

Meteorcomm, LLC.

EMC TEST REPORT FOR

**ITCR-NG Base
Model: 65030**

Tested to The Following Standards:

**FCC Part 80 Subpart E
217.6125-219.9875MHz**

Report No.: 109255-3

Date of issue: November 6, 2024



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:

Meteorcomm, LLC.
1201 SW 7th Street
Renton, WA 98057

Representative: George Stults
Customer Reference Number: PO32132

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

Stacey Noriega
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Project Number: 109225

September 23, 2024

September 25-27, 2024 and October 8-10, 2024

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.

A handwritten signature in black ink, reading "Steve Behm", is positioned above a horizontal line.

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 80 Subpart E

Test Procedure	Description	Modifications	Results
80.215 (l) 2.1046	Power Output	MOD#1 & 2	Pass
2.1049	Bandwidth	MOD#1 & 2	Pass
80.209	Frequency Stability	MOD#1 & 2	Pass
80.211 (f)	Conducted Spurious Emissions and Mask	MOD#1 & 2	Pass
80.211 (f)	Radiated Spurious Emissions	MOD#1 (Except for testing <1GHz in half and full rate modulations) & MOD#2	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

Modification #1 (MOD#1) = DEV-001273 - 0.47uF caps from power supply input block to chassis.
MOD#1 was in place for all unintentional radiated emissions.
MOD#1 was in place for all intentional emissions except for radiated spurious emissions less than 1GHz half rate and full rate.

Modification #2 (MOD#2) = DEV-001270 NGR Base PS - Replaces power supply modified by Rad.

Modifications listed above must be incorporated into all production units.

Conditions During Testing

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

Summary of Conditions

None

Equipment Under Test (EUT)

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

Configuration 1

Equipment Under Test:

Device	Manufacturer	Model #	S/N
ITCR-NG Base	Meteorcomm LLC.	65030	65BRF13008MC

Support Equipment:

Device	Manufacturer	Model #	S/N
ITCR-NG Wayside	Meteorcomm LLC.	65010A	65WR002008MC
AC/DC Switching Adaptor	Mean Well	GST280A48-C6P	SC200W0884
AC/DC Switching Adaptor	Mean Well	GST280A12-C6P	EC08104020
Attenuator	Fairview Microwave	SA3N1007-30	NA
Attenuator	Fairview Microwave	SA3N1007-30	NA
Attenuator	Fairview Microwave	SA3N1007-30	NA
Vector Signal Generator	Rhode & Schwarz	SMBVIOOB	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	Netgear	GS108Tv2	29SE4C5302E60
Smart Switch	NA	NA	NA

Configuration 2

Equipment Under Test:

Device	Manufacturer	Model #	S/N
ITCR-NG Base	Meteorcomm LLC	65030	65BRF13008MC

Support Equipment:

Device	Manufacturer	Model #	S/N
Programmable DC Power Supply	BK Precision Supply	XLN8018	351EL1073
Laptop	Dell	Latitude	8X7DMH2
Prosafe 8-Port Gigabit	Netgear	GS108Tv2	29SE4C5302E60
Smart Switch	NA	NA	NA

General Product Information:

Description of EUT	
Railway Transceiver	
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
Modulation Type(s):	Full Rate 2 bits / symbol Half Rate 2 bits / symbol PI/8 DQPSK 3 bits / symbol PI/8 16APSK 4 bits /symbol
Maximum Duty Cycle:	50%, but may be increased for testing
Number of TX Chains:	1
Antenna Type(s) and Gain:	Not specified by manufacturer
Beamforming Type:	NA
Antenna Connection Type:	External Connector
Nominal Input Voltage:	48VDC
Firmware / Software used for Test:	S/W Part Number P65000-A01-0.1.90.01 ITC-ROOT gec12a0f (dev) 2024-05-14 16:16:14 S/W Part Number P65000-M01-0.1.135.01 ITC-APP g4a81412a6 2024-05-14 19:09:07 S/W Part Number P65000-R01-0.0.80.0 Baseband-0 g6da029fdf 2024-05-14 14:04:26 S/W Part Number P65000-R01-0.0.80.0 Baseband-1 g6da029fdf 2024-05-14 14:05:06 S/W Part Number P65000-F01-00.00.48.00 FPGA ge45a0e8f 2024-04-09 12:35:12 S/W Part Number P65000-B01-0.1.92.01 Bootloader g5c50125 2024-06-25 19:24:32 S/W Part Number P65000-S01-0.1.92.01 Failsafe g5c50125 2024-06-25 19:24:32 Attenuator settings used to compensate differences in PAPR HALF_RATE PI/4 DQPSK 0.0dB FULL_RATE PI/4 DQPSK 0.0 dB PI/8-DQPSK -0.4 dB PI/8-16APSK -1.3 dB
The validity of results is dependent on the stated product details, the accuracy of which the manufacturer assumes full responsibility.	

EUT Photo(s)



EUT

Support Equipment Photo(s)



Support EUT



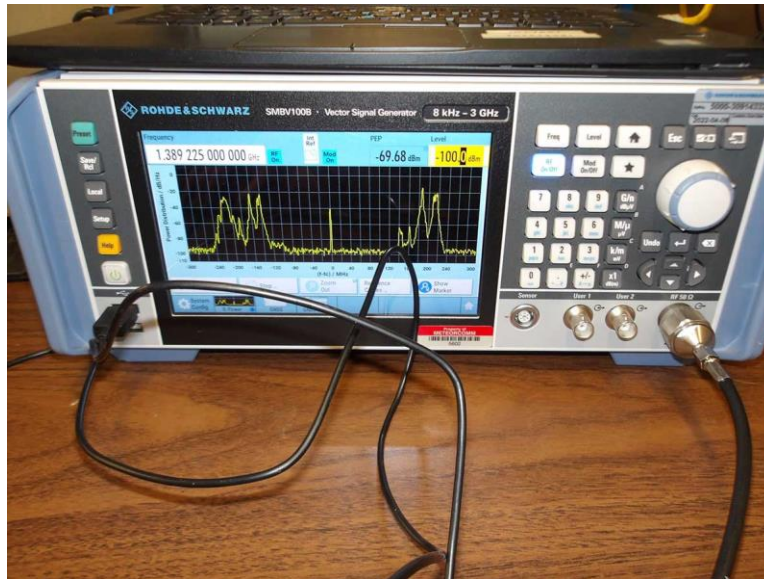
DC Power Supply, #1



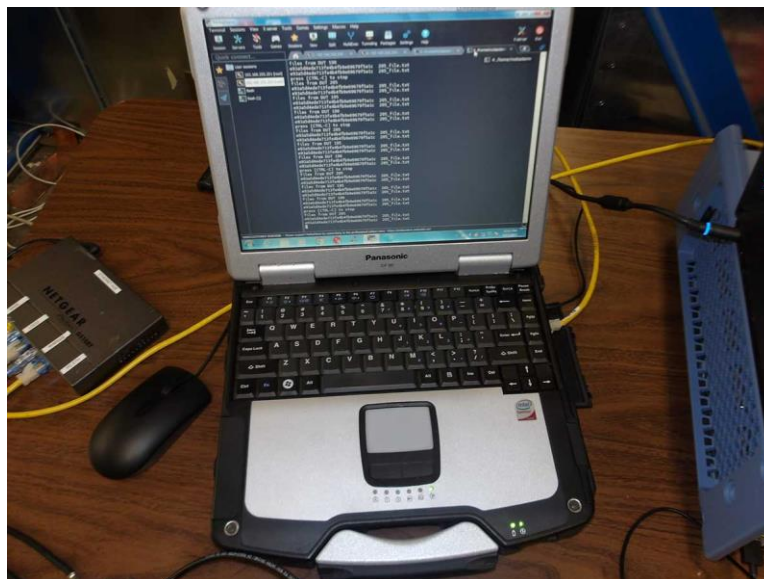
DC Power Supply, #2



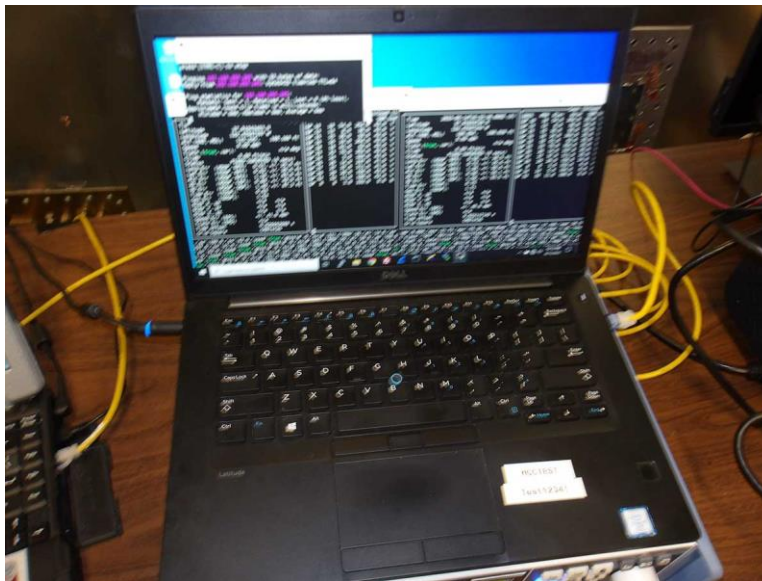
Support Attenuators



Signal Generator



Laptop, #1



Laptop, #2

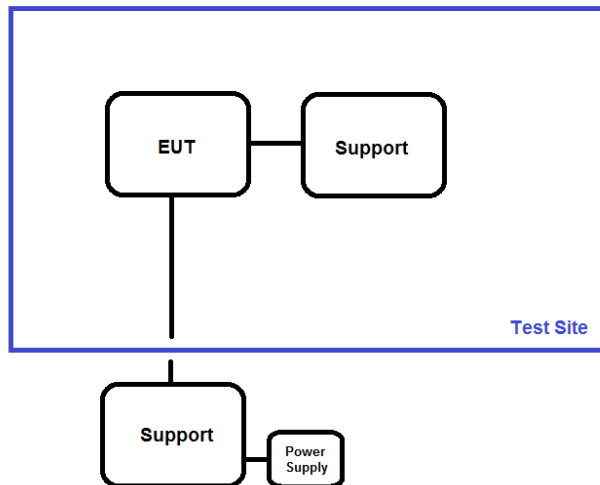


Ethernet Hub

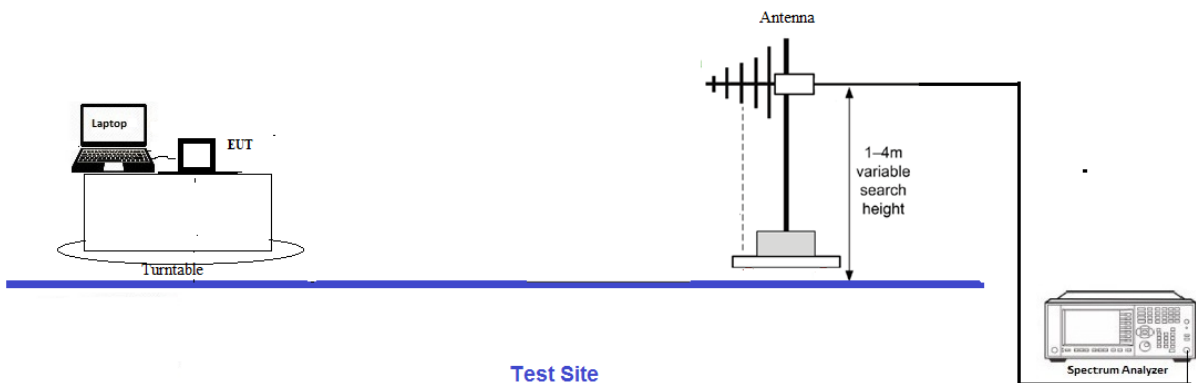
Block Diagram(s) of Test Setup

Configuration#	Setup Description of Block Diagram
1, Radiated	Powered by DC powered supply. Ethernet ports connected to Ethernet hub, laptop, and support EUT located outside chamber. GPS port connected to GPS signal located outside chamber. GPIO ports connected to unterminated cables. RX ports terminated into 50Ω. TX port connected to attenuators then Spectrum analyzer for conducted measurements.
1, Conducted	Powered by DC powered supply. Ethernet ports connected to Ethernet hub, laptop, and support EUT. GPS port connected to GPS signal. GPIO ports connected to unterminated cables. RX ports terminated into 50Ω. TX port connected to attenuators then support EUT

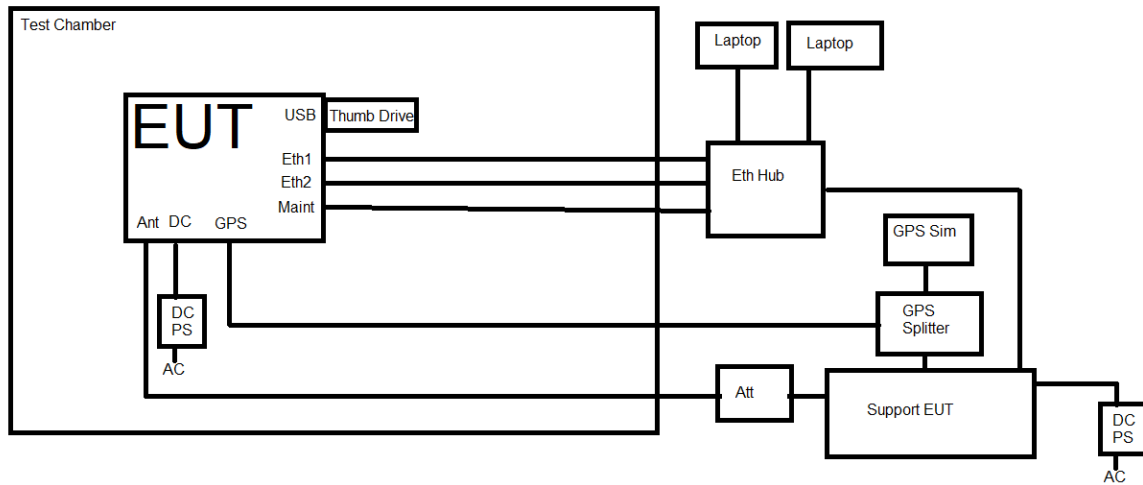
Test Setup Block Diagram



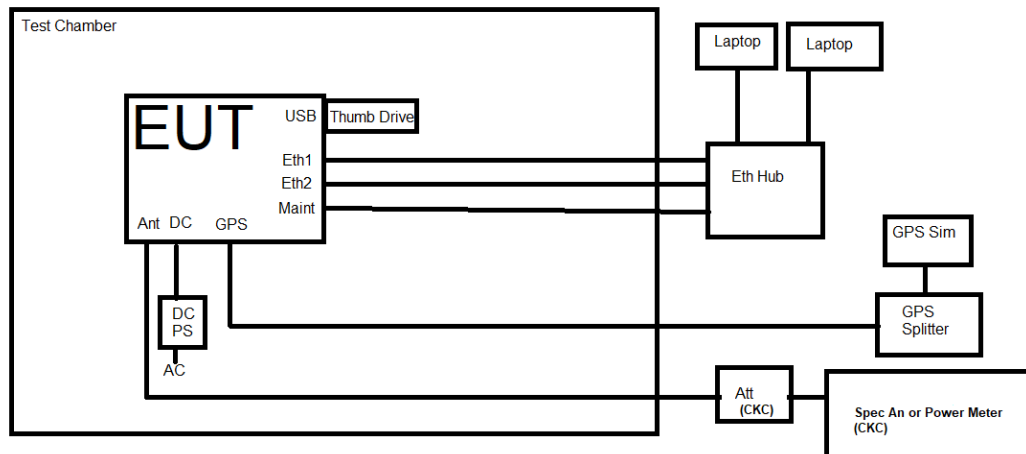
Radiated test setup



Block Diagram: Radiated



Block Diagram: Conducted



FCC PART 80 SUBPART E

80.215 (I) 2.1046 - Power Output

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	C. Plumadore
Test Method:	ANSI C63.26 (2015)	Test Date(s):	10/9/2024-10/10/2024
Configuration:	2		
Test Setup:	The unit is in a temperature chamber for temperature variation. The voltage is varied. The EUT's RF port is connected to a Spectrum analyzer 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, half rate, pi/8, and pi/8-16 modulations investigated. Per the manufacturer, the fundamental power limit will change depending on the licensee and installation. For testing purposes, the limit is assumed to be 86W. Modification #1 & 2 was in place for testing.		

Environmental Conditions			
Temperature (°C)	23.5	Relative Humidity (%):	37

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	10/11/2023	10/11/2025
P05748	Attenuator	Pasternack	PE7004-20	2/26/2024	2/26/2026
02757	Temperature Chamber	Bemco	F100/350-8	12/8/2022	12/8/2024
C00194	30db Attenuator	Fairview Microwave	SA3N1007-30	9/26/2024	9/26/2026
03029	Thermometer, Digital Infrared	Fluke	566	4/14/2023	4/14/2025

Test Data Summary - RF Conducted Measurement (Ch1)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
217.6125	-30	V _{Nom}	Full Rate	48.74	74.82	Pass
217.6125	-20	V _{Nom}	Full Rate	48.90	77.62	Pass
217.6125	-10	V _{Nom}	Full Rate	48.99	79.25	Pass
217.6125	0	V _{Nom}	Full Rate	48.81	76.03	Pass
217.6125	10	V _{Nom}	Full Rate	49.01	79.62	Pass
217.6125	20	V _{Nom}	Full Rate	49.21	83.37	Pass
217.6125	30	V _{Nom}	Full Rate	48.93	78.16	Pass
217.6125	40	V _{Nom}	Full Rate	49.03	79.98	Pass
217.6125	50	V _{Nom}	Full Rate	49.03	79.98	Pass
217.6125	20	V _{Min}	Full Rate	48.89	77.45	Pass
217.6125	20	V _{Max}	Full Rate	48.86	76.91	Pass

Test Data Summary - RF Conducted Measurement (Ch96)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
219.9875	-30	V _{Nom}	Full Rate	48.79	75.68	Pass
219.9875	-20	V _{Nom}	Full Rate	48.82	76.21	Pass
219.9875	-10	V _{Nom}	Full Rate	48.75	74.99	Pass
219.9875	0	V _{Nom}	Full Rate	48.88	77.27	Pass
219.9875	10	V _{Nom}	Full Rate	49.05	80.35	Pass
219.9875	20	V _{Nom}	Full Rate	49.24	83.95	Pass
219.9875	30	V _{Nom}	Full Rate	49.00	79.43	Pass
219.9875	40	V _{Nom}	Full Rate	49.05	80.35	Pass
219.9875	50	V _{Nom}	Full Rate	49.08	80.91	Pass
219.9875	20	V _{Min}	Full Rate	48.94	78.34	Pass
219.9875	20	V _{Max}	Full Rate	48.90	77.62	Pass

Test Data Summary - RF Conducted Measurement (Ch1)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
217.6125	-30	V _{Nom}	Half Rate	48.76	75.16	Pass
217.6125	-20	V _{Nom}	Half Rate	48.62	72.78	Pass
217.6125	-10	V _{Nom}	Half Rate	48.82	76.21	Pass
217.6125	0	V _{Nom}	Half Rate	48.86	76.91	Pass
217.6125	10	V _{Nom}	Half Rate	49.08	80.91	Pass
217.6125	20	V _{Nom}	Half Rate	49.25	84.14	Pass
217.6125	30	V _{Nom}	Half Rate	49.00	79.43	Pass
217.6125	40	V _{Nom}	Half Rate	49.03	79.98	Pass
217.6125	50	V _{Nom}	Half Rate	49.07	80.72	Pass
217.6125	20	V _{Min}	Half Rate	48.92	77.98	Pass
217.6125	20	V _{Max}	Half Rate	48.94	78.34	Pass

Test Data Summary - RF Conducted Measurement (Ch96)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
219.9875	-30	V _{Nom}	Half Rate	48.80	75.86	Pass
219.9875	-20	V _{Nom}	Half Rate	48.68	73.79	Pass
219.9875	-10	V _{Nom}	Half Rate	48.26	66.99	Pass
219.9875	0	V _{Nom}	Half Rate	48.92	77.98	Pass
219.9875	10	V _{Nom}	Half Rate	48.96	78.70	Pass
219.9875	20	V _{Nom}	Half Rate	49.23	83.75	Pass
219.9875	30	V _{Nom}	Half Rate	49.04	80.17	Pass
219.9875	40	V _{Nom}	Half Rate	49.08	80.91	Pass
219.9875	50	V _{Nom}	Half Rate	49.12	81.66	Pass
219.9875	20	V _{Min}	Half Rate	48.98	79.07	Pass
219.9875	20	V _{Max}	Half Rate	48.97	78.89	Pass

Test Data Summary - RF Conducted Measurement (Ch1)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
217.6125	-30	V _{Nom}	Pi/8	48.20	66.07	Pass
217.6125	-20	V _{Nom}	Pi/8	48.10	64.57	Pass
217.6125	-10	V _{Nom}	Pi/8	47.92	61.94	Pass
217.6125	0	V _{Nom}	Pi/8	48.50	70.79	Pass
217.6125	10	V _{Nom}	Pi/8	48.33	68.07	Pass
217.6125	20	V _{Nom}	Pi/8	48.75	74.99	Pass
217.6125	30	V _{Nom}	Pi/8	48.48	70.47	Pass
217.6125	40	V _{Nom}	Pi/8	48.52	71.12	Pass
217.6125	50	V _{Nom}	Pi/8	48.55	71.61	Pass
217.6125	20	V _{Min}	Pi/8	48.41	69.34	Pass
217.6125	20	V _{Max}	Pi/8	48.40	69.18	Pass

Test Data Summary - RF Conducted Measurement (Ch96)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
219.9875	-30	V _{Nom}	Pi/8	48.24	66.68	Pass
219.9875	-20	V _{Nom}	Pi/8	48.17	65.61	Pass
219.9875	-10	V _{Nom}	Pi/8	48.40	69.18	Pass
219.9875	0	V _{Nom}	Pi/8	48.39	69.02	Pass
219.9875	10	V _{Nom}	Pi/8	48.40	69.18	Pass
219.9875	20	V _{Nom}	Pi/8	48.88	77.27	Pass
219.9875	30	V _{Nom}	Pi/8	48.52	71.12	Pass
219.9875	40	V _{Nom}	Pi/8	48.55	71.61	Pass
219.9875	50	V _{Nom}	Pi/8	48.58	72.11	Pass
219.9875	20	V _{Min}	Pi/8	48.46	70.15	Pass
219.9875	20	V _{Max}	Pi/8	48.40	69.18	Pass

Test Data Summary - RF Conducted Measurement (Ch1)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
217.6125	-30	V _{Nom}	Pi/8-16	48.36	68.55	Pass
217.6125	-20	V _{Nom}	Pi/8-16	48.38	68.87	Pass
217.6125	-10	V _{Nom}	Pi/8-16	48.55	71.61	Pass
217.6125	0	V _{Nom}	Pi/8-16	48.49	70.63	Pass
217.6125	10	V _{Nom}	Pi/8-16	48.51	70.96	Pass
217.6125	20	V _{Nom}	Pi/8-16	48.90	77.62	Pass
217.6125	30	V _{Nom}	Pi/8-16	48.61	72.61	Pass
217.6125	40	V _{Nom}	Pi/8-16	48.66	73.45	Pass
217.6125	50	V _{Nom}	Pi/8-16	48.72	74.47	Pass
217.6125	20	V _{Min}	Pi/8-16	48.52	71.12	Pass
217.6125	20	V _{Max}	Pi/8-16	48.52	71.12	Pass

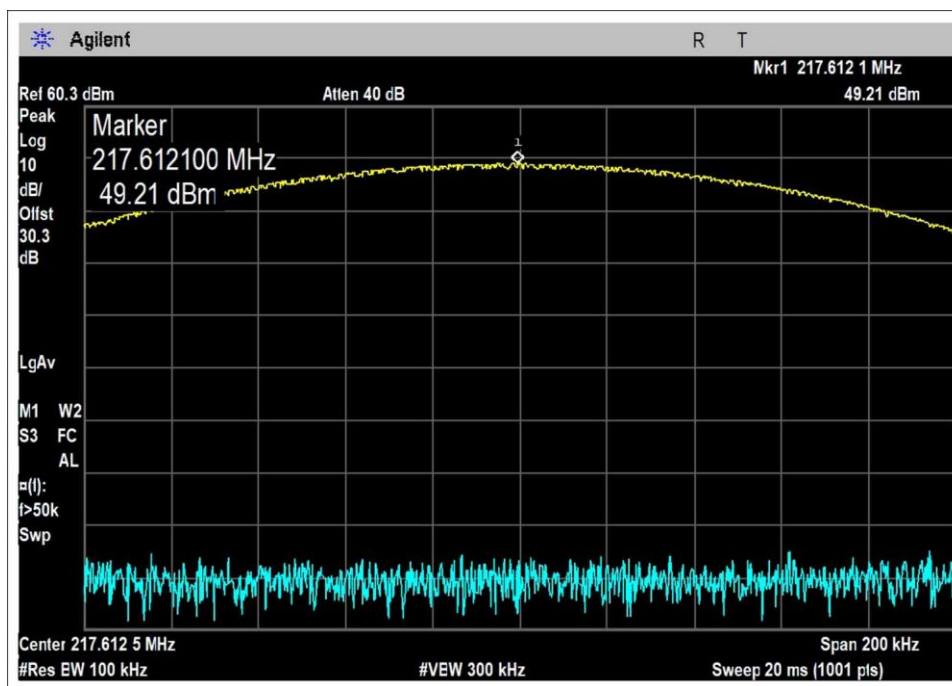
Test Data Summary - RF Conducted Measurement (Ch96)						
Frequency (MHz)	Temperature (°C)	Voltage	Modulation	Conducted Power (dBm)	Conducted Power (Watts)	Results
219.9875	-30	V _{Nom}	Pi/8-16	48.40	69.18	Pass
219.9875	-20	V _{Nom}	Pi/8-16	48.39	69.02	Pass
219.9875	-10	V _{Nom}	Pi/8-16	48.48	70.45	Pass
219.9875	0	V _{Nom}	Pi/8-16	48.53	71.29	Pass
219.9875	10	V _{Nom}	Pi/8-16	48.54	71.45	Pass
219.9875	20	V _{Nom}	Pi/8-16	49.00	79.43	Pass
219.9875	30	V _{Nom}	Pi/8-16	48.64	73.11	Pass
219.9875	40	V _{Nom}	Pi/8-16	48.70	74.13	Pass
219.9875	50	V _{Nom}	Pi/8-16	48.76	75.16	Pass
219.9875	20	V _{Min}	Pi/8-16	48.57	71.94	Pass
219.9875	20	V _{Max}	Pi/8-16	48.56	71.78	Pass

Parameter Definitions:

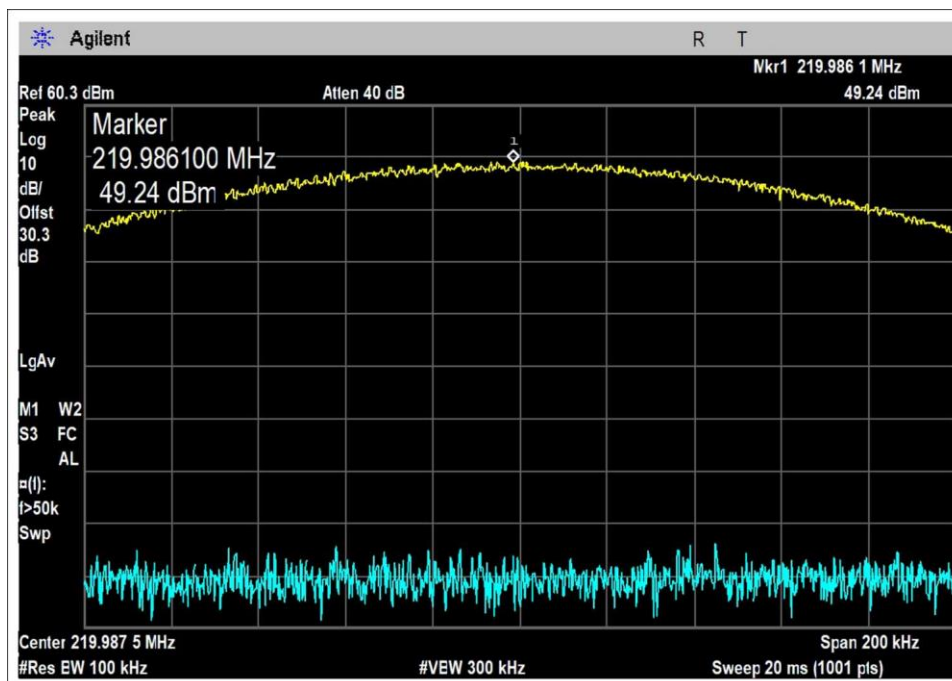
Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V _{Nom} :	48VDC
V _{Min} :	21VDC
V _{Max} :	61VDC

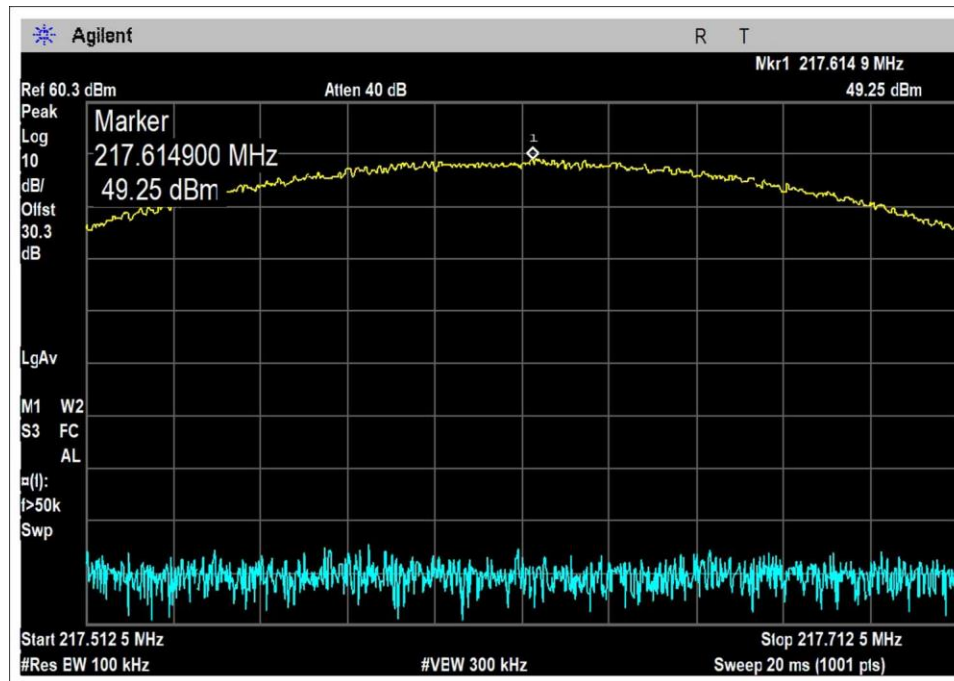
Test Plots



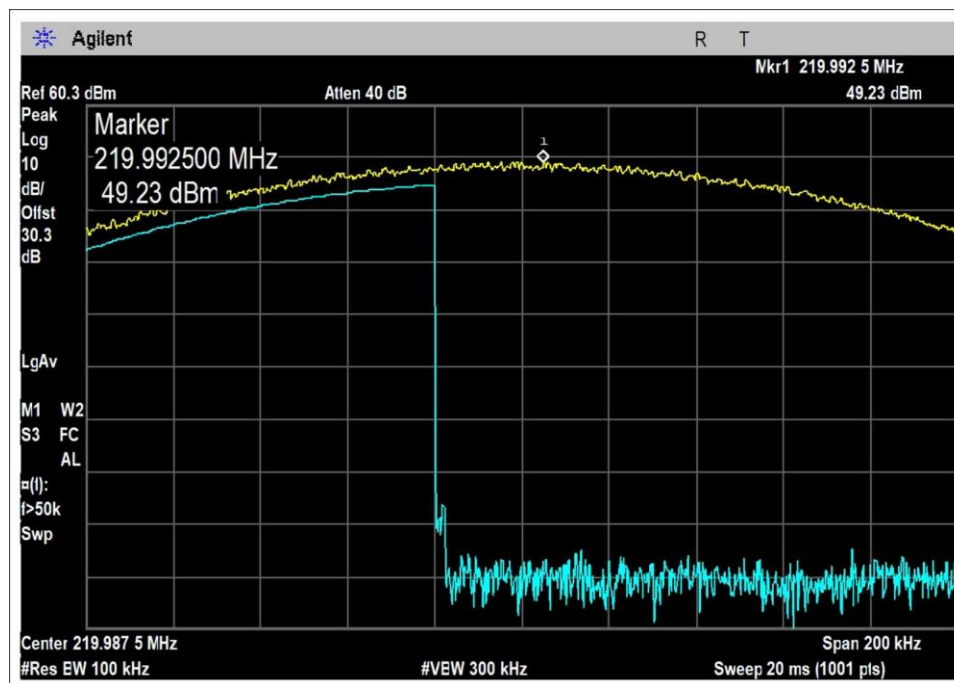
217.6125MHz Full Rate



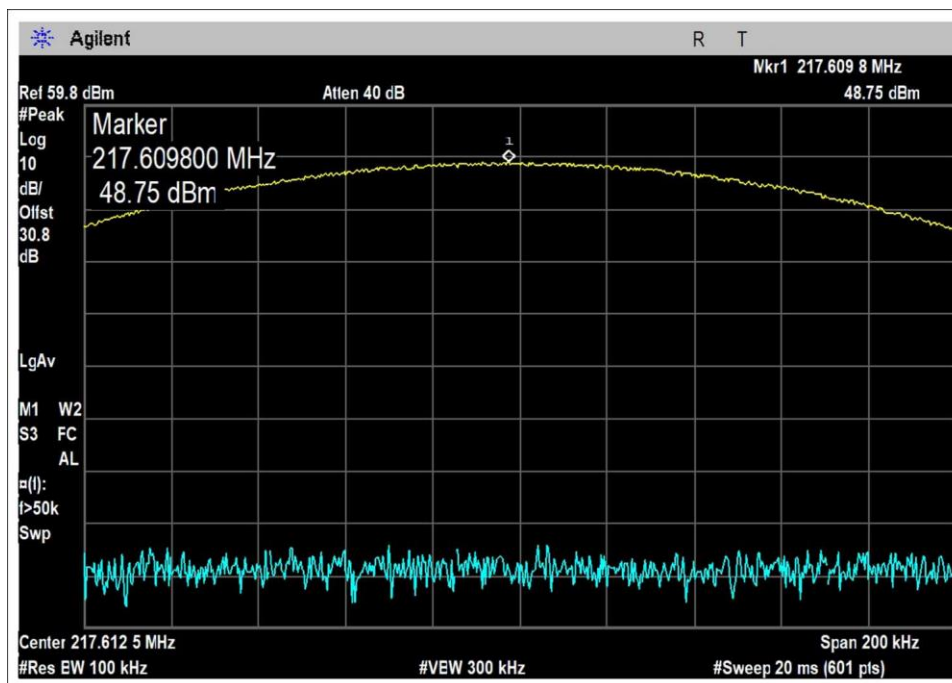
219.9875MHz Full Rate



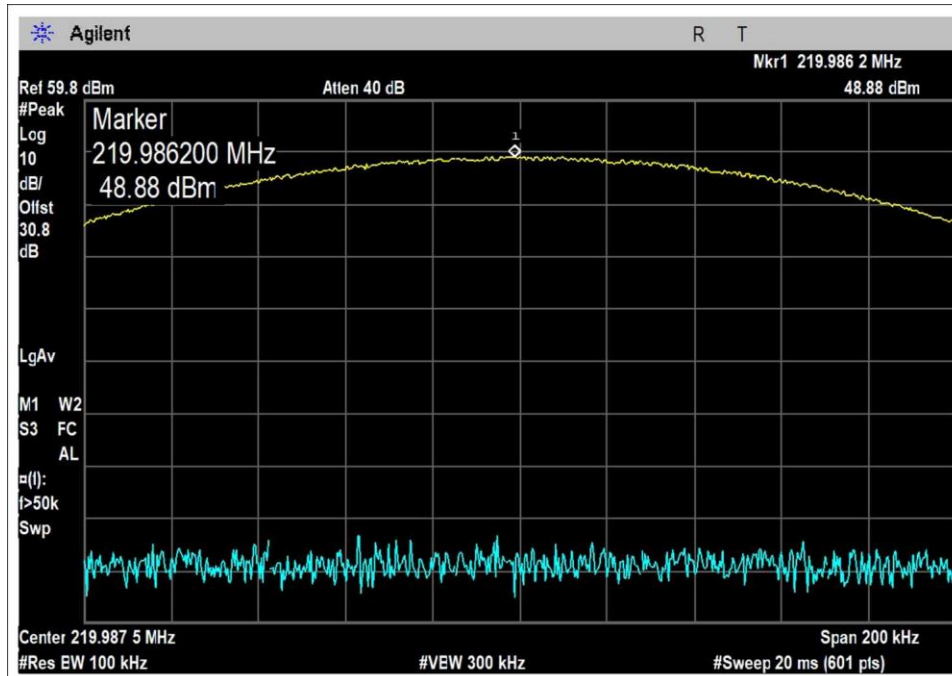
217.6125MHz, Half Rate



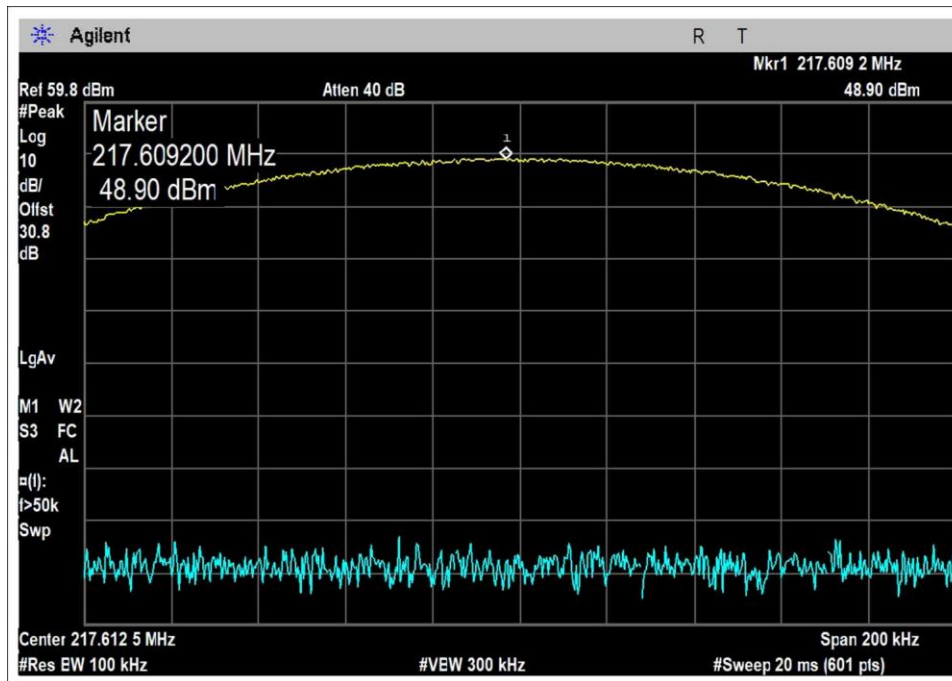
219.9875MHz, Half Rate



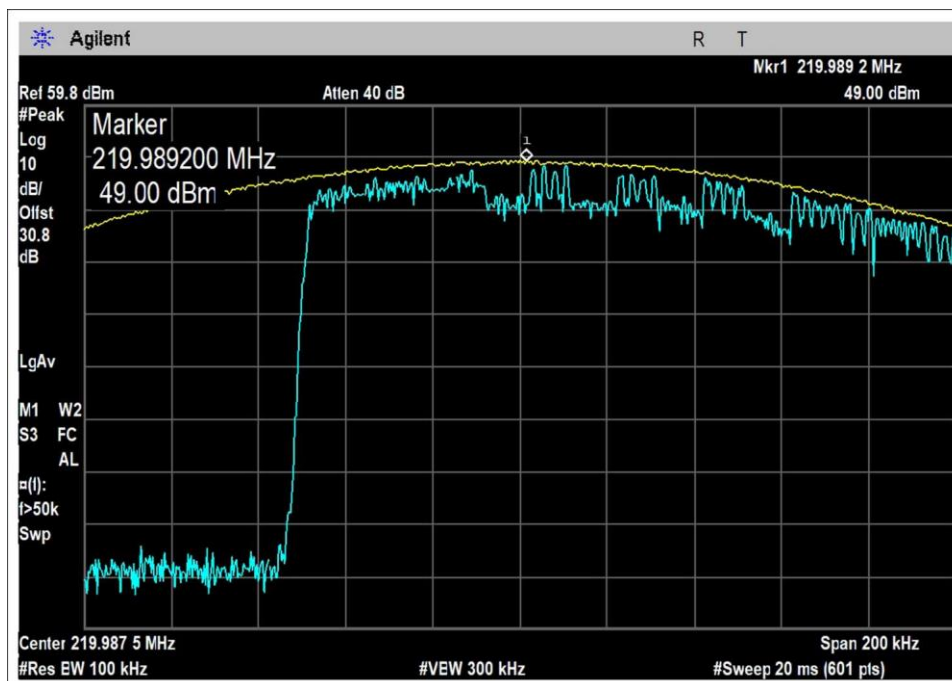
217.6125MHz, Pi/8



219.9875MHz, Pi/8



217.6125MHz, Pi/8-16



219.9875MHz, Pi/8-16

Test Setup Photo(s)



View 1



View 2

2.1049 - Occupied Bandwidth

Test Setup/Conditions			
Test Location:	Bothell Lab Bench	Test Engineer:	C. Plumadore
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/26/2024 and 10/8/2024
Configuration:	1		
Test Setup:	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, pi/8, and pi/8-16 modulations investigated. Per the manufacturer, the bandwidth limitations are outside the scope of Part 80 based on the emission designator for this equipment, it will be up to the licensee to ensure the bandwidth/designator is used as appropriately licensed. Modification #1 & 2 was in place for testing.		

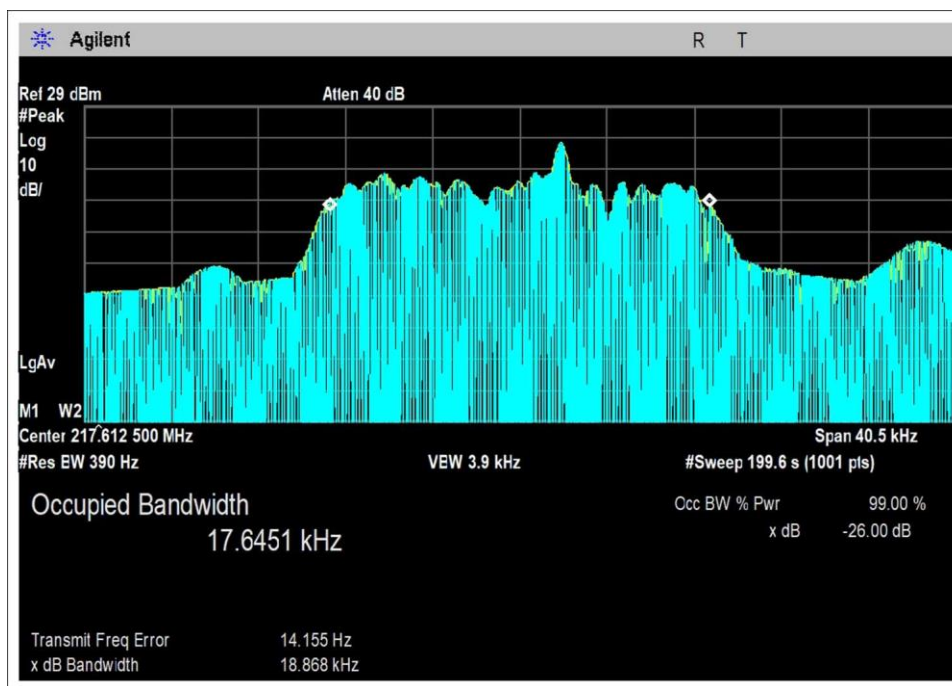
Environmental Conditions			
Temperature (°C)	25	Relative Humidity (%):	44

Test Equipment					
Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
03807	Spectrum Analyzer	Agilent	E4440A	10/10/2023	10/10/2025
P06452	Cable	Andrews	NA	2/8/2023	2/8/2025
C00194	30db Attenuator	Fairview Microwave	SA3N1007-30	9/26/2024	9/26/2026

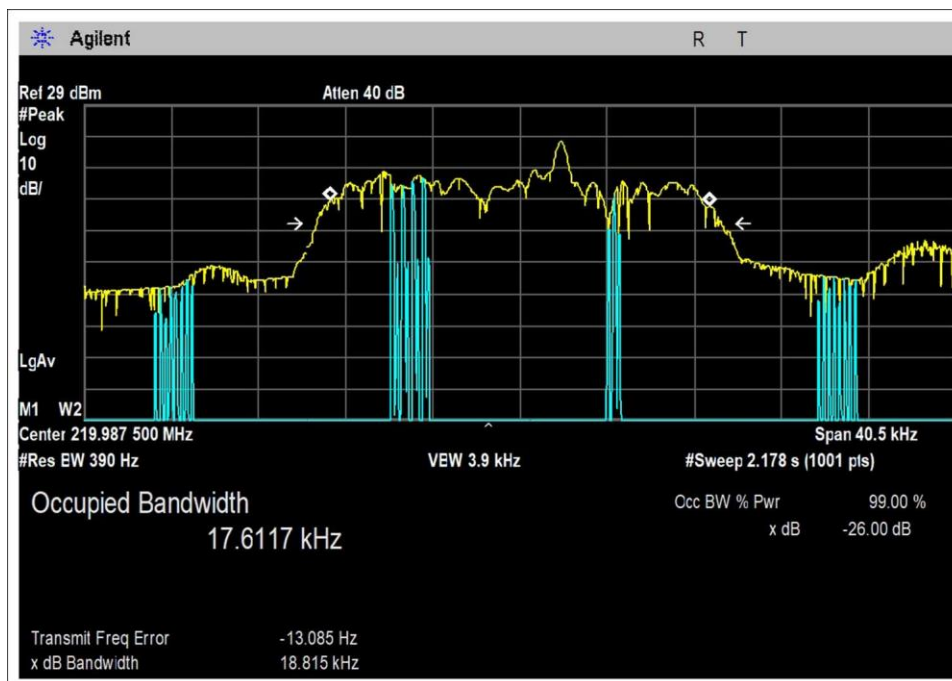
99% Occupied Bandwidth

Test Data Summary				
Frequency (MHz)	Modulation	Measured (kHz)	Limit (kHz)	Results
217.6125	Full Rate	17.6451	20kHz	Pass
219.9875	Full Rate	17.6117	20kHz	Pass
217.6125	Half Rate	8.8771	11.25kHz	Pass
219.9875	Half Rate	8.8531	11.25kHz	Pass
217.6125	Pi/8	17.9236	20kHz	Pass
219.9875	Pi/8	17.9044	20kHz	Pass
217.6125	Pi/8-16	17.5600	20kHz	Pass
219.9875	Pi/8-16	17.5602	20kHz	Pass

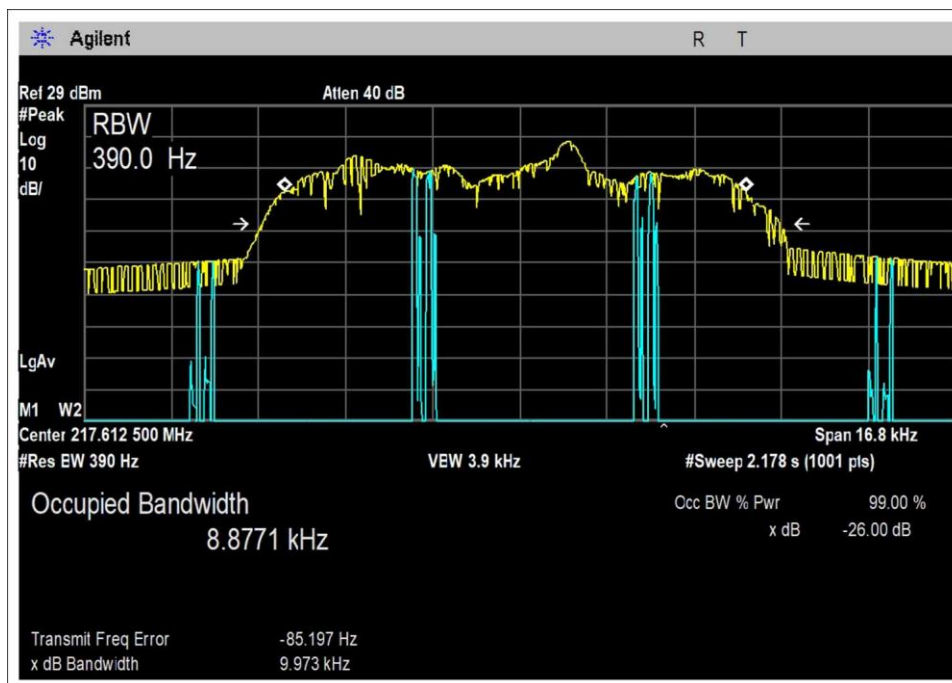
Test Plots



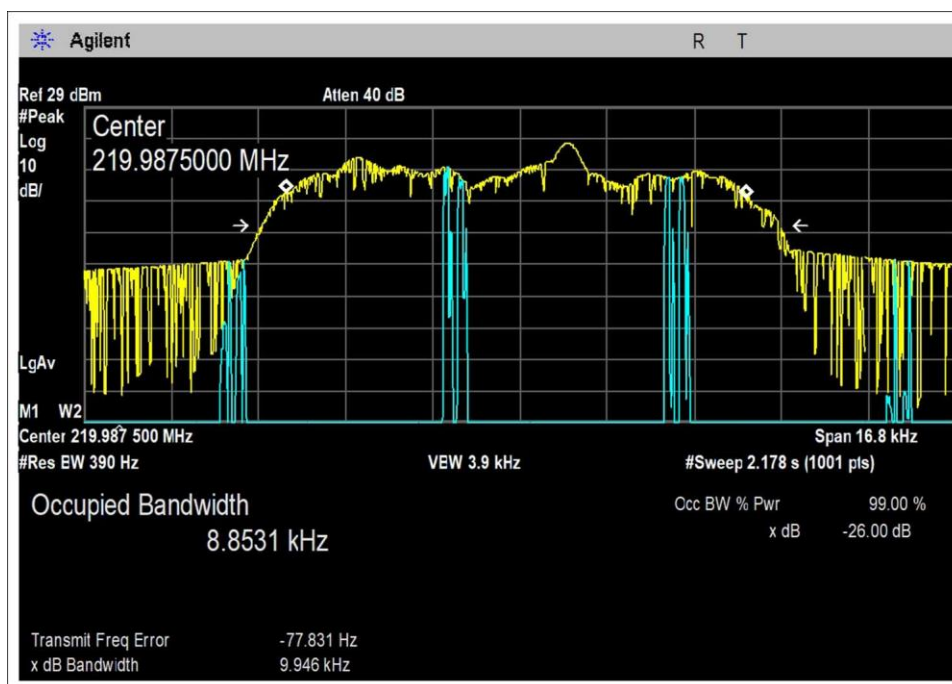
217.6125MHz, Full Rate



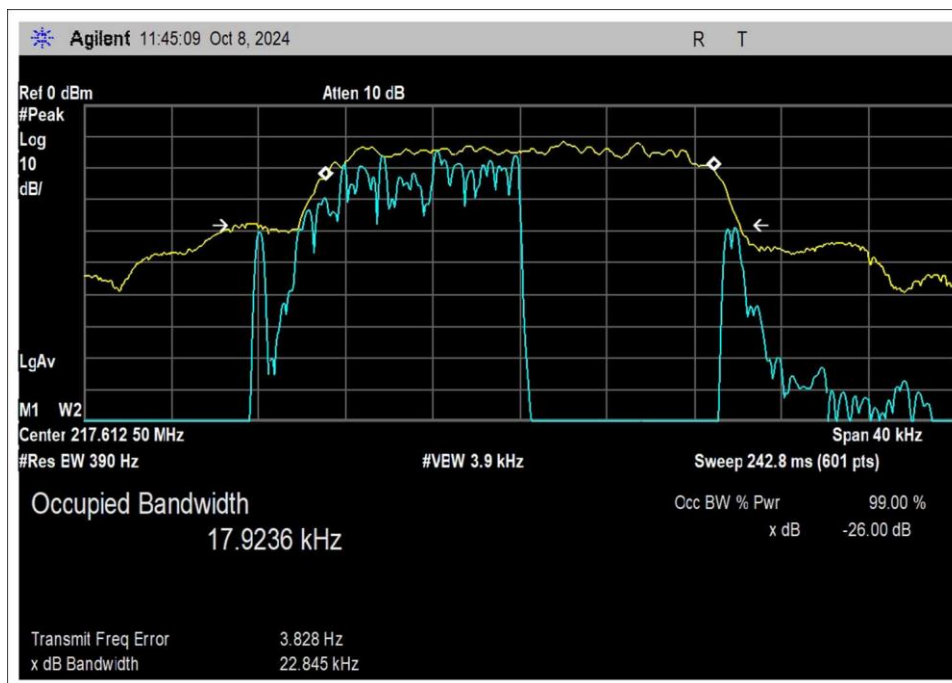
219.9875MHz, Full Rate



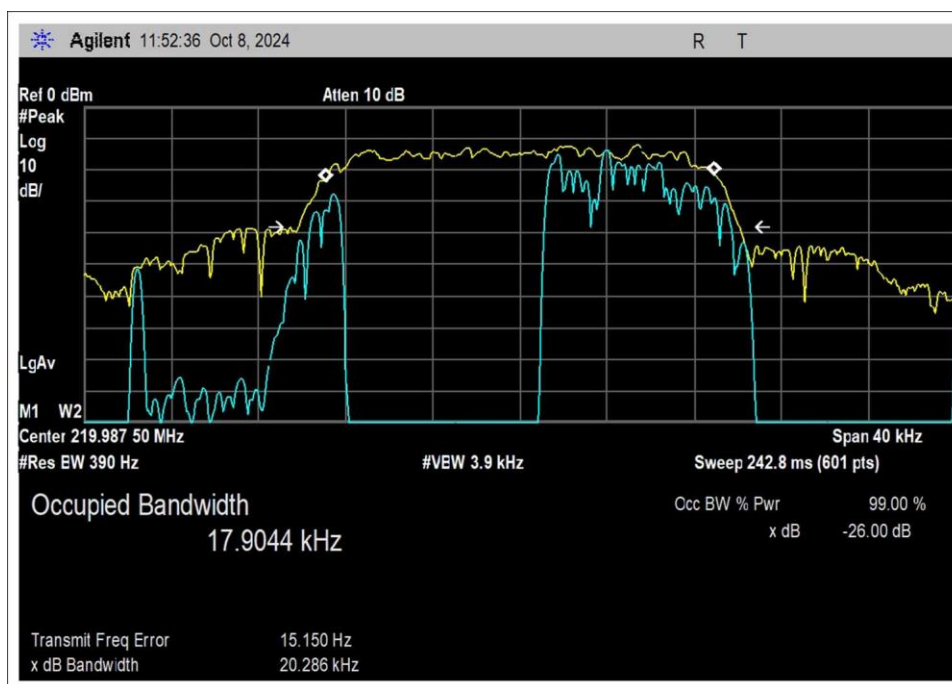
217.6125MHz, Half Rate



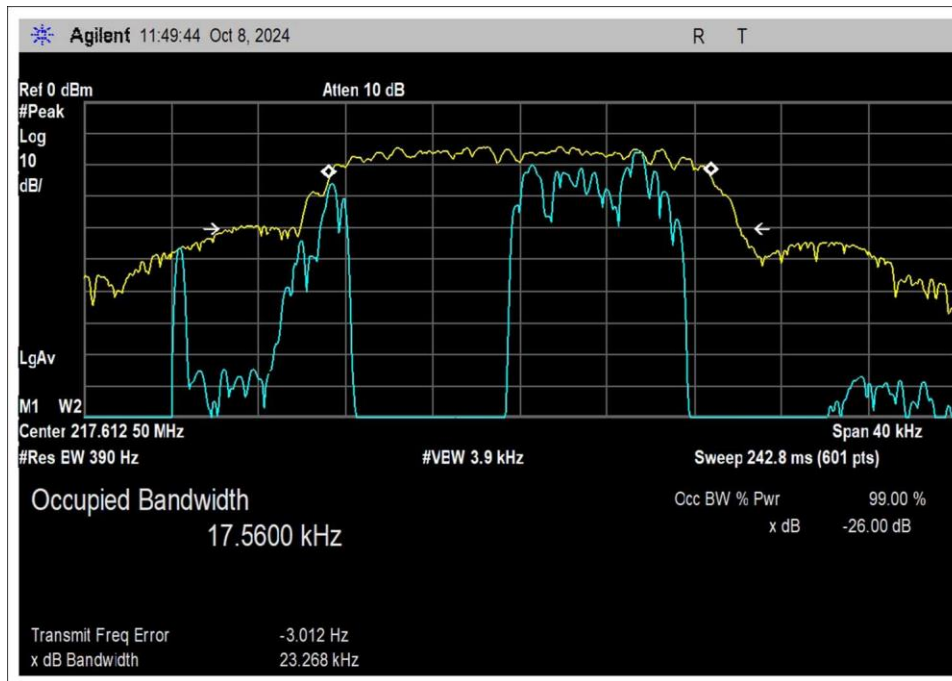
219.9875MHz, Half Rate



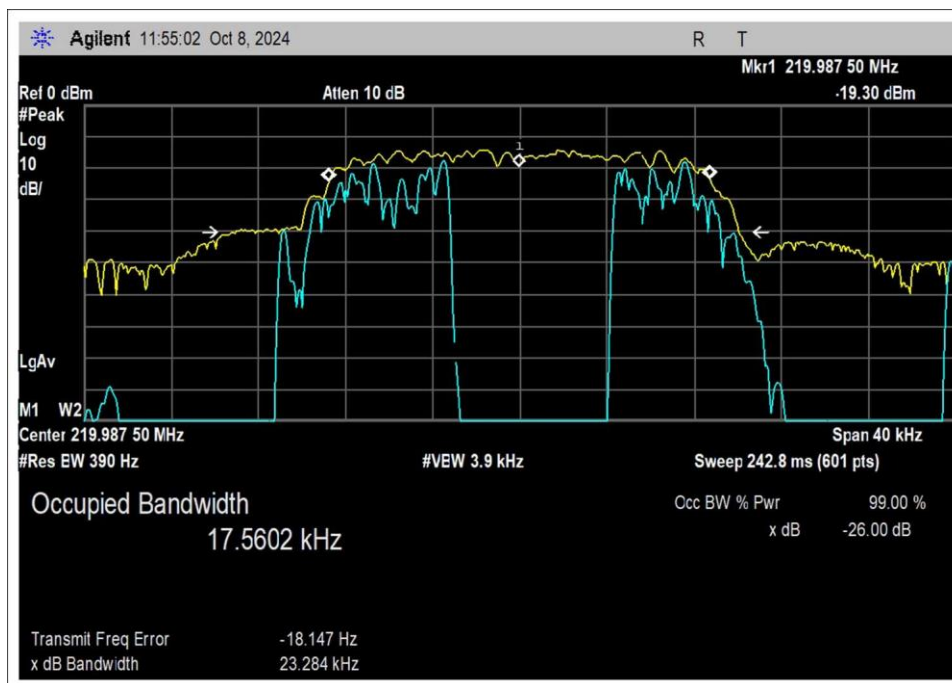
217.6125MHz, Pi/8



219.9875MHz, Pi/8



217.6125MHz, Pi/8-16



219.9875MHz, Pi/8-16

Test Setup Photo(s)



80.209 - Frequency Stability

Test Setup/Conditions

Test Location:	Bothell Lab Bench	Test Engineer:	C. Plumadore
Test Method:	ANSI C63.26 (2015)	Test Date(s):	10/9/2024-10/10/2024
Configuration:	2		
Test Setup:	The unit is in a temperature chamber for temperature variation. The voltage is varied. 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. The limit is assumed as 5ppm from 80.209 (6) Band 216-220MHz. Modification #1 & 2 was in place for testing.		

Environmental Conditions

Temperature (°C)	23.4	Relative Humidity (%):	38
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Test Equipment

Asset#	Description	Manufacturer	Model	Cal Date	Cal Due
02872	Spectrum Analyzer	Agilent	E4440A	10/11/2023	10/11/2025
P05748	Attenuator	Pasternack	PE7004-20	2/26/2024	2/26/2026
02757	Temperature Chamber	Bemco	F100/350-8	12/8/2022	12/8/2024
C00194	30db Attenuator	Fairview Microwave	SA3N1007-30	9/26/2024	9/26/2026

Test Data Summary

Modulation: CW				
Temp (°C)	Voltage	Ch 1 (PPM)	Ch 96 (PPM)	Results
-30	V _{Nom}	0.00000	0.00000	Pass
-20	V _{Nom}	0.01379	0.01364	
-10	V _{Nom}	0.00000	0.01364	
0	V _{Nom}	0.00460	0.00455	
10	V _{Nom}	0.00460	0.00455	
20	V _{Nom}	0.04595	0.04546	
30	V _{Nom}	0.03217	0.03182	
40	V _{Nom}	0.04136	0.04091	
50	V _{Nom}	0.06433	0.06364	
20	V _{Min}	0.04136	0.04091	
20	V _{Max}	0.04136	0.04091	
Maximum Deviation		.06433	.06364	

Parameter Definitions:

Measurements performed at input voltage according to manufacturer specification.

Parameter	Value
V _{Nom} :	48VDC
V _{Min} :	21VDC
V _{Max} :	61VDC

Test Setup Photo(s)



View 1



View 2

80.211(f) - Conducted Spurious Emissions Mask

Test Setup/Conditions																																
Test Location:	Bothell Lab Bench	Test Engineer:	C. Plumadore																													
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/27/2024																													
Configuration:	1																															
Test Setup:	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, pi/8 and pi/8-16 modulations investigated in separate datasheets. The emission mask was built with an RMS Average measurement of the fundamental Outside of the span shown in the emission mask plots, the following bandwidths were used: <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> Average values as indicated on datasheet are RMS.. (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; (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 (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. <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 conducted</td></tr></table> 11/4/24 Pet the manufacturer the masks are built with 80.211(f), with an assumed 20kHz ABW for Full Rate, pi/8 and pi/8-16 and 11.25kHz ABW for Half Rate, it will be the responsibility of the licensee to ensure mask applicability. Modification #1 & 2 was in place for testing.			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 conducted
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 conducted																														

Environmental Conditions			
Temperature (°C)	22.1	Relative Humidity (%):	48.7

Test Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717
 Customer: **Meteorcomm LLC.**
 Specification: **47 CFR §90.210(b) Spurious Emissions**
 Work Order #: **109225** Date: 10/8/2024
 Test Type: **Conducted Emissions** Time: 14:52:16
 Tested By: C. Plumadore Sequence#: 1
 Software: EMITest 5.03.20 48VDC

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

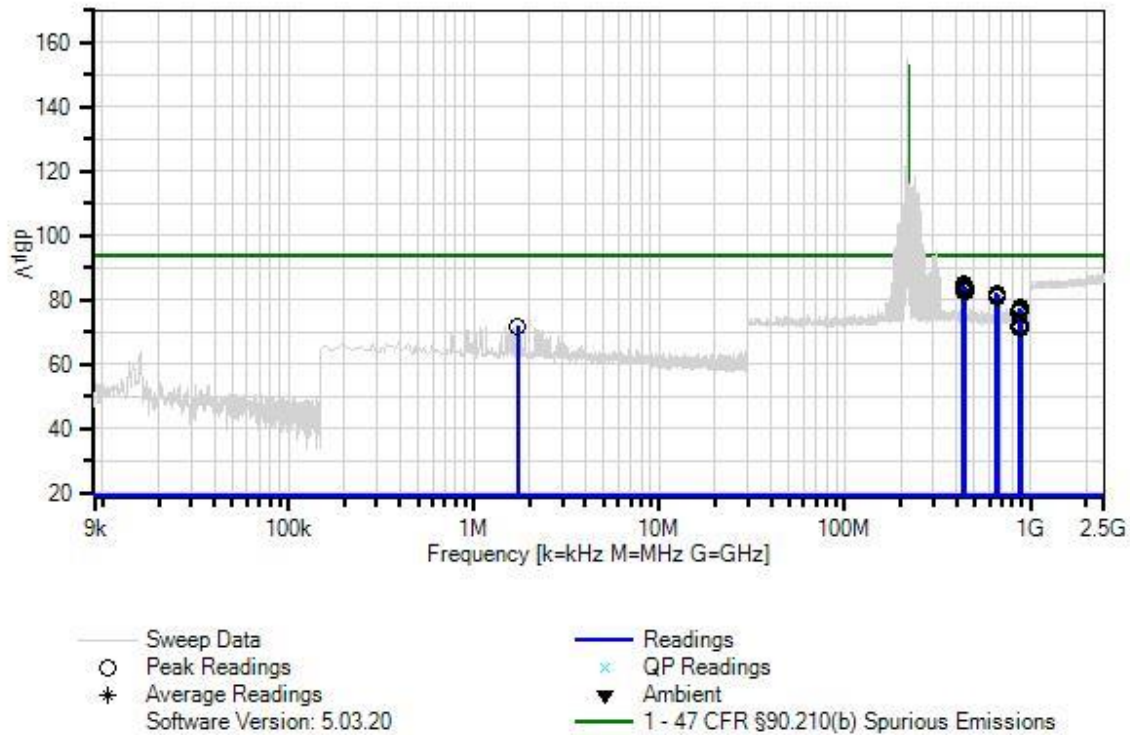
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Frequency: 9kHz-2.5GHz
Test Method: ANSI 63.26
Modification #1 & 2 was in place for testing.

Meteorcomm LLC, WO#: 109225 Sequence#: 1 Date: 10/8/2024
47 CFR §90.210(b) Spurious Emissions Test Lead: 48VDC RF port



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	ANP05748	Attenuator	PE7004-20	2/26/2024	2/26/2026
	AN03807	Spectrum Analyzer	E4440A	10/10/2023	10/10/2025
T2	ANC00194	Attenuator	SA3N1007-30	9/26/2024	9/26/2026
T3	ANP06452	Cable	Heliac	2/8/2023	2/8/2025

Measurement Data:

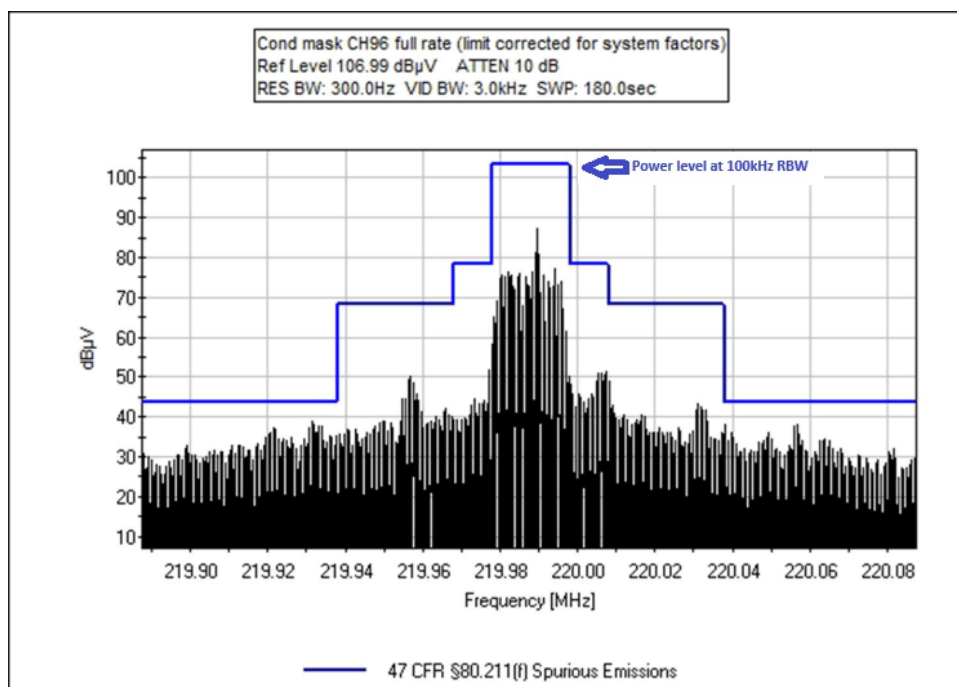
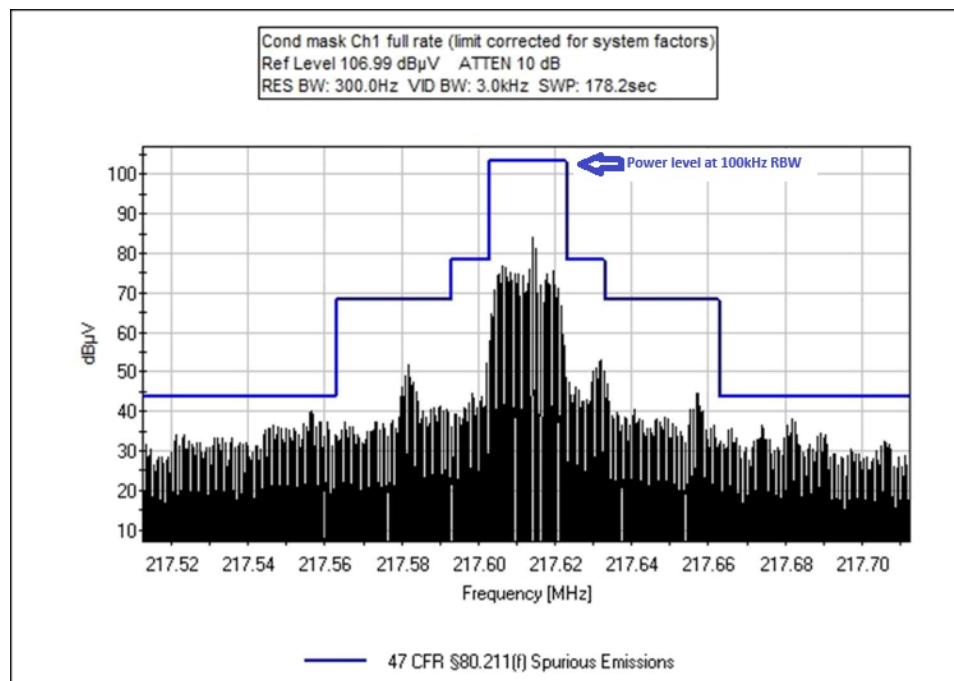
Reading listed by margin.

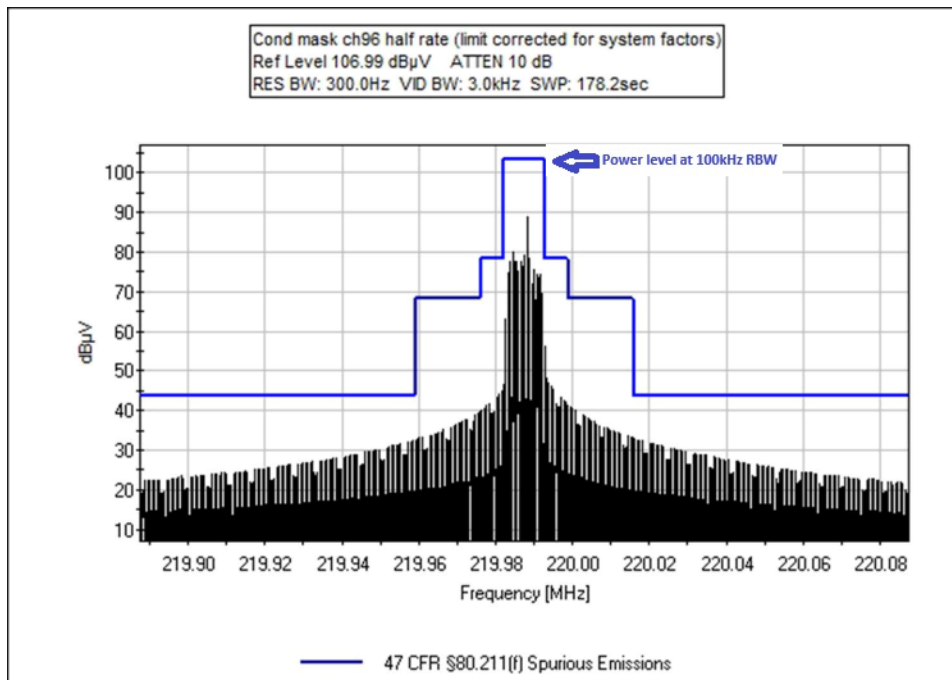
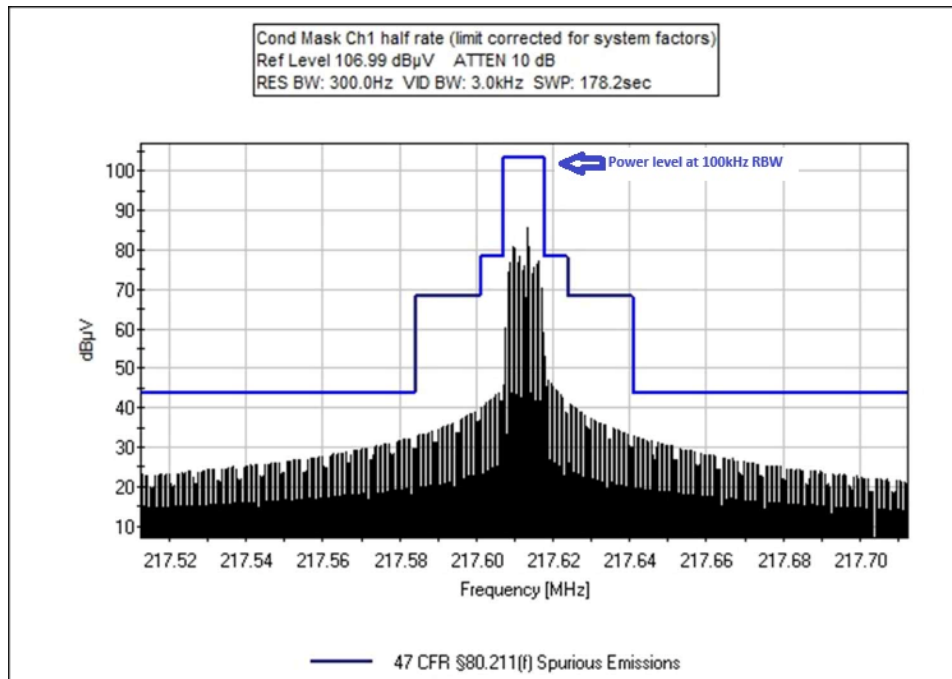
Test Lead: RF port

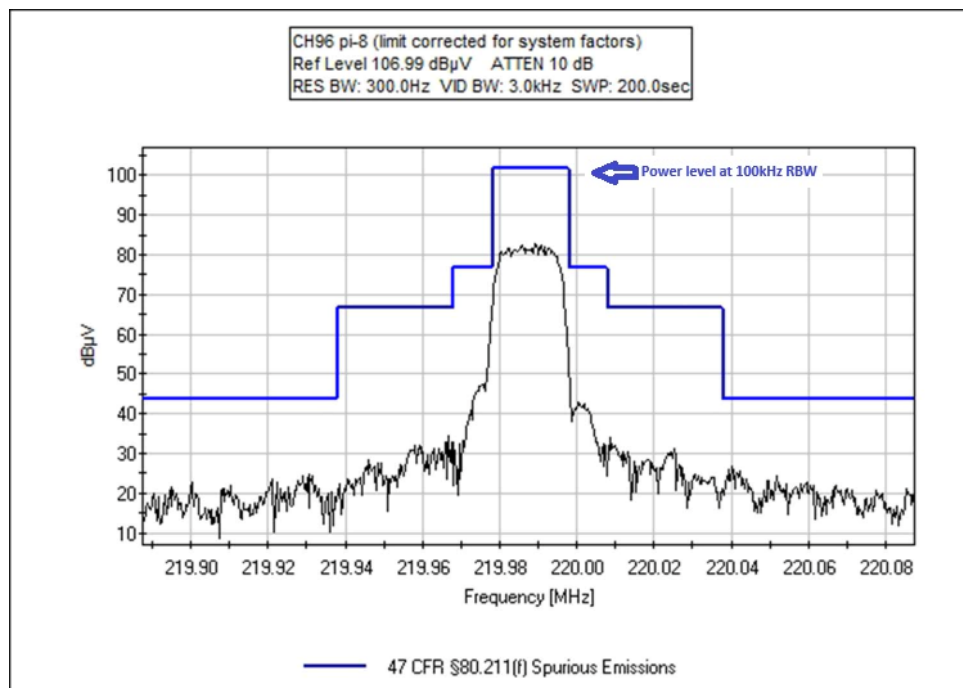
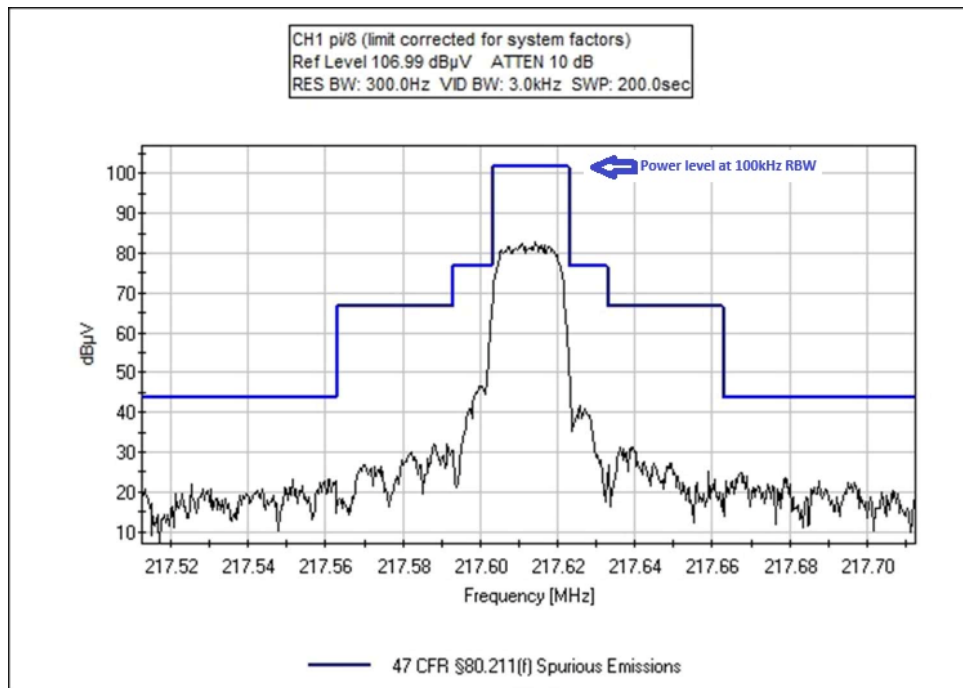
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB		Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	435.218M	34.3	+20.0	+30.0	+0.5		+0.0	84.8	94.0 217.6125 pi/8	-9.2	RF po
2	435.199M	34.2	+20.0	+30.0	+0.5		+0.0	84.7	94.0 217.6125Mhz pi/8-16	-9.3	RF po
3	439.962M	33.7	+20.0	+30.0	+0.5		+0.0	84.2	94.0 219.9875 pi/8-16	-9.8	RF po
4	440.019M	33.5	+20.0	+30.0	+0.5		+0.0	84.0	94.0 220.0125 pi/8	-10.0	RF po
5	440.030M	33.4	+20.0	+30.0	+0.5		+0.0	83.9	94.0 220.0125 pi/8-16	-10.1	RF po
6	443.986M	33.3	+20.0	+30.0	+0.5		+0.0	83.8	94.0 221.9875 pi/8-16	-10.2	RF po
7	439.971M	33.1	+20.0	+30.0	+0.5		+0.0	83.6	94.0 219.9875 pi/8	-10.4	RF po
8	443.966M	33.1	+20.0	+30.0	+0.5		+0.0	83.6	94.0 221.9875 pi/8	-10.4	RF po
9	435.202M	33.1	+20.0	+30.0	+0.5		+0.0	83.6	94.0 217.6125 full rate	-10.4	RF po
10	435.224M	32.8	+20.0	+30.0	+0.5		+0.0	83.3	94.0 217.6125 half rate	-10.7	RF po
11	439.976M	32.4	+20.0	+30.0	+0.5		+0.0	82.9	94.0 219.9875 full rate	-11.1	RF po
12	439.981M	32.2	+20.0	+30.0	+0.5		+0.0	82.7	94.0 219.9875MHz half rate	-11.3	RF po
13	443.935M	32.1	+20.0	+30.0	+0.5		+0.0	82.6	94.0 221.9875 full rate	-11.4	RF po
14	443.978M	31.9	+20.0	+30.0	+0.5		+0.0	82.4	94.0 221.9875 half rate	-11.6	RF po
15	652.812M	31.4	+20.0	+30.0	+0.7		+0.0	82.1	94.0 217.6125 full rate	-11.9	RF po
16	659.962M	31.3	+20.0	+30.0	+0.7		+0.0	82.0	94.0 219.9875 full rate	-12.0	RF po
17	652.833M	31.2	+20.0	+30.0	+0.7		+0.0	81.9	94.0 217.6125Mhz pi/8-16	-12.1	RF po
18	652.816M	31.1	+20.0	+30.0	+0.7		+0.0	81.8	94.0 217.6125 half rate	-12.2	RF po
19	659.952M	31.0	+20.0	+30.0	+0.7		+0.0	81.7	94.0 219.9875MHz half rate	-12.3	RF po
20	652.840M	31.0	+20.0	+30.0	+0.7		+0.0	81.7	94.0 217.6125 pi/8	-12.3	RF po
21	665.976M	31.0	+20.0	+30.0	+0.7		+0.0	81.7	94.0 221.9875 pi/8-16	-12.3	RF po
22	660.019M	31.0	+20.0	+30.0	+0.7		+0.0	81.7	94.0 220.0125 pi/8-16	-12.3	RF po

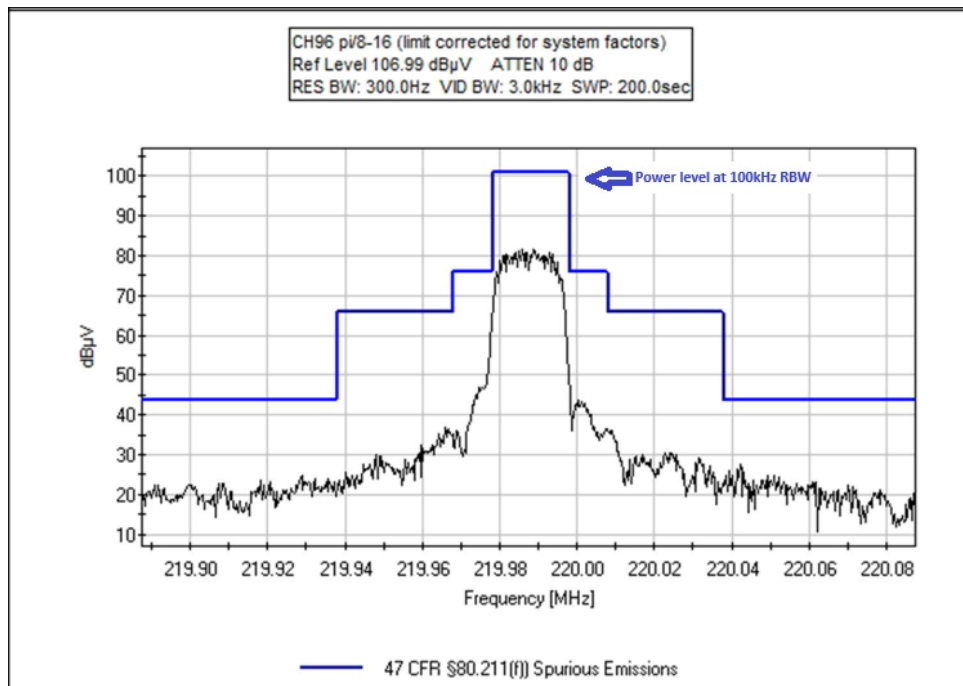
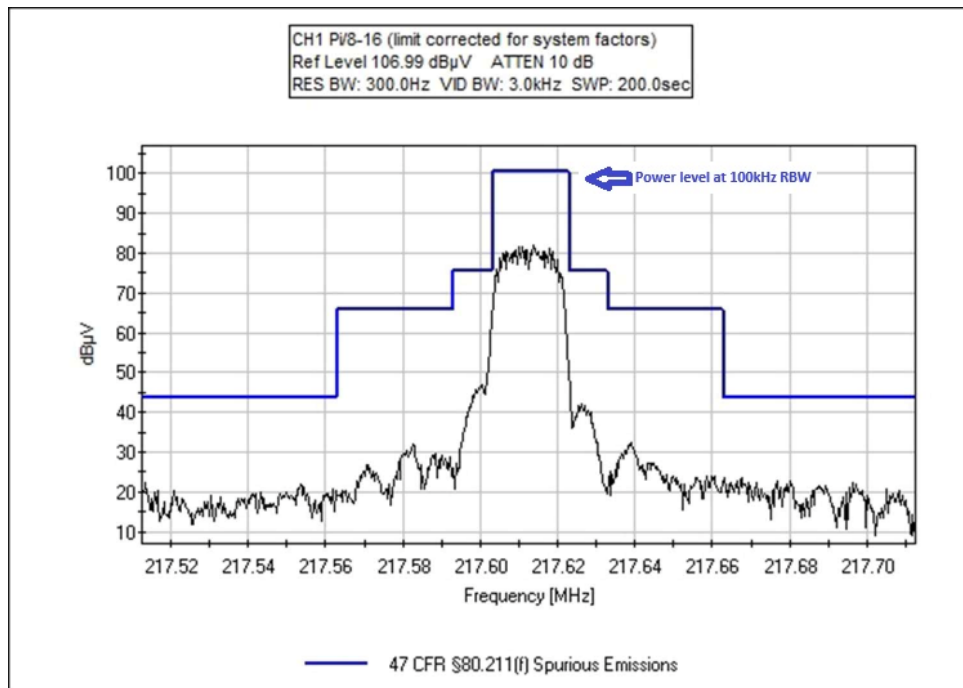
23	665.969M	30.8	+20.0	+30.0	+0.7	+0.0	81.5	94.0	-12.5	RF po
								221.9875	half rate	
24	659.969M	30.8	+20.0	+30.0	+0.7	+0.0	81.5	94.0	-12.5	RF po
								219.9875	pi/8-16	
25	660.060M	30.8	+20.0	+30.0	+0.7	+0.0	81.5	94.0	-12.5	RF po
								220.0125	pi/8	
26	665.964M	30.5	+20.0	+30.0	+0.7	+0.0	81.2	94.0	-12.8	RF po
								221.9875	full rate	
27	659.952M	30.3	+20.0	+30.0	+0.7	+0.0	81.0	94.0	-13.0	RF po
								219.9875	pi/8	
28	665.961M	30.2	+20.0	+30.0	+0.7	+0.0	80.9	94.0	-13.1	RF po
								221.9875	pi/8	
29	879.886M	27.0	+20.0	+30.0	+0.8	+0.0	77.8	94.0	-16.2	RF po
								219.9875MHz	half rate	
30	887.904M	26.4	+20.0	+30.0	+0.8	+0.0	77.2	94.0	-16.8	RF po
								221.9875	half rate	
31	870.497M	25.9	+20.0	+30.0	+0.8	+0.0	76.7	94.0	-17.3	RF po
								217.6125	half rate	
32	879.926M	25.8	+20.0	+30.0	+0.8	+0.0	76.6	94.0	-17.4	RF po
								219.9875	full rate	
33	887.951M	25.8	+20.0	+30.0	+0.8	+0.0	76.6	94.0	-17.4	RF po
								221.9875	full rate	
34	870.434M	25.4	+20.0	+30.0	+0.8	+0.0	76.2	94.0	-17.8	RF po
								217.6125	full rate	
35	887.851M	21.6	+20.0	+30.0	+0.8	+0.0	72.4	94.0	-21.6	RF po
								221.9875	pi/8	
36	1.737M	21.8	+20.0	+29.9	+0.1	+0.0	71.8	94.0	-22.2	RF po
37	880.060M	21.0	+20.0	+30.0	+0.8	+0.0	71.8	94.0	-22.2	RF po
								220.0125	pi/8-16	
38	870.403M	20.9	+20.0	+30.0	+0.8	+0.0	71.7	94.0	-22.3	RF po
								217.6125Mhz	pi/8-16	
39	880.042M	20.8	+20.0	+30.0	+0.8	+0.0	71.6	94.0	-22.4	RF po
								219.9875	pi/8-16	
40	870.386M	20.7	+20.0	+30.0	+0.8	+0.0	71.5	94.0	-22.5	RF po
								217.6125	pi/8	
41	880.045M	20.7	+20.0	+30.0	+0.8	+0.0	71.5	94.0	-22.5	RF po
								219.9875	pi/8	
42	887.980M	20.7	+20.0	+30.0	+0.8	+0.0	71.5	94.0	-22.5	RF po
								221.9875	pi/8-16	
43	879.954M	20.6	+20.0	+30.0	+0.8	+0.0	71.4	94.0	-22.6	RF po
								220.0125	pi/8	

Test Plots









Test Setup Photo(s)



80.211(f) - Radiated Spurious Emissions

Test Setup/Conditions																																
Test Location:	Bothell Lab C3	Test Engineer:	C. Plumadore																													
Test Method:	ANSI C63.26 (2015)	Test Date(s):	9/23/2024-9/26/2024																													
Configuration:	1																															
Test Setup:	The emission mask was built with an RMS Average measurement of the fundamental, Outside of the span shown in the emission mask plots, the following bandwidths were used: <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> For the final tabular converted to dBm uses equation (d) from ANSI C63.26 (2015) 5.2.7: EIRP (dBm) = E (dBμV/m) + 20log(D) – 104.8; where D is the measurement distance (in the far field region) in m. (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; (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 (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. <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 conducted.</td></tr></table> Converting -13dBm EIRP to field strength at 3 meters. E (dBμV/m) = EIRP (dBm)-20Log(D)+104.8 E (dBμV/m) = -13-20Log(3)+104.8 E (dBμV/m)=82.2 Modification #1 & 2 was in place for testing MOD#1 was in place for all intentional emissions except for radiated spurious emissions less than 1GHz, Half rate and full rate.			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 conducted.
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 conducted.																														

Test Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717
 Customer: **Meteorcomm LLC.**
 Specification: **47 CFR §80.211(f) Spurious Emissions**
 Work Order #: **109225** Date: 9/25/2024
 Test Type: **Radiated Scan** Time: 14:09:43
 Tested By: C. Plumadore Sequence#: 5
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Full Rate and Half Rate
 Test Environment Conditions:
 Temperature: 22.1°C
 Humidity: 48.7%
 Pressure: 101.8 kPa

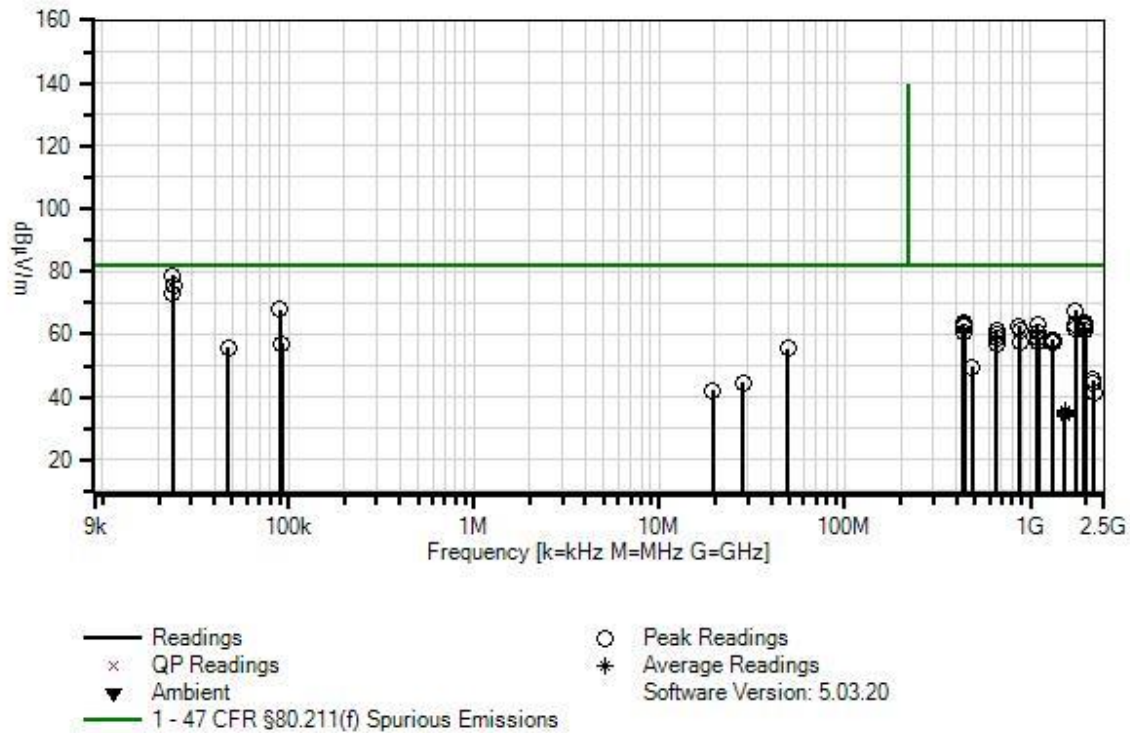
 Frequency: 9k-2500MHz

 Test set up:
 Uploading, downloading files on ethernet
 Receiving GNSS
 Standby receiver

 Test Method: ANSI 63.26

Modification #1 & 2 was in place for testing.
 MOD#1 was in place for all intentional emissions except for radiated spurious emissions less than 1GHz, Half rate and full rate.

Meteorcomm LLC, W/O#: 109225 Sequence#: 5 Date: 9/25/2024
47 CFR §80.211(f) Spurious Emissions Test Distance: 3 Meters Vert



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T5	AN02307	Preamp	8447D	8/9/2023	8/9/2025
T6	AN03803	Spectrum Analyzer	E4440A	2/12/2024	2/12/2026
T7	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T8	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T9	ANP07504	Cable	CLU40-KMKM-02.00F	1/19/2024	1/19/2026
T10	AN00052	Loop Antenna	6502	4/19/2024	4/19/2026

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	23.805k	66.5	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	78.8	82.2	-3.4	Vert
2	24.087k	63.0	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	75.3	82.2 217.6125 half rate	-6.9	paral
3	23.805k	60.4	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	72.7	82.2	-9.5	paral
4	90.357k	58.1	+0.0 +0.0 +0.0	+0.0 +0.0 +9.7	+0.0 +0.0	+0.0 +0.0	+0.0	67.8	82.2	-14.4	paral
5	1740.990M	73.3	+0.0 +0.0 +0.4	+2.1 +0.0 +0.0	+0.0 -35.2	+0.6 +26.5	+0.0	67.7	82.2 217.6125 full rate	-14.5	Vert
6	1741.075M	73.3	+0.0 +0.0 +0.4	+2.1 +0.0 +0.0	+0.0 -35.2	+0.6 +26.5	+0.0	67.7	82.2 217.6125 half rate	-14.5	Vert
7	1958.708M	66.8	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.9	+0.7 +28.1	+0.0	63.5	82.2 217.6125 full rate	-18.7	Vert
8	435.220M	64.9	+23.1 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0	+0.3 +0.0	+0.0	63.4	82.2 217.6125 half rate	-18.8	Horiz
9	1088.048M	73.0	+0.0 +0.0 +0.3	+1.7 +0.0 +0.0	+0.0 -37.0	+0.4 +24.7	+0.0	63.1	82.2 217.6125 full rate	-19.1	Vert
10	1958.278M	66.4	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.9	+0.7 +28.1	+0.0	63.1	82.2 217.6125 half rate	-19.1	Vert
11	435.225M	64.5	+23.1 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0	+0.3 +0.0	+0.0	63.0	82.2 217.6125Mhz full rate	-19.2	Horiz
12	1759.860M	68.2	+0.0 +0.0 +0.4	+2.1 +0.0 +0.0	+0.0 -35.1	+0.6 +26.8	+0.0	63.0	82.2 219.9875 full rate	-19.2	Vert
13	870.435M	56.3	+29.0 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0	+0.4 +0.0	+0.0	62.5	82.2 217.6125 half rate	-19.7	Horiz
14	870.435M	56.2	+29.0 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0	+0.4 +0.0	+0.0	62.4	82.2 217.6125Mhz full rate	-19.8	Horiz
15	1979.938M	65.7	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.9	+0.7 +28.1	+0.0	62.4	82.2 219.9875 full rate	-19.8	Vert

16	439.970M	63.8	+23.0 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	62.2	82.2 219.9875 90% rate full rate	-20.0	Horiz
17	1759.975M	66.7	+0.0 +0.0 +0.4	+2.1 +0.0 +0.0	+0.0 -35.1 +26.8	+0.6 +0.0 +0.0	+0.0	61.5	82.2 219.9875 half rate	-20.7	Vert
18	879.955M	55.4	+28.9 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0	61.5	82.2 219.9875 half rate	-20.7	Horiz
19	1979.932M	64.3	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.9 +28.1	+0.7 +0.0 +0.0	+0.0	61.0	82.2 219.9875 half rate	-21.2	Vert
20	659.962M	57.1	+27.7 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	60.9	82.2 219.9875 half rate	-21.3	Horiz
21	439.975M	62.4	+23.0 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	60.8	82.2 219.9875 half rate	-21.4	Horiz
22	1088.452M	70.5	+0.0 +0.0 +0.3	+1.7 +0.0 +0.0	+0.0 -37.0 +24.7	+0.4 +0.0 +0.0	+0.0	60.6	82.2 217.6125 half rate	-21.6	Vert
23	659.998M	56.0	+27.7 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	59.8	82.2 219.9875 full rate	-22.4	Horiz
24	1100.008M	68.8	+0.0 +0.0 +0.3	+1.7 +0.0 +0.0	+0.0 -36.9 +24.7	+0.4 +0.0 +0.0	+0.0	59.0	82.2 219.9875 half rate	-23.2	Vert
25	652.842M	55.1	+27.6 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	58.8	82.2 217.6125 half rate	-23.4	Horiz
26	1305.620M	66.5	+0.0 +0.0 +0.3	+1.8 +0.0 +0.0	+0.0 -36.1 +25.4	+0.5 +0.0 +0.0	+0.0	58.4	82.2 217.6125 full rate	-23.8	Vert
27	1319.980M	65.9	+0.0 +0.0 +0.3	+1.8 +0.0 +0.0	+0.0 -36.0 +25.4	+0.5 +0.0 +0.0	+0.0	57.9	82.2 219.9875 half rate	-24.3	Vert
28	1319.950M	65.8	+0.0 +0.0 +0.3	+1.8 +0.0 +0.0	+0.0 -36.0 +25.4	+0.5 +0.0 +0.0	+0.0	57.8	82.2 219.9875 full rate	-24.4	Vert
29	1099.948M	67.3	+0.0 +0.0 +0.3	+1.7 +0.0 +0.0	+0.0 -36.9 +24.7	+0.4 +0.0 +0.0	+0.0	57.5	82.2 219.9875 full rate	-24.7	Vert
30	1305.615M	65.5	+0.0 +0.0 +0.3	+1.8 +0.0 +0.0	+0.0 -36.1 +25.4	+0.5 +0.0 +0.0	+0.0	57.4	82.2 217.6125 half rate	-24.8	Vert
31	879.950M	51.2	+28.9 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0	57.3	82.2 219.9875 full rate	-24.9	Horiz
32	652.812M	53.4	+27.6 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	57.1	82.2 217.6125Mhz full rate	-25.1	Horiz

33	91.908k	47.3	+0.0 +0.0 +0.0	+0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	57.0	82.2	-25.2	perp
34	47.775k	45.5	+0.0 +0.0 +0.0	+0.0 +0.0 +10.3	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	55.8	82.2	-26.4	perp
35	49.100M	69.4	+12.7 -27.7 +0.0	+0.3 +0.0 +0.0	+0.5 +0.0 +0.0	+0.1 +0.0 +0.0	+0.0 +0.0 +0.0	55.3	82.2 217.6125Mhz full rate	-26.9	Vert
36	487.100M	50.0	+24.2 -27.9 +0.0	+1.1 +0.0 +0.0	+1.9 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0 +0.0 +0.0	49.6	82.2 217.6125Mhz full rate	-32.6	Vert
37	2176.060M	48.8	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.8 +0.0	+0.7 +28.0 +0.0	+0.0 +0.0 +0.0	45.5	82.2 217.6125 full rate	-36.7	Vert
38	28.239M	37.5	+0.0 +0.0 +0.0	+0.3 +0.0 +6.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	44.5	82.2	-37.7	perp
39	2176.005M	47.6	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.8 +0.0	+0.7 +28.0 +0.0	+0.0 +0.0 +0.0	44.3	82.2 217.6125 half rate	-37.9	Vert
40	19.314M	33.6	+0.0 +0.0 +0.0	+0.2 +0.0 +8.2	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	42.0	82.2	-40.2	perp
41	2199.950M	44.5	+0.0 +0.0 +0.4	+2.4 +0.0 +0.0	+0.0 -34.7 +0.0	+0.7 +28.1 +0.0	+0.0 +0.0 +0.0	41.4	82.2 219.9875 full rate	-40.8	Vert
42	1523.292M Ave	43.0	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	35.7	82.2 217.6125 half rate	-46.5	Vert
43	1539.858M Ave	42.5	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	35.2	82.2 219.9875 half rate	-47.0	Vert
^	1539.858M	78.4	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	71.1	82.2 219.9875 half rate	-11.1	Vert
45	1540.042M Ave	41.7	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	34.4	82.2 219.9875 full rate	-47.8	Vert
^	1540.042M	79.7	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	72.4	82.2 219.9875 full rate	-9.8	Vert
47	1523.243M Ave	41.1	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	33.8	82.2 217.6125 full rate	-48.4	Vert
^	1523.292M	79.3	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	72.0	82.2 217.6125 half rate	-10.2	Vert
^	1523.243M	78.6	+0.0 +0.0 +0.4	+1.9 +0.0 +0.0	+0.0 -35.5 +0.0	+0.5 +25.4 +0.0	+0.0 +0.0 +0.0	71.3	82.2 217.6125 full rate	-10.9	Vert

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE, Suite A • Bothell, WA 98021 • (425) 402-1717
 Customer: **Meteorcomm LLC.**
 Specification: **47 CFR §80.211(f) Spurious Emissions**
 Work Order #: **109225** Date: 10/8/2024
 Test Type: **Radiated Scan** Time: 09:40:22
 Tested By: C. Plumadore Sequence#: 31
 Software: EMITest 5.03.20

Equipment Tested:

Device	Manufacturer	Model #	S/N
Configuration 1			

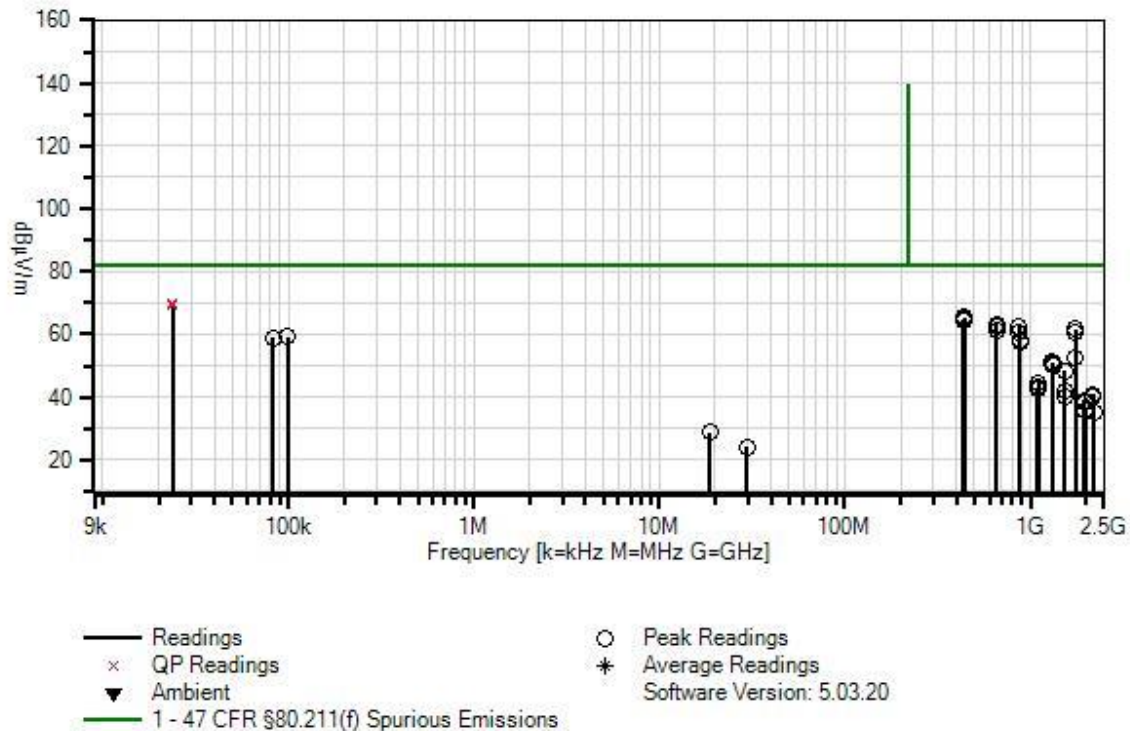
Support Equipment:

Device	Manufacturer	Model #	S/N
Configuration 1			

Test Conditions / Notes:

Pi/8 & Pi/8-16 Test Environment Conditions: Temperature: 22.1°C Humidity: 48.7% Pressure: 101.8 kPa Frequency: 9kHz-2.5GHz Test set up: Uploading, downloading files on ethernet Receiving GNSS Test Method: ANSI 63.26 Modification #1 & 2 was in place for testing MOD#1 was in place for all intentional emissions except for radiated spurious emissions less than 1GHz, Half rate and full rate.

Meteorcomm LLC. W/O#: 109225 Sequence#: 31 Date: 10/8/2024
47 CFR §80.211(f) Spurious Emissions Test Distance: 3 Meters parallel



Test Equipment:

ID	Asset #	Description	Model	Calibration Date	Cal Due Date
T1	AN03824	Biconilog Antenna	3142E	5/9/2023	5/9/2025
T2	ANP05333	Cable	Heliac	8/8/2023	8/8/2025
T3	ANP05360	Cable	RG214	8/8/2023	8/8/2025
T4	ANP06011	Cable	Heliac	11/16/2023	11/16/2025
T5	AN02307	Preamp	8447D	8/9/2023	8/9/2025
	AN03803	Spectrum Analyzer	E4440A	2/12/2024	2/12/2026
T6	AN03540	Preamp	83017A	3/24/2023	3/24/2025
T7	AN02374ANSI	Horn Antenna	RGA-60	5/26/2023	5/26/2025
T8	ANP06515	Cable	Heliac	2/28/2024	2/28/2026
T9	ANP07504	Cable	CLU40-KMKM-02.00F	1/19/2024	1/19/2026
T10	AN00052	Loop Antenna	6502	4/19/2024	4/19/2026

Measurement Data:

Reading listed by margin.

Test Distance: 3 Meters

#	Freq	Rdng	T1 T5 T9	T2 T6 T10	T3 T7	T4 T8	Dist	Corr	Spec	Margin	Polar
	MHz	dBμV	dB	dB	dB	dB	Table	dBμV/m	dBμV/m	dB	Ant
1	23.946k	57.3	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	69.6	82.2 217.6125MHz pi/8-16	-12.6	paral
2	23.805k	56.7	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	69.0	82.2 217.6125MHz pi/8	-13.2	paral
^	23.805k	67.8	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	80.1	82.2 217.6125MHz pi/8	-2.1	paral
^	23.946k	66.5	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	78.8	82.2 217.6125MHz pi/8-16	-3.4	paral
^	23.946k	65.1	+0.0 +0.0 +0.0	+0.0 +0.0 +12.3	+0.0 +0.0	+0.0 +0.0	+0.0	77.4	82.2	-4.8	paral
^	23.664k	55.5	+0.0 +0.0 +0.0	+0.0 +0.0 +12.4	+0.0 +0.0	+0.0 +0.0	+0.0	67.9	82.2	-14.3	paral
7	439.969M	66.9	+23.0 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0	+0.3 +0.0	+0.0	65.3	82.2 219.9875MHz pi/8-16	-16.9	Vert
8	435.220M	66.2	+23.1 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0	+0.3 +0.0	+0.0	64.7	82.2 217.6125MHz pi/8	-17.5	Vert
9	439.978M	66.2	+23.0 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0	+0.3 +0.0	+0.0	64.6	82.2 219.9875Mhz pi/8	-17.6	Vert
10	435.216M	66.0	+23.1 -27.6 +0.0	+1.0 +0.0 +0.0	+1.7 +0.0	+0.3 +0.0	+0.0	64.5	82.2 217.6125MHz pi/8-16	-17.7	Vert
11	659.951M	59.3	+27.7 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0	+0.3 +0.0	+0.0	63.1	82.2 219.9875Mhz pi/8	-19.1	Vert
12	659.940M	59.0	+27.7 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0	+0.3 +0.0	+0.0	62.8	82.2 219.9875MHz pi/8-16	-19.4	Vert
13	652.826M	59.0	+27.6 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0	+0.3 +0.0	+0.0	62.7	82.2 217.6125MHz pi/8-16	-19.5	Vert
14	870.451M	56.3	+29.0 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0	+0.4 +0.0	+0.0	62.5	82.2 217.6125MHz pi/8-16	-19.7	Vert
15	1741.050M	67.1	+0.0 +0.0 +0.4	+0.0 -35.2 +0.0	+0.0 +26.5	+0.6 +2.2	+0.0	61.6	82.2 217.6125MHz pi/8-16	-20.6	Vert

16	652.850M	57.6	+27.6 -27.9 +0.0	+1.3 +0.0 +0.0	+2.4 +0.0 +0.0	+0.3 +0.0 +0.0	+0.0	61.3	82.2 217.6125MHz pi/8	-20.9	Vert
17	870.426M	54.5	+29.0 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0	60.7	82.2 217.6125MHz pi/8	-21.5	Vert
18	1740.633M	66.1	+0.0 +0.0 +0.4	+0.0 -35.2 +0.0	+0.0 +26.5 +2.2	+0.6 +0.0 +0.0	+0.0	60.6	82.2 217.6125MHz pi/8	-21.6	Vert
19	99.005k	49.6	+0.0 +0.0 +0.0	+0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	59.3	82.2	-22.9	paral
20	82.555k	49.3	+0.0 +0.0 +0.0	+0.0 +0.0 +9.7	+0.0 +0.0 +0.0	+0.0 +0.0 +0.0	+0.0	59.0	82.2	-23.2	paral
21	879.953M	52.3	+28.9 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0	58.4	82.2 219.9875MHz pi/8-16	-23.8	Vert
22	879.966M	51.5	+28.9 -27.2 +0.0	+1.5 +0.0 +0.0	+2.5 +0.0 +0.0	+0.4 +0.0 +0.0	+0.0	57.6	82.2 219.9875Mhz pi/8	-24.6	Vert
23	1759.825M	57.9	+0.0 +0.0 +0.4	+0.0 -35.1 +0.0	+0.0 +26.8 +2.2	+0.6 +0.0 +0.0	+0.0	52.8	82.2 219.9875 pi/8	-29.4	Vert
24	1759.833M	57.4	+0.0 +0.0 +0.4	+0.0 -35.1 +0.0	+0.0 +26.8 +2.2	+0.6 +0.0 +0.0	+0.0	52.3	82.2 219.9875MHz pi/8-16	-29.9	Vert
25	1305.833M	59.2	+0.0 +0.0 +0.3	+0.0 -36.1 +0.0	+0.0 +25.4 +1.8	+0.5 +1.8 +0.0	+0.0	51.1	82.2 217.6125MHz pi/8-16	-31.1	Vert
26	1319.817M	58.7	+0.0 +0.0 +0.3	+0.0 -36.0 +0.0	+0.0 +25.4 +1.9	+0.5 +1.9 +0.0	+0.0	50.8	82.2 219.9875MHz pi/8-16	-31.4	Vert
27	1305.475M	58.5	+0.0 +0.0 +0.3	+0.0 -36.1 +0.0	+0.0 +25.4 +1.8	+0.5 +1.8 +0.0	+0.0	50.4	82.2 217.6125MHz pi/8	-31.8	Vert
28	1320.050M	58.0	+0.0 +0.0 +0.3	+0.0 -36.0 +0.0	+0.0 +25.4 +1.9	+0.5 +1.9 +0.0	+0.0	50.1	82.2 219.9875 pi/8	-32.1	Vert
29	1523.346M	55.6	+0.0 +0.0 +0.4	+0.0 -35.5 +0.0	+0.0 +25.4 +2.0	+0.5 +2.0 +0.0	+0.0	48.4	82.2 217.6125MHz pi/8	-33.8	Vert
30	1523.062M	55.1	+0.0 +0.0 +0.4	+0.0 -35.5 +0.0	+0.0 +25.4 +2.0	+0.5 +2.0 +0.0	+0.0	47.9	82.2 217.6125MHz pi/8-16	-34.3	Vert
31	1099.996M	54.4	+0.0 +0.0 +0.3	+0.0 -36.9 +0.0	+0.0 +24.7 +1.7	+0.4 +1.7 +0.0	+0.0	44.6	82.2 219.9875MHz pi/8-16	-37.6	Vert
32	1100.012M	52.9	+0.0 +0.0 +0.3	+0.0 -36.9 +0.0	+0.0 +24.7 +1.7	+0.4 +1.7 +0.0	+0.0	43.1	82.2 219.9875 pi/8	-39.1	Vert

33	1088.254M	52.6	+0.0 +0.0 +0.3	+0.0 -37.0 +0.0	+0.0 +24.7	+0.4 +1.7	+0.0	42.7	82.2 217.6125MHz pi/8- 16	-39.5	Vert
34	1088.062M	52.4	+0.0 +0.0 +0.3	+0.0 -37.0 +0.0	+0.0 +24.7	+0.4 +1.7	+0.0	42.5	82.2 217.6125MHz pi/8	-39.7	Vert
35	1539.938M	48.9	+0.0 +0.0 +0.4	+0.0 -35.5 +0.0	+0.0 +25.4	+0.5 +2.0	+0.0	41.7	82.2 219.9875MHz pi/8- 16	-40.5	Vert
36	2176.200M	44.1	+0.0 +0.0 +0.4	+0.0 -34.8 +0.0	+0.0 +28.0	+0.7 +2.5	+0.0	40.9	82.2 217.6125MHz pi/8	-41.3	Vert
37	1539.938M	47.5	+0.0 +0.0 +0.4	+0.0 -35.5 +0.0	+0.0 +25.4	+0.5 +2.0	+0.0	40.3	82.2 219.9875 pi/8	-41.9	Vert
38	2176.133M	43.4	+0.0 +0.0 +0.4	+0.0 -34.8 +0.0	+0.0 +28.0	+0.7 +2.5	+0.0	40.2	82.2 217.6125MHz pi/8- 16	-42.0	Vert
39	1958.396M	42.3	+0.0 +0.0 +0.4	+0.0 -34.9 +0.0	+0.0 +28.1	+0.7 +2.4	+0.0	39.0	82.2 217.6125MHz pi/8	-43.2	Vert
40	1958.571M	41.8	+0.0 +0.0 +0.4	+0.0 -34.9 +0.0	+0.0 +28.1	+0.7 +2.4	+0.0	38.5	82.2 217.6125MHz pi/8- 16	-43.7	Vert
41	1979.821M	39.3	+0.0 +0.0 +0.4	+0.0 -34.9 +0.0	+0.0 +28.1	+0.7 +2.4	+0.0	36.0	82.2 219.9875 pi/8	-46.2	Vert
42	1979.679M	39.1	+0.0 +0.0 +0.4	+0.0 -34.9 +0.0	+0.0 +28.1	+0.7 +2.4	+0.0	35.8	82.2 219.9875MHz pi/8- 16	-46.4	Vert
43	2199.817M	38.3	+0.0 +0.0 +0.4	+0.0 -34.7 +0.0	+0.0 +28.1	+0.7 +2.5	+0.0	35.3	82.2 219.9875 pi/8	-46.9	Vert
44	2199.717M	37.8	+0.0 +0.0 +0.4	+0.0 -34.7 +0.0	+0.0 +28.1	+0.7 +2.5	+0.0	34.8	82.2 219.9875MHz pi/8- 16	-47.4	Vert
45	18.687M	20.2	+0.0 +0.0 +0.0	+0.0 +0.0 +8.4	+0.0 +0.0	+0.0 +0.2	+0.0	28.8	82.2	-53.4	paral
46	29.582M	17.7	+0.0 +0.0 +0.0	+0.0 +0.0 +6.0	+0.0 +0.0	+0.0 +0.3	+0.0	24.0	82.2	-58.2	paral

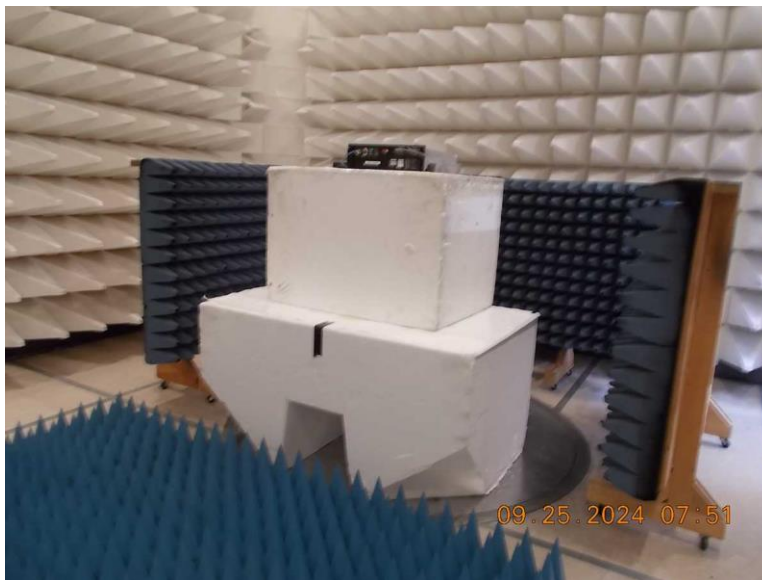
Test Setup Photo(s)



Below 1GHz, Front View



Below 1GHz, Back View



Above 1GHz, 1.5m

Supplemental Information

Measurement Uncertainty

Uncertainty Value	Parameter
5.77 dB	Radiated Emissions
0.673 dB	RF Conducted Measurements
5.77×10^{-10}	Frequency Deviation
0.00005 s	Time Deviation
3.18 dB	Mains Conducted Emissions

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.

End of Report