



# RADIO TEST REPORT

Test Report No. : 12866863S-A-R1

**Applicant** : Sony Corporation, Japan and Sony Group Companies  
**Type of Equipment** : AV RECEIVER  
**Model No.** : XAV-1500  
**FCC ID** : AK8XAV1500  
**Test regulation** : FCC Part 15 Subpart C: 2018  
**Test Result** : Complied (Refer to SECTION 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. This test report covers Radio technical requirements.  
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 12866863S-A. 12866863S-A is replaced with this report.

**Date of test:** May 20 and 21, 2019

**Representative test engineer:** T. Kawakami  
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**Approved by:** A. Hayashi  
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Leader  
Consumer Technology Division



CERTIFICATE 1266.03

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

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## **SECTION 1: Customer information**

Company Name : Sony Corporation, Japan and Sony Group Companies  
Address : 700/402 Moo. 7, Amata City Chonburi Industrial Estate, Don Hua Roh,  
Muang Chonburi, Chonburi 20000, Thailand  
Telephone Number : +66 38 214900 17 Ext : 1932  
Contact Person : Jumroen Phaoenchoke

The information provided from the customer is as follows;

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

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

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

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

Type of Equipment : AV RECEIVER  
Model No. : XAV-1500  
Serial No. : Refer to Section 4, Clause 4.2  
Rating : DC 12 V  
Receipt Date of Sample : May 14, 2019  
(Information from test lab.)  
Country of Mass-production : Thailand  
Condition of EUT : Engineering prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Modification of EUT : No Modification by the test lab.

### **2.2 Product Description**

Model: XAV-1500 (referred to as the EUT in this report) is an AV RECEIVER.

### **General Specification**

Clock frequency(ies) in the system : 32.768 kHz, 9.25 MHz, 12 MHz (Tuner), 12 MHz (DSP IC), 24 MHz,  
25 MHz, 26 MHz

### **Radio Specification**

#### **Bluetooth**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : FHSS, GFSK,  $\pi/4$ -DQPSK, 8DPSK  
Antenna type : Meander Monopole antenna  
Antenna Gain : -1.059 dBi (Peak), -5.62 dBi (Average)  
Clock frequency : 26 MHz

Frequency of operation: FM 87.5 MHz - 108.0 MHz, AM 531 kHz - 1602 kHz  
Intermediate frequency: FM CCIR: -2055.2 kHz to - 230.1 kHz and +217.2 kHz to +2017.2 kHz

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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 March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.207 Conducted limits  
Section 15.247 Operation within the bands 902-928MHz,  
2400-2483.5MHz, and 5725-5850MHz

\* 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 ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	-	N/A	-	
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1) ----- IC: RSS-247 5.1 (b)	See data.	Complied a)	Conducted	
20dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1) ----- IC: RSS-247 5.1 (a)		Complied a)	Conducted	
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1)(iii) ----- IC: RSS-247 5.1 (d)		Complied b)	Conducted	
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: -	FCC: Section 15.247(a)(1)(iii) ----- IC: RSS-247 5.1 (d)		Complied c)	Conducted	
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(a)(b)(1) ----- IC: RSS-247 5.4 (b)		Complied d)	Conducted	
Spurious Emission & Band Edge Compliance	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- IC: RSS-Gen 6.13	FCC: Section 15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10		3.2 dB 494.995 MHz, QP, Hori., Tx, DH5 2441 MHz	Complied# e) / f)	Conducted/ Radiated (above 30 MHz) *1)

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

\*1) Radiated test was selected over 30 MHz based on section 15.247(d).

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.

#### **FCC Part 15.31 (e)**

The EUT provides stable voltage constantly to the wireless transmitter regardless of input voltage.

Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

#### **FCC Part 15.203 Antenna requirement**

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

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### 3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	RSS-Gen 6.7	IC: -	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

#### EMI

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

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .  
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Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.9 dB	2.8 dB	2.9 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.1 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.7 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.1 dB	-
	1 GHz-6 GHz	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

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

### 3.5 Test Location

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A2LA Certificate Number: 1266.03  
FCC Test Firm Registration Number: 626366

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

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

Refer to APPENDIX.



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

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

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: BDR: Ext.=23, Int.=39  EDR: Ext.=73, Int.=48  Software: CSR BlueSuite BlueTest Version 2.4.0.0</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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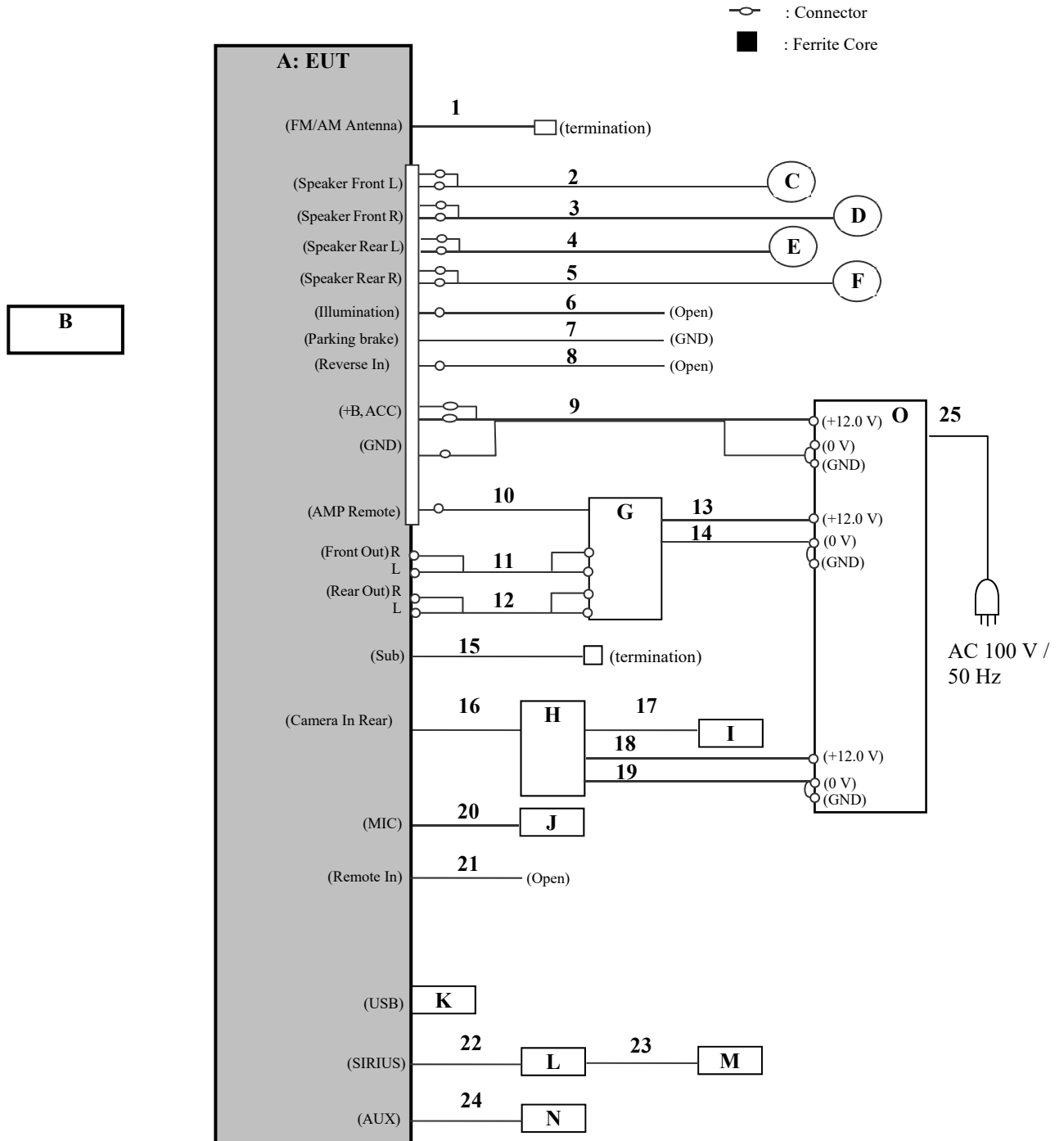
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4.2 Configuration and peripherals



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

**Description of EUT and support equipment**

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	AV RECEIVER	XAV-1500	023 *1) 024 *2)	Sony	EUT
B	Remote Commander	RM-X170	-	Sony	-
C	Speaker 1	IS-10	-	Sony	-
D	Speaker 2	IS-10	-	Sony	-
E	Speaker 3	XS-GTF1625R	-	Sony	-
F	Speaker 4	XS-GTF1625R	-	Sony	-
G	Stereo Power Amplifier	XM-GS4	0000052	Sony	-
H	Rear View Camera	XA-R800C	100114	Sony	-
I	Camera	-	-	Sony	-
J	MIC	-	-	Sony	-
K	USB Memory	SDK-USM4GU	-	Sony	-
L	SIRIUS XM Connect Vehicle Tuner	SXV300	1627	XM Network	-
M	Vehicle Satellite Radio Antenna	NGVA3	1624A	XM Network	-
N	Digital Media Player	NW-A828	5072265	Sony	-
O	DC Power Supply	PAN35-10A	NA000955	Kikusui Corp.	-

\*1) Used for Radiated emissions tests.

\*2) Used for Antenna terminal conducted tests

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**List of cables used**

No.	Name	Length (m)	Shield (Cable)	Shield (Connector)	Remarks
1	FM antenna	1.0	Shielded	Shielded	-
2	Speaker (1)	0.15+2.4 0.15 *1)	Unshielded	Unshielded	-
3	Speaker (2)	0.15+2.4 0.15 *1)	Unshielded	Unshielded	-
4	Speaker (3)	0.15+1.9 0.15 *1)	Unshielded	Unshielded	-
5	Speaker (4)	0.15+1.9 0.15 *1)	Unshielded	Unshielded	-
6	Illumination	0.15+1.0 0.15 *1)	Unshielded	Unshielded	-
7	Parking	2.0	Unshielded	Unshielded	-
8	Reverse In	0.15+1.0 0.15 *1)	Unshielded	Unshielded	-
9	DC Power	0.15+1.3 0.15 *1)	Unshielded	Unshielded	-
10	AMP Remote	0.15+1.4 0.15 *1)	Unshielded	Unshielded	-
11	RCA (Front Audio Out)	5.1	Shielded	Shielded	-
12	RCA (Rear Audio Out)	5.2	Shielded	Shielded	-
13	DC Power (+)	1.4	Unshielded	Unshielded	-
14	DC Power (-)	1.4	Unshielded	Unshielded	-
15	RCA (Sub Audio Out)	1.2	Shielded	Shielded	-
16	RCA (Rear Camera)	3.0	Shielded	Shielded	-
17	Camera	3.0	Shielded	Shielded	-
18	DC Power (+)	0.9	Unshielded	Unshielded	-
19	DC Power (-)	0.9	Unshielded	Unshielded	-
20	MIC	3.5	Shielded	Shielded	-
21	REMOTE IN	0.2+0.1+1.0	Shielded	Shielded	-
22	Tuner	0.6	Shielded	Shielded	-
23	Radio Antenna	7.1	Shielded	Shielded	-
24	Audio	1.8	Shielded	Shielded	-
25	AC	1.8	Unshielded	Unshielded	-

\*1) Used for Antenna terminal test

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## **SECTION 5: Radiated Spurious Emission**

### **Test Procedure**

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 2.0 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 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 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).**

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: 1/T (T: burst length, refer to Burst rate confirmation sheet) Detector: Peak	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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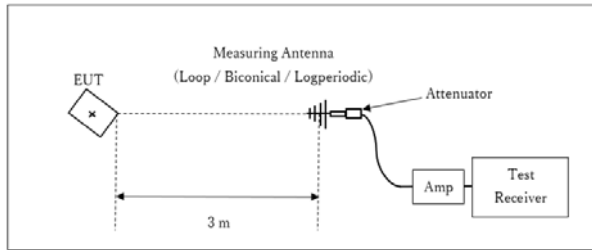
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**Figure 2: Test Setup**

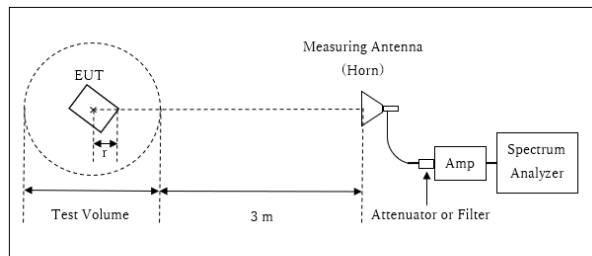
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



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

Distance Factor:  $20 \times \log(3.89 \text{ m} / 3.0 \text{ m}) = 2.26 \text{ dB}$

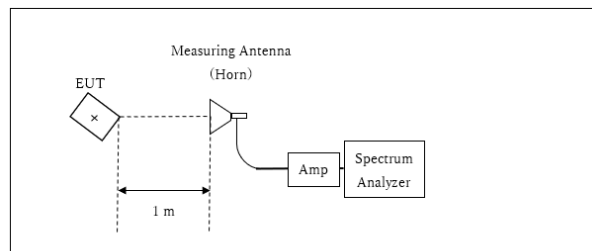
\* Test Distance:  $(3 + \text{Test Volume} / 2) - r = 3.89 \text{ m}$

Test Volume : 2.0 m

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

$r = 0.11 \text{ m}$

13 GHz - 26.5 GHz



× : Center of turn table

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

\*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of 0 deg. to 30 deg. of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

**Combinations of the worst case**

Antenna polarization	Carrier	Spurious (Below 1 GHz)	Spurious (1 GHz – 2.8 GHz)	Spurious (2.8 GHz – 13 GHz)	Spurious (13 GHz – 18 GHz)	Spurious (18 GHz – 26.5 GHz)
Horizontal	30 deg.	30 deg.	30 deg.	30 deg.	0 deg.	0 deg.
Vertical	30 deg.	30 deg.	30 deg.	30 deg.	0 deg.	0 deg.

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

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## **SECTION 6: Antenna Terminal Conducted Tests**

### **Test Procedure**

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

<b>Test</b>	<b>Span</b>	<b>RBW</b>	<b>VBW</b>	<b>Sweep time</b>	<b>Detector</b>	<b>Trace</b>	<b>Instrument used</b>
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: 160 MHz BW)
Carrier Frequency Separation	3 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	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)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 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 = 10 kHz)

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

**Test data : APPENDIX**

**Test result : Pass**

**APPENDIX 1: Test data**

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

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 20, 2019  
Temperature / Humidity 26 deg. C / 44 % RH  
Engineer Takahiro Kawakami  
Mode Tx

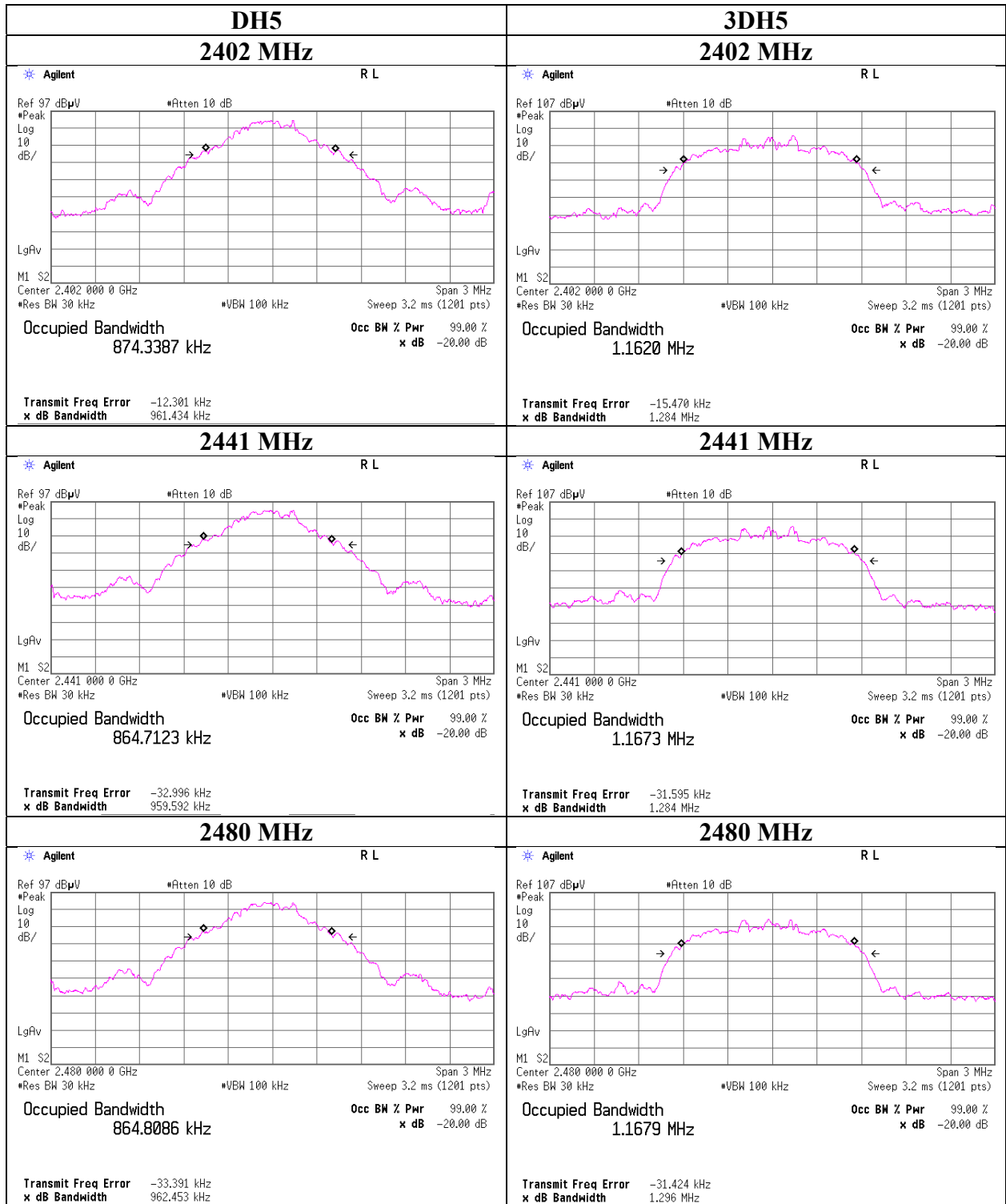
Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.961	874.3387	1.000	>= 0.641
DH5	2441.0	0.960	864.7123	1.000	>= 0.640
DH5	2480.0	0.962	864.8086	1.000	>= 0.642
DH5	Hopping On	-	78553.0	-	-
3DH5	2402.0	1.284	1162.0	1.000	>= 0.856
3DH5	2441.0	1.284	1167.3	1.000	>= 0.856
3DH5	2480.0	1.296	1167.9	1.000	>= 0.864
3DH5	Hopping On	-	78635.9	-	-

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

No limit applies to 20dB Bandwidth.



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



UL Japan, Inc.

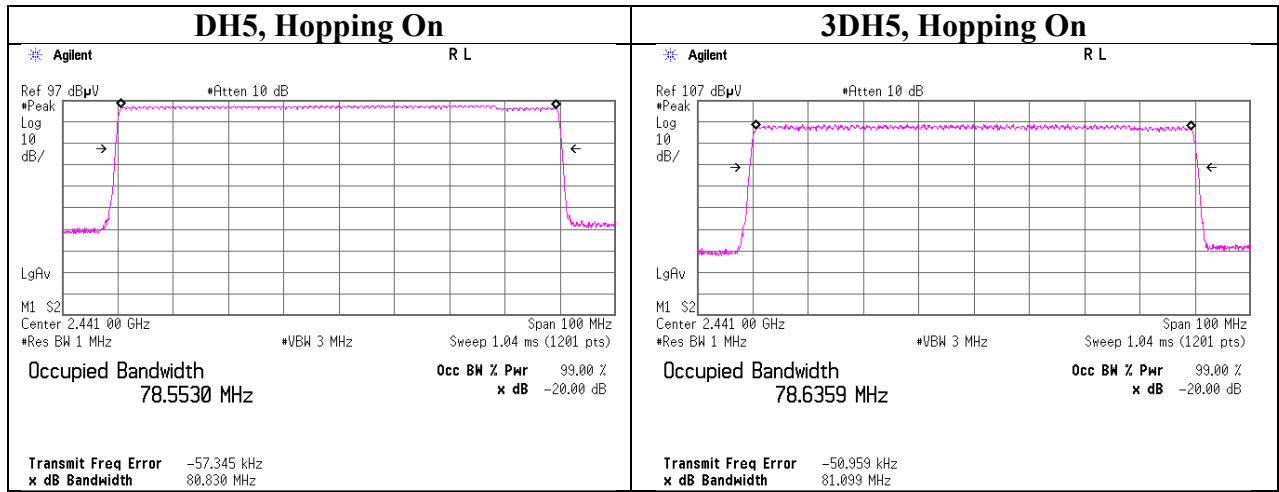
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

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



**UL Japan, Inc.**

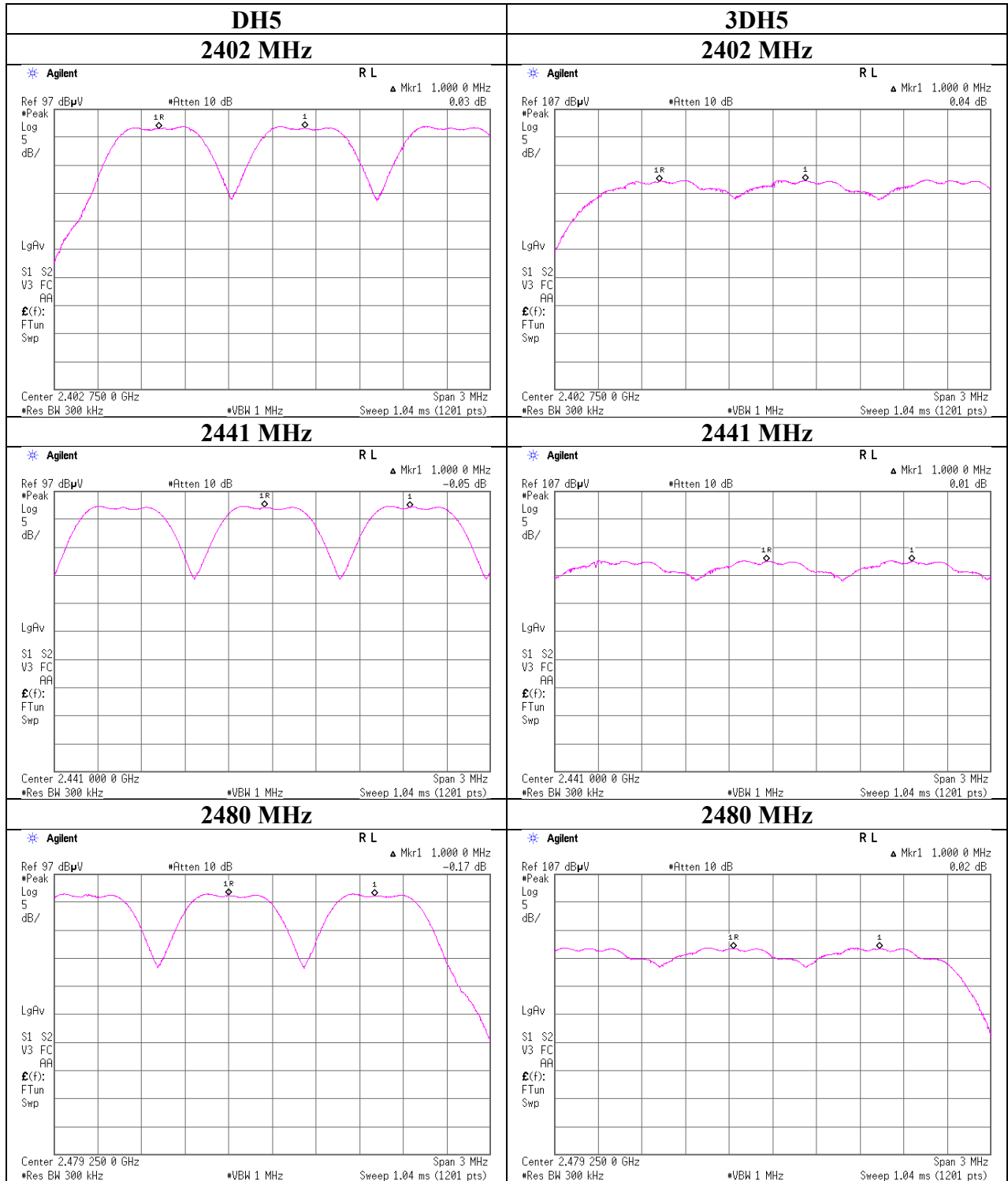
**Shonan EMC Lab.**

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### Carrier Frequency Separation



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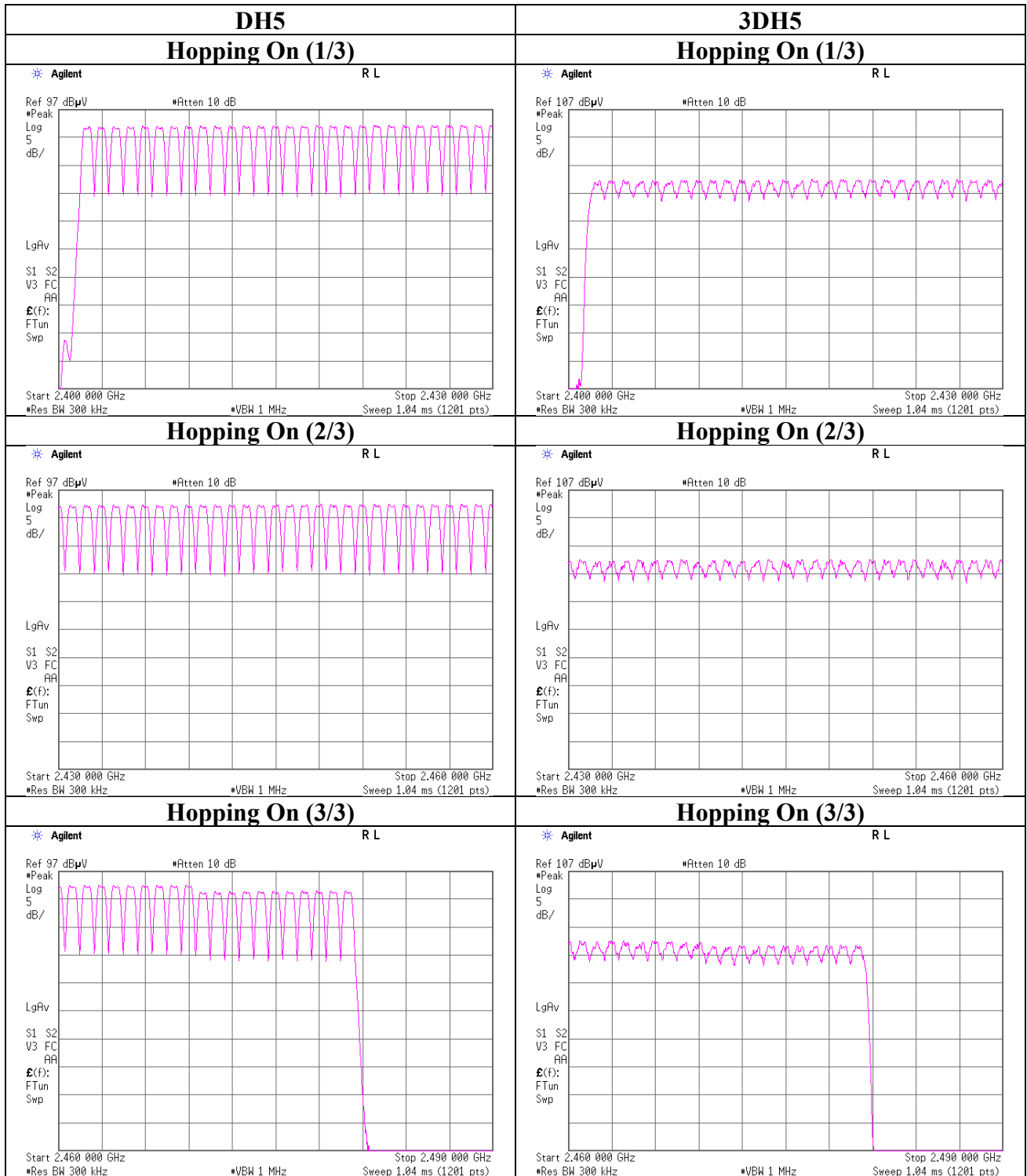
### Number of Hopping Frequency

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 20, 2019  
Temperature / Humidity 26 deg. C / 44 % RH  
Engineer Takahiro Kawakami  
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.**

**Shonan EMC Lab.**

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### Dwell time

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 20, 2019  
Temperature / Humidity 26 deg. C / 44 % RH  
Engineer Takahiro Kawakami  
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	0.416	134	400
DH3	26.0 times / 5 sec. x	31.6 sec. =	165 times	1.675	276	400
DH5	17.0 times / 5 sec. x	31.6 sec. =	108 times	2.922	316	400
3DH1	51.0 times / 5 sec. x	31.6 sec. =	323 times	0.434	140	400
3DH3	26.0 times / 5 sec. x	31.6 sec. =	165 times	1.695	280	400
3DH5	17.0 times / 5 sec. x	31.6 sec. =	108 times	2.942	318	400

Sample Calculation

Result = Number of transmission x Length of transmission

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

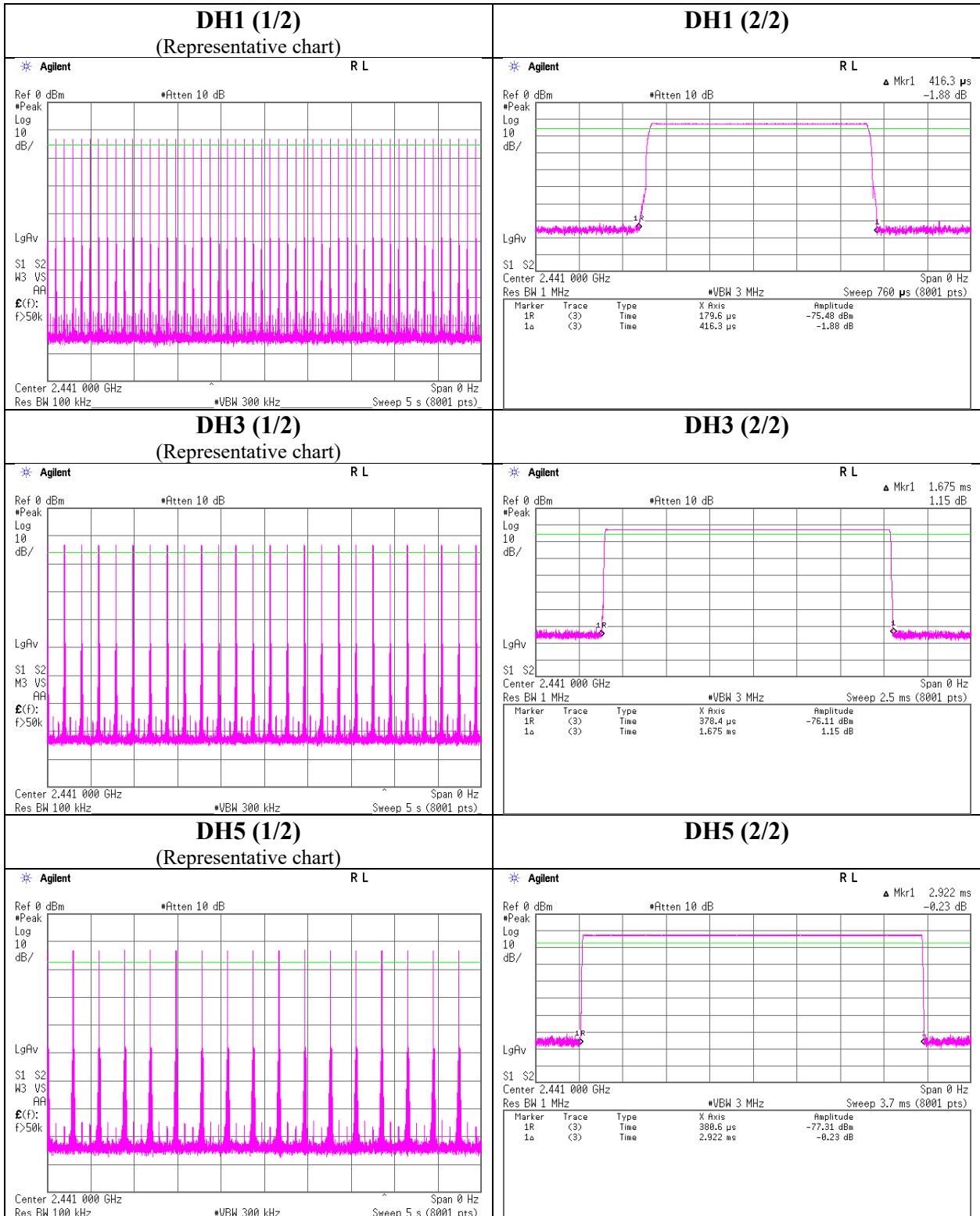
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	51	51	51	51
DH3	26	26	26	26	26	26
DH5	17	17	17	17	17	17
3DH1	51	51	51	51	51	51
3DH3	26	26	26	26	26	26
3DH5	17	17	17	17	17	17

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



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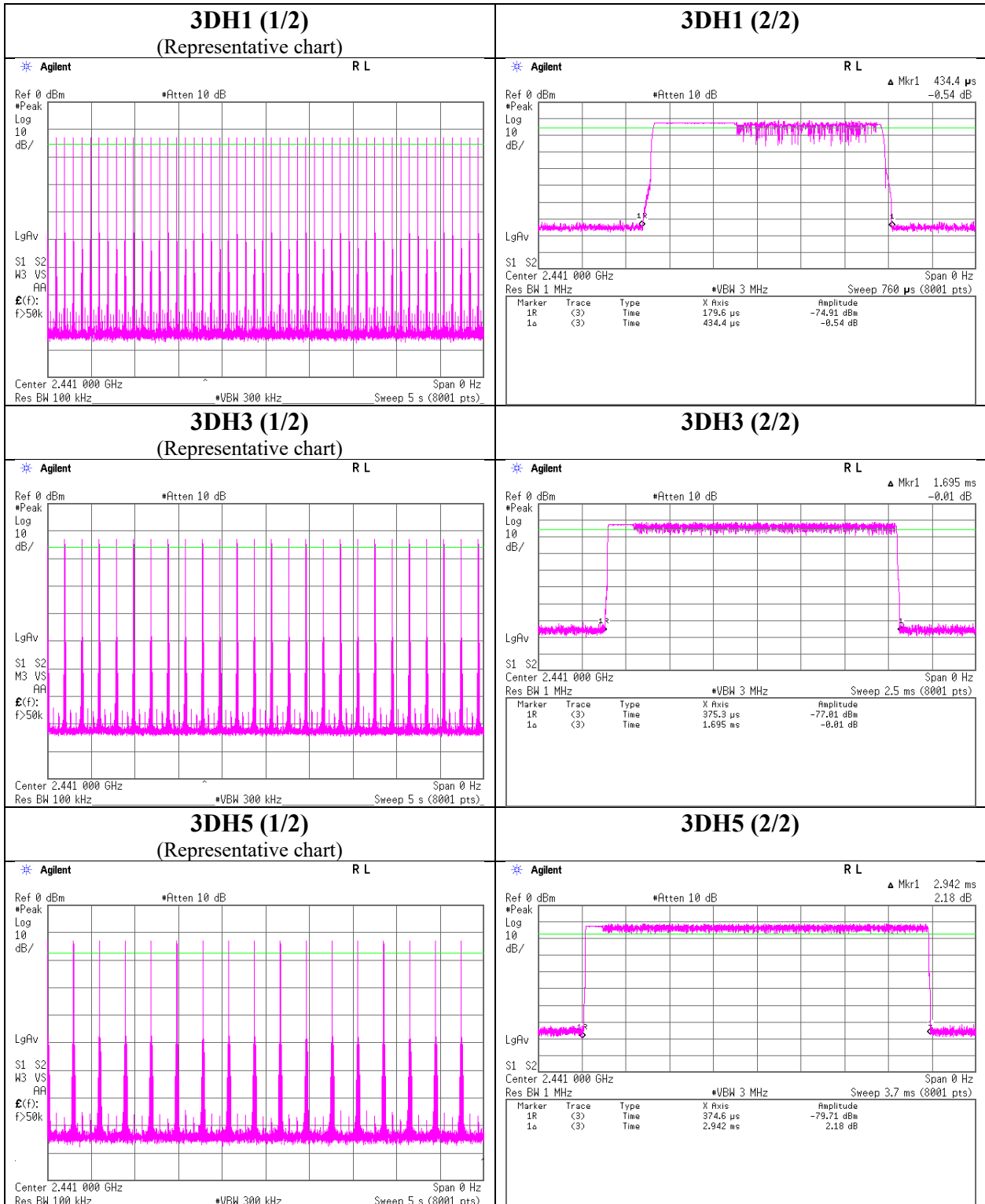
**Shonan EMC Lab.**

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**Dwell time**



**UL Japan, Inc.**

**Shonan EMC Lab.**

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## Maximum Peak Output Power

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 20, 2019  
Temperature / Humidity 26 deg. C / 44 % RH  
Engineer Takahiro Kawakami  
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	-12.44	1.20	9.82	-1.42	0.72	20.96	125	22.38	-1.06	-2.48	0.56	36.02	4000	38.50
DH5	2441.0	-11.97	1.21	9.82	-0.94	0.81	20.96	125	21.90	-1.06	-2.00	0.63	36.02	4000	38.02
DH5	2480.0	-12.65	1.23	9.82	-1.60	0.69	20.96	125	22.56	-1.06	-2.66	0.54	36.02	4000	38.68
2DH5	2402.0	-10.94	1.20	9.82	0.08	1.02	20.96	125	20.88	-1.06	-0.98	0.80	36.02	4000	37.00
2DH5	2441.0	-10.66	1.21	9.82	0.37	1.09	20.96	125	20.59	-1.06	-0.69	0.85	36.02	4000	36.71
2DH5	2480.0	-11.38	1.23	9.82	-0.33	0.93	20.96	125	21.29	-1.06	-1.39	0.73	36.02	4000	37.41
3DH5	2402.0	-10.46	1.20	9.82	0.56	1.14	20.96	125	20.40	-1.06	-0.50	0.89	36.02	4000	36.52
3DH5	2441.0	-10.24	1.21	9.82	0.79	1.20	20.96	125	20.17	-1.06	-0.27	0.94	36.02	4000	36.29
3DH5	2480.0	-10.84	1.23	9.82	0.21	1.05	20.96	125	20.75	-1.06	-0.85	0.82	36.02	4000	36.87

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.  
However, the limit level 125mW of AFH mode was used for the test.

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

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 20, 2019  
Temperature / Humidity 26 deg. C / 44 % RH  
Engineer Takahiro Kawakami  
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	-14.30	1.20	9.82	-3.28	0.47	1.08	-2.20	0.60
DH5	2441.0	-13.92	1.21	9.82	-2.89	0.51	1.08	-1.81	0.66
DH5	2480.0	-14.69	1.23	9.82	-3.64	0.43	1.08	-2.56	0.55
2DH5	2402.0	-14.90	1.20	9.82	-3.88	0.41	1.06	-2.82	0.52
2DH5	2441.0	-14.69	1.21	9.82	-3.66	0.43	1.06	-2.60	0.55
2DH5	2480.0	-15.39	1.23	9.82	-4.34	0.37	1.06	-3.28	0.47
3DH5	2402.0	-14.95	1.20	9.82	-3.93	0.40	1.05	-2.88	0.52
3DH5	2441.0	-14.73	1.21	9.82	-3.70	0.43	1.05	-2.65	0.54
3DH5	2480.0	-15.39	1.23	9.82	-4.34	0.37	1.05	-3.29	0.47

Sample Calculation:

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

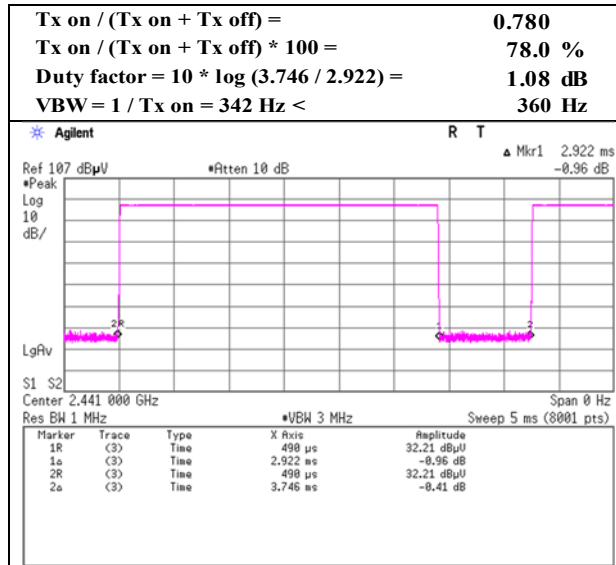
Result (Burst power average) = Time average + Duty factor

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

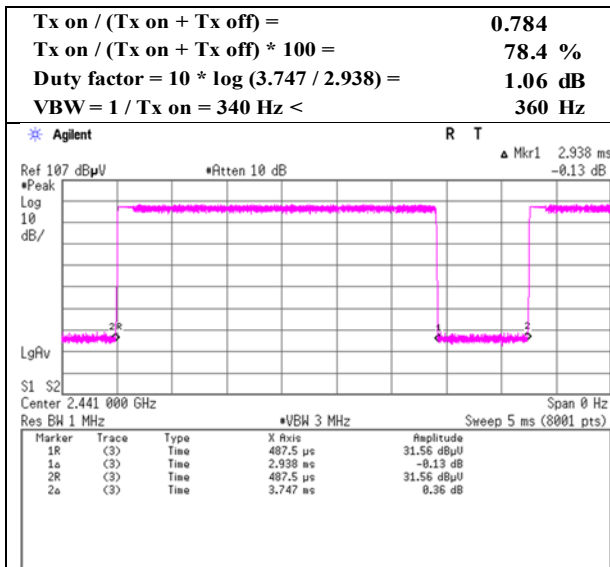
### Burst Rate Confirmation

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab. No.5 Shielded Room  
Date May 20, 2019  
Temperature / Humidity 26 deg. C / 44 % RH  
Engineer Takahiro Kawakami  
Mode Tx, Hopping Off

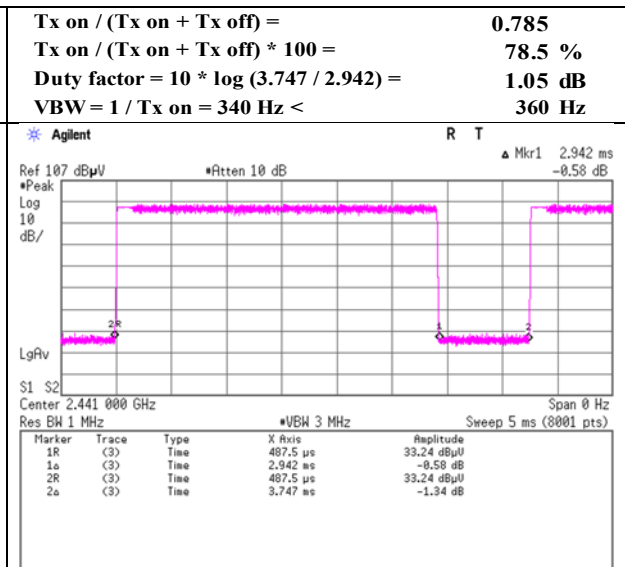
#### DH5



#### 2DH5



#### 3DH5



## Radiated Spurious Emission

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, DH5 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	137.520	QP	40.93	14.37	7.59	32.13	0.00	30.76	43.50	12.7	209	81	
Hori.	147.835	QP	42.60	14.72	7.79	32.12	0.00	32.99	43.50	10.5	261	103	
Hori.	494.998	QP	46.91	17.72	9.60	31.94	0.00	42.29	46.00	3.7	100	135	
Hori.	959.993	QP	33.61	22.22	11.20	30.56	0.00	36.47	46.00	9.5	176	180	
Hori.	2390.000	PK	47.09	27.86	14.15	41.59	2.26	49.77	73.90	24.1	250	39	
Hori.	3118.325	PK	49.65	28.85	5.81	41.88	2.26	44.69	73.90	29.2	282	138	
Hori.	4804.000	PK	51.61	31.43	6.45	42.88	2.26	48.87	73.90	25.0	120	33	
Hori.	7206.000	PK	48.01	36.79	8.13	42.92	2.26	52.27	73.90	21.6	150	0	
Hori.	9608.000	PK	48.85	38.51	9.30	43.17	2.26	55.75	73.90	18.1	150	0	
Hori.	2390.000	AV	35.34	27.86	14.15	41.59	2.26	38.02	53.90	15.8	250	39	VBW: 360 Hz
Hori.	3118.325	AV	40.03	28.85	5.81	41.88	2.26	35.07	53.90	18.8	282	138	VBW: 360 Hz
Hori.	4804.000	AV	44.02	31.43	6.45	42.88	2.26	41.28	53.90	12.6	120	33	VBW: 360 Hz
Hori.	7206.000	AV	36.60	36.79	8.13	42.92	2.26	40.86	53.90	13.0	150	0	VBW: 360 Hz
Hori.	9608.000	AV	36.85	38.51	9.30	43.17	2.26	43.75	53.90	10.1	150	0	VBW: 360 Hz
Vert.	37.811	QP	31.70	15.67	6.62	32.19	0.00	21.80	40.00	18.2	100	125	
Vert.	116.362	QP	43.80	12.76	7.27	32.14	0.00	31.69	43.50	11.8	100	14	
Vert.	147.835	QP	40.58	14.72	7.79	32.12	0.00	30.97	43.50	12.5	100	46	
Vert.	181.040	QP	33.23	16.03	7.87	32.09	0.00	25.04	43.50	18.4	100	12	
Vert.	494.918	QP	42.96	17.72	9.60	31.94	0.00	38.34	46.00	7.6	100	182	
Vert.	2390.000	PK	47.44	27.86	14.15	41.59	2.26	50.12	73.90	23.7	112	357	
Vert.	3118.325	PK	49.33	28.85	5.81	41.88	2.26	44.37	73.90	29.5	206	113	
Vert.	4804.000	PK	52.96	31.43	6.45	42.88	2.26	50.22	73.90	23.6	120	312	
Vert.	7206.000	PK	48.55	36.79	8.13	42.92	2.26	52.81	73.90	21.0	150	0	
Vert.	9608.000	PK	48.81	38.51	9.30	43.17	2.26	55.71	73.90	18.1	150	0	
Vert.	2390.000	AV	35.49	27.86	14.15	41.59	2.26	38.17	53.90	15.7	112	357	VBW: 360 Hz
Vert.	3118.325	AV	40.73	28.85	5.81	41.88	2.26	35.77	53.90	18.1	206	113	VBW: 360 Hz
Vert.	4804.000	AV	45.96	31.43	6.45	42.88	2.26	43.22	53.90	10.6	120	312	VBW: 360 Hz
Vert.	7206.000	AV	36.55	36.79	8.13	42.92	2.26	40.81	53.90	13.0	150	0	VBW: 360 Hz
Vert.	9608.000	AV	36.93	38.51	9.30	43.17	2.26	43.83	53.90	10.0	150	0	VBW: 360 Hz

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

Distance factor : 1 GHz - 13 GHz : 20log(3.89 m / 3.0 m) = 2.26 dB

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

\* These results have sufficient margin without taking account Dwell time factor.

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	84.02	27.86	14.16	41.60	2.26	86.70	-	-	Carrier
Vert.	2400.000	PK	43.36	27.86	14.16	41.60	2.26	46.04	66.70	20.6	
Vert.	2402.000	PK	90.78	27.86	14.16	41.60	2.26	93.46	-	-	Carrier
Hori.	2400.000	PK	39.57	27.86	14.16	41.60	2.26	42.25	73.46	31.2	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.89 m / 3.0 m) = 2.26 dB

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

**UL Japan, Inc.**

**Shonan EMC Lab.**

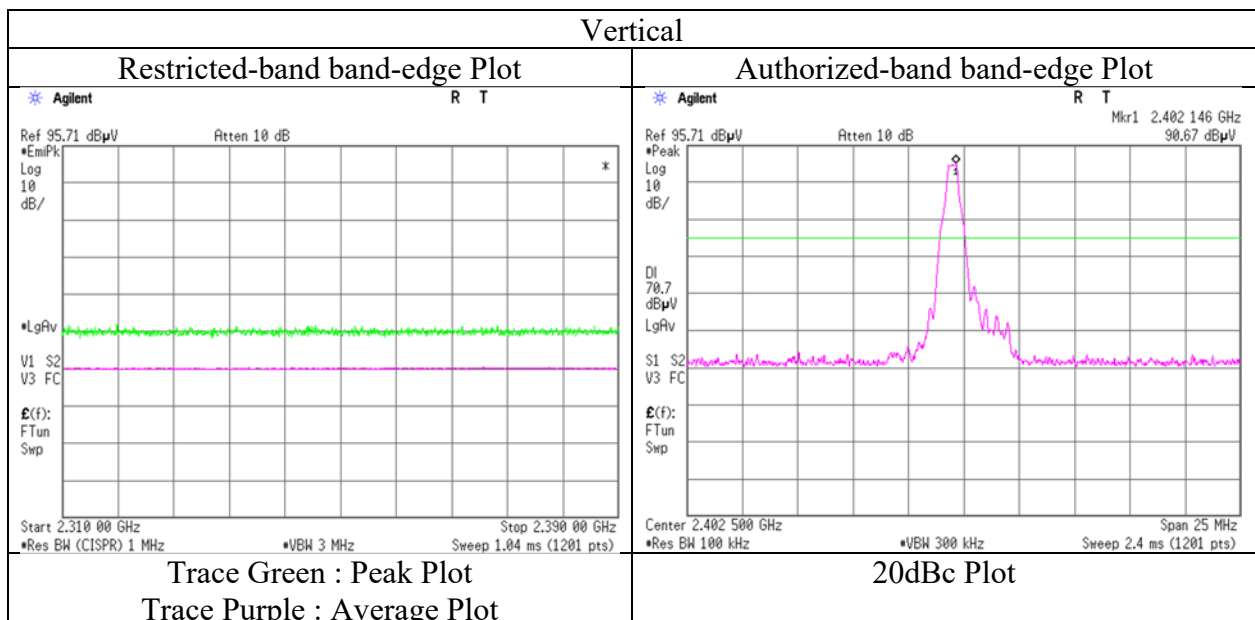
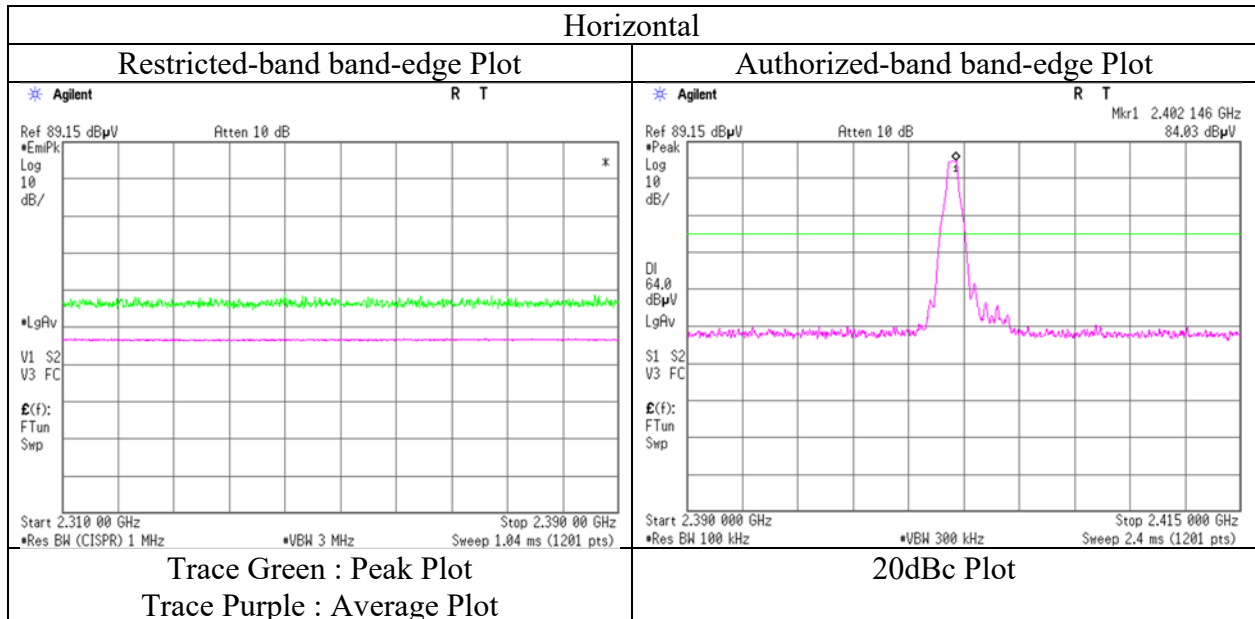
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	May 21, 2019
Temperature / Humidity	22 deg. C / 56% RH
Engineer	Toshinori Yamada
	(1 GHz -2.8 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.**

**Shonan EMC Lab.**

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

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## Radiated Spurious Emission

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, DH5 2441 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	137.477	QP	47.62	14.37	7.59	32.13	0.00	37.45	43.50	6.0	216	82	
Hori.	147.804	QP	42.44	14.72	7.79	32.12	0.00	32.83	43.50	10.6	262	94	
Hori.	494.995	QP	47.34	17.72	9.60	31.94	0.00	42.72	46.00	3.2	100	136	
Hori.	959.990	QP	34.03	22.22	11.20	30.56	0.00	36.89	46.00	9.1	174	181	
Hori.	4882.000	PK	52.93	31.37	6.48	42.89	2.26	50.15	73.90	23.7	145	103	
Hori.	7323.000	PK	48.74	37.01	8.13	43.15	2.26	52.99	73.90	20.9	150	0	
Hori.	9764.000	PK	47.84	38.92	9.28	43.01	2.26	55.29	73.90	18.6	150	0	
Hori.	4882.000	AV	46.39	31.37	6.48	42.89	2.26	43.61	53.90	10.2	145	103	VBW: 360 Hz
Hori.	7323.000	AV	36.74	37.01	8.13	43.15	2.26	40.99	53.90	12.9	150	0	VBW: 360 Hz
Hori.	9764.000	AV	36.40	38.92	9.28	43.01	2.26	43.85	53.90	10.0	150	0	VBW: 360 Hz
Vert.	54.699	QP	46.23	9.62	6.77	32.19	0.00	30.43	40.00	9.5	100	44	
Vert.	116.592	QP	44.48	12.78	7.27	32.14	0.00	32.39	43.50	11.1	100	70	
Vert.	149.243	QP	43.22	14.73	7.81	32.12	0.00	33.64	43.50	9.8	100	73	
Vert.	181.286	QP	32.75	16.04	7.87	32.09	0.00	24.57	43.50	18.9	100	15	
Vert.	494.995	QP	42.94	17.72	9.60	31.94	0.00	38.32	46.00	7.6	100	187	
Vert.	4882.000	PK	53.15	31.37	6.48	42.89	2.26	50.37	73.90	23.5	222	211	
Vert.	7323.000	PK	48.71	37.01	8.13	43.15	2.26	52.96	73.90	20.9	150	0	
Vert.	9764.000	PK	48.45	38.92	9.28	43.01	2.26	55.90	73.90	18.0	150	0	
Vert.	4882.000	AV	46.34	31.37	6.48	42.89	2.26	43.56	53.90	10.3	222	211	VBW: 360 Hz
Vert.	7323.000	AV	36.94	37.01	8.13	43.15	2.26	41.19	53.90	12.7	150	0	VBW: 360 Hz
Vert.	9764.000	AV	36.39	38.92	9.28	43.01	2.26	43.84	53.90	10.0	150	0	VBW: 360 Hz

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

Distance factor : 1 GHz - 13 GHz : 20log(3.89 m / 3.0 m) = 2.26 dB

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

\* These results have sufficient margin without taking account Dwell time factor.

**UL Japan, Inc.**

**Shonan EMC Lab.**

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## Radiated Spurious Emission

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, DH5 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	137.476	QP	46.69	14.37	7.59	32.13	0.00	36.52	43.50	6.9	230	78	
Hori.	147.801	QP	44.01	14.72	7.79	32.12	0.00	34.40	43.50	9.1	252	85	
Hori.	494.993	QP	46.54	17.72	9.60	31.94	0.00	41.92	46.00	4.0	100	134	
Hori.	959.987	QP	25.82	22.22	11.20	30.56	0.00	28.68	46.00	17.3	167	196	
Hori.	2483.500	PK	48.47	27.65	14.22	41.62	2.26	50.98	73.90	22.9	111	28	
Hori.	4960.000	PK	52.02	31.54	6.51	42.91	2.26	49.42	73.90	24.4	140	100	
Hori.	7440.000	PK	48.37	37.10	8.12	43.38	2.26	52.47	73.90	21.4	150	0	
Hori.	9920.000	PK	47.96	38.97	9.28	42.84	2.26	55.63	73.90	18.2	150	0	
Hori.	2483.500	AV	35.62	27.65	14.22	41.62	2.26	38.13	53.90	15.7	111	28	VBW: 360 Hz
Hori.	4960.000	AV	44.74	31.54	6.51	42.91	2.26	42.14	53.90	11.7	140	100	VBW: 360 Hz
Hori.	7440.000	AV	36.96	37.10	8.12	43.38	2.26	41.06	53.90	12.8	150	0	VBW: 360 Hz
Hori.	9920.000	AV	36.13	38.97	9.28	42.84	2.26	43.80	53.90	10.1	150	0	VBW: 360 Hz
Vert.	54.659	QP	44.75	9.63	6.76	32.19	0.00	28.95	40.00	11.0	100	112	
Vert.	117.012	QP	44.97	12.82	7.27	32.14	0.00	32.92	43.50	10.5	100	13	
Vert.	149.330	QP	42.32	14.74	7.81	32.12	0.00	32.75	43.50	10.7	100	58	
Vert.	179.991	QP	33.11	15.99	7.87	32.09	0.00	24.88	43.50	18.6	100	358	
Vert.	494.993	QP	42.77	17.72	9.60	31.94	0.00	38.15	46.00	7.8	100	187	
Vert.	2483.500	PK	48.85	27.65	14.22	41.62	2.26	51.36	73.90	22.5	140	357	
Vert.	4960.000	PK	52.94	31.54	6.51	42.91	2.26	50.34	73.90	23.5	151	206	
Vert.	7440.000	PK	48.52	37.10	8.12	43.38	2.26	52.62	73.90	21.2	150	0	
Vert.	9920.000	PK	47.83	38.97	9.28	42.84	2.26	55.50	73.90	18.4	150	0	
Vert.	2483.500	AV	36.34	27.65	14.22	41.62	2.26	38.85	53.90	15.0	140	357	VBW: 360 Hz
Vert.	4960.000	AV	45.84	31.54	6.51	42.91	2.26	43.24	53.90	10.6	151	206	VBW: 360 Hz
Vert.	7440.000	AV	36.93	37.10	8.12	43.38	2.26	41.03	53.90	12.8	150	0	VBW: 360 Hz
Vert.	9920.000	AV	36.15	38.97	9.28	42.84	2.26	43.82	53.90	10.0	150	0	VBW: 360 Hz

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

Distance factor : 1 GHz - 13 GHz : 20log(3.89 m / 3.0 m) = 2.26 dB

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

\* These results have sufficient margin without taking account Dwell time factor.

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**Shonan EMC Lab.**

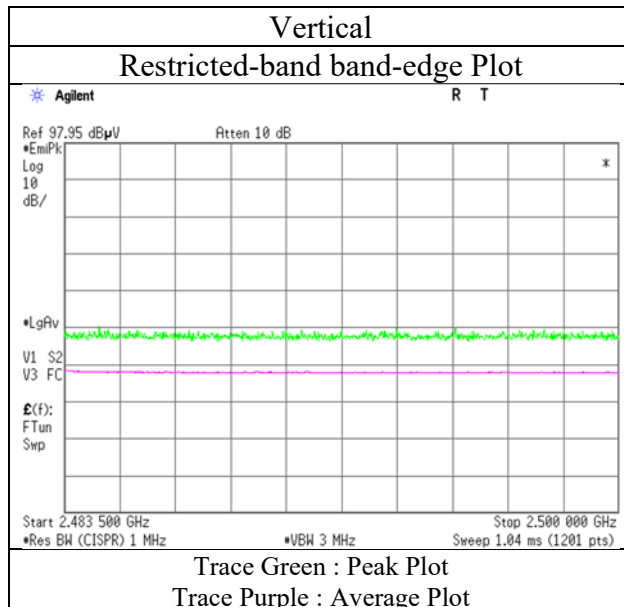
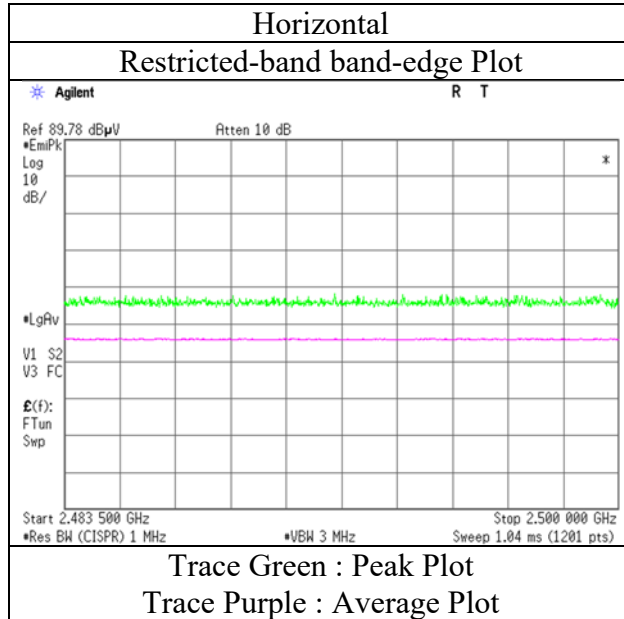
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Facsimile : +81 463 50 6401

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

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 21, 2019  
Temperature / Humidity 22 deg. C / 56% RH  
Engineer Toshinori Yamada  
(1 GHz -2.8 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. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	137.495	QP	46.63	14.37	7.59	32.13	0.00	36.46	43.50	7.0	221	81	
Hori.	147.804	QP	44.46	14.72	7.79	32.12	0.00	34.85	43.50	8.6	225	84	
Hori.	494.988	QP	46.30	17.72	9.60	31.94	0.00	41.68	46.00	4.3	100	138	
Hori.	959.982	QP	26.15	22.22	11.20	30.56	0.00	29.01	46.00	16.9	184	196	
Hori.	2390.000	PK	47.54	27.86	14.15	41.59	2.26	50.22	73.90	23.6	151	120	
Hori.	4804.000	PK	50.24	31.43	6.45	42.88	2.26	47.50	73.90	26.4	161	69	
Hori.	7206.000	PK	48.06	36.79	8.13	42.92	2.26	52.32	73.90	21.5	150	0	
Hori.	9608.000	PK	48.45	38.51	9.30	43.17	2.26	55.35	73.90	18.5	150	0	
Hori.	2390.000	AV	34.12	27.86	14.15	41.59	2.26	36.80	53.90	17.1	151	120	VBW: 360 Hz
Hori.	4804.000	AV	40.61	31.43	6.45	42.88	2.26	37.87	53.90	16.0	161	69	VBW: 360 Hz
Hori.	7206.000	AV	36.61	36.79	8.13	42.92	2.26	40.87	53.90	13.0	150	0	VBW: 360 Hz
Hori.	9608.000	AV	36.81	38.51	9.30	43.17	2.26	43.71	53.90	10.1	150	0	VBW: 360 Hz
Vert.	54.787	QP	37.85	9.59	6.76	32.19	0.00	22.01	40.00	17.9	100	113	
Vert.	117.558	QP	45.01	12.86	7.27	32.14	0.00	33.00	43.50	10.5	100	50	
Vert.	148.412	QP	41.54	14.72	7.80	32.12	0.00	31.94	43.50	11.5	100	131	
Vert.	182.083	QP	31.11	16.05	7.87	32.09	0.00	22.94	43.50	20.5	100	357	
Vert.	494.988	QP	42.78	17.72	9.60	31.94	0.00	38.16	46.00	7.8	100	187	
Vert.	2390.000	PK	47.60	27.86	14.15	41.59	2.26	50.28	73.90	23.6	115	356	
Vert.	4804.000	PK	51.40	31.43	6.45	42.88	2.26	48.66	73.90	25.2	167	69	
Vert.	7206.000	PK	47.88	36.79	8.13	42.92	2.26	52.14	73.90	21.7	150	0	
Vert.	9608.000	PK	48.41	38.51	9.30	43.17	2.26	55.31	73.90	18.5	150	0	
Vert.	2390.000	AV	35.53	27.86	14.15	41.59	2.26	38.21	53.90	15.6	115	356	VBW: 360 Hz
Vert.	4804.000	AV	41.83	31.43	6.45	42.88	2.26	39.09	53.90	14.8	167	69	VBW: 360 Hz
Vert.	7206.000	AV	36.51	36.79	8.13	42.92	2.26	40.77	53.90	13.1	150	0	VBW: 360 Hz
Vert.	9608.000	AV	36.85	38.51	9.30	43.17	2.26	43.75	53.90	10.1	150	0	VBW: 360 Hz

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

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

\* These results have sufficient margin without taking account Dwell time factor.

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	86.14	27.86	14.16	41.60	2.26	88.82	-	-	Carrier
Hori.	2400.000	PK	39.66	27.86	14.16	41.60	2.26	42.34	68.82	26.4	
Vert.	2402.000	PK	90.12	27.86	14.16	41.60	2.26	92.80	-	-	Carrier
Vert.	2400.000	PK	42.68	27.86	14.16	41.60	2.26	45.36	72.80	27.4	

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

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

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**Shonan EMC Lab.**

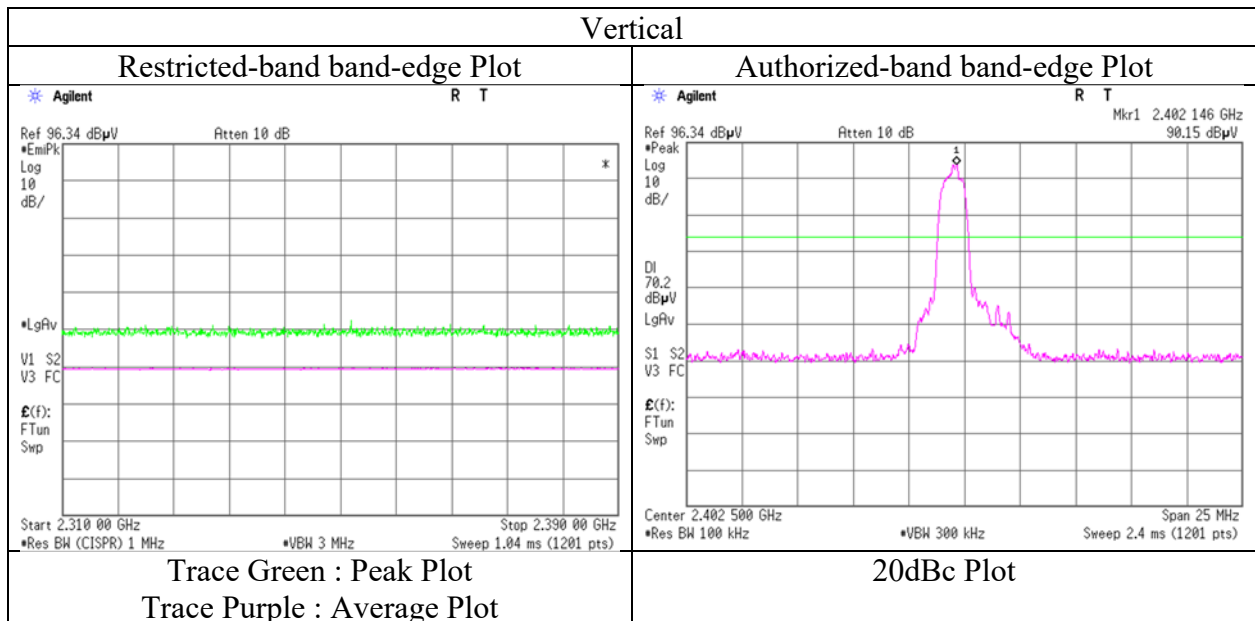
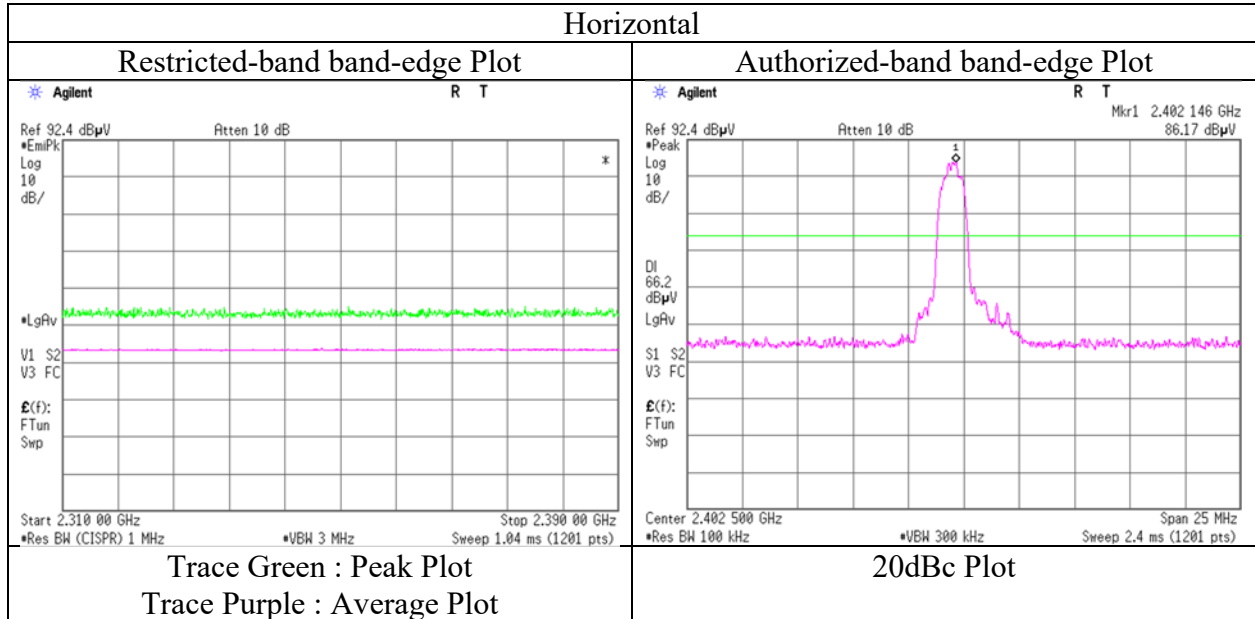
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 21, 2019  
Temperature / Humidity 22 deg. C / 56% RH  
Engineer Toshinori Yamada  
(1 GHz -2.8 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. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2441 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	137.493	QP	47.30	14.37	7.59	32.13	0.00	37.13	43.50	6.3	230	86	
Hori.	147.779	QP	43.35	14.72	7.79	32.12	0.00	33.74	43.50	9.7	218	99	
Hori.	494.993	QP	46.21	17.72	9.60	31.94	0.00	41.59	46.00	4.4	100	133	
Hori.	959.987	QP	26.08	22.22	11.20	30.56	0.00	28.94	46.00	17.0	177	197	
Hori.	4882.000	PK	49.41	31.37	6.48	42.89	2.26	46.63	73.90	27.2	161	67	
Hori.	7323.000	PK	48.87	37.01	8.13	43.15	2.26	53.12	73.90	20.7	150	0	
Hori.	9764.000	PK	47.91	38.92	9.28	43.01	2.26	55.36	73.90	18.5	150	0	
Hori.	4882.000	AV	39.19	31.37	6.48	42.89	2.26	36.41	53.90	17.4	161	67	VBW: 360 Hz
Hori.	7323.000	AV	36.85	37.01	8.13	43.15	2.26	41.10	53.90	12.8	150	0	VBW: 360 Hz
Hori.	9764.000	AV	36.43	38.92	9.28	43.01	2.26	43.88	53.90	10.0	150	0	VBW: 360 Hz
Vert.	51.738	QP	42.35	10.62	6.80	32.19	0.00	27.58	40.00	12.4	100	119	
Vert.	116.590	QP	45.53	12.78	7.27	32.14	0.00	33.44	43.50	10.0	100	50	
Vert.	143.997	QP	45.75	14.57	7.72	32.12	0.00	35.92	43.50	7.5	100	158	
Vert.	180.000	QP	32.72	15.99	7.87	32.09	0.00	24.49	43.50	19.0	100	357	
Vert.	494.993	QP	43.05	17.72	9.60	31.94	0.00	38.43	46.00	7.5	100	188	
Vert.	4882.000	PK	51.10	31.37	6.48	42.89	2.26	48.32	73.90	25.5	157	208	
Vert.	7323.000	PK	48.24	37.01	8.13	43.15	2.26	52.49	73.90	21.4	150	0	
Vert.	9764.000	PK	47.99	38.92	9.28	43.01	2.26	55.44	73.90	18.4	150	0	
Vert.	4882.000	AV	42.52	31.37	6.48	42.89	2.26	39.74	53.90	14.1	157	208	VBW: 360 Hz
Vert.	7323.000	AV	36.87	37.01	8.13	43.15	2.26	41.12	53.90	12.7	150	0	VBW: 360 Hz
Vert.	9764.000	AV	36.37	38.92	9.28	43.01	2.26	43.82	53.90	10.0	150	0	VBW: 360 Hz

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

Distance factor : 1 GHz - 13 GHz :  $20\log(3.89\text{ m} / 3.0\text{ m}) = 2.26\text{ dB}$

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

\* These results have sufficient margin without taking account Dwell time factor.

## Radiated Spurious Emission

Report No. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3 No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	137.494	QP	47.31	14.37	7.59	32.13	0.00	37.14	43.50	6.3	229	82	
Hori.	147.801	QP	43.74	14.72	7.79	32.12	0.00	34.13	43.50	9.3	213	88	
Hori.	494.997	QP	47.15	17.72	9.60	31.94	0.00	42.53	46.00	3.4	100	136	
Hori.	959.986	QP	26.38	22.22	11.20	30.56	0.00	29.24	46.00	16.7	179	193	
Hori.	2483.500	PK	47.18	27.65	14.22	41.62	2.26	49.69	73.90	24.2	244	26	
Hori.	4960.000	PK	50.13	31.54	6.51	42.91	2.26	47.53	73.90	26.3	258	168	
Hori.	7440.000	PK	48.65	37.10	8.12	43.38	2.26	52.75	73.90	21.1	100	0	
Hori.	9920.000	PK	47.28	38.97	9.28	42.84	2.26	54.95	73.90	18.9	100	0	
Hori.	2483.500	AV	35.43	27.65	14.22	41.62	2.26	37.94	53.90	15.9	244	26	VBW: 360 Hz
Hori.	4960.000	AV	40.16	31.54	6.51	42.91	2.26	37.56	53.90	16.3	258	168	VBW: 360 Hz
Hori.	7440.000	AV	36.72	37.10	8.12	43.38	2.26	40.82	53.90	13.0	100	0	VBW: 360 Hz
Hori.	9920.000	AV	36.09	38.97	9.28	42.84	2.26	43.76	53.90	10.1	100	0	VBW: 360 Hz
Vert.	54.743	QP	43.53	9.61	6.77	32.19	0.00	27.72	40.00	12.2	100	115	
Vert.	116.534	QP	45.13	12.77	7.27	32.14	0.00	33.03	43.50	10.4	100	60	
Vert.	144.002	QP	45.36	14.57	7.72	32.12	0.00	35.53	43.50	7.9	100	161	
Vert.	180.009	QP	33.53	15.99	7.87	32.09	0.00	25.30	43.50	18.2	100	356	
Vert.	494.997	QP	42.81	17.72	9.60	31.94	0.00	38.19	46.00	7.8	100	182	
Vert.	2483.500	PK	48.33	27.65	14.22	41.62	2.26	50.84	73.90	23.0	138	355	
Vert.	4960.000	PK	50.90	31.54	6.51	42.91	2.26	48.30	73.90	25.6	154	206	
Vert.	7440.000	PK	48.16	37.10	8.12	43.38	2.26	52.26	73.90	21.6	100	0	
Vert.	9920.000	PK	47.22	38.97	9.28	42.84	2.26	54.89	73.90	19.0	100	0	
Vert.	2483.500	AV	35.76	27.65	14.22	41.62	2.26	38.27	53.90	15.6	138	355	VBW: 360 Hz
Vert.	4960.000	AV	41.24	31.54	6.51	42.91	2.26	38.64	53.90	15.2	154	206	VBW: 360 Hz
Vert.	7440.000	AV	36.76	37.10	8.12	43.38	2.26	40.86	53.90	13.0	100	0	VBW: 360 Hz
Vert.	9920.000	AV	36.19	38.97	9.28	42.84	2.26	43.86	53.90	10.0	100	0	VBW: 360 Hz

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

Distance factor : 1 GHz - 13 GHz : 20log(3.89 m / 3.0 m) = 2.26 dB

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

\* These results have sufficient margin without taking account Dwell time factor.

**UL Japan, Inc.**

**Shonan EMC Lab.**

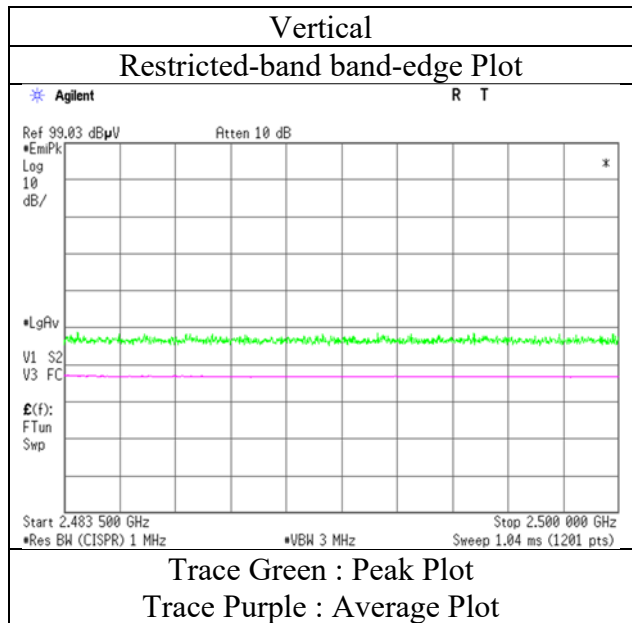
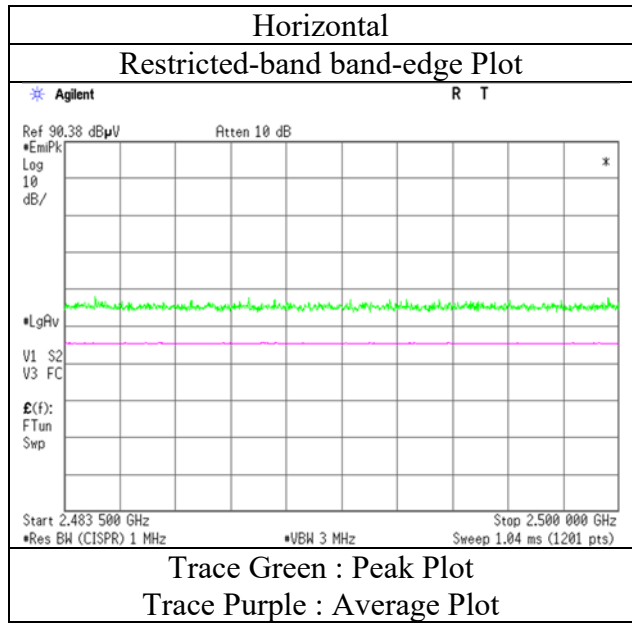
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**Radiated Spurious Emission**  
**(Reference Plot for band-edge)**

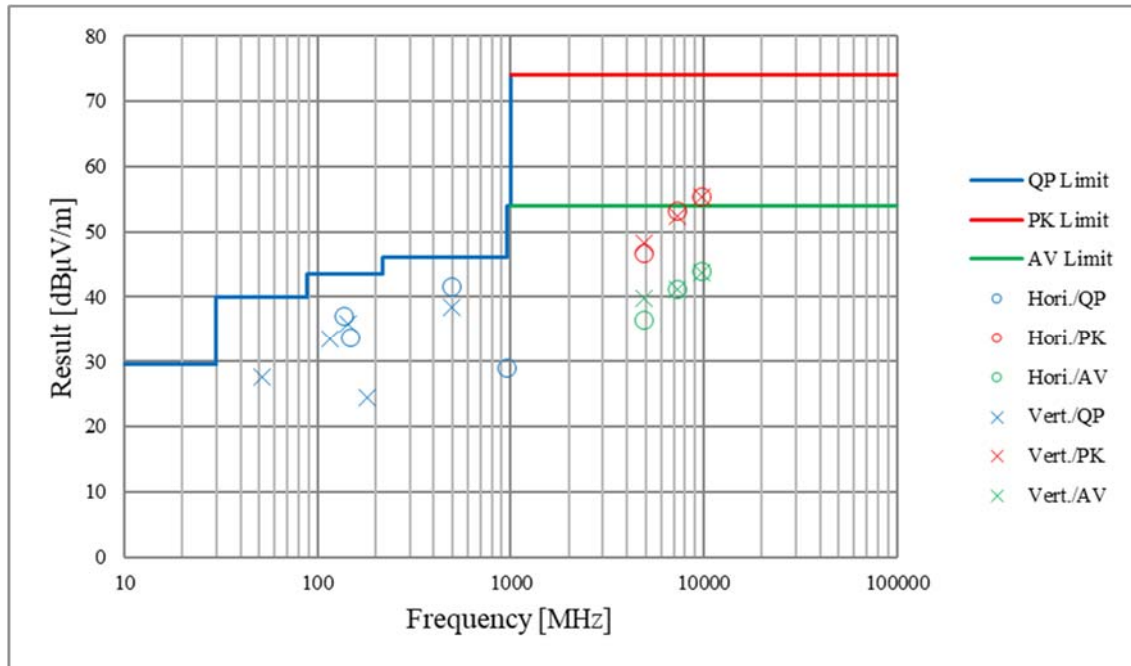
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Semi Anechoic Chamber No.3  
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Temperature / Humidity 22 deg. C / 56% RH  
Engineer Toshinori Yamada  
(1 GHz -2.8 GHz)  
Mode Tx, Hopping Off, 3DH5 2480 MHz



\* 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. 12866863S-A-R1  
Test place Shonan EMC Lab.  
Semi Anechoic Chamber No.3  
Date May 21, 2019 May 21, 2019  
Temperature / Humidity 23 deg. C / 57 % RH 22 deg. C / 56% RH  
Engineer Takahiro Kawakami Toshinori Yamada  
(30 MHz -1000 MHz) (1 GHz -26.5 GHz)  
Mode Tx, Hopping Off, 3DH5 2441 MHz

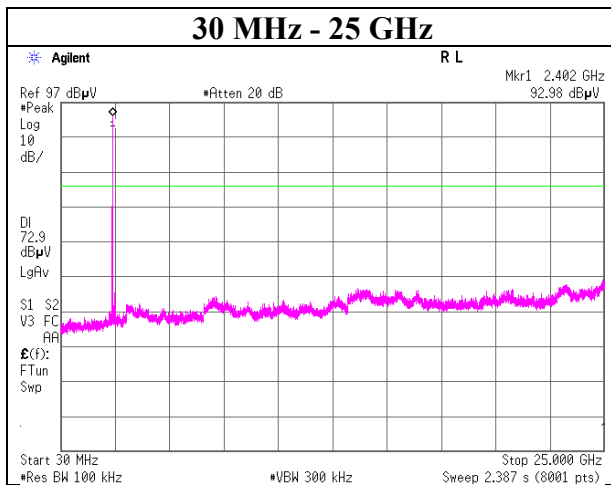
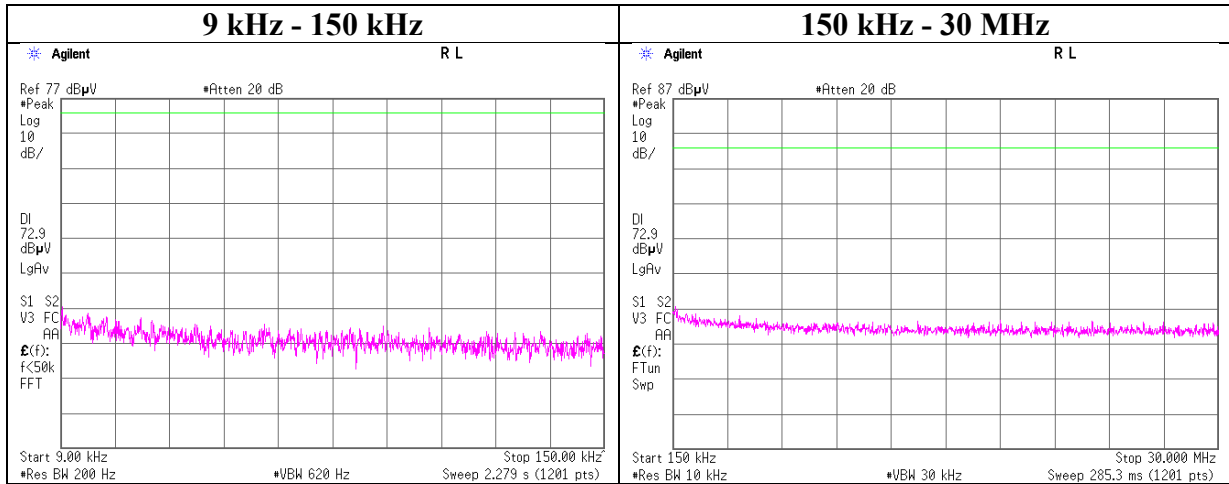


\*These plots data contains sufficient number to show the trend of characteristic features for EUT.

## Conducted Spurious Emission

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 20, 2019
Temperature / Humidity	26 deg. C / 44 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

### 2402 MHz



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**Shonan EMC Lab.**

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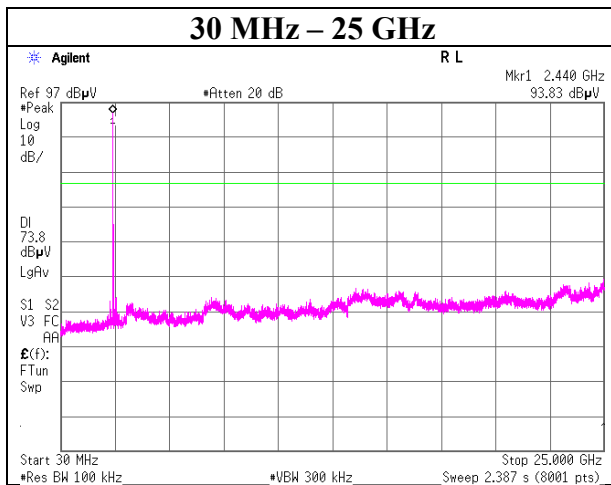
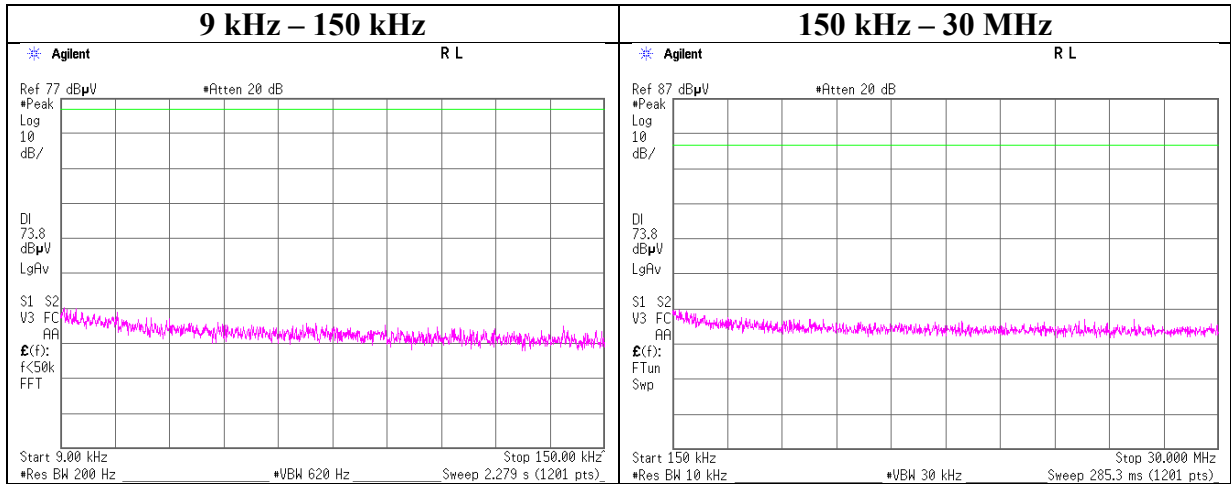
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 20, 2019
Temperature / Humidity	26 deg. C / 44 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

### 2441 MHz



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**Shonan EMC Lab.**

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Telephone : +81 463 50 6400

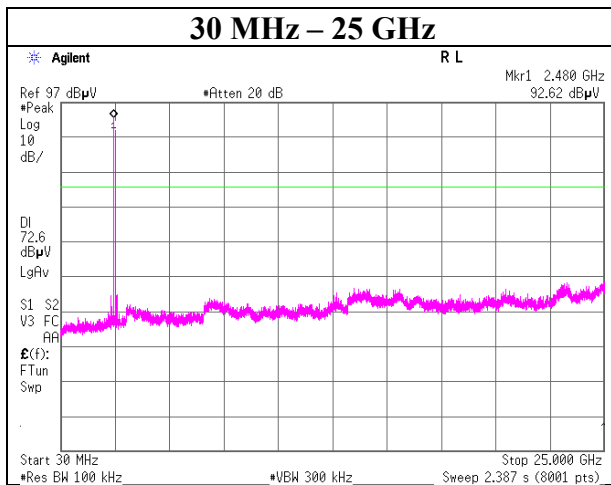
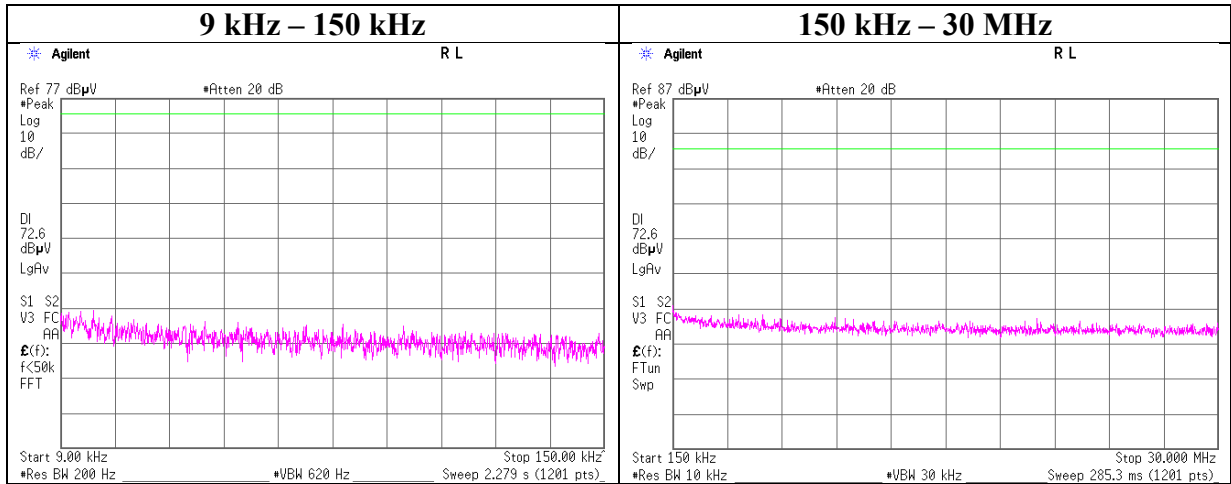
Facsimile : +81 463 50 6401



## Conducted Spurious Emission

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 20, 2019
Temperature / Humidity	26 deg. C / 44 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, DH5

### 2480 MHz



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**Shonan EMC Lab.**

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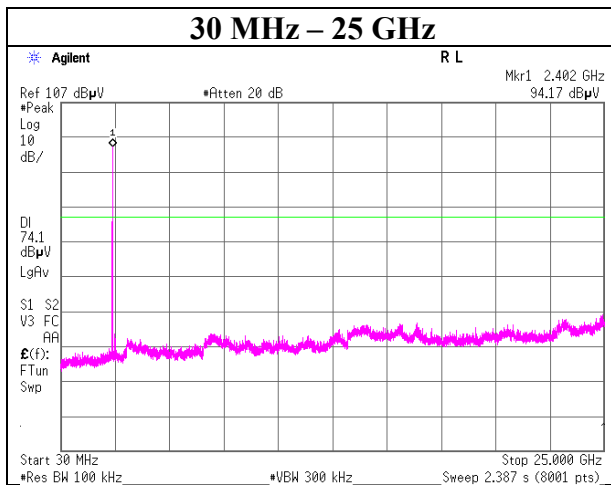
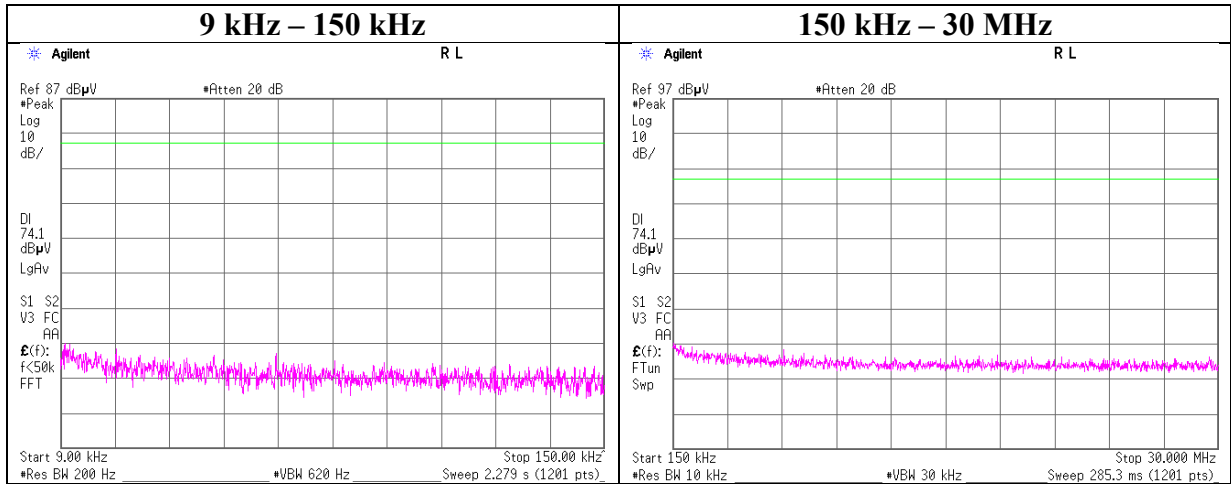
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 20, 2019
Temperature / Humidity	26 deg. C / 44 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

### 2402 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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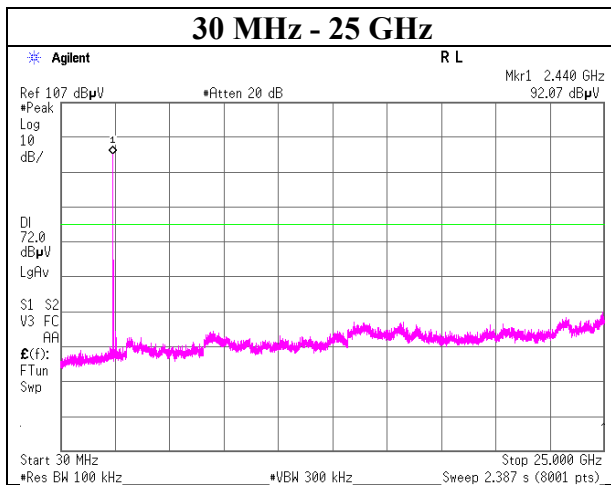
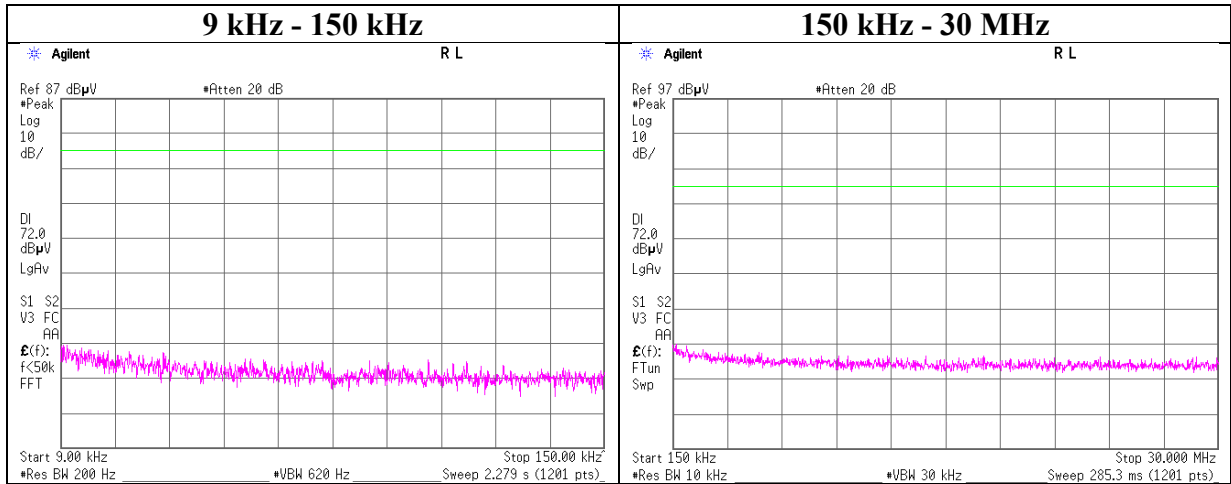
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 20, 2019
Temperature / Humidity	26 deg. C / 44 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

### 2441 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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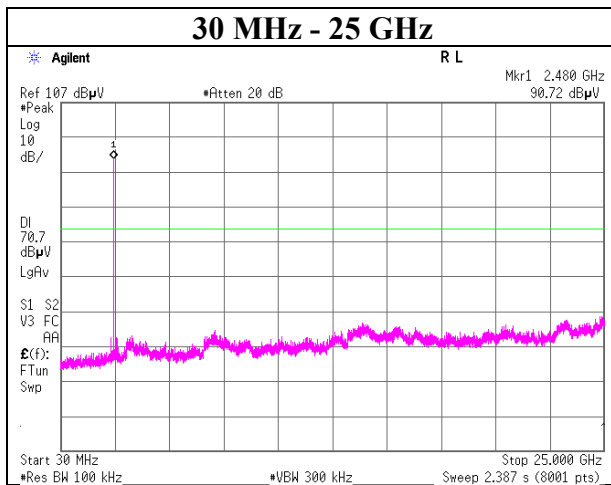
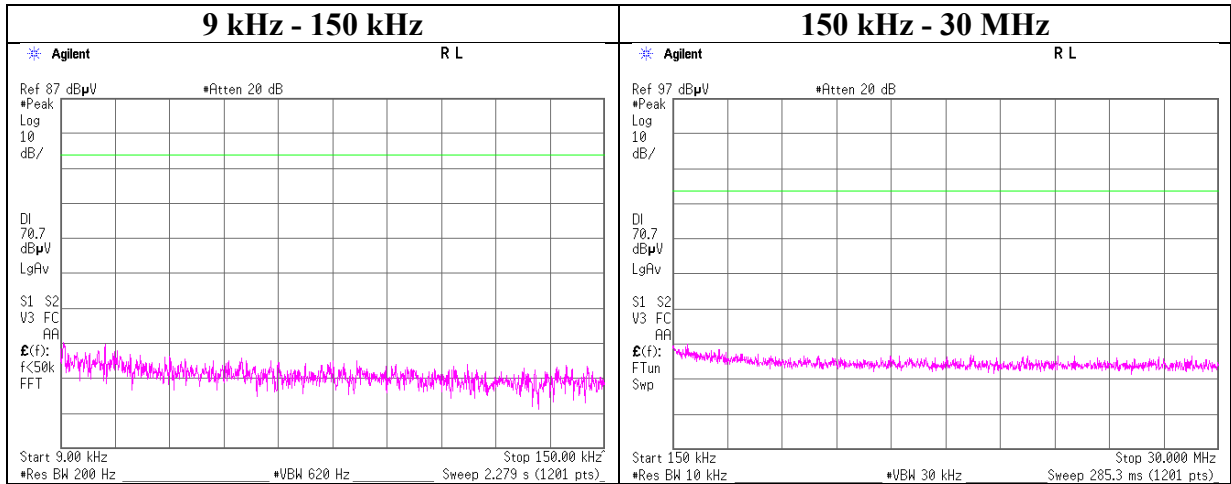
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

## Conducted Spurious Emission

Report No.	12866863S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	May 20, 2019
Temperature / Humidity	26 deg. C / 44 % RH
Engineer	Takahiro Kawakami
Mode	Tx, Hopping Off, 3DH5

### 2480 MHz



**UL Japan, Inc.**

**Shonan EMC Lab.**

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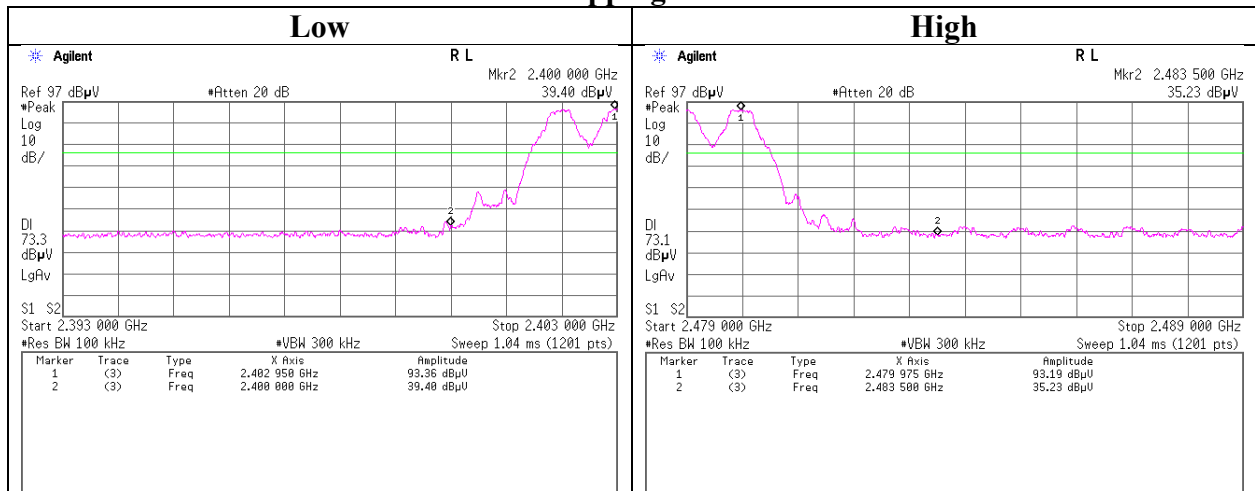
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

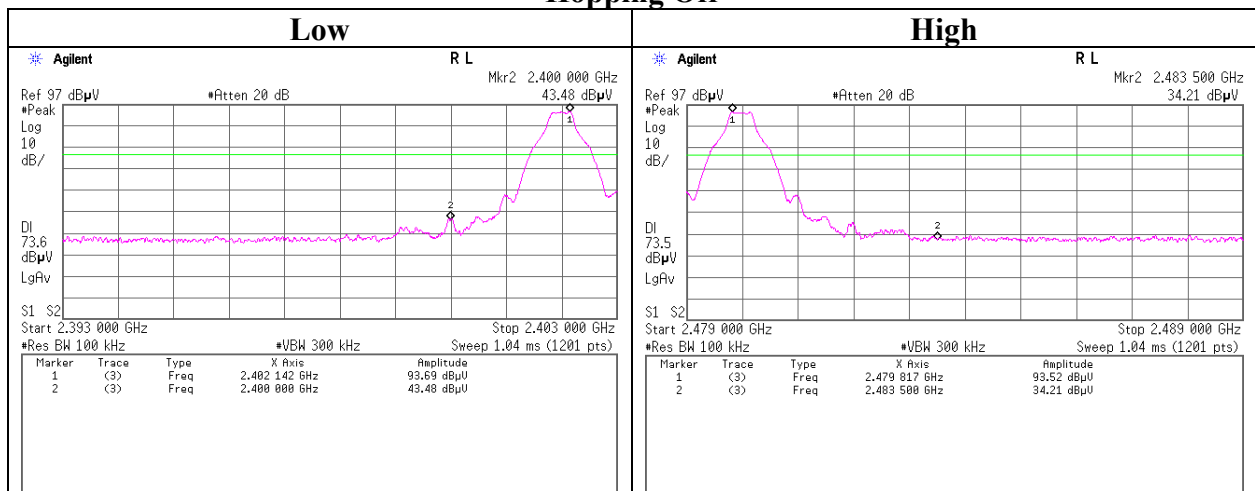
## Conducted Emission Band Edge compliance

Report No. 12866863S-A-R1  
 Test place Shonan EMC Lab. No.5 Shielded Room  
 Date May 20, 2019  
 Temperature / Humidity 26 deg. C / 44 % RH  
 Engineer Takahiro Kawakami  
 Mode Tx DH5

### Hopping On



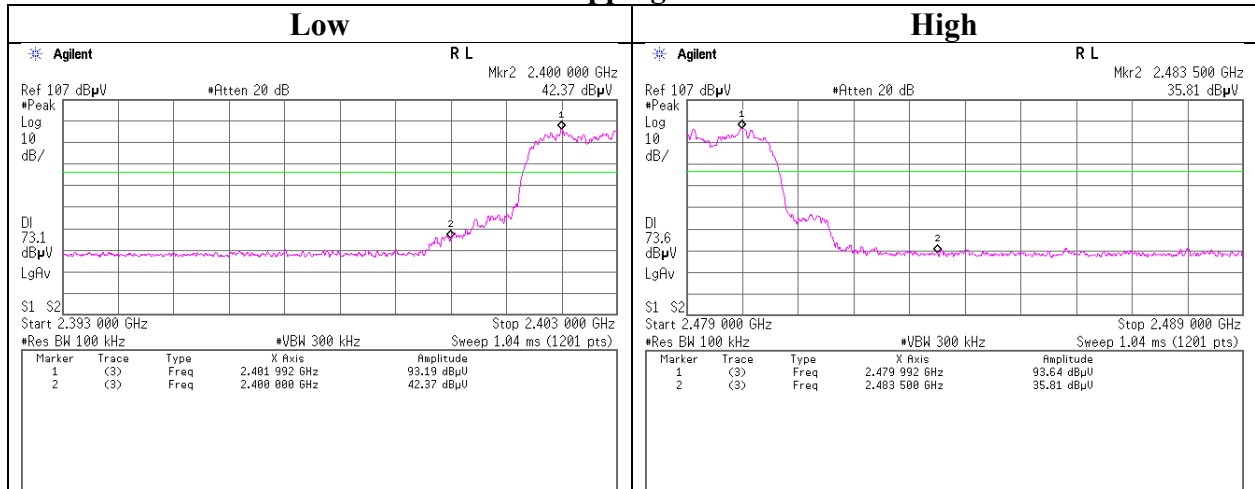
### Hopping Off



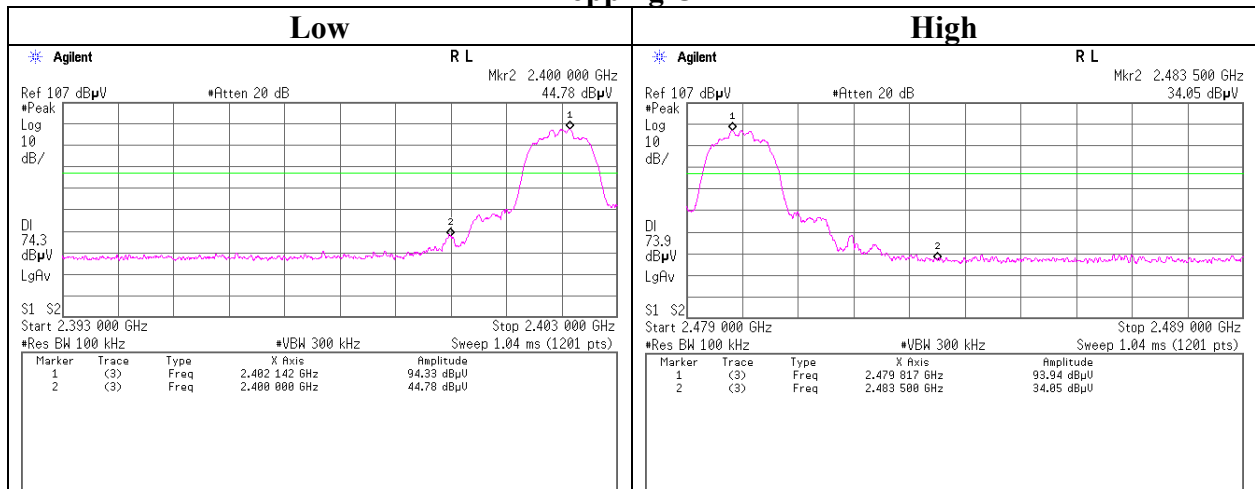
## Conducted Emission Band Edge compliance

Report No. 12866863S-A-R1  
 Test place Shonan EMC Lab. No.5 Shielded Room  
 Date May 20, 2019  
 Temperature / Humidity 26 deg. C / 44 % RH  
 Engineer Takahiro Kawakami  
 Mode Tx 3DH5

### Hopping On



### Hopping Off



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## APPENDIX 2: Test instruments

### Test Instruments

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-07	AT	145111	Digital Tester	SANWA	PC500	7019232	2018/10/17	2019/10/31	12
SAT10-13	AT	151610	Attenuator	Weinschel Corp.	54A-10	81626	2019/3/27	2020/3/31	12
SCC-G12	AT	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2019/3/27	2020/3/31	12
SOS-19	AT	175823	Humidity Indicator	CUSTOM	CTH-201	-	2018/12/5	2019/12/31	12
SPM-07	AT	146247	Power Meter	AGILENT	8990B	MY5100272	2018/7/13	2019/7/31	12
SPSS-04	AT	146310	Power sensor	AGILENT	N1923A	MY5326009	2018/7/13	2019/7/31	12
SSA-03	AT,RE	145801	Spectrum Analyzer	AGILENT	E4448A	MY48250152	2018/8/30	2019/8/31	12
COTS-SEMI-5	RE	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-	-
KJM-02	RE	146432	Measure	TAJIMA	GL19-55	-	-	-	-
SAEC-03(NSA)	RE	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2019/4/8	2020/4/30	12
SAEC-03(SVSWR)	RE	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2019/5/3	2020/5/31	12
SAF-03	RE	145126	Pre Amplifier	SONOMA	310N	290213	2019/2/5	2020/2/29	12
SAF-06	RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2019/2/8	2020/2/29	12
SAF-08	RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2019/3/5	2020/3/31	12
SAT10-05	RE	145136	Attenuator(above1GHz)	AGILENT	8493C-010	74864	2018/11/25	2019/11/30	12
SAT6-13	RE	167094	Attenuator	JFW	50HF-006N		2019/2/5	2020/2/29	12
SBA-03	RE	145023	Biconical Antenna	Schwarzbeck	BBA9106	91032666	2018/6/17	2019/6/30	12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	RE	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141P	-/0901-271(RF Selector)	2019/4/19	2020/4/30	12
SCC-G15	RE	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2019/3/27	2020/3/31	12
SCC-G40	RE	166491	Coaxial Cable	Junkosha	MWX221-01000NFSN MS/B	1612S005	2019/1/25	2020/1/31	12
SCC-G43	RE	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104 E	SN MY 13406/4E	2018/7/10	2019/7/31	12
SCC-G44	RE	168300	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800070/4A	2019/3/26	2020/3/31	12
SFL-02	RE	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2018/11/16	2019/11/30	12
SHA-03	RE	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2018/7/23	2019/7/31	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	2018/7/23	2019/7/31	12
SLA-07	RE	145529	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	2018/6/17	2019/6/30	12
SOS-05	RE	146293	Humidity Indicator	A&D	AD-5681	4062518	2018/10/25	2019/10/31	12
STR-08	RE	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2018/11/28	2019/11/30	12
STS-03	RE	146210	Digital Hitester	HIOKI	3805-50	80997823	2018/10/16	2019/10/31	12

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

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

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

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

UL Japan, Inc.

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