# RADIO TEST REPORT

## Test Report No. : 10699546H-A-R1

| | | |
|---|---|---|
| **Applicant** | : | **Omron Healthcare Co., Ltd.** |
| **Type of Equipment** | : | **Blood Pressure Monitor** |
| **Model No.** | : | **HEM-6320T-Z (BP654)** |
| **FCC ID** | : | **Q6ZHEM6321T** |
| **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 the 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 10699546H-A. 10699546H-A is replaced with this report.

**Date of test:** February 10 and 27, 2015

**Representative test engineer:**
S. Matsuyama
Satofumi Matsuyama
Engineer
Consumer Technology Division

**Approved by:**
Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap

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# REVISION HISTORY

## Original Test Report No.: 10699546H-A

| Revision | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| - (Original) | 10699546H-A | March 5, 2015 | - | - |
| 1 | 10699546H-A-R1 | March 16, 2015 | P. 4 | Addition of note about model number. |

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# SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | Omron Healthcare Co., Ltd. |
| Address | : | 53 Kunotsubo, Terado-cho, Muko, Kyoto 617-0002 Japan |
| Telephone Number | : | +81-75-925-2012 |
| Facsimile Number | : | +81-75-925-2013 |
| Contact Person | : | Hirokazu Furukawa |

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

## 2.1 Identification of E.U.T.

| | | |
|---|---|---|
| Type of Equipment | : | Blood Pressure Monitor |
| Model No. | : | HEM-6320T-Z (BP654) |
| Serial No. | : | Refer to Section 4, Clause 4.2 |
| Rating | : | DC 2.1-3.6V |
| Receipt Date of Sample | : | February 7, 2015 (for Radiated Spurious Emission)<br>February 26, 2015 (for Antenna Terminal Conducted Tests) |
| Country of Mass-production | : | Vietnam |
| Condition of EUT | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT | : | No Modification by the test lab |

## 2.2 Product Description

### General Specification

| | | |
|---|---|---|
| Clock frequency(ies) in the system | : | 32.768kHz, 26MHz, 16MHz |

The EUT has two model numbers: HEM-6320T-Z and BP654.
HEM-6320T-Z is for internal use. Also, BP654 is for user.

Variant model: HEM-6321T-Z

For HEM-6321T-Z, following functions are added from to the base model (EUT).
- User exchange switch to Circuit board. (A raw circuit board is the same.)
- Backlight on display.
  (Displays of each model are different. HEM-6321T-Z uses a transmissive-type display.)

### Radio Specification

**Bluetooth (Low Energy)**

| | | |
|---|---|---|
| Radio Type | : | Transceiver |
| Frequency of Operation | : | 2402-2480MHz |
| Modulation | : | GFSK |
| Bandwidth & Channel Spacing | : | 1MHz & 2MHz |
| Power Supply (radio part input) | : | DC 3.4-3.6V |
| Antenna type | : | Chip Antenna |
| Antenna Gain | : | 2.72dBi |

# 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<br>Section 15.207 Conducted limits<br>Section 15.247 Operation within the bands 902-928MHz,<br>2400-2483.5MHz, and 5725-5850MHz |

## 3.2 Procedures and results

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|---|---|---|---|---|---|
| Conducted Emission | **FCC:** ANSI C63.4:2009<br>7. AC powerline Conducted Emission measurements | **FCC:** Section 15.207 | N/A *1) | N/A | - |
| | **IC:** RSS-Gen 8.8 | **IC:** RSS-Gen 8.8 | | | |
| 6dB Bandwidth | **FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" | **FCC:** Section 15.247(a)(2) | See data. | Complied | Conducted |
| | **IC:** - | **IC:** RSS-210 A8.2(a) | | | |
| Maximum Peak Output Power | **FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" | **FCC:** Section 15.247(b)(3) | | Complied | Conducted |
| | **IC:** RSS-Gen 6.12 | **IC:** RSS-210 A8.4(4) | | | |
| Power Density | **FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" | **FCC:** Section 15.247 (e) | | Complied | Conducted |
| | **IC:** - | **IC:** RSS-210 A8.2(b) | | | |
| Spurious Emission Restricted Band Edges | **FCC:** "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" | **FCC:** Section15.247(d) | 2.6dB<br>7320.000MHz, AV, Vertical | Complied | Conducted/ Radiated |
| | **IC:** RSS-Gen 6.13 | **IC:** RSS-210 A8.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | | | |
| Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.<br>*1) This test is not applicable since the EUT is battery operation device. | | | | | |

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

**FCC Part 15.31 (e)**

The test was performed with the New Battery and the stable voltage was supplied to the EUT during the tests. Therefore, the EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

## 3.3 Addition to standard

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

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) | 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

| Power meter (±dB) | |
|---|---|
| Below 1GHz | Above 1GHz |
| 0.7dB | 1.5dB |

| Antenna terminal conducted emission and Power density (±dB) | | | Antenna terminal conducted emission (±dB) | | Channel power (±dB) |
|---|---|---|---|---|---|
| Below 1GHz | 1GHz-3GHz | 3GHz-18GHz | 18GHz-26.5GHz | 26.5GHz-40GHz | |
| 1.5dB | 1.7dB | 2.8dB | 2.8dB | 2.9dB | 2.6dB |

Radiated emission test(3m)

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
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
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| | IC Registration Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms |
|---|---|---|---|---|
| No.1 semi-anechoic chamber | 2973C-1 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | No.1 Power source room |
| No.2 semi-anechoic chamber | 2973C-2 | 7.5 x 5.8 x 5.2m | 4.0 x 4.0m | - |
| No.3 semi-anechoic chamber | 2973C-3 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.3 Preparation room |
| No.3 shielded room | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.4 semi-anechoic chamber | 2973C-4 | 12.0 x 8.5 x 5.9m | 6.8 x 5.75m | No.4 Preparation room |
| No.4 shielded room | - | 4.0 x 6.0 x 2.7m | N/A | - |
| No.5 semi-anechoic chamber | - | 6.0 x 6.0 x 3.9m | 6.0 x 6.0m | - |
| No.6 shielded room | - | 4.0 x 4.5 x 2.7m | 4.0 x 4.5 m | - |
| No.6 measurement room | - | 4.75 x 5.4 x 3.0m | 4.75 x 4.15 m | - |
| No.7 shielded room | - | 4.7 x 7.5 x 2.7m | 4.7 x 7.5m | - |
| No.8 measurement room | - | 3.1 x 5.0 x 2.7m | N/A | - |
| No.9 measurement room | - | 8.0 x 4.6 x 2.8m | 2.4 x 2.4m | - |
| No.11 measurement room | - | 6.2 x 4.7 x 3.0m | 4.8 x 4.6m | - |

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

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

Refer to APPENDIX.

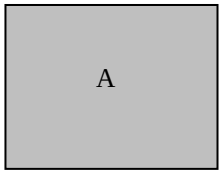
# SECTION 4: Operation of E.U.T. during testing

## 4.1 Operating Mode(s)

Bluetooth Low Energy (BT LE): Transmitting (Tx), Payload: PRBS9

| Test Item | Operating Mode | Tested frequency |
|---|---|---|
| 6dB Bandwidth<br>Maximum Peak Output Power<br>Power Density<br>Spurious Emission<br>99% Occupied Bandwidth | BT LE | 2402MHz<br>2440MHz<br>2480MHz |
| *Transmitting duty was 100% on all tests<br>*Power of the EUT was set by the software as follows;<br>Power settings: 0dBm<br>Software: OPM_Communication_TOOL<br>*This setting of software is the worst case.<br>Any conditions under the normal use do not exceed the condition of setting.<br>In addition, end users cannot change the settings of the output power of the product. | | |

## 4.2 Configuration and peripherals




* Setup(s) was taken into consideration and test data was taken under worse case conditions.

**Description of EUT**

| No. | Item | Model number | Serial number | Manufacturer | Remarks |
|---|---|---|---|---|---|
| A | Blood Pressure Monitor | HEM-6320T-Z (BP654) | ES115010076VF *1)<br>475568-089 *2) | Omron Healthcare Co., Ltd. | EUT |

*1) Used for Radiated Emission test
*2) Used for Antenna Terminal conducted test

## SECTION 5: Radiated Spurious Emission

**Test Procedure**

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)".

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

**Test Antennas are used as below;**

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

In any 100kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

**20dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

| Frequency | Below 1GHz | Above 1GHz | | 20dBc |
|---|---|---|---|---|
| Instrument used | Test Receiver | Spectrum Analyzer | | Spectrum Analyzer |
| Detector | QP | PK | AV *2) | PK |
| IF Bandwidth | BW 120kHz | RBW: 1MHz<br>VBW: 3MHz | Average Power Method:<br>12.2.5.1<br>RBW: 1MHz<br>VBW: 3MHz<br>Trace: 100 traces<br>Detector: Power Averaging (RMS) | RBW: 100kHz<br>VBW: 300kHz |
| Test Distance | 3m | 3m (below 10GHz),<br>1m *1) (above 10GHz) | | 3m (below 10GHz),<br>1m *1) (above 10GHz) |

*1) Distance Factor: 20 x log (3.0m/1.0m) = 9.5dB
*2) Average Power Measurement was performed based on 6.0 & 12.2.5 of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)"

- 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.

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

**Measurement range : 30M-26.5GHz**
**Test data : APPENDIX**
**Test result : Pass**

## SECTION 6: Antenna Terminal Conducted Tests

**Test Procedure**

The tests were made with below setting connected to the antenna port.

| Test | Span | RBW | VBW | Sweep time | Detector | Trace | Instrument used |
|---|---|---|---|---|---|---|---|
| 6dB Bandwidth | 1MHz | 100kHz | 300kHz | 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 | Sample | Clear write | Spectrum Analyzer |
| Maximum Peak Output Power | - | - | - | Auto | Peak/ Average *1) | - | Power Meter (Sensor: 50MHz BW) |
| Peak Power Density | 1.5 times the 6dB Bandwidth | 3kHz | 10kHz | Auto | Peak | Max Hold | Spectrum Analyzer *2) |
| Conducted Spurious Emission *3) | 9kHz to 150kHz | 200Hz | 620Hz | Auto | Peak | Max Hold | Spectrum Analyzer |
| | 150kHz to 30MHz | 9.1kHz | 27kHz | | | | |

*1) Reference data.
*2) Section 10.2 Method PKPSD (peak PSD) of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)".
*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

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

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

# APPENDIX 1: Data of EMI test

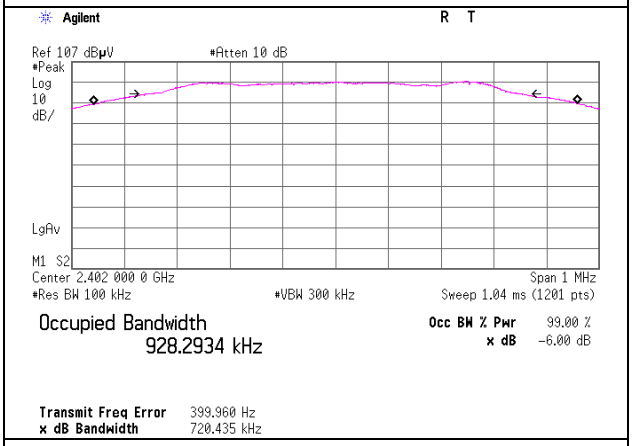
## 6dB Bandwidth

| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx |

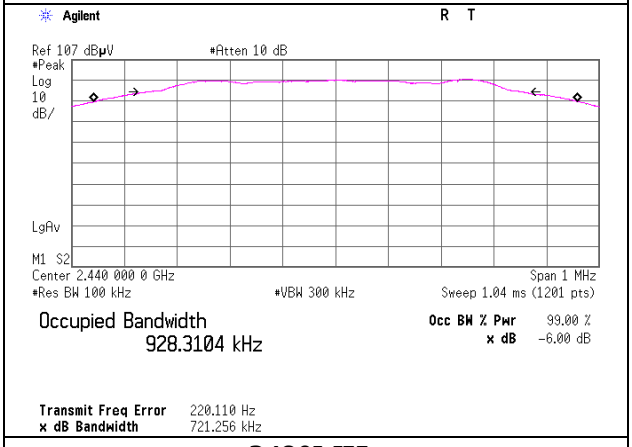
| Frequency [MHz] | 6dB Bandwidth [MHz] | Limit [kHz] |
|---|---|---|
| 2402 | 0.720 | >500 |
| 2440 | 0.721 | >500 |
| 2480 | 0.722 | >500 |

# 6dB Bandwidth

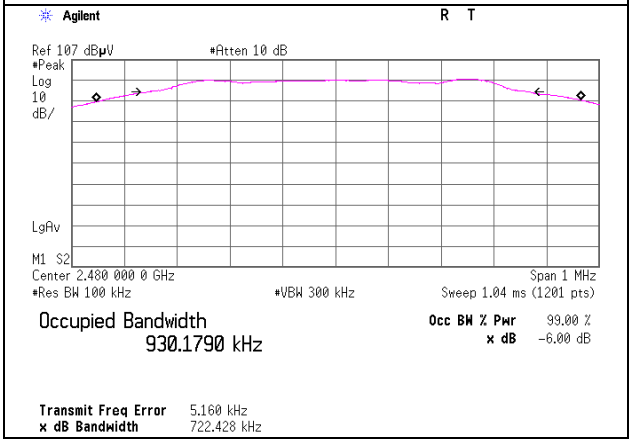
## 2402MHz




## 2440MHz




## 2480MHz





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# Maximum Peak Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx |

| Freq. | Reading | Cable Loss | Atten. | Result | | Limit | | Margin |
|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBm] | [dB] | [dB] | [dBm] | [mW] | [dBm] | [mW] | [dB] |
| 2402 | -8.71 | 0.10 | 10.00 | 1.39 | 1.38 | 30.00 | 1000 | 28.61 |
| 2440 | -8.62 | 0.10 | 10.00 | 1.48 | 1.41 | 30.00 | 1000 | 28.52 |
| 2480 | -8.49 | 0.10 | 10.00 | 1.61 | 1.45 | 30.00 | 1000 | 28.39 |

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

# Average Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx |

[AV]

| Freq. | Reading | Cable Loss | Atten. | Result | | Limit | | Margin |
|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBm] | [dB] | [dB] | [dBm] | [mW] | [dBm] | [mW] | [dB] |
| 2402 | -8.84 | 0.10 | 10.00 | 1.26 | 1.34 | 30.00 | 1000 | 28.74 |
| 2440 | -8.75 | 0.10 | 10.00 | 1.35 | 1.36 | 30.00 | 1000 | 28.65 |
| 2480 | -8.62 | 0.10 | 10.00 | 1.48 | 1.41 | 30.00 | 1000 | 28.52 |

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

# Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 10699546H
Date 02/10/2015
Temperature/ Humidity 25deg. C / 31% RH
Engineer Yuta Moriya
Mode BT LE Tx 2402MHz

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 44.609 | QP | 28.4 | 12.5 | 7.4 | 38.8 | 9.5 | 40.0 | 30.5 | Floor Noise |
| Hori | 115.491 | QP | 28.5 | 12.3 | 8.3 | 38.8 | 10.3 | 43.5 | 33.2 | Floor Noise |
| Hori | 200.440 | QP | 28.2 | 16.6 | 9.1 | 38.9 | 15.0 | 43.5 | 28.5 | Floor Noise |
| Hori | 417.835 | QP | 27.6 | 18.4 | 10.7 | 38.5 | 18.2 | 46.0 | 27.8 | Floor Noise |
| Hori | 514.629 | QP | 27.3 | 19.5 | 11.3 | 38.2 | 19.9 | 46.0 | 26.1 | Floor Noise |
| Hori | 702.608 | QP | 27.0 | 22.4 | 12.3 | 38.2 | 23.5 | 46.0 | 22.5 | Floor Noise |
| Hori | 2390.000 | PK | 41.5 | 27.4 | 3.2 | 32.8 | 39.3 | 73.9 | 34.6 | |
| Hori | 4804.000 | PK | 41.7 | 31.5 | 5.4 | 31.9 | 46.7 | 73.9 | 27.2 | |
| Hori | 7206.000 | PK | 46.8 | 36.8 | 6.6 | 33.0 | 57.2 | 73.9 | 16.7 | Z-axis |
| Hori | 9608.000 | PK | 42.6 | 38.8 | 7.3 | 33.4 | 55.3 | 73.9 | 18.6 | |
| Hori | 2390.000 | AV | 34.2 | 27.4 | 3.2 | 32.8 | 32.0 | 53.9 | 21.9 | |
| Hori | 4804.000 | AV | 34.9 | 31.5 | 5.4 | 31.9 | 39.9 | 53.9 | 14.0 | |
| Hori | 7206.000 | AV | 40.0 | 36.8 | 6.6 | 33.0 | 50.4 | 53.9 | 3.5 | Z-axis |
| Hori | 9608.000 | AV | 34.7 | 38.8 | 7.3 | 33.4 | 47.4 | 53.9 | 6.5 | |
| Vert | 44.609 | QP | 28.1 | 12.5 | 7.4 | 38.8 | 9.2 | 40.0 | 30.8 | Floor Noise |
| Vert | 115.491 | QP | 28.5 | 12.3 | 8.3 | 38.8 | 10.3 | 43.5 | 33.2 | Floor Noise |
| Vert | 200.440 | QP | 28.4 | 16.6 | 9.1 | 38.9 | 15.2 | 43.5 | 28.3 | Floor Noise |
| Vert | 417.835 | QP | 27.7 | 18.4 | 10.7 | 38.5 | 18.3 | 46.0 | 27.7 | Floor Noise |
| Vert | 514.629 | QP | 27.3 | 19.5 | 11.3 | 38.2 | 19.9 | 46.0 | 26.1 | Floor Noise |
| Vert | 702.608 | QP | 27.0 | 22.4 | 12.3 | 38.2 | 23.5 | 46.0 | 22.5 | Floor Noise |
| Vert | 2390.000 | PK | 41.8 | 27.4 | 3.2 | 32.8 | 39.6 | 73.9 | 34.3 | |
| Vert | 4804.000 | PK | 42.0 | 31.5 | 5.4 | 31.9 | 47.0 | 73.9 | 26.9 | |
| Vert | 7206.000 | PK | 46.8 | 36.8 | 6.6 | 33.0 | 57.2 | 73.9 | 16.7 | |
| Vert | 9608.000 | PK | 43.9 | 38.8 | 7.3 | 33.4 | 56.6 | 73.9 | 17.3 | Y-axis |
| Vert | 2390.000 | AV | 33.1 | 27.4 | 3.2 | 32.8 | 30.9 | 53.9 | 23.0 | |
| Vert | 4804.000 | AV | 34.2 | 31.5 | 5.4 | 31.9 | 39.2 | 53.9 | 14.7 | |
| Vert | 7206.000 | AV | 40.5 | 36.8 | 6.6 | 33.0 | 50.9 | 53.9 | 3.0 | |
| Vert | 9608.000 | AV | 35.9 | 38.8 | 7.3 | 33.4 | 48.6 | 53.9 | 5.3 | Y-axis |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).
*The 10th harmonic was not seen so the result was its base noise level.
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

**20dBc Data Sheet**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 2402.000 | PK | 93.2 | 27.4 | 3.2 | 32.8 | 91.0 | - | - | Carrier |
| Hori | 2400.000 | PK | 38.7 | 27.4 | 3.2 | 32.8 | 36.5 | 71.0 | 34.5 | |
| Vert | 2402.000 | PK | 88.6 | 27.4 | 3.2 | 32.8 | 86.4 | - | - | Carrier |
| Vert | 2400.000 | PK | 35.7 | 27.4 | 3.2 | 32.8 | 33.5 | 66.4 | 32.9 | |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amprifier)

# Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 10699546H
Date 02/10/2015
Temperature/ Humidity 25deg. C / 31% RH
Engineer Yuta Moriya
Mode BT LE Tx 2440MHz

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 44.600 | QP | 28.3 | 12.5 | 7.4 | 38.8 | 9.4 | 40.0 | 30.6 | Floor Noise |
| Hori | 115.000 | QP | 28.4 | 12.2 | 8.3 | 38.8 | 10.1 | 43.5 | 33.4 | Floor Noise |
| Hori | 200.000 | QP | 28.1 | 16.6 | 9.1 | 38.9 | 14.9 | 43.5 | 28.6 | Floor Noise |
| Hori | 417.000 | QP | 27.5 | 18.4 | 10.7 | 38.5 | 18.1 | 46.0 | 27.9 | Floor Noise |
| Hori | 515.000 | QP | 27.3 | 19.5 | 11.3 | 38.2 | 19.9 | 46.0 | 26.1 | Floor Noise |
| Hori | 702.000 | QP | 27.0 | 22.4 | 12.3 | 38.2 | 23.5 | 46.0 | 22.5 | Floor Noise |
| Hori | 4880.000 | PK | 41.7 | 31.8 | 5.5 | 31.9 | 47.1 | 73.9 | 26.8 | |
| Hori | 7320.000 | PK | 45.8 | 37.0 | 6.5 | 33.0 | 56.3 | 73.9 | 17.6 | Z-axis |
| Hori | 9760.000 | PK | 44.6 | 38.9 | 7.4 | 33.4 | 57.5 | 73.9 | 16.4 | |
| Hori | 4880.000 | AV | 33.2 | 31.8 | 5.5 | 31.9 | 38.6 | 53.9 | 15.3 | |
| Hori | 7320.000 | AV | 38.8 | 37.0 | 6.5 | 33.0 | 49.3 | 53.9 | 4.6 | Z-axis |
| Hori | 9760.000 | AV | 35.9 | 38.9 | 7.4 | 33.4 | 48.8 | 53.9 | 5.1 | |
| Vert | 44.600 | QP | 28.1 | 12.5 | 7.4 | 38.8 | 9.2 | 40.0 | 30.8 | Floor Noise |
| Vert | 115.000 | QP | 28.4 | 12.2 | 8.3 | 38.8 | 10.1 | 43.5 | 33.4 | Floor Noise |
| Vert | 200.000 | QP | 28.3 | 16.6 | 9.1 | 38.9 | 15.1 | 43.5 | 28.4 | Floor Noise |
| Vert | 417.000 | QP | 27.7 | 18.4 | 10.7 | 38.5 | 18.3 | 46.0 | 27.7 | Floor Noise |
| Vert | 515.000 | QP | 27.3 | 19.5 | 11.3 | 38.2 | 19.9 | 46.0 | 26.1 | Floor Noise |
| Vert | 702.000 | QP | 27.0 | 22.4 | 12.3 | 38.2 | 23.5 | 46.0 | 22.5 | Floor Noise |
| Vert | 4880.000 | PK | 42.5 | 31.8 | 5.5 | 31.9 | 47.9 | 73.9 | 26.0 | |
| Vert | 7320.000 | PK | 47.7 | 37.0 | 5.7 | 33.0 | 57.4 | 73.9 | 16.5 | |
| Vert | 9760.000 | PK | 44.4 | 38.9 | 7.4 | 33.4 | 57.3 | 73.9 | 16.6 | Y-axis |
| Vert | 4880.000 | AV | 34.1 | 31.8 | 5.5 | 31.9 | 39.5 | 53.9 | 14.4 | |
| Vert | 7320.000 | AV | 40.8 | 37.0 | 6.5 | 33.0 | 51.3 | 53.9 | 2.6 | |
| Vert | 9760.000 | AV | 36.3 | 38.9 | 7.4 | 33.4 | 49.2 | 53.9 | 4.7 | Y-axis |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).
*The 10th harmonic was not seen so the result was its base noise level.
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

# Radiated Spurious Emission

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 10699546H
Date 02/10/2015
Temperature/ Humidity 25deg. C / 31% RH
Engineer Yuta Moriya
Mode BT LE Tx 2480MHz

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| Hori | 44.600 | QP | 28.2 | 12.5 | 7.4 | 38.8 | 9.3 | 40.0 | 30.7 | Floor Noise |
| Hori | 115.000 | QP | 28.4 | 12.2 | 8.3 | 38.8 | 10.1 | 43.5 | 33.4 | Floor Noise |
| Hori | 200.000 | QP | 28.1 | 16.6 | 9.1 | 38.9 | 14.9 | 43.5 | 28.6 | Floor Noise |
| Hori | 417.000 | QP | 27.6 | 18.4 | 10.7 | 38.5 | 18.2 | 46.0 | 27.8 | Floor Noise |
| Hori | 515.000 | QP | 27.4 | 19.5 | 11.3 | 38.2 | 20.0 | 46.0 | 26.0 | Floor Noise |
| Hori | 702.000 | QP | 27.1 | 22.4 | 12.3 | 38.2 | 23.6 | 46.0 | 22.4 | Floor Noise |
| Hori | 2483.500 | PK | 42.8 | 27.6 | 3.3 | 32.7 | 41.0 | 73.9 | 32.9 | |
| Hori | 4960.000 | PK | 41.1 | 32.0 | 5.5 | 31.9 | 46.7 | 73.9 | 27.3 | |
| Hori | 7440.000 | PK | 42.9 | 37.2 | 6.5 | 33.1 | 53.5 | 73.9 | 20.4 | Z-axis |
| Hori | 9920.000 | PK | 43.6 | 39.0 | 7.4 | 33.5 | 56.5 | 73.9 | 17.4 | |
| Hori | 2483.500 | AV | 34.4 | 27.6 | 3.3 | 32.7 | 32.6 | 53.9 | 21.3 | |
| Hori | 4960.000 | AV | 33.5 | 32.0 | 5.5 | 31.9 | 39.1 | 53.9 | 14.8 | |
| Hori | 7440.000 | AV | 34.4 | 37.2 | 6.5 | 33.1 | 45.0 | 53.9 | 8.9 | Z-axis |
| Hori | 9920.000 | AV | 35.4 | 39.0 | 7.4 | 33.5 | 48.3 | 53.9 | 5.6 | |
| Vert | 44.600 | QP | 28.2 | 12.5 | 7.4 | 38.8 | 9.3 | 40.0 | 30.7 | Floor Noise |
| Vert | 115.000 | QP | 28.4 | 12.2 | 8.3 | 38.8 | 10.1 | 43.5 | 33.4 | Floor Noise |
| Vert | 200.000 | QP | 28.3 | 16.6 | 9.1 | 38.9 | 15.1 | 43.5 | 28.4 | Floor Noise |
| Vert | 417.000 | QP | 27.6 | 18.4 | 10.7 | 38.5 | 18.2 | 46.0 | 27.8 | Floor Noise |
| Vert | 515.000 | QP | 27.4 | 19.5 | 11.3 | 38.2 | 20.0 | 46.0 | 26.0 | Floor Noise |
| Vert | 702.000 | QP | 27.1 | 22.4 | 12.3 | 38.2 | 23.6 | 46.0 | 22.4 | Floor Noise |
| Vert | 2483.500 | PK | 42.3 | 27.6 | 3.3 | 32.7 | 40.5 | 73.9 | 33.4 | |
| Vert | 4960.000 | PK | 41.7 | 32.0 | 5.5 | 31.9 | 47.3 | 73.9 | 26.6 | |
| Vert | 7440.000 | PK | 44.4 | 37.2 | 6.5 | 33.1 | 55.0 | 73.9 | 19.0 | |
| Vert | 9920.000 | PK | 44.3 | 39.0 | 7.4 | 33.5 | 57.2 | 73.9 | 16.7 | Y-axis |
| Vert | 2483.500 | AV | 33.8 | 27.6 | 3.3 | 32.7 | 32.0 | 53.9 | 21.9 | |
| Vert | 4960.000 | AV | 33.9 | 32.0 | 5.5 | 31.9 | 39.5 | 53.9 | 14.4 | |
| Vert | 7440.000 | AV | 37.5 | 37.2 | 6.5 | 33.1 | 48.1 | 53.9 | 5.8 | |
| Vert | 9920.000 | AV | 37.3 | 39.0 | 7.4 | 33.5 | 50.2 | 53.9 | 3.8 | Y-axis |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Ampl

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

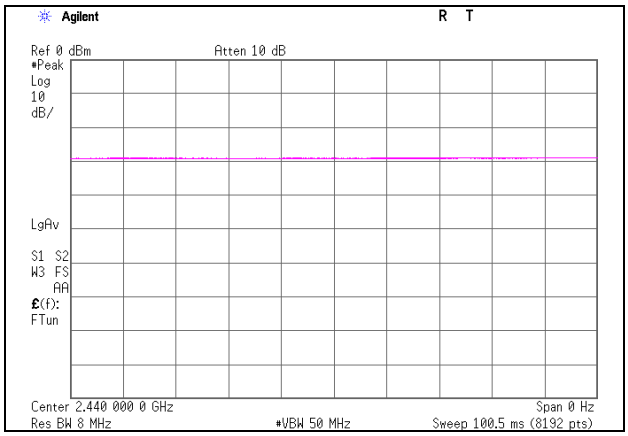
*The 10th harmonic was not seen so the result was its base noise level.

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

**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

# Burst rate confirmation

| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/10/2015 |
| Temperature/ Humidity | 24deg. C / 30% RH |
| Engineer | Tomoki Matsui |
| Mode | BT LE Tx 2440MHz |

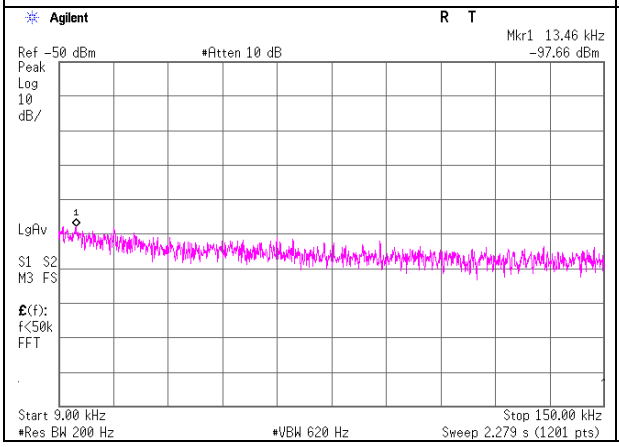


# Conducted Spurious Emission

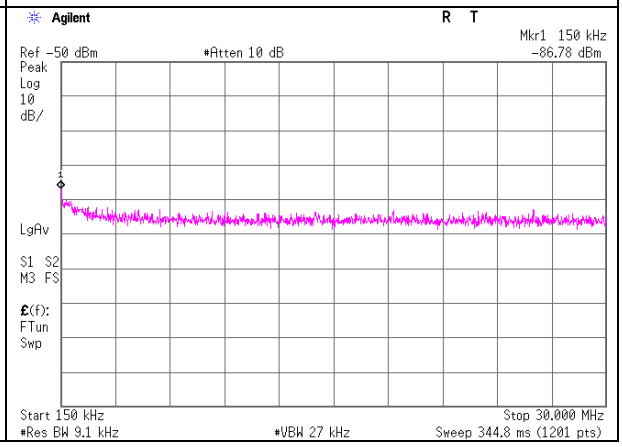
| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx 2402MHz |

## BT LE Tx 2402MHz

### 9kHz-150kHz




### 150kHz-30MHz




| Frequency [kHz] | Reading [dBm] | Cable Loss [dB] | Attenator [dB] | Antenna Gain [dBi] | EIRP [dBm] | Distance [m] | Ground bounce [dB] | E (field strength) [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13.46 | -97.7 | 0.01 | 10.0 | 2.7 | -84.9 | 300 | 6.0 | -23.7 | 45.0 | 68.7 | |
| 150.00 | -86.8 | 0.01 | 10.0 | 2.7 | -74.1 | 300 | 6.0 | -12.8 | 24.0 | 36.8 | |

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

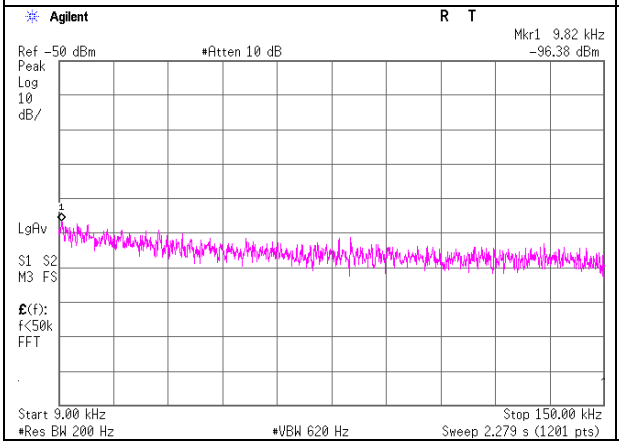
EIRP=Reading+Cable Loss+Attenator+Antenna Gain+10*log(N)

# Conducted Spurious Emission

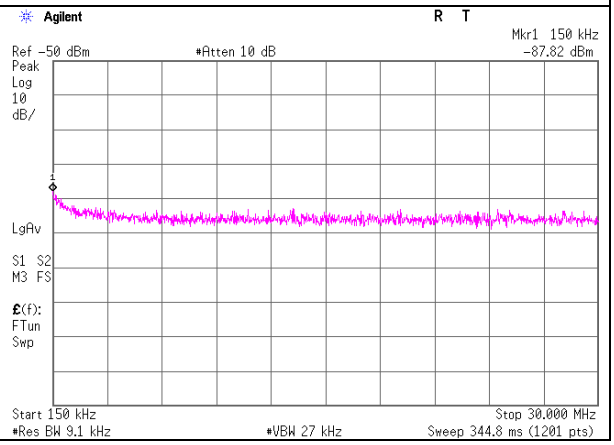
| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx 2440MHz |

## BT LE Tx 2440MHz

### 9kHz-150kHz




### 150kHz-30MHz




| Frequency [kHz] | Reading [dBm] | Cable Loss [dB] | Attenator [dB] | Antenna Gain [dBi] | EIRP [dBm] | Distance [m] | Ground bounce [dB] | E (field strength) [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9.82 | -96.4 | 0.01 | 10.0 | 2.7 | -83.7 | 300 | 6.0 | -22.4 | 47.7 | 70.1 | |
| 150.00 | -87.8 | 0.01 | 10.0 | 2.7 | -75.1 | 300 | 6.0 | -13.8 | 24.0 | 37.8 | |

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

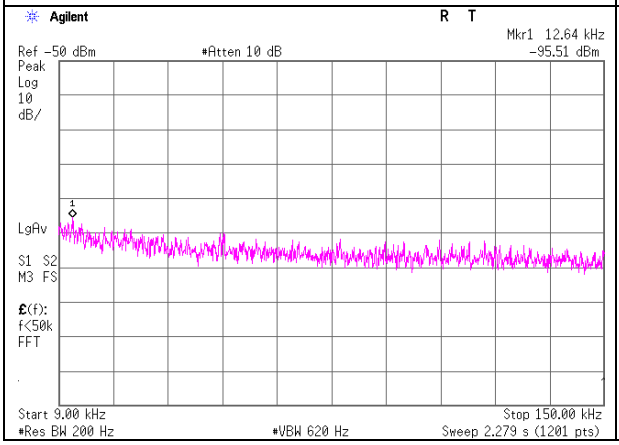
EIRP=Reading+Cable Loss+Attenator+Antenna Gain+10*log(N)

# Conducted Spurious Emission

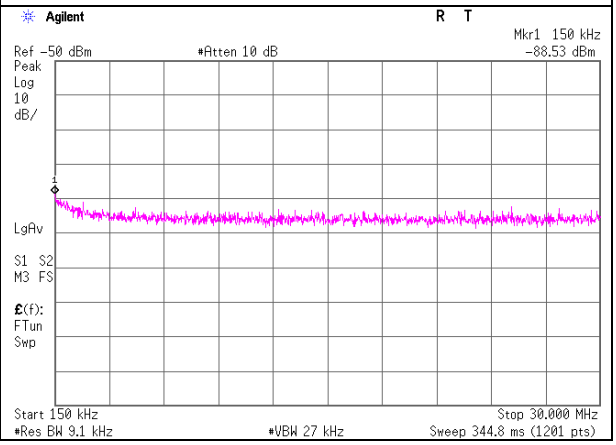
| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx 2480MHz |

## BT LE Tx 2480MHz

### 9kHz-150kHz




### 150kHz-30MHz




| Frequency [kHz] | Reading [dBm] | Cable Loss [dB] | Attenator [dB] | Antenna Gain [dBi] | EIRP [dBm] | Distance [m] | Ground bounce [dB] | E (field strength) [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12.64 | -95.5 | 0.01 | 10.0 | 2.7 | -82.8 | 300 | 6.0 | -21.5 | 45.5 | 67.0 | |
| 150.00 | -88.5 | 0.01 | 10.0 | 2.7 | -75.8 | 300 | 6.0 | -14.5 | 24.0 | 38.5 | |

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss+Attenator+Antenna Gain+10*log(N)

# Power Density

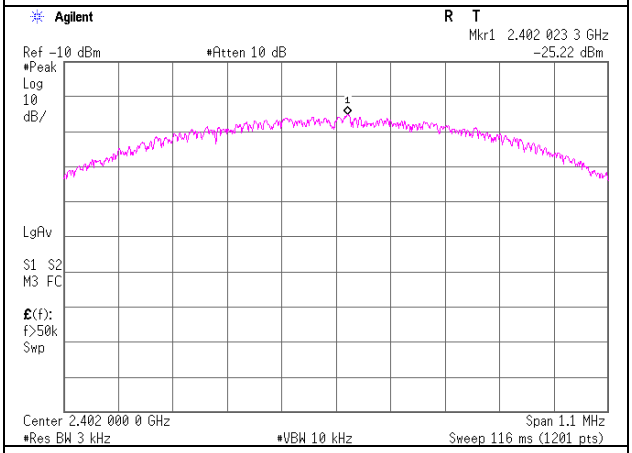
| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx |

| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. [dB] | Result [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 2402.00 | -25.22 | 0.10 | 9.98 | -15.14 | 8.00 | 23.14 |
| 2440.00 | -25.22 | 0.10 | 9.98 | -15.14 | 8.00 | 23.14 |
| 2480.00 | -25.00 | 0.10 | 9.98 | -14.92 | 8.00 | 22.92 |

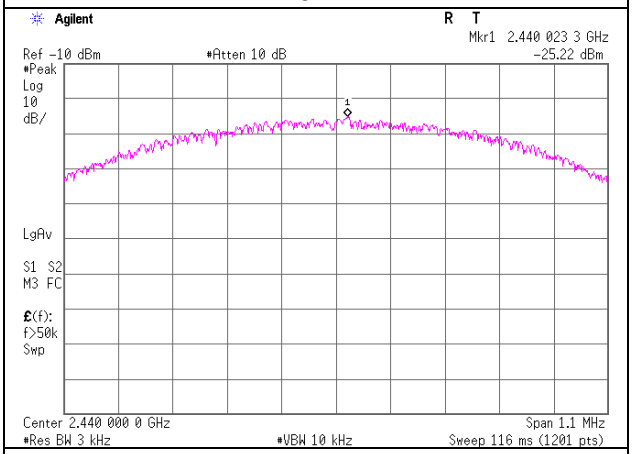
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator

# Power Density

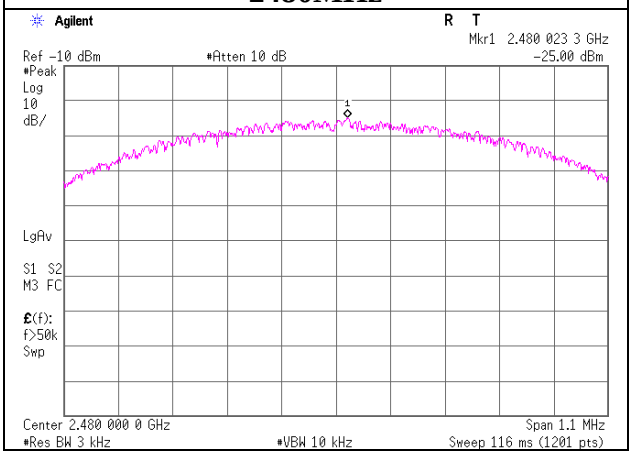
## 2402MHz




## 2440MHz



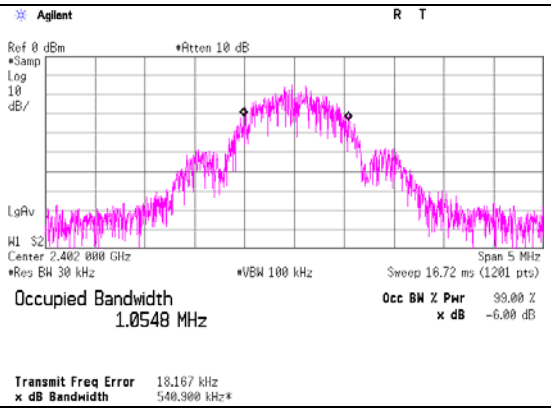

## 2480MHz



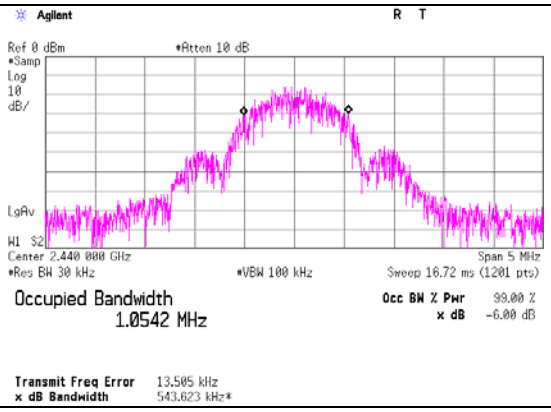
# 99%Occupied Bandwidth

| | |
|---|---|
| Test place | Ise EMC Lab. No.4 Measurement Room |
| Report No. | 10699546H |
| Date | 02/27/2015 |
| Temperature/ Humidity | 25deg. C / 41% RH |
| Engineer | Satofumi Matsuyama |
| Mode | BT LE Tx |

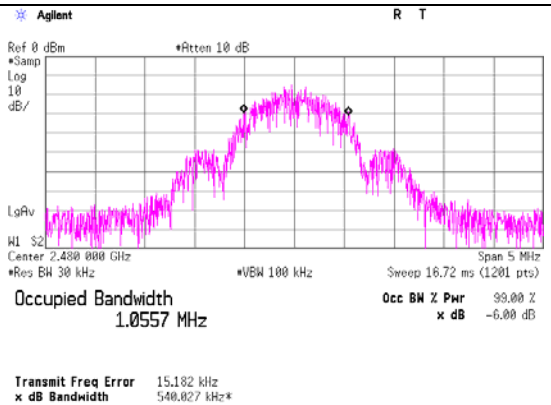
## 2402MHz




## 2440MHz




## 2480MHz



# APPENDIX 2: Test instruments

**EMI test equipment**

| Control No. | Instrument | Manufacturer | Model No | Serial No | Test Item | Calibration Date * Interval(month) |
|---|---|---|---|---|---|---|
| MAEC-04 | Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-10005 | RE | 2014/02/28 * 12 |
| MOS-15 | Thermo-Hygrometer | Custom | CTH-180 | 1501 | RE | 2015/01/13 * 12 |
| MJM-23 | Measure | ASKUL | - | - | RE | - |
| COTS-MEMI | EMI measurement program | TSJ | TEPTO-DV | - | RE | - |
| MTR-01 | Test Receiver | Rohde & Schwarz | ESI40 | 100084 | RE | 2014/11/10 * 12 |
| MBA-05 | Biconical Antenna | Schwarzbeck | BBA9106 | 1302 | RE | 2014/11/22 * 12 |
| MLA-08 | Logperiodic Antenna | Schwarzbeck | UKLP9140-A | N/A | RE | 2014/11/22 * 12 |
| MCC-50 | Coaxial Cable | UL Japan | - | - | RE | 2014/06/02 * 12 |
| MAT-68 | Attenuator | Anritsu | MP721B | 6200961025 | RE | 2014/11/11 * 12 |
| MPA-19 | Pre Amplifier | MITEQ | MLA-10K01-B01-35 | 1237616 | RE | 2015/02/03 * 12 |
| MSA-15 | Spectrum Analyzer | Agilent | E4440A | MY46187105 | RE | 2014/11/11 * 12 |
| MHA-21 | Horn Antenna 1-18GHz | Schwarzbeck | BBHA9120D | 9120D-557 | RE | 2014/08/12 * 12 |
| MCC-141 | Microwave Cable | Junkosha | MWX221 | 1305S002R(1m) / 1405S146(5m) | RE | 2014/06/11 * 12 |
| MPA-12 | MicroWave System Amplifier | Agilent | 83017A | MY39500780 | RE | 2014/03/11 * 12 |
| MHA-16 | Horn Antenna 15-40GHz | Schwarzbeck | BBHA9170 | BBHA9170306 | RE | 2014/05/26 * 12 |
| MHF-26 | High Pass Filter 3.5-18.0GHz | UL Japan | HPF SELECTOR | 002 | RE | 2014/09/24 * 12 |
| MSA-04 | Spectrum Analyzer | Agilent | E4448A | US44300523 | AT | 2014/11/12 * 12 |
| MPM-09 | Power Meter | Anritsu | ML2495A | 6K00003348 | AT | 2014/10/06 * 12 |
| MPSE-12 | Power sensor | Anritsu | MA2411B | 011598 | AT | 2014/10/06 * 12 |
| MAT-22 | Attenuator(10dB) 1-18GHz | Orient Microwave | BX10-0476-00 | - | AT | 2014/03/13 * 12 |
| MTW-04 | Torque wrench | HUBER+SUHNER | 74 Z-0-0-21 | 17129 | AT | 2015/01/16 * 36 |
| MOS-23 | Thermo-Hygrometer | Custom | CTH-201 | 0004 | AT | 2014/12/22 * 12 |
| MAT-24 | Attenuator(10dB) (above1GHz) | Agilent | 8493C | 71389 | AT | 2014/06/12 * 12 |

**The expiration date of the calibration is the end of the expired month.**
**All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.**

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

**Test Item:**

**RE: Radiated Emission**
**AT: Antenna Terminal Conducted test**