COMPLIANCE WORLDWIDE INC.
TEST REPORT 162-22

In Accordance with the Requirements of

Federal Communications Commission 47 CFR Part 15.250, Subpart C
Wideband Systems within the band 5925 to 7250 MHz
ISED RSS-220, Issue 1 (March 2009) + Amendment 1 (July 2018)
Devices Using Ultra-Wideband (UWB) Technology

Issued to

Ciholas, Inc.
3700 Bell Road
Newburgh, IN 47630

For the

MU250
UWB Module

FCC ID: 2ALIR-MU250
IC: 26788-MU250

Report Issued on July 29, 2022

Tested by

Sean P. Defelice

Sean P. Defelice

Reviewed by

Larry K. Stillings

Larry K. Stillings

Table of Contents

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1. Scope

This test report certifies that the Ciholas MU250 UWB Module as tested, meets the FCC Part 15.250, Subpart C and ISED Canada RSS-220 requirements. The scope of this test report is limited to the test sample provided by the client, only in as much as that sample represents other production units. If any significant changes are made to the unit, the changes shall be evaluated and a retest may be required.

2. Product Details

2.1. Manufacturer:	Ciholas, Inc.
2.2. Product Name:	MU250 UWB Module
2.3. Model Number:	A02772
2.4. Serial Number:	MU250 FCC2, AN202 (0109030D)
2.5. Description:	The MU250 is part of a wireless system that relies on ultra-wideband (UWB) pulses and time-stamp information to determine real-time location tracking data.
2.6. Power Source:	5 VDC via USB from laptop to AN202 support board
2.7. Hardware Revision:	v1.1
2.8. Software Revision:	N/A
2.9. Modulation Type:	Pulse Modulation, Frequency Hopping
2.10. Operating Frequency:	CH 5 – 6.49 GHz Nominal
2.11. EMC Modifications:	None

3. Product Configuration

3.1 Operational Characteristics & Software

Connect via a virtual USB connection to a laptop. Using the custom embedded firmware configure the module to operate on Channel 5. The module is tested for operation with PRF 16 and PRF 64 at a 6.8 MBPS data rate.

3.2. Cables

Cable Type	Length	Shield	From	To
USB Cable	6M	Yes	EUT	Laptop

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3. Product Configuration (cont.)

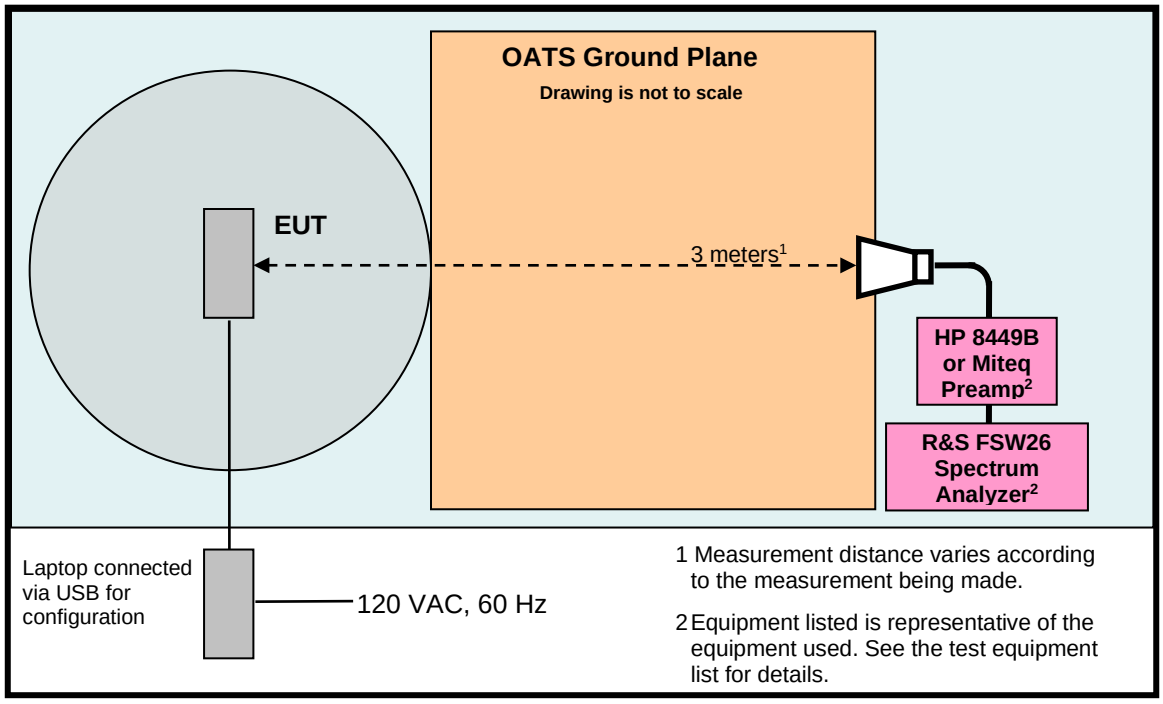
3.3. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Volts	Freq (Hz)	Description/Function
Ciholas	MU250/A02772	FCC2	5	DC	UWB Module

3.4. Support Equipment

Manufacturer	Model/Part # / Options	Serial Number	Input Voltage	Freq (Hz)	Description/Function
Dell	XPS 13 – L321X	41647808737	120	60	For configuring the UWB Module

3.5. Test Setup Diagram



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4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
EMI Test Receiver, 9kHz - 7GHz [1]	Rohde & Schwarz	ESR7	101156	10/25/2022	1 Year
EMI Test Receiver, 10 Hz - 7GHz [1]	Rohde & Schwarz	ESR7	101770	7/23/2022	1 Year
Spectrum Analyzer, 2 Hz to 26.5 GHz[2]	Rohde & Schwarz	FSW26	102057	6/24/2023	2 Years
Spectrum Analyzer, 9 kHz to 40 GHz[3]	Rohde & Schwarz	FSV40	100899	8/12/2022	2 Years
Spectrum Analyzer 10 Hz – 40 GHz[4]	Rohde & Schwarz	FSVR40	100909	9/18/2022	2 Years
Loop Antenna 9 kHz - 30 MHz	EMCO	6512	9309-1139	4/14/2025	3 Years
Biconilog Antenna, 30 MHz - 2 GHz	Sunol Sciences	JB1	A050913	7/1/2023	2 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00143292	5/11/2024	2 Years
Dbl Ridged Guide Antenna 1- 18 GHz	ETS-Lindgren	3117	00227631	4/21/2024	2 Years
Preamplifier 100 MHz to 7 GHz	Miteq	AFS3-00100200-10-15P-4	988773	3/31/2023	1 Year
Preamplifier 100 MHz to 18 GHz	Miteq	AMF-7D-00101800-30-10P	1953081	3/31/2023	1 Year
Preamplifier 2 to 12 GHz	JCA	JCA48-4111B1	7087S	3/31/2023	1 Year
Preamplifier, 1 GHz to 26.5 GHz	Hewlett Packard	8449B	3008A01323	11/30/2023	2 Years
Preamplifier 18 to 40 GHz	Miteq	JSD42-21004200-40-5P	649199/649219	3/31/2023	1 Year
Horn Antenna 18 to 40 GHz	Com Power	AH-840	101032	1/25/2024	2 Years
High Pass Filter 8 to 18 GHz	Micro-Tronics	HPM50107	G036	3/30/2023	1 Year
Barometric Pressure/Humidity & Temp Datalogger	Extech Instruments	SD700	Q590483	10/14/2022	1 Year

[1] ESR7 Firmware revision: V3.48 SP3, Date installed: 09/30/2020 Previous V3.48 SP2, installed 07/23/2020.
[2] FSW26 Firmware revision: V4.71 SP1, Date installed: 11/16/2020 Previous V4.61, installed 08/11/2020.
[3] FSV40 Firmware revision: V2.30 SP4, Date installed: 05/04/2016 Previous V2.30 SP1, installed 10/22/2014.
[4] FSVR40 Firmware revision: V2.23 SP1, Date installed: 08/19/2016 Previous V2.23, installed 10/22/2014.

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4. Measurements Parameters (continued)

4.2. Measurement & Equipment Setup

Test Dates:	12/10/2021, 3/17/2022, 3/22/2022, 4/1/2022, 4/8/2022, 4/11/2022, 4/13/2022, 7/29/2022
Test Engineers:	Sean Defelice
Normal Site Temperature (15 - 35°C):	21.6
Relative Humidity (20 -75%RH):	35
Frequency Range:	30 kHz to 40 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	200 Hz – 10 kHz to 150 kHz 9 kHz – 10 to 30 MHz 120 kHz - 30 MHz to 1 GHz 1 MHz - Above 1 GHz
EMI Receiver Avg Bandwidth:	≥ 3 * RBW or IF(BW)
Detector Function:	Peak, Quasi-Peak, RMS & CISPR Average

4.3. Measurement Procedure

Test measurements were made in accordance FCC Parts 15.209, 15.250 Subpart C, and ISED RSS-220.

The test methods used to generate the data is this test report is in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

4.4. Measurement Uncertainty

The following uncertainties are expressed for an expansion/coverage factor of K=2.

RF Frequency (out of band)	$\pm$ 1x10^{-8}
Radiated Emission of Transmitter to 100 GHz	$\pm$ 4.55 dB
Radiated Emission of Receiver	$\pm$ 4.55 dB
Temperature	$\pm$ 0.91^{o} C
Humidity	$\pm$ 5%

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5. Measurements Summary

Test Requirement	FCC Rule Requirement	ISED Rule Requirement	Test Report Section	Result	Comment
Antenna Requirement	15.203	RSS-220 5.1 (b)	6.1	Compliant	
Operational Requirements	15.250 (a)	RSS-220	6.2	Compliant	
Wideband Bandwidth	15.250 (b)	RSS-220 2 RSS-220 5.1	6.3	Compliant	
Spurious Radiated Emissions	15.250 (d) (1) 15.209	RSS-220 3.4	6.4	Compliant	
Radiated Emissions in GPS Bands	15.250 (d) (2)	RSS-220 5.3.1 (e)	6.5	Compliant	
RMS Power in a 1 MHz Bandwidth	15.250 (d) (1)	RSS-220 5.3.1 (d)	6.6	Compliant	
Peak Emissions in a 50 MHz Bandwidth	15.250 (d) (3)	RSS-220 5.3.1 (g)	6.7	Compliant	
Conducted Emissions	15.207	RSS-GEN	6.8	N/A	
99% Emission Bandwidth	N/A	RSS-GEN	6.9	Compliant	

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6. Measurement Data

6.1. Antenna Requirement (15.203, RSS-220 5.1 (b))

Requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply

Result: Compliant, the antenna utilized by the product is a PCB etched board antenna.

6.2. Operational Requirements of the Device under Test (15.250 (a), RSS-220)

Requirement: The -10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925 to 7250 MHz band under all conditions of operation including the effects from stepped frequency, frequency hopping or other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Note: The widest bandwidth from the two PRFs was used.

Result: Compliant

6.2.1 Frequency Stability over Temperature

Temp °C	Measured Frequency	-10 dB Band Edges		15.250 Frequency Band		Result
	(MHz)	Lower	Upper	F_{MIN} (MHz)	F_{MAX} (MHz)	
OATS	6506	6214.3	6790.7	5925	7250	Compliant
Ambient	6500	6163.3	6865.6	5925	7250	Compliant
-20	6500	6122.4	6903.6	5925	7250	Compliant
-10	6500	6144.4	6896.6	5925	7250	Compliant
0	6500	6145.4	6871.6	5925	7250	Compliant
+10	6500	6166.3	6865.6	5925	7250	Compliant
+20	6500	6164.3	6863.6	5925	7250	Compliant
+30	6500	6163.3	6859.6	5925	7250	Compliant
+40	6500	6169.3	6837.7	5925	7250	Compliant
+50	6500	6169.3	6838.7	5925	7250	Compliant

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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220, 5.1)

Requirements: FCC: The -10 dB bandwidth of the fundamental emission shall be at least 50 MHz.

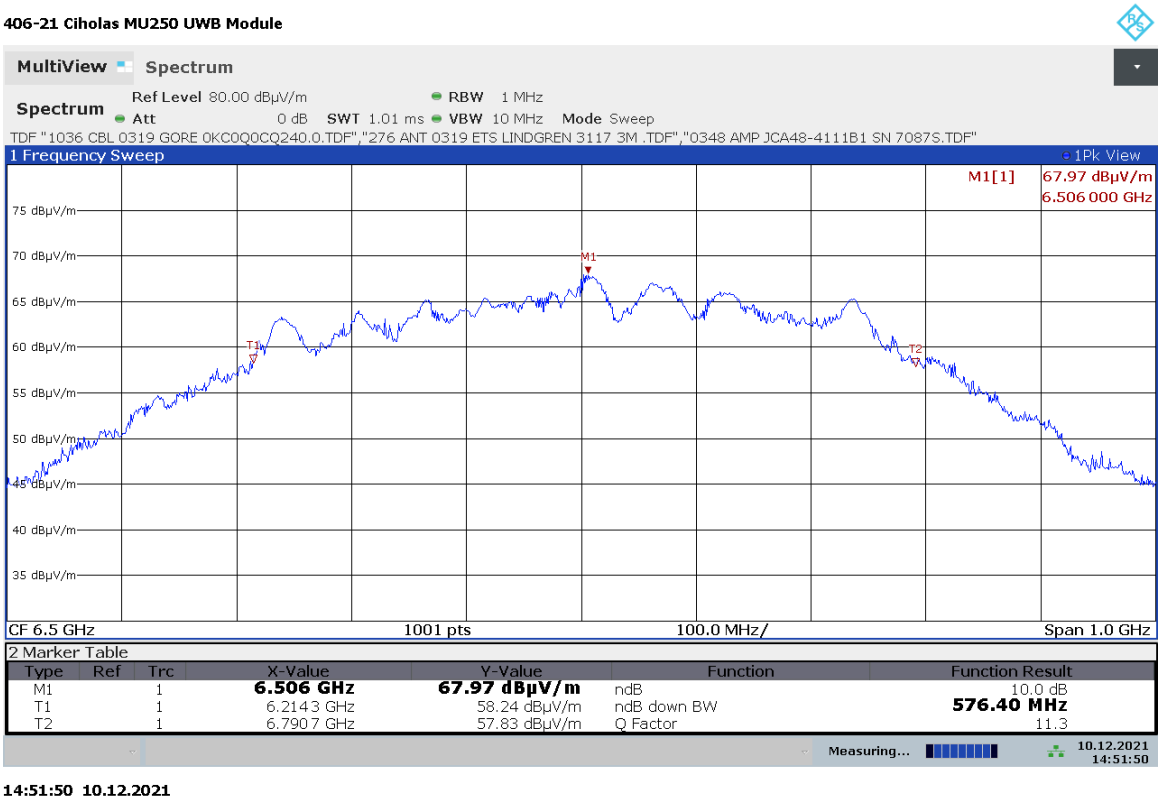
ISED: A UWB device is an intentional radiator that has either a -10 dB bandwidth of at least 500 MHz or a -10 dB fractional bandwidth greater than 0.2. The -10 dB bandwidth of the device shall be totally contained in the band 3.1-10.6 GHz.

Result: Compliant

6.3.1. Measurement Data – Values in GHz

f_M	The highest emission peak	6.506
f_L	10 dB below the highest peak	6.2143
f_H	10 dB above the highest peak	6.7907
Bandwidth	Calculated: (f_H - f_L)	0.5764

6.3.2. Measurement Plot of 10 dB frequencies, 16M PRF



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6. Measurement Data (continued)

6.3. Wideband Bandwidth (15.250 (b), RSS-220, 5.1 continued)

6.3.3. Measurement Data – Values in GHz

f_M	The highest emission peak	6.488
f_L	10 dB below the highest peak	6.2103
f_H	10 dB above the highest peak	6.7907
Bandwidth	Calculated: (f_H - f_L)	0.5804

6.3.4. Measurement Plot of 10 dB frequencies, 64M PRF

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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), 15.209, RSS-220 3.4)

Requirement: The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 - 1990	-63.3	31.9
1990 - 3100	-61.3	33.9
3100 – 5925	-51.3	43.9
5925 – 7250	-41.3	53.9
7250 – 10,600	-51.3	43.9
Above 10,600	-61.3	33.9

Spurious Radiated Emissions (RSS-220 5.3.1 (d))

Requirement: The radiated emissions at or below 960 MHz from a device shall not exceed the limits in Section 3.4. The radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 – 4750	-70.0	25.2
4750 – 10,600	-41.3	53.9
Above 10,600	-61.3	33.9

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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), 15.209, RSS-220 3.4 continued)

Radiated Emissions Field Strength Limits at 3 Meters (Section 15.250 (d),15.209)

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
0.009 to 0.490	2,400/F	128.5 to 93.8
0.490 to 1.705	24,000/F	73.8 to 63
1.705 - 30	30	69.5
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
960 - 40,000	500	54

Test Notes: Refer to Section 4.1 for the test equipment used.

Frequency Range:	30 kHz to 40 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	200 Hz – 10 kHz to 150 kHz 9 kHz – 150 kHz to 30 MHz 120 kHz – 30 MHz to 1 GHz 1 MHz – Above 1 GHz
EMI Receiver Avg Bandwidth (minimum):	≥ 3 * RBW or IF(BW)
Detector Function:	Peak, Quasi-Peak & Average

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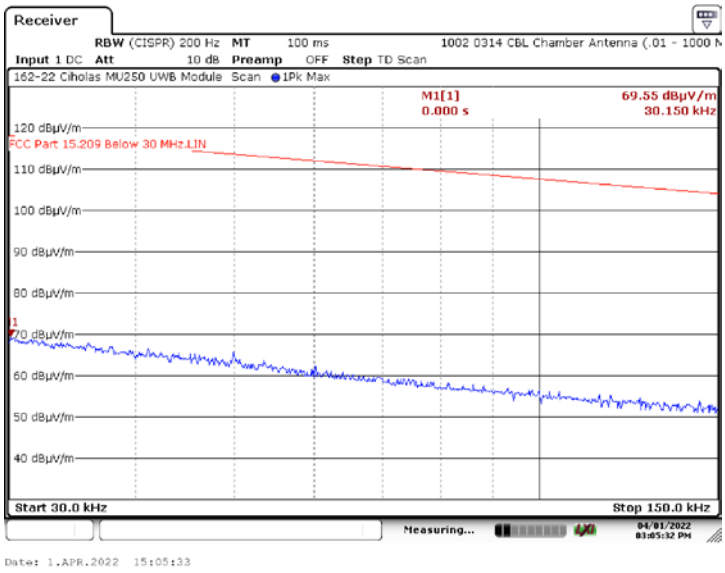
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

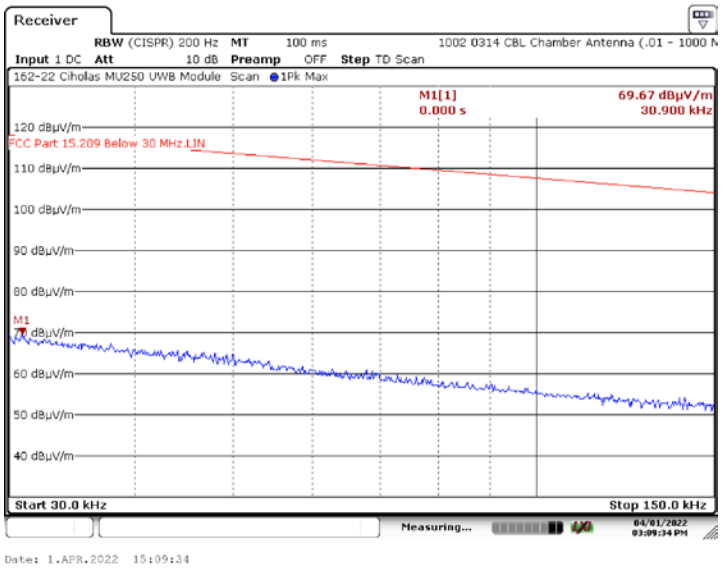
6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.1 Parallel Measurement Antenna – 30 to 150 kHz



6.4.1.2 Perpendicular Measurement Antenna – 30 to 150 kHz



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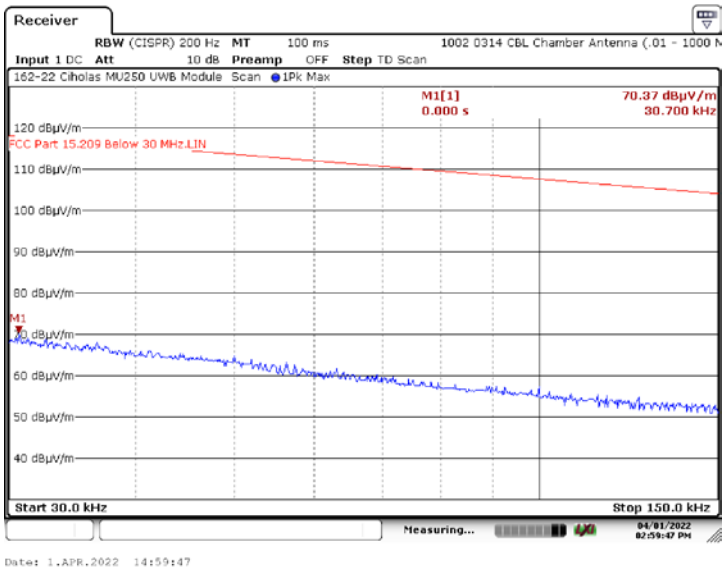
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.3 Ground Parallel Measurement Antenna – 30 to 150 kHz



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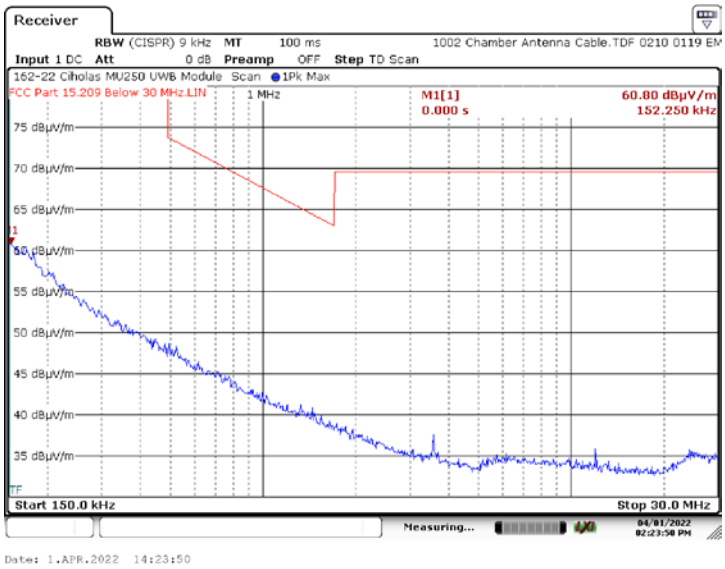
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

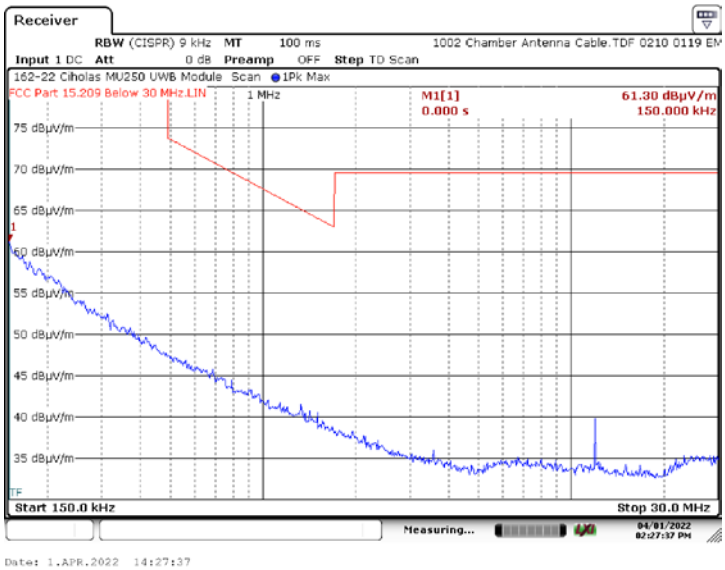
6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.4 Parallel Measurement Antenna – 150 kHz to 30 MHz



6.4.1.5 Perpendicular Measurement Antenna – 150 kHz to 30 MHz



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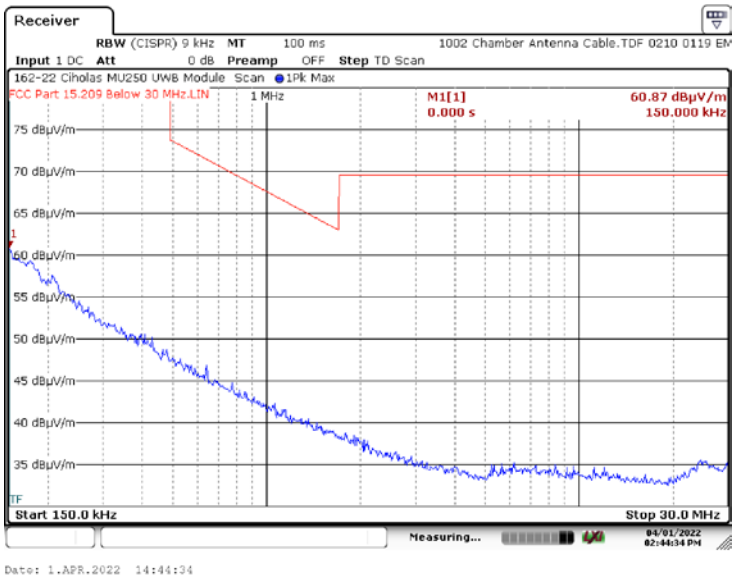
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

The device was prescreened in our 3 Meter Semi-Anechoic Chamber. There were no measurable emissions below 960 MHz on our 3 Meter OATS.

6.4.1.6 Ground Parallel Measurement Antenna – 150 kHz to 30 MHz



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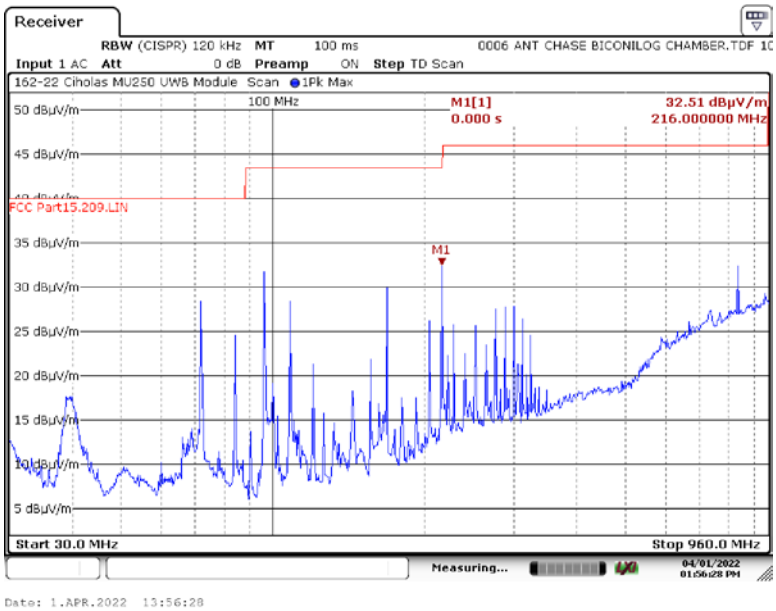
6. Measurement Data (continued)

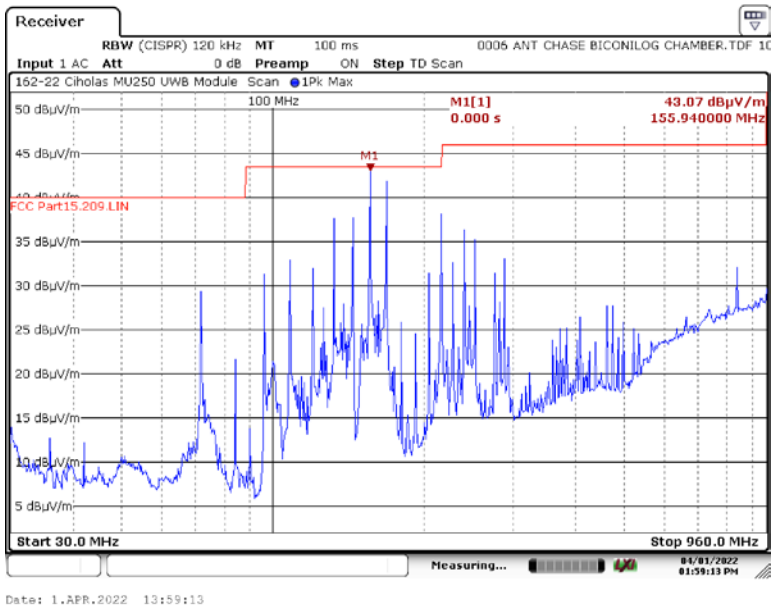
6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

6.4.1.7 Horizontal Polarity – 30 to 960 MHz – 16M PRF



6.4.1.8 Vertical Polarity – 30 to 960 MHz – 16M PRF



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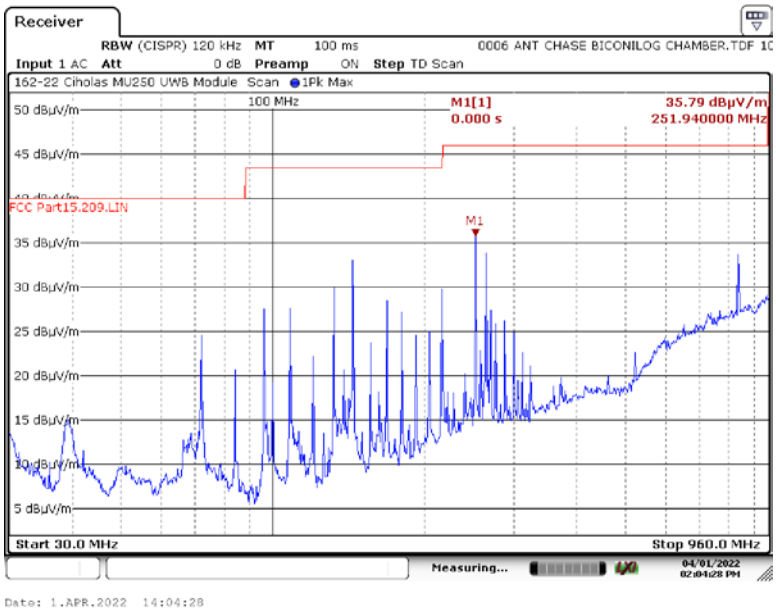
6. Measurement Data (continued)

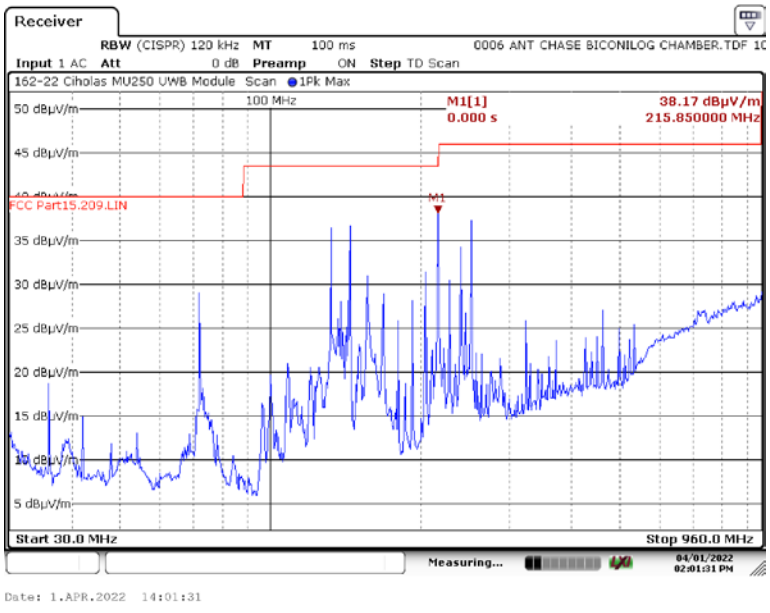
6.4. Spurious Radiated Emissions (15.250 (d) (5), 15.209, RSS-220 3.4 continued)

6.4.1. 30 kHz to 960 MHz, measured at 3 Meters

6.4.1.9 Horizontal Polarity – 30 to 960 MHz – 64M PRF



6.4.1.10 Vertical Polarity – 30 to 960 MHz – 64M PRF



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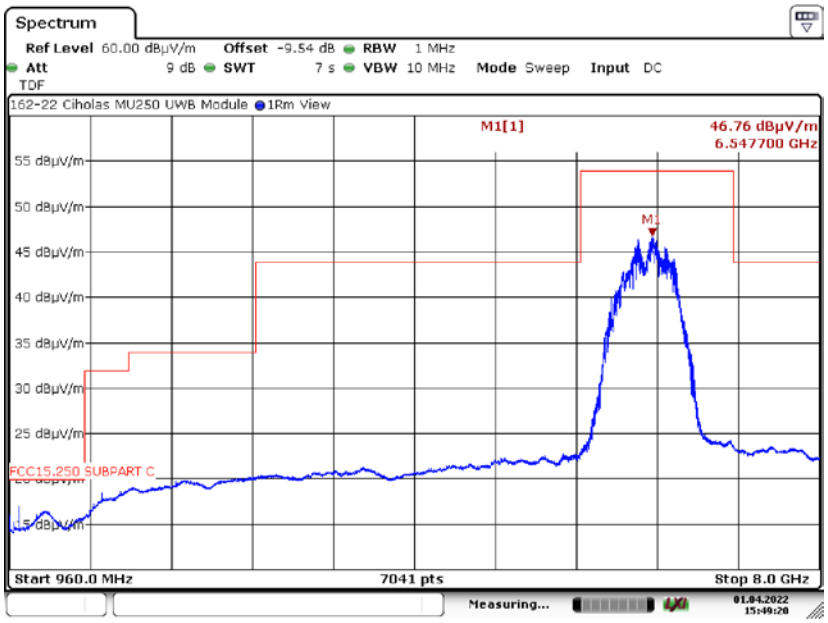
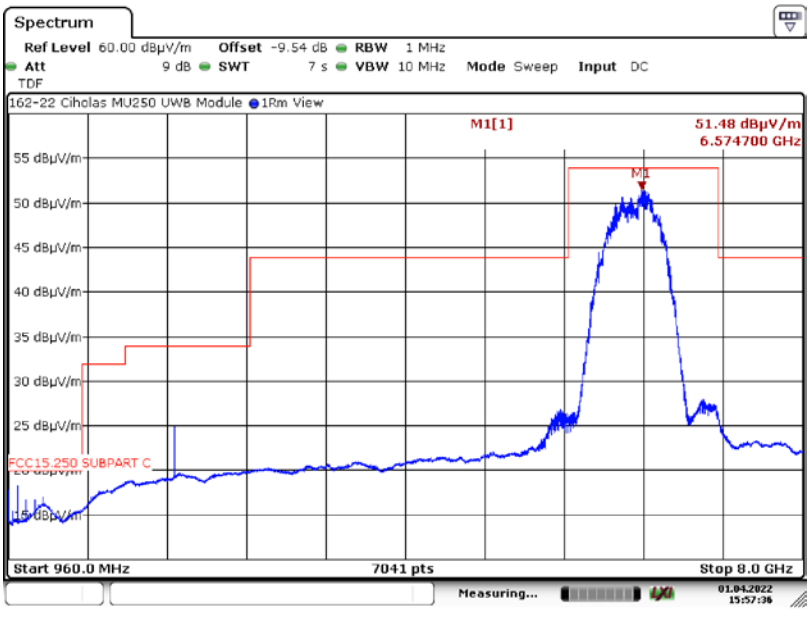
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1(d))

6.4.11. 960 MHz to 8 GHz Horizontal at 1 Meter – 16M PRF



6.4.12. 960 MHz to 8 GHz Vertical at 1 Meter – 16M PRF



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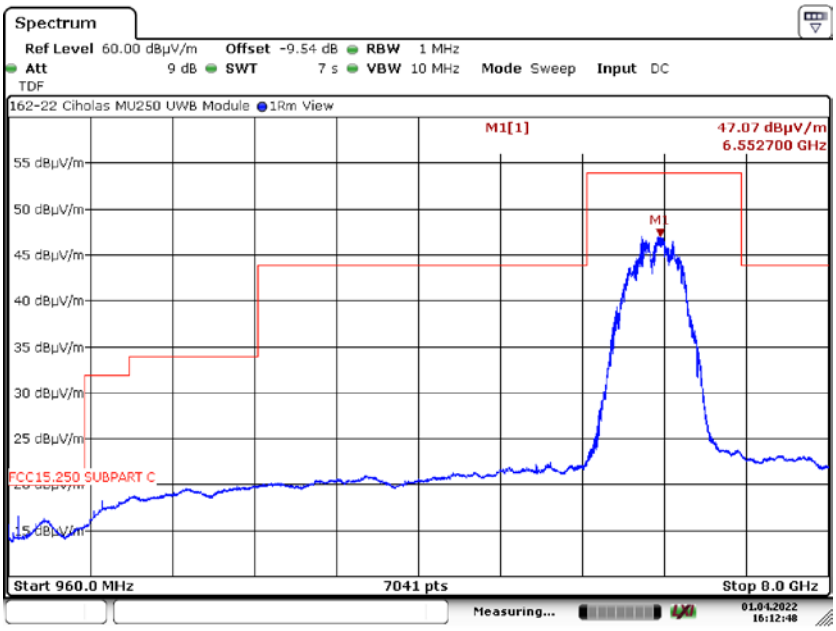
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1(d))

6.4.13. 960 MHz to 8 GHz Horizontal at 1 Meter – 64M PRF



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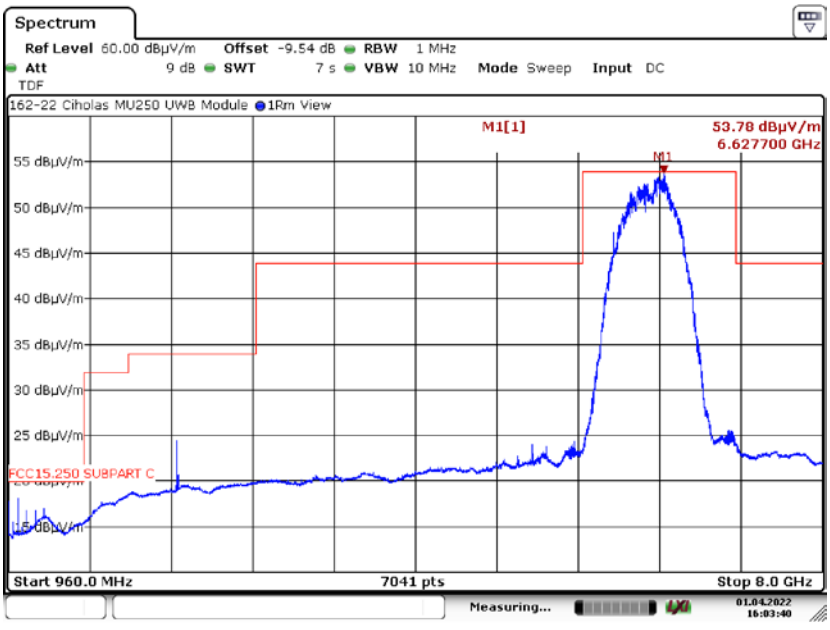
6.4.14. 960 MHz to 8 GHz Vertical at 1 Meter – 64M PRF



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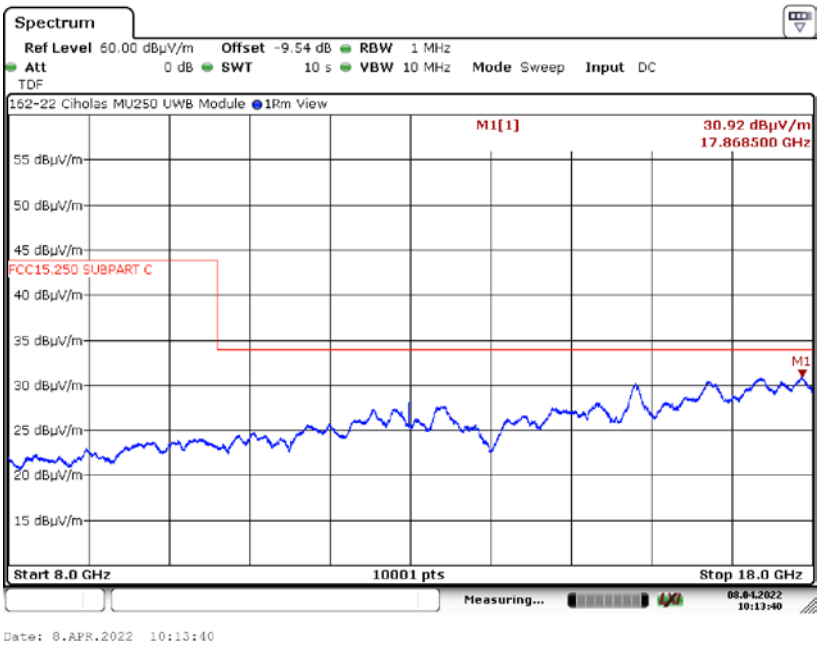
6. Measurement Data (continued)

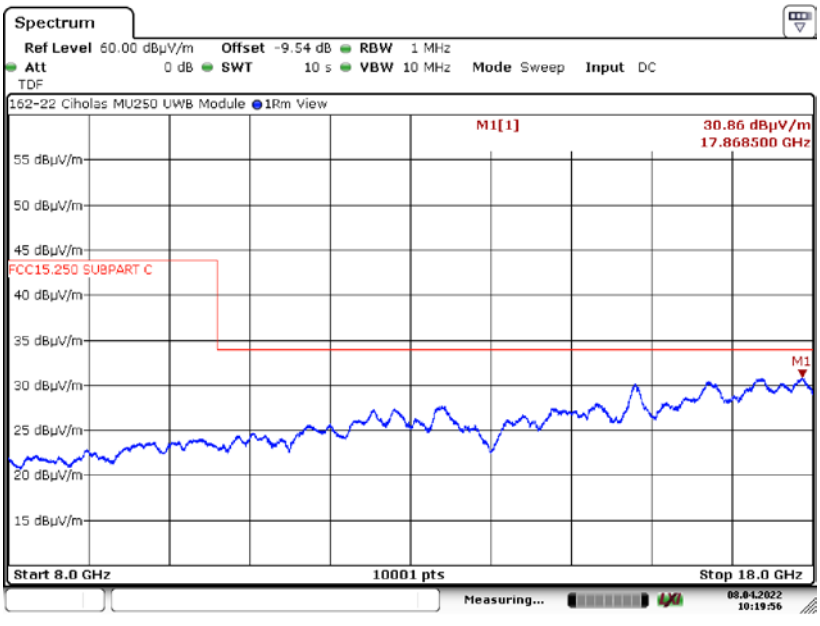
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.15. 8 to 18 GHz Horizontal at 1 Meter – 16M PRF



Date: 8.APR.2022 10:13:40

6.4.16. 8 to 18 GHz Vertical at 1 Meter – 16M PRF



Date: 8.APR.2022 10:19:56

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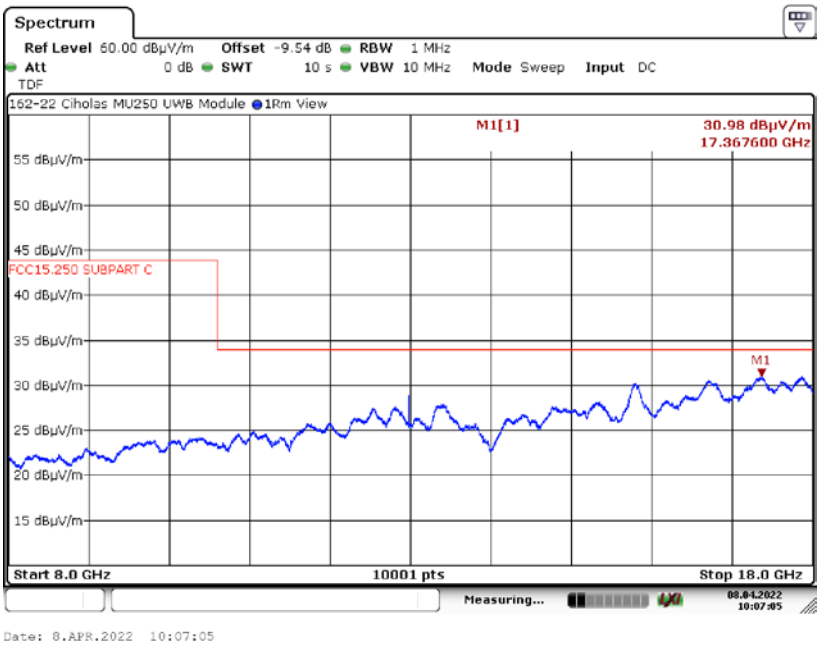
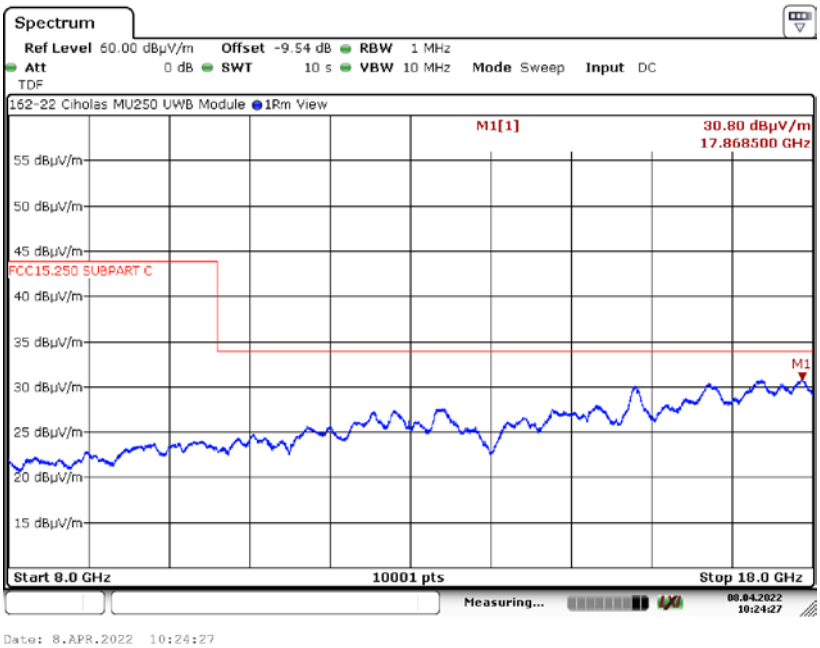
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.17. 8 to 18 GHz Horizontal at 1 Meter – 64M PRF



6.4.18. 8 to 18 GHz Vertical at 1 Meter – 64M PRF



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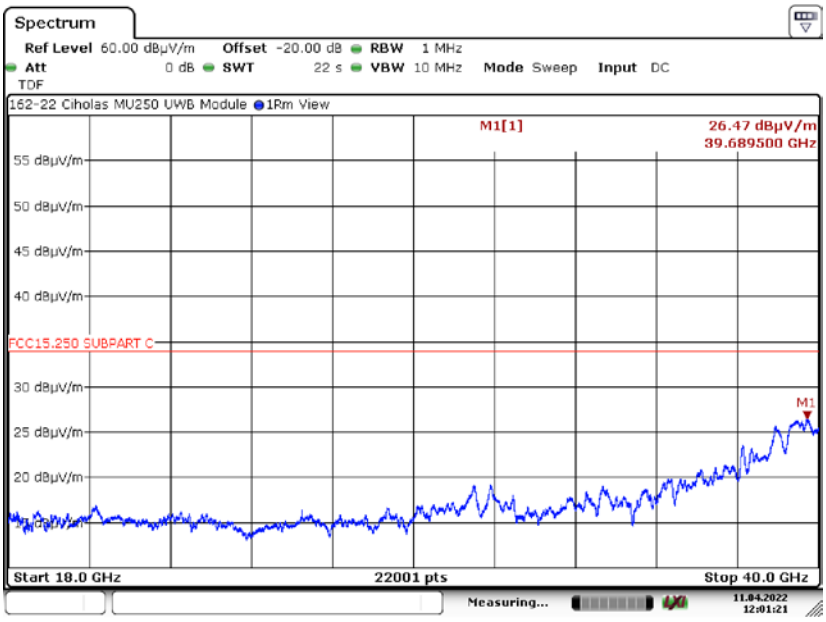
6. Measurement Data (continued)

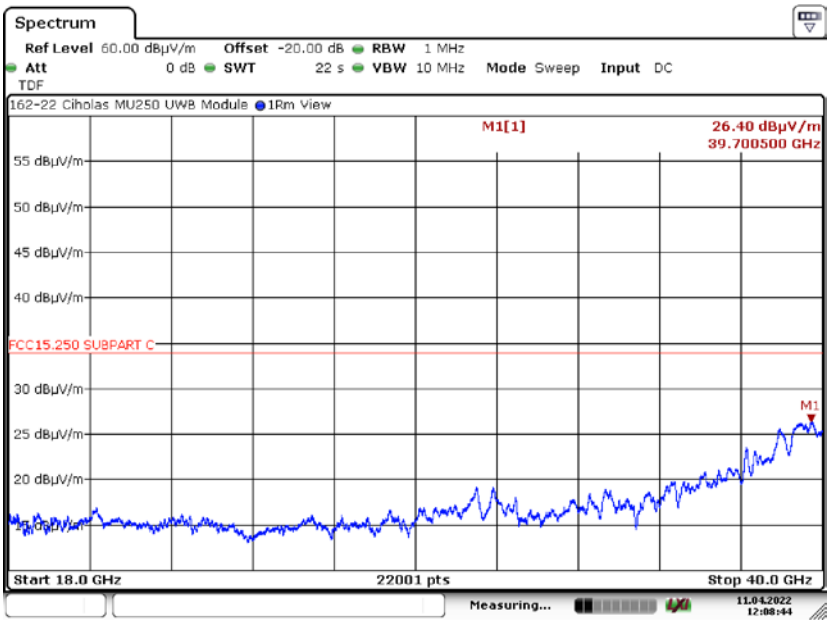
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.19. 18 to 40 GHz Horizontal at 0.3 Meter – 16M PRF



Date: 11.APR.2022 12:01:21

6.4.20. 18 to 40 GHz Vertical at 0.3 Meter – 16M PRF



Date: 11.APR.2022 12:08:44

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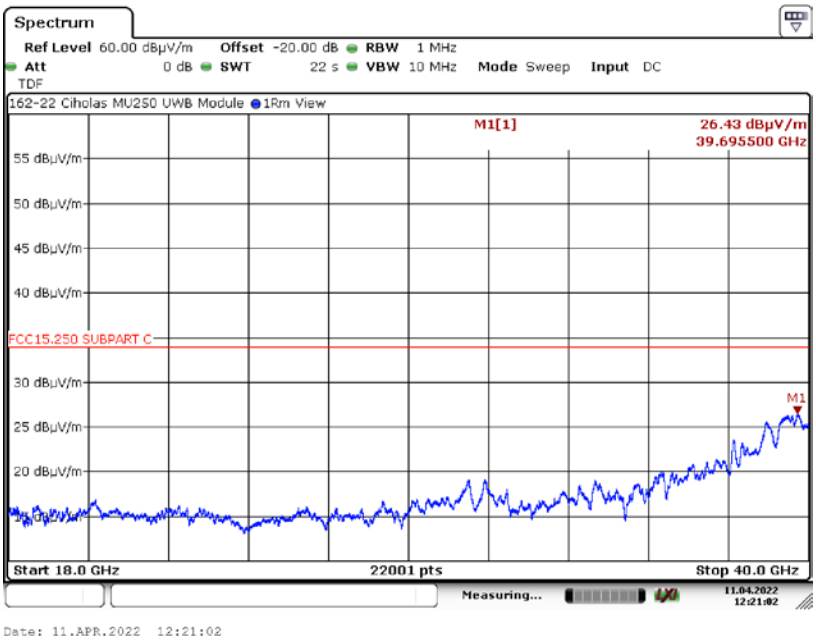
6. Measurement Data (continued)

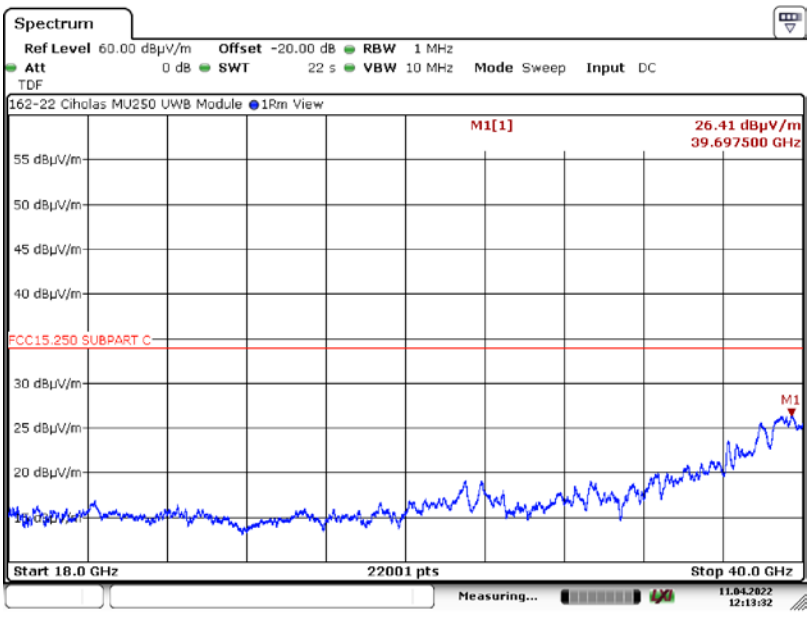
6.4. Spurious Radiated Emissions (15.250 (d) (1), RSS-220 5.3.1 (d) continued)

6.4.21. 18 to 40 GHz Horizontal at 0.3 Meter – 64M PRF



Date: 11.APR.2022 12:21:02

6.4.22. 18 to 40 GHz Vertical at 0.3 Meter – 64M PRF



Date: 11.APR.2022 12:13:32

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6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (RSS-220 5.3.1 (d) Continued)

Requirement: The radiated emissions at or below 960 MHz from a device shall not exceed the limits in Section 3.4. The radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
960 - 1610	-75.3	19.9
1610 – 4750	-70.0	25.2
4750 – 10,600	-41.3	53.9
Above 10,600	-61.3	33.9

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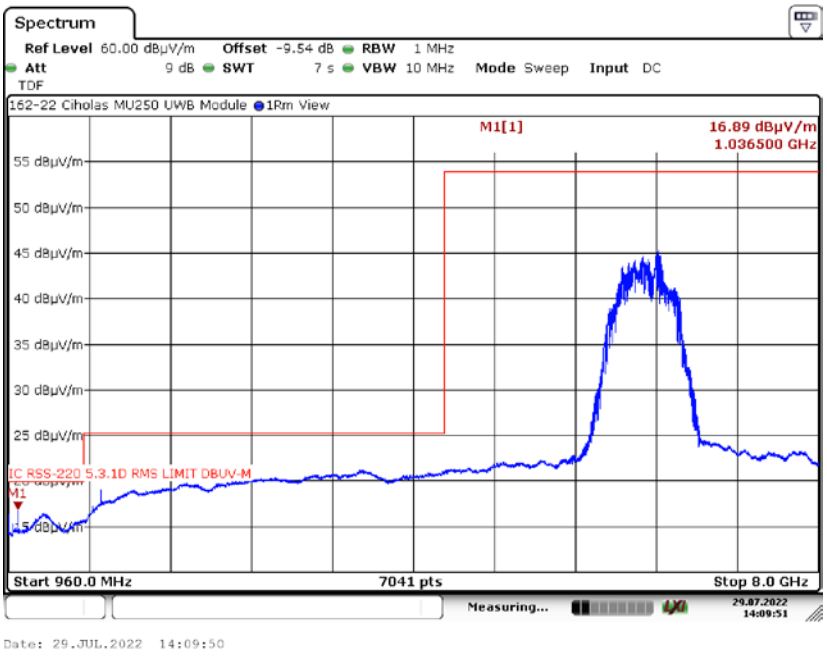
6. Measurement Data (continued)

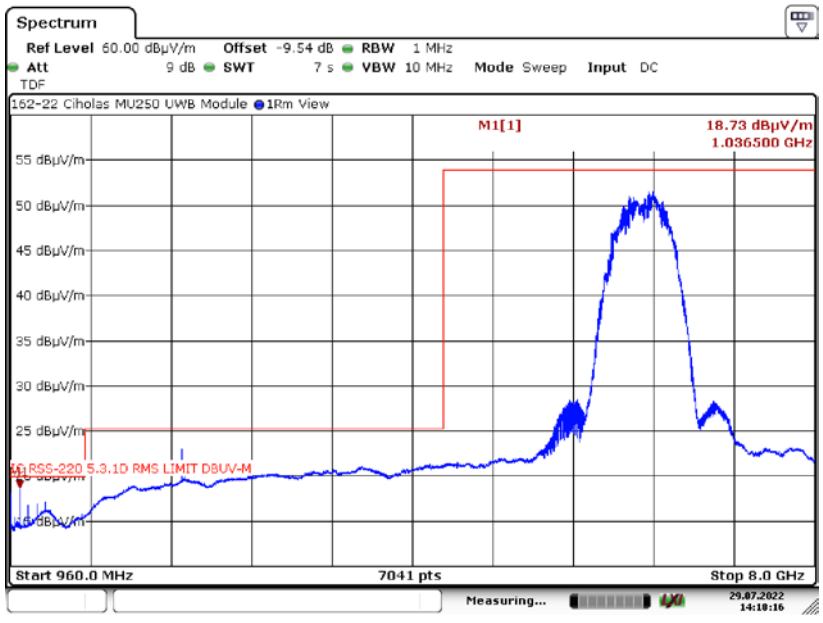
6.4. Spurious Radiated Emissions (RSS-220 5.3.1(d) Continued)

6.4.23. 960 MHz to 8 GHz Horizontal at 1 Meter – 16M PRF



Date: 29.JUL.2022 14:09:50

6.4.24. 960 MHz to 8 GHz Vertical at 1 Meter – 16M PRF



Date: 29.JUL.2022 14:10:16

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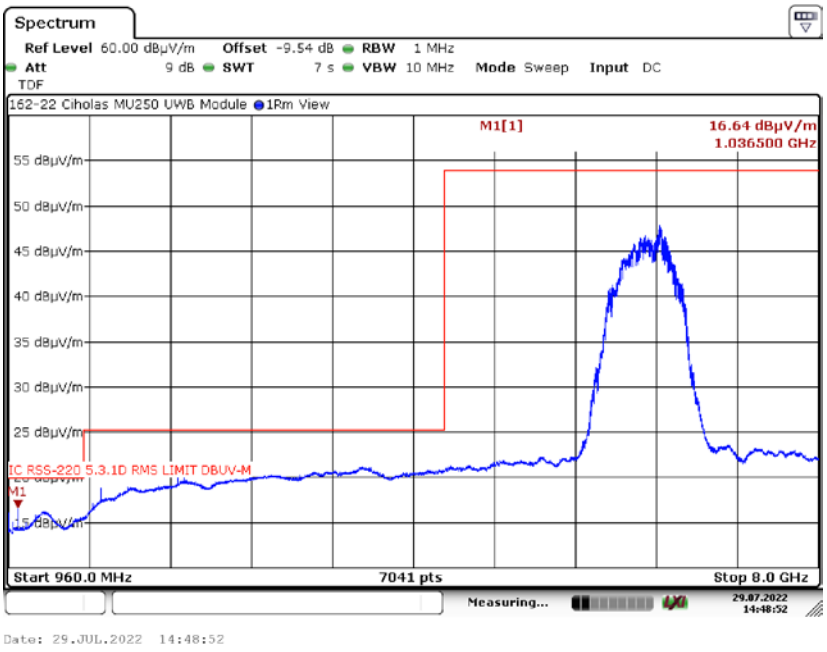
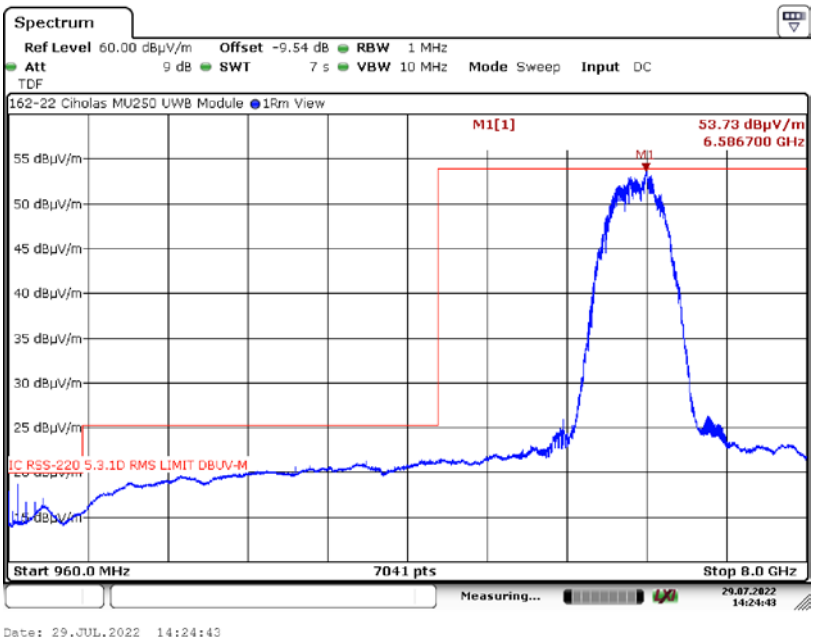
6. Measurement Data (continued)

6.4. Spurious Radiated Emissions (RSS-220 5.3.1(d) Continued)

6.4.25. 960 MHz to 8 GHz Horizontal at 1 Meter – 64M PRF



6.4.26. 960 MHz to 8 GHz Vertical at 1 Meter – 64M PRF



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6. Measurement Data (continued)

6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

Requirement: In addition to the radiated emission limits specified in the table in paragraph (d) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
1164 - 1240	-85.3	9.9
1559 - 1610	-85.3	9.9

6.5.1. Measurement & Equipment Setup

EMI Receiver IF Bandwidth:	1 kHz
EMI Receiver Avg Bandwidth:	10 kHz
Detector Function:	RMS

6.5.2. Test Procedure

Test measurements were made in accordance with ANSI C63.10:2013, American National Standard for Testing Unlicensed Wireless Devices.

6.5.3. 1164 to 1240 MHz & 1559 to 1610 MHz

There were no broadband emissions related to the UWB transmitter. Measured signals were narrowband and related to the microprocessor / clocks and do not fall under the requirements of this section.

At 3 Meters the -85.3 dBm limit is converted to a field strength limit of 9.9 dBuV/m using a distance correction factor of 95.2.

A distance correction factor of -9.54 dB was entered into the analyzer as an offset since the measurements were made at 1 meter.

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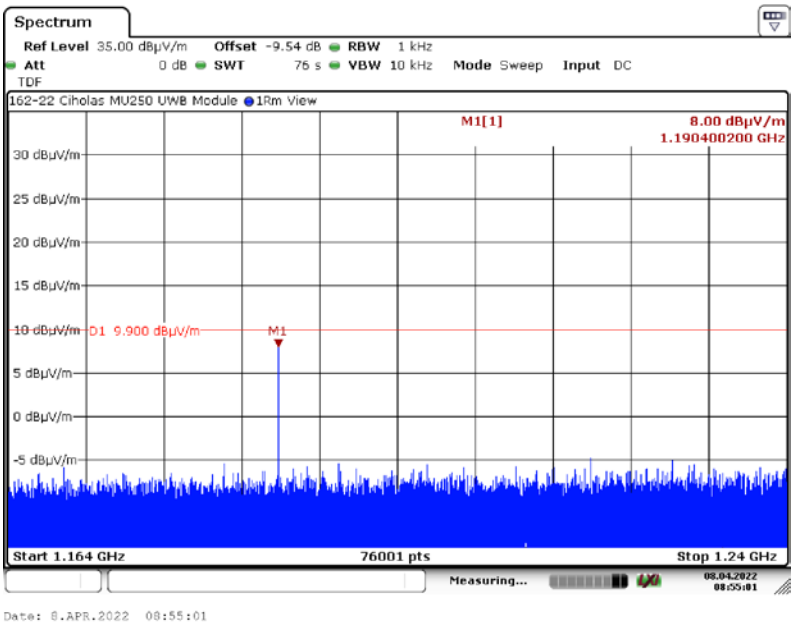
6. Measurement Data (continued)

6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

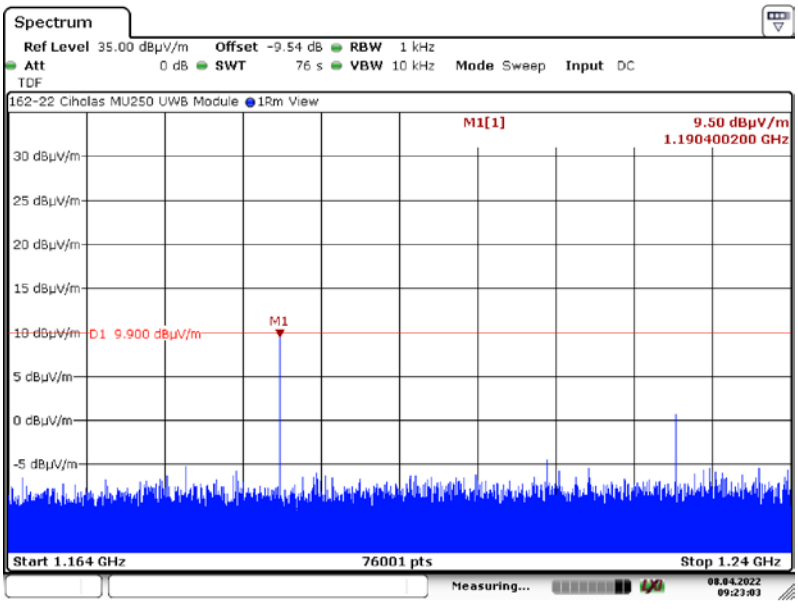
6.5.4 1164 to 1240 MHz Band

6.5.4.1 Horizontal Measurement Polarity 1164 to 1240 MHz – 16M PRF



Date: 8.APR.2022 08:55:01

6.5.4.2 Vertical Measurement Polarity 1164 to 1240 MHz – 16M PRF



Date: 8.APR.2022 09:23:03

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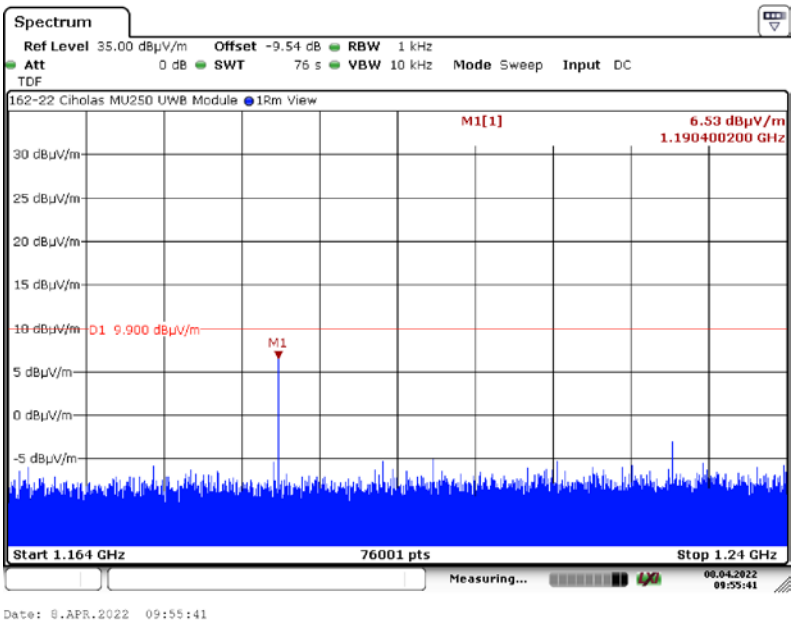
6. Measurement Data (continued)

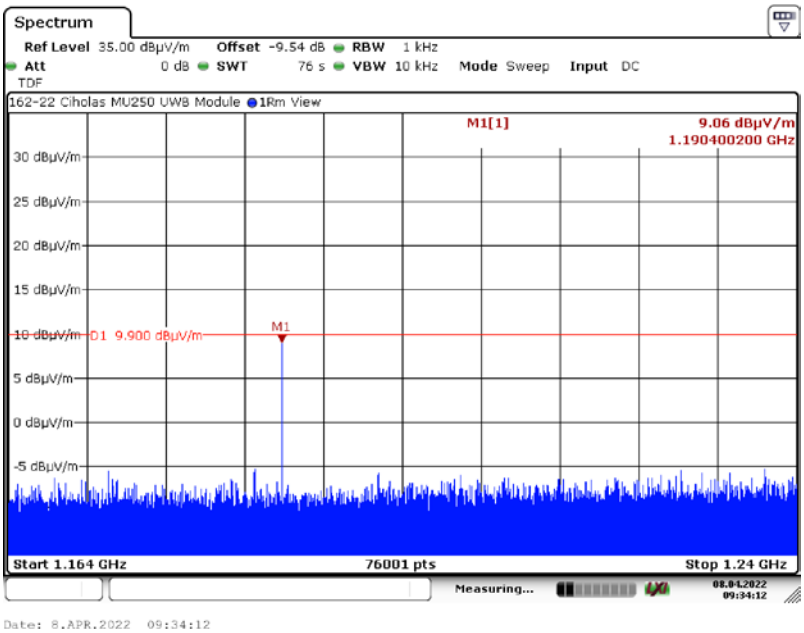
6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

6.5.4 1164 to 1240 MHz Band

6.5.4.3 Horizontal Measurement Polarity 1164 to 1240 MHz – 64M PRF



6.5.4.4 Vertical Measurement Polarity 1164 to 1240 MHz – 64M PRF



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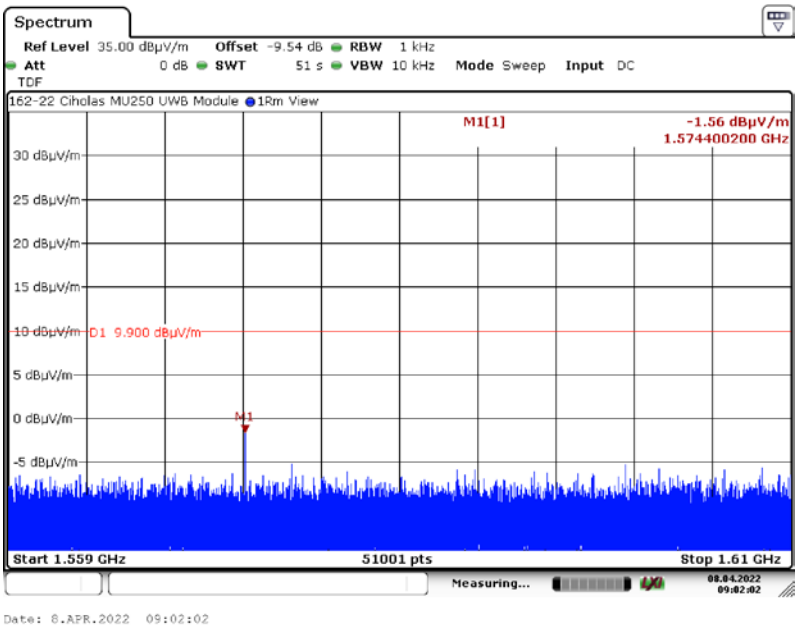
6. Measurement Data (continued)

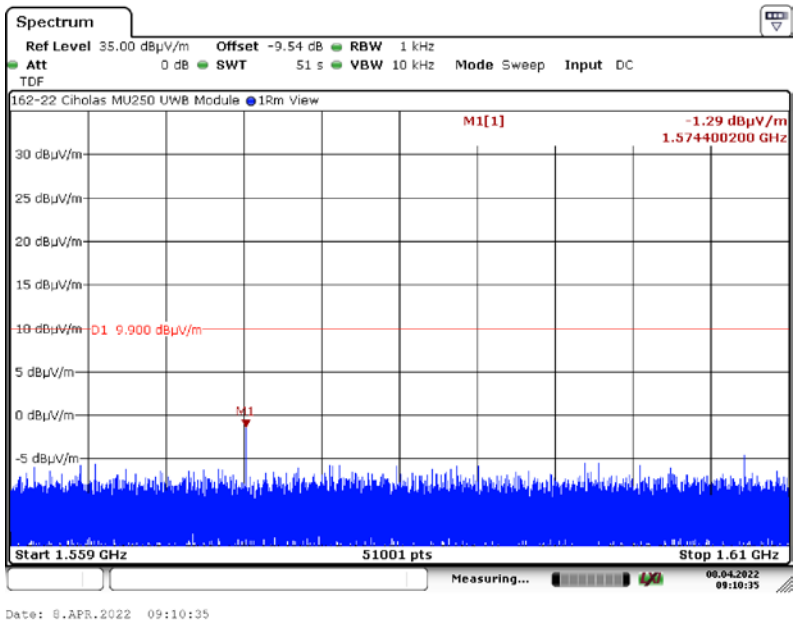
6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

6.5.5 1559 to 1610 MHz Band

6.5.5.1 Horizontal Measurement Polarity 1559 to 1610 MHz – 16M PRF



6.5.5.2 Vertical Measurement Polarity 1559 to 1610 MHz – 16M PRF



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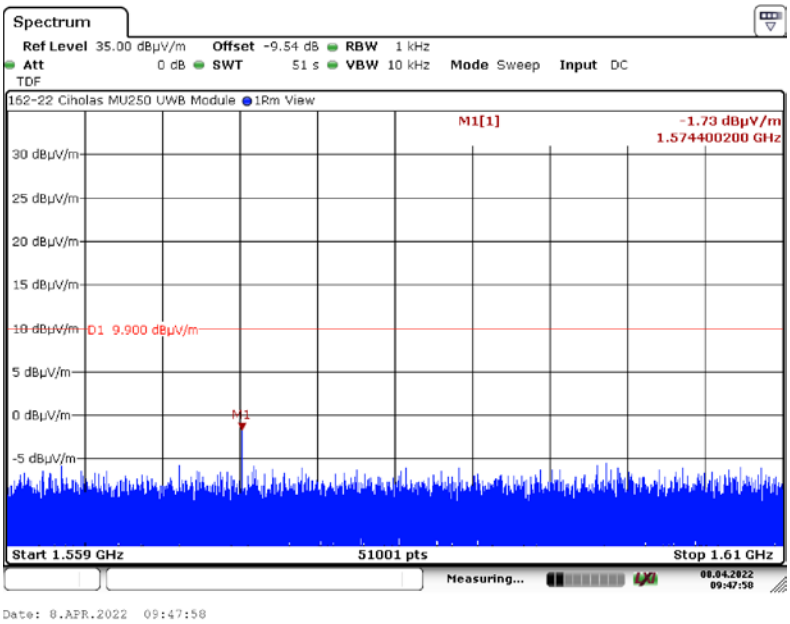
6. Measurement Data (continued)

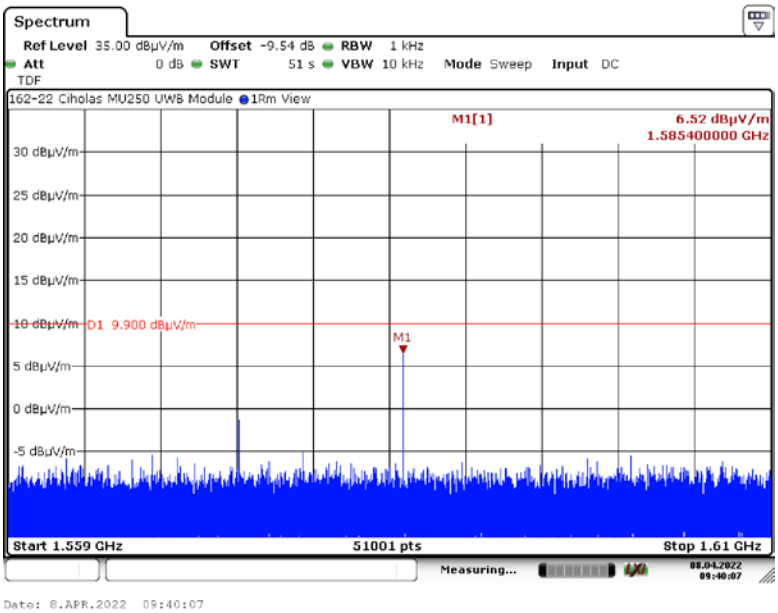
6.5. Spurious Radiated Emissions in GPS Bands (15.250 (d) (2), RSS-220 5.3.1 (e))

6.5.5 1559 to 1610 MHz Band

6.5.5.3 Horizontal Measurement Polarity 1559 to 1610 MHz – 64M PRF



6.5.5.4 Vertical Measurement Polarity 1559 to 1610 MHz – 64M PRF



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
5925 - 7250	-41.3	53.9

Frequency Range:	6 to 7 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	1 MHz
EMI Receiver Avg Bandwidth	10 MHz
Detector Function:	RMS 1 mS Average

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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.4900	51.45	53.90	-2.45	V	147	136	Compliant

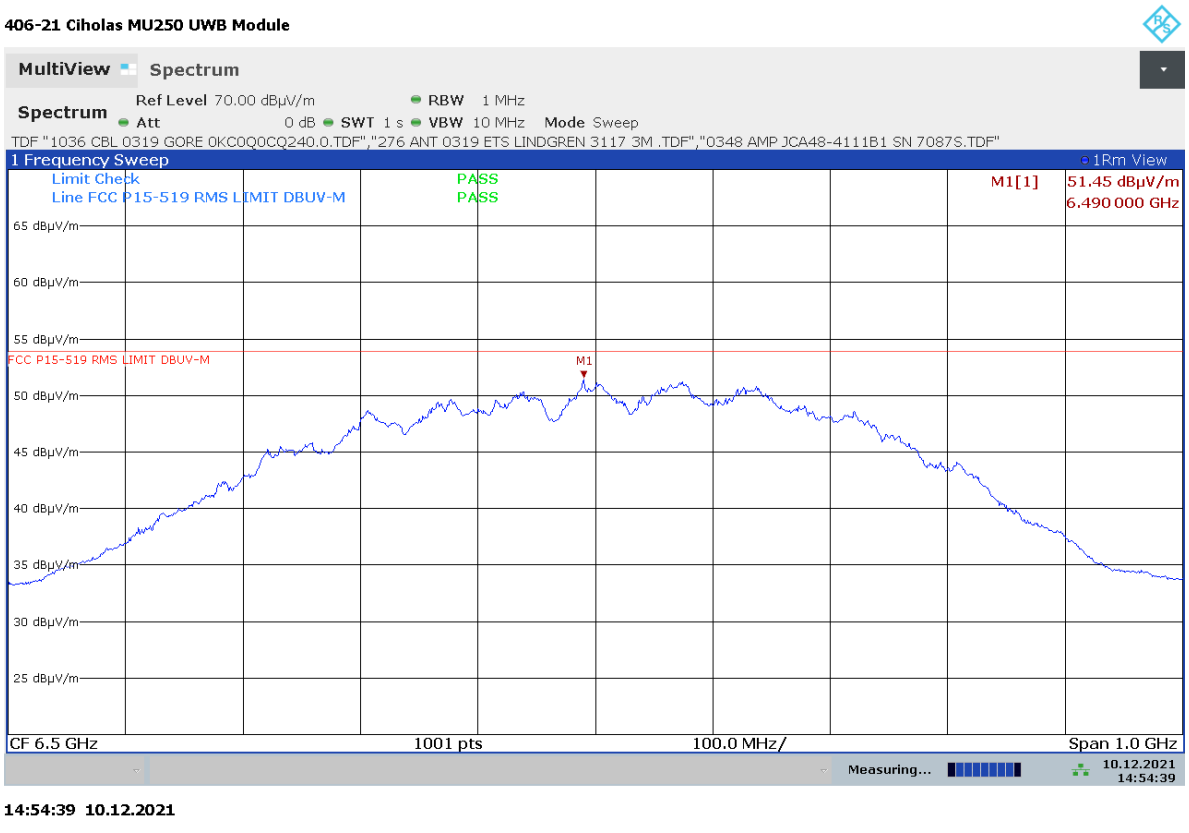
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.4900	-43.75	-41.30	-2.45	V	147	136	Compliant

6.6.1. Plot of RMS Power at 3 Meters, 16M PRF



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6. Measurement Data (continued)

6.6. RMS Power in a 1 MHz Bandwidth (15.250 (d) (1), RSS-220 5.3.1 (d))

Requirement: The limit for operation in the 5925 to 7250 MHz band is -41.3 dBm EIRP.

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.4900	53.66	53.90	-0.24	V	147	136	Compliant

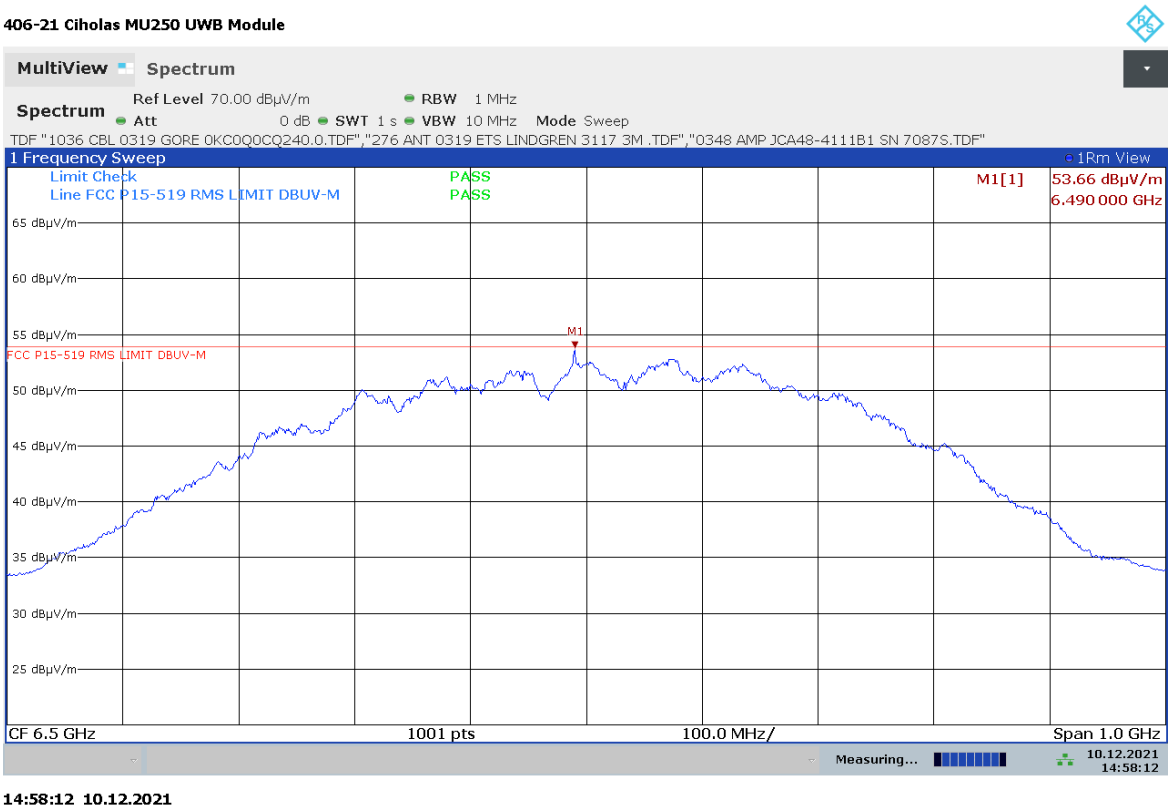
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.4900	-41.54	-41.30	-0.24	V	147	136	Compliant

6.6.2. Plot of RMS Power at 3 Meters, 64M PRF



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

The EIRP in terms of dBm, can be converted to a field strength, in dBµV/m at 3 Meters by adding 95.2.

Frequency (MHz)	EIRP (dBm)	EIRP at 3 Meters (dBµV/m)
5925 - 7250	0	95.2

Frequency Range:	6 to 7 GHz
Measurement Distance:	3 Meters
EMI Receiver IF Bandwidth:	50 MHz
EMI Receiver Avg Bandwidth	80 MHz
Detector Function:	Peak, Max Held

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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.496	94.69	95.20	-0.51	V	147	136	Compliant

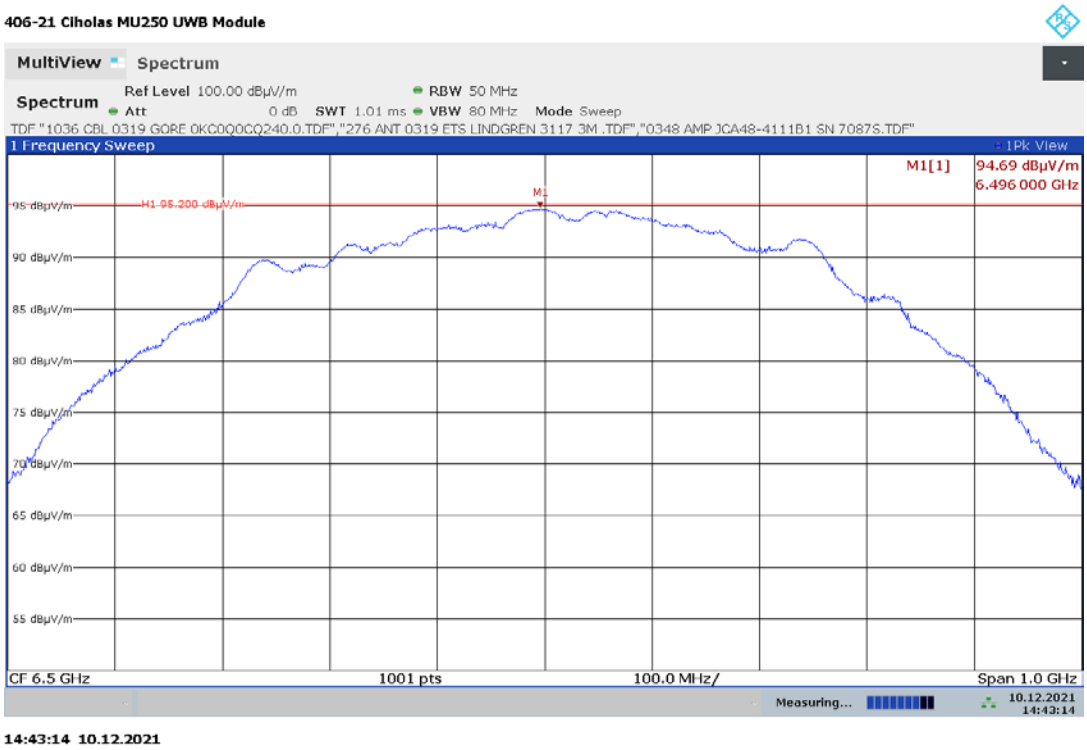
Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3

EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.496	-0.51	0.00	-0.51	V	147	136	Compliant

6.7.1 Plot of Peak Power at 3 Meters, 64M PRF



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6. Measurement Data (continued)

6.7. Peak Emissions in a 50 MHz Bandwidth (15.250 (d) (3), RSS-220 5.3.1 (g))

Requirement: There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP.

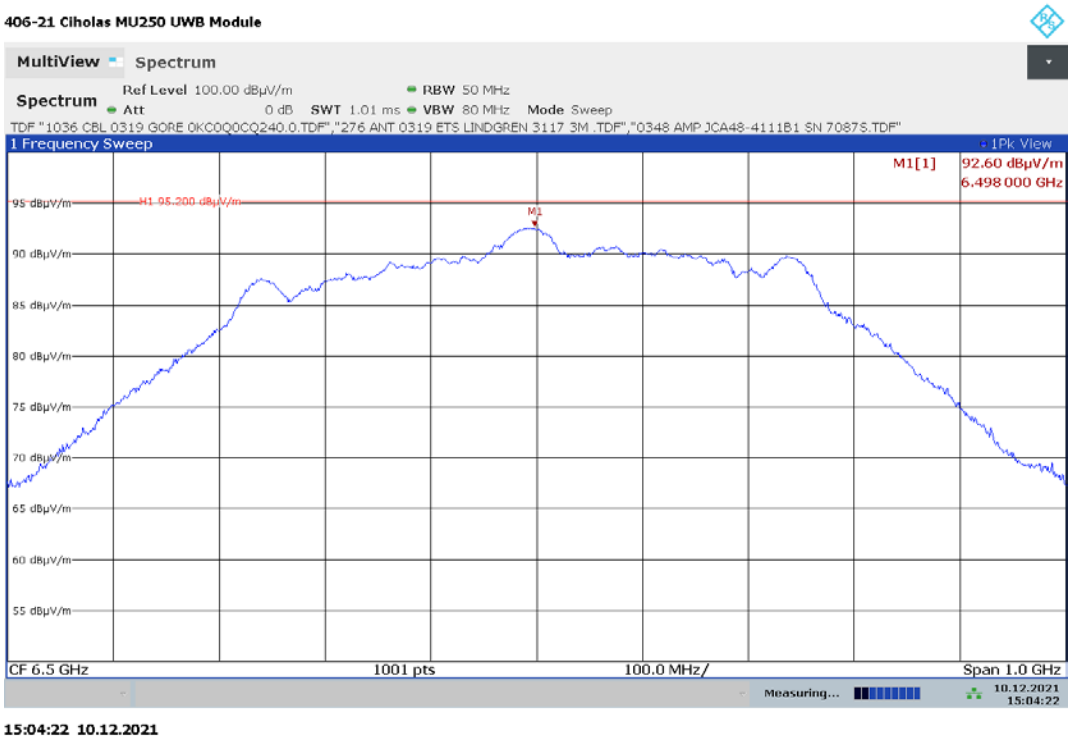
Frequency (GHz)	Amplitude[1]	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBµV/m)	(dBµV/m)	(dB)	H/V	cm	Deg	
6.498	92.60	95.20	-2.60	V	147	136	Compliant

Notes: [1] Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

Equation (22) from ANSI C63.10-2013, EIRP = E_{meas} + 20 log (d_{meas}) – 104.7; d_{meas} = 3
EIRP (dBm) = E_{meas} (dBµV/m) – 95.2

Frequency (GHz)	Amplitude[1] (dBm)	Limit (dBm)	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	EIRP	EIRP	(dB)	H/V	cm	Deg	
6.498	-2.60	0.00	-2.60	V	147	136	Compliant

6.7.2 Plot of Peak Power at 3 Meters, 64M PRF



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6. Measurement Data (continued)

6.8 Conducted Emissions Test Setup

6.8.1. Regulatory Limit: FCC Part 15.207, RSS-Gen

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-Peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50
* Decreases with the logarithm of the frequency.		

6.8.2 Measurement Equipment and Software Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due
EMI Receiver	Rohde & Schwarz	ESR7	101156	10/25/2023
LISN	EMCO	3825/2	9109-1860	1/4/2023
Manufacturer	**Software Description**		**Title/Model #**	**Rev.**
Compliance Worldwide	Test Report Generation Software		Test Report Generator	1.0

6.8.3. Measurement & Equipment Setup

Test Date:	N/A
Test Engineer:	N/A
Site Temperature (°C):	N/A
Relative Humidity (%RH):	N/A
Frequency Range:	0.15 MHz to 30 MHz
EMI Receiver IF Bandwidth:	9 kHz
EMI Receiver Avg Bandwidth:	≥ 3 * RBW or IF(BW)
Detector Functions:	Peak, Quasi-Peak. & Average

6.8.4. Test Procedure

Test measurements were made in accordance with ANSI C63.4-2014, Standard Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronics Equipment in the Range of 9 kHz to 40 GHz.

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6. Measurement Data (continued)

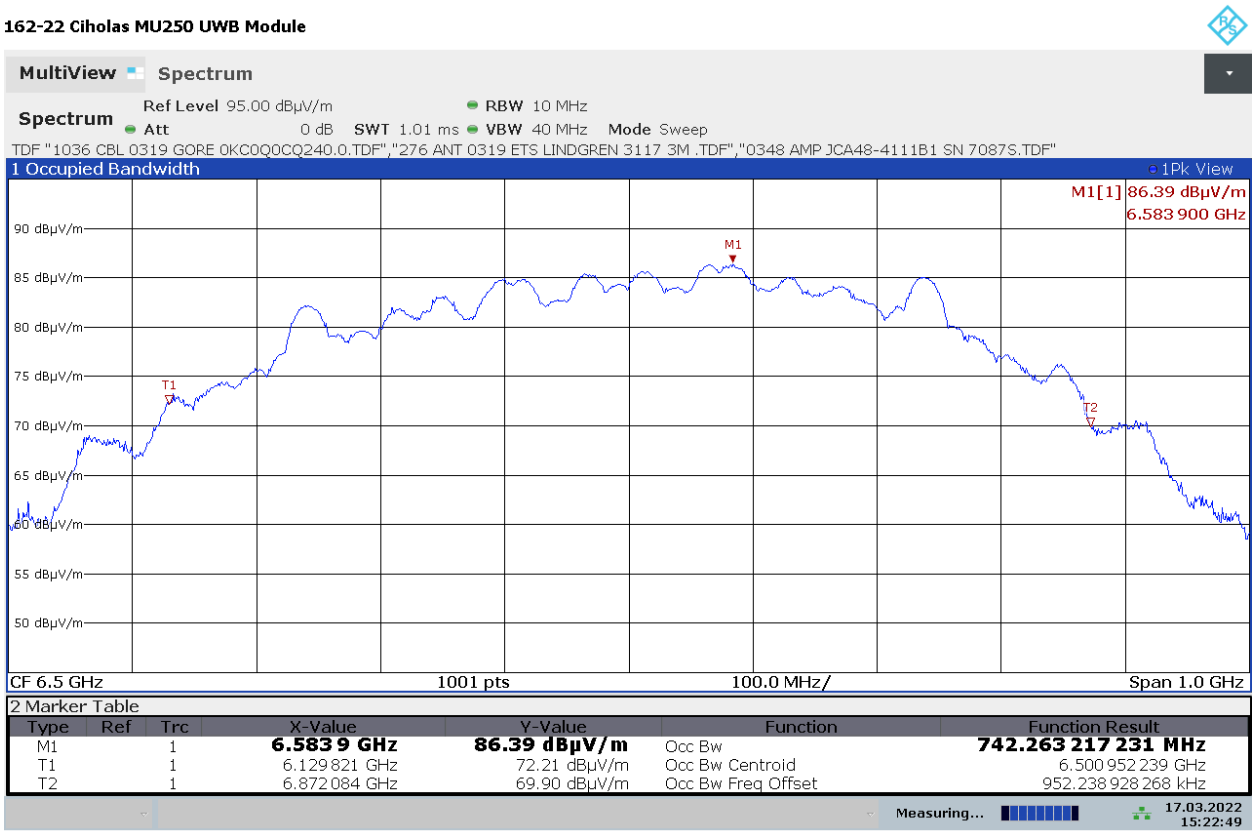
6.9. 99% Emission Bandwidth (RSS-GEN 6.7)

Requirement: The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs RSS-Gen, Section 6.7.

Test Note: The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

6.9.1 Plot of 99% Emission Bandwidth, 16M PRF 742.26 MHz



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6. Measurement Data (continued)

6.9. 99% Emission Bandwidth (RSS-GEN 6.7)

Requirement: The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs RSS-Gen, Section 6.7.

Test Note: The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

6.9.2 Plot of 99% Emission Bandwidth, 64M PRF 718.26 MHz

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7. Test Site Description

Compliance Worldwide is located at 357 Main Street in Sandown, New Hampshire. The test sites at Compliance Worldwide are used for conducted and radiated emissions testing in accordance with the Federal Communications Commission (FCC) and Industry Canada standards. Through our American Association for Laboratory Accreditation (A2LA) ISO Guide 17025 Accreditation our test sites are designated with the FCC (designation number **US1091**), Industry Canada (file number **IC 3023A-1)** and VCCI (Member number 3168) under registration number A-0274.

Compliance Worldwide is also designated as a Phase 1 CAB under APEC-MRA (US0132) for Australia/New Zealand AS/NZS CISPR 32, Chinese-Taipei (Taiwan) BSMI CNS 13438 and Korea (RRA) KN 11, KN 13, KN 14-1, KN 22, KN 32, KN 61000-6-3, KN 61000-6-4.

The radiated emissions test site is a 3 and 10 meter enclosed open area test site (OATS). Personnel, support equipment and test equipment are located in the basement beneath the OATS ground plane.

The conducted emissions site is part of a 16' x 20' x 12' ferrite tile chamber and uses one of the walls for the vertical ground plane. A second conducted emissions site is also located in the basement of the OATS site with a 2.3 x 2.5 meter ground plane and a 2.4 x 2.4 meter vertical wall.

The radiated emissions test site for measurements above 1GHz is a 3 Meter open area test site (OATS) with a 3.6 by 3.6 meter anechoic absorber floor patch to achieve a quasi-free space measurement environment per ANSI C63.4/C63.10 and CISPR 16-1-4 standards.

The sites are designed to test products or systems 1.5 meters W x 1.5 meters L x 2.0 meters H, floor standing or table top.

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8. Test Images

8.1. Spurious and Harmonic Emissions – 30 kHz to 1 GHz Front

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8. Test Images

8.2. Spurious and Harmonic Emissions – 30 kHz to 30 MHz Rear

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8. Test Images

8.3. Spurious and Harmonic Emissions – 30 MHz to 1 GHz Rear

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8. Test Images

8.4. Spurious and Harmonic Emissions – 1 to 18 GHz Front

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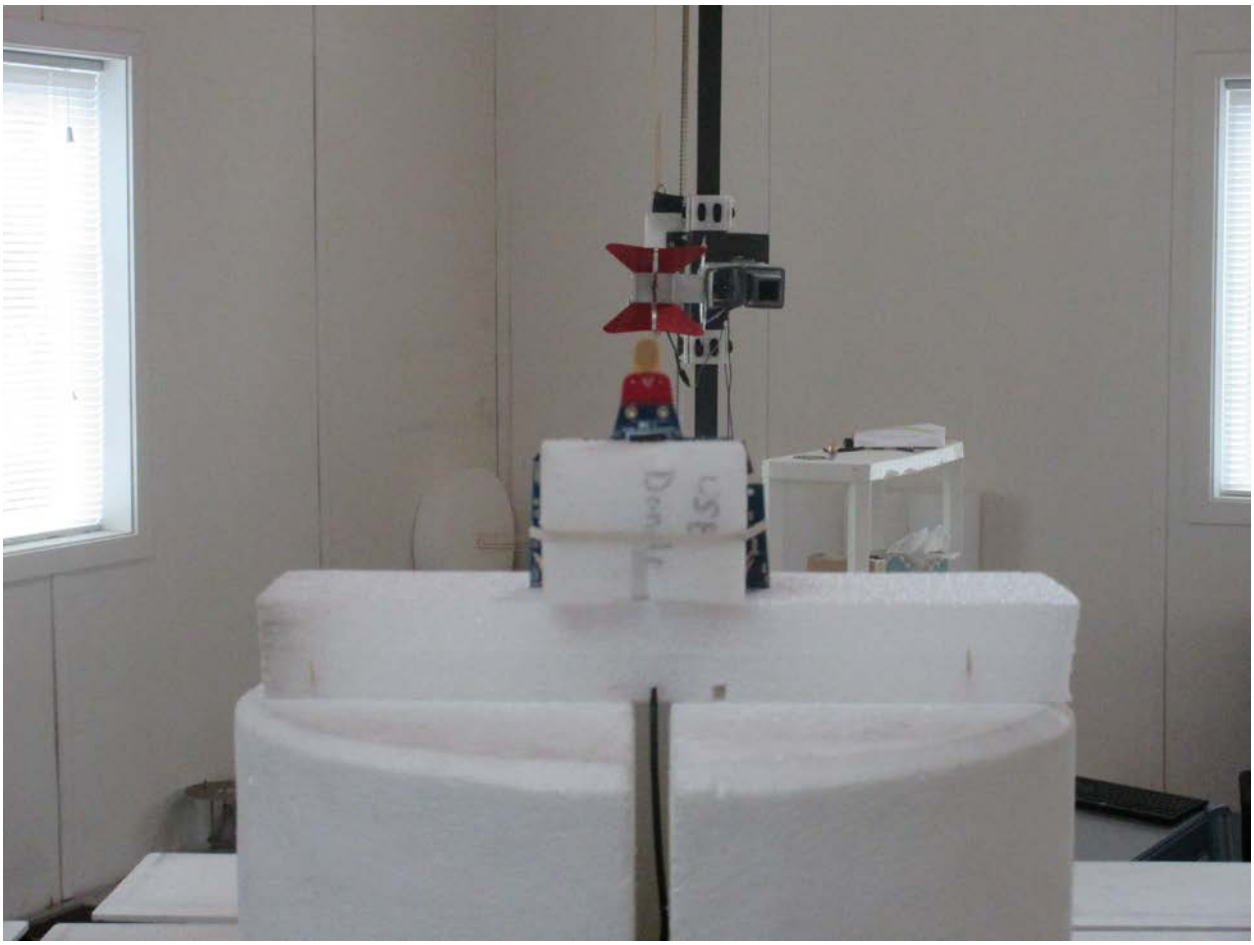
8. Test Images

8.5. Spurious and Harmonic Emissions – 1 to 18 GHz Rear



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8. Test Images

8.6. Spurious and Harmonic Emissions – 18 to 40 GHz Side

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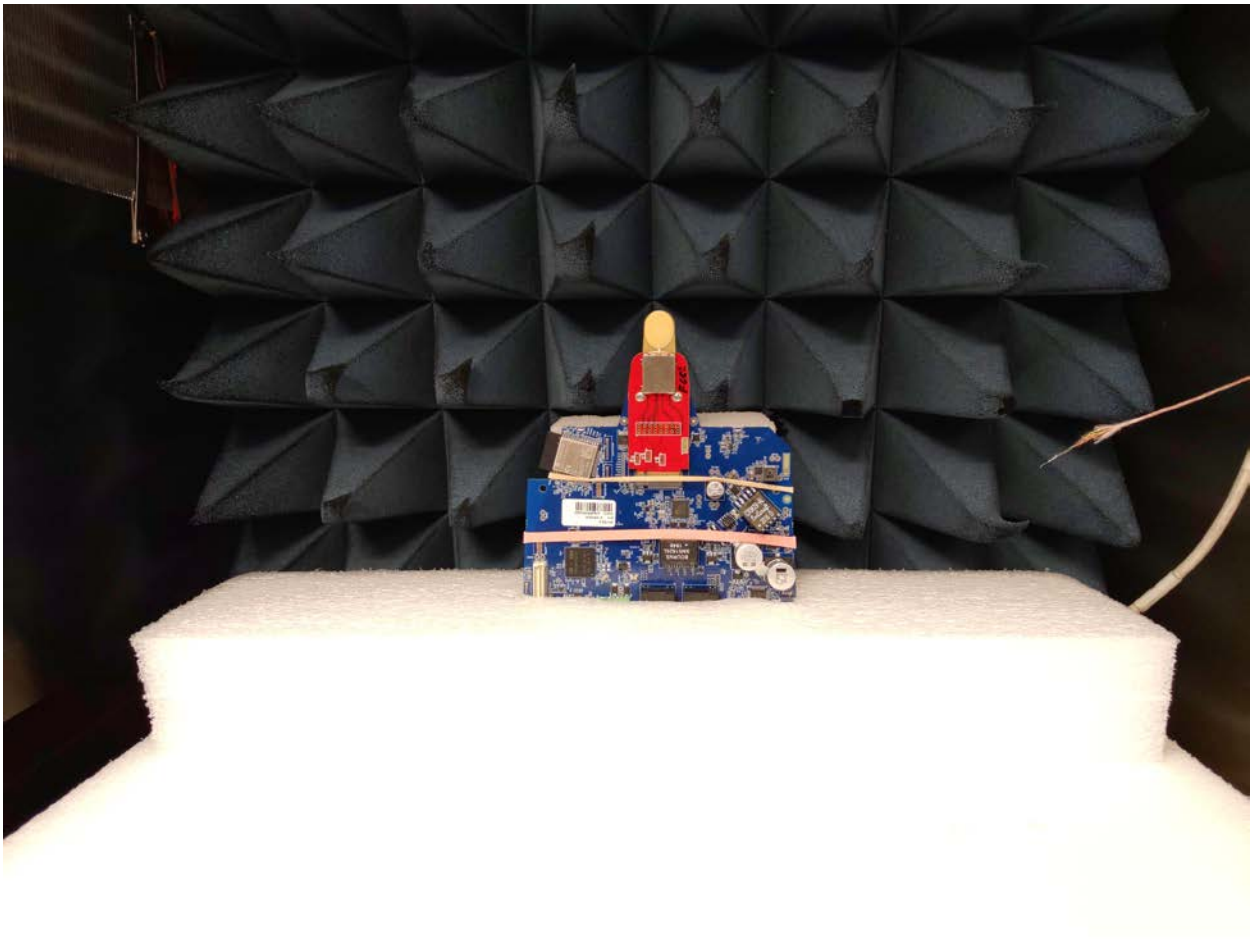
8. Test Images

8.7. Frequency Stability (Setup)



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