



# RADIO TEST REPORT

**Test Report No. : 13325207H-A-R1**

**Applicant** : Sony Interactive Entertainment Inc.  
**Type of EUT** : Remote Control  
**Model Number of EUT** : CFI-ZMR1  
**FCC ID** : AK8CFIZMR1  
**Test regulation** : FCC Part 15 Subpart C: 2020  
**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 13325207H-A. 13325207H-A is replaced with this report.

**Date of test:** April 20 and 21, 2020

**Representative test engineer:** T. Noguchi  
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Engineer  
Consumer Technology Division

**Approved by:** Takayuki S.  
Takayuki Shimada  
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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## **REVISION HISTORY**

**Original Test Report No.: 13325207H-A**

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13325207H-A	May 21, 2020	-	-
1	13325207H-A-R1	June 5, 2020	P49	Added note for Ferrite core

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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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## **SECTION 1: Customer information**

Company Name	Sony Interactive Entertainment Inc.
Brand Name	SONY
Address	1-7-1 Konan, Minato-ku, Tokyo, 108-0075 Japan
Telephone Number	+81-50-3807-5639
Facsimile Number	+81-50-3807-9594
Contact Person	Miho Nakamura

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)
  - 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	Remote Control
Model Number	CFI-ZMR1
Serial Number	Refer to SECTION 4.2
Country of Manufacture	China
Receipt Date	April 18, 2020
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: CFI-ZMR1 (referred to as the EUT in this report) is a Remote Control.

### **Product Specification**

Operating Temperature	+5 deg. C to +35 deg. C
Power Supply	DC 3.0 V

### **Radio Specification: Bluetooth**

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi$ /4DQPSK, 8DPSK)
Bandwidth & Channel spacing	79MHz & 1MHz
Method of frequency generation	Synthesizer
Antenna Type	IFA
Antenna Gain	4.2 dBi max
Maximum clock frequency	6 GHz

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

### **3.1 Test Specification**

Test Specification : FCC Part 15 Subpart C  
FCC Part 15 final revised on April 1, 2020 and effective June 1, 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	16.4 dB 2483.500 MHz, AV, Horizontal	Complied e) / f)	Conducted/ Radiated (above 30 MHz) *2)

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.

\*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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**FCC Part 15.31 (e)**

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

**FCC Part 15.203 Antenna requirement**

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement 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 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  $k=2$ .  
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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

**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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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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## **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>
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: 7  Software: BT Tool, Version: W1645  (Date: 2020.4.20, 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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## 4.2 Configuration and peripherals

**This page has been submitted for a separate exhibit.**

## **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.

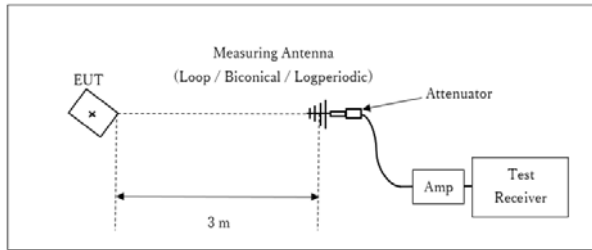
### **20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).**

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.

**Figure 2: Test Setup**

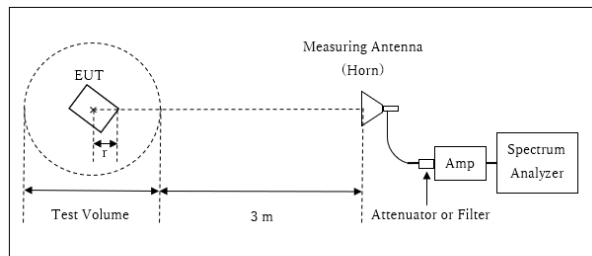
Below 1 GHz



× : 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:  $20 \times \log(3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$

\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.75 \text{ m}$

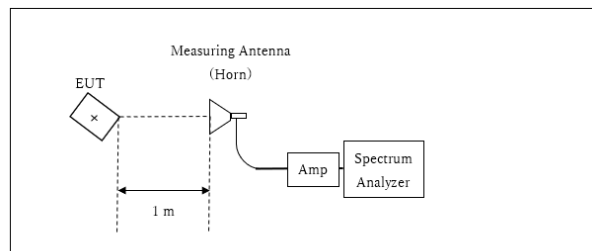
Test Volume : 1.5 m

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

$r = 0.0 \text{ m}$

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

10 GHz - 30 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.

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

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

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## **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 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.

**Test data : APPENDIX**

**Test result : Pass**

## APPENDIX 1: Test data

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

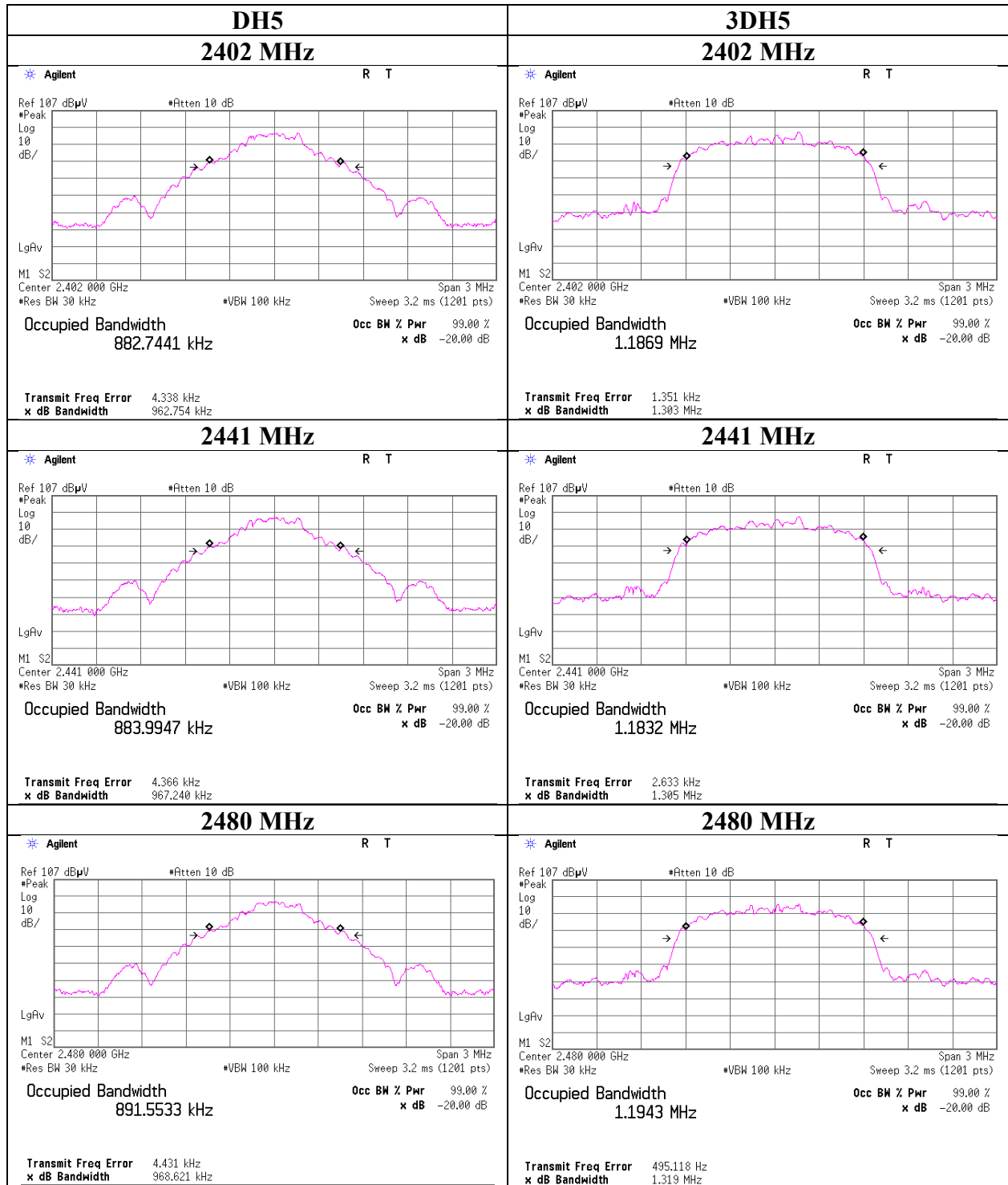
Report No. 13325207H  
Test place Ise EMC Lab. No.4 Measurement Room  
Date April 20, 2020  
Temperature / Humidity 23 deg. C / 60 % RH  
Engineer Yuta Moriya  
Mode Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.963	882.744	1.000	>= 0.642
DH5	2441.0	0.967	883.995	1.000	>= 0.645
DH5	2480.0	0.969	891.553	1.000	>= 0.646
DH5	Hopping On	-	78643.700	-	-
3DH5	2402.0	1.303	1186.900	1.000	>= 0.869
3DH5	2441.0	1.305	1183.200	1.000	>= 0.870
3DH5	2480.0	1.319	1194.300	1.000	>= 0.879
3DH5	Hopping On	-	78736.900	-	-

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

### 20dB Bandwidth and 99% Occupied Bandwidth



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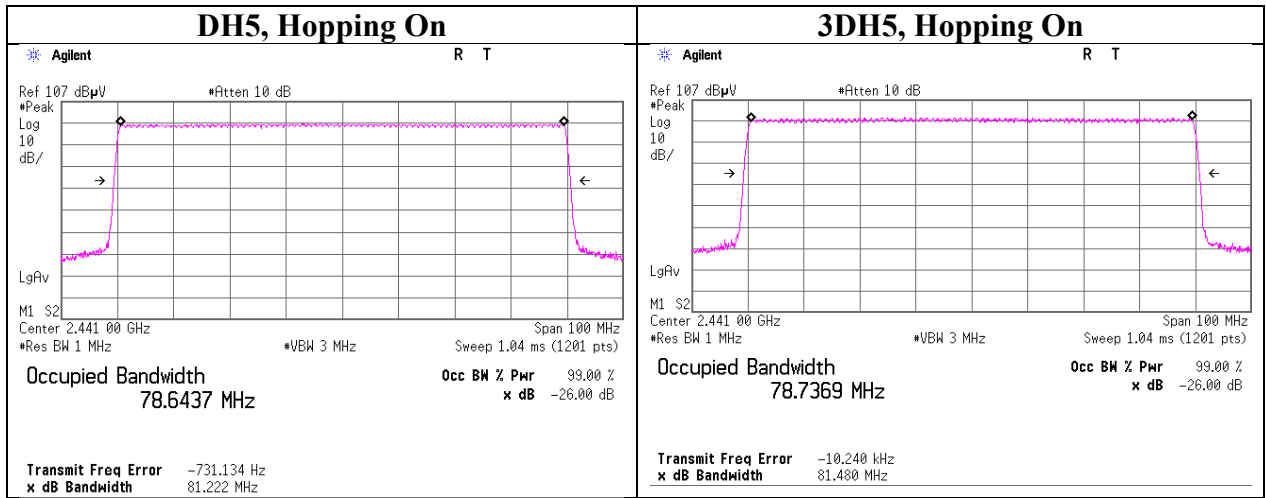
**Ise EMC Lab.**

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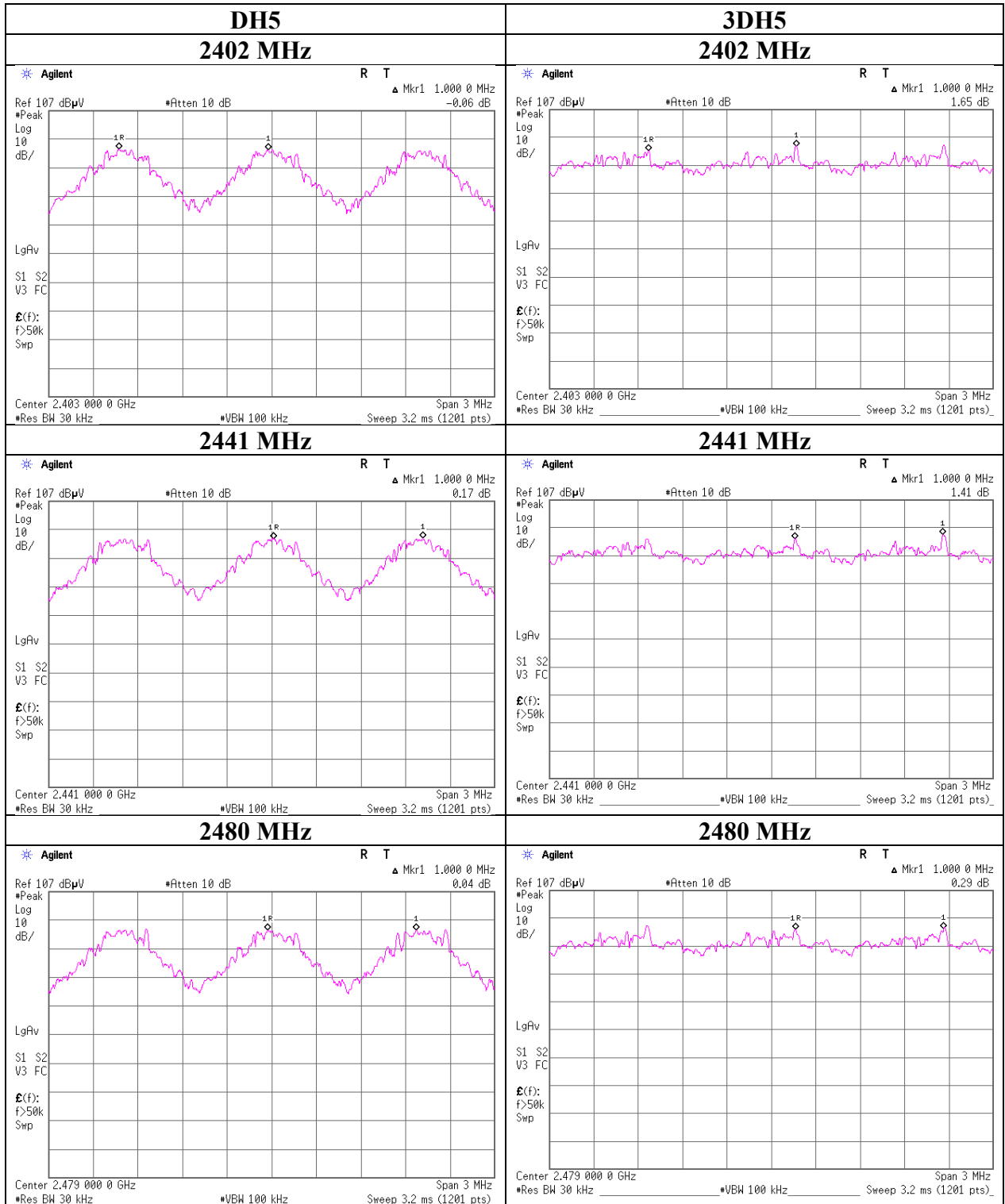
Facsimile : +81 596 24 8124

**20dB Bandwidth and 99% Occupied Bandwidth**





### Carrier Frequency Separation



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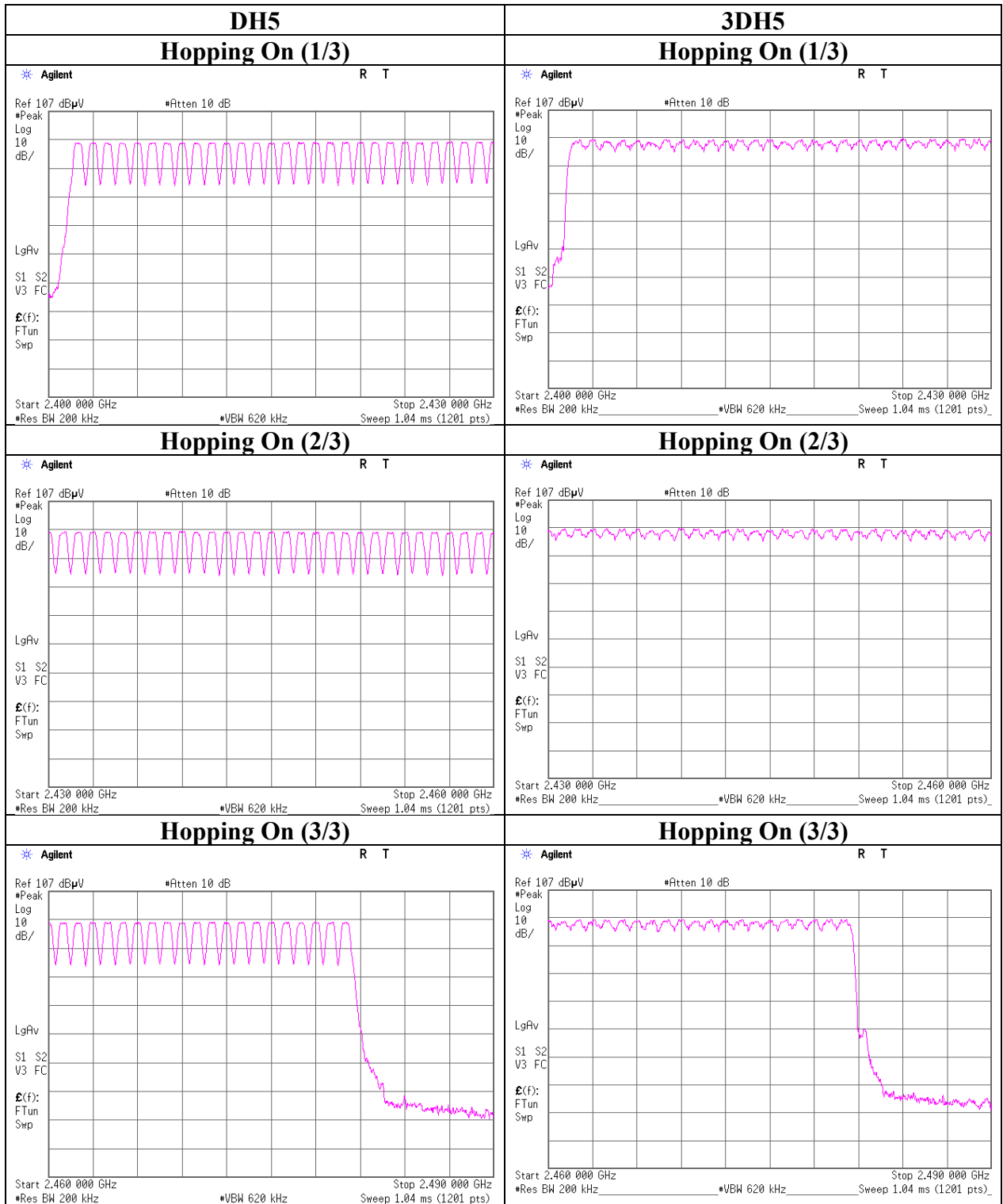
### Number of Hopping Frequency

Report No. 13325207H  
Test place Ise EMC Lab. No.4 Measurement Room  
Date April 20, 2020  
Temperature / Humidity 23 deg. C / 60 % RH  
Engineer Yuta Moriya  
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**



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### Dwell time

Report No. 13325207H  
Test place Ise EMC Lab. No.4 Measurement Room  
Date April 20, 2020  
Temperature / Humidity 23 deg. C / 60 % 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	49.8 times /	5 sec. x	31.6 sec. =	315 times	0.387	400
DH3	26.8 times /	5 sec. x	31.6 sec. =	170 times	1.649	400
DH5	20.8 times /	5 sec. x	31.6 sec. =	132 times	2.897	400
3DH1	50.0 times /	5 sec. x	31.6 sec. =	316 times	0.395	400
3DH3	26.8 times /	5 sec. x	31.6 sec. =	170 times	1.652	400
3DH5	19.2 times /	5 sec. x	31.6 sec. =	122 times	2.903	400

Sample Calculation

Result = Number of transmission x Length of transmission

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

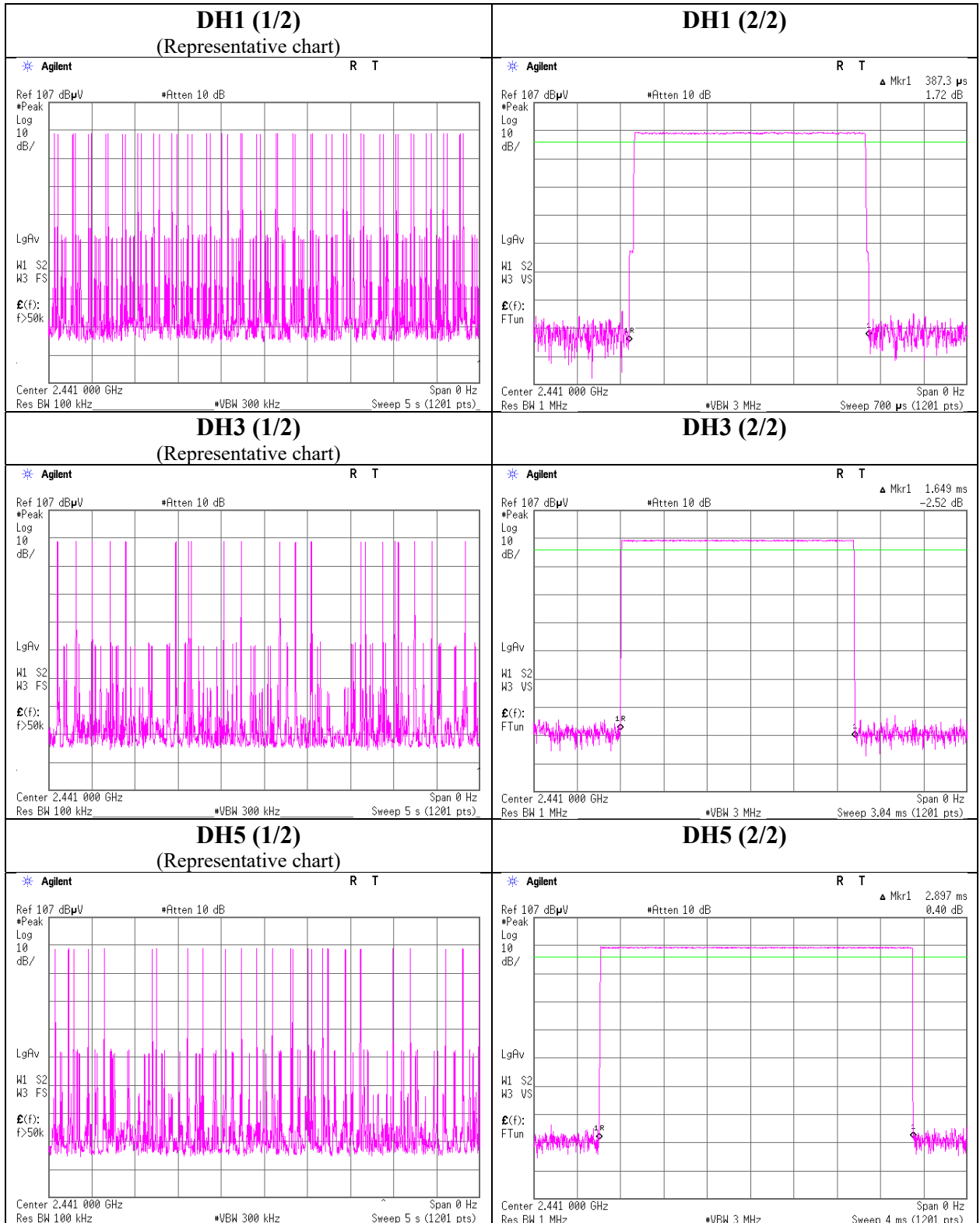
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	50	50	49	50	49.8
DH3	22	33	28	25	26	26.8
DH5	21	20	19	23	21	20.8
3DH1	50	50	50	50	50	50
3DH3	26	27	23	30	28	26.8
3DH5	20	19	20	19	18	19.2

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.**

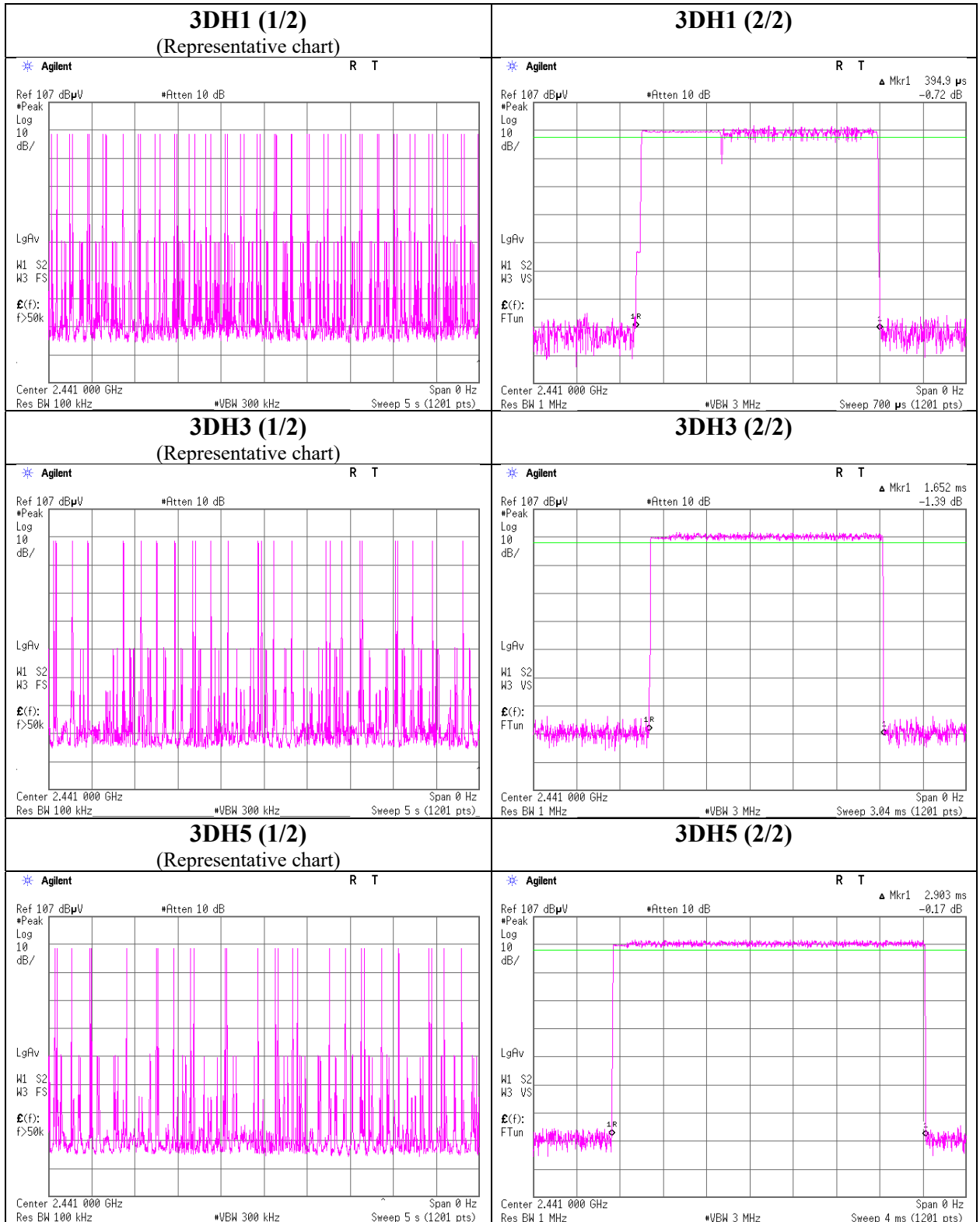
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**Dwell time**



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## Maximum Peak Output Power

Report No. 13325207H  
Test place Ise EMC Lab. No.4 Measurement Room  
Date April 20, 2020  
Temperature / Humidity 23 deg. C / 60 % 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	Antenna Gain [dBi]	Result		Limit		Margin
					[dBm]	[mW]	[dBm]	[mW]			[dB]	[dBm]	[mW]	[dBm]	
DH5	2402.0	-11.01	2.09	9.99	1.07	1.28	20.96	125	19.89	4.20	5.27	3.37	36.02	4000	30.75
DH5	2441.0	-10.67	2.10	9.99	1.42	1.39	20.96	125	19.54	4.20	5.62	3.65	36.02	4000	30.40
DH5	2480.0	-10.83	2.11	9.99	1.27	1.34	20.96	125	19.69	4.20	5.47	3.52	36.02	4000	30.55
2DH5	2402.0	-8.68	2.09	9.99	3.40	2.19	20.96	125	17.56	4.20	7.60	5.75	36.02	4000	28.42
2DH5	2441.0	-8.33	2.10	9.99	3.76	2.38	20.96	125	17.20	4.20	7.96	6.25	36.02	4000	28.06
2DH5	2480.0	-8.49	2.11	9.99	3.61	2.30	20.96	125	17.35	4.20	7.81	6.04	36.02	4000	28.21
3DH5	2402.0	-8.39	2.09	9.99	3.69	2.34	20.96	125	17.27	4.20	7.89	6.15	36.02	4000	28.13
3DH5	2441.0	-8.14	2.10	9.99	3.95	2.48	20.96	125	17.01	4.20	8.15	6.53	36.02	4000	27.87
3DH5	2480.0	-8.29	2.11	9.99	3.81	2.40	20.96	125	17.15	4.20	8.01	6.32	36.02	4000	28.01

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.

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

Report No. 13325207H  
Test place Ise EMC Lab. No.4 Measurement Room  
Date April 20, 2020  
Temperature / Humidity 23 deg. C / 60 % RH  
Engineer Yuta Moriya  
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
					[dBm]	[mW]
DH5	2402.0	-12.56	2.09	9.99	-0.48	0.90
DH5	2441.0	-12.23	2.10	9.99	-0.14	0.97
DH5	2480.0	-12.37	2.11	9.99	-0.27	0.94
2DH5	2402.0	-12.59	2.09	9.99	-0.51	0.89
2DH5	2441.0	-12.26	2.10	9.99	-0.17	0.96
2DH5	2480.0	-12.33	2.11	9.99	-0.23	0.95
3DH5	2402.0	-12.56	2.09	9.99	-0.48	0.90
3DH5	2441.0	-12.17	2.10	9.99	-0.08	0.98
3DH5	2480.0	-12.31	2.11	9.99	-0.21	0.95

Sample Calculation:

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

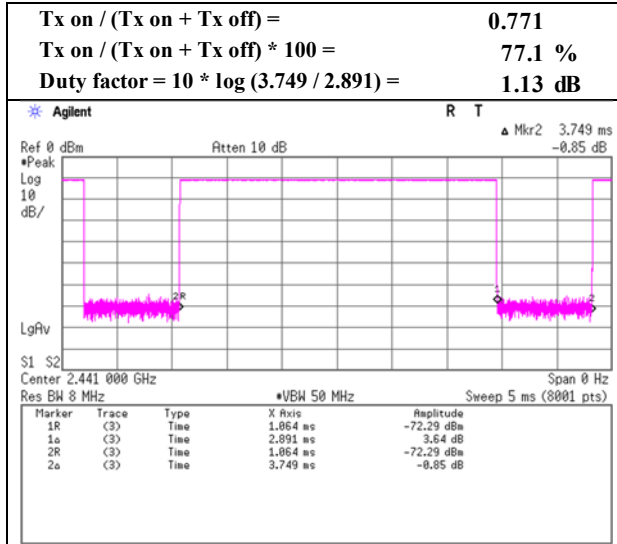
\*The equipment and cables were not used for factor 0 dB of the data sheets.



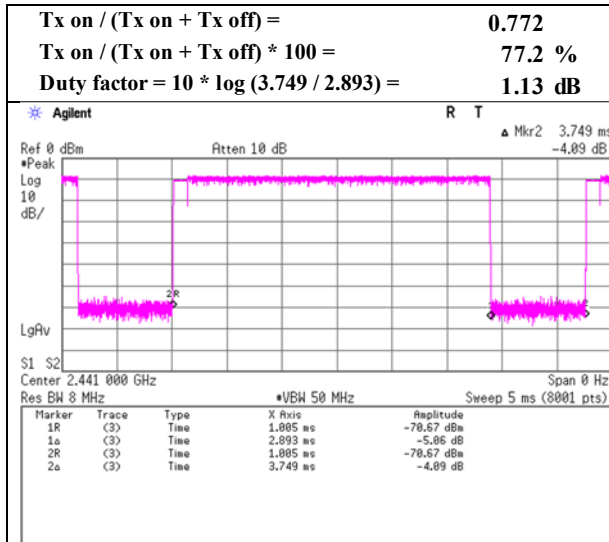
## Burst Rate Confirmation

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off

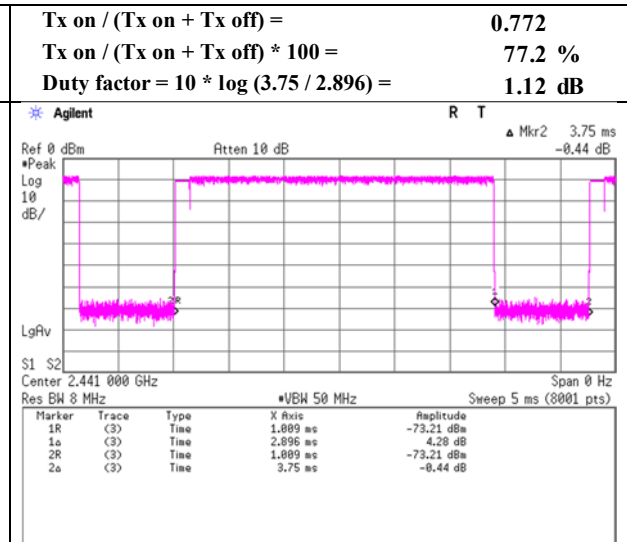
### DH5



### 2DH5



### 3DH5



## Radiated Spurious Emission

Report No.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(Above 10 GHz)	(Below 1 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.	44.560	QP	26.6	13.3	7.3	30.4	-	16.7	40.0	23.3	
Hori.	62.470	QP	26.6	7.3	7.5	30.4	-	11.1	40.0	28.9	
Hori.	77.658	QP	26.3	6.6	7.7	30.3	-	10.3	40.0	29.7	
Hori.	103.249	QP	25.9	10.8	8.0	30.2	-	14.6	43.5	28.9	
Hori.	157.798	QP	25.1	15.3	8.6	29.8	-	19.1	43.5	24.4	
Hori.	228.800	QP	24.5	11.2	9.2	29.4	-	15.5	46.0	30.5	
Hori.	2390.000	PK	45.1	27.6	4.3	35.2	-	41.8	73.9	32.1	
Hori.	4804.000	PK	42.9	31.6	6.1	34.4	-	46.2	73.9	27.7	Floor noise
Hori.	7206.000	PK	43.3	36.1	6.8	34.3	-	51.9	73.9	22.0	Floor noise
Hori.	9608.000	PK	44.5	38.6	7.5	34.9	-	55.7	73.9	18.2	Floor noise
Hori.	2390.000	AV	36.3	27.6	4.3	35.2	1.1	34.1	53.9	19.8	*1)
Hori.	4804.000	AV	34.5	31.6	6.1	34.4	-	37.8	53.9	16.1	Floor noise
Hori.	7206.000	AV	34.8	36.1	6.8	34.3	-	43.4	53.9	10.5	Floor noise
Hori.	9608.000	AV	36.3	38.6	7.5	34.9	-	47.5	53.9	6.4	Floor noise
Vert.	44.560	QP	26.7	13.3	7.3	30.4	-	16.8	40.0	23.2	
Vert.	62.470	QP	26.6	7.3	7.5	30.4	-	11.1	40.0	28.9	
Vert.	77.658	QP	26.3	6.6	7.7	30.3	-	10.3	40.0	29.7	
Vert.	103.249	QP	25.9	10.8	8.0	30.2	-	14.6	43.5	28.9	
Vert.	157.798	QP	25.1	15.3	8.6	29.8	-	19.1	43.5	24.4	
Vert.	228.800	QP	24.5	11.2	9.2	29.4	-	15.5	46.0	30.5	
Vert.	2390.000	PK	45.0	27.6	4.3	35.2	-	41.7	73.9	32.2	
Vert.	4804.000	PK	42.9	31.6	6.1	34.4	-	46.2	73.9	27.7	Floor noise
Vert.	7206.000	PK	43.8	36.1	6.8	34.3	-	52.4	73.9	21.5	Floor noise
Vert.	9608.000	PK	44.2	38.6	7.5	34.9	-	55.4	73.9	18.5	Floor noise
Vert.	2390.000	AV	36.0	27.6	4.3	35.2	1.1	33.8	53.9	20.1	*1)
Vert.	4804.000	AV	34.6	31.6	6.1	34.4	-	37.9	53.9	16.0	Floor noise
Vert.	7206.000	AV	34.7	36.1	6.8	34.3	-	43.3	53.9	10.6	Floor noise
Vert.	9608.000	AV	36.4	38.6	7.5	34.9	-	47.6	53.9	6.3	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  $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$

10 GHz - 30 GHz  $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

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

### 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	101.4	27.6	4.3	35.2	98.1	-	-	Carrier
Hori.	2400.000	PK	49.3	27.6	4.3	35.2	46.0	78.1	32.1	
Vert.	2402.000	PK	99.5	27.6	4.3	35.2	96.1	-	-	Carrier
Vert.	2400.000	PK	46.6	27.6	4.3	35.2	43.3	76.1	32.9	

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

Distance factor: 1 GHz - 10 GHz  $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$

**UL Japan, Inc.**

**Ise EMC Lab.**

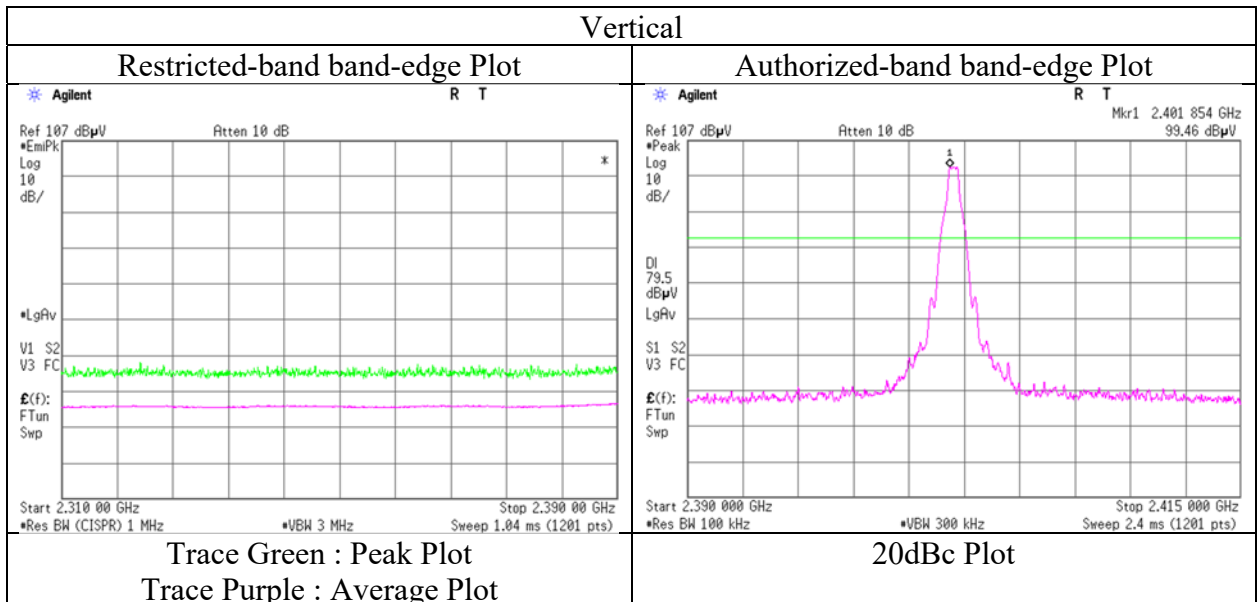
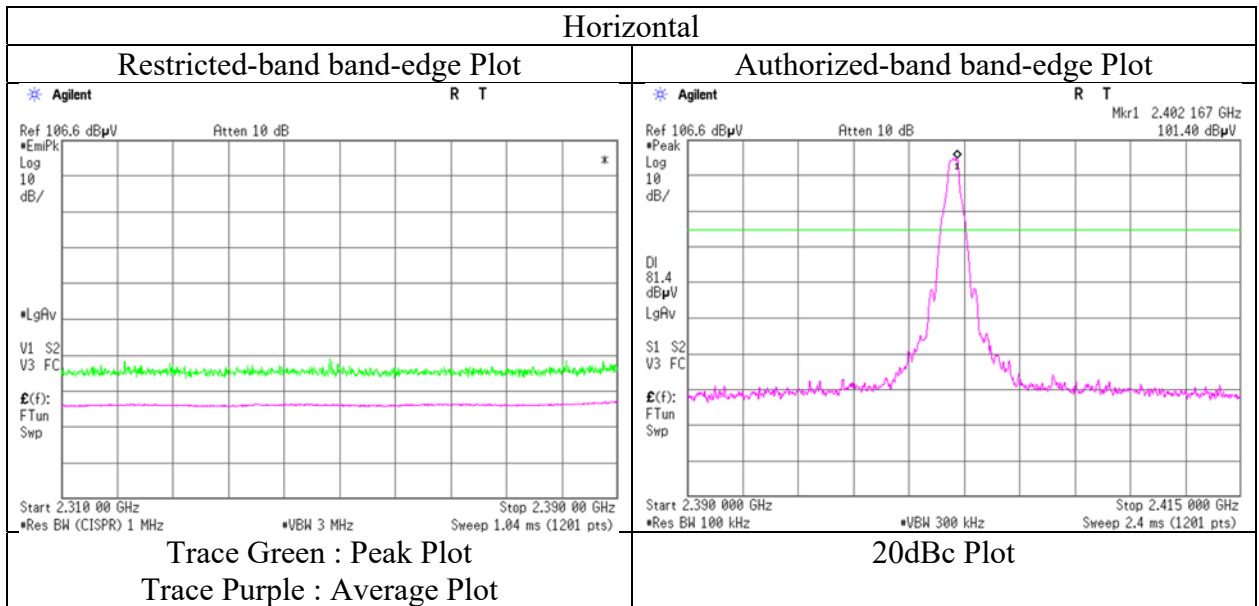
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 13325207H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 20, 2020  
Temperature / Humidity 20 deg. C / 56 % RH  
Engineer Hiroyuki Furutaka  
(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.

**UL Japan, Inc.**

**Ise EMC Lab.**

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## Radiated Spurious Emission

Report No.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(Above 10 GHz)	(Below 1 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.	51.772	QP	26.8	10.6	7.4	30.4	-	14.4	40.0	25.6	
Hori.	63.001	QP	26.3	7.3	7.5	30.4	-	10.7	40.0	29.3	
Hori.	78.128	QP	26.2	6.6	7.7	30.3	-	10.3	40.0	29.7	
Hori.	97.069	QP	25.8	9.8	8.0	30.2	-	13.3	43.5	30.2	
Hori.	115.513	QP	25.6	12.5	8.2	30.1	-	16.1	43.5	27.4	
Hori.	242.821	QP	24.4	11.6	9.3	29.3	-	16.0	46.0	30.0	
Hori.	4882.000	PK	42.7	31.6	6.1	34.4	-	45.9	73.9	28.0	Floor noise
Hori.	7323.000	PK	42.3	36.1	6.9	34.4	-	50.9	73.9	23.0	Floor noise
Hori.	9764.000	PK	44.0	39.2	7.6	34.9	-	55.9	73.9	18.0	Floor noise
Hori.	4882.000	AV	34.3	31.6	6.1	34.4	-	37.5	53.9	16.4	Floor noise
Hori.	7323.000	AV	34.4	36.1	6.9	34.4	-	43.0	53.9	10.9	Floor noise
Hori.	9764.000	AV	35.7	39.2	7.6	34.9	-	47.6	53.9	6.3	Floor noise
Vert.	51.772	QP	26.8	10.6	7.4	30.4	-	14.4	40.0	25.6	
Vert.	63.001	QP	26.3	7.3	7.5	30.4	-	10.7	40.0	29.3	
Vert.	78.128	QP	26.2	6.6	7.7	30.3	-	10.3	40.0	29.7	
Vert.	97.069	QP	25.8	9.8	8.0	30.2	-	13.3	43.5	30.2	
Vert.	115.513	QP	25.6	12.5	8.2	30.1	-	16.1	43.5	27.4	
Vert.	242.821	QP	24.5	11.6	9.3	29.3	-	16.1	46.0	29.9	
Vert.	4882.000	PK	42.5	31.6	6.1	34.4	-	45.7	73.9	28.2	Floor noise
Vert.	7323.000	PK	42.1	36.1	6.9	34.4	-	50.7	73.9	23.2	Floor noise
Vert.	9764.000	PK	43.8	39.2	7.6	34.9	-	55.7	73.9	18.2	Floor noise
Vert.	4882.000	AV	34.5	31.6	6.1	34.4	-	37.7	53.9	16.2	Floor noise
Vert.	7323.000	AV	34.3	36.1	6.9	34.4	-	42.9	53.9	11.0	Floor noise
Vert.	9764.000	AV	35.6	39.2	7.6	34.9	-	47.5	53.9	6.4	Floor noise

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

\*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 (3.75 m / 3.0 m) = 1.94 dB  
                          10 GHz - 30 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

Report No.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(Above 10 GHz)	(Below 1 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.	35.808	QP	27.1	16.5	7.1	30.4	-	20.2	40.0	19.8	
Hori.	51.554	QP	26.6	10.7	7.4	30.4	-	14.3	40.0	25.7	
Hori.	60.993	QP	26.7	7.6	7.5	30.4	-	11.4	40.0	28.6	
Hori.	99.691	QP	26.3	10.3	8.0	30.2	-	14.4	43.5	29.1	
Hori.	114.151	QP	25.7	12.2	8.1	30.1	-	15.9	43.5	27.6	
Hori.	216.798	QP	24.6	11.0	9.1	29.5	-	15.3	46.0	30.8	
Hori.	2483.500	PK	48.3	27.5	4.4	35.2	-	44.9	73.9	29.0	
Hori.	4960.000	PK	42.1	31.6	6.1	34.5	-	45.4	73.9	28.6	Floor noise
Hori.	7440.000	PK	41.8	36.3	6.9	34.4	-	50.5	73.9	23.4	Floor noise
Hori.	9920.000	PK	44.0	38.9	7.6	34.9	-	55.7	73.9	18.2	Floor noise
Hori.	2483.500	AV	38.5	27.5	4.4	35.2	1.1	36.3	53.9	17.6	*1)
Hori.	4960.000	AV	34.0	31.6	6.1	34.5	-	37.3	53.9	16.7	Floor noise
Hori.	7440.000	AV	34.3	36.3	6.9	34.4	-	43.0	53.9	10.9	Floor noise
Hori.	9920.000	AV	35.8	38.9	7.6	34.9	-	47.5	53.9	6.4	Floor noise
Vert.	35.808	QP	27.1	16.5	7.1	30.4	-	20.2	40.0	19.8	
Vert.	51.554	QP	26.6	10.7	7.4	30.4	-	14.3	40.0	25.7	
Vert.	60.993	QP	26.7	7.6	7.5	30.4	-	11.4	40.0	28.6	
Vert.	99.691	QP	26.3	10.3	8.0	30.2	-	14.4	43.5	29.1	
Vert.	114.151	QP	25.7	12.2	8.1	30.1	-	15.9	43.5	27.6	
Vert.	216.798	QP	24.7	11.0	9.1	29.5	-	15.4	46.0	30.7	
Vert.	2483.500	PK	47.2	27.5	4.4	35.2	-	43.8	73.9	30.1	
Vert.	4960.000	PK	43.0	31.6	6.1	34.5	-	46.3	73.9	27.7	Floor noise
Vert.	7440.000	PK	42.7	36.3	6.9	34.4	-	51.4	73.9	22.5	Floor noise
Vert.	9920.000	PK	44.3	38.9	7.6	34.9	-	56.0	73.9	17.9	Floor noise
Vert.	2483.500	AV	38.0	27.5	4.4	35.2	1.1	35.8	53.9	18.1	*1)
Vert.	4960.000	AV	34.2	31.6	6.1	34.5	-	37.5	53.9	16.5	Floor noise
Vert.	7440.000	AV	34.0	36.3	6.9	34.4	-	42.7	53.9	11.2	Floor noise
Vert.	9920.000	AV	35.9	38.9	7.6	34.9	-	47.6	53.9	6.3	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).

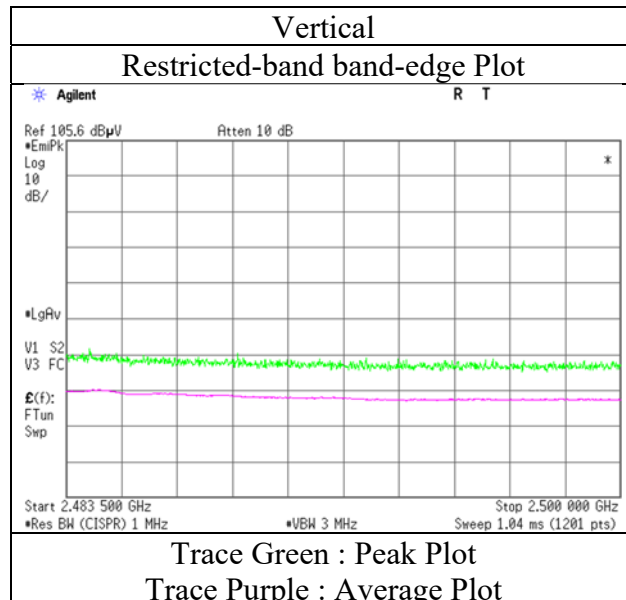
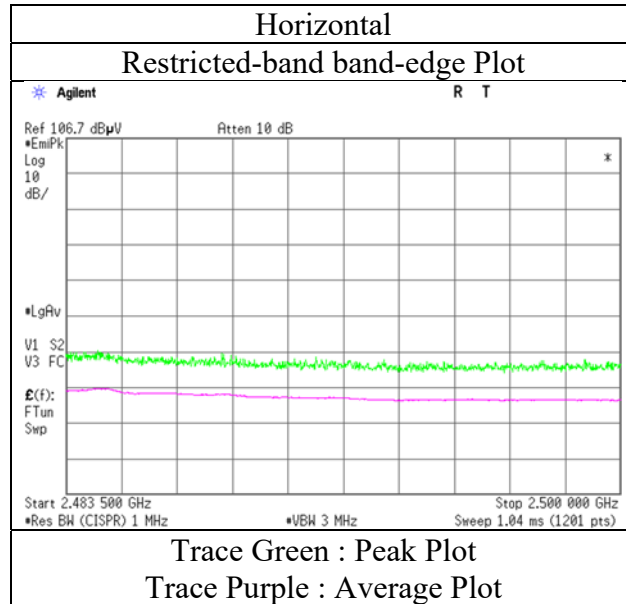
Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB  
10 GHz - 30 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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

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

Report No. 13325207H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 20, 2020  
Temperature / Humidity 20 deg. C / 56 % RH  
Engineer Hiroyuki Furutaka  
(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.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(Above 10 GHz)	(Below 1 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.	51.837	QP	29.1	10.6	7.4	30.4	-	16.7	40.0	23.3	
Hori.	59.128	QP	26.4	8.2	7.5	30.4	-	11.7	40.0	28.4	
Hori.	73.410	QP	26.3	6.3	7.7	30.3	-	10.0	40.0	30.0	
Hori.	89.288	QP	26.1	8.4	7.9	30.2	-	12.2	43.5	31.4	
Hori.	105.847	QP	25.7	11.2	8.1	30.2	-	14.8	43.5	28.7	
Hori.	239.761	QP	24.5	11.5	9.3	29.3	-	16.0	46.0	30.0	
Hori.	2390.000	PK	45.9	27.6	4.3	35.2	-	42.6	73.9	31.3	
Hori.	4804.000	PK	43.1	31.6	6.1	34.4	-	46.4	73.9	27.5	Floor noise
Hori.	7206.000	PK	42.7	36.1	6.8	34.3	-	51.3	73.9	22.6	Floor noise
Hori.	9608.000	PK	43.7	38.6	7.5	34.9	-	54.9	73.9	19.0	Floor noise
Hori.	2390.000	AV	36.7	27.6	4.3	35.2	1.1	34.5	53.9	19.4	*1)
Hori.	4804.000	AV	34.3	31.6	6.1	34.4	-	37.6	53.9	16.3	Floor noise
Hori.	7206.000	AV	34.6	36.1	6.8	34.3	-	43.2	53.9	10.7	Floor noise
Hori.	9608.000	AV	35.7	38.6	7.5	34.9	-	46.9	53.9	7.0	Floor noise
Vert.	51.837	QP	29.1	10.6	7.4	30.4	-	16.7	40.0	23.3	
Vert.	59.128	QP	26.4	8.2	7.5	30.4	-	11.7	40.0	28.4	
Vert.	73.410	QP	26.3	6.3	7.7	30.3	-	10.0	40.0	30.0	
Vert.	89.288	QP	26.1	8.4	7.9	30.2	-	12.2	43.5	31.4	
Vert.	105.847	QP	25.7	11.2	8.1	30.2	-	14.8	43.5	28.7	
Vert.	239.761	QP	24.4	11.5	9.3	29.3	-	15.9	46.0	30.1	
Vert.	2390.000	PK	45.2	27.6	4.3	35.2	-	41.9	73.9	32.0	
Vert.	4804.000	PK	42.6	31.6	6.1	34.4	-	45.9	73.9	28.0	Floor noise
Vert.	7206.000	PK	43.5	36.1	6.8	34.3	-	52.1	73.9	21.8	Floor noise
Vert.	9608.000	PK	43.2	38.6	7.5	34.9	-	54.4	73.9	19.5	Floor noise
Vert.	2390.000	AV	36.4	27.6	4.3	35.2	1.1	34.2	53.9	19.7	*1)
Vert.	4804.000	AV	34.4	31.6	6.1	34.4	-	37.7	53.9	16.2	Floor noise
Vert.	7206.000	AV	34.8	36.1	6.8	34.3	-	43.4	53.9	10.5	Floor noise
Vert.	9608.000	AV	36.0	38.6	7.5	34.9	-	47.2	53.9	6.7	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 (3.75 m / 3.0 m) = 1.94 dB

10 GHz - 30 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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

### 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	101.8	27.6	4.3	35.2	98.5	-	-	Carrier
Hori.	2400.000	PK	48.3	27.6	4.3	35.2	45.0	78.5	33.5	
Vert.	2402.000	PK	100.5	27.6	4.3	35.2	97.2	-	-	Carrier
Vert.	2400.000	PK	46.2	27.6	4.3	35.2	42.9	77.2	34.3	

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

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

**UL Japan, Inc.**

**Ise EMC Lab.**

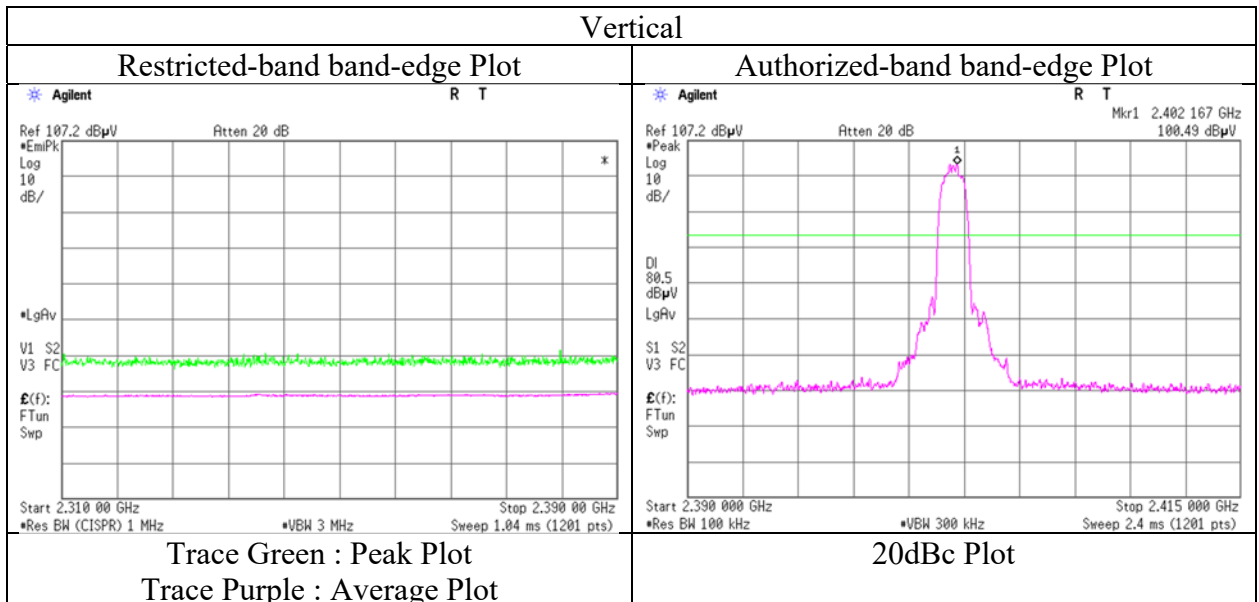
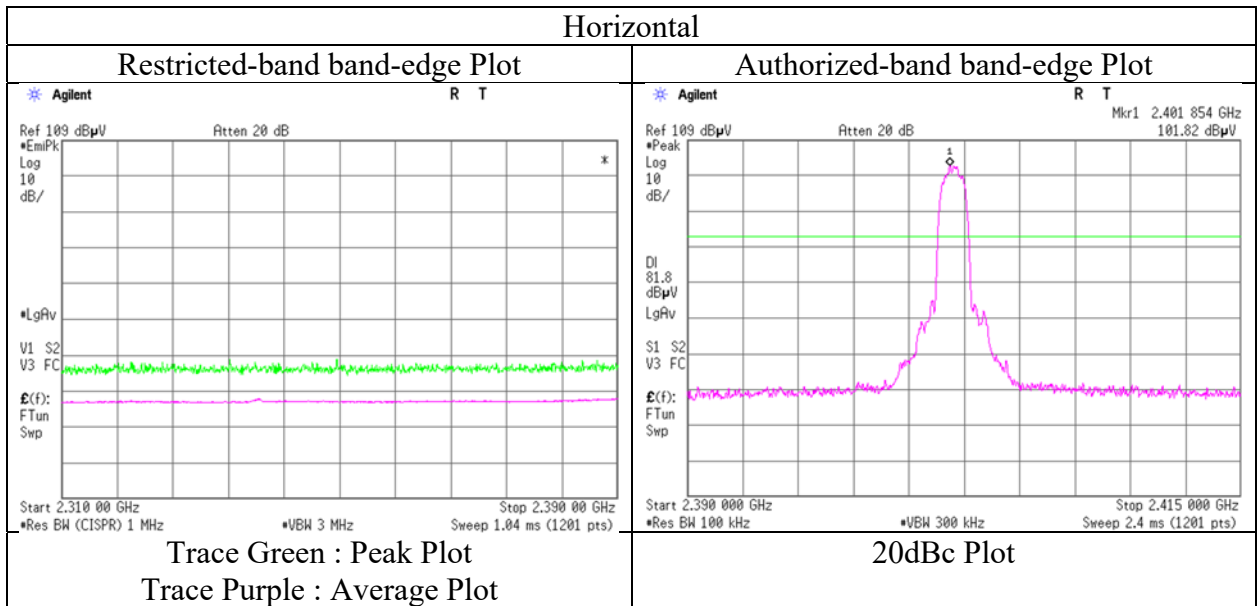
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

Report No.	13325207H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	April 20, 2020
Temperature / Humidity	20 deg. C / 56 % RH
Engineer	Hiroyuki Furutaka (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.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka (1 GHz -10 GHz)	Takafumi Noguchi (Above 10 GHz)	Hiroyuki Furutaka (Below 1 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.	55.005	QP	26.0	9.5	7.4	30.4	-	12.5	40.0	27.5	
Hori.	62.219	QP	26.3	7.4	7.5	30.4	-	10.8	40.0	29.2	
Hori.	71.753	QP	26.1	6.3	7.7	30.3	-	9.7	40.0	30.3	
Hori.	85.020	QP	26.1	7.6	7.8	30.3	-	11.2	40.0	28.8	
Hori.	100.184	QP	26.0	10.3	8.0	30.2	-	14.1	43.5	29.4	
Hori.	224.802	QP	24.1	11.1	9.2	29.4	-	15.0	46.0	31.0	
Hori.	4882.000	PK	42.0	31.6	6.1	34.4	-	45.2	73.9	28.7	Floor noise
Hori.	7323.000	PK	42.1	36.1	6.9	34.4	-	50.7	73.9	23.2	Floor noise
Hori.	9764.000	PK	43.3	39.2	7.6	34.9	-	55.2	73.9	18.7	Floor noise
Hori.	4882.000	AV	34.5	31.6	6.1	34.4	-	37.7	53.9	16.2	Floor noise
Hori.	7323.000	AV	34.4	36.1	6.9	34.4	-	43.0	53.9	10.9	Floor noise
Hori.	9764.000	AV	35.7	39.2	7.6	34.9	-	47.6	53.9	6.3	Floor noise
Vert.	55.005	QP	26.0	9.5	7.4	30.4	-	12.5	40.0	27.5	
Vert.	62.219	QP	26.3	7.4	7.5	30.4	-	10.8	40.0	29.2	
Vert.	71.753	QP	26.1	6.3	7.7	30.3	-	9.7	40.0	30.3	
Vert.	85.020	QP	26.1	7.6	7.8	30.3	-	11.2	40.0	28.8	
Vert.	100.184	QP	26.0	10.3	8.0	30.2	-	14.1	43.5	29.4	
Vert.	224.802	QP	24.1	11.1	9.2	29.4	-	15.0	46.0	31.0	
Vert.	4882.000	PK	43.1	31.6	6.1	34.4	-	46.3	73.9	27.6	Floor noise
Vert.	7323.000	PK	42.1	36.1	6.9	34.4	-	50.7	73.9	23.2	Floor noise
Vert.	9764.000	PK	44.1	39.2	7.6	34.9	-	56.0	73.9	17.9	Floor noise
Vert.	4882.000	AV	34.1	31.6	6.1	34.4	-	37.3	53.9	16.6	Floor noise
Vert.	7323.000	AV	34.5	36.1	6.9	34.4	-	43.1	53.9	10.8	Floor noise
Vert.	9764.000	AV	35.7	39.2	7.6	34.9	-	47.6	53.9	6.3	Floor noise

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

\*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 (3.75 m / 3.0 m) = 1.94 dB  
                          10 GHz - 30 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

Report No.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka	Takafumi Noguchi	Hiroyuki Furutaka
	(1 GHz -10 GHz)	(Above 10 GHz)	(Below 1 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.	55.427	QP	26.5	9.4	7.4	30.4	-	12.9	40.0	27.1	
Hori.	61.657	QP	26.7	7.5	7.5	30.4	-	11.3	40.0	28.7	
Hori.	69.631	QP	26.4	6.4	7.6	30.3	-	10.1	40.0	29.9	
Hori.	77.620	QP	26.3	6.6	7.7	30.3	-	10.3	40.0	29.7	
Hori.	91.797	QP	25.9	8.9	7.9	30.2	-	12.5	43.5	31.1	
Hori.	225.320	QP	24.5	11.1	9.2	29.4	-	15.4	46.0	30.6	
Hori.	2483.500	PK	51.2	27.5	4.4	35.2	-	47.9	73.9	26.0	
Hori.	4960.000	PK	43.2	31.6	6.1	34.5	-	46.5	73.9	27.5	Floor noise
Hori.	7440.000	PK	42.1	36.3	6.9	34.4	-	50.8	73.9	23.1	Floor noise
Hori.	9920.000	PK	43.5	38.9	7.6	34.9	-	55.2	73.9	18.7	Floor noise
Hori.	2483.500	AV	39.7	27.5	4.4	35.2	1.1	37.5	53.9	16.4	*1)
Hori.	4960.000	AV	34.1	31.6	6.1	34.5	-	37.4	53.9	16.6	Floor noise
Hori.	7440.000	AV	34.4	36.3	6.9	34.4	-	43.1	53.9	10.8	Floor noise
Hori.	9920.000	AV	35.7	38.9	7.6	34.9	-	47.4	53.9	6.5	Floor noise
Vert.	55.427	QP	26.5	9.4	7.4	30.4	-	12.9	40.0	27.1	
Vert.	61.657	QP	26.7	7.5	7.5	30.4	-	11.3	40.0	28.7	
Vert.	69.631	QP	26.4	6.4	7.6	30.3	-	10.1	40.0	29.9	
Vert.	77.620	QP	26.3	6.6	7.7	30.3	-	10.3	40.0	29.7	
Vert.	91.797	QP	25.9	8.9	7.9	30.2	-	12.5	43.5	31.1	
Vert.	225.320	QP	24.5	11.1	9.2	29.4	-	15.4	46.0	30.6	
Vert.	2483.500	PK	47.5	27.5	4.4	35.2	-	44.1	73.9	29.8	
Vert.	4960.000	PK	42.4	31.6	6.1	34.5	-	45.7	73.9	28.3	Floor noise
Vert.	7440.000	PK	42.3	36.3	6.9	34.4	-	51.0	73.9	22.9	Floor noise
Vert.	9920.000	PK	44.0	38.9	7.6	34.9	-	55.7	73.9	18.2	Floor noise
Vert.	2483.500	AV	38.3	27.5	4.4	35.2	1.1	36.1	53.9	17.8	*1)
Vert.	4960.000	AV	34.2	31.6	6.1	34.5	-	37.5	53.9	16.5	Floor noise
Vert.	7440.000	AV	34.5	36.3	6.9	34.4	-	43.2	53.9	10.7	Floor noise
Vert.	9920.000	AV	36.0	38.9	7.6	34.9	-	47.7	53.9	6.2	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).

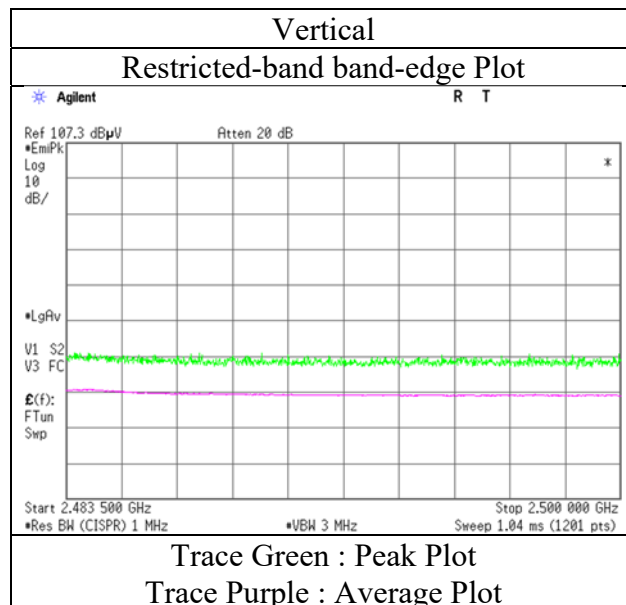
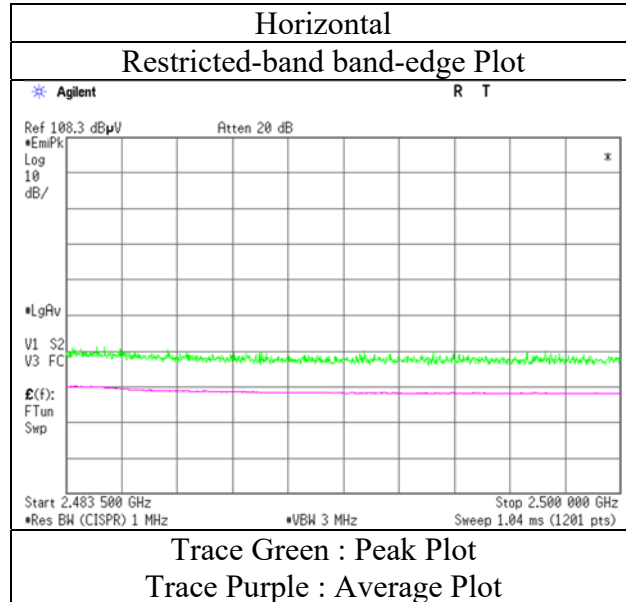
Distance factor:    1 GHz - 10 GHz     $20\log(3.75\text{ m} / 3.0\text{ m}) = 1.94\text{ dB}$   
                              10 GHz - 30 GHz     $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

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

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

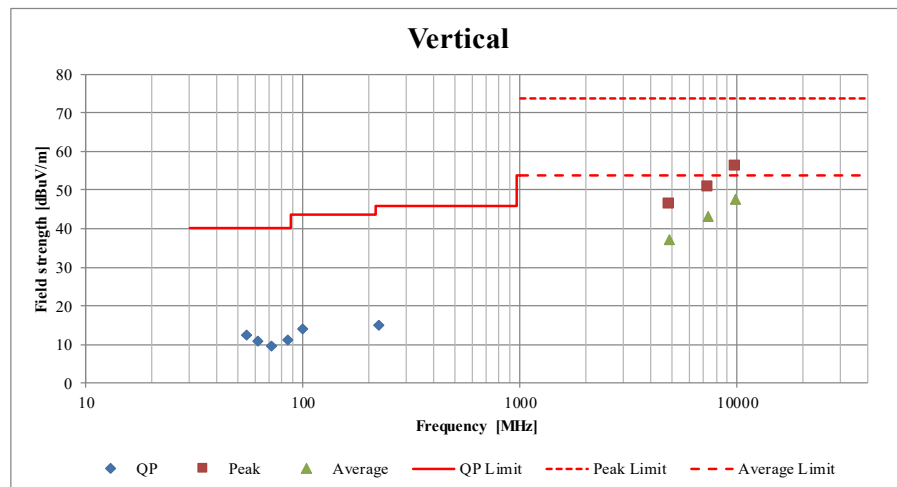
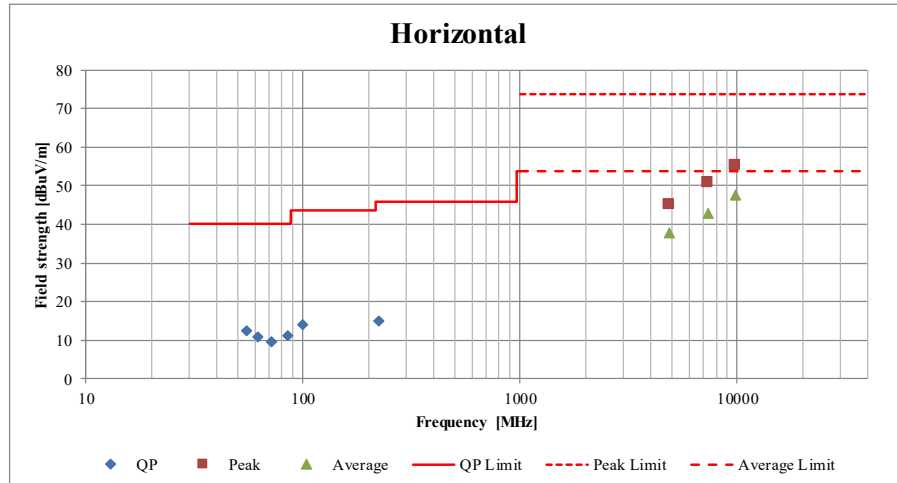
Report No. 13325207H  
Test place Ise EMC Lab.  
Semi Anechoic Chamber No.2  
Date April 20, 2020  
Temperature / Humidity 20 deg. C / 56 % RH  
Engineer Hiroyuki Furutaka  
(1 GHz -10 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz



\* 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.	13325207H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	April 20, 2020	April 20, 2020	April 21, 2020
Temperature / Humidity	20 deg. C / 56 % RH	21 deg. C / 52 % RH	21 deg. C / 34 % RH
Engineer	Hiroyuki Furutaka (1 GHz -10 GHz)	Takafumi Noguchi (Above 10 GHz)	Hiroyuki Furutaka (Below 1 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		

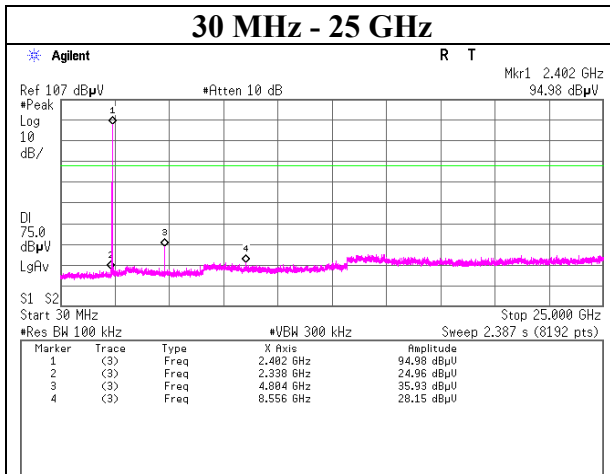
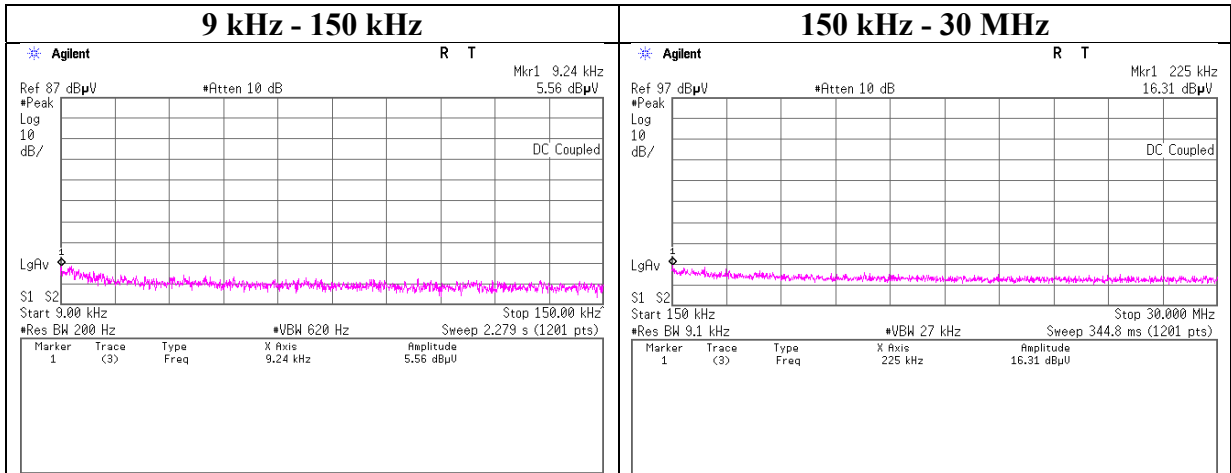


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Conducted Spurious Emission

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, DH5

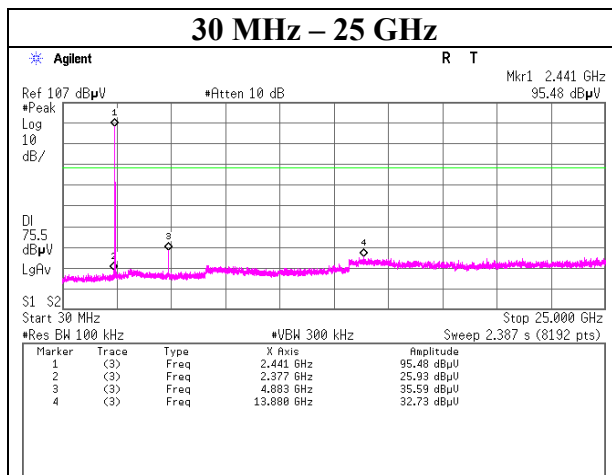
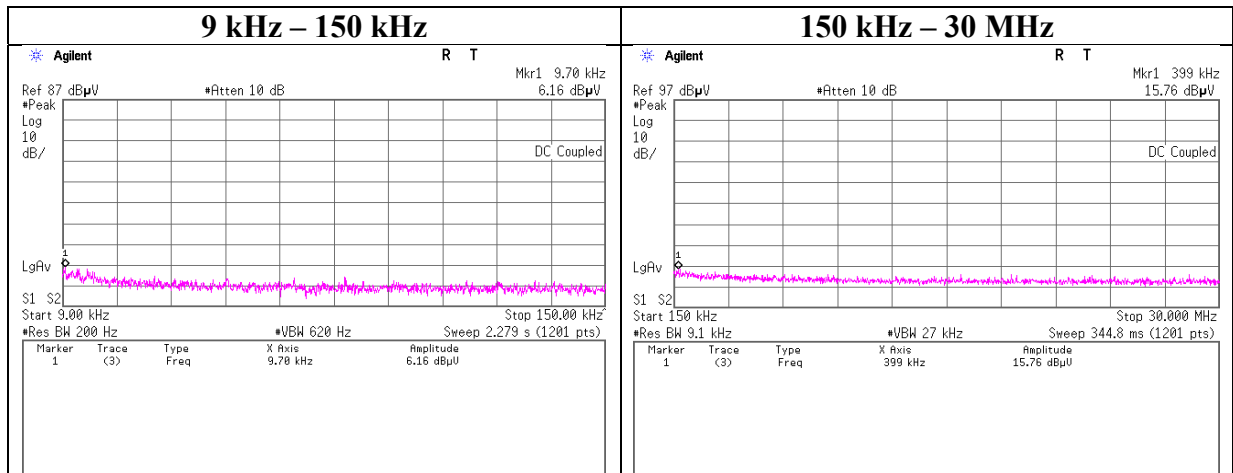
### 2402 MHz



## Conducted Spurious Emission

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, DH5

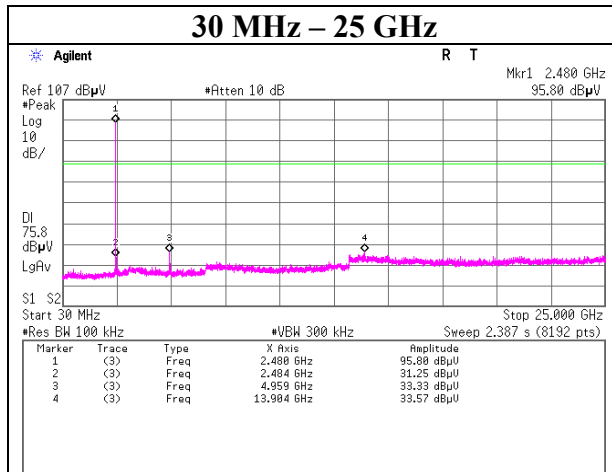
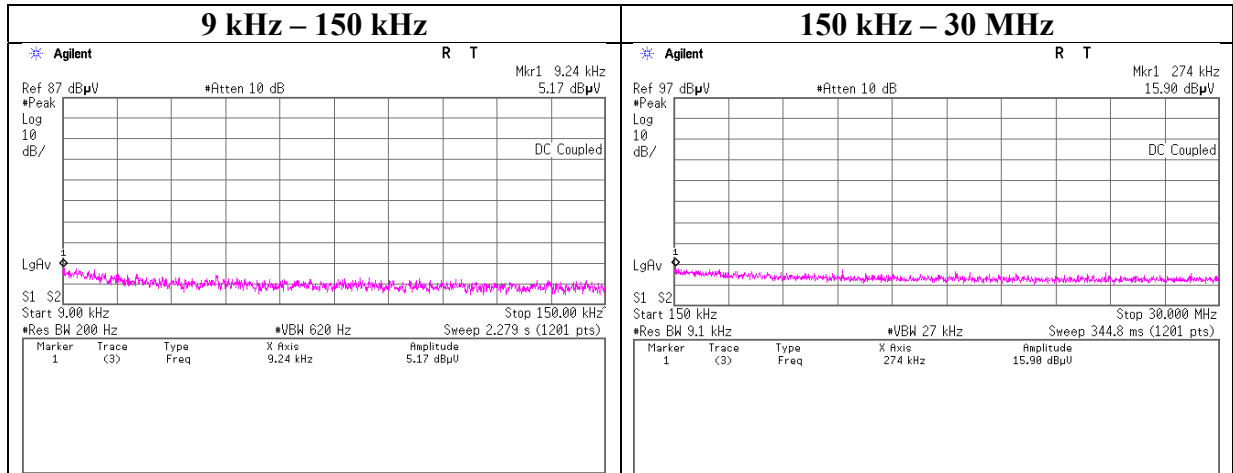
### 2441 MHz



## Conducted Spurious Emission

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, DH5

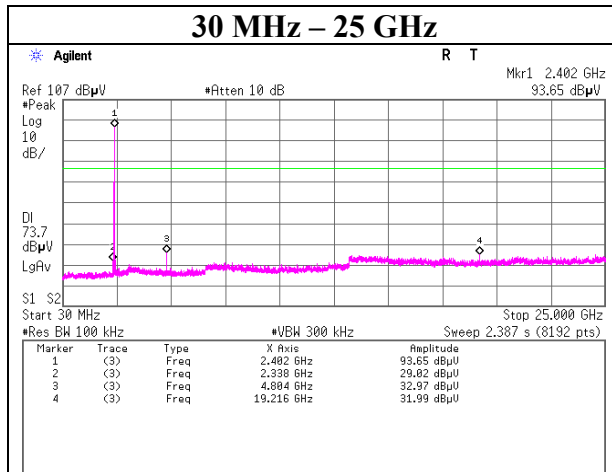
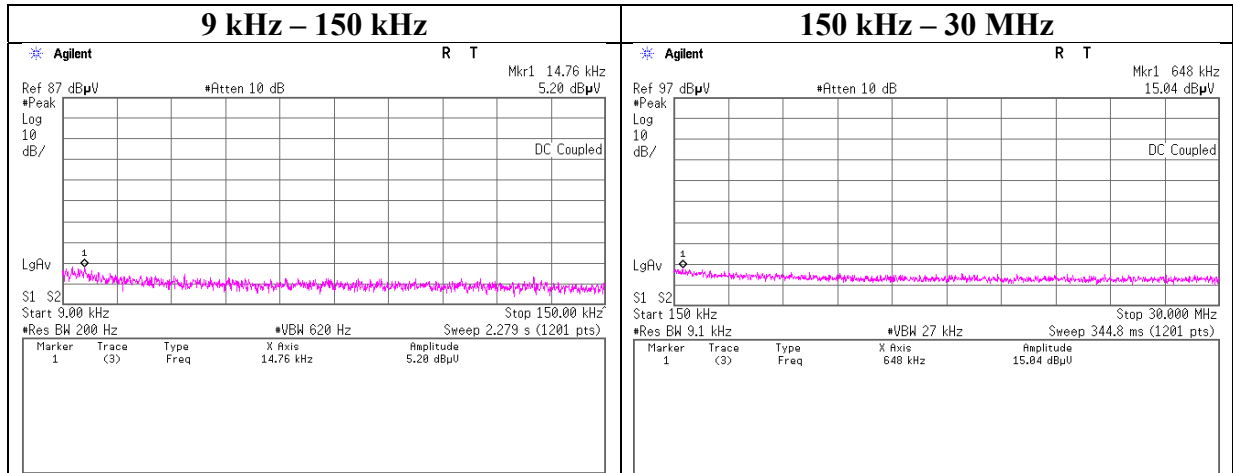
### 2480 MHz



## Conducted Spurious Emission

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, 3DH5

### 2402 MHz

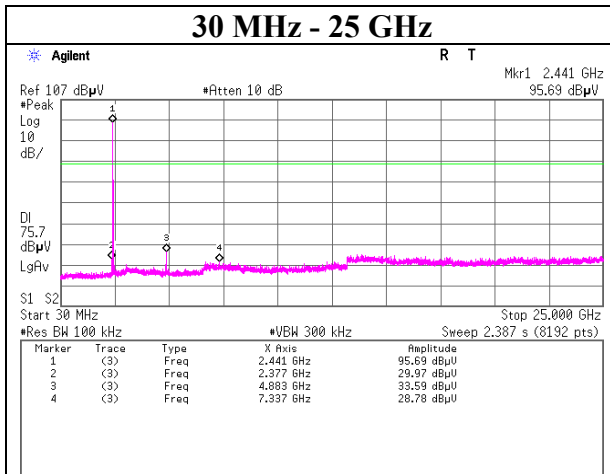
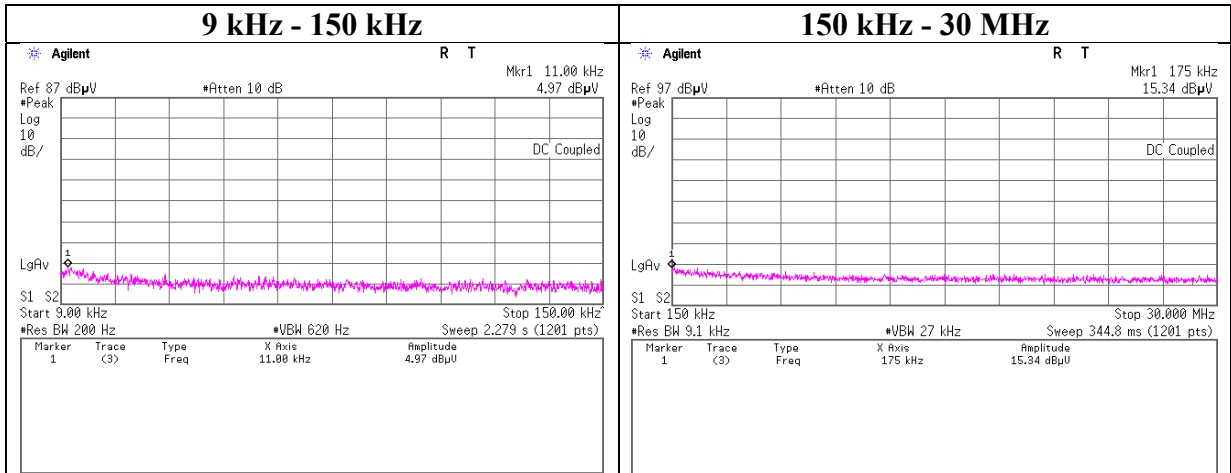




## Conducted Spurious Emission

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, 3DH5

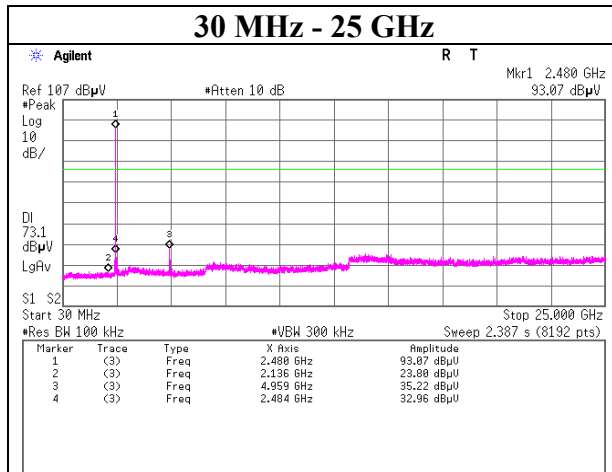
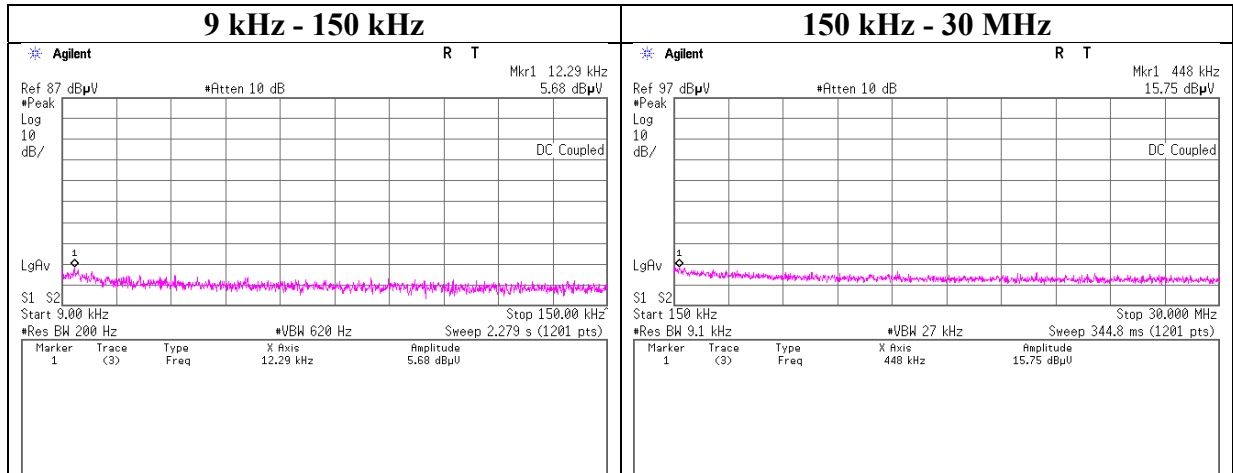
### 2441 MHz



## Conducted Spurious Emission

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx, Hopping Off, 3DH5

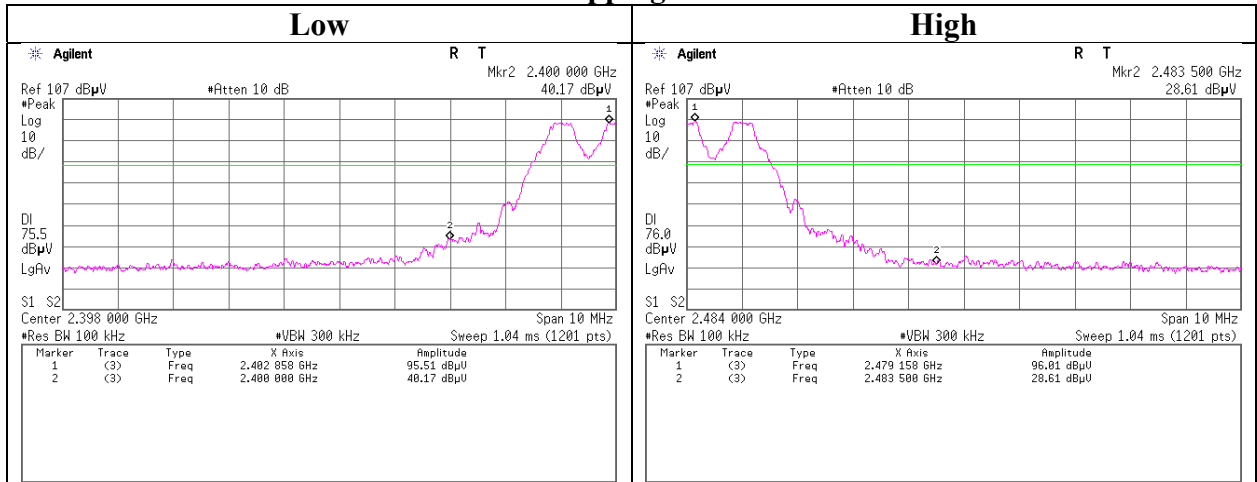
### 2480 MHz



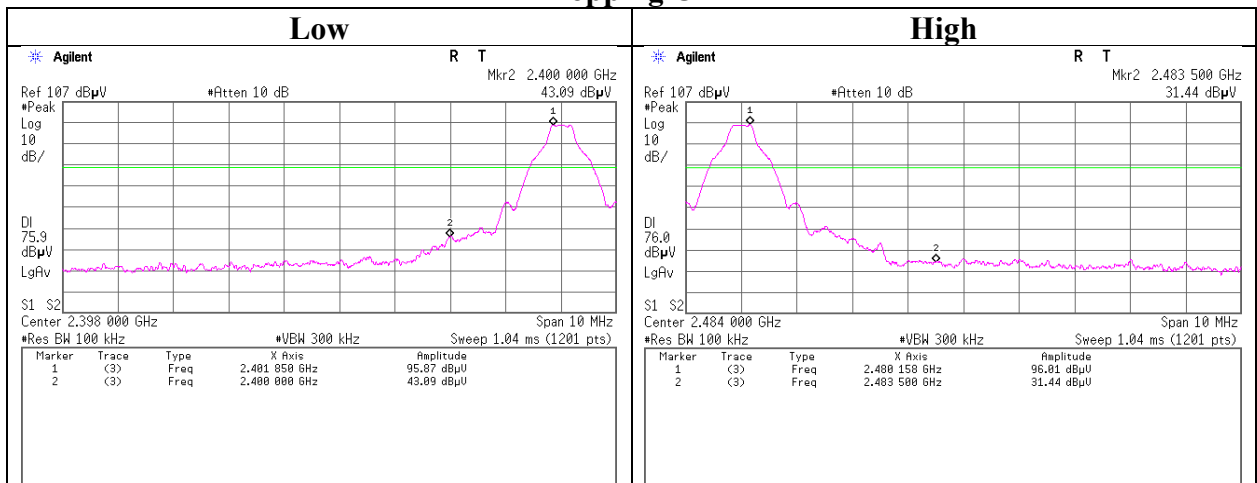
## Conducted Emission Band Edge compliance

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx DH5

### Hopping On



### Hopping Off



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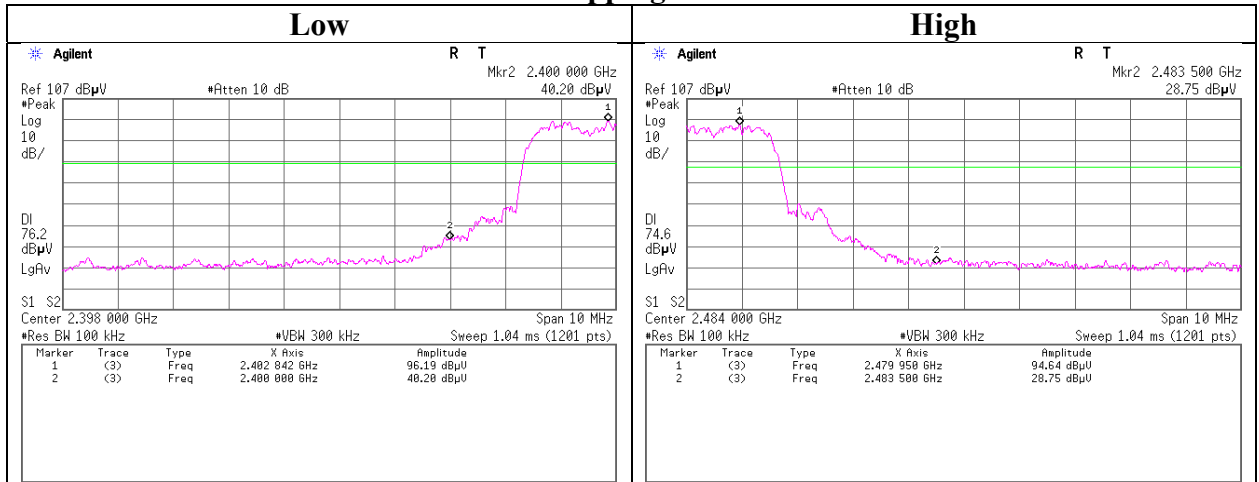
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

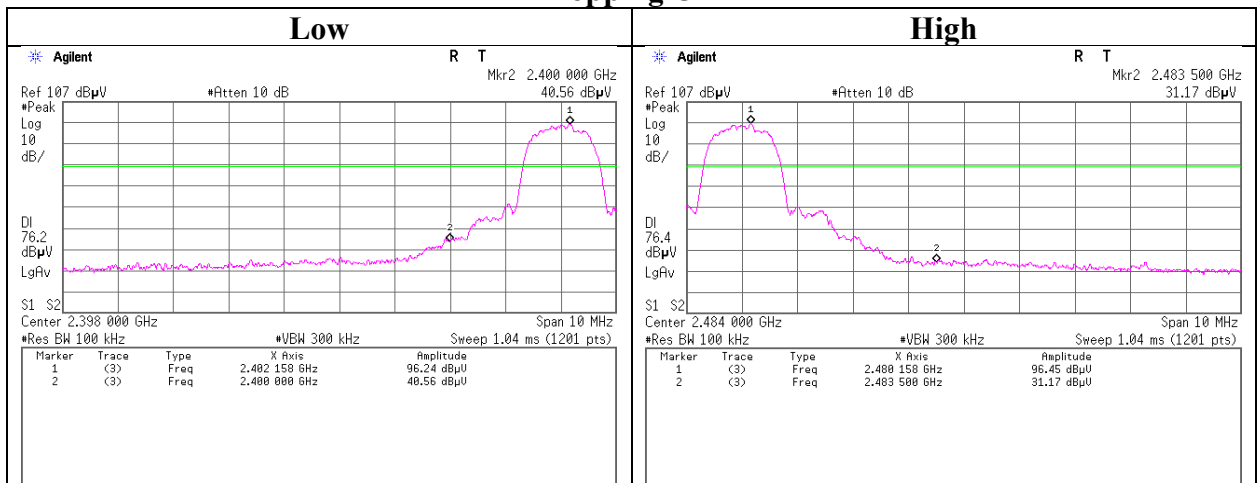
## Conducted Emission Band Edge compliance

Report No. 13325207H  
 Test place Ise EMC Lab. No.4 Measurement Room  
 Date April 20, 2020  
 Temperature / Humidity 23 deg. C / 60 % RH  
 Engineer Yuta Moriya  
 Mode Tx 3DH5

### Hopping On



### Hopping Off



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## 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-12	141809	Power Meter	ANRITSU	ML2495A	825002	2019/05/16	12
AT	MPSE-17	141830	Power sensor	ANRITSU	MA2411B	738285	2019/05/16	12
AT	MAT-91	141420	Attenuator	Weinschel Associates	WA56-10	56100307	2019/05/17	12
AT	MOS-42	192303	Thermo-Hygrometer	CUSTOM	CTH-201	0014	2019/12/19	12
AT	MCC-138	141410	Microwave cable	Huber+Suhner	SUCOFLEX 102	37953/2	2019/09/18	12
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM	CTH-201	0013	2019/12/19	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	2019/08/20	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-M EMI-02	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	2019/04/01	24
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	254	2019/09/03	12
RE	MCC-216	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 537073/126E(5 m)	2020/02/18	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	2020/01/07	12
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170306	2019/10/08	12
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	2019/09/11	12
RE	MHF-06	141404	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	2019/05/17	12
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	2019/11/07	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103B+BBA9106	8031	2019/08/23	12
RE	MCC-12	141317	Coaxial Cable	Fujikura/Agilent	-	-	2019/09/03	12
RE	MLA-21	141265	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-190	2019/08/23	12
RE	MPA-09	141578	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10845	2019/09/06	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	2019/08/08	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	2018/06/29	24
RE	MCC-224	160324	Coaxial Cable	Huber+Suhner	SUCOFLEX 102A	MY009/2A	2019/11/22	12
RE	MPA-22	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-3 3-8P / AMF-4F-2600400-3 3-8P	1871355 / 1871328	2019/09/27	12
RE	MHA-29	141517	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	152399	2019/09/19	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

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