Nalloy, LLC

TEST REPORT FOR

Model: XVZQ49

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.207 & 15.247
(HYBRID 902-928MHz)

Report No.: 107941-28

Date of issue: April 11, 2023

Test Certificate # 803.01

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

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

TABLE OF CONTENTS

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Nalloy, LLC
2301 5th Avenue
Seattle, WA 98108

Representative: Naga Suryadevara
Customer Reference Number: 2D-10266822

REPORT PREPARED BY:

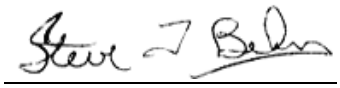
Kim Romero
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 107941

DATE OF EQUIPMENT RECEIPT: December 14, 2020
DATE(S) OF TESTING: December 14 & 17, 2020 January 26, 2023, February 23, 2023, & March 2, 2023

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 (HYBRID 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	NA1
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
15.247 (f)	Hybrid Systems Time of Occupancy	NA	Pass
15.247 (f)	Hybrid Systems Power Spectral Density	NA	Pass
15.207	AC Conducted Emissions	NA	Pass

NA = Not Applicable
NA1 = This test is not applicable under Hybrid System requirements section 15.247 (f).

ISO/IEC 17025 Decision Rule
The equipment sample utilized for testing is selected by the manufacturer. The declaration of pass or fail herein is a binary statement for simple acceptance rule (ILAC G8) based upon assessment to the specification(s) listed above, without consideration of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

Modifications During Testing

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

Summary of Conditions
No modifications were made during testing.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

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

Summary of Conditions
None

EQUIPMENT UNDER TEST (EUT)

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

Configuration 1

Equipment Tested:

Device	Manufacturer	Model #	S/N
N/A	Nalloy, LLC	XVZQ49	(FCC ID 2AVOB-XVZQ49)

Support Equipment:

Device	Manufacturer	Model #	S/N
PoE Injector	Ubiquiti	GP-C500-120G XVZQ49	NA

Configuration 2

Equipment Tested:

Device	Manufacturer	Model #	S/N
N/A	Nalloy, LLC	XVZQ49	(FCC ID 2AVOB-XVZQ49)

Support Equipment:

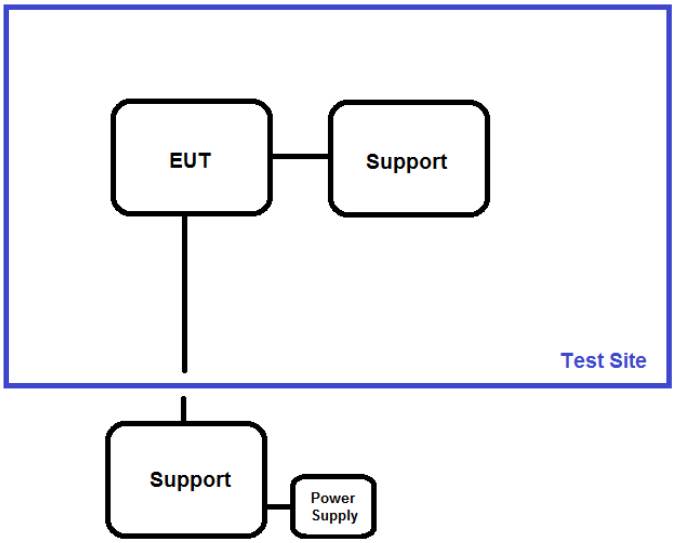
Device	Manufacturer	Model #	S/N
PoE Injector	Allnet	ALL048900V2	NA
Switching Power Supply (For PoE Injector)	Fuyuang	FY5502000	NA

General Product Information:

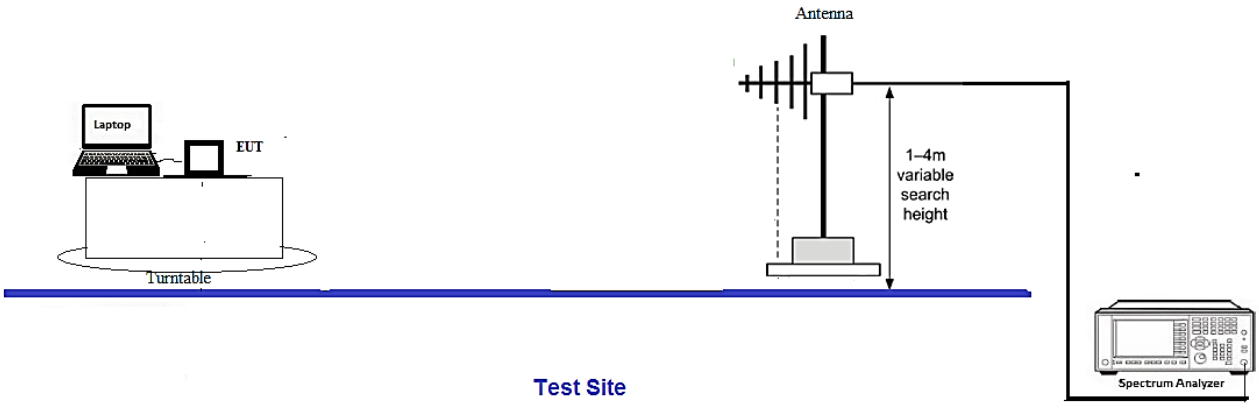
Product Information	Manufacturer-Provided Details
Equipment Type:	Radio Module
Type of Wideband System:	Hybrid
Operating Frequency Range:	902.4-927.6MHz
Number of Hopping Channels:	64
Modulation Type(s):	GFSK-2
Maximum Duty Cycle:	100% as worst case
Number of TX Chains:	2
Antenna Type(s) and Gain:	Swivel Type Dipole, 1.57dBi declared per manufacturer
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	Module Input (3.3V nominal)
Firmware / Software used for Test:	Railtest_v2.2.0 Realterm 2.0.0.70
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

Block Diagram of Test Setup(s)

Test Setup Block Diagram



Radiated test setup



FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson/M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/14/2020, 12/17/2020
Configuration:	1		
Test Setup:	EUT is continuously transmitting. EUT has 2 antenna ports, only 1 can be used at a time. Investigated both antenna ports, worst case data reported. Spectrum analyzer and appropriate attenuation connected to antenna port under test, external antenna is removed to make direct RF conducted measurements.		

Environmental Conditions			
Temperature (ºC)	19-22	Relative Humidity (%):	34-40

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021
P06007	Cable	Andrew	Heliax	1/20/2020	1/20/2022
P05748	Attenuator	Pasternack	PE7004-20	3/4/2020	3/4/2022

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

20dB Occupied Bandwidth

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
902.4	0	GFSK-2	246.2	*See Note	N/A
914.8	0	GFSK-2	247.3		
927.6	0	GFSK-2	247.2		
902.4	1	GFSK-2	247.2	*See Note	N/A
914.8	1	GFSK-2	247.6		
927.6	1	GFSK-2	247.2		

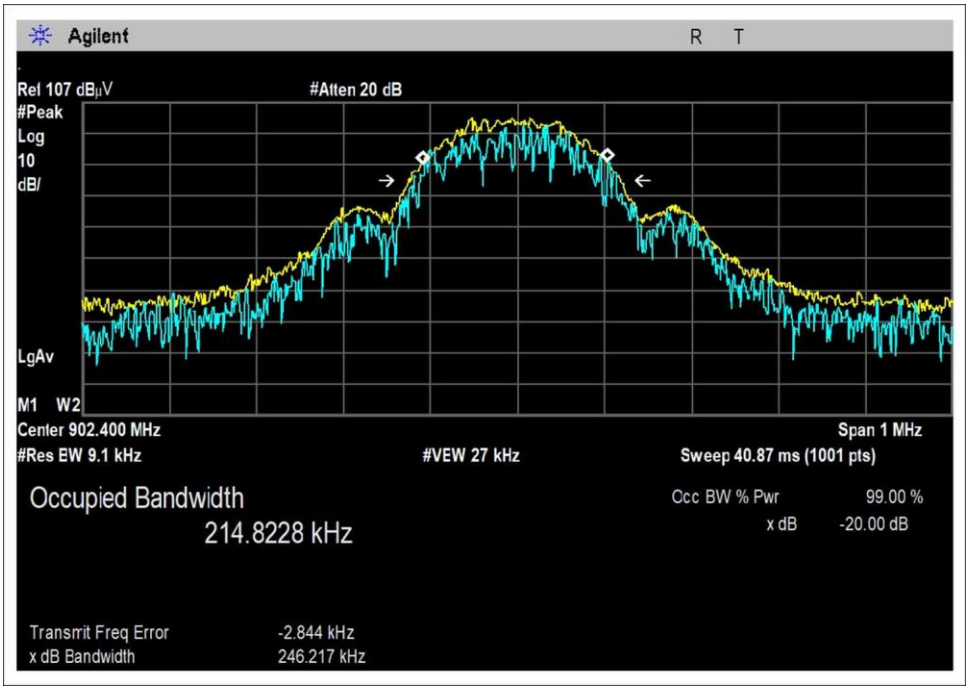
DTS Bandwidth

Test Data Summary					
Frequency (MHz)	**Antenna Port**	**Modulation**	**Measured (kHz)**	**Limit (kHz)**	**Results**
902.4	0	GFSK-2	254.6	None	N/A
914.8	0	GFSK-2	251.9	None	N/A
927.6	0	GFSK-2	251.2	None	N/A
902.4	1	GFSK-2	254.9	None	N/A
914.8	1	GFSK-2	251.9	None	N/A
927.6	1	GFSK-2	251.4	None	N/A

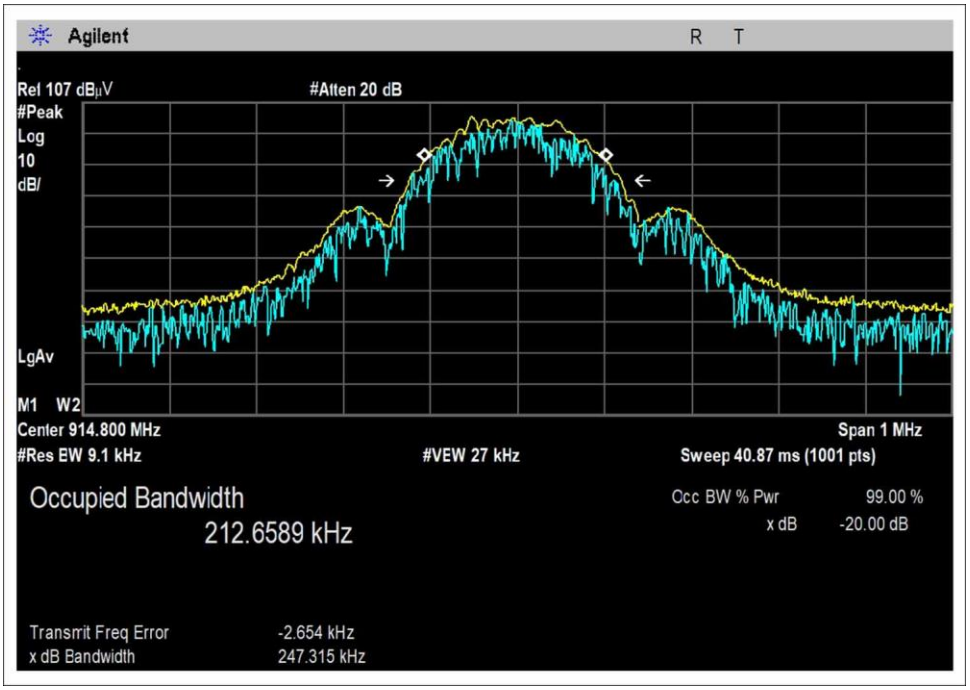
*For this Hybrid mode there is no requirement to meet the FHSS or DTS bandwidth limits. See Supplemental Section of data in 15.247 (f) Hybrid Systems.

Plot(s)

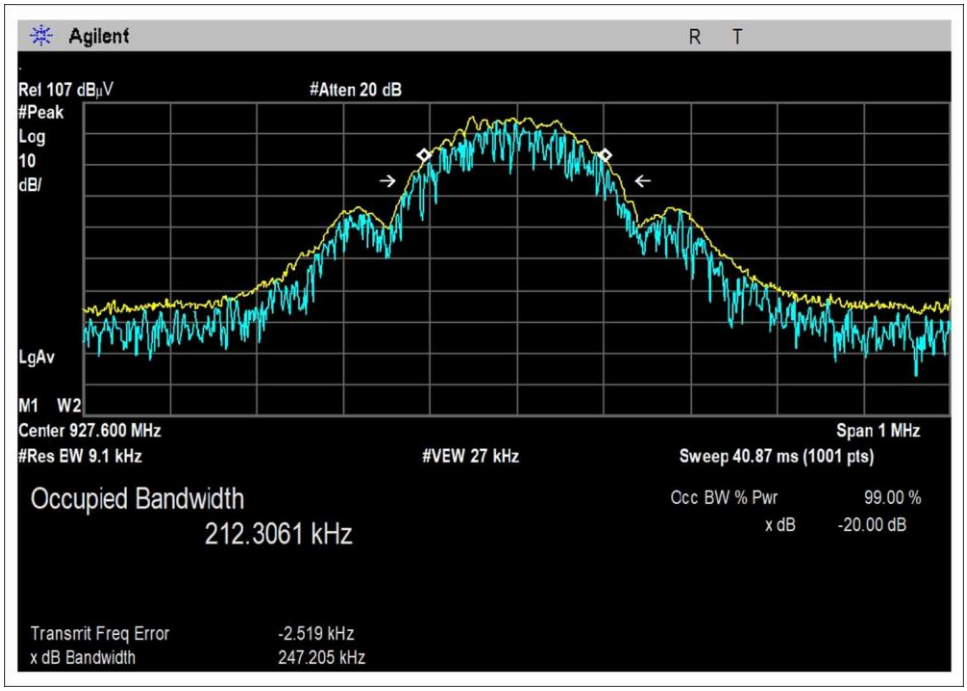
20dB Occupied Bandwidth



Antenna 0; Low Channel



Antenna 0; Middle Channel



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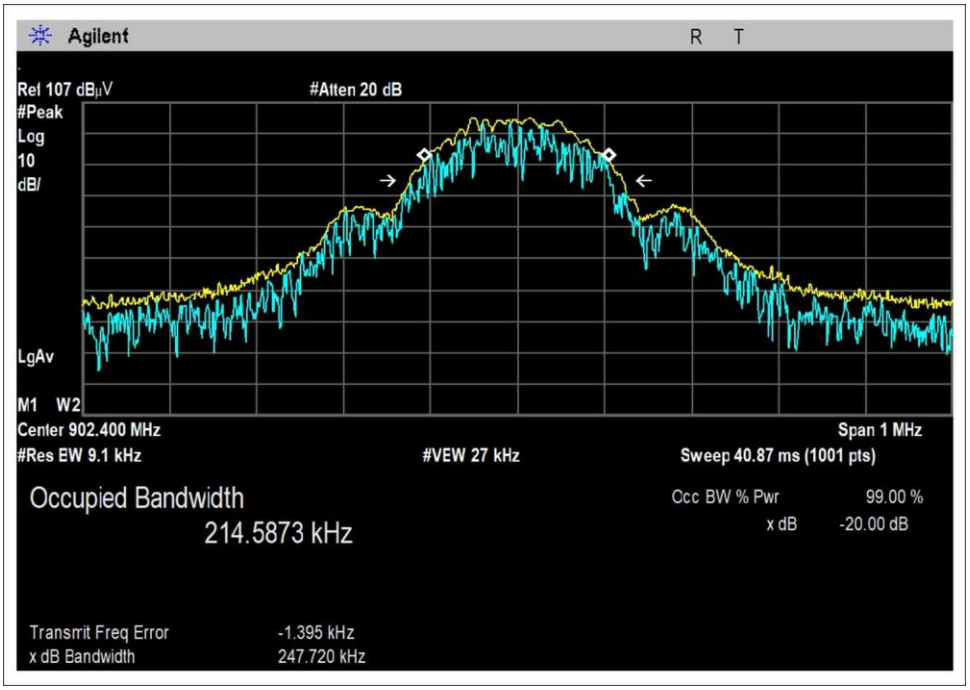

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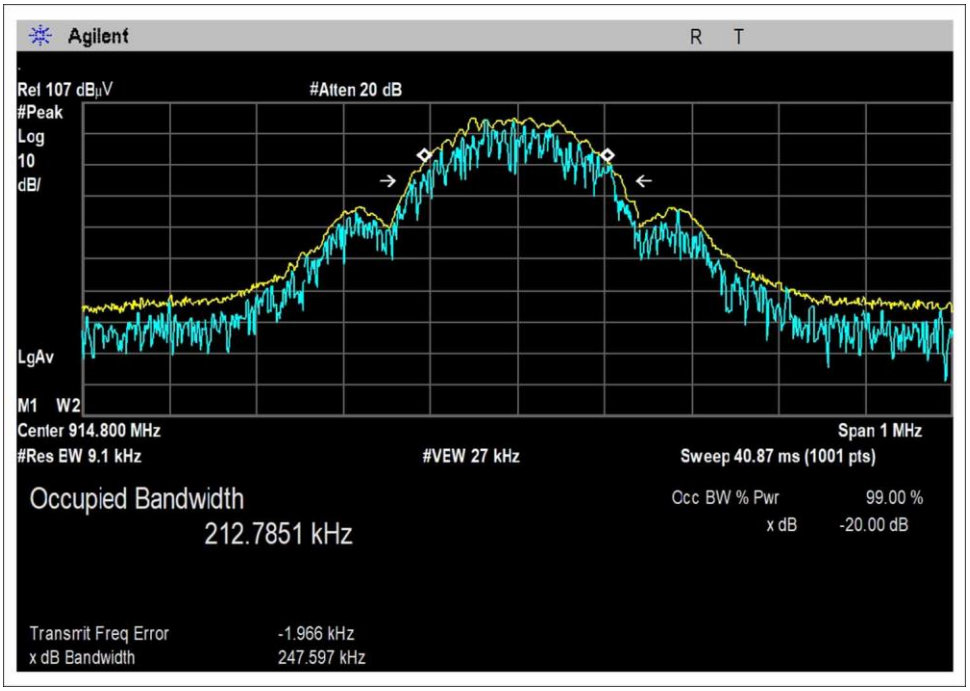
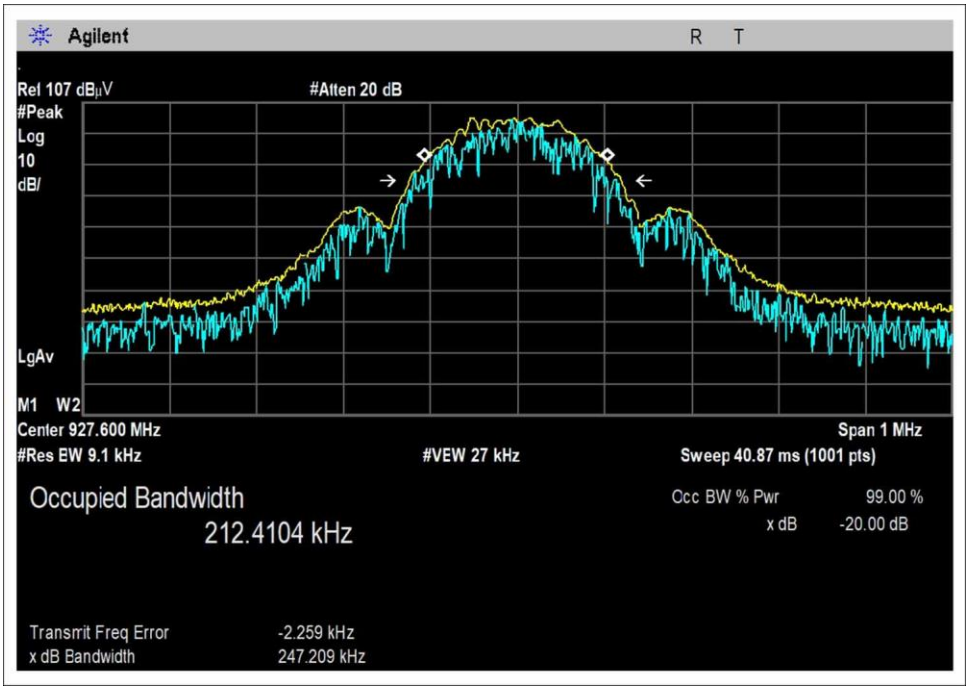
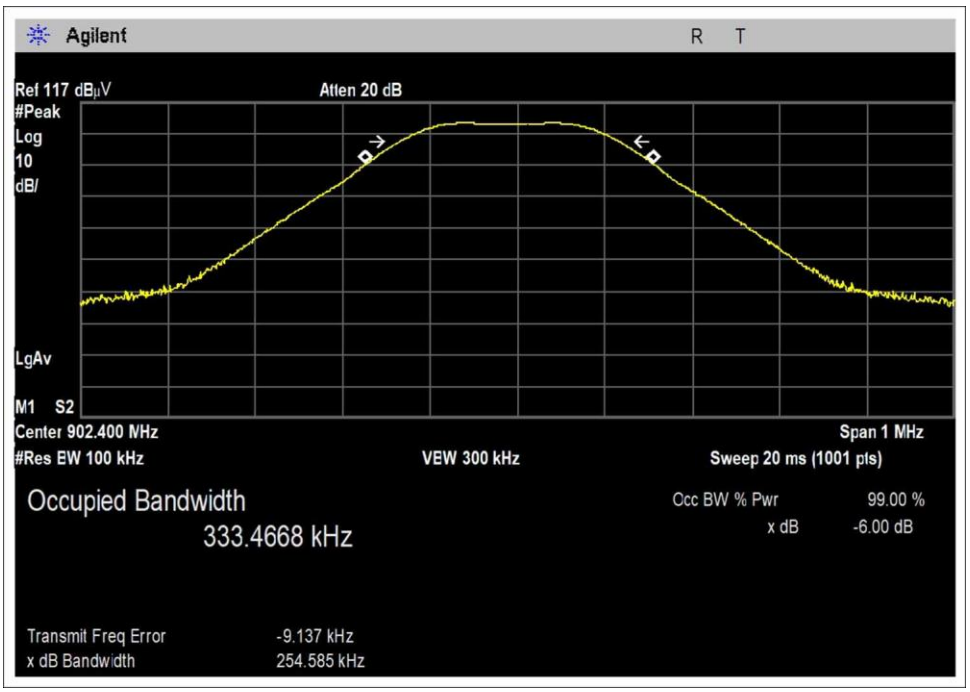


Antenna 1; Middle Channel

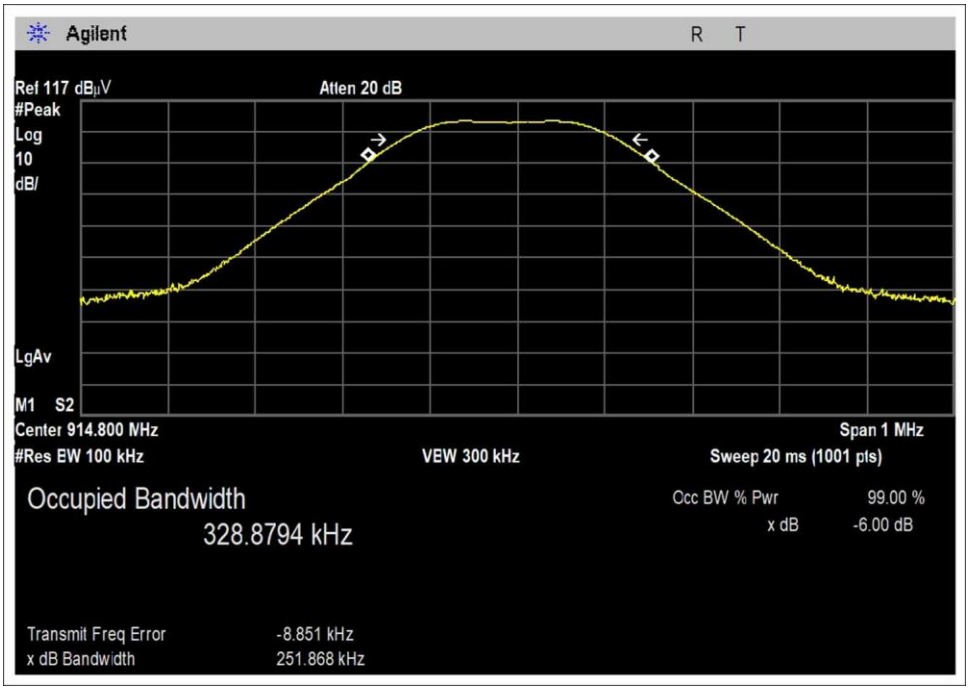


Antenna 1; High Channel

DTS Bandwidth



Antenna 0; Low Channel



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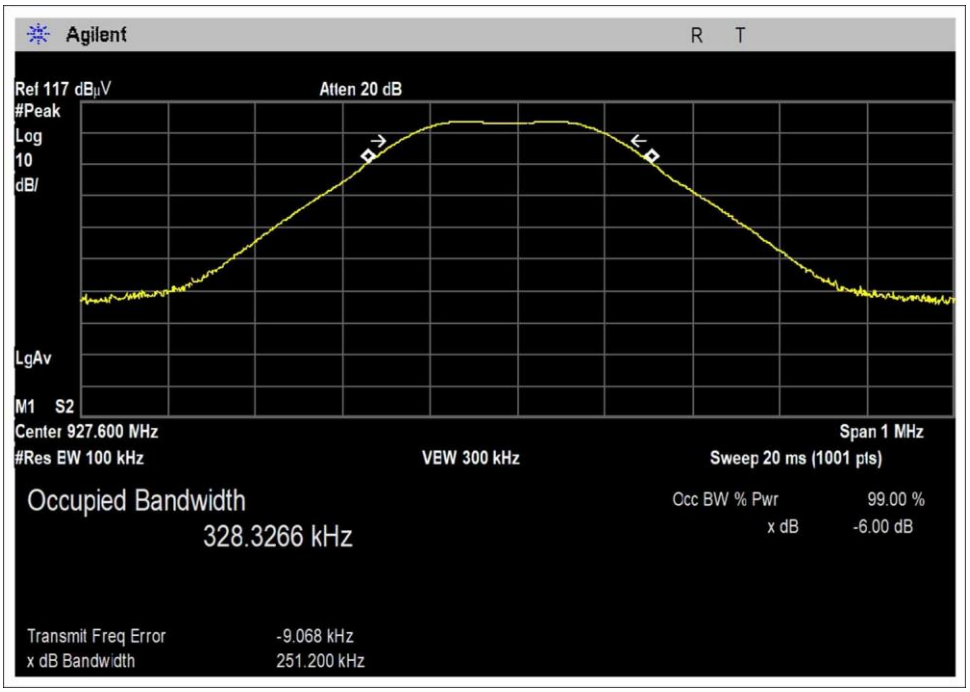

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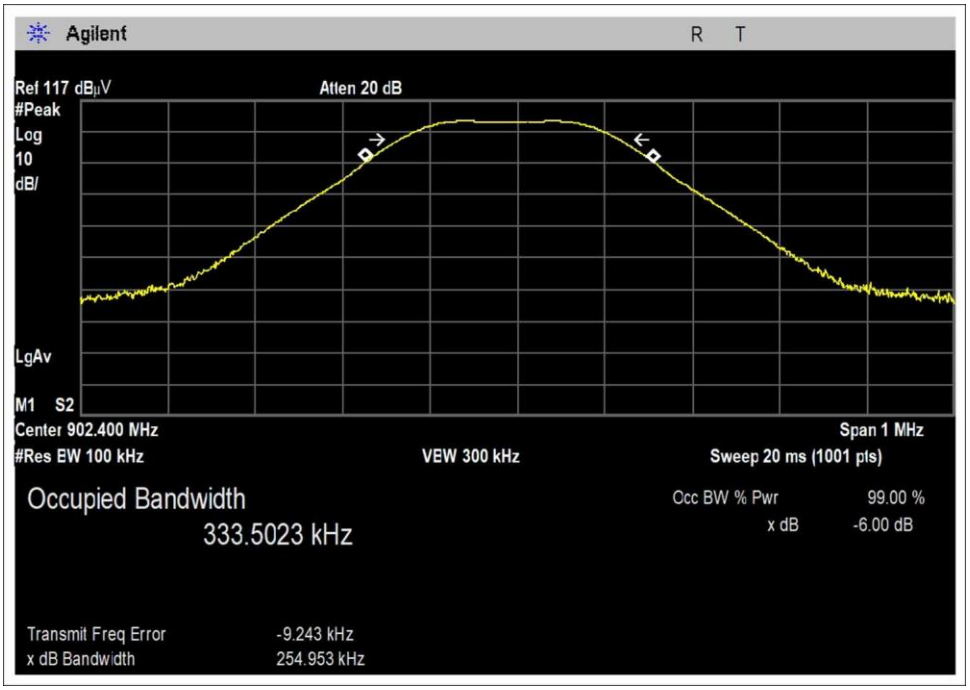

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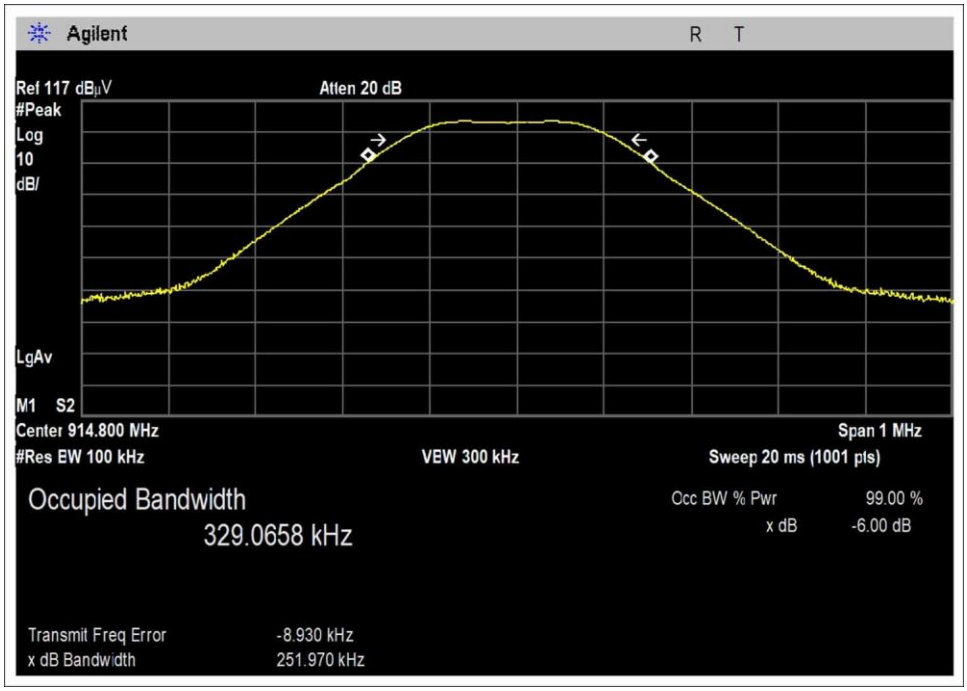
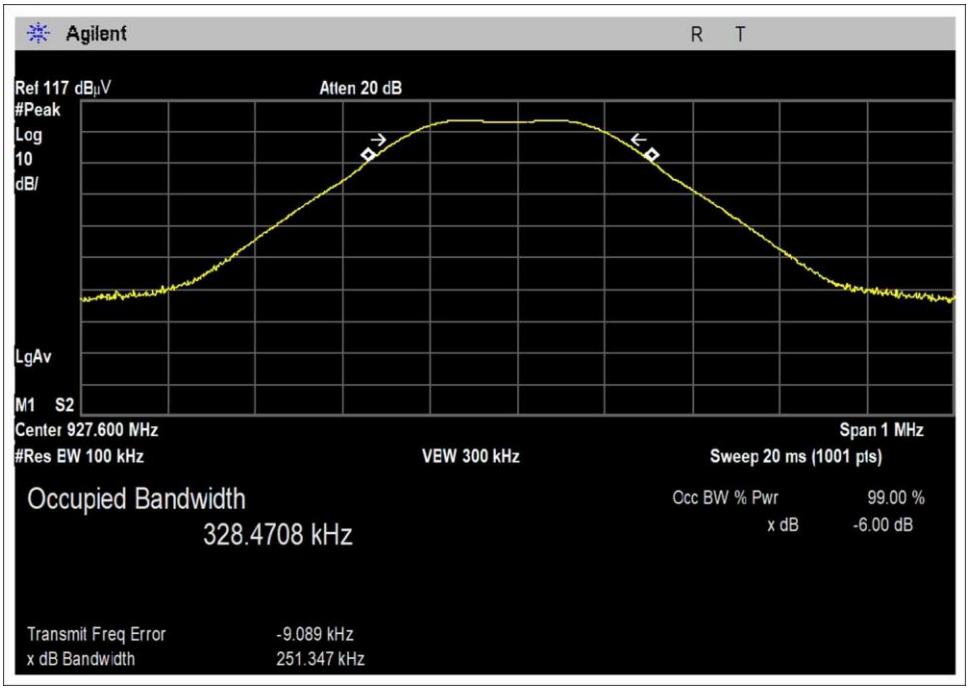


Antenna 1; Middle Channel

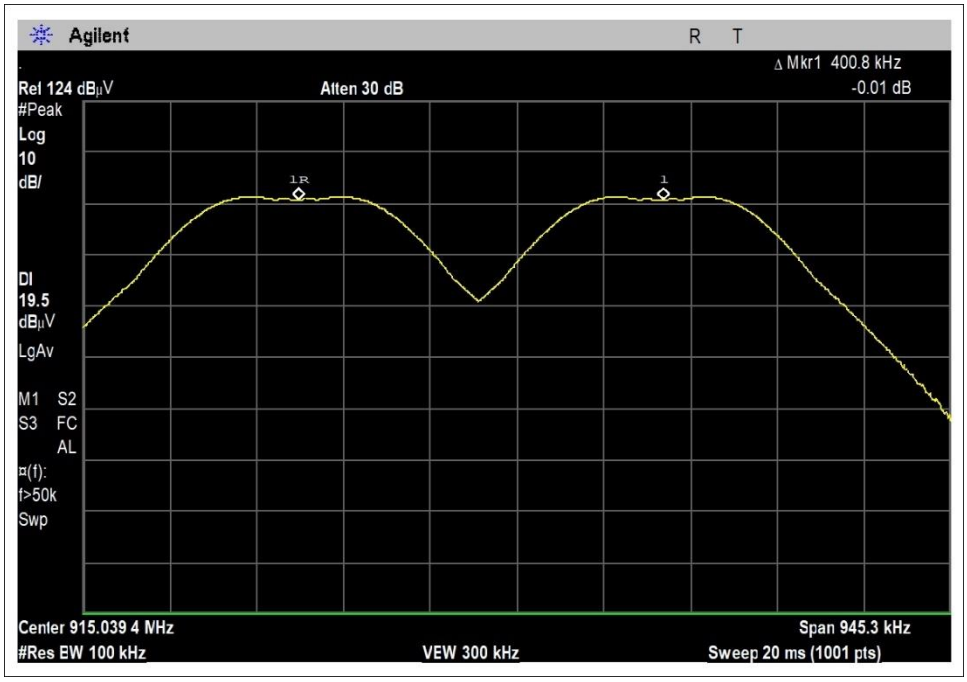


Antenna 1; High Channel

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**
0, 1	GFSK-2	400.8	>247.720	Pass

Plot(s)

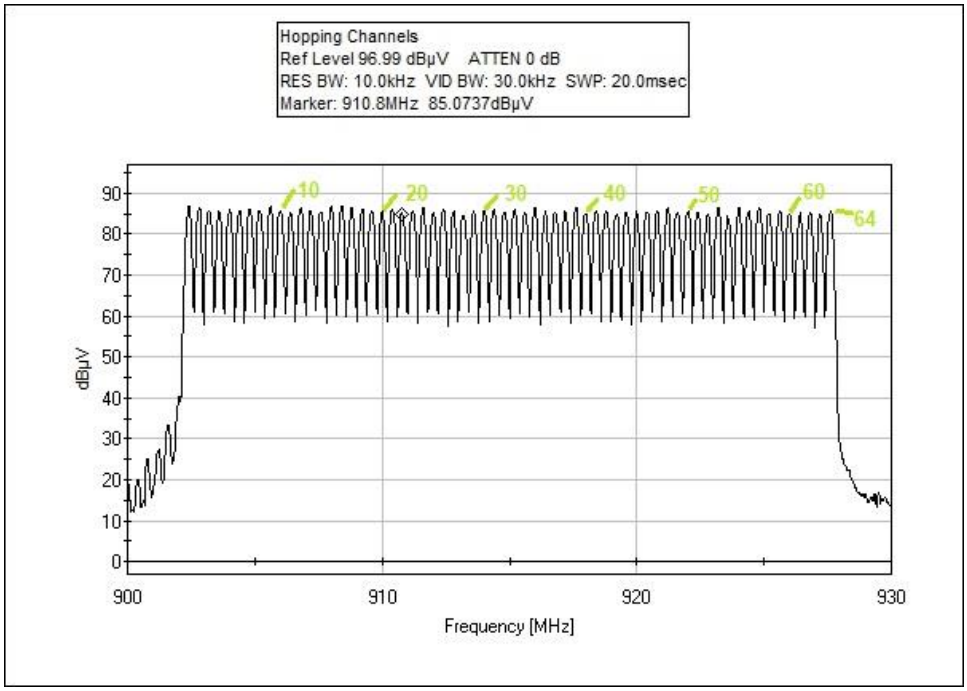


15.247(a)(1)(i) Number of Hopping Channels

Test Data Summary				
Antenna Port	**Operational Mode**	**Measured (Channels)**	**Limit (Channels)**	**Results**
1	GFSK-2	64	*See Note	Pass

*For this Hybrid Mode there is no minimum number of hopping channels.

Plot(s)



Test Setup Photo(s)

Antenna 0

Antenna 1

15.247(b)(2) Output Power

Test Data Summary - Voltage Variations					
Frequency (MHz)	Modulation / Ant Port	$V_{Minimum}$ (dBm)	$V_{Nominal}$ (dBm)	$V_{Maximum}$ (dBm)	Max Deviation from $V_{Nominal}$ (dB)
902.4	GFSK-2/0	13.8	13.8	13.8	0.0
914.8	GFSK-2/0	13.7	13.7	13.7	0.0
927.6	GFSK-2/0	14.0	14.0	14.0	0.0
902.4	GFSK-2/1	13.8	13.8	13.8	0.0
914.8	GFSK-2/1	13.7	13.7	13.7	0.0
927.6	GFSK-2/1	14.0	14.0	14.0	0.0

Test performed using operational mode with the highest output power, representing worst case.

Parameter Definitions:

Measurements performed at input voltage Vnominal ± 15%.

Parameter	Value
$V_{Nominal}$:	115
$V_{Minimum}$:	98
$V_{Maximum}$:	132

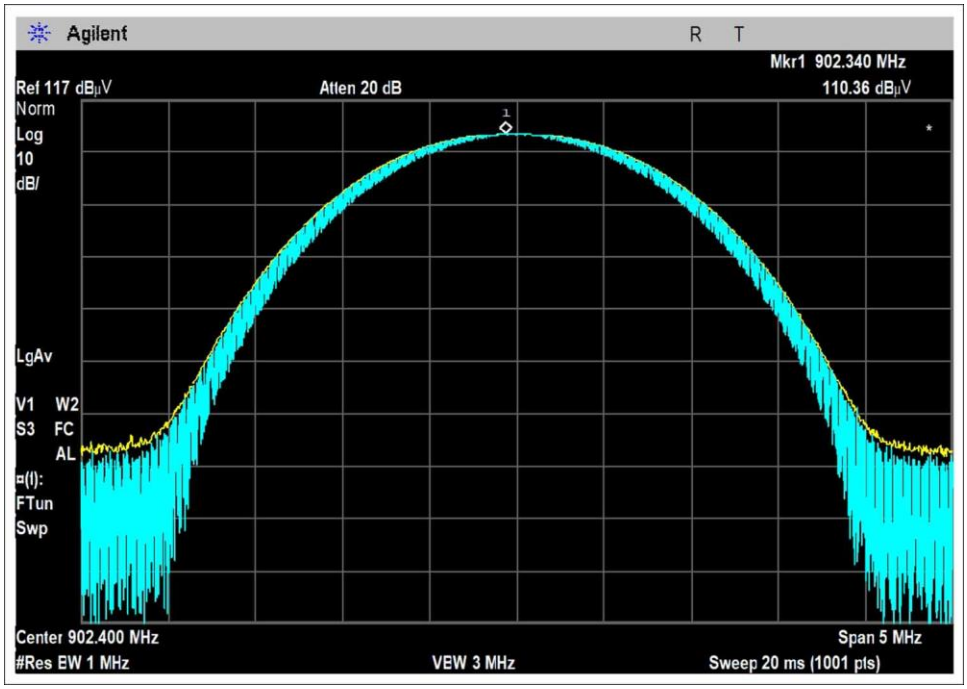
Test Data Summary - RF Conducted Measurement					
$Limit = 30dBm\ Conducted/36dBm\ EIRP$					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
902.4	GFSK-2/0	Swivel Type Dipole, 1.57dBi	13.8	≤30	Pass
914.8	GFSK-2/0	Swivel Type Dipole, 1.57dBi	13.7	≤30	Pass
927.6	GFSK-2/0	Swivel Type Dipole, 1.57dBi	14.0	≤30	Pass
902.4	GFSK-2/1	Swivel Type Dipole, 1.57dBi	13.8	≤30	Pass
914.8	GFSK-2/1	Swivel Type Dipole, 1.57dBi	13.7	≤30	Pass
927.6	GFSK-2/1	Swivel Type Dipole, 1.57dBi	14.0	≤30	Pass

*For this Hybrid Mode there is no minimum number of hopping channels required for the 1 Watt (30dBm) limit.

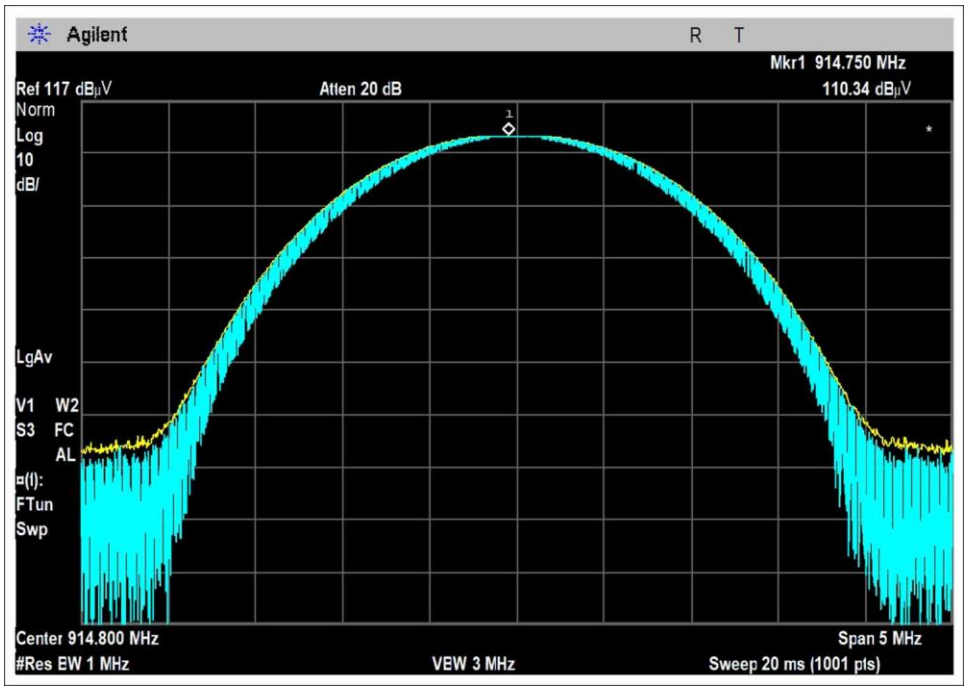
The limit is calculated according to a maximum of 1W (30 dBm) conducted power with a maximum of 6dBi gain antenna in accordance with 15.247(b)

$Limit = 30 - Roundup(G - 6)$

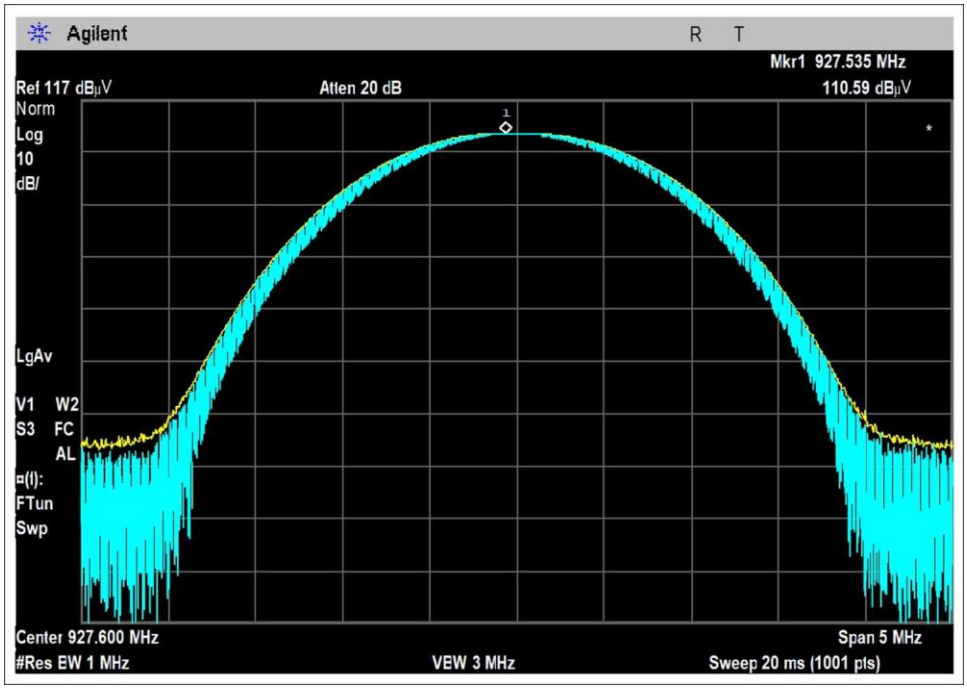
Plot(s)



Antenna 0; Low Channel



Antenna 0; Middle Channel



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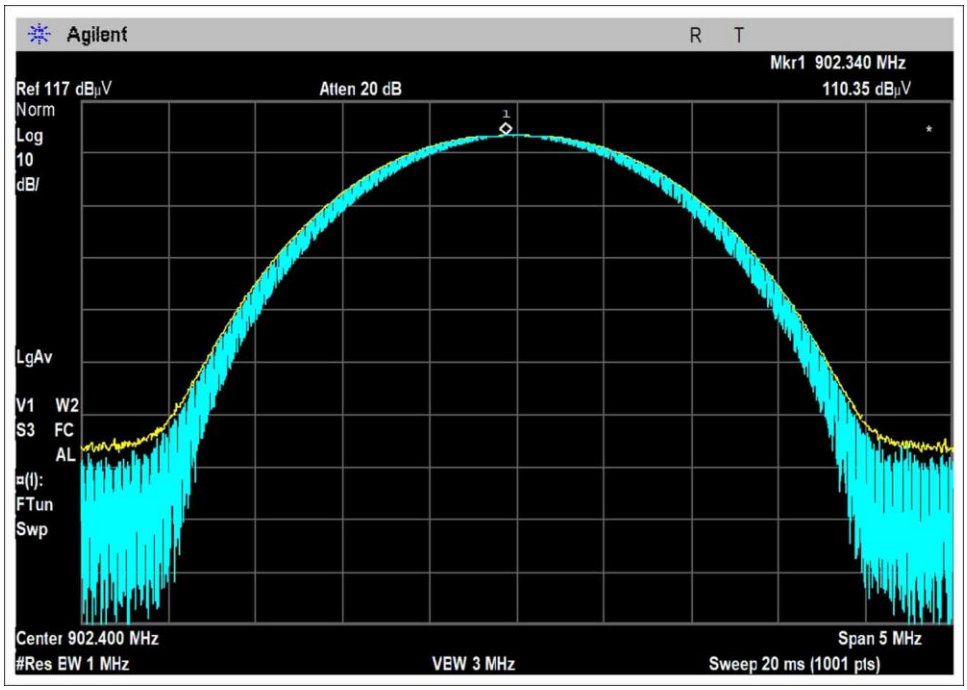
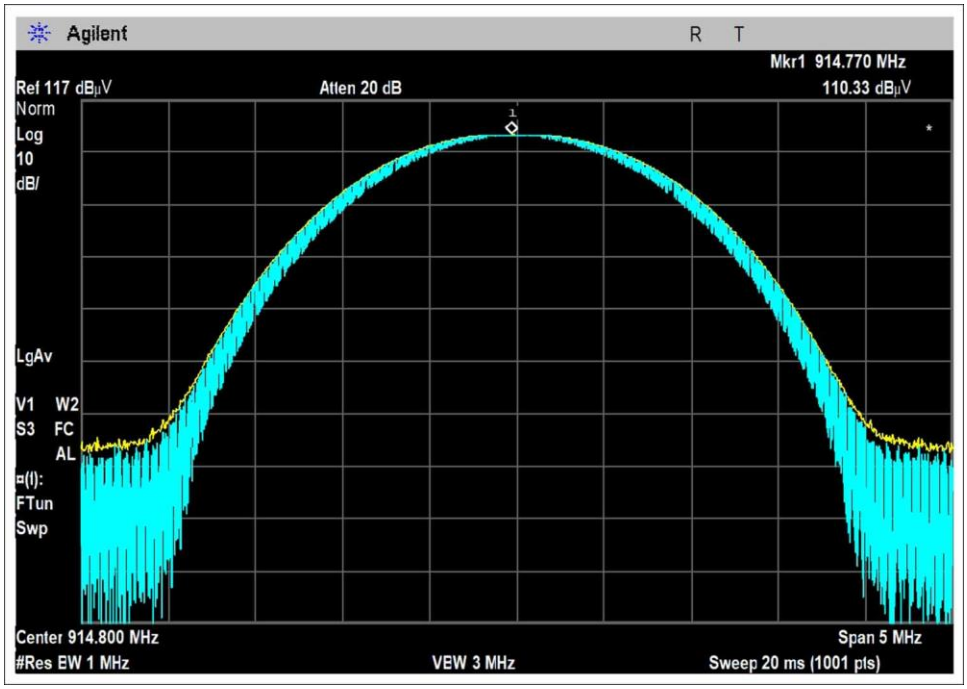
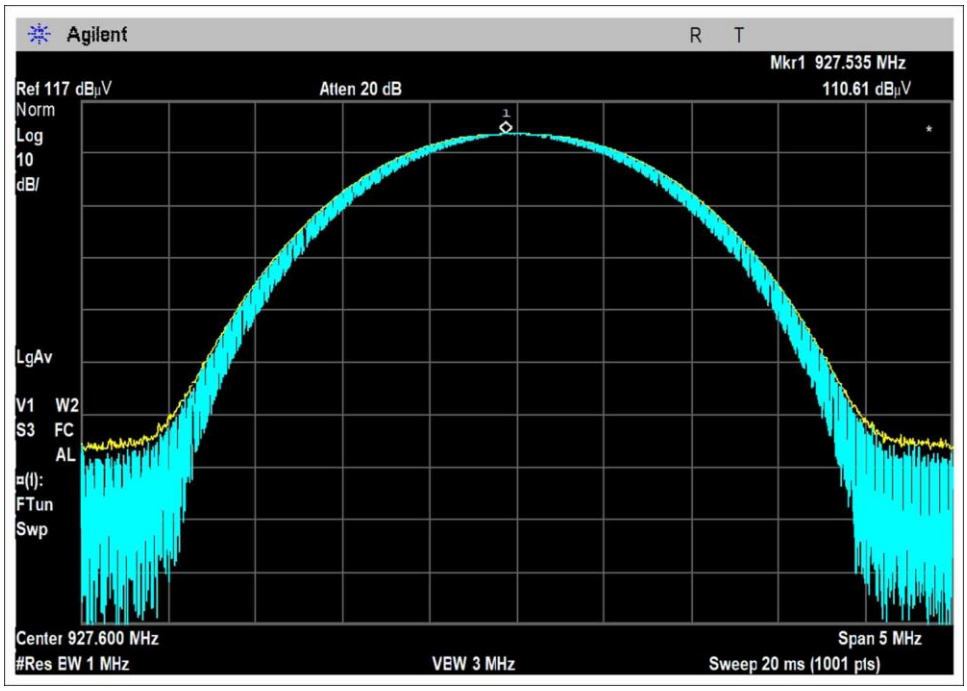


Antenna 1; Low Channel



Antenna 1; Middle Channel



Antenna 1; High Channel

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(b) Power Output (902-928 MHz DTS)**		
Work Order #:	**107516**	Date:	2/23/2023
Test Type:	**Conducted Emissions**	Time:	13:57:24
Tested By:	Matt Harrison	Sequence#:	18
Software:	EMITest 5.03.20		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

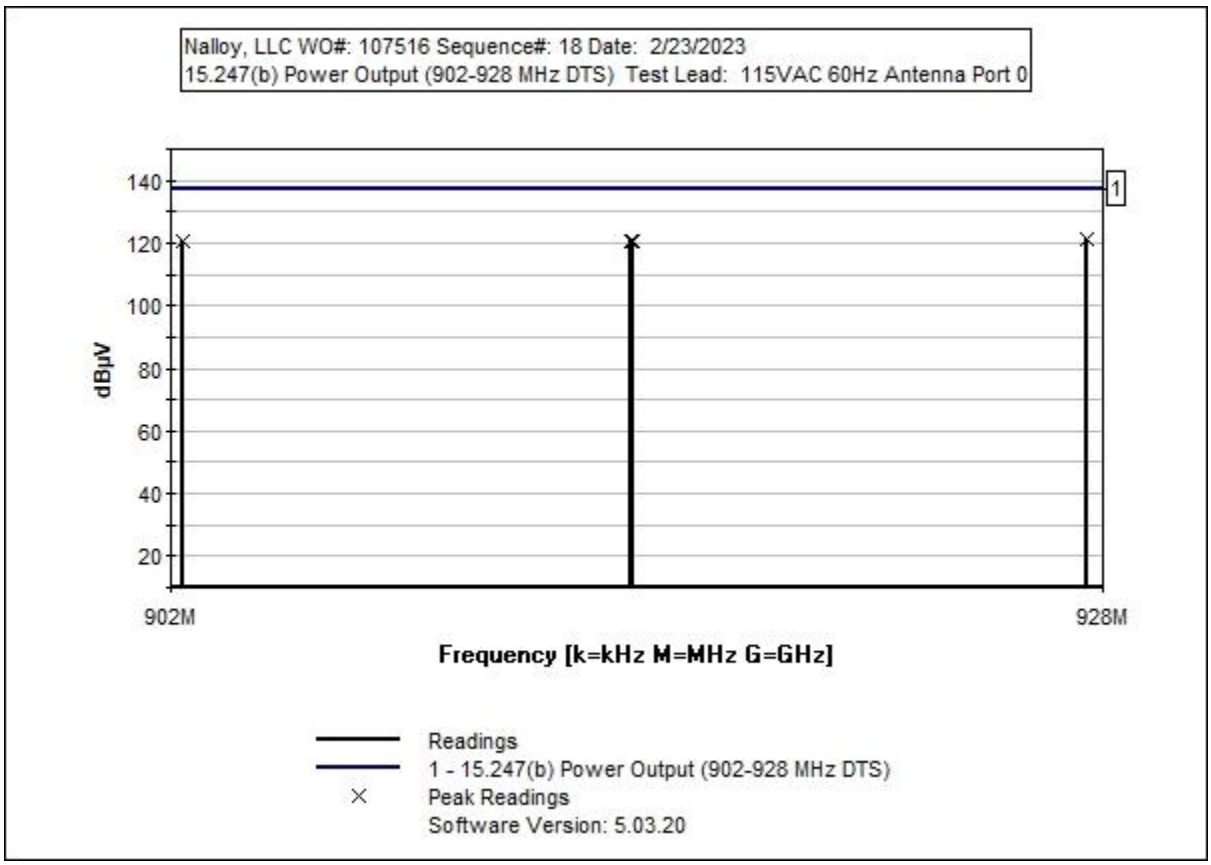
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 20°C
Humidity: 33%
Pressure: 102.1kPa

Method: ANSI C63.10: 2013

Frequency range: Fundamental

Setup:
Continuously Transmitting
Antenna 0 and Antenna 1 ports measured
Channels measured: (0) 902.4 MHz, (31) 914.8MHz High (63) 927.6MHz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	6/8/2021	6/8/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024

Measurement Data: Reading listed by margin. Test Lead: Antenna Port 0

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	927.535M	110.6	+10.1	+0.3	+0.0		+0.0	121.0	137.0 14 dBm	-16.0	Anten
2	927.535M	110.6	+10.1	+0.3	+0.0		+0.0	121.0	137.0 14 dBm	-16.0	Anten
3	902.340M	110.4	+10.1	+0.3	+0.0		+0.0	120.8	137.0 14 dBm	-16.2	Anten
4	902.340M	110.3	+10.1	+0.3	+0.0		+0.0	120.8	137.0 14 dBm	-16.3	Anten
5	914.750M	110.3	+10.1	+0.3	+0.0		+0.0	120.7	137.0 14 dBm	-16.3	Anten
6	914.770M	110.3	+10.1	+0.3	+0.0		+0.0	120.7	137.0 14 dBm	-16.3	Anten

Test Setup Photo(s)

Antenna 0

Antenna 1

15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**104760**	Date:	12/17/2020
Test Type:	**Conducted Emissions**	Time:	17:33:39
Tested By:	M. Harrison/M. Atkinson	Sequence#:	12
Software:	EMITest 5.03.20		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

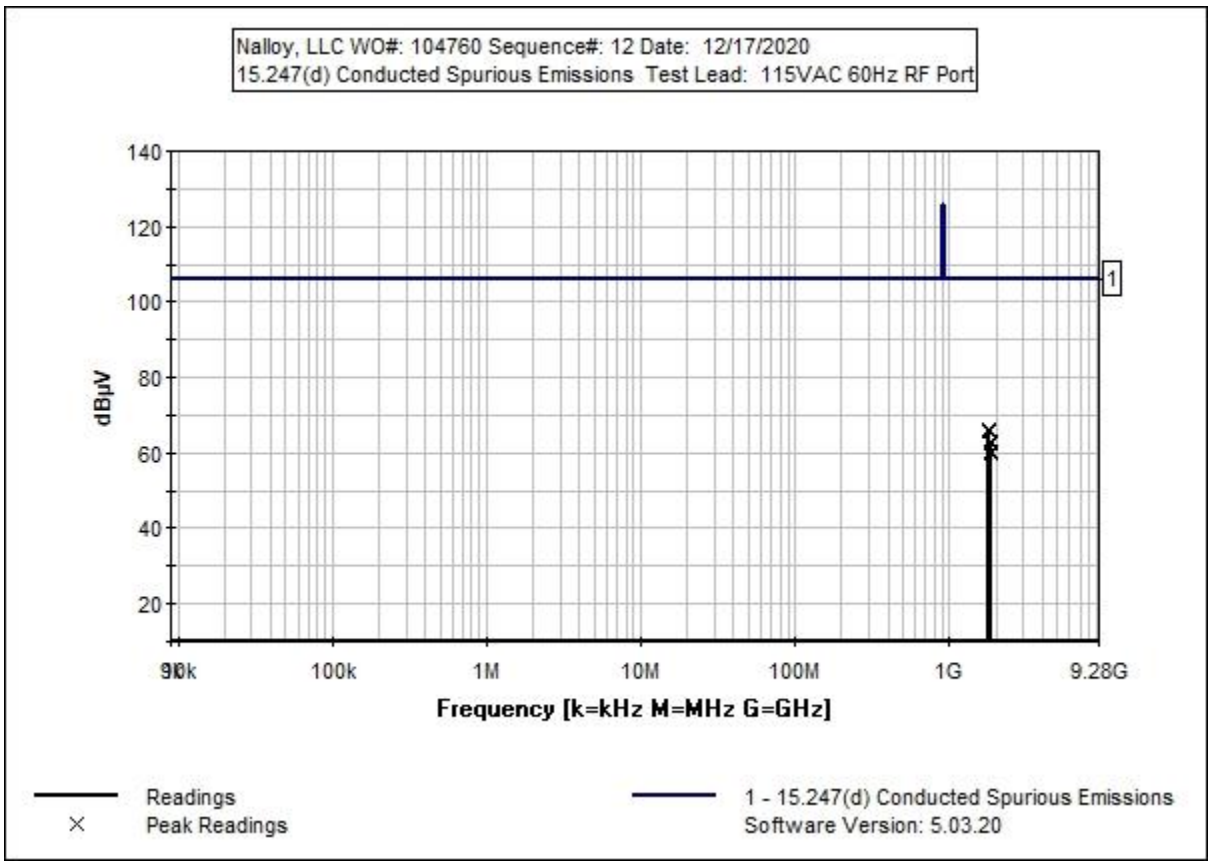
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 20°C
Humidity: 33%
Pressure: 102.1kPa

Method: ANSI C63.10 (2013)

Frequency range: 9kHz-10GHz

Setup:
Continuously Transmitting
Antenna 0 and Antenna 1 ports measured
Channels measured: (0) 902.4 MHz, (31) 914.8MHz High (63) 927.6MHz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	ANP06007	Cable	Heliax	1/20/2020	1/20/2022
T2	ANP05748	Attenuator	PE7004-20	3/4/2020	3/4/2022

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

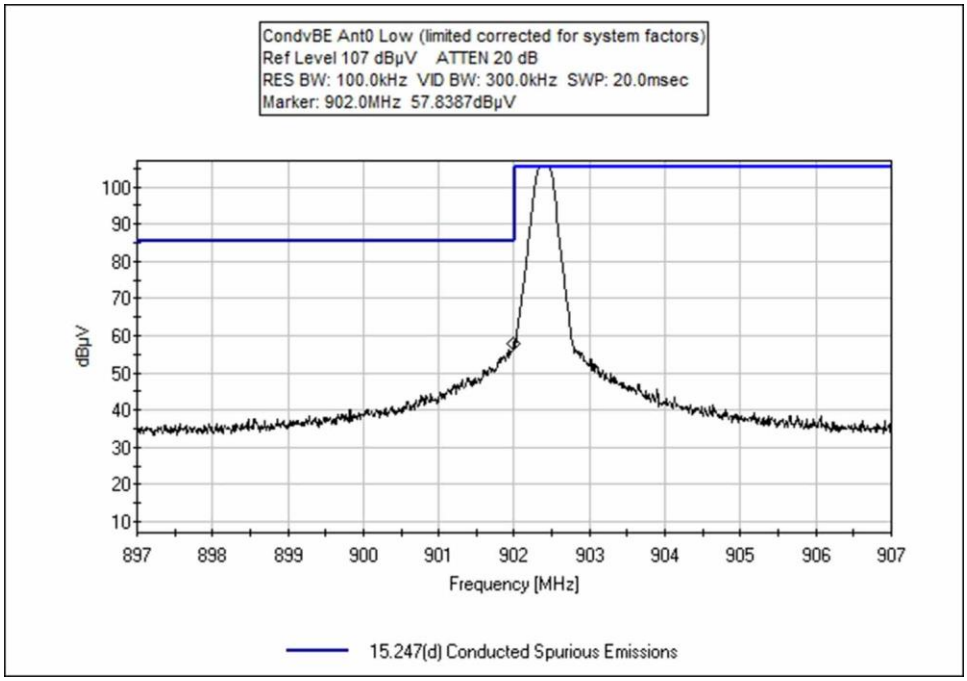
#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1804.000M	45.8	+0.6	+20.0			+0.0	66.4	105.9 ant1	-39.5	Ant1
2	1804.000M	44.9	+0.6	+20.0			+0.0	65.5	105.9 ant0	-40.4	Ant0
3	1832.000M	42.2	+0.7	+20.0			+0.0	62.9	105.9 ant0	-43.0	Ant0
4	1832.000M	41.7	+0.7	+20.0			+0.0	62.4	105.9 ant1	-43.5	Ant1
5	1851.000M	39.9	+0.7	+20.0			+0.0	60.6	105.9 ant0	-45.3	Ant0
6	1851.000M	39.3	+0.7	+20.0			+0.0	60.0	105.9 ant1	-45.9	Ant1

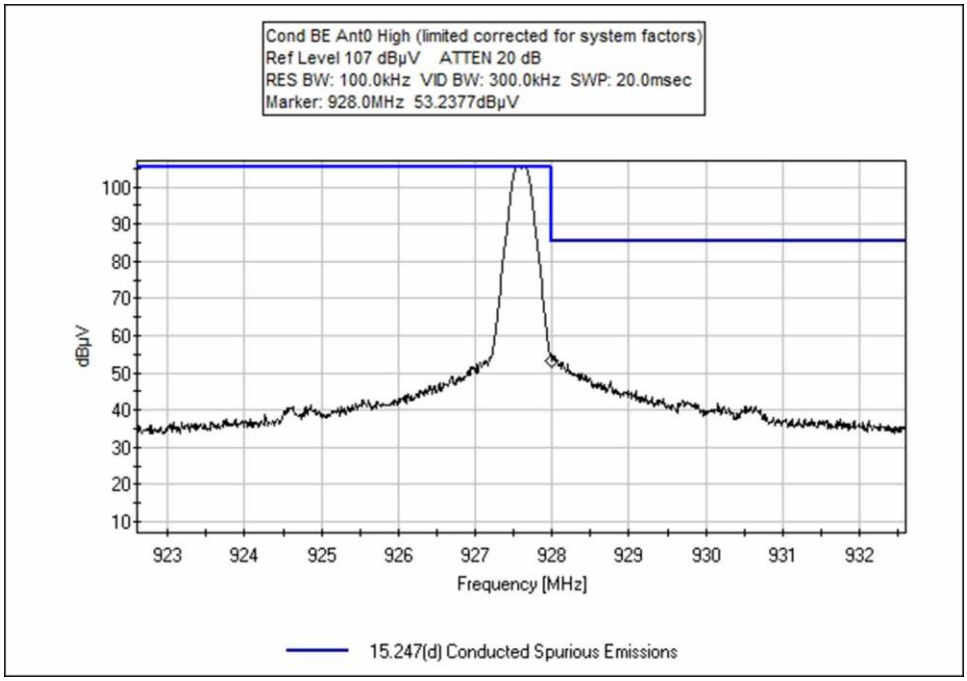
Band Edge

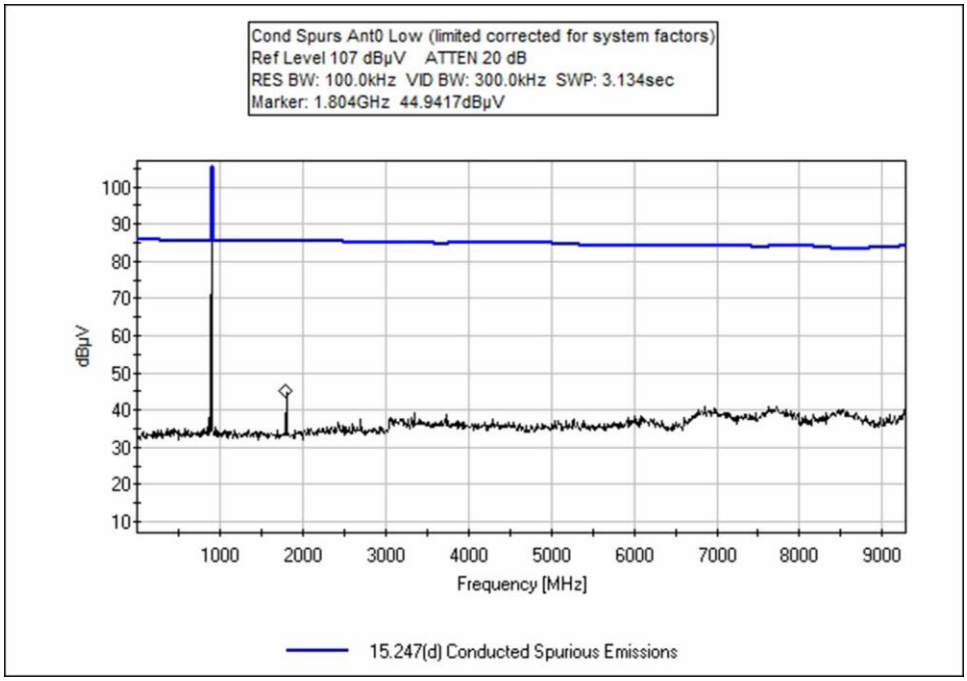
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB. Operating Mode: Single Channel (Low and High)				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902 (Ant Port 0)	GFSK-2	78.3	<105.9	Pass
928 (Ant Port 0)	GFSK-2	73.7	<105.9	Pass
902 (Ant Port 1)	GFSK-2	78.4	<105.9	Pass
928 (Ant Port 1)	GFSK-2	73.6	<105.9	Pass

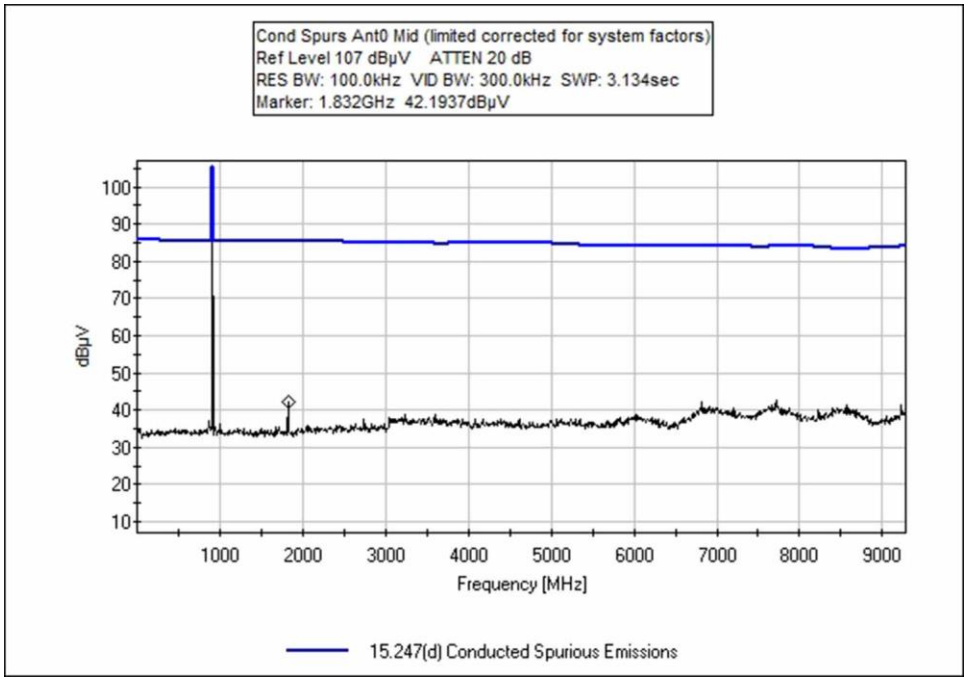
Band Edge Summary				
Limit applied: Max Power/100kHz - 20dB. Operating Mode: Hopping				
Frequency (MHz)	**Modulation**	**Measured (dBm)**	**Limit (dBm)**	**Results**
902 (Ant Port 0)	GFSK-2	81.6	<105.9	Pass
928 (Ant Port 0)	GFSK-2	75.9	<105.9	Pass
902 (Ant Port 1)	GFSK-2	73.1	<105.9	Pass
928 (Ant Port 1)	GFSK-2	82.2	<105.9	Pass

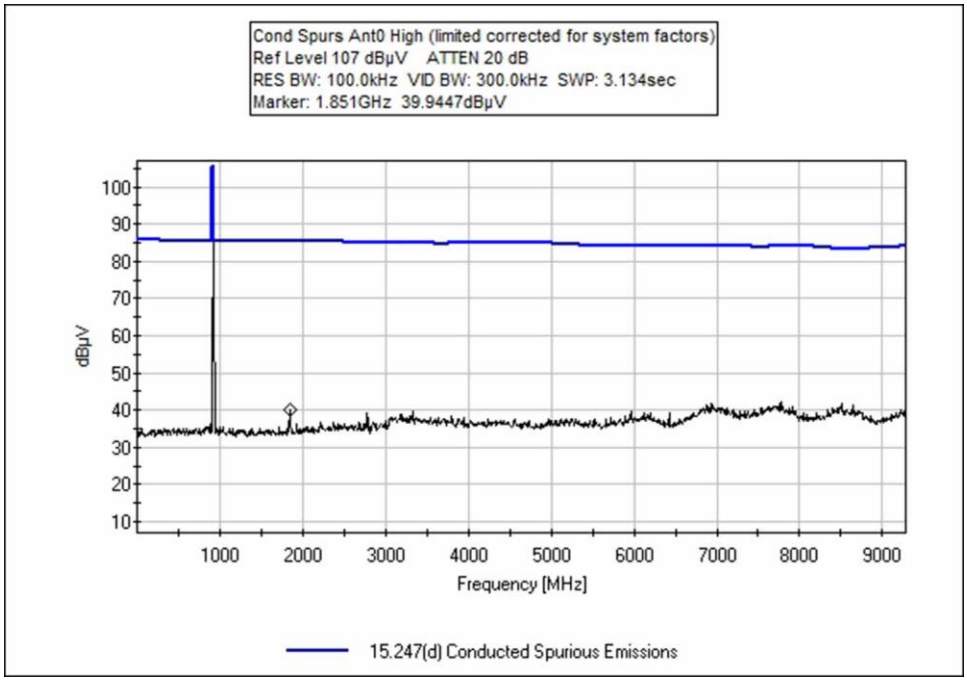
Band Edge Plots

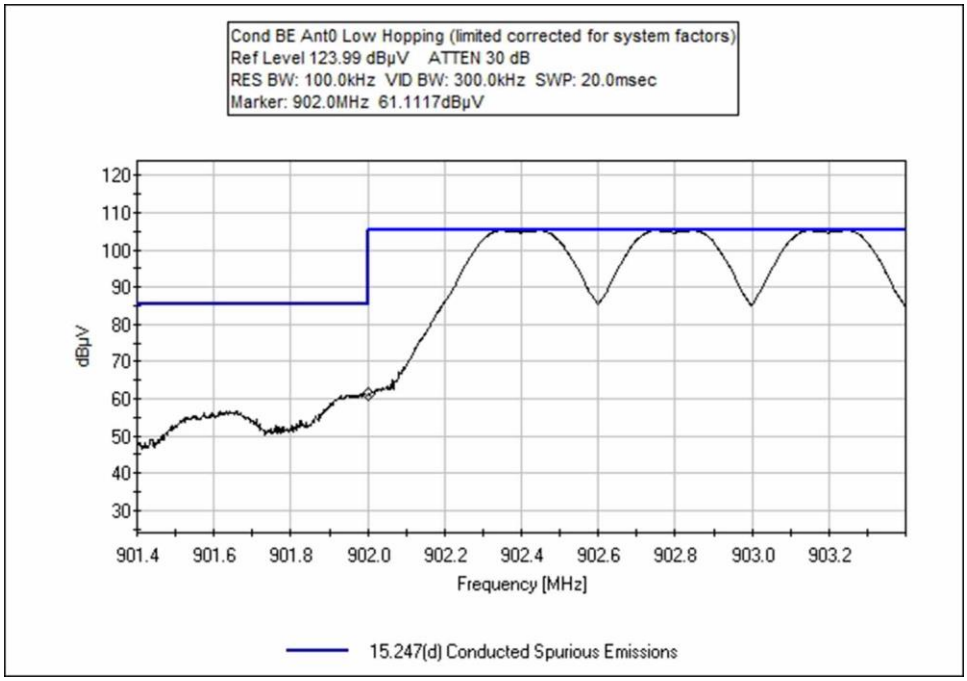


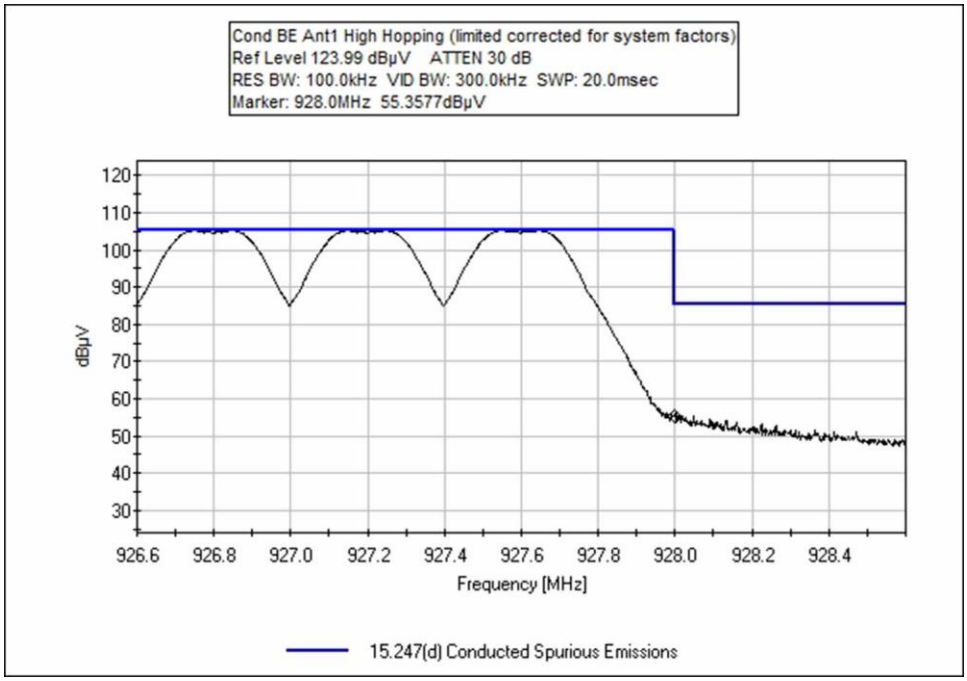


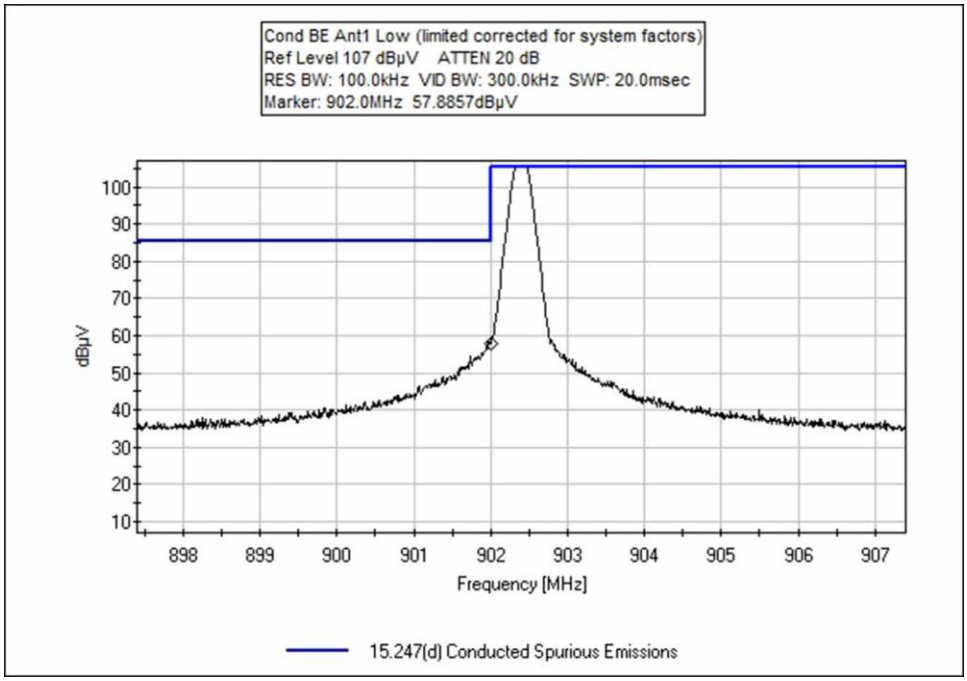

Cond Spurs Ant0 Low (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.134sec
Marker: 1.804GHz 44.9417dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

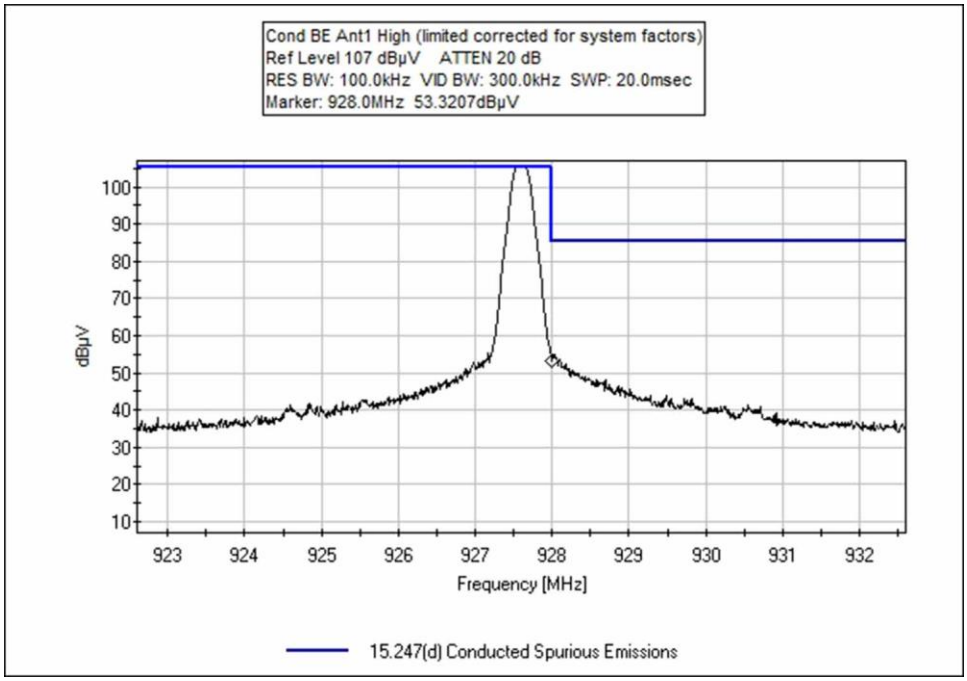

Cond Spurs Ant0 Mid (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.134sec
Marker: 1.832GHz 42.1937dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

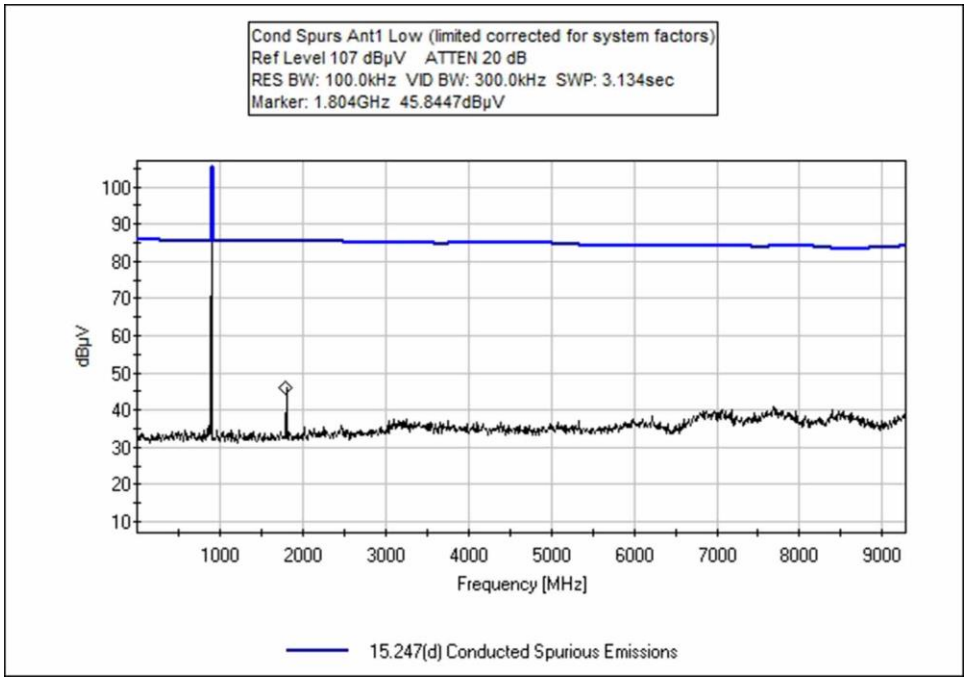

Cond Spurs Ant0 High (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.134sec
Marker: 1.851GHz 39.9447dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

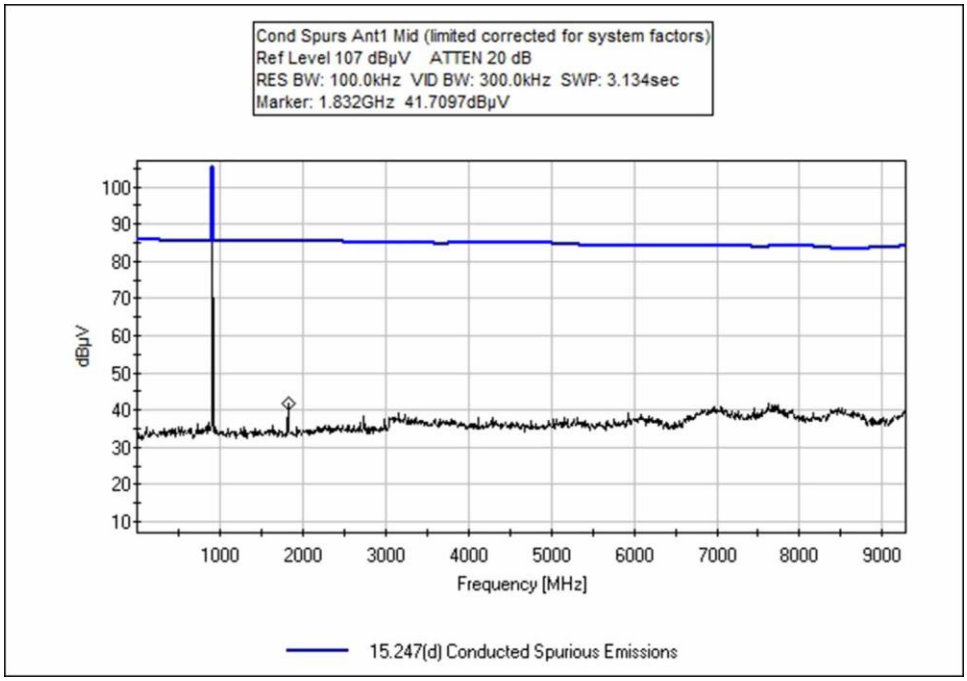

Cond BE Ant0 Low Hopping (limited corrected for system factors)
Ref Level 123.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 61.1117dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
901.4
901.6
901.8
902.0
902.2
902.4
902.6
902.8
903.0
903.2
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

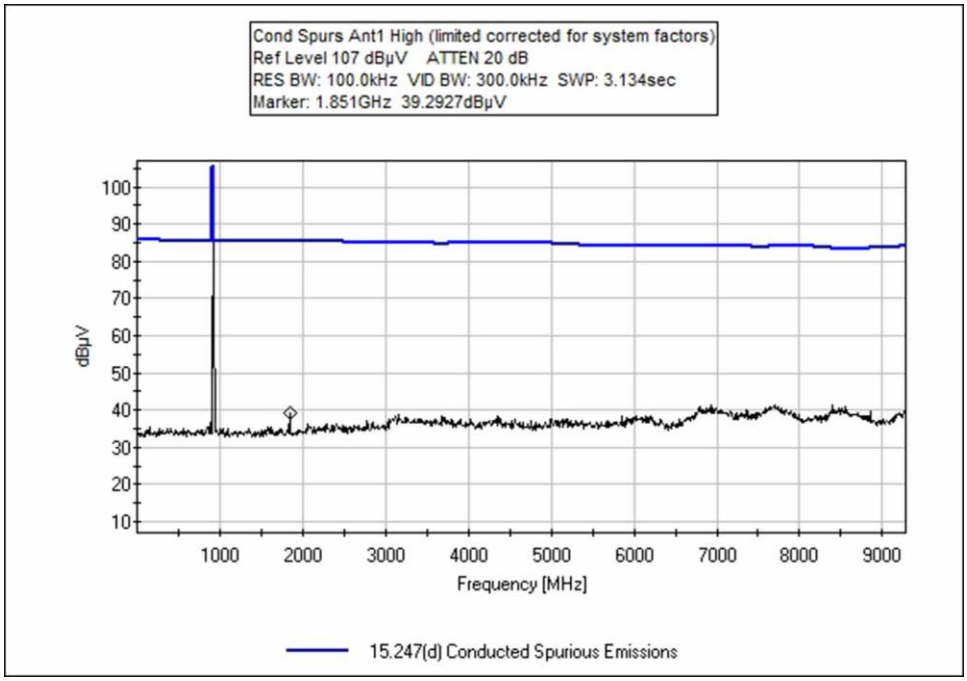

Cond BE Ant1 High Hopping (limited corrected for system factors)
Ref Level 123.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 55.3577dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
926.6
926.8
927.0
927.2
927.4
927.6
927.8
928.0
928.2
928.4
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

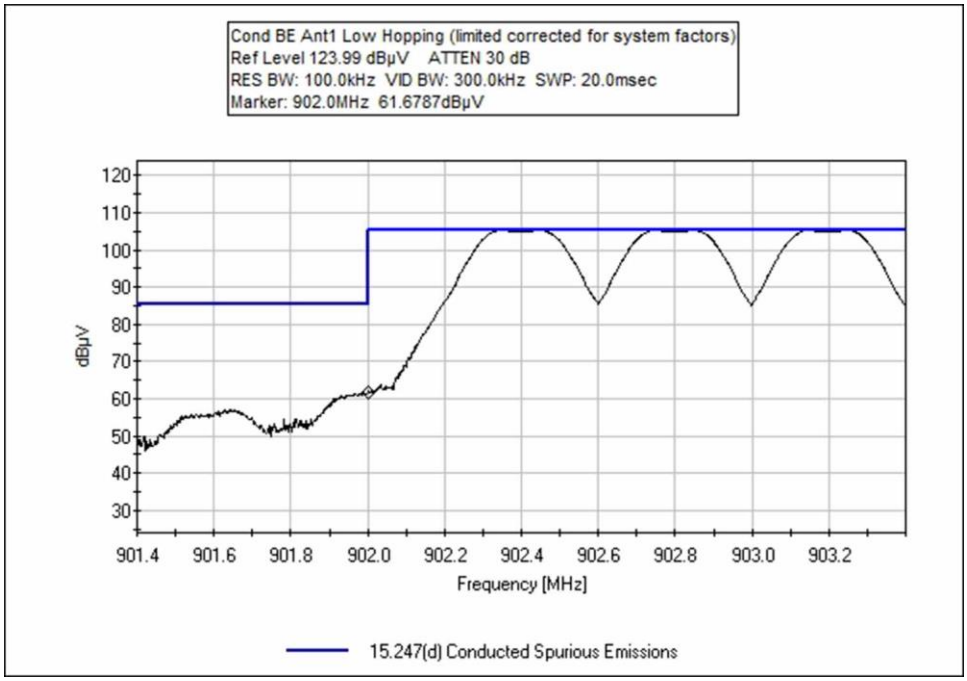

Cond BE Ant1 Low (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 57.8857dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

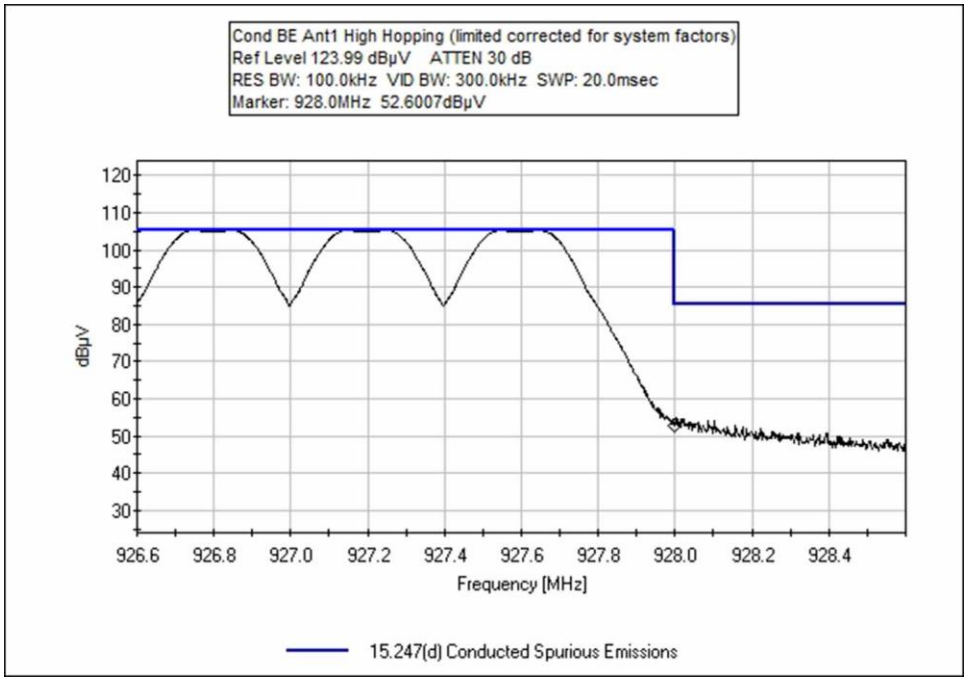

Cond BE Ant1 High (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 53.3207dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond Spurs Ant1 Low (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.134sec
Marker: 1.804GHz 45.8447dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond Spurs Ant1 Mid (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.134sec
Marker: 1.832GHz 41.7097dBµV
dBµV
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond Spurs Ant1 High (limited corrected for system factors)
Ref Level 107 dBµV ATTEN 20 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 3.134sec
Marker: 1.851GHz 39.2927dBµV
dBµV
100
90
80
70
60
50
40
30
20
10
1000
2000
3000
4000
5000
6000
7000
8000
9000
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond BE Ant1 Low Hopping (limited corrected for system factors)
Ref Level 123.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 61.6787dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
901.4
901.6
901.8
902.0
902.2
902.4
902.6
902.8
903.0
903.2
Frequency [MHz]
15.247(d) Conducted Spurious Emissions


Cond BE Ant1 High Hopping (limited corrected for system factors)
Ref Level 123.99 dBµV ATTEN 30 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 52.6007dBµV
dBµV
120
110
100
90
80
70
60
50
40
30
926.6
926.8
927.0
927.2
927.4
927.6
927.8
928.0
928.2
928.4
Frequency [MHz]
15.247(d) Conducted Spurious Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(d) Conducted Spurious Emissions**		
Work Order #:	**104760**	Date:	12/17/2020
Test Type:	**Conducted Emissions**	Time:	17:33:39
Tested By:	M. Harrison/M. Atkinson	Sequence#:	12
Software:	EMITest 5.03.20		115VAC 60Hz

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: 20°C
Humidity: 33%
Pressure: 102.1kPa

Method: ANSI C63.10 (2013)

Frequency range: 9kHz-10GHz

Setup:
Continuously Transmitting
Antenna 0 and Antenna 1 ports measured
Channels measured: (0) 902.4 MHz, (31) 914.8MHz High (63) 927.6MHz

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	ANP06007	Cable	Heliax	1/20/2020	1/20/2022
T2	ANP05748	Attenuator	PE7004-20	3/4/2020	3/4/2022

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	902.000M	61.7	+0.5	+20.0			+0.0	82.2	105.9 ant1 hop	-23.7	RF Po
2	902.000M	61.1	+0.5	+20.0			+0.0	81.6	105.9 ant0 hop	-24.3	RF Po
3	902.000M	57.9	+0.5	+20.0			+0.0	78.4	105.9 ant1	-27.5	Ant1
4	902.000M	57.8	+0.5	+20.0			+0.0	78.3	105.9 ant0	-27.6	Ant0
5	928.000M	55.4	+0.5	+20.0			+0.0	75.9	105.9 ant0 hop	-30.0	RF Po
6	928.000M	53.2	+0.5	+20.0			+0.0	73.7	105.9 ant0	-32.2	Ant0
7	928.000M	53.1	+0.5	+20.0			+0.0	73.6	105.9 ant1	-32.3	Ant1
8	928.000M	52.6	+0.5	+20.0			+0.0	73.1	105.9 ant1 hop	-32.8	RF Po

Test Setup Photo(s)

Antenna 0

Antenna 1

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107516**	Date:	3/2/2023
Test Type:	**Maximized Emissions**	Time:	10:30:53
Tested By:	M. Harrison	Sequence#:	4
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

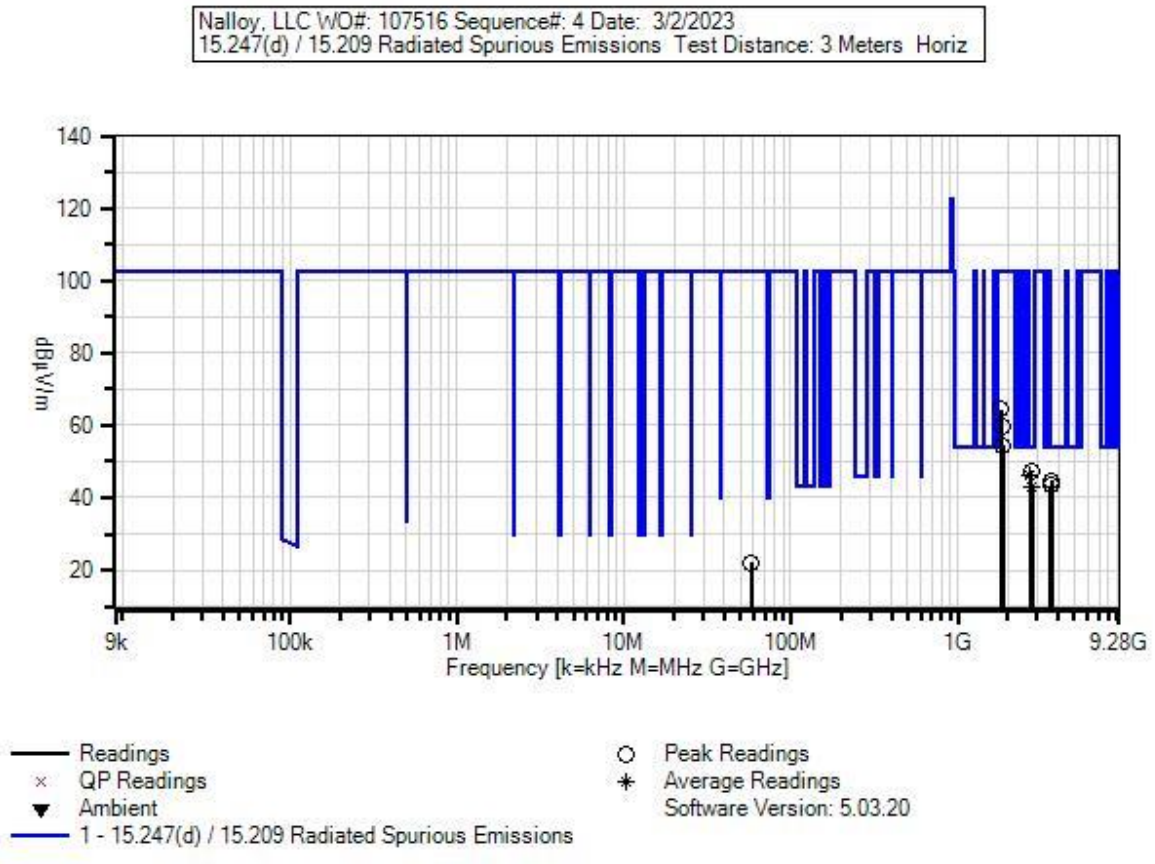
Test Environment Conditions:
Temperature: 20°C
Humidity: 43%
Pressure: 102.7kPa

Method: ANSI C63.10 (2013)

Frequency range: 9kHz-10GHz

Setup:
SBS Module
Antenna 0
Low Channel (0) 902.4 MHz, Mid (31) 914.8MHz, High (63) 927.6MHz
GFSK-2
100% Duty Cycle
PWR Level Setting: 200
PWR Output: 20dBm
POE powered

Note: No EUT emissions found within 20 dB of the limit below 30MHz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T2	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T3	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T4	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T6	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T7	AN02307	Preamp	8447D	1/6/2022	1/6/2024
T8	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T9	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
	AN03807	Spectrum Analyzer	E4440A	10/6/2022	10/6/2024
	AN02672	Spectrum Analyzer	E4446A	5/9/2022	5/9/2024
T10	ANP06515	Cable	Heliax	3/1/2023	3/1/2025

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

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2744.400M	48.0	-34.1 +0.5 +0.0	+29.3 +0.3 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	47.5	54.0	-6.5	Horiz
2	2707.200M Ave	46.7	-34.1 +0.5 +0.0	+29.5 +0.2 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	46.3	54.0	-7.7	Horiz
^	2707.200M	54.6	-34.1 +0.5 +0.0	+29.5 +0.2 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	54.2	54.0	+0.2	Horiz
4	3659.515M	41.9	-33.8 +0.4 +0.0	+31.7 +0.2 +3.7	+0.0 +0.0	+0.6 +0.0	+0.0	44.7	54.0	-9.3	Horiz
5	3609.665M	40.5	-33.8 +0.4 +0.0	+31.7 +0.3 +3.7	+0.0 +0.0	+0.5 +0.0	+0.0	43.3	54.0	-10.7	Horiz
6	2782.800M Ave	43.5	-34.1 +0.5 +0.0	+29.3 +0.3 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	43.0	54.0	-11.0	Horiz
^	2782.800M	51.1	-34.1 +0.5 +0.0	+29.3 +0.3 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	50.6	54.0	-3.4	Horiz
8	1804.515M	68.4	-34.7 +0.3 +0.0	+27.3 +0.6 +2.2	+0.0 +0.0	+0.4 +0.0	+0.0	64.5	102.4	-37.9	Horiz
9	1829.495M	63.1	-34.7 +0.3 +0.0	+27.5 +0.6 +2.3	+0.0 +0.0	+0.4 +0.0	+0.0	59.5	102.4	-42.9	Horiz
10	1855.025M	57.8	-34.7 +0.3 +0.0	+27.7 +0.6 +2.3	+0.0 +0.0	+0.4 +0.0	+0.0	54.4	102.4	-48.0	Horiz
11	58.200M	36.3	+0.0 +0.0 +0.5	+0.0 +0.0 +0.0	+0.5 -27.8	+0.1 +12.5	+0.0	22.1	102.4	-80.3	Horiz

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**107516**	Date:	3/2/2023
Test Type:	**Maximized Emissions**	Time:	10:47:10
Tested By:	Matt Harrison	Sequence#:	5
Software:	EMITest 5.03.20		

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

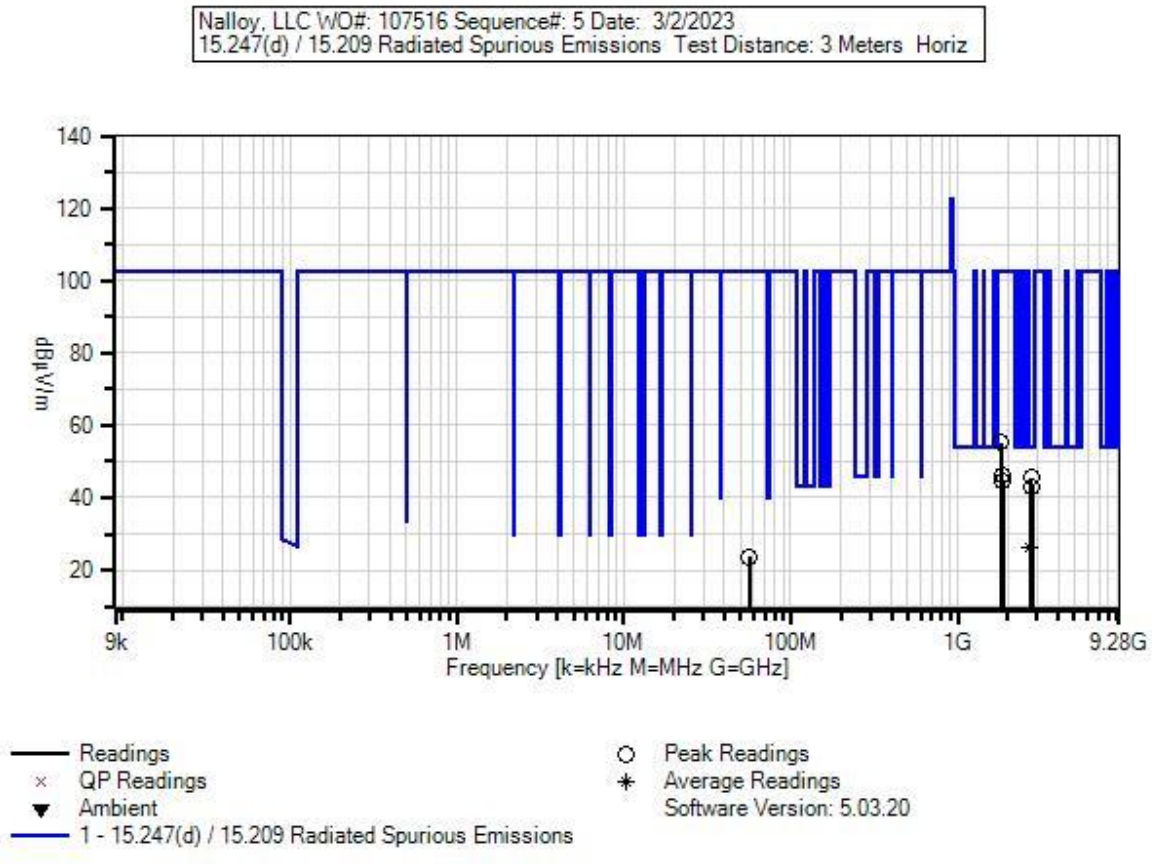
Test Environment Conditions:
Temperature: 20°C
Humidity: 43%
Pressure: 102.7kPa

Method: ANSI C63.10 (2013)

Frequency range: 9kHz-10GHz

Setup:
SBS Module
Antenna 1
Low Channel (0) 902.4 MHz, Mid (31) 914.8MHz, High (63) 927.6MHz
GFSK-2
100% Duty Cycle
PWR Level Setting: 200
PWR Output: 20dBm
POE powered

Note: No EUT Emissions found within 20dB of the limit below 30MHz.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03540	Preamp	83017A	5/14/2021	5/14/2023
T2	AN02374ANSI	Horn Antenna	RGA-60	5/25/2021	5/25/2023
T3	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T4	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T5	ANP07504	Cable	CLU40-KMKM-02.00F	1/26/2021	1/26/2023
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T6	AN03170	High Pass Filter	HM1155-11SS	9/16/2021	9/16/2023
T7	AN02307	Preamp	8447D	1/6/2022	1/6/2024
	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T8	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T9	ANP05360	Cable	RG214	2/4/2022	2/4/2024
	AN03807	Spectrum Analyzer	E4440A	10/6/2022	10/6/2024
	AN02672	Spectrum Analyzer	E4446A	5/9/2022	5/9/2024
T10	ANP06515	Cable	Heliax	3/1/2023	3/1/2025

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

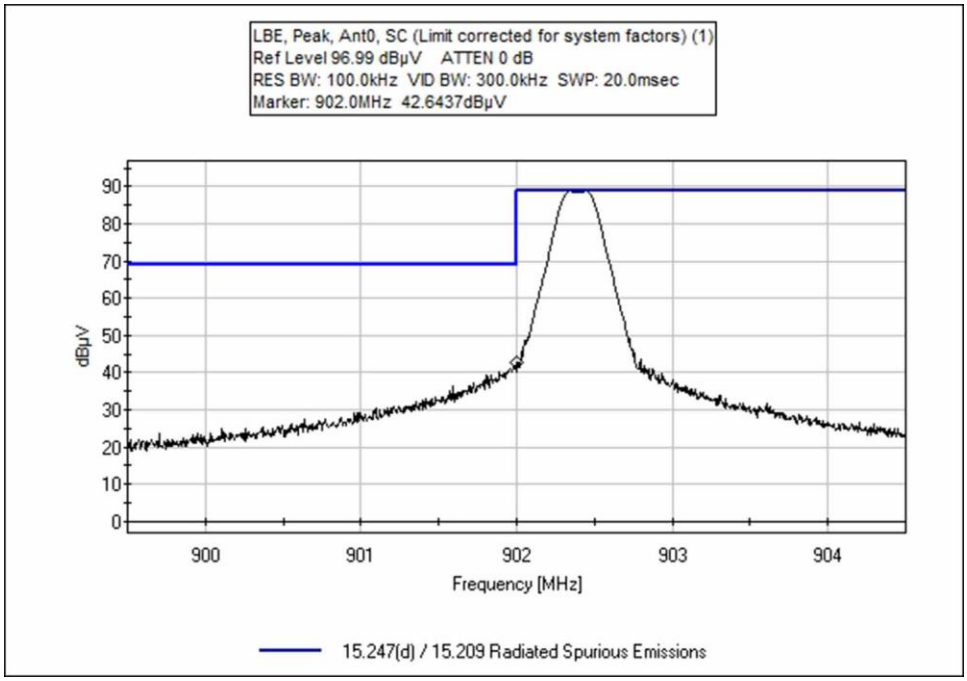
#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	2744.400M	46.0	-34.1 +0.5 +0.0	+29.3 +0.3 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	45.5	54.0	-8.5	Horiz
2	2782.460M	43.5	-34.1 +0.5 +0.0	+29.3 +0.3 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	43.0	54.0	-11.0	Horiz
3	2707.200M Ave	26.7	-34.1 +0.5 +0.0	+29.5 +0.2 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	26.3	54.0	-27.7	Horiz
^	2707.200M	51.8	-34.1 +0.5 +0.0	+29.5 +0.2 +3.0	+0.0 +0.0	+0.5 +0.0	+0.0	51.4	54.0	-2.6	Horiz
5	1804.800M	59.2	-34.7 +0.3 +0.0	+27.3 +0.6 +2.2	+0.0 +0.0	+0.4 +0.0	+0.0	55.3	102.4	-47.1	Horiz
6	1829.600M	49.9	-34.7 +0.3 +0.0	+27.5 +0.6 +2.3	+0.0 +0.0	+0.4 +0.0	+0.0	46.3	102.4	-56.1	Horiz
7	1855.090M	48.2	-34.7 +0.3 +0.0	+27.7 +0.6 +2.3	+0.0 +0.0	+0.4 +0.0	+0.0	44.8	102.4	-57.6	Horiz
8	56.750M	38.1	+0.0 +0.0 +0.5	+0.0 +0.0 +0.0	+0.5 -27.8	+0.1 +12.4	+0.0	23.8	102.4	-78.6	Horiz

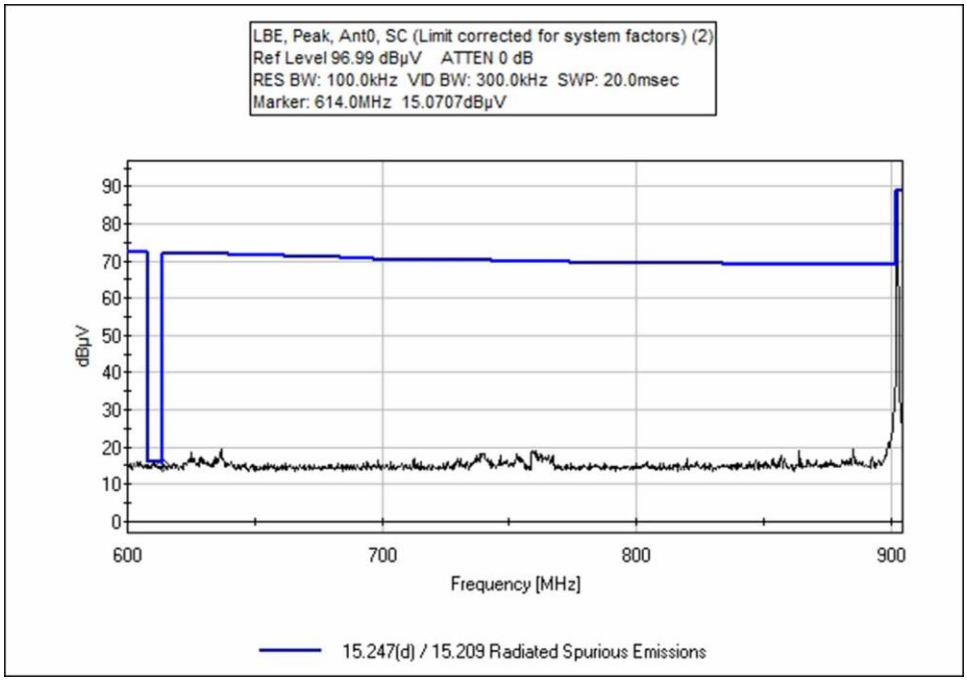
Band Edge

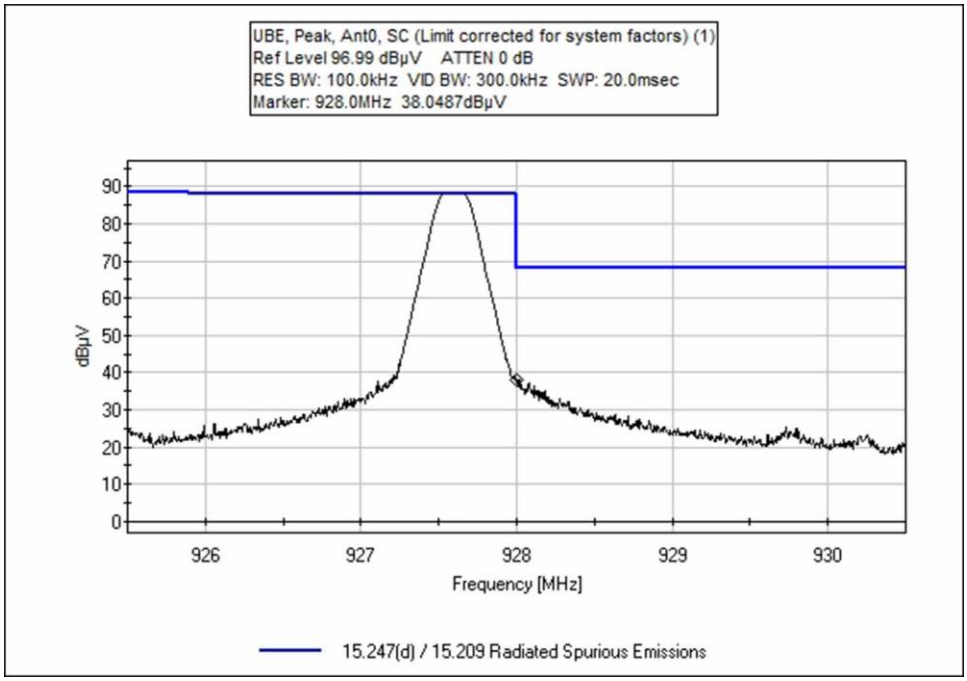
Band Edge Summary					
Operating Mode: Single Channel (Low and High)					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614 (Port 0)	GFSK-2	Swivel Type Dipole	39.6	<46	Pass
902 (Port 0)	GFSK-2	Swivel Type Dipole	76	<102.4	Pass
928 (Port 0)	GFSK-2	Swivel Type Dipole	72.1	<102.4	Pass
960 (Port 0)	GFSK-2	Swivel Type Dipole	46.4	<54	Pass
614 (Port 1)	GFSK-2	Swivel Type Dipole	39.5	<46	Pass
902 (Port 1)	GFSK-2	Swivel Type Dipole	75.7	<102.4	Pass
928 (Port 1)	GFSK-2	Swivel Type Dipole	69.2	<102.4	Pass
960 (Port 1)	GFSK-2	Swivel Type Dipole	46.1	<54	Pass

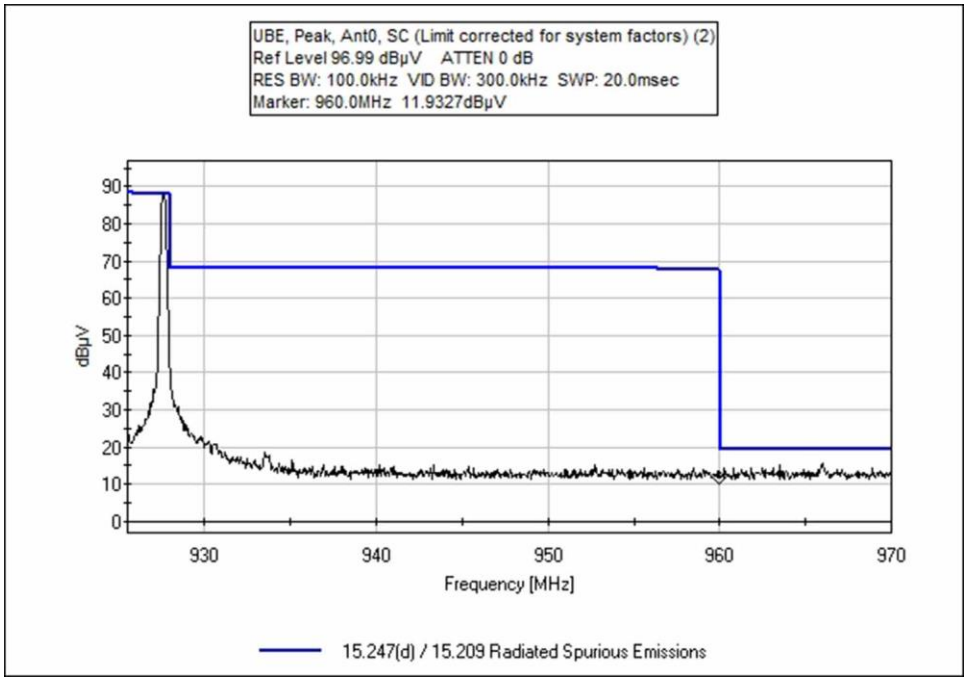
Band Edge Summary					
Operating Mode: Hopping					
Frequency (MHz)	**Modulation**	**Ant. Type**	**Field Strength (dBuV/m @3m)**	**Limit (dBuV/m @3m)**	**Results**
614 (Port 0)	GFSK-2	Swivel Type Dipole	39.5	<46	Pass
902 (Port 0)	GFSK-2	Swivel Type Dipole	79.8	<102.4	Pass
928 (Port 0)	GFSK-2	Swivel Type Dipole	65.8	<102.4	Pass
960 (Port 0)	GFSK-2	Swivel Type Dipole	43.8	<54	Pass
614 (Port 1)	GFSK-2	Swivel Type Dipole	39.5	<46	Pass
902 (Port 1)	GFSK-2	Swivel Type Dipole	79	<102.4	Pass
928 (Port 1)	GFSK-2	Swivel Type Dipole	70	<102.4	Pass
960 (Port 1)	GFSK-2	Swivel Type Dipole	43.9	<54	Pass

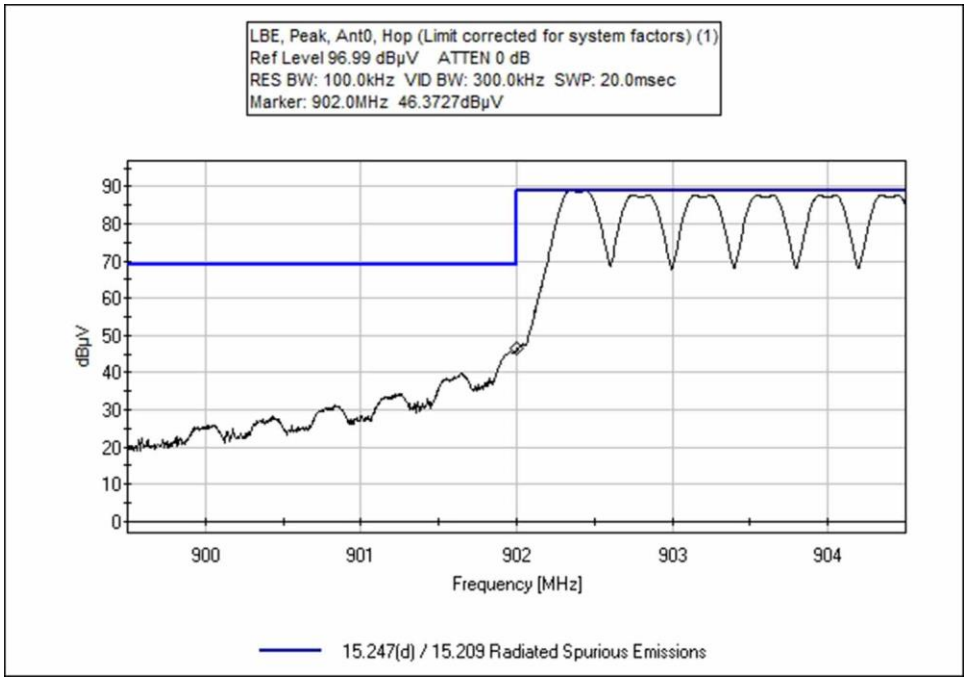
Band Edge Plots

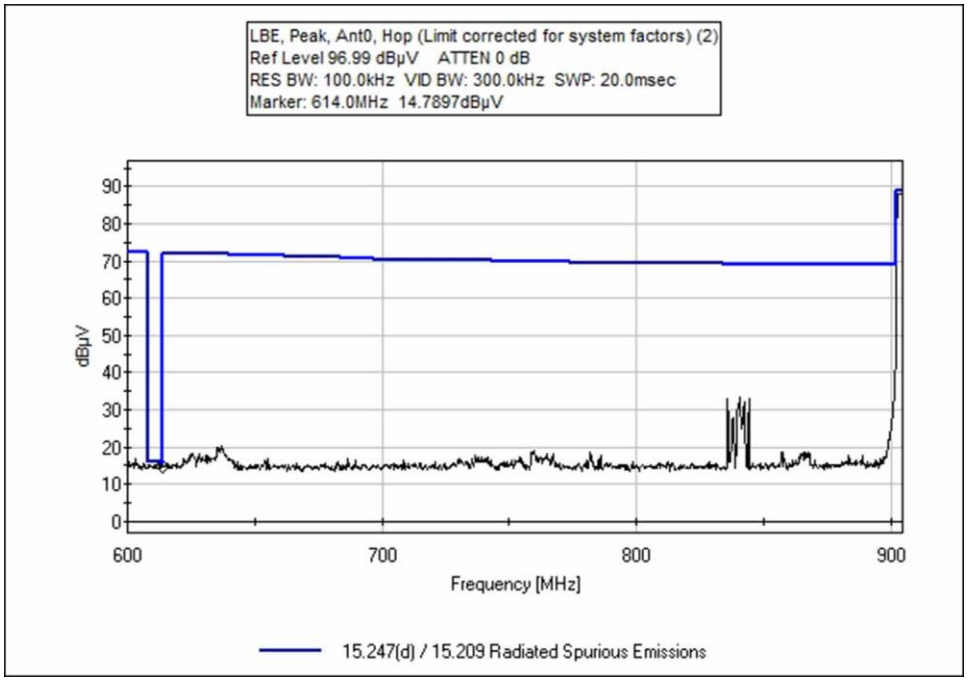


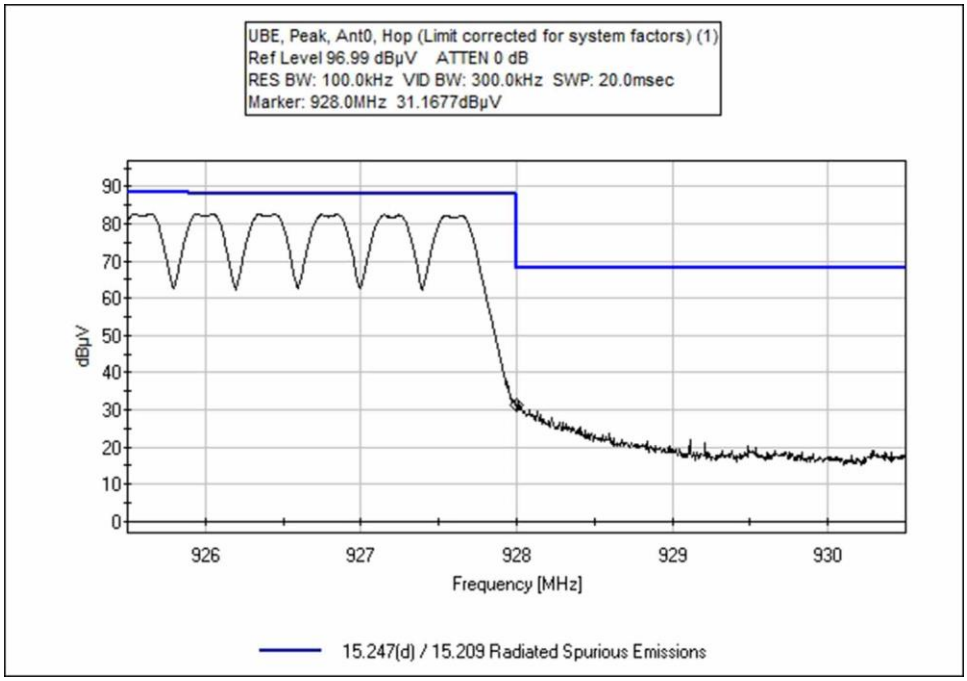


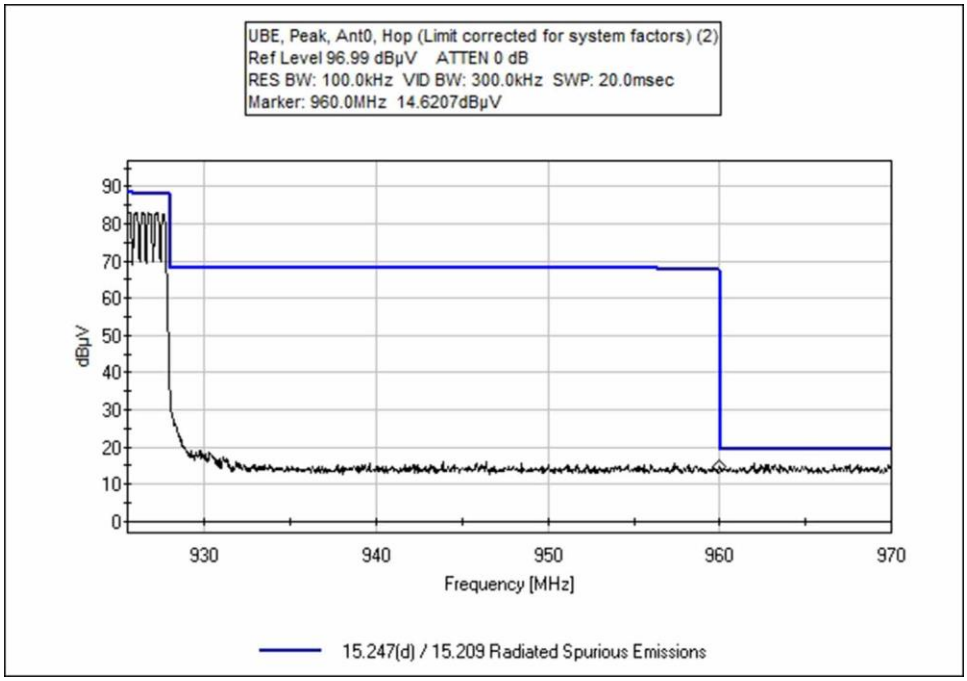

UBE, Peak, Ant0, SC (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 38.0487dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
929
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

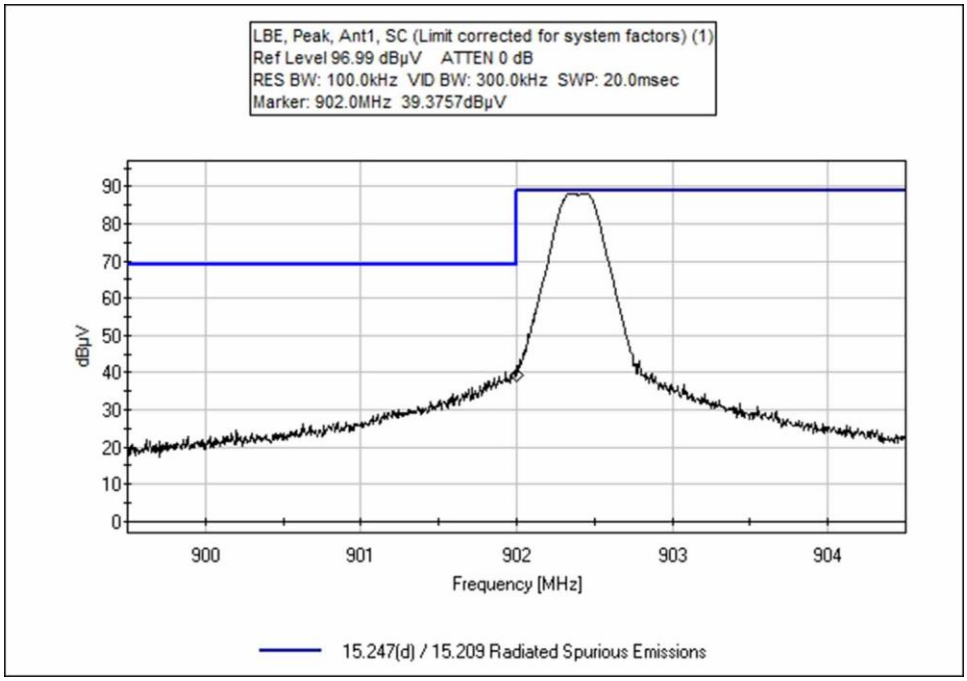

UBE, Peak, Ant0, SC (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 11.9327dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
930
940
950
960
970
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

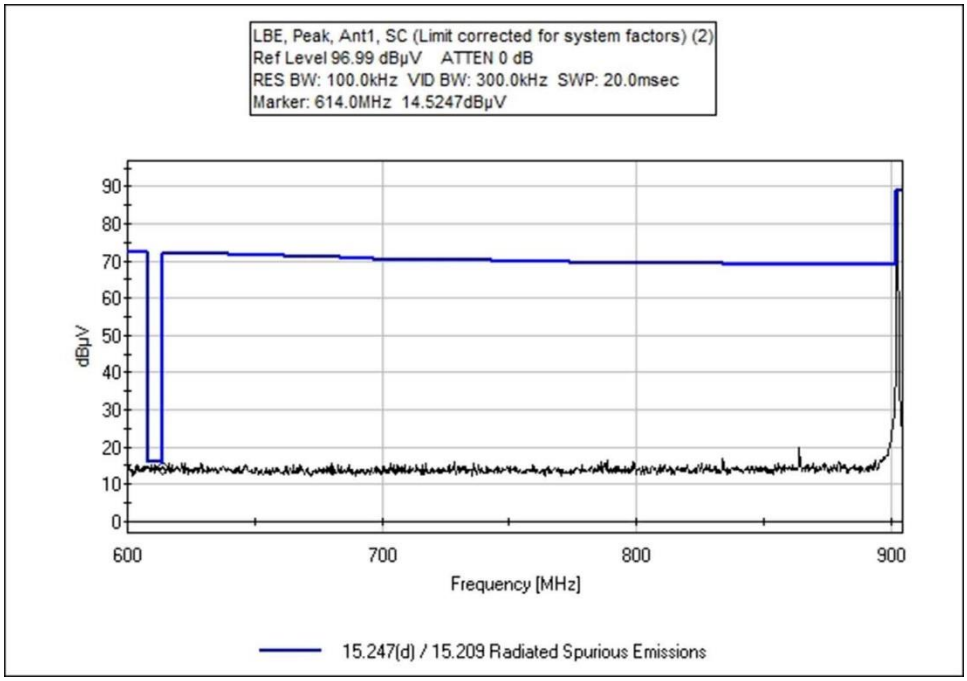

LBE, Peak, Ant0, Hop (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 46.3727dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
900
901
902
903
904
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

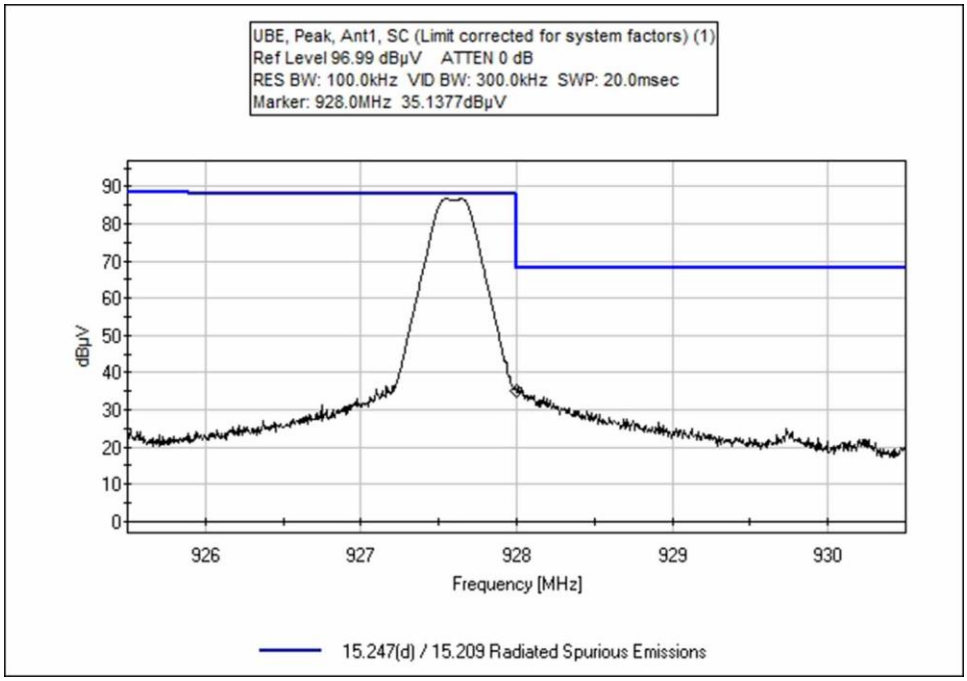

LBE, Peak, Ant0, Hop (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 614.0MHz 14.7897dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
600
700
800
900
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

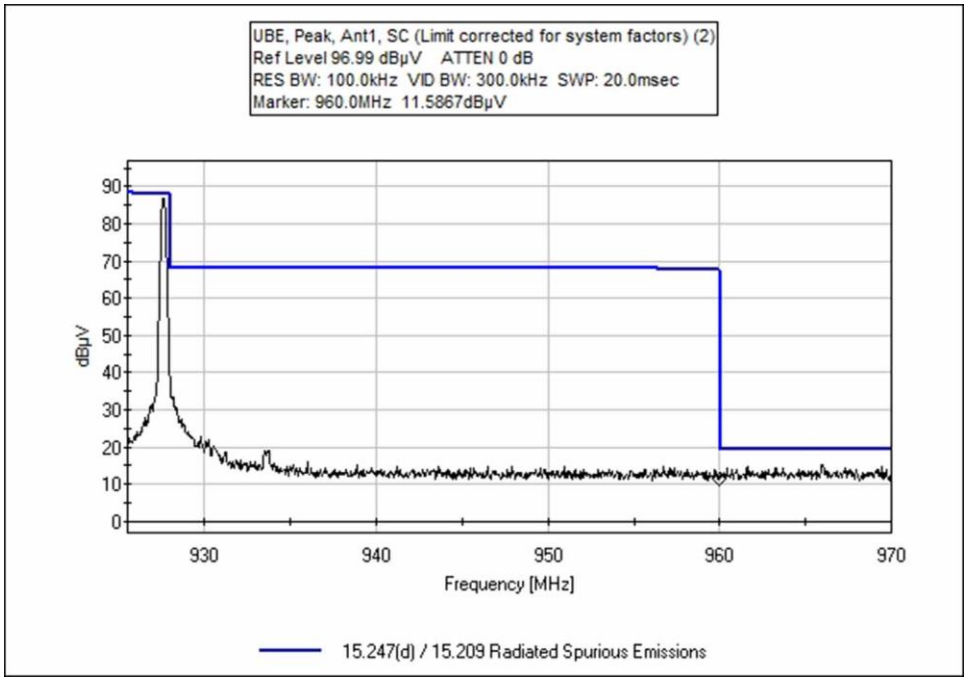

UBE, Peak, Ant0, Hop (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 31.1677dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
929
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

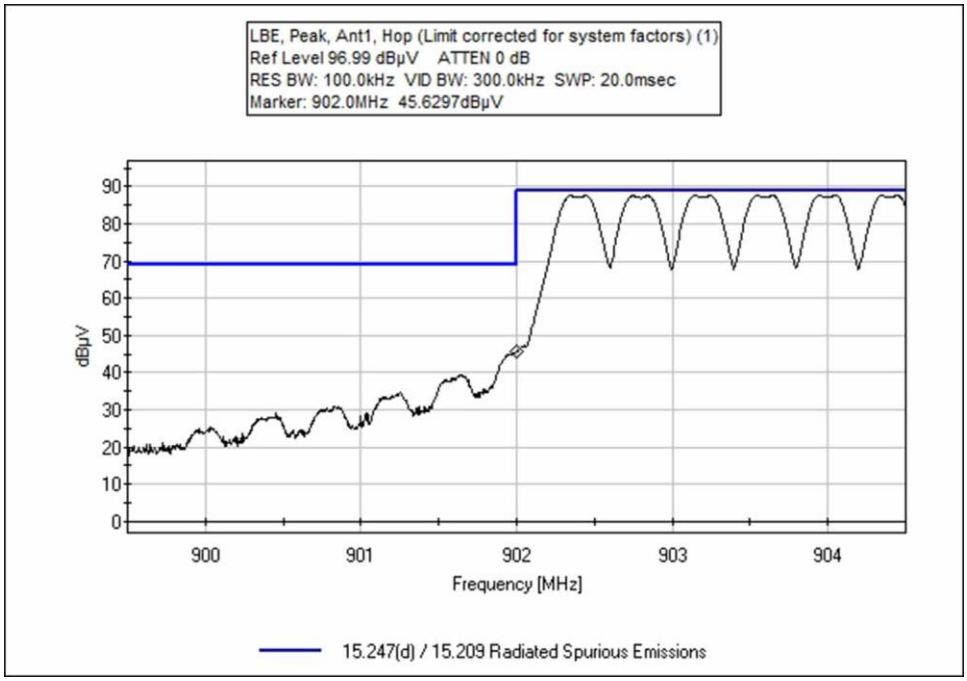

UBE, Peak, Ant0, Hop (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 960.0MHz 14.6207dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
930
940
950
960
970
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

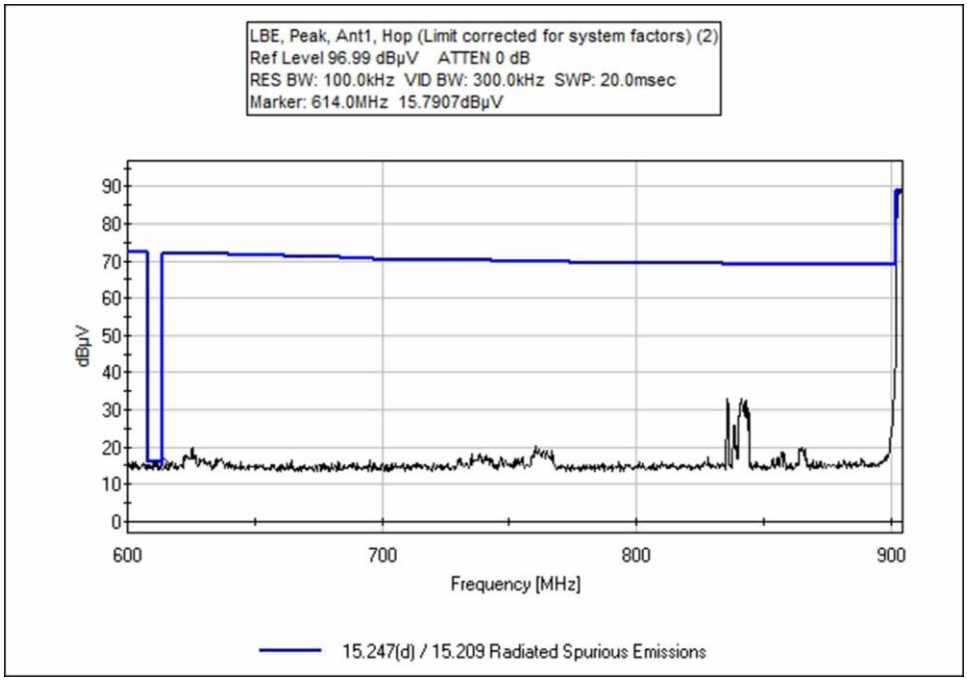

LBE, Peak, Ant1, SC (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 902.0MHz 39.3757dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

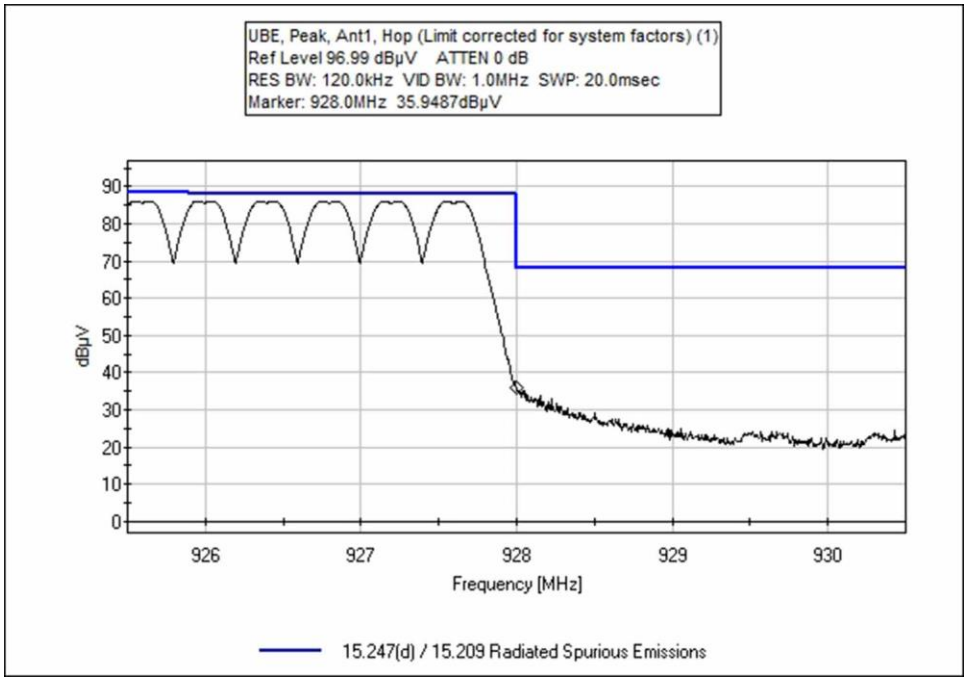

LBE, Peak, Ant1, SC (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 614.0MHz 14.5247dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions

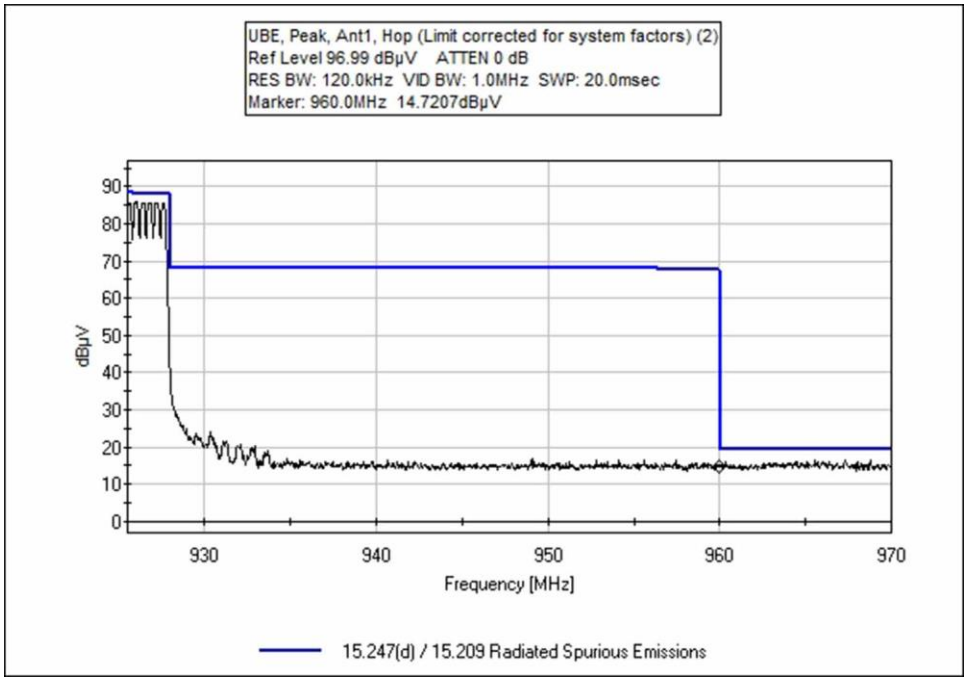

UBE, Peak, Ant1, SC (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 100.0kHz VID BW: 300.0kHz SWP: 20.0msec
Marker: 928.0MHz 35.1377dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
929
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


UBE, Peak, Ant1, SC (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 11.5867dBµV
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


LBE, Peak, Ant1, Hop (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: 902.0MHz 45.6297dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


LBE, Peak, Ant1, Hop (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: 614.0MHz 15.7907dBµV
dBµV
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


UBE, Peak, Ant1, Hop (Limit corrected for system factors) (1)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 928.0MHz 35.9487dBµV
dBµV
90
80
70
60
50
40
30
20
10
0
926
927
928
929
930
Frequency [MHz]
15.247(d) / 15.209 Radiated Spurious Emissions


UBE, Peak, Ant1, Hop (Limit corrected for system factors) (2)
Ref Level 96.99 dBµV ATTEN 0 dB
RES BW: 120.0kHz VID BW: 1.0MHz SWP: 20.0msec
Marker: 960.0MHz 14.7207dBµV
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

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**104760**	Date:	1/26/2023
Test Type:	**Maximized Emissions**	Time:	12:47:09
Tested By:	M. Harrison/M. Atkinson	Sequence#:	8
Software:	EMITest 5.03.20		

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: 20°C
Humidity: 33%
Pressure: 102.1kPa

Method: ANSI C63.10: 2013

Frequency range: 614-960 MHz

Setup:
SBS Module
Antenna 0
Low Channel (0) 902.4 MHz, High (63) 927.6MHz
GFSK-2
100% Duty Cycle
PWR Level Setting: 200
PWR Output: 20dBm
POE powered.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T2	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T3	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T4	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T5	AN02673	Spectrum Analyzer	E4446A	2/3/2021	2/3/2023

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	13.3	+30.7 +0.0	+1.6	+2.4	+0.3	+0.0	48.3	54.0 Hop	-5.7	Horiz
2	960.000M	13.2	+30.7 +0.0	+1.6	+2.4	+0.3	+0.0	48.2	54.0 SC	-5.8	Horiz
3	614.000M QP	9.3	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	40.0	46.0 SC	-6.0	Horiz
4	614.000M QP	9.2	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	39.9	46.0 Hop	-6.1	Horiz
^	614.000M	14.2	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	44.9	46.0 Hop	-1.1	Horiz
^	614.000M	12.5	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	43.2	46.0 SC	-2.8	Horiz
7	902.000M	37.5	+29.6 +0.0	+1.5	+2.3	+0.3	+0.0	71.2	102.4 Hop	-31.2	Horiz
8	902.000M	36.8	+29.6 +0.0	+1.5	+2.3	+0.3	+0.0	70.5	102.4 SC	-31.9	Horiz
9	928.000M	33.7	+30.6 +0.0	+1.6	+2.4	+0.3	+0.0	68.6	102.4 SC	-33.8	Horiz
10	928.000M	30.6	+30.6 +0.0	+1.6	+2.4	+0.3	+0.0	65.5	102.4 Hop	-36.9	Horiz

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(d) / 15.209 Radiated Spurious Emissions**		
Work Order #:	**104760**	Date:	1/26/2023
Test Type:	**Maximized Emissions**	Time:	13:57:32
Tested By:	M. Harrison/M. Atkinson	Sequence#:	9
Software:	EMITest 5.03.20		

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: 20°C
Humidity: 33%
Pressure: 102.1kPa

Method: ANSI C63.10: 2013

Frequency range: 614-960 MHz

Setup:
SBS Module
Antenna 1
Low Channel (0) 902.4 MHz, High (63) 927.6MHz
GFSK-2
100% Duty Cycle
PWR Level Setting: 200
PWR Output: 20dBm
POE powered.

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03628	Biconilog Antenna	3142E	6/3/2021	6/3/2023
T2	ANP05333	Cable	Heliax	3/14/2022	3/14/2024
T3	ANP05360	Cable	RG214	2/4/2022	2/4/2024
T4	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T5	AN02673	Spectrum Analyzer	E4446A	2/3/2021	2/3/2023

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	13.1	+30.7 +0.0	+1.6	+2.4	+0.3	+0.0	48.1	54.0 SC	-5.9	Horiz
2	614.000M QP	9.4	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	40.1	46.0 SC	-5.9	Horiz
3	614.000M QP	9.4	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	40.1	46.0 Hop	-5.9	Horiz
^	614.000M	15.5	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	46.2	46.0 Hop	+0.2	Horiz
^	614.000M	13.2	+27.2 +0.0	+1.3	+1.9	+0.3	+0.0	43.9	46.0 SC	-2.1	Horiz
6	960.000M	13.0	+30.7 +0.0	+1.6	+2.4	+0.3	+0.0	48.0	54.0 Hop	-6.0	Horiz
7	902.000M	37.4	+29.6 +0.0	+1.5	+2.3	+0.3	+0.0	71.1	102.4 Hop	-31.3	Horiz
8	902.000M	35.3	+29.6 +0.0	+1.5	+2.3	+0.3	+0.0	69.0	102.4 SC	-33.4	Horiz
9	928.000M	33.4	+30.6 +0.0	+1.6	+2.4	+0.3	+0.0	68.3	102.4 SC	-34.1	Horiz
10	928.000M	31.9	+30.6 +0.0	+1.6	+2.4	+0.3	+0.0	66.8	102.4 Hop	-35.6	Horiz

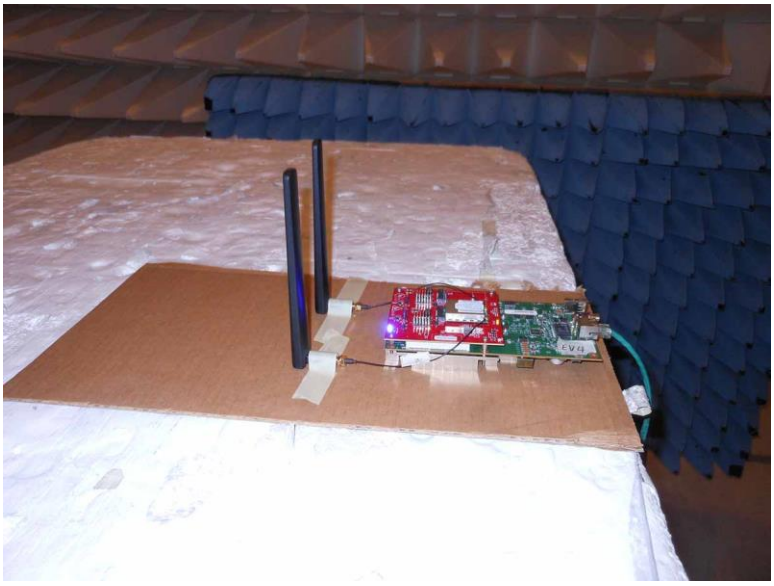
Test Setup Photo(s)

Below 1GHz

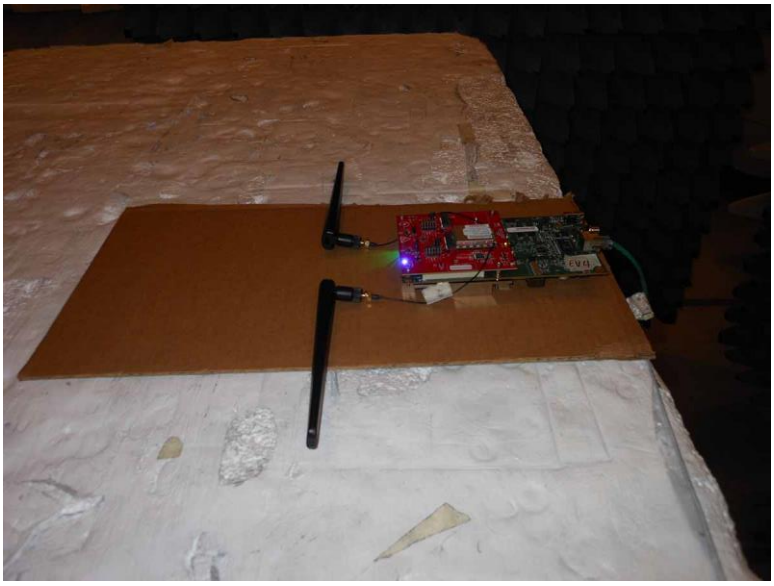
Above 1GHz; View 1

Above 1GHz; View 2

X Axis



Y Axis



Z Axis

15.247 (f) Hybrid Systems Time of Occupancy

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Harrison
Test Method:	ANSI C63.10 (2013)	Test Date(s):	12/17/2020
Configuration:	1		
Test Setup:	EUT is continuously transmitting. EUT has 2 antenna ports, only 1 can be used at a time. Investigated both antenna ports, worst case data reported. Spectrum analyzer and appropriate attenuation connected to antenna port under test, external antenna is removed to make direct RF conducted measurements.		

Environmental Conditions			
Temperature (ºC)	19-22	Relative Humidity (%):	34-40

Test Equipment					
Asset#	**Description**	**Manufacturer**	**Model**	**Cal Date**	**Cal Due**
02673	Spectrum Analyzer	Agilent	E4446A	2/22/2019	2/22/2021
P06007	Cable	Andrew	Heliax	1/20/2020	1/20/2022
P05748	Attenuator	Pasternack	PE7004-20	3/4/2020	3/4/2022

Test Data Summary

Observation Period, P_{obs} is derived from the following:

$$P_{Obs} = (number\ of\ hopping\ frequencies) * 0.4$$

Antenna Port	Operational Mode	Measured (ms)	Limit (ms/P_{obs})	Results
0, 1	GFSK-2	391.2ms	≤400	Pass

Measured results are calculated as follows:

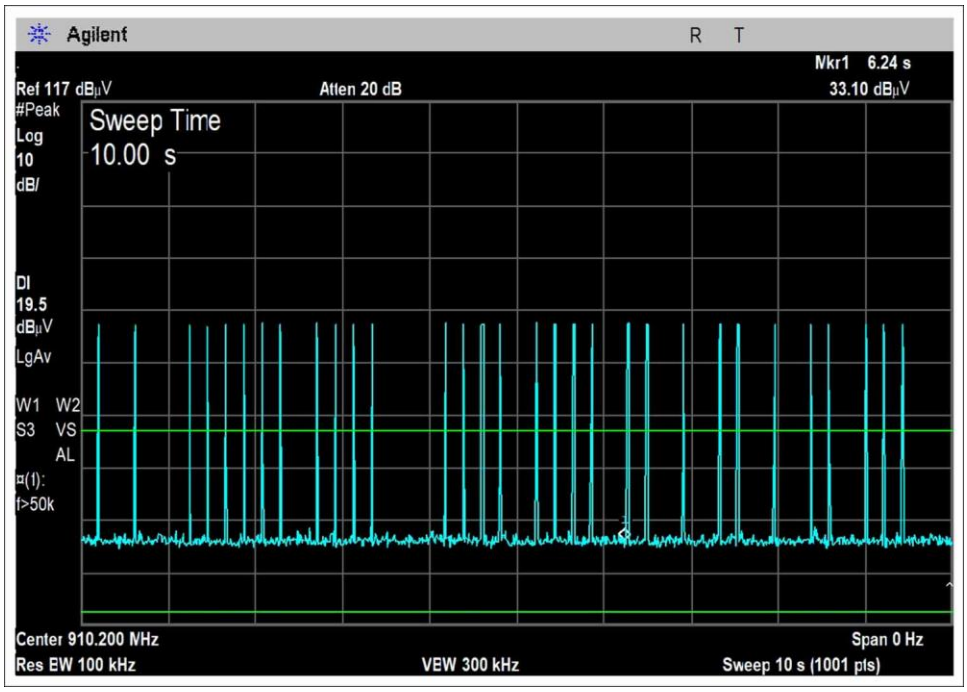
$$Dwell\ time = \left(\sum_{Bursts} RF\ Burst\ On\ Time + \sum_{Control} Control\ Signal\ On\ time \right) \Big|_{P_{obs}}$$

Actual Calculated Values:

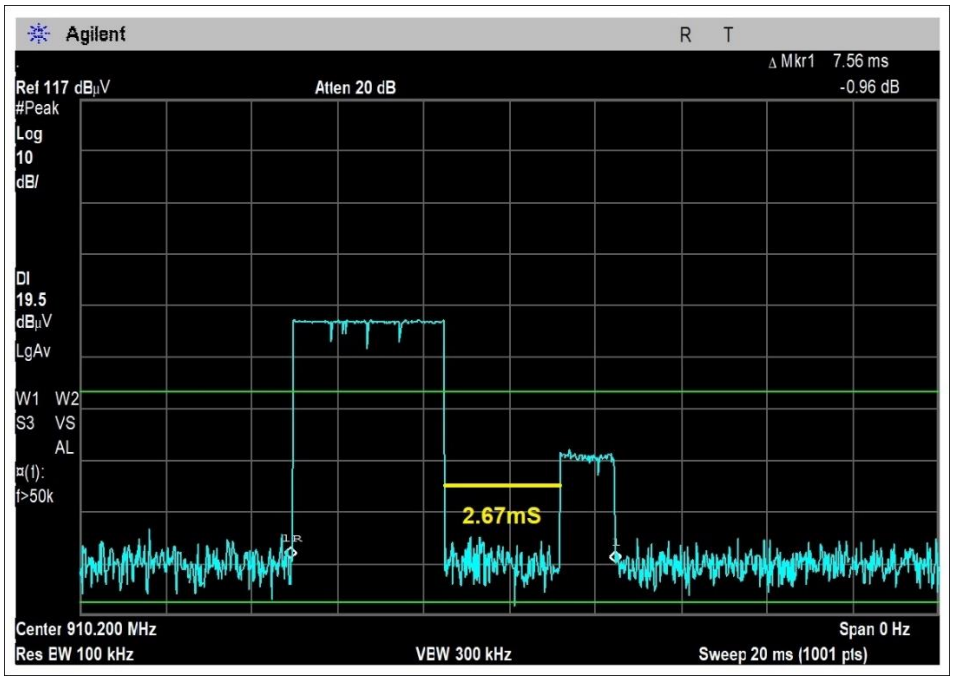
Parameter	Value
Observation Period (P_{obs}):	25.6s
Number of RF Bursts / P_{obs}:	80
On time of RF Burst:	4.89ms
Number of Control or other signals / P_{obs}:	0
On time of Control or other Signals:	0
Total Measured On Time:	391.2ms

Note: The number of bursts in a 25.6 second window was extrapolated from a worst case 10 second measurement window (31 bursts in 10 second window = 80 bursts in 25.6 second window)

Plot(s)



10 second observation window



Worst case burst on time (4.89ms)

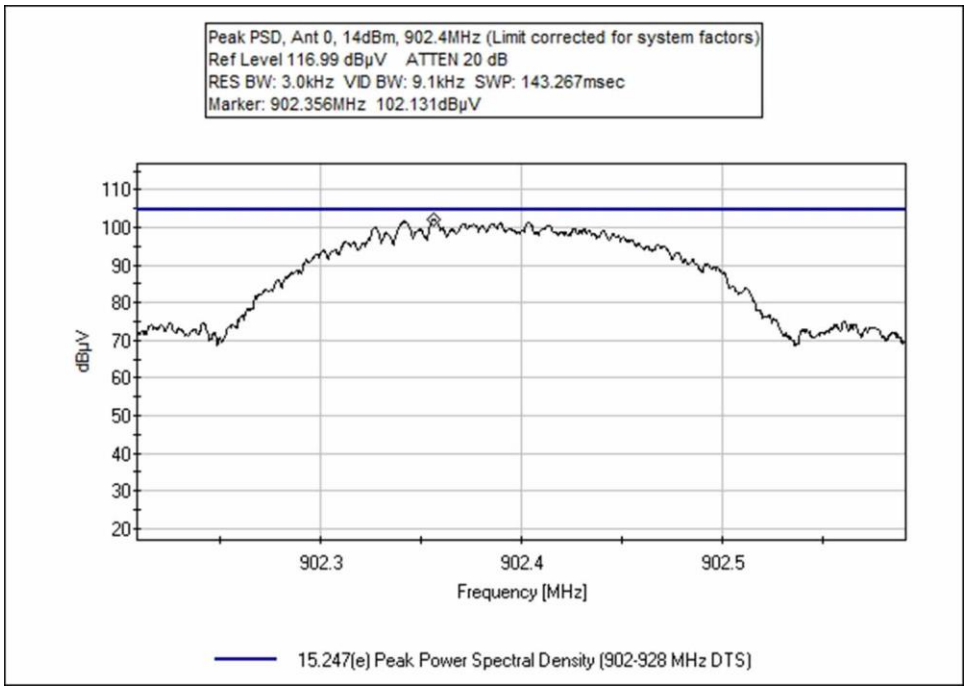
Test Setup Photo(s)

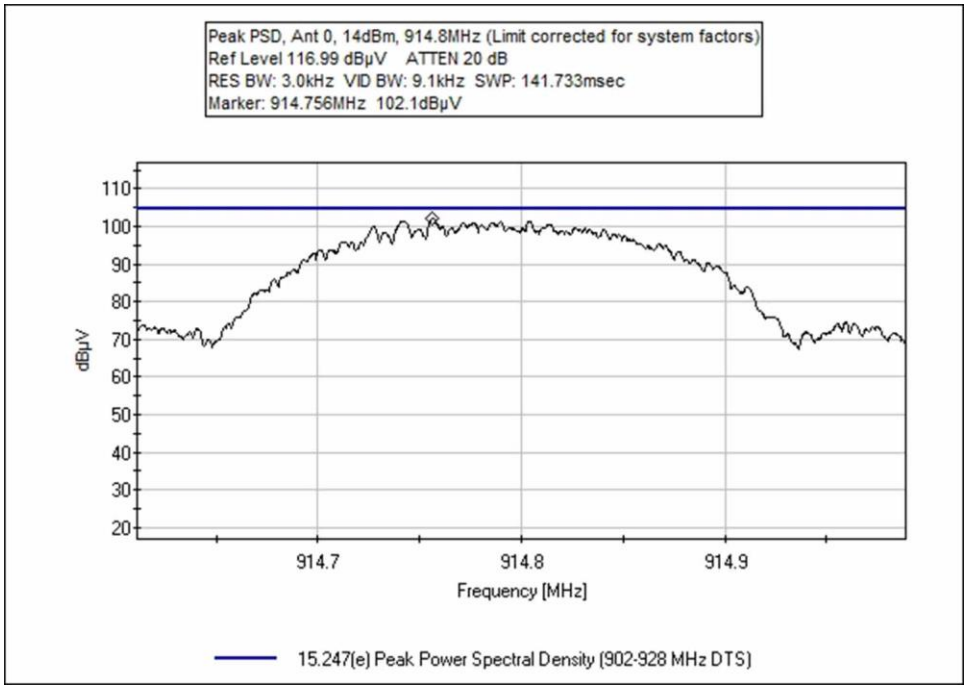
15.247 (f) Hybrid Systems Power Spectral Density

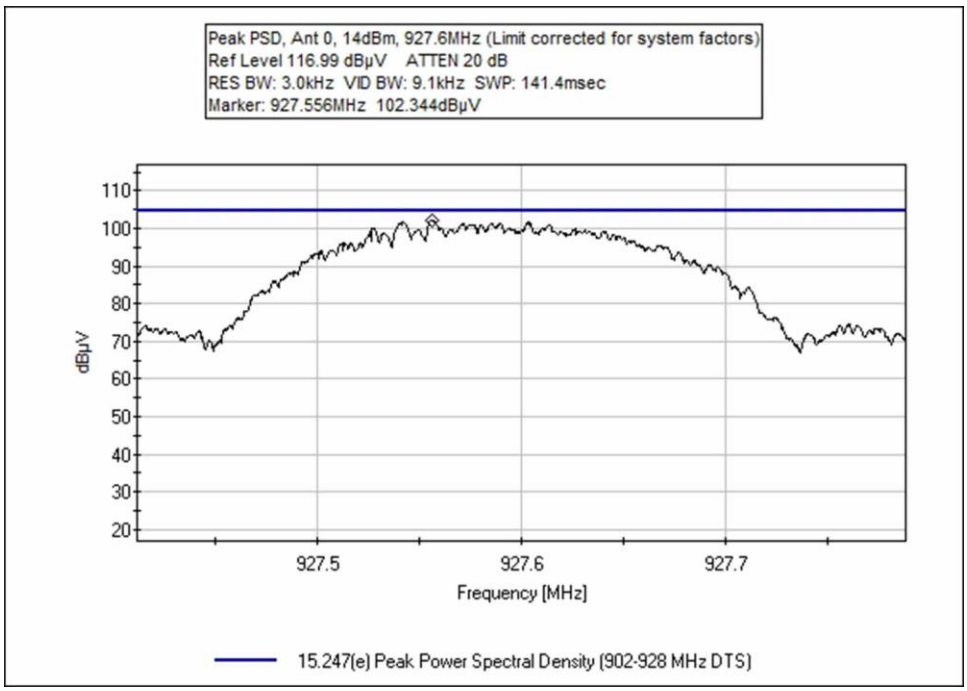
Power Spectral Density

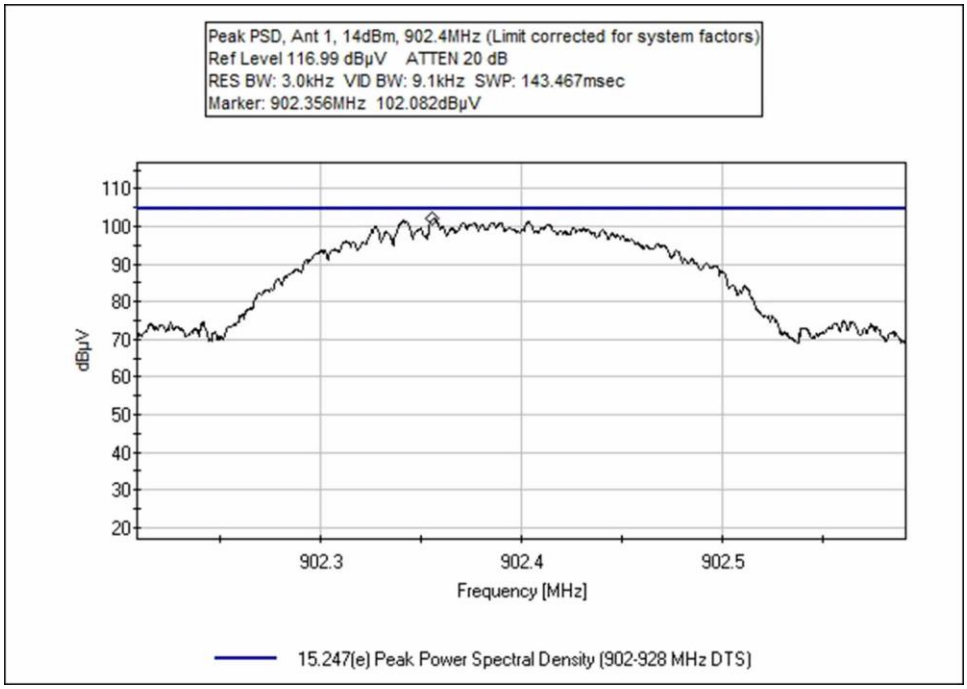
Test Data Summary - RF Conducted Measurement				
Measurement Method: PKPSD				
Frequency (MHz)	**Modulation**	**Measured (dBm/3kHz)**	**Limit (dBm/3kHz)**	**Results**
902.4	GFSK-2/0	5.5	≤8	Pass
914.8	GFSK-2/0	5.5	≤8	Pass
927.6	GFSK-2/0	5.7	≤8	Pass
902.4	GFSK-2/1	5.8	≤8	Pass
914.8	GFSK-2/1	5.5	≤8	Pass
927.6	GFSK-2/1	5.5	≤8	Pass

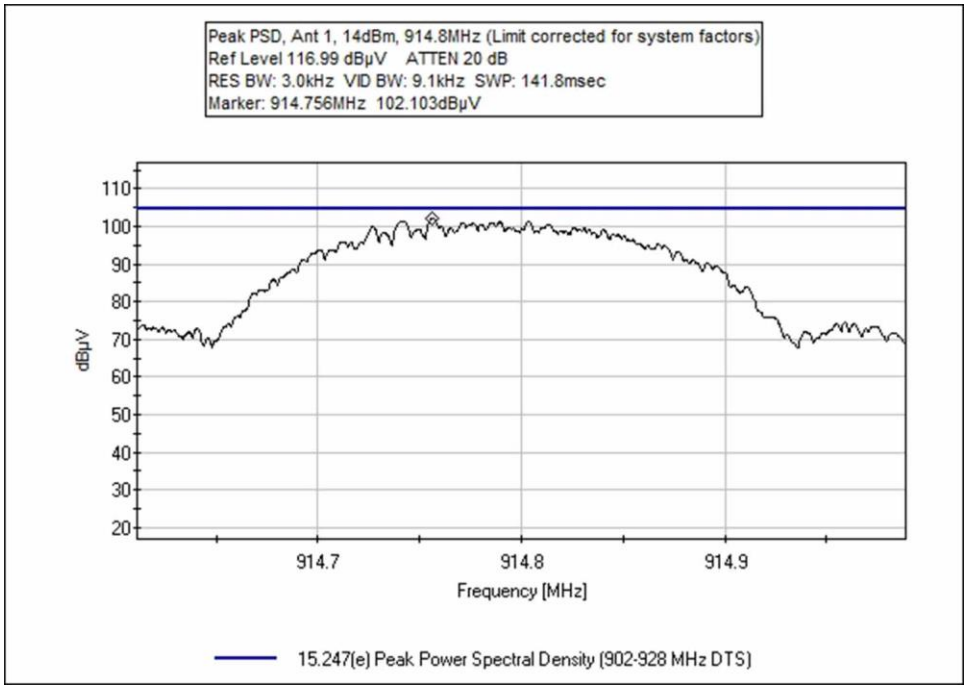
Plot(s)

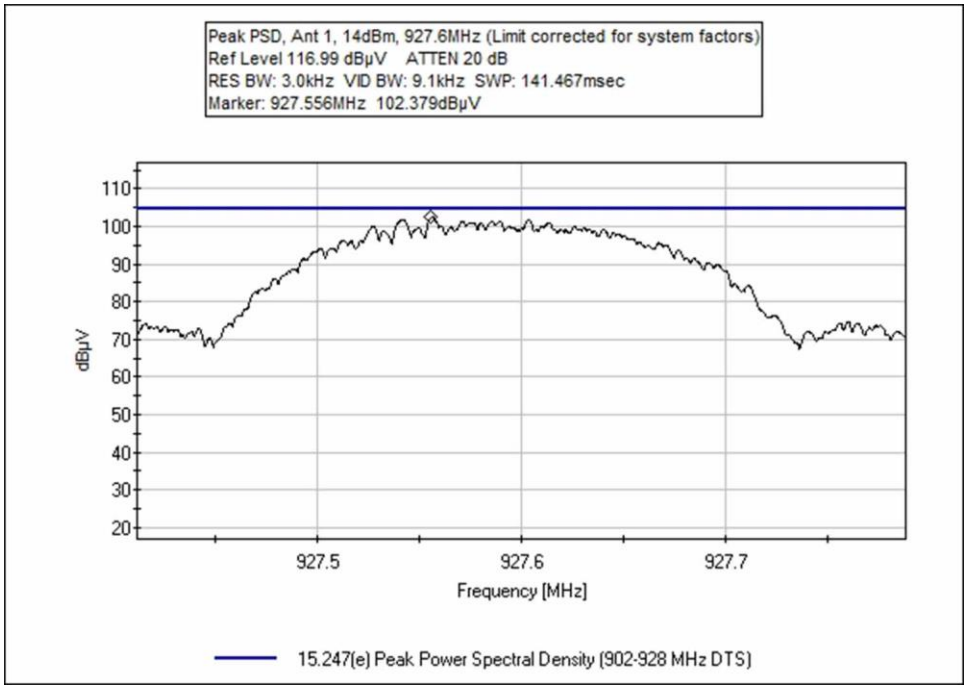



Peak PSD, Ant 0, 14dBm, 914.8MHz (Limit corrected for system factors)
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 141.733msec
Marker: 914.756MHz 102.1dBµV
110
100
90
80
70
60
50
40
30
20
dBµV
914.7
914.8
914.9
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)


Peak PSD, Ant 0, 14dBm, 927.6MHz (Limit corrected for system factors)
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 141.4msec
Marker: 927.556MHz 102.344dBµV
110
100
90
80
70
60
50
40
30
20
dBµV
927.5
927.6
927.7
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)


Peak PSD, Ant 1, 14dBm, 902.4MHz (Limit corrected for system factors)
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 143.467msec
Marker: 902.356MHz 102.082dBµV
110
100
90
80
70
60
50
40
30
20
dBµV
902.3
902.4
902.5
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)


Peak PSD, Ant 1, 14dBm, 914.8MHz (Limit corrected for system factors)
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 141.8msec
Marker: 914.756MHz 102.103dBµV
110
100
90
80
70
60
50
40
30
20
dBµV
914.7
914.8
914.9
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)


Peak PSD, Ant 1, 14dBm, 927.6MHz (Limit corrected for system factors)
Ref Level 116.99 dBµV ATTEN 20 dB
RES BW: 3.0kHz VID BW: 9.1kHz SWP: 141.467msec
Marker: 927.556MHz 102.379dBµV
dBµV
110
100
90
80
70
60
50
40
30
20
927.5
927.6
927.7
Frequency [MHz]
15.247(e) Peak Power Spectral Density (902-928 MHz DTS)

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.247(e) Peak Power Spectral Density (902-928 MHz DTS)**		
Work Order #:	**107516**	Date:	2/23/2023
Test Type:	**Conducted Emissions**	Time:	13:28:02
Tested By:	Matt Harrison	Sequence#:	17
Software:	EMITest 5.03.20		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

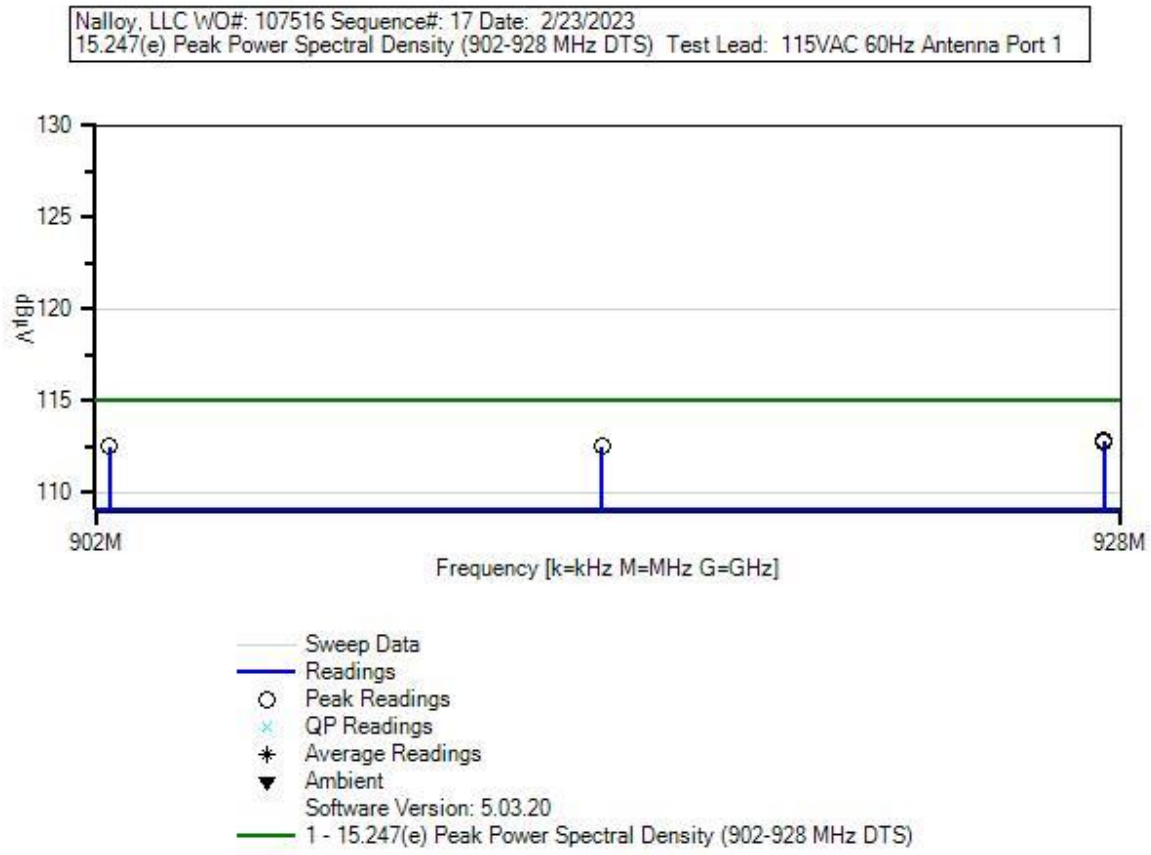
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 20°C
Humidity: 33%
Pressure: 102.1kPa

Method: ANSI C63.10: 2013

Frequency range: Fundamental

Setup:
Continuously Transmitting
Antenna 0 and Antenna 1 ports measured
Channels measured: (0) 902.4 MHz, (31) 914.8MHz High (63) 927.6MHz



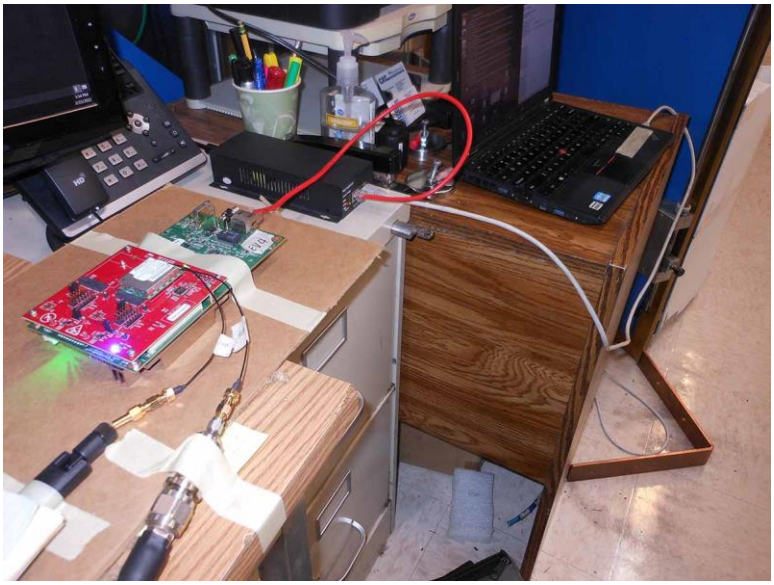
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05503	Attenuator	766-10	6/8/2021	6/8/2023
T2	ANP06540	Cable	Heliax	1/17/2022	1/17/2024
T3	AN02660	Spectrum Analyzer	E4446A	12/6/2022	12/6/2024

Measurement Data: Reading listed by margin. Test Lead: Antenna Port 1

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	927.556M	102.4	+10.1	+0.3	+0.0		+0.0	112.8	115.0 14 dBm	-2.2	Anten
2	927.556M	102.3	+10.1	+0.3	+0.0		+0.0	112.7	115.0 14 dBm	-2.3	Anten
3	914.756M	102.1	+10.1	+0.3	+0.0		+0.0	112.5	115.0 14 dBm	-2.5	Anten
4	902.356M	102.1	+10.1	+0.3	+0.0		+0.0	112.5	115.0 14dBm	-2.5	Anten
5	914.756M	102.1	+10.1	+0.3	+0.0		+0.0	112.5	115.0 14dBm	-2.5	Anten
6	902.356M	102.1	+10.1	+0.3	+0.0		+0.0	112.5	115.0 14dBm	-2.5	Anten

Test Setup Photo(s)



15.207 AC Conducted Emissions

Test Setup / Conditions / Data

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**104760**	Date:	12/14/2020
Test Type:	**Conducted Emissions**	Time:	10:09:11
Tested By:	Michael Atkinson	Sequence#:	14
Software:	EMITest 5.03.20		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

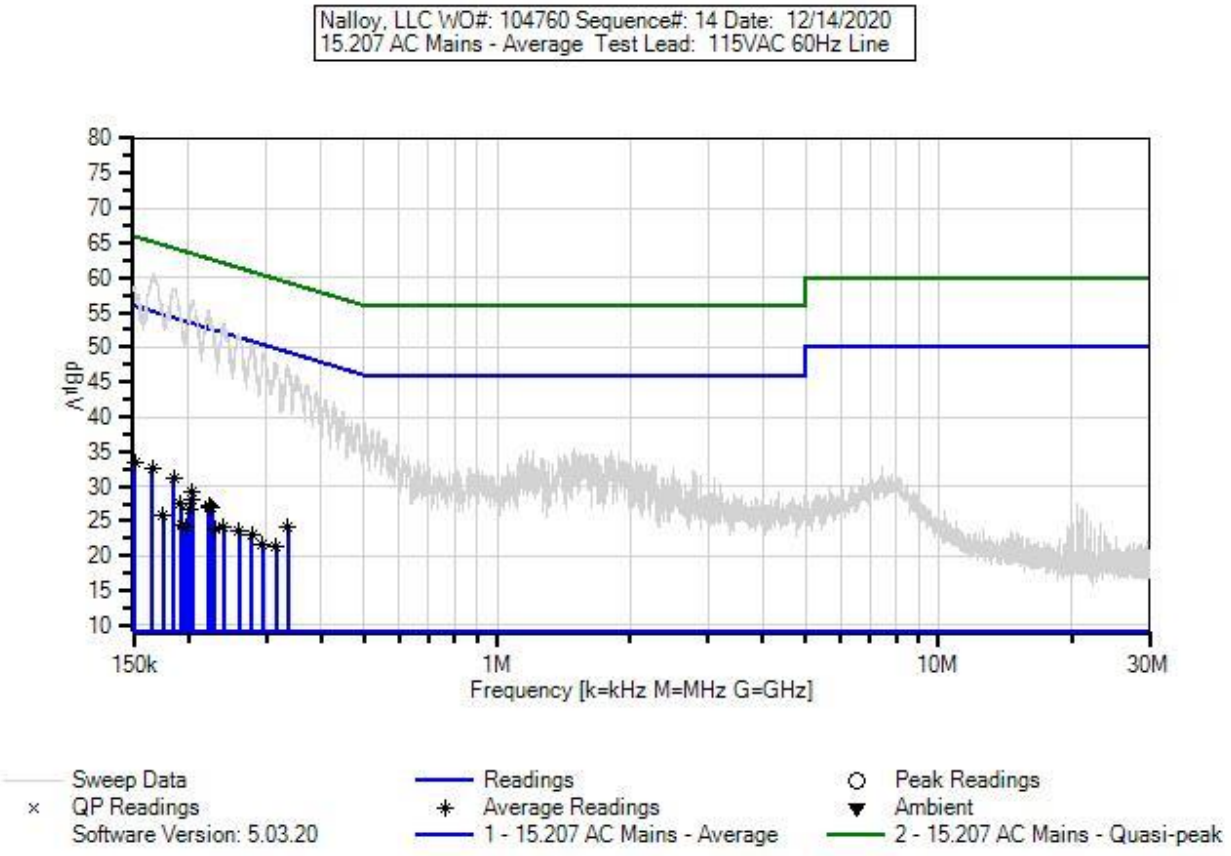
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 19°C
Humidity: 34%
Pressure: 102.0kPa

Method: ANSI C63.10 (2013)

Frequency range: 0.15-30MHz

Setup:
Continuously transmitting. Antenna 0 and antenna 1 investigated, worst case reported. Low, mid, and high channels investigated, worst case reported.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022
T2	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T3	ANP06515	Cable	Heliax	7/1/2020	7/1/2022
T4	ANP06219	Attenuator	768-10	4/7/2020	4/7/2022
T5	AN01311	50uH LISN-Line1 (L)	3816/2	2/24/2020	2/24/2022
	AN01311	50uH LISN-Line2 (N)	3816/2	2/24/2020	2/24/2022

Measurement Data: Reading listed by margin. Test Lead: Line

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	150.943k	24.6	+1.6	+0.0	+0.0	+9.1	+0.0	33.5	55.9	-22.4	Line
	Ave		-1.8								
^	150.943k	49.9	+1.6	+0.0	+0.0	+9.1	+0.0	58.8	55.9	+2.9	Line
			-1.8								
3	165.824k	24.6	+0.5	+0.0	+0.0	+9.1	+0.0	32.6	55.2	-22.6	Line
	Ave		-1.6								
^	165.824k	52.6	+0.5	+0.0	+0.0	+9.1	+0.0	60.6	55.2	+5.4	Line
			-1.6								
5	185.212k	23.0	+0.3	+0.0	+0.0	+9.1	+0.0	31.1	54.2	-23.1	Line
	Ave		-1.3								
^	185.212k	50.5	+0.3	+0.0	+0.0	+9.1	+0.0	58.6	54.2	+4.4	Line
			-1.3								
7	204.495k	21.1	+0.2	+0.0	+0.0	+9.1	+0.0	29.2	53.4	-24.2	Line
	Ave		-1.2								
8	335.437k	15.4	+0.1	+0.0	+0.0	+9.1	+0.0	24.0	49.3	-25.3	Line
	Ave		-0.6								
^	335.437k	38.9	+0.1	+0.0	+0.0	+9.1	+0.0	47.5	49.3	-1.8	Line
			-0.6								
10	221.891k	18.9	+0.3	+0.0	+0.0	+9.1	+0.0	27.3	52.7	-25.4	Line
	Ave		-1.0								
11	203.237k	20.0	+0.2	+0.0	+0.0	+9.1	+0.0	28.1	53.5	-25.4	Line
	Ave		-1.2								
12	222.625k	18.6	+0.3	+0.0	+0.0	+9.1	+0.0	27.0	52.7	-25.7	Line
	Ave		-1.0								
13	225.664k	18.5	+0.3	+0.0	+0.0	+9.1	+0.0	26.9	52.6	-25.7	Line
	Ave		-1.0								
^	221.891k	46.9	+0.3	+0.0	+0.0	+9.1	+0.0	55.3	52.7	+2.6	Line
			-1.0								
^	222.625k	46.9	+0.3	+0.0	+0.0	+9.1	+0.0	55.3	52.7	+2.6	Line
			-1.0								
16	191.500k	19.5	+0.3	+0.0	+0.0	+9.1	+0.0	27.6	54.0	-26.4	Line
	Ave		-1.3								
17	200.932k	18.5	+0.2	+0.0	+0.0	+9.1	+0.0	26.6	53.6	-27.0	Line
	Ave		-1.2								
^	204.494k	48.7	+0.2	+0.0	+0.0	+9.1	+0.0	56.8	53.4	+3.4	Line
			-1.2								
^	203.237k	48.7	+0.2	+0.0	+0.0	+9.1	+0.0	56.8	53.5	+3.3	Line
			-1.2								
20	278.651k	14.7	+0.1	+0.0	+0.0	+9.1	+0.0	23.1	50.9	-27.8	Line
	Ave		-0.8								
^	278.650k	42.0	+0.1	+0.0	+0.0	+9.1	+0.0	50.4	50.9	-0.5	Line
			-0.8								
22	259.781k	15.2	+0.2	+0.0	+0.0	+9.1	+0.0	23.6	51.4	-27.8	Line
	Ave		-0.9								
^	259.781k	43.6	+0.2	+0.0	+0.0	+9.1	+0.0	52.0	51.4	+0.6	Line
			-0.9								

24 Ave	239.602k	15.9	+0.2 -1.0	+0.0	+0.0	+9.1	+0.0	24.2	52.1	-27.9	Line
^	239.602k	45.2	+0.2 -1.0	+0.0	+0.0	+9.1	+0.0	53.5	52.1	+1.4	Line
26 Ave	315.856k	13.0	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	21.5	49.8	-28.3	Line
^	315.855k	39.4	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	47.9	49.8	-1.9	Line
28 Ave	229.332k	15.6	+0.3 -1.0	+0.0	+0.0	+9.1	+0.0	24.0	52.5	-28.5	Line
^	225.664k	45.9	+0.3 -1.0	+0.0	+0.0	+9.1	+0.0	54.3	52.6	+1.7	Line
^	229.332k	43.2	+0.3 -1.0	+0.0	+0.0	+9.1	+0.0	51.6	52.5	-0.9	Line
31 Ave	294.672k	13.2	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	21.7	50.4	-28.7	Line
^	294.672k	40.7	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	49.2	50.4	-1.2	Line
33 Ave	175.152k	17.7	+0.4 -1.4	+0.0	+0.0	+9.1	+0.0	25.8	54.7	-28.9	Line
^	175.151k	47.6	+0.4 -1.4	+0.0	+0.0	+9.1	+0.0	55.7	54.7	+1.0	Line
35 Ave	194.015k	16.3	+0.3 -1.2	+0.0	+0.0	+9.1	+0.0	24.5	53.9	-29.4	Line
^	191.500k	47.7	+0.3 -1.3	+0.0	+0.0	+9.1	+0.0	55.8	54.0	+1.8	Line
37 Ave	197.578k	16.2	+0.2 -1.2	+0.0	+0.0	+9.1	+0.0	24.3	53.7	-29.4	Line
^	200.931k	47.9	+0.2 -1.2	+0.0	+0.0	+9.1	+0.0	56.0	53.6	+2.4	Line
^	197.578k	45.1	+0.2 -1.2	+0.0	+0.0	+9.1	+0.0	53.2	53.7	-0.5	Line
^	194.015k	45.0	+0.3 -1.2	+0.0	+0.0	+9.1	+0.0	53.2	53.9	-0.7	Line

Test Location:	CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • 1-800-500-4EMC (4362)		
Customer:	**Nalloy, LLC**		
Specification:	**15.207 AC Mains - Average**		
Work Order #:	**104760**	Date:	12/14/2020
Test Type:	**Conducted Emissions**	Time:	09:58:57
Tested By:	Michael Atkinson	Sequence#:	13
Software:	EMITest 5.03.20		115VAC 60Hz

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

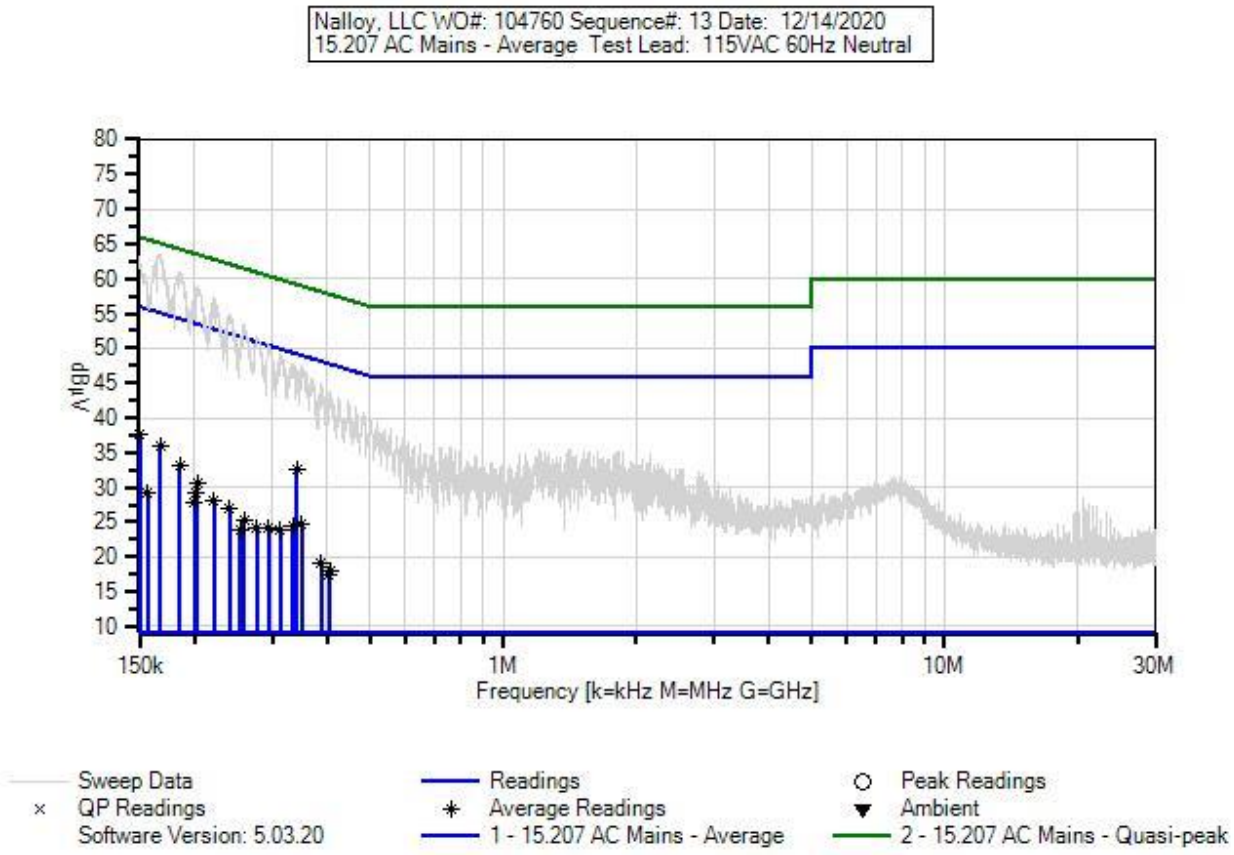
Test Conditions / Notes:

Test Environment Conditions:
Temperature: 19°C
Humidity: 34%
Pressure: 102.0kPa

Method: ANSI C63.10 (2013)

Frequency range: 0.15-30MHz

Setup:
Continuously transmitting. Antenna 0 and antenna 1 investigated, worst case reported. Low, mid, and high channels investigated, worst case reported.



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	2/22/2019	2/22/2021
T1	AN02611	High Pass Filter	HE9615-150K-50-720B	1/10/2020	1/10/2022
T2	ANP06540	Cable	Heliax	8/23/2019	8/23/2021
T3	ANP06515	Cable	Heliax	7/1/2020	7/1/2022
T4	ANP06219	Attenuator	768-10	4/7/2020	4/7/2022
	AN01311	50uH LISN-Line1 (L)	3816/2	2/24/2020	2/24/2022
T5	AN01311	50uH LISN-Line2 (N)	3816/2	2/24/2020	2/24/2022

Measurement Data: Reading listed by margin. Test Lead: Neutral

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV	dBµV	dB	Ant
1	340.244k	22.8	+0.1	+0.0	+0.0	+9.1	+0.0	32.6	49.2	-16.6	Neutr
	Ave		-0.6								
^	340.243k	37.2	+0.1	+0.0	+0.0	+9.1	+0.0	47.0	49.2	-2.2	Neutr
			-0.6								
3	150.104k	24.3	+2.4	+0.0	+0.0	+9.1	+0.0	37.6	56.0	-18.4	Neutr
	Ave		-1.8								
^	150.103k	50.0	+2.4	+0.0	+0.0	+9.1	+0.0	63.3	56.0	+7.3	Neutr
			-1.8								
5	167.605k	24.8	+0.4	+0.0	+0.0	+9.1	+0.0	35.8	55.1	-19.3	Neutr
	Ave		-1.5								
^	167.605k	52.5	+0.4	+0.0	+0.0	+9.1	+0.0	63.5	55.1	+8.4	Neutr
			-1.5								
7	185.421k	22.6	+0.3	+0.0	+0.0	+9.1	+0.0	33.3	54.2	-20.9	Neutr
	Ave		-1.3								
^	185.420k	50.3	+0.3	+0.0	+0.0	+9.1	+0.0	61.0	54.2	+6.8	Neutr
			-1.3								
9	203.236k	20.1	+0.2	+0.0	+0.0	+9.1	+0.0	30.6	53.5	-22.9	Neutr
	Ave		-1.2								
10	201.350k	18.8	+0.2	+0.0	+0.0	+9.1	+0.0	29.3	53.6	-24.3	Neutr
	Ave		-1.2								
11	350.213k	14.9	+0.1	+0.0	+0.0	+9.1	+0.0	24.7	49.0	-24.3	Neutr
	Ave		-0.6								
^	350.212k	37.9	+0.1	+0.0	+0.0	+9.1	+0.0	47.7	49.0	-1.3	Neutr
			-0.6								
13	221.052k	17.7	+0.3	+0.0	+0.0	+9.1	+0.0	28.1	52.8	-24.7	Neutr
	Ave		-1.0								
^	221.052k	46.8	+0.3	+0.0	+0.0	+9.1	+0.0	57.2	52.8	+4.4	Neutr
			-1.0								
15	333.301k	14.7	+0.1	+0.0	+0.0	+9.1	+0.0	24.5	49.4	-24.9	Neutr
	Ave		-0.6								
^	333.301k	38.2	+0.1	+0.0	+0.0	+9.1	+0.0	48.0	49.4	-1.4	Neutr
			-0.6								
17	240.440k	16.7	+0.2	+0.0	+0.0	+9.1	+0.0	26.9	52.1	-25.2	Neutr
	Ave		-0.9								
^	240.439k	44.8	+0.2	+0.0	+0.0	+9.1	+0.0	55.0	52.1	+2.9	Neutr
			-0.9								
19	199.988k	17.4	+0.2	+0.0	+0.0	+9.1	+0.0	27.9	53.6	-25.7	Neutr
	Ave		-1.2								
^	203.236k	48.5	+0.2	+0.0	+0.0	+9.1	+0.0	59.0	53.5	+5.5	Neutr
			-1.2								
^	201.350k	48.1	+0.2	+0.0	+0.0	+9.1	+0.0	58.6	53.6	+5.0	Neutr
			-1.2								
^	199.987k	47.1	+0.2	+0.0	+0.0	+9.1	+0.0	57.6	53.6	+4.0	Neutr
			-1.2								

23 Ave	312.652k	14.0	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	23.9	49.9	-26.0	Neutr
^	312.651k	39.2	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	49.1	49.9	-0.8	Neutr
25 Ave	293.960k	14.2	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	24.1	50.4	-26.3	Neutr
^	293.960k	40.6	+0.1 -0.7	+0.0	+0.0	+9.1	+0.0	50.5	50.4	+0.1	Neutr
27 Ave	258.713k	15.0	+0.2 -0.8	+0.0	+0.0	+9.1	+0.0	25.1	51.5	-26.4	Neutr
28 Ave	156.706k	17.6	+0.7 -1.7	+0.0	+0.0	+9.1	+0.0	29.1	55.6	-26.5	Neutr
^	156.706k	48.2	+0.7 -1.7	+0.0	+0.0	+9.1	+0.0	59.7	55.6	+4.1	Neutr
30 Ave	276.515k	14.0	+0.1 -0.8	+0.0	+0.0	+9.1	+0.0	24.0	50.9	-26.9	Neutr
^	276.514k	41.8	+0.1 -0.8	+0.0	+0.0	+9.1	+0.0	51.8	50.9	+0.9	Neutr
32 Ave	254.273k	13.7	+0.2 -0.8	+0.0	+0.0	+9.1	+0.0	23.8	51.6	-27.8	Neutr
^	258.713k	43.3	+0.2 -0.8	+0.0	+0.0	+9.1	+0.0	53.4	51.5	+1.9	Neutr
^	254.273k	41.5	+0.2 -0.8	+0.0	+0.0	+9.1	+0.0	51.6	51.6	+0.0	Neutr
35 Ave	387.417k	9.4	+0.2 -0.5	+0.0	+0.0	+9.1	+0.0	19.2	48.1	-28.9	Neutr
^	387.417k	35.2	+0.2 -0.5	+0.0	+0.0	+9.1	+0.0	45.0	48.1	-3.1	Neutr
37 Ave	405.041k	8.3	+0.2 -0.5	+0.0	+0.0	+9.1	+0.0	18.1	47.7	-29.6	Neutr
38 Ave	402.727k	7.6	+0.2 -0.5	+0.0	+0.0	+9.1	+0.0	17.4	47.8	-30.4	Neutr
^	405.040k	34.1	+0.2 -0.5	+0.0	+0.0	+9.1	+0.0	43.9	47.7	-3.8	Neutr
^	402.726k	33.8	+0.2 -0.5	+0.0	+0.0	+9.1	+0.0	43.6	47.8	-4.2	Neutr

Test Setup Photo(s)

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.