Itron, Inc.

REVISED TEST REPORT FOR 107748-1

500W / RIVAWA
Model: ERW-1601-001*

500WR / RIVAWRA
Model: ERW-1601-010*
***(See Appendix A for Manufacturer's Declaration)**

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(FHSS 902-928MHz)

Report No.: 107748-1A

Date of issue: June 19, 2023

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

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

Test Certificate # 803.01

Testing the Future
CKC LABORATORIES, INC.

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Itron, Inc.
2401 N, State Street
Waseca, MN 56093

Representative: Dan Bomsta
Customer Reference Number: 271751

REPORT PREPARED BY:

Lisa Bevington
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107748

DATE OF EQUIPMENT RECEIPT: February 14, 2023
DATE(S) OF TESTING: February 14, 15,and 23, 2023
May 19, 26, 30, 2023 & June 2, 2023

Revision History

Original: Testing of 500W / RIVAWA, Model: ERW-1601-001 and 500WR / RIVAWA, Model: ERW-1601-010 to FCC Part 15 Subpart C Sections 15.247 (FHSS 902-928MHz).

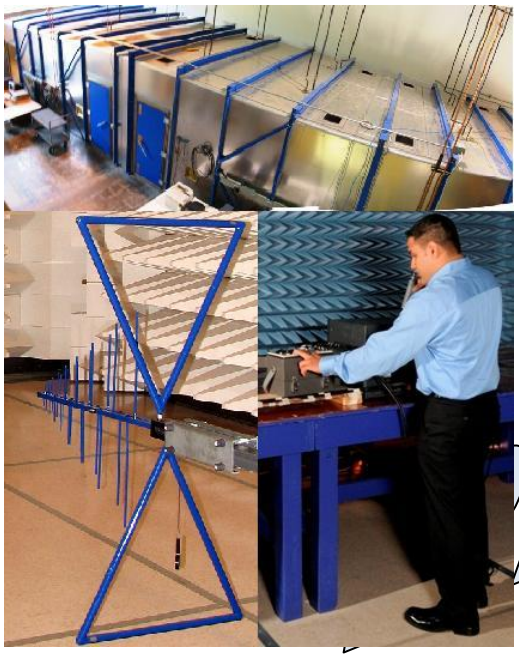
Revision A: Added Radiated Spurious Emissions & Band Edge data for External Antenna.

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.
Canyon Park
22116 23rd Drive S.E., Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20

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	NA	Pass
15.247(d)	RF Conducted Emissions	NA	Pass
15.247(d)	Radiated Emissions & Band Edge	NA	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not Applicable
NA1 = The manufacturer declares the EUT is battery powered.
NP = CKC Laboratories was not contracted to perform test.

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

Modifications During Testing

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

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

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

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

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

Configuration 1

Equipment Under Test:

Device	Manufacturer	Model #	S/N
500W / RIVAWA	Itron, Inc.	ERW-1601-001	01042023-cond

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	5CD941CCWS
Laptop PSU	HP	TPN-CA14	WHGRE0AVKCR55T
Adapter Board	Itron, Inc.	None	None

Configuration 2

Equipment Under Test:

Device	Manufacturer	Model #	S/N
500W / RIVAWA	Itron, Inc.	ERW-1601-001	01042023-rivawa-rad

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	5CD941CCWS
Laptop PSU	HP	TPN-CA14	WHGRE0AVKCR55T
Adapter Board	Itron, Inc.	None	None

Configuration 3

Equipment Under Test:

Device	Manufacturer	Model #	S/N
500WR / RIVAWRA	Itron, Inc.	ERW-1601-010	01042023-rivawra-rad

Support Equipment:

Device	Manufacturer	Model #	S/N
Laptop	HP	14-dq1033cl	5CD941CCWS
Laptop PSU	HP	TPN-CA14	WHGRE0AVKCR55T
Adapter Board	Itron, Inc.	None	None

Configuration 4 (External Antenna)

Equipment Under Test:

Device	Manufacturer	Model #	S/N
500W / RIVAWA	Itron, Inc.	ERW-1601-001	2803441-rivawa-rad-2

Support Equipment:

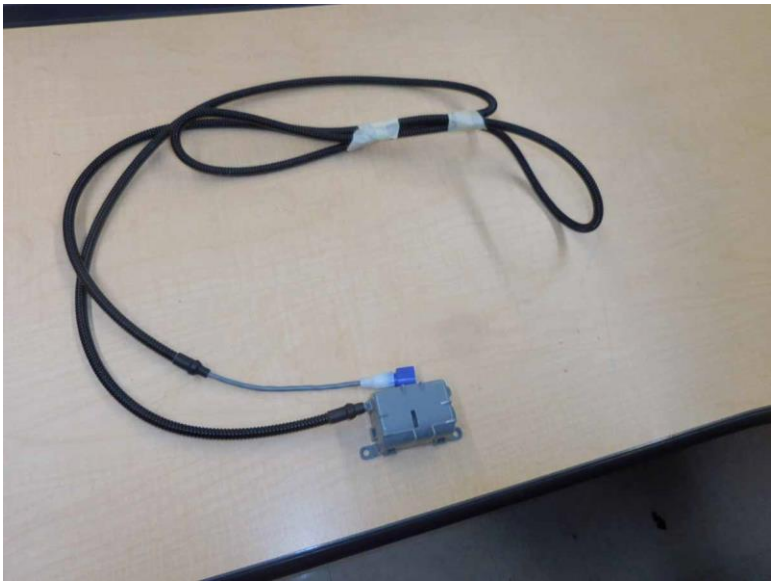
Device	Manufacturer	Model #	S/N
Antenna	Itron, Inc.	CFG-0900-003	12194430
Ground Plane	Itron, Inc.	4ft	NA
Openway Riva Gas Disconnect Flood Sensor 8'	Itorn, Inc.	TEL-7103-008	54AADFWYRAW

General Product Information:

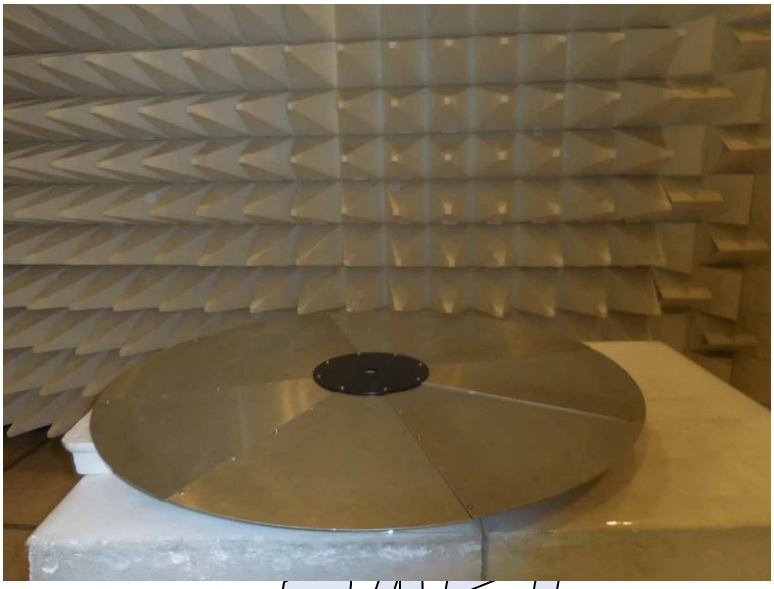
Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Operating Frequency Range:	902.4-927.6
Number of Hopping Channels:	64
Receiver Bandwidth and Synchronization:	The manufacturer declares the receiver input bandwidth matches the transmit channel bandwidth and shifts frequencies in synchronization with the transmitter.
Modulation Type(s):	GFSK, 150kbps
Maximum Duty Cycle:	Tested at 100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	4.78dBi, Internal Meander Antenna 2.5 dBi, External Omni Antenna
Beamforming Type:	NA
Antenna Connection Type:	Integral (External connector provided to facilitate testing)
Nominal Input Voltage:	Battery (6VDC)
Firmware / Software used for Test:	CLI Tool V.8.02.0 CSL V.9.1.5.0
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

Support Equipment Photo(s)

Antenna



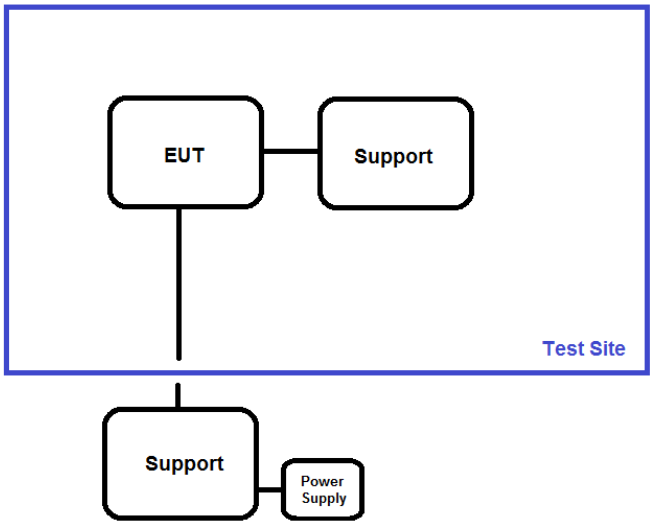
Flood Sensor

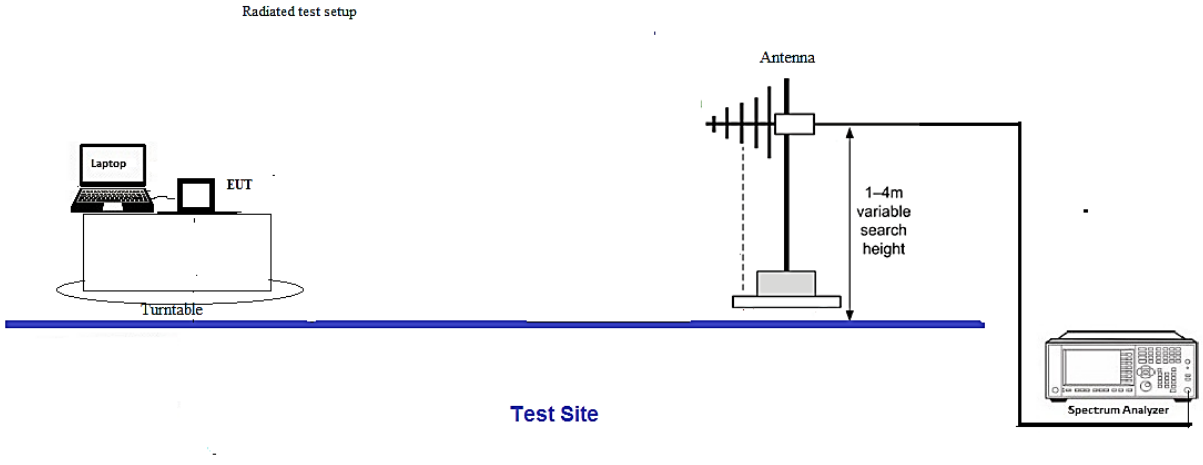


Ground Plane

Block Diagram of Test Setup(s)

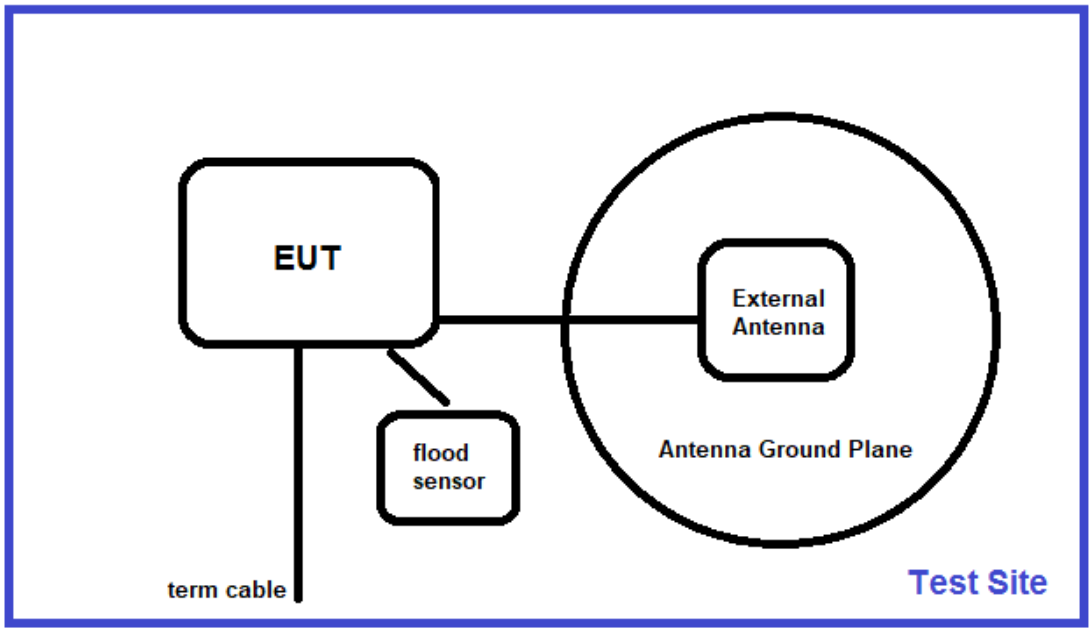
Test Setup Block Diagram





Test Setup Block Diagram

(External Antenna on Metal Lid Configurations)



FCC Part 15 Subpart C

15.247 Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	2/14/2023
Configuration:	1		
Test Setup:	EUT is setup for conducted measurements. It is directly connected to the analyzer via cable and attenuator.		

Environmental Conditions			
Temperature (ºC)	21	Relative Humidity (%):	38

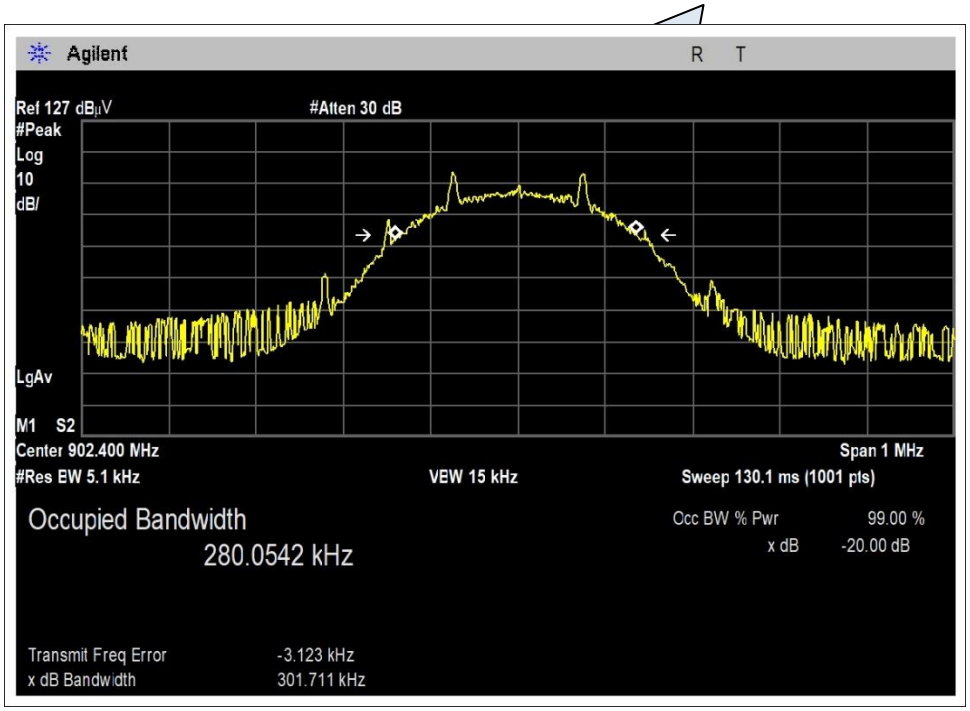
Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
P05503	Attenuator	Narda	766-10	6/8/2021	6/8/2023
P05353	Cable	Andrews	Heliax	2/23/2022	2/23/2024
03807	Spectrum Analyzer	Agilent	E4440A	10/6/2022	10/6/2024

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

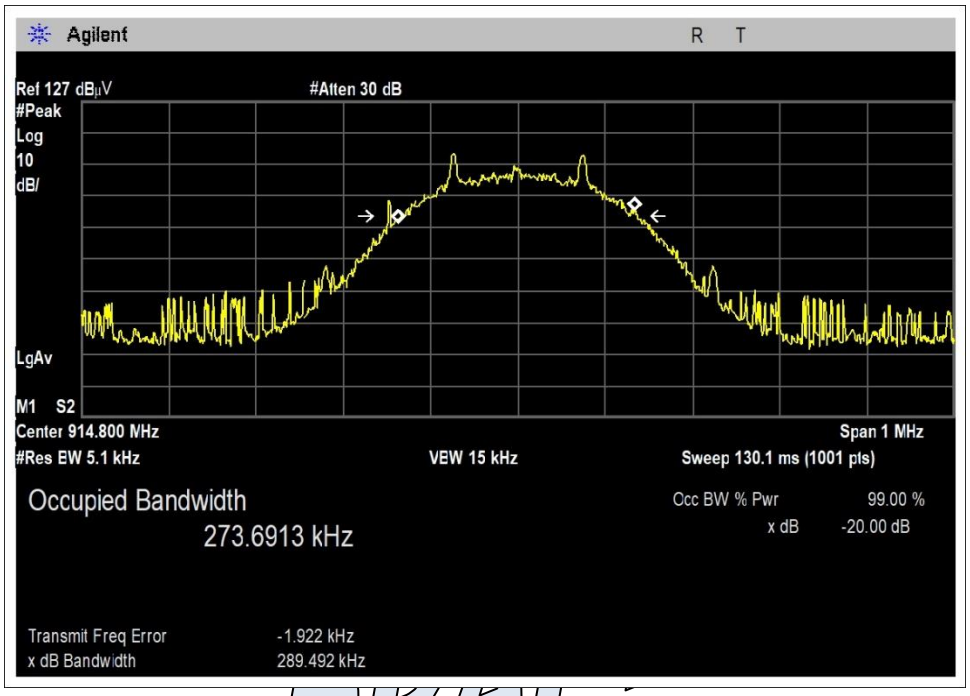
Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
902.4	1	GFSK	301.7	*See Note	NA
914.8	1	GFSK	289.5		
927.6	1	GFSK	283.8		

*For this Hybrid mode there is no requirement to meet the FHSS or DTS bandwidth limits. See Supplemental Section of data in 15.247 (f) Hybrid Systems.

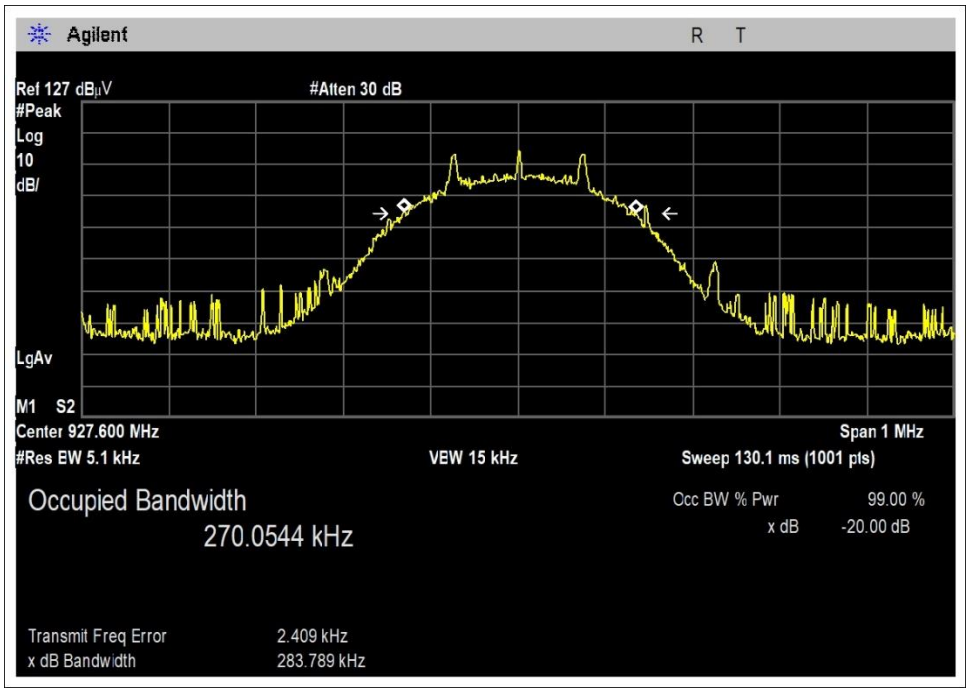
Plot(s)



Low Channel



Middle Channel

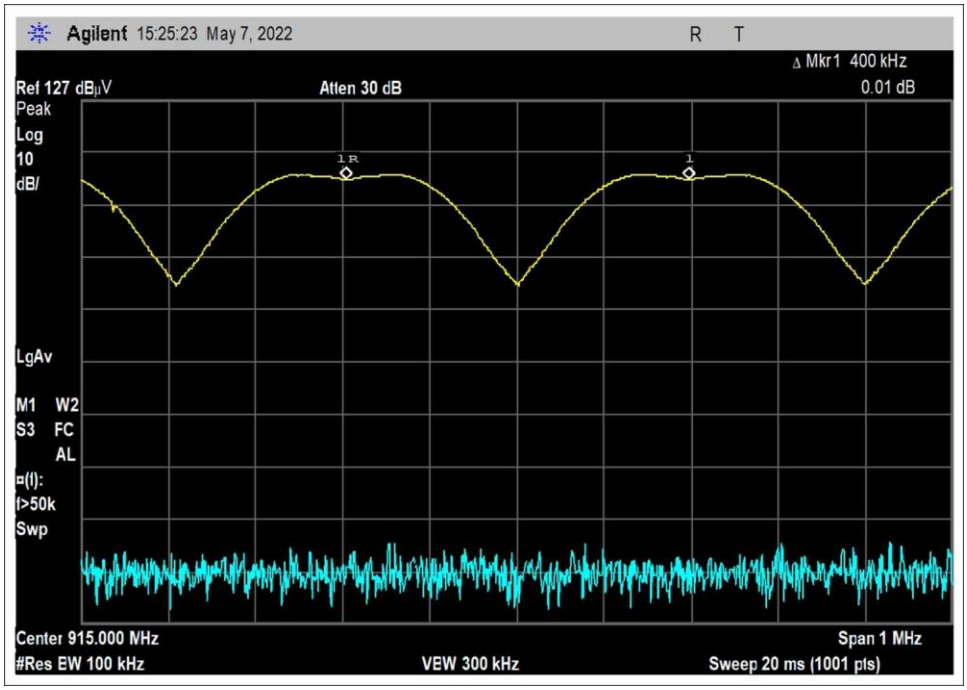


High Channel

15.247(a)(1) Carrier Separation

Test Data Summary				
Limit applied: 20dB bandwidth of the hopping channel.				
Antenna Port	**Operational Mode**	**Measured (kHz)**	**Limit (kHz)**	**Results**
1	Hopping	400	>301.7	Pass

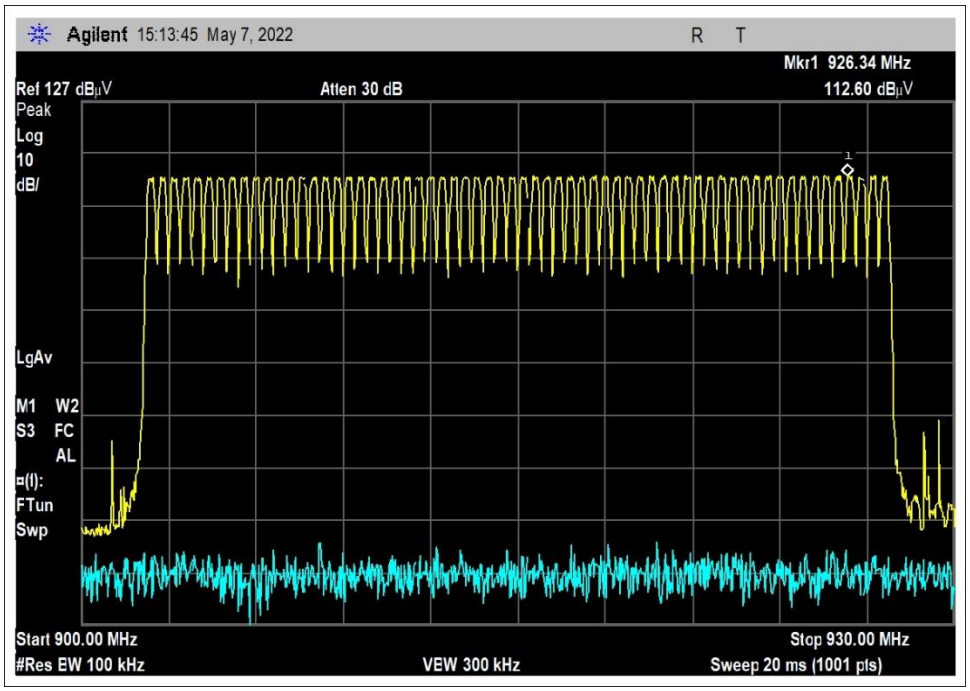
Plot(s)



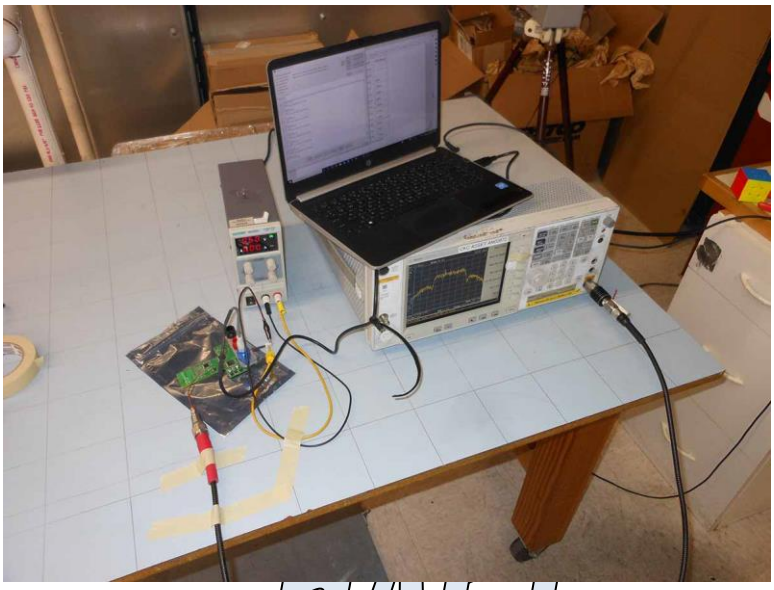
15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
$Limit = \begin{cases} 50\ Channels \mid 20\ dB\ BW < 250kHz \\ 25\ Channels \mid 20\ dB\ BW \geq 250kHz \end{cases}$				
Antenna Port	**Operational Mode**	**Measured (Channels)**	**Limit (Channels)**	**Results**
1	Hopping	64	≥25	Pass

Plot(s)



Test Setup Photo(s)



15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Bothell Lab C3	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	2/14/2023
Configuration:	1		
Test Setup:	EUT is setup for conducted measurements. It is directly connected to the analyzer via cable and attenuator.		

Test Data Summary - Voltage Variations

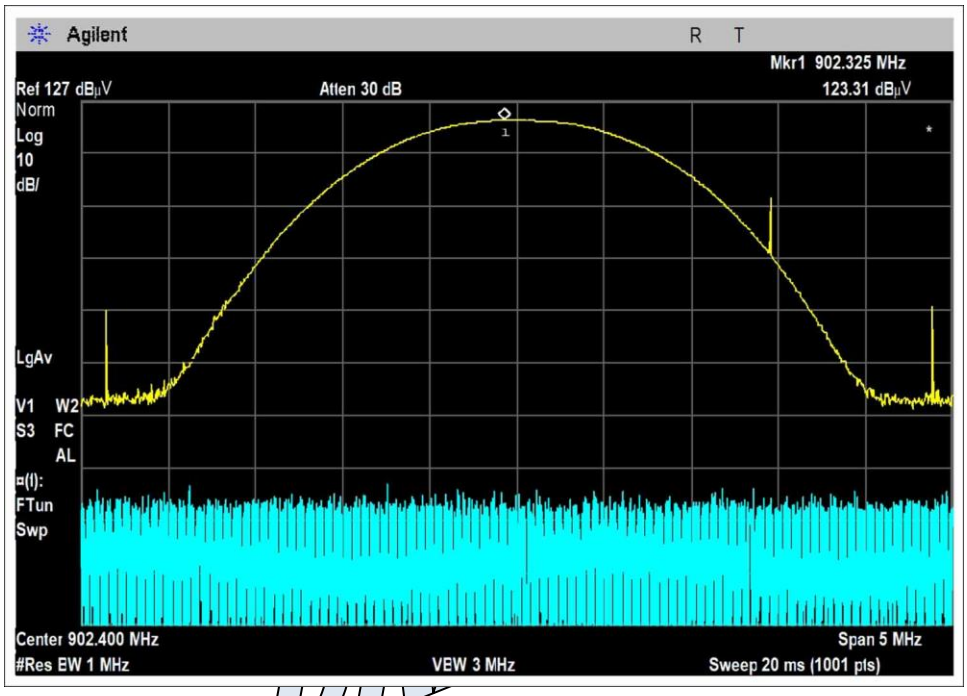
This equipment is battery powered. Power output tests were performed using a fresh battery.

Test Data Summary - RF Conducted Measurement

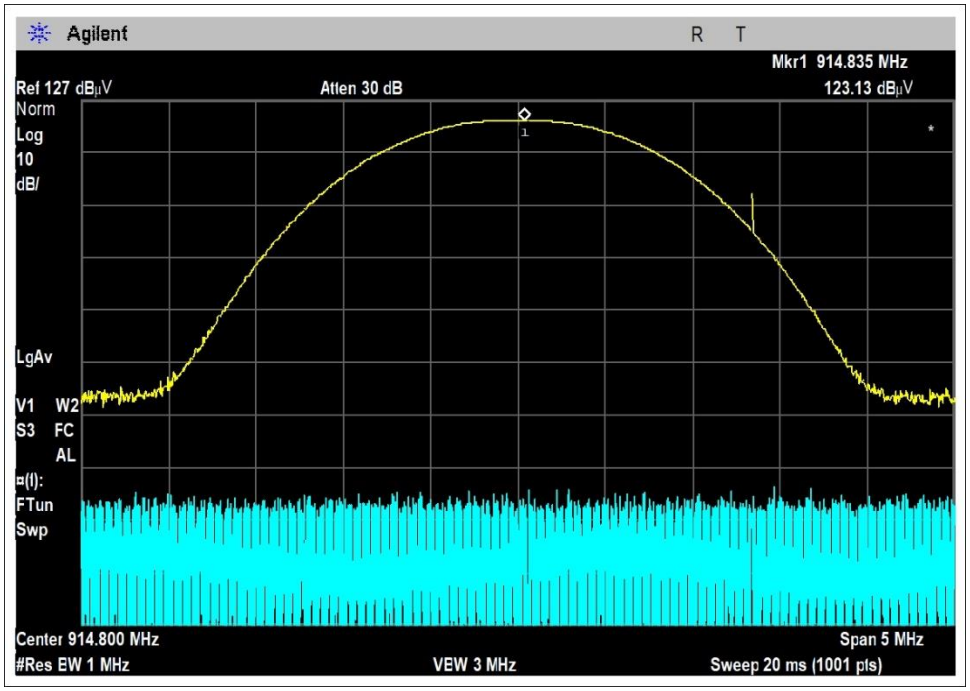
$$Limit = \begin{cases} 30dBm\ Conducted/36dBm\ EIRP \mid \geq 50\ Channels \\ 24dBm\ Conducted/30dBm\ EIRP \mid < 50\ Channels\ (\min 25) \end{cases}$$

Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
902.4	GFSK	Meander 4.78dBi	26.6	≤30	Pass
914.8	GFSK	Meander 4.78dBi	26.4	≤30	Pass
927.6	GFSK	Meander 4.78dBi	26.3	≤30	Pass

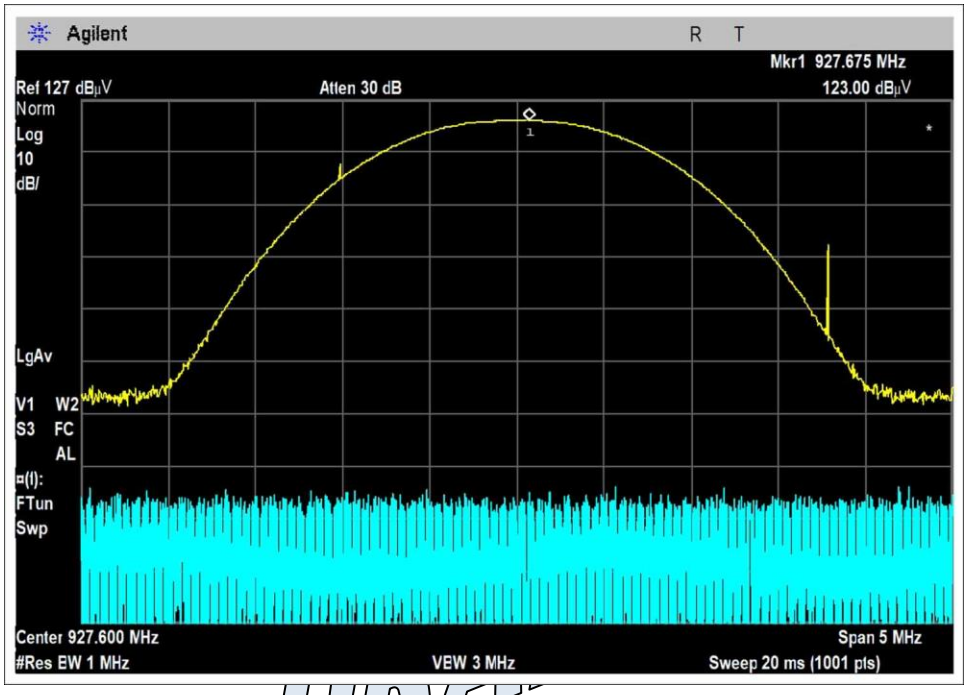
Plots



Low Channel



Middle Channel



High Channel

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(b) Power Output (902-928 MHz FHSS >50 Channels)**		
Work Order #:	**107748**	Date:	2/14/2023
Test Type:	**Conducted Emissions**	Time:	07:33:34
Tested By:	Matt Harrison	Sequence#:	1
Software:	EMITest 5.03.20		6VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

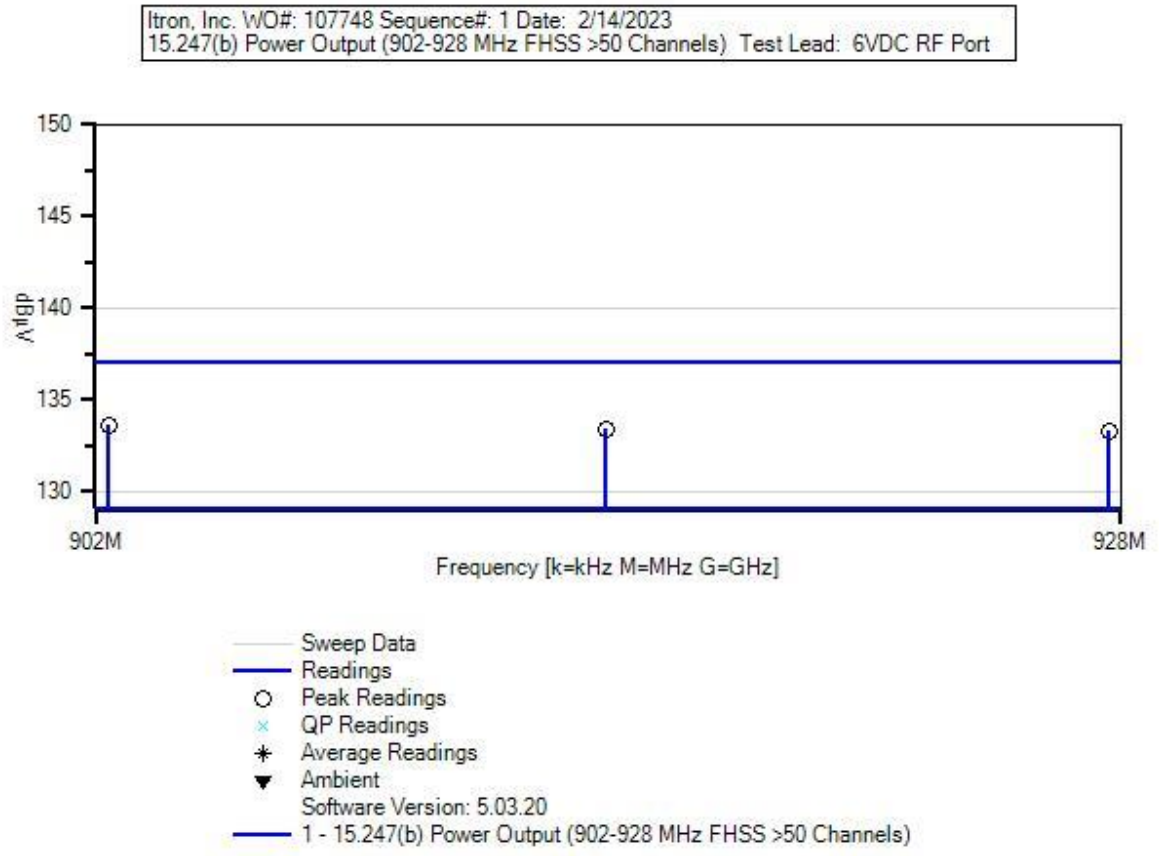
Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 18.6°C
Pressure: 100.9kPa
Humidity: 40%

Frequency Range: Fundamental
Frequency Tested: 902.4, 914.8, 927.6
Firmware Power Setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10 (2013)
Test Mode: Transmitting
Test Setup: EUT is set up for conducted measurement. It is directly connected to the Analyzer via cable and attenuator.
Modifications Added: None



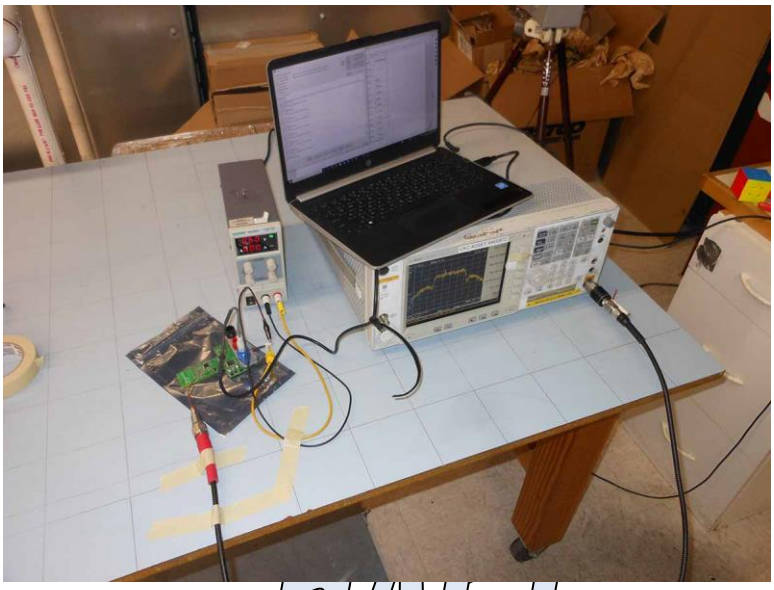
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	6/8/2021	6/8/2023
T2	ANP05353	Cable	Heliax	2/23/2022	2/23/2024
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023

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

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	902.325M	123.3	+10.1	+0.2			+0.0	133.6	137.0	-3.4	RF Po
2	914.835M	123.1	+10.1	+0.2			+0.0	133.4	137.0	-3.6	RF Po
3	927.675M	123.0	+10.1	+0.2			+0.0	133.3	137.0	-3.7	RF Po

Test Setup Photo(s)



15.247(d) RF Conducted Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**107748**	Date:	2/14/2023
Test Type:	**Conducted Emissions**	Time:	09:41:59
Tested By:	Matt Harrison	Sequence#:	4
Software:	EMITest 5.03.20		6VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

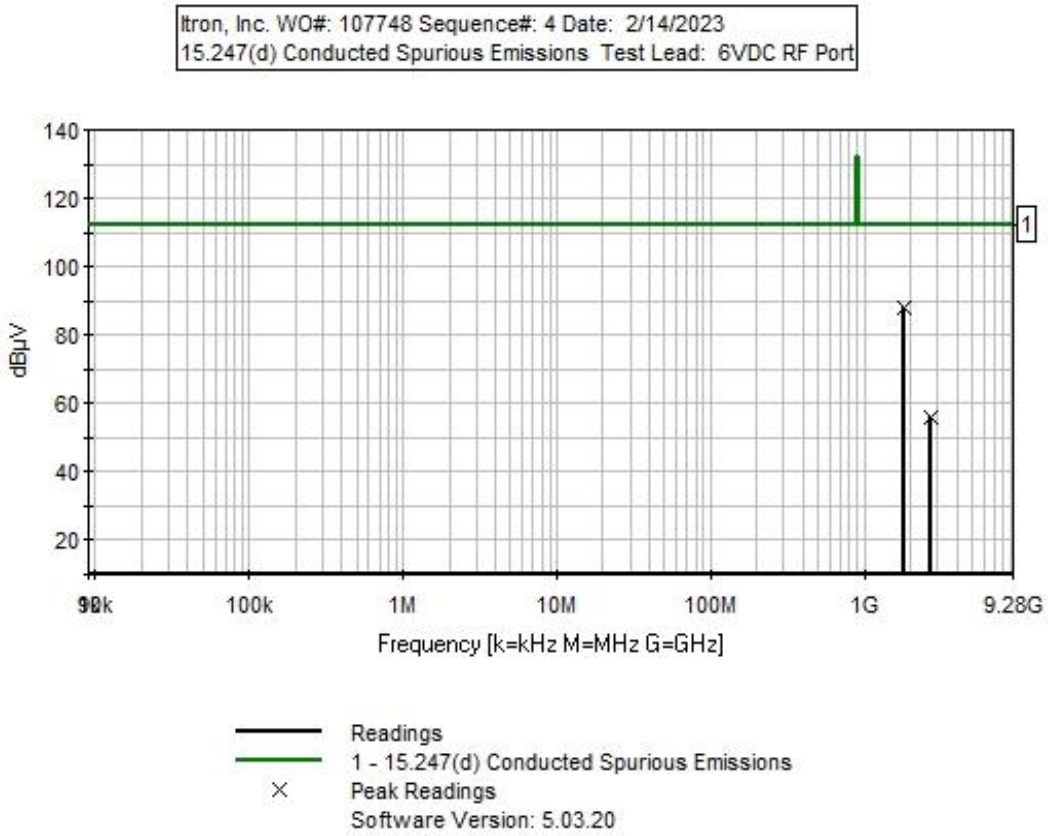
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 18.6°C
Pressure: 100.9kPa
Humidity: 40%

Frequency Range: 30M-10GHz
Frequency Tested: 914.8 (Low, Middle, and High channels were investigated, and worst case is represented)

Firmware Power Setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10 (2013)
Test Mode: Transmitting
Test Setup: EUT is set up for conducted measurement. It is directly connected to the Analyzer via cable and attenuator.
Modifications Added: None



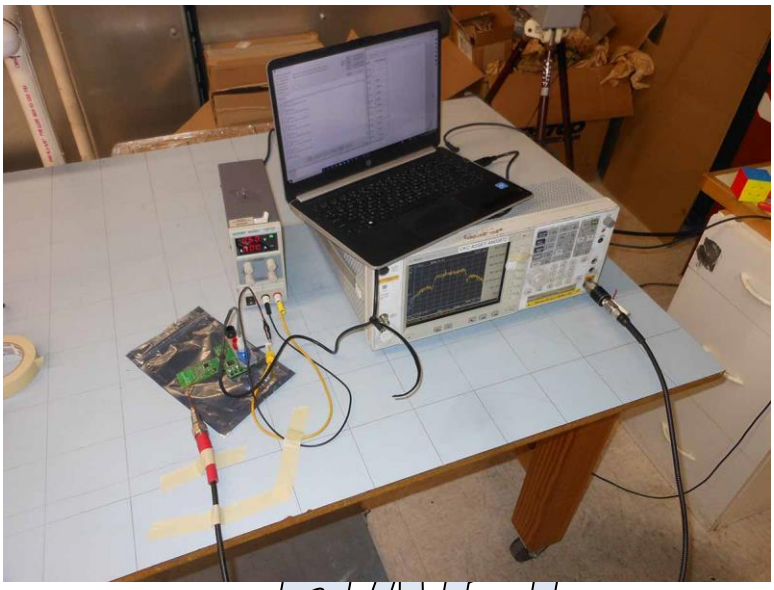
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	6/8/2021	6/8/2023
T2	ANP05353	Cable	Heliax	2/23/2022	2/23/2024
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023

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

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1829.750M	77.6	+10.2	+0.3			+0.0	88.1	112.3	-24.2	RF Po
2	2744.620M	45.3	+10.2	+0.4			+0.0	55.9	112.3	-56.4	RF Po

Test Setup Photo(s)



15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107748**	Date:	2/23/2023
Test Type:	**Radiated Scan**	Time:	07:21:11
Tested By:	Matt Harrison	Sequence#:	23
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

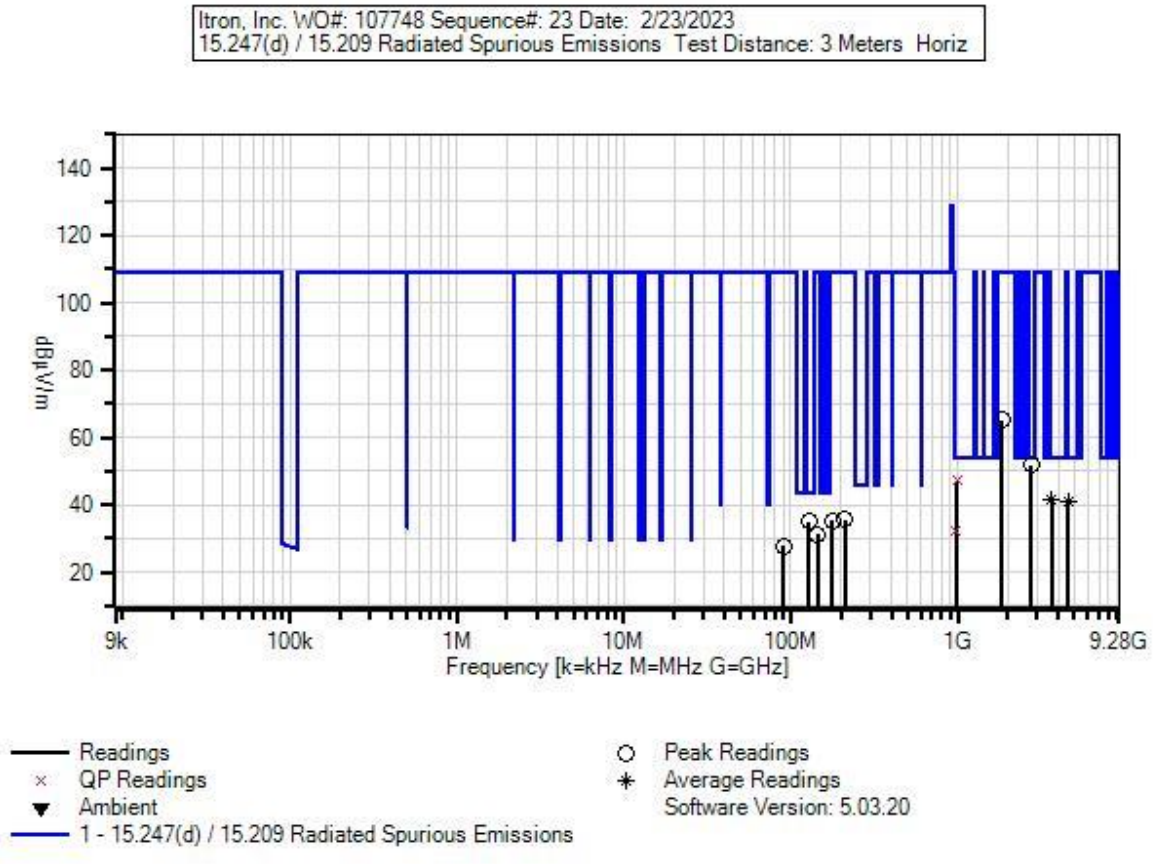
Test Environment Conditions:
Temperature: 18.6°C
Pressure: 100.9kPa
Humidity: 40%

Frequency Range: 9k-10GHz
Frequency Tested: 914.8 (Low, Middle, and High channels were investigated, and worst case is represented)

Firmware Power Setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10 (2013)
Test Mode: Transmitting
Test Setup: EUT is setup in a tabletop configuration. It is 80cm high for below 1GHz and 150cm above 1GHz, on a Styrofoam table.
Modifications Added: None

Notes: No emissions found within 20dB of the limit below 30MHz.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T4	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T5	AN02307	Preamp	8447D	1/6/2022	1/6/2024
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T6	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06452	Cable	Heliax	1/17/2022	1/17/2024
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T9	AN03155	Preamp	83017A	2/13/2023	2/13/2025

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

#	Freq	Rdng	T1 T5 T9	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2744.490M	50.8	+0.0 +0.0 -33.2	+0.0 +29.3	+0.5 +0.3	+2.8 +1.3	+0.0	51.8	54.0	-2.2	Horiz
2	992.740M QP	39.9	+29.9 -27.1 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	47.1	54.0	-6.9	Vert
^	992.740M	44.0	+29.9 -27.1 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	51.2	54.0	-2.8	Vert
4	128.610M	47.7	+13.4 -27.6 +0.0	+0.7 +0.0	+0.1 +0.0	+0.7 +0.0	+0.0	35.0	43.5	-8.5	Vert
5	3659.200M Ave	36.7	+0.0 +0.0 -32.8	+0.0 +31.7	+0.6 +0.2	+3.5 +1.5	+0.0	41.4	54.0	-12.6	Horiz
^	3659.200M	48.8	+0.0 +0.0 -32.8	+0.0 +31.7	+0.6 +0.2	+3.5 +1.5	+0.0	53.5	54.0	-0.5	Horiz
7	4574.000M Ave	34.4	+0.0 +0.0 -32.8	+0.0 +32.2	+0.6 +0.5	+4.2 +1.7	+0.0	40.8	54.0	-13.2	Horiz
^	4574.000M	48.0	+0.0 +0.0 -32.8	+0.0 +32.2	+0.6 +0.5	+4.2 +1.7	+0.0	54.4	54.0	+0.4	Horiz
9	974.860M QP	24.9	+30.3 -27.2 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	32.4	54.0	-21.6	Vert
^	974.860M	49.7	+30.3 -27.2 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	57.2	54.0	+3.2	Vert
11	1829.470M	66.9	+0.0 +0.0 -33.7	+0.0 +27.5	+0.4 +0.6	+2.3 +1.0	+0.0	65.0	109.0	-44.0	Horiz
12	210.120M	44.4	+16.5 -27.2 +0.0	+0.9 +0.0	+0.1 +0.0	+0.8 +0.0	+0.0	35.5	109.0	-73.5	Vert
13	177.630M	45.2	+15.8 -27.4 +0.0	+0.9 +0.0	+0.1 +0.0	+0.7 +0.0	+0.0	35.3	109.0	-73.7	Vert
14	145.710M	43.1	+14.1 -27.6 +0.0	+0.8 +0.0	+0.1 +0.0	+0.7 +0.0	+0.0	31.2	109.0	-77.8	Vert
15	90.990M	41.5	+12.8 -27.8 +0.0	+0.6 +0.0	+0.1 +0.0	+0.5 +0.0	+0.0	27.7	109.0	-81.3	Vert

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107748**	Date:	2/23/2023
Test Type:	**Radiated Scan**	Time:	07:46:02
Tested By:	Matt Harrison	Sequence#:	19
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

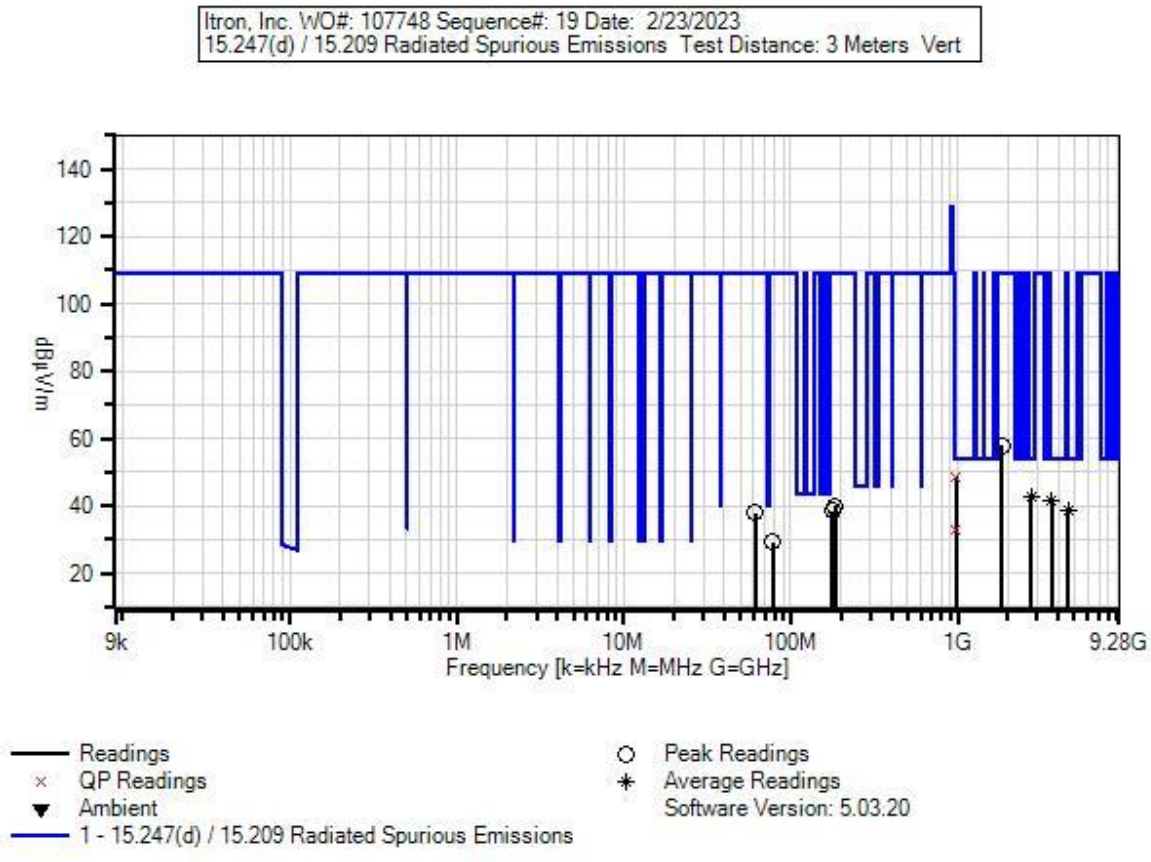
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 18.6°C
Pressure: 100.9kPa
Humidity: 40%

Frequency Range: 9k-10GHz
Frequency Tested: 902.4, 914.8, 927.6
Firmware Power Setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10 (2013)
Test Mode: Transmitting
Test Setup: EUT is setup in a tabletop configuration. It is 80cm high for below 1GHz and 150cm above 1GHz, on a Styrofoam table.
Modifications Added: None

Notes: No emissions found within 20dB of the limit below 30MHz.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T4	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T5	AN02307	Preamp	8447D	1/6/2022	1/6/2024
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T6	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T7	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T8	ANP06452	Cable	Heliax	1/17/2022	1/17/2024
	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024
T9	AN03155	Preamp	83017A	2/13/2023	2/13/2025

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

#	Freq	Rdng	T1 T5 T9	T2 T6	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	981.250M QP	41.2	+30.1 -27.1 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	48.6	54.0	-5.4	Vert
^	981.250M	46.7	+30.1 -27.1 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	54.1	54.0	+0.1	Vert
3	2744.400M Ave	41.6	+0.0 +0.0 -33.2	+0.0 +29.3	+0.5 +0.3	+2.8 +1.3	+0.0	42.6	54.0	-11.4	Vert
^	2744.400M	52.7	+0.0 +0.0 -33.2	+0.0 +29.3	+0.5 +0.3	+2.8 +1.3	+0.0	53.7	54.0	-0.3	Vert
5	3659.200M Ave	36.8	+0.0 +0.0 -32.8	+0.0 +31.7	+0.6 +0.2	+3.5 +1.5	+0.0	41.5	54.0	-12.5	Vert
^	3659.200M	48.5	+0.0 +0.0 -32.8	+0.0 +31.7	+0.6 +0.2	+3.5 +1.5	+0.0	53.2	54.0	-0.8	Vert
7	4573.940M Ave	32.0	+0.0 +0.0 -32.8	+0.0 +32.2	+0.6 +0.5	+4.2 +1.7	+0.0	38.4	54.0	-15.6	Vert
^	4573.940M	45.1	+0.0 +0.0 -32.8	+0.0 +32.2	+0.6 +0.5	+4.2 +1.7	+0.0	51.5	54.0	-2.5	Vert
9	981.940M QP	25.4	+30.1 -27.1 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	32.8	54.0	-21.2	Vert
^	981.940M	49.9	+30.1 -27.1 +0.0	+2.5 +0.0	+0.3 +0.0	+1.6 +0.0	+0.0	57.3	54.0	+3.3	Vert
11	1829.765M	59.8	+0.0 +0.0 -33.7	+0.0 +27.5	+0.4 +0.6	+2.3 +1.0	+0.0	57.9	109.0	-51.1	Vert
12	184.470M	49.7	+15.6 -27.3 +0.0	+0.9 +0.0	+0.1 +0.0	+0.8 +0.0	+0.0	39.8	109.0	-69.2	Vert
13	175.920M	48.4	+15.7 -27.4 +0.0	+0.9 +0.0	+0.1 +0.0	+0.7 +0.0	+0.0	38.4	109.0	-70.6	Vert
14	61.350M	52.0	+12.6 -27.8 +0.0	+0.5 +0.0	+0.1 +0.0	+0.5 +0.0	+0.0	37.9	109.0	-71.1	Vert
15	77.880M	43.0	+12.7 -27.8 +0.0	+0.6 +0.0	+0.1 +0.0	+0.5 +0.0	+0.0	29.1	109.0	-79.9	Vert

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107748**	Date:	5/26/2023
Test Type:	**Maximized Emissions**	Time:	19:59:38
Tested By:	Michael Atkinson	Sequence#:	53
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

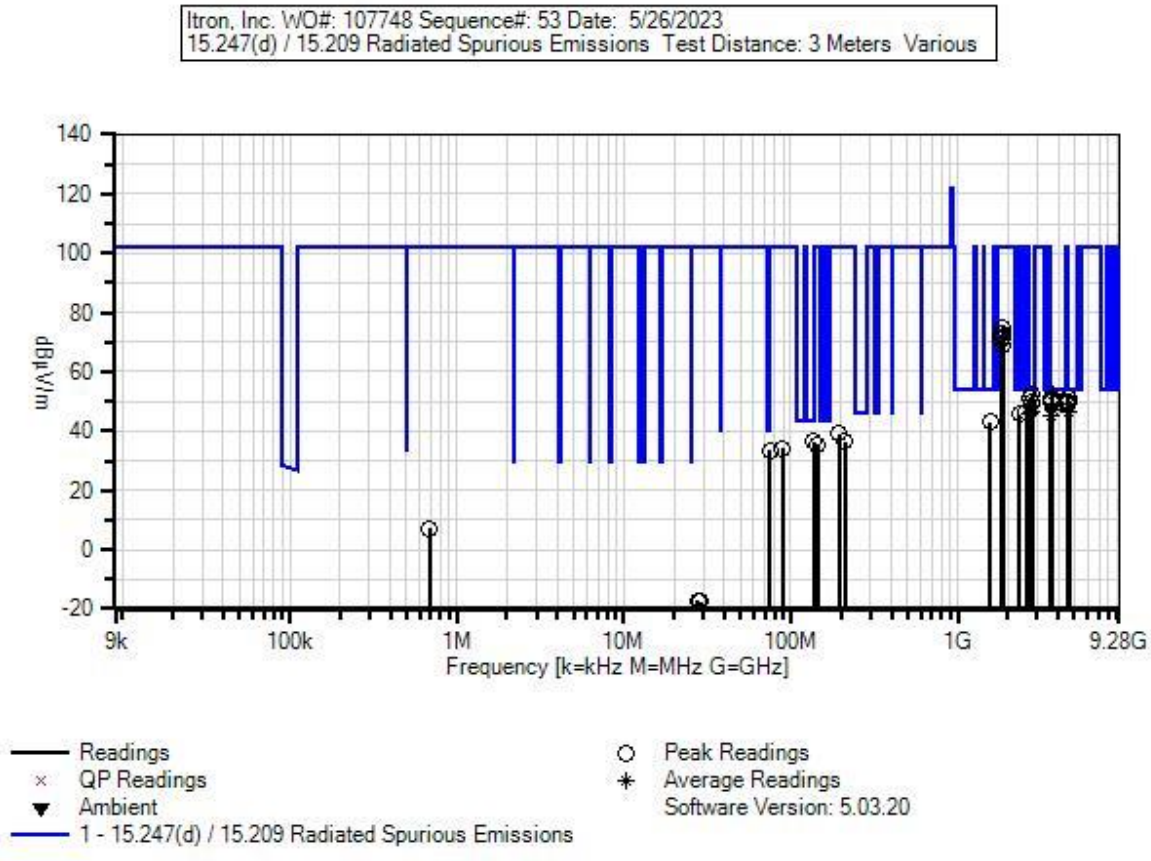
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 24° C
Pressure: 100.9 kPa
Humidity: 43%

Frequency Range: 9kHz-10GHz
Frequency tested: 902.4, 914.8, 927.6
Firmware power setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10: 2013
Test Mode: Transmitting
Test Setup: EUT is setup in a tabletop configuration. It is 80cm high for below 1GHz and 150cm above 1GHz, on a Styrofoam table.
Modifications Added: None

Horizontal and Vertical antenna polarities investigated above 30MHz, worst case reported.
3 orthogonal axes investigated below 30MHz, worst case reported.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T2	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T3	ANP06454	Cable	Heliax	1/25/2022	1/25/2024
T4	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T5	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025
T6	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T7	ANP06515	Cable	Heliax	3/1/2023	3/1/2025
T8	AN01467ANSI	Horn Antenna	3115	6/14/2021	6/14/2023
T9	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T10	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T11	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025
T12	ANP07929	Attenuator	PE7004-6	3/7/2022	3/7/2024

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

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7 T11	T4 T8 T12	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	3710.220M	44.1	+0.0	+0.0	+1.4	+0.0	+0.0	52.7	54.0	-1.3	Vert
	Ave		+0.0	+0.0	+3.6	+30.7			High		
			-33.9	+0.2	+0.8	+5.8					
^	3710.220M	50.2	+0.0	+0.0	+1.4	+0.0	+0.0	58.8	54.0	+4.8	Vert
			+0.0	+0.0	+3.6	+30.7			High		
			-33.9	+0.2	+0.8	+5.8					
3	2783.050M	47.7	+0.0	+0.0	+1.2	+0.0	+0.0	52.1	54.0	-1.9	Horz
			+0.0	+0.0	+3.0	+28.1			High		
			-34.5	+0.3	+0.5	+5.8					
4	2707.270M	46.8	+0.0	+0.0	+1.2	+0.0	+0.0	51.3	54.0	-2.7	Horz
			+0.0	+0.0	+3.0	+28.3			Low		
			-34.5	+0.2	+0.5	+5.8					
5	4574.020M	39.2	+0.0	+0.0	+1.5	+0.0	+0.0	51.2	54.0	-2.8	Vert
			+0.0	+0.0	+4.2	+32.4			Mid		
			-33.8	+0.5	+1.3	+5.9					
6	4573.820M	39.1	+0.0	+0.0	+1.5	+0.0	+0.0	51.0	54.0	-3.0	Horz
			+0.0	+0.0	+4.2	+32.3			Mid		
			-33.8	+0.5	+1.3	+5.9					
7	3659.300M	42.3	+0.0	+0.0	+1.4	+0.0	+0.0	50.8	54.0	-3.2	Vert
			+0.0	+0.0	+3.7	+30.5			Mid		
			-34.0	+0.2	+0.9	+5.8					
8	3659.100M	42.0	+0.0	+0.0	+1.4	+0.0	+0.0	50.5	54.0	-3.5	Horz
			+0.0	+0.0	+3.7	+30.5			Mid		
			-34.0	+0.2	+0.9	+5.8					
9	4638.040M	37.6	+0.0	+0.0	+1.6	+0.0	+0.0	49.9	54.0	-4.1	Horz
			+0.0	+0.0	+4.2	+32.6			High		
			-33.8	+0.4	+1.4	+5.9					
10	2744.300M	45.3	+0.0	+0.0	+1.2	+0.0	+0.0	49.8	54.0	-4.2	Horz
			+0.0	+0.0	+3.0	+28.2			Mid		
			-34.5	+0.3	+0.5	+5.8					
11	3609.625M	41.1	+0.0	+0.0	+1.3	+0.0	+0.0	49.6	54.0	-4.4	Horz
			+0.0	+0.0	+3.7	+30.3			Low		
			-34.0	+0.3	+1.0	+5.9					
12	4512.305M	38.3	+0.0	+0.0	+1.5	+0.0	+0.0	49.6	54.0	-4.4	Vert
			+0.0	+0.0	+4.2	+32.0			Low		
			-33.8	+0.5	+1.1	+5.8					
13	4512.025M	37.8	+0.0	+0.0	+1.5	+0.0	+0.0	49.1	54.0	-4.9	Horz
			+0.0	+0.0	+4.2	+32.0			Low		
			-33.8	+0.5	+1.1	+5.8					
14	2782.820M	44.2	+0.0	+0.0	+1.2	+0.0	+0.0	48.5	54.0	-5.5	Vert
	Ave		+0.0	+0.0	+3.0	+28.0			High		
			-34.5	+0.3	+0.5	+5.8					
^	2782.820M	50.0	+0.0	+0.0	+1.2	+0.0	+0.0	54.3	54.0	+0.3	Vert
			+0.0	+0.0	+3.0	+28.0			High		
			-34.5	+0.3	+0.5	+5.8					

16	74.540M	19.4	+0.5 +12.9 +0.0	+0.5 +0.0 +0.0	+0.2 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	33.5	40.0	-6.5	Vert
17	3710.540M Ave	38.4	+0.0 +0.0 -33.9	+0.0 +0.0 +0.2	+1.4 +3.6 +0.8	+0.0 +30.7 +5.8	+0.0	47.0	54.0 High	-7.0	Horz
^	3710.540M	45.9	+0.0 +0.0 -33.9	+0.0 +0.0 +0.2	+1.4 +3.6 +0.8	+0.0 +30.7 +5.8	+0.0	54.5	54.0 High	+0.5	Horz
19	136.420M	20.7	+0.7 +14.0 +0.0	+0.7 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	36.4	43.5	-7.1	Vert
20	4638.080M Ave	34.3	+0.0 +0.0 -33.8	+0.0 +0.0 +0.4	+1.6 +4.2 +1.4	+0.0 +32.6 +5.9	+0.0	46.6	54.0 High	-7.4	Vert
^	4638.080M	42.4	+0.0 +0.0 -33.8	+0.0 +0.0 +0.4	+1.6 +4.2 +1.4	+0.0 +32.6 +5.9	+0.0	54.7	54.0 High	+0.7	Vert
22	2744.480M Ave	41.9	+0.0 +0.0 -34.5	+0.0 +0.0 +0.3	+1.2 +3.0 +0.5	+0.0 +28.2 +5.8	+0.0	46.4	54.0 Mid	-7.6	Vert
^	2744.480M	48.0	+0.0 +0.0 -34.5	+0.0 +0.0 +0.3	+1.2 +3.0 +0.5	+0.0 +28.2 +5.8	+0.0	52.5	54.0 Mid	-1.5	Vert
24	2707.205M Ave	41.6	+0.0 +0.0 -34.5	+0.0 +0.0 +0.2	+1.2 +3.0 +0.5	+0.0 +28.3 +5.8	+0.0	46.1	54.0 Low	-7.9	Vert
^	2707.205M	48.4	+0.0 +0.0 -34.5	+0.0 +0.0 +0.2	+1.2 +3.0 +0.5	+0.0 +28.3 +5.8	+0.0	52.9	54.0 Low	-1.1	Vert
26	2350.000M	42.9	+0.0 +0.0 -34.6	+0.0 +0.0 +0.2	+1.1 +2.7 +0.5	+0.0 +27.2 +5.8	+0.0	45.8	54.0	-8.2	Vert
27	3609.325M Ave	36.8	+0.0 +0.0 -34.0	+0.0 +0.0 +0.3	+1.3 +3.7 +1.0	+0.0 +30.3 +5.9	+0.0	45.3	54.0 Low	-8.7	Vert
^	3609.325M	43.9	+0.0 +0.0 -34.0	+0.0 +0.0 +0.3	+1.3 +3.7 +1.0	+0.0 +30.3 +5.9	+0.0	52.4	54.0 Low	-1.6	Vert
29	1567.000M	43.5	+0.0 +0.0 -35.4	+0.0 +0.0 +0.4	+0.9 +2.1 +0.4	+0.0 +25.3 +5.8	+0.0	43.0	54.0	-11.0	Vert
30	1855.300M	73.9	+0.0 +0.0 -35.0	+0.0 +0.0 +0.6	+1.0 +2.3 +0.4	+0.0 +26.1 +5.8	+0.0	75.1	102.0 High	-26.9	Vert
31	1804.825M	72.1	+0.0 +0.0 -35.1	+0.0 +0.0 +0.6	+1.0 +2.2 +0.4	+0.0 +25.7 +5.8	+0.0	72.7	102.0 Low	-29.3	Vert
32	1829.400M	71.7	+0.0 +0.0 -35.1	+0.0 +0.0 +0.6	+1.0 +2.3 +0.4	+0.0 +25.9 +5.8	+0.0	72.6	102.0 Mid	-29.4	Vert

33	1829.360M	70.7	+0.0 +0.0 -35.1	+0.0 +0.0 +0.6	+1.0 +2.3 +0.4	+0.0 +25.9 +5.8	+0.0	71.6	102.0 Mid	-30.4	Horz
34	1804.800M	70.2	+0.0 +0.0 -35.1	+0.0 +0.0 +0.6	+1.0 +2.2 +0.4	+0.0 +25.7 +5.8	+0.0	70.8	102.0 Low	-31.2	Horz
35	1855.340M	67.9	+0.0 +0.0 -35.0	+0.0 +0.0 +0.6	+1.0 +2.3 +0.4	+0.0 +26.1 +5.8	+0.0	69.1	102.0 High	-32.9	Horz
36	2575.000M	41.9	+0.0 +0.0 -34.5	+0.0 +0.0 +0.4	+1.2 +2.9 +0.5	+0.0 +28.3 +5.8	+0.0	46.5	102.0	-55.5	Horz
37	193.710M	21.7	+0.9 +15.4 +0.0	+0.8 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	39.1	102.0	-62.9	Horiz
38	211.200M	17.8	+0.9 +16.6 +0.0	+0.8 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	36.4	102.0	-65.6	Horiz
39	145.260M	19.6	+0.8 +14.2 +0.0	+0.7 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	35.6	102.0	-66.4	Vert
40	89.330M	20.4	+0.6 +12.6 +0.0	+0.5 +0.0 +0.0	+0.2 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	34.3	102.0	-67.7	Vert
41	75.220M	19.3	+0.5 +12.9 +0.0	+0.5 +0.0 +0.0	+0.2 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	33.4	102.0	-68.6	Horiz
42	687.900k	37.8	+0.0 +0.0 +0.0	+0.0 +9.5 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	-40.0	7.3	102.0	-94.7	Para
43	27.680M	17.9	+0.0 +0.0 +0.0	+0.0 +4.7 +0.0	+0.1 +0.3 +0.0	+0.0 +0.0 +0.0	-40.0	-17.0	102.0	-119.0	Groun
44	28.680M	18.0	+0.0 +0.0 +0.0	+0.0 +4.2 +0.0	+0.1 +0.3 +0.0	+0.0 +0.0 +0.0	-40.0	-17.4	102.0	-119.4	Groun
45	28.680M	13.8	+0.0 +0.0 +0.0	+0.0 +4.2 +0.0	+0.1 +0.3 +0.0	+0.0 +0.0 +0.0	-40.0	-21.6	102.0	-123.6	Para

Band Edge

Band Edge Summary (Configuration 2)					
Operating Mode: Single Channel (Low and High)					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK	Meander	39.9	<46	Pass
902	GFSK	Meander	81.4	<109	Pass
928	GFSK	Meander	78.0	<109	Pass
960	GFSK	Meander	48.2	<54	Pass

Band Edge Summary (Configuration 2)					
Operating Mode: Hopping					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK	Meander	39.9	<46	Pass
902	GFSK	Meander	83.2	<109	Pass
928	GFSK	Meander	73.9	<109	Pass
960	GFSK	Meander	46.9	<54	Pass

Band Edge Summary (Configuration 3)					
Operating Mode: Single Channel (Low and High)					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK	Meander	39.7	<46	Pass
902	GFSK	Meander	80.4	<109	Pass
928	GFSK	Meander	80.6	<109	Pass
960	GFSK	Meander	46.2	<54	Pass

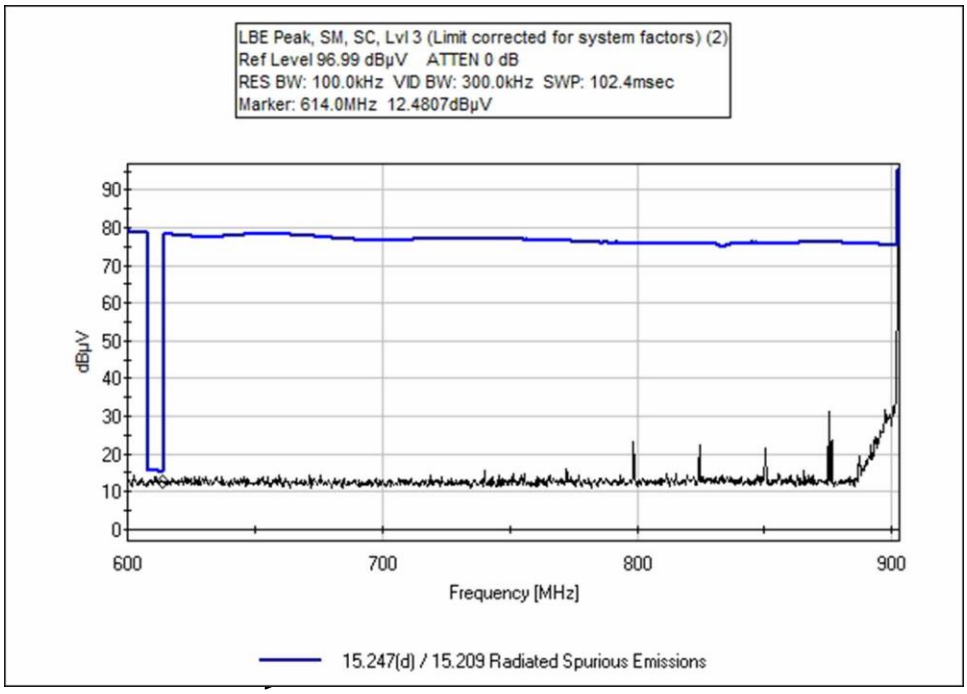
Band Edge Summary (Configuration 3)					
Operating Mode: Hopping					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK	Meander	39.7	<46	Pass
902	GFSK	Meander	83.2	<109	Pass
928	GFSK	Meander	78.6	<109	Pass
960	GFSK	Meander	46.1	<54	Pass

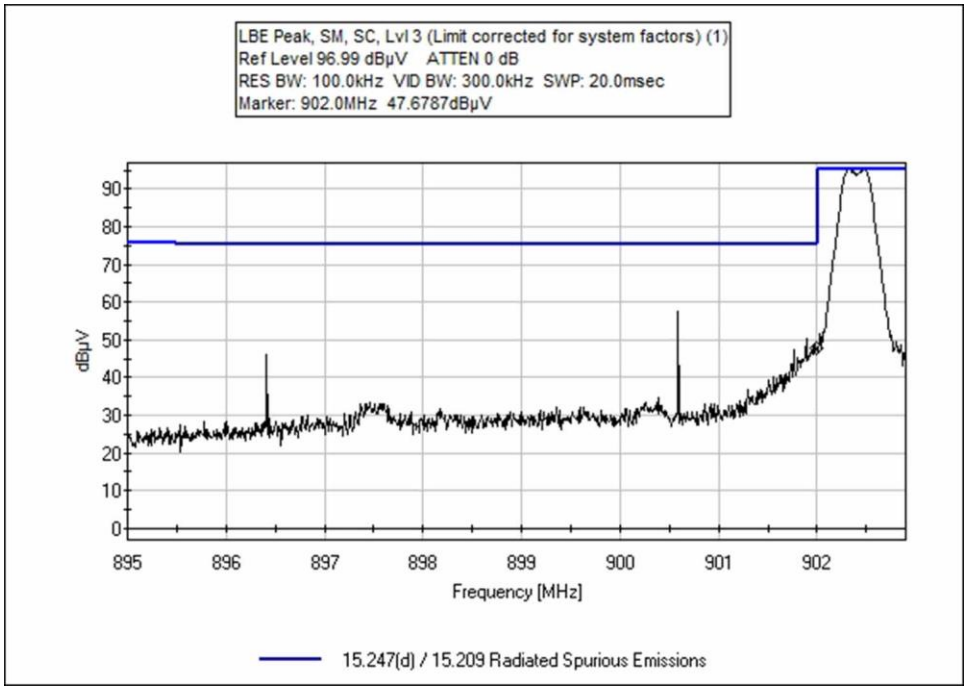
Band Edge Summary (Configuration 4)					
Operating Mode: Single Channel (Low and High)					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK	External Antenna – Pit on Metal Lid	40.5	<46	Pass
902	GFSK	External Antenna – Pit on Metal Lid	69.4	<102	Pass
928	GFSK	External Antenna – Pit on Metal Lid	75.8	<106	Pass
960	GFSK	External Antenna – Pit on Metal Lid	45.0	<54	Pass

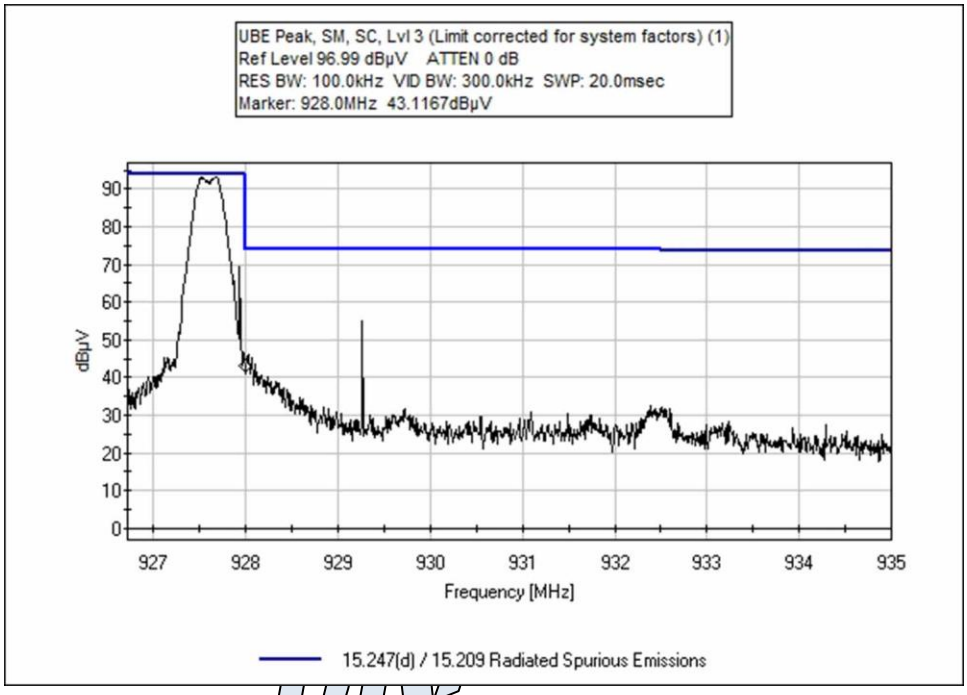
Band Edge Summary (Configuration 4)					
Operating Mode: Hopping					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614	GFSK	External Antenna – Pit on Metal Lid	40.5	<46	Pass
902	GFSK	External Antenna – Pit on Metal Lid	71.0	<102	Pass
928	GFSK	External Antenna – Pit on Metal Lid	74.7	<106	Pass
960	GFSK	External Antenna – Pit on Metal Lid	45.1	<54	Pass

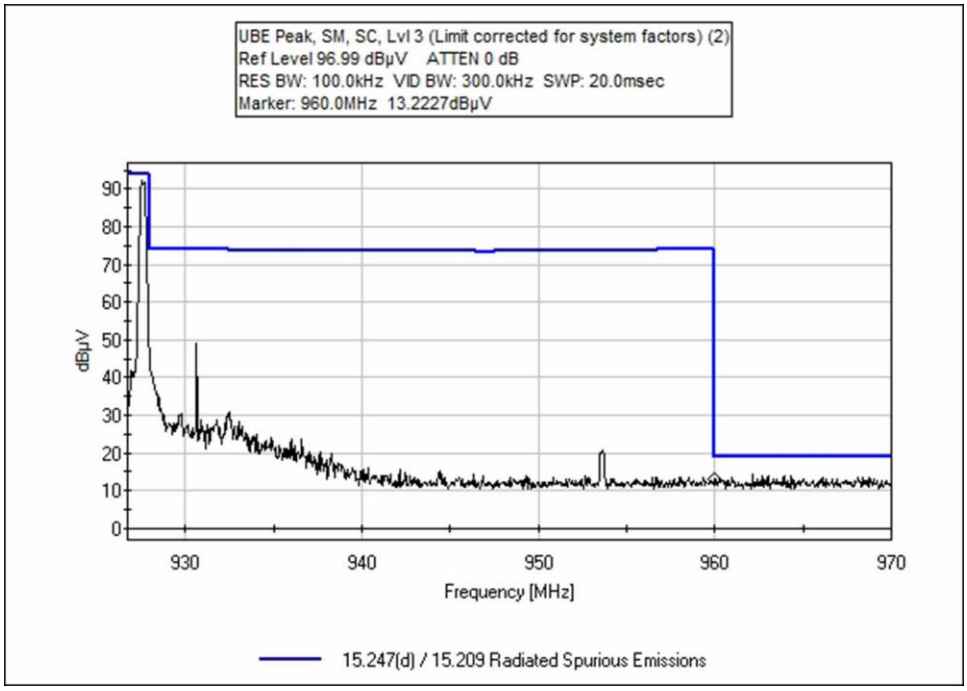
Band Edge Plots

Configuration 2; Single Channel

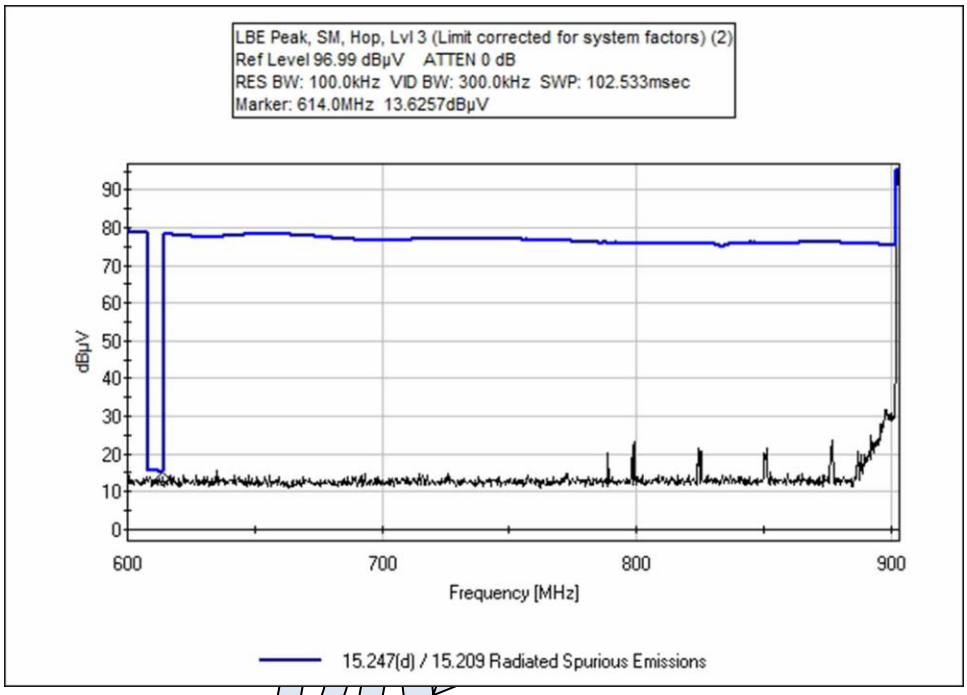


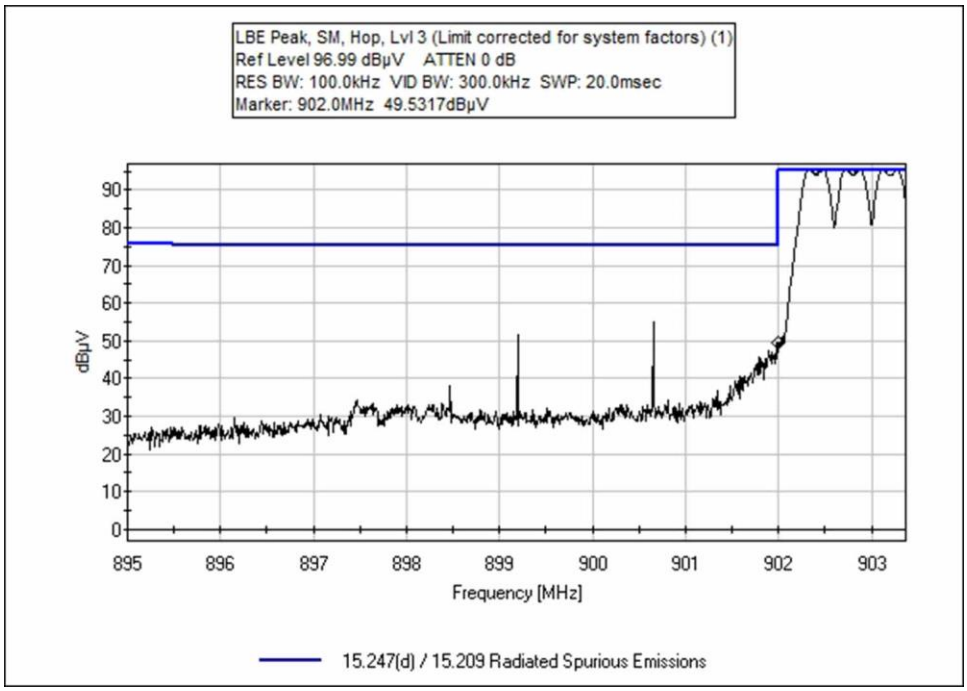


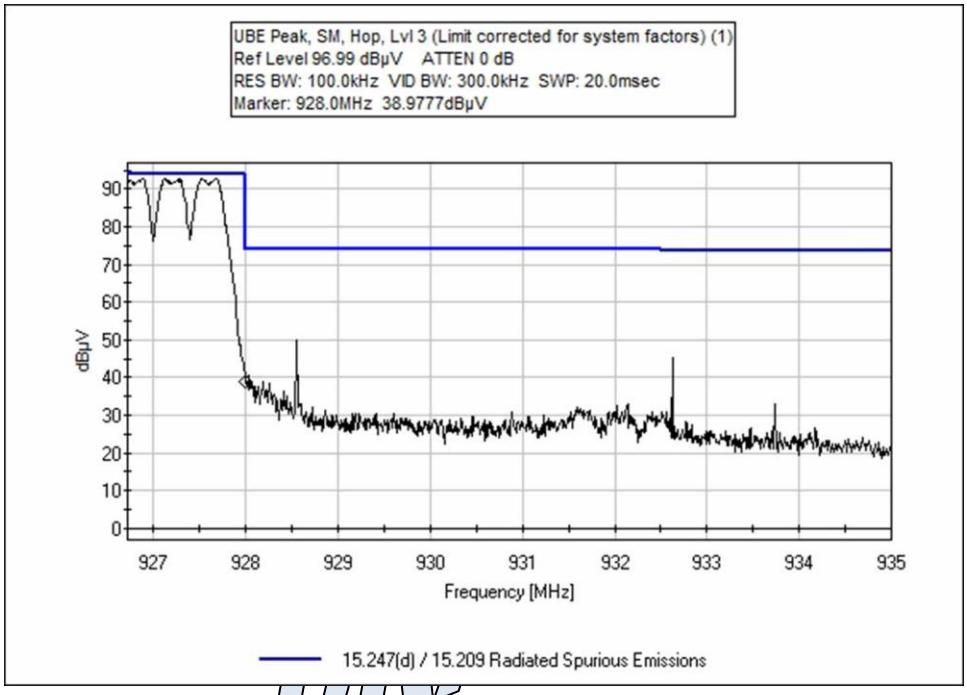

UBE Peak, SM, SC, Lvl 3 (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 43.1167dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

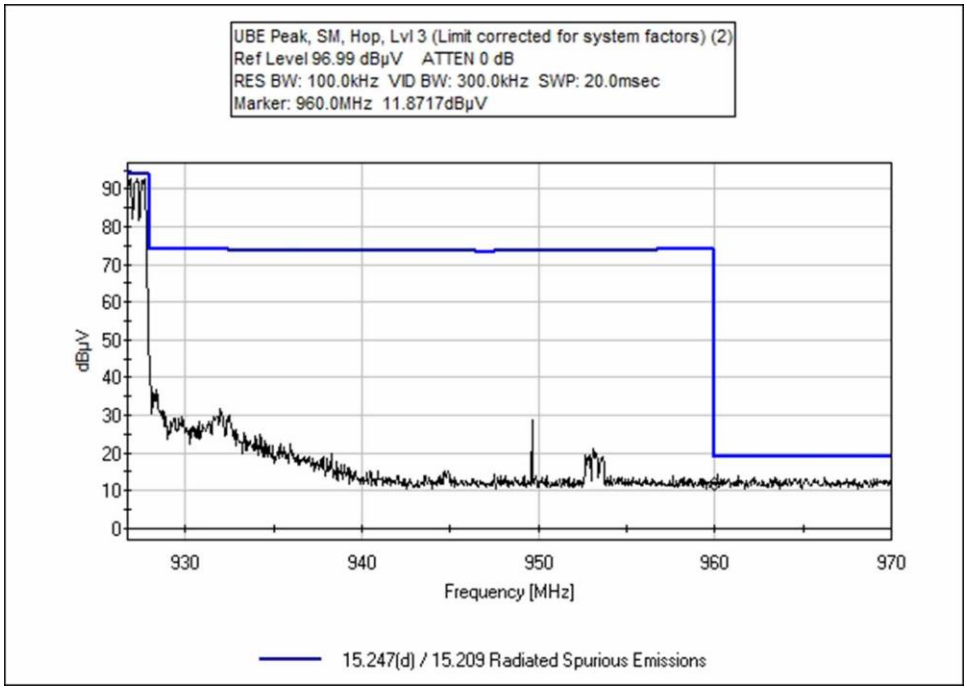

UBE Peak, SM, SC, Lvl 3 (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 13.2227dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Configuration 2; Hopping

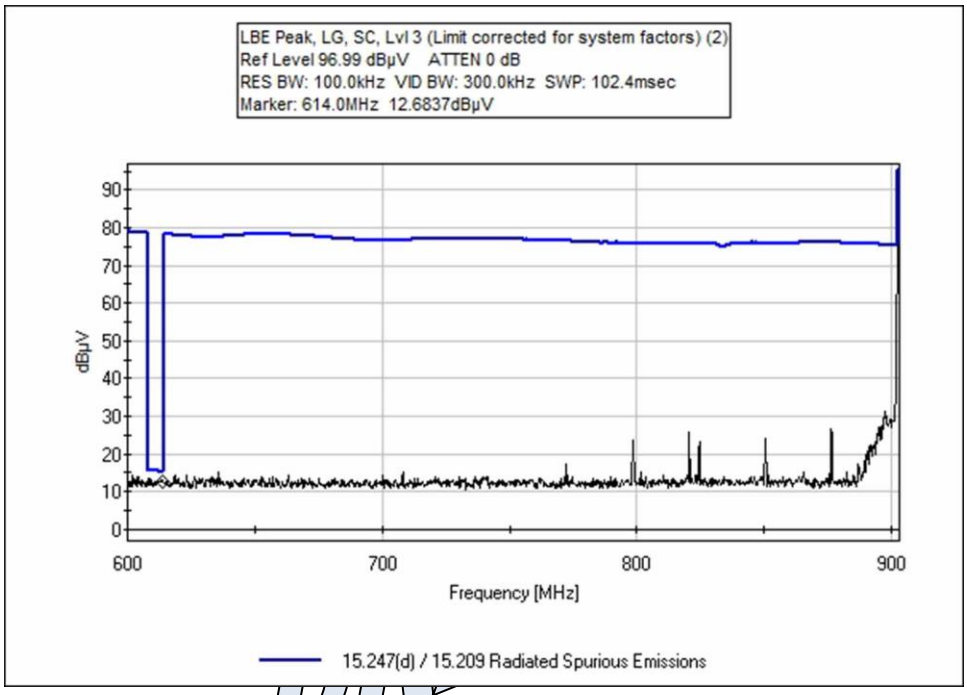


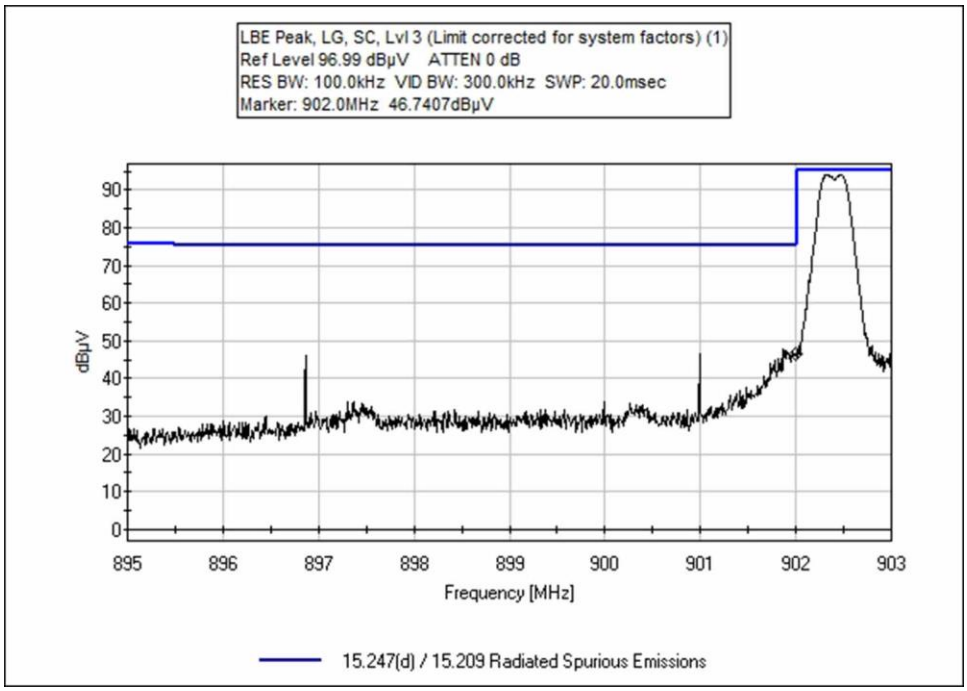


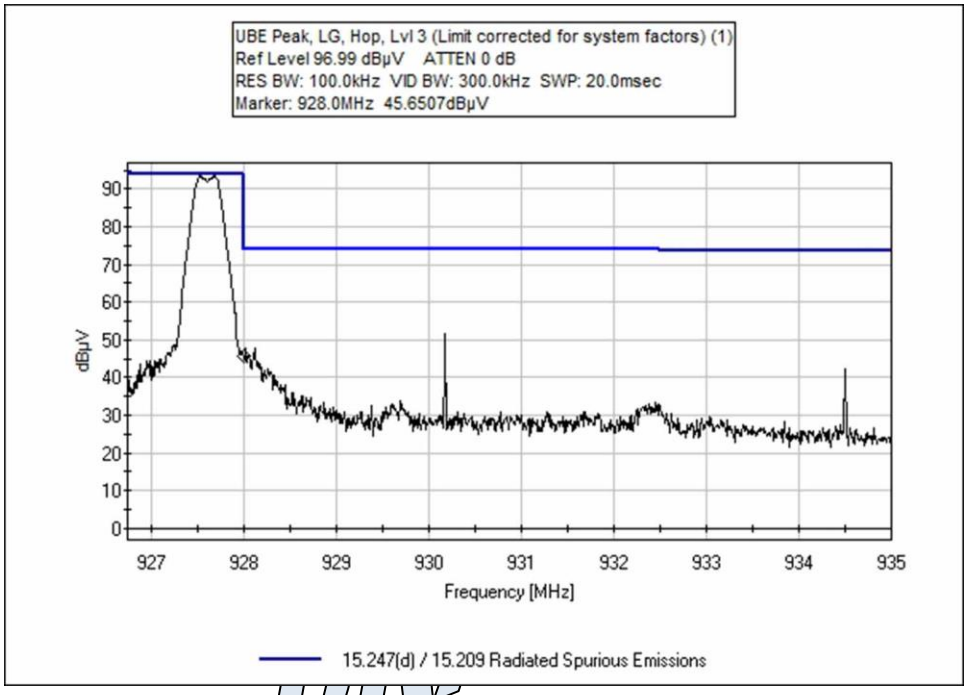

UBE Peak, SM, Hop, Lvl 3 (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 38.9777dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
927
928
929
930
931
932
933
934
935
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

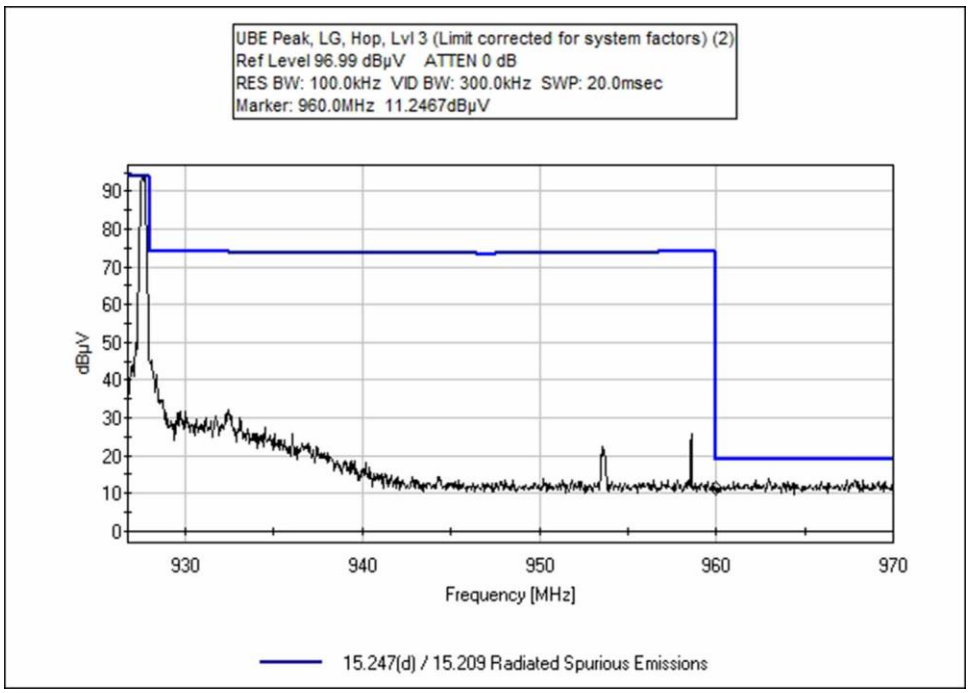

UBE Peak, SM, Hop, Lvl 3 (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 11.8717dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
930
940
950
960
970
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Configuration 3; Single Channel

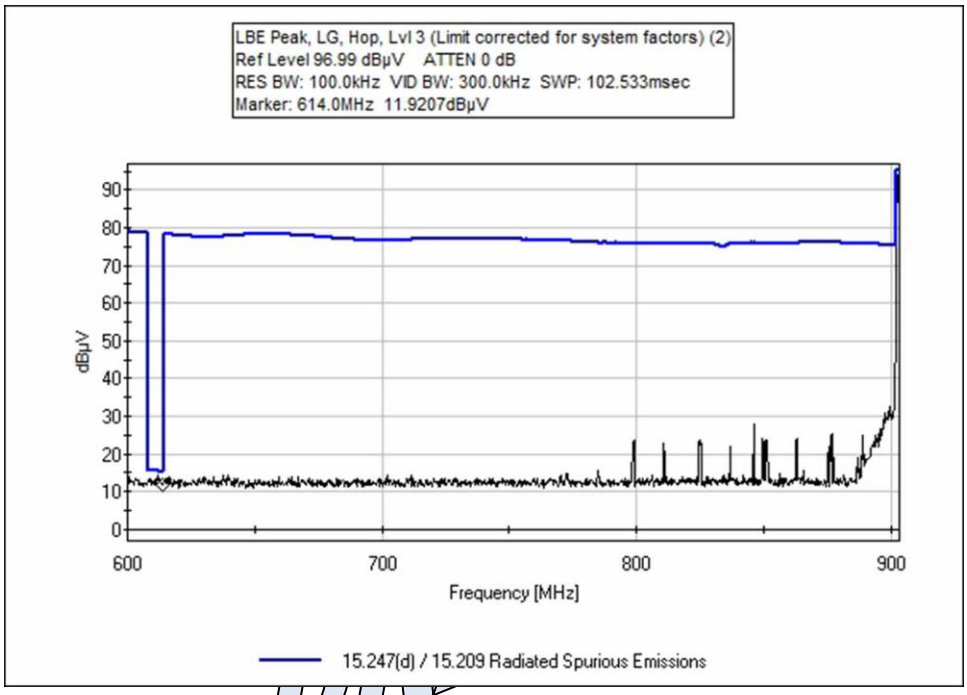


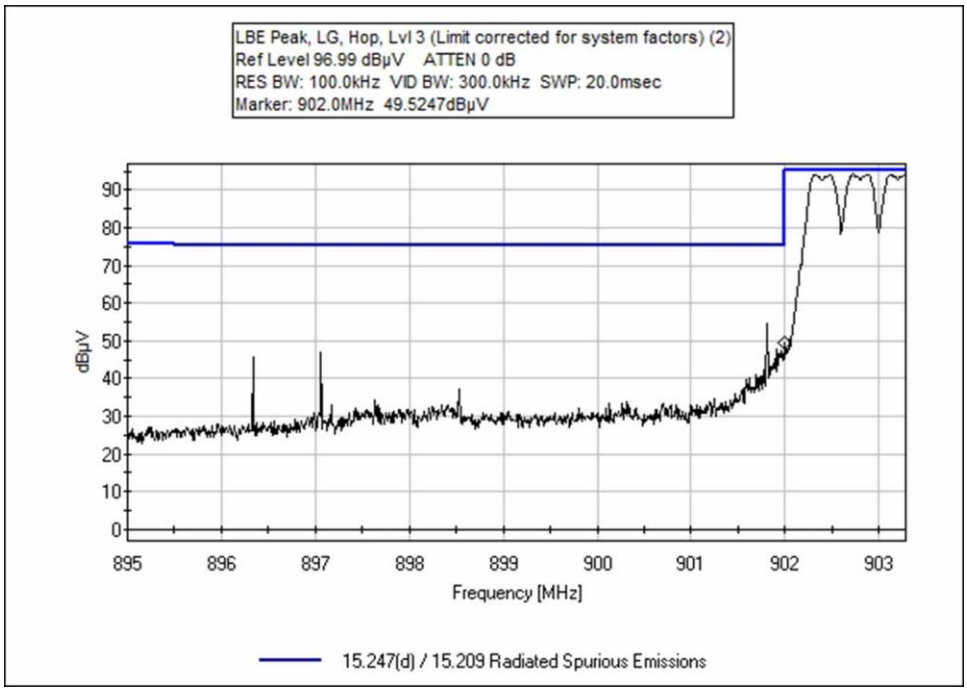


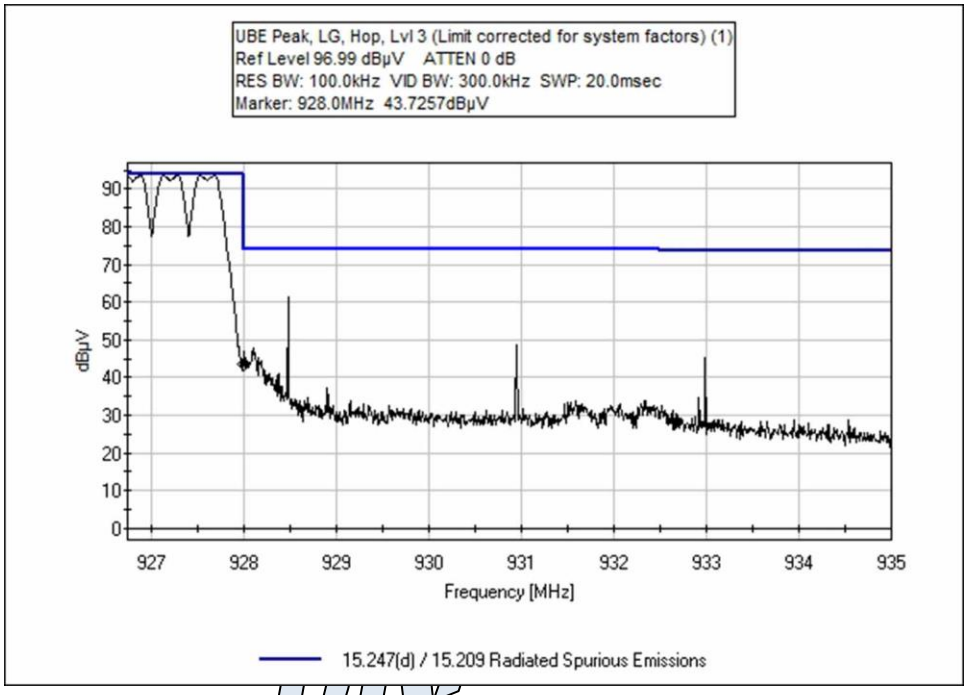

UBE Peak, LG, Hop, Lvl 3 (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 45.6507dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
927
928
929
930
931
932
933
934
935
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

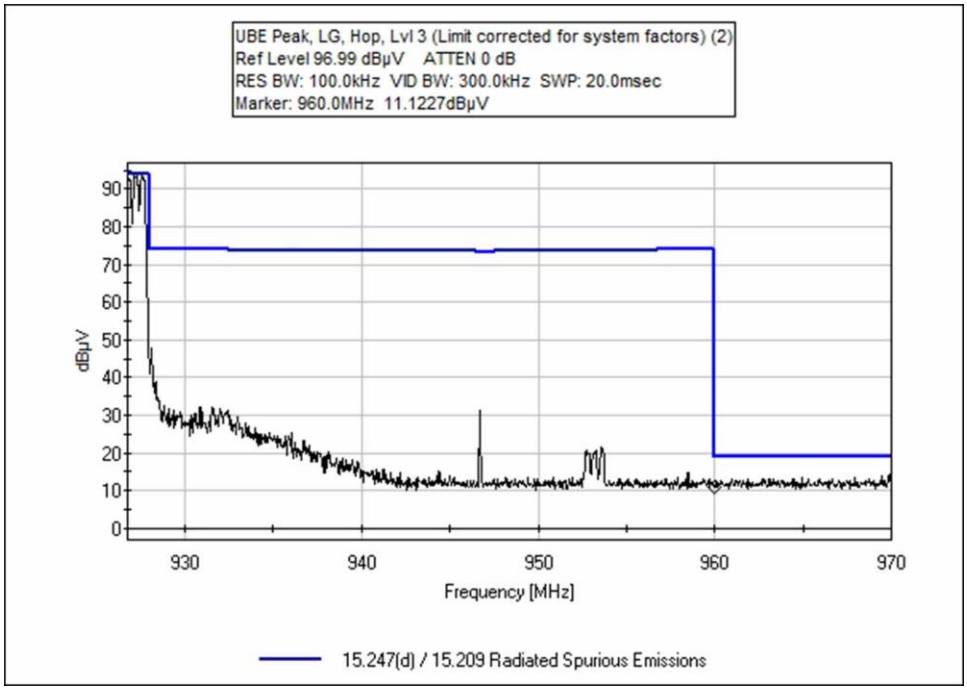

UBE Peak, LG, Hop, Lvl 3 (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 11.2467dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
930
940
950
960
970
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Configuration 3; Hopping

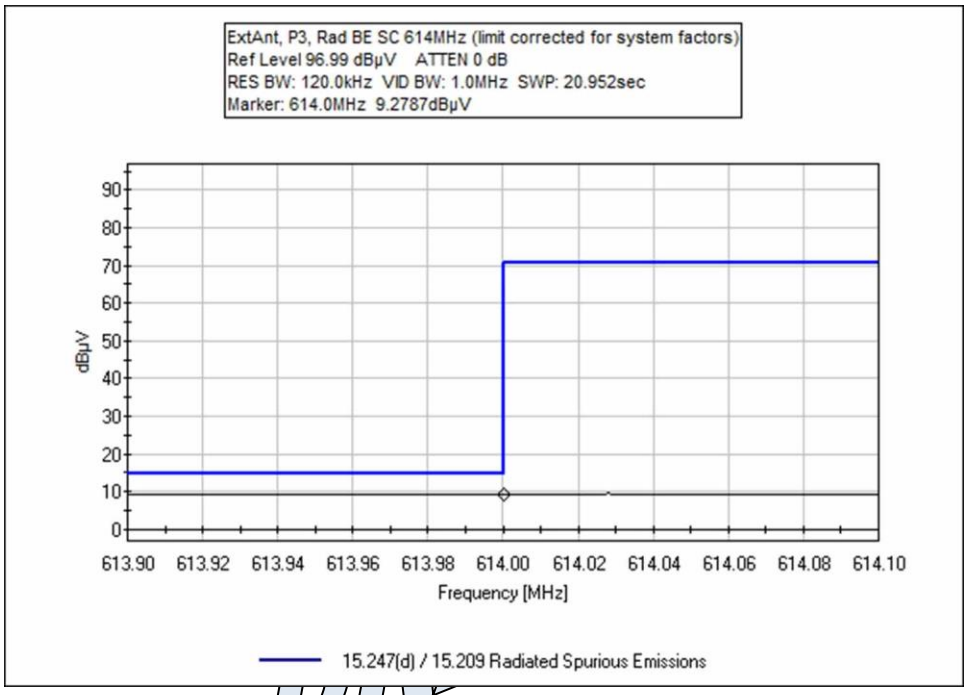


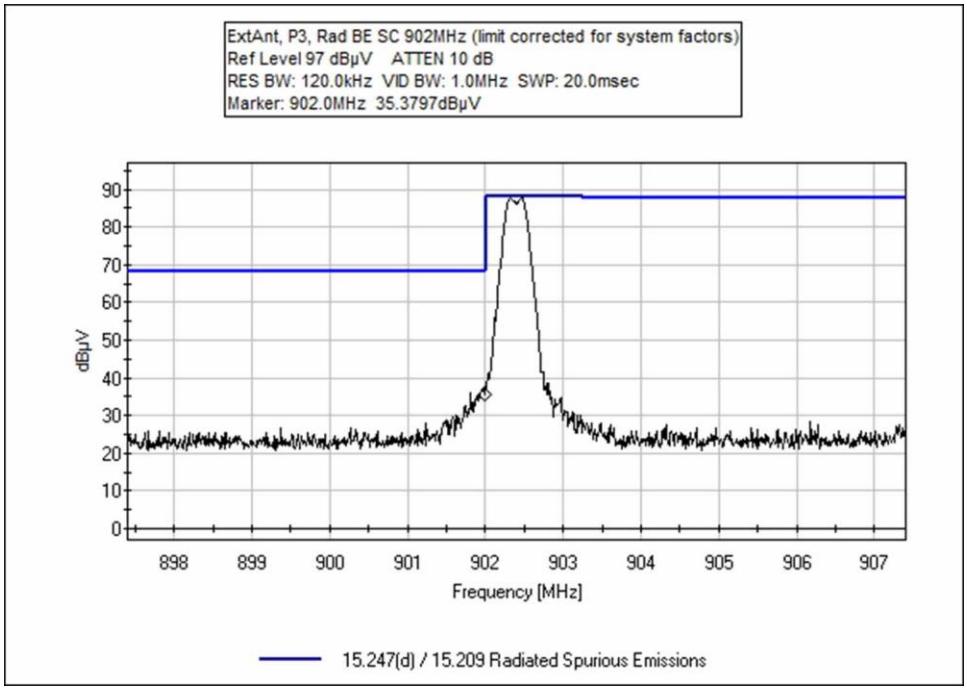


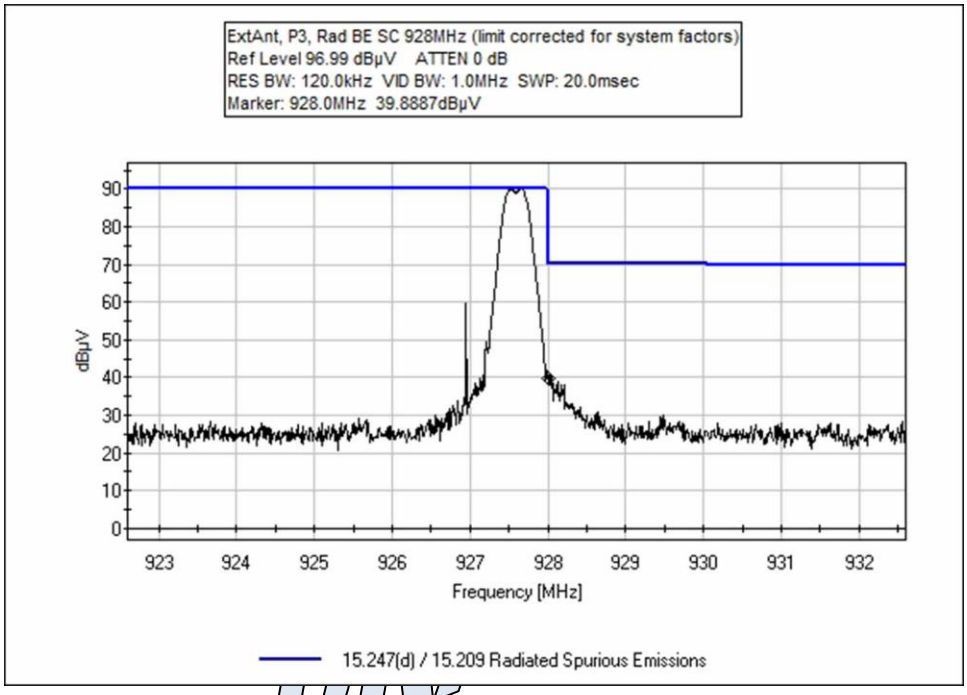

UBE Peak, LG, Hop, Lvl 3 (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 43.7257dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

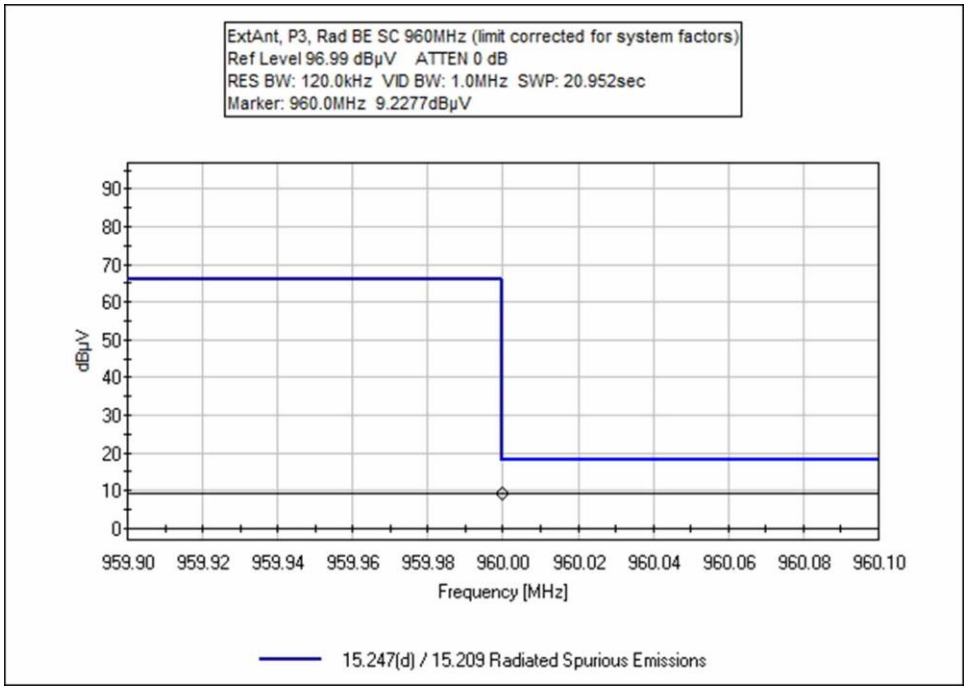

UBE Peak, LG, Hop, Lvl 3 (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 11.1227dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Configuration 4; Single Channel

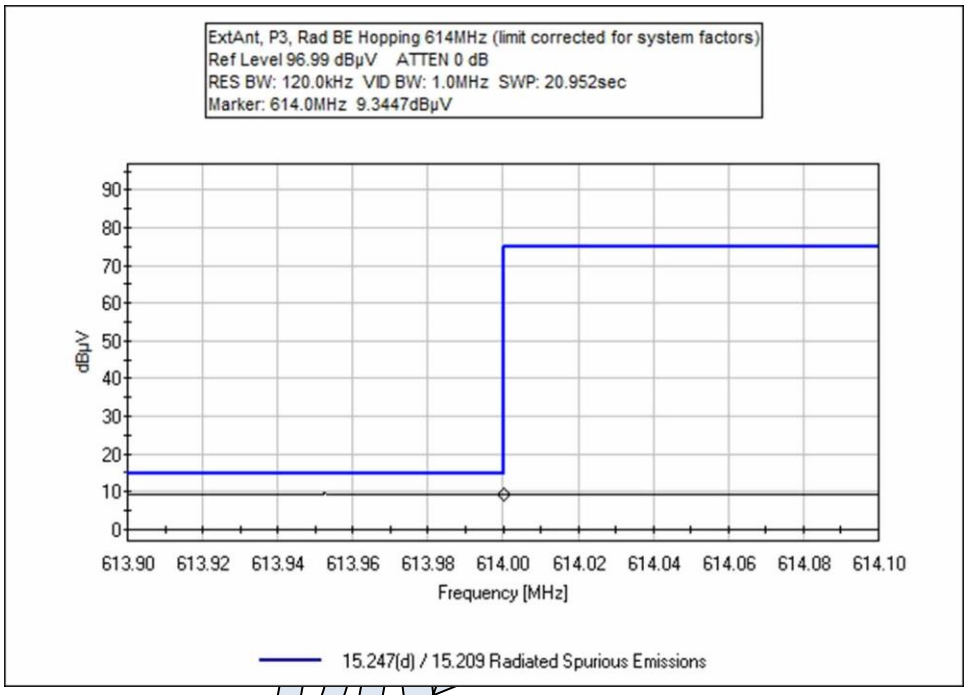


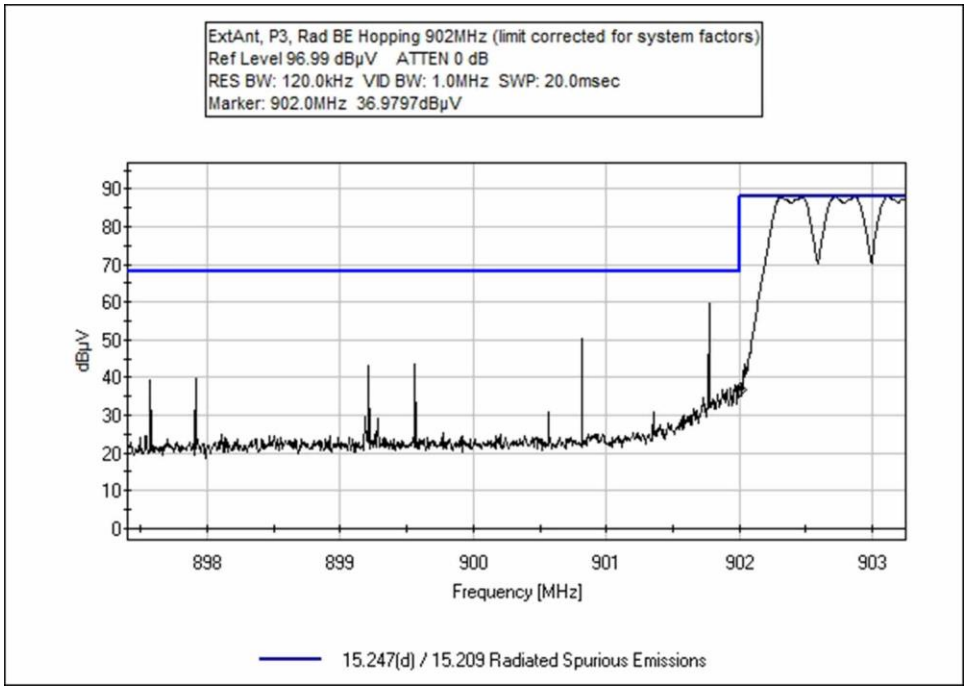


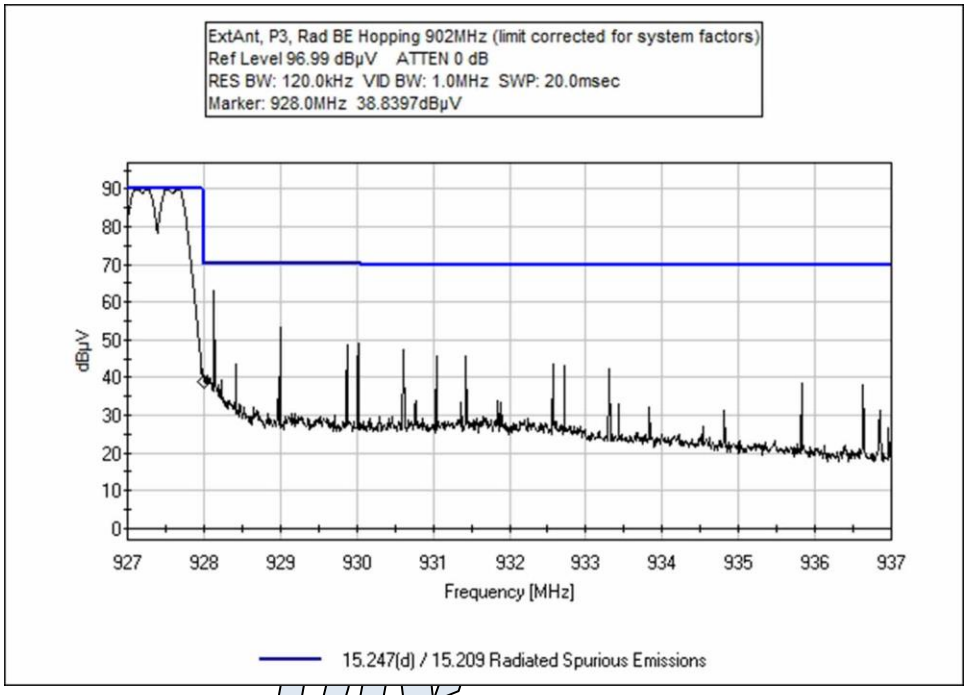

ExtAnt, P3, Rad BE SC 928MHz (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 928.0MHz 39.8887dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
923
924
925
926
927
928
929
930
931
932
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

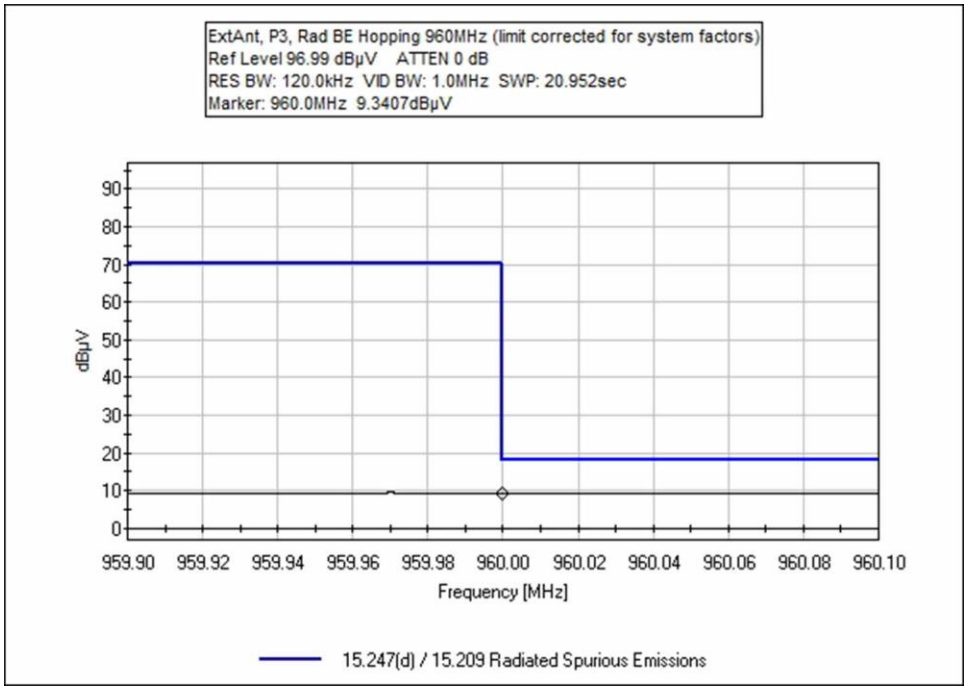

ExtAnt, P3, Rad BE SC 960MHz (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.952sec
Marker: 960.0MHz 9.2277dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
959.90
959.92
959.94
959.96
959.98
960.00
960.02
960.04
960.06
960.08
960.10
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Configuration 4; Hopping






ExtAnt, P3, Rad BE Hopping 902MHz (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 928.0MHz 38.8397dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


ExtAnt, P3, Rad BE Hopping 960MHz (limit corrected for system factors)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.952sec
Marker: 960.0MHz 9.3407dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107748**	Date:	2/14/2023
Test Type:	**Radiated Scan**	Time:	12:42:01
Tested By:	Matt Harrison	Sequence#:	6
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 18.6°C
Pressure: 100.9kPa
Humidity: 40%

Frequency Range: 600-970MHz
Frequency Tested: 902.4, 927.6
Firmware Power Setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10 (2013)
Test Mode: Transmitting
Test Setup: EUT is set up in a tabletop configuration. It is 80cm high on a Styrofoam table.
Modifications Added: None

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T4	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T5	ANP05333	Cable	Heliax	3/14/2022	3/14/2024

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	960.000M	13.2	+30.7 +1.6	+2.4	+0.3	+0.0	+0.0	48.2	54.0 SC	-5.8	Vert
2	614.000M QP	9.2	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	39.9	46.0 Hop	-6.1	Vert
3	614.000M QP	9.2	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	39.9	46.0 SC	-6.1	Vert
^	614.000M	13.6	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	44.3	46.0 Hop	-1.7	Vert
^	614.000M	12.5	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	43.2	46.0 SC	-2.8	Vert
6	960.000M	11.9	+30.7 +1.6	+2.4	+0.3	+0.0	+0.0	46.9	54.0 Hop	-7.1	Vert
7	902.000M	49.5	+29.6 +1.5	+2.3	+0.3	+0.0	+0.0	83.2	109.0 Hop	-25.8	Vert
8	902.000M	47.7	+29.6 +1.5	+2.3	+0.3	+0.0	+0.0	81.4	109.0 SC	-27.6	Vert
9	928.000M	43.1	+30.6 +1.6	+2.4	+0.3	+0.0	+0.0	78.0	109.0 SC	-31.0	Vert
10	928.000M	39.0	+30.6 +1.6	+2.4	+0.3	+0.0	+0.0	73.9	109.0 Hop	-35.1	Vert

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107748**	Date:	2/15/2023
Test Type:	**Radiated Scan**	Time:	13:00:10
Tested By:	Matt Harrison	Sequence#:	13
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 18.6°C
Pressure: 100.9kPa
Humidity: 40%

Frequency Range: 600-970MHz
Frequency Tested: 902.4, 927.6
Firmware Power Setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10 (2013)
Test Mode: Transmitting
Test Setup: EUT is set up in a tabletop configuration. It is 80cm high on a Styrofoam table.
Modifications Added: None

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T2	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T3	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T4	AN02872	Spectrum Analyzer	E4440A	11/29/2021	11/29/2023
T5	ANP05333	Cable	Heliax	3/14/2022	3/14/2024

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

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	614.000M QP	9.0	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	39.7	46.0 Hop	-6.3	Vert
2	614.000M QP	9.0	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	39.7	46.0 SC	-6.3	Vert
^	614.000M	12.7	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	43.4	46.0 SC	-2.6	Vert
^	614.000M	11.9	+27.2 +1.3	+1.9	+0.3	+0.0	+0.0	42.6	46.0 Hop	-3.4	Vert
5	960.000M	11.2	+30.7 +1.6	+2.4	+0.3	+0.0	+0.0	46.2	54.0 SC	-7.8	Vert
6	960.000M	11.1	+30.7 +1.6	+2.4	+0.3	+0.0	+0.0	46.1	54.0 Hop	-7.9	Vert
7	902.000M	49.5	+29.6 +1.5	+2.3	+0.3	+0.0	+0.0	83.2	109.0 Hop	-25.8	Vert
8	928.000M	45.7	+30.6 +1.6	+2.4	+0.3	+0.0	+0.0	80.6	109.0 SC	-28.4	Vert
9	902.000M	46.7	+29.6 +1.5	+2.3	+0.3	+0.0	+0.0	80.4	109.0 SC	-28.6	Vert
10	928.000M	43.7	+30.6 +1.6	+2.4	+0.3	+0.0	+0.0	78.6	109.0 Hop	-30.4	Vert

Test Location:	CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Itron, Inc.**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107748**	Date:	5/26/2023
Test Type:	**Radiated Scan**	Time:	15:19:58
Tested By:	Michael Atkinson	Sequence#:	50
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 4			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 4			

Test Conditions / Notes:

Test Environment Conditions:
Temperature: 24° C
Pressure: 100.9 kPa
Humidity: 43%

Frequency Range: 600-970 MHz
Frequency tested: 902.4, 927.6
Firmware power setting: Level 3
EUT Firmware:
Protocol /MCS/Modulation: GFSK 150kbps

Test Method: ANSI C63.10: 2013
Test Mode: Transmitting
Test Setup: EUT is setup for external antenna configuration, on 80cm high on a styrofoam table.
Modifications Added: None

Horizontal and Vertical antenna polarities investigated, worst case reported.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T2	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T3	ANP06454	Cable	Heliax	1/25/2022	1/25/2024
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T4	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

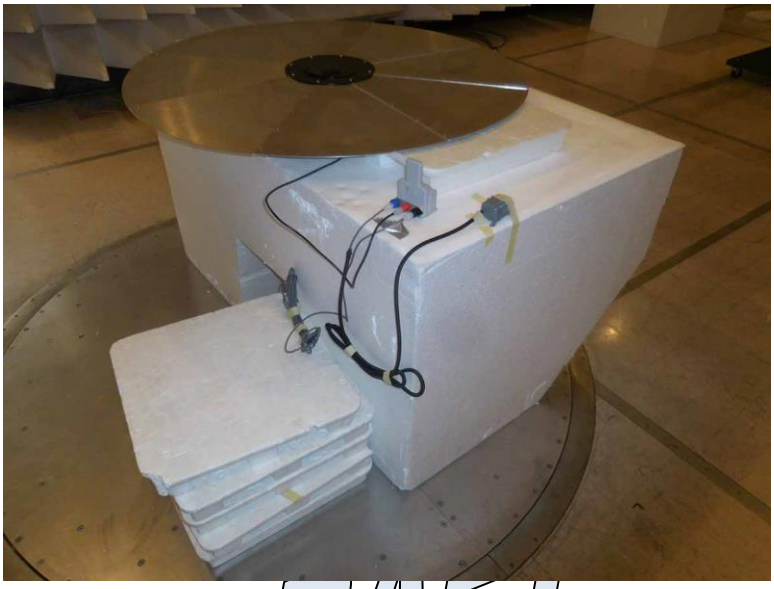
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	614.000M QP	9.3	+1.9	+1.3	+0.6	+27.4	+0.0	40.5	46.0 Hopping	-5.5	Vert
2	614.000M QP	9.3	+1.9	+1.3	+0.6	+27.4	+0.0	40.5	46.0 SC	-5.5	Vert
3	960.000M QP	9.3	+2.4	+1.6	+0.7	+31.1	+0.0	45.1	54.0 Hopping	-8.9	Vert
4	960.000M QP	9.2	+2.4	+1.6	+0.7	+31.1	+0.0	45.0	54.0 SC	-9.0	Vert
5	928.000M	39.9	+2.4	+1.6	+0.7	+31.2	+0.0	75.8	106.0 SC	-30.2	Vert
6	902.000M	37.0	+2.3	+1.5	+0.7	+29.5	+0.0	71.0	102.0 Hopping	-31.0	Vert
7	928.000M	38.8	+2.4	+1.6	+0.7	+31.2	+0.0	74.7	106.0 Hopping	-31.3	Vert
8	902.000M	35.4	+2.3	+1.5	+0.7	+29.5	+0.0	69.4	102.0 SC	-32.6	Vert

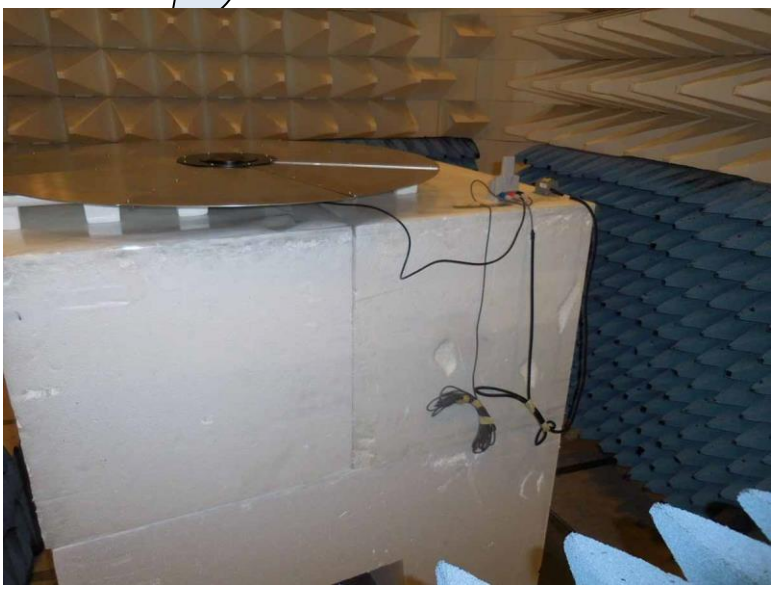
Test Setup Photo(s)

Below 1GHz; Configuration 2

Below 1GHz; Configuration 3



Below 1GHz, Configuration 4



Above 1GHz, Configuration 4

Appendix A: Manufacturer Declaration

The following Models have been tested by CKC Laboratories:
Models: ERW-1601-001 and ERW-1601-010

The manufacturer declares that the following additional models are identical electrically or any differences between them do not affect their EMC characteristics, and therefore meets the level of testing equivalent to the tested models.

Device	Manufacturer	Model #	S/N
500W / RIVAWA	Itron, Inc.	ERW-1601-002	NA
500W / RIVAWA	Itron, Inc.	ERW-1601-003	NA
500W / RIVAWA	Itron, Inc.	ERW-1601-004	NA
500W / RIVAWA	Itron, Inc.	ERW-1601-005	NA
500W / RIVAWA	Itron, Inc.	ERW-1601-006	NA
500W / RIVAWA	Itron, Inc.	ERW-1601-007	NA
500W / RIVAWA	Itron, Inc.	ERW-1601-008	NA

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.