



RADIO TEST REPORT

Test Report No. : 11624584H-B

Applicant : VAIO Corporation
Type of Equipment : Digital Music Score
Model No. : DMS-W1
FCC ID : 2AL4MDMS-W1
Test regulation : FCC Part 15 Subpart C: 2017
* WLAN part
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: April 17 to May 16, 2017

Representative test engineer:


Tomoki Matsui
Engineer
Consumer Technology Division

Approved by:


Takahiro Hatakeda
Leader
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11624584H-B

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SECTION 1: Customer information

Company Name	:	VAIO Corporation
Address	:	5432 Toyoshina, Azumino-shi, Nagano, 399-8282 Japan
Telephone Number	:	+81-263-50-7391
Facsimile Number	:	+81-263-50-7015
Contact Person	:	Masami Ogawa

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

2.1 Identification of E.U.T.

Type of Equipment	:	Digital Music Score
Model No.	:	DMS-W1
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5.0 V (USB), DC 3.7 V (Battery)
Receipt Date of Sample	:	April 17, 2017
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: DMS-W1 (referred to as the EUT in this report) is a Digital Music Score.

General Specification

Clock frequency(ies) in the system	:	996 MHz, 630 MHz, 650 MHz, 528 MHz, 480 MHz, 26 MHz, 24 MHz, 32.768 KHz
Operating Temperature	:	5 deg. C - +35 deg. C

Radio Specification

Radio Type	:	Transceiver
Power Supply (inner)	:	DC 1.8 V / DC 3.15 V

	IEEE802.11b *1)	IEEE802.11g/n (20 M band) *1)	IEEE802.11a/n (20 M band)	IEEE802.11n (40 M band)	Bluetooth Ver.3.0 with EDR function
Frequency of operation	2412 MHz -2462 MHz	2412 MHz -2462 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5580 MHz 5660 MHz - 5700 MHz *2)	5190 MHz -5230 MHz 5270 MHz -5310 MHz 5510 MHz -5550 MHz 5670 MHz *2)	2402 MHz -2480MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		FHSS (GFSK, $\pi/4$ -DQPSK, 8-DPSK)
Channel spacing	5 MHz		20MHz	40MHz	1MHz
Antenna type	monopole pattern antenna				
Antenna Gain	0.3 dBi		2.6 dBi		0.3 dBi
Antenna Connector type	Surface mounted coaxial connector				Surface mounted coaxial connector

*1) This test report applies for WLAN (IEEE802.11b/g/n-20 [2412 MHz – 2462 MHz]).

*2) 5600MHz-5650MHz is not used.

*Wireless LAN and Bluetooth do not transmit simultaneously.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

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

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

* The revision on June 14, 2017, does not affect the test specification applied to the EUT.

* Also the EUT complies with FCC Part 15 Subpart B.

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	QP 15.4 dB, 0.15000 MHz, L AV 17.9 dB, 0.50640 MHz, N	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(a)(2) IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: -	FCC: Section 15.247(e) IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section 15.247(d) IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	0.6 dB 2390.000 MHz, AV, Hori.	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 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 1.8 V/3.15 V) constantly to RF Part 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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Antenna terminal test Uncertainty (+/-)							
Power meter		Conducted emission and Power density			Conducted emission		Channel power
Below 1 GHz	Above 1 GHz	Below 1 GHz	1 GHz - 3 GHz	3 GHz - 18 GHz	18 GHz - 26.5 GHz	26.5 GHz - 40 GHz	
0.9 dB	1.0 dB	1.4 dB	1.5 dB	2.8 dB	2.8 dB	2.9 dB	2.6 dB

Frequency range	Conducted emission using AMN(LISN) (+/-)
0.009 MHz - 0.15 MHz	3.5 dB
0.15 MHz - 30 MHz	3.0 dB

Test distance	Radiated emission (+/-) 9 kHz - 30 MHz
3 m	3.8 dB
10 m	3.7 dB

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*) (+/-)		(10 m*) (+/-)	
	30 MHz - 200 MHz	200 MHz - 1000 MHz	30 MHz - 200 MHz	200 MHz - 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

Radiated emission (Above 1 GHz)				
(3 m*) (+/-)		(1 m*) (+/-)		(10 m*) (+/-)
1 GHz - 6 GHz	6 GHz - 18 GHz	10 GHz - 26.5 GHz	26.5 GHz - 40 GHz	1 GHz - 18 GHz
5.2 dB	5.4 dB	5.5 dB	5.5 dB	5.4 dB

*Measurement distance

Conducted Emission test

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

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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3.5 Test Location

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Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m 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 Test data, 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)

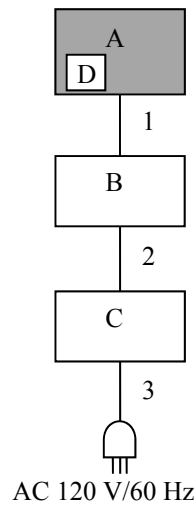
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	54 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 6, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b: 15 dBm 11g: 11 dBm 11n: 11 dBm Software: MAC F/W version : Rev. 8.9.0.0.48 PHY F/W version : Rev. 8.2.0.0.232 (FDSP: 1.162) *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.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission, Radiated Spurious Emission (Below 1 GHz), Conducted Spurious Emission	11g Tx *1)	2462 MHz
Radiated Spurious Emission (Above 1 GHz)	11b Tx 11g Tx *2)	2412 MHz 2437 MHz 2462 MHz
Band-edge	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2462 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
*1) The mode was tested as a representative, because it had the highest peak output power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.		

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

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Digital Music Score	DMS-W1	38 *1), *2) 10 *3)	VAIO Corporation	EUT
B	Laptop PC	VJZ13AA11N	SKU013PVT1-S-06	VAIO Corporation	-
C	AC Adapter	VGP-AC19V74	1492510110002343	SONY	-
D	Micro SD Card	SDSDH-008G-J95	6356PKA053ES	SanDisk	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB Cable	1.0 *1) 2.5 *2)	Shielded	Shielded	-
2	DC Cable	1.8	Unshielded	Unshielded	-
3	AC Cable	2.0	Unshielded	Unshielded	-

*1) Used for Conducted emission

*2) Used for Radiated emission

*3) Used for Antenna terminal conducted tests

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.

The rear of tabletop was located 40 cm 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 80 cm 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 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm 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 MHz – 30 MHz
Test data	: APPENDIX
Test result	: Pass

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

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

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

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

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

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

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

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results	RBW: 100 kHz VBW: 300kHz
Test Distance	3 m	4.3 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)		4.3 m *2) (1 GHz – 10 GHz), 1 m *3) (10 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

*2) Distance Factor: $20 \times \log(4.3 \text{ m} / 3.0 \text{ m}) = 3.13 \text{ dB}$

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

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

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
6dB Bandwidth	20 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 kHz				
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart. (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)							

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

Test data	: APPENDIX
Test result	: Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

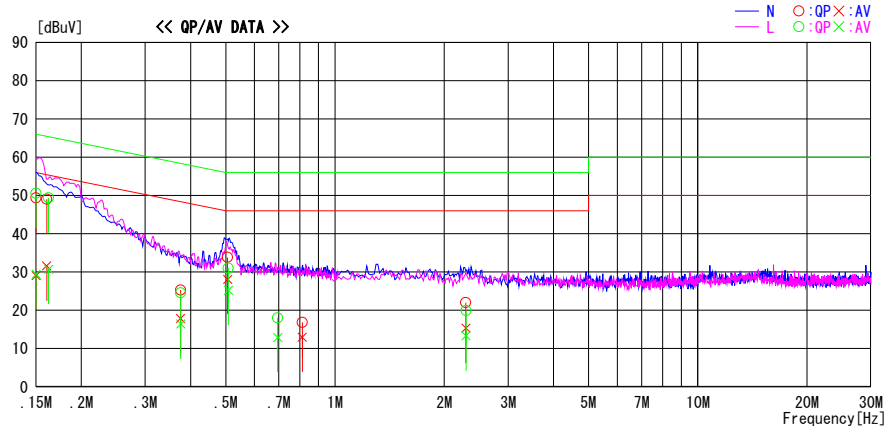
UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2017/05/16

Report No. : 11624584H

Temp./Humi. : 24 deg. C / 42 % RH
Engineer : Hironobu Ohnishi

Mode / Remarks : Tx 11g 2462 MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	36.2	15.9	13.2	49.4	29.1	66.0	56.0	16.6	26.9	N	
0.16040	35.8	18.4	13.2	49.0	31.6	65.4	55.4	16.4	23.8	N	
0.37550	12.1	4.7	13.2	25.3	17.9	58.4	48.4	33.1	30.5	N	
0.50640	20.5	14.8	13.3	33.8	28.1	56.0	46.0	22.2	17.9	N	
0.81270	3.5	-0.3	13.3	16.8	13.0	56.0	46.0	39.2	33.0	N	
2.29370	8.4	1.7	13.6	22.0	15.3	56.0	46.0	34.0	30.7	N	
0.15000	37.4	16.2	13.2	50.6	29.4	66.0	56.0	15.4	26.6	L	
0.16250	36.2	17.5	13.2	49.4	30.7	65.3	55.3	15.9	24.6	L	
0.37580	11.4	3.2	13.2	24.6	16.4	58.4	48.4	33.8	32.0	L	
0.50830	17.7	11.9	13.3	31.0	25.2	56.0	46.0	25.0	20.8	L	
0.69540	4.7	-0.4	13.3	18.0	12.9	56.0	46.0	38.0	33.1	L	
2.29860	6.3	-0.3	13.6	19.9	13.3	56.0	46.0	36.1	32.7	L	

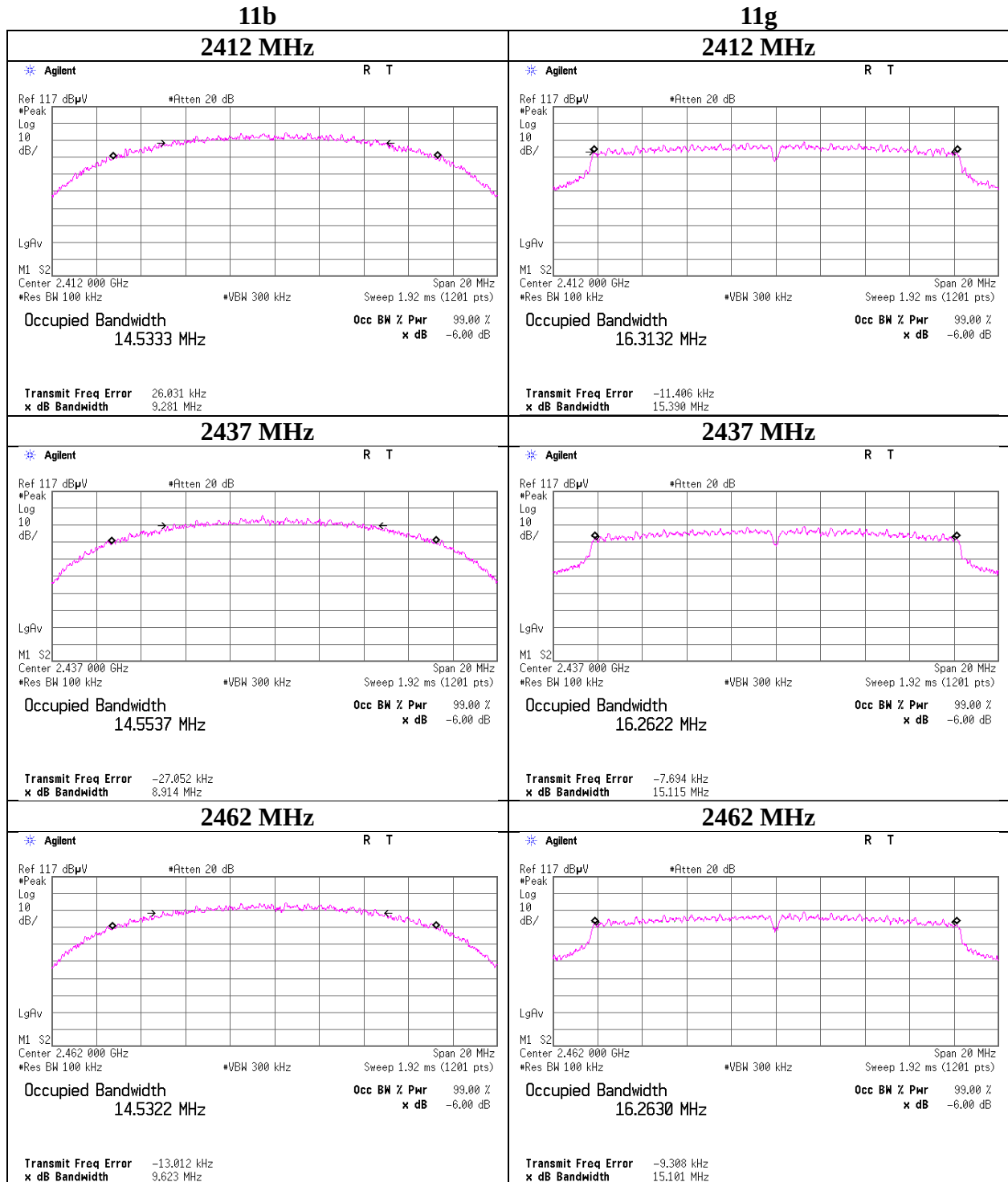
CHART: WITH FACTOR Peak hold data. CALCULATION: RESULT = READING + C.F (LISN + CABLE + ATTEN)
Except for the above table: adequate margin data below the limits.

6dB Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11624584H
Date	April 18, 2017
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Takumi Shimada
Mode	Tx

Mode	Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
11b	2412	9.281	> 500
	2437	8.914	> 500
	2462	9.623	> 500
11g	2412	15.390	> 500
	2437	15.115	> 500
	2462	15.101	> 500
11n-20	2412	15.344	> 500
	2437	15.080	> 500
	2462	15.099	> 500

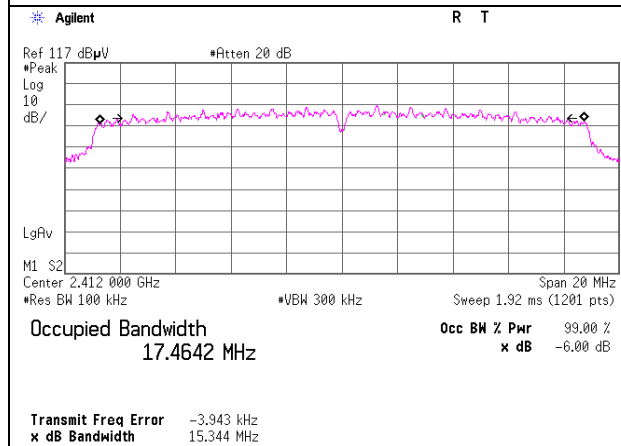
6dB Bandwidth



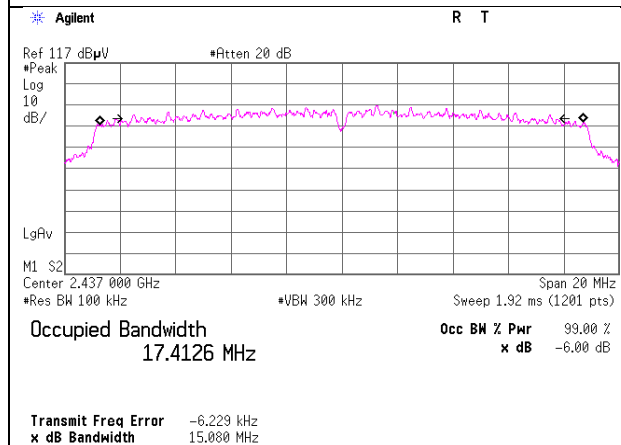
6dB Bandwidth

11n-20

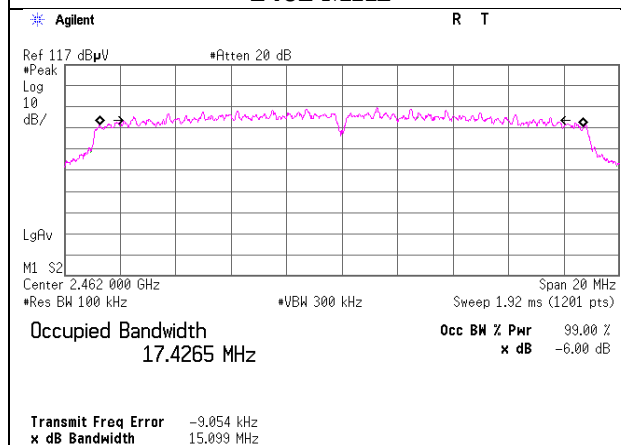
2412 MHz



2437 MHz



2462 MHz



Maximum Peak Output Power

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11624584H
Date	April 17, 2017
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Takumi Shimada
Mode	Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	6.72	0.70	9.48	16.90	48.98	30.00	1000	13.10
2437	6.76	0.70	9.48	16.94	49.43	30.00	1000	13.06
2462	6.81	0.70	9.48	16.99	50.00	30.00	1000	13.01

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	9.03	0.70	9.48	19.21	83.37	30.00	1000	10.79
2437	9.22	0.70	9.48	19.40	87.10	30.00	1000	10.60
2462	9.26	0.70	9.48	19.44	87.90	30.00	1000	10.56

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	9.03	0.70	9.48	19.21	83.37	30.00	1000	10.79
2437	9.16	0.70	9.48	19.34	85.90	30.00	1000	10.66
2462	9.19	0.70	9.48	19.37	86.50	30.00	1000	10.63

Sample Calculation:

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

Maximum Peak Output Power
(Worst Rate Check)

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11624584H
Date	April 17, 2017
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Takumi Shimada
Mode	Tx

11b 2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	6.58	
2	6.66	
5.5	6.70	
11	6.76	*

*: Worst Rate

11g 2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	8.97	
9	8.76	
12	9.02	
18	9.03	
24	9.15	
36	9.08	
48	9.07	
54	9.22	*

*: Worst Rate

11n-20 2437 MHz

MCS	Reading	Remark
	[dBm]	
0	8.93	
1	8.94	
2	9.01	
3	9.04	
4	9.01	
5	8.99	
6	9.16	*
7	9.06	

*: Worst Rate

All comparisons were carried out on same frequency and measurement factors.

Average Output Power (Reference data for SAR testing)

Test place	Ise EMC Lab. No.3 Measurement Room
Report No.	11624584H
Date	April 17, 2017
Temperature / Humidity	25 deg. C / 51 % RH
Engineer	Takumi Shimada
Mode	Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	4.44	0.70	9.48	14.62	28.95	0.03	14.65	29.15
2437	4.51	0.70	9.48	14.69	29.42	0.03	14.72	29.62
2462	4.29	0.70	9.48	14.47	27.96	0.03	14.50	28.16

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	0.25	0.70	9.48	10.43	11.03	0.16	10.59	11.45
2437	0.18	0.70	9.48	10.36	10.86	0.16	10.52	11.26
2462	-0.27	0.70	9.48	9.91	9.79	0.16	10.07	10.15

11n-20 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	0.31	0.70	9.48	10.49	11.19	0.18	10.67	11.66
2437	0.24	0.70	9.48	10.42	11.01	0.18	10.60	11.47
2462	-0.02	0.70	9.48	10.16	10.37	0.18	10.34	10.80

Sample Calculation:

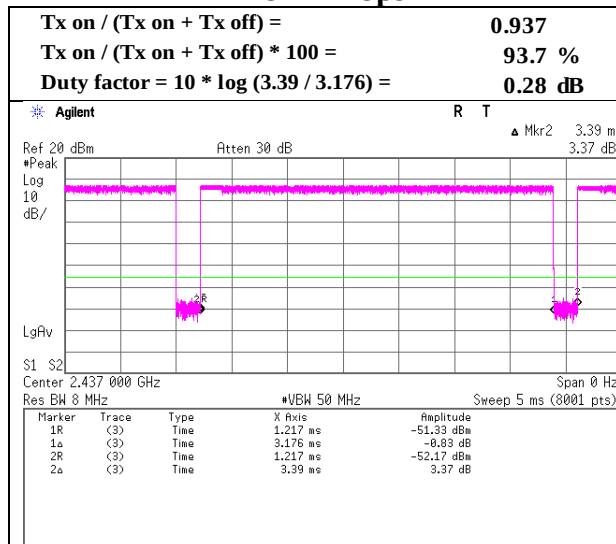
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

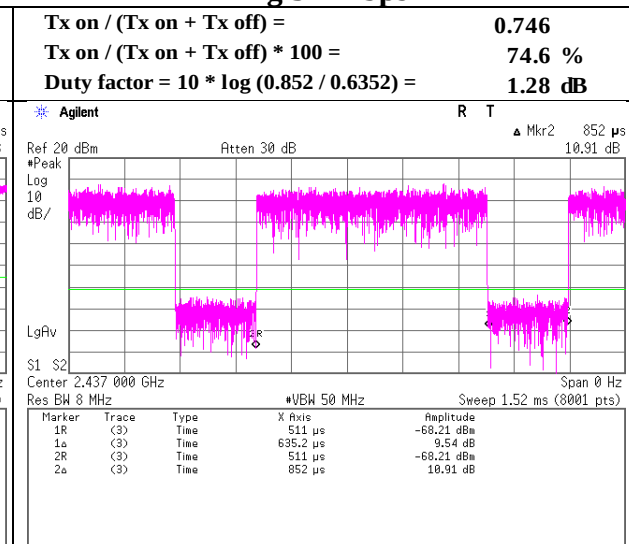
Burst rate confirmation

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11624584H
Date	April 18, 2017
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Takumi Shimada
Mode	Tx

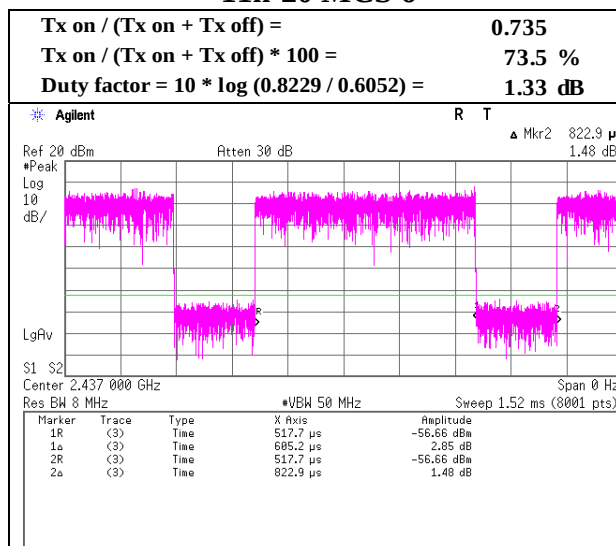
11b 11 Mbps



11g 54 Mbps



11n-20 MCS 6



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

UL Japan, Inc.

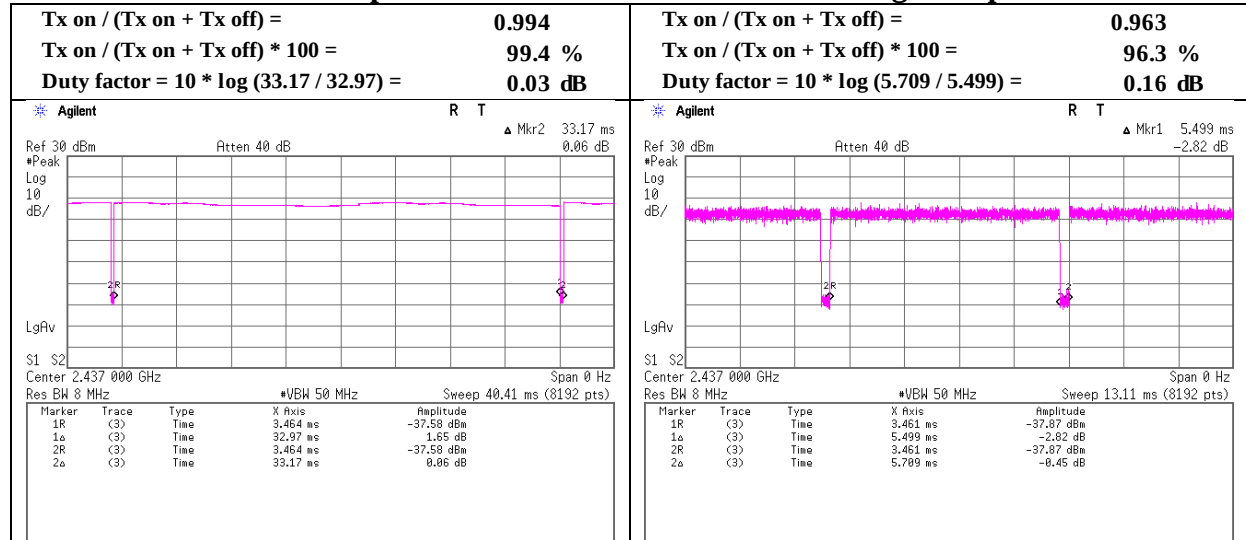
Ise EMC Lab.

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

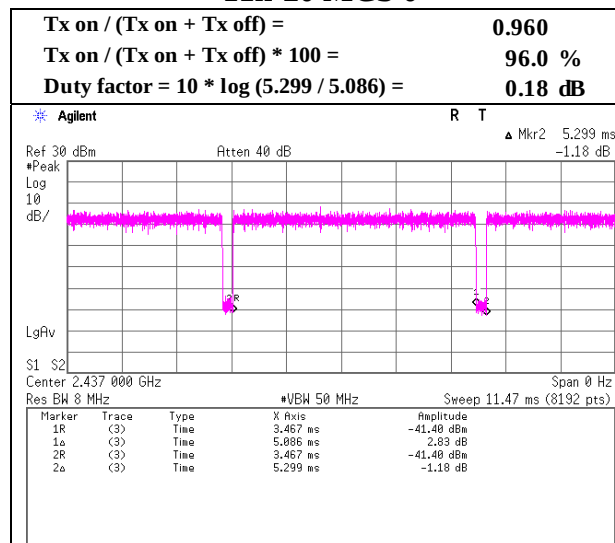
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

11b 1 Mbps



11n-20 MCS 0



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No. 11624584H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3 No.4
Date April 17, 2017 April 23, 2017
Temperature / Humidity 20 deg. C / 50 % RH 19 deg. C / 37 % RH
Engineer Tomoki Matsui Tomoki Matsui
(1 GHz -10 GHz) (Above 10 GHz)
Mode Tx 11b 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	49.4	26.7	6.5	32.4	-	50.2	73.9	23.7	Floor noise
Hori	4824.000	PK	44.4	31.1	8.7	31.4	-	52.8	73.9	21.1	
Hori	7236.000	PK	39.3	35.7	10.0	32.1	-	52.9	73.9	21.0	
Hori	9648.000	PK	39.9	37.2	10.6	32.9	-	54.8	73.9	19.1	
Hori	14472.000	PK	42.6	41.5	0.0	32.5	-	51.6	73.9	22.3	
Hori	19296.000	PK	42.7	37.0	-1.8	32.8	-	45.1	73.9	28.8	
Hori	24120.000	PK	46.0	39.0	-0.7	33.1	-	51.2	73.9	22.7	
Hori	2390.000	AV	41.3	26.7	6.5	32.4	0.3	42.4	53.9	11.5	*1)
Hori	4824.000	AV	36.0	31.1	8.7	31.4	0.3	44.7	53.9	9.2	
Hori	7236.000	AV	30.4	35.7	10.0	32.1	-	44.0	53.9	9.9	Floor noise
Hori	9648.000	AV	31.5	37.2	10.6	32.9	-	46.4	53.9	7.5	Floor noise
Hori	14472.000	AV	33.7	41.5	0.0	32.5	0.3	43.0	53.9	10.9	
Hori	19296.000	AV	34.6	37.0	-1.8	32.8	0.3	37.3	53.9	16.6	
Hori	24120.000	AV	38.6	39.0	-0.7	33.1	0.3	44.1	53.9	9.8	
Vert	2390.000	PK	50.0	26.7	6.5	32.4	-	50.8	73.9	23.1	Floor noise
Vert	4824.000	PK	47.5	31.1	8.7	31.4	-	55.9	73.9	18.0	
Vert	7236.000	PK	39.3	35.7	9.1	32.1	-	52.0	73.9	21.9	
Vert	9648.000	PK	39.9	37.2	10.0	32.9	-	54.2	73.9	19.7	
Vert	14472.000	PK	43.9	41.5	0.0	32.5	-	52.9	73.9	21.0	
Vert	19296.000	PK	45.1	37.0	-1.8	32.8	-	47.5	73.9	26.4	
Vert	24120.000	PK	48.2	39.0	-0.7	33.1	-	53.4	73.9	20.5	
Vert	2390.000	AV	42.4	26.7	6.5	32.4	0.3	43.5	53.9	10.4	*1)
Vert	4824.000	AV	39.1	31.1	8.7	31.4	0.3	47.8	53.9	6.1	
Vert	7236.000	AV	30.4	35.7	9.1	32.1	-	43.1	53.9	10.8	Floor noise
Vert	9648.000	AV	31.5	37.2	10.0	32.9	-	45.8	53.9	8.1	Floor noise
Vert	14472.000	AV	36.4	41.5	0.0	32.5	0.3	45.7	53.9	8.2	
Vert	19296.000	AV	38.9	37.0	-1.8	32.8	0.3	41.6	53.9	12.3	
Vert	24120.000	AV	40.0	39.0	-0.7	33.1	0.3	45.5	53.9	8.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz $20\log(4.3\text{ m} / 3.0\text{ m}) = 3.13\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

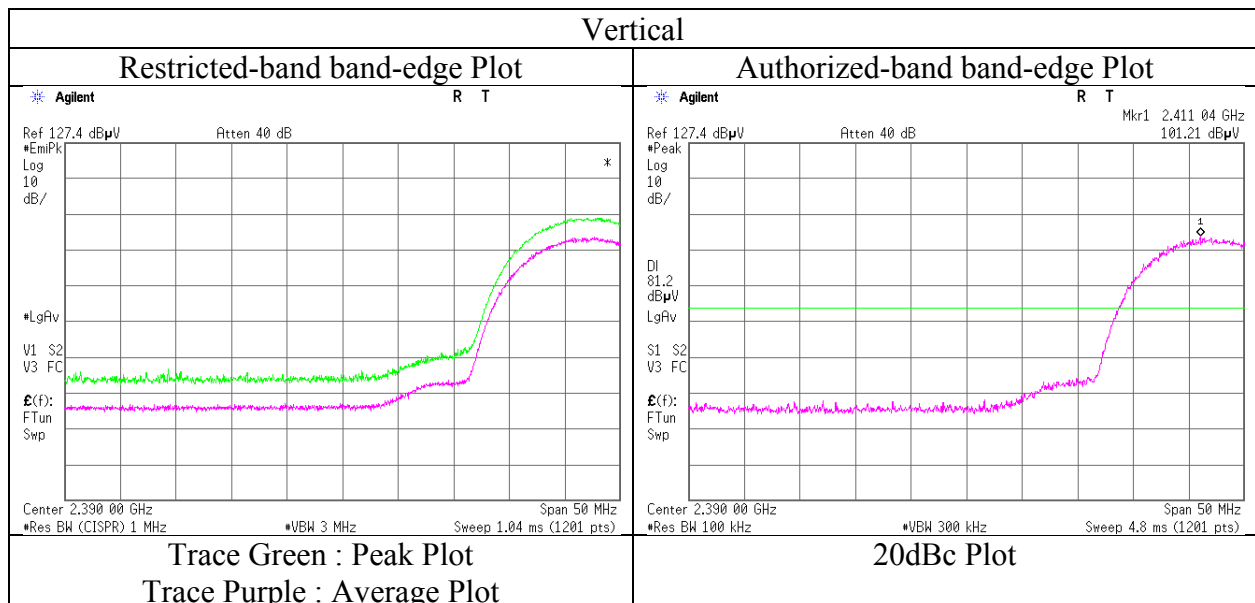
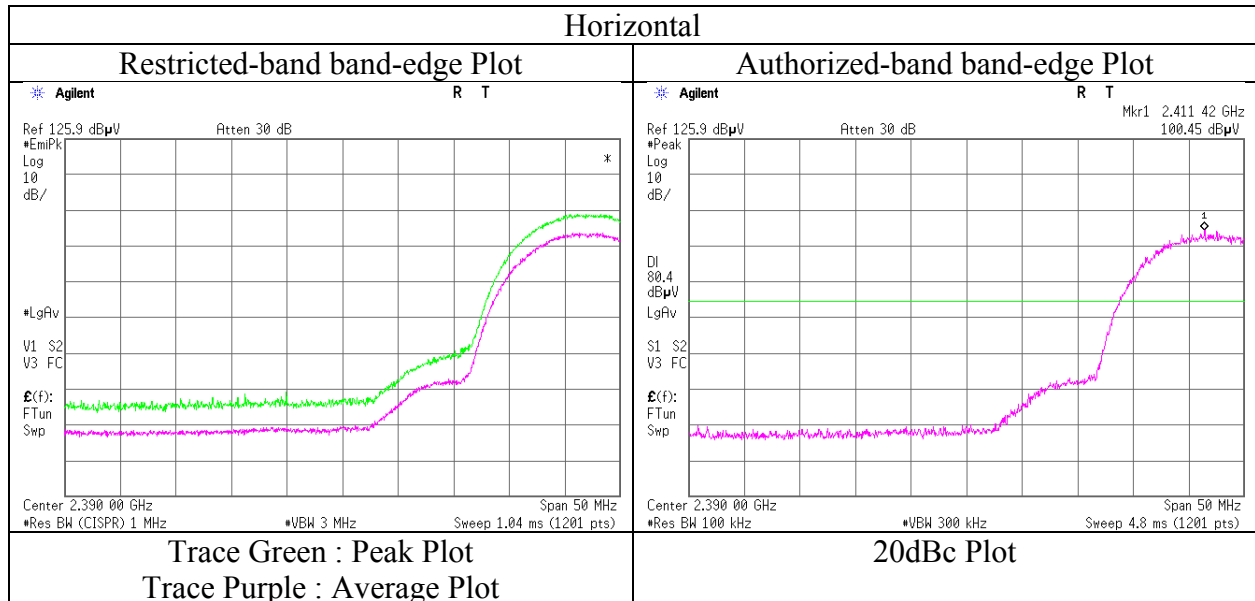
20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	100.5	26.7	6.5	32.4	101.3	-	-	Carrier
Hori	2400.000	PK	58.1	26.7	6.5	32.4	58.9	81.3	22.4	
Vert	2412.000	PK	101.2	26.7	6.5	32.4	102.0	-	-	Carrier
Vert	2400.000	PK	59.4	26.7	6.5	32.4	60.2	82.0	21.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11624584H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2017
Temperature / Humidity	20 deg. C / 50 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx 11b 2412 MHz



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

UL Japan, Inc.

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Radiated Spurious Emission

Report No.	11624584H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	April 17, 2017	April 23, 2017
Temperature / Humidity	21 deg. C / 59 % RH	19 deg. C / 37 % RH
Engineer	Shuichi Ohyama (1 GHz -10 GHz)	Tomoki Matsui (Above 10 GHz)
Mode	Tx 11b 2437 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	44.8	31.2	8.7	31.4	-	53.3	73.9	20.6	
Hori	7311.000	PK	40.4	35.6	10.0	32.2	-	53.8	73.9	20.1	Floor noise
Hori	9748.000	PK	41.1	37.2	10.6	33.0	-	55.9	73.9	18.0	Floor noise
Hori	14622.000	PK	42.9	41.2	0.2	32.5	-	51.8	73.9	22.1	
Hori	19496.000	PK	43.1	37.0	-1.8	32.8	-	45.5	73.9	28.4	
Hori	24370.000	PK	44.8	39.0	-0.6	33.1	-	50.1	73.9	23.8	
Hori	4874.000	AV	35.2	31.2	8.7	31.4	0.3	44.0	53.9	9.9	
Hori	7311.000	AV	32.4	35.6	10.0	32.2	-	45.8	53.9	8.1	Floor noise
Hori	9748.000	AV	32.2	37.2	10.6	33.0	-	47.0	53.9	6.9	Floor noise
Hori	14622.000	AV	33.8	41.2	0.2	32.5	0.3	43.0	53.9	10.9	
Hori	19496.000	AV	35.1	37.0	-1.8	32.8	0.3	37.8	53.9	16.1	
Hori	24370.000	AV	36.4	39.0	-0.6	33.1	0.3	42.0	53.9	11.9	
Vert	4874.000	PK	45.2	31.2	8.7	31.4	-	53.7	73.9	20.2	
Vert	7311.000	PK	40.3	35.6	9.1	32.2	-	52.8	73.9	21.1	Floor noise
Vert	9748.000	PK	40.5	37.2	10.6	33.0	-	55.3	73.9	18.6	Floor noise
Vert	14622.000	PK	43.3	41.2	0.2	32.5	-	52.2	73.9	21.7	
Vert	19496.000	PK	45.1	37.0	-1.8	32.8	-	47.5	73.9	26.4	
Vert	24370.000	PK	45.7	39.0	-0.6	33.1	-	51.0	73.9	22.9	
Vert	4874.000	AV	35.4	31.2	8.7	31.4	0.3	44.2	53.9	9.7	
Vert	7311.000	AV	32.6	35.6	10.0	32.2	-	46.0	53.9	7.9	Floor noise
Vert	9748.000	AV	32.1	37.2	10.6	33.0	-	46.9	53.9	7.0	Floor noise
Vert	14622.000	AV	35.9	41.2	0.2	32.5	0.3	45.1	53.9	8.8	
Vert	19496.000	AV	37.5	37.0	-1.8	32.8	0.3	40.2	53.9	13.7	
Vert	24370.000	AV	37.3	39.0	-0.6	33.1	0.3	42.9	53.9	11.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.3 m / 3.0 m) = 3.13 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 11624584H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3 No.4
Date April 17, 2017 April 23, 2017
Temperature / Humidity 21 deg. C / 59 % RH 19 deg. C / 37 % RH
Engineer Shuichi Ohyama Tomoki Matsui
(1 GHz -10 GHz) (Above 10 GHz)
Mode Tx 11b 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	50.5	26.8	6.6	32.4	-	51.5	73.9	22.4	Floor noise
Hori	4924.000	PK	44.7	31.4	8.7	31.3	-	53.5	73.9	20.4	
Hori	7386.000	PK	40.0	35.5	9.9	32.2	-	53.2	73.9	20.7	
Hori	9848.000	PK	40.5	37.2	10.7	33.0	-	55.4	73.9	18.5	
Hori	14772.000	PK	42.7	41.0	0.3	32.5	-	51.5	73.9	22.4	
Hori	19696.000	PK	43.8	36.9	-1.7	32.8	-	46.2	73.9	27.7	
Hori	24620.000	PK	46.6	38.9	-0.5	33.2	-	51.8	73.9	22.1	
Hori	2483.500	AV	42.7	26.8	6.6	32.4	0.3	44.0	53.9	9.9	*1)
Hori	4924.000	AV	35.5	31.4	8.7	31.3	0.3	44.6	53.9	9.3	
Hori	7386.000	AV	30.1	35.5	9.9	32.2	-	43.3	53.9	10.6	Floor noise
Hori	9848.000	AV	30.3	37.2	10.7	33.0	-	45.2	53.9	8.7	Floor noise
Hori	14772.000	AV	33.8	41.0	0.3	32.5	0.3	42.9	53.9	11.0	
Hori	19696.000	AV	35.9	36.9	-1.7	32.8	0.3	38.6	53.9	15.3	
Hori	24620.000	AV	38.0	38.9	-0.5	33.2	0.3	43.5	53.9	10.4	
Vert	2483.500	PK	51.8	26.8	6.6	32.4	-	52.8	73.9	21.1	Floor noise
Vert	4924.000	PK	46.7	31.4	8.7	31.3	-	55.5	73.9	18.4	
Vert	7386.000	PK	40.3	35.5	9.9	32.2	-	53.5	73.9	20.4	
Vert	9848.000	PK	40.3	37.2	10.7	33.0	-	55.2	73.9	18.7	
Vert	14772.000	PK	43.4	41.0	0.3	32.5	-	52.2	73.9	21.7	
Vert	19696.000	PK	44.8	36.9	-1.7	32.8	-	47.2	73.9	26.7	
Vert	24620.000	PK	47.3	38.9	-0.5	33.2	-	52.5	73.9	21.4	
Vert	2483.500	AV	43.6	26.8	6.6	32.4	0.3	44.9	53.9	9.0	*1)
Vert	4924.000	AV	38.8	31.4	8.7	31.3	0.3	47.9	53.9	6.0	
Vert	7386.000	AV	30.2	35.5	9.9	32.2	-	43.4	53.9	10.5	Floor noise
Vert	9848.000	AV	30.3	37.2	10.7	33.0	-	45.2	53.9	8.7	Floor noise
Vert	14772.000	AV	36.1	41.0	0.3	32.5	0.3	45.2	53.9	8.7	
Vert	19696.000	AV	37.2	36.9	-1.7	32.8	0.3	39.9	53.9	14.0	
Vert	24620.000	AV	39.0	38.9	-0.5	33.2	0.3	44.5	53.9	9.4	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

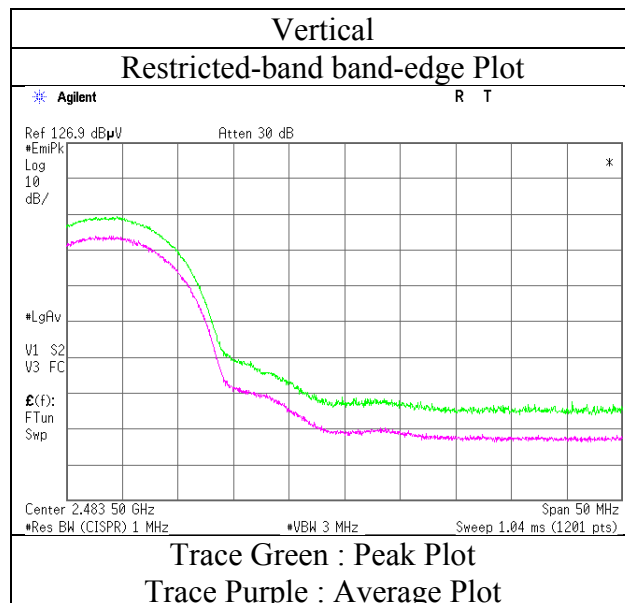
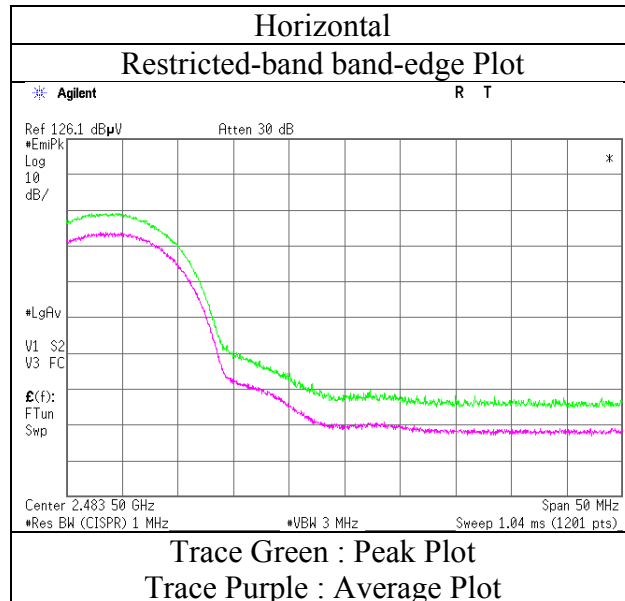
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(4.3\text{ m} / 3.0\text{ m}) = 3.13\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11624584H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2017
Temperature / Humidity	21 deg. C / 59 % RH
Engineer	Shuichi Ohyama
	(1 GHz -10 GHz)
Mode	Tx 11b 2462 MHz



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

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Radiated Spurious Emission

Report No. 11624584H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3 No.4
Date April 17, 2017 April 23, 2017
Temperature / Humidity 20 deg. C / 50 % RH 19 deg. C / 37 % RH
Engineer Tomoki Matsui Tomoki Matsui
(1 GHz -10 GHz) (Above 10 GHz)
Mode Tx 11g 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	65.5	26.7	6.5	32.4	-	66.3	73.9	7.6	Floor noise
Hori	4824.000	PK	41.3	31.1	8.7	31.4	-	49.7	73.9	24.2	
Hori	7236.000	PK	39.3	35.7	10.0	32.1	-	52.9	73.9	21.0	
Hori	9648.000	PK	39.9	37.2	10.6	32.9	-	54.8	73.9	19.1	
Hori	14472.000	PK	42.8	41.5	0.0	32.5	-	51.8	73.9	22.1	
Hori	19296.000	PK	44.1	37.0	-1.8	32.8	-	46.5	73.9	27.4	
Hori	24120.000	PK	46.7	39.0	-0.7	33.1	-	51.9	73.9	22.0	
Hori	2390.000	AV	49.9	26.7	6.5	32.4	1.3	52.0	53.9	1.9	*1)
Hori	4824.000	AV	33.5	31.1	8.7	31.4	1.3	43.2	53.9	10.7	Floor noise
Hori	7236.000	AV	30.4	35.7	10.0	32.1	-	44.0	53.9	9.9	
Hori	9648.000	AV	31.5	37.2	10.6	32.9	-	46.4	53.9	7.5	
Hori	14472.000	AV	34.0	41.5	0.0	32.5	1.3	44.3	53.9	9.6	
Hori	19296.000	AV	35.2	37.0	-1.8	32.8	1.3	38.9	53.9	15.0	
Hori	24120.000	AV	38.3	39.0	-0.7	33.1	1.3	44.8	53.9	9.1	
Vert	2390.000	PK	65.6	26.7	6.5	32.4	-	66.4	73.9	7.5	Floor noise
Vert	4824.000	PK	43.1	31.1	8.7	31.4	-	51.5	73.9	22.4	
Vert	7236.000	PK	39.3	35.7	9.1	32.1	-	52.0	73.9	21.9	
Vert	9648.000	PK	39.9	37.2	10.0	32.9	-	54.2	73.9	19.7	
Vert	14472.000	PK	42.9	41.5	0.0	32.5	-	51.9	73.9	22.0	
Vert	19296.000	PK	46.1	37.0	-1.8	32.8	-	48.5	73.9	25.4	
Vert	24120.000	PK	47.9	39.0	-0.7	33.1	-	53.1	73.9	20.8	
Vert	2390.000	AV	50.2	26.7	6.5	32.4	1.3	52.3	53.9	1.6	*1)
Vert	4824.000	AV	34.9	31.1	8.7	31.4	1.3	44.6	53.9	9.3	Floor noise
Vert	7236.000	AV	30.4	35.7	9.1	32.1	-	43.1	53.9	10.8	
Vert	9648.000	AV	31.5	37.2	10.0	32.9	-	45.8	53.9	8.1	
Vert	14472.000	AV	36.1	41.5	0.0	32.5	1.3	46.4	53.9	7.5	
Vert	19296.000	AV	39.6	37.0	-1.8	32.8	1.3	43.3	53.9	10.6	
Vert	24120.000	AV	40.1	39.0	-0.7	33.1	1.3	46.6	53.9	7.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz $20\log(4.3\text{ m} / 3.0\text{ m}) = 3.13\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

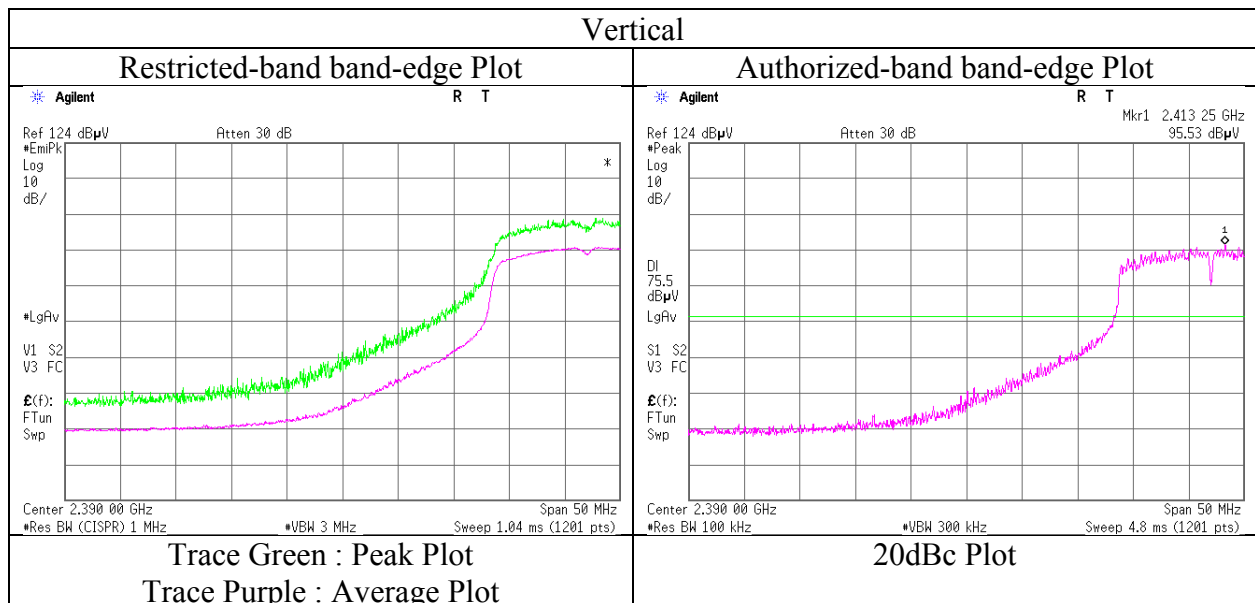
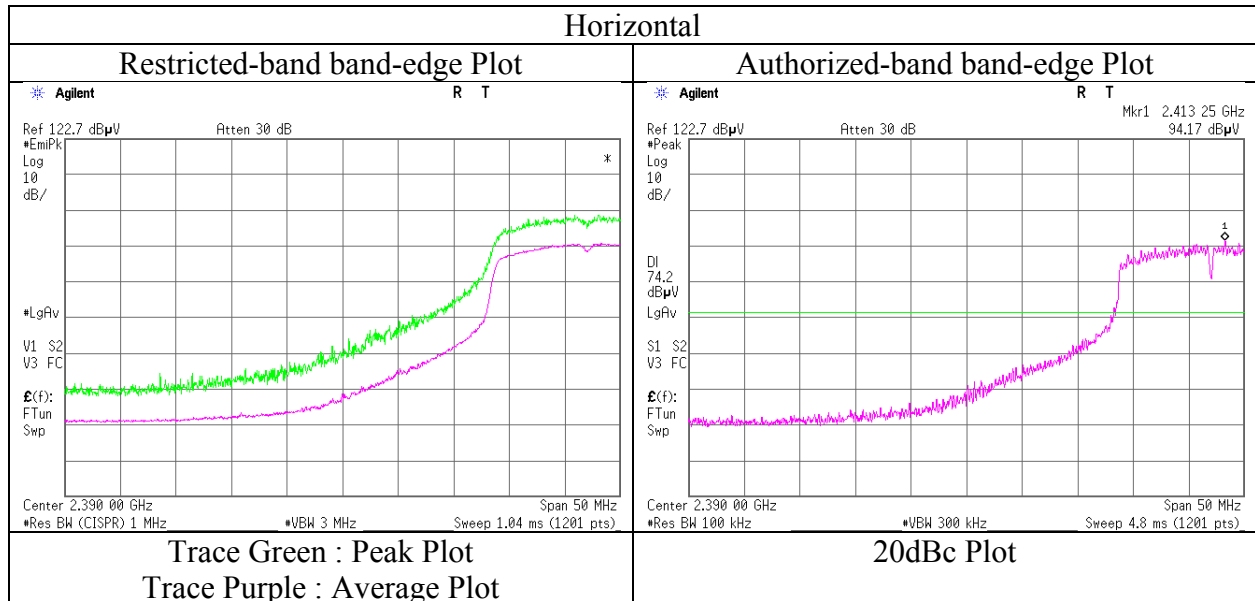
20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2412.000	PK	94.2	26.7	6.5	32.4	95.0	-	-	Carrier
Hori	2400.000	PK	64.7	26.7	6.5	32.4	65.5	75.0	9.5	
Vert	2412.000	PK	95.5	26.7	6.5	32.4	96.3	-	-	Carrier
Vert	2400.000	PK	65.8	26.7	6.5	32.4	66.6	76.3	9.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11624584H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2017
Temperature / Humidity	20 deg. C / 50 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx 11g 2412 MHz



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

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Radiated Spurious Emission

Report No.	11624584H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	April 17, 2017	April 23, 2017
Temperature / Humidity	21 deg. C / 59 % RH	19 deg. C / 37 % RH
Engineer	Shuichi Ohyama (1 GHz -10 GHz)	Tomoki Matsui (Above 10 GHz)
Mode	Tx 11g 2437 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	44.0	31.2	8.7	31.4	-	52.5	73.9	21.4	
Hori	7311.000	PK	40.8	35.6	10.0	32.2	-	54.2	73.9	19.7	Floor noise
Hori	9748.000	PK	40.6	37.2	10.6	33.0	-	55.4	73.9	18.5	Floor noise
Hori	14622.000	PK	43.2	41.2	0.2	32.5	-	52.1	73.9	21.8	
Hori	19496.000	PK	43.6	37.0	-1.8	32.8	-	46.0	73.9	27.9	
Hori	24370.000	PK	45.1	39.0	-0.6	33.1	-	50.4	73.9	23.5	
Hori	4874.000	AV	33.3	31.2	8.7	31.4	1.3	43.1	53.9	10.8	
Hori	7311.000	AV	32.2	35.6	10.0	32.2	-	45.6	53.9	8.3	Floor noise
Hori	9748.000	AV	32.4	37.2	10.6	33.0	-	47.2	53.9	6.7	Floor noise
Hori	14622.000	AV	33.8	41.2	0.2	32.5	1.3	44.0	53.9	9.9	
Hori	19496.000	AV	36.0	37.0	-1.8	32.8	1.3	39.7	53.9	14.2	
Hori	24370.000	AV	36.9	39.0	-0.6	33.1	1.3	43.5	53.9	10.4	
Vert	4874.000	PK	44.2	31.2	8.7	31.4	-	52.7	73.9	21.2	
Vert	7311.000	PK	40.2	35.6	10.0	32.2	-	53.6	73.9	20.3	Floor noise
Vert	9748.000	PK	41.0	37.2	10.6	33.0	-	55.8	73.9	18.1	Floor noise
Vert	14622.000	PK	43.3	41.2	0.2	32.5	-	52.2	73.9	21.7	
Vert	19496.000	PK	45.6	37.0	-1.8	32.8	-	48.0	73.9	25.9	
Vert	24370.000	PK	46.2	39.0	-0.6	33.1	-	51.5	73.9	22.4	
Vert	4874.000	AV	33.2	31.2	8.7	31.4	1.3	43.0	53.9	10.9	
Vert	7311.000	AV	32.6	35.6	10.0	32.2	-	46.0	53.9	7.9	Floor noise
Vert	9748.000	AV	32.3	37.2	10.6	33.0	-	47.1	53.9	6.8	Floor noise
Vert	14622.000	AV	36.1	41.2	0.2	32.5	1.3	46.3	53.9	7.6	
Vert	19496.000	AV	38.6	37.0	-1.8	32.8	1.3	42.3	53.9	11.6	
Vert	24370.000	AV	37.7	39.0	-0.6	33.1	1.3	44.3	53.9	9.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz 20log (4.3 m / 3.0 m) = 3.13 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	11624584H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Date	April 17, 2017	April 22, 2017	April 23, 2017
Temperature / Humidity	21 deg. C / 59 % RH	21 deg. C / 41 % RH	19 deg. C / 37 % RH
Engineer	Shuichi Ohyama (1 GHz -10 GHz)	Tomoki Matsui (Below 1GHz)	Tomoki Matsui (Above 10 GHz)
Mode	Tx 11g 2462 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	64.589	QP	35.7	6.8	7.8	32.1	-	18.2	40.0	21.8	
Hori	154.103	QP	38.6	15.2	8.7	32.0	-	30.5	43.5	13.0	
Hori	162.235	QP	37.7	15.6	8.8	32.0	-	30.1	43.5	13.4	
Hori	178.473	QP	32.9	16.2	9.0	32.0	-	26.1	43.5	17.4	
Hori	186.569	QP	32.0	16.3	9.0	32.0	-	25.3	43.5	18.2	
Hori	257.250	QP	40.8	12.0	9.6	31.9	-	30.5	46.0	15.5	
Hori	2483.500	PK	69.4	26.8	6.6	32.4	-	70.4	73.9	3.5	
Hori	4924.000	PK	41.7	31.4	8.7	31.3	-	50.5	73.9	23.4	
Hori	7386.000	PK	40.3	35.5	9.9	32.2	-	53.5	73.9	20.4	Floor noise
Hori	9848.000	PK	40.3	37.2	10.7	33.0	-	55.2	73.9	18.7	Floor noise
Hori	14772.000	PK	42.9	41.0	0.3	32.5	-	51.7	73.9	22.2	
Hori	19696.000	PK	43.9	36.9	-1.7	32.8	-	46.3	73.9	27.6	
Hori	24620.000	PK	46.1	38.9	-0.5	33.2	-	51.3	73.9	22.6	
Hori	2483.500	AV	49.2	26.8	6.6	32.4	1.3	51.5	53.9	2.4	*1)
Hori	4924.000	AV	31.5	31.4	8.7	31.3	1.3	41.6	53.9	12.3	
Hori	7386.000	AV	30.3	35.5	9.9	32.2	-	43.5	53.9	10.4	Floor noise
Hori	9848.000	AV	30.1	37.2	10.7	33.0	-	45.0	53.9	8.9	Floor noise
Hori	14772.000	AV	34.1	41.0	0.3	32.5	1.3	44.2	53.9	9.7	
Hori	19696.000	AV	35.8	36.9	-1.7	32.8	1.3	39.5	53.9	14.4	
Hori	24620.000	AV	37.9	38.9	-0.5	33.2	1.3	44.4	53.9	9.5	
Vert	50.000	QP	39.0	10.8	7.6	32.1	-	25.3	40.0	14.7	
Vert	64.484	QP	31.8	6.8	7.8	32.1	-	14.3	40.0	25.7	
Vert	82.892	QP	31.5	7.2	8.1	32.1	-	14.7	40.0	25.3	
Vert	143.995	QP	35.4	14.6	8.7	32.0	-	26.7	43.5	16.8	
Vert	162.273	QP	34.8	15.6	8.8	32.0	-	27.2	43.5	16.3	
Vert	558.500	QP	27.9	18.5	11.4	32.1	-	25.7	46.0	20.3	
Vert	2483.500	PK	68.5	26.8	6.6	32.4	-	69.5	73.9	4.4	
Vert	4924.000	PK	41.3	31.4	8.7	31.3	-	50.1	73.9	23.8	
Vert	7386.000	PK	39.8	35.5	9.9	32.2	-	53.0	73.9	20.9	Floor noise
Vert	9848.000	PK	40.3	37.2	10.7	33.0	-	55.2	73.9	18.7	Floor noise
Vert	14772.000	PK	43.8	41.0	0.3	32.5	-	52.6	73.9	21.3	
Vert	19696.000	PK	44.5	36.9	-1.7	32.8	-	46.9	73.9	27.0	
Vert	24620.000	PK	46.8	38.9	-0.5	33.2	-	52.0	73.9	21.9	
Vert	2483.500	AV	48.6	26.8	6.6	32.4	1.3	50.9	53.9	3.0	*1)
Vert	4924.000	AV	30.9	31.4	8.7	31.3	1.3	41.0	53.9	12.9	
Vert	7386.000	AV	30.1	35.5	9.9	32.2	-	43.3	53.9	10.6	Floor noise
Vert	9848.000	AV	30.3	37.2	10.7	33.0	-	45.2	53.9	8.7	Floor noise
Vert	14772.000	AV	35.8	41.0	0.3	32.5	1.3	45.9	53.9	8.0	
Vert	19696.000	AV	37.1	36.9	-1.7	32.8	1.3	40.8	53.9	13.1	
Vert	24620.000	AV	39.1	38.9	-0.5	33.2	1.3	45.6	53.9	8.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

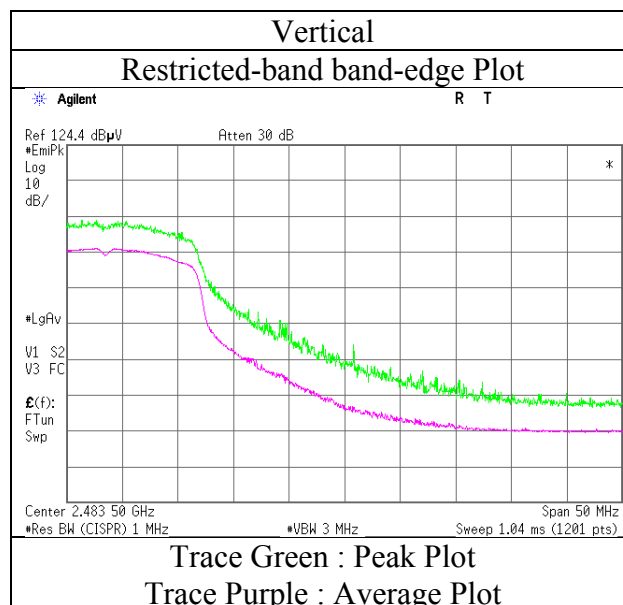
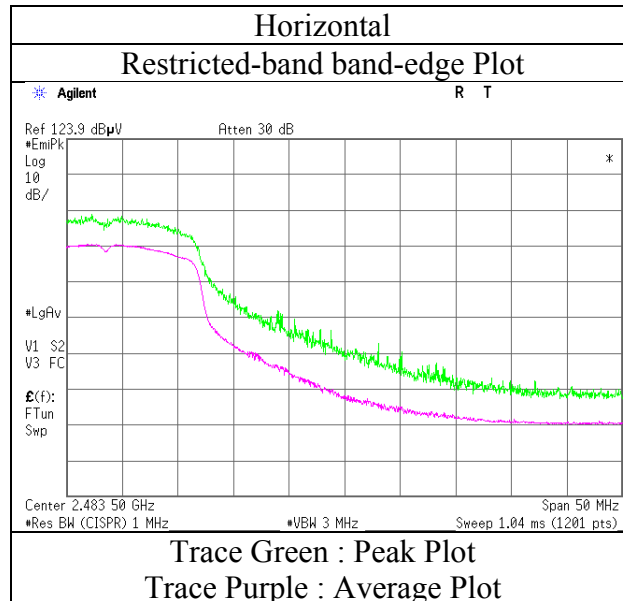
Distance factor: 1 GHz - 10 GHz 20log (4.3 m / 3.0 m) = 3.13 dB

10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11624584H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2017
Temperature / Humidity	21 deg. C / 59 % RH
Engineer	Shuichi Ohyama (1 GHz -10 GHz)
Mode	Tx 11g 2462 MHz



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

UL Japan, Inc.

Ise EMC Lab.

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Radiated Spurious Emission

Report No. 11624584H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date April 17, 2017
Temperature / Humidity 20 deg. C / 50 % RH
Engineer Tomoki Matsui
(1 GHz -10 GHz)
Mode Tx 11n-20 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2390.000	PK	68.0	26.7	6.5	32.4	-	68.8	73.9	5.1	
Hori	2390.000	AV	51.2	26.7	6.5	32.4	1.3	53.3	53.9	0.6	*1)
Vert	2390.000	PK	68.1	26.7	6.5	32.4	-	68.9	73.9	5.0	
Vert	2390.000	AV	51.1	26.7	6.5	32.4	1.3	53.2	53.9	0.7	*1)

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

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

Distance factor: 1 GHz - 10 GHz $20\log(4.3\text{ m} / 3.0\text{ m}) = 3.13\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

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	2412.000	PK	94.7	26.7	6.5	32.4	95.5	-	-	Carrier
Hori	2400.000	PK	66.2	26.7	6.5	32.4	67.0	75.5	8.5	
Vert	2412.000	PK	94.9	26.7	6.5	32.4	95.7	-	-	Carrier
Vert	2400.000	PK	65.3	26.7	6.5	32.4	66.1	75.7	9.6	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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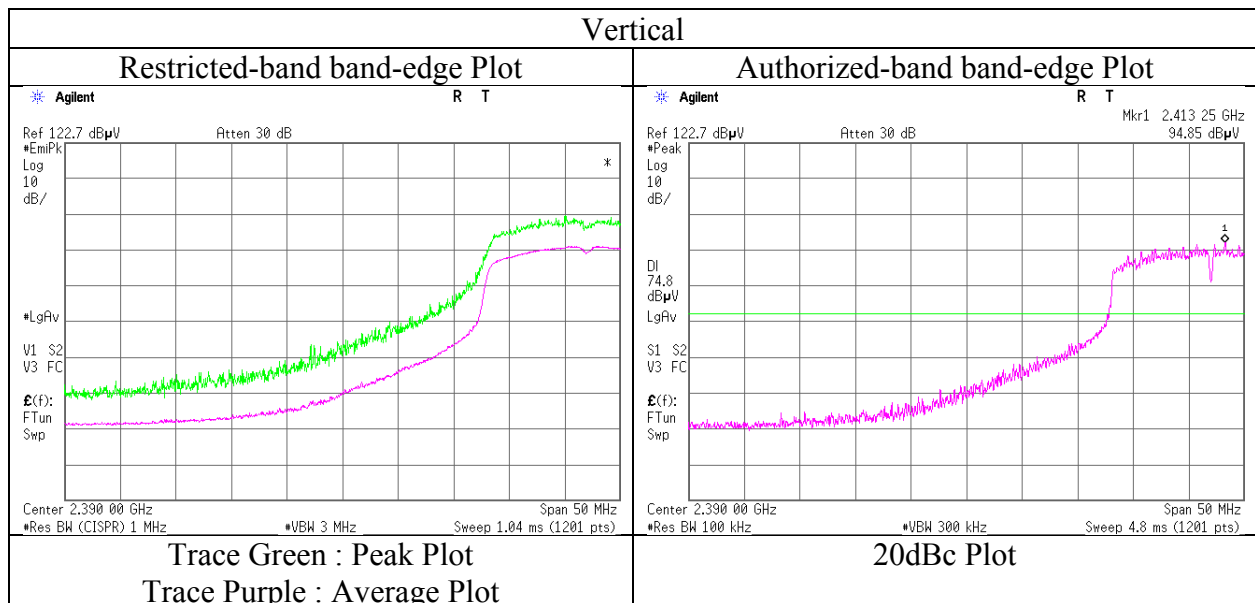
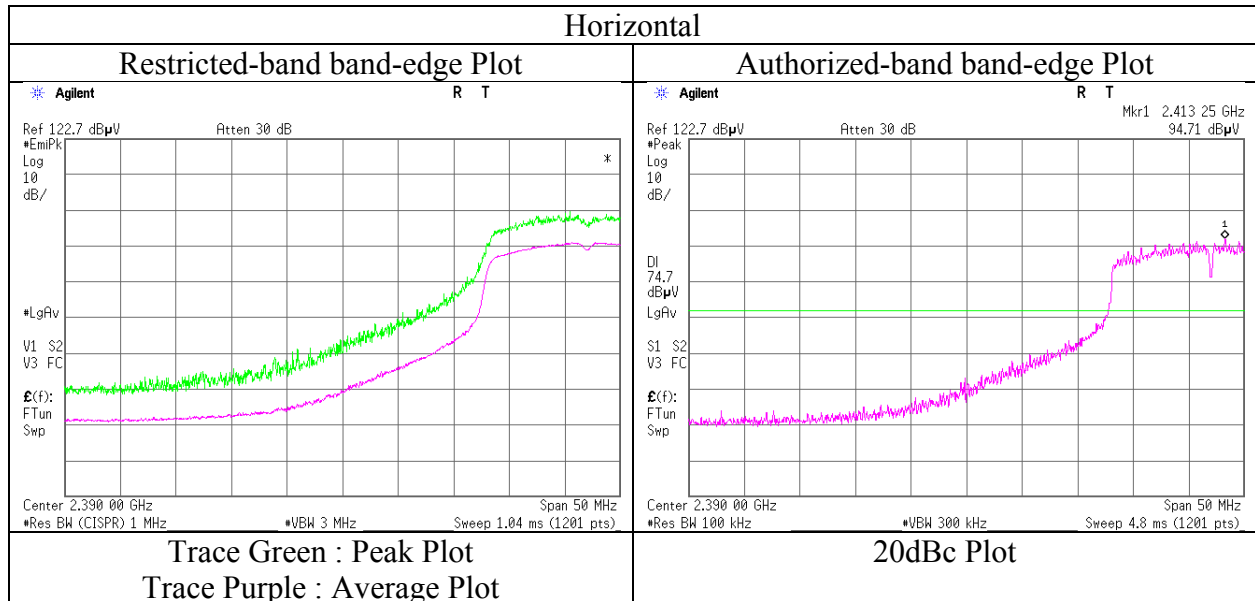
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11624584H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2017
Temperature / Humidity	20 deg. C / 50 % RH
Engineer	Tomoki Matsui
	(1 GHz -10 GHz)
Mode	Tx 11n-20 2412 MHz



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

Radiated Spurious Emission

Report No. 11624584H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date April 17, 2017
Temperature / Humidity 21 deg. C / 59 % RH
Engineer Shuichi Ohyama
(1 GHz -10 GHz)
Mode Tx 11n-20 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2483.500	PK	69.8	26.8	6.6	32.4	-	70.8	73.9	3.1	
Hori	2483.500	AV	50.6	26.8	6.6	32.4	1.3	52.9	53.9	1.0	*1)
Vert	2483.500	PK	68.6	26.8	6.6	32.4	-	69.6	73.9	4.3	
Vert	2483.500	AV	50.2	26.8	6.6	32.4	1.3	52.5	53.9	1.4	*1)

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

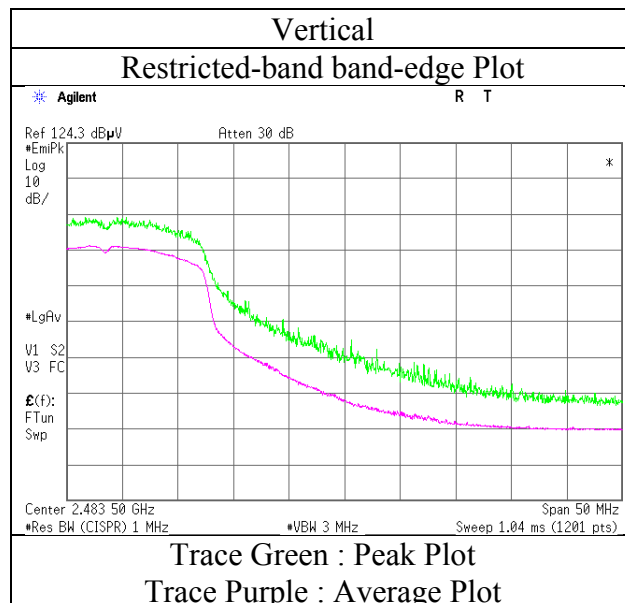
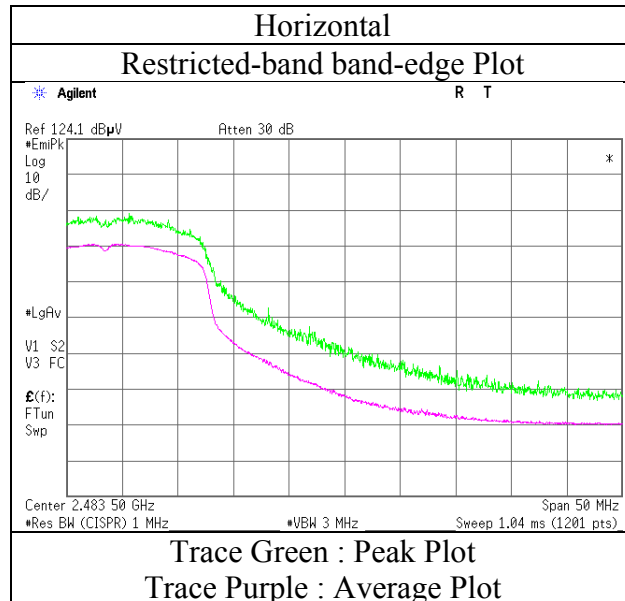
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (4.3 m / 3.0 m) = 3.13 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	11624584H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	April 17, 2017
Temperature / Humidity	21 deg. C / 59 % RH
Engineer	Shuichi Ohyama
	(1 GHz -10 GHz)
Mode	Tx 11n-20 2462 MHz



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

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Ise EMC Lab.

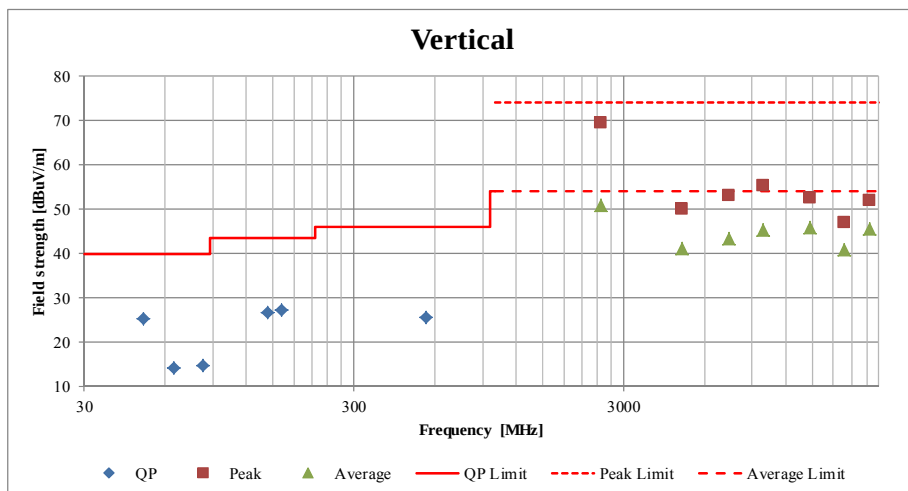
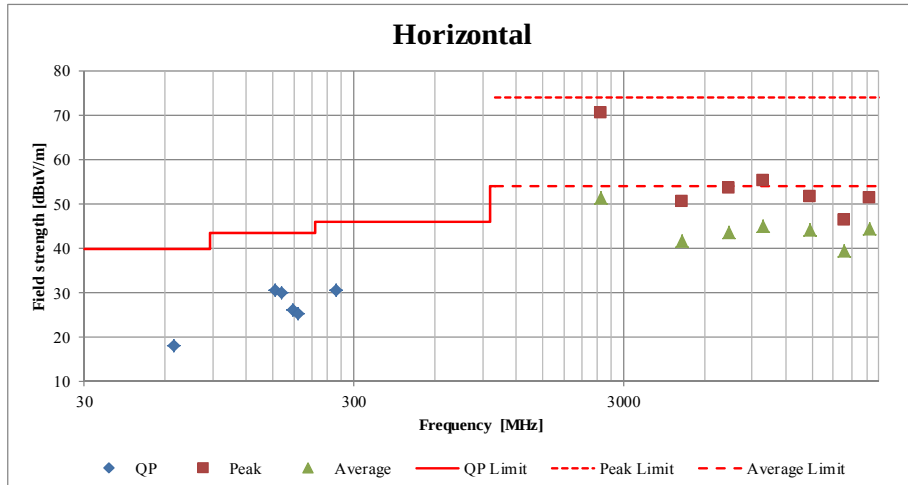
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Radiated Spurious Emission (Plot data, Worst case)

Report No.	11624584H	No.4	No.4
Test place	Ise EMC Lab.	April 22, 2017	April 23, 2017
Semi Anechoic Chamber	No.3	21 deg. C / 41 % RH	19 deg. C / 37 % RH
Date	April 17, 2017	Tomoki Matsui	Tomoki Matsui
Temperature / Humidity	21 deg. C / 59 % RH	(Below 1 GHz)	(Above 10 GHz)
Engineer	Shuichi Ohyama		
Mode	(1 GHz -10 GHz) Tx 11g 2462 MHz		



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

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Ise EMC Lab.

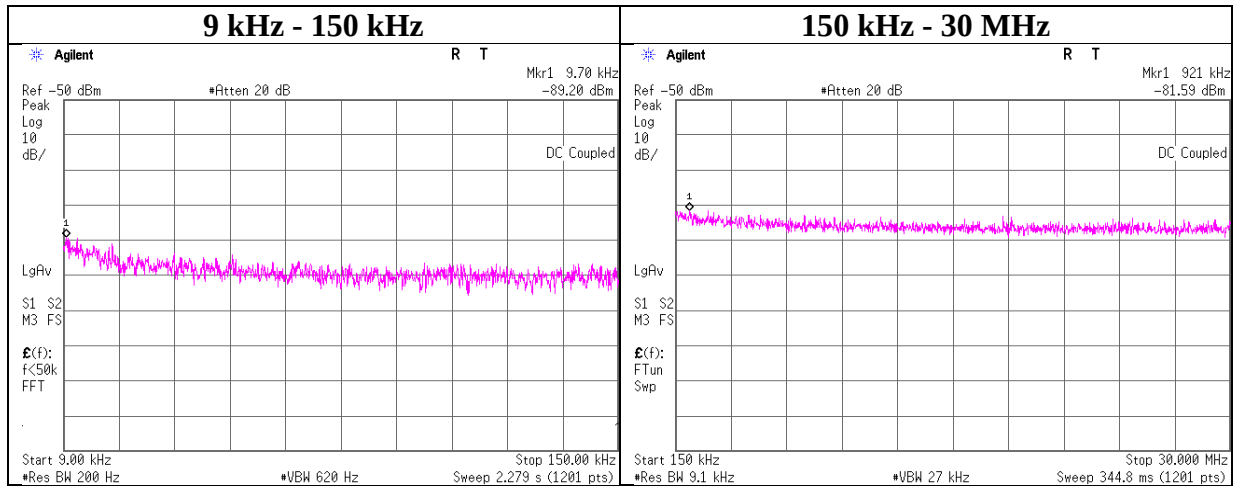
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Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11624584H
Date	April 18, 2017
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Takumi Shimada
Mode	Tx 11g 2462 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.70	-89.2	0.71	9.8	2.0	1	-76.7	300	6.0	-15.4	47.8	63.2	
921.00	-81.6	0.71	9.8	2.0	1	-69.0	30	6.0	12.2	28.3	16.1	

$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11624584H
Date	April 18, 2017
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Takumi Shimada
Mode	Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-18.90	2.07	9.48	-7.35	8.00	15.35
2437.00	-20.23	2.08	9.48	-8.67	8.00	16.67
2462.00	-21.00	2.09	9.48	-9.43	8.00	17.43

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-25.55	2.07	9.48	-14.00	8.00	22.00
2437.00	-24.50	2.08	9.48	-12.94	8.00	20.94
2462.00	-25.26	2.09	9.48	-13.69	8.00	21.69

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-25.85	2.07	9.48	-14.30	8.00	22.30
2437.00	-25.72	2.08	9.48	-14.16	8.00	22.16
2462.00	-25.47	2.09	9.48	-13.90	8.00	21.90

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.

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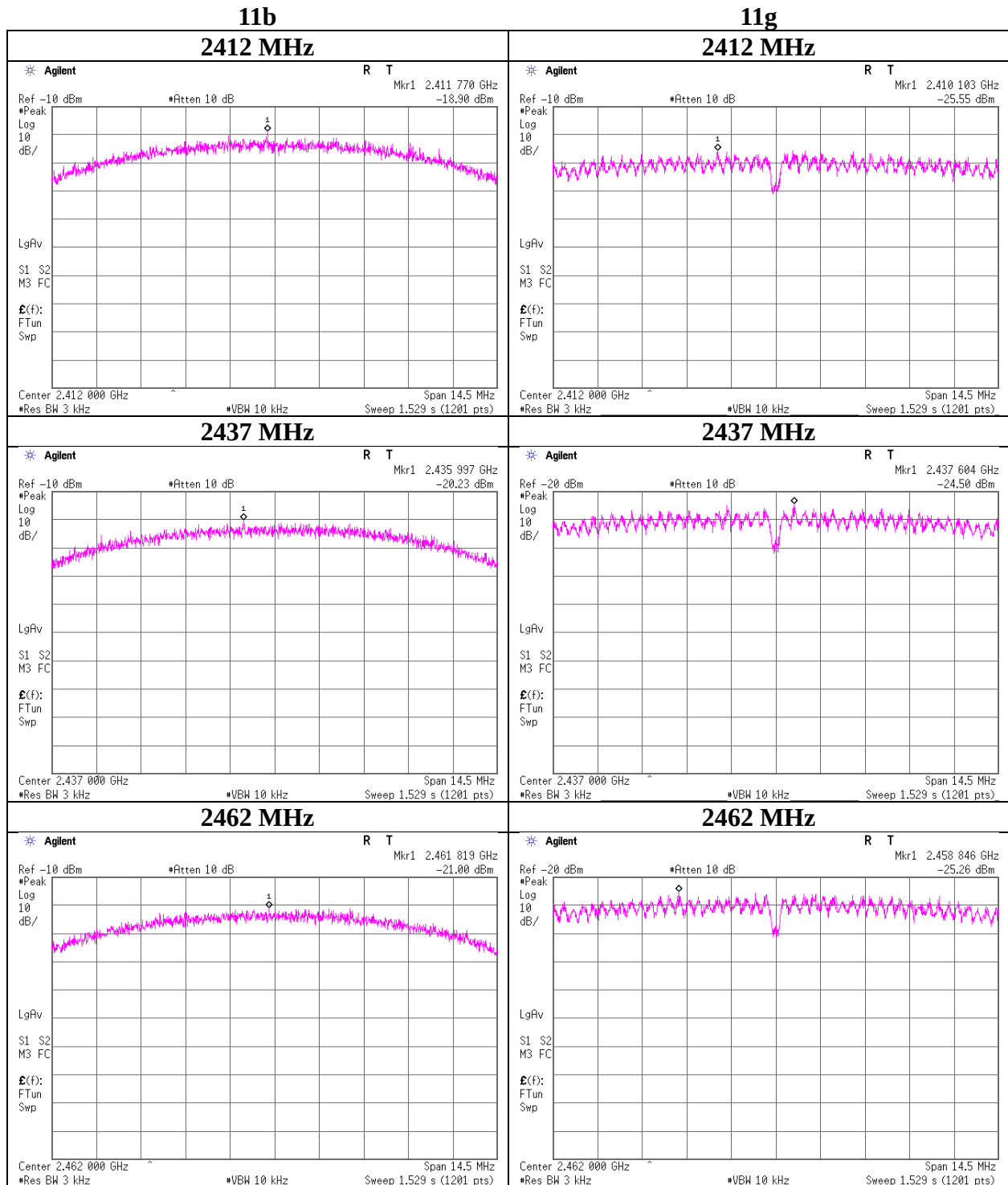
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Facsimile : +81 596 24 8124

Power Density



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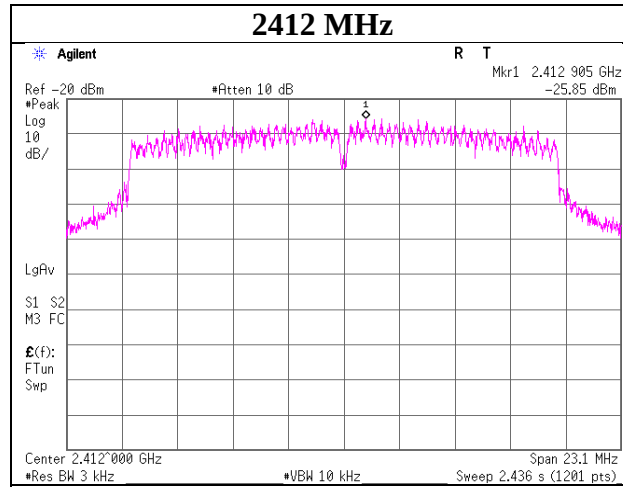
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

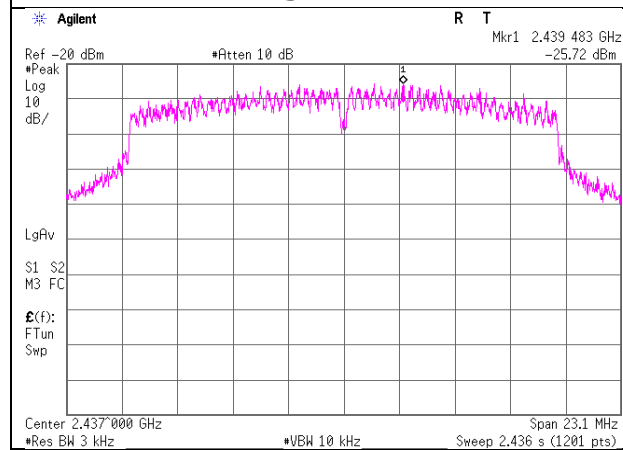
Power Density

11n-20

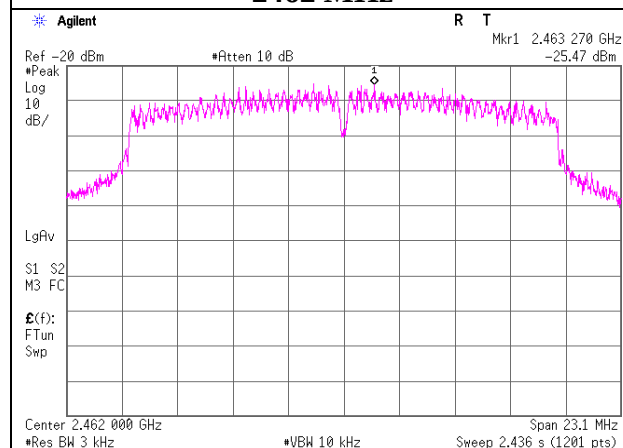
2412 MHz



2437 MHz



2462 MHz



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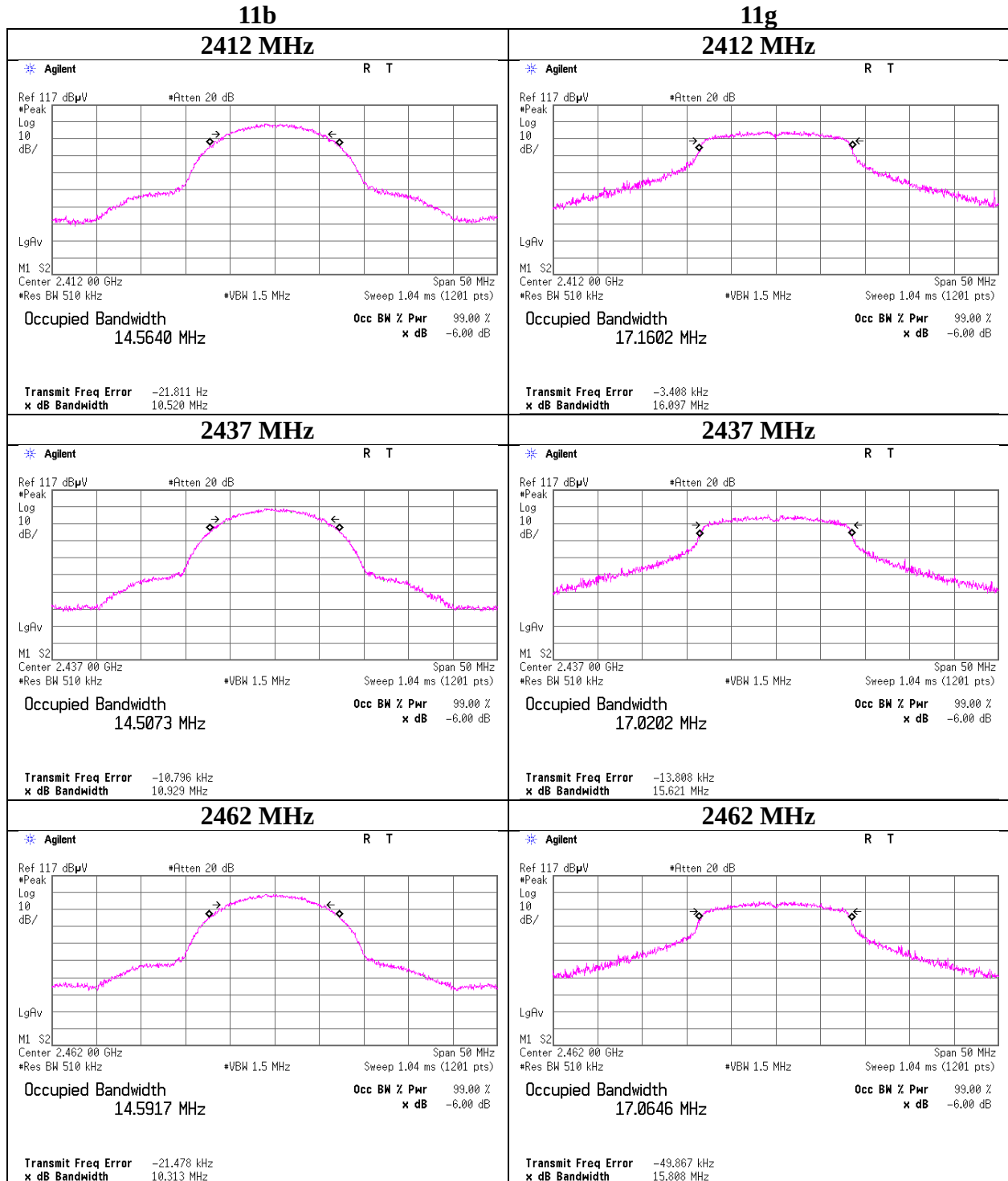
Telephone : +81 596 24 8999

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99% Occupied Bandwidth

Test place
Report No.
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.6 Measurement Room
11624584H
April 18, 2017
24 deg. C / 41 % RH
Takumi Shimada
Tx



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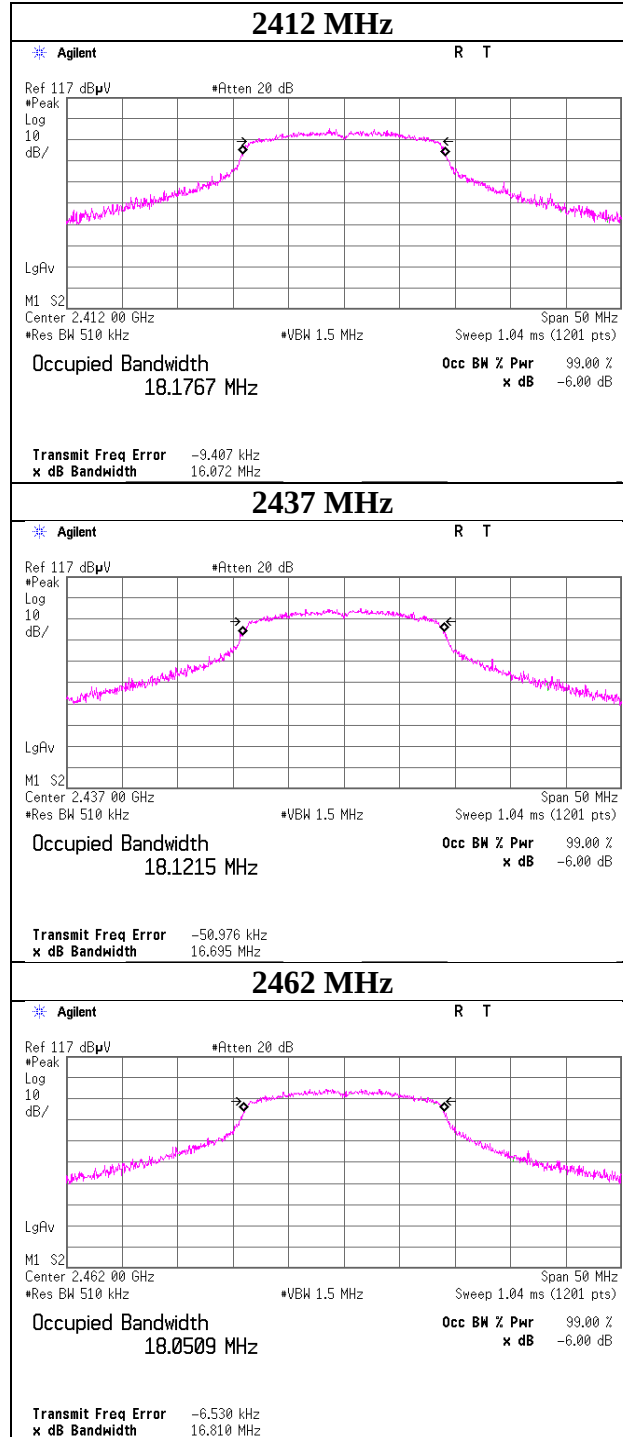
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	11624584H
Date	April 18, 2017
Temperature / Humidity	24 deg. C / 41 % RH
Engineer	Takumi Shimada
Mode	Tx

11n-20



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APPENDIX 2: Test instruments

Test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	CE	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	CE	2016/12/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE	2016/11/10 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2016/10/21 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE	2016/07/07 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/ 5D-2W(5m)/ 5D-2W(0.8m)/ 5D-2W(1m)	-	CE	2017/02/24 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2016/12/21 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	CE	2016/08/23 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2016/06/06 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2016/06/06 * 12
MAT-90	Attenuator	Weinschel Associates	WA56-10	56100306	AT	2016/06/09 * 12
MOS-29	Thermo-Hygrometer	Custom	CTH-201	2901	AT	2017/01/20 * 12
MCC-66	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28636/2	AT	2017/04/04 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	AT	2017/03/24 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2016/11/28 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2017/01/20 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/20 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	RE	2017/02/21 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2016/05/29 * 12 *1)
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2016/05/20 * 12 *1)
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2017/03/21 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2017/01/19 * 12
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2016/09/21 * 12
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2016/10/19 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2017/01/20 * 12
MJM-26	Measure	KOMELON	KMC-36	-	RE	-
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2017/01/12 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2016/11/23 * 12
MLA-23	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-192	RE	2017/01/26 * 12

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Test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2016/06/20 * 12
MAT-97	Attenuator	KEYSIGHT	8491A	MY52462282	RE	2016/10/31 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2017/03/27 * 12
MMM-10	DIGITAL HiTESTER	Hioki	3805	051201148	RE	2017/01/19 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2016/08/17 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2016/09/28 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2016/06/21 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	00650	RE	2016/10/21 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2016/06/24 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2016/09/19 * 12

***1) This test equipment was used for the tests before the expiration date of the calibration.**

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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