



# **CERTIFICATION TEST REPORT**

**Report Number. :** 12727679-E8V2

**Applicant :** WARMBOARD INC  
8035 SOQUEL DR  
APTOS, CA 95003, U.S.A.

**Model :** WRC-01

**FCC ID :** 2ASM7-WRC01

**IC :** 24839-WRC01

**EUT Description :** WARMBOARD RESET CONTROLLER WITH LORA WIRELESS COMMUNICATION

**Test Standard(s) :** FCC 47 CFR PART 1 SUBPART I  
FCC 47 CFR PART 2 SUBPART J  
ISED RSS – 102 ISSUE 5

**Date Of Issue:**

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NVLAP Lab code: 200065-0

Revision History

| Rev. | Issue Date | Revisions                                | Revised By |
|------|------------|------------------------------------------|------------|
| V1   | 4/4/2019   | Initial Issue                            | --         |
| V2   | 4/9/2019   | Updated report to address TCB's question | Tina Chu   |

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** WARMBOARD INC  
8035 SOQUEL DR  
APTOS, CA 95003, U.S.A.

**EUT DESCRIPTION:** WARMBOARD RESET CONTROLLER WITH LORA  
WIRELESS COMMUNICATION

**MODEL:** WRC-01

| APPLICABLE STANDARDS                    |              |
|-----------------------------------------|--------------|
| STANDARD                                | TEST RESULTS |
| FCC PART 1 SUBPART I & PART 2 SUBPART J | Complies     |
| ISED RSS 102 ISSUE 5                    | Complies     |

UL Verification Services Inc. 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.

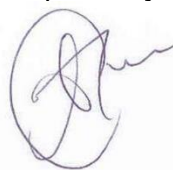
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## 2. TEST METHODOLOGY

All calculations were made in accordance with FCC KDB 447498 D01 and KDB 447498 D03 and IC Safety Code 6.

## 3. REFERENCES

All measurements were made as documented in test report UL Verification Services Inc. Document 12727679-E4 for operation in the 915 MHz.

Antenna gain data is excerpted from the applicable test report.

## 4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, and 47658 Kato Road, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0.

## 5. DESCRIPTION OF EUT

The EUT is a Reset Controller with LoRa 915MHz wireless communication. It receives data from the Manifold Controller(s) and helps distribute and modulate water temperatures based on those needs. It is categorized as Digital Transmission System (DTS).

## 6. MAXIMUM PERMISSIBLE RF EXPOSURE

### 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 <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposure</b>         |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *100                                | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *900/f <sup>2</sup>                 | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1,500                                                      |                               |                               | f/300                               | 6                        |
| 1,500-100,000                                                  |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                       | 614                           | 1.63                          | *100                                | 30                       |
| 1.34-30                                                        | 824/f                         | 2.19/f                        | *180/f <sup>2</sup>                 | 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. IC RULES

For the purpose of this standard, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

**Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)**

| Frequency Range<br>(MHz) | Electric Field<br>(V/m rms) | Magnetic Field<br>(A/m rms)       | Power Density<br>(W/m <sup>2</sup> ) | Reference Period<br>(minutes) |
|--------------------------|-----------------------------|-----------------------------------|--------------------------------------|-------------------------------|
| 0.003-10 <sup>21</sup>   | 83                          | 90                                | -                                    | Instantaneous*                |
| 0.1-10                   | -                           | 0.73/ $f$                         | -                                    | 6**                           |
| 1.1-10                   | 87/ $f^{0.5}$               | -                                 | -                                    | 6**                           |
| 10-20                    | 27.46                       | 0.0728                            | -2                                   | 6                             |
| 20-48                    | 58.07/ $f^{0.25}$           | 0.1540/ $f^{0.25}$                | 8.944/ $f^{0.5}$                     | 6                             |
| 48-300                   | 22.06                       | 0.05852                           | 1.291                                | 6                             |
| 300-6000                 | 3.142 $f^{0.3417}$          | 0.008335 $f^{0.3417}$             | 0.02619 $f^{0.6834}$                 | 6                             |
| 6000-15000               | 61.4                        | 0.163                             | 10                                   | 6                             |
| 15000-150000             | 61.4                        | 0.163                             | 10                                   | 616000/ $f^{1.2}$             |
| 150000-300000            | 0.158 $f^{0.5}$             | 4.21 x 10 <sup>-4</sup> $f^{0.5}$ | 6.67 x 10 <sup>-5</sup> $f$          | 616000/ $f^{1.2}$             |

**Note:**  $f$  is frequency in MHz.

\* Based on nerve stimulation (NS).

\*\* Based on specific absorption rate (SAR).

### **6.3. EQUATIONS**

#### **POWER DENSITY**

Power density is given by:

$$S = \text{EIRP} / (4 * \text{Pi} * D^2)$$

Where

S = Power density in mW/cm<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in mW

D = Separation distance in cm

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

#### **DISTANCE**

Distance is given by:

$$D = \text{SQRT} (\text{EIRP} / (4 * \text{Pi} * S))$$

Where

D = Separation distance in cm

EIRP = Equivalent Isotropic Radiated Power in mW

S = Power density in mW/cm<sup>2</sup>

#### **SOURCE-BASED DUTY CYCLE**

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

$$\text{Source-based time-averaged EIRP} = (\text{DC} / 100) * \text{EIRP}$$

Where

DC = Duty Cycle in %, as applicable

EIRP = Equivalent Isotropic Radiated Power in W

## 6.4. IC EXEMPTION

### INDUSTRY CANADA EXEMPTION

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $1.31 \times 10^{-2} f^{0.6834}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

## 7. RF EXPOSURE RESULTS

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   | Separation Distance (cm) | Output Peak Power (dBm) | Antenna Peak Gain (dBi) | Duty Cycle (%) | EIRP (mW) | FCC Power Density (mW/cm <sup>2</sup> ) | IC Power Density (W/m <sup>2</sup> ) | FCC Power Density (mW/cm <sup>2</sup> ) Limit | IC Power Density (W/m <sup>2</sup> ) Limit |
| 915 MHz                                     | normal | 20                       | 20.00                   | 2.20                    | 100.0          | 166.0     | 0.033                                   | 0.33                                 | 0.61                                          | 2.77                                       |

### Notes:

1. The device operates above 300 MHz and below 6 GHz with a maximum EIRP less than or equal to 1.38 Watts in the 915Mhz band as a mobile device with a minimum separation distance of 20 cm, therefore it is exempt from routine RF Exposure Evaluation under RSS-102.
2. A tolerance value of +2 dB was included in the output power values above to cover the output power tolerance of +/-2 dB under extreme conditions in the real filed as declared by the applicant.

**END OF REPORT**