



RADIO TEST REPORT

Test Report No. : 12053884S-A

Applicant : Alpine Electronics, Inc.
Type of Equipment : CAR AUDIO
Model No. : CDE-175BT
FCC ID : A269ZUA155
Test regulation : FCC Part 15 Subpart C: 2018
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)

Date of test: January 9 to 16, 2018

Representative test engineer:

Yosuke Ishikawa

Engineer

Consumer Technology Division

Approved by:

Hikaru Shirasawa

Engineer

Consumer Technology Division



JAB
Testing
RTL02610

- ☐ 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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Shonan EMC Lab.

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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	Alpine Electronics, Inc.
Address	:	20-1 Yoshima Industrial Park, Iwaki-shi, Fukushima, 970-1192 Japan
Telephone Number	:	+81-246-36-4111
Facsimile Number	:	+81-246-36-6090
Contact Person	:	Mitsuru Yoshida

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

2.1 Identification of E.U.T.

Type of Equipment	:	CAR AUDIO
Model No.	:	CDE-175BT
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12 V
Receipt Date of Sample	:	December 27, 2017
Country of Mass-production	:	Thailand
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: CDE-175BT (referred to as the EUT in this report) is a CAR AUDIO.

General Specification

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

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz to 2480 MHz, 1 MHz each
Modulation	:	FHSS/ GFSK/ $\pi/4$ DQPSK/ 8DPSK
Power Supply (radio part input)	:	DC 3.3 V
Antenna type	:	Top-GND-coupled loop
Antenna Gain	:	Peak Gain -1.8 dBi, Ave.Gain -5.2 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on January 2, 2018 and effective February 1, 2018

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

* The revision on January 2, 2018, does not affect the test specification applied to the EUT.

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	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	7.6 dB 48.004 MHz, QP, Vert. Tx, Hopping Off, DH5 2441 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 test is not applicable since the EUT has no AC mains.

*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 equipment provides the wireless transmitter with stable power supply (DC 3.3 V). 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	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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

3.4 Uncertainty

EMI

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

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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
Radiated emission (Measurement distance: 3 m)	30 MHz-200 MHz	4.3 dB	4.3 dB	4.3 dB	-	-
	200 MHz-1 GHz	5.9 dB	5.9 dB	5.9 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 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
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 %

Radiated emission test

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

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

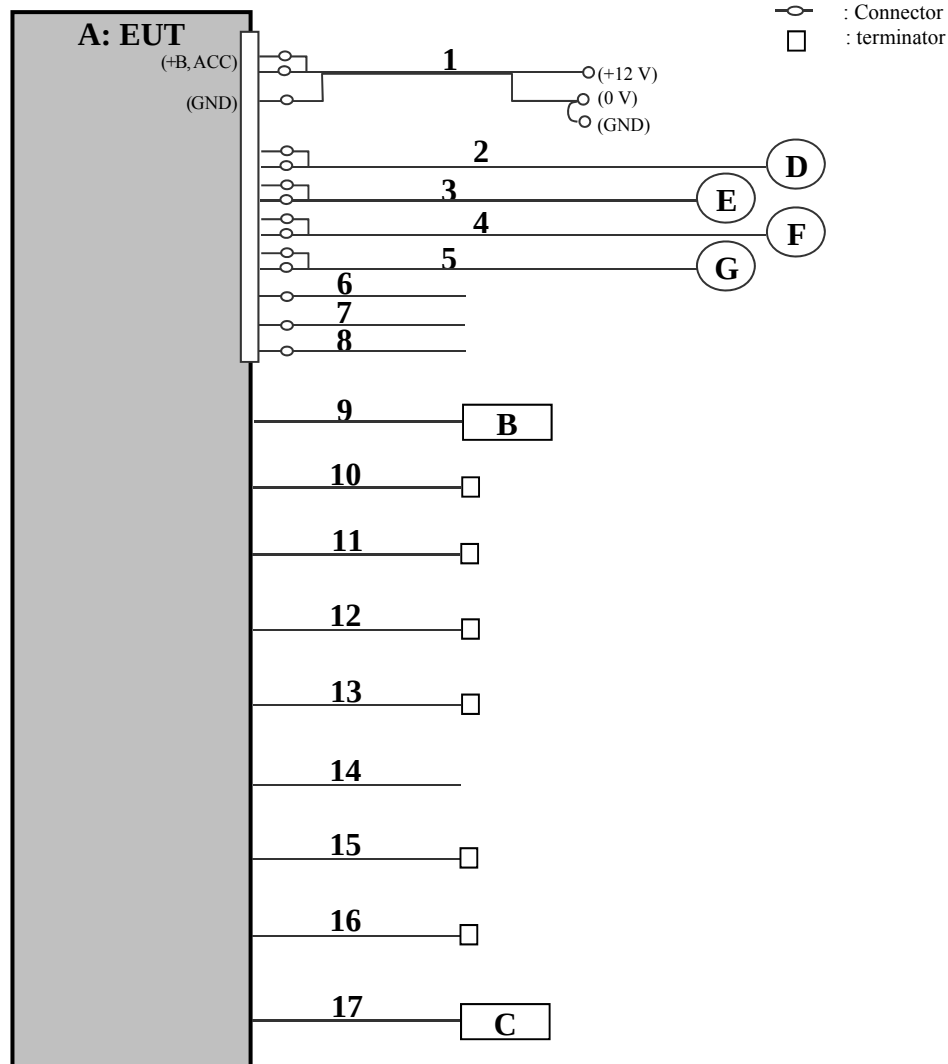
4.1 Operating Mode(s)

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 test items based on Bluetooth Core specification. *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 BlueTest3 Ver. 2.5.8.667 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	CAR AUDIO	CDE-175BT	019 *1) 025 *2)	Alpine Electronics, Inc.	EUT
B	USB memory	USM4GU	-	Sony	-
C	Mic	-	-	Alpine Electronics, Inc.	-
D	Speaker 1	LV-002	S11014200773	L&V	-
E	Speaker 2	LV-002	S11014200773	L&V	-
F	Speaker 3	LV-002	S11014200775	L&V	-
G	Speaker 4	LV-002	S11014200775	L&V	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Power	0.20 + 2.0	Unshielded	Unshielded	-
2	Speaker (1)	0.20 + 3.0	Unshielded	Unshielded	-
3	Speaker (2)	0.20 + 3.0	Unshielded	Unshielded	-
4	Speaker (3)	0.20 + 3.0	Unshielded	Unshielded	-
5	Speaker (4)	0.20 + 3.0	Unshielded	Unshielded	-
6	Illumination	0.20 + 1.0	Unshielded	Unshielded	-
7	Remote Turn-On	0.20 + 1.0	Unshielded	Unshielded	-
8	Power Antenna	0.20 + 1.0	Unshielded	Unshielded	-
9	USB	1.0	Shielded	Shielded	-
10	AUX	1.5	Shielded	Shielded	-
11	RCA (Front Audio Out)	1.5	Shielded	Shielded	-
12	RCA (Rear Audio Out)	1.5	Shielded	Shielded	-
13	RCA (Sub Audio Out)	1.5	Shielded	Shielded	-
14	Remote	2.0	Shielded	Shielded	-
15	Antenna (FM/AM)	1.2	Shielded	Shielded	-
16	Antenna (Sirius X)	1.2	Shielded	Shielded	-
17	Mic	3.5	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 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	3.88 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 26.5 GHz)		3.88 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: $20 \times \log(3.88 \text{ m}/3.0 \text{ m}) = 2.24 \text{ dB}$

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

The noise levels were confirmed at angle of 0 deg. to 30 deg. based on the product specification to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Worst case:

Antenna polarization	Carrier (Band edge)	Spurious			
		Below 1 GHz	Above 1 GHz		
			1 GHz – 2.8 GHz	2.8 GHz - 13 GHz	13 GHz – 26.5 GHz
Horizontal	0 deg.	0 deg.	0 deg.	0 deg.	0 deg.
Vertical	0 deg.	0 deg.	0 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: 50MHz 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.							

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, 99% Occupied Bandwidth and Carrier Frequency Separation

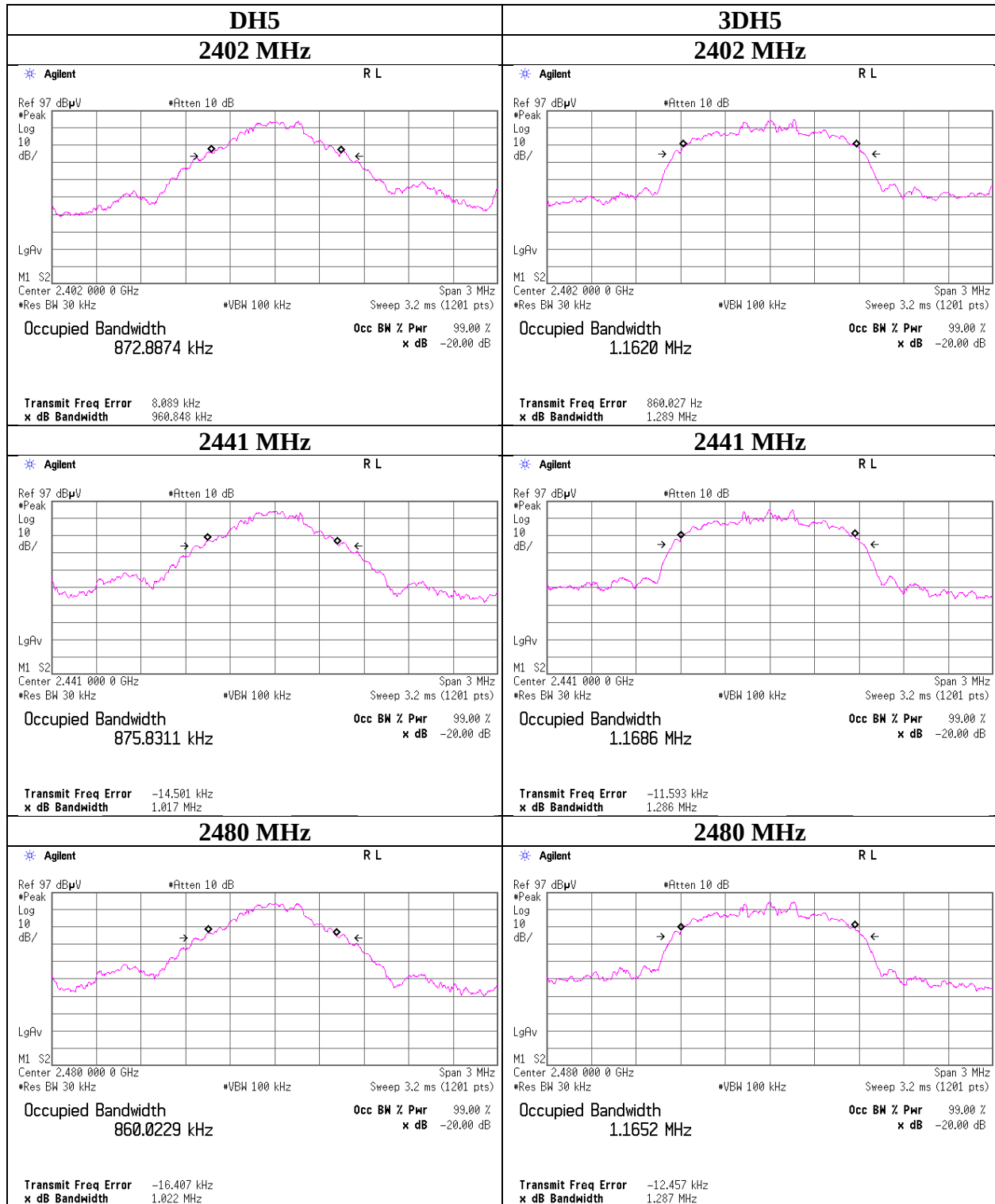
Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12053884S-A
Date	January 9, 2018
Temperature / Humidity	23 deg. C / 47 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, Tx, Hopping On

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	872.9	1.000	≥ 0.641
DH5	2441.0	1.017	875.8	1.000	≥ 0.678
DH5	2480.0	1.022	860.0	1.000	≥ 0.681
DH5	Hopping On	-	78554.5	-	-
3DH5	2402.0	1.289	1162.0	1.000	≥ 0.860
3DH5	2441.0	1.286	1168.6	1.000	≥ 0.858
3DH5	2480.0	1.287	1165.2	1.000	≥ 0.858
3DH5	Hopping On	-	78582.7	-	-

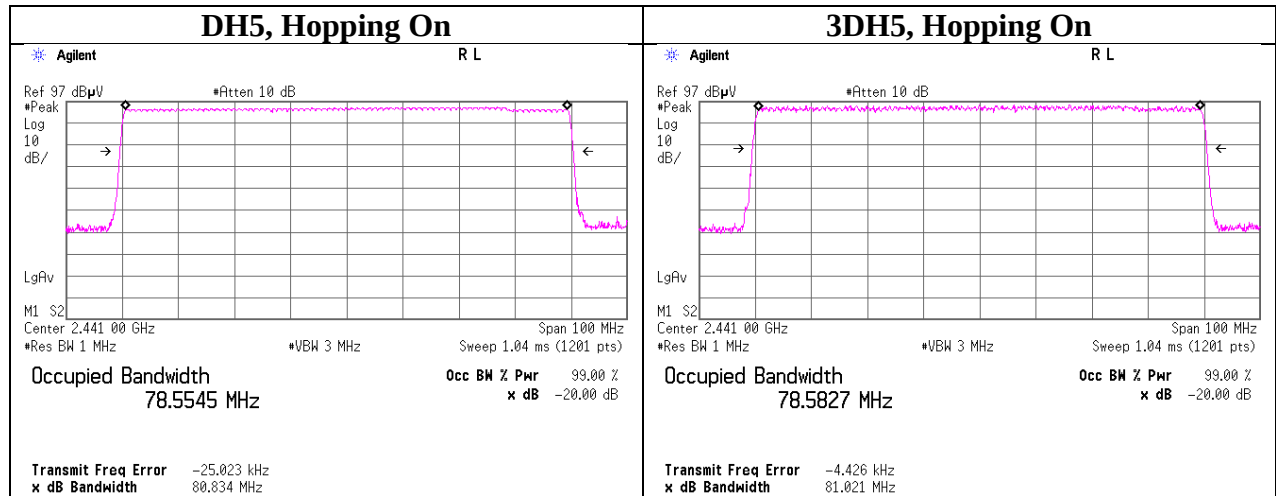
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20dB Bandwidth and 99% Occupied Bandwidth



20dB Bandwidth and 99% Occupied Bandwidth



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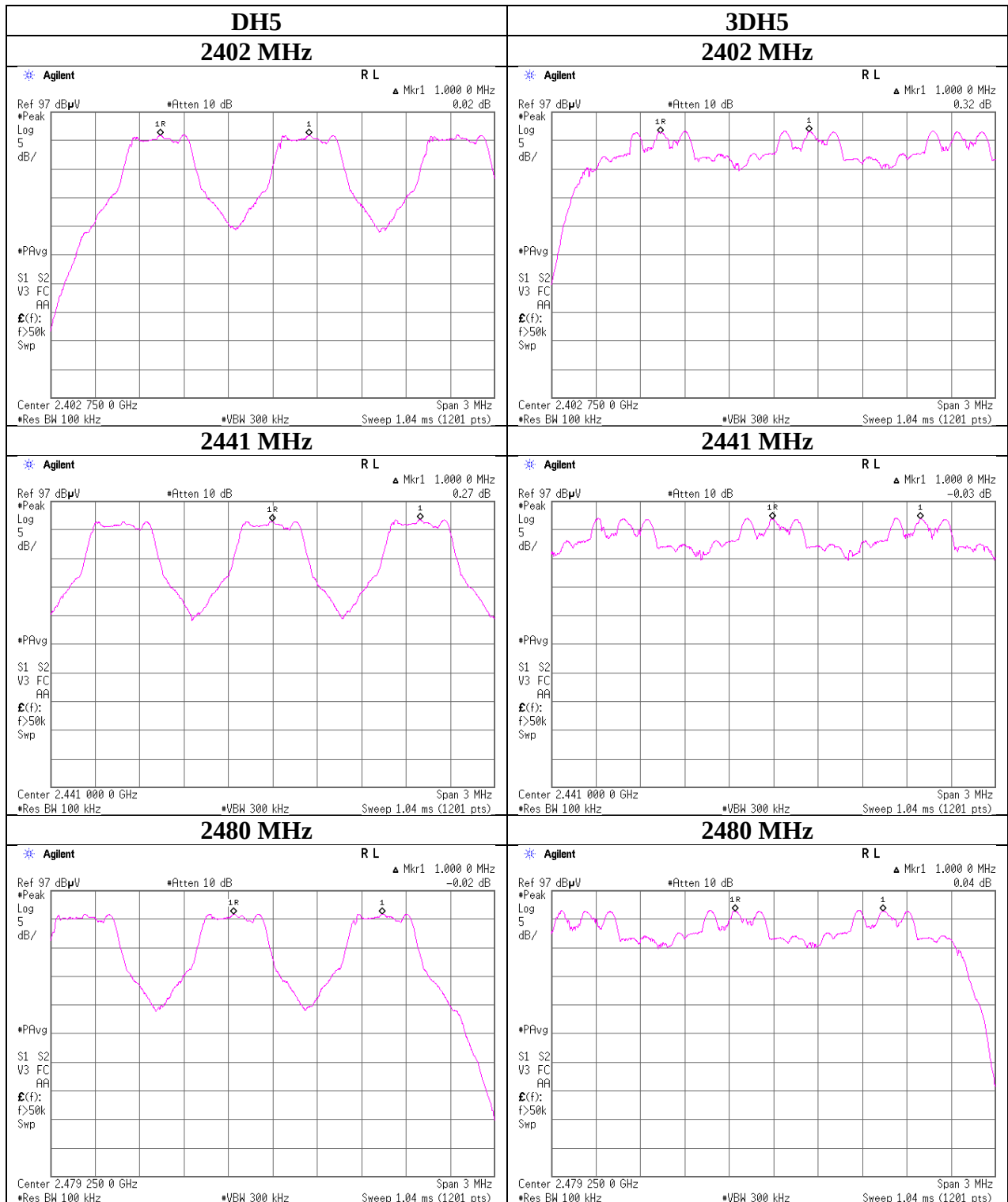
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Carrier Frequency Separation



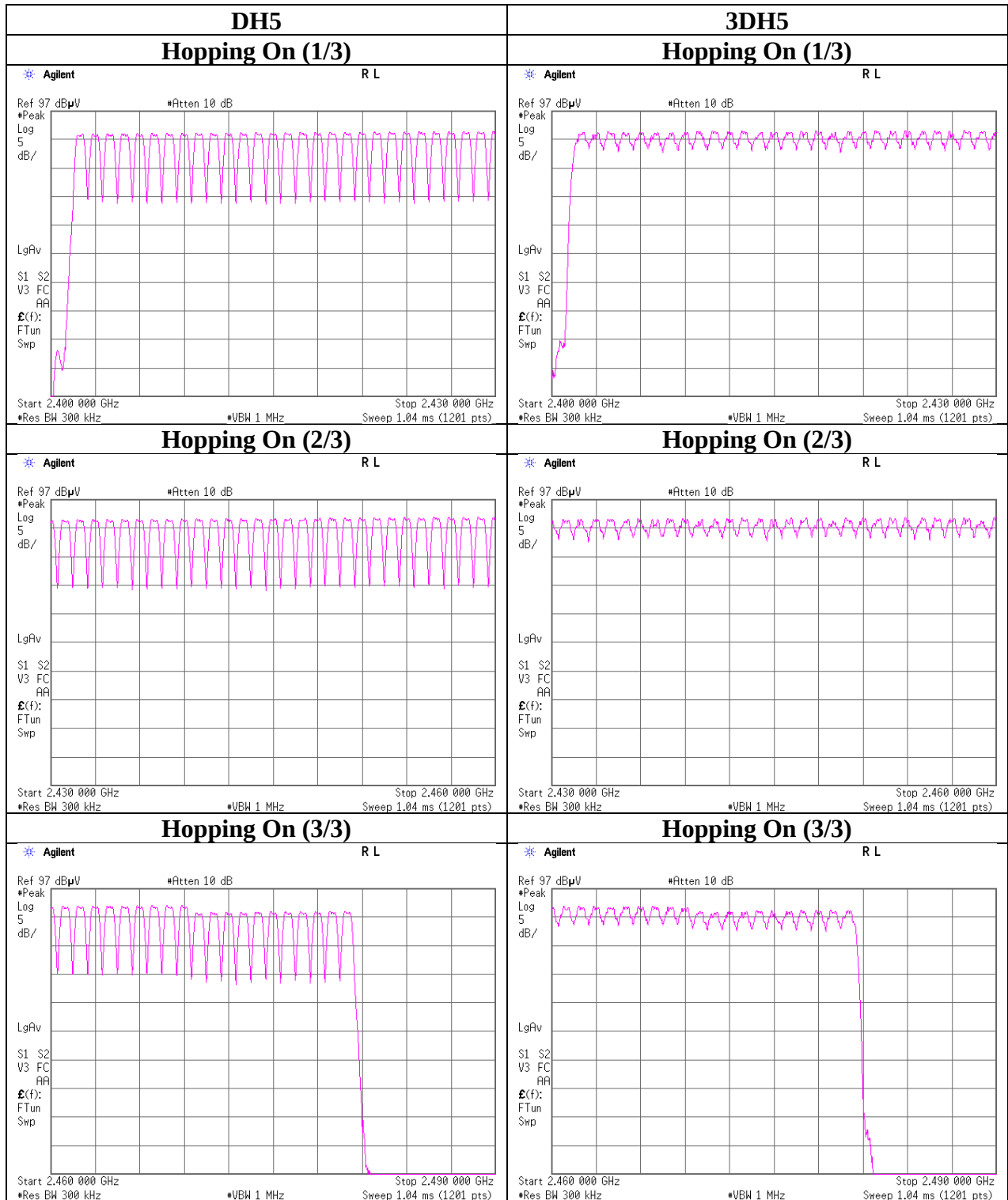
Number of Hopping Frequency

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 12053884S-A
Date January 9, 2018
Temperature / Humidity 23 deg. C / 47 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping On

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

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

Number of Hopping Frequency



Dwell time

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12053884S-A
Date	January 9, 2018
Temperature / Humidity	23 deg. C / 47 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping On

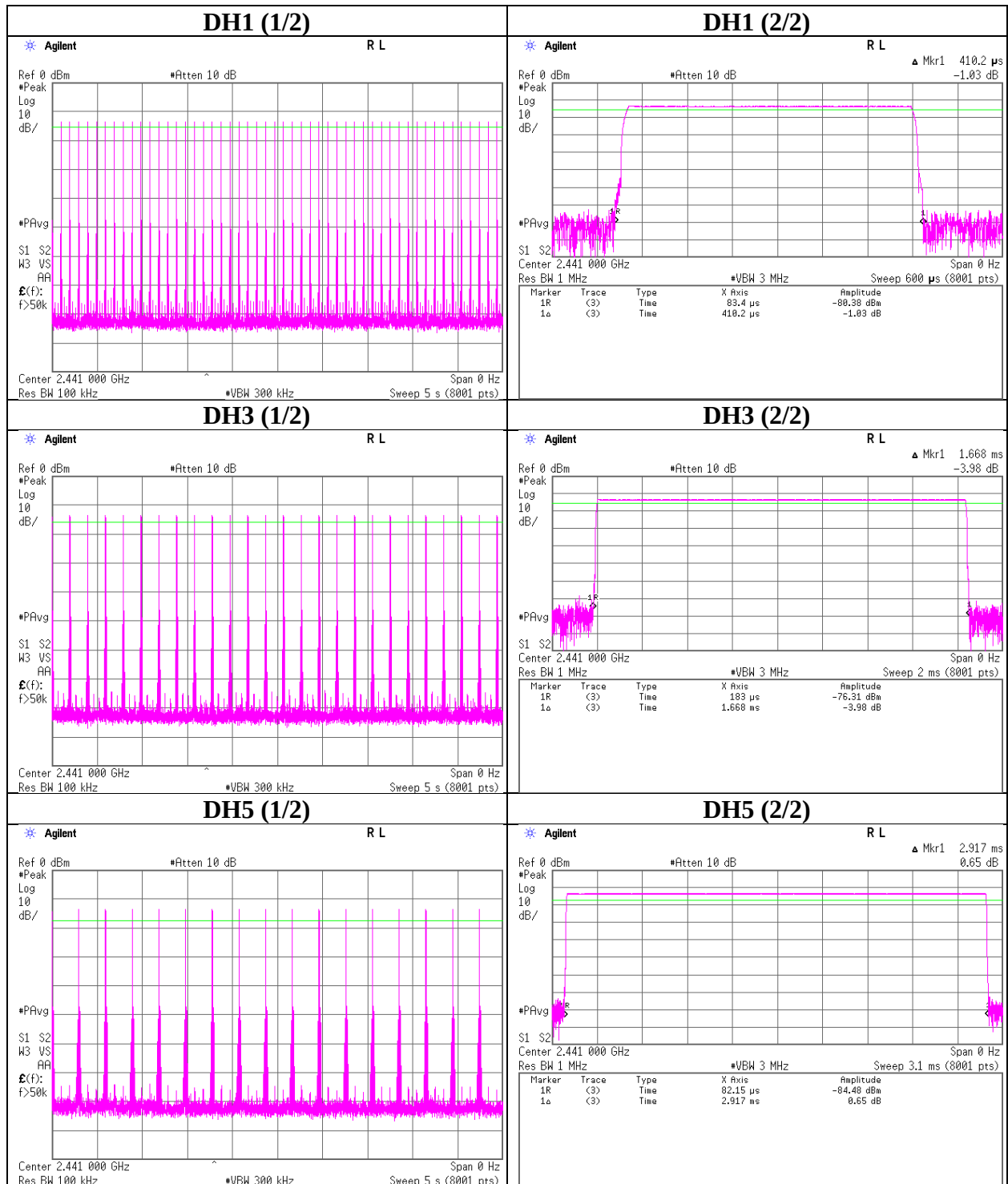
Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period				Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	51.0 times	/	5 sec.	x 31.6 sec. = 323 times	0.410	132	400
DH3	26.0 times	/	5 sec.	x 31.6 sec. = 165 times	1.668	275	400
DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.917	315	400
3DH1	51.0 times	/	5 sec.	x 31.6 sec. = 323 times	0.430	139	400
3DH3	26.0 times	/	5 sec.	x 31.6 sec. = 165 times	1.680	277	400
3DH5	17.0 times	/	5 sec.	x 31.6 sec. = 108 times	2.931	317	400

Sample Calculation

Result = Number of transmission x Length of transmission

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

Dwell time



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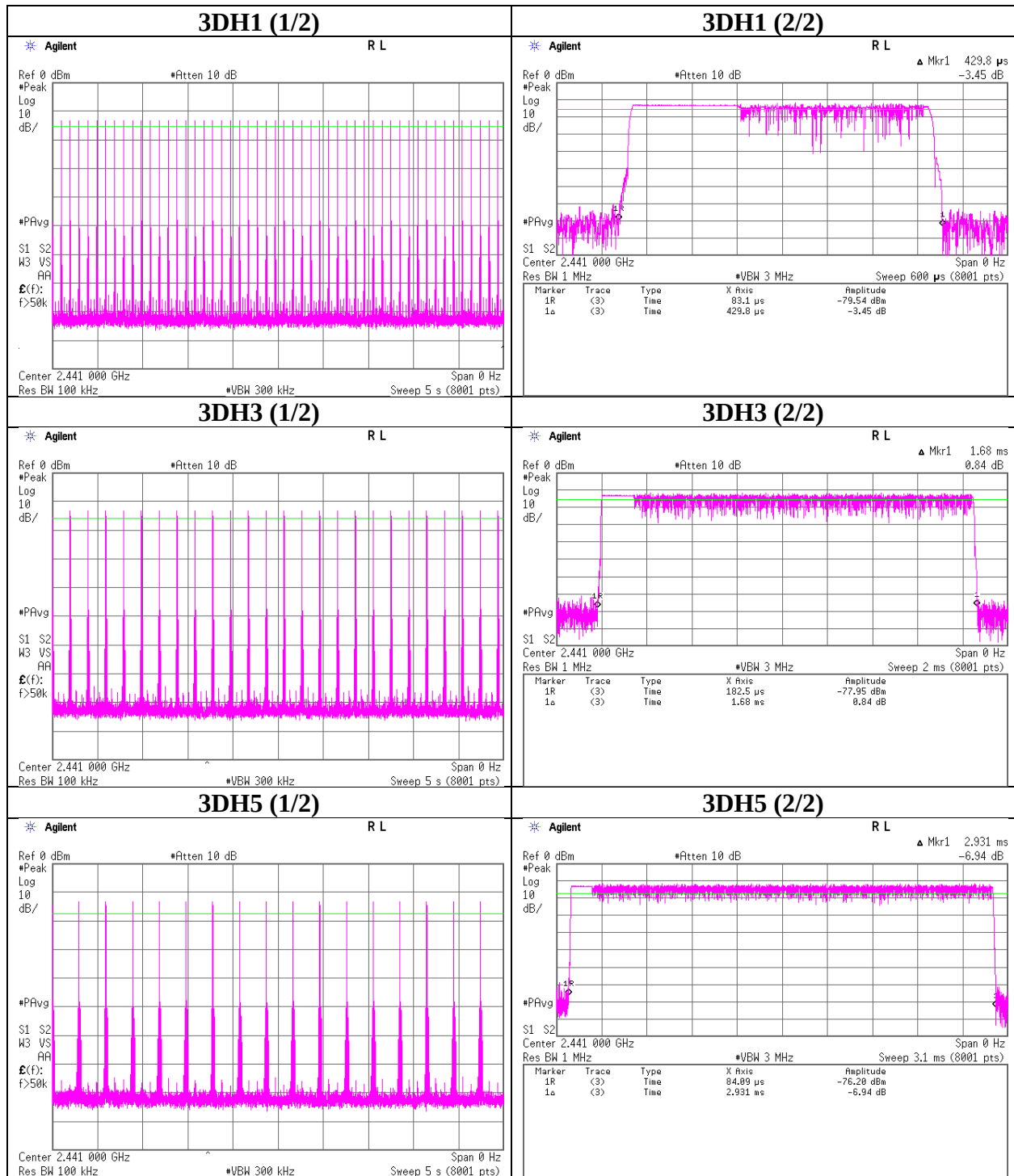
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Dwell time



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Maximum Peak Output Power

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12053884S-A
Date	January 9, 2018
Temperature / Humidity	23 deg. C / 47 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-12.75	1.92	9.85	-0.98	0.80	20.96	125	21.94
DH5	2441.0	-12.22	1.94	9.84	-0.44	0.90	20.96	125	21.40
DH5	2480.0	-12.86	1.95	9.84	-1.07	0.78	20.96	125	22.03
2DH5	2402.0	-11.35	1.92	9.85	0.42	1.10	20.96	125	20.54
2DH5	2441.0	-11.10	1.94	9.84	0.68	1.17	20.96	125	20.28
2DH5	2480.0	-11.56	1.95	9.84	0.23	1.05	20.96	125	20.73
3DH5	2402.0	-11.05	1.92	9.85	0.72	1.18	20.96	125	20.24
3DH5	2441.0	-10.78	1.94	9.84	1.00	1.26	20.96	125	19.96
3DH5	2480.0	-11.05	1.95	9.84	0.74	1.19	20.96	125	20.22

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.

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

As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

Average Output Power (Reference data for RF Exposure)

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12053884S-A
Date	January 9, 2018
Temperature / Humidity	23 deg. C / 47 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	-14.88	1.92	9.85	-3.11	0.49	1.10	-2.01	0.63
DH5	2441.0	-14.27	1.94	9.84	-2.49	0.56	1.10	-1.39	0.73
DH5	2480.0	-14.87	1.95	9.84	-3.08	0.49	1.10	-1.98	0.63
2DH5	2402.0	-15.65	1.92	9.85	-3.88	0.41	1.08	-2.80	0.52
2DH5	2441.0	-15.31	1.94	9.84	-3.53	0.44	1.08	-2.45	0.57
2DH5	2480.0	-15.79	1.95	9.84	-4.00	0.40	1.08	-2.92	0.51
3DH5	2402.0	-15.67	1.92	9.85	-3.90	0.41	1.07	-2.83	0.52
3DH5	2441.0	-15.30	1.94	9.84	-3.52	0.44	1.07	-2.45	0.57
3DH5	2480.0	-15.79	1.95	9.84	-4.00	0.40	1.07	-2.93	0.51

Sample Calculation:

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

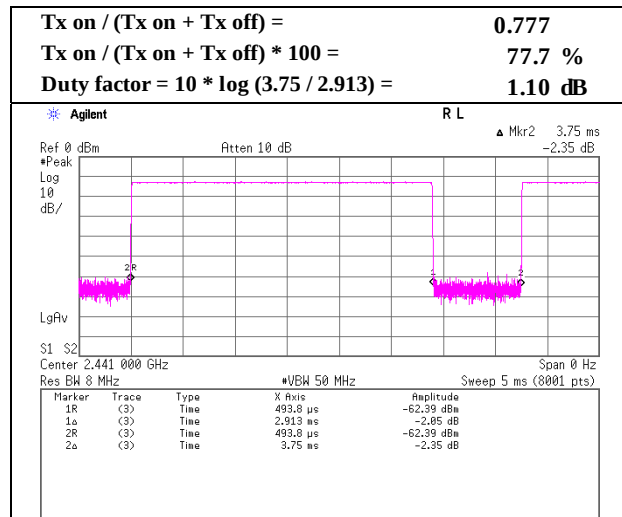
Result (Burst power average) = Time average + Duty factor

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

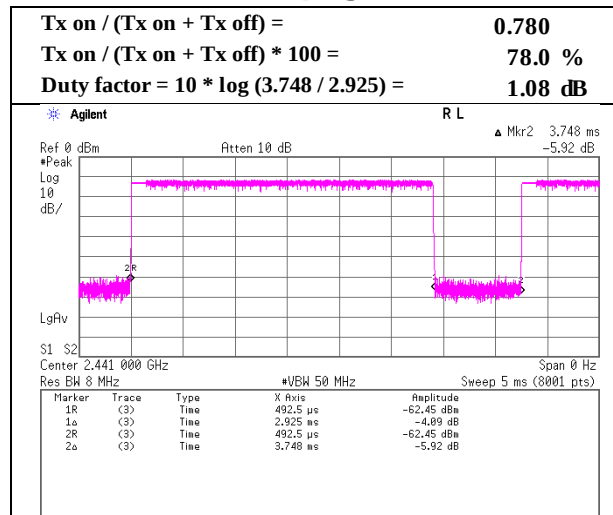
Burst Rate Confirmation

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off

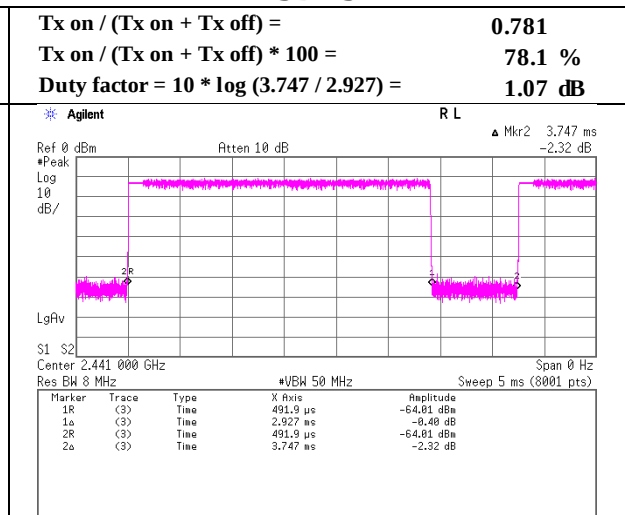
DH5



2DH5



3DH5



Radiated Spurious Emission

Report No. 12053884S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date January 16, 2018 January 15, 2018
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH
Engineer Yosuke Ishikawa Yosuke Ishikawa
(30 MHz – 1000 MHz) (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.	48.008	QP	37.60	11.46	7.22	31.89	0.00	24.39	40.00	15.6	189	235	
Hori.	60.016	QP	41.40	7.72	7.06	31.88	0.00	24.30	40.00	15.7	368	250	
Hori.	78.008	QP	33.00	6.20	8.01	31.87	0.00	15.34	40.00	24.6	253	211	
Hori.	119.985	QP	23.80	12.93	8.01	31.83	0.00	12.91	43.50	30.5	280	56	
Hori.	167.996	QP	26.30	15.65	8.82	31.79	0.00	18.98	43.50	24.5	182	8	
Hori.	192.008	QP	29.30	16.26	8.84	31.77	0.00	22.63	43.50	20.8	166	182	
Hori.	204.000	QP	37.40	11.39	5.70	31.76	0.00	22.73	43.50	20.7	199	271	
Hori.	384.008	QP	33.30	15.43	7.03	31.62	0.00	24.14	46.00	21.8	100	247	
Hori.	2390.000	PK	46.70	27.16	14.12	36.83	2.24	53.39	73.90	20.5	147	310	
Hori.	4804.000	PK	47.46	31.14	6.61	36.99	2.24	50.46	73.90	23.4	262	146	
Hori.	7206.000	PK	46.72	36.48	8.15	37.81	2.24	55.78	73.90	18.1	150	0	
Hori.	9608.000	PK	46.62	38.20	9.14	38.48	2.24	57.72	73.90	16.2	150	0	
Hori.	2390.000	AV	32.84	27.16	14.12	36.83	2.24	39.53	53.90	14.4	147	310	
Hori.	4804.000	AV	35.77	31.14	6.61	36.99	2.24	38.77	53.90	15.1	262	146	
Hori.	7206.000	AV	33.41	36.48	8.15	37.81	2.24	42.47	53.90	11.4	150	0	
Hori.	9608.000	AV	34.20	38.20	9.14	38.48	2.24	45.30	53.90	8.6	150	0	
Vert.	46.811	QP	38.80	11.89	7.21	31.89	0.00	26.01	40.00	13.9	100	4	
Vert.	48.001	QP	45.40	11.46	7.22	31.89	0.00	32.19	40.00	7.8	100	11	
Vert.	60.021	QP	40.50	7.72	7.06	31.88	0.00	23.40	40.00	16.6	100	332	
Vert.	65.997	QP	32.90	6.82	7.07	31.88	0.00	14.91	40.00	25.0	100	246	
Vert.	204.005	QP	30.70	11.39	5.70	31.76	0.00	16.03	43.50	27.4	100	20	
Vert.	384.010	QP	31.60	15.43	7.03	31.62	0.00	22.44	46.00	23.5	100	273	
Vert.	2390.000	PK	46.65	27.16	14.12	36.83	2.24	53.34	73.90	20.6	127	47	
Vert.	4804.000	PK	47.25	31.14	6.61	36.99	2.24	50.25	73.90	23.7	160	6	
Vert.	7206.000	PK	46.91	36.48	8.15	37.81	2.24	55.97	73.90	17.9	154	2	
Vert.	9608.000	PK	46.36	38.20	9.14	38.48	2.24	57.46	73.90	16.4	150	0	
Vert.	2390.000	AV	32.91	27.16	14.12	36.83	2.24	39.60	53.90	14.3	127	47	
Vert.	4804.000	AV	35.87	31.14	6.61	36.99	2.24	38.87	53.90	15.0	160	6	
Vert.	7206.000	AV	34.14	36.48	8.15	37.81	2.24	43.20	53.90	10.7	154	2	
Vert.	9608.000	AV	34.17	38.20	9.14	38.48	2.24	45.27	53.90	8.6	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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	78.98	27.20	14.13	36.83	2.24	85.72	-	-	Carrier
Hori.	2400.000	PK	37.83	27.20	14.12	36.83	2.24	44.56	65.72	21.2	
Vert.	2402.000	PK	84.95	27.20	14.13	36.83	2.24	91.69	-	-	Carrier
Vert.	2400.000	PK	38.43	27.20	14.12	36.83	2.24	45.16	71.69	26.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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

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Shonan EMC Lab.

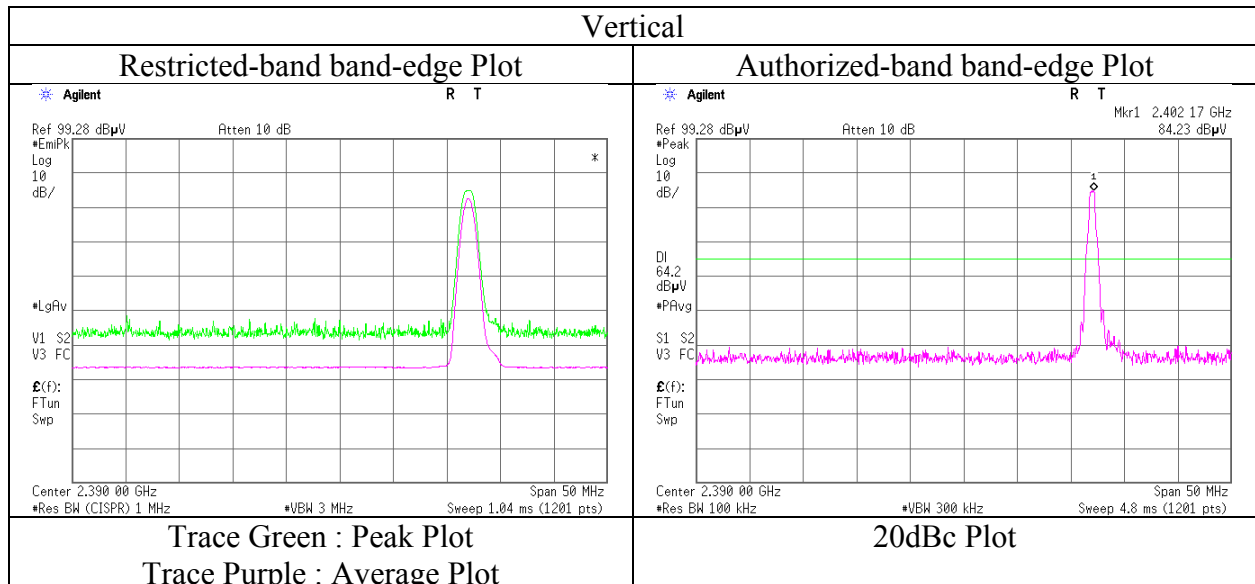
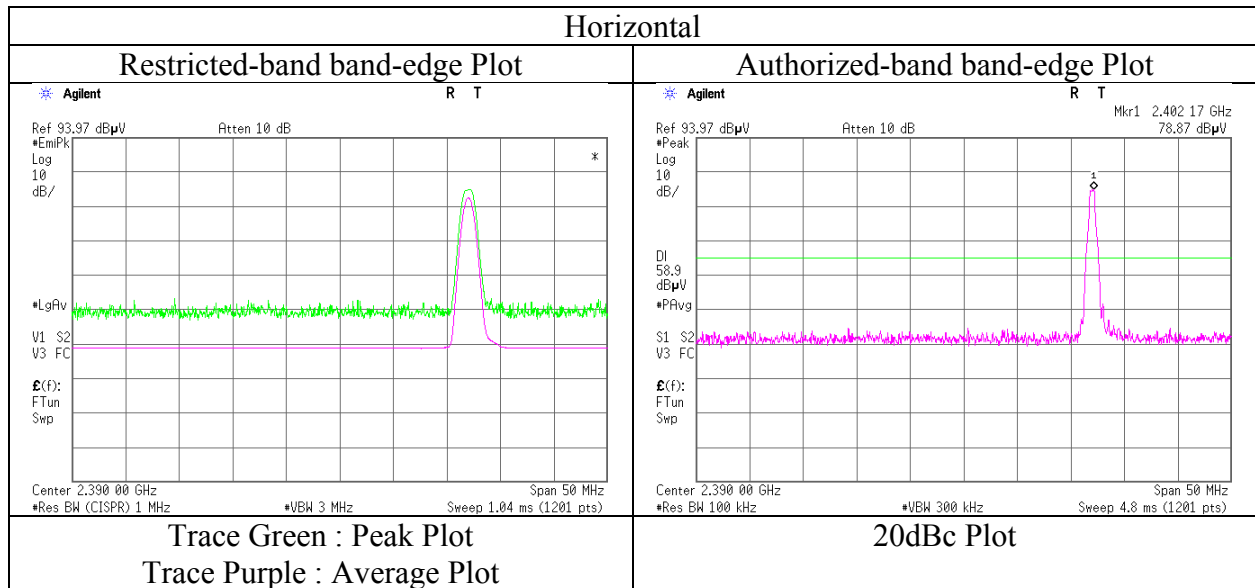
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12053884S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	January 15, 2018
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Yosuke Ishikawa
	(1 GHz -18 GHz)
Mode	Tx, Hopping Off, DH5 2402 MHz



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

Radiated Spurious Emission

Report No. 12053884S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date January 16, 2018 January 15, 2018
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH
Engineer Yosuke Ishikawa Yosuke Ishikawa
(30 MHz – 1000 MHz) (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.	48.010	QP	37.30	11.46	7.22	31.89	0.00	24.09	40.00	15.9	202	230	
Hori.	60.019	QP	42.20	7.72	7.06	31.88	0.00	25.10	40.00	14.9	343	249	
Hori.	77.986	QP	33.90	6.20	8.01	31.87	0.00	16.24	40.00	23.7	236	215	
Hori.	96.004	QP	28.20	9.27	8.10	31.85	0.00	13.72	43.50	29.7	319	240	
Hori.	107.994	QP	28.10	11.20	7.97	31.84	0.00	15.43	43.50	28.0	275	59	
Hori.	186.057	QP	26.60	16.19	8.81	31.78	0.00	19.82	43.50	23.6	156	3	
Hori.	288.017	QP	31.40	12.99	6.36	31.68	0.00	19.07	46.00	26.9	100	303	
Hori.	348.002	QP	30.60	14.56	6.80	31.61	0.00	20.35	46.00	25.6	100	227	
Hori.	4882.000	PK	47.61	31.31	6.64	37.03	2.24	50.77	73.90	23.1	194	151	
Hori.	7323.000	PK	47.84	36.65	8.18	37.88	2.24	57.03	73.90	16.9	150	0	
Hori.	9764.000	PK	47.20	38.51	9.19	38.67	2.24	58.47	73.90	15.4	150	0	
Hori.	4882.000	AV	36.74	31.31	6.64	37.03	2.24	39.90	53.90	14.0	194	151	
Hori.	7323.000	AV	33.61	36.65	8.18	37.88	2.24	42.80	53.90	11.1	150	0	
Hori.	9764.000	AV	34.56	38.51	9.19	38.67	2.24	45.83	53.90	8.1	150	0	
Vert.	46.808	QP	39.10	11.89	7.21	31.89	0.00	26.31	40.00	13.6	100	2	
Vert.	48.004	QP	45.60	11.46	7.22	31.89	0.00	32.39	40.00	7.6	100	351	
Vert.	62.777	QP	39.90	7.30	7.03	31.88	0.00	22.35	40.00	17.6	100	69	
Vert.	66.005	QP	32.70	6.82	7.07	31.88	0.00	14.71	40.00	25.2	100	230	
Vert.	77.995	QP	28.60	6.20	8.01	31.87	0.00	10.94	40.00	29.0	100	89	
Vert.	384.009	QP	31.60	15.43	7.03	31.62	0.00	22.44	46.00	23.5	100	273	
Vert.	4882.000	PK	47.19	31.31	6.64	37.03	2.24	50.35	73.90	23.6	153	4	
Vert.	7323.000	PK	48.06	36.65	8.18	37.88	2.24	57.25	73.90	16.7	161	3	
Vert.	9764.000	PK	47.22	38.51	9.19	38.67	2.24	58.49	73.90	15.4	150	0	
Vert.	4882.000	AV	35.55	31.31	6.64	37.03	2.24	38.71	53.90	15.2	153	4	
Vert.	7323.000	AV	34.38	36.65	8.18	37.88	2.24	43.57	53.90	10.3	161	3	
Vert.	9764.000	AV	34.51	38.51	9.19	38.67	2.24	45.78	53.90	8.1	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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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Shonan EMC Lab.

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

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Facsimile : +81 463 50 6401

Radiated Spurious Emission

Report No. 12053884S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date January 16, 2018 January 15, 2018
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH
Engineer Yosuke Ishikawa Yosuke Ishikawa
(30 MHz – 1000 MHz) (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.	48.013	QP	37.00	11.46	7.22	31.89	0.00	23.79	40.00	16.2	212	237	
Hori.	78.006	QP	34.40	6.20	8.01	31.87	0.00	16.74	40.00	23.2	246	223	
Hori.	84.010	QP	33.40	6.96	8.20	31.86	0.00	16.70	40.00	23.3	328	36	
Hori.	168.017	QP	26.30	15.65	8.82	31.79	0.00	18.98	43.50	24.5	202	5	
Hori.	186.021	QP	26.80	16.19	8.81	31.78	0.00	20.02	43.50	23.4	195	4	
Hori.	215.999	QP	34.30	11.48	5.80	31.74	0.00	19.84	43.50	23.6	100	265	
Hori.	324.011	QP	33.50	13.97	6.62	31.65	0.00	22.44	46.00	23.5	100	227	
Hori.	2483.500	PK	46.59	27.48	14.23	36.79	2.24	53.75	73.90	20.2	266	299	
Hori.	4960.000	PK	46.97	31.48	6.67	37.07	2.24	50.29	73.90	23.6	190	150	
Hori.	7440.000	PK	46.96	36.81	8.20	37.95	2.24	56.26	73.90	17.6	150	0	
Hori.	9920.000	PK	47.52	38.82	9.21	38.87	2.24	58.92	73.90	15.0	150	0	
Hori.	2483.500	AV	32.79	27.48	14.23	36.79	2.24	39.95	53.90	14.0	266	299	
Hori.	4960.000	AV	35.78	31.48	6.67	37.07	2.24	39.10	53.90	14.8	190	150	
Hori.	7440.000	AV	33.71	36.81	8.20	37.95	2.24	43.01	53.90	10.9	150	0	
Hori.	9920.000	AV	34.70	38.82	9.21	38.87	2.24	46.10	53.90	7.8	150	0	
Vert.	46.806	QP	38.60	11.89	7.21	31.89	0.00	25.81	40.00	14.1	100	8	
Vert.	48.003	QP	45.20	11.46	7.22	31.89	0.00	31.99	40.00	8.0	100	4	
Vert.	54.007	QP	27.70	9.53	7.24	31.89	0.00	12.58	40.00	27.4	100	148	
Vert.	60.026	QP	41.30	7.72	7.06	31.88	0.00	24.20	40.00	15.8	100	339	
Vert.	63.770	QP	39.60	7.15	7.02	31.88	0.00	21.89	40.00	18.1	100	81	
Vert.	240.020	QP	32.40	11.66	5.99	31.71	0.00	18.34	46.00	27.6	100	134	
Vert.	2483.500	PK	46.96	27.48	14.23	36.79	2.24	54.12	73.90	19.8	109	1	
Vert.	4960.000	PK	47.60	31.48	6.67	37.07	2.24	50.92	73.90	23.0	137	9	
Vert.	7440.000	PK	47.11	36.81	8.20	37.95	2.24	56.41	73.90	17.5	177	2	
Vert.	9920.000	PK	47.65	38.82	9.21	38.87	2.24	59.05	73.90	14.9	150	0	
Vert.	2483.500	AV	32.83	27.48	14.23	36.79	2.24	39.99	53.90	13.9	109	1	
Vert.	4960.000	AV	37.13	31.48	6.67	37.07	2.24	40.45	53.90	13.5	137	9	
Vert.	7440.000	AV	34.16	36.81	8.20	37.95	2.24	43.46	53.90	10.4	177	2	
Vert.	9920.000	AV	34.61	38.82	9.21	38.87	2.24	46.01	53.90	7.9	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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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Shonan EMC Lab.

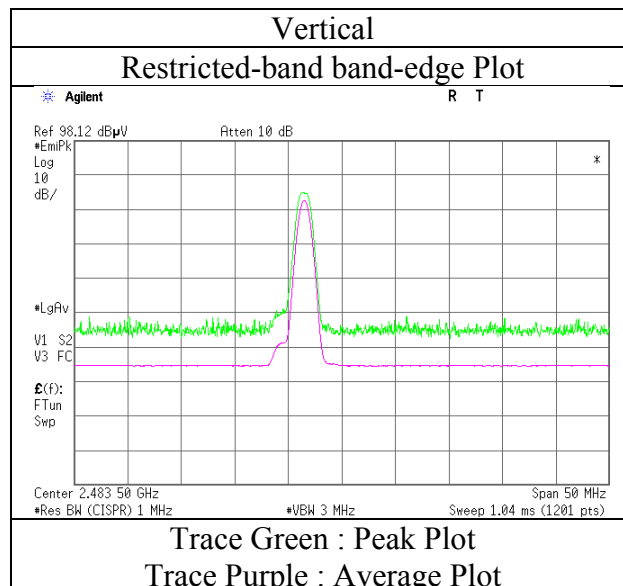
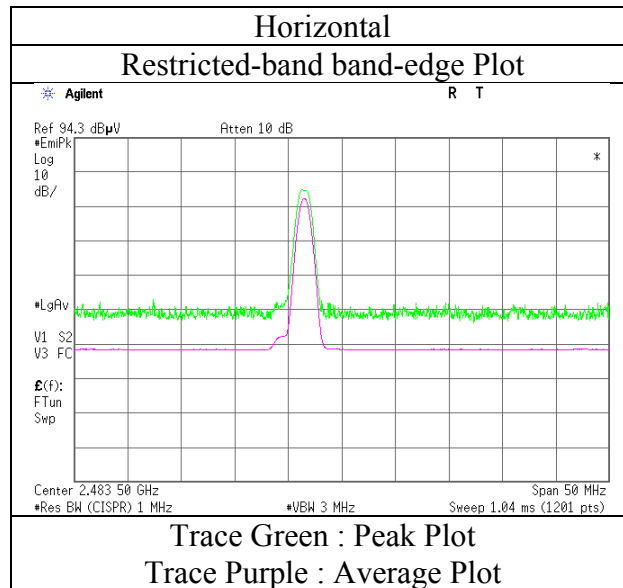
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12053884S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	January 15, 2018
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Yosuke Ishikawa
	(1 GHz – 18 GHz)
Mode	Tx, Hopping Off, DH5 2480 MHz



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

Radiated Spurious Emission

Report No. 12053884S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date January 16, 2018 January 15, 2018
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH
Engineer Yosuke Ishikawa Yosuke Ishikawa
(30 MHz – 1000 MHz) (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.	48.017	QP	37.00	11.45	7.22	31.89	0.00	23.78	40.00	16.2	236	240	
Hori.	60.018	QP	42.70	7.72	7.06	31.88	0.00	25.60	40.00	14.4	337	248	
Hori.	78.005	QP	34.50	6.20	8.01	31.87	0.00	16.84	40.00	23.1	261	232	
Hori.	108.010	QP	28.10	11.20	7.97	31.84	0.00	15.43	43.50	28.0	281	63	
Hori.	132.012	QP	25.30	13.78	8.23	31.82	0.00	15.49	43.50	28.0	229	246	
Hori.	156.010	QP	29.50	15.13	8.74	31.80	0.00	21.57	43.50	21.9	212	2	
Hori.	192.018	QP	28.90	16.26	8.84	31.77	0.00	22.23	43.50	21.2	191	176	
Hori.	258.026	QP	33.60	12.00	6.13	31.69	0.00	20.04	46.00	25.9	131	161	
Hori.	2390.000	PK	46.65	27.16	14.12	36.83	2.24	53.34	73.90	20.6	147	309	
Hori.	4804.000	PK	46.93	31.14	6.61	36.99	2.24	49.93	73.90	24.0	185	142	
Hori.	7206.000	PK	46.82	36.48	8.15	37.81	2.24	55.88	73.90	18.0	150	0	
Hori.	9608.000	PK	47.11	38.20	9.14	38.48	2.24	58.21	73.90	15.7	150	0	
Hori.	2390.000	AV	32.88	27.16	14.12	36.83	2.24	39.57	53.90	14.3	147	309	
Hori.	4804.000	AV	33.49	31.14	6.61	36.99	2.24	36.49	53.90	17.4	185	142	
Hori.	7206.000	AV	33.41	36.48	8.15	37.81	2.24	42.47	53.90	11.4	150	0	
Hori.	9608.000	AV	34.11	38.20	9.14	38.48	2.24	45.21	53.90	8.7	150	0	
Vert.	42.001	QP	24.50	13.63	7.11	31.89	0.00	13.35	40.00	26.6	100	354	
Vert.	46.813	QP	38.60	11.89	7.21	31.89	0.00	25.81	40.00	14.1	100	11	
Vert.	48.004	QP	45.00	11.46	7.22	31.89	0.00	31.79	40.00	8.2	100	2	
Vert.	62.781	QP	40.30	7.30	7.03	31.88	0.00	22.75	40.00	17.2	100	94	
Vert.	264.026	QP	35.90	12.20	6.18	31.69	0.00	22.59	46.00	23.4	100	148	
Vert.	2390.000	PK	46.77	27.16	14.12	36.83	2.24	53.46	73.90	20.4	130	47	
Vert.	4804.000	PK	46.71	31.14	6.61	36.99	2.24	49.71	73.90	24.2	156	6	
Vert.	7206.000	PK	47.11	36.48	8.15	37.81	2.24	56.17	73.90	17.7	163	10	
Vert.	9608.000	PK	47.10	38.20	9.14	38.48	2.24	58.20	73.90	15.7	150	0	
Vert.	2390.000	AV	32.96	27.16	14.12	36.83	2.24	39.65	53.90	14.3	130	47	
Vert.	4804.000	AV	33.57	31.14	6.61	36.99	2.24	36.57	53.90	17.3	156	6	
Vert.	7206.000	AV	33.67	36.48	8.15	37.81	2.24	42.73	53.90	11.2	163	10	
Vert.	9608.000	AV	34.14	38.20	9.14	38.48	2.24	45.24	53.90	8.7	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

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	79.75	27.20	14.13	36.83	2.24	86.49	-	-	Carrier
Hori.	2400.000	PK	37.76	27.20	14.12	36.83	2.24	44.49	66.49	22.0	
Vert.	2402.000	PK	84.80	27.20	14.13	36.83	2.24	91.54	-	-	Carrier
Vert.	2400.000	PK	38.56	27.20	14.12	36.83	2.24	45.29	71.54	26.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88 \text{ m} / 3.0 \text{ m}) = 2.24 \text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

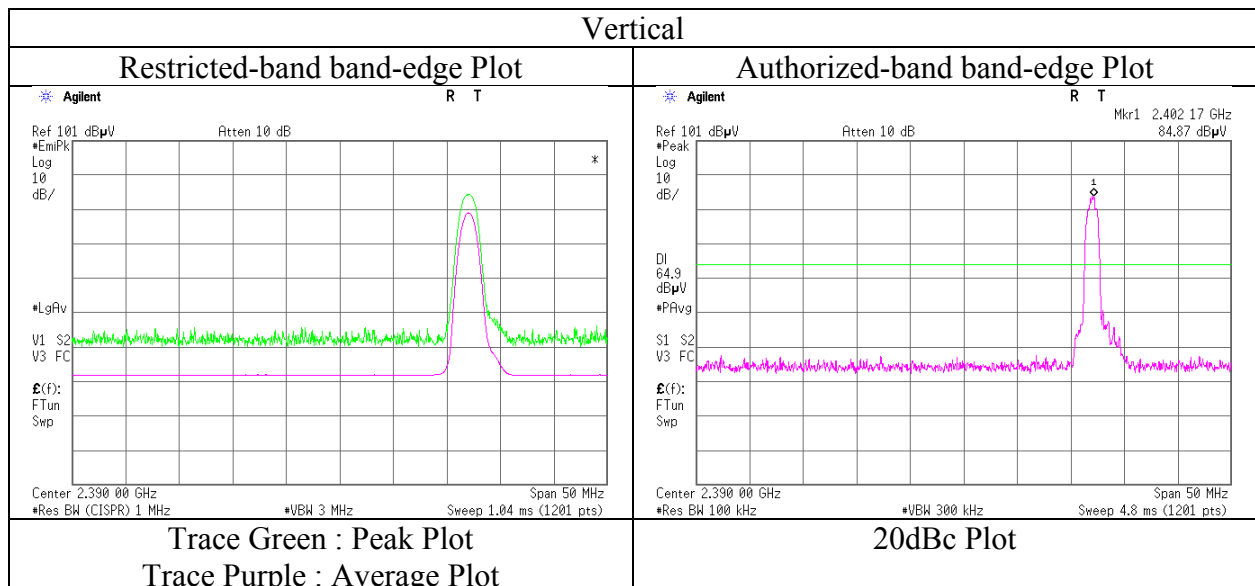
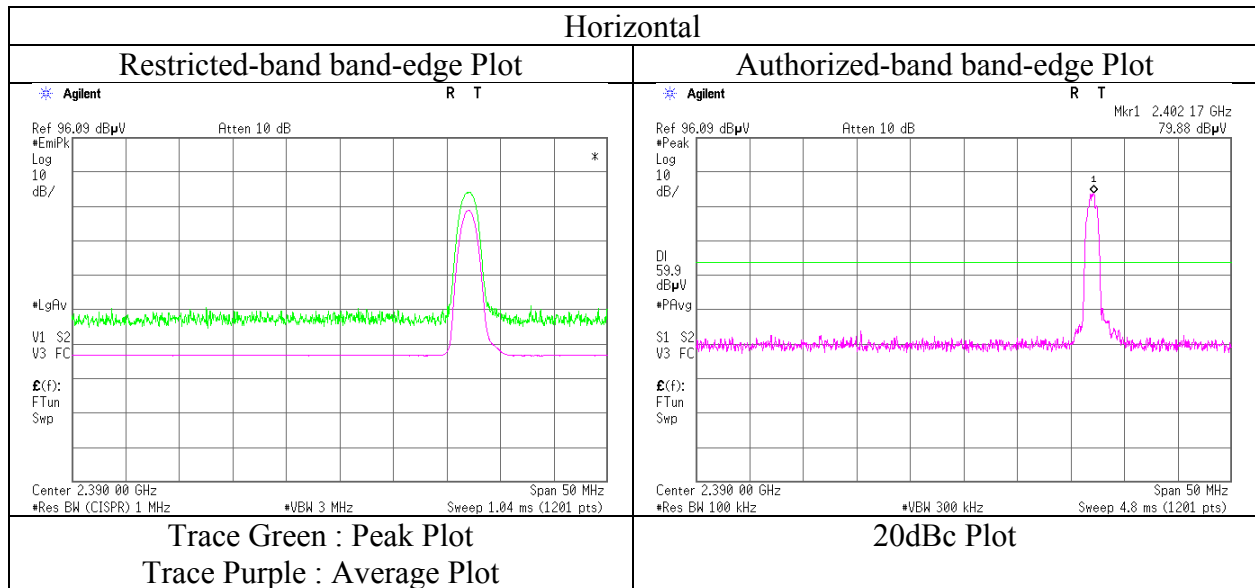
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12053884S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	January 15, 2018
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Yosuke Ishikawa
	(1 GHz – 18 GHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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

Radiated Spurious Emission

Report No. 12053884S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date January 16, 2018 January 15, 2018
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH
Engineer Yosuke Ishikawa Yosuke Ishikawa
(30 MHz – 1000 MHz) (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.	60.029	QP	41.60	7.72	7.06	31.88	0.00	24.50	40.00	15.5	353	245	
Hori.	78.012	QP	34.50	6.20	8.01	31.87	0.00	16.84	40.00	23.1	278	229	
Hori.	84.008	QP	33.80	6.96	8.20	31.86	0.00	17.10	40.00	22.9	361	45	
Hori.	192.006	QP	29.30	16.26	8.84	31.77	0.00	22.63	43.50	20.8	217	173	
Hori.	198.050	QP	28.30	16.32	8.88	31.77	0.00	21.73	43.50	21.7	192	177	
Hori.	300.002	QP	31.20	13.39	6.45	31.68	0.00	19.36	46.00	26.6	100	236	
Hori.	4882.000	PK	46.87	31.31	6.64	37.03	2.24	50.03	73.90	23.9	189	153	
Hori.	7323.000	PK	47.42	36.65	8.18	37.88	2.24	56.61	73.90	17.3	150	0	
Hori.	9764.000	PK	47.07	38.51	9.19	38.67	2.24	58.34	73.90	15.6	150	0	
Hori.	4882.000	AV	34.01	31.31	6.64	37.03	2.24	37.17	53.90	16.7	189	153	
Hori.	7323.000	AV	33.61	36.65	8.18	37.88	2.24	42.80	53.90	11.1	150	0	
Hori.	9764.000	AV	34.67	38.51	9.19	38.67	2.24	45.94	53.90	8.0	150	0	
Vert.	46.803	QP	37.90	11.89	7.21	31.89	0.00	25.11	40.00	14.8	100	3	
Vert.	48.005	QP	44.60	11.46	7.22	31.89	0.00	31.39	40.00	8.6	100	7	
Vert.	60.021	QP	41.30	7.72	7.06	31.88	0.00	24.20	40.00	15.8	100	2	
Vert.	63.205	QP	39.40	7.24	7.02	31.88	0.00	21.78	40.00	18.2	100	99	
Vert.	66.005	QP	32.90	6.82	7.07	31.88	0.00	14.91	40.00	25.0	100	206	
Vert.	384.007	QP	31.30	15.43	7.03	31.62	0.00	22.14	46.00	23.8	100	273	
Vert.	4882.000	PK	46.98	31.31	6.64	37.03	2.24	50.14	73.90	23.8	137	4	
Vert.	7323.000	PK	47.01	36.65	8.18	37.88	2.24	56.20	73.90	17.7	144	2	
Vert.	9764.000	PK	47.28	38.51	9.19	38.67	2.24	58.55	73.90	15.4	150	0	
Vert.	4882.000	AV	33.60	31.31	6.64	37.03	2.24	36.76	53.90	17.1	137	4	
Vert.	7323.000	AV	34.11	36.65	8.18	37.88	2.24	43.30	53.90	10.6	144	2	
Vert.	9764.000	AV	34.65	38.51	9.19	38.67	2.24	45.92	53.90	8.0	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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.

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 12053884S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2
Date January 16, 2018 January 15, 2018
Temperature / Humidity 24 deg. C / 36 % RH 22 deg. C / 34 % RH
Engineer Yosuke Ishikawa Yosuke Ishikawa
(30 MHz – 1000 MHz) (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.	60.022	QP	42.00	7.72	7.06	31.88	0.00	24.90	40.00	15.1	329	244	
Hori.	120.013	QP	24.40	12.93	8.01	31.83	0.00	13.51	43.50	29.9	250	55	
Hori.	156.006	QP	29.60	15.13	8.74	31.80	0.00	21.67	43.50	21.8	198	2	
Hori.	192.011	QP	29.40	16.26	8.84	31.77	0.00	22.73	43.50	20.7	160	185	
Hori.	198.024	QP	28.20	16.32	8.88	31.77	0.00	21.63	43.50	21.8	170	182	
Hori.	264.030	QP	38.90	12.20	6.18	31.69	0.00	25.59	46.00	20.4	127	252	
Hori.	2483.500	PK	46.95	27.48	14.23	36.79	2.24	54.11	73.90	19.8	269	298	
Hori.	4960.000	PK	46.60	31.48	6.67	37.07	2.24	49.92	73.90	24.0	161	145	
Hori.	7440.000	PK	47.22	36.81	8.20	37.95	2.24	56.52	73.90	17.4	150	0	
Hori.	9920.000	PK	47.28	38.82	9.21	38.87	2.24	58.68	73.90	15.2	150	0	
Hori.	2483.500	AV	32.77	27.48	14.23	36.79	2.24	39.93	53.90	14.0	269	298	
Hori.	4960.000	AV	33.85	31.48	6.67	37.07	2.24	37.17	53.90	16.7	161	145	
Hori.	7440.000	AV	33.69	36.81	8.20	37.95	2.24	42.99	53.90	10.9	150	0	
Hori.	9920.000	AV	34.67	38.82	9.21	38.87	2.24	46.07	53.90	7.8	150	0	
Vert.	46.811	QP	38.30	11.89	7.21	31.89	0.00	25.51	40.00	14.4	100	7	
Vert.	48.010	QP	44.50	11.46	7.22	31.89	0.00	31.29	40.00	8.7	100	351	
Vert.	54.009	QP	27.50	9.53	7.24	31.89	0.00	12.38	40.00	27.6	100	171	
Vert.	60.029	QP	41.20	7.72	7.06	31.88	0.00	24.10	40.00	15.9	100	340	
Vert.	63.217	QP	39.10	7.24	7.02	31.88	0.00	21.48	40.00	18.5	100	101	
Vert.	78.017	QP	28.50	6.20	8.01	31.87	0.00	10.84	40.00	29.1	100	130	
Vert.	215.999	QP	30.90	11.48	5.80	31.74	0.00	16.44	43.50	27.0	100	105	
Vert.	2483.500	PK	46.86	27.48	14.23	36.79	2.24	54.02	73.90	19.9	180	2	
Vert.	4960.000	PK	46.88	31.48	6.67	37.07	2.24	50.20	73.90	23.7	136	8	
Vert.	7440.000	PK	47.11	36.81	8.20	37.95	2.24	56.41	73.90	17.5	150	0	
Vert.	9920.000	PK	47.31	38.82	9.21	38.87	2.24	58.71	73.90	15.2	150	0	
Vert.	2483.500	AV	32.87	27.48	14.23	36.79	2.24	40.03	53.90	13.9	180	2	
Vert.	4960.000	AV	34.50	31.48	6.67	37.07	2.24	37.82	53.90	16.1	136	8	
Vert.	7440.000	AV	33.70	36.81	8.20	37.95	2.24	43.00	53.90	10.9	150	0	
Vert.	9920.000	AV	34.69	38.82	9.21	38.87	2.24	46.09	53.90	7.8	150	0	

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

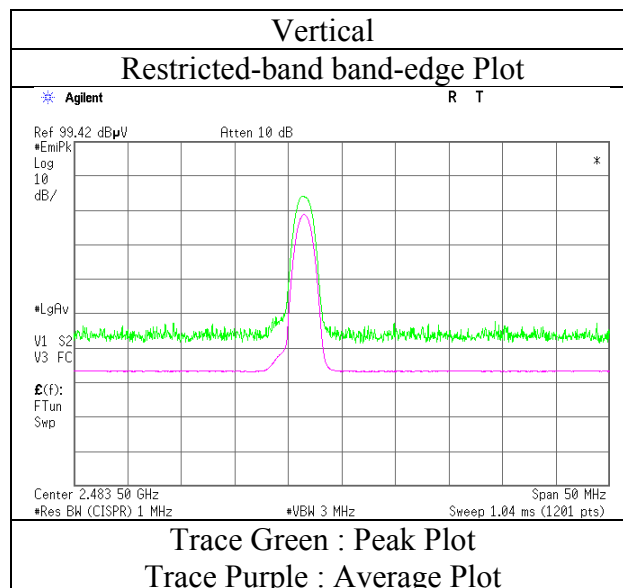
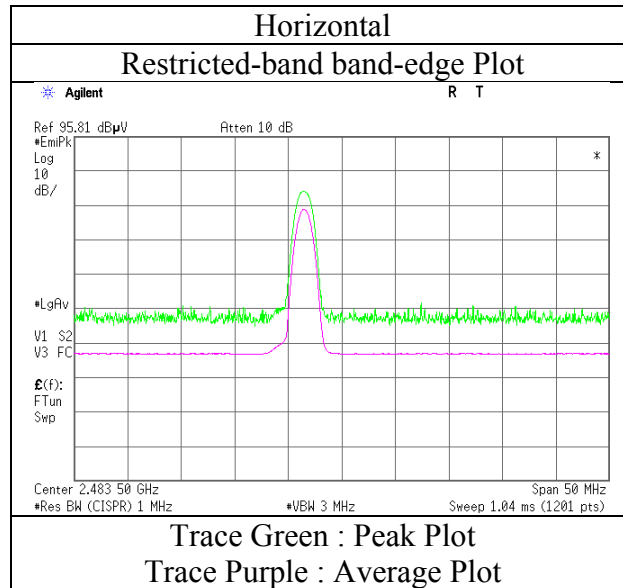
Distance factor : 1 GHz - 13 GHz : $20\log(3.88\text{ m} / 3.0\text{ m}) = 2.24\text{ dB}$

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 (Reference Plot for band-edge)

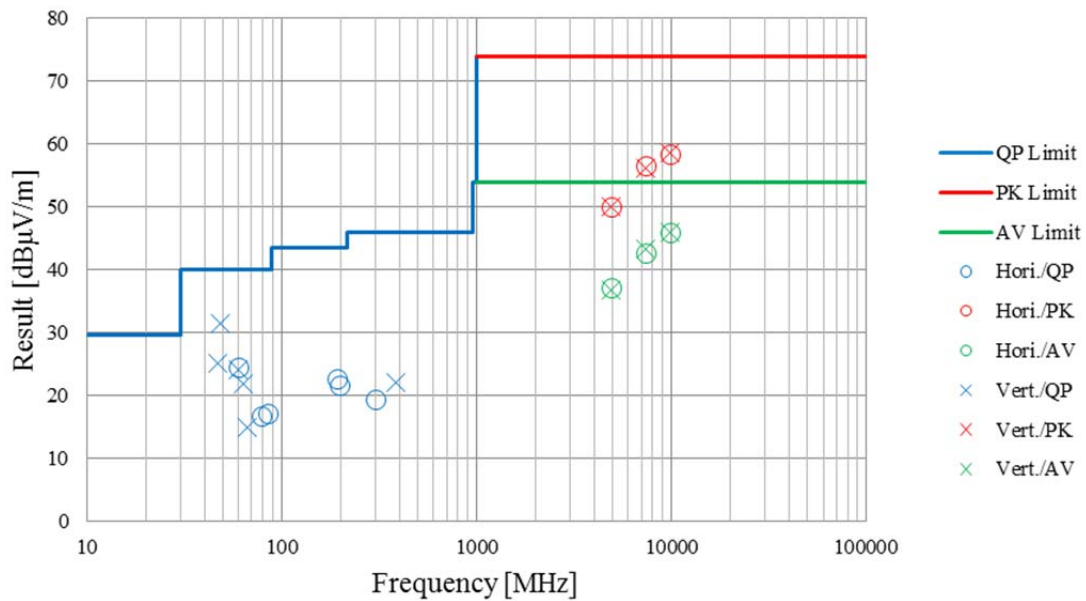
Report No.	12053884S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	January 15, 2018
Temperature / Humidity	22 deg. C / 34 % RH
Engineer	Yosuke Ishikawa
	(1 GHz – 18 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12053884S-A	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	2	2
Date	January 16, 2018	January 15, 2018
Temperature / Humidity	24 deg. C / 36 % RH	22 deg. C / 34 % RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa
	(30 MHz – 1000 MHz)	(1 GHz – 18 GHz)
	(18 GHz – 26.5 GHz)	
Mode	Tx, Hopping Off, 3DH5 2441 MHz	

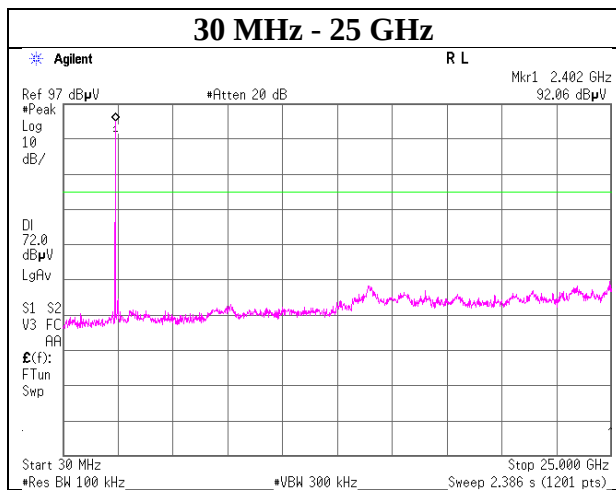
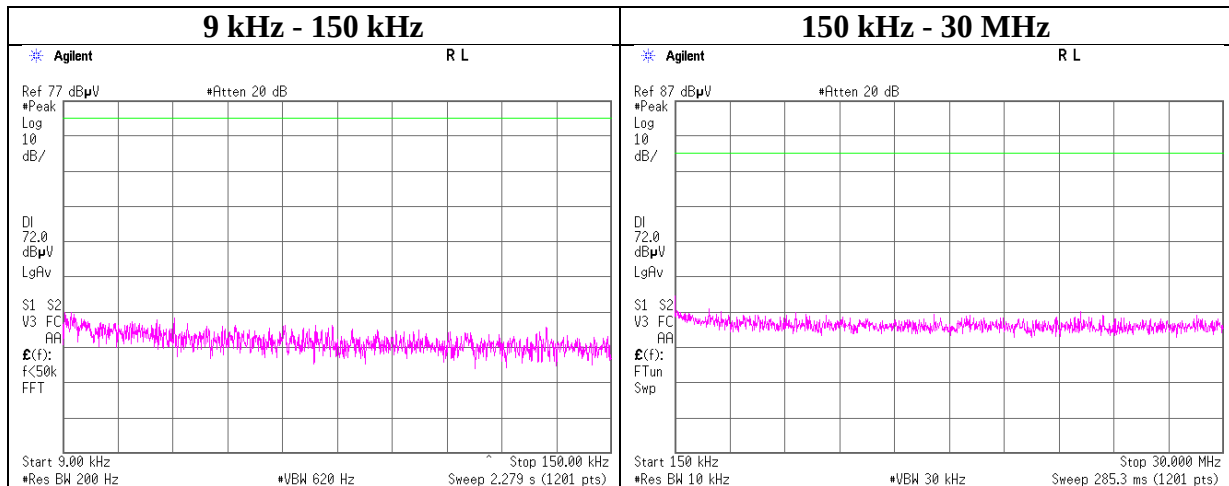


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off, DH5

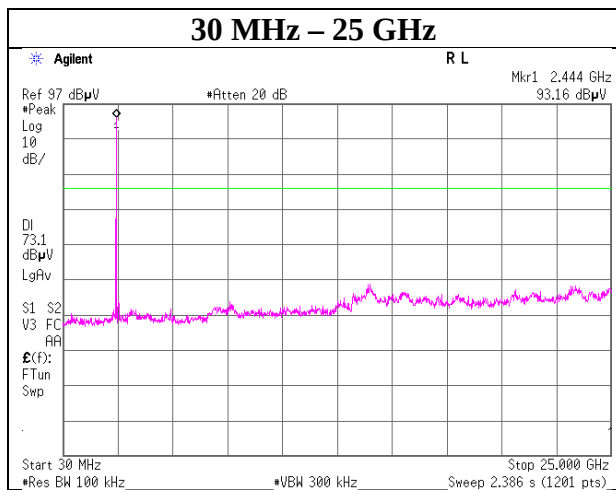
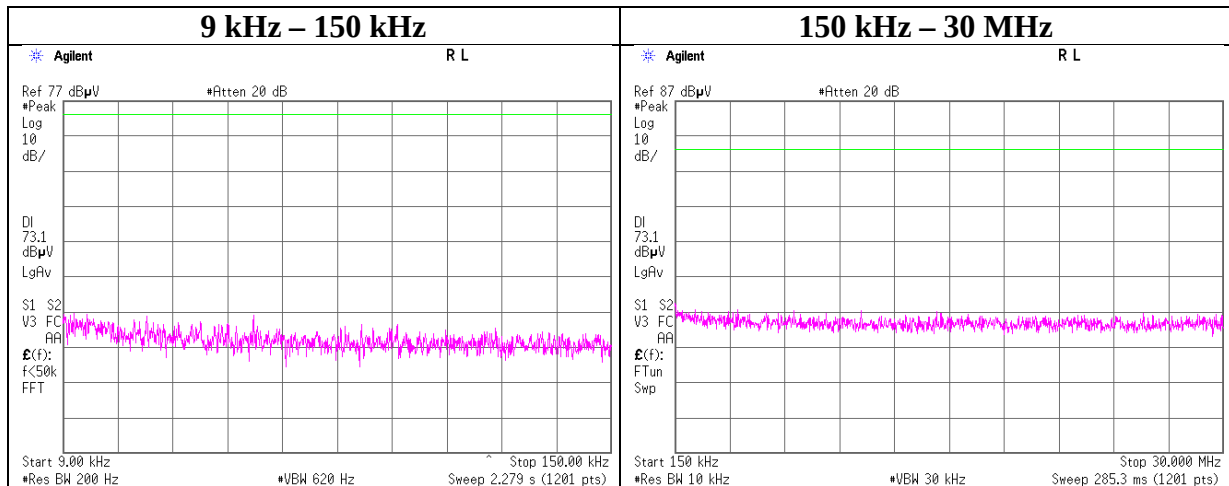
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off, DH5

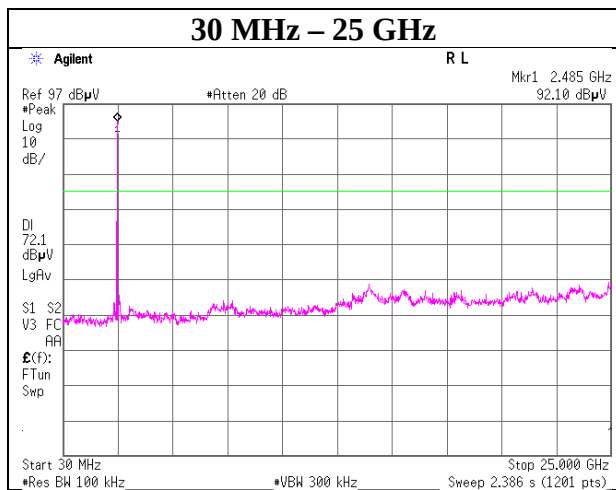
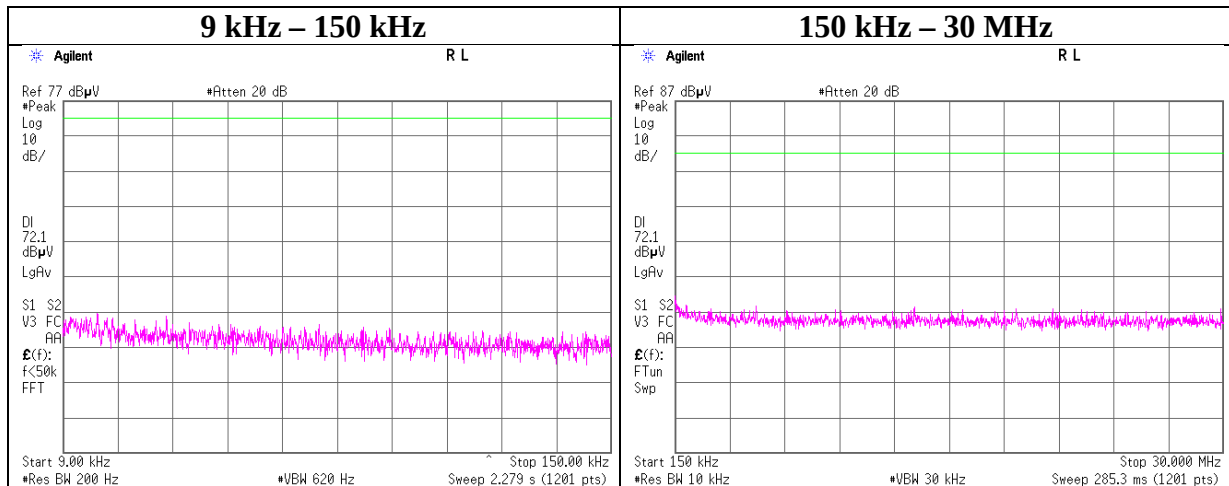
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off, DH5

2480 MHz



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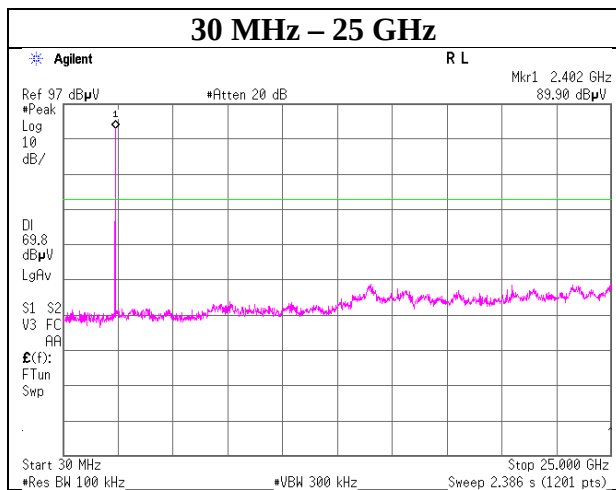
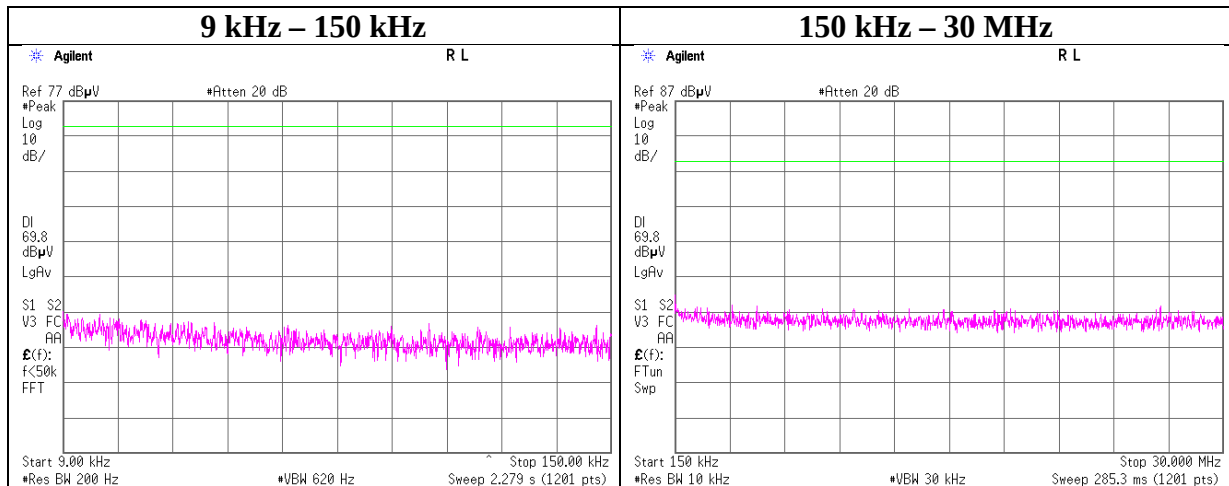
Telephone : +81 463 50 6400

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Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off, 3DH5

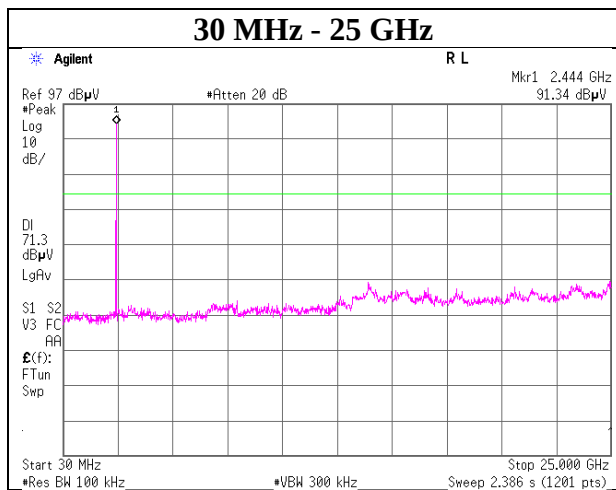
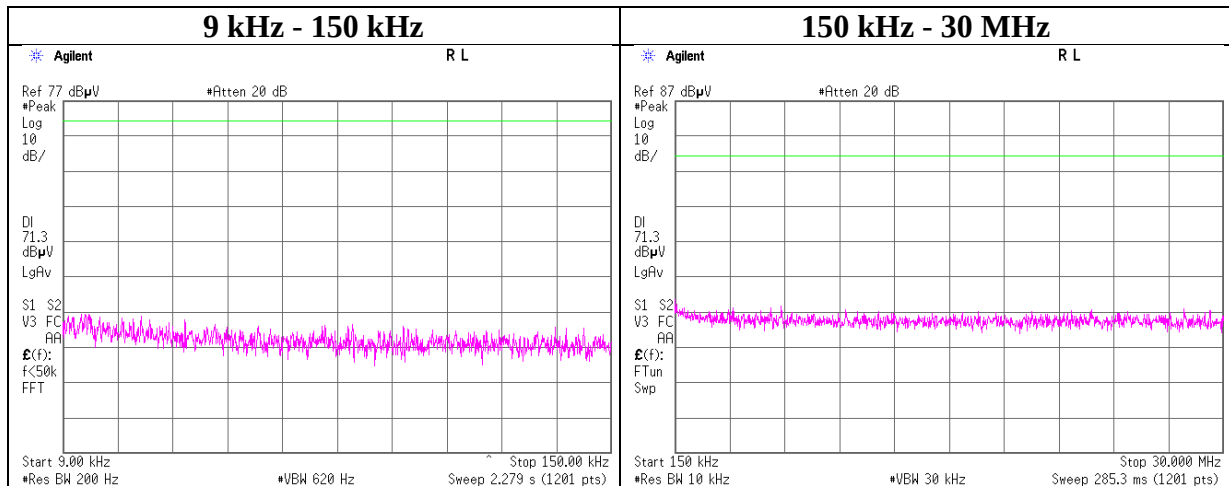
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off, 3DH5

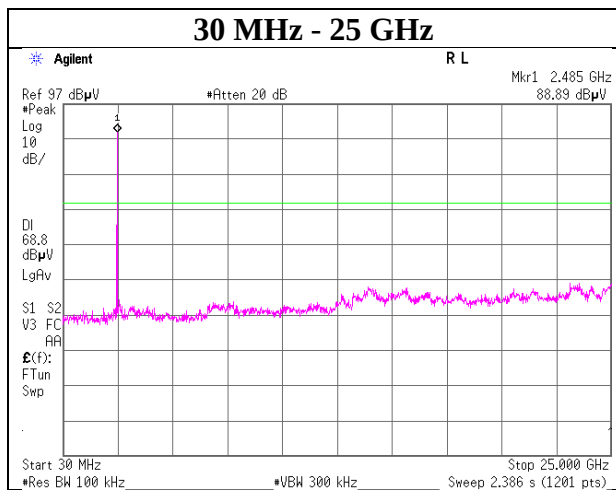
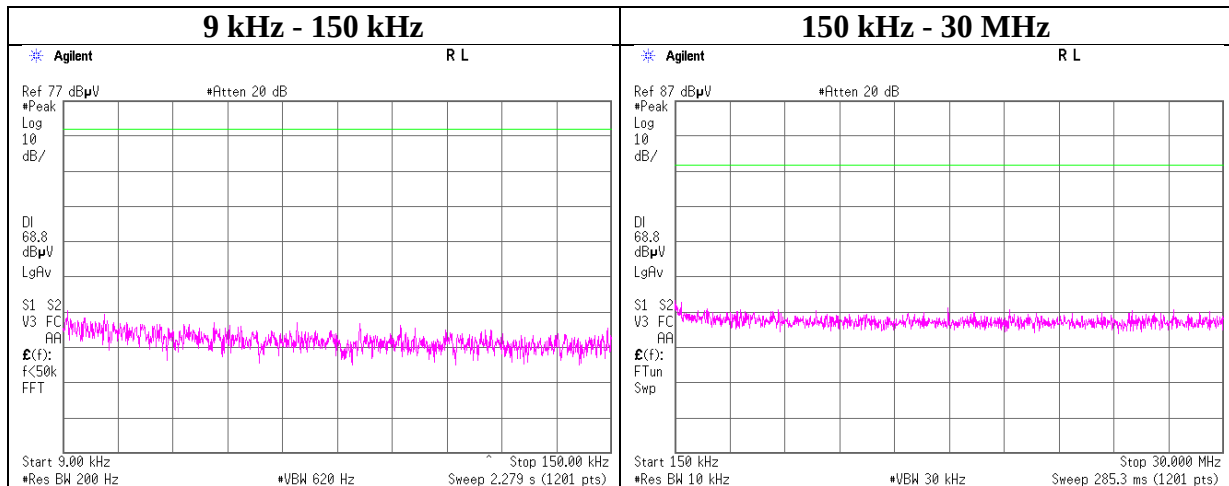
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx, Hopping Off, 3DH5

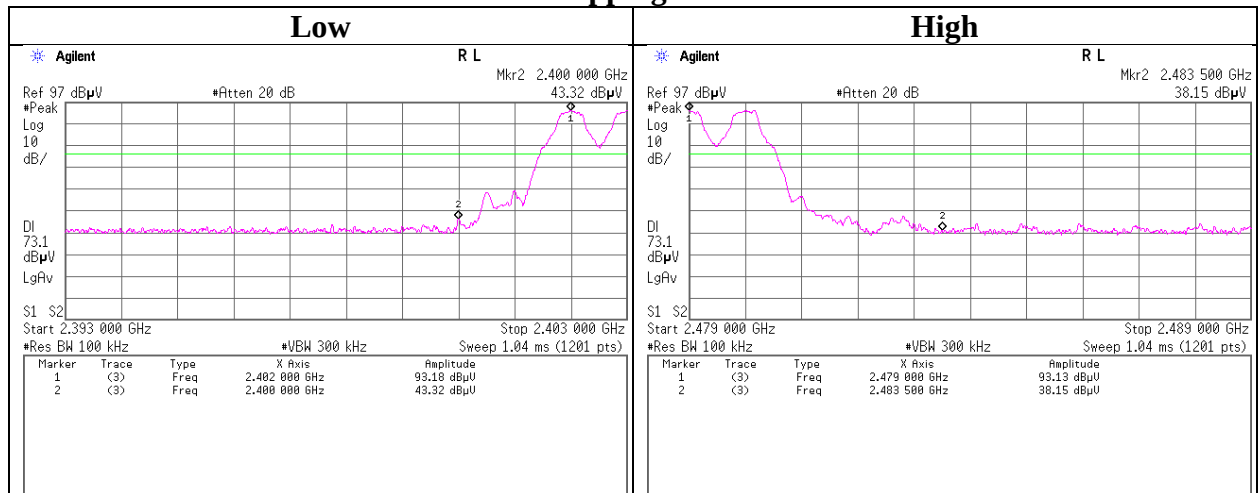
2480 MHz



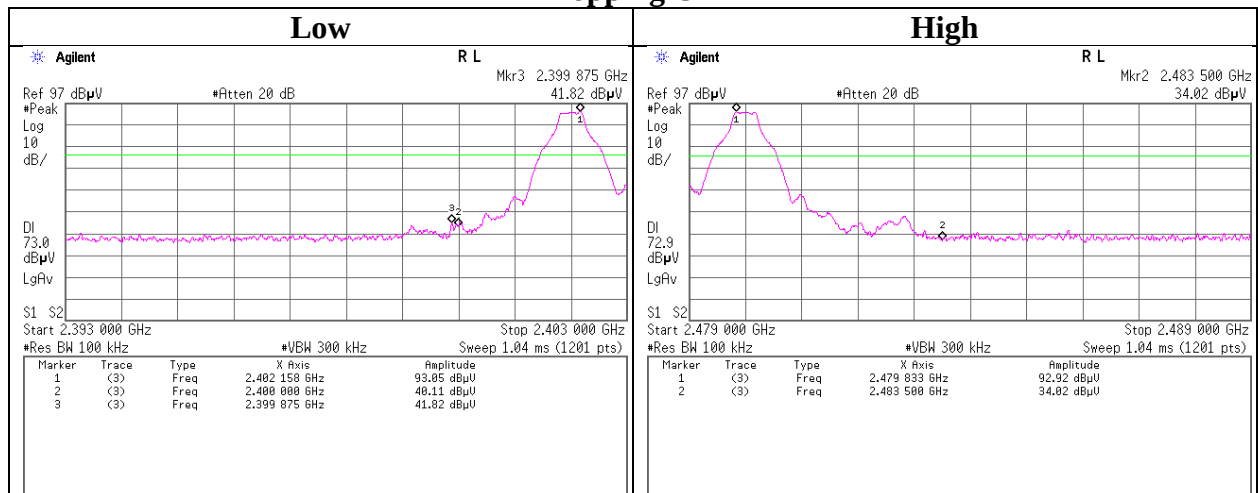
Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	12053884S-A
Date	January 9, 2018
Temperature / Humidity	23 deg. C / 47 % RH
Engineer	Makoto Hosaka
Mode	Tx DH5

Hopping On



Hopping Off



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Shonan EMC Lab.

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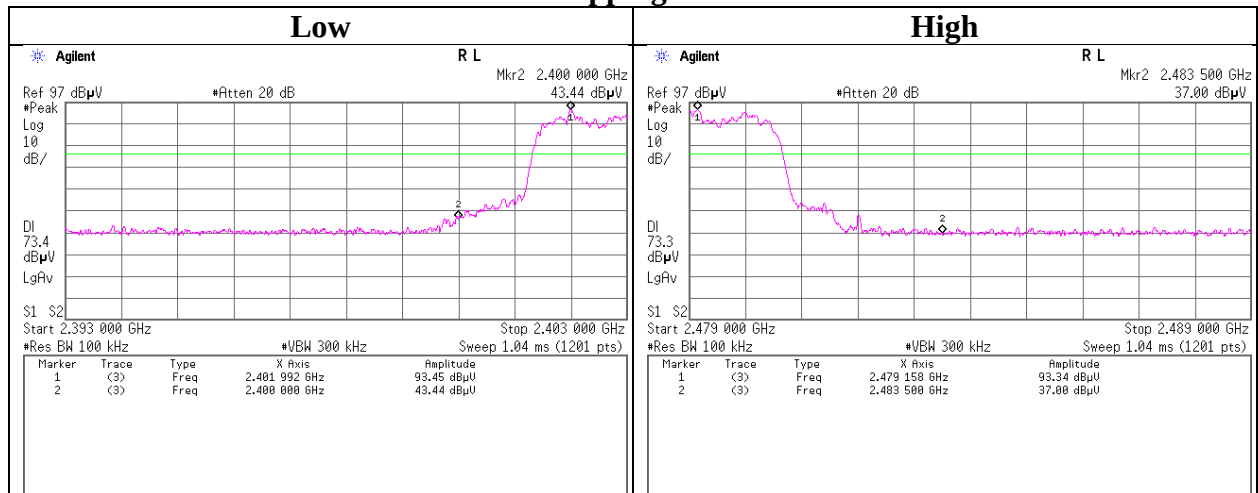
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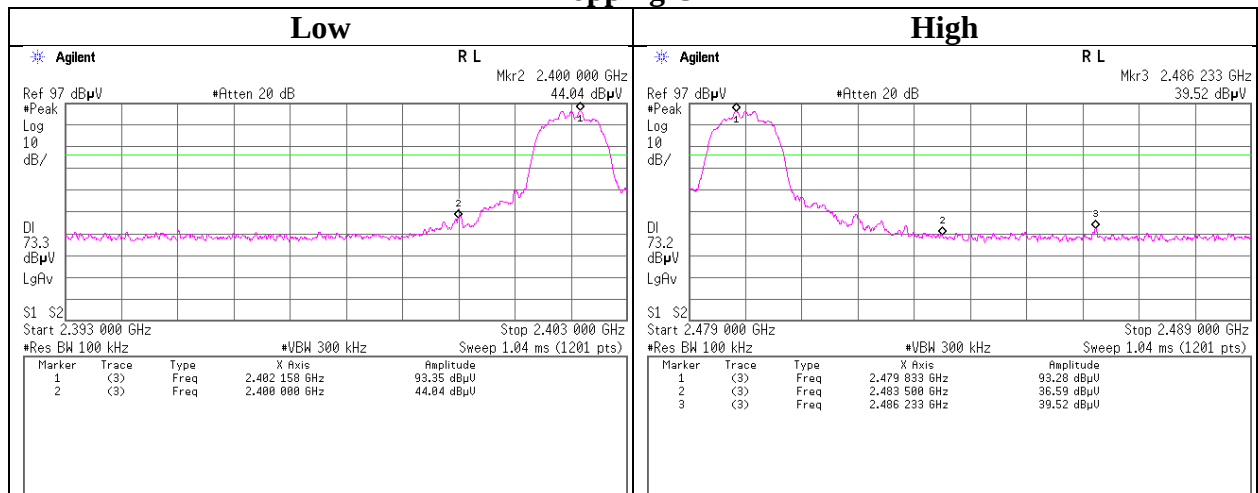
Conducted Emission Band Edge compliance

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 12053884S-A
Date : January 9, 2018
Temperature / Humidity : 23 deg. C / 47 % RH
Engineer : Makoto Hosaka
Mode : Tx 3DH5

Hopping On



Hopping Off



UL Japan, Inc.

Shonan EMC Lab.

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APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	AT	2017/10/12 * 12
SAT10-12	Attenuator	Weinschel Corp.	54A-10	81601	AT	2017/03/23 * 12
SCC-G32	Coaxial Cable	Junkosha	MWX241-02000 KMSKMS	OCT-09-13-005	AT	2017/11/22 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2017/10/16 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2017/02/17 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2017/06/13 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2017/05/08 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000 NFSNMS/B	1612S005	RE	2017/01/08 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2017/08/14 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2017/10/30 * 12
SRENT-08	Spectrum Analyzer	Agilent	E4448A	MY50180019	RE	2017/10/12 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE	-
SAEC-02(SVSW R)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSW R)	2	RE	2017/07/18 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,C E,RFI,MF)	-	RE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE	2017/03/08 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2017/11/22 * 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-G19	Coaxial Cable	Suhner	SUCOFLEX 102A	1188/2A	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2017/04/20 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2017/02/09 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2017/02/09 * 12
SAT3-11	Attenuator	JFW	50HF-003N	-	RE	2017/02/23 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2017/11/23 * 12
SCC-B1/B3/B5/B 7/B8/B13/SRSE- 02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhne r/Suhner/Suhner/Suhner/ TOYO	8D2W/12DSFA/1 41PE/141PE/141P E/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SCC-B2/B4/B6/B 7/B8/B13/SRSE- 02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhne r/Suhner/Suhner/Suhner/ TOYO	8D2W/12DSFA/1 41PE/141PE/141P E/141PE/NS4906	-/0901-270(RF Selector)	RE	2017/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2017/01/05 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2017/09/26 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2017/06/08 * 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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