



# RADIO TEST REPORT

**Test Report No. : 13097799H-K-R2**

**Applicant** : **JVCKENWOOD Corporation**

**Type of EUT** : **SMART HEADSETS**

**Model Number of EUT** : **WS-A1**

**FCC ID** : **ASIZWSA1**

**Test regulation** : **FCC Part 15 Subpart C: 2020**  
**\*Bluetooth (BR / EDR) parts**

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

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report covers Radio technical requirements.  
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 13097799H-K-R1. 13097799H-K-R1 is replaced with this report.

**Date of test:** May 26 to June 19, 2020

**Representative test engineer:**

Takeshi Hiyaji  
Engineer  
Consumer Technology Division

**Approved by:**

Tsubasa Takayama  
Leader  
Consumer Technology Division



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.  
\*As for the range of Accreditation in NVLAP, you may refer to the WEB address,  
[http://japan.ul.com/resources/emc\\_accredited/](http://japan.ul.com/resources/emc_accredited/)

This report contains data that are not covered by the NVLAP accreditation.

There is no testing item of "Non-accreditation".

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## REVISION HISTORY

**Original Test Report No.: 13097799H-K**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13097799H-K	July 6, 2020	-	-
1	13097799H-K-R1	July 22, 2020	P7	Corrected the explanatory note *1)
1	13097799H-K-R1	July 22, 2020	P13	Corrected IF Bandwidth of AV detection above 1 GHz (Deletion of note relating to 1/T)
1	13097799H-K-R1	July 22, 2020	P13	Corrected the explanatory note *1)
1	13097799H-K-R1	July 22, 2020	P15	Addition of note for the EUT;  “This EUT has two units, Left Earphone and Right Earphone. The test was conducted on the Left Earphone since there is no difference.”
1	13097799H-K-R1	July 22, 2020	P29	Deleted Duty Factor on 9608.000 MHz (AV)
2	13097799H-K-R2	July 28, 2020	P1	Changed A2LA logo to NVLAP logo
2	13097799H-K-R2	July 28, 2020	P12	Corrected product name of Item B; “Charger” to “Jig”

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

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

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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## **SECTION 1: Customer information**

Company Name : JVCKENWOOD Corporation  
Address : 3-12 Moriyacho, Kanagawa-ku, Yokohama-shi, Kanagawa, 221-0022,  
Japan  
Telephone Number : +81-45-450-2865  
Facsimile Number : +81-45-450-4531  
Contact Person : Takayuki Uchida

The information provided from the customer is as follows;

- Applicant, Type 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
  - 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**

Type : SMART HEADSETS  
Model Number : WS-A1  
Serial Number : Refer to SECTION 4.2  
Rating : DC 3.7 V  
Receipt Date : May 22, 2020  
Country of Mass-production : China  
Condition : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification : No Modification by the test lab.

## 2.2 Product Description

Model: WS-A1 (referred to as the EUT in this report) is a SMART HEADSETS.

### General Specification

Operating Temperature : +5 deg. C to +40 deg. C

### Radio Specification

#### **Bluetooth (BR / EDR function)**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : FHSS  
Antenna type : PIFA Antenna  
Antenna Gain : -1.3 dBi  
Maximum clock frequency : 32 MHz

#### **Bluetooth Low Energy**

Equipment Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480MHz  
Type of Modulation : GFSK  
Antenna Type : PIFA Antenna  
Antenna Gain : -1.3 dBi  
Maximum clock frequency : 32 MHz

\*This report is applied to Bluetooth (BR / EDR function) part.

## 2.3 Variant model

This EUT has variant model: WS-A1G.

The difference between the EUT and variant model is circuit and Software.

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on May 26, 2020 and effective July 27, 2020 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

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

\* 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 ----- ISED: RSS-Gen 8.8	FCC: Section 15.207 ----- ISED: RSS-Gen 8.8	-	N/A	*1)
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ----- ISED: RSS-247 5.1 (b)	See data.	Complied a)	Conducted
20dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ----- ISED: RSS-247 5.1 (a)		Complied a)	Conducted
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(iii) ----- ISED: RSS-247 5.1 (d)		Complied b)	Conducted
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(iii) ----- ISED: RSS-247 5.1 (d)		Complied c)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section15.247(a)(b)(1) ----- ISED: RSS-247 5.4 (b)		Complied d)	Conducted
Spurious Emission & Band Edge Compliance	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section15.247(d) ----- ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10		8.9 dB 7440.000 MHz, PK, Vert.	Complied e) / f)

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 is not the device that is designed to be connected to the public utility (AC) power line, and besides, the EUT in the Wireless Charging Case does not transmit the radio waves.

\*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.

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

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**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

**FCC Part 15.31 (e)**

The EUT is a battery-operated device and test was performed with the full-charged battery. 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	- a)	Conducted
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  $k=2$ .  
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#### Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.4 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.6 dB

#### Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.4 dB
	0.15 MHz to 30 MHz	2.9 dB

#### Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		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	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

### 3.5 Test Location

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\*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

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.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

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

Refer to APPENDIX.

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **SECTION 4: Operation of EUT during testing**

### **4.1 Operating Mode(s)**

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

<b>Test Item</b>	<b>Mode</b>	<b>Tested frequency</b>
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
<p>*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)</p> <p>*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.</p> <p>* 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.</p> <p>*EUT has the power settings by the software as follows;  Power settings: Same as production model  Software: Bluetest3 ver.3.2.3  (Date: May 21, 2020, Storage location: Driven by connected PC)</p> <p>*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.</p>		

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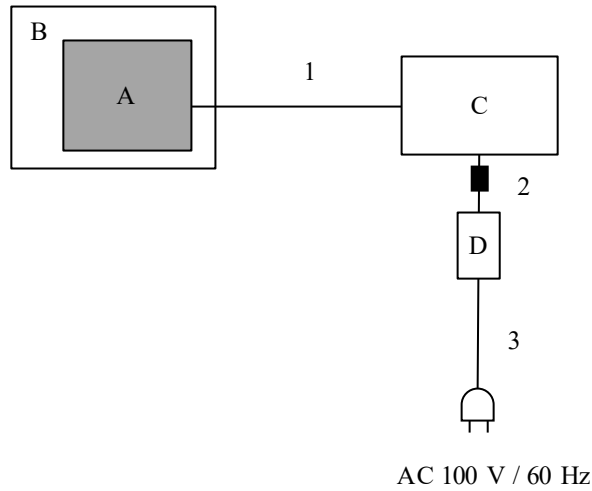
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Facsimile : +81 596 24 8124

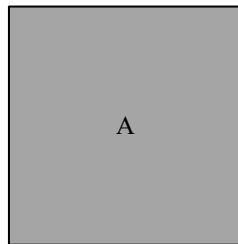
## 4.2 Configuration and peripherals

### For Antenna Terminal Conducted Tests



■ : Standard Ferrite Core

### For Radiated Spurious 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	Remark
A	SMART HEADSETS	WS-A1	001 for *AT 002 for *RE	JVCKENWOOD Corporation	EUT
B	Jig	-	-	JVCKENWOOD Corporation	-
C	Laptop PC	CF-N8HWCDPS	0BKSA08723	Panasonic	-
D	AC Adapter	CF-AA6372B	6372BM409X18054B	Panasonic	-

### List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB Cable	0.2	Shielded	Shielded	-
2	DC Cable	1.0	Unshielded	Unshielded	-
3	AC Cable	0.8	Unshielded	Unshielded	-

\*AT: Antenna Terminal Conducted Tests  
RE: Radiated Spurious Emission test

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **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 VBW: 3 MHz	RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz

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

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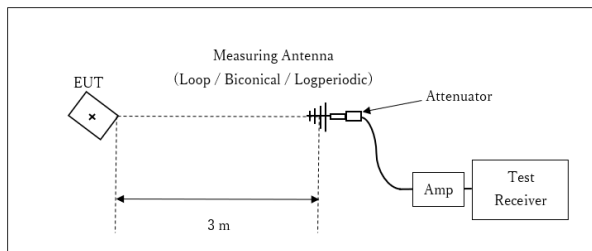
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Figure 2: Test Setup**

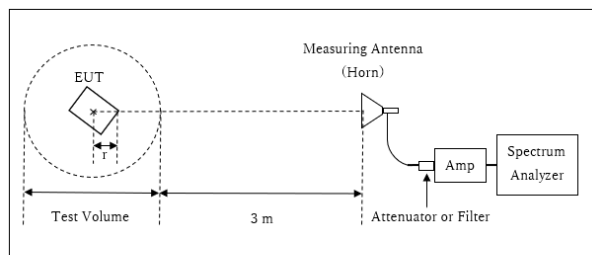
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



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

Distance Factor:  $20 \times \log(4 \text{ m} / 3.0 \text{ m}) = 2.50 \text{ dB}$

\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 4 \text{ m}$

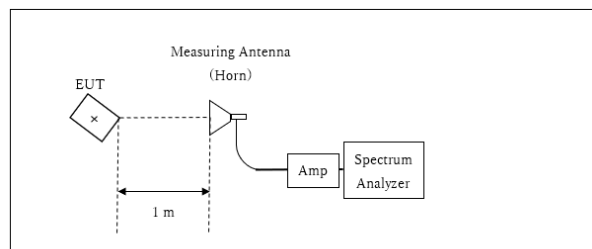
Test Volume : 2.0 m

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

r = 0.0 m

\* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

10 GHz - 26.5 GHz



× : Center of turn table

Distance Factor:  $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

\*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise. This EUT has two units, Left Earphone and Right Earphone. The test was conducted on the Left Earphone which had the worst level of spurious.

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
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 Hz	620 Hz	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 low enough 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 Ohms. 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.

This EUT has two units, Left Earphone and Right Earphone. The test was conducted on the Left Earphone since there is no difference.

**Test data : APPENDIX**

**Test result : Pass**

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## APPENDIX 1: Test data

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

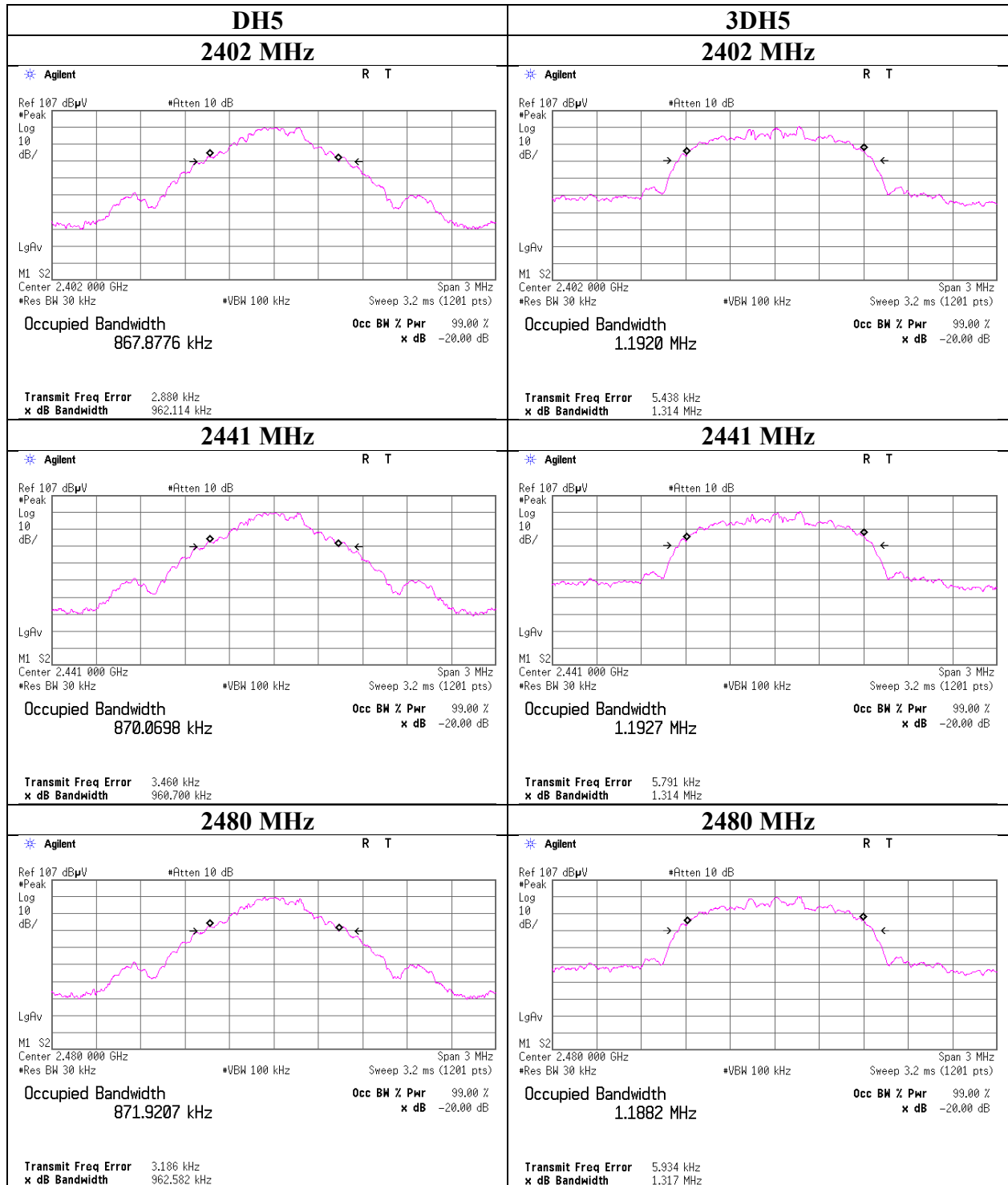
Report No. 13097799H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date May 26, 2020  
Temperature / Humidity 23 deg. C / 57 % RH  
Engineer Yuta Moriya  
Mode Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.962	867.878	1.000	$\geq 0.641$
DH5	2441.0	0.961	870.070	1.000	$\geq 0.641$
DH5	2480.0	0.963	871.921	1.000	$\geq 0.642$
DH5	Hopping On	-	78646.800	-	-
3DH5	2402.0	1.314	1192.000	1.000	$\geq 0.876$
3DH5	2441.0	1.314	1192.700	1.000	$\geq 0.876$
3DH5	2480.0	1.317	1188.200	1.000	$\geq 0.878$
3DH5	Hopping On	-	78711.600	-	-

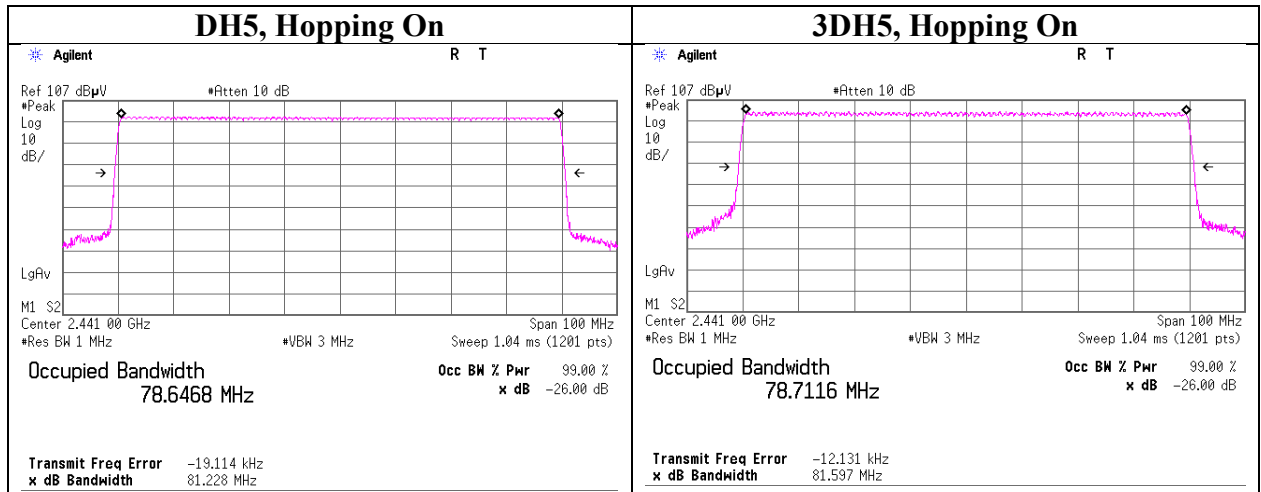
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).  
No limit applies to 20dB Bandwidth.



### 20dB Bandwidth and 99% Occupied Bandwidth



## 20dB Bandwidth and 99% Occupied Bandwidth



**UL Japan, Inc.**

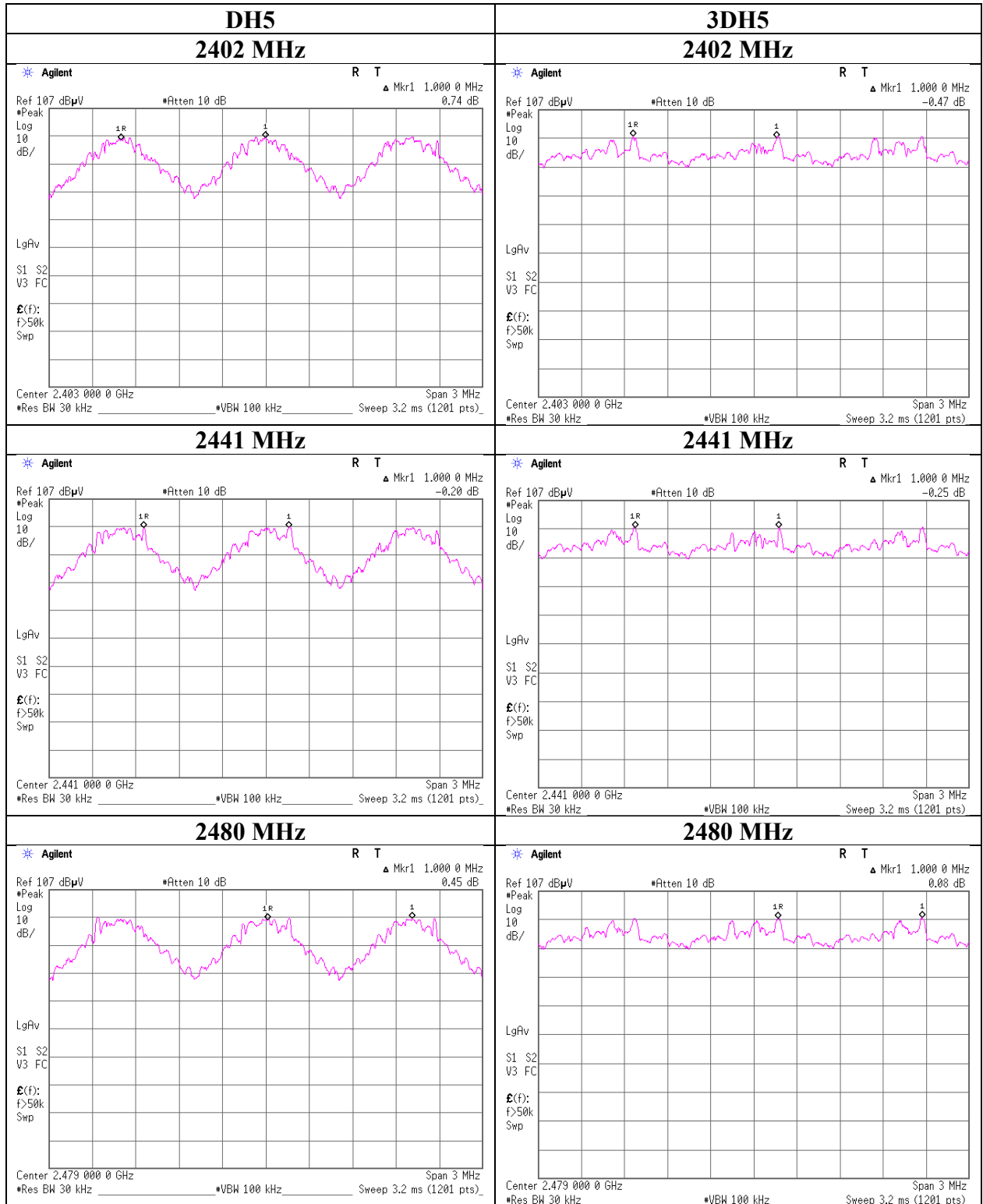
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Facsimile : +81 596 24 8124

### Carrier Frequency Separation



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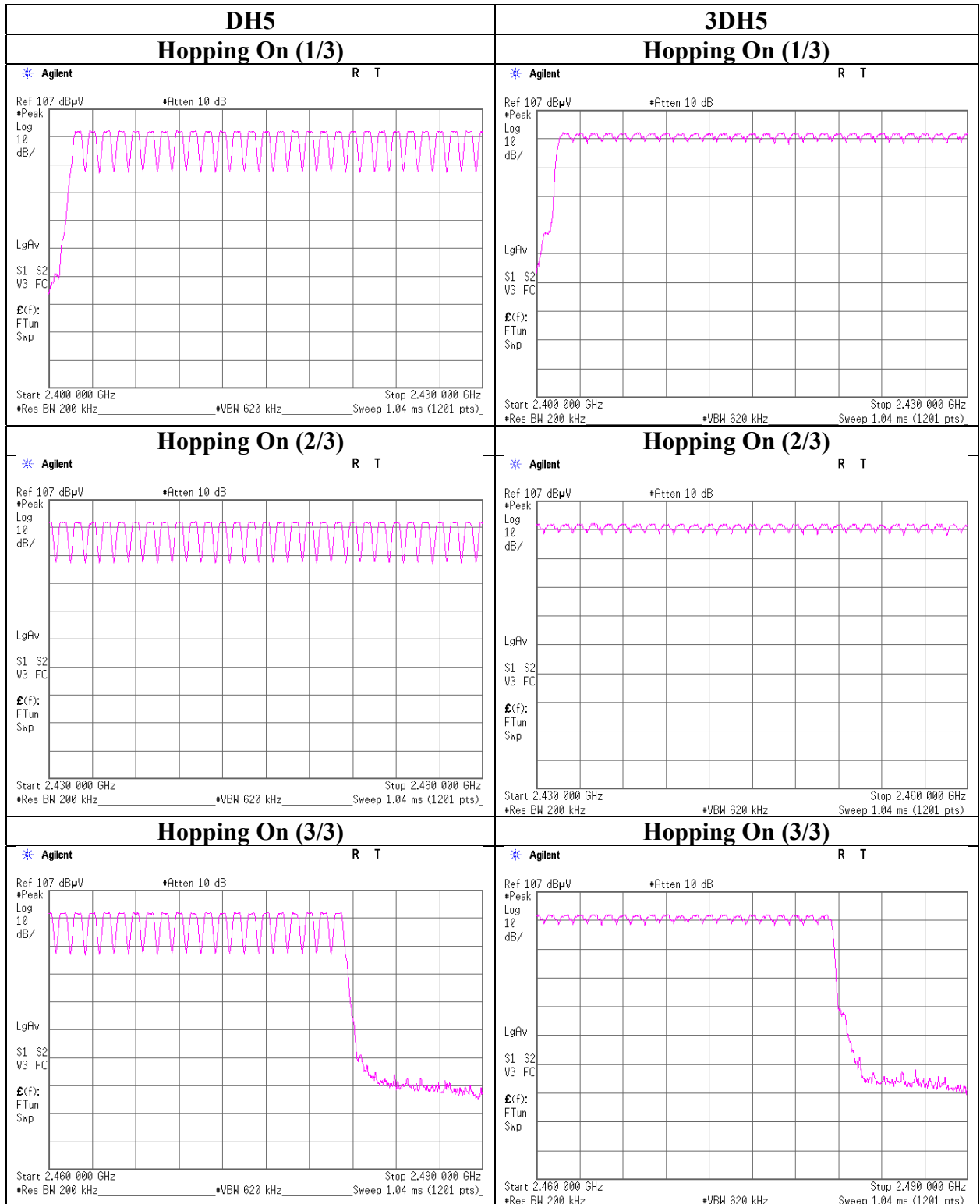
### Number of Hopping Frequency

Report No. 13097799H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date May 26, 2020  
Temperature / Humidity 23 deg. C / 57 % RH  
Engineer Yuta Moriya  
Mode Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	$\geq 15$
3DH5	79	$\geq 15$

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**



**UL Japan, Inc.**

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### Dwell time

Report No. 13097799H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date May 26, 2020  
Temperature / Humidity 23 deg. C / 57 % RH  
Engineer Yuta Moriya  
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 [msec]	Result [msec]	Limit [msec]	
DH1	51.0 times /	5 sec. x	31.6 sec. =	323 times	0.394	127	400
DH3	25.4 times /	5 sec. x	31.6 sec. =	161 times	1.654	266	400
DH5	16.8 times /	5 sec. x	31.6 sec. =	107 times	2.910	311	400
3DH1	51.0 times /	5 sec. x	31.6 sec. =	323 times	0.403	130	400
3DH3	17.0 times /	5 sec. x	31.6 sec. =	108 times	2.910	314	400
3DH5	16.8 times /	5 sec. x	31.6 sec. =	107 times	2.910	311	400

Sample Calculation

Result = Number of transmission x Length of transmission

\*Average data of 5 tests.(except Inquiry)

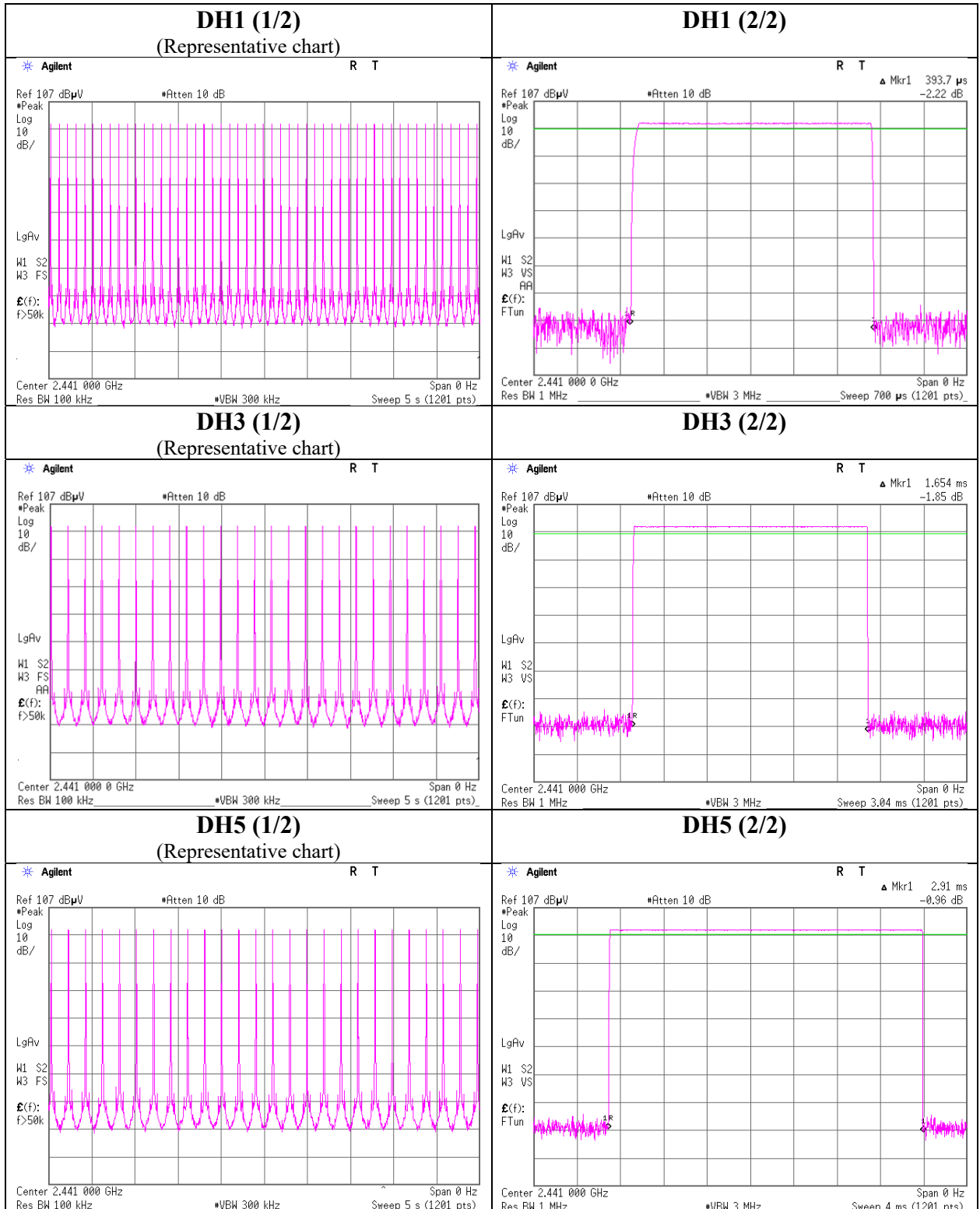
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	50	51	52	51	51
DH3	26	25	25	25	26	25.4
DH5	17	17	17	16	17	16.8
3DH1	50	51	51	52	51	51
3DH3	17	17	17	17	17	17
3DH5	17	16	17	17	17	16.8

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  $N \times 0.4s$ , where  $N$  is the number of channels being used in the hopping sequence ( $20 \leq N \leq 79$ ), is always less than  $0.4s$  regardless of packet size. This is confirmed in the test report for  $N = 79$ .

**Dwell time**



**UL Japan, Inc.**

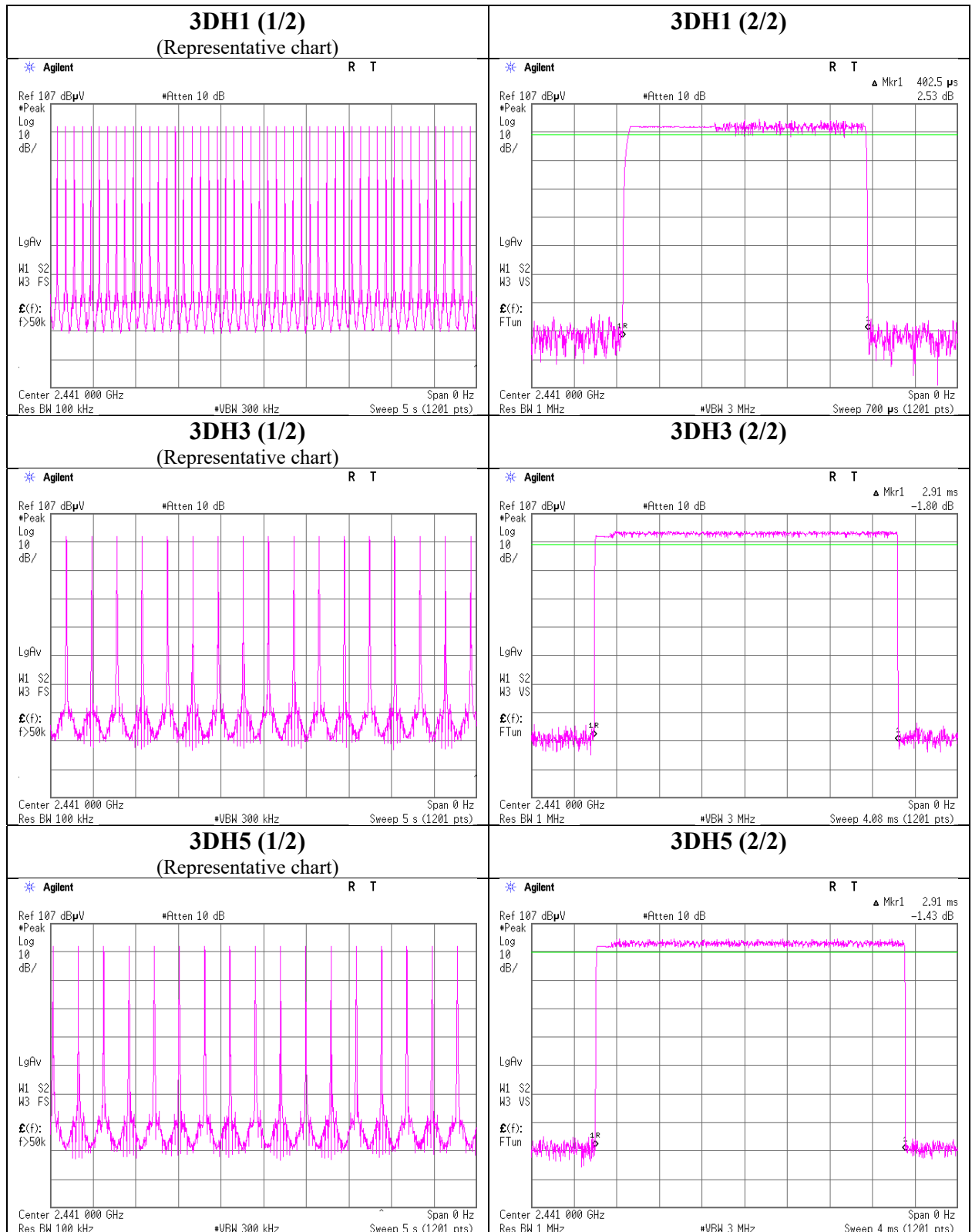
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

**Dwell time**



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## Maximum Peak Output Power

Report No. 13097799H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date May 26, 2020  
Temperature / Humidity 23 deg. C / 57 % RH  
Engineer Yuta Moriya  
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
					Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-7.92	1.79	10.06	3.93	2.47	20.96	125	17.03	-1.30	2.63	1.83	36.02	4000	33.39
DH5	2441.0	-7.96	1.80	10.06	3.90	2.45	20.96	125	17.06	-1.30	2.60	1.82	36.02	4000	33.42
DH5	2480.0	-8.03	1.81	10.06	3.84	2.42	20.96	125	17.12	-1.30	2.54	1.79	36.02	4000	33.48
2DH5	2402.0	-5.38	1.79	10.06	6.47	4.44	20.96	125	14.49	-1.30	5.17	3.29	36.02	4000	30.85
2DH5	2441.0	-5.48	1.80	10.06	6.38	4.35	20.96	125	14.58	-1.30	5.08	3.22	36.02	4000	30.94
2DH5	2480.0	-5.52	1.81	10.06	6.35	4.32	20.96	125	14.61	-1.30	5.05	3.20	36.02	4000	30.97
3DH5	2402.0	-5.04	1.79	10.06	6.81	4.80	20.96	125	14.15	-1.30	5.51	3.56	36.02	4000	30.51
3DH5	2441.0	-5.10	1.80	10.06	6.76	4.74	20.96	125	14.20	-1.30	5.46	3.52	36.02	4000	30.56
3DH5	2480.0	-5.20	1.81	10.06	6.67	4.65	20.96	125	14.29	-1.30	5.37	3.44	36.02	4000	30.65

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: 20ch) 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 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

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

Report No. 13097799H  
Test place Ise EMC Lab. No.6 Measurement Room  
Date May 26, 2020  
Temperature / Humidity 23 deg. C / 57 % RH  
Engineer Yuta Moriya  
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	-9.26	1.79	10.06	2.59	1.82	1.12	3.71	2.35
DH5	2441.0	-9.28	1.80	10.06	2.58	1.81	1.12	3.70	2.34
DH5	2480.0	-9.37	1.81	10.06	2.50	1.78	1.12	3.62	2.30
2DH5	2402.0	-9.29	1.79	10.06	2.56	1.80	1.11	3.67	2.33
2DH5	2441.0	-9.37	1.80	10.06	2.49	1.77	1.11	3.60	2.29
2DH5	2480.0	-9.45	1.81	10.06	2.42	1.75	1.11	3.53	2.25
3DH5	2402.0	-9.29	1.79	10.06	2.56	1.80	1.11	3.67	2.33
3DH5	2441.0	-9.32	1.80	10.06	2.54	1.79	1.11	3.65	2.32
3DH5	2480.0	-9.43	1.81	10.06	2.44	1.75	1.11	3.55	2.26

Sample Calculation:

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

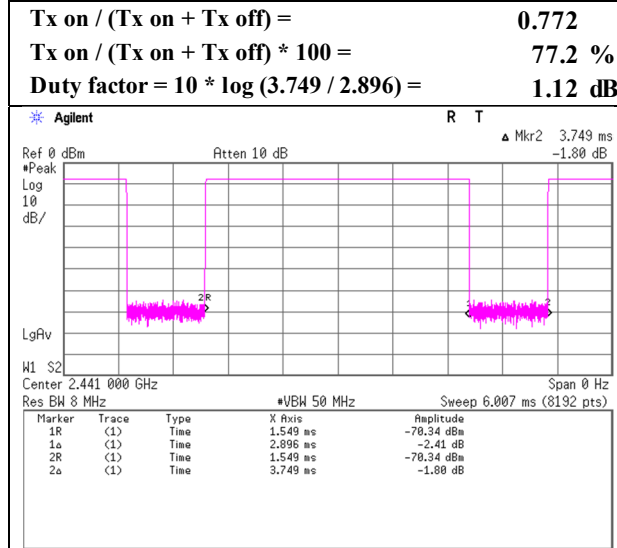
Result (Burst power average) = Time average + Duty factor

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

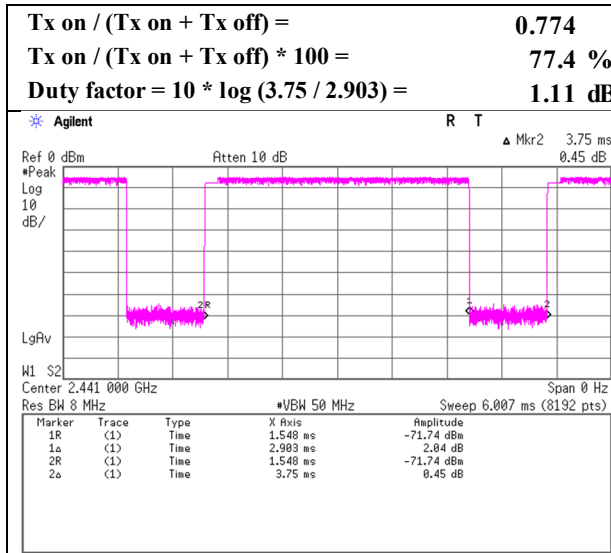
## Burst Rate Confirmation

Report No. 13097799H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date June 25, 2020  
 Temperature / Humidity 23 deg. C / 56 % RH  
 Engineer Junya Okuno  
 Mode Tx, Hopping Off

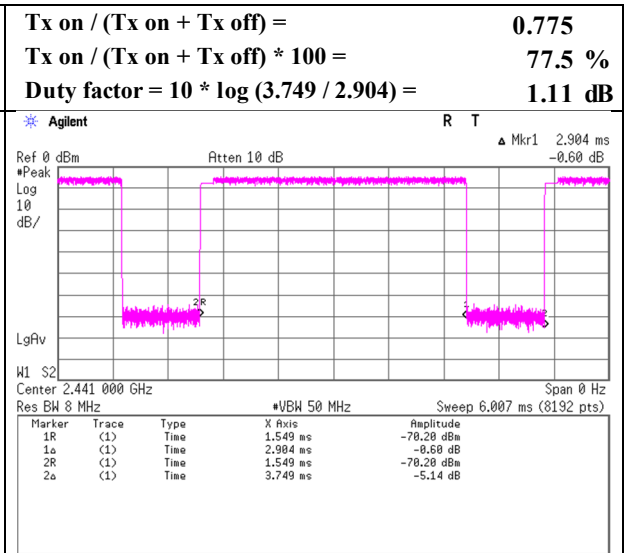
### DH5



### 2DH5

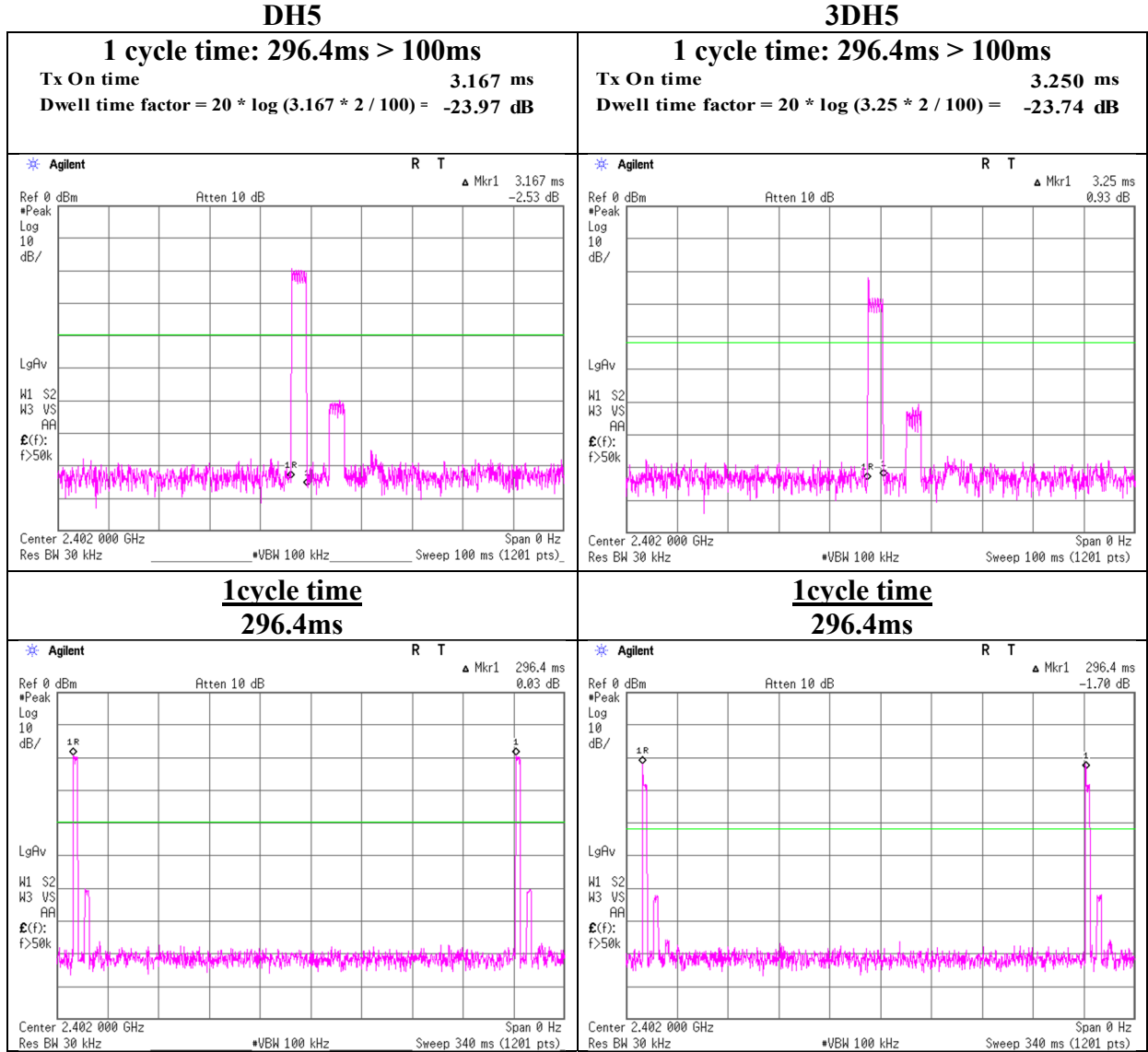


### 3DH5



## Duty cycle correction factor

Report No.	13097799H
Test place	Ise EMC Lab. No.1 Shielded Room
Date	June 19, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Takafumi Noguchi
Mode	Tx, Hopping On



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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

## Radiated Spurious Emission

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 31, 2020 May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH 24 deg. C / 58 % RH  
Engineer Junya Okuno Takeshi Hiyaji  
(1 GHz -10 GHz) Below 1 GHz,  
Above 10 GHz  
Mode Tx, Hopping Off, DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	47.080	QP	22.0	12.2	7.3	32.2	-	9.4	40.0	30.6	Floor noise
Hori.	168.603	QP	21.6	15.7	8.8	32.1	-	14.1	43.5	29.4	Floor noise
Hori.	332.417	QP	21.3	14.6	10.2	32.0	-	14.1	46.0	31.9	Floor noise
Hori.	453.286	QP	21.0	16.6	11.0	32.0	-	16.7	46.0	29.3	Floor noise
Hori.	840.452	QP	20.4	21.3	13.2	31.2	-	23.7	46.0	22.4	Floor noise
Hori.	952.410	QP	19.4	22.1	13.8	30.6	-	24.6	46.0	21.4	Floor noise
Hori.	2390.000	PK	44.9	27.7	3.1	32.7	-	42.9	73.9	31.0	
Hori.	4804.000	PK	43.6	31.6	7.7	31.7	-	51.2	73.9	22.7	
Hori.	7206.000	PK	50.7	36.0	9.1	32.6	-	63.2	73.9	10.7	
Hori.	9608.000	PK	41.6	38.5	9.6	33.3	-	56.5	73.9	17.5	Floor noise
Hori.	2390.000	AV	32.8	27.7	3.1	32.7	1.1	32.0	53.9	21.9	
Hori.	4804.000	AV	35.1	31.6	7.7	31.7	1.1	43.8	53.9	10.1	
Hori.	9608.000	AV	31.5	38.5	9.6	33.3	-	46.4	53.9	7.6	Floor noise
Vert.	47.000	QP	21.9	12.3	7.3	32.2	-	9.3	40.0	30.7	Floor noise
Vert.	168.603	QP	21.6	15.7	8.8	32.1	-	14.1	43.5	29.4	Floor noise
Vert.	332.417	QP	21.3	14.6	10.2	32.0	-	14.1	46.0	31.9	Floor noise
Vert.	453.286	QP	21.0	16.6	11.0	32.0	-	16.7	46.0	29.3	Floor noise
Vert.	840.452	QP	20.4	21.3	13.2	31.2	-	23.7	46.0	22.4	Floor noise
Vert.	952.410	QP	19.3	22.1	13.8	30.6	-	24.5	46.0	21.5	Floor noise
Vert.	2390.000	PK	42.3	27.7	3.1	32.7	-	40.4	73.9	33.5	
Vert.	4804.000	PK	43.3	31.6	7.7	31.7	-	50.9	73.9	23.0	
Vert.	7206.000	PK	50.1	36.0	9.1	32.6	-	62.6	73.9	11.3	
Vert.	9608.000	PK	41.8	38.5	9.6	33.3	-	56.6	73.9	17.3	Floor noise
Vert.	2390.000	AV	31.8	27.7	3.1	32.7	1.1	31.0	53.9	22.9	
Vert.	4804.000	AV	34.6	31.6	7.7	31.7	1.1	43.3	53.9	10.6	
Vert.	9608.000	AV	31.6	38.5	9.6	33.3	-	46.4	53.9	7.5	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log(4 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	85.8	27.7	3.1	32.7	83.8	-	-	Carrier
Hori.	2400.000	PK	36.3	27.7	3.1	32.7	34.4	63.8	29.4	
Vert.	2402.000	PK	87.4	27.7	3.1	32.7	85.4	-	-	Carrier
Vert.	2400.000	PK	36.2	27.7	3.1	32.7	34.3	65.4	31.1	

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

### Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7206.000	AV	44.0	36.0	9.1	32.6	-23.97	32.6	53.9	21.3	*
Vert.	7206.000	AV	41.7	36.0	9.1	32.6	-23.97	30.2	53.9	23.7	*

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

- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

\*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log(4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 40 GHz 20log(1.0 m / 3.0 m) = -9.5dB

**UL Japan, Inc.**

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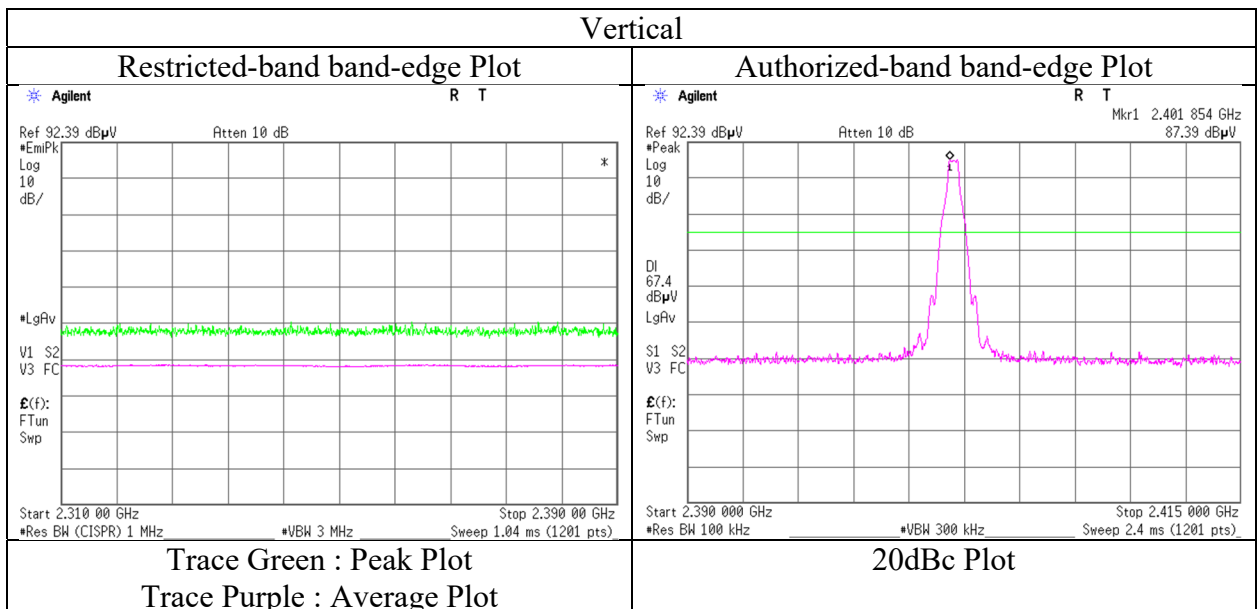
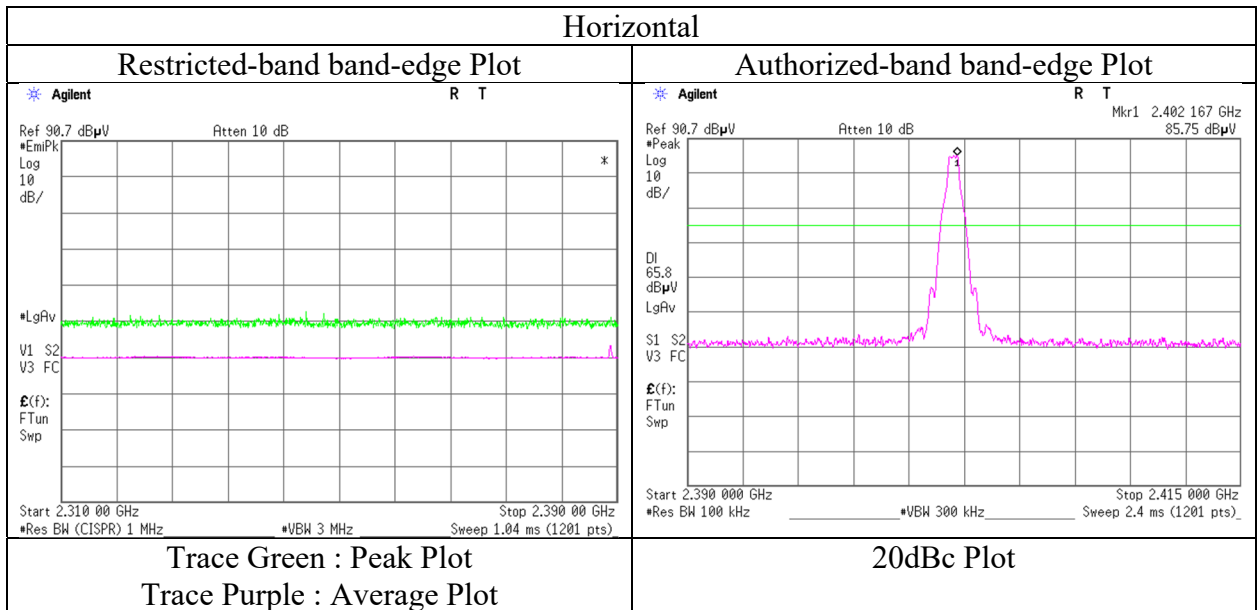
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH  
Engineer Junya Okuno  
(1 GHz -10 GHz)  
Mode Tx, Hopping Off, DH5 2402 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020 No.3  
Temperature / Humidity 22 deg. C / 49 % RH 24 deg. C / 58 % RH  
Engineer Junya Okuno Takeshi Hiyaji  
(1 GHz -10 GHz) Below 1 GHz,  
Above 10 GHz  
Mode Tx, Hopping Off, DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	37.778	QP	22.0	15.6	7.2	32.2	-	12.6	40.0	27.4	Floor noise
Hori.	164.606	QP	21.3	15.6	8.8	32.1	-	13.7	43.5	29.8	Floor noise
Hori.	283.260	QP	20.9	13.3	9.8	32.0	-	12.1	46.0	33.9	Floor noise
Hori.	349.236	QP	21.2	15.0	10.3	32.0	-	14.5	46.0	31.5	Floor noise
Hori.	569.820	QP	21.3	18.4	11.7	32.0	-	19.4	46.0	26.6	Floor noise
Hori.	891.056	QP	20.1	22.1	13.5	31.0	-	24.7	46.0	21.3	Floor noise
Hori.	4882.000	PK	43.6	31.5	7.7	31.6	-	51.2	73.9	22.7	
Hori.	7323.000	PK	51.5	36.2	9.1	32.6	-	64.2	73.9	9.7	
Hori.	9764.000	PK	42.0	38.8	9.6	33.4	-	57.0	73.9	16.9	Floor noise
Hori.	4882.000	AV	35.3	31.5	7.7	31.6	1.1	44.0	53.9	9.9	
Hori.	9764.000	AV	31.6	38.8	9.6	33.4	-	46.7	53.9	7.2	Floor noise
Vert.	37.778	QP	21.7	15.6	7.2	32.2	-	12.3	40.0	27.7	Floor noise
Vert.	164.606	QP	21.3	15.6	8.8	32.1	-	13.7	43.5	29.8	Floor noise
Vert.	283.260	QP	21.1	13.3	9.8	32.0	-	12.3	46.0	33.7	Floor noise
Vert.	349.236	QP	21.4	15.0	10.3	32.0	-	14.7	46.0	31.3	Floor noise
Vert.	569.820	QP	21.1	18.4	11.7	32.0	-	19.2	46.0	26.8	Floor noise
Vert.	891.056	QP	20.3	22.1	13.5	31.0	-	24.9	46.0	21.1	Floor noise
Vert.	4882.000	PK	42.8	31.5	7.7	31.6	-	50.4	73.9	23.5	
Vert.	7323.000	PK	51.5	36.2	9.1	32.6	-	64.2	73.9	9.7	
Vert.	9764.000	PK	41.8	38.8	9.6	33.4	-	56.8	73.9	17.1	Floor noise
Vert.	4882.000	AV	33.7	31.5	7.7	31.6	1.1	42.4	53.9	11.5	
Vert.	9764.000	AV	31.6	38.8	9.6	33.4	-	46.6	53.9	7.3	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log(4 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

### Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7323.000	AV	44.9	36.2	9.1	32.6	-23.97	33.6	53.9	20.3	*
Vert.	7323.000	AV	46.1	36.2	9.1	32.6	-23.97	34.8	53.9	19.1	*

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

- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

\*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log(4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5dB

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Radiated Spurious Emission

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 31, 2020 May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH 24 deg. C / 58 % RH  
Engineer Junya Okuno Takeshi Hiyaji  
(1 GHz -10 GHz) Below 1 GHz,  
Above 10 GHz  
Mode Tx, Hopping Off, DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	37.484	QP	22.7	15.7	7.2	32.2	-	13.4	40.0	26.6	Floor noise
Hori.	173.723	QP	21.3	16.0	8.9	32.0	-	14.1	43.5	29.4	Floor noise
Hori.	285.570	QP	21.3	13.4	9.8	32.0	-	12.5	46.0	33.5	Floor noise
Hori.	407.123	QP	21.0	15.9	10.7	32.0	-	15.6	46.0	30.4	Floor noise
Hori.	587.748	QP	21.2	18.9	11.9	32.0	-	20.0	46.0	26.0	Floor noise
Hori.	889.407	QP	20.4	22.1	13.5	31.0	-	25.0	46.0	21.0	Floor noise
Hori.	2483.500	PK	44.9	27.5	3.2	32.7	-	42.8	73.9	31.1	
Hori.	4960.000	PK	44.0	31.6	7.7	31.6	-	51.6	73.9	22.3	
Hori.	7440.000	PK	50.9	36.3	9.1	32.7	-	63.6	73.9	10.3	
Hori.	9920.000	PK	40.3	38.9	9.6	33.5	-	55.4	73.9	18.5	Floor noise
Hori.	2483.500	AV	34.0	27.5	3.2	32.7	1.1	33.1	53.9	20.8	
Hori.	4960.000	AV	35.3	31.6	7.7	31.6	1.1	44.0	53.9	9.9	
Hori.	9920.000	AV	31.8	38.9	9.6	33.5	-	46.9	53.9	7.0	Floor noise
Vert.	37.484	QP	22.3	15.7	7.2	32.2	-	13.0	40.0	27.0	Floor noise
Vert.	173.723	QP	21.5	16.0	8.9	32.0	-	14.3	43.5	29.2	Floor noise
Vert.	285.570	QP	21.3	13.4	9.8	32.0	-	12.5	46.0	33.5	Floor noise
Vert.	407.123	QP	21.0	15.9	10.7	32.0	-	15.6	46.0	30.4	Floor noise
Vert.	587.748	QP	21.3	18.9	11.9	32.0	-	20.1	46.0	25.9	Floor noise
Vert.	889.407	QP	20.2	22.1	13.5	31.0	-	24.8	46.0	21.2	Floor noise
Vert.	2483.500	PK	43.2	27.5	3.2	32.7	-	41.1	73.9	32.8	
Vert.	4960.000	PK	42.3	31.6	7.7	31.6	-	50.0	73.9	23.9	
Vert.	7440.000	PK	51.8	36.3	9.1	32.7	-	64.5	73.9	9.4	
Vert.	9920.000	PK	40.9	38.9	9.6	33.5	-	56.0	73.9	17.9	Floor noise
Vert.	2483.500	AV	33.1	27.5	3.2	32.7	1.1	32.2	53.9	21.7	
Vert.	4960.000	AV	32.0	31.6	7.7	31.6	1.1	40.8	53.9	13.1	
Vert.	9920.000	AV	31.3	38.9	9.6	33.5	-	46.4	53.9	7.5	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz  $20\log(4\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7440.000	AV	41.8	36.3	9.1	32.7	-23.97	30.6	53.9	23.3	*
Vert.	7440.000	AV	43.7	36.3	9.1	32.7	-23.97	32.5	53.9	21.4	*

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))  
- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

\*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz  $20\log(4.0\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

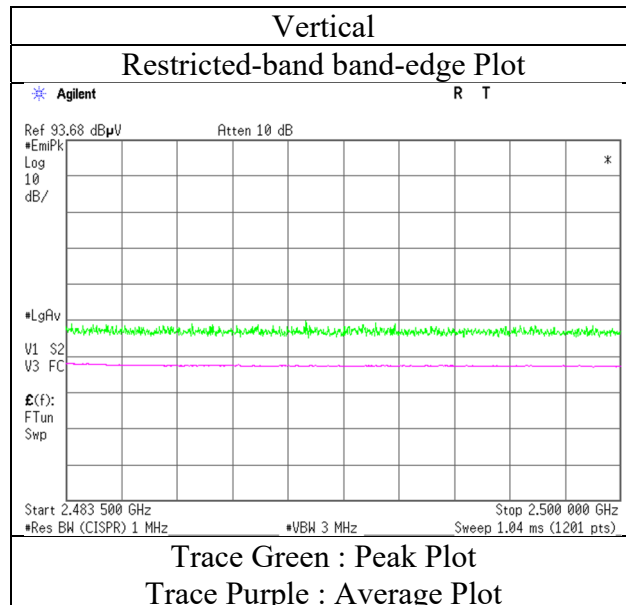
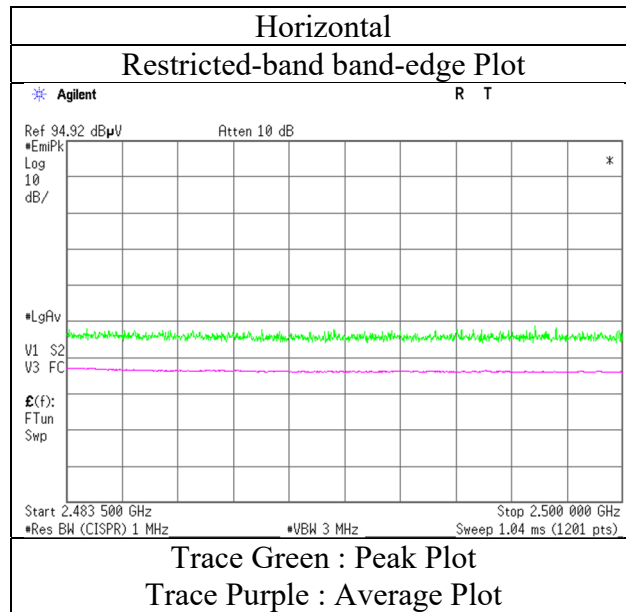
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124



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

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH  
Engineer Junya Okuno  
(1 GHz -10 GHz)  
Mode Tx, Hopping Off, DH5 2480 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 31, 2020 May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH 24 deg. C / 58 % RH  
Engineer Junya Okuno Takeshi Hiyaji  
(1 GHz -10 GHz) Below 1 GHz,  
Above 10 GHz  
Mode Tx, Hopping Off, 3DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	35.195	QP	22.1	16.6	7.1	32.2	-	13.7	40.0	26.4	Floor noise
Hori.	178.028	QP	21.7	16.2	8.9	32.0	-	14.7	43.5	28.8	Floor noise
Hori.	276.307	QP	21.2	13.2	9.8	32.0	-	12.2	46.0	33.9	Floor noise
Hori.	358.985	QP	21.3	15.0	10.4	32.0	-	14.8	46.0	31.3	Floor noise
Hori.	625.860	QP	21.0	19.5	12.1	32.0	-	20.5	46.0	25.5	Floor noise
Hori.	919.375	QP	20.2	22.2	13.6	30.8	-	25.2	46.0	20.8	Floor noise
Hori.	2390.000	PK	42.1	27.7	3.1	32.7	-	40.1	73.9	33.8	
Hori.	4804.000	PK	43.6	31.6	7.7	31.7	-	51.2	73.9	22.7	
Hori.	7206.000	PK	50.0	36.0	9.1	32.6	-	62.5	73.9	11.4	
Hori.	9608.000	PK	42.2	38.5	9.6	33.3	-	57.0	73.9	16.9	Floor noise
Hori.	2390.000	AV	31.8	27.7	3.1	32.7	1.1	31.0	53.9	22.9	
Hori.	4804.000	AV	34.8	31.6	7.7	31.7	1.1	43.5	53.9	10.4	
Hori.	9608.000	AV	31.5	38.5	9.6	33.3	-	46.4	53.9	7.5	Floor noise
Vert.	35.195	QP	22.3	16.6	7.1	32.2	-	13.9	40.0	26.2	Floor noise
Vert.	178.028	QP	21.6	16.2	8.9	32.0	-	14.6	43.5	28.9	Floor noise
Vert.	276.307	QP	21.3	13.2	9.8	32.0	-	12.3	46.0	33.8	Floor noise
Vert.	358.985	QP	21.3	15.0	10.4	32.0	-	14.8	46.0	31.3	Floor noise
Vert.	625.860	QP	21.2	19.5	12.1	32.0	-	20.7	46.0	25.3	Floor noise
Vert.	919.375	QP	20.4	22.2	13.6	30.8	-	25.4	46.0	20.6	Floor noise
Vert.	2390.000	PK	43.5	27.7	3.1	32.7	-	41.5	73.9	32.4	
Vert.	4804.000	PK	42.9	31.6	7.7	31.7	-	50.5	73.9	23.4	
Vert.	7206.000	PK	50.5	36.0	9.1	32.6	-	63.0	73.9	10.9	
Vert.	9608.000	PK	42.3	38.5	9.6	33.3	-	57.1	73.9	16.8	Floor noise
Vert.	2390.000	AV	39.2	27.7	3.1	32.7	1.1	38.4	53.9	15.5	
Vert.	4804.000	AV	33.7	31.6	7.7	31.7	1.1	42.4	53.9	11.5	
Vert.	9608.000	AV	31.8	38.5	9.6	33.3	-	46.6	53.9	7.3	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

### 20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	86.1	27.7	3.1	32.7	84.1	-	-	Carrier
Hori.	2400.000	PK	38.3	27.7	3.1	32.7	36.3	64.1	27.8	
Vert.	2402.000	PK	85.7	27.7	3.1	32.7	83.8	-	-	Carrier
Vert.	2400.000	PK	38.5	27.7	3.1	32.7	36.6	63.8	27.2	

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

### Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7206.000	AV	42.6	36.0	9.1	32.6	-23.74	31.3	53.9	22.6	*
Vert.	7206.000	AV	42.8	36.0	9.1	32.6	-23.74	31.6	53.9	22.3	*

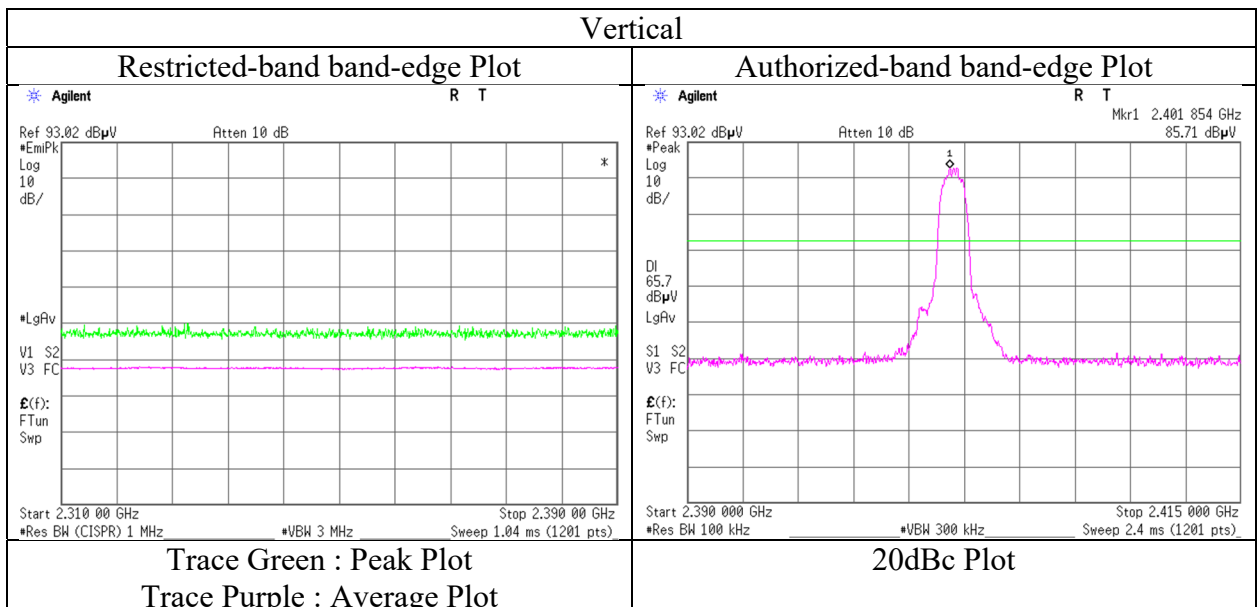
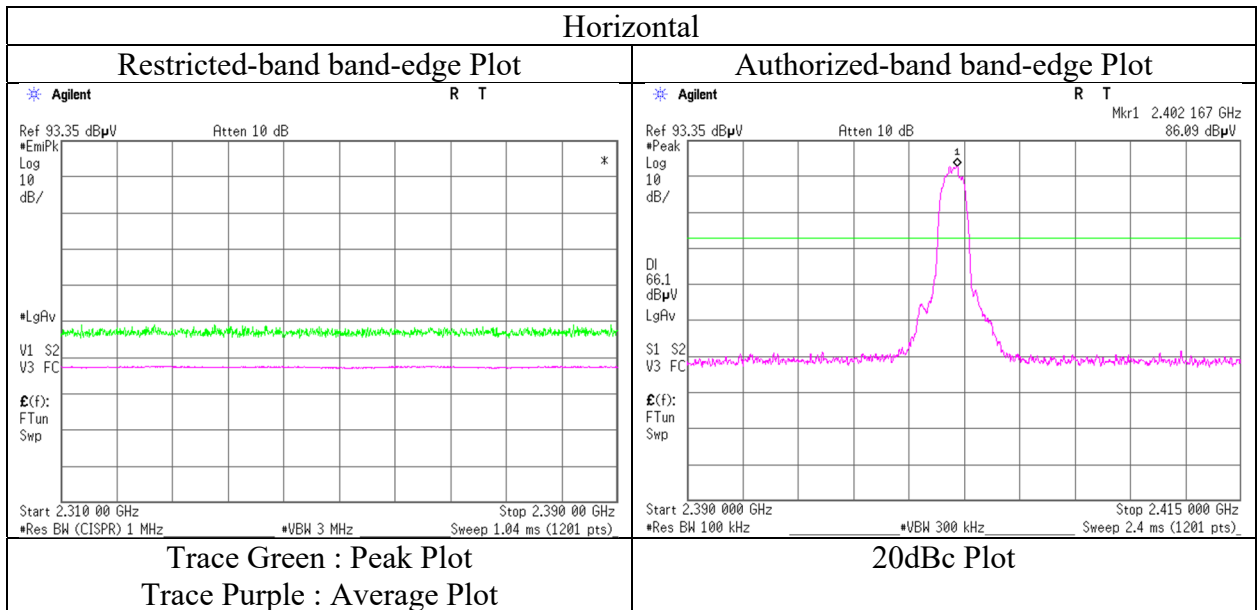
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))  
- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

\*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB

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

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH  
Engineer Junya Okuno  
(1 GHz -10 GHz)  
Mode Tx, Hopping Off, 3DH5 2402 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

## Radiated Spurious Emission

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020 No.3  
Temperature / Humidity 22 deg. C / 49 % RH 24 deg. C / 58 % RH  
Engineer Junya Okuno Takeshi Hiyaji  
(1 GHz -10 GHz) Below 1 GHz,  
Above 10 GHz  
Mode Tx, Hopping Off, 3DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	35.750	QP	22.4	16.4	7.1	32.2	-	13.7	40.0	26.3	Floor noise
Hori.	176.352	QP	21.5	16.2	8.9	32.0	-	14.6	43.5	28.9	Floor noise
Hori.	282.050	QP	21.2	13.3	9.8	32.0	-	12.3	46.0	33.7	Floor noise
Hori.	471.593	QP	21.2	17.0	11.1	32.0	-	17.4	46.0	28.6	Floor noise
Hori.	741.875	QP	21.0	20.1	12.7	31.8	-	22.1	46.0	23.9	Floor noise
Hori.	911.612	QP	20.3	22.2	13.6	30.8	-	25.2	46.0	20.8	Floor noise
Hori.	4882.000	PK	43.3	31.5	4.5	31.6	1.1	48.8	73.9	25.2	
Hori.	7323.000	PK	50.6	36.2	5.7	32.6	1.1	61.0	73.9	12.9	
Hori.	9764.000	PK	42.4	38.8	6.6	33.4	-	54.3	73.9	19.6	Floor noise
Hori.	4882.000	AV	35.5	31.5	4.5	31.6	-	39.9	53.9	14.0	
Hori.	9764.000	AV	31.8	38.8	6.6	33.4	-	43.8	53.9	10.1	Floor noise
Vert.	35.750	QP	22.5	16.4	7.1	32.2	-	13.8	40.0	26.2	Floor noise
Vert.	176.352	QP	21.6	16.2	8.9	32.0	-	14.7	43.5	28.8	Floor noise
Vert.	282.050	QP	21.2	13.3	9.8	32.0	-	12.3	46.0	33.7	Floor noise
Vert.	471.593	QP	21.1	17.0	11.1	32.0	-	17.3	46.0	28.7	Floor noise
Vert.	741.875	QP	21.2	20.1	12.7	31.8	-	22.3	46.0	23.7	Floor noise
Vert.	911.612	QP	20.4	22.2	13.6	30.8	-	25.3	46.0	20.7	Floor noise
Vert.	4882.000	PK	42.2	31.5	4.5	31.6	-	46.6	73.9	27.3	
Vert.	7323.000	PK	51.5	36.2	5.7	32.6	-	60.8	73.9	13.1	
Vert.	9764.000	PK	42.3	38.8	6.6	33.4	-	54.3	73.9	19.6	Floor noise
Vert.	4882.000	AV	33.6	31.5	4.5	31.6	1.1	39.1	53.9	14.8	
Vert.	9764.000	AV	31.8	38.8	6.6	33.4	-	43.8	53.9	10.1	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz  $20\log(4\text{ m} / 3.0\text{ m}) = 2.5\text{ dB}$   
10 GHz - 26.5 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7323.000	AV	44.8	36.2	5.7	32.6	-23.74	30.3	53.9	23.6	*
Vert.	7323.000	AV	46.3	36.2	5.7	32.6	-23.74	31.8	53.9	22.1	*

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

- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

\*Above noise was synchronized with carrier frequency.

## Radiated Spurious Emission

Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020 No.3  
Temperature / Humidity 22 deg. C / 49 % RH 24 deg. C / 58 % RH  
Engineer Junya Okuno Takeshi Hiyaji  
(1 GHz -10 GHz) Below 1 GHz,  
Above 10 GHz  
Mode Tx, Hopping Off, 3DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	33.758	QP	21.5	17.2	7.1	32.2	-	13.6	40.0	26.4	Floor noise
Hori.	176.098	QP	21.4	16.2	8.9	32.0	-	14.5	43.5	29.0	Floor noise
Hori.	278.019	QP	21.3	13.2	9.8	32.0	-	12.3	46.0	33.7	Floor noise
Hori.	466.894	QP	21.3	16.9	11.1	32.0	-	17.4	46.0	28.7	Floor noise
Hori.	769.170	QP	20.9	20.5	12.8	31.6	-	22.6	46.0	23.4	Floor noise
Hori.	903.596	QP	20.2	22.2	13.5	30.9	-	25.0	46.0	21.0	Floor noise
Hori.	2483.500	PK	44.9	27.5	3.2	32.7	-	42.8	73.9	31.1	
Hori.	4960.000	PK	44.1	31.6	7.7	31.6	-	51.8	73.9	22.1	
Hori.	7440.000	PK	51.1	36.3	9.1	32.7	-	63.9	73.9	10.1	
Hori.	9920.000	PK	42.3	38.9	9.6	33.5	-	57.3	73.9	16.6	Floor noise
Hori.	2483.500	AV	35.3	27.5	3.2	32.7	1.1	34.4	53.9	19.6	
Hori.	4960.000	AV	34.8	31.6	7.7	31.6	1.1	43.5	53.9	10.4	
Hori.	9920.000	AV	31.9	38.9	9.6	33.5	-	47.0	53.9	6.9	Floor noise
Vert.	33.758	QP	21.8	17.2	7.1	32.2	-	13.9	40.0	26.1	Floor noise
Vert.	176.098	QP	21.3	16.2	8.9	32.0	-	14.4	43.5	29.1	Floor noise
Vert.	278.019	QP	21.4	13.2	9.8	32.0	-	12.4	46.0	33.6	Floor noise
Vert.	466.894	QP	21.2	16.9	11.1	32.0	-	17.3	46.0	28.8	Floor noise
Vert.	769.170	QP	21.0	20.5	12.8	31.6	-	22.7	46.0	23.3	Floor noise
Vert.	903.596	QP	20.1	22.2	13.5	30.9	-	24.9	46.0	21.1	Floor noise
Vert.	2483.500	PK	44.9	27.5	3.2	32.7	-	42.8	73.9	31.1	
Vert.	4960.000	PK	43.2	31.6	7.7	31.6	-	50.9	73.9	23.0	
Vert.	7440.000	PK	52.3	36.3	9.1	32.7	-	65.1	73.9	8.9	
Vert.	9920.000	PK	42.7	38.9	9.6	33.5	-	57.7	73.9	16.2	Floor noise
Vert.	2483.500	AV	35.5	27.5	3.2	32.7	1.1	34.5	53.9	19.4	
Vert.	4960.000	AV	33.6	31.6	7.7	31.6	1.1	42.3	53.9	11.6	
Vert.	9920.000	AV	31.9	38.9	9.6	33.5	-	47.0	53.9	6.9	Floor noise

Result = 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).

Distance factor: 1 GHz - 10 GHz 20log (4 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

### Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	7440.000	AV	44.4	36.3	9.1	32.7	-23.74	33.4	53.9	20.5	*
Vert.	7440.000	AV	46.0	36.3	9.1	32.7	-23.74	35.0	53.9	18.9	*

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

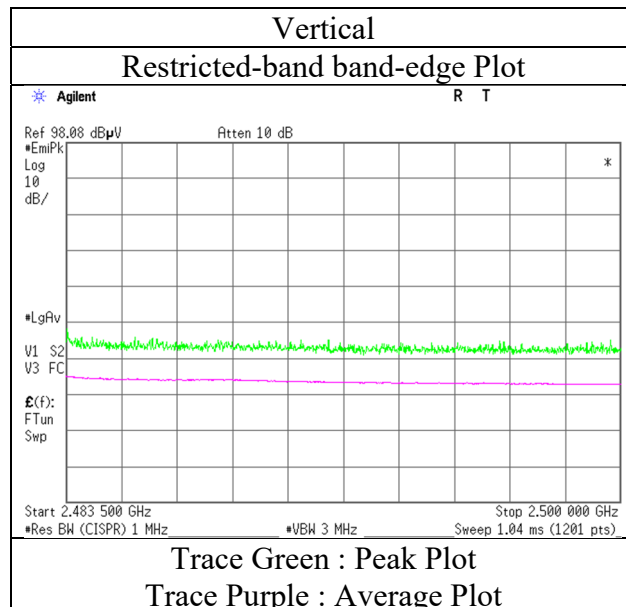
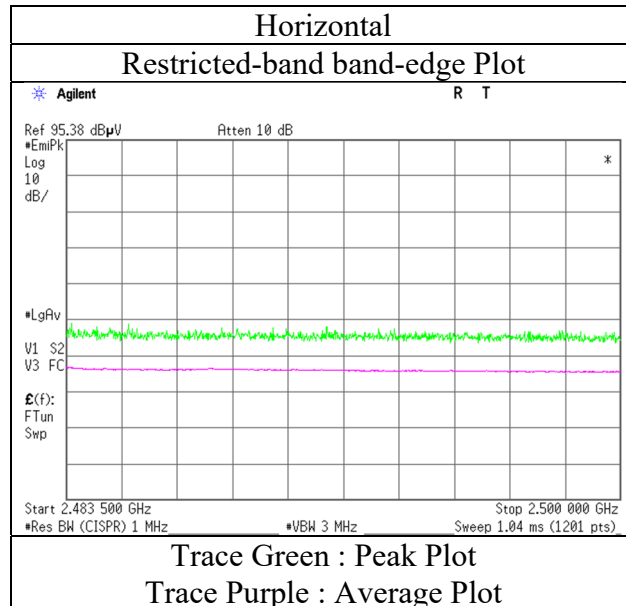
- Gain(Amplifier) + Dwell time factor (Refer to dwell time data sheet)

\*Above noise was synchronized with carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (4.0 m / 3.0 m) = 2.5 dB  
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

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

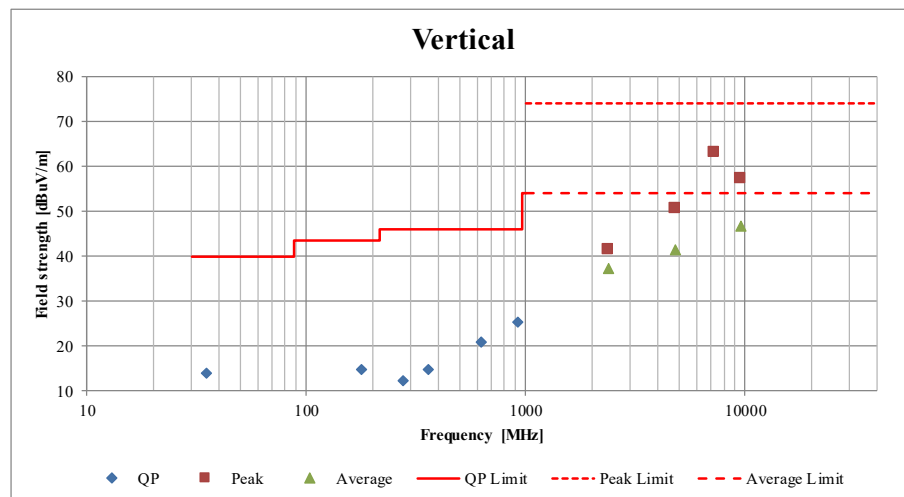
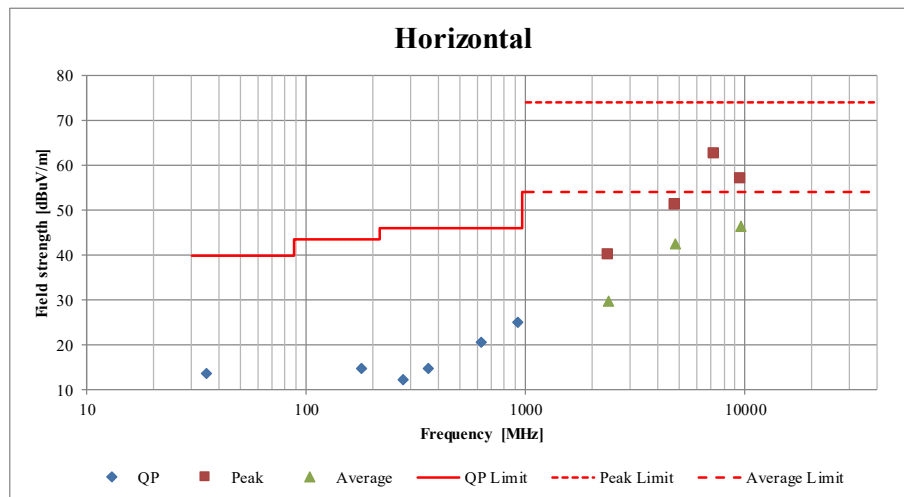
Report No. 13097799H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 31, 2020  
Temperature / Humidity 22 deg. C / 49 % RH  
Engineer Junya Okuno  
(1 GHz -10 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz



\* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions. Final result of restricted band edge was shown in tabular data.

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

Report No.	13097799H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	May 31, 2020	May 31, 2020
Temperature / Humidity	22 deg. C / 49 % RH	24 deg. C / 58 % RH
Engineer	Junya Okuno (1 GHz -10 GHz)	Takeshi Hiyaji Below 1 GHz, Above 10 GHz
Mode	Tx, Hopping Off, 3DH5 2441 MHz	

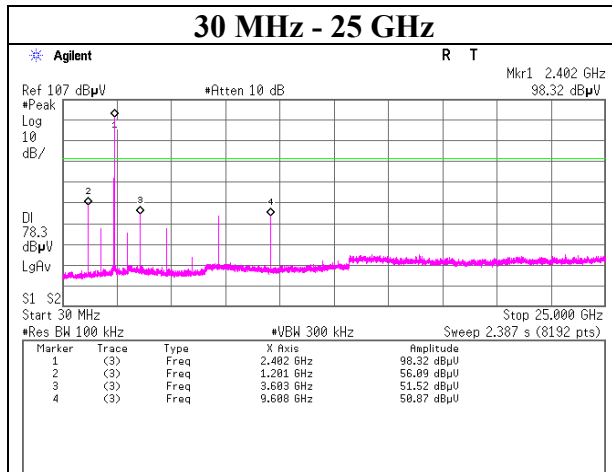
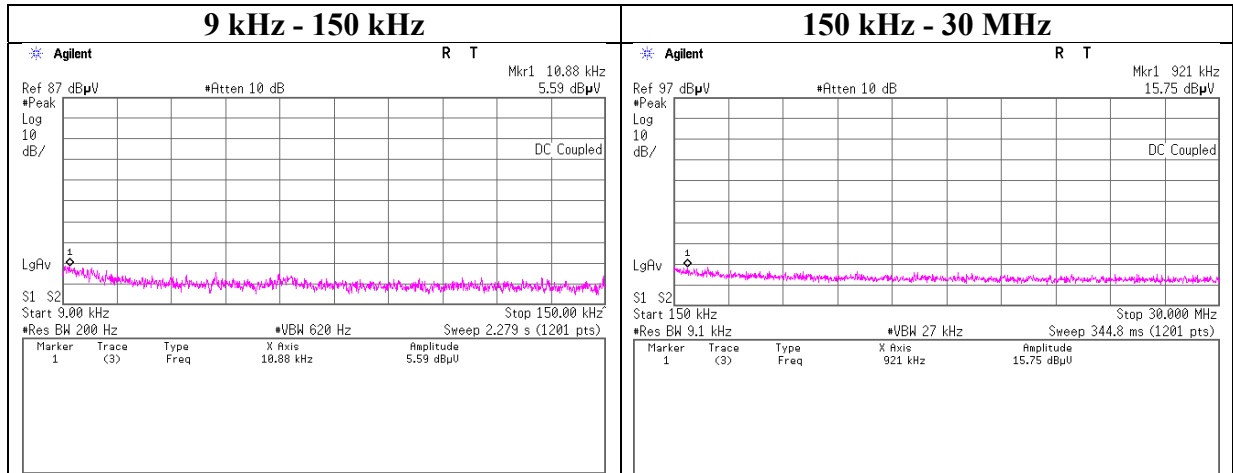


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Conducted Spurious Emission

Report No.	13097799H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	May 26, 2020
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

### 2402 MHz



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**Ise EMC Lab.**

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Telephone : +81 596 24 8999

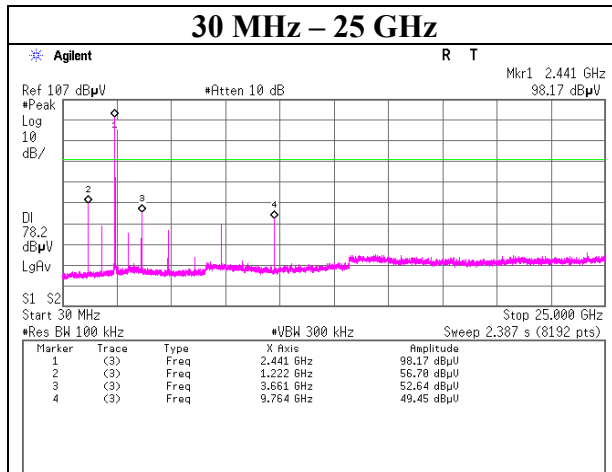
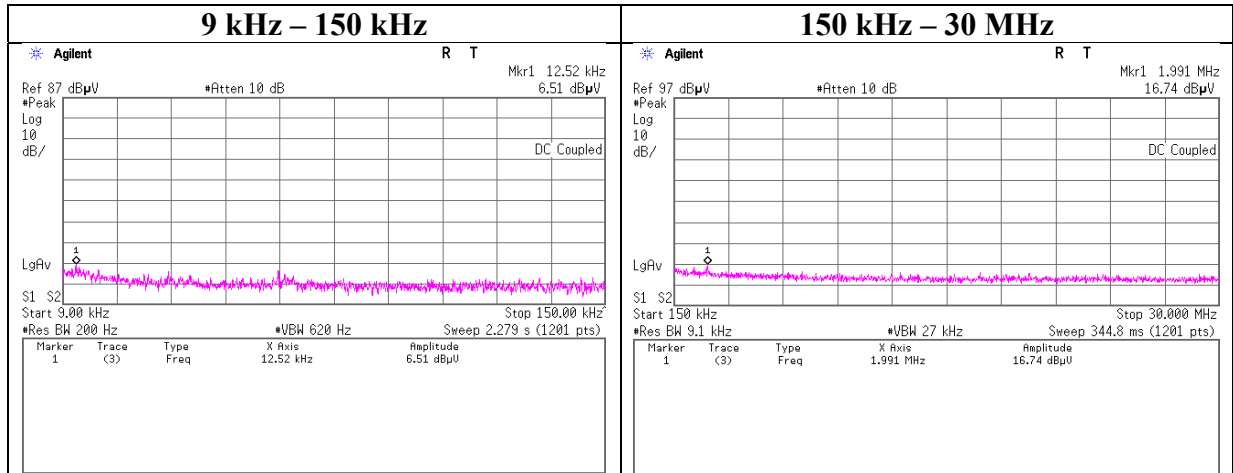
Facsimile : +81 596 24 8124



## Conducted Spurious Emission

Report No.	13097799H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	May 26, 2020
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

### 2441 MHz



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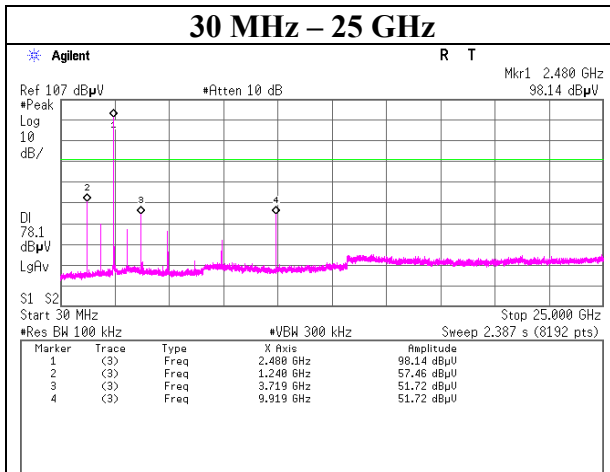
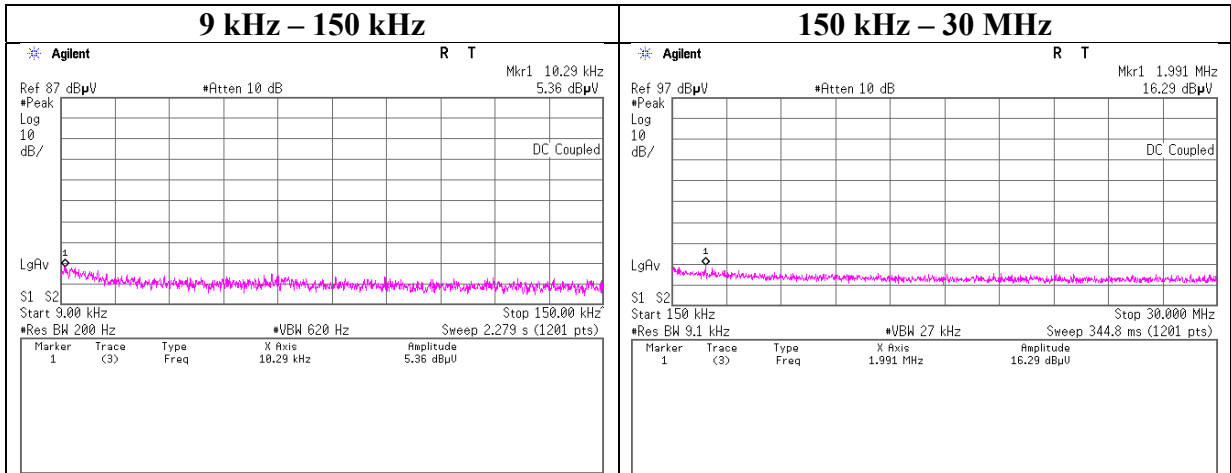
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Report No. 13097799H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date May 26, 2020  
 Temperature / Humidity 23 deg. C / 57 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, DH5

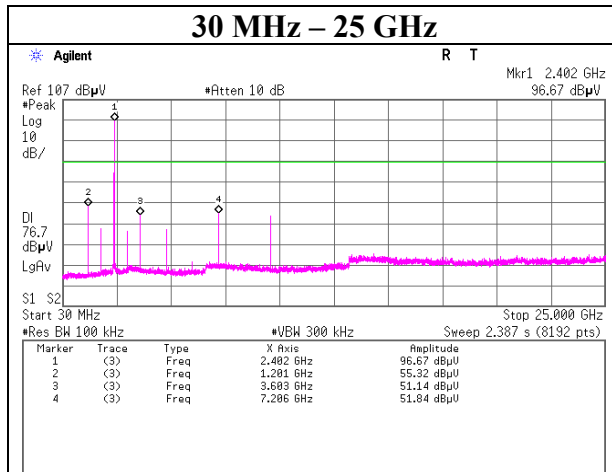
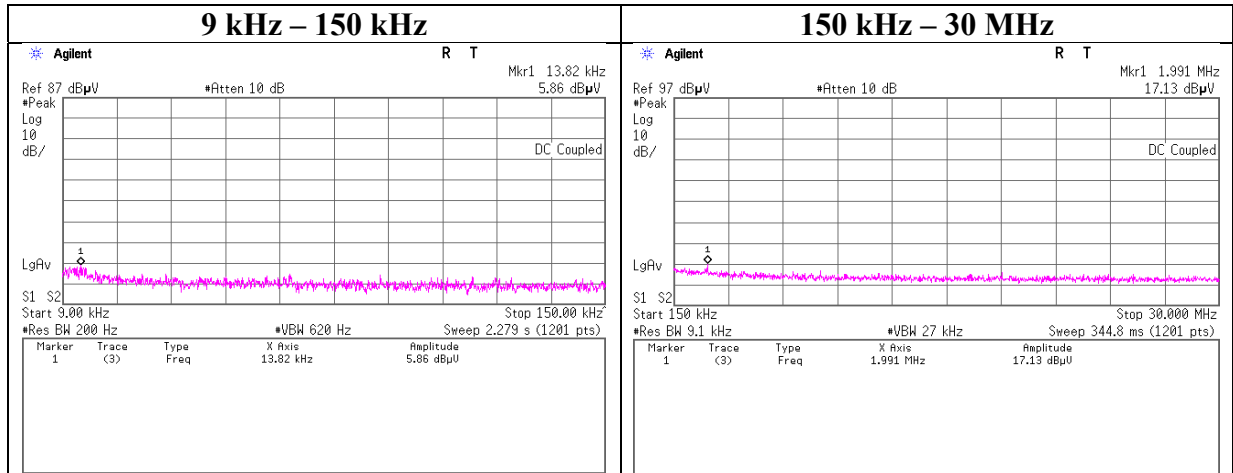
### 2480 MHz



## Conducted Spurious Emission

Report No.	13097799H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	May 26, 2020
Temperature / Humidity	23 deg. C / 57 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

### 2402 MHz



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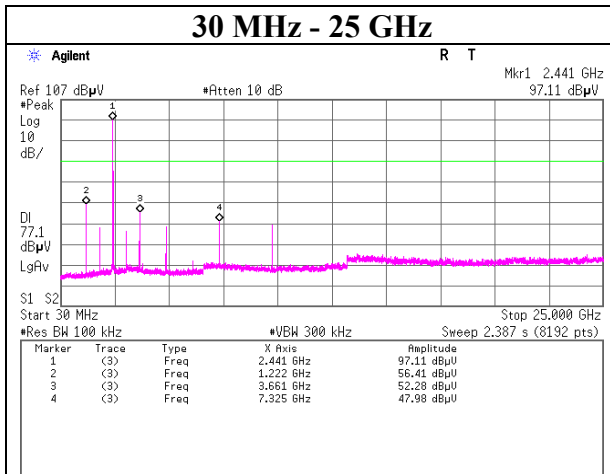
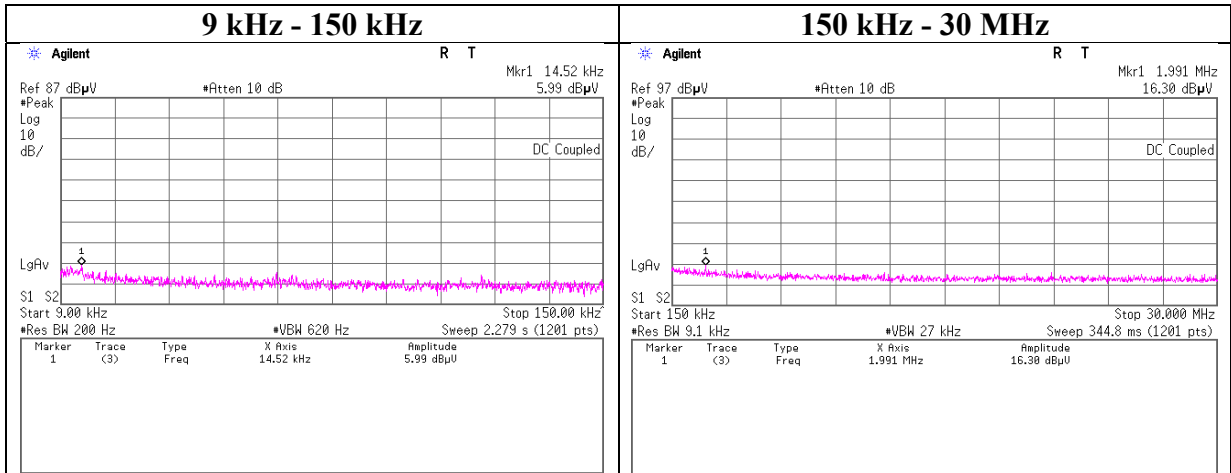
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## Conducted Spurious Emission

Report No. 13097799H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date May 26, 2020  
 Temperature / Humidity 23 deg. C / 57 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, 3DH5

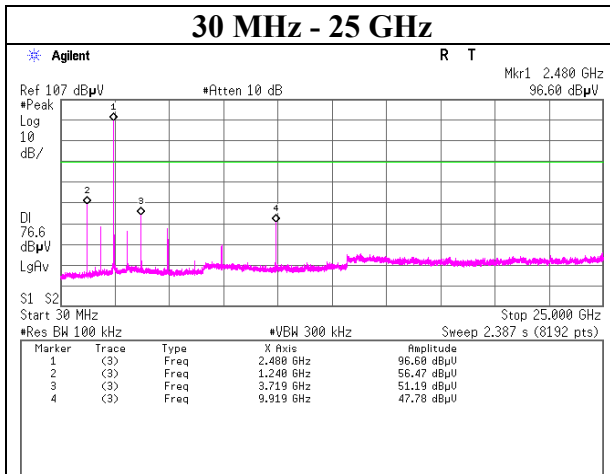
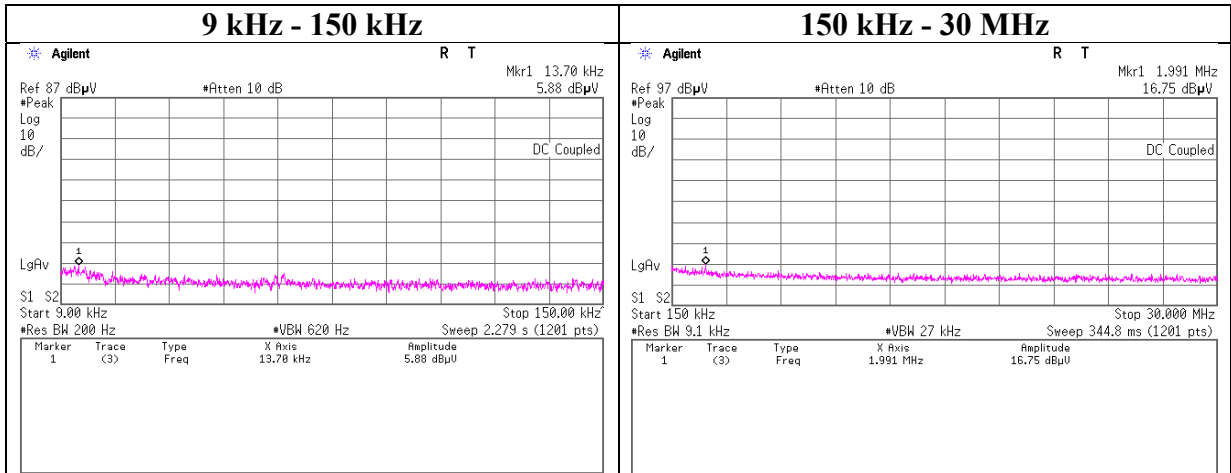
### 2441 MHz



## Conducted Spurious Emission

Report No. 13097799H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date May 26, 2020  
 Temperature / Humidity 23 deg. C / 57 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, 3DH5

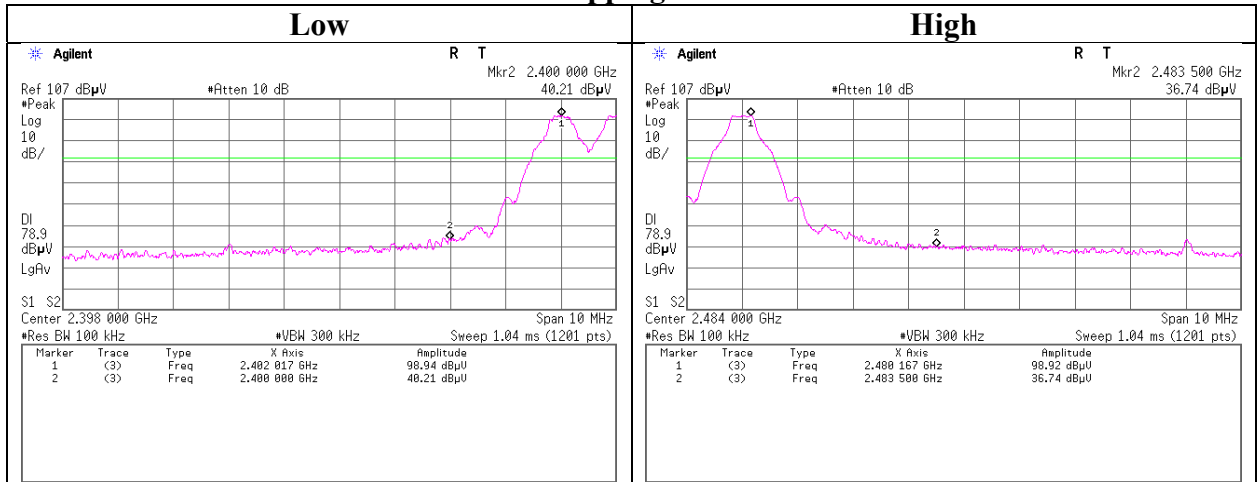
### 2480 MHz



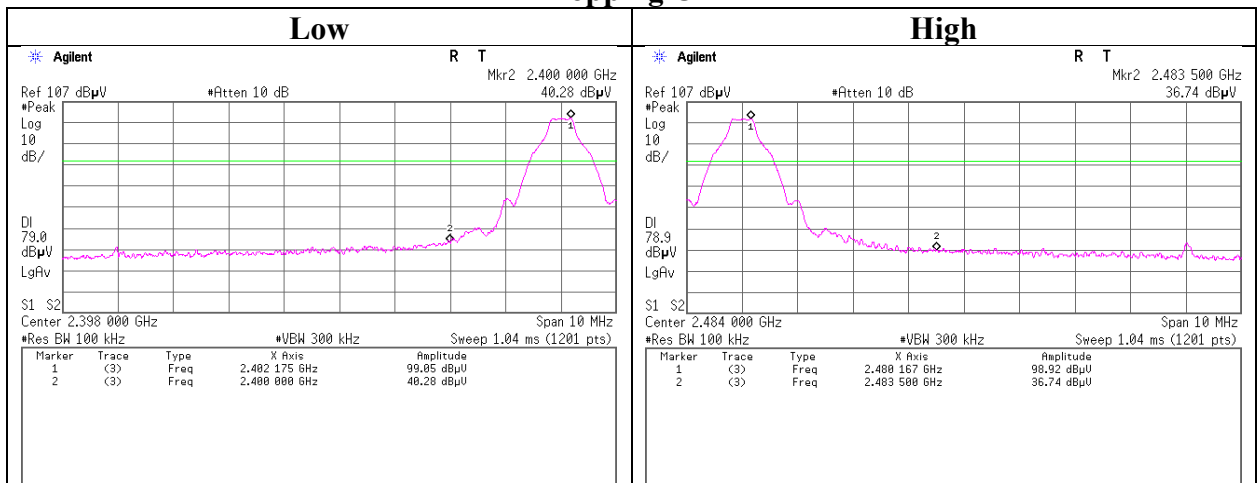
## Conducted Emission Band Edge compliance

Report No. 13097799H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date May 26, 2020  
 Temperature / Humidity 23 deg. C / 57 % RH  
 Engineer Yuta Moriya  
 Mode Tx DH5

### Hopping On



### Hopping Off



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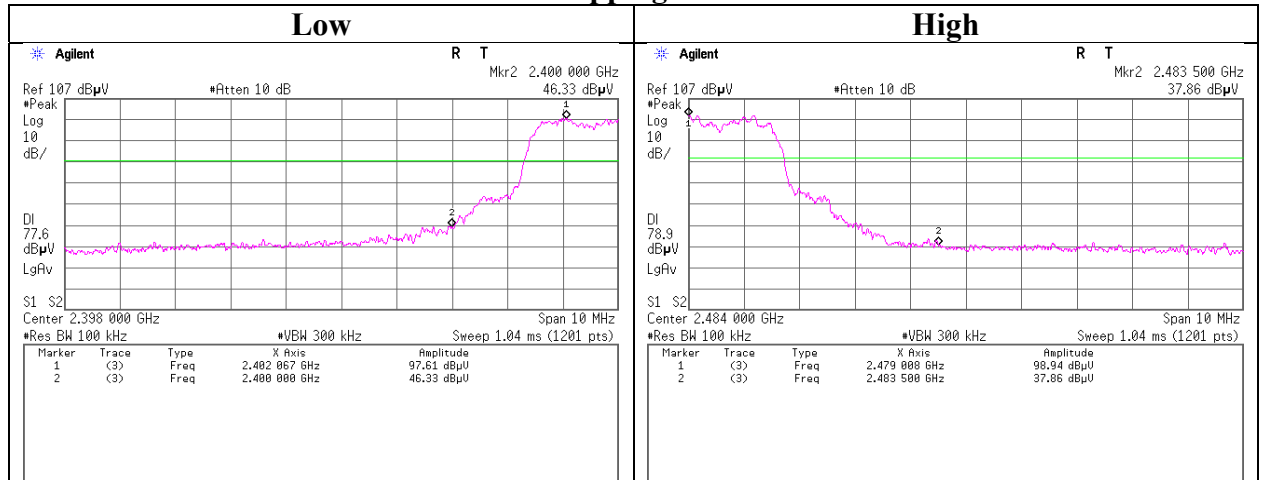
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

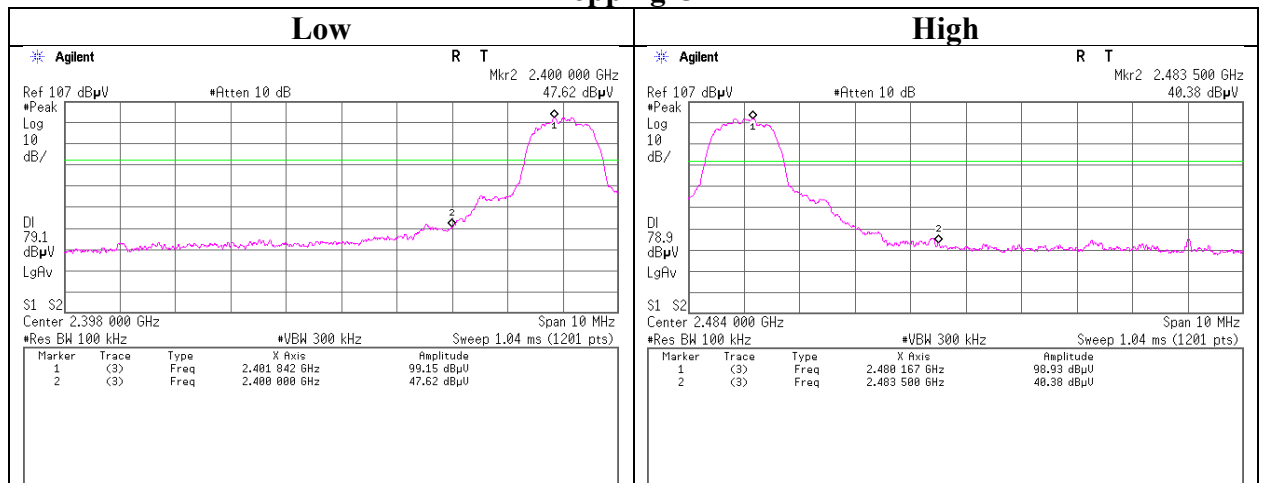
## Conducted Emission Band Edge compliance

Report No. 13097799H  
 Test place Ise EMC Lab. No.6 Measurement Room  
 Date May 26, 2020  
 Temperature / Humidity 23 deg. C / 57 % RH  
 Engineer Yuta Moriya  
 Mode Tx 3DH5

### Hopping On



### Hopping Off



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**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

## **APPENDIX 2: Test instruments**

### **Test equipment**

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	2019/10/06	12
AT	MPM-13	141810	Power Meter	ANRITSU	ML2495A	824014	2019/10/09	12
AT	MPSE-18	141832	Power sensor	ANRITSU	MA2411B	738174	2019/10/09	12
AT	MCC-138	141410	Microwave cable	Huber+Suhner	SUCOFLEX 102	37953/2	2019/09/18	12
AT	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	2019/12/09	12
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	2020/01/07	12
RE	MAEC-01	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	2020/06/08	24
RE	MOS-27	141566	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	2020/01/07	12
RE	MMM-03	141530	Digital Tester	Fluke Corporation	FLUKE 26-3	78030621	2019/08/20	12
RE	MJM-25	142226	Measure	KOMELON	KMC-36	-	-	-
RE	MAEC-01-SVSWR	141994	AC1_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 10m	DA-06881	2019/04/16	24
RE	MHA-05	141511	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	253	2019/09/03	12
RE	MCC-217	141393	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	2019/08/06	12
RE	MPA-01	141576	Pre Amplifier	Keysight Technologies Inc	8449B	3008A01671	2020/02/20	12
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	2019/09/11	12
RE	COTS-M EMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAT-08	141213	Attenuator(6dB)	Weinschel Corp	2	BK7971	2019/11/14	12
RE	KBA-05	141198	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	2513	2020/04/22	12
RE	MCC-02	141350	Coaxial Cable	Suhner/storm/Agilent/T SJ	-	-	2019/06/27	12
RE	MTR-09	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	2020/06/03	12
RE	MLA-20	141264	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-189	2020/04/22	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	2020/02/10	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 test  
AT: Antenna Terminal Conducted test

**UL Japan, Inc.**

**Ise EMC Lab.**

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124