



RADIO TEST REPORT

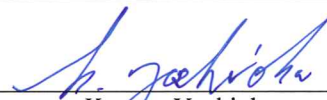
Test Report No. : 10697030H-A-R1

Applicant : OMRON Corporation
Type of Equipment : Carrier ID Reader/Writer (RFID)
Model No. : V640-HAM11-ETN-V2 (Amplifier Unit)
FCC ID : E4EV640HAM11V2
Test regulation : FCC Part 15 Subpart C: 2015
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 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 10697030H-A. 10697030H-A is replaced with this report.

Date of test: March 12 to 18, 2015

Representative test engineer:


Kazuya Yoshioka
Engineer
Consumer Technology Division

Approved by:


Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP[®]

NVLAP LAB CODE: 200572-0

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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.: 10697030H-A

| Revision | Test report No. | Date | Page revised | Contents |
|-----------------|-----------------|----------------|--------------|---|
| - (Original) | 10697030H-A | March 25, 2015 | - | - |
| 1 | 10697030H-A-R1 | April 10, 2015 | P. 5 | Correction: Detector of the worst margin for Electric Field Strength of Fundamental Emission in clause 3.2 |
| 1 | 10697030H-A-R1 | April 10, 2015 | P. 9 | Correction of name of antenna in Clause 4.2 |
| 1 | 10697030H-A-R1 | April 10, 2015 | P. 15 | Correction of data for Radiated Emission below 30MHz (Fundamental and Spurious Emission) in APPENDIX 1 |
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SECTION 1: Customer information

Company Name : OMRON Corporation
Address : 2-2-1, NISHI-KUSATSU, KUSATSU-CITY, SHIGA-PREF., 525-0035
JAPAN
Telephone Number : +81-77-565-5287
Facsimile Number : +81-77-565-5569
Contact Person : Hiroaki Motoshima

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

2.1 Identification of E.U.T.

Type of Equipment : Carrier ID Reader/Writer (RFID)
Model No. : V640-HAM11-ETN-V2 (Amplifier Unit)
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 24V
Receipt Date of Sample : February 24, 2015
Country of Mass-production : Japan
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

General Specification

Clock frequency(ies) in the system : 8MHz (for both types), 125MHz (Ethernet Communication type only)

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 134.2 kHz
Modulation : Amplitude Shift Keying
Power Supply (radio part input) : DC 5V
Antenna type : Loop Coil Antenna

Similar model

This EUT has similar model: V640-HAM11-V4.

- V640-HAM11-ETN-V2: Ethernet Communication type and Normal distance type
 - V640-HAM11-V4: Serial Communication type and Normal distance type
- There is no difference except for these.

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
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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 15.207 Conducted Emission
Section 15.209 Radiated emission limits, general requirements

* The EUT complies with FCC Part 15 Subpart B: 2014, final revised on December 23, 2014.

FCC Part 15.31 (e)

This EUT provides stable voltage (DC 5V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The EUT has an external antenna connector, but it is installed by the professionals. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.2 Procedures and results

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|-----|---|--|---|----------|-----------|---|----------|
| 1 | Conducted Emission | <FCC> ANSI C63.4:2009 7. AC powerline conducted emission measurements <IC> RSS-Gen 8.8 | <FCC> Section 15.207 <IC> RSS-Gen 8.8 | - | N/A | [QP] 10.4dB 6.15480MHz, L [AV] 0.4dB 0.47780MHz, L | Complied |
| 2 | Electric Field Strength of Fundamental Emission | <FCC> ANSI C63.4:2009 13. Measurement of intentional radiators <IC> RSS-Gen 6.4, 6.12 | <FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9 | Radiated | N/A | 12.2dB 0.13420MHz 0 deg., PK (PK with Duty factor) | Complied |
| 3 | Electric Field Strength of Spurious Emission | <FCC> ANSI C63.4:2009 13. Measurement of intentional radiators <IC> RSS-Gen 6.4, 6.13 | <FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9 | Radiated | N/A | 2.5dB 58.781MHz, Vertical, QP | Complied |
| 4 | -26dB Bandwidth | <FCC> ANSI C63.4:2009 13. Measurement of intentional radiators <IC> - | <FCC> Reference data <IC> - | Radiated | N/A | N/A | N/A |

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

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Facsimile : +81 596 24 8124

3.3 Addition to standard

| No. | Item | Test Procedure | Specification | Remarks | Deviation | Worst margin | Results |
|-----|-------------------------|----------------|---------------|----------|-----------|--------------|---------|
| 1 | 99% Occupied Band Width | RSS-Gen 6.6 | - | Radiated | 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 | 3.5dB |
| No.2 | 3.5dB |
| No.3 | 3.4dB |
| No.4 | 3.5dB |

| Test room (semi-anechoic chamber) | Radiated emission | | | | | | |
|--------------------------------------|-------------------|------------------|-----------------|----------------|-----------------|-------------------|-------------------|
| | (3m*)(+dB) | | | | (1m*)(+dB) | | (0.5m*)(+dB) |
| | 9kHz -30MHz | 30MHz -300MHz | 300MHz -1GHz | 1GHz -10GHz | 10GHz -18GHz | 18GHz -26.5GHz | 26.5GHz -40GHz |
| No.1 | 4.3dB | 5.5dB | 6.3dB | 5.5dB | 5.8dB | 5.8dB | 4.3dB |
| No.2 | 4.2dB | 5.4dB | 6.3dB | 5.4dB | 5.7dB | 5.9dB | 5.6dB |
| No.3 | 4.4dB | 5.4dB | 6.4dB | 5.2dB | 5.5dB | 5.8dB | 5.5dB |
| No.4 | 4.7dB | 5.6dB | 6.4dB | 5.3dB | 5.7dB | 5.9dB | 5.5dB |

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

Conducted emission test

[QP]

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

[AV]

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

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.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
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 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 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

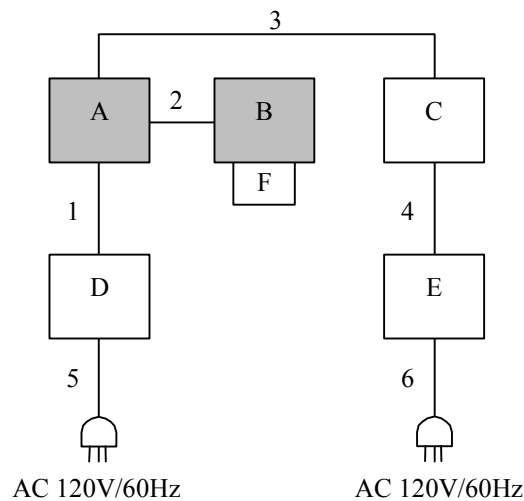
4.1 Operating Modes

| Test mode | Remarks |
|---|---------|
| Transmitting 134.2kHz With Tag mode | *1) |
| PC Software: UcomV640 Version: 1.0.0.0 The EUT does not have a Power Control function. The test was performed with a fixed value. Mass-produced product will have same level as it. | |

*1) This EUT has two modes which Tag is attached to the EUT or not. The worst case was confirmed with and without Tag, as a result, the test with Tag was the worst case. Therefore the test with Tag was performed only.

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

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 | Remarks |
|-----|---------------------------------|------------------------------------|---------------|-------------------|---------|
| A | Carrier ID Reader/Writer (RFID) | V640-HAM11-ETN-V2 (Amplifier Unit) | 5 | OMRON Corporation | EUT |
| B | CIDRW Head (Antenna) | V640-HS61 | 8 | OMRON Corporation | EUT |
| C | Switching HUB | W4S1-05B | 17310K | OMRON Corporation | - |
| D | Power Supply | S8VS-01524 | - | OMRON Corporation | - |
| E | Power Supply | S8VS-03024 | - | OMRON Corporation | - |
| F | Tag | RI-TRP-DR2B-30 | 1 | OMRON Corporation | - |

List of cables used

| No. | Name | Length (m) | Shield | | Remark |
|-----|---------------|------------|------------|------------|--------|
| | | | Cable | Connector | |
| 1 | DC Cable | 2.0 | Unshielded | Unshielded | - |
| 2 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 3 | LAN Cable | 5.0 | Shielded | Shielded | - |
| 4 | DC Cable | 0.6 | Unshielded | Unshielded | - |
| 5 | AC Cable | 1.9 | Unshielded | Unshielded | - |
| 6 | AC Cable | 1.9 | Unshielded | Unshielded | - |

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: 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 cable and AC 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.

Detector : QP CISPR AV detector (IF BW 9 kHz)
Measurement range : 0.15-30MHz
Test data : APPENDIX 1
Test result : Pass

Date: March 14, 2015

Test engineer: Kazuya Yoshioka

SECTION 6: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, 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.

Frequency : From 9kHz to 30MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0deg., 45deg., 90deg., 135deg., and 180deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency : From 30MHz to 1GHz

The measuring antenna height varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

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 |
| Test Distance | 3m *1) | 3m *1) | 3m *1) | 3m *2) | 3m |

*1) Distance Factor: $40 \times \log(3m/300m) = -80dB$

*2) Distance Factor: $40 \times \log(3m/30m) = -40dB$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

- 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.

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

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

Measurement range : **9kHz-1GHz**
Test data : **APPENDIX 1**
Test result : **Pass**

Date: March 12, 2015
March 13, 2015

Test engineer: Kazuya Yoshioka
Kenshi Shimomura

UL Japan, Inc.

Ise EMC Lab.

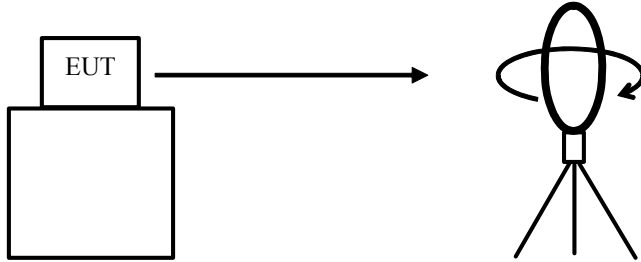
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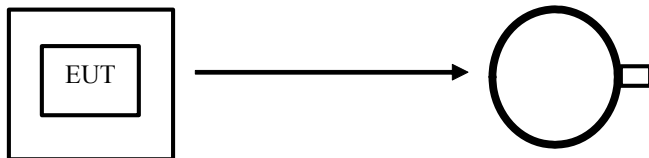
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

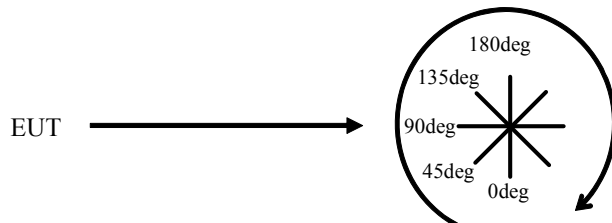


Top View (Horizontal)



Antenna was not rotated.

Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 7: -26dB 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 |
|-----------------|--------|------|------|-------|----------|----------|-------------------|
| -26dB Bandwidth | 100kHz | 1kHz | 3kHz | Auto | Peak | Max Hold | Spectrum Analyzer |

Test data : APPENDIX 1
Test result : Pass

SECTION 8: 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 |
|------------------------|---|------|--------------------|-------|----------|--------------|-------------------|
| 99% Occupied Bandwidth | Enough width to display -26dB Bandwidth | 1kHz | Three times of RBW | Auto | Peak *1) | Max Hold *1) | Spectrum Analyzer |

*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.
Peak hold was applied as Worst-case measurement.

Test data : APPENDIX 1
Test result : Pass

APPENDIX 1: Data of EMI test

Conducted Emission

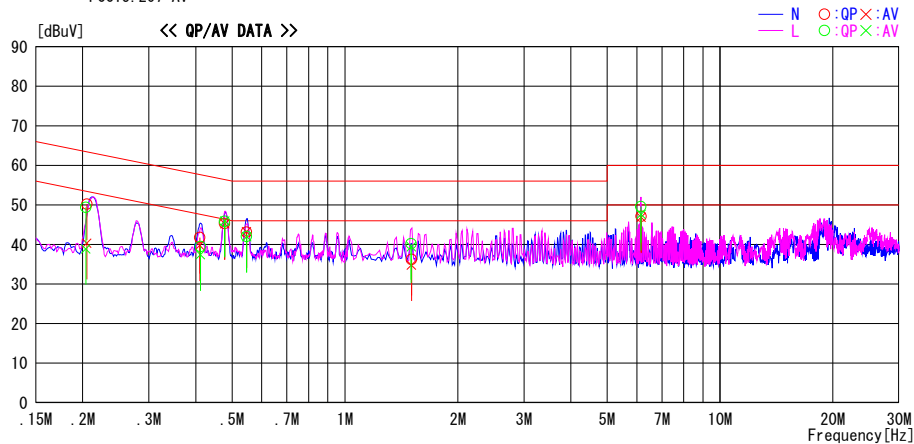
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/03/14

Report No. : 10697030H
 Temp./Humi. : 23deg. C / 39% RH
 Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 134.2kHz with tag

LIMIT : FCC15.207 QP
 FCC15.207 AV



| Frequency [MHz] | Reading Level | | Corr. Factor [dB] | Results | | Limit | | Margin | | Phase | Comment |
|--------------------|---------------|--------------|-------------------------|--------------|--------------|--------------|--------------|------------|------------|-------|---------|
| | QP [dBuV] | AV [dBuV] | | QP [dBuV] | AV [dBuV] | QP [dBuV] | AV [dBuV] | QP [dB] | AV [dB] | | |
| 0.20511 | 27.2 | 17.3 | 23.0 | 50.2 | 40.3 | 63.4 | 53.4 | 13.2 | 13.1 | N | |
| 0.40980 | 18.8 | 16.9 | 22.9 | 41.7 | 39.8 | 57.7 | 47.7 | 16.0 | 7.9 | N | |
| 0.47781 | 22.4 | 22.3 | 22.9 | 45.3 | 45.2 | 56.4 | 46.4 | 11.1 | 1.2 | N | |
| 0.54630 | 20.3 | 20.4 | 22.8 | 43.1 | 43.2 | 56.0 | 46.0 | 12.9 | 2.8 | N | |
| 1.50360 | 13.2 | 11.8 | 23.0 | 36.2 | 34.8 | 56.0 | 46.0 | 19.8 | 11.2 | N | |
| 6.15780 | 23.6 | 23.4 | 23.5 | 47.1 | 46.9 | 60.0 | 50.0 | 12.9 | 3.1 | N | |
| 0.20375 | 26.4 | 15.9 | 23.0 | 49.4 | 38.9 | 63.5 | 53.5 | 14.1 | 14.6 | L | |
| 0.41161 | 16.6 | 14.5 | 22.9 | 39.5 | 37.4 | 57.6 | 47.6 | 18.1 | 10.2 | L | |
| 0.47780 | 22.9 | 23.1 | 22.9 | 45.8 | 46.0 | 56.4 | 46.4 | 10.6 | 0.4 | L | |
| 0.54655 | 19.2 | 19.2 | 22.8 | 42.0 | 42.0 | 56.0 | 46.0 | 14.0 | 4.0 | L | |
| 1.50280 | 17.2 | 16.4 | 23.0 | 40.2 | 39.4 | 56.0 | 46.0 | 15.8 | 6.6 | L | |
| 6.15480 | 26.1 | 24.1 | 23.5 | 49.6 | 47.6 | 60.0 | 50.0 | 10.4 | 2.4 | L | |

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + FILTER + ATTEN + CABLE)
Except for the above table : adequate margin data below the limits.

*The test result is rounded off to one or two decimal places, so some differences might be observed.

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10697030H
Date : 03/13/2015
Temperature/ Humidity : 20 deg. C / 30% RH
Engineer : Kenshi Shimomura
Mode : Tx 134.2kHz

PK or QP

| Ant Deg [deg] | 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 |
|---------------|-----------------|----------|----------------|-------------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| 0 | 0.13420 | PK | 67.1 | 19.6 | -73.9 | 0.0 | - | 12.8 | 45.0 | 32.2 | Fundamental |
| 0 | 0.26840 | PK | 24.9 | 19.6 | -73.9 | 0.0 | - | -29.4 | 39.0 | 68.4 | |
| 0 | 0.40260 | PK | 28.4 | 19.6 | -73.9 | 0.0 | - | -25.9 | 35.5 | 61.4 | |
| 0 | 0.53680 | QP | 15.5 | 19.5 | -33.9 | 0.0 | - | 1.1 | 33.0 | 31.9 | |
| 0 | 0.67100 | QP | 17.7 | 19.5 | -33.8 | 0.0 | - | 3.4 | 31.1 | 27.7 | |
| 0 | 0.80520 | QP | 15.3 | 19.5 | -33.8 | 0.0 | - | 1.0 | 29.5 | 28.5 | |
| 0 | 0.93940 | QP | 11.9 | 19.5 | -33.8 | 0.0 | - | -2.4 | 28.1 | 30.5 | |
| 0 | 1.07360 | QP | 10.5 | 19.5 | -33.8 | 0.0 | - | -3.8 | 26.9 | 30.7 | |
| 0 | 1.20780 | QP | 7.9 | 19.5 | -33.8 | 0.0 | - | -6.4 | 25.9 | 32.3 | |
| 0 | 1.34200 | QP | 9.3 | 19.5 | -33.7 | 0.0 | - | -4.9 | 25.0 | 29.9 | |

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

PK with Duty factor

| Ant Deg [deg] | 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 |
|---------------|-----------------|----------|----------------|-------------------|-----------|-----------|------------------|-----------------|----------------|-------------|--------|
| 0 | 0.13420 | PK | 67.1 | 19.6 | -73.9 | 0.0 | 0.0 | 12.8 | 25.0 | 12.2 | |
| 0 | 0.26840 | PK | 24.9 | 19.6 | -73.9 | 0.0 | 0.0 | -29.4 | 19.0 | 48.4 | |
| 0 | 0.40260 | PK | 28.4 | 19.6 | -73.9 | 0.0 | 0.0 | -25.9 | 15.5 | 41.4 | |

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

* Since the peak emission result satisfied the average limit, the peak emission result with Duty Factor was calculated as Duty 100%.

Result of the fundamental emission at 3m without Distance factor

PK or QP

| Ant Deg [deg] | 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 |
|---------------|-----------------|----------|----------------|-------------------|-----------|-----------|------------------|-----------------|----------------|-------------|-------------|
| 0 | 0.13420 | PK | 67.1 | 19.6 | 6.1 | 0.0 | - | 92.8 | - | - | Fundamental |

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

* All spurious emissions lower than this result.

Radiated Emission above 30MHz (Spurious Emission)

DATA OF RADIATED EMISSION TEST

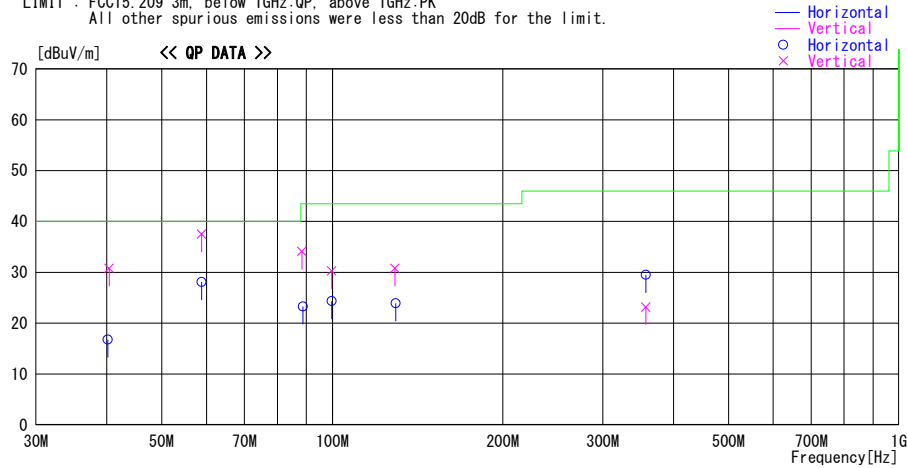
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2015/03/12

Report No. : 10697030H

Temp./Humi. : 21deg. C / 39% RH
Engineer : Kazuya Yoshioka

Mode / Remarks : Tx 134.2kHz Worst-axis(Ant Hori:Z Vert:Z ECU Hori:X Vert:X) with tag

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



| Frequency [MHz] | Reading [dBuV] | DET | Antenna | Loss& | Level [dBuV/m] | Angle [Deg] | Height [cm] | Polar. | Limit [dBuV/m] | Margin [dB] | Comment |
|--------------------|-------------------|-----|------------------|--------------|-------------------|----------------|----------------|--------|-------------------|----------------|---------|
| | | | Factor [dB/m] | Gain [dB] | | | | | | | |
| 40.142 | 49.2 | QP | 14.4 | -46.8 | 16.8 | 0 | 265 | Hori. | 40.0 | 23.2 | |
| 40.394 | 63.3 | QP | 14.3 | -46.8 | 30.8 | 0 | 100 | Vert. | 40.0 | 9.2 | |
| 58.781 | 76.3 | QP | 7.8 | -46.6 | 37.5 | 93 | 100 | Vert. | 40.0 | 2.5 | |
| 58.781 | 66.9 | QP | 7.8 | -46.6 | 28.1 | 350 | 374 | Hori. | 40.0 | 11.9 | |
| 88.737 | 61.4 | QP | 8.3 | -46.4 | 23.3 | 349 | 206 | Hori. | 43.5 | 20.2 | |
| 88.376 | 72.3 | QP | 8.2 | -46.4 | 34.1 | 290 | 100 | Vert. | 43.5 | 9.4 | |
| 99.723 | 66.5 | QP | 10.1 | -46.3 | 30.3 | 274 | 100 | Vert. | 43.5 | 13.2 | |
| 99.715 | 60.5 | QP | 10.1 | -46.3 | 24.3 | 0 | 287 | Hori. | 43.5 | 19.2 | |
| 129.432 | 56.3 | QP | 13.5 | -45.9 | 23.9 | 334 | 153 | Hori. | 43.5 | 19.6 | |
| 128.972 | 63.2 | QP | 13.5 | -45.9 | 30.8 | 331 | 100 | Vert. | 43.5 | 12.7 | |
| 357.604 | 57.3 | QP | 16.4 | -44.2 | 29.5 | 165 | 100 | Hori. | 46.0 | 16.5 | |
| 357.443 | 51.0 | QP | 16.4 | -44.2 | 23.2 | 146 | 100 | Vert. | 46.0 | 22.8 | |

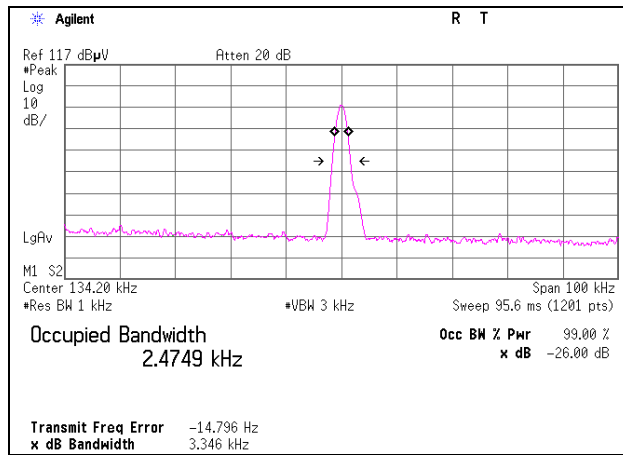
CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz--:HORN
CALCULATION : RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE + ATTEN. -GAIN(AMP))

*The test result is rounded off to one or two decimal places, so some differences might be observed.

-26dB Bandwidth and 99% Occupied Bandwidth

Report No. 10697030H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.3
 Date 03/18/2015
 Temperature / Humidity 23 deg. C / 44 % RH
 Engineer Takumi Shimada
 Mode Tx 134.2 kHz

| -26dB Bandwidth [kHz] | 99% Occupied Bandwidth [kHz] |
|--------------------------|---------------------------------|
| 3.346 | 2.4749 |



APPENDIX 2: Test instruments

EMI test equipment

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|-------------|-----------------------------|----------------------|--|-------------|-----------|---------------------------------------|
| MAEC-02 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-06902 | RE/CE | 2014/06/25 * 12 |
| MOS-22 | Thermo-Hygrometer | Custom | CTH-201 | 0003 | RE/CE | 2015/01/13 * 12 |
| MJM-14 | Measure | KOMELON | KMC-36 | - | RE/CE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE/CE | - |
| MSA-14 | Spectrum Analyzer | Agilent | E4440A | MY48250080 | RE/CE | 2014/10/17 * 12 |
| MTR-03 | Test Receiver | Rohde & Schwarz | ESCI | 100300 | RE/CE | 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 | 2015/02/06 * 12 |
| MAT-02 | Attenuator | Weinschel Corp | 2 | BL0968 | RE | 2014/11/11 * 12 |
| MPA-15 | Pre Amplifier | SONOMA INSTRUMENT | 315 | 260698 | RE | 2014/06/16 * 12 |
| MLPA-01 | Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100017 | RE | 2014/10/04 * 12 |
| MCC-13 | Coaxial Cable | Fujikura | 3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m) | - | RE | 2015/02/06 * 12 |
| MCC-143 | Coaxial Cable | UL Japan | - | - | RE | 2014/07/28 * 12 |
| MAT-68 | Attenuator | Anritsu | MP721B | 6200961025 | RE | 2014/11/11 * 12 |
| MLS-25 | LISN(AMN) | Schwarzbeck | NSLK8127 | 8127-731 | CE(EUT) | 2014/07/09 * 12 |
| MLS-26 | LISN(AMN) | Schwarzbeck | NSLK8127 | 8127-732 | CE(AE) | 2014/07/09 * 12 |
| MTA-28 | Terminator | TME | CT-01 | - | CE | 2014/11/26 * 12 |
| MAT-65 | Attenuator(13dB) | JFW Industries, Inc. | 50FP-013H2 N | - | CE | 2015/01/29 * 12 |
| MHF-24 | High Pass Filter 0.15-30MHz | Rohde & Schwarz | EZ-25/3 | 100041 | CE | 2015/02/19 * 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:

CE: Conducted Emission

RE: Spurious emission

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