**FCC CFR47 PART 15 SUBPART C**

**CERTIFICATION TEST REPORT**

**FOR**

**RFID MODULE**

**MODEL NUMBER: RI12C**

**FCC ID: ACJ9TGRI12C**

**REPORT NUMBER: 10275679H-A**

**ISSUE DATE: May 9, 2014**

*Prepared for*
**PANASONIC CORPORATION OF NORTH AMERICA**
**ONE PANASONIC WAY, 4B-8**
**SECAUCUS, NEW JERSEY, 07094, USA**

*Prepared by*
**UL Japan, Inc.**
**Ise HQ EMC Lab.**
**4383-326 Asama-cho, Ise-shi**
**Mie-ken 516-0021 JAPAN**
**TEL: +81 596 24 8999**
**FAX: +81 596 24 8124**

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

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 05/09/2014 | Initial Issue | T. Hatakeda |



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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** PANASONIC CORPORATION OF NORTH AMERICA
ONE PANASONIC WAY, 4B-8
SECAUCUS, NEW JERSEY, 07094, USA

**EUT DESCRIPTION:** RFID MODULE

**MODEL:** RI12C

**SERIAL NUMBER:** DFUP2352ZB1311

**DATE TESTED:** April 18 to 21, 2014

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 15 SUBPART C | Pass |

UL Japan, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Japan, Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Japan, Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Japan, Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL Japan, Inc. By:

T. Hatakeda

Takahiro Hatakeda
Leader
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Tested By:

T. Shimada

Takumi Shimada
Engineer
Consumer Technology Division



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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN.

UL Japan, Inc. is accredited by NVLAP, Laboratory Code 200572-0
The full scope of accreditation can be viewed at
http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m



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## 4.3. MEASUREMENT 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 | 3.6dB |
| 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 | 4.0dB | 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

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



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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is an RFID module that is embedded inside Panasonic laptop model FZ-G1. The radio module is manufactured by NXP.

## 5.2. MAXIMUM TRANSMITTER FIELD STRENGTH

The field strength of the transmitter is as follows:

| Frequency Range (MHz) | Mode | Output Power (dBuV/m @ 30m) |
|---|---|---|
| 13.56 | Normal Mode without tag | 23.5 |
| 13.56 | Normal Mode with Type A tag | 18.5 |
| 13.56 | Normal Mode with Type B tag | 9.2 |

## 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Loop antenna.

## 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was HID OMNIKEY Workbench.exe

## 5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was inside the tablet PC.
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.

Preliminary test was performed on the EUT with/without Tag.
The Conducted emission and Spurious emission (above 30MHz) tests were performed with Tag which had the worst data.

## 5.6. MODIFICATIONS

No modifications were made during testing.



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## 5.7. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| Laptop | Panasonic | FZ-G1 | 3JTSA37945 | -- |
| AC Adapter | Panasoinc | CF-AA6413C M1 | 6413CM113400007G | DoC |

**I/O CABLES**

| I/O CABLE LIST | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No.** | **Port** | **# of Identical Ports** | **Connector Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | AC | 1 | AC | Un-Sheilded | 0.9m | N/A |
| 2 | DC | 1 | DC | Un-Sheilded | 1.8m | N/A |



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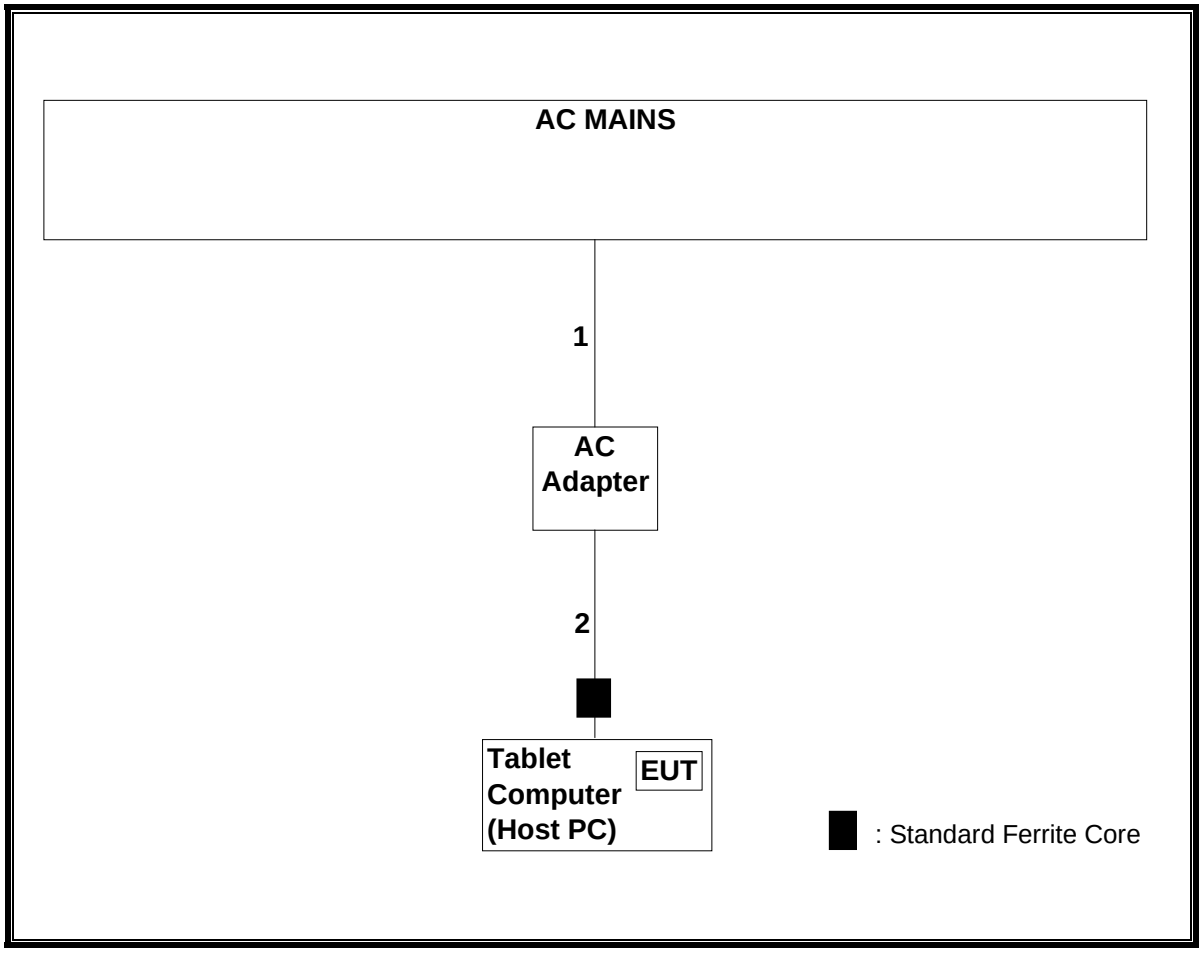
**TEST SETUP**

The EUT is installed in a host tablet computer during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



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# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| MAEC-03 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-10005 | RE/CE | 2014/02/27 * 12 |
| MOS-13 | Thermo-Hygrometer | Custom | CTH-180 | 1301 | RE/CE | 2014/02/20 * 12 |
| MJM-16 | Measure | KOMELON | KMC-36 | - | RE/CE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE/CE | - |
| MSA-03 | Spectrum Analyzer | Agilent | E4448A | MY44020357 | RE/CE | 2014/04/08 * 12 |
| MTR-08 | Test Receiver | Rohde & Schwarz | ESCI | 100767 | RE/CE | 2013/08/20 * 12 |
| MBA-03 | Biconical Antenna | Schwarzbeck | BBA9106 | 1915 | RE | 2013/10/13 * 12 |
| MLA-03 | Logperiodic Antenna | Schwarzbeck | USLP9143 | 174 | RE | 2013/10/13 * 12 |
| MCC-51 | Coaxial cable | UL Japan | - | - | RE | 2013/07/23 * 12 |
| MAT-70 | Attenuator(6dB) | Agilent | 8491A-006 | MY52460153 | RE | 2014/04/14 * 12 |
| MPA-13 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | RE | 2014/03/14 * 12 |
| MLS-07 | LISN(AMN) | Schwarzbeck | NSLK8127 | 8127364 | CE(EUT) | 2014/01/27 * 12 |
| MCC-112 | Coaxial cable | Fujikura/Suhner/TSJ | 5D-2W(10m)/SFM141(3m)/sucoform141-PE(1m)/421-010(1.5m)/RFM-E321(Switcher) | -/00640 | RE/CE | 2013/07/23 * 12 |
| MAT-66 | Attenuator(13dB) | JFW Industries, Inc. | 50FP-013H2 N | - | CE | 2014/01/29 * 12 |
| MLPA-01 | Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100017 | RE | 2013/10/30 * 12 |
| MCC-143 | Coaxial Cable | UL Japan | - | - | RE | 2013/07/22 * 12 |
| MSA-10 | Spectrum Analyzer | Agilent | E4448A | MY46180655 | RE | 2014/02/20 * 12 |
| MLPA-06 | Loop Antenna | UL Japan | - | - | FT | Pre Check |
| MCC-138 | Microwave cable | HUBER+SUHNER | SUCOFLEX 102 | 37953/2 | FT | 2013/10/18 * 12 |
| MOS-14 | Thermo-Hygrometer | Custom | CTH-201 | 1401 | FT | 2014/02/20 * 12 |
| MCH-04 | Temperature and Humidity Chamber | Tabai Espec | PL-2KP | 14015723 | FT | 2013/08/23 * 12 |
| MFC-01 | Microwave Counter | Advantest | R5373 | 120100309 | FT | 2013/08/07 * 12 |

The expiration date of the calibration is the end of the expired month.
As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

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

Test Item:
CE: Conducted emission
RE: Radiated emission
FT: Frequency Tolerance



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# 7. RADIATED EMISSION TEST RESULTS

## 7.1. LIMITS AND PROCEDURE

**LIMIT**

§15.225

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Limits for radiated disturbance of an intentional radiator | | |
|---|---|---|
| Frequency range (MHz) | Limits (µV/m) | Measurement Distance (m) |
| 0.009 – 0.490 | 2400 / F (kHz) | 300 |
| 0.490 – 1.705 | 24000 / F (kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100** | 3 |
| 88 - 216 | 150** | 3 |
| 216 – 960 | 200** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)



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In addition:

§15.209 (d) The emission limits shown the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

**TEST PROCEDURE**

ANSI C63.4

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 30 MHz to 1000 MHz.



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**RESULTS**

## 7.2. FUNDAMENTAL EMISSION

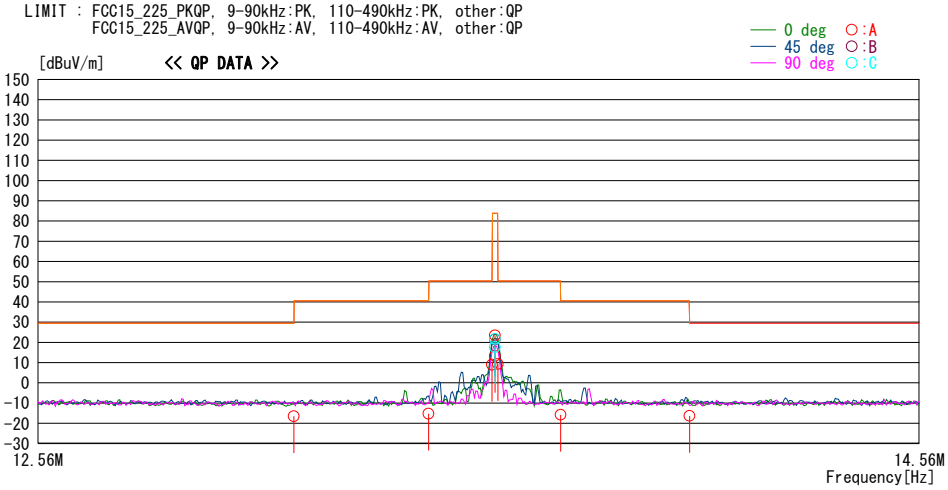
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/18

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./ Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz without tag Worst axis X

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. | Reading | DET | Ant.Fac | Loss | Gain | Result | Limit | Margin | Antenna | | Table | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | | [deg] | |
| 13.11000 | 29.5 | QP | 19.7 | -33.5 | 32.2 | -16.5 | 29.5 | 46.0 | 0 | A | 177 | |
| 13.41000 | 30.6 | QP | 19.7 | -33.4 | 32.2 | -15.3 | 40.5 | 55.8 | 0 | A | 177 | |
| 13.55300 | 54.9 | QP | 19.7 | -33.4 | 32.2 | 9.0 | 50.4 | 41.4 | 0 | A | 177 | |
| 13.56000 | 69.4 | QP | 19.7 | -33.4 | 32.2 | 23.5 | 83.9 | 60.4 | 0 | A | 177 | |
| 13.56000 | 67.3 | QP | 19.7 | -33.4 | 32.2 | 21.4 | 83.9 | 62.5 | 45 | B | 159 | |
| 13.56000 | 63.5 | QP | 19.7 | -33.4 | 32.2 | 17.6 | 83.9 | 66.3 | 90 | C | 281 | |
| 13.56000 | 67.5 | QP | 19.7 | -33.4 | 32.2 | 21.6 | 83.9 | 62.3 | 135 | C | 175 | |
| 13.56000 | 59.2 | QP | 19.7 | -33.4 | 32.2 | 13.3 | 83.9 | 70.6 | 0 | A | 358 | Loop Hori |
| 13.56700 | 55.2 | QP | 19.7 | -33.4 | 32.2 | 9.3 | 50.4 | 41.1 | 0 | A | 177 | |
| 13.71000 | 30.1 | QP | 19.7 | -33.4 | 32.2 | -15.8 | 40.5 | 56.3 | 0 | A | 177 | |
| 14.01000 | 29.5 | QP | 19.7 | -33.4 | 32.2 | -16.4 | 29.5 | 45.9 | 0 | A | 177 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.) - distance fac.



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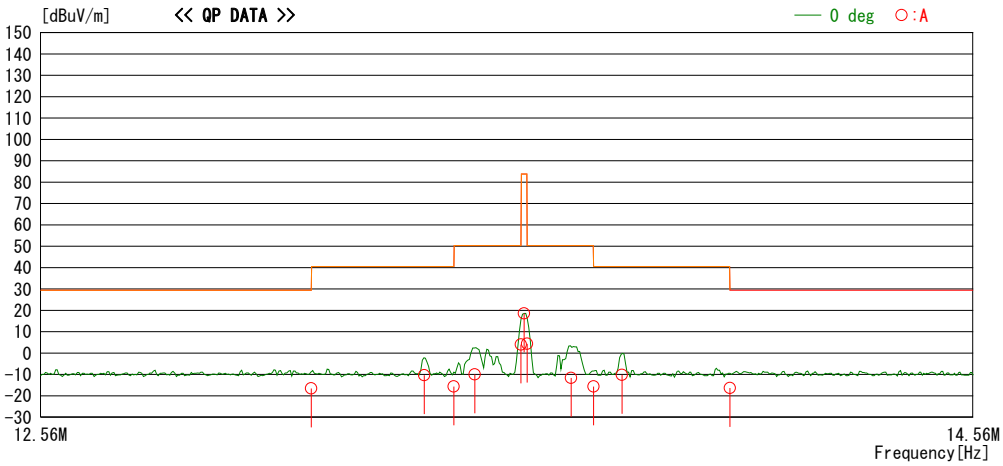
# DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/18

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./ Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type A tag Worst axis X

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. | Reading | DET | Ant.Fac | Loss | Gain | Result | Limit | Margin | Antenna | | Table | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | | [deg] | |
| 13.11000 | 29.5 | QP | 19.7 | -33.5 | 32.2 | -16.5 | 29.5 | 46.0 | 0 | A | 25 | |
| 13.34740 | 35.7 | QP | 19.7 | -33.5 | 32.2 | -10.3 | 40.5 | 50.8 | 0 | A | 25 | |
| 13.41000 | 30.2 | QP | 19.7 | -33.4 | 32.2 | -15.7 | 40.5 | 56.2 | 0 | A | 25 | |
| 13.45480 | 36.0 | QP | 19.7 | -33.4 | 32.2 | -9.9 | 50.4 | 60.3 | 0 | A | 25 | |
| 13.55300 | 49.9 | QP | 19.7 | -33.4 | 32.2 | 4.0 | 50.4 | 46.4 | 0 | A | 25 | |
| 13.56000 | 64.4 | QP | 19.7 | -33.4 | 32.2 | 18.5 | 83.9 | 65.4 | 0 | A | 25 | |
| 13.56700 | 50.3 | QP | 19.7 | -33.4 | 32.2 | 4.4 | 50.4 | 46.0 | 0 | A | 25 | |
| 13.66170 | 34.2 | QP | 19.7 | -33.4 | 32.2 | -11.7 | 50.4 | 62.1 | 0 | A | 25 | |
| 13.71000 | 30.2 | QP | 19.7 | -33.4 | 32.2 | -15.7 | 40.5 | 56.2 | 0 | A | 25 | |
| 13.77170 | 35.7 | QP | 19.7 | -33.4 | 32.2 | -10.2 | 40.5 | 50.7 | 0 | A | 25 | |
| 14.01000 | 29.6 | QP | 19.7 | -33.4 | 32.2 | -16.3 | 29.5 | 45.8 | 0 | A | 25 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.) - distance fac.



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# DATA OF RADIATED EMISSION TEST

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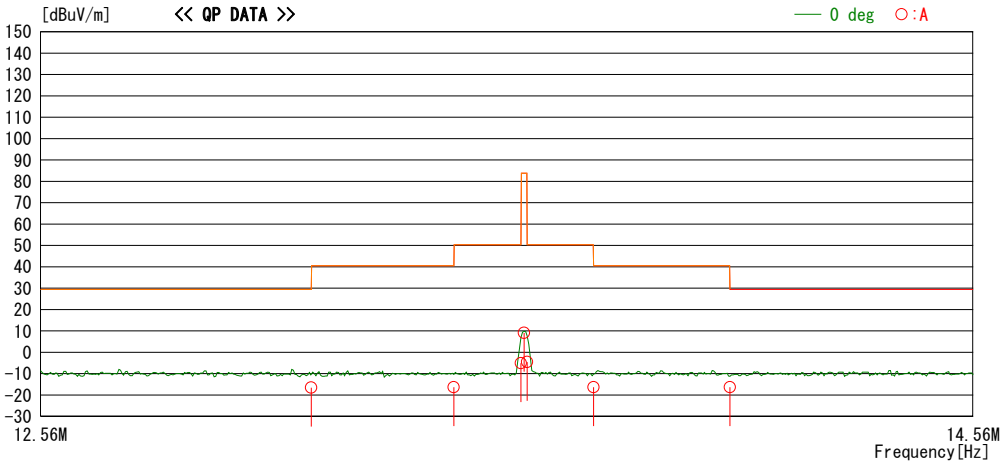
Date : 2014/04/18

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./ Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type B tag Worst axis X

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. | Reading | DET | Ant.Fac | Loss | Gain | Result | Limit | Margin | Antenna | | Table | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | | [deg] | |
| 13.11000 | 29.5 | QP | 19.7 | -33.5 | 32.2 | -16.5 | 29.5 | 46.0 | 0 | A | 178 | |
| 13.41000 | 29.6 | QP | 19.7 | -33.4 | 32.2 | -16.3 | 40.5 | 56.8 | 0 | A | 178 | |
| 13.55300 | 40.9 | QP | 19.7 | -33.4 | 32.2 | -5.0 | 50.4 | 55.4 | 0 | A | 178 | |
| 13.56000 | 55.1 | QP | 19.7 | -33.4 | 32.2 | 9.2 | 83.9 | 74.7 | 0 | A | 178 | |
| 13.56700 | 41.3 | QP | 19.7 | -33.4 | 32.2 | -4.6 | 50.4 | 55.0 | 0 | A | 178 | |
| 13.71000 | 29.6 | QP | 19.7 | -33.4 | 32.2 | -16.3 | 40.5 | 56.8 | 0 | A | 178 | |
| 14.01000 | 29.5 | QP | 19.7 | -33.4 | 32.2 | -16.4 | 29.5 | 45.9 | 0 | A | 178 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.) - distance fac.



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## Result of the fundamental emission at 3m without Distance factor

**QP**

| Ant Deg [deg] | Frequency | Detector | Reading | Ant | Loss | Gain | Duty | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 13.56000 | QP | 69.4 | 19.7 | 6.6 | 32.2 | - | 63.5 | - | - | without tag |
| 0 | 13.56000 | QP | 64.4 | 19.7 | 6.6 | 32.2 | - | 58.5 | - | - | with Type A tag |
| 0 | 13.56000 | QP | 55.1 | 19.7 | 6.6 | 32.2 | - | 49.2 | - | - | with Type B tag |

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



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## 7.3. SPURIOUS EMISSIONS (0.15 – 30 MHz)

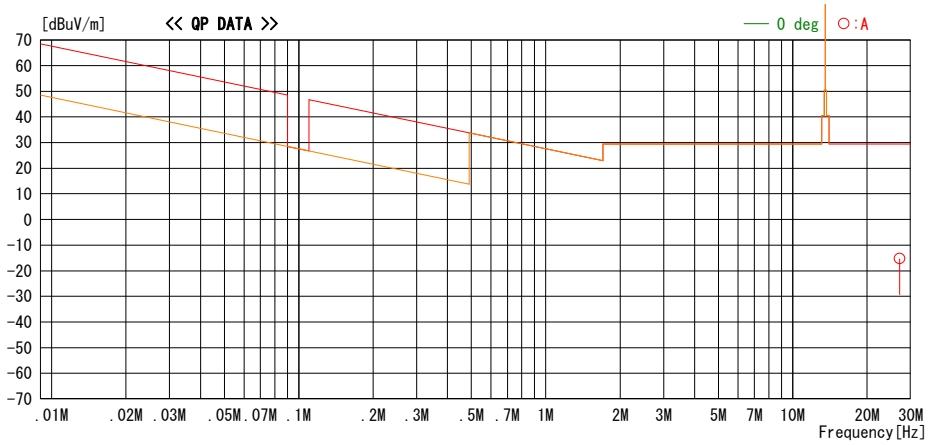
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/18

Report No. : 10275679H
Power : AC120V / 60Hz
Temp. / Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz without tag Worst axis X

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. | Reading | DET | Ant.Fac | Loss | Gain | Result | Limit | Margin | Antenna | | Table | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | | [deg] | |
| 27.12000 | 29.4 | QP | 20.7 | -33.2 | 32.2 | -15.3 | 29.5 | 44.8 | 0 | A | 177 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.) - distance fac.



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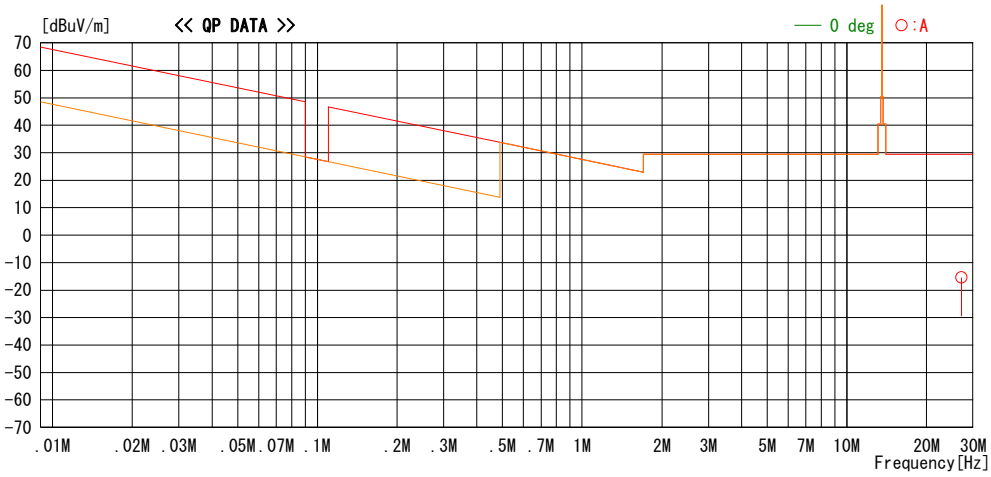
# DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/18

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./ Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type A tag Worst axis X

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. [MHz] | Reading [dBuV] | DET | Ant.Fac [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna [deg] | | Table [deg] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27.12000 | 29.3 | QP | 20.7 | -33.2 | 32.2 | -15.4 | 29.5 | 44.9 | 0 | A | 25 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.) - distance fac.



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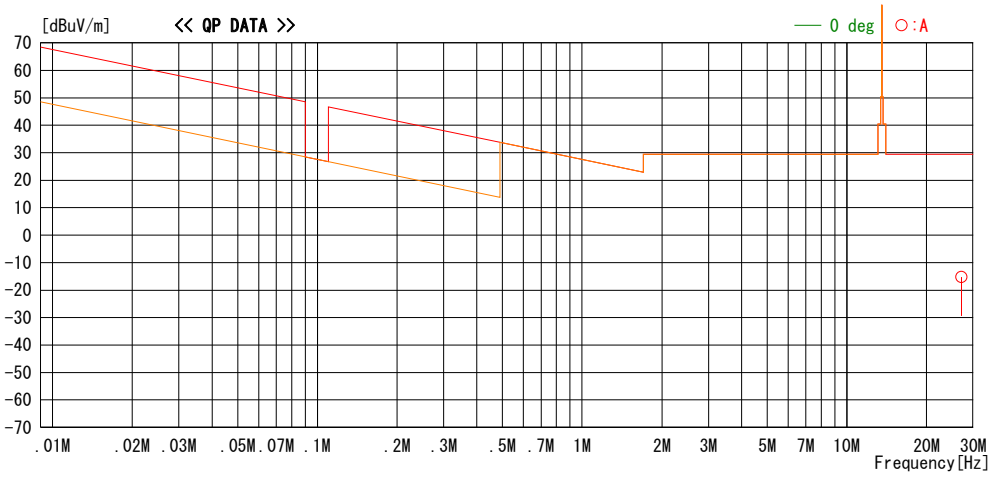
# DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/18

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./ Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type B tag Worst axis X

LIMIT : FCC15_225_PKQP, 9-90kHz:PK, 110-490kHz:PK, other:QP
FCC15_225_AVQP, 9-90kHz:AV, 110-490kHz:AV, other:QP




| Freq. | Reading | DET | Ant.Fac | Loss | Gain | Result | Limit | Margin | Antenna | | Table | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dB] | [dBuV/m] | [dBuV/m] | [dB] | [deg] | | [deg] | |
| 27.12000 | 29.4 | QP | 20.7 | -33.2 | 32.2 | -15.3 | 29.5 | 44.8 | 0 | A | 178 | |

CHART: WITH FACTOR , ANT TYPE: LOOP Except for the data below : adequate margin data below the limits.
CALCULATION : RESULT = READING + ANT FACTOR + LOSS(CABLE + ATTEN.) - GAIN(AMP.) - distance fac.



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## 7.4. SPURIOUS EMISSION 30 TO 1000 MHz

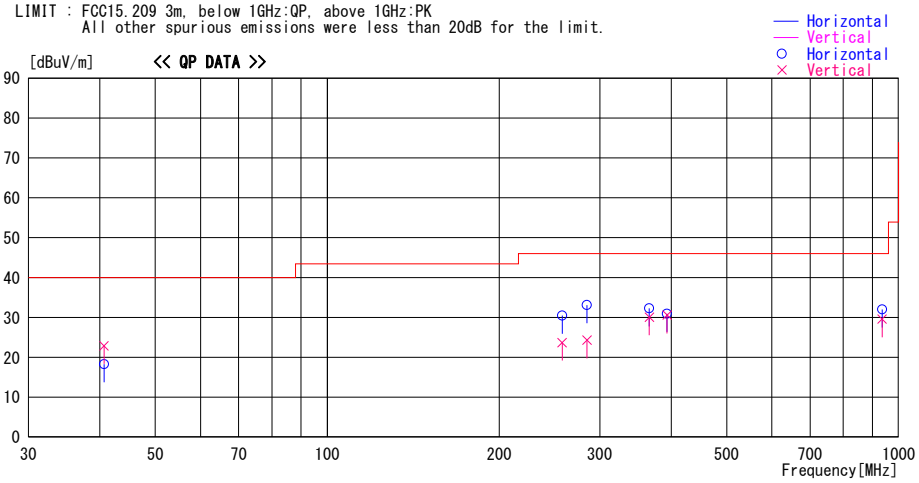
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/19

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./Humi. : 24deg. C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type A tag Wrost axis(Hor:X / Ver:X)

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




| Frequency | Reading | DET | Antenna Factor | Loss& Gain | Level | Angle | Height | Polar. | Limit | Margin | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBuV] | | [dB/m] | [dB] | [dBuV/m] | [Deg] | [cm] | | [dBuV/m] | [dB] | |
| 40.680 | 29.0 | QP | 14.3 | -25.0 | 18.3 | 25 | 371 | Hori. | 40.0 | 21.7 | |
| 40.680 | 33.6 | QP | 14.3 | -25.0 | 22.9 | 308 | 100 | Vert. | 40.0 | 17.1 | |
| 257.640 | 35.2 | QP | 17.7 | -22.4 | 30.5 | 20 | 124 | Hori. | 46.0 | 15.5 | |
| 257.640 | 28.4 | QP | 17.7 | -22.4 | 23.7 | 349 | 100 | Vert. | 46.0 | 22.3 | |
| 284.760 | 36.2 | QP | 19.0 | -22.1 | 33.1 | 172 | 120 | Hori. | 46.0 | 12.9 | |
| 284.760 | 27.4 | QP | 19.0 | -22.1 | 24.3 | 306 | 100 | Vert. | 46.0 | 21.7 | |
| 366.120 | 37.4 | QP | 16.5 | -21.6 | 32.3 | 177 | 100 | Hori. | 46.0 | 13.7 | |
| 366.120 | 35.2 | QP | 16.5 | -21.6 | 30.1 | 359 | 177 | Vert. | 46.0 | 15.9 | |
| 393.240 | 35.0 | QP | 17.3 | -21.4 | 30.9 | 191 | 100 | Hori. | 46.0 | 15.1 | |
| 393.240 | 34.7 | QP | 17.3 | -21.4 | 30.6 | 337 | 161 | Vert. | 46.0 | 15.4 | |
| 935.640 | 26.2 | QP | 23.1 | -17.3 | 32.0 | 136 | 100 | Hori. | 46.0 | 14.0 | |
| 935.640 | 23.8 | QP | 23.1 | -17.3 | 29.6 | 138 | 115 | Vert. | 46.0 | 16.4 | |

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



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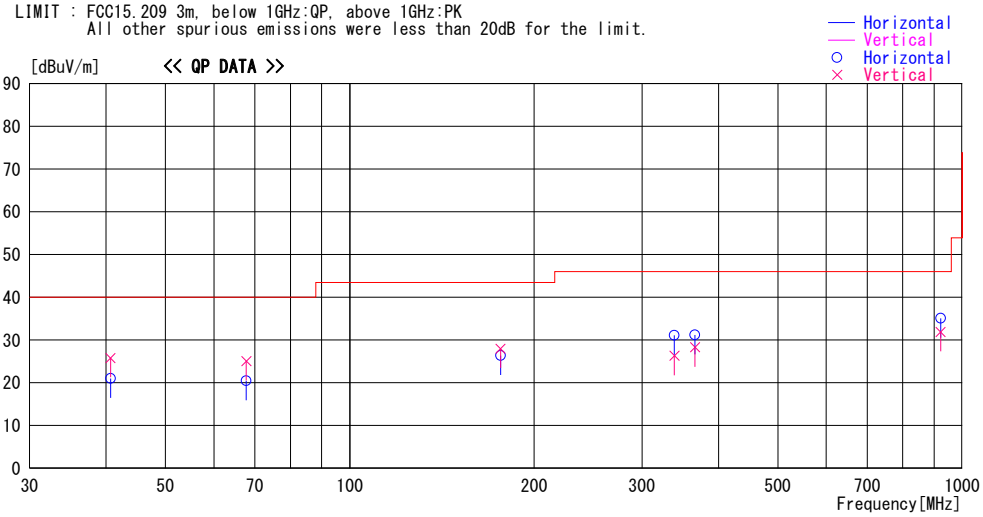
# DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/19

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./Humi. : 24deg. C / 34% RH
Engineer : Takuni Shimada

Mode / Remarks : Tx 13.56MHz with Type B tag Wrost axis(Hor:X / Ver:X)

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 Factor [dB/m] | Loss& Gain [dB] | Level [dBuV/m] | Angle [Deg] | Height [cm] | Polar. | Limit [dBuV/m] | Margin [dB] | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.680 | 31.7 | QP | 14.3 | -25.0 | 21.0 | 238 | 239 | Hori. | 40.0 | 19.0 | |
| 40.680 | 36.5 | QP | 14.3 | -25.0 | 25.8 | 150 | 100 | Vert. | 40.0 | 14.2 | |
| 67.800 | 38.2 | QP | 6.8 | -24.5 | 20.5 | 230 | 256 | Hori. | 40.0 | 19.5 | |
| 67.800 | 42.8 | QP | 6.8 | -24.5 | 25.1 | 340 | 100 | Vert. | 40.0 | 14.9 | |
| 176.280 | 33.6 | QP | 16.0 | -23.2 | 26.4 | 66 | 189 | Hori. | 43.5 | 17.1 | |
| 176.280 | 35.2 | QP | 16.0 | -23.2 | 28.0 | 136 | 100 | Vert. | 43.5 | 15.5 | |
| 339.000 | 37.2 | QP | 15.6 | -21.7 | 31.1 | 173 | 100 | Hori. | 46.0 | 14.9 | |
| 339.000 | 32.4 | QP | 15.6 | -21.7 | 26.3 | 215 | 169 | Vert. | 46.0 | 19.7 | |
| 366.120 | 36.3 | QP | 16.5 | -21.6 | 31.2 | 172 | 100 | Hori. | 46.0 | 14.8 | |
| 366.120 | 33.4 | QP | 16.5 | -21.6 | 28.3 | 200 | 140 | Vert. | 46.0 | 17.7 | |
| 922.080 | 29.7 | QP | 22.8 | -17.4 | 35.1 | 146 | 100 | Hori. | 46.0 | 10.9 | |
| 922.080 | 26.5 | QP | 22.8 | -17.4 | 31.9 | 162 | 120 | Vert. | 46.0 | 14.1 | |

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



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# 8. AC MAINS LINE CONDUCTED EMISSIONS

**LIMITS**

§15.207

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency range (MHz) | Limits (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Notes:<br>1. The lower limit shall apply at the transition frequencies<br>2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

**TEST PROCEDURE**

ANSI C63.4



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**RESULTS**

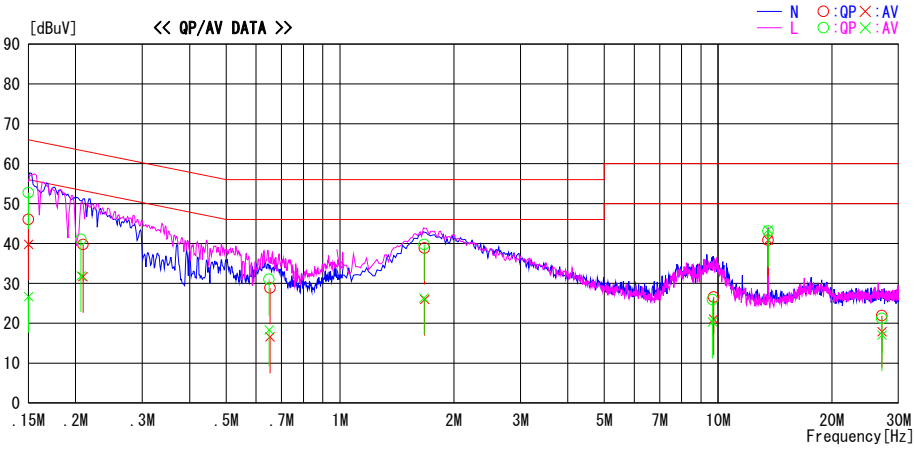
# DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/19

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type A tag

LIMIT : FCC15.207 QP
FCC15.207 AV




| Frequency | Reading Level | | Corr. | Results | | Limit | | Margin | | Phase | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | QP | AV | Factor | QP | AV | QP | AV | QP | AV | | |
| [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dB] | [dB] | | |
| 0.15000 | 32.8 | 26.6 | 13.2 | 46.0 | 39.8 | 66.0 | 56.0 | 20.0 | 16.2 | N | |
| 0.20904 | 26.4 | 18.4 | 13.3 | 39.7 | 31.7 | 63.2 | 53.2 | 23.5 | 21.5 | N | |
| 0.65305 | 15.5 | 3.3 | 13.3 | 28.8 | 16.6 | 56.0 | 46.0 | 27.2 | 29.4 | N | |
| 1.67429 | 25.3 | 12.5 | 13.5 | 38.8 | 26.0 | 56.0 | 46.0 | 17.2 | 20.0 | N | |
| 9.72269 | 12.6 | 7.1 | 14.0 | 26.6 | 21.1 | 60.0 | 50.0 | 33.4 | 28.9 | N | |
| 13.56000 | 26.5 | 26.6 | 14.3 | 40.8 | 40.9 | 60.0 | 50.0 | 19.2 | 9.1 | N | Carrier |
| 27.12000 | 7.0 | 3.0 | 14.9 | 21.9 | 17.9 | 60.0 | 50.0 | 38.1 | 32.1 | N | |
| 0.15000 | 39.5 | 13.5 | 13.2 | 52.7 | 26.7 | 66.0 | 56.0 | 13.3 | 29.3 | L | |
| 0.20672 | 27.7 | 18.6 | 13.3 | 41.0 | 31.9 | 63.3 | 53.3 | 22.3 | 21.4 | L | |
| 0.64950 | 17.7 | 5.0 | 13.3 | 31.0 | 18.3 | 56.0 | 46.0 | 25.0 | 27.7 | L | |
| 1.66745 | 26.2 | 12.8 | 13.5 | 39.7 | 26.3 | 56.0 | 46.0 | 16.3 | 19.7 | L | |
| 9.66728 | 11.9 | 6.3 | 14.0 | 25.9 | 20.3 | 60.0 | 50.0 | 34.1 | 29.7 | L | |
| 13.56000 | 28.8 | 29.1 | 14.3 | 43.1 | 43.4 | 60.0 | 50.0 | 16.9 | 6.6 | L | Carrier |
| 27.12000 | 6.3 | 2.2 | 14.9 | 21.2 | 17.1 | 60.0 | 50.0 | 38.8 | 32.9 | L | |

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



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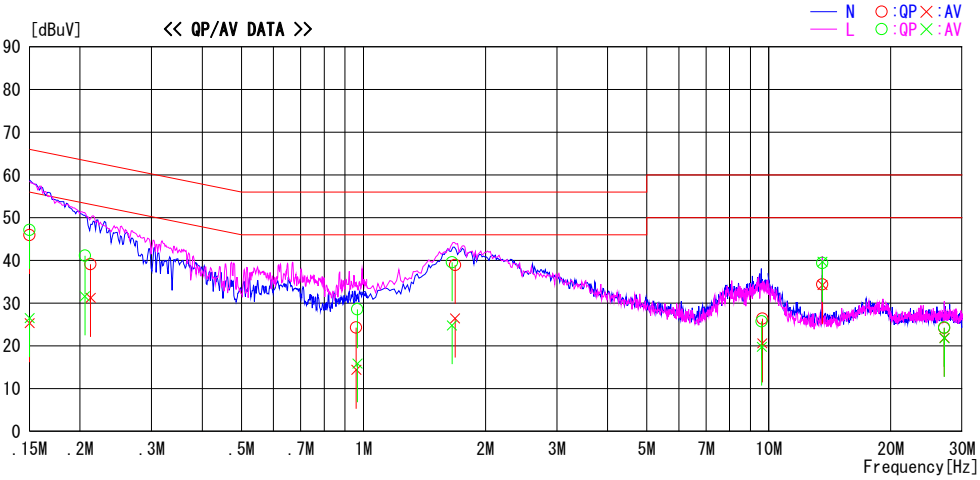
# DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise HQ EMC Lab. No.3 Semi Anechoic Chamber
Date : 2014/04/19

Report No. : 10275679H
Power : AC120V / 60Hz
Temp./Humi. : 24deg.C / 34% RH
Engineer : Takumi Shimada

Mode / Remarks : Tx 13.56MHz with Type B tag

LIMIT : FCC15.207 QP
FCC15.207 AV




| Frequency | Reading Level | | Corr. | Results | | Limit | | Margin | | Phase | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | QP | AV | Factor | QP | AV | QP | AV | QP | AV | | |
| [MHz] | [dBuV] | [dBuV] | [dB] | [dBuV] | [dBuV] | [dBuV] | [dBuV] | [dB] | [dB] | | |
| 0.15000 | 32.7 | 12.1 | 13.2 | 45.9 | 25.3 | 66.0 | 56.0 | 20.1 | 30.7 | N | |
| 0.21220 | 25.8 | 17.9 | 13.3 | 39.1 | 31.2 | 63.1 | 53.1 | 24.0 | 21.9 | N | |
| 0.96036 | 11.0 | 1.1 | 13.3 | 24.3 | 14.4 | 56.0 | 46.0 | 31.7 | 31.6 | N | |
| 1.68266 | 25.4 | 12.9 | 13.5 | 38.9 | 26.4 | 56.0 | 46.0 | 17.1 | 19.6 | N | |
| 9.63690 | 12.4 | 6.6 | 14.0 | 26.4 | 20.6 | 60.0 | 50.0 | 33.6 | 29.4 | N | |
| 13.56000 | 20.1 | 19.9 | 14.3 | 34.4 | 34.2 | 60.0 | 50.0 | 25.6 | 15.8 | N | Carrier |
| 27.12000 | 9.3 | 7.0 | 14.9 | 24.2 | 21.9 | 60.0 | 50.0 | 35.8 | 28.1 | N | |
| 0.15000 | 33.9 | 13.3 | 13.2 | 47.1 | 26.5 | 66.0 | 56.0 | 18.9 | 29.5 | L | |
| 0.20545 | 27.8 | 18.3 | 13.3 | 41.1 | 31.6 | 63.4 | 53.4 | 22.3 | 21.8 | L | |
| 0.96592 | 15.3 | 2.6 | 13.3 | 28.6 | 15.9 | 56.0 | 46.0 | 27.4 | 30.1 | L | |
| 1.65360 | 26.1 | 11.3 | 13.5 | 39.6 | 24.8 | 56.0 | 46.0 | 16.4 | 21.2 | L | |
| 9.61372 | 11.7 | 5.8 | 14.0 | 25.7 | 19.8 | 60.0 | 50.0 | 34.3 | 30.2 | L | |
| 13.56000 | 25.1 | 25.4 | 14.3 | 39.4 | 39.7 | 60.0 | 50.0 | 20.6 | 10.3 | L | Carrier |
| 27.12000 | 9.4 | 6.9 | 14.9 | 24.3 | 21.8 | 60.0 | 50.0 | 35.7 | 28.2 | L | |

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



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# 9. FREQUENCY STABILITY

**LIMIT**

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

**TEST PROCEDURE**

ANSI C63.4



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**RESULTS**

| Test Condition deg.C | Volts | Test Timing | Measured freq [MHz] | Freq error [MHz] | Result [ppm] | Limit (+/- 0.01%) [+/- ppm] | Margin [ppm] |
|---|---|---|---|---|---|---|---|
| 20deg.C | 138V | Power on | 13.560067 | 0.000067 | 4.94 | 100.00 | 95.06 |
| | | on 2min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| | | on 5min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| | | on 10min. | 13.560064 | 0.000064 | 4.72 | 100.00 | 95.28 |
| | 120V | Power on | 13.560066 | 0.000066 | 4.87 | 100.00 | 95.13 |
| | | on 2min. | 13.560066 | 0.000066 | 4.86 | 100.00 | 95.14 |
| | | on 5min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| | | on 10min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| | 102V | Power on | 13.560066 | 0.000066 | 4.87 | 100.00 | 95.13 |
| | | on 2min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| | | on 5min. | 13.560064 | 0.000064 | 4.72 | 100.00 | 95.28 |
| | | on 10min. | 13.560064 | 0.000064 | 4.72 | 100.00 | 95.28 |
| 50deg.C. | 120V | Power on | 13.560060 | 0.000060 | 4.42 | 100.00 | 95.58 |
| | | on 2min. | 13.560059 | 0.000059 | 4.35 | 100.00 | 95.65 |
| | | on 5min. | 13.560066 | 0.000066 | 4.87 | 100.00 | 95.13 |
| | | on 10min. | 13.560074 | 0.000074 | 5.46 | 100.00 | 94.54 |
| 40deg.C. | | Power on | 13.560064 | 0.000064 | 4.72 | 100.00 | 95.28 |
| | | on 2min. | 13.560053 | 0.000053 | 3.91 | 100.00 | 96.09 |
| | | on 5min. | 13.560054 | 0.000054 | 3.98 | 100.00 | 96.02 |
| | | on 10min. | 13.560056 | 0.000056 | 4.13 | 100.00 | 95.87 |
| 30deg.C. | | Power on | 13.560088 | 0.000088 | 6.49 | 100.00 | 93.51 |
| | | on 2min. | 13.560067 | 0.000067 | 4.94 | 100.00 | 95.06 |
| | | on 5min. | 13.560061 | 0.000061 | 4.50 | 100.00 | 95.50 |
| | | on 10min. | 13.560056 | 0.000056 | 4.13 | 100.00 | 95.87 |
| 20deg.C. | | Power on | 13.560066 | 0.000066 | 4.87 | 100.00 | 95.13 |
| | | on 2min. | 13.560066 | 0.000066 | 4.86 | 100.00 | 95.14 |
| | | on 5min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| | | on 10min. | 13.560065 | 0.000065 | 4.79 | 100.00 | 95.21 |
| 10deg.C. | | Power on | 13.560125 | 0.000125 | 9.22 | 100.00 | 90.78 |
| | | on 2min. | 13.560112 | 0.000112 | 8.26 | 100.00 | 91.74 |
| | | on 5min. | 13.560105 | 0.000105 | 7.74 | 100.00 | 92.26 |
| | | on 10min. | 13.560095 | 0.000095 | 7.01 | 100.00 | 92.99 |
| 0deg.C. | | Power on | 13.560121 | 0.000121 | 8.92 | 100.00 | 91.08 |
| | | on 2min. | 13.560120 | 0.000120 | 8.85 | 100.00 | 91.15 |
| | | on 5min. | 13.560119 | 0.000119 | 8.78 | 100.00 | 91.22 |
| | | on 10min. | 13.560118 | 0.000118 | 8.70 | 100.00 | 91.30 |
| -10deg.C. | | Power on | 13.560115 | 0.000115 | 8.48 | 100.00 | 91.52 |
| | | on 2min. | 13.560138 | 0.000138 | 10.18 | 100.00 | 89.82 |
| | | on 5min. | 13.560136 | 0.000136 | 10.03 | 100.00 | 89.97 |
| | | on 10min. | 13.560135 | 0.000135 | 9.96 | 100.00 | 90.04 |
| -20deg.C | | Power on | 13.560107 | 0.000107 | 7.89 | 100.00 | 92.11 |
| | | on 2min. | 13.560145 | 0.000145 | 10.69 | 100.00 | 89.31 |
| | | on 5min. | 13.560145 | 0.000145 | 10.69 | 100.00 | 89.31 |
| | | on 10min. | 13.560145 | 0.000145 | 10.69 | 100.00 | 89.31 |
| -30deg.C | | Power on | 13.560099 | 0.000099 | 7.30 | 100.00 | 92.70 |
| | | on 2min. | 13.560152 | 0.000152 | 11.21 | 100.00 | 88.79 |
| | | on 5min. | 13.560154 | 0.000154 | 11.36 | 100.00 | 88.64 |
| | | on 10min. | 13.560153 | 0.000153 | 11.28 | 100.00 | 88.72 |

Limit : 13.56 13.56 MHz +/-0.01 % (+/- 100ppm) = +/- 0.001356 MHz

*The test was begun from 50 deg.C and the temperature was lowered each 10 deg.C.



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