



RADIO TEST REPORT

Test Report No. : 13181388H-A

Applicant : Sony Interactive Entertainment Inc.
Type of Equipment : Wireless Controller
Model No. : CFI-ZCT1W
FCC ID : AK8CFIZCT1
Test regulation : FCC Part 15 Subpart C: 2019
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 above regulation.
4. The test results in this 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 US Government.
8. The information provided from the customer for this report is identified in SECTION 1.

Date of test: December 23, 2019 to January 8, 2020

Representative test engineer:


Akihiko Maeda
Engineer
Consumer Technology Division

Approved by:


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/

- ☐ This report contains data that are not covered by the NVLAP accreditation.
☒ There is no testing item of "Non-accreditation".

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

REVISION HISTORY

Original Test Report No.: 13181388H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13181388H-A	January 27, 2020	-	-

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

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		

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

CONTENTS	PAGE
SECTION 1: Customer information.....	5
SECTION 2: Equipment under test (E.U.T.).....	5
SECTION 3: Test specification, procedures & results.....	6
SECTION 4: Operation of E.U.T. during testing.....	10
SECTION 5: Conducted Emission.....	12
SECTION 6: Radiated Spurious Emission	13
SECTION 7: Antenna Terminal Conducted Tests.....	15
APPENDIX 1: Test data	16
Conducted Emission	16
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation.....	20
Number of Hopping Frequency	24
Dwell time.....	26
Maximum Peak Output Power.....	29
Average Output Power.....	30
Radiated Spurious Emission	32
Conducted Spurious Emission	43
Conducted Emission Band Edge compliance	49
APPENDIX 2: Test instruments	51
APPENDIX 3: Photographs of test setup	52
Conducted Emission	52
Radiated Spurious Emission	53
Worst Case Position	54

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 Equipment, Model No., FCC ID on the cover and other relevant pages
 - Operating/Test Mode(s) (Mode(s)) on all the relevant pages
 - SECTION 1: Customer information
 - SECTION 2: Equipment under test (E.U.T.)
 - SECTION 4: Operation of E.U.T. during testing
- * The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment	Wireless Controller
Model No	CFI-ZCT1W
Serial No	Refer to SECTION 4.2
Country of Manufacture	China
Receipt Date of Sample (Information from test lab.)	December 20, 2019
Condition of EUT	Production 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: CFI-ZCT1W is the Wireless Controller.

Product Specification

Operating Temperature	5 deg. C to 35 deg. C
Power Supply	DC 5 V (USB Bus Power)
Battery Supply	DC 3.65 V

Radio Specification: Bluetooth

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Bandwidth & Channel spacing	79MHz & 1MHz
Method of frequency generation	Synthesizer
Antenna Type	IFA
Antenna Gain	2.7 dBi max
Maximum clock frequency	6 GHz

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

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on July 19, 2019 and effective August 19, 2019 except 15.258

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
and 5725-5850 MHz

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	16.74 dB 0.20190 MHz, N	Complied a)	-
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 b)	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 b)	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 c)	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 d)	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 e)	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	6.5 dB 432.726 MHz, Vertical, QP	Complied f) / g)	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 Conducted Emission)
- b) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)
- c) Refer to APPENDIX 1 (data of Number of Hopping Frequency)
- d) Refer to APPENDIX 1 (data of Dwell time)
- e) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
- f) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
- g) 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.

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

FCC Part 15.31 (e)

The EUT is a battery-operated device and test was performed with the full-charged battery.

This EUT provides stable voltage constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	- 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 $k=2$.
Ise EMC Lab.

Antenna Terminal test

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

Conducted emission

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

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

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

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

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

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

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)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test) *2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative. * It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification. *EUT has the power settings by the software as follows; Power settings: 7 Software: BT Tool, Version: W1645 Firmware: PlayStationWirelessControllerFW_for_functionControl, Version: 0.1.85 (Date: November 27, 2019 / Storage location: IC101) *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.		

4.2 Configuration and peripherals

This page has been submitted for a separate exhibit.

SECTION 5: Conducted Emission

Test Procedure and conditions

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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80 cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

1) For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

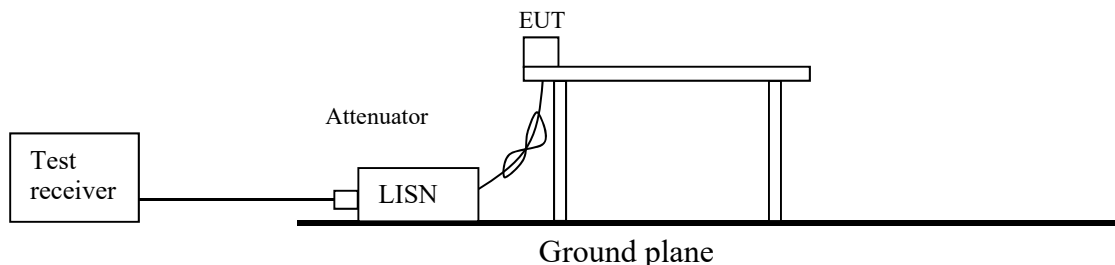
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15 MHz - 30 MHz
Test data	: APPENDIX
Test result	: Pass

Figure 1: Test Setup



SECTION 6: 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.

UL Japan, Inc.

Ise EMC Lab.

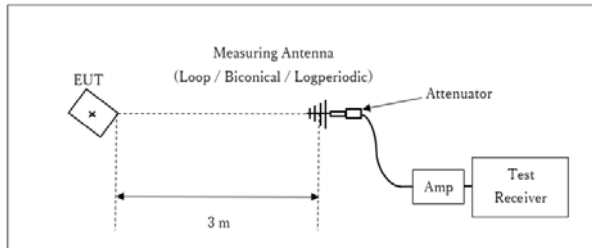
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Figure 2: Test Setup

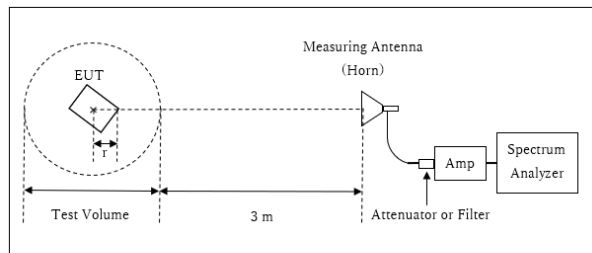
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log (4.0 \text{ m} / 3.0 \text{ m}) = 2.5 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 4.0 \text{ m}$

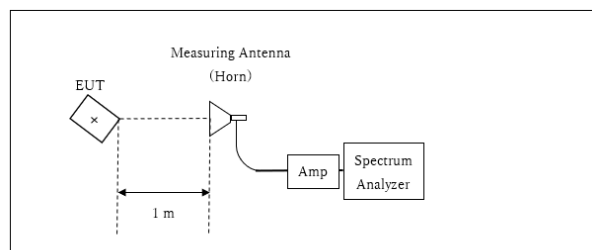
Test Volume : 2.0 m

(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 - 26.5 GHz



x : 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 - 26.5 GHz

Test data : APPENDIX

Test result : Pass

SECTION 7: 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)	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)

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

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

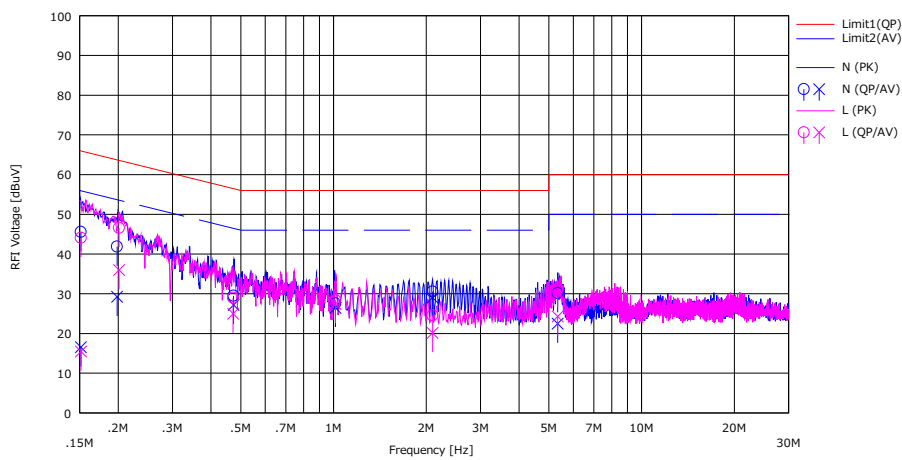
Facsimile : +81 596 24 8124

APPENDIX 1: Test data

Conducted Emission

Report No. 13181388H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date January 8, 2020
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, DH5 2441 MHz

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		USN	LOSS	Results		Limit		Margin		Phase	Comment
		[QP] [dBuV]	[AV] [dBuV]			[QP] [dBuV]	[AV] [dBuV]	[QP] [dBuV]	[AV] [dBuV]	[QP] [dB]	[AV] [dB]		
1	0.15132	32.10	3.10	0.07	13.38	45.55	16.55	65.90	55.90	20.35	39.35	N	
2	0.19830	28.40	15.80	0.07	13.39	41.86	29.26	63.70	53.70	21.84	24.44	N	
3	0.47353	16.00	13.70	0.08	13.42	29.50	27.20	56.50	46.50	27.00	19.30	N	
4	1.01432	14.00	12.90	0.08	13.46	27.54	26.44	56.00	46.00	28.46	19.56	N	
5	2.09606	16.90	15.40	0.09	13.54	30.53	29.03	56.00	46.00	25.47	16.97	N	
6	5.33797	16.30	8.60	0.15	13.70	30.15	22.45	60.00	50.00	29.85	27.55	N	
7	0.15140	30.60	2.00	0.07	13.38	44.05	15.45	65.90	55.90	21.85	40.45	L	
8	0.20133	33.10	22.50	0.07	13.39	46.56	35.96	63.60	53.60	17.04	17.64	L	
9	0.47190	15.50	11.50	0.05	13.42	28.97	24.97	56.50	46.50	27.53	21.53	L	
10	1.01463	14.80	13.90	0.06	13.46	28.32	27.42	56.00	46.00	27.68	18.58	L	
11	2.09706	10.90	6.50	0.10	13.54	24.54	20.14	56.00	46.00	31.46	25.86	L	
12	5.33977	17.40	10.40	0.16	13.70	31.26	24.26	60.00	50.00	28.74	25.74	L	

Except for the above table: adequate margin data below the limits.

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)

UL Japan, Inc.

Ise EMC Lab.

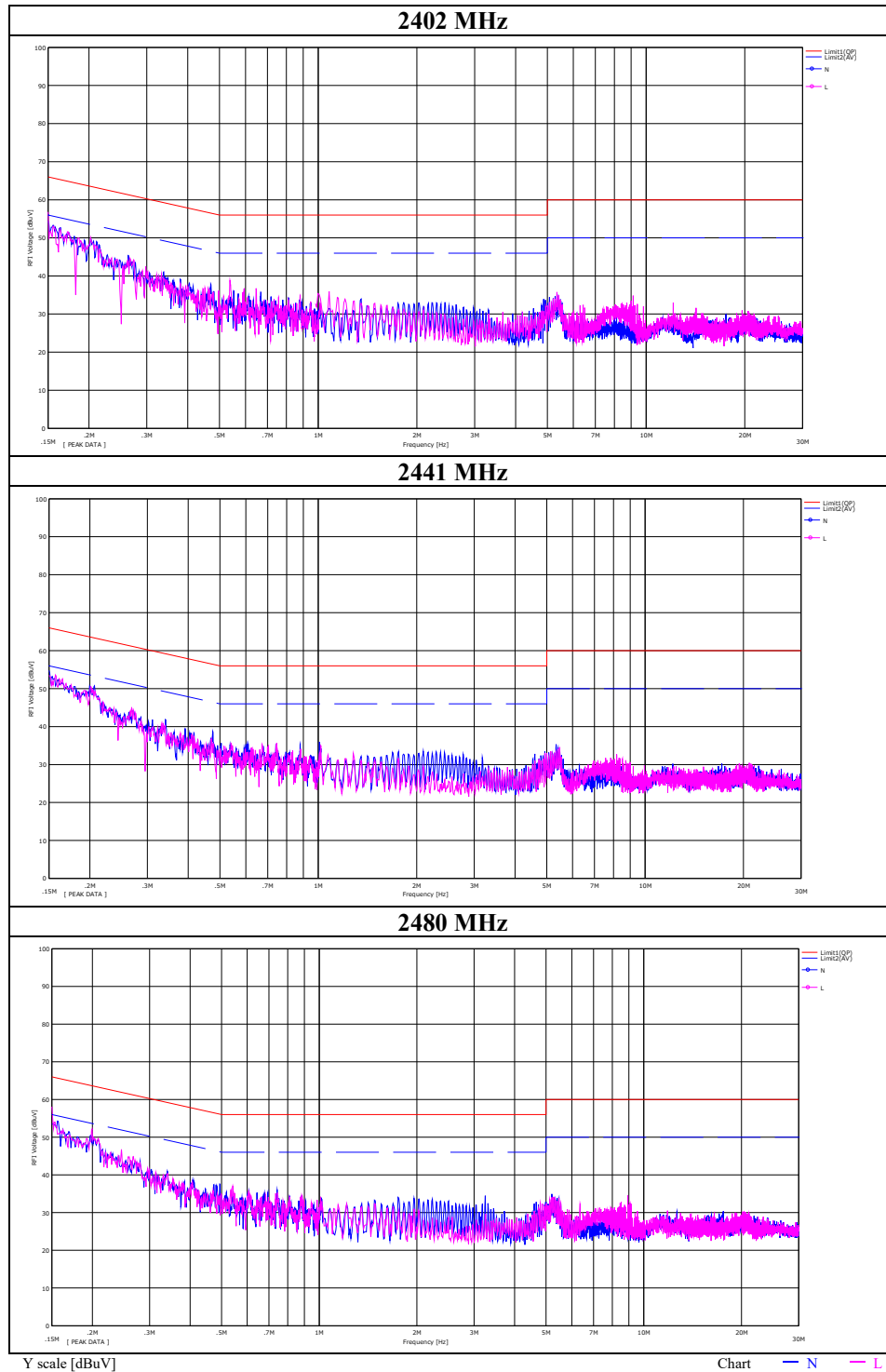
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 13181388H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date January 8, 2020
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, DH5



UL Japan, Inc.

Ise EMC Lab.

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

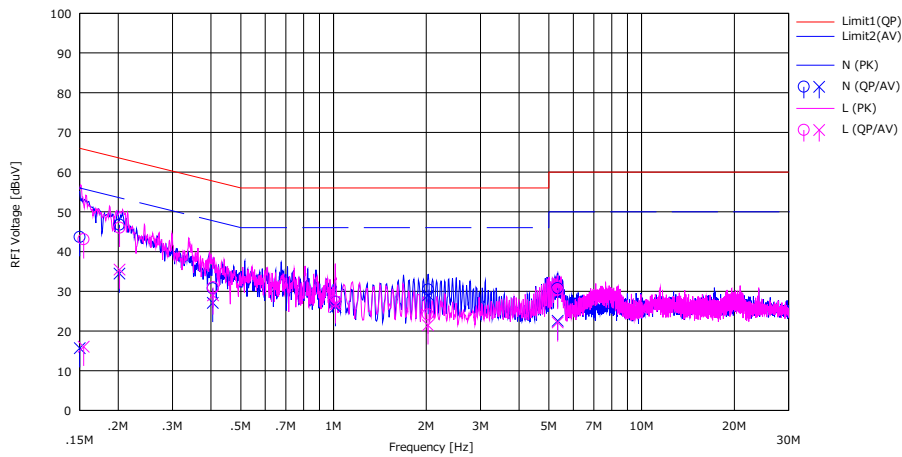
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 13181388H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date January 8, 2020
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, 3DH5 2441 MHz

Limit : FCC_Part 15 Subpart C(15.207)



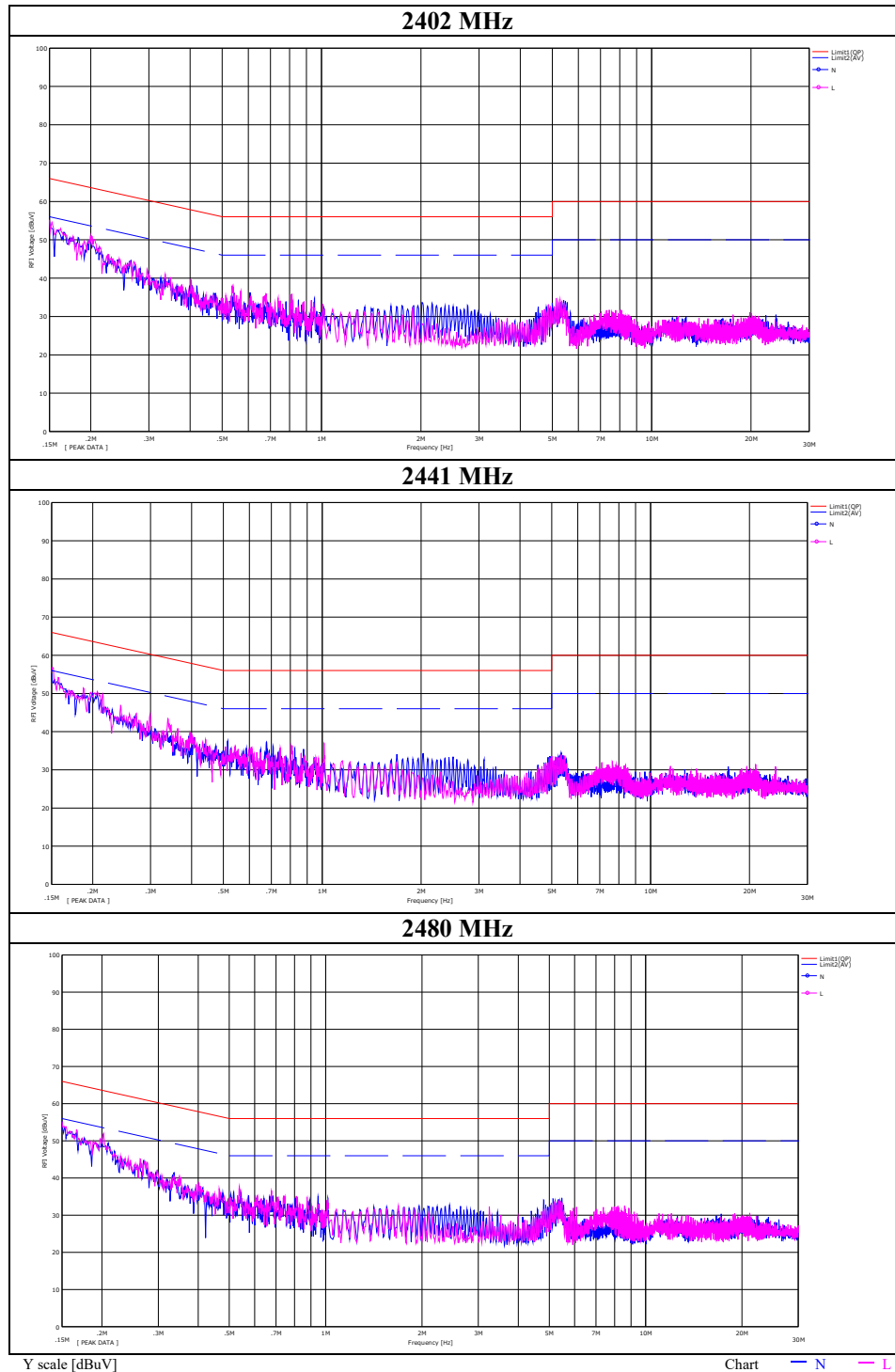
No.	Freq. [MHz]	Reading		USN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	30.20	2.20	0.07	13.38	43.65	15.65	66.00	56.00	22.35	40.35	N	
2	0.20190	33.30	21.00	0.07	13.39	46.76	34.46	63.50	53.50	16.74	19.04	N	
3	0.40545	17.20	13.60	0.08	13.41	30.69	27.09	57.70	47.70	27.01	20.61	N	
4	1.01452	13.80	12.50	0.08	13.46	27.34	26.04	56.00	46.00	28.66	19.96	N	
5	2.02835	16.80	15.40	0.09	13.53	30.42	29.02	56.00	46.00	25.58	16.98	N	
6	5.33870	16.90	8.70	0.15	13.70	30.75	22.55	60.00	50.00	29.25	27.45	N	
7	0.15455	29.60	2.60	0.07	13.38	43.05	16.05	65.80	55.80	22.75	39.75	L	
8	0.20205	32.50	22.00	0.07	13.39	45.96	35.46	63.50	53.50	17.54	18.04	L	
9	0.40641	17.50	15.50	0.05	13.41	30.96	28.96	57.70	47.70	26.74	18.74	L	
10	1.01494	13.90	13.20	0.06	13.46	27.42	26.72	56.00	46.00	28.58	19.28	L	
11	2.02615	10.50	7.80	0.10	13.53	24.13	21.43	56.00	46.00	31.87	24.57	L	
12	5.34087	16.50	8.30	0.16	13.70	30.36	22.16	60.00	50.00	29.64	27.84	L	

Except for the above table: adequate margin data below the limits.

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)

Conducted Emission

Report No. 13181388H
Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Date January 8, 2020
Temperature / Humidity 22 deg. C / 40 % RH
Engineer Takumi Shimada
Mode Tx, Hopping Off, 3DH5



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

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

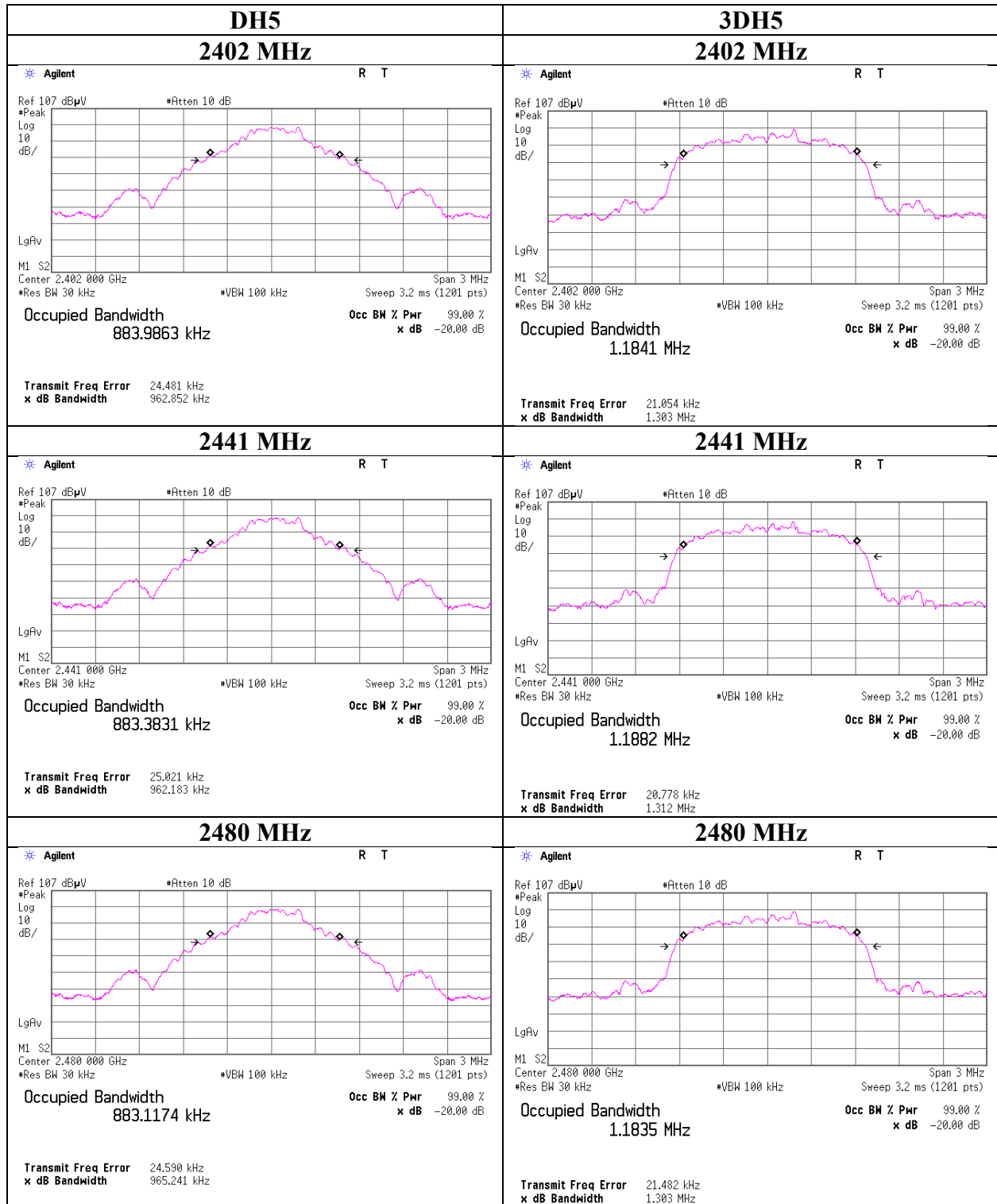
Report No. 13181388H
Test place Ise EMC Lab. No.3 Measurement Room
Date December 23, 2019
Temperature / Humidity 21 deg. C / 32 % RH
Engineer Akihiko Maeda
Mode Tx, Hopping Off, Tx, Hopping On

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	883.986	1.000	≥ 0.642
DH5	2441.0	0.962	883.383	1.000	≥ 0.641
DH5	2480.0	0.965	883.117	1.000	≥ 0.643
DH5	Hopping On	-	78609.6	-	-
3DH5	2402.0	1.303	1184.100	1.000	≥ 0.869
3DH5	2441.0	1.312	1188.200	1.000	≥ 0.875
3DH5	2480.0	1.303	1183.500	1.000	≥ 0.869
3DH5	Hopping On	-	78642.6	-	-

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.

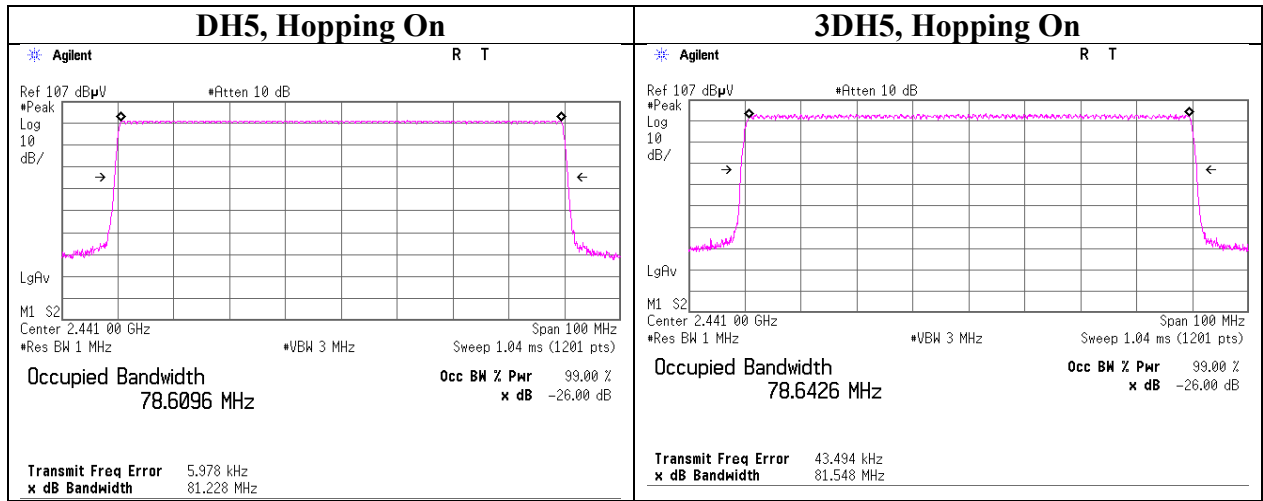
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth and 99% Occupied Bandwidth



UL Japan, Inc.

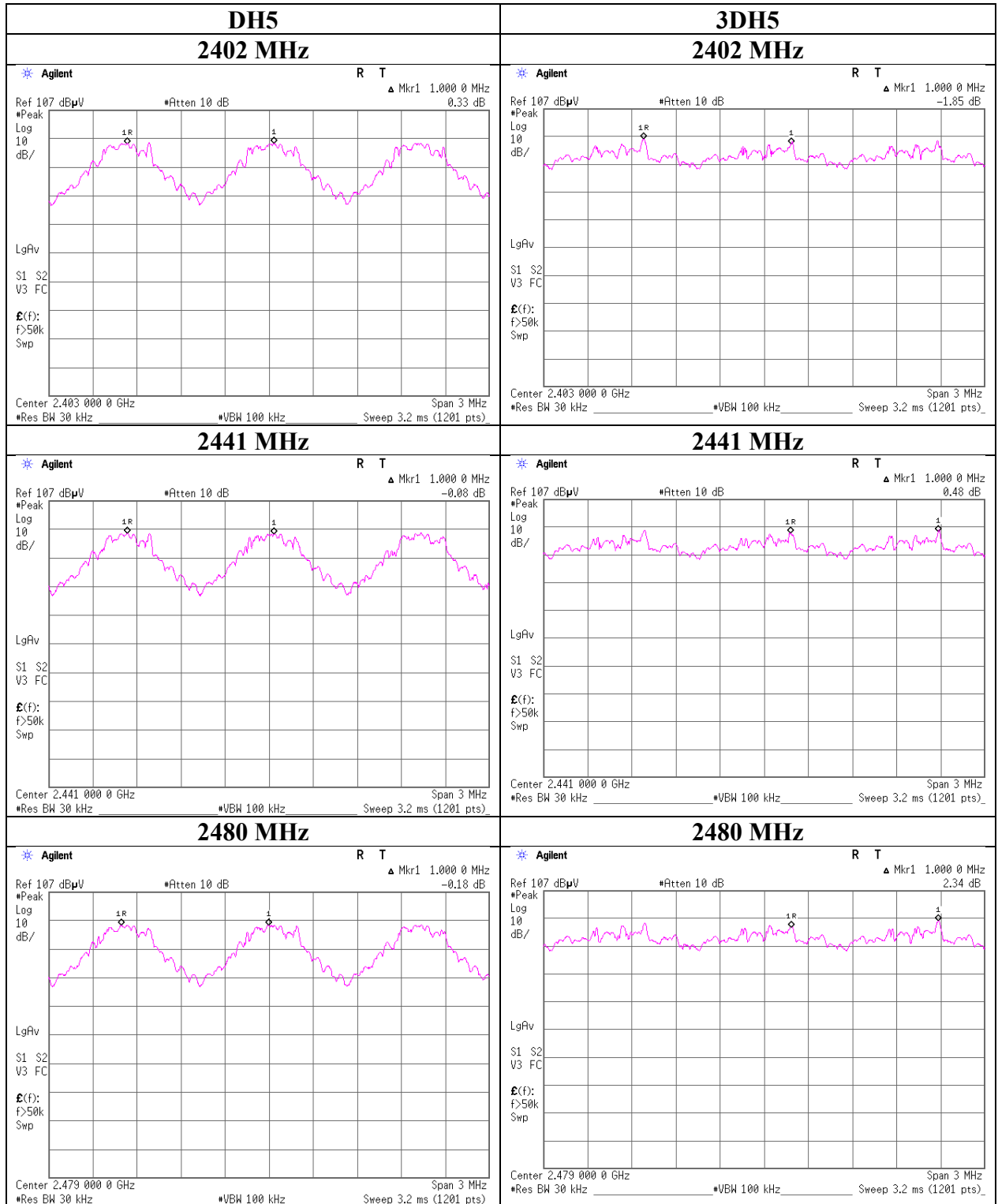
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Carrier Frequency Separation



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

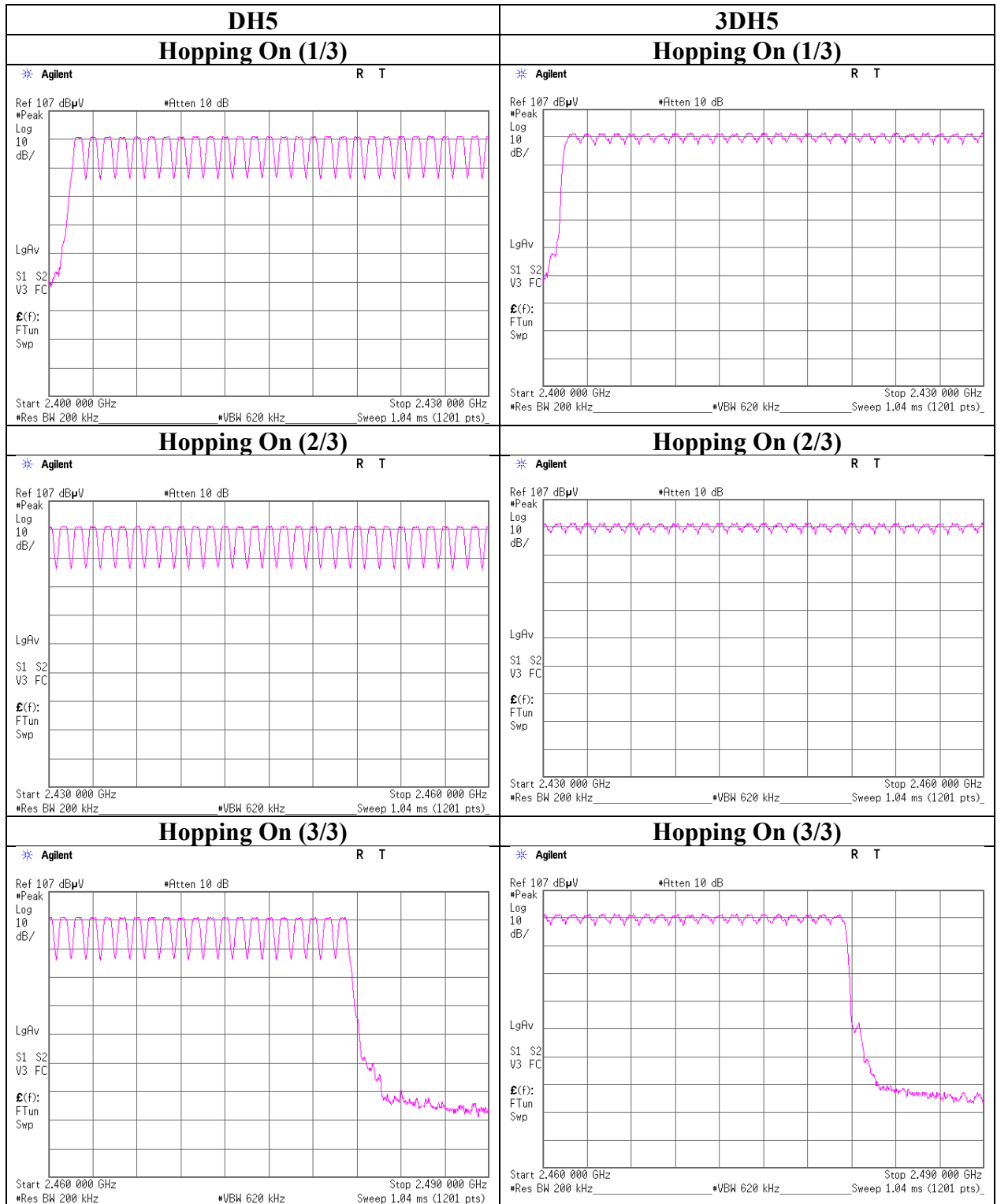
Number of Hopping Frequency

Report No. 13181388H
Test place Ise EMC Lab. No.3 Measurement Room
Date December 23, 2019
Temperature / Humidity 21 deg. C / 32 % RH
Engineer Akihiko Maeda
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



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

Dwell time

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
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	0.373	118	400
DH3	25.0 times	/	5 sec. x	31.6 sec. = 158 times	1.630	258	400
DH5	21.8 times	/	5 sec. x	31.6 sec. = 138 times	2.877	397	400
3DH1	50.4 times	/	5 sec. x	31.6 sec. = 319 times	0.381	122	400
3DH3	25.2 times	/	5 sec. x	31.6 sec. = 160 times	1.631	261	400
3DH5	20.0 times	/	5 sec. x	31.6 sec. = 127 times	2.883	366	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

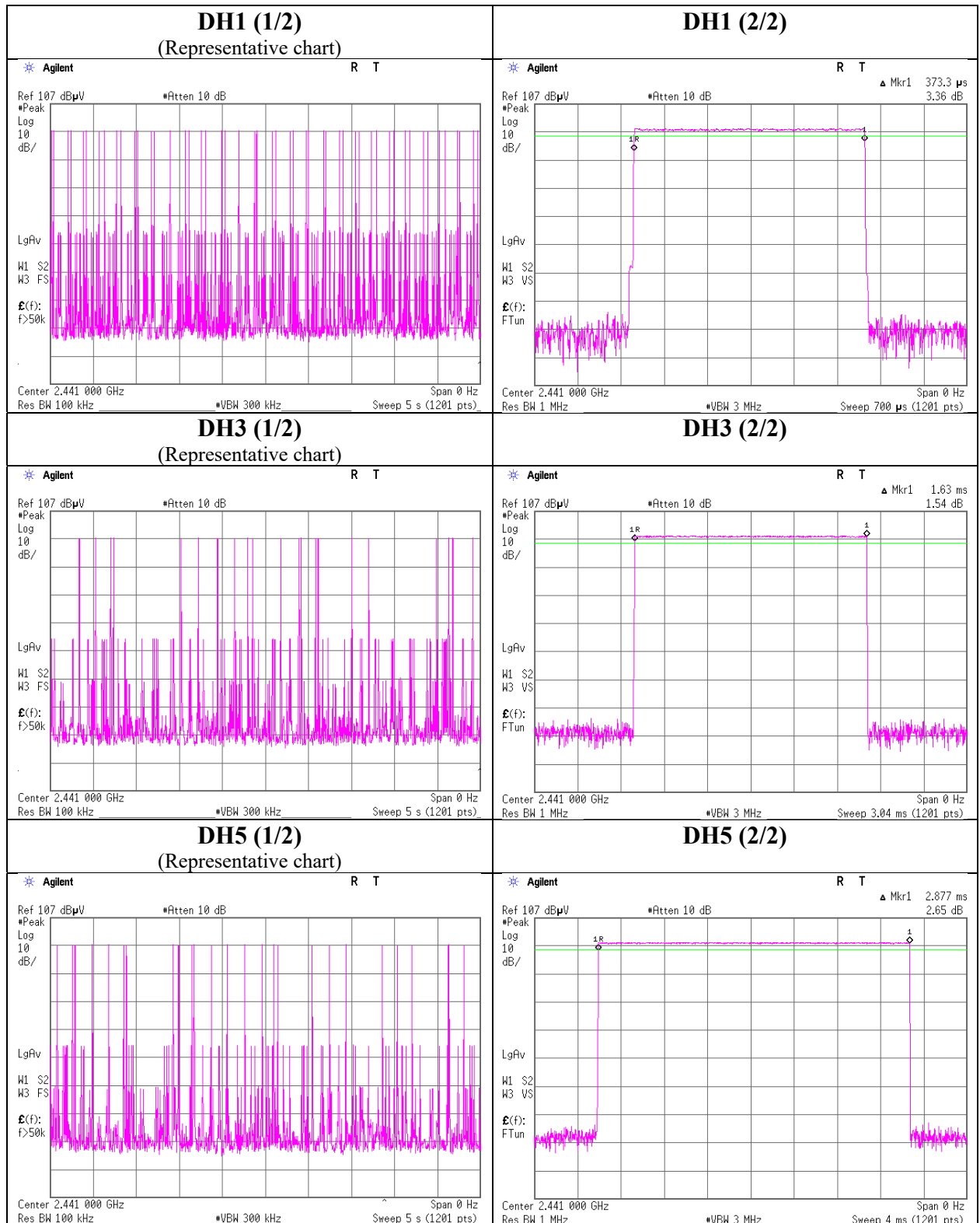
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	50	50	49	50	49.8
DH3	21	22	32	24	26	25
DH5	19	23	21	26	20	21.8
3DH1	51	51	49	51	50	50.4
3DH3	27	21	24	27	27	25.2
3DH5	22	21	18	17	22	20

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.

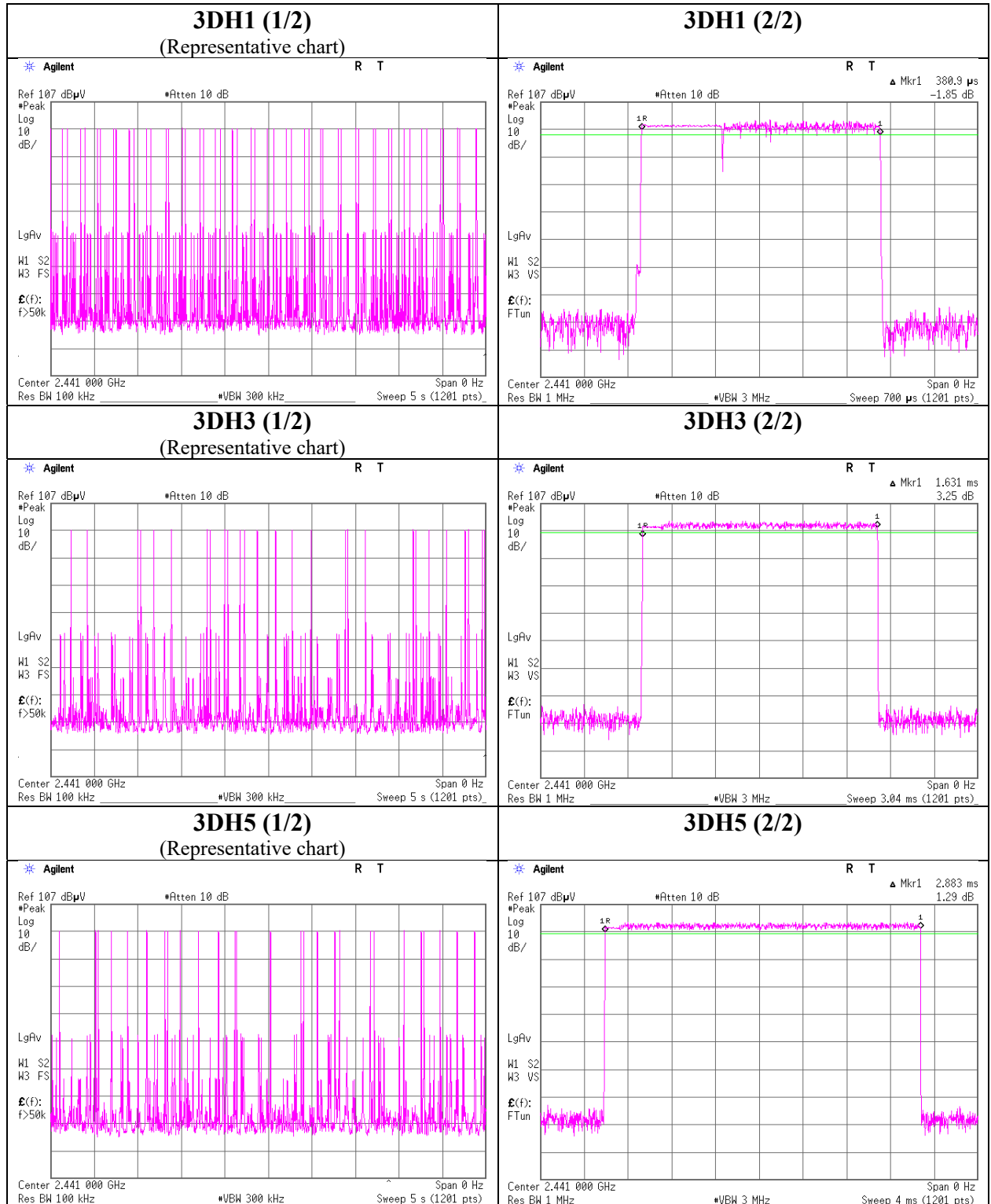
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Dwell time



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

Maximum Peak Output Power

Report No. 13181388H
Test place Ise EMC Lab. No.3 Measurement Room
Date December 23, 2019
Temperature / Humidity 21 deg. C / 32 % RH
Engineer Akihiko Maeda
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	-9.26	0.80	9.49	1.03	1.27	20.96	125	19.93	2.70	3.73	2.36	36.02	4000	32.29
DH5	2441.0	-9.03	0.80	9.49	1.26	1.34	20.96	125	19.70	2.70	3.96	2.49	36.02	4000	32.06
DH5	2480.0	-9.09	0.80	9.49	1.20	1.32	20.96	125	19.76	2.70	3.90	2.45	36.02	4000	32.12
2DH5	2402.0	-6.80	0.80	9.49	3.49	2.23	20.96	125	17.47	2.70	6.19	4.16	36.02	4000	29.83
2DH5	2441.0	-6.61	0.80	9.49	3.68	2.33	20.96	125	17.28	2.70	6.38	4.35	36.02	4000	29.64
2DH5	2480.0	-6.67	0.80	9.49	3.62	2.30	20.96	125	17.34	2.70	6.32	4.29	36.02	4000	29.70
3DH5	2402.0	-6.58	0.80	9.49	3.71	2.35	20.96	125	17.25	2.70	6.41	4.38	36.02	4000	29.61
3DH5	2441.0	-6.38	0.80	9.49	3.91	2.46	20.96	125	17.05	2.70	6.61	4.58	36.02	4000	29.41
3DH5	2480.0	-6.47	0.80	9.49	3.82	2.41	20.96	125	17.14	2.70	6.52	4.49	36.02	4000	29.50

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.

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

Average Output Power
(Reference data for RF Exposure)

Report No. 13181388H
Test place Ise EMC Lab. No.3 Measurement Room
Date December 23, 2019
Temperature / Humidity 21 deg. C / 32 % RH
Engineer Akihiko Maeda
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)	
					[dBm]	[mW]
DH5	2402.0	-10.90	0.80	9.49	-0.61	0.87
DH5	2441.0	-10.66	0.80	9.49	-0.37	0.92
DH5	2480.0	-10.72	0.80	9.49	-0.43	0.91
2DH5	2402.0	-10.83	0.80	9.49	-0.54	0.88
2DH5	2441.0	-10.62	0.80	9.49	-0.33	0.93
2DH5	2480.0	-10.65	0.80	9.49	-0.36	0.92
3DH5	2402.0	-10.82	0.80	9.49	-0.53	0.89
3DH5	2441.0	-10.58	0.80	9.49	-0.29	0.94
3DH5	2480.0	-10.63	0.80	9.49	-0.34	0.92

Sample Calculation:

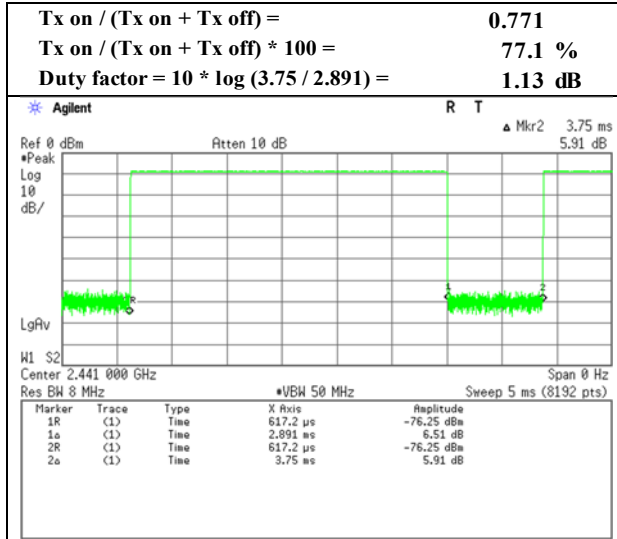
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

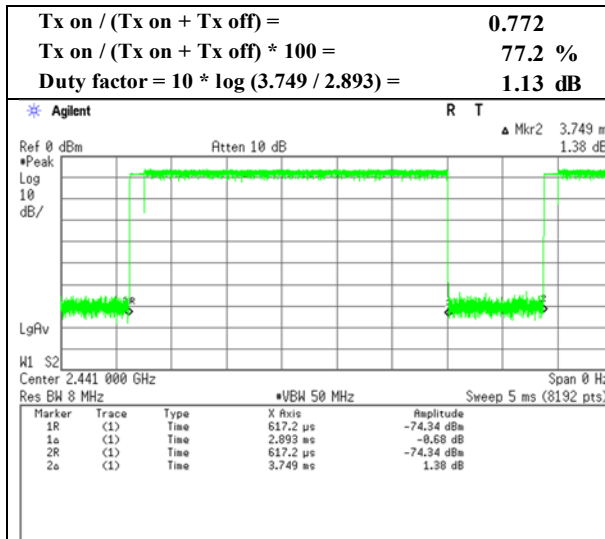
Burst Rate Confirmation

Report No. 13181388H
Test place Ise EMC Lab. No.3 Measurement Room
Date December 23, 2019
Temperature / Humidity 21 deg. C / 32 % RH
Engineer Akihiko Maeda
Mode Tx, Hopping Off

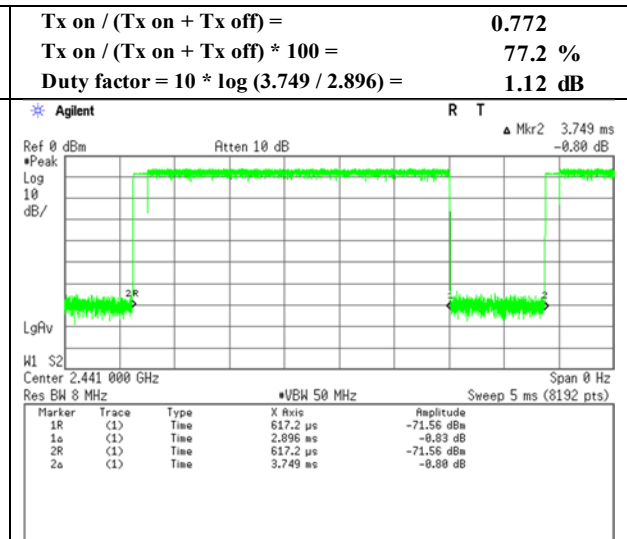
DH5



2DH5



3DH5



Radiated Spurious Emission

Report No.	13181388H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	January 6, 2020	January 7, 2020	January 8, 2020
Temperature / Humidity	17 deg. C / 32 % RH	18 deg. C / 35 % RH	22 deg. C / 43 % RH
Engineer	Takumi Shimada	Takumi Shimada	Takumi Shimada
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(30 MHz -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.	80.590	QP	44.4	6.9	8.2	32.1	-	27.4	40.0	12.6	
Hori.	131.620	QP	37.5	13.9	8.8	32.1	-	28.1	43.5	15.4	
Hori.	323.222	QP	39.7	14.3	10.3	31.9	-	32.3	46.0	13.7	
Hori.	360.547	QP	34.4	15.1	10.5	31.9	-	28.0	46.0	18.0	
Hori.	432.646	QP	35.4	16.3	11.0	32.0	-	30.8	46.0	15.2	
Hori.	576.942	QP	28.1	18.6	11.8	32.0	-	26.5	46.0	19.6	
Hori.	2390.000	PK	45.2	27.9	5.9	31.9	-	47.1	73.9	26.8	
Hori.	4804.000	PK	42.5	31.7	8.1	31.3	-	50.9	73.9	23.0	Floor noise
Hori.	7206.000	PK	42.6	36.2	9.5	32.4	-	56.0	73.9	18.0	Floor noise
Hori.	9608.000	PK	42.2	38.0	10.4	32.8	-	57.8	73.9	16.1	Floor noise
Hori.	2390.000	AV	33.4	27.9	5.9	31.9	1.1	36.5	53.9	17.5	*1)
Hori.	4804.000	AV	32.5	31.7	8.1	31.3	-	41.0	53.9	13.0	Floor noise
Hori.	7206.000	AV	33.5	36.2	9.5	32.4	-	46.8	53.9	7.1	Floor noise
Hori.	9608.000	AV	31.5	38.0	10.4	32.8	-	47.1	53.9	6.8	Floor noise
Vert.	80.613	QP	42.3	6.9	8.2	32.1	-	25.3	40.0	14.7	
Vert.	131.600	QP	41.9	13.9	8.8	32.1	-	32.5	43.5	11.0	
Vert.	323.282	QP	38.0	14.3	10.3	31.9	-	30.6	46.0	15.4	
Vert.	360.577	QP	38.9	15.1	10.5	31.9	-	32.5	46.0	13.5	
Vert.	432.726	QP	43.7	16.3	11.0	32.0	-	39.1	46.0	6.9	
Vert.	576.972	QP	34.5	18.6	11.8	32.0	-	32.9	46.0	13.2	
Vert.	2390.000	PK	48.3	27.9	5.9	31.9	-	50.2	73.9	23.7	
Vert.	4804.000	PK	43.5	31.7	8.1	31.3	-	52.0	73.9	21.9	Floor noise
Vert.	7206.000	PK	43.3	36.2	9.5	32.4	-	56.6	73.9	17.3	Floor noise
Vert.	9608.000	PK	40.9	38.0	10.4	32.8	-	56.5	73.9	17.4	Floor noise
Vert.	2390.000	AV	34.5	27.9	5.9	31.9	1.1	37.6	53.9	16.3	*1)
Vert.	4804.000	AV	32.5	31.7	8.1	31.3	-	41.0	53.9	12.9	Floor noise
Vert.	7206.000	AV	32.8	36.2	9.5	32.4	-	46.1	53.9	7.8	Floor noise
Vert.	9608.000	AV	31.6	38.0	10.4	32.8	-	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 (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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	96.9	27.9	5.9	31.9	98.8	-	-	Carrier
Hori.	2400.000	PK	44.0	27.9	5.9	31.9	45.9	78.8	32.9	
Vert.	2402.000	PK	96.8	27.9	5.9	31.9	98.7	-	-	Carrier
Vert.	2400.000	PK	44.0	27.9	5.9	31.9	45.9	78.7	32.8	

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

UL Japan, Inc.

Ise EMC Lab.

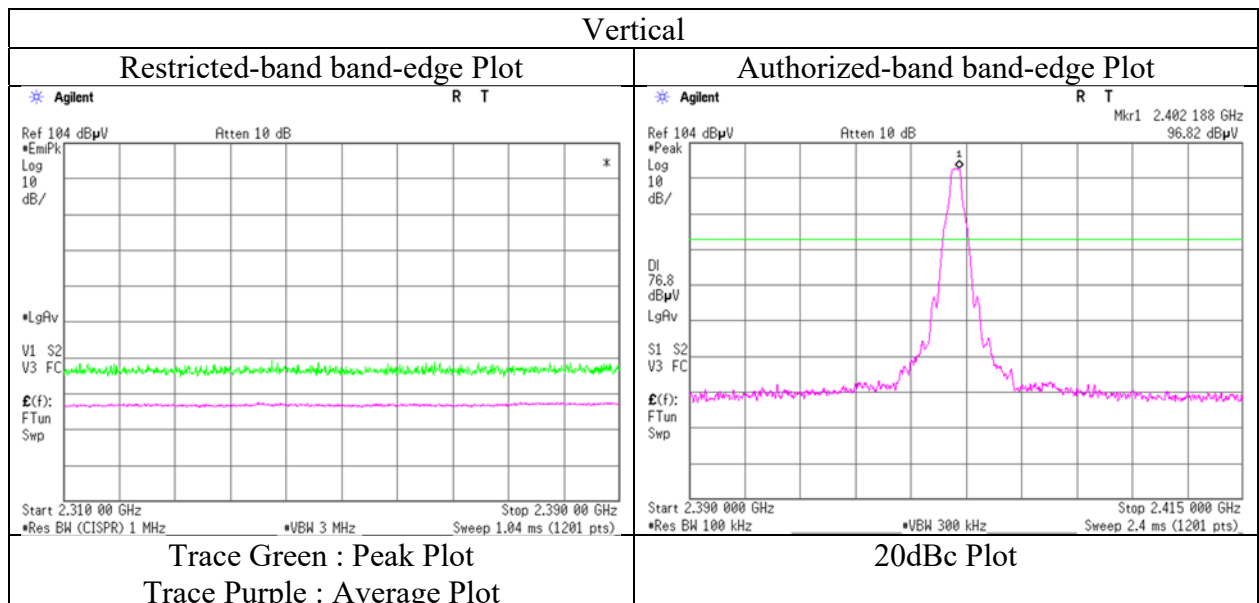
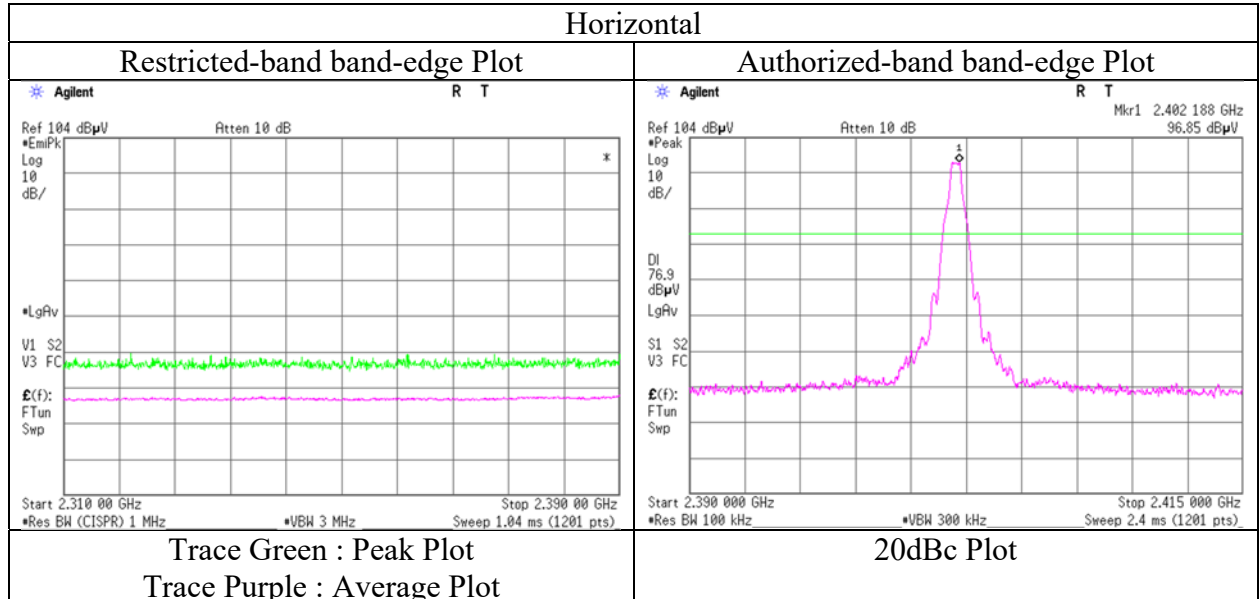
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13181388H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	January 6, 2020
Temperature / Humidity	17 deg. C / 32 % RH
Engineer	Takumi Shimada
	(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.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	13181388H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	January 6, 2020	January 7, 2020	January 8, 2020
Temperature / Humidity	17 deg. C / 32 % RH	18 deg. C / 35 % RH	22 deg. C / 43 % RH
Engineer	Takumi Shimada	Takumi Shimada	Takumi Shimada
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(30 MHz -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.	72.080	QP	43.3	6.3	8.1	32.1	-	25.5	40.0	14.5	
Hori.	131.610	QP	36.4	13.9	8.8	32.1	-	27.0	43.5	16.5	
Hori.	323.222	QP	40.3	14.3	10.3	31.9	-	32.9	46.0	13.1	
Hori.	360.547	QP	33.9	15.1	10.5	31.9	-	27.5	46.0	18.5	
Hori.	432.646	QP	35.6	16.3	11.0	32.0	-	31.0	46.0	15.0	
Hori.	576.942	QP	28.5	18.6	11.8	32.0	-	26.9	46.0	19.2	
Hori.	4882.000	PK	41.0	31.6	8.1	31.2	-	49.4	73.9	24.5	Floor noise
Hori.	7323.000	PK	42.0	36.5	9.5	32.5	-	55.6	73.9	18.3	Floor noise
Hori.	9764.000	PK	41.8	38.3	10.5	32.9	-	57.7	73.9	16.2	Floor noise
Hori.	4882.000	AV	30.2	31.6	8.1	31.2	-	38.6	53.9	15.3	Floor noise
Hori.	7323.000	AV	31.4	36.5	9.5	32.5	-	44.9	53.9	9.0	Floor noise
Hori.	9764.000	AV	31.4	38.3	10.5	32.9	-	47.3	53.9	6.6	Floor noise
Vert.	72.092	QP	47.8	6.3	8.1	32.1	-	30.0	40.0	10.0	
Vert.	131.630	QP	38.3	13.9	8.8	32.1	-	28.9	43.5	14.6	
Vert.	323.282	QP	42.1	14.3	10.3	31.9	-	34.7	46.0	11.3	
Vert.	360.577	QP	40.6	15.1	10.5	31.9	-	34.2	46.0	11.8	
Vert.	432.726	QP	43.6	16.3	11.0	32.0	-	39.0	46.0	7.0	
Vert.	576.726	QP	30.4	18.6	11.8	32.0	-	28.7	46.0	17.3	
Vert.	4882.000	PK	40.6	31.6	8.1	31.2	-	49.0	73.9	24.9	Floor noise
Vert.	7332.000	PK	41.6	36.5	9.5	32.5	-	55.2	73.9	18.7	Floor noise
Vert.	9764.000	PK	41.8	38.3	10.5	32.9	-	57.7	73.9	16.3	Floor noise
Vert.	4882.000	AV	28.6	31.6	8.1	31.2	-	37.0	53.9	16.9	Floor noise
Vert.	7332.000	AV	31.4	36.5	9.5	32.5	-	44.9	53.9	9.0	Floor noise
Vert.	9764.000	AV	31.4	38.3	10.5	32.9	-	47.2	53.9	6.7	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 (4.0 m / 3.0 m) = 2.5 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13181388H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	January 6, 2020	January 7, 2020	January 8, 2020
Temperature / Humidity	17 deg. C / 32 % RH	18 deg. C / 35 % RH	22 deg. C / 43 % RH
Engineer	Takumi Shimada	Takumi Shimada	Takumi Shimada
	(1 GHz -10 GHz)	(10 GHz -26.5 GHz)	(30 MHz -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.	72.080	QP	42.3	6.3	8.1	32.1	-	24.5	40.0	15.5	
Hori.	131.610	QP	31.4	13.9	8.8	32.1	-	22.0	43.5	21.5	
Hori.	323.222	QP	39.6	14.3	10.3	31.9	-	32.2	46.0	13.8	
Hori.	360.547	QP	32.8	15.1	10.5	31.9	-	26.4	46.0	19.6	
Hori.	432.646	QP	36.0	16.3	11.0	32.0	-	31.4	46.0	14.6	
Hori.	576.942	QP	28.2	18.6	11.8	32.0	-	26.6	46.0	19.5	
Hori.	2483.500	PK	44.2	27.7	6.0	31.8	-	46.0	73.9	27.9	
Hori.	4960.000	PK	40.0	31.6	8.1	31.2	-	48.5	73.9	25.4	Floor noise
Hori.	7440.000	PK	40.2	36.6	9.5	32.5	-	53.8	73.9	20.1	Floor noise
Hori.	9920.000	PK	41.5	38.5	10.5	33.0	-	57.5	73.9	16.4	Floor noise
Hori.	2483.500	AV	33.9	27.7	6.0	31.8	1.1	36.9	53.9	17.0	*1)
Hori.	4960.000	AV	30.8	31.6	8.1	31.2	-	39.3	53.9	14.6	Floor noise
Hori.	7440.000	AV	31.7	36.6	9.5	32.5	-	45.3	53.9	8.6	Floor noise
Hori.	9920.000	AV	31.6	38.5	10.5	33.0	-	47.7	53.9	6.2	Floor noise
Vert.	72.092	QP	47.1	6.3	8.1	32.1	-	29.3	40.0	10.7	
Vert.	131.630	QP	39.6	13.9	8.8	32.1	-	30.2	43.5	13.3	
Vert.	323.282	QP	41.8	14.3	10.3	31.9	-	34.4	46.0	11.6	
Vert.	360.577	QP	40.3	15.1	10.5	31.9	-	33.9	46.0	12.1	
Vert.	432.726	QP	43.7	16.3	11.0	32.0	-	39.1	46.0	6.9	
Vert.	576.726	QP	30.2	18.6	11.8	32.0	-	28.5	46.0	17.5	
Vert.	2483.500	PK	43.2	27.7	6.0	31.8	-	45.0	73.9	28.9	
Vert.	4960.000	PK	40.2	31.6	8.1	31.2	-	48.7	73.9	25.2	Floor noise
Vert.	7440.000	PK	41.0	36.6	9.5	32.5	-	54.6	73.9	19.3	Floor noise
Vert.	9920.000	PK	41.0	38.5	10.5	33.0	-	57.1	73.9	16.8	Floor noise
Vert.	2483.500	AV	34.0	27.7	6.0	31.8	1.1	36.9	53.9	17.0	*1)
Vert.	4960.000	AV	31.0	31.6	8.1	31.2	-	39.5	53.9	14.4	Floor noise
Vert.	7440.000	AV	31.5	36.6	9.5	32.5	-	45.1	53.9	8.8	Floor noise
Vert.	9920.000	AV	31.7	38.5	10.5	33.0	-	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

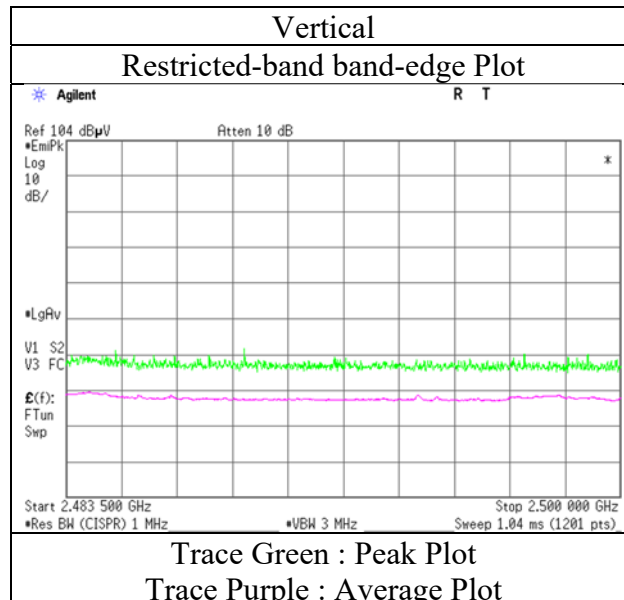
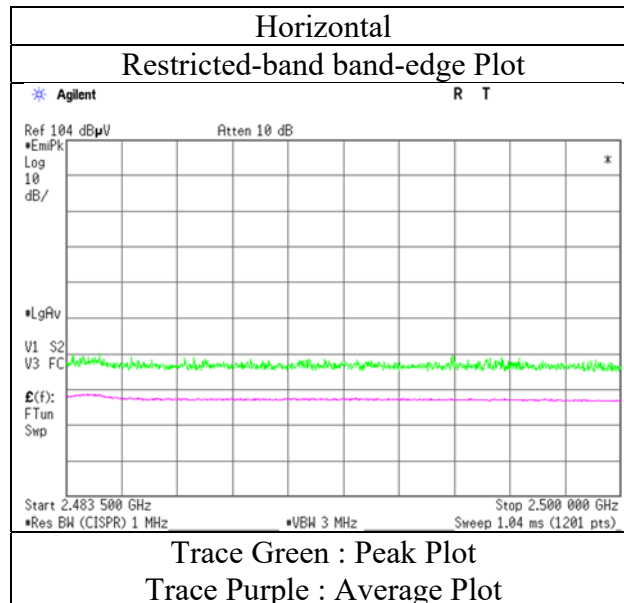
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13181388H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	January 6, 2020
Temperature / Humidity	17 deg. C / 32 % RH
Engineer	Takumi Shimada (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.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 13181388H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date January 7, 2020 January 8, 2020
Temperature / Humidity 18 deg. C / 35 % RH 22 deg. C / 43 % RH
Engineer Takumi Shimada Takumi Shimada
(1 GHz -26.5 GHz) (30 MHz -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.	72.080	QP	43.3	6.3	8.1	32.1	-	25.5	40.0	14.5	
Hori.	131.610	QP	31.2	13.9	8.8	32.1	-	21.8	43.5	21.7	
Hori.	323.222	QP	39.8	14.3	10.3	31.9	-	32.4	46.0	13.6	
Hori.	360.547	QP	31.4	15.1	10.5	31.9	-	25.0	46.0	21.0	
Hori.	432.646	QP	35.2	16.3	11.0	32.0	-	30.6	46.0	15.4	
Hori.	576.942	QP	28.0	18.6	11.8	32.0	-	26.4	46.0	19.7	
Hori.	2390.000	PK	44.0	27.9	5.9	31.9	-	45.9	73.9	28.0	
Hori.	4804.000	PK	39.4	31.7	8.1	31.3	-	47.8	73.9	26.1	Floor noise
Hori.	7206.000	PK	40.8	36.2	9.5	32.4	-	54.1	73.9	19.8	Floor noise
Hori.	9608.000	PK	40.4	38.0	10.4	32.8	-	56.0	73.9	17.9	Floor noise
Hori.	2390.000	AV	31.8	27.9	5.9	31.9	1.1	34.8	53.9	19.1	*1)
Hori.	4804.000	AV	31.0	31.7	8.1	31.3	-	39.4	53.9	14.5	Floor noise
Hori.	7206.000	AV	32.5	36.2	9.5	32.4	-	45.8	53.9	8.1	Floor noise
Hori.	9608.000	AV	31.6	38.0	10.4	32.8	-	47.2	53.9	6.7	Floor noise
Vert.	72.092	QP	47.5	6.3	8.1	32.1	-	29.7	40.0	10.3	
Vert.	131.630	QP	42.8	13.9	8.8	32.1	-	33.4	43.5	10.1	
Vert.	323.282	QP	40.9	14.3	10.3	31.9	-	33.5	46.0	12.5	
Vert.	360.577	QP	39.5	15.1	10.5	31.9	-	33.1	46.0	12.9	
Vert.	432.726	QP	44.1	16.3	11.0	32.0	-	39.5	46.0	6.5	
Vert.	576.726	QP	29.6	18.6	11.8	32.0	-	27.9	46.0	18.1	
Vert.	2390.000	PK	47.6	27.9	5.9	31.9	-	49.5	73.9	24.4	
Vert.	4804.000	PK	39.4	31.7	8.1	31.3	-	47.8	73.9	26.1	Floor noise
Vert.	7206.000	PK	41.0	36.2	9.5	32.4	-	54.3	73.9	19.6	Floor noise
Vert.	9608.000	PK	40.5	38.0	10.4	32.8	-	56.1	73.9	17.8	Floor noise
Vert.	2390.000	AV	33.8	27.9	5.9	31.9	1.1	36.8	53.9	17.1	*1)
Vert.	4804.000	AV	32.3	31.7	8.1	31.3	-	40.8	53.9	13.1	Floor noise
Vert.	7206.000	AV	32.0	36.2	9.5	32.4	-	45.3	53.9	8.6	Floor noise
Vert.	9608.000	AV	31.7	38.0	10.4	32.8	-	47.3	53.9	6.6	Floor noise

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

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

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

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

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	93.7	27.9	5.9	31.9	95.7	-	-	Carrier
Hori.	2400.000	PK	43.2	27.9	5.9	31.9	45.1	75.7	30.6	
Vert.	2402.000	PK	96.5	27.9	5.9	31.9	98.4	-	-	Carrier
Vert.	2400.000	PK	43.9	27.9	5.9	31.9	45.8	78.4	32.6	

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

UL Japan, Inc.

Ise EMC Lab.

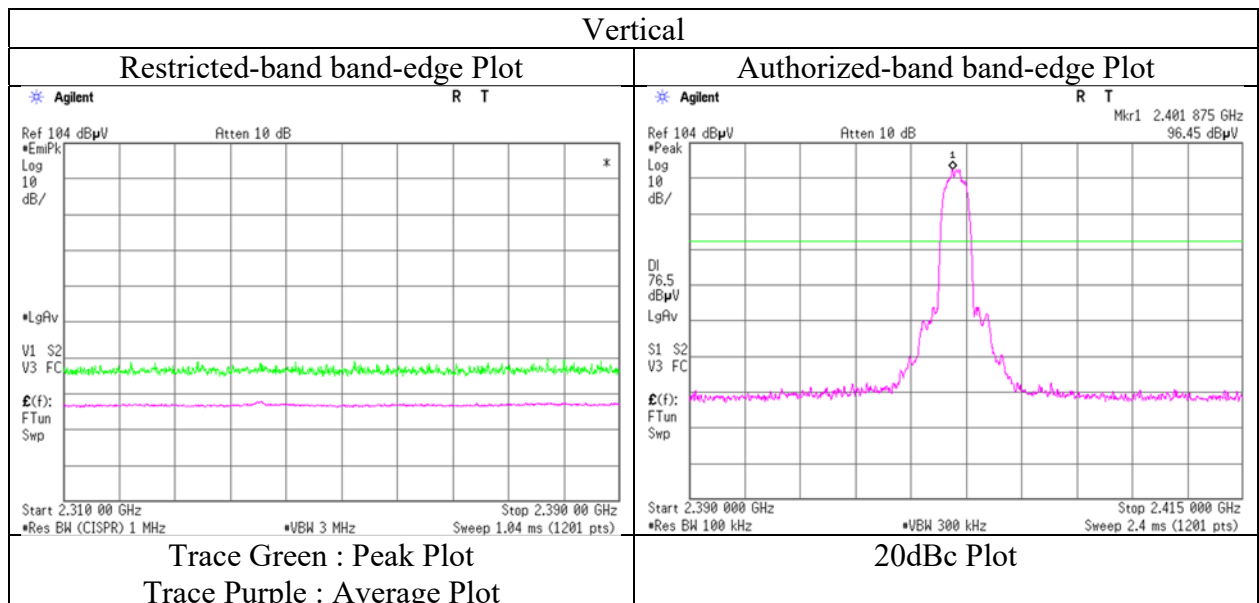
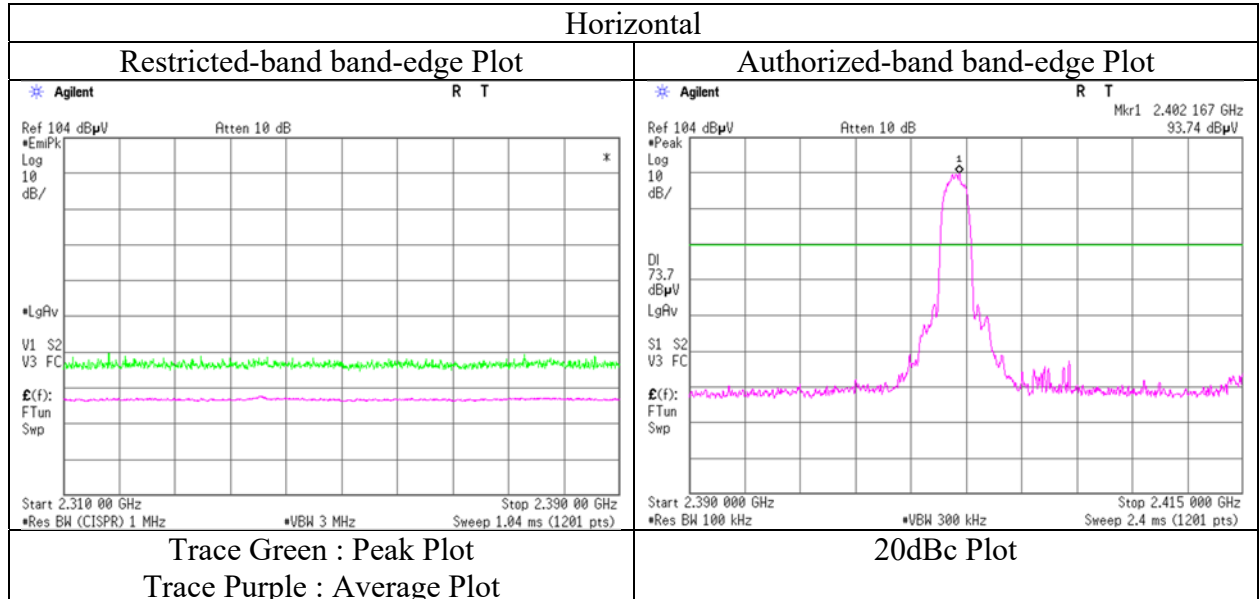
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13181388H	No.4
Test place	Ise EMC Lab.	January 8, 2020
Semi Anechoic Chamber	No.4	January 8, 2020
Date	January 7, 2020	22 deg. C / 43 % RH
Temperature / Humidity	18 deg. C / 35 % RH	Takumi Shimada
Engineer	Takumi Shimada	(30 MHz -1 GHz)
Mode	(1 GHz -10 GHz)	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.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 13181388H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date January 7, 2020 January 8, 2020
Temperature / Humidity 18 deg. C / 35 % RH 22 deg. C / 43 % RH
Engineer Takumi Shimada Takumi Shimada
(1 GHz -26.5 GHz) (30 MHz -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.	72.080	QP	45.3	6.3	8.1	32.1	-	27.5	40.0	12.5	
Hori.	131.610	QP	33.0	13.9	8.8	32.1	-	23.6	43.5	19.9	
Hori.	323.222	QP	39.5	14.3	10.3	31.9	-	32.1	46.0	13.9	
Hori.	360.547	QP	31.1	15.1	10.5	31.9	-	24.7	46.0	21.3	
Hori.	432.646	QP	34.6	16.3	11.0	32.0	-	30.0	46.0	16.0	
Hori.	576.942	QP	28.3	18.6	11.8	32.0	-	26.7	46.0	19.4	
Hori.	4882.000	PK	39.3	31.6	8.1	31.2	-	47.7	73.9	26.2	Floor noise
Hori.	7323.000	PK	41.1	36.5	9.5	32.5	-	54.7	73.9	19.2	Floor noise
Hori.	9764.000	PK	38.8	38.3	10.5	32.9	-	54.7	73.9	19.2	Floor noise
Hori.	4882.000	AV	30.8	31.6	8.1	31.2	-	39.2	53.9	14.7	Floor noise
Hori.	7323.000	AV	31.8	36.5	9.5	32.5	-	45.3	53.9	8.6	Floor noise
Hori.	9764.000	AV	30.4	38.3	10.5	32.9	-	46.2	53.9	7.7	Floor noise
Vert.	72.092	QP	49.1	6.3	8.1	32.1	-	31.3	40.0	8.7	
Vert.	131.630	QP	38.6	13.9	8.8	32.1	-	29.2	43.5	14.3	
Vert.	323.282	QP	40.6	14.3	10.3	31.9	-	33.2	46.0	12.8	
Vert.	360.577	QP	39.6	15.1	10.5	31.9	-	33.2	46.0	12.8	
Vert.	432.726	QP	43.6	16.3	11.0	32.0	-	39.0	46.0	7.0	
Vert.	576.726	QP	29.6	18.6	11.8	32.0	-	27.9	46.0	18.1	
Vert.	4882.000	PK	40.9	31.6	8.1	31.2	-	49.4	73.9	24.5	Floor noise
Vert.	7323.000	PK	40.5	36.5	9.5	32.5	-	54.1	73.9	19.8	Floor noise
Vert.	9764.000	PK	40.0	38.3	10.5	32.9	-	55.9	73.9	18.0	Floor noise
Vert.	4882.000	AV	30.8	31.6	8.1	31.2	-	39.2	53.9	14.7	Floor noise
Vert.	7323.000	AV	31.7	36.5	9.5	32.5	-	45.3	53.9	8.6	Floor noise
Vert.	9764.000	AV	30.4	38.3	10.5	32.9	-	46.2	53.9	7.7	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 (4.0 m / 3.0 m) = 2.5 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13181388H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date January 7, 2020 January 8, 2020
Temperature / Humidity 18 deg. C / 35 % RH 22 deg. C / 43 % RH
Engineer Takumi Shimada Takumi Shimada
(1 GHz -26.5 GHz) (30 MHz -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.	72.080	QP	44.7	6.3	8.1	32.1	-	26.9	40.0	13.1	
Hori.	131.610	QP	33.7	13.9	8.8	32.1	-	24.3	43.5	19.2	
Hori.	323.222	QP	38.9	14.3	10.3	31.9	-	31.5	46.0	14.5	
Hori.	360.547	QP	30.4	15.1	10.5	31.9	-	24.0	46.0	22.0	
Hori.	432.646	QP	34.0	16.3	11.0	32.0	-	29.4	46.0	16.6	
Hori.	576.942	QP	28.4	18.6	11.8	32.0	-	26.8	46.0	19.3	
Hori.	2483.500	PK	44.2	27.7	6.0	31.8	-	46.1	73.9	27.8	
Hori.	4960.000	PK	39.1	31.6	8.1	31.2	-	47.6	73.9	26.3	Floor noise
Hori.	7440.000	PK	39.6	36.6	9.5	32.5	-	53.2	73.9	20.7	Floor noise
Hori.	9920.000	PK	39.5	38.5	10.5	33.0	-	55.5	73.9	18.4	Floor noise
Hori.	2483.500	AV	34.2	27.7	6.0	31.8	1.1	37.2	53.9	16.7	*1)
Hori.	4960.000	AV	32.1	31.6	8.1	31.2	-	40.6	53.9	13.3	Floor noise
Hori.	7440.000	AV	32.8	36.6	9.5	32.5	-	46.4	53.9	7.5	Floor noise
Hori.	9920.000	AV	31.2	38.5	10.5	33.0	-	47.2	53.9	6.7	Floor noise
Vert.	72.092	QP	48.8	6.3	8.1	32.1	-	31.0	40.0	9.0	
Vert.	131.630	QP	37.4	13.9	8.8	32.1	-	28.0	43.5	15.5	
Vert.	323.282	QP	40.0	14.3	10.3	31.9	-	32.6	46.0	13.4	
Vert.	360.577	QP	39.3	15.1	10.5	31.9	-	32.9	46.0	13.1	
Vert.	432.726	QP	43.5	16.3	11.0	32.0	-	38.9	46.0	7.1	
Vert.	576.726	QP	29.6	18.6	11.8	32.0	-	27.9	46.0	18.1	
Vert.	2483.500	PK	46.9	27.7	6.0	31.8	-	48.7	73.9	25.2	
Vert.	4960.000	PK	39.9	31.6	8.1	31.2	-	48.4	73.9	25.5	Floor noise
Vert.	7440.000	PK	40.0	36.6	9.5	32.5	-	53.5	73.9	20.4	Floor noise
Vert.	9920.000	PK	39.4	38.5	10.5	33.0	-	55.4	73.9	18.5	Floor noise
Vert.	2483.500	AV	33.6	27.7	6.0	31.8	1.1	36.6	53.9	17.3	*1)
Vert.	4960.000	AV	31.0	31.6	8.1	31.2	-	39.5	53.9	14.4	Floor noise
Vert.	7440.000	AV	31.3	36.6	9.5	32.5	-	44.8	53.9	9.1	Floor noise
Vert.	9920.000	AV	31.0	38.5	10.5	33.0	-	47.1	53.9	6.8	Floor noise

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

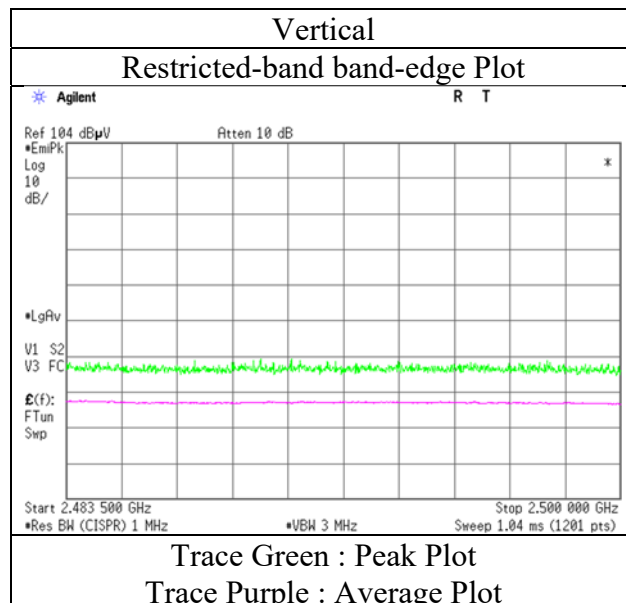
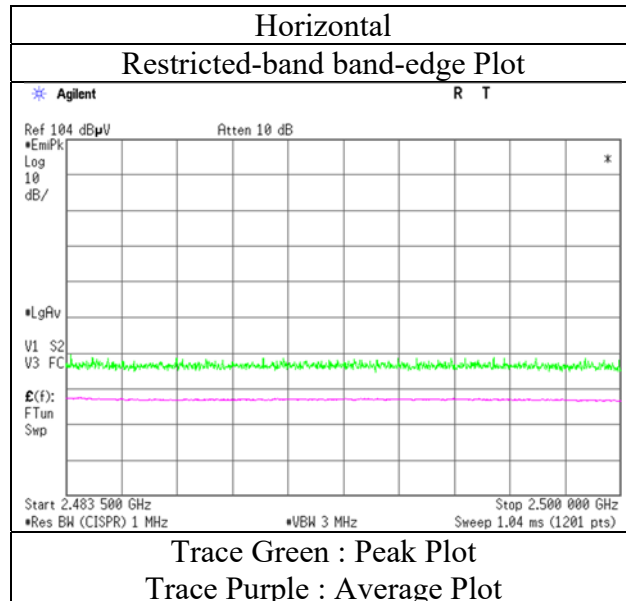
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

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

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

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

Report No. 13181388H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date January 7, 2020
Temperature / Humidity 18 deg. C / 35 % RH
Engineer Takumi Shimada
(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.

UL Japan, Inc.

Ise EMC Lab.

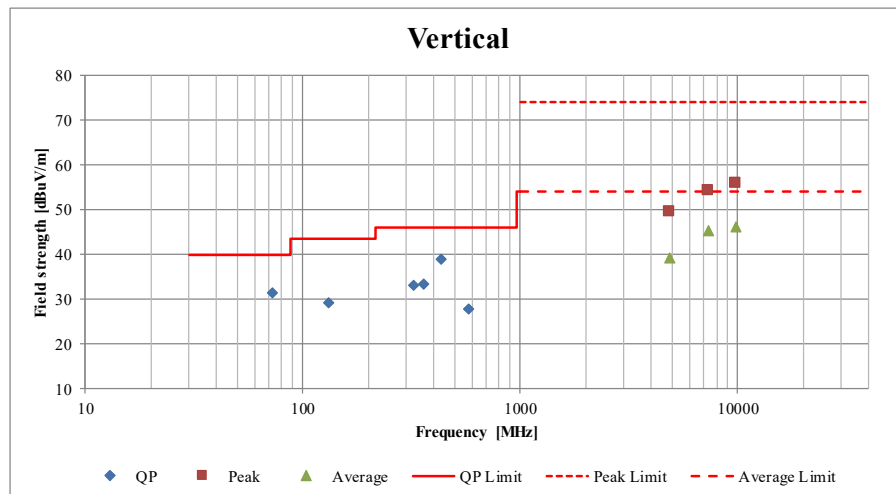
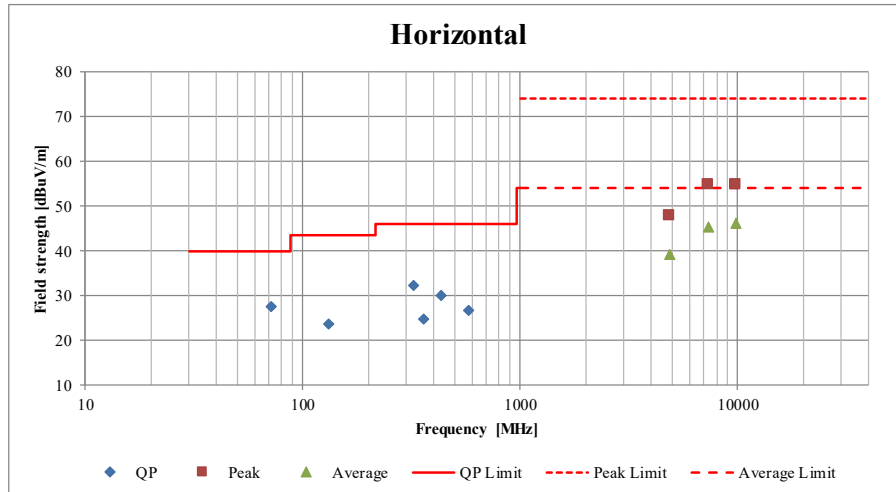
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Report No.	13181388H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	January 7, 2020	January 8, 2020
Temperature / Humidity	18 deg. C / 35 % RH	22 deg. C / 43 % RH
Engineer	Takumi Shimada	Takumi Shimada
	(1 GHz -26.5 GHz)	(30 MHz -1 GHz)
Mode	Tx, Hopping Off, 3DH5	2441 MHz

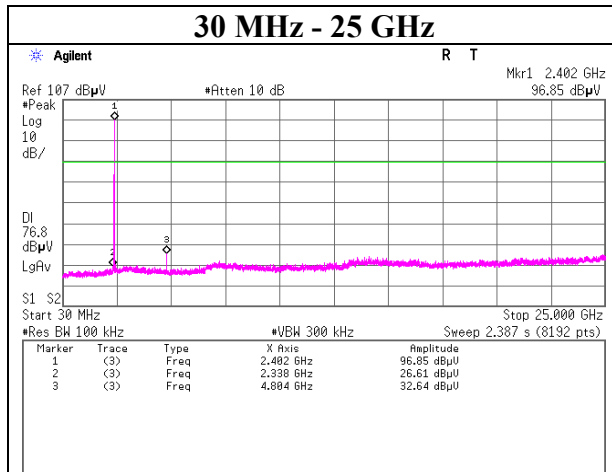
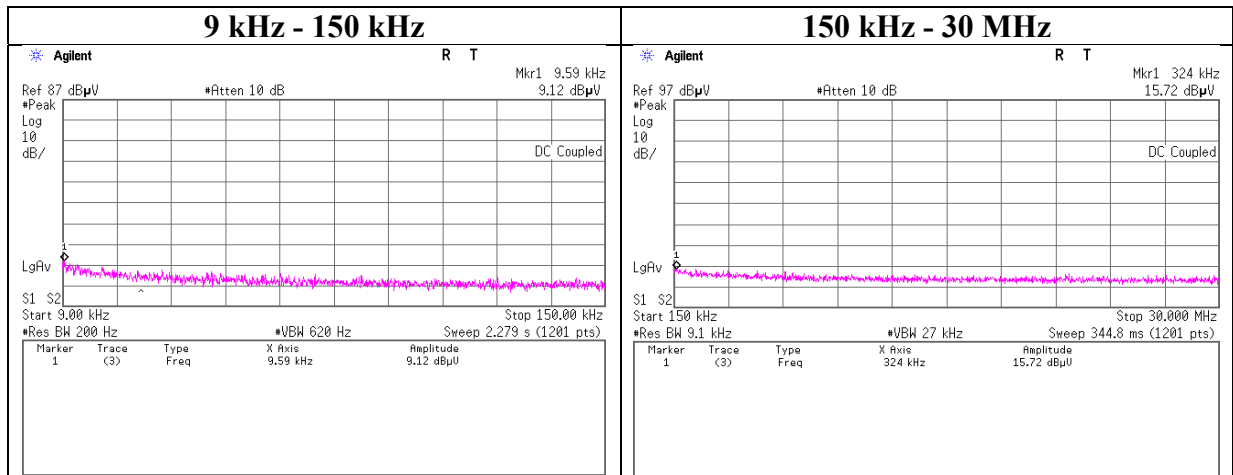


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off, DH5

2402 MHz



UL Japan, Inc.

Ise EMC Lab.

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

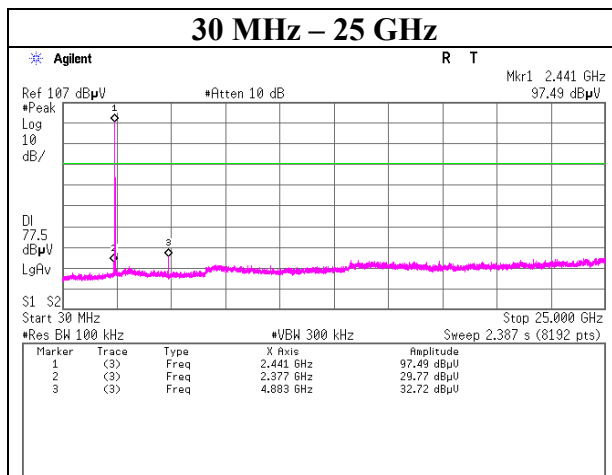
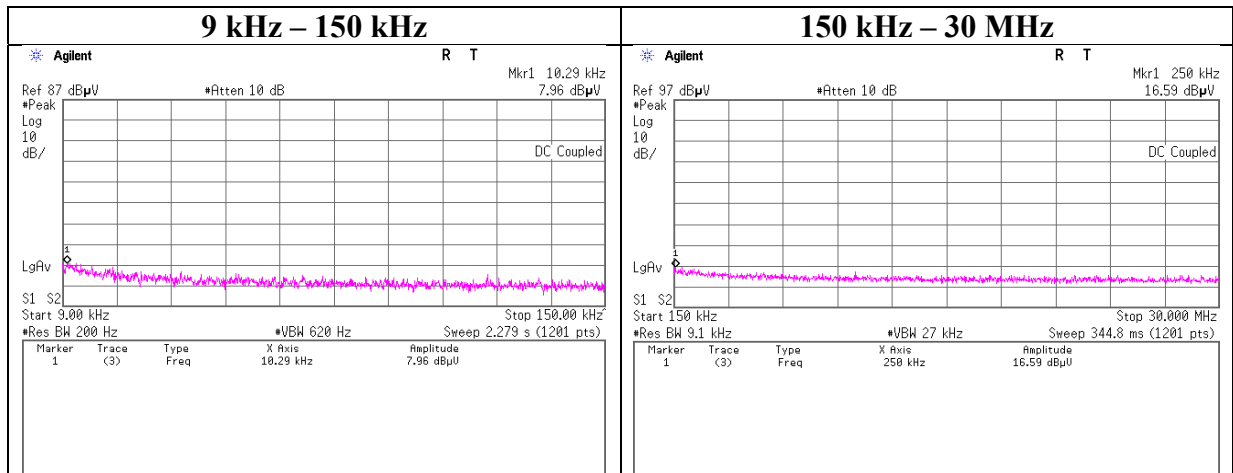
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off, DH5

2441 MHz



UL Japan, Inc.

Ise EMC Lab.

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

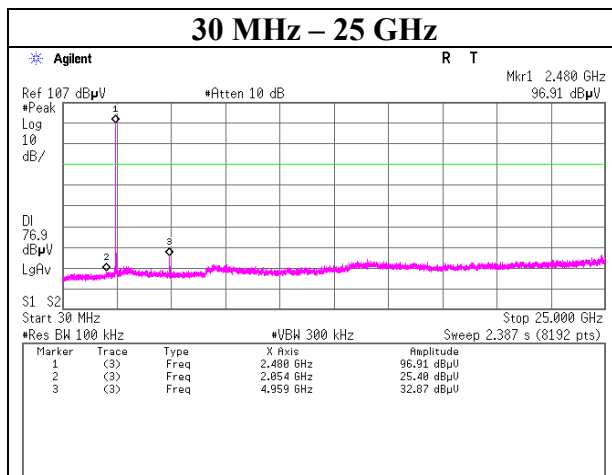
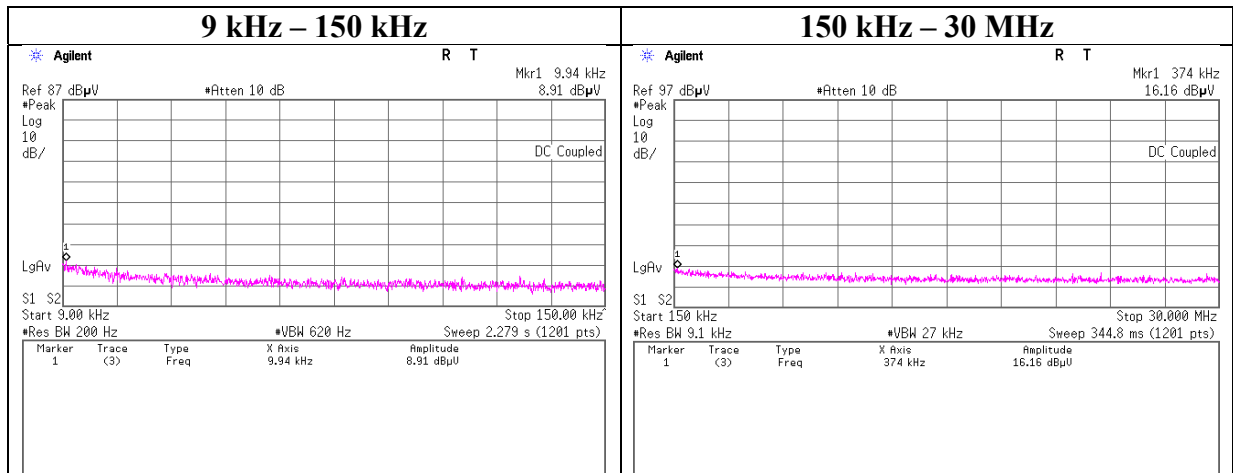
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off, DH5

2480 MHz



UL Japan, Inc.

Ise EMC Lab.

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

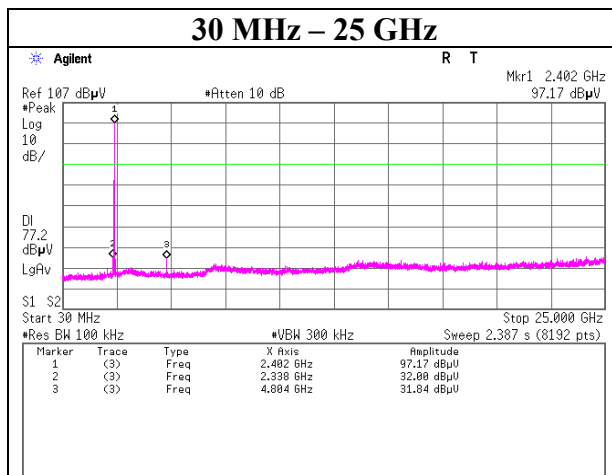
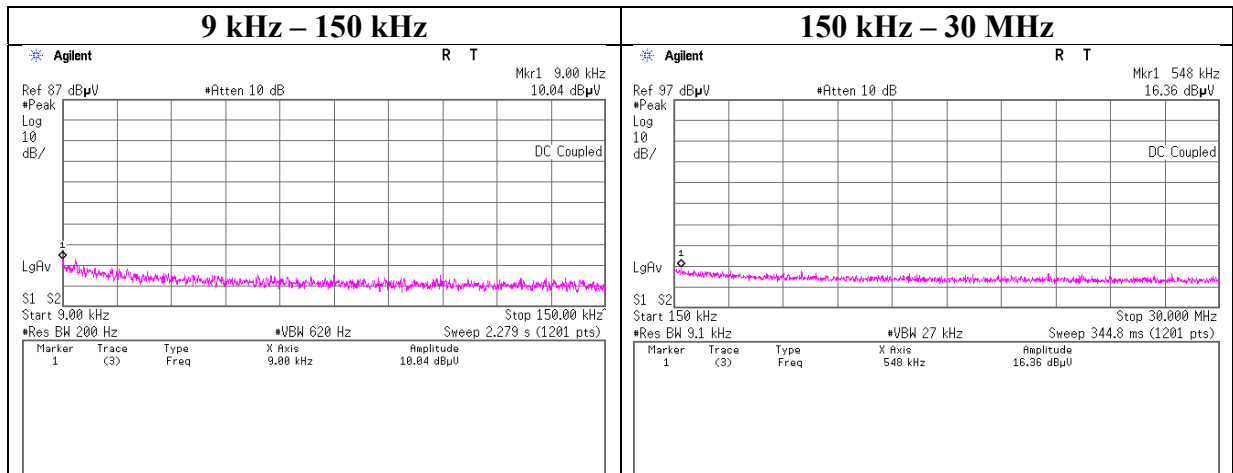
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off, 3DH5

2402 MHz



UL Japan, Inc.

Ise EMC Lab.

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

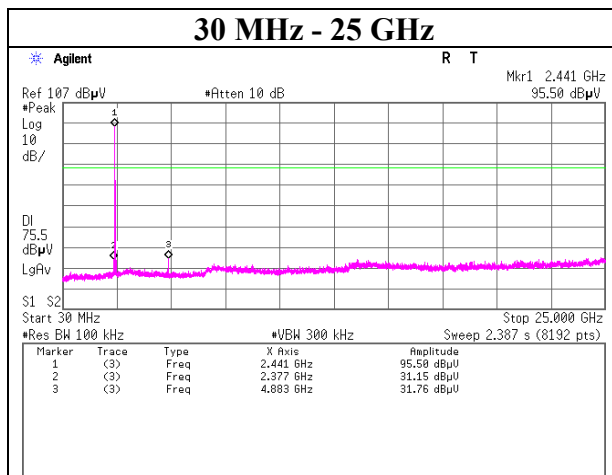
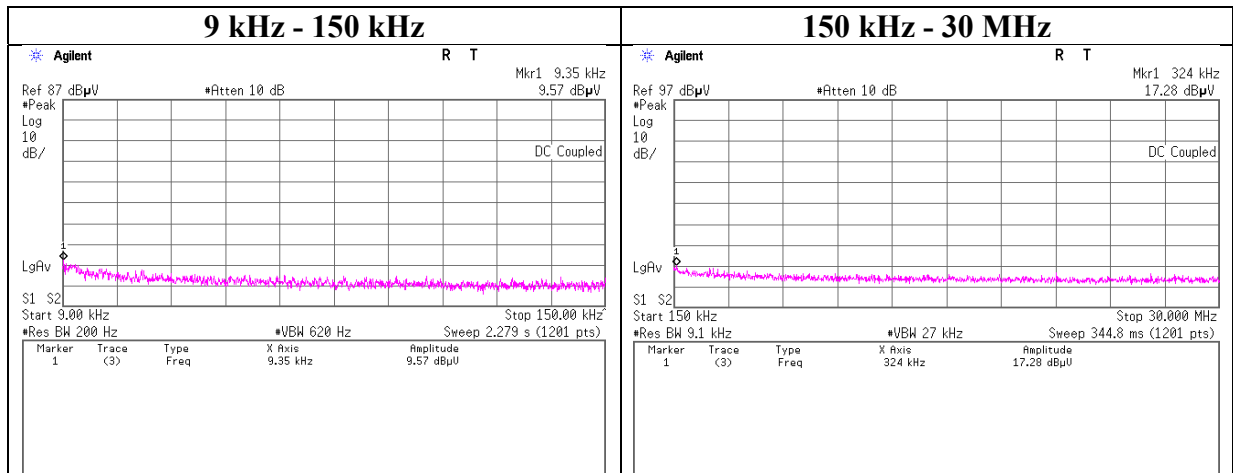
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off, 3DH5

2441 MHz



UL Japan, Inc.

Ise EMC Lab.

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

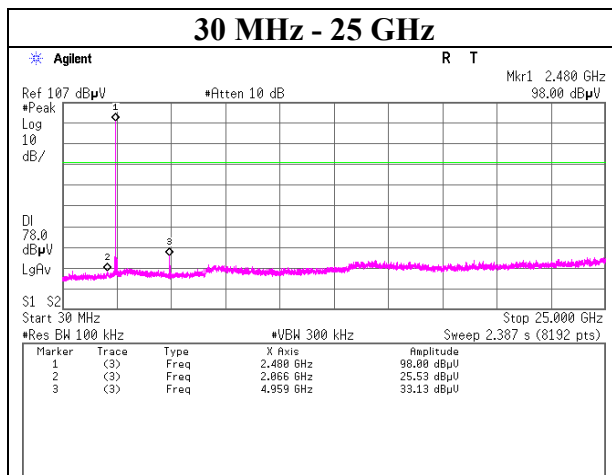
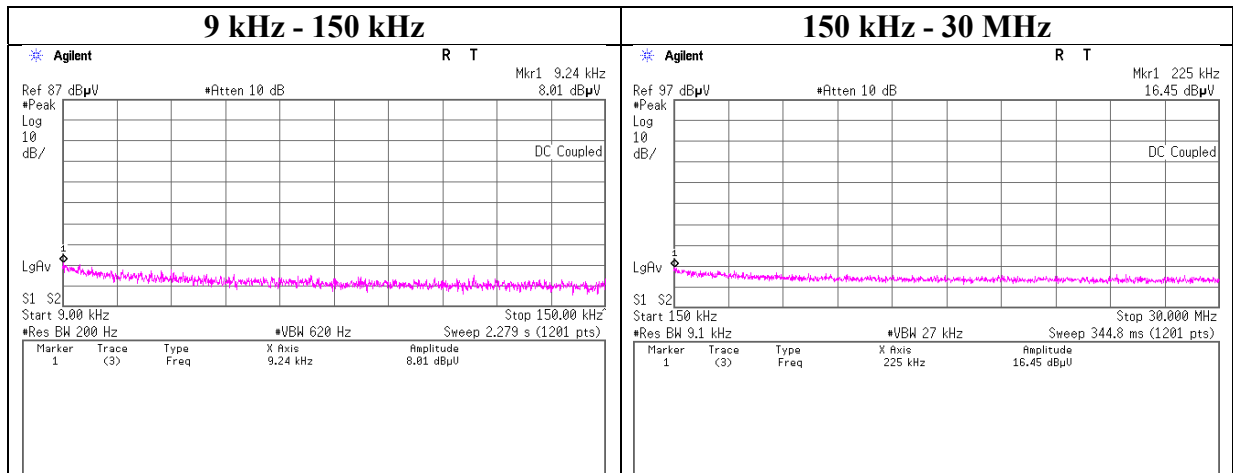
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx, Hopping Off, 3DH5

2480 MHz



UL Japan, Inc.

Ise EMC Lab.

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

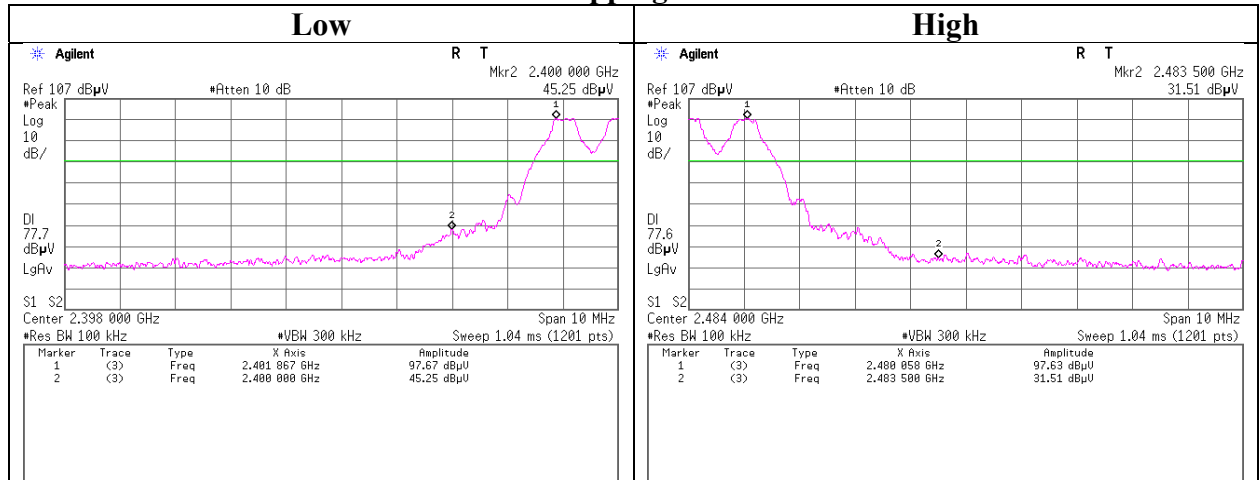
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

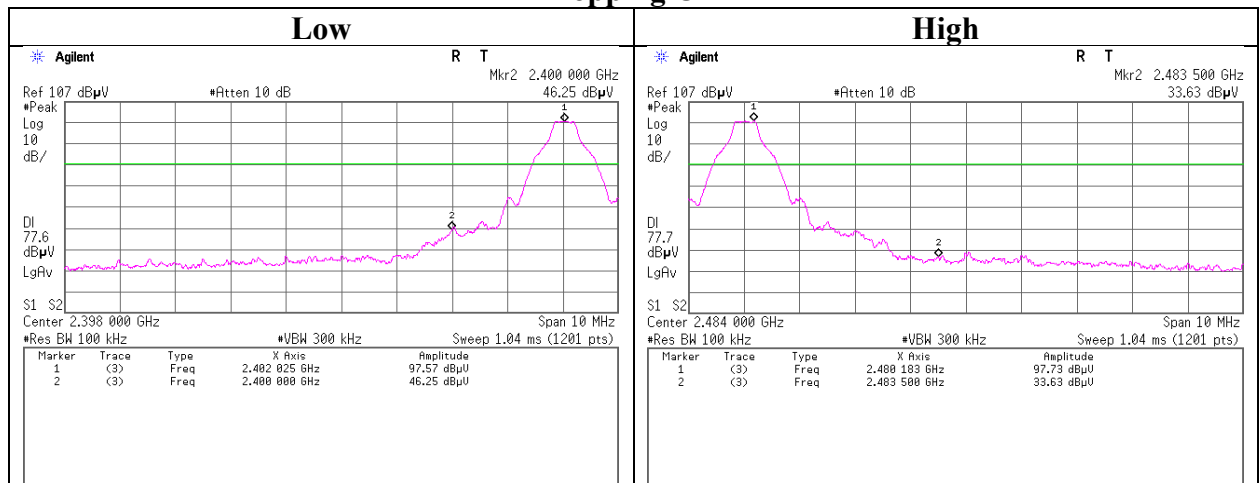
Conducted Emission Band Edge compliance

Report No. 13181388H
Test place Ise EMC Lab. No.3 Measurement Room
Date December 23, 2019
Temperature / Humidity 21 deg. C / 32 % RH
Engineer Akihiko Maeda
Mode Tx DH5

Hopping On



Hopping Off



UL Japan, Inc.

Ise EMC Lab.

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

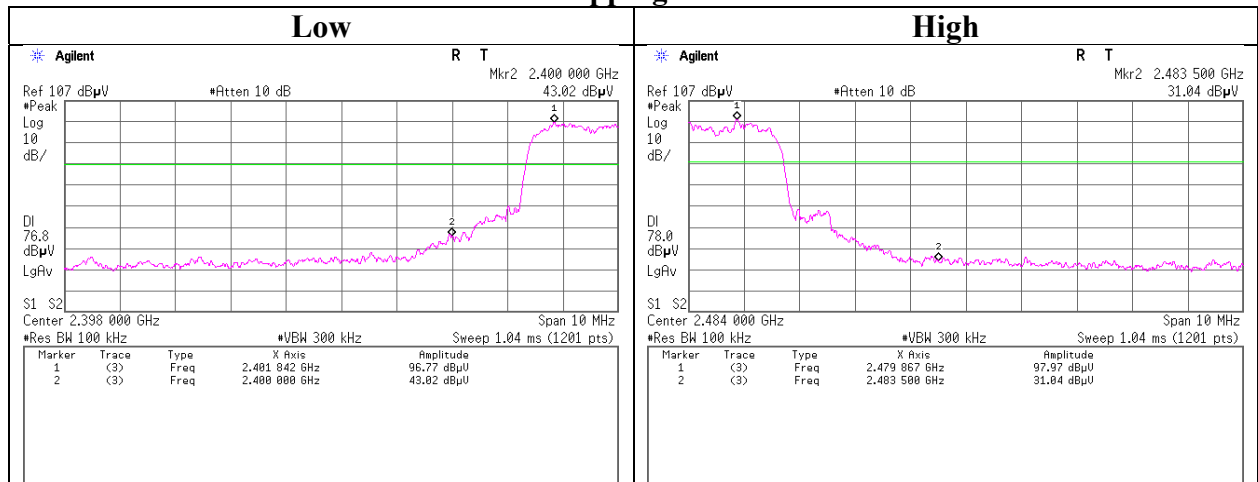
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

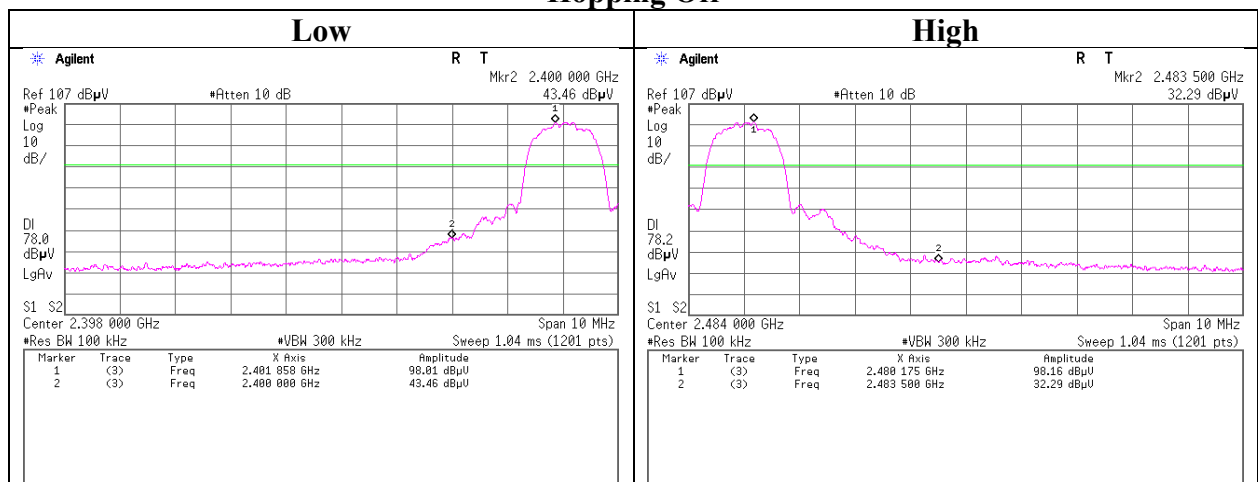
Conducted Emission Band Edge compliance

Report No.	13181388H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	December 23, 2019
Temperature / Humidity	21 deg. C / 32 % RH
Engineer	Akihiko Maeda
Mode	Tx 3DH5

Hopping On



Hopping Off



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

APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
AT	141900	Spectrum Analyzer	AGILENT	E4440A	MY46185823	11/20/2019	11/30/2020	12
AT	141810	Power Meter	ANRITSU	ML2495A	824014	10/09/2019	10/31/2020	12
AT	141832	Power sensor	ANRITSU	MA2411B	738174	10/09/2019	10/31/2020	12
AT	141223	Attenuator	Weinschel Associates	WA56-10	56100306	05/17/2019	05/31/2020	12
AT	141554	Thermo-Hygrometer	CUSTOM	CTH-180	1301	01/07/2020	01/31/2021	12
RE	141902	Spectrum Analyzer	AGILENT	E4440A	MY46187105	10/09/2019	10/31/2020	12
RE	142285	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-0003	-	-	-
RE	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	01/31/2021	12
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	04/30/2021	24
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/17/2019	06/30/2020	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	09/26/2019	09/30/2020	12
RE	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/11/2019	09/30/2020	12
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/16/2019	10/31/2020	12
RE	141267	Logperiodic Antenna(200-1000M Hz)	Schwarzbeck	VUSLP9111B	9111B-192	08/24/2019	08/31/2020	12
RE	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/02/2019	08/31/2020	12
RE	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/08/2019	02/29/2020	12
RE	141397	Coaxial Cable	UL Japan	-	-	06/18/2019	06/30/2020	12
RE	192303	Thermo-Hygrometer	CUSTOM	CTH-201	0014	12/19/2019	12/31/2020	12
RE	141506	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA91703 07	10/08/2019	10/31/2020	12
RE	141425	Biconical Antenna	Schwarzbeck	VHA9103+BBA9106	1302	08/24/2019	08/31/2020	12
RE	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2019	02/29/2020	12
CE	141357	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	07/05/2019	07/31/2020	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/08/2019	02/29/2020	12
CE	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	12/02/2019	12/31/2020	12
CE	141217	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W/SFM141/421-010/sucoform141-P	-/04178	06/18/2019	06/30/2020	12

*Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.

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

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

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

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

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124