



# TEST REPORT

## KCTL Inc.

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Report No.:  
KR20-SRF0028-A

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# KCTL

### 1. Client

- Name : POWEROS.CO.,LTD
- Address : Bizdong-B117, SKN TECHNOPARK, 124, Sagimakgol-ro,  
Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
- Date of Receipt : 2019-11-28

2. Use of Report : Certification

3. Name of Product and Model : Fault Detector / PIA-1010

4. Manufacturer and Country of Origin : POWEROS.CO.,LTD / Korea

5. FCC ID : 2AVA6-PIA-1010

6. Date of Test : 2020-01-15 to 2020-01-17

7. Test Standards : 47 CFR Part 1.1310

8. Test Results : Refer to the test result in the test report

|             |                                                                                                                          |                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Affirmation | Tested by                                                                                                                | Technical Manager                                                                                                        |
|             | Name : Euijung Kim<br><br>(Signature) | Name : Bobae Lee<br><br>(Signature) |

2020-02-11

## KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

#### Report revision history

| Date       | Revision       | Page No |
|------------|----------------|---------|
| 2020-01-31 | Initial report | -       |
| 2020-02-11 | Updated        | 4       |
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Note. The report No. KR20-SRF0028 is superseded by the report No. KR20-SRF0028-A.



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## 1. General information

Client : POWEROS.CO.,LTD  
 Address : Bizdong-B117, SKN TECHNOPARK, 124, Sagimakgol-ro, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea  
 Manufacturer : POWEROS.CO.,LTD  
 Address : Bizdong-B117, SKN TECHNOPARK, 124, Sagimakgol-ro, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea  
 Laboratory : KCTL Inc.  
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132  
 VCCI Registration No. : R-20080, G-20078, C-20059, T-20056  
 Industry Canada Registration No. : 8035A  
 KOLAS No.: KT231

## 2. Device information

Equipment under test : Fault Detector  
 Model : PIA-1010  
 Frequency range : 904 MHz ~ 925 MHz  
 Modulation technique : LoRa (DTS)  
 Number of channels : 43 ch  
 Power source : DC 3.6 V  
 Antenna specification : Patch Antenna  
 Antenna gain : 1.05 dBi  
 Software version : V1.0  
 Hardware version : V1.0  
 Test device serial No. : 1903-0096  
 Operation temperature : 23 °C

### 2.1. Accessory information

| Equipment | Manufacturer | Model | Serial No. | Power source |
|-----------|--------------|-------|------------|--------------|
| N/A       | -            | -     | -          | -            |

## 2.2. Frequency/channel operations

This device contains the following capabilities: LORA

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---------|----------------|---------|----------------|
| 1       | 904.0 MHz      | 23      | 915.0 MHz      |
| 2       | 904.5 MHz      | 24      | 915.5 MHz      |
| 3       | 905.0 MHz      | 25      | 916.0 MHz      |
| 4       | 905.5 MHz      | 26      | 916.5 MHz      |
| 5       | 906.0 MHz      | 27      | 917.0 MHz      |
| 6       | 906.5 MHz      | 28      | 917.5 MHz      |
| 7       | 907.0 MHz      | 29      | 918.0 MHz      |
| 8       | 907.5 MHz      | 30      | 918.5 MHz      |
| 9       | 908.0 MHz      | 31      | 919.0 MHz      |
| 10      | 908.5 MHz      | 32      | 919.5 MHz      |
| 11      | 909.0 MHz      | 33      | 920.0 MHz      |
| 12      | 909.5 MHz      | 34      | 920.5 MHz      |
| 13      | 910.0 MHz      | 35      | 921.0 MHz      |
| 14      | 910.5 MHz      | 36      | 921.5 MHz      |
| 15      | 911.0 MHz      | 37      | 922.0 MHz      |
| 16      | 911.5 MHz      | 38      | 922.5 MHz      |
| 17      | 912.0 MHz      | 39      | 923.0 MHz      |
| 18      | 912.5 MHz      | 40      | 923.5 MHz      |
| 19      | 913.0 MHz      | 41      | 924.0 MHz      |
| 20      | 913.5 MHz      | 42      | 924.5 MHz      |
| 21      | 914.0 MHz      | 43      | 925.0 MHz      |
| 22      | 914.5 MHz      |         |                |

## 3. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{CISPR}$  measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

| Parameter          | Expanded uncertainty ( $\pm$ ) |
|--------------------|--------------------------------|
| Conducted RF power | 1.76 dB                        |

## 4. RF Exposure

### FCC

#### Regulation

This document is prepared to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC rules and Regulations.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Table 1 – Limits for Maximum Permissible Exposure (MPE)

| Frequency Range<br>(MHz)                                  | Electric Field<br>Strength<br>[V/m] | Magnetic Field<br>Strength<br>[A/m] | Power Density<br>[mW/cm <sup>2</sup> ] | Averaging<br>Time<br>[minute] |
|-----------------------------------------------------------|-------------------------------------|-------------------------------------|----------------------------------------|-------------------------------|
| (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 <sup>2</sup>                    | 6                             |
| 30 ~ 300                                                  | 61.4                                | 0.163                               | 1.0                                    | 6                             |
| 300 ~ 1 500                                               | /                                   | /                                   | f/300                                  | 6                             |
| 1 500 ~ 15 000                                            | /                                   | /                                   | 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 <sup>2</sup>                    | 30                            |
| 30 ~ 300                                                  | 27.5                                | 0.073                               | 0.2                                    | 30                            |
| 300 ~ 1 500                                               | /                                   | /                                   | f/1 500                                | 30                            |
| 1 500 ~ 15 000                                            | /                                   | /                                   | 1.0                                    | 30                            |

*f*=frequency in MHz, \* = plane-wave equivalent power density

Per the guidance of KDB 680106, the E-field and H-field limits shown in the table above are extended down to 100 kHz

## 4.1. Test results

### FCC

#### MPE (Maximum Permissible Exposure) Prediction

Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \quad (\Rightarrow R = \sqrt{PG/4\pi S})$$

S = power density [ $\text{mW}/\text{cm}^2$ ]

P = Power input to antenna [ $\text{mW}$ ]

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna [ $\text{cm}$ ]

### RF Exposure Compliance Issue

The information should be included in the user's manual:

This appliance and its antenna must not be co-located or operation is conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

#### Calculation Result of RF exposure (FCC)

- SF 9

Maximum tune-up tolerance

| Mode   | Frequency<br>[MHz] | Max<br>Tune-up<br>Power<br>[dBm] | Max<br>Tune-up<br>Power<br>[mW] | Ant<br>Gain<br>[dBi] | Ant<br>Gain<br>[mW] | Power<br>density<br>at 20 cm<br>[mW/cm <sup>2</sup> ] | Limit<br>[mW/cm <sup>2</sup> ] |
|--------|--------------------|----------------------------------|---------------------------------|----------------------|---------------------|-------------------------------------------------------|--------------------------------|
| Lowest | 904                | 19.50                            | 89.13                           | 1.05                 | 1.27                | 0.022 58                                              | 1.000 0                        |

## 5. Measurement Equipment

| Equipment Name        | Manufacturer | Model No.                                     | Serial No. | Next Cal. Date |
|-----------------------|--------------|-----------------------------------------------|------------|----------------|
| Spectrum Analyzer     | R&S          | FSV40                                         | 100988     | 21.01.03       |
| Wideband Power Sensor | R&S          | NRP-Z81                                       | 102398     | 21.01.21       |
| ATTENUATOR            | R&S          | DNF<br>Dämpfungsglied<br>10 dB in<br>N-50 Ohm | 31212      | 20.05.13       |

**End of test report**

*KCTL*