



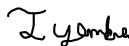
RADIO TEST REPORT

Test Report No. : 13473127S-A-R2

Applicant : TOPCON CORPORATION
Type of EUT : Bluetooth Module
Model Number of EUT : CYBT-333047-02
FCC ID : H5P-333047
Test regulation : FCC Part 15 Subpart C: 2020
* Bluetooth BDR/EDR part
Test Result : Complied (Refer to SECTION 3.2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
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 13473127S-A-R1. 13473127S-A-R1 is replaced with this report.

Date of test: August 24 to 27, 2020

Representative test engineer: 
Toshinori Yamada
Engineer
Consumer Technology Division

Approved by: 
Akio Hayashi
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".

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

REVISION HISTORY

Original Test Report No.: 13473127S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13473127S-A	September 25, 2020	-	-
1	13473127S-A-R1	October 8, 2020	5	Update of Rating: From “DC 3.3 V (DC 2.97 V – DC 3.6 V)” to “DC 3.3 V (DC 2.3 V – DC 3.6 V)”
2	13473127S-A-R2	October 26, 2020	9	Correction of Power settings: From “BDR: 0 dBm, EDR: 0 dBm” to “BDR: Fixed, EDR: Fixed”

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

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.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

CONTENTS	PAGE
SECTION 1: Customer information.....	5
SECTION 2: Equipment under test (EUT).....	5
SECTION 3: Test specification, procedures & results.....	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Conducted Emission.....	11
SECTION 6: Radiated Spurious Emission	12
SECTION 7: Antenna Terminal Conducted Tests.....	14
APPENDIX 1: Test data	15
Conducted Emission	15
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation	19
Number of Hopping Frequency	23
Dwell time.....	25
Maximum Peak Output Power.....	28
Average Output Power.....	29
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.....	53
Conducted Emission	53
Radiated Spurious Emission	54
Worst Case Position.....	55
Antenna Terminal Conducted Tests.....	56

SECTION 1: Customer information

Company Name	:	TOPCON CORPORATION
Address	:	75-1, Hasunuma-cho, Itabashi-ku, Tokyo, 174-8580 Japan
Telephone Number	:	+81-3-3558-2634
Facsimile Number	:	+81-3-3966-0038
Contact Person	:	Eiji Takeuchi

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT) other than the Receipt Date
- SECTION 4: Operation of EUT during testing

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

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type	:	Bluetooth Module
Model Number	:	CYBT-333047-02
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 3.3 V (DC 2.3 V – DC 3.6 V)
Receipt Date	:	May 13, 2020
Country of Mass-production	:	U.S.A.
Condition	:	Production model
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: CYBT-333047-02 (referred to as the EUT in this report) is a Bluetooth Module.

Radio Specification

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480MHz
Type of Modulation	:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna Type	:	$1/2 \lambda$ sleeve antenna
Antenna Gain	:	2.14 dBi
Clock frequency (Maxmum)	:	24 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

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	17.9 dB, 0.15000 MHz, N QP Mode: Tx DH5 2402 MHz	Complied a)	-
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(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: Section 15.247(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: Section 15.247(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: Section 15.247(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: Section 15.247(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: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	10.4 dB 45.076 MHz, QP, Vertical Mode: Tx DH5 2480 MHz	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.

FCC Part 15.31 (e)

The RF Module has its own regulator. The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The EUT has a unique coupling/antenna connector (UFL). Therefore, the equipment complies with the antenna requirement.

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

3.3 Addition to standard

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

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.5 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.0 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.0 dB	-
	1 GHz-6 GHz	4.9 dB	4.9 dB	4.9 dB	-
	6 GHz-18 GHz	5.5 dB	5.5 dB	5.5 dB	-
	18 GHz-40 GHz	5.4 dB	5.4 dB	5.4 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.8 dB	5.8 dB	5.8 dB	-
	18 GHz-40 GHz	5.7 dB	5.7 dB	5.7 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	0.98 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.75 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.12 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.06 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.24 dB
Spurious emission (Conducted) below 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %
Temperature	0.95 deg.C.
Voltage	0.83 %

3.5 Test Location

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
JAB Accreditation No. RTL02610

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 EUT during testing

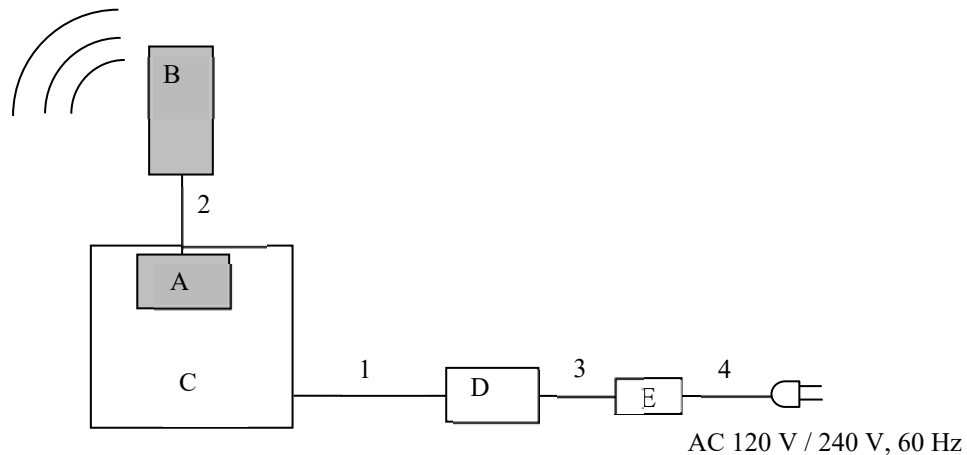
4.1 Operating Mode(s)

Bluetooth: Transmitting, 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: BDR: Fixed EDR: Fixed Software: Cybluetool Ver.0.1.97.1 (Date: 2018.11.22, Storage location: Driven by connected PC) *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



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 120 V of the worst voltage as representative.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Module	CYBT-333047-02	No.5	Cypress Semiconductor	EUT
B	Sleeve antenna	1029-C17586	-	HOKO ELECTRONICS CO., LTD	EUT
C	Evaluation Board of Bluetooth	CYBT-333047-EVAL	1903-1-007 3	Cypress Semiconductor	-
D	Laptop Computer	ThinkPad L580	PF-1PMM0X	LENOVO	-
E	AC Adapter	ADLX45YCC2A	8SSA10E75842L1 CZ9480J61	LENOVO	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	0.3+2.0	Shielded	Shielded	-
2	Antenna	0.15	Shielded	Shielded	-
3	DC	1.5	Unshielded	Unshielded	-
4	AC	0.8	Unshielded	Unshielded	-

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.

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). 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.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a shielded room.

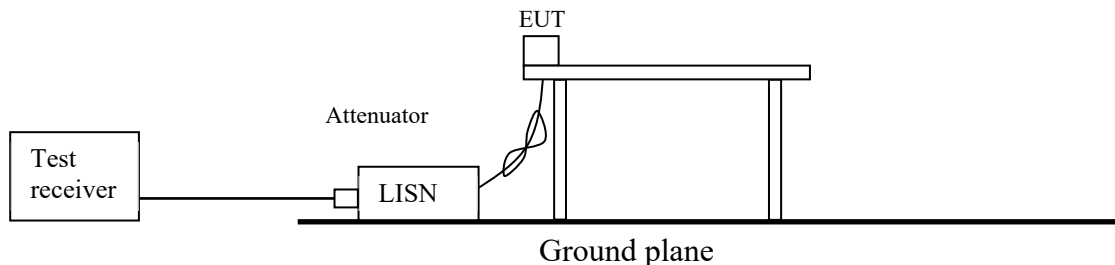
The EUT was connected to a LISN (AMN) via host device.

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 platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. 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.

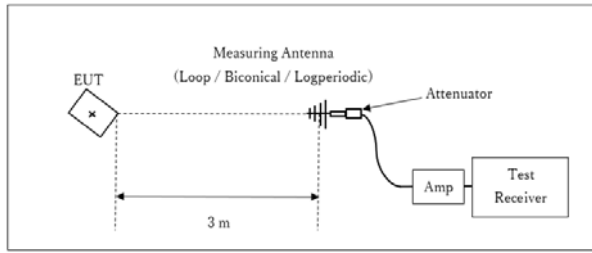
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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: 100 kHz VBW: 300 kHz

*1) Measurement with Average detector was not performed. The limit for Average detector is applied to the measurement value with Peak detector used Duty cycle correction factor (DCCF).

Figure 2: Test Setup

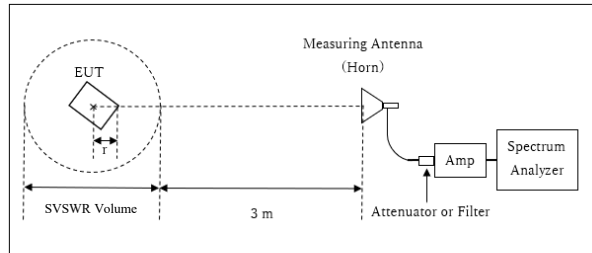
Below 1 GHz



× : 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: $20 \times \log (3.86 \text{ m} / 3.0 \text{ m}) = 2.19 \text{ dB}$

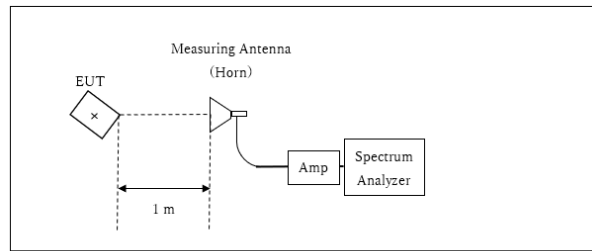
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.86 \text{ m}$

SVSWR Volume : 2.0 m

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

$r = 0.14 \text{ m}$

13 GHz - 26.5 GHz



× : Center of turn table

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

*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.

	30 MHz - 1000 MHz	1 GHz -10 GHz	10 GHz -18 GHz	18 GHz -26 GHz
EUT axis	Horizontal: X Vertical: X	Horizontal: X Vertical: Z	Horizontal: X Vertical: X	Horizontal: X Vertical: X
Antenna axis	Horizontal: X Vertical: X	Horizontal: X Vertical: Y	Horizontal: X Vertical: X	Horizontal: X Vertical: X

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

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

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	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3) *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	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) *4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.							

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

Test data : APPENDIX
Test result : Pass

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

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

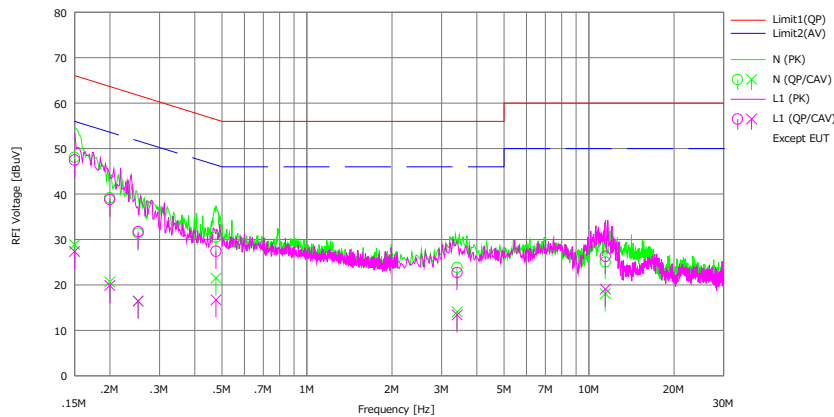
UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2020/08/27

Mode : Tx DH5 2402 MHz
Power : DC 5 V
Temp./Humi. : 22 deg.C / 63 %RH

Remarks : AC Adapter: AC 120 V / 60 Hz

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Makoto Hosaka

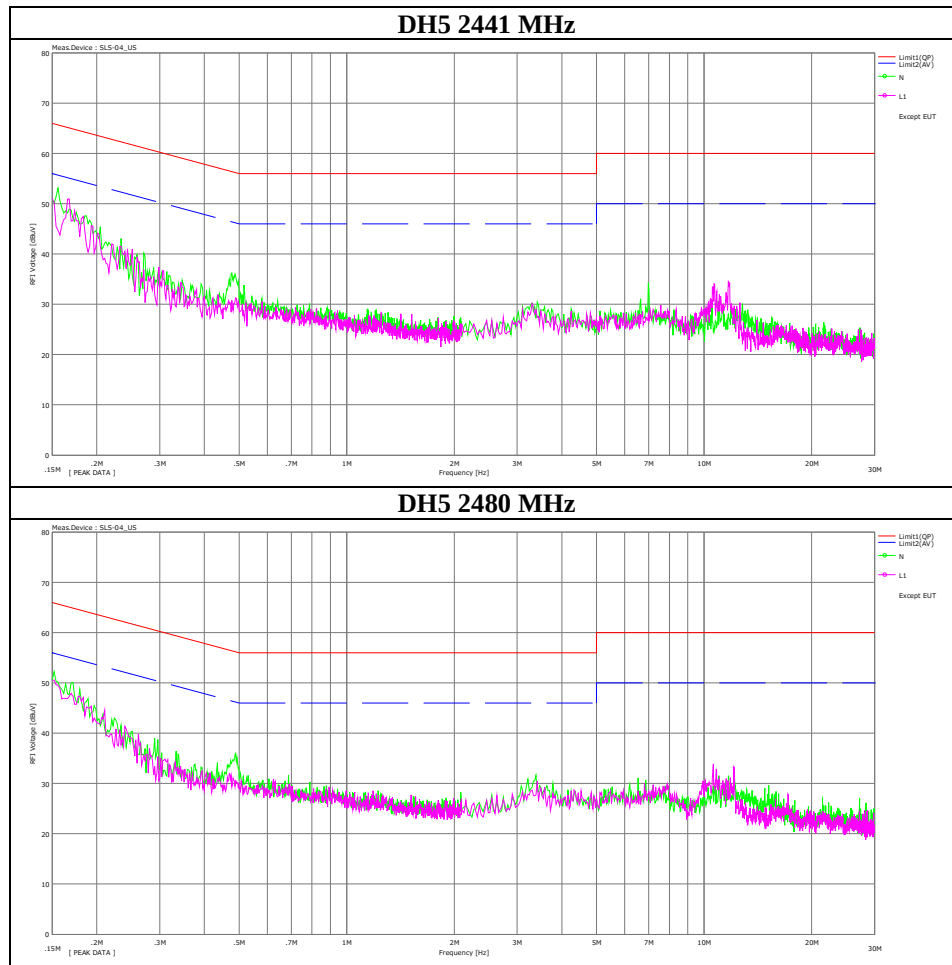


No.	Freq. [MHz]	Reading		USN	LOSS	Results		Limit		Margin		Phase	Comment
		[dBUV]	[dBAV]			[dBUV]	[dBAV]	[dBUV]	[dBAV]	[dBA]	[dBA]		
1	0.15000	35.60	16.40	9.61	2.84	48.05	28.85	66.00	56.00	17.9	27.1	N	
2	0.20000	26.70	8.20	9.60	2.85	39.15	20.65	63.61	53.61	24.4	32.9	N	
3	0.25200	18.90	4.00	9.61	2.85	31.36	16.46	61.69	51.69	30.3	35.2	N	
4	0.47600	18.00	9.00	9.63	2.88	30.51	21.51	56.41	46.41	25.9	24.9	N	
5	3.40400	11.10	1.30	9.68	3.05	23.83	14.03	56.00	46.00	32.1	31.9	N	
6	11.42000	11.90	4.90	9.83	3.31	25.04	18.04	60.00	50.00	34.9	31.9	N	
7	0.15000	35.00	14.90	9.61	2.84	47.45	27.35	66.00	56.00	18.5	28.6	L1	
8	0.20000	26.30	7.40	9.61	2.85	38.76	19.86	63.61	53.61	24.8	33.7	L1	
9	0.25200	19.30	4.00	9.59	2.85	31.74	16.44	61.69	51.69	29.9	35.2	L1	
10	0.47600	14.90	4.20	9.63	2.88	27.41	16.71	56.41	46.41	29.0	29.7	L1	
11	3.40400	10.00	0.70	9.67	3.05	22.72	13.42	56.00	46.00	33.2	32.5	L1	
12	11.42000	13.20	6.00	9.75	3.31	26.26	19.06	60.00	50.00	33.7	30.9	L1	

Calculation: Result[dBuV] = Reading[dBuV] + C.Fac(LISN(AMN) + Cable + ATT)[dB]
LISN(AMN) = SLS-04

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

Conducted Emission



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

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.2 Shielded Room
Date : 2020/08/27

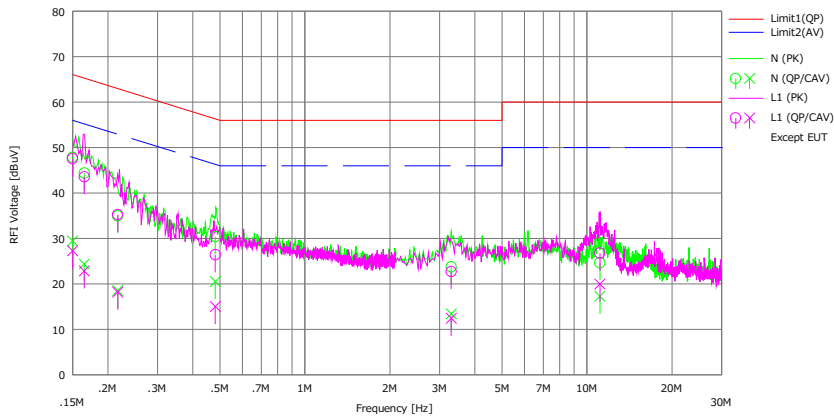
Mode : Tx 3DH5 2402 MHz

Power : DC 5 V
Temp./Humi. : 22 deg.C / 51 %RH

Remarks : AC Adapter: AC 120 V / 60 Hz

Limit : FCC_Part 15 Subpart C(15.207)

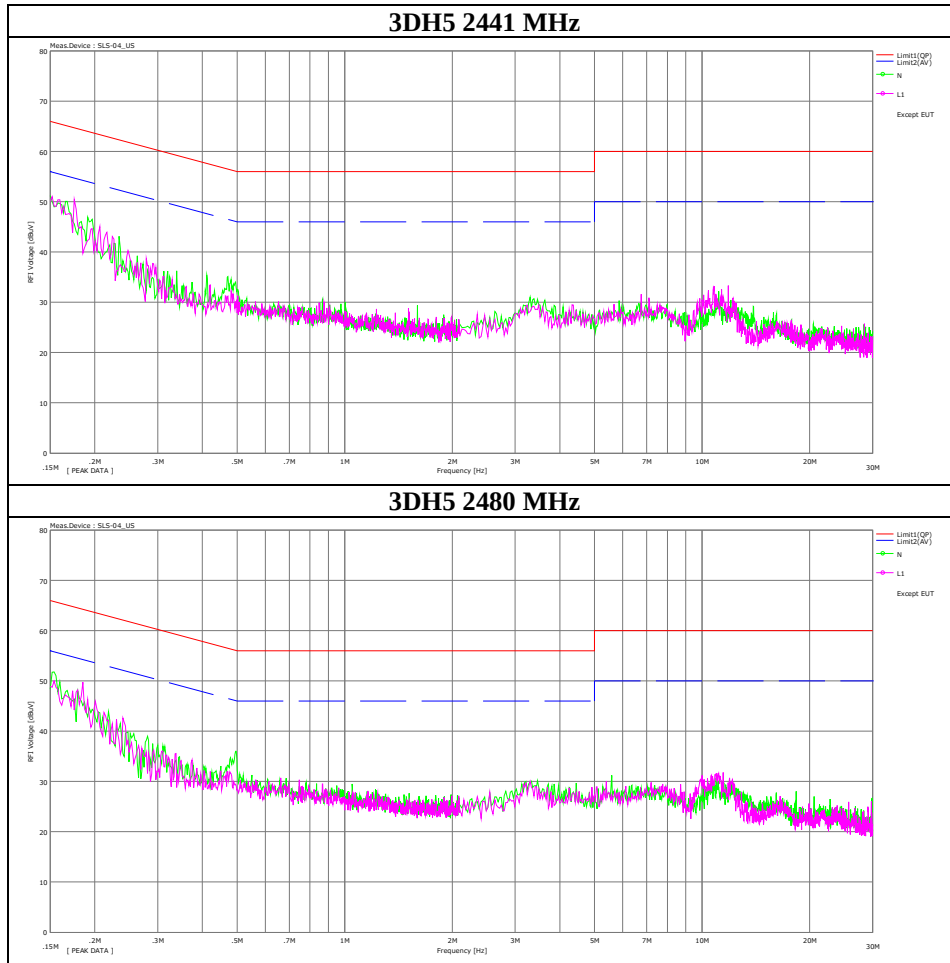
Engineer : Makoto Hosaka



No.	Freq. [MHz]	Reading		LISN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]			<QP> [dBuV]	<CAV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
		[dBuV]	[dBuV]			[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	35.40	17.00	9.61	2.84	47.85	29.45	66.00	56.00	18.1	26.5	N	
2	0.16500	31.90	11.90	9.61	2.84	44.35	24.35	65.21	55.21	20.8	30.8	N	
3	0.21700	22.50	6.10	9.60	2.85	34.95	18.55	62.93	52.93	27.9	34.3	N	
4	0.48100	17.90	8.00	9.63	2.88	30.41	20.51	56.32	46.32	25.9	25.8	N	
5	3.30000	11.00	0.70	9.68	3.04	23.72	13.42	56.00	46.00	32.2	32.5	N	
6	11.10900	11.50	4.10	9.83	3.31	24.64	17.24	60.00	50.00	35.3	32.7	N	
7	0.15000	35.10	14.80	9.61	2.84	47.55	27.25	66.00	56.00	18.4	28.7	L1	
8	0.16500	31.10	10.40	9.60	2.84	43.54	22.84	65.21	55.21	21.6	32.3	L1	
9	0.21700	22.80	5.70	9.60	2.85	35.25	18.15	62.93	52.93	27.6	34.7	L1	
10	0.48100	13.90	2.50	9.63	2.88	26.41	15.01	56.32	46.32	29.9	31.3	L1	
11	3.30000	10.00	-0.30	9.66	3.04	22.70	12.40	56.00	46.00	33.3	33.6	L1	
12	11.10900	13.70	6.90	9.75	3.31	26.76	19.96	60.00	50.00	33.2	30.0	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN)= SLS-04

Conducted Emission



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, 99%Occupied Bandwidth and Carrier Frequency Separation

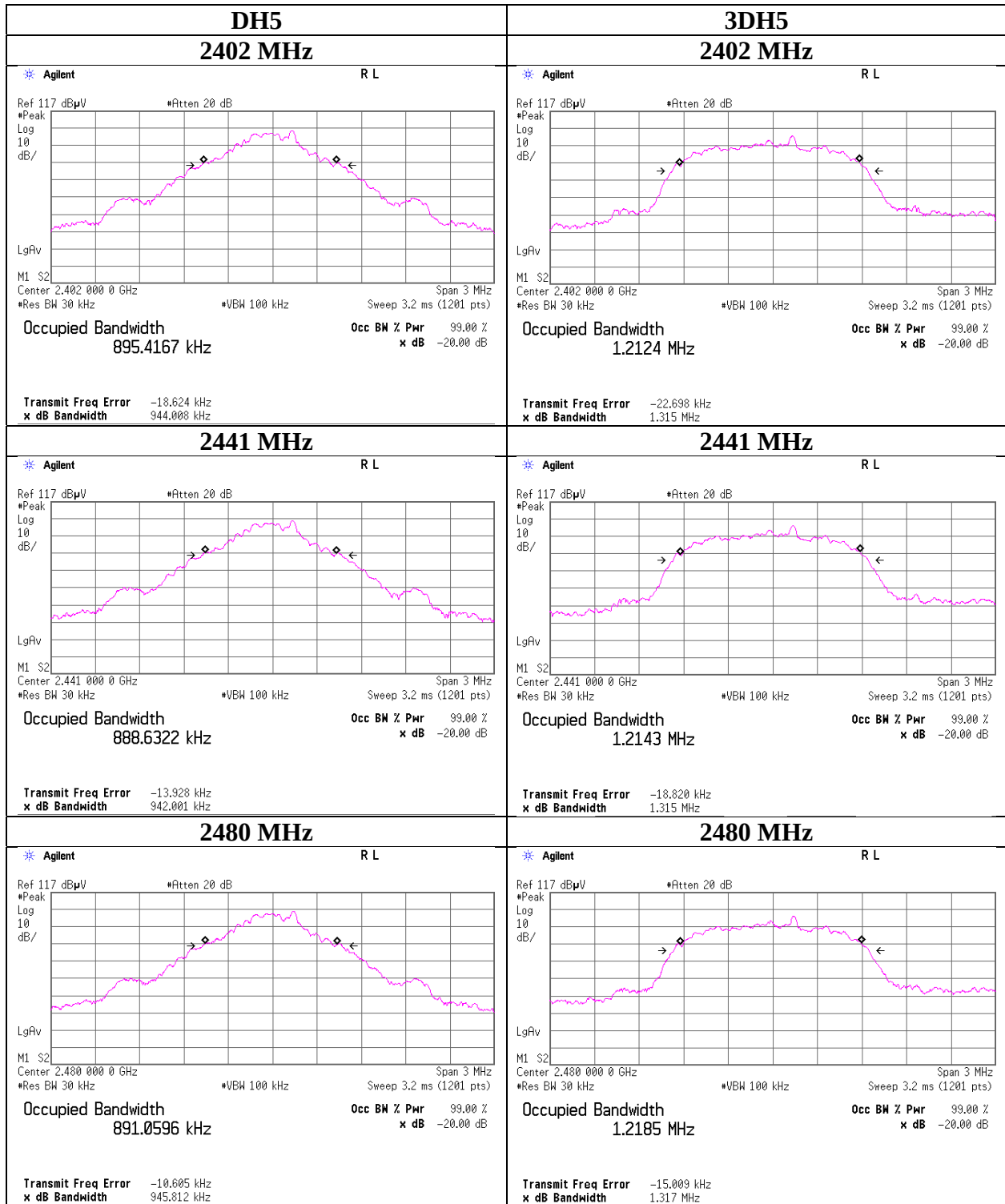
Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 24, 2020 August 25, 2020
Temperature / Humidity 22 deg. C / 62 % RH 24 deg. C / 52 % RH
Engineer Toshinori Yamada Toshinori Yamada
Mode Tx, Hopping Off, Tx, Hopping On

Mode	Freq.	20dB Bandwidth	99% Occupied Bandwidth	Carrier Frequency Separation	Limit for Carrier Frequency separation
	[MHz]	[MHz]	[kHz]	[MHz]	[MHz]
DH5	2402.0	0.944	895.4167	1.000	>= 0.629
DH5	2441.0	0.942	888.6322	1.000	>= 0.628
DH5	2480.0	0.946	891.0596	1.000	>= 0.631
DH5	Hopping On	-	78558.1	-	-
3DH5	2402.0	1.315	1212.4	1.000	>= 0.877
3DH5	2441.0	1.315	1214.3	1.000	>= 0.877
3DH5	2480.0	1.317	1218.5	1.000	>= 0.878
3DH5	Hopping On	-	78713.5	-	-

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.

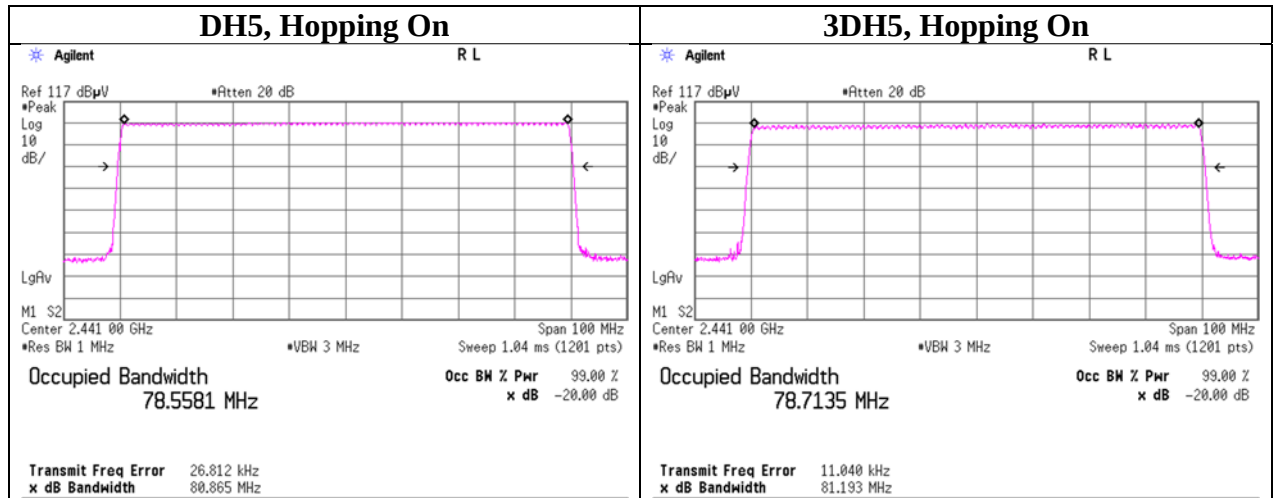
Shonan EMC Lab.

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.

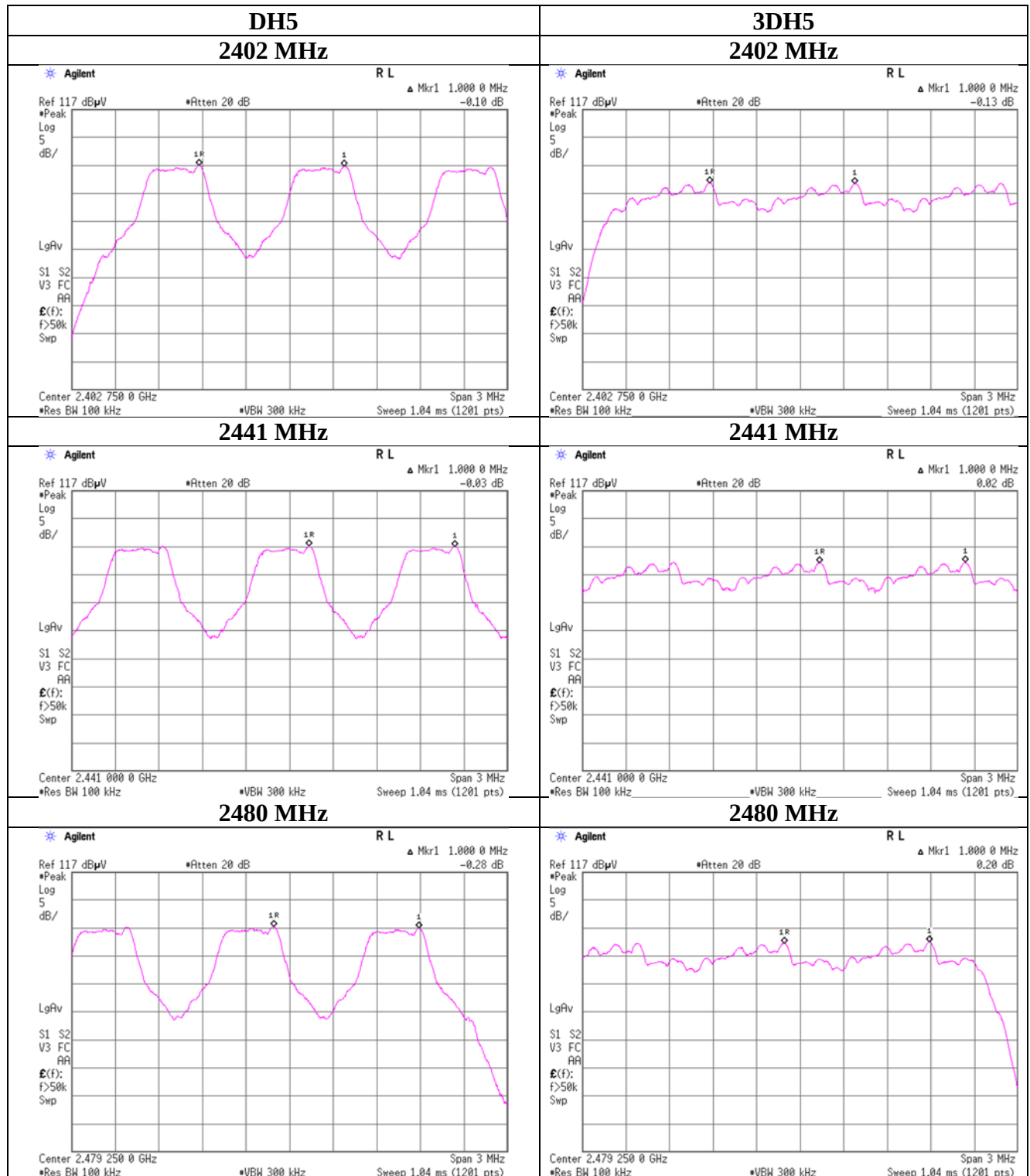
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Carrier Frequency Separation



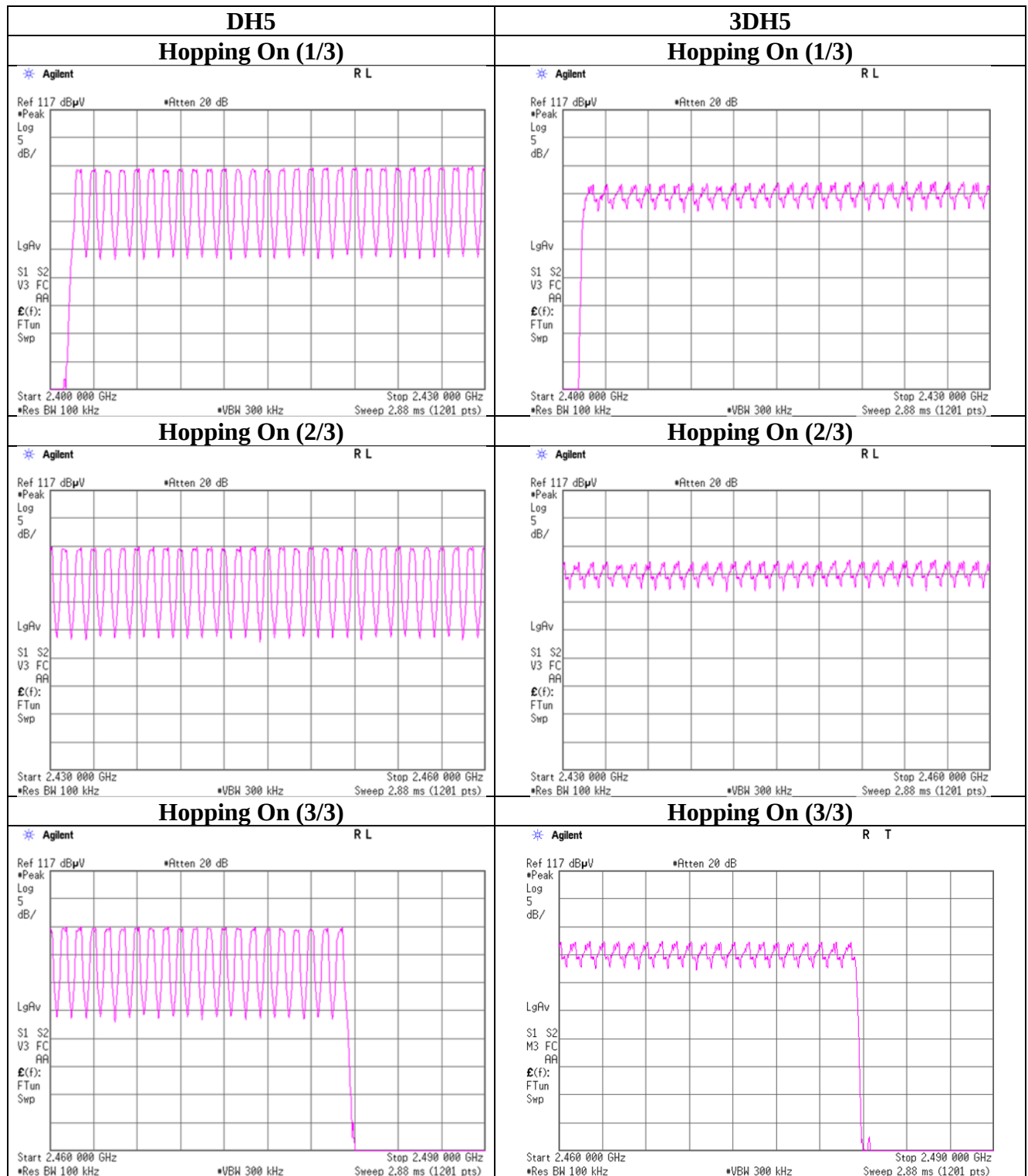
Number of Hopping Frequency

Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 25, 2020
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Toshinori Yamada
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.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time

Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 25, 2020
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Toshinori Yamada
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	48.8 times	/	5 sec. x 31.6 sec. = 309 times	0.398	123	400
DH3	25.6 times	/	5 sec. x 31.6 sec. = 162 times	1.654	268	400
DH5	20.4 times	/	5 sec. x 31.6 sec. = 129 times	2.903	374	400
3DH1	49.6 times	/	5 sec. x 31.6 sec. = 314 times	0.403	127	400
3DH3	27.4 times	/	5 sec. x 31.6 sec. = 174 times	1.655	288	400
3DH5	18.8 times	/	5 sec. x 31.6 sec. = 119 times	2.911	346	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

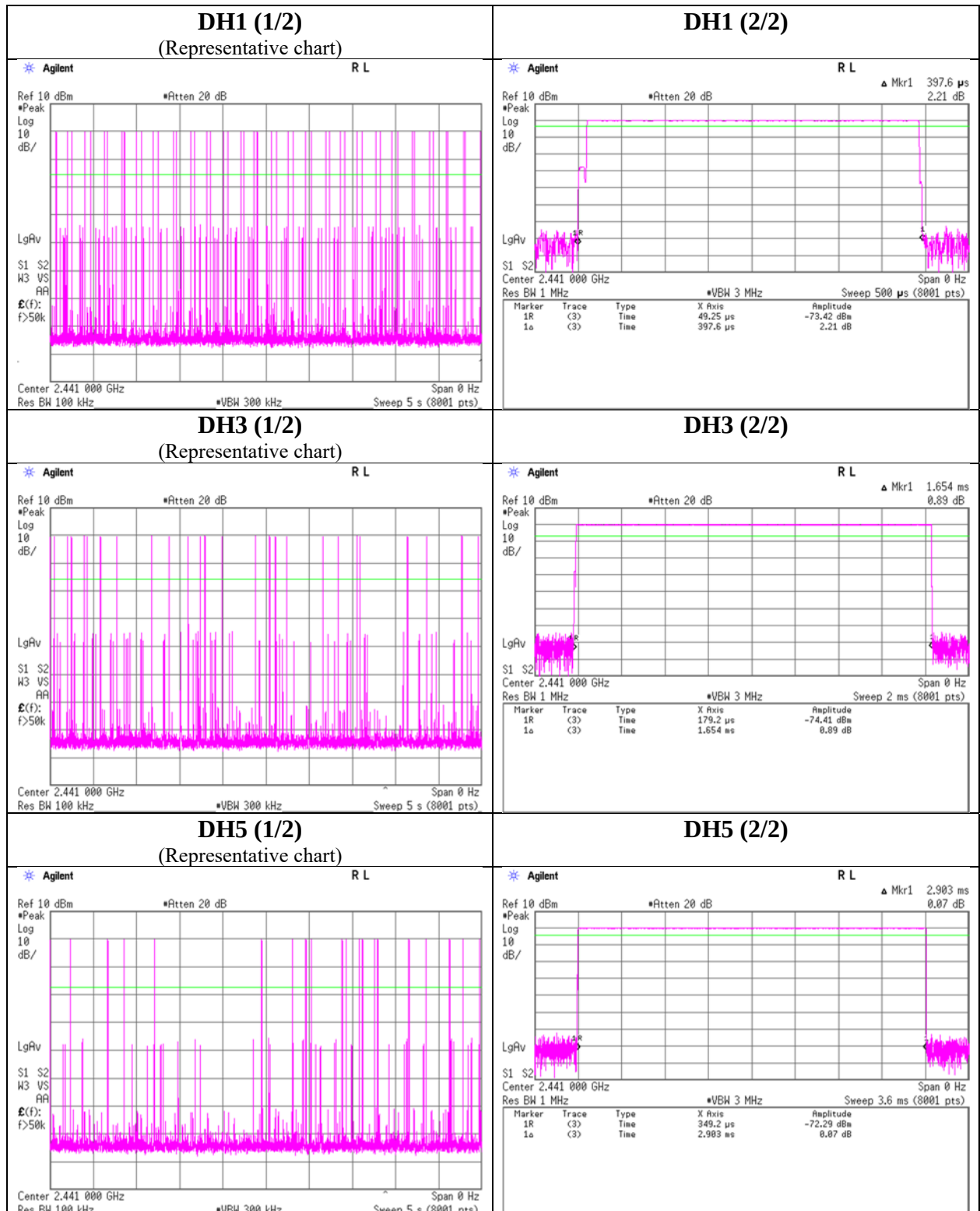
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	49	48	47	51	49	48.8
DH3	26	26	29	23	24	25.6
DH5	20	22	21	20	19	20.4
3DH1	49	50	50	50	49	49.6
3DH3	29	29	27	26	26	27.4
3DH5	20	18	20	19	17	18.8

Sample Calculation

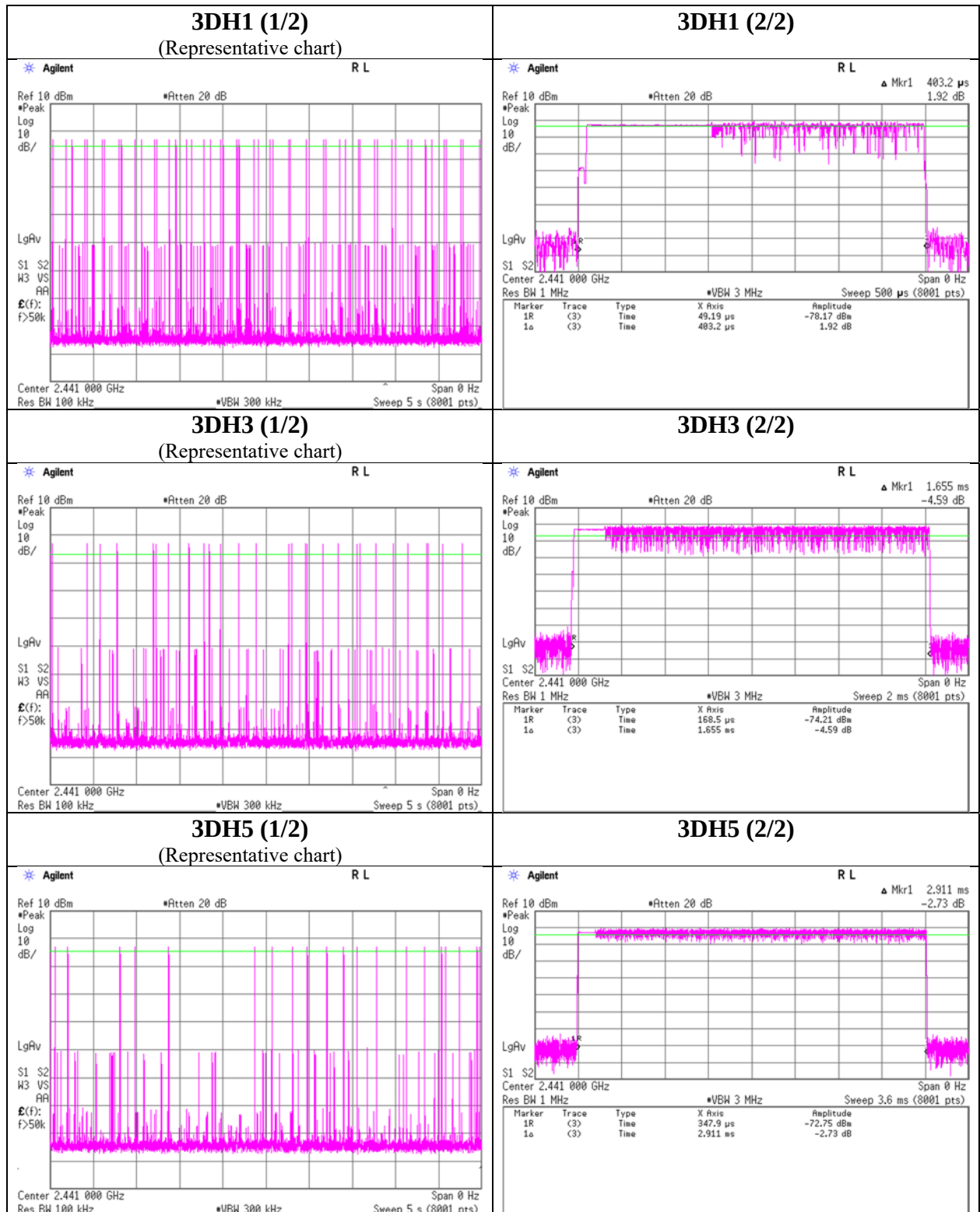
Average = Summation (Sampling 1 to 5) / 5

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

Dwell time



Dwell time



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

Maximum Peak Output Power

Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 24, 2020
Temperature / Humidity 22 deg. C / 62 % RH
Engineer Toshinori Yamada
Mode Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247						
					Result		Limit		Margin	Antenna Gain	Result		Limit		Margin	
					[dBm]	[mW]	[dBm]	[mW]			[dB]	[dBi]	[dBm]	[mW]		[dBm]
	[MHz]	[dBm]	[dB]	[dB]												
DH5	2402.0	-0.57	1.12	9.63	10.18	10.42	20.96	125	10.78	2.14	12.32	17.06	36.02	4000	23.70	
DH5	2441.0	-0.25	1.12	9.63	10.50	11.22	20.96	125	10.46	2.14	12.64	18.37	36.02	4000	23.38	
DH5	2480.0	-0.14	1.12	9.63	10.61	11.51	20.96	125	10.35	2.14	12.75	18.84	36.02	4000	23.27	
2DH5	2402.0	-1.08	1.12	9.63	9.67	9.27	20.96	125	11.29	2.14	11.81	15.17	36.02	4000	24.21	
2DH5	2441.0	-0.53	1.12	9.63	10.22	10.52	20.96	125	10.74	2.14	12.36	17.22	36.02	4000	23.66	
2DH5	2480.0	-0.48	1.12	9.63	10.27	10.64	20.96	125	10.69	2.14	12.41	17.42	36.02	4000	23.61	
3DH5	2402.0	-0.65	1.12	9.63	10.10	10.23	20.96	125	10.86	2.14	12.24	16.75	36.02	4000	23.78	
3DH5	2441.0	-0.21	1.12	9.63	10.54	11.32	20.96	125	10.42	2.14	12.68	18.54	36.02	4000	23.34	
3DH5	2480.0	-0.10	1.12	9.63	10.65	11.61	20.96	125	10.31	2.14	12.79	19.01	36.02	4000	23.23	

Sample Calculation:
Result = Reading + Cable Loss + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

Average Output Power (Reference data for RF Exposure)

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
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	-1.95	1.12	9.63	8.80	7.59	1.11	9.91	9.79
DH5	2441.0	-1.82	1.12	9.63	8.93	7.82	1.11	10.04	10.09
DH5	2480.0	-1.78	1.12	9.63	8.97	7.89	1.11	10.08	10.19
2DH5	2402.0	-4.84	1.12	9.63	5.91	3.90	1.11	7.02	5.04
2DH5	2441.0	-4.23	1.12	9.63	6.52	4.49	1.11	7.63	5.79
2DH5	2480.0	-4.15	1.12	9.63	6.60	4.57	1.11	7.71	5.90
3DH5	2402.0	-4.75	1.12	9.63	6.00	3.98	1.11	7.11	5.14
3DH5	2441.0	-4.14	1.12	9.63	6.61	4.58	1.11	7.72	5.92
3DH5	2480.0	-4.12	1.12	9.63	6.63	4.60	1.11	7.74	5.94

Sample Calculation:

Result (Time average) = Reading + Cable Loss + Attenuator Loss

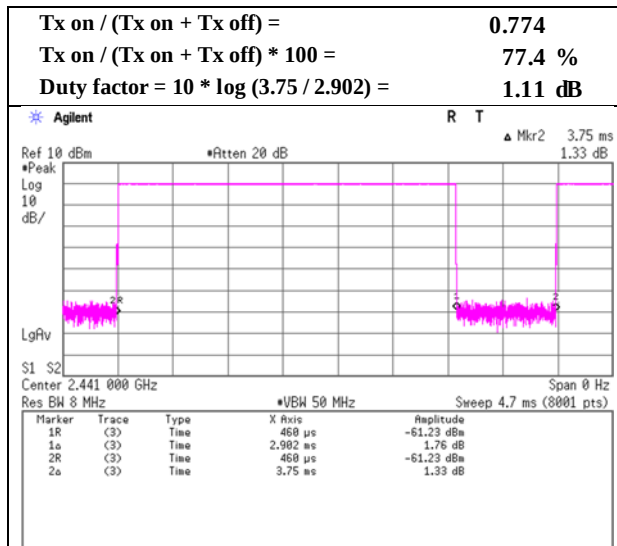
Result (Burst power average) = Time average + Duty factor

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

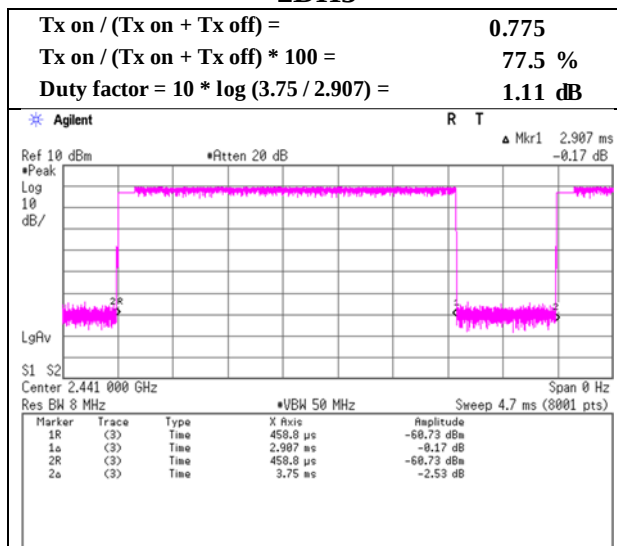
Burst Rate Confirmation

Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 24, 2020
Temperature / Humidity 22 deg. C / 62 % RH
Engineer Toshinori Yamada
Mode Tx, Hopping Off

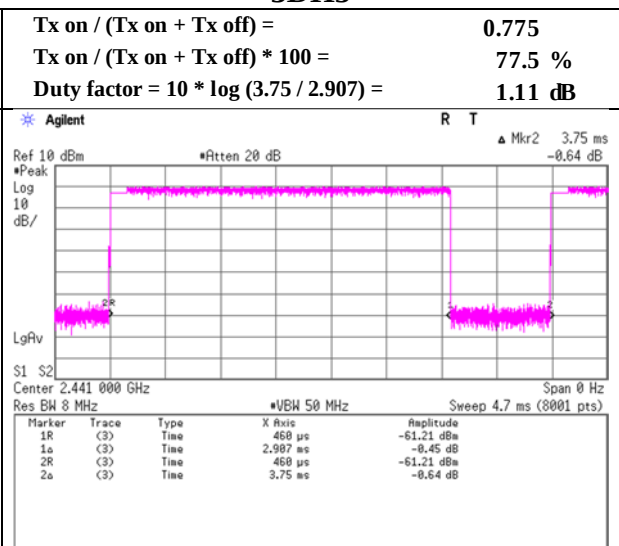
DH5



2DH5



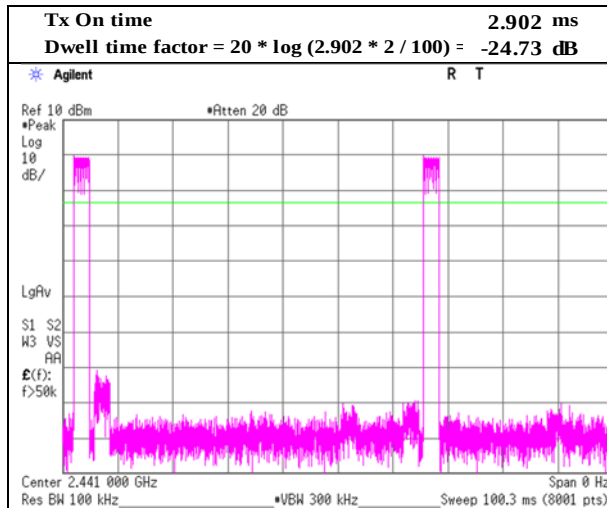
3DH5



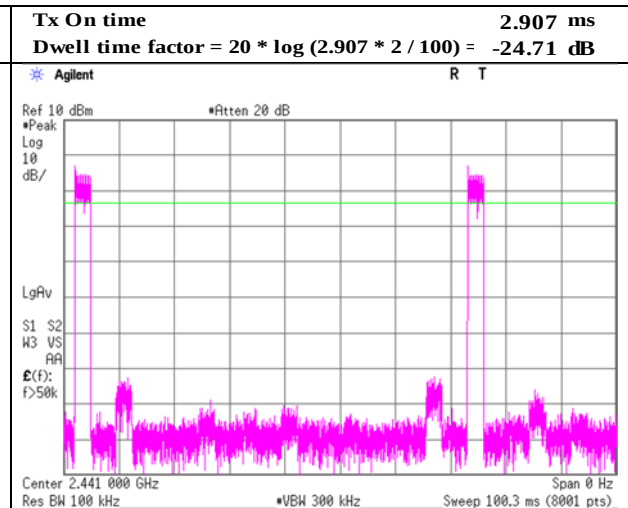
Duty cycle correction factor

Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 25, 2020
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Toshinori Yamada
Mode Tx, Hopping On

DH5



3DH5



Radiated Spurious Emission

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 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.	63.808	QP	21.70	7.46	7.23	31.83	0.00	4.56	40.0	35.4	150	130	-
Hori.	186.358	QP	21.70	16.27	8.95	31.78	0.00	15.14	43.5	28.3	200	2	
Hori.	305.448	QP	31.90	13.71	6.59	31.79	0.00	20.41	46.0	25.5	100	25	
Hori.	800.037	QP	21.20	20.74	9.18	32.03	0.00	19.09	46.0	26.9	150	321	
Hori.	976.024	QP	20.40	22.34	9.94	30.85	0.00	21.83	53.9	32.0	150	347	
Hori.	1441.288	PK	51.44	25.15	13.00	39.24	2.19	52.54	73.9	21.3	154	153	
Hori.	2390.000	PK	44.59	27.93	13.91	39.55	2.19	49.07	73.9	24.8	135	295	
Hori.	4804.000	PK	51.41	31.47	7.17	39.73	2.19	52.51	73.9	21.3	153	266	
Hori.	7206.000	PK	48.48	36.90	8.89	39.51	2.19	56.95	73.9	16.9	134	277	
Hori.	9608.000	PK	45.82	38.23	10.40	39.66	2.19	56.98	73.9	16.9	150	0	
Vert.	44.979	QP	39.70	13.03	7.39	31.83	0.00	28.29	40.0	11.7	100	237	
Vert.	120.042	QP	32.80	13.13	8.20	31.80	0.00	22.33	43.5	21.1	100	125	
Vert.	385.275	QP	23.70	15.28	7.11	31.84	0.00	14.25	46.0	31.7	100	358	
Vert.	456.004	QP	27.80	16.59	7.50	31.93	0.00	19.96	46.0	26.0	100	303	
Vert.	996.689	QP	20.50	22.45	10.04	30.63	0.00	22.36	53.9	31.5	100	236	
Vert.	1441.288	PK	50.32	25.15	13.00	39.24	2.19	49.23	73.9	24.6	154	219	
Vert.	2390.000	PK	45.51	27.93	13.91	39.55	2.19	47.80	73.9	26.1	134	21	
Vert.	4804.000	PK	50.88	31.47	7.17	39.73	2.19	49.79	73.9	24.1	146	141	
Vert.	7206.000	PK	48.25	36.90	8.89	39.51	2.19	54.53	73.9	19.3	206	358	
Vert.	9608.000	PK	46.01	38.23	10.40	39.66	2.19	54.98	73.9	18.9	150	0	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1441.288	PK	51.44	25.15	13.00	39.24	-24.73	2.19	27.81	53.9	26.0	*1)
Hori.	2390.000	PK	44.59	27.93	13.91	39.55	-24.73	2.19	24.34	53.9	29.5	
Hori.	4804.000	PK	51.41	31.47	7.17	39.73	-24.73	2.19	27.78	53.9	26.1	
Hori.	7206.000	PK	48.48	36.90	8.89	39.51	-24.73	2.19	32.22	53.9	21.6	
Hori.	9608.000	PK	45.82	38.23	10.40	39.66	-24.73	2.19	32.25	53.9	21.6	
Vert.	1441.288	PK	50.32	25.15	13.00	39.24	-24.73	2.19	26.69	53.9	27.2	*1)
Vert.	2390.000	PK	45.51	27.93	13.91	39.55	-24.73	2.19	25.26	53.9	28.6	
Vert.	4804.000	PK	50.88	31.47	7.17	39.73	-24.73	2.19	27.25	53.9	26.6	
Vert.	7206.000	PK	48.25	36.90	8.89	39.51	-24.73	2.19	31.99	53.9	21.9	
Vert.	9608.000	PK	46.01	38.23	10.40	39.66	-24.73	2.19	32.44	53.9	21.4	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

*1) These point are the same duty cycle as Carrier.

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	101.66	27.92	13.92	39.56	2.19	106.13	-	-	Carrier
Hori.	2400.000	PK	43.78	27.92	13.92	39.56	2.19	48.25	86.13	37.8	
Vert.	2402.000	PK	102.55	27.92	13.92	39.56	2.19	107.02	-	-	Carrier
Vert.	2400.000	PK	43.02	27.92	13.92	39.56	2.19	47.49	87.02	39.5	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

UL Japan, Inc.

Shonan EMC Lab.

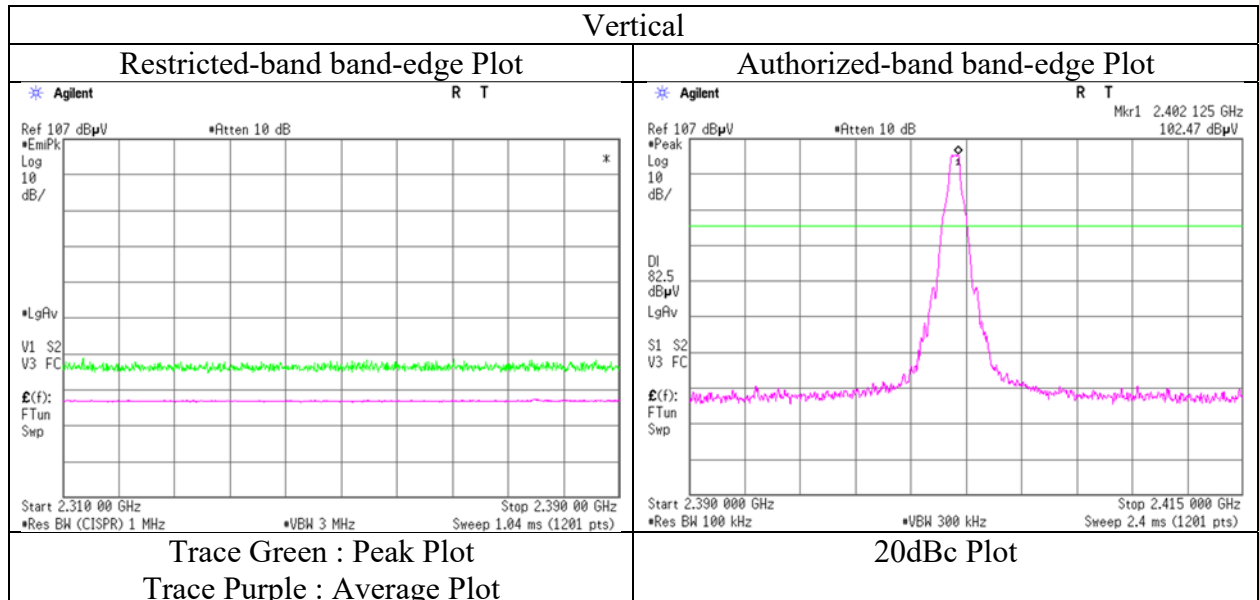
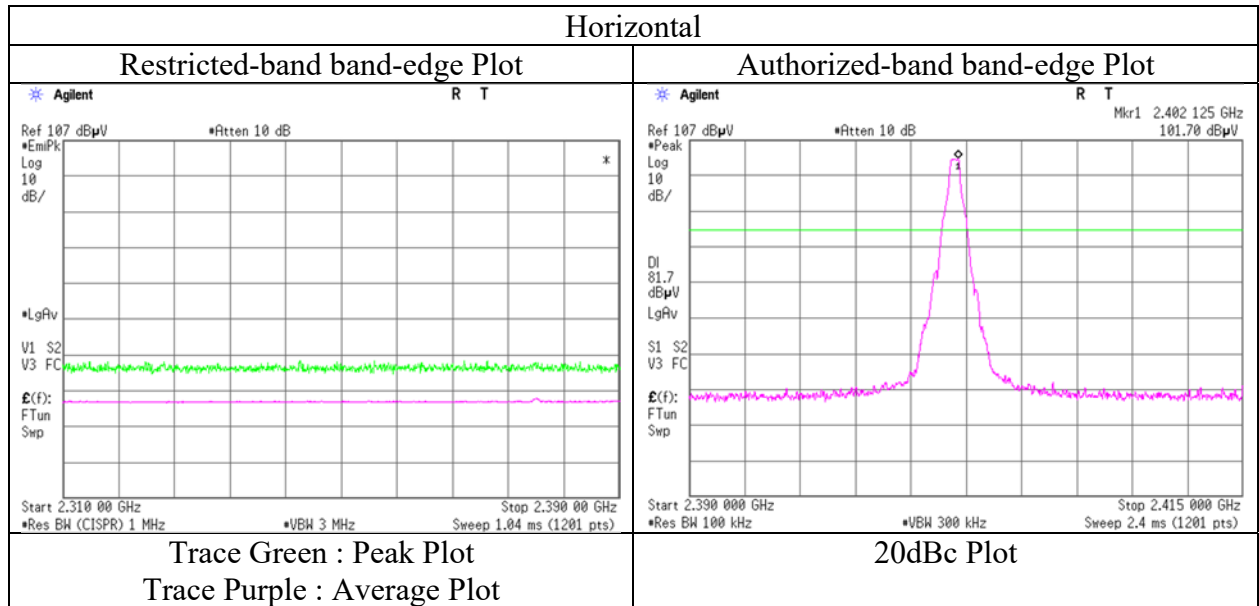
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 25, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Makoto Hosaka
	(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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 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.	63.319	QP	22.00	7.55	7.23	31.83	0.00	4.95	40.0	35.0	300	4	-
Hori.	167.845	QP	22.70	15.54	8.96	31.78	0.00	15.42	43.5	28.0	150	2	
Hori.	323.765	QP	30.30	14.29	6.71	31.79	0.00	19.51	46.0	26.4	100	201	
Hori.	800.087	QP	21.10	20.74	9.18	32.03	0.00	18.99	46.0	27.0	100	15	
Hori.	962.333	QP	22.60	22.21	9.87	30.99	0.00	23.69	53.9	30.2	150	39	
Hori.	1464.600	PK	53.00	25.06	13.02	39.24	2.19	54.03	73.9	19.8	143	146	
Hori.	4882.000	PK	52.76	31.51	7.22	39.72	2.19	53.96	73.9	19.9	149	296	
Hori.	7323.000	PK	48.71	36.94	8.98	39.57	2.19	57.25	73.9	16.6	107	279	
Hori.	9764.000	PK	45.44	38.63	10.45	39.47	2.19	57.24	73.9	16.6	150	0	
Vert.	45.466	QP	40.20	12.84	7.40	31.83	0.00	28.61	40.0	11.3	100	229	
Vert.	120.104	QP	29.00	13.14	8.20	31.80	0.00	18.54	43.5	24.9	100	81	
Vert.	358.861	QP	24.80	15.08	6.94	31.81	0.00	15.01	46.0	30.9	100	354	
Vert.	456.134	QP	27.40	16.59	7.50	31.93	0.00	19.56	46.0	26.4	100	76	
Vert.	990.249	QP	21.00	22.39	10.01	30.70	0.00	22.70	53.9	31.2	100	54	
Vert.	1464.652	PK	51.34	25.06	13.02	39.24	2.19	52.37	73.9	21.5	150	216	
Vert.	4882.000	PK	52.94	31.51	7.22	39.72	2.19	54.14	73.9	19.7	144	104	
Vert.	7323.000	PK	47.98	36.94	8.98	39.57	2.19	56.52	73.9	17.3	209	358	
Vert.	9764.000	PK	45.68	38.63	10.45	39.47	2.19	57.48	73.9	16.4	150	0	

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.86 \text{ m} / 3.0 \text{ m}) = 2.19 \text{ dB}$

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

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1464.600	PK	53.00	25.06	13.02	39.24	-24.73	2.19	29.30	53.9	24.6	*1)
Hori.	4882.000	PK	52.76	31.51	7.22	39.72	-24.73	2.19	29.23	53.9	24.6	
Hori.	7323.000	PK	48.71	36.94	8.98	39.57	-24.73	2.19	32.52	53.9	21.3	
Hori.	9764.000	PK	45.44	38.63	10.45	39.47	-24.73	2.19	32.51	53.9	21.3	
Vert.	1464.652	PK	51.34	25.06	13.02	39.24	-24.73	2.19	27.64	53.9	26.2	*1)
Vert.	4882.000	PK	52.94	31.51	7.22	39.72	-24.73	2.19	29.41	53.9	24.4	
Vert.	7323.000	PK	47.98	36.94	8.98	39.57	-24.73	2.19	31.79	53.9	22.1	
Vert.	9764.000	PK	45.68	38.63	10.45	39.47	-24.73	2.19	32.75	53.9	21.1	

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.86 \text{ m} / 3.0 \text{ m}) = 2.19 \text{ dB}$

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

Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

*1) These point are the same duty cycle as Carrier.

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

Radiated Spurious Emission

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 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.	65.027	QP	23.20	7.22	7.22	31.83	0.00	5.81	40.0	34.1	144	230	-
Hori.	168.002	QP	21.90	15.54	8.96	31.78	0.00	14.62	43.5	28.8	200	234	
Hori.	323.697	QP	29.90	14.29	6.71	31.79	0.00	19.11	46.0	26.8	100	47	
Hori.	799.979	QP	21.40	20.74	9.18	32.03	0.00	19.29	46.0	26.7	100	271	
Hori.	961.131	QP	23.30	22.20	9.87	31.00	0.00	24.37	53.9	29.5	150	192	
Hori.	1488.042	PK	53.70	24.95	13.05	39.24	2.19	54.65	73.9	19.2	150	150	
Hori.	2483.500	PK	47.42	27.84	14.00	39.58	2.19	51.87	73.9	22.0	146	308	
Hori.	4960.000	PK	57.42	31.69	7.29	39.71	2.19	58.88	73.9	15.0	146	291	
Hori.	7440.000	PK	48.13	37.02	9.06	39.62	2.19	56.78	73.9	17.1	138	139	
Hori.	9920.000	PK	44.14	38.66	10.48	39.28	2.19	56.19	73.9	17.7	150	0	
Vert.	45.076	QP	41.00	12.99	7.40	31.83	0.00	29.56	40.0	10.4	100	130	
Vert.	119.984	QP	29.30	13.13	8.20	31.80	0.00	18.83	43.5	24.6	100	151	
Vert.	348.122	QP	24.70	15.01	6.87	31.80	0.00	14.78	46.0	31.2	100	294	
Vert.	456.030	QP	27.80	16.59	7.50	31.93	0.00	19.96	46.0	26.0	100	209	
Vert.	990.949	QP	21.40	22.40	10.01	30.69	0.00	23.12	53.9	30.7	100	0	
Vert.	1488.029	PK	51.30	24.95	13.05	39.24	2.19	52.25	73.9	21.6	136	229	
Vert.	2483.500	PK	49.91	27.84	14.00	39.58	2.19	54.36	73.9	19.5	130	0	
Vert.	4960.000	PK	58.19	31.69	7.29	39.71	2.19	59.65	73.9	14.2	138	140	
Vert.	7440.000	PK	47.71	37.02	9.06	39.62	2.19	56.36	73.9	17.5	153	50	
Vert.	9920.000	PK	45.12	38.66	10.48	39.28	2.19	57.17	73.9	16.7	150	0	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1488.042	PK	53.70	24.95	13.05	39.24	-24.73	2.19	29.92	53.9	23.9	*1)
Hori.	2483.500	PK	47.42	27.84	14.00	39.58	-24.73	2.19	27.14	53.9	26.7	
Hori.	4960.000	PK	57.42	31.69	7.29	39.71	-24.73	2.19	34.15	53.9	19.7	
Hori.	7440.000	PK	48.13	37.02	9.06	39.62	-24.73	2.19	32.05	53.9	21.8	
Hori.	9920.000	PK	44.14	38.66	10.48	39.28	-24.73	2.19	31.46	53.9	22.4	
Vert.	1488.029	PK	51.30	24.95	13.05	39.24	-24.73	2.19	27.52	53.9	26.3	*1)
Vert.	2483.500	PK	49.91	27.84	14.00	39.58	-24.73	2.19	29.63	53.9	24.2	
Vert.	4960.000	PK	58.19	31.69	7.29	39.71	-24.73	2.19	34.92	53.9	18.9	
Vert.	7440.000	PK	47.71	37.02	9.06	39.62	-24.73	2.19	31.63	53.9	22.2	
Vert.	9920.000	PK	45.12	38.66	10.48	39.28	-24.73	2.19	32.44	53.9	21.4	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

*1) These point are the same duty cycle as Carrier.

UL Japan, Inc.

Shonan EMC Lab.

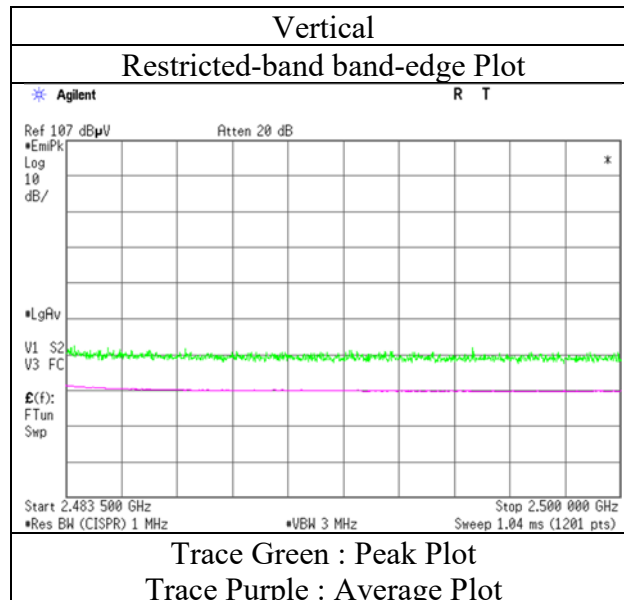
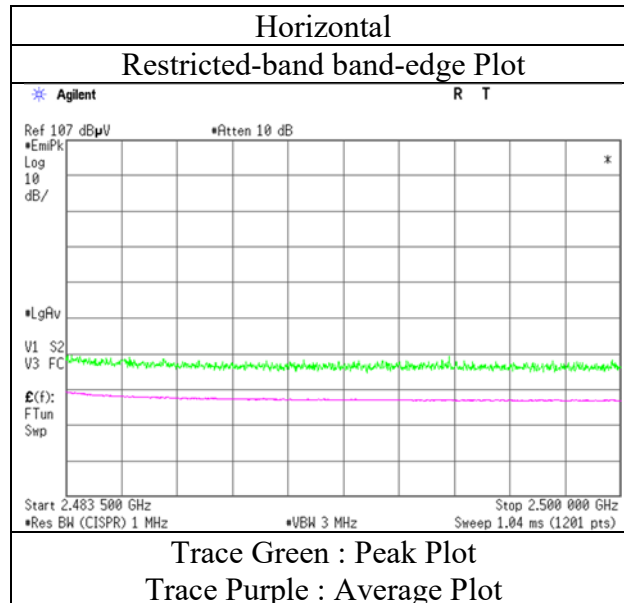
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No. 13473127S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date August 25, 2020
Temperature / Humidity 23 deg. C / 58 % RH
Engineer Makoto Hosaka
(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.

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

Radiated Spurious Emission

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 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.	63.879	QP	21.90	7.44	7.23	31.83	0.00	4.74	40.0	35.2	103	221	-
Hori.	164.424	QP	22.30	15.38	8.95	31.78	0.00	14.85	43.5	28.6	132	358	
Hori.	320.246	QP	29.80	14.18	6.69	31.79	0.00	18.88	46.0	27.1	100	1	
Hori.	799.995	QP	21.00	20.74	9.18	32.03	0.00	18.89	46.0	27.1	100	213	
Hori.	987.949	QP	23.80	22.39	10.00	30.72	0.00	25.47	53.9	28.4	150	159	
Hori.	1440.967	PK	50.22	25.15	13.00	39.24	2.19	51.32	73.9	22.5	149	148	
Hori.	2390.000	PK	46.54	27.93	13.91	39.55	2.19	51.02	73.9	22.8	136	321	
Hori.	4804.000	PK	50.17	31.47	7.17	39.73	2.19	51.27	73.9	22.6	107	264	
Hori.	7206.000	PK	46.46	36.90	8.89	39.51	2.19	54.93	73.9	18.9	135	279	
Hori.	9608.000	PK	45.51	38.23	10.40	39.66	2.19	56.67	73.9	17.2	150	0	
Vert.	45.493	QP	40.50	12.83	7.40	31.83	0.00	28.90	40.0	11.1	100	202	
Vert.	119.996	QP	30.20	13.13	8.20	31.80	0.00	19.73	43.5	23.7	100	223	
Vert.	369.095	QP	23.60	15.07	7.00	31.82	0.00	13.85	46.0	32.1	122	352	
Vert.	456.093	QP	28.10	16.59	7.50	31.93	0.00	20.26	46.0	25.7	100	348	
Vert.	963.366	QP	23.40	22.22	9.88	30.98	0.00	24.52	53.9	29.3	100	352	
Vert.	1441.314	PK	49.42	25.15	13.00	39.24	2.19	50.52	73.9	23.3	141	216	
Vert.	2390.000	PK	44.86	27.93	13.91	39.55	2.19	49.34	73.9	24.5	153	0	
Vert.	4804.000	PK	50.23	31.47	7.17	39.73	2.19	51.33	73.9	22.5	173	143	
Vert.	7206.000	PK	45.93	36.90	8.89	39.51	2.19	54.40	73.9	19.5	150	356	
Vert.	9608.000	PK	45.99	38.23	10.40	39.66	2.19	57.15	73.9	16.7	150	0	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1440.967	PK	50.22	25.15	13.00	39.24	-24.71	2.19	26.61	53.9	27.2	*1)
Hori.	2390.000	PK	46.54	27.93	13.91	39.55	-24.71	2.19	26.31	53.9	27.5	
Hori.	4804.000	PK	50.17	31.47	7.17	39.73	-24.71	2.19	26.56	53.9	27.3	
Hori.	7206.000	PK	46.46	36.90	8.89	39.51	-24.71	2.19	30.22	53.9	23.6	
Hori.	9608.000	PK	45.51	38.23	10.40	39.66	-24.71	2.19	31.96	53.9	21.9	
Vert.	1441.314	PK	49.42	25.15	13.00	39.24	-24.71	2.19	25.81	53.9	28.0	*1)
Vert.	2390.000	PK	44.86	27.93	13.91	39.55	-24.71	2.19	24.63	53.9	29.2	
Vert.	4804.000	PK	50.23	31.47	7.17	39.73	-24.71	2.19	26.62	53.9	27.2	
Vert.	7206.000	PK	45.93	36.90	8.89	39.51	-24.71	2.19	29.69	53.9	24.2	
Vert.	9608.000	PK	45.99	38.23	10.40	39.66	-24.71	2.19	32.44	53.9	21.4	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

*1) These point are the same duty cycle as Carrier.

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	89.90	27.92	13.92	39.56	2.19	94.37	-	-	Carrier
Hori.	2400.000	PK	41.35	27.92	13.92	39.56	2.19	45.82	74.37	28.5	
Vert.	2402.000	PK	99.00	27.92	13.92	39.56	2.19	103.47	-	-	Carrier
Vert.	2400.000	PK	42.53	27.92	13.92	39.56	2.19	47.00	83.47	36.4	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

UL Japan, Inc.

Shonan EMC Lab.

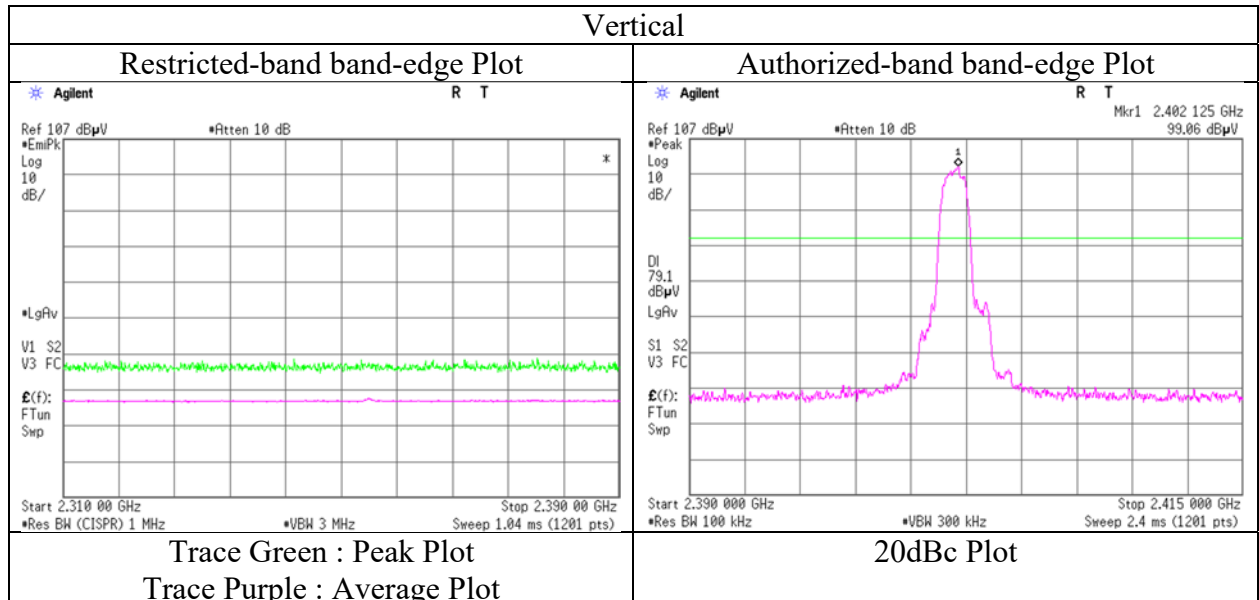
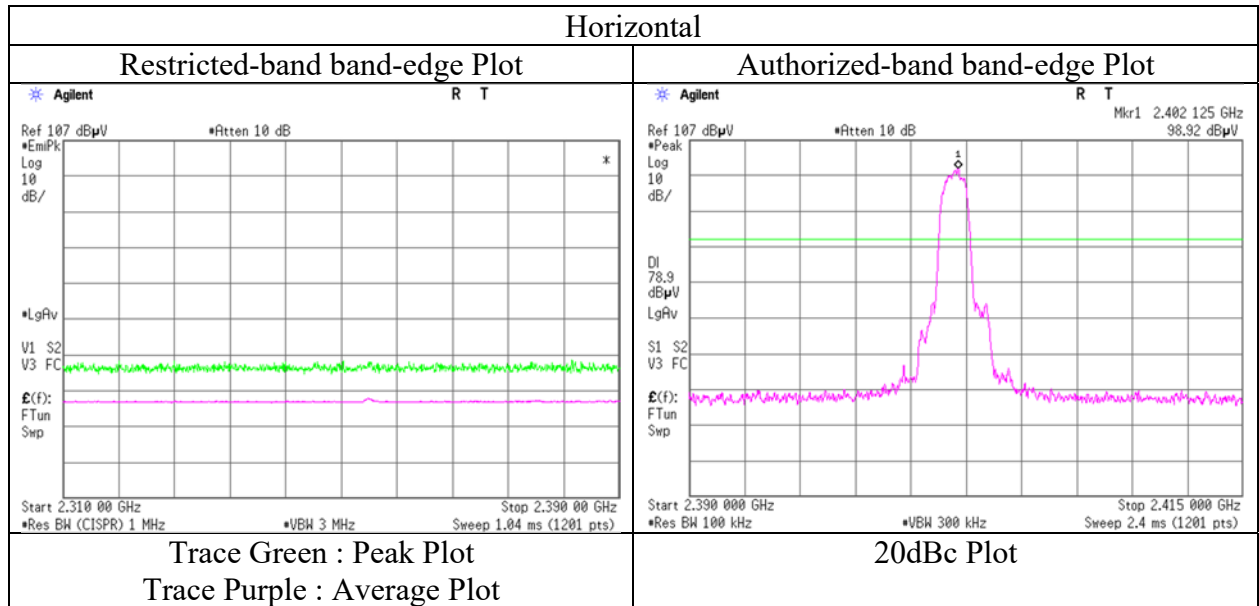
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 25, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Makoto Hosaka
	(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.

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

Radiated Spurious Emission

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 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.	64.820	QP	23.80	7.26	7.21	31.83	0.00	6.44	40.0	33.5	103	279	-
Hori.	158.678	QP	21.30	15.18	8.91	31.78	0.00	13.61	43.5	29.8	144	31	
Hori.	311.598	QP	28.90	13.87	6.63	31.79	0.00	17.61	46.0	28.3	100	74	
Hori.	800.011	QP	22.00	20.74	9.18	32.03	0.00	19.89	46.0	26.1	100	0	
Hori.	960.863	QP	21.50	22.20	9.86	31.01	0.00	22.55	53.9	31.3	150	284	
Hori.	1464.698	PK	51.13	25.06	13.02	39.24	2.19	52.16	73.9	21.7	144	150	
Hori.	4882.000	PK	50.97	31.51	7.22	39.72	2.19	52.17	73.9	21.7	148	296	
Hori.	7323.000	PK	45.14	36.94	8.98	39.57	2.19	53.68	73.9	20.2	152	293	
Hori.	9764.000	PK	45.38	38.63	10.45	39.47	2.19	57.18	73.9	16.7	150	0	
Vert.	45.580	QP	40.10	12.80	7.40	31.83	0.00	28.47	40.0	11.5	100	292	
Vert.	120.011	QP	30.70	13.13	8.20	31.80	0.00	20.23	43.5	23.2	100	172	
Vert.	366.797	QP	23.80	15.06	6.99	31.82	0.00	14.03	46.0	31.9	102	0	
Vert.	456.064	QP	27.40	16.59	7.50	31.93	0.00	19.56	46.0	26.4	100	244	
Vert.	987.870	QP	22.20	22.39	10.00	30.72	0.00	23.87	53.9	30.0	100	153	
Vert.	1464.343	PK	49.09	25.06	13.02	39.24	2.19	50.12	73.9	23.7	142	213	
Vert.	4882.000	PK	52.00	31.51	7.22	39.72	2.19	53.20	73.9	20.7	150	138	
Vert.	7323.000	PK	45.29	36.94	8.98	39.57	2.19	53.83	73.9	20.0	176	350	
Vert.	9764.000	PK	45.77	38.63	10.45	39.47	2.19	57.57	73.9	16.3	150	0	

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.86 \text{ m} / 3.0 \text{ m}) = 2.19 \text{ dB}$

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

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1464.698	PK	51.13	25.06	13.02	39.24	-24.71	2.19	27.45	53.9	26.4	*1)
Hori.	4882.000	PK	50.97	31.51	7.22	39.72	-24.71	2.19	27.74	53.9	26.1	
Hori.	7323.000	PK	45.14	36.94	8.98	39.57	-24.71	2.19	29.25	53.9	24.6	
Hori.	9764.000	PK	45.38	38.63	10.45	39.47	-24.71	2.19	32.75	53.9	21.1	
Vert.	1464.343	PK	49.09	25.06	13.02	39.24	-24.71	2.19	25.69	53.9	28.2	*1)
Vert.	4882.000	PK	52.00	31.51	7.22	39.72	-24.71	2.19	28.77	53.9	25.1	
Vert.	7323.000	PK	45.29	36.94	8.98	39.57	-24.71	2.19	29.40	53.9	24.5	
Vert.	9764.000	PK	45.77	38.63	10.45	39.47	-24.71	2.19	33.14	53.9	20.7	

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.86 \text{ m} / 3.0 \text{ m}) = 2.19 \text{ dB}$

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

Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

*1) These point are the same duty cycle as Carrier.

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

Radiated Spurious Emission

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 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.	65.767	QP	22.40	7.10	7.27	31.83	0.00	4.94	40.0	35.0	100	215	-
Hori.	151.567	QP	20.40	14.93	8.84	31.78	0.00	12.39	43.5	31.1	199	354	
Hori.	326.484	QP	30.20	14.38	6.73	31.79	0.00	19.52	46.0	26.4	100	205	
Hori.	800.034	QP	21.10	20.74	9.18	32.03	0.00	18.99	46.0	27.0	150	3	
Hori.	963.964	QP	22.90	22.23	9.88	30.97	0.00	24.04	53.9	29.8	100	24	
Hori.	1488.042	PK	52.43	24.95	13.05	39.24	2.19	53.38	73.9	20.5	149	146	
Hori.	2483.500	PK	48.87	27.84	14.00	39.58	2.19	53.32	73.9	20.5	100	0	
Hori.	4960.000	PK	55.84	31.69	7.29	39.71	2.19	57.30	73.9	16.6	145	291	
Hori.	7440.000	PK	46.48	37.02	9.06	39.62	2.19	55.13	73.9	18.7	146	327	
Hori.	9920.000	PK	44.94	38.66	10.48	39.28	2.19	56.99	73.9	16.9	150	0	
Vert.	44.979	QP	39.60	13.03	7.39	31.83	0.00	28.19	40.0	11.8	100	3	
Vert.	119.994	QP	30.10	13.13	8.20	31.80	0.00	19.63	43.5	23.8	103	201	
Vert.	353.579	QP	24.00	15.08	6.90	31.81	0.00	14.17	46.0	31.8	100	325	
Vert.	455.998	QP	27.90	16.59	7.50	31.93	0.00	20.06	46.0	25.9	100	358	
Vert.	990.992	QP	22.70	22.40	10.01	30.69	0.00	24.42	53.9	29.4	100	311	
Vert.	1488.089	PK	49.92	24.95	13.05	39.24	2.19	50.87	73.9	23.0	135	221	
Vert.	2483.500	PK	48.53	27.84	14.00	39.58	2.19	52.98	73.9	20.9	160	0	
Vert.	4960.000	PK	56.15	31.69	7.29	39.71	2.19	57.61	73.9	16.2	140	142	
Vert.	7440.000	PK	45.89	37.02	9.06	39.62	2.19	54.54	73.9	19.3	150	70	
Vert.	9920.000	PK	44.89	38.66	10.48	39.28	2.19	56.94	73.9	16.9	150	0	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Peak measurement value with Duty cycle correction factor (DCCF)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	DCCF [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1488.042	PK	52.43	24.95	13.05	39.24	-24.71	2.19	28.67	53.9	25.2	*1)
Hori.	2483.500	PK	48.87	27.84	14.00	39.58	-24.71	2.19	28.61	53.9	25.2	
Hori.	4960.000	PK	55.84	31.69	7.29	39.71	-24.71	2.19	32.59	53.9	21.3	
Hori.	7440.000	PK	46.48	37.02	9.06	39.62	-24.71	2.19	30.42	53.9	23.4	
Hori.	9920.000	PK	44.94	38.66	10.48	39.28	-24.71	2.19	32.28	53.9	21.6	
Vert.	1488.089	PK	49.92	24.95	13.05	39.24	-24.71	2.19	26.16	53.9	27.7	*1)
Vert.	2483.500	PK	48.53	27.84	14.00	39.58	-24.71	2.19	28.27	53.9	25.6	
Vert.	4960.000	PK	56.15	31.69	7.29	39.71	-24.71	2.19	32.90	53.9	21.0	
Vert.	7440.000	PK	45.89	37.02	9.06	39.62	-24.71	2.19	29.83	53.9	24.0	
Vert.	9920.000	PK	44.89	38.66	10.48	39.28	-24.71	2.19	32.23	53.9	21.6	

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

Distance factor : 1 GHz - 10 GHz : 20log(3.86 m / 3.0 m) = 2.19 dB

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

Duty cycle correction factor (DCCF) refer to "Duty cycle correction factor" sheet.

*1) These point are the same duty cycle as Carrier.

UL Japan, Inc.

Shonan EMC Lab.

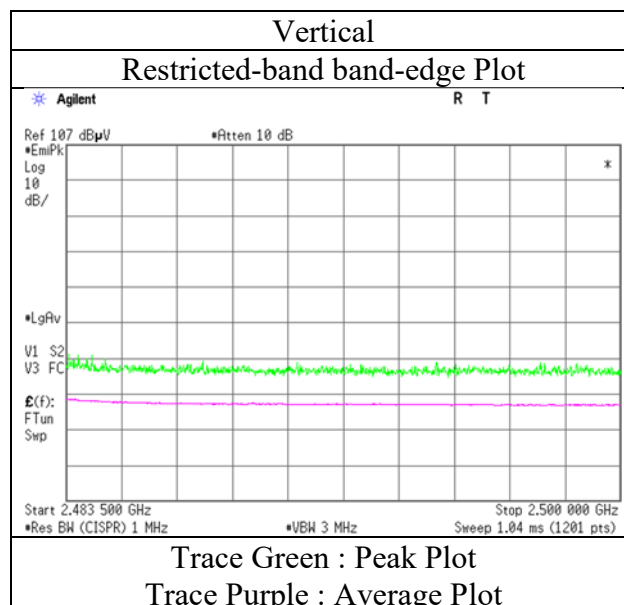
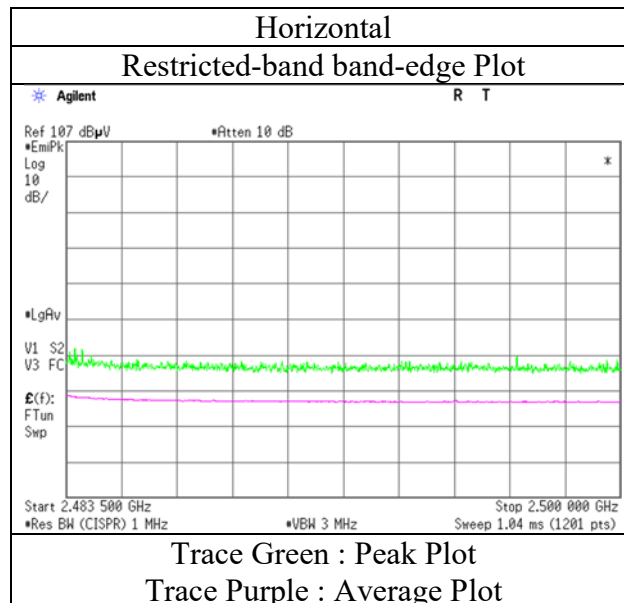
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 25, 2020
Temperature / Humidity	23 deg. C / 58 % RH
Engineer	Makoto Hosaka (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.

UL Japan, Inc.

Shonan EMC Lab.

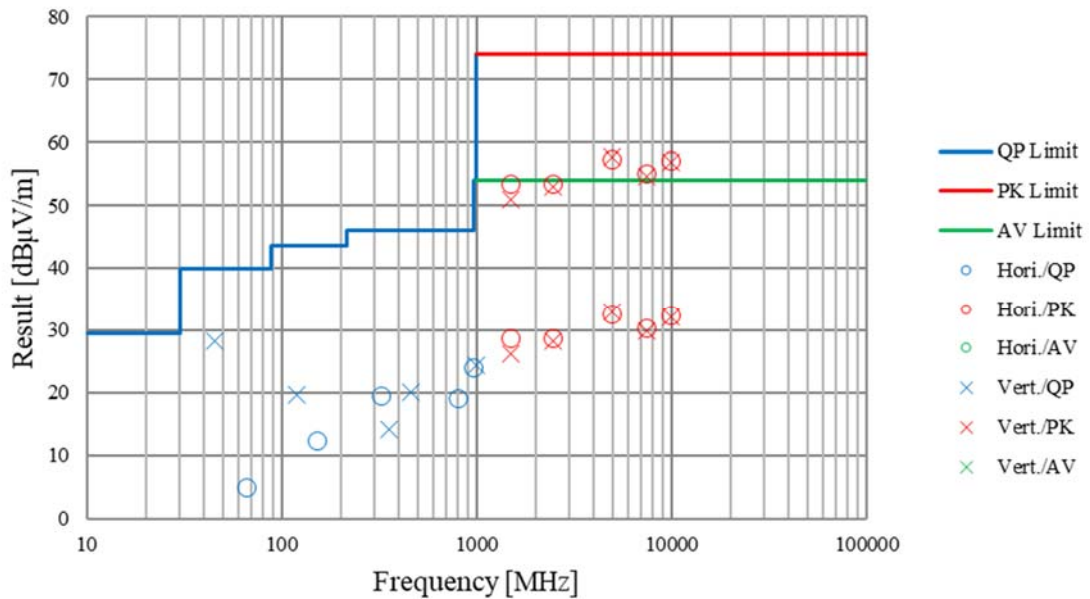
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	13473127S-A-R2		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	August 26, 2020	August 25, 2020	August 26, 2020
Temperature / Humidity	22 deg. C / 63 % RH	23 deg. C / 58 % RH	22 deg. C / 55 % RH
Engineer	Makoto Hosaka	Makoto Hosaka	Makoto Hosaka
	(Below 1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz		

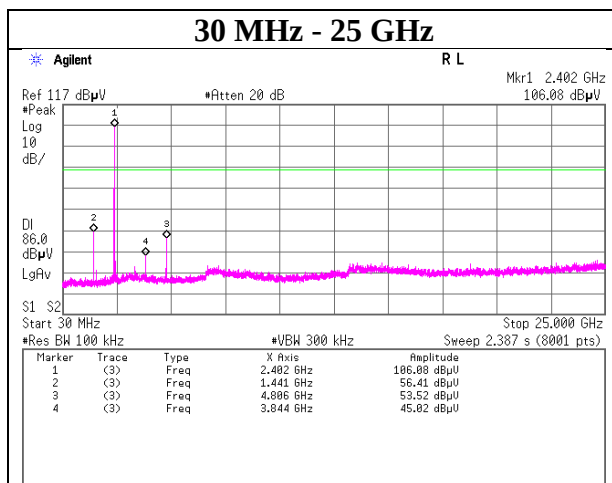
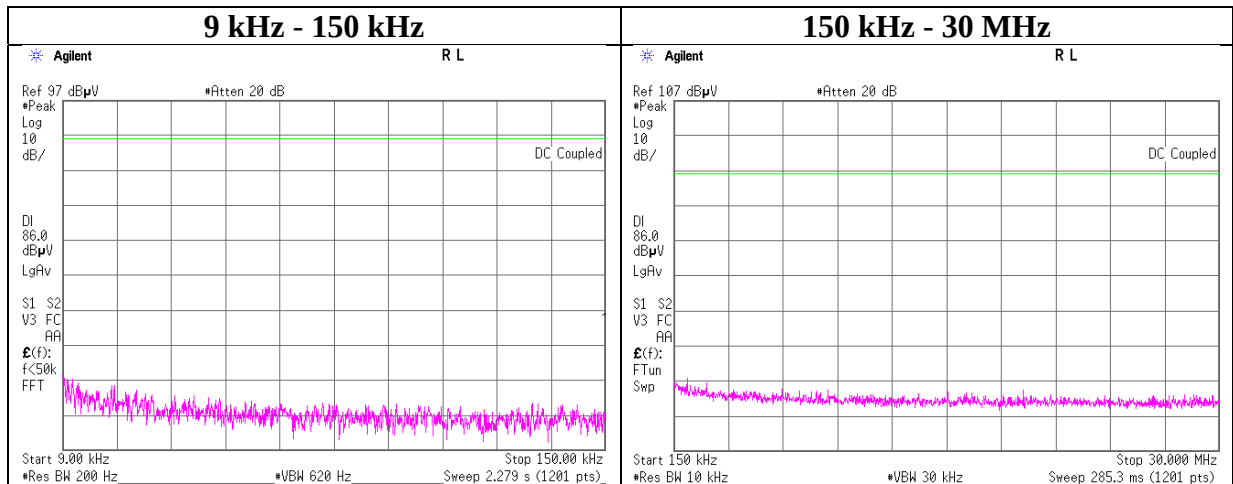


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
Mode	Tx, Hopping Off, DH5

2402 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

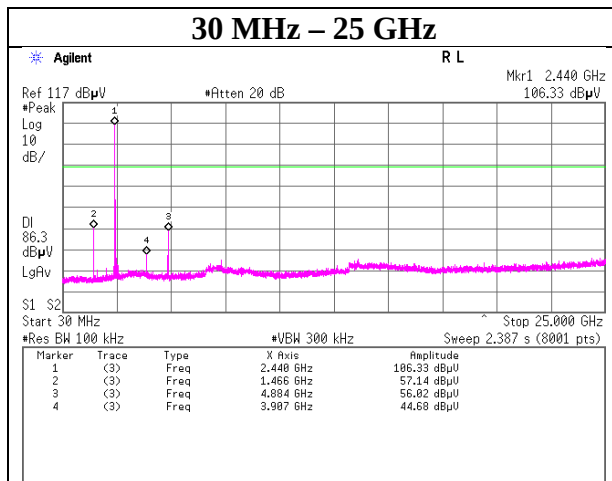
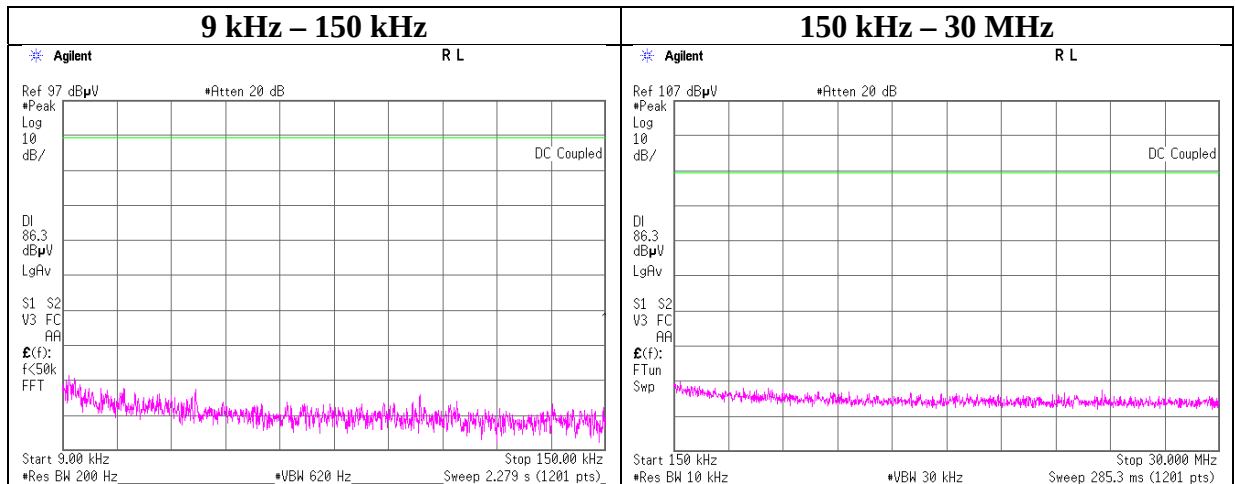
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
Mode	Tx, Hopping Off, DH5

2441 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

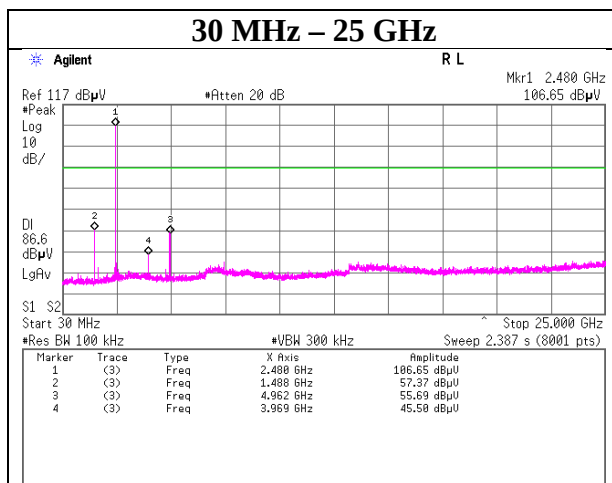
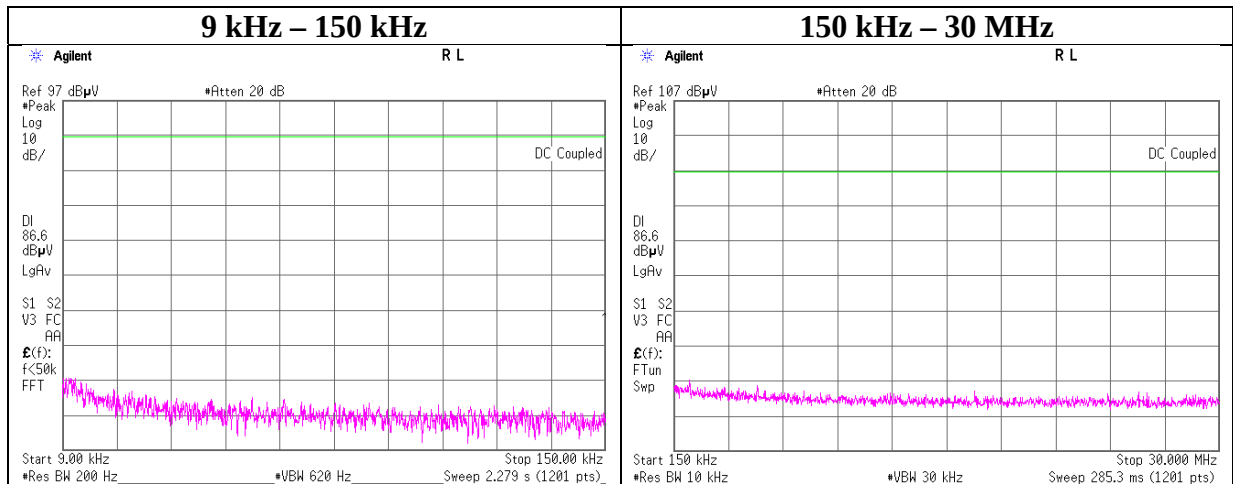
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
Mode	Tx, Hopping Off, DH5

2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

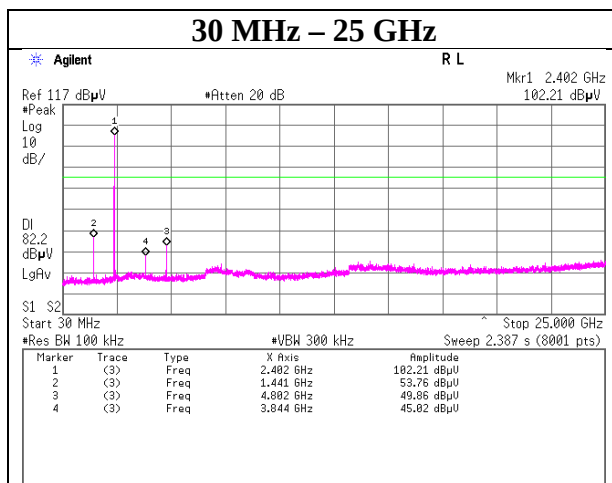
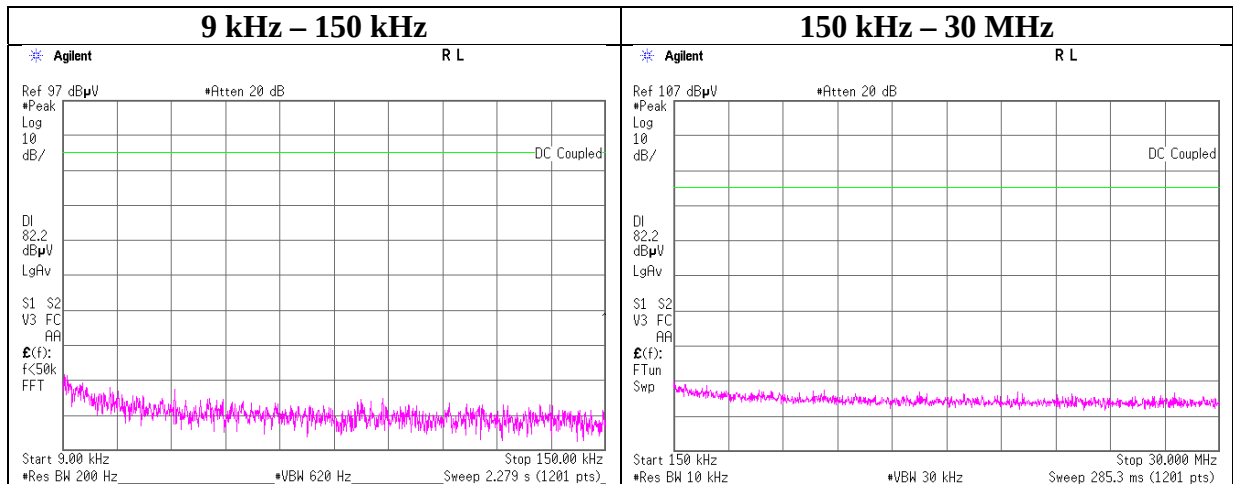
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
Mode	Tx, Hopping Off, 3DH5

2402 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

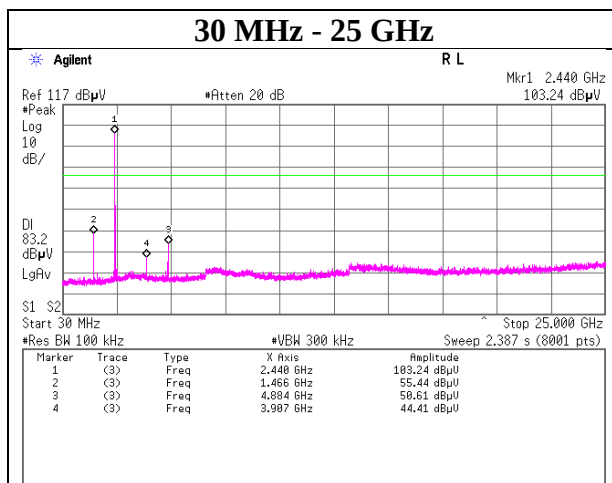
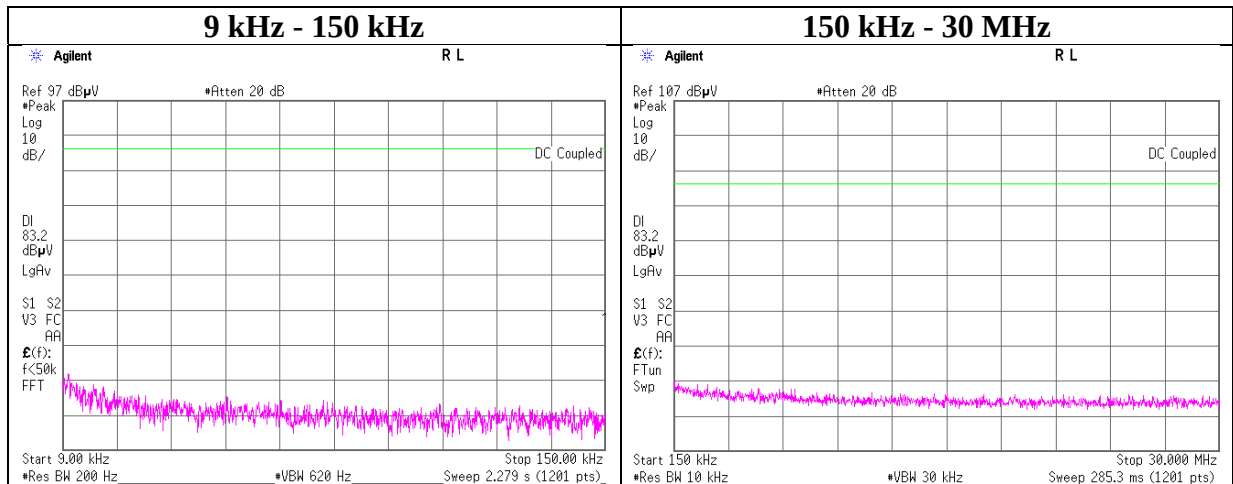
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
Mode	Tx, Hopping Off, 3DH5

2441 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

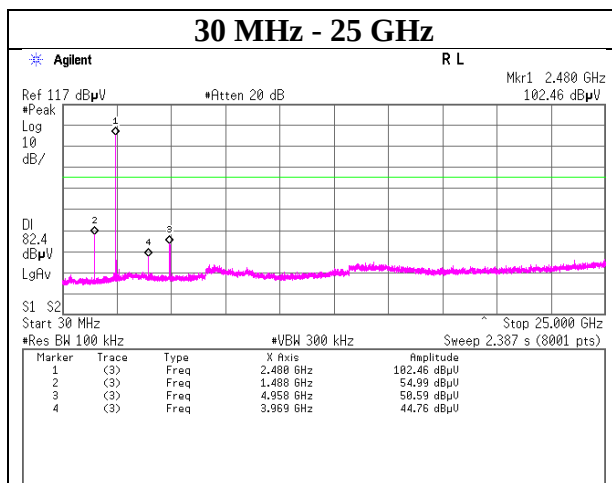
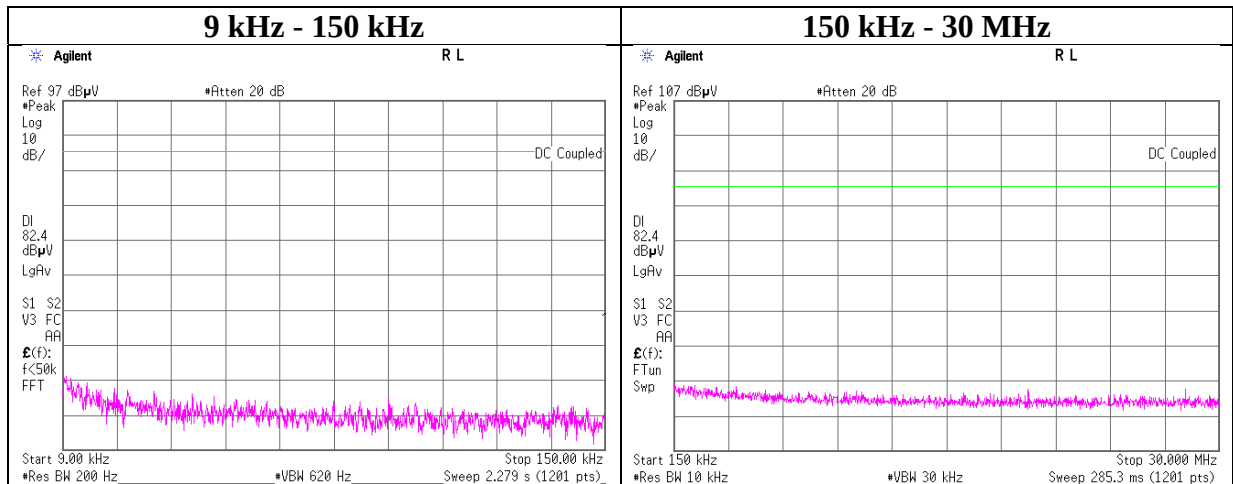
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	13473127S-A-R2
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	August 24, 2020
Temperature / Humidity	22 deg. C / 62 % RH
Engineer	Toshinori Yamada
Mode	Tx, Hopping Off, 3DH5

2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

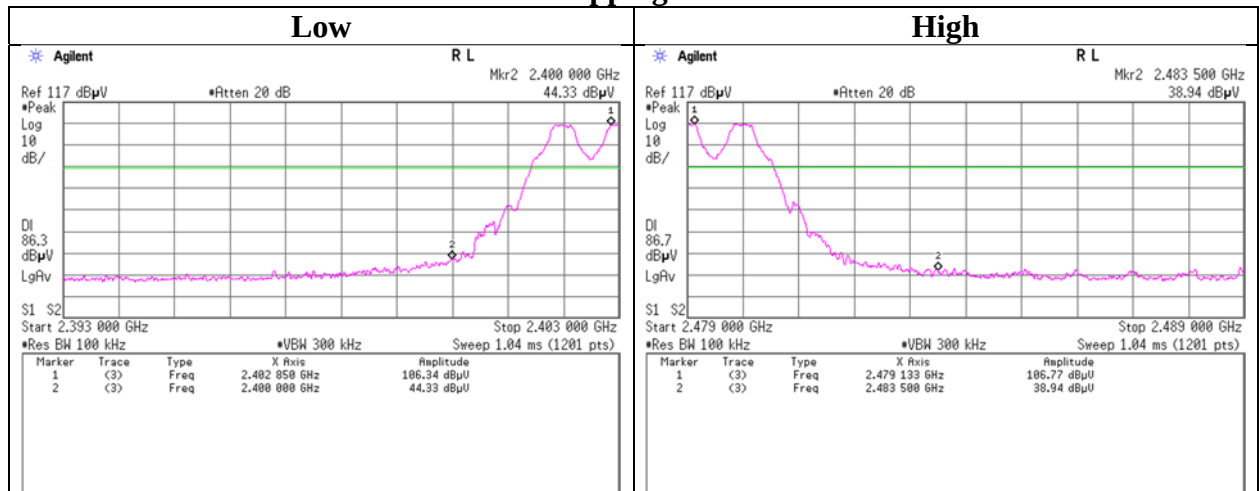
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

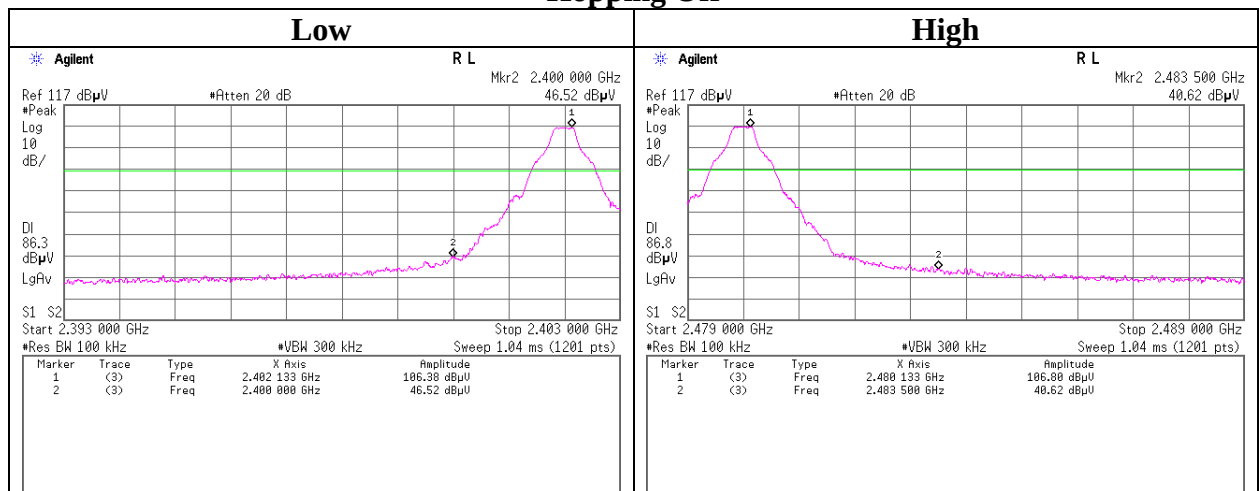
Conducted Emission Band Edge compliance

Report No. 13473127S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date August 24, 2020 August 25, 2020
Temperature / Humidity 22 deg. C / 62 % RH 24 deg. C / 52 % RH
Engineer Toshinori Yamada Toshinori Yamada
Mode Tx DH5

Hopping On



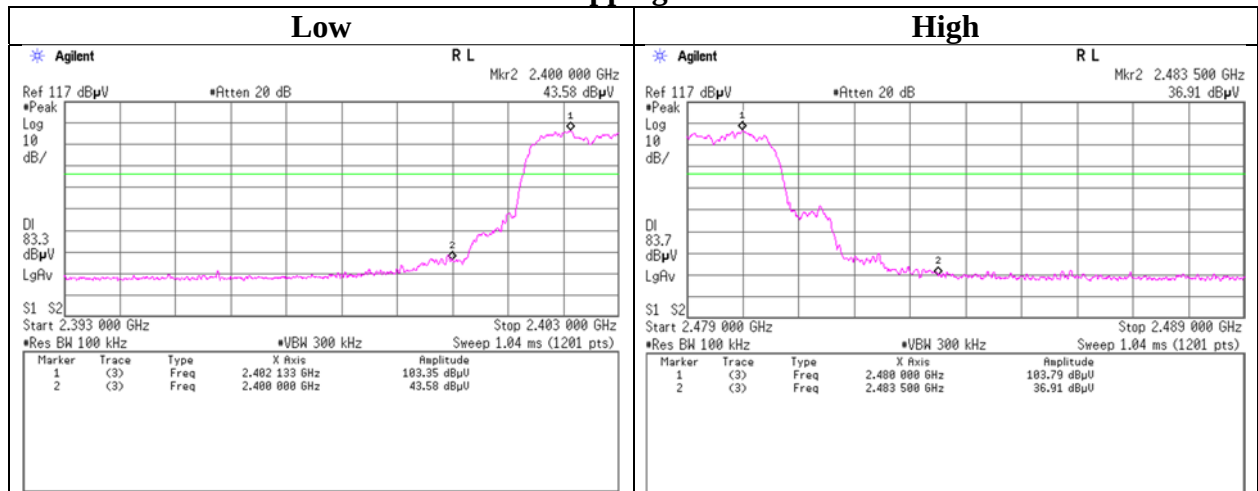
Hopping Off



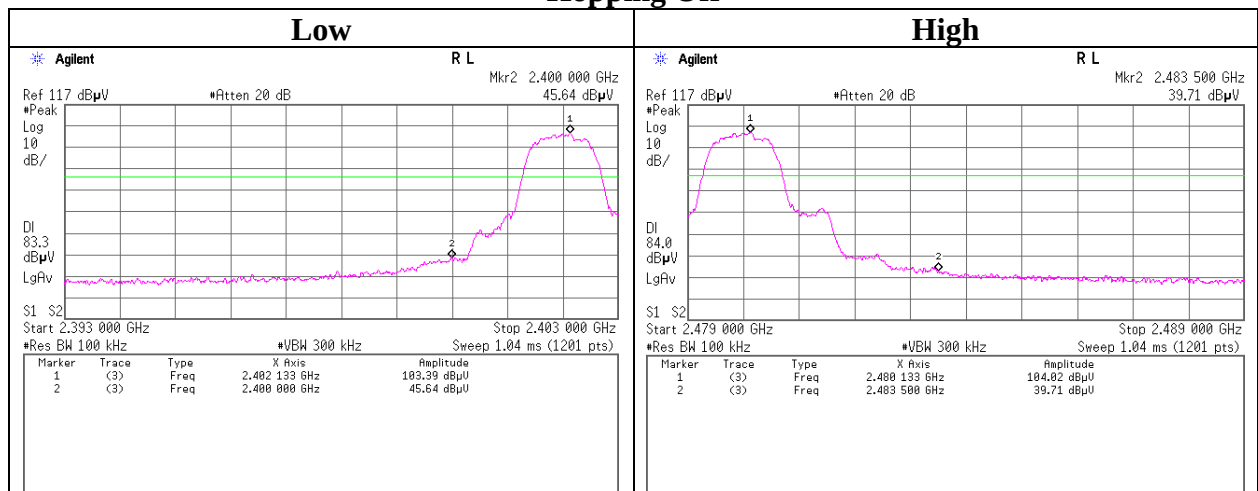
Conducted Emission Band Edge compliance

Report No.	13473127S-A-R2	
Test place	Shonan EMC Lab. No.5 Shielded Room	
Date	August 24, 2020	August 25, 2020
Temperature / Humidity	22 deg. C / 62 % RH	24 deg. C / 52 % RH
Engineer	Toshinori Yamada	Toshinori Yamada
Mode	Tx 3DH5	

Hopping On



Hopping Off



APPENDIX 2: Test instruments

Test equipment

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2019/10/01	12
AT	SAT10-09	145132	Attenuator	Weinschel Corp.	54A-10	W5692	2019/11/05	12
AT	SCC-G12	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2020/03/02	12
AT	SCC-H20	159940	Microwave cable	RS Pro	R-132G7210 100CO	-	2019/11/07	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2019/12/12	12
AT	SPM-07	146247	Power Meter	Keysight Technologies Inc	8990B	MY5100272	2020/05/27	12
AT	SPSS-04	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2020/05/27	12
AT	SRENT-15	160899	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185516	2020/01/15	12
CE	KAT3-12	144896	Attenuator	JFW IND. INC.	50HF-003N	-	2020/07/16	12
CE	SCC-B12/B13/SRSE-02	144969	Coaxial Cable&RF Selector	Suhner/Suhner/T OYO	RG223U/141PE /NS4906	-/0901-270(RF Selector)	2020/04/17	12
CE	SLS-04	145541	LISN	Rohde & Schwarz	ENV216	100514	2020/02/19	12
CE	SOS-22	191839	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2019/12/12	12
CE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2020/04/24	12
CE	STS-02	145793	Digital Hitester	Hioki	3805-50	80997819	2020/04/09	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,M E,PE)	-	-	-
CE,RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2019/12/05	12
RE	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2019/11/05	12
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2020/04/08	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2020/05/04	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2020/02/19	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2020/06/02	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2020/03/03	12
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2019/11/06	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2020/08/18	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032664	2020/04/04	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/T OYO	8D2W/12DSFA /141PE/141PE/1 41PE/141PE/NS 4906	-/0901-269(RF Selector)	2020/04/12	12
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/T OYO	8D2W/12DSFA /141PE/141PE/1 41PE/141PE/NS 4906	-/0901-269(RF Selector)	2020/04/12	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2020/01/31	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2020/03/04	12

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

Test equipment

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2020/01/08	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2020/05/12	12
RE	SCC-G62	196985	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	803650/2	2020/03/10	12
RE	SCC-G68	200008	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	575616/4	2020/07/07	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2019/11/06	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-725	2020/05/27	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	00094868	2020/06/15	12
RE	SHA-08	194683	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA 9120 C	694	2020/02/17	12
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess - Elektronik	VUSLP9111B	193	2020/04/04	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2019/12/12	12
RE	STR-07	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2019/09/13	12
RE	STS-01	145792	Digital Hitester	Hioki	3805-50	80997812	2019/10/01	12

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

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

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

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

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

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