



# RADIO TEST REPORT

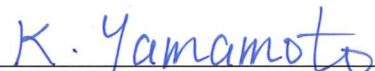
**Test Report No. : 10666775H-A-R1**

**Applicant** : DENSO CORPORATION  
**Type of Equipment** : Electronic Key  
**Model No.** : 14FBC  
**Test regulation** : FCC Part 15 Subpart C: 2015  
**FCC ID** : HYQ14FBC  
**Test Result** : Complied

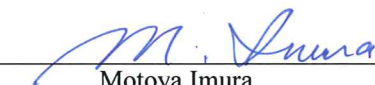
1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national 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 test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 10666775H-A. 10666775H-A is replaced with this report.

**Date of test:** February 2, 2015

**Representative test engineer:**

  
Koji Yamamoto  
Engineer  
Consumer Technology Division

**Approved by:**

  
Motoya Imura  
Engineer  
Consumer Technology Division



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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

## REVISION HISTORY

# Original Test Report No.: 10666775H-A

[illegible]

**UL Japan, Inc.**

## Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

---

| <b>CONTENTS</b>                                                                                          | <b>PAGE</b> |
|----------------------------------------------------------------------------------------------------------|-------------|
| <b>SECTION 1: Customer information</b> .....                                                             | <b>4</b>    |
| <b>SECTION 2: Equipment under test (E.U.T.)</b> .....                                                    | <b>4</b>    |
| <b>SECTION 3: Test specification, procedures &amp; results</b> .....                                     | <b>5</b>    |
| <b>SECTION 4: Operation of E.U.T. during testing</b> .....                                               | <b>8</b>    |
| <b>SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)</b> ..... | <b>9</b>    |
| <b>SECTION 6: Automatically deactivate</b> .....                                                         | <b>10</b>   |
| <b>SECTION 7: -20dB and 99% Occupied Bandwidth</b> .....                                                 | <b>10</b>   |
| <b>APPENDIX 1: Data of EMI test</b> .....                                                                | <b>11</b>   |
| Automatically deactivate .....                                                                           | 11          |
| Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission) .....                   | 13          |
| -20dB and 99% Occupied Bandwidth .....                                                                   | 15          |
| <b>APPENDIX 2: Test Instruments</b> .....                                                                | <b>17</b>   |
| <b>APPENDIX 3: Photographs of test setup</b> .....                                                       | <b>18</b>   |
| Radiated emission .....                                                                                  | 18          |
| Worst case position .....                                                                                | 19          |

---

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **SECTION 1: Customer information**

Company Name : DENSO CORPORATION  
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan  
Telephone Number : +81-566-61-5242  
Facsimile Number : +81-566-25-4837  
Contact Person : MASAYUKI YAMAMOTO

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

### **2.1 Identification of E.U.T.**

Type of Equipment : Electronic Key  
Model No. : 14FBC  
Serial No. : Refer to Clause 4.2  
Rating : DC 3.0V  
Receipt Date of Sample : January 31, 2015  
Country of Mass-production : Japan, United States of America, and China  
Condition of EUT : Production prototype  
(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: 14FBC (referred to as the EUT in this report) is the Electronic Key.

#### **General Specification**

Clock frequency(ies) in the system : 8 MHz (IC Clock), 18.37MHz (RF)

#### **Radio Specification**

Radio Type : Transceiver  
Frequency of Operation : 314.35 MHz / 312.10 MHz \*1)  
Modulation : FSK (F1D)  
Power Supply (radio part input) : DC 3.0V  
Type of Battery : One lithium battery  
Antenna type : Built-in type (Fixed)  
Receiving frequency of Operation : 134.2kHz \*2)

\*1) These two different frequencies are not emitted simultaneously.

\*2) The test of receiver part was performed separately from this test report, and the conformability is confirmed.

\* Original model No.: 14FBC has 4 switches.

Variation models have 3 switches (Type A and Type B) and 2 switches.

The difference of Original model and Variation models is only the number of switch.

They are completely identical in RF characteristics.

Therefore the test was performed with the representative original type which was the worst one.

---

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### **SECTION 3: Test specification, procedures & results**

#### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C: 2015, final revised on January 21, 2015

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.231 Periodic operation in the band 40.66 - 40.70MHz  
and above 70MHz

#### **3.2 Procedures and results**

| Item                                               | Test Procedure                                                                | Specification                                              | Worst margin                                                                      | Results  | Remarks  |
|----------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------|-----------------------------------------------------------------------------------|----------|----------|
| Conducted emission                                 | FCC: ANSI C63.4:2009<br>7. AC powerline<br>conducted emission<br>measurements | FCC: Section 15.207                                        | N/A                                                                               | N/A*1)   | -        |
|                                                    | IC: RSS-Gen 8.8                                                               | IC: RSS-Gen 8.8                                            |                                                                                   |          |          |
| Automatically Deactivate                           | FCC: ANSI C63.4:2009<br>13. Measurement of<br>intentional radiators           | FCC: Section<br>15.231(a)(1)                               | N/A                                                                               | Complied | Radiated |
|                                                    | IC: -                                                                         | IC: RSS-210 A1.1.1                                         |                                                                                   |          |          |
| Electric Field Strength<br>of Fundamental Emission | FCC: ANSI C63.4:2009<br>13. Measurement of<br>intentional radiators           | FCC: Section 15.231(b)                                     | 8.7dB<br>Horizontal<br>PK with Duty<br>factor<br>(Tx 314.35MHz)<br>(Tx 312.10MHz) | Complied | Radiated |
|                                                    | IC: RSS-Gen 6.12                                                              | IC: RSS-210 A1.1.2                                         |                                                                                   |          |          |
| Electric Field Strength<br>of Spurious Emission    | FCC: ANSI C63.4:2009<br>13. Measurement of<br>intentional radiators           | FCC: Section 15.205<br>Section 15.209<br>Section 15.231(b) | 3.7dB<br>3143.500MHz<br>Horizontal<br>PK with Duty<br>factor<br>(Tx 314.35MHz)    | Complied | Radiated |
|                                                    | IC: RSS-Gen 6.13                                                              | IC: RSS-210 A1.1.2,<br>2.5.1<br>RSS-Gen 8.9                |                                                                                   |          |          |
| -20dB Bandwidth                                    | FCC: ANSI C63.4:2009<br>13. Measurement of<br>intentional radiators           | FCC: Section 15.231(c)                                     | N/A                                                                               | Complied | Radiated |
|                                                    | IC: -                                                                         | IC: Reference data                                         |                                                                                   |          |          |

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

\*1) The test is not applicable since the EUT does not have AC Mains.

#### **FCC Part 15.31 (e)**

This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to the EUT during the tests. Therefore, the 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.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.3 Addition to standard

| Item                   | Test Procedure  | Specification | Worst margin | Results  | Remarks  |
|------------------------|-----------------|---------------|--------------|----------|----------|
| 99% Occupied Bandwidth | IC: RSS-Gen 6.6 | IC: -         | N/A          | Complied | Radiated |

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<br>(semi-anechoic chamber) | Radiated emission |                  |                 |                |                 |                   |                   |
|--------------------------------------|-------------------|------------------|-----------------|----------------|-----------------|-------------------|-------------------|
|                                      | (3m*)(+dB)        |                  |                 |                | (1m*)(+dB)      |                   | (0.5m*)(+dB)      |
|                                      | 9kHz<br>-30MHz    | 30MHz<br>-300MHz | 300MHz<br>-1GHz | 1GHz<br>-10GHz | 10GHz<br>-18GHz | 18GHz<br>-26.5GHz | 26.5GHz<br>-40GHz |
| No.1                                 | 4.0dB             | 5.1dB            | 5.0dB           | 5.1dB          | 6.0dB           | 4.9dB             | 4.3dB             |
| No.2                                 | 3.9dB             | 5.2dB            | 5.0dB           | 4.9dB          | 5.9dB           | 4.7dB             | 4.2dB             |
| No.3                                 | 4.3dB             | 5.1dB            | 5.2dB           | 5.2dB          | 6.0dB           | 4.8dB             | 4.2dB             |
| No.4                                 | 4.6dB             | 5.2dB            | 5.0dB           | 5.2dB          | 6.0dB           | 5.7dB             | 4.2dB             |

\*3m/1m/0.5m = Measurement distance

#### Radiated emission test(3m)

[Electric Field Strength of Fundamental Emission]

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

[Electric Field Strength of Spurious Emission]

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

### 3.5 Test Location

UL Japan, Inc. Ise EMC Lab. \*NVLAP Lab. code: 200572-0  
 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN  
 Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

|                            | 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 | 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 | 2973C-2                | 7.5 x 5.8 x 5.2m           | 4.0 x 4.0m                                                       | -                      |
| No.3 semi-anechoic chamber | 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 | 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           | 4.0 x 4.5 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 4.6 x 2.8m           | 2.4 x 2.4m                                                       | -                      |
| No.11 measurement room     | -                      | 6.2 x 4.7 x 3.0m           | 4.8 x 4.6m                                                       | -                      |

\* 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 Data of EMI, Test instruments, and Test set up.

Refer to APPENDIX.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

### **4.1 Operating Modes**

| Test Item                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Mode                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Automatically Deactivate                                                                                                                                                                                                                                                                                                                                                                                                                                                | Normal use mode, 314.35 MHz<br>Normal use mode, 312.10 MHz                       |
| Electric Field Strength of Fundamental Emission<br>Electric Field Strength of Spurious Emission<br>-20dB & 99% Occupied Bandwidth                                                                                                                                                                                                                                                                                                                                       | Transmitting mode (Tx), 314.35 MHz *1)<br>Transmitting mode (Tx), 312.10 MHz *1) |
| <p>* The system was configured in typical fashion (as a customer would normally use it) for testing.<br/> *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transmitter button is being pressed (For Normal use mode, the EUT transmits when it receives 134.2kHz radio signal and transmitter button is being pressed.)<br/> End users cannot change the settings of the output power of the product.</p> |                                                                                  |

### **4.2 Configuration and peripherals**

A

\* Setup was taken into consideration and test data was taken under worse case conditions.

#### **Description of EUT**

| No. | Item           | Model number | Serial number      | Manufacturer      | Remarks |
|-----|----------------|--------------|--------------------|-------------------|---------|
| A   | Electronic Key | 14FBC        | 001 *1)<br>002 *2) | DENSO CORPORATION | EUT     |

\*1) Used for Automatically Deactivate test only.

\*2) Used for other tests except for Automatically Deactivate test.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)**

### **Test Procedure and conditions**

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The EUT was set on the center of the tabletop.  
 Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.  
 Photographs of the set up are shown in Appendix 3.

### **[Transmitting mode]**

#### **(Below 30MHz)**

The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

#### **(Above 30MHz)**

The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 3m.

The measuring antenna height was 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 and horizontal antenna polarization.

The radiated emission measurements were made with the following detector function of the test receiver/spectrum analyzer.

### **Test Antennas are used as below;**

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

|               | 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             | Above 1GHz                     |
|---------------|----------------------------------------------|----------------------|-----------------------|----------------------|--------------------------------|--------------------------------|
| Detector Type | Peak                                         | Peak                 | Peak                  | Peak                 | Peak and Peak with Duty factor | Peak and Peak with Duty factor |
| IF Bandwidth  | 200Hz                                        | 200Hz                | 9.1kHz                | 9.1kHz               | 120kHz                         | PK: S/A:RBW 1MHz, VBW:3MHz     |

- The carrier level was measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.

Noise levels of all the frequencies were measured at the position.

This EUT has two modes which mechanical key is inserted or not. The worst case was confirmed with and without mechanical key, as a result, the test with mechanical key was the worst case. Therefore the test with mechanical key was performed only.

\*The result is rounded off to the second decimal place, so some differences might be observed.

|                          |                      |
|--------------------------|----------------------|
| <b>Measurement range</b> | <b>: 9kHz-3.2GHz</b> |
| <b>Test data</b>         | <b>: APPENDIX</b>    |
| <b>Test result</b>       | <b>: Pass</b>        |

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **SECTION 6: Automatically deactivate**

### **Test Procedure**

The measurement was performed with Electric field strength using a spectrum analyzer.

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

## **SECTION 7: -20dB and 99% Occupied Bandwidth**

### **Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

| Test                   | Span                                   | RBW         | VBW                | Sweep         | Detector | Trace    | Instrument used   |
|------------------------|----------------------------------------|-------------|--------------------|---------------|----------|----------|-------------------|
| 20dB Bandwidth         | 150kHz                                 | 1.5kHz      | 5.1kHz             | Auto          | Peak     | Max Hold | Spectrum Analyzer |
| 99% Occupied Bandwidth | Enough width to display 20dB Bandwidth | 1 % of Span | Three times of RBW | Auto (Single) | Peak     | Max Hold | Spectrum Analyzer |

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

---

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

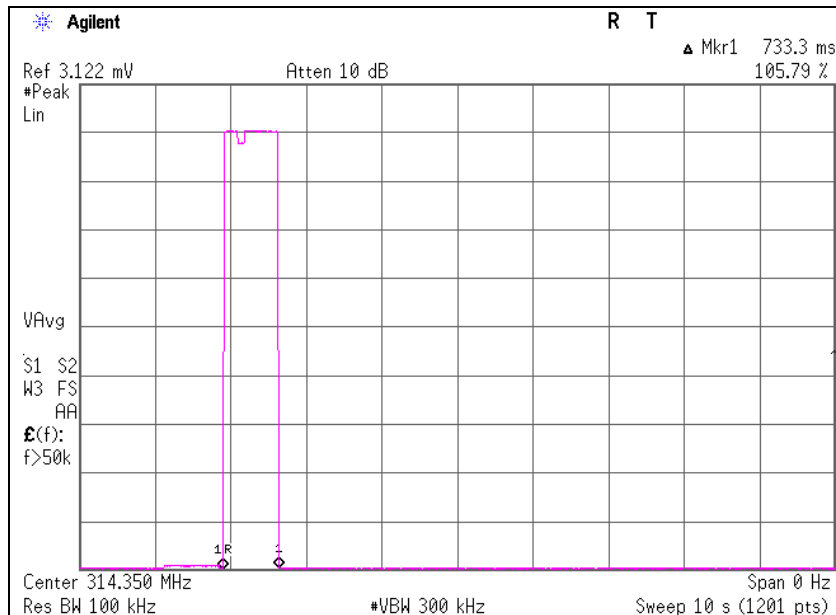
Facsimile : +81 596 24 8124

## APPENDIX 1: Data of EMI test

### Automatically deactivate 314.35MHz

|                       |                                         |
|-----------------------|-----------------------------------------|
| Test place            | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No.            | 10666775H                               |
| Date                  | 02/02/2015                              |
| Temperature/ Humidity | 23 deg. C / 39% RH                      |
| Engineer              | Masatoshi Nishiguchi                    |
| Mode                  | Normal use mode 314.35MHz               |

| Time of Transmitting<br>[sec] | Limit<br>[sec] | Result |
|-------------------------------|----------------|--------|
| 0.7333                        | 5.00           | Pass   |



**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

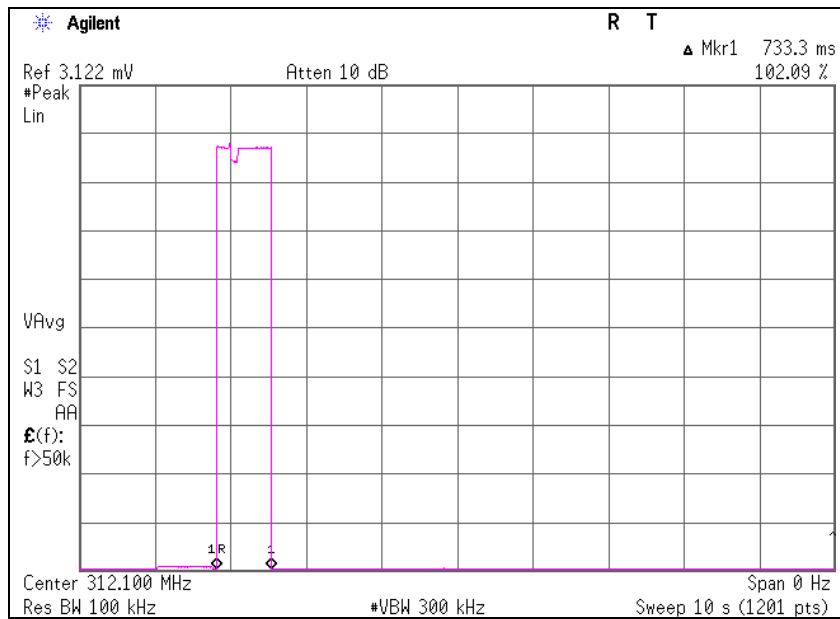
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Automatically deactivate**  
**312.10MHz**

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10666775H  
Date : 02/02/2015  
Temperature/ Humidity : 23 deg. C / 39% RH  
Engineer : Masatoshi Nishiguchi  
Mode : Normal use mode, 312.10 MHz

| Time of<br>Transmitting<br>[sec] | Limit<br>[sec] | Result |
|----------------------------------|----------------|--------|
| 0.7333                           | 5.00           | Pass   |



**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)**

### **314.35MHz**

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10666775H  
Date : 02/02/2015  
Temperature/ Humidity : 23 deg. C / 39% RH  
Engineer : Koji Yamamoto  
Mode : Transmitting mode (Tx), 314.35 MHz

#### **PK**

| Frequency<br>[MHz] | Detector | Reading<br>[dBuV] |      | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] |      | Limit<br>[dBuV/m] | Margin<br>[dB] |      | Remark<br>Inside or Outside<br>of Restricted Bands |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-------------------|----------------|------|----------------------------------------------------|
|                    |          | Hor               | Ver  |                         |              |              |                        | Hor                | Ver  |                   | Hor            | Ver  |                                                    |
| 314.350            | PK       | 70.5              | 66.5 | 15.0                    | 8.8          | 27.5         | -                      | 66.8               | 62.8 | 95.5              | 28.7           | 32.7 | Carrier                                            |
| 628.700            | PK       | 28.8              | 29.0 | 20.0                    | 10.1         | 28.3         | -                      | 30.6               | 30.8 | 75.5              | 44.9           | 44.7 | Outside                                            |
| 943.050            | PK       | 28.0              | 28.2 | 23.0                    | 11.3         | 27.1         | -                      | 35.2               | 35.4 | 75.5              | 40.3           | 40.1 | Outside                                            |
| 1257.400           | PK       | 45.2              | 44.3 | 25.7                    | 2.0          | 35.8         | -                      | 37.1               | 36.2 | 75.5              | 38.4           | 39.3 | Outside                                            |
| 1571.750           | PK       | 45.3              | 45.7 | 26.5                    | 2.3          | 35.4         | -                      | 38.7               | 39.1 | 73.9              | 35.2           | 34.8 | Inside                                             |
| 1886.100           | PK       | 46.9              | 45.0 | 27.3                    | 2.5          | 35.2         | -                      | 41.5               | 39.6 | 75.5              | 34.0           | 35.9 | Outside                                            |
| 2200.450           | PK       | 45.1              | 43.8 | 27.2                    | 2.7          | 35.0         | -                      | 40.0               | 38.7 | 73.9              | 33.9           | 35.2 | Inside                                             |
| 2514.800           | PK       | 49.1              | 45.3 | 26.9                    | 2.8          | 34.9         | -                      | 43.9               | 40.1 | 75.5              | 31.6           | 35.4 | Outside                                            |
| 2829.150           | PK       | 48.7              | 48.3 | 27.6                    | 3.0          | 34.8         | -                      | 44.5               | 44.1 | 73.9              | 29.4           | 29.8 | Inside                                             |
| 3143.500           | PK       | 54.9              | 53.5 | 28.3                    | 3.2          | 34.6         | -                      | 51.8               | 50.4 | 75.5              | 23.7           | 25.1 | Outside                                            |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

#### **PK with Duty factor**

| Frequency<br>[MHz] | Detector | Reading<br>[dBuV] |      | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] |      | Limit<br>[dBuV/m] | Margin<br>[dB] |      | Remark  |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-------------------|----------------|------|---------|
|                    |          | Hor               | Ver  |                         |              |              |                        | Hor                | Ver  |                   | Hor            | Ver  |         |
| 314.350            | PK       | 70.5              | 66.5 | 15.0                    | 8.8          | 27.5         | 0.0                    | 66.8               | 62.8 | 75.5              | 8.7            | 12.7 | Carrier |
| 628.700            | PK       | 28.8              | 29.0 | 20.0                    | 10.1         | 28.3         | 0.0                    | 30.6               | 30.8 | 55.5              | 24.9           | 24.7 | Outside |
| 943.050            | PK       | 28.0              | 28.2 | 23.0                    | 11.3         | 27.1         | 0.0                    | 35.2               | 35.4 | 55.5              | 20.3           | 20.1 | Outside |
| 1257.400           | PK       | 45.2              | 44.3 | 25.7                    | 2.0          | 35.8         | 0.0                    | 37.1               | 36.2 | 55.5              | 18.4           | 19.3 | Outside |
| 1571.750           | PK       | 45.3              | 45.7 | 26.5                    | 2.3          | 35.4         | 0.0                    | 38.7               | 39.1 | 53.9              | 15.2           | 14.8 | Inside  |
| 1886.100           | PK       | 46.9              | 45.0 | 27.3                    | 2.5          | 35.2         | 0.0                    | 41.5               | 39.6 | 55.5              | 14.0           | 15.9 | Outside |
| 2200.450           | PK       | 45.1              | 43.8 | 27.2                    | 2.7          | 35.0         | 0.0                    | 40.0               | 38.7 | 53.9              | 13.9           | 15.2 | Inside  |
| 2514.800           | PK       | 49.1              | 45.3 | 26.9                    | 2.8          | 34.9         | 0.0                    | 43.9               | 40.1 | 55.5              | 11.6           | 15.4 | Outside |
| 2829.150           | PK       | 48.7              | 48.3 | 27.6                    | 3.0          | 34.8         | 0.0                    | 44.5               | 44.1 | 53.9              | 9.4            | 9.8  | Inside  |
| 3143.500           | PK       | 54.9              | 53.5 | 28.3                    | 3.2          | 34.6         | 0.0                    | 51.8               | 50.4 | 55.5              | 3.7            | 5.1  | Outside |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor.

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Since the peak emission result satisfied the average limit, duty factor was omitted.

Although Duty of this product was 100% or less, the result of AV (PK with Duty factor) was calculated by applying Duty 100% as worst.

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)**  
**312.10MHz**

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10666775H  
Date : 02/02/2015  
Temperature/ Humidity : 23 deg. C / 39% RH  
Engineer : Koji Yamamoto  
Mode : Transmitting mode (Tx), 312.10 MHz

**PK**

| Frequency<br>[MHz] | Detector | Reading<br>[dBuV] |      | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] |      | Limit<br>dBuV/m | Margin<br>[dB] |      | Remark<br>Inside or Outside<br>of Restricted Bands |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-----------------|----------------|------|----------------------------------------------------|
|                    |          | Hor               | Ver  |                         |              |              |                        | Hor                | Ver  |                 | Hor            | Ver  |                                                    |
| 312.100            | PK       | 70.5              | 67.3 | 14.9                    | 8.8          | 27.5         | -                      | 66.7               | 63.5 | 95.4            | 28.7           | 31.9 | Carrier                                            |
| 624.200            | PK       | 28.8              | 28.8 | 20.0                    | 10.1         | 28.4         | -                      | 30.5               | 30.5 | 75.4            | 44.9           | 44.9 | Outside                                            |
| 936.300            | PK       | 27.9              | 27.9 | 22.9                    | 11.3         | 27.1         | -                      | 35.0               | 35.0 | 75.4            | 40.4           | 40.4 | Outside                                            |
| 1248.400           | PK       | 45.6              | 45.6 | 25.7                    | 2.0          | 35.8         | -                      | 37.5               | 37.5 | 75.4            | 37.9           | 37.9 | Outside                                            |
| 1560.500           | PK       | 45.3              | 45.1 | 26.4                    | 2.3          | 35.5         | -                      | 38.5               | 38.3 | 73.9            | 35.4           | 35.6 | Inside                                             |
| 1872.600           | PK       | 46.2              | 44.6 | 27.2                    | 2.5          | 35.2         | -                      | 40.7               | 39.1 | 75.4            | 34.7           | 36.3 | Outside                                            |
| 2184.700           | PK       | 44.8              | 43.8 | 27.3                    | 2.6          | 35.0         | -                      | 39.7               | 38.7 | 75.4            | 35.7           | 36.7 | Outside                                            |
| 2496.800           | PK       | 49.3              | 45.3 | 26.9                    | 2.8          | 34.9         | -                      | 44.1               | 40.1 | 73.9            | 29.8           | 33.8 | Inside                                             |
| 2808.900           | PK       | 49.2              | 47.0 | 27.5                    | 3.0          | 34.8         | -                      | 44.9               | 42.7 | 73.9            | 29.0           | 31.2 | Inside                                             |
| 3121.000           | PK       | 54.7              | 53.1 | 28.2                    | 3.2          | 34.6         | -                      | 51.5               | 49.9 | 75.4            | 23.9           | 25.5 | Outside                                            |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier)

**PK with Duty factor**

| Frequency<br>[MHz] | Detector | Reading<br>[dBuV] |      | Ant<br>Factor<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Result<br>[dBuV/m] |      | Limit<br>dBuV/m | Margin<br>[dB] |      | Remark  |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-----------------|----------------|------|---------|
|                    |          | Hor               | Ver  |                         |              |              |                        | Hor                | Ver  |                 | Hor            | Ver  |         |
| 312.100            | PK       | 70.5              | 67.3 | 14.9                    | 8.8          | 27.5         | 0.0                    | 66.7               | 63.5 | 75.4            | 8.7            | 11.9 | Carrier |
| 624.200            | PK       | 28.8              | 28.8 | 20.0                    | 10.1         | 28.4         | 0.0                    | 30.5               | 30.5 | 55.4            | 24.9           | 24.9 | Outside |
| 936.300            | PK       | 27.9              | 27.9 | 22.9                    | 11.3         | 27.1         | 0.0                    | 35.0               | 35.0 | 55.4            | 20.4           | 20.4 | Outside |
| 1248.400           | PK       | 45.6              | 45.6 | 25.7                    | 2.0          | 35.8         | 0.0                    | 37.5               | 37.5 | 55.4            | 17.9           | 17.9 | Outside |
| 1560.500           | PK       | 45.3              | 45.1 | 26.4                    | 2.3          | 35.5         | 0.0                    | 38.5               | 38.3 | 53.9            | 15.4           | 15.6 | Inside  |
| 1872.600           | PK       | 46.2              | 44.6 | 27.2                    | 2.5          | 35.2         | 0.0                    | 40.7               | 39.1 | 55.4            | 14.7           | 16.3 | Outside |
| 2184.700           | PK       | 44.8              | 43.8 | 27.3                    | 2.6          | 35.0         | 0.0                    | 39.7               | 38.7 | 55.4            | 15.7           | 16.7 | Outside |
| 2496.800           | PK       | 49.3              | 45.3 | 26.9                    | 2.8          | 34.9         | 0.0                    | 44.1               | 40.1 | 53.9            | 9.8            | 13.8 | Inside  |
| 2808.900           | PK       | 49.2              | 47.0 | 27.5                    | 3.0          | 34.8         | 0.0                    | 44.9               | 42.7 | 53.9            | 9.0            | 11.2 | Inside  |
| 3121.000           | PK       | 54.7              | 53.1 | 28.2                    | 3.2          | 34.6         | 0.0                    | 51.5               | 49.9 | 55.4            | 3.9            | 5.5  | Outside |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor.

\*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Since the peak emission result satisfied the average limit, duty factor was omitted.  
Although Duty of this product was 100% or less, the result of AV (PK with Duty factor) was calculated by applying Duty 100% as worst.

**-20dB and 99% Occupied Bandwidth**  
**314.35MHz/312.10MHz**

|                       |                                         |
|-----------------------|-----------------------------------------|
| Test place            | Ise EMC Lab. No.2 Semi Anechoic Chamber |
| Report No.            | 10666775H                               |
| Date                  | 02/02/2015                              |
| Temperature/ Humidity | 23 deg. C / 39% RH                      |
| Engineer              | Koji Yamamoto                           |
| Mode                  | Transmitting mode (Tx)                  |

Bandwidth Limit : Fundamental Frequency      **312.10** MHz x 0.25% =    780.25    kHz

\* The above limit was calculated from more stringent nominal frequency.

\* Method of KDB 926416 for systems employing non sweeping frequencies was referred.

**314.35MHz**

|                          |
|--------------------------|
| -20dB Bandwidth<br>[kHz] |
| 37.15                    |

**312.10MHz**

|                          |
|--------------------------|
| -20dB Bandwidth<br>[kHz] |
| 36.95                    |

|                          |                          |        |
|--------------------------|--------------------------|--------|
| -20dB Bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
| 37.15+36.95=74.10        | 780.25                   | Pass   |

Bandwidth Limit : Fundamental Frequency      **314.35** MHz x 0.25% =    785.88    kHz

|                                 |                          |        |
|---------------------------------|--------------------------|--------|
| 99% Occupied Bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
| 36.33                           | 785.88                   | Pass   |

Bandwidth Limit : Fundamental Frequency      **312.10** MHz x 0.25% =    780.25    kHz

|                                 |                          |        |
|---------------------------------|--------------------------|--------|
| 99% Occupied Bandwidth<br>[kHz] | Bandwidth Limit<br>[kHz] | Result |
| 36.36                           | 780.25                   | Pass   |

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

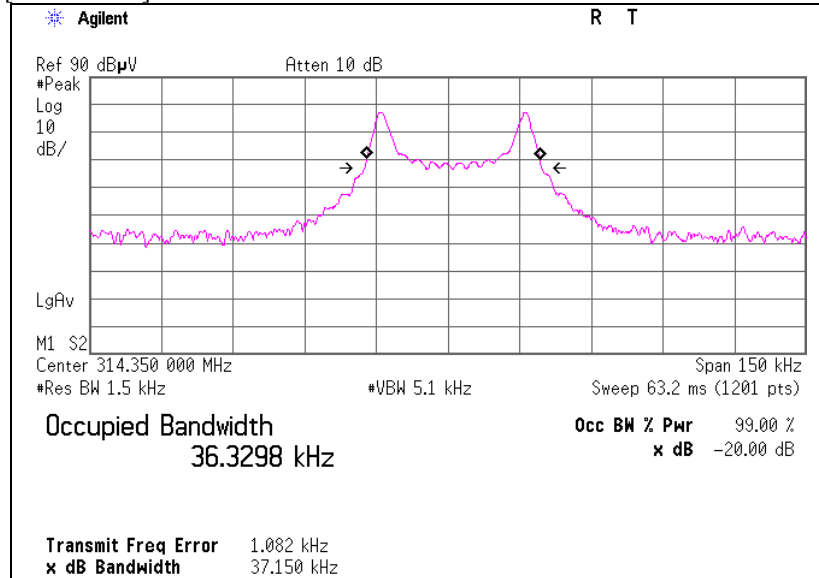
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

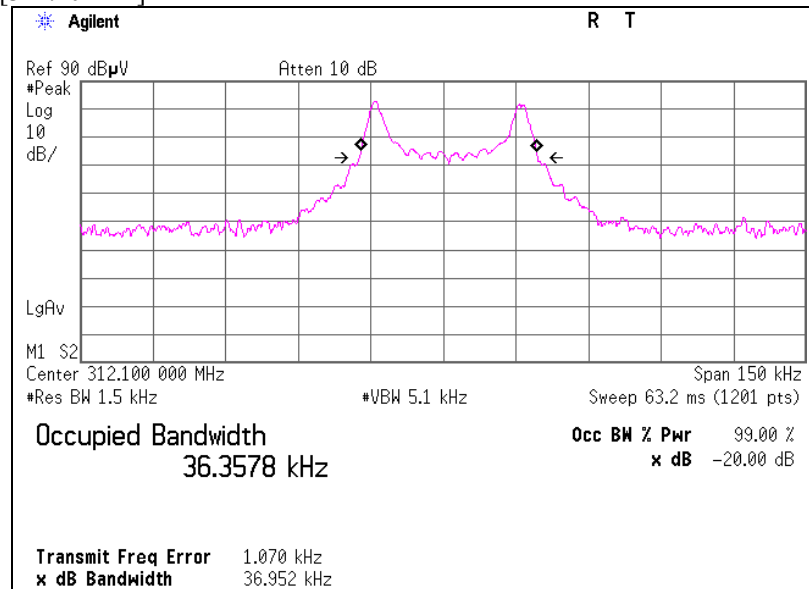
**-20dB and 99% Occupied Bandwidth**  
**314.35MHz/312.10MHz**

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber  
Report No. : 10666775H  
Date : 02/02/2015  
Temperature/ Humidity : 23 deg. C / 39% RH  
Engineer : Koji Yamamoto  
Mode : Transmitting mode (Tx)

[314.35MHz]



[312.10MHz]



**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **APPENDIX 2: Test Instruments**

### **EMI test equipment**

| <b>Control No.</b> | <b>Instrument</b>          | <b>Manufacturer</b> | <b>Model No</b>          | <b>Serial No</b>               | <b>Test Item</b> | <b>Calibration Date *<br/>Interval(month)</b> |
|--------------------|----------------------------|---------------------|--------------------------|--------------------------------|------------------|-----------------------------------------------|
| MAEC-02            | Semi Anechoic Chamber(NSA) | TDK                 | Semi Anechoic Chamber 3m | DA-06902                       | RE               | 2014/06/25 * 12                               |
| MOS-22             | Thermo-Hygrometer          | Custom              | CTH-201                  | 0003                           | RE               | 2015/01/13 * 12                               |
| MJM-14             | Measure                    | KOMELON             | KMC-36                   | -                              | RE               | -                                             |
| COTS-MEMI          | EMI measurement program    | TSJ                 | TEPTO-DV                 | -                              | RE               | -                                             |
| MRENT-116          | Spectrum Analyzer          | Agilent             | E4440A                   | MY46187620                     | RE               | 2014/03/05 * 12                               |
| MTR-03             | Test Receiver              | Rohde & Schwarz     | ESCI                     | 100300                         | RE               | 2014/06/03 * 12                               |
| MBA-02             | Biconical Antenna          | Schwarzbeck         | BBA9106                  | VHA91032008                    | RE               | 2014/10/18 * 12                               |
| MLA-02             | Logperiodic Antenna        | Schwarzbeck         | USLP9143                 | 201                            | RE               | 2014/10/18 * 12                               |
| MCC-12             | Coaxial Cable              | Fujikura/Agilent    | -                        | -                              | RE               | 2014/02/20 * 12                               |
| MAT-07             | Attenuator(6dB)            | Weinschel Corp      | 2                        | BK7970                         | RE               | 2014/11/11 * 12                               |
| MPA-09             | Pre Amplifier              | Agilent             | 8447D                    | 2944A10845                     | RE               | 2014/09/26 * 12                               |
| MHA-06             | Horn Antenna 1-18GHz       | Schwarzbeck         | BBHA9120D                | 254                            | RE               | 2014/02/21 * 12                               |
| MCC-166            | Microwave Cable            | Junkosha            | MWX221                   | 1303S120(1m) /<br>1311S167(5m) | RE               | 2014/09/24 * 12                               |
| MPA-10             | Pre Amplifier              | Agilent             | 8449B                    | 3008A02142                     | RE               | 2015/01/28 * 12                               |

**The expiration date of the calibration is the end of the expired month.**

**All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.**

**As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.**

#### **Test Item:**

**RE: Radiated emission, 99% Occupied Bandwidth, -20dB bandwidth, Automatically deactivate and Duty cycle tests**

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124