



RADIO TEST REPORT

Test Report No. : 11761678S-A-R1

Applicant : Alpine Electronics, Inc.
Type of Equipment : Car Audio
Model No. : BIS01
FCC ID : A269ZUA153
Test regulation : FCC Part 15 Subpart C: 2017
Test Result : Complied


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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 11761678S-A

Date of test: June 14 to 17, 2017

Representative test engineer:


Morikawa Hiroyuki
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

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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 : Car Audio
Model No. : BIS01
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 14 V
Receipt Date of Sample : June 5, 2017
Country of Mass-production : Hungary, China
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: BIS01 (referred to as the EUT in this report) is a Car Audio.

General Specification

Clock frequency(ies) in the system : 26 MHz, 32.768 kHz

Radio Specification

Bluetooth

Equipment Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Type of Modulation : GFSK, $\pi/4$ -DQPSK, 8DPSK
Power Supply (inner) : DC 3.3 V/ 1.8 V
Antenna Type : $\lambda/4$ pattern Antenna
Antenna Gain : 2.3 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

* The revision on June 14, 2017, 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	7.3 dB 249.999 MHz, QP, Hori.	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 does not have AC power ports.

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

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

FCC Part 15.31 (e)

The EUT provides stable voltage (DC 3.3 V/ 1.8 V) constantly to the wireless transmitter regardless of input voltage. Instead of a new battery, DC power supply was used for the test. That does not affect the test result, Therefore this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

The equipment and its antenna comply with the requirement since the antenna is built in the equipment and it cannot be replaced by end users. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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

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)	9 kHz-30 MHz	3.1 dB	3.1 dB	3.1 dB	-	-
	30 MHz-200 MHz	4.6 dB	4.4 dB	4.6 dB	-	-
	200 MHz-1 GHz	5.8 dB	5.7 dB	5.8 dB	-	-
Radiated emission (Measurement distance: 1 m)	1 GHz-13 GHz	4.9 dB	4.9 dB	4.9 dB	-	-
	13 GHz-18 GHz	4.6 dB	4.6 dB	4.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	18 GHz-40 GHz	4.9 dB	4.9 dB	4.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.72 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.85 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.74 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.91 dB
Spurious emission (Conducted) below 1GHz	1.6 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.3 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.2 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.3 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.4 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

Radiated emission test

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

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	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

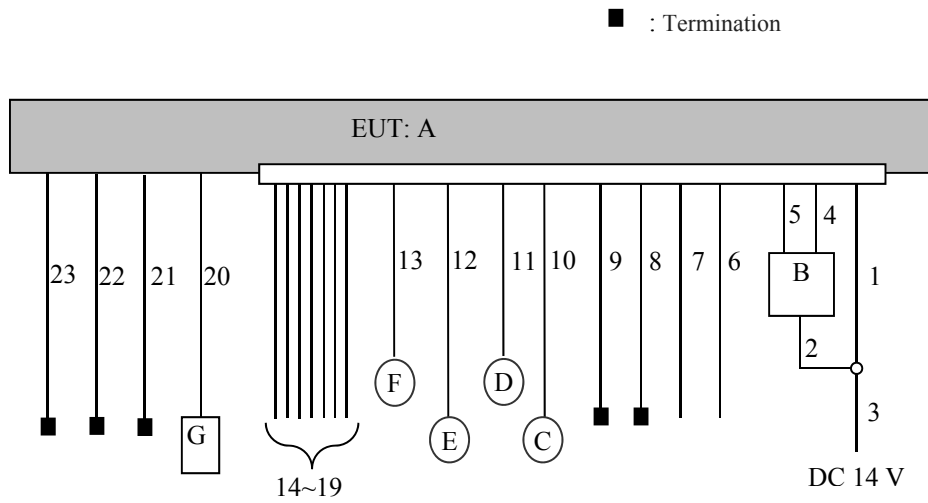
4.1 Operating Mode(s)

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

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test)</p> <p>*2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative.</p> <p>* It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows;</p> <p>- Power settings: Fixed</p> <p>- Software: Tera Term Version 4.8.3</p> <p>*This setting of software is the worst case.</p> <p>Any conditions under the normal use do not exceed the condition of setting.</p> <p>In addition, end users cannot change the settings of the output power of the product.</p>		

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Car Audio	BIS01	AL5656H0200015 *1) AL5656H0200030 *2)	Alpine Electronics, Inc.	EUT
B	New CAN-BOX HS	1807 846	G0033968	HAR MAN	-
C	Speaker	KFC-RS160	-	KENWOOD	-
D	Speaker	KFC-RS160	-	KENWOOD	-
E	Speaker	KFC-RS160	-	KENWOOD	-
F	Speaker	KFC-RS160	-	KENWOOD	-
G	USB Memory	JF V33/2GHz	526394 0345	Transcend	-

*1) Used for radiated emission test

*2) Used for antenna terminal conducted test

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC	0.3	Unshielded	Unshielded	-
2	DC	0.6	Unshielded	Unshielded	-
3	DC	1.0	Unshielded	Unshielded	-
4	B-CAN+	0.3 + 0.6	Unshielded	Unshielded	-
5	B-CAN-	0.3 + 0.6	Unshielded	Unshielded	-
6	LAN	0.3 + 1.0	Unshielded	Unshielded	-
7	RS232C	0.3 + 0.7	Shielded	Shielded	-
8	Signal	0.3 + 1.5	Shielded	Shielded	-
9	Signal	0.3 + 1.5	Shielded	Shielded	-
10	Speaker	0.3 + 1.9	Unshielded	Unshielded	-
11	Speaker	0.3 + 1.9	Unshielded	Unshielded	-
12	Speaker	0.3 + 1.9	Unshielded	Unshielded	-
13	Speaker	0.3 + 1.9	Unshielded	Unshielded	-
14	Signal	0.3 + 1.0	Unshielded	Unshielded	-
15	Signal	0.3 + 1.0	Unshielded	Unshielded	-
16	Signal	0.3 + 1.0	Unshielded	Unshielded	-
17	Signal	0.3 + 1.0	Unshielded	Unshielded	-
18	Signal	0.3	Unshielded	Unshielded	-
19	Signal	0.3	Unshielded	Unshielded	-
20	USB	0.5 + 1.0	Shielded	Shielded	-
21	ANT1	5.3	Shielded	Shielded	-
22	ANT2	5.3	Shielded	Shielded	-
23	ANT3	5.3	Shielded	Shielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

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

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

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

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

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

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

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz
Test Distance	3 m	3.9 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 25 GHz)		3.9 m*2) (1 GHz – 13 GHz), 1 m*3) (13 GHz – 25 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: $20 \times \log(3.9 \text{ m}/3.0 \text{ m}) = 2.28 \text{ dB}$

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

The EUT was set at 17.1 degree as normal position according to the EUT's specification.

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

Measurement range : 30 MHz - 25 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	Sample	Max Hold *1)	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.

(9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)

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

Test data : APPENDIX

Test result : Pass

APPENDIX 1: Test data

20dB Bandwidth and Carrier Frequency Separation

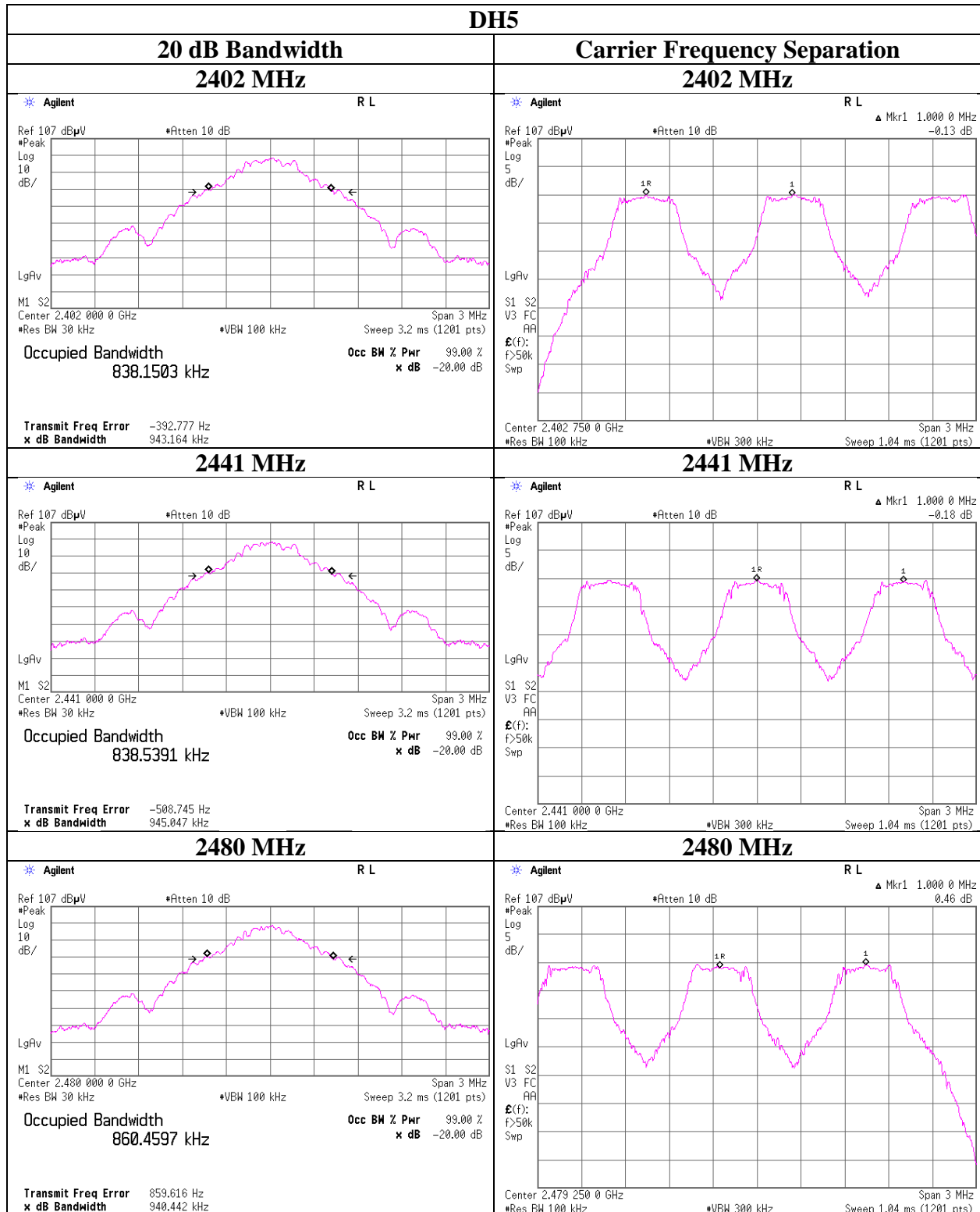
Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11761678S-A-R1
Date June 14, 2017
Temperature / Humidity 25 deg. C / 49 % RH
Engineer Makoto Hosaka
Mode Tx, Hopping On

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.943	1.000	>= 0.629
DH5	2441.0	0.945	1.000	>= 0.630
DH5	2480.0	0.940	1.000	>= 0.627
3DH5	2402.0	1.313	1.000	>= 0.875
3DH5	2441.0	1.310	1.000	>= 0.873
3DH5	2480.0	1.314	1.000	>= 0.876

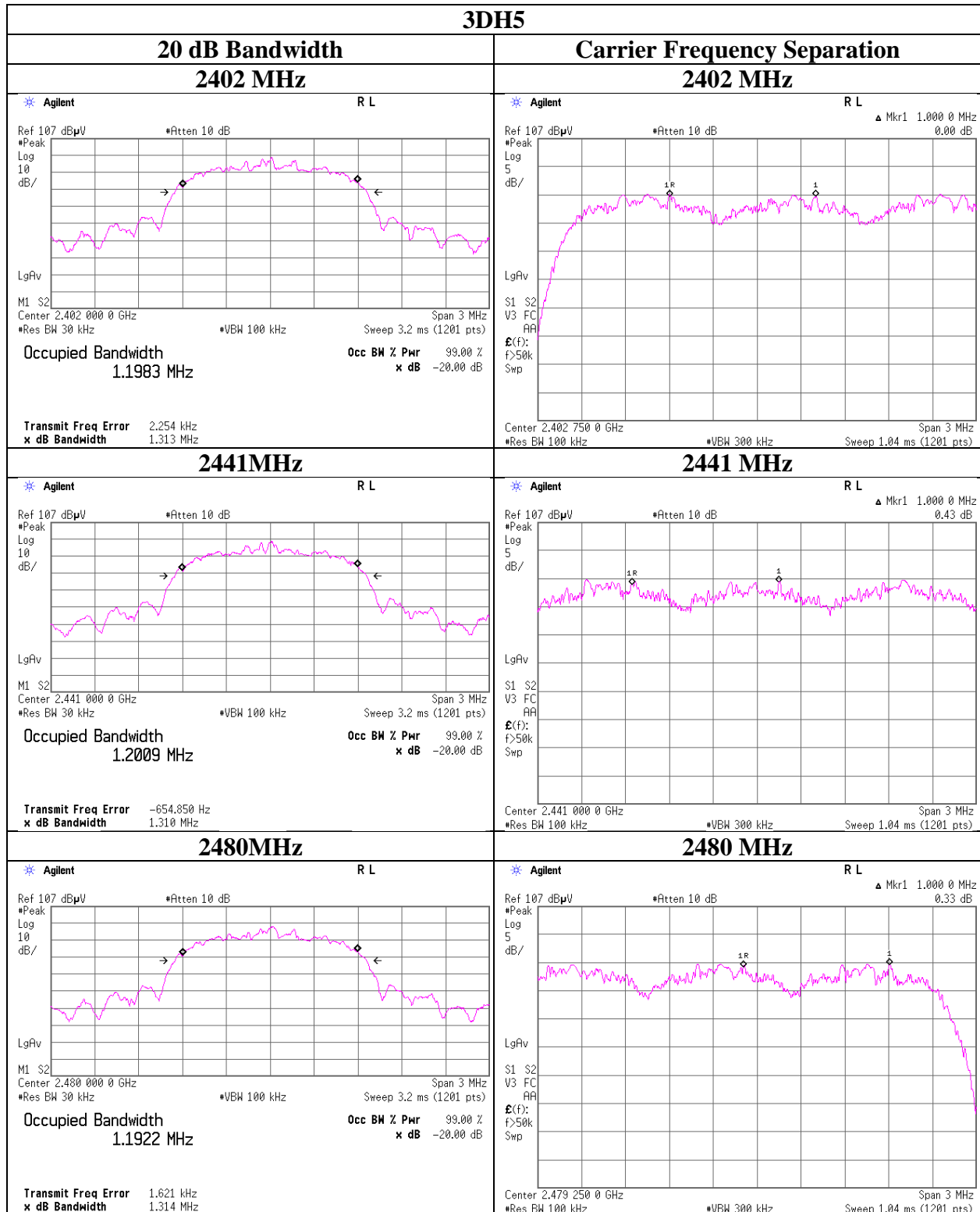
Limit: Two-thirds of 20dB Bandwidth or 25kHz (whichever is greater).

No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation



20dB Bandwidth and Carrier Frequency Separation



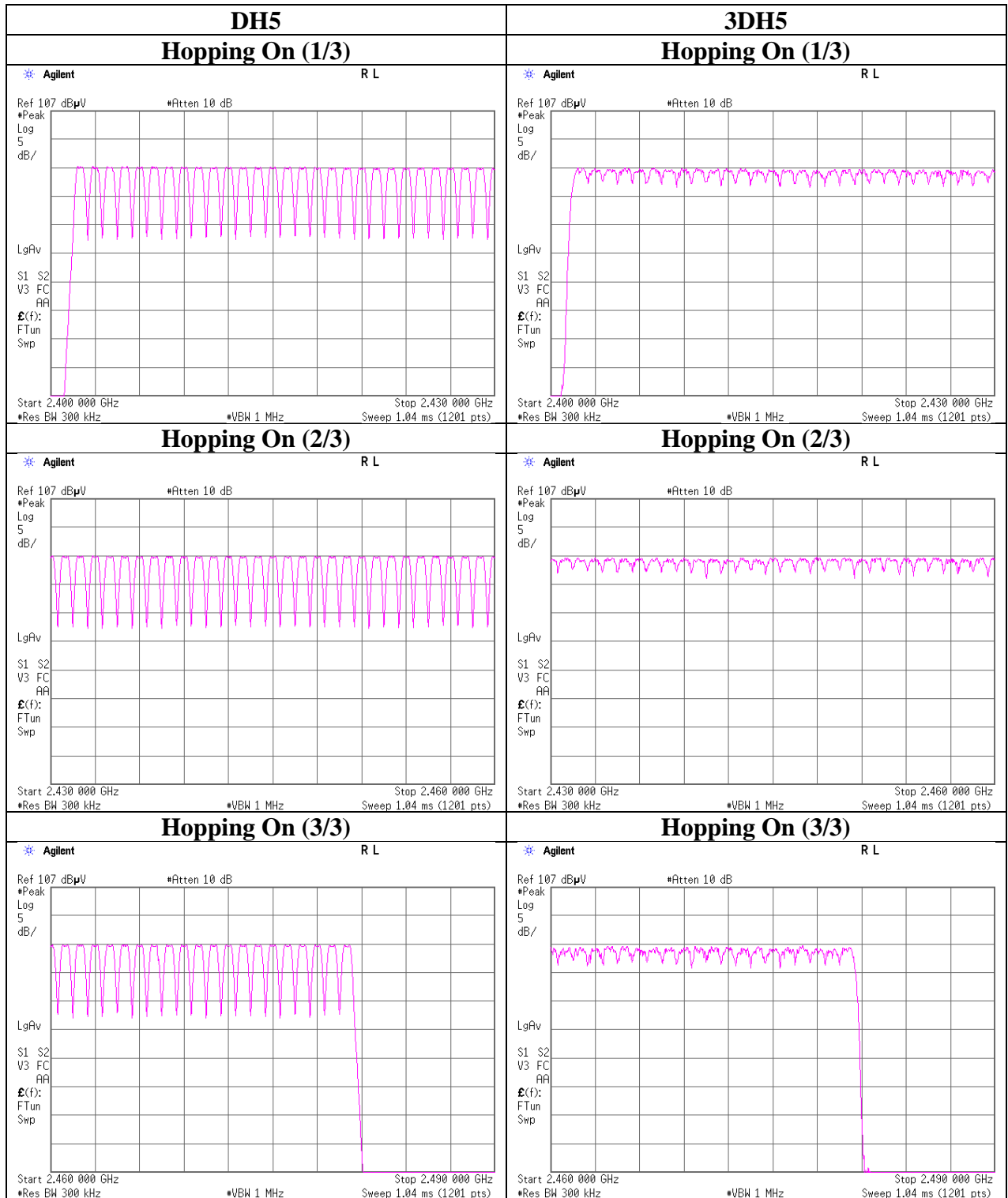
Number of Hopping Frequency

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11761678S-A-R1
Date June 14, 2017
Temperature / Humidity 25 deg. C / 49 % 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



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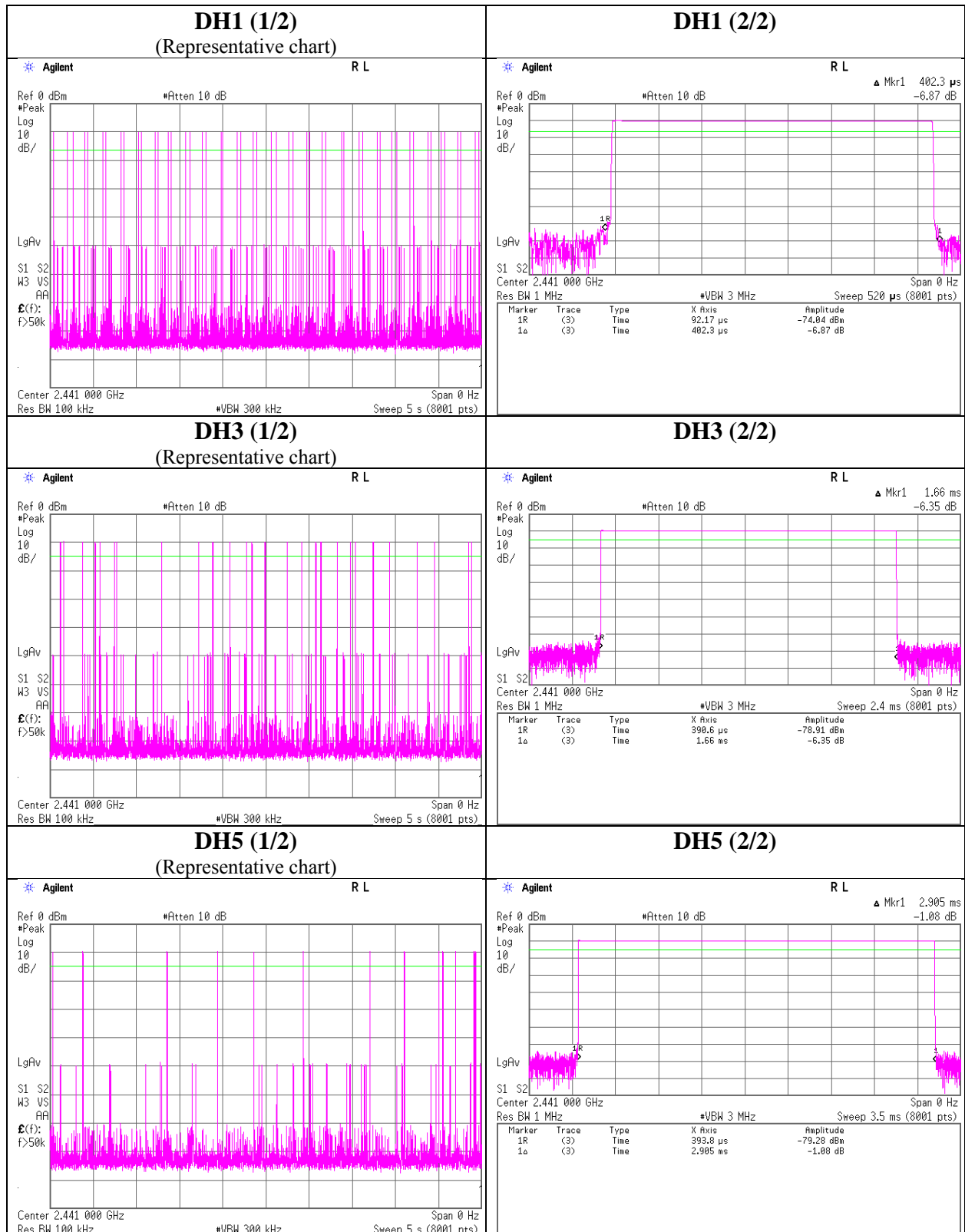
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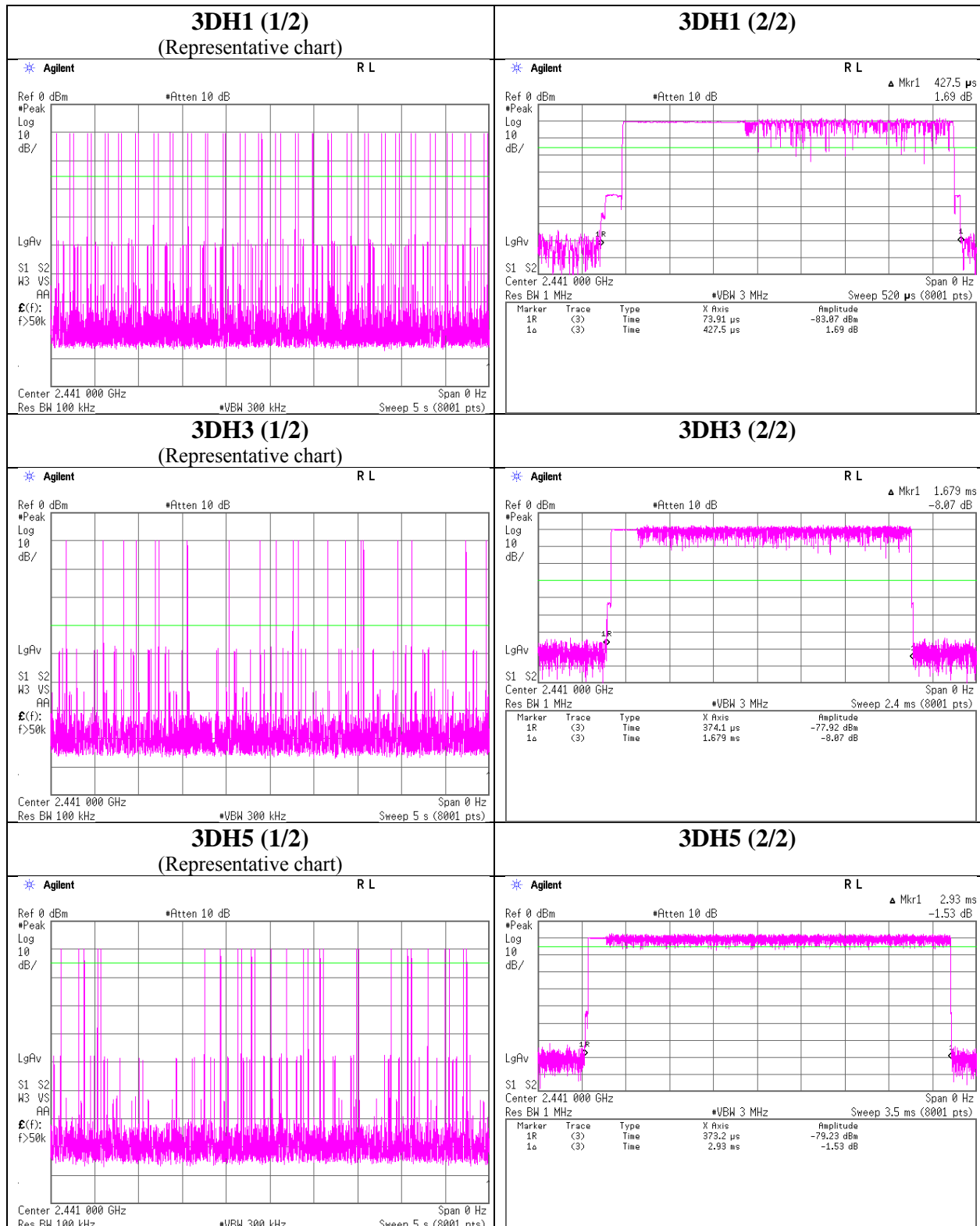
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time



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. : 11761678S-A-R1
Date : June 14, 2017
Temperature / Humidity : 25 deg. C / 49 % 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	-9.65	1.62	9.96	1.93	1.56	20.96	125	19.03
DH5	2441.0	-9.99	1.62	9.97	1.60	1.45	20.96	125	19.36
DH5	2480.0	-10.00	1.63	9.97	1.60	1.45	20.96	125	19.36
2DH5	2402.0	-7.17	1.62	9.96	4.41	2.76	20.96	125	16.55
2DH5	2441.0	-7.41	1.62	9.97	4.18	2.62	20.96	125	16.78
2DH5	2480.0	-7.34	1.63	9.97	4.26	2.67	20.96	125	16.70
3DH5	2402.0	-7.16	1.62	9.96	4.42	2.77	20.96	125	16.54
3DH5	2441.0	-7.39	1.62	9.97	4.20	2.63	20.96	125	16.76
3DH5	2480.0	-7.47	1.63	9.97	4.13	2.59	20.96	125	16.83

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. 11761678S-A-R1
Date June 14, 2017
Temperature / Humidity 25 deg. C / 49 % 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	-11.17	1.62	9.96	0.41	1.10	1.12	1.53	1.42
DH5	2441.0	-11.51	1.62	9.97	0.08	1.02	1.12	1.20	1.32
DH5	2480.0	-11.55	1.63	9.97	0.05	1.01	1.12	1.17	1.31
2DH5	2402.0	-11.11	1.62	9.96	0.47	1.11	1.06	1.53	1.42
2DH5	2441.0	-11.36	1.62	9.97	0.23	1.05	1.06	1.29	1.35
2DH5	2480.0	-11.33	1.63	9.97	0.27	1.06	1.06	1.33	1.36
3DH5	2402.0	-11.57	1.62	9.96	0.01	1.00	1.04	1.05	1.27
3DH5	2441.0	-11.86	1.62	9.97	-0.27	0.94	1.04	0.77	1.19
3DH5	2480.0	-11.91	1.63	9.97	-0.31	0.93	1.04	0.73	1.18

Sample Calculation:

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

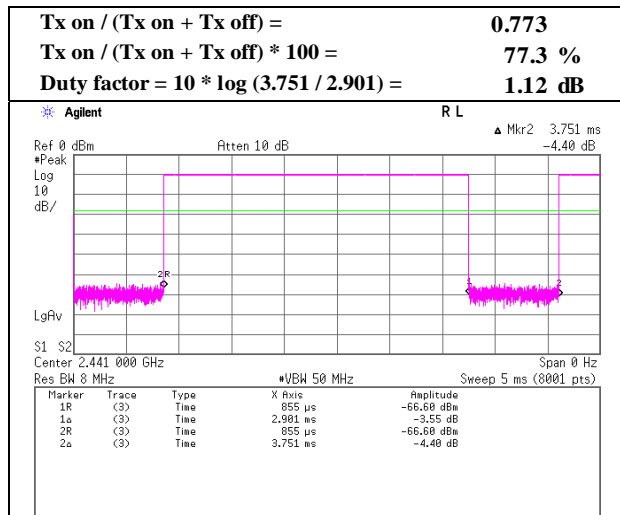
Result (Burst power average) = Time average + Duty factor

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

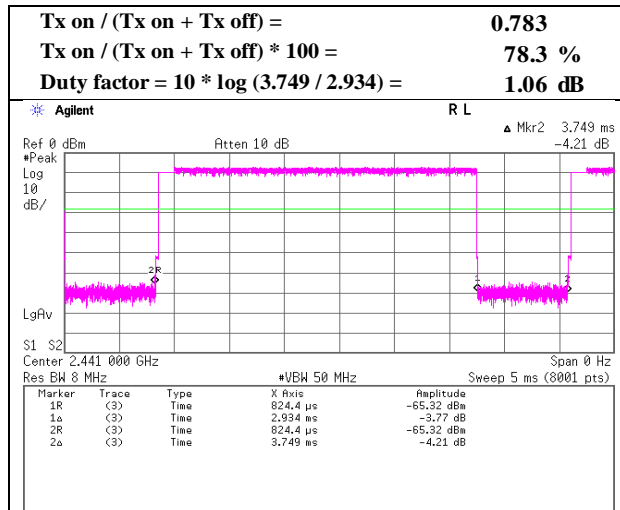
Burst Rate Confirmation

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off

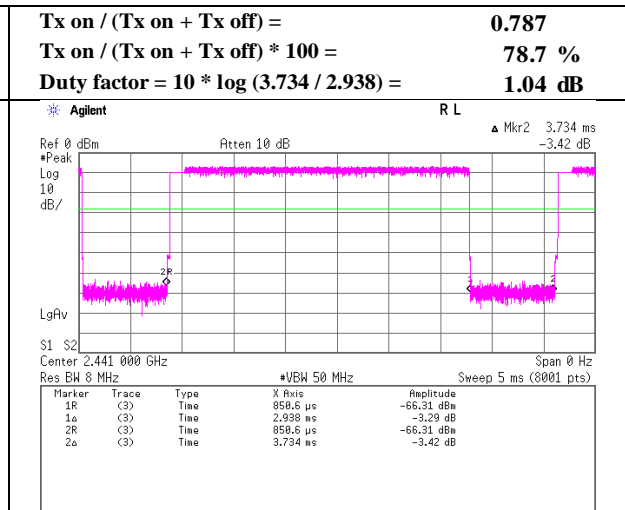
DH5



2DH5



3DH5



Radiated Spurious Emission

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017 June 17, 2017
Temperature / Humidity 22 deg. C / 52 % RH 24 deg. C / 48 % RH
Engineer Owaki Yasumasa Morikawa Hiroyuki
(1 GHz -26.5 GHz) (30MHz-1000MHz)
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.	31.745	QP	35.67	16.89	6.66	32.13	0.00	27.09	40.00	12.9	300	356	
Hori.	91.750	QP	33.47	8.54	7.67	32.09	0.00	17.59	43.50	25.9	263	104	
Hori.	250.001	QP	47.85	11.68	8.45	31.92	0.00	36.06	46.00	9.9	146	196	
Hori.	332.797	QP	41.19	14.12	8.89	31.87	0.00	32.33	46.00	13.6	160	332	
Hori.	499.195	QP	35.56	17.62	9.64	31.84	0.00	30.98	46.00	15.0	100	229	
Hori.	699.989	QP	28.01	19.58	10.39	31.74	0.00	26.24	46.00	19.7	100	319	
Hori.	745.910	QP	33.05	20.03	10.53	31.67	0.00	31.94	46.00	14.0	125	265	
Hori.	831.997	QP	34.19	21.01	10.82	31.31	0.00	34.71	46.00	11.2	118	156	
Hori.	2390.000	PK	43.21	27.41	14.06	36.83	2.28	50.13	73.90	23.7	123	158	
Hori.	3494.430	PK	47.30	28.75	5.92	36.72	2.28	47.53	73.90	26.3	106	147	
Hori.	4804.000	PK	45.58	31.13	6.41	36.99	2.28	48.41	73.90	25.4	143	206	
Hori.	7206.000	PK	46.29	36.44	8.09	37.81	2.28	55.29	73.90	18.6	134	73	
Hori.	9608.000	PK	45.68	38.63	9.30	38.48	2.28	57.41	73.90	16.4	100	0	
Hori.	2390.000	AV	30.90	27.41	14.06	36.83	2.28	37.82	53.90	16.0	123	158	
Hori.	3494.430	AV	35.07	28.75	5.92	36.72	2.28	35.30	53.90	18.6	106	147	
Hori.	4804.000	AV	35.15	31.13	6.41	36.99	2.28	37.98	53.90	15.9	143	206	
Hori.	7206.000	AV	35.53	36.44	8.09	37.81	2.28	44.53	53.90	9.3	134	73	
Hori.	9608.000	AV	33.44	38.63	9.30	38.48	2.28	45.17	53.90	8.7	100	0	
Vert.	35.006	QP	37.43	15.92	6.73	32.13	0.00	27.95	40.00	12.0	151	233	
Vert.	89.192	QP	30.18	8.07	7.72	32.09	0.00	13.88	43.50	29.6	102	194	
Vert.	166.392	QP	31.73	15.67	8.02	32.02	0.00	23.40	43.50	20.1	100	266	
Vert.	250.001	QP	42.76	11.68	8.45	31.92	0.00	30.97	46.00	15.0	100	338	
Vert.	332.798	QP	38.67	14.12	8.89	31.87	0.00	29.81	46.00	16.1	100	311	
Vert.	499.949	QP	25.58	17.64	9.64	31.84	0.00	21.02	46.00	24.9	100	170	
Vert.	665.599	QP	35.05	19.36	10.26	31.82	0.00	32.85	46.00	13.1	100	215	
Vert.	2390.000	PK	42.68	27.41	14.06	36.83	2.28	49.60	73.90	24.3	135	178	
Vert.	3328.005	PK	45.37	28.64	5.83	36.73	2.28	45.39	73.90	28.5	123	203	
Vert.	3494.430	PK	44.81	28.75	5.92	36.72	2.28	45.04	73.90	28.8	114	202	
Vert.	4804.000	PK	45.23	31.13	6.41	36.99	2.28	48.06	73.90	25.8	132	226	
Vert.	7206.000	PK	46.10	36.44	8.09	37.81	2.28	55.10	73.90	18.8	144	161	
Vert.	9608.000	PK	45.95	38.63	9.30	38.48	2.28	57.68	73.90	16.2	100	0	
Vert.	2390.000	AV	30.89	27.41	14.06	36.83	2.28	37.81	53.90	16.0	135	178	
Vert.	3328.005	AV	35.12	28.64	5.83	36.73	2.28	35.14	53.90	18.7	123	203	
Vert.	3494.430	AV	34.75	28.75	5.92	36.72	2.28	34.98	53.90	18.9	114	202	
Vert.	4804.000	AV	34.23	31.13	6.41	36.99	2.28	37.06	53.90	16.8	132	226	
Vert.	7206.000	AV	35.72	36.44	8.09	37.81	2.28	44.72	53.90	9.1	144	161	
Vert.	9608.000	AV	33.48	38.63	9.30	38.48	2.28	45.21	53.90	8.6	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	81.95	27.46	14.07	36.83	2.28	88.93	-	-	Carrier
Hori.	2400.000	PK	34.11	27.45	14.07	36.83	2.28	41.08	68.93	27.9	
Vert.	2402.000	PK	82.68	27.46	14.07	36.83	2.28	89.66	-	-	Carrier
Vert.	2400.000	PK	34.15	27.45	14.07	36.83	2.28	41.12	69.66	28.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

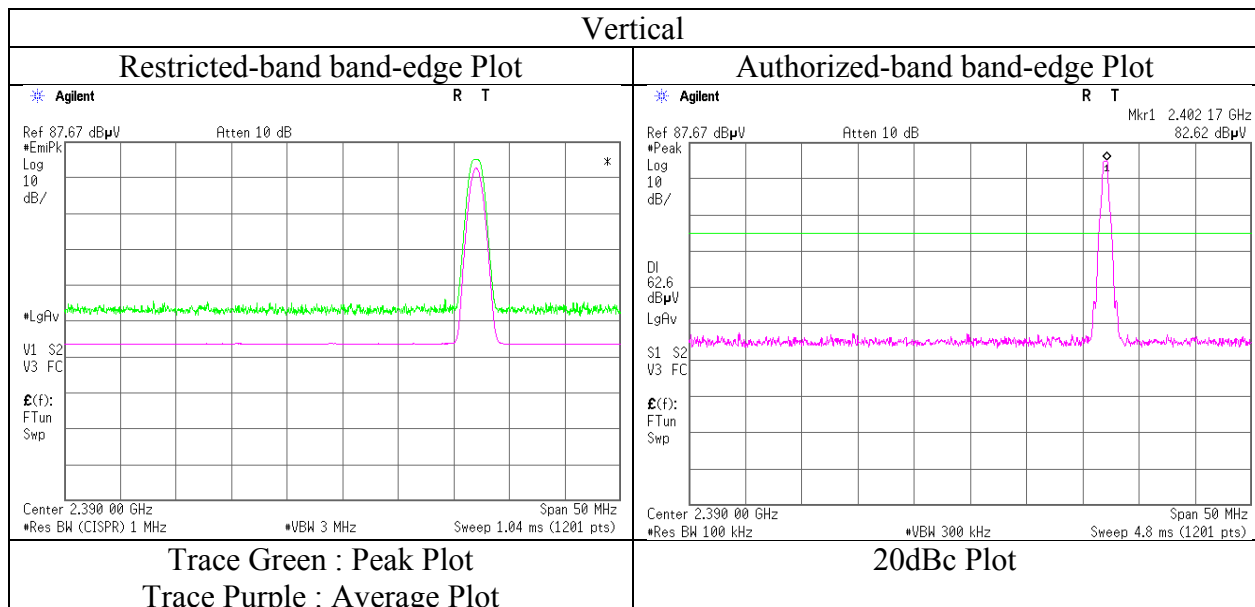
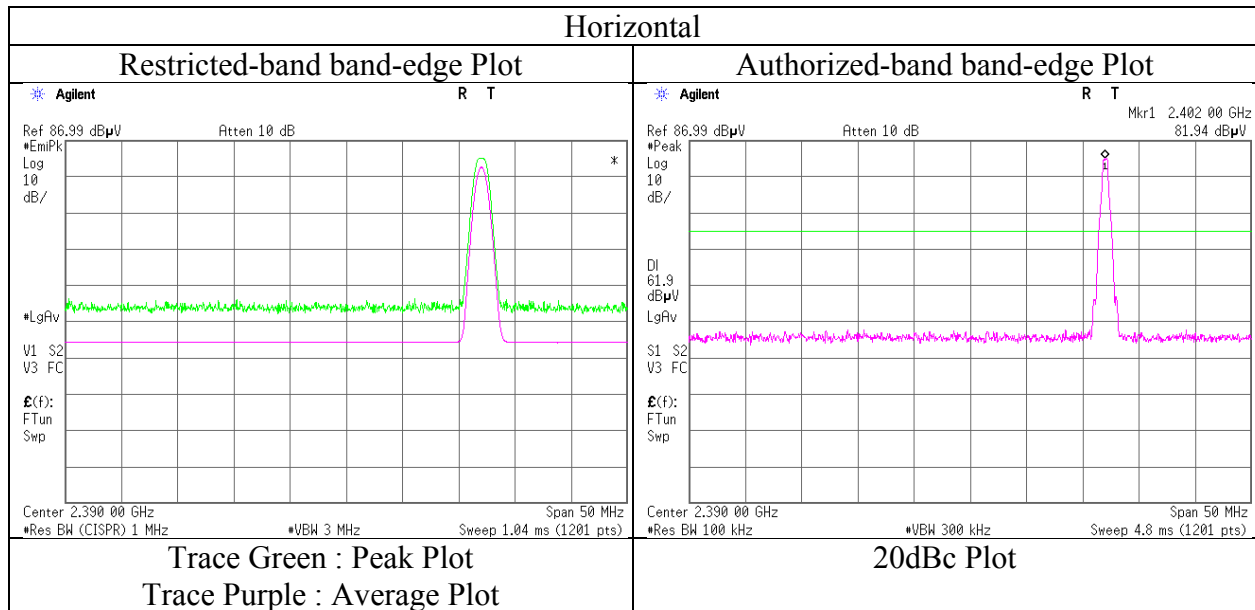
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Owaki Yasumasa
(1 GHz -26.5 GHz)
Mode Tx, Hopping Off, DH5 2402 MHz



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

Radiated Spurious Emission

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017 June 17, 2017
Temperature / Humidity 22 deg. C / 52 % RH 24 deg. C / 48 % RH
Engineer Owaki Yasumasa Morikawa Hiroyuki
(1 GHz -26.5 GHz) (30MHz-1000MHz)
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.	31.995	QP	29.27	16.82	6.67	32.13	0.00	20.63	40.00	19.3	119	87	
Hori.	91.383	QP	37.89	8.47	7.68	32.09	0.00	21.95	43.50	21.5	300	79	
Hori.	250.001	QP	45.98	11.68	8.45	31.92	0.00	34.19	46.00	11.8	153	187	
Hori.	332.798	QP	45.00	14.12	8.89	31.87	0.00	36.14	46.00	9.8	171	190	
Hori.	499.195	QP	37.15	17.62	9.64	31.84	0.00	32.57	46.00	13.4	100	218	
Hori.	665.591	QP	35.36	19.36	10.26	31.82	0.00	33.16	46.00	12.8	100	88	
Hori.	3494.379	PK	48.43	28.75	5.92	36.72	2.28	48.66	73.90	25.2	117	141	
Hori.	4882.000	PK	44.71	31.29	6.47	37.03	2.28	47.72	73.90	26.1	144	209	
Hori.	7323.000	PK	45.83	36.77	8.25	37.88	2.28	55.25	73.90	18.6	135	71	
Hori.	9764.000	PK	45.35	38.75	9.40	38.67	2.28	57.11	73.90	16.7	100	0	
Hori.	3494.379	AV	41.35	28.75	5.92	36.72	2.28	41.58	53.90	12.3	117	141	
Hori.	4882.000	AV	34.38	31.29	6.47	37.03	2.28	37.39	53.90	16.5	144	209	
Hori.	7323.000	AV	33.43	36.77	8.25	37.88	2.28	42.85	53.90	11.0	135	71	
Hori.	9764.000	AV	32.56	38.75	9.40	38.67	2.28	44.32	53.90	9.5	100	0	
Vert.	32.003	QP	38.71	16.81	6.67	32.13	0.00	30.06	40.00	9.9	157	201	
Vert.	75.609	QP	29.49	6.23	7.42	32.10	0.00	11.04	40.00	28.9	159	3	
Vert.	92.333	QP	29.67	8.64	7.67	32.09	0.00	13.89	43.50	29.6	100	211	
Vert.	166.402	QP	29.56	15.67	8.02	32.02	0.00	21.23	43.50	22.2	100	290	
Vert.	250.001	QP	42.05	11.68	8.45	31.92	0.00	30.26	46.00	15.7	100	325	
Vert.	332.798	QP	42.05	14.12	8.89	31.87	0.00	33.19	46.00	12.8	204	144	
Vert.	499.202	QP	34.65	17.62	9.64	31.84	0.00	30.07	46.00	15.9	100	189	
Vert.	715.713	QP	25.83	19.74	10.44	31.71	0.00	24.30	46.00	21.7	122	202	
Vert.	3494.379	PK	47.98	28.75	5.92	36.72	2.28	48.21	73.90	25.6	129	162	
Vert.	4882.000	PK	44.37	31.29	6.47	37.03	2.28	47.38	73.90	26.5	133	223	
Vert.	7323.000	PK	45.68	36.77	8.25	37.88	2.28	55.10	73.90	18.8	137	162	
Vert.	9764.000	PK	45.61	38.75	9.40	38.67	2.28	57.37	73.90	16.5	100	0	
Vert.	3494.379	AV	42.71	28.75	5.92	36.72	2.28	42.94	53.90	10.9	129	162	
Vert.	4882.000	AV	32.75	31.29	6.47	37.03	2.28	35.76	53.90	18.1	133	223	
Vert.	7323.000	AV	34.32	36.77	8.25	37.88	2.28	43.74	53.90	10.1	137	162	
Vert.	9764.000	AV	32.50	38.75	9.40	38.67	2.28	44.26	53.90	9.6	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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

Radiated Spurious Emission

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017 June 17, 2017
Temperature / Humidity 22 deg. C / 52 % RH 24 deg. C / 48 % RH
Engineer Owaki Yasumasa Morikawa Hiroyuki
(1 GHz -26.5 GHz) (30MHz-1000MHz)
Mode Tx, Hopping Off, DH5 2480 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	31.751	QP	28.30	16.89	6.66	32.13	0.00	19.72	40.00	20.2	156	357	
Hori.	55.466	QP	34.15	9.12	6.89	32.12	0.00	18.04	40.00	21.9	314	259	
Hori.	89.226	QP	31.94	8.07	7.72	32.09	0.00	15.64	43.50	27.8	210	296	
Hori.	250.001	QP	47.47	11.68	8.45	31.92	0.00	35.68	46.00	10.3	133	190	
Hori.	256.620	QP	33.99	11.91	8.49	31.92	0.00	22.47	46.00	23.5	156	168	
Hori.	332.795	QP	39.55	14.12	8.89	31.87	0.00	30.69	46.00	15.3	131	222	
Hori.	499.196	QP	35.87	17.62	9.64	31.84	0.00	31.29	46.00	14.7	100	98	
Hori.	665.600	QP	35.72	19.36	10.26	31.82	0.00	33.52	46.00	12.4	100	248	
Hori.	831.994	QP	35.08	21.01	10.82	31.31	0.00	35.60	46.00	10.4	119	158	
Hori.	2483.500	PK	42.92	27.79	14.17	36.79	2.28	50.37	73.90	23.5	113	165	
Hori.	3494.406	PK	46.32	28.75	5.92	36.72	2.28	46.55	73.90	27.3	116	179	
Hori.	4960.000	PK	44.23	31.45	6.52	37.07	2.28	47.41	73.90	26.4	142	208	
Hori.	7440.000	PK	46.36	37.11	8.40	37.95	2.28	56.20	73.90	17.7	134	133	
Hori.	9920.000	PK	44.84	38.87	9.49	38.87	2.28	56.61	73.90	17.2	100	0	
Hori.	2483.500	AV	30.81	27.79	14.17	36.79	2.28	38.26	53.90	15.6	113	165	
Hori.	3494.406	AV	39.77	28.75	5.92	36.72	2.28	40.00	53.90	13.9	116	179	
Hori.	4960.000	AV	33.26	31.45	6.52	37.07	2.28	36.44	53.90	17.4	142	208	
Hori.	7440.000	AV	35.44	37.11	8.40	37.95	2.28	45.28	53.90	8.6	134	133	
Hori.	9920.000	AV	32.07	38.87	9.49	38.87	2.28	43.84	53.90	10.0	100	0	
Vert.	32.479	QP	40.08	16.67	6.68	32.13	0.00	31.30	40.00	8.7	106	109	
Vert.	43.963	QP	33.41	12.70	6.89	32.12	0.00	20.88	40.00	19.1	102	209	
Vert.	55.466	QP	33.91	9.12	6.89	32.12	0.00	17.80	40.00	22.2	100	125	
Vert.	92.442	QP	31.67	8.66	7.67	32.09	0.00	15.91	43.50	27.5	100	232	
Vert.	166.402	QP	31.08	15.67	8.02	32.02	0.00	22.75	43.50	20.7	108	291	
Vert.	250.000	QP	42.91	11.68	8.45	31.92	0.00	31.12	46.00	14.8	100	210	
Vert.	332.592	QP	41.65	14.12	8.89	31.87	0.00	32.79	46.00	13.2	100	140	
Vert.	499.196	QP	35.98	17.62	9.64	31.84	0.00	31.40	46.00	14.6	100	295	
Vert.	721.473	QP	27.98	19.79	10.45	31.71	0.00	26.51	46.00	19.4	100	144	
Vert.	831.994	QP	32.07	21.01	10.82	31.31	0.00	32.59	46.00	13.4	100	157	
Vert.	2483.500	PK	43.19	27.79	14.17	36.79	2.28	50.64	73.90	23.2	137	181	
Vert.	3494.406	PK	46.66	28.75	5.92	36.72	2.28	46.89	73.90	27.0	128	176	
Vert.	4960.000	PK	44.40	31.45	6.52	37.07	2.28	47.58	73.90	26.3	145	228	
Vert.	7440.000	PK	46.33	37.11	8.40	37.95	2.28	56.17	73.90	17.7	143	182	
Vert.	9920.000	PK	44.94	38.87	9.49	38.87	2.28	56.71	73.90	17.1	100	0	
Vert.	2483.500	AV	31.27	27.79	14.17	36.79	2.28	38.72	53.90	15.1	137	181	
Vert.	3494.406	AV	42.68	28.75	5.92	36.72	2.28	42.91	53.90	10.9	128	176	
Vert.	4960.000	AV	33.14	31.45	6.52	37.07	2.28	36.32	53.90	17.5	145	228	
Vert.	7440.000	AV	36.24	37.11	8.40	37.95	2.28	46.08	53.90	7.8	143	182	
Vert.	9920.000	AV	31.92	38.87	9.49	38.87	2.28	43.69	53.90	10.2	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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.

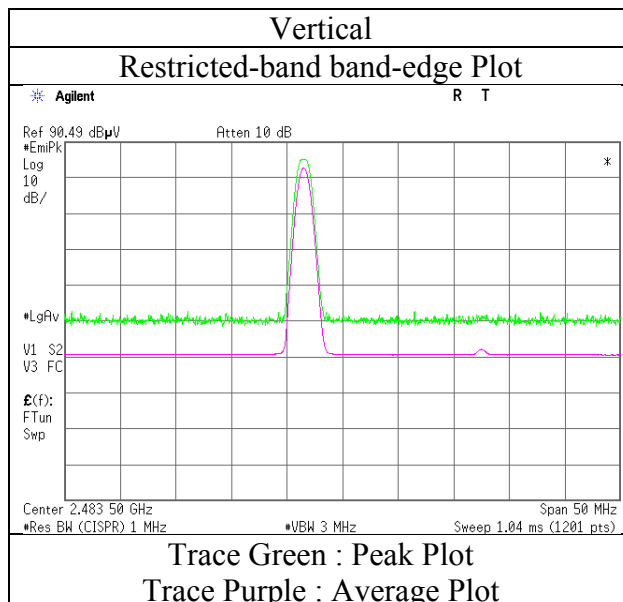
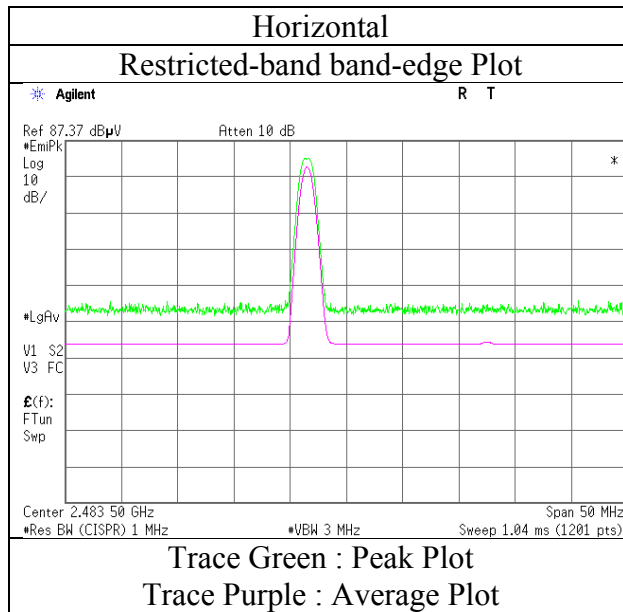
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Owaki Yasumasa
(1 GHz -26.5 GHz)
Mode Tx, Hopping Off, DH5 2480 MHz



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

Radiated Spurious Emission

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017 June 17, 2017
Temperature / Humidity 22 deg. C / 52 % RH 24 deg. C / 48 % RH
Engineer Owaki Yasumasa Morikawa Hiroyuki
(1 GHz -26.5 GHz) (30MHz-1000MHz)
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.	44.518	QP	25.95	12.47	6.91	32.12	0.00	13.21	40.00	26.7	176	262	
Hori.	90.371	QP	33.48	8.29	7.70	32.09	0.00	17.38	43.50	26.1	248	279	
Hori.	195.500	QP	26.07	16.24	7.98	32.00	0.00	18.29	43.50	25.2	155	301	
Hori.	250.000	QP	50.19	11.68	8.45	31.92	0.00	38.40	46.00	7.6	147	185	
Hori.	332.799	QP	42.20	14.12	8.89	31.87	0.00	33.34	46.00	12.6	133	227	
Hori.	499.195	QP	32.25	17.62	9.64	31.84	0.00	27.67	46.00	18.3	100	89	
Hori.	665.596	QP	38.71	19.36	10.26	31.82	0.00	36.51	46.00	9.4	100	219	
Hori.	714.708	QP	33.06	19.73	10.43	31.72	0.00	31.50	46.00	14.5	129	232	
Hori.	831.994	QP	37.02	21.01	10.82	31.31	0.00	37.54	46.00	8.4	111	144	
Hori.	2390.000	PK	43.87	27.41	14.06	36.83	2.28	50.79	73.90	23.1	141	164	
Hori.	3494.403	PK	44.12	28.75	5.92	36.72	2.28	44.35	73.90	29.5	112	156	
Hori.	4804.000	PK	51.84	31.13	6.41	36.99	2.28	54.67	73.90	19.2	161	211	
Hori.	7206.000	PK	46.70	36.44	8.09	37.81	2.28	55.70	73.90	18.2	137	75	
Hori.	9608.000	PK	46.01	38.63	9.30	38.48	2.28	57.74	73.90	16.1	100	0	
Hori.	2390.000	AV	30.87	27.41	14.06	36.83	2.28	37.79	53.90	16.1	141	164	
Hori.	3494.403	AV	32.87	28.75	5.92	36.72	2.28	33.10	53.90	20.8	112	156	
Hori.	4804.000	AV	42.89	31.13	6.41	36.99	2.28	45.72	53.90	8.1	161	211	
Hori.	7206.000	AV	34.43	36.44	8.09	37.81	2.28	43.43	53.90	10.4	137	75	
Hori.	9608.000	AV	33.53	38.63	9.30	38.48	2.28	45.26	53.90	8.6	100	0	
Vert.	33.493	QP	37.08	16.37	6.70	32.13	0.00	28.02	40.00	11.9	100	294	
Vert.	44.009	QP	31.59	12.68	6.89	32.12	0.00	19.04	40.00	20.9	100	330	
Vert.	92.249	QP	34.87	8.62	7.67	32.09	0.00	19.07	43.50	24.4	100	112	
Vert.	166.398	QP	31.56	15.67	8.02	32.02	0.00	23.23	43.50	20.2	107	272	
Vert.	250.001	QP	44.85	11.68	8.45	31.92	0.00	33.06	46.00	12.9	100	4	
Vert.	332.798	QP	42.07	14.12	8.89	31.87	0.00	33.21	46.00	12.7	100	131	
Vert.	499.196	QP	34.65	17.62	9.64	31.84	0.00	30.07	46.00	15.9	135	193	
Vert.	831.991	QP	31.36	21.01	10.82	31.31	0.00	31.88	46.00	14.1	100	155	
Vert.	2390.000	PK	43.82	27.41	14.06	36.83	2.28	50.74	73.90	23.1	137	176	
Vert.	3494.403	PK	43.17	28.75	5.92	36.72	2.28	43.40	73.90	30.5	114	190	
Vert.	4804.000	PK	49.26	31.13	6.41	36.99	2.28	52.09	73.90	21.8	130	226	
Vert.	7206.000	PK	47.17	36.44	8.09	37.81	2.28	56.17	73.90	17.7	133	161	
Vert.	9608.000	PK	46.27	38.63	9.30	38.48	2.28	58.00	73.90	15.9	100	0	
Vert.	2390.000	AV	30.97	27.41	14.06	36.83	2.28	37.89	53.90	16.0	137	176	
Vert.	3494.403	AV	33.90	28.75	5.92	36.72	2.28	34.13	53.90	19.7	114	190	
Vert.	4804.000	AV	39.77	31.13	6.41	36.99	2.28	42.60	53.90	11.3	130	226	
Vert.	7206.000	AV	34.36	36.44	8.09	37.81	2.28	43.36	53.90	10.5	133	161	
Vert.	9608.000	AV	33.59	38.63	9.30	38.48	2.28	45.32	53.90	8.5	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.9 m / 3.0 m) = 2.28 dB

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

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

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	80.85	27.46	14.07	36.83	2.28	87.83	-	-	Carrier
Hori.	2400.000	PK	34.82	27.45	14.07	36.83	2.28	41.79	67.83	26.0	
Vert.	2402.000	PK	82.88	27.46	14.07	36.83	2.28	89.86	-	-	Carrier
Vert.	2400.000	PK	34.96	27.45	14.07	36.83	2.28	41.93	69.86	27.9	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.9 m / 3.0 m) = 2.28 dB

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

UL Japan, Inc.

Shonan EMC Lab.

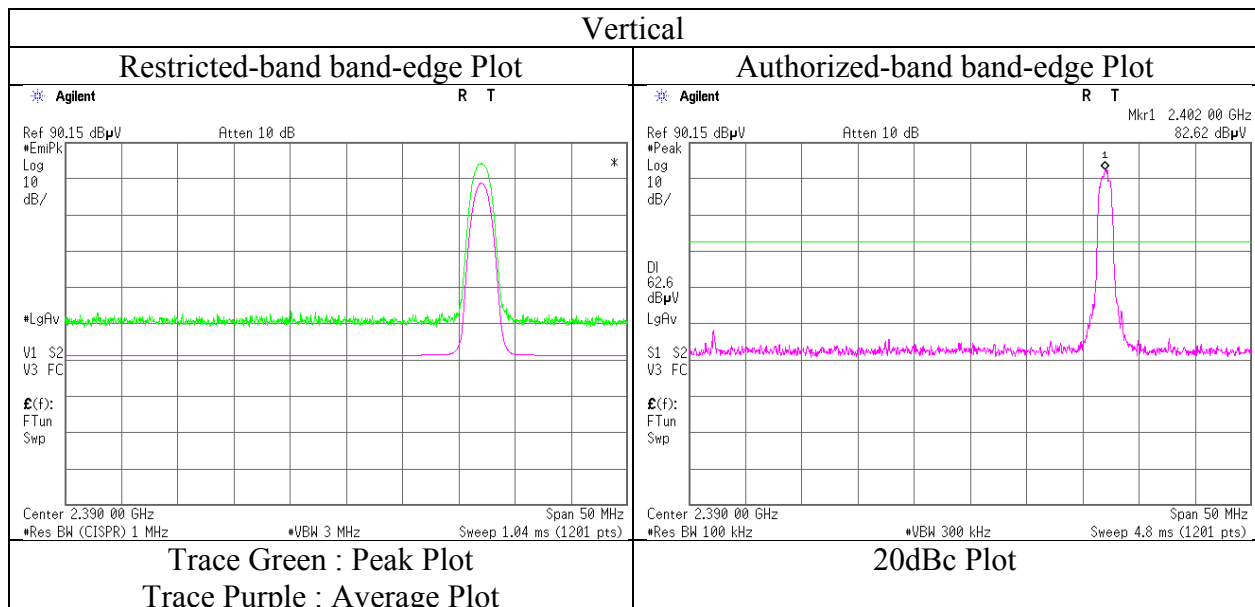
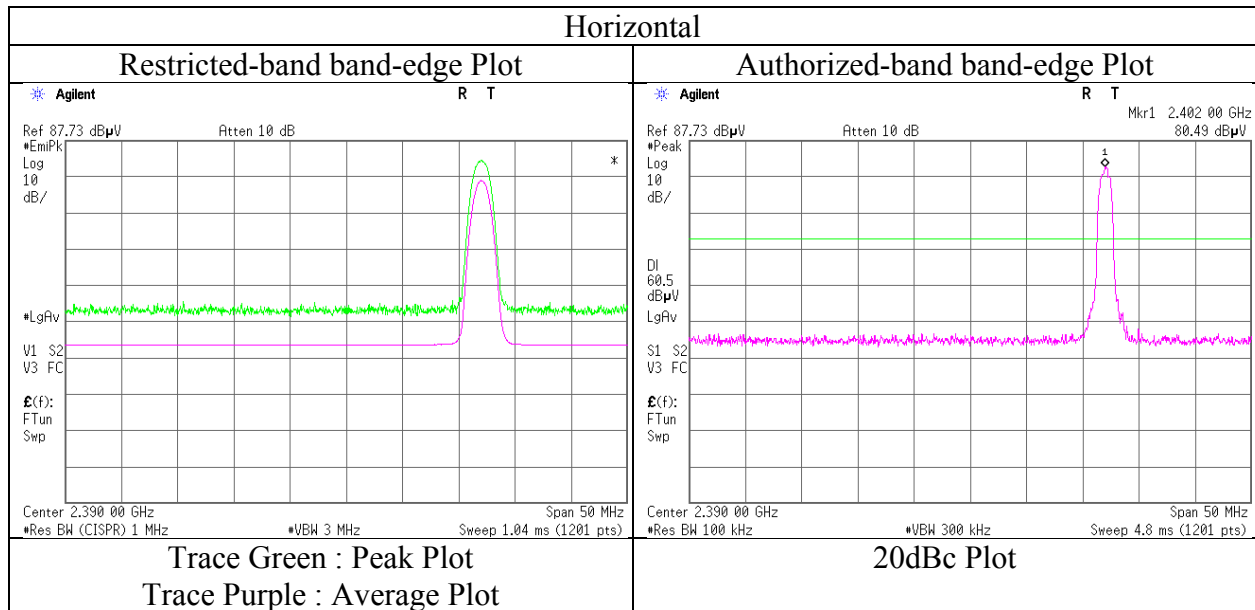
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11761678S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3AC
Date	June 14, 2017
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Owaki Yasumasa (1 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017 June 17, 2017
Temperature / Humidity 22 deg. C / 52 % RH 24 deg. C / 48 % RH
Engineer Owaki Yasumasa Morikawa Hiroyuki
(1 GHz -26.5 GHz) (30MHz-1000MHz)
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.	31.754	QP	28.95	16.89	6.66	32.13	0.00	20.37	40.00	19.6	148	92	
Hori.	44.012	QP	23.25	12.68	6.89	32.12	0.00	10.70	40.00	29.3	148	296	
Hori.	55.462	QP	34.78	9.13	6.89	32.12	0.00	18.68	40.00	21.3	394	263	
Hori.	91.785	QP	35.77	8.54	7.67	32.09	0.00	19.89	43.50	23.6	318	71	
Hori.	249.999	QP	50.40	11.68	8.45	31.92	0.00	38.61	46.00	7.3	149	184	
Hori.	332.798	QP	41.48	14.12	8.89	31.87	0.00	32.62	46.00	13.3	100	150	
Hori.	499.195	QP	35.96	17.62	9.64	31.84	0.00	31.38	46.00	14.6	100	230	
Hori.	665.594	QP	36.67	19.36	10.26	31.82	0.00	34.47	46.00	11.5	100	218	
Hori.	723.804	QP	31.65	19.82	10.46	31.70	0.00	30.23	46.00	15.7	100	198	
Hori.	831.994	QP	37.35	21.01	10.82	31.31	0.00	37.87	46.00	8.1	118	139	
Hori.	3494.397	PK	47.57	28.75	5.92	36.72	2.28	47.80	73.90	26.1	119	161	
Hori.	4882.000	PK	51.66	31.29	6.47	37.03	2.28	54.67	73.90	19.2	153	209	
Hori.	7323.000	PK	46.11	36.77	8.25	37.88	2.28	55.53	73.90	18.3	128	68	
Hori.	9764.000	PK	45.46	38.75	9.40	38.67	2.28	57.22	73.90	16.6	100	0	
Hori.	3494.397	AV	41.66	28.75	5.92	36.72	2.28	41.89	53.90	12.0	119	161	
Hori.	4882.000	AV	42.67	31.29	6.47	37.03	2.28	45.68	53.90	8.2	153	209	
Hori.	7323.000	AV	33.33	36.77	8.25	37.88	2.28	42.75	53.90	11.1	128	68	
Hori.	9764.000	AV	32.58	38.75	9.40	38.67	2.28	44.34	53.90	9.5	100	0	
Vert.	31.506	QP	38.08	16.96	6.66	32.13	0.00	29.57	40.00	10.4	100	116	
Vert.	90.926	QP	34.88	8.39	7.70	32.09	0.00	18.88	43.50	24.6	100	148	
Vert.	249.999	QP	45.85	11.68	8.45	31.92	0.00	34.06	46.00	11.9	100	348	
Vert.	332.798	QP	41.78	14.12	8.89	31.87	0.00	32.92	46.00	13.0	100	132	
Vert.	499.167	QP	35.48	17.62	9.64	31.84	0.00	30.90	46.00	15.1	100	290	
Vert.	665.592	QP	32.05	19.36	10.26	31.82	0.00	29.85	46.00	16.1	100	174	
Vert.	713.994	QP	31.08	19.72	10.43	31.72	0.00	29.51	46.00	16.4	100	143	
Vert.	3494.397	PK	48.66	28.75	5.92	36.72	2.28	48.89	73.90	25.0	136	164	
Vert.	4882.000	PK	49.14	31.29	6.47	37.03	2.28	52.15	73.90	21.7	135	221	
Vert.	7323.000	PK	45.97	36.77	8.25	37.88	2.28	55.39	73.90	18.5	139	165	
Vert.	9764.000	PK	45.74	38.75	9.40	38.67	2.28	57.50	73.90	16.4	100	0	
Vert.	3494.397	AV	42.82	28.75	5.92	36.72	2.28	43.05	53.90	10.8	136	164	
Vert.	4882.000	AV	39.29	31.29	6.47	37.03	2.28	42.30	53.90	11.6	135	221	
Vert.	7323.000	AV	33.74	36.77	8.25	37.88	2.28	43.16	53.90	10.7	139	165	
Vert.	9764.000	AV	32.35	38.75	9.40	38.67	2.28	44.11	53.90	9.7	100	0	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.9 m / 3.0 m) = 2.28 dB

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

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

Radiated Spurious Emission

Report No. 11761678S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3AC
Date June 14, 2017 June 17, 2017
Temperature / Humidity 22 deg. C / 52 % RH 24 deg. C / 48 % RH
Engineer Owaki Yasumasa Morikawa Hiroyuki
(1 GHz -26.5 GHz) (30MHz-1000MHz)
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.	32.012	QP	31.09	16.81	6.67	32.13	0.00	22.44	40.00	17.5	321	40	
Hori.	87.905	QP	42.77	7.80	7.73	32.09	0.00	26.21	40.00	13.7	230	87	
Hori.	250.001	QP	48.38	11.68	8.45	31.92	0.00	36.59	46.00	9.4	154	186	
Hori.	332.796	QP	42.16	14.12	8.89	31.87	0.00	33.30	46.00	12.7	126	13	
Hori.	500.000	QP	30.71	17.64	9.64	31.84	0.00	26.15	46.00	19.8	100	145	
Hori.	665.592	QP	36.46	19.36	10.26	31.82	0.00	34.26	46.00	11.7	100	220	
Hori.	738.026	QP	33.78	19.96	10.50	31.68	0.00	32.56	46.00	13.4	100	215	
Hori.	831.993	QP	37.29	21.01	10.82	31.31	0.00	37.81	46.00	8.1	114	144	
Hori.	2483.500	PK	43.37	27.79	14.17	36.79	2.28	50.82	73.90	23.0	143	160	
Hori.	3494.370	PK	43.66	28.75	5.92	36.72	2.28	43.89	73.90	30.0	108	149	
Hori.	4960.000	PK	51.66	31.45	6.52	37.07	2.28	54.84	73.90	19.0	159	187	
Hori.	7440.000	PK	46.11	37.11	8.40	37.95	2.28	55.95	73.90	17.9	133	62	
Hori.	9920.000	PK	44.37	38.87	9.49	38.87	2.28	56.14	73.90	17.7	100	0	
Hori.	2483.500	AV	30.95	27.79	14.17	36.79	2.28	38.40	53.90	15.5	143	160	
Hori.	3494.370	AV	33.12	28.75	5.92	36.72	2.28	33.35	53.90	20.5	108	149	
Hori.	4960.000	AV	42.72	31.45	6.52	37.07	2.28	45.90	53.90	8.0	159	187	
Hori.	7440.000	AV	33.28	37.11	8.40	37.95	2.28	43.12	53.90	10.7	133	62	
Hori.	9920.000	AV	32.40	38.87	9.49	38.87	2.28	44.17	53.90	9.7	100	0	
Vert.	33.508	QP	36.78	16.36	6.70	32.13	0.00	27.71	40.00	12.2	100	175	
Vert.	166.399	QP	32.19	15.67	8.02	32.02	0.00	23.86	43.50	19.6	100	258	
Vert.	249.999	QP	42.46	11.68	8.45	31.92	0.00	30.67	46.00	15.3	100	317	
Vert.	332.798	QP	41.83	14.12	8.89	31.87	0.00	32.97	46.00	13.0	185	328	
Vert.	499.198	QP	35.05	17.62	9.64	31.84	0.00	30.47	46.00	15.5	100	192	
Vert.	723.971	QP	28.09	19.82	10.46	31.70	0.00	26.67	46.00	19.3	100	138	
Vert.	2483.500	PK	46.22	27.79	14.17	36.79	2.28	53.67	73.90	20.2	136	181	
Vert.	3494.370	PK	44.61	28.75	5.92	36.72	2.28	44.84	73.90	29.0	102	174	
Vert.	4960.000	PK	48.83	31.45	6.52	37.07	2.28	52.01	73.90	21.8	131	223	
Vert.	7440.000	PK	46.34	37.11	8.40	37.95	2.28	56.18	73.90	17.7	131	174	
Vert.	9920.000	PK	44.91	38.87	9.49	38.87	2.28	56.68	73.90	17.2	100	0	
Vert.	2483.500	AV	31.42	27.79	14.17	36.79	2.28	38.87	53.90	15.0	136	181	
Vert.	3494.370	AV	35.69	28.75	5.92	36.72	2.28	35.92	53.90	17.9	102	174	
Vert.	4960.000	AV	39.27	31.45	6.52	37.07	2.28	42.45	53.90	11.4	131	223	
Vert.	7440.000	AV	34.23	37.11	8.40	37.95	2.28	44.07	53.90	9.8	131	174	
Vert.	9920.000	AV	32.15	38.87	9.49	38.87	2.28	43.92	53.90	9.9	100	0	

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

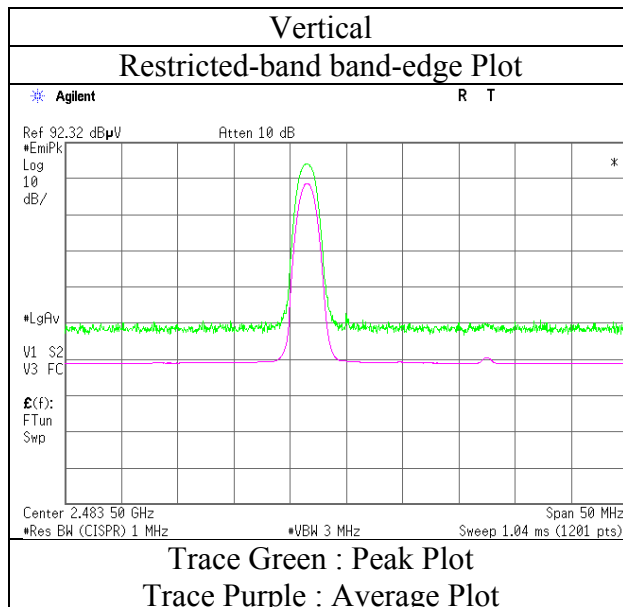
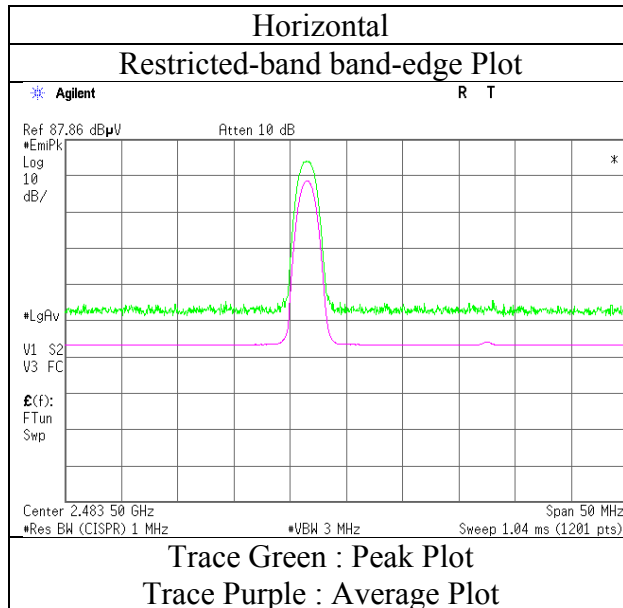
Distance factor : 1 GHz - 13 GHz : $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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)

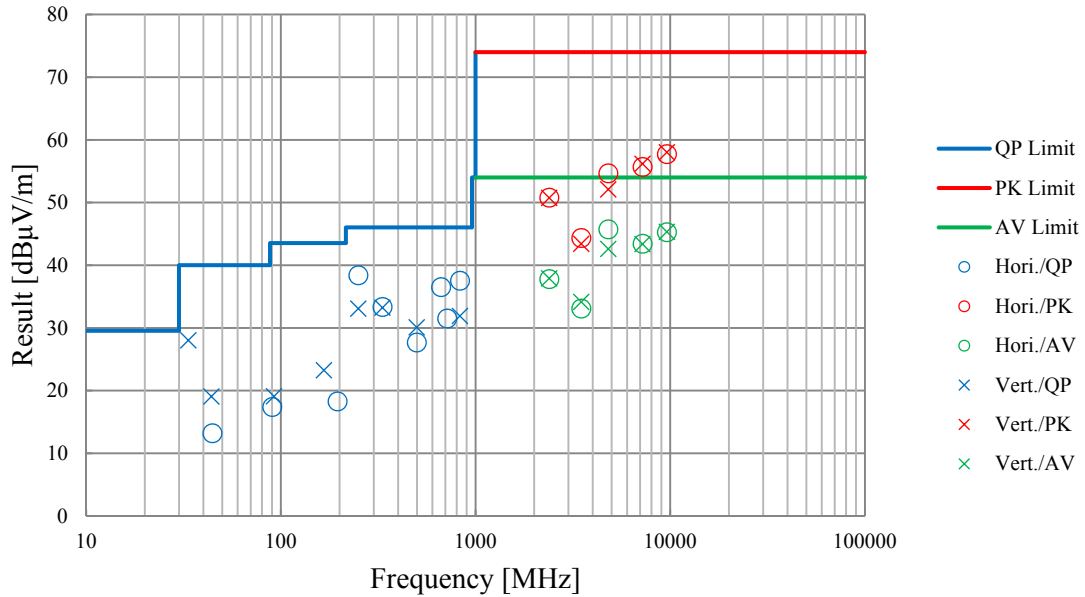
Report No.	11761678S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3AC
Date	June 14, 2017
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Owaki Yasumasa (1 GHz -26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	11761678S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	3AC	
Date	June 14, 2017	June 17, 2017
Temperature / Humidity	22 deg. C / 52 % RH	24 deg. C / 48 % RH
Engineer	Owaki Yasumasa	Morikawa Hiroyuki
	(1 GHz -26.5 GHz)	(30MHz-1000MHz)
Mode	Tx, Hopping Off, 3DH5 2402 MHz	

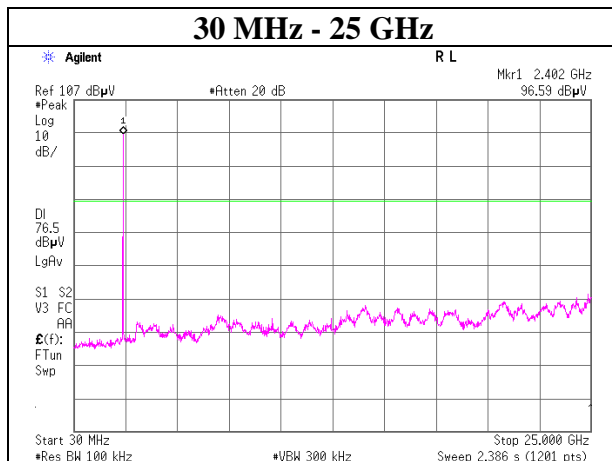
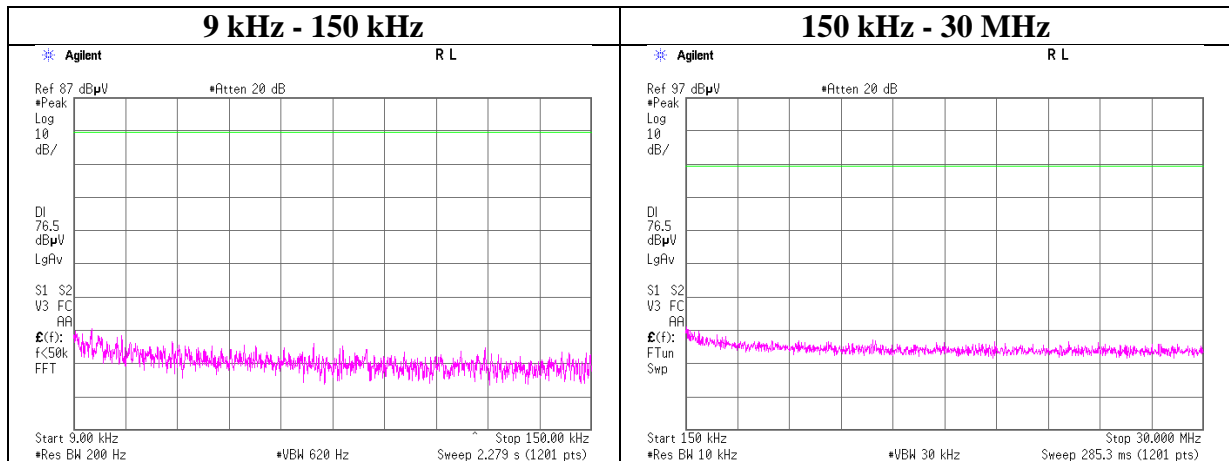


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

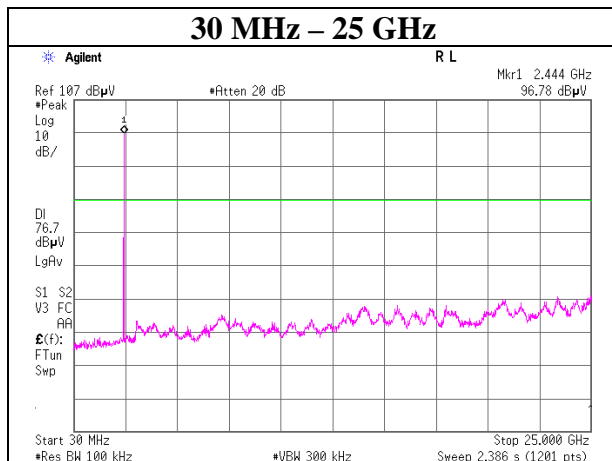
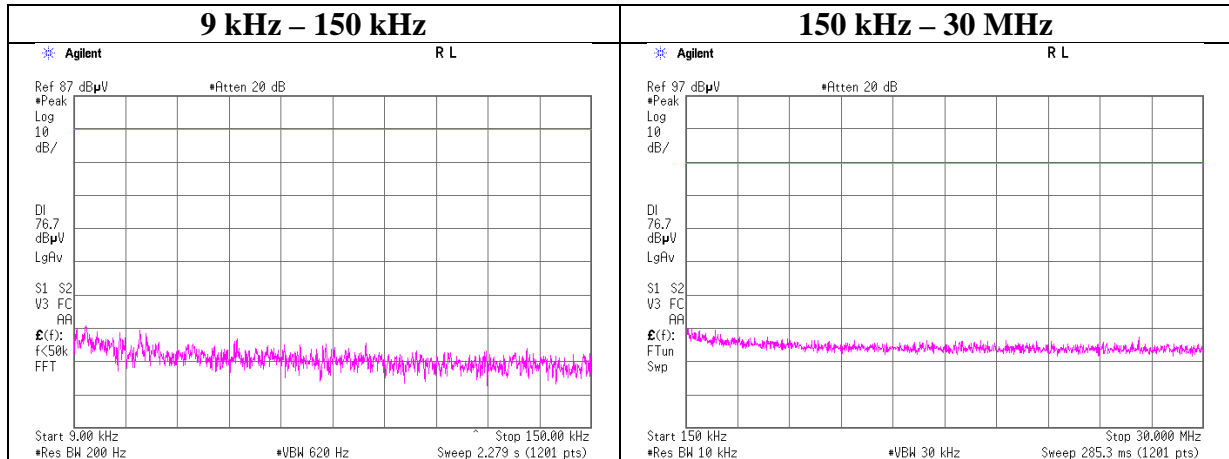
2402 MHz



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

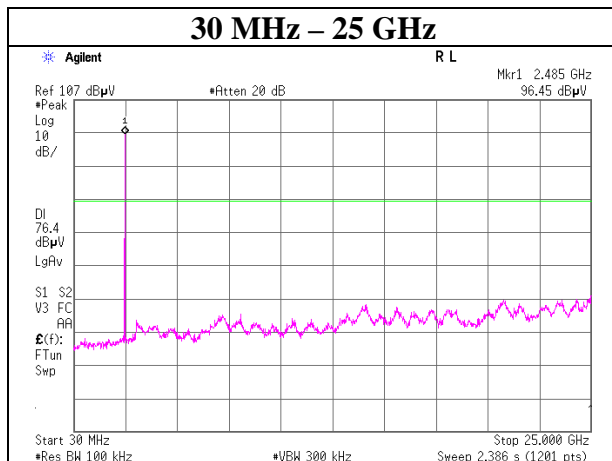
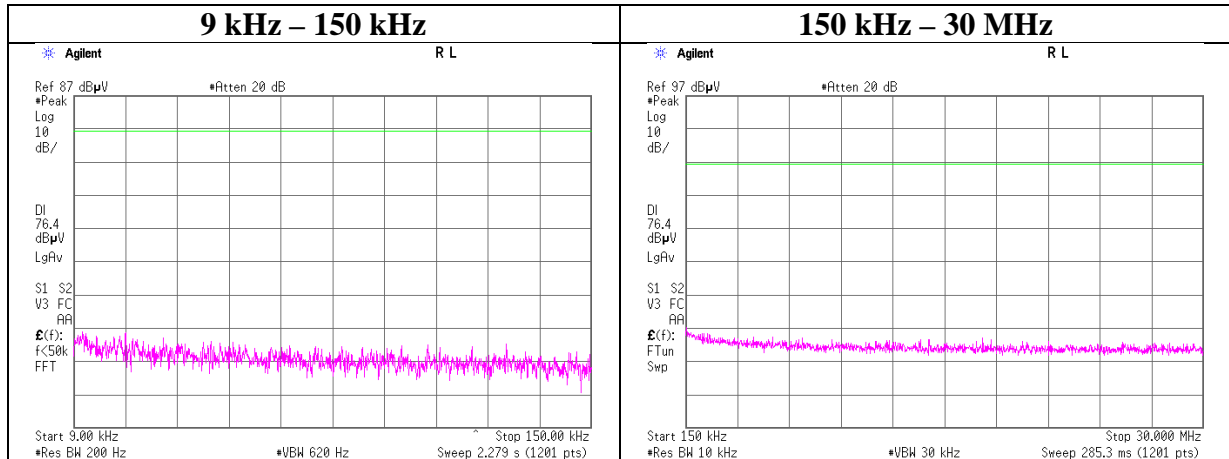
2441 MHz



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, DH5

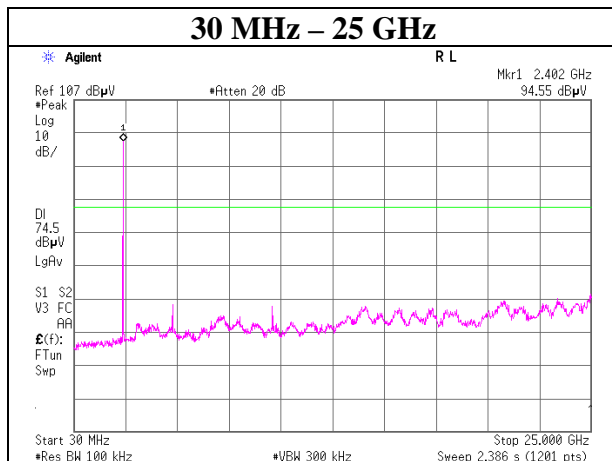
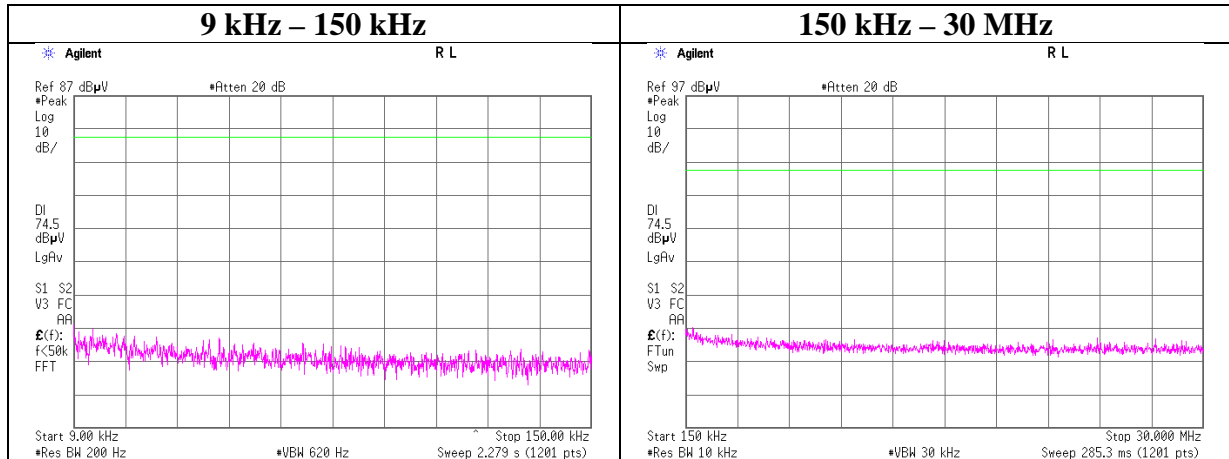
2480 MHz



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, 3DH5

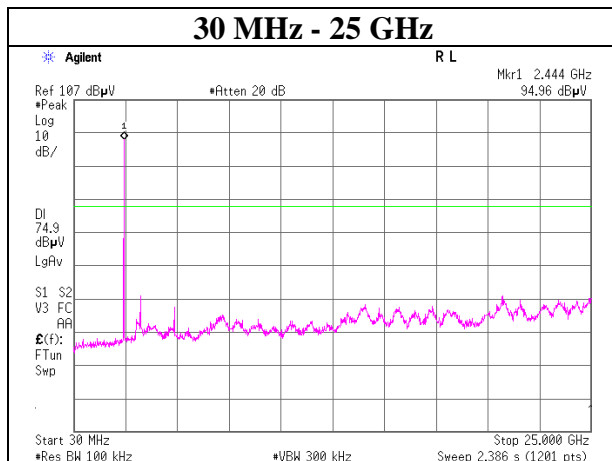
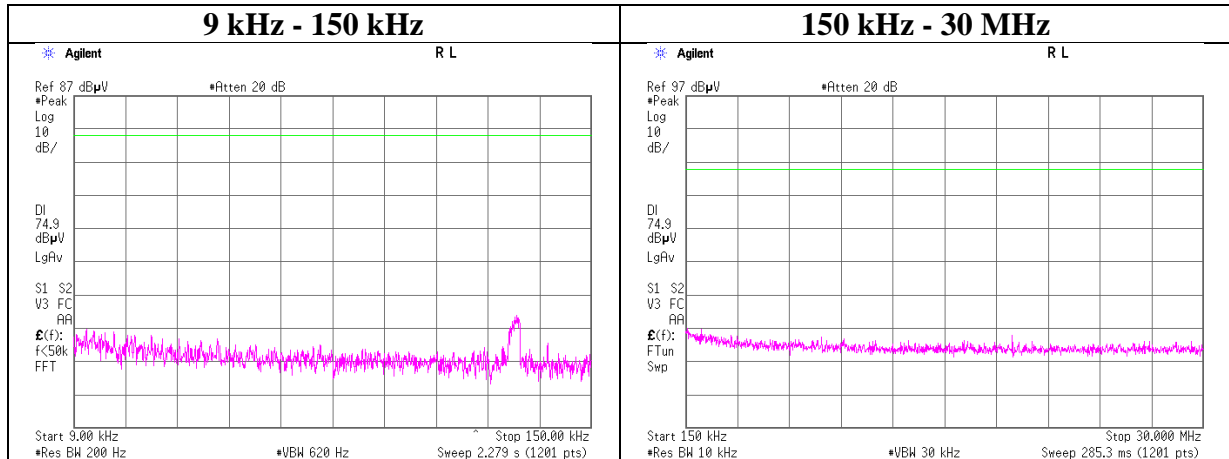
2402 MHz



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, 3DH5

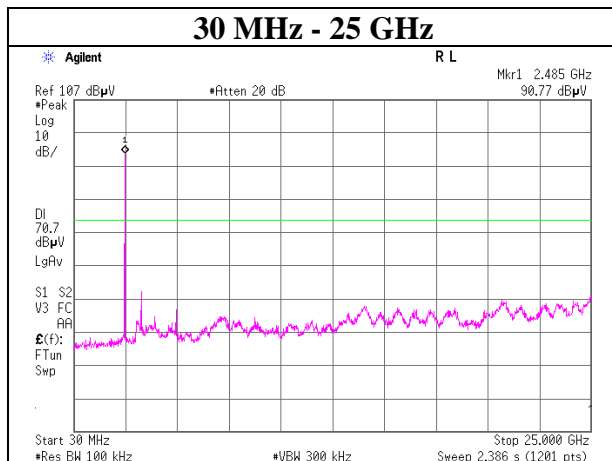
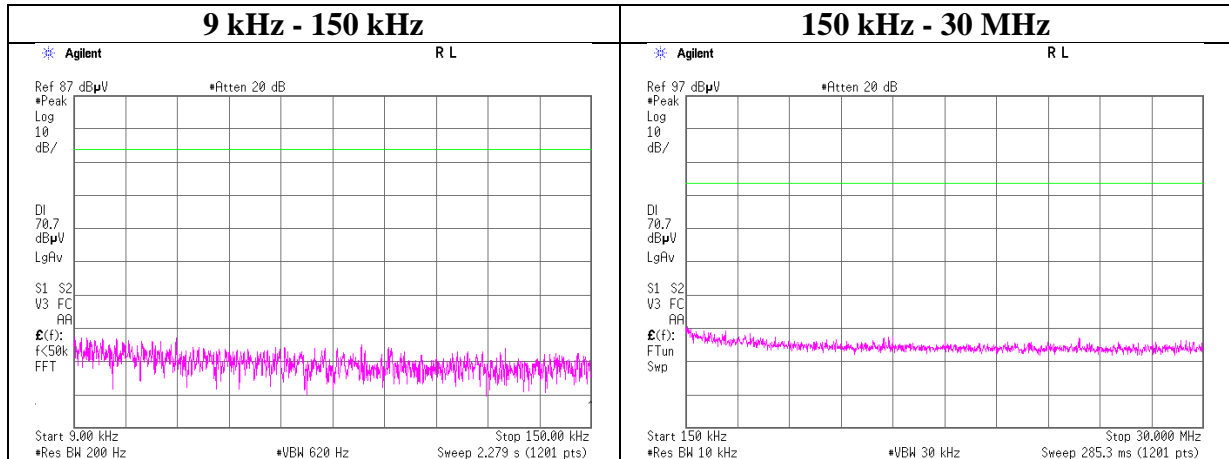
2441 MHz



Conducted Spurious Emission

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx, Hopping Off, 3DH5

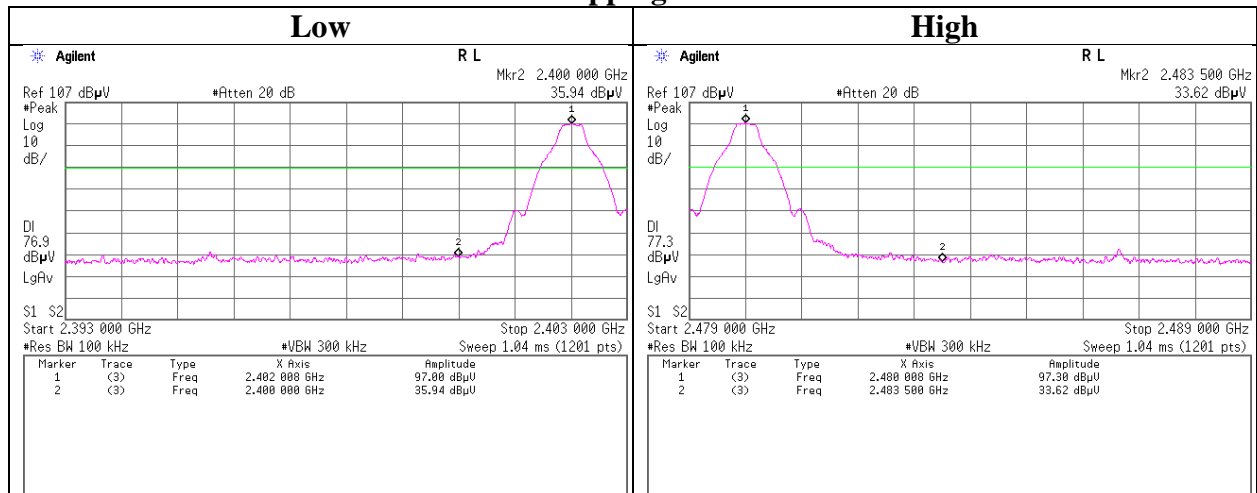
2480 MHz



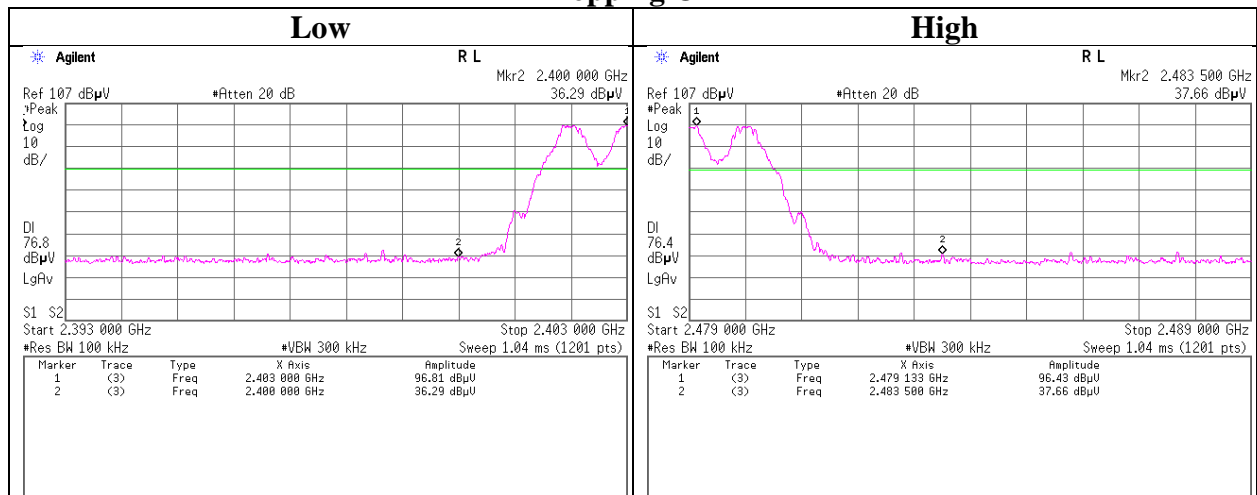
Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx DH5

Hopping On



Hopping Off



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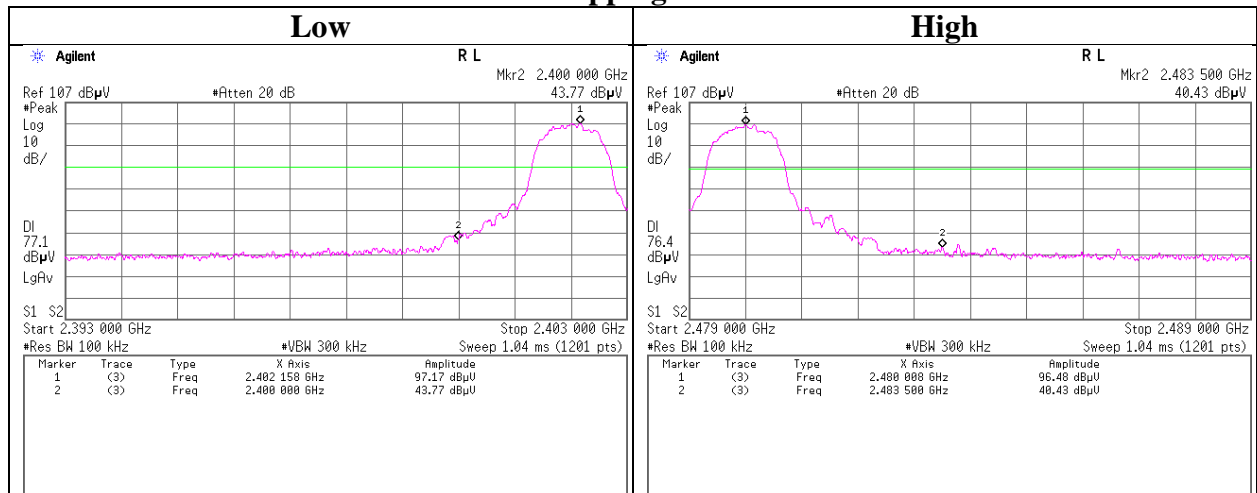
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

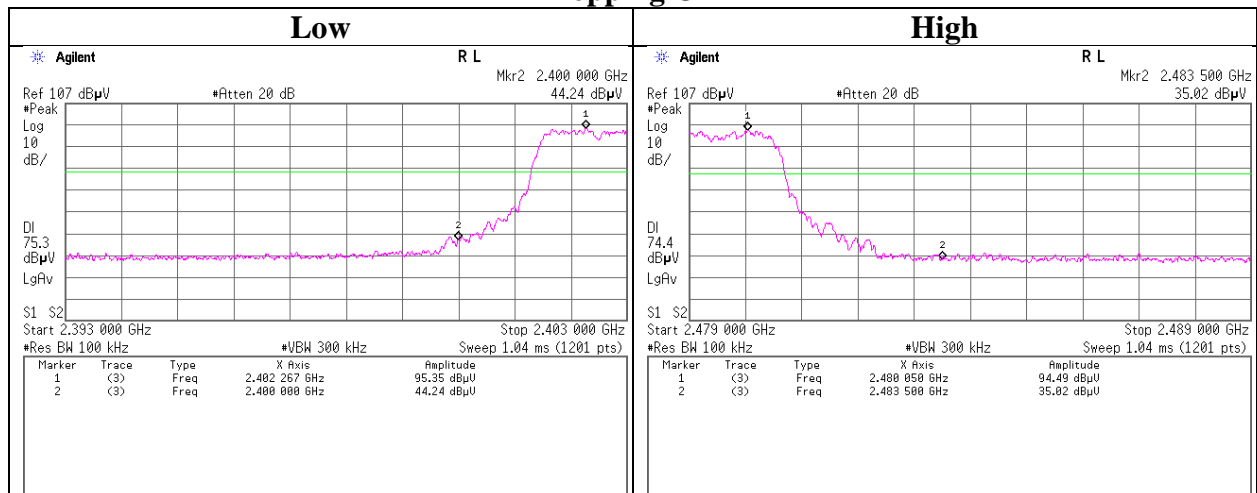
Conducted Emission Band Edge compliance

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx 3DH5

Hopping On



Hopping Off



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Telephone : +81 463 50 6400

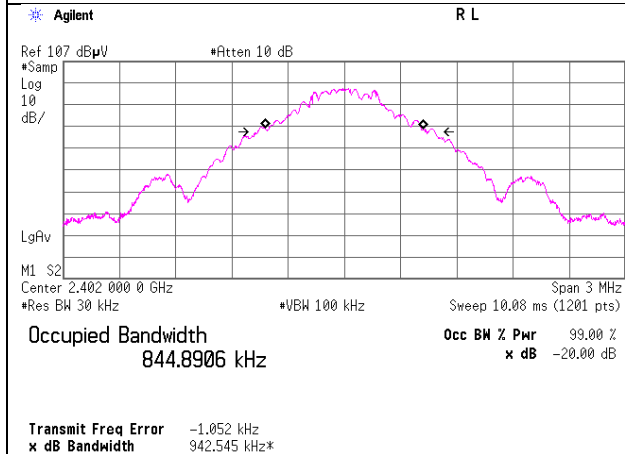
Facsimile : +81 463 50 6401

99%Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11761678S-A-R1
Date	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH
Engineer	Makoto Hosaka
Mode	Tx Hopping Off

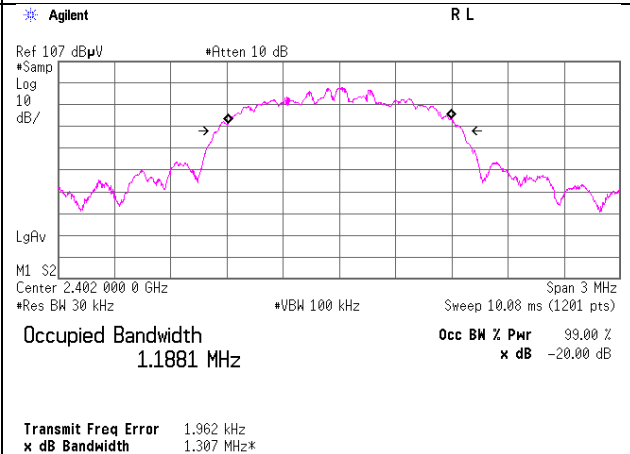
Hopping Off, DH5

2402 MHz

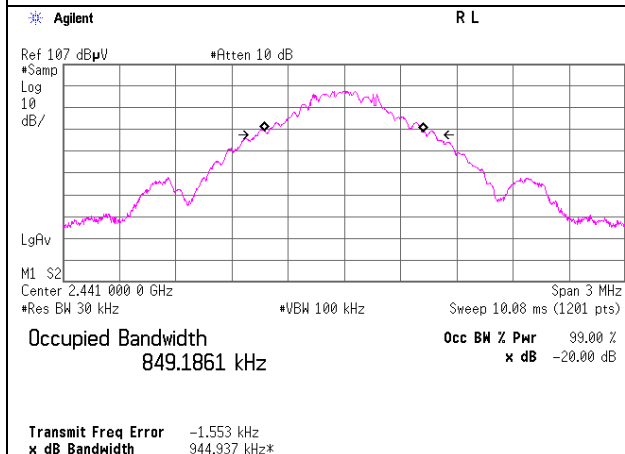


Hopping Off, 3DH5

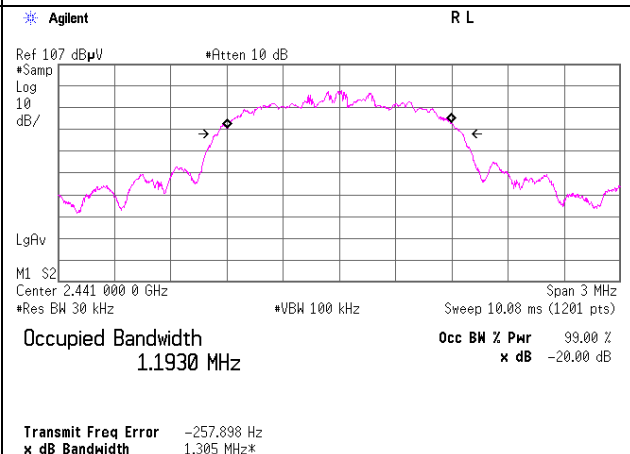
2402 MHz



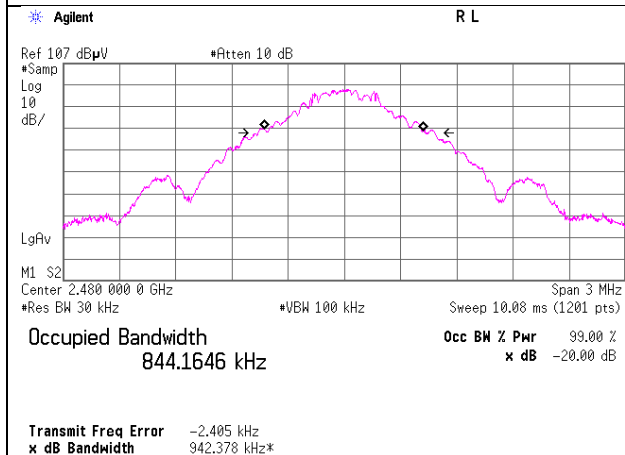
2441 MHz



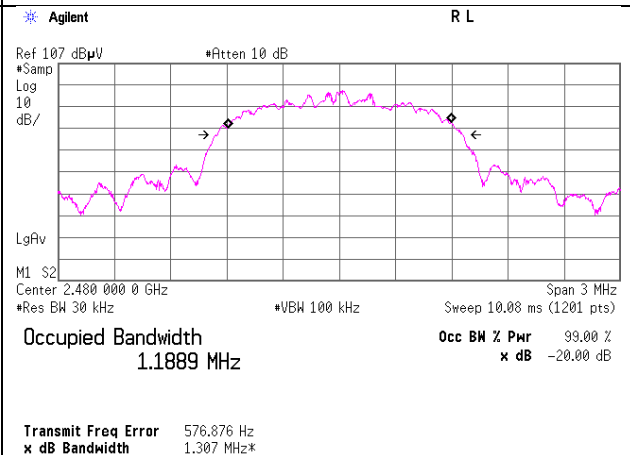
2441 MHz



2480 MHz



2480 MHz



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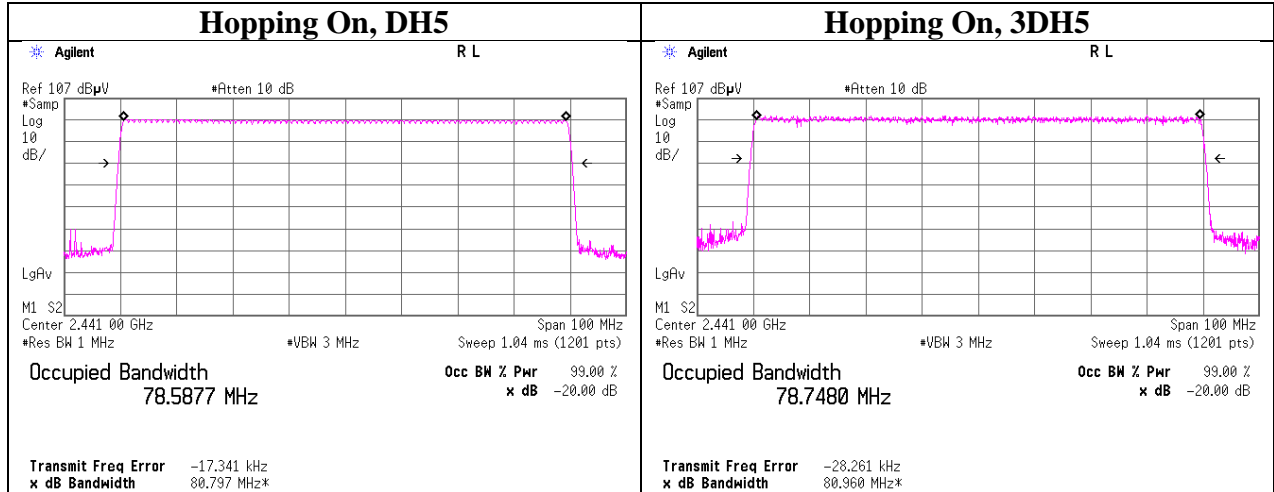
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room	
Report No.	11761678S-A-R1	
Date	June 14, 2017	June 14, 2017
Temperature / Humidity	25 deg. C / 49 % RH	25 deg. C / 49 % RH
Engineer	Makoto Hosaka	Makoto Hosaka
Mode	Tx Hopping On	



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2017/05/01 * 12
SPSS-05	Power sensor	Agilent	N1923A	MY5349008	AT	2017/05/01 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2016/09/26 * 12
SAT10-13	Attenuator	Weinschel Corp.	54A-10	81626	AT	2017/03/23 * 12
SCC-G12	Coaxial Cable	Suhner	SUCOFLEX 102	30790/2	AT	2017/03/23 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2016/12/13 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2016/10/17 * 12
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2016/07/25 * 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	2016/06/14 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2017/05/08 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2016/08/22 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2016/10/12 * 12
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	RE	2017/03/07 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RF, MF)	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2016/10/17 * 12
SCC-G40	Coaxial Cable	Junkosha	MWX221-01000NF SNMS/B	1612S005	RE	2017/01/08 * 12
SAT10-05	Attenuator(above 1GHz)	Agilent	8493C-010	74864	RE	2016/11/07 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2016/11/29 * 12
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2017/06/11 * 12
STR-08	Test Receiver	Rohde & Schwarz	ESW44	101581	RE	2016/11/08 * 12
SBA-03	Biconical Antenna	Schwarzbeck	BBA9106	91032666	RE	2016/10/18 * 12
SLA-07	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	RE	2017/01/26 * 12
SAT6-08	Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-406(40)	-	RE	2016/08/04 * 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	2017/04/07 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2017/02/09 * 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	2016/09/27 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2017/03/23 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KMSKMS	-	RE	2017/04/20 * 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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