

Meteorcomm LLC.

EMC TEST REPORT FOR

**ITCR-NG Wayside
Model: 65010**

Tested to The Following Standards:

FCC Part 90 Subparts I, K, and T

217.6125-219.9875MHz and 220.0125-221.9875MHz

Report No.: 108416-3

Date of issue: November 16, 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.

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TABLE OF CONTENTS

Administrative Information	3
Test Report Information	3
Report Authorization	3
Test Facility Information	4
Software Versions	4
Site Registration & Accreditation Information	4
Summary of Results	5
Modifications During Testing	5
Conditions During Testing	5
Equipment Under Test	6
General Product Information	7
FCC Part 90 Subparts I, K, and T	15
90.205, 90.723, 90.729, 90.259 Power Output	15
90.209, 90.733 (d) Occupied Bandwidth	22
90.213 Frequency Stability	28
90.210 Conducted Emission Mask and Spurs	31
90.210 Radiated Spurious Emissions	41
Supplemental Information	54
Measurement Uncertainty	54
Emissions Test Details	54

ADMINISTRATIVE INFORMATION

Test Report Information

REPORT PREPARED FOR:

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Representative: George Stults
Customer Reference Number: PO30478

REPORT PREPARED BY:

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Project Number: 108416

DATE OF EQUIPMENT RECEIPT:

September 15, 2023

DATE(S) OF TESTING:

September 15-22, 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.
22116 23rd Drive SE, Suite A
Bothell, WA 98021

Software Versions

CKC Laboratories Proprietary Software	Version
EMITest Emissions	5.03.20
EMITest Immunity	5.03.10

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 90 Subparts I, K, and T

Test Procedure	Description	Modifications	Results
90.205, 90.723, 90.729, 90.259	Power Output	NA	Pass
90.209, 90.733 (d)	Occupied Bandwidth	NA	Pass
90.213	Frequency Stability	NA	Pass
90.210	Conducted Spurious Emissions and Mask	NA	Pass
90.210	Radiated Spurious Emissions	NA	Pass

NA = Not Applicable

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

The following channels were selected for testing:

Ch1 = 217.6125MHz
 Ch96 = 219.9875MHz
 Ch 97 = 220.0125MHz
 Ch 176 = 221.9875MHz

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 (Meanwell DC Supply)

Equipment Tested:

Device	Manufacturer	Model #	S/N
ITCR-NG Wayside	Meteorcomm, LLC	65010	65WR001056MC

Support Equipment:

Device	Manufacturer	Model #	S/N
ITCR-NG Wayside	Meteorcomm, LLC	65010	65WR000002HW
AC/DC Switching Adaptor	Mean Well	GST280A12-C6P	EC051B7718
AC/DC Switching Adaptor	Mean Well	GST280A12-C6P	EB96422312
Attenuator	Fairview Microwave	SA3N1007-30	NA
Attenuator	Fairview Microwave	SA3N1007-30	NA
Attenuator	Fairview Microwave	SA3N1007-30	NA
Vector Signal Generator	Rhode & Schwarz	SMBV100B	1423.1003K02-102044-an
Laptop	Panasonic	CF-30	T1260Z
Laptop	Dell	Latitude	8X7DMH2
GPS 4-way Splitter	GPSS	S14-SF	NA
USB Thumb Drive	Micro Center	64GB	NA
Prosafe 8-Port Gigabit Smart Switch	Netgear	GS108Tv2	29SE4C5302E60

Configuration 3 (BK DC Supply, No Receiver Support Unit)

Equipment Tested:

Device	Manufacturer	Model #	S/N
ITCR-NG Wayside	Meteorcomm, LLC	65010	65WR001056MC

Support Equipment:

Device	Manufacturer	Model #	S/N
Programmable DC Power Supply	BK Precision	XLN8018	351EL1073
AC/DC Switching Adaptor	Mean Well	GST280A12-C6P	EB96422312
Vector Signal Generator	Rhode & Schwarz	SMBV100B	1423.1003K02-102044-an
Laptop	Panasonic	CF-30	T1260Z
Laptop	Dell	Latitude	8X7DMH2
GPS 4-way Splitter	GPSS	S14-SF	NA
USB Thumb Drive	Micro Center	64GB	NA
Prosafe 8-Port Gigabit Smart Switch	Netgear	GS108Tv2	29SE4C5302E60

General Product Information:

Product Information	Manufacturer-Provided Details
Equipment Type:	Stand-Alone Equipment
Type of Transmission System:	Proprietary for Locomotive
Operating Frequency Range(s):	217.6125-219.9875MHz AND 220.0125-221.9875MHz
Modulation Type(s):	DQPSK Full Rate and Half Rate
Maximum Duty Cycle:	10%, but may be increased for testing
Number of TX Chains:	1
Antenna Type(s) and Gain:	Not specified by manufacturer, but typical railroad antenna 4.55dBi
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	13.6VDC
Firmware / Software used for Test:	0.1.76 Linux 0.1.121 FPGA MobaXterm v23.2
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)



Support EUT



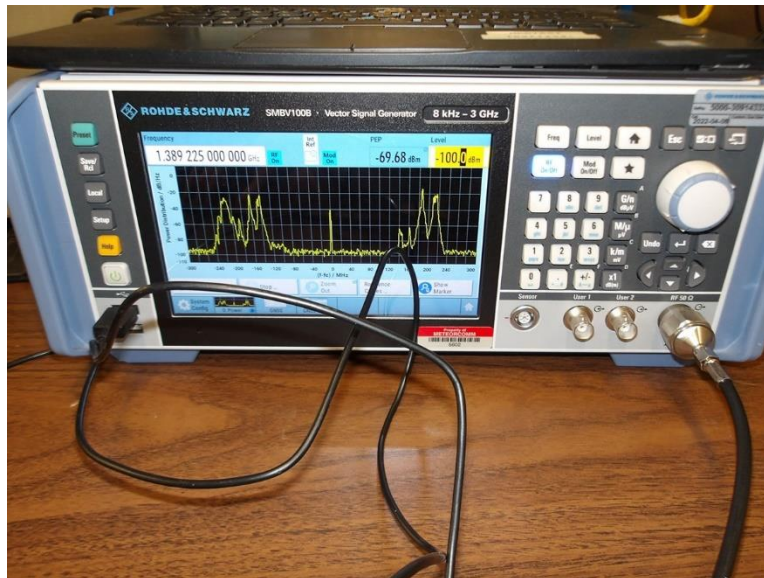
DC Power Supply 1



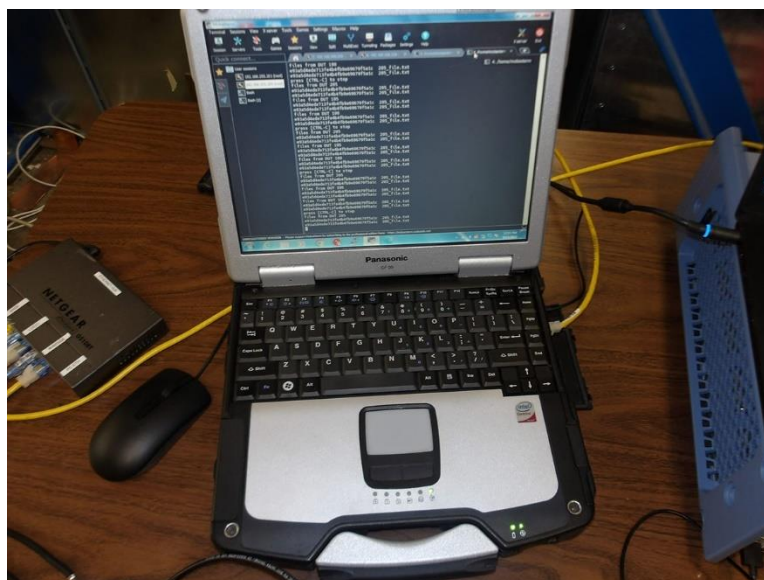
DC Power Supply 2



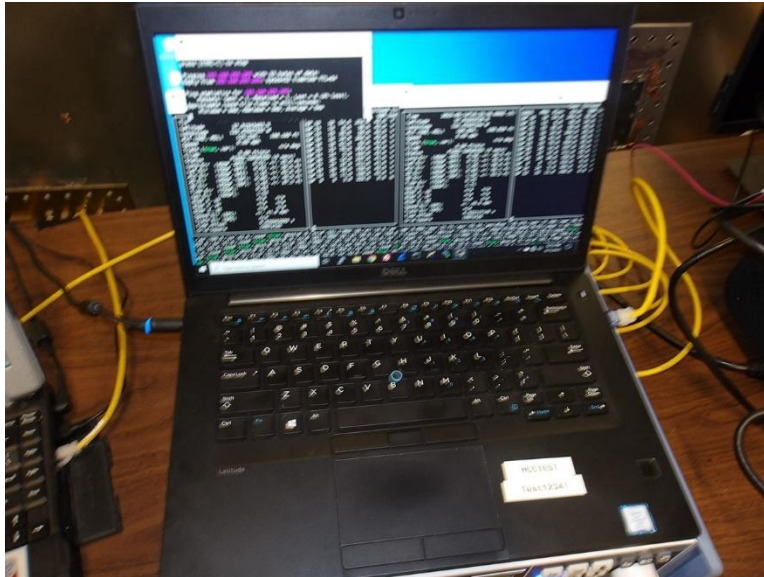
Attenuators



Signal Generator



Laptop 1



Laptop 2



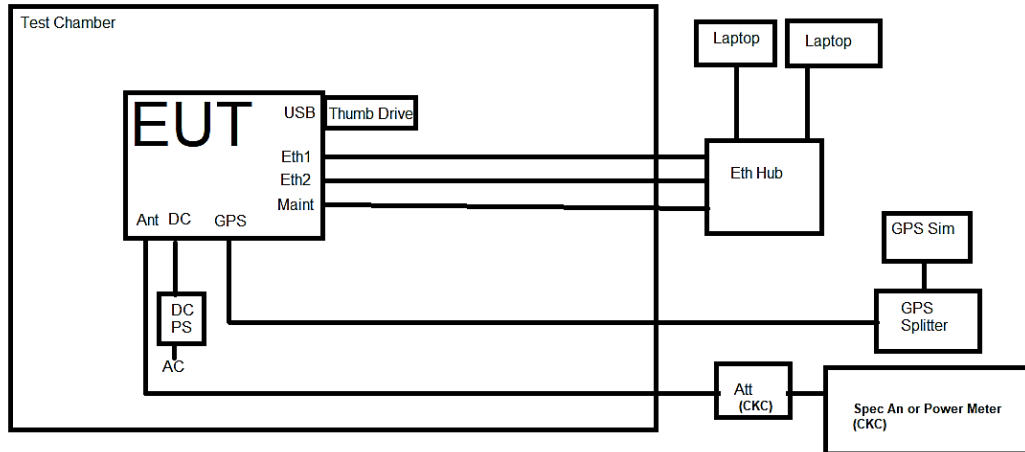
GPS Splitter



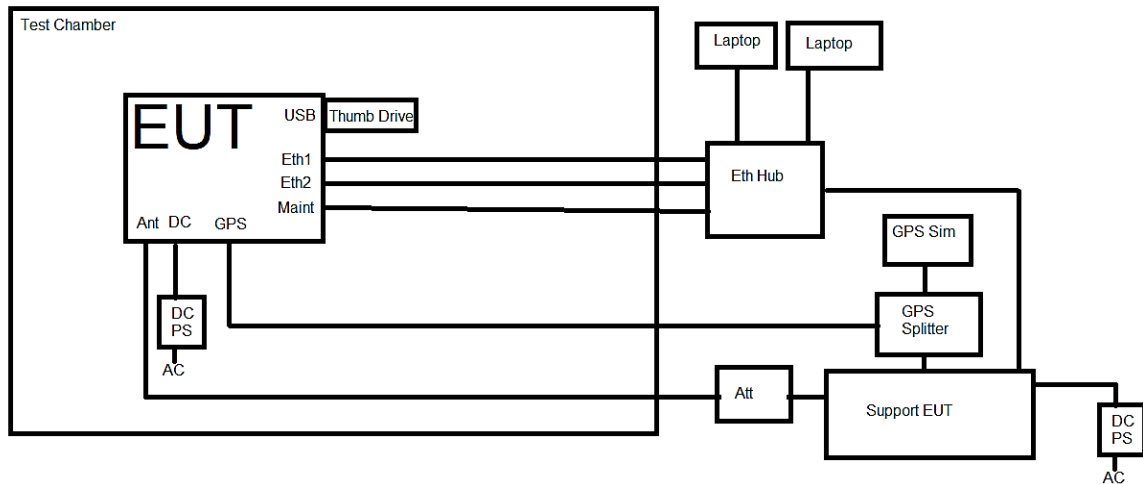
Ethernet Hub

Block Diagram(s) of Test Setup

RF Conducted Setup



Radiated Setup



FCC PART 90 SUBPARTS I, K, AND T

90.205, 90.723, 90.729, 90.259 Power Output

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/18/2023 to 9/19/2023
Configuration:	3		
Test Setup:	<p>The unit is in a temperature chamber for temperature variation. The voltage is varied and measured with a DMM. The EUT's RF port is connected to a peak power meter with appropriate attenuation. The bandwidth settings are low enough to resolve the center frequency of the emission. Once the EUT transmitter is turned on, it is transmitting continuously with its normal duty cycle, full rate and half rate modulations investigated.</p> <p>The applicable limits are:</p> <ol style="list-style-type: none"> 1) 217-220MHz: up to 2W according to 90.259 2) 220-221MHz: up to 50W according to 90.729 3) 221-222MHz: up to 500W according to 90.723 <p>Per the manufacturer, the max power is recorded for all channels tested and the licensee must consider these limitations.</p>		

Environmental Conditions			
Temperature (°C)	23-26	Relative Humidity (%):	42-46

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03478	Power Sensor	Rohde & Schwarz	NRP-Z81	5/8/2023	5/8/2025
P07623	Attenuator	API Weinschel	47-20-34	3/16/2022	3/16/2024
P07628	Low Pass Filter	Mini-Circuits	NLP-90+	4/27/2022	4/27/2024
P06452	Cable	Andrews	Heliac	2/8/2023	2/8/2025
02757	Temperature Chamber	Bemco	F100/350-8	12/8/2022	12/8/2024
03029	Thermometer, Digital Infrared	Fluke	566	4/14/2023	4/14/2025
03514	Multimeter	Fluke	87	10/20/2022	10/20/2024

Test Data Summary - RF Conducted Measurement (Ch1)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
217.6125	-30	V _{Nom}	Full Rate	25.88	Pass*
217.6125	-20	V _{Nom}	Full Rate	27.93	Pass*
217.6125	-10	V _{Nom}	Full Rate	28.58	Pass*
217.6125	0	V _{Nom}	Full Rate	25.00	Pass*
217.6125	10	V _{Nom}	Full Rate	25.41	Pass*
217.6125	20	V _{Nom}	Full Rate	26.12	Pass*
217.6125	30	V _{Nom}	Full Rate	26.49	Pass*
217.6125	40	V _{Nom}	Full Rate	26.79	Pass*
217.6125	50	V _{Nom}	Full Rate	27.23	Pass*
217.6125	20	V _{Min}	Full Rate	26.12	Pass*
217.6125	20	V _{Max}	Full Rate	26.18	Pass*

* Equipment meets maximum 2W power limit in accordance with 90.259(a)(4), operation at higher power is permitted only when licensee has obtained appropriate spectrum authorization.

Test Data Summary - RF Conducted Measurement (Ch96)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
219.9875	-30	V _{Nom}	Full Rate	23.71	Pass*
219.9875	-20	V _{Nom}	Full Rate	24.15	Pass*
219.9875	-10	V _{Nom}	Full Rate	24.27	Pass*
219.9875	0	V _{Nom}	Full Rate	24.89	Pass*
219.9875	10	V _{Nom}	Full Rate	25.23	Pass*
219.9875	20	V _{Nom}	Full Rate	26.06	Pass*
219.9875	30	V _{Nom}	Full Rate	26.24	Pass*
219.9875	40	V _{Nom}	Full Rate	26.49	Pass*
219.9875	50	V _{Nom}	Full Rate	26.98	Pass*
219.9875	20	V _{Min}	Full Rate	26.12	Pass*
219.9875	20	V _{Max}	Full Rate	25.88	Pass*

* Equipment meets maximum 2W power limit in accordance with 90.259(a)(4), operation at higher power is permitted only when licensee has obtained appropriate spectrum authorization.

Test Data Summary - RF Conducted Measurement (Ch97)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
220.0125	-30	V _{Nom}	Full Rate	23.71	Pass
220.0125	-20	V _{Nom}	Full Rate	24.04	Pass
220.0125	-10	V _{Nom}	Full Rate	24.38	Pass
220.0125	0	V _{Nom}	Full Rate	24.89	Pass
220.0125	10	V _{Nom}	Full Rate	25.23	Pass
220.0125	20	V _{Nom}	Full Rate	26.06	Pass
220.0125	30	V _{Nom}	Full Rate	26.24	Pass
220.0125	40	V _{Nom}	Full Rate	26.49	Pass
220.0125	50	V _{Nom}	Full Rate	26.98	Pass
220.0125	20	V _{Min}	Full Rate	25.88	Pass
220.0125	20	V _{Max}	Full Rate	25.88	Pass

Test Data Summary - RF Conducted Measurement (Ch176)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
221.9875	-30	V _{Nom}	Full Rate	31.62	Pass
221.9875	-20	V _{Nom}	Full Rate	32.58	Pass
221.9875	-10	V _{Nom}	Full Rate	32.89	Pass
221.9875	0	V _{Nom}	Full Rate	24.83	Pass
221.9875	10	V _{Nom}	Full Rate	25.18	Pass
221.9875	20	V _{Nom}	Full Rate	25.94	Pass
221.9875	30	V _{Nom}	Full Rate	26.06	Pass
221.9875	40	V _{Nom}	Full Rate	26.30	Pass
221.9875	50	V _{Nom}	Full Rate	26.79	Pass
221.9875	20	V _{Min}	Full Rate	25.64	Pass
221.9875	20	V _{Max}	Full Rate	25.76	Pass

Test Data Summary - RF Conducted Measurement (Ch1)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
217.6125	-30	V _{Nom}	Half Rate	25.76	Pass*
217.6125	-20	V _{Nom}	Half Rate	27.61	Pass*
217.6125	-10	V _{Nom}	Half Rate	28.31	Pass*
217.6125	0	V _{Nom}	Half Rate	25.18	Pass*
217.6125	10	V _{Nom}	Half Rate	25.64	Pass*
217.6125	20	V _{Nom}	Half Rate	26.98	Pass*
217.6125	30	V _{Nom}	Half Rate	26.61	Pass*
217.6125	40	V _{Nom}	Half Rate	26.73	Pass*
217.6125	50	V _{Nom}	Half Rate	27.04	Pass*
217.6125	20	V _{Min}	Half Rate	26.18	Pass*
217.6125	20	V _{Max}	Half Rate	26.18	Pass*

* Equipment meets maximum 2W power limit in accordance with 90.259(a)(4), operation at higher power is permitted only when licensee has obtained appropriate spectrum authorization.

Test Data Summary - RF Conducted Measurement (Ch96)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
219.9875	-30	V _{Nom}	Half Rate	20.94	Pass*
219.9875	-20	V _{Nom}	Half Rate	22.44	Pass*
219.9875	-10	V _{Nom}	Half Rate	23.50	Pass*
219.9875	0	V _{Nom}	Half Rate	25.06	Pass*
219.9875	10	V _{Nom}	Half Rate	25.53	Pass*
219.9875	20	V _{Nom}	Half Rate	26.92	Pass*
219.9875	30	V _{Nom}	Half Rate	26.00	Pass*
219.9875	40	V _{Nom}	Half Rate	26.36	Pass*
219.9875	50	V _{Nom}	Half Rate	26.79	Pass*
219.9875	20	V _{Min}	Half Rate	25.76	Pass*
219.9875	20	V _{Max}	Half Rate	25.82	Pass*

* Equipment meets maximum 2W power limit in accordance with 90.259(a)(4), operation at higher power is permitted only when licensee has obtained appropriate spectrum authorization.

Test Data Summary - RF Conducted Measurement (Ch97)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
220.0125	-30	V _{Nom}	Half Rate	20.94	Pass
220.0125	-20	V _{Nom}	Half Rate	23.12	Pass
220.0125	-10	V _{Nom}	Half Rate	23.88	Pass
220.0125	0	V _{Nom}	Half Rate	25.00	Pass
220.0125	10	V _{Nom}	Half Rate	25.53	Pass
220.0125	20	V _{Nom}	Half Rate	26.92	Pass
220.0125	30	V _{Nom}	Half Rate	26.12	Pass
220.0125	40	V _{Nom}	Half Rate	26.36	Pass
220.0125	50	V _{Nom}	Half Rate	26.79	Pass
220.0125	20	V _{Min}	Half Rate	25.76	Pass
220.0125	20	V _{Max}	Half Rate	25.82	Pass

Test Data Summary - RF Conducted Measurement (Ch176)					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
221.9875	-30	V _{Nom}	Half Rate	31.12	Pass
221.9875	-20	V _{Nom}	Half Rate	32.36	Pass
221.9875	-10	V _{Nom}	Half Rate	32.58	Pass
221.9875	0	V _{Nom}	Half Rate	24.95	Pass
221.9875	10	V _{Nom}	Half Rate	25.47	Pass
221.9875	20	V _{Nom}	Half Rate	26.79	Pass
221.9875	30	V _{Nom}	Half Rate	26.06	Pass
221.9875	40	V _{Nom}	Half Rate	26.18	Pass
221.9875	50	V _{Nom}	Half Rate	26.61	Pass
221.9875	20	V _{Min}	Half Rate	25.59	Pass
221.9875	20	V _{Max}	Half Rate	25.76	Pass

Parameter Definitions:

Measurements performed at input voltage $V_{Nominal} \pm 15\%$.

Parameter	Value
V_{Nom} :	13.6VDC
V_{Min} :	11.56VDC
V_{Max} :	15.64VDC

Test Data Summary - RF Conducted Measurement (Lowest Power Setting)					
Additionally, the power was measured with a 20dB lower setting					
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (Watts)	Results
217.6125	20	V_{Nom}	Full Rate	0.26	Pass
219.9875	20	V_{Nom}	Full Rate	0.26	Pass
220.0125	20	V_{Nom}	Full Rate	0.26	Pass
221.9875	20	V_{Nom}	Full Rate	0.26	Pass
217.6125	20	V_{Nom}	Half Rate	0.31	Pass
219.9875	20	V_{Nom}	Half Rate	0.31	Pass
220.0125	20	V_{Nom}	Half Rate	0.31	Pass
221.9875	20	V_{Nom}	Half Rate	0.31	Pass

Test Setup Photo(s)



Temperature Chamber Power Meter



Conducted RF In Temperature Chamber

90.209, 90.733 (d) Occupied Bandwidth

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/20/2023
Configuration:	3		
Test Setup:	<p>The EUT's RF port is connected to a spectrum analyzer directly with appropriate attenuation. The EUT is transmitting continuously with its normal duty cycle, full rate and half rate modulations investigated.</p> <p>The bandwidth limitations are considered in 90.209 as well as 90.733 where channel aggregation is used, the authorized bandwidth is assumed to be 20kHz for the Full Rate modulation and 11.25kHz for the Half Rate modulation.</p>		

Environmental Conditions			
Temperature (°C)	25	Relative Humidity (%):	44

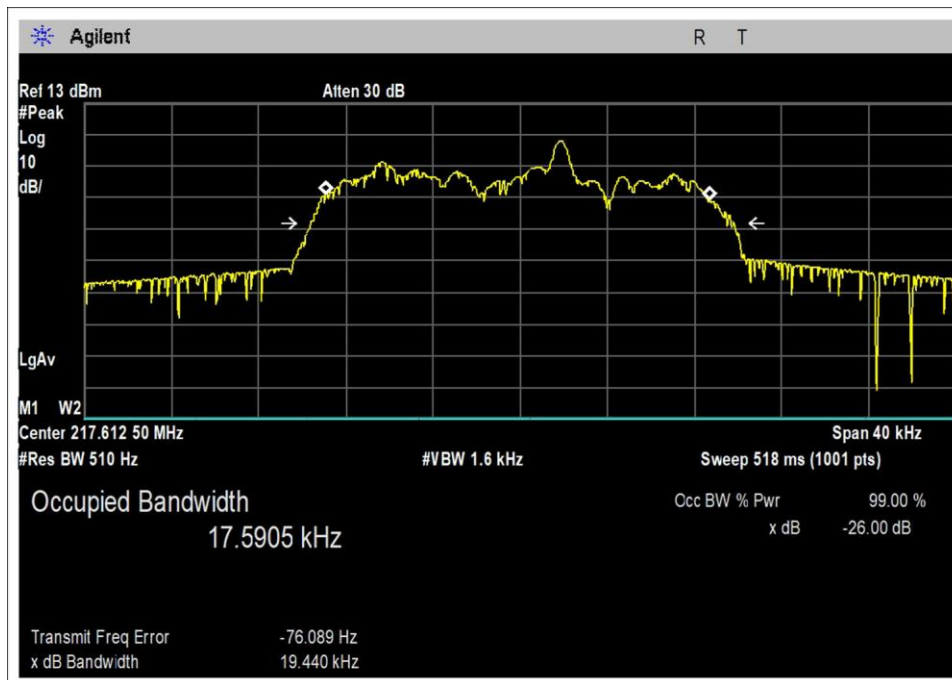
Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03803	Spectrum Analyzer	Agilent	E4440A	2/23/2022	2/23/2024
P07623	Attenuator	API Weinschel	47-20-34	3/16/2022	3/16/2024
P07628	Low Pass Filter	Mini-Circuits	NLP-90+	4/27/2022	4/27/2024
P06452	Cable	Andrews	Heliac	2/8/2023	2/8/2025

99% Occupied Bandwidth

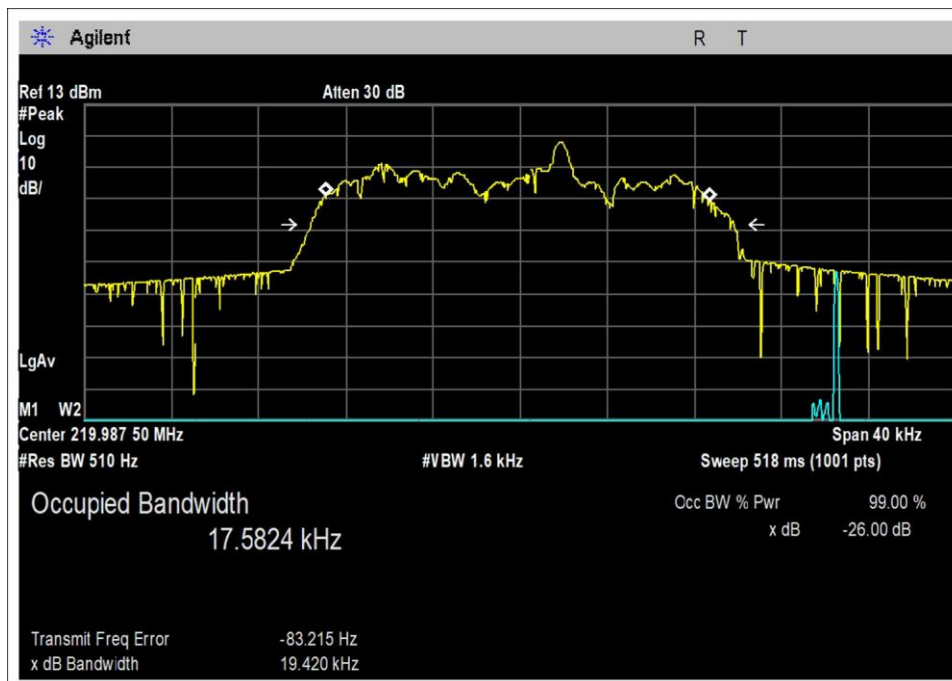
Test Data Summary				
Frequency (MHz)	Modulation	Measured (kHz)	Limit (kHz)	Results
217.6125	Full Rate	17.5905	20kHz	Pass
219.9875	Full Rate	17.5824	20kHz	Pass
220.0125	Full Rate	17.6166	20kHz	Pass
221.9875	Full Rate	17.4987	20kHz	Pass
217.6125	Half Rate	8.8603	11.25kHz	Pass
219.9875	Half Rate	8.7975	11.25kHz	Pass
220.0125	Half Rate	8.7113	11.25kHz	Pass
221.9875	Half Rate	8.8208	11.25kHz	Pass

Plot(s)

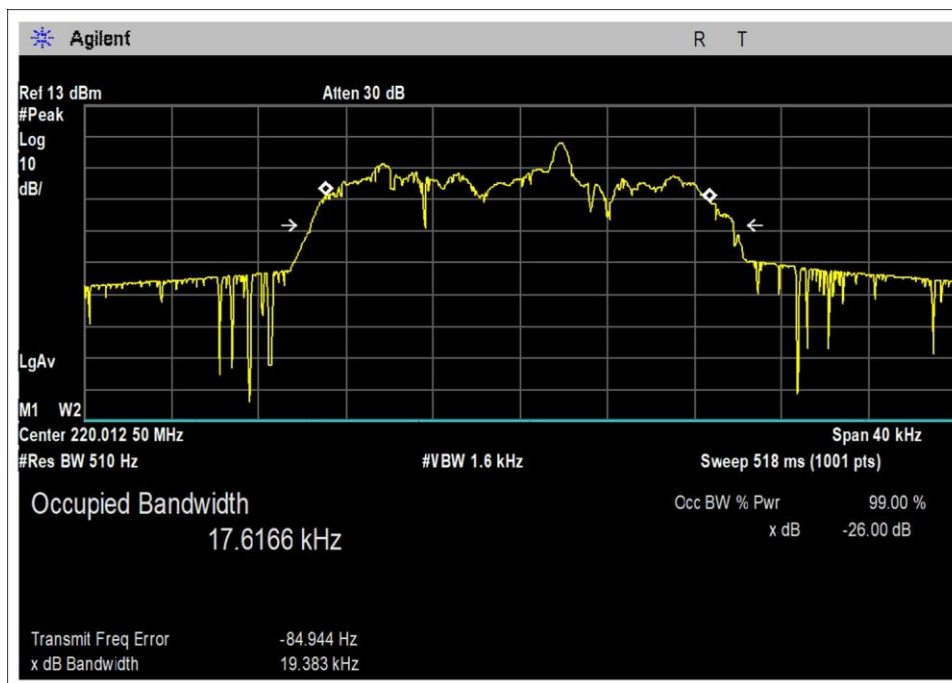
Full Rate



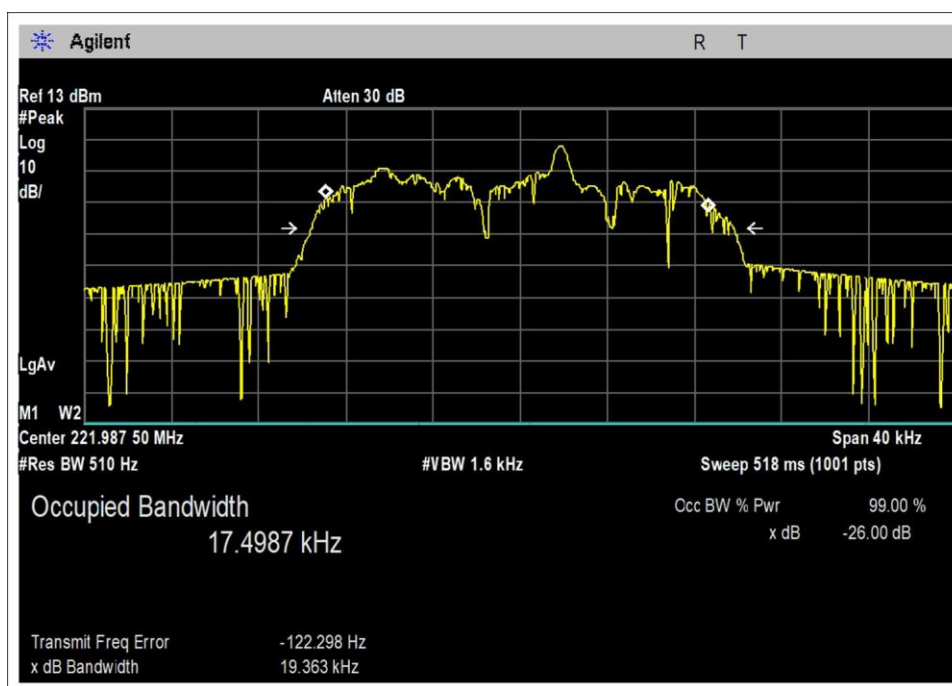
Channel 1



Channel 96

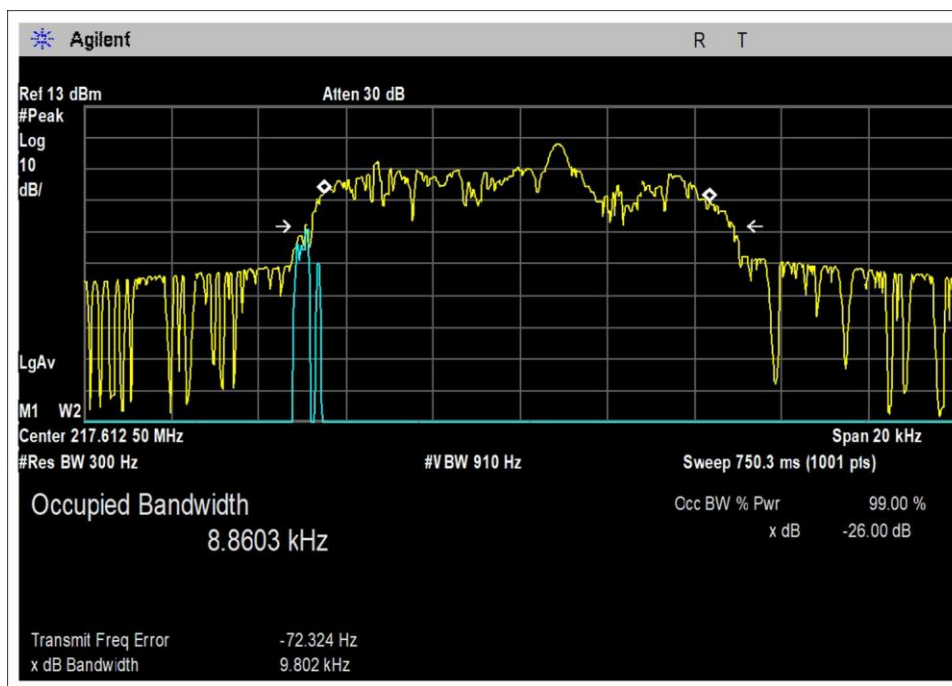


Channel 97

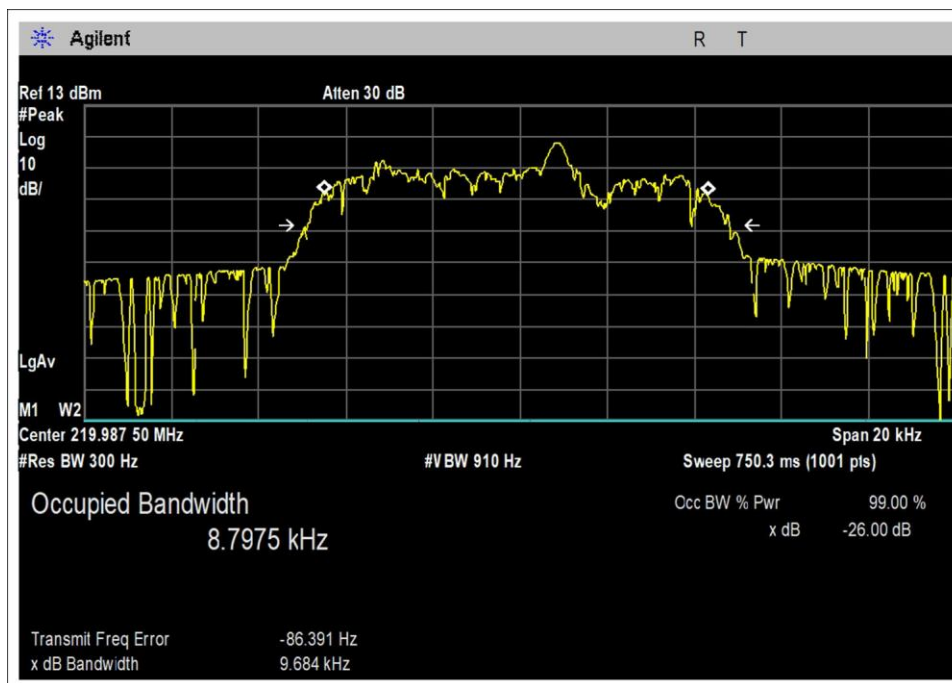


Channel 176

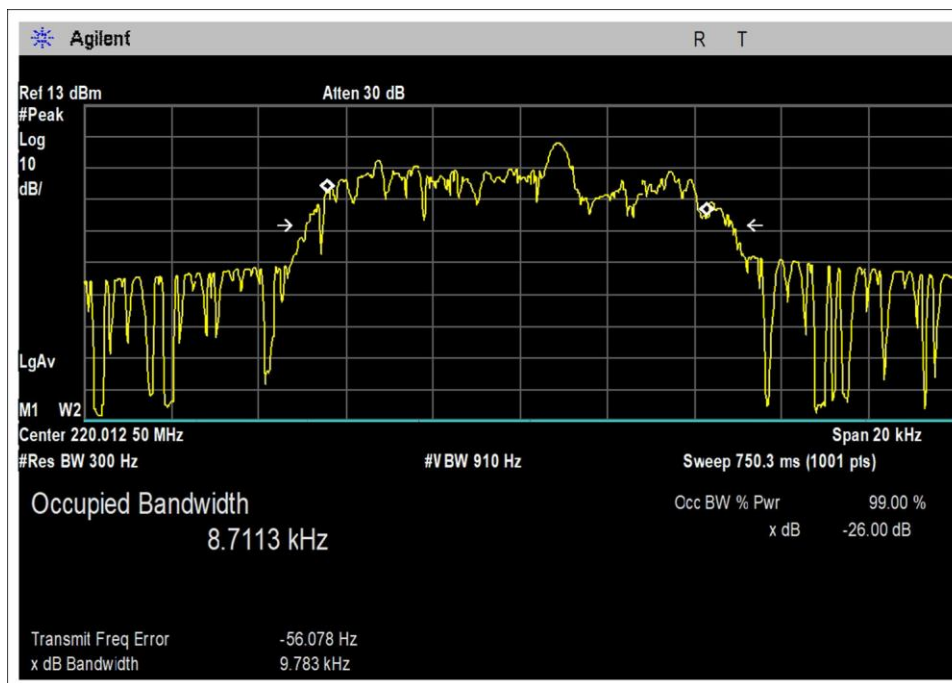
Half Rate



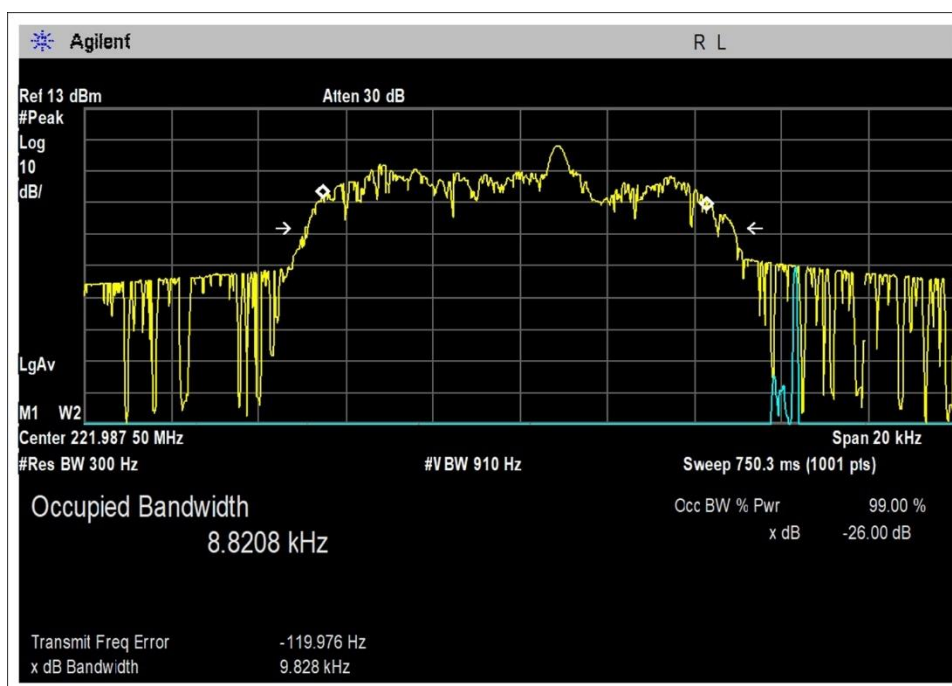
Channel 1



Channel 96



Channel 97



Channel 176

Test Setup Photo(s)



Temperature Chamber Spectrum Analyzer



Conducted RF In Temperature Chamber

90.213 Frequency Stability

Test Setup/Conditions

Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/18/2023 to 9/19/2023
Configuration:	3		
Test Setup:	<p>The unit is in a temperature chamber for temperature variation. The voltage is varied and measured with a DMM. The EUT's RF port is connected to a spectrum analyzer directly with appropriate attenuation. The bandwidth settings are low enough to resolve the center frequency of the emission. Once the EUT transmitter is turned on, it is transmitting continuously with its normal duty cycle, full rate and half rate modulations investigated.</p> <p>Per 90.213, the manufacturer declares the EUT is a module station, the limit in the table for frequencies falling in the band 216-220MHz is 1.0ppm, for band 220-222 MHz the limit is 1.5ppm.</p>		

Environmental Conditions

Temperature (°C)	23-26	Relative Humidity (%):	42-46
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Test Equipment

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03803	Spectrum Analyzer	Agilent	E4440A	2/23/2022	2/23/2024
P07623	Attenuator	API Weinschel	47-20-34	3/16/2022	3/16/2024
P07628	Low Pass Filter	Mini-Circuits	NLP-90+	4/27/2022	4/27/2024
P06452	Cable	Andrews	Heliac	2/8/2023	2/8/2025
02757	Temperature Chamber	Bemco	F100/350-8	12/8/2022	12/8/2024
03029	Thermometer, Digital Infrared	Fluke	566	4/14/2023	4/14/2025
03514	Multimeter	Fluke	87	10/20/2022	10/20/2024

Test Data Summary						
Modulation: Full Rate						
Temp (°C)	Voltage	Ch 1 (PPM)	Ch 96 (PPM)	Ch 97 (PPM)	Ch176 (PPM)	Results
-30	V _{Nom}	0.68929	0.68185	0.68177	0.58561	Pass
-20	V _{Nom}	0.41358	0.40911	0.45452	0.45047	
-10	V _{Nom}	0.32167	0.31820	0.31816	0.31533	
0	V _{Nom}	0.55143	0.68185	0.54542	0.58561	
10	V _{Nom}	0.55143	0.54548	0.45452	0.45047	
20	V _{Nom}	0.00000	0.00000	0.00000	0.00000	
30	V _{Nom}	0.00000	0.13637	0.27271	0.22524	
40	V _{Nom}	0.00000	0.00000	0.13635	0.18019	
50	V _{Nom}	0.18381	0.18183	0.04545	0.04505	
20	V _{Min}	0.03217	0.02727	0.01364	0.01802	
20	V _{Max}	0.01838	0.01364	0.01364	0.00450	
Maximum Deviation		0.68929	0.68185	0.68177	0.58561	

Test Data Summary						
Modulation: Half Rate						
Temp (°C)	Voltage	Ch 1 (PPM)	Ch 96 (PPM)	Ch 97 (PPM)	Ch176 (PPM)	Results
-30	V _{Nom}	0.73525	0.72731	0.68178	0.67571	Pass
-20	V _{Nom}	0.41358	0.40911	0.45452	0.49552	
-10	V _{Nom}	0.32167	0.31820	0.36361	0.31533	
0	V _{Nom}	0.55144	0.59094	0.59087	0.49552	
10	V _{Nom}	0.55144	0.54548	0.45452	0.45047	
20	V _{Nom}	0.00000	0.00000	0.00000	0.00000	
30	V _{Nom}	0.09191	0.09091	0.22726	0.18019	
40	V _{Nom}	0.09191	0.04546	0.09090	0.04505	
50	V _{Nom}	0.09191	0.09091	0.18181	0.09009	
20	V _{Min}	0.22977	0.31820	0.18181	0.18019	
20	V _{Max}	0.00002	0.18183	0.04545	0.00001	
Maximum Deviation		0.73525	0.72731	0.68178	0.67571	

Parameter Definitions:

Measurements performed at input voltage V_{nominal} ± 15%.

Parameter	Value
V _{Nom} :	13.6VDC
V _{Min} :	11.56VDC
V _{Max} :	15.64VDC

Test Setup Photo(s)



Temperature Chamber Spectrum Analyzer



Conducted RF In Temperature Chamber

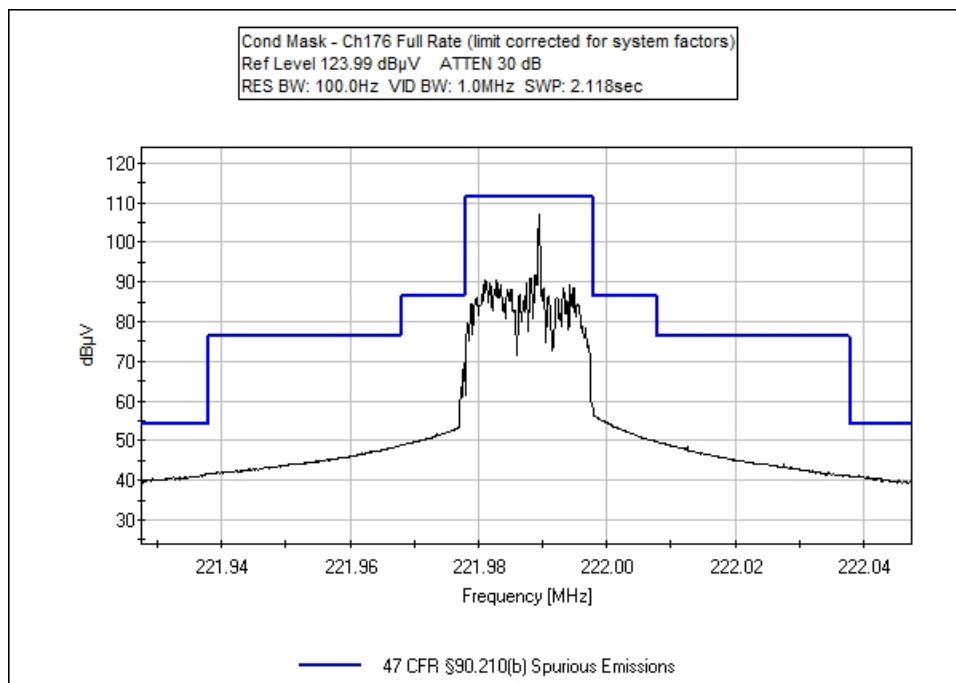
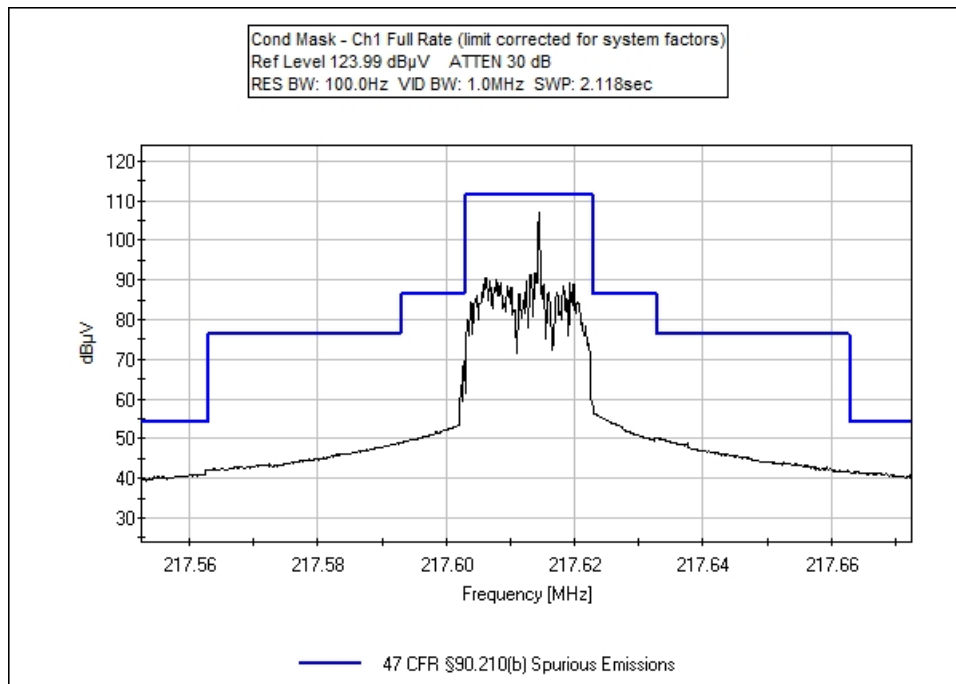
90.210 Conducted Emission Mask and Spurs

Test Setup/Conditions											
Test Location:	Bothell Lab Bench	Test Engineer:	M. Atkinson								
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/22/2023								
Configuration:	3										
Test Setup:	<p>The EUT's RF port is connected to a spectrum analyzer directly with appropriate attenuation. The EUT is transmitting continuously with its normal duty cycle, full rate and half rate modulations investigated in separate datasheets.</p> <p>The emission mask was built with an RMS Average measurement of the fundamental, with the lowest value selected from an investigation on Ch1, Ch96, Ch97, and Ch176. The worst case low RMS average for full rate was 26.1W, half rate was 26.3W. Conducted spurs was run on the 4 channels selected, mask data shown for Ch1 and Ch176.</p> <p>Outside of the span shown in the emission mask plots, the following bandwidths were used:</p> <table><tr><td>9kHz-150kHz:</td><td>200Hz RBW</td></tr><tr><td>150kHz-30MHz:</td><td>9kHz RBW</td></tr><tr><td>30-1000MHz:</td><td>100kHz RBW</td></tr><tr><td>1000MHz and above:</td><td>1MHz RBW</td></tr></table> <p>Average values as indicated on datasheet are RMS.</p> <p>Per the manufacturer, a 20kHz ABW for Full Rate and 11.25kHz ABW for Half Rate was used to build 90.210B masks accordingly, it will be up the licensee to ensure the mask applicability.</p> <p>Conducted spurious emissions performed at ambient temperature and nominal voltage using the same setup also used for temperature testing.</p>			9kHz-150kHz:	200Hz RBW	150kHz-30MHz:	9kHz RBW	30-1000MHz:	100kHz RBW	1000MHz and above:	1MHz RBW
9kHz-150kHz:	200Hz RBW										
150kHz-30MHz:	9kHz RBW										
30-1000MHz:	100kHz RBW										
1000MHz and above:	1MHz RBW										

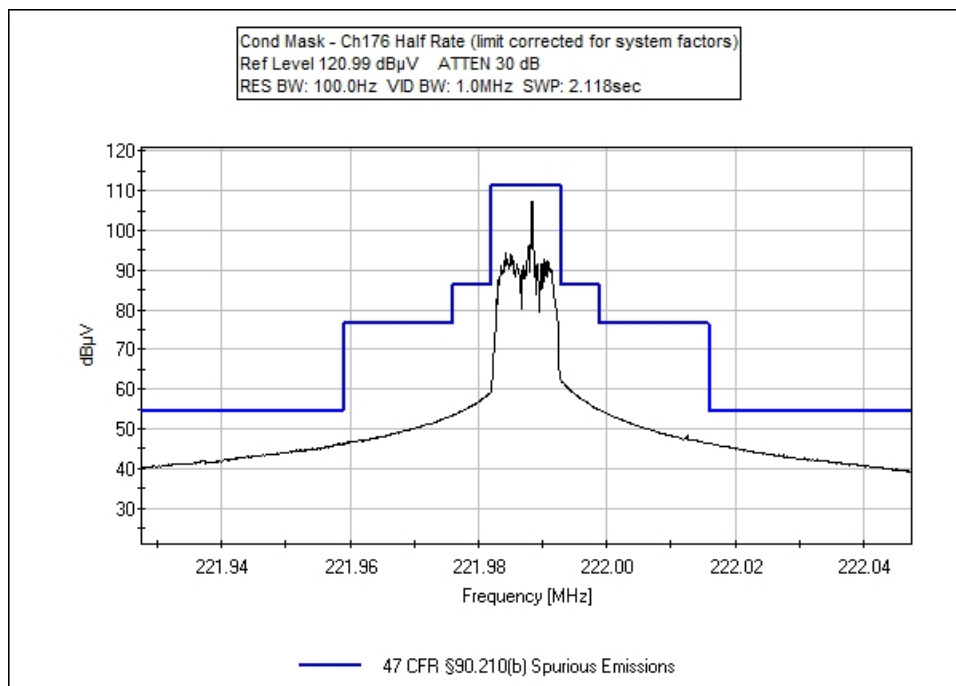
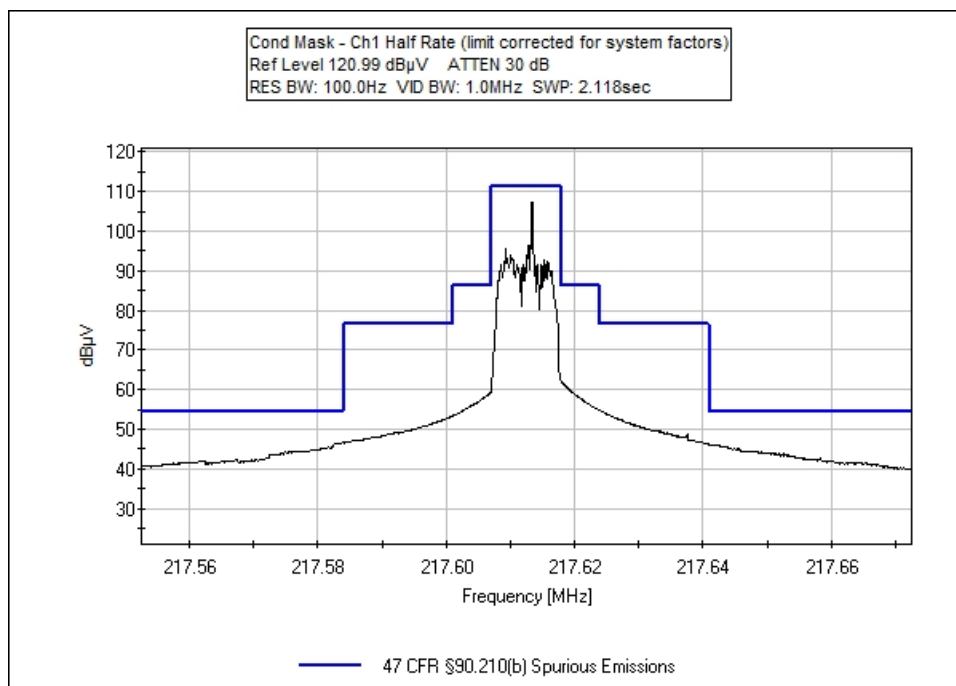
Environmental Conditions			
Temperature (°C)	22	Relative Humidity (%):	46

Plot(s)

Full Rate



Half Rate



Test Conditions / Setup

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)
 Customer: **Meteorcomm LLC**
 Specification: **47 CFR §90.210(b) Spurious Emissions**
 Work Order #: **108416** Date: 9/21/2023
 Test Type: **Conducted Emissions** Time: 15:59:10
 Tested By: Michael Atkinson Sequence#: 53
 Software: EMITest 5.03.20 13.6VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

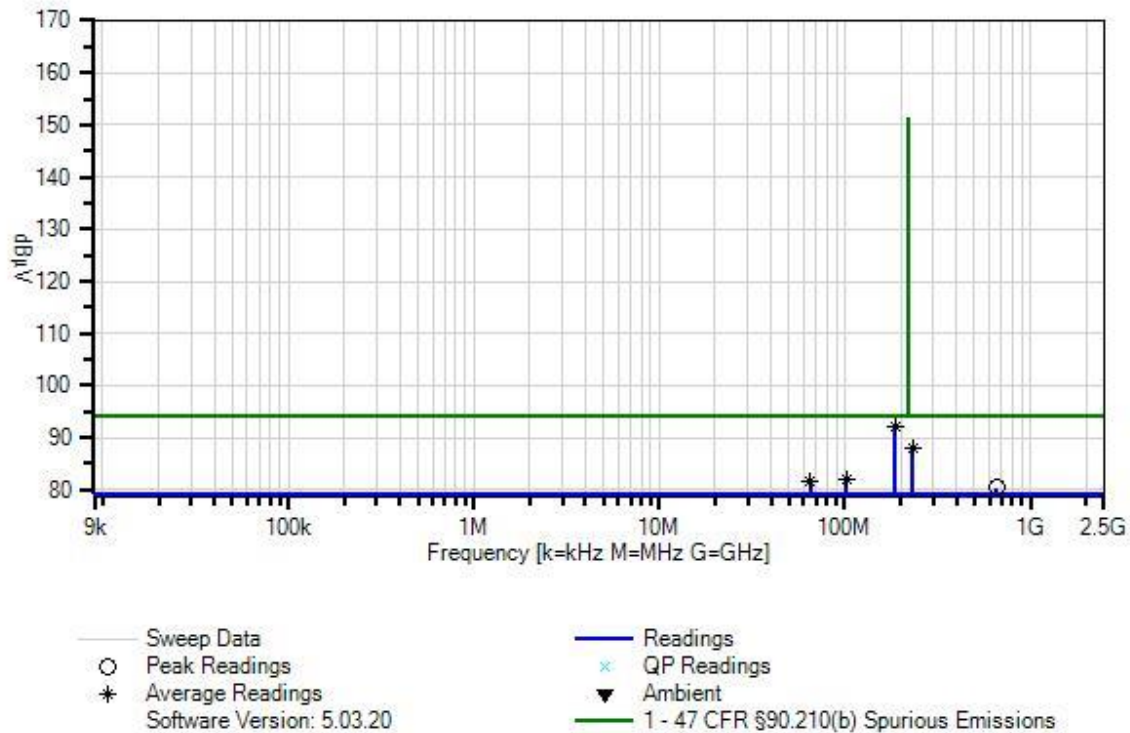
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 23°C Humidity: 51% Pressure: 101.5kPa Test Method: ANSI C63.26 (2015) Frequency Range: 9kHz-2.5GHz

Meteorcomm LLC WO#: 108416 Sequence#: 53 Date: 9/21/2023
47 CFR §90.210(b) Spurious Emissions Test Lead: 13.6VDC RF Port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	ANP07623	Attenuator	47-20-34	3/16/2022	3/16/2024
T3	ANP07638	Attenuator	47-20-34	5/3/2022	5/3/2024
T4	ANP06452	Cable	Heliac	2/8/2023	2/8/2025

Measurement Data:

Reading listed by margin.

Test Lead: RF Port

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	186.070M Ave	52.4	+0.0	+19.6	+19.7	+0.4	+0.0	92.1	94.0	-1.9	RF Po
2	233.200M Ave	48.5	+0.0	+19.6	+19.6	+0.4	+0.0	88.1	94.0	-5.9	RF Po
3	102.092M Ave	42.7	+0.0	+19.6	+19.6	+0.2	+0.0	82.1	94.0	-11.9	RF Po
4	65.078M Ave	42.4	+0.0	+19.6	+19.6	+0.2	+0.0	81.8	94.0	-12.2	RF Po
5	660.050M	40.3	+0.0	+19.7	+19.7	+0.7	+0.0	80.4	94.0 220.0125	-13.6	RF Po
6	2296.000M	36.9	+0.0	+19.9	+19.8	+1.3	+0.0	77.9	94.0 noise floor	-16.1	RF Po
7	440.040M	38.1	+0.0	+19.6	+19.6	+0.5	+0.0	77.8	94.0 220.0125	-16.2	RF Po
8	439.960M	35.9	+0.0	+19.6	+19.6	+0.5	+0.0	75.6	94.0 219.9875	-18.4	RF Po
9	443.980M	34.7	+0.0	+19.6	+19.6	+0.5	+0.0	74.4	94.0 221.9875	-19.6	RF Po
10	435.260M	34.5	+0.0	+19.6	+19.6	+0.5	+0.0	74.2	94.0 217.6125	-19.8	RF Po
11	652.850M	33.7	+0.0	+19.7	+19.7	+0.7	+0.0	73.8	94.0 217.6125	-20.2	RF Po
12	665.950M	33.2	+0.0	+19.7	+19.7	+0.7	+0.0	73.3	94.0 221.9875	-20.7	RF Po
13	659.940M	32.7	+0.0	+19.7	+19.7	+0.7	+0.0	72.8	94.0 219.9875	-21.2	RF Po

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)
 Customer: **Meteorcomm LLC**
 Specification: **47 CFR §90.210(b) Spurious Emissions**
 Work Order #: **108416** Date: 9/21/2023
 Test Type: **Conducted Emissions** Time: 16:25:41
 Tested By: Michael Atkinson Sequence#: 54
 Software: EMITest 5.03.20 13.6VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 3			

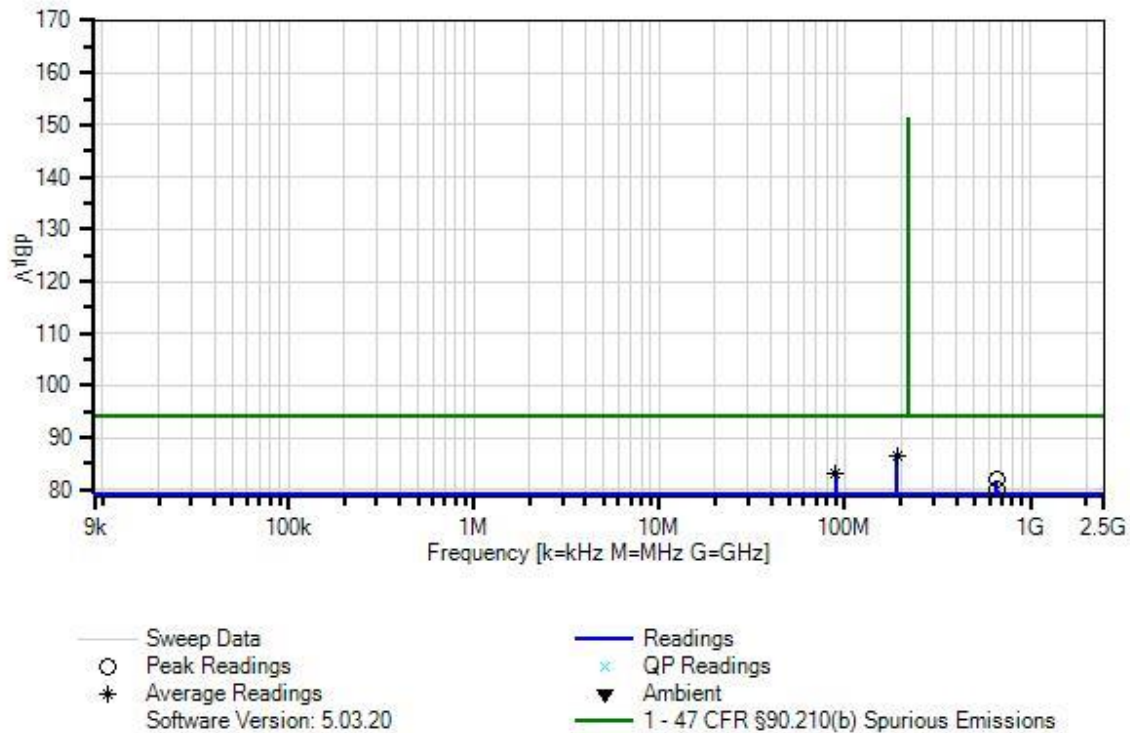
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 3			

Test Conditions / Notes:

Test Environment Conditions: Temperature: 23°C Humidity: 51% Pressure: 101.5kPa Test Method: ANSI C63.26 (2015) Frequency Range: 9kHz-2.5GHz

Meteorcomm LLC WO#: 108416 Sequence#: 54 Date: 9/21/2023
47 CFR §90.210(b) Spurious Emissions Test Lead: 13.6VDC RF Port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03803	Spectrum Analyzer	E4440A	2/23/2022	2/23/2024
T2	ANP07623	Attenuator	47-20-34	3/16/2022	3/16/2024
T3	ANP07638	Attenuator	47-20-34	5/3/2022	5/3/2024
T4	ANP06452	Cable	Heliac	2/8/2023	2/8/2025

Measurement Data:

Reading listed by margin.

Test Lead: RF Port

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	190.846M Ave	46.8	+0.0	+19.6	+19.7	+0.4	+0.0	86.5	94.0	-7.5	RF Po
2	89.157M Ave	43.8	+0.0	+19.6	+19.6	+0.2	+0.0	83.2	94.0	-10.8	RF Po
3	652.858M	41.8	+0.0	+19.7	+19.7	+0.7	+0.0	81.9	94.0 217.6125	-12.1	RF Po
4	660.018M	40.0	+0.0	+19.7	+19.7	+0.7	+0.0	80.1	94.0 219.9875	-13.9	RF Po
5	665.970M	40.0	+0.0	+19.7	+19.7	+0.7	+0.0	80.1	94.0 221.9875	-13.9	RF Po
6	435.240M	39.3	+0.0	+19.6	+19.6	+0.5	+0.0	79.0	94.0 217.6125	-15.0	RF Po
7	660.083M	38.1	+0.0	+19.7	+19.7	+0.7	+0.0	78.2	94.0 220.0125	-15.8	RF Po
8	439.970M	38.2	+0.0	+19.6	+19.6	+0.5	+0.0	77.9	94.0 219.9875	-16.1	RF Po
9	440.035M	38.0	+0.0	+19.6	+19.6	+0.5	+0.0	77.7	94.0 220.0125	-16.3	RF Po
10	2260.000M	36.2	+0.0	+19.9	+19.8	+1.3	+0.0	77.2	94.0 noise floor	-16.8	RF Po
11	443.953M	36.3	+0.0	+19.6	+19.6	+0.5	+0.0	76.0	94.0 221.9875	-18.0	RF Po
12	319.200M	32.9	+0.0	+19.6	+19.6	+0.4	+0.0	72.5	94.0	-21.5	RF Po

Test Setup Photo(s)



Conducted RF In Temperature Chamber

90.210 Radiated Spurious Emissions

Test Setup/Conditions																																
Test Location:	Bothell Lab C3	Test Engineer:	S. Pittsford/M. Atkinson																													
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/15/23 to 9/18/23																													
Configuration:	1																															
Test Setup:	<p>The emission mask was built with an RMS Average measurement of the fundamental, with the lowest value selected from an investigation on Ch1, Ch96, Ch97, and Ch176 on both full and half rates. The mask was then converted in terms of field strength for a 3m measurement.</p> <p>Outside of the span shown in the emission mask plots, the following bandwidths were used:</p> <table><tr><td>9kHz-150kHz:</td><td>200Hz RBW</td></tr><tr><td>150kHz-30MHz:</td><td>9kHz RBW</td></tr><tr><td>30-1000MHz:</td><td>100kHz RBW</td></tr><tr><td>1000MHz and above:</td><td>1MHz RBW</td></tr></table> <p>For the final tabular converted to dBm uses equation (d) from ANSI C63.26 (2015) 5.2.7:</p> <p>EIRP (dBm) = E (dBμV/m) + 20log(D) – 104.8; where D is the measurement distance (in the far field region) in m.</p> <p>Per 80.211f:</p> <p>(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;</p> <p>(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and</p> <p>(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus 10log₁₀ (mean power in watts) dB.</p> <table><tr><td>Limit</td><td>=</td><td>Power – Required Attenuation</td></tr><tr><td></td><td>=</td><td>10 Log P – (43 +10Log P)</td></tr><tr><td></td><td>=</td><td>10 Log P – 43 – 10Log P</td></tr><tr><td></td><td>=</td><td>-43 dBW</td></tr><tr><td></td><td>=</td><td>0.00005W (0.05mW)</td></tr><tr><td></td><td>=</td><td>10 Log 0.00005/0.001</td></tr><tr><td></td><td>=</td><td>-13dBm (94dBμV) at any power level.</td></tr></table>			9kHz-150kHz:	200Hz RBW	150kHz-30MHz:	9kHz RBW	30-1000MHz:	100kHz RBW	1000MHz and above:	1MHz RBW	Limit	=	Power – Required Attenuation		=	10 Log P – (43 +10Log P)		=	10 Log P – 43 – 10Log P		=	-43 dBW		=	0.00005W (0.05mW)		=	10 Log 0.00005/0.001		=	-13dBm (94dBμV) at any power level.
9kHz-150kHz:	200Hz RBW																															
150kHz-30MHz:	9kHz RBW																															
30-1000MHz:	100kHz RBW																															
1000MHz and above:	1MHz RBW																															
Limit	=	Power – Required Attenuation																														
	=	10 Log P – (43 +10Log P)																														
	=	10 Log P – 43 – 10Log P																														
	=	-43 dBW																														
	=	0.00005W (0.05mW)																														
	=	10 Log 0.00005/0.001																														
	=	-13dBm (94dBμV) at any power level.																														

Test Data Summary (Above 1GHz)				
Frequency (MHz)	Measured (dBμV/m) @ 3m	Convert to EIRP (dBm)	Limit (dBm)	Results
1886.0	56.8	-38.5	-13	Pass
1894.0	55.2	-40.1	-13	Pass
1894.0	51.0	-44.3	-13	Pass
1500.0	47.8	-47.5	-13	Pass
1775.9	47.2	-48.1	-13	Pass
2498.0	46.9	-48.4	-13	Pass
1500.0	46.9	-48.4	-13	Pass
2199.8	46.8	-48.5	-13	Pass
2199.8	46.7	-48.6	-13	Pass
2402.0	46.7	-48.6	-13	Pass
2200.1	46.1	-49.2	-13	Pass
1776.1	45.6	-49.7	-13	Pass
2219.9	45.3	-50.0	-13	Pass
2200.4	45.2	-50.1	-13	Pass
1740.9	45.0	-50.3	-13	Pass
2176.0	44.8	-50.5	-13	Pass
2370.0	44.7	-50.6	-13	Pass
2176.1	44.5	-50.8	-13	Pass
1740.9	44.0	-51.3	-13	Pass
1759.9	44.0	-51.3	-13	Pass
2200.0	43.6	-51.7	-13	Pass
1700.0	43.3	-52.0	-13	Pass
1760.2	43.2	-52.1	-13	Pass
2219.9	42.9	-52.4	-13	Pass
1775.7	42.9	-52.4	-13	Pass
1400.0	42.0	-53.3	-13	Pass
1399.0	41.9	-53.4	-13	Pass
1202.0	41.5	-53.8	-13	Pass
1300.0	41.0	-54.3	-13	Pass
1759.8	41.0	-54.3	-13	Pass
1300.0	40.6	-54.7	-13	Pass
1201.0	40.4	-54.9	-13	Pass
1600.0	39.8	-55.5	-13	Pass
1100.2	35.9	-59.4	-13	Pass
1100.0	35.3	-60.0	-13	Pass
1110.1	34.1	-61.2	-13	Pass

Test Data Summary (30-1000MHz)				
Frequency (MHz)	Measured (dBμV/m) @ 3m	Convert to EIRP (dBm)	Limit (dBm)	Results
870.47	52.9	-42.4	-13	Pass
880.05	52.8	-42.5	-13	Pass
879.93	51.5	-43.8	-13	Pass
887.95	51.0	-44.3	-13	Pass
879.95	48.3	-47.0	-13	Pass
660.04	47.6	-47.7	-13	Pass
652.84	46.6	-48.7	-13	Pass
659.95	44.9	-50.4	-13	Pass
250.05	41.4	-53.9	-13	Pass
42.96	41.4	-53.9	-13	Pass
55.11	41.3	-54.0	-13	Pass
250.05	40.7	-54.6	-13	Pass
92.64	39.7	-55.6	-13	Pass
125.04	37.8	-57.5	-13	Pass
440.03	36.8	-58.5	-13	Pass
439.98	35.7	-59.6	-13	Pass
443.97	35.1	-60.2	-13	Pass
125.04	34.0	-61.3	-13	Pass
143.40	33.4	-61.9	-13	Pass
435.23	31.5	-63.8	-13	Pass

Test Data Summary (9kHz-30MHz)				
Frequency (MHz)	Measured (dBμV/m) @ 3m	Convert to EIRP (dBm)	Limit (dBm)	Results
0.066	51.2	-44.1	-13	Pass
28.687	22.2	-73.1	-13	Pass
0.180	54.9	-40.4	-13	Pass

Test Conditions / Setup

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)
 Customer: **Meteorcomm LLC**
 Specification: **47 CFR §90.210(b) Spurious Emissions**
 Work Order #: **108416** Date: 9/18/2023
 Test Type: **Radiated Scan** Time: 10:46:35
 Tested By: Michael 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: 23°C
 Humidity: 48%
 Pressure: 101.3kPa

Test Method: ANSI C63.26 (2015)

Frequency Range: 9k-30MHz

Test Setup:

EUT is transmitting, full rate and half rate data rate/modulation investigated, worst case reported. Ch1, Ch96, CH97, and Ch176 investigated. EUT transmitting at max power and additionally investigated a 20dB lower power setting. Highest power setting data collected is representative of worst case. The unit is terminated into a 50ohm load (attenuators and receiver).

3 unshielded Ethernet cables are run to support ethernet hubs outside the chamber.

The antenna out is connected to a support unit via coax cable and attenuators.

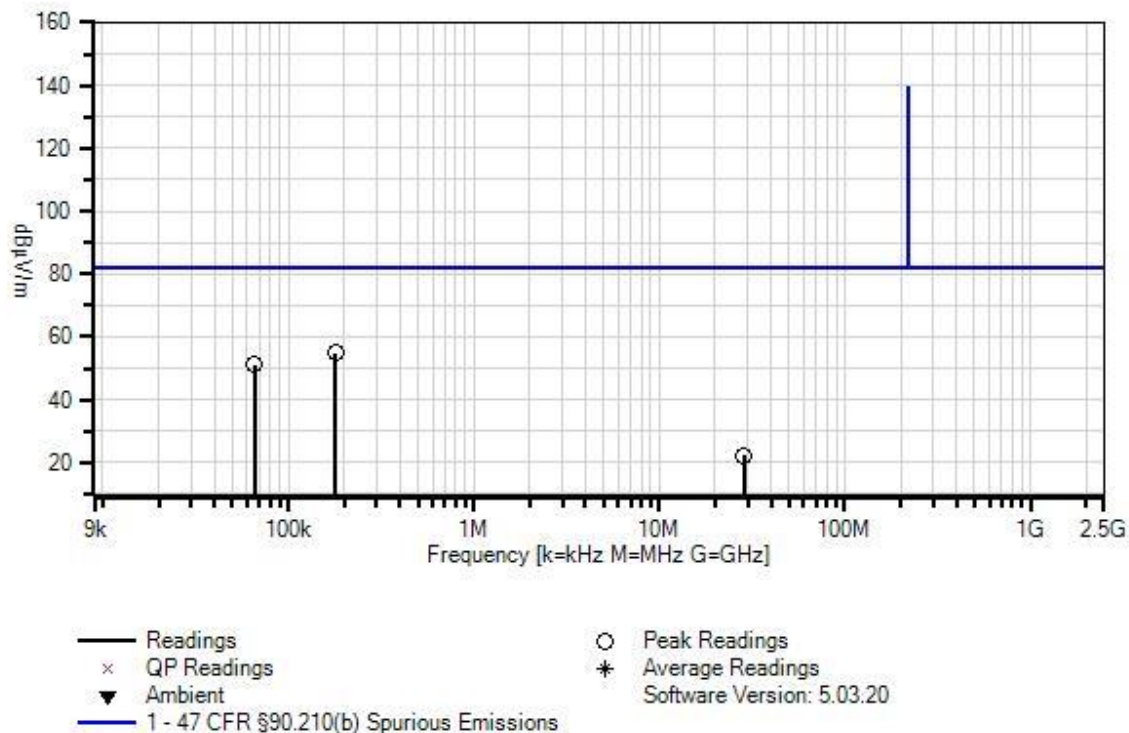
GPS is run from the unit to a GPS splitter and simulated GPS signal.

EUT is DC powered and is powered by a DC supply located under the turntable.

USB Port terminated into a USB thumb drive.

IO ports terminated in to open circuit.

Meteorcomm LLC WD#: 108416 Sequence#: 9 Date: 9/18/2023
47 CFR §90.210(b) Spurious Emissions Test Distance: 3 Meters Perp, Para & Ground Para



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T1	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T2	AN00052	Loop Antenna	6502	5/11/2022	5/11/2024
T3	ANP06515	Cable	Heliac	3/1/2023	3/1/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	180.000k	45.6	+0.0	+9.3	+0.0		+0.0	54.9	82.2	-27.3	Perp, 136
2	65.793k	41.7	+0.0	+9.5	+0.0		+0.0	51.2	82.2	-31.0	Perp, 136
3	28.687M	17.6	+0.1	+4.2	+0.3		+0.0	22.2	82.2	-60.0	Perp, 136

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)
 Customer: **Meteorcomm LLC**
 Specification: **47 CFR §90.210(b) Spurious Emissions**
 Work Order #: **108416** Date: 9/18/2023
 Test Type: **Radiated Scan** Time: 10:19:20
 Tested By: Michael Atkinson Sequence#: 8
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

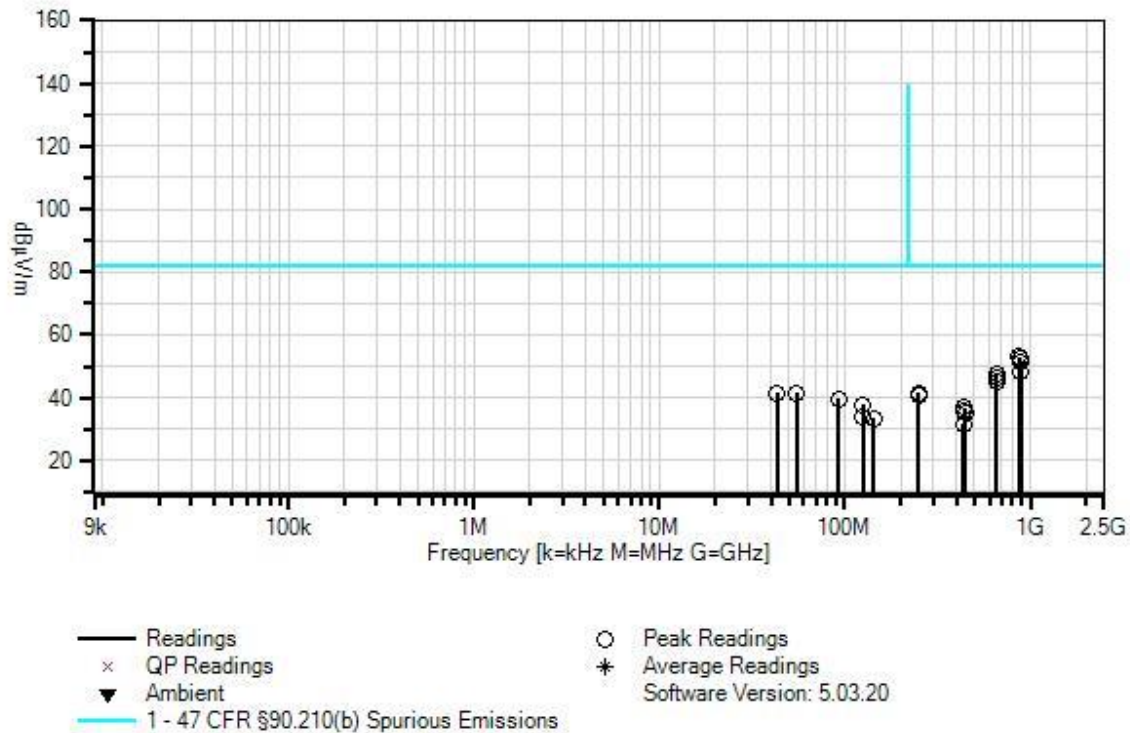
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

<p>Test Environment Conditions:</p> <p>Temperature: 23°C</p> <p>Humidity: 48%</p> <p>Pressure: 101.3kPa</p> <p>Test Method: ANSI C63.26 (2015)</p> <p>Frequency Range: 30-1000MHz</p> <p>Test Setup:</p> <p>EUT is transmitting, full rate and half rate data rate/modulation investigated, worst case reported. Ch1, Ch96, CH97, and Ch176 investigated. EUT transmitting at max power and additionally investigated a 20dB lower power setting. Highest power setting data collected is representative of worst case. The unit is terminated into a 50ohm load (attenuators and receiver).</p> <p>3 unshielded Ethernet cables are run to support ethernet hubs outside the chamber.</p> <p>The antenna out is connected to a support unit via coax cable and attenuators.</p> <p>GPS is run from the unit to a GPS splitter and simulated GPS signal.</p> <p>EUT is DC powered and is powered by a DC supply located under the turntable.</p> <p>USB Port terminated into a USB thumb drive.</p> <p>IO ports terminated in to open circuit.</p>
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Meteorcomm LLC WO#: 108416 Sequence#: 8 Date: 9/18/2023
47 CFR §90.210(b) Spurious Emissions Test Distance: 3 Meters Horiz



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T2	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T3	AN02307	Preamplifier	8447D	8/9/2023	8/9/2025
T4	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T5	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T6	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	870.468M	46.4	+0.0 +2.5	+0.7 +29.0	-27.2	+1.5	+0.0	52.9	82.2 217.6125	-29.3	Vert 112
2	880.052M	46.4	+0.0 +2.5	+0.7 +28.9	-27.2	+1.5	+0.0	52.8	82.2 220.0125	-29.4	Vert 127
3	879.929M	45.1	+0.0 +2.5	+0.7 +28.9	-27.2	+1.5	+0.0	51.5	82.2 219.9875	-30.7	Vert 112
4	887.948M	44.6	+0.0 +2.5	+0.7 +28.9	-27.2	+1.5	+0.0	51.0	82.2 221.9875	-31.2	Vert 102
5	879.952M	41.9	+0.0 +2.5	+0.7 +28.9	-27.2	+1.5	+0.0	48.3	82.2 219.9875	-33.9	Vert 99
6	660.038M	43.5	+0.0 +2.4	+0.6 +27.7	-27.9	+1.3	+0.0	47.6	82.2 220.0125	-34.6	Vert 127
7	652.841M	42.6	+0.0 +2.4	+0.6 +27.6	-27.9	+1.3	+0.0	46.6	82.2 217.6125	-35.6	Vert 112
8	659.946M	40.8	+0.0 +2.4	+0.6 +27.7	-27.9	+1.3	+0.0	44.9	82.2 219.9875	-37.3	Vert 112
9	250.050M	47.6	+0.0 +1.2	+0.4 +18.2	-26.8	+0.8	+0.0	41.4	82.2	-40.8	Horiz 127
10	42.960M	53.4	+0.0 +0.4	+0.2 +14.8	-27.7	+0.3	+0.0	41.4	82.2	-40.8	Vert 178
11	55.110M	55.8	+0.0 +0.5	+0.2 +12.2	-27.7	+0.3	+0.0	41.3	82.2	-40.9	Vert 178
12	250.050M	46.9	+0.0 +1.2	+0.4 +18.2	-26.8	+0.8	+0.0	40.7	82.2	-41.5	Vert 178
13	92.640M	52.9	+0.0 +0.7	+0.2 +12.9	-27.5	+0.5	+0.0	39.7	82.2	-42.5	Vert 178
14	125.040M	50.3	+0.0 +0.8	+0.3 +13.3	-27.4	+0.5	+0.0	37.8	82.2	-44.4	Vert 178
15	440.033M	38.2	+0.0 +1.7	+0.5 +23.0	-27.6	+1.0	+0.0	36.8	82.2 220.0125	-45.4	Vert 127
16	439.975M	37.1	+0.0 +1.7	+0.5 +23.0	-27.6	+1.0	+0.0	35.7	82.2 219.9875	-46.5	Vert 112
17	443.973M	36.5	+0.0 +1.7	+0.5 +23.1	-27.7	+1.0	+0.0	35.1	82.2 221.9875	-47.1	Horiz 99
18	125.040M	46.5	+0.0 +0.8	+0.3 +13.3	-27.4	+0.5	+0.0	34.0	82.2	-48.2	Horiz 127
19	143.400M	45.1	+0.0 +0.8	+0.3 +14.0	-27.3	+0.5	+0.0	33.4	82.2	-48.8	Vert 178
20	435.228M	32.8	+0.0 +1.7	+0.5 +23.1	-27.6	+1.0	+0.0	31.5	82.2 217.6125	-50.7	Vert 112

Test Location: CKC Laboratories • 22116 23rd Drive SE, Suite A • Bothell, WA. 98021 • 1-800-500-4EMC (4362)
 Customer: **Meteorcomm LLC**
 Specification: **47 CFR §90.210(b) Spurious Emissions**
 Work Order #: **108416** Date: 9/15/2023
 Test Type: **Radiated Scan** Time: 18:23:57
 Tested By: Michael Atkinson Sequence#: 8
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

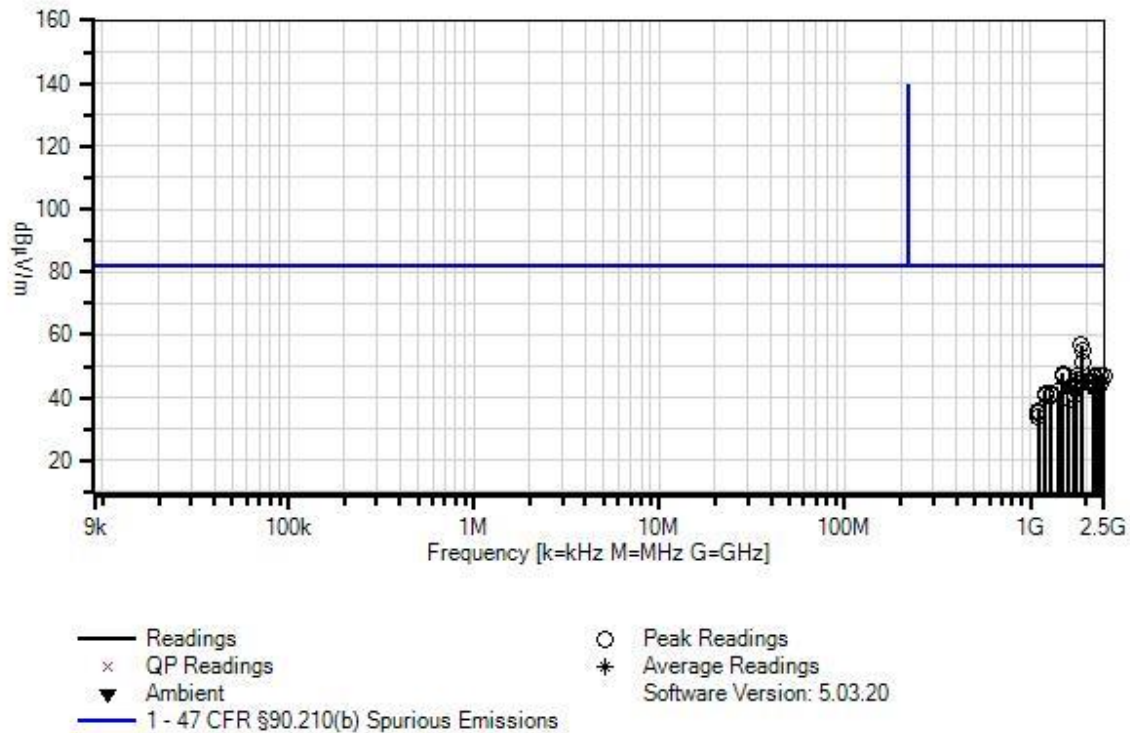
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

<p>Test Environment Conditions:</p> <p>Temperature: 23°C</p> <p>Humidity: 48%</p> <p>Pressure: 101.3kPa</p> <p>Test Method: ANSI C63.26 (2015)</p> <p>Frequency Range: 1-2.5GHz</p> <p>Test Setup:</p> <p>EUT is transmitting, full rate and half rate data rate/modulation investigated, worst case reported. Ch1, Ch96, CH97, and Ch176 investigated. EUT transmitting at max power and additionally investigated a 20dB lower power setting. Highest power setting data collected is representative of worst case. The unit is terminated into a 50ohm load (attenuators and receiver).</p> <p>3 unshielded Ethernet cables are run to support ethernet hubs outside the chamber.</p> <p>The antenna out is connected to a support unit via coax cable and attenuators.</p> <p>GPS is run from the unit to a GPS splitter and simulated GPS signal.</p> <p>EUT is DC powered and is powered by a DC supply located under the turntable.</p> <p>USB Port terminated into a USB thumb drive.</p>

Meteorcomm LLC W/O#: 108416 Sequence#: 8 Date: 9/15/2023
47 CFR §90.210(b) Spurious Emissions Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN02673	Spectrum Analyzer	E4446A	3/2/2023	3/2/2025
T2	ANP06454	Cable	Heliac	1/25/2022	1/25/2024
T3	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T4	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T5	ANP06515	Cable	Heliac	3/1/2023	3/1/2025
T6	ANP07504	Cable	CLU40-KMKM-02.00F	1/24/2023	1/24/2025

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

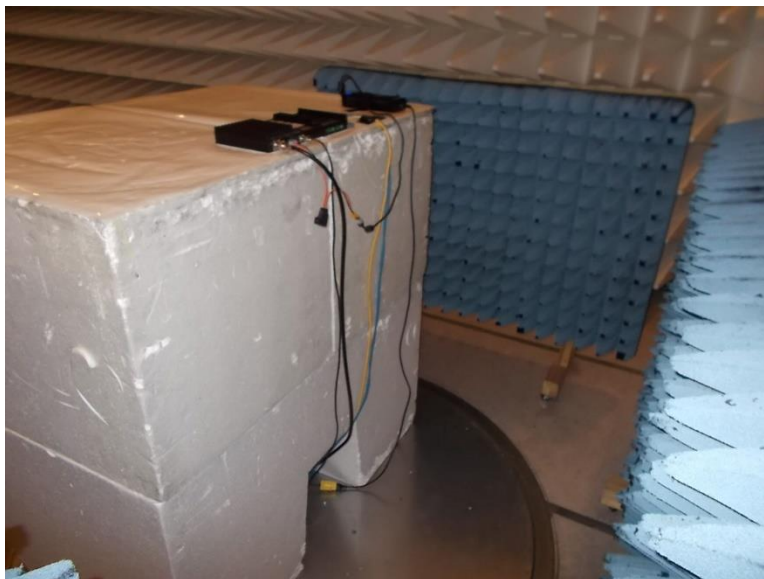
#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 T6 dB	T3 dB	T4 dB	Dist Table	Corr dBμV/m	Spec dBμV/m	Margin dB	Polar Ant
1	1886.000M	60.0	+0.0 +2.3	+1.0 +0.5	-35.0	+28.0	+0.0	56.8	82.2	-25.4	Vert
2	1894.000M	58.4	+0.0 +2.3	+1.0 +0.5	-35.0	+28.0	+0.0	55.2	82.2	-27.0	Vert
3	1894.000M	54.2	+0.0 +2.3	+1.0 +0.5	-35.0	+28.0	+0.0	51.0	82.2	-31.2	Horiz
4	1500.000M	54.6	+0.0 +2.1	+0.9 +0.4	-35.5	+25.3	+0.0	47.8	82.2	-34.4	Vert
5	1775.860M	51.7	+0.0 +2.2	+1.0 +0.4	-35.1	+27.0	+0.0	47.2	82.2 221.9875	-35.0	Horiz
6	2498.000M	47.9	+0.0 +2.9	+1.1 +0.5	-34.6	+29.1	+0.0	46.9	82.2	-35.3	Horiz
7	1500.000M	53.7	+0.0 +2.1	+0.9 +0.4	-35.5	+25.3	+0.0	46.9	82.2	-35.3	Horiz
8	2199.760M	49.2	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	46.8	82.2 219.9875	-35.4	Vert
9	2199.840M	49.1	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	46.7	82.2 219.9875	-35.5	Horiz
10	2402.000M	48.3	+0.0 +2.8	+1.1 +0.5	-34.6	+28.6	+0.0	46.7	82.2	-35.5	Vert
11	2200.120M	48.5	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	46.1	82.2 220.0125	-36.1	Horiz
12	1776.060M	50.1	+0.0 +2.2	+1.0 +0.4	-35.1	+27.0	+0.0	45.6	82.2 221.9875	-36.6	Vert
13	2219.880M	47.7	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	45.3	82.2 221.9875	-36.9	Horiz
14	2200.410M	47.6	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	45.2	82.2 220.0125	-37.0	Vert
15	1740.940M	50.1	+0.0 +2.2	+1.0 +0.4	-35.2	+26.5	+0.0	45.0	82.2 217.6125	-37.2	Vert
16	2176.020M	47.6	+0.0 +2.5	+1.0 +0.5	-34.8	+28.0	+0.0	44.8	82.2 217.6125	-37.4	Vert
17	2370.000M	46.5	+0.0 +2.7	+1.1 +0.5	-34.6	+28.5	+0.0	44.7	82.2	-37.5	Horiz
18	2176.100M	47.3	+0.0 +2.5	+1.0 +0.5	-34.8	+28.0	+0.0	44.5	82.2 217.6125	-37.7	Horiz
19	1740.900M	49.1	+0.0 +2.2	+1.0 +0.4	-35.2	+26.5	+0.0	44.0	82.2 217.6125	-38.2	Horiz
20	1759.860M	48.7	+0.0 +2.2	+1.0 +0.4	-35.1	+26.8	+0.0	44.0	82.2 219.9875	-38.2	Horiz
21	2200.000M	46.0	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	43.6	82.2 219.9875	-38.6	Vert
22	1700.000M	48.9	+0.0 +2.2	+1.0 +0.4	-35.2	+26.0	+0.0	43.3	82.2	-38.9	Vert
23	1760.160M	47.9	+0.0 +2.2	+1.0 +0.4	-35.1	+26.8	+0.0	43.2	82.2 220.0125	-39.0	Vert

24	2219.880M	45.3	+0.0 +2.6	+1.1 +0.5	-34.7	+28.1	+0.0	42.9	82.2 221.9875	-39.3	Vert
25	1775.720M	47.4	+0.0 +2.2	+1.0 +0.4	-35.1	+27.0	+0.0	42.9	82.2 221.9875	-39.3	Vert
26	1400.000M	49.2	+0.0 +2.0	+0.9 +0.4	-35.8	+25.3	+0.0	42.0	82.2	-40.2	Vert
27	1399.000M	49.1	+0.0 +2.0	+0.9 +0.4	-35.8	+25.3	+0.0	41.9	82.2	-40.3	Horiz
28	1202.000M	49.6	+0.0 +1.9	+0.8 +0.4	-36.4	+25.2	+0.0	41.5	82.2	-40.7	Vert
29	1300.000M	48.6	+0.0 +1.9	+0.8 +0.4	-36.1	+25.4	+0.0	41.0	82.2	-41.2	Vert
30	1759.840M	45.7	+0.0 +2.2	+1.0 +0.4	-35.1	+26.8	+0.0	41.0	82.2 219.9785	-41.2	Vert
31	1300.000M	48.2	+0.0 +1.9	+0.8 +0.4	-36.1	+25.4	+0.0	40.6	82.2	-41.6	Horiz
32	1201.000M	48.5	+0.0 +1.9	+0.8 +0.4	-36.4	+25.2	+0.0	40.4	82.2	-41.8	Horiz
33	1600.000M	46.3	+0.0 +2.1	+0.9 +0.4	-35.4	+25.5	+0.0	39.8	82.2	-42.4	Vert
34	1100.180M	45.2	+0.0 +1.8	+0.8 +0.3	-36.9	+24.7	+0.0	35.9	82.2 220.0125	-46.3	Vert
35	1099.960M	44.6	+0.0 +1.8	+0.8 +0.3	-36.9	+24.7	+0.0	35.3	82.2 219.9875	-46.9	Vert
36	1110.100M	43.3	+0.0 +1.8	+0.8 +0.3	-36.9	+24.8	+0.0	34.1	82.2 221.9875	-48.1	Vert

Test Setup Photo(s)



Below 1GHz



Above 1GHz

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.