

**COMPLIANCE WORLDWIDE INC.
TEST REPORT #107-23RF**

**In Accordance with the Requirements of
FCC PART 2.1093 Radio Frequency Exposure Evaluation:
Portable Devices**

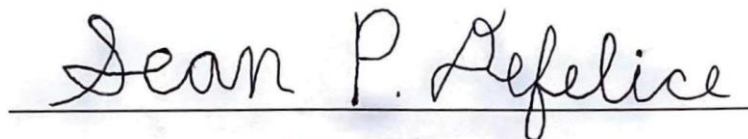
**Issued to
Ciholas, Inc.
3700 Bell Road
Newburgh, IN 47630**

**For the
MU202
UWB Module**

FCC ID: 2ALIR-MU202

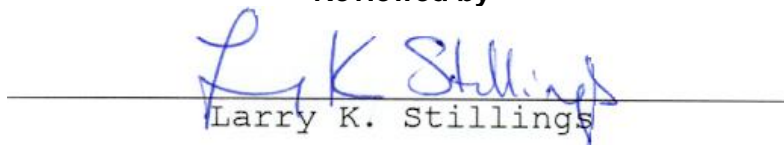
Report Issued on February 22, 2023

Tested by



Sean P. Defelice

Reviewed by



This test report shall not be reproduced, except in full, without written permission from Compliance Worldwide, Inc.

1. Scope

This test report certifies that the Ciholas MU202 Module, as tested, meets the FCC Part 2.1093 requirements exempting the device from a SAR Evaluation.

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
2.2. Product Name: MU202 Module
2.3. Model Number: A02824
2.4. Serial Number: 109195
2.5. Description: The MU202 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 power
2.7. Hardware Revision: 1.0.1
2.8. Software Revision: N/A
2.9. Modulation Type: Pulse Modulation, Frequency Hopping
2.10. Operating Frequencies: 4.49 GHz (Channel 3), Nominal (500 MHz BW)
2.11. EMC Modifications: None

3. Product Configuration

3.1 Operational Characteristics & Software

Connect the MU202 to a laptop via a UWB cable. The laptop is used with the devices embedded firmware and serial port software to configure the radio module. The module was configured for transmitting at 16M and 64M PRFs at a 6.8 Mbps data rate.

The module was tested using a support PCB to provide connectivity from the USB interface to the modules M2 connector. No other circuitry on that support PCB was enabled during testing. The enclosure was used for convenience of orienting the module in its worst case orientation. The enclosure provides no shielding and is absent of any reflective surfaces that would impact the RF signal leaving the module's antenna.

3.2. EUT Hardware

Manufacturer	Model/Part # / Options	Serial Number	Input Volts	Freq (Hz)	Description/Function
Ciholas	MU202	109195	5	DC	UWB Module

3.3. EUT Cables/Transducers

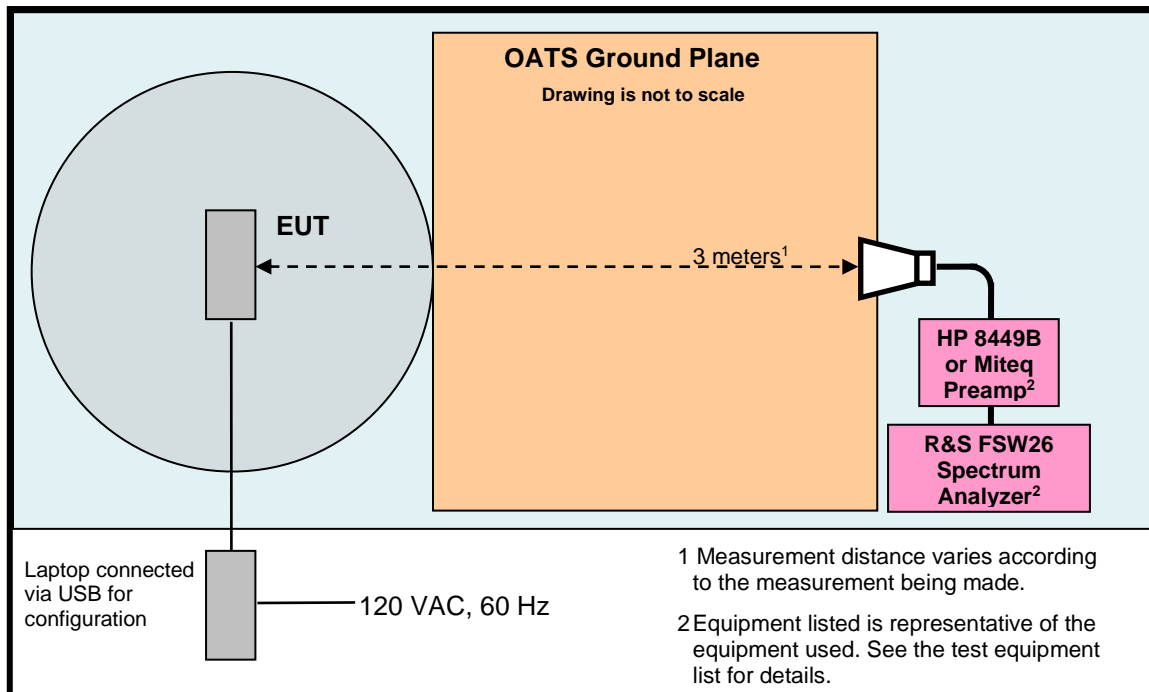
Cable Type	Length	Shield	From	To
USB	10M	Yes	EUT	Laptop

3. Product Configuration (cont.)

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



4. Measurements Parameters

4.1. Measurement Equipment Used to Perform Test

Device	Manufacturer	Model No.	Serial No.	Cal Due	Interval
Spectrum Analyzer, 2 Hz to 26.5 GHz ²	Rohde & Schwarz	FSW26	102057	6/24/2023	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 2 to 12 GHz	JCA	JCA48-4111B1	7087S	3/31/2023	1 Year
Barometric Pressure/Humidity & Temp Datalogger	Extech Instruments	SD700	Q590483	10/14/2023	2 Years

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.

4.2. Measurement & Equipment Setup

Test Dates: 11/30/2020

Test Engineers: Sean Defelice

Normal Site Temperature (15 - 35°C): 21.6

Relative Humidity (20 -75%RH): 35

Frequency Ranges: 4 to 5 GHz

Measurement Distance: 3 Meters

EMI Receiver IF Bandwidth: 1 MHz - Above 1 GHz

EMI Receiver Avg Bandwidth: $\geq 3 * \text{RBW or IF(BW)}$

Detector Function: Peak, Max Hold

4. Measurements Parameters (continued)

4.3. Measurement Procedure

Test measurements were made in accordance FCC Parts 15.209 Subpart C, 15.519 Subpart F.

The test methods used to generate the data in 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)	$\pm 1 \times 10^{-8}$
Radiated Emission of Transmitter to 100 GHz	± 4.55 dB
Radiated Emission of Receiver	± 4.55 dB
Temperature	$\pm 0.91^{\circ}$ C
Humidity	$\pm 5\%$

5. Measurement Data

5.1. Peak Emissions in a 50 MHz Bandwidth (15.519 (e), 15.521 (g) continued)

5.1.1 Plot of Peak Power at 3 Meters (Channel 3, 16M PRF)

Frequency (GHz)	Amplitude ¹	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBμV/m)	(dBμV/m)	(dB)	H/V	cm	Deg	
4.487	94.81	95.20	-0.39	V	120	0	Compliant

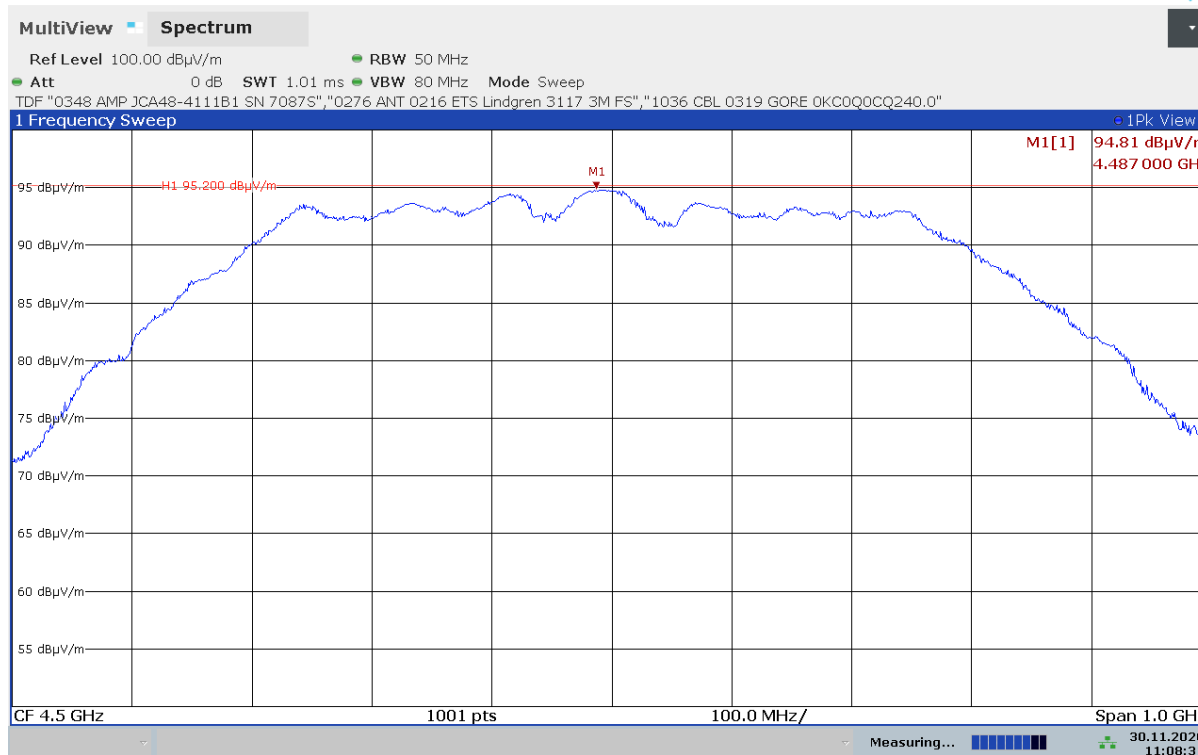
Notes: ¹ Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

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	
4.487	-0.39	0.00	-0.39	V	120	0	Compliant

301-20 Ciholas MU202 UWB



11:08:32 30.11.2020

5. Measurement Data (continued)

5.1. Peak Emissions in a 50 MHz Bandwidth (15.519 (e), 15.521 (g) continued)

5.1.2 Plot of Peak Power at 3 Meters (Channel 3, 64M PRF)

Frequency (GHz)	Amplitude ¹	Limit	Margin	Ant Polarity	Ant Height	Turntable Azimuth	Result
	(dBμV/m)	(dBμV/m)	(dB)	H/V	cm	Deg	
4.491	93.80	95.20	-1.40	V	120	0	Compliant

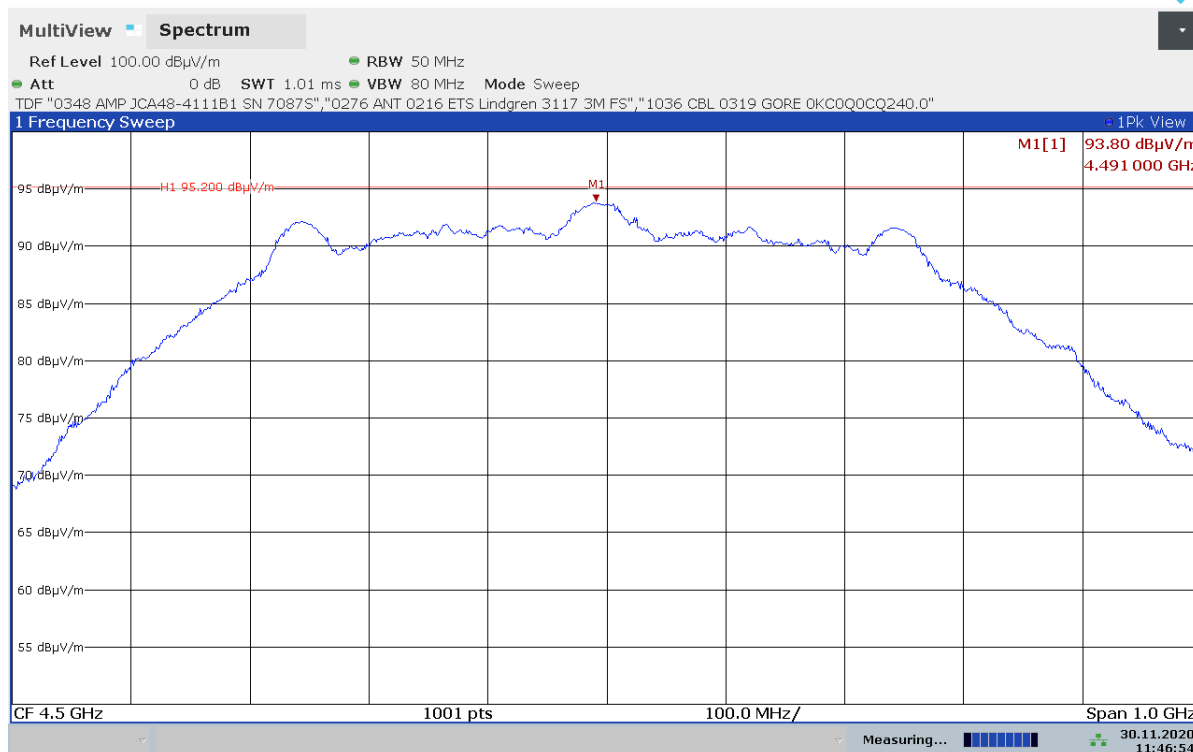
Notes: ¹ Antenna Factor (AF), Cable Factor (CF) and External Preamplifier Gain (PAG) have been entered into the analyzer as transducer factors.

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	
4.491	-1.40	0.00	-1.40	V	120	0	Compliant

301-20 Ciholas MU202 UWB



11:46:54 30.11.2020

5. Measurement Data (continued)

5.2. Public Exposure to Radio Frequency Energy Levels (2.1093)

5.2.1. 2.1093 Requirements

Requirement: Portable devices are subject to radio frequency radiation exposure requirements. For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

Evaluation of compliance with the exposure limits in § 1.1310 of this chapter, and preparation of an EA if the limits are exceeded, is necessary for portable devices having single RF sources with more than an available maximum time-averaged power of 1 mW.

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it may not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period.

Power levels from Section 5.1

Channel	Frequency	Peak Field Strength	Distance	Antenna Gain ¹	Measured Output Power	Measured Output Power	Output Power Limit	Result
	(GHz)	(dBμV/m)	(m)	(dBi)	(dBm)	(mW)	(mW)	
3	4.487	94.81	3.0	0.000	-0.39	0.908	1	Compliant
3	4.491	93.80	3.0	0.000	-1.40	0.720	1	Compliant

Note: Antenna gain is included in the field strength measurements. Measured Power is determined by 3M Peak Field Strength – 95.2 = dBm

Conclusion: The device under test meets the exclusion requirement detailed in FCC OET 447498 D01, dated October 23, 2015 Clause 4.3.1 (a).