



RADIO TEST REPORT

Test Report No. : 13063553S-B-R2

Applicant : PIONEER CORPORATION
Type of Equipment : RDS AV RECEIVER
Model No. : DMH-W4660NEX
FCC ID : AJDK111
Test regulation : FCC Part 15 Subpart C: 2019
*Bluetooth BDR/EDR part
Test items : Antenna Terminal Conducted Tests
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 13063553S-B-R1. 13063553S-B-R1 is replaced with this report.

Date of test: October 4, 2019

Representative test engineer:

M. Hosaka

Makoto Hosaka
Engineer

Consumer Technology Division

Approved by:

K. Takeyama

Kazutaka Takeyama
Engineer

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.: 13063553S-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13063553S-B	November 28, 2019	-	-
1	13063553S-B-R1	January 7, 2020	P.6	Modification of the clock frequency for Bluetooth Wi-Fi module from 32.768 MHz to 32.768 kHz
			P.6	Modification of the clock frequency for CHIPS from 32.768 MHz to 32.768 kHz
			P.6	GNSS Frequency of Operation from: See table below. to: GPS: 1575.42 MHz GLONASS: 1598.025 MHz -1605.375 MHz Galileo: 1575.42 MHz
			P.7	Modification of the reference test report number from: No.13063554M-A to: No.13063554M-A-R1
2	13063553S-B-R2	January 27, 2020	P.1	Addition of Test items: Antenna Terminal Conducted Tests
			P.6	Modification of product description from: is a RDS AV RECEIVER to: is an RDS AV RECEIVER
			P.6	Removed from Clock frequency (ies) in the system: “Bluetooth Wi-Fi module: 32.768 kHz”
			P.7	Modification of the reference test report number from: No.13063554M-A-R1 to: No.13063554M-A-R2

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 (E.U.T.).....	5
SECTION 3: Test specification, procedures & results.....	7
SECTION 4: Operation of E.U.T. during testing.....	10
SECTION 5: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Test data	13
20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation.....	13
Number of Hopping Frequency	17
Dwell time.....	19
Maximum Peak Output Power.....	22
Average Output Power.....	23
Conducted Spurious Emission	25
Conducted Emission Band Edge compliance	31
APPENDIX 2: Test instruments	33
APPENDIX 3: Photographs of test setup	34
Antenna Terminal Conducted Test	34

SECTION 1: Customer information

Company Name	:	PIONEER CORPORATION
Address	:	25-1, Yamada, Kawagoe-shi, Saitama, 350-8555, JAPAN
Telephone Number	:	+81-49-228-7681
Facsimile Number	:	+81-49-228-6172
Contact Person	:	Shigeru Yoshida

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	:	RDS AV RECEIVER
Model No.	:	DMH-W4660NEX
Serial No.	:	Refer to SECTION 4.2
Rating	:	DC 14.4 V (DC 10.8 V to 15.1 V)
Receipt Date of Sample (Information from test lab.)	:	September 11, 2019
Country of Mass-production	:	Thailand
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: DMH-W4660NEX (referred to as the EUT in this report) is an RDS AV RECEIVER.

General Specification

The clock frequencies used in the EUT:

Clock frequency(ies) in the system : DC-DC CONVERTER: 1008 kHz/ 700.5 kHz, 365.8 kHz/ 413.9 kHz
FM/AM TUNER: 55.467 MHz (VCO: 5.9904 GHz/ 6.2208 GHz)
MAIN PROCESSER: 24 MHz
SYSTEM MICRO COMPUTER: 12.5 MHz
LCD BACK LIGHT: 515.7 kHz/ 476.6 kHz
LINE AMPLIFIER: 515.7 kHz/ 476.6 kHz
CHIPS: 26 MHz, 32.768 kHz, 10 MHz
HDMI RECEIVER: 27 MHz
VIDEO DECODER: 32 MHz
WWR UNIT: 55.467 MHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2.4 GHz: 2402 MHz - 2480 MHz (Bluetooth BDR/EDR, Bluetooth Low Energy) 2412 MHz - 2462 MHz (IEEE 802.11b/g/n) 5 GHz 5745 MHz (IEEE 802.11a/n-20) 5755 MHz (IEEE 802.11n-40/ac-40) 5775 MHz (IEEE 802.11ac-80)
Modulation	:	DSSS (IEEE 802.11b), OFDM (IEEE 802.11g/n/a/ac) FHSS (Bluetooth BDR/EDR) GFSK (Bluetooth Low Energy)
Power Supply (inner)	:	DC 3.3 V/1.8 V
Antenna type	:	Monopole Antenna
Antenna Gain	:	2.4 GHz: -9.4 dBi (Bluetooth BDR/EDR, Bluetooth Low Energy) -11.9 dBi (IEEE 802.11b/g/n) 5 GHz: -11.1 dBi
Operating Temperature	:	-10 deg. C to +60 deg. C

GNSS

Radio Type	:	Receiver
Frequency of Operation	:	GPS: 1575.42 MHz GLONASS: 1598.025 MHz -1605.375 MHz Galileo: 1575.42 MHz
Antenna type	:	External Antenna
Antenna Gain	:	2.0 dBi (Elevation Angle:90 deg.) -6.0 dBi (Elevation Angle:10 deg.)

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

*The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	N/A	N/A	- *1)
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ISED: RSS-247 5.1 (b)	N/A	N/A a)	Conducted
20dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ISED: RSS-247 5.1 (a)	See data.	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	See data.	Complied f)	Conducted/ Radiated (above 30 MHz) *2)

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

*1) The test is not applicable since the EUT does not have AC power ports.

*2) For the Radiated spurious emission test, refer to test report No.13063554M-A-R2.

a) Refer to APPENDIX 1 (data of Carrier Frequency Separation)

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)

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)

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

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

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	RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

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

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Shonan EMC Lab.

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 %

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

A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	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.

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 4: Operation of E.U.T. during testing

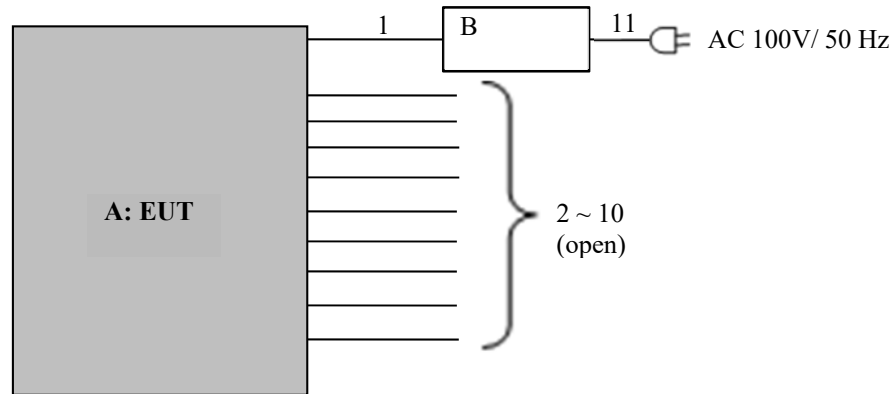
4.1 Operating Mode(s)

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. *EUT has the power settings by the software as follows; Power settings: Fixed Software: SoC : 0.0601107 SYS : 7.13 *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.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Car Audio with Bluetooth/WLAN/GPS	DMH-W4660NEX	SGTM000072UC	Pioneer Corporation	EUT
B	DC Power Supply	PAN 35-10A	DE001677	Kikusui	-

List of cables used

No.	Name	Length (m)	eld		Remark
			Cable	Connector	
1	DC (+B, ACC, GND)	0.15 + 2.4	Unshielded	Unshielded	-
2	Speaker Front L	0.15	Unshielded	Unshielded	-
3	Speaker Front R	0.15	Unshielded	Unshielded	-
4	Speaker Rear L	0.15	Unshielded	Unshielded	-
5	Speaker Rear R	0.15	Unshielded	Unshielded	-
6	System Remote Control	0.15	Unshielded	Unshielded	-
7	ILL +	0.15	Unshielded	Unshielded	-
8	Reverse Gear Signal In	0.15	Unshielded	Unshielded	-
9	Parking Brake	2.0	Unshielded	Unshielded	-
10	Car Speed Signal In	0.15	Unshielded	Unshielded	-
11	AC	2.0	Unshielded	Unshielded	-

SECTION 5: 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: 160 MHz 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)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)							

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

Test data	: APPENDIX
Test result	: Pass

APPENDIX 1: Test data

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

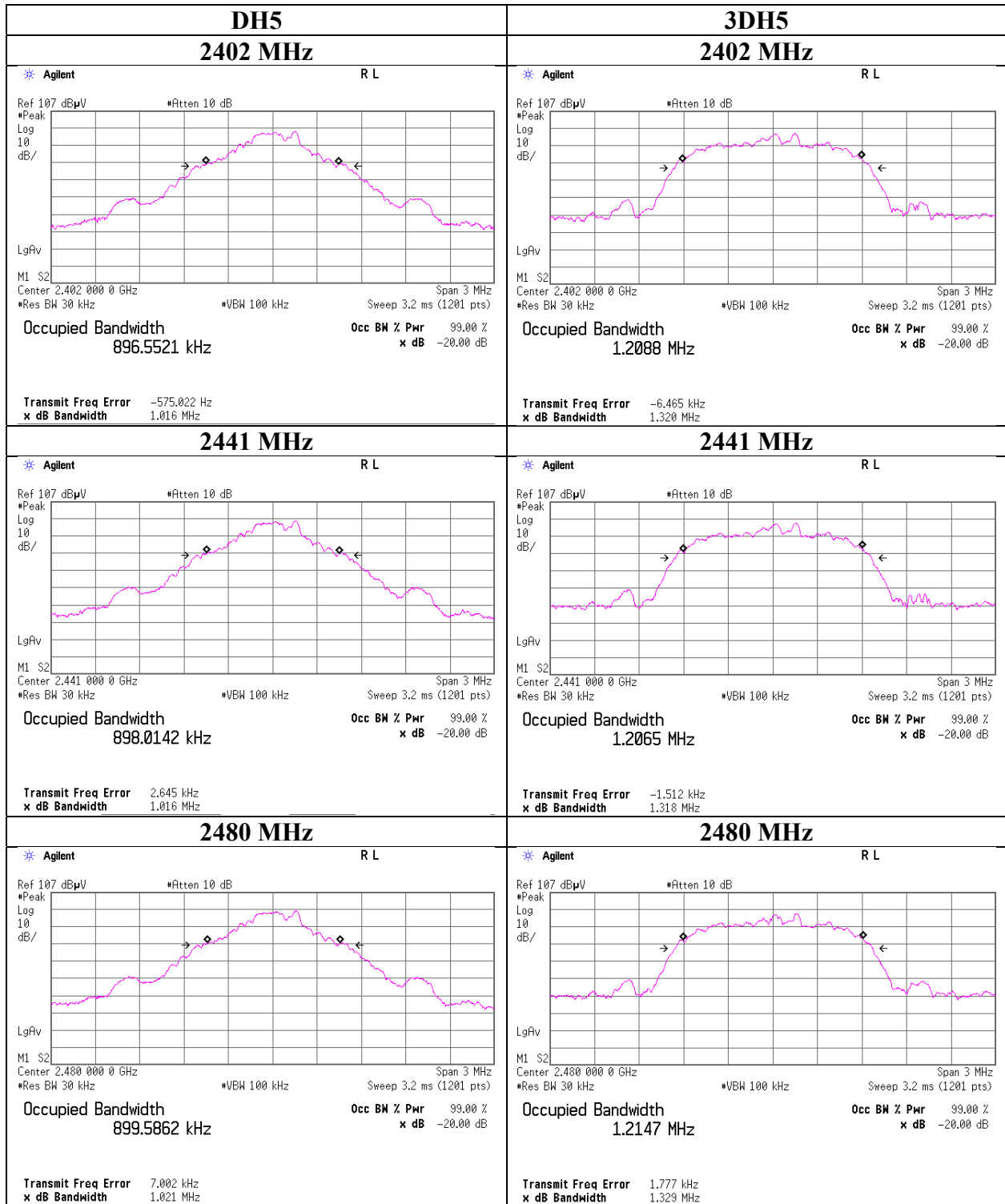
Report No.	13063553S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 4, 2019
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	1.016	896.5521	1.000	≥ 0.677
DH5	2441.0	1.016	898.0142	1.000	≥ 0.677
DH5	2480.0	1.021	899.5862	1.000	≥ 0.680
DH5	Hopping On	-	78632.4	-	-
3DH5	2402.0	1.320	1208.8	1.000	≥ 0.880
3DH5	2441.0	1.318	1206.5	1.000	≥ 0.879
3DH5	2480.0	1.329	1214.7	1.000	≥ 0.886
3DH5	Hopping On	-	78731.0	-	-

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.

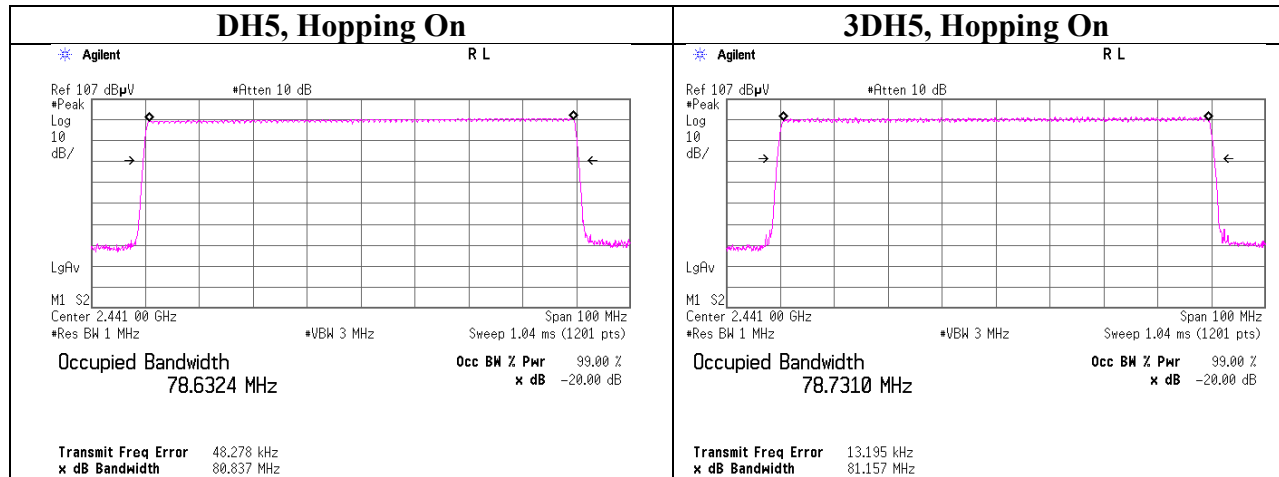
Shonan EMC Lab.

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.

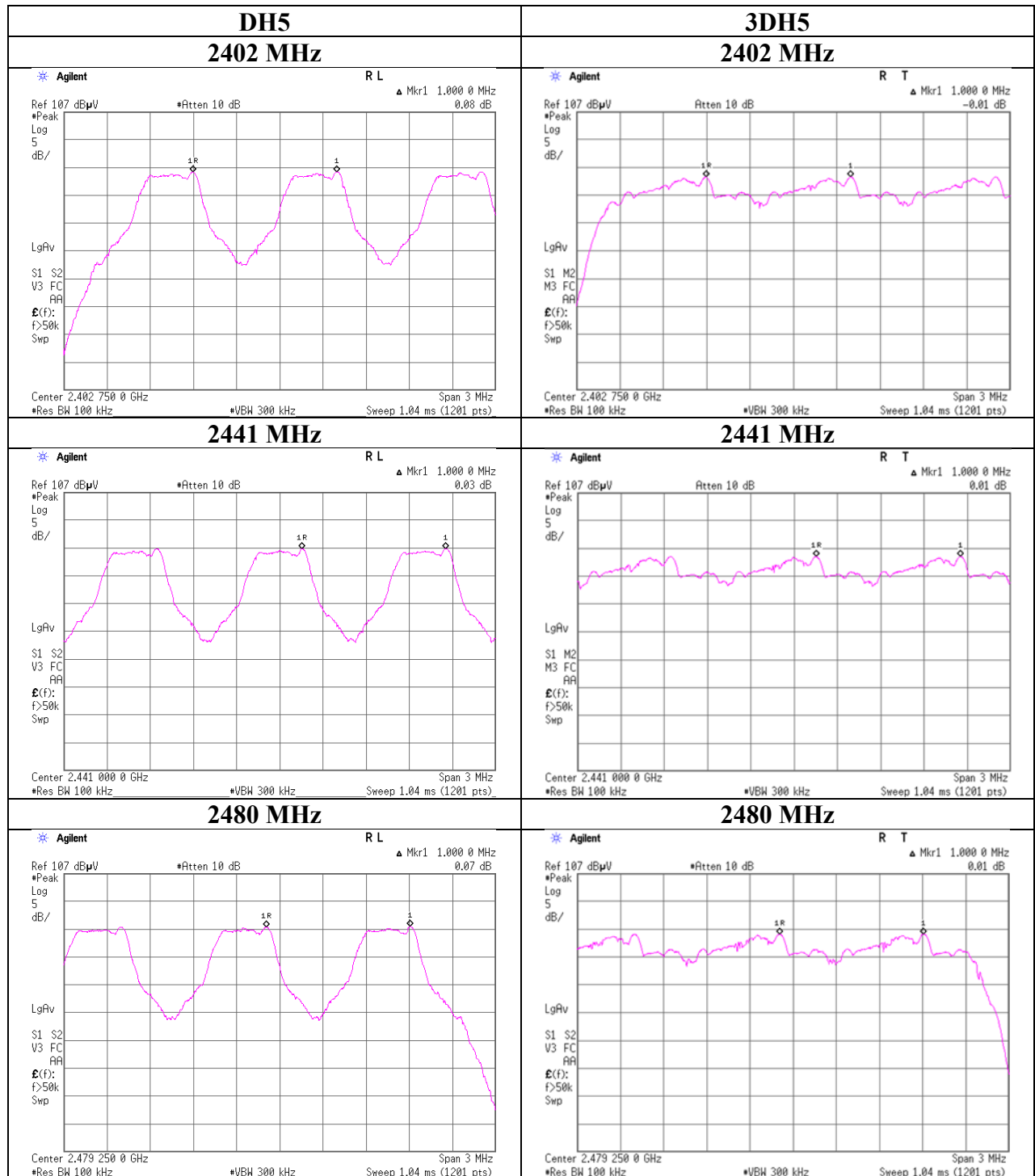
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Carrier Frequency Separation



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

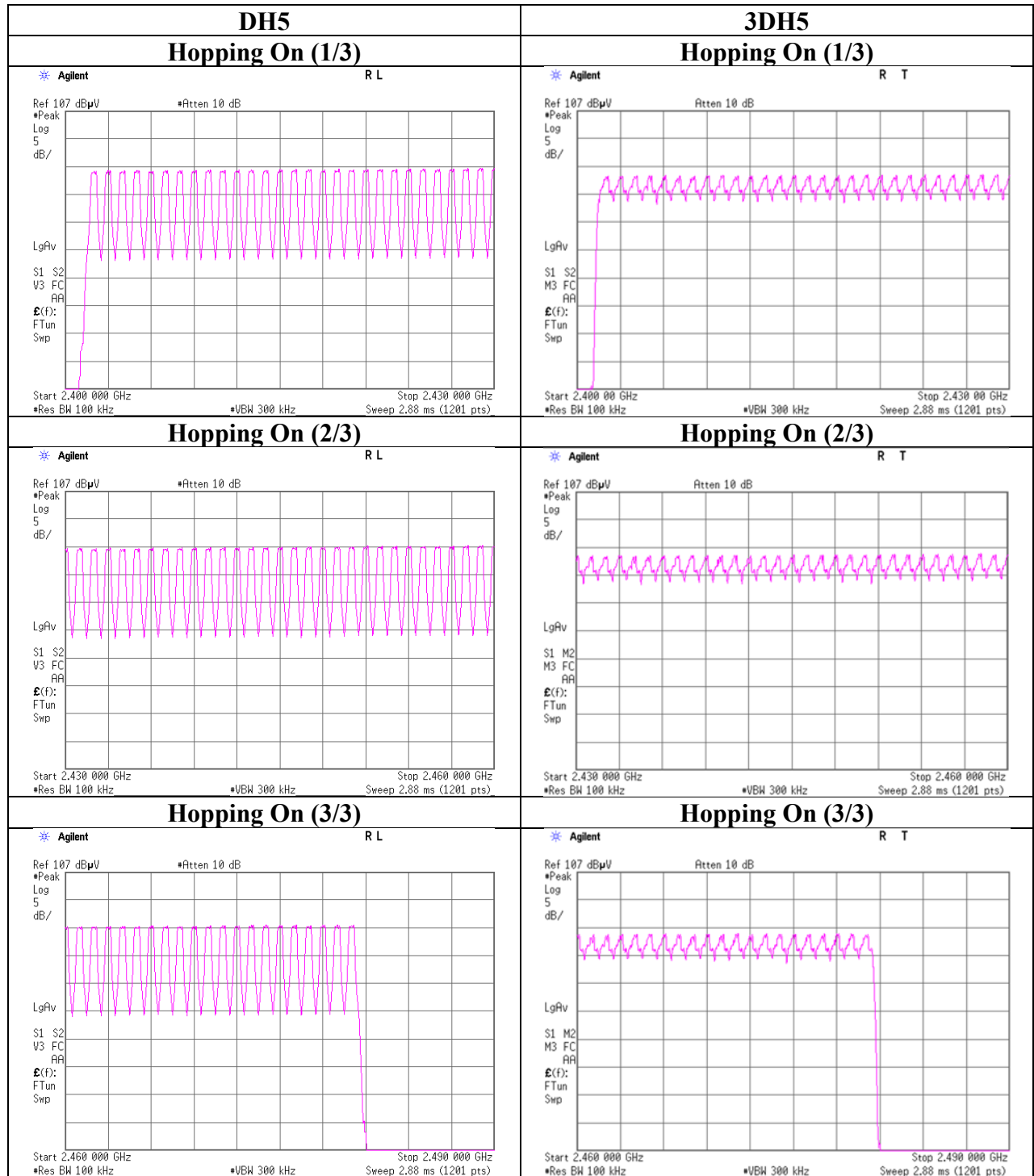
Number of Hopping Frequency

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
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



Dwell time

Report No.	13063553S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 4, 2019
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Makoto Hosaka
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	50.2 times /	5 sec. x	31.6 sec. =	318 times	0.422	400
DH3	25.2 times /	5 sec. x	31.6 sec. =	160 times	1.678	400
DH5	18.4 times /	5 sec. x	31.6 sec. =	117 times	2.926	400
3DH1	49.4 times /	5 sec. x	31.6 sec. =	313 times	0.427	400
3DH3	26.2 times /	5 sec. x	31.6 sec. =	166 times	1.679	400
3DH5	18.4 times /	5 sec. x	31.6 sec. =	117 times	2.930	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

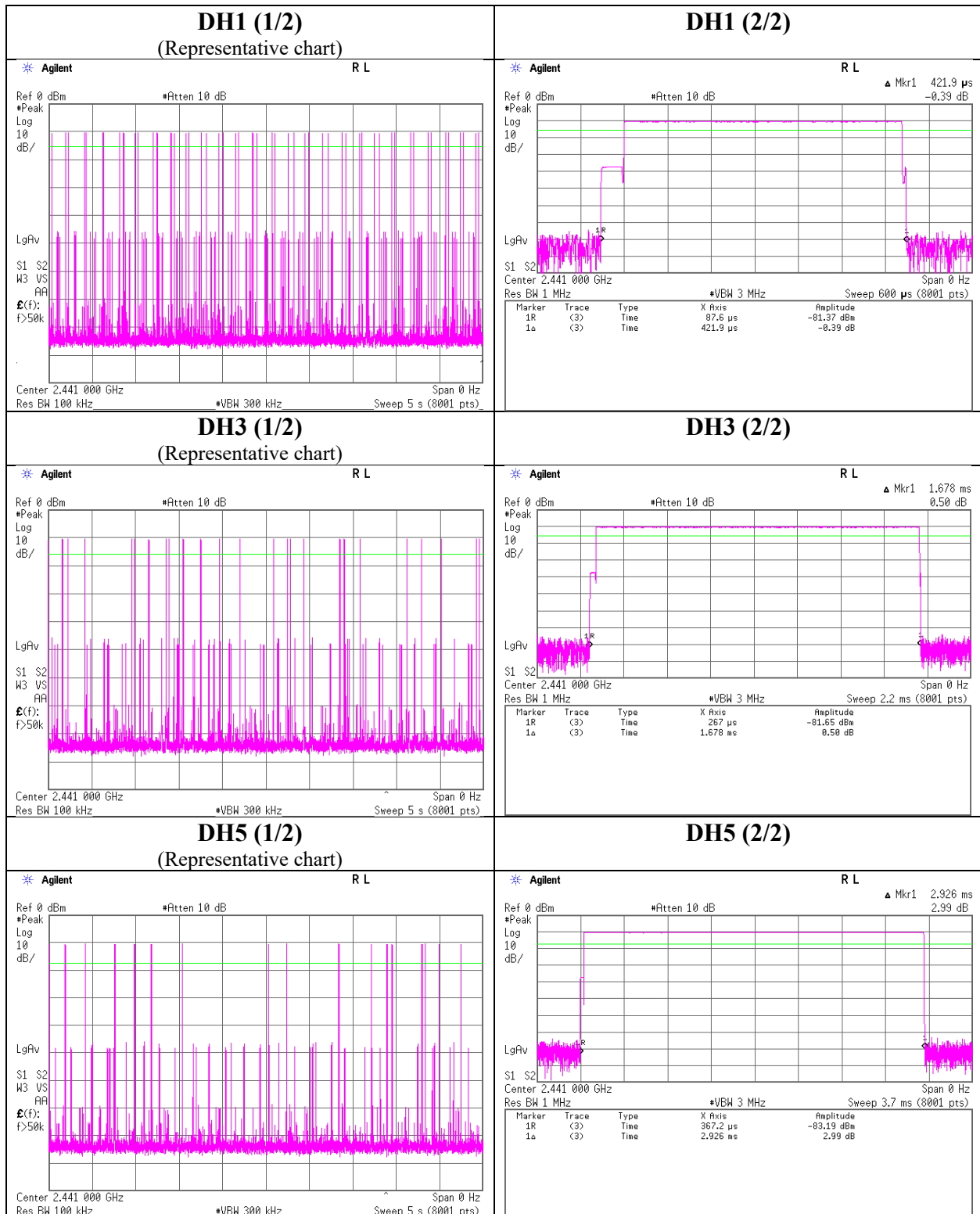
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	50	50	49	52	50.2
DH3	25	25	27	24	25	25.2
DH5	17	20	16	16	23	18.4
3DH1	50	50	47	49	51	49.4
3DH3	25	28	26	25	27	26.2
3DH5	18	17	19	18	20	18.4

Sample Calculation

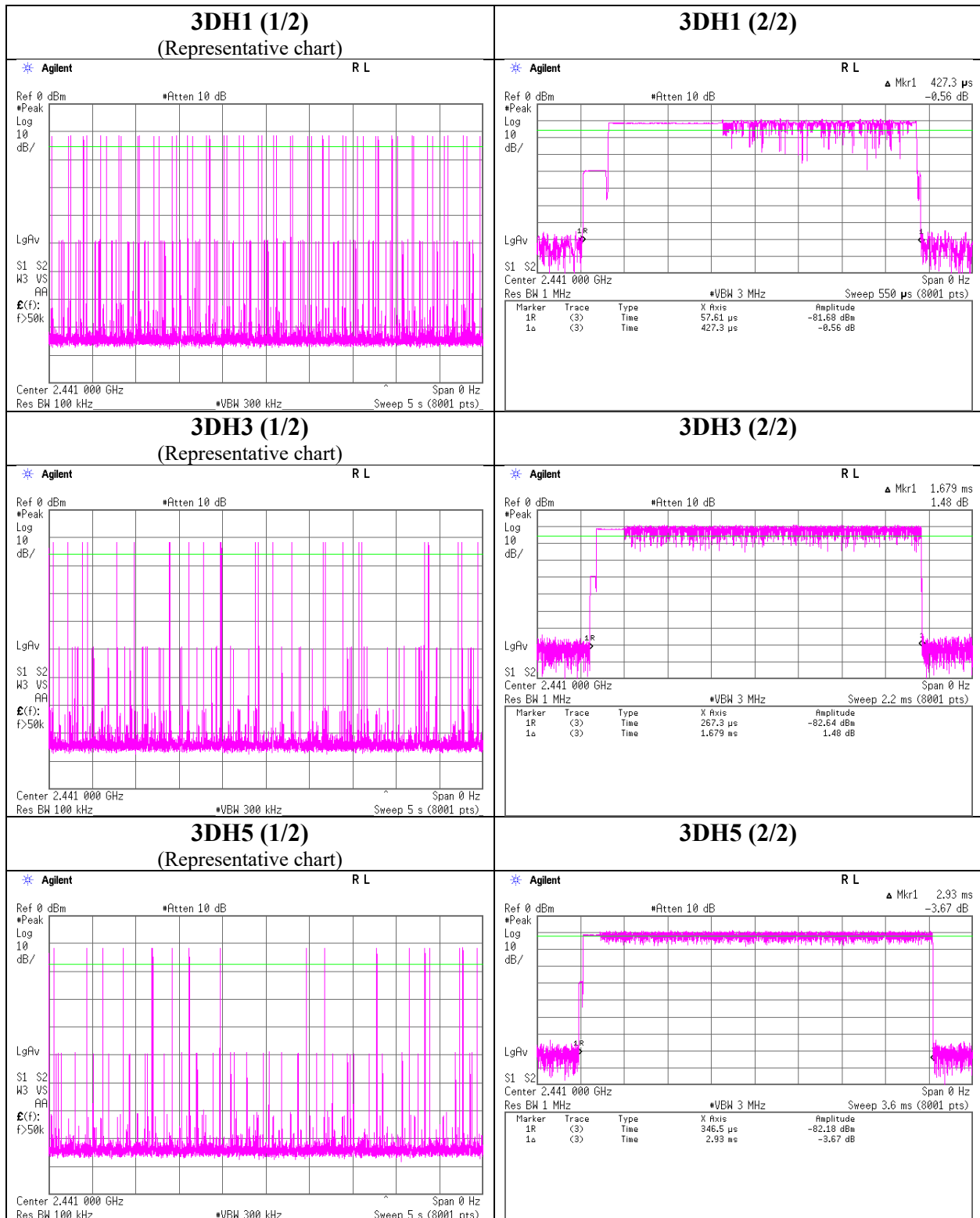
Average = Summation (Sampling 1 to 5) / 5

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. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
					Result		Limit		Margin	Antenna Gain [dBi]	Result		Limit		Margin
					[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-10.51	1.23	9.82	0.54	1.13	20.96	125	20.42	-9.40	-8.86	0.13	36.02	4000	44.88
DH5	2441.0	-9.84	1.24	9.82	1.22	1.32	20.96	125	19.74	-9.40	-8.18	0.15	36.02	4000	44.20
DH5	2480.0	-9.45	1.24	9.82	1.61	1.45	20.96	125	19.35	-9.40	-7.79	0.17	36.02	4000	43.81
2DH5	2402.0	-8.79	1.23	9.82	2.26	1.68	20.96	125	18.70	-9.40	-7.14	0.19	36.02	4000	43.16
2DH5	2441.0	-8.53	1.24	9.82	2.53	1.79	20.96	125	18.43	-9.40	-6.87	0.21	36.02	4000	42.89
2DH5	2480.0	-8.21	1.24	9.82	2.85	1.93	20.96	125	18.11	-9.40	-6.55	0.22	36.02	4000	42.57
3DH5	2402.0	-8.68	1.23	9.82	2.37	1.73	20.96	125	18.59	-9.40	-7.03	0.20	36.02	4000	43.05
3DH5	2441.0	-8.18	1.24	9.82	2.88	1.94	20.96	125	18.08	-9.40	-6.52	0.22	36.02	4000	42.54
3DH5	2480.0	-8.05	1.24	9.82	3.01	2.00	20.96	125	17.95	-9.40	-6.39	0.23	36.02	4000	42.41

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

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

Average Output Power (Reference data for RF Exposure)

Report No.	13063553S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 4, 2019
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Makoto Hosaka
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	-12.24	1.23	9.82	-1.19	0.76	1.08	-0.11	0.97
DH5	2441.0	-11.51	1.24	9.82	-0.45	0.90	1.08	0.63	1.16
DH5	2480.0	-11.07	1.24	9.82	-0.01	1.00	1.08	1.07	1.28
2DH5	2402.0	-12.77	1.23	9.82	-1.72	0.67	1.08	-0.64	0.86
2DH5	2441.0	-12.47	1.24	9.82	-1.41	0.72	1.08	-0.33	0.93
2DH5	2480.0	-12.09	1.24	9.82	-1.03	0.79	1.08	0.05	1.01
3DH5	2402.0	-12.84	1.23	9.82	-1.79	0.66	1.07	-0.72	0.85
3DH5	2441.0	-12.34	1.24	9.82	-1.28	0.74	1.07	-0.21	0.95
3DH5	2480.0	-12.14	1.24	9.82	-1.08	0.78	1.07	-0.01	1.00

Sample Calculation:

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

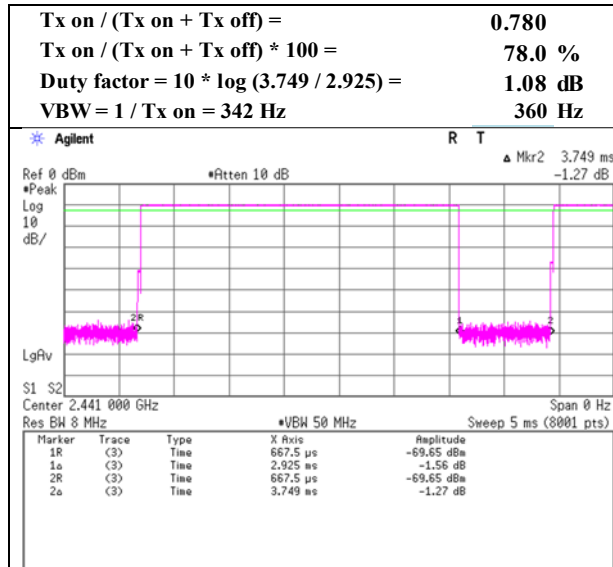
Result (Burst power average) = Time average + Duty factor

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

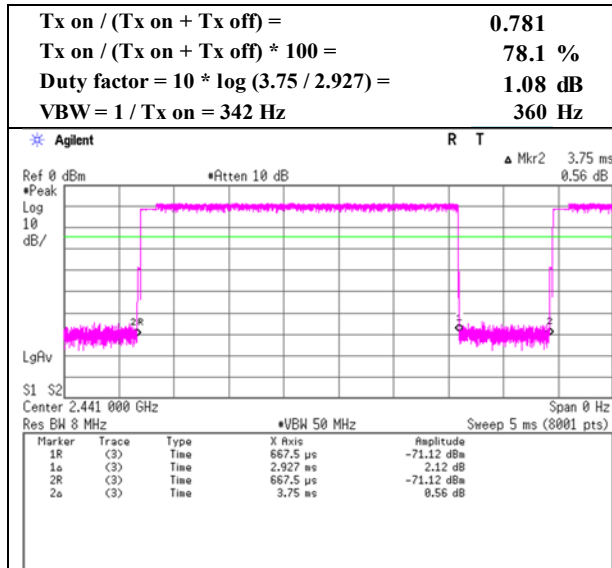
Burst Rate Confirmation

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off

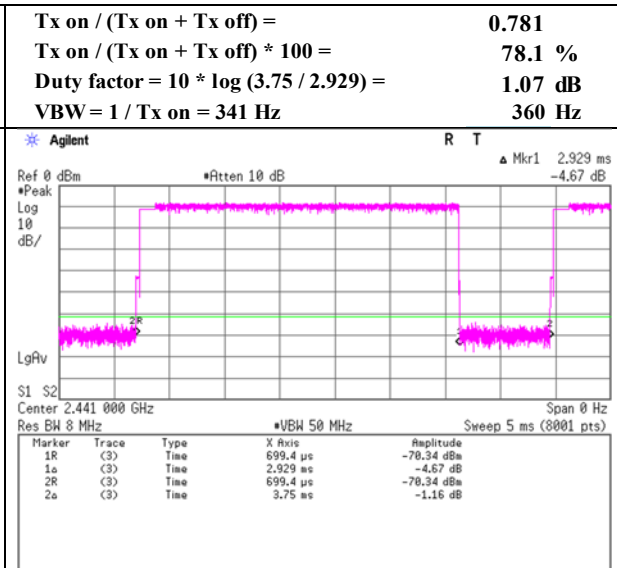
DH5



2DH5



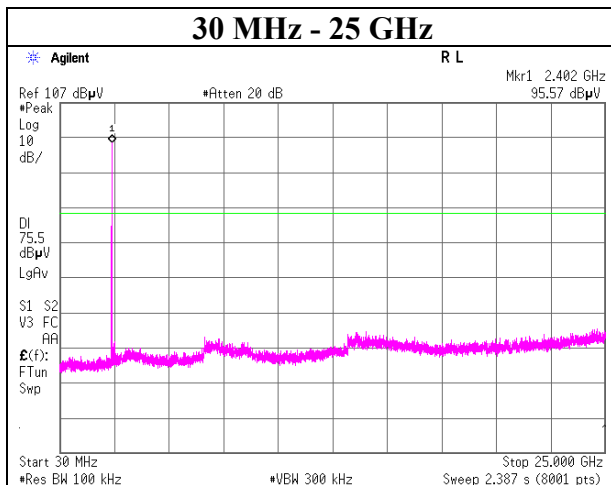
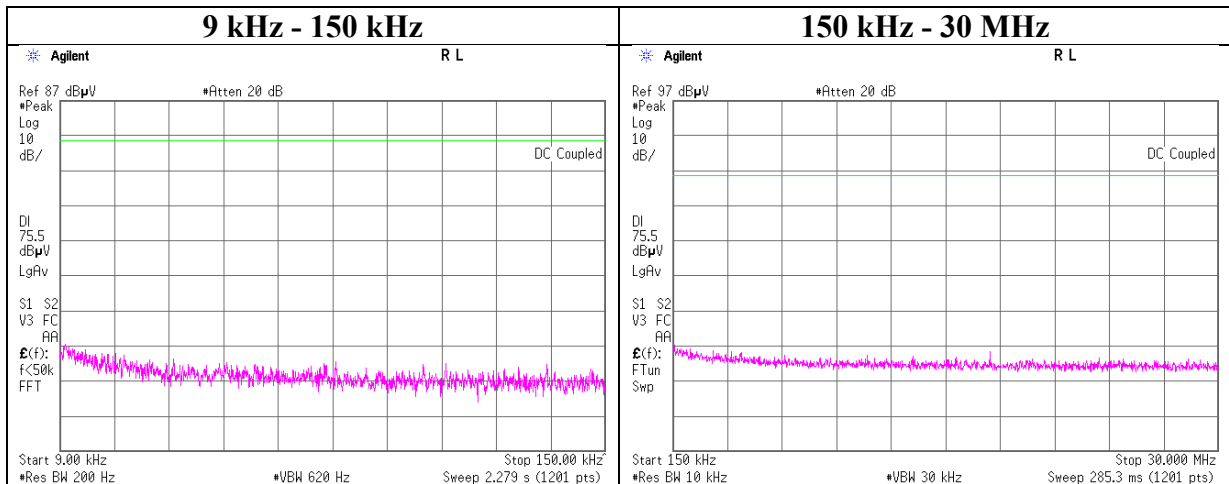
3DH5



Conducted Spurious Emission

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off, DH5

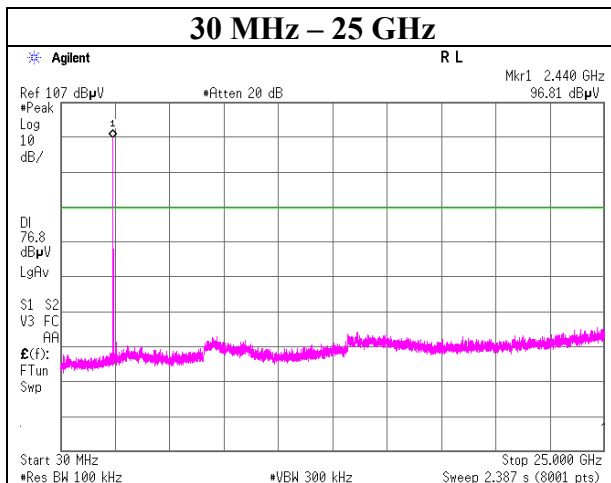
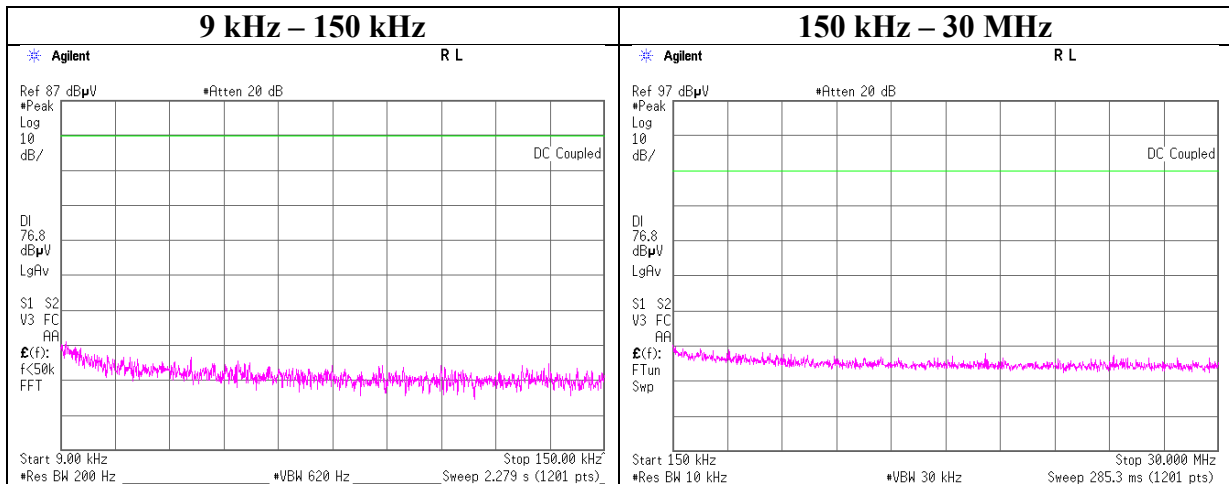
2402 MHz



Conducted Spurious Emission

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off, DH5

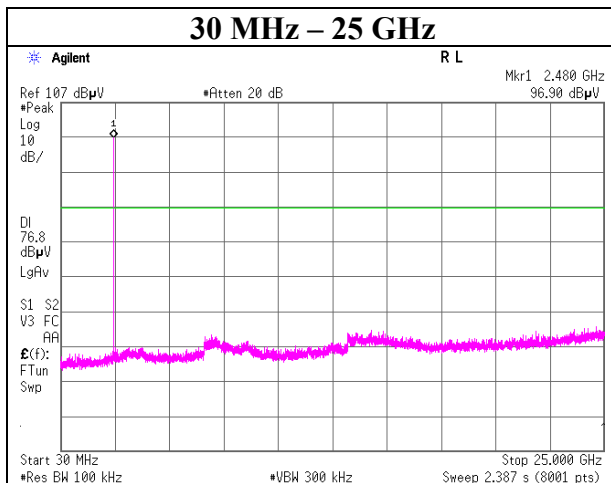
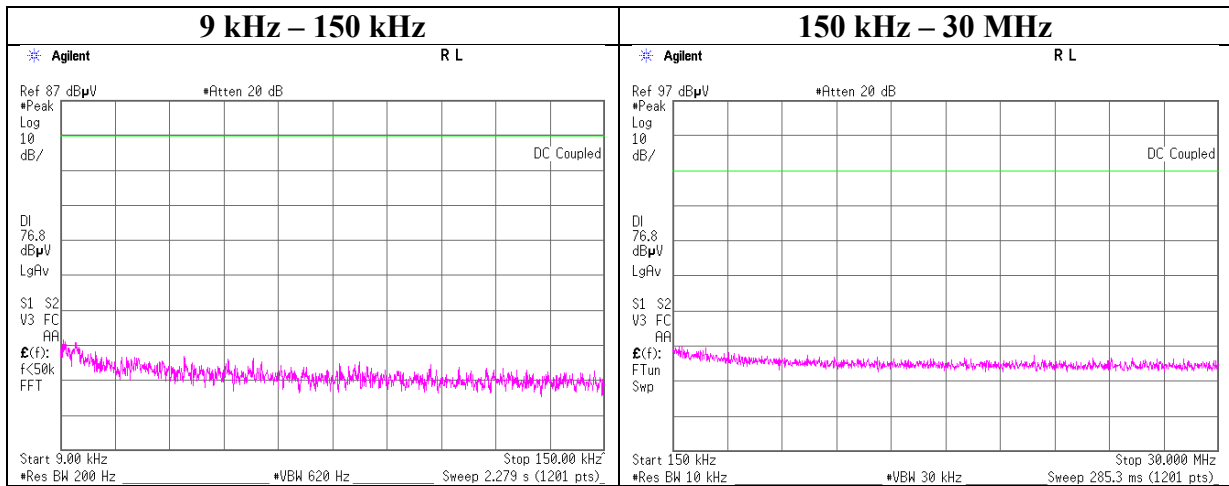
2441 MHz



Conducted Spurious Emission

Report No.	13063553S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 4, 2019
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

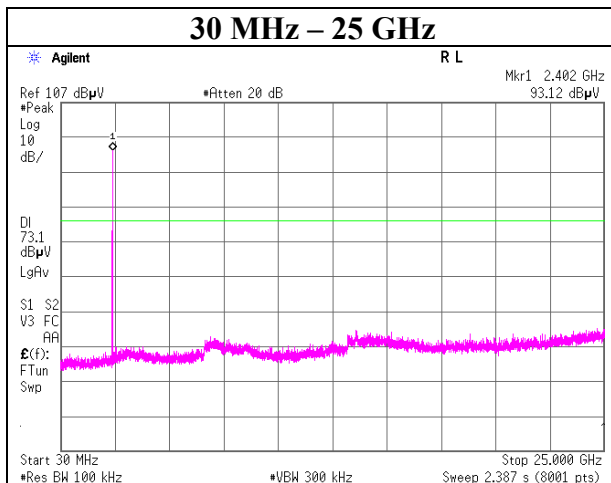
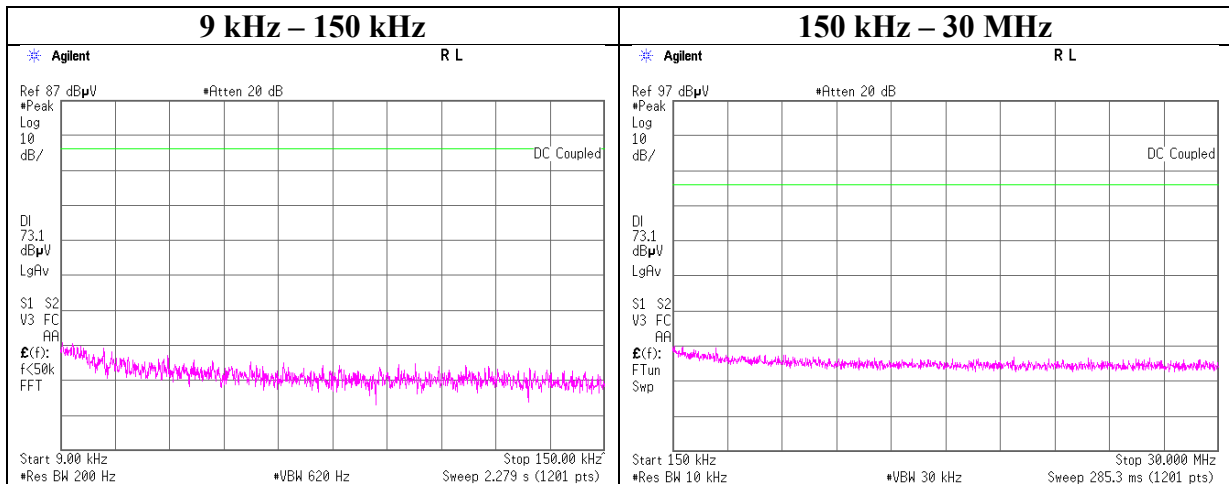
2480 MHz



Conducted Spurious Emission

Report No.	13063553S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 4, 2019
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, 3DH5

2402 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

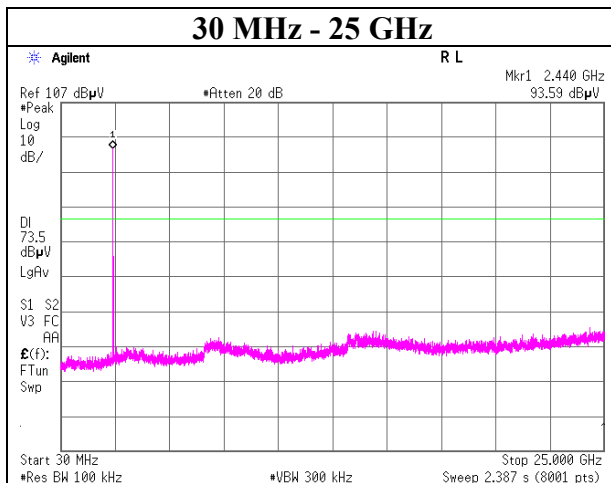
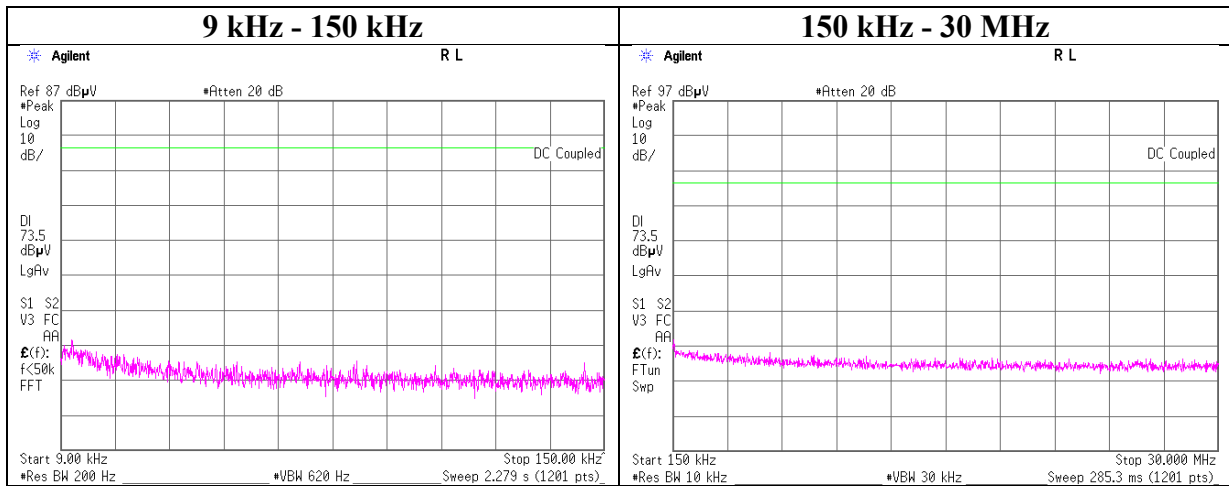
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off, 3DH5

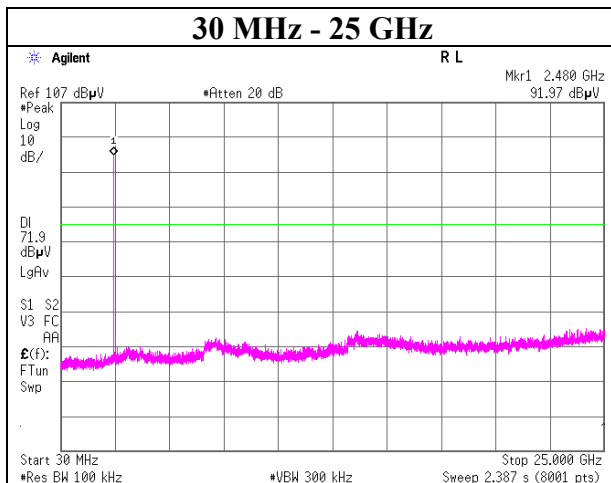
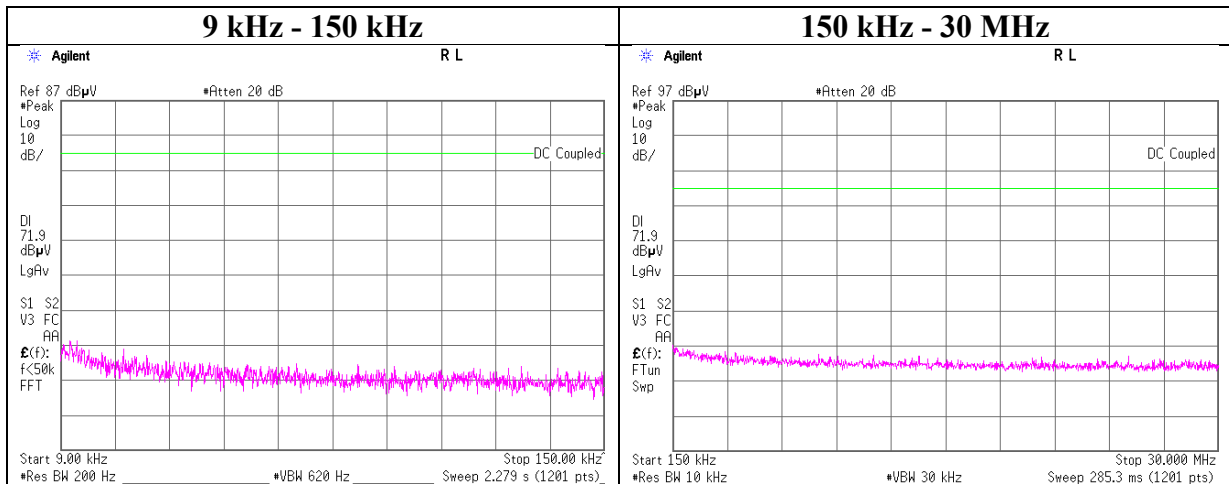
2441 MHz



Conducted Spurious Emission

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off, 3DH5

2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

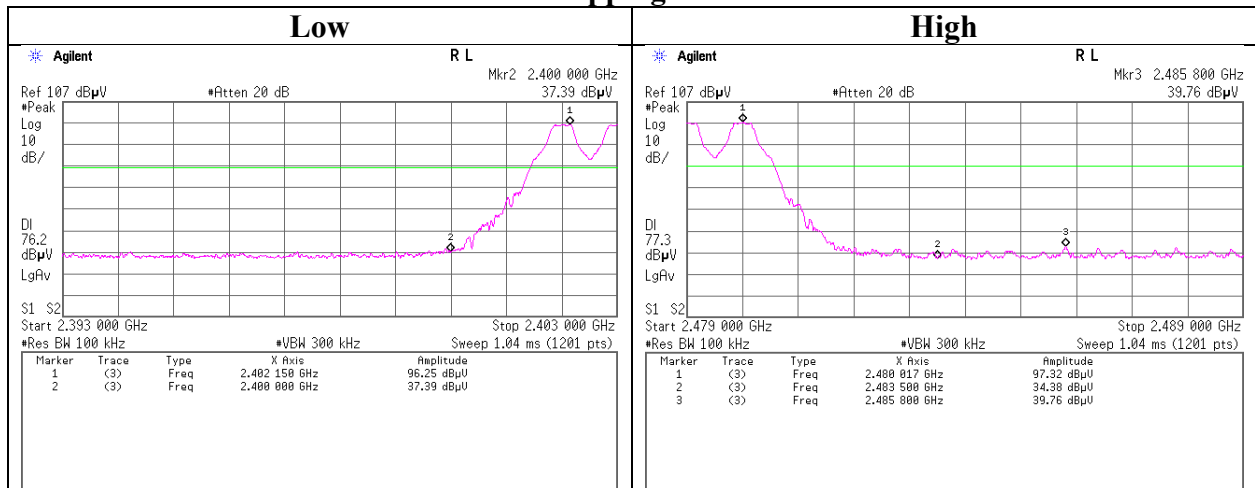
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

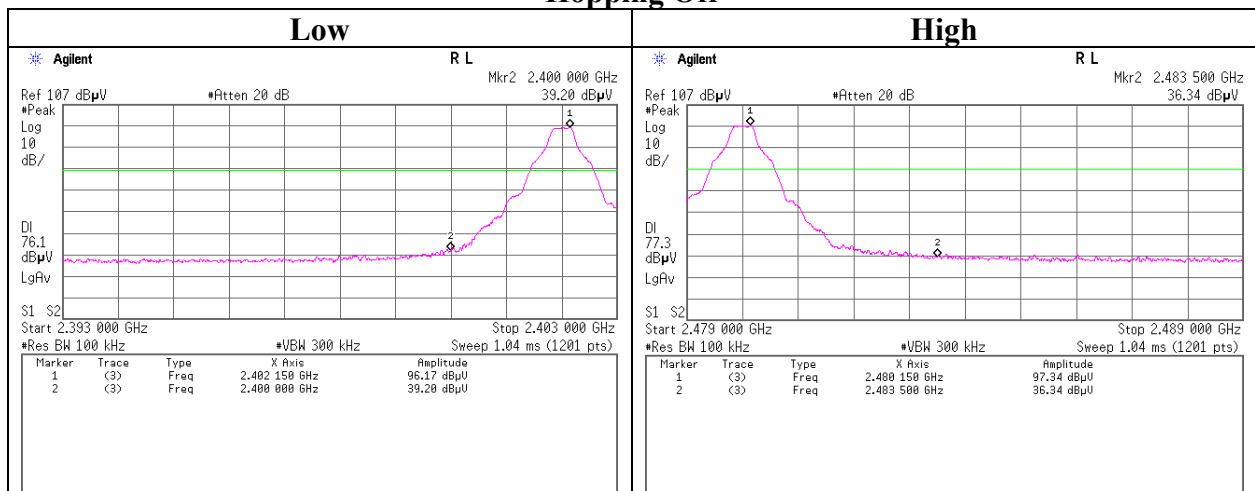
Conducted Emission Band Edge compliance

Report No. 13063553S-B-R2
Test place Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date October 4, 2019
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Makoto Hosaka
Mode Tx DH5

Hopping On



Hopping Off



UL Japan, Inc.

Shonan EMC Lab.

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

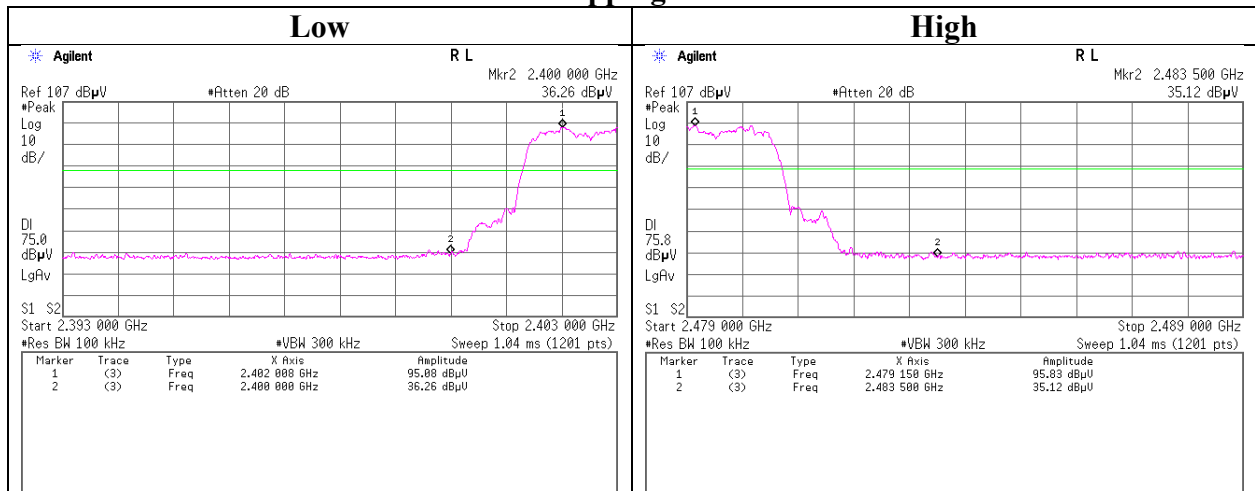
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

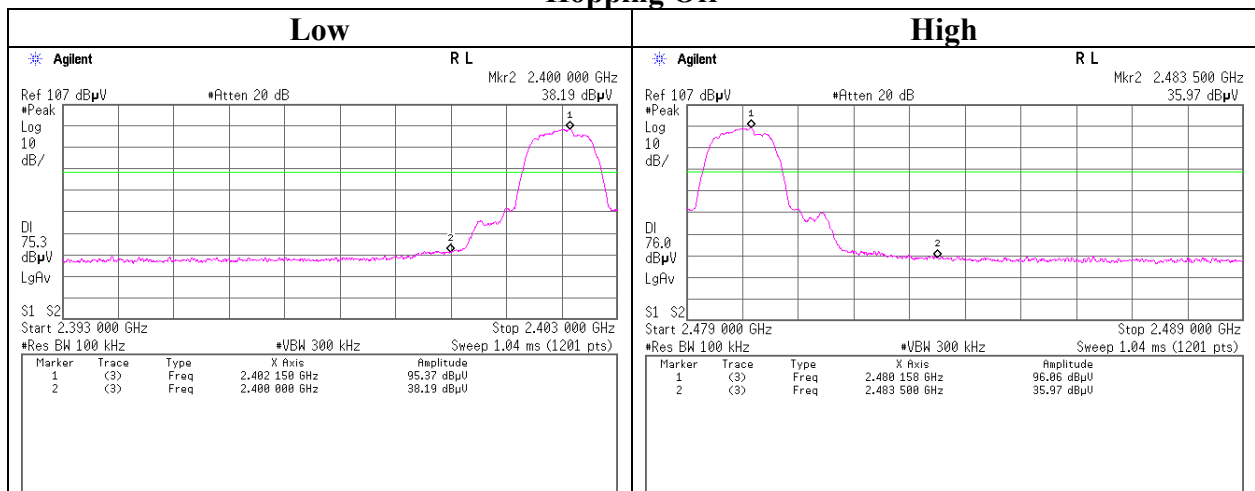
Conducted Emission Band Edge compliance

Report No.	13063553S-B-R2
Test place	Shonan EMC Lab. No.5 Semi Anechoic Chamber
Date	October 4, 2019
Temperature / Humidity	24 deg. C / 51 % RH
Engineer	Makoto Hosaka
Mode	Tx 3DH5

Hopping On



Hopping Off



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 2: Test instruments

Test Instruments

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-07	AT	145111	Digital Tester	SANWA	PC500	7019232	2019/10/1	2020/10/31	12
SAT10-14	AT	154591	Attenuator	Weinschel Corp.	54A-10	81595	2019/4/16	2020/4/30	12
SCC-G39	AT	151616	Coaxial Cable	Junkosha	MWX241-01000KMSK MS/B	1612Q037	2018/12/25	2019/12/31	12
SOS-09	AT	146318	Humidity Indicator	A&D	AD-5681	4061484	2018/12/5	2019/12/31	12
SPM-13	AT	169910	Power Meter	EMC Instruments Corporation	8990B	MY51000448	2019/3/6	2020/3/31	12
SPSS-06	AT	169911	Power sensor	EMC Instruments Corporation	N1923A	MY57270004	2019/3/6	2020/3/31	12
SRENT-15	AT	160899	Spectrum Analyzer	AGILENT (KEYSIGHT)	E4440A	MY46185516	2019/1/21	2020/1/31	12
STM-G8	AT	171615	Terminator	Weinschel - API Technologies Corp	M1459A	88997	2019/7/4	2020/7/31	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: AT: Antenna Terminal Conducted test