



RADIO TEST REPORT


Test Report No. : 12525890H

Applicant : DENSO CORPORATION
Type of Equipment : Smart Card Key
Model No. : 14CCL
FCC ID : HYQ14CCL
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied


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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
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7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.

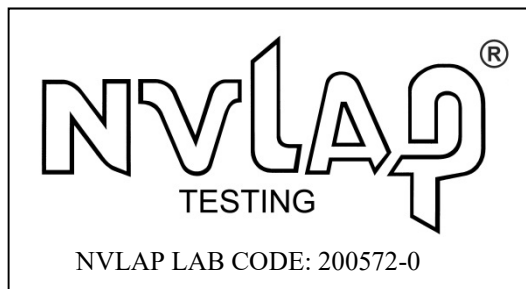
Date of test: October 3, 2018

Representative test engineer:


Shuichi Ohyama
Engineer
Consumer Technology Division

Approved by:


Motoya Imura
Leader
Consumer Technology Division



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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12525890H

| Revision | Test report No. | Date | Page revised | Contents |
|-----------------|-----------------|---------------------|--------------|----------|
| - (Original) | 12525890H | November 7, 2018 | - | - |
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SECTION 1: Customer information

Company Name : DENSO CORPORATION
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number : +81-566-20-3955
Facsimile Number : +81-566-25-4837
Contact Person : TAKAYUKI HATTORI

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

2.1 Identification of E.U.T.

Type of Equipment : Smart Card Key
Model No. : 14CCL
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 3.0 V
Receipt Date of Sample : September 27, 2018
Country of Mass-production : Japan, United states of America and China
Condition of EUT : Engineering 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: 14CCL (referred to as the EUT in this report) is a Smart Card Key.

Radio Type : Transceiver
Frequency of Operation : 433.58 MHz / 434.42 MHz*
*These two different frequencies are not emitted simultaneously.
Clock frequency(ies) in the system : 13.081 MHz Crystal / 8 MHz (IC)
Modulation : FSK (F1D)
Type of Battery : One lithium battery
Antenna type : Built-in type (Fixed)
Receiving frequency of Operation : 134.2 kHz *1)

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

* Model: 14CCL has two types; Type A and Type B.
The worst case was confirmed with Type A and Type B at pre check.
The test was performed with Type B, which had the worst result.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

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

3.2 Procedures and results

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|--|---|---|---|-----------|----------|
| Conducted emission | FCC: ANSI C63.10:2013 6 Standard test methods ----- IC: RSS-Gen 8.8 | FCC: Section 15.207 ----- IC: RSS-Gen 8.8 | N/A | N/A *1) | - |
| Automatically Deactivate | FCC: ANSI C63.10:2013 6 Standard test methods ----- IC: - | FCC: Section 15.231(a)(1) ----- IC: RSS-210 A1.1 | N/A | Complied | Radiated |
| Electric Field Strength of Fundamental Emission | FCC: ANSI C63.10:2013 6 Standard test methods ----- IC: RSS-Gen 6.12 | FCC: Section 15.231(b) ----- IC: RSS-210 A1.2 | 6.2 dB 433.580 MHz Vertical PK with Duty factor | Complied# | Radiated |
| Electric Field Strength of Spurious Emission | FCC: ANSI C63.10:2013 6 Standard test methods ----- IC: RSS-Gen 6.13 | FCC: Section 15.205 Section 15.209 Section 15.231(b) ----- IC: RSS-210 A1.2, 4.4 RSS-Gen 8.9 | 6.8 dB 4344.200 MHz Horizontal PK with Duty factor <434.42 MHz> | Complied | Radiated |
| -20dB Bandwidth | FCC: ANSI C63.10:2013 6 Standard test methods ----- IC: - | FCC: Section 15.231(c) ----- IC: Reference data | N/A | Complied | Radiated |

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.

Symbols:

Complied

The data of this test item has enough margin, more than the measurement uncertainty.

Complied#

The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

FCC 15.31 (e)

This test was performed with the New Battery (DC 3.0 V) 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.

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3.3 Addition to standard

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|-------------------------|-----------------|------------------|--------------|----------|----------|
| 99 % Occupied Bandwidth | IC: RSS-Gen 6.7 | IC: RSS-210 A1.3 | N/A | Complied | Radiated |

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

3.4 Uncertainty

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

| Polarity | Radiated emission (Below 1 GHz) | | | |
|------------|---------------------------------|---------------------|-------------------|---------------------|
| | (3 m*)(+/-) | | (10 m*)(+/-) | |
| | 30 MHz to 200 MHz | 200 MHz to 1000 MHz | 30 MHz to 200 MHz | 200 MHz to 1000 MHz |
| Horizontal | 4.8 dB | 5.2 dB | 4.8 dB | 5.0 dB |
| Vertical | 5.0 dB | 6.3 dB | 4.9 dB | 5.0 dB |

| Radiated emission (Above 1 GHz) | | | | |
|---------------------------------|-----------------|--------------------|--------------------|-----------------|
| (3 m*)(+/-) | | (1 m*)(+/-) | | (10 m*)(+/-) |
| 1 GHz to 6 GHz | 6 GHz to 18 GHz | 10 GHz to 26.5 GHz | 26.5 GHz to 40 GHz | 1 GHz to 18 GHz |
| 5.2 dB | 5.5 dB | 5.9 dB | 5.9 dB | 5.5 dB |

* Measurement distance

| Automatically Deactivate |
|--------------------------|
| 0.10 % |

| Bandwidth |
|-----------|
| 0.96 % |

3.5 Test Location

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 NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

| Test site | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms | Maximum measurement distance |
|----------------------------|------------------------|----------------------------|--|------------------------|------------------------------|
| No.1 semi-anechoic chamber | 2973C-1 | 19.2 x 11.2 x 7.7 | 7.0 x 6.0 | No.1 Power source room | 10 m |
| No.2 semi-anechoic chamber | 2973C-2 | 7.5 x 5.8 x 5.2 | 4.0 x 4.0 | - | 3 m |
| No.3 semi-anechoic chamber | 2973C-3 | 12.0 x 8.5 x 5.9 | 6.8 x 5.75 | No.3 Preparation room | 3 m |
| No.3 shielded room | - | 4.0 x 6.0 x 2.7 | N/A | - | - |
| No.4 semi-anechoic chamber | 2973C-4 | 12.0 x 8.5 x 5.9 | 6.8 x 5.75 | No.4 Preparation room | 3 m |
| No.4 shielded room | - | 4.0 x 6.0 x 2.7 | N/A | - | - |
| No.5 semi-anechoic chamber | - | 6.0 x 6.0 x 3.9 | 6.0 x 6.0 | - | - |
| No.6 shielded room | - | 4.0 x 4.5 x 2.7 | 4.0 x 4.5 | - | - |
| No.6 measurement room | - | 4.75 x 5.4 x 3.0 | 4.75 x 4.15 | - | - |
| No.7 shielded room | - | 4.7 x 7.5 x 2.7 | 4.7 x 7.5 | - | - |
| No.8 measurement room | - | 3.1 x 5.0 x 2.7 | 3.1 x 5.0 | - | - |
| No.9 measurement room | - | 8.8 x 4.6 x 2.8 | 2.4 x 2.4 | - | - |
| No.11 measurement room | - | 6.2 x 4.7 x 3.0 | 4.8 x 4.6 | - | - |

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

3.6 Test data, Test instruments, and Test set up

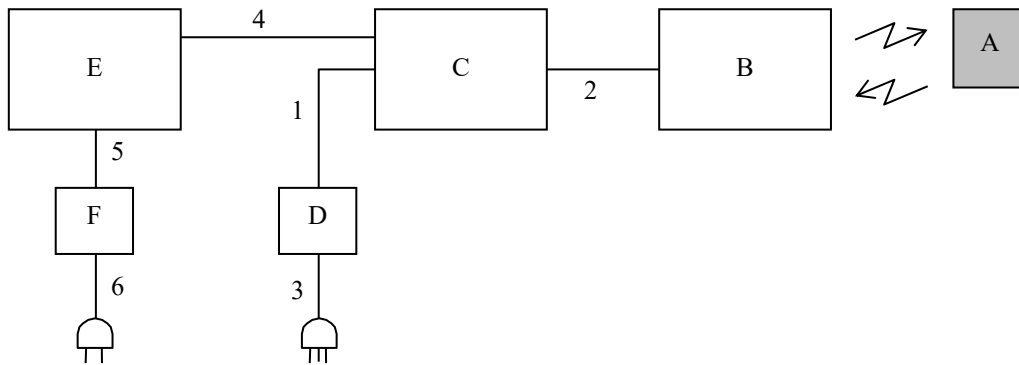
Refer to APPENDIX.

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

4.1 Operating Mode(s)

| Test Item* | Mode |
|---|--|
| Automatically Deactivate | Normal use mode, 433.58 MHz *1) Normal use mode, 434.42 MHz *1) |
| Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20 dB & 99 % Occupied Bandwidth | Transmitting mode (Tx), 433.58 MHz *2) Transmitting mode (Tx), 434.42 MHz *2) |
| * The system was configured in typical fashion (as a customer would normally use it) for testing. *1) The EUT transmits only when it receives 134.2 kHz radio signal. End users cannot change the settings of the output power of the product. *2) 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. This button was attached just for testing.(for making continuous transmission) | |

4.2 Configuration and peripherals



AC 120 V / 60 Hz AC 120 V / 60 Hz

* Cabling and setup(s) 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 | Remarks |
|-----|------------------|--------------|----------------------------|-------------------|---------|
| A | Smart Card Key | 14CCL | 002 *1) 001 *2) | DENSO CORPORATION | EUT |
| B | Door handle unit | - | - | DENSO CORPORATION | *1) |
| C | Test bench | - | - | DENSO CORPORATION | *1) |
| D | AC Adapter | - | - | DENSO CORPORATION | *1) |
| E | Laptop PC | L540 | R90B035F | Lenovo | *1) |
| F | AC Adapter | ADLX65NCC2A | 11S45N0263Z1ZS9948C7 3U | Lenovo | *1) |

*1) Used for Normal use mode only.

*2) Used for Transmitting mode only.

List of cables used

| No. | Name | Length (m) | Shield | | Remark |
|-----|---------------------|------------|------------|------------|--------|
| | | | Cable | Connector | |
| 1 | DC Cable | 3.0 | Unshielded | Unshielded | *1) |
| 2 | DC and Signal Cable | 1.5 | Unshielded | Unshielded | *1) |
| 3 | AC Cable | 2.0 | Unshielded | Unshielded | *1) |
| 4 | USB Cable | 1.8 | Shielded | Shielded | *1) |
| 5 | DC Cable | 1.7 | Unshielded | Unshielded | *1) |
| 6 | AC Cable | 0.9 | Unshielded | Unshielded | *1) |

*1) Used for Normal use mode only.

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

Test Procedure and conditions

[For below 30 MHz]

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

[For 30 MHz to 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The measuring antenna height was varied between 1 and 4 m 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.

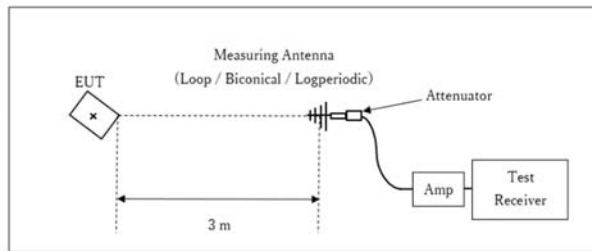
Test Antennas are used as below;

| | | | | |
|--------------|--------------|-------------------|------------------|-------------|
| Frequency | Below 30 MHz | 30 MHz to 200 MHz | 200 MHz to 1 GHz | Above 1 GHz |
| Antenna Type | Loop | Biconical | Logperiodic | Horn |

| | | | | | | |
|---------------|--|------------------------|-------------------------|------------------------|--------------------------------|--------------------------------|
| | From 9 kHz to 90 kHz and From 110 kHz to 150 kHz | From 90 kHz to 110 kHz | From 150 kHz to 490 kHz | From 490 kHz to 30 MHz | From 30 MHz to 1 GHz | Above 1 GHz |
| Detector Type | Peak | Peak | Peak | Peak | Peak and Peak with Duty factor | Peak and Peak with Duty factor |
| IF Bandwidth | 200 Hz | 200 Hz | 9.1 kHz | 9.1 kHz | 120 kHz | PK: S/A: RBW 1 MHz, VBW: 3 MHz |

[Test Setup]

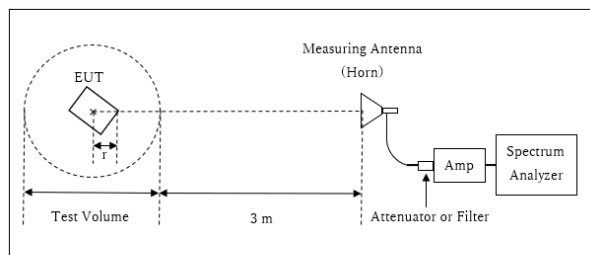
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT
 × : Center of turn table

Distance Factor: $20 \times \log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.75 \text{ m}$

Test Volume : 1.5 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.0 \text{ m}$

* The test was performed with $r = 0.0 \text{ m}$ since EUT is small and it was the rather conservative condition.

- The carrier level (or, noise levels) was (or were) 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 without mechanical key was the worst case. Therefore the test without mechanical key was performed only.

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

Measurement range : 9 kHz - 4.4 GHz
Test data : APPENDIX
Test result : Pass

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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: -20 dB and 99 % Occupied Bandwidth

Test Procedure

The test was measured with a spectrum analyzer using a test fixture.

| Test | Span | RBW | VBW | Sweep | Detector | Trace | Instrument used |
|-------------------------|---|-----------------|--------------------|--------------|-----------------|--------------|------------------------|
| 20 dB Bandwidth | 150 kHz | 1.5 kHz | 5.1 kHz | Auto | Peak | Max Hold | Spectrum Analyzer |
| 99 % Occupied Bandwidth | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto | Peak | Max Hold | Spectrum Analyzer |

Peak hold was applied as Worst-case measurement.

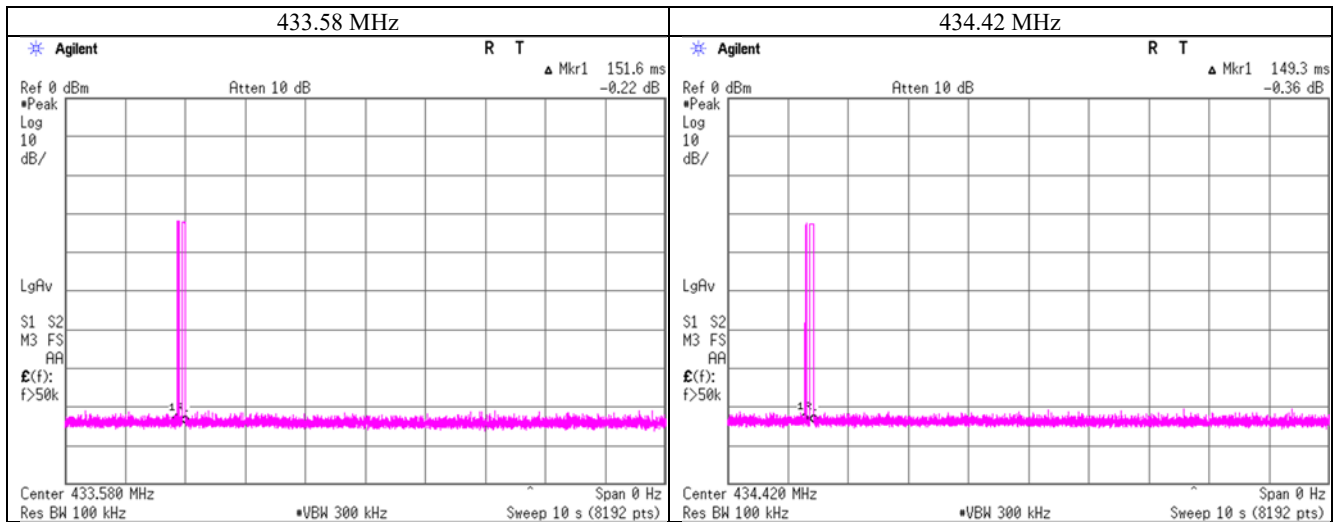
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Automatically deactivate

Report No. 12525890H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date 10/03/2018 (Night)
Temperature / Humidity 23 deg. C / 51 % RH
Engineer Shuichi Ohyama
Mode Normal use mode

| Tx Freq | Time of Transmitting [sec] | Limit [sec] | Result |
|------------|----------------------------|-------------|--------|
| 433.58 MHz | 0.1516 | 5.00 | Pass |
| 434.42 MHz | 0.1493 | 5.00 | Pass |



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

Report No. 12525890H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date 10/03/2018 (Day) 10/03/2018 (Night)
Temperature/ Humidity 23 deg. C / 51 % RH 23 deg. C / 51 % RH
Engineer Koji Yamamoto Shuichi Ohyama
(Below 1GHz) (Above 1GHz)
Mode Transmitting mode 433.58 MHz

QP or PK

| Frequency [MHz] | Detector | Reading [dBuV] | | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | | Limit [dBuV/m] | Margin [dB] | | Remark Inside or Outside of Restricted Bands |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-------------------|----------------|------|--|
| | | Hor | Ver | | | | | Hor | Ver | | Hor | Ver | |
| 433.580 | PK | 77.9 | 78.8 | 16.1 | 9.5 | 29.8 | - | 73.7 | 74.6 | 100.8 | 27.1 | 26.2 | Carrier |
| 867.160 | PK | 33.6 | 32.3 | 21.8 | 11.2 | 28.2 | - | 38.4 | 37.1 | 80.8 | 42.4 | 43.7 | Outside |
| 1300.740 | PK | 47.5 | 47.9 | 25.7 | 3.8 | 35.3 | - | 41.7 | 42.1 | 73.9 | 32.2 | 31.8 | Inside |
| 1734.320 | PK | 47.0 | 47.4 | 24.9 | 4.1 | 34.8 | - | 41.2 | 41.6 | 80.8 | 39.6 | 39.2 | Outside |
| 2167.900 | PK | 47.7 | 46.2 | 27.9 | 4.4 | 34.5 | - | 45.5 | 44.0 | 80.8 | 35.3 | 36.8 | Outside |
| 2601.480 | PK | 46.5 | 46.8 | 27.4 | 4.6 | 34.4 | - | 44.1 | 44.4 | 80.8 | 36.7 | 36.4 | Outside |
| 3035.060 | PK | 46.6 | 46.0 | 28.5 | 4.8 | 34.3 | - | 45.6 | 45.0 | 80.8 | 35.2 | 35.8 | Outside |
| 3468.640 | PK | 45.4 | 45.5 | 29.2 | 5.0 | 33.9 | - | 45.7 | 45.8 | 80.8 | 35.1 | 35.0 | Outside |
| 3902.220 | PK | 45.1 | 45.2 | 29.8 | 5.2 | 33.6 | - | 46.5 | 46.6 | 73.9 | 27.4 | 27.3 | Inside |
| 4335.800 | PK | 44.4 | 44.6 | 30.6 | 5.4 | 33.6 | - | 46.8 | 47.0 | 73.9 | 27.1 | 26.9 | Inside |

PK with Duty factor

| Frequency [MHz] | Detector | Reading [dBuV] | | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | | Limit [dBuV/m] | Margin [dB] | | Remark |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-------------------|----------------|------|---------|
| | | Hor | Ver | | | | | Hor | Ver | | Hor | Ver | |
| 433.580 | PK | 77.9 | 78.8 | 16.1 | 9.5 | 29.8 | 0.0 | 73.7 | 74.6 | 80.8 | 7.1 | 6.2 | Carrier |
| 867.160 | PK | 33.6 | 32.3 | 21.8 | 11.2 | 28.2 | 0.0 | 38.4 | 37.1 | 60.8 | 22.4 | 23.7 | Outside |
| 1300.740 | PK | 47.5 | 47.9 | 25.7 | 3.8 | 35.3 | 0.0 | 41.7 | 42.1 | 53.9 | 12.2 | 11.8 | Inside |
| 1734.320 | PK | 47.0 | 47.4 | 24.9 | 4.1 | 34.8 | 0.0 | 41.2 | 41.6 | 60.8 | 19.6 | 19.2 | Outside |
| 2167.900 | PK | 47.7 | 46.2 | 27.9 | 4.4 | 34.5 | 0.0 | 45.5 | 44.0 | 60.8 | 15.3 | 16.8 | Outside |
| 2601.480 | PK | 46.5 | 46.8 | 27.4 | 4.6 | 34.4 | 0.0 | 44.1 | 44.4 | 60.8 | 16.7 | 16.4 | Outside |
| 3035.060 | PK | 46.6 | 46.0 | 28.5 | 4.8 | 34.3 | 0.0 | 45.6 | 45.0 | 60.8 | 15.2 | 15.8 | Outside |
| 3468.640 | PK | 45.4 | 45.5 | 29.2 | 5.0 | 33.9 | 0.0 | 45.7 | 45.8 | 60.8 | 15.1 | 15.0 | Outside |
| 3902.220 | PK | 45.1 | 45.2 | 29.8 | 5.2 | 33.6 | 0.0 | 46.5 | 46.6 | 53.9 | 7.4 | 7.3 | Inside |
| 4335.800 | PK | 44.4 | 44.6 | 30.6 | 5.4 | 33.6 | 0.0 | 46.8 | 47.0 | 53.9 | 7.1 | 6.9 | Inside |

Sample calculation:

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

Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator) - Gain (Amplifier) + Duty factor

For above 1GHz : Distance Factor: $20 \times \log(3.75 \text{ m}/3.0 \text{ m}) = 1.94 \text{ dB}$

*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.

The result of AV (PK with Duty factor) was calculated by applying Duty 100%.

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

Report No. 12525890H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date 10/03/2018 (Day) 10/03/2018 (Night)
Temperature/ Humidity 23 deg. C / 51 % RH 23 deg. C / 51 % RH
Engineer Koji Yamamoto Shuichi Ohyama
(Below 1GHz) (Above 1GHz)
Mode Transmitting mode 434.42 MHz

QP or PK

| Frequency [MHz] | Detector | Reading [dBuV] | | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | | Limit dBuV/m | Margin [dB] | | Remark Inside or Outside of Restricted Bands |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-----------------|----------------|------|--|
| | | Hor | Ver | | | | | Hor | Ver | | Hor | Ver | |
| 434.420 | PK | 77.3 | 78.0 | 16.1 | 9.5 | 29.8 | - | 73.1 | 73.8 | 100.8 | 27.7 | 27.0 | Carrier |
| 868.840 | PK | 33.9 | 33.5 | 21.8 | 11.2 | 28.2 | - | 38.7 | 38.3 | 80.8 | 42.1 | 42.5 | Outside |
| 1303.260 | PK | 47.8 | 47.4 | 25.8 | 3.8 | 35.3 | - | 42.1 | 41.7 | 73.9 | 31.8 | 32.2 | Inside |
| 1737.680 | PK | 47.1 | 47.0 | 24.9 | 4.1 | 34.8 | - | 41.3 | 41.2 | 80.8 | 39.5 | 39.6 | Outside |
| 2172.100 | PK | 47.9 | 46.3 | 27.9 | 4.4 | 34.5 | - | 45.7 | 44.1 | 80.8 | 35.1 | 36.7 | Outside |
| 2606.520 | PK | 46.3 | 46.4 | 27.5 | 4.6 | 34.4 | - | 44.0 | 44.1 | 80.8 | 36.8 | 36.7 | Outside |
| 3040.940 | PK | 46.9 | 46.5 | 28.5 | 4.8 | 34.3 | - | 45.9 | 45.5 | 80.8 | 34.9 | 35.3 | Outside |
| 3475.360 | PK | 45.3 | 45.0 | 29.2 | 5.0 | 33.9 | - | 45.6 | 45.3 | 80.8 | 35.2 | 35.5 | Outside |
| 3909.780 | PK | 45.6 | 45.4 | 29.8 | 5.2 | 33.6 | - | 47.0 | 46.8 | 73.9 | 26.9 | 27.1 | Inside |
| 4344.200 | PK | 44.7 | 44.5 | 30.6 | 5.4 | 33.6 | - | 47.1 | 46.9 | 73.9 | 26.8 | 27.0 | Inside |

PK with Duty factor

| Frequency [MHz] | Detector | Reading [dBuV] | | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result [dBuV/m] | | Limit dBuV/m | Margin [dB] | | Remark |
|--------------------|----------|-------------------|------|-------------------------|--------------|--------------|------------------------|--------------------|------|-----------------|----------------|------|---------|
| | | Hor | Ver | | | | | Hor | Ver | | Hor | Ver | |
| 434.420 | PK | 77.3 | 78.0 | 16.1 | 9.5 | 29.8 | 0.0 | 73.1 | 73.8 | 80.8 | 7.7 | 7.0 | Carrier |
| 868.840 | PK | 33.9 | 33.5 | 21.8 | 11.2 | 28.2 | 0.0 | 38.7 | 38.3 | 60.8 | 22.1 | 22.5 | Outside |
| 1303.260 | PK | 47.8 | 47.4 | 25.8 | 3.8 | 35.3 | 0.0 | 42.1 | 41.7 | 53.9 | 11.8 | 12.2 | Inside |
| 1737.680 | PK | 47.1 | 47.0 | 24.9 | 4.1 | 34.8 | 0.0 | 41.3 | 41.2 | 60.8 | 19.5 | 19.6 | Outside |
| 2172.100 | PK | 47.9 | 46.3 | 27.9 | 4.4 | 34.5 | 0.0 | 45.7 | 44.1 | 60.8 | 15.1 | 16.7 | Outside |
| 2606.520 | PK | 46.3 | 46.4 | 27.5 | 4.6 | 34.4 | 0.0 | 44.0 | 44.1 | 60.8 | 16.8 | 16.7 | Outside |
| 3040.940 | PK | 46.9 | 46.5 | 28.5 | 4.8 | 34.3 | 0.0 | 45.9 | 45.5 | 60.8 | 14.9 | 15.3 | Outside |
| 3475.360 | PK | 45.3 | 45.0 | 29.2 | 5.0 | 33.9 | 0.0 | 45.6 | 45.3 | 60.8 | 15.2 | 15.5 | Outside |
| 3909.780 | PK | 45.6 | 45.4 | 29.8 | 5.2 | 33.6 | 0.0 | 47.0 | 46.8 | 53.9 | 6.9 | 7.1 | Inside |
| 4344.200 | PK | 44.7 | 44.5 | 30.6 | 5.4 | 33.6 | 0.0 | 47.1 | 46.9 | 53.9 | 6.8 | 7.0 | Inside |

Sample calculation:

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

Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator) - Gain (Amplifier) + Duty factor

For above 1GHz : Distance Factor: $20 \times \log(3.75 \text{ m}/3.0 \text{ m}) = 1.94 \text{ dB}$

*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.

The result of AV (PK with Duty factor) was calculated by applying Duty 100%.

UL Japan, Inc.

Ise EMC Lab.

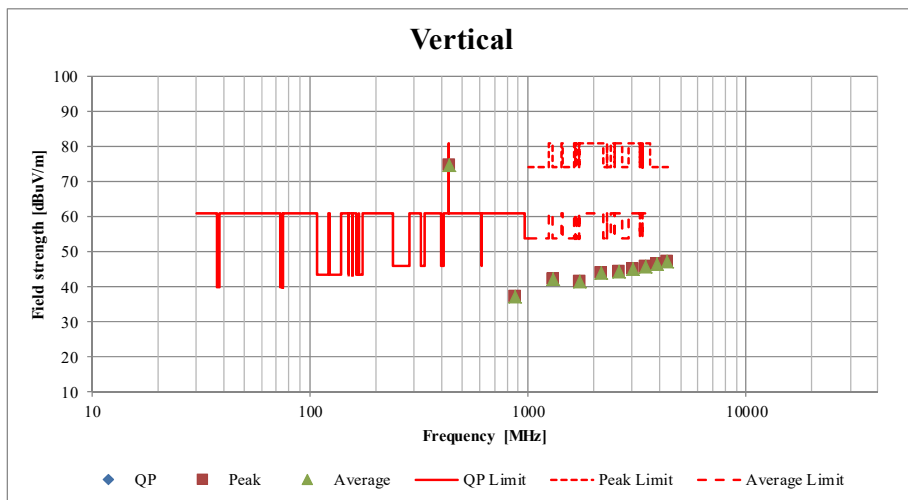
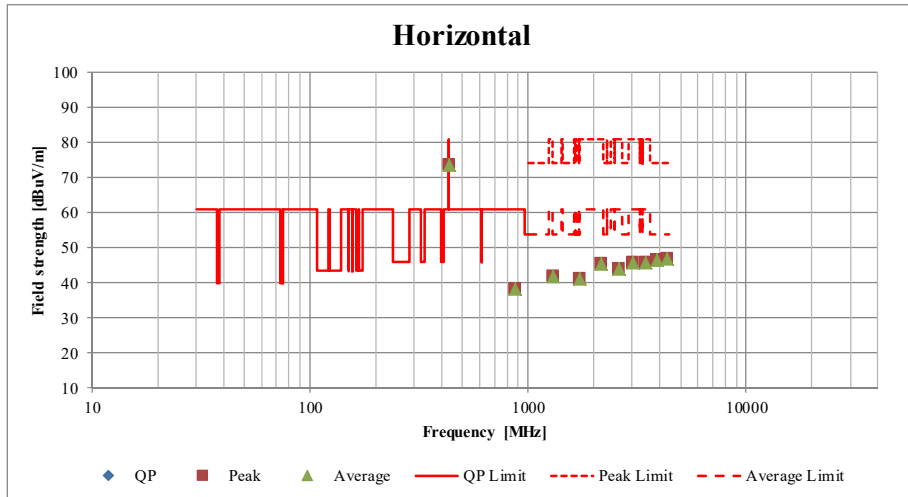
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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

| | | |
|------------------------|-------------------------------|--------------------------------|
| Report No. | 12525890H | |
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.2 | |
| Date | 10/03/2018 (Day) | 10/03/2018 (Night) |
| Temperature / Humidity | 23 deg. C / 51 % RH | 23 deg. C / 51 % RH |
| Engineer | Koji Yamamoto (Below 1GHz) | Shuichi Ohyama (Above 1GHz) |
| Mode | Transmitting mode 433.58 MHz | |



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

-20dB and 99% Occupied Bandwidth

Report No. 12525890H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date 10/03/2018 (Night)
Temperature / Humidity 23 deg. C / 51 % RH
Engineer Shuichi Ohyama
Mode Transmitting mode 433.58 MHz / 434.42 MHz

Bandwidth Limit : Fundamental Frequency **433.58** MHz x 0.25% = 1083.95 kHz

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

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

433.58 MHz

| |
|--------------------------|
| -20dB Bandwidth [kHz] |
| 37.16 |

434.42 MHz

| |
|--------------------------|
| -20dB Bandwidth [kHz] |
| 37.04 |

| -20dB Bandwidth [kHz] | Bandwidth Limit [kHz] | Result |
|--------------------------|--------------------------|--------|
| 37.16 + 37.04 = 74.20 | 1083.95 | Pass |

Bandwidth Limit : Fundamental Frequency **433.58** MHz x 0.25% = 1083.95 kHz

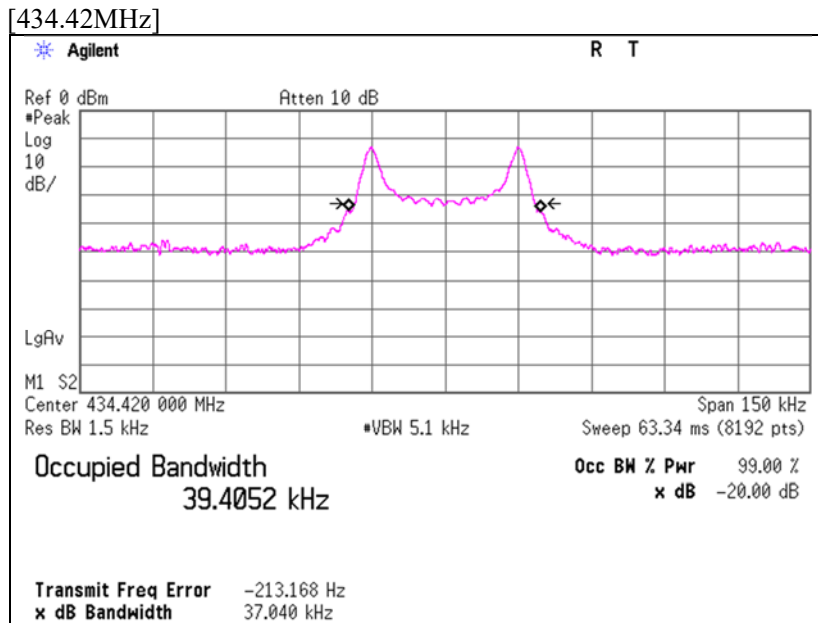
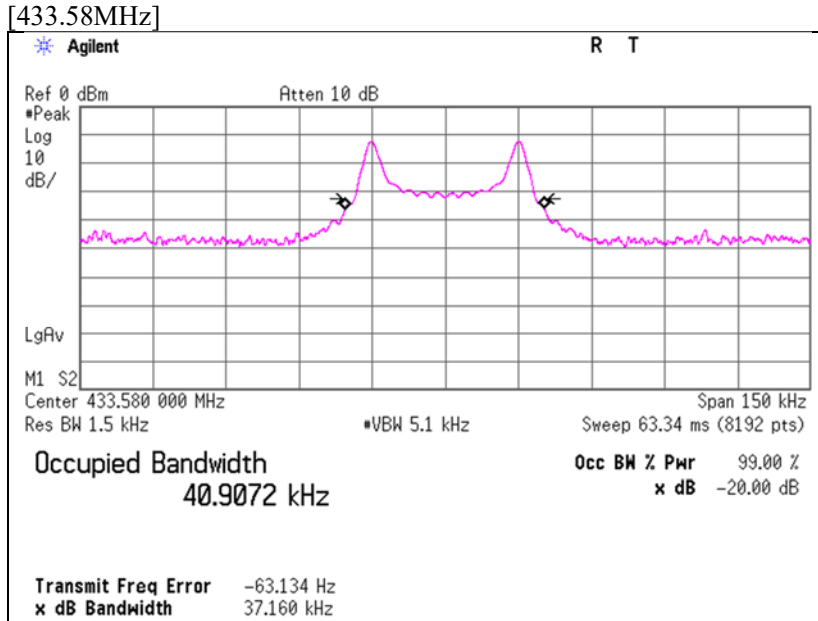
| 99% Occupied Bandwidth [kHz] | Bandwidth Limit [kHz] | Result |
|---------------------------------|--------------------------|--------|
| 40.9072 | 1083.95 | Pass |

Bandwidth Limit : Fundamental Frequency **434.42** MHz x 0.25% = 1086.05 kHz

| 99% Occupied Bandwidth [kHz] | Bandwidth Limit [kHz] | Result |
|---------------------------------|--------------------------|--------|
| 39.4052 | 1086.05 | Pass |

-20dB and 99% Occupied Bandwidth

Report No. 12525890H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.2
 Date 10/03/2018 (Night)
 Temperature / Humidity 23 deg. C / 51 % RH
 Engineer Shuichi Ohyama
 Mode Transmitting mode 433.58 MHz / 434.42 MHz



APPENDIX 2: Test instruments

Test Instruments

| Test item | LIMS ID | Description | Manufacturer | Model | Serial | Last Calibration Date | Calibration Due Date | Cal Int |
|-----------|---------|-----------------------------------|-------------------|--------------------------|-------------------------------|-----------------------|----------------------|---------|
| RE | 141427 | Biconical Antenna | Schwarzbeck | VHA9103B | 8031 | 5/31/2018 | 5/31/2019 | 12 |
| RE | 142006 | AC2_Semi Anechoic Chamber(SVSWR) | TDK | Semi Anechoic Chamber 3m | DA-06902 | 4/2/2018 | 4/29/2019 | 12 |
| RE | 141542 | Digital Tester | Fluke Corporation | FLUKE 26-3 | 78030611 | 8/21/2018 | 8/31/2019 | 12 |
| RE | 141152 | EMI measurement program | TSJ | TEPTO-DV | - | - | - | - |
| RE | 141265 | Logperiodic Antenna(200-1000 MHz) | Schwarzbeck | VUSLP9111B | 911B-190 | 5/31/2018 | 5/31/2019 | 12 |
| RE | 142228 | Measure | KOMELON | KMC-36 | - | - | - | - |
| RE | 141203 | Attenuator(6dB) | Weinschel Corp | 2 | BK7970 | 11/14/2017 | 11/30/2018 | 12 |
| RE | 141578 | Pre Amplifier | AGILENT | 8447D | 2944A10845 | 9/19/2018 | 9/30/2019 | 12 |
| RE | 141556 | Thermo-Hygrometer | CUSTOM | CTH-201 | 0003 | 12/21/2017 | 12/31/2018 | 12 |
| RE | 141512 | Horn Antenna 1-18GHz | Schwarzbeck | BBHA9120D | 254 | 6/6/2018 | 6/30/2019 | 12 |
| RE | 141392 | Microwave Cable | Junkosha | MWX221 | 1604S253(1 m) / 1608S087(5 m) | 8/8/2018 | 8/31/2019 | 12 |
| RE | 141579 | Pre Amplifier | AGILENT | 8449B | 3008A02142 | 1/23/2018 | 1/31/2019 | 12 |
| RE | 141885 | Spectrum Analyzer | AGILENT | E4448A | US44300523 | 11/14/2017 | 11/30/2018 | 12 |
| RE | 142004 | AC2_Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-06902 | 6/29/2018 | 6/30/2020 | 24 |
| RE | 141942 | Test Receiver | Rohde & Schwarz | ESCI | 100300 | 8/8/2018 | 8/31/2019 | 12 |
| RE | 141317 | Coaxial Cable | Fujikura/Agilent | - | - | 2/23/2018 | 2/28/2019 | 12 |
| RE | 142645 | Loop Antenna | UL Japan | - | - | - | - | - |

*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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, -20 dB bandwidth and Automatically deactivate tests

UL Japan, Inc.

Ise EMC Lab.

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