



RADIO TEST REPORT

Test Report No. : 11284471S-A-R2

Applicant : Alpine Electronics, Inc.
Type of Equipment : Display and audio unit
Model No. : iLX-107
FCC ID : A269ZUA148
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the 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 11284471S-A-R1. 11284471S-A-R1 is replaced with this report.

Date of test: July 23 to September 7, 2016

Representative test engineer:


Yosuke Ishikawa
Engineer
Consumer Technology Division

Approved by:


Akio Hayashi
Leader
Consumer Technology Division



- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

13-EM-F0429

[illegible]

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Radiated Spurious Emission	11
SECTION 6: Antenna Terminal Conducted Tests.....	12
APPENDIX 1: Test data	13
20dB Bandwidth and Carrier Frequency Separation.....	13
Number of Hopping Frequency	16
Dwell time.....	18
Maximum Peak Output Power	21
Average Output Power	22
Radiated Spurious Emission	24
Conducted Spurious Emission	35
Conducted Emission Band Edge compliance	41
99%Occupied Bandwidth	43
APPENDIX 2: Test instruments	45
APPENDIX 3: Photographs of test setup	46
Radiated Spurious Emission	46

SECTION 1: Customer information

Company Name	:	Alpine Electronics, Inc.
Address	:	20-1 Yoshima-Kogyodanchi, Iwaki-shi, Fukushima, 970-1192 Japan
Telephone Number	:	+81-246-36-4111
Facsimile Number	:	+81-246-36-6492
Contact Person	:	Mitsuru Yoshida

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

2.1 Identification of E.U.T.

Type of Equipment	:	Display and audio unit
Model No.	:	iLX-107
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 12 V
Receipt Date of Sample	:	July 21, 2016
Country of Mass-production	:	Japan
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: iLX-107 (referred to as the EUT in this report) is a Display and audio unit.

General Specification

Clock frequency(ies) in the system	:	37.4 MHz (RF Module)
------------------------------------	---	----------------------

Radio Specification

Bluetooth

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	FHSS
Power Supply (radio part input)	:	DC 3.3 V / 1.8 V
Antenna type	:	Chip
Antenna Gain (without cable loss)	:	1.9 dBi
Antenna Cable	:	0.15 dB

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on November 14, 2016 and effective December 14, 2016
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 14, 2016, 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 *1)
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (2)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1) IC: RSS-247 5.1 (1)		-	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (4)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 IC: -	FCC: Section15.247(a)(1)(iii) IC: RSS-247 5.1 (4)		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 (2)		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	3.1 dB 181.529 MHz, QP, Horizontal Tx 2441 MHz, DH5	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/ 1.8 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 product. Therefore, the EUT complies with the requirement.

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	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

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
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.1 dB	2.1 dB	2.6 dB	2.2 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	2.7 dB	2.7 dB	3.1 dB	-
	30 MHz-300 MHz	4.4 dB	4.4 dB	4.6 dB	-
	300 MHz-1 GHz	5.6 dB	5.5 dB	5.3 dB	-
	1 GHz-13 GHz	5.2 dB	5.2 dB	5.2 dB	-
Radiated emission (Measurement distance: 1 m)	13 GHz-18 GHz	4.9 dB	4.9 dB	4.9 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	0.76 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.79 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.08 dB
Spurious emission (Conducted) below 1GHz	1.5 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.4 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.5 dB
Bandwidth Measurement	0.66 %
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

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
JAB Accreditation No. RTL02610

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	10m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
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
Inquiry

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 Inquiry	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5 Inquiry	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5 Inquiry	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5 Inquiry	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test) *2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative. *EUT has the power settings by the software as follows; Power settings: 4 Software: Ver0.630 *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.		

UL Japan, Inc.

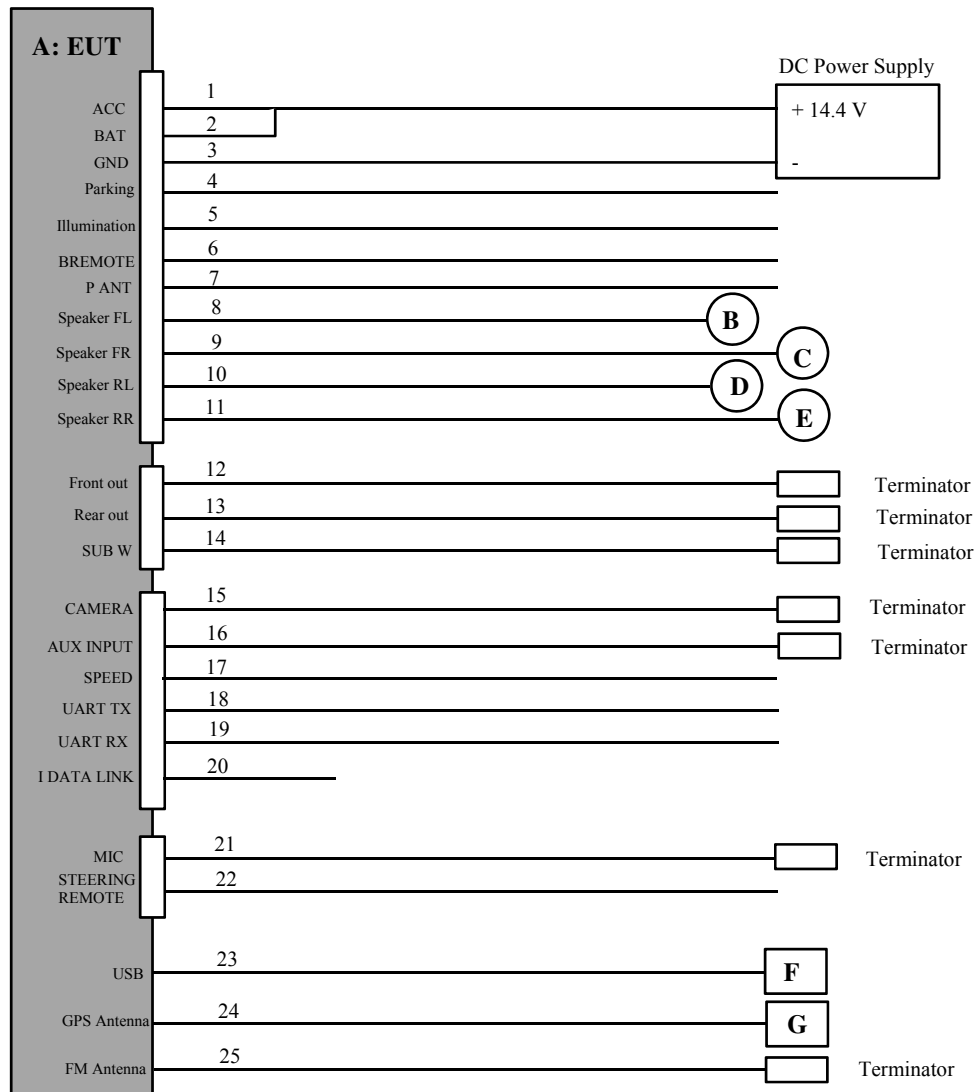
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

4.2 Configuration and peripherals



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

* The testing was performed with DC 14.4 V. As the stable voltage (DC 3.3 V/ 1.8 V) is provided to RF module, it does not influence on the test result.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Display and audio unit	iLX-107	39 *1) senko_no1 *2) 40 *3)	Alpine Electronics, Inc.	EUT
B	Speaker	KFC-RS160	-	KENWOOD	-
C	Speaker	KFC-RS160	-	KENWOOD	-
D	Speaker	KFC-RS160	-	KENWOOD	-
E	Speaker	KFC-RS160	-	KENWOOD	-
F	USB Memory	USL4GM-W	-	Sony	-
G	GPS Antenna	-	-	Alpine Electronics, Inc.	-

*1) Used for Antenna Terminal conducted test

*2) Used for Antenna Terminal conducted test of Inquiry mode

*3) Used for Radiated Emission test

List of cables used

No.	Cable Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	ACC	1.6	Unshielded	Unshielded	-
2	BAT	0.3	Unshielded	Unshielded	-
3	GND	1.6	Unshielded	Unshielded	-
4	Parking	2.0	Unshielded	Unshielded	-
5	Illumination	2.0	Unshielded	Unshielded	-
6	REMOTE	1.7	Unshielded	Unshielded	-
7	P ANT	1.7	Unshielded	Unshielded	-
8	Speaker FL	2.2	Unshielded	Unshielded	-
9	Speaker FR	2.2	Unshielded	Unshielded	-
10	Speaker RL	2.2	Unshielded	Unshielded	-
11	Speaker RR	2.2	Unshielded	Unshielded	-
12	Front out	1.7	Shielded	Shielded	-
13	Rear out	1.8	Shielded	Shielded	-
14	SUB W	1.6	Shielded	Shielded	-
15	CAMERA	2.1	Shielded	Shielded	-
16	AUX In	3.1	Shielded	Shielded	-
17	SPEED	1.6	Unshielded	Unshielded	-
18	UART TX	2.0	Unshielded	Unshielded	-
19	UART RX	2.0	Unshielded	Unshielded	-
20	I DATA LINK	0.15	Unshielded	Unshielded	-
21	MIC	3.2	Shielded	Shielded	-
22	STEERING REMOTE	3.1	Unshielded	Unshielded	-
23	USB	1.5	Shielded	Shielded	-
24	GPS Antenna	2.47	Shielded	Shielded	-
25	FM Antenna	2.1	Shielded	Shielded	-

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

SECTION 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 Styrofoam and covered with polyvinyl chloride. 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 300 MHz	300 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	4.39 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 26.5 GHz),		4.39 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: $20 \times \log (4.39 \text{ m}/3.0 \text{ m}) = 3.31 \text{ dB}$

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

The carrier level and noise levels were confirmed at an 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 (30 deg.) that has the maximum noise.

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

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

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

SECTION 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 *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *3)	-	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 *2)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) The measurement was performed with Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement. *2) 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. *3) Reference data							

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

Test data	: APPENDIX
Test result	: Pass

UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

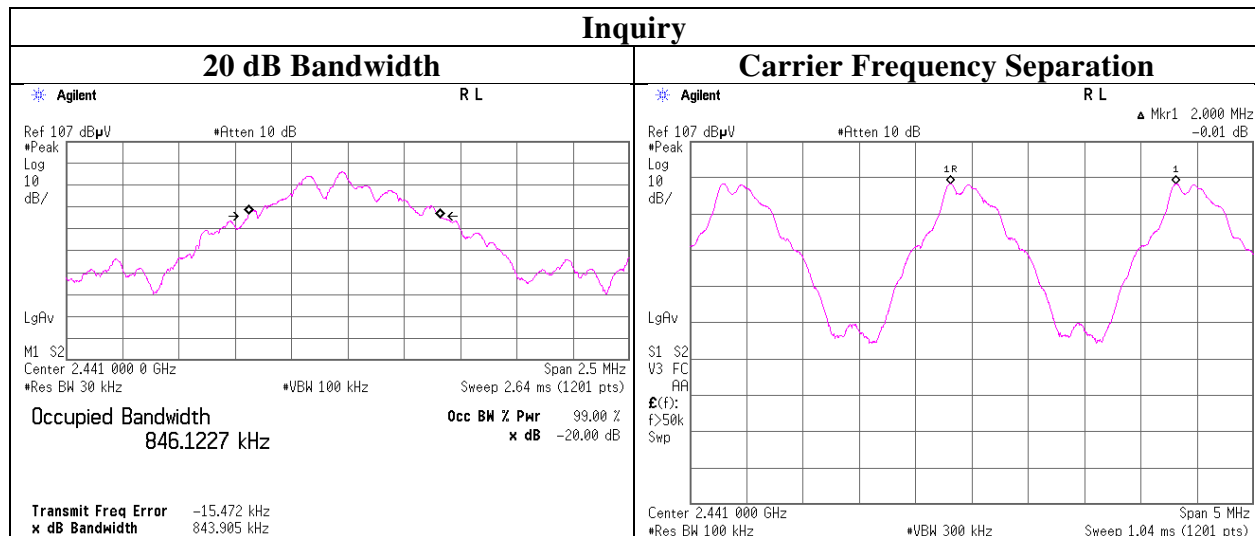
APPENDIX 1: Test data

20dB Bandwidth and Carrier Frequency Separation

Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	11284471S-A-R2	
Date	September 1, 2016	September 7, 2016
Temperature / Humidity	26 deg. C / 49 % RH	24 deg. C / 44 % RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa
Mode	Tx, Hopping Off	

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.988	1.000	≥ 0.658
DH5	2441.0	1.001	1.000	≥ 0.668
DH5	2480.0	0.982	1.000	≥ 0.655
3DH5	2402.0	1.293	1.000	≥ 0.862
3DH5	2441.0	1.294	1.000	≥ 0.862
3DH5	2480.0	1.301	1.000	≥ 0.867
Inquiry	2441.0	0.844	2.000	≥ 0.563

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



UL Japan, Inc.

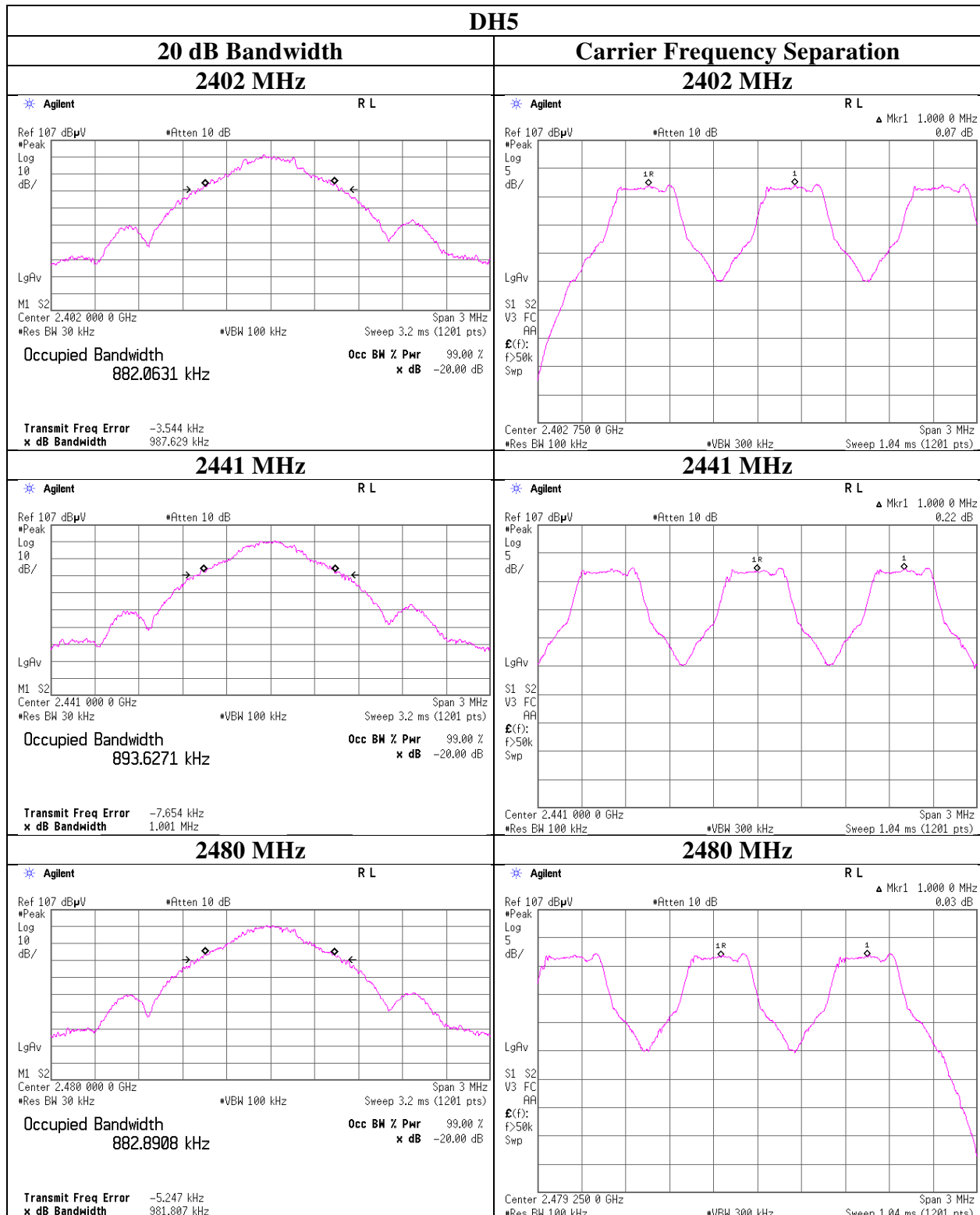
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

20dB Bandwidth and Carrier Frequency Separation



UL Japan, Inc.

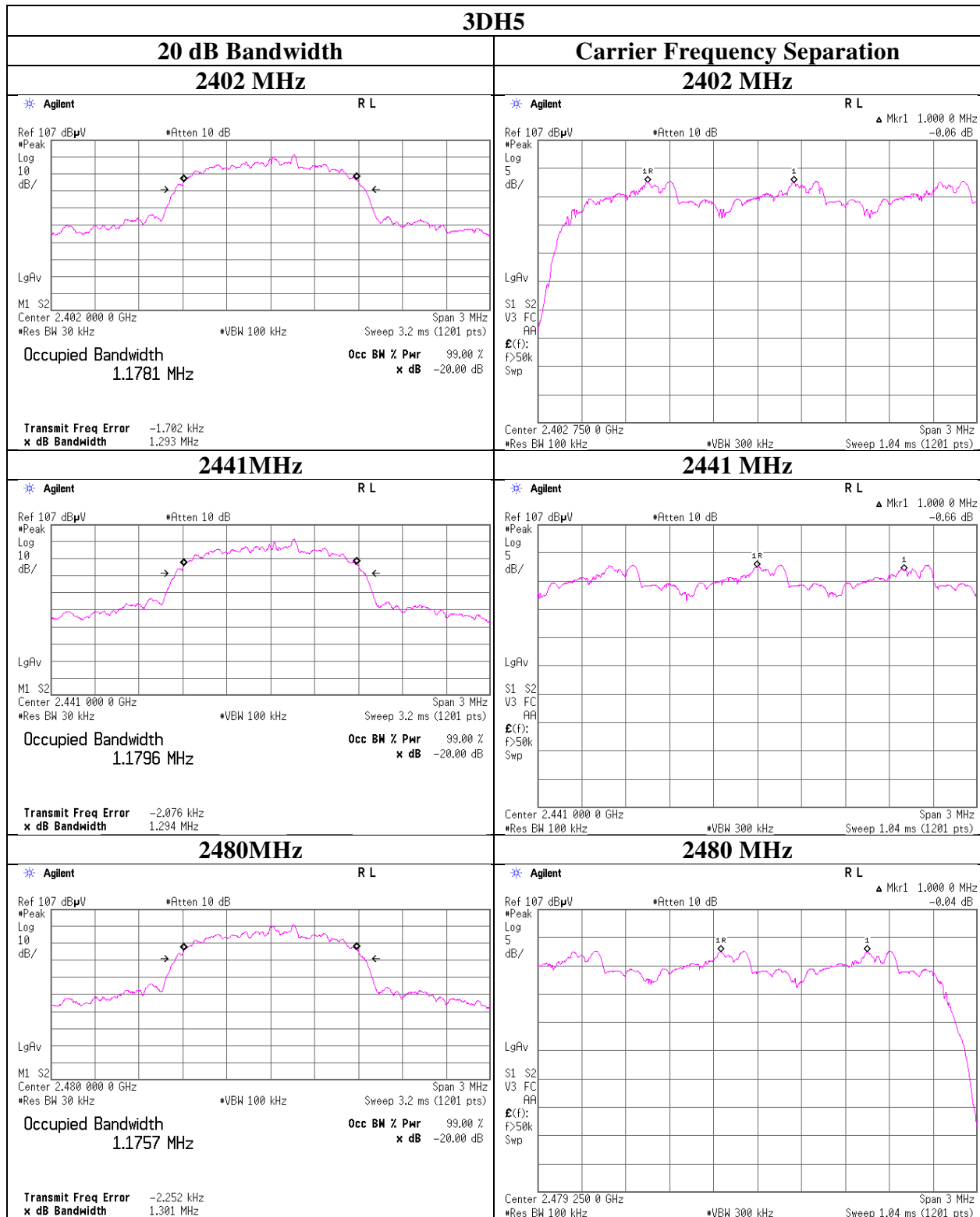
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

20dB Bandwidth and Carrier Frequency Separation

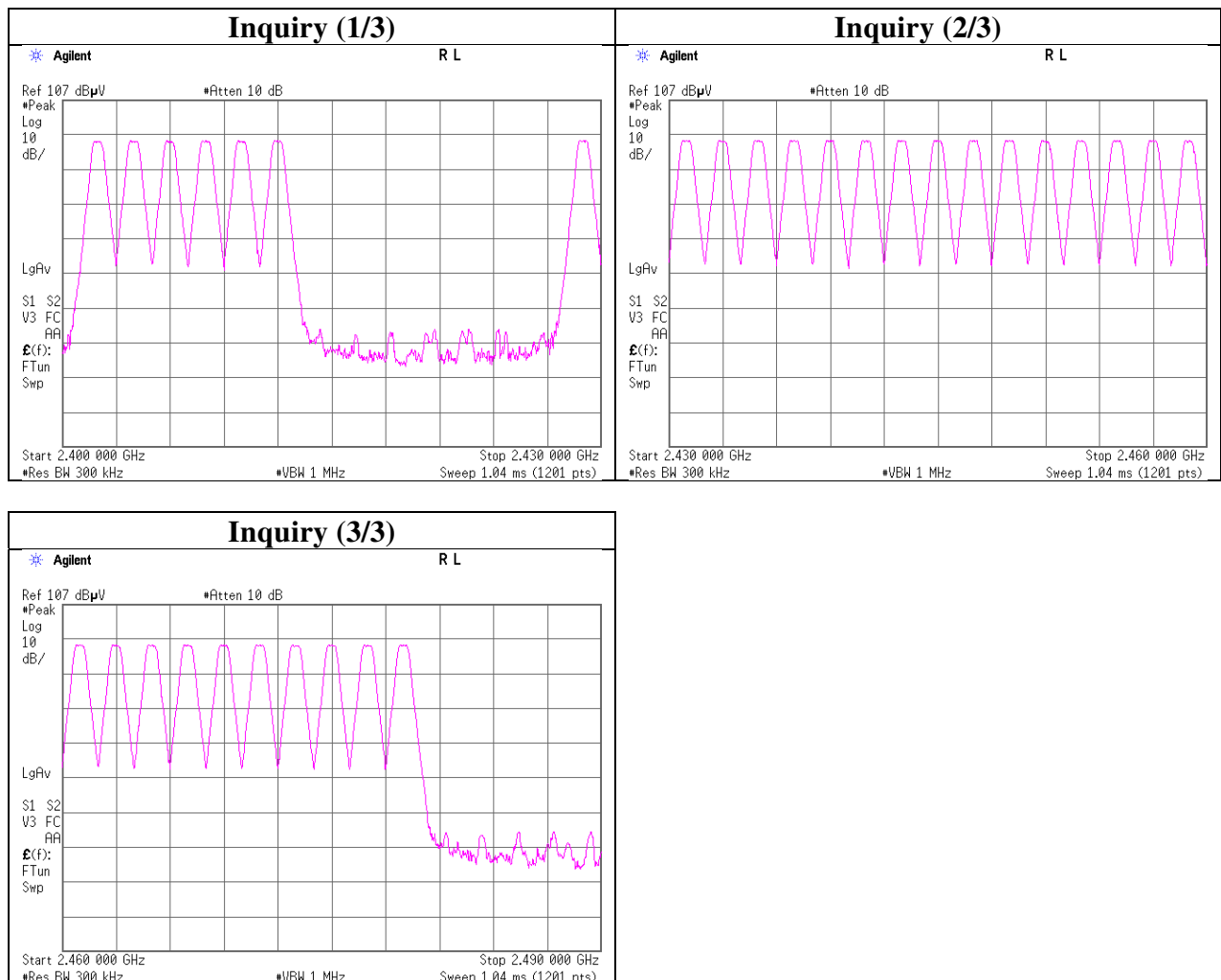


Number of Hopping Frequency

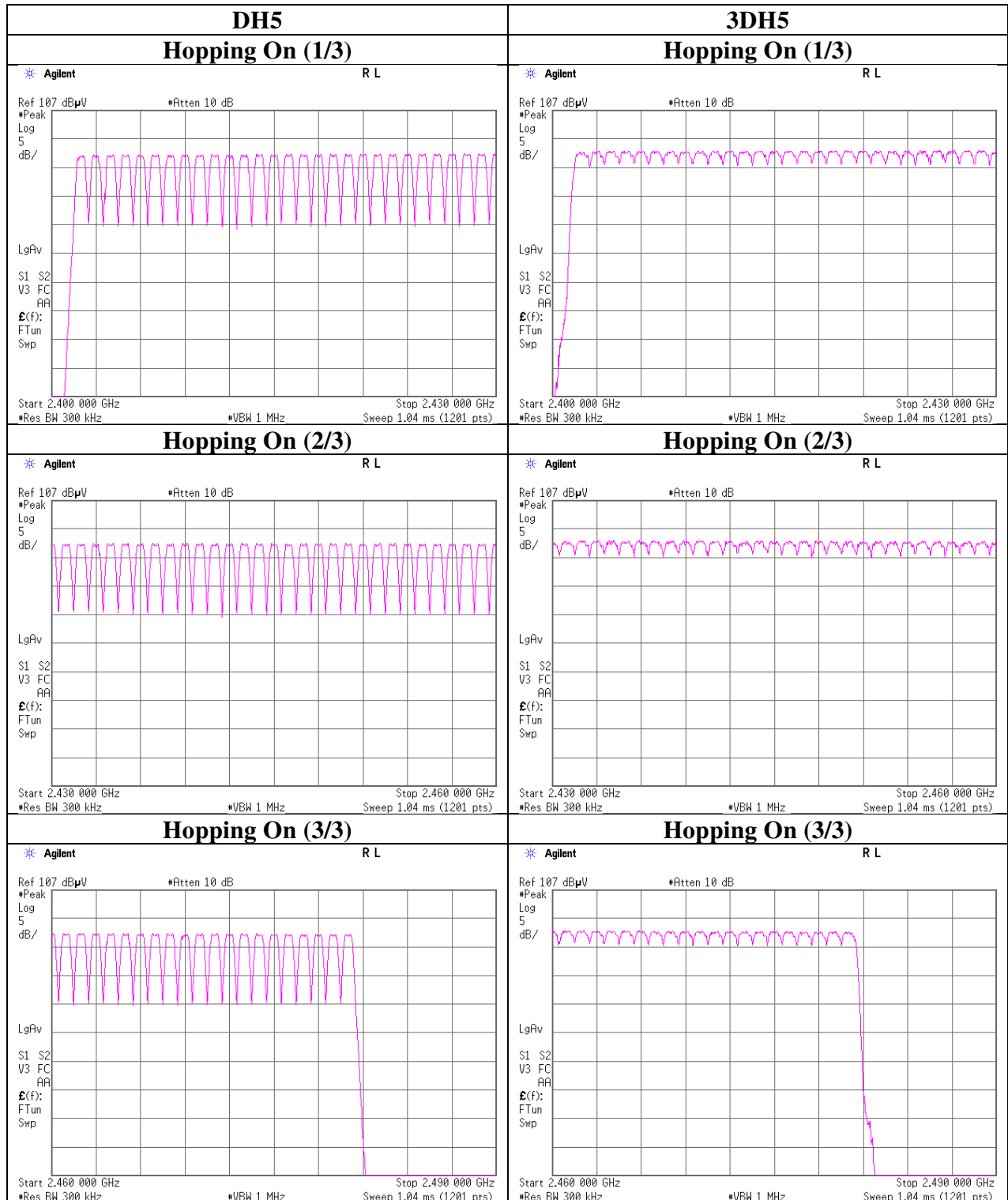
Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	11284471S-A-R2	
Date	September 1, 2016	September 7, 2016
Temperature / Humidity	26 deg. C / 49 % RH	24 deg. C / 44 % RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa
Mode	Tx, Hopping On	

Mode	Number of channel [channels]	Limit [channels]
DH5	79	>= 15
3DH5	79	>= 15
Inquiry	32	>= 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.	11284471S-A-R2	
Date	September 1, 2016	September 7, 2016
Temperature / Humidity	26 deg. C / 49 % RH	24 deg. C / 44 % RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa
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	48.8 times / 5 sec. x	31.6 sec. = 309 times	0.407	126	400
DH3	25.0 times / 5 sec. x	31.6 sec. = 158 times	1.664	263	400
DH5	17.0 times / 5 sec. x	31.6 sec. = 108 times	2.920	315	400
3DH1	47.8 times / 5 sec. x	31.6 sec. = 303 times	0.410	124	400
3DH3	26.2 times / 5 sec. x	31.6 sec. = 166 times	1.660	276	400
3DH5	16.0 times / 5 sec. x	31.6 sec. = 102 times	2.913	297	400
Inquiry	100.0 times / 1 sec. x	12.8 sec. = 1280 times	0.113	145	400

Sample Calculation

Result = Number of transmission x Length of transmission

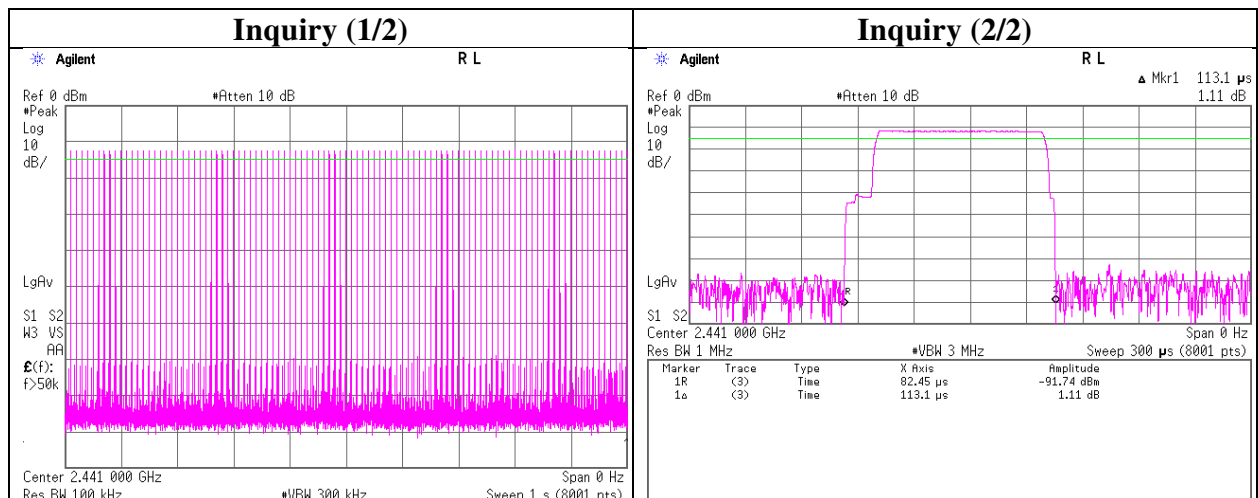
*Average data of 5 tests.(except Inquiry)

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	46	50	50	49	49	48.8
DH3	27	29	22	22	25	25.0
DH5	18	16	20	15	16	17.0
3DH1	47	49	48	48	47	47.8
3DH3	27	23	31	26	24	26.2
3DH5	13	13	17	18	19	16.0

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 $N = 79$.



UL Japan, Inc.

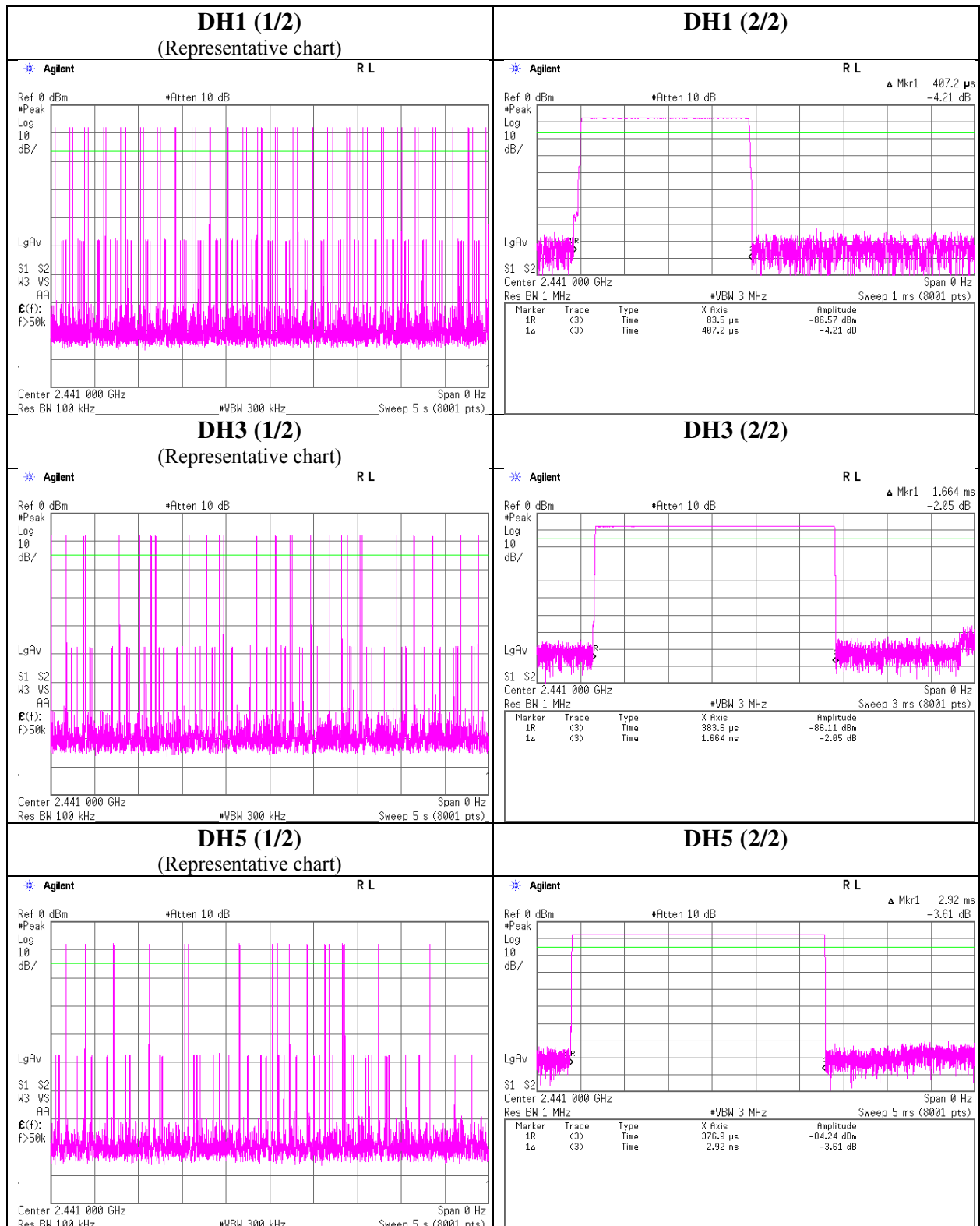
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time



UL Japan, Inc.

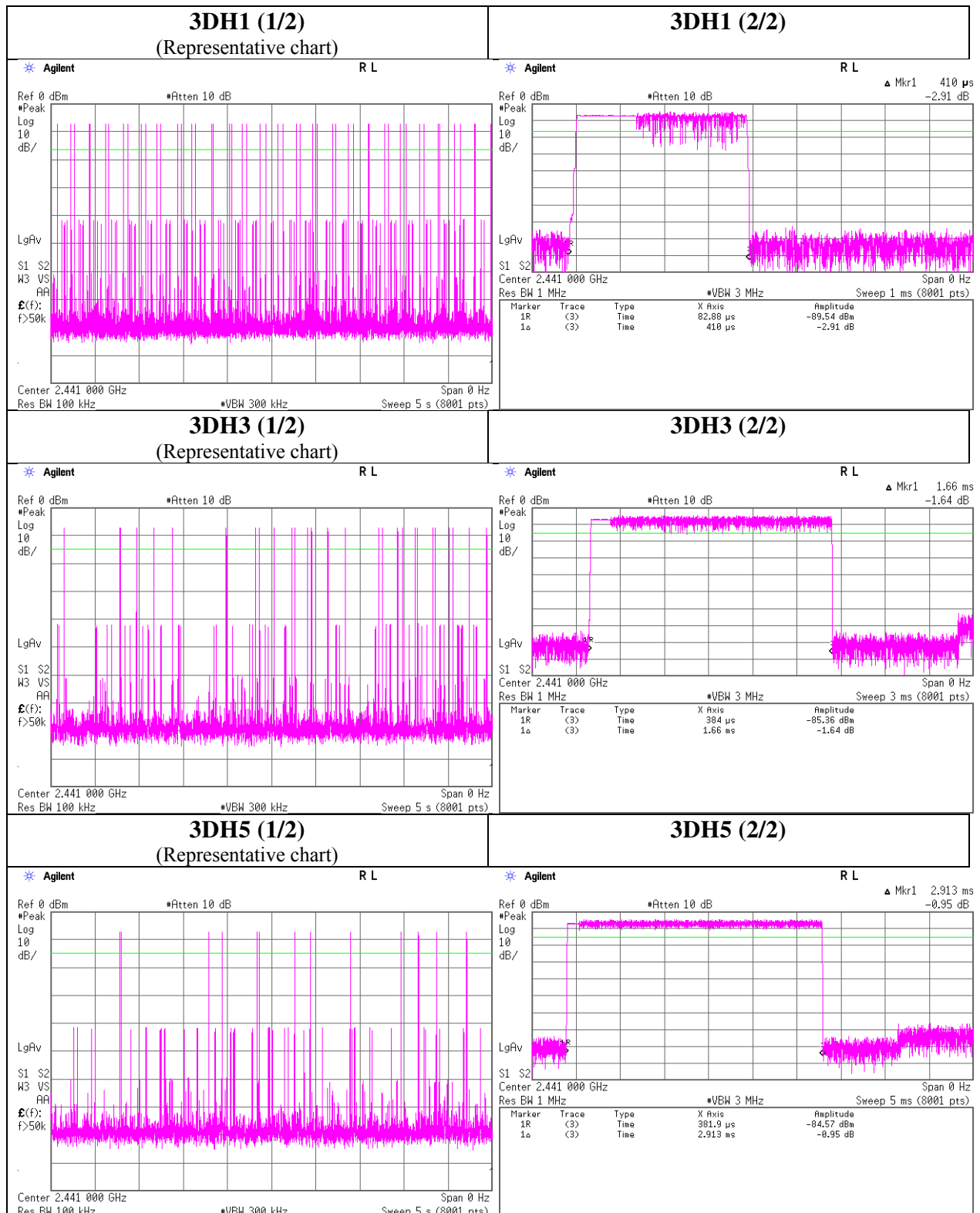
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time



UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Maximum Peak Output Power

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11284471S-A-R2
Date September 1, 2016
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx, Hopping Off

Mode	Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
	[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
DH5	2402.0	-7.62	0.95	10.01	3.34	2.16	20.96	125	17.62
DH5	2441.0	-7.41	0.95	10.01	3.55	2.26	20.96	125	17.41
DH5	2480.0	-7.60	0.95	10.01	3.36	2.17	20.96	125	17.60
2DH5	2402.0	-4.83	0.95	10.01	6.13	4.10	20.96	125	14.83
2DH5	2441.0	-4.64	0.95	10.01	6.32	4.29	20.96	125	14.64
2DH5	2480.0	-4.83	0.95	10.01	6.13	4.10	20.96	125	14.83
3DH5	2402.0	-4.55	0.95	10.01	6.41	4.38	20.96	125	14.55
3DH5	2441.0	-4.35	0.95	10.01	6.61	4.58	20.96	125	14.35
3DH5	2480.0	-4.54	0.95	10.01	6.42	4.39	20.96	125	14.54

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. : 11284471S-A-R2
Date : September 1, 2016
Temperature / Humidity : 26 deg. C / 49 % RH
Engineer : Yosuke Ishikawa
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	-8.95	0.95	10.01	2.01	1.59	1.09	3.10	2.04
DH5	2441.0	-8.76	0.95	10.01	2.20	1.66	1.09	3.29	2.13
DH5	2480.0	-8.93	0.95	10.01	2.03	1.60	1.09	3.12	2.05
2DH5	2402.0	-8.47	0.95	10.01	2.49	1.77	1.10	3.59	2.29
2DH5	2441.0	-8.36	0.95	10.01	2.60	1.82	1.10	3.70	2.34
2DH5	2480.0	-8.62	0.95	10.01	2.34	1.71	1.10	3.44	2.21
3DH5	2402.0	-8.48	0.95	10.01	2.48	1.77	1.10	3.58	2.28
3DH5	2441.0	-8.36	0.95	10.01	2.60	1.82	1.10	3.70	2.34
3DH5	2480.0	-8.61	0.95	10.01	2.35	1.72	1.10	3.45	2.21

Sample Calculation:

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

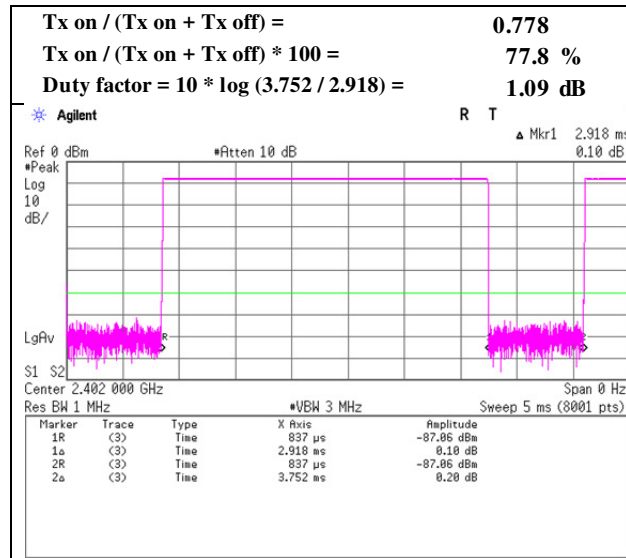
Result (Burst power average) = Frame power + Duty factor

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

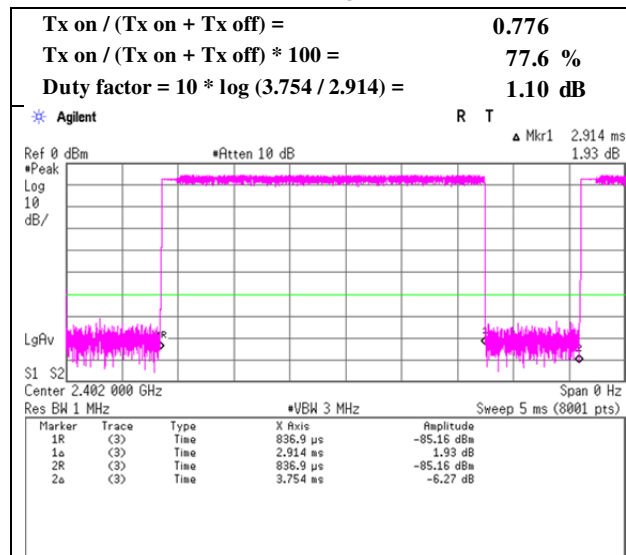
Burst Rate Confirmation

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11284471S-A-R2
Date : September 1, 2016
Temperature / Humidity : 26 deg. C / 49 % RH
Engineer : Yosuke Ishikawa
Mode : Tx, Hopping Off

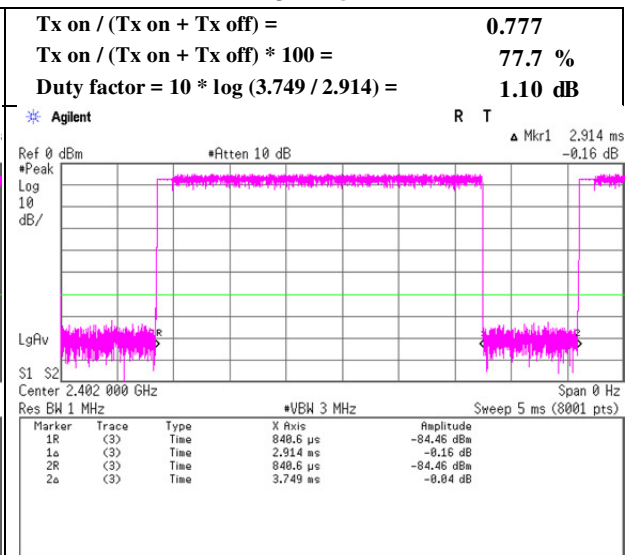
DH5



2DH5



3DH5



Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
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.	172.071	QP	40.9	15.6	8.0	32.1	0.0	32.4	43.5	11.1	191	305	
Hori.	176.785	QP	47.9	15.7	8.0	32.1	0.0	39.5	43.5	3.9	189	310	
Hori.	181.500	QP	44.8	15.9	8.0	32.1	0.0	36.6	43.5	6.9	182	296	
Hori.	516.219	QP	40.0	17.6	9.6	31.9	0.0	35.3	46.0	10.6	100	53	
Hori.	960.259	QP	36.5	22.7	11.2	30.5	0.0	39.9	53.9	14.0	114	253	
Hori.	2390.000	PK	46.5	27.8	13.8	36.9	3.3	54.5	73.9	19.4	175	140	
Hori.	2798.450	PK	42.7	28.1	14.2	36.9	3.3	51.4	73.9	22.5	149	172	
Hori.	4804.000	PK	47.1	31.4	6.0	36.5	3.3	51.3	73.9	22.6	200	155	
Hori.	7206.000	PK	44.1	36.9	7.6	36.6	3.3	55.3	73.9	18.5	150	0	
Hori.	2390.000	AV	34.6	27.8	13.8	36.9	3.3	42.6	53.9	11.3	175	140	
Hori.	2798.450	AV	36.7	28.1	14.2	36.9	3.3	45.3	53.9	8.5	149	172	
Hori.	4804.000	AV	39.1	31.4	6.0	36.5	3.3	43.3	53.9	10.6	200	155	
Hori.	7206.000	AV	32.2	36.9	7.6	36.6	3.3	43.4	53.9	10.5	150	0	
Vert.	72.001	QP	48.5	5.9	7.1	32.2	0.0	29.3	40.0	10.6	100	102	
Vert.	77.789	QP	46.9	5.9	7.6	32.2	0.0	28.2	40.0	11.8	100	142	
Vert.	172.071	QP	44.2	15.6	8.0	32.1	0.0	35.7	43.5	7.8	100	169	
Vert.	176.788	QP	46.4	15.7	8.0	32.1	0.0	38.0	43.5	5.4	100	11	
Vert.	181.502	QP	45.3	15.9	8.0	32.1	0.0	37.1	43.5	6.4	100	256	
Vert.	612.005	QP	40.2	19.1	10.0	31.9	0.0	37.4	46.0	8.5	100	196	
Vert.	2390.000	PK	47.1	27.8	13.8	36.9	3.3	55.1	73.9	18.8	153	65	
Vert.	2798.450	PK	45.8	28.1	14.2	36.9	3.3	54.5	73.9	19.4	167	179	
Vert.	4804.000	PK	46.0	31.4	6.0	36.5	3.3	50.2	73.9	23.7	147	14	
Vert.	7206.000	PK	43.7	36.9	7.6	36.6	3.3	54.9	73.9	18.9	150	0	
Vert.	2390.000	AV	34.5	27.8	13.8	36.9	3.3	42.5	53.9	11.3	153	65	
Vert.	2798.450	AV	38.9	28.1	14.2	36.9	3.3	47.6	53.9	6.3	167	179	
Vert.	4804.000	AV	38.4	31.4	6.0	36.5	3.3	42.6	53.9	11.3	147	14	
Vert.	7206.000	AV	32.5	36.9	7.6	36.6	3.3	43.6	53.9	10.2	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(4.39 \text{ m} / 3.0 \text{ m}) = 3.31 \text{ dB}$

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

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	87.0	27.8	13.8	36.9	3.3	95.0	-	-	
Hori.	2400.000	PK	37.5	27.8	13.8	36.9	3.3	45.6	75.0	29.5	
Vert.	2402.000	PK	87.6	27.8	13.8	36.9	3.3	95.6	-	-	
Vert.	2400.000	PK	37.5	27.8	13.8	36.9	3.3	45.5	75.6	30.1	

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

Distance factor : 1 GHz - 13 GHz : $20\log(4.39 \text{ m} / 3.0 \text{ m}) = 3.31 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

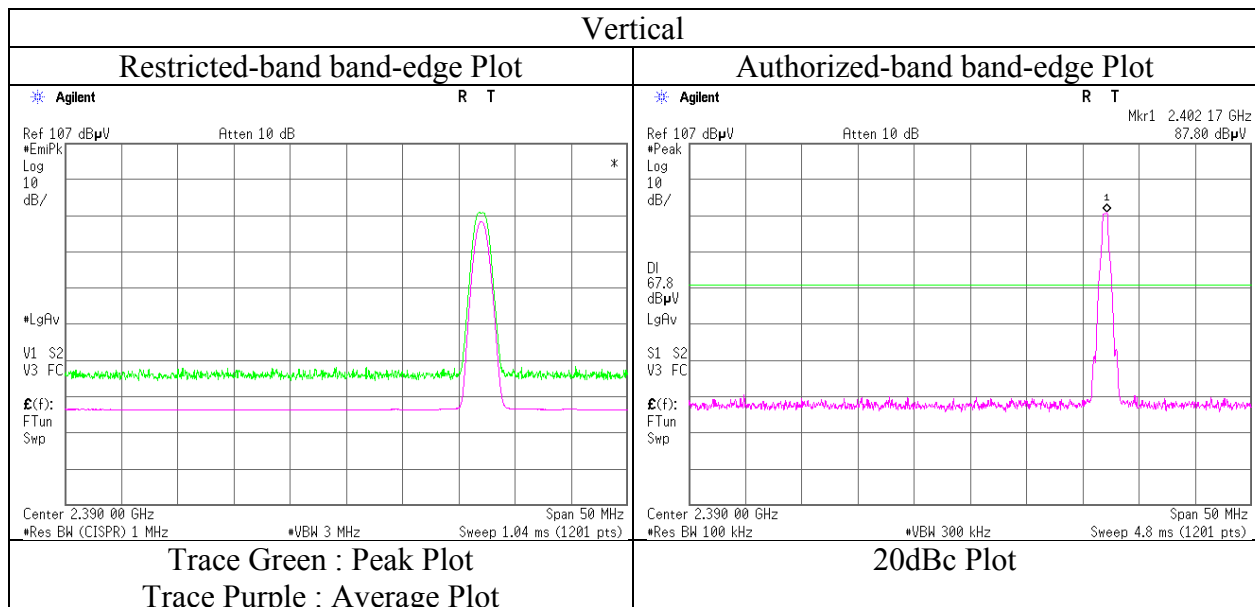
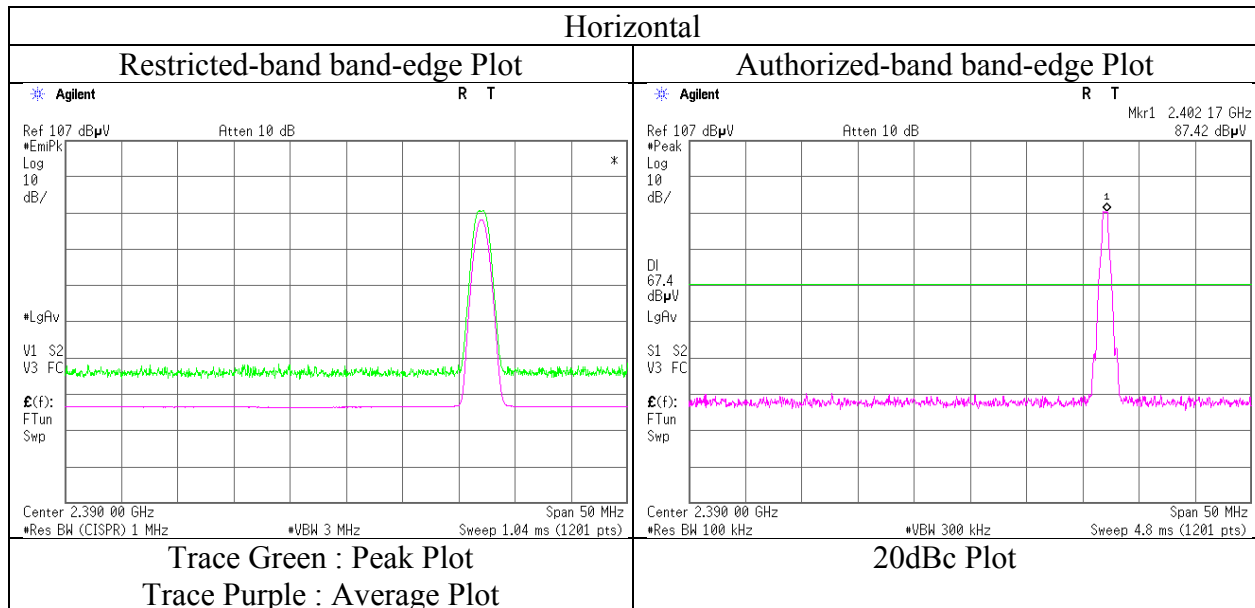
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11284471S-A-R2
Date	July 23, 2016
Temperature / Humidity	24 deg. C / 64 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5 2402 MHz



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
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.	176.787	QP	47.0	15.7	8.0	32.1	0.0	38.6	43.5	4.8	189	310	
Hori.	181.529	QP	48.6	15.9	8.0	32.1	0.0	40.4	43.5	3.1	183	293	
Hori.	535.073	QP	44.1	17.9	9.7	32.0	0.0	39.8	46.0	6.2	100	61	
Hori.	960.259	QP	36.5	22.7	11.2	30.5	0.0	39.9	53.9	14.0	116	253	
Hori.	2798.451	PK	42.6	28.1	14.2	36.9	3.3	51.3	73.9	22.6	161	149	
Hori.	4882.000	PK	48.5	31.7	6.0	36.5	3.3	53.0	73.9	20.8	205	167	
Hori.	7323.000	PK	46.5	36.9	7.6	36.7	3.3	57.7	73.9	16.2	150	0	
Hori.	2798.451	AV	36.6	28.1	14.2	36.9	3.3	45.3	53.9	8.6	161	149	
Hori.	4882.000	AV	41.5	31.7	6.0	36.5	3.3	46.0	53.9	7.8	205	167	
Hori.	7323.000	AV	34.4	36.9	7.6	36.7	3.3	45.6	53.9	8.3	150	0	
Vert.	71.999	QP	47.6	5.9	7.1	32.2	0.0	28.4	40.0	11.5	100	132	
Vert.	167.359	QP	44.4	15.4	8.0	32.1	0.0	35.7	43.5	7.8	100	190	
Vert.	176.786	QP	46.1	15.7	8.0	32.1	0.0	37.7	43.5	5.7	100	359	
Vert.	181.499	QP	48.1	15.9	8.0	32.1	0.0	39.9	43.5	3.6	100	260	
Vert.	186.216	QP	45.3	16.0	7.9	32.1	0.0	37.2	43.5	6.3	100	125	
Vert.	612.005	QP	40.3	19.1	10.0	31.9	0.0	37.5	46.0	8.4	100	195	
Vert.	2798.450	PK	44.9	28.1	14.2	36.9	3.3	53.6	73.9	20.3	168	181	
Vert.	4882.000	PK	48.0	31.7	6.0	36.5	3.3	52.5	73.9	21.3	199	126	
Vert.	7323.000	PK	46.9	36.9	7.6	36.7	3.3	58.0	73.9	15.8	150	0	
Vert.	2798.450	AV	39.1	28.1	14.2	36.9	3.3	47.8	53.9	6.0	168	181	
Vert.	4882.000	AV	39.1	31.7	6.0	36.5	3.3	43.6	53.9	10.3	199	126	
Vert.	7323.000	AV	34.1	36.9	7.6	36.7	3.3	45.3	53.9	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 : $20\log(4.39\text{ m} / 3.0\text{ m}) = 3.31\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
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.	176.787	QP	47.0	15.7	8.0	32.1	0.0	38.6	43.5	4.8	186	306	
Hori.	181.501	QP	48.5	15.9	8.0	32.1	0.0	40.3	43.5	3.2	184	292	
Hori.	530.358	QP	44.5	17.9	9.7	32.0	0.0	40.1	46.0	5.9	100	58	
Hori.	960.257	QP	36.5	22.7	11.2	30.5	0.0	39.9	53.9	14.0	115	254	
Hori.	2483.500	PK	46.8	27.9	13.9	36.9	3.3	55.1	73.9	18.8	163	147	
Hori.	2798.452	PK	45.4	28.1	14.2	36.9	3.3	54.1	73.9	19.8	153	166	
Hori.	4960.000	PK	47.2	32.0	6.1	36.5	3.3	52.0	73.9	21.8	220	173	
Hori.	7440.000	PK	47.1	37.0	7.6	36.7	3.3	58.3	73.9	15.6	150	0	
Hori.	2483.500	AV	34.8	27.9	13.9	36.9	3.3	43.1	53.9	10.7	163	147	
Hori.	2798.452	AV	35.6	28.1	14.2	36.9	3.3	44.3	53.9	9.6	153	166	
Hori.	4960.000	AV	37.3	32.0	6.1	36.5	3.3	42.2	53.9	11.7	220	173	
Hori.	7440.000	AV	34.5	37.0	7.6	36.7	3.3	45.7	53.9	8.2	150	0	
Vert.	82.502	QP	47.4	6.3	7.7	32.2	0.0	29.3	40.0	10.7	100	130	
Vert.	167.358	QP	44.5	15.4	8.0	32.1	0.0	35.8	43.5	7.7	100	202	
Vert.	176.787	QP	48.4	15.7	8.0	32.1	0.0	40.0	43.5	3.4	100	2	
Vert.	181.501	QP	48.3	15.9	8.0	32.1	0.0	40.1	43.5	3.4	100	257	
Vert.	186.213	QP	45.5	16.0	7.9	32.1	0.0	37.4	43.5	6.1	100	128	
Vert.	205.072	QP	43.1	16.3	8.2	32.0	0.0	35.5	43.5	7.9	100	98	
Vert.	611.999	QP	40.2	19.1	10.0	31.9	0.0	37.4	46.0	8.5	100	209	
Vert.	2483.500	PK	47.2	27.9	13.9	36.9	3.3	55.5	73.9	18.4	169	163	
Vert.	2798.451	PK	46.1	28.1	14.2	36.9	3.3	54.8	73.9	19.1	170	174	
Vert.	4960.000	PK	47.4	32.0	6.1	36.5	3.3	52.2	73.9	21.6	156	135	
Vert.	7440.000	PK	46.9	37.0	7.6	36.7	3.3	58.0	73.9	15.8	100	0	
Vert.	2483.500	AV	34.7	27.9	13.9	36.9	3.3	43.0	53.9	10.9	169	163	
Vert.	2798.451	AV	39.1	28.1	14.2	36.9	3.3	47.8	53.9	6.0	170	174	
Vert.	4960.000	AV	37.7	32.0	6.1	36.5	3.3	42.6	53.9	11.3	156	135	
Vert.	7440.000	AV	34.5	37.0	7.6	36.7	3.3	45.6	53.9	8.2	100	0	

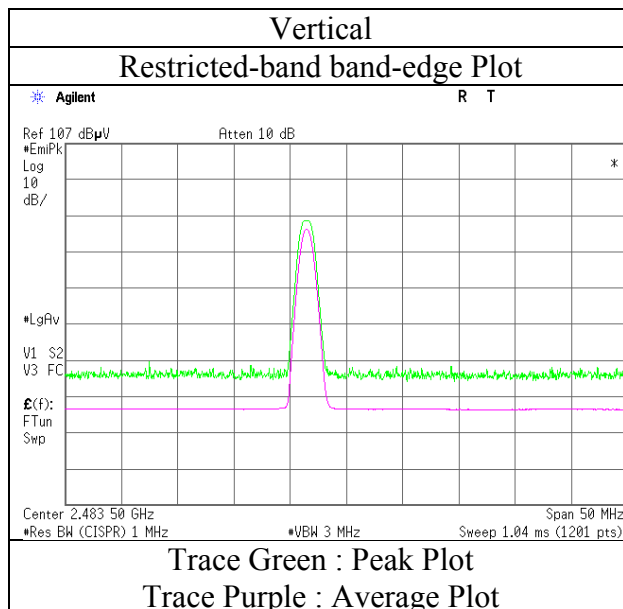
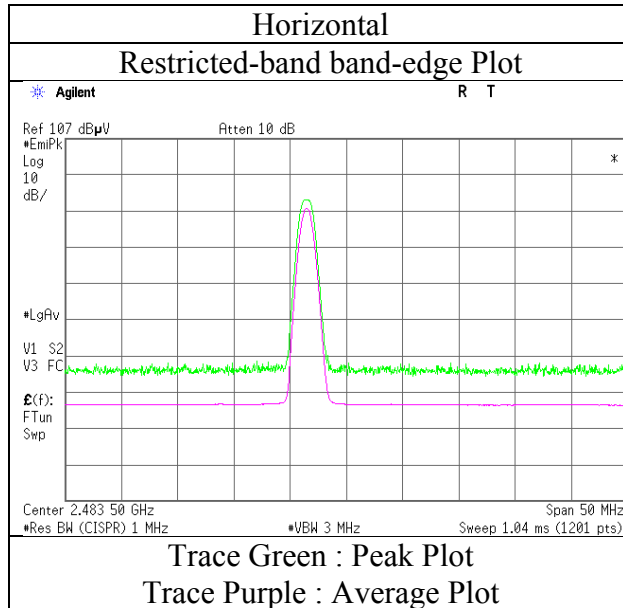
Result = Reading + Ant.Fac. + Loss (Cable+ (Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.39 \text{ m} / 3.0 \text{ m}) = 3.31 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11284471S-A-R2
Date	July 23, 2016
Temperature / Humidity	24 deg. C / 64 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5 2480 MHz



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
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.	82.501	QP	51.6	6.3	7.7	32.2	0.0	33.5	40.0	6.5	221	73	
Hori.	176.790	QP	42.0	15.7	8.0	32.1	0.0	33.6	43.5	9.8	181	145	
Hori.	525.722	QP	38.7	17.8	9.7	32.0	0.0	34.2	46.0	11.7	100	53	
Hori.	960.258	QP	36.1	22.7	11.2	30.5	0.0	39.5	53.9	14.4	114	254	
Hori.	2390.000	PK	44.8	27.8	13.8	36.9	3.3	52.8	73.9	21.1	191	134	
Hori.	2798.450	PK	45.7	28.1	14.2	36.9	3.3	54.3	73.9	19.5	155	159	
Hori.	4804.000	PK	47.4	31.4	6.0	36.5	3.3	51.6	73.9	22.2	112	86	
Hori.	7206.000	PK	44.5	36.9	7.6	36.6	3.3	55.7	73.9	18.2	150	0	
Hori.	2390.000	AV	33.0	27.8	13.8	36.9	3.3	41.0	53.9	12.8	191	134	
Hori.	2798.450	AV	35.0	28.1	14.2	36.9	3.3	43.7	53.9	10.2	155	159	
Hori.	4804.000	AV	35.6	31.4	6.0	36.5	3.3	39.8	53.9	14.1	112	86	
Hori.	7206.000	AV	32.4	36.9	7.6	36.6	3.3	43.6	53.9	10.3	150	0	
Vert.	73.051	QP	53.7	5.9	7.2	32.2	0.0	34.6	40.0	5.4	100	73	
Vert.	77.789	QP	51.4	5.9	7.6	32.2	0.0	32.7	40.0	7.3	100	123	
Vert.	82.500	QP	50.1	6.3	7.7	32.2	0.0	32.0	40.0	7.9	100	130	
Vert.	176.789	QP	48.3	15.7	8.0	32.1	0.0	39.9	43.5	3.5	100	56	
Vert.	181.499	QP	42.0	15.9	8.0	32.1	0.0	33.8	43.5	9.7	100	359	
Vert.	612.005	QP	37.6	19.1	10.0	31.9	0.0	34.8	46.0	11.1	100	215	
Vert.	2390.000	PK	44.5	27.8	13.8	36.9	3.3	52.5	73.9	21.3	216	83	
Vert.	2798.450	PK	46.7	28.1	14.2	36.9	3.3	55.4	73.9	18.5	163	174	
Vert.	4804.000	PK	47.2	31.4	6.0	36.5	3.3	51.4	73.9	22.5	154	27	
Vert.	7206.000	PK	45.3	36.9	7.6	36.6	3.3	56.5	73.9	17.4	150	0	
Vert.	2390.000	AV	33.0	27.8	13.8	36.9	3.3	41.0	53.9	12.9	216	83	
Vert.	2798.450	AV	39.2	28.1	14.2	36.9	3.3	47.9	53.9	5.9	163	174	
Vert.	4804.000	AV	36.1	31.4	6.0	36.5	3.3	40.3	53.9	13.6	154	27	
Vert.	7206.000	AV	32.5	36.9	7.6	36.6	3.3	43.6	53.9	10.2	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(4.39 \text{ m} / 3.0 \text{ m}) = 3.31 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

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	83.3	27.8	13.8	36.9	3.3	91.4	-	-	Carrier
Hori.	2400.000	PK	36.3	27.8	13.8	36.9	3.3	44.3	71.4	27.0	
Vert.	2402.000	PK	82.6	27.8	13.8	36.9	3.3	90.6	-	-	Carrier
Vert.	2400.000	PK	36.7	27.8	13.8	36.9	3.3	44.7	70.6	26.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(4.39 \text{ m} / 3.0 \text{ m}) = 3.31 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

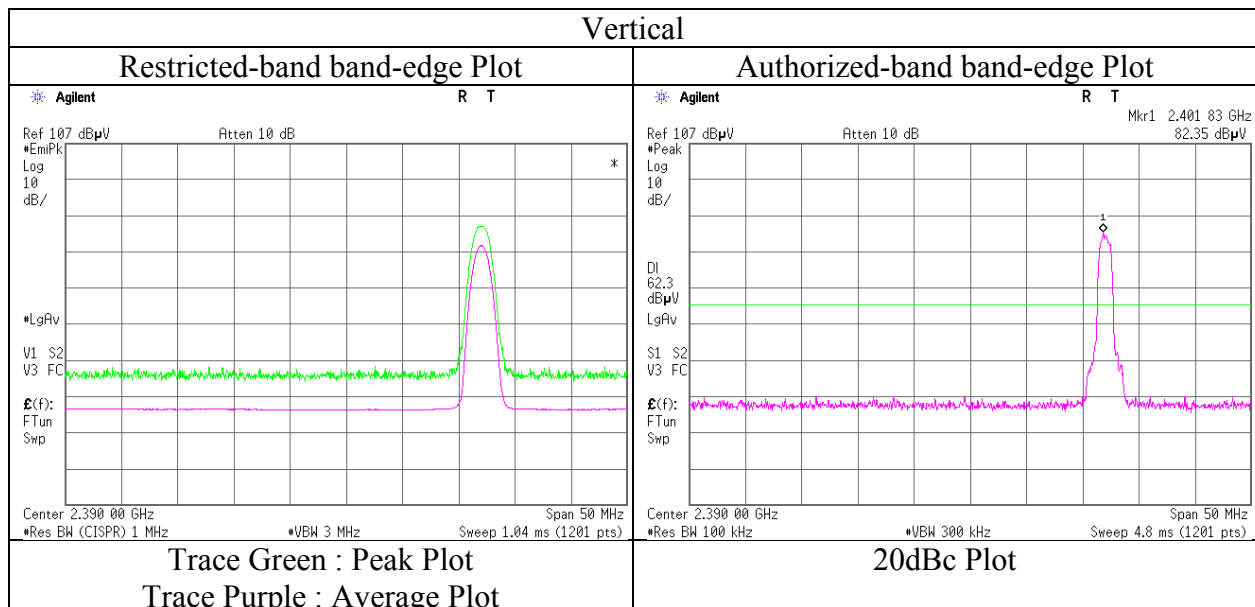
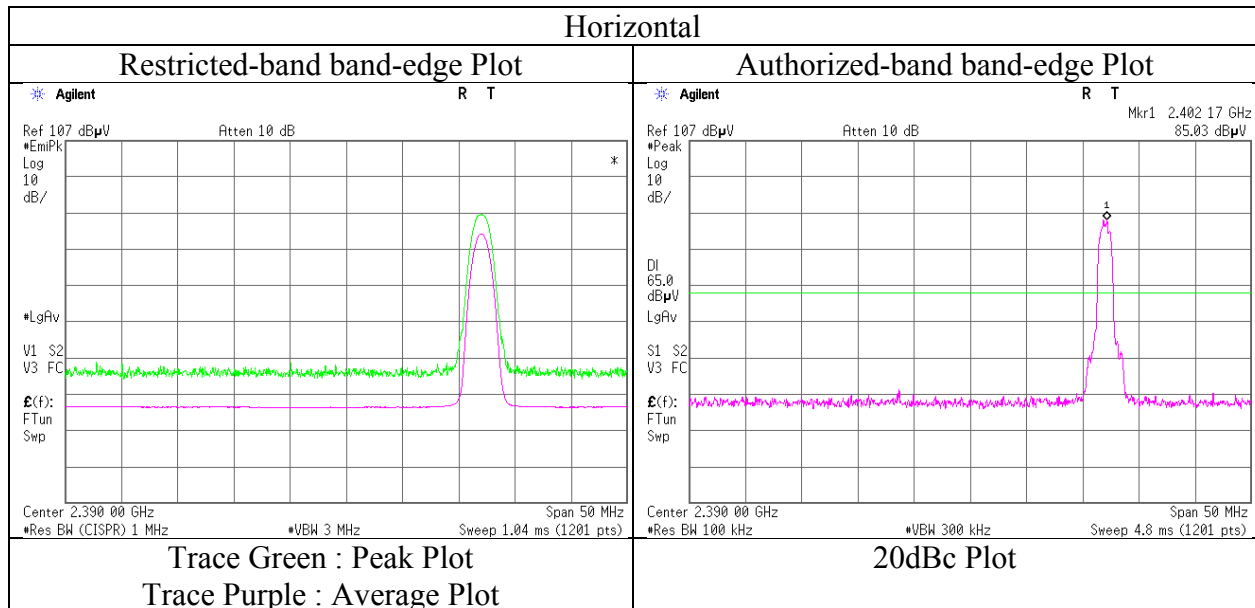
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11284471S-A-R2
Date	July 23, 2016
Temperature / Humidity	24 deg. C / 64 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, 3DH5 2402 MHz



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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
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.	73.073	QP	50.9	5.9	7.2	32.2	0.0	31.8	40.0	8.2	245	132	
Hori.	82.498	QP	51.0	6.3	7.7	32.2	0.0	32.9	40.0	7.0	222	74	
Hori.	176.794	QP	42.7	15.7	8.0	32.1	0.0	34.3	43.5	9.1	181	128	
Hori.	520.931	QP	39.7	17.7	9.7	32.0	0.0	35.1	46.0	10.8	100	47	
Hori.	960.260	QP	36.4	22.7	11.2	30.5	0.0	39.8	53.9	14.1	117	255	
Hori.	2798.450	PK	45.8	28.1	14.2	36.9	3.3	54.4	73.9	19.4	144	176	
Hori.	4882.000	PK	45.5	31.7	6.0	36.5	3.3	50.0	73.9	23.8	132	137	
Hori.	7323.000	PK	45.7	36.9	7.6	36.7	3.3	56.8	73.9	17.0	150	0	
Hori.	2798.450	AV	35.0	28.1	14.2	36.9	3.3	43.6	53.9	10.2	144	176	
Hori.	4882.000	AV	35.6	31.7	6.0	36.5	3.3	40.1	53.9	13.8	132	137	
Hori.	7323.000	AV	32.9	36.9	7.6	36.7	3.3	44.1	53.9	9.8	150	0	
Vert.	73.073	QP	53.9	5.9	7.2	32.2	0.0	34.8	40.0	5.2	100	50	
Vert.	77.785	QP	50.7	5.9	7.6	32.2	0.0	32.0	40.0	8.0	100	119	
Vert.	82.501	QP	49.5	6.3	7.7	32.2	0.0	31.4	40.0	8.6	100	136	
Vert.	176.785	QP	48.3	15.7	8.0	32.1	0.0	39.9	43.5	3.5	100	72	
Vert.	181.499	QP	42.4	15.9	8.0	32.1	0.0	34.2	43.5	9.3	100	32	
Vert.	540.000	QP	34.7	18.0	9.7	32.0	0.0	30.5	46.0	15.5	141	182	
Vert.	2798.450	PK	47.7	28.1	14.2	36.9	3.3	56.3	73.9	17.5	171	175	
Vert.	4882.000	PK	45.8	31.7	6.0	36.5	3.3	50.3	73.9	23.6	153	135	
Vert.	7323.000	PK	45.9	36.9	7.6	36.7	3.3	57.1	73.9	16.8	150	0	
Vert.	2798.450	AV	39.0	28.1	14.2	36.9	3.3	47.7	53.9	6.2	171	175	
Vert.	4882.000	AV	35.5	31.7	6.0	36.5	3.3	40.0	53.9	13.9	153	135	
Vert.	7323.000	AV	32.8	36.9	7.6	36.7	3.3	44.0	53.9	9.9	150	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(4.39 \text{ m} / 3.0 \text{ m}) = 3.31 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
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.	77.791	QP	50.5	5.9	7.6	32.2	0.0	31.8	40.0	8.2	300	240	
Hori.	82.500	QP	52.9	6.3	7.7	32.2	0.0	34.8	40.0	5.1	226	71	
Hori.	87.214	QP	48.4	7.3	7.7	32.2	0.0	31.2	40.0	8.7	218	71	
Hori.	176.791	QP	42.8	15.7	8.0	32.1	0.0	34.4	43.5	9.0	181	133	
Hori.	535.074	QP	39.0	17.9	9.7	32.0	0.0	34.7	46.0	11.3	100	61	
Hori.	960.261	QP	35.7	22.7	11.2	30.5	0.0	39.1	53.9	14.8	108	255	
Hori.	2483.500	PK	45.0	27.9	13.9	36.9	3.3	53.3	73.9	20.6	163	174	
Hori.	2798.450	PK	45.7	28.1	14.2	36.9	3.3	54.3	73.9	19.5	160	167	
Hori.	4960.000	PK	44.8	32.0	6.1	36.5	3.3	49.7	73.9	24.2	189	184	
Hori.	7440.000	PK	45.8	37.0	7.6	36.7	3.3	57.0	73.9	16.9	150	0	
Hori.	2483.500	AV	33.0	27.9	13.9	36.9	3.3	41.2	53.9	12.6	163	174	
Hori.	2798.450	AV	35.6	28.1	14.2	36.9	3.3	44.3	53.9	9.6	160	167	
Hori.	4960.000	AV	33.8	32.0	6.1	36.5	3.3	38.6	53.9	15.2	189	184	
Hori.	7440.000	AV	32.8	37.0	7.6	36.7	3.3	44.0	53.9	9.9	150	0	
Vert.	73.070	QP	51.7	5.9	7.2	32.2	0.0	32.6	40.0	7.4	100	89	
Vert.	77.787	QP	51.9	5.9	7.6	32.2	0.0	33.2	40.0	6.8	100	109	
Vert.	82.500	QP	51.1	6.3	7.7	32.2	0.0	33.0	40.0	6.9	100	146	
Vert.	176.786	QP	48.4	15.7	8.0	32.1	0.0	40.0	43.5	3.4	100	62	
Vert.	181.521	QP	42.4	15.9	8.0	32.1	0.0	34.2	43.5	9.3	100	42	
Vert.	612.005	QP	38.5	19.1	10.0	31.9	0.0	35.7	46.0	10.2	100	193	
Vert.	2483.500	PK	45.5	27.9	13.9	36.9	3.3	53.8	73.9	20.1	164	144	
Vert.	2798.450	PK	46.8	28.1	14.2	36.9	3.3	55.5	73.9	18.4	154	173	
Vert.	4960.000	PK	44.9	32.0	6.1	36.5	3.3	49.8	73.9	24.1	158	147	
Vert.	7440.000	PK	45.7	37.0	7.6	36.7	3.3	56.9	73.9	17.0	150	0	
Vert.	2483.500	AV	33.0	27.9	13.9	36.9	3.3	41.3	53.9	12.6	164	144	
Vert.	2798.450	AV	39.3	28.1	14.2	36.9	3.3	48.0	53.9	5.9	154	173	
Vert.	4960.000	AV	33.2	32.0	6.1	36.5	3.3	38.0	53.9	15.9	158	147	
Vert.	7440.000	AV	32.9	37.0	7.6	36.7	3.3	44.0	53.9	9.8	150	0	

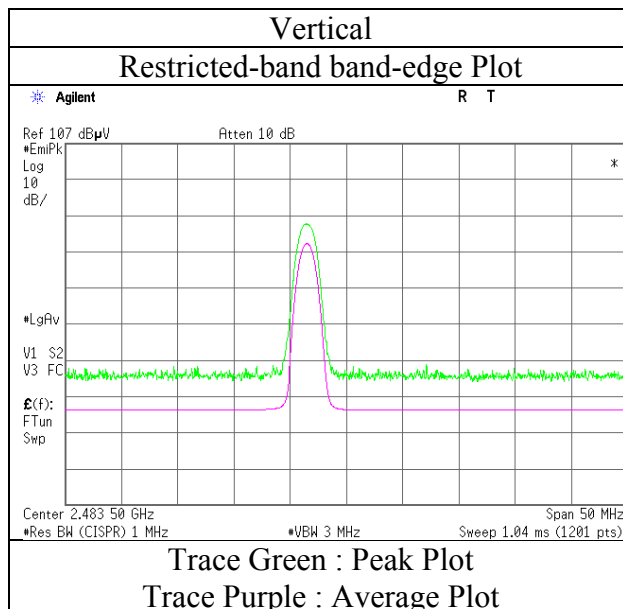
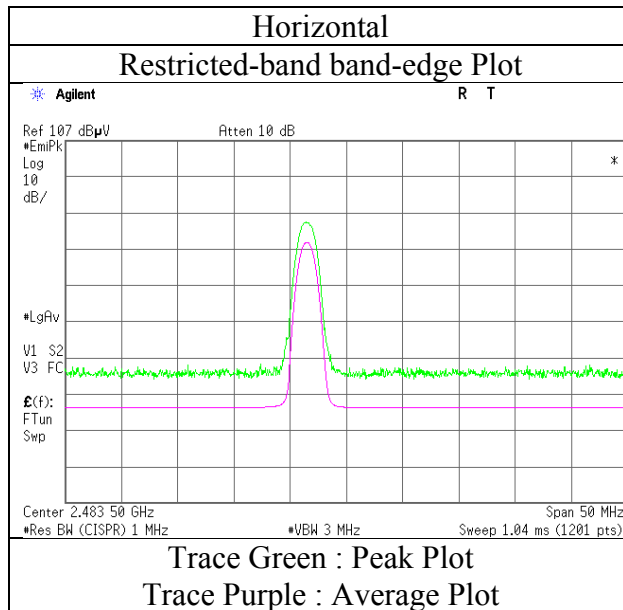
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(4.39\text{ m} / 3.0\text{ m}) = 3.31\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

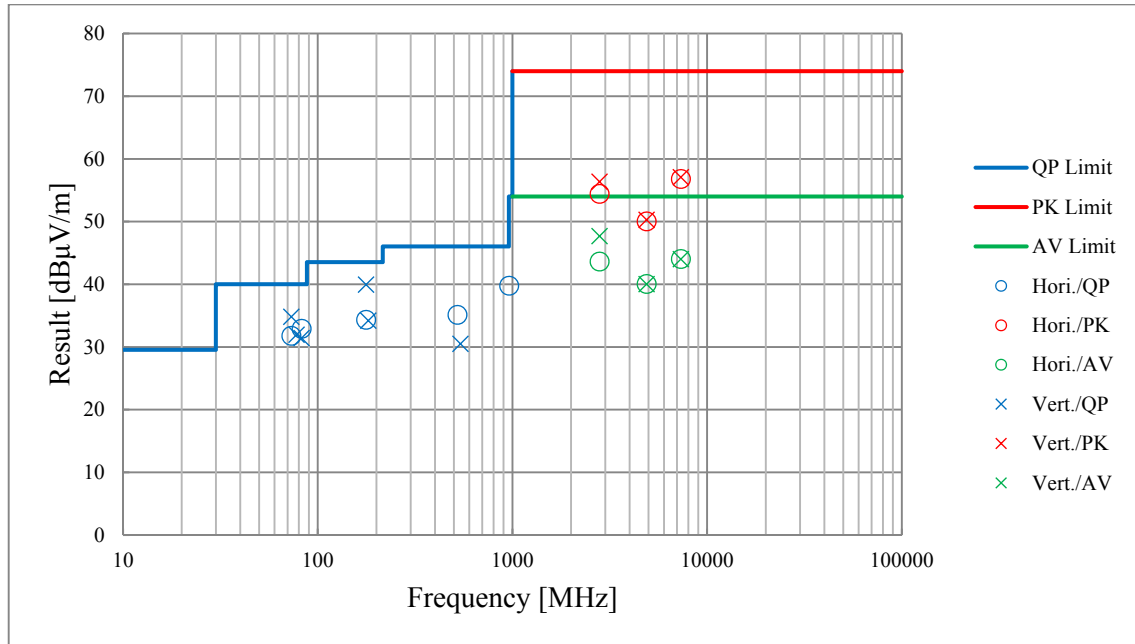
Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11284471S-A-R2
Date	July 23, 2016
Temperature / Humidity	24 deg. C / 64 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11284471S-A-R2
Date : July 23, 2016 July 24, 2016
Temperature / Humidity : 24 deg. C / 64 % RH 24 deg. C / 60 % RH
Engineer : Makoto Hosaka Makoto Hosaka
Mode : Tx, Hopping Off, 3DH5 2441 MHz

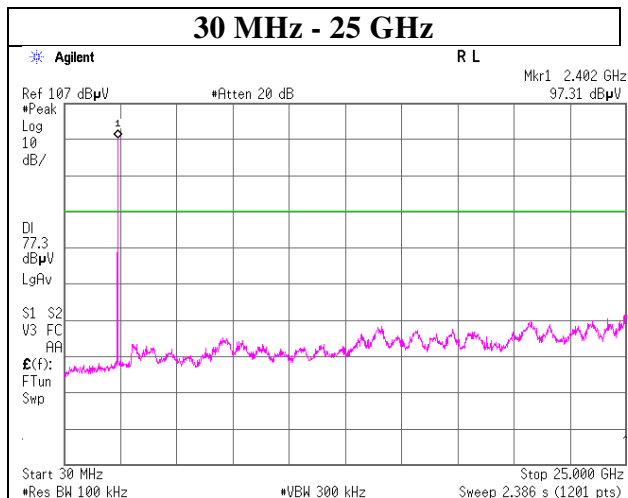
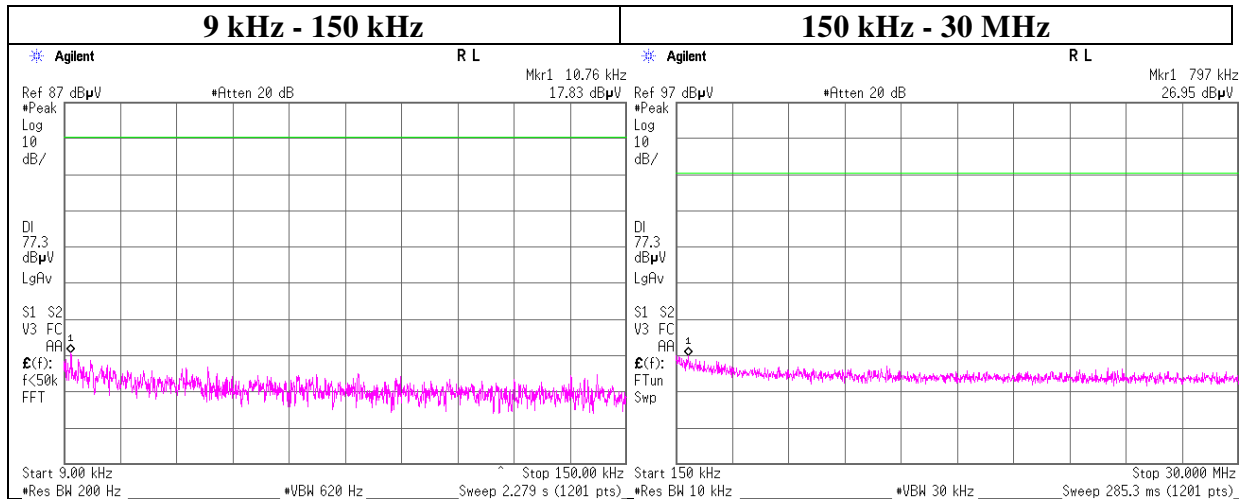


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11284471S-A-R2
Date : September 1, 2016
Temperature / Humidity : 26 deg. C / 49 % RH
Engineer : Yosuke Ishikawa
Mode : Tx, Hopping Off, DH5

2402 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

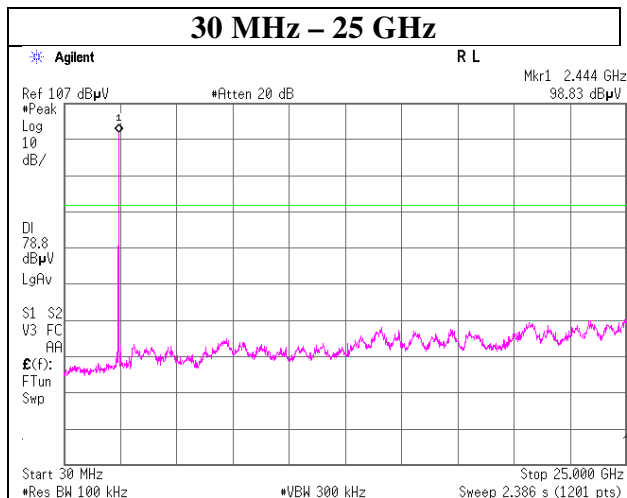
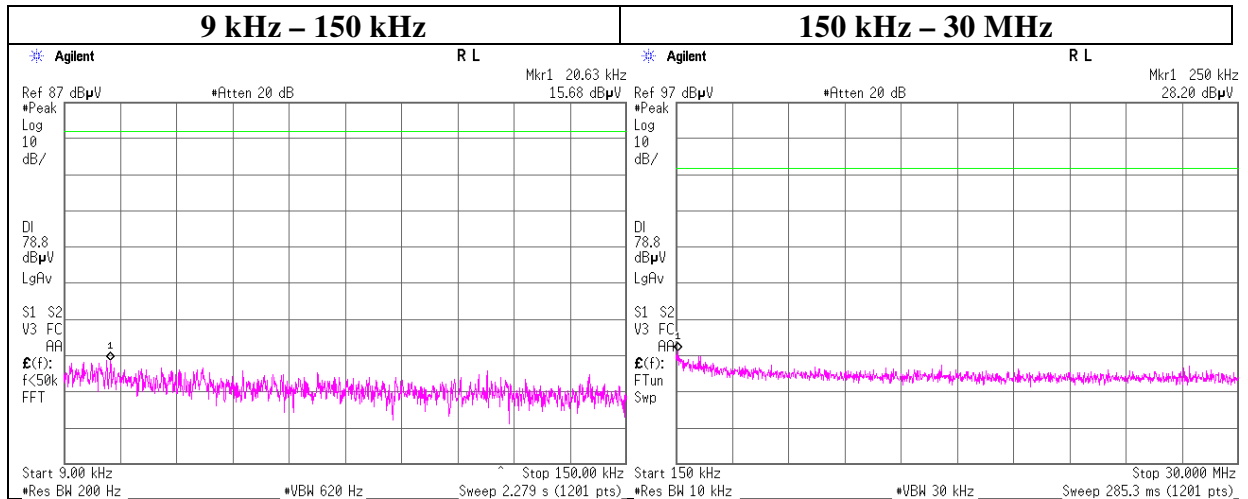
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Test place : Shonan EMC Lab. No. No.5 Shielded Room
Report No. : 11284471S-A-R2
Date : September 1, 2016
Temperature / Humidity : 26 deg. C / 49 % RH
Engineer : Yosuke Ishikawa
Mode : Tx, Hopping Off, DH5

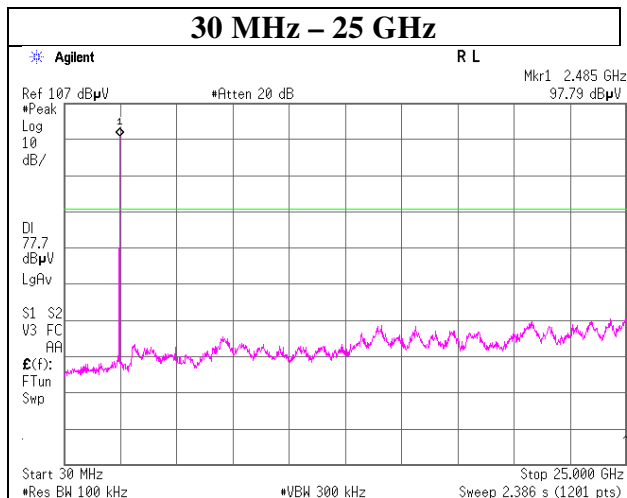
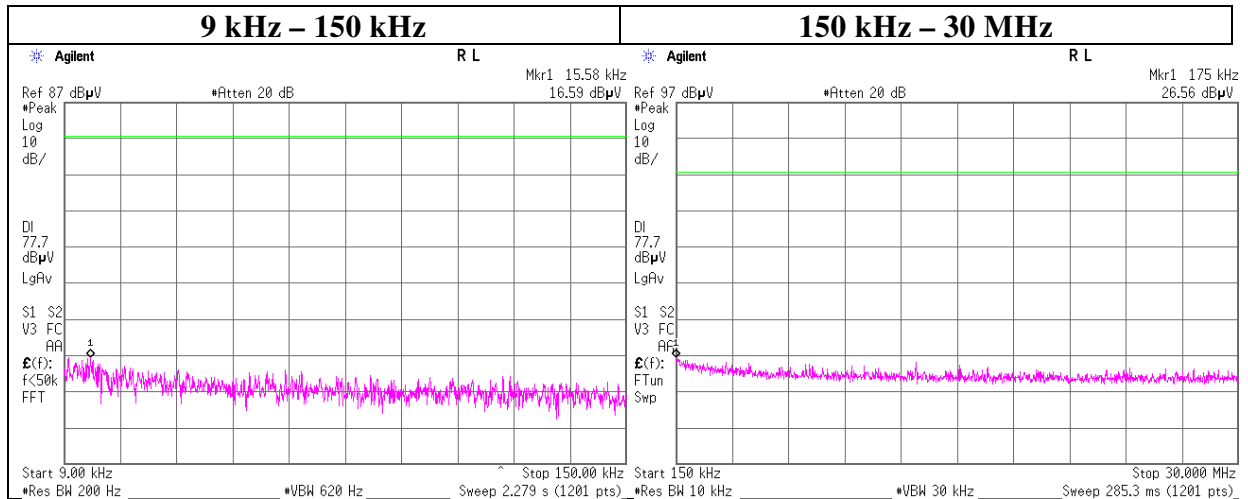
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No. No.5 Shielded Room
Report No. : 11284471S-A-R2
Date : September 1, 2016
Temperature / Humidity : 26 deg. C / 49 % RH
Engineer : Yosuke Ishikawa
Mode : Tx, Hopping Off, DH5

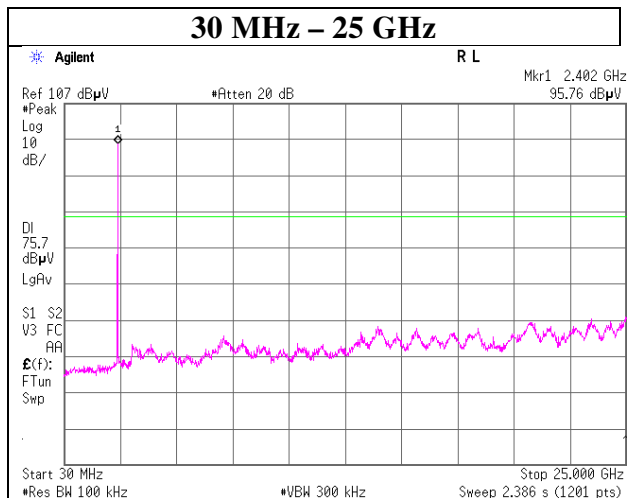
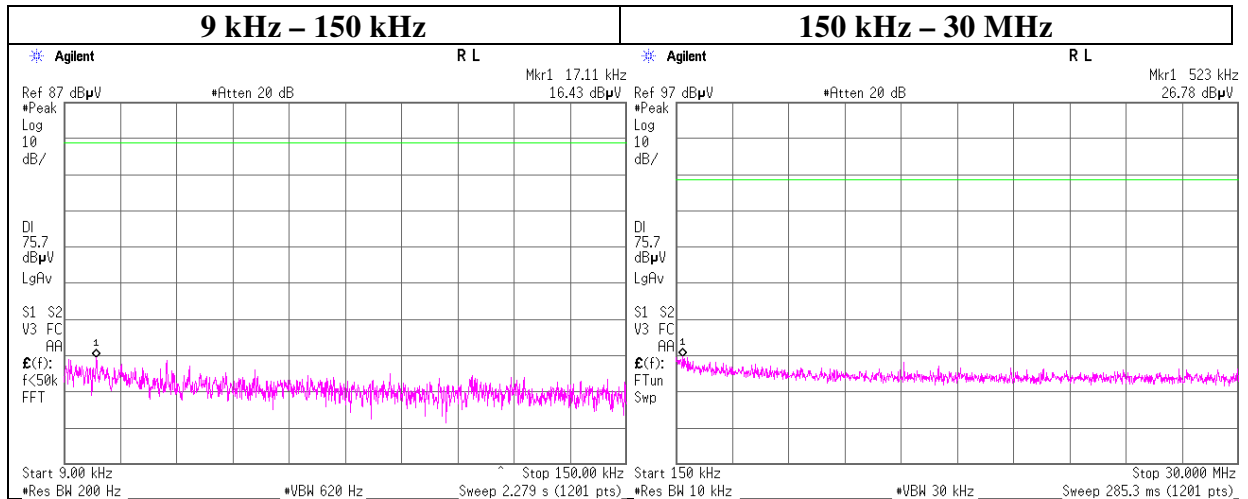
2480 MHz



Conducted Spurious Emission

Test place Shonan EMC Lab. No. No.5 Shielded Room
Report No. 11284471S-A-R2
Date September 1, 2016
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx, Hopping Off, 3DH5

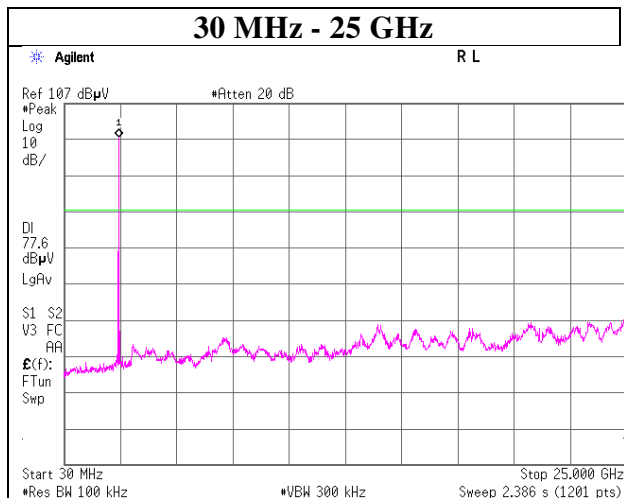
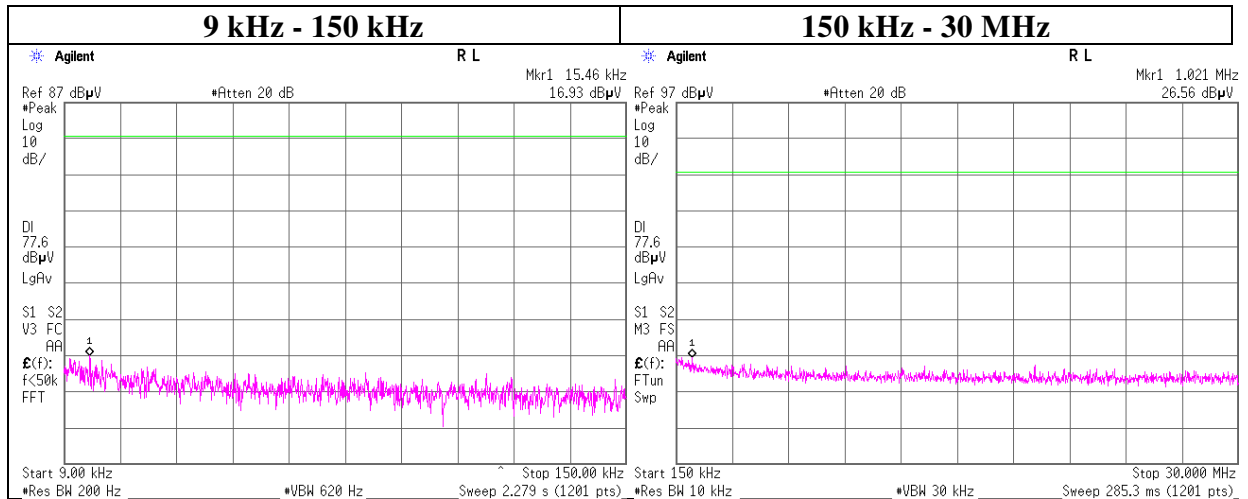
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No. No.5 Shielded Room
Report No. : 11284471S-A-R2
Date : September 1, 2016
Temperature / Humidity : 26 deg. C / 49 % RH
Engineer : Yosuke Ishikawa
Mode : Tx, Hopping Off, 3DH5

2441 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

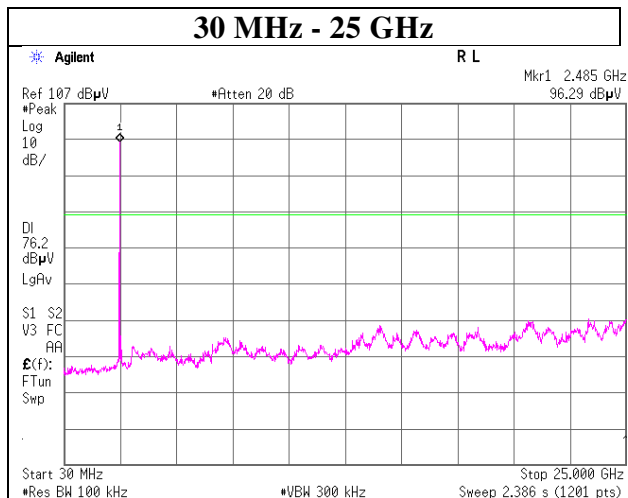
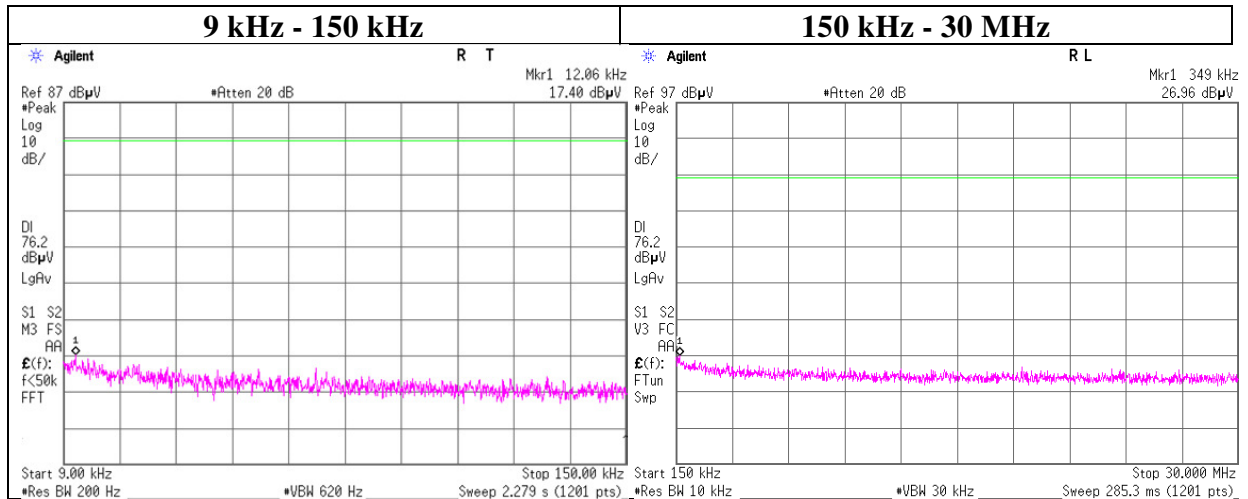
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Test place Shonan EMC Lab. No. No.5 Shielded Room
Report No. 11284471S-A-R2
Date September 1, 2016
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx, Hopping Off, 3DH5

2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

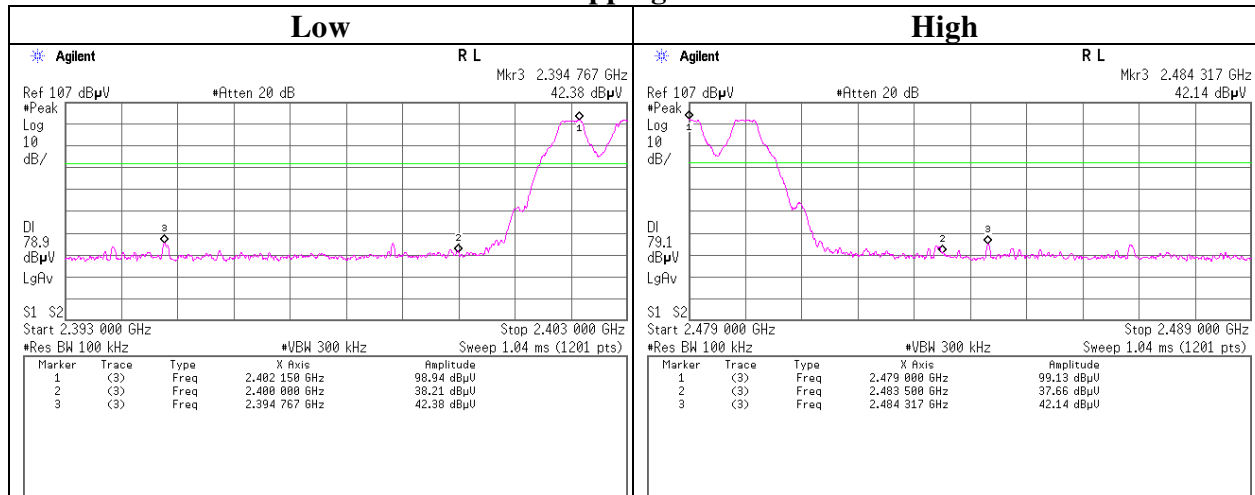
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

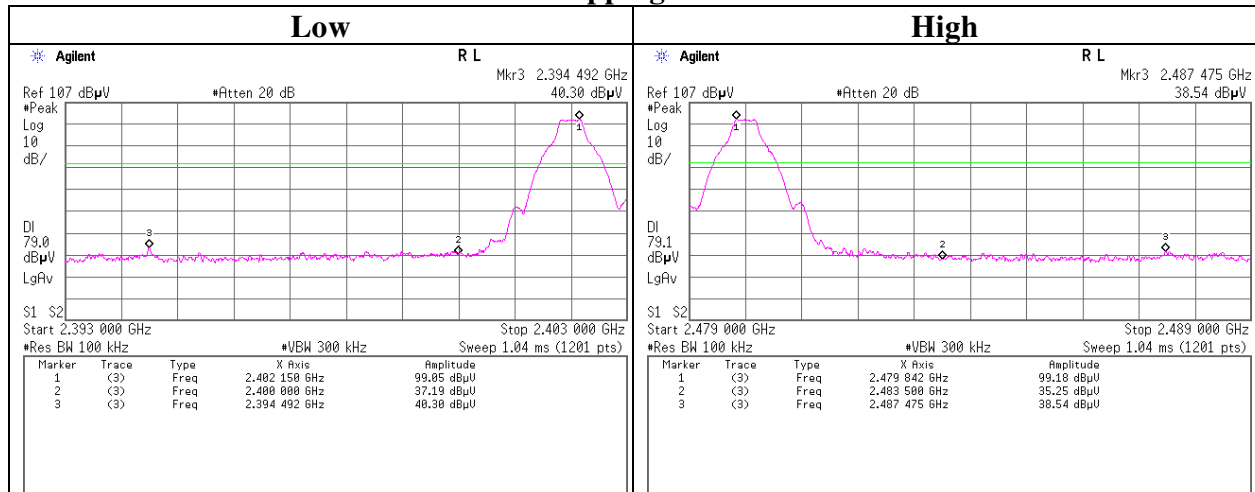
Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No. No.5 Shielded Room
Report No.	11284471S-A-R2
Date	September 1, 2016
Temperature / Humidity	26 deg. C / 49 % RH
Engineer	Yosuke Ishikawa
Mode	Tx DH5

Hopping On



Hopping Off



UL Japan, Inc.

Shonan EMC Lab.

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

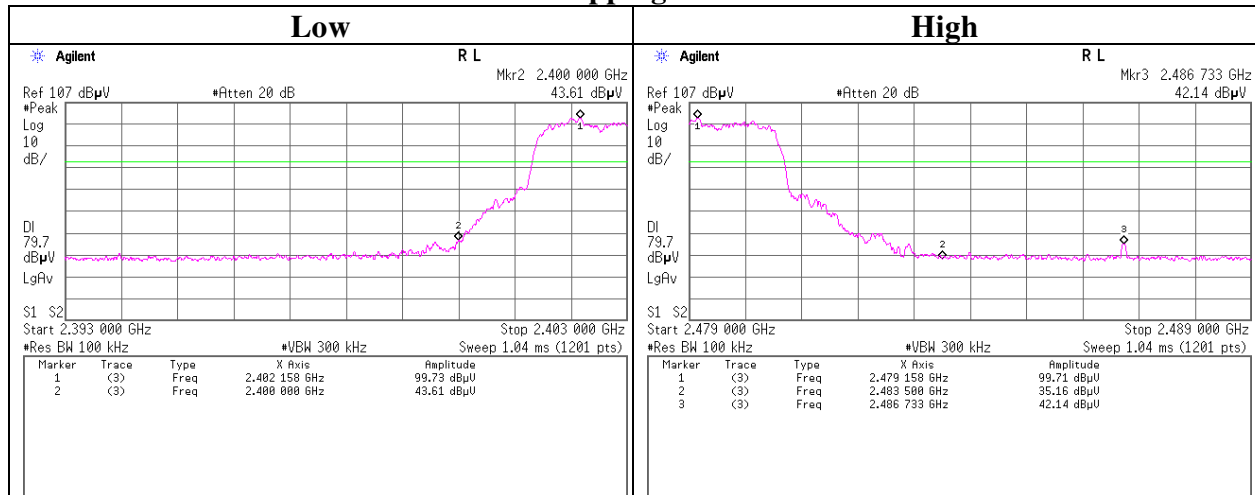
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

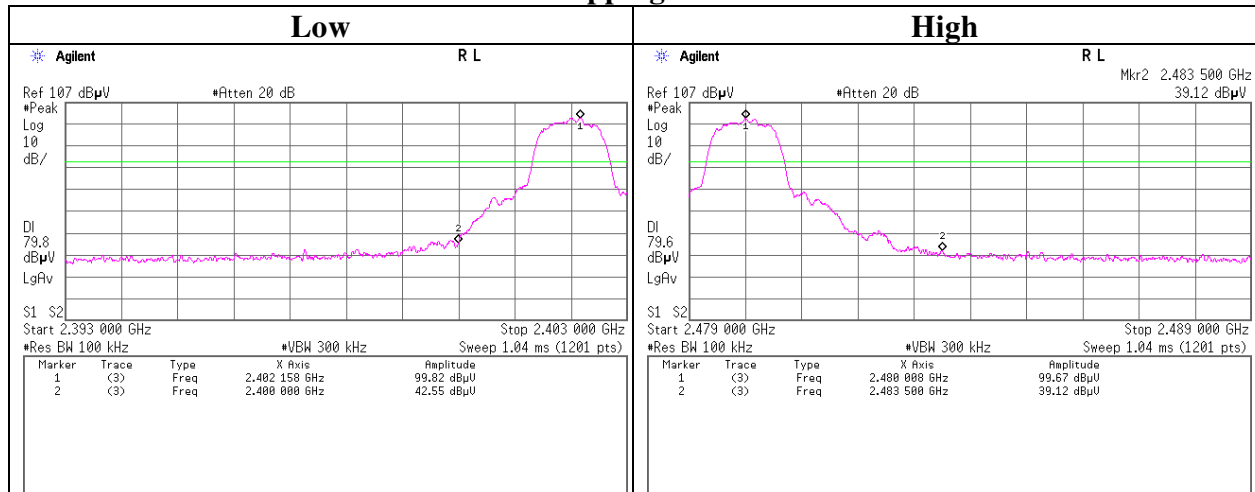
Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No. No.5 Shielded Room
Report No.	11284471S-A-R2
Date	September 1, 2016
Temperature / Humidity	26 deg. C / 49 % RH
Engineer	Yosuke Ishikawa
Mode	Tx 3DH5

Hopping On



Hopping Off



UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

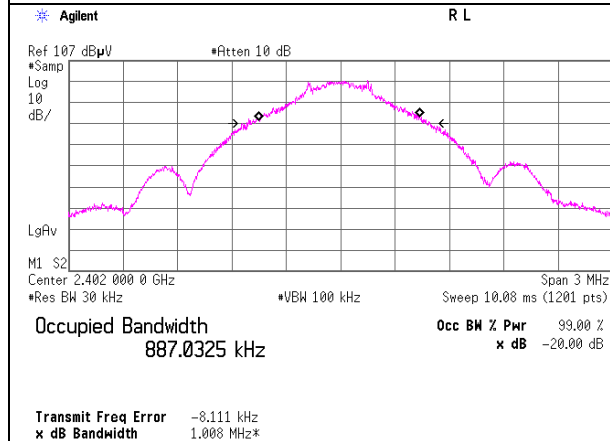
Facsimile : +81 463 50 6401

99% Occupied Bandwidth

Test place	Shonan EMC Lab. No. No.5 Shielded Room
Report No.	11284471S-A-R2
Date	September 1, 2016
Temperature / Humidity	26 deg. C / 49 % RH
Engineer	Yosuke Ishikawa
Mode	Tx Hopping Off

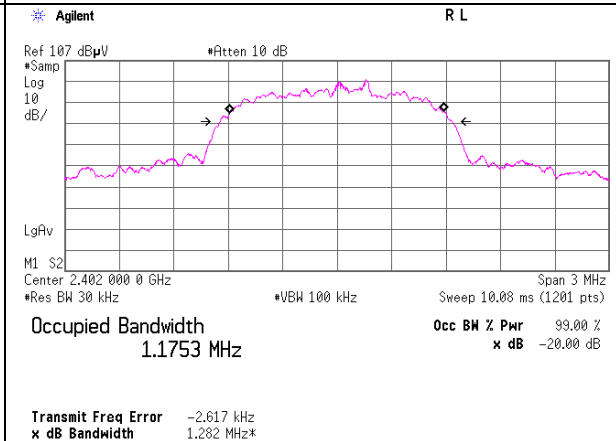
Hopping Off, DH5

2402 MHz

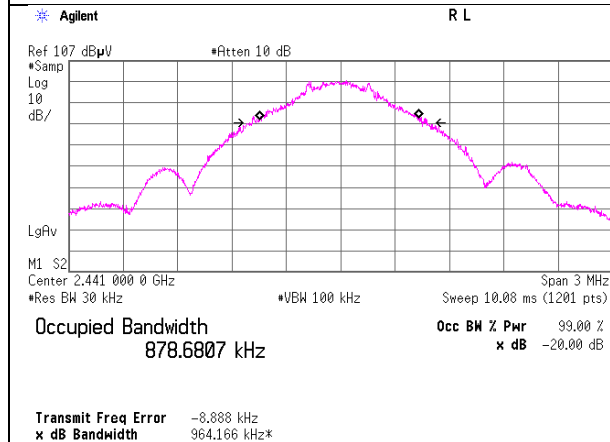


Hopping Off, 3DH5

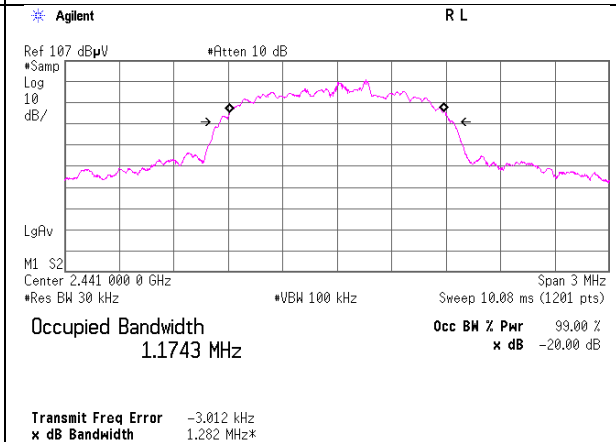
2402 MHz



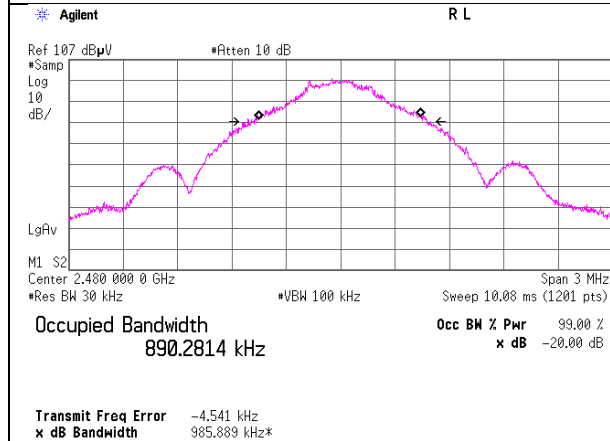
2441 MHz



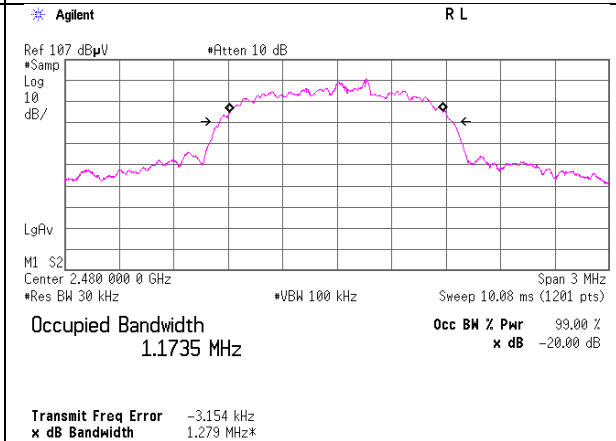
2441 MHz



2480 MHz



2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

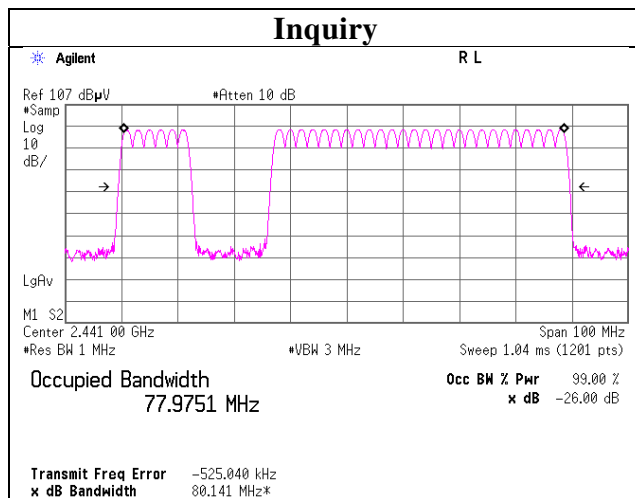
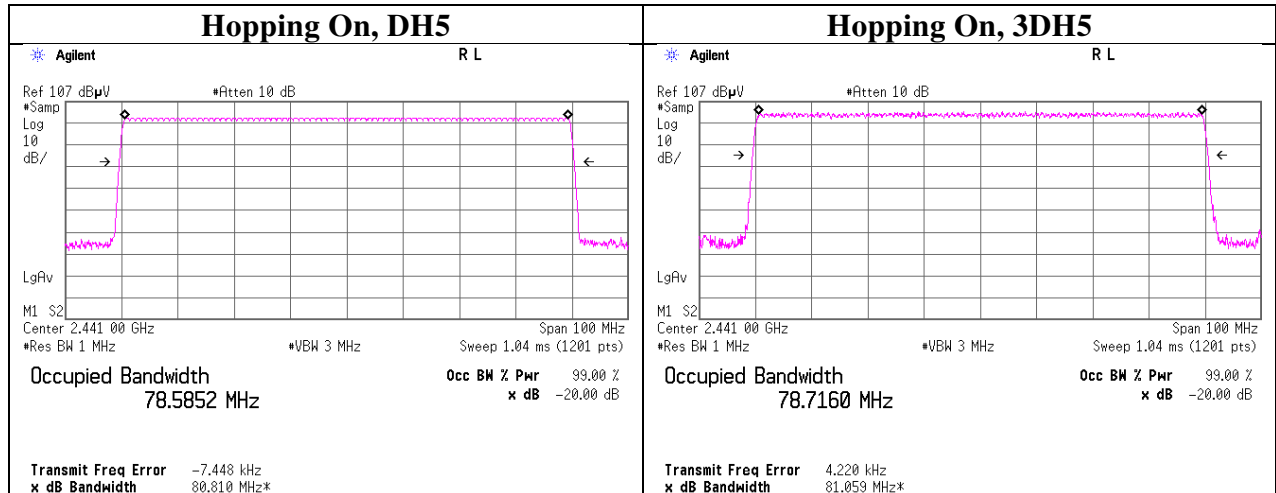
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	11284471S-A-R2	
Date	September 1, 2016	September 7, 2016
Temperature / Humidity	26 deg. C / 49 % RH	24 deg. C / 44 % RH
Engineer	Yosuke Ishikawa	
Mode	Tx Hopping On	



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2016/07/15 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2015/10/11 * 12
SLA-03	Logperiodic Antenna	Schwarzbeck	UHALP9108A	UHALP 9108-A 0901	RE	2015/10/11 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2015/08/31 * 12
SCC-C1/C2/C3/C4/C5/C10/SRSE-03	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	RE	2016/04/22 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2016/02/25 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2016/03/28 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE,RFI,MF)	-	RE	-
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2015/10/22 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2015/11/18 * 12
SHA-05	Horn Antenna	ETS LINDGREN	3160-09	LM4210	RE	2016/03/24 * 12
SAF-09	Pre Amplifier	TOYO Corporation	HAP18-26W	00000018	RE	2015/09/07 * 12
SCC-G20	Coaxial Cable	Junkosha	J12J102518-00	APR-15-15-003	RE	2016/04/18 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2016/04/18 * 12
SAJ-01	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-S001	RE	Pre Check
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2016/03/28 * 12
KAF-02	Pre Amplifier	Hewlett Packard	8449B	3008A01268	RE	2016/04/22 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-018	RE	2016/06/23 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2016/05/11 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2015/08/11 * 12
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2015/08/28 * 12
SAT10-05	Attenuator(above1GHz)	Agilent	8493C-010	74864	RE	2015/11/04 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2015/11/16 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2016/04/04 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2016/04/04 * 12
SCC-G11	Coaxial Cable	Suhner	SUCOFLEX 102	31595/2	AT	2016/03/23 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	AT	2015/11/04 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2016/03/23 * 12
SAT10-10	Attenuator	Weinschel Corp.	54A-10	37584	AT	2016/04/18 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2015/09/16 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	AT	2015/11/18 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2015/12/07 * 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

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