



RADIO TEST REPORT

Test Report No. : 11873611H-B

Applicant : **VAIO Corporation**
Type of Equipment : **Bluetooth Speaker**
Model No. : **P01**
FCC ID : **2AL4MP01**
Test regulation : **FCC Part 15 Subpart C: 2017**
Test Result : **Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this 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 NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: July 31 to August 3, 2017

Representative test engineer:

Shuichi Ohyama

Engineer

Consumer Technology Division

Approved by:

Satofumi Matsuyama

Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11873611H-B

[illegible]

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SECTION 1: Customer information

Company Name	:	VAIO Corporation
Address	:	5432 Toyoshina, Azumino-shi, Nagano, 399-8282 Japan
Telephone Number	:	+81-263-50-7391
Facsimile Number	:	+81-263-50-7015
Contact Person	:	Masami Ogawa

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth Speaker
Model No.	:	P01
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5.0 V (USB), DC 3.7 V (Battery)
Receipt Date of Sample	:	July 31, 2017
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: P01 (referred to as the EUT in this report) is a Bluetooth Speaker.

General Specification

Clock frequency(ies) in the system	:	80 MHz, 26 MHz
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Radio Specification

[Bluetooth (Ver. 3.0)]

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Power Supply (radio part input)	:	DC 1.8 V, DC 1.35 V
Antenna type	:	$\lambda/4$ monopole Antenna (Pattern Antenna)
Antenna Gain	:	2.15dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 14, 2017 and effective July 14, 2017

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	ANSI C63.10-2013 6. Standard test methods	Section 15.207	QP 23.6 dB 0.74580 MHz, L AV 27.1 dB, 0.74090 MHz, L, Tx DH5 2480 MHz / 0.74580 MHz, L, Tx 3DH5 2480 MHz	Complied	-
Carrier Frequency Separation	FCC Public Notice DA 00-705	Section15.247(a)(1)	See data.	Complied	Conducted
20dB Bandwidth	FCC Public Notice DA 00-705	Section15.247(a)(1)		Complied	Conducted
Number of Hopping Frequency	FCC Public Notice DA 00-705	Section15.247(a)(1)(iii)		Complied	Conducted
Dwell time	FCC Public Notice DA 00-705	Section15.247(a)(1)(iii)		Complied	Conducted
Maximum Peak Output Power	FCC Public Notice DA 00-705	Section15.247(a)(b)(1)		Complied	Conducted
Spurious Emission & Band Edge Compliance	FCC Public Notice DA 00-705	Section15.247(d)	3.8 dB 2557.975 MHz, Horizontal, AV	Complied	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).

* 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 (DC 1.8 V, DC 1.35 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.
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Antenna terminal test	Uncertainty (+/-)
RF output power	1.2 dB
Antenna terminal conducted emission / Power density / Burst power	3.1 dB
Adjacent channel power / Channel power	
Below 3 GHz	1.8 dB
3 GHz to 6 GHz	2.7 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	3.1 dB
0.15 MHz - 30 MHz	2.5 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.8 dB
10 m	3.6 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	5.2 dB	6.3 dB	5.0 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
5.2 dB	5.5 dB	5.5 dB	5.4 dB	5.5 dB

*Measurement distance

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

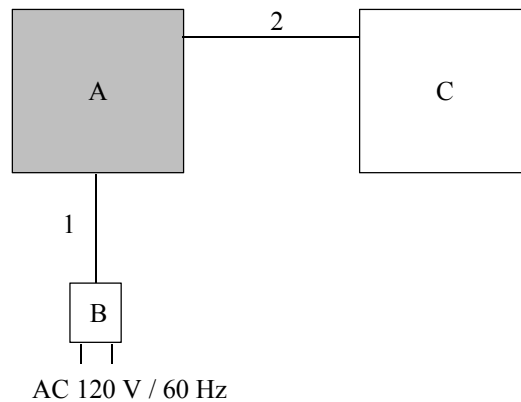
4.1 Operating Mode(s)

Bluetooth (BT): Transmitting (Tx), Payload: PRBS9

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission	Tx (Hopping Off) DH5, 3DH5	2480 MHz
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)</p> <p>*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.</p> <p>* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows; Power settings: BDR: Ext.=23, Int.=39 EDR: Ext.=23, Int.=39 Software: Bluetest3 1612260 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.</p>		

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Speaker	P01	Pechat-FCC1 *1) Pechat-FCC2 *2)	VAIO Corporation	EUT
B	AC Adaptor	CP-AD2	5241927	SONY	-
C	Jig	-	-	-	-

*1) Used for Conducted emission and Radiated emission

*2) Used for Antenna terminal conducted tests

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	Signal Cable	0.3	Unshielded	Unshielded	-

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

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

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

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

SECTION 6: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3 m*2) (1 GHz to 10 GHz), 1 m*3) (10 GHz to 26.5 GHz)		3 m*2) (1 GHz to 10 GHz), 1 m*3) (10 GHz to 26.5 GHz)

*1) Although DA 00-705 accepts VBW = 10 Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.

*2) Distance Factor: $20 \times \log(4.5 \text{ m}/3.0 \text{ m}) = 3.53 \text{ dB}$

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

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

Measurement range	: 30 MHz - 26.5 GHz
Test data	: APPENDIX
Test result	: Pass

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.							

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

Test data	: APPENDIX
Test result	: Pass

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APPENDIX 1: Test data

Conducted Emission

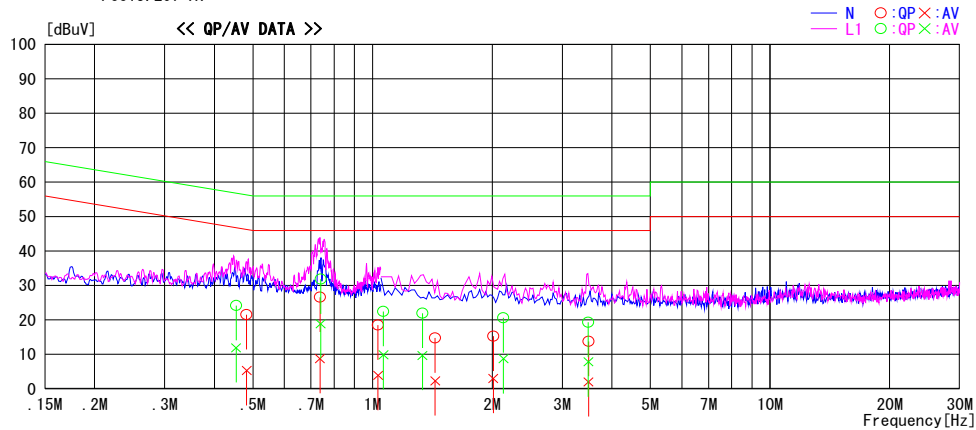
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2017/08/01

Report No. : 11873611H
Temp./Humi. : 24 deg. C / 58 % RH
Engineer : Ryota Yamanaka

Mode / Remarks : Tx DH5 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

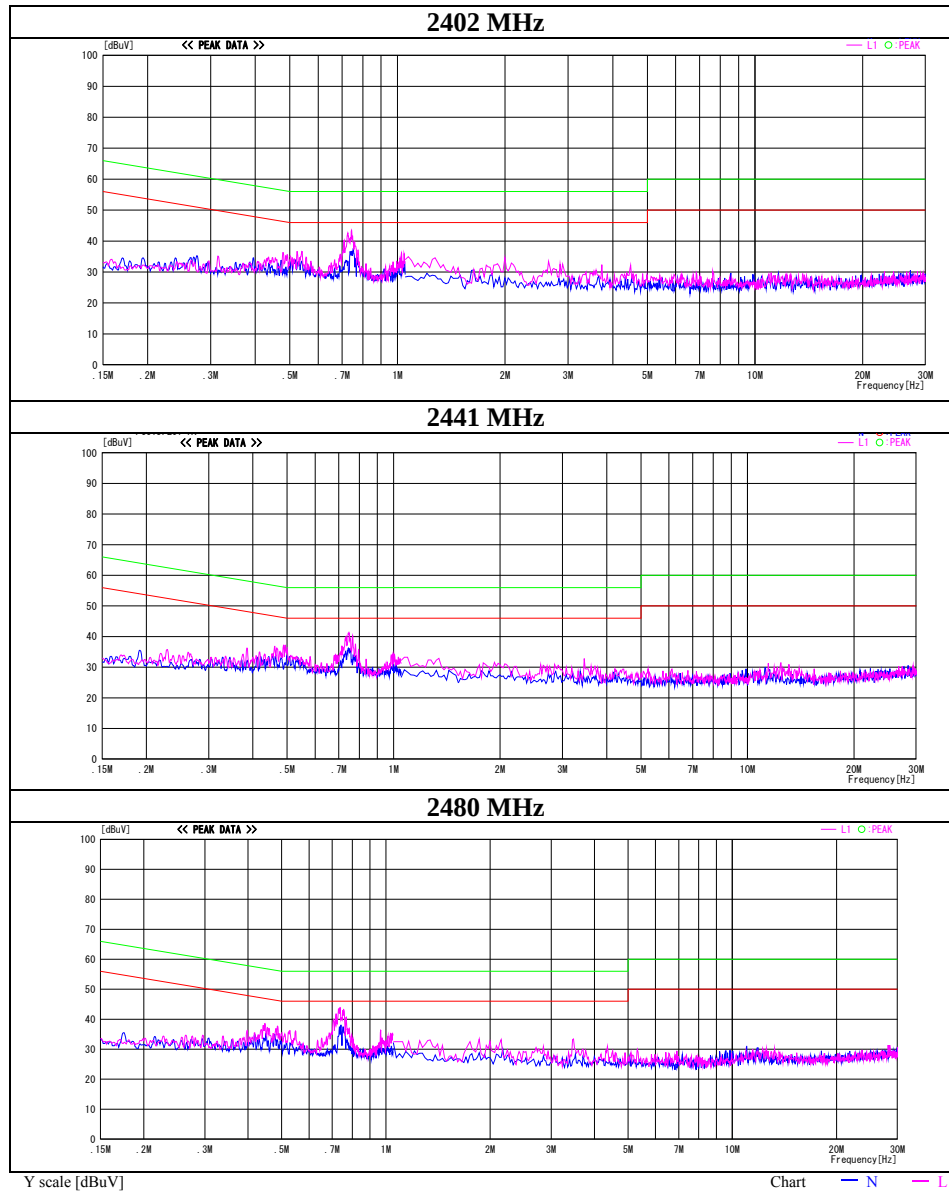


Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.48220	8.1	-8.1	13.4	21.5	5.3	56.3	46.3	34.8	41.0	N	
0.73760	13.2	-4.6	13.4	26.6	8.8	56.0	46.0	29.4	37.2	N	
1.03210	5.1	-9.5	13.4	18.5	3.9	56.0	46.0	37.5	42.1	N	
1.43680	1.4	-11.1	13.4	14.8	2.3	56.0	46.0	41.2	43.7	N	
2.01300	1.7	-10.6	13.6	15.3	3.0	56.0	46.0	40.7	43.0	N	
3.49560	0.0	-11.7	13.7	13.7	2.0	56.0	46.0	42.3	44.0	N	
0.45380	10.8	-1.5	13.4	24.2	11.9	56.8	46.8	32.6	34.9	L	
0.74090	18.4	5.5	13.4	31.8	18.9	56.0	46.0	24.2	27.1	L	
1.06530	9.0	-3.5	13.4	22.4	9.9	56.0	46.0	33.6	36.1	L	
1.33450	8.5	-3.7	13.4	21.9	9.7	56.0	46.0	34.1	36.3	L	
2.13377	7.0	-4.9	13.6	20.6	8.7	56.0	46.0	35.4	37.3	L	
3.48960	5.6	-5.9	13.7	19.3	7.8	56.0	46.0	36.7	38.2	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATTEN)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Test place : Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11873611H
Date : August 1, 2017
Temperature / Humidity : 24 deg. C / 58 % RH
Engineer : Ryota Yamanaka
Mode : Tx, Hopping Off, DH5



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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

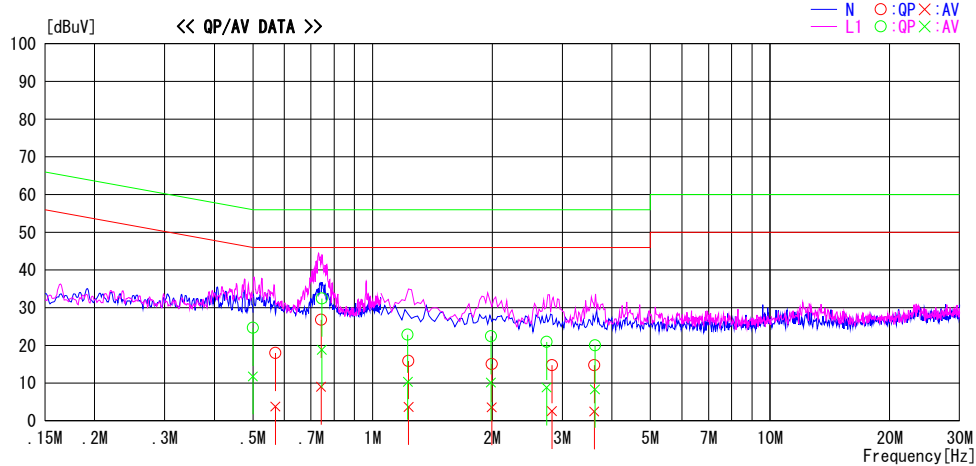
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.3 Semi Anechoic Chamber
Date : 2017/08/01

Report No. : 11873611H
Temp./Humi. : 24 deg. C / 58 % RH
Engineer : Ryota Yamanaka

Mode / Remarks : Tx 3DH5 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

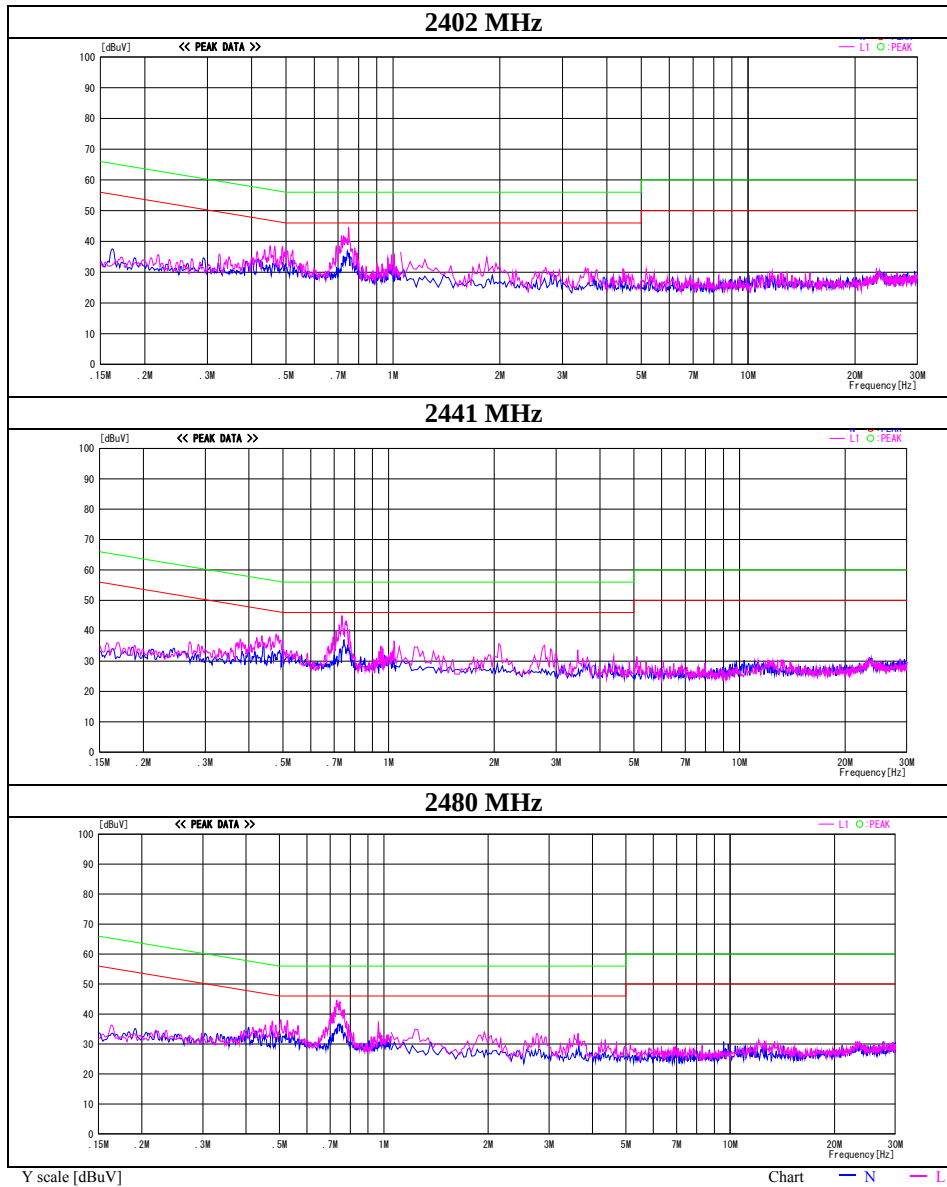


Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.56940	4.6	-9.6	13.4	18.0	3.8	56.0	46.0	38.0	42.2	N	
0.74200	13.4	-4.3	13.4	26.8	9.1	56.0	46.0	29.2	36.9	N	
1.23140	2.5	-9.7	13.4	15.9	3.7	56.0	46.0	40.1	42.3	N	
1.99380	1.5	-10.0	13.6	15.1	3.6	56.0	46.0	40.9	42.4	N	
2.82820	1.2	-11.0	13.6	14.8	2.6	56.0	46.0	41.2	43.4	N	
3.60980	1.0	-11.3	13.8	14.8	2.5	56.0	46.0	41.2	43.5	N	
0.50008	11.3	-1.6	13.4	24.7	11.8	56.0	46.0	31.3	34.2	L	
0.74580	19.0	5.5	13.4	32.4	18.9	56.0	46.0	23.6	27.1	L	
1.22620	9.4	-3.0	13.4	22.8	10.4	56.0	46.0	33.2	35.6	L	
1.98520	8.8	-3.4	13.6	22.4	10.2	56.0	46.0	33.6	35.8	L	
2.73980	7.3	-4.7	13.6	20.9	8.9	56.0	46.0	35.1	37.1	L	
3.62880	6.2	-5.5	13.8	20.0	8.3	56.0	46.0	36.0	37.7	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATTEN)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Test place Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No. 11873611H
Date August 1, 2017
Temperature / Humidity 24 deg. C / 58 % RH
Engineer Ryota Yamanaka
Mode Tx, Hopping Off, 3DH5



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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

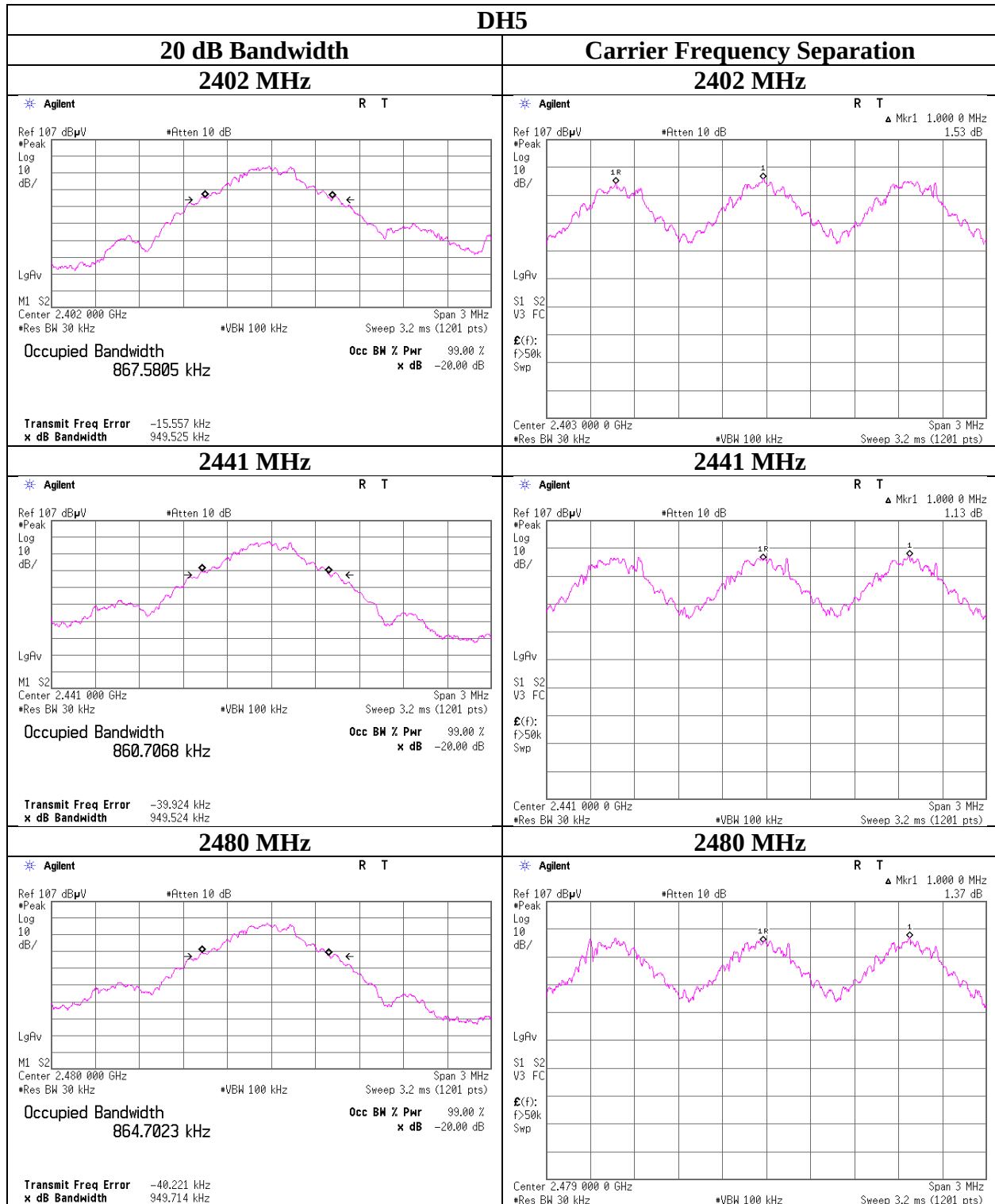
20dB Bandwidth and Carrier Frequency Separation

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11873611H
Date August 3, 2017
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yuta Moriya
Mode Tx, Hopping On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.950	1.000	≥ 0.633
DH5	2441.0	0.950	1.000	≥ 0.633
DH5	2480.0	0.950	1.000	≥ 0.633
3DH5	2402.0	1.258	1.000	≥ 0.839
3DH5	2441.0	1.274	1.000	≥ 0.849
3DH5	2480.0	1.259	1.000	≥ 0.839

Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).
No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation



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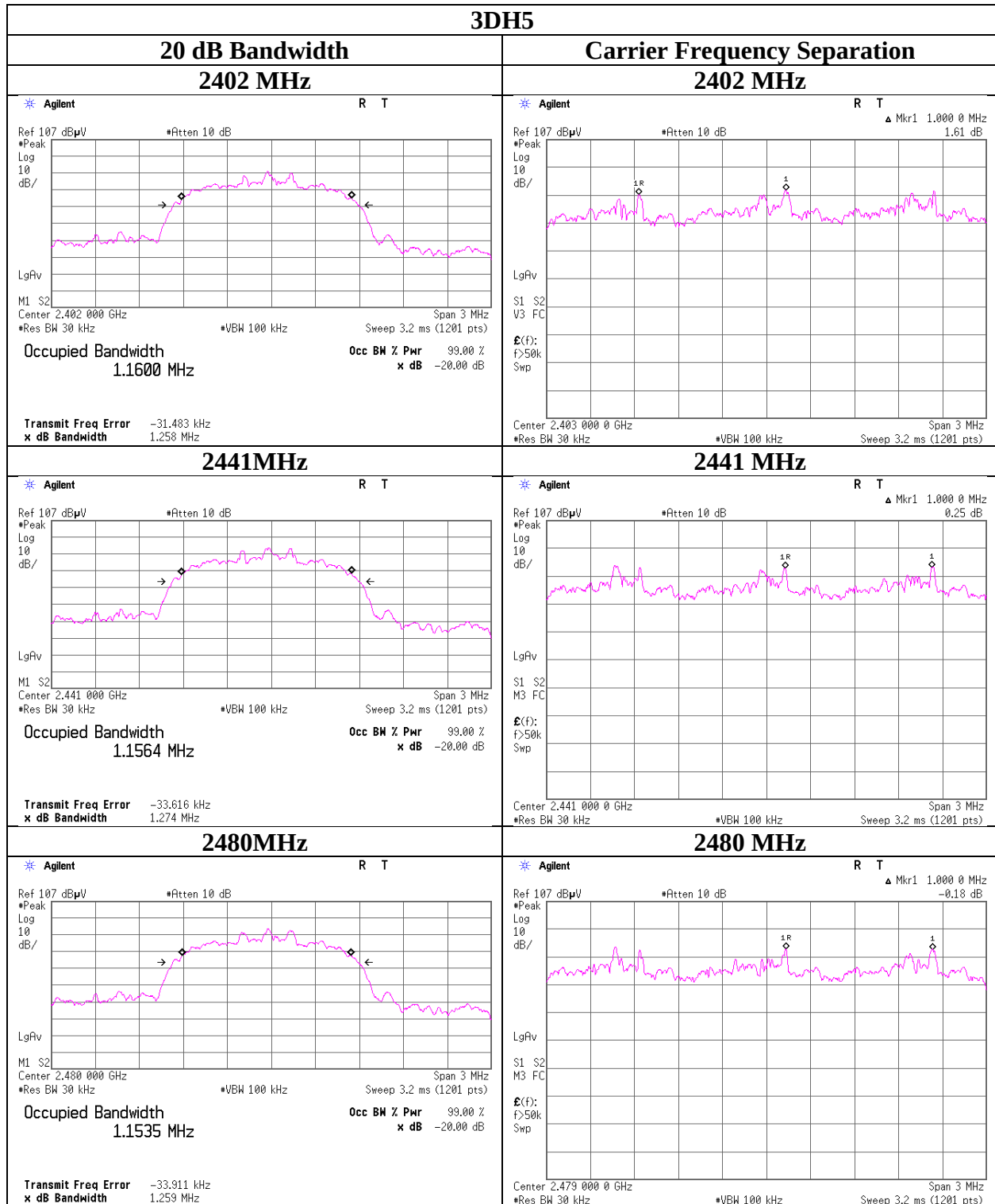
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

20dB Bandwidth and Carrier Frequency Separation



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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

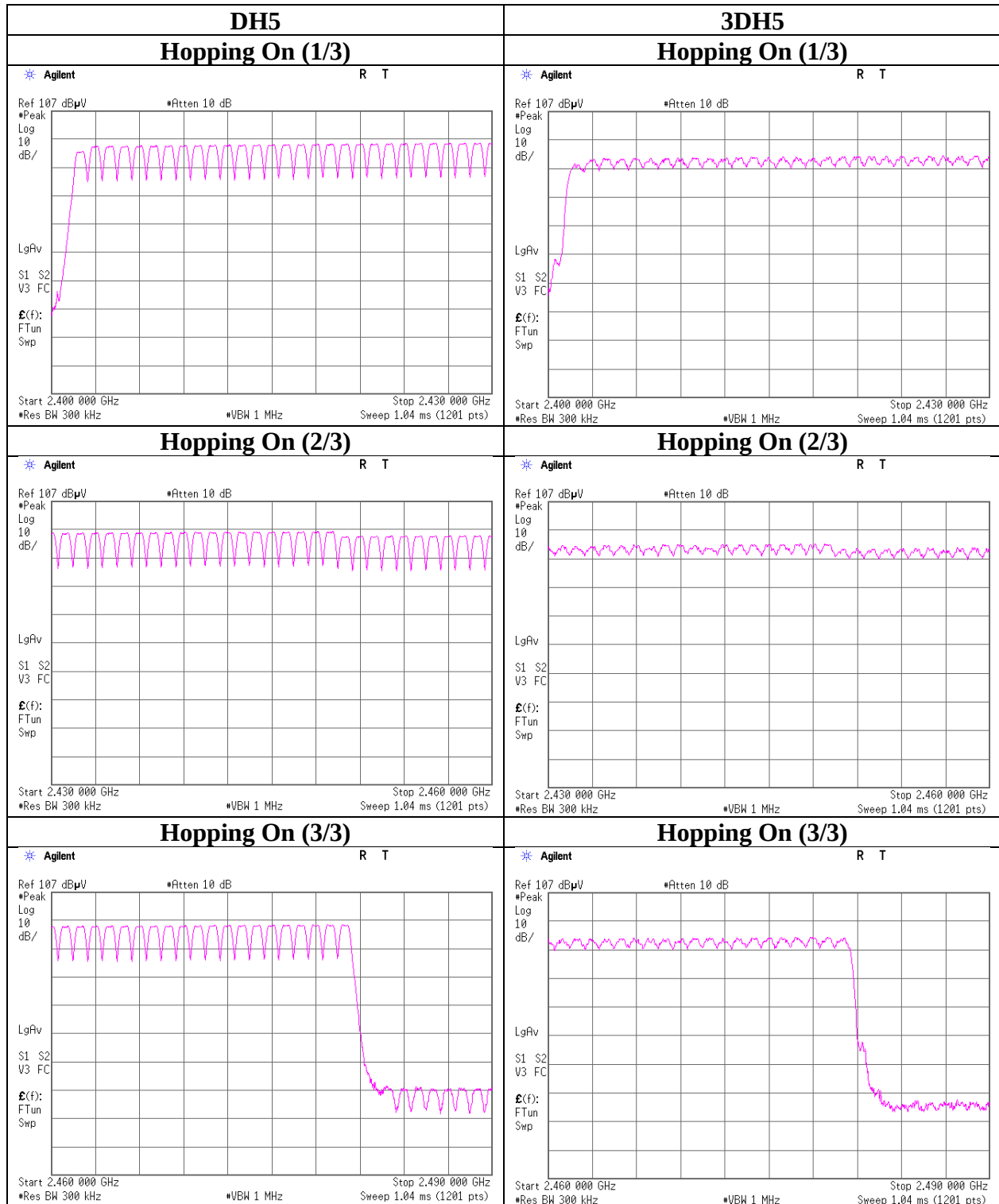
Number of Hopping Frequency

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11873611H
Date August 3, 2017
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yuta Moriya
Mode Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	≥ 15
3DH5	79	≥ 15

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

Number of Hopping Frequency



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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Dwell time

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11873611H
Date August 3, 2017
Temperature / Humidity 24 deg. C / 52 % RH
Engineer Yuta Moriya
Mode Tx, Hopping On

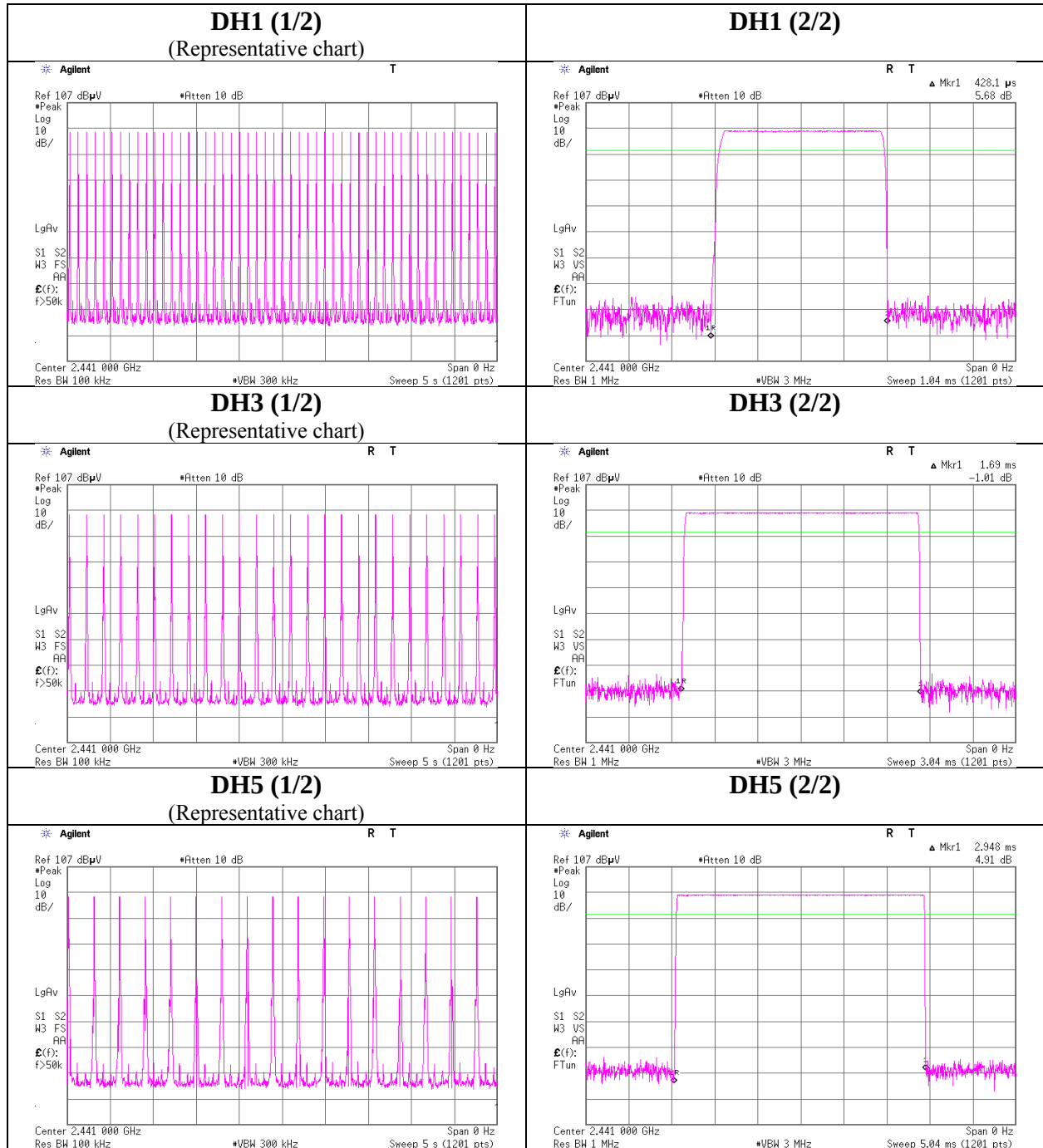
Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period				Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	51.0 times	/	5 sec.	x 31.6 sec. = 323 times	0.428	138	400
DH3	26.0 times	/	5 sec.	x 31.6 sec. = 165 times	1.690	279	400
DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.948	318	400
3DH1	51.0 times	/	5 sec.	x 31.6 sec. = 323 times	0.440	142	400
3DH3	26.0 times	/	5 sec.	x 31.6 sec. = 165 times	1.700	281	400
3DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.948	318	400

Sample Calculation

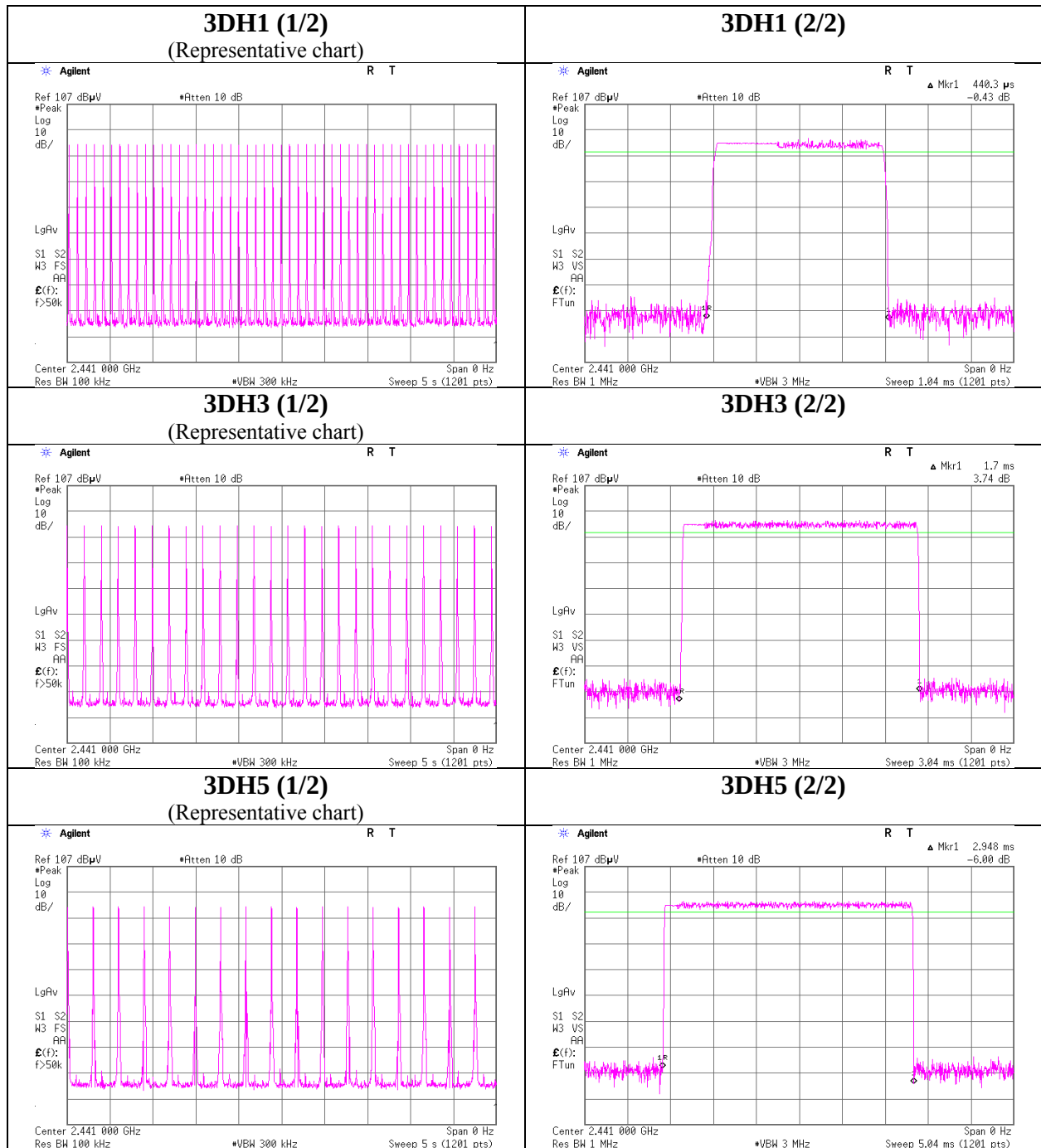
Result = Number of transmission x Length of transmission

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



Maximum Peak Output Power

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11873611H
Date : August 3, 2017
Temperature / Humidity : 24 deg. C / 52 % RH
Engineer : Yuta Moriya
Mode : Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-13.59	0.80	10.06	-2.73	0.53	20.96	125	23.69
DH5	2441.0	-10.34	0.80	10.06	0.52	1.13	20.96	125	20.44
DH5	2480.0	-10.91	0.80	10.06	-0.05	0.99	20.96	125	21.01
2DH5	2402.0	-16.07	0.80	10.06	-5.21	0.30	20.96	125	26.17
2DH5	2441.0	-12.98	0.80	10.06	-2.12	0.61	20.96	125	23.08
2DH5	2480.0	-13.47	0.80	10.06	-2.61	0.55	20.96	125	23.57
3DH5	2402.0	-15.29	0.80	10.06	-4.43	0.36	20.96	125	25.39
3DH5	2441.0	-12.41	0.80	10.06	-1.55	0.70	20.96	125	22.51
3DH5	2480.0	-12.92	0.80	10.06	-2.06	0.62	20.96	125	23.02

Sample Calculation:

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

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

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)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
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	-15.34	0.80	10.06	-4.48	0.36	1.04	-3.44	0.45
DH5	2441.0	-11.95	0.80	10.06	-1.09	0.78	1.04	-0.05	0.99
DH5	2480.0	-12.49	0.80	10.06	-1.63	0.69	1.04	-0.59	0.87
2DH5	2402.0	-20.28	0.80	10.06	-9.42	0.11	1.01	-8.41	0.14
2DH5	2441.0	-17.06	0.80	10.06	-6.20	0.24	1.01	-5.19	0.30
2DH5	2480.0	-17.58	0.80	10.06	-6.72	0.21	1.01	-5.71	0.27
3DH5	2402.0	-20.27	0.80	10.06	-9.41	0.11	1.02	-8.39	0.14
3DH5	2441.0	-17.05	0.80	10.06	-6.19	0.24	1.02	-5.17	0.30
3DH5	2480.0	-17.57	0.80	10.06	-6.71	0.21	1.02	-5.69	0.27

Sample Calculation:

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

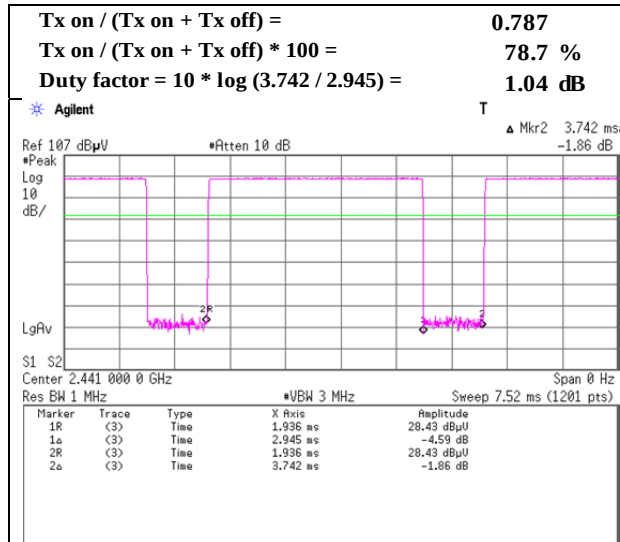
Result (Burst power average) = Time average + Duty factor

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

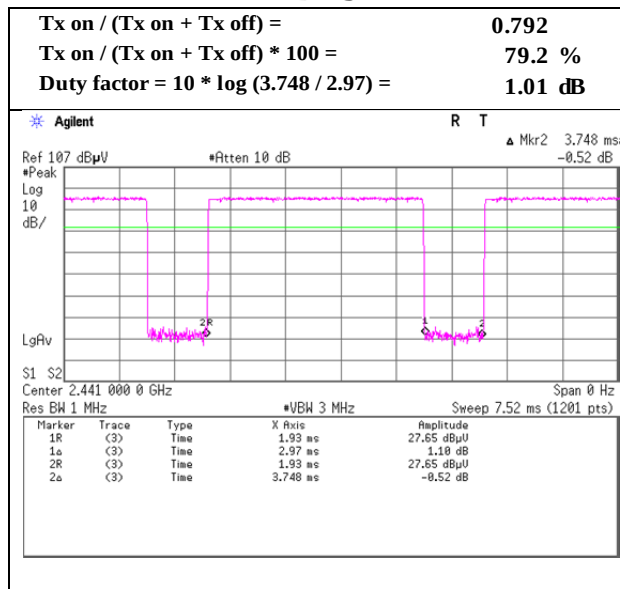
Burst Rate Confirmation

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11873611H
Date : August 3, 2017
Temperature / Humidity : 24 deg. C / 52 % RH
Engineer : Yuta Moriya
Mode : Tx, Hopping Off

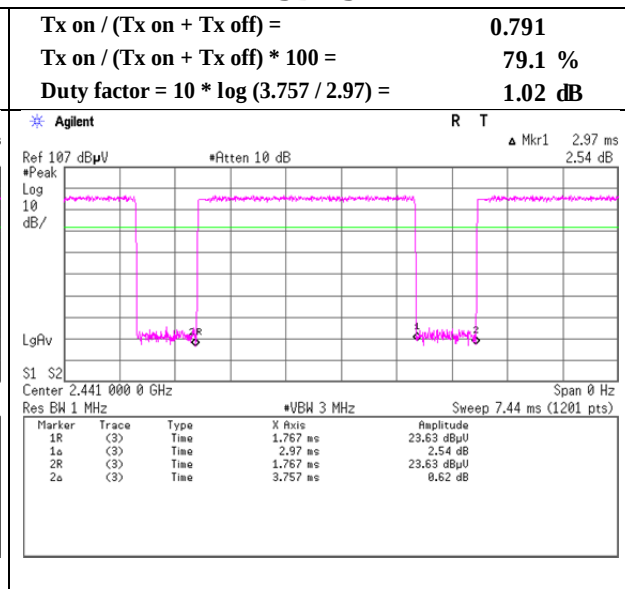
DH5



2DH5



3DH5



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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 11873611H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 31, 2017 Day July 31, 2017 Night
Temperature / Humidity 24 deg. C / 63 % RH 22 deg. C / 58 % RH
Engineer Tomoki Matsui Shuichi Ohyama
(1 GHz -10 GHz) (Below 1 GHz and 10 GHz - 26.5 GHz)
Mode Tx, Hopping Off, DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	46.820	QP	22.0	11.9	7.4	32.2	9.1	40.0	30.9	
Hori	74.200	QP	22.2	6.4	7.8	32.2	4.2	40.0	35.8	
Hori	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Hori	328.000	QP	34.9	14.1	10.2	32.0	27.2	46.0	18.8	
Hori	336.000	QP	35.3	14.3	10.3	32.0	27.9	46.0	18.1	
Hori	910.660	QP	20.2	22.1	13.5	30.9	24.9	46.0	21.1	
Hori	2390.000	PK	42.5	27.7	6.8	32.4	44.6	73.9	29.3	
Hori	2557.975	PK	52.1	28.0	6.9	32.4	54.6	73.9	19.3	
Hori	4804.000	PK	45.2	31.6	9.0	31.4	54.4	73.9	19.5	
Hori	7206.000	PK	41.6	36.0	10.4	32.1	55.9	73.9	18.0	Floor noise
Hori	9608.000	PK	42.6	38.5	11.0	32.9	59.2	73.9	14.7	Floor noise
Hori	2390.000	AV	29.8	27.7	6.8	32.4	31.9	53.9	22.0	
Hori	2557.975	AV	47.6	28.0	6.9	32.4	50.1	53.9	3.8	
Hori	4804.000	AV	37.7	31.6	9.0	31.4	46.9	53.9	7.0	
Hori	7206.000	AV	29.3	36.0	10.4	32.1	43.6	53.9	10.3	Floor noise
Hori	9608.000	AV	30.2	38.5	11.0	32.9	46.8	53.9	7.1	Floor noise
Vert	47.907	QP	29.8	11.5	7.4	32.2	16.5	40.0	23.5	
Vert	74.483	QP	28.6	6.4	7.8	32.2	10.6	40.0	29.4	
Vert	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Vert	328.000	QP	36.6	14.1	10.2	32.0	28.9	46.0	17.1	
Vert	336.000	QP	36.8	14.3	10.3	32.0	29.4	46.0	16.6	
Vert	911.460	QP	20.3	22.1	13.5	30.9	25.0	46.0	21.0	
Vert	2390.000	PK	42.5	27.7	6.8	32.4	44.6	73.9	29.3	
Vert	2557.975	PK	51.3	28.0	6.9	32.4	53.8	73.9	20.1	
Vert	4804.000	PK	44.6	31.6	9.0	31.4	53.8	73.9	20.1	
Vert	7206.000	PK	41.6	36.0	10.4	32.1	55.9	73.9	18.0	Floor noise
Vert	9608.000	PK	42.6	38.5	11.0	32.9	59.2	73.9	14.7	Floor noise
Vert	2390.000	AV	29.9	27.7	6.8	32.4	32.0	53.9	21.9	
Vert	2557.975	AV	46.7	28.0	6.9	32.4	49.2	53.9	4.7	
Vert	4804.000	AV	35.1	31.6	9.0	31.4	44.3	53.9	9.6	
Vert	7206.000	AV	29.3	36.0	10.4	32.1	43.6	53.9	10.3	Floor noise
Vert	9608.000	AV	30.2	38.5	11.0	32.9	46.8	53.9	7.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	93.5	27.7	6.9	32.4	95.7	-	-	Carrier
Hori	2400.000	PK	40.2	27.7	6.9	32.4	42.4	75.7	33.3	
Vert	2402.000	PK	92.6	27.7	6.9	32.4	94.8	-	-	Carrier
Vert	2400.000	PK	39.9	27.7	6.9	32.4	42.1	74.8	32.7	

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

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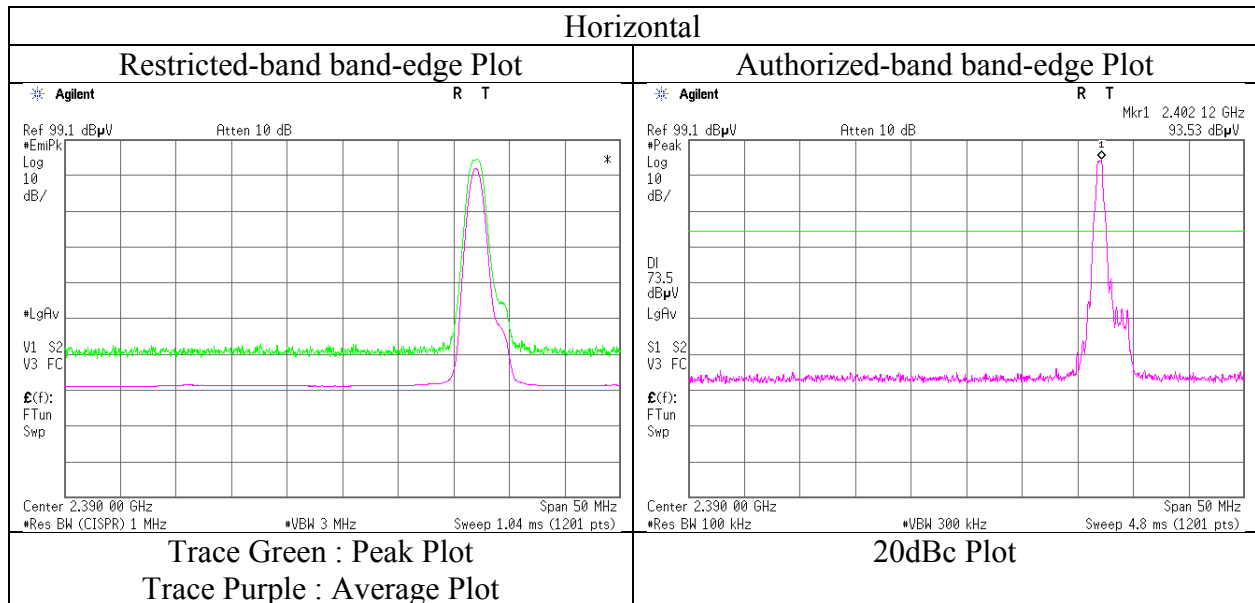
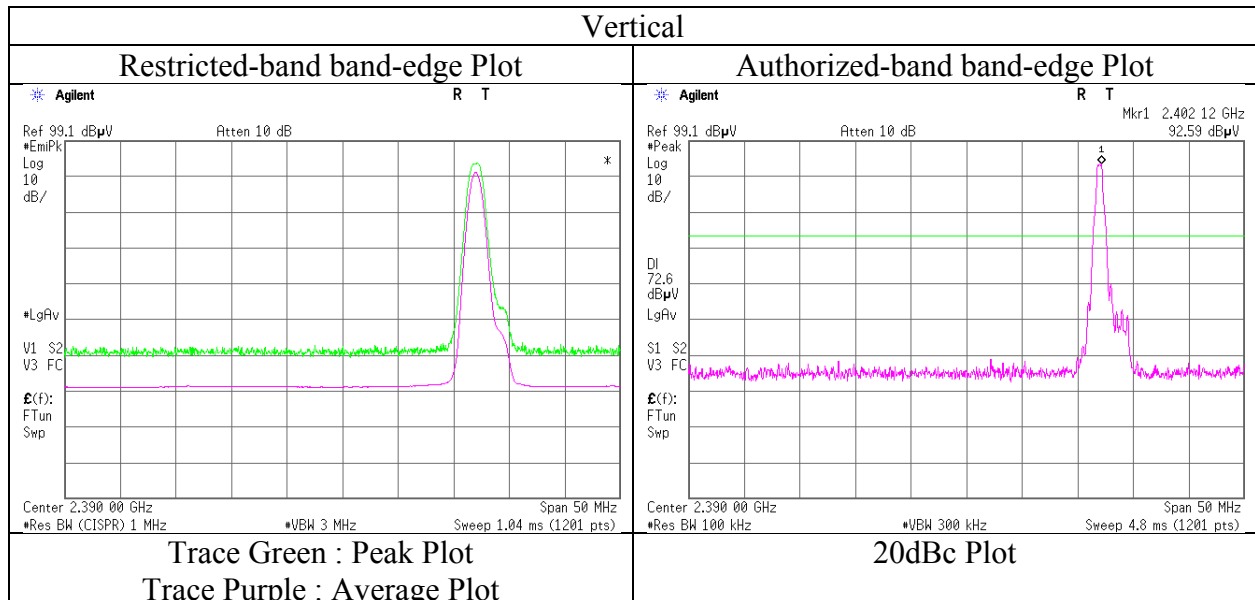
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11873611H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 31, 2017 Day
Temperature / Humidity	24 deg. C / 63 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz



* Final result of restricted band edge was shown in tabular data.

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Radiated Spurious Emission

Report No. 11873611H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 31, 2017 Day No.3 July 31, 2017 Night
Temperature / Humidity 24 deg. C / 63 % RH 22 deg. C / 58 % RH
Engineer Tomoki Matsui Shuichi Ohyama
(1 GHz - 10 GHz) (Below 1 GHz and 10 GHz - 26.5 GHz)
Mode Tx, Hopping Off, DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	46.150	QP	22.3	12.2	7.4	32.2	9.7	40.0	30.3	
Hori	71.650	QP	22.4	6.3	7.8	32.2	4.3	40.0	35.7	
Hori	150.000	QP	21.6	15.1	8.7	32.1	13.3	43.5	30.2	
Hori	328.000	QP	33.1	14.1	10.2	32.0	25.4	46.0	20.6	
Hori	336.000	QP	34.5	14.3	10.3	32.0	27.1	46.0	18.9	
Hori	942.662	QP	20.3	22.2	13.7	30.8	25.4	46.0	20.6	
Hori	2596.973	PK	50.3	28.1	7.0	32.3	53.1	73.9	20.8	
Hori	4882.000	PK	45.5	31.9	9.0	31.4	55.0	73.9	18.9	
Hori	7323.000	PK	40.6	36.2	10.3	32.2	54.9	73.9	19.0	Floor noise
Hori	9764.000	PK	40.3	38.7	11.1	33.0	57.1	73.9	16.8	Floor noise
Hori	2596.973	AV	45.5	28.1	7.0	32.3	48.3	53.9	5.6	
Hori	4882.000	AV	38.0	31.9	9.0	31.4	47.5	53.9	6.4	
Hori	7323.000	AV	28.5	36.2	10.3	32.2	42.8	53.9	11.1	Floor noise
Hori	9764.000	AV	28.6	38.7	11.1	33.0	45.4	53.9	8.5	Floor noise
Vert	48.417	QP	29.9	11.4	7.4	32.2	16.5	40.0	23.5	
Vert	73.917	QP	28.7	6.4	7.8	32.2	10.7	40.0	29.3	
Vert	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Vert	328.000	QP	34.3	14.1	10.2	32.0	26.6	46.0	19.4	
Vert	336.000	QP	36.6	14.3	10.3	32.0	29.2	46.0	16.8	
Vert	933.329	QP	20.3	22.2	13.7	30.8	25.4	46.0	20.6	
Vert	2596.973	PK	48.6	28.1	7.0	32.3	51.4	73.9	22.5	
Vert	4882.000	PK	44.3	31.9	9.0	31.4	53.8	73.9	20.1	
Vert	7323.000	PK	40.6	36.2	10.3	32.2	54.9	73.9	19.0	Floor noise
Vert	9764.000	PK	40.3	38.7	11.1	33.0	57.1	73.9	16.8	Floor noise
Vert	2596.973	AV	42.6	28.1	7.0	32.3	45.4	53.9	8.5	
Vert	4882.000	AV	36.8	31.9	9.0	31.4	46.3	53.9	7.6	
Vert	7323.000	AV	28.5	36.2	10.3	32.2	42.8	53.9	11.1	Floor noise
Vert	9764.000	AV	28.6	38.7	11.1	33.0	45.4	53.9	8.5	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 11873611H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 31, 2017 Day July 31, 2017 Night
Temperature / Humidity 24 deg. C / 63 % RH 22 deg. C / 58 % RH
Engineer Tomoki Matsui Shuichi Ohyama
(1 GHz -10 GHz) (Below 1 GHz and 10 GHz - 26.5 GHz)
Mode Tx, Hopping Off, DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	45.583	QP	22.5	12.4	7.4	32.2	10.1	40.0	29.9	
Hori	75.617	QP	22.3	6.5	7.9	32.2	4.5	40.0	35.5	
Hori	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Hori	328.000	QP	32.2	14.1	10.2	32.0	24.5	46.0	21.5	
Hori	336.000	QP	34.3	14.3	10.3	32.0	26.9	46.0	19.1	
Hori	927.995	QP	20.3	22.2	13.6	30.8	25.3	46.0	20.7	
Hori	2483.500	PK	44.4	27.8	6.9	32.4	46.7	73.9	27.2	
Hori	2636.000	PK	46.9	28.2	7.0	32.3	49.8	73.9	24.1	
Hori	4960.000	PK	42.6	32.1	9.1	31.3	52.5	73.9	21.4	
Hori	7440.000	PK	41.1	36.4	10.3	32.2	55.6	73.9	18.3	Floor noise
Hori	9920.000	PK	41.4	38.9	11.1	33.1	58.3	73.9	15.6	Floor noise
Hori	2483.500	AV	31.1	27.8	6.9	32.4	33.4	53.9	20.5	
Hori	2636.000	AV	40.6	28.2	7.0	32.3	43.5	53.9	10.4	
Hori	4960.000	AV	33.5	32.1	9.1	31.3	43.4	53.9	10.5	
Hori	7440.000	AV	28.6	36.4	10.3	32.2	43.1	53.9	10.8	Floor noise
Hori	9920.000	AV	28.5	38.9	11.1	33.1	45.4	53.9	8.5	Floor noise
Vert	48.983	QP	29.2	11.2	7.5	32.2	15.7	40.0	24.3	
Vert	74.200	QP	28.5	6.4	7.8	32.2	10.5	40.0	29.5	
Vert	150.000	QP	21.6	15.1	8.7	32.1	13.3	43.5	30.2	
Vert	328.000	QP	34.1	14.1	10.2	32.0	26.4	46.0	19.6	
Vert	336.000	QP	36.0	14.3	10.3	32.0	28.6	46.0	17.4	
Vert	938.662	QP	20.3	22.2	13.7	30.8	25.4	46.0	20.6	
Vert	2483.500	PK	43.6	27.8	6.9	32.4	45.9	73.9	28.0	
Vert	2636.000	PK	47.5	28.2	7.0	32.3	50.4	73.9	23.5	
Vert	4960.000	PK	43.3	32.1	9.1	31.3	53.2	73.9	20.7	
Vert	7440.000	PK	41.1	36.4	10.3	32.2	55.6	73.9	18.3	Floor noise
Vert	9920.000	PK	41.4	38.9	11.1	33.1	58.3	73.9	15.6	Floor noise
Vert	2483.500	AV	31.1	27.8	6.9	32.4	33.4	53.9	20.5	
Vert	2636.000	AV	41.6	28.2	7.0	32.3	44.5	53.9	9.4	
Vert	4960.000	AV	34.5	32.1	9.1	31.3	44.4	53.9	9.5	
Vert	7440.000	AV	28.6	36.4	10.3	32.2	43.1	53.9	10.8	Floor noise
Vert	9920.000	AV	28.5	38.9	11.1	33.1	45.4	53.9	8.5	Floor noise

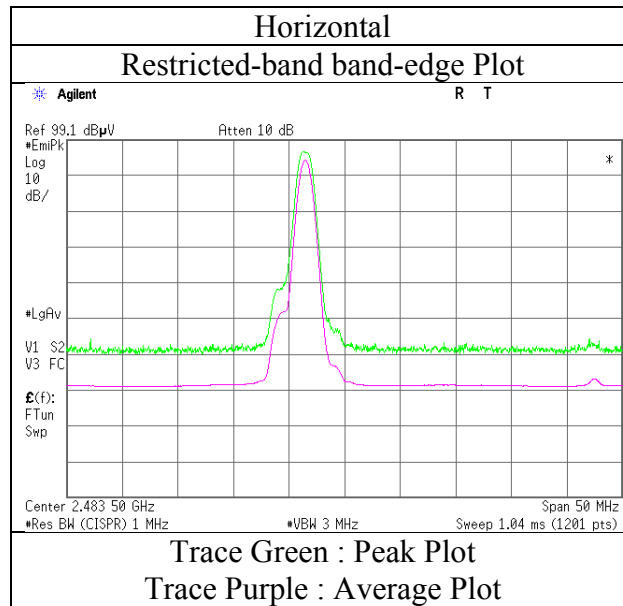
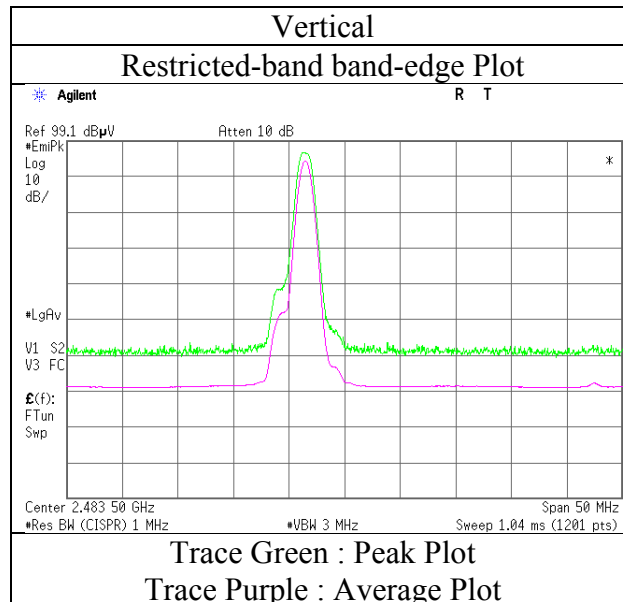
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(4.5\text{ m} / 3.0\text{ m}) = 3.53\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11873611H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 31, 2017 Day
Temperature / Humidity	24 deg. C / 63 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 11873611H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 31, 2017 Day July 31, 2017 Night
Temperature / Humidity 24 deg. C / 63 % RH 22 deg. C / 58 % RH
Engineer Tomoki Matsui Shuichi Ohyama
(1 GHz -10 GHz) (Below 1 GHz and 10 GHz - 26.5 GHz)
Mode Tx, Hopping Off, 3DH5 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	49.267	QP	21.9	11.1	7.5	32.2	8.3	40.0	31.7	
Hori	76.750	QP	22.2	6.6	7.9	32.2	4.5	40.0	35.5	
Hori	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Hori	328.000	QP	34.8	14.1	10.2	32.0	27.1	46.0	18.9	
Hori	336.000	QP	34.3	14.3	10.3	32.0	26.9	46.0	19.1	
Hori	922.662	QP	20.3	22.2	13.6	30.9	25.2	46.0	20.8	
Hori	2390.000	PK	42.6	27.7	6.8	32.4	44.7	73.9	29.2	
Hori	2557.975	PK	50.2	28.0	6.9	32.4	52.7	73.9	21.2	
Hori	4804.000	PK	40.9	31.6	9.0	31.4	50.1	73.9	23.8	Floor noise
Hori	7206.000	PK	41.6	36.0	10.4	32.1	55.9	73.9	18.0	Floor noise
Hori	9608.000	PK	42.6	38.5	11.0	32.9	59.2	73.9	14.7	Floor noise
Hori	2390.000	AV	29.9	27.7	6.8	32.4	32.0	53.9	21.9	
Hori	2557.975	AV	42.9	28.0	6.9	32.4	45.4	53.9	8.5	
Hori	4804.000	AV	29.8	31.6	9.0	31.4	39.0	53.9	14.9	Floor noise
Hori	7206.000	AV	29.3	36.0	10.4	32.1	43.6	53.9	10.3	Floor noise
Hori	9608.000	AV	30.2	38.5	11.0	32.9	46.8	53.9	7.1	Floor noise
Vert	48.983	QP	29.1	11.2	7.5	32.2	15.6	40.0	24.4	
Vert	74.483	QP	27.8	6.4	7.8	32.2	9.8	40.0	30.2	
Vert	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Vert	328.000	QP	36.0	14.1	10.2	32.0	28.3	46.0	17.7	
Vert	336.000	QP	36.4	14.3	10.3	32.0	29.0	46.0	17.0	
Vert	917.329	QP	20.3	22.2	13.6	30.9	25.2	46.0	20.8	
Vert	2390.000	PK	42.5	27.7	6.8	32.4	44.6	73.9	29.3	
Vert	2557.975	PK	48.7	28.0	6.9	32.4	51.2	73.9	22.7	
Vert	4804.000	PK	40.9	31.6	9.0	31.4	50.1	73.9	23.8	Floor noise
Vert	7206.000	PK	41.6	36.0	10.4	32.1	55.9	73.9	18.0	Floor noise
Vert	9608.000	PK	42.6	38.5	11.0	32.9	59.2	73.9	14.7	Floor noise
Vert	2390.000	AV	29.8	27.7	6.8	32.4	31.9	53.9	22.0	
Vert	2557.975	AV	41.4	28.0	6.9	32.4	43.9	53.9	10.0	
Vert	4804.000	AV	28.7	31.6	9.0	31.4	37.9	53.9	16.0	Floor noise
Vert	7206.000	AV	29.3	36.0	10.4	32.1	43.6	53.9	10.3	Floor noise
Vert	9608.000	AV	30.2	38.5	11.0	32.9	46.8	53.9	7.1	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	89.1	27.7	6.9	32.4	91.3	-	-	Carrier
Hori	2400.000	PK	45.9	27.7	6.9	32.4	48.1	71.3	23.2	
Vert	2402.000	PK	88.3	27.7	6.9	32.4	90.5	-	-	Carrier
Vert	2400.000	PK	45.3	27.7	6.9	32.4	47.5	70.5	23.0	

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

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Ise EMC Lab.

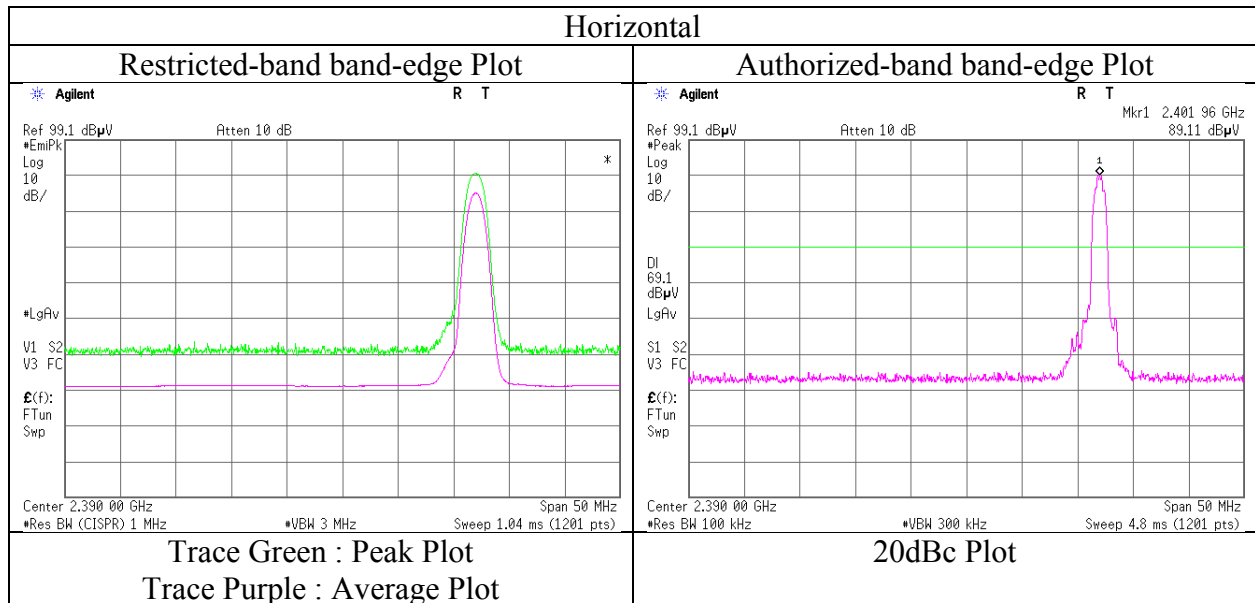
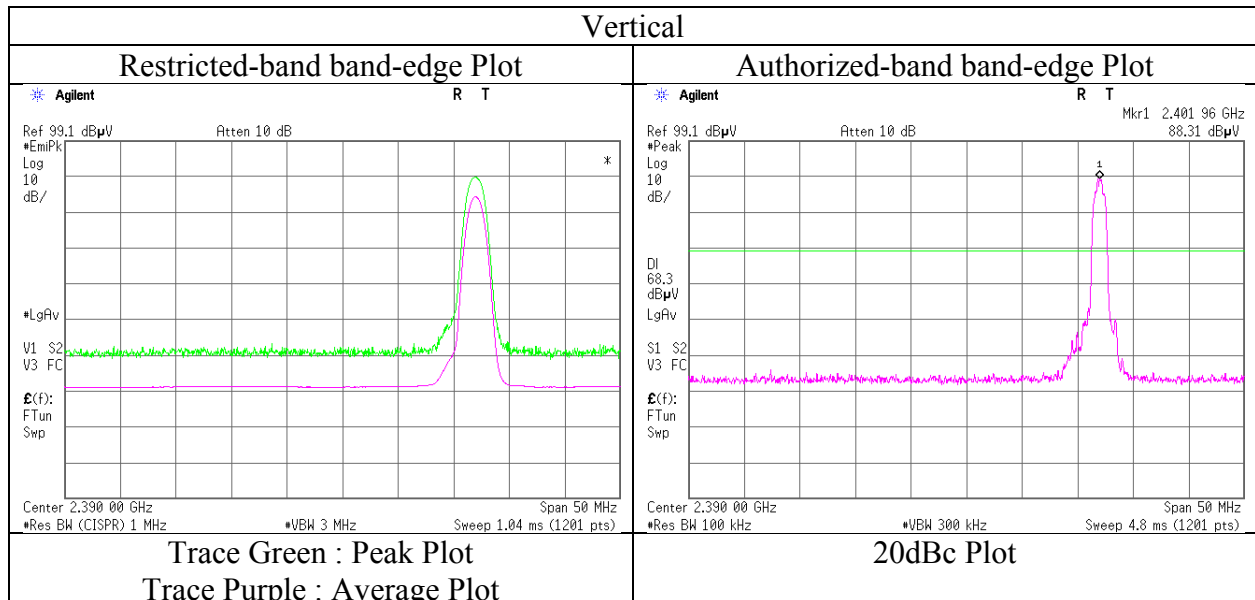
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11873611H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 31, 2017 Day
Temperature / Humidity	24 deg. C / 63 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 11873611H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 31, 2017 Day July 31, 2017 Night
Temperature / Humidity 24 deg. C / 63 % RH 22 deg. C / 58 % RH
Engineer Tomoki Matsui Shuichi Ohyama
(1 GHz -10 GHz) (Below 1 GHz and 10 GHz - 26.5 GHz)
Mode Tx, Hopping Off, 3DH5 2441 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	49.267	QP	22.2	11.1	7.5	32.2	8.6	40.0	31.4	
Hori	76.467	QP	22.4	6.6	7.9	32.2	4.7	40.0	35.3	
Hori	150.000	QP	21.6	15.1	8.7	32.1	13.3	43.5	30.2	
Hori	328.000	QP	34.8	14.1	10.2	32.0	27.1	46.0	18.9	
Hori	336.000	QP	34.9	14.3	10.3	32.0	27.5	46.0	18.5	
Hori	947.995	QP	20.5	22.2	13.7	30.7	25.7	46.0	20.3	
Hori	2596.973	PK	47.6	28.1	7.0	32.3	50.4	73.9	23.5	
Hori	4882.000	PK	39.7	31.9	9.0	31.4	49.2	73.9	24.7	Floor noise
Hori	7323.000	PK	40.6	36.2	10.3	32.2	54.9	73.9	19.0	Floor noise
Hori	9764.000	PK	40.3	38.7	11.1	33.0	57.1	73.9	16.8	Floor noise
Hori	2596.973	AV	40.1	28.1	7.0	32.3	42.9	53.9	11.0	
Hori	4882.000	AV	27.7	31.9	9.0	31.4	37.2	53.9	16.7	Floor noise
Hori	7323.000	AV	28.5	36.2	10.3	32.2	42.8	53.9	11.1	Floor noise
Hori	9764.000	AV	28.6	38.7	11.1	33.0	45.4	53.9	8.5	Floor noise
Vert	47.283	QP	29.3	11.8	7.4	32.2	16.3	40.0	23.7	
Vert	71.933	QP	27.2	6.3	7.8	32.2	9.1	40.0	30.9	
Vert	150.000	QP	21.6	15.1	8.7	32.1	13.3	43.5	30.2	
Vert	328.000	QP	36.0	14.1	10.2	32.0	28.3	46.0	17.7	
Vert	336.000	QP	37.1	14.3	10.3	32.0	29.7	46.0	16.3	
Vert	937.329	QP	20.3	22.2	13.7	30.8	25.4	46.0	20.6	
Vert	2596.973	PK	47.4	28.1	7.0	32.3	50.2	73.9	23.7	
Vert	4882.000	PK	39.7	31.9	9.0	31.4	49.2	73.9	24.7	Floor noise
Vert	7323.000	PK	40.6	36.2	10.3	32.2	54.9	73.9	19.0	Floor noise
Vert	9764.000	PK	40.3	38.7	11.1	33.0	57.1	73.9	16.8	Floor noise
Vert	2596.973	AV	39.8	28.1	7.0	32.3	42.6	53.9	11.3	
Vert	4882.000	AV	27.7	31.9	9.0	31.4	37.2	53.9	16.7	Floor noise
Vert	7323.000	AV	28.5	36.2	10.3	32.2	42.8	53.9	11.1	Floor noise
Vert	9764.000	AV	28.6	38.7	11.1	33.0	45.4	53.9	8.5	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 11873611H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date July 31, 2017 Day No.3 July 31, 2017 Night
Temperature / Humidity 24 deg. C / 63 % RH 22 deg. C / 58 % RH
Engineer Tomoki Matsui Shuichi Ohyama
(1 GHz -10 GHz) (Below 1 GHz and 10 GHz - 26.5 GHz)
Mode Tx, Hopping Off, 3DH5 2480 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	46.717	QP	22.1	12.0	7.4	32.2	9.3	40.0	30.7	
Hori	73.350	QP	22.4	6.4	7.8	32.2	4.4	40.0	35.6	
Hori	150.000	QP	21.5	15.1	8.7	32.1	13.2	43.5	30.3	
Hori	328.000	QP	34.3	14.1	10.2	32.0	26.6	46.0	19.4	
Hori	336.000	QP	35.0	14.3	10.3	32.0	27.6	46.0	18.4	
Hori	939.995	QP	20.4	22.2	13.7	30.8	25.5	46.0	20.5	
Hori	2483.500	PK	43.0	27.8	6.9	32.4	45.3	73.9	28.6	
Hori	2636.000	PK	45.7	28.2	7.0	32.3	48.6	73.9	25.3	
Hori	4960.000	PK	39.6	32.1	9.1	31.3	49.5	73.9	24.4	Floor noise
Hori	7440.000	PK	41.1	36.4	10.3	32.2	55.6	73.9	18.3	Floor noise
Hori	9920.000	PK	41.4	38.9	11.1	33.1	58.3	73.9	15.6	Floor noise
Hori	2483.500	AV	30.7	27.8	6.9	32.4	33.0	53.9	20.9	
Hori	2636.000	AV	37.2	28.2	7.0	32.3	40.1	53.9	13.8	
Hori	4960.000	AV	27.9	32.1	9.1	31.3	37.8	53.9	16.1	Floor noise
Hori	7440.000	AV	28.6	36.4	10.3	32.2	43.1	53.9	10.8	Floor noise
Hori	9920.000	AV	28.5	38.9	11.1	33.1	45.4	53.9	8.5	Floor noise
Vert	46.717	QP	29.5	12.0	7.4	32.2	16.7	40.0	23.3	
Vert	73.633	QP	28.6	6.4	7.8	32.2	10.6	40.0	29.4	
Vert	150.000	QP	21.6	15.1	8.7	32.1	13.3	43.5	30.2	
Vert	328.000	QP	36.0	14.1	10.2	32.0	28.3	46.0	17.7	
Vert	336.000	QP	36.8	14.3	10.3	32.0	29.4	46.0	16.6	
Vert	918.662	QP	20.5	22.2	13.6	30.9	25.4	46.0	20.6	
Vert	2483.500	PK	42.7	27.8	6.9	32.4	45.0	73.9	28.9	
Vert	2636.000	PK	45.5	28.2	7.0	32.3	48.4	73.9	25.5	
Vert	4960.000	PK	39.6	32.1	9.1	31.3	49.5	73.9	24.4	Floor noise
Vert	7440.000	PK	41.1	36.4	10.3	32.2	55.6	73.9	18.3	Floor noise
Vert	9920.000	PK	41.4	38.9	11.1	33.1	58.3	73.9	15.6	Floor noise
Vert	2483.500	AV	30.6	27.8	6.9	32.4	32.9	53.9	21.0	
Vert	2636.000	AV	36.7	28.2	7.0	32.3	39.6	53.9	14.3	
Vert	4960.000	AV	27.9	32.1	9.1	31.3	37.8	53.9	16.1	Floor noise
Vert	7440.000	AV	28.6	36.4	10.3	32.2	43.1	53.9	10.8	Floor noise
Vert	9920.000	AV	28.5	38.9	11.1	33.1	45.4	53.9	8.5	Floor noise

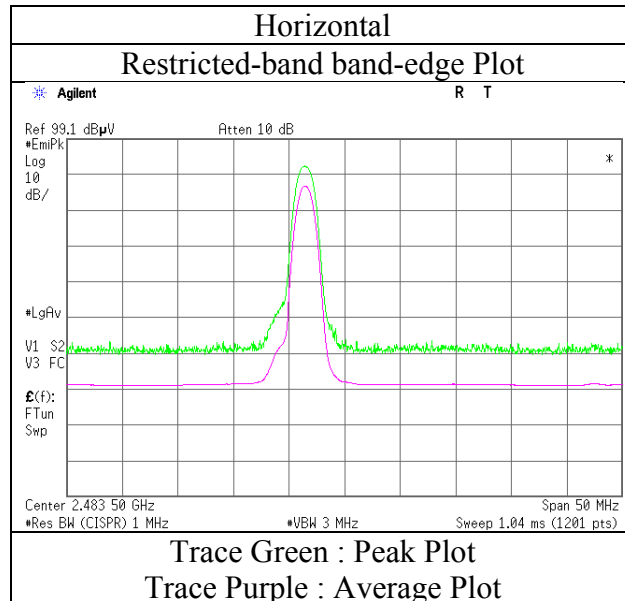
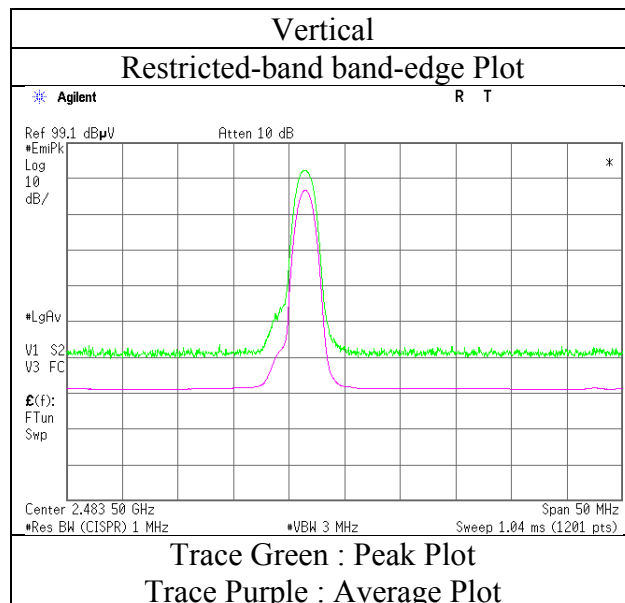
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log(4.5 m / 3.0 m) = 3.53 dB
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11873611H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 31, 2017 Day
Temperature / Humidity	24 deg. C / 63 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



* Final result of restricted band edge was shown in tabular data.

UL Japan, Inc.

Ise EMC Lab.

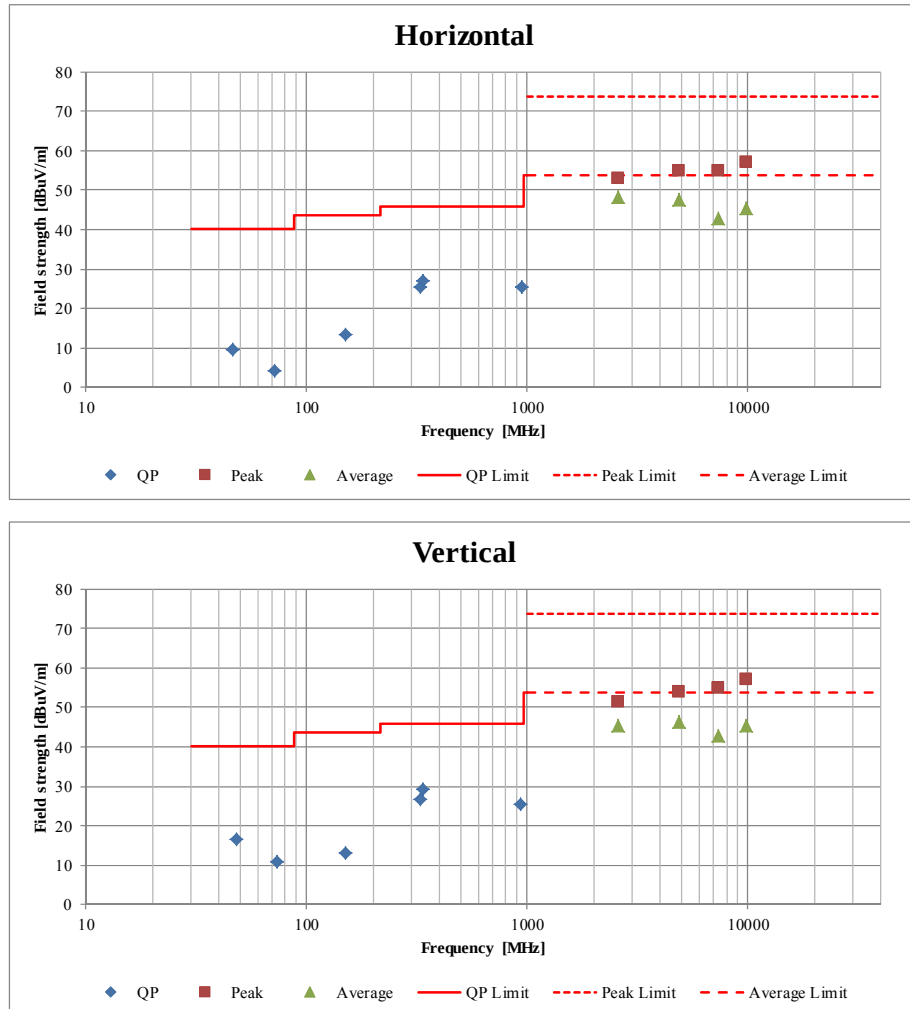
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Report No.	11873611H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.3
Date	July 31, 2017 Day	July 31, 2017 Night
Temperature / Humidity	24 deg. C / 63 % RH	22 deg. C / 58 % RH
Engineer	Tomoki Matsui	Shuichi Ohyama
	(1 GHz - 10 GHz)	(Below 1 GHz and 10 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2441 MHz	

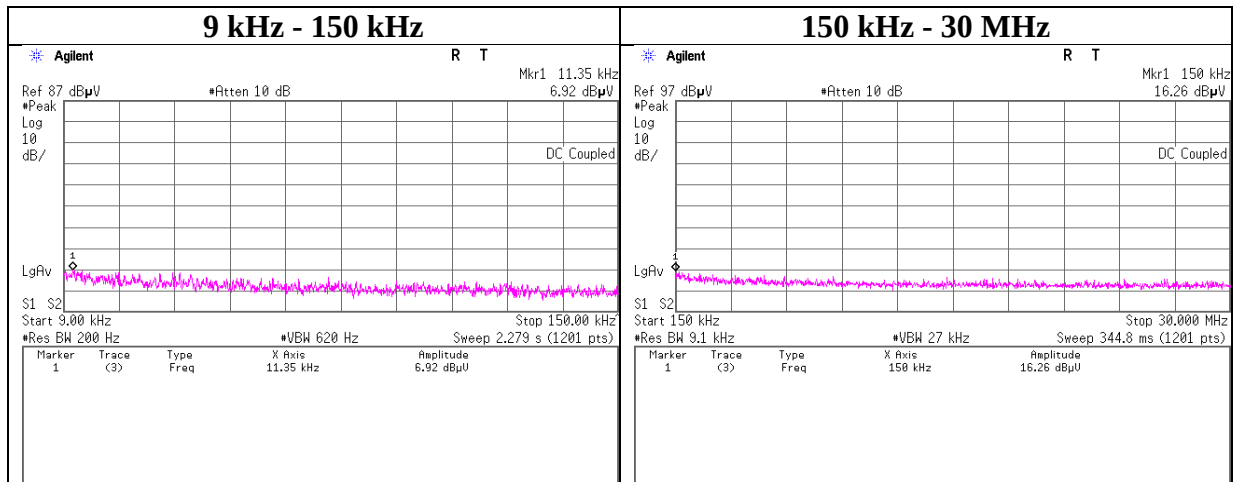
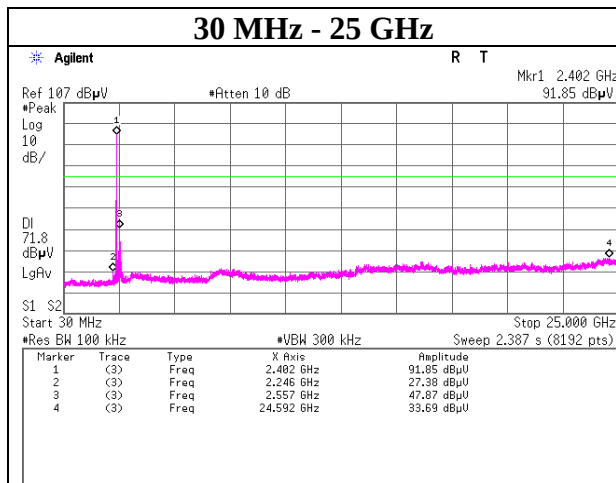


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

2402 MHz



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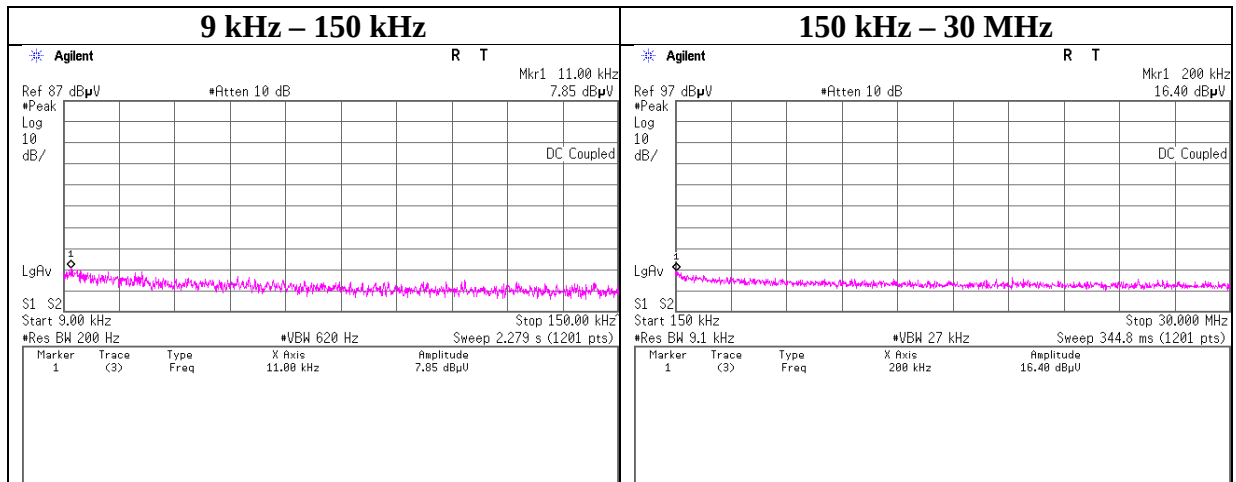
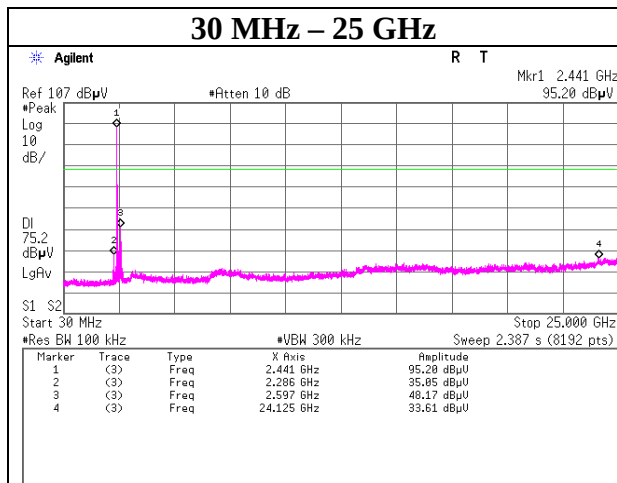
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

2441 MHz



UL Japan, Inc.

Ise EMC Lab.

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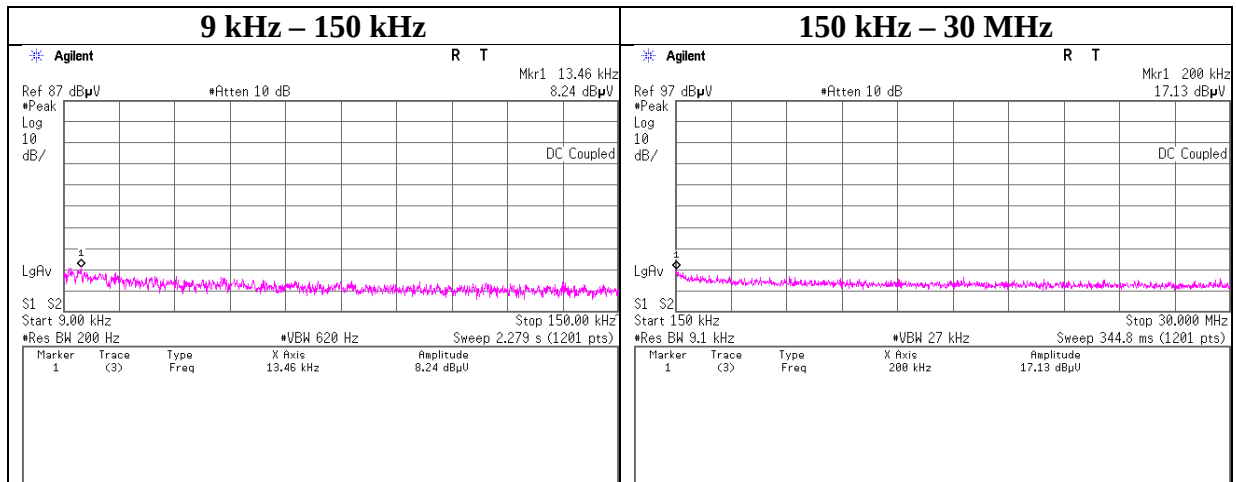
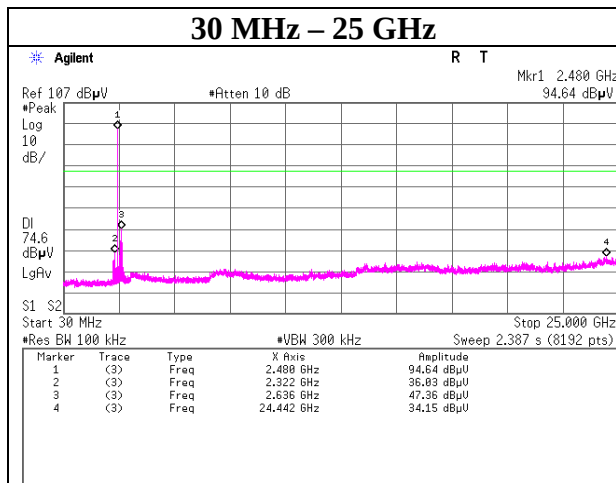
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, DH5

2480 MHz



UL Japan, Inc.

Ise EMC Lab.

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

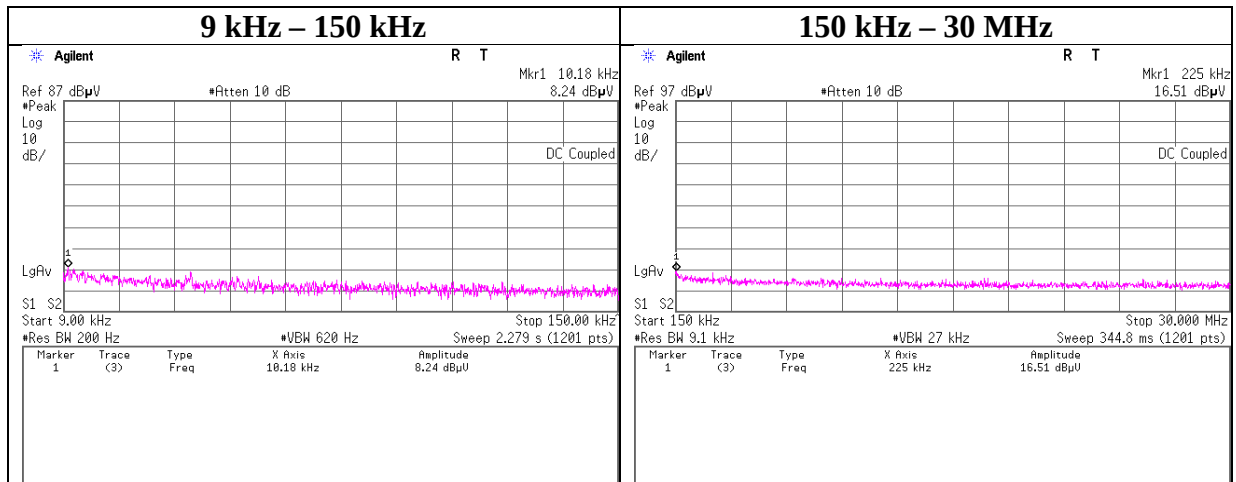
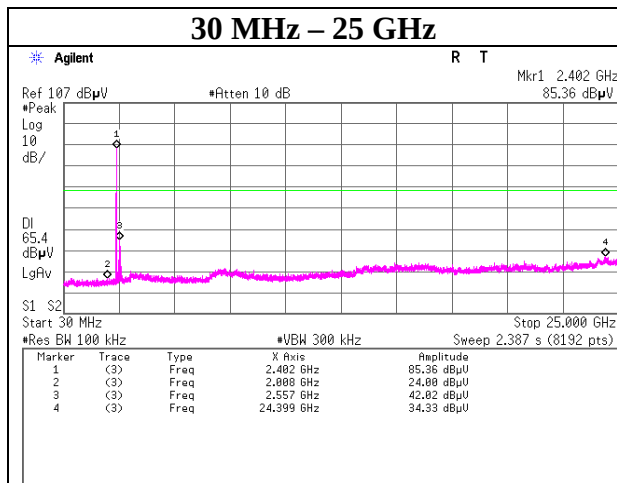
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5

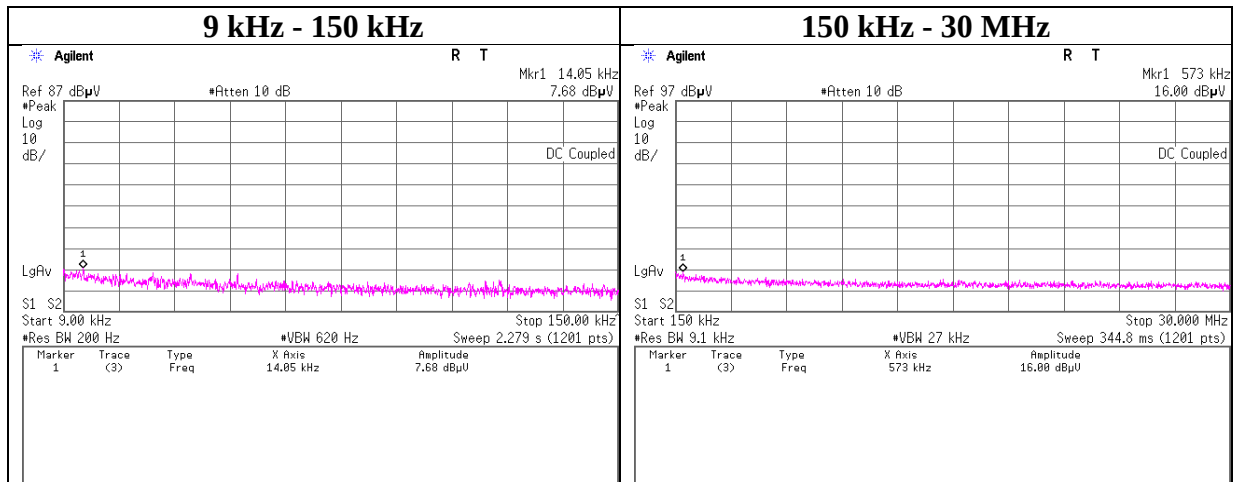
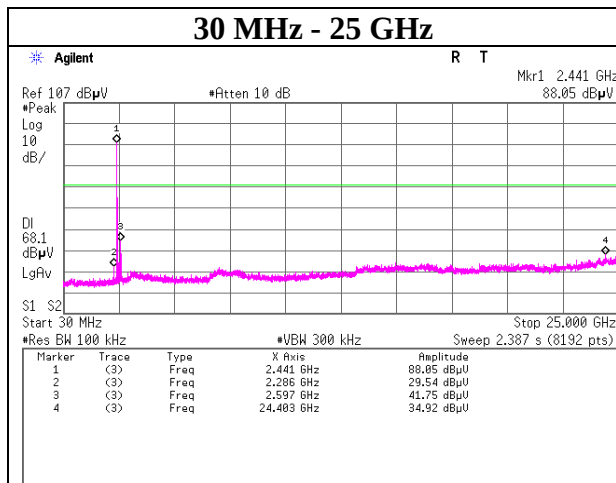
2402 MHz



Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5

2441 MHz



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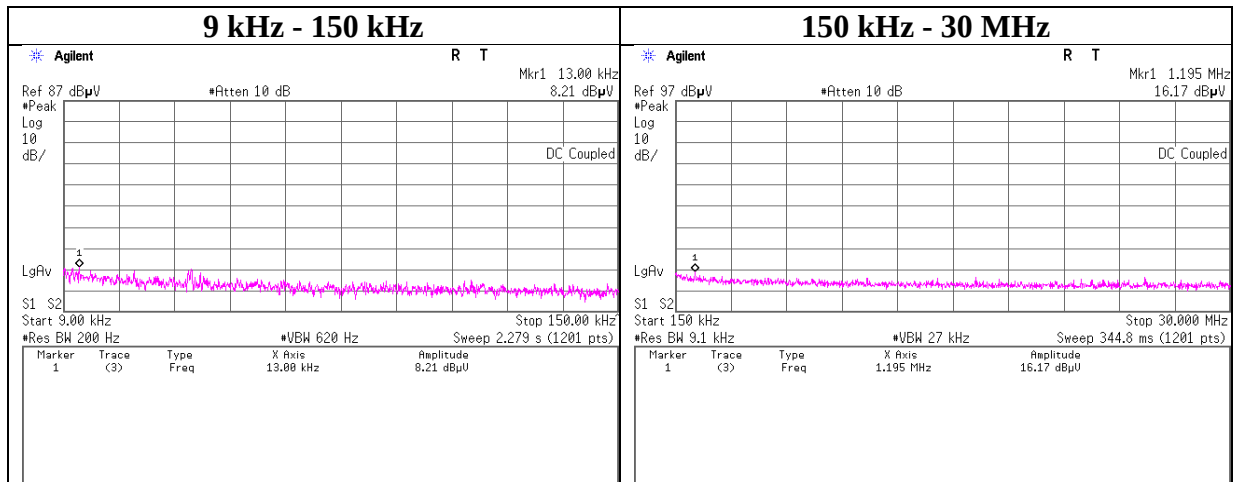
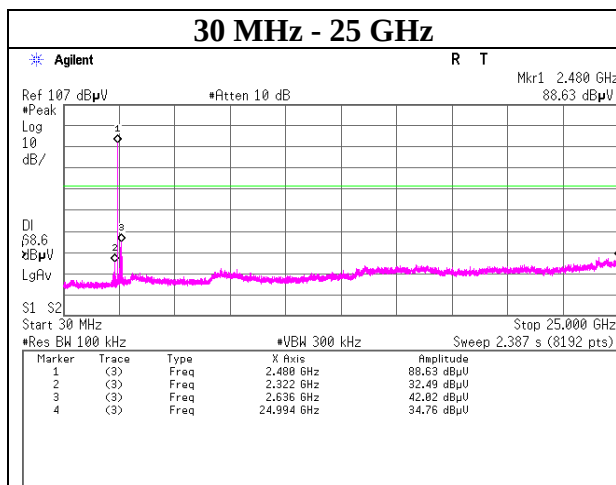
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx, Hopping Off, 3DH5

2480 MHz



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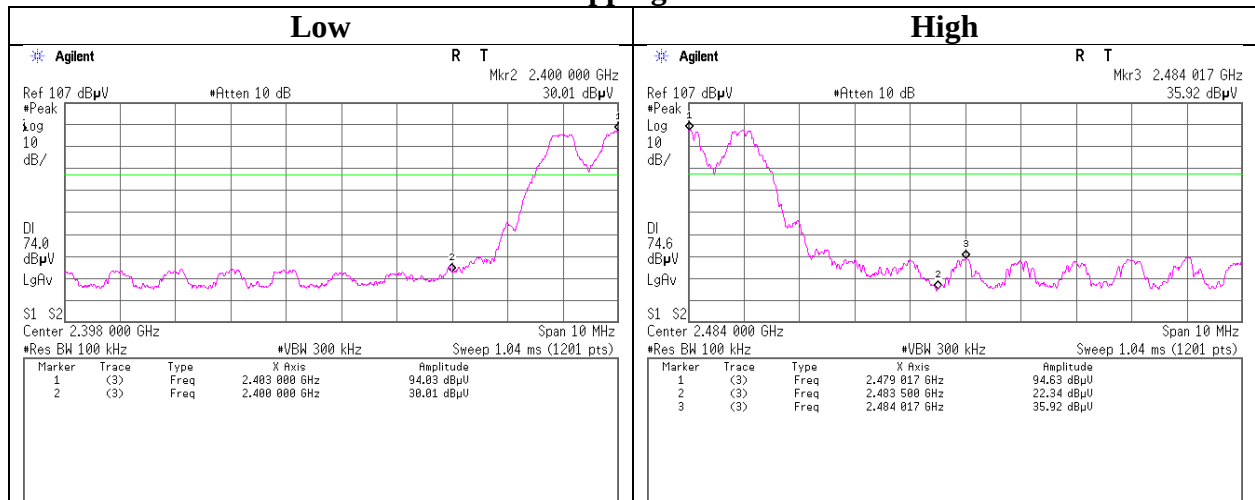
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

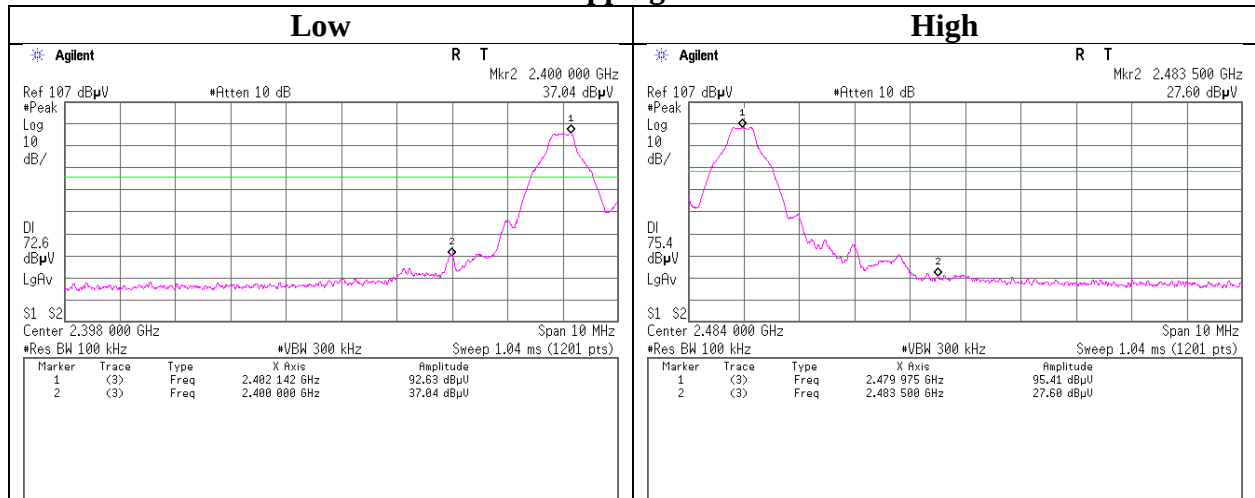
Conducted Emission Band Edge compliance

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11873611H
Date : August 3, 2017
Temperature / Humidity : 24 deg. C / 52 % RH
Engineer : Yuta Moriya
Mode : Tx DH5

Hopping On



Hopping Off



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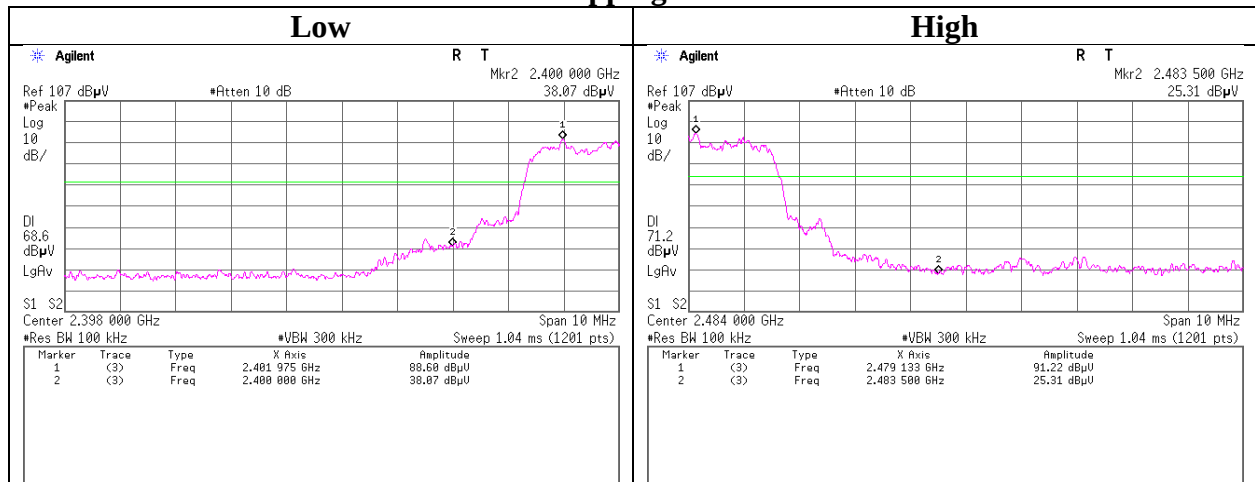
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

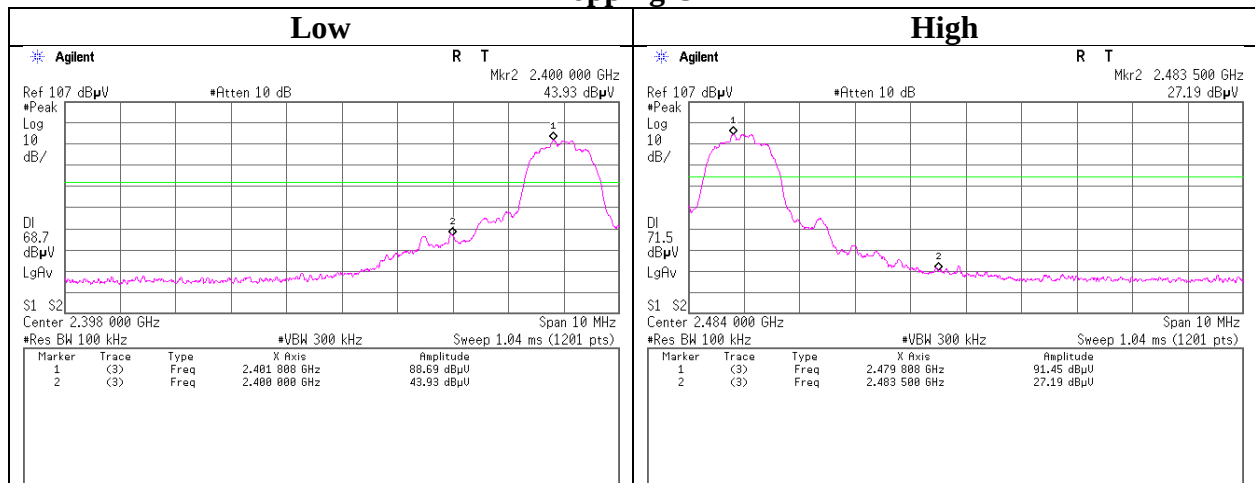
Conducted Emission Band Edge compliance

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11873611H
Date : August 3, 2017
Temperature / Humidity : 24 deg. C / 52 % RH
Engineer : Yuta Moriya
Mode : Tx 3DH5

Hopping On



Hopping Off



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Telephone : +81 596 24 8999

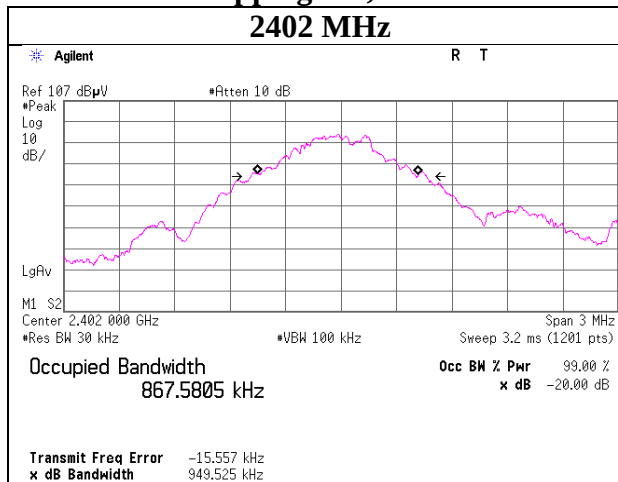
Facsimile : +81 596 24 8124

99% Occupied Bandwidth

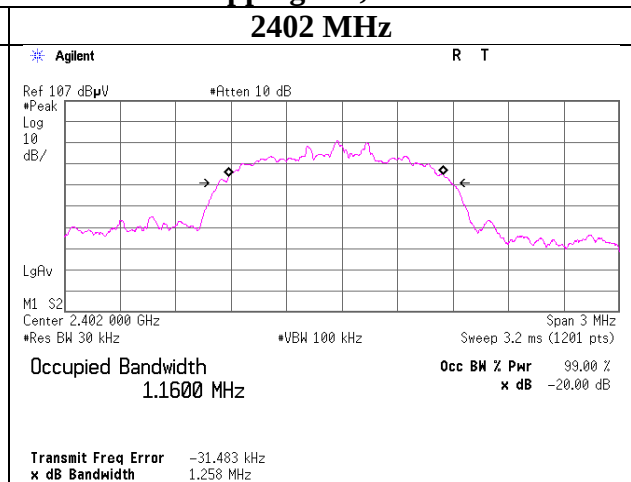
Test place
Report No.
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.11 Measurement Room
11873611H
August 3, 2017
24 deg. C / 52 % RH
Yuta Moriya
Tx Hopping Off

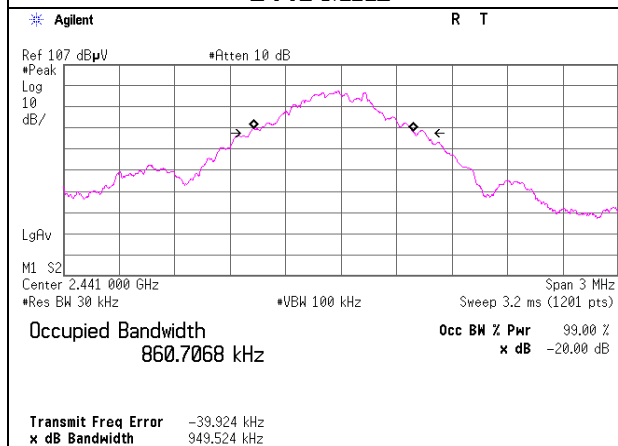
Hopping Off, DH5



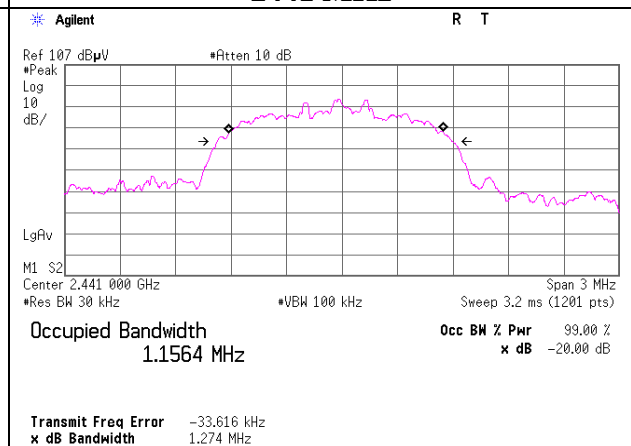
Hopping Off, 3DH5



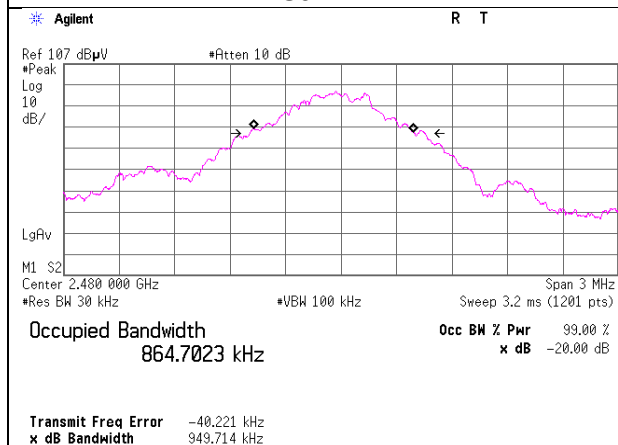
2441 MHz



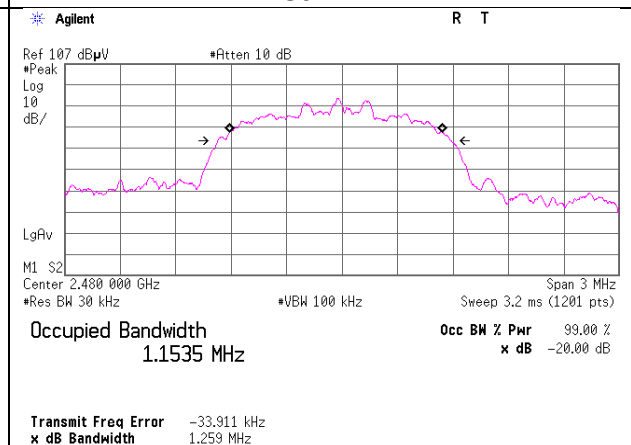
2441 MHz



2480 MHz



2480 MHz



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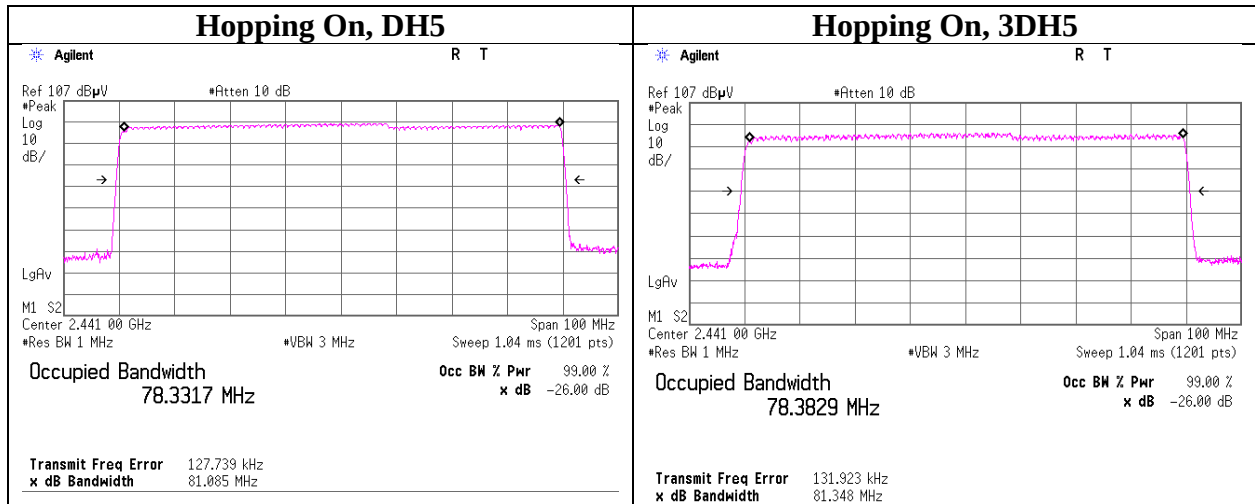
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11873611H
Date	August 3, 2017
Temperature / Humidity	24 deg. C / 52 % RH
Engineer	Yuta Moriya
Mode	Tx Hopping On



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APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE/CE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE/CE	2017/05/29 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2017/05/29 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2017/03/21 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2017/05/14 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE/CE	2017/01/19 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2016/09/21 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE/CE	2016/09/15 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2016/10/15 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2017/01/26 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2016/12/05 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2017/07/24 * 12
MCC-112	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(3m)/ sucoform141-PE(1m)/ 421-010(1.5m)/ RFM-E321(Switcher)	-/00640	CE	2017/07/12 * 12
MAT-66	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/12/24 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2016/12/13 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2017/06/20 * 12
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	AT	2017/02/21 * 12
MAT-58	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2016/12/15 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2017/06/20 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	AT	2017/01/19 * 12

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

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

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

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

UL Japan, Inc.

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

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