ Channels \mid 20\ dB\ BW \geq 250kHz \end{cases}$				
Antenna Port	**Operational Mode**	**Measured (Channels)**	**Limit (Channels)**	**Results**
1	Hopping OOK	120	≥50	Pass
1	Hopping GFSK 10kbps	512 calculated, 99 measured	≥50	Pass
1	Hopping GFSK 150kbps	64	≥50	Pass

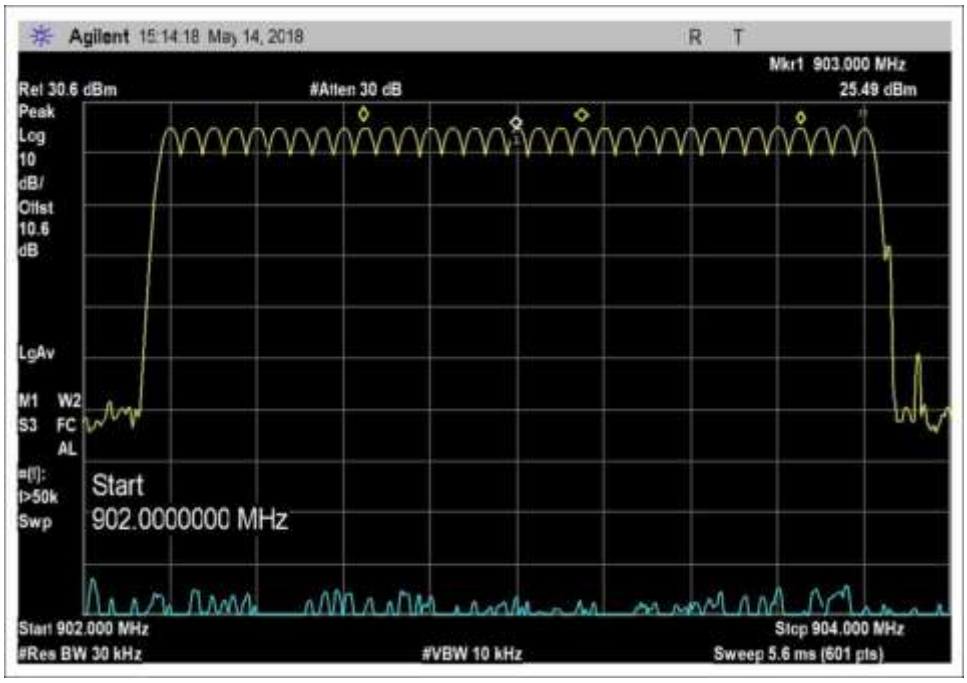
Plots



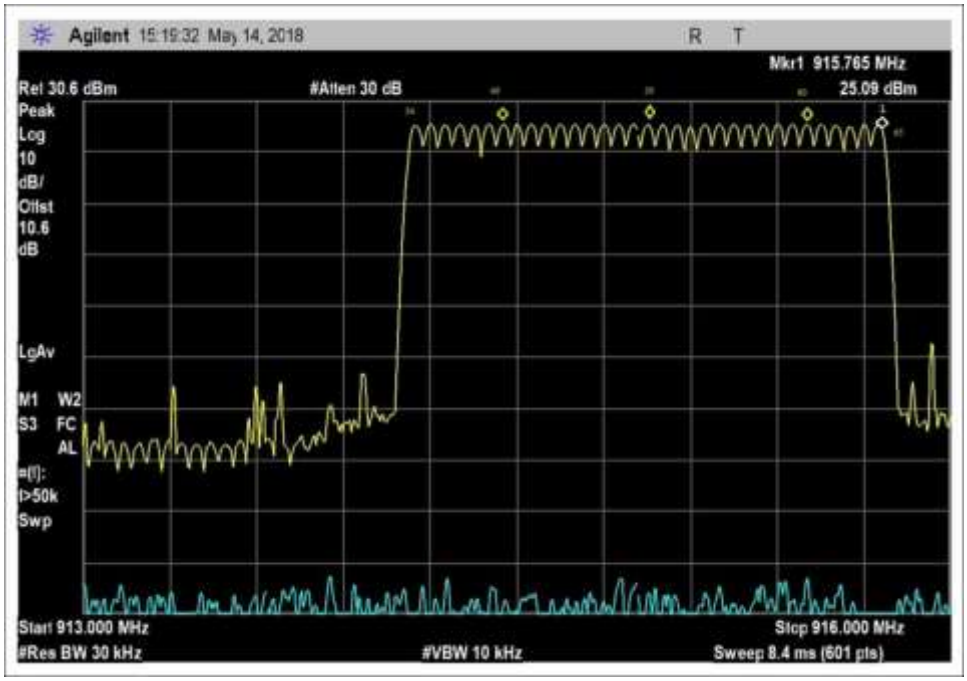
OOK



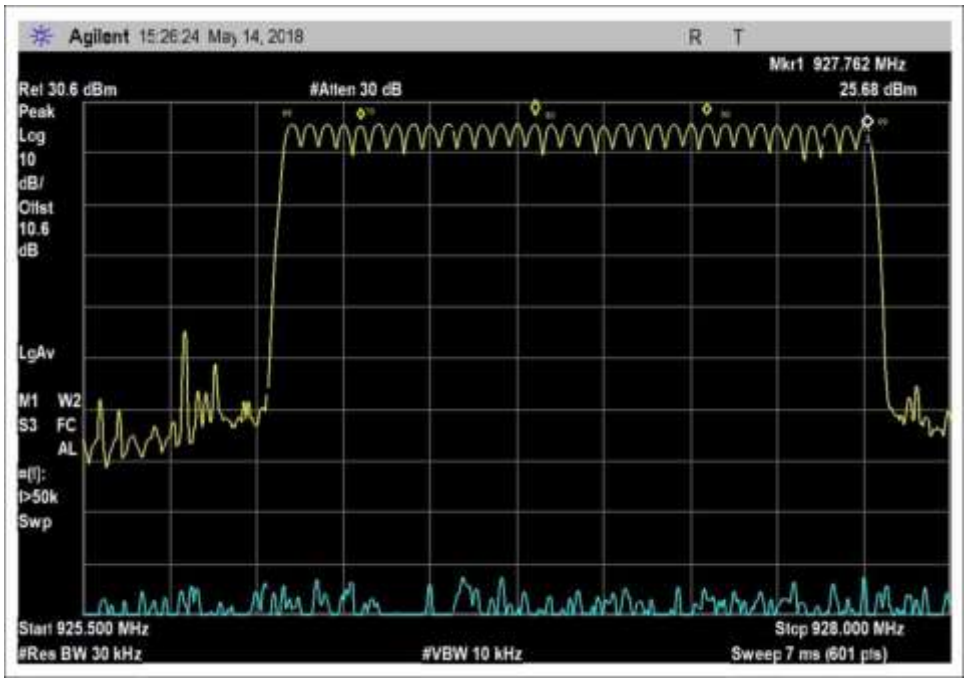
OOK



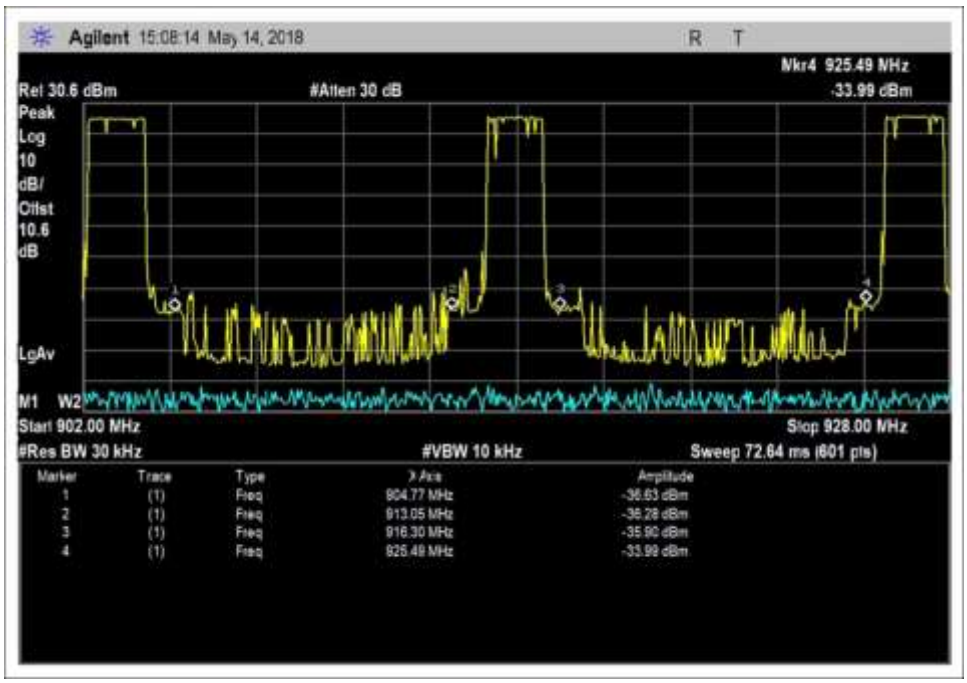
GFSK 10kbps



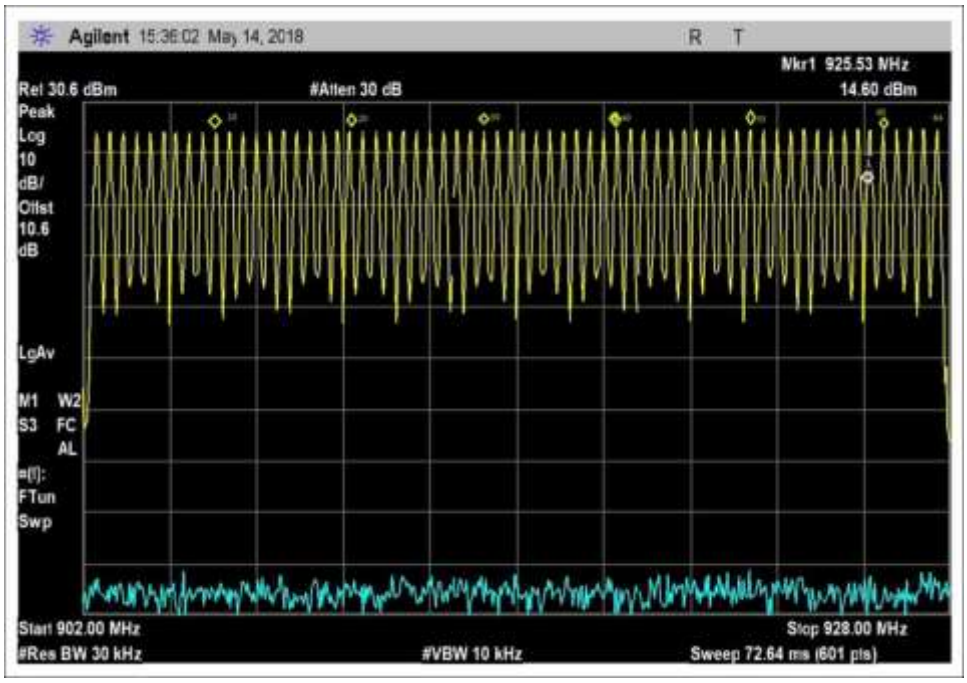
GFSK 10kbps



GFSK 10kbps



GFSK 10kbps, 902-928MHz

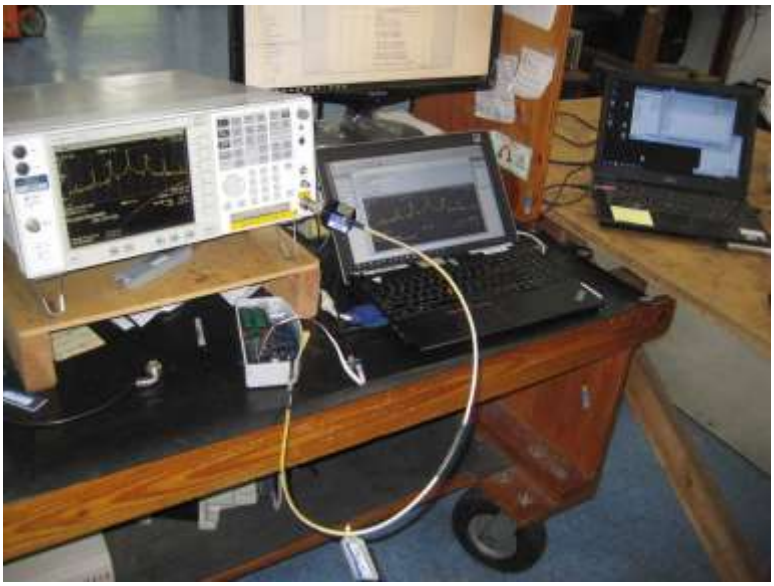


GFSK 150kbps, 902-928MHz

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

See Appendix A for manufacturer declaration of time of occupancy calculations.

Test Setup Photo



15.247(b)(1) Output Power

Test Data Summary - Voltage Variations

This equipment is battery powered and manufacturer declares the equipment cannot operate while charging. Power output tests were performed using a fresh battery.

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
903	OOK Power level 1	Trace 2.3	8.2	≤ 30	Pass
915	OOK Power level 1	Trace 2.3	7.8	≤ 30	Pass
926.8	OOK Power level 1	Trace 2.3	7.7	≤ 30	Pass
903	OOK Power level 3	Trace 2.0	21.0	≤ 30	Pass
915	OOK Power level 3	Trace 2.0	21.5	≤ 30	Pass
926.8	OOK Power level 3	Trace 2.0	21.9	≤ 30	Pass
902.2	GFSK power level 3 10kbps	Trace 2.0	25.7	≤ 30	Pass
915	GFSK power level 3 10kbps	Trace 2.0	25.6	≤ 30	Pass
927.75	GFSK power level 3 10kbps	Trace 2.0	**26.0**	≤ 30	Pass
902.4	GFSK power level 3 150kbps	Trace 2.0	25.3	≤ 30	Pass
915.6	GFSK power level 3 150kbps	Trace 2.0	25.7	≤ 30	Pass
927.6	GFSK power level 3 150kbps	Trace 2.0	25.9	≤ 30	Pass

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92821 • 714 993 6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(b) Power Output (902-928 MHz DTS)**		
Work Order #:	**101080**	Date:	5/15/2018
Test Type:	**Conducted Emissions**	Time:	12:02:10
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		120/60Hz

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 the test bench. RF characteristic is evaluated at the temporarily antenna port.
A support laptop configures the EUT in test mode. Transmit Freq pulse at 6.8% duty cycle, 56.33ms pulse

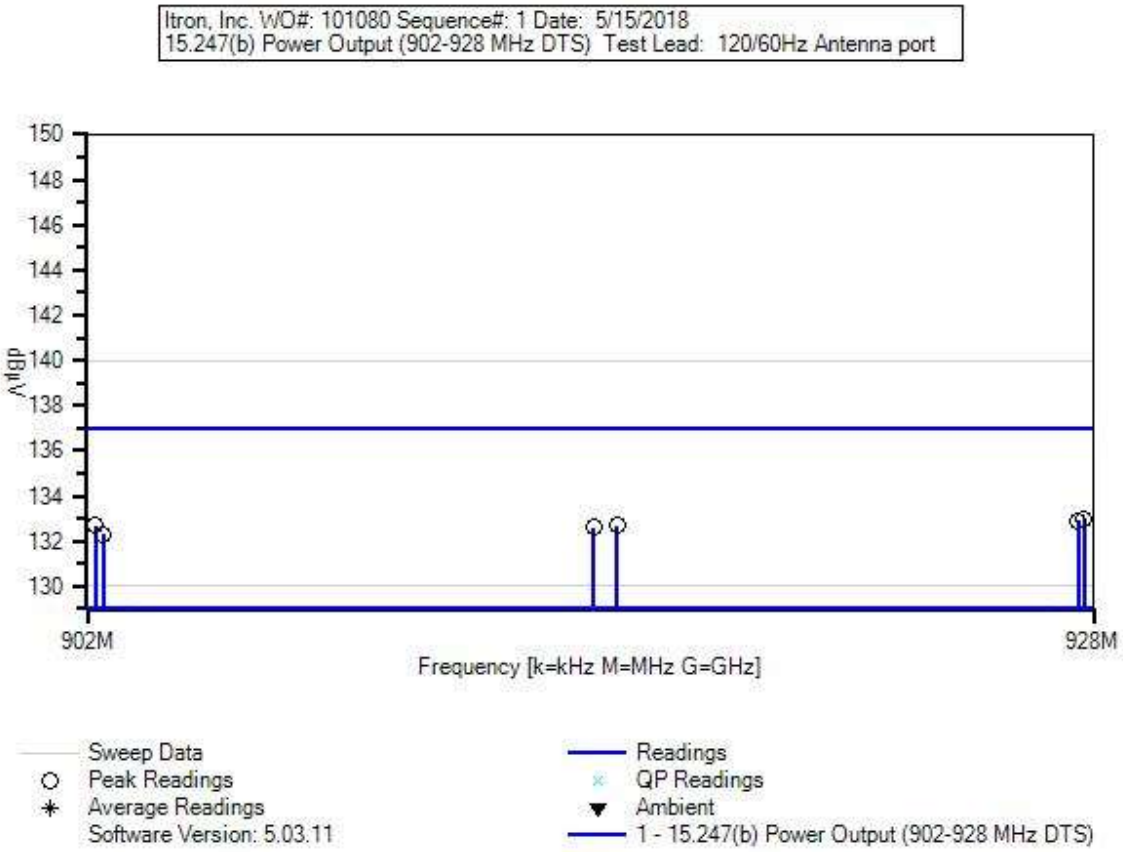
Frequency: 902-928MHz

OOK Power level 1, Tx frequency: 903-926.8MHz
OOK Power level 3, Tx frequency: 903-926.8MHz
GFSK 10kbps Power level 3 Tx frequency; 902.2 - 927.75MHz
GFSK 150kbps Power level 3 Tx Frequency: 902.4-927.6MHz

Frequency range of measurement = Fundamental
BRW=VBW=1MHz

Test environment conditions:
Temperature: 20°C
Relative Humidity: 50%
Pressure: 100kPa

Site A
ANSI C63.10-2013


Itron, Inc. WO#: 101080 Sequence#: 1 Date: 5/15/2018
15.247(b) Power Output (902-928 MHz DTS) Test Lead: 120/60Hz Antenna port
150
148
146
144
142
140
138
136
134
132
130
dBµV
902M
928M
Frequency [k=kHz M=MHz G=GHz]
Sweep Data
Peak Readings
Average Readings
Software Version: 5.03.11
Readings
QP Readings
Ambient
1 - 15.247(b) Power Output (902-928 MHz DTS)

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	ANP06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
T3	AN03430	Attenuator	75A-10-12	12/19/2017	12/19/2019

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

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	927.750M	122.4	+0.0	+0.5	+10.1		+0.0	133.0	137.0	-4.0	Anten
									GFSK Power Level 3 10kpbs		
2	927.600M	122.3	+0.0	+0.5	+10.1		+0.0	132.9	137.0	-4.1	Anten
									GFSK Power Level 3 150 kbps		
3	915.600M	122.1	+0.0	+0.5	+10.1		+0.0	132.7	137.0	-4.3	Anten
									GFSK Power Level 3 150 kbps		
4	902.200M	122.1	+0.0	+0.5	+10.1		+0.0	132.7	137.0	-4.3	Anten
									GFSK Power Level 3 10kpbs		
5	915.000M	122.0	+0.0	+0.5	+10.1		+0.0	132.6	137.0	-4.4	Anten
									GFSK Power Level 3 10kpbs		
6	902.400M	121.7	+0.0	+0.5	+10.1		+0.0	132.3	137.0	-4.7	Anten
									GFSK Power Level 3 150 kbps		
7	926.800M	118.3	+0.0	+0.5	+10.1		+0.0	128.9	137.0	-8.1	Anten
									OOK Power Level 3		
8	915.000M	117.9	+0.0	+0.5	+10.1		+0.0	128.5	137.0	-8.5	Anten
									OOK Power Level 3		
9	903.000M	117.4	+0.0	+0.5	+10.1		+0.0	128.0	137.0	-9.0	Anten
									OOK Power Level 3		
10	903.000M	104.6	+0.0	+0.5	+10.1		+0.0	115.2	137.0	-21.8	Anten
									OOK Power level 1		
11	915.000M	104.2	+0.0	+0.5	+10.1		+0.0	114.8	137.0	-22.2	Anten
									OOK Power level 1		
12	926.800M	104.1	+0.0	+0.5	+10.1		+0.0	114.7	137.0	-22.3	Anten
									OOK Power level 1		

Test Data Summary - Radiated 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)**	**Field Strength (dBuV/m @3m)**	**Measured connected power (dBm)**	**Limit (dBm)**	**Results**
903	OOK power level 3	Trace **2.0***	118.2	21.0	≤ 30	Pass

Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30\ G}$$

Or equivalently, in logarithmic form:

$$P(dBm) = E(dBuV/m) + 20LOG(d) - G\ - 104.77$$

* Note: This calculation performed to back calculate antenna gain which was not provided at the time of testing, from measured radiated field strength and conducted power.

Antenna gain calculated with **minimum** conducted Power

21.0 = 118.2 + 20 log (3) -G – 104.77
G = 118.2 + 9.5 – 104.77 – 21
G = 2

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 #:	**101080**	Date:	5/15/2018
Test Type:	**Maximized Emissions**	Time:	14:45:22
Tested By:	Don Nguyen	Sequence#:	2
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 turn table. The EUT is powered from fresh battery and programmed to transmit continuously.
Operation mode: OOK Power Level 3

Operating frequency: 903-926.8MHz

Frequency of measurement: 902-928MHz
RBW=120kHz, VBW=360kHz

Site A
Test Method: ANSI C63.10 (2013)
Temperature: 21.3°C
Relative Humidity: 48.3%rh

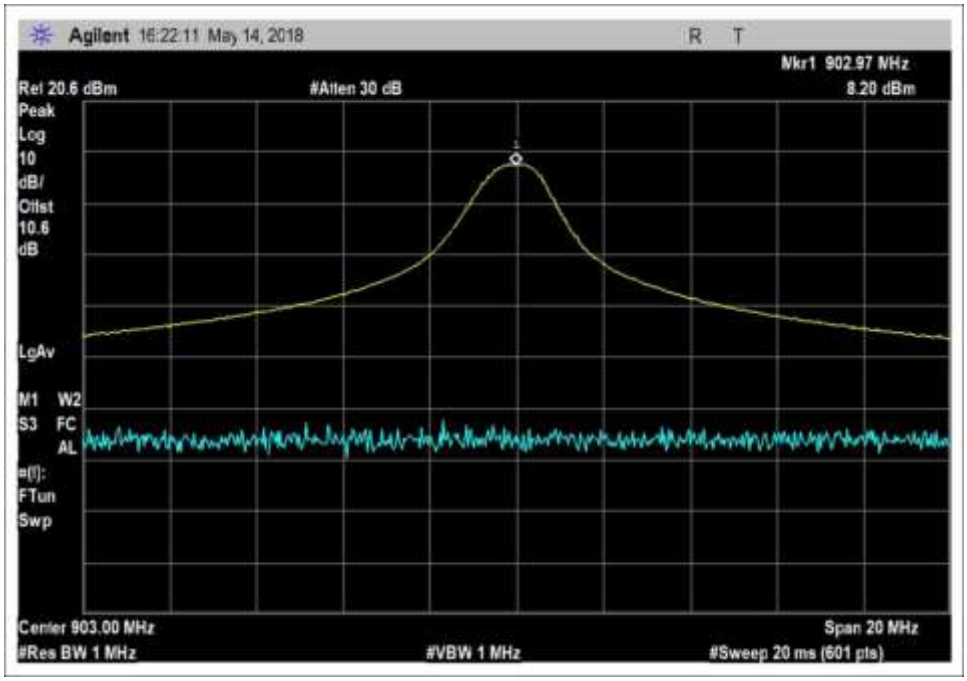
Test Equipment:

ID	Asset #/Serial #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T2	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T3	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T4	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T5	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T6	AN00309	Preamp	8447D	2/19/2018	2/19/2020

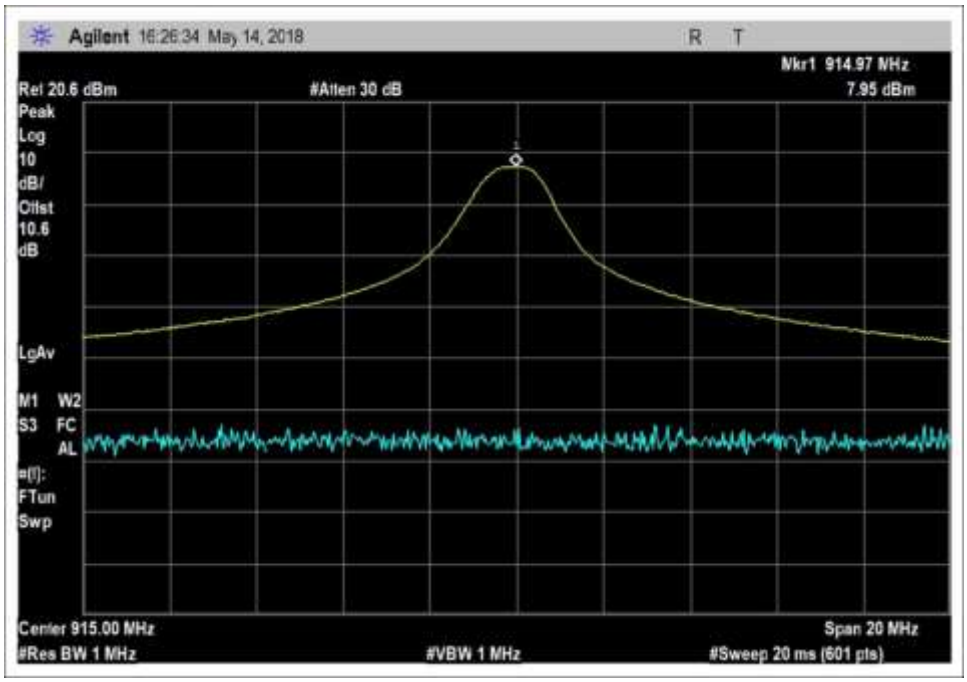
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	903.000M	110.1	+5.9 +6.1	+0.5 -27.2	+0.0	+22.8	+0.0	118.2	125.2	-7.0	Horiz

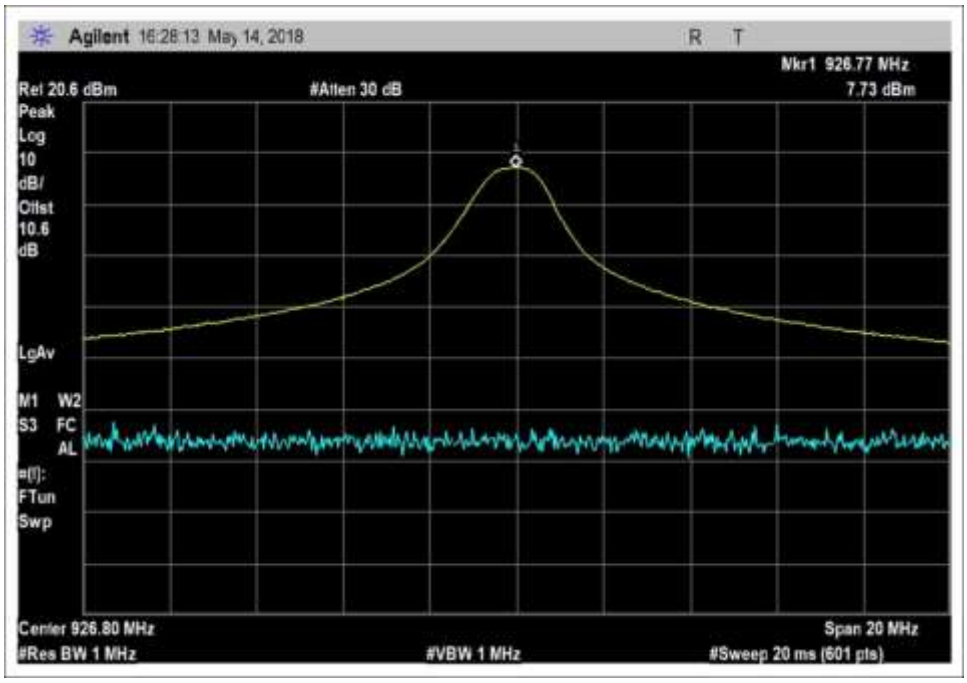
Plots



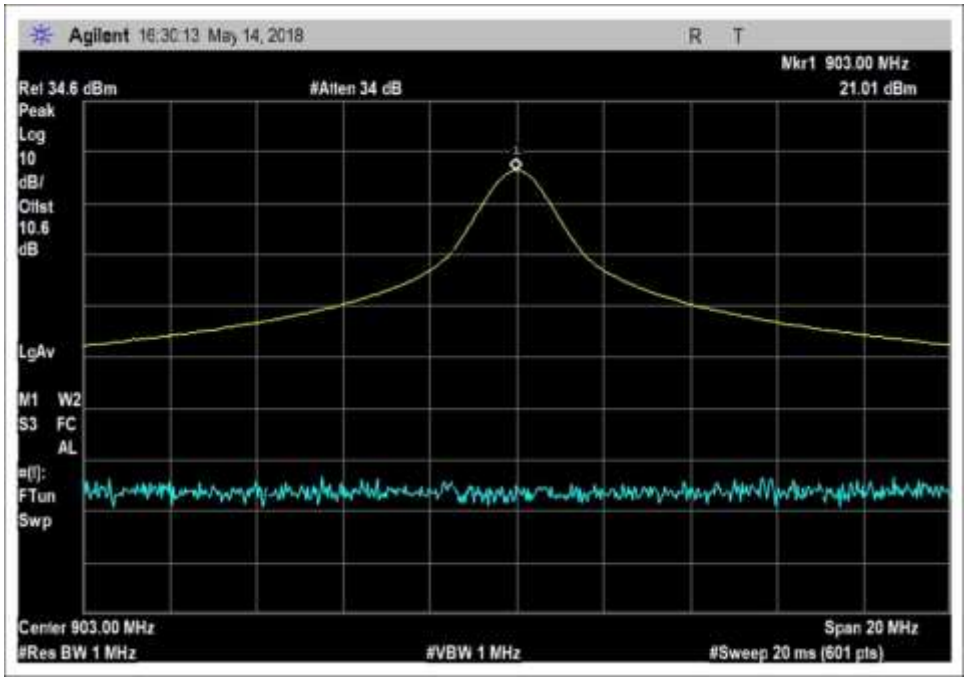
OOK Power level 1, 903MHz



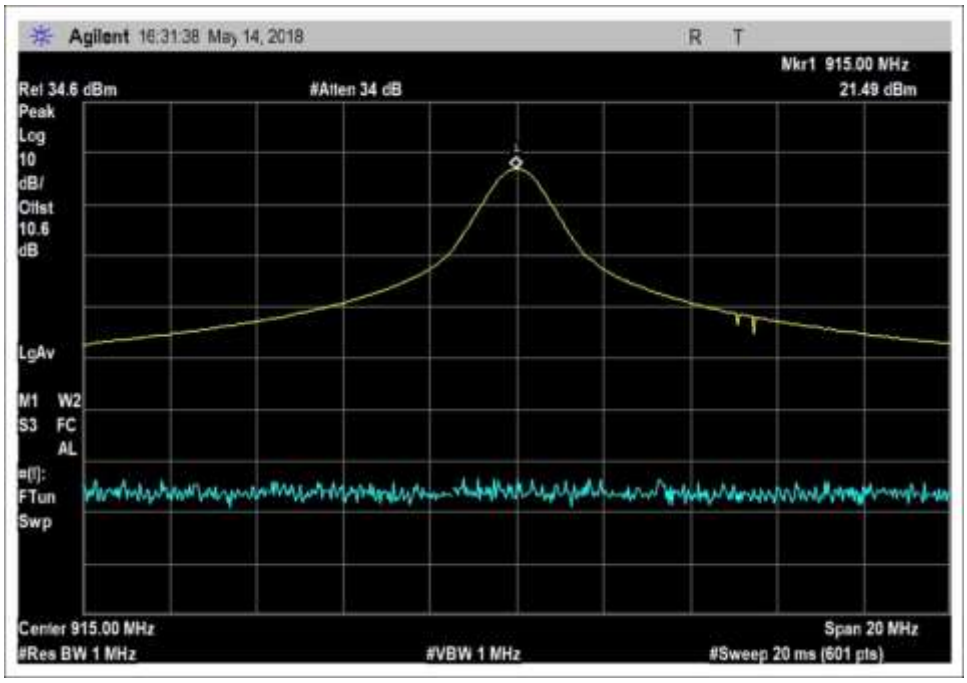
OOK Power level 1, 915MHz



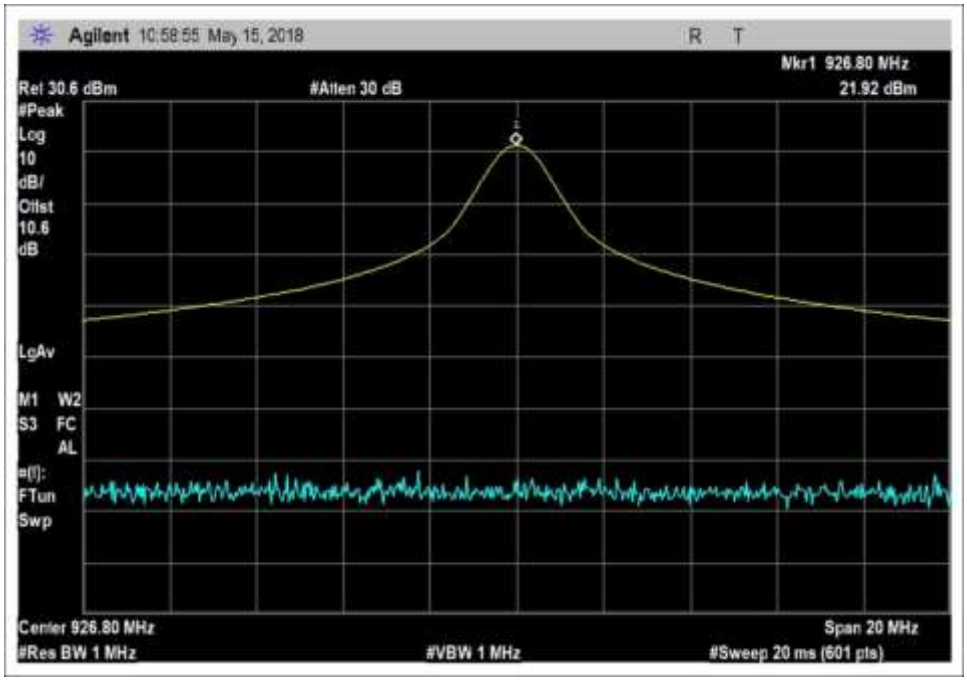
OOK Power level 1, 926MHz



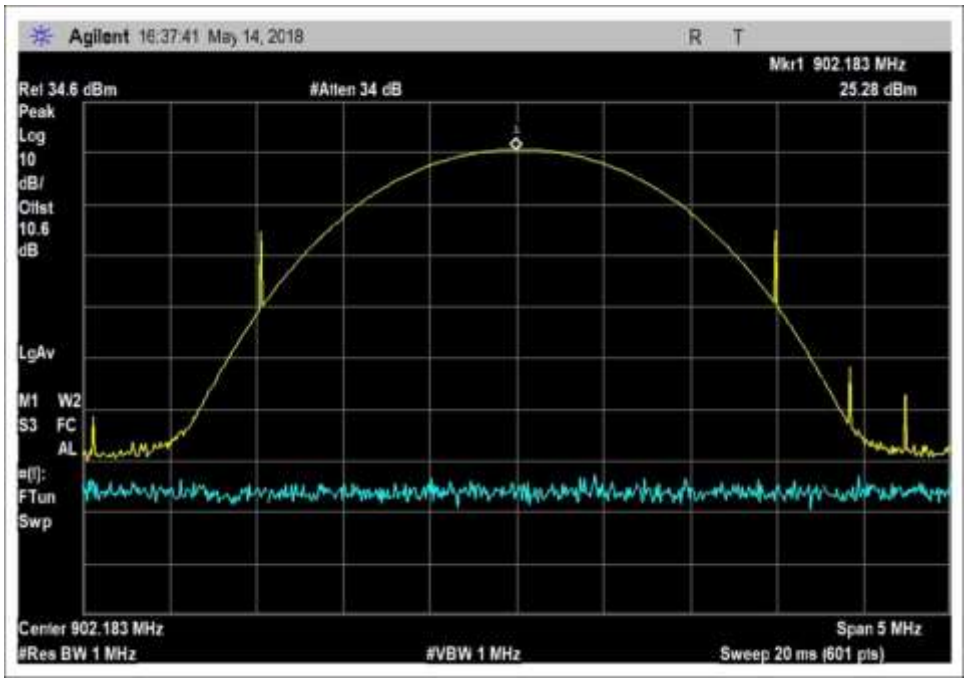
OOK Power level 3, 903MHz



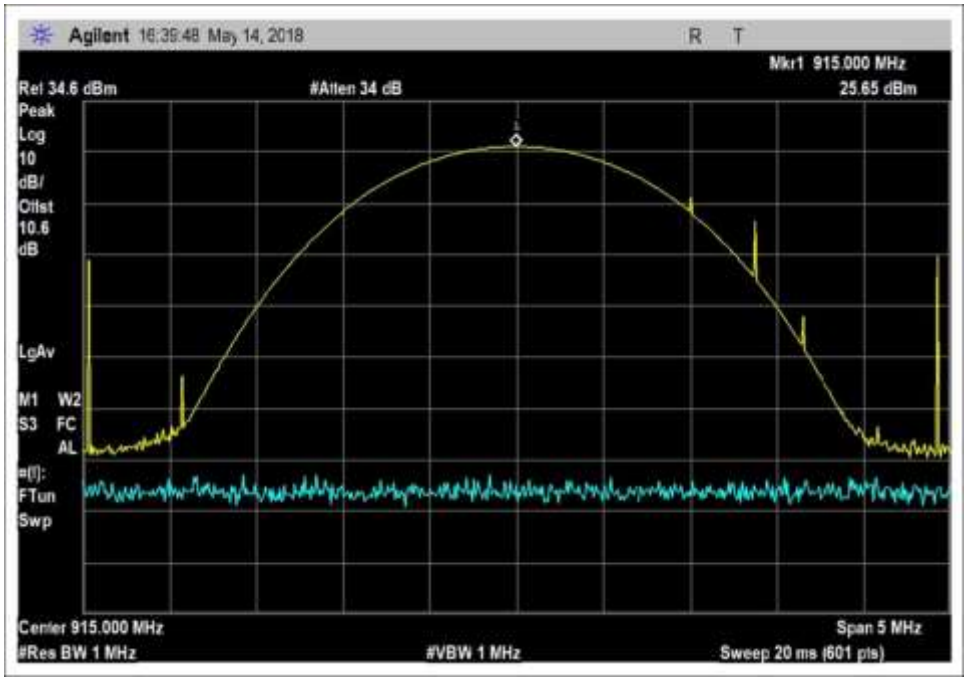
OOK Power level 3, 915MHz



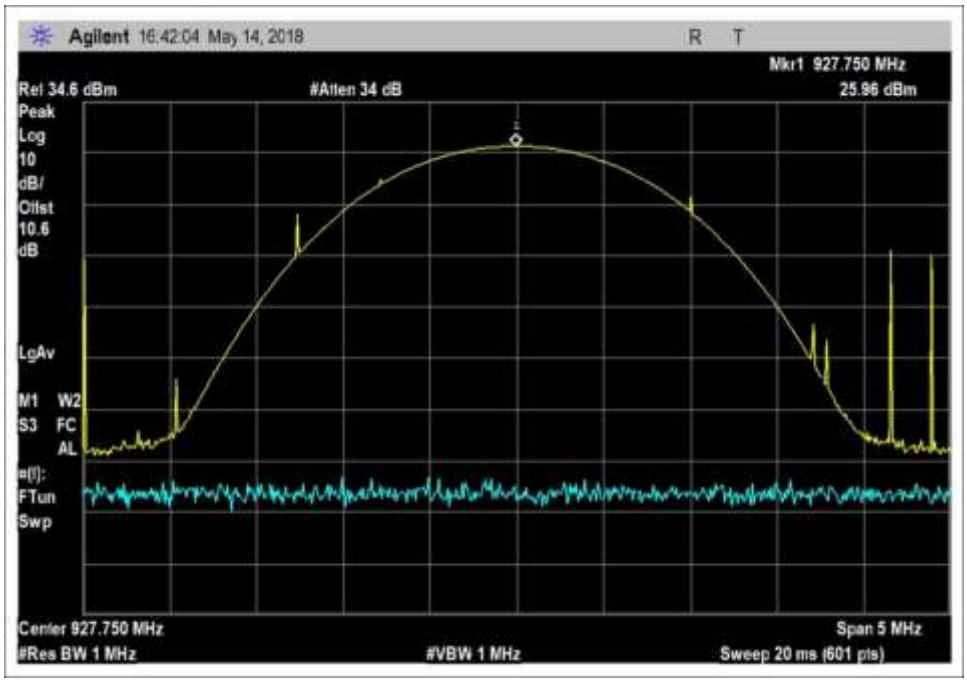
OOK Power level, 926MHz



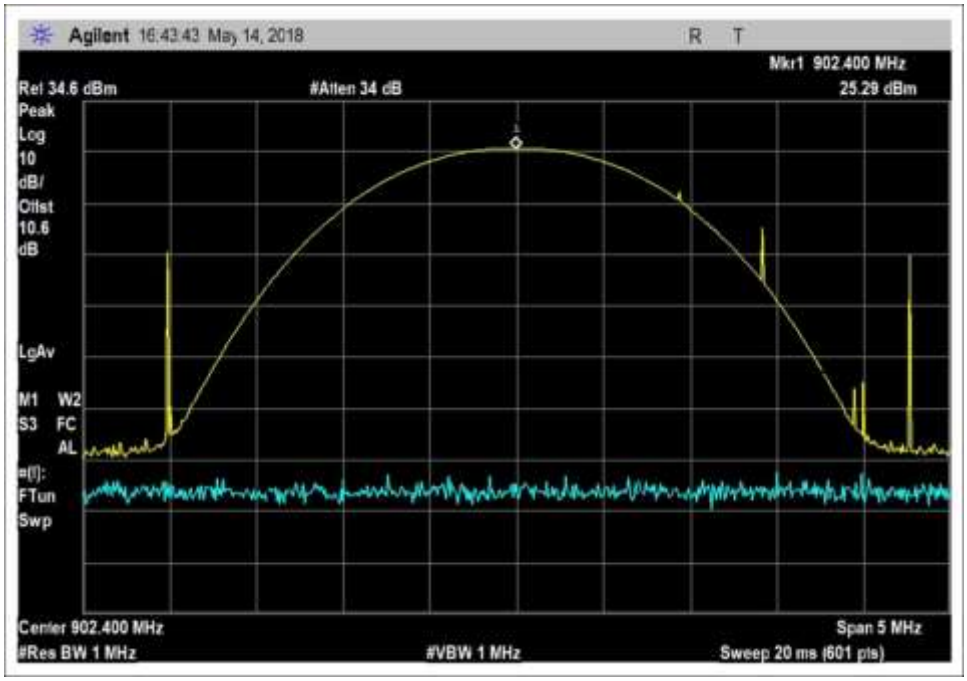
GFSK Power level 3, 10kbps, 902MHz



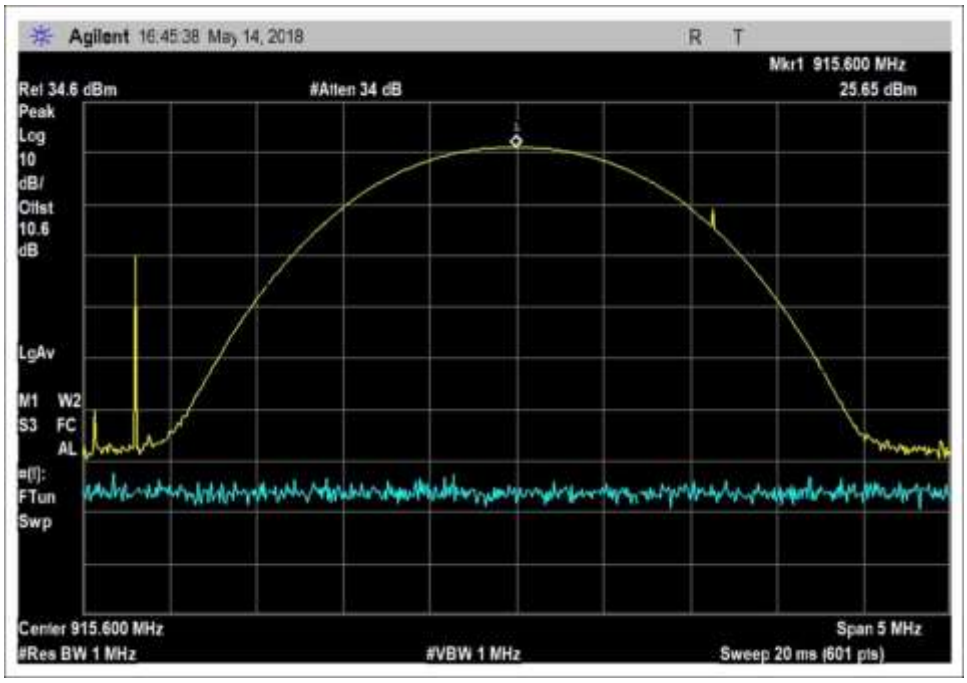
GFSK Power level 3, 10kbps, 915MHz



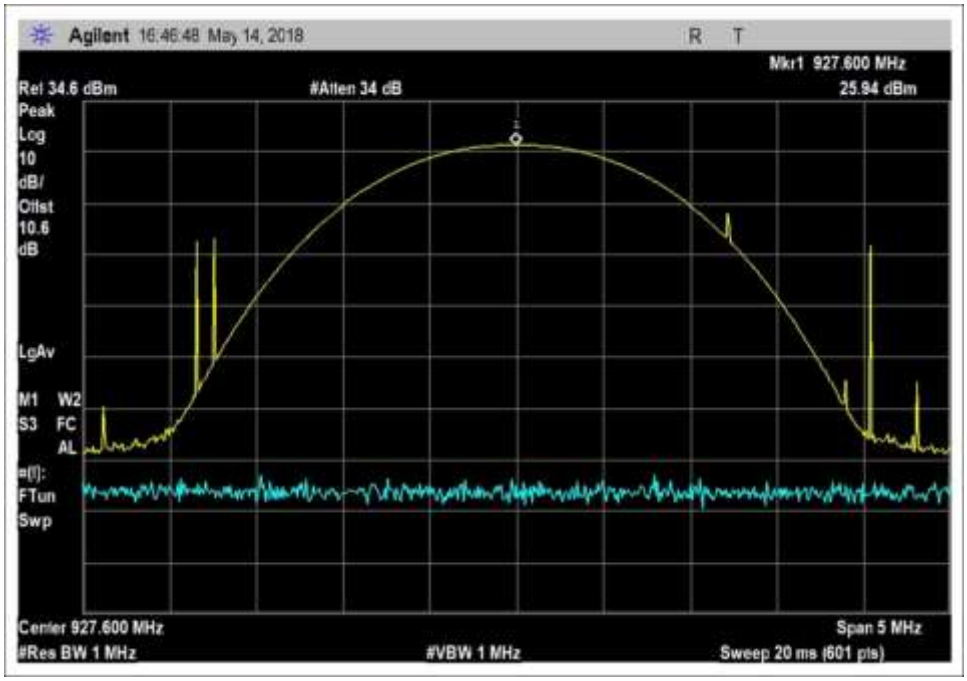
GFSK Power level 3, 10kbps, 927MHz



GFSK Power level 3, 150kbps, 902MHz

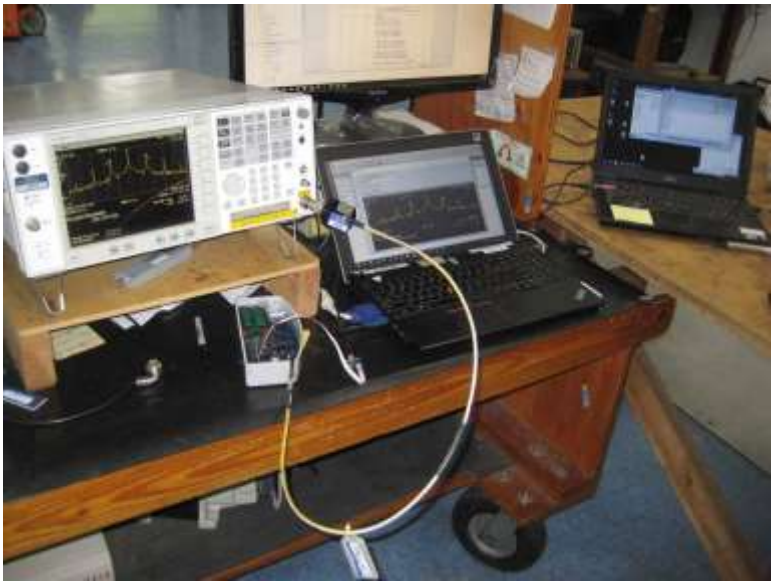


GFSK Power level 3, 150kbps, 915MHz



GFSK Power level 3, 150kbps, 927MHz

Test Setup Photos



Test Setup

Below 1GHz

Below 1GHz

15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 110 N. Olinda Place • Brea, CA 92821 • 714 993 6112		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**101080**	Date:	5/15/2018
Test Type:	**Conducted Emissions**	Time:	12:02:10
Tested By:	E. Wong	Sequence#:	1
Software:	EMITest 5.03.11		120/60Hz

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 the test bench. RF characteristic is evaluated at the temporarily antenna port.
A support laptop configures the EUT in test mode. Transmit Freq pulse at 6.8% duty cycle, 56.33ms pulse

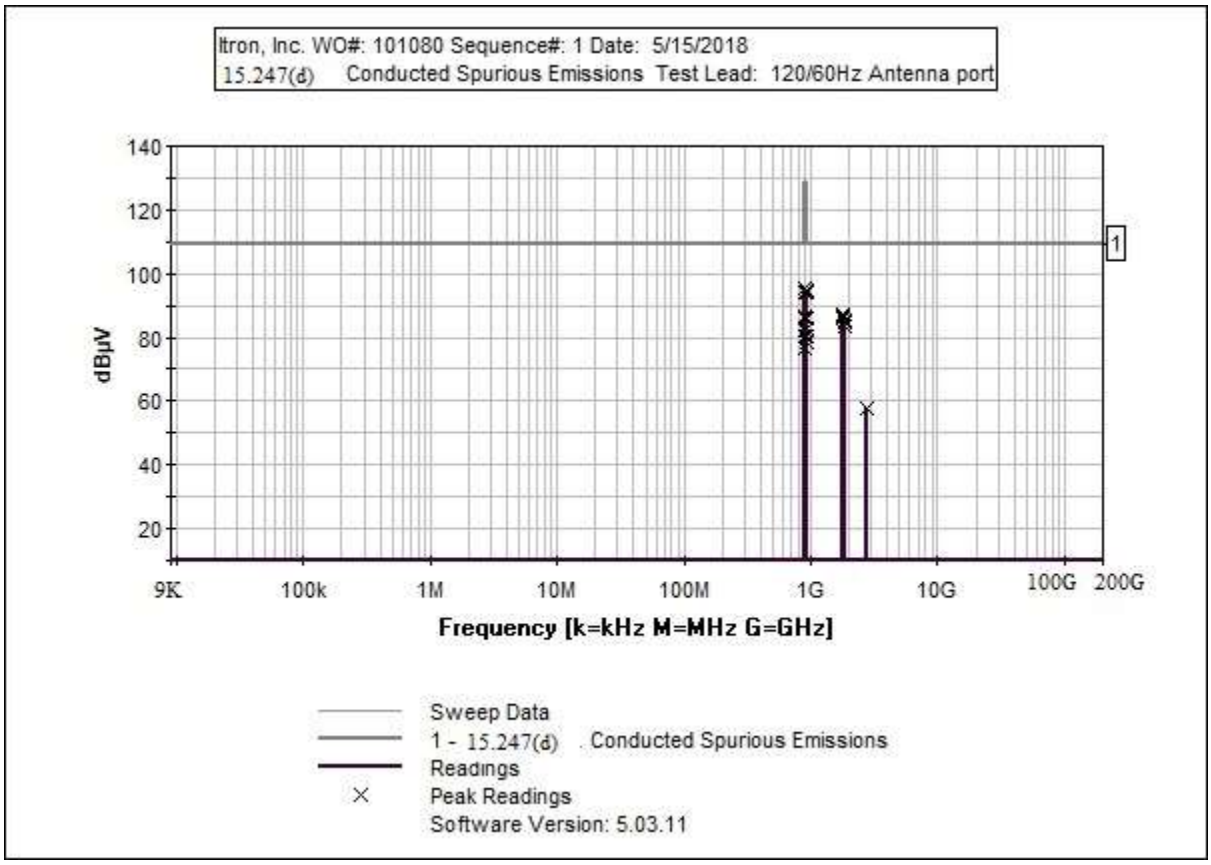
Frequency: 902-928MHz

OOK Power level 1, Tx frequency: 903-926.8MHz
OOK Power level 3, Tx frequency: 903-926.8MHz
GFSK 10kbps Power level 3 Tx frequency; 902.2 - 927.75MHz
GFSK 150kbps Power level 3 Tx Frequency: 902.4-927.6MHz

Frequency range of measurement = 9 kHz- 10 GHz.
9 kH -150 kHz;RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz;RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz;RBW=120 kHz,VBW=120 kHz,
1000 MHz-10000 MHz;RBW=1 MHz,VBW=1 MHz.

Test environment conditions:
Temperature: 20°C
Relative Humidity: 50%
Pressure: 100kPa

Site A
ANSI C63.10-2013


Itron, Inc. WO#: 101080 Sequence#: 1 Date: 5/15/2018
15.247(d) Conducted Spurious Emissions Test Lead: 120/60Hz Antenna port
140
120
100
80
60
40
20
dBµV
1
9K
100k
1M
10M
100M
1G
10G
100G
200G
Frequency [k=kHz M=MHz G=GHz]
Sweep Data
1 - 15.247(d) . Conducted Spurious Emissions
Readings
Peak Readings
Software Version: 5.03.11

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	ANP06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
T3	AN03430	Attenuator	75A-10-12	12/19/2017	12/19/2019

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

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	902.000M	76.1	+0.0	+0.5	+10.1		+0.0	86.7	95.2 Bandedge_OOK_level1_L	-8.5	Anten
2	902.000M	84.9	+0.0	+0.5	+10.1		+0.0	95.5	109.0 Bandedge_OOK_Level3_L	-13.5	Anten
3	928.000M	84.3	+0.0	+0.5	+10.1		+0.0	94.9	109.0 Bandedge_OOK_Level3_H	-14.1	Anten
4	902.000M	83.8	+0.0	+0.5	+10.1		+0.0	94.4	109.0 bandedge_OOK_level3_L_Hopping	-14.6	Anten
5	928.000M	70.0	+0.0	+0.5	+10.1		+0.0	80.6	95.2 Bandedge_OOK_level1_H	-14.6	Anten
6	928.000M	83.4	+0.0	+0.5	+10.1		+0.0	94.0	109.0 bandedge_OOK_level3_H_Hopping	-15.0	Anten
7	1806.000M	75.0	+0.0	+0.7	+10.2		+0.0	85.9	109.0 OOK_Level3	-23.1	Anten
8	1830.000M	73.8	+0.0	+0.7	+10.1		+0.0	84.6	109.0 OOK_Level3	-24.4	Anten
9	1853.600M	72.7	+0.0	+0.7	+10.1		+0.0	83.5	109.0 OOK_Level3	-25.5	Anten
10	1804.400M	76.4	+0.0	+0.7	+10.2		+0.0	87.3	113.0 GFSK-10K_Level3	-25.7	Anten
11	1804.750M	75.7	+0.0	+0.7	+10.2		+0.0	86.6	113.0 GFSK-150K_Level3	-26.4	Anten
12	902.000M	75.6	+0.0	+0.5	+10.1		+0.0	86.2	113.0 Bandedge_GFSK-10K_Level3_L	-26.8	Anten
13	928.000M	75.2	+0.0	+0.5	+10.1		+0.0	85.8	113.0 Bandedge_GFSK-10K_Level3_H	-27.2	Anten
14	1830.000M	74.7	+0.0	+0.7	+10.1		+0.0	85.5	113.0 GFSK-10K_Level3	-27.5	Anten
15	1831.167M	73.9	+0.0	+0.7	+10.1		+0.0	84.7	113.0 GFSK_150K_Level3	-28.3	Anten
16	1855.500M	73.7	+0.0	+0.7	+10.1		+0.0	84.5	113.0 GFSK-10K_Level3	-28.5	Anten

17	1855.167M	72.9	+0.0	+0.7	+10.1	+0.0	83.7	113.0	-29.3	Anten GFSK-150K_Level3
18	928.000M	72.1	+0.0	+0.5	+10.1	+0.0	82.7	113.0	-30.3	Anten bandedge_GFSK_10K Level3_H_Hop
19	902.000M	71.7	+0.0	+0.5	+10.1	+0.0	82.3	113.0	-30.7	Anten bandedge_GFSK_10K_Level3_L_Hop
20	928.000M	69.9	+0.0	+0.5	+10.1	+0.0	80.5	113.0	-32.5	Anten Bandedge_GFSK_150K_Level3_H
21	902.000M	69.5	+0.0	+0.5	+10.1	+0.0	80.1	113.0	-32.9	Anten Bandedge_GFSK-150K_Level3_L
22	928.000M	67.9	+0.0	+0.5	+10.1	+0.0	78.5	113.0	-34.5	Anten bandedge_GFSK_150k_Level3_H_Hop
23	902.000M	65.7	+0.0	+0.5	+10.1	+0.0	76.3	113.0	-36.7	Anten bandedge_GFSK_150K_Level3_L_Hop
24	2745.017M	46.7	+0.0	+0.9	+10.0	+0.0	57.6	113.0	-55.4	Anten GFSK-10K_Level3

Band Edge

Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB.				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902	OOK Power level 1	-20.3	< -11.8	Pass
928	OOK Power level 1	-26.4	< -11.8	Pass
902	OOK Power level 3	-11.5	< 2	Pass
928	OOK Power level 3	-12.1	< 2	Pass
902	GFSK power level 3 10kbps	-20.8	< 6	Pass
928	GFSK power level 3 10kbps	-21.2	< 6	Pass
902	GFSK power level 3 150kbps	-26.9	< 6	Pass
928	GFSK power level 3 150kbps	-26.5	< 6	Pass

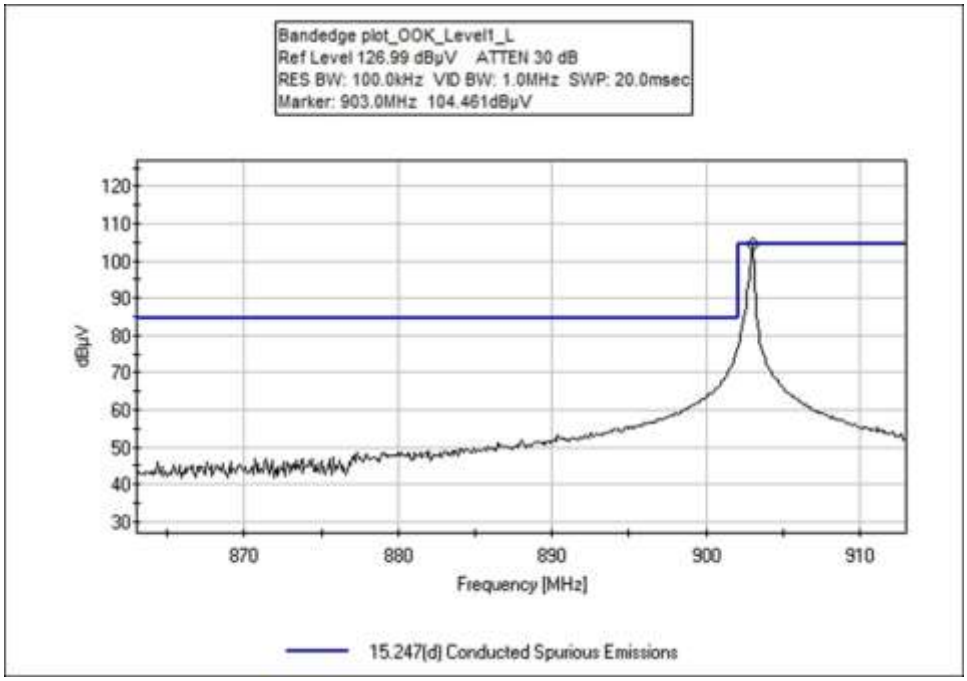
Hopping

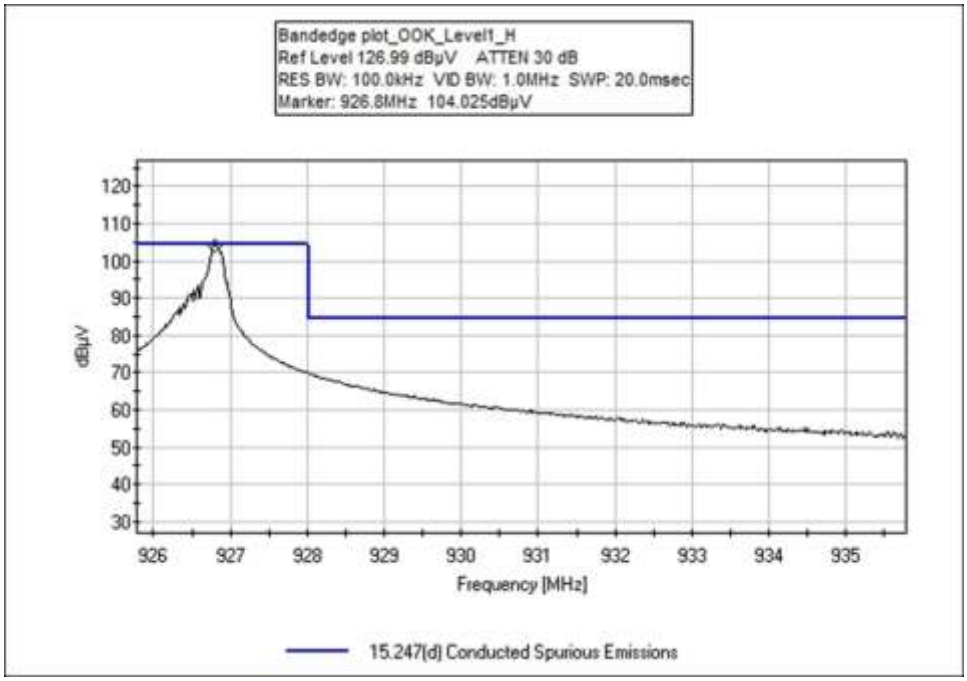
Frequency (MHz)	Modulation	Measured (dBm)	Limit (dBm)	Results
902	OOK Power level 3*	-12.6	< 2	Pass
928	OOK Power level 3*	-13.0	< 2	Pass

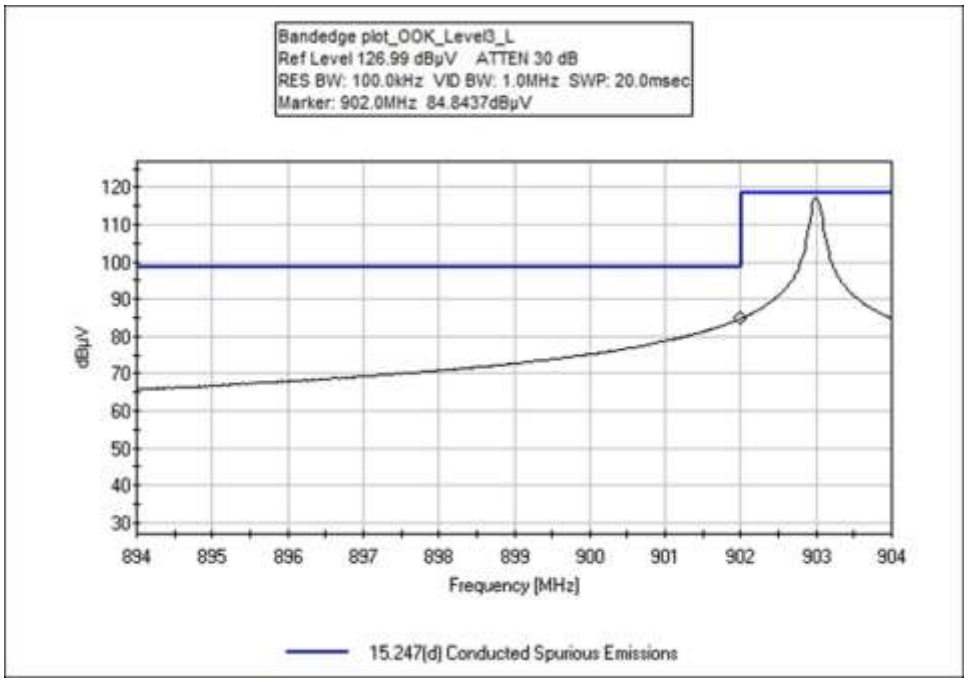
* Worst case of the OOK

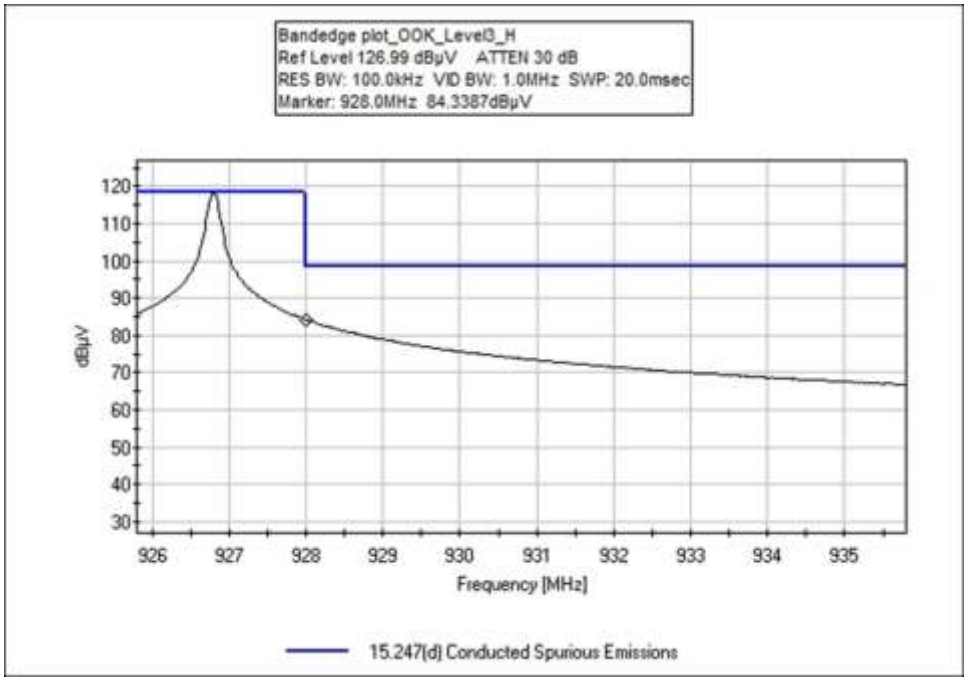
902	GFSK power level 3 10kbps	-24.3	< 6	Pass
928	GFSK power level 3 10kbps	-28.5	< 6	Pass
902	GFSK power level 3 150kbps	-28.5	< 6	Pass
928	GFSK power level 3 150kbps	-30.7	< 6	Pass

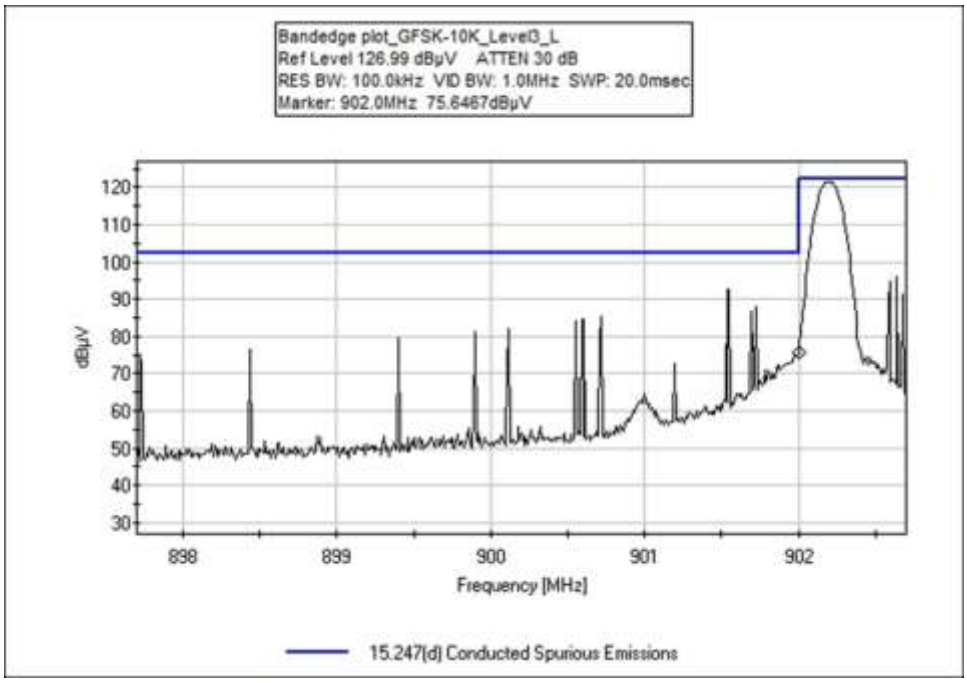
Band Edge Plots

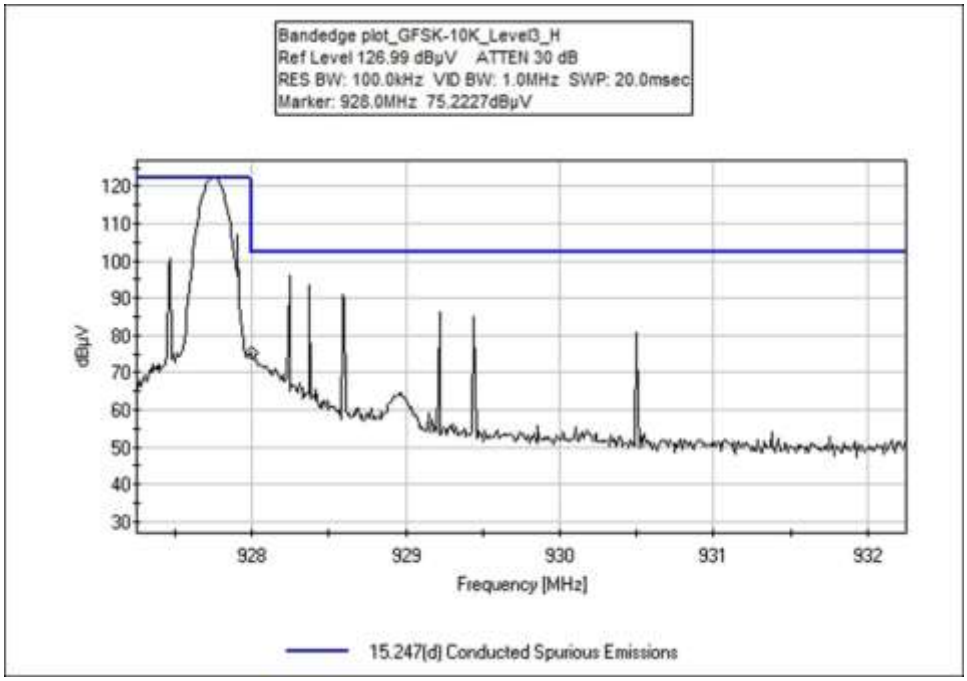


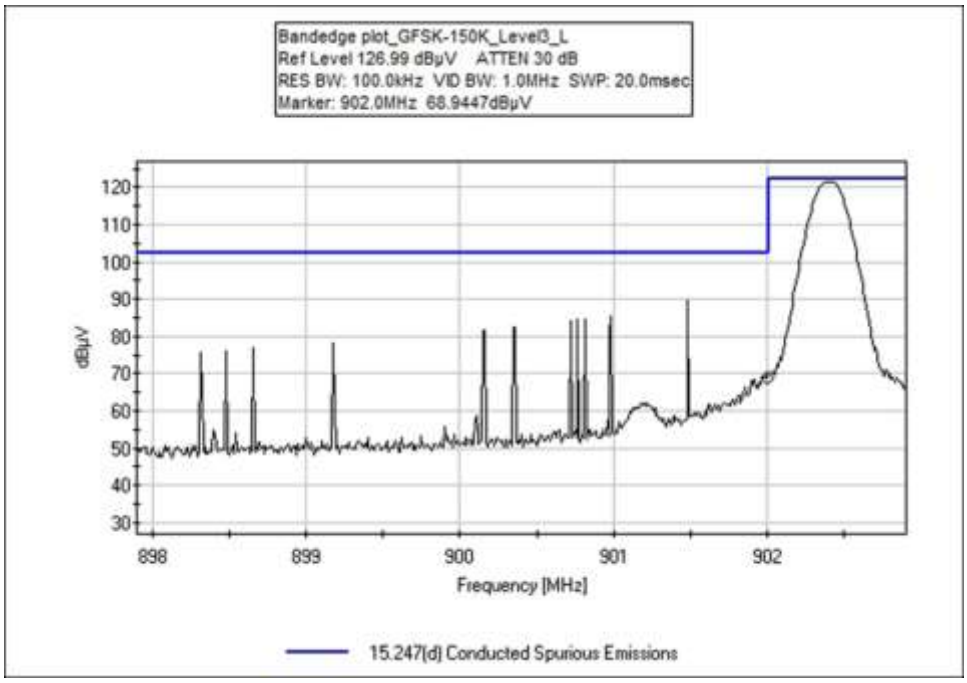


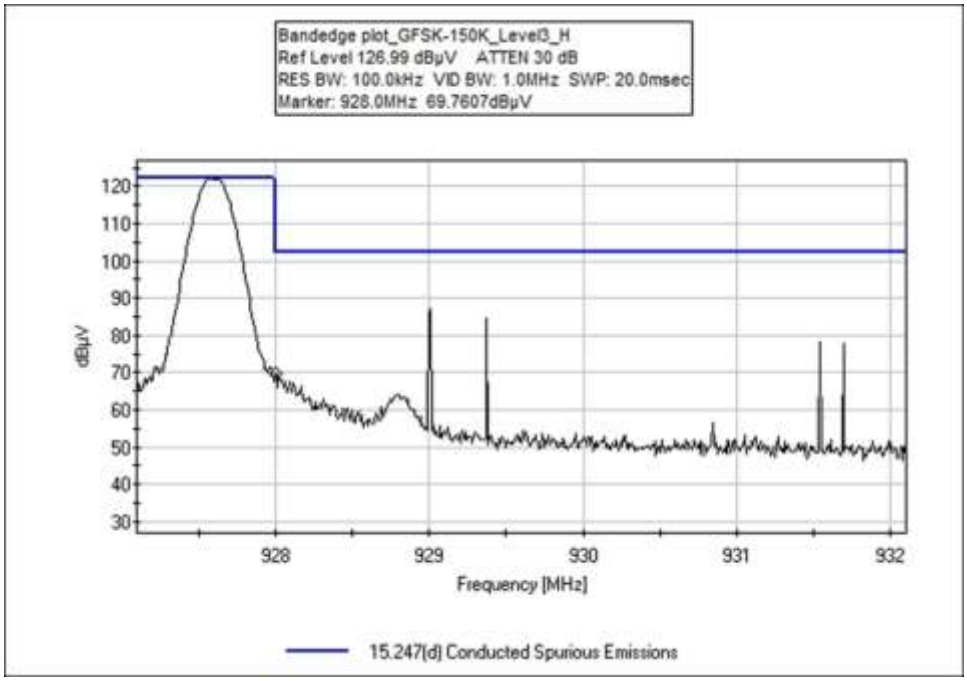

Bandedge plot_OOK_Level3_L
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 902.0MHz 84.8437dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
894
895
896
897
898
899
900
901
902
903
904
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Bandedge plot_OOK_Level3_H
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 928.0MHz 84.3387dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
926
927
928
929
930
931
932
933
934
935
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

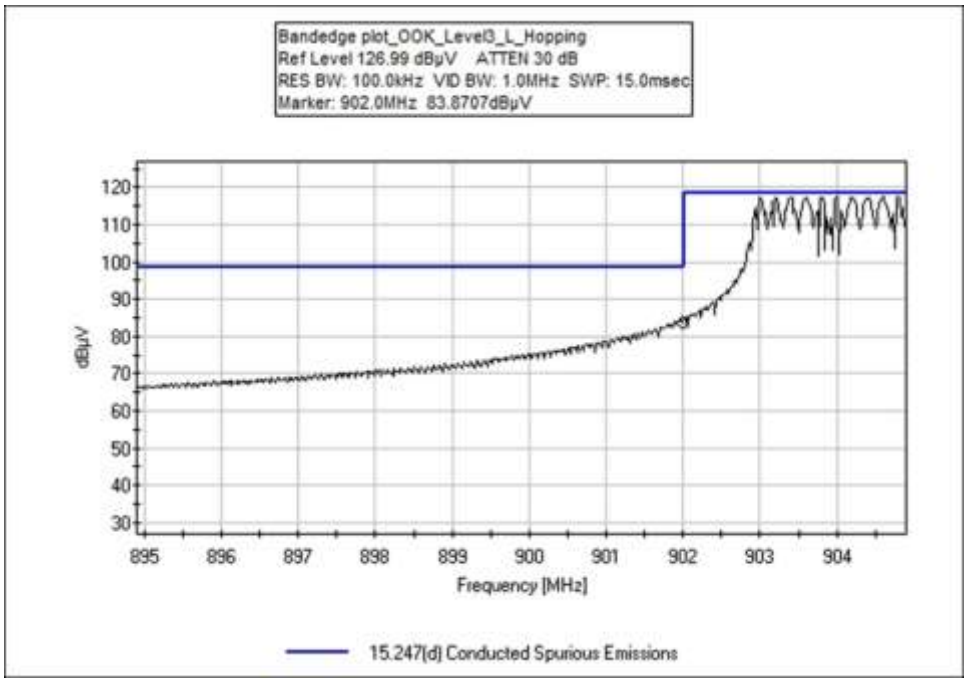

Bandedge plot_GFSK-10K_Level3_L
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 902.0MHz 75.6467dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
898
899
900
901
902
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

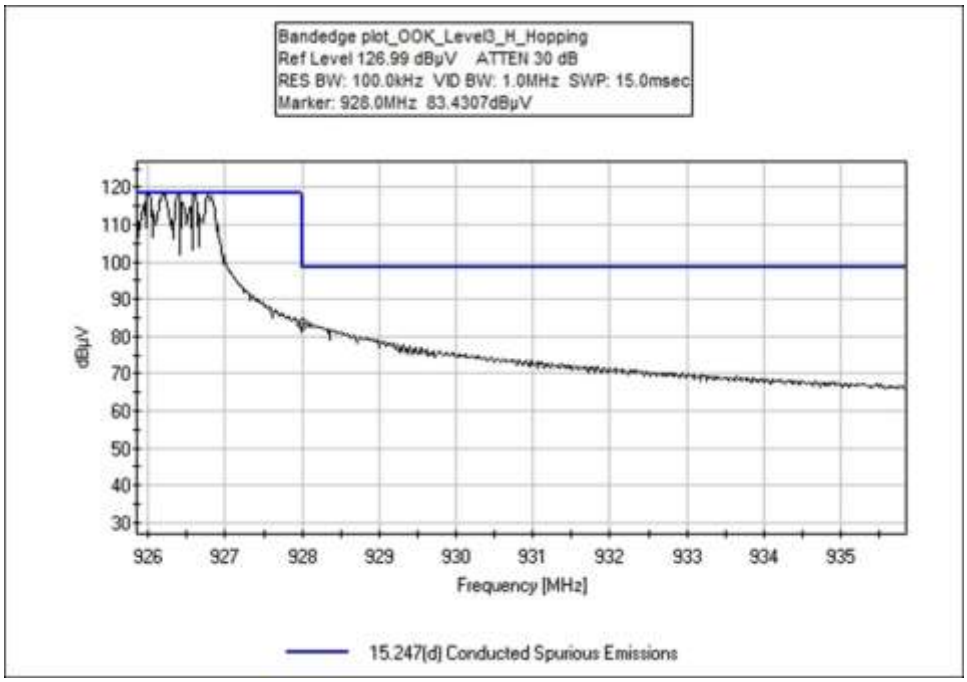

Bandedge plot_GFSK-10K_Level3_H
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 928.0MHz 75.2227dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
928
929
930
931
932
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

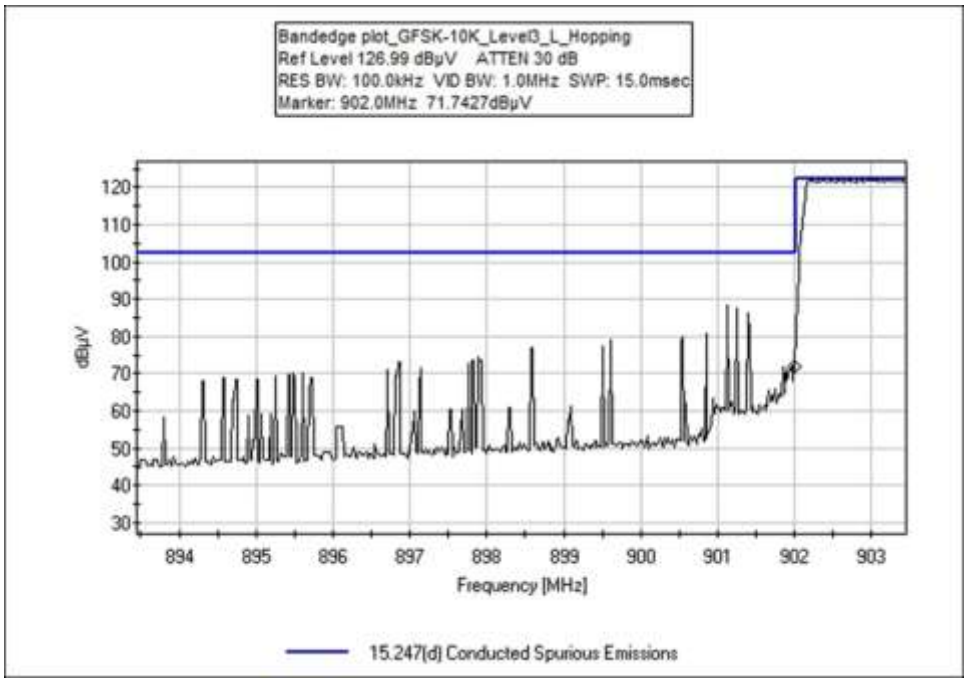

Bandedge plot_GFSK-150K_Level3_L
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 902.0MHz 68.9447dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
898
899
900
901
902
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

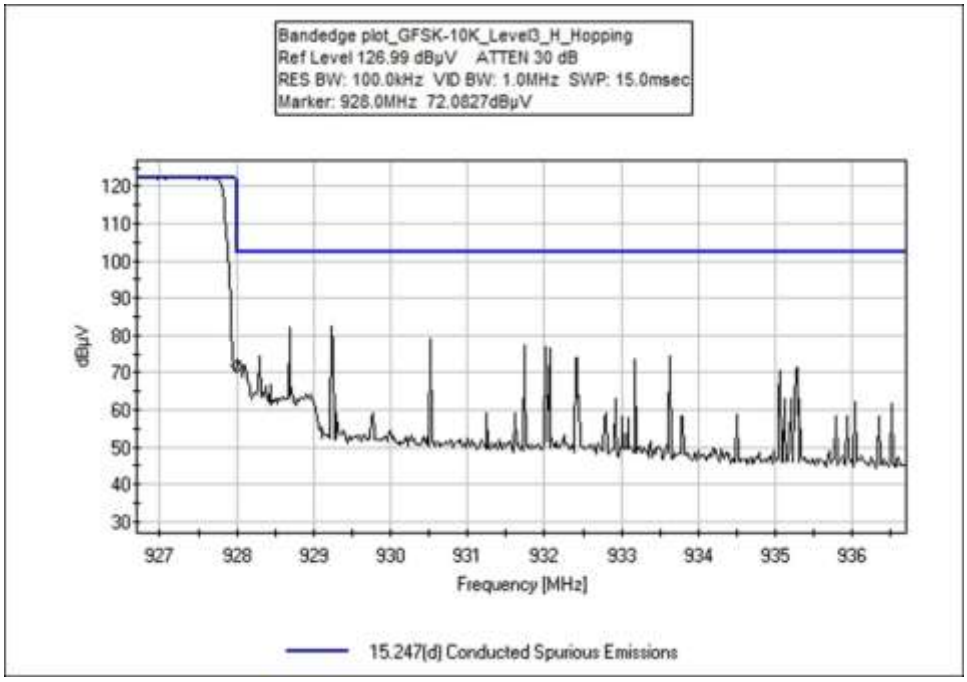

Bandedge plot_GFSK-150K_Level3_H
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 928.0MHz 69.7607dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
928
929
930
931
932
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

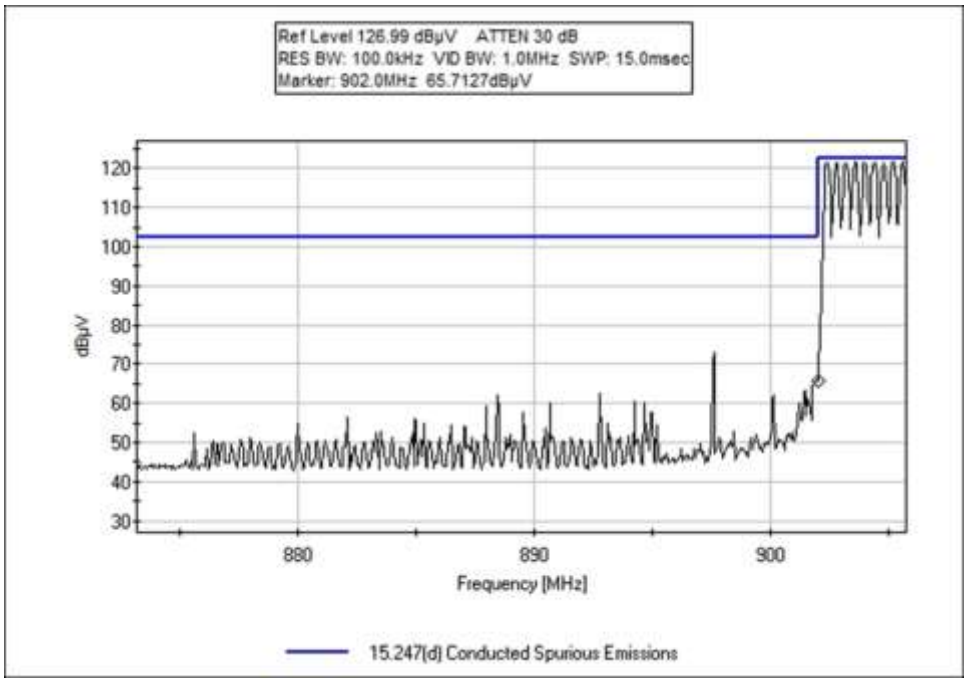
Hopping

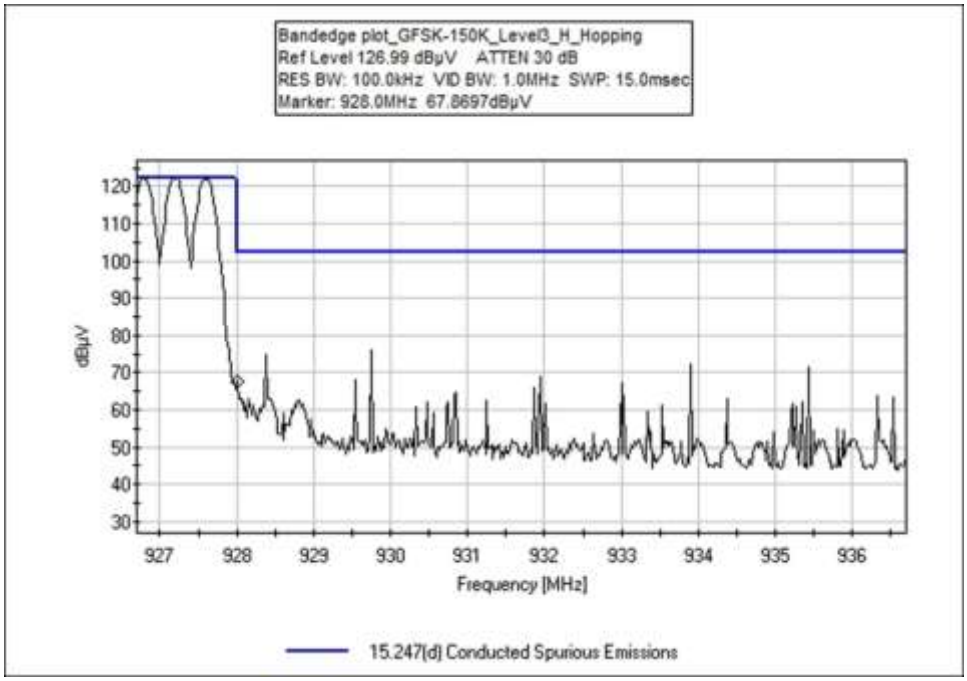

Bandedge plot_OOK_Level3_L_Hopping
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 15.0msec
Marker: 902.0MHz 83.8707dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
895
896
897
898
899
900
901
902
903
904
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Bandedge plot_OOK_Level3_H_Hopping
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 15.0msec
Marker: 928.0MHz 83.4307dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
926
927
928
929
930
931
932
933
934
935
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

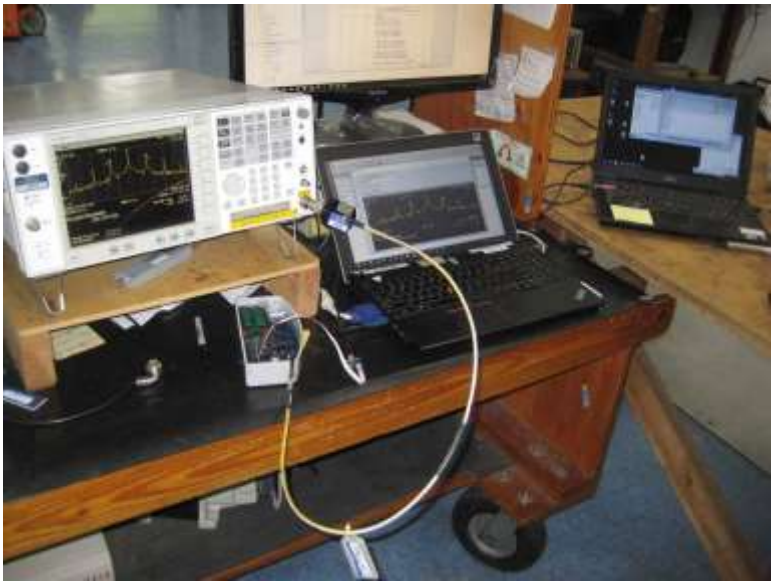

Bandedge plot_GFSK-10K_Level3_L_Hopping
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 15.0msec
Marker: 902.0MHz 71.7427dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
894
895
896
897
898
899
900
901
902
903
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Bandedge plot_GFSK-10K_Level3_H_Hopping
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 15.0msec
Marker: 928.0MHz 72.0827dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
927
928
929
930
931
932
933
934
935
936
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 15.0msec
Marker: 902.0MHz 65.7127dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
880
890
900
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Bandedge plot_GFSK-150K_Level3_H_Hopping
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 1.0MHz SWP: 15.0msec
Marker: 926.0MHz 67.8697dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
927
928
929
930
931
932
933
934
935
936
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

Test Setup Photo



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 #:	**101080**	Date:	5/17/2018
Test Type:	**Maximized Emissions**	Time:	12:29:11
Tested By:	E. Wong	Sequence#:	3
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:

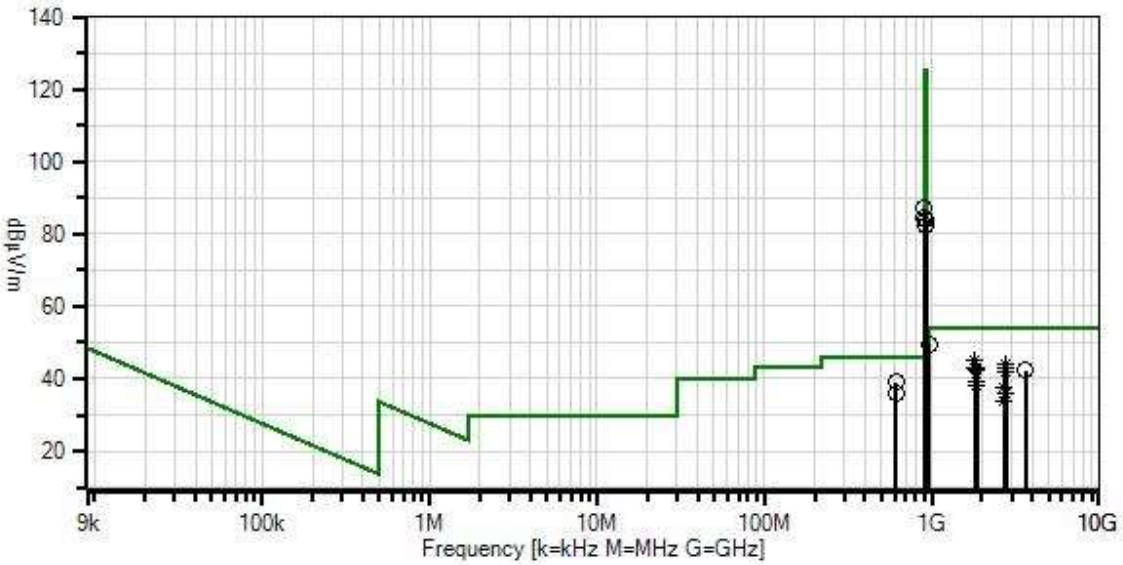
The EUT is placed on a turn table. The EUT is powered from fresh battery and programmed to transmit continuously.
Operation mode: OOK Power Level 3 (worst case of OOK protocol)

Operating frequency: 903-926.8MHz

Frequency range of measurement = 9 kHz- 10 GHz.
9 kH -150 kHz;RBW=200 Hz,VBW=200 Hz;
150 kHz-30 MHz;RBW=9 kHz,VBW=9 kHz;
30 MHz-1000 MHz;RBW=120 kHz,VBW=120 kHz,
1000 MHz-10000 MHz;RBW=1 MHz,VBW=1 MHz.

Site A
Test Method: ANSI C63.10 (2013)
Temperature: 21.3°C
Relative Humidity: 48.3%

Itron, Inc. WO#: 101080 Sequence#: 3 Date: 5/17/2018
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
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T3	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T6	AN00309	Preamp	8447D	2/19/2018	2/19/2020
T7	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T8	ANP06544	Cable	32026-29094K-29094K-36TC	12/21/2017	12/21/2019
T9	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
T10	AN02749	High Pass Filter	9SH10-1000/T10000-O/O	9/11/2017	9/11/2019
T11	AN00786	Preamp	83017A	5/12/2018	5/12/2020
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020

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	960.000M	40.6	+0.0 +0.5 +0.0	+6.1 -27.3 +0.0	+23.7 +0.0 +0.0	+6.1 +0.0	+0.0	49.7	54.0	-4.3	Horiz
2	960.000M	40.3	+0.0 +0.5 +0.0	+6.1 -27.3 +0.0	+23.7 +0.0 +0.0	+6.1 +0.0	+0.0	49.4	54.0 bandedge H_hopping	-4.6	Horiz
3	614.000M	35.5	+0.0 +0.4 +0.0	+6.0 -27.5 +0.0	+20.0 +0.0 +0.0	+4.7 +0.0	+0.0	39.1	46.0	-6.9	Horiz
4	1805.958M Ave	53.2	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.0 -38.9	+0.0 +0.7	+0.0	44.9	54.0	-9.1	Horiz
^	1805.958M	71.9	+0.0 +0.0 +2.5	+0.0 +0.0 +0.4	+0.0 +27.0 -38.9	+0.0 +0.7	+0.0	63.6	54.0	+9.6	Horiz
6	614.000M	32.5	+0.0 +0.4 +0.0	+6.0 -27.5 +0.0	+20.0 +0.0 +0.0	+4.7 +0.0	+0.0	36.1	46.0 hopping	-9.9	Horiz
7	2780.317M Ave	47.7	+0.0 +0.0 +3.3	+0.0 +0.0 +1.1	+0.0 +29.5 -38.6	+0.0 +0.9	+0.0	43.9	54.0	-10.1	Horiz
^	2780.317M	66.2	+0.0 +0.0 +3.3	+0.0 +0.0 +1.1	+0.0 +29.5 -38.6	+0.0 +0.9	+0.0	62.4	54.0	+8.4	Horiz

9	1805.967M	51.4	+0.0	+0.0	+0.0	+0.0	+0.0	43.1	54.0	-10.9	Vert
	Ave		+0.0	+0.0	+27.0	+0.7					
			+2.5	+0.4	-38.9						
	^ 1805.967M	70.1	+0.0	+0.0	+0.0	+0.0	+0.0	61.8	54.0	+7.8	Vert
			+0.0	+0.0	+27.0	+0.7					
			+2.5	+0.4	-38.9						
11	1830.017M	51.2	+0.0	+0.0	+0.0	+0.0	+0.0	43.0	54.0	-11.0	Vert
	Ave		+0.0	+0.0	+27.1	+0.7					
			+2.5	+0.4	-38.9						
	^ 1830.017M	69.9	+0.0	+0.0	+0.0	+0.0	+0.0	61.7	54.0	+7.7	Vert
			+0.0	+0.0	+27.1	+0.7					
			+2.5	+0.4	-38.9						
13	902.000M	79.0	+0.0	+6.1	+22.8	+5.9	+0.0	87.1	98.2	-11.1	Horiz
			+0.5	-27.2	+0.0	+0.0					
			+0.0	+0.0	+0.0						
14	2745.000M	46.9	+0.0	+0.0	+0.0	+0.0	+0.0	42.8	54.0	-11.2	Horiz
	Ave		+0.0	+0.0	+29.4	+0.9					
			+3.2	+1.0	-38.6						
	^ 2745.000M	65.4	+0.0	+0.0	+0.0	+0.0	+0.0	61.3	54.0	+7.3	Horiz
			+0.0	+0.0	+29.4	+0.9					
			+3.2	+1.0	-38.6						
16	1853.600M	50.5	+0.0	+0.0	+0.0	+0.0	+0.0	42.5	54.0	-11.5	Vert
	Ave		+0.0	+0.0	+27.2	+0.7					
			+2.6	+0.4	-38.9						
	^ 1853.600M	68.2	+0.0	+0.0	+0.0	+0.0	+0.0	60.2	54.0	+6.2	Vert
			+0.0	+0.0	+27.2	+0.7					
			+2.6	+0.4	-38.9						
18	3611.933M	44.1	+0.0	+0.0	+0.0	+0.0	+0.0	42.2	54.0	-11.8	Vert
			+0.0	+0.0	+31.1	+1.2					
			+3.8	+0.4	-38.4						
19	2780.333M	45.6	+0.0	+0.0	+0.0	+0.0	+0.0	41.8	54.0	-12.2	Vert
	Ave		+0.0	+0.0	+29.5	+0.9					
			+3.3	+1.1	-38.6						
	^ 2780.333M	64.0	+0.0	+0.0	+0.0	+0.0	+0.0	60.2	54.0	+6.2	Vert
			+0.0	+0.0	+29.5	+0.9					
			+3.3	+1.1	-38.6						
21	902.000M	76.5	+0.0	+6.1	+22.8	+5.9	+0.0	84.6	98.2	-13.6	Horiz
			+0.5	-27.2	+0.0	+0.0			Bandedge		
			+0.0	+0.0	+0.0				L_hopping		
22	928.000M	75.4	+0.0	+6.1	+23.2	+6.0	+0.0	83.9	98.2	-14.3	Horiz
			+0.5	-27.3	+0.0	+0.0					
			+0.0	+0.0	+0.0						
23	1853.333M	47.4	+0.0	+0.0	+0.0	+0.0	+0.0	39.4	54.0	-14.6	Horiz
	Ave		+0.0	+0.0	+27.2	+0.7					
			+2.6	+0.4	-38.9						
	^ 1853.333M	66.1	+0.0	+0.0	+0.0	+0.0	+0.0	58.1	54.0	+4.1	Horiz
			+0.0	+0.0	+27.2	+0.7					
			+2.6	+0.4	-38.9						
25	928.000M	74.0	+0.0	+6.1	+23.2	+6.0	+0.0	82.5	98.2	-15.7	Horiz
			+0.5	-27.3	+0.0	+0.0			bandedge		
			+0.0	+0.0	+0.0				H_hopping		

26	1830.000M	46.2	+0.0	+0.0	+0.0	+0.0	+0.0	38.0	54.0	-16.0	Horiz
	Ave		+0.0	+0.0	+27.1	+0.7					
			+2.5	+0.4	-38.9						
^	1830.000M	64.2	+0.0	+0.0	+0.0	+0.0	+0.0	56.0	54.0	+2.0	Horiz
			+0.0	+0.0	+27.1	+0.7					
			+2.5	+0.4	-38.9						
28	2708.942M	42.1	+0.0	+0.0	+0.0	+0.0	+0.0	37.7	54.0	-16.3	Horiz
	Ave		+0.0	+0.0	+29.1	+0.9					
			+3.2	+1.0	-38.6						
^	2708.942M	60.1	+0.0	+0.0	+0.0	+0.0	+0.0	55.7	54.0	+1.7	Horiz
			+0.0	+0.0	+29.1	+0.9					
			+3.2	+1.0	-38.6						
30	2745.017M	39.8	+0.0	+0.0	+0.0	+0.0	+0.0	35.7	54.0	-18.3	Vert
	Ave		+0.0	+0.0	+29.4	+0.9					
			+3.2	+1.0	-38.6						
^	2745.017M	56.8	+0.0	+0.0	+0.0	+0.0	+0.0	52.7	54.0	-1.3	Vert
			+0.0	+0.0	+29.4	+0.9					
			+3.2	+1.0	-38.6						
32	2708.950M	38.4	+0.0	+0.0	+0.0	+0.0	+0.0	34.0	54.0	-20.0	Vert
	Ave		+0.0	+0.0	+29.1	+0.9					
			+3.2	+1.0	-38.6						
^	2708.950M	53.4	+0.0	+0.0	+0.0	+0.0	+0.0	49.0	54.0	-5.0	Vert
			+0.0	+0.0	+29.1	+0.9					
			+3.2	+1.0	-38.6						

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 #:	**101080**	Date:	5/17/2018
Test Type:	**Maximized Emissions**	Time:	14:57:40
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:

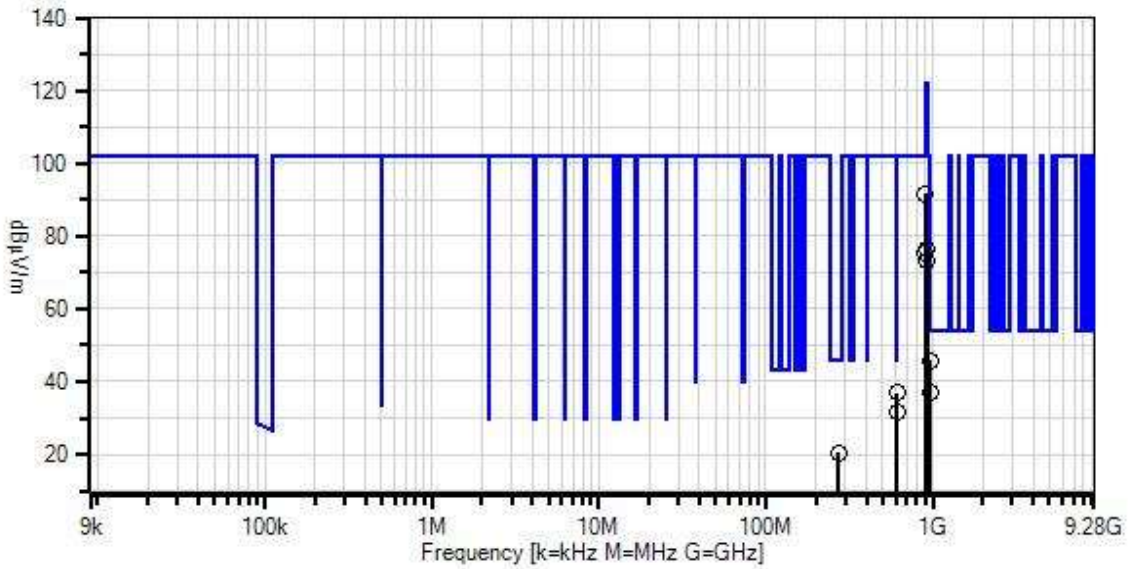
The EUT is placed on a turn table. The EUT is powered from fresh battery and programmed to transmit continuously.
Operation mode: GFSK 10kbps Power Level 3

Operating frequency: 902.2-927.75MHz

Frequency range of measurement = 9 kHz- 1 GHz.
9kHz -150kHz; RBW=200 Hz, VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz, VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz, VBW=120 kHz

Site A
Test Method: ANSI C63.10 (2013)
Temperature: 21.3°C
Relative Humidity: 48.3%

Itron, Inc. WO#: 101080 Sequence#: 4 Date: 5/17/2018
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
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T3	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T6	AN00309	Preamp	8447D	2/19/2018	2/19/2020
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	960.000M	36.7	+0.0 +0.5	+23.7 -27.3	+6.1	+6.1	+0.0	45.8	54.0 Bandedge _hopping	-8.2	Horiz
2	614.000M	33.2	+0.0 +0.4	+20.0 -27.5	+6.0	+4.7	+0.0	36.8	46.0 Bandedge _hopping	-9.2	Horiz
3	902.000M	83.5	+0.0 +0.5	+22.8 -27.2	+6.1	+5.9	+0.0	91.6	102.2	-10.6	Horiz
4	614.000M	28.1	+0.0 +0.4	+20.0 -27.5	+6.0	+4.7	+0.0	31.7	46.0	-14.3	Horiz
5	960.000M	27.9	+0.0 +0.5	+23.7 -27.3	+6.1	+6.1	+0.0	37.0	54.0	-17.0	Horiz
6	271.250M	26.3	+0.0 +0.2	+13.1 -28.0	+6.0	+2.9	+0.0	20.5	46.0	-25.5	Vert
7	928.000M	67.8	+0.0 +0.5	+23.2 -27.3	+6.1	+6.0	+0.0	76.3	102.2	-25.9	Horiz
8	902.000M	67.2	+0.0 +0.5	+22.8 -27.2	+6.1	+5.9	+0.0	75.3	102.2 Bandedge _hopping	-26.9	Horiz
9	928.000M	64.5	+0.0 +0.5	+23.2 -27.3	+6.1	+6.0	+0.0	73.0	102.2 Bandedge _hopping	-29.2	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 #:	**101080**	Date:	6/14/2018
Test Type:	**Maximized Emissions**	Time:	11:32:12
Tested By:	Don Nguyen	Sequence#:	0
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:

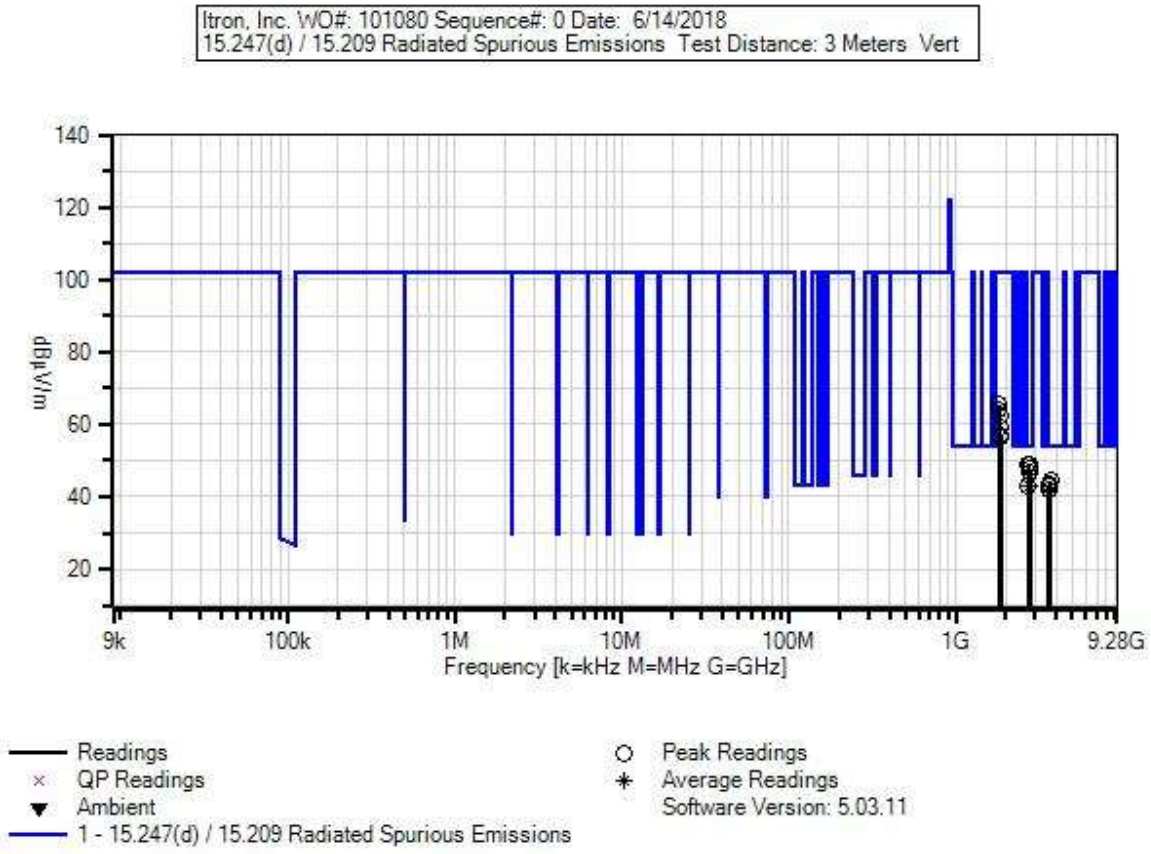
The EUT is placed on turn table. The EUT is powered from fresh battery and programmed to transmit continuously.
Operation mode: GFSK 10kbps Power Level 3

Operating frequency: 902.2-927.75MHz

Frequency range of measurement = 1GHz-10GHz.
RBW=1 MHz,VBW=3 MHz.

Site A
Test Method: ANSI C63.10 (2013)
Temperature: 23.2°C
Relative Humidity: 58.8%

Note: New GFKS test scripts with 110ms pulse


Itron, Inc. WO#: 101080 Sequence#: 0 Date: 6/14/2018
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert
140
120
100
80
60
40
20
dBµV/m
9k
100k
1M
10M
100M
1G
9.28G
Frequency [k=kHz M=MHz G=GHz]
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
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T3	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
T4	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T5	AN02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
T6	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	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2745.000M	53.4	+0.0 +1.4	+29.4 +0.2	+3.2	-38.6	+0.0	49.0	54.0 915MHz	-5.0	Horiz
2	2706.608M	53.5	+0.0 +1.4	+29.1 +0.2	+3.2	-38.6	+0.0	48.8	54.0 902.2MHz	-5.2	Vert
3	2745.000M	52.3	+0.0 +1.4	+29.4 +0.2	+3.2	-38.6	+0.0	47.9	54.0 915MHz	-6.1	Vert
4	2783.250M	50.7	+0.0 +1.4	+29.5 +0.2	+3.3	-38.6	+0.0	46.5	54.0 927.75MHz	-7.5	Horiz
5	3711.000M	45.1	+0.0 +1.8	+31.9 +0.2	+3.8	-38.3	+0.0	44.5	54.0 927.75MHz	-9.5	Horiz
6	3660.000M	44.5	+0.0 +1.8	+31.6 +0.2	+3.8	-38.3	+0.0	43.6	54.0 915MHz	-10.4	Horiz
7	3608.808M	45.0	+0.0 +1.8	+31.1 +0.2	+3.8	-38.4	+0.0	43.5	54.0 902.2MHz	-10.5	Vert
8	2706.608M	47.9	+0.0 +1.4	+29.1 +0.2	+3.2	-38.6	+0.0	43.2	54.0 902.2MHz	-10.8	Horiz
9	3608.808M	44.7	+0.0 +1.8	+31.1 +0.2	+3.8	-38.4	+0.0	43.2	54.0 902.2MHz	-10.8	Horiz
10	2783.250M Ave	47.0	+0.0 +1.4	+29.5 +0.2	+3.3	-38.6	+0.0	42.8	54.0 927.75MHz	-11.2	Vert
^	2783.250M	55.7	+0.0 +1.4	+29.5 +0.2	+3.3	-38.6	+0.0	51.5	54.0 927.75MHz	-2.5	Vert
12	3660.000M	42.9	+0.0 +1.8	+31.6 +0.2	+3.8	-38.3	+0.0	42.0	54.0 915MHz	-12.0	Vert
13	1804.408M	73.5	+0.0 +1.1	+27.0 +0.3	+2.5	-38.9	+0.0	65.5	102.2 902.2MHz	-36.7	Vert
14	1804.408M	72.0	+0.0 +1.1	+27.0 +0.3	+2.5	-38.9	+0.0	64.0	102.2 902.2MHz	-38.2	Horiz
15	1830.000M	70.2	+0.0 +1.1	+27.1 +0.3	+2.5	-38.9	+0.0	62.3	102.2 915MHz	-39.9	Vert
16	1830.000M	66.8	+0.0 +1.1	+27.1 +0.3	+2.5	-38.9	+0.0	58.9	102.2 915MHz	-43.3	Horiz
17	1855.500M	64.6	+0.0 +1.1	+27.3 +0.3	+2.6	-38.9	+0.0	57.0	102.2 927.75MHz	-45.2	Vert
18	1855.500M	64.1	+0.0 +1.1	+27.3 +0.3	+2.6	-38.9	+0.0	56.5	102.2 927.75MHz	-45.7	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 #:	**101080**	Date:	5/17/2018
Test Type:	**Maximized Emissions**	Time:	16:05:00
Tested By:	E. Wong	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			

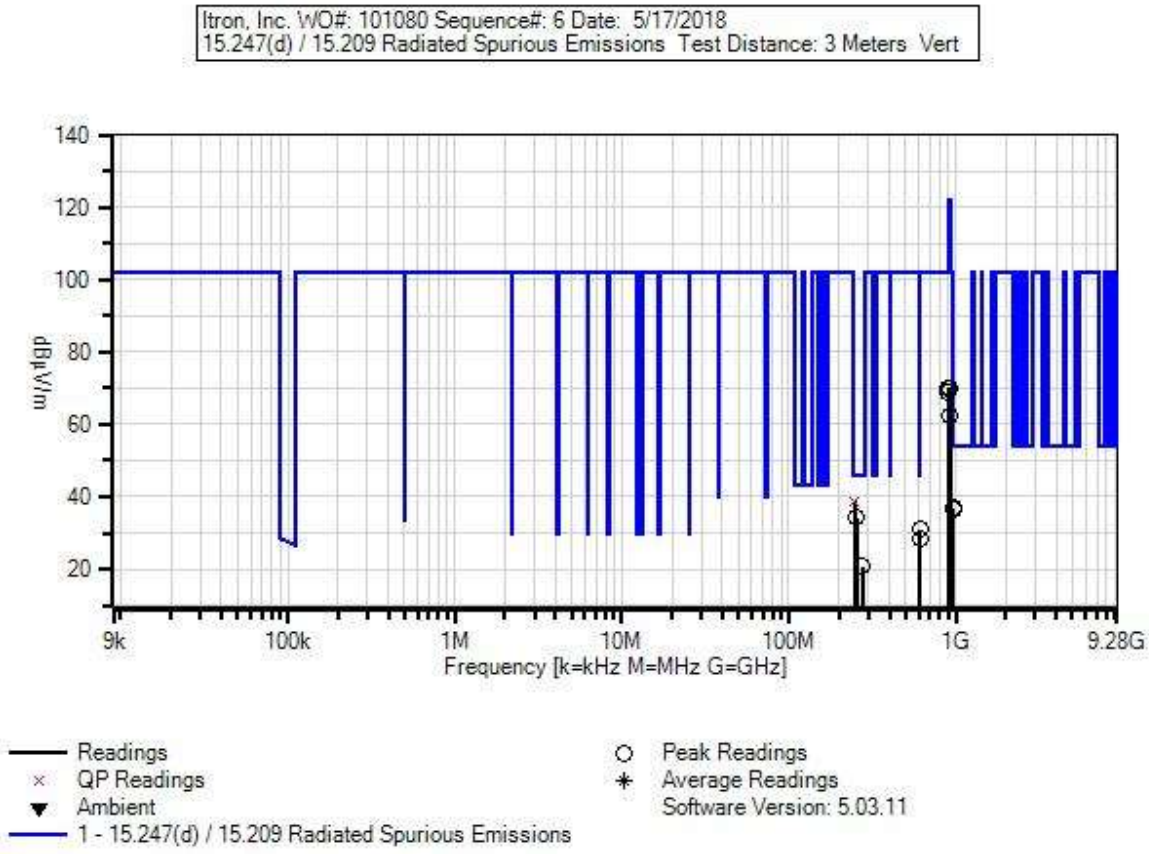
Test Conditions / Notes:

The EUT is placed on a turn table. The EUT is powered from fresh battery and programmed to transmit continuously.
Operation mode: GFSK 150kbps Power Level 3

Operating frequency: 902.4-927.6MHz

Frequency range of measurement = 9 kHz- 1 GHz.
9kHz -150kHz; RBW=200 Hz, VBW=200 Hz;
150 kHz-30 MHz; RBW=9 kHz, VBW=9 kHz;
30 MHz-1000 MHz; RBW=120 kHz, VBW=120 kHz

Site A
Test Method: ANSI C63.10 (2013)
Temperature: 21.3°C
Relative Humidity: 48.3%


Itron, Inc. WO#: 101080 Sequence#: 6 Date: 5/17/2018
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Vert
140
120
100
80
60
40
20
dBµV/m
9k
100k
1M
10M
100M
1G
9.28G
Frequency [k=kHz M=MHz G=GHz]
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
T1	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T2	AN01995	Biconilog Antenna	CBL6111C	4/23/2018	4/23/2020
T3	ANP05275	Attenuator	1W	4/5/2018	4/5/2020
T4	ANP05198	Cable-Amplitude +15C to +45C (dB)	8268	12/7/2016	12/7/2018
T5	ANP05050	Cable	RG223/U	1/20/2017	1/20/2019
T6	AN00309	Preamp	8447D	2/19/2018	2/19/2020
	AN00314	Loop Antenna	6502	5/13/2018	5/13/2020

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

#	Freq	Rdng	T1 T5	T2 T6	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	246.667M	45.0	+0.0	+12.7	+6.0	+2.8	+0.0	38.7	46.0	-7.3	Vert
	QP		+0.2	-28.0							
^	246.667M	49.1	+0.0	+12.7	+6.0	+2.8	+0.0	42.8	46.0	-3.2	Vert
			+0.2	-28.0							
3	253.960M	40.3	+0.0	+12.9	+6.0	+2.8	+0.0	34.2	46.0	-11.8	Vert
			+0.2	-28.0							
4	614.000M	27.4	+0.0	+20.0	+6.0	+4.7	+0.0	31.0	46.0	-15.0	Horiz
			+0.4	-27.5							
5	960.000M	27.9	+0.0	+23.7	+6.1	+6.1	+0.0	37.0	54.0	-17.0	Horiz
			+0.5	-27.3					Bandedge		
									_Hopping		
6	960.000M	27.4	+0.0	+23.7	+6.1	+6.1	+0.0	36.5	54.0	-17.5	Horiz
			+0.5	-27.3							
7	614.000M	24.8	+0.0	+20.0	+6.0	+4.7	+0.0	28.4	46.0	-17.6	Horiz
			+0.4	-27.5					Bandedge		
									_Hopping		
8	274.750M	26.3	+0.0	+13.1	+6.0	+3.0	+0.0	20.6	46.0	-25.4	Vert
			+0.2	-28.0							
9	928.000M	61.6	+0.0	+23.2	+6.1	+6.0	+0.0	70.1	102.2	-32.1	Horiz
			+0.5	-27.3							
10	902.000M	61.9	+0.0	+22.8	+6.1	+5.9	+0.0	70.0	102.2	-32.2	Horiz
			+0.5	-27.2					Bandedge		
									_Hopping		
11	902.000M	60.5	+0.0	+22.8	+6.1	+5.9	+0.0	68.6	102.2	-33.6	Horiz
			+0.5	-27.2							
12	928.000M	54.1	+0.0	+23.2	+6.1	+6.0	+0.0	62.6	102.2	-39.6	Horiz
			+0.5	-27.3					Bandedge		
									_Hopping		

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 #:	**101080**	Date:	6/14/2018
Test Type:	**Maximized Emissions**	Time:	13:13:28
Tested By:	Don Nguyen	Sequence#:	1
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:

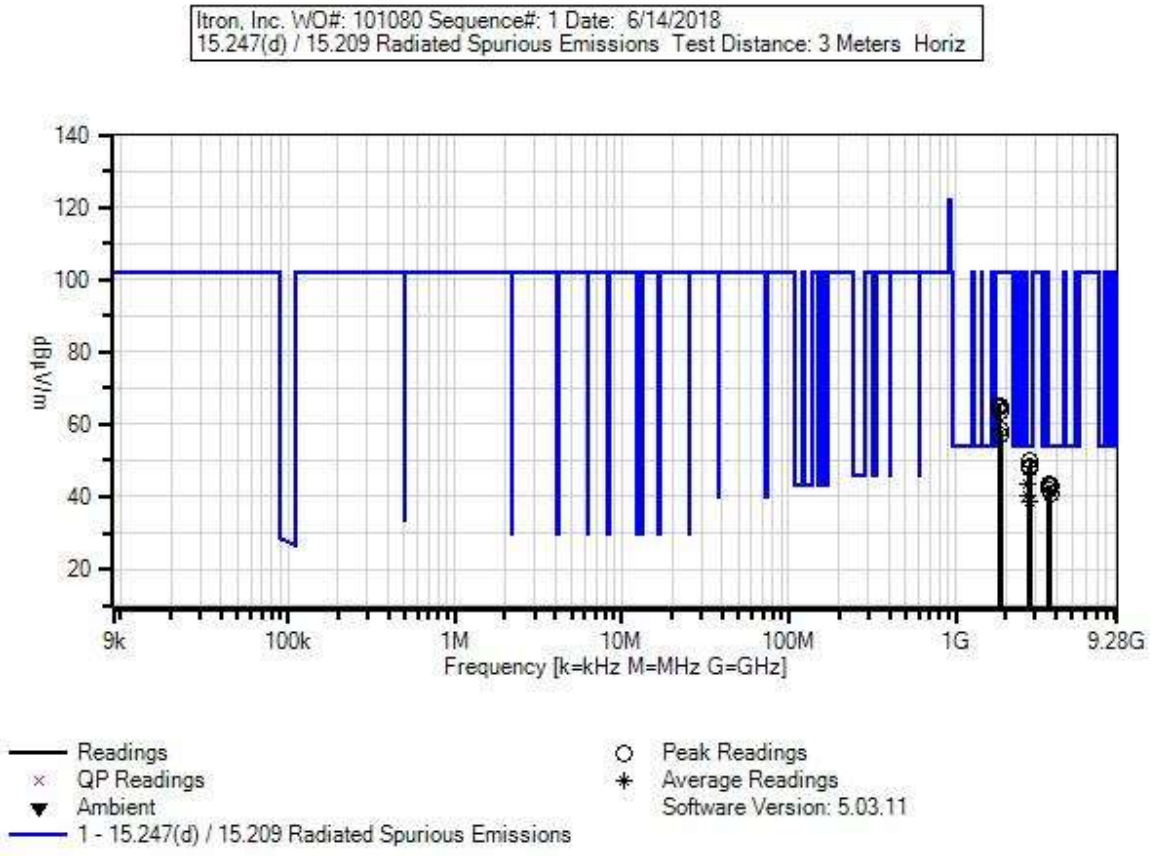
The EUT is placed on turn table. The EUT is powered from fresh battery and programmed to transmit continuously.
Operation mode: GFSK 150kbps Power Level 3

Operating frequency: 902.4-927.6MHz

Frequency range of measurement = 1GHz-10GHz.
RBW=1 MHz,VBW=3 MHz.

Site A
Test Method: ANSI C63.10 (2013)
Temperature: 23.2°C
Relative Humidity: 58.8%

Note: New GFKS test scripts with 110ms pulse


Itron, Inc. WO#: 101080 Sequence#: 1 Date: 6/14/2018
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz
140
120
100
80
60
40
20
dBµV/m
9k
100k
1M
10M
100M
1G
9.28G
Frequency [k=kHz M=MHz G=GHz]
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
T1	AN00786	Preamp	83017A	5/12/2018	5/12/2020
T2	AN00849	Horn Antenna	3115	3/14/2018	3/14/2020
T3	AN02946	Cable	32022-2-2909K-36TC	12/12/2017	12/12/2019
T4	ANP07139	Cable	ANDL1-PNMNM-48	3/1/2017	3/1/2019
	AN02672	Spectrum Analyzer	E4446A	3/2/2017	3/2/2019
T5	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	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2782.800M	54.1	-38.6 +0.2	+29.5	+1.4	+3.3	+0.0	49.9	54.0 927.6MHz	-4.1	Vert
2	2746.800M	52.9	-38.6 +0.2	+29.4	+1.4	+3.2	+0.0	48.5	54.0 915.6MHz	-5.5	Vert
3	2746.800M	52.2	-38.6 +0.2	+29.4	+1.4	+3.2	+0.0	47.8	54.0 915.6MHz	-6.2	Horiz
4	2707.200M Ave	48.3	-38.6 +0.2	+29.1	+1.4	+3.2	+0.0	43.6	54.0 902.4MHz	-10.4	Vert
^	2707.200M	56.9	-38.6 +0.2	+29.1	+1.4	+3.2	+0.0	52.2	54.0 902.4MHz	-1.8	Vert
6	3609.600M	44.9	-38.4 +0.2	+31.1	+1.8	+3.8	+0.0	43.4	54.0 902.4MHz	-10.6	Vert
7	3710.400M	43.7	-38.3 +0.2	+31.9	+1.8	+3.8	+0.0	43.1	54.0 927.6MHz	-10.9	Vert
8	3662.400M	43.9	-38.3 +0.2	+31.6	+1.8	+3.8	+0.0	43.0	54.0 915.6MHz	-11.0	Horiz
9	3662.400M	43.0	-38.3 +0.2	+31.6	+1.8	+3.8	+0.0	42.1	54.0 915.6MHz	-11.9	Vert
10	3710.400M	41.3	-38.3 +0.2	+31.9	+1.8	+3.8	+0.0	40.7	54.0 927.6MHz	-13.3	Horiz
11	2707.200M Ave	44.9	-38.6 +0.2	+29.1	+1.4	+3.2	+0.0	40.2	54.0 902.4MHz	-13.8	Horiz
^	2707.200M	54.6	-38.6 +0.2	+29.1	+1.4	+3.2	+0.0	49.9	54.0 902.4MHz	-4.1	Horiz
13	2782.800M Ave	42.6	-38.6 +0.2	+29.5	+1.4	+3.3	+0.0	38.4	54.0 927.6MHz	-15.6	Horiz
^	2782.800M	55.2	-38.6 +0.2	+29.5	+1.4	+3.3	+0.0	51.0	54.0 927.6MHz	-3.0	Horiz

15	1804.800M	73.2	-38.9 +0.3	+27.0	+1.1	+2.5	+0.0	65.2	102.2 902.4MHz	-37.0	Horiz
16	1831.200M	72.9	-38.9 +0.3	+27.1	+1.1	+2.5	+0.0	65.0	102.2 915.6MHz	-37.2	Vert
17	1804.800M	72.4	-38.9 +0.3	+27.0	+1.1	+2.5	+0.0	64.4	102.2 902.4MHz	-37.8	Vert
18	1831.200M	71.2	-38.9 +0.3	+27.1	+1.1	+2.5	+0.0	63.3	102.2 915.6MHz	-38.9	Horiz
19	1855.200M	66.1	-38.9 +0.3	+27.3	+1.1	+2.6	+0.0	58.5	102.2 927.6MHz	-43.7	Vert
20	1855.200M	64.6	-38.9 +0.3	+27.3	+1.1	+2.6	+0.0	57.0	102.2 927.6MHz	-45.2	Horiz

Band Edge

Non-Hopping

Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	OOK Power level 1	Trace	32.6	<46	Pass
902	OOK Power level 1	Trace	79.5	< 85.2	Pass
928	OOK Power level 1	Trace	68.9	< 85.2	Pass
960	OOK Power level 1	Trace	38.9	<54	Pass

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	OOK Power level 3	Trace	39.1	<46.0	Pass
902	OOK Power level 3	Trace	87.1	< 98.2	Pass
928	OOK Power level 3	Trace	83.9	< 98.2	Pass
960	OOK Power level 3	Trace	49.7	< 54	Pass

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK power level 3 10kbps	Trace	31.7	<46	Pass
902	GFSK power level 3 10kbps	Trace	91.6	< 102.2	Pass
928	GFSK power level 3 10kbps	Trace	76.3	< 102.2	Pass
960	GFSK power level 3 10kbps	Trace	37	<54	Pass

Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK power level 3 150kbps	Trace	31.0	<46	Pass
902	GFSK power level 3 150kbps	Trace	68.6	<102.2	Pass
928	GFSK power level 3 150kbps	Trace	70.1	< 102.2	Pass
960	GFSK power level 3 150kbps	Trace	36.5	<54	Pass

Hopping

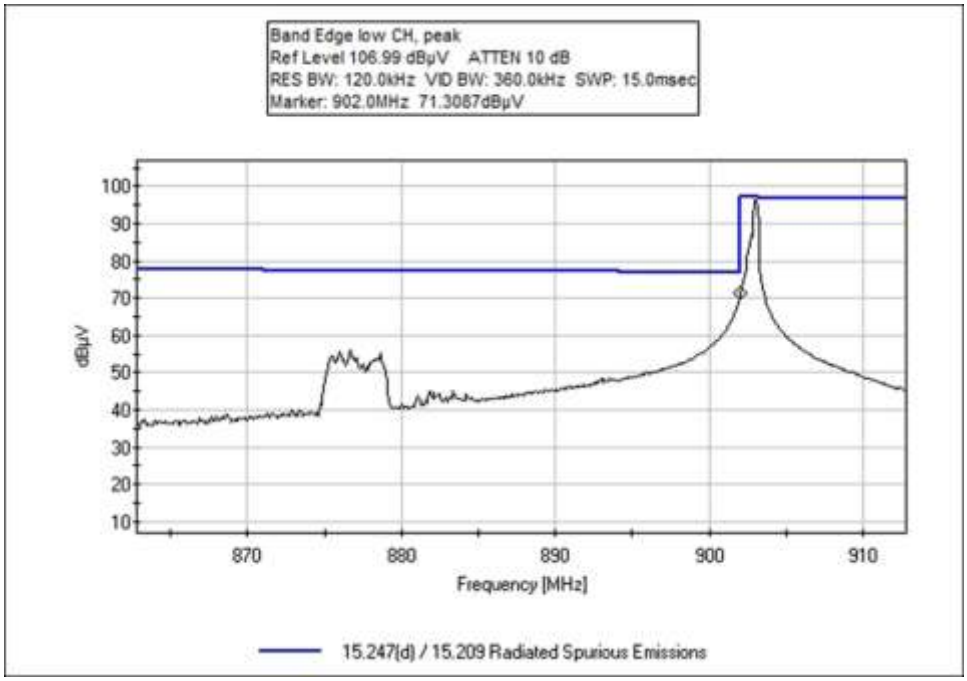
Band Edge Summary					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	OOK Power level 3*	Trace	36.1	<46	Pass
902	OOK Power level 3*	Trace	84.6	< 98.2	Pass
928	OOK Power level 3*	Trace	82.5	< 98.2	Pass
960	OOK Power level 3*	Trace	49.4	<54	Pass

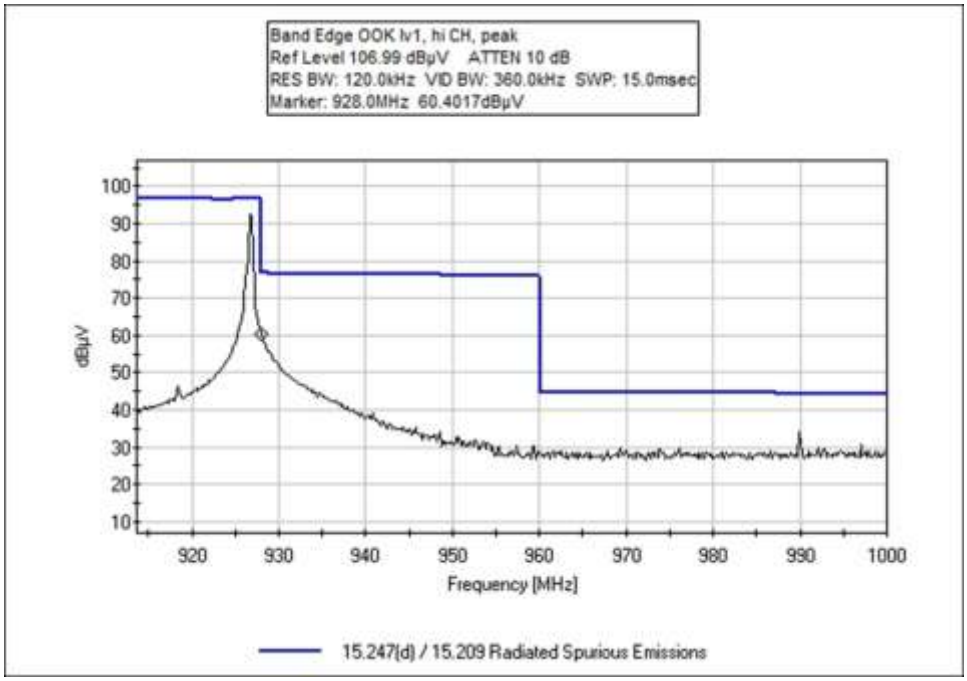
* Worst case of the OOK

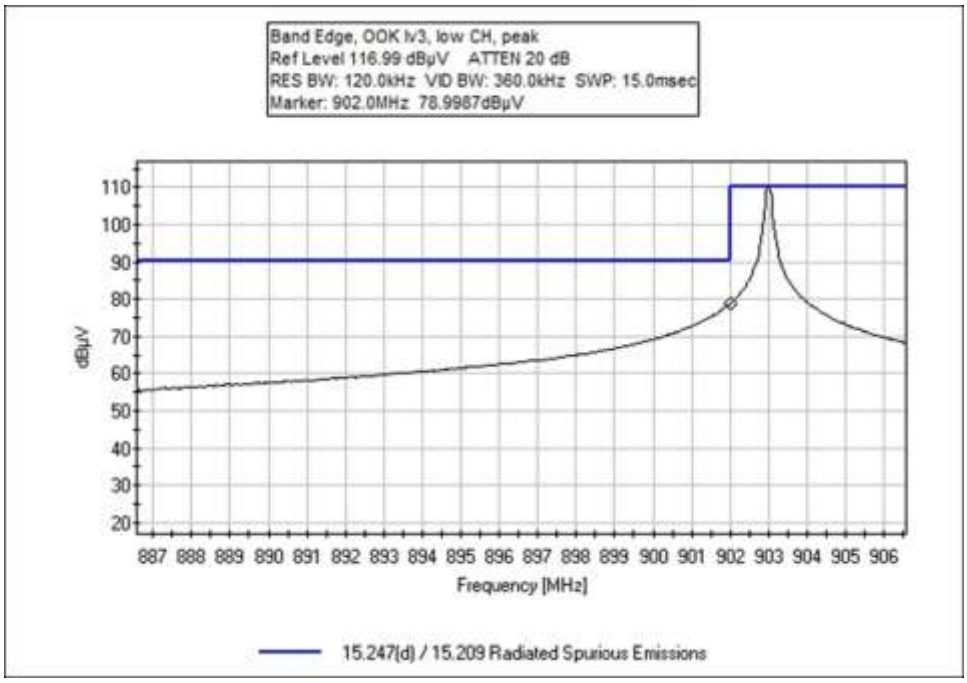
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK power level 3 10kbps	Trace	36.8	<46	Pass
902	GFSK power level 3 10kbps	Trace	75.3	< 102.2	Pass
928	GFSK power level 3 10kbps	Trace	73.0	< 102.2	Pass
960	GFSK power level 3 10kbps	Trace	45.8	<54	Pass

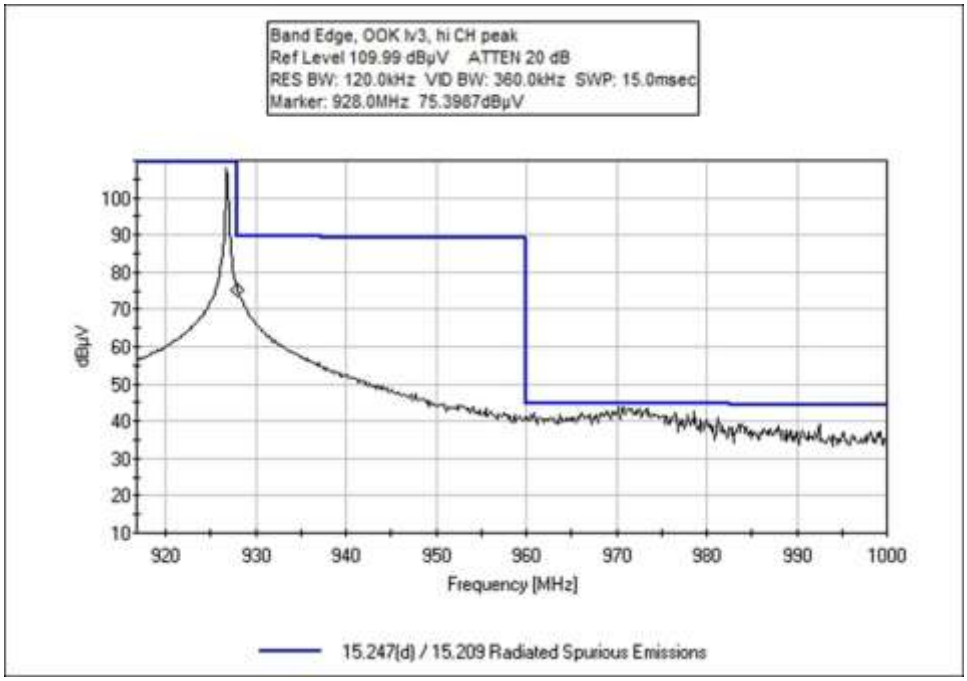
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK power level 3 150kbps	Trace	28.4	< 46	Pass
902	GFSK power level 3 150kbps	Trace	70.0	< 102.2	Pass
928	GFSK power level 3 150kbps	Trace	62.6	< 102.2	Pass
960	GFSK power level 3 150kbps	Trace	37.0	<54	Pass

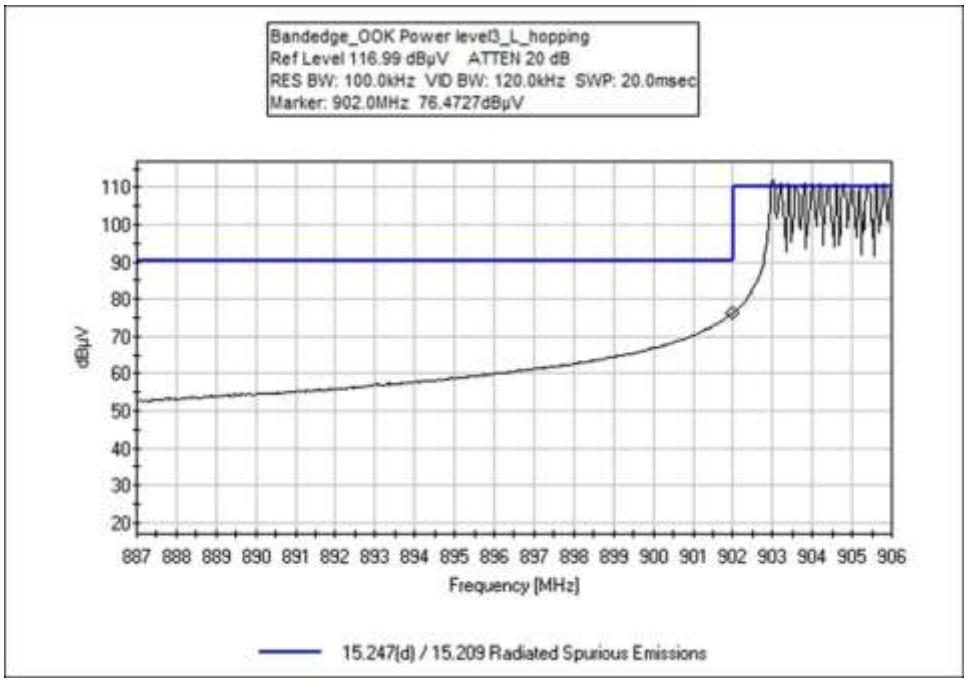
Band Edge Plots

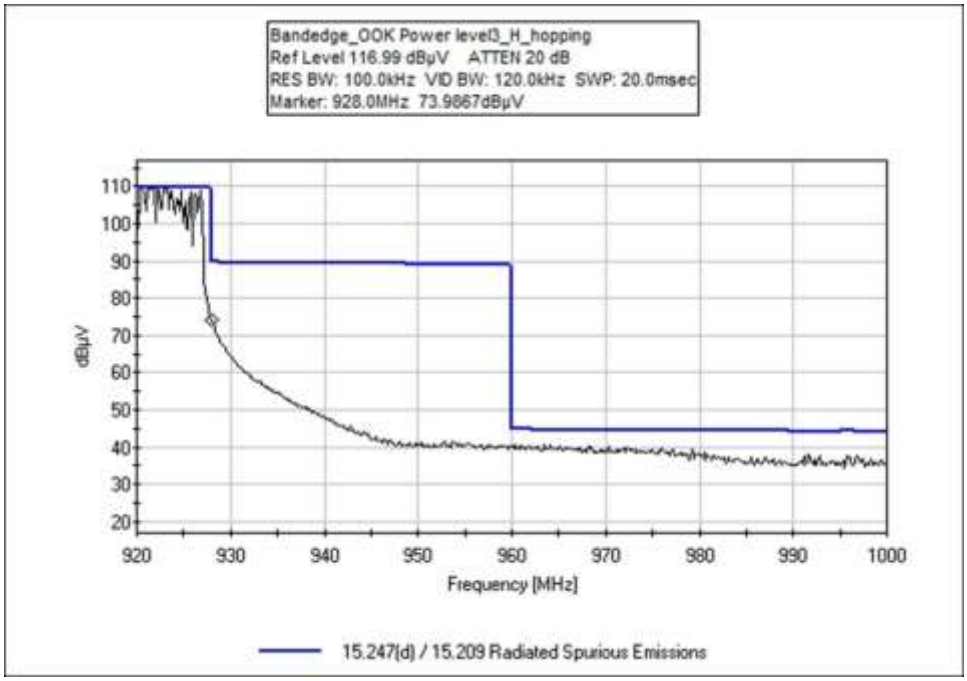


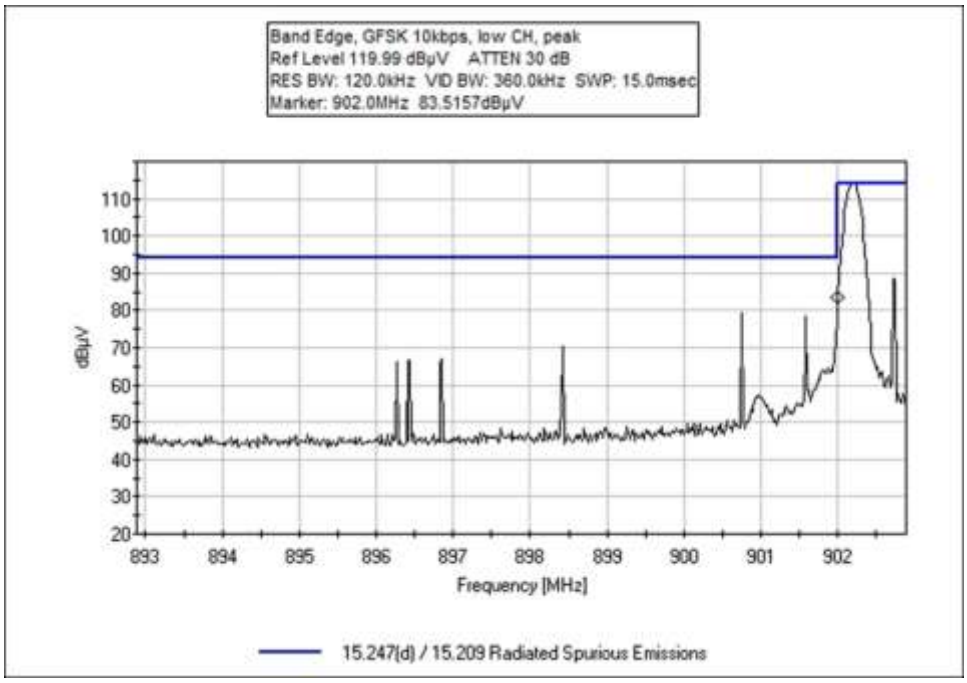


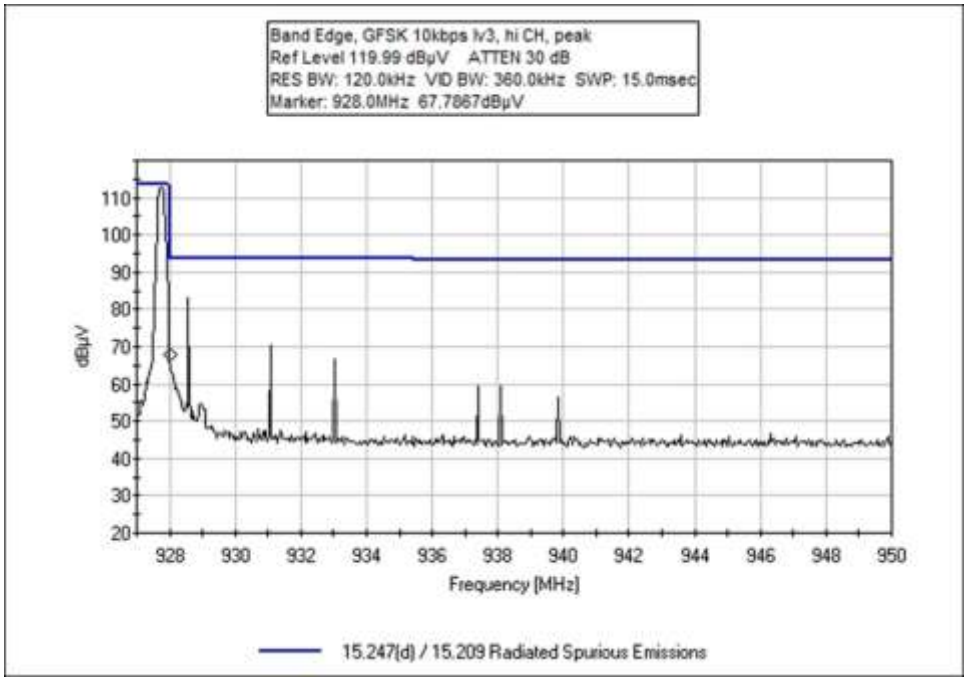

Band Edge, OOK lv3, low CH, peak
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 902.0MHz 78.9987dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

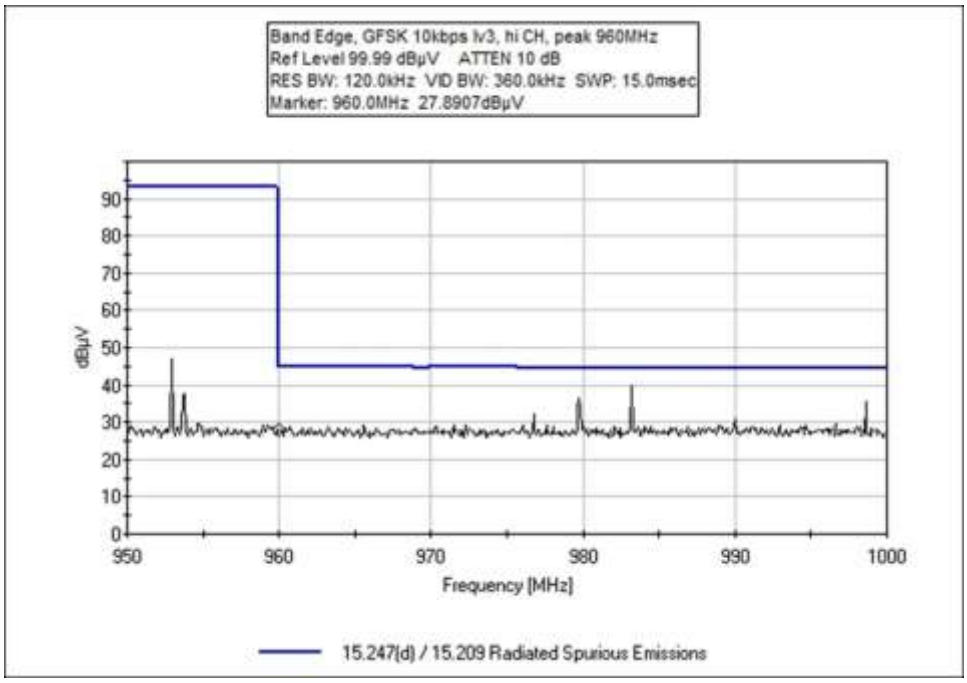

Band Edge, OOK lv3, hi CH peak
Ref Level 109.99 dBµV ATTEN 20 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 928.0MHz 75.3987dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
920 930 940 950 960 970 980 990 1000
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

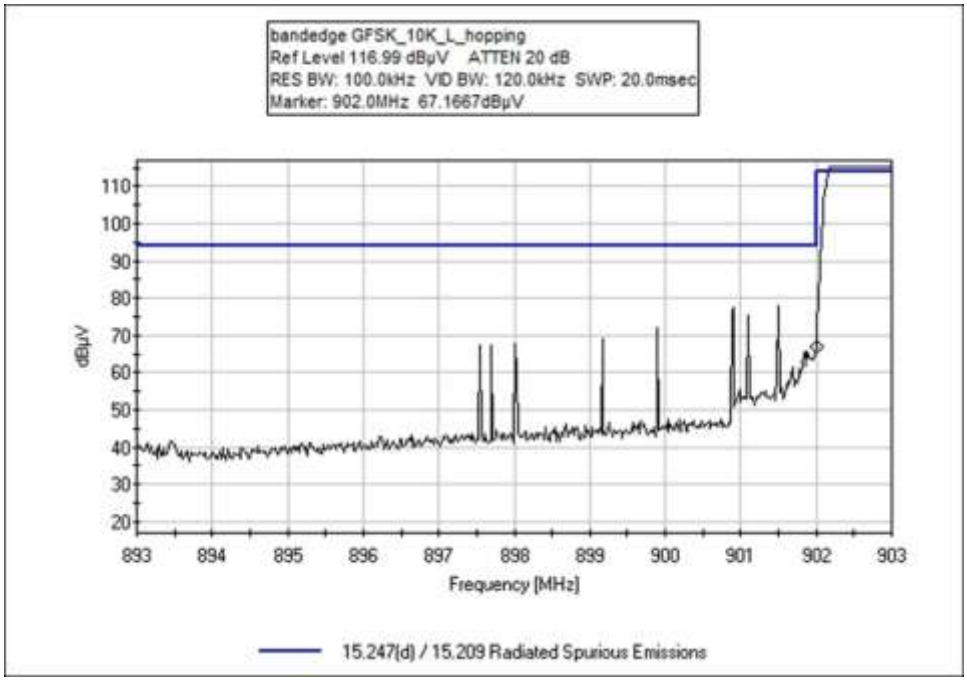

Bandedge_OOK Power level3_L_hopping
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 902.0MHz 76.4727dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

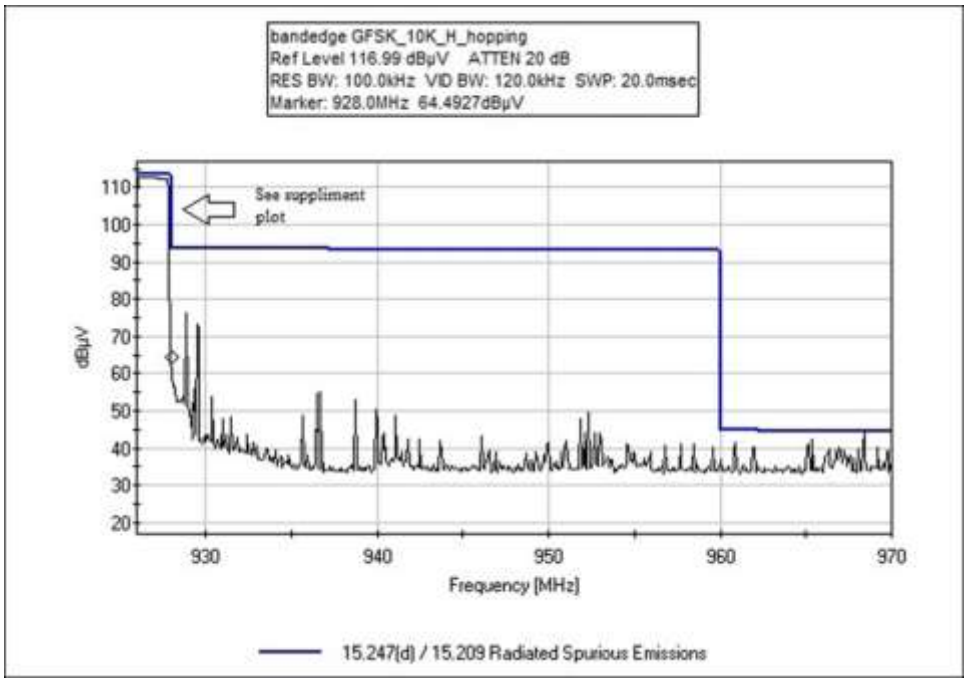

Bandedge_OOK Power level3_H_hopping
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 928.0MHz 73.9867dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
920 930 940 950 960 970 980 990 1000
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

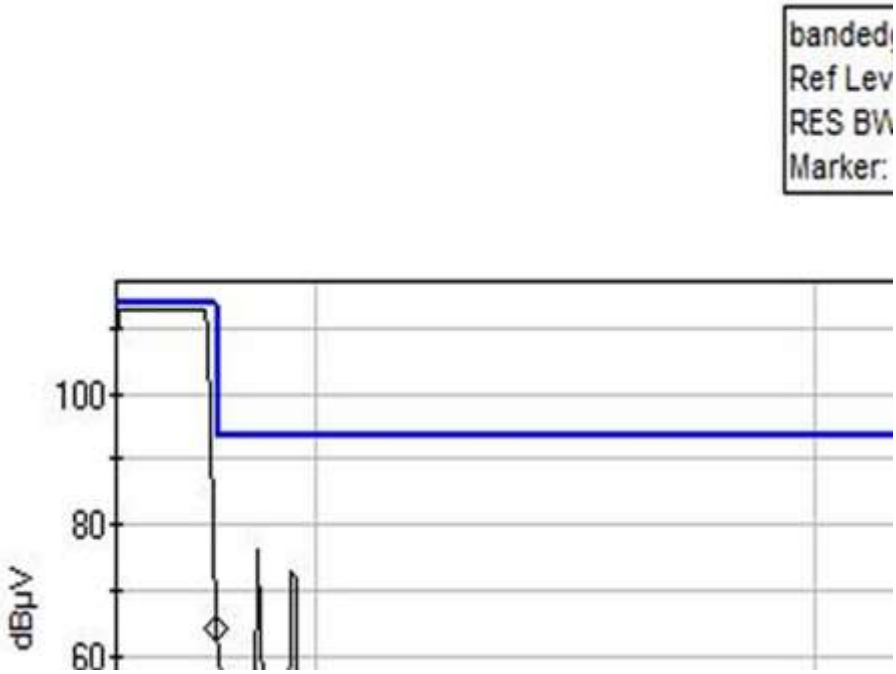

Band Edge, GFSK 10kbps, low CH, peak
Ref Level 119.99 dBµV ATTEN 30 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 902.0MHz 83.5157dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
893
894
895
896
897
898
899
900
901
902
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge, GFSK 10kbps lv3, hi CH, peak
Ref Level 119.99 dBµV ATTEN 30 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 928.0MHz 67.7867dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
928
930
932
934
936
938
940
942
944
946
948
950
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

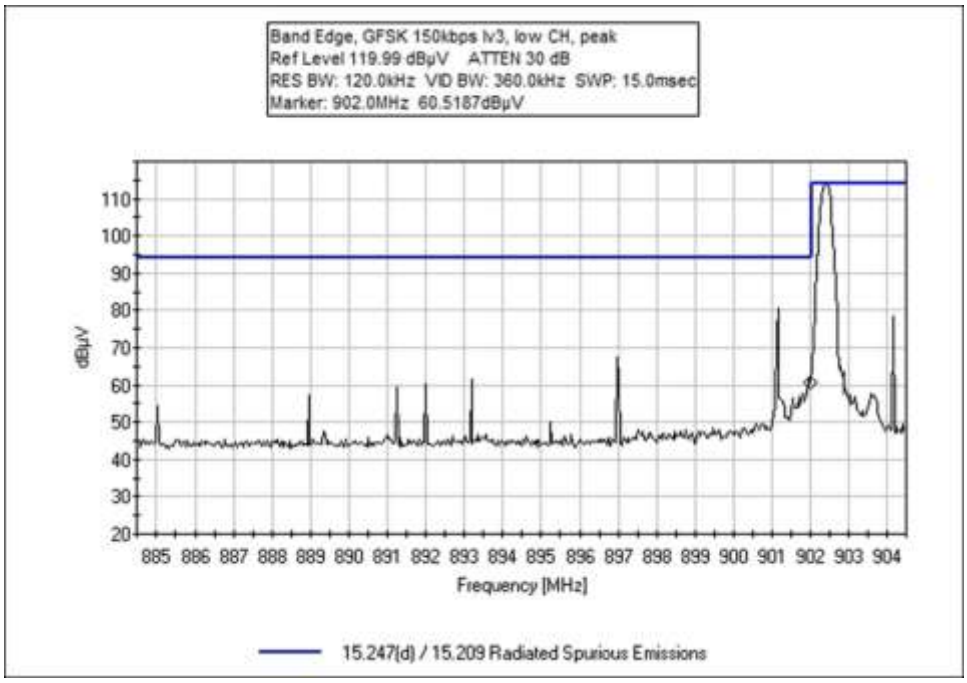

Band Edge, GFSK 10kbps lv3, hi CH, peak 960MHz
Ref Level 99.99 dBµV ATTEN 10 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 960.0MHz 27.8907dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

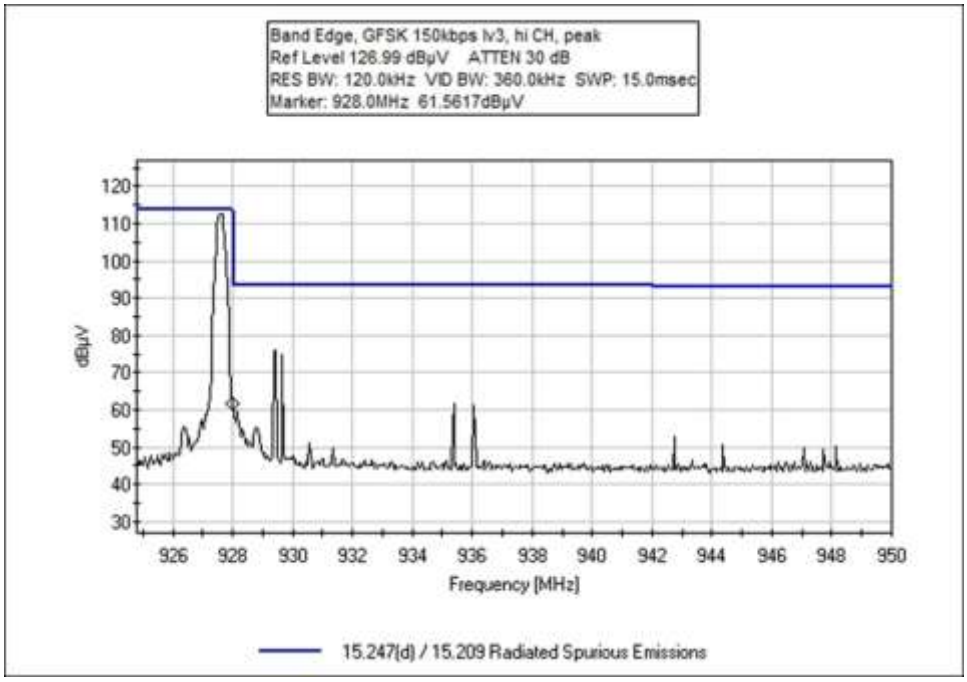

bandedge GFSK_10K_L_hopping
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 902.0MHz 67.1667dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

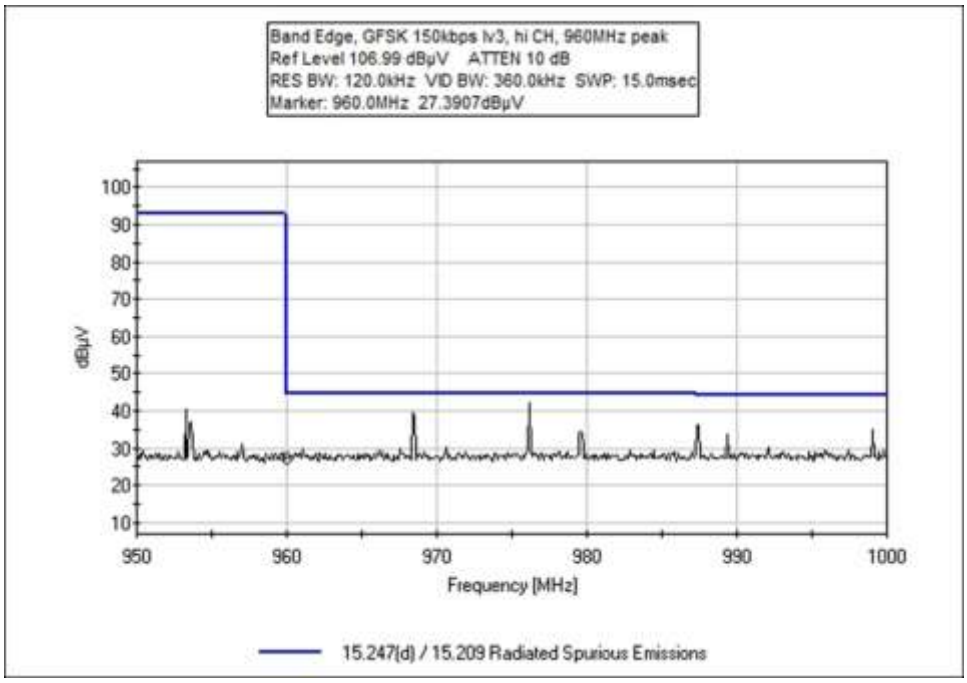

bandedge GFSK_10K_H_hopping
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 928.0MHz 64.4927dBµV
See suppliment plot
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

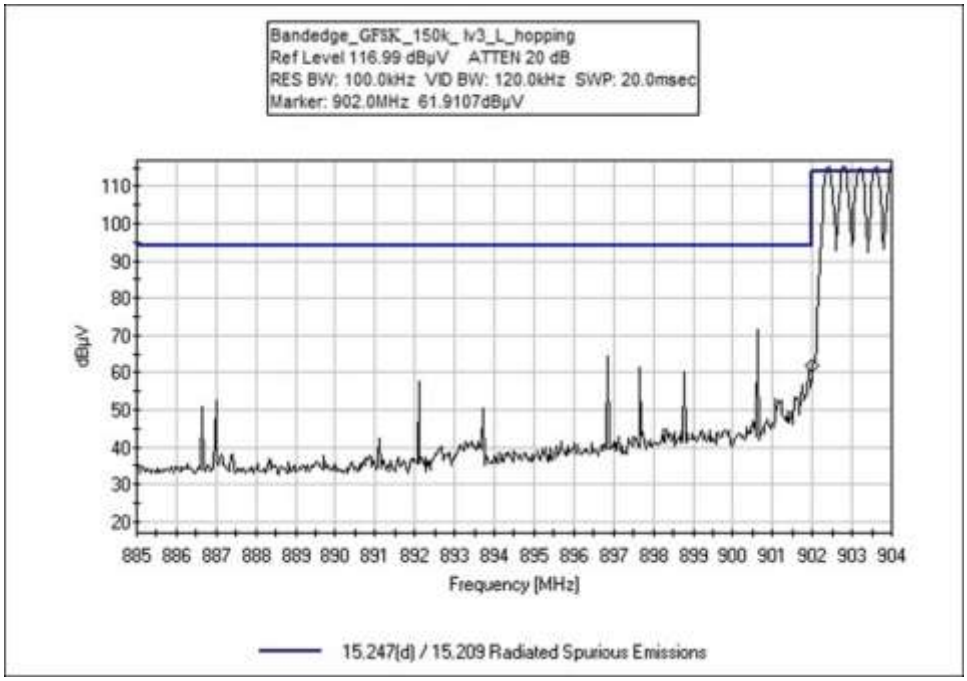

dBµV

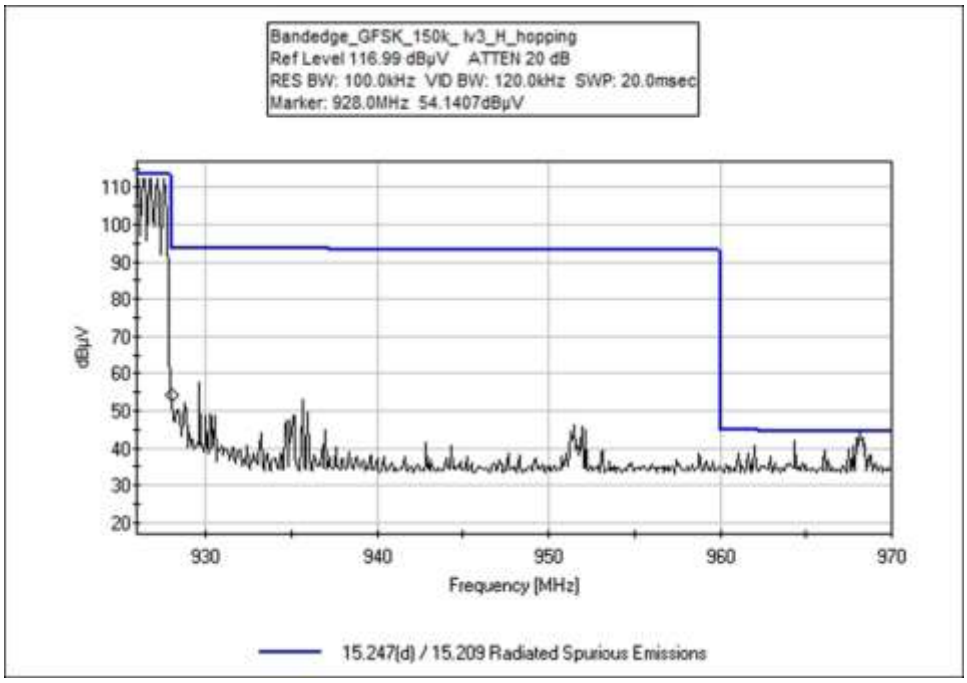
Zoomed View


Band Edge, GFSK 150kbps lv3, low CH, peak
Ref Level 119.99 dBµV ATTEN 30 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 902.0MHz 60.5187dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge, GFSK 150kbps lv3, hi CH, peak
Ref Level 126.99 dBµV ATTEN 30 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 928.0MHz 61.5617dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
926 928 930 932 934 936 938 940 942 944 946 948 950
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Band Edge, GFSK 150kbps lv3, hi CH, 960MHz peak
Ref Level 106.99 dBµV ATTEN 10 dB
RES BW: 120.0kHz VID BW: 360.0kHz SWP: 15.0msec
Marker: 960.0MHz 27.3907dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
950
960
970
980
990
1000
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Bandedge_GFSK_150k_ lv3_L_hopping
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 902.0MHz 61.9107dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


Bandedge_GFSK_150k_ lv3_H_hopping
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 120.0kHz SWP: 20.0msec
Marker: 928.0MHz 54.1407dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
930
940
950
960
970
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup Photos

Below 1GHz

Below 1GHz

Above 1GHz

Above 1GHz

Above 1GHz Cone placement

Above 1GHz Cone placement

Appendix A: Customer Provided Information

Intelis-Gas Occupancy

The purpose of this document is to give an overview of the worst case Inteles-Gas Time of Occupancy, for FCC rule 15.247(a)(1)(i).

The table below itemizes the transmission durations of the three types of packets in the worst-case mode. Channel selection for each packet is from a unique pseudo random algorithm. With the algorithms the channels are used equally on the average.

Packet Type	Packet Duration (ms)	PHY Mode	Max Transmissions per channel selection in 20 seconds	Total transmission time in 20 second period per channel (ms)
Type A	< 48.2	10 kbps GFSK	4	192.8
Type B	< 57	10 kbps GFSK	7	< 399
Type C	variable	10 kbps GFSK	1	<400

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.