FCC Part 1 Subpart I
FCC Part 2 Subpart J

RF EXPOSURE REPORT

FOR

QUICK PLUG-IN CONTROLLER

MODEL NUMBER: WV-OM

FCC ID: M3U-WVOM
CONTAINS FCC ID: QOQ-BGM13P

REPORT NUMBER: R14978455-E3

ISSUE DATE: 2024-07-05

Prepared for
HUNTER INDUSTRIES
1940 DIAMOND STREET
SAN MARCOS, CA 92078-5120, UNITED STATES

Prepared by
UL LLC
12 LABORATORY DR.
RESEARCH TRIANGLE PARK, NC 27709, U.S.A.
TEL: (919) 549-1400

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-10-31	Initial Issue	Charles Moody
V2	2024-02-05	Hyphen added to model name and FCCID	Niklas Haydon
V3	2024-06-07	Updated LoRa Avg Power. Updated BLE Avg Power. Updated Antenna Gain	Noah Bennett
V4	2024-07-05	Updated LoRa Antenna Gain	Noah Bennett

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Hunter Industries
                          1940 Diamond Street
                          San Marcos, CA 92078-5120, United States

EUT DESCRIPTION: Quick plug-in controller

MODEL: WV-OM

SERIAL NUMBER: 434261, 347826

SAMPLE RECEIVED DATE: 2023-10-11 TO 2023-10-17

DATE TESTED: 2023-10-16

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Complies

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.
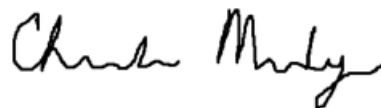
This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For
UL LLC By: Prepared By:

Michael Ferrer   Charles Moody
Staff Engineer   Electrical Engineer
Consumer, Medical and IT Segment   Consumer, Medical and IT Segment
UL LLC   UL LLC

2. TEST METHODOLOGY

All calculations were made in accordance with FCC Parts 1.1310, 2.1091, 2.1093, KDB 447498 D01 v06, KDB 447498 D03 V01, IEEE Std C95.1-2005, and IEEE Std C95.3-2002

3. REFERENCES

Declared maximum average output power and antenna gain is excerpted from client documentation.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, certification # 0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
☒	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1.   METROLOGICAL TRACEABILITY

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

5.2.   DECISION RULES

For all tests where the applicable U_{LAB} <= U_{MAX} the Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2, where U_{MAX} = 30% (0.3) for RF Exposure evaluations. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

For all tests where the applicable U_{LAB} > U_{MAX} the Decision Rule is based on Guarded Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.3.2, with a guard band equal to (U_{LAB} – U_{MAX}), where U_{MAX} = 30% (0.3) for RF Exposure evaluations. (Test results are adjusted by the value of the guard band to determine conformity with a specified requirement.)

6. MAXIMUM PERMISSIBLE EXPOSURE (LIMITS AND EQUATIONS)

6.1. FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f^2	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*100	30
1.34-30	824/f	2.19/f	*180/f^2	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

Notes:

(1) Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

(2) General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure

6.2.   EQUATIONS

POWER DENSITY

Power density is given by:

S = EIRP / (4 * Pi * D^2)

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

SOURCE-BASED DUTY CYCLE

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

Where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in mW

MIMO AND COLOCATED TRANSMITTERS (IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the EIRP (in linear units) of each transmitter.

Total EIRP = (EIRP1) + (EIRP2) + ... + (EIRPn)

where

EIRPx = Source-based time-averaged EIRP of chain x or transmitter x

The total EIRP is then used to calculate the Power Density or the Distance as applicable.

MIMO AND COLOCATED TRANSMITTERS (NON-IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply:

The Power Density at the specified separation distance is calculated for each transmitter chain or transmitter.

The fraction of the exposure limit is calculated for each chain or transmitter as
(Power Density of chain or transmitter) / (Limit applicable to that chain or transmitter).

The fractions are summed.

Compliance is established if the sum of the fractions is less than or equal to one.

7. RF EXPOSURE RESULTS

This report contains data provided by the customer which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

Client Provided Data:
1.) Max Declared Avg. Output Power
2.) Antenna Gain

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

Single Chain and non-colocated transmitters								
Band	**Mode**	**Separ. Distance** (cm)	**Output AVG Power** (dBm)	**Ant. Gain** (dBi)	**Duty Cycle** (%)	**EIRP** (mW)	**FCC PD** (mW/cm^2)	**FCC PD Limit** (mW/cm^2)
900 MHz	LoRa	20	14.50	1.30	100.0	38.02	0.008	0.600
2.4 GHz	BLE	20	9.00	1.00	100.0	10.00	0.002	1.000
Combined		20				48.02	0.010	0.60

Notes:

1. The worst-case antenna gain was used for all calculations made in this report.
2. For MPE, KDB447498 requires the calculations to use the maximum rated power; that power should be declared by the manufacturer and should not be lower than the measured power. If the power has a tolerance, then we also need to check that the measured power is within the tolerance.
3. The manufacturer configures output power so that the maximum power, after accounting for manufacturing tolerances, will never exceed the maximum power level measured.
4. 100% Duty cycle used as worst case.
5. Combined calculation assumes that the two radios simultaneously transmit as a worst case scenario.
6. Limit is based off the 900MHz LoRa radio as worst-case scenario.

END OF TEST REPORT