



RADIO TEST REPORT

Test Report No. : 12012868S-F-R1

Applicant : Sony Corporation
Type of Equipment : Wireless Noise Canceling Stereo Headset
Model No. : WF-SP700N
FCC ID : AK8WFSP700N
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. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 12012868S-F. 12012868S-F is replaced with this report.

Date of test: November 1 to 8, 2017

Representative test engineer:

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Engineer
Consumer Technology Division

Approved by:

Toyokazu Imamura
Leader
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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
Address	:	1-7-1 Konan Minato-ku, Tokyo, 108-0075, Japan
Telephone Number	:	+81-50-3141-6224
Contact Person	:	Kohei Akane

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless Noise Canceling Stereo Headset
Model No.	:	WF-SP700N
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.7 V: Built-in lithium-ion rechargeable battery DC 5 V: When charged using BC-WFSP700N
Receipt Date of Sample	:	October 18, 2017
Country of Mass-production	:	Malaysia
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: WF-SP700N (referred to as the EUT in this report) is a Wireless Noise Canceling Stereo Headset.

General Specification

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

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK , $\pi/4$ -DQPSK , 8DQPSK
Power Supply (radio part input)	:	DC 1.35 V
Antenna type	:	FPC Antenna
Antenna Gain	:	-1.43 dBi (Lch), -2.08 dBi (Rch)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 2, 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

* The revision on November 2, 2017, does not affect the test specification applied to the EUT.

* Also the EUT complies with FCC Part 15 Subpart B. Refer to the test report: 12012868S-J.

3.2 Procedures and results

Item	Test 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 *1)
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (b)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (a)		Complied	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (d)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (d)		Complied	Conducted
Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.12	FCC: Section15.247(a)(b)(1) IC: RSS-247 5.4 (b)		Complied	Conducted
Spurious Emission & Band Edge Compliance	FCC: FCC Public Notice DA 00-705 IC: RSS-Gen 6.13	FCC: Section15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	12.8 dB 4960.000 MHz, PK, Hori. Tx, 3DH5 2480 MHz	Complied	Conducted/ Radiated (above 30 MHz) *2)

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

*1) The EUT operates with a battery. AC Line can be connected to the EUT via other device's USB port; however, the EUT stops transmission during recharging. Therefore, the test is not applicable to the EUT.

*2) 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)

The EUT is a battery-operated device and test was performed with the full-charged battery. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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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 $k=2$.

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.5 dB	2.6 dB	2.5 dB	2.5 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.1 dB	3.1 dB	3.1 dB	-	-
	30 MHz-200 MHz	4.6 dB	4.4 dB	4.6 dB	-	-
	200 MHz-1 GHz	5.8 dB	5.7 dB	5.8 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB	-	-
	13 GHz-18 GHz	4.6 dB	4.6 dB	4.6 dB	-	-
	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 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	0.72 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.85 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.91 dB
Spurious emission (Conducted) below 1GHz	1.6 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.3 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.2 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

Radiated emission test

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

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

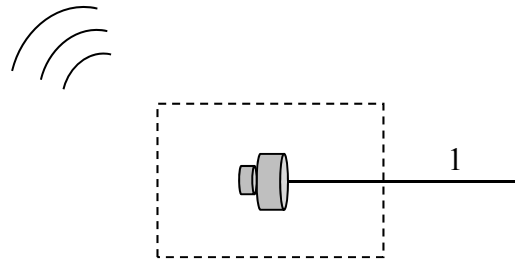
4.1 Operating Mode(s)

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
*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test) *2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative. * It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification. *EUT has the power settings by the software as follows; Power settings: BDR: Ext.=24, Int.=55 EDR: Ext.=175 Int.=57 Software: CSR BlueSuite BlueTest3 Version 2.6.6 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

4.2 Configuration and peripherals



A: EUT

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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless Noise Canceling Stereo Headset *1)	WF-SP700N	ET00063 *2) ET00062 *3)	Sony	EUT

*1) EUT has two sides: L side and R side. The test had been pre-checked and performed with the worst side.

*2) Used for Antenna Terminal conducted test

*3) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal	0.01	Unshielded	Unshielded	*4)

*4) Cable for test operation

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. The 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	3.98 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 26.5 GHz)		3.98 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 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: $20 \times \log (3.98 \text{ m}/3.0 \text{ m}) = 2.47 \text{ dB}$

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

- 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.

Antenna polarization	Frequency					
	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	13 GHz - 18 GHz	18 GHz - 26.5 GHz	Carrier
Horizontal	X	Y	Y	X	Y	Y
Vertical	X	X	X	X	Y	Z

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

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Sample	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 160MHz 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) The measurement was performed with Max Hold since the duty cycle was not 100 %.

*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.

Test data : APPENDIX

Test result : Pass

APPENDIX 1: Test data

20dB Bandwidth and Carrier Frequency Separation

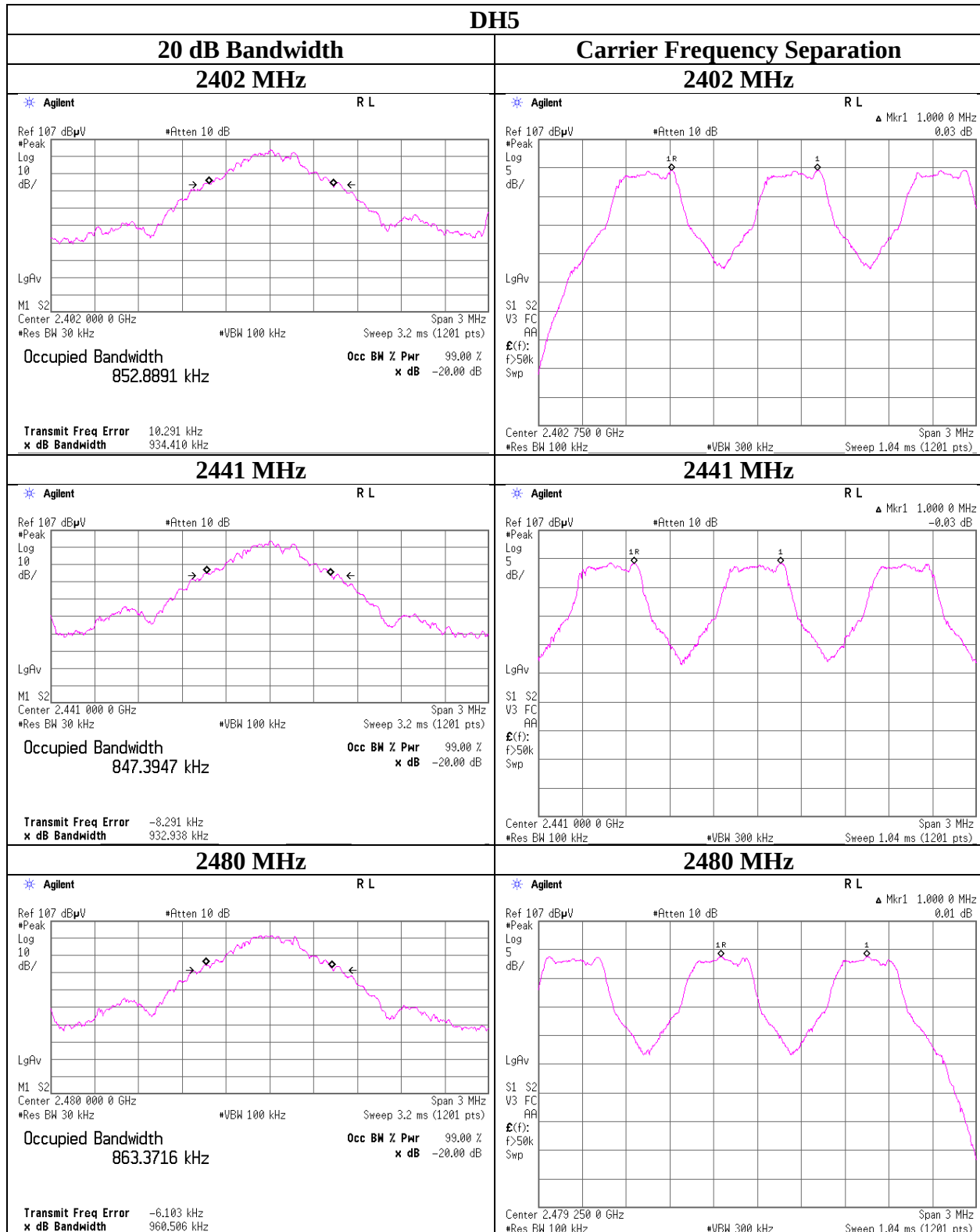
Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 12012868S-F-R1
Date November 1, 2017
Temperature / Humidity 23 deg. C / 37 % RH
Engineer Tatsuya Arai
Mode Tx, Hopping Off, DH5

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.934	1.000	≥ 0.623
DH5	2441.0	0.933	1.000	≥ 0.622
DH5	2480.0	0.961	1.000	≥ 0.640
3DH5	2402.0	1.305	1.000	≥ 0.870
3DH5	2441.0	1.291	1.000	≥ 0.861
3DH5	2480.0	1.275	1.003	≥ 0.850

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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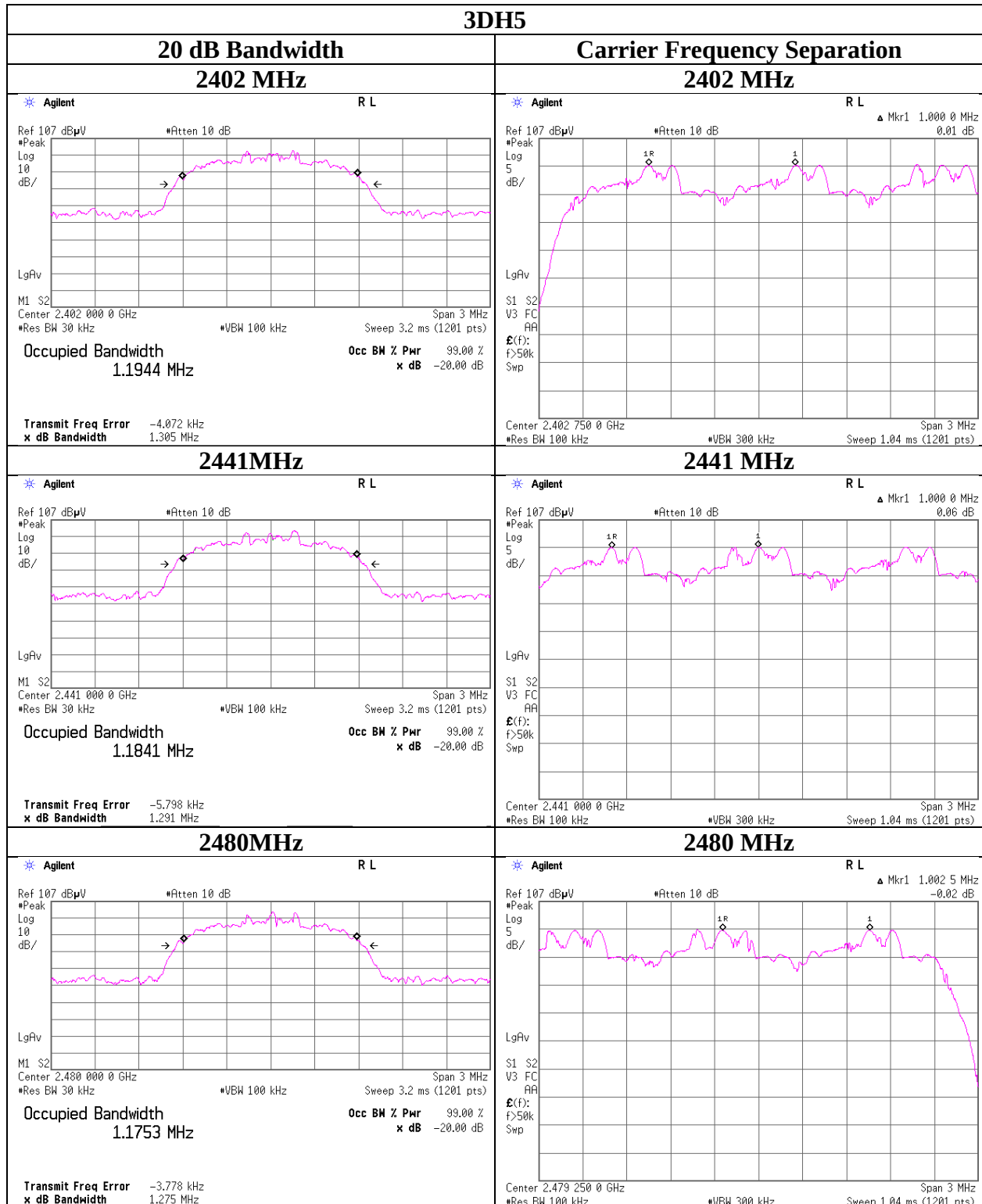
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20dB Bandwidth and Carrier Frequency Separation



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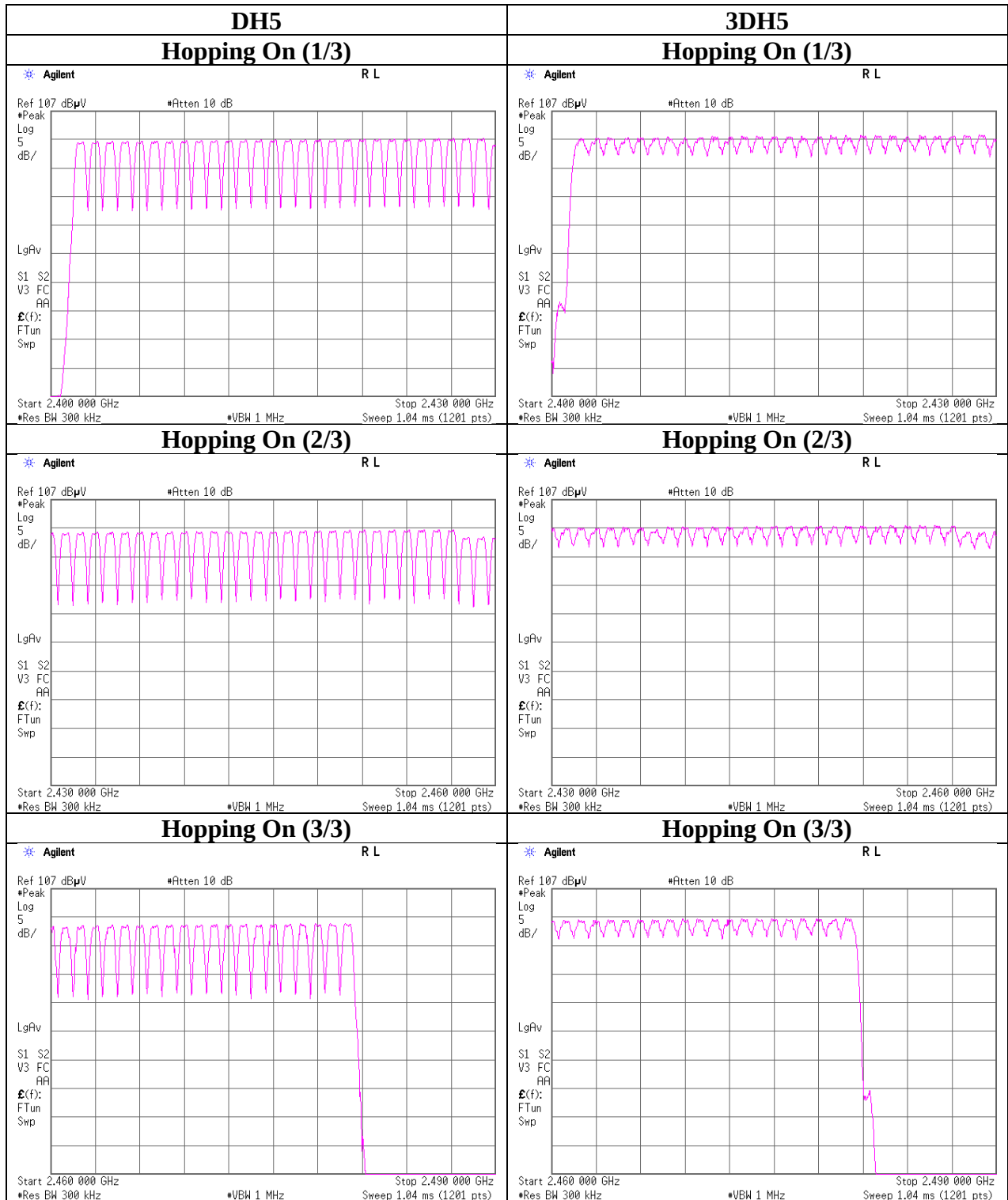
Number of Hopping Frequency

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 12012868S-F-R1
Date November 1, 2017
Temperature / Humidity 23 deg. C / 37 % RH
Engineer Tatsuya Arai
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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Dwell time

Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	12012868S-F-R1	
Date	November 1, 2017	November 2, 2017
Temperature / Humidity	23 deg. C / 37 % RH	22 deg. C / 41 % RH
Engineer	Tatsuya Arai	Makoto Hosaka
Mode	Tx, Hopping On, DH5	Tx, Hopping On, 3DH5

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	50.6 times	/	5 sec.	x 31.6 sec. = 320 times	0.426	136	400
DH3	25.4 times	/	5 sec.	x 31.6 sec. = 161 times	1.685	271	400
DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.933	317	400
3DH1	50.4 times	/	5 sec.	x 31.6 sec. = 319 times	0.440	140	400
3DH3	25.4 times	/	5 sec.	x 31.6 sec. = 161 times	1.692	272	400
3DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.949	318	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

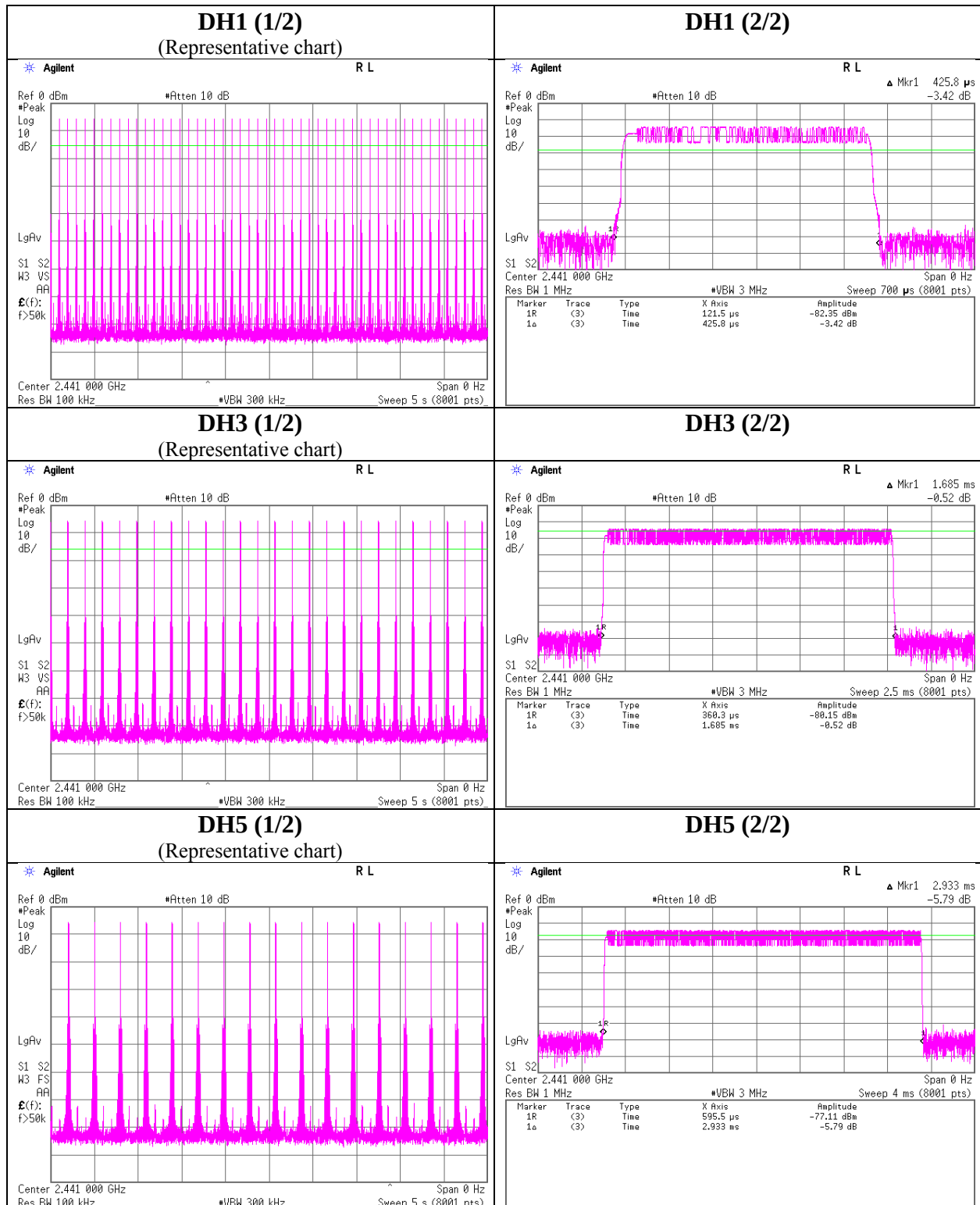
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	50	51	51	51	50.6
DH3	26	25	25	26	25	25.4
DH5	17	17	17	17	17	17
3DH1	50	51	51	50	50	50.4
3DH3	26	26	25	25	25	25.4
3DH5	17	17	17	17	17	17

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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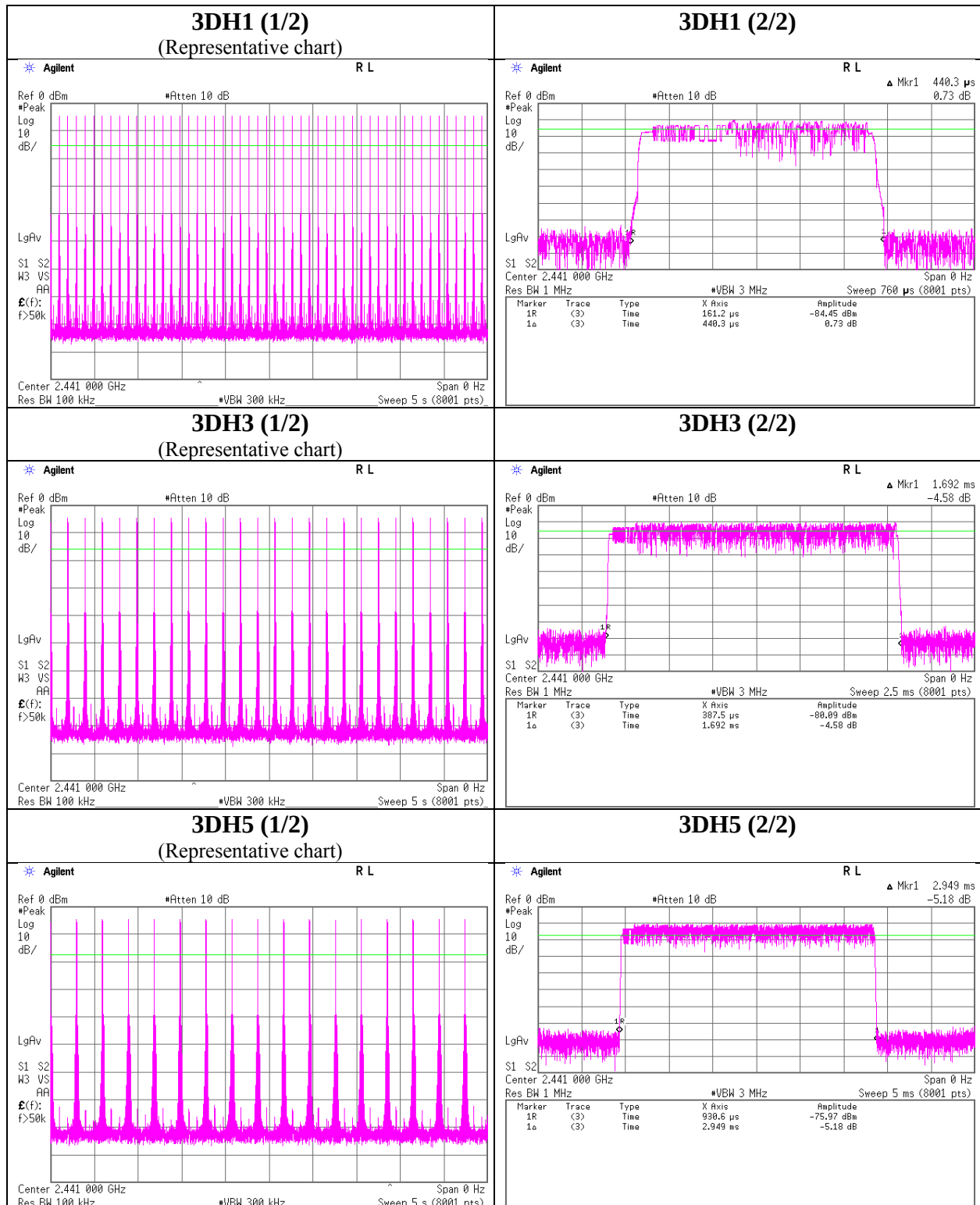
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Dwell time



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Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off

R side

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-5.05	1.63	9.85	6.43	4.40	20.96	125	14.53
DH5	2441.0	-5.28	1.64	9.84	6.20	4.17	20.96	125	14.76
DH5	2480.0	-5.79	1.65	9.84	5.70	3.72	20.96	125	15.26
2DH5	2402.0	-3.60	1.63	9.85	7.88	6.14	20.96	125	13.08
2DH5	2441.0	-3.65	1.64	9.84	7.83	6.07	20.96	125	13.13
2DH5	2480.0	-3.98	1.65	9.84	7.51	5.64	20.96	125	13.45
3DH5	2402.0	-3.37	1.63	9.85	8.11	6.47	20.96	125	12.85
3DH5	2441.0	-3.32	1.64	9.84	8.16	6.55	20.96	125	12.80
3DH5	2480.0	-3.75	1.65	9.84	7.74	5.94	20.96	125	13.22

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.

L side

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-5.86	1.63	9.85	5.62	3.65	20.96	125	15.34
DH5	2441.0	-5.93	1.64	9.84	5.55	3.59	20.96	125	15.41
DH5	2480.0	-6.32	1.65	9.84	5.17	3.29	20.96	125	15.79
2DH5	2402.0	-4.09	1.63	9.85	7.39	5.48	20.96	125	13.57
2DH5	2441.0	-4.07	1.64	9.84	7.41	5.51	20.96	125	13.55
2DH5	2480.0	-4.37	1.65	9.84	7.12	5.15	20.96	125	13.84
3DH5	2402.0	-3.87	1.63	9.85	7.61	5.77	20.96	125	13.35
3DH5	2441.0	-3.83	1.64	9.84	7.65	5.82	20.96	125	13.31
3DH5	2480.0	-4.11	1.65	9.84	7.38	5.47	20.96	125	13.58

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.

Average Output Power (Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12012868S-F-R1
Date	November 1, 2017
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Tatsuya Arai
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	-6.55	1.63	9.85	4.93	3.11	1.01	5.94	3.93
DH5	2441.0	-6.80	1.64	9.84	4.68	2.94	1.01	5.69	3.71
DH5	2480.0	-7.32	1.65	9.84	4.17	2.61	1.01	5.18	3.30
2DH5	2402.0	-6.75	1.63	9.85	4.73	2.97	1.01	5.74	3.75
2DH5	2441.0	-6.89	1.64	9.84	4.59	2.88	1.01	5.60	3.63
2DH5	2480.0	-7.38	1.65	9.84	4.11	2.58	1.01	5.12	3.25
3DH5	2402.0	-6.75	1.63	9.85	4.73	2.97	1.01	5.74	3.75
3DH5	2441.0	-6.90	1.64	9.84	4.58	2.87	1.01	5.59	3.62
3DH5	2480.0	-7.39	1.65	9.84	4.10	2.57	1.01	5.11	3.24

Sample Calculation:

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

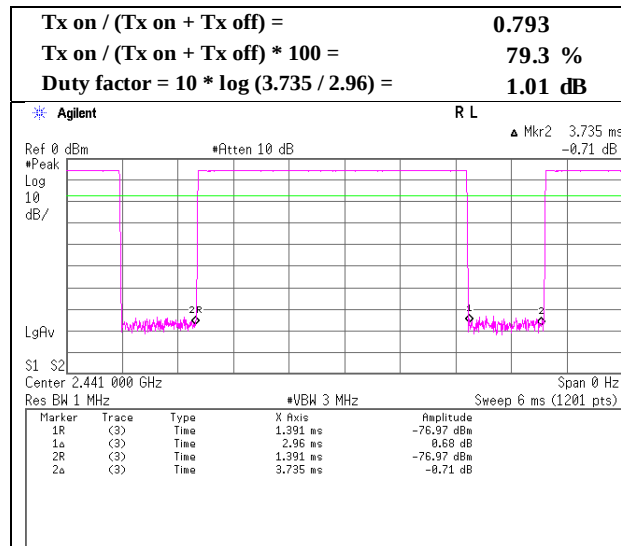
Result (Burst power average) = Time average + Duty factor

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

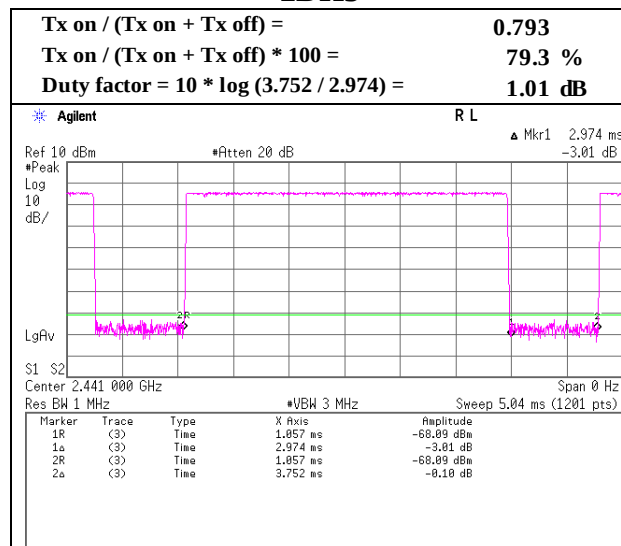
Burst Rate Confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12012868S-F-R1
Date	November 2, 2017
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off

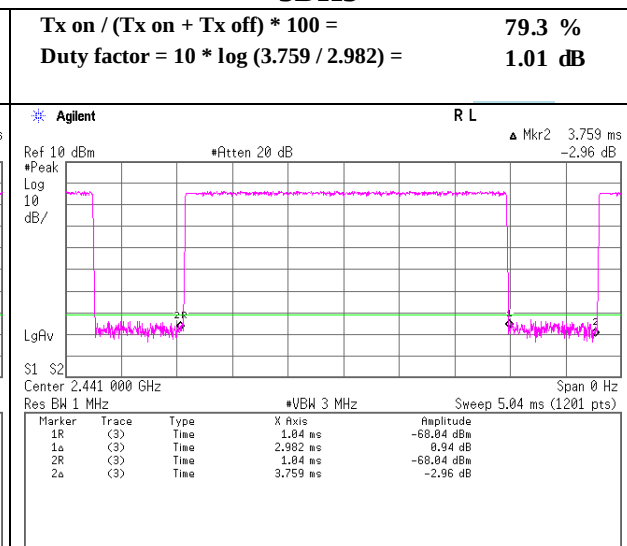
DH5



2DH5



3DH5



Dwell time factor

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 12012868S-F-R1
Date November 2, 2017
Temperature / Humidity 22 deg. C / 41 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping Off

DH5		3DH5	
1 cycle time: 194.6ms > 100ms		1 cycle time: 194.6ms > 100ms	
Tx On time	2.960 ms	Tx On time	2.982 ms
Dwell time factor = $20 * \log (2.96 * 2 / 100) =$		Dwell time factor = $20 * \log (2.982 * 2 / 100) =$	
-24.55 dB		-24.49 dB	

A hopping channel might be occupied 2 times within 100 ms on minimum hopping mode (AFH). Therefore Tx On time was multiplied by 2. As for Tx On time, refer to "Burst Rate Confirmation".

Radiated Spurious Emission

Report No.	12012868S-F-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	November 8, 2017	November 1, 2017	November 4, 2017
Temperature / Humidity	23 deg. C / 53 % RH	22 deg. C / 41 % RH	22 deg. C / 48 % RH
Engineer	Shiro Kobayashi	Shiro Kobayashi	Shiro Kobayashi
	(30 MHz - 1 GHz)	(1 GHz - 13 GHz)	(13 MHz - 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.	37.012	QP	21.69	15.45	7.19	31.83	0.00	12.50	40.00	27.5	100	359	
Hori.	140.754	QP	21.56	14.37	8.64	31.78	0.00	12.79	43.50	30.7	100	0	
Hori.	440.399	QP	21.13	16.55	7.86	31.83	0.00	13.71	46.00	32.2	100	0	
Hori.	652.002	QP	21.44	19.46	8.85	32.02	0.00	17.73	46.00	28.2	100	0	
Hori.	2390.000	PK	45.02	27.14	14.27	40.85	2.47	48.05	73.90	25.9	182	1	
Hori.	4804.000	PK	55.74	31.13	6.79	41.86	2.47	54.27	73.90	19.6	147	117	
Hori.	7206.000	PK	45.78	36.35	8.41	41.18	2.47	51.83	73.90	22.1	150	1	
Hori.	9608.000	PK	45.31	38.11	9.48	40.59	2.47	54.78	73.90	19.1	150	1	
Hori.	19220.000	PK	44.92	40.44	12.83	45.28	-9.54	43.37	73.90	30.5	142	73	
Hori.	2390.000	AV	33.43	27.14	14.27	40.85	2.47	36.46	53.90	17.4	182	1	
Hori.	19220.000	AV	34.64	40.44	12.83	45.28	-9.54	33.09	53.90	20.8	142	73	
Vert.	32.380	QP	21.95	16.83	7.08	31.83	0.00	14.03	40.00	25.9	100	0	
Vert.	193.787	QP	21.23	16.56	9.02	31.77	0.00	15.04	43.50	28.4	100	359	
Vert.	309.402	QP	21.17	13.72	6.86	31.76	0.00	9.99	46.00	36.0	100	359	
Vert.	2390.000	PK	46.03	27.14	14.27	40.85	2.47	49.06	73.90	24.8	247	58	
Vert.	4804.000	PK	55.67	31.13	6.79	41.86	2.47	54.20	73.90	19.7	121	91	
Vert.	7206.000	PK	45.36	36.35	8.41	41.18	2.47	51.41	73.90	22.5	150	1	
Vert.	9608.000	PK	45.30	38.11	9.48	40.59	2.47	54.77	73.90	19.1	150	1	
Vert.	19220.000	PK	45.32	40.44	12.83	45.28	-9.54	43.77	73.90	30.1	129	223	
Vert.	2390.000	AV	33.45	27.14	14.27	40.85	2.47	36.48	53.90	17.4	247	58	
Vert.	19220.000	AV	35.32	40.44	12.83	45.28	-9.54	33.77	53.90	20.1	129	223	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	48.08	31.13	6.79	41.86	-24.55	2.47	22.06	53.90	31.8	
Hori.	7206.000	AV	33.60	36.35	8.41	41.18	-24.55	2.47	15.10	53.90	38.8	
Hori.	9608.000	AV	32.41	38.11	9.48	40.59	-24.55	2.47	17.33	53.90	36.6	
Vert.	4804.000	AV	47.48	31.13	6.79	41.86	-24.55	2.47	21.46	53.90	32.4	
Vert.	7206.000	AV	33.59	36.35	8.41	41.18	-24.55	2.47	15.09	53.90	38.8	
Vert.	9608.000	AV	32.48	38.11	9.48	40.59	-24.55	2.47	17.40	53.90	36.5	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell (time) factor refer to "Dwell time factor Calculation chart" sheet.

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	86.89	27.18	14.28	40.84	2.47	89.98	-	-	Carrier
Hori.	2400.000	PK	36.66	27.17	14.27	40.84	2.47	39.73	69.98	30.3	
Vert.	2402.000	PK	86.25	27.18	14.28	40.84	2.47	89.34	-	-	Carrier
Vert.	2400.000	PK	40.49	27.17	14.27	40.84	2.47	43.56	69.34	25.8	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

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Shonan EMC Lab.

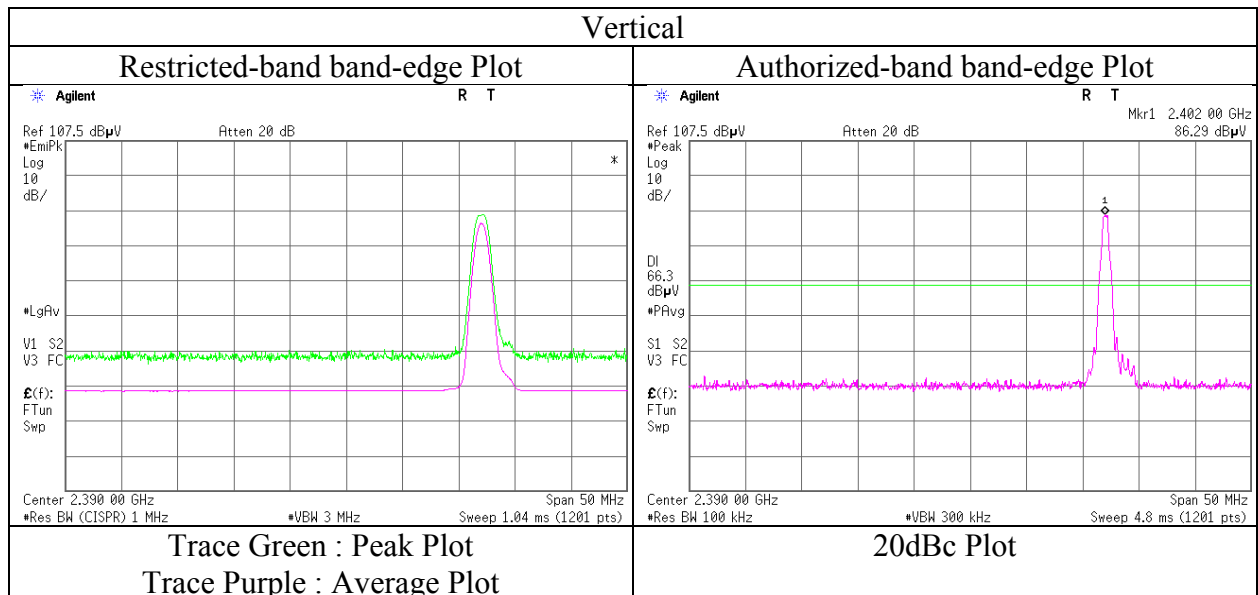
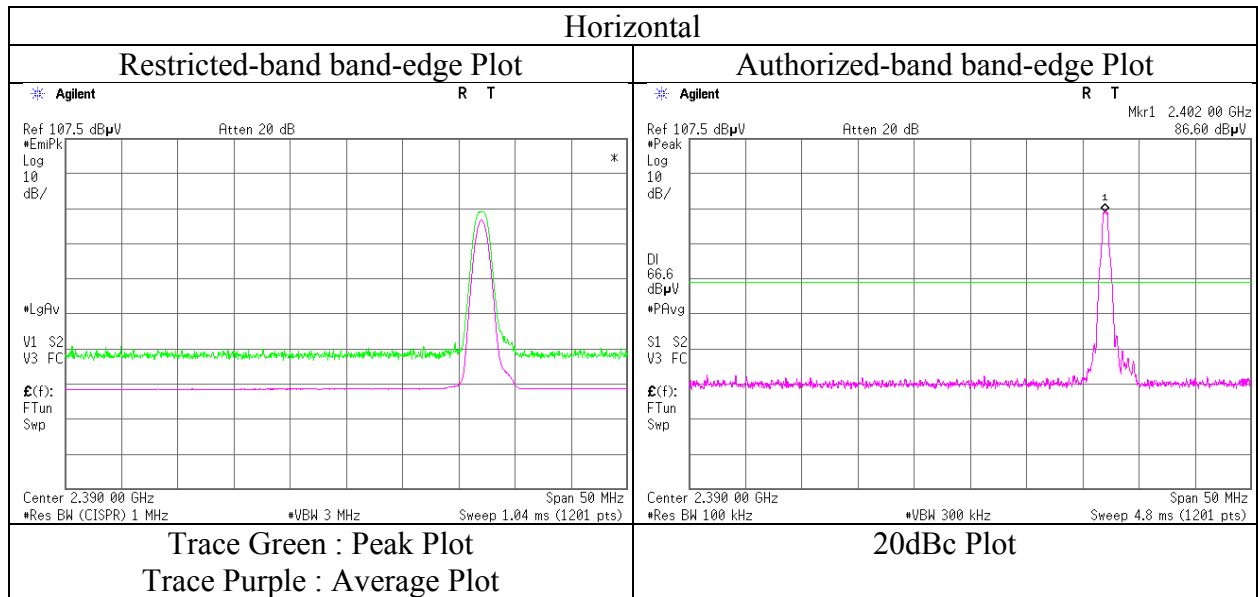
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12012868S-F-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 1, 2017
Temperature / Humidity	22 deg. C / 41 % RH
Engineer	Shiro Kobayashi
	(1 GHz - 13 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz



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

Radiated Spurious Emission

Report No.	12012868S-F-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.1	No.1
Date	November 8, 2017	November 1, 2017	November 4, 2017
Temperature / Humidity	23 deg. C / 53 % RH	22 deg. C / 41 % RH	22 deg. C / 48 % RH
Engineer	Shiro Kobayashi	Shiro Kobayashi	Shiro Kobayashi
	(30 MHz - 1 GHz)	(1 GHz - 13 GHz)	(13 MHz - 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.	176.968	QP	21.28	15.87	8.97	31.77	0.00	14.35	43.50	29.1	100	0	
Hori.	640.402	QP	21.56	19.39	8.79	32.01	0.00	17.73	46.00	28.2	100	359	
Hori.	935.847	QP	20.77	22.24	10.10	31.03	0.00	22.08	46.00	23.9	100	0	
Hori.	4882.000	PK	56.54	31.31	6.87	41.76	2.47	55.43	73.90	18.5	141	323	
Hori.	7323.000	PK	46.40	36.51	8.57	41.27	2.47	52.68	73.90	21.2	150	1	
Hori.	9764.000	PK	45.02	38.37	9.60	40.62	2.47	54.84	73.90	19.1	150	1	
Hori.	19524.000	PK	45.54	40.34	12.97	45.30	-9.54	44.01	73.90	29.8	123	173	
Hori.	19524.000	AV	39.25	40.34	12.97	45.30	-9.54	37.72	53.90	16.1	123	173	
Vert.	32.933	QP	22.01	16.68	7.09	31.83	0.00	13.95	40.00	26.0	100	0	
Vert.	171.621	QP	21.46	15.58	8.98	31.77	0.00	14.25	43.50	29.2	100	359	
Vert.	514.024	QP	22.20	17.90	8.23	31.90	0.00	16.43	46.00	29.5	100	0	
Vert.	590.812	QP	21.35	19.02	8.56	31.95	0.00	16.98	46.00	29.0	100	0	
Vert.	4882.000	PK	54.60	31.31	6.87	41.76	2.47	53.49	73.90	20.4	115	259	
Vert.	7323.000	PK	45.99	36.51	8.57	41.27	2.47	52.27	73.90	21.6	150	1	
Vert.	9764.000	PK	45.01	38.37	9.60	40.62	2.47	54.83	73.90	19.1	150	1	
Vert.	19524.000	PK	46.43	40.34	12.97	45.30	-9.54	44.90	73.90	29.0	131	203	
Vert.	19524.000	AV	41.64	40.34	12.97	45.30	-9.54	40.11	53.90	13.7	131	203	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	48.32	31.31	6.87	41.76	-24.55	2.47	22.66	53.90	31.2	
Hori.	7323.000	AV	34.25	36.51	8.57	41.27	-24.55	2.47	15.98	53.90	37.9	
Hori.	9764.000	AV	32.78	38.37	9.60	40.62	-24.55	2.47	18.05	53.90	35.9	
Vert.	4882.000	AV	48.30	31.31	6.87	41.76	-24.55	2.47	22.64	53.90	31.3	
Vert.	7323.000	AV	34.29	36.51	8.57	41.27	-24.55	2.47	16.02	53.90	37.9	
Vert.	9764.000	AV	32.93	38.37	9.60	40.62	-24.55	2.47	18.20	53.90	35.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell (time) factor refer to "Dwell time factor Calculation chart" sheet.

Radiated Spurious Emission

Report No. 12012868S-F-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2017 November 4, 2017
Temperature / Humidity 23 deg. C / 53 % RH 22 deg. C / 48 % RH
Engineer Shiro Kobayashi Shiro Kobayashi
(30 MHz - 1 GHz) (1 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.	31.694	QP	21.58	17.01	7.06	31.83	0.00	13.82	40.00	26.1	100	0	
Hori.	141.099	QP	21.41	14.38	8.64	31.78	0.00	12.65	43.50	30.8	100	359	
Hori.	633.198	QP	21.42	19.35	8.76	32.00	0.00	17.53	46.00	28.4	100	0	
Hori.	2483.500	PK	46.40	27.45	14.32	40.81	2.47	49.83	73.90	24.0	114	60	
Hori.	4960.000	PK	60.45	31.48	6.76	41.65	2.47	59.51	73.90	14.3	136	48	
Hori.	7440.000	PK	47.00	36.68	8.29	41.36	2.47	53.08	73.90	20.8	150	0	
Hori.	9920.000	PK	45.66	38.63	9.45	40.66	2.47	55.55	73.90	18.3	150	0	
Hori.	19836.000	PK	45.38	40.24	13.31	45.36	-9.54	44.03	73.90	29.8	125	86	
Hori.	2483.500	AV	34.63	27.45	14.32	40.81	2.47	38.06	53.90	15.8	114	60	
Hori.	19836.000	AV	34.78	40.24	13.31	45.36	-9.54	33.43	53.90	20.4	125	86	
Vert.	33.656	QP	21.64	16.49	7.11	31.83	0.00	13.41	40.00	26.5	100	0	
Vert.	181.133	QP	21.53	16.08	8.97	31.77	0.00	14.81	43.50	28.6	100	359	
Vert.	522.400	QP	21.22	18.02	8.27	31.91	0.00	15.60	46.00	30.4	100	0	
Vert.	990.953	QP	20.33	22.55	10.35	30.63	0.00	22.60	53.90	31.3	100	0	
Vert.	2483.500	PK	45.81	27.45	14.32	40.81	2.47	49.24	73.90	24.6	192	49	
Vert.	4960.000	PK	60.10	31.48	6.76	41.65	2.47	59.16	73.90	14.7	150	249	
Vert.	7440.000	PK	47.20	36.68	8.29	41.36	2.47	53.28	73.90	20.6	150	0	
Vert.	9920.000	PK	45.49	38.63	9.45	40.66	2.47	55.38	73.90	18.5	150	0	
Vert.	19836.000	PK	45.13	40.24	13.31	45.36	-9.54	43.78	73.90	30.1	126	62	
Vert.	2483.500	AV	33.81	27.45	14.32	40.81	2.47	37.24	53.90	16.6	192	49	
Vert.	19836.000	AV	35.10	40.24	13.31	45.36	-9.54	33.75	53.90	20.1	126	62	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	55.64	31.48	6.76	41.65	-24.55	2.47	30.15	53.90	23.8	
Hori.	7440.000	AV	35.66	36.68	8.29	41.36	-24.55	2.47	17.19	53.90	36.7	
Hori.	9920.000	AV	33.63	38.63	9.45	40.66	-24.55	2.47	18.97	53.90	34.9	
Vert.	4960.000	AV	55.27	31.48	6.76	41.65	-24.55	2.47	29.78	53.90	24.1	
Vert.	7440.000	AV	35.79	36.68	8.29	41.36	-24.55	2.47	17.32	53.90	36.6	
Vert.	9920.000	AV	33.61	38.63	9.45	40.66	-24.55	2.47	18.95	53.90	34.9	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell (time) factor refer to "Dwell time factor Calculation chart" sheet.

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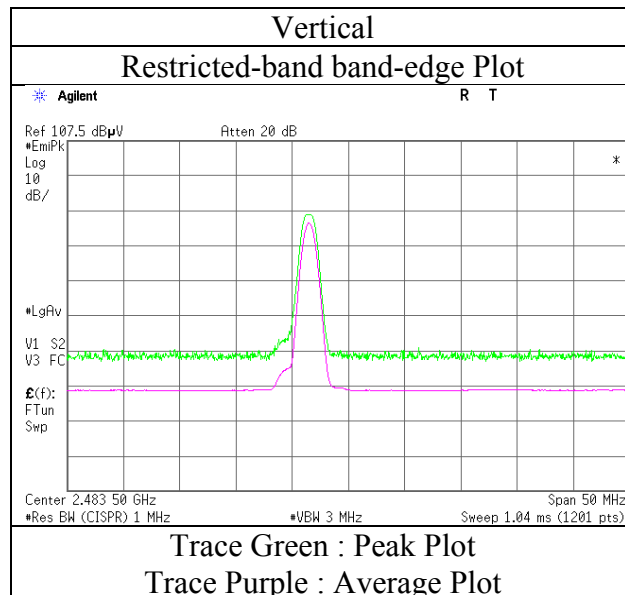
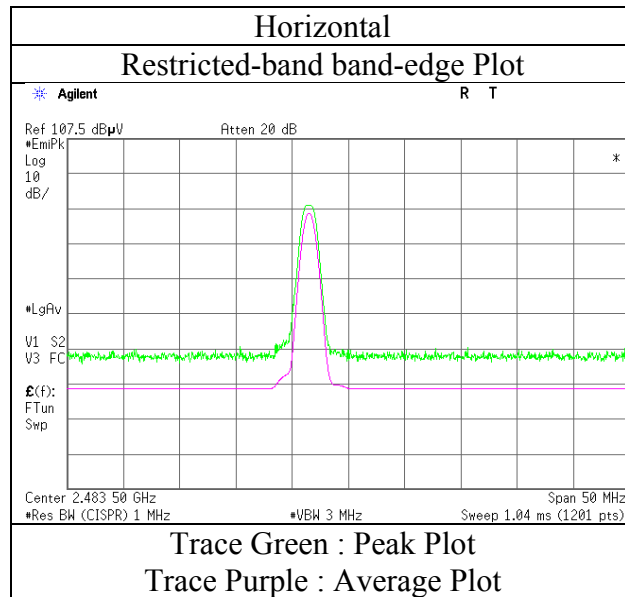
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12012868S-F-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 4, 2017
Temperature / Humidity	22 deg. C / 48 % RH
Engineer	Shiro Kobayashi
	(1 GHz – 2.8 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



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

Radiated Spurious Emission

Report No. 12012868S-F-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2017 November 4, 2017
Temperature / Humidity 23 deg. C / 53 % RH 22 deg. C / 48 % RH
Engineer Shiro Kobayashi Shiro Kobayashi
(30 MHz - 1 GHz) (1 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.	31.105	QP	21.39	17.17	7.05	31.83	0.00	13.78	40.00	26.2	100	0	
Hori.	529.012	QP	21.13	18.12	8.31	31.93	0.00	15.63	46.00	30.3	100	0	
Hori.	794.006	QP	21.37	20.72	9.47	31.80	0.00	19.76	46.00	26.2	100	359	
Hori.	2390.000	PK	46.71	27.14	14.23	40.85	2.47	49.70	73.90	24.2	155	55	
Hori.	4804.000	PK	60.79	31.13	6.72	41.86	2.47	59.25	73.90	14.6	142	40	
Hori.	7206.000	PK	46.53	36.35	8.21	41.18	2.47	52.38	73.90	21.5	150	0	
Hori.	9608.000	PK	46.88	38.11	9.37	40.59	2.47	56.24	73.90	17.6	150	0	
Hori.	19212.000	PK	45.58	40.44	12.83	45.28	-9.54	44.03	73.90	29.8	139	74	
Hori.	2390.000	AV	34.49	27.14	14.23	40.85	2.47	37.48	53.90	16.4	155	55	
Hori.	19212.000	AV	38.60	40.44	12.83	45.28	-9.54	37.05	53.90	16.8	139	74	
Vert.	33.315	QP	21.81	16.58	7.11	31.83	0.00	13.67	40.00	26.3	100	0	
Vert.	182.280	QP	21.43	16.13	8.97	31.77	0.00	14.76	43.50	28.7	100	0	
Vert.	450.796	QP	21.27	16.75	7.91	31.84	0.00	14.09	46.00	31.9	100	359	
Vert.	940.286	QP	20.89	22.27	10.11	31.00	0.00	22.27	46.00	23.7	100	0	
Vert.	2390.000	PK	46.29	27.14	14.23	40.85	2.47	49.28	73.90	24.6	194	89	
Vert.	4804.000	PK	61.83	31.13	6.72	41.86	2.47	60.29	73.90	13.6	149	270	
Vert.	7206.000	PK	46.72	36.35	8.21	41.18	2.47	52.57	73.90	21.3	150	0	
Vert.	9608.000	PK	46.41	38.11	9.37	40.59	2.47	55.77	73.90	18.1	150	0	
Vert.	19212.000	PK	46.42	40.44	12.83	45.28	-9.54	44.87	73.90	29.0	131	229	
Vert.	2390.000	AV	34.28	27.14	14.23	40.85	2.47	37.27	53.90	16.6	194	89	
Vert.	19212.000	AV	39.06	40.44	12.83	45.28	-9.54	37.51	53.90	16.3	131	229	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.47 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4804.000	AV	53.37	31.13	6.72	41.86	-24.49	2.47	27.34	53.90	26.6	
Hori.	7206.000	AV	35.25	36.35	8.21	41.18	-24.49	2.47	16.61	53.90	37.3	
Hori.	9608.000	AV	34.62	38.11	9.37	40.59	-24.49	2.47	19.49	53.90	34.4	
Vert.	4804.000	AV	54.77	31.13	6.72	41.86	-24.49	2.47	28.74	53.90	25.2	
Vert.	7206.000	AV	35.24	36.35	8.21	41.18	-24.49	2.47	16.60	53.90	37.3	
Vert.	9608.000	AV	34.55	38.11	9.37	40.59	-24.49	2.47	19.42	53.90	34.5	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.47 dB

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

Dwell (time) factor refer to "Dwell time factor Calculation chart" sheet.

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	93.13	27.18	14.24	40.84	2.47	96.18	-	-	Carrier
Hori.	2399.509	PK	53.10	27.17	14.23	40.84	2.47	56.13	76.18	20.1	
Hori.	2400.000	PK	53.87	27.17	14.23	40.84	2.47	56.90	76.18	19.3	
Vert.	2402.000	PK	88.88	27.18	14.24	40.84	2.47	91.93	-	-	Carrier
Vert.	2399.516	PK	49.30	27.17	14.23	40.84	2.47	52.33	71.93	19.6	
Vert.	2400.000	PK	49.85	27.17	14.23	40.84	2.47	52.88	71.93	19.1	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.98 m / 3.0 m) = 2.47 dB

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

UL Japan, Inc.

Shonan EMC Lab.

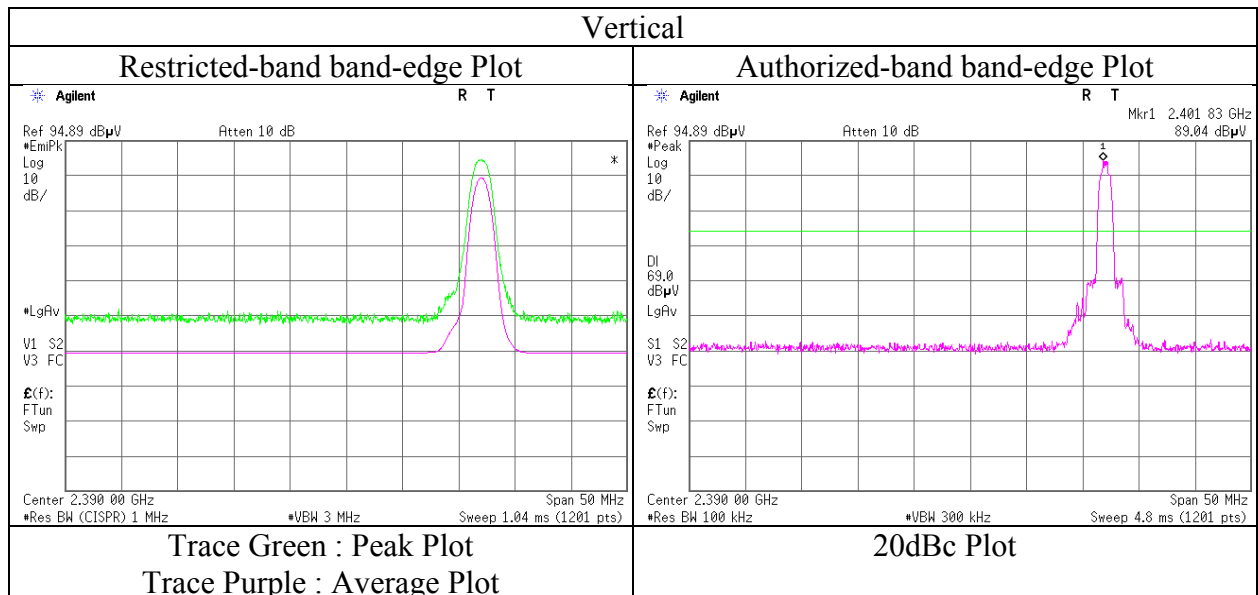
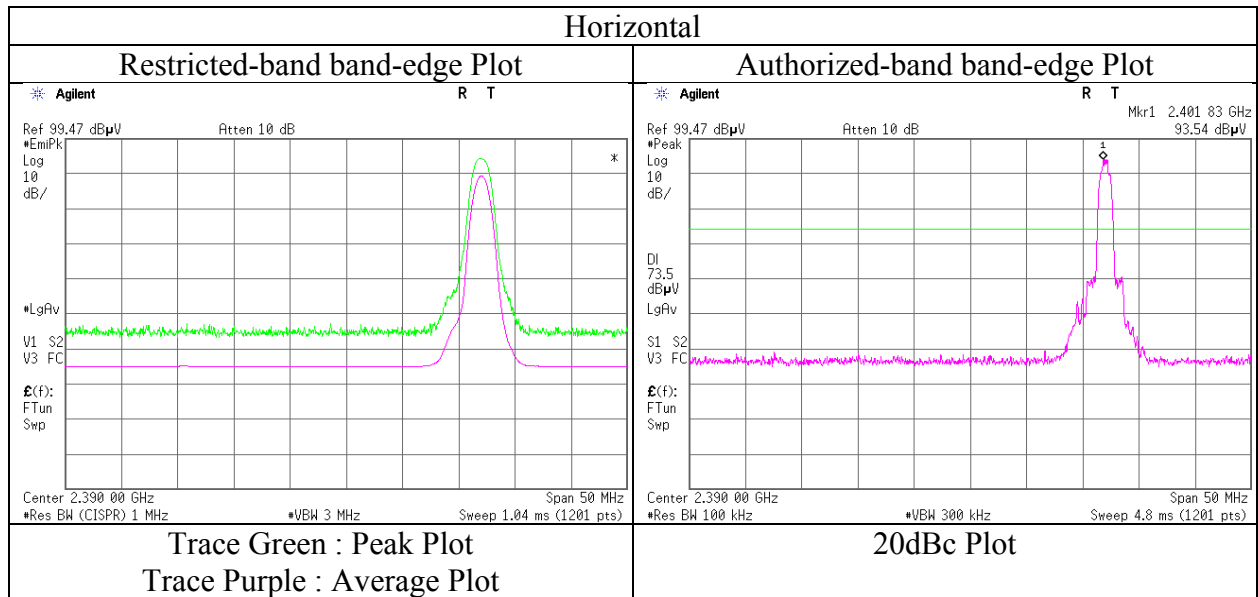
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12012868S-F-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 4, 2017
Temperature / Humidity	22 deg. C / 48 % RH
Engineer	Shiro Kobayashi
	(1 GHz – 2.8 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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

Radiated Spurious Emission

Report No. 12012868S-F-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2017 November 4, 2017
Temperature / Humidity 23 deg. C / 53 % RH 22 deg. C / 48 % RH
Engineer Shiro Kobayashi Shiro Kobayashi
(30 MHz - 1 GHz) (1 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.	35.142	QP	21.65	16.08	7.15	31.83	0.00	13.05	40.00	26.9	100	0	
Hori.	190.728	QP	21.59	16.44	9.01	31.77	0.00	15.27	43.50	28.2	100	0	
Hori.	392.995	QP	21.13	15.61	7.57	31.79	0.00	12.52	46.00	33.4	100	0	
Hori.	4882.000	PK	61.25	31.31	6.74	41.76	2.47	60.01	73.90	13.8	127	43	
Hori.	7323.000	PK	47.46	36.51	8.24	41.27	2.47	53.41	73.90	20.4	150	0	
Hori.	9764.000	PK	46.10	38.37	9.41	40.62	2.47	55.73	73.90	18.1	150	0	
Hori.	19524.000	PK	45.64	40.34	12.97	45.30	-9.54	44.11	73.90	29.7	129	175	
Hori.	19524.000	AV	38.88	40.34	12.97	45.30	-9.54	37.35	53.90	16.5	129	175	
Vert.	45.810	QP	21.91	12.57	7.40	31.82	0.00	10.06	40.00	29.9	100	0	
Vert.	184.577	QP	21.49	16.21	8.98	31.77	0.00	14.91	43.50	28.5	100	359	
Vert.	843.993	QP	21.23	21.33	9.72	31.62	0.00	20.66	46.00	25.3	100	0	
Vert.	905.592	QP	21.11	22.07	10.02	31.29	0.00	21.91	46.00	24.0	100	359	
Vert.	4882.000	PK	60.59	31.31	6.74	41.76	2.47	59.35	73.90	14.5	129	275	
Vert.	7323.000	PK	47.85	36.51	8.24	41.27	2.47	53.80	73.90	20.1	150	0	
Vert.	9764.000	PK	46.91	38.37	9.41	40.62	2.47	56.54	73.90	17.3	150	0	
Vert.	19524.000	PK	46.23	40.34	12.97	45.30	-9.54	44.70	73.90	29.2	133	52	
Vert.	19524.000	AV	39.88	40.34	12.97	45.30	-9.54	38.35	53.90	15.5	133	52	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4882.000	AV	54.01	31.31	6.74	41.76	-24.49	2.47	28.28	53.90	25.6	
Hori.	7323.000	AV	35.78	36.51	8.24	41.27	-24.49	2.47	17.24	53.90	36.7	
Hori.	9764.000	AV	34.30	38.37	9.41	40.62	-24.49	2.47	19.44	53.90	34.5	
Vert.	4882.000	AV	53.25	31.31	6.74	41.76	-24.49	2.47	27.52	53.90	26.4	
Vert.	7323.000	AV	35.77	36.51	8.24	41.27	-24.49	2.47	17.23	53.90	36.7	
Vert.	9764.000	AV	34.24	38.37	9.41	40.62	-24.49	2.47	19.38	53.90	34.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.98\text{ m} / 3.0\text{ m}) = 2.47\text{ dB}$

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

Dwell (time) factor refer to "Dwell time factor Calculation chart" sheet.

Radiated Spurious Emission

Report No. 12012868S-F-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2017 November 4, 2017
Temperature / Humidity 23 deg. C / 53 % RH 22 deg. C / 48 % RH
Engineer Shiro Kobayashi Shiro Kobayashi
(30 MHz - 1 GHz) (1 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.	189.549	QP	21.37	16.40	9.00	31.77	0.00	15.00	43.50	28.5	100	0	
Hori.	574.817	QP	21.37	18.78	8.50	31.96	0.00	16.69	46.00	29.3	100	359	
Hori.	766.587	QP	21.34	20.43	9.36	31.89	0.00	19.24	46.00	26.7	100	0	
Hori.	2483.500	PK	47.27	27.45	14.32	40.81	2.47	50.70	73.90	23.2	114	36	
Hori.	4960.000	PK	61.98	31.48	6.76	41.65	2.47	61.04	73.90	12.8	150	51	
Hori.	7440.000	PK	47.10	36.68	8.29	41.36	2.47	53.18	73.90	20.7	150	0	
Hori.	9920.000	PK	45.96	38.63	9.45	40.66	2.47	55.85	73.90	18.0	150	0	
Hori.	19836.000	PK	45.12	40.24	13.31	45.36	-9.54	43.77	73.90	30.1	143	209	
Hori.	2483.500	AV	35.59	27.45	14.32	40.81	2.47	39.02	53.90	14.8	114	36	
Hori.	19836.000	AV	38.26	40.24	13.31	45.36	-9.54	36.91	53.90	16.9	143	209	
Vert.	30.851	QP	21.37	17.23	7.04	31.83	0.00	13.81	40.00	26.1	100	0	
Vert.	181.939	QP	21.52	16.11	8.97	31.77	0.00	14.83	43.50	28.6	100	359	
Vert.	696.999	QP	21.23	19.72	9.08	31.97	0.00	18.06	46.00	27.9	100	0	
Vert.	947.186	QP	20.54	22.30	10.13	30.94	0.00	22.03	46.00	23.9	100	0	
Vert.	2483.500	PK	46.67	27.45	14.32	40.81	2.47	50.10	73.90	23.8	215	71	
Vert.	4960.000	PK	59.40	31.48	6.76	41.65	2.47	58.46	73.90	15.4	151	256	
Vert.	7440.000	PK	47.26	36.68	8.29	41.36	2.47	53.34	73.90	20.5	150	0	
Vert.	9920.000	PK	45.59	38.63	9.45	40.66	2.47	55.48	73.90	18.4	150	0	
Vert.	19836.000	PK	45.89	40.24	13.31	45.36	-9.54	44.54	73.90	29.3	135	62	
Vert.	2483.500	AV	34.80	27.45	14.32	40.81	2.47	38.23	53.90	15.6	215	71	
Vert.	19836.000	AV	39.88	40.24	13.31	45.36	-9.54	38.53	53.90	15.3	135	62	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell time factor relaxation

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Dwell Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4960.000	AV	54.60	31.48	6.76	41.65	-24.49	2.47	29.17	53.90	24.7	
Hori.	7440.000	AV	35.76	36.68	8.29	41.36	-24.49	2.47	17.35	53.90	36.5	
Hori.	9920.000	AV	33.84	38.63	9.45	40.66	-24.49	2.47	19.24	53.90	34.7	
Vert.	4960.000	AV	51.57	31.48	6.76	41.65	-24.49	2.47	26.14	53.90	27.8	
Vert.	7440.000	AV	35.78	36.68	8.29	41.36	-24.49	2.47	17.37	53.90	36.5	
Vert.	9920.000	AV	33.81	38.63	9.45	40.66	-24.49	2.47	19.21	53.90	34.7	

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

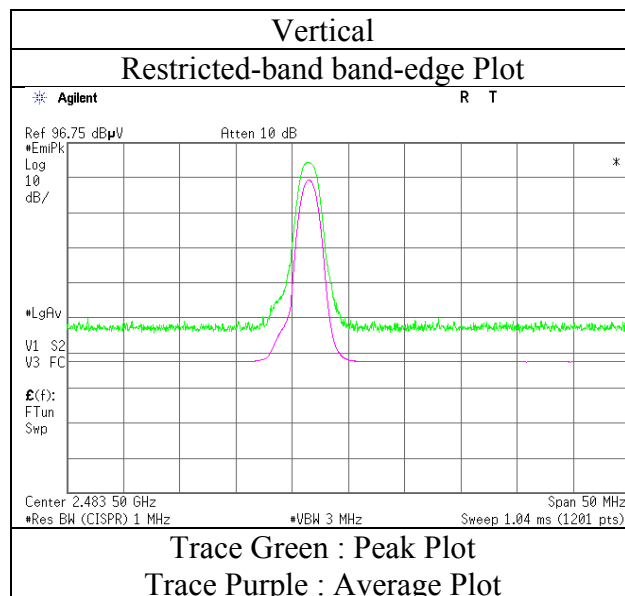
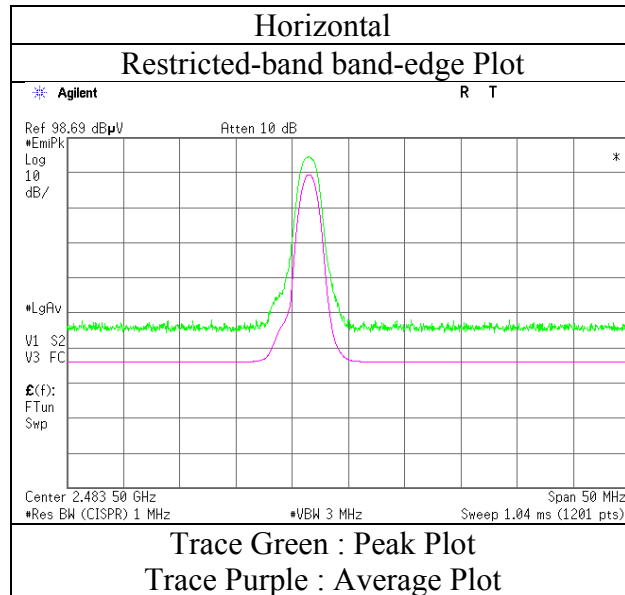
Distance factor : 1 GHz - 13 GHz : 20log (3.98 m / 3.0 m) = 2.47 dB

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

Dwell (time) factor refer to "Dwell time factor Calculation chart" sheet.

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

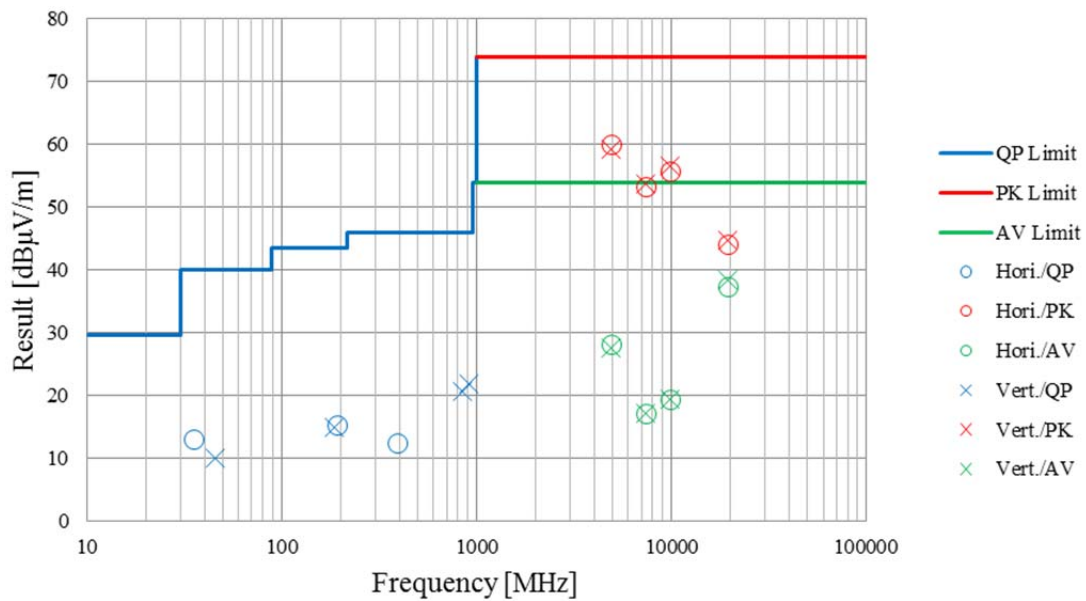
Report No. 12012868S-F-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 4, 2017
Temperature / Humidity 22 deg. C / 48 % RH
Engineer Shiro Kobayashi
(1 GHz – 2.8 GHz)
Mode Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission **(Plot data, Worst case)**

Report No.	12012868S-F-R1	No.1
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	
Date	November 8, 2017	November 4, 2017
Temperature / Humidity	23 deg. C / 53 % RH	22 deg. C / 48 % RH
Engineer	Shiro Kobayashi	Shiro Kobayashi
	(30 MHz - 1 GHz)	(1 GHz - 26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz	

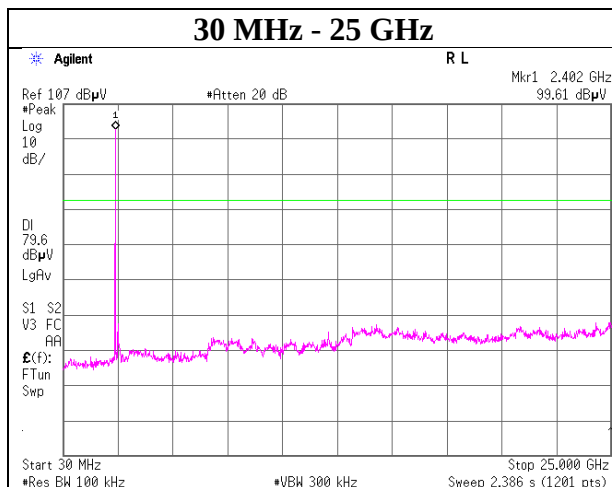
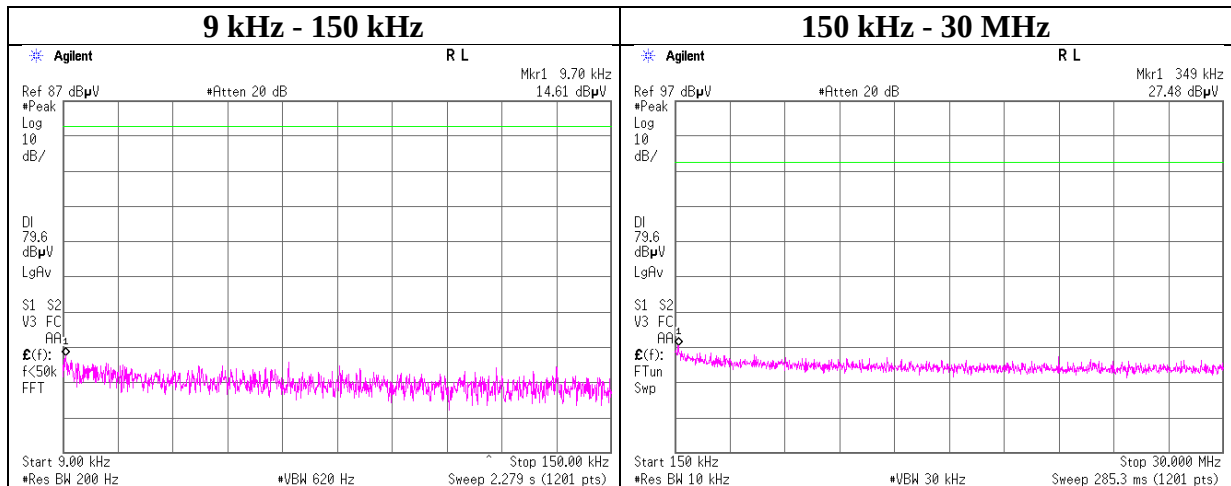


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off, DH5

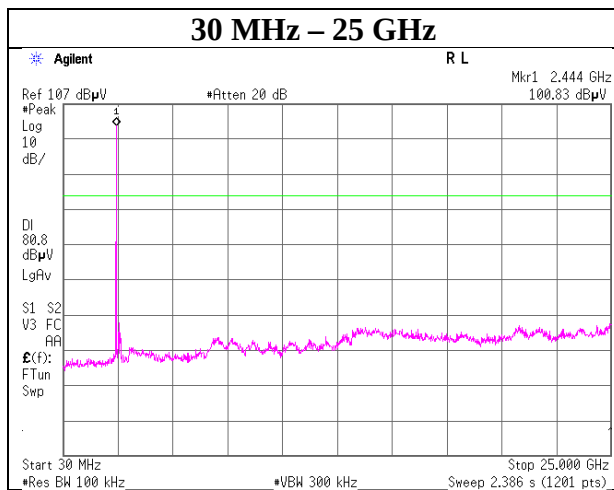
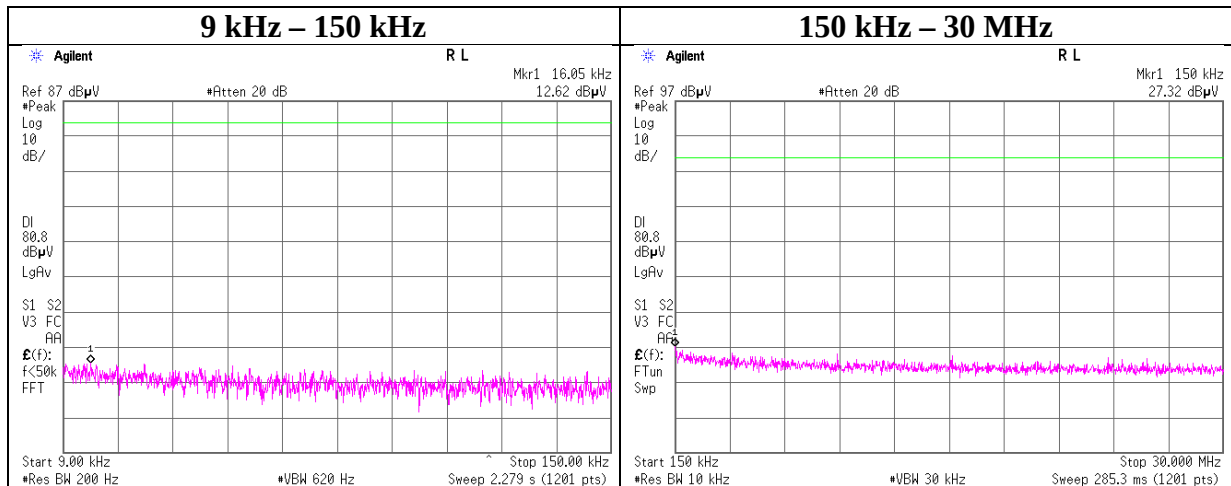
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off, DH5

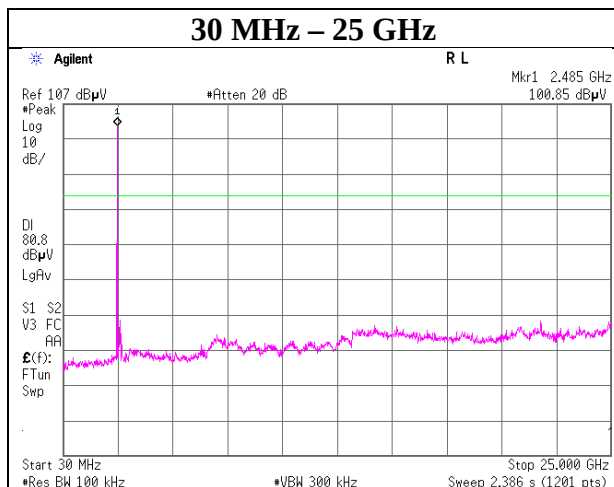
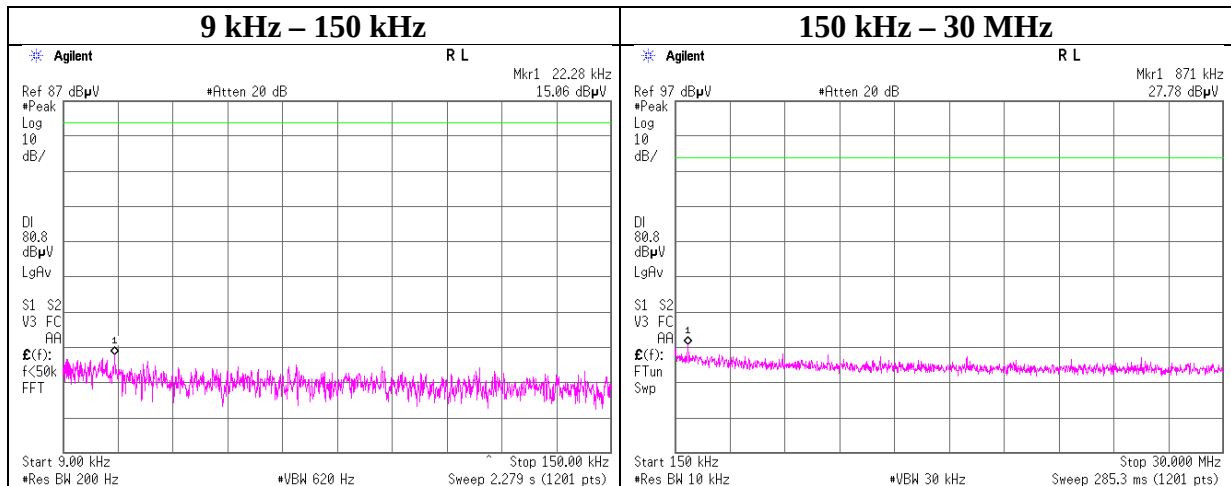
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off, DH5

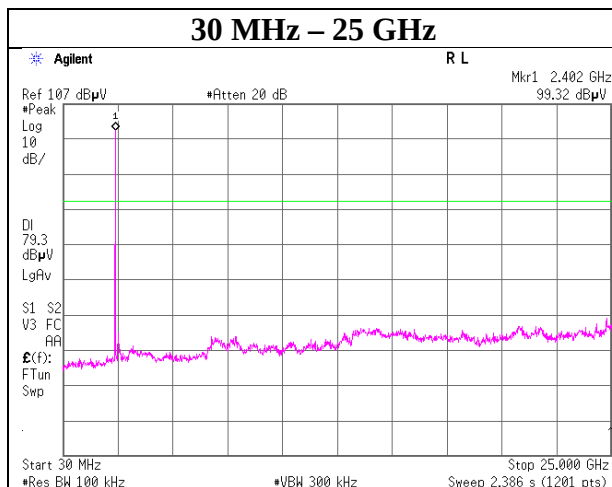
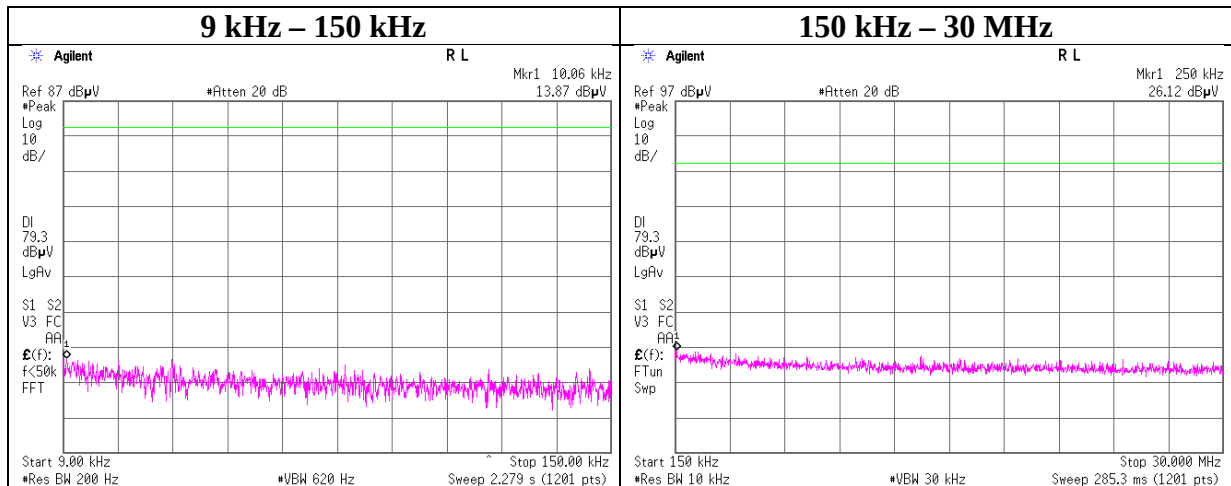
2480 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off, 3DH5

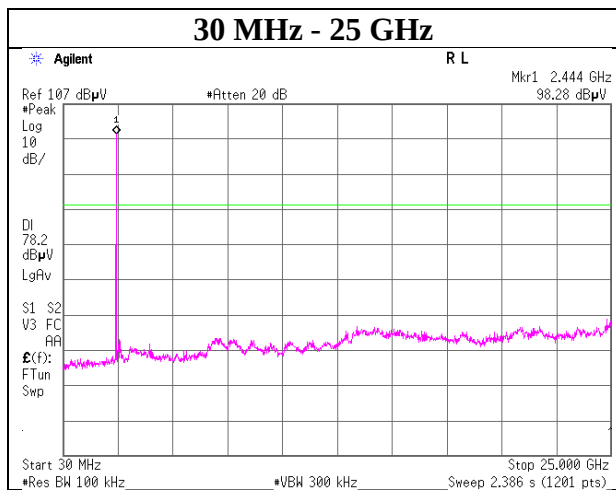
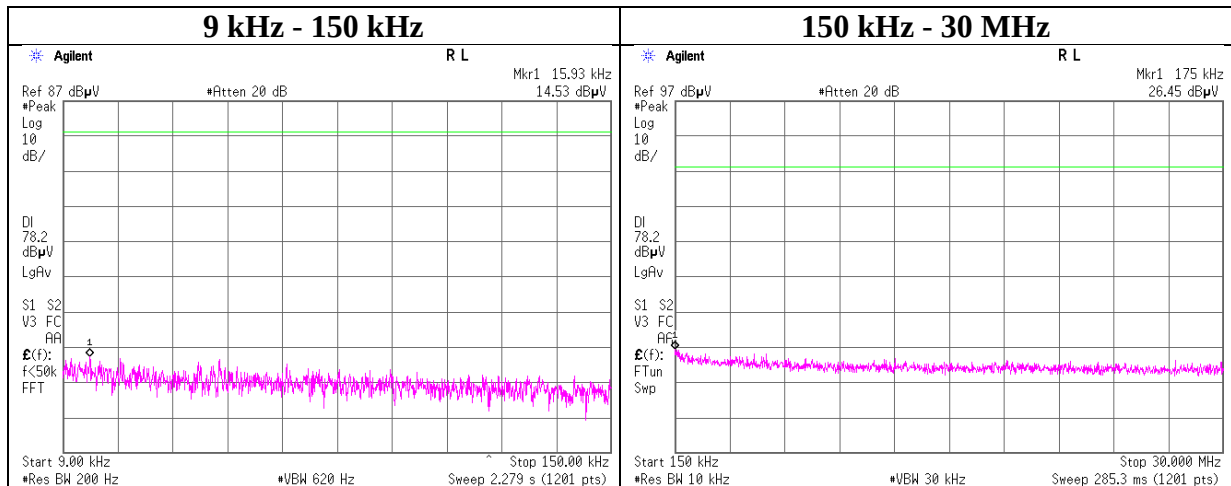
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off, 3DH5

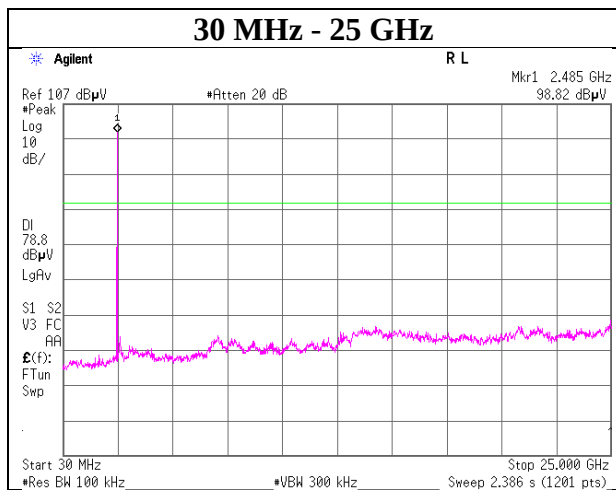
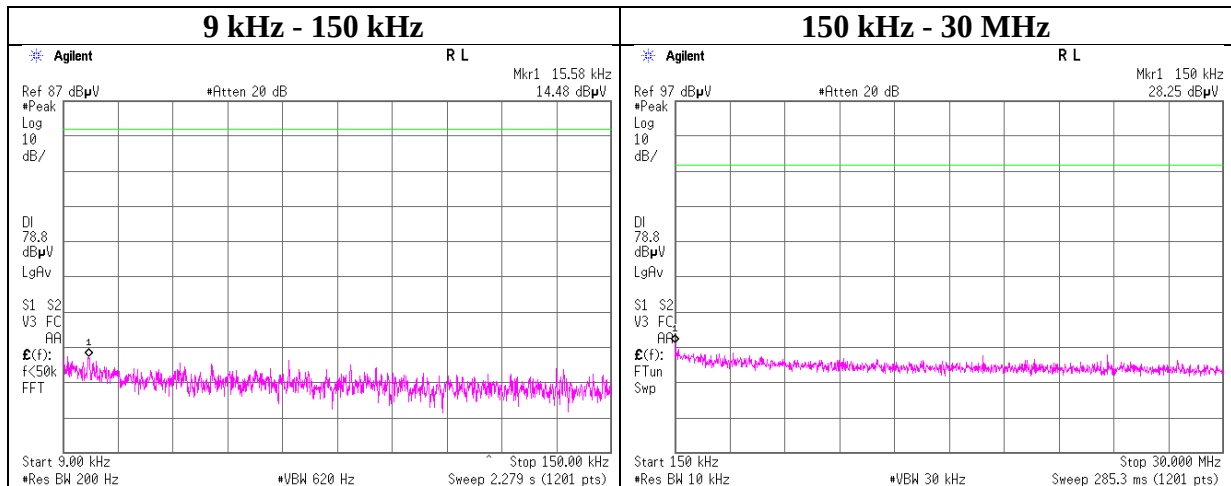
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx, Hopping Off, 3DH5

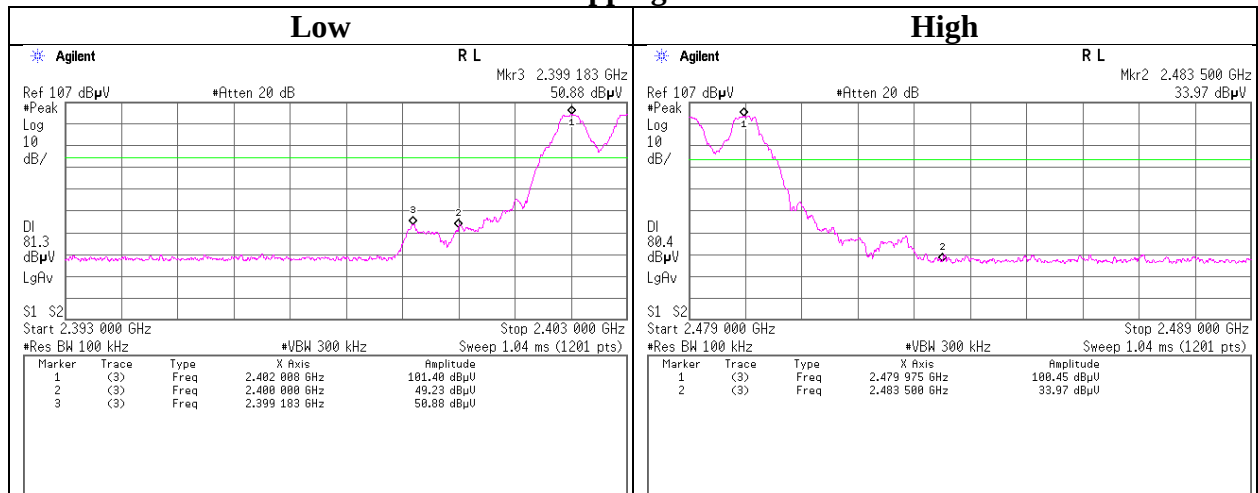
2480 MHz



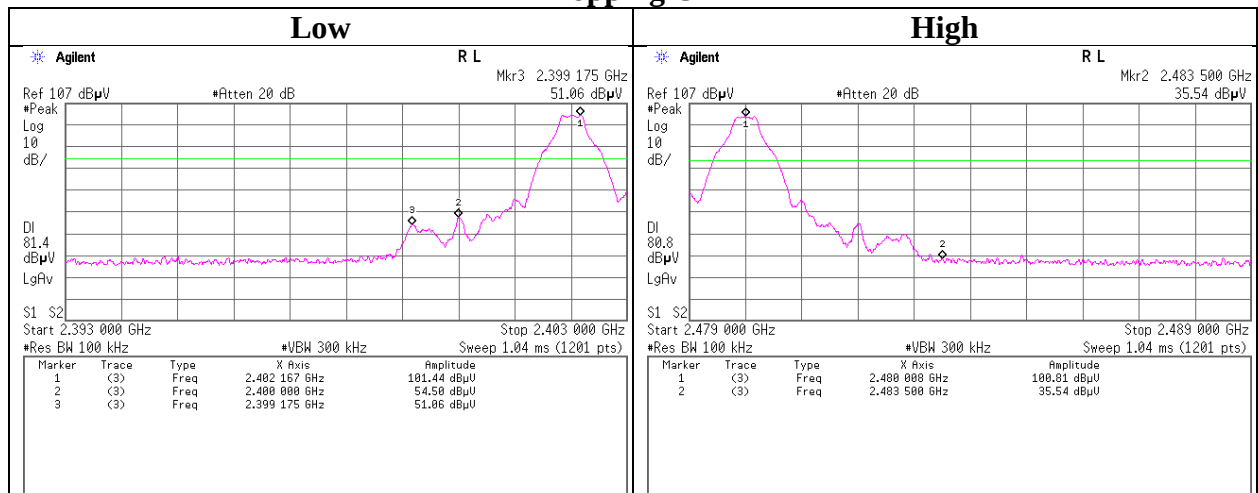
Conducted Emission Band Edge compliance

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx DH5

Hopping On



Hopping Off



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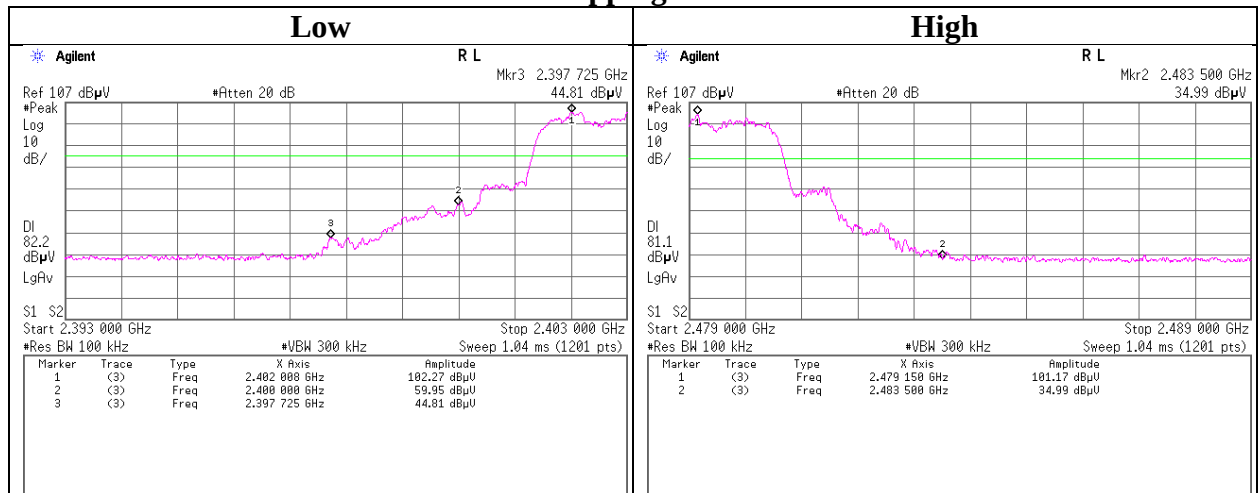
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

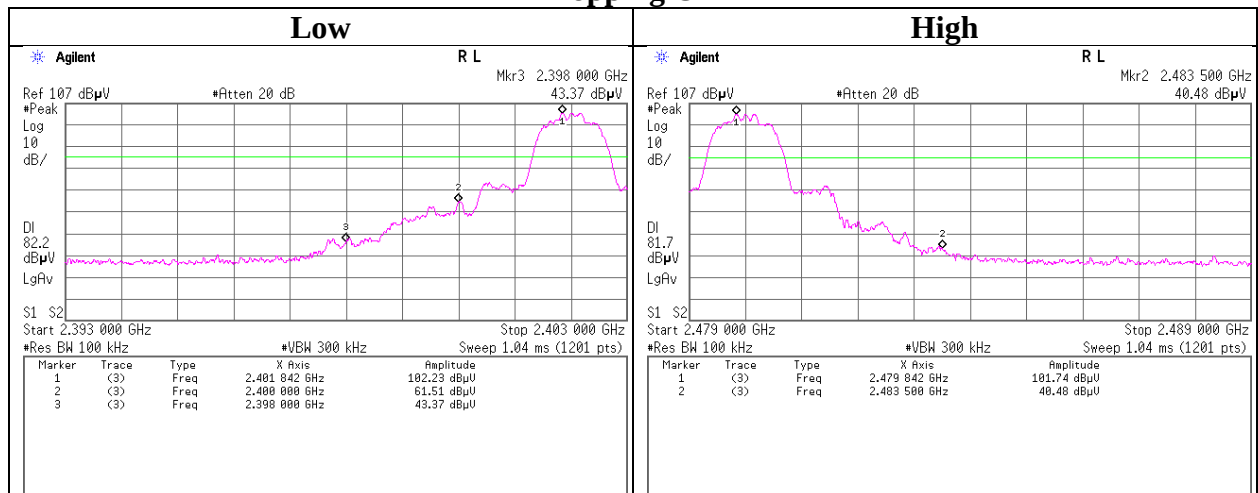
Conducted Emission Band Edge compliance

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12012868S-F-R1
Date : November 1, 2017
Temperature / Humidity : 23 deg. C / 37 % RH
Engineer : Tatsuya Arai
Mode : Tx 3DH5
November 2, 2017
22 deg. C / 44 % RH
Makoto Hosaka

Hopping On



Hopping Off



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Telephone : +81 463 50 6400

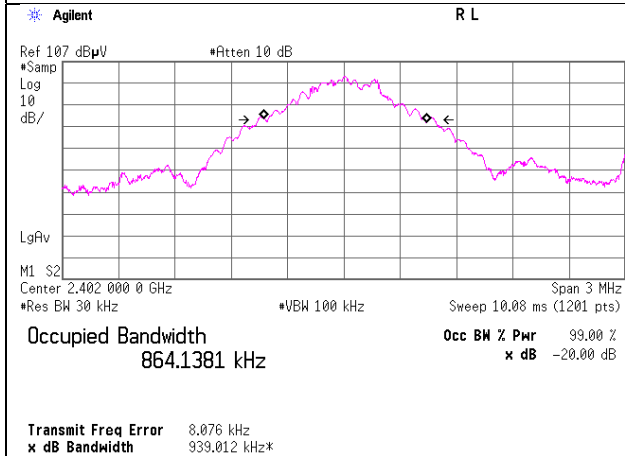
Facsimile : +81 463 50 6401

99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12012868S-F-R1
Date	November 1, 2017
Temperature / Humidity	23 deg. C / 37 % RH
Engineer	Tatsuya Arai
Mode	Tx Hopping Off

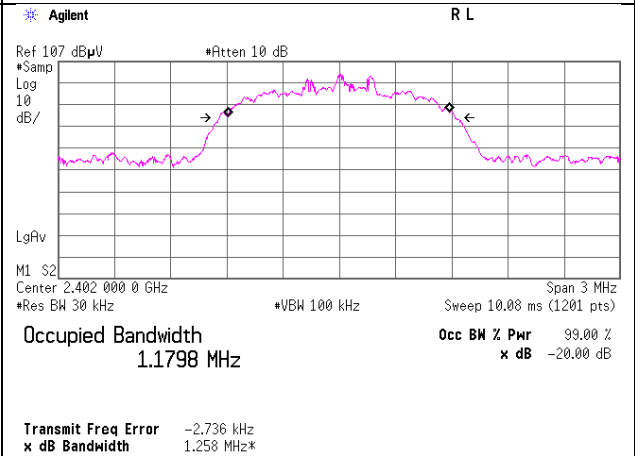
Hopping Off, DH5

2402 MHz

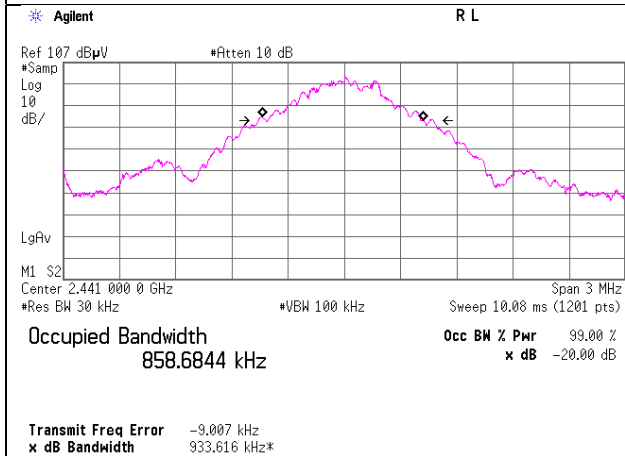


Hopping Off, 3DH5

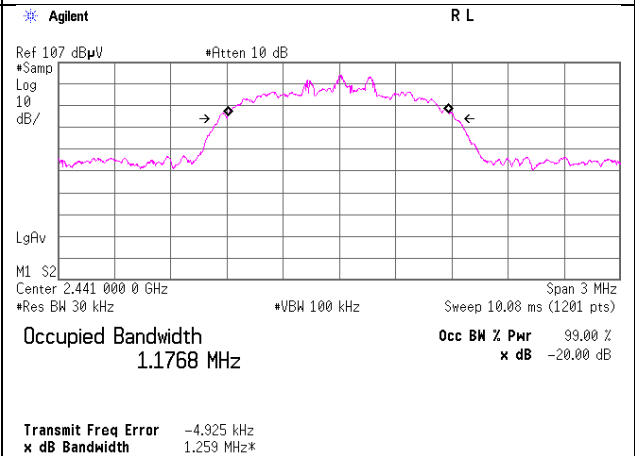
2402 MHz



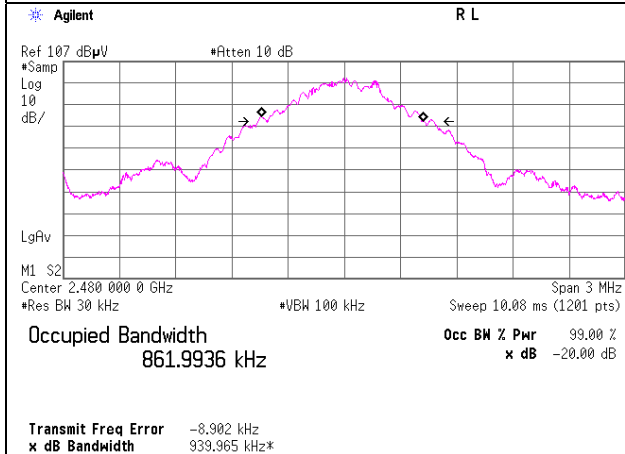
2441 MHz



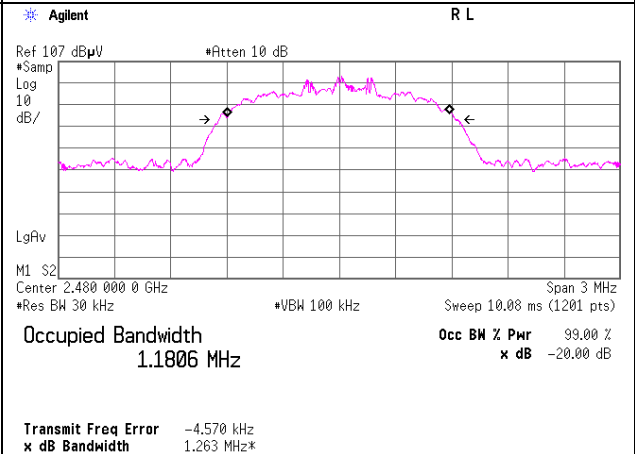
2441 MHz



2480 MHz



2480 MHz



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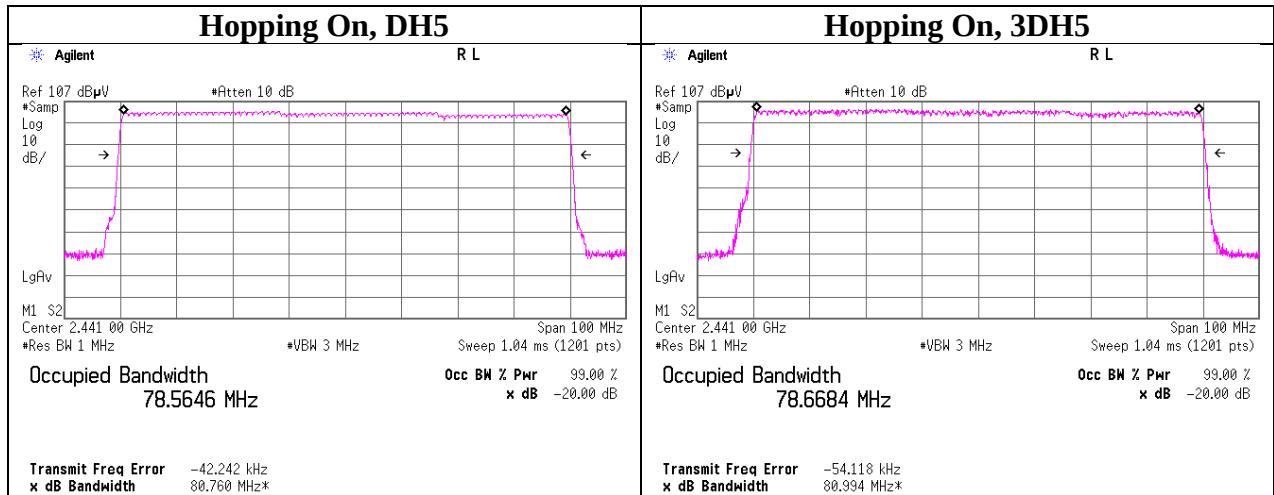
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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	12012868S-F-R1	
Date	November 1, 2017	November 2, 2017
Temperature / Humidity	23 deg. C / 37 % RH	22 deg. C / 44 % RH
Engineer	Tatsuya Arai	Makoto Hosaka
Mode	Tx Hopping On	



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2017/03/23 * 12
SAT10-12	Attenuator	Weinschel Corp.	54A-10	81601	AT	2017/03/23 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT	2017/03/07 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2017/06/09 * 12
SAF-04	Pre Amplifier	TOYO Corporation	TPA0118-36	1440489	RE	2017/03/17 * 12
SCC-G05	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-03 7	RE	2017/01/08 * 12
SCC-G22	Coaxial Cable	Suhner	SUCOFLEX 104	296199/4	RE	2017/05/08 * 12
SHA-01	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-725	RE	2017/08/14 * 12
SOS-15	Humidity Indicator	A&D	AD-5681	7478311	RE	2017/02/21 * 12
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	RE	2017/10/12 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE ,RFI,MF)	-	RE	-
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2017/10/16 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000N F SNMS/B	1612S005	RE	2017/01/08 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2016/11/07 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2016/11/29 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2016/11/07 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2017/04/20 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2017/03/15 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2017/09/22 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000K M SKMS	-	RE	2017/04/20 * 12
SCC-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2017/03/23 * 12
SAEC-01(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	RE	2017/07/20 * 12
SRENT-10	Spectrum Analyzer	Agilent	E4440A	US41421511	RE	2016/12/05 * 12
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2017/02/09 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2016/12/15 * 12
SAT3-09	Attenuator	JFW	50HF-003N	-	RE	2017/08/24 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2017/10/21 * 12
SCC-A1/A3/A5/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	RE	2017/04/07 * 12
SCC-A2/A4/A6/A7/A8/A13/SRSE-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	RE	2017/04/07 * 12
SLA-05	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	RE	2017/01/05 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2017/10/30 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2017/04/12 * 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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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