

Davis Instruments

REVISED TEST REPORT TO 107032-13

Vantage Pro2 ISS
Model: 6329

Tested to The Following Standards:

FCC Part 15 Subpart C Section(s)

15.247
(FHSS 902-928MHz)

Report No.: 107032-13A

Date of issue: October 14, 2022



Test Certificate # 803.01

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

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

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ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

Davis Instruments
3465 Diablo Avenue
Hayward, CA 94545

Representative: Jeremiah Jeffress
Customer Reference Number: PO8074

DATE OF EQUIPMENT RECEIPT:**DATE(S) OF TESTING:****REPORT PREPARED BY:**

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

Project Number: 107032

June 28, 2022

June 28, 29, and 30 2022

Revision History

Original: Testing of Vantage Pro2 ISS, Model: 6329 to FCC Part 15 Subpart C Section(s) 15.247 (FHSS 902-928MHz).

Revision A: Correct Antenna Gain from 2dBi to 0.97dBi. Add Antenna Gain Verification to Appendix A.

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.
1120 Fulton Place
Fremont, CA 94539

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	Mod.#1	Pass
15.247(a)(1)	Carrier Separation	Mod.#1	Pass
15.247(a)(1)(i)	Number of Hopping Channels	Mod.#1	Pass
15.247(a)(1)(i)	Average Time of Occupancy	Mod.#1	Pass
15.247(b)(2)	Output Power	Mod.#1	Pass
15.247(d)	RF Conducted Emissions & Band Edge	Mod.#1	Pass
15.247(d)	Radiated Emissions & Band Edge	Mod.#1	Pass
15.207	AC Conducted Emissions	NA	NA1

NA = Not applicable

NA1 = Not applicable because the EUT is powered by 3.3VDC internal battery

ISO/IEC 17025 Decision Rule

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

Modifications During Testing

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

Summary of Conditions

Mod #1: Add Capacitor=3.3pF and one inductor = 8.2nH before antenna

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 Name	Manufacturer	Model #	S/N
Vantage Pro2 ISS	Davis Instruments	6329	Board 3

Support Equipment:

Device Name	Manufacturer	Model #	S/N
Laptop	Samsung	NP-NF130	ZWSS93KB300719A
AC/DC Adapter for Laptop	Samsung	PA-1400-14	CNBA4400266AD2VH13502 RQ

Configuration 2

Equipment Under Test:

Device Name	Manufacturer	Model #	S/N
Vantage Pro2 ISS	Davis Instruments	6329	Board 2

Support Equipment:

Device Name	Manufacturer	Model #	S/N
Laptop	Samsung	NP-NF130	ZWSS93KB300719A
AC/DC Adapter for Laptop	Samsung	PA-1400-14	CNBA4400266AD2VH13502 RQ

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Wideband System:	FHSS
Operating Frequency Range:	902-928MHz
Number of Hopping Channels:	51
Receiver Bandwidth and Synchronization:	Not applicable since the EUT does not have a receiving mode
Modulation Type(s):	GFSK
Maximum Duty Cycle:	100%
Number of TX Chains:	1
Antenna Type(s) and Gain:	Dedicated and 0.97dBi
Beamforming Type:	NA
Antenna Connection Type:	Dedicated
Nominal Input Voltage:	3.3VDC
Firmware / Software used for Test:	Tera-Term version 4.106
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT Photo(s)



Support Equipment Photo(s)



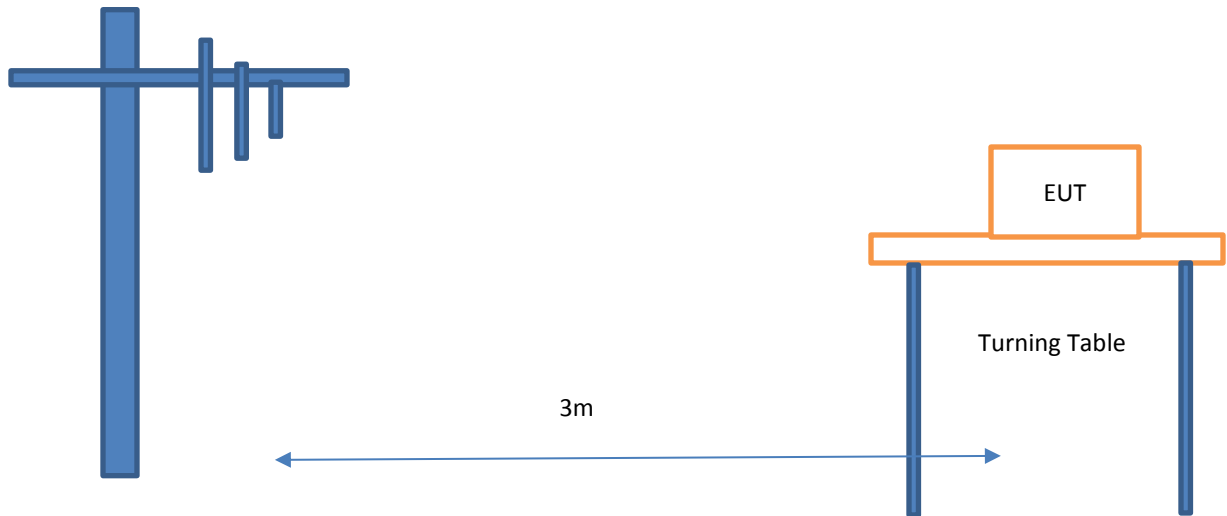
Laptop Adapter



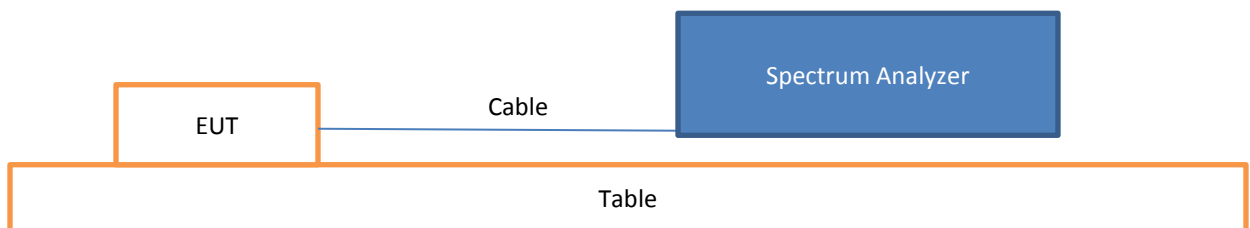
Laptop

Block Diagram of Test Setup(s)

Radiated Method Setup



Conducted Method Setup



FCC Part 15 Subpart C

15.247(a) Transmitter Characteristics

Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013)	Test Date(s):	6/29/2022
Configuration:	1		
Declaration	Modification #1 was in place during test.		
Test Setup:	The EUT is placed on a non-conducted table and set as continuously transmitting as intended. The EUT is connected straight to the Spectrum Analyzer		

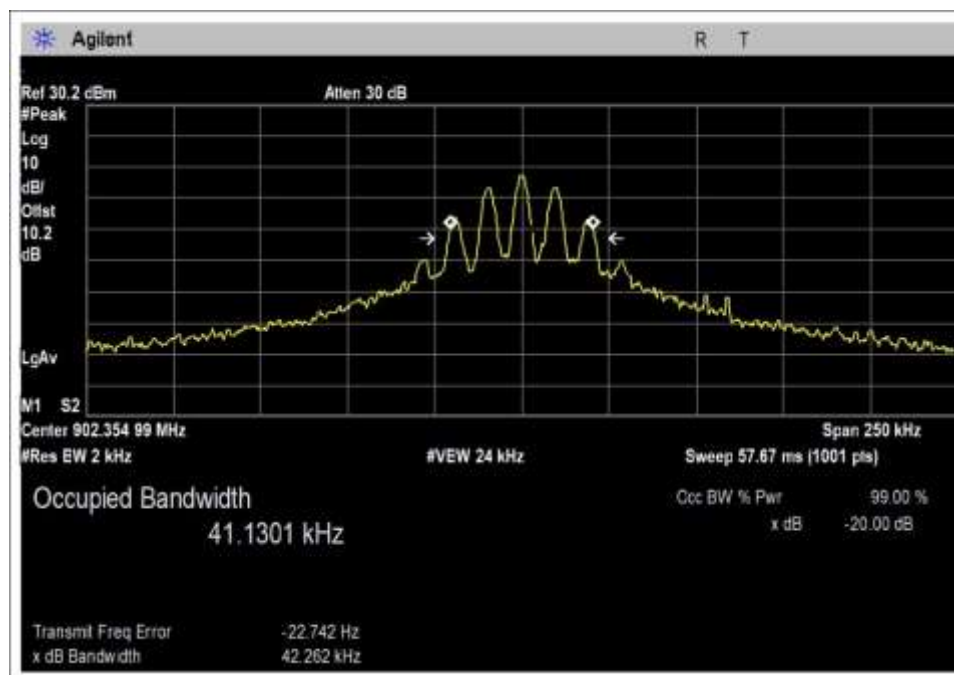
Environmental Conditions			
Temperature (°C)	23.3	Relative Humidity (%):	44

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P06902	Cable	Astrolab	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
P07365	Attenuator	Weinschel	54A-10	5/26/2021	5/26/2023
02660	Spectrum Analyzer	Agilent	E4446A	12/4/2020	12/4/2022

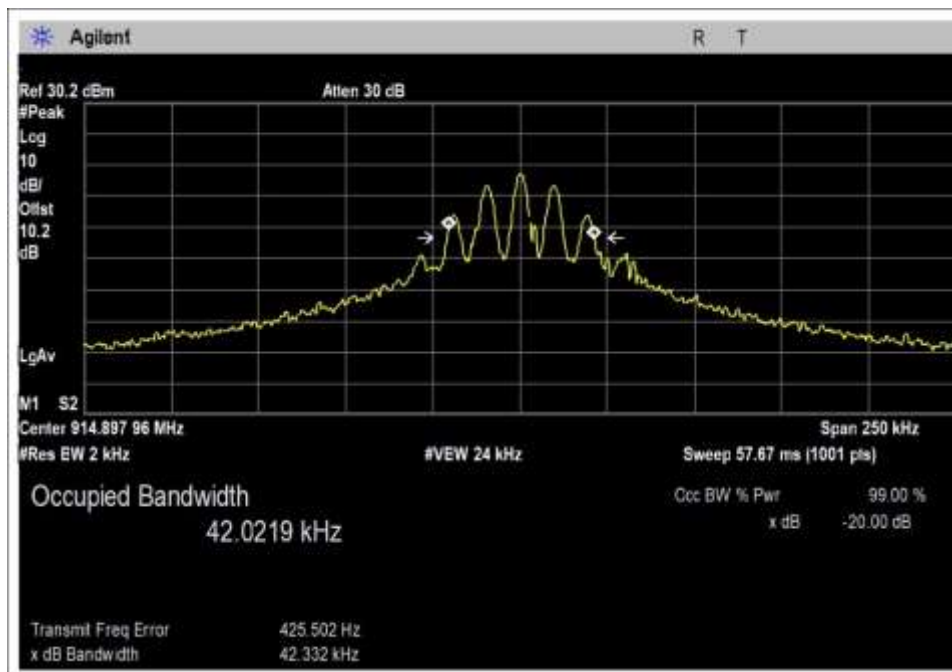
15.247(a)(1)(i) 20 dB Bandwidth

Test Data Summary					
Frequency (MHz)	Antenna Port	Modulation	Measured (kHz)	Limit (kHz)	Results
902.355	1	GFSK	42.262	≤500	Pass
914.898	1	GFSK	42.332	≤500	Pass
927.442	1	GFSK	42.277	≤500	Pass

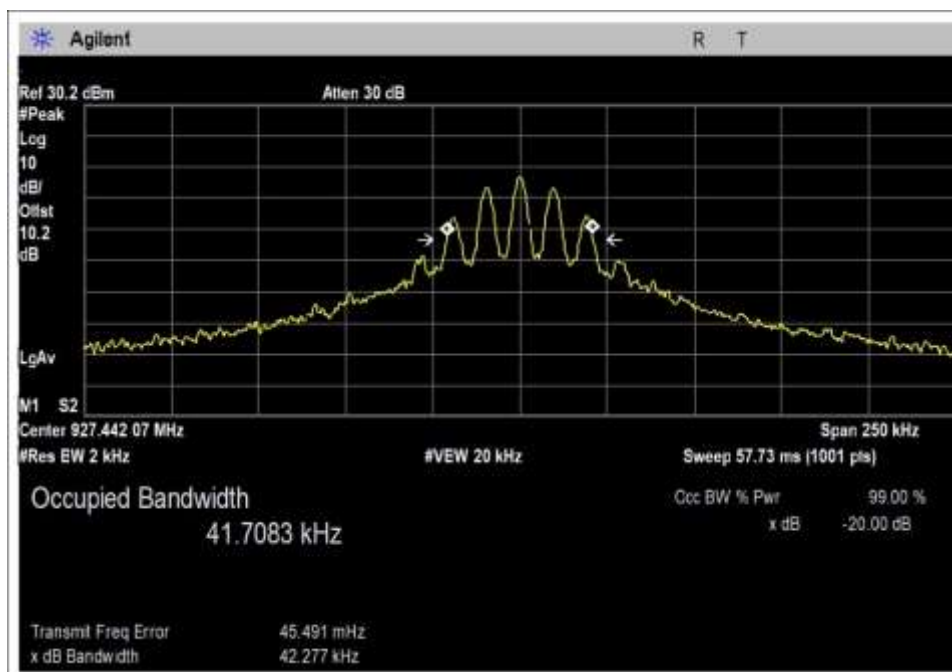
Plot(s)



Low Channel



Middle Channel

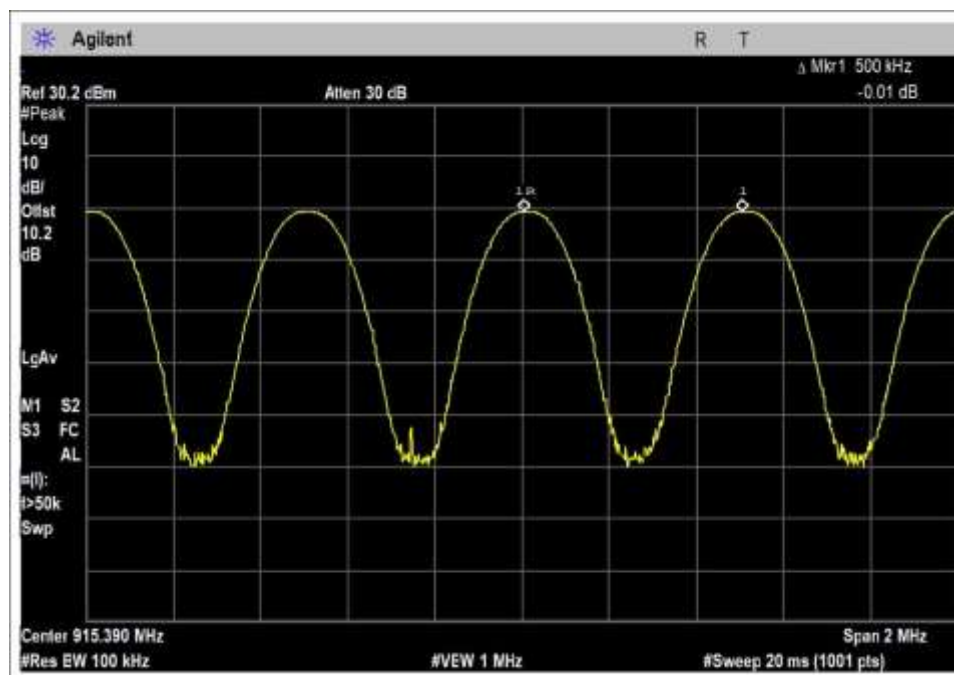


High Channel

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	500	> 42.332	Pass

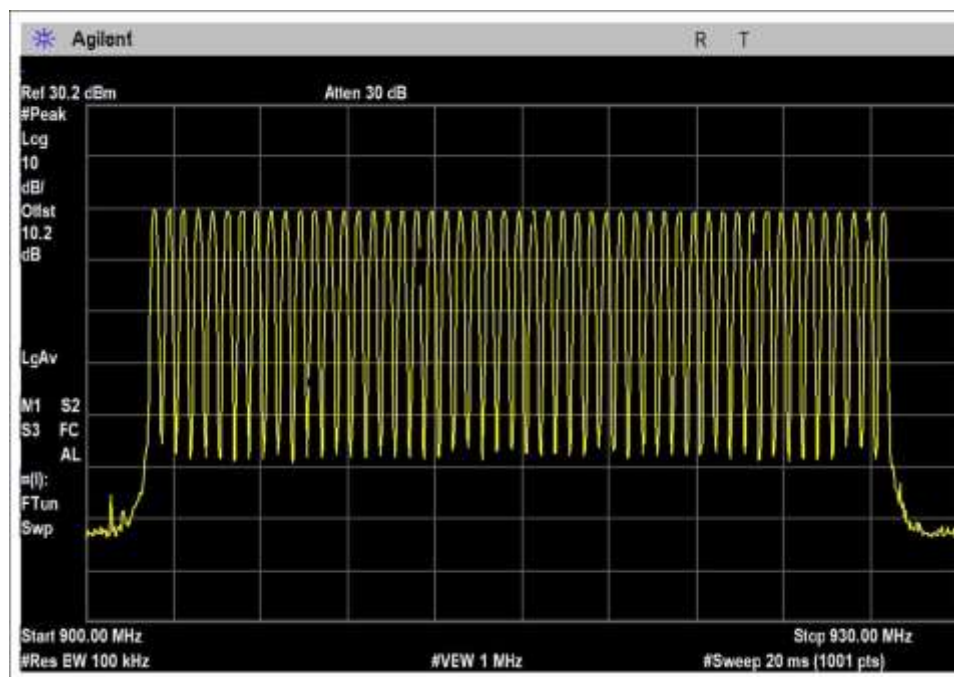
Plot(s)



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

Test Data Summary				
$Limit = \begin{cases} 50 \text{ Channels} & 20 \text{ dB BW} < 250 \text{ kHz} \\ 25 \text{ Channels} & 20 \text{ dB BW} \geq 250 \text{ kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (Channels)	Limit (Channels)	Results
1	Hopping	51	≥ 50	Pass

Plot(s)



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

Test Data Summary				
Observation Period, P_{obs} is derived from the following: $P_{obs} = \begin{cases} 20 \text{ Seconds} & 20 \text{ dB BW} < 250\text{kHz} \\ 10 \text{ Seconds} & 20 \text{ dB BW} \geq 250\text{kHz} \end{cases}$				
Antenna Port	Operational Mode	Measured (ms)	Limit (ms/ P_{obs})	Results
1	Hopping	8	≤ 400	Pass

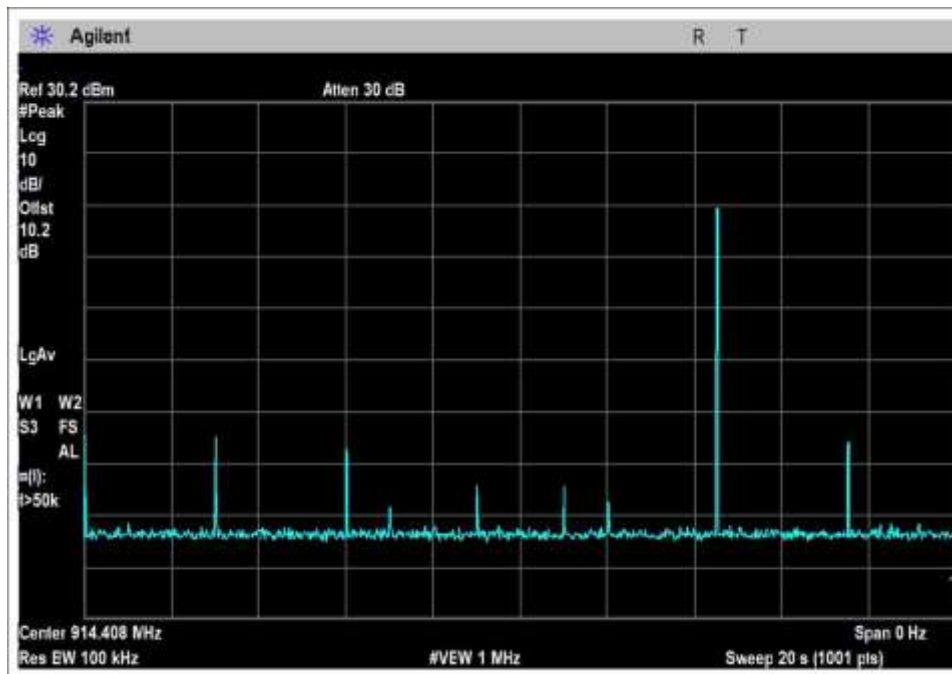
Measured results are calculated as follows:

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

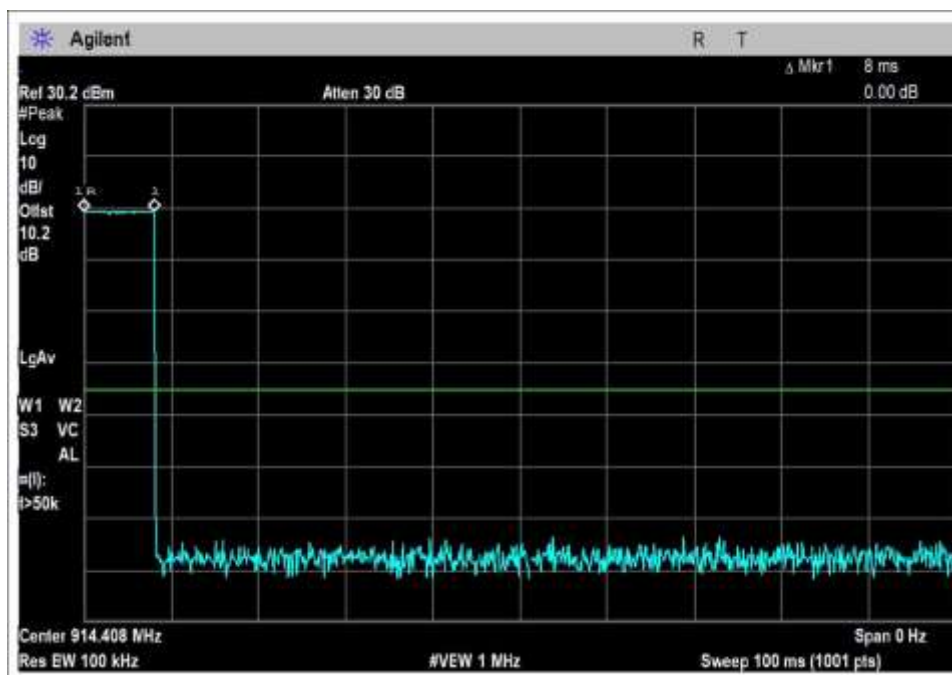
Actual Calculated Values:

Parameter	Value
Observation Period (P_{obs}):	20s
Number of RF Bursts / P_{obs} :	1
On time of RF Burst:	8ms
Number of Control or other signals / P_{obs} :	0
On time of Control or other Signals:	0
Total Measured On Time:	8ms

Plot(s)



Average Occupancy



Dwell Time

Test Setup Photo(s)



Test Setup



Test Setup; Close View

15.247(b)(2) Output Power

Test Setup/Conditions			
Test Location:	Fremont Lab C3	Test Engineer:	Hieu Song Nguyenpham
Test Method:	ANSI C63.10 (2013)	Test Date(s):	6/29/2022
Configuration:	1		
Declaration	Modification #1 was in place during test.		
Test Setup:	The EUT is placed on a non-conducted table and set as continuously transmitting as intended. The EUT is connected straight to the Spectrum Analyzer		

Environmental Conditions			
Temperature (°C)	23.3	Relative Humidity (%):	44

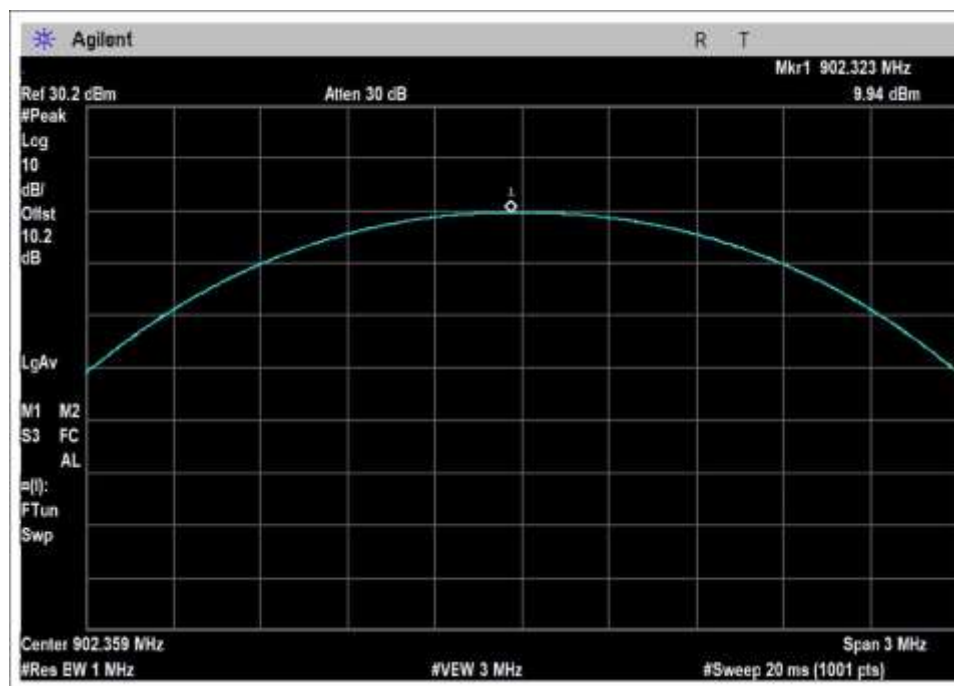
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
P06902	Cable	Astrolab	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
P07365	Attenuator	Weinschel	54A-10	5/26/2021	5/26/2023
02660	Spectrum Analyzer	Agilent	E4446A	12/4/2020	12/4/2022

Test Data Summary - Voltage Variations

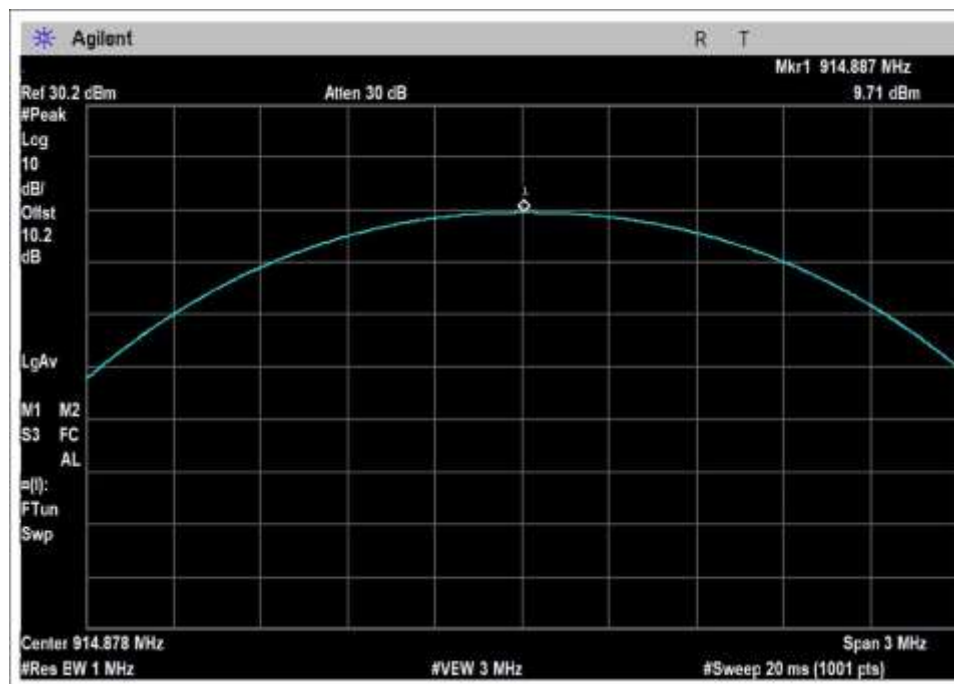
This equipment is battery powered. Power output tests were performed using a fresh battery.

Test Data Summary - RF Conducted Measurement					
$\text{Limit} = \begin{cases} 30\text{dBm Conducted}/36\text{dBm EIRP} & \geq 50 \text{ Channels} \\ 24\text{dBm Conducted}/30\text{dBm EIRP} & < 50 \text{ Channels (min 25)} \end{cases}$					
Frequency (MHz)	Modulation	Ant. Type / Gain (dBi)	Measured (dBm)	Limit (dBm)	Results
902.355	GFSK	Dedicated /0.97	9.94	≤30	Pass
914.898	GFSK	Dedicated /0.97	9.71	≤30	Pass
927.442	GFSK	Dedicated /0.97	9.42	≤30	Pass

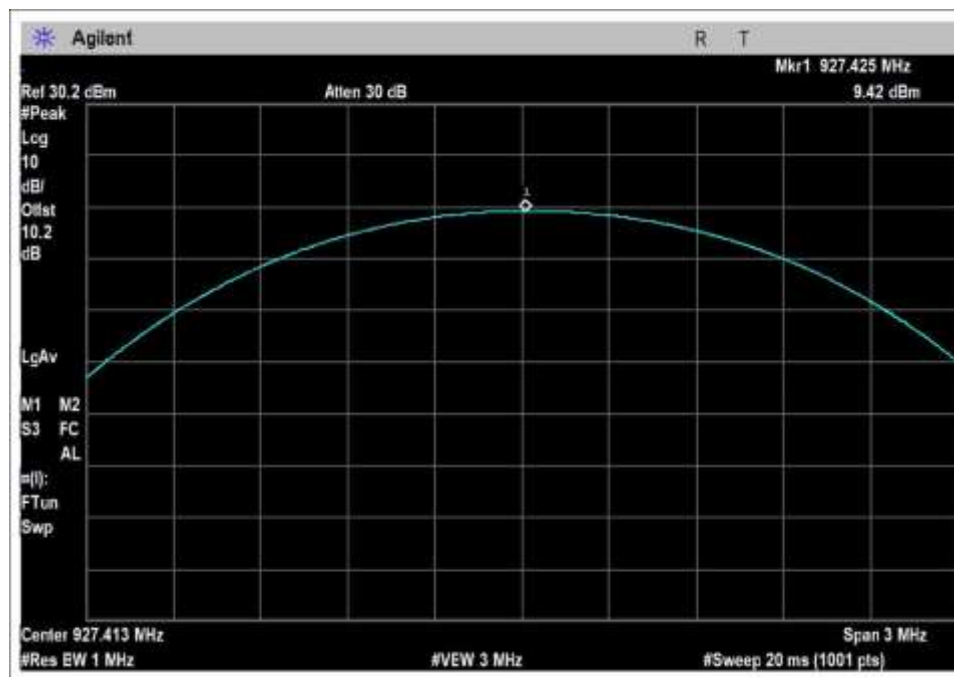
Plot Data



Low Channel



Middle Channel



High Channel

15.247(d) RF Conducted Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **107032** Date: 6/30/2022
 Test Type: **Conducted Spurious Emission** Time: 1:42:26 PM
 Tested By: Hieu Song Nguyenpham Sequence#: 35
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

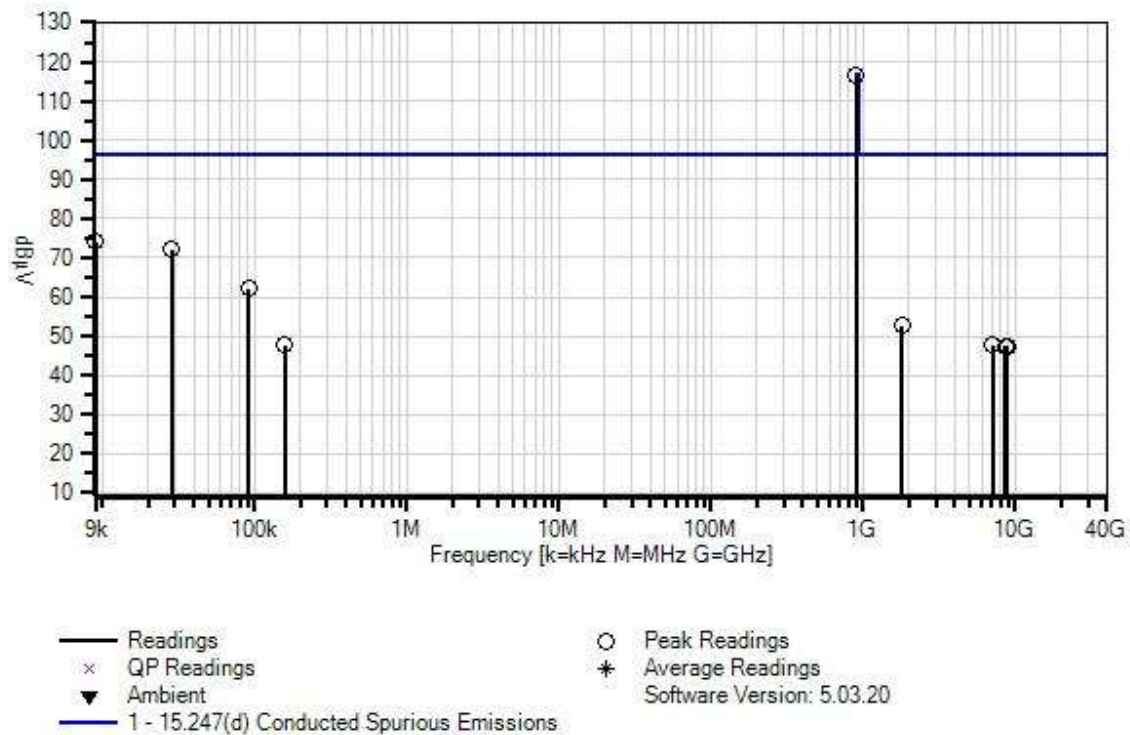
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Conducted Spurious Emission
 Frequency Range: 9kHz to 10000MHz
 Application: Tera-Term version 4.106
 Test Environment Conditions:
 Temperature: 22.1°C
 Relative Humidity: 42%
 Atmospheric Pressure: 101.8kPa
 High Clock: 24MHz
 Gain of the antenna = 0.97dBi
 Method: ANSI C63.10 (2013)
 RBW = 100kHz
 VBW = 300kHz
 The EUT is placed on the table and set as continuously transmitting as intended. The EUT is connected straight to the Spectrum Analyzer
 Note: Low Channel
 Modification #1 was in place during test.

Davis Instruments W/O#: 107032 Sequence#: 35 Date: 6/30/2022
15.247(d) Conducted Spurious Emissions Test Distance: None



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T2	ANP07365	Attenuator	54A-10	5/26/2021	5/26/2023

Measurement Data:

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB			Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	902.454M	106.5	+0.4	+9.8			+0.0	116.7	117.0	-0.3	None
2	9.000k	64.4	+0.0	+9.7			+0.0	74.1	96.4	-22.3	None
3	28.836k	62.5	+0.0	+9.7			+0.0	72.2	96.4	-24.2	None
4	91.594k	52.4	+0.0	+9.7			+0.0	62.1	96.4	-34.3	None
5	1803.830M	42.2	+0.7	+9.9			+0.0	52.8	96.4	-43.6	None
6	159.600k	38.1	+0.0	+9.7			+0.0	47.8	96.4	-48.6	None
7	158.797k	38.0	+0.0	+9.7			+0.0	47.7	96.4	-48.7	None
8	7095.168M	36.1	+1.5	+10.0			+0.0	47.6	96.4	-48.8	None
9	8551.514M	35.8	+1.6	+10.0			+0.0	47.4	96.4	-49.0	None
10	8769.285M	35.8	+1.6	+10.0			+0.0	47.4	96.4	-49.0	None



Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **107032** Date: 6/30/2022
 Test Type: **Conducted Spurious Emission** Time: 2:02:52 PM
 Tested By: Hieu Song Nguyenpham Sequence#: 36
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

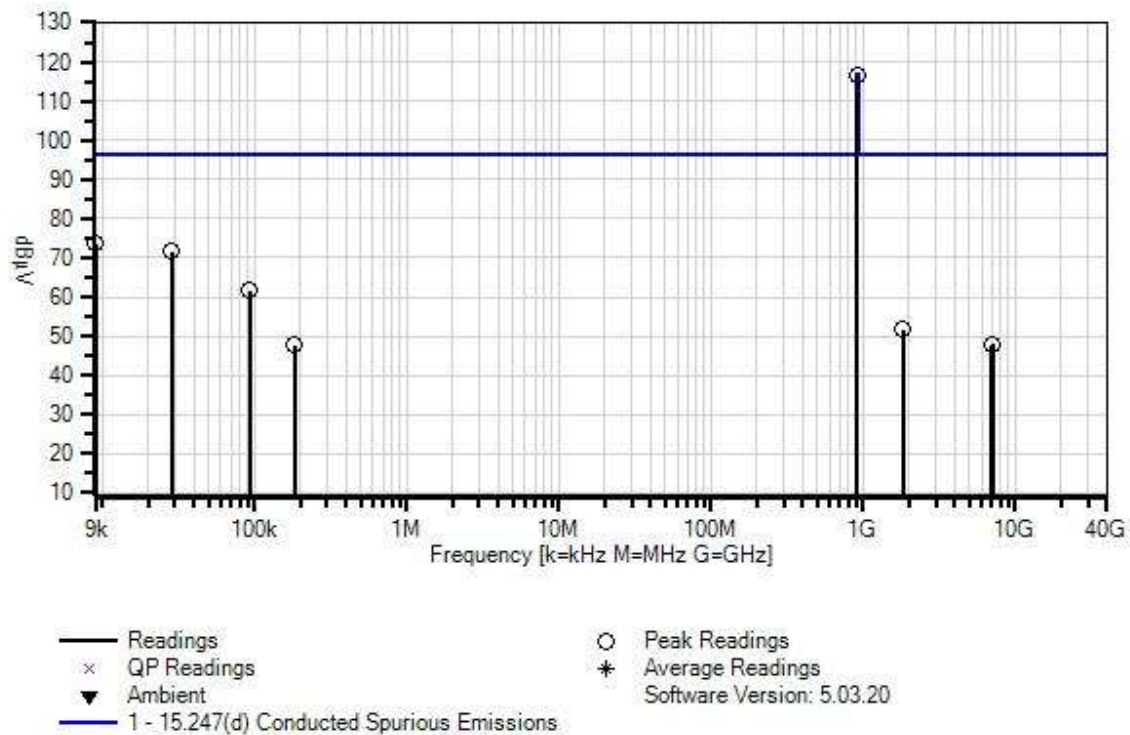
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Conducted Spurious Emission Frequency Range: 9kHz to 10000MHz Application: Tera-Term version 4.106 Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa High Clock: 24MHz Gain of the antenna = 0.97dBi Method: ANSI C63.10 (2013) RBW = 100kHz VBW = 300kHz The EUT is placed on the table and set as continuously transmitting as intended. The EUT is connected straight to the Spectrum Analyzer Note: Middle Channel Modification #1 was in place during test.

Davis Instruments W/O#: 107032 Sequence#: 36 Date: 6/30/2022
15.247(d) Conducted Spurious Emissions Test Distance: None



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T2	ANP07365	Attenuator	54A-10	5/26/2021	5/26/2023

Measurement Data:

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB			Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	915.159M	106.3	+0.4	+9.8			+0.0	116.5	117.0	-0.5	None
2	9.000k	63.8	+0.0	+9.7			+0.0	73.5	96.4	-22.9	None
3	28.773k	62.0	+0.0	+9.7			+0.0	71.7	96.4	-24.7	None
4	92.998k	51.9	+0.0	+9.7			+0.0	61.6	96.4	-34.8	None
5	1829.428M	41.1	+0.7	+9.9			+0.0	51.7	96.4	-44.7	None
6	7067.947M	36.4	+1.5	+10.0			+0.0	47.9	96.4	-48.5	None
7	182.469k	38.1	+0.0	+9.7			+0.0	47.8	96.4	-48.6	None
8	6931.840M	36.2	+1.5	+10.0			+0.0	47.7	96.4	-48.7	None
9	7020.310M	36.2	+1.5	+10.0			+0.0	47.7	96.4	-48.7	None
10	7101.974M	36.1	+1.5	+10.0			+0.0	47.6	96.4	-48.8	None



Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **15.247(d) Conducted Spurious Emissions**
 Work Order #: **107032** Date: 6/30/2022
 Test Type: **Conducted Spurious Emission** Time: 2:17:52 PM
 Tested By: Hieu Song Nguyenpham Sequence#: 37
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

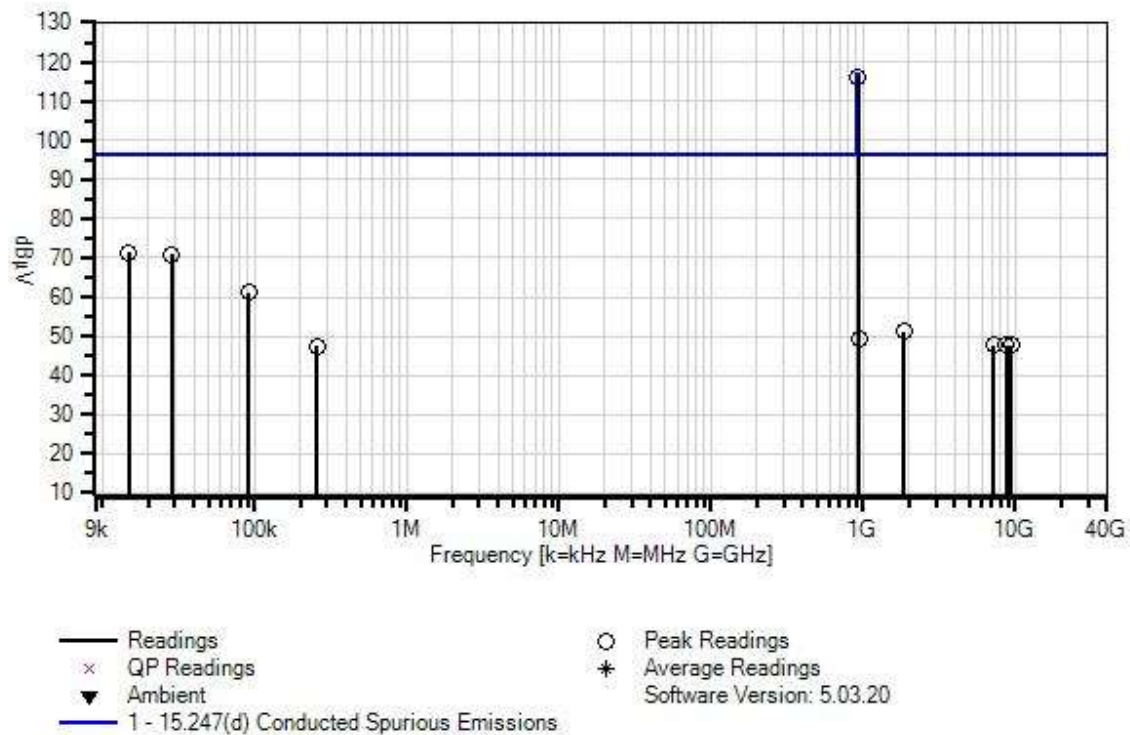
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Conducted Spurious Emission Frequency Range: 9kHz to 10000MHz Application: Tera-Term version 4.106 Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa High Clock: 24MHz Gain of the antenna = 0.97dBi Method: ANSI C63.10 (2013) RBW=100kHz VBW=300kHz The EUT is placed on the table and set as continuously transmitting as intended. The EUT is connected straight to the Spectrum Analyzer Note: High Channel Modification #1 was in place during test.

Davis Instruments W/O#: 107032 Sequence#: 37 Date: 6/30/2022
15.247(d) Conducted Spurious Emissions Test Distance: None



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T2	ANP07365	Attenuator	54A-10	5/26/2021	5/26/2023

Measurement Data:

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB			Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	927.196M	106.0	+0.4	+9.8			+0.0	116.2	117.0	-0.8	None
2	14.992k	61.7	+0.0	+9.7			+0.0	71.4	96.4	-25.0	None
3	28.711k	61.1	+0.0	+9.7			+0.0	70.8	96.4	-25.6	None
4	91.594k	51.4	+0.0	+9.7			+0.0	61.1	96.4	-35.3	None
5	1855.027M	40.7	+0.7	+9.9			+0.0	51.3	96.4	-45.1	None
6	931.208M	39.3	+0.4	+9.8			+0.0	49.5	96.4	-46.9	None
7	7163.222M	36.2	+1.5	+10.0			+0.0	47.7	96.4	-48.7	None
8	9347.740M	36.1	+1.6	+10.0			+0.0	47.7	96.4	-48.7	None
9	8633.178M	36.0	+1.6	+10.0			+0.0	47.6	96.4	-48.8	None
10	256.694k	37.8	+0.0	+9.7			+0.0	47.5	96.4	-48.9	None

Band Edge

Band Edge Summary

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

Operating Mode: Single Channel (Low and High)

Frequency (MHz)	Modulation	Measured (dBuV)	Limit (dBuV)	Results
902	GFSK	58.1697	<96.4	Pass
928	GFSK	52.2470	<96.4	Pass

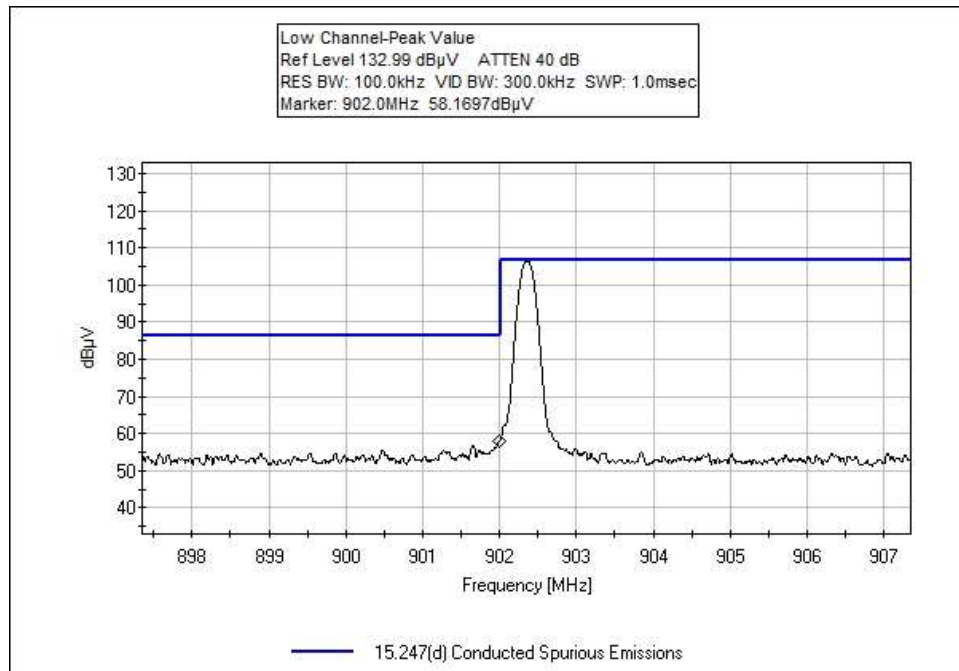
Band Edge Summary

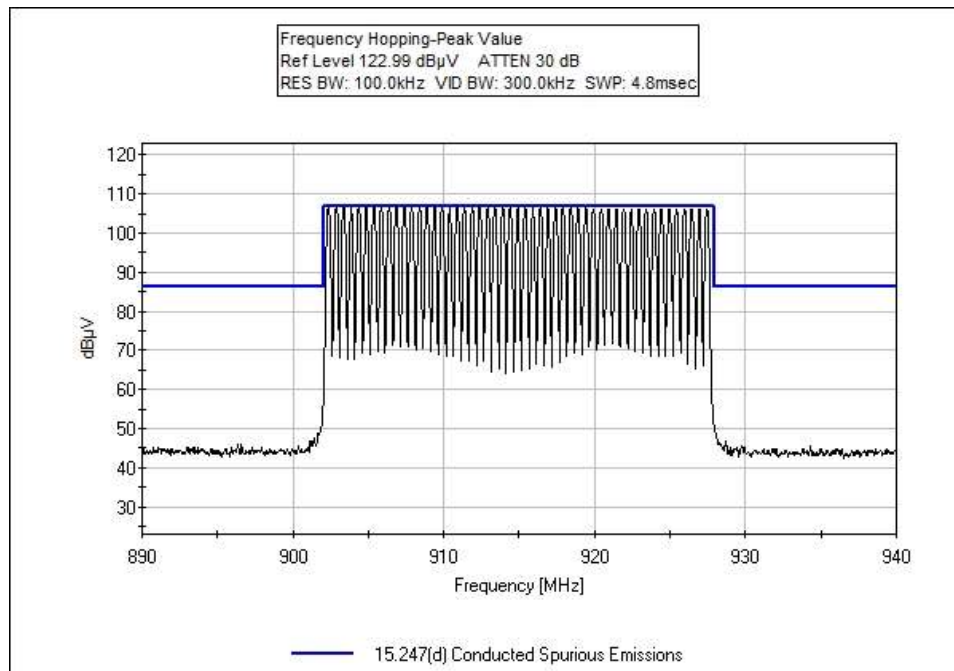
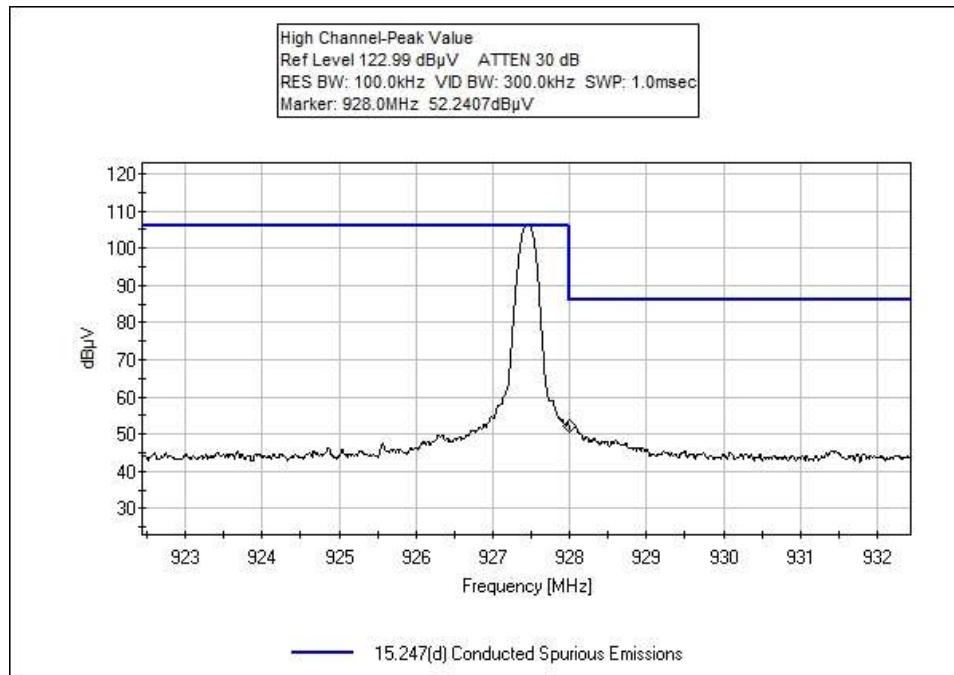
Limit applied: Max Power/100kHz - 20dB.

Operating Mode: Hopping

Frequency (MHz)	Modulation	Measured (dBuV)	Limit (dBuV)	Results
902	GFSK	58.1865	<96.4	Pass
928	GFSK	52.3254	<96.4	Pass

Band Edge Plots





Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **FCC 15.247 Conducted Spurious Emissions (Band Edge)**
 Work Order #: **107032** Date: 6/30/2022
 Test Type: **Conducted Spurious Emission** Time:
 Tested By: Hieu Song Nguyenpham Sequence#:
 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:

<p>Band Edge</p> <p>Application: Tera-Term version 4.106</p> <p>Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa</p> <p>High Clock: 24MHz Gain of the antenna= 0.97dBi Method: ANSI C63.10 (2013)</p> <p>RBW=100kHz VBW=300kHz</p> <p>The EUT is placed on the table and set as continuously transmitting as intended. The EUT is connected straight to the Spectrum Analyzer</p> <p>Modification #1 was in place during test.</p>
--

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
	ANP07365	Attenuator	54A-10	5/26/2021	5/26/2023

Test Setup Photo(s)



Test Setup



Test Setup; Close View

15.247(d) Radiated Emissions & Band Edge

Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107032** Date: 6/29/2022
 Test Type: **Radiated Scan** Time: 13:39:40
 Tested By: Hieu Song Nguyenpham Sequence#: 20
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

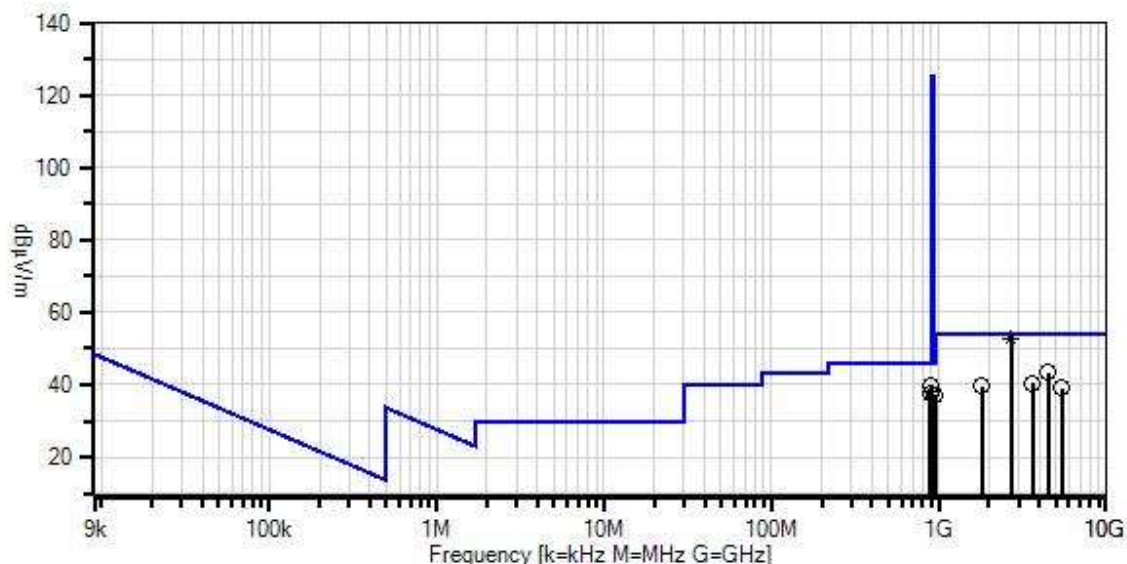
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Radiated Emission Frequency Range: 9kHz to 10GHz Application: Tera-Term version 4.106 Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa High Clock: 24MHz Gain of the antenna = 0.97dBi Method: ANSI C63.10 (2013) The EUT is set up and operated as intended. It is powered by an internal battery No emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz Note: Low Channel Modification #1 was in place during test.

Davis Instruments WO#: 107032 Sequence#: 20 Date: 6/29/2022
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Horiz



— Readings
× QP Readings
▼ Ambient
○ Peak Readings
* Average Readings
Software Version: 5.03.20
1 - 15.247(d) / 15.209 Radiated Spurious Emissions

Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T4	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
T5	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T6	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T7	AN03172	High Pass Filter	HM1155-11SS	3/22/2022	3/22/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2 T6	T3 T7	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB μ V	dB	dB	dB	dB	Table	dB μ V/m	dB μ V/m	dB	Ant
1	2707.049M	72.7	+28.9	+1.5	+2.7	+0.9	+0.0	52.5	54.0	-1.5	Horiz
	Ave		+0.0	-54.5	+0.3						
^	2707.049M	73.9	+28.9	+1.5	+2.7	+0.9	+0.0	53.7	54.0	-0.3	Horiz
			+0.0	-54.5	+0.3						
3	898.350M	36.2	+29.7	-31.3	+0.7	+1.3	+0.0	39.9	46.0	-6.1	Horiz
			+3.3	+0.0	+0.0						
4	890.302M	34.0	+29.6	-31.3	+0.7	+1.3	+0.0	37.6	46.0	-8.4	Horiz
			+3.3	+0.0	+0.0						
5	953.480M	30.8	+31.9	-30.8	+0.7	+1.3	+0.0	37.3	46.0	-8.7	Horiz
			+3.4	+0.0	+0.0						
6	4511.735M	60.0	+31.4	+1.9	+3.6	+1.1	+0.0	43.5	54.0	-10.5	Horiz
			+0.0	-54.8	+0.3						
7	3609.474M	57.8	+31.3	+1.7	+3.2	+1.0	+0.0	40.3	54.0	-13.7	Horiz
			+0.0	-55.0	+0.3						
8	1804.802M	63.3	+26.7	+1.2	+2.2	+0.7	+0.0	39.7	54.0	-14.3	Horiz
			+0.0	-54.8	+0.4						
9	5414.206M	53.5	+33.1	+2.1	+3.9	+1.2	+0.0	39.0	54.0	-15.0	Horiz
			+0.0	-55.1	+0.3						

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
 Work Order #: **107032** Date: 6/29/2022
 Test Type: **Radiated Scan** Time: 11:12:09
 Tested By: Hieu Song Nguyenpham Sequence#: 16
 Software: EMITest 5.03.20

Equipment Tested:

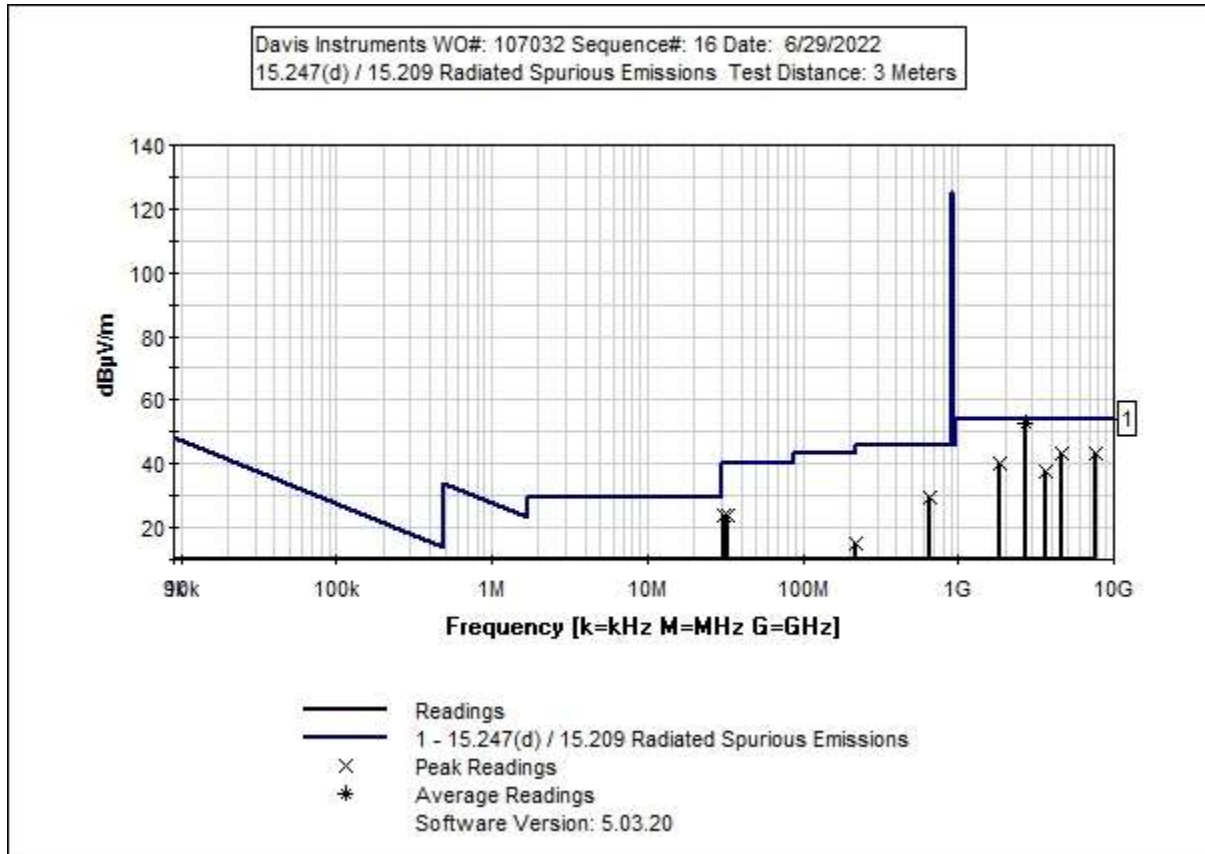
Device	Manufacturer	Model #	S/N
Configuration 2			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

Radiated Emission Frequency Range: 9kHz to 10GHz Application: Tera-Term version 4.106 Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa High Clock: 24MHz Gain of the antenna = 0.97dBi Method: ANSI C63.10 (2013) The EUT is set up and operated as intended. It is powered by an internal battery No emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz Note: Middle Channel Modification #1 was in place during test.
--



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T4	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
T5	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T6	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T7	AN03172	High Pass Filter	HM1155-11SS	3/22/2022	3/22/2024
	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data:

Reading listed by order taken.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	7583.577M	54.4	+35.4 +0.0	+2.5 -55.4	+4.7 +0.3	+1.5	+0.0	43.4	54.0	-10.6	Horiz
2	2744.691M	73.8	+29.0 +0.0	+1.5 -54.6	+2.7 +0.3	+0.9	+0.0	53.6	54.0	-0.4	Horiz
3	2744.691M Ave	72.7	+29.0 +0.0	+1.5 -54.6	+2.7 +0.3	+0.9	+0.0	52.5	54.0	-1.5	Horiz
4	1829.770M	63.4	+26.8 +0.0	+1.2 -54.8	+2.2 +0.4	+0.7	+0.0	39.9	54.0	-14.1	Horiz
5	3659.690M	55.2	+31.4 +0.0	+1.7 -54.9	+3.2 +0.3	+1.0	+0.0	37.9	54.0	-16.1	Horiz
6	4574.460M	59.2	+31.6 +0.0	+1.9 -54.6	+3.6 +0.3	+1.1	+0.0	43.1	54.0	-10.9	Horiz
7	654.627M	30.4	+26.9 +2.7	-32.0 +0.0	+0.6	+1.0	+0.0	29.6	46.0	-16.4	Horiz
8	32.595M	31.3	+23.7 +0.4	-32.0 +0.0	+0.0	+0.2	+0.0	23.6	40.0	-16.4	Horiz
9	30.599M	30.6	+24.5 +0.4	-32.0 +0.0	+0.0	+0.1	+0.0	23.6	40.0	-16.4	Horiz
10	218.591M	29.7	+15.3 +1.4	-31.9 +0.0	+0.3	+0.5	+0.0	15.3	46.0	-30.7	Horiz



Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
Customer: **Davis Instruments**
Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**
Work Order #: **107032** Date: 6/29/2022
Test Type: **Radiated Scan** Time: 12:12:49
Tested By: Hieu Song Nguyenpham Sequence#: 19
Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 2			

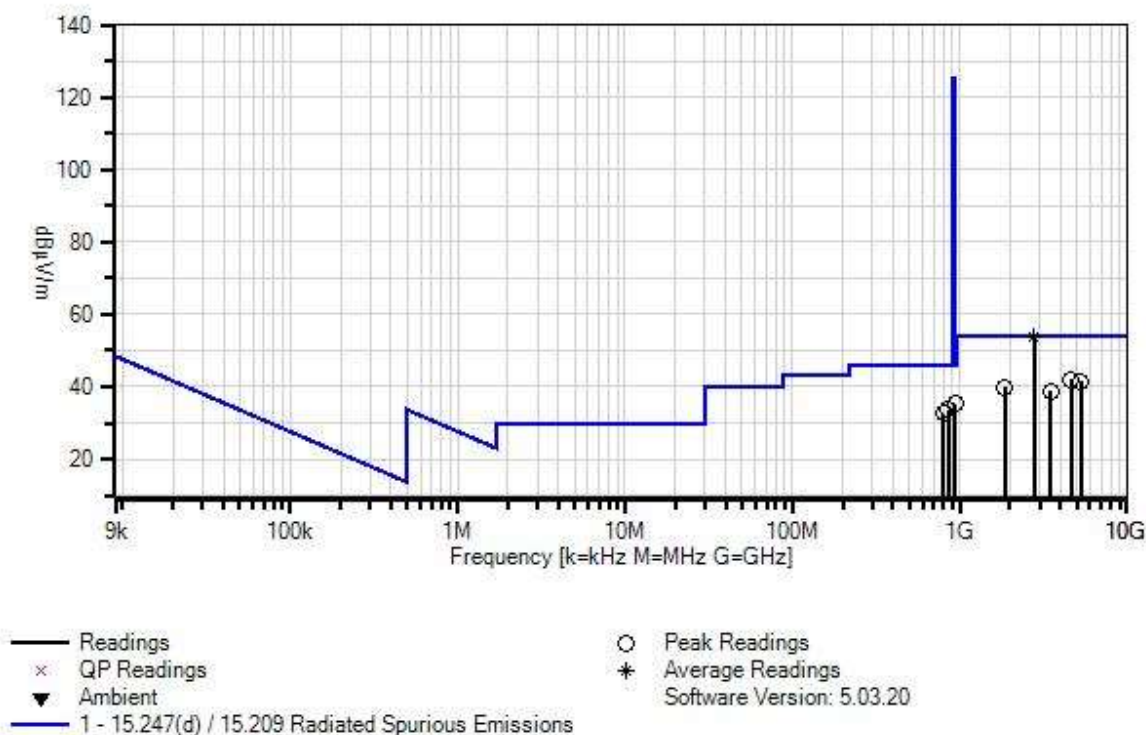
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 2			

Test Conditions / Notes:

<p>Radiated Emission Frequency Range: 9kHz to 10GHz</p> <p>Application: Tera-Term version 4.106</p> <p>Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa</p> <p>High Clock: 24MHz Gain of the antenna = 0.97dBi Method: ANSI C63.10 (2013)</p> <p>The EUT is set up and operated as intended. It is powered by an internal battery</p> <p>No emission from the EUT has been found in 20dB tolerant from 9kHz to 30MHz</p> <p>Note: High Channel</p> <p>Modification #1 was in place during test.</p>

Davis Instruments WO#: 107032 Sequence#: 19 Date: 6/29/2022
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02113	Horn Antenna-ANSI C63.5	3115	3/11/2021	3/11/2023
T2	AN03302	Cable	32026-29094K-29094K-72TC	1/10/2022	1/10/2024
T3	ANP01210	Cable	FSJ1P-50A-4A	11/2/2020	11/2/2022
T4	ANP06902	Cable	32022-29094K-29094K-36TC	8/13/2020	8/13/2022
T5	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
T6	AN03738	Preamp	BZRYE-00101800-221055-202323	2/4/2022	2/4/2024
T7	AN03172	High Pass Filter	HM1155-11SS	3/22/2022	3/22/2024
	ANP07508	Preamp	310N	5/9/2022	5/9/2024
	AN00432	Loop Antenna	6502	7/19/2021	7/19/2023
	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 T7 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	2782.340M Ave	74.0	+29.1 +0.0	+1.5 -54.7	+2.7 +0.3	+0.9	+0.0	53.8	54.0	-0.2	Horiz
^	2782.340M	74.6	+29.1 +0.0	+1.5 -54.7	+2.7 +0.3	+0.9	+0.0	54.4	54.0	+0.4	Horiz
3	938.579M	29.5	+31.3 +3.4	-30.9 +0.0	+0.7 +0.0	+1.3	+0.0	35.3	46.0	-10.7	Horiz
4	4636.498M	57.9	+31.8 +0.0	+1.9 -54.6	+3.7 +0.3	+1.1	+0.0	42.1	54.0	-11.9	Horiz
5	855.827M	30.4	+29.6 +3.2	-31.5 +0.0	+0.7 +0.0	+1.2	+0.0	33.6	46.0	-12.4	Horiz
6	5256.704M	55.9	+33.0 +0.0	+2.1 -54.8	+3.8 +0.3	+1.2	+0.0	41.5	54.0	-12.5	Horiz
7	794.927M	30.5	+28.9 +3.0	-31.8 +0.0	+0.7 +0.0	+1.2	+0.0	32.5	46.0	-13.5	Horiz
8	1854.870M	63.2	+26.9 +0.0	+1.2 -54.8	+2.2 +0.4	+0.7	+0.0	39.8	54.0	-14.2	Horiz
9	3494.531M	56.3	+31.2 +0.0	+1.7 -54.9	+3.2 +0.3	+1.0	+0.0	38.8	54.0	-15.2	Horiz

Band Edge

Band Edge Summary

Operating Mode: Single Channel (Low and High)

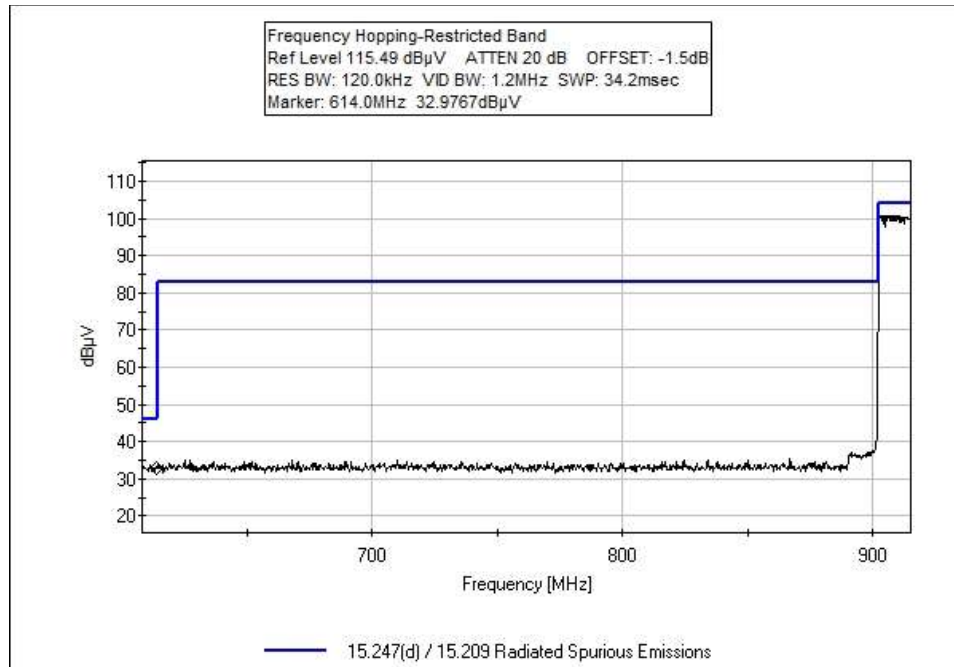
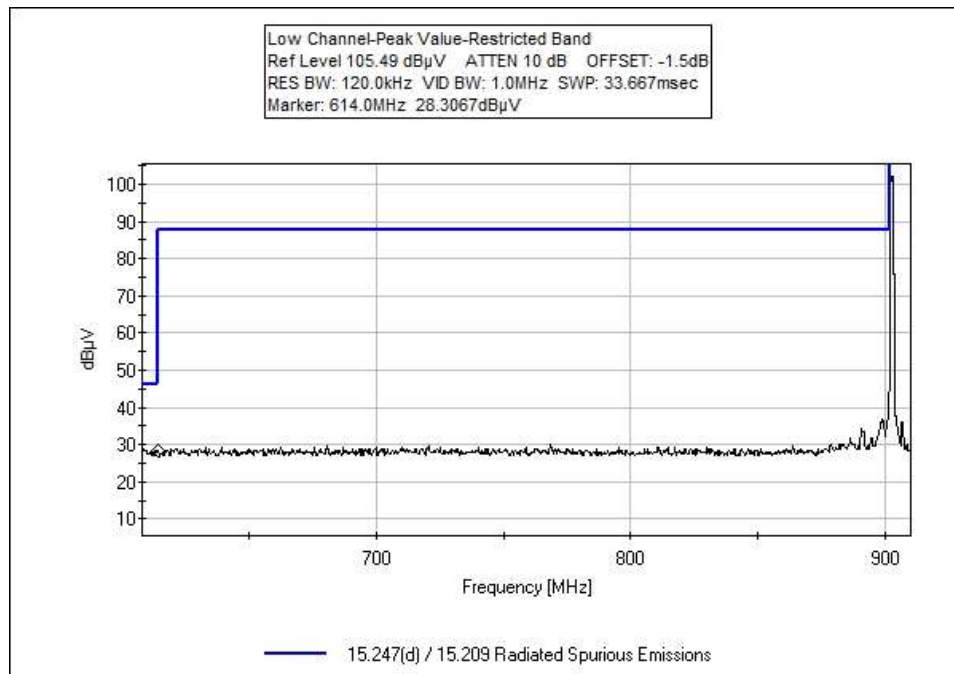
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK	Dedicated	28.3	<46	Pass
902	GFSK	Dedicated	55.1	<82.9	Pass
928	GFSK	Dedicated	43.4	<82.9	Pass
960	GFSK	Dedicated	32.5	<54	Pass

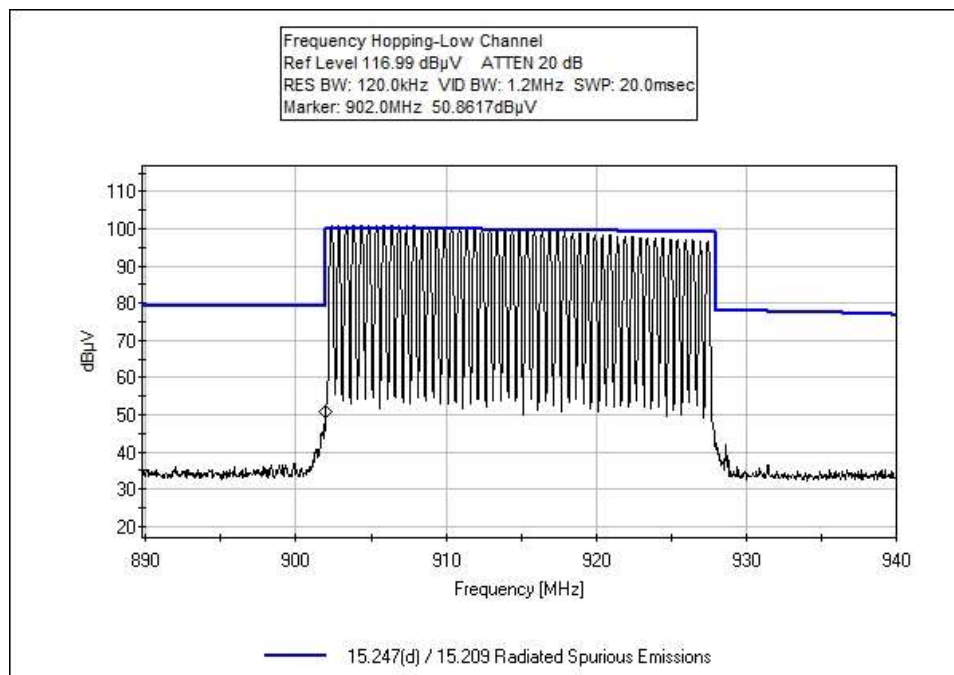
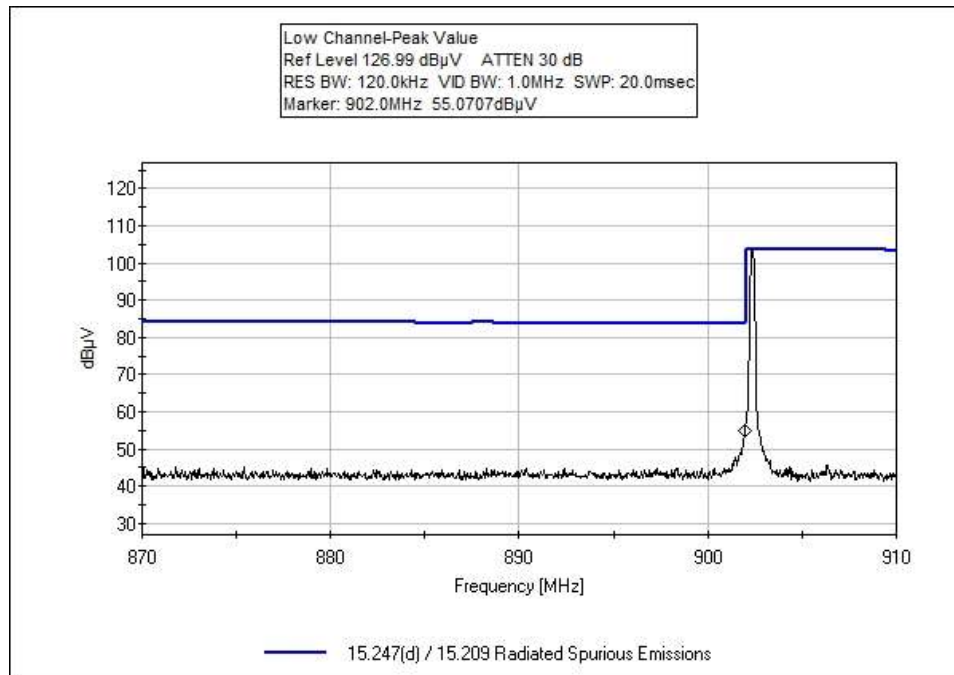
Band Edge Summary

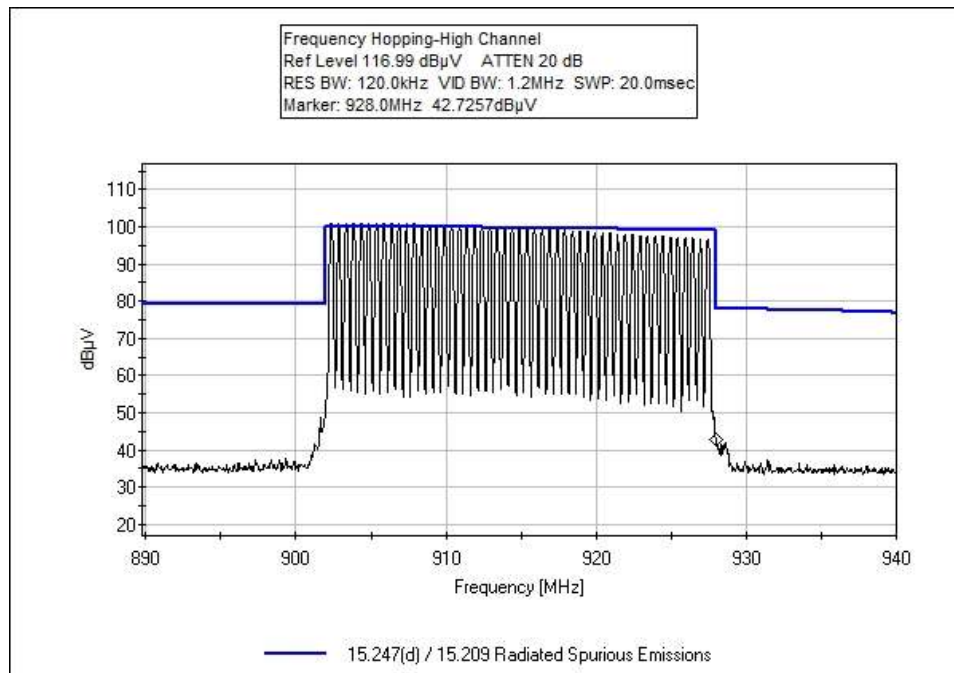
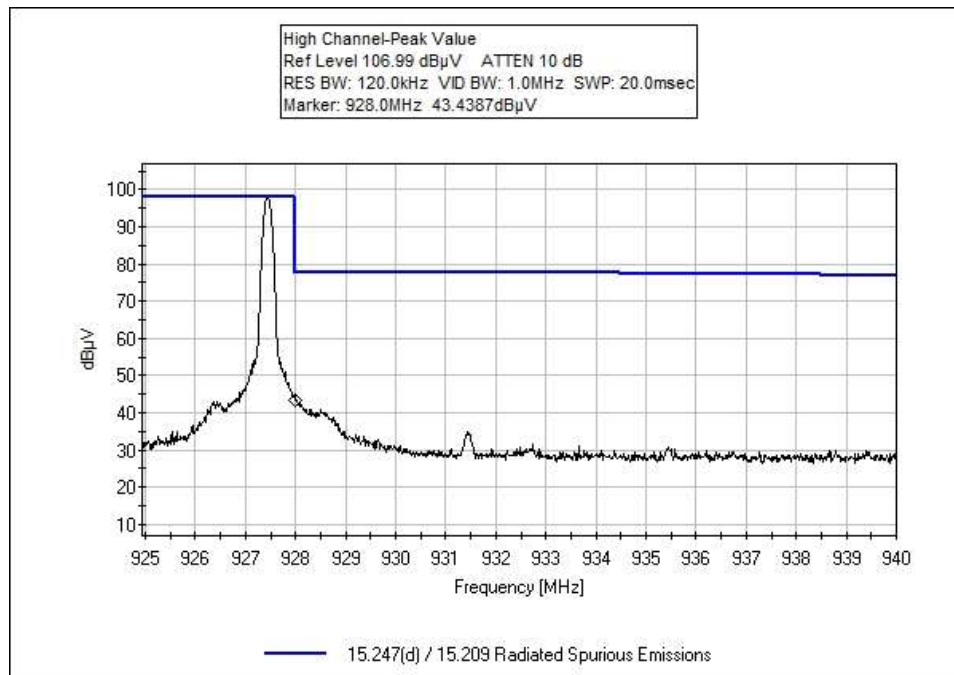
Operating Mode: Hopping

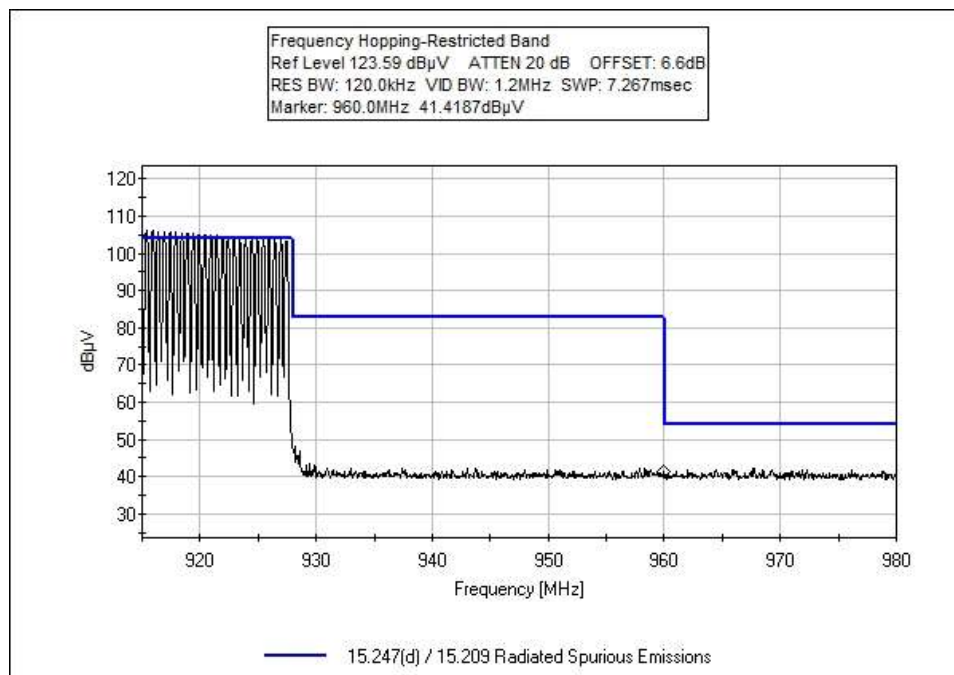
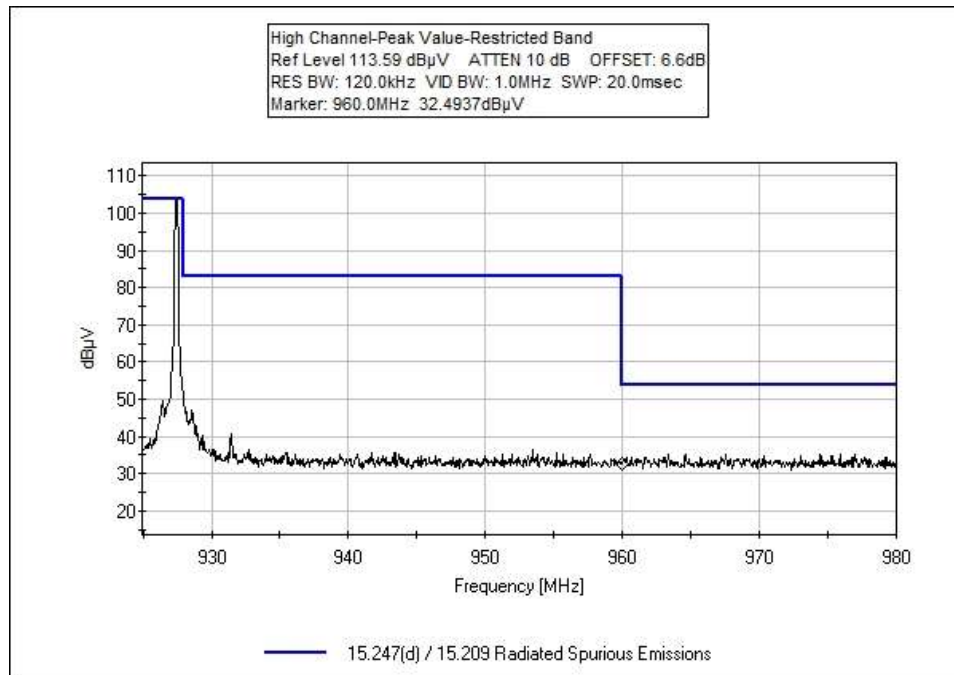
Frequency (MHz)	Modulation	Ant. Type	Field Strength (dBuV/m @3m)	Limit (dBuV/m @3m)	Results
614	GFSK	Dedicated	32.98	<46	Pass
902	GFSK	Dedicated	50.86	<82.9	Pass
928	GFSK	Dedicated	42.73	<82.9	Pass
960	GFSK	Dedicated	41.42	<54	Pass

Band Edge Plots









Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 1120 Fulton Place • Fremont, CA 94539 • (510) 249-1170
 Customer: **Davis Instruments**
 Specification: **FCC 15.247 / FCC 15.209 Radiated Spurious Emissions (Band Edge)**
 Work Order #: **107032** Date: 6/29/2022
 Test Type: **Radiated Scan** Time:
 Tested By: Hieu Song Nguyenpham Sequence#:
 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:

Band Edge Application: Tera-Term version 4.106 Test Environment Conditions: Temperature: 22.1°C Relative Humidity: 42% Atmospheric Pressure: 101.8kPa High Clock: 24MHz Gain of the antenna= 0.97dBi Method: ANSI C63.10 2013 The EUT is set up and operated as intended. It is powered by an internal battery Modification #1 was in place during test.
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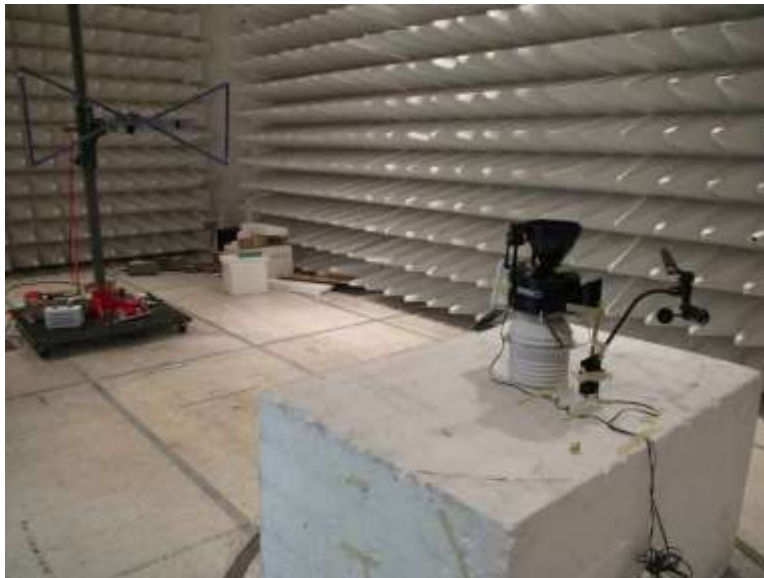
Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02660	Spectrum Analyzer	E4446A	12/4/2020	12/4/2022
	ANP01187	Cable	CNT-195	7/6/2020	7/6/2022
	ANP06691	Cable	PE3062-180	3/16/2022	3/16/2024
	ANP06694	Cable	PE3062-480	3/16/2022	3/16/2024
	AN01995	Biconilog Antenna	CBL6111C	4/19/2022	4/19/2024
	ANP07508	Preamp	310N	5/9/2022	5/9/2024

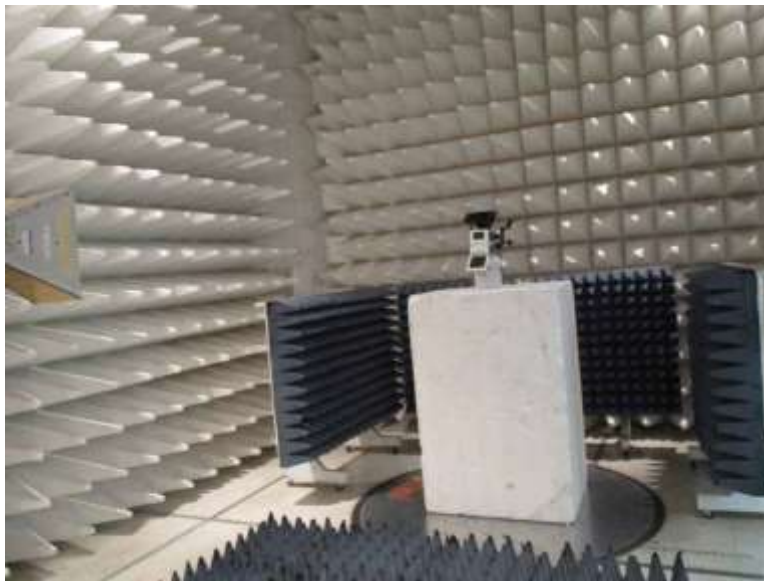
Test Setup Photo(s)



Below 1GHz; Front View



Below 1GHz; Back View



Above 1GHz; Front View



Above 1GHz; Back View

Appendix A: Antenna Gain Verification

Measured power, set at lowest channel (902.323MHz)

power set at 11dBm,

Conducted power = 9.94 dBm

Radiated field strength = [106.11dBuV/m@3m](#)

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

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

Or equivalently, in logarithmic form:

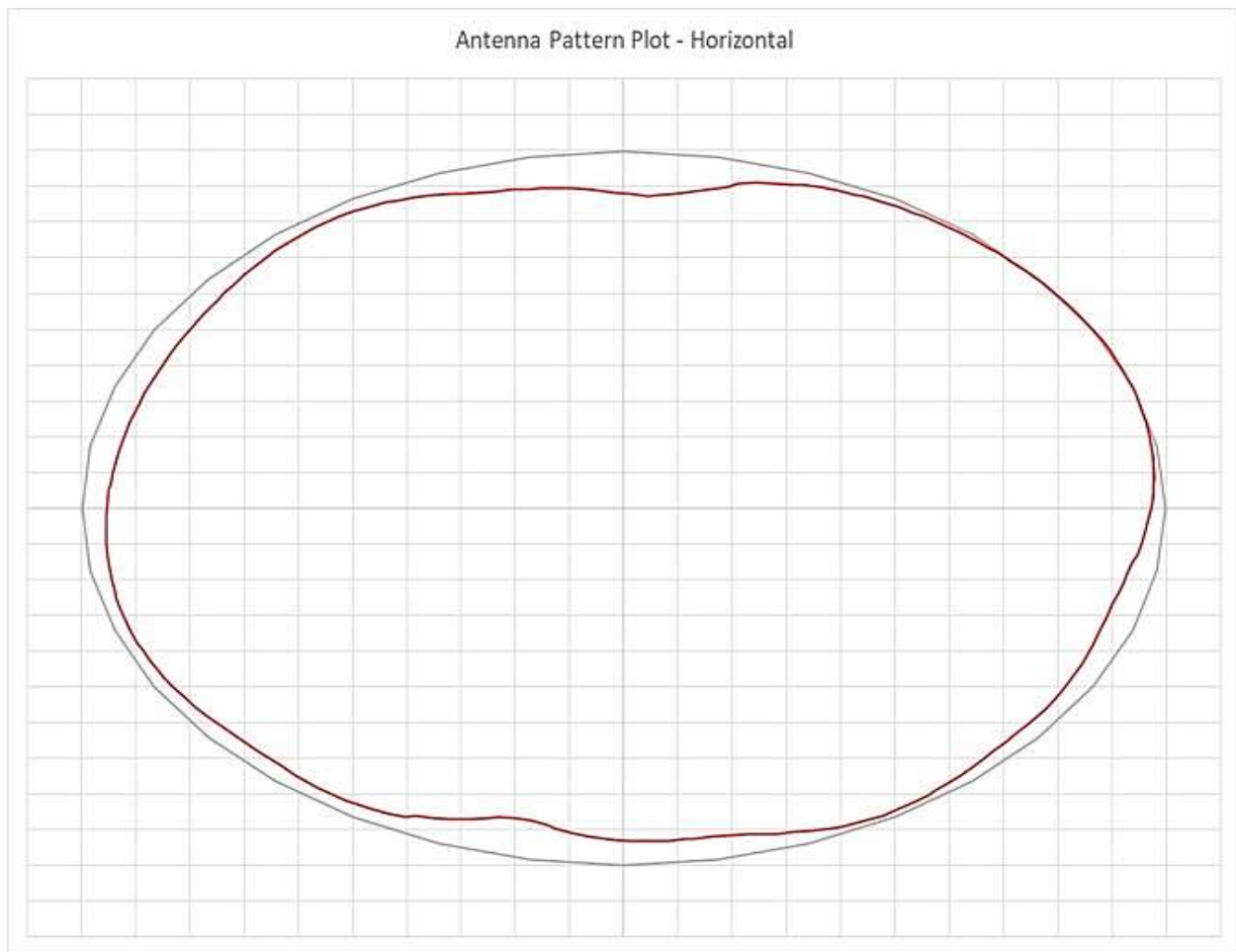
$$P(dBm) = E(dBuV/m) + 20LOG(d) - G - 104.77$$

$$9.94dBm = 106.11 \text{ dBuV/m@3m} + 20 \text{ Log}(3) - G - 104.77$$

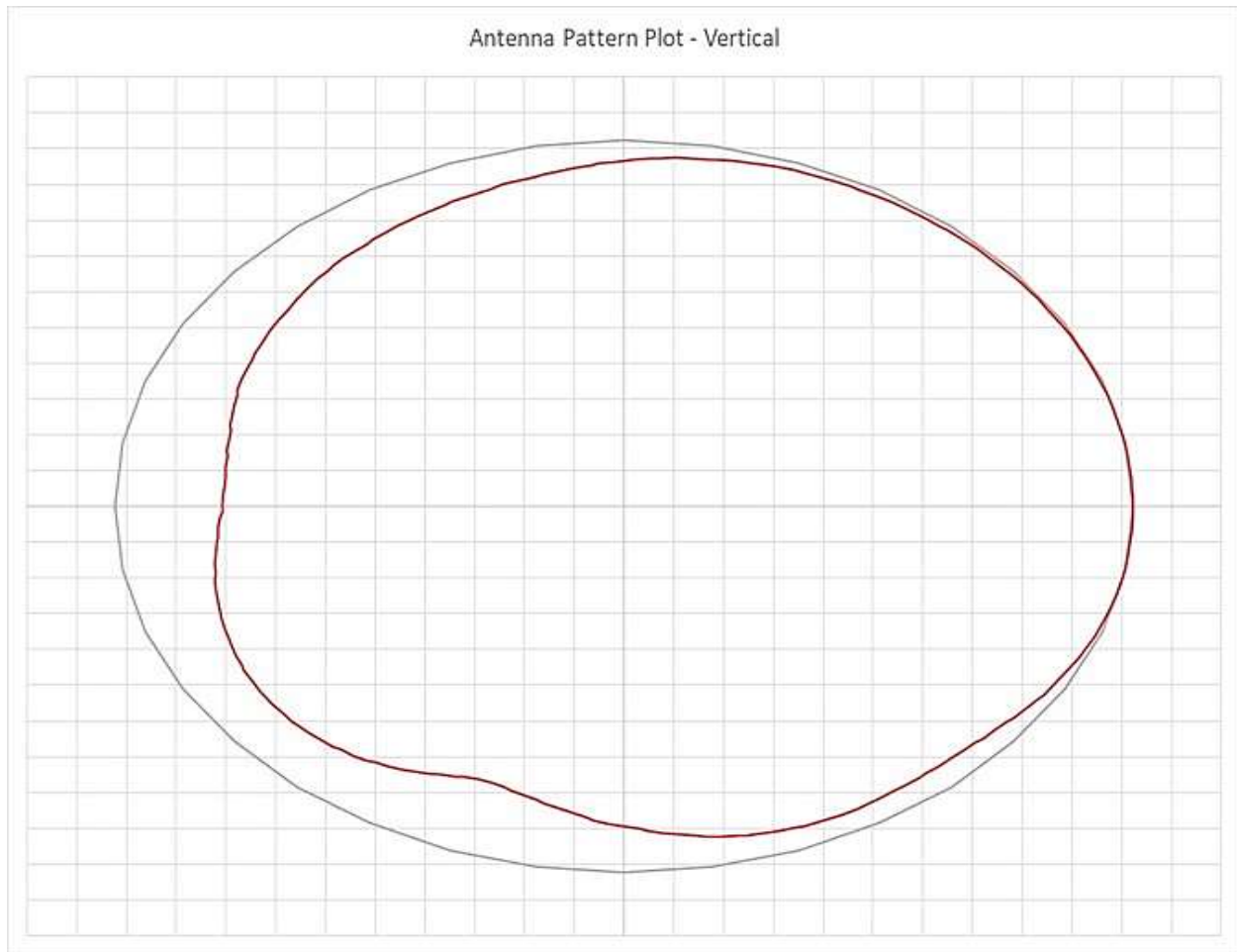
$$G = \text{106.11dBuV/m@3m} + 20\text{Log}3 - 104.7 - (9.94)$$

$$G = 106.11 + 9.5 - 104.7 - 9.94$$

$$G = +0.97 \text{ dBi}$$



Note: Grey line represents omnidirectional gain based on peak value.



Note: Grey line represents omnidirectional gain based on peak value.

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 $\text{dB}\mu\text{V}/\text{m}$, the spectrum analyzer reading in $\text{dB}\mu\text{V}$ 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	($\text{dB}\mu\text{V}$)
+	Antenna Factor	(dB/m)
+	Cable Loss	(dB)
-	Distance Correction	(dB)
-	Preamplifier Gain	(dB)
=	Corrected Reading	($\text{dB}\mu\text{V}/\text{m}$)

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.