



Test report No. : 10646854H-B-R2
Page : 1 of 56
Issued date : February 9, 2015
Revised date : April 7, 2015
FCC ID : A6RNW01A


RADIO TEST REPORT


Test Report No. : 10646854H-B-R2

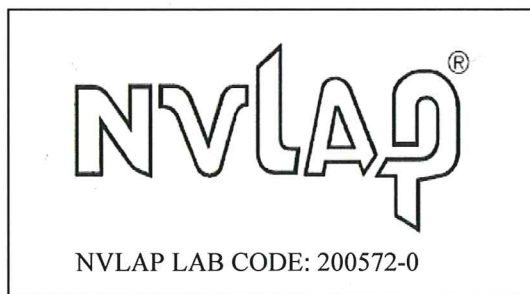
Applicant : Yamaha Corporation
Type of Equipment : Network Module
Model No. : NW-01
FCC ID : A6RNW01A
Test regulation : FCC Part 15 Subpart C: 2015
*Bluetooth part
Test Result : Complied

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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 10646854H-B-R1. 10646854H-B-R1 is replaced with this report.

Date of test: January 14 to April 1, 2015

Representative test engineer: 
Keisuke Kawamura
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Approved by: 
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This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
<http://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

REVISION HISTORY

Original Test Report No.: 10646854H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10646854H-B	February 9, 2015	-	-
1	10646854H-B-R1	April 2, 2015	P1	Correction: Date of test
1	10646854H-B-R1	April 2, 2015	P18	Addition: Tested Date, Temperature, Humidity and Engineer
1	10646854H-B-R1	April 2, 2015	P20	Correction: Test data of Carrier Frequency Separation
2	10646854H-B-R2	April 7, 2015	P5	Correction: Power Supply (inner) of WLAN part DC 1.8V → DC 3.3V

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SECTION 1: Customer information

Company Name : Yamaha Corporation
Address : 10-1 Nakazawa-cho, Naka-ku, Hamamatsu Shizuoka, 430-8650, Japan
Telephone Number : +81-53-460-2376
Facsimile Number : +81-53-460-2379
Contact Person : Toshihiro Inoue

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

2.1 Identification of E.U.T.

Type of Equipment : Network Module
Model No. : NW-01
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC 5.0V
Receipt Date of Sample : January 10, 2015
Country of Mass-production : Malaysia
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 32.768kHz, 2.25MHz, 6MHz, 22.5792MHz, 24.576MHz, 25MHz,
26MHz, 50MHz, 400MHz
Operating temperature : 0deg. C to +67deg. C

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Radio Specification

WLAN (IEEE802.11b/g/n-20)

Equipment Type	Transceiver
Frequency of Operation	2412-2462MHz
Type of Modulation	DSSS, OFDM
Bandwidth & Channel spacing	20MHz & 5MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.3V
Antenna Type	Dipole Antenna
Antenna Gain	Antenna with 30mm RF CABLE: 2.7dBi Antenna with 120mm RF CABLE: 2.5dBi Antenna with 160mm RF CABLE: 2.4dBi Antenna with 200mm RF CABLE: 2.3dBi Antenna with 500mm RF CABLE: 1.8dBi

Bluetooth (Ver. 2.1 with EDR function)

Equipment Type	Transceiver
Frequency of Operation	2402-2480MHz
Type of Modulation	FHSS (GFSK, $\pi/4$ DQPSK, 8DPSK)
Bandwidth & Channel spacing	1MHz & 1MHz
Method of frequency generation	Synthesizer
Power Supply (inner)	DC 3.3V
Antenna Type	Dipole Antenna
Antenna Gain	Antenna with 30mm RF CABLE: 2.7dBi Antenna with 120mm RF CABLE: 2.5dBi Antenna with 160mm RF CABLE: 2.4dBi Antenna with 200mm RF CABLE: 2.3dBi Antenna with 500mm RF CABLE: 1.8dBi

*This test report applies for Bluetooth.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on January 21, 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

* The revision on January 21, 2015 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 C63.4:2009 7. AC powerline conducted emission measurements IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	QP 29.5dB, 0.15000MHz, L/N 0.15218MHz, L AV 36.1dB, 14.33320MHz, L	Complied	-
Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-210 A8.1 (b)	See data.	Complied	Conducted
20dB Bandwidth	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1) ----- IC: RSS-210 A8.1 (a)		Complied	Conducted
Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-210 A8.1 (d)		Complied	Conducted
Dwell time	FCC: FCC Public Notice DA 00-705 ----- IC: -	FCC: Section15.247(a)(1)(iii) ----- IC: RSS-210 A8.1 (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-210 A8.4 (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-210 A8.5 RSS-Gen 8.9 RSS-Gen 8.10		8.7dB 7440.000MHz, Horizontal, AV	Complied

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

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

FCC Part 15.31 (e)

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

FCC Part 15.203 Antenna requirement

The EUT has a unique antenna connector (U.FL on the Module and Reverse SMA for Antenna itself). Therefore the equipment complies with the requirement of Section 15.203/212.

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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.

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.6dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Conducted Emission test

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

Radiated emission test (3m)

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

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3.5 Test Location

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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

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

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping off) DH5, 3DH5	2402MHz 2441MHz 2480MHz
Carrier Frequency Separation	Tx (Hopping on) DH5, 3DH5 Inquiry	2402MHz 2441MHz 2480MHz
20dB Bandwidth	Tx (Hopping off) DH5, 3DH5 Inquiry	2402MHz 2441MHz 2480MHz
Number of Hopping Frequency	Tx (Hopping on) DH5, 3DH5 Inquiry	-
Dwell time	Tx (Hopping on), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5 Inquiry	-
Maximum Peak Output Power	Tx (Hopping off) DH5, 2DH5, 3DH5 Inquiry	2402MHz 2441MHz 2480MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping on -Hopping off	2402MHz 2480MHz
99% Occupied Bandwidth	Tx DH5, 3DH5 -Hopping on -Hopping off	2402MHz 2441MHz 2480MHz
<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) *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>*EUT has the power settings by the software as follows; Power settings: -1.75dBm Software: Ver.4.3.1 *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.</p>		

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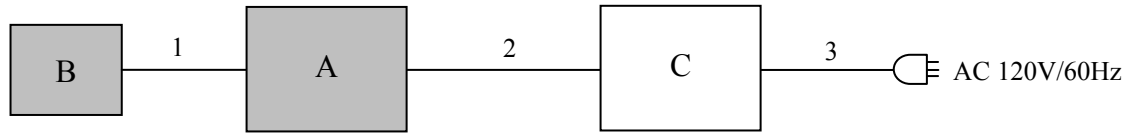
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4.2 Configuration and peripherals



* 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	Network Module	NW-01	2 for AT* 3 for other tests	Yamaha Corporation	EUT
B	Antenna	L08RF001-CS-R	-	ADVANCED-CONNECTEK INC.	EUT
C	DC Power Supply	PMC35-2A	13090501	KIKUSUI	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna Cable	0.5 *1)	Unshielded	Unshielded	-
2	DC Cable	2.7	Unshielded	Unshielded	-
3	AC Cable	0.8	Unshielded	Unshielded	-

*1) After pre-check, the test was performed with the worst antenna cable 500mm as a representative.

*AT: Antenna Terminal Conducted test

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber .

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

The height of the measuring antenna varied between 1 and 4m 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	Below 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc 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 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz *1)	RBW: 100kHz VBW: 300kHz
Test Distance	3m	3m (below 10GHz), 1m*2) (above 10GHz)		3m (below 10GHz), 1m*2) (above 10GHz)

*1) Although 00-705 accepts VBW=10Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.

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

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

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

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
20dB Bandwidth	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Peak	Max Hold *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50MHz BW)
Carrier Frequency Separation	3MHz	30kHz	100kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30MHz	300kHz	1MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100kHz, 1MHz	300kHz, 3MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
	30MHz to 25GHz (Less or equal to 5GHz)	100kHz	300kHz				
Conducted Spurious Emission Band Edge compliance	10MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) The measurement was performed with Max Hold since the duty cycle was not 100%. *2) Reference data *3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz).							

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: Data of EMI test

Conducted Emission

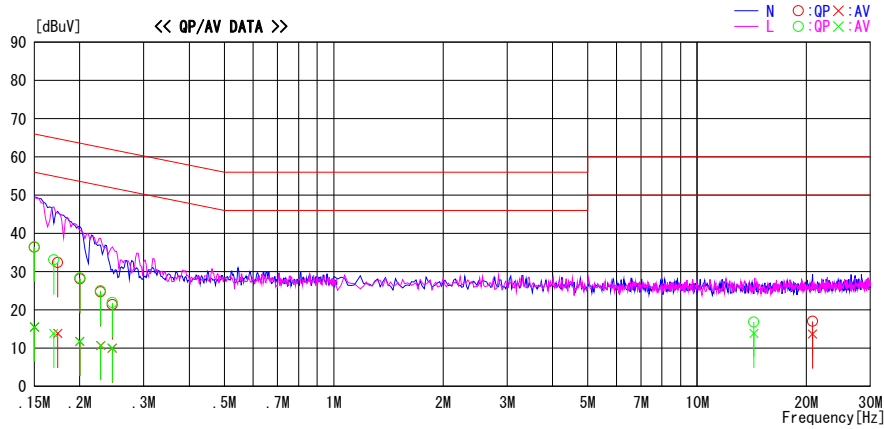
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
 Date : 2015/01/16

Report No. : 10646854H
 Temp./Humi. : 20deg. C / 31% RH
 Engineer : Tsubasa Takayama

Mode / Remarks : BT DH5 2402MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
0.15000	23.2	2.3	13.2	36.4	15.5	66.0	56.0	29.6	40.5	N
0.17393	19.2	0.7	13.2	32.4	13.9	64.8	54.8	32.4	40.9	N
0.20003	14.9	-1.4	13.2	28.1	11.8	63.6	53.6	35.5	41.8	N
0.22830	11.5	-2.5	13.2	24.7	10.7	62.5	52.5	37.8	41.8	N
0.24570	8.2	-3.2	13.2	21.4	10.0	61.9	51.9	40.5	41.9	N
20.77703	2.1	-1.2	14.9	17.0	13.7	60.0	50.0	43.0	36.3	N
0.15000	23.3	2.4	13.2	36.5	15.6	66.0	56.0	29.5	40.4	L
0.16958	19.9	0.7	13.2	33.1	13.9	65.0	55.0	31.9	41.1	L
0.20003	15.2	-1.4	13.2	28.4	11.8	63.6	53.6	35.2	41.8	L
0.22830	11.8	-2.5	13.2	25.0	10.7	62.5	52.5	37.5	41.8	L
0.24570	8.7	-3.1	13.2	21.9	10.1	61.9	51.9	40.0	41.8	L
14.33320	2.3	-0.6	14.5	16.8	13.9	60.0	50.0	43.2	36.1	L

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTN + CABLE)
 Except for the above table : adequate margin data below the limits.

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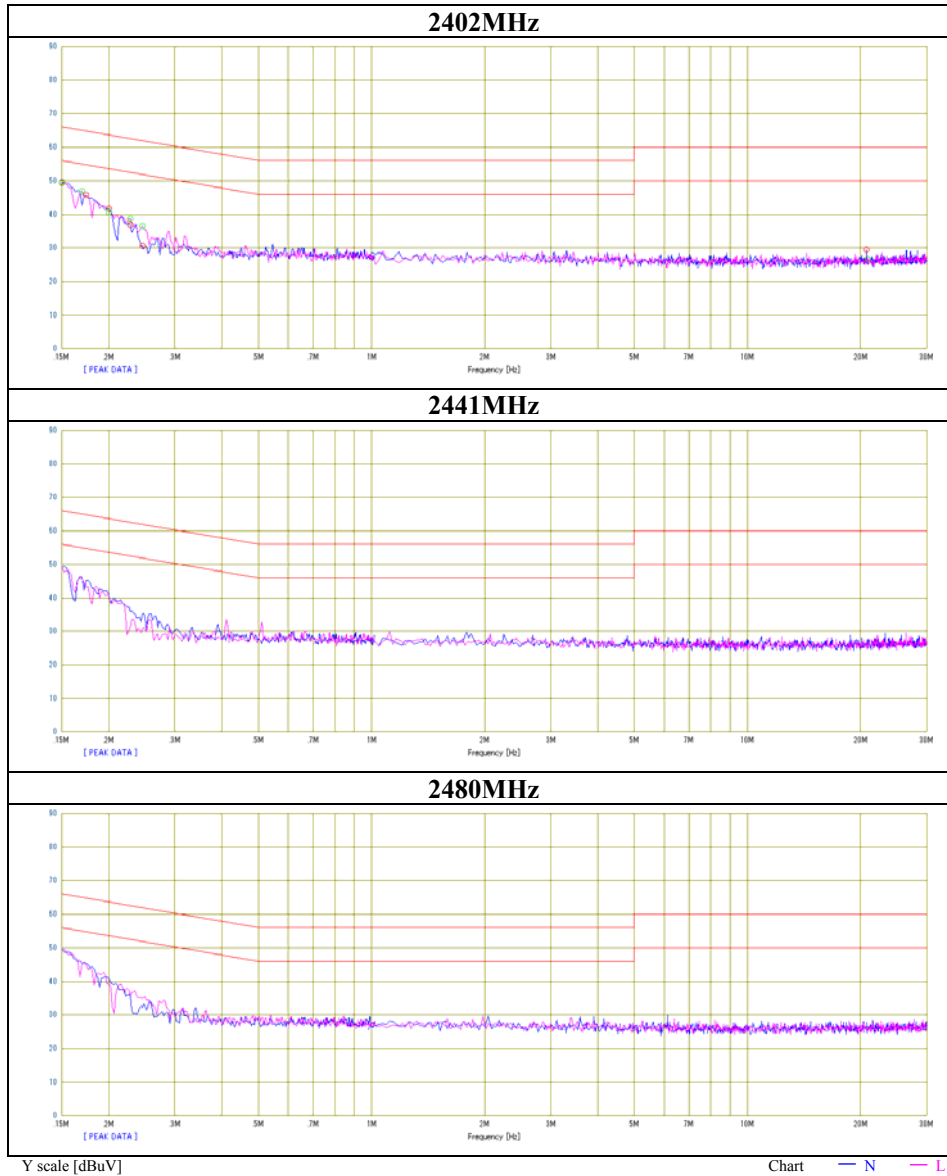
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Conducted Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10646854H
Date : January 16, 2014
Temperature/ Humidity : 20 deg. C / 31% RH
Engineer : Tsubasa Takayama
Mode : Tx DH5



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Conducted Emission

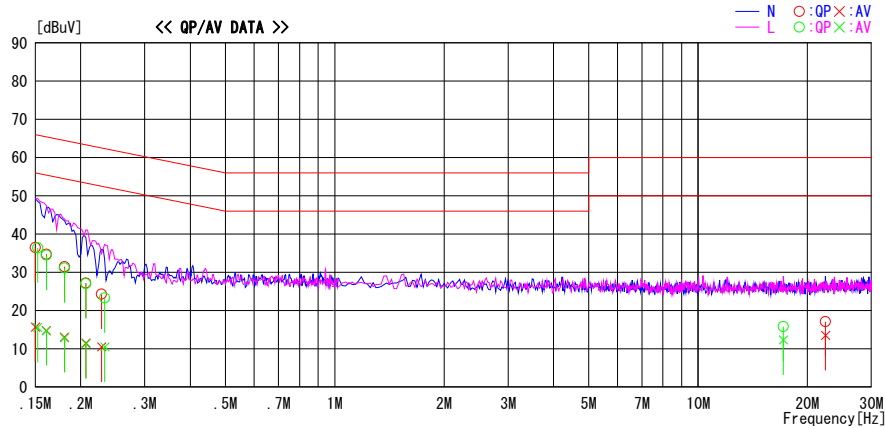
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
 Date : 2015/01/16

Report No. : 10646854H
 Temp./Humi. : 20deg. C / 31% RH
 Engineer : Tsubasa Takayama

Mode / Remarks : BT 3DH5 2402MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]	
0.15000	23.3	2.5	13.2	36.5	15.7	66.0	56.0	29.5	40.3	N
0.16088	21.5	1.6	13.2	34.7	14.8	65.4	55.4	30.7	40.6	N
0.18045	18.3	-0.1	13.2	31.5	13.1	64.5	54.5	33.0	41.4	N
0.20655	14.0	-1.7	13.2	27.2	11.5	63.3	53.3	36.1	41.8	N
0.22830	11.1	-2.7	13.2	24.3	10.5	62.5	52.5	38.2	42.0	N
22.43115	2.1	-1.5	15.0	17.1	13.5	60.0	50.0	42.9	36.5	N
0.15218	23.2	2.4	13.2	36.4	15.6	65.9	55.9	29.5	40.3	L
0.16088	21.3	1.5	13.2	34.5	14.7	65.4	55.4	30.9	40.7	L
0.18045	17.9	-0.3	13.2	31.1	12.9	64.5	54.5	33.4	41.6	L
0.20655	13.8	-1.9	13.2	27.0	11.3	63.3	53.3	36.3	42.0	L
0.23265	10.1	-2.7	13.2	23.3	10.5	62.4	52.4	39.1	41.9	L
17.16802	1.1	-2.4	14.7	15.8	12.3	60.0	50.0	44.2	37.7	L

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + ATTEN + CABLE)
 Except for the above table : adequate margin data below the limits.

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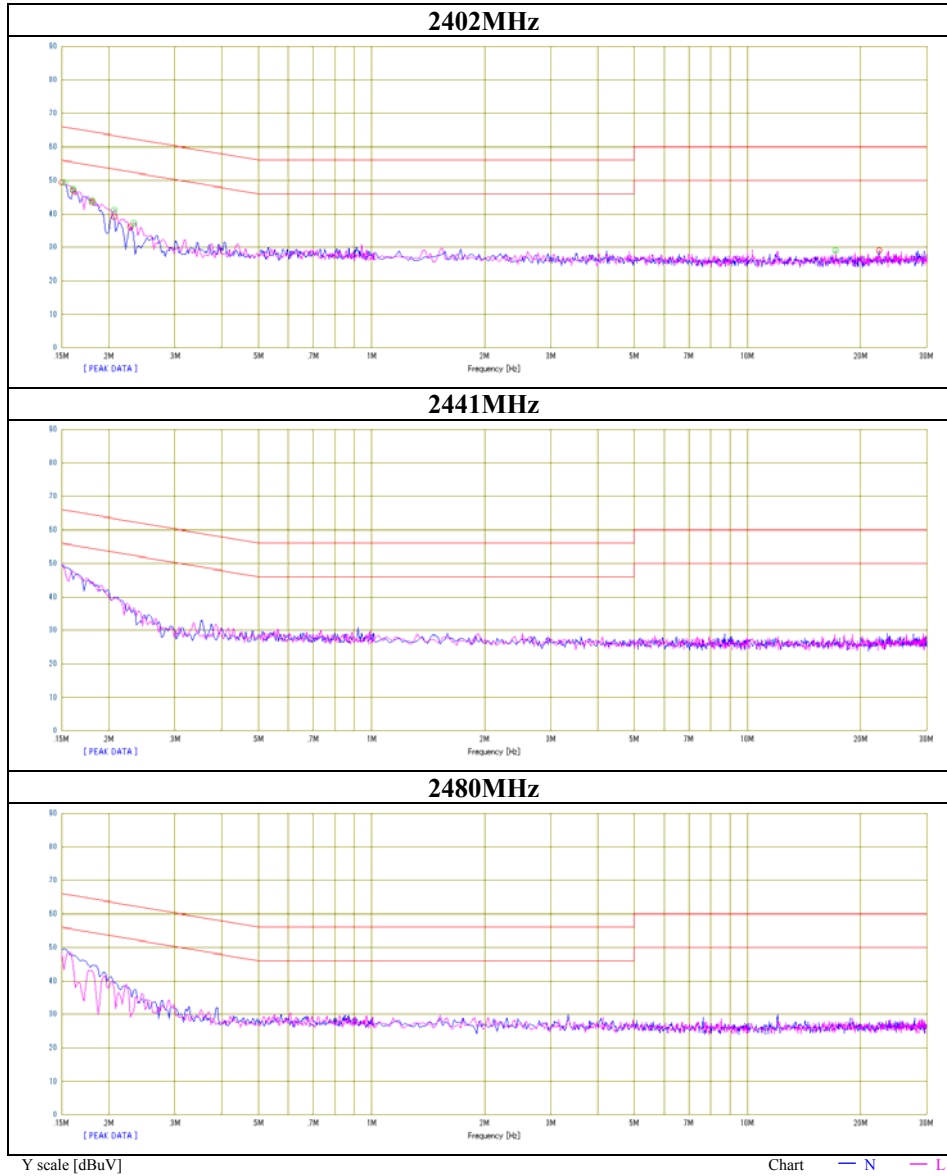
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Facsimile : +81 596 24 8124

Conducted Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10646854H
Date	January 16, 2014
Temperature/ Humidity	20 deg. C / 31% RH
Engineer	Tsubasa Takayama
Mode	Tx 3DH5



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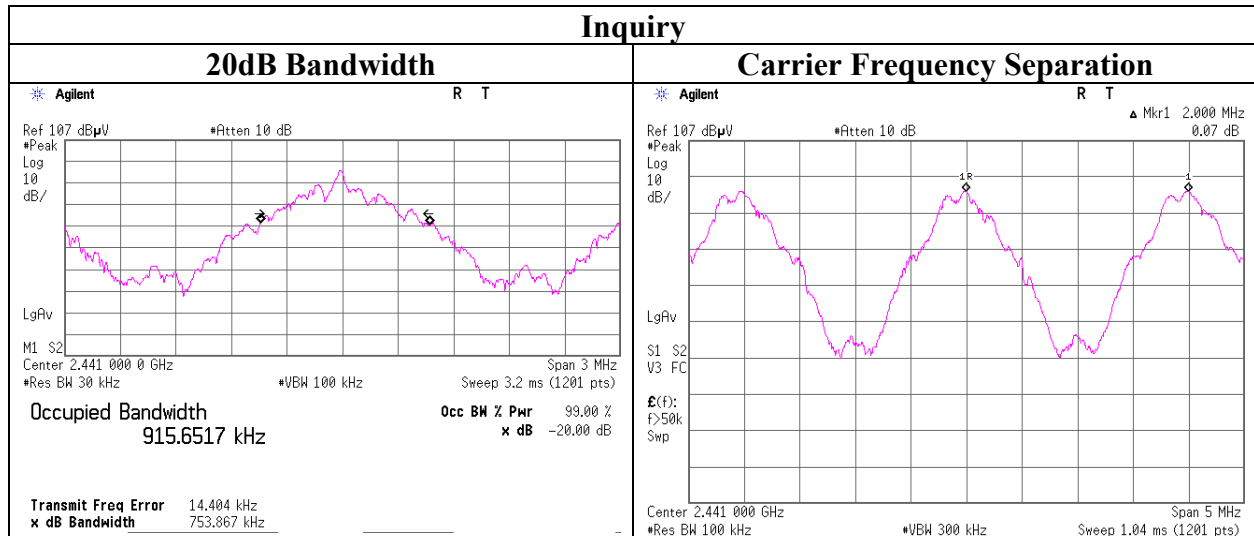
Facsimile : +81 596 24 8124

20dB Bandwidth and Carrier Frequency Separation

Test place	Ise EMC Lab. No.11 Measurement Room	
Report No.	10646854H	
Date	01/14/2015	04/01/2015
Temperature/ Humidity	24deg. C / 22% RH	24deg. C / 42% RH
Engineer	Tomoki Matsui	Shinichi Miyazono
Mode	Tx (Hopping on) DH5/3DH5/Inquiry	

Mode	Freq. [MHz]	20dB Bandwidth [MHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	0.812	1.000	≧ 0.542
DH5	2441.0	0.804	1.000	≧ 0.536
DH5	2480.0	0.812	1.000	≧ 0.541
3DH5	2402.0	1.285	1.000	≧ 0.857
3DH5	2441.0	1.315	1.000	≧ 0.877
3DH5	2480.0	1.288	1.000	≧ 0.859
Inquiry	2441.0	0.754	2.000	≧ 0.503

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



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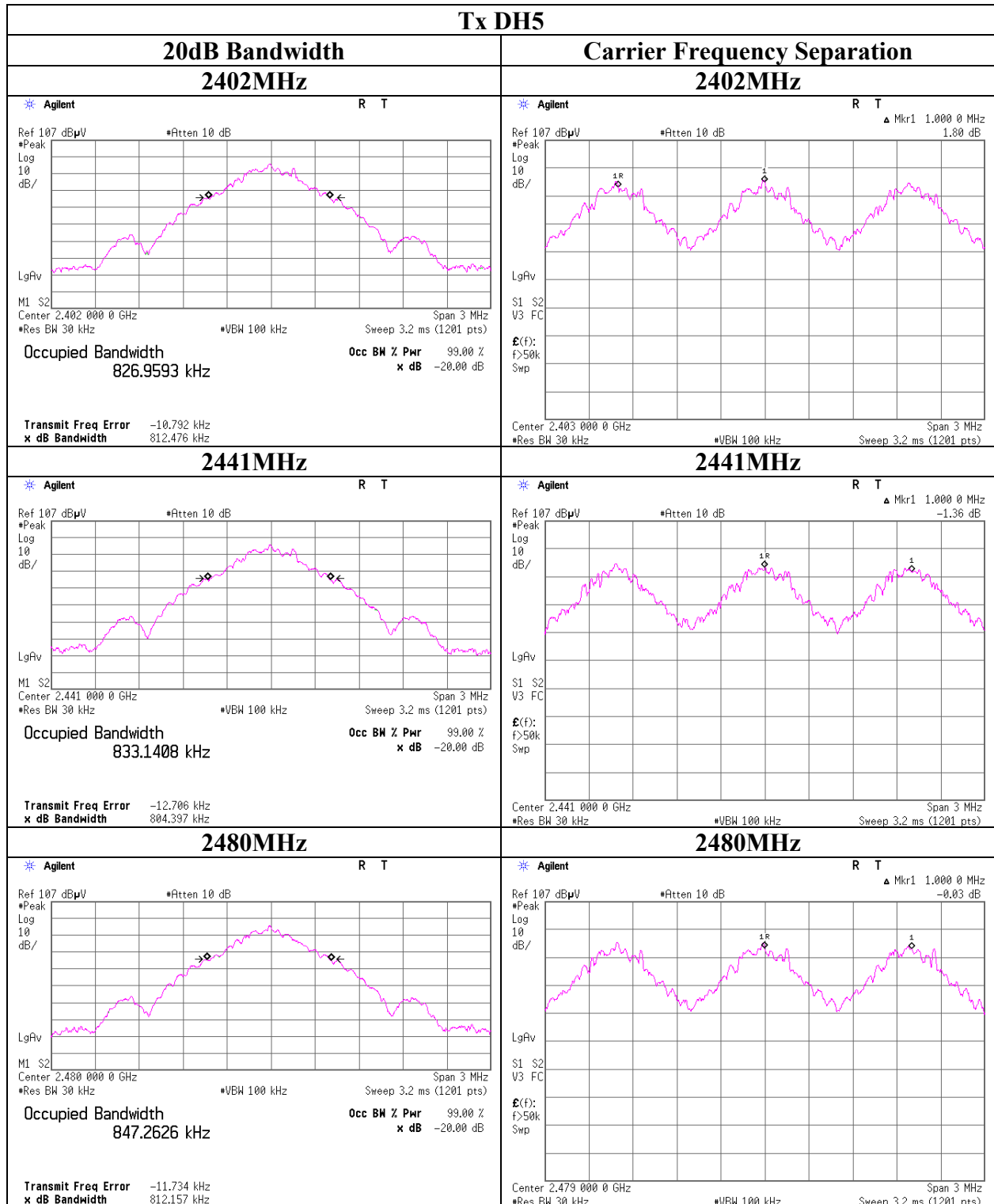
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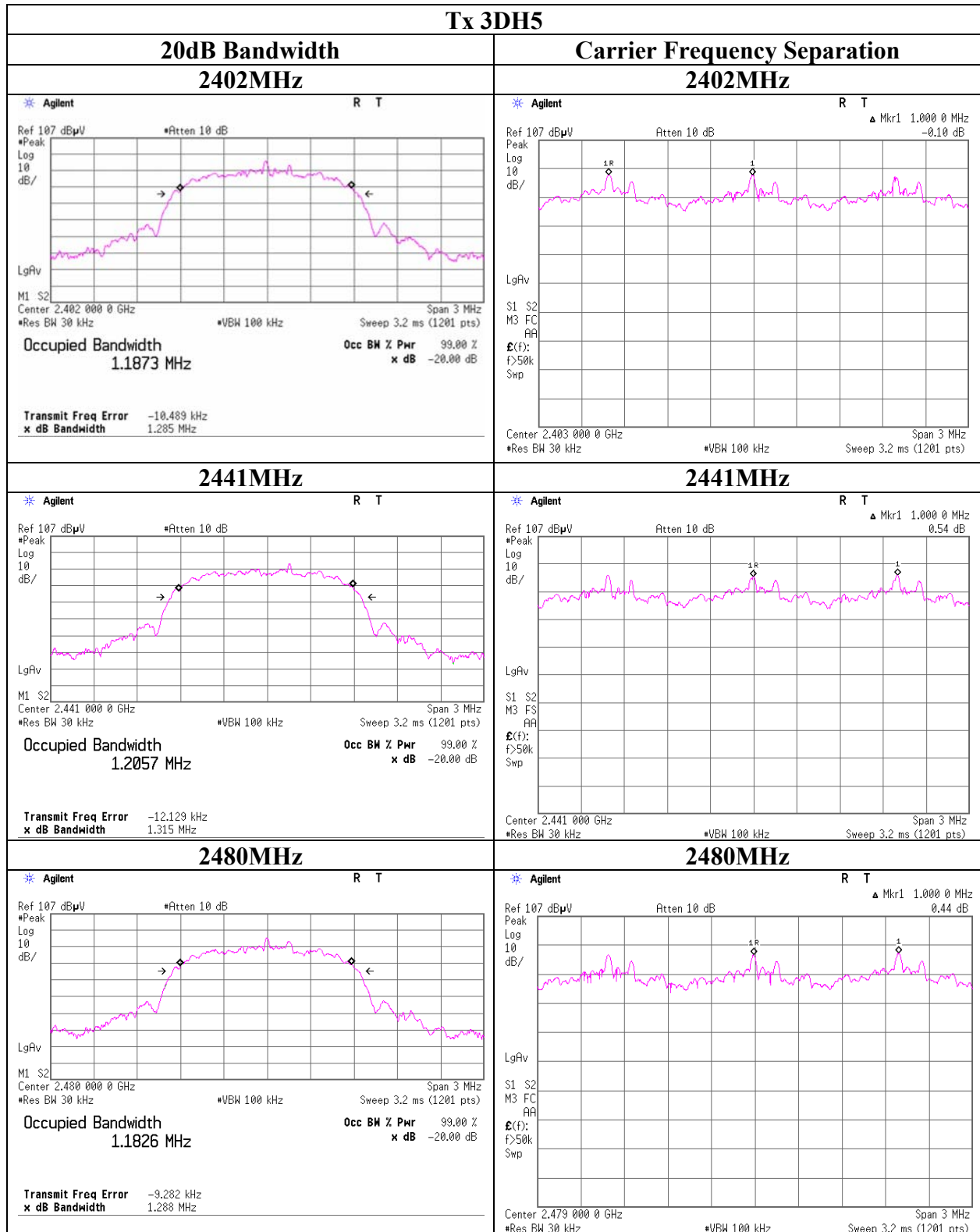
20dB Bandwidth and Carrier Frequency Separation



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Ise EMC Lab.

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20dB Bandwidth and Carrier Frequency Separation



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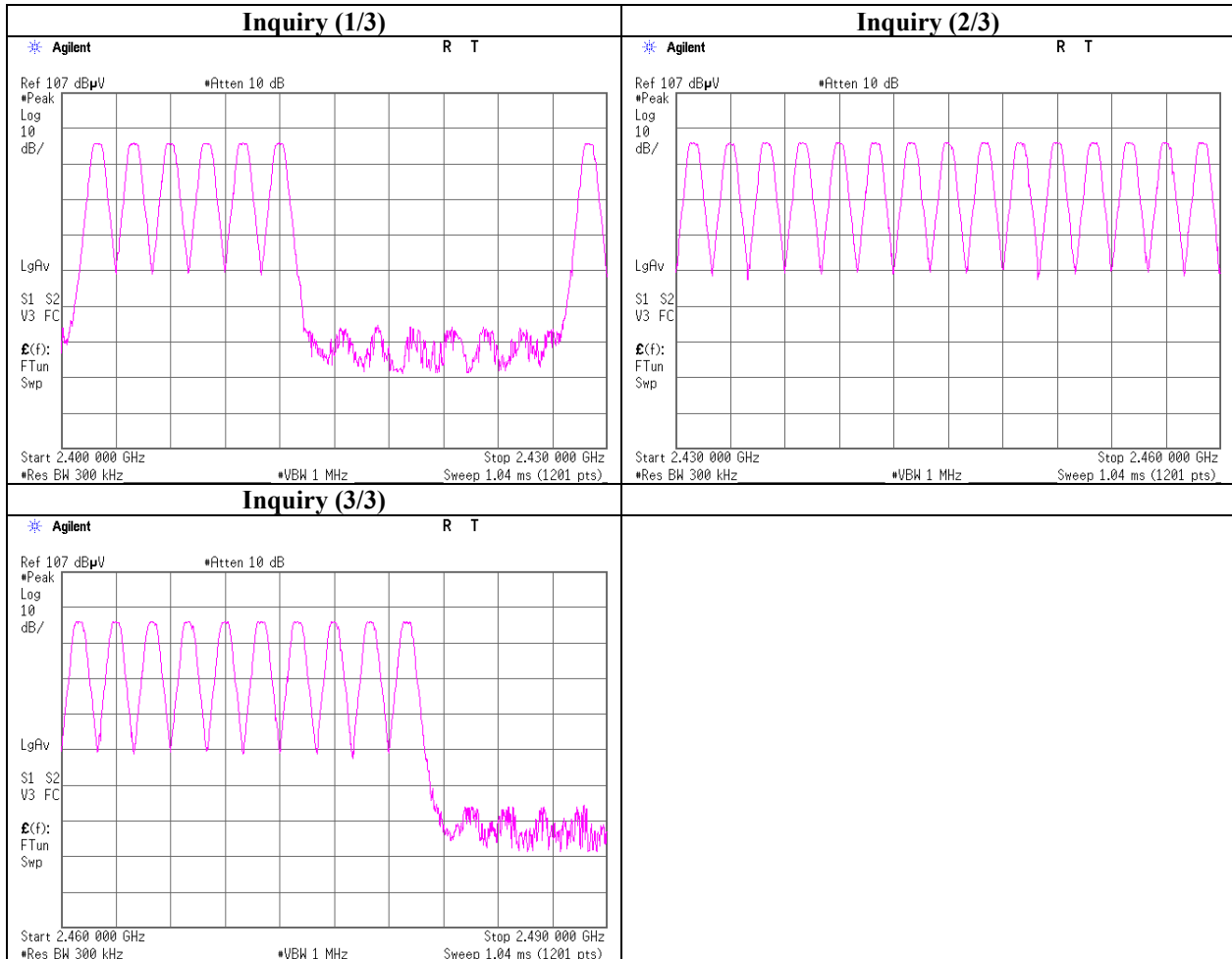
Facsimile : +81 596 24 8124

Number of Hopping Frequency

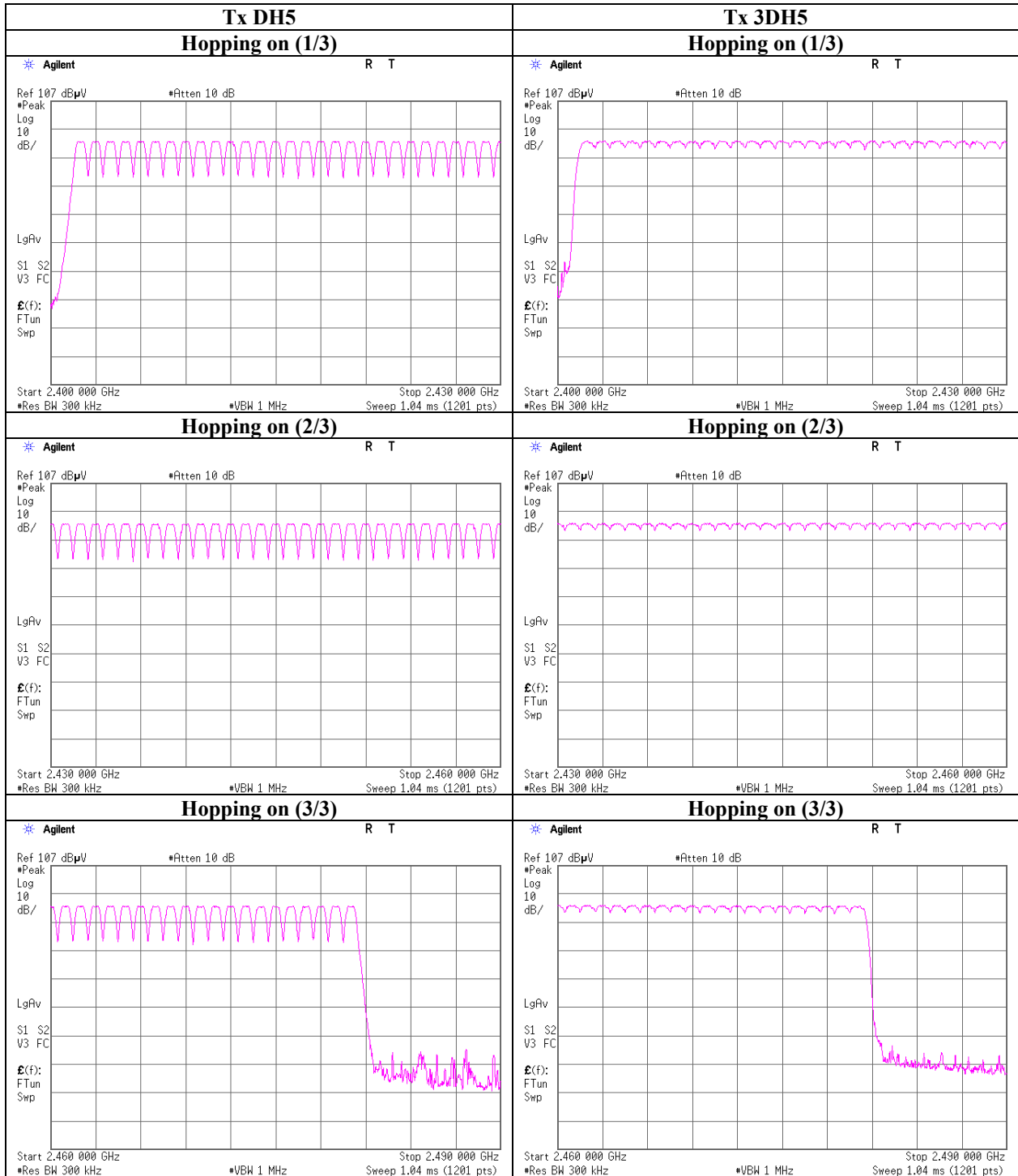
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping on) DH5/3DH5/Inquiry

Mode	Number of channel [times]	Limit [times]
DH5	79	>= 15
3DH5	79	>= 15
Inquiry	32	>= 15

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



Number of Hopping Frequency



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Dwell time

Test place : Ise EMC Lab. No.11 Measurement Room
 Report No. : 10646854H
 Date : 01/14/2015
 Temperature/ Humidity : 24deg. C / 22% RH
 Engineer : Tomoki Matsui
 Mode : Tx (Hopping on) DH5/3DH5/Inquiry

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 time [msec]	Result [msec]	Limit [msec]
DH1	50.4 times / 5 sec. x	31.6 sec. =	319 times	0.429	137
DH3	25.2 times / 5 sec. x	31.6 sec. =	160 times	1.697	272
DH5	18.2 times / 5 sec. x	31.6 sec. =	116 times	2.940	341
3DH1	48.6 times / 5 sec. x	31.6 sec. =	308 times	0.425	131
3DH3	25.8 times / 5 sec. x	31.6 sec. =	164 times	1.678	275
3DH5	19.2 times / 5 sec. x	31.6 sec. =	122 times	2.937	358
Inquiry	100.0 times / 1 sec. x	12.8 sec. =	1280 times	0.120	153

Sample Calculation

Result = Number of transmission x Length of transmission time

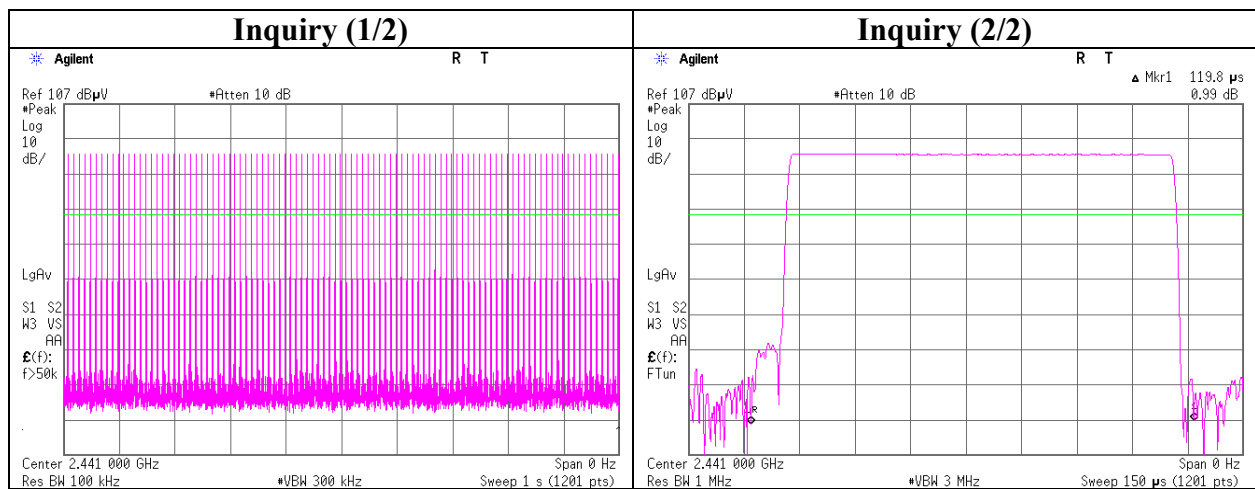
*Average data of 5 tests.(except Inquiry)

Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	50	51	50	51	50	50.4
DH3	25	24	29	24	24	25.2
DH5	22	19	11	19	20	18.2
3DH1	50	50	50	47	46	48.6
3DH3	30	19	27	28	25	25.8
3DH5	23	16	23	15	19	19.2

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 $N=79$.



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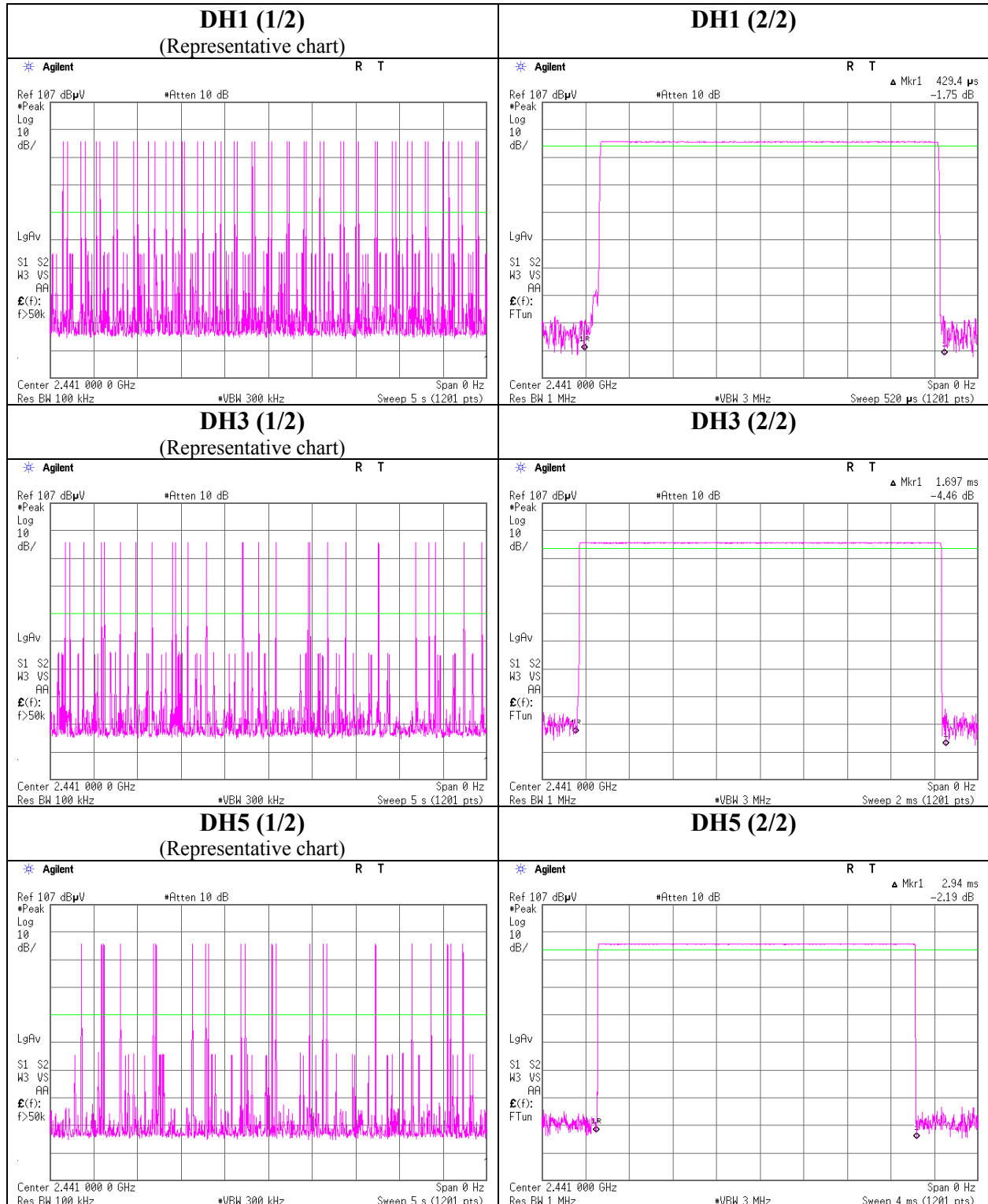
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Dwell time



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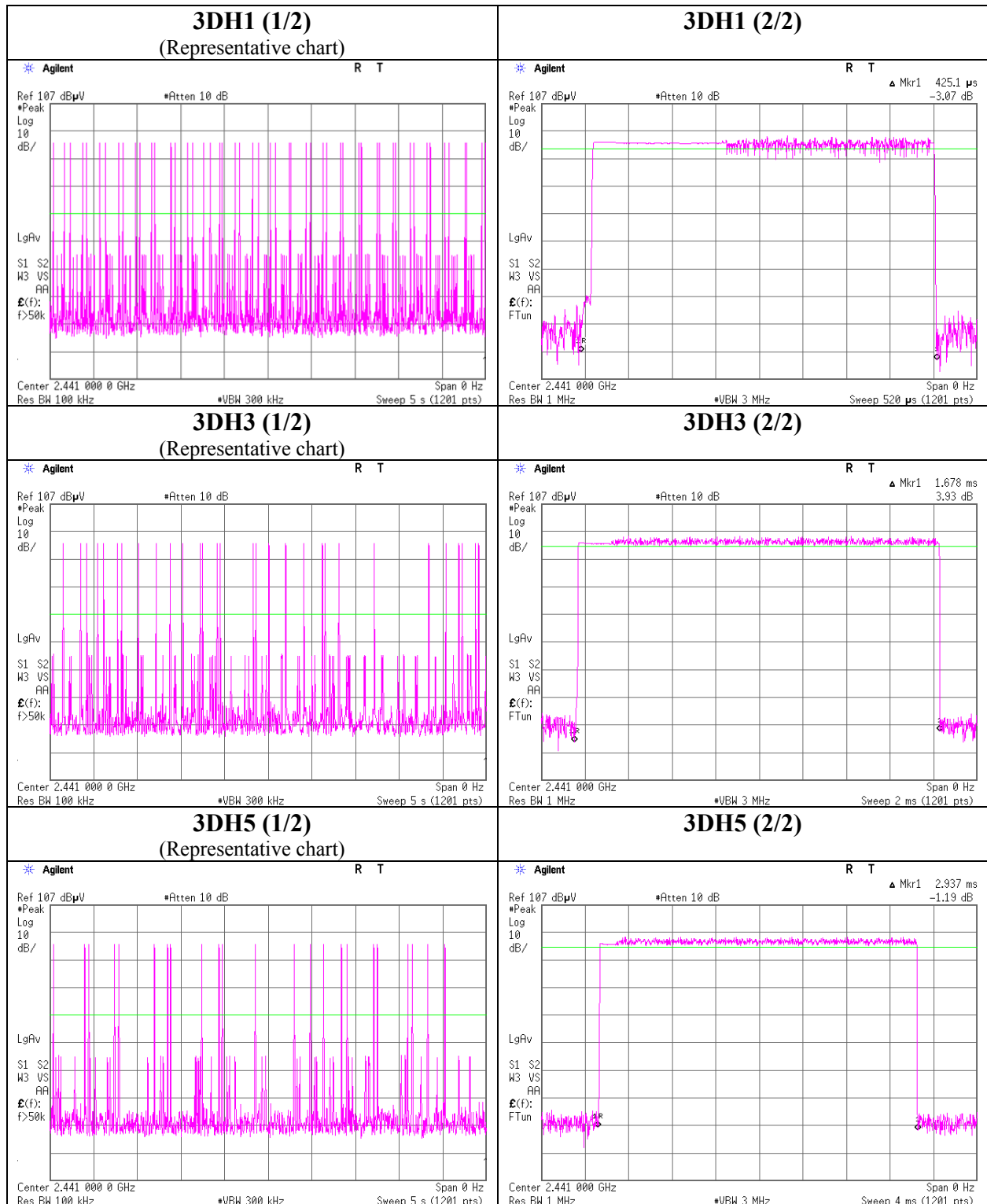
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Dwell time



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Maximum Peak Output Power

Test place : Ise EMC Lab. No.11 Measurement Room
 Report No. : 10646854H
 Date : 01/14/2015
 Temperature/ Humidity : 24deg. C / 22% RH
 Engineer : Tomoki Matsui
 Mode : Tx (Hopping off) DH5/2DH5/3DH5/Inquiry

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]	
DH5	2402.0	-10.11	2.08	6.11	-1.92	0.64	20.96	125	22.88
DH5	2441.0	-10.17	2.09	6.11	-1.97	0.64	20.96	125	22.93
DH5	2480.0	-10.21	2.11	6.11	-1.99	0.63	20.96	125	22.95
2DH5	2402.0	-7.61	2.08	6.11	0.58	1.14	20.96	125	20.38
2DH5	2441.0	-7.69	2.09	6.11	0.51	1.12	20.96	125	20.45
2DH5	2480.0	-7.72	2.11	6.11	0.50	1.12	20.96	125	20.46
3DH5	2402.0	-7.08	2.08	6.11	1.11	1.29	20.96	125	19.85
3DH5	2441.0	-7.13	2.09	6.11	1.07	1.28	20.96	125	19.89
3DH5	2480.0	-7.17	2.11	6.11	1.05	1.27	20.96	125	19.91
Inquiry	2441.0	-10.22	0.15	9.98	-0.09	0.98	20.96	125	21.05

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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.

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Average Output Power
(Reference data for SAR testing)

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 10646854H
Date : 01/14/2015
Temperature/ Humidity : 24deg. C / 22% RH
Engineer : Tomoki Matsui
Mode : Tx (Hopping off) DH5/3DH5

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Duty factor [dB]	Result with Duty factor	
					[dBm]	[mW]		[dBm]	[mW]
DH5	2402.0	-11.37	2.08	6.11	-3.18	0.48	1.08	-2.10	0.62
DH5	2441.0	-11.45	2.09	6.11	-3.25	0.47	1.08	-2.17	0.61
DH5	2480.0	-11.49	2.11	6.11	-3.27	0.47	1.08	-2.19	0.60
3DH5	2402.0	-11.31	2.08	6.11	-3.12	0.49	1.08	-2.04	0.63
3DH5	2441.0	-11.40	2.09	6.11	-3.20	0.48	1.08	-2.12	0.61
3DH5	2480.0	-11.43	2.11	6.11	-3.21	0.48	1.08	-2.13	0.61

Sample Calculation:

Result with Duty factor = Result + Duty factor

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Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
 Report No. : 10646854H
 Date : 01/15/2015 01/15/2015 01/16/2015
 Temperature/ Humidity : 22deg. C / 36% RH 22deg. C / 36% RH 20deg. C / 32% RH
 Engineer : Keisuke Kawamura Kenshi Shimomura Tsubasa Takayama
 (1-10GHz) (10-26.5GHz) (Below 1GHz)
 Mode : Tx, DH5 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	37.681	QP	25.1	15.1	6.8	28.5	18.5	40.0	21.5	
Hori	120.317	QP	28.1	12.9	7.6	28.2	20.4	43.5	23.1	
Hori	181.020	QP	23.4	16.4	8.0	27.9	19.9	43.5	23.6	
Hori	325.034	QP	31.0	15.3	8.8	27.6	27.5	46.0	18.5	
Hori	825.015	QP	30.0	22.1	11.0	27.5	35.6	46.0	10.4	
Hori	878.250	QP	28.1	22.4	11.2	27.3	34.4	46.0	11.6	
Hori	2390.000	PK	45.7	27.0	2.8	34.7	40.8	73.9	33.1	
Hori	4804.000	PK	42.0	31.8	4.8	33.9	44.7	73.9	29.2	
Hori	9608.000	PK	42.9	38.0	6.8	34.4	53.3	73.9	20.6	
Hori	2390.000	AV	32.7	27.0	2.8	34.7	27.8	53.9	26.1	
Hori	4804.000	AV	31.5	31.8	4.8	33.9	34.2	53.9	19.7	
Hori	9608.000	AV	31.7	38.0	6.8	34.4	42.1	53.9	11.8	
Vert	37.883	QP	25.5	15.1	6.8	28.5	18.9	40.0	21.1	
Vert	120.789	QP	30.2	12.9	7.6	28.2	22.5	43.5	21.0	
Vert	200.018	QP	28.2	16.6	8.1	27.9	25.0	43.5	18.5	
Vert	275.000	QP	31.1	18.4	8.6	27.5	30.6	46.0	15.4	
Vert	325.023	QP	38.2	15.3	8.8	27.6	34.7	46.0	11.3	
Vert	525.000	QP	28.2	18.9	9.6	28.5	28.2	46.0	17.8	
Vert	825.012	QP	29.7	22.1	11.0	27.5	35.3	46.0	10.7	
Vert	2390.000	PK	45.8	27.0	2.8	34.7	40.9	73.9	33.0	
Vert	4804.000	PK	42.4	31.8	4.8	33.9	45.1	73.9	28.8	
Vert	9608.000	PK	42.5	38.0	6.8	34.4	52.9	73.9	21.0	
Vert	2390.000	AV	32.5	27.0	2.8	34.7	27.6	53.9	26.3	
Vert	4804.000	AV	31.6	31.8	4.8	33.9	34.3	53.9	19.6	
Vert	9608.000	AV	31.7	38.0	6.8	34.4	42.1	53.9	11.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)=9.5dB$

26.5GHz-40GHz $20\log(3.0m/0.5m)=15.6dB$

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	101.4	27.0	2.8	34.7	96.5	-	-	Carrier
Hori	2400.000	PK	44.5	27.0	2.8	34.7	39.6	76.5	36.9	
Hori	7206.000	PK	44.3	35.7	5.7	33.8	51.9	76.5	24.6	
Vert	2402.000	PK	98.1	27.0	2.8	34.7	93.2	-	-	Carrier
Vert	2400.000	PK	42.3	27.0	2.8	34.7	37.4	73.2	35.8	
Vert	7206.000	PK	42.6	35.7	5.7	33.8	50.2	73.2	23.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10646854H
Date 01/15/2015 01/15/2015 01/16/2015
Temperature/ Humidity 22deg. C / 36% RH 22deg. C / 36% RH 20deg. C / 32% RH
Engineer Keisuke Kawamura Kenshi Shimomura Tsubasa Takayama
(1-10GHz) (10-26.5GHz) (Below 1GHz)
Mode Tx, DH5 2441MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	37.681	QP	25.6	15.1	6.8	28.5	19.0	40.0	21.0	
Hori	120.317	QP	28.4	12.9	7.6	28.2	20.7	43.5	22.8	
Hori	189.092	QP	23.6	16.5	8.1	27.9	20.3	43.5	23.2	
Hori	325.034	QP	30.8	15.3	8.8	27.6	27.3	46.0	18.7	
Hori	825.015	QP	29.7	22.1	11.0	27.5	35.3	46.0	10.7	
Hori	878.250	QP	28.2	22.4	11.2	27.3	34.5	46.0	11.5	
Hori	4882.000	PK	42.0	32.0	4.8	33.9	44.9	73.9	29.0	
Hori	7323.000	PK	45.8	35.8	5.7	33.8	53.5	73.9	20.4	
Hori	9764.000	PK	42.9	38.3	6.9	34.5	53.6	73.9	20.3	
Hori	4882.000	AV	31.5	32.0	4.8	33.9	34.4	53.9	19.5	
Hori	7323.000	AV	37.0	35.8	5.7	33.8	44.7	53.9	9.3	
Hori	9764.000	AV	31.7	38.3	6.9	34.5	42.4	53.9	11.5	
Vert	37.887	QP	25.7	15.1	6.8	28.5	19.1	40.0	20.9	
Vert	120.729	QP	30.4	12.9	7.6	28.2	22.7	43.5	20.8	
Vert	200.018	QP	28.6	16.6	8.1	27.9	25.4	43.5	18.1	
Vert	275.000	QP	31.2	18.4	8.6	27.5	30.7	46.0	15.3	
Vert	325.037	QP	33.9	15.3	8.8	27.6	30.4	46.0	15.6	
Vert	825.012	QP	30.2	22.1	11.0	27.5	35.8	46.0	10.2	
Vert	875.023	QP	28.8	22.3	11.1	27.3	34.9	46.0	11.1	
Vert	4882.000	PK	42.4	32.0	4.8	33.9	45.3	73.9	28.6	
Vert	7323.000	PK	45.2	35.8	5.7	33.8	52.9	73.9	21.0	
Vert	9764.000	PK	42.5	38.3	6.9	34.5	53.2	73.9	20.7	
Vert	4882.000	AV	31.6	32.0	4.8	33.9	34.5	53.9	19.4	
Vert	7323.000	AV	36.6	35.8	5.7	33.8	44.3	53.9	9.6	
Vert	9764.000	AV	31.7	38.3	6.9	34.5	42.4	53.9	11.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

26.5GHz-40GHz $20\log(3.0m/0.5m)=15.6dB$

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10646854H
Date 01/15/2015 01/15/2015 01/16/2015
Temperature/ Humidity 22deg. C / 36% RH 22deg. C / 36% RH 20deg. C / 32% RH
Engineer Keisuke Kawamura Kenshi Shimomura Tsubasa Takayama
(1-10GHz) (10-26.5GHz) (Below 1GHz)
Mode Tx, DH5 2480MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	37.672	QP	25.0	15.1	6.8	28.5	18.4	40.0	21.6	
Hori	120.320	QP	28.2	12.9	7.6	28.2	20.5	43.5	23.0	
Hori	191.370	QP	26.5	16.5	8.1	27.9	23.2	43.5	20.3	
Hori	325.034	QP	31.0	15.3	8.8	27.6	27.5	46.0	18.5	
Hori	825.015	QP	30.1	22.1	11.0	27.5	35.7	46.0	10.3	
Hori	835.650	QP	28.1	22.1	11.0	27.5	33.7	46.0	12.3	
Hori	2483.500	PK	50.3	26.9	2.8	34.7	45.3	73.9	28.6	
Hori	4960.000	PK	42.0	32.2	4.8	34.0	45.0	73.9	28.9	
Hori	7440.000	PK	46.0	35.8	5.7	33.9	53.6	73.9	20.3	
Hori	9920.000	PK	42.9	38.7	7.0	34.5	54.1	73.9	19.8	
Hori	2483.500	AV	37.1	26.9	2.8	34.7	32.1	53.9	21.8	
Hori	4960.000	AV	31.5	32.2	4.8	34.0	34.5	53.9	19.4	
Hori	7440.000	AV	37.6	35.8	5.7	33.9	45.2	53.9	8.7	
Hori	9920.000	AV	31.7	38.7	7.0	34.5	42.9	53.9	11.0	
Vert	37.878	QP	25.8	15.1	6.8	28.5	19.2	40.0	20.8	
Vert	120.722	QP	30.2	12.9	7.6	28.2	22.5	43.5	21.0	
Vert	200.020	QP	28.5	16.6	8.1	27.9	25.3	43.5	18.2	
Vert	275.000	QP	31.4	18.4	8.6	27.5	30.9	46.0	15.1	
Vert	325.041	QP	33.8	15.3	8.8	27.6	30.3	46.0	15.7	
Vert	825.012	QP	30.0	22.1	11.0	27.5	35.6	46.0	10.4	
Vert	875.023	QP	28.4	22.3	11.1	27.3	34.5	46.0	11.5	
Vert	2483.500	PK	48.9	26.9	2.8	34.7	43.9	73.9	30.0	
Vert	4960.000	PK	42.4	32.2	4.8	34.0	45.4	73.9	28.5	
Vert	7440.000	PK	46.6	35.8	5.7	33.9	54.2	73.9	19.7	
Vert	9920.000	PK	42.5	38.7	7.0	34.5	53.7	73.9	20.2	
Vert	2483.500	AV	36.7	26.9	2.8	34.7	31.7	53.9	22.2	
Vert	4960.000	AV	31.6	32.2	4.8	34.0	34.6	53.9	19.3	
Vert	7440.000	AV	37.5	35.8	5.7	33.9	45.1	53.9	8.8	
Vert	9920.000	AV	31.7	38.7	7.0	34.5	42.9	53.9	11.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

26.5GHz-40GHz $20\log(3.0m/0.5m)=15.6dB$

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10646854H
Date 01/15/2015 01/15/2015 01/16/2015
Temperature/ Humidity 22deg. C / 36% RH 22deg. C / 36% RH 20deg. C / 32% RH
Engineer Keisuke Kawamura Kenshi Shimomura Tsubasa Takayama
(1-10GHz) (10-26.5GHz) (Below 1GHz)
Mode Tx, 3DH5 2402MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	37.620	QP	23.9	15.1	6.8	28.5	17.3	40.0	22.7	
Hori	123.289	QP	28.1	13.1	7.6	28.1	20.7	43.5	22.8	
Hori	141.626	QP	27.2	14.5	7.7	28.1	21.3	43.5	22.2	
Hori	325.042	QP	31.2	15.3	8.8	27.6	27.7	46.0	18.3	
Hori	825.010	QP	31.0	22.1	11.0	27.5	36.6	46.0	9.4	
Hori	880.620	QP	28.2	22.4	11.2	27.3	34.5	46.0	11.5	
Hori	2390.000	PK	49.8	27.0	2.8	34.7	44.9	73.9	29.0	
Hori	4804.000	PK	42.0	31.8	4.8	33.9	44.7	73.9	29.2	
Hori	9608.000	PK	42.9	38.0	6.8	34.4	53.3	73.9	20.6	
Hori	2390.000	AV	33.7	27.0	2.8	34.7	28.8	53.9	25.1	
Hori	4804.000	AV	31.5	31.8	4.8	33.9	34.2	53.9	19.7	
Hori	9608.000	AV	31.7	38.0	6.8	34.4	42.1	53.9	11.8	
Vert	37.550	QP	25.8	15.1	6.8	28.5	19.2	40.0	20.8	
Vert	60.240	QP	31.4	7.8	7.1	28.4	17.9	40.0	22.1	
Vert	123.421	QP	32.1	13.1	7.6	28.1	24.7	43.5	18.8	
Vert	275.000	QP	29.9	18.4	8.6	27.5	29.4	46.0	16.6	
Vert	325.042	QP	33.4	15.3	8.8	27.6	29.9	46.0	16.1	
Vert	525.030	QP	29.1	18.9	9.6	28.5	29.1	46.0	16.9	
Vert	825.010	QP	30.1	22.1	11.0	27.5	35.7	46.0	10.3	
Vert	2390.000	PK	48.1	27.0	2.8	34.7	43.2	73.9	30.7	
Vert	4804.000	PK	42.4	31.8	4.8	33.9	45.1	73.9	28.8	
Vert	9608.000	PK	42.5	38.0	6.8	34.4	52.9	73.9	21.0	
Vert	2390.000	AV	33.7	27.0	2.8	34.7	28.8	53.9	25.1	
Vert	4804.000	AV	31.6	31.8	4.8	33.9	34.3	53.9	19.6	
Vert	9608.000	AV	31.7	38.0	6.8	34.4	42.1	53.9	11.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$
26.5GHz-40GHz $20\log(3.0m/0.5m)=15.6dB$

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	99.9	27.0	2.8	34.7	95.0	-	-	Carrier
Hori	2400.000	PK	44.3	27.0	2.8	34.7	39.4	75.0	35.6	
Hori	3202.614	PK	48.6	28.4	3.2	34.3	45.9	75.0	29.1	
Hori	7206.000	PK	43.5	35.7	5.7	33.8	51.1	75.0	23.9	
Vert	2402.000	PK	98.4	27.0	2.8	34.7	93.5	-	-	Carrier
Vert	2400.000	PK	43.4	27.0	2.8	34.7	38.5	73.5	35.0	
Vert	3202.614	PK	51.9	28.4	3.2	34.3	49.2	73.5	24.3	
Vert	7206.000	PK	42.0	35.7	5.7	33.8	49.6	73.5	23.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10646854H
Date 01/15/2015 01/15/2015 01/16/2015
Temperature/ Humidity 22deg. C / 36% RH 22deg. C / 36% RH 20deg. C / 32% RH
Engineer Keisuke Kawamura Kenshi Shimomura Tsubasa Takayama
(1-10GHz) (10-26.5GHz) (Below 1GHz)
Mode Tx, 3DH5 2441MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	37.620	QP	24.2	15.1	6.8	28.5	17.6	40.0	22.4	
Hori	123.221	QP	27.8	13.1	7.6	28.1	20.4	43.5	23.1	
Hori	178.280	QP	27.0	16.3	8.0	28.0	23.3	43.5	20.2	
Hori	325.038	QP	31.0	15.3	8.8	27.6	27.5	46.0	18.5	
Hori	825.010	QP	31.0	22.1	11.0	27.5	36.6	46.0	9.4	
Hori	835.620	QP	28.9	22.1	11.0	27.5	34.5	46.0	11.5	
Hori	4882.000	PK	42.0	32.0	4.8	33.9	44.9	73.9	29.0	
Hori	7323.000	PK	46.2	35.8	5.7	33.8	53.9	73.9	20.0	
Hori	9764.000	PK	42.9	38.3	6.9	34.5	53.6	73.9	20.3	
Hori	4882.000	AV	31.5	32.0	4.8	33.9	34.4	53.9	19.5	
Hori	7323.000	AV	36.1	35.8	5.7	33.8	43.8	53.9	10.1	
Hori	9764.000	AV	31.7	38.3	6.9	34.5	42.4	53.9	11.5	
Vert	37.560	QP	25.7	15.1	6.8	28.5	19.1	40.0	20.9	
Vert	80.230	QP	33.2	6.4	7.3	28.4	18.5	40.0	21.5	
Vert	126.692	QP	31.2	13.4	7.7	28.1	24.2	43.5	19.3	
Vert	275.000	QP	31.2	18.4	8.6	27.5	30.7	46.0	15.3	
Vert	325.038	QP	33.3	15.3	8.8	27.6	29.8	46.0	16.2	
Vert	525.032	QP	29.2	18.9	9.6	28.5	29.2	46.0	16.8	
Vert	825.010	QP	30.1	22.1	11.0	27.5	35.7	46.0	10.3	
Vert	4882.000	PK	42.4	32.0	4.8	33.9	45.3	73.9	28.6	
Vert	7323.000	PK	45.6	35.8	5.7	33.8	53.3	73.9	20.6	
Vert	9764.000	PK	42.5	38.3	6.9	34.5	53.2	73.9	20.7	
Vert	4882.000	AV	31.6	32.0	4.8	33.9	34.5	53.9	19.4	
Vert	7323.000	AV	35.5	35.8	5.7	33.8	43.2	53.9	10.8	
Vert	9764.000	AV	31.7	38.3	6.9	34.5	42.4	53.9	11.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)=9.5dB$

26.5GHz-40GHz $20\log(3.0m/0.5m)=15.6dB$

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2441.000	PK	100.3	26.9	2.8	34.7	95.3	-	-	Carrier
Hori	3254.603	PK	47.1	28.6	3.3	34.2	44.8	75.3	30.5	
Vert	2441.000	PK	100.4	26.9	2.8	34.7	95.4	-	-	Carrier
Vert	3254.603	PK	47.5	28.6	3.3	34.2	45.2	75.4	30.2	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10646854H
Date 01/15/2015 01/15/2015 01/16/2015
Temperature/ Humidity 22deg. C / 36% RH 22deg. C / 36% RH 20deg. C / 32% RH
Engineer Keisuke Kawamura Kenshi Shimomura Tsubasa Takayama
(1-10GHz) (10-26.5GHz) (Below 1GHz)
Mode Tx, 3DH5 2480MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	37.682	QP	24.9	15.1	6.8	28.5	18.3	40.0	21.7	
Hori	123.312	QP	27.7	13.1	7.6	28.1	20.3	43.5	23.2	
Hori	178.280	QP	27.0	16.3	8.0	28.0	23.3	43.5	20.2	
Hori	325.032	QP	31.2	15.3	8.8	27.6	27.7	46.0	18.3	
Hori	825.010	QP	30.8	22.1	11.0	27.5	36.4	46.0	9.6	
Hori	835.620	QP	28.2	22.1	11.0	27.5	33.8	46.0	12.2	
Hori	2483.500	PK	54.5	26.9	2.8	34.7	49.5	73.9	24.4	
Hori	4960.000	PK	42.0	32.2	4.8	34.0	45.0	73.9	28.9	
Hori	7440.000	PK	47.0	35.8	5.7	33.9	54.6	73.9	19.3	
Hori	9920.000	PK	42.9	38.7	7.0	34.5	54.1	73.9	19.8	
Hori	2483.500	AV	38.5	26.9	2.8	34.7	33.5	53.9	20.4	
Hori	4960.000	AV	31.5	32.2	4.8	34.0	34.5	53.9	19.4	
Hori	7440.000	AV	36.5	35.8	5.7	33.9	44.1	53.9	9.8	
Hori	9920.000	AV	31.7	38.7	7.0	34.5	42.9	53.9	11.0	
Vert	37.783	QP	25.9	15.1	6.8	28.5	19.3	40.0	20.7	
Vert	120.822	QP	30.8	12.9	7.6	28.2	23.1	43.5	20.4	
Vert	200.020	QP	28.2	16.6	8.1	27.9	25.0	43.5	18.5	
Vert	275.000	QP	31.3	18.4	8.6	27.5	30.8	46.0	15.2	
Vert	325.032	QP	33.7	15.3	8.8	27.6	30.2	46.0	15.8	
Vert	825.010	QP	29.8	22.1	11.0	27.5	35.4	46.0	10.6	
Vert	875.027	QP	28.1	22.3	11.1	27.3	34.2	46.0	11.8	
Vert	2483.500	PK	54.3	26.9	2.8	34.7	49.3	73.9	24.6	
Vert	4960.000	PK	42.4	32.2	4.8	34.0	45.4	73.9	28.5	
Vert	7440.000	PK	46.7	35.8	5.7	33.9	54.3	73.9	19.6	
Vert	9920.000	PK	42.5	38.7	7.0	34.5	53.7	73.9	20.2	
Vert	2483.500	AV	38.0	26.9	2.8	34.7	33.0	53.9	20.9	
Vert	4960.000	AV	31.6	32.2	4.8	34.0	34.6	53.9	19.3	
Vert	7440.000	AV	36.9	35.8	5.7	33.9	44.5	53.9	9.4	
Vert	9920.000	AV	31.7	38.7	7.0	34.5	42.9	53.9	11.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz $20\log(3.0m/1.0m)= 9.5dB$

26.5GHz-40GHz $20\log(3.0m/0.5m)=15.6dB$

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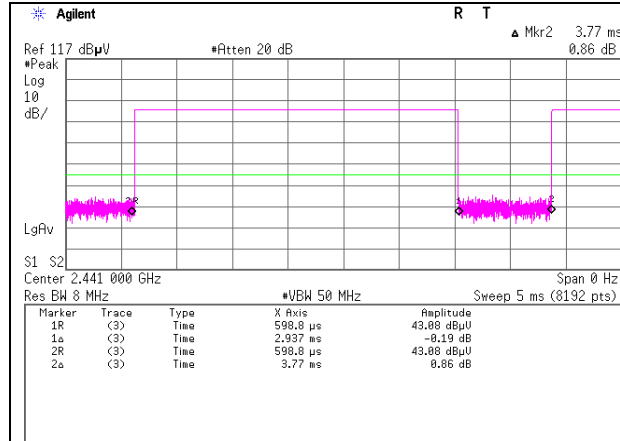
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

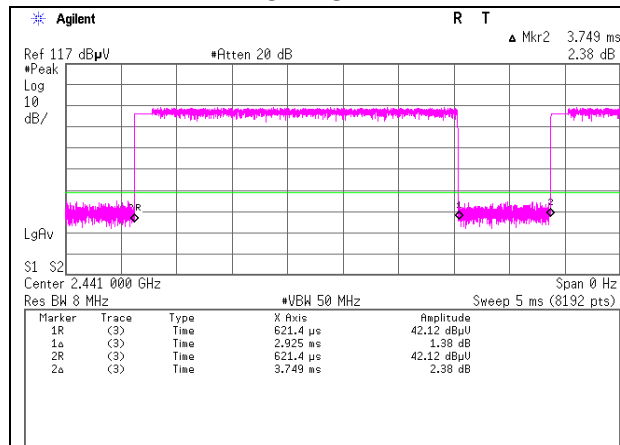
Burst Rate Confirmation

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5/3DH5

DH5



3DH5



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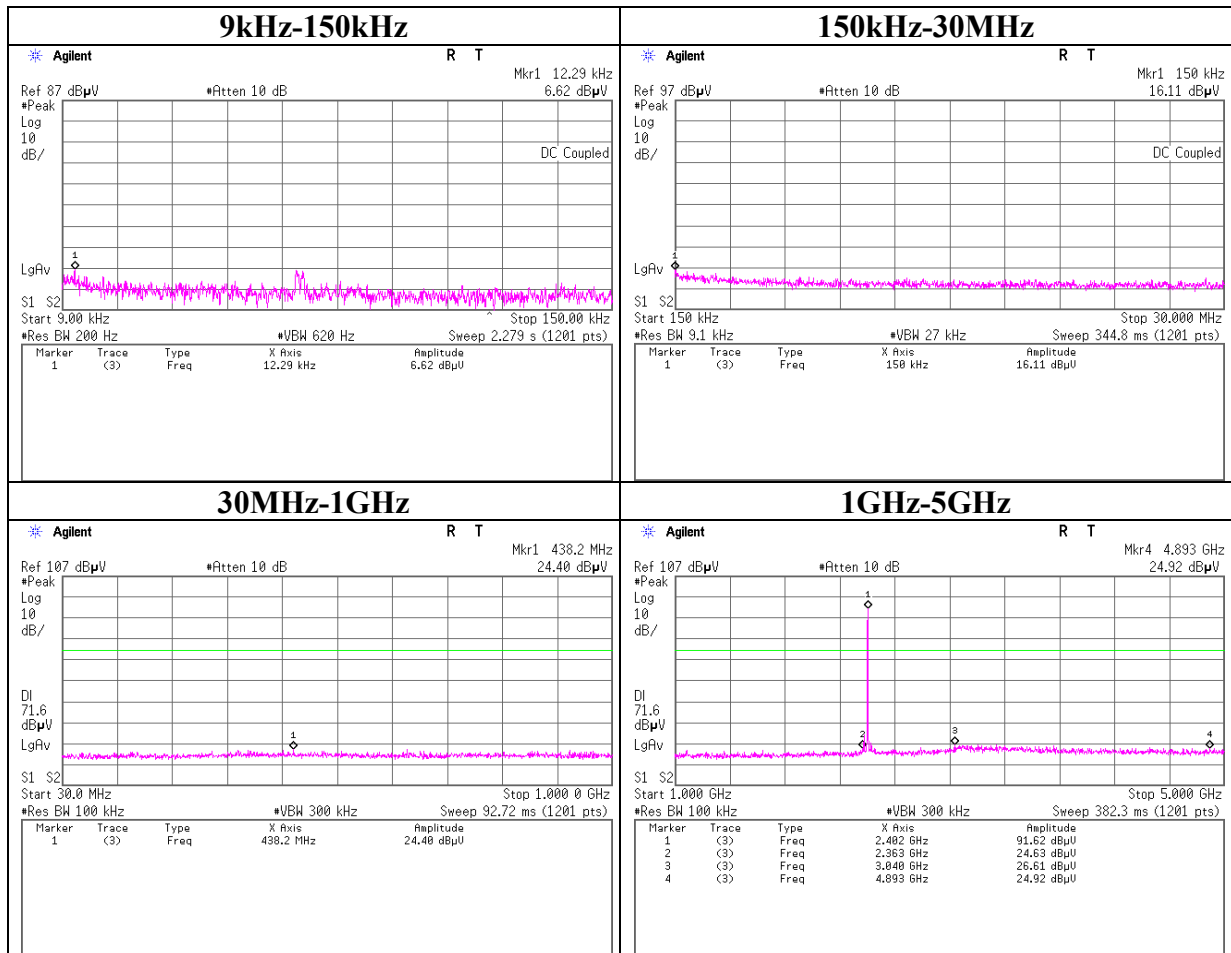
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5

Tx DH5 2402MHz



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Ise EMC Lab.

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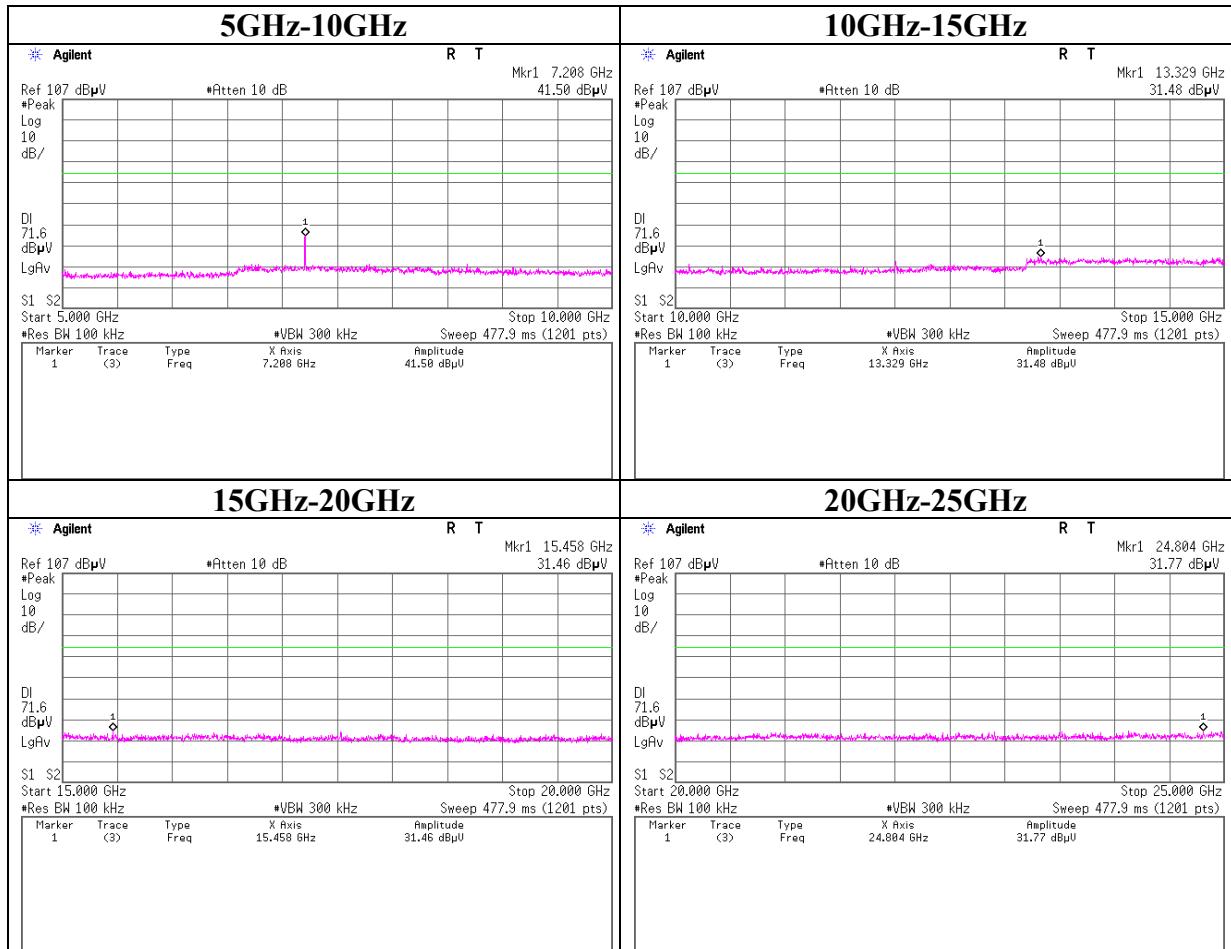
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5

Tx DH5 2402MHz



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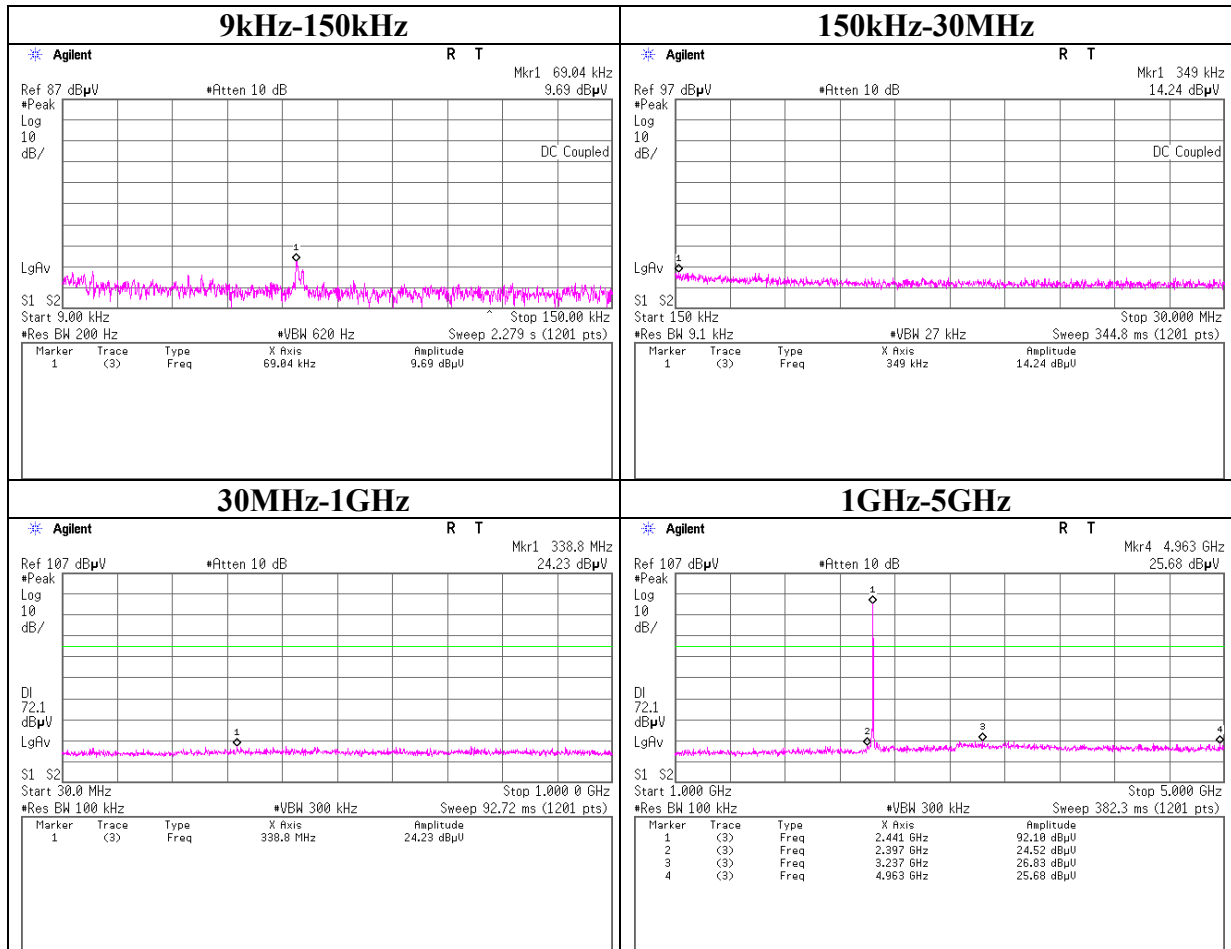
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5

Tx DH5 2441MHz



UL Japan, Inc.

Ise EMC Lab.

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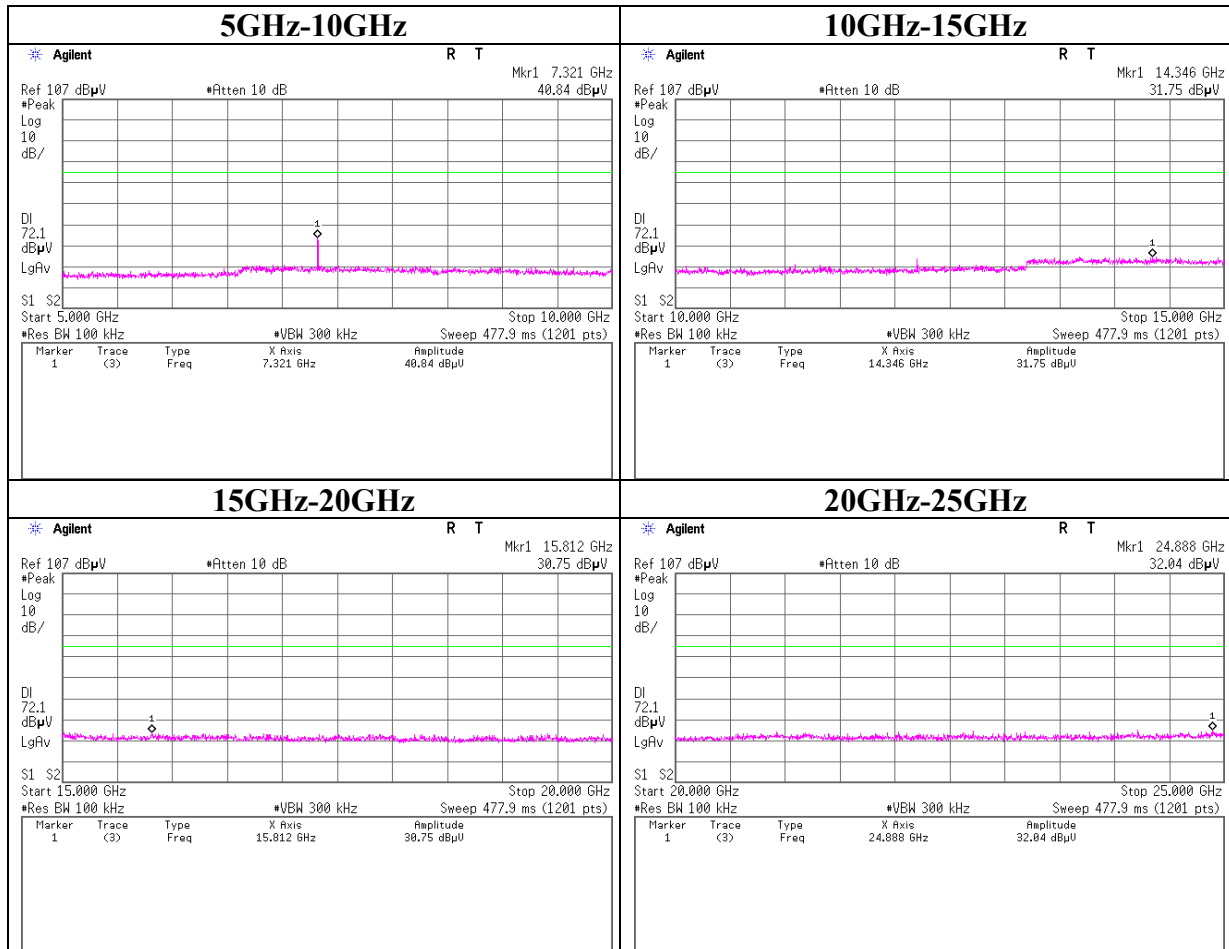
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5

Tx DH5 2441MHz



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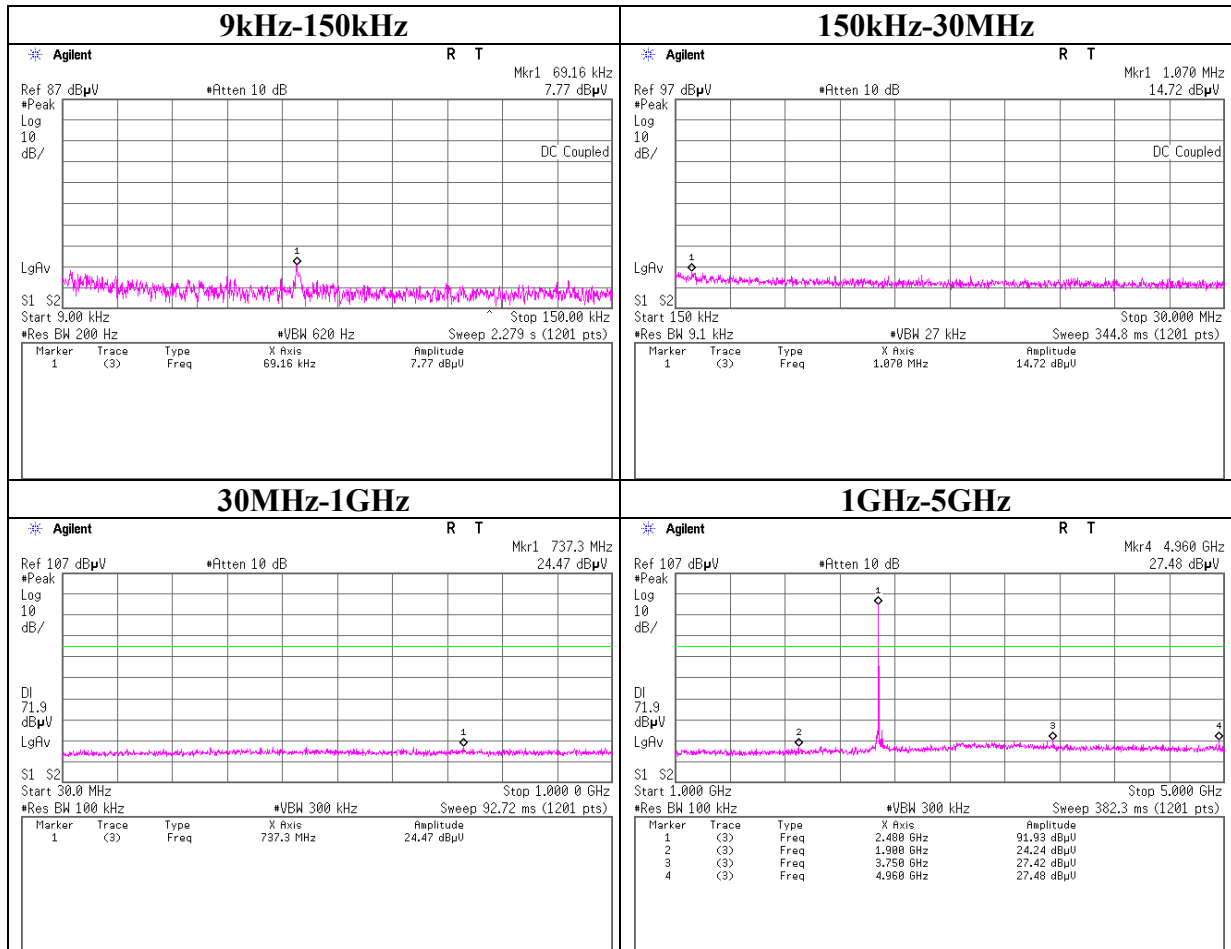
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5

Tx DH5 2480MHz



UL Japan, Inc.

Ise EMC Lab.

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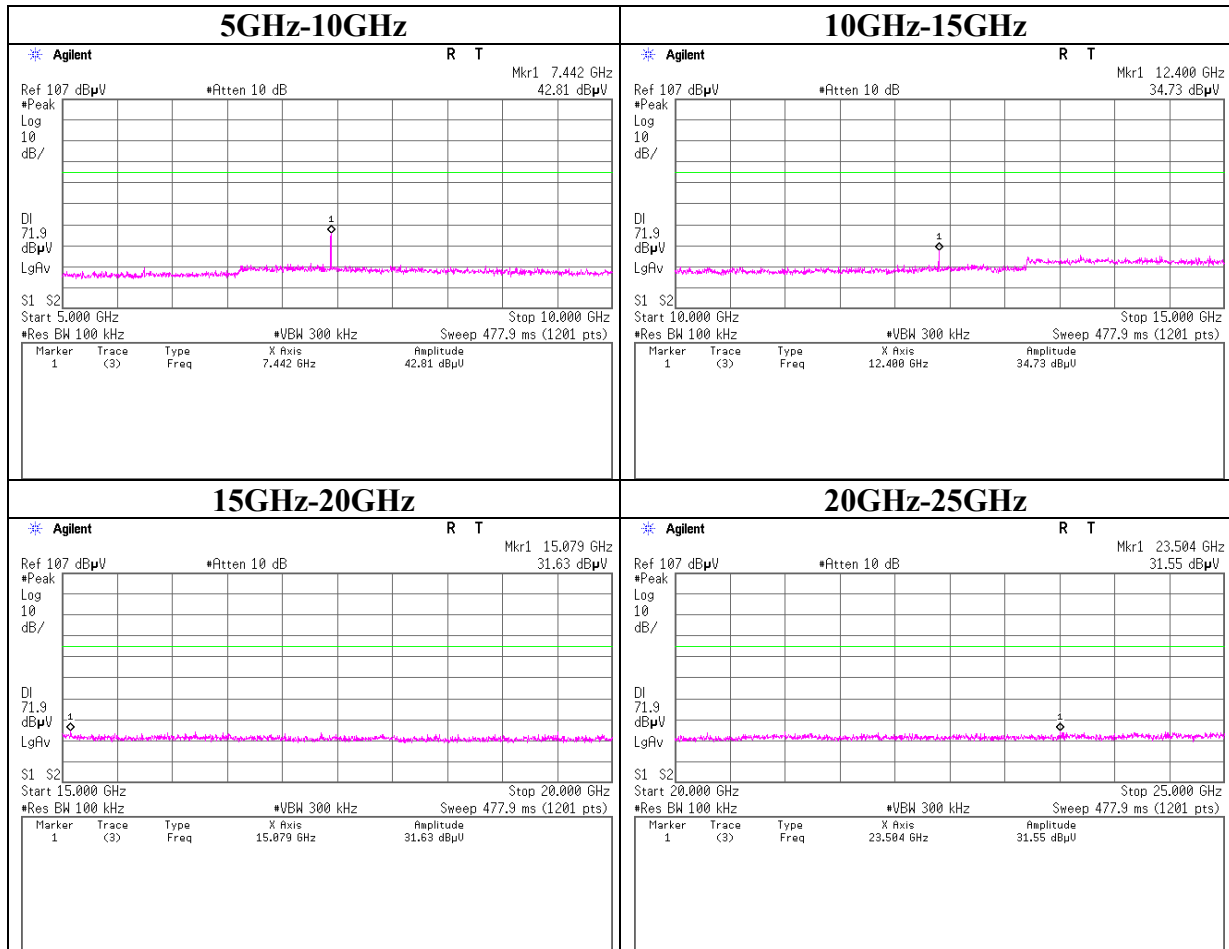
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5

Tx DH5 2480MHz



UL Japan, Inc.

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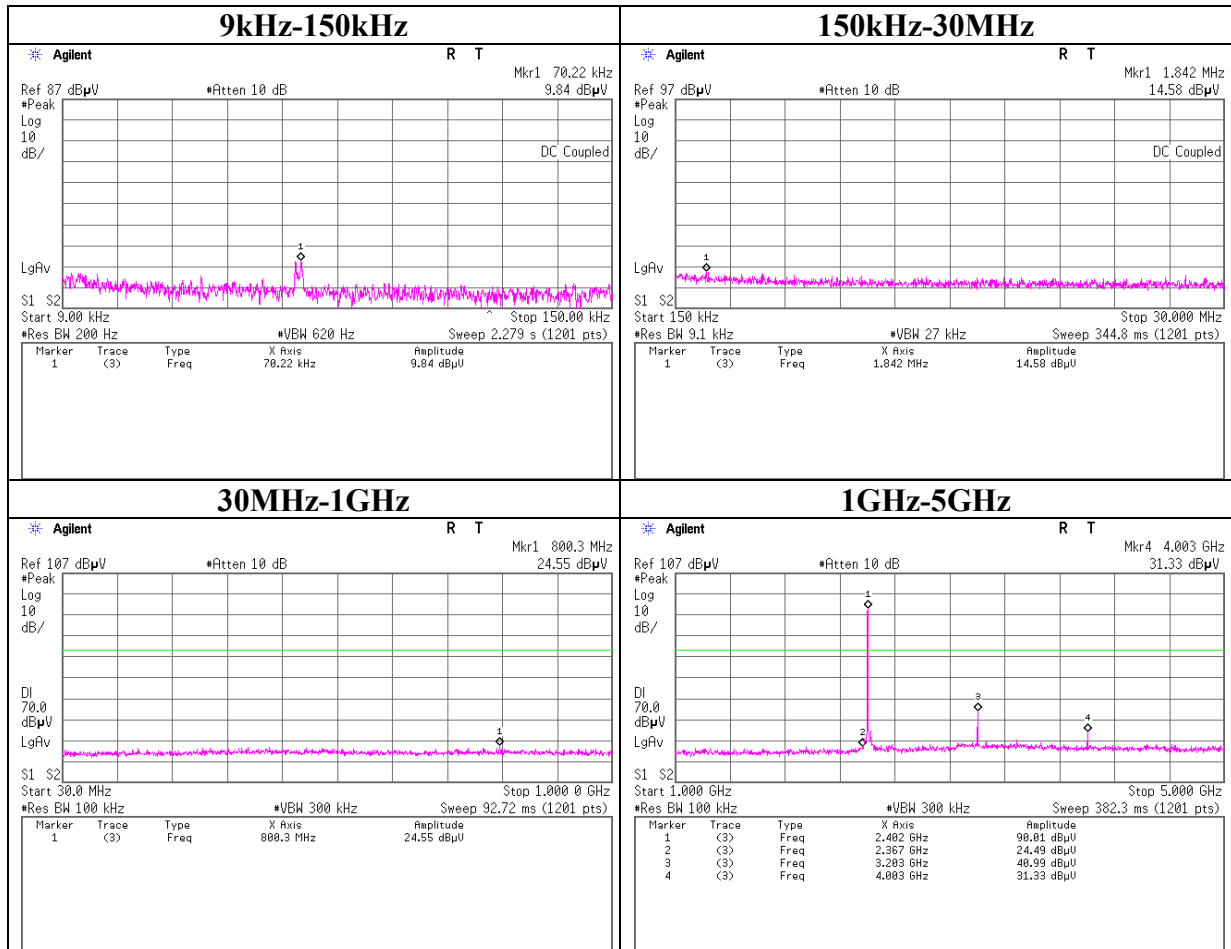
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) 3DH5

Tx 3DH5 2402MHz



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Ise EMC Lab.

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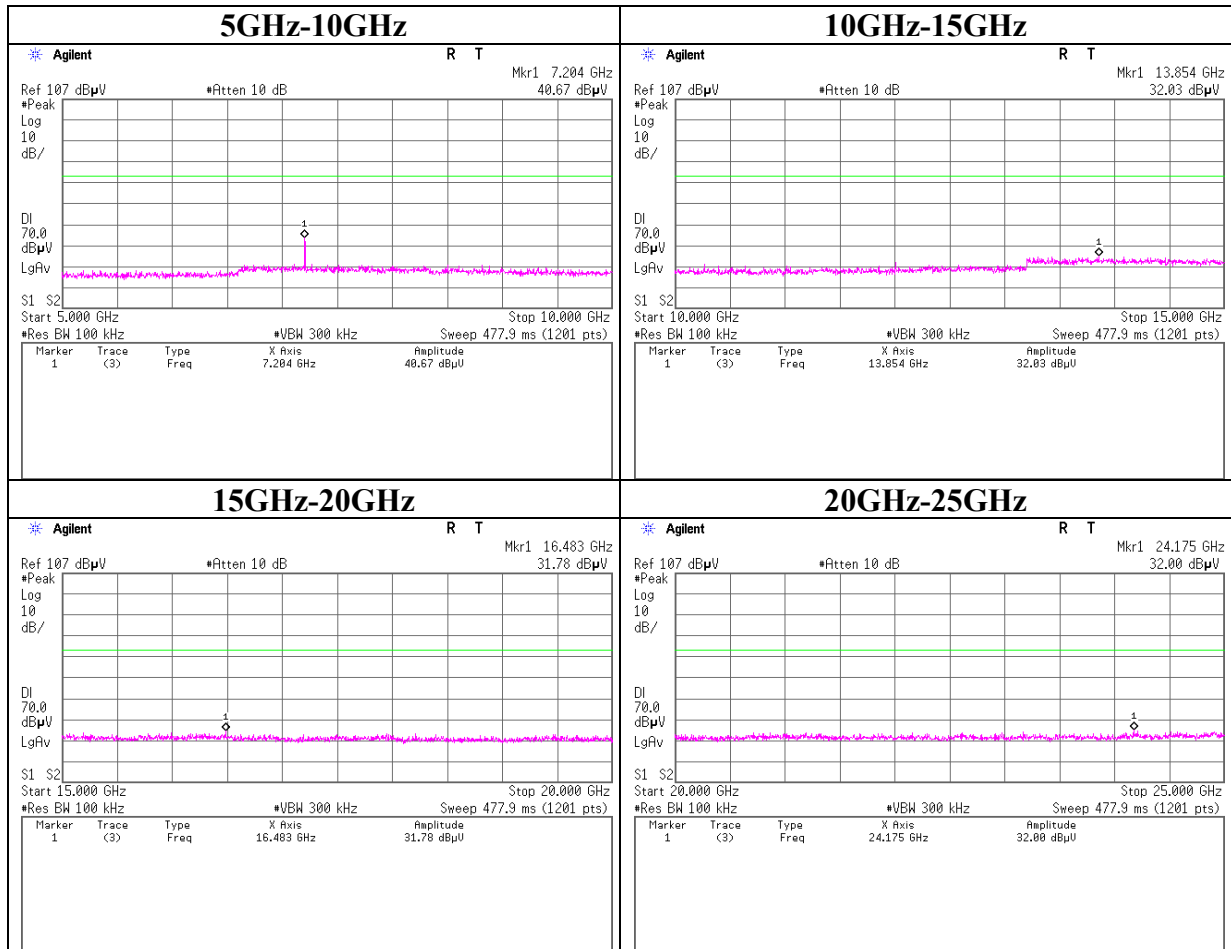
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) 3DH5

Tx 3DH5 2402MHz



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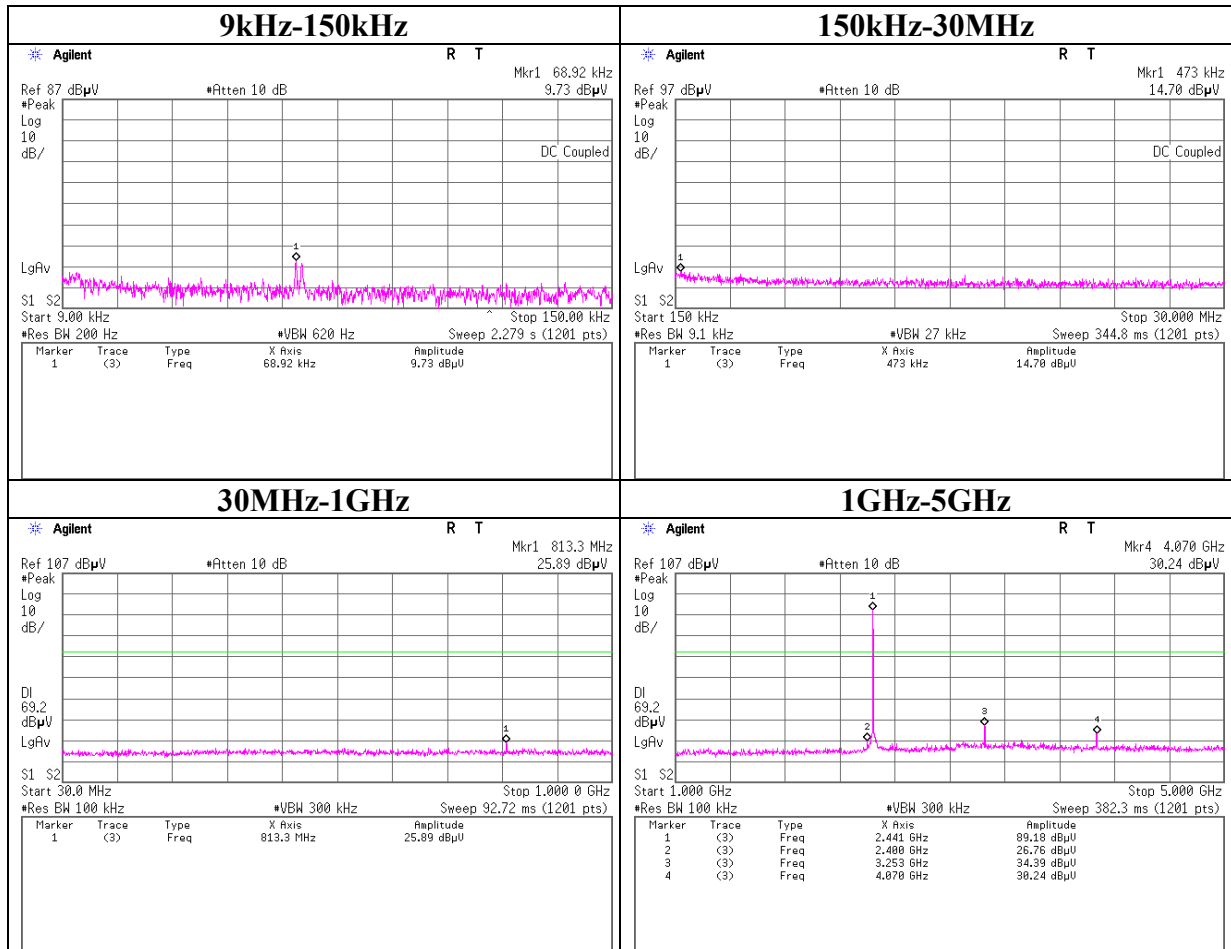
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) 3DH5

Tx 3DH5 2441MHz



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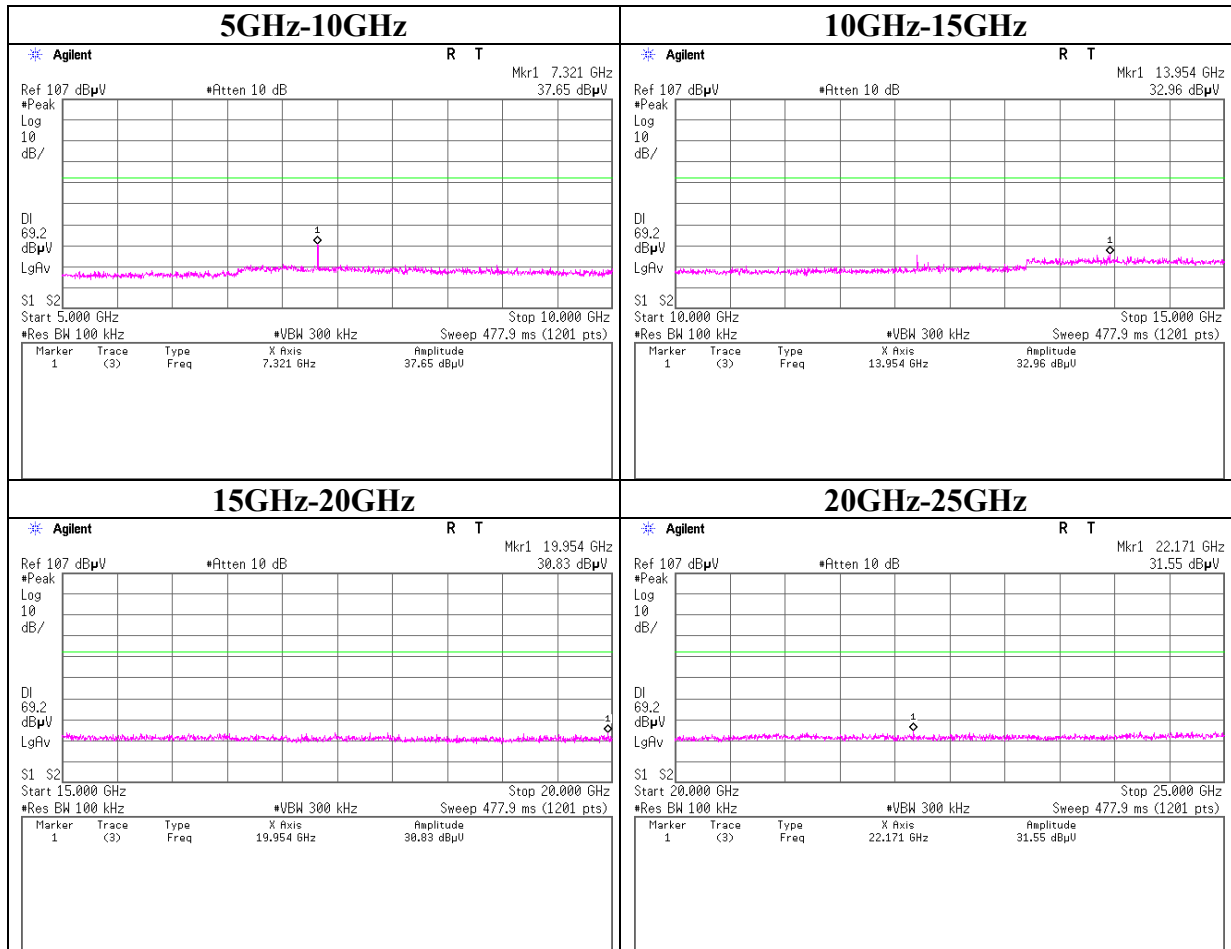
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) 3DH5

Tx 3DH5 2441MHz



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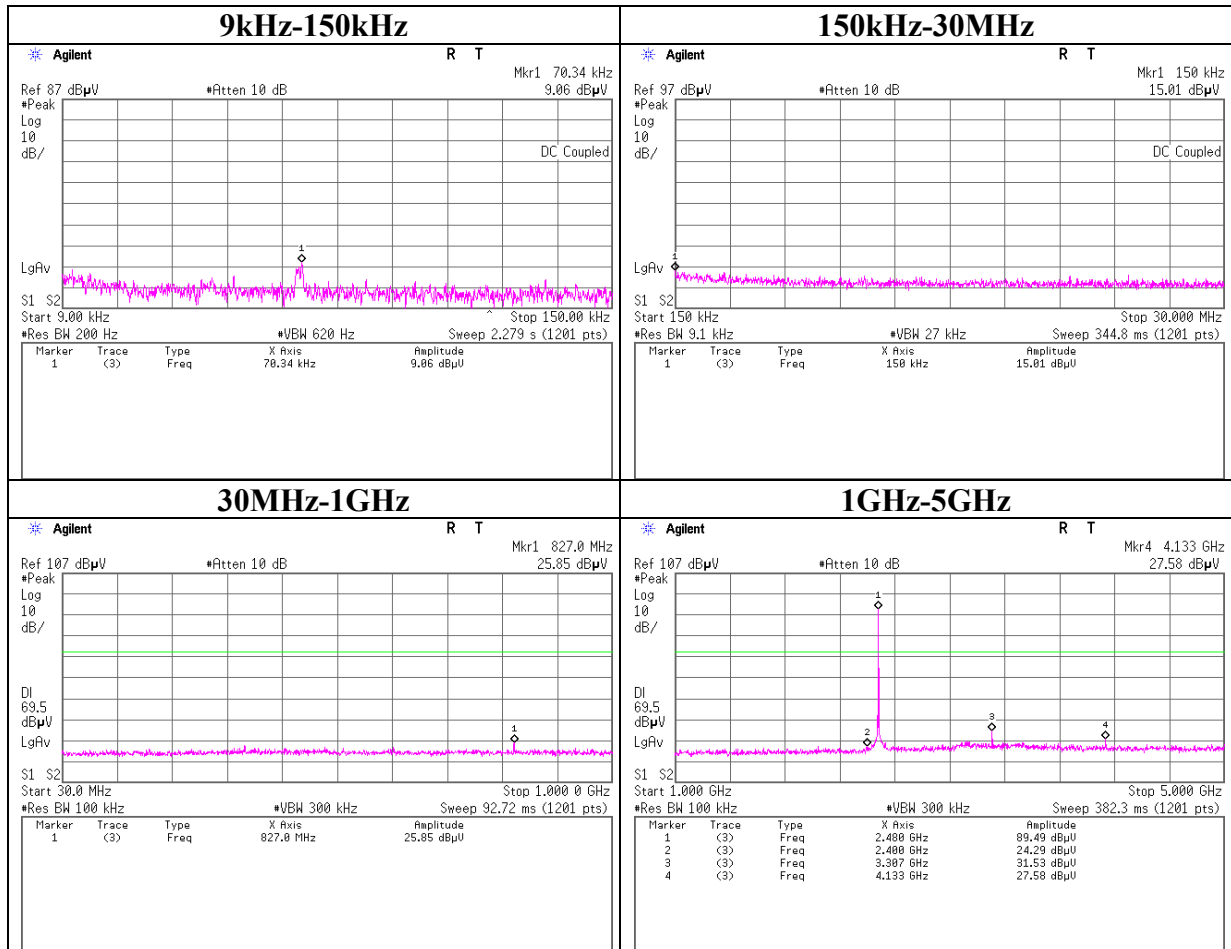
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) 3DH5

Tx 3DH5 2480MHz



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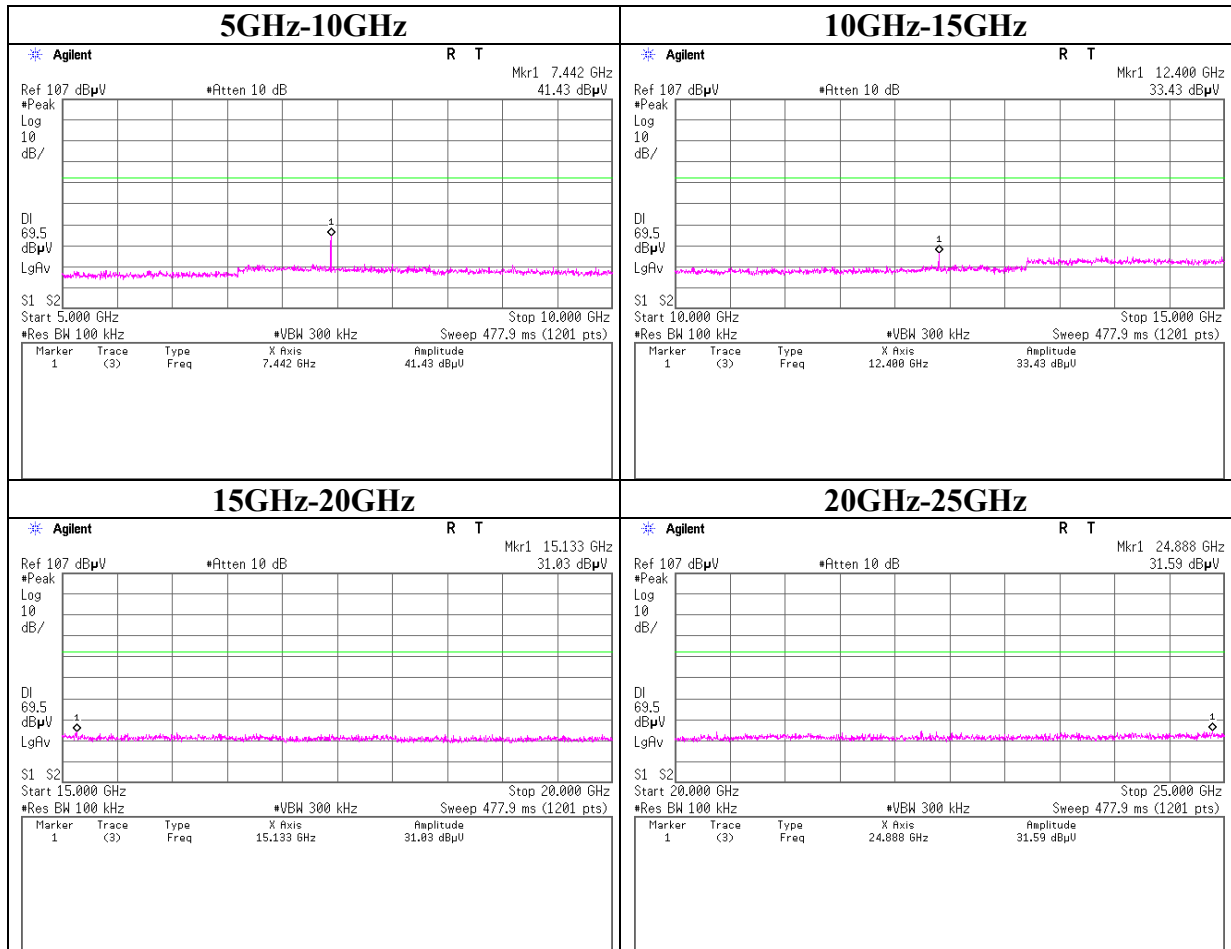
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) 3DH5

Tx 3DH5 2480MHz



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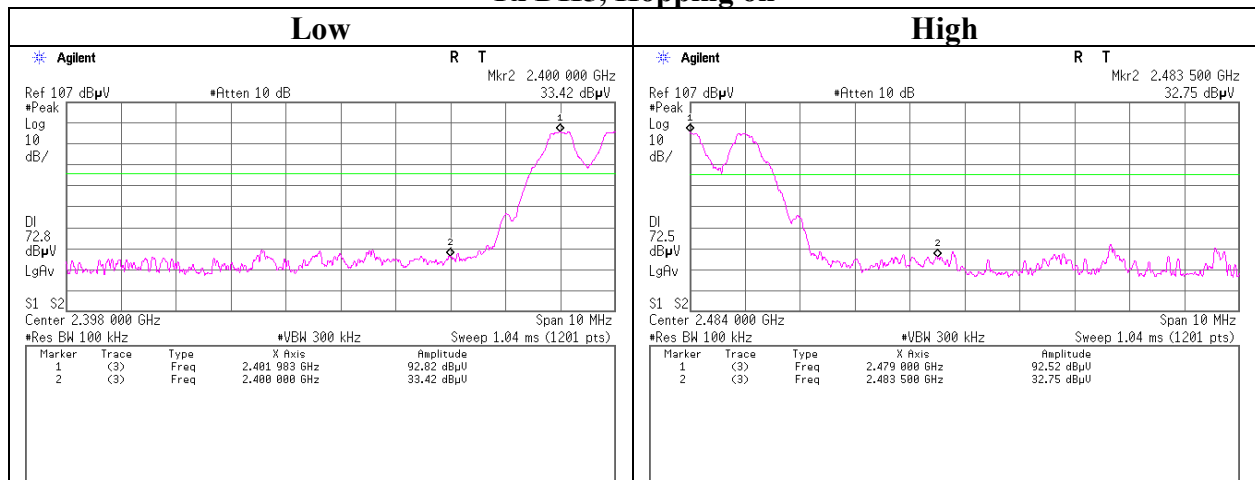
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

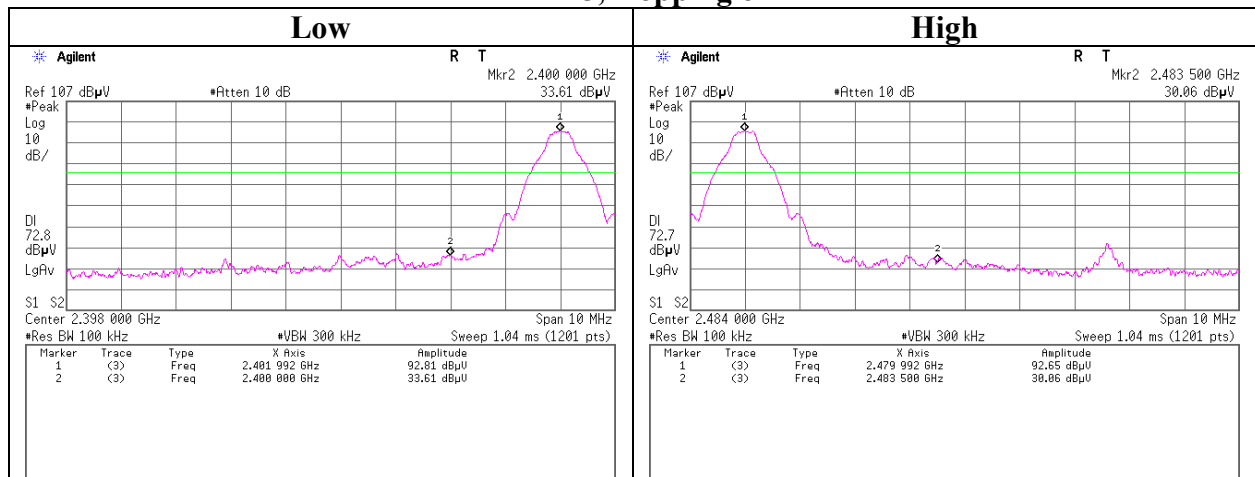
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping on/off) DH5

Tx DH5, Hopping on



Tx DH5, Hopping off



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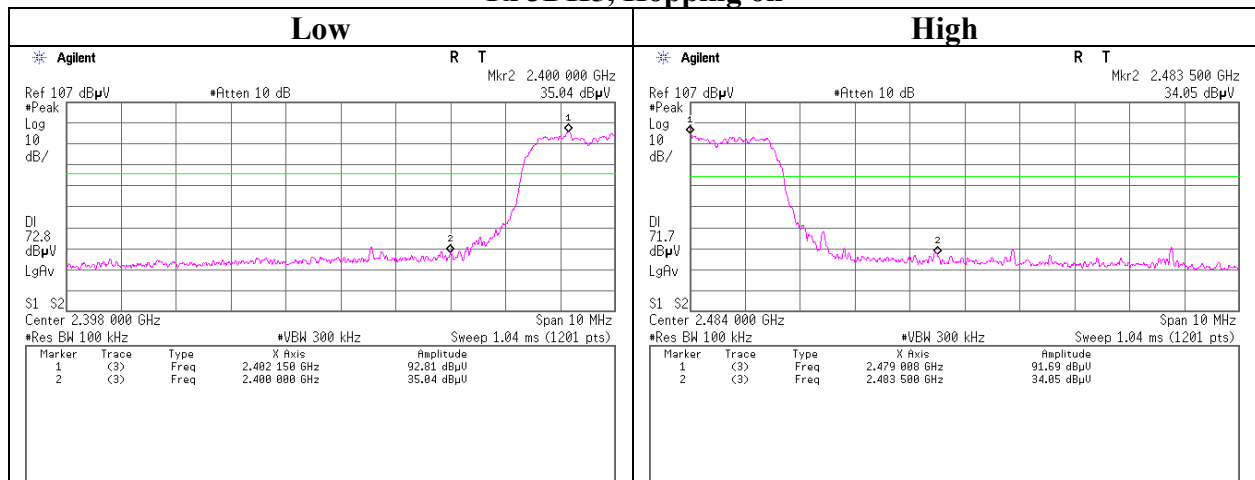
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

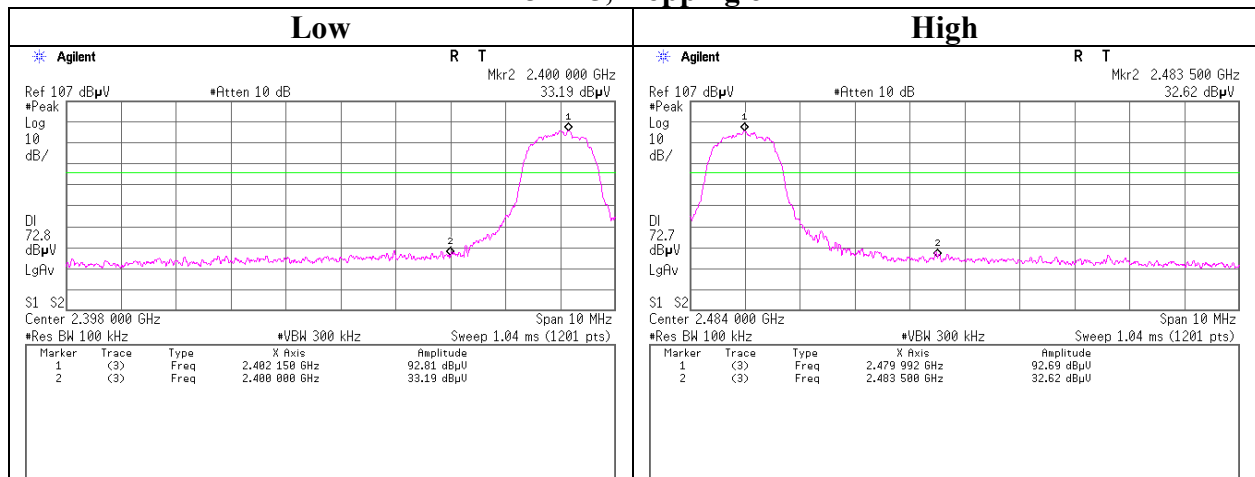
Conducted Emission Band Edge compliance

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping on/off) 3DH5

Tx 3DH5, Hopping on



Tx 3DH5, Hopping off



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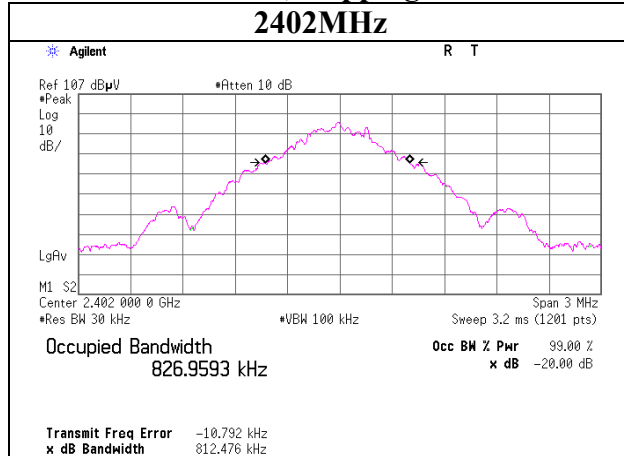
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

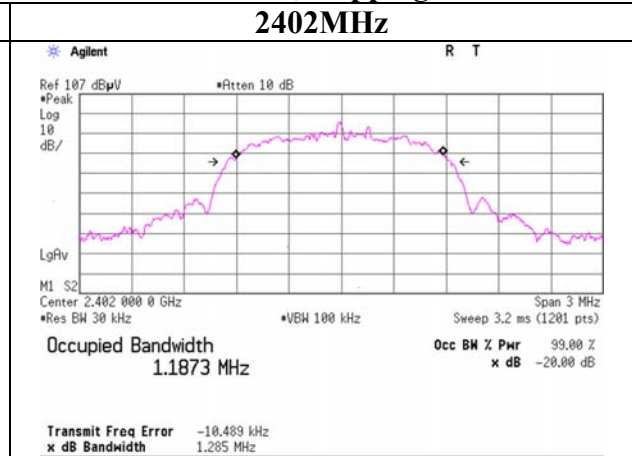
99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping off) DH5/3DH5

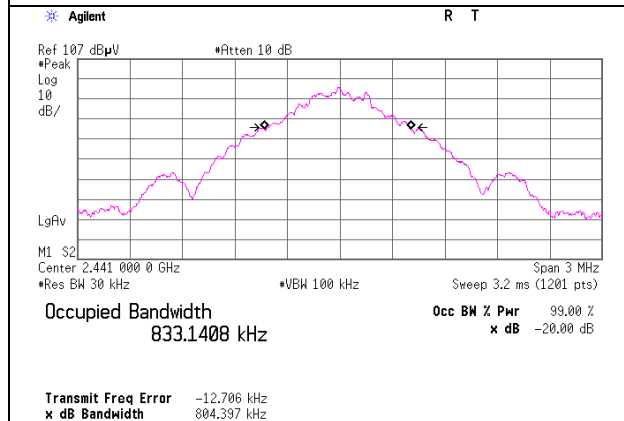
Tx DH5, Hopping off



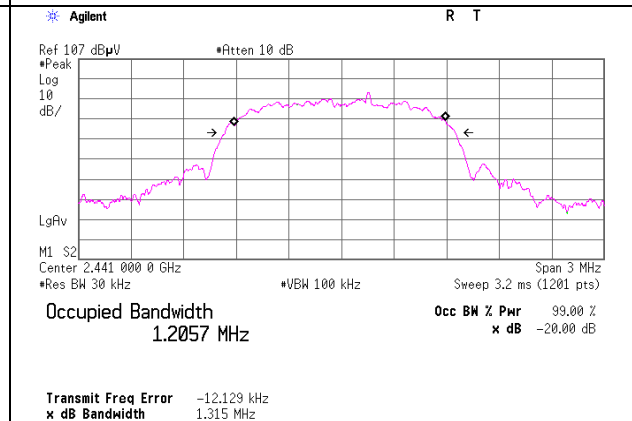
Tx 3DH5, Hopping off



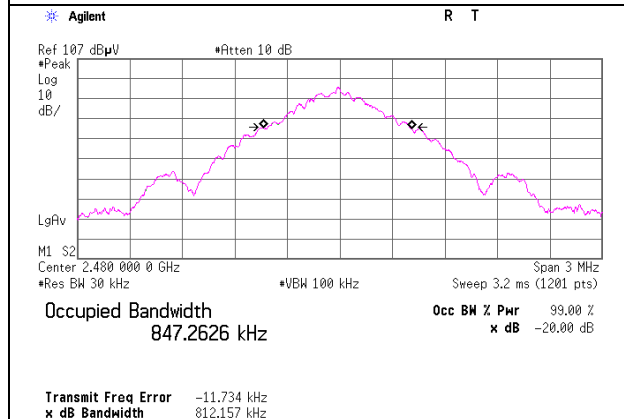
2441MHz



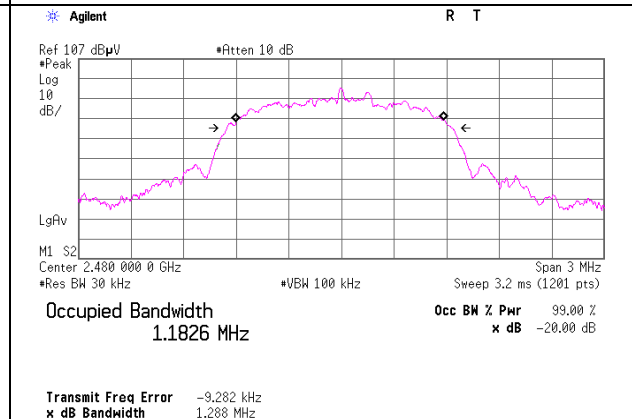
2441MHz



2480MHz



2480MHz



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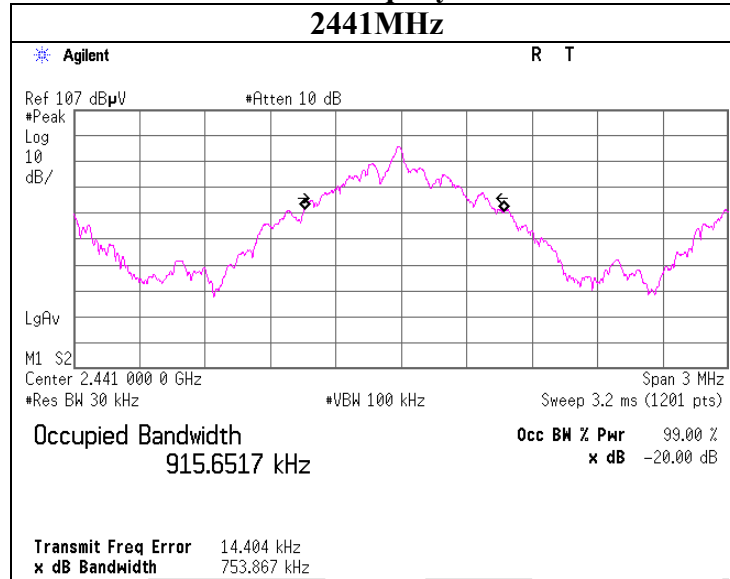
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10646854H
Date 01/14/2015
Temperature/ Humidity 24deg. C / 22% RH
Engineer Tomoki Matsui
Mode Tx Inquiry

Tx Inquiry 2441MHz



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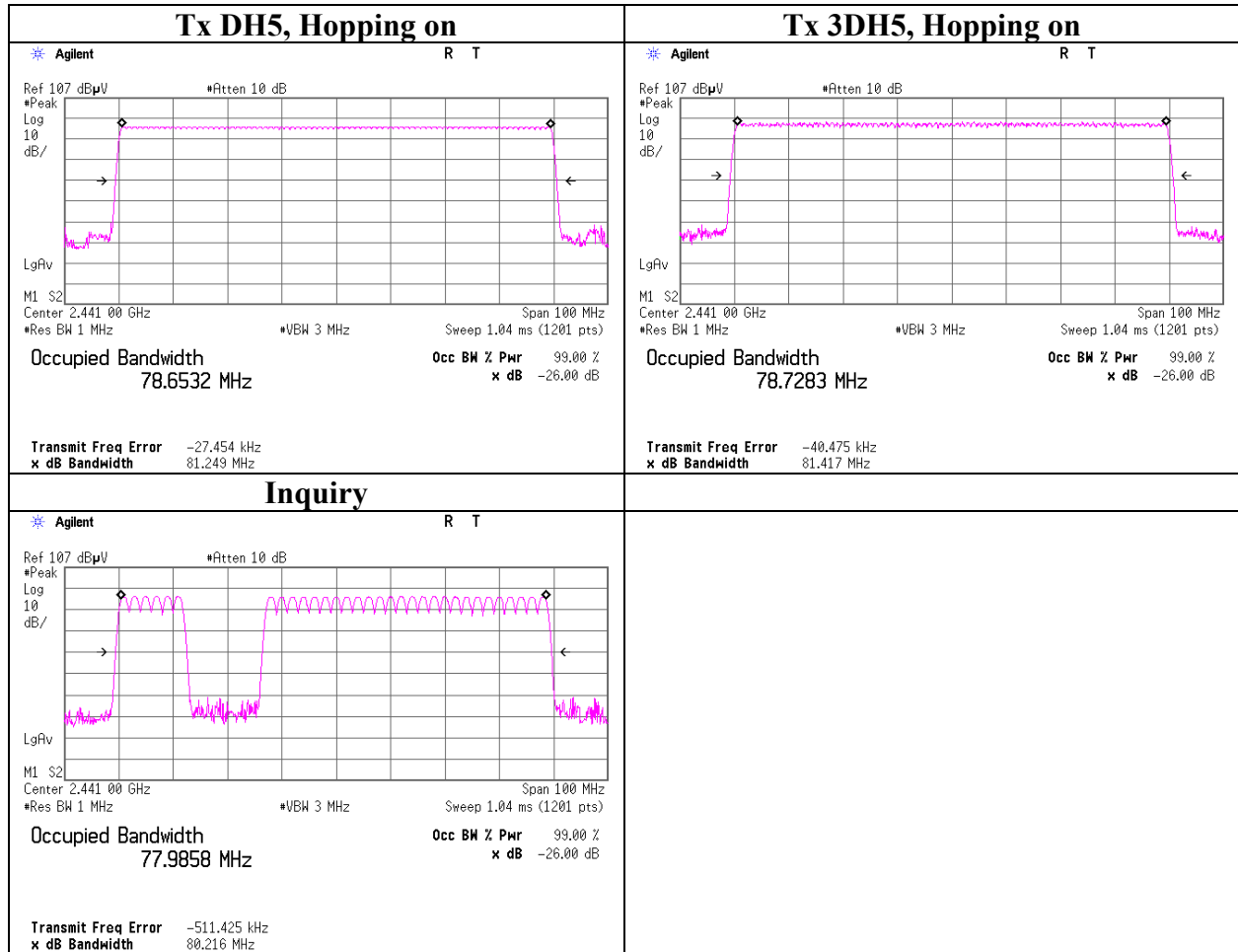
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10646854H
Date	01/14/2015
Temperature/ Humidity	24deg. C / 22% RH
Engineer	Tomoki Matsui
Mode	Tx (Hopping on) DH5/3DH5/Inquiry



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MOTS-MATM	Antenna Terminal Measurement Software	UL Japan	-	-	AT	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	AT	2014/10/17 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2014/10/06 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2014/10/06 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 12
MAT-19	Attenuator(6dB)(above 1 GHz)	HIROSE ELECTRIC CO.,LTD.	AT-106	-	AT	2015/01/07 * 12
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2014/04/14 * 12
MCC-36	Microwave Cable	Hirose Electric	U.FL-2LP-066-A-(200)	-	AT	2014/09/12 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2014/12/22 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MRENT-116	Spectrum Analyzer	Agilent	E4440A	MY46187620	RE	2014/03/05 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2014/05/21 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2014/02/21 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE/RE	2014/11/12 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE/RE	2014/06/03 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(EUT)	2014/07/10 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2014/01/20 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2014/02/20 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2014/01/29 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2014/02/20 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 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: CE: Conducted Emission test

RE: Radiated Emission test

AT: Antenna Terminal Conducted test

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