# RADIO TEST REPORT

## Test Report No. : 12851267S-A-R1

| | | |
|---|---|---|
| **Applicant** | : | **Citizen Watch Co., Ltd.** |
| **Type of Equipment** | : | **BLE Hybrid Watch** |
| **Model No.** | : | **YF05MV-01** |
| **FCC ID** | : | **YUQ-YF0MV01** |
| **Test regulation** | : | **FCC Part 15 Subpart C: 2019** |
| **Test Result** | : | **Complied (Refer to SECTION 3.2)** |

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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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 12851267S-A. 12851267S-A is replaced with this report.

**Date of test:** September 2 to October 29, 2019

**Representative test engineer:**
Toshinori Yamada
Engineer
Consumer Technology Division

**Approved by:**
Kazutaka Takeyama
Engineer
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".

# REVISION HISTORY

## Original Test Report No.: 12851267S-A

| Revision | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| - (Original) | 12851267S-A | October 30, 2019 | - | - |
| 1 | 12851267S-A-R1 | November 12, 2019 | 6 | Correction of Test Procedure in 3.2:<br>"KDB 558074 D01 15.247 Meas Guidance v05" to<br>"KDB 558074 D01 15.247 Meas Guidance v05r02" |
| | | | 9 | Correction of Model No. of BLE Hybrid Watch:<br>"YF05MV-01 *1), YF0MV *2)" to<br>"YF05MV-01" |
| | | | 17 | Deletion of unnecessary comment:<br>"The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01." |

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

| | |
|---|---|
| A2LA | The American Association for Laboratory Accreditation |
| AC | Alternating Current |
| AFH | Adaptive Frequency Hopping |
| AM | Amplitude Modulation |
| Amp, AMP | Amplifier |
| ANSI | American National Standards Institute |
| Ant, ANT | Antenna |
| AP | Access Point |
| Atten., ATT | Attenuator |
| AV | Average |
| BPSK | Binary Phase-Shift Keying |
| BR | Bluetooth Basic Rate |
| BT | Bluetooth |
| BLE / BT LE | Bluetooth Low Energy |
| BW | BandWidth |
| Cal Int | Calibration Interval |
| CCK | Complementary Code Keying |
| Ch., CH | Channel |
| CISPR | Comite International Special des Perturbations Radioelectriques |
| CW | Continuous Wave |
| DBPSK | Differential BPSK |
| DC | Direct Current |
| DFS | Dynamic Frequency Selection |
| DQPSK | Differential QPSK |
| DSSS | Direct Sequence Spread Spectrum |
| EDR | Enhanced Data Rate |
| EIRP, e.i.r.p. | Equivalent Isotropically Radiated Power |
| EMC | ElectroMagnetic Compatibility |
| EMI | ElectroMagnetic Interference |
| EN | European Norm |
| ERP, e.r.p. | Effective Radiated Power |
| 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 |
| NS | No signal detect. |
| NSA | Normalized Site Attenuation |
| NVLAP | National Voluntary Laboratory Accreditation Program |
| OBW | Occupied Band Width |
| OFDM | Orthogonal Frequency Division Multiplexing |
| P/M | Power meter |
| PCB | Printed Circuit Board |
| PER | Packet Error Rate |
| PHY | Physical Layer |
| PK | Peak |
| PN | Pseudo random Noise |
| PRBS | Pseudo-Random Bit Sequence |
| PSD | Power Spectral Density |
| QAM | Quadrature Amplitude Modulation |
| QP | Quasi-Peak |
| QPSK | Quadri-Phase Shift Keying |
| RBW | Resolution Band Width |
| RDS | Radio Data System |
| RE | Radio Equipment |
| RF | Radio Frequency |
| RMS | Root Mean Square |
| RSS | Radio Standards Specifications |
| Rx | Receiving |
| SA, S/A | Spectrum Analyzer |
| SG | Signal Generator |
| SVSWR | Site-Voltage Standing Wave Ratio |
| TR | Test Receiver |
| Tx | Transmitting |
| VBW | Video BandWidth |
| Vert. | Vertical |
| WLAN | Wireless LAN |

**CONTENTS** **PAGE**

# SECTION 1: Customer information

| | | |
|---|---|---|
| Company Name | : | Citizen Watch Co., Ltd. |
| Address | : | 6-1-12, Tanashi-cho, nishi-tokyo-shi, Tokyo 188-8511, Japan |
| Telephone Number | : | +81-42-467-6218 |
| Facsimile Number | : | +81-42-467-1549 |
| Contact Person | : | Syunya Syohji |

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 | : | BLE Hybrid Watch |
| Model No. | : | YF05MV-01 |
| Serial No. | : | Refer to SECTION 4.2 |
| Rating | : | DC 3.0 V (Battery) |
| Receipt Date of Sample (Information from test lab.) | : | August 23, 2019 |
| Country of Mass-production | : | China |
| Condition of EUT | : | Production prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification of EUT | : | No Modification by the test lab. |

## 2.2 Product Description

Model: YF05MV-01 (referred to as the EUT in this report) is a BLE Hybrid Watch.

**Radio Specification**

| | | |
|---|---|---|
| Equipment Type | : | Transceiver |
| Frequency of Operation | : | 2402 MHz - 2480 MHz |
| Type of Modulation | : | GFSK |
| Antenna Type | : | Loop Trace |
| Antenna Gain | : | -11.58 dBi |
| Clock frequency (Maximum) | : | 16 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

* Also the EUT complies with FCC Part 15 Subpart B.

## 3.2 Procedures and results

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|---|---|---|---|---|---|
| Conducted Emission | **FCC:** ANSI C63.10-2013 6. Standard test methods | **FCC:** Section 15.207 | - | N/A | *1) |
| | **ISED:** RSS-Gen 8.8 | **ISED:** RSS-Gen 8.8 | | | |
| 6dB Bandwidth | **FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 | **FCC:** Section 15.247(a)(2) | See data. | Complied a) | Conducted |
| | **ISED:** - | **ISED:** RSS-247 5.2(a) | | | |
| Maximum Peak Output Power | **FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 | **FCC:** Section 15.247(b)(3) | | Complied b) | Conducted |
| | **ISED:** RSS-Gen 6.12 | **ISED:** RSS-247 5.4(d) | | | |
| Power Density | **FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 | **FCC:** Section 15.247(e) | | Complied c) | Conducted |
| | **ISED:** - | **ISED:** RSS-247 5.2(b) | | | |
| Spurious Emission Restricted Band Edges | **FCC:** KDB 558074 D01 15.247 Meas Guidance v05r02 | **FCC:** Section15.247(d) | 4.8 dB 7206.000 MHz, AV, Horizontal Mode: Tx BT LE, 2402 MHz | Complied# d), e) | Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2) |
| | **ISED:** RSS-Gen 6.13 | **ISED:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10 | | | |

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT has no AC mains.
*2) 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 6 dB Bandwidth and 99 % Occupied Bandwidth)
b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
c) Refer to APPENDIX 1 (data of Power Density)
d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
e) 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 EUT provides stable voltage constantly to the wireless transmitter regardless of input voltage.
Instead of a new battery, the EUT was supplied from PC via USB for the test. That does not affect the test result, therefore the EUT complies with the requirement.

**FCC Part 15.203 Antenna requirement**
It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement.

## 3.3 Addition to standard

| Item | Test Procedure | Specification | Worst margin | Results | Remarks |
|---|---|---|---|---|---|
| 99% Occupied Bandwidth | RSS-Gen 6.7 | **ISED:** - | N/A | -<br>a) | Conducted |
| Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.<br>a) 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.

Shonan EMC Lab.

| 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 (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 (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

UL Japan, Inc. Shonan EMC Lab.
1-22-3, Megumigaoka, Hiratsuka-shi, Kanagawa-ken 259-1220 JAPAN
Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
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

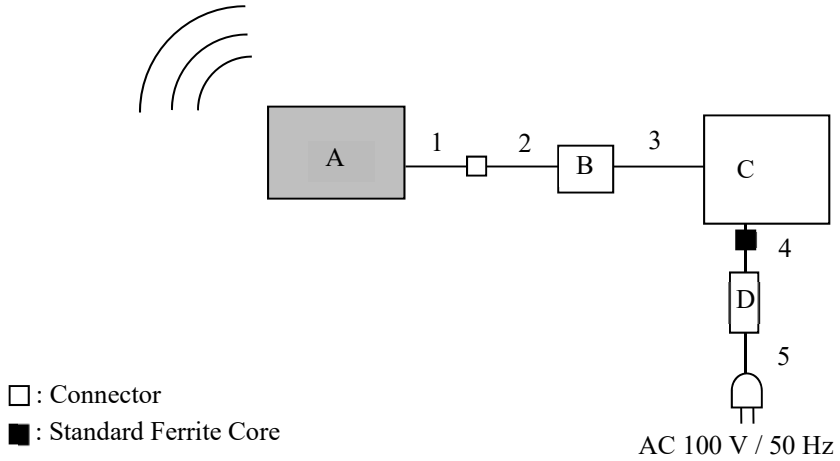
Refer to APPENDIX.

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

## 4.1 Operating Mode(s)

| Mode | Tested frequency | Remarks* |
|---|---|---|
| Tx, Bluetooth Low Energy | 2402 MHz<br>2440 MHz<br>2480 MHz | Maximum Packet Size, PRBS9 |
| *Power of the EUT was set by the software as follows;<br>Power settings: Fixed<br>Software: Connection Manager Ver.3.0/10<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




□ : Connector
■ : Standard Ferrite Core

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

| No. | Item | Model number | Serial number | Manufacturer | Remarks |
|---|---|---|---|---|---|
| A | BLE Hybrid Watch | YF05MV-01 | W1U0000107 *1)<br>W00060P4FE *2) | CITIZEN WATCH CO., LTD. | EUT |
| B | Development Kit | - | - | - | - |
| C | Laptop Computer | Latitude E5500 | 0DW634 | DELL | - |
| D | AC Adapter | HA90PE0-00 | 0W529 | DELL | - |

*1) Used for Radiated Emission tests
*2) Used for Antenna Terminal Conducted tests

**List of cables used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | Signal | 0.1 | Unshielded | Unshielded | *3) |
| 2 | Signal | 0.1 | Unshielded | Unshielded | - |
| 3 | USB | 1.0 | Shielded | Shielded | - |
| 4 | DC | 1.7 | Unshielded | Unshielded | - |
| 5 | AC | 0.9 | Unshielded | Unshielded | - |

*3) Cable for test operation

## SECTION 5: 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 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 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 |

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

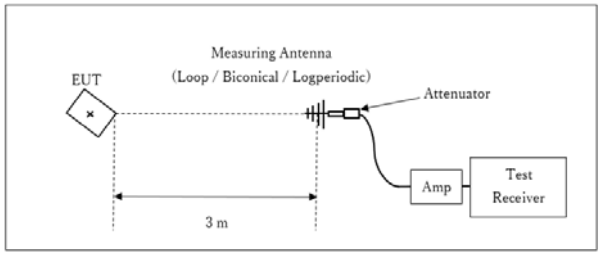
**20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).**

| Frequency | 30 MHz to 1 GHz | Above 1 GHz | | 20 dBc |
|---|---|---|---|---|
| Instrument used | Test Receiver | Spectrum Analyzer | | Spectrum Analyzer |
| Detector | QP | PK | AV *1) | PK |
| IF Bandwidth | BW 120 kHz | RBW: 1 MH<br>VBW: 3 MH | 11.12.2.5.2<br>RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging<br>(Linear voltage)<br>Trace: 100 traces<br>Duty factor was<br>added to the results. | RBW: 100 kHz<br>VBW: 300 kHz |

*1) Average Power Measurement was performed based on ANSI C63.10-2013.

**Figure 1: Test Setup**

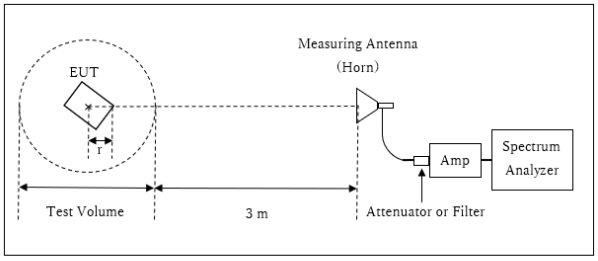
Below 1 GHz




× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz

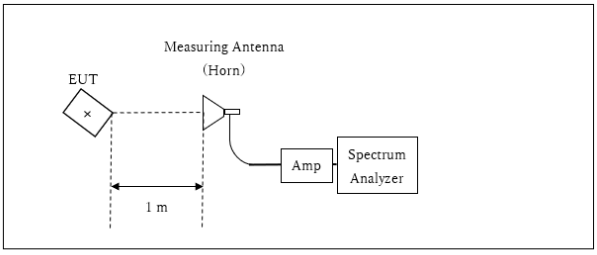



r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.965 m / 3.0 m) = 2.43 dB
* Test Distance: (3 + Test Volume /2) - r = 3.965 m

Test Volume : 2.0 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.035 m

13 GHz – 26.5 GHz




× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.54 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 (30 MHz - 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 | X | X | X | Z | X | X |
| Vertical | Y | X | Y | Y | 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 6: Antenna Terminal Conducted Tests

**Test Procedure**

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

| Test | Span | RBW | VBW | Sweep time | Detector | Trace | Instrument used |
|---|---|---|---|---|---|---|---|
| 6dB Bandwidth | 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/ Average *2) | - | Power Meter (Sensor: 50 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 *5) | 9kHz to 150kHz | 200 Hz | 620 Hz | Auto | Peak | Max Hold | Spectrum Analyzer |
| | 150kHz to 30MHz | 10 kHz | 30 kHz | | | | |

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
*5) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

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

## 6 dB Bandwidth and 99 % Occupied Bandwidth

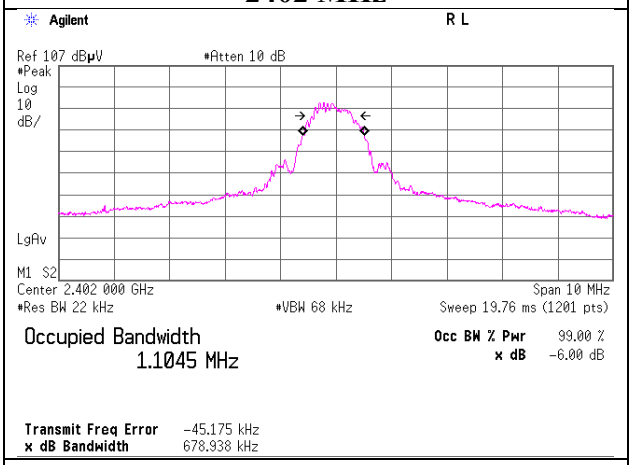
| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.3 Shielded Room |
| Date | October 29, 2019 |
| Temperature / Humidity | 23 deg. C / 47 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE |

| Mode | Frequency [MHz] | 99% Occupied Bandwidth [kHz] | 6dB Bandwidth [MHz] | Limit for 6dB Bandwidth [MHz] |
|---|---|---|---|---|
| BT LE | 2402 | 1104.5 | 0.758 | > 0.5000 |
| | 2440 | 1123.2 | 0.766 | > 0.5000 |
| | 2480 | 1107.3 | 0.756 | > 0.5000 |

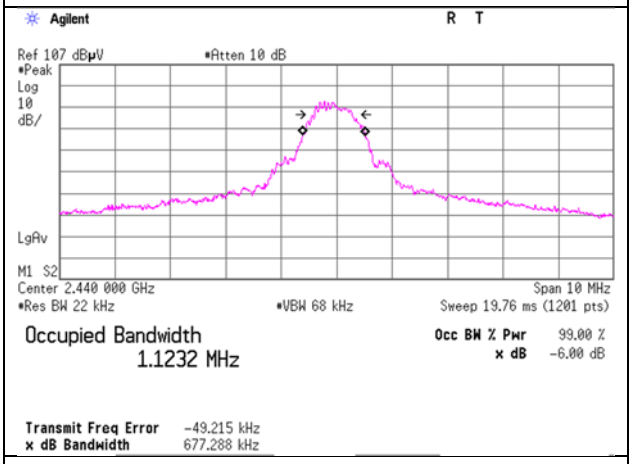
# 99%Occupied Bandwidth

## BT LE

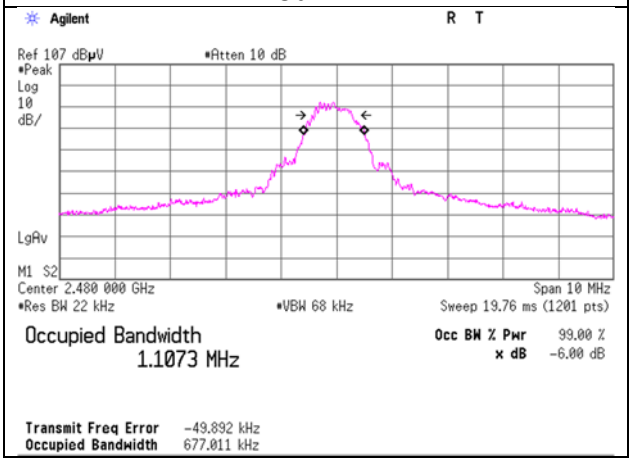
### 2402 MHz




### 2440 MHz



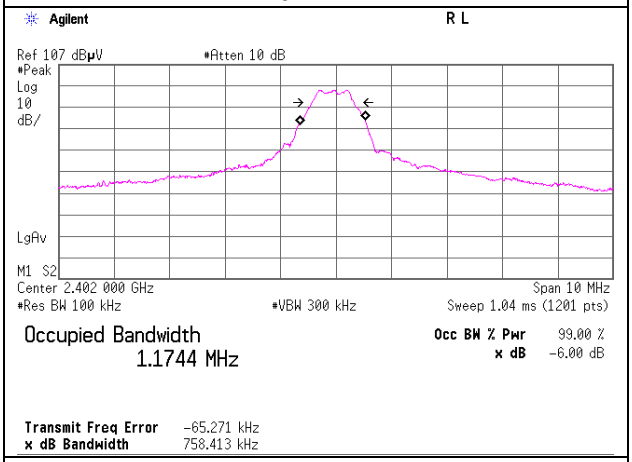

### 2480 MHz



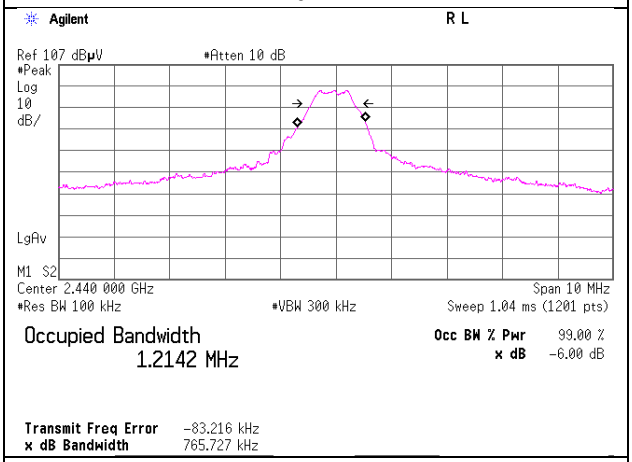
# 6dB Bandwidth

## BT LE

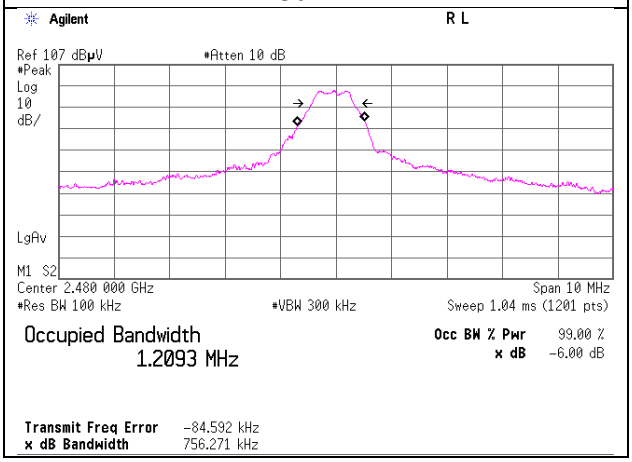
### 2402 MHz




### 2440 MHz




### 2480 MHz



# Maximum Peak Output Power

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.3 Shielded Room |
| Date | October 29, 2019 |
| Temperature / Humidity | 23 deg. C / 47 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE |

| | | | | Conducted Power | | | | | e.i.r.p. for RSS-247 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. | Reading | Cable Loss | Atten. Loss | Result | | Limit | | Margin | Antenna Gain | Result | | Limit | | Margin |
| [MHz] | [dBm] | [dB] | [dB] | [dBm] | [mW] | [dBm] | [mW] | [dB] | [dBi] | [dBm] | [mW] | [dBm] | [mW] | [dB] |
| 2402 | -11.43 | 1.28 | 9.82 | -0.33 | 0.93 | 30.00 | 1000 | 30.33 | -11.58 | -11.91 | 0.06 | 36.02 | 4000 | 47.93 |
| 2440 | -11.49 | 1.29 | 9.82 | -0.38 | 0.92 | 30.00 | 1000 | 30.38 | -11.58 | -11.96 | 0.06 | 36.02 | 4000 | 47.98 |
| 2480 | -11.78 | 1.30 | 9.82 | -0.66 | 0.86 | 30.00 | 1000 | 30.66 | -11.58 | -12.24 | 0.06 | 36.02 | 4000 | 48.26 |

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

# Average Output Power
# (Reference data for RF Exposure)

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.3 Shielded Room |
| Date | October 29, 2019 |
| Temperature / Humidity | 23 deg. C / 47 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE |

BT LE

| Freq. | Reading | Cable Loss | Atten. Loss | Result (Time average) | | Duty factor | Result (Burst power average) | |
|---|---|---|---|---|---|---|---|---|
| [MHz] | [dBm] | [dB] | [dB] | [dBm] | [mW] | [dB] | [dBm] | [mW] |
| 2402 | -14.31 | 1.28 | 9.82 | -3.21 | 0.48 | 2.03 | -1.18 | 0.76 |
| 2440 | -14.28 | 1.29 | 9.82 | -3.17 | 0.48 | 2.03 | -1.14 | 0.77 |
| 2480 | -14.35 | 1.30 | 9.82 | -3.23 | 0.48 | 2.03 | -1.20 | 0.76 |

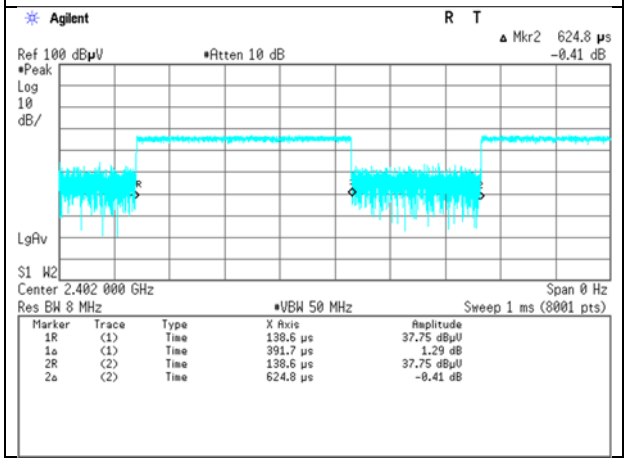
Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

# Burst rate confirmation (for Average Output Power)

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.1 Semi Anechoic Chamber |
| Date | September 3, 2019 |
| Temperature / Humidity | 24 deg. C / 51 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE |

## BT LE

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.627** |
| **Tx on / (Tx on + Tx off) * 100 =** | **62.7 %** |
| **Duty factor = 10 * log (0.6248 / 0.3917) =** | **2.03 dB** |



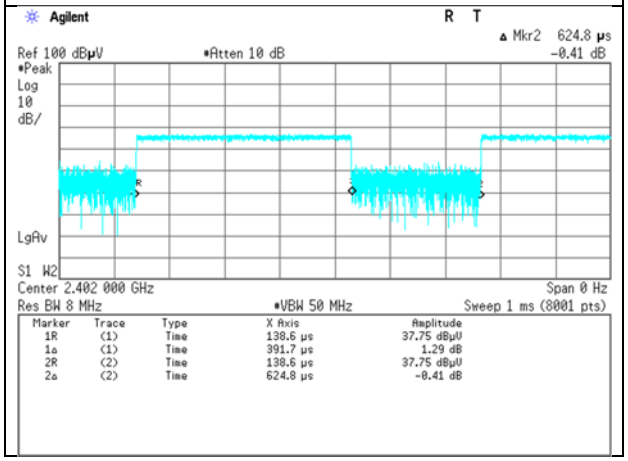

* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

# Burst rate confirmation (for Radiated Spurious Emission)

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.1 Semi Anechoic Chamber |
| Date | September 3, 2019 |
| Temperature / Humidity | 24 deg. C / 51 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE |

## BT LE

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.627** |
| **Tx on / (Tx on + Tx off) * 100 =** | **62.7 %** |
| **Duty factor = 20 * log (0.6248 / 0.3917) =** | **4.06 dB** |




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

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 12851267S-A-R1 | |
| Test place | Shonan EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.1 |
| Date | September 2, 2019 | September 3, 2019 |
| Temperature / Humidity | 23 deg. C / 56 % RH | 24 deg. C / 51 % RH |
| Engineer | Toshinori Yamada | Hiromasa Sato |
| | (30 MHz - 1000 MHz) | (1 GHz – 26.5 GHz) |
| Mode | Tx BT LE, 2402 MHz | |

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 59.998 | QP | 42.50 | 8.20 | 7.27 | 31.84 | 0.00 | 26.13 | 40.0 | 13.8 | 363 | 215 | |
| Hori. | 133.197 | QP | 38.70 | 13.98 | 8.53 | 31.81 | 0.00 | 29.40 | 43.5 | 14.1 | 127 | 218 | |
| Hori. | 324.804 | QP | 39.80 | 14.39 | 7.45 | 31.77 | 0.00 | 29.87 | 46.0 | 16.1 | 100 | 233 | |
| Hori. | 420.798 | QP | 35.80 | 16.07 | 8.08 | 31.83 | 0.00 | 28.12 | 46.0 | 17.8 | 230 | 72 | |
| Hori. | 750.400 | QP | 25.50 | 20.17 | 9.20 | 31.93 | 0.00 | 22.94 | 46.0 | 23.0 | 100 | 112 | |
| Hori. | 914.462 | QP | 25.80 | 22.07 | 9.90 | 31.23 | 0.00 | 26.54 | 46.0 | 19.4 | 100 | 133 | |
| Hori. | 987.945 | QP | 23.40 | 22.33 | 10.22 | 30.65 | 0.00 | 25.30 | 53.9 | 28.6 | 100 | 120 | |
| Hori. | 2390.000 | PK | 46.48 | 28.31 | 14.62 | 39.59 | 2.43 | 52.25 | 73.9 | 21.6 | 193 | 148 | |
| Hori. | 4804.000 | PK | 46.55 | 31.60 | 7.10 | 39.75 | 2.43 | 47.93 | 73.9 | 25.9 | 170 | 275 | |
| Hori. | 7206.000 | PK | 46.05 | 37.15 | 9.00 | 39.53 | 2.43 | 55.10 | 73.9 | 18.8 | 150 | 0 | |
| Vert. | 60.256 | QP | 45.10 | 8.17 | 7.27 | 31.84 | 0.00 | 28.70 | 40.0 | **11.3** | 100 | 158 | |
| Vert. | 586.041 | QP | 24.00 | 18.85 | 8.52 | 31.95 | 0.00 | 19.42 | 46.0 | 26.5 | 100 | 308 | |
| Vert. | 2390.000 | PK | 45.89 | 28.31 | 14.62 | 39.59 | 2.43 | 51.66 | 73.9 | 22.2 | 129 | 262 | |
| Vert. | 4804.000 | PK | 47.00 | 31.60 | 7.10 | 39.75 | 2.43 | 48.38 | 73.9 | 25.5 | 168 | 321 | |
| Vert. | 7206.000 | PK | 46.65 | 37.15 | 9.00 | 39.53 | 2.43 | 55.70 | 73.9 | 18.2 | 150 | 0 | |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

**Average measurement value with duty factor**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2390.000 | AV | 36.07 | 28.31 | 14.62 | 39.59 | 4.06 | 2.43 | 45.90 | 53.9 | 8.0 | *1) |
| Hori. | 4804.000 | AV | 38.98 | 31.60 | 7.10 | 39.75 | 4.06 | 2.43 | 44.42 | 53.9 | 9.4 | |
| Hori. | 7206.000 | AV | 35.95 | 37.15 | 9.00 | 39.53 | 4.06 | 2.43 | 49.06 | 53.9 | **4.8** | |
| Vert. | 2390.000 | AV | 36.37 | 28.31 | 14.62 | 39.59 | 4.06 | 2.43 | 46.20 | 53.9 | 7.7 | *1) |
| Vert. | 4804.000 | AV | 38.80 | 31.60 | 7.10 | 39.75 | 4.06 | 2.43 | 44.24 | 53.9 | 9.6 | |
| Vert. | 7206.000 | AV | 35.47 | 37.15 | 9.00 | 39.53 | 4.06 | 2.43 | 48.58 | 53.9 | 5.3 | |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 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)

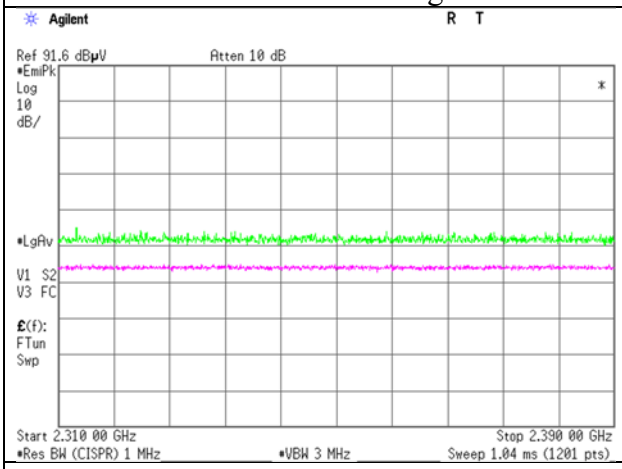
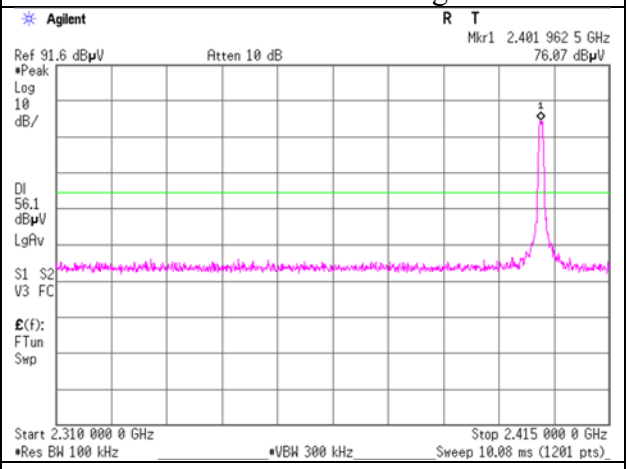
**20 dBc Data Sheet** **(RBW 100 kHz, VBW 300 kHz)**

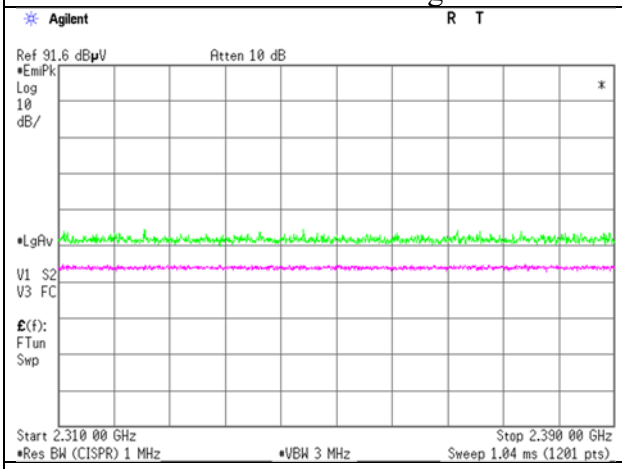
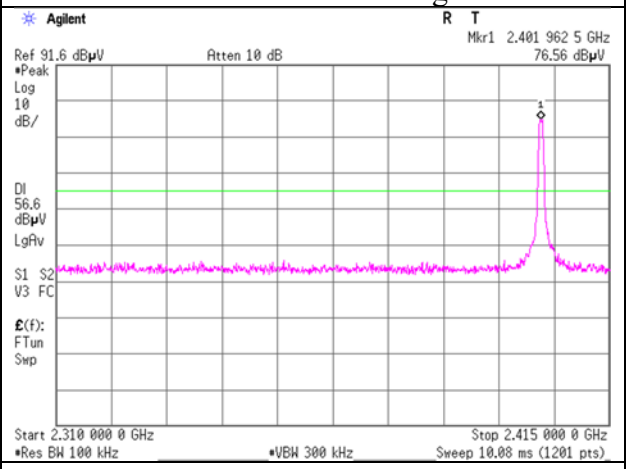
| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2402.000 | PK | 75.56 | 28.28 | 14.63 | 39.59 | 2.43 | 81.31 | - | - | Carrier |
| Hori. | 2400.000 | PK | 41.91 | 28.29 | 14.63 | 39.59 | 2.43 | 47.67 | 61.3 | 13.6 | |
| Vert. | 2402.000 | PK | 76.29 | 28.28 | 14.63 | 39.59 | 2.43 | 82.04 | - | - | Carrier |
| Vert. | 2400.000 | PK | 41.03 | 28.29 | 14.63 | 39.59 | 2.43 | 46.79 | 62.0 | 15.2 | |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. |
| Semi Anechoic Chamber | No.1 |
| Date | September 3, 2019 |
| Temperature / Humidity | 24 deg. C / 51 % RH |
| Engineer | Hiromasa Sato |
| | (1 GHz – 26.5 GHz) |
| Mode | Tx BT LE, 2402 MHz |

| Horizontal | |
|---|---|
| Restricted-band band-edge Plot | Authorized-band band-edge Plot |
|  |  |
| Trace Green : Peak Plot<br>Trace Purple : Average Plot | 20dBc Plot |

| Vertical | |
|---|---|
| Restricted-band band-edge Plot | Authorized-band band-edge Plot |
|  |  |
| Trace Green : Peak Plot<br>Trace Purple : Average Plot | 20dBc Plot |

* 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. | 12851267S-A-R1 | |
| Test place | Shonan EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.1 |
| Date | September 2, 2019 | September 3, 2019 |
| Temperature / Humidity | 23 deg. C / 56 % RH | 24 deg. C / 51 % RH |
| Engineer | Toshinori Yamada | Hiromasa Sato |
| | (30 MHz - 1000 MHz) | (1 GHz – 26.5 GHz) |
| Mode | Tx BT LE, 2440 MHz | |

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 60.200 | QP | 42.20 | 8.18 | 7.28 | 31.84 | 0.00 | 25.82 | 40.0 | 14.1 | 356 | 208 | |
| Hori. | 133.193 | QP | 40.00 | 13.98 | 8.53 | 31.81 | 0.00 | 30.70 | 43.5 | 12.8 | 136 | 212 | |
| Hori. | 324.746 | QP | 39.00 | 14.39 | 7.45 | 31.77 | 0.00 | 29.07 | 46.0 | 16.9 | 100 | 243 | |
| Hori. | 420.796 | QP | 33.70 | 16.07 | 8.08 | 31.83 | 0.00 | 26.02 | 46.0 | 19.9 | 241 | 77 | |
| Hori. | 750.569 | QP | 27.60 | 20.17 | 9.20 | 31.93 | 0.00 | 25.04 | 46.0 | 20.9 | 100 | 98 | |
| Hori. | 914.460 | QP | 26.20 | 22.07 | 9.90 | 31.23 | 0.00 | 26.94 | 46.0 | 19.0 | 100 | 122 | |
| Hori. | 986.835 | QP | 23.00 | 22.32 | 10.22 | 30.66 | 0.00 | 24.88 | 53.9 | 29.0 | 100 | 120 | |
| Hori. | 4880.000 | PK | 47.13 | 31.66 | 7.14 | 39.74 | 2.43 | 48.62 | 73.9 | 25.2 | 151 | 281 | |
| Hori. | 7320.000 | PK | 44.50 | 37.24 | 9.03 | 39.60 | 2.43 | 53.60 | 73.9 | 20.3 | 150 | 0 | |
| Vert. | 60.194 | QP | 45.40 | 8.18 | 7.28 | 31.84 | 0.00 | 29.02 | 40.0 | **10.9** | 100 | 155 | |
| Vert. | 586.041 | QP | 24.20 | 18.85 | 8.52 | 31.95 | 0.00 | 19.62 | 46.0 | 26.3 | 100 | 302 | |
| Vert. | 4880.000 | PK | 46.63 | 31.66 | 7.14 | 39.74 | 2.43 | 48.12 | 73.9 | 25.7 | 185 | 147 | |
| Vert. | 7320.000 | PK | 44.28 | 37.24 | 9.03 | 39.60 | 2.43 | 53.38 | 73.9 | 20.5 | 156 | 78 | |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

**Average measurement value with duty factor**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 4880.000 | AV | 38.64 | 31.66 | 7.14 | 39.74 | 4.06 | 2.43 | 44.19 | 53.9 | 9.7 | |
| Hori. | 7320.000 | AV | 35.13 | 37.24 | 9.03 | 39.60 | 4.06 | 2.43 | 48.29 | 53.9 | 5.6 | |
| Vert. | 4880.000 | AV | 38.11 | 31.66 | 7.14 | 39.74 | 4.06 | 2.43 | 43.66 | 53.9 | 10.2 | |
| Vert. | 7320.000 | AV | 35.39 | 37.24 | 9.03 | 39.60 | 4.06 | 2.43 | 48.55 | 53.9 | **5.3** | |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 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)

# Radiated Spurious Emission

| | | |
|---|---|---|
| Report No. | 12851267S-A-R1 | |
| Test place | Shonan EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.1 |
| Date | September 2, 2019 | September 3, 2019 |
| Temperature / Humidity | 23 deg. C / 56 % RH | 24 deg. C / 51 % RH |
| Engineer | Toshinori Yamada | Hiromasa Sato |
| | (30 MHz - 1000 MHz) | (1 GHz – 26.5 GHz) |
| Mode | Tx BT LE, 2480 MHz | |

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

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Height [cm] | Angle [deg] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 59.992 | QP | 42.90 | 8.20 | 7.27 | 31.84 | 0.00 | 26.53 | 40.0 | 13.4 | 336 | 211 | |
| Hori. | 133.194 | QP | 40.10 | 13.98 | 8.53 | 31.81 | 0.00 | 30.80 | 43.5 | 12.7 | 137 | 203 | |
| Hori. | 324.855 | QP | 39.30 | 14.39 | 7.45 | 31.77 | 0.00 | 29.37 | 46.0 | 16.6 | 100 | 223 | |
| Hori. | 420.780 | QP | 33.50 | 16.07 | 8.08 | 31.83 | 0.00 | 25.82 | 46.0 | 20.1 | 253 | 72 | |
| Hori. | 750.627 | QP | 25.90 | 20.18 | 9.20 | 31.93 | 0.00 | 23.35 | 46.0 | 22.6 | 100 | 99 | |
| Hori. | 914.453 | QP | 24.40 | 22.07 | 9.90 | 31.23 | 0.00 | 25.14 | 46.0 | 20.8 | 100 | 151 | |
| Hori. | 987.976 | QP | 22.30 | 22.33 | 10.22 | 30.65 | 0.00 | 24.20 | 53.9 | 29.7 | 100 | 123 | |
| Hori. | 2483.500 | PK | 54.43 | 28.16 | 14.71 | 39.62 | 2.43 | 60.11 | 73.9 | 13.7 | 241 | 142 | |
| Hori. | 4960.000 | PK | 47.06 | 31.83 | 7.18 | 39.72 | 2.43 | 48.78 | 73.9 | 25.1 | 148 | 272 | |
| Hori. | 7440.000 | PK | 44.39 | 37.38 | 9.04 | 39.68 | 2.43 | 53.56 | 73.9 | 20.3 | 150 | 0 | |
| Vert. | 59.963 | QP | 45.30 | 8.21 | 7.27 | 31.84 | 0.00 | 28.94 | 40.0 | **11.0** | 100 | 154 | |
| Vert. | 586.041 | QP | 23.70 | 18.85 | 8.52 | 31.95 | 0.00 | 19.12 | 46.0 | 26.8 | 100 | 302 | |
| Vert. | 2483.500 | PK | 53.04 | 28.16 | 14.71 | 39.62 | 2.43 | 58.72 | 73.9 | 15.1 | 126 | 263 | |
| Vert. | 4960.000 | PK | 45.79 | 31.83 | 7.18 | 39.72 | 2.43 | 47.51 | 73.9 | 26.3 | 129 | 153 | |
| Vert. | 7440.000 | PK | 43.73 | 37.38 | 9.04 | 39.68 | 2.43 | 52.90 | 73.9 | 21.0 | 150 | 0 | |

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

**Average measurement value with duty factor**

| Polarity | Frequency [MHz] | Detector | Reading [dBuV] | Ant.Fac. [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Distance Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2483.500 | AV | 37.02 | 28.16 | 14.71 | 39.62 | 4.06 | 2.43 | 46.76 | 53.9 | 7.1 | *1) |
| Hori. | 4960.000 | AV | 37.88 | 31.83 | 7.18 | 39.72 | 4.06 | 2.43 | 43.66 | 53.9 | 10.2 | |
| Hori. | 7440.000 | AV | 35.50 | 37.38 | 9.04 | 39.68 | 4.06 | 2.43 | 48.73 | 53.9 | **5.1** | |
| Vert. | 2483.500 | AV | 36.77 | 28.16 | 14.71 | 39.62 | 4.06 | 2.43 | 46.51 | 53.9 | 7.3 | *1) |
| Vert. | 4960.000 | AV | 37.43 | 31.83 | 7.18 | 39.72 | 4.06 | 2.43 | 43.21 | 53.9 | 10.6 | |
| Vert. | 7440.000 | AV | 35.55 | 37.38 | 9.04 | 39.68 | 4.06 | 2.43 | 48.78 | 53.9 | **5.1** | |

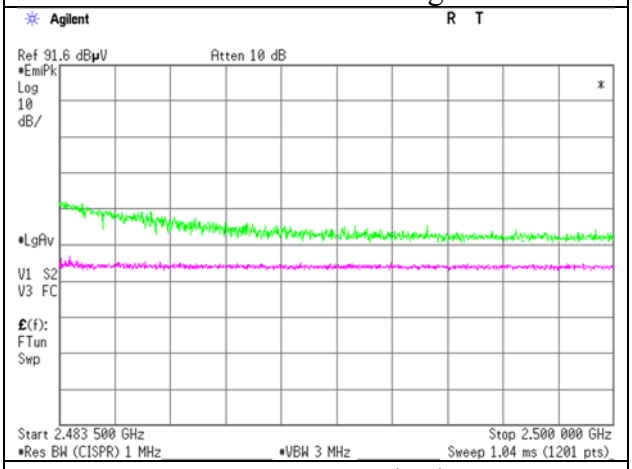
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.965 m / 3.0 m) = 2.43 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.
*1) Not out of band emission (Leakage Power)

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

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. |
| Semi Anechoic Chamber | No.1 |
| Date | September 3, 2019 |
| Temperature / Humidity | 24 deg. C / 51 % RH |
| Engineer | Hiromasa Sato |
| | (1 GHz – 26.5 GHz) |
| Mode | Tx BT LE, 2480 MHz |

Horizontal

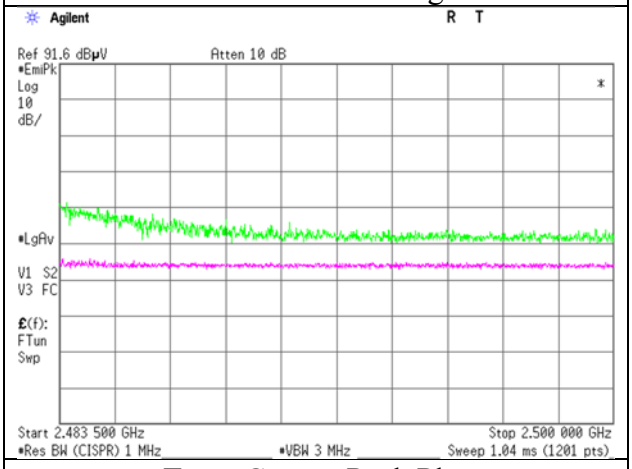
Restricted-band band-edge Plot




Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

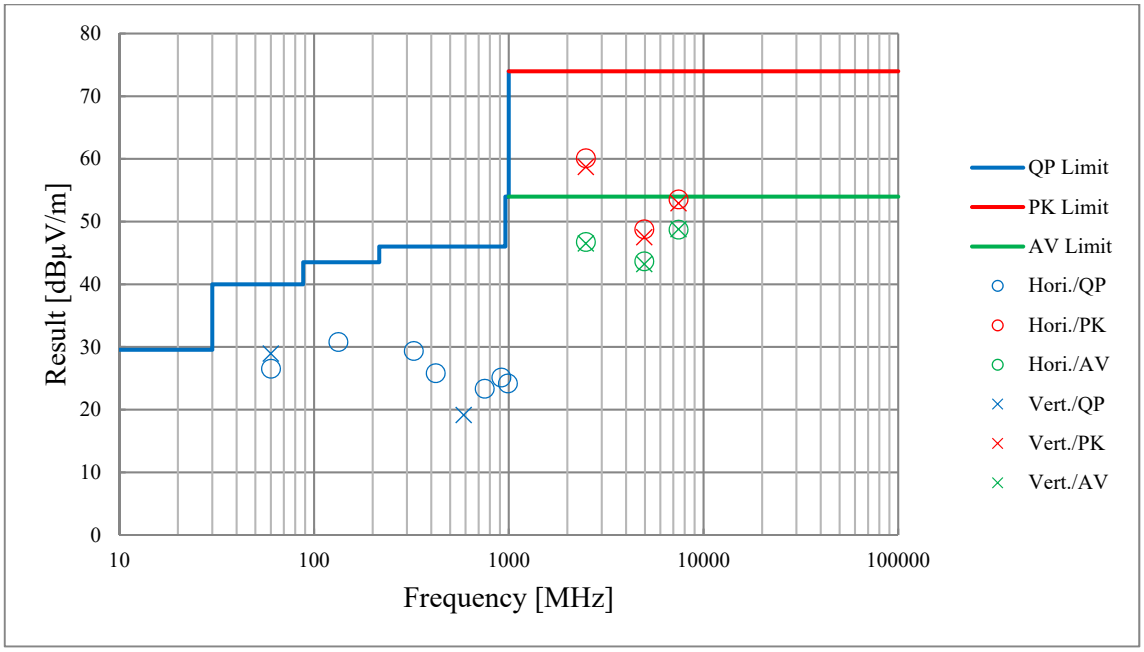



Trace Green : Peak Plot
Trace Purple : Average Plot

* 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. | 12851267S-A-R1 | |
| Test place | Shonan EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.1 |
| Date | September 2, 2019 | September 3, 2019 |
| Temperature / Humidity | 23 deg. C / 56 % RH | 24 deg. C / 51 % RH |
| Engineer | Toshinori Yamada | Hiromasa Sato |
| | (30 MHz - 1000 MHz) | (1 GHz – 26.5 GHz) |
| Mode | Tx BT LE, 2480 MHz | |

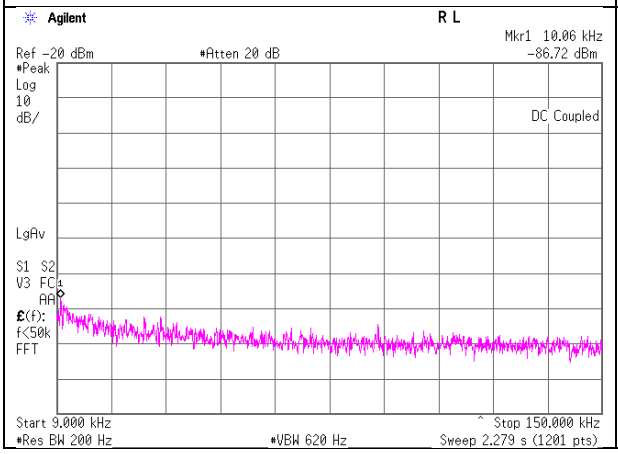



*These plots data contains sufficient number to show the trend of characteristic features for EUT.

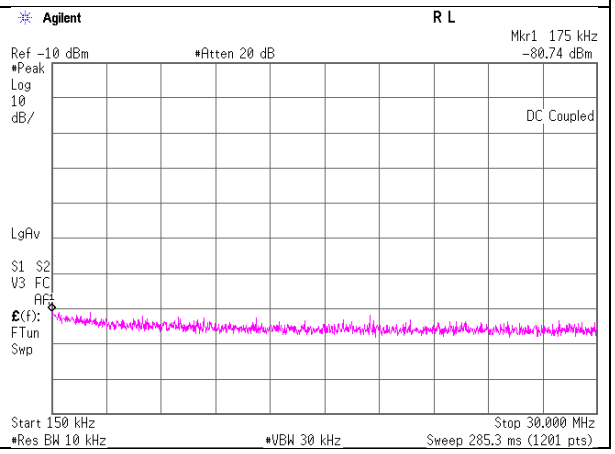
# Conducted Spurious Emission

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.3 Shielded Room |
| Date | October 29, 2019 |
| Temperature / Humidity | 23 deg. C / 47 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE 2480 MHz |

## 9 kHz - 150 kHz




## 150 kHz - 30 MHz




| Frequency [kHz] | Reading [dBm] | Cable Loss [dB] | Attenuator Loss [dB] | Antenna Gain* [dBi] | N (Number of Output) | EIRP [dBm] | Distance [m] | Ground bounce [dB] | E (field strength) [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10.06 | -86.72 | 0.01 | 9.7 | 2.0 | 1 | -75.0 | 300 | 6.0 | -13.7 | 47.5 | 61.2 | |
| 175.00 | -80.74 | 0.01 | 9.7 | 2.0 | 1 | -69.0 | 300 | 6.0 | -7.7 | 22.7 | 30.4 | |

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

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

N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

# Power Density

| | |
|---|---|
| Report No. | 12851267S-A-R1 |
| Test place | Shonan EMC Lab. No.3 Shielded Room |
| Date | October 29, 2019 |
| Temperature / Humidity | 23 deg. C / 47 % RH |
| Engineer | Hiromasa Sato |
| Mode | Tx BT LE |

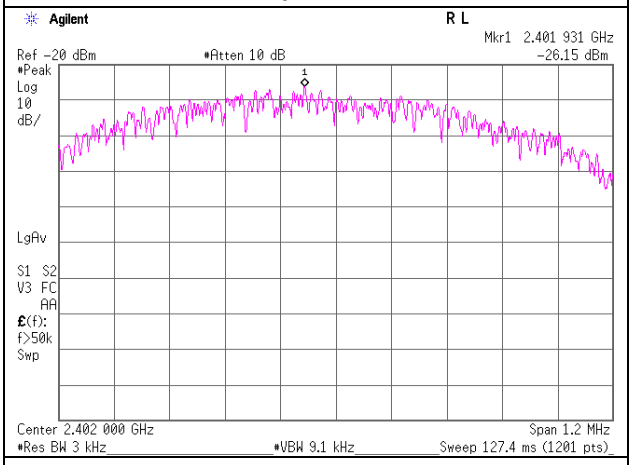
| Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. Loss [dB] | Result [dBm] | Limit [dBm] | Margin [dB] |
|---|---|---|---|---|---|---|
| 2402 | -26.15 | 1.28 | 9.82 | -15.05 | 8.00 | 23.05 |
| 2440 | -26.34 | 1.29 | 9.82 | -15.23 | 8.00 | 23.23 |
| 2480 | -26.66 | 1.30 | 9.82 | -15.54 | 8.00 | 23.54 |

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

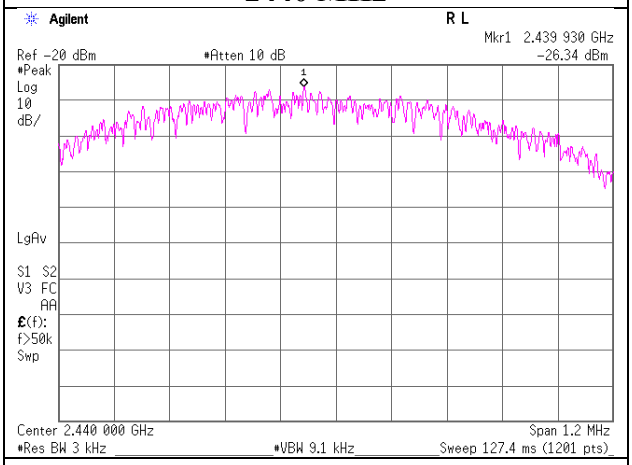
# Power Density

## BT LE

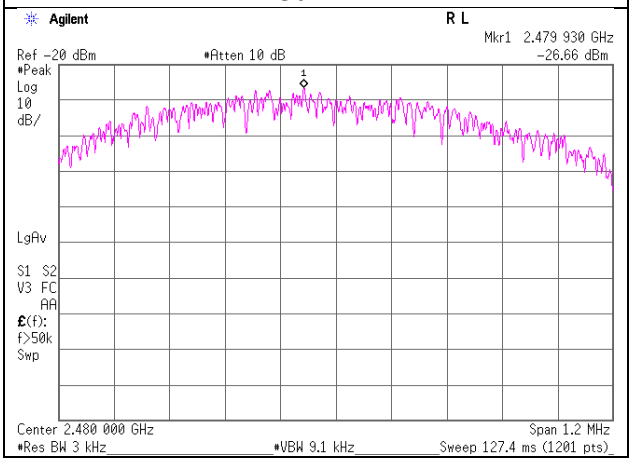
### 2402 MHz




### 2440 MHz




### 2480 MHz



# APPENDIX 2: Test instruments

**Test Instruments (1 / 2)**

| Local ID | Test Name | LIMS ID | Description | Manufacturer | Model | Serial | Last Calibration Date | Calibration Due Date | Calibration Interval (Month) |
|---|---|---|---|---|---|---|---|---|---|
| SAT10-14 | AT | 154591 | Attenuator | Weinschel Corp. | 54A-10 | 81595 | 2019/4/16 | 2020/4/30 | 12 |
| SCC-G12 | AT | 145040 | Coaxial Cable | Suhner | SUCOFLEX 102 | 30790/2 | 2019/3/27 | 2020/3/31 | 12 |
| SOS-06 | AT | 146294 | Humidity Indicator | A&D | AD-5681 | 4062118 | 2018/12/5 | 2019/12/31 | 12 |
| SPM-07 | AT | 146247 | Power Meter | AGILENT | 8990B | MY51002722 | 2019/7/16 | 2020/7/31 | 12 |
| SPSS-04 | AT | 146310 | Power sensor | AGILENT | N1923A | MY53260009 | 2019/7/16 | 2020/7/31 | 12 |
| SRENT-15 | AT | 160899 | Spectrum Analyzer | AGILENT (KEYSIGHT) | E4440A | MY46185516 | 2019/1/21 | 2020/1/31 | 12 |
| COTS-SEMI-5 | RE | 170932 | EMI Software | TSJ | TEPTO-DV3(RE,CE,ME,PE) | - | - | - | - |
| KAT6-04 | RE | 144899 | Attenuator | Inmet | 18N-6dB | - | 2018/12/25 | 2019/12/31 | 12 |
| KBA-01 | RE | 146343 | Biconical Antenna | Schwarzbeck | BBA9106 | 1748 | 2019/6/5 | 2020/6/30 | 12 |
| KJM-09 | RE | 145929 | Measure | KOMELON | KMC-36 | - | - | - | - |
| SAEC-01(NSA) | RE | 145597 | Semi-Anechoic Chamber | TDK | SAEC-01(NSA) | 1 | 2019/4/2 | 2020/4/30 | 12 |
| SAEC-01(SVSWR) | RE | 145561 | Semi-Anechoic Chamber | TDK | SAEC-01(SVSWR) | 1 | 2019/5/6 | 2020/5/30 | 12 |
| SAF-01 | RE | 145003 | Pre Amplifier | SONOMA | 310N | 290211 | 2019/2/5 | 2020/2/29 | 12 |
| SAF-04 | RE | 145127 | Pre Amplifier | Toyo Corporation | TPA0118-36 | 2072554 | 2019/6/4 | 2020/6/30 | 12 |
| SAF-08 | RE | 145007 | Pre Amplifier | Toyo Corporation | HAP18-26W | 19 | 2019/3/5 | 2020/3/31 | 12 |
| SAT10-05 | RE | 145136 | Attenuator(above1GHz) | AGILENT | 8493C-010 | 74864 | 2018/11/25 | 2019/11/30 | 12 |
| SAT3-09 | RE | 144959 | Attenuator | JFW | 50HF-003N | - | 2019/8/6 | 2020/8/31 | 12 |

## Test Instruments (2/ 2)

| Local ID | Test Name | LIMS ID | Description | Manufacturer | Model | Serial | Last Calibration Date | Calibration Due Date | Calibration Interval (Month) |
|---|---|---|---|---|---|---|---|---|---|
| SCC-A1/A3/A5/A7/A8/A13/SRSE-01 | RE | 144967 | Coaxial Cable&RF Selector | Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO | 8D2W/12DSFA/141PE/141PE/141PE/141P | -/0901-269(RF Selector) | 2019/4/19 | 2020/4/30 | 12 |
| SCC-A2/A4/A6/A7/A8/A13/SRSE-01 | RE | 144968 | Coaxial Cable&RF Selector | Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO | 8D2W/12DSFA/141PE/141PE/141PE/141P | -/0901-269(RF Selector) | 2019/4/19 | 2020/4/30 | 12 |
| SCC-G05 | RE | 145039 | Coaxial Cable | Junkosha | J12J102207-00 | APR-30-15-037 | 2019/1/25 | 2020/1/31 | 12 |
| SCC-G15 | RE | 145176 | Coaxial Cable | Suhner | SUCOFLEX 102 | 32703/2 | 2019/3/27 | 2020/3/31 | 12 |
| SCC-G41 | RE | 151617 | Coaxial Cable | Junkosha | MWX221-01000NFSNMS/B | 1612S006 | 2019/1/25 | 2020/1/31 | 12 |
| SCC-G56 | RE | 179539 | Coaxial Cable | Huber+Suhner | SUCOFLEX 104 | 803289/4 | 2019/5/16 | 2020/5/31 | 12 |
| SCC-G57 | RE | 179540 | Coaxial Cable | Huber+Suhner | SUCOFLEX 102 | 802815/2 | 2019/5/16 | 2020/5/31 | 12 |
| SFL-02 | RE | 145301 | Highpass Filter | MICRO-TRONICS | HPM50111 | 51 | 2018/11/16 | 2019/11/30 | 12 |
| SHA-01 | RE | 145383 | Horn Antenna | Schwarzbeck | BBHA9120D | 9120D-725 | 2019/5/9 | 2020/5/31 | 12 |
| SHA-04 | RE | 145512 | Horn Antenna | ETS LINDGREN | 3160-09 | 94868 | 2019/6/26 | 2020/6/30 | 12 |
| SLA-05 | RE | 145527 | Logperiodic Antenna | Schwarzbeck | VUSLP9111B | 193 | 2019/4/1 | 2020/4/30 | 12 |
| SOS-01 | RE | 146316 | Humidity Indicator | A&D | AD-5681 | 4062555 | 2018/10/25 | 2019/10/31 | 12 |
| SSA-02 | RE | 145800 | Spectrum Analyzer | AGILENT | E4448A | MY48250106 | 2019/4/4 | 2020/4/30 | 12 |
| STR-01 | RE | 145790 | Test Receiver | Rohde & Schwarz | ESU40 | 100093 | 2019/4/14 | 2020/4/30 | 12 |
| STS-01 | RE | 145792 | Digital Hitester | HIOKI | 3805-50 | 80997812 | 2019/10/1 | 2020/10/31 | 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: RE: Radiated Emission test**
**AT: Antenna terminal conducted test**