# RADIO TEST REPORT

## Test Report No. 14299869H-A-R2

| | |
|---|---|
| **Customer** | **DENSO TEN Limited** |
| **Description of EUT** | **Car Audio** |
| **Model Number of EUT** | **TN0036A** |
| **FCC ID** | **BABTN0036A** |
| **Test Regulation** | **FCC Part 15 Subpart C** |
| **Test Result** | **Complied (Refer to SECTION 3)** |
| **Issue Date** | **November 27, 2023** |
| **Remarks** | **-** |

| **Representative Test Engineer** | **Approved By** |
|---|---|
| Y. Yamazaki | Ryota Yamanaka |
| Yuichiro Yamazaki<br>Engineer | Ryota Yamanaka<br>Engineer |

CERTIFICATE 5107.02

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# REVISION HISTORY

## Original Test Report No.: 14299869H-A

This report is a revised version of 14299869H-A-R1. 14299869H-A-R1 is replaced with this report.

| Revision | Test Report No. | Date | Page Revised Contents |
|---|---|---|---|
| -<br>(Original) | 14299869H-A | May 20, 2022 | - |
| 1 | 14299869H-A-R1 | November 7, 2023 | P.5 Section 2.2<br>Correction of Antenna Gain:<br>Bluetooth: from -0.86 dBi to -0.84 dBi<br>WLAN: from 4.31 dBi to 2.90 dBi |
| 1 | 14299869H-A-R1 | November 7, 2023 | P.24 Maximum Peak Output Power<br>Recalculation of e.i.r.p. by Antenna Gain changed |
| 2 | 14299869H-A-R2 | November 27, 2023 | P.5 SECTION 2.1<br>Correction of Sample Receipt Date from November 20, 2021 to April 24, 2024 |
| 2 | 14299869H-A-R2 | November 27, 2023 | P.5 SECTION 2.2<br>Deletion of sentence about simultaneous transmission |
| 2 | 14299869H-A-R2 | November 27, 2023 | P.11<br>Correction of No.10 Cable information:<br>- Cable name: from Signal Cable to USB Cable<br>- Shield (Cable and Connector) from Unshielded to Shielded |

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

| | | | |
|---|---|---|---|
| A2LA | The American Association for Laboratory Accreditation | ICES | Interference-Causing Equipment Standard |
| AC | Alternating Current | IEC | International Electrotechnical Commission |
| AFH | Adaptive Frequency Hopping | IEEE | Institute of Electrical and Electronics Engineers |
| AM | Amplitude Modulation | IF | Intermediate Frequency |
| Amp, AMP | Amplifier | ILAC | International Laboratory Accreditation Conference |
| ANSI | American National Standards Institute | ISED | Innovation, Science and Economic Development Canada |
| Ant, ANT | Antenna | ISO | International Organization for Standardization |
| AP | Access Point | JAB | Japan Accreditation Board |
| ASK | Amplitude Shift Keying | LAN | Local Area Network |
| Atten., ATT | Attenuator | LIMS | Laboratory Information Management System |
| AV | Average | MCS | Modulation and Coding Scheme |
| BPSK | Binary Phase-Shift Keying | MRA | Mutual Recognition Arrangement |
| BR | Bluetooth Basic Rate | N/A | Not Applicable |
| BT | Bluetooth | NIST | National Institute of Standards and Technology |
| BT LE | Bluetooth Low Energy | NS | No signal detect. |
| BW | BandWidth | NSA | Normalized Site Attenuation |
| Cal Int | Calibration Interval | NVLAP | National Voluntary Laboratory Accreditation Program |
| CCK | Complementary Code Keying | OBW | Occupied Band Width |
| Ch., CH | Channel | OFDM | Orthogonal Frequency Division Multiplexing |
| CISPR | Comite International Special des Perturbations Radioelectriques | P/M | Power meter |
| CW | Continuous Wave | PCB | Printed Circuit Board |
| DBPSK | Differential BPSK | PER | Packet Error Rate |
| DC | Direct Current | PHY | Physical Layer |
| D-factor | Distance factor | PK | Peak |
| DFS | Dynamic Frequency Selection | PN | Pseudo random Noise |
| DQPSK | Differential QPSK | PRBS | Pseudo-Random Bit Sequence |
| DSSS | Direct Sequence Spread Spectrum | PSD | Power Spectral Density |
| EDR | Enhanced Data Rate | QAM | Quadrature Amplitude Modulation |
| EIRP, e.i.r.p. | Equivalent Isotropically Radiated Power | QP | Quasi-Peak |
| EMC | ElectroMagnetic Compatibility | QPSK | Quadri-Phase Shift Keying |
| EMI | ElectroMagnetic Interference | RBW | Resolution Band Width |
| EN | European Norm | RDS | Radio Data System |
| ERP, e.r.p. | Effective Radiated Power | RE | Radio Equipment |
| EU | European Union | RF | Radio Frequency |
| EUT | Equipment Under Test | RMS | Root Mean Square |
| Fac. | Factor | RSS | Radio Standards Specifications |
| FCC | Federal Communications Commission | Rx | Receiving |
| FHSS | Frequency Hopping Spread Spectrum | SA, S/A | Spectrum Analyzer |
| FM | Frequency Modulation | SG | Signal Generator |
| Freq. | Frequency | SVSWR | Site-Voltage Standing Wave Ratio |
| FSK | Frequency Shift Keying | TR | Test Receiver |
| GFSK | Gaussian Frequency-Shift Keying | Tx | Transmitting |
| GNSS | Global Navigation Satellite System | VBW | Video BandWidth |
| GPS | Global Positioning System | Vert. | Vertical |
| Hori. | Horizontal | WLAN | Wireless LAN |

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# SECTION 1: Customer Information

| | |
|---|---|
| Company Name | DENSO TEN Limited |
| Address | 2-28, Gosho-dori 1-Chome, Hyogo-ku, Kobe 652-8510 JAPAN |
| Telephone Number | +81-78-682-2159 |
| Contact Person | Kaoru Abe |

The information provided from the customer is as follows;
- Customer, Description of EUT, Model Number of EUT, 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 (EUT) other than the Receipt Date and Test Date
- SECTION 4: Operation of EUT 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 (EUT)

## 2.1 Identification of EUT

| | |
|---|---|
| Description | Car Audio |
| Model Number | TN0036A |
| Serial Number | Refer to SECTION 4.2 |
| Condition | Engineering prototype<br>(Not for Sale: This sample is equivalent to mass-produced items.) |
| Modification | No Modification by the test lab |
| Receipt Date | April 24, 2022 |
| Test Date | April 24 to May 10, 2022 |

## 2.2 Product Description

**General Specification**

| | |
|---|---|
| Rating | DC 12 V |
| Operating temperature | -20 deg. C to +65 deg. C (Performance assured temperature range) |

**Radio Specification**

**Bluetooth (BR / EDR)**

| | |
|---|---|
| Equipment Type | Transceiver |
| Frequency of Operation | 2402 MHz to 2480 MHz |
| Type of Modulation | FHSS (GFSK, π/4 DQPSK, 8 DPSK) |
| Antenna Gain | -0.84 dBi (peak) |

**WLAN (IEEE802.11a/11n-20)**

| | | |
|---|---|---|
| Equipment Type | Transceiver | |
| Frequency of Operation | 20 MHz Band: | 5765 MHz |
| Type of Modulation | OFDM | |
| Antenna Gain | 2.90 dBi (peak) | |

* This test report applies to Bluetooth part.

# SECTION 3: Test Specification, Procedures & Results

## 3.1 Test Specification

| | |
|---|---|
| Test Specification | FCC Part 15 Subpart C<br>FCC Part 15 final revised on April 1, 2022 and effective May 2, 2022 |
| Title | FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators<br>Section 15.207 Conducted limits<br>Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz |

* The revision does not affect the test result conducted before its effective date.

## 3.2 Procedures and Results

| Item | Test Procedure | Specification | Worst Margin | Results | Remarks |
|---|---|---|---|---|---|
| Conducted Emission | ANSI C63.10-2013<br>6. Standard test methods | Section 15.207 | **N/A** | N/A | *1) |
| Carrier Frequency Separation | KDB 558074 D01 15.247 Meas Guidance v05r02 | Section15.247(a)(1) | See data. | Complied a) | Conducted |
| 20dB Bandwidth | KDB 558074 D01 15.247 Meas Guidance v05r02 | Section15.247(a)(1) | | Complied a) | Conducted |
| Number of Hopping Frequency | KDB 558074 D01 15.247 Meas Guidance v05r02 | Section15.247(a)(1)(iii) | | Complied b) | Conducted |
| Dwell time | KDB 558074 D01 15.247 Meas Guidance v05r02 | Section15.247(a)(1)(iii) | | Complied c) | Conducted |
| Maximum Peak Output Power | KDB 558074 D01 15.247 Meas Guidance v05r02 | Section15.247(a)(b)(1) | | Complied d) | Conducted |
| Spurious Emission & Band Edge Compliance | KDB 558074 D01 15.247 Meas Guidance v05r02 | Section15.247(d) | 11.5 dB<br>926.3 MHz, QP, Hori. | Complied e) / f) | Conducted/ Radiated (above 30 MHz) *1) |

Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593.
* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.
*2) Radiated test was selected over 30 MHz based on section 15.247(d).

a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)
b) Refer to APPENDIX 1 (data of Number of Hopping Frequency)
c) Refer to APPENDIX 1 (data of Dwell time)
d) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
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

**FCC Part 15.31 (e)**

This EUT provides stable voltage constantly to RF Module regardless of input voltage. Therefore, this 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 of Section 15.203.

## 3.3 Addition to Standard

| Item | Test Procedure | Specification | Worst Margin | Results | Remarks |
|---|---|---|---|---|---|
| 99% Occupied Bandwidth | **ISED:** RSS-Gen 6.7 | **ISED:** - | N/A | -<br>a) | Conducted |
| a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation) | | | | | |

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.

**Radiated emission**

| Measurement distance | Frequency range | | Uncertainty (+/-) |
|---|---|---|---|
| 3 m | 9 kHz to 30 MHz | | 3.2 dB |
| 10 m | | | 3.0 dB |
| 3 m | 30 MHz to 200 MHz | Horizontal | 4.8 dB |
| | | Vertical | 5.0 dB |
| | 200 MHz to 1000 MHz | Horizontal | 5.1 dB |
| | | Vertical | 6.2 dB |
| 10 m | 30 MHz to 200 MHz | Horizontal | 4.8 dB |
| | | Vertical | 4.8 dB |
| | 200 MHz to 1000 MHz | Horizontal | 5.0 dB |
| | | Vertical | 5.0 dB |
| 3 m | 1 GHz to 6 GHz | | 4.9 dB |
| | 6 GHz to 18 GHz | | 5.2 dB |
| 1 m | 10 GHz to 26.5 GHz | | 5.4 dB |
| | 26.5 GHz to 40 GHz | | 5.4 dB |
| 10 m | 1 GHz to 18 GHz | | 5.4 dB |

**Antenna Terminal test**

| Test Item | Uncertainty (+/-) |
|---|---|
| 20 dB Bandwidth / 99 % Occupied Bandwidth | 0.96 % |
| Maximum Peak Output Power / Average Output Power | 1.5 dB |
| Carrier Frequency Separation | 0.42 % |
| Dwell time / Burst rate | 0.10 % |
| Conducted Spurious Emission | 2.7 dB |

## 3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919
ISED Lab Company Number: 2973C / CAB identifier: JP0002
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 Japan
Telephone: +81-596-24-8999

| Test site | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms | Maximum measurement distance |
|---|---|---|---|---|
| No.1 semi-anechoic chamber | 19.2 x 11.2 x 7.7 | 7.0 x 6.0 | No.1 Power source room | 10 m |
| No.2 semi-anechoic chamber | 7.5 x 5.8 x 5.2 | 4.0 x 4.0 | - | 3 m |
| No.3 semi-anechoic chamber | 12.0 x 8.5 x 5.9 | 6.8 x 5.75 | No.3 Preparation room | 3 m |
| No.3 shielded room | 4.0 x 6.0 x 2.7 | N/A | - | - |
| No.4 semi-anechoic chamber | 12.0 x 8.5 x 5.9 | 6.8 x 5.75 | No.4 Preparation room | 3 m |
| No.4 shielded room | 4.0 x 6.0 x 2.7 | N/A | - | - |
| No.5 semi-anechoic chamber | 6.0 x 6.0 x 3.9 | 6.0 x 6.0 | - | - |
| No.5 measurement room | 6.4 x 6.4 x 3.0 | 6.4 x 6.4 | - | - |
| No.6 shielded room | 4.0 x 4.5 x 2.7 | 4.0 x 4.5 | - | - |
| No.6 measurement room | 4.75 x 5.4 x 3.0 | 4.75 x 4.15 | - | - |
| No.7 shielded room | 4.7 x 7.5 x 2.7 | 4.7 x 7.5 | - | - |
| No.8 measurement room | 3.1 x 5.0 x 2.7 | 3.1 x 5.0 | - | - |
| No.9 measurement room | 8.8 x 4.6 x 2.8 | 2.4 x 2.4 | - | - |
| No.10 shielded room | 3.8 x 2.8 x 2.8 | 3.8 x 2.8 | - | - |
| No.11 measurement room | 4.0 x 3.4 x 2.5 | N/A | - | - |
| No.12 measurement room | 2.6 x 3.4 x 2.5 | N/A | - | - |
| Large Chamber | 16.9 x 22.1 x 10.17 | 16.9 x 22.1 | - | 10 m |
| Small Chamber | 5.3 x 6.69 x 3.59 | 5.3 x 6.69 | - | - |

## 3.6 Test Data, Test Instruments, and Test Set Up

Refer to APPENDIX.

# SECTION 4: Operation of EUT during testing

## 4.1 Operating Mode(s)

| Mode | Remarks* |
|---|---|
| Bluetooth (BT) | BR / EDR, Payload: PRBS9 |

*EUT has the power settings by the software as follows;
Power Setting: BDR: +6.5 dBm
EDR: +6.0 dBm
Software: Diagnostics Mode Version: 1.0
(Date: November 25, 2021, Storage location: EUT memory)
*This setting of software is the worst case.
Any conditions under the normal use do not exceed the condition of setting.
In addition, end users cannot change the settings of the output power of the product.

Details of Operating Mode(s)

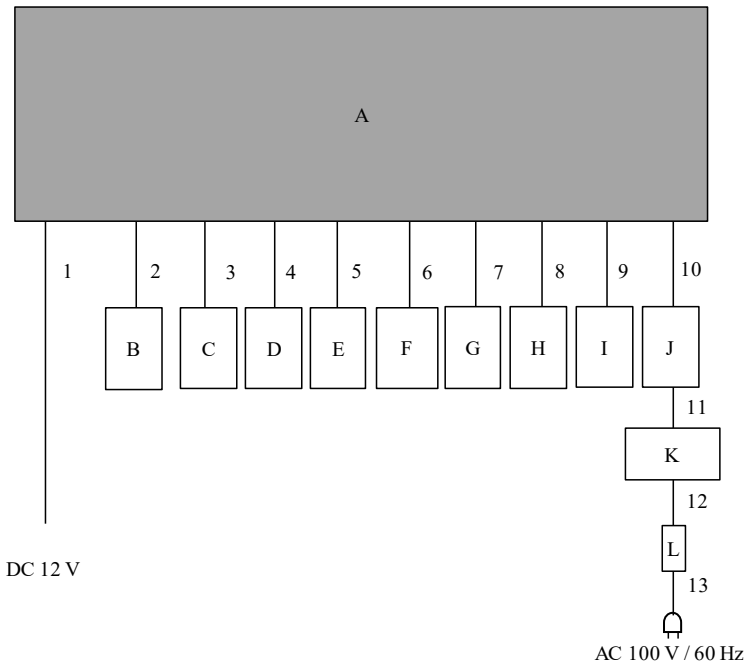
| Test Item | Mode | Hopping | Tested Frequency |
|---|---|---|---|
| Radiated Spurious Emission (Below 1 GHz) | Tx 3DH5 *1) | Off | 2402 MHz |
| Radiated Spurious Emission (Above 1 GHz)<br>Conducted Spurious Emission | Tx DH5<br>Tx 3DH5 | Off | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Carrier Frequency Separation | Tx DH5<br>Tx 3DH5 | On | 2402 MHz<br>2441 MHz<br>2480 MHz |
| 20dB Bandwidth | Tx DH5<br>Tx 3DH5 | Off | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Number of Hopping Frequency | Tx DH5<br>Tx 3DH5 | On | - |
| Dwell time | Tx DH1, DH3, DH5<br>Tx 3DH1, 3DH3, 3DH5 | On | - |
| Maximum Peak Output Power | Tx DH5<br>Tx 2DH5<br>Tx 3DH5 | Off | 2402 MHz<br>2441 MHz<br>2480 MHz |
| Band Edge Compliance<br>(Conducted) | Tx DH5<br>Tx 3DH5 | On<br>Off | 2402 MHz<br>2480 MHz |
| 99% Occupied Bandwidth | Tx DH5<br>Tx 3DH5 | On<br>Off | 2402 MHz<br>2441 MHz<br>2480 MHz |

*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)
*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.
*It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.

*1) Conducted emissions and Spurious emissions for frequencies below 1 GHz were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.

## 4.2 Configuration and Peripherals

**for Antenna Terminal test**




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

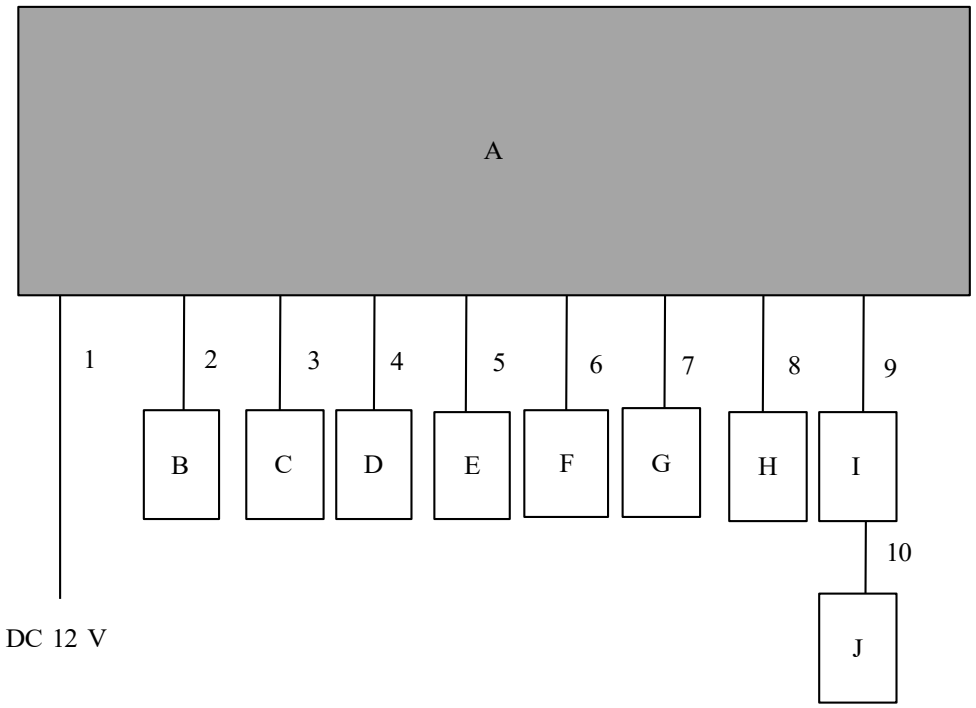
**Description of EUT and Support Equipment**

| No. | Item | Model Number | Serial Number | Manufacturer | Remarks |
|---|---|---|---|---|---|
| A | Car Audio | TN0036A | 114000-83790000 | DENSO TEN Limited | EUT |
| B | Steering switch | 84250-58150-B0 | No.1 | TOKAI RIKA | - |
| C | Microphone module | 86730-78010 | No.10 | Panasonic | - |
| D | Back camera | 867B0-78070 | No.5 | Panasonic | - |
| E | Speaker Dummy Load | SP Dummy | No.4 | DENSO TEN Limited | - |
| F | AM/FM Sharkfin AMP | 86760-K0010 | No.4 | YOKOWO | - |
| G | DAB Antenna AMP | 863C0-60050 | No.PQB02919 | DENSO TEN Limited | - |
| H | GNSS Antenna | 86880-78010 | UI034347 | HARADA | - |
| I | USB I/F Box | 86190-78020 | 500881 | Panasonic | - |
| J | Jig Board | - | - | - | - |
| K | Laptop PC | PR63PBAA337AD7X | 6F053913H | TOSHIBA | - |
| L | AC Adapter | PA51770-1ACA | FX10800NSKACC | TOSHIBA | - |

**List of Cables Used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | DC Cable | 4.0 | Unshielded | Unshielded | - |
| 2 | Signal Cable | 3.0 | Unshielded | Unshielded | - |
| 3 | Audio Cable | 3.0 | Shielded | Shielded | - |
| 4 | Signal Cable | 5.0 | Unshielded | Unshielded | - |
| 5 | Speaker Cable | 3.0 | Unshielded | Unshielded | - |
| 6 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 7 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 8 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 9 | Signal Cable | 2.0 | Unshielded | Unshielded | - |
| 10 | Signal Cable | 2.3 | Unshielded | Unshielded | - |
| 11 | USB Cable | 1.0 | Shielded | Shielded | - |
| 12 | DC Cable | 1.7 | Unshielded | Unshielded | - |
| 13 | AC Cable | 0.8 | Unshielded | Unshielded | - |

**for Radiated emission test**




* 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 | Car Audio | TN0036A | 114000-83790000 | DENSO TEN Limited | EUT |
| B | Steering switch | 84250-58150-B0 | No.1 | TOKAI RIKA | - |
| C | Microphone module | 86730-78010 | No.10 | Panasonic | - |
| D | Back camera | 867B0-78070 | No.5 | Panasonic | - |
| E | Speaker Dummy Load | SP Dummy | No.4 | DENSO TEN Limited | - |
| F | AM/FM Sharkfin AMP | 86760-K0010 | No.4 | YOKOWO | - |
| G | DAB Antenna AMP | 863C0-60050 | No.PQB02919 | DENSO TEN Limited | - |
| H | GNSS Antenna | 86880-78010 | UI034347 | HARADA | - |
| I | USB I/F Box | 86190-78020 | 500881 | Panasonic | - |
| J | iPhone | MD297B/A | C34JJ55EDTWD | Apple | - |

**List of Cables Used**

| No. | Name | Length (m) | Shield | | Remarks |
|---|---|---|---|---|---|
| | | | Cable | Connector | |
| 1 | DC Cable | 4.0 | Unshielded | Unshielded | - |
| 2 | Signal Cable | 3.0 | Unshielded | Unshielded | - |
| 3 | Audio Cable | 3.0 | Shielded | Shielded | - |
| 4 | Signal Cable | 5.0 | Unshielded | Unshielded | - |
| 5 | Speaker Cable | 3.0 | Unshielded | Unshielded | - |
| 6 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 7 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 8 | Antenna Cable | 2.0 | Shielded | Shielded | - |
| 9 | Signal Cable | 2.0 | Unshielded | Unshielded | - |
| 10 | USB Cable | 1.0 | Shielded | Shielded | - |

# SECTION 5: Radiated Spurious Emission

**Test Procedure**

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 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 |

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.

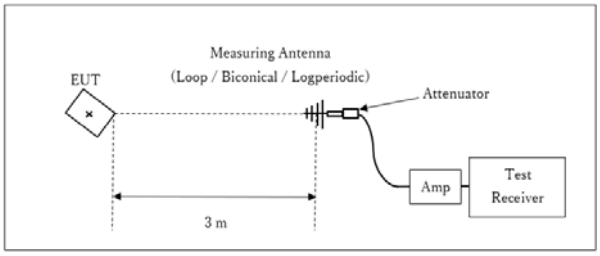
**20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).**

| Frequency | Below 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 MHz<br>VBW: 3 MHz | RBW: 1 MHz<br>VBW: 3 MHz<br>Detector:<br>Power Averaging (RMS)<br>Trace: 100 traces<br>Duty factor was added to the results. | RBW: 100 kHz<br>VBW: 300 kHz |

*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r02.

**Figure 2: Test Setup**

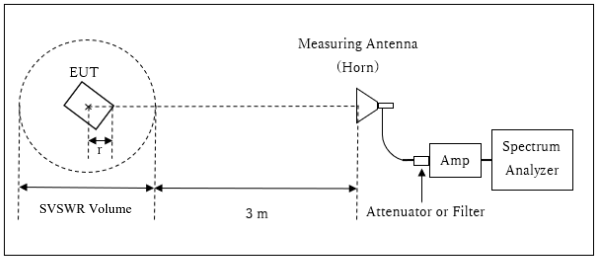
Below 1 GHz




× : Center of turn table

Test Distance: 3 m

1 GHz to 10 GHz




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

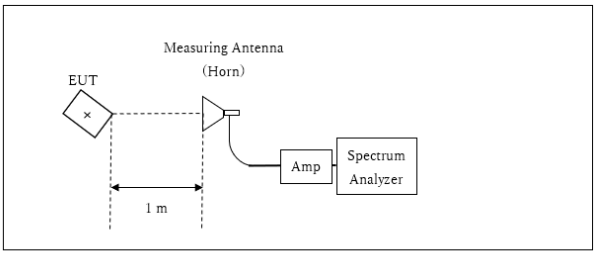
other than DH5 2402 MHz
Distance Factor: 20 x log (3.85 m / 3.0 m) = 2.17 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.85 m

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.15 m

DH5 2402 MHz
Distance Factor: 20 x log (3.60 m / 3.0 m) = 1.59 dB
* Test Distance: (3 + SVSWR Volume /2) - r = 3.60 m

SVSWR Volume : 1.5 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.15 m

10 GHz to 26.5 GHz




× : Center of turn table

Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.5 dB
*Test Distance: 1 m

The test was made on EUT at the normal use position.

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

**Measurement Range : 30 MHz to 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 |
|---|---|---|---|---|---|---|---|
| 20dB Bandwidth | 3 MHz | 30 kHz | 100 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: 50MHz BW) |
| Carrier Frequency Separation | 3 MHz | 30 kHz | 100 kHz | Auto | Peak | Max Hold | Spectrum Analyzer |
| Number of Hopping Frequency | 30 MHz | 200 kHz | 620 kHz | Auto | Peak | Max Hold | Spectrum Analyzer |
| Dwell Time | Zero Span | 100 kHz, 1 MHz | 300 kHz, 3 MHz | As necessary capture the entire dwell time per hopping channel | Peak | Clear Write | Spectrum Analyzer |
| Conducted Spurious Emission *3) *4) | 9 kHz to 150 kHz | 200 Hz | 620 Hz | Auto | Peak | Max Hold | Spectrum Analyzer |
| | 150 kHz to 30 MHz | 9.1 kHz | 27 kHz | | | | |
| | 30 MHz to 25 GHz | 100 kHz | 300 kHz | | | | |
| Conducted Spurious Emission Band Edge compliance | 10 MHz | 100 kHz | 300 kHz | Auto | Peak | Max Hold | Spectrum Analyzer |

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz) *4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohmes. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 – 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

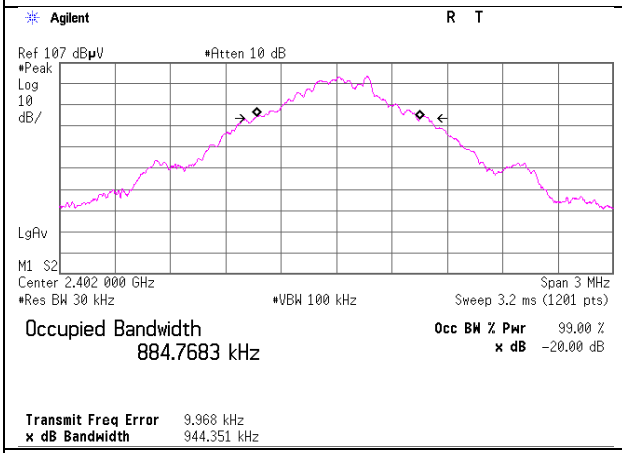
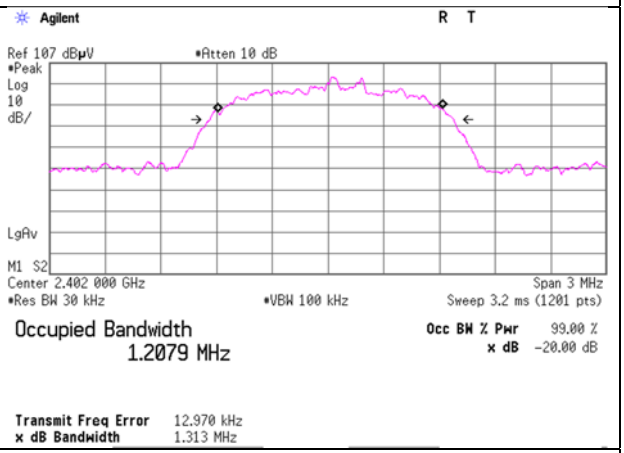
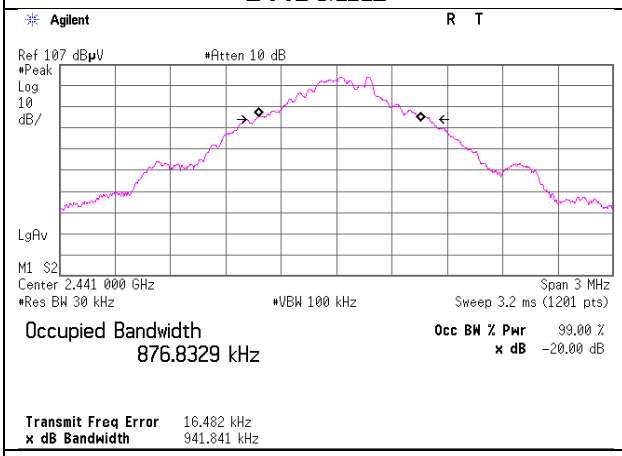
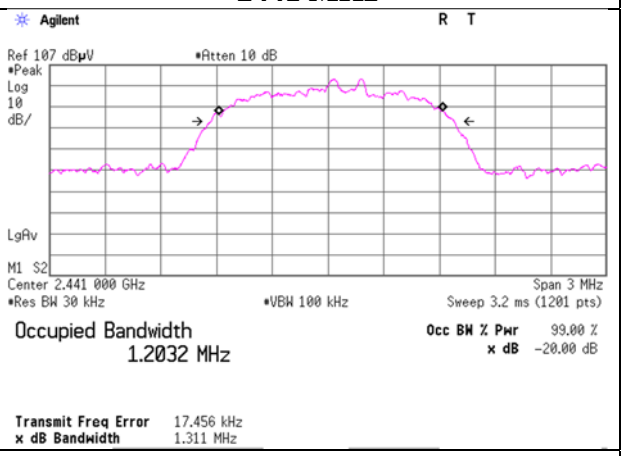
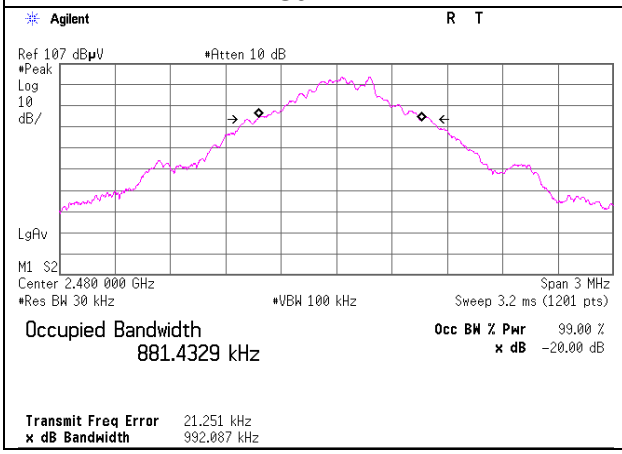
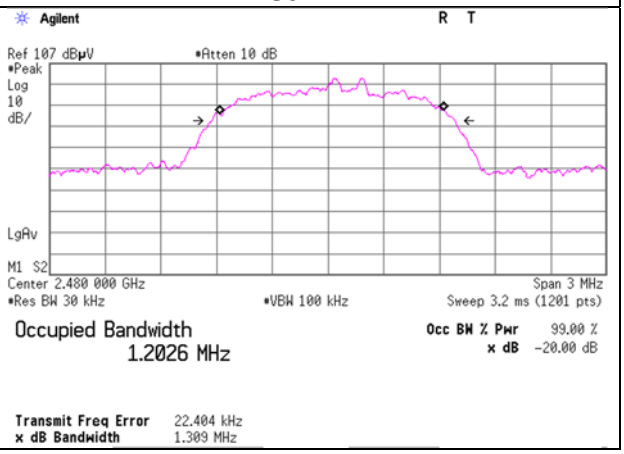
## 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room | |
| Date | May 9, 2022 | May 10, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH | 24 deg. C / 39 % RH |
| Engineer | Nachi Konegawa | Takumi Nishida |
| Mode | Tx, Hopping Off, Tx, Hopping On | |

| Mode | Freq. [MHz] | 20 dB Bandwidth [MHz] | 99 % Occupied Bandwidth [kHz] | Carrier Frequency Separation [MHz] | Limit for Carrier Frequency separation [MHz] |
|---|---|---|---|---|---|
| DH5 | 2402.0 | 0.944 | 884.768 | 1.000 | >= 0.629 |
| DH5 | 2441.0 | 0.942 | 876.833 | 1.000 | >= 0.628 |
| DH5 | 2480.0 | 0.992 | 881.433 | 1.000 | >= 0.661 |
| DH5 | Hopping On | - | 78623.200 | - | - |
| 3DH5 | 2402.0 | 1.313 | 1207.900 | 1.000 | >= 0.875 |
| 3DH5 | 2441.0 | 1.311 | 1203.200 | 1.000 | >= 0.874 |
| 3DH5 | 2480.0 | 1.309 | 1202.600 | 1.000 | >= 0.873 |
| 3DH5 | Hopping On | - | 78666.400 | - | - |

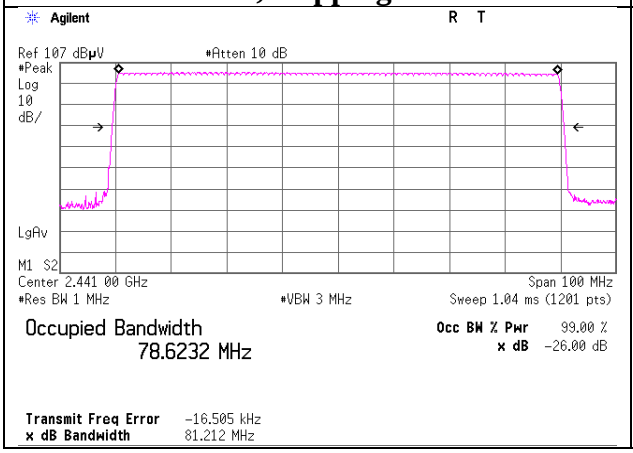
Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).
No limit applies to 20 dB Bandwidth.

# 20dB Bandwidth and 99% Occupied Bandwidth

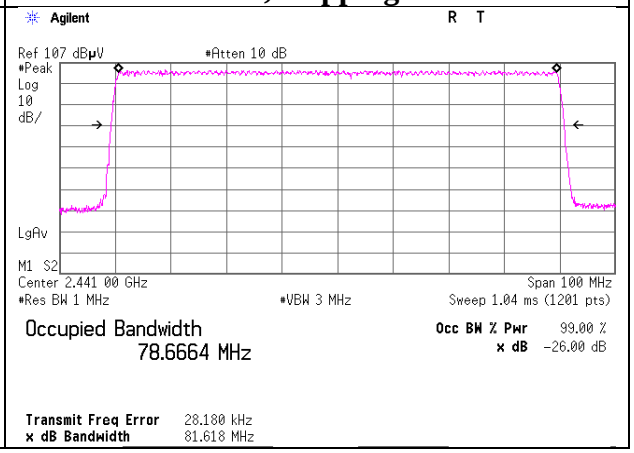
| DH5 | 3DH5 |
|---|---|
| **2402 MHz** | **2402 MHz** |
|  |  |
| **2441 MHz** | **2441 MHz** |
|  |  |
| **2480 MHz** | **2480 MHz** |
|  |  |

# 20dB Bandwidth and 99% Occupied Bandwidth

## DH5, Hopping On



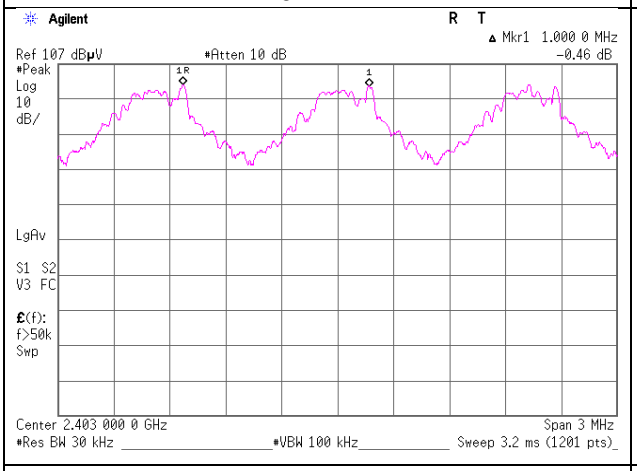

## 3DH5, Hopping On



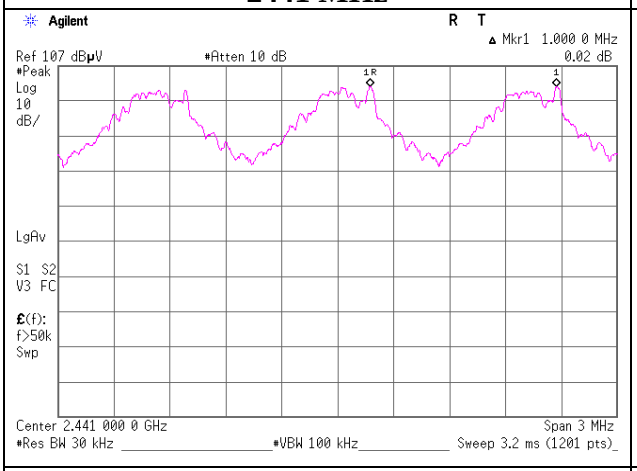
# Carrier Frequency Separation

## DH5

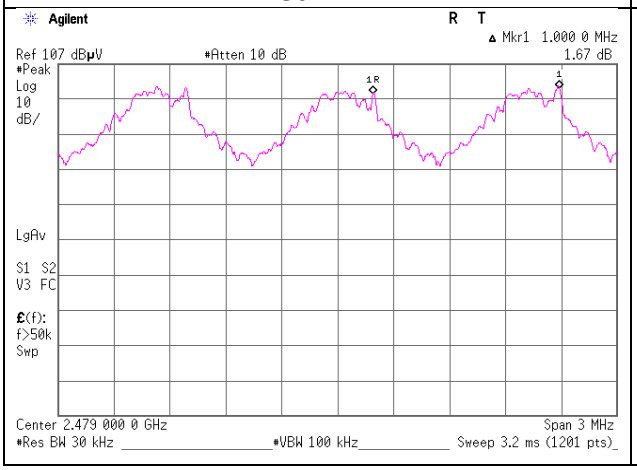
### 2402 MHz




### 2441 MHz

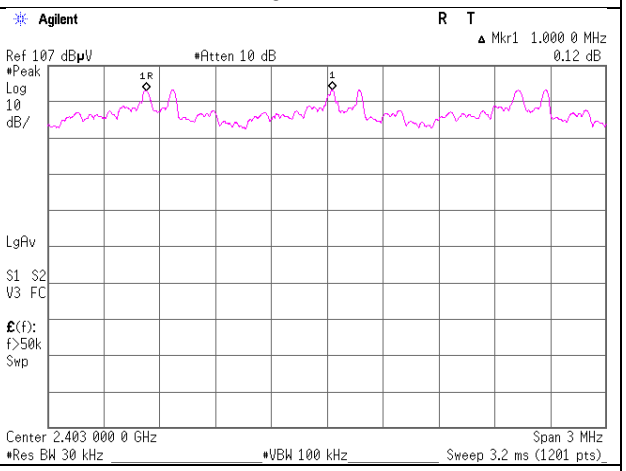



### 2480 MHz

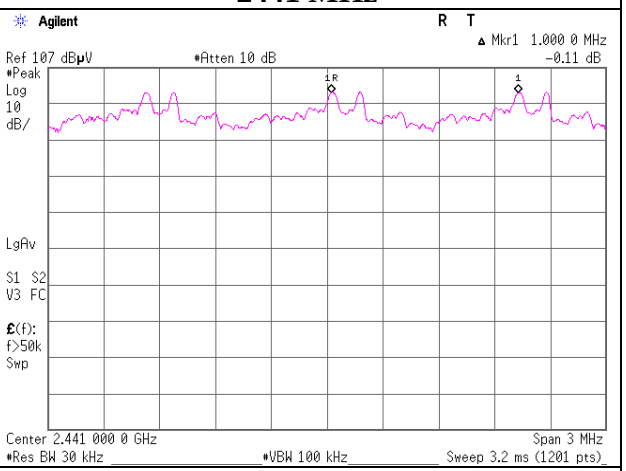



## 3DH5

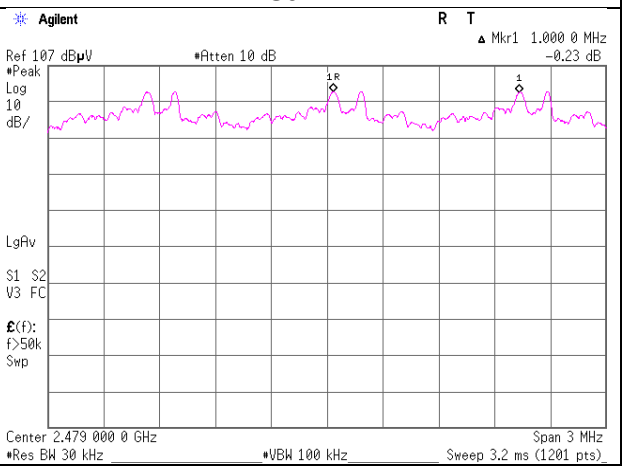
### 2402 MHz




### 2441 MHz




### 2480 MHz



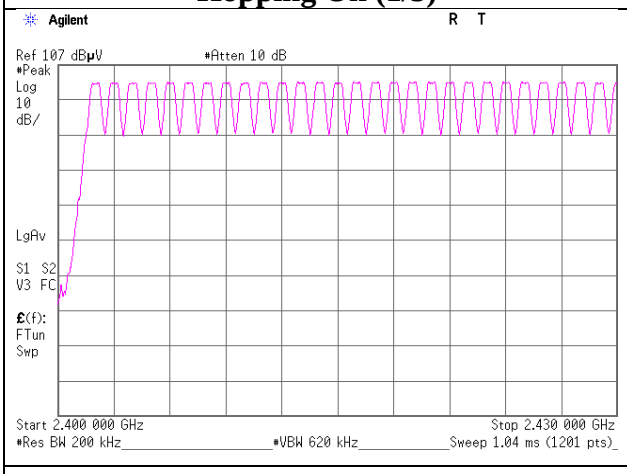
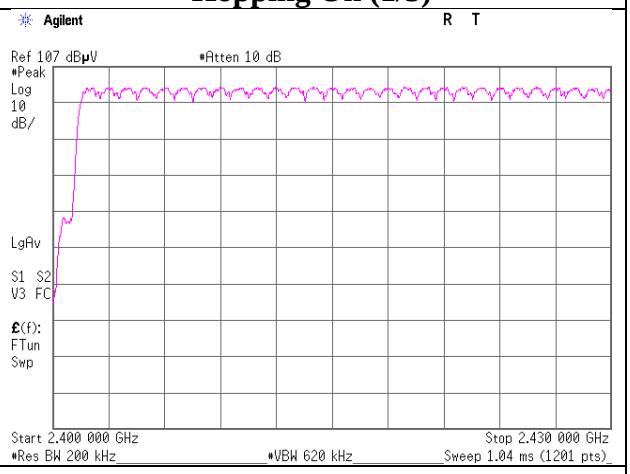
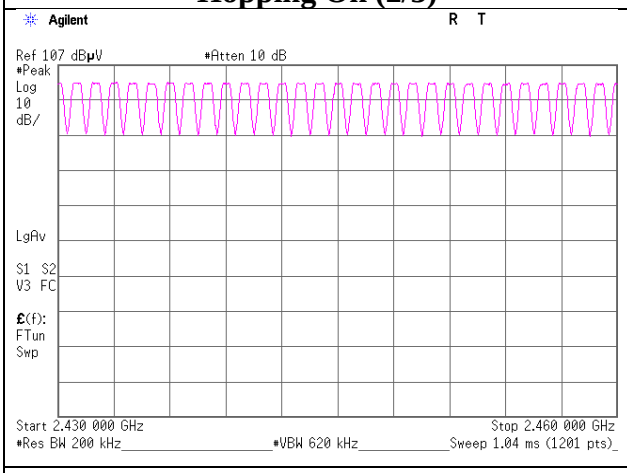
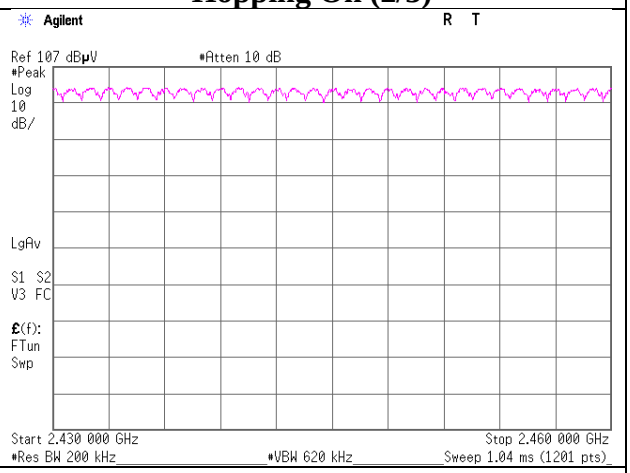
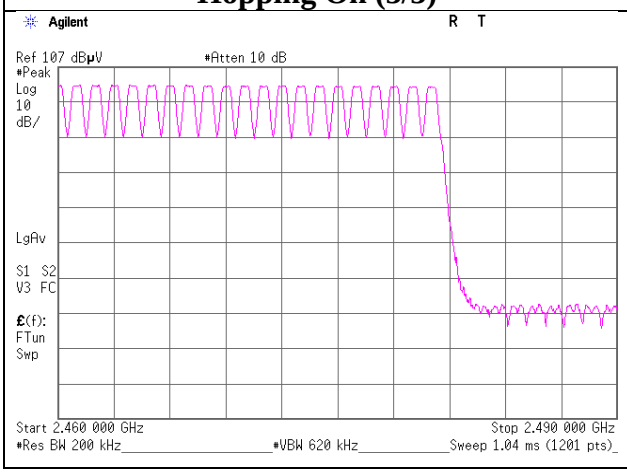
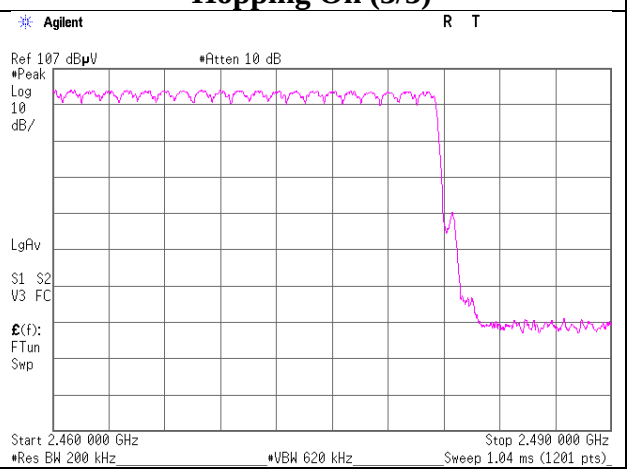
# Number of Hopping Frequency

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room | |
| Date | May 9, 2022 | May 10, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH | 24 deg. C / 39 % RH |
| Engineer | Nachi Konegawa | Takumi Nishida |
| Mode | Tx, Hopping On | |

| Mode | Number of channel [channels] | Limit [channels] |
|---|---|---|
| DH5 | 79 | >= 15 |
| 3DH5 | 79 | >= 15 |

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

# Number of Hopping Frequency

| DH5 | 3DH5 |
|---|---|
| **Hopping On (1/3)** | **Hopping On (1/3)** |
|  |  |
| **Hopping On (2/3)** | **Hopping On (2/3)** |
|  |  |
| **Hopping On (3/3)** | **Hopping On (3/3)** |
|  |  |

# Dwell time

| | | |
|---|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room | |
| Date | May 9, 2022 | May 10, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH | 24 deg. C / 39 % RH |
| Engineer | Nachi Konegawa | Takumi Nishida |
| Mode | Tx, Hopping On | |

| Mode | Number of transmission in a 31.6 (79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period | Length of transmission [ms] | Result [ms] | Limit [ms] |
|---|---|---|---|---|
| DH1 | 50.8 times / 5 s x 31.6 s = 322 times | 0.422 | 136 | 400 |
| DH3 | 25.8 times / 5 s x 31.6 s = 164 times | 1.685 | 276 | 400 |
| DH5 | 20.8 times / 5 s x 31.6 s = 132 times | 2.940 | 388 | 400 |
| 3DH1 | 50.0 times / 5 s x 31.6 s = 316 times | 0.426 | 135 | 400 |
| 3DH3 | 26.6 times / 5 s x 31.6 s = 169 times | 1.685 | 285 | 400 |
| 3DH5 | 20.8 times / 5 s x 31.6 s = 132 times | 2.940 | 388 | 400 |

Sample Calculation
Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

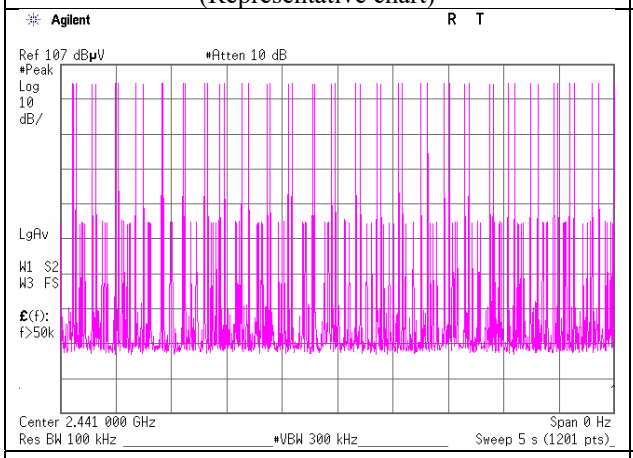
| Mode | Sampling [times] | | | | | Average [times] |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| DH1 | 51 | 50 | 51 | 50 | 52 | 50.8 |
| DH3 | 27 | 26 | 23 | 26 | 27 | 25.8 |
| DH5 | 18 | 20 | 22 | 22 | 22 | 20.8 |
| 3DH1 | 49 | 51 | 49 | 51 | 50 | 50 |
| 3DH3 | 28 | 27 | 28 | 23 | 27 | 26.6 |
| 3DH5 | 22 | 19 | 19 | 22 | 22 | 20.8 |

Sample Calculation
Average = Summation (Sampling 1 to 5) / 5

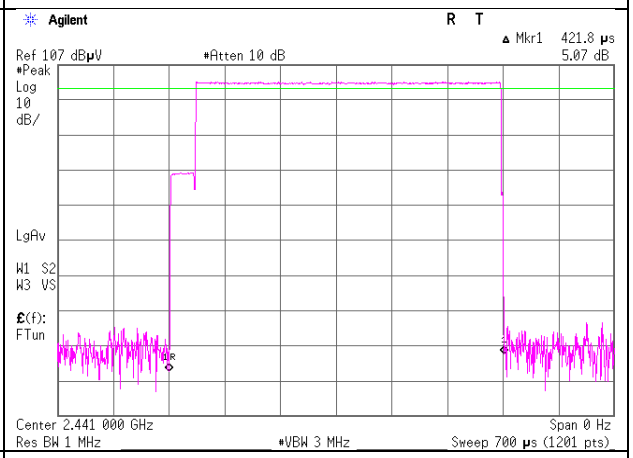
This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in N x 0.4 s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4 s regardless of packet size. This is confirmed in the test report for N = 79.

# Dwell time

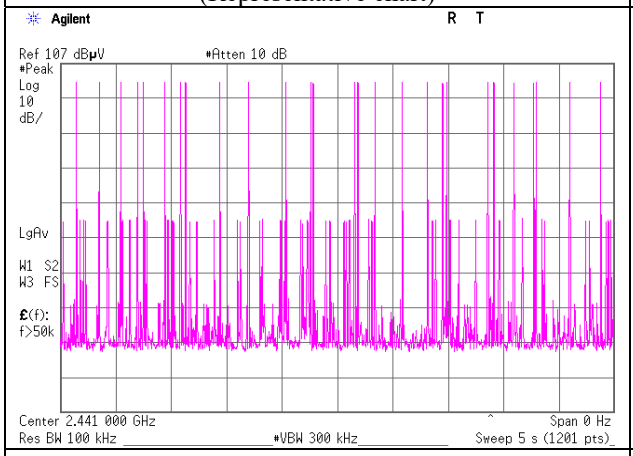
## DH1 (1/2)
(Representative chart)



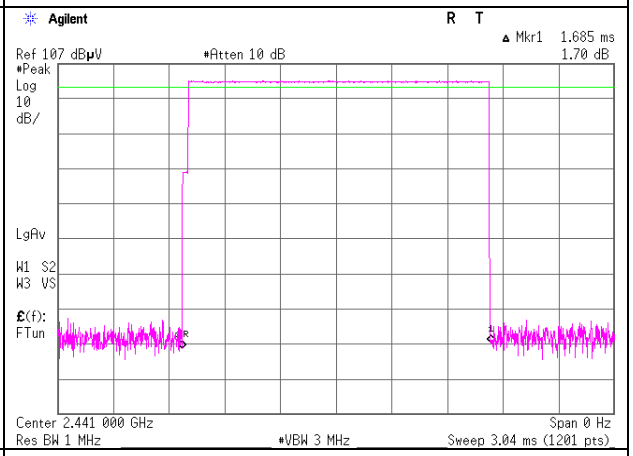

## DH1 (2/2)



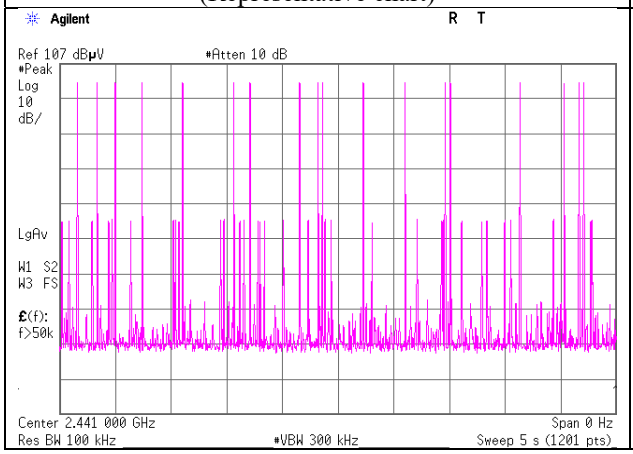

## DH3 (1/2)
(Representative chart)



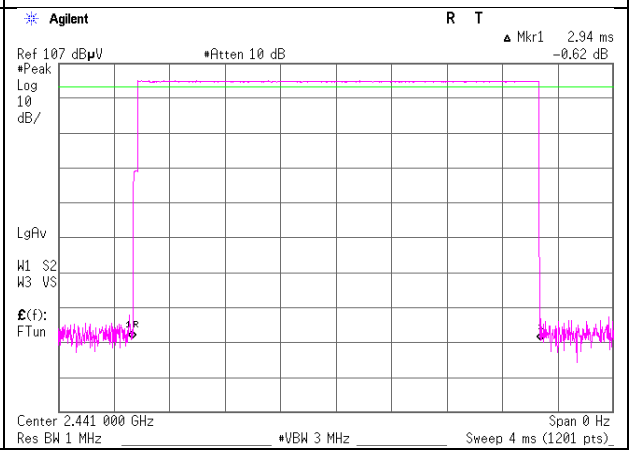

## DH3 (2/2)




## DH5 (1/2)
(Representative chart)

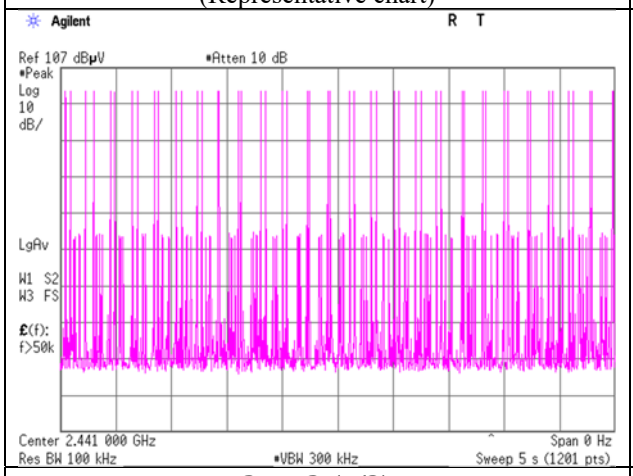



## DH5 (2/2)

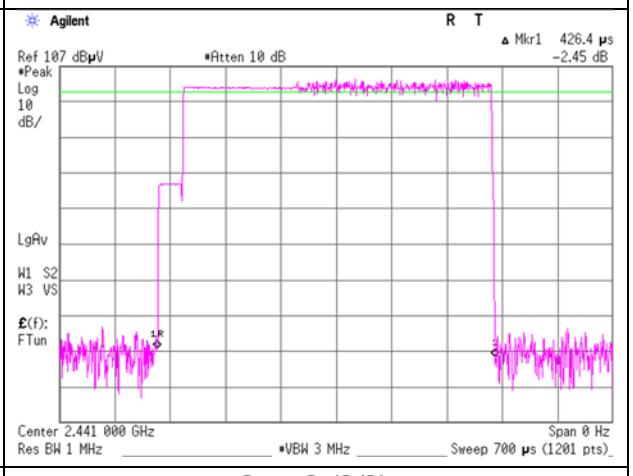


# Dwell time

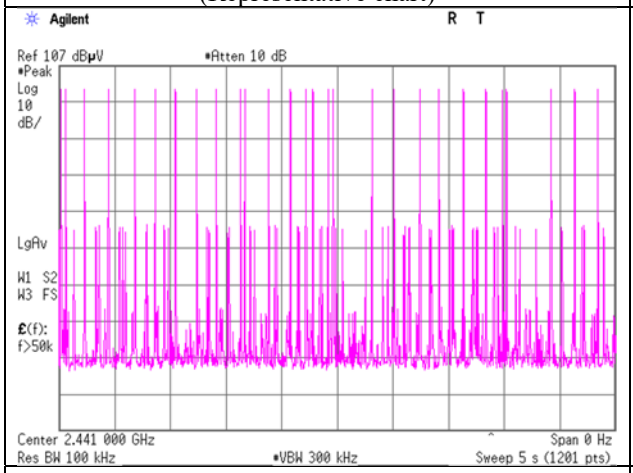
## 3DH1 (1/2)
(Representative chart)



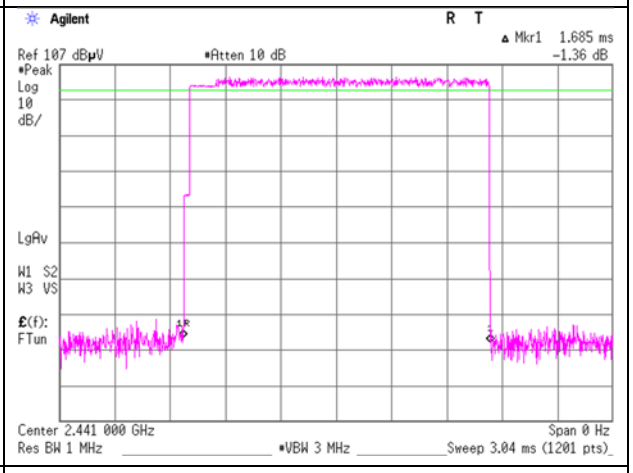

## 3DH1 (2/2)



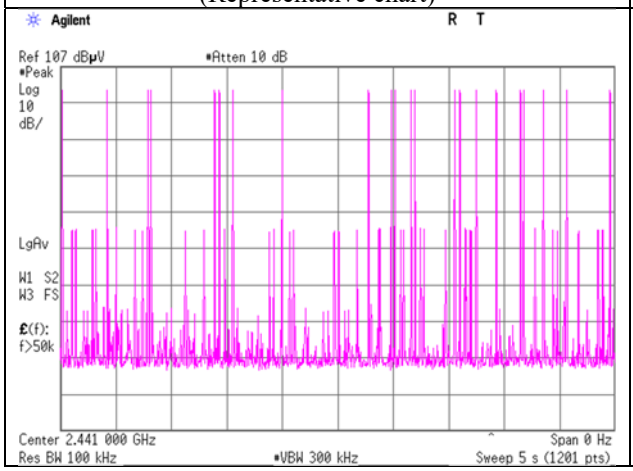

## 3DH3 (1/2)
(Representative chart)



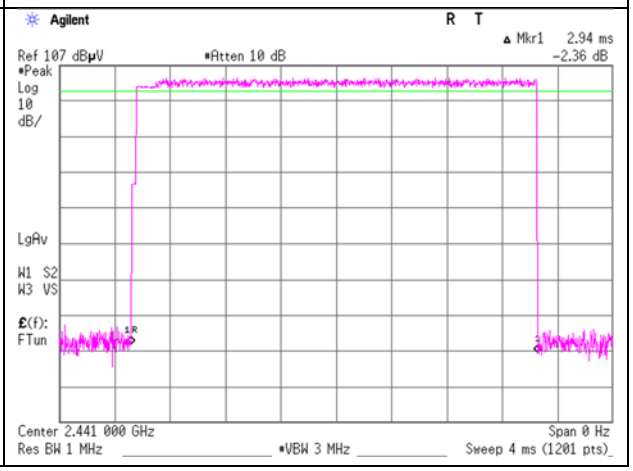

## 3DH3 (2/2)




## 3DH5 (1/2)
(Representative chart)




## 3DH5 (2/2)



# Maximum Peak Output Power

| | |
|---|---|
| Test place | Ise EMC Lab. No.2 Measurement Room |
| Date | April 24, 2022 |
| Temperature / Humidity | 21 deg. C / 58 % RH |
| Engineer | Kiyoshiro Okazaki |
| Mode | Tx, Hopping Off |

| | | | | | Conducted Power | | | | | e.i.r.p. for RSS-247 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mode | 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] |
| DH5 | 2402.0 | -5.81 | 1.03 | 10.11 | 5.33 | 3.41 | 20.96 | 125 | 15.63 | -0.84 | 4.49 | 2.81 | 36.02 | 4000 | 31.53 |
| DH5 | 2441.0 | -4.88 | 1.03 | 10.11 | 6.26 | 4.23 | 20.96 | 125 | 14.70 | -0.84 | 5.42 | 3.48 | 36.02 | 4000 | 30.60 |
| DH5 | 2480.0 | -5.76 | 1.04 | 10.11 | 5.39 | 3.46 | 20.96 | 125 | 15.58 | -0.84 | 4.55 | 2.85 | 36.02 | 4000 | 31.48 |
| 2DH5 | 2402.0 | -3.16 | 1.03 | 10.11 | 7.98 | 6.28 | 20.96 | 125 | 12.98 | -0.84 | 7.14 | 5.17 | 36.02 | 4000 | 28.88 |
| 2DH5 | 2441.0 | -3.29 | 1.03 | 10.11 | 7.85 | 6.10 | 20.96 | 125 | 13.11 | -0.84 | 7.01 | 5.02 | 36.02 | 4000 | 29.01 |
| 2DH5 | 2480.0 | -3.67 | 1.04 | 10.11 | 7.48 | 5.59 | 20.96 | 125 | 13.49 | -0.84 | 6.64 | 4.61 | 36.02 | 4000 | 29.39 |
| 3DH5 | 2402.0 | -2.91 | 1.03 | 10.11 | 8.23 | 6.65 | 20.96 | 125 | 12.73 | -0.84 | 7.39 | 5.48 | 36.02 | 4000 | 28.63 |
| 3DH5 | 2441.0 | -3.02 | 1.03 | 10.11 | 8.12 | 6.49 | 20.96 | 125 | 12.84 | -0.84 | 7.28 | 5.35 | 36.02 | 4000 | 28.74 |
| 3DH5 | 2480.0 | -3.46 | 1.04 | 10.11 | 7.69 | 5.87 | 20.96 | 125 | 13.28 | -0.84 | 6.85 | 4.84 | 36.02 | 4000 | 29.18 |

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20 ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

As this device had AFH mode and frequency separation could not meet the requirement of over 20 dB BW without 2/3 relaxation, 125 mW power limit was applied to it.

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

| | |
|---|---|
| Test place | Ise EMC Lab. No.2 Measurement Room |
| Date | April 24, 2022 |
| Temperature / Humidity | 21 deg. C / 58 % RH |
| Engineer | Kiyoshiro Okazaki |
| Mode | Tx, Hopping Off |

| Mode | Freq. [MHz] | Reading [dBm] | Cable Loss [dB] | Atten. Loss [dB] | Result (Time average) [dBm] | Result (Time average) [mW] | Duty factor [dB] | Result (Burst power average) [dBm] | Result (Burst power average) [mW] |
|---|---|---|---|---|---|---|---|---|---|
| DH5 | 2402.0 | -7.42 | 1.03 | 10.11 | 3.72 | 2.36 | 1.08 | 4.80 | 3.02 |
| DH5 | 2441.0 | -6.49 | 1.03 | 10.11 | 4.65 | 2.92 | 1.08 | 5.73 | 3.74 |
| DH5 | 2480.0 | -7.24 | 1.04 | 10.11 | 3.91 | 2.46 | 1.08 | 4.99 | 3.16 |
| 2DH5 | 2402.0 | -6.76 | 1.03 | 10.11 | 4.38 | 2.74 | 1.08 | 5.46 | 3.52 |
| 2DH5 | 2441.0 | -6.91 | 1.03 | 10.11 | 4.23 | 2.65 | 1.08 | 5.31 | 3.40 |
| 2DH5 | 2480.0 | -7.35 | 1.04 | 10.11 | 3.80 | 2.40 | 1.08 | 4.88 | 3.08 |
| 3DH5 | 2402.0 | -6.74 | 1.03 | 10.11 | 4.40 | 2.75 | 1.08 | 5.48 | 3.53 |
| 3DH5 | 2441.0 | -6.83 | 1.03 | 10.11 | 4.31 | 2.70 | 1.08 | 5.39 | 3.46 |
| 3DH5 | 2480.0 | -7.34 | 1.04 | 10.11 | 3.81 | 2.40 | 1.08 | 4.89 | 3.08 |

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

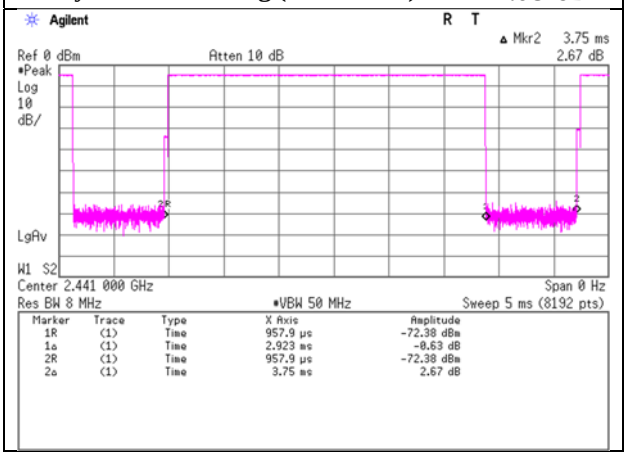
*The equipment and cables were not used for factor 0 dB of the data sheets.

# Burst Rate Confirmation

| | |
|---|---|
| Test place | Ise EMC Lab. No.2 Measurement Room |
| Date | April 24, 2022 |
| Temperature / Humidity | 21 deg. C / 58 % RH |
| Engineer | Kiyoshiro Okazaki |
| Mode | Tx, Hopping Off |

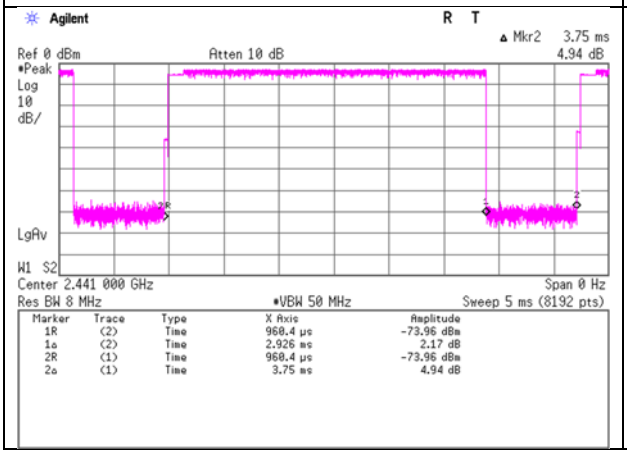
## DH5

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.779** |
| **Tx on / (Tx on + Tx off) * 100 =** | **77.9 %** |
| **Duty factor = 10 * log (3.75 / 2.923) =** | **1.08 dB** |



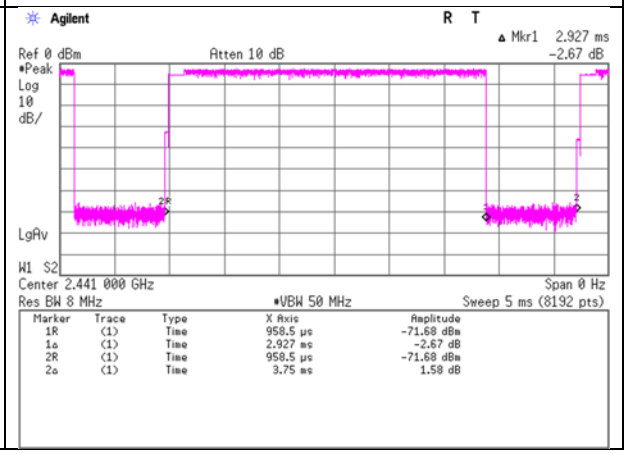

## 2DH5

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.780** |
| **Tx on / (Tx on + Tx off) * 100 =** | **78.0 %** |
| **Duty factor = 10 * log (3.75 / 2.926) =** | **1.08 dB** |




## 3DH5

| | |
|---|---|
| **Tx on / (Tx on + Tx off) =** | **0.781** |
| **Tx on / (Tx on + Tx off) * 100 =** | **78.1 %** |
| **Duty factor = 10 * log (3.75 / 2.927) =** | **1.08 dB** |



# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.2 | No.3 |
| Date | April 24, 2022 | April 26, 2022 |
| Temperature / Humidity | 21 deg. C / 58 % RH | 22 deg. C / 66 % RH |
| Engineer | Kiyoshiro Okazaki (1 GHz -10 GHz) | Yuichiro Yamazaki (Above 10 GHz) |
| Mode | Tx, Hopping Off, DH5 2402 MHz | |

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (QP / PK) [dBuV] | Reading (AV) [dBuV] | Ant. Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result (QP / PK) [dBuV/m] | Result (AV) [dBuV/m] | Limit (QP / PK) [dBuV/m] | Limit (AV) [dBuV/m] | Margin (QP / PK) [dB] | Margin (AV) [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2390.0 | 44.3 | 32.5 | 27.6 | 4.6 | 34.9 | 1.1 | 41.6 | 30.9 | 73.9 | 53.9 | 32.3 | 23.0 | *1) |
| Hori. | 4804.0 | 42.3 | 34.0 | 31.5 | 6.9 | 34.1 | - | 46.6 | 38.3 | 73.9 | 53.9 | 27.3 | 15.6 | Floor noise |
| Hori. | 7206.0 | 42.5 | 33.4 | 35.9 | 8.3 | 34.1 | - | 52.6 | 43.5 | 73.9 | 53.9 | 21.3 | 10.4 | Floor noise |
| Hori. | 9608.0 | 43.0 | 34.4 | 38.7 | 8.8 | 34.7 | - | 55.9 | 47.3 | 73.9 | 53.9 | 18.0 | 6.6 | Floor noise |
| Vert. | 2390.0 | 45.3 | 35.8 | 27.6 | 4.6 | 34.9 | 1.1 | 42.6 | 34.3 | 73.9 | 53.9 | 31.3 | 19.6 | *1) |
| Vert. | 4804.0 | 43.6 | 34.7 | 31.5 | 6.9 | 34.1 | - | 47.9 | 39.0 | 73.9 | 53.9 | 26.0 | 14.9 | Floor noise |
| Vert. | 7206.0 | 44.0 | 35.3 | 35.9 | 8.3 | 34.1 | - | 54.1 | 45.4 | 73.9 | 53.9 | 19.8 | 8.5 | Floor noise |
| Vert. | 9608.0 | 44.1 | 34.4 | 38.7 | 8.8 | 34.7 | - | 57.0 | 47.3 | 73.9 | 53.9 | 16.9 | 6.6 | Floor noise |

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

*QP detector was used up to 1GHz.

*1) Not Out of Band emission(Leakage Power)

**20dBc Data Sheet**

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (PK) [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2402.0 | 99.5 | 27.6 | 4.6 | 34.9 | 96.8 | - | - | Carrier |
| Hori. | 2400.0 | 41.1 | 27.6 | 4.6 | 34.9 | 38.4 | 76.8 | 38.4 | |
| Vert. | 2402.0 | 101.2 | 27.6 | 4.6 | 34.9 | 98.5 | - | - | Carrier |
| Vert. | 2400.0 | 41.8 | 27.6 | 4.6 | 34.9 | 39.1 | 78.5 | 39.4 | |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

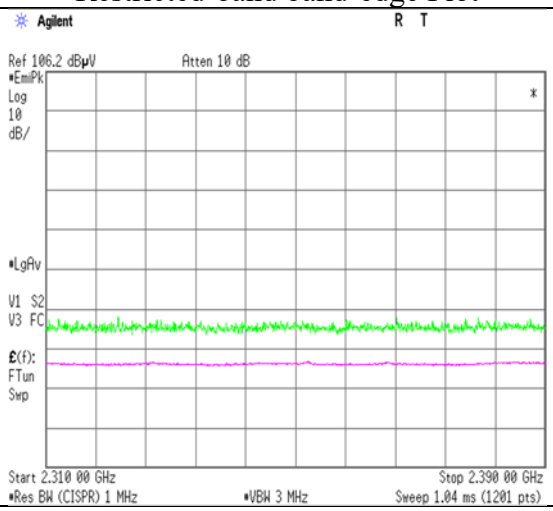
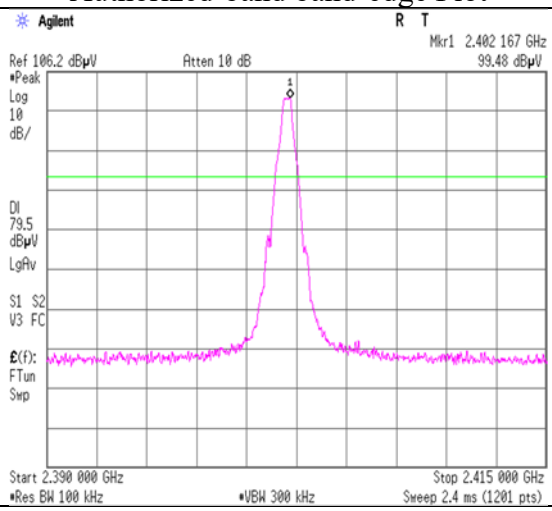
Distance factor: 1 GHz - 10 GHz 20log (3.6 m / 3.0 m) = 1.59 dB

10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

***These results have sufficient margin without taking account Duty cycle correction factor.**

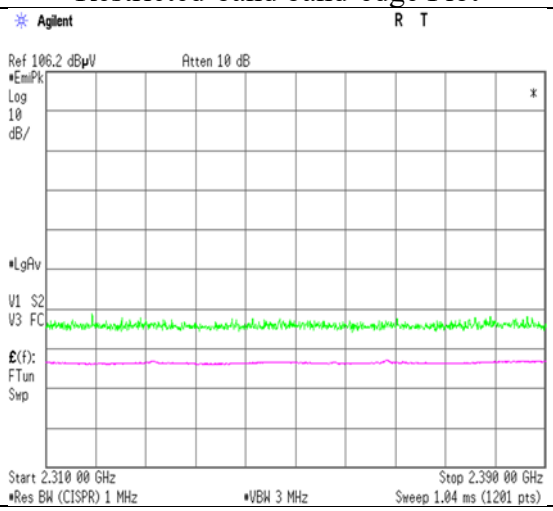
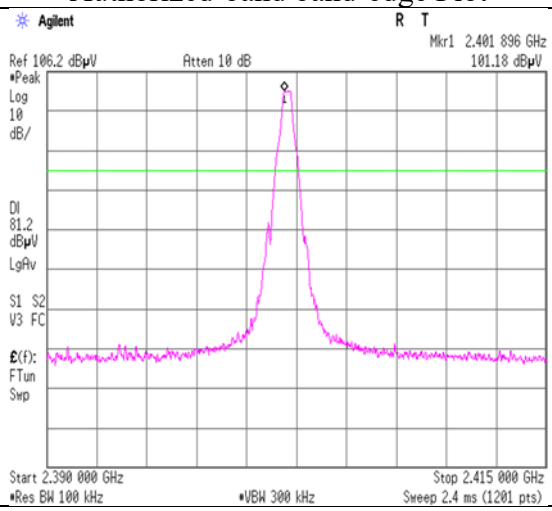
# Radiated Spurious Emission
## (Reference Plot for band-edge)

| | |
|---|---|
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.2 |
| Date | April 24, 2022 |
| Temperature / Humidity | 21 deg. C / 58 % RH |
| Engineer | Kiyoshiro Okazaki<br>(1 GHz -10 GHz) |
| Mode | Tx, Hopping Off, DH5 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

| | | |
|---|---|---|
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.3 |
| Date | April 25, 2022 | April 26, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH | 22 deg. C / 66 % RH |
| Engineer | Hiroyuki Furutaka | Yuichiro Yamazaki |
| | (1 GHz -10 GHz) | (Above 10 GHz) |
| Mode | Tx, Hopping Off, DH5 2441 MHz | |

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (QP / PK) [dBuV] | Reading (AV) [dBuV] | Ant. Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result (QP / PK) [dBuV/m] | Result (AV) [dBuV/m] | Limit (QP / PK) [dBuV/m] | Limit (AV) [dBuV/m] | Margin (QP / PK) [dB] | Margin (AV) [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 4882.0 | 43.7 | 34.4 | 31.3 | 6.6 | 35.7 | - | 45.8 | 36.5 | 73.9 | 53.9 | 28.1 | 17.4 | Floor noise |
| Hori. | 7323.0 | 44.0 | 35.0 | 36.1 | 7.5 | 35.9 | - | 51.8 | 42.8 | 73.9 | 53.9 | 22.2 | 11.2 | Floor noise |
| Hori. | 9764.0 | 45.0 | 35.6 | 39.1 | 8.4 | 36.4 | - | 56.1 | 46.7 | 73.9 | 53.9 | 17.8 | 7.2 | Floor noise |
| Vert. | 4882.0 | 44.6 | 34.9 | 31.3 | 6.6 | 35.7 | - | 46.7 | 37.0 | 73.9 | 53.9 | 27.2 | 16.9 | Floor noise |
| Vert. | 7323.0 | 45.4 | 35.1 | 36.1 | 7.5 | 35.9 | - | 53.2 | 42.9 | 73.9 | 53.9 | 20.8 | 11.1 | Floor noise |
| Vert. | 9764.0 | 44.8 | 35.7 | 39.1 | 8.4 | 36.4 | - | 55.9 | 46.8 | 73.9 | 53.9 | 18.0 | 7.1 | Floor noise |

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

*QP detector was used up to 1GHz.

| | | |
|---|---|---|
| Distance factor: | 1 GHz - 10 GHz | 20log (3.85 m / 3.0 m) = 2.17 dB |
| | 10 GHz - 26.5 GHz | 20log (1.0 m / 3.0 m) = -9.5 dB |

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.3 |
| Date | April 25, 2022 | April 26, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH | 22 deg. C / 66 % RH |
| Engineer | Hiroyuki Furutaka | Yuichiro Yamazaki |
| | (1 GHz -10 GHz) | (Above 10 GHz) |
| Mode | Tx, Hopping Off, DH5 2480 MHz | |

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (QP / PK) [dBuV] | Reading (AV) [dBuV] | Ant. Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result (QP / PK) [dBuV/m] | Result (AV) [dBuV/m] | Limit (QP / PK) [dBuV/m] | Limit (AV) [dBuV/m] | Margin (QP / PK) [dB] | Margin (AV) [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2483.5 | 48.0 | 37.6 | 27.6 | 4.7 | 36.3 | 1.1 | 44.0 | 34.7 | 73.9 | 53.9 | 29.9 | 19.2 | *1) |
| Hori. | 4960.0 | 42.8 | 34.8 | 31.4 | 6.6 | 35.7 | - | 45.0 | 37.0 | 73.9 | 53.9 | 28.9 | 16.9 | Floor noise |
| Hori. | 7440.0 | 43.8 | 35.0 | 36.3 | 7.6 | 35.9 | - | 51.8 | 43.0 | 73.9 | 53.9 | 22.2 | 11.0 | Floor noise |
| Hori. | 9920.0 | 44.6 | 36.2 | 39.0 | 8.5 | 36.4 | - | 55.6 | 47.2 | 73.9 | 53.9 | 18.3 | 6.7 | Floor noise |
| Vert. | 2483.5 | 49.2 | 38.5 | 27.6 | 4.7 | 36.3 | 1.1 | 45.2 | 35.6 | 73.9 | 53.9 | 28.7 | 18.3 | *1) |
| Vert. | 4960.0 | 43.2 | 34.6 | 31.4 | 6.6 | 35.7 | - | 45.4 | 36.8 | 73.9 | 53.9 | 28.5 | 17.1 | Floor noise |
| Vert. | 7440.0 | 44.2 | 35.5 | 36.3 | 7.6 | 35.9 | - | 52.2 | 43.5 | 73.9 | 53.9 | 21.8 | 10.5 | Floor noise |
| Vert. | 9920.0 | 44.0 | 35.8 | 39.0 | 8.5 | 36.4 | - | 55.0 | 46.8 | 73.9 | 53.9 | 18.9 | 7.1 | Floor noise |

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

*QP detector was used up to 1GHz.

*1) Not Out of Band emission(Leakage Power)

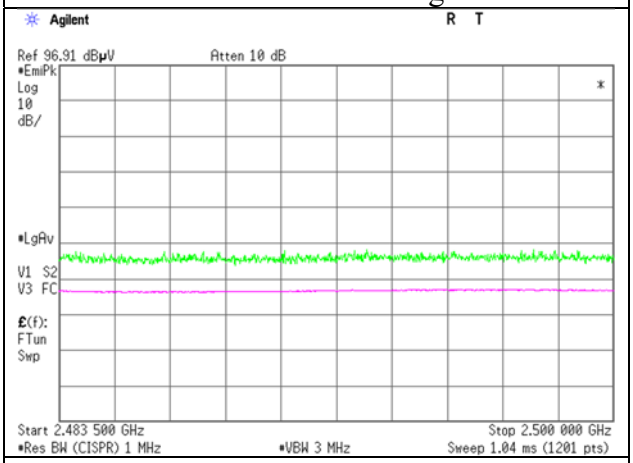
| | | |
|---|---|---|
| Distance factor: | 1 GHz - 10 GHz | 20log (3.85 m / 3.0 m) = 2.17 dB |
| | 10 GHz - 26.5 GHz | 20log (1.0 m / 3.0 m) = -9.5 dB |

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

| | |
|---|---|
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.1 |
| Date | April 25, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH |
| Engineer | Hiroyuki Furutaka |
| Mode | Tx, Hopping Off, DH5 2480 MHz |

Horizontal

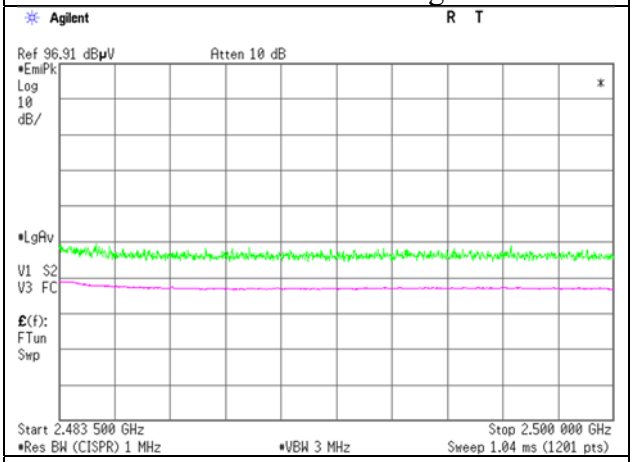
Restricted-band band-edge Plot




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

| | | | |
|---|---|---|---|
| Test place | Ise EMC Lab. | | |
| Semi Anechoic Chamber | No.1 | No.3 | No.3 |
| Date | April 25, 2022 | April 26, 2022 | May 9, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH | 22 deg. C / 66 % RH | 21 deg. C / 34 % RH |
| Engineer | Hiroyuki Furutaka | Yuichiro Yamazaki | Junki Nagatomi |
| | (1 GHz - 10 GHz) | (Above 10 GHz) | (Below 1 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2402 MHz | | |

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (QP / PK) [dBuV] | Reading (AV) [dBuV] | Ant. Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result (QP / PK) [dBuV/m] | Result (AV) [dBuV/m] | Limit (QP / PK) [dBuV/m] | Limit (AV) [dBuV/m] | Margin (QP / PK) [dB] | Margin (AV) [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 87.8 | 29.1 | - | 8.2 | 8.0 | 32.2 | - | 13.1 | - | 40.0 | - | 26.9 | - | |
| Hori. | 264.2 | 33.1 | - | 12.9 | 9.7 | 32.0 | - | 23.7 | - | 46.0 | - | 22.4 | - | |
| Hori. | 416.0 | 31.0 | - | 16.3 | 10.8 | 32.0 | - | 26.2 | - | 46.0 | - | 19.8 | - | |
| Hori. | 600.0 | 28.3 | - | 19.4 | 12.0 | 32.0 | - | 27.7 | - | 46.0 | - | 18.3 | - | |
| Hori. | 926.3 | 29.4 | - | 22.2 | 13.7 | 30.8 | - | 34.6 | - | 46.0 | - | 11.5 | - | |
| Hori. | 1000.0 | 28.3 | - | 22.5 | 14.1 | 30.4 | - | 34.5 | - | 53.9 | - | 19.4 | - | |
| Hori. | 2390.0 | 45.4 | 36.3 | 27.7 | 4.7 | 36.3 | 1.1 | 41.5 | 33.5 | 73.9 | 53.9 | 32.4 | 20.4 | *1) |
| Hori. | 4804.0 | 42.9 | 34.0 | 31.2 | 6.6 | 35.8 | - | 45.0 | 36.1 | 73.9 | 53.9 | 29.0 | 17.9 | Floor noise |
| Hori. | 7206.0 | 44.1 | 34.8 | 35.9 | 7.5 | 35.9 | - | 51.7 | 42.4 | 73.9 | 53.9 | 22.3 | 11.6 | Floor noise |
| Hori. | 9608.0 | 44.7 | 35.4 | 38.7 | 8.4 | 36.3 | - | 55.5 | 46.2 | 73.9 | 53.9 | 18.4 | 7.7 | Floor noise |
| Vert. | 86.4 | 27.6 | - | 7.9 | 8.0 | 32.2 | - | 11.3 | - | 40.0 | - | 28.7 | - | |
| Vert. | 264.2 | 34.2 | - | 12.9 | 9.7 | 32.0 | - | 24.8 | - | 46.0 | - | 21.3 | - | |
| Vert. | 416.0 | 34.1 | - | 16.3 | 10.8 | 32.0 | - | 29.3 | - | 46.0 | - | 16.7 | - | |
| Vert. | 600.0 | 31.1 | - | 19.4 | 12.0 | 32.0 | - | 30.5 | - | 46.0 | - | 15.5 | - | |
| Vert. | 926.2 | 28.3 | - | 22.2 | 13.7 | 30.8 | - | 33.5 | - | 46.0 | - | 12.6 | - | |
| Vert. | 1000.0 | 31.5 | - | 22.5 | 14.1 | 30.4 | - | 37.7 | - | 53.9 | - | 16.2 | - | |
| Vert. | 2390.0 | 45.6 | 36.4 | 27.7 | 4.7 | 36.3 | 1.1 | 41.7 | 33.6 | 73.9 | 53.9 | 32.2 | 20.3 | *1) |
| Vert. | 4804.0 | 42.5 | 33.8 | 31.2 | 6.6 | 35.8 | - | 44.6 | 35.9 | 73.9 | 53.9 | 29.4 | 18.1 | Floor noise |
| Vert. | 7206.0 | 44.1 | 34.6 | 35.9 | 7.5 | 35.9 | - | 51.7 | 42.2 | 73.9 | 53.9 | 22.2 | 11.8 | Floor noise |
| Vert. | 9608.0 | 44.3 | 35.3 | 38.7 | 8.4 | 36.3 | - | 55.1 | 46.1 | 73.9 | 53.9 | 18.8 | 7.8 | Floor noise |

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

*QP detector was used up to 1GHz.

*1) Not Out of Band emission(Leakage Power)

**20dBc Data Sheet**

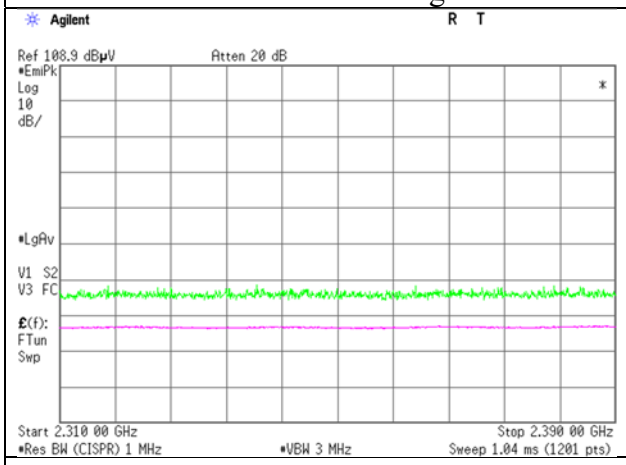
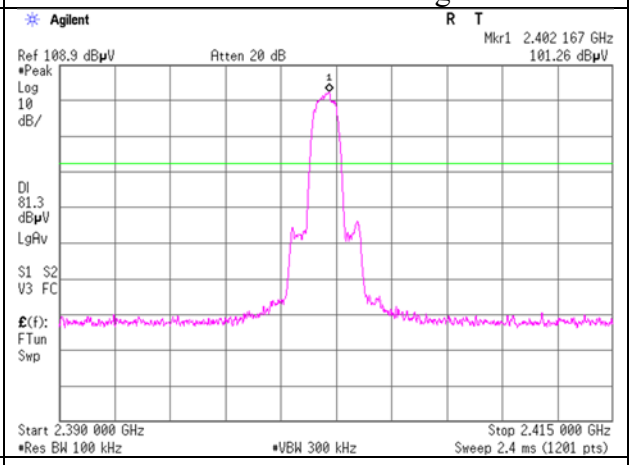
| Polarity [Hori/Vert] | Frequency [MHz] | Reading (PK) [dBuV] | Ant Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2402.0 | 101.3 | 27.6 | 4.7 | 36.3 | 97.3 | - | - | Carrier |
| Hori. | 2400.0 | 44.6 | 27.6 | 4.7 | 36.3 | 40.7 | 77.3 | 36.7 | |
| Vert. | 2402.0 | 101.5 | 27.6 | 4.7 | 36.3 | 97.6 | - | - | Carrier |
| Vert. | 2400.0 | 43.9 | 27.6 | 4.7 | 36.3 | 40.0 | 77.6 | 37.6 | |

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Distance factor: 1 GHz - 10 GHz 20log (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

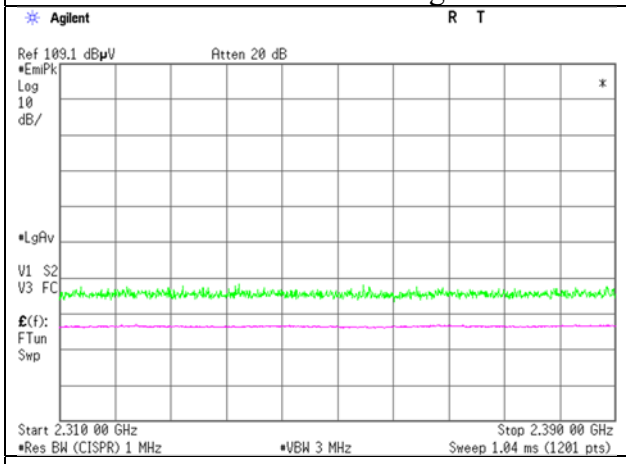
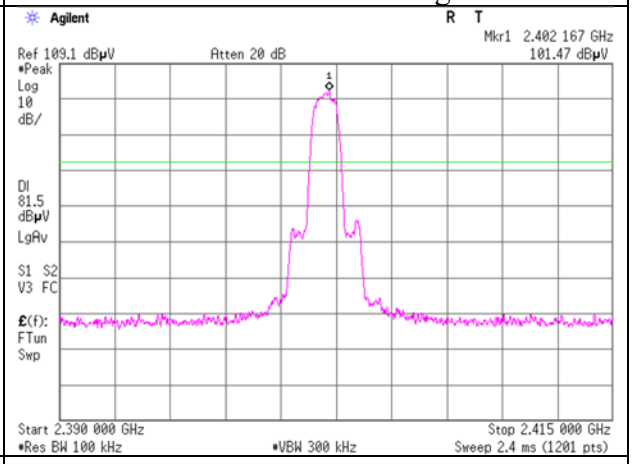
# Radiated Spurious Emission
## (Reference Plot for band-edge)

| | |
|---|---|
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.1 |
| Date | April 25, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH |
| Engineer | Hiroyuki Furutaka |
| Mode | Tx, Hopping Off, 3DH5 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

| | | |
|---|---|---|
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.3 |
| Date | April 25, 2022 | April 26, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH | 22 deg. C / 66 % RH |
| Engineer | Hiroyuki Furutaka | Yuichiro Yamazaki |
| | (1 GHz - 10 GHz) | (Above 10 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2441 MHz | |

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (QP / PK) [dBuV] | Reading (AV) [dBuV] | Ant. Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result (QP / PK) [dBuV/m] | Result (AV) [dBuV/m] | Limit (QP / PK) [dBuV/m] | Limit (AV) [dBuV/m] | Margin (QP / PK) [dB] | Margin (AV) [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 4882.0 | 43.0 | 34.2 | 31.3 | 6.6 | 35.7 | - | 45.1 | 36.3 | 73.9 | 53.9 | 28.8 | 17.6 | Floor noise |
| Hori. | 7323.0 | 44.6 | 34.9 | 36.1 | 7.5 | 35.9 | - | 52.4 | 42.7 | 73.9 | 53.9 | 21.6 | 11.3 | Floor noise |
| Hori. | 9764.0 | 45.1 | 35.3 | 39.1 | 8.4 | 36.4 | - | 56.2 | 46.4 | 73.9 | 53.9 | 17.7 | 7.5 | Floor noise |
| Vert. | 4882.0 | 43.6 | 35.4 | 31.3 | 6.6 | 35.7 | 1.1 | 45.7 | 38.6 | 73.9 | 53.9 | 28.2 | 15.3 | |
| Vert. | 7323.0 | 43.8 | 34.7 | 36.1 | 7.5 | 35.9 | - | 51.6 | 42.5 | 73.9 | 53.9 | 22.4 | 11.5 | Floor noise |
| Vert. | 9764.0 | 45.0 | 35.4 | 39.1 | 8.4 | 36.4 | - | 56.1 | 46.5 | 73.9 | 53.9 | 17.8 | 7.4 | Floor noise |

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

*QP detector was used up to 1GHz.

| | | |
|---|---|---|
| Distance factor: | 1 GHz - 10 GHz | 20log (3.85 m / 3.0 m) = 2.17 dB |
| | 10 GHz - 26.5 GHz | 20log (1.0 m / 3.0 m) = -9.5 dB |

# Radiated Spurious Emission

| | | |
|---|---|---|
| Test place | Ise EMC Lab. | |
| Semi Anechoic Chamber | No.1 | No.3 |
| Date | April 25, 2022 | April 26, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH | 22 deg. C / 66 % RH |
| Engineer | Hiroyuki Furutaka | Yuichiro Yamazaki |
| | (1 GHz - 10 GHz) | (Above 10 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2480 MHz | |

| Polarity [Hori/Vert] | Frequency [MHz] | Reading (QP / PK) [dBuV] | Reading (AV) [dBuV] | Ant. Factor [dB/m] | Loss [dB] | Gain [dB] | Duty Factor [dB] | Result (QP / PK) [dBuV/m] | Result (AV) [dBuV/m] | Limit (QP / PK) [dBuV/m] | Limit (AV) [dBuV/m] | Margin (QP / PK) [dB] | Margin (AV) [dB] | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hori. | 2483.5 | 47.9 | 38.0 | 27.6 | 4.7 | 36.3 | 1.1 | 43.9 | 35.1 | 73.9 | 53.9 | 30.0 | 18.8 | *1) |
| Hori. | 4960.0 | 44.0 | 34.6 | 31.4 | 6.6 | 35.7 | - | 46.2 | 36.8 | 73.9 | 53.9 | 27.7 | 17.1 | Floor noise |
| Hori. | 7440.0 | 43.9 | 35.2 | 36.3 | 7.6 | 35.9 | - | 51.9 | 43.2 | 73.9 | 53.9 | 22.1 | 10.8 | Floor noise |
| Hori. | 9920.0 | 44.0 | 35.9 | 39.0 | 8.5 | 36.4 | - | 55.0 | 46.9 | 73.9 | 53.9 | 18.9 | 7.0 | Floor noise |
| Vert. | 2483.5 | 48.5 | 38.7 | 27.6 | 4.7 | 36.3 | 1.1 | 44.5 | 35.8 | 73.9 | 53.9 | 29.4 | 18.1 | *1) |
| Vert. | 4960.0 | 42.9 | 34.5 | 31.4 | 6.6 | 35.7 | - | 45.1 | 36.7 | 73.9 | 53.9 | 28.8 | 17.2 | Floor noise |
| Vert. | 7440.0 | 43.3 | 35.1 | 36.3 | 7.6 | 35.9 | - | 51.3 | 43.1 | 73.9 | 53.9 | 22.7 | 10.9 | Floor noise |
| Vert. | 9920.0 | 44.0 | 35.7 | 39.0 | 8.5 | 36.4 | - | 55.0 | 46.7 | 73.9 | 53.9 | 18.9 | 7.2 | Floor noise |

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Result (AV)= Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

*QP detector was used up to 1GHz.

*1) Not Out of Band emission(Leakage Power)

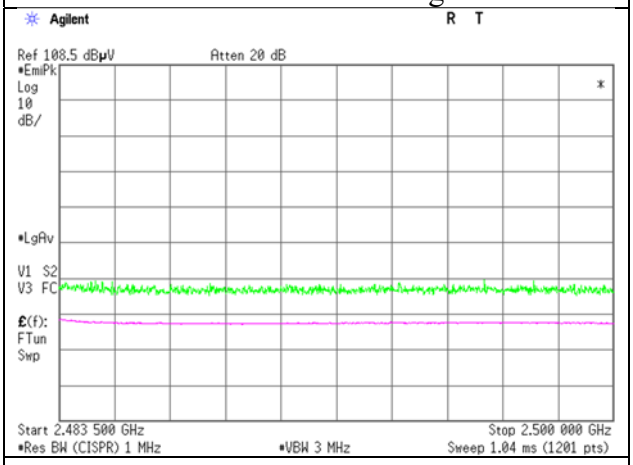
| | | |
|---|---|---|
| Distance factor: | 1 GHz - 10 GHz | 20log (3.85 m / 3.0 m) = 2.17 dB |
| | 10 GHz - 26.5 GHz | 20log (1.0 m / 3.0 m) = -9.5 dB |

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

| | |
|---|---|
| Test place | Ise EMC Lab. |
| Semi Anechoic Chamber | No.1 |
| Date | April 25, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH |
| Engineer | Hiroyuki Furutaka<br>(1 GHz - 10 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2480 MHz |

Horizontal

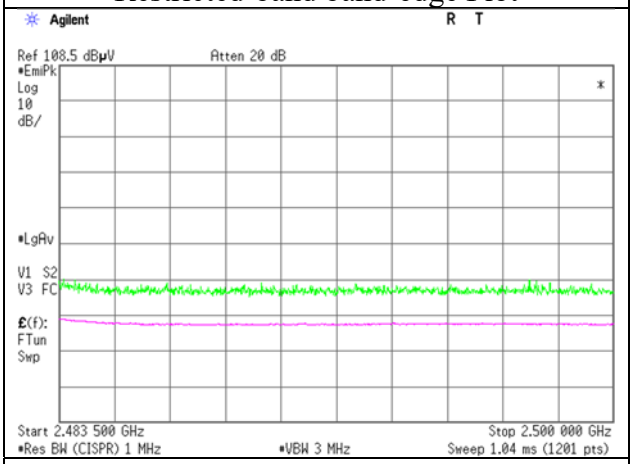
Restricted-band band-edge Plot




Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

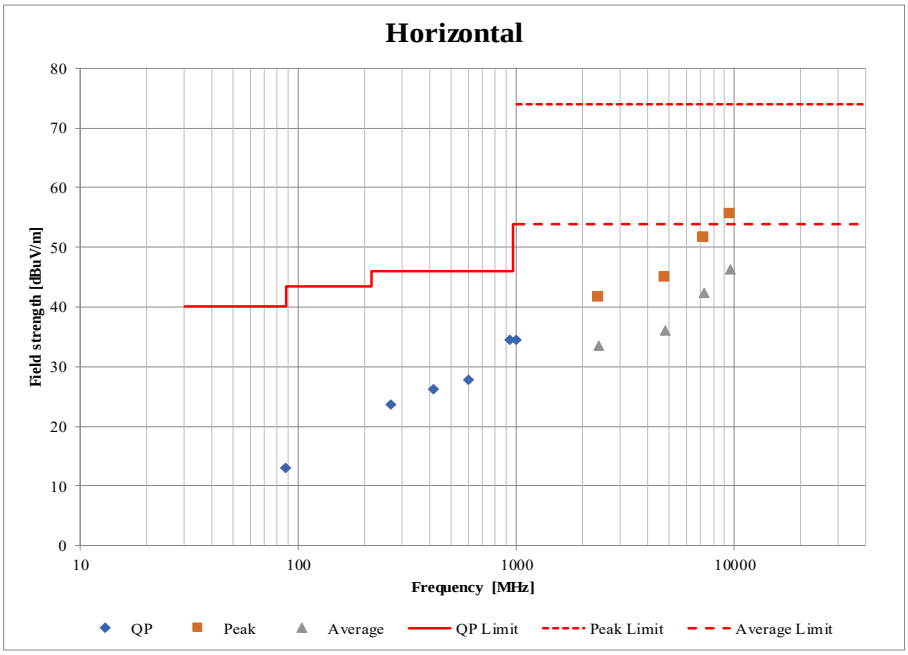


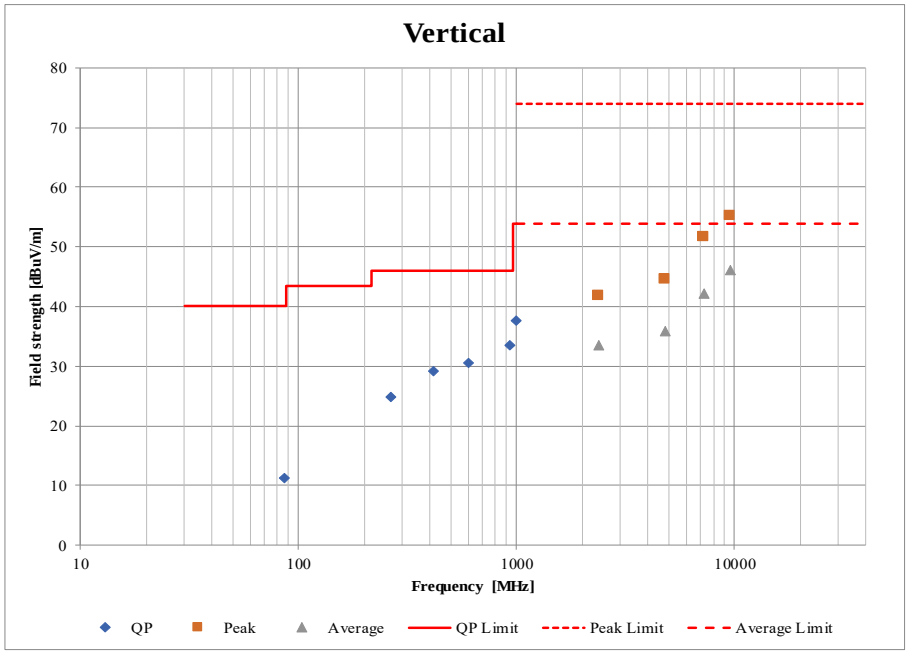

Trace Green : Peak Plot
Trace Purple : Average Plot

* 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 mode for Maximum Peak Output Power)

| | | | |
|---|---|---|---|
| Test place | Ise EMC Lab. | | |
| Semi Anechoic Chamber | No.1 | No.3 | No.3 |
| Date | April 25, 2022 | April 26, 2022 | May 9, 2022 |
| Temperature / Humidity | 22 deg. C / 44 % RH | 22 deg. C / 66 % RH | 21 deg. C / 34 % RH |
| Engineer | Hiroyuki Furutaka<br>(1 GHz - 10 GHz) | Yuichiro Yamazaki<br>(Above 10 GHz) | Junki Nagatomi<br>(Below 1 GHz) |
| Mode | Tx, Hopping Off, 3DH5 2402 MHz | | |



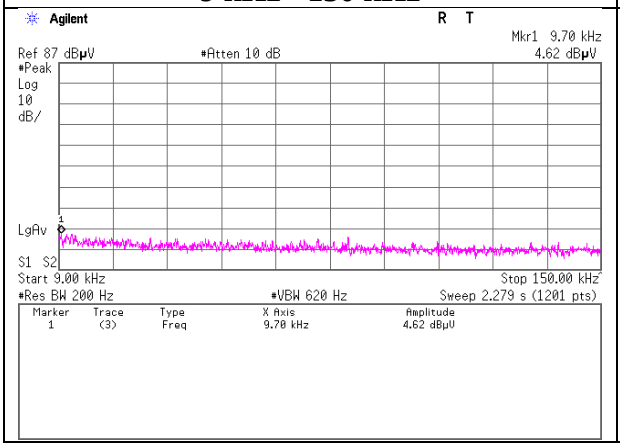

*These plots data contains sufficient number to show the trend of characteristic features for EUT.

# Conducted Spurious Emission

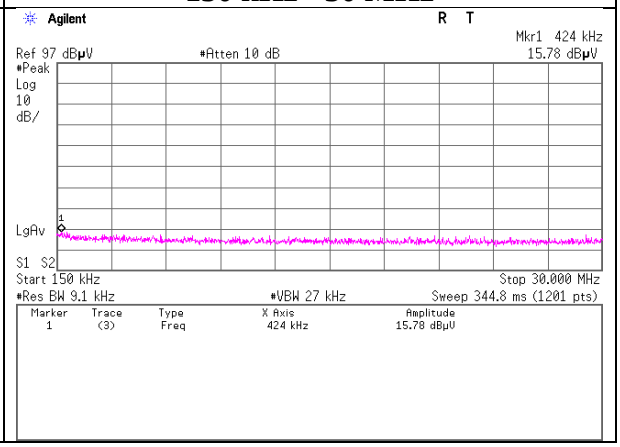
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 9, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH |
| Engineer | Nachi Konegawa |
| Mode | Tx, Hopping Off, DH5 |

## 2402 MHz

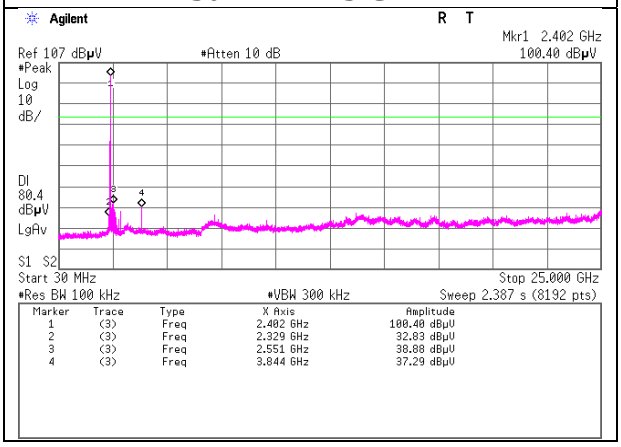
### 9 kHz - 150 kHz




### 150 kHz - 30 MHz




### 30 MHz - 25 GHz

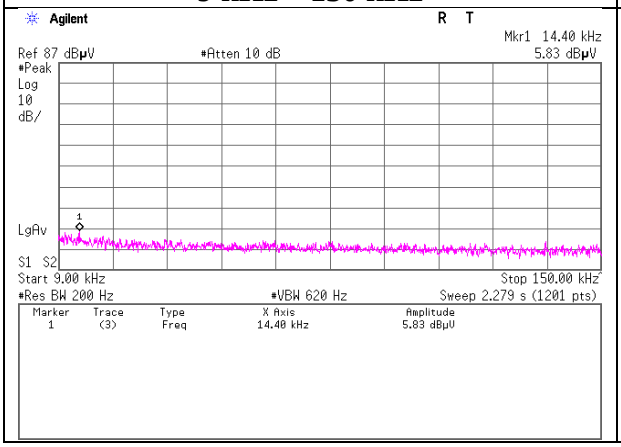


# Conducted Spurious Emission

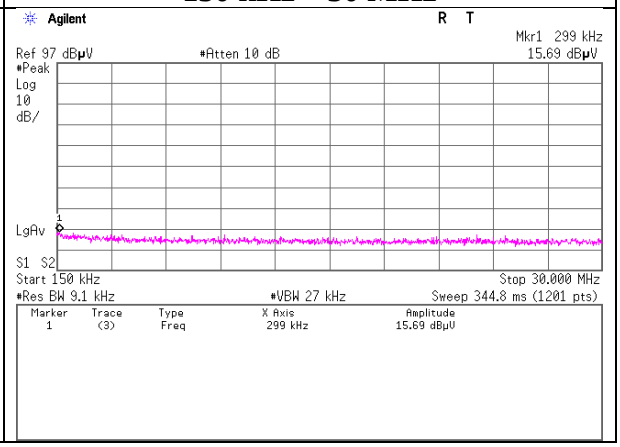
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 9, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH |
| Engineer | Nachi Konegawa |
| Mode | Tx, Hopping Off, DH5 |

## 2441 MHz

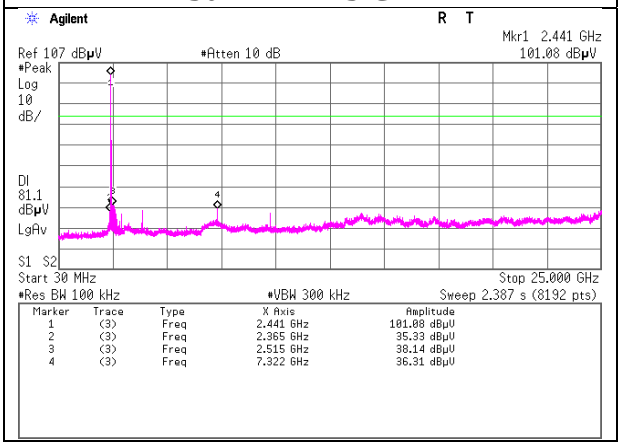
### 9 kHz – 150 kHz




### 150 kHz – 30 MHz




### 30 MHz – 25 GHz

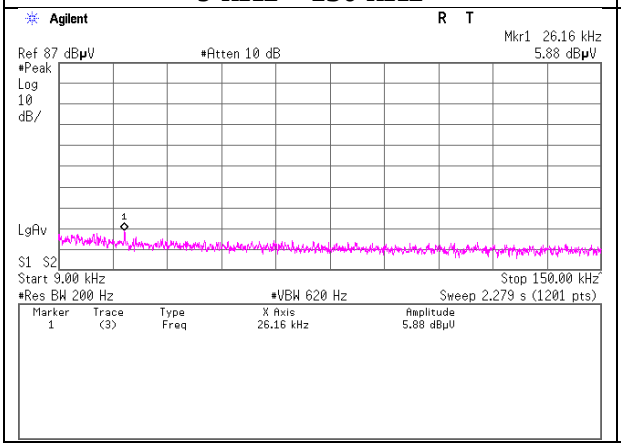


# Conducted Spurious Emission

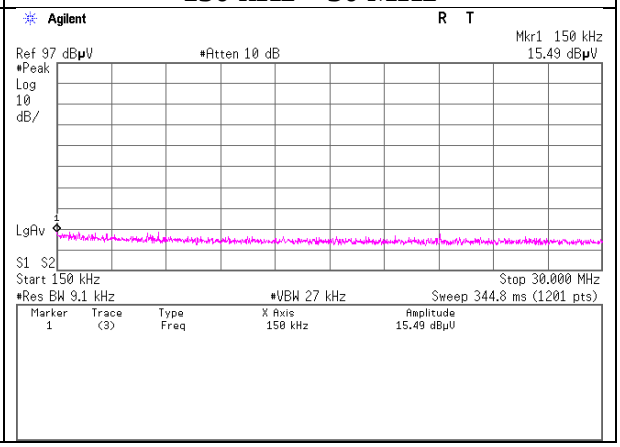
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 9, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH |
| Engineer | Nachi Konegawa |
| Mode | Tx, Hopping Off, DH5 |

## 2480 MHz

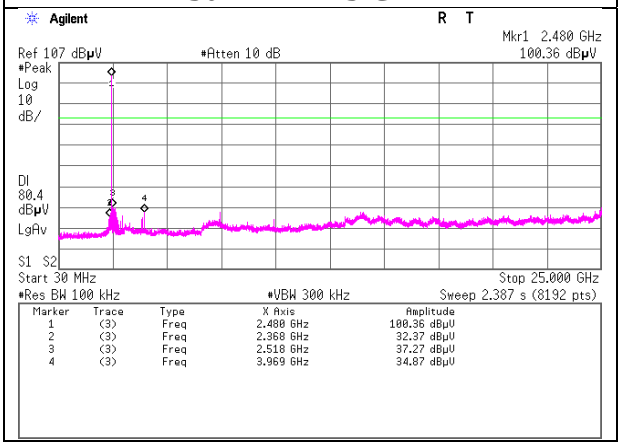
### 9 kHz – 150 kHz




### 150 kHz – 30 MHz




### 30 MHz – 25 GHz

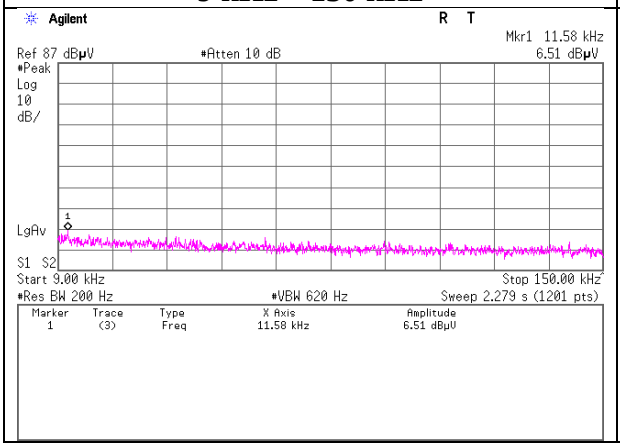


# Conducted Spurious Emission

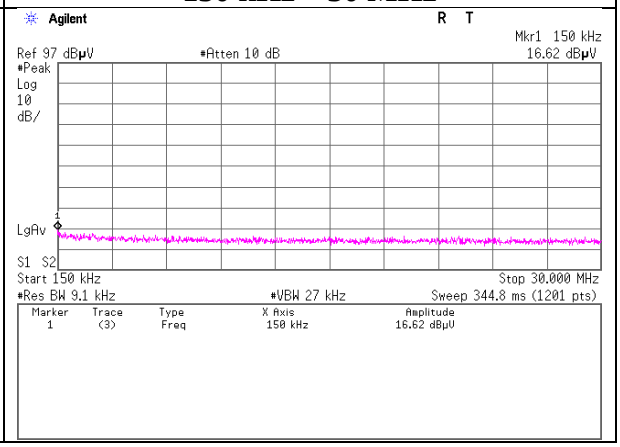
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 10, 2022 |
| Temperature / Humidity | 24 deg. C / 39 % RH |
| Engineer | Takumi Nishida |
| Mode | Tx, Hopping Off, 3DH5 |

## 2402 MHz

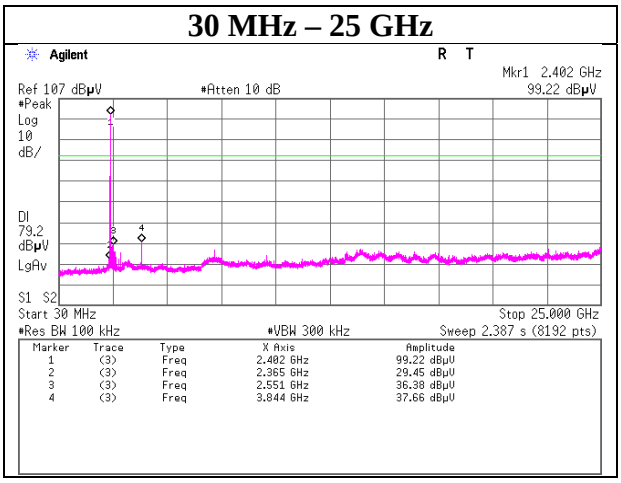
### 9 kHz – 150 kHz




### 150 kHz – 30 MHz




### 30 MHz – 25 GHz

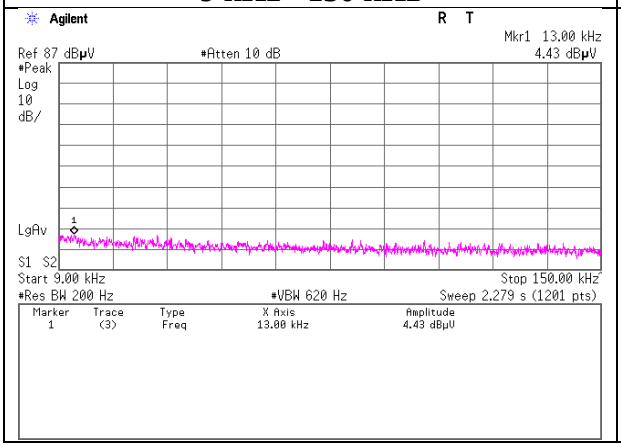


# Conducted Spurious Emission

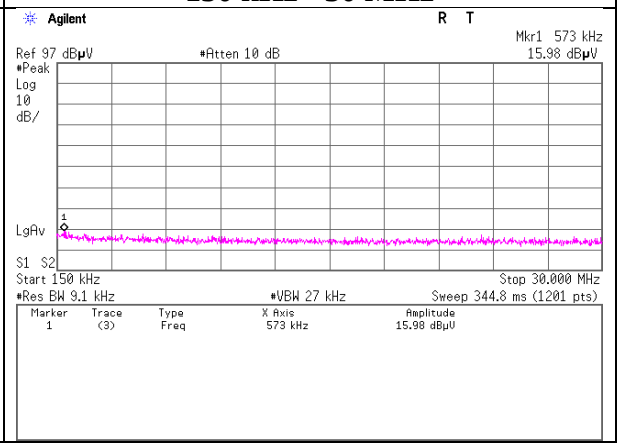
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 10, 2022 |
| Temperature / Humidity | 24 deg. C / 39 % RH |
| Engineer | Takumi Nishida |
| Mode | Tx, Hopping Off, 3DH5 |

## 2441 MHz

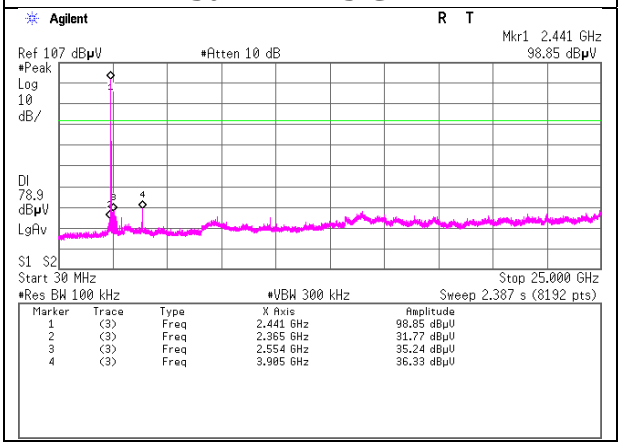
### 9 kHz - 150 kHz




### 150 kHz - 30 MHz




### 30 MHz - 25 GHz

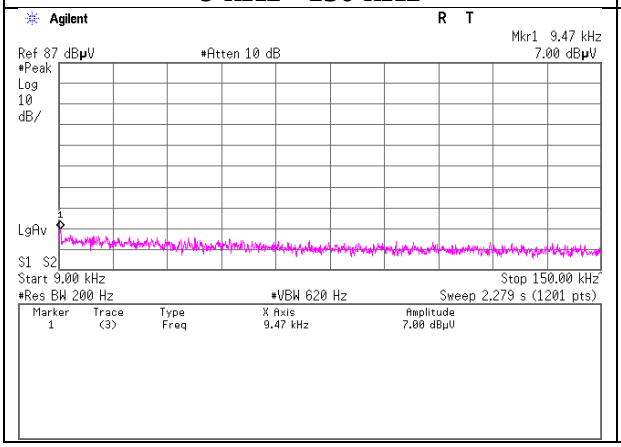


# Conducted Spurious Emission

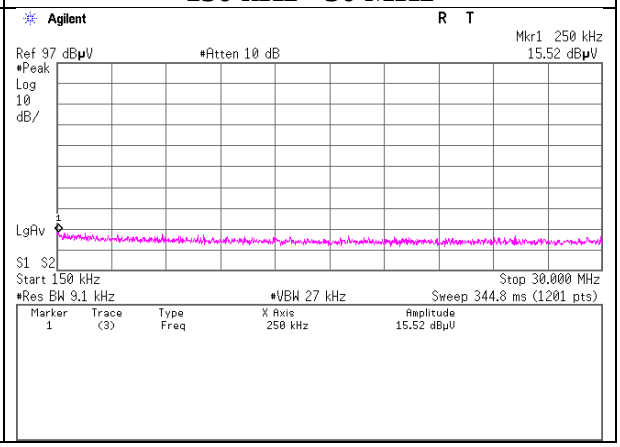
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 10, 2022 |
| Temperature / Humidity | 24 deg. C / 39 % RH |
| Engineer | Takumi Nishida |
| Mode | Tx, Hopping Off, 3DH5 |

## 2480 MHz

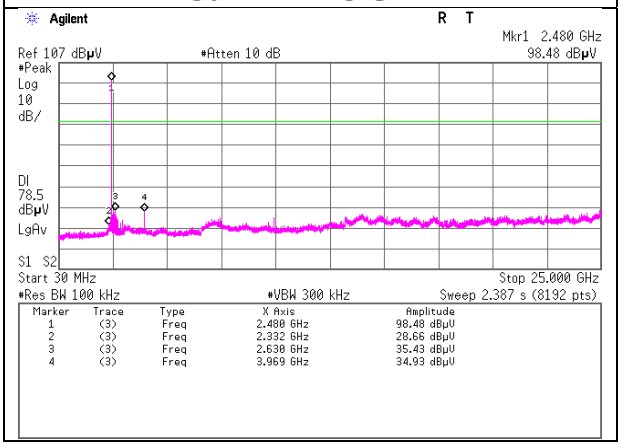
### 9 kHz - 150 kHz




### 150 kHz - 30 MHz




### 30 MHz - 25 GHz

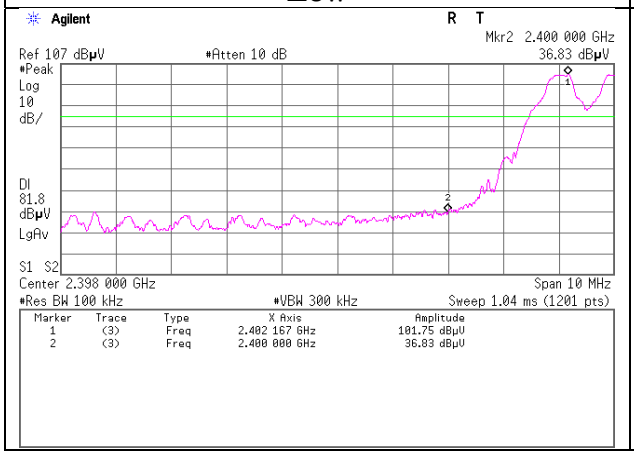


# Conducted Emission Band Edge compliance

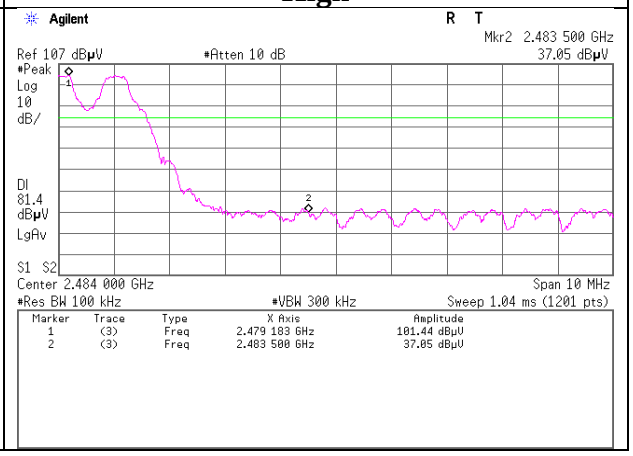
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 9, 2022 |
| Temperature / Humidity | 26 deg. C / 33 % RH |
| Engineer | Nachi Konegawa |
| Mode | Tx DH5 |

## Hopping On

### Low

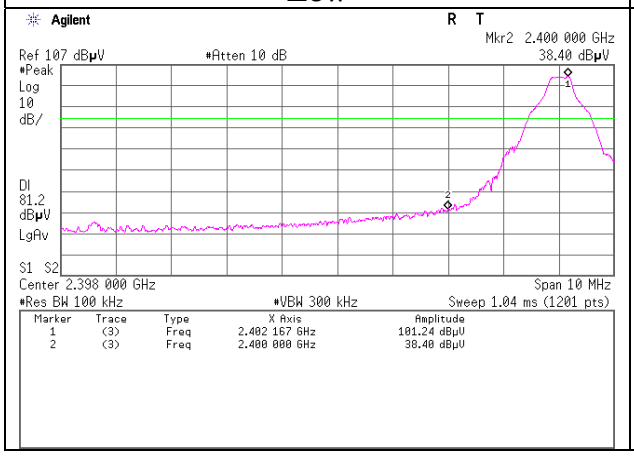



### High

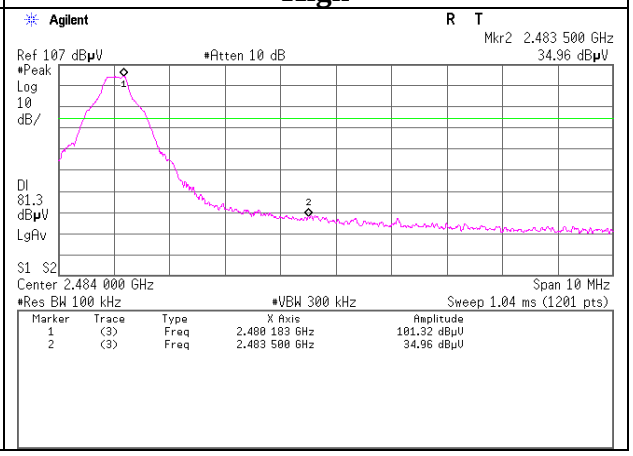



## Hopping Off

### Low




### High

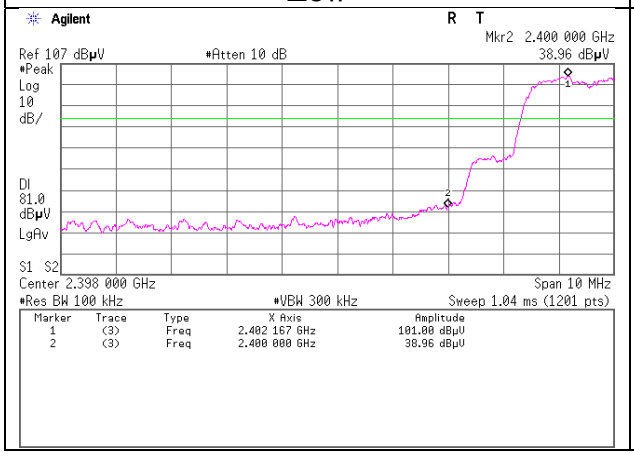


# Conducted Emission Band Edge compliance

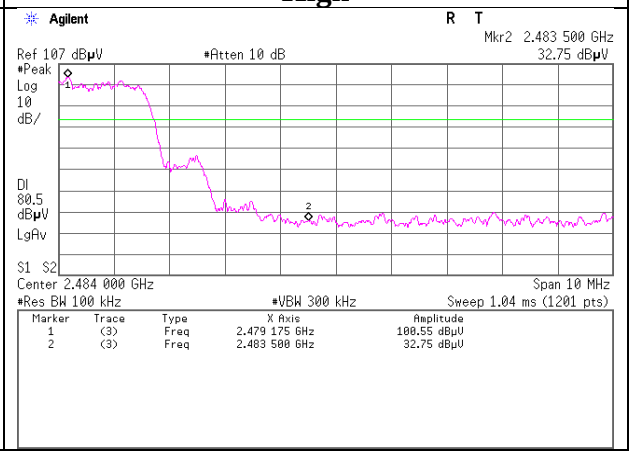
| | |
|---|---|
| Test place | Ise EMC Lab. No.6 Measurement Room |
| Date | May 10, 2022 |
| Temperature / Humidity | 24 deg. C / 39 % RH |
| Engineer | Takumi Nishida |
| Mode | Tx 3DH5 |

## Hopping On

### Low

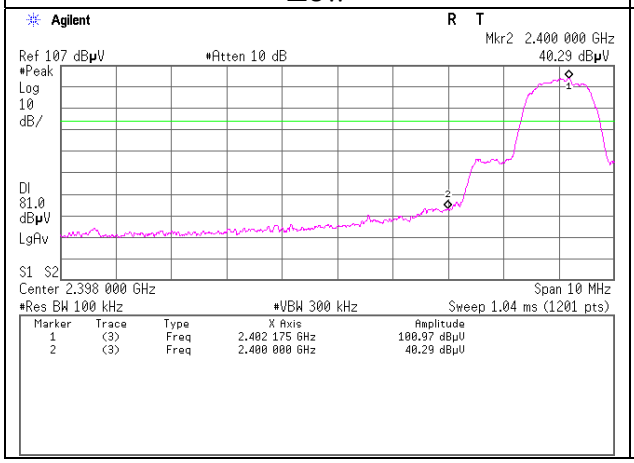



### High

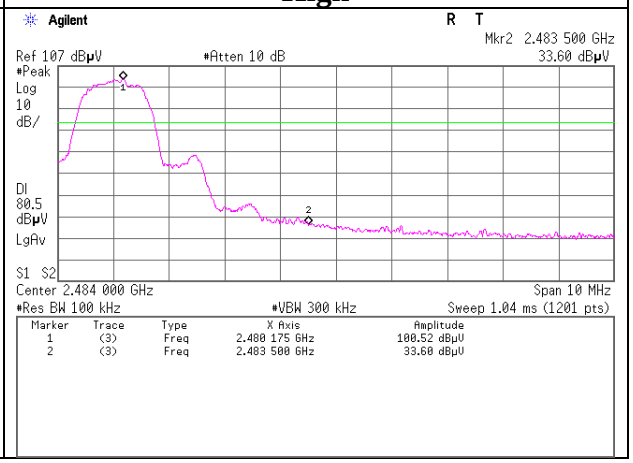



## Hopping Off

### Low




### High



# APPENDIX 2: Test Instruments

## Test Equipment (1/2)

| Test Item | Local ID | LIMS ID | Description | Manufacturer | Model | Serial | Last Calibration Date | Cal Int |
|---|---|---|---|---|---|---|---|---|
| AT | MAT-23 | 141361 | Attenuator(10dB) 1-18GHz | Orient Microwave | BX10-0476-00 | - | 04/06/2022 | 12 |
| AT | MAT-89 | 141419 | Attenuator | Weinschel Associates | WA56-10 | 56100305 | 05/14/2021 | 12 |
| AT | MCC-244 | 197219 | Microwave cable | Huber+Suhner | SF126E/11PC35/ 11PC35/2000MM | 536999/126E | 03/17/2022 | 12 |
| AT | MCC-96 | 141375 | Microwave Cable 1G-40GHz | Suhner | SUCOFLEX102 | 30817/2 | 05/08/2022 | 12 |
| AT | MMM-18 | 141558 | Digital Tester(TRUE RMS MULTIMETER) | Fluke Corporation | 115 | 17930030 | 05/24/2021 | 12 |
| AT | MOS-14 | 141561 | Thermo-Hygrometer | CUSTOM. Inc | CTH-201 | 1401 | 01/10/2022 | 12 |
| AT | MPM-16 | 141812 | Power Meter | Keysight Technologies Inc | 8990B | MY51000271 | 08/11/2021 | 12 |
| AT | MPSE-22 | 141842 | Power sensor | Keysight Technologies Inc | N1923A | MY54070003 | 08/11/2021 | 12 |
| AT | MSA-22 | 141978 | Spectrum Analyzer | Keysight Technologies Inc | E4448A | MY46180899 | 03/24/2022 | 12 |
| RE | COTS-MEMI-02 | 178648 | EMI measurement program | TSJ (Techno Science Japan) | TEPTO-DV | - | - | - |
| RE | MAEC-01 | 141998 | AC1_Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 10m | DA-06881 | 06/08/2020 | 24 |
| RE | MAEC-01-SVSWR | 141994 | AC1_Semi Anechoic Chamber(SVSWR) | TDK | Semi Anechoic Chamber 10m | DA-06881 | 04/05/2021 | 24 |
| RE | MAEC-02 | 142004 | AC2_Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-06902 | 05/26/2020 | 24 |
| RE | MAEC-02-SVSWR | 142006 | AC2_Semi Anechoic Chamber(SVSWR) | TDK | Semi Anechoic Chamber 3m | DA-06902 | 04/09/2021 | 24 |
| RE | MAEC-03 | 142008 | AC3_Semi Anechoic Chamber(NSA) | TDK | Semi Anechoic Chamber 3m | DA-10005 | 05/22/2020 | 24 |
| RE | MAEC-03-SVSWR | 142013 | AC3_Semi Anechoic Chamber(SVSWR) | TDK | Semi Anechoic Chamber 3m | DA-10005 | 04/01/2021 | 24 |
| RE | MAT-95 | 142314 | Attenuator | Pasternack Enterprises | PE7390-6 | D/C 1504 | 06/09/2021 | 12 |
| RE | MBA-08 | 141427 | Biconical Antenna | Schwarzbeck Mess-Elektronik OHG | VHA9103B+ BBA9106 | 08031 | 07/10/2021 | 12 |
| RE | MCC-177 | 141226 | Microwave Cable | Junkosha | MMX221-00500DMSDMS | 1502S304 | 03/17/2022 | 12 |
| RE | MCC-217 | 141393 | Microwave Cable | Junkosha | MWX221 | 1604S254(1 m) / 1608S088(5 m) | 08/04/2021 | 12 |
| RE | MCC-218 | 141394 | Microwave Cable | Junkosha | MWX221 | 1607S141(1 m) / 1608S264(5 m) | 09/30/2021 | 12 |
| RE | MCC-231 | 177964 | Microwave Cable | Junkosha INC. | MMX221 | 1901S329(1m)/ 1902S579(5m) | 03/15/2022 | 12 |
| RE | MCC-51 | 141323 | Coaxial cable | UL Japan | - | - | 07/19/2021 | 12 |
| RE | MHA-05 | 141511 | Horn Antenna 1-18GHz | Schwarzbeck Mess-Elektronik OHG | BBHA9120D | 253 | 09/24/2021 | 12 |
| RE | MHA-06 | 141512 | Horn Antenna 1-18GHz | Schwarzbeck Mess-Elektronik OHG | BBHA9120D | 254 | 10/21/2021 | 12 |
| RE | MHA-16 | 141513 | Horn Antenna 15-40GHz | Schwarzbeck Mess-Elektronik OHG | BBHA9170 | BBHA9170306 | 06/07/2021 | 12 |
| RE | MHA-20 | 141507 | Horn Antenna 1-18GHz | Schwarzbeck Mess-Elektronik OHG | BBHA9120D | 258 | 11/09/2021 | 12 |
| RE | MHF-06 | 141404 | High Pass Filter 3.5-24GHz | TOKIMEC | TF323DCA | 601 | 05/18/2021 | 12 |
| RE | MHF-22 | 141293 | High Pass Filter 7-20GHz | TOKIMEC | TF37NCCB | 602 | 02/24/2022 | 12 |
| RE | MHF-25 | 141232 | High Pass Filter 3.5-18.0GHz | UL Japan | HPF SELECTOR | 001 | 09/30/2021 | 12 |

## Test Equipment (2/2)

| Test Item | Local ID | LIMS ID | Description | Manufacturer | Model | Serial | Last Calibration Date | Cal Int |
|---|---|---|---|---|---|---|---|---|
| RE | MJM-16 | 142183 | Measure | KOMELON | KMC-36 | - | - | - |
| RE | MJM-25 | 142226 | Measure | KOMELON | KMC-36 | - | - | - |
| RE | MJM-27 | 142228 | Measure | KOMELON | KMC-36 | - | - | - |
| RE | MLA-22 | 141266 | Logperiodic Antenna (200-1000MHz) | Schwarzbeck Mess-Elektronik OHG | VUSLP9111B | 9111B-191 | 08/21/2021 | 12 |
| RE | MMM-01 | 141542 | Digital Tester | Fluke Corporation | FLUKE 26-3 | 78030611 | 08/10/2021 | 12 |
| RE | MMM-03 | 141530 | Digital Tester | Fluke Corporation | FLUKE 26-3 | 78030621 | 08/10/2021 | 12 |
| RE | MMM-08 | 141532 | DIGITAL HiTESTER | HIOKI E.E. CORPORATION | 3805 | 51201197 | 01/16/2022 | 12 |
| RE | MOS-13 | 141554 | Thermo-Hygrometer | CUSTOM. Inc | CTH-201 | 1301 | 01/10/2022 | 12 |
| RE | MOS-27 | 141566 | Thermo-Hygrometer | CUSTOM. Inc | CTH-201 | A08Q26 | 01/10/2022 | 12 |
| RE | MOS-41 | 192300 | Thermo-Hygrometer | CUSTOM. Inc | CTH-201 | 0013 | 12/19/2021 | 12 |
| RE | MPA-01 | 141576 | Pre Amplifier | Keysight Technologies Inc | 8449B | 3008A01671 | 02/22/2022 | 12 |
| RE | MPA-10 | 141579 | Pre Amplifier | Keysight Technologies Inc | 8449B | 3008A02142 | 02/22/2022 | 12 |
| RE | MPA-11 | 141580 | MicroWave System Amplifier | Keysight Technologies Inc | 83017A | MY39500779 | 03/17/2022 | 12 |
| RE | MPA-13 | 141582 | Pre Amplifier | SONOMA INSTRUMENT | 310 | 260834 | 02/25/2022 | 12 |
| RE | MRENT-130 | 141855 | Spectrum Analyzer | Keysight Technologies Inc | E4440A | MY46187750 | 11/28/2021 | 12 |
| RE | MSA-22 | 141978 | Spectrum Analyzer | Keysight Technologies Inc | E4448A | MY46180899 | 03/24/2022 | 12 |
| RE | MTR-08 | 141949 | Test Receiver | Rohde & Schwarz | ESCI | 100767 | 08/05/2021 | 12 |

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

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

**Test item: RE: Radiated Emission**
**AT: Antenna Terminal Conducted**