
FCC MPE Evaluation Report

Report No: WD-RF-R-230400-E0

Product Name : Reader
Model Name : DR20
FCC ID : 2AZ3JDR20
Applicant : Rhombus Systems, Inc.
Received Date : Nov. 17, 2023
Tested Date : Dec. 18, 2023 ~ Dec. 25, 2023
Applicable Standard : 47 CFR FCC Part 2.1091
47 CFR FCC Part 1.1310
KDB 447498 D01
OET Bulletin 65 Supplement C



Wendell Industrial Co., Ltd
Wendell EMC & RF Laboratory

Caution:

This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment.

Please note that the measurement uncertainty are provided for informational purpose only and are not used in determining the Pass/Fail results.


This report must not be used to claim product endorsement by TAF or any agency of the government.

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Test Report

Issued Date: December 25, 2023

Project No.: 23Q110607

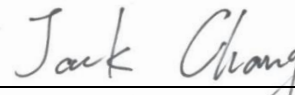
| | |
|--|--|
| Product Name | Reader |
| Trade Name | rhombus |
| Brand Trademark |  rhombus |
| Model Name | DR20 |
| FCC ID | 2AZ3JDR20 |
| Applicant | Rhombus Systems, Inc. |
| Manufacturer | Rhombus Systems, Inc. |
| EUT Rated Voltage | DC 8V ~ 28V |
| EUT Test Voltage | DC 28V |
| EUT Supports Radios Application | Bluetooth BR/EDR/LE NFC 13.56M |
| Applicable Standard | 47 CFR FCC Part 2.1091 47 CFR FCC Part 1.1310 KDB 447498 D01 OET Bulletin 65 Supplement C |
| RF Evaluation | 0.00468 mW/cm ² |
| Test Result | Complied |

Documented :



(Specialist / Emma Lu)

Technical Engineer :



(Section Manager / Jack Chang)

Approved :



(Project Manager / Gary Wu)

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Document Revision History

| Report No. | Issue date | Description |
|-------------------|--------------------|---|
| WD-RF-R-230280-E0 | September 14, 2023 | Initial report |
| WD-RF-R-230400-E0 | December 25, 2023 | <p>This is to request a Class II permissive change for FCC ID: 2AZ3JDR20, originally granted on 10/26/2023.</p> <p>The modification is concerned with following:</p> <ol style="list-style-type: none">1. Adding new PCB board, change non-RF related layout.2. The power layouts are moved to the shielding case, away from the antenna.3. Replace component for L3.4. Back cover adding heat sink. <p>Therefore only radiated emission below 1G has been evaluated for this C2PC. Adding internal photographs for new PCB.</p> |

Reference Testing Standard

| Standard | Description | Version |
|------------------------------|--|---------------|
| 47 CFR FCC Part 2.1091 | Radiofrequency radiation exposure evaluation: mobile devices. | -- |
| 47 CFR FCC Part 1.1310 | Radiofrequency radiation exposure limits. | -- |
| KDB 447498 D01 | RF Exposure procedures and equipment authorization policies for mobile and portable devices. | V06 |
| OET Bulletin 65 Supplement C | Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields. | Edition 01-01 |

1 Generation Information

1.1 Applicant

Rhombus Systems, Inc.
1920 20th St, Sacramento, CA 95811

1.2 Manufacturer

Rhombus Systems, Inc.
1920 20th St, Sacramento, CA 95811

1.3 Description of Equipment under Test

| | |
|----------------------------|---|
| Product Name | Reader |
| Model No. | DR20 |
| FCC ID | 2AZ3JDR20 |
| Frequency Range | Bluetooth:2402~2480MHz NFC:13.56 MHz |
| Antenna Information | Refer to the table "Antenna List" |

The above equipment was tested by Wendell EMC & RF Laboratory For compliance with the requirements set forth in 47 CFR § 2.1091 / 47 CFR § 1.1310. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties

Antenna List

| No. | Manufacturer | Model No. | Antenna Type | Peak Gain |
|-----|---------------------|--------------------|--------------|---------------------|
| 1 | INPAQ Technology Co | RFFPA332305IMAB304 | FPCB Antenna | 1.97 dBi for 2.4GHz |
| 2 | INPAQ Technology Co | RFNFC363005IMFB301 | PCB Antenna | N/A |

1.4 Test Facility

| Items | Required (IEC 60068-1) |
|----------------------------|------------------------|
| Temperature (°C) | 15-35 |
| Humidity (% RH) | 25-75 |
| Barometric pressure (mbar) | 860-1060 |

Description: Accredited by TAF
Accredited Number: 2965

Issued by: Wendell Industrial Co., Ltd

Lab Address: 6F/6F-1, No.188, Baoqiao Rd., Xindian Dist.,
New Taipei City 23145, Taiwan (R.O.C)

Test Lab: Wendell EMC & RF Laboratory

Test Location: 1F., No. 119, Wugong 3rd Rd., Wugu Dist.,
New Taipei City 248, Taiwan (R.O.C.)

Designation Number: TW0025

Test Firm Registration Number: 665221

2 Mobile device Assessment Procedure

In 47 CFR § 2.1091, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. In this context, the term “fixed location” means that the device is physically secured at one location and is not able to be easily moved to another location.

3 RF Exposure Assessment

Estimation of the expected exposure in power density can be made with the following equation:

$$S = \frac{P \times G}{4\pi \times R^2} = \frac{\text{EIRP}}{4\pi \times R^2}$$

S: power density

P: power input to the antenna

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.

EIRP: Effective Isotropic Radiated Power

4 Limit Requirement

In 47 CFR § 1.1310, use of the device as based upon the user's awareness and ability to exercise control over human exposure. The two categories defined are Occupational/Controlled Exposure and General Population/Uncontrolled. These two categories are defined as follow:

Occupational/Controlled Exposure:

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.

General Population/Uncontrolled:

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.

| Limits for Occupational / Controlled Exposure | | | | |
|---|-----------------------------------|-----------------------------------|--|---|
| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm ²) | Averaging Time E ² , H ² or S (minutes) |
| 0.3-3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0-30 | 1,842 / 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 |

Note :

- (1) f = frequency in MHz
- (2) * = Plane-wave equivalent power density

| Limits for General Population / Uncontrolled Exposure | | | | |
|---|-----------------------------------|-----------------------------------|--|---|
| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm ²) | Averaging Time E ² , H ² or S (minutes) |
| 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 |
| 300-1500 | -- | -- | f / 1,500 | 30 |
| 1,500-100,000 | -- | -- | 1.0 | 30 |

Note :

- (1) f = frequency in MHz
- (2) * = Plane-wave equivalent power density

5 Test Results

| Mode | Max. Power (E.I.R.P) | | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) | Result |
|------------|-------------------------|-------|------------------|--|--------------------------------|--------|
| | dBm | mW | | | | |
| BT | 12.41 | 17.42 | 20 | 0.00347 | 1 | Pass |
| LE | 7.85 | 6.10 | 20 | 0.00121 | 1 | Pass |
| NFC 13.56M | -30.99 | 0.001 | 20 | 0.00000000 | 0.978933354 | Pass |

Note :

- * Each Function of the max power which perform MPE of any configurations.
- * The total power of BT 、LE and NFC transmission at the same time is the largest.
- * dB μ V/m to dBm conversion formula : $\text{dBm} = \text{dB}\mu\text{V/m} + 20 \cdot \log(\text{m}) - 104.77$ (m = 3m distance)
- * NFC_13.56MHz Max.Power = 64.24 dB μ V/m = -30.99 dBm
- * The frequency (range) used by the radio frequency function is 1.5GHz~100GHz, the RF field strength limits is e.i.r.p. less than or equal to 1mW/cm².
- * The limit is equal to the minimum value.
- * The Max total MPE = BT + LE + NFC 13.56M = 0.00468 (mW/cm²)

--- END ---