



RADIO TEST REPORT

Test Report No. : 12666110S-A-R1

Applicant : Sony Corporation, Japan and Sony Group Companies
Type of Equipment : AV RECEIVER
Model No. : XAV-AX150
FCC ID : AK8XAVAX150
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied (Refer to Section 3.2)

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2. The results in this report apply only to the sample tested.
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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 12666110S-A. 12666110S-A is replaced with this report.

Date of test: December 27, 2018 to January 18, 2019

Representative test engineer: *K. Noda*
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- The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
 There is no testing item of "Non-accreditation".

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13-EM-F0429

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SECTION 1: Customer information

Company Name : Sony Corporation, Japan and Sony Group Companies
Address : 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan
Telephone Number : +66 38 214900 17 Ext : 1932
Contact Person : Jumroen Phaoenchoke

The information provided from the customer is as follows:

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

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

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

2.1 Identification of E.U.T.

Type of Equipment : AV RECEIVER
Model No. : XAV-AX150
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 12 V
Receipt Date of Sample : December 26, 2018
(Information from test lab.)
Country of Mass-production : Thailand
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model: XAV-AX150 (referred to as the EUT in this report) is a AV RECEIVER.

Radio Specification

Bluetooth

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : FHSS, GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna type : Meander Monopole antenna
Antenna Gain : -0.63 dBi
Clock frequency : 26 MHz (Crystal)

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

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

3.2 Procedures and results

Item	Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	N/A*2)	N/A	-
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 *1) ----- IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-247 5.1 (b)	See data.	Complied a)	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 *1) ----- IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-247 5.1 (a)		Complied a)	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 *1) ----- IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-247 5.1 (d)		Complied b)	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 *1) ----- IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-247 5.1 (d)		Complied c)	Conducted
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 *1) ----- IC: RSS-Gen 6.12	FCC: Section15.247(a)(b)(1) ----- IC: RSS-247 5.4 (b)		Complied d)	Conducted
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 *1) ----- IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	9.1 dB 9764 MHz, AV, Hori. Tx, Hopping Off, 3DH5 2441 MHz	Complied e/f)	Conducted/ Radiated (above 30 MHz) *3)

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

*1) Since measurement was performed before issue of KDB 558074 v05r01, we referred to DA 00-705 which had been accepted provisionally.

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

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

a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)

b) Refer to APPENDIX 1 (data of Number of Hopping Frequency)

c) Refer to APPENDIX 1 (data of Dwell time)

d) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

e) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

f) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)

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

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

FCC Part 15.203 Antenna requirement

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

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	RSS-Gen 6.7	IC: -	N/A	Complied a)	Conducted

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

a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)

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

3.4 Uncertainty

EMI

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

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

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

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3.5 Test Location

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JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

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

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)</p> <p>*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.</p> <p>* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows; Power settings: BDR: Ext.=23, Int.=39 EDR: Ext.=73, Int.=48 Software: CSR BlueSuite BlueTest Version 2.5.8</p> <p>*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.</p>		

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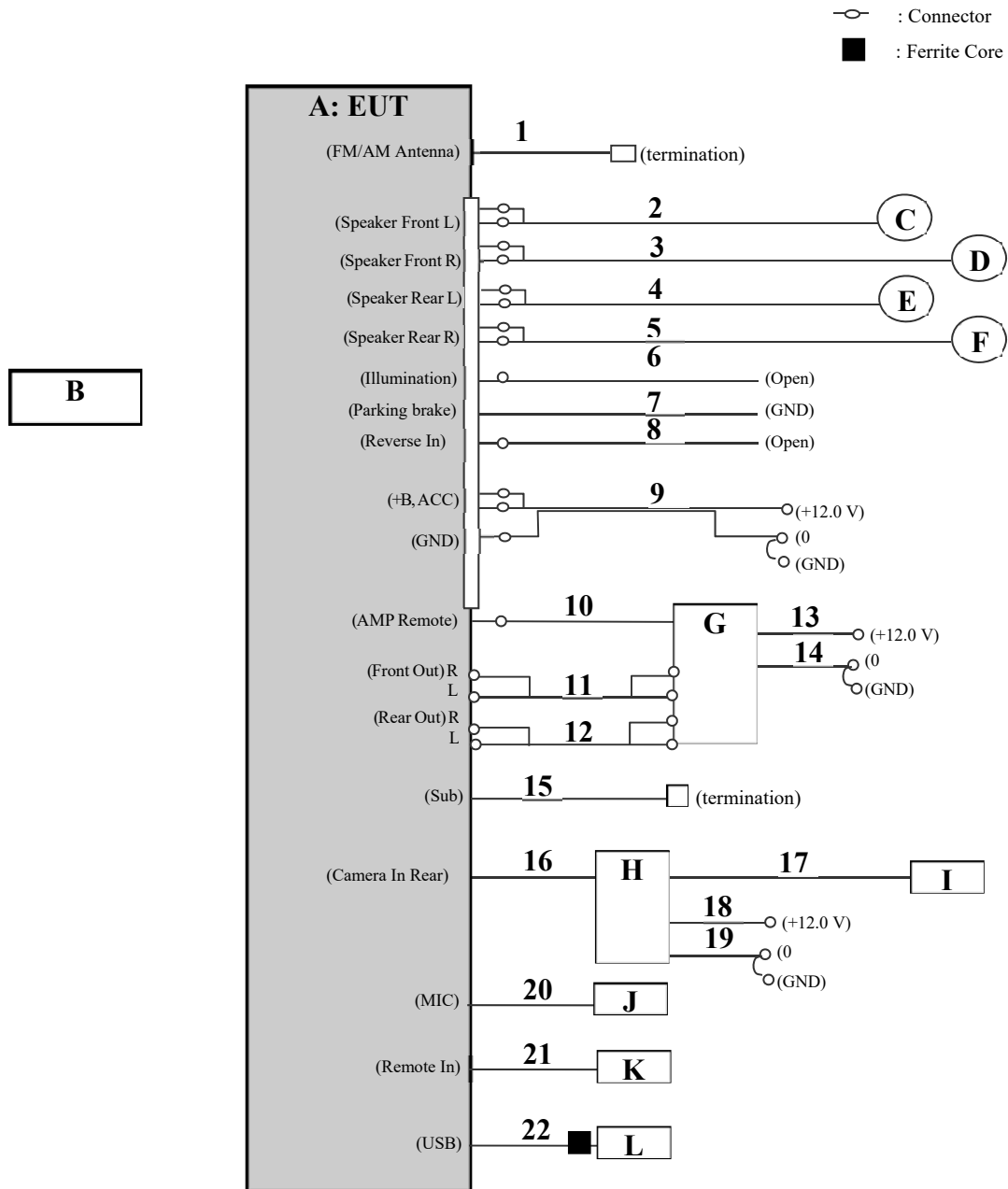
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4.2 Configuration and peripherals



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

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	AV Receiver	XAV-AX150	3 *1) 2 *2)	Sony	EUT
B	Remote Commander	RM-X170	-	Sony	-
C	Speaker 1	IS-10	-	Sony	-
D	Speaker 2	IS-10	-	Sony	-
E	Speaker 3	XS-GTF1625R	-	Sony	-
F	Speaker 4	XS-GTF1625R	-	Sony	-
G	Stereo Power Amplifier	XM-4S	0000052	Sony	-
H	Rear View Camera	XA-R800C	100114	Sony	-
I	Camera	-	-	Sony	-
J	MIC	-	-	Sony	-
K	Wired Remote Controller	RM-X4S	-	Sony	-
L	USB Memory	SDK-USM4GL(B)	09421HDDDB	Sony	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield (Cable)	Shield (Connector)	Remarks
1	FM antenna	1.0	Shielded	Shielded	-
2	Speaker (1)	0.15+2.4	Unshielded	Unshielded	-
3	Speaker (2)	0.15+2.4	Unshielded	Unshielded	-
4	Speaker (3)	0.15+1.9	Unshielded	Unshielded	-
5	Speaker (4)	0.15+1.9	Unshielded	Unshielded	-
6	Illumination	0.15+1.0	Unshielded	Unshielded	-
7	Parking	2.0	Unshielded	Unshielded	-
8	Reverse In	0.15+1.0	Unshielded	Unshielded	-
9	DC Power	0.15+1.3	Unshielded	Unshielded	-
10	AMP Remote	0.15+1.4	Unshielded	Unshielded	-
11	RCA (Front Audio Out)	5.0	Shielded	Shielded	-
12	RCA (Rear Audio Out)	5.0	Shielded	Shielded	-
13	DC Power (+)	1.3	Unshielded	Unshielded	-
14	DC Power (-)	1.3	Unshielded	Unshielded	-
15	RCA (Sub Audio Out)	1.0	Shielded	Shielded	-
16	RCA (Rear Camera)	3.0	Shielded	Shielded	-
17	Camera	3.0	Shielded	Shielded	-
18	DC Power (+)	0.9	Unshielded	Unshielded	-
19	DC Power (-)	0.9	Unshielded	Unshielded	-
20	MIC	3.5	Shielded	Shielded	-
21	REMOTE IN	2.0	Shielded	Shielded	-
22	USB	1.5	Shielded	Shielded	-

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SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 2.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

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.

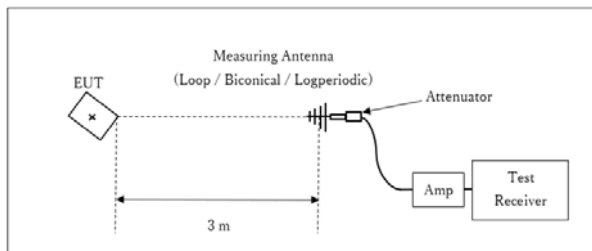
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

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

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

Figure 2: Test Setup

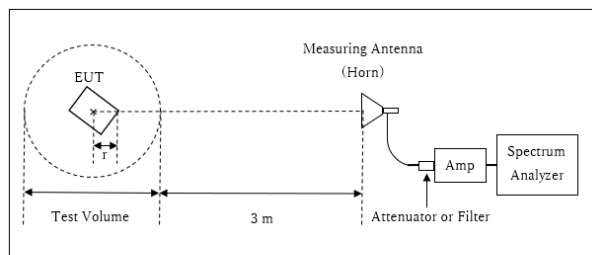
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



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

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

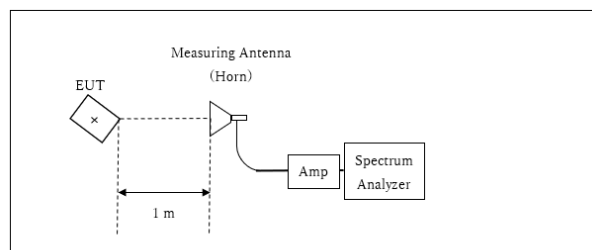
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.89 \text{ m}$

Test Volume : 2.0 m

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

$r = 0.11 \text{ m}$

13 GHz - 26.5 GHz



× : Center of turn table

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

*Test Distance: 1 m

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

Combinations of the worst case

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

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

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SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

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:50 MHz BW)
Carrier Frequency Separation	3 MHz	100 kHz	300 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	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

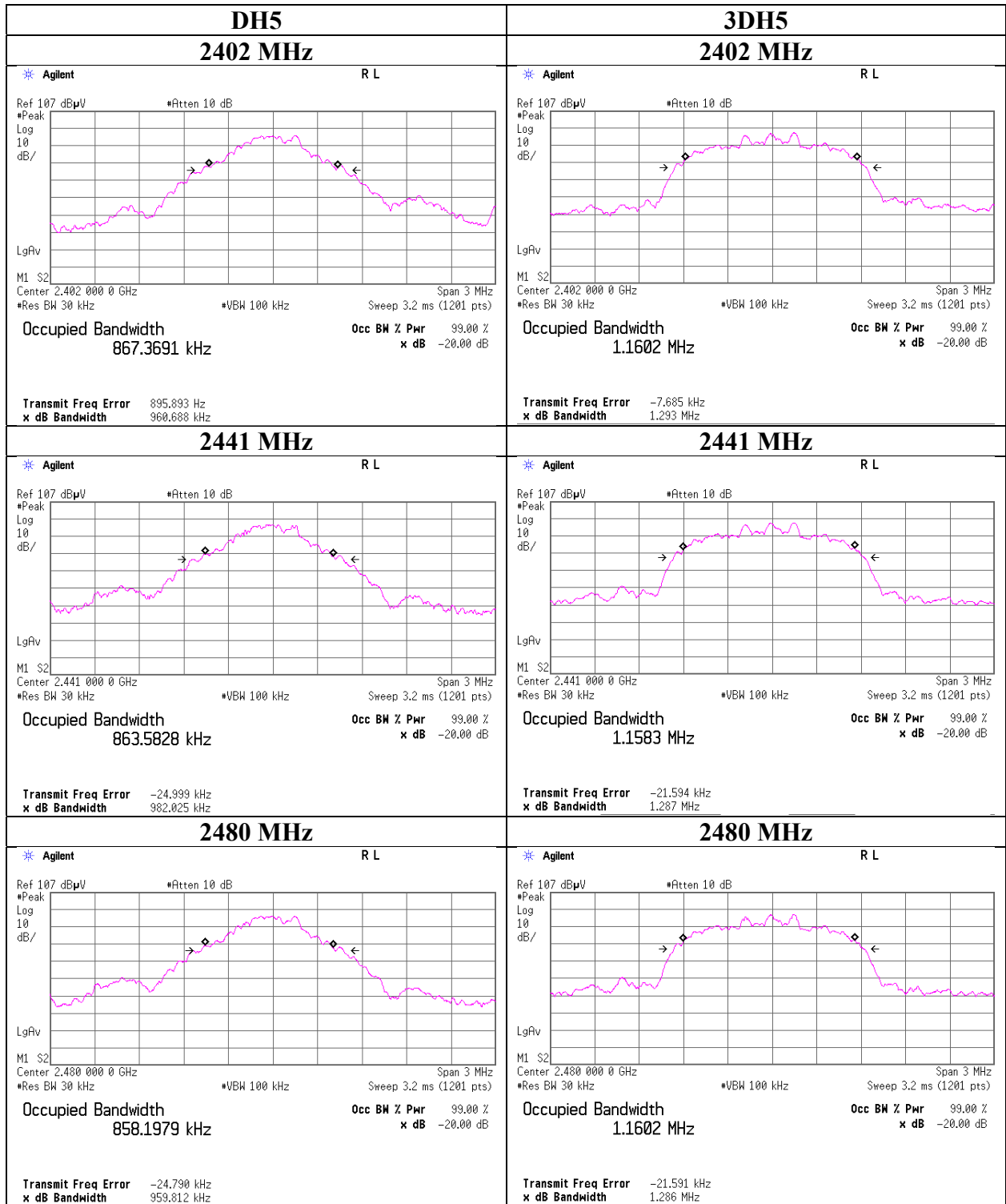
Report No. 12666110S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date December 27, 2018
Temperature / Humidity 22 deg. C / 29% RH
Engineer Kazuya Noda
Mode Tx

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.961	867.369	1.010	≥ 0.640
DH5	2441.0	0.982	863.583	1.005	≥ 0.655
DH5	2480.0	0.960	858.198	1.000	≥ 0.640
DH5	Hopping On	-	78548.9	-	-
3DH5	2402.0	1.293	1160.2	1.005	≥ 0.862
3DH5	2441.0	1.287	1158.3	0.998	≥ 0.858
3DH5	2480.0	1.286	1160.2	1.003	≥ 0.858
3DH5	Hopping On	-	78608.2	-	-

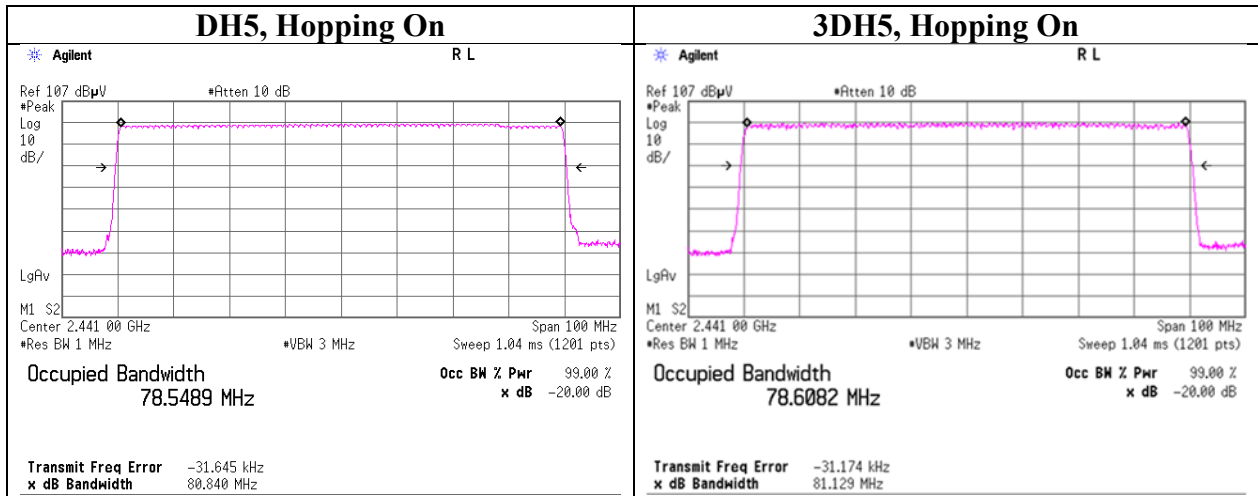
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20dB Bandwidth and 99% Occupied Bandwidth



20dB Bandwidth and 99% Occupied Bandwidth



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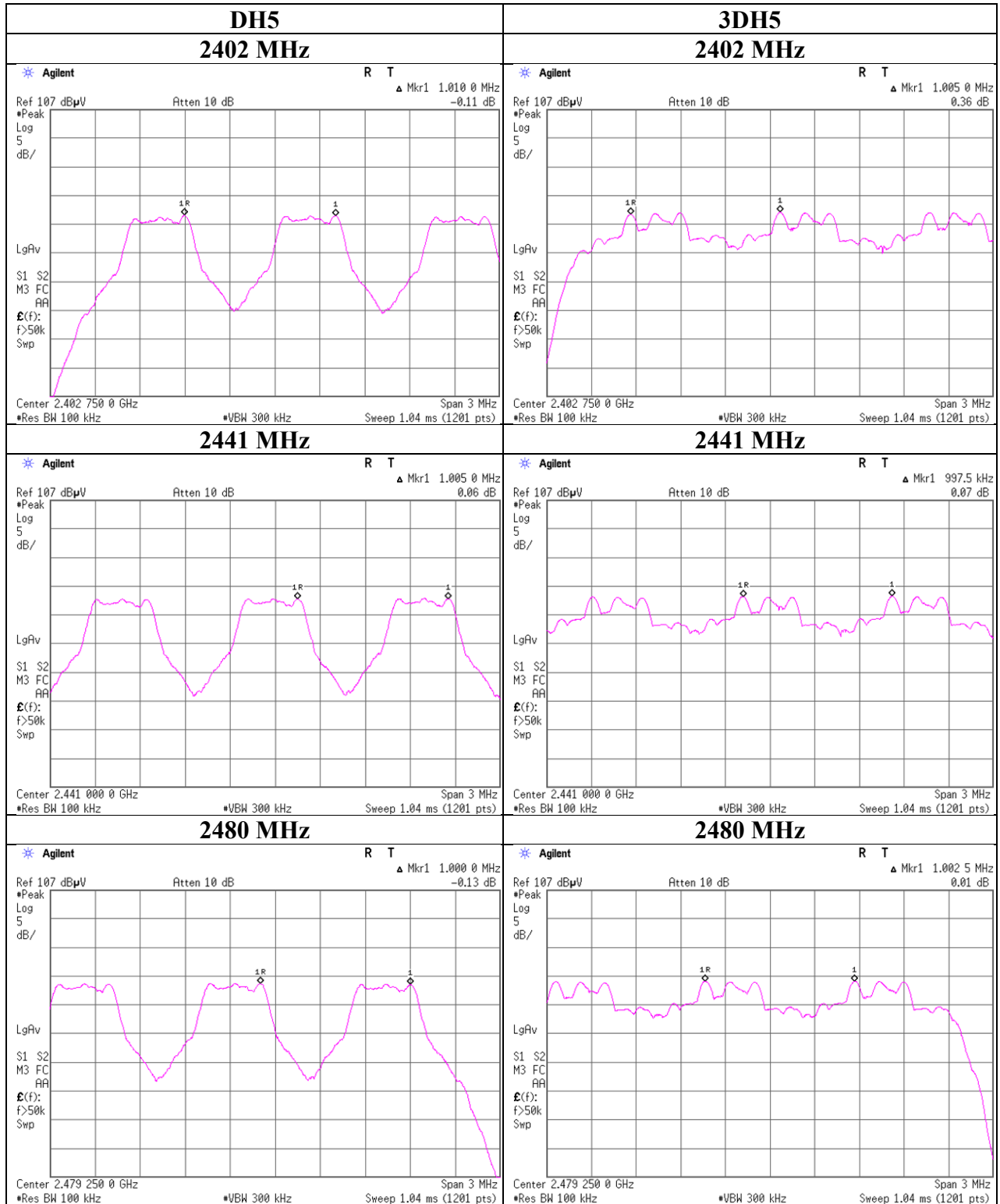
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Carrier Frequency Separation



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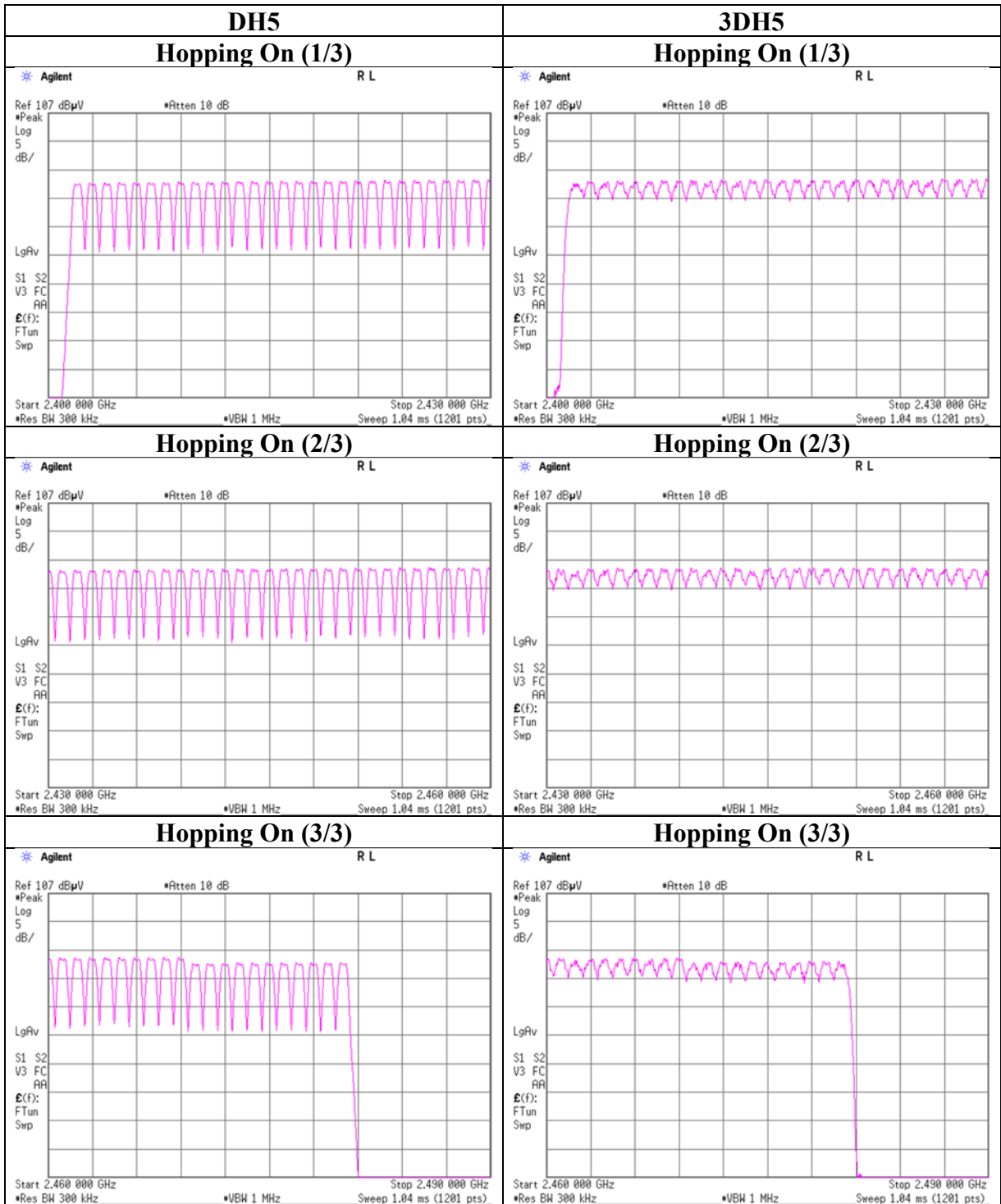
Number of Hopping Frequency

Report No. 12666110S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date December 27, 2018
Temperature / Humidity 22 deg. C / 29% RH
Engineer Kazuya Noda
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. 12666110S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date December 27, 2018
Temperature / Humidity 22 deg. C / 29% RH
Engineer Kazuya Noda
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	50.0 times /	5 sec. x	31.6 sec. =	316 times	0.414	400
DH3	25.0 times /	5 sec. x	31.6 sec. =	158 times	1.671	400
DH5	16.0 times /	5 sec. x	31.6 sec. =	102 times	2.920	400
3DH1	50.0 times /	5 sec. x	31.6 sec. =	316 times	0.432	400
3DH3	25.0 times /	5 sec. x	31.6 sec. =	158 times	1.683	400
3DH5	16.0 times /	5 sec. x	31.6 sec. =	102 times	2.934	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

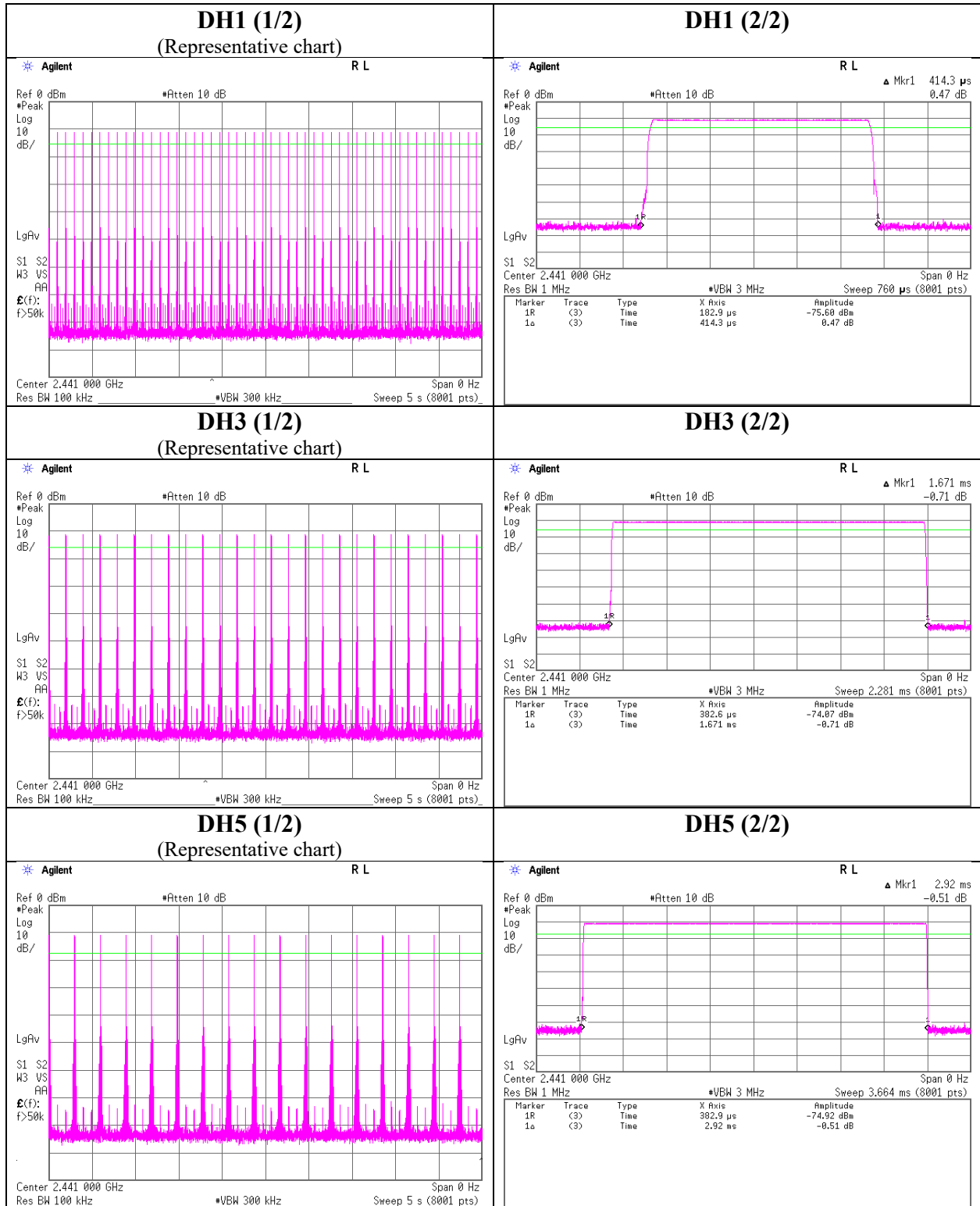
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	50	50	50	50	50
DH3	25	25	25	25	25	25
DH5	16	16	16	16	16	16
3DH1	50	50	50	50	50	50
3DH3	25	25	25	25	25	25
3DH5	16	16	16	16	16	16

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5

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

Dwell time



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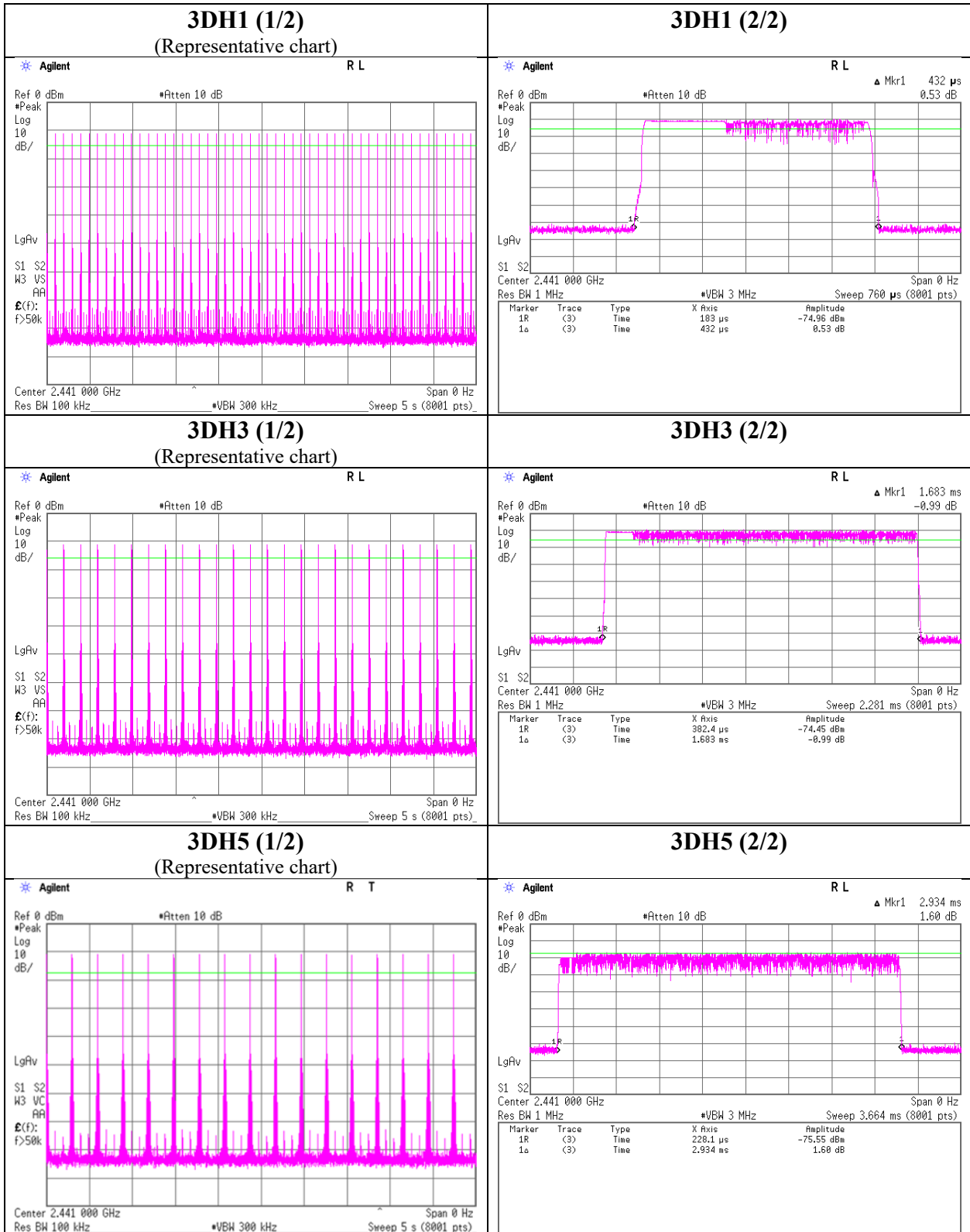
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

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Dwell time



UL Japan, Inc.

Shonan EMC Lab.

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Maximum Peak Output Power

Report No. 12666110S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date December 27, 2018
Temperature / Humidity 22 deg. C / 29% RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
					Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-10.88	1.15	9.82	0.09	1.02	20.96	125	20.87	-0.63	-0.54	0.88	36.02	4000	36.56
DH5	2441.0	-10.30	1.15	9.82	0.67	1.17	20.96	125	20.29	-0.64	0.03	1.01	36.02	4000	35.99
DH5	2480.0	-10.94	1.17	9.82	0.05	1.01	20.96	125	20.91	-0.65	-0.60	0.87	36.02	4000	36.62
2DH5	2402.0	-9.64	1.15	9.82	1.33	1.36	20.96	125	19.63	-0.66	0.67	1.17	36.02	4000	35.35
2DH5	2441.0	-9.06	1.15	9.82	1.91	1.55	20.96	125	19.05	-0.67	1.24	1.33	36.02	4000	34.78
2DH5	2480.0	-9.71	1.17	9.82	1.28	1.34	20.96	125	19.68	-0.68	0.60	1.15	36.02	4000	35.42
3DH5	2402.0	-9.14	1.15	9.82	1.83	1.52	20.96	125	19.13	-0.69	1.14	1.30	36.02	4000	34.88
3DH5	2441.0	-8.61	1.15	9.82	2.36	1.72	20.96	125	18.60	-0.70	1.66	1.47	36.02	4000	34.36
3DH5	2480.0	-9.19	1.17	9.82	1.80	1.51	20.96	125	19.16	-0.71	1.09	1.29	36.02	4000	34.93

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. 12666110S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date December 27, 2018
Temperature / Humidity 22 deg. C / 29% RH
Engineer Kazuya Noda
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	-12.78	1.15	9.82	-1.81	0.66	1.09	-0.72	0.85
DH5	2441.0	-12.07	1.15	9.82	-1.10	0.78	1.09	-0.01	1.00
DH5	2480.0	-12.75	1.17	9.82	-1.76	0.67	1.09	-0.67	0.86
2DH5	2402.0	-13.53	1.15	9.82	-2.56	0.55	1.07	-1.49	0.71
2DH5	2441.0	-12.96	1.15	9.82	-1.99	0.63	1.07	-0.92	0.81
2DH5	2480.0	-13.57	1.17	9.82	-2.58	0.55	1.07	-1.51	0.71
3DH5	2402.0	-13.50	1.15	9.82	-2.53	0.56	1.06	-1.47	0.71
3DH5	2441.0	-12.93	1.15	9.82	-1.96	0.64	1.06	-0.90	0.81
3DH5	2480.0	-13.53	1.17	9.82	-2.54	0.56	1.06	-1.48	0.71

Sample Calculation:

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

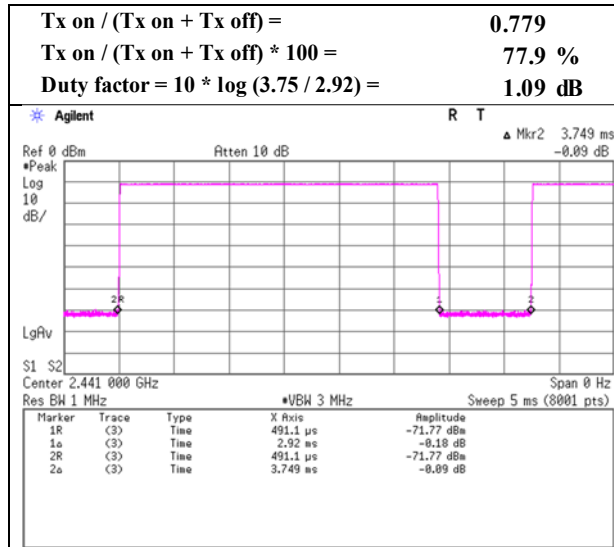
Result (Burst power average) = Time average + Duty factor

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

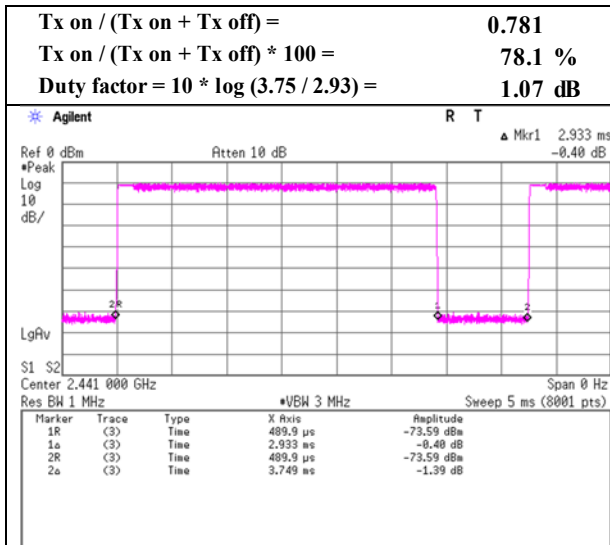
Burst Rate Confirmation

Report No. 12666110S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date December 27, 2018
Temperature / Humidity 22 deg. C / 29% RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

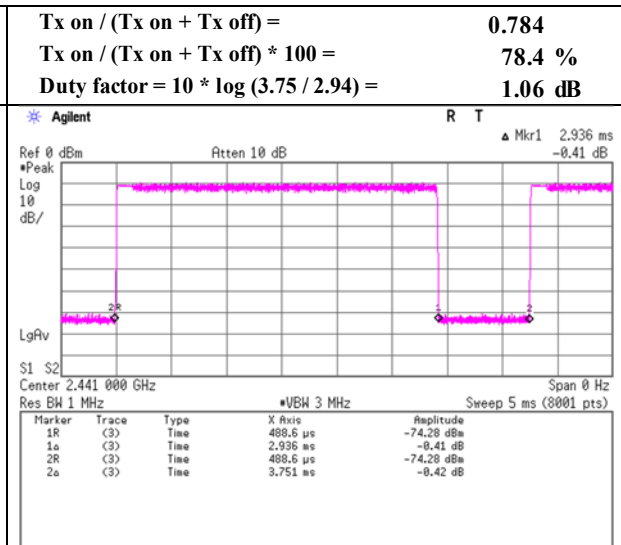
DH5



2DH5



3DH5



Radiated Spurious Emission

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.	59.934	QP	41.91	8.17	7.24	31.82	0.00	25.50	40.00	14.5	227	284	
Hori.	90.003	QP	43.54	8.20	8.37	31.81	0.00	28.30	43.50	15.2	185	315	
Hori.	423.247	QP	43.67	16.11	7.58	31.86	0.00	35.50	46.00	10.5	100	163	
Hori.	457.084	QP	43.32	16.83	7.72	31.89	0.00	35.98	46.00	10.0	100	271	
Hori.	2390.000	PK	45.78	27.89	14.02	39.46	2.26	50.49	73.90	23.4	193	142	
Hori.	4804.000	PK	49.19	31.35	6.53	39.50	2.26	49.83	73.90	24.0	163	144	
Hori.	7206.000	PK	44.06	36.78	7.58	39.29	2.26	51.39	73.90	22.5	100	0	
Hori.	9608.000	PK	44.88	38.10	8.65	39.52	2.26	54.37	73.90	19.5	100	0	
Hori.	2390.000	AV	33.17	27.89	14.02	39.46	2.26	37.88	53.90	16.0	193	142	
Hori.	4804.000	AV	39.69	31.35	6.53	39.50	2.26	40.33	53.90	13.5	163	144	
Hori.	7206.000	AV	32.82	36.78	7.58	39.29	2.26	40.15	53.90	13.7	100	0	
Hori.	9608.000	AV	32.59	38.10	8.65	39.52	2.26	42.08	53.90	11.8	100	0	
Vert.	38.870	QP	37.74	15.29	7.22	31.83	0.00	28.42	40.00	11.5	100	237	
Vert.	47.207	QP	41.89	12.19	7.41	31.82	0.00	29.67	40.00	10.3	100	6	
Vert.	71.830	QP	42.76	6.43	7.67	31.82	0.00	25.04	40.00	14.9	100	243	
Vert.	109.254	QP	36.38	11.82	8.14	31.80	0.00	24.54	43.50	18.9	100	217	
Vert.	2390.000	PK	46.82	27.89	14.02	39.46	2.26	51.53	73.90	22.3	241	171	
Vert.	4804.000	PK	48.62	31.35	6.53	39.50	2.26	49.26	73.90	24.6	209	215	
Vert.	7206.000	PK	44.81	36.78	7.58	39.29	2.26	52.14	73.90	21.7	100	0	
Vert.	9608.000	PK	44.90	38.10	8.65	39.52	2.26	54.39	73.90	19.5	100	0	
Vert.	2390.000	AV	33.16	27.89	14.02	39.46	2.26	37.87	53.90	16.0	241	171	
Vert.	4804.000	AV	39.71	31.35	6.53	39.50	2.26	40.35	53.90	13.5	209	215	
Vert.	7206.000	AV	32.03	36.78	7.58	39.29	2.26	39.36	53.90	14.5	100	0	
Vert.	9608.000	AV	32.60	38.10	8.65	39.52	2.26	42.09	53.90	11.8	100	0	

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

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	81.19	27.88	14.03	39.46	2.26	85.90	-	-	Carrier
Hori.	2400.000	PK	37.52	27.89	14.03	39.46	2.26	42.24	65.90	23.6	
Vert.	2402.000	PK	88.07	27.88	14.03	39.46	2.26	92.78	-	-	Carrier
Vert.	2400.000	PK	39.85	27.89	14.03	39.46	2.26	44.57	72.78	28.2	

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

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

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

UL Japan, Inc.

Shonan EMC Lab.

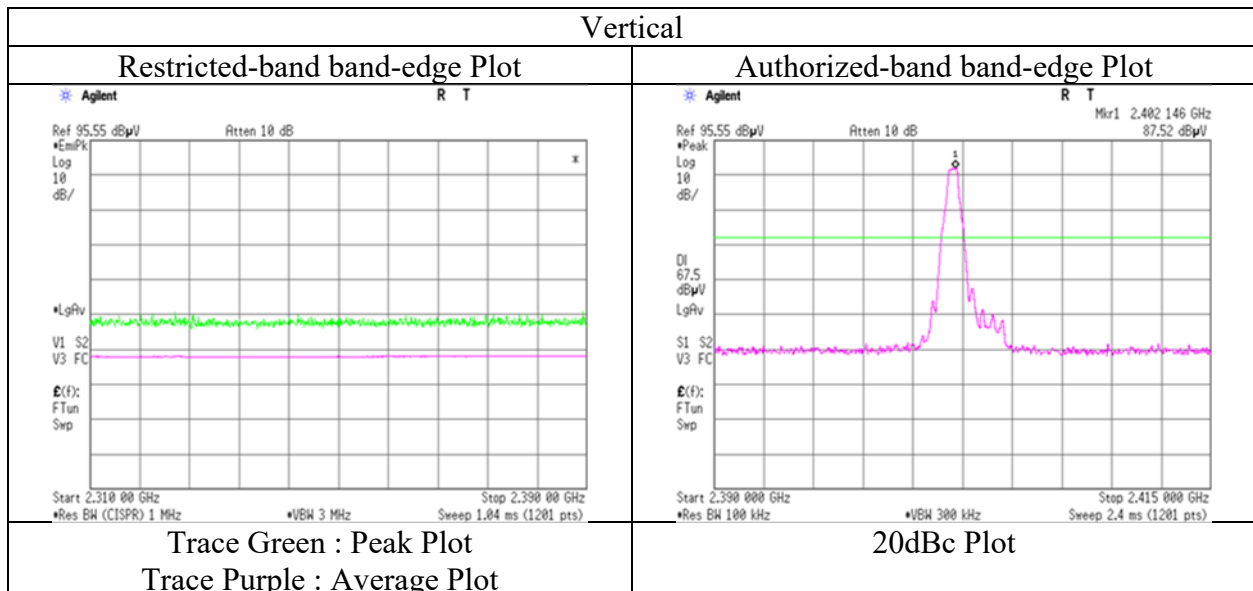
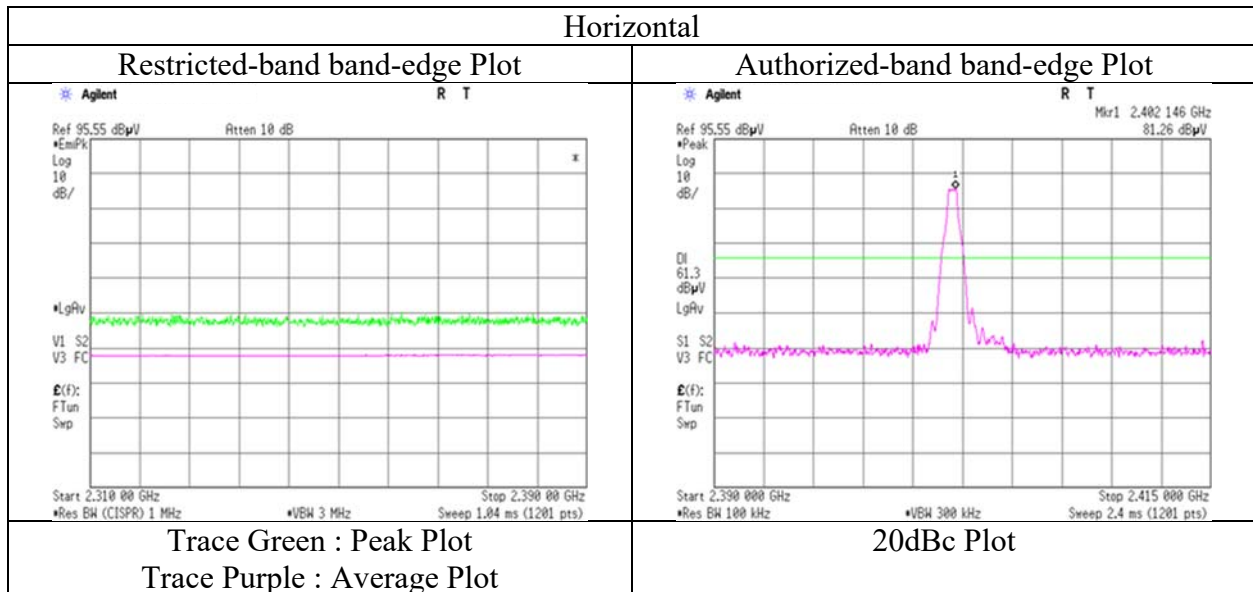
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12666110S-A-R1	No.1	No.1
Test place	Shonan EMC Lab.	January 18, 2019	January 18, 2019
Semi Anechoic Chamber	No.1	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Date	January 18, 2019	Takahiro Suzuki	Takahiro Suzuki
Temperature / Humidity	22 deg. C / 35 % RH	(30 MHz -1 GHz)	(1 GHz -18 GHz)
Engineer	Takahiro Suzuki	(1 GHz -18 GHz)	(18 GHz - 26.5 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.

Radiated Spurious Emission

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.	61.634	QP	41.77	7.83	7.23	31.82	0.00	25.01	40.00	14.9	230	287	
Hori.	92.219	QP	43.27	8.68	8.34	31.81	0.00	28.48	43.50	15.0	195	289	
Hori.	423.317	QP	43.55	16.11	7.58	31.86	0.00	35.38	46.00	10.6	100	159	
Hori.	457.061	QP	43.04	16.83	7.72	31.89	0.00	35.70	46.00	10.3	100	265	
Hori.	4882.000	PK	49.32	31.19	6.56	39.50	2.26	49.83	73.90	24.0	156	132	
Hori.	7323.000	PK	44.97	36.71	7.64	39.35	2.26	52.23	73.90	21.6	100	0	
Hori.	9764.000	PK	45.26	38.61	8.80	39.41	2.26	55.52	73.90	18.3	100	0	
Hori.	4882.000	AV	40.22	31.19	6.56	39.50	2.26	40.73	53.90	13.1	156	132	
Hori.	7323.000	AV	32.23	36.71	7.64	39.35	2.26	39.49	53.90	14.4	100	0	
Hori.	9764.000	AV	32.61	38.61	8.80	39.41	2.26	42.87	53.90	11.0	100	0	
Vert.	38.807	QP	37.57	15.30	7.22	31.83	0.00	28.26	40.00	11.7	100	211	
Vert.	47.139	QP	42.00	12.21	7.41	31.82	0.00	29.80	40.00	10.2	100	2	
Vert.	70.297	QP	43.09	6.58	7.53	31.82	0.00	25.38	40.00	14.6	100	250	
Vert.	95.105	QP	38.99	9.25	8.30	31.81	0.00	24.73	43.50	18.7	100	223	
Vert.	4882.000	PK	48.86	31.19	6.56	39.50	2.26	49.37	73.90	24.5	216	147	
Vert.	7323.000	PK	45.14	36.71	7.64	39.35	2.26	52.40	73.90	21.5	100	0	
Vert.	9764.000	PK	45.43	38.61	8.80	39.41	2.26	55.69	73.90	18.2	100	0	
Vert.	4882.000	AV	39.78	31.19	6.56	39.50	2.26	40.29	53.90	13.6	216	147	
Vert.	7323.000	AV	32.39	36.71	7.64	39.35	2.26	39.65	53.90	14.2	100	0	
Vert.	9764.000	AV	32.68	38.61	8.80	39.41	2.26	42.94	53.90	10.9	100	0	

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

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

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

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

Radiated Spurious Emission

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.	59.258	QP	40.85	8.35	7.27	31.82	0.00	24.65	40.00	15.3	229	238	
Hori.	91.017	QP	43.24	8.37	8.35	31.81	0.00	28.15	43.50	15.3	184	321	
Hori.	423.294	QP	43.86	16.11	7.58	31.86	0.00	35.69	46.00	10.3	100	158	
Hori.	457.112	QP	43.21	16.83	7.72	31.89	0.00	35.87	46.00	10.1	100	268	
Hori.	2483.500	PK	45.95	27.64	14.09	39.46	2.26	50.48	73.90	23.4	132	209	
Hori.	4960.000	PK	49.48	31.40	6.61	39.50	2.26	50.25	73.90	23.6	130	65	
Hori.	7440.000	PK	46.49	36.84	7.69	39.42	2.26	53.86	73.90	20.0	100	0	
Hori.	9920.000	PK	46.26	38.77	8.97	39.30	2.26	56.96	73.90	16.9	100	0	
Hori.	2483.500	AV	33.41	27.64	14.09	39.46	2.26	37.94	53.90	15.9	132	209	
Hori.	4960.000	AV	39.80	31.40	6.61	39.50	2.26	40.57	53.90	13.3	130	65	
Hori.	7440.000	AV	33.01	36.84	7.69	39.42	2.26	40.38	53.90	13.5	100	0	
Hori.	9920.000	AV	33.20	38.77	8.97	39.30	2.26	43.90	53.90	10.0	100	0	
Vert.	38.697	QP	38.38	15.33	7.22	31.83	0.00	29.10	40.00	10.9	100	263	
Vert.	47.229	QP	40.56	12.18	7.41	31.82	0.00	28.33	40.00	11.6	100	11	
Vert.	70.627	QP	43.17	6.54	7.57	31.82	0.00	25.46	40.00	14.5	100	219	
Vert.	102.108	QP	38.12	10.56	8.19	31.81	0.00	25.06	43.50	18.4	100	289	
Vert.	2483.500	PK	45.16	27.64	14.09	39.46	2.26	49.69	73.90	24.2	211	190	
Vert.	4960.000	PK	47.54	31.40	6.61	39.50	2.26	48.31	73.90	25.5	129	195	
Vert.	7440.000	PK	45.32	36.84	7.69	39.42	2.26	52.69	73.90	21.2	100	0	
Vert.	9920.000	PK	45.96	38.77	8.97	39.30	2.26	56.66	73.90	17.2	100	0	
Vert.	2483.500	AV	33.49	27.64	14.09	39.46	2.26	38.02	53.90	15.8	211	190	
Vert.	4960.000	AV	36.24	31.40	6.61	39.50	2.26	37.01	53.90	16.8	129	195	
Vert.	7440.000	AV	33.02	36.84	7.69	39.42	2.26	40.39	53.90	13.5	100	0	
Vert.	9920.000	AV	33.19	38.77	8.97	39.30	2.26	43.89	53.90	10.0	100	0	

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

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

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

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

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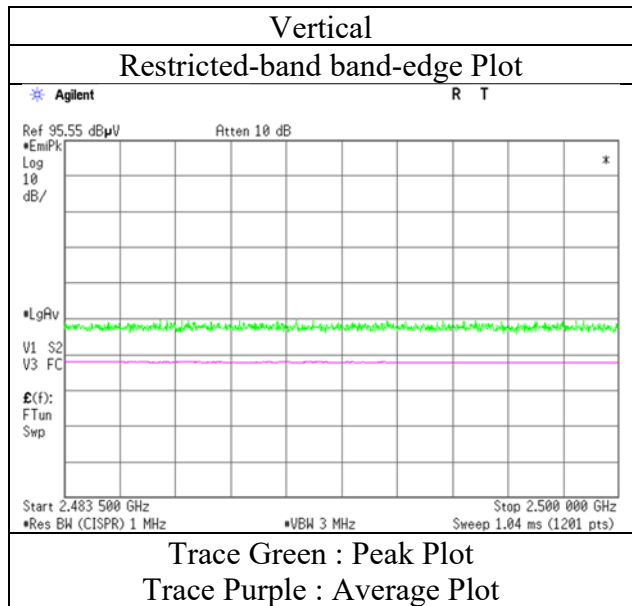
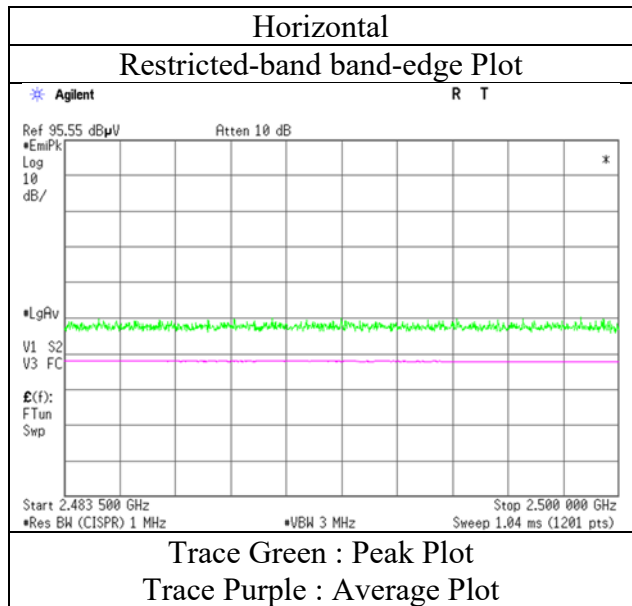
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12666110S-A-R1	No.1	No.1
Test place	Shonan EMC Lab.	January 18, 2019	January 18, 2019
Semi Anechoic Chamber	No.1	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Date	January 18, 2019	Takahiro Suzuki	Takahiro Suzuki
Temperature / Humidity	22 deg. C / 35 % RH	(30 MHz -1 GHz)	(1 GHz -18 GHz)
Engineer	Takahiro Suzuki	Yosuke Ishikawa	(18 GHz – 26.5 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz		



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.	60.261	QP	42.34	8.09	7.62	31.82	0.00	26.23	40.00	13.7	225	340	
Hori.	91.332	QP	44.19	8.46	8.04	31.81	0.00	28.88	43.50	14.6	181	302	
Hori.	423.280	QP	43.12	16.11	7.58	31.86	0.00	34.95	46.00	11.0	100	156	
Hori.	457.013	QP	43.23	16.82	7.72	31.89	0.00	35.88	46.00	10.1	100	270	
Hori.	2390.000	PK	46.00	27.89	14.02	39.46	2.26	50.71	73.90	23.1	151	138	
Hori.	4804.000	PK	47.93	31.35	6.53	39.50	2.26	48.57	73.90	25.3	192	55	
Hori.	7206.000	PK	43.50	36.78	7.58	39.29	2.26	50.83	73.90	23.0	100	0	
Hori.	9608.000	PK	44.12	38.10	8.65	39.52	2.26	53.61	73.90	20.2	100	0	
Hori.	2390.000	AV	33.11	27.89	14.02	39.46	2.26	37.82	53.90	16.0	151	138	
Hori.	4804.000	AV	35.24	31.35	6.53	39.50	2.26	35.88	53.90	18.0	192	55	
Hori.	7206.000	AV	32.16	36.78	7.58	39.29	2.26	39.49	53.90	14.4	100	0	
Hori.	9608.000	AV	32.79	38.10	8.65	39.52	2.26	42.28	53.90	11.6	100	0	
Vert.	38.916	QP	38.00	15.27	7.29	31.83	0.00	28.73	40.00	11.2	100	252	
Vert.	47.262	QP	40.76	12.17	7.43	31.82	0.00	28.54	40.00	11.4	100	3	
Vert.	69.606	QP	43.45	6.65	7.75	31.82	0.00	26.03	40.00	13.9	100	278	
Vert.	100.718	QP	37.87	10.36	8.17	31.81	0.00	24.59	43.50	18.9	100	223	
Vert.	2390.000	PK	45.95	27.89	14.02	39.46	2.26	50.66	73.90	23.2	265	171	
Vert.	4804.000	PK	46.39	31.35	6.53	39.50	2.26	47.03	73.90	26.8	164	213	
Vert.	7206.000	PK	44.48	36.78	7.58	39.29	2.26	51.81	73.90	22.0	100	0	
Vert.	9608.000	PK	45.98	38.10	8.65	39.52	2.26	55.47	73.90	18.4	100	0	
Vert.	2390.000	AV	33.15	27.89	14.02	39.46	2.26	37.86	53.90	16.0	265	171	
Vert.	4804.000	AV	35.22	31.35	6.53	39.50	2.26	35.86	53.90	18.0	164	213	
Vert.	7206.000	AV	32.17	36.78	7.58	39.29	2.26	39.50	53.90	14.4	100	0	
Vert.	9608.000	AV	32.81	38.10	8.65	39.52	2.26	42.30	53.90	11.6	100	0	

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

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

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	81.99	27.88	14.03	39.46	2.26	86.70	-	-	Carrier
Hori.	2400.000	PK	36.80	27.89	14.03	39.46	2.26	41.52	66.70	25.1	
Vert.	2402.000	PK	88.98	27.88	14.03	39.46	2.26	93.69	-	-	Carrier
Vert.	2400.000	PK	42.33	27.89	14.03	39.46	2.26	47.05	73.69	26.6	

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

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

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

UL Japan, Inc.

Shonan EMC Lab.

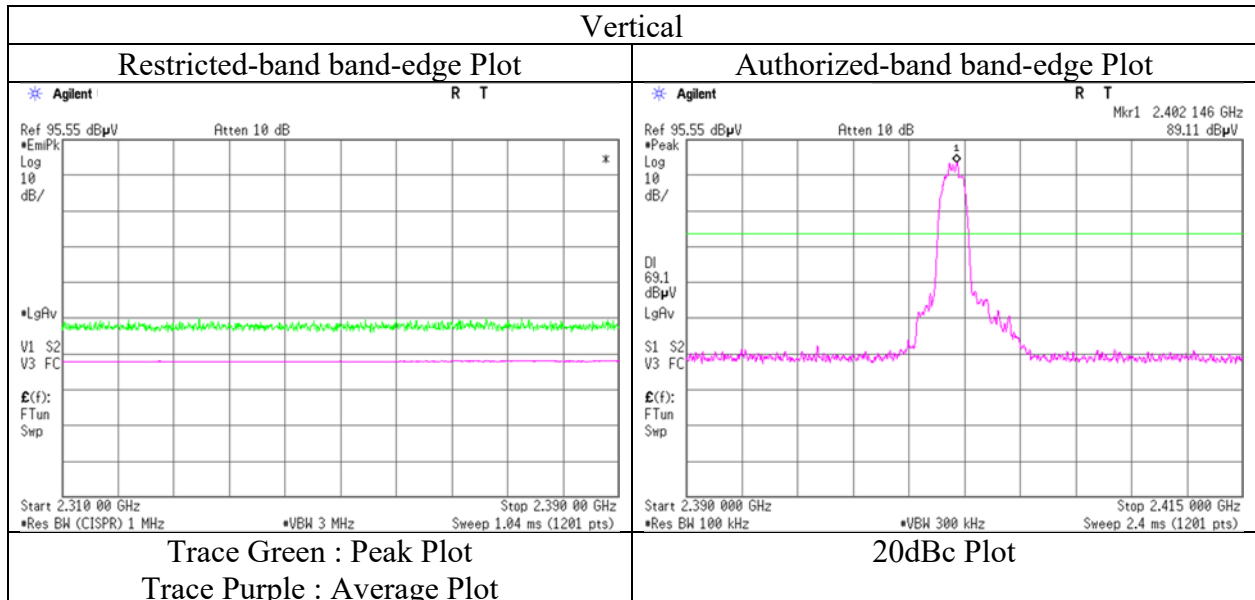
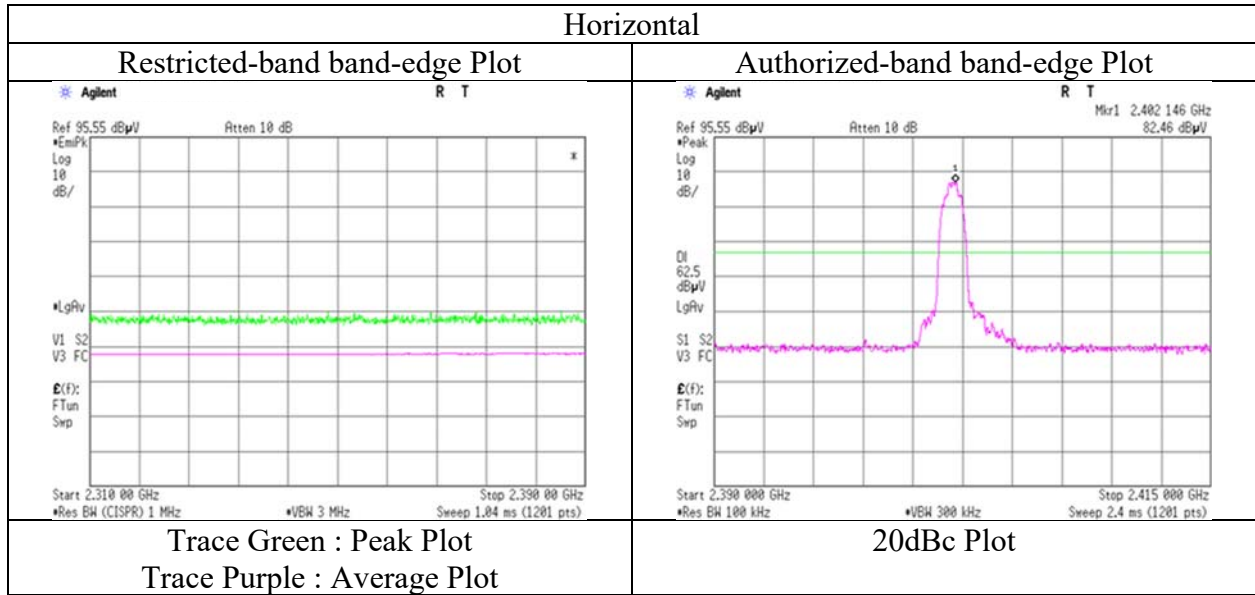
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Telephone : +81 463 50 6400

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12666110S-A-R1	No.1	No.1
Test place	Shonan EMC Lab.	January 18, 2019	January 18, 2019
Semi Anechoic Chamber	No.1	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Date	January 18, 2019	Takahiro Suzuki	Takahiro Suzuki
Temperature / Humidity	22 deg. C / 35 % RH	(30 MHz -1 GHz)	(1 GHz -18 GHz)
Engineer	Takahiro Suzuki	Yosuke Ishikawa	(18 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz		



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.	58.735	QP	42.00	8.48	7.29	31.82	0.00	25.95	40.00	14.0	224	280	
Hori.	93.213	QP	42.66	8.89	8.33	31.81	0.00	28.07	43.50	15.4	191	316	
Hori.	423.316	QP	42.77	16.11	7.58	31.86	0.00	34.60	46.00	11.4	100	159	
Hori.	457.109	QP	43.09	16.83	7.72	31.89	0.00	35.75	46.00	10.2	100	273	
Hori.	4882.000	PK	47.99	31.19	6.56	39.50	2.26	48.50	73.90	25.4	111	80	
Hori.	7323.000	PK	46.45	36.71	7.64	39.35	2.26	53.71	73.90	20.1	100	0	
Hori.	9764.000	PK	46.33	38.61	8.80	39.41	2.26	56.59	73.90	17.3	100	0	
Hori.	4882.000	AV	35.86	31.19	6.56	39.50	2.26	36.37	53.90	17.5	111	80	
Hori.	7323.000	AV	34.03	36.71	7.64	39.35	2.26	41.29	53.90	12.6	100	0	
Hori.	9764.000	AV	34.54	38.61	8.80	39.41	2.26	44.80	53.90	9.1	100	0	
Vert.	39.012	QP	38.83	15.25	7.22	31.83	0.00	29.47	40.00	10.5	100	231	
Vert.	47.135	QP	41.37	12.21	7.41	31.82	0.00	29.17	40.00	10.8	100	1	
Vert.	70.119	QP	41.51	6.61	7.52	31.82	0.00	23.82	40.00	16.1	100	238	
Vert.	109.553	QP	37.49	11.85	8.14	31.80	0.00	25.68	43.50	17.8	100	250	
Vert.	4882.000	PK	46.58	31.19	6.56	39.50	2.26	47.09	73.90	26.8	191	71	
Vert.	7323.000	PK	44.15	36.71	7.64	39.35	2.26	51.41	73.90	22.4	100	0	
Vert.	9764.000	PK	45.31	38.61	8.80	39.41	2.26	55.57	73.90	18.3	100	0	
Vert.	4882.000	AV	34.96	31.19	6.56	39.50	2.26	35.47	53.90	18.4	191	71	
Vert.	7323.000	AV	32.39	36.71	7.64	39.35	2.26	39.65	53.90	14.2	100	0	
Vert.	9764.000	AV	32.95	38.61	8.80	39.41	2.26	43.21	53.90	10.6	100	0	

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

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

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

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

Radiated Spurious Emission

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 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.	60.422	QP	42.23	8.06	7.24	31.82	0.00	25.71	40.00	14.2	224	314	
Hori.	77.943	QP	38.04	6.32	8.18	31.81	0.00	20.73	40.00	19.2	227	104	
Hori.	90.199	QP	42.85	8.23	8.36	31.81	0.00	27.63	43.50	15.8	190	284	
Hori.	93.570	QP	40.43	8.95	8.32	31.81	0.00	25.89	43.50	17.6	265	327	
Hori.	423.320	QP	42.99	16.11	7.58	31.86	0.00	34.82	46.00	11.1	100	95	
Hori.	456.902	QP	43.13	16.82	7.72	31.89	0.00	35.78	46.00	10.2	100	199	
Hori.	2483.500	PK	45.48	27.64	14.09	39.46	2.26	50.01	73.90	23.8	229	149	
Hori.	4960.000	PK	46.43	31.40	6.61	39.50	2.26	47.20	73.90	26.7	150	61	
Hori.	7440.000	PK	44.85	36.84	7.69	39.42	2.26	52.22	73.90	21.6	100	0	
Hori.	9920.000	PK	44.51	38.77	8.97	39.30	2.26	55.21	73.90	18.6	100	0	
Hori.	2483.500	AV	32.98	27.64	14.09	39.46	2.26	37.51	53.90	16.3	229	149	
Hori.	4960.000	AV	34.72	31.40	6.61	39.50	2.26	35.49	53.90	18.4	150	61	
Hori.	7440.000	AV	32.97	36.84	7.69	39.42	2.26	40.34	53.90	13.5	100	0	
Hori.	9920.000	AV	33.12	38.77	8.97	39.30	2.26	43.82	53.90	10.0	100	0	
Vert.	39.209	QP	38.17	15.17	7.24	31.83	0.00	28.75	40.00	11.2	100	161	
Vert.	47.153	QP	41.24	12.20	7.41	31.82	0.00	29.03	40.00	10.9	100	51	
Vert.	70.633	QP	43.86	6.54	7.57	31.82	0.00	26.15	40.00	13.8	100	64	
Vert.	77.271	QP	41.78	6.33	8.14	31.81	0.00	24.44	40.00	15.5	100	231	
Vert.	97.324	QP	38.25	9.66	8.26	31.81	0.00	24.36	43.50	19.1	100	64	
Vert.	2483.500	PK	45.40	27.64	14.09	39.46	2.26	49.93	73.90	23.9	275	185	
Vert.	4960.000	PK	46.15	31.40	6.61	39.50	2.26	46.92	73.90	26.9	100	3	
Vert.	7440.000	PK	45.56	36.84	7.69	39.42	2.26	52.93	73.90	20.9	100	0	
Vert.	9920.000	PK	46.43	38.77	8.97	39.30	2.26	57.13	73.90	16.7	100	0	
Vert.	2483.500	AV	33.11	27.64	14.09	39.46	2.26	37.64	53.90	16.2	275	185	
Vert.	4960.000	AV	33.79	31.40	6.61	39.50	2.26	34.56	53.90	19.3	100	3	
Vert.	7440.000	AV	33.03	36.84	7.69	39.42	2.26	40.40	53.90	13.5	100	0	
Vert.	9920.000	AV	33.14	38.77	8.97	39.30	2.26	43.84	53.90	10.0	100	0	

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

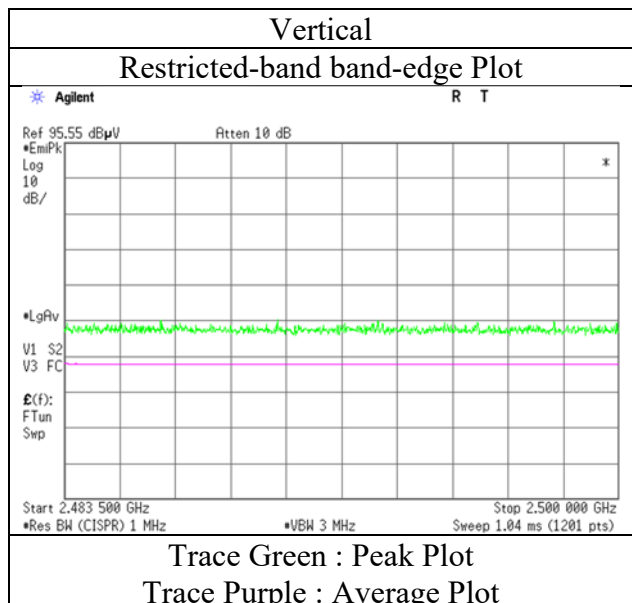
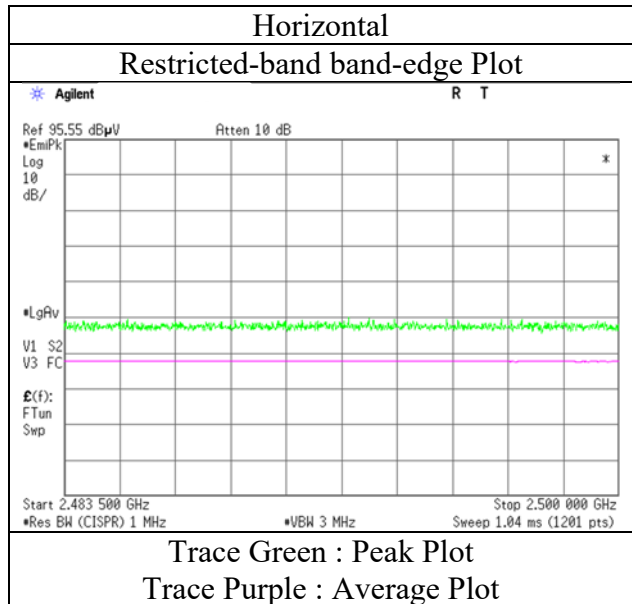
Distance factor : 1 GHz - 13 GHz : 20log (3.89 m / 3.0 m) = 2.26 dB

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

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

Radiated Spurious Emission
(Reference Plot for band-edge)

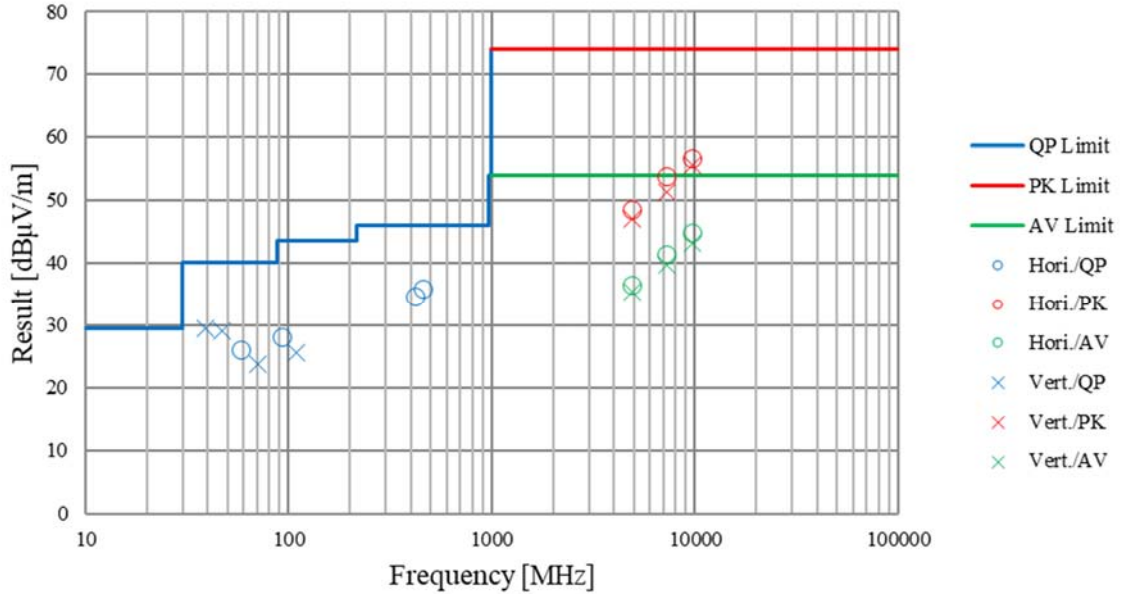
Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki	Yosuke Ishikawa	Takahiro Suzuki
	(30 MHz -1 GHz)	(1 GHz -18 GHz)	(18 GHz – 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz		



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12666110S-A-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	January 18, 2019	January 18, 2019	January 18, 2019
Temperature / Humidity	22 deg. C / 35 % RH	20 deg. C / 30 % RH	22 deg. C / 35 % RH
Engineer	Takahiro Suzuki (30 MHz -1 GHz)	Yosuke Ishikawa (1 GHz -18 GHz)	Takahiro Suzuki (18 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz		

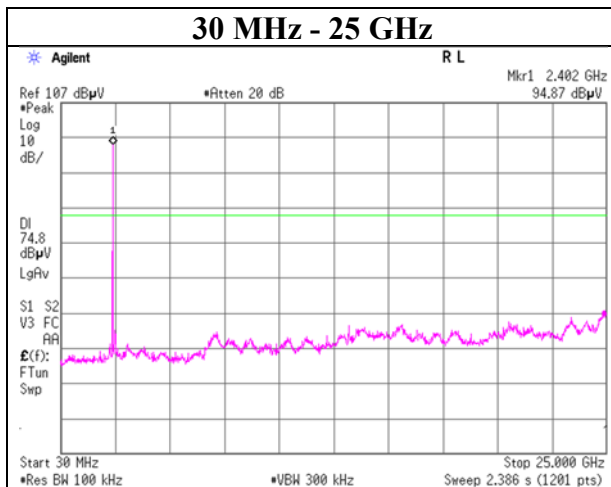
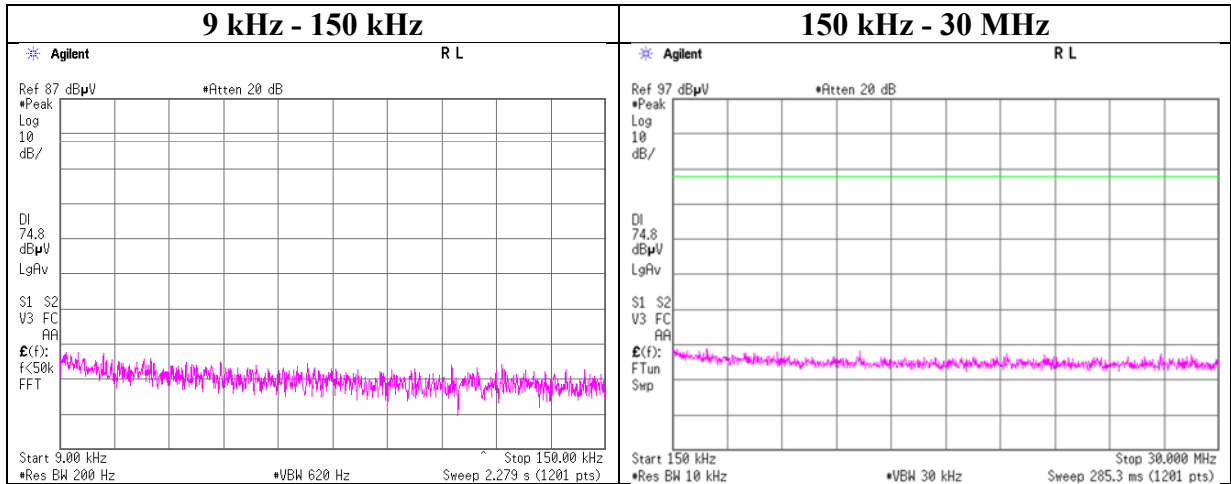


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx, Hopping Off, DH5

2402 MHz



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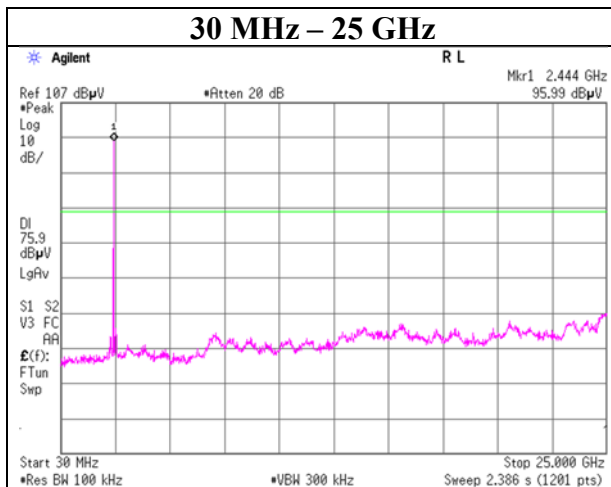
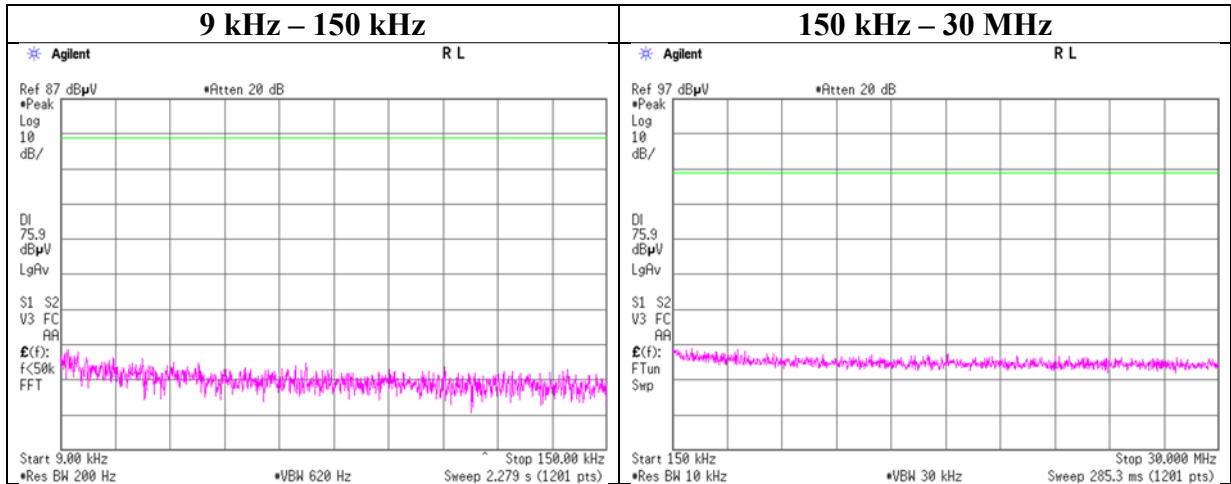
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx, Hopping Off, DH5

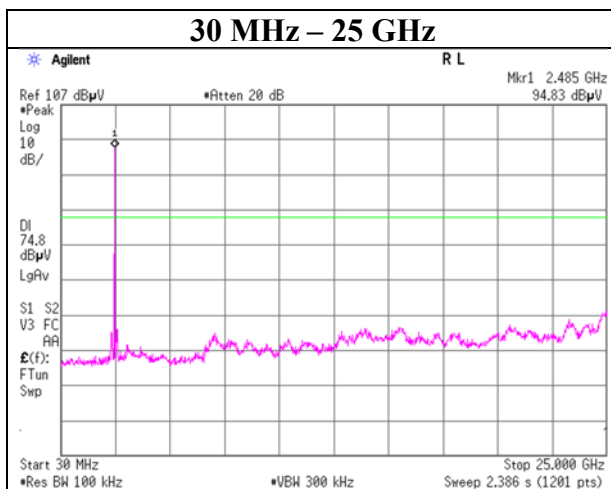
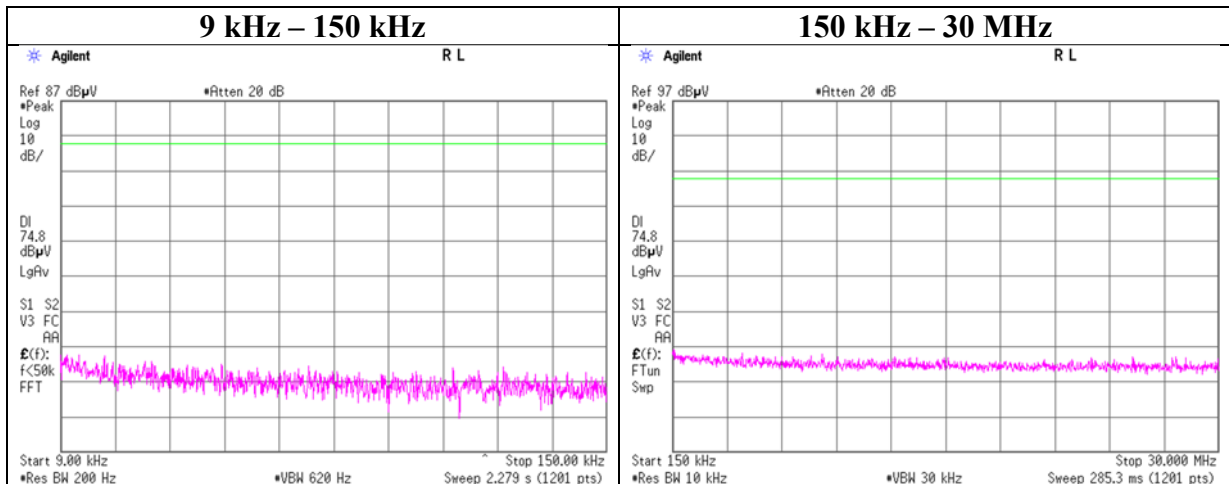
2441 MHz



Conducted Spurious Emission

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx, Hopping Off, DH5

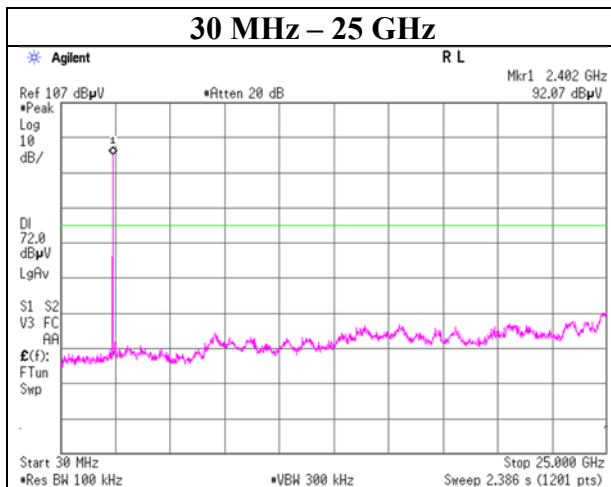
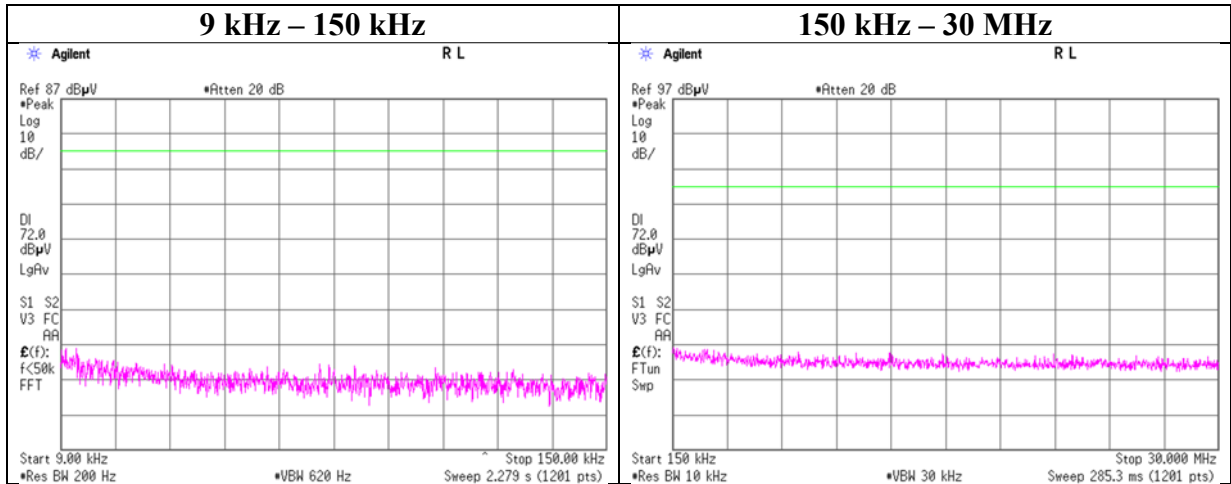
2480 MHz



Conducted Spurious Emission

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx, Hopping Off, 3DH5

2402 MHz



UL Japan, Inc.

Shonan EMC Lab.

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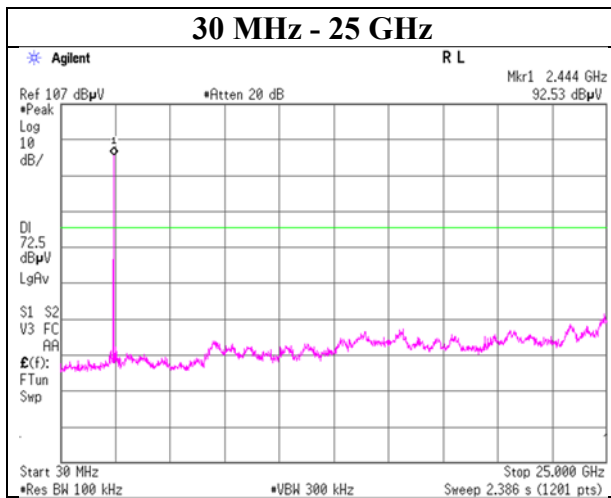
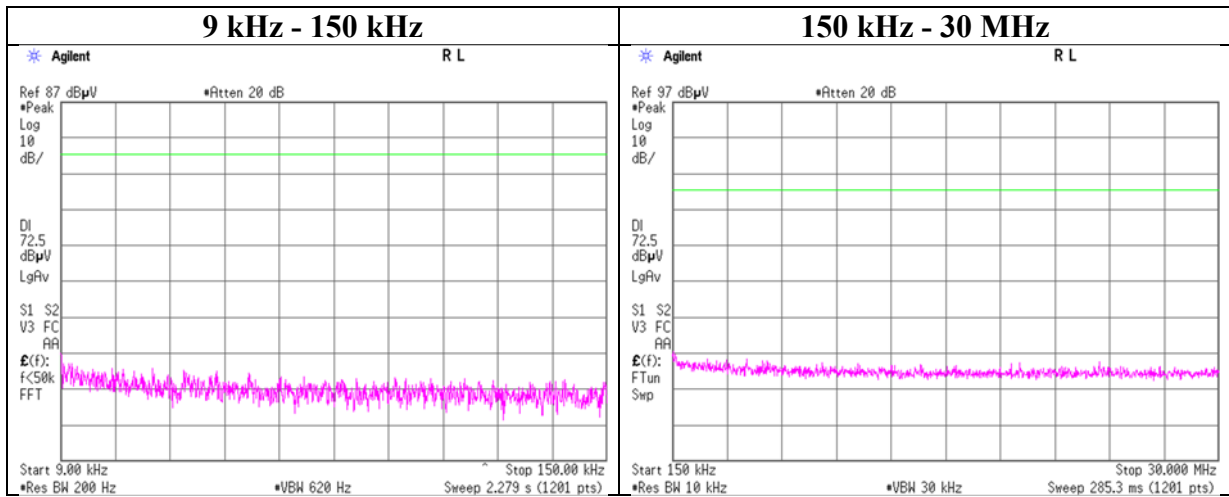
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx, Hopping Off, 3DH5

2441 MHz



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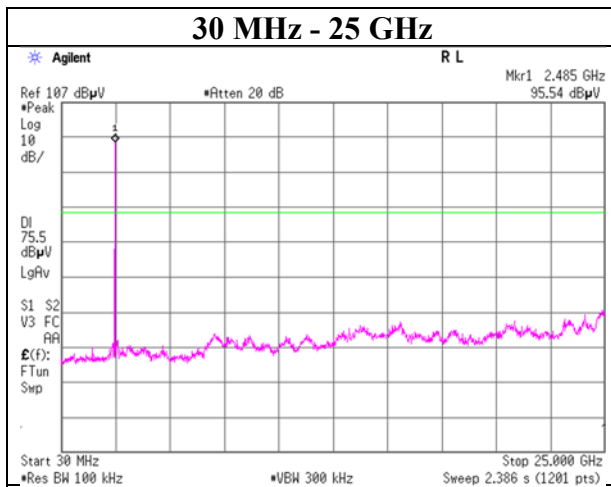
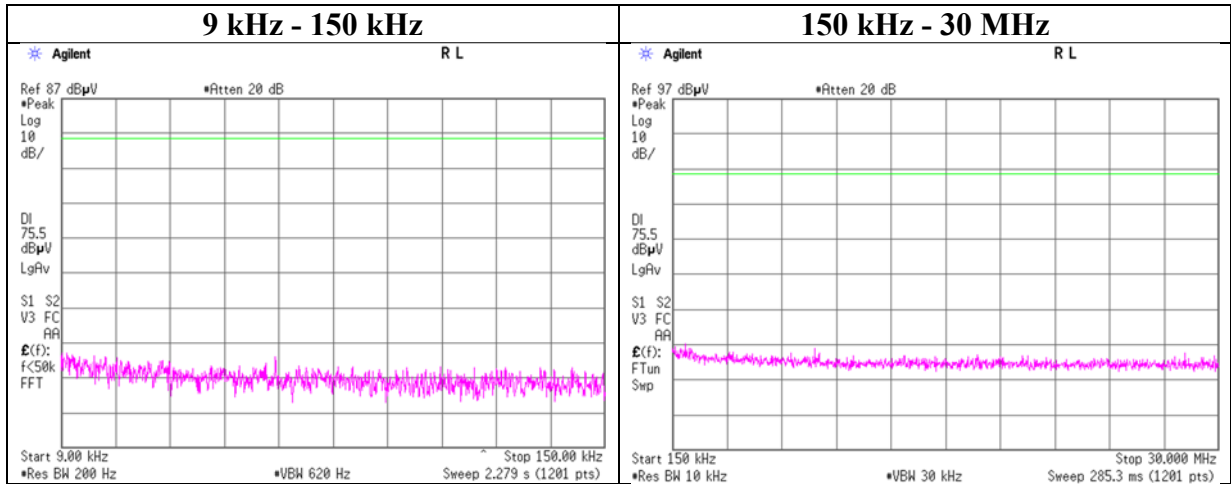
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx, Hopping Off, 3DH5

2480 MHz



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Shonan EMC Lab.

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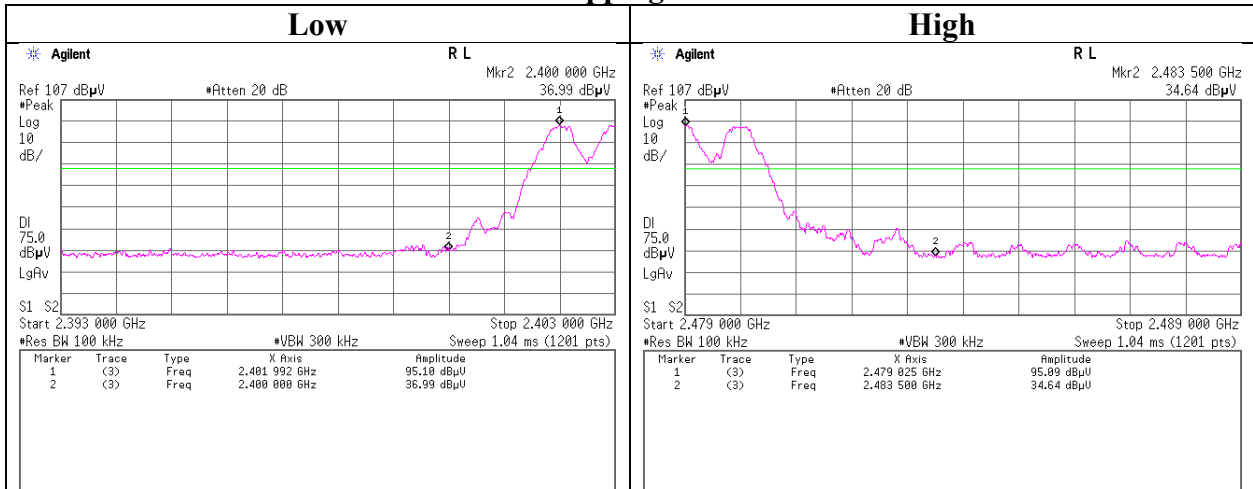
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

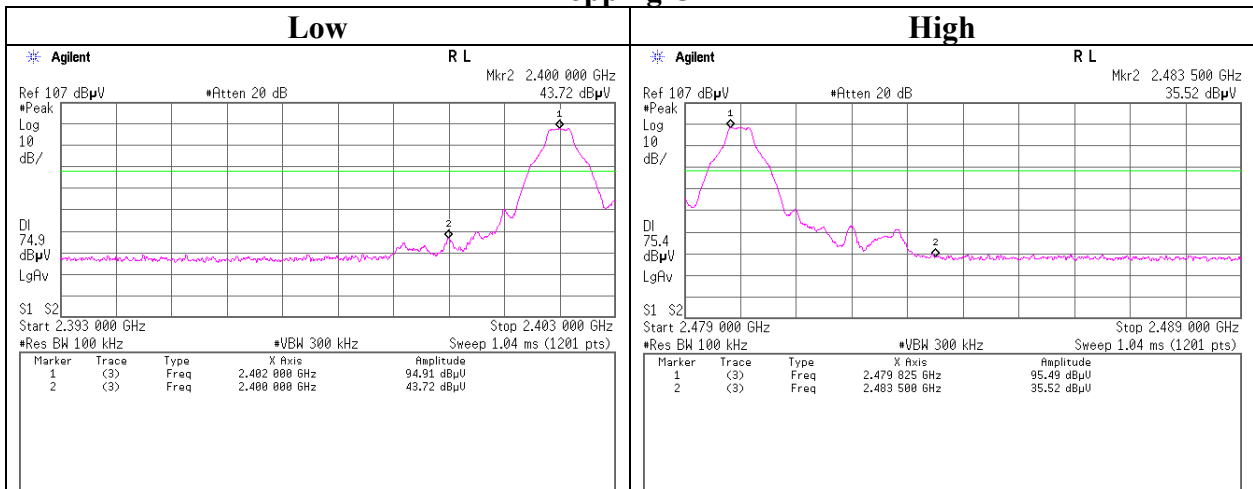
Conducted Emission Band Edge compliance

Report No.	12666110S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	December 27, 2018
Temperature / Humidity	22 deg. C / 29% RH
Engineer	Kazuya Noda
Mode	Tx DH5

Hopping On



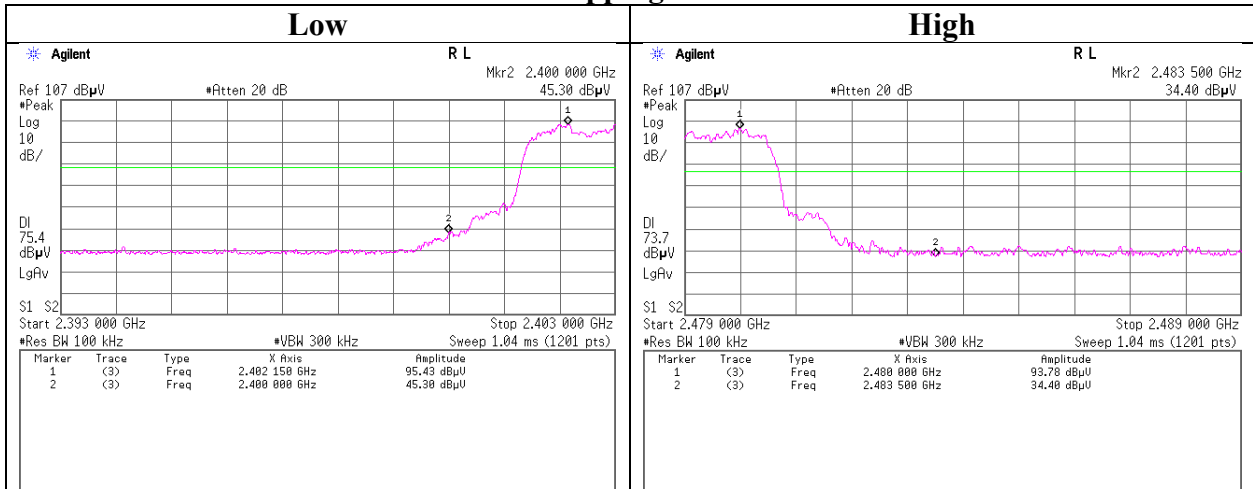
Hopping Off



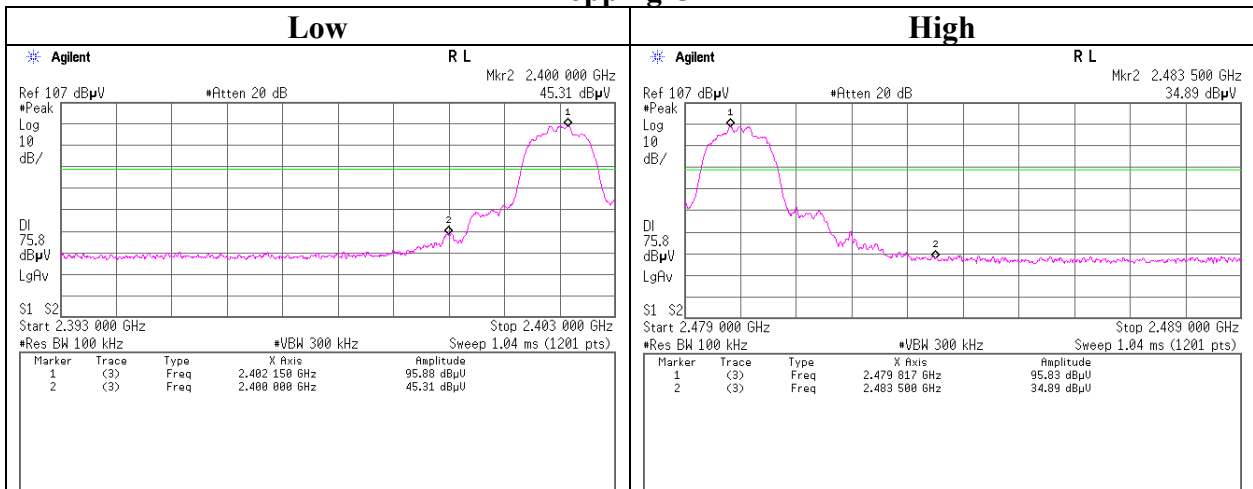
Conducted Emission Band Edge compliance

Report No. 12666110S-A-R1
 Test place Shonan EMC Lab. No.5 Shielded Room
 Date December 27, 2018
 Temperature / Humidity 22 deg. C / 29% RH
 Engineer Kazuya Noda
 Mode Tx 3DH5

Hopping On



Hopping Off



APPENDIX 2: Test instruments

Test Instruments (1/2)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KSA-08	AT	145089	Spectrum Analyzer	AGILENT	E4446A	MY46180525	2018/10/7	2019/10/31	12
SAT10-14	AT	154591	Attenuator	Weinschel Corp.	54A-10	81595	2018/4/20	2019/4/30	12
SCC-G12	AT	145040	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	2018/3/19	2019/3/31	12
SOS-09	AT	146318	Humidity Indicator	A&D	AD-5681	4061484	2018/12/5	2019/12/31	12
SPM-07	AT	146247	Power Meter	AGILENT	8990B	MY5100272	2018/7/13	2019/7/31	12
SPSS-04	AT	146310	Power sensor	AGILENT	N1923A	MY5326009	2018/7/13	2019/7/31	12
STS-05	AT	146212	Digital Hitester	HIOKI	3805-50	80997828	2018/10/16	2019/10/31	12
COTS-SEMI-5	RE	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME,PE)	-	-	-	-
CSA-07	RE	143643	Spectrum Analyzer	AGILENT	E4448A	MY52490024	2018/5/23	2019/5/31	12
KAT6-04	RE	144899	Attenuator	Inmet	18N-6dB	-	2018/12/25	2019/12/31	12
KJM-09	RE	145929	Measure	KOMELON	KMC-36	-	-	-	-
SAEC-01(NSA)	RE	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2018/5/29	2019/5/31	12
SAEC-01(SVSWR)	RE	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2018/7/19	2019/7/31	12
SAF-01	RE	145003	Pre Amplifier	SONOMA	310N	290211	2018/2/16	2019/2/28	12
SAF-04	RE	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2018/6/26	2019/6/30	12
SAF-08	RE	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2018/3/27	2019/3/31	12
SAT10-06	RE	145137	Attenuator	AGILENT	8493C-010	74865	2018/11/25	2019/11/30	12
SAT3-09	RE	144959	Attenuator	JFW	50HF-003N	-	2018/8/23	2019/8/31	12
SBA-01	RE	145161	Biconical Antenna	Schwarzbeck	BBA9106	91032664	2018/6/5	2019/6/30	12
SCC-A1/A3/A5/A7/A8/A13/SRSE-01	RE	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSF A/141PE/141PE/141PE/141P	-/0901-269(RF Selector)	2018/4/9	2019/4/30	12
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	RE	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSF A/141PE/141PE/141PE/141P	-/0901-269(RF Selector)	2018/4/9	2019/4/30	12
SCC-G33	RE	145184	Coaxial Cable	Junkosha	MWX241-01000KMSK MS	-	2018/4/20	2019/4/30	12
SCC-G40	RE	166491	Coaxial Cable	Junkosha	MWX221-01000NFSN MS/B	1612S005	2019/1/25	2020/1/31	12
SCC-G43	RE	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104 E	SN MY 13406/4E	2018/7/10	2019/7/31	12
SCC-G44	RE	168300	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800070/4A	2018/3/28	2019/3/31	12
SCC-G45	RE	168301	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102 E	800137/2E A	2018/3/28	2019/3/31	12
SFL-18	RE	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2018/4/20	2019/4/30	12
SHA-01	RE	145383	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	2018/7/23	2019/7/31	12
SHA-04	RE	145512	Horn Antenna	ETS LINDGREN	Sep-60	LM3640	2018/7/23	2019/7/31	12
SLA-05	RE	145527	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	2018/6/5	2019/6/30	12

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Test Instruments (2/2)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SOS-01	RE	146316	Humidity Indicator	A&D	AD-5681	4062555	2018/10/25	2019/10/31	12
STR-01	RE	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2018/4/13	2019/4/30	12
STS-01	RE	145792	Digital Hitester	HIOKI	3805-50	80997812	2018/10/16	2019/10/31	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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test**