



RADIO TEST REPORT

Test Report No. : 11095831S-A-R1

Applicant : Alpine Electronics Inc.
Type of Equipment : Car Navigation Unit
Model No. : X109D
FCC ID : A269ZUA147
Test regulation : FCC Part 15 Subpart C: 2015
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 11095831S-A. 11095831S-A is replaced with this report.

Date of test: March 1 to 7, 2016

Representative test engineer:

Hiroyuki Morikawa
Engineer
Consumer Technology Division

Approved by:

Akio Hayashi
Leader
Consumer Technology Division



JAB
Testing
RTL02610

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

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Shonan EMC Lab.

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11095831S-A-R1

[illegible]

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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 Navigation Unit
Model No.	:	X109D
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 14.4 V
Receipt Date of Sample	:	February 4, 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: X109D (referred to as the EUT in this report) is a Car Navigation Unit.

General Specification

Clock frequency used in the EUT: 38.4 MHz (Bluetooth 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
Antenna type	:	PCB F-Inverted Antenna
Antenna Gain	:	-9.0 dBi (without cable loss)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on November 23, 2015

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

*Some parts are effective on and after December 17, 2015 or December 23, 2015. The revision 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 (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	4.0 dB Tx, Hopping Off, DH5 2402 MHz 216.000 MHz, QP, Horizontal	Complied	Conducted/ Radiated *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) and KDB 558074 D01 12.2.7.

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

FCC Part 15.31 (e)

This EUT provides stable voltage (DC 3.3 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	-	Conducted

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

3.4 Uncertainty

EMI

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

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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

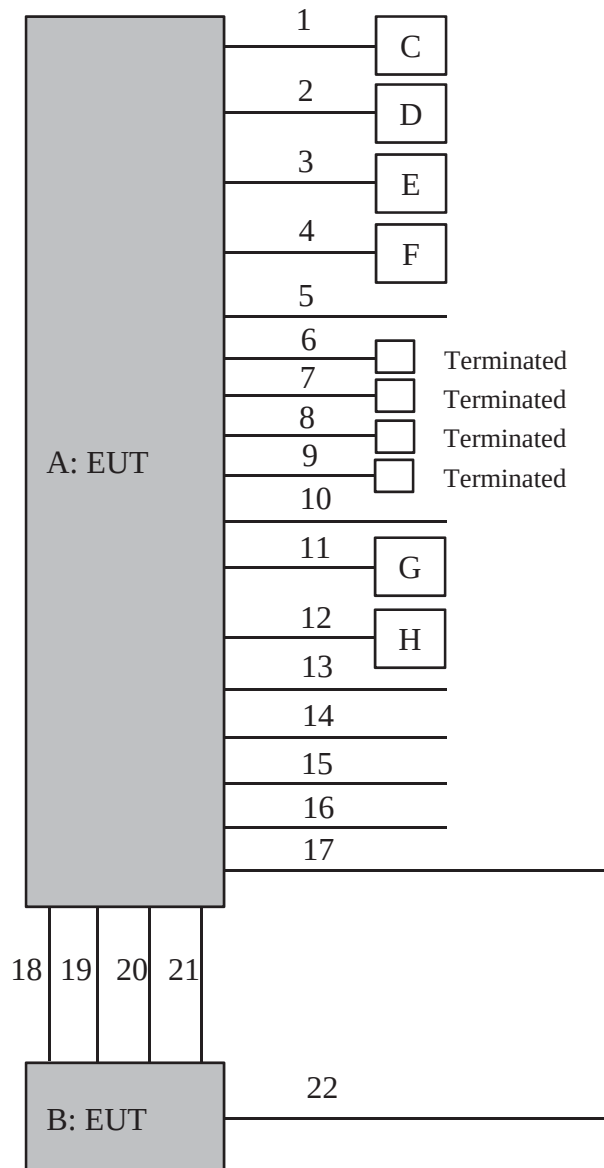
4.1 Operating Mode(s)

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

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test) *2DH mode (2Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative. * It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all test items based on Bluetooth Core specification. *EUT has the power settings by the software as follows; Power settings: Fixed Software: BTST.exe, Ver.2.0.0.10 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.		

4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Navigation Unit	X109D	001 *1) 002 *2)	ALPINE	EUT
B	Display	X109D	001 *1) 002 *2)	ALPINE	EUT
C	Speaker	LV-002	S11014200775	L&V	-
D	Speaker	LV-002	S11014200775	L&V	-
E	Speaker	LV-002	S11014200773	L&V	-
F	Speaker	LV-002	S11014200773	L&V	-
G	MIC	-	-	ALPINE	-
H	GPS antenna	YOP-5245AL08	-	YOKOWO CO, Ltd.	-

*1) Used for Antenna Terminal conducted test

*2) Used for Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	3.2	Unshielded	Unshielded	-
2	Signal Cable	3.2	Unshielded	Unshielded	-
3	Signal Cable	3.2	Unshielded	Unshielded	-
4	Signal Cable	3.2	Unshielded	Unshielded	-
5	AUX Cable	2.2	Unshielded	Unshielded	-
6	Front Out Cable	4.0	Unshielded	Unshielded	-
7	Rear Out Cable	4.0	Unshielded	Unshielded	-
8	SUBW Cable	3.9	Unshielded	Unshielded	-
9	Antenna Cable	0.3	Unshielded	Unshielded	-
10	USB Cable	3.0	Unshielded	Unshielded	-
11	MIC Cable	4.0	Unshielded	Unshielded	-
12	GPS Cable	2.5	Unshielded	Unshielded	-
13	HDMI Cable	3.0	Unshielded	Unshielded	-
14	Speed Sensor Cable	2.0	Unshielded	Unshielded	-
15	Camera Cable	1.2	Unshielded	Unshielded	-
16	Controller Cable	0.4	Unshielded	Unshielded	-
17	DC Cable	2.0	Unshielded	Unshielded	-
18	HDMI Cable	1.6	Unshielded	Unshielded	-
19	Display Cable	1.0	Unshielded	Unshielded	-
20	Remote Cable	1.4	Unshielded	Unshielded	-
21	EXT.KEY Cable	1.4	Unshielded	Unshielded	-
22	DC Cable	2.0	Unshielded	Unshielded	-

SECTION 5: Radiated Spurious Emission

Test Procedure

[For below 1 GHz]

EUT was placed on a platform of nominal size, 1.0 m by 2.0 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.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.7 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 FCC 15.205 / 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 m (below 13 GHz), 1 m*2) (above 13 GHz)		3 m (below 13 GHz), 1 m*2) (above 13 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: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

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

Frequency	30-1000 MHz	1-2.8 GHz	2.8-13 GHz	13-26.5 GHz
Worst angle	0 deg.	30 deg.	0 deg.	0 deg.

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

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

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SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	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 *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	10 kHz	30 kHz				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) The measurement was performed with Max Hold since the duty cycle was not 100 %.

*2) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz -150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

*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

APPENDIX 1: Test data

20dB Bandwidth and Carrier Frequency Separation

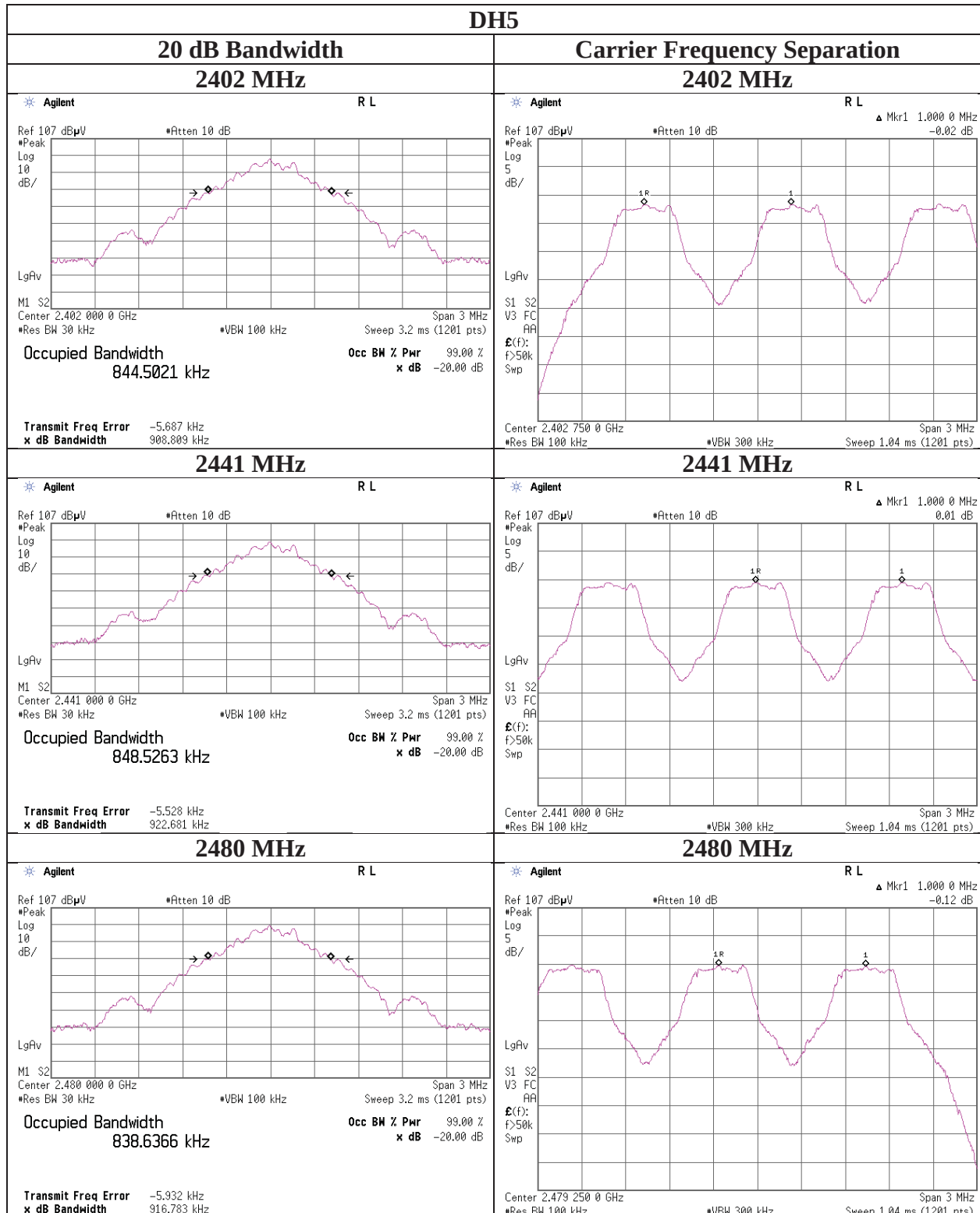
Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx, Hopping Off, DH5

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.909	1.000	>= 0.606
DH5	2441.0	0.923	1.000	>= 0.615
DH5	2480.0	0.917	1.000	>= 0.611
3DH5	2402.0	1.289	1.000	>= 0.860
3DH5	2441.0	1.290	1.000	>= 0.860
3DH5	2480.0	1.291	1.000	>= 0.860

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

No limit applies to 20dB Bandwidth.

20dB Bandwidth and Carrier Frequency Separation



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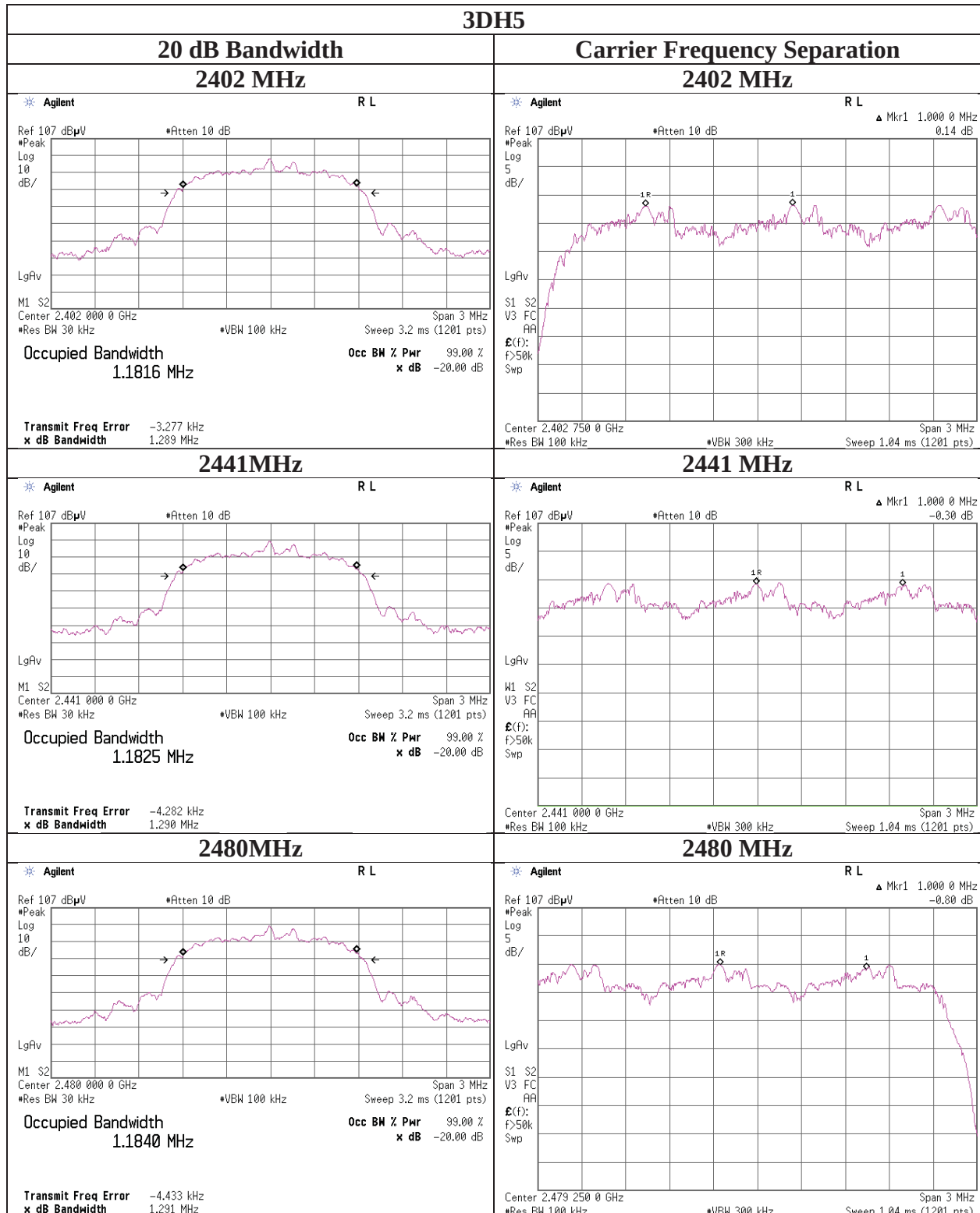
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20dB Bandwidth and Carrier Frequency Separation



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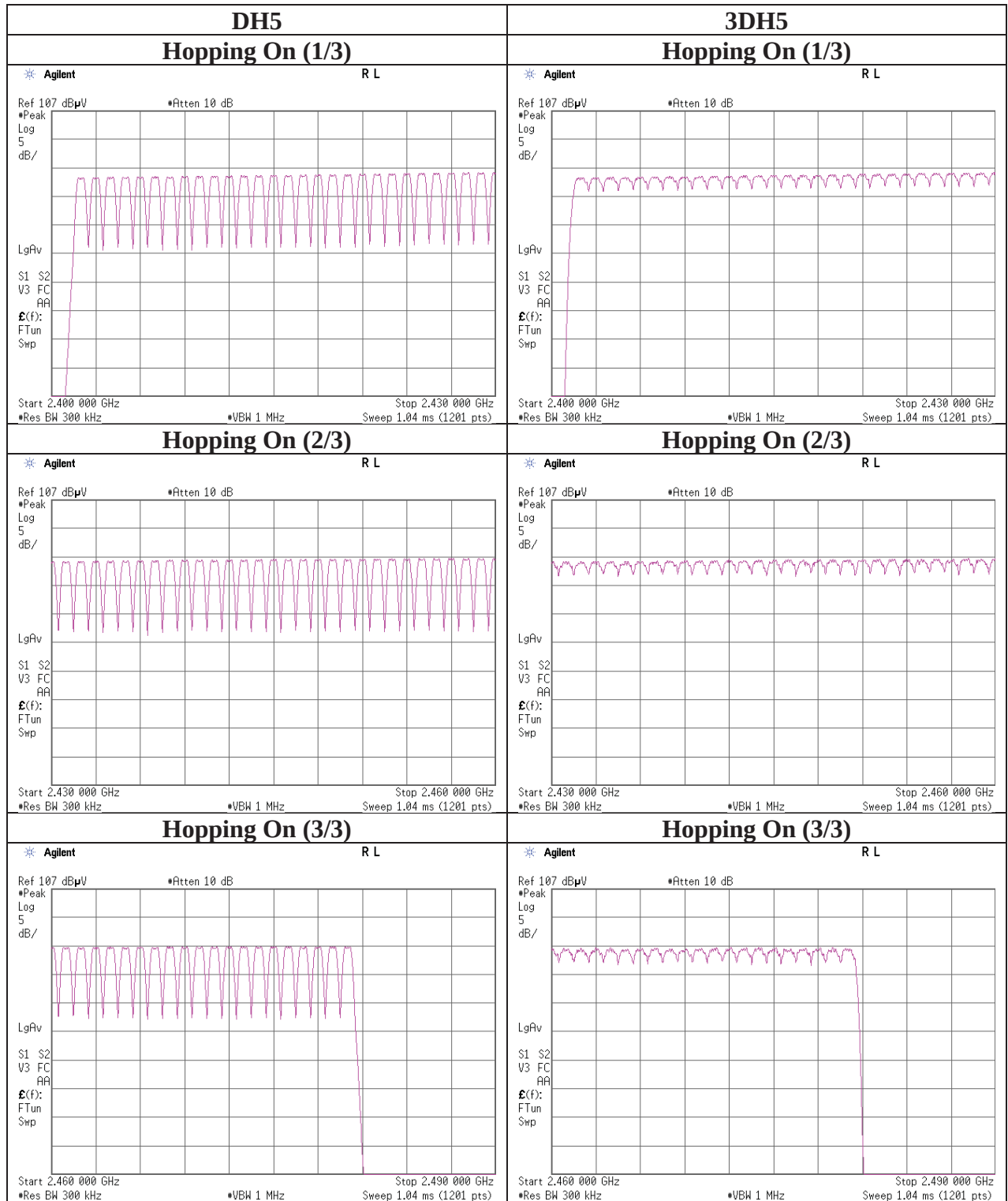
Number of Hopping Frequency

Test place Shonan EMC Lab. No.5 Shielded Room
Report No. 11095831S-A-R1
Date March 1, 2016
Temperature / Humidity 25 deg. C / 51 % RH
Engineer Hiroyuki Morikawa
Mode Tx, Hopping On

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

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

Number of Hopping Frequency



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Dwell time

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx, Hopping On

Mode	Number of transmission in a 31.6(79 Hopping x 0.4) / 12.8 (32 Hopping x 0.4) second period				Length of transmission [msec]	Result [msec]	Limit [msec]
DH1	50.8 times /	5 sec. x	31.6 sec. =	322 times	0.410	132	400
DH3	24.8 times /	5 sec. x	31.6 sec. =	157 times	1.674	263	400
DH5	17.0 times /	5 sec. x	31.6 sec. =	108 times	2.924	316	400
3DH1	23.2 times /	5 sec. x	31.6 sec. =	147 times	0.423	62	400
3DH3	22.0 times /	5 sec. x	31.6 sec. =	140 times	1.675	235	400
3DH5	19.8 times /	5 sec. x	31.6 sec. =	126 times	2.926	369	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

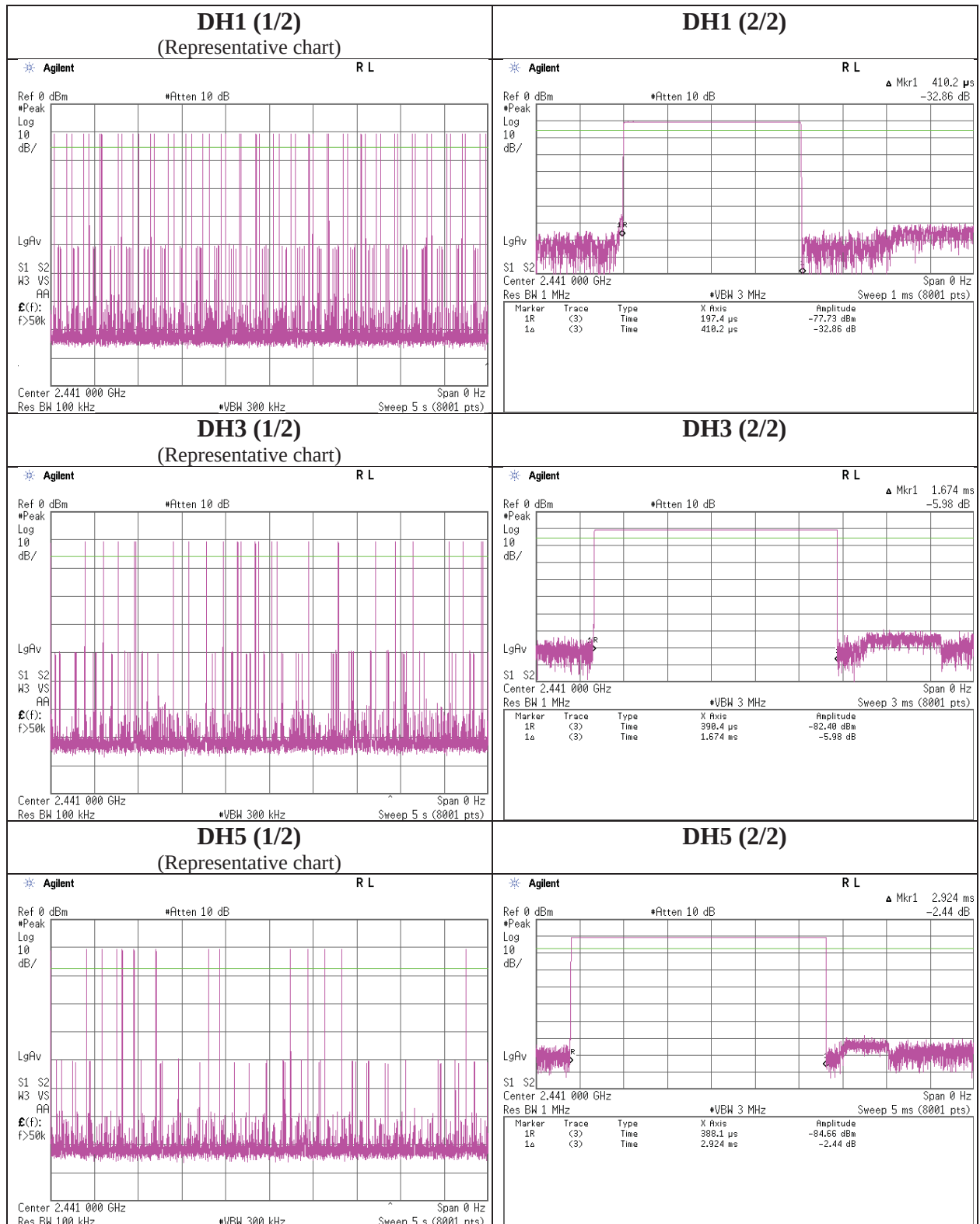
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	51	51	50	50.8
DH3	25	26	22	27	24	24.8
DH5	14	12	18	20	21	17
3DH1	20	23	26	22	25	23.2
3DH3	20	24	22	20	24	22
3DH5	18	23	19	16	23	19.8

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5

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

Dwell time



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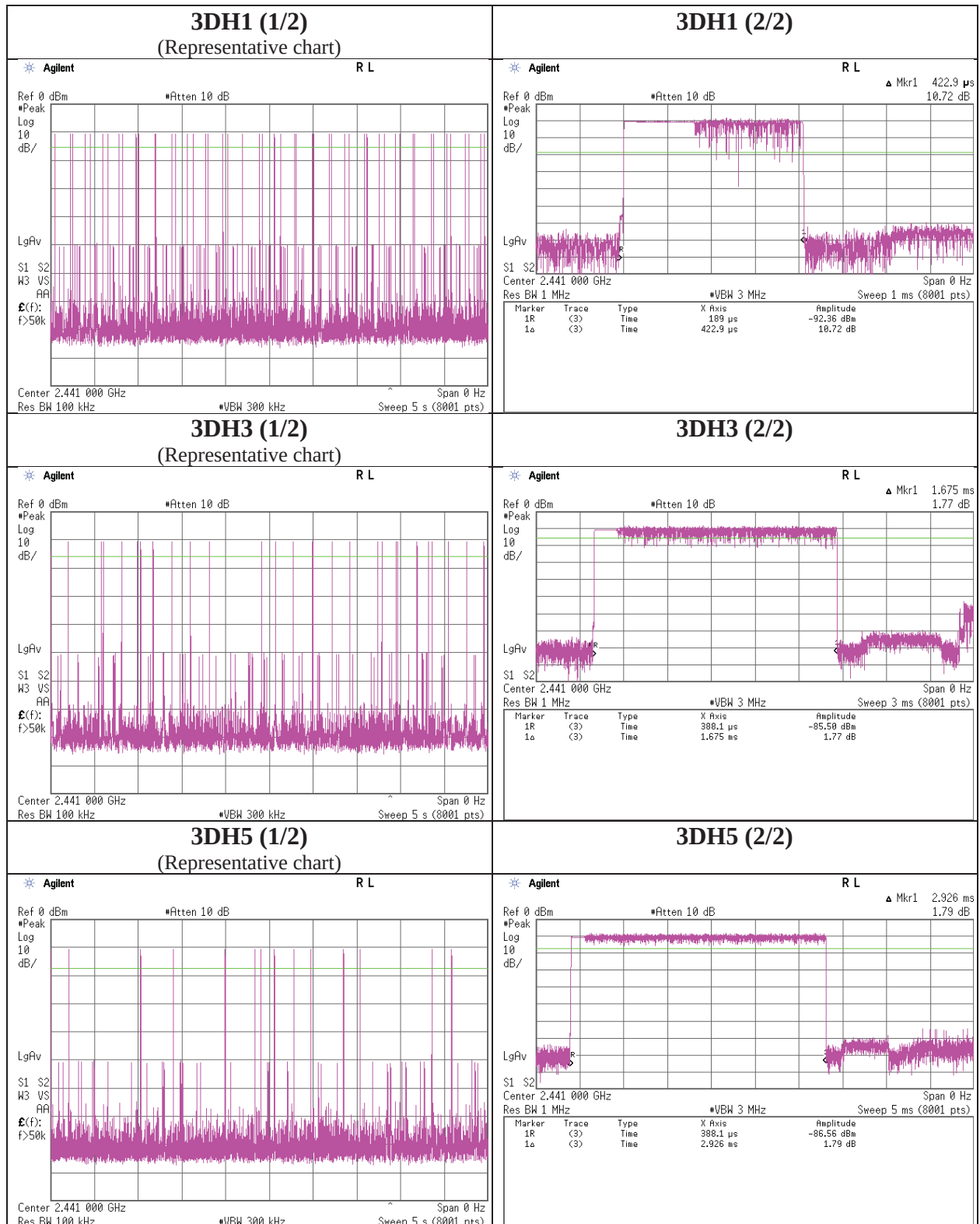
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Dwell time



Maximum Peak Output Power

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
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	-11.44	1.34	9.67	-0.43	0.91	20.96	125	21.39
DH5	2441.0	-10.37	1.35	9.67	0.65	1.16	20.96	125	20.31
DH5	2480.0	-10.01	1.36	9.67	1.02	1.26	20.96	125	19.94
2DH5	2402.0	-9.20	1.34	9.67	1.81	1.52	20.96	125	19.15
2DH5	2441.0	-8.22	1.35	9.67	2.80	1.91	20.96	125	18.16
2DH5	2480.0	-7.88	1.36	9.67	3.15	2.07	20.96	125	17.81
3DH5	2402.0	-8.70	1.34	9.67	2.31	1.70	20.96	125	18.65
3DH5	2441.0	-7.71	1.35	9.67	3.31	2.14	20.96	125	17.65
3DH5	2480.0	-7.41	1.36	9.67	3.62	2.30	20.96	125	17.34

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)

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx, Hopping Off

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Frame power)		Duty factor [dB]	Result (Burst power)	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	-13.02	1.34	9.67	-2.01	0.63	1.08	-0.93	0.81
DH5	2441.0	-11.86	1.35	9.67	-0.84	0.82	1.08	0.24	1.06
DH5	2480.0	-11.46	1.36	9.67	-0.43	0.91	1.08	0.65	1.16
2DH5	2402.0	-13.16	1.34	9.67	-2.15	0.61	1.08	-1.07	0.78
2DH5	2441.0	-12.04	1.35	9.67	-1.02	0.79	1.08	0.06	1.01
2DH5	2480.0	-11.70	1.36	9.67	-0.67	0.86	1.08	0.41	1.10
3DH5	2402.0	-13.13	1.34	9.67	-2.12	0.61	1.08	-1.04	0.79
3DH5	2441.0	-12.02	1.35	9.67	-1.00	0.79	1.08	0.08	1.02
3DH5	2480.0	-11.70	1.36	9.67	-0.67	0.86	1.08	0.41	1.10

Sample Calculation:

Result (Frame power) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

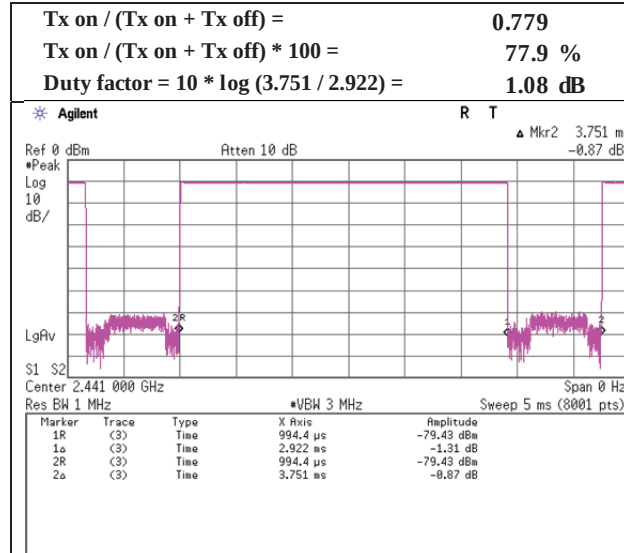
Result (Burst power) = Frame power + Duty factor

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

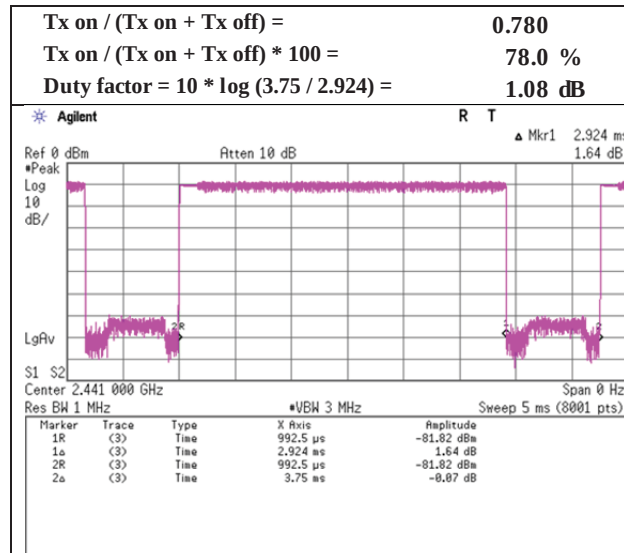
Burst Rate Confirmation

Test place : Shonan EMC Lab. No.1 Measurement Room
Report No. : 11095831S-A-R1
Date : March 7, 2016
Temperature / Humidity : 25 deg. C / 44 % RH
Engineer : Shinichi Takano
Mode : Tx, Hopping Off

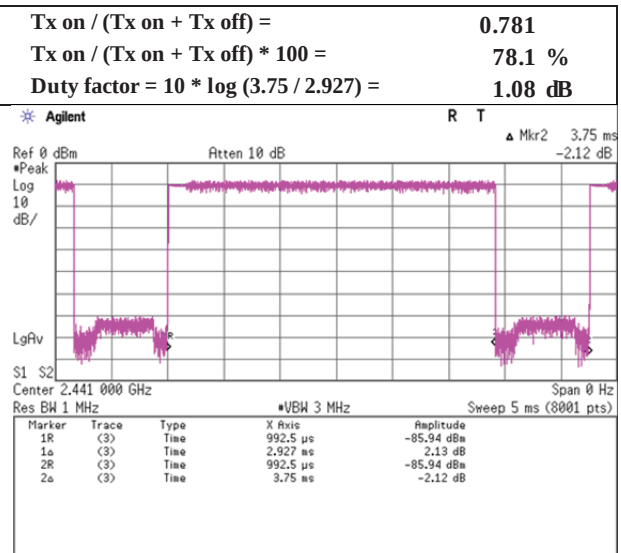
DH5



2DH5



3DH5



Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11095831S-A-R1
Date : March 2, 2016 March 1, 2016
Temperature / Humidity : 25 deg. C / 21 % RH 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa
(30-1000 MHz) (1-26.5 GHz)
Mode : Tx, Hopping Off, DH5 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	112.156	QP	46.0	11.5	7.5	32.1	0.0	32.9	43.5	10.6	302	81	
Hori.	188.994	QP	42.9	16.0	8.1	32.1	0.0	34.9	43.5	8.6	179	105	
Hori.	216.000	QP	46.8	16.5	8.2	32.0	0.0	39.5	43.5	4.0	157	305	
Hori.	324.000	QP	48.7	14.4	8.8	32.0	0.0	39.9	46.0	6.1	100	66	
Hori.	360.004	QP	45.3	15.2	9.0	31.9	0.0	37.6	46.0	8.4	100	148	
Hori.	755.994	QP	41.1	20.7	10.5	31.8	0.0	40.5	46.0	5.5	124	167	
Hori.	945.003	QP	34.1	22.6	11.1	30.6	0.0	37.2	46.0	8.8	109	183	
Hori.	2390.000	PK	46.4	27.8	13.7	41.0	2.9	49.8	73.9	24.1	100	240	
Hori.	4804.000	PK	44.3	31.4	5.8	39.6	2.9	44.8	73.9	29.1	100	0	
Hori.	7206.000	PK	45.1	36.9	7.2	40.1	2.9	52.0	73.9	21.9	100	0	
Hori.	9608.000	PK	44.8	38.5	8.2	39.6	2.9	54.8	73.9	19.1	100	0	
Hori.	2390.000	AV	34.3	27.8	13.7	41.0	2.9	37.7	53.9	16.2	100	240	
Hori.	4804.000	AV	32.0	31.4	5.8	39.6	2.9	32.5	53.9	21.4	100	0	
Hori.	7206.000	AV	32.7	36.9	7.2	40.1	2.9	39.6	53.9	14.3	100	0	
Hori.	9608.000	AV	32.2	38.5	8.2	39.6	2.9	42.2	53.9	11.7	100	0	
Vert.	37.340	QP	42.6	14.9	6.8	32.2	0.0	32.1	40.0	7.9	100	82	
Vert.	112.160	QP	48.2	11.5	7.5	32.1	0.0	35.1	43.5	8.4	120	259	
Vert.	945.001	QP	34.3	22.6	11.1	30.6	0.0	37.4	46.0	8.6	106	195	
Vert.	2390.000	PK	46.1	27.8	13.7	41.0	2.9	49.5	73.9	24.4	136	147	
Vert.	4804.000	PK	44.4	31.4	5.8	39.6	2.9	44.9	73.9	29.0	100	0	
Vert.	7206.000	PK	45.5	36.9	7.2	40.1	2.9	52.4	73.9	21.5	100	0	
Vert.	9608.000	PK	44.4	38.5	8.2	39.6	2.9	54.4	73.9	19.5	100	0	
Vert.	2390.000	AV	33.9	27.8	13.7	41.0	2.9	37.3	53.9	16.6	136	147	
Vert.	4804.000	AV	32.3	31.4	5.8	39.6	2.9	32.8	53.9	21.1	100	0	
Vert.	7206.000	AV	33.5	36.9	7.2	40.1	2.9	40.4	53.9	13.5	100	0	
Vert.	9608.000	AV	32.2	38.5	8.2	39.6	2.9	42.2	53.9	11.7	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

* 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	87.7	27.8	13.7	41.0	2.9	91.1	-	-	Carrier
Hori.	2400.000	PK	38.3	27.8	13.7	41.0	2.9	41.7	71.1	29.4	
Vert.	2402.000	PK	90.0	27.8	13.7	41.0	2.9	93.4	-	-	Carrier
Vert.	2400.000	PK	37.1	27.8	13.7	41.0	2.9	40.5	73.4	32.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

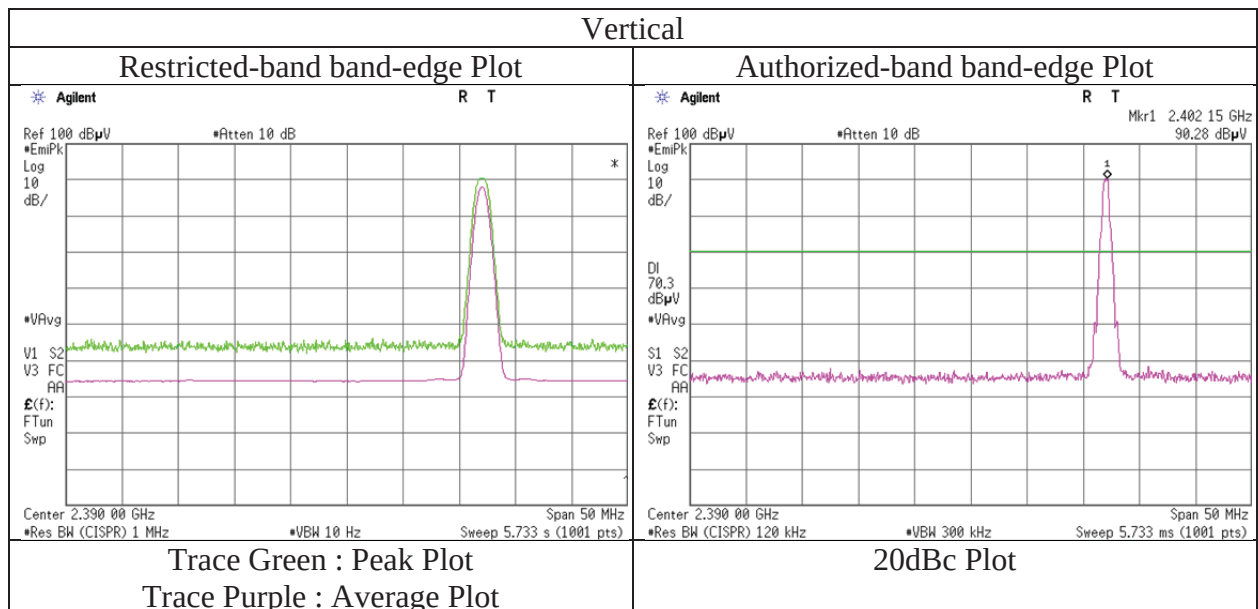
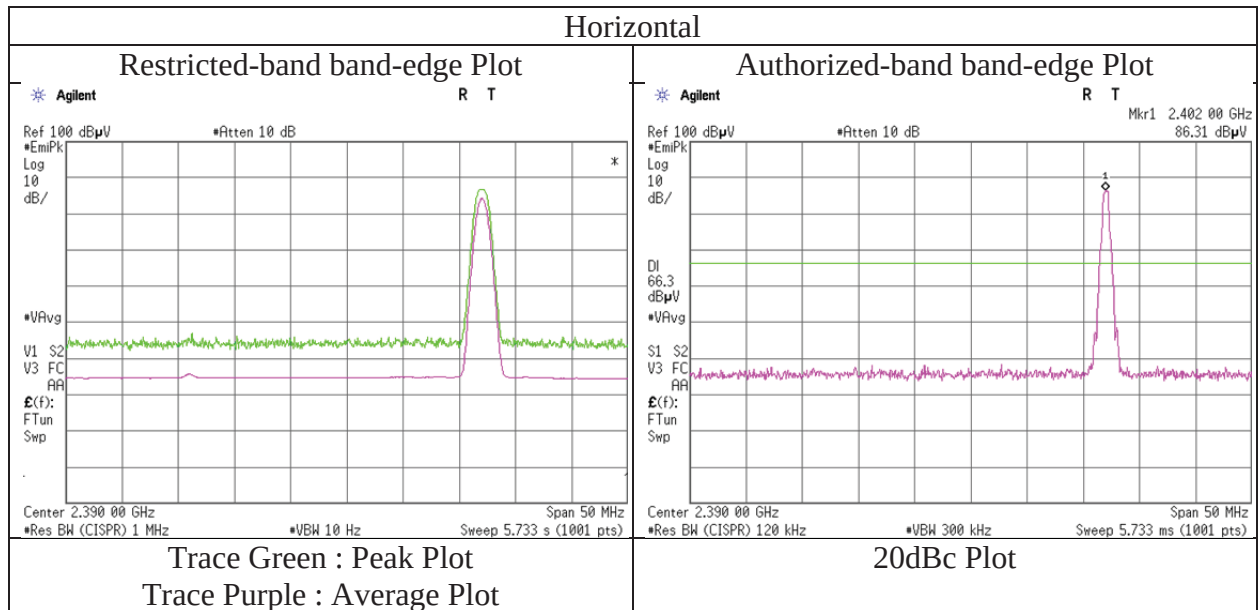
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 31 % RH
Engineer	Yosuke Ishikawa (1-26.5 GHz)
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. : 11095831S-A-R1
Date : March 2, 2016 March 1, 2016
Temperature / Humidity : 25 deg. C / 21 % RH 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa
(30-1000 MHz) (1-26.5 GHz)
Mode : Tx, Hopping Off, DH5 2441 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	188.991	QP	42.9	16.0	8.1	32.1	0.0	34.9	43.5	8.6	177	109	
Hori.	216.000	QP	45.3	16.5	8.2	32.0	0.0	38.0	43.5	5.5	154	307	
Hori.	323.989	QP	48.8	14.4	8.8	32.0	0.0	40.0	46.0	6.0	100	60	
Hori.	359.992	QP	44.7	15.2	9.0	31.9	0.0	37.0	46.0	9.0	100	154	
Hori.	755.994	QP	41.1	20.7	10.5	31.8	0.0	40.5	46.0	5.5	124	174	
Hori.	944.996	QP	35.1	22.6	11.1	30.6	0.0	38.2	46.0	7.8	100	190	
Hori.	4882.000	PK	44.6	31.7	5.9	39.5	2.9	45.6	73.9	28.3	100	0	
Hori.	7323.000	PK	45.7	36.9	7.3	40.2	2.9	52.6	73.9	21.3	100	0	
Hori.	9764.000	PK	45.1	38.5	8.3	39.5	2.9	55.3	73.9	18.6	100	0	
Hori.	4882.000	AV	32.1	31.7	5.9	39.5	2.9	33.1	53.9	20.8	100	0	
Hori.	7323.000	AV	33.3	36.9	7.3	40.2	2.9	40.2	53.9	13.7	100	0	
Hori.	9764.000	AV	32.5	38.5	8.3	39.5	2.9	42.7	53.9	11.2	100	0	
Vert.	37.341	QP	42.2	14.8	6.8	32.2	0.0	31.6	40.0	8.4	100	88	
Vert.	112.159	QP	45.2	11.5	7.5	32.1	0.0	32.1	43.5	11.4	100	258	
Vert.	944.993	QP	35.2	22.6	11.1	30.6	0.0	38.3	46.0	7.7	100	197	
Vert.	4882.000	PK	44.0	31.7	5.9	39.5	2.9	45.0	73.9	28.9	100	0	
Vert.	7323.000	PK	45.1	36.9	7.3	40.2	2.9	52.0	73.9	21.9	100	0	
Vert.	9764.000	PK	44.1	38.5	8.3	39.5	2.9	54.3	73.9	19.6	100	0	
Vert.	4882.000	AV	32.1	31.7	5.9	39.5	2.9	33.1	53.9	20.8	100	0	
Vert.	7323.000	AV	33.0	36.9	7.3	40.2	2.9	39.9	53.9	14.0	100	0	
Vert.	9764.000	AV	32.2	38.5	8.3	39.5	2.9	42.4	53.9	11.5	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11095831S-A-R1
Date : March 2, 2016 March 1, 2016
Temperature / Humidity : 25 deg. C / 21 % RH 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa
(30-1000 MHz) (1-26.5 GHz)
Mode : Tx, Hopping Off, DH5 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	188.994	QP	43.4	16.0	8.1	32.1	0.0	35.4	43.5	8.1	176	113	
Hori.	215.986	QP	45.1	16.5	8.2	32.0	0.0	37.8	43.5	5.7	152	303	
Hori.	323.999	QP	49.8	14.4	8.8	32.0	0.0	41.0	46.0	5.0	100	63	
Hori.	351.008	QP	48.9	15.0	8.9	31.9	0.0	40.9	46.0	5.1	100	195	
Hori.	755.992	QP	39.0	20.7	10.5	31.8	0.0	38.4	46.0	7.6	119	165	
Hori.	2483.500	PK	47.0	27.9	13.8	41.0	2.9	50.6	73.9	23.3	195	126	
Hori.	4960.000	PK	45.3	32.0	6.0	39.4	2.9	46.8	73.9	27.1	100	0	
Hori.	7440.000	PK	45.9	37.0	7.5	40.4	2.9	52.9	73.9	21.0	100	0	
Hori.	9920.000	PK	45.4	38.4	8.4	39.4	2.9	55.7	73.9	18.2	100	0	
Hori.	2483.500	AV	34.4	27.9	13.8	41.0	2.9	38.0	53.9	15.9	195	126	
Hori.	4960.000	AV	32.5	32.0	6.0	39.4	2.9	34.0	53.9	19.9	100	0	
Hori.	7440.000	AV	34.1	37.0	7.5	40.4	2.9	41.1	53.9	12.8	100	0	
Hori.	9920.000	AV	33.3	38.4	8.4	39.4	2.9	43.6	53.9	10.3	100	0	
Vert.	37.350	QP	41.7	14.8	6.8	32.2	0.0	31.1	40.0	8.9	100	127	
Vert.	112.162	QP	44.0	11.5	7.5	32.1	0.0	30.9	43.5	12.6	100	110	
Vert.	944.994	QP	35.5	22.6	11.1	30.6	0.0	38.6	46.0	7.4	110	193	
Vert.	2483.500	PK	46.3	27.9	13.8	41.0	2.9	49.9	73.9	24.0	116	154	
Vert.	4960.000	PK	44.8	32.0	6.0	39.4	2.9	46.3	73.9	27.6	100	0	
Vert.	7440.000	PK	45.7	37.0	7.5	40.4	2.9	52.7	73.9	21.2	100	0	
Vert.	9920.000	PK	45.6	38.4	8.4	39.4	2.9	55.9	73.9	18.0	100	0	
Vert.	2483.500	AV	34.3	27.9	13.8	41.0	2.9	37.9	53.9	16.0	116	154	
Vert.	4960.000	AV	32.4	32.0	6.0	39.4	2.9	33.9	53.9	20.0	100	0	
Vert.	7440.000	AV	33.5	37.0	7.5	40.4	2.9	40.5	53.9	13.4	100	0	
Vert.	9920.000	AV	33.2	38.4	8.4	39.4	2.9	43.5	53.9	10.4	100	0	

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

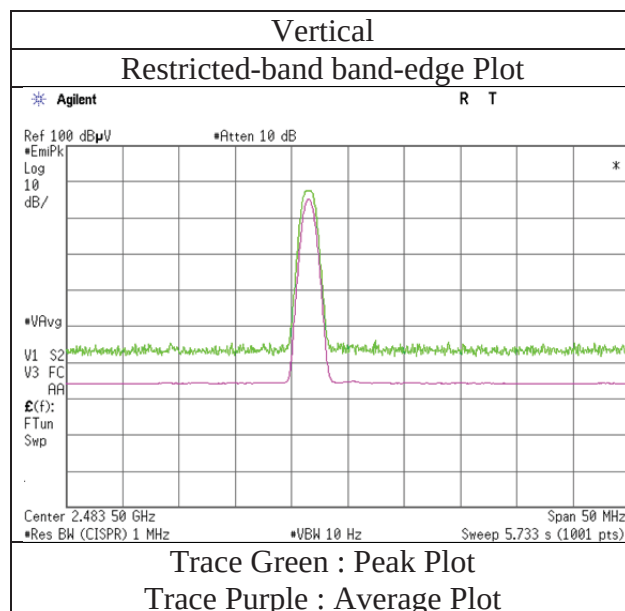
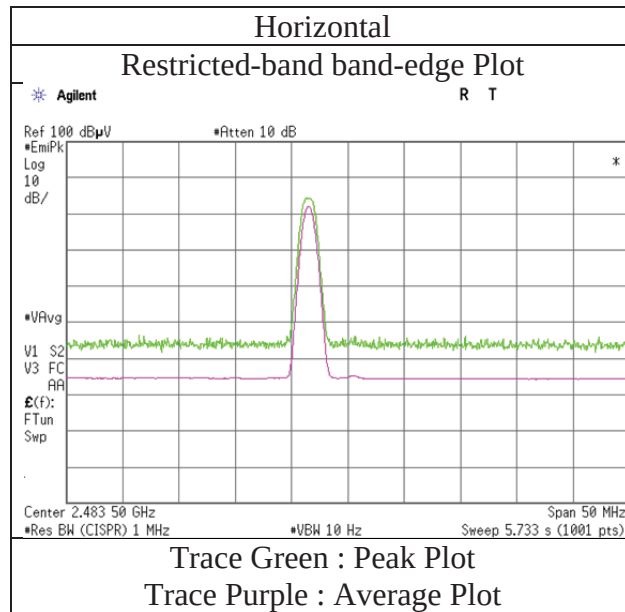
Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

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

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

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 31 % RH
Engineer	Yosuke Ishikawa
	(1-26.5 GHz)
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. : 11095831S-A-R1
Date : March 2, 2016 March 1, 2016
Temperature / Humidity : 25 deg. C / 21 % RH 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa
(30-1000 MHz) (1-26.5 GHz)
Mode : Tx, Hopping Off, 3DH5 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	188.994	QP	43.4	16.0	8.1	32.1	0.0	35.4	43.5	8.1	176	113	
Hori.	215.986	QP	45.1	16.5	8.2	32.0	0.0	37.8	43.5	5.7	152	303	
Hori.	323.999	QP	49.8	14.4	8.8	32.0	0.0	41.0	46.0	5.0	100	63	
Hori.	351.008	QP	48.9	15.0	8.9	31.9	0.0	40.9	46.0	5.1	100	195	
Hori.	755.992	QP	39.0	20.7	10.5	31.8	0.0	38.4	46.0	7.6	119	165	
Hori.	2390.000	PK	46.6	27.8	13.7	41.0	2.9	50.0	73.9	23.9	100	247	
Hori.	4804.000	PK	44.5	31.4	5.8	39.6	2.9	45.0	73.9	28.9	100	0	
Hori.	7206.000	PK	45.2	36.9	7.2	40.1	2.9	52.1	73.9	21.8	100	0	
Hori.	9608.000	PK	44.4	38.5	8.2	39.6	2.9	54.4	73.9	19.5	100	0	
Hori.	2390.000	AV	34.4	27.8	13.7	41.0	2.9	37.8	53.9	16.1	100	247	
Hori.	4804.000	AV	32.5	31.4	5.8	39.6	2.9	33.0	53.9	20.9	100	0	
Hori.	7206.000	AV	33.0	36.9	7.2	40.1	2.9	39.9	53.9	14.0	100	0	
Hori.	9608.000	AV	32.3	38.5	8.2	39.6	2.9	42.3	53.9	11.6	100	0	
Vert.	37.350	QP	41.7	14.8	6.8	32.2	0.0	31.1	40.0	8.9	100	127	
Vert.	112.162	QP	44.0	11.5	7.5	32.1	0.0	30.9	43.5	12.6	100	110	
Vert.	944.994	QP	35.5	22.6	11.1	30.6	0.0	38.6	46.0	7.4	110	193	
Vert.	2390.000	PK	46.4	27.8	13.7	41.0	2.9	49.8	73.9	24.1	144	146	
Vert.	4804.000	PK	44.6	31.4	5.8	39.6	2.9	45.1	73.9	28.8	100	0	
Vert.	7206.000	PK	45.9	36.9	7.2	40.1	2.9	52.8	73.9	21.1	100	0	
Vert.	9608.000	PK	44.1	38.5	8.2	39.6	2.9	54.1	73.9	19.8	100	0	
Vert.	2390.000	AV	34.0	27.8	13.7	41.0	2.9	37.4	53.9	16.5	144	146	
Vert.	4804.000	AV	32.0	31.4	5.8	39.6	2.9	32.5	53.9	21.4	100	0	
Vert.	7206.000	AV	33.6	36.9	7.2	40.1	2.9	40.5	53.9	13.4	100	0	
Vert.	9608.000	AV	32.1	38.5	8.2	39.6	2.9	42.1	53.9	11.8	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

* 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	86.3	27.8	13.7	41.0	2.9	89.7	-	-	Carrier
Hori.	2400.000	PK	37.8	27.8	13.7	41.0	2.9	41.2	69.7	28.5	
Vert.	2402.000	PK	90.0	27.8	13.7	41.0	2.9	93.4	-	-	Carrier
Vert.	2400.000	PK	37.7	27.8	13.7	41.0	2.9	41.1	73.4	32.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

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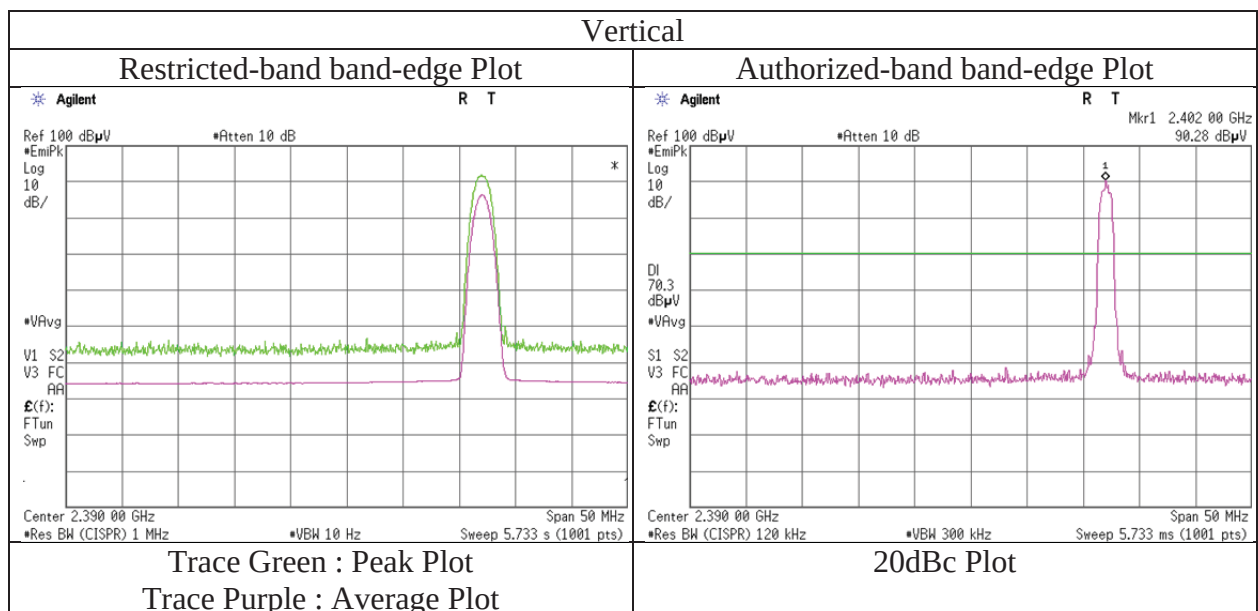
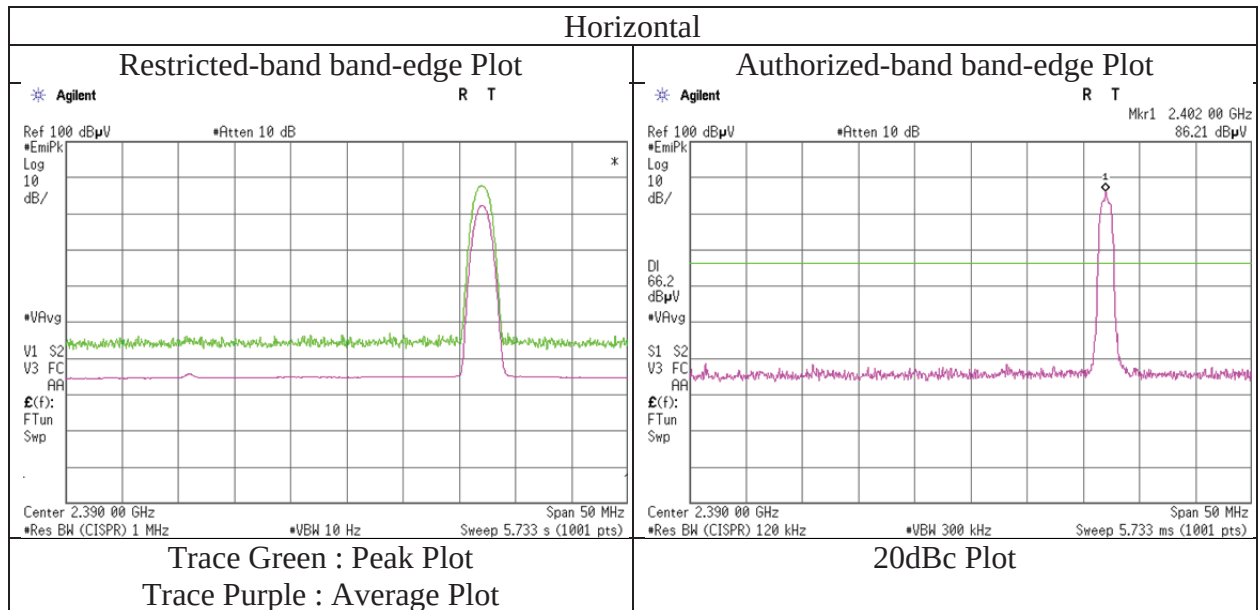
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 31 % RH
Engineer	Yosuke Ishikawa
	(1-26.5 GHz)
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. : 11095831S-A-R1
Date : March 2, 2016 March 1, 2016
Temperature / Humidity : 25 deg. C / 21 % RH 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa
(30-1000 MHz) (1-26.5 GHz)
Mode : Tx, Hopping Off, 3DH5 2441 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	215.998	QP	45.3	16.5	8.2	32.0	0.0	38.0	43.5	5.5	158	302	
Hori.	323.993	QP	49.7	14.4	8.8	32.0	0.0	40.9	46.0	5.1	100	65	
Hori.	351.007	QP	48.7	15.0	8.9	31.9	0.0	40.7	46.0	5.3	100	200	
Hori.	427.490	QP	40.1	16.4	9.2	31.9	0.0	33.8	46.0	12.2	100	208	
Hori.	755.995	QP	38.5	20.7	10.5	31.8	0.0	37.9	46.0	8.1	128	162	
Hori.	4882.000	PK	43.9	31.7	5.9	39.5	2.9	44.9	73.9	29.0	100	0	
Hori.	7323.000	PK	45.4	36.9	7.3	40.2	2.9	52.3	73.9	21.6	100	0	
Hori.	9764.000	PK	44.8	38.5	8.3	39.5	2.9	55.0	73.9	18.9	100	0	
Hori.	4882.000	AV	32.1	31.7	5.9	39.5	2.9	33.1	53.9	20.8	100	0	
Hori.	7323.000	AV	33.4	36.9	7.3	40.2	2.9	40.3	53.9	13.6	100	0	
Hori.	9764.000	AV	32.6	38.5	8.3	39.5	2.9	42.8	53.9	11.1	100	0	
Vert.	37.332	QP	41.3	14.9	6.8	32.2	0.0	30.8	40.0	9.2	100	77	
Vert.	112.164	QP	42.2	11.5	7.5	32.1	0.0	29.1	43.5	14.4	100	255	
Vert.	944.992	QP	35.3	22.6	11.1	30.6	0.0	38.4	46.0	7.6	100	192	
Vert.	4882.000	PK	43.8	31.7	5.9	39.5	2.9	44.8	73.9	29.1	100	0	
Vert.	7323.000	PK	45.4	36.9	7.3	40.2	2.9	52.3	73.9	21.6	100	0	
Vert.	9764.000	PK	44.9	38.5	8.3	39.5	2.9	55.1	73.9	18.8	100	0	
Vert.	4882.000	AV	32.0	31.7	5.9	39.5	2.9	33.0	53.9	20.9	100	0	
Vert.	7323.000	AV	33.0	36.9	7.3	40.2	2.9	39.9	53.9	14.0	100	0	
Vert.	9764.000	AV	32.2	38.5	8.3	39.5	2.9	42.4	53.9	11.5	100	0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

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

Radiated Spurious Emission

Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11095831S-A-R1
Date : March 2, 2016 March 1, 2016
Temperature / Humidity : 25 deg. C / 21 % RH 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa Yosuke Ishikawa
(30-1000 MHz) (1-26.5 GHz)
Mode : Tx, Hopping Off, 3DH5 2480 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	189.001	QP	43.2	16.0	8.1	32.1	0.0	35.2	43.5	8.3	180	109	
Hori.	216.000	QP	45.1	16.5	8.2	32.0	0.0	37.8	43.5	5.7	157	315	
Hori.	323.997	QP	49.6	14.4	8.8	32.0	0.0	40.8	46.0	5.2	100	60	
Hori.	351.005	QP	48.7	15.0	8.9	31.9	0.0	40.7	46.0	5.3	100	203	
Hori.	404.999	QP	41.7	16.1	9.1	32.0	0.0	34.9	46.0	11.1	100	227	
Hori.	944.993	QP	32.7	22.6	11.1	30.6	0.0	35.8	46.0	10.2	100	177	
Hori.	2483.500	PK	46.2	27.9	13.8	41.0	2.9	49.8	73.9	24.1	100	200	
Hori.	4960.000	PK	45.0	32.0	6.0	39.4	2.9	46.5	73.9	27.4	100	0	
Hori.	7440.000	PK	45.4	37.0	7.5	40.4	2.9	52.4	73.9	21.5	100	0	
Hori.	9920.000	PK	46.8	38.4	8.4	39.4	2.9	57.1	73.9	16.8	100	0	
Hori.	2483.500	AV	33.9	27.9	13.8	41.0	2.9	37.5	53.9	16.4	100	200	
Hori.	4960.000	AV	32.4	32.0	6.0	39.4	2.9	33.9	53.9	20.0	100	0	
Hori.	7440.000	AV	34.0	37.0	7.5	40.4	2.9	41.0	53.9	12.9	100	0	
Hori.	9920.000	AV	33.5	38.4	8.4	39.4	2.9	43.8	53.9	10.1	100	0	
Vert.	37.340	QP	41.4	14.8	6.8	32.2	0.0	30.8	40.0	9.2	100	64	
Vert.	112.176	QP	42.0	11.5	7.5	32.1	0.0	28.9	43.5	14.6	149	260	
Vert.	944.992	QP	35.5	22.6	11.1	30.6	0.0	38.6	46.0	7.4	100	191	
Vert.	2483.500	PK	46.5	27.9	13.8	41.0	2.9	50.1	73.9	23.8	113	157	
Vert.	4960.000	PK	45.6	32.0	6.0	39.4	2.9	47.1	73.9	26.8	100	0	
Vert.	7440.000	PK	45.5	37.0	7.5	40.4	2.9	52.5	73.9	21.4	100	0	
Vert.	9920.000	PK	46.8	38.4	8.4	39.4	2.9	57.1	73.9	16.8	100	0	
Vert.	2483.500	AV	34.3	27.9	13.8	41.0	2.9	37.9	53.9	16.0	113	157	
Vert.	4960.000	AV	32.4	32.0	6.0	39.4	2.9	33.9	53.9	20.0	100	0	
Vert.	7440.000	AV	33.6	37.0	7.5	40.4	2.9	40.6	53.9	13.3	100	0	
Vert.	9920.000	AV	33.2	38.4	8.4	39.4	2.9	43.5	53.9	10.4	100	0	

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

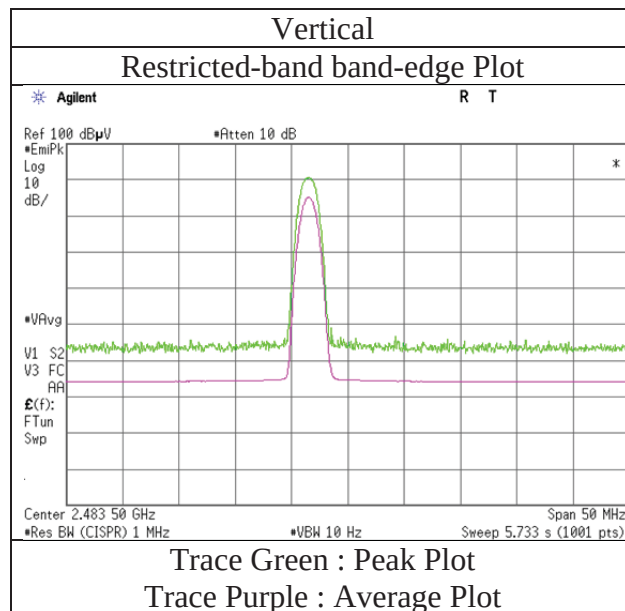
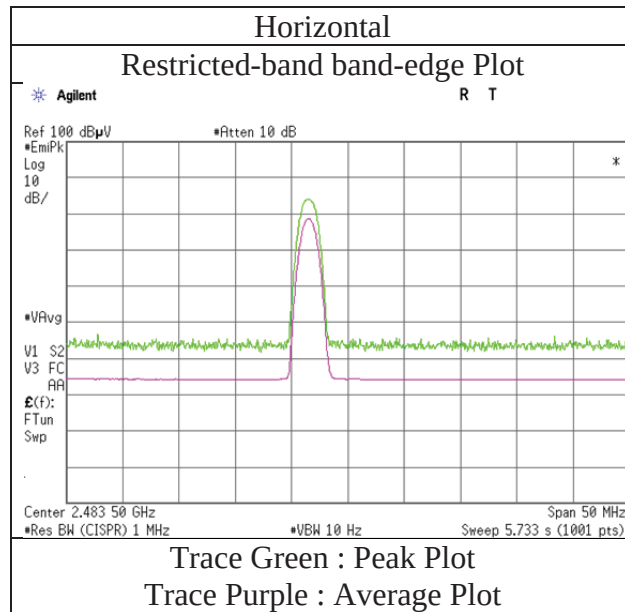
Distance factor : 1 GHz - 13 GHz : $20\log(3.7\text{ m} / 3.0\text{ m}) = 2.9\text{ dB}$

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

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

Radiated Spurious Emission (Reference Plot for band-edge)

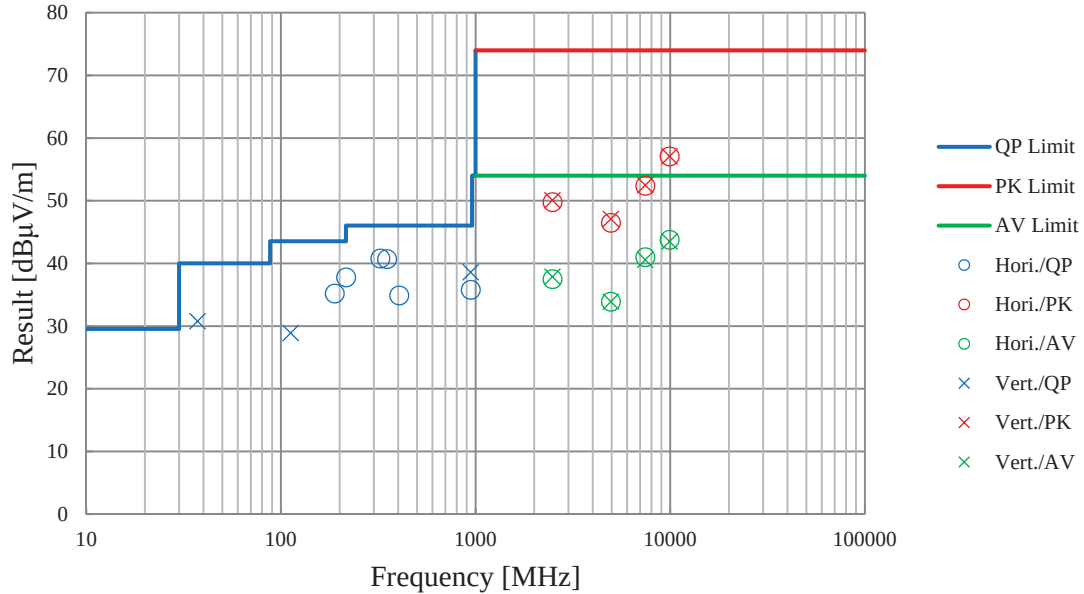
Test place : Shonan EMC Lab. No.3 Semi Anechoic Chamber
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 31 % RH
Engineer : Yosuke Ishikawa
(1-26.5 GHz)
Mode : Tx, Hopping Off, 3DH5 2480 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

Test place	Shonan EMC Lab. No.3 Semi Anechoic Chamber	
Report No.	11095831S-A-R1	
Date	March 2, 2016	March 1, 2016
Temperature / Humidity	25 deg. C / 21 % RH	25 deg. C / 31 % RH
Engineer	Yosuke Ishikawa	Yosuke Ishikawa
	(30-1000 MHz)	(1-26.5 GHz)
Mode	Tx, Hopping Off, 3DH5 2480 MHz	

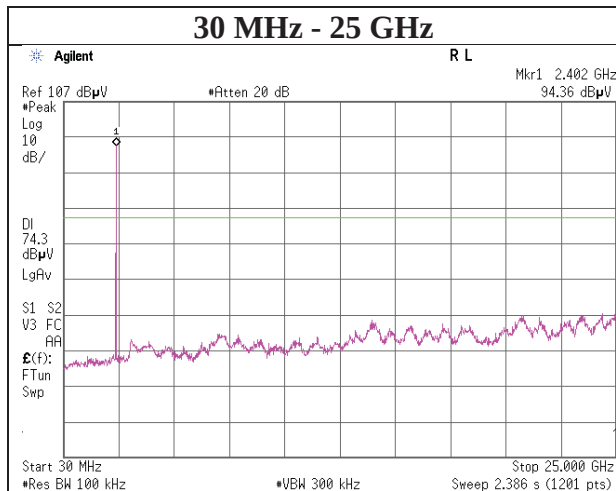
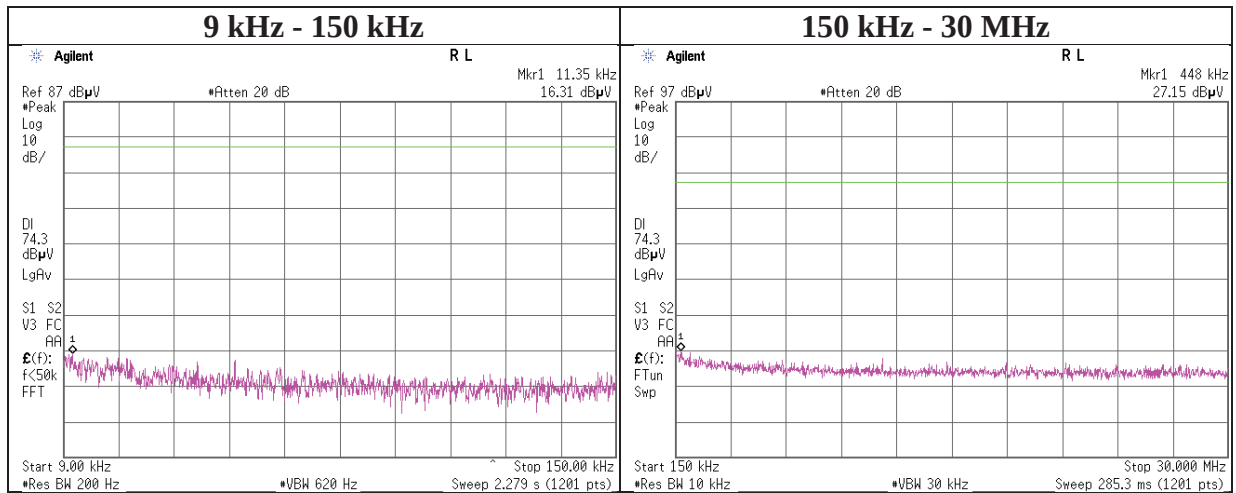


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx, Hopping Off, DH5

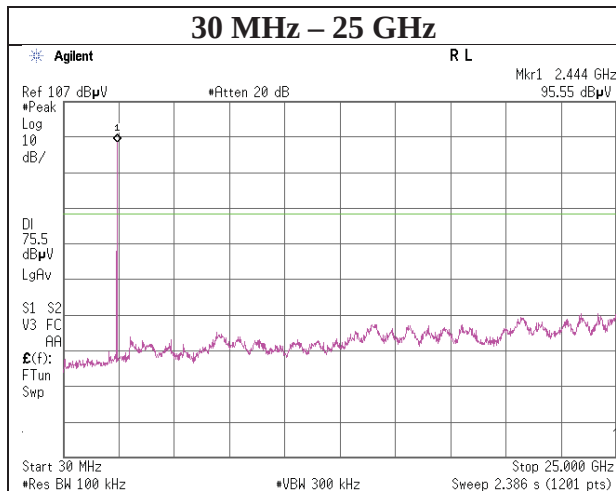
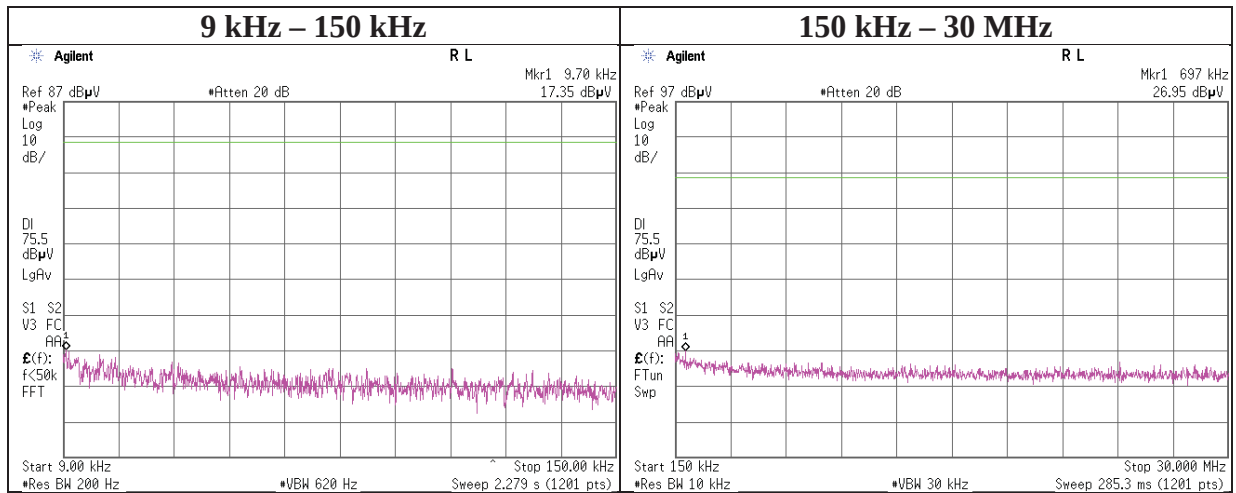
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx, Hopping Off, 3DH5

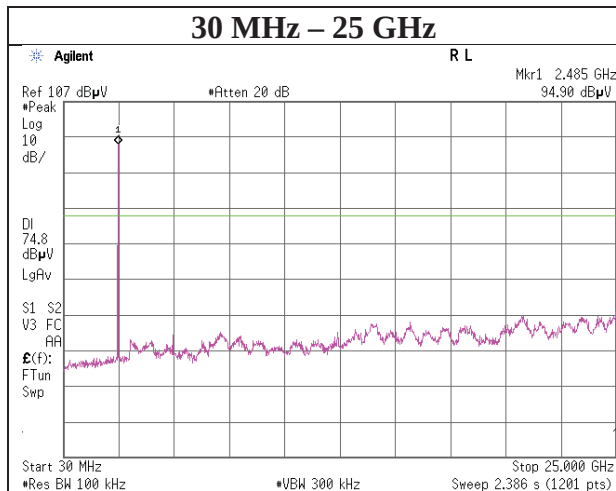
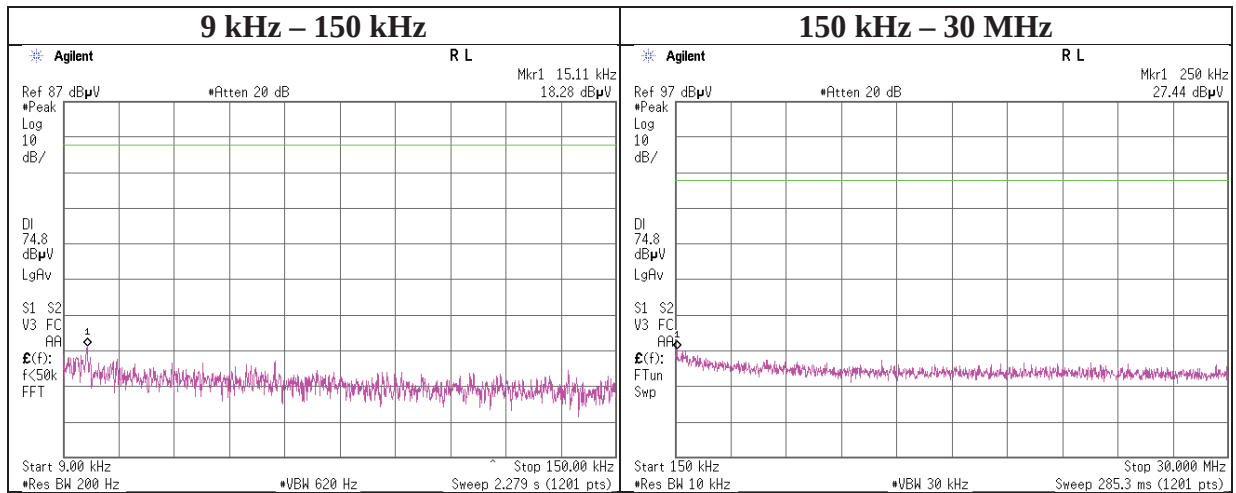
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx, Hopping Off, DH5

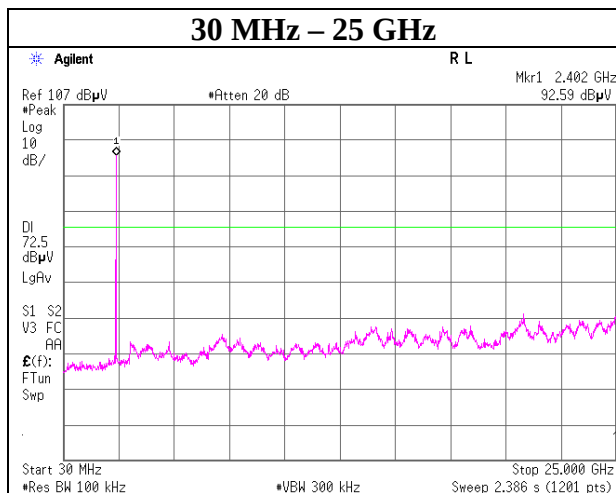
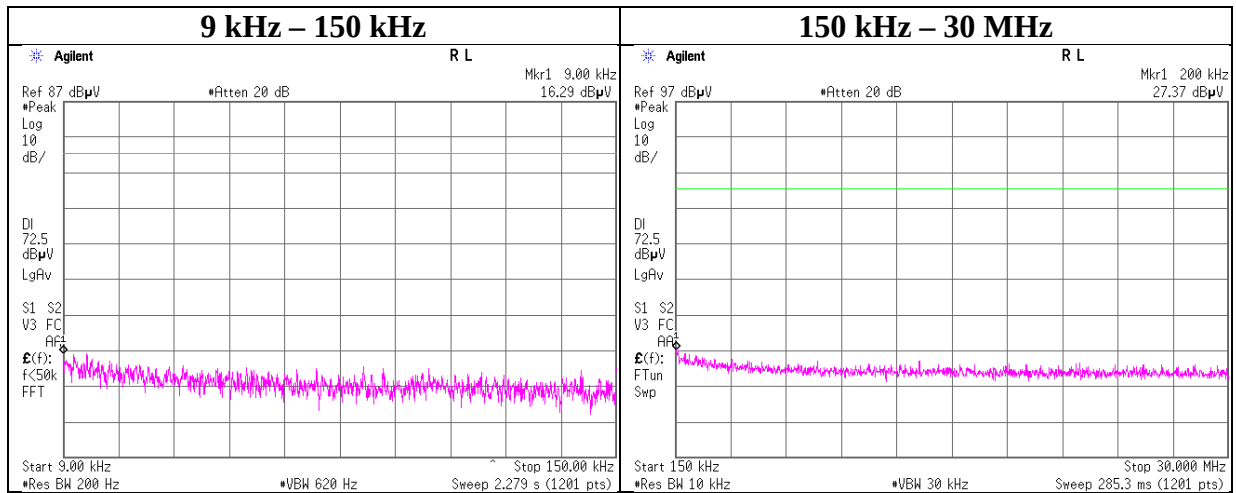
2480 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx, Hopping Off, 3DH5

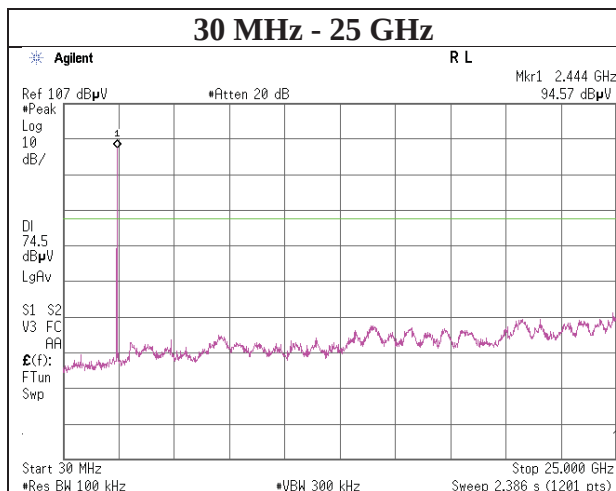
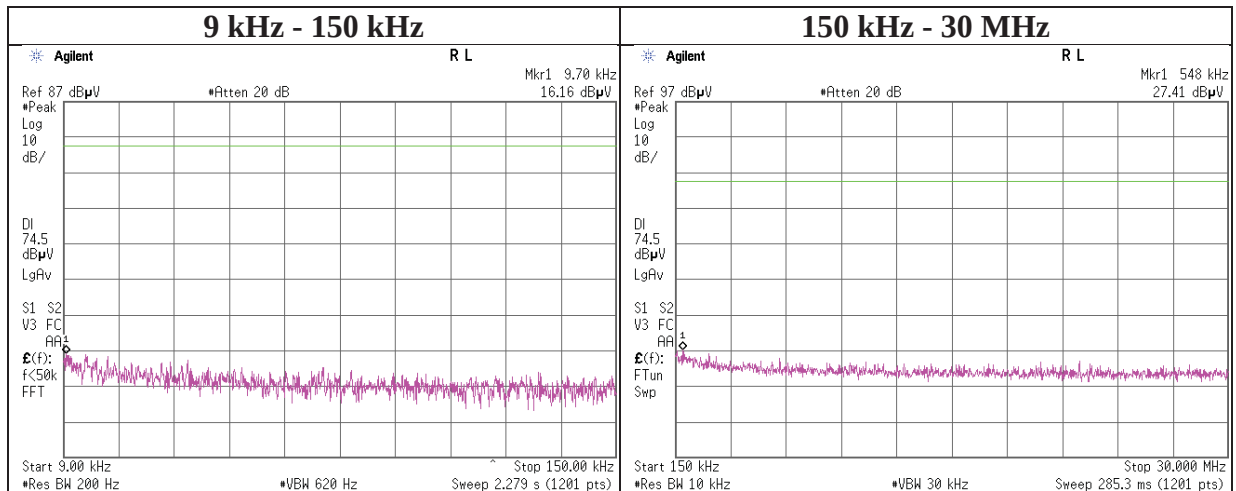
2402 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx, Hopping Off, 3DH5

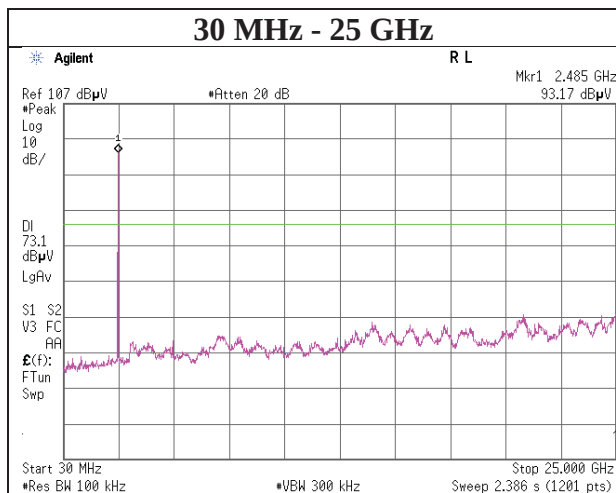
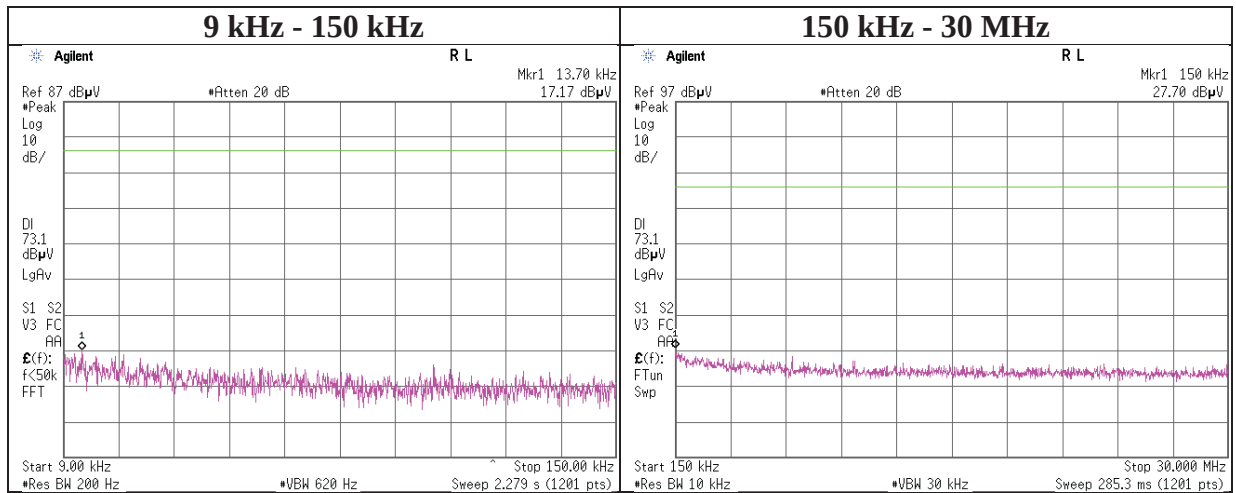
2441 MHz



Conducted Spurious Emission

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx, Hopping Off, 3DH5

2480 MHz



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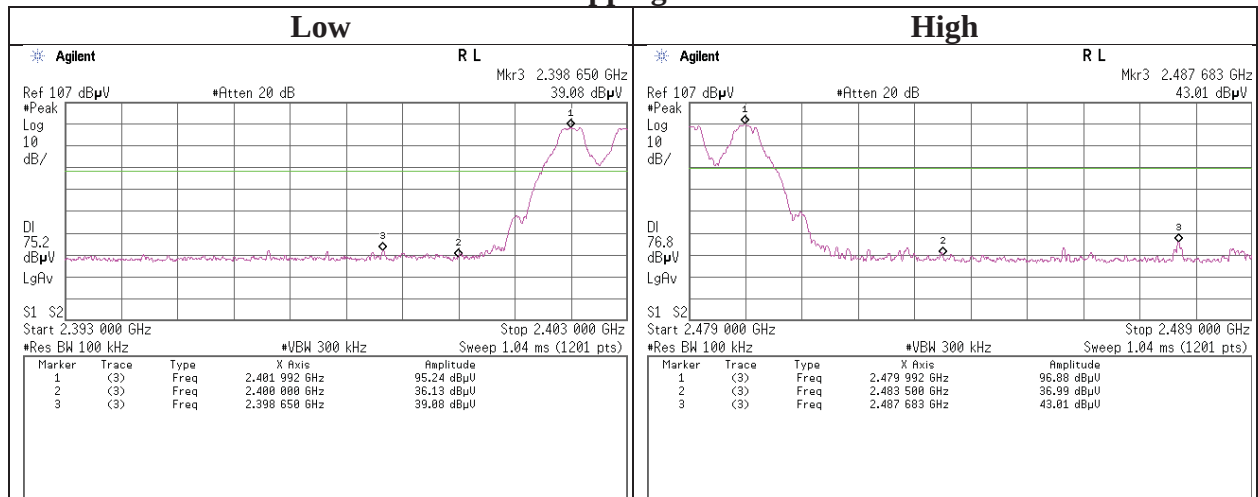
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

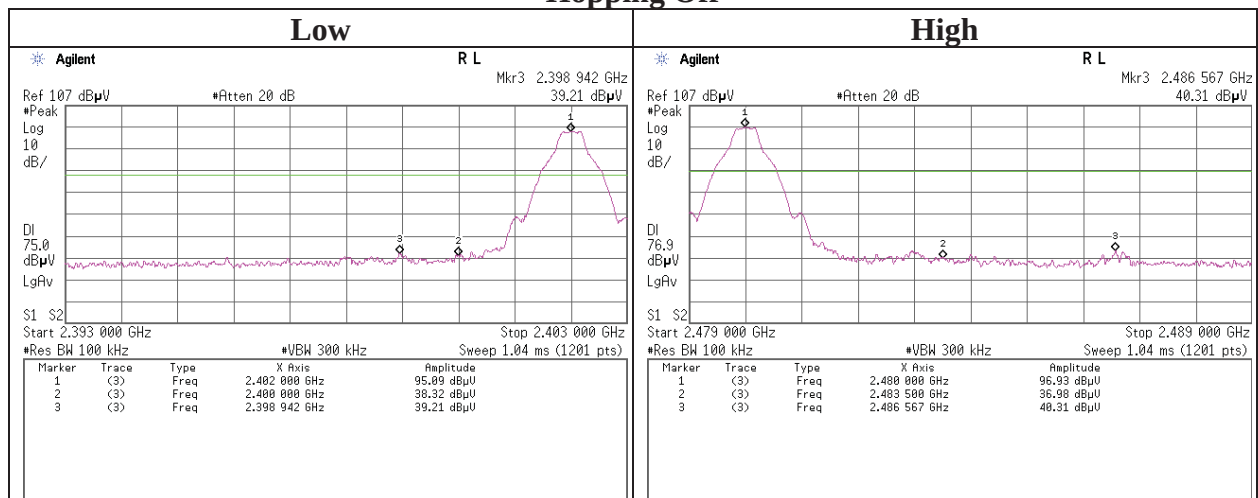
Conducted Emission Band Edge compliance

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx DH5

Hopping On



Hopping Off



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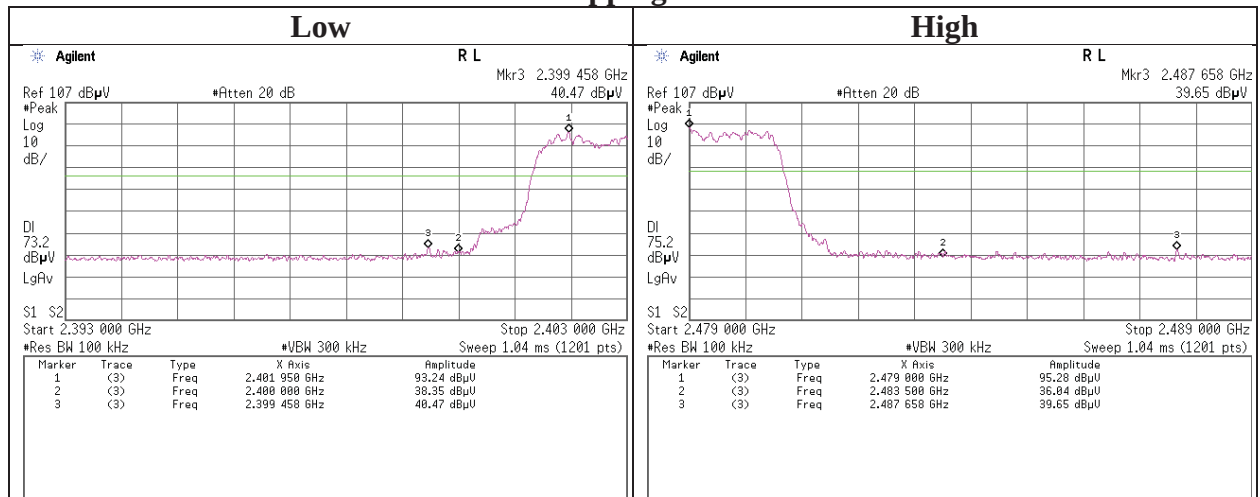
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

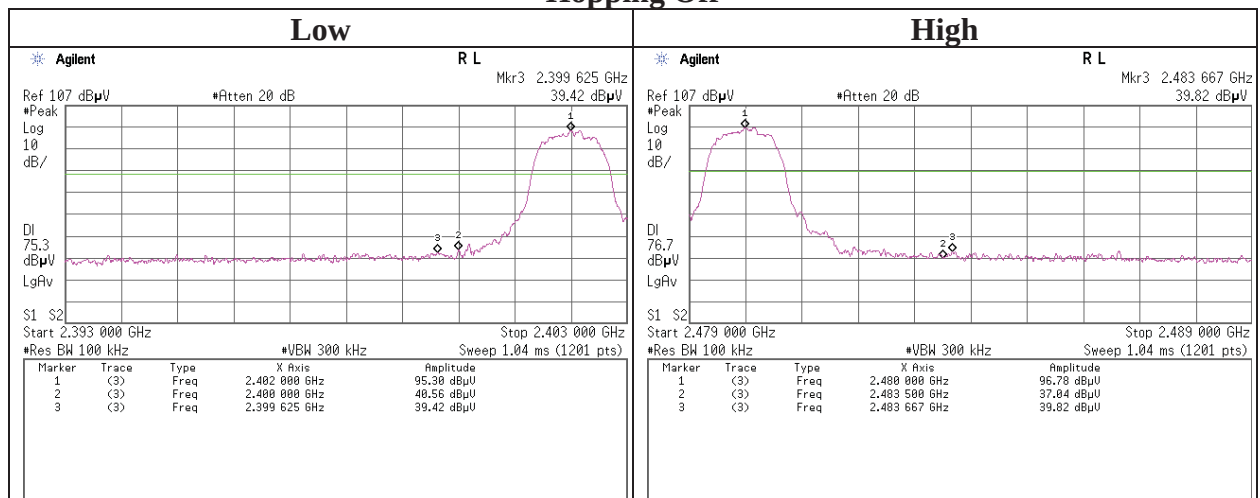
Conducted Emission Band Edge compliance

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx 3DH5

Hopping On



Hopping Off



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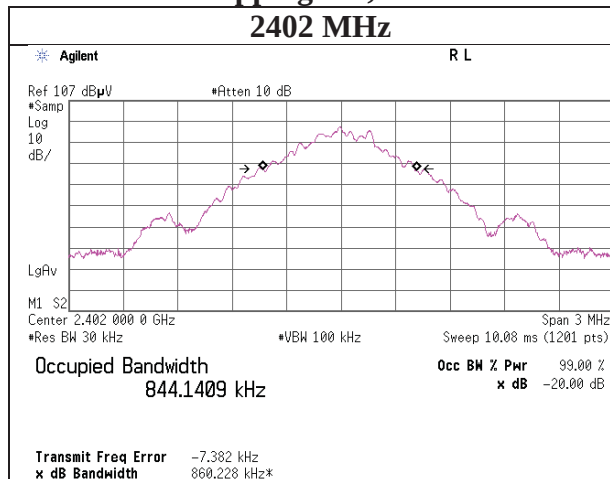
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

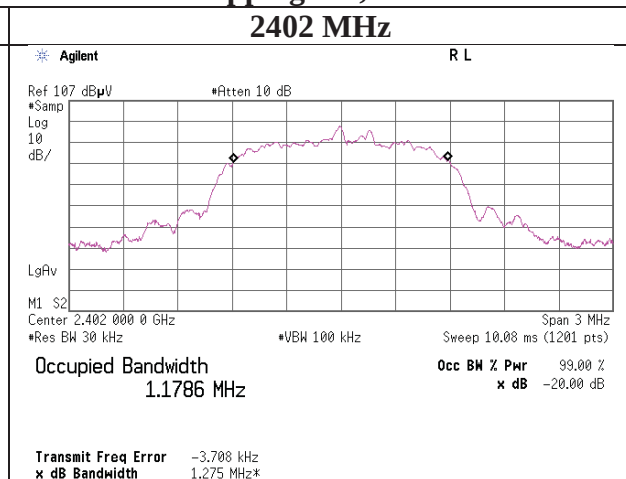
99%Occupied Bandwidth

Test place : Shonan EMC Lab. No.5 Shielded Room
Report No. : 11095831S-A-R1
Date : March 1, 2016
Temperature / Humidity : 25 deg. C / 51 % RH
Engineer : Hiroyuki Morikawa
Mode : Tx Hopping Off

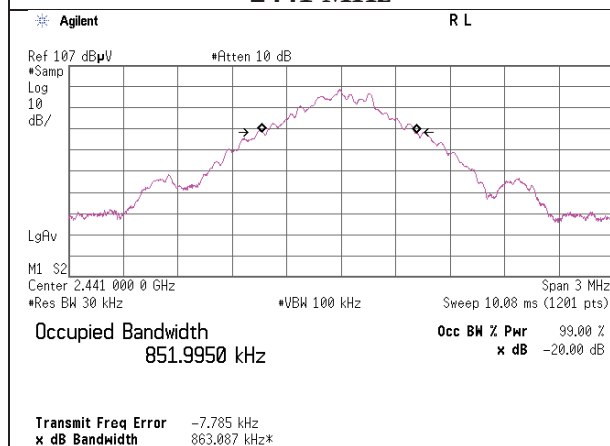
Hopping Off, DH5



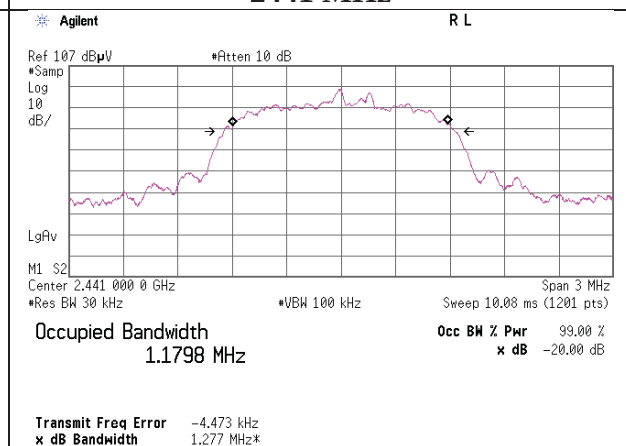
Hopping Off, 3DH5



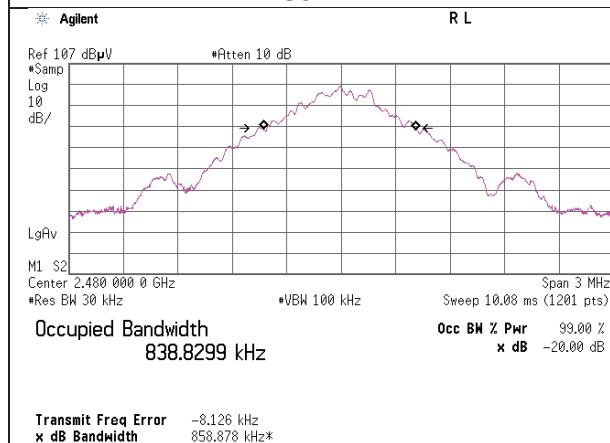
2441 MHz



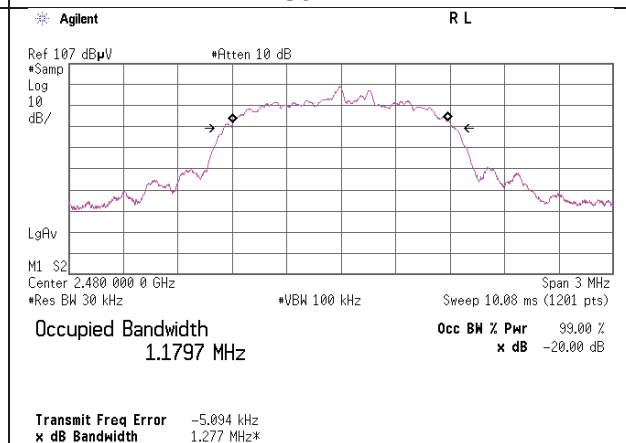
2441 MHz



2480 MHz



2480 MHz



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Shonan EMC Lab.

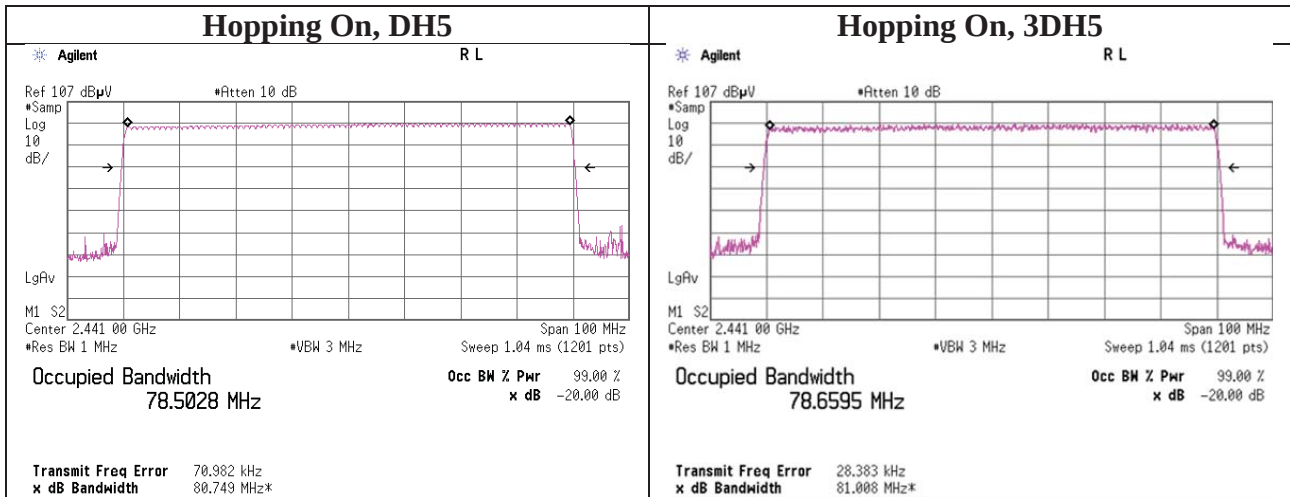
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

99% Occupied Bandwidth

Test place	Shonan EMC Lab. No.5 Shielded Room
Report No.	11095831S-A-R1
Date	March 1, 2016
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Hiroyuki Morikawa
Mode	Tx Hopping On



APPENDIX 2: Test instruments

Test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	1440491	RE	2015/05/27 * 12
SCC-G04	Coaxial Cable	Junkosha	J12J102207-00	JUN-12-14-018	RE	2015/06/08 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2015/05/19 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2015/08/11 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2015/10/22 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2015/03/23 * 12
SJM-15	Measure	ASKUL	-	-	RE	-
SAEC-03(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	RE	2015/08/28 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,MF)	-	RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2015/11/18 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM3640	RE	2015/03/17 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2015/03/23 * 12
SCC-G15	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	RE	2015/03/11 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-0100 0KMSKMS	-	RE	2015/04/09 * 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
SAEC-03(NSA)	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	RE	2015/07/16 * 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/T OYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(R F Selector)	RE	2015/04/17 * 12
SAF-03	Pre Amplifier	SONOMA	310N	290213	RE	2016/02/25 * 12
STR-06	Test Receiver	Rohde & Schwarz	ESCI	101259	RE	2015/03/24 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2015/09/16 * 12
SPM-07	Power Meter	Agilent	8990B	MY5100272	AT	2015/04/02 * 12
SPSS-04	Power sensor	Agilent	N1923A	MY5326009	AT	2015/04/02 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2015/03/11 * 12
SAT10-09	Attenuator	Weinschel Corp.	54A-10	W5692	AT	2015/11/04 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2015/12/07 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	AT	2015/11/18 * 12
SRENT-05	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187752	AT	2015/10/05 * 12
SOS-13	Humidity Indicator	Custom	CTH-202	Q.C.17	AT	2015/12/07 * 12
KTS-08	Digital Tester	SANWA	PC500	7019224	AT	2015/05/20 * 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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