



# **RADIO TEST REPORT**

**Test Report No. : 12945978S-A-R2**

**Applicant : CASIO COMPUTER CO., LTD.**

**Type of Equipment : RF Module**

**Model No. : M1**

**FCC ID : BBQM1**

**Test regulation : FCC Part 15 Subpart C: 2019**

**Test Result : Complied (Refer to SECTION 3.2)**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test 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 the A2LA accreditation body.
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. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 12945978S-A-R1. 12945978S-A-R1 is replaced with this report.

**Date of test:** August 29 to September 11, 2019

**Representative test engineer:**

K. Noda

Kazuya Noda  
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Consumer Technology Division

**Approved by:**

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Leader

Consumer Technology Division



CERTIFICATE 1266.03

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
- ☒ There is no testing item of "Non-accreditation".

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## **REVISION HISTORY**

### **Original Test Report No.: 12945978S-A**

| Revision     | Test report No. | Date               | Page revised | Contents                                                                                                                                                                                                                                         |
|--------------|-----------------|--------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| - (Original) | 12945978S-A     | September 26, 2019 | -            | -                                                                                                                                                                                                                                                |
| 1            | 12945978S-A-R1  | November 14, 2019  | 9            | Addition of Item D (Jig board) in 4.2                                                                                                                                                                                                            |
| 2            | 12945978S-A-R2  | November 19, 2019  | 9            | Addition of comment to *1) in 4.2:<br>“Pattern and Matching Circuit of Jig board are designed in perfectly accordance with “Instruction Manual for M1”.”<br><br>Correction of “Shield” of Cable No. 4 (AC) in 4.2:<br>“Shielded” to “Unshielded” |

## Reference: Abbreviations (Including words undescribed in this report)

|                |                                                                 |         |                                                     |
|----------------|-----------------------------------------------------------------|---------|-----------------------------------------------------|
| A2LA           | The American Association for Laboratory Accreditation           | NS      | No signal detect.                                   |
| AC             | Alternating Current                                             | NSA     | Normalized Site Attenuation                         |
| AFH            | Adaptive Frequency Hopping                                      | NVLAP   | National Voluntary Laboratory Accreditation Program |
| AM             | Amplitude Modulation                                            | OBW     | Occupied Band Width                                 |
| Amp, AMP       | Amplifier                                                       | OFDM    | Orthogonal Frequency Division Multiplexing          |
| ANSI           | American National Standards Institute                           | P/M     | Power meter                                         |
| Ant, ANT       | Antenna                                                         | PCB     | Printed Circuit Board                               |
| AP             | Access Point                                                    | PER     | Packet Error Rate                                   |
| Atten., ATT    | Attenuator                                                      | PHY     | Physical Layer                                      |
| AV             | Average                                                         | PK      | Peak                                                |
| BPSK           | Binary Phase-Shift Keying                                       | PN      | Pseudo random Noise                                 |
| BR             | Bluetooth Basic Rate                                            | PRBS    | Pseudo-Random Bit Sequence                          |
| BT             | Bluetooth                                                       | PSD     | Power Spectral Density                              |
| BT LE          | Bluetooth Low Energy                                            | QAM     | Quadrature Amplitude Modulation                     |
| BW             | BandWidth                                                       | QP      | Quasi-Peak                                          |
| Cal Int        | Calibration Interval                                            | QPSK    | Quadri-Phase Shift Keying                           |
| CCK            | Complementary Code Keying                                       | RBW     | Resolution Band Width                               |
| Ch., CH        | Channel                                                         | RDS     | Radio Data System                                   |
| CISPR          | Comite International Special des Perturbations Radioelectriques | RE      | Radio Equipment                                     |
| CW             | Continuous Wave                                                 | RF      | Radio Frequency                                     |
| DBPSK          | Differential BPSK                                               | RMS     | Root Mean Square                                    |
| DC             | Direct Current                                                  | RSS     | Radio Standards Specifications                      |
| DFS            | Dynamic Frequency Selection                                     | Rx      | Receiving                                           |
| DQPSK          | Differential QPSK                                               | SA, S/A | Spectrum Analyzer                                   |
| DSSS           | Direct Sequence Spread Spectrum                                 | SG      | Signal Generator                                    |
| EDR            | Enhanced Data Rate                                              | SVSWR   | Site-Voltage Standing Wave Ratio                    |
| EIRP, e.i.r.p. | Equivalent Isotropically Radiated Power                         | TR      | Test Receiver                                       |
| EMC            | ElectroMagnetic Compatibility                                   | Tx      | Transmitting                                        |
| EMI            | ElectroMagnetic Interference                                    | VBW     | Video BandWidth                                     |
| EN             | European Norm                                                   | Vert.   | Vertical                                            |
| ERP, e.r.p.    | Effective Radiated Power                                        | WLAN    | Wireless LAN                                        |
| EU             | European Union                                                  |         |                                                     |
| EUT            | Equipment Under Test                                            |         |                                                     |
| Fac.           | Factor                                                          |         |                                                     |
| FCC            | Federal Communications Commission                               |         |                                                     |
| FHSS           | Frequency Hopping Spread Spectrum                               |         |                                                     |
| FM             | Frequency Modulation                                            |         |                                                     |
| Freq.          | Frequency                                                       |         |                                                     |
| GFSK           | Gaussian Frequency-Shift Keying                                 |         |                                                     |
| GNSS           | Global Navigation Satellite System                              |         |                                                     |
| GPS            | Global Positioning System                                       |         |                                                     |
| Hori.          | Horizontal                                                      |         |                                                     |
| ICES           | Interference-Causing Equipment Standard                         |         |                                                     |
| IEC            | International Electrotechnical Commission                       |         |                                                     |
| IEEE           | Institute of Electrical and Electronics Engineers               |         |                                                     |
| IF             | Intermediate Frequency                                          |         |                                                     |
| ILAC           | International Laboratory Accreditation Conference               |         |                                                     |
| ISED           | Innovation, Science and Economic Development Canada             |         |                                                     |
| ISO            | International Organization for Standardization                  |         |                                                     |
| JAB            | Japan Accreditation Board                                       |         |                                                     |
| LAN            | Local Area Network                                              |         |                                                     |
| LIMS           | Laboratory Information Management System                        |         |                                                     |
| MCS            | Modulation and Coding Scheme                                    |         |                                                     |
| MRA            | Mutual Recognition Arrangement                                  |         |                                                     |
| NIST           | National Institute of Standards and Technology                  |         |                                                     |

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## **SECTION 1: Customer information**

|                  |   |                                                         |
|------------------|---|---------------------------------------------------------|
| Company Name     | : | CASIO COMPUTER CO., LTD.                                |
| Address          | : | 2-1, Sakaecho 3 chome, Hamura-shi, Tokyo 205-8555 Japan |
| Telephone Number | : | +81-42-579-7282                                         |
| Facsimile Number | : | +81-42-579-7702                                         |
| Contact Person   | : | Hiroaki Suzuki                                          |

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

\* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

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

|                                                        |   |                                                                                            |
|--------------------------------------------------------|---|--------------------------------------------------------------------------------------------|
| Type of Equipment                                      | : | RF Module                                                                                  |
| Model No.                                              | : | M1                                                                                         |
| Serial No.                                             | : | Refer to SECTION 4.2                                                                       |
| Rating                                                 | : | Typical: DC 3.0 V, Min.: DC 1.9 V, Max.: DC 3.3 V                                          |
| Receipt Date of Sample<br>(Information from test lab.) | : | August 28, 2019                                                                            |
| Country of Mass-production                             | : | China, Thailand, Japan                                                                     |
| Condition of EUT                                       | : | Engineering 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**

Model: M1 (referred to as the EUT in this report) is an RF Module.

### **Radio Specification**

|                           |   |                        |
|---------------------------|---|------------------------|
| Radio Type                | : | Transceiver            |
| Frequency of Operation    | : | 2402 MHz - 2480 MHz    |
| Modulation                | : | GFSK                   |
| Channel spacing           | : | 2 MHz                  |
| Antenna type              | : | Chip (Monopole)        |
| Antenna Gain              | : | 2.5 dBi                |
| Operating Temperature     | : | -10 deg.C to +60 deg.C |
| Clock frequency (Maximum) | : | 32 MHz                 |

## SECTION 3: Test specification, procedures & results

### 3.1 Test Specification

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,  
and 5725-5850 MHz

### 3.2 Procedures and results

| Item                                          | Test Procedure                                                              | Specification                                                              | Worst margin                                                         | Results            | Remarks                                                           |
|-----------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------|-------------------------------------------------------------------|
| Conducted Emission                            | FCC: ANSI C63.10-2013<br>6. Standard test methods<br>ISED: RSS-Gen 8.8      | FCC: Section 15.207<br>ISED: RSS-Gen 8.8                                   | 21.8 dB,<br>0.41983 MHz<br>& 0.49272 MHz, N, QP<br>Mode: Tx 2480 MHz | Complied<br>a)     | -                                                                 |
| 6dB Bandwidth                                 | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: -            | FCC: Section<br>15.247(a)(2)<br>ISED: RSS-247 5.2(a)                       | See data.                                                            | Complied<br>b)     | Conducted                                                         |
| Maximum Peak<br>Output Power                  | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: RSS-Gen 6.12 | FCC: Section<br>15.247(b)(3)<br>ISED: RSS-247 5.4(d)                       |                                                                      | Complied<br>c)     | Conducted                                                         |
| Power Density                                 | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: -            | FCC: Section 15.247(e)<br>ISED: RSS-247 5.2(b)                             |                                                                      | Complied<br>d)     | Conducted                                                         |
| Spurious Emission<br>Restricted Band<br>Edges | FCC: KDB 558074 D01<br>15.247<br>Meas Guidance v05r02<br>ISED: RSS-Gen 6.13 | FCC: Section 15.247(d)<br>ISED: RSS-247 5.5<br>RSS-Gen 8.9<br>RSS-Gen 8.10 | 5.4 dB<br>7440.00 MHz, AV,<br>Horizontal<br>Mode: Tx 2480 MHz        | Complied<br>e), f) | Conducted<br>(below 30 MHz)/<br>Radiated<br>(above 30 MHz)<br>*1) |

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

\*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6.

- a) Refer to APPENDIX 1 (data of Conducted Emission)
- b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)
- c) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
- d) Refer to APPENDIX 1 (data of Power Density)
- e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
- f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

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

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

\* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

#### FCC Part 15.31 (e)

The RF Module has its own regulator. The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

#### FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement.

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### 3.3 Addition to standard

| Item                                                                        | Test Procedure | Specification | Worst margin | Results | Remarks   |
|-----------------------------------------------------------------------------|----------------|---------------|--------------|---------|-----------|
| 99% Occupied Bandwidth                                                      | RSS-Gen 6.7    | ISED: -       | N/A          | -<br>b) | Conducted |
| b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth) |                |               |              |         |           |

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

### 3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

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| Item                                             | Frequency range | Uncertainty (+/-) |                |                |                |
|--------------------------------------------------|-----------------|-------------------|----------------|----------------|----------------|
|                                                  |                 | No. 1 SAC / SR    | No. 2 SAC / SR | No. 3 SAC / SR | No. 4 SAC / SR |
| Conducted emission (AC Mains) LISN               | 150 kHz-30 MHz  | 2.9 dB            | 2.8 dB         | 2.9 dB         | 2.9 dB         |
| Radiated emission<br>(Measurement distance: 3 m) | 9 kHz-30 MHz    | 3.0 dB            | 3.0 dB         | 3.1 dB         | -              |
|                                                  | 30 MHz-200 MHz  | 4.6 dB            | 4.6 dB         | 4.7 dB         | -              |
|                                                  | 200 MHz-1 GHz   | 6.0 dB            | 6.0 dB         | 6.1 dB         | -              |
|                                                  | 1 GHz-6 GHz     | 4.8 dB            | 4.8 dB         | 4.8 dB         | -              |
|                                                  | 6 GHz-18 GHz    | 5.4 dB            | 5.4 dB         | 5.4 dB         | -              |
|                                                  | 18 GHz-40 GHz   | 5.6 dB            | 5.6 dB         | 5.6 dB         | -              |
| Radiated emission<br>(Measurement distance: 1 m) | 1 GHz-18 GHz    | 5.7 dB            | 5.7 dB         | 5.7 dB         | -              |
|                                                  | 18 GHz-40 GHz   | 5.9 dB            | 5.9 dB         | 5.9 dB         | -              |

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

| Antenna terminal test                                   | Uncertainty (+/-) |
|---------------------------------------------------------|-------------------|
| Power Measurement above 1 GHz (Average Detector)_SPM-06 | 0.81 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-06    | 1.53 dB           |
| Power Measurement above 1 GHz (Average Detector)_SPM-07 | 0.95 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-07    | 1.21 dB           |
| Power Measurement above 1 GHz (Average Detector)_SPM-13 | 0.90 dB           |
| Power Measurement above 1 GHz (Peak Detector)_SPM-13    | 1.04 dB           |
| Spurious emission (Conducted) below 1GHz                | 1.8 dB            |
| Spurious emission (Conducted) 1 GHz-3 GHz               | 1.7 dB            |
| Spurious emission (Conducted) 3 GHz-18 GHz              | 2.3 dB            |
| Spurious emission (Conducted) 18 GHz-26.5 GHz           | 2.4 dB            |
| Spurious emission (Conducted) 26.5 GHz-40 GHz           | 2.4 dB            |
| Bandwidth Measurement                                   | 0.61 %            |
| Duty cycle and Time Measurement                         | 0.012 %           |

### 3.5 Test Location

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A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

| Test site                  | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Maximum measurement distance |
|----------------------------|----------------------------|------------------------------------------------------------------|------------------------------|
| No.1 Semi-anechoic chamber | 20.6 x 11.3 x 7.65         | 20.6 x 11.3                                                      | 10 m                         |
| No.2 Semi-anechoic chamber | 20.6 x 11.3 x 7.65         | 20.6 x 11.3                                                      | 10 m                         |
| No.3 Semi-anechoic chamber | 12.7 x 7.7 x 5.35          | 12.7 x 7.7                                                       | 5 m                          |
| No.4 Semi-anechoic chamber | 8.1 x 5.1 x 3.55           | 8.1 x 5.1                                                        | -                            |
| No.1 Shielded room         | 6.8 x 4.1 x 2.7            | 6.8 x 4.1                                                        | -                            |
| No.2 Shielded room         | 6.8 x 4.1 x 2.7            | 6.8 x 4.1                                                        | -                            |
| No.3 Shielded room         | 6.3 x 4.7 x 2.7            | 6.3 x 4.7                                                        | -                            |
| No.4 Shielded room         | 4.4 x 4.7 x 2.7            | 4.4 x 4.7                                                        | -                            |
| No.5 Shielded room         | 7.8 x 6.4 x 2.7            | 7.8 x 6.4                                                        | -                            |
| No.6 Shielded room         | 7.8 x 6.4 x 2.7            | 7.8 x 6.4                                                        | -                            |
| No.8 shielded room         | 3.45 x 5.5 x 2.4           | 3.45 x 5.5                                                       | -                            |
| No.1 Measurement room      | 2.55 x 4.1 x 2.5           | -                                                                | -                            |

### 3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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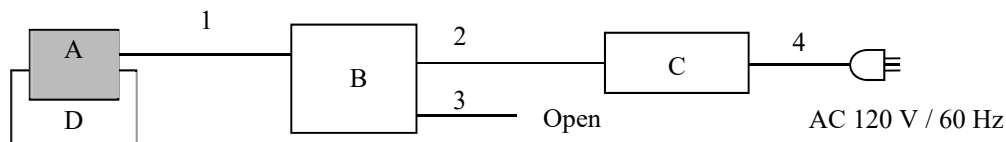
Facsimile : +81 463 50 6401

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

### 4.1 Operating Mode(s)

| Mode                                                                                                                                                                                                                                                                                                                                        | Remarks*                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| Tx (Transmitting), Bluetooth Low Energy                                                                                                                                                                                                                                                                                                     | Maximum Packet Size, PRBS9 |
| *The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)                                                                                                                                                                                                                                     |                            |
| *Power of the EUT was set by the software as follows;<br>Power settings: Fixed<br>Software: BLE RF Test Version 9.9<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



\* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

#### Description of EUT and Support equipment

| No. | Item             | Model number | Serial number | Manufacturer | Remarks |
|-----|------------------|--------------|---------------|--------------|---------|
| A   | RF Module        | M1           | 16            | Casio        | EUT     |
| B   | Watch            | ECB-10       | 16            | Casio        | -       |
| C   | Power Supply(DC) | PAN35-10A    | NA000955      | KIKUSUI      | -       |
| D   | Jig board        | -            | -             | Casio        | *1)     |

\*1) Jig board to connect between RF module and Antenna. Pattern and Matching Circuit of Jig board are designed in perfectly accordance with "Instruction Manual for M1".

#### List of cables used

| No. | Name         | Length (m) | Shield     |            | Remarks |
|-----|--------------|------------|------------|------------|---------|
|     |              |            | Cable      | Connector  |         |
| 1   | Signal Cable | 0.11       | Unshielded | Unshielded | -       |
| 2   | DC           | 0.1 + 2.1  | Unshielded | Unshielded | *2)     |
| 3   | Signal Cable | 0.1        | Unshielded | Unshielded | *3)     |
| 4   | AC           | 2.0        | Unshielded | Unshielded | -       |

\*2) Cable for test operation

\*3) Cable for system reset during the development, for the product

## **SECTION 5: Conducted Emission**

### **Test Procedure and conditions**

EUT was placed on a platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

The rear of tabletop was located 40 cm 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 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a shielded room.

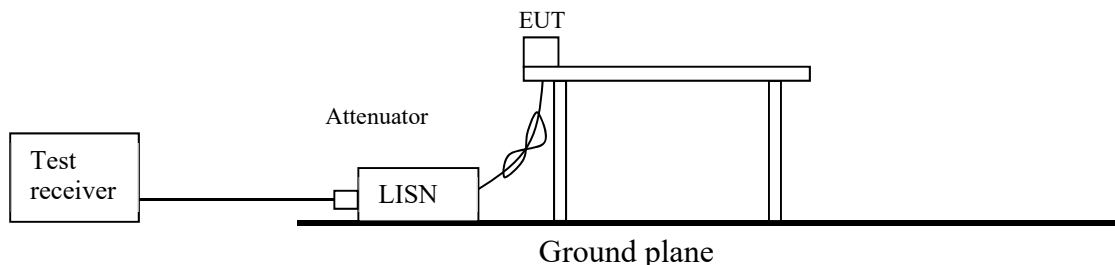
The EUT was connected to a LISN (AMN) via DC power supply.

An overview sweep with peak detection has been performed.

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

|                          |                            |
|--------------------------|----------------------------|
| <b>Detector</b>          | <b>: QP and CISPR AV</b>   |
| <b>Measurement range</b> | <b>: 0.15 MHz - 30 MHz</b> |
| <b>Test data</b>         | <b>: APPENDIX</b>          |
| <b>Test result</b>       | <b>: Pass</b>              |

**Figure 1: Test Setup**



## **SECTION 6: Radiated Spurious Emission**

### **Test Procedure**

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]

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

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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.

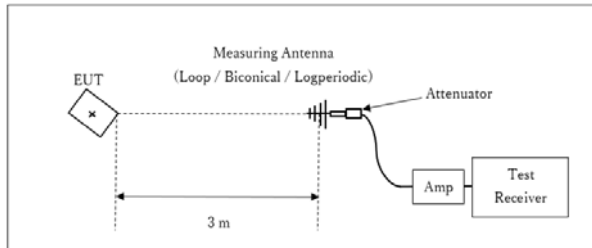
#### **Test Antennas are used as below;**

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

|                 |               |                          |                          |
|-----------------|---------------|--------------------------|--------------------------|
| Frequency       | Below 1 GHz   | Above 1 GHz              |                          |
| Instrument used | Test Receiver | Spectrum Analyzer        |                          |
| Detector        | QP            | PK                       | AV                       |
| IF Bandwidth    | BW 120 kHz    | RBW: 1 MHz<br>VBW: 3 MHz | RBW: 1 MHz<br>VBW: 3 MHz |

**Figure 2: Test Setup**

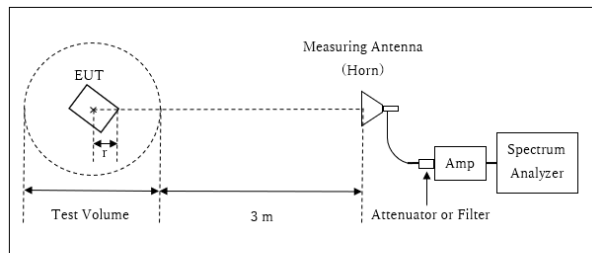
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor:  $20 \times \log (3.995 \text{ m} / 3.0 \text{ m}) = 2.49 \text{ dB}$

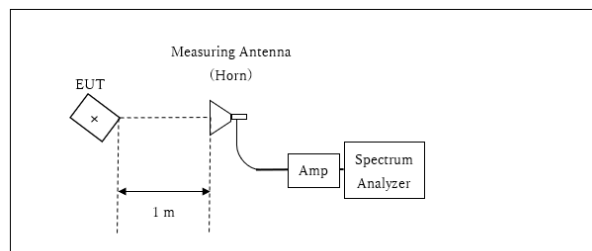
\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.995 \text{ m}$

Test Volume : 2.0 m

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

$r = 0.005 \text{ m}$

13 GHz – 26.5 GHz



x : Center of turn table

Distance Factor:  $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

\*Test Distance: 1 m

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.

| Antenna polarization | Carrier | Spurious (Below 1 GHz) | Spurious (1 GHz - 2.8 GHz) | Spurious (2.8 GHz - 13 GHz) | Spurious (13 GHz - 18 GHz) | Spurious (18 GHz - 26.5 GHz) |
|----------------------|---------|------------------------|----------------------------|-----------------------------|----------------------------|------------------------------|
| Horizontal           | Y       | X                      | Y                          | Y                           | X                          | X                            |
| Vertical             | Z       | X                      | Z                          | Z                           | X                          | X                            |

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

**Measurement range** : 30 MHz - 26.5 GHz

**Test data** : APPENDIX

**Test result** : Pass

## **SECTION 7: 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10 MHz                                  | 100 kHz         | 300 kHz            | Auto       | Peak                 | Max Hold | Spectrum Analyzer                   |
| 99% Occupied Bandwidth *1)                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Enough width to display emission skirts | 1 to 5 % of OBW | Three times of RBW | Auto       | Peak                 | Max Hold | Spectrum Analyzer                   |
| Maximum Peak Output Power                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -                                       | -               | -                  | Auto       | Peak/<br>Average *2) | -        | Power Meter<br>(Sensor: 160 MHz BW) |
| Peak Power Density                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.5 times the 6dB Bandwidth             | 3 kHz           | 9.1 kHz            | Auto       | Peak                 | Max Hold | Spectrum Analyzer *3)               |
| Conducted Spurious Emission *4)                                                                                                                                                                                                                                                                                                                                                                                                                                               | 9kHz to 150kHz                          | 200 Hz          | 620 Hz             | Auto       | Peak                 | Max Hold | Spectrum Analyzer                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 150kHz to 30MHz                         | 10 kHz          | 30 kHz             |            |                      |          |                                     |
| <div>*1) Peak hold was applied as Worst-case measurement.</div> <div>*2) Reference data</div> <div>*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".</div> <div>*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.<br/>Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.<br/>(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz).</div> |                                         |                 |                    |            |                      |          |                                     |

The test results and limit are rounded off to two decimals place, so some differences might be observed.  
 The equipment and cables were not used for factor 0 dB of the data sheets.

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

## APPENDIX 1: Test data

### Conducted Emission

#### DATA OF CONDUCTED EMISSION TEST

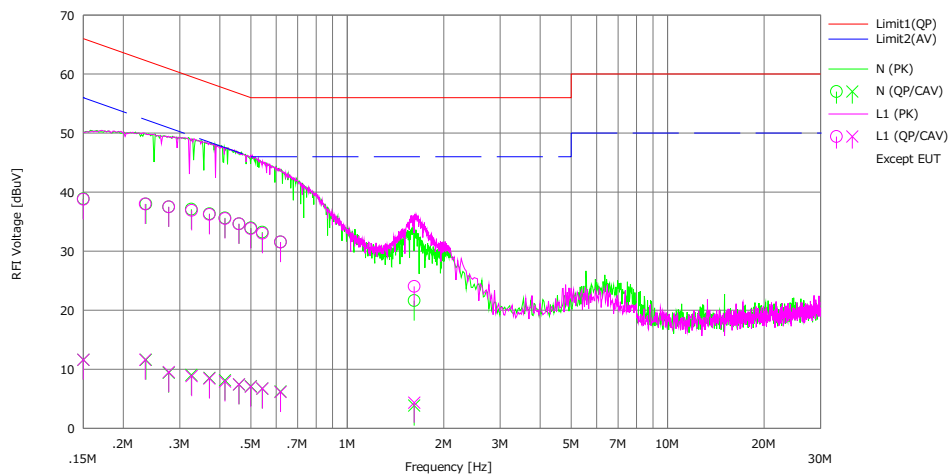
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room  
Date : 2019/09/10

Company : CASIO COMPUTER CO., LTD  
Kind of EUT : RF Module  
Model No. : M1  
Serial No. : 16  
Remarks : -

Mode : Tx, BLE, 2402 MHz  
Order No. : 12945978S  
Power : AC 120 V / 60 Hz (DC 3 V)  
Temp./Humi. : 22 deg.C / 58 %RH

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



| No. | Freq.<br>[MHz] | Reading        |                 | C.Fac | Results        |                 | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|-----------------|-------|----------------|-----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | (QP)<br>[dBuV] | (CAV)<br>[dBuV] |       | (QP)<br>[dBuV] | (CAV)<br>[dBuV] | (QP)<br>[dBuV] | (AV)<br>[dBuV] | (QP)<br>[dB] | (AV)<br>[dB] |       |         |
| 1   | 0.15000        | 26.40          | -0.90           | 12.50 | 38.90          | 11.60           | 66.00          | 56.00          | 27.1         | 44.4         | N     |         |
| 2   | 0.23512        | 25.50          | -0.90           | 12.50 | 38.00          | 11.60           | 62.27          | 52.27          | 24.2         | 40.6         | N     |         |
| 3   | 0.27698        | 25.00          | -3.10           | 12.50 | 37.50          | 9.40            | 60.91          | 50.91          | 23.4         | 41.5         | N     |         |
| 4   | 0.32592        | 24.60          | -3.50           | 12.52 | 37.12          | 9.02            | 59.55          | 49.55          | 22.4         | 40.5         | N     |         |
| 5   | 0.37130        | 23.80          | -4.00           | 12.53 | 36.33          | 8.53            | 58.47          | 48.47          | 22.1         | 39.9         | N     |         |
| 6   | 0.41506        | 23.10          | -4.40           | 12.52 | 35.62          | 8.12            | 57.55          | 47.55          | 21.9         | 39.4         | N     |         |
| 7   | 0.45929        | 22.10          | -5.10           | 12.53 | 34.63          | 7.43            | 56.71          | 46.71          | 22.0         | 39.2         | N     |         |
| 8   | 0.49998        | 21.40          | -5.40           | 12.53 | 33.93          | 7.13            | 56.00          | 46.00          | 22.0         | 38.8         | N     |         |
| 9   | 0.54295        | 20.70          | -5.80           | 12.53 | 33.23          | 6.73            | 56.00          | 46.00          | 22.7         | 39.2         | N     |         |
| 10  | 0.61902        | 19.00          | -6.30           | 12.54 | 31.54          | 6.24            | 56.00          | 46.00          | 24.4         | 39.7         | N     |         |
| 11  | 1.61772        | 9.00           | -8.80           | 12.63 | 21.63          | 3.83            | 56.00          | 46.00          | 34.3         | 42.1         | N     |         |
| 12  | 0.15000        | 26.30          | -0.90           | 12.50 | 38.80          | 11.60           | 66.00          | 56.00          | 27.2         | 44.4         | L1    |         |
| 13  | 0.23420        | 25.50          | -0.90           | 12.50 | 38.00          | 11.60           | 62.30          | 52.30          | 24.3         | 40.7         | L1    |         |
| 14  | 0.27732        | 25.00          | -3.00           | 12.50 | 37.50          | 9.50            | 60.90          | 50.90          | 23.4         | 41.4         | L1    |         |
| 15  | 0.32678        | 24.40          | -3.70           | 12.52 | 36.92          | 8.82            | 59.53          | 49.53          | 22.6         | 40.7         | L1    |         |
| 16  | 0.37123        | 23.70          | -4.10           | 12.53 | 36.23          | 8.43            | 58.47          | 48.47          | 22.2         | 40.0         | L1    |         |
| 17  | 0.41528        | 23.00          | -4.60           | 12.52 | 35.52          | 7.92            | 57.54          | 47.54          | 22.0         | 39.6         | L1    |         |
| 18  | 0.45919        | 22.10          | -5.10           | 12.53 | 34.63          | 7.43            | 56.71          | 46.71          | 22.0         | 39.2         | L1    |         |
| 19  | 0.49973        | 21.30          | -5.50           | 12.53 | 33.83          | 7.03            | 56.00          | 46.00          | 22.1         | 38.9         | L1    |         |
| 20  | 0.54342        | 20.50          | -5.80           | 12.53 | 33.03          | 6.73            | 56.00          | 46.00          | 22.9         | 39.2         | L1    |         |
| 21  | 0.61892        | 19.00          | -6.40           | 12.54 | 31.54          | 6.14            | 56.00          | 46.00          | 24.4         | 39.8         | L1    |         |
| 22  | 1.61838        | 11.40          | -8.30           | 12.63 | 24.03          | 4.33            | 56.00          | 46.00          | 31.9         | 41.6         | L1    |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
LISN(AMN): SLS-03

UL Japan, Inc.

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## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

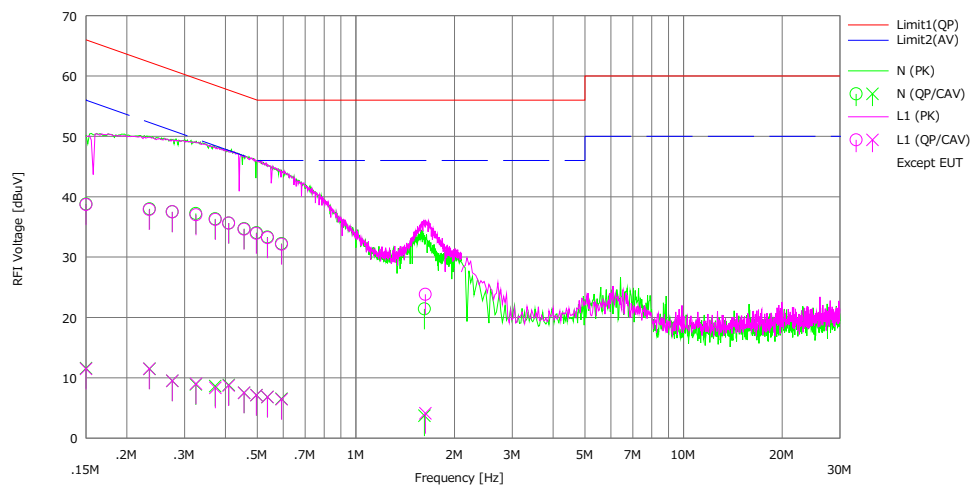
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room  
Date : 2019/09/11

Company : CASIO COMPUTER CO., LTD  
Kind of EUT : RF Module  
Model No. : M1  
Serial No. : 16  
Remarks : -

Mode : Tx, BLE, 2440 MHz  
Order No. : 12945978S  
Power : AC 120 V / 60 Hz (DC 3 V)  
Temp./Humi. : 22 deg.C / 58 %RH

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



| No. | Freq.<br>[MHz] | Reading        |                 | C.Fac | Results        |                 | Limit          |                | Margin       |              | Phase | Comment |
|-----|----------------|----------------|-----------------|-------|----------------|-----------------|----------------|----------------|--------------|--------------|-------|---------|
|     |                | [QP]<br>[dBuV] | [CAV]<br>[dBuV] |       | [QP]<br>[dBuV] | [CAV]<br>[dBuV] | [QP]<br>[dBuV] | [AV]<br>[dBuV] | [QP]<br>[dB] | [AV]<br>[dB] |       |         |
| 1   | 0.15000        | 26.30          | -0.90           | 12.50 | 38.80          | 11.60           | 66.00          | 56.00          | 27.2         | 44.4         | N     |         |
| 2   | 0.23449        | 25.50          | -1.00           | 12.50 | 38.00          | 11.50           | 62.29          | 52.29          | 24.2         | 40.7         | N     |         |
| 3   | 0.27502        | 25.00          | -3.00           | 12.50 | 37.50          | 9.50            | 60.96          | 50.96          | 23.4         | 41.4         | N     |         |
| 4   | 0.32451        | 24.70          | -3.60           | 12.51 | 37.21          | 8.91            | 59.59          | 49.59          | 22.3         | 40.6         | N     |         |
| 5   | 0.37198        | 23.80          | -3.90           | 12.53 | 36.33          | 8.63            | 58.46          | 48.46          | 22.1         | 39.8         | N     |         |
| 6   | 0.40931        | 23.10          | -3.70           | 12.52 | 35.62          | 8.82            | 57.66          | 47.66          | 22.0         | 38.8         | N     |         |
| 7   | 0.45610        | 22.20          | -5.00           | 12.52 | 34.72          | 7.52            | 56.76          | 46.76          | 22.0         | 39.2         | N     |         |
| 8   | 0.49749        | 21.50          | -5.40           | 12.53 | 34.03          | 7.13            | 56.04          | 46.04          | 22.0         | 38.9         | N     |         |
| 9   | 0.53688        | 20.80          | -5.70           | 12.53 | 33.33          | 6.83            | 56.00          | 46.00          | 22.6         | 39.1         | N     |         |
| 10  | 0.59314        | 19.70          | -6.00           | 12.54 | 32.24          | 6.54            | 56.00          | 46.00          | 23.7         | 39.4         | N     |         |
| 11  | 1.61790        | 8.80           | -8.90           | 12.63 | 21.43          | 3.73            | 56.00          | 46.00          | 34.5         | 42.2         | N     |         |
| 12  | 0.15000        | 26.20          | -1.00           | 12.50 | 38.70          | 11.50           | 66.00          | 56.00          | 27.3         | 44.5         | L1    |         |
| 13  | 0.23397        | 25.40          | -1.00           | 12.50 | 37.90          | 11.50           | 62.31          | 52.31          | 24.4         | 40.8         | L1    |         |
| 14  | 0.27532        | 25.00          | -3.00           | 12.50 | 37.50          | 9.50            | 60.96          | 50.96          | 23.4         | 41.4         | L1    |         |
| 15  | 0.32512        | 24.50          | -3.50           | 12.52 | 37.02          | 9.02            | 59.57          | 49.57          | 22.5         | 40.5         | L1    |         |
| 16  | 0.37246        | 23.70          | -4.20           | 12.53 | 36.23          | 8.33            | 58.45          | 48.45          | 22.2         | 40.1         | L1    |         |
| 17  | 0.40882        | 23.10          | -3.80           | 12.52 | 35.62          | 8.72            | 57.67          | 47.67          | 22.0         | 38.9         | L1    |         |
| 18  | 0.45564        | 22.10          | -5.00           | 12.52 | 34.62          | 7.52            | 56.77          | 46.77          | 22.1         | 39.2         | L1    |         |
| 19  | 0.49696        | 21.40          | -5.40           | 12.53 | 33.93          | 7.13            | 56.05          | 46.05          | 22.1         | 38.9         | L1    |         |
| 20  | 0.53732        | 20.70          | -5.70           | 12.53 | 33.23          | 6.83            | 56.00          | 46.00          | 22.7         | 39.1         | L1    |         |
| 21  | 0.59331        | 19.60          | -6.10           | 12.54 | 32.14          | 6.44            | 56.00          | 46.00          | 23.8         | 39.5         | L1    |         |
| 22  | 1.62850        | 11.20          | -8.50           | 12.63 | 23.83          | 4.13            | 56.00          | 46.00          | 32.1         | 41.8         | L1    |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
LISN(AMN):SLS-03

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## Conducted Emission

### DATA OF CONDUCTED EMISSION TEST

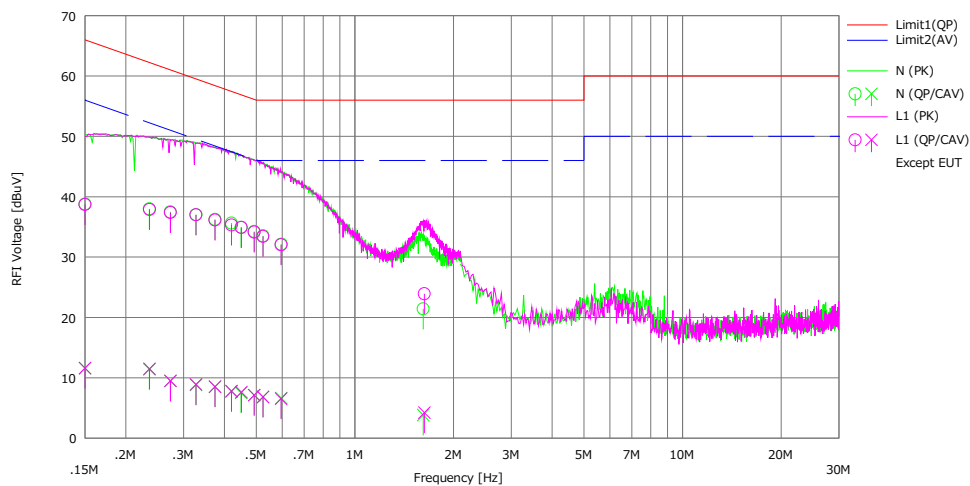
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room  
Date : 2019/09/11

Company : CASIO COMPUTER CO., LTD  
Kind of EUT : RF Module  
Model No. : M1  
Serial No. : 16  
Remarks : -

Mode : Tx, BLE, 2480 MHz  
Order No. : 12945978S  
Power : AC 120 V / 60 Hz (DC 3 V)  
Temp./Humi. : 22 deg.C / 58 %RH

Limit : FCC\_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



| No. | Freq.<br>[MHz] | Reading |        | C.Fac | Results |        | Limit  |        | Margin |      | Phase | Comment |
|-----|----------------|---------|--------|-------|---------|--------|--------|--------|--------|------|-------|---------|
|     |                | [QP]    | [CAV]  |       | [QP]    | [CAV]  | [QP]   | [AV]   | [QP]   | [AV] |       |         |
|     |                | [dBuV]  | [dBuV] | [dB]  | [dBuV]  | [dBuV] | [dBuV] | [dBuV] | [dB]   | [dB] |       |         |
| 1   | 0.15000        | 26.30   | -0.90  | 12.50 | 38.80   | 11.60  | 66.00  | 56.00  | 27.2   | 44.4 | N     |         |
| 2   | 0.23604        | 25.50   | -1.10  | 12.50 | 38.00   | 11.40  | 62.23  | 52.23  | 24.2   | 40.8 | N     |         |
| 3   | 0.27339        | 25.00   | -3.00  | 12.49 | 37.49   | 9.49   | 61.01  | 51.01  | 23.5   | 41.5 | N     |         |
| 4   | 0.32758        | 24.50   | -3.70  | 12.52 | 37.02   | 8.82   | 59.51  | 49.51  | 22.4   | 40.6 | N     |         |
| 5   | 0.37445        | 23.70   | -4.00  | 12.53 | 36.23   | 8.53   | 58.40  | 48.40  | 22.1   | 39.8 | N     |         |
| 6   | 0.41983        | 23.10   | -4.80  | 12.52 | 35.62   | 7.72   | 57.45  | 47.45  | 21.8   | 39.7 | N     |         |
| 7   | 0.44979        | 22.40   | -5.00  | 12.52 | 34.92   | 7.52   | 56.88  | 46.88  | 21.9   | 39.3 | N     |         |
| 8   | 0.49272        | 21.70   | -5.40  | 12.53 | 34.23   | 7.13   | 56.12  | 46.12  | 21.8   | 38.9 | N     |         |
| 9   | 0.52404        | 21.00   | -5.70  | 12.53 | 33.53   | 6.83   | 56.00  | 46.00  | 22.4   | 39.1 | N     |         |
| 10  | 0.59590        | 19.60   | -5.90  | 12.54 | 32.14   | 6.64   | 56.00  | 46.00  | 23.8   | 39.3 | N     |         |
| 11  | 1.61650        | 8.80    | -8.80  | 12.63 | 21.43   | 3.83   | 56.00  | 46.00  | 34.5   | 42.1 | N     |         |
| 12  | 0.15000        | 26.20   | -0.90  | 12.50 | 38.70   | 11.60  | 66.00  | 56.00  | 27.3   | 44.4 | L1    |         |
| 13  | 0.23608        | 25.40   | -1.00  | 12.50 | 37.90   | 11.50  | 62.23  | 52.23  | 24.3   | 40.7 | L1    |         |
| 14  | 0.27346        | 24.90   | -3.00  | 12.49 | 37.39   | 9.49   | 61.01  | 51.01  | 23.6   | 41.5 | L1    |         |
| 15  | 0.32724        | 24.50   | -3.60  | 12.52 | 37.02   | 8.92   | 59.52  | 49.52  | 22.5   | 40.6 | L1    |         |
| 16  | 0.37412        | 23.60   | -4.00  | 12.53 | 36.13   | 8.53   | 58.41  | 48.41  | 22.2   | 39.8 | L1    |         |
| 17  | 0.42019        | 22.80   | -4.70  | 12.52 | 35.32   | 7.82   | 57.44  | 47.44  | 22.1   | 39.6 | L1    |         |
| 18  | 0.45018        | 22.40   | -4.90  | 12.52 | 34.92   | 7.62   | 56.87  | 46.87  | 21.9   | 39.2 | L1    |         |
| 19  | 0.49312        | 21.60   | -5.40  | 12.53 | 34.13   | 7.13   | 56.12  | 46.12  | 21.9   | 38.9 | L1    |         |
| 20  | 0.52416        | 20.90   | -5.70  | 12.53 | 33.43   | 6.83   | 56.00  | 46.00  | 22.5   | 39.1 | L1    |         |
| 21  | 0.59559        | 19.50   | -6.00  | 12.54 | 32.04   | 6.54   | 56.00  | 46.00  | 23.9   | 39.4 | L1    |         |
| 22  | 1.62890        | 11.30   | -8.40  | 12.63 | 23.93   | 4.23   | 56.00  | 46.00  | 32.0   | 41.7 | L1    |         |

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]  
LISN(AMN): SLS-03

UL Japan, Inc.

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1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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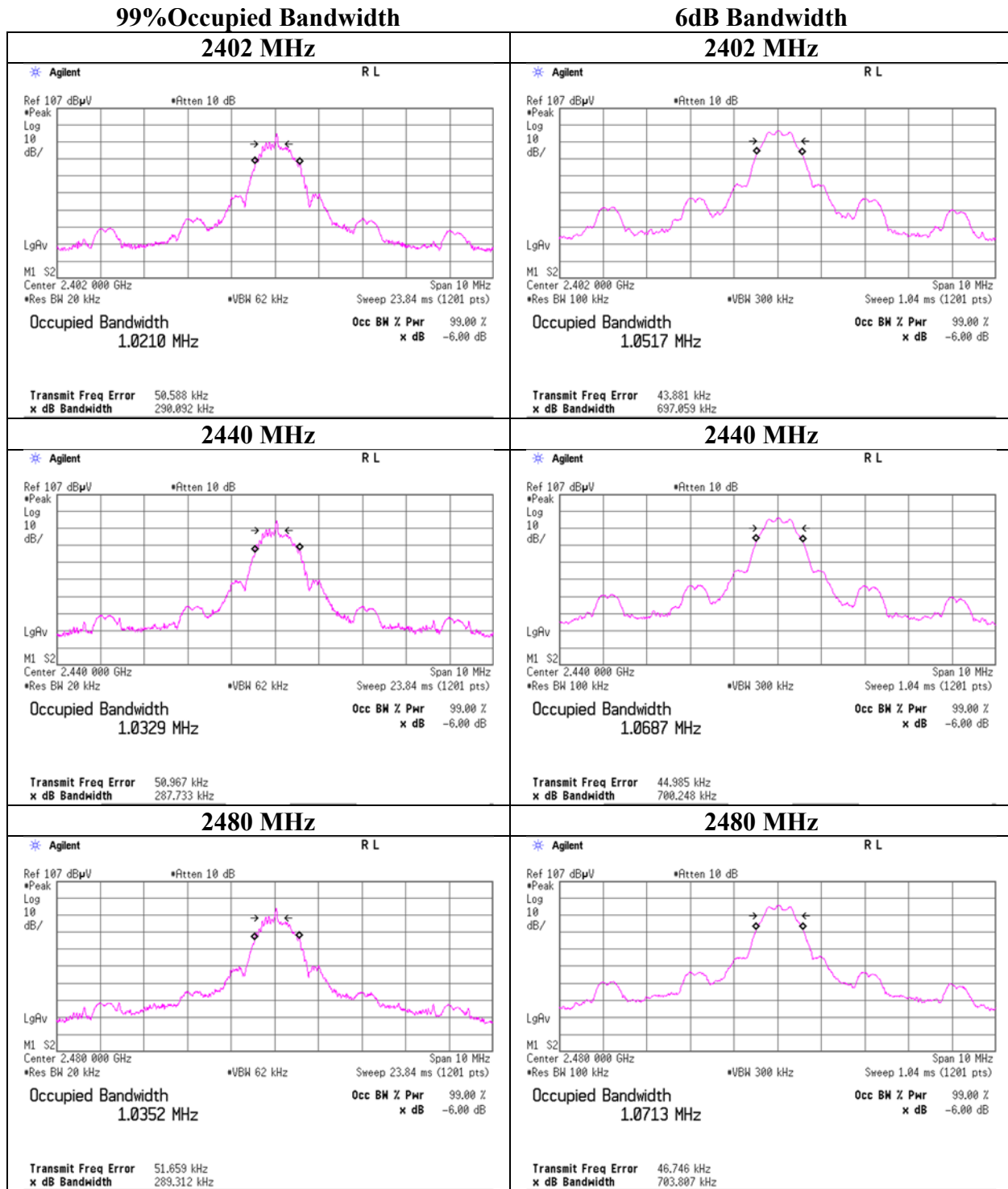
**6 dB Bandwidth and 99 % Occupied Bandwidth**

Report No. 12945978S-A-R2  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date August 29, 2019  
Temperature / Humidity 24 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx BT LE

| Mode  | Frequency<br>[MHz] | 99% Occupied<br>Bandwidth<br>[kHz] | 6dB Bandwidth<br>[MHz] | Limit for<br>6dB Bandwidth<br>[MHz] |
|-------|--------------------|------------------------------------|------------------------|-------------------------------------|
| BT LE | 2402               | 1021.0                             | 0.697                  | > 0.5000                            |
|       | 2440               | 1032.9                             | 0.700                  | > 0.5000                            |
|       | 2480               | 1035.2                             | 0.704                  | > 0.5000                            |

## 99%Occupied Bandwidth

BT LE



**UL Japan, Inc.**

**Shonan EMC Lab.**

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

## Maximum Peak Output Power

Report No. 12945978S-A-R2  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date August 29, 2019  
Temperature / Humidity 24 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx BT LE

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Conducted Power |      |       |      |        |                 | e.i.r.p. for RSS-247 |      |       |      |        |  |
|----------------|------------------|-----------------------|------------------------|-----------------|------|-------|------|--------|-----------------|----------------------|------|-------|------|--------|--|
|                |                  |                       |                        | Result          |      | Limit |      | Margin | Antenna<br>Gain | Result               |      | Limit |      | Margin |  |
|                |                  |                       |                        | [dBm]           | [mW] | [dBm] | [mW] |        |                 | [dBm]                | [mW] | [dBm] | [mW] |        |  |
| 2402           | -13.12           | 1.23                  | 9.82                   | -2.07           | 0.62 | 30.00 | 1000 | 32.07  | 2.50            | 0.43                 | 1.10 | 36.02 | 4000 | 35.59  |  |
| 2440           | -13.49           | 1.24                  | 9.82                   | -2.43           | 0.57 | 30.00 | 1000 | 32.43  | 2.50            | 0.07                 | 1.02 | 36.02 | 4000 | 35.95  |  |
| 2480           | -13.76           | 1.25                  | 9.82                   | -2.69           | 0.54 | 30.00 | 1000 | 32.69  | 2.50            | -0.19                | 0.96 | 36.02 | 4000 | 36.21  |  |

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

\*The equipment and cables were not used for factor 0 dB of the data sheets.

## Average Output Power (Reference data for RF Exposure / SAR testing)

Report No. 12945978S-A-R2  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date August 29, 2019  
Temperature / Humidity 24 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx BT LE

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result<br>(Time average) |      | Duty<br>factor<br>[dB] | Result<br>(Burst power average) |      |
|----------------|------------------|-----------------------|------------------------|--------------------------|------|------------------------|---------------------------------|------|
|                |                  |                       |                        | [dBm]                    | [mW] |                        | [dBm]                           | [mW] |
| 2402           | -15.58           | 1.23                  | 9.82                   | -4.53                    | 0.35 | 1.49                   | -3.04                           | 0.50 |
| 2440           | -16.02           | 1.24                  | 9.82                   | -4.96                    | 0.32 | 1.49                   | -3.47                           | 0.45 |
| 2480           | -16.37           | 1.25                  | 9.82                   | -5.30                    | 0.30 | 1.49                   | -3.81                           | 0.42 |

Sample Calculation:

Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

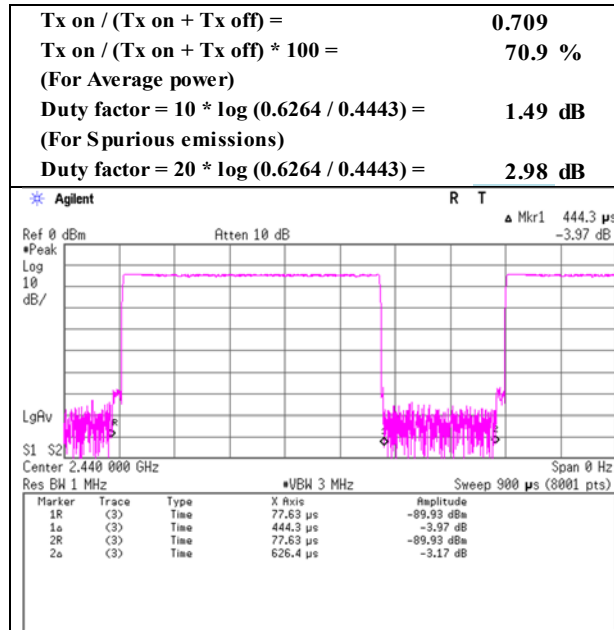
Result (Burst power average) = Time average + Duty factor

\*The equipment and cables were not used for factor 0 dB of the data sheets.

## Burst rate confirmation

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12945978S-A-R2                        |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | August 29, 2019                       |
| Temperature / Humidity | 24 deg. C / 53 % RH                   |
| Engineer               | Kazuya Noda                           |
| Mode                   | Tx BT LE                              |

### BT LE



\* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

## Radiated Spurious Emission

|                        |                     |                     |
|------------------------|---------------------|---------------------|
| Report No.             | 12945978S-A-R2      |                     |
| Test place             | Shonan EMC Lab.     |                     |
| Semi Anechoic Chamber  | No.2                | No.1                |
| Date                   | September 10, 2019  | September 8, 2019   |
| Temperature / Humidity | 22 deg. C / 58 % RH | 23 deg. C / 60 % RH |
| Engineer               | Kazuya Noda         | Kenichi Adachi      |
|                        | (30 MHz - 1000 MHz) | (1 GHz - 26.5 GHz)  |
| Mode                   | Tx BT LE 2402 MHz   |                     |

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Distance<br>Factor [dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|-------------------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 32.000             | QP       | 22.70             | 17.92              | 6.89         | 31.93        | 0.00                    | 15.58              | 40.00             | 24.4           | 100            | 2              |        |
| Hori.    | 480.000            | QP       | 22.40             | 17.24              | 8.00         | 31.63        | 0.00                    | 16.01              | 46.00             | 29.9           | 100            | 71             |        |
| Hori.    | 640.000            | QP       | 21.50             | 19.27              | 8.70         | 31.63        | 0.00                    | 17.84              | 46.00             | 28.1           | 100            | 1              |        |
| Hori.    | 758.543            | QP       | 21.30             | 20.22              | 9.23         | 31.46        | 0.00                    | 19.29              | 46.00             | 26.7           | 100            | 359            |        |
| Hori.    | 896.000            | QP       | 20.90             | 22.05              | 9.83         | 30.93        | 0.00                    | 21.85              | 46.00             | 24.1           | 100            | 2              |        |
| Hori.    | 2390.000           | PK       | 45.23             | 28.31              | 14.62        | 39.59        | 2.49                    | 51.06              | 73.90             | 22.8           | 154            | 206            |        |
| Hori.    | 2400.000           | PK       | 46.21             | 28.29              | 14.63        | 39.59        | 2.49                    | 52.03              | 73.90             | 21.8           | 154            | 206            |        |
| Hori.    | 4804.000           | PK       | 48.00             | 31.60              | 7.10         | 39.75        | 2.49                    | 49.44              | 73.90             | 24.4           | 193            | 50             |        |
| Hori.    | 7206.000           | PK       | 46.02             | 37.15              | 9.00         | 39.53        | 2.49                    | 55.13              | 73.90             | 18.7           | 210            | 229            |        |
| Vert.    | 192.000            | QP       | 21.80             | 16.36              | 8.98         | 31.81        | 0.00                    | 15.33              | 43.50             | 28.1           | 100            | 1              |        |
| Vert.    | 456.194            | QP       | 21.60             | 16.75              | 7.92         | 31.65        | 0.00                    | 14.62              | 46.00             | 31.3           | 100            | 358            |        |
| Vert.    | 736.000            | QP       | 21.40             | 20.12              | 9.12         | 31.51        | 0.00                    | 19.13              | 46.00             | 26.8           | 100            | 3              |        |
| Vert.    | 800.000            | QP       | 21.30             | 20.84              | 9.40         | 31.34        | 0.00                    | 20.20              | 46.00             | 25.8           | 100            | 358            |        |
| Vert.    | 864.000            | QP       | 21.10             | 21.79              | 9.68         | 31.08        | 0.00                    | 21.49              | 46.00             | 24.5           | 100            | 1              |        |
| Vert.    | 2390.000           | PK       | 45.00             | 28.31              | 14.62        | 39.59        | 2.49                    | 50.83              | 73.90             | 23.0           | 181            | 192            |        |
| Vert.    | 2400.000           | PK       | 46.59             | 28.29              | 14.63        | 39.59        | 2.49                    | 52.41              | 73.90             | 21.4           | 181            | 192            |        |
| Vert.    | 4804.000           | PK       | 48.33             | 31.60              | 7.10         | 39.75        | 2.49                    | 49.77              | 73.90             | 24.1           | 167            | 227            |        |
| Vert.    | 7206.000           | PK       | 45.85             | 37.15              | 9.00         | 39.53        | 2.49                    | 54.96              | 73.90             | 18.9           | 160            | 2              |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

### Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Distance<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2390.000           | AV       | 35.51             | 28.31              | 14.62        | 39.59        | 2.98                   | 2.49                       | 44.32              | 53.90             | 9.5            | *1)    |
| Hori.    | 2400.000           | AV       | 35.45             | 28.29              | 14.63        | 39.59        | 2.98                   | 2.49                       | 44.25              | 53.90             | 9.6            |        |
| Hori.    | 4804.000           | AV       | 39.83             | 31.60              | 7.10         | 39.75        | 2.98                   | 2.49                       | 44.25              | 53.90             | 9.6            |        |
| Hori.    | 7206.000           | AV       | 35.88             | 37.15              | 9.00         | 39.53        | 2.98                   | 2.49                       | 47.97              | 53.90             | 5.9            |        |
| Vert.    | 2390.000           | AV       | 36.00             | 28.31              | 14.62        | 39.59        | 2.98                   | 2.49                       | 44.81              | 53.90             | 9.0            | *1)    |
| Vert.    | 2400.000           | AV       | 35.77             | 28.29              | 14.63        | 39.59        | 2.98                   | 2.49                       | 44.57              | 53.90             | 9.3            |        |
| Vert.    | 4804.000           | AV       | 40.00             | 31.60              | 7.10         | 39.75        | 2.98                   | 2.49                       | 44.42              | 53.90             | 9.4            |        |
| Vert.    | 7206.000           | AV       | 35.36             | 37.15              | 9.00         | 39.53        | 2.98                   | 2.49                       | 47.45              | 53.90             | 6.4            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.995 m / 3.0 m) = 2.49 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

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**Shonan EMC Lab.**

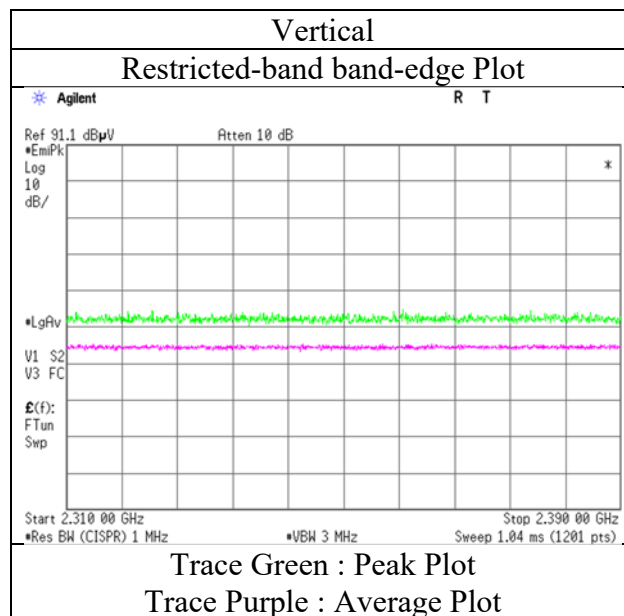
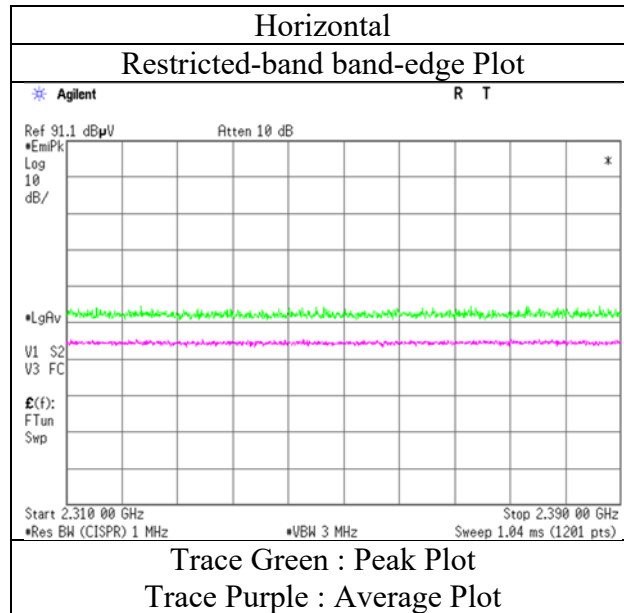
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## Radiated Spurious Emission (Reference Plot for band-edge)

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12945978S-A-R2      |
| Test place             | Shonan EMC Lab.     |
| Semi Anechoic Chamber  | No.1                |
| Date                   | September 8, 2019   |
| Temperature / Humidity | 23 deg. C / 60 % RH |
| Engineer               | Kenichi Adachi      |
|                        | (1 GHz – 26.5 GHz)  |
| Mode                   | Tx BT LE 2402 MHz   |



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

|                        |                     |                     |
|------------------------|---------------------|---------------------|
| Report No.             | 12945978S-A-R2      |                     |
| Test place             | Shonan EMC Lab.     |                     |
| Semi Anechoic Chamber  | No.2                | No.1                |
| Date                   | September 10, 2019  | September 8, 2019   |
| Temperature / Humidity | 22 deg. C / 58 % RH | 23 deg. C / 60 % RH |
| Engineer               | Kazuya Noda         | Kenichi Adachi      |
|                        | (30 MHz - 1000 MHz) | (1 GHz - 26.5 GHz)  |
| Mode                   | Tx BT LE 2440 MHz   |                     |

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Distance<br>Factor [dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|-------------------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 32.000             | QP       | 22.70             | 17.92              | 6.89         | 31.93        | 0.00                    | 15.58              | 40.00             | 24.4           | 100            | 359            |        |
| Hori.    | 439.986            | QP       | 21.90             | 16.37              | 7.83         | 31.65        | 0.00                    | 14.45              | 46.00             | 31.5           | 100            | 3              |        |
| Hori.    | 480.000            | QP       | 22.50             | 17.24              | 8.00         | 31.63        | 0.00                    | 16.11              | 46.00             | 29.8           | 100            | 74             |        |
| Hori.    | 640.000            | QP       | 21.50             | 19.27              | 8.70         | 31.63        | 0.00                    | 17.84              | 46.00             | 28.1           | 100            | 1              |        |
| Hori.    | 896.000            | QP       | 21.00             | 22.05              | 9.83         | 30.93        | 0.00                    | 21.95              | 46.00             | 24.0           | 100            | 358            |        |
| Hori.    | 4880.000           | PK       | 47.67             | 31.66              | 7.14         | 39.74        | 2.49                    | 49.22              | 73.90             | 24.6           | 166            | 54             |        |
| Hori.    | 7320.000           | PK       | 45.35             | 37.24              | 9.03         | 39.60        | 2.49                    | 54.51              | 73.90             | 19.3           | 171            | 122            |        |
| Vert.    | 192.000            | QP       | 21.90             | 16.36              | 8.98         | 31.81        | 0.00                    | 15.43              | 43.50             | 28.0           | 100            | 2              |        |
| Vert.    | 683.966            | QP       | 21.50             | 19.61              | 8.88         | 31.58        | 0.00                    | 18.41              | 46.00             | 27.5           | 100            | 359            |        |
| Vert.    | 736.000            | QP       | 21.50             | 20.12              | 9.12         | 31.51        | 0.00                    | 19.23              | 46.00             | 26.7           | 100            | 1              |        |
| Vert.    | 800.000            | QP       | 21.30             | 20.84              | 9.40         | 31.34        | 0.00                    | 20.20              | 46.00             | 25.8           | 100            | 357            |        |
| Vert.    | 864.000            | QP       | 21.10             | 21.79              | 9.68         | 31.08        | 0.00                    | 21.49              | 46.00             | 24.5           | 100            | 1              |        |
| Vert.    | 4880.000           | PK       | 48.22             | 31.66              | 7.14         | 39.74        | 2.49                    | 49.77              | 73.90             | 24.1           | 173            | 84             |        |
| Vert.    | 7320.000           | PK       | 46.04             | 37.24              | 9.03         | 39.60        | 2.49                    | 55.20              | 73.90             | 18.7           | 196            | 279            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.995 \text{ m} / 3.0 \text{ m}) = 2.49 \text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

### Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Distance<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 4880.000           | AV       | 40.28             | 31.66              | 7.14         | 39.74        | 2.98                   | 2.49                       | 44.81              | 53.90             | 9.0            |        |
| Hori.    | 7320.000           | AV       | 35.77             | 37.24              | 9.03         | 39.60        | 2.98                   | 2.49                       | 47.91              | 53.90             | 5.9            |        |
| Vert.    | 4880.000           | AV       | 40.31             | 31.66              | 7.14         | 39.74        | 2.98                   | 2.49                       | 44.84              | 53.90             | 9.0            |        |
| Vert.    | 7320.000           | AV       | 35.86             | 37.24              | 9.03         | 39.60        | 2.98                   | 2.49                       | 48.00              | 53.90             | 5.9            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.995 \text{ m} / 3.0 \text{ m}) = 2.49 \text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

## Radiated Spurious Emission

|                        |                     |                     |
|------------------------|---------------------|---------------------|
| Report No.             | 12945978S-A-R2      |                     |
| Test place             | Shonan EMC Lab.     |                     |
| Semi Anechoic Chamber  | No.2                | No.1                |
| Date                   | September 10, 2019  | September 8, 2019   |
| Temperature / Humidity | 22 deg. C / 58 % RH | 23 deg. C / 60 % RH |
| Engineer               | Kazuya Noda         | Kenichi Adachi      |
|                        | (30 MHz - 1000 MHz) | (1 GHz - 26.5 GHz)  |
| Mode                   | Tx BT LE 2480 MHz   |                     |

(\* PK: Peak, AV: Average, QP: Quasi-Peak)

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Distance<br>Factor [dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Height<br>[cm] | Angle<br>[deg] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|-------------------------|--------------------|-------------------|----------------|----------------|----------------|--------|
| Hori.    | 32.000             | QP       | 22.70             | 17.92              | 6.89         | 31.93        | 0.00                    | 15.58              | 40.00             | 24.4           | 100            | 358            |        |
| Hori.    | 480.000            | QP       | 22.50             | 17.24              | 8.00         | 31.63        | 0.00                    | 16.11              | 46.00             | 29.8           | 100            | 81             |        |
| Hori.    | 640.000            | QP       | 21.40             | 19.27              | 8.70         | 31.63        | 0.00                    | 17.74              | 46.00             | 28.2           | 100            | 357            |        |
| Hori.    | 896.000            | QP       | 20.90             | 22.05              | 9.83         | 30.93        | 0.00                    | 21.85              | 46.00             | 24.1           | 100            | 1              |        |
| Hori.    | 917.426            | QP       | 20.60             | 22.02              | 9.92         | 30.77        | 0.00                    | 21.77              | 46.00             | 24.2           | 100            | 358            |        |
| Hori.    | 2483.500           | PK       | 45.35             | 28.16              | 14.71        | 39.62        | 2.49                    | 51.09              | 73.90             | 22.8           | 201            | 287            |        |
| Hori.    | 4960.000           | PK       | 46.27             | 31.83              | 7.18         | 39.72        | 2.49                    | 48.05              | 73.90             | 25.8           | 206            | 61             |        |
| Hori.    | 7440.000           | PK       | 45.88             | 37.38              | 9.04         | 39.68        | 2.49                    | 55.11              | 73.90             | 18.7           | 175            | 161            |        |
| Vert.    | 192.000            | QP       | 21.90             | 16.36              | 8.98         | 31.81        | 0.00                    | 15.43              | 43.50             | 28.0           | 100            | 1              |        |
| Vert.    | 619.020            | QP       | 21.40             | 19.51              | 8.60         | 31.62        | 0.00                    | 17.89              | 46.00             | 28.1           | 100            | 358            |        |
| Vert.    | 736.000            | QP       | 21.40             | 20.12              | 9.12         | 31.51        | 0.00                    | 19.13              | 46.00             | 26.8           | 100            | 2              |        |
| Vert.    | 800.000            | QP       | 21.20             | 20.84              | 9.40         | 31.34        | 0.00                    | 20.10              | 46.00             | 25.9           | 100            | 359            |        |
| Vert.    | 864.000            | QP       | 21.00             | 21.79              | 9.68         | 31.08        | 0.00                    | 21.39              | 46.00             | 24.6           | 100            | 1              |        |
| Vert.    | 2483.500           | PK       | 45.77             | 28.16              | 14.71        | 39.62        | 2.49                    | 51.51              | 73.90             | 22.3           | 165            | 156            |        |
| Vert.    | 4960.000           | PK       | 47.35             | 31.83              | 7.18         | 39.72        | 2.49                    | 49.13              | 73.90             | 24.7           | 170            | 88             |        |
| Vert.    | 7440.000           | PK       | 45.82             | 37.38              | 9.04         | 39.68        | 2.49                    | 55.05              | 73.90             | 18.8           | 154            | 73             |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.995 \text{ m} / 3.0 \text{ m}) = 2.49 \text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

### Average measurement value with duty factor

| Polarity | Frequency<br>[MHz] | Detector | Reading<br>[dBuV] | Ant.Fac.<br>[dB/m] | Loss<br>[dB] | Gain<br>[dB] | Duty<br>Factor<br>[dB] | Distance<br>Factor<br>[dB] | Result<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|----------|--------------------|----------|-------------------|--------------------|--------------|--------------|------------------------|----------------------------|--------------------|-------------------|----------------|--------|
| Hori.    | 2483.500           | AV       | 36.13             | 28.16              | 14.71        | 39.62        | 2.98                   | 2.49                       | 44.85              | 53.90             | 9.0            | *1)    |
| Hori.    | 4960.000           | AV       | 37.82             | 31.83              | 7.18         | 39.72        | 2.98                   | 2.49                       | 42.58              | 53.90             | 11.3           |        |
| Hori.    | 7440.000           | AV       | 36.23             | 37.38              | 9.04         | 39.68        | 2.98                   | 2.49                       | 48.44              | 53.90             | 5.4            |        |
| Vert.    | 2483.500           | AV       | 36.23             | 28.16              | 14.71        | 39.62        | 2.98                   | 2.49                       | 44.95              | 53.90             | 8.9            | *1)    |
| Vert.    | 4960.000           | AV       | 37.72             | 31.83              | 7.18         | 39.72        | 2.98                   | 2.49                       | 42.48              | 53.90             | 11.4           |        |
| Vert.    | 7440.000           | AV       | 36.11             | 37.38              | 9.04         | 39.68        | 2.98                   | 2.49                       | 48.32              | 53.90             | 5.5            |        |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz :  $20\log(3.995 \text{ m} / 3.0 \text{ m}) = 2.49 \text{ dB}$

13 GHz - 40 GHz :  $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

\*1) Not out of band emission (Leakage Power)

**UL Japan, Inc.**

**Shonan EMC Lab.**

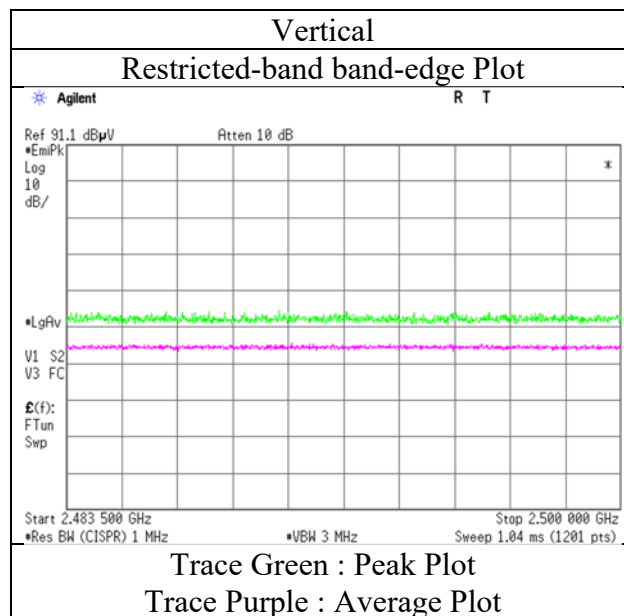
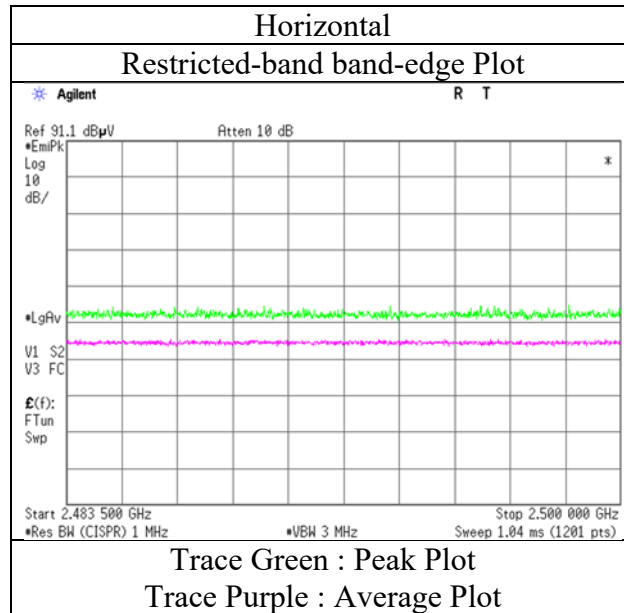
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## Radiated Spurious Emission (Reference Plot for band-edge)

|                        |                     |
|------------------------|---------------------|
| Report No.             | 12945978S-A-R2      |
| Test place             | Shonan EMC Lab.     |
| Semi Anechoic Chamber  | No.1                |
| Date                   | September 8, 2019   |
| Temperature / Humidity | 23 deg. C / 60 % RH |
| Engineer               | Kenichi Adachi      |
|                        | (1 GHz – 26.5 GHz)  |
| Mode                   | Tx BT LE 2480 MHz   |

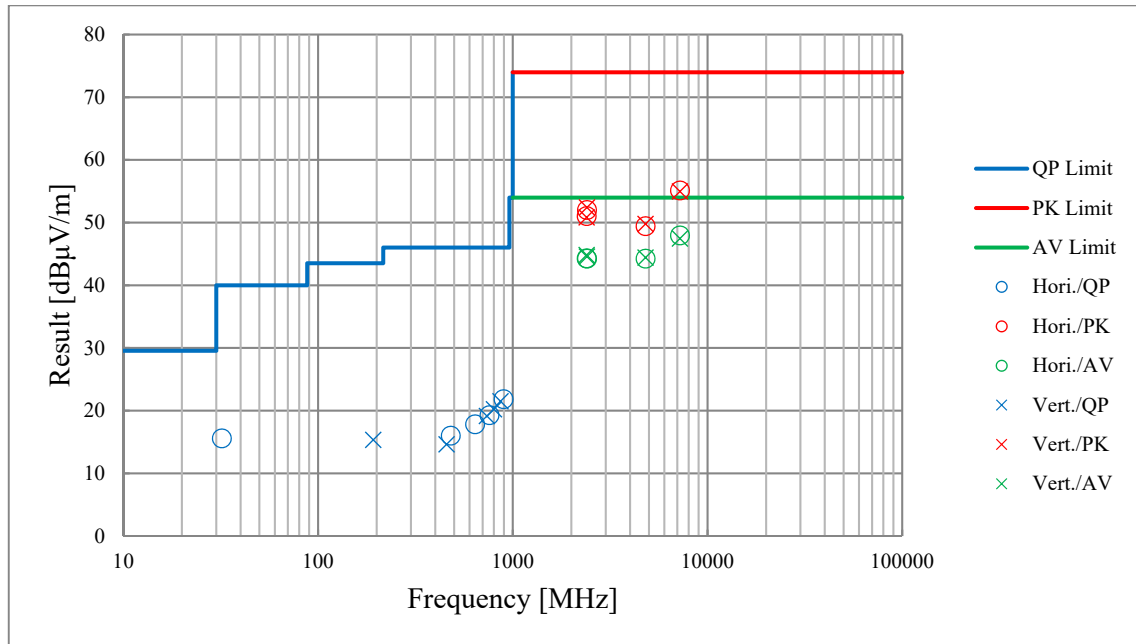


\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

Final result of restricted band edge was shown in tabular data.

**Radiated Spurious Emission**  
**(Plot data, Worst case)**

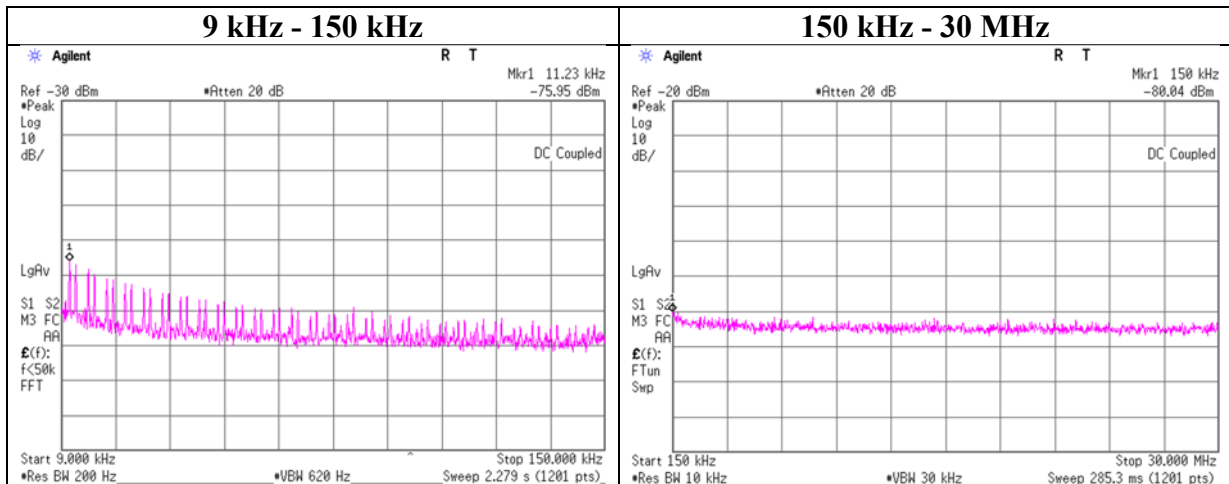
|                        |                     |                     |
|------------------------|---------------------|---------------------|
| Report No.             | 12945978S-A-R2      | No.1                |
| Test place             | Shonan EMC Lab.     | September 8, 2019   |
| Semi Anechoic Chamber  | No.2                | September 10, 2019  |
| Date                   | September 10, 2019  | 22 deg. C / 58 % RH |
| Temperature / Humidity | 22 deg. C / 58 % RH | 23 deg. C / 60 % RH |
| Engineer               | Kazuya Noda         | Kenichi Adachi      |
|                        | (30 MHz - 1000 MHz) | (1 GHz - 26.5 GHz)  |
| Mode                   | Tx BT LE 2402 MHz   |                     |



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

## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12945978S-A-R2                        |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | August 29, 2019                       |
| Temperature / Humidity | 24 deg. C / 53 % RH                   |
| Engineer               | Kazuya Noda                           |
| Mode                   | Tx BT LE 2402 MHz                     |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 11.23              | -75.95           | 0.02                  | 9.74                       | 2.5                      | 1                          | -63.69        | 300             | 6.00                     | -2.44                             | 46.50             | 48.94          |        |
| 150.00             | -80.04           | 0.02                  | 9.74                       | 2.5                      | 1                          | -67.78        | 300             | 6.00                     | -6.53                             | 24.00             | 30.53          |        |

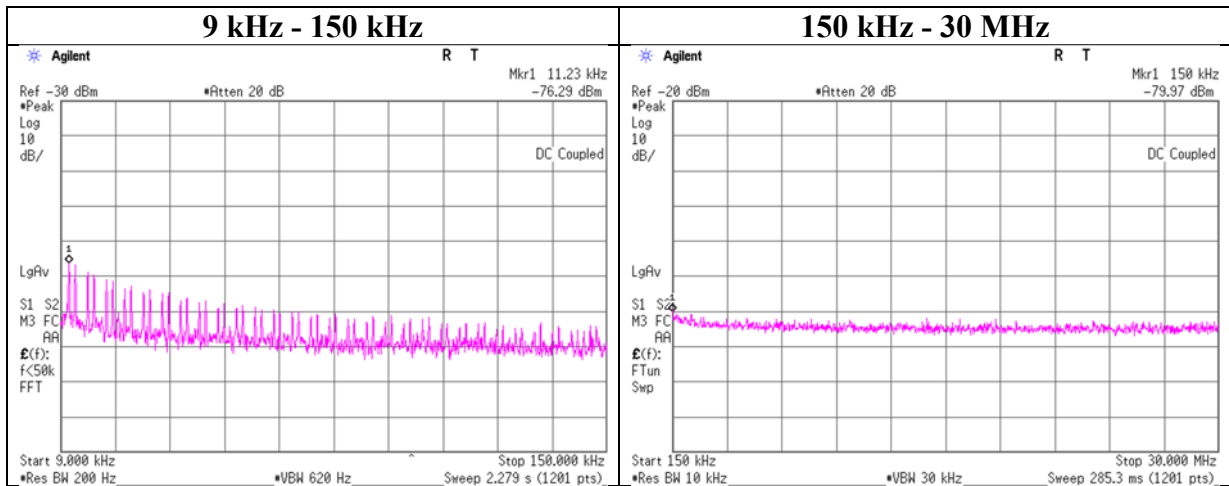
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12945978S-A-R2                        |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | August 29, 2019                       |
| Temperature / Humidity | 24 deg. C / 53 % RH                   |
| Engineer               | Kazuya Noda                           |
| Mode                   | Tx BT LE 2440 MHz                     |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 11.23              | -76.29           | 0.02                  | 9.74                       | 2.5                      | 1                          | -64.03        | 300             | 6.00                     | -2.78                             | 46.50             | 49.28          |        |
| 150.00             | -79.97           | 0.02                  | 9.74                       | 2.5                      | 1                          | -67.71        | 300             | 6.00                     | -6.46                             | 24.00             | 30.46          |        |

$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

$$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$$

N: Number of output

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**Shonan EMC Lab.**

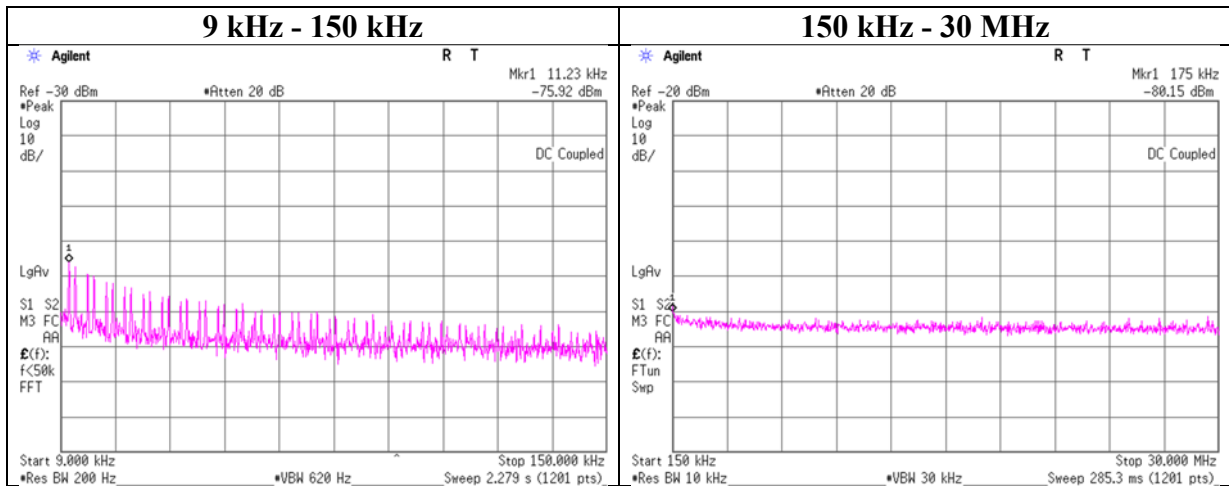
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Facsimile : +81 463 50 6401

## Conducted Spurious Emission

|                        |                                       |
|------------------------|---------------------------------------|
| Report No.             | 12945978S-A-R2                        |
| Test place             | Shonan EMC Lab. No.1 Measurement Room |
| Date                   | August 29, 2019                       |
| Temperature / Humidity | 24 deg. C / 53 % RH                   |
| Engineer               | Kazuya Noda                           |
| Mode                   | Tx BT LE 2480 MHz                     |



| Frequency<br>[kHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Attenuator<br>Loss<br>[dB] | Antenna<br>Gain<br>[dBi] | N<br>(Number<br>of Output) | EIRP<br>[dBm] | Distance<br>[m] | Ground<br>bounce<br>[dB] | E<br>(field strength)<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Remark |
|--------------------|------------------|-----------------------|----------------------------|--------------------------|----------------------------|---------------|-----------------|--------------------------|-----------------------------------|-------------------|----------------|--------|
| 11.23              | -75.92           | 0.02                  | 9.74                       | 2.5                      | 1                          | -63.66        | 300             | 6.00                     | -2.41                             | 46.50             | 48.91          |        |
| 175.00             | -80.15           | 0.02                  | 9.74                       | 2.5                      | 1                          | -67.89        | 300             | 6.00                     | -6.64                             | 22.70             | 29.34          |        |

$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

### **Power Density**

Report No. 12945978S-A-R2  
Test place Shonan EMC Lab. No.1 Measurement Room  
Date August 29, 2019  
Temperature / Humidity 24 deg. C / 53 % RH  
Engineer Kazuya Noda  
Mode Tx BT LE

| Freq.<br>[MHz] | Reading<br>[dBm] | Cable<br>Loss<br>[dB] | Atten.<br>Loss<br>[dB] | Result<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] |
|----------------|------------------|-----------------------|------------------------|-----------------|----------------|----------------|
| 2402           | -28.18           | 1.23                  | 9.82                   | -17.13          | 8.00           | 25.13          |
| 2440           | -28.54           | 1.24                  | 9.82                   | -17.48          | 8.00           | 25.48          |
| 2480           | -28.80           | 1.25                  | 9.82                   | -17.73          | 8.00           | 25.73          |

Sample Calculation:

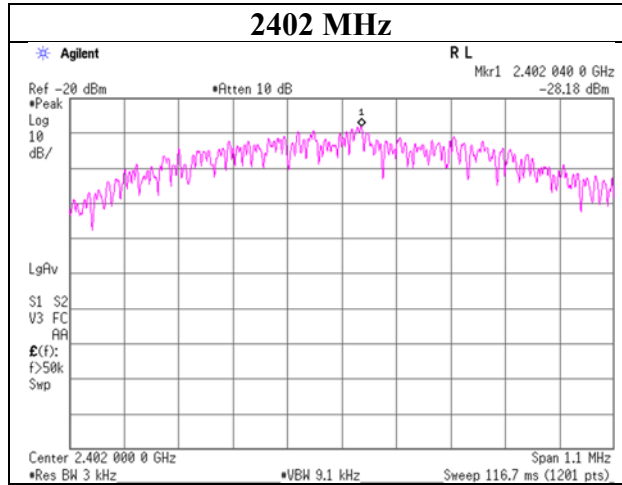
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

\*The equipment and cables were not used for factor 0 dB of the data sheets.

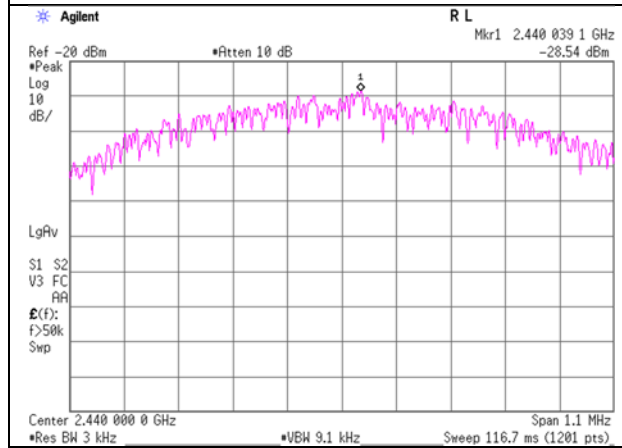
## Power Density

### BT LE

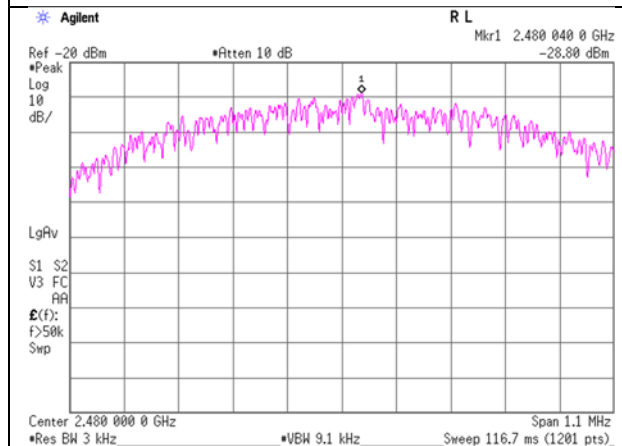
#### 2402 MHz



#### 2440 MHz



#### 2480 MHz



## APPENDIX 2: Test instruments

### Test Instruments

| Local ID                       | Test Name | LIMS ID | Description               | Manufacturer                         | Model                                 | Serial                  | Last Calibration Date | Calibration Due Date | Calibration Interval (Month) |
|--------------------------------|-----------|---------|---------------------------|--------------------------------------|---------------------------------------|-------------------------|-----------------------|----------------------|------------------------------|
| KTS-08                         | AT        | 145095  | Digital Tester            | SANWA                                | PC500                                 | 7019224                 | 4/2/2019              | 4/30/2020            | 12                           |
| SAT10-14                       | AT        | 154591  | Attenuator                | Weinschel Corp.                      | 54A-10                                | 81595                   | 4/16/2019             | 4/30/2020            | 12                           |
| SCC-G31                        | AT        | 145042  | Coaxial Cable             | Junkosha                             | MWX241-01000KMSK MS                   | OCT-08-13-046           | 4/16/2019             | 4/30/2020            | 12                           |
| SOS-13                         | AT        | 146321  | Humidity Indicator        | CUSTOM                               | CTH-202                               | Q.C.17                  | 12/5/2018             | 12/31/2019           | 12                           |
| SPM-07                         | AT        | 146247  | Power Meter               | AGILENT                              | 8990B                                 | MY510027 2              | 7/16/2019             | 7/31/2020            | 12                           |
| SPSS-04                        | AT        | 146310  | Power sensor              | AGILENT                              | N1923A                                | MY532600 9              | 7/16/2019             | 7/31/2020            | 12                           |
| SRENT-09                       | AT        | 150461  | Spectrum Analyzer         | AGILENT (KEYSIGHT)                   | E4440A                                | MY461863 92             | 1/3/2019              | 1/31/2020            | 12                           |
| KAT3-12                        | CE        | 144896  | Attenuator                | JFW IND. INC.                        | 50HF-003N                             | -                       | 7/18/2019             | 7/31/2020            | 12                           |
| SCC-B12/B13/SRSE-02            | CE        | 144969  | Coaxial Cable&RF Selector | Suhner/Suhner/TOYO                   | RG223U/141 PE/NS4906                  | -/0901-270(RF Selector) | 4/19/2019             | 4/30/2020            | 12                           |
| SLS-03                         | CE        | 145540  | LISN                      | Rohde & Schwarz                      | ENV216                                | 100513                  | 2/21/2019             | 2/29/2020            | 12                           |
| SOS-04                         | CE        | 146292  | Humidity Indicator        | A&D                                  | AD-5681                               | 4061512                 | 12/5/2018             | 12/31/2019           | 12                           |
| COTS-SEMI-5                    | CE,RE     | 170932  | EMI Software              | TSJ                                  | TEPTO-DV3(RE,CE, ME,PE)               | -                       | -                     | -                    | -                            |
| SJM-09                         | CE,RE     | 145336  | Measure                   | PROMART                              | SEN1935                               | -                       | -                     | -                    | -                            |
| STR-02                         | CE,RE     | 145791  | Test Receiver             | Rohde & Schwarz                      | ESCI                                  | 100575                  | 10/19/2018            | 10/31/2019           | 12                           |
| STS-02                         | CE,RE     | 145793  | Digital Hitester          | HIOKI                                | 3805-50                               | 80997819                | 4/2/2019              | 4/30/2020            | 12                           |
| KJM-09                         | RE        | 145929  | Measure                   | KOMELON                              | KMC-36                                | -                       | -                     | -                    | -                            |
| SAEC-01(SVSWR)                 | RE        | 145561  | Semi-Anechoic Chamber     | TDK                                  | SAEC-01(SVSWR)                        | 1                       | 5/6/2019              | 5/30/2020            | 12                           |
| SAEC-02(NSA)                   | RE        | 145563  | Semi-Anechoic Chamber     | TDK                                  | SAEC-02(NSA)                          | 2                       | 4/4/2019              | 4/30/2020            | 12                           |
| SAF-02                         | RE        | 145004  | Pre Amplifier             | SONOMA                               | 310N                                  | 290212                  | 2/5/2019              | 2/29/2020            | 12                           |
| SAF-04                         | RE        | 145127  | Pre Amplifier             | Toyo Corporation                     | TPA0118-36                            | 2072554                 | 6/4/2019              | 6/30/2020            | 12                           |
| SAF-08                         | RE        | 145007  | Pre Amplifier             | Toyo Corporation                     | HAP18-26W                             | 19                      | 3/5/2019              | 3/31/2020            | 12                           |
| SAT10-05                       | RE        | 145136  | Attenuator(ab ove1GHz)    | AGILENT                              | 8493C-010                             | 74864                   | 11/25/2018            | 11/30/2019           | 12                           |
| SAT3-11                        | RE        | 150921  | Attenuator                | JFW                                  | 50HF-003N                             | -                       | 1/25/2019             | 1/31/2020            | 12                           |
| SAT6-14                        | RE        | 167095  | Attenuator                | JFW                                  | 50HF-006N                             | -                       | 2/5/2019              | 2/29/2020            | 12                           |
| SBA-02                         | RE        | 145022  | Biconical Antenna         | Schwarzbeck                          | BBA9106                               | 91032665                | 4/1/2019              | 4/30/2020            | 12                           |
| SCC-B1/B3/B5/B7/B8/B13/SRSE-02 | RE        | 144975  | Coaxial Cable&RF Selector | Fujikura/Fujikura/Suhner/Suhner/TOYO | 8D2W/12DSF A/141PE/141 PE/141PE/14 1P | -/0901-270(RF Selector) | 4/19/2019             | 4/30/2020            | 12                           |
| SCC-B2/B4/B6/B7/B8/B13/SRSE-02 | RE        | 144976  | Coaxial Cable&RF Selector | Fujikura/Fujikura/Suhner/Suhner/TOYO | 8D2W/12DSF A/141PE/141 PE/141PE/14 1P | -/0901-270(RF Selector) | 4/19/2019             | 4/30/2020            | 12                           |
| SCC-G05                        | RE        | 145039  | Coaxial Cable             | Junkosha                             | J12J102207-00                         | APR-30-15-037           | 1/25/2019             | 1/31/2020            | 12                           |
| SCC-G15                        | RE        | 145176  | Coaxial Cable             | Suhner                               | SUCOFLEX 102                          | 32703/2                 | 3/27/2019             | 3/31/2020            | 12                           |

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| Local ID | Test Name | LIMS ID | Description         | Manufacturer  | Model        | Serial     | Last Calibration Date | Calibration Due Date | Calibration Interval (Month) |
|----------|-----------|---------|---------------------|---------------|--------------|------------|-----------------------|----------------------|------------------------------|
| SCC-G56  | RE        | 179539  | Coaxial Cable       | Huber+Suhner  | SUCOFLEX 104 | 803289/4   | 5/16/2019             | 5/31/2020            | 12                           |
| SCC-G57  | RE        | 179540  | Coaxial Cable       | Huber+Suhner  | SUCOFLEX 102 | 802815/2   | 5/16/2019             | 5/31/2020            | 12                           |
| SFL-02   | RE        | 145301  | Highpass Filter     | MICRO-TRONICS | HPM50111     | 51         | 11/16/2018            | 11/30/2019           | 12                           |
| SHA-01   | RE        | 145383  | Horn Antenna        | Schwarzbeck   | BBHA9120D    | 9120D-725  | 5/9/2019              | 5/31/2020            | 12                           |
| SHA-04   | RE        | 145512  | Horn Antenna        | ETS LINDGREN  | Sep-60       | LM3640     | 6/26/2019             | 6/30/2020            | 12                           |
| SLA-06   | RE        | 145528  | Logperiodic Antenna | Schwarzbeck   | VUSLP9111B   | 195        | 4/1/2019              | 4/30/2020            | 12                           |
| SOS-01   | RE        | 146316  | Humidity Indicator  | A&D           | AD-5681      | 4062555    | 10/25/2018            | 10/31/2019           | 12                           |
| SOS-03   | RE        | 146317  | Humidity Indicator  | A&D           | AD-5681      | 4063325    | 10/25/2018            | 10/31/2019           | 12                           |
| SSA-03   | RE        | 145801  | Spectrum Analyzer   | AGILENT       | E4448A       | MY48250152 | 2019/8/8              | 2020/8/31            | 12                           |
| STS-01   | RE        | 145792  | Digital Hitester    | HIOKI         | 3805-50      | 80997812   | 2018/10/16            | 2019/10/31           | 12                           |

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

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

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

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

Test item: CE: Conducted Emission test  
RE: Radiated Emission test  
AT: Antenna Terminal Conducted test