# RADIO TEST REPORT

## Test Report No. : 30DE0252-HO-01-B-R1

| | | |
|---|---|---|
| **Applicant** | : | **DENSO WAVE INCORPORATED** |
| **Type of Equipment** | : | **Contactless IC Card Reader/Writer** |
| **Model No.** | : | **PR-450UDM** |
| **Test standard** | : | **FCC Part 15 Subpart C : 2009**<br>**Section 15.207 and 15.225** |
| **FCC ID** | : | **PZWPR450UDM** |
| **Test Result** | : | **Complied** |

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This report is a revised version of 30DE0252-HO-01-B. 30DE0252-HO-01-B is replaced with this report.

**Date of test:** December 16, 2009 to January 20, 2010

**Tested by:**

S. Matsuyama
Satofumi Matsuyama
EMC Services

Norihisa Hashimoto
EMC Services

T. Shimada
Takumi Shimada
EMC Services

H. Furutaka
Hiroyuki Furutaka
EMC Services

**Approved by:**

M. Fujimura
Mitsuru Fujimura
Site Manager of EMC Services

NVLAP®
NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address, http://uljapan.co.jp/emc/nvlap.html

**UL Japan, Inc.**
**Head Office EMC Lab.**
**4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN**
**Telephone : +81 596 24 8116**
**Facsimile : +81 596 24 8124**

CONTENTS PAGE



**UL Japan, Inc.**
**Head Office EMC Lab.**
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116
Facsimile : +81 596 24 8124

# SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | DENSO WAVE INCORPORATED |
| Address | : | 1 Yoshiike, Kusaki, Agui-cho, Chita-gun, Aichi, 470-2297 Japan |
| Telephone Number | : | +81-569-49-5298 |
| Facsimile Number | : | +81-569-49-5488 |
| Contact Person | : | Hideki Hokimoto |

# SECTION 2: Equipment under test (E.U.T.)

## 2.1 Identification of E.U.T.

| | | |
|---|---|---|
| Type of Equipment | : | Contactless IC Card Reader/Writer |
| Model No. | : | PR-450UDM |
| Serial No. | : | Refer to Section 4, Clause 4.2 |
| Rating | : | DC 5V |
| Receipt Date of Sample | : | December 11, 2009 |
| Country of Mass-production | : | Japan |
| Condition of EUT | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT | : | No Modification by the test lab |

## 2.2 Product Description

Model No: PR-450UDM (referred to as the EUT in this report) is the Contactless IC Card Reader/Writer.

| | | |
|---|---|---|
| Feature of EUT | : | The PR-450UDM reader/writer, which is easy to plug in to your host computer with a USB cable, is an IC card reader/writer capable of reading contactless IC cards. |

**General Specification**

| | | |
|---|---|---|
| Clock frequency(ies) in the system | : | 13.56MHz (CPU), 12MHz (USB Interface) |

**Radio Specification**

| | | |
|---|---|---|
| Equipment Type | : | Transceiver |
| Frequency of Operation | : | 13.56MHz |
| Type of Modulation | : | Amplitude Modulate |
| Antenna Type | : | loop antenna |
| Antenna Connector Type | : | fixed |
| Power Supply (inner) | : | DC4.1V, DC3.5V |

# SECTION 3: Test specification, procedures & results

## 3.1 Test Specification

Test Specification : FCC Part15 Subpart C: 2009, final revised on December 2, 2009

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 : Conducted limits
Section 15.225 : Operation within the band 13.110-14.010MHz

## 3.2 Procedures and results

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|---|---|---|---|---|---|
| Conducted emission | ANSI C63.4:2009<br>7. AC powerline conducted emission measurements | Section 15.207 | **[QP]**<br>16.5dB, 0.30561MHz, N<br>(Standby mode)<br>**[AV]**<br>7.1dB, 0.30561MHz, N<br>(Standby mode) | Complied | - |
| Electric Field Strength of Fundamental Emission | ANSI C63.4:2009<br>13. Measurement of intentional radiators | Section 15.225(a) | 50.9dB, 13.56MHz<br>QP, 0deg.<br>(Transmitting (Tx and Rx) Without Tag mode) | Complied | Radiated |
| Spectrum Mask | ANSI C63.4:2009<br>13. Measurement of intentional radiators | Section 15.225(b)(c) | 17.0dB, 14.09010MHz<br>QP, 0deg.<br>(Transmitting (Tx and Rx) Without Tag mode) | Complied | Radiated |
| 20dB Bandwidth | ANSI C63.4:2009<br>13. Measurement of intentional radiators | Section15.215(c) | See data | Complied | Radiated |
| Electric Field Strength of Spurious Emission | ANSI C63.4:2009<br>13. Measurement of intentional radiators | Section15.209,<br>Section 15.225 (d) | 0.8dB<br>528.838MHz,<br>Horizontal, QP<br>(Transmitting (Tx and Rx) With Tag mode) | Complied | Radiated |
| Frequency Tolerance | ANSI C63.4:2009<br>13. Measurement of intentional radiators | Section15.225(e) | See data | Complied | Radiated |
| Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15 | | | | | |

**FCC 15.31 (e)**
This EUT provides stable voltage (DC5.0V) constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

### 3.3 Addition to standard

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|---|---|---|---|---|---|
| 99% Occupied Band Width | RSS-Gen 4.6.1 | RSS-Gen 4.6.1 | N/A | N/A | N/A |

Other than above, no addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

**EMI**
The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

| Test room (semi-anechoic chamber) | Conducted emission (±dB) |
|---|---|
| | 150kHz-30MHz |
| No.1 | 2.6dB |
| No.2 | 2.9dB |
| No.3 | 3.3dB |
| No.4 | 2.8dB |

| Test room (semi-anechoic chamber) | Radiated emission (10m*)(±dB) | | | Radiated emission (3m*)(±dB) | | | | | (1m*)(±dB) |
|---|---|---|---|---|---|---|---|---|---|
| | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 1GHz -18GHz | 18GHz -26.5GHz | 26.5GHz -40GHz |
| No.1 | 2.7dB | 4.8dB | 5.0dB | 2.9dB | 4.8dB | 5.0dB | 3.9dB | 4.5dB | 4.4dB |
| No.2 | - | - | - | 3.5dB | 4.8dB | 5.1dB | 4.0dB | 4.3dB | 4.2dB |
| No.3 | - | - | - | 3.8dB | 4.6dB | 4.7dB | 4.0dB | 4.5dB | 4.4dB |
| No.4 | - | - | - | 3.5dB | 4.4dB | 4.9dB | 4.0dB | 4.6dB | 4.5dB |

*10m/3m/1m = Measurement distance

| Frequency counter (±) | |
|---|---|
| Normal condition | Extreme condition |
| $7 \times 10^{-6}$ | $9 \times 10^{-6}$ |

Conducted emission test
The data listed in this test report has enough margin, more than the site margin.

Radiated emission test (3m and 10m)
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

### 3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8116 Facsimile : +81 596 24 8124

| | FCC Registration Number | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms |
|---|---|---|---|---|---|
| No.1 semi-anechoic chamber | 313583 | 2973C-1 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | No.1 Power source room |
| No.2 semi-anechoic chamber | 655103 | 2973C-2 | 7.5 x 5.8 x 5.2m | 4.0 x 4.0m | - |
| No.3 semi-anechoic chamber | 148738 | 2973C-3 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.3 Preparation room |
| No.3 shielded room | - | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.4 semi-anechoic chamber | 134570 | 2973C-4 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.4 Preparation room |
| No.4 shielded room | - | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.5 semi-anechoic chamber | - | - | 6.0 x 6.0 x 3.9m | 6.0 x 6.0m | - |
| No.6 shielded room | - | - | 4.0 x 4.5 x 2.7m | 4.75 x 5.4 m | - |
| No.6 measurement room | - | - | 4.75 x 5.4 x 3.0m | 4.75 x 4.15 m | - |
| No.7 shielded room | - | - | 4.7 x 7.5 x 2.7m | 4.7 x 7.5m | - |
| No.8 measurement room | - | - | 3.1 x 5.0 x 2.7m | N/A | - |
| No.9 measurement room | - | - | 8.0 x 4.5 x 2.8m | 2.0 x 2.0m | - |
| No.10 measurement room | - | - | 2.6 x 2.8 x 2.5m | 2.4 x 2.4m | - |
| No.11 measurement room | - | - | 3.1 x 3.4 x 3.0m | 2.4 x 3.4m | - |

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

### 3.6 Test set up, Data of EMI, and Test instruments

Refer to APPENDIX.

# SECTION 4: Operation of E.U.T. during testing

## 4.1 Operating Modes

The mode is used :

| Mode |
|---|
| (1) Transmitting (Tx and Rx) with Tag mode<br>(2) Transmitting (Tx and Rx) without Tag mode<br>(3) Transmitting (Tx and Rx) without Tag (Antenna: 50Ω terminated) mode<br>(4) Standby mode<br>(5) Continuous Transmitting mode |
| The EUT was operated in a manner similar to typical use during the tests.<br>The EUT Transmits and Receives at the same time and there is no receiving mode. |

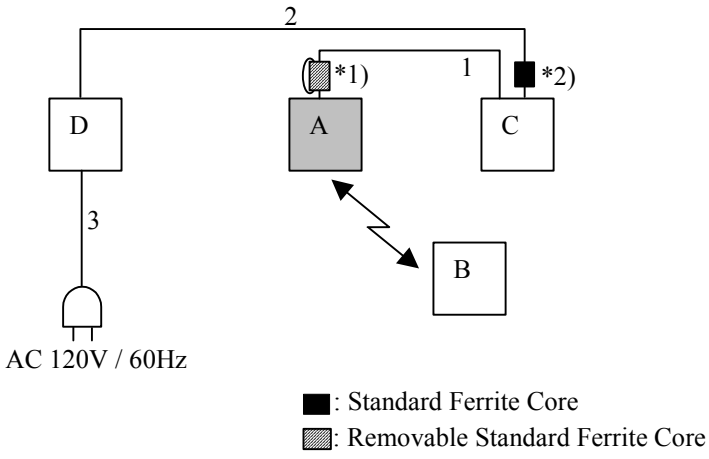
| Test Item | Operating mode* |
|---|---|
| Conducted emission | (1), (2), (3), (4) |
| Electric Field Strength of Fundamental Emission | (1), (2) |
| Spectrum Mask | (1), (2) |
| Electric Field Strength of Spurious Emission | (1), (2) |
| 20dB Bandwidth | (1) |
| Frequency Tolerance | (5) |

Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

Frequency Tolerance:

Temperature : -30deg.C to +50deg.C Step 10deg.C
Voltage : Normal Voltage DC 5.0V
Maximum Voltage DC 5.75V, Minimum Voltage DC 4.25V (DC 5.0V ±15%)
*This EUT provides stable voltage (DC5.0V) constantly to RF Part regardless of input voltage

## 4.2 Configuration and peripherals




*Cabling and setup were taken into consideration and test data was taken under worse case conditions.

**Description of EUT and Support equipment**

| No. | Item | Model number | Serial number | Manufacturer | Remark |
|---|---|---|---|---|---|
| A | Contactless IC Card Reader/Writer | PR-450UDM | 4665006390811487 | DENSO WAVE INCORPORATED | EUT |
| B | Tag | - | 001 | - | - |
| C | Personal Computer | 2672-N6J | 99-AYPWZ 03/10 | IBM | - |
| D | AC Adapter | 02K6810 | 11S02K6810Z1Z3 BJ236551 | IBM | - |

**List of cables used**

| No. | Name | Length (m) | Shield | | Remark |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | USB Cable | 1.2 | Shielded | Shielded | Ferrite Core: 2 turns *1) |
| 2 | DC Cable | 1.8 | Shielded | Shielded | Ferrite Core: 1 turns *2) |
| 3 | AC Cable | 1.0 | Unshielded | Unshielded | - |

**<Notes for Ferrite cores>**

*1) 1 Ferrite Core, Model No. USB-4 (Manufacturer: KITAGAWA INDUSTRIES CO., LTD.), 5cm from Item A, 2 turns
*This is Removal Ferrite Core that is included in finished goods.

*2) Generally ferrite core is attached to the DC cable of Personal Computer. Therefore the test was performed with the core.

## SECTION 5: Conducted emission

**Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

**Detector : QP and AV**
**Measurement range : 0.15-30MHz**
**Test data : APPENDIX**
**Test result : Pass**

## SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask )

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.
The height of the measuring antenna varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
The measurements were performed for both vertical (angle of loop antenna: 0deg., 45deg., 90deg., and 135 deg.) and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

**Test Antennas are used as below;**

| Frequency | Below 30MHz | 30MHz to 300MHz | 300MHz to 1GHz |
|---|---|---|---|
| Antenna Type | Loop | Biconical | Logperiodic |

| Frequency | From 9kHz to 90kHz and From 110kHz to 150kHz | From 90kHz to 110kHz | From 150kHz to 490kHz | From 490kHz to 30MHz | From 30MHz to 1GHz |
|---|---|---|---|---|---|
| Instrument used | Test Receiver | | | | |
| Detector | PK/AV | QP | PK/AV | QP | QP |
| IF Bandwidth | 200Hz | 200Hz | 9kHz | 9kHz | 120kHz |

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

* FCC Part 15 Section 15.31 (f)(2) / IC RSS-Gen 4.11 (9kHz-30MHz)

$$9\text{kHz} - 490\text{kHz}\,[\text{Limit at 3m}] = [\text{Limit at 300m}] - 40\log\left(\frac{3}{300}\right)$$

$$490\text{kHz} - 30\text{MHz}\,[\text{Limit at 3m}] = [\text{Limit at 30m}] - 40\log\left(\frac{3}{30}\right)$$

**Measurement range : 0.09M-1GHz**
**Test data : APPENDIX**
**Test result : Pass**

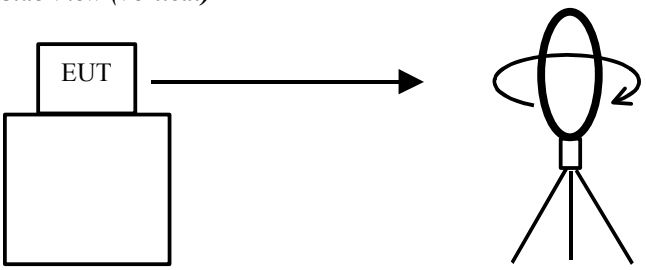
## SECTION 7: Other test

| Test | Span | RBW | VBW | Sweep time | Detector | Trace | Instrument used |
|---|---|---|---|---|---|---|---|
| 20dB Bandwidth | 100kHz | 1kHz | 3kHz | Auto | Peak | Max Hold | Spectrum Analyzer |
| 99% Occupied Bandwidth | Enough width to display 20dB Bandwidth | 1 to 3% of Span | Three times of RBW | Auto | Peak | Max Hold | Spectrum Analyzer |
| Frequency Tolerance | - | - | - | - | - | - | Frequency counter |

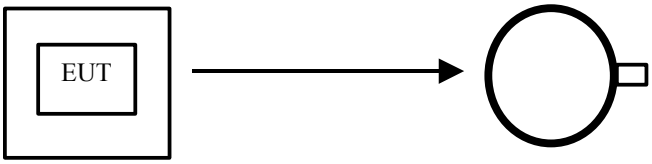
**Test data : APPENDIX**
**Test result : Pass**

**Figure 1: Direction of the Loop Antenna**

*Side View (Vertical)*

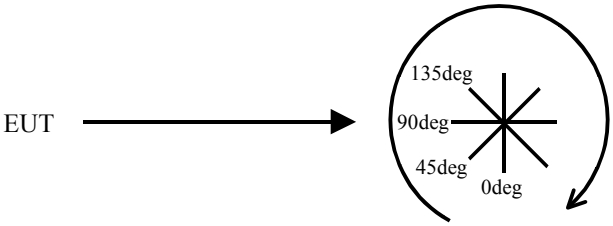



*Top View (Horizontal)*




Antenna was not rotated.

*Top View (Vertical)*




Front side: 0 deg.
Forward direction: clockwise