



RADIO TEST REPORT

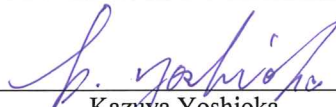
Test Report No. : 10517044H-A-R1

Applicant : silex technology, Inc.
Type of Equipment : Low power IoT wireless LAN module
Model No. : SX-ULPAN
FCC ID : N6C-SXULPAN
Test regulation : FCC Part 15 Subpart C: 2015
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)
7. This report is a revised version of 10517044H-A. 10517044H-A is replaced with this report.

Date of test: November 19, 2014 to January 13, 2015

Representative test engineer:


Kazuya Yoshioka
Engineer
Consumer Technology Division

Approved by:


Takahiro Hatakeda
Leader
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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>

UL Japan, Inc.

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REVISION HISTORY

Original Test Report No.: 10517044H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10517044H-A	February 2, 2015	-	-
1	10517044H-A-R1	February 5, 2015	P.6	Correction of FCC Part 15.203/212 Antenna requirement sentence in section 3.2

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SECTION 1: Customer information

Company Name : silex technology, Inc.
Address : 2-3-1 Hikaridai, Seika-cho, Kyoto 619-0237, Japan
Telephone Number : +81-774-98-3878
Facsimile Number : +81-774-98-3758
Contact Person : Toshiro Kometani

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

2.1 Identification of E.U.T.

Type of Equipment : Low power IoT wireless LAN module
Model No. : SX-ULPAN
Serial No. : Refer to Clause 5.2
Rating : DC3.3V
Receipt Date of Sample : September 22, 2014
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 No: SX-ULPAN (referred to as the EUT in this report) is the Low power IoT wireless LAN module.

General Specification

Clock frequency(ies) in the system : 40MHz

Radio Specification

Radio Type : Transceiver
Method of Frequency Generation : Synthesizer
Power Supply (inner) : DC1.2V

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Radio Specification

	IEEE802.11b	IEEE802.11g	IEEE802.11a	IEEE802.11n (20 M band)
Frequency of operation	2412-2462MHz *1)	2412-2462MHz *1)	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	2412-2462MHz *1) 5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)	
Channel spacing	5MHz		20MHz	<u>2.4GHz band</u> 5MHz <u>5GHz band</u> 20MHz
Antenna type	External printed PCB antenna / On board printed PCB antenna			
Antenna Gain: G _{ANT}	<u>External printed PCB antenna</u> 1.8dBi@2.4GHz band, 3.9dBi@5GHz band <u>On board printed PCB antenna</u> 2.1dBi@2.4GHz band, 2.2dBi@5GHz band			
Antenna Connector type	U.FL Alternative connector			

*1) 2412-2462MHz is applied for this test report.

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 16.7dB, 0.15435MHz, N AV 27.7dB, 0.35155MHz, N	Complied	-
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on June 5, 2014)" ----- IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 8.9 RSS-Gen 8.10	1.2dB 4874.000MHz, AV, Hori.	Complied	Conducted/ Radiated

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 15.31 (e)

The RF Module has own regulator.

The RF Module is constantly provided voltage through own regulator regardless of input voltage (DC3.3V).

Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The EUT has a unique antenna connector (U.FL on the Module).

Therefore the equipment complies with the requirement of 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 report meets the limits unless the uncertainty is taken into consideration.

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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.

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)	11Mbps, PN9
IEEE 802.11g (11g)	36Mbps, PN9
IEEE 802.11n 20MHz BW (11n-20)	MCS 3, 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 Setting: 11b: 2412MHz 14.5, 2437MHz 13.5, 2462MHz 12.5 11g: 2412MHz 13.0, 2437MHz 14.0, 2462MHz 11.0 11n-20: 2412MHz 12.5, 2437MHz 15.0, 2462MHz 10.5 - Software: ART2 Ver.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.	

<2.4GHz band>

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	11n-20 Tx *1)	2437MHz *1)
Radiated Spurious Emission (Below 1GHz)	11n-20 Tx *1)	2437MHz *1)
Radiated Spurious Emission (Above 1GHz)	11b Tx 11n-20 Tx *2)	2412MHz 2437MHz 2462MHz
Conducted Spurious Emission	11n-20 Tx *1)	2437MHz *1)
6dB Bandwidth Maximum Peak Output Power Average Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412MHz 2437MHz 2462MHz

*1) The operating mode and tested frequency were tested as a representative, because it had the highest 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.

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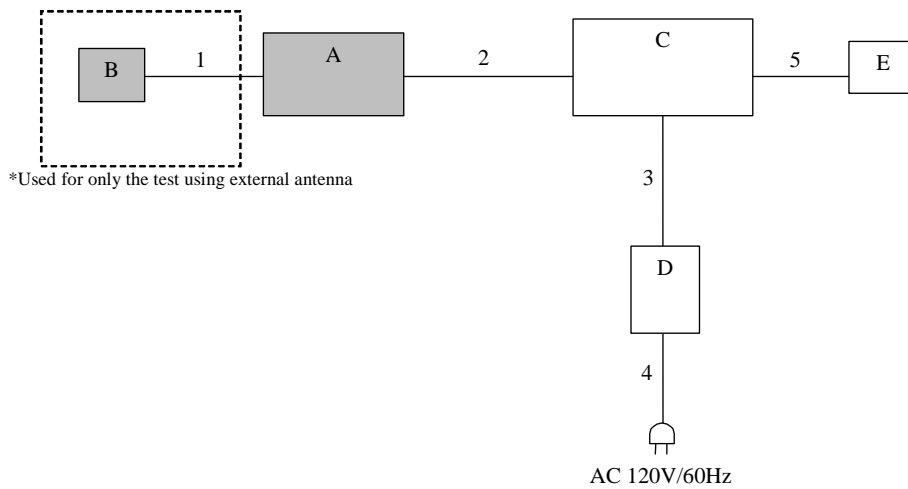
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4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Low power IoT wireless LAN module	SX-ULPAN	ES2-12	silex technology, Inc.	EUT
B	Antenna	Unictron	AA258	silex technology, Inc.	EUT
C	Laptop PC	E6510	SX00804	DELL	-
D	AC Adapter	LA90PE0-01	CN-03T6XF-71615-1AK0927-A001	DELL	-
E	Mouse	M056UC	F19010K9	DELL	*1)

*1) Used for Conducted emission test only

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.15	Shielded	Shielded	-
2	USB Cable	1.5	Shielded	Shielded	-
3	DC Cable	1.8	Shielded	Shielded	-
4	AC Cable	0.9	Unshielded	Unshielded	-
5	Mouse Cable	1.8	Shielded	Shielded	*1)

*1) Used for Conducted emission test only

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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

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)".

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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	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 *1)	PK
IF Bandwidth	BW 120kHz	RBW: 1MHz VBW: 3MHz	Average Power Method: <u>WLAN: 12.2.5</u> RBW: 1MHz VBW: 3MHz Detector: Power Averaging (RMS) Trace: at least 100 traces	RBW: 100kHz VBW: 300kHz
Test Distance	3m	3m (below 10GHz), 1m *2) (above 10GHz)		3m (below 10GHz), 1m *2) (above 10GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)"

*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 (Antenna and Module) 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
6dB Bandwidth	20MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 5% of OBW	Three times of RBW	Auto	Peak	Max Hold*1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50MHz BW)
Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

*1) The measurement was performed with Max Hold since the duty cycle was not 100%.
*2) Reference data
*3) Section 10.2 Method PKPSD (peak PSD) of "558074 D01 DTS Meas Guidance v03r02 (Issued on June 5, 2014)".
*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 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

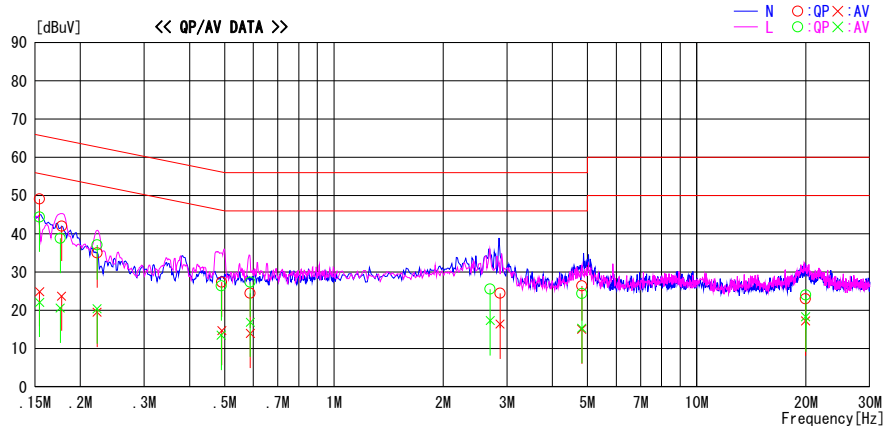
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
Date : 2014/12/25

Report No. : 10517044H
 Temp./Humi. : 23deg. C / 29% RH
 Engineer : Tsubasa Takayama

Mode / Remarks : Tx 11n-20 2437MHz Internal antenna

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]	
0.15435	35.9	11.7	13.2	49.1	24.9	65.8	55.8	16.7	30.9	N
0.17755	28.8	10.5	13.2	42.0	23.7	64.6	54.6	22.6	30.9	N
0.22250	21.8	6.3	13.2	35.0	19.5	62.7	52.7	27.7	33.2	N
0.49075	14.2	1.5	13.2	27.4	14.7	56.2	46.2	28.8	31.5	N
0.58790	11.2	0.7	13.3	24.5	14.0	56.0	46.0	31.5	32.0	N
2.86959	11.0	2.9	13.5	24.5	16.4	56.0	46.0	31.5	29.6	N
4.81964	12.6	1.3	13.8	26.4	15.1	56.0	46.0	29.6	30.9	N
19.94161	8.2	2.4	14.8	23.0	17.2	60.0	50.0	37.0	32.8	N
0.15435	31.2	8.9	13.2	44.4	22.1	65.8	55.8	21.4	33.7	L
0.17610	25.6	7.4	13.2	38.8	20.6	64.7	54.7	25.9	34.1	L
0.22250	23.9	7.2	13.2	37.1	20.4	62.7	52.7	25.6	32.3	L
0.48930	13.2	0.3	13.2	26.4	13.5	56.2	46.2	29.8	32.7	L
0.58790	14.1	3.6	13.3	27.4	16.9	56.0	46.0	28.6	29.1	L
2.69520	12.1	3.8	13.5	25.6	17.3	56.0	46.0	30.4	28.7	L
4.81964	10.6	1.5	13.8	24.4	15.3	56.0	46.0	31.6	30.7	L
19.97502	9.2	3.5	14.8	24.0	18.3	60.0	50.0	36.0	31.7	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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Conducted Emission

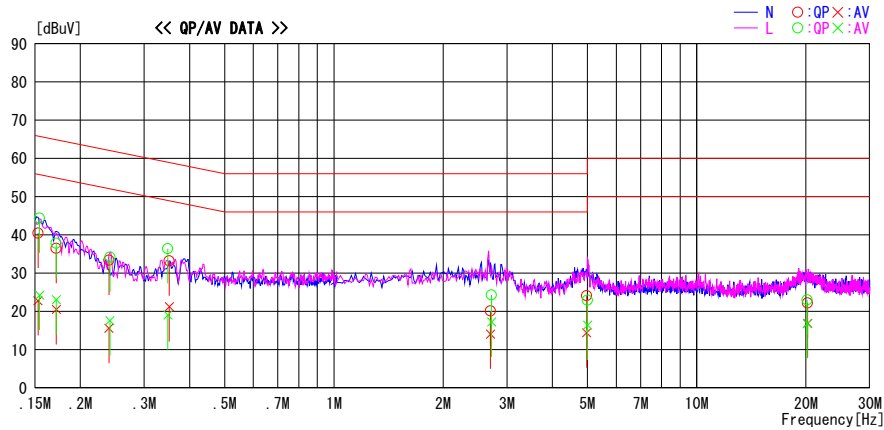
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
 Date : 2014/12/25

Report No. : 10517044H
 Temp./Humi. : 23deg. C / 29% RH
 Engineer : Tsubasa Takayama

Mode / Remarks : Tx 11n-20 2437MHz External antenna

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]	
0.15290	27.3	9.6	13.2	40.5	22.8	65.8	55.8	25.3	33.0	N
0.17175	23.3	7.3	13.2	36.5	20.5	64.9	54.9	28.4	34.4	N
0.23990	20.2	2.4	13.2	33.4	15.6	62.1	52.1	28.7	36.5	N
0.35155	20.0	8.0	13.2	33.2	21.2	58.9	48.9	25.7	27.7	N
2.70330	6.6	0.6	13.5	20.1	14.1	56.0	46.0	35.9	31.9	N
4.97081	10.3	0.6	13.8	24.1	14.4	56.0	46.0	31.9	31.6	N
20.20894	7.4	2.1	14.8	22.2	16.9	60.0	50.0	37.8	33.1	N
0.15435	31.2	11.0	13.2	44.4	24.2	65.8	55.8	21.4	31.6	L
0.17175	24.6	9.9	13.2	37.8	23.1	64.9	54.9	27.1	31.8	L
0.24135	21.0	4.4	13.2	34.2	17.6	62.0	52.0	27.8	34.4	L
0.34865	23.2	5.9	13.2	36.4	19.1	59.0	49.0	22.6	29.9	L
2.71842	10.8	3.7	13.5	24.3	17.2	56.0	46.0	31.7	28.8	L
5.00104	9.1	2.6	13.8	22.9	16.4	60.0	50.0	37.1	33.6	L
20.17552	8.2	2.0	14.8	23.0	16.8	60.0	50.0	37.0	33.2	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.

6dB Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10517044H
Date 11/26/2014
Temperature/ Humidity 22 deg. C / 47% RH
Engineer Kazuya Yoshioka
Mode 11b Tx / 11g Tx / 11n-20 Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	10.380	>500
2437	10.524	>500
2462	10.455	>500

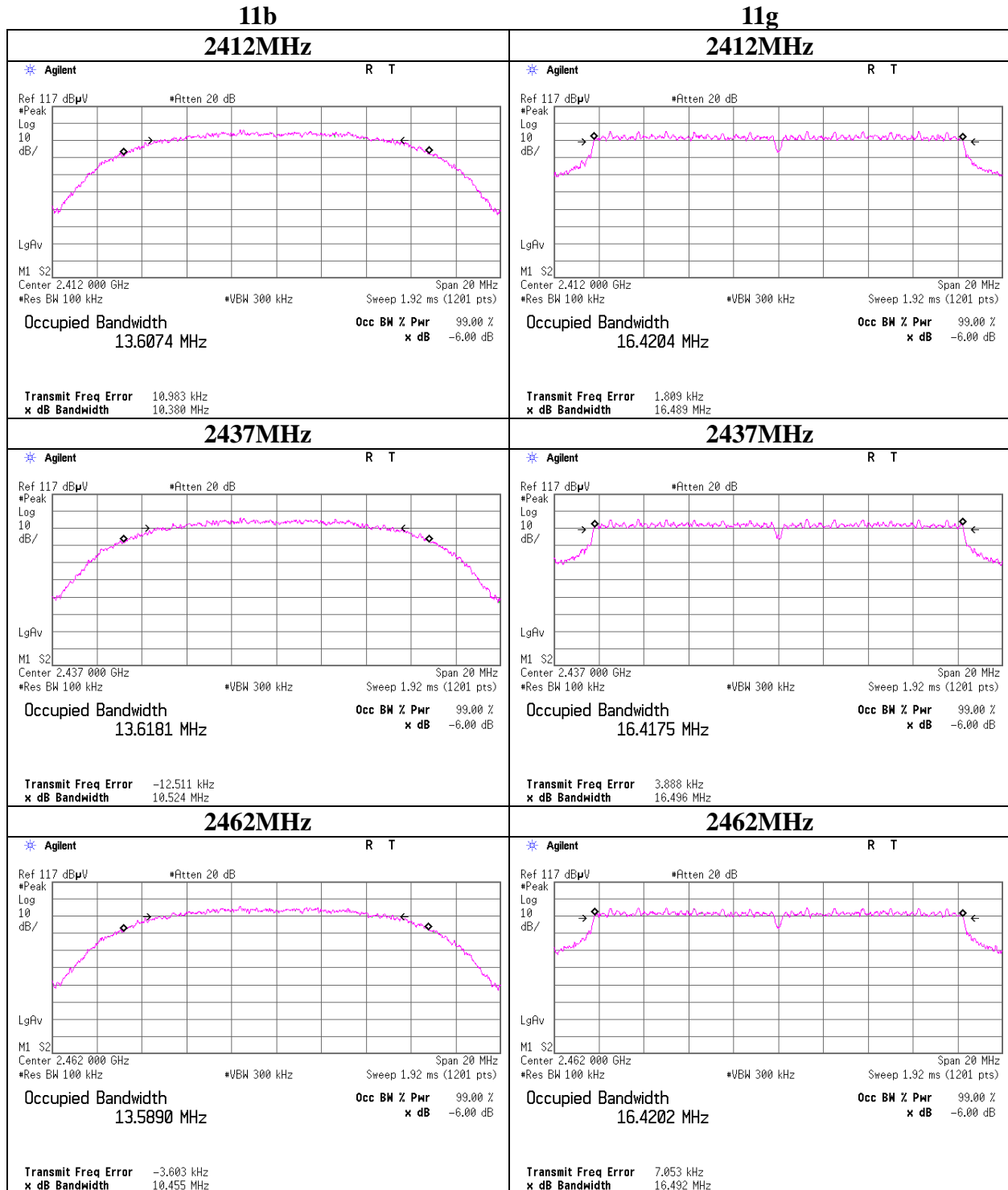
11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	16.489	>500
2437	16.496	>500
2462	16.492	>500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	17.688	>500
2437	17.710	>500
2462	17.703	>500

6dB Bandwidth



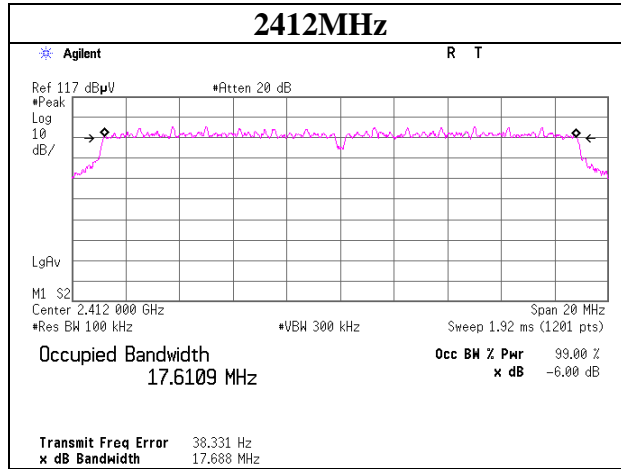
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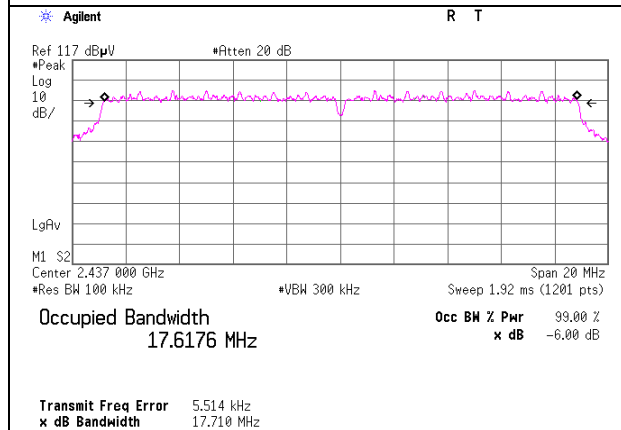
6dB Bandwidth

11n-20

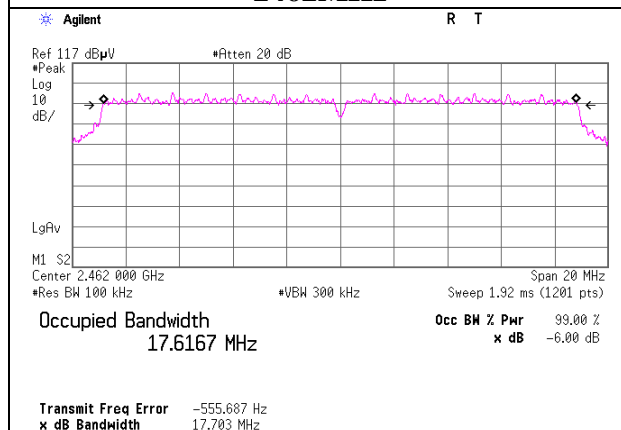
2412MHz



2437MHz



2462MHz



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Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room	
Report No.	10517044H	
Date	11/19/2014	01/06/2015
Temperature/ Humidity	22 deg. C / 30% RH	20 deg. C / 50% RH
Engineer	Yuta Moriya	Kenshi Shimomura
Mode	11b Tx	

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	5.94	0.77	10.04	16.75	47.32	30.00	1000	13.25
2437	5.00	0.77	10.04	15.81	38.11	30.00	1000	14.19
2462	3.82	0.77	10.04	14.63	29.04	30.00	1000	15.37

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [Mbps]	Reading [dBm]	Guard Interval	Remark
1	5.74	long	
2	5.94	long	
2	5.65	short	
5.5	5.47	long	
5.5	5.53	short	
11	6.14	long	*
11	6.06	short	

*: Worst Rate

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

Difference between worst rate check data and formal test result is due to the different test condition.

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Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room	
Report No.	10517044H	
Date	11/19/2014	01/06/2015
Temperature/ Humidity	22 deg. C / 30% RH	20 deg. C / 50% RH
Engineer	Yuta Moriya	Kenshi Shimomura
Mode	11g Tx	

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	12.35	0.77	10.04	23.16	207.01	30.00	1000	6.84
2437	13.03	0.77	10.04	23.84	242.10	30.00	1000	6.16
2462	10.70	0.77	10.04	21.51	141.58	30.00	1000	8.49

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
6	11.11	
9	10.89	
12	11.03	
18	11.05	
24	13.02	
36	13.14	*
48	12.41	
54	12.28	

*: Worst Rate

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

Difference between worst rate check data and formal test result is due to the different test condition.

Maximum Peak Output Power

Test place	Ise EMC Lab. No.6 Measurement Room	
Report No.	10517044H	
Date	11/19/2014	01/06/2015
Temperature/ Humidity	22 deg. C / 30% RH	20 deg. C / 50% RH
Engineer	Yuta Moriya	Kenshi Shimomura
Mode	11n-20 Tx	

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	12.17	0.77	10.04	22.98	198.61	30.00	1000	7.02
2437	13.60	0.77	10.04	24.41	276.06	30.00	1000	5.59
2462	10.55	0.77	10.04	21.36	136.77	30.00	1000	8.64

Sample Calculation:
Result = Reading + Cable Loss + Attenuator

2437MHz

Rate [MCS]	Reading [dBm]	Guard Interval	Remark
0	11.06	long	
1	10.94	long	
2	10.92	long	
3	13.20	long	*
4	13.10	long	
5	12.45	long	
6	12.31	long	
7	12.25	long	
0	10.97	short	
1	10.95	short	
2	11.02	short	
3	13.14	short	
4	13.08	short	
5	12.22	short	
6	12.28	short	
7	12.24	short	

*: Worst Rate

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

Difference between worst rate check data and formal test result is due to the different test condition.

Average Output Power

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10517044H
Date	01/06/2015
Temperature/ Humidity	20 deg. C / 50% RH
Engineer	Kenshi Shimomura
Mode	11b Tx / 11g Tx / 11n-20 Tx

[AV]

11b **11Mbps Long GI**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	3.24	0.77	10.04	14.05	25.41	30.00	1000	15.95
2437	2.20	0.77	10.04	13.01	20.00	30.00	1000	16.99
2462	1.07	0.77	10.04	11.88	15.42	30.00	1000	18.12

11g **36Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.45	0.77	10.04	12.26	16.83	30.00	1000	17.74
2437	2.54	0.77	10.04	13.35	21.63	30.00	1000	16.65
2462	-0.92	0.77	10.04	9.89	9.75	30.00	1000	20.11

11n-20 **MCS3 Long GI**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2412	1.16	0.77	10.04	11.97	15.74	30.00	1000	18.03
2437	3.65	0.77	10.04	14.46	27.93	30.00	1000	15.54
2462	-1.02	0.77	10.04	9.79	9.53	30.00	1000	20.21

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber	
Report No.	10517044H	
Date	12/22/2014	12/24/2014
Temperature/ Humidity	22 deg. C / 38% RH	22 deg. C / 30% RH
Engineer	Satofumi Matsuyama	Tomohisa Nakagawa
	(1-10GHz)	(Above 10GHz)
Mode	External Antenna 11b Tx 2412MHz	

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	54.6	27.0	3.5	34.7	-	50.4	73.9	23.5	
Hori	4824.000	PK	51.7	31.9	5.8	33.9	-	55.5	73.9	18.4	
Hori	7236.000	PK	42.5	35.7	7.1	33.8	-	51.5	73.9	22.4	Floor Noise
Hori	12060.000	PK	44.2	39.5	-2.0	33.6	-	48.1	73.9	25.8	Floor Noise
Hori	14472.000	PK	44.1	40.8	-1.8	32.5	-	50.6	73.9	23.3	Floor Noise
Hori	16884.000	PK	45.3	40.1	-0.8	32.6	-	52.0	73.9	21.9	Floor Noise
Hori	2390.000	AV	46.6	27.0	3.5	34.7	0.2	42.6	53.9	11.4	*1)
Hori	4824.000	AV	43.8	31.9	5.8	33.9	0.2	47.8	53.9	6.2	
Hori	7236.000	AV	34.5	35.7	7.1	33.8	-	43.5	53.9	10.4	Floor Noise
Hori	12060.000	AV	34.0	39.5	-2.0	33.6	-	37.9	53.9	16.0	Floor Noise
Hori	14472.000	AV	34.3	40.8	-1.8	32.5	-	40.8	53.9	13.1	Floor Noise
Hori	16884.000	AV	35.1	40.1	-0.8	32.6	-	41.8	53.9	12.1	Floor Noise
Vert	2390.000	PK	53.9	27.0	3.5	34.7	-	49.7	73.9	24.2	
Vert	4824.000	PK	54.9	31.9	5.8	33.9	-	58.7	73.9	15.2	
Vert	7236.000	PK	42.8	35.7	7.1	33.8	-	51.8	73.9	22.1	Floor Noise
Vert	12060.000	PK	43.6	39.5	-2.0	33.6	-	47.5	73.9	26.4	Floor Noise
Vert	14472.000	PK	44.3	40.8	-1.8	32.5	-	50.8	73.9	23.1	Floor Noise
Vert	16884.000	PK	44.3	40.1	-0.8	32.6	-	51.0	73.9	22.9	Floor Noise
Vert	2390.000	AV	46.2	27.0	3.5	34.7	0.2	42.2	53.9	11.8	*1)
Vert	4824.000	AV	46.8	31.9	5.8	33.9	0.2	50.8	53.9	3.2	
Vert	7236.000	AV	34.5	35.7	7.1	33.8	-	43.5	53.9	10.4	Floor Noise
Vert	12060.000	AV	34.5	39.5	-2.0	33.6	-	38.4	53.9	15.5	Floor Noise
Vert	14472.000	AV	35.1	40.8	-1.8	32.5	-	41.6	53.9	12.3	Floor Noise
Vert	16884.000	AV	35.4	40.1	-0.8	32.6	-	42.1	53.9	11.8	Floor Noise

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

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

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

*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	105.6	27.0	3.5	34.7	101.4	-	-	Carrier
Hori	2400.000	PK	57.2	27.0	3.5	34.7	53.0	81.4	28.4	
Hori	9648.000	PK	39.5	38.1	8.1	34.4	51.3	81.4	30.1	
Vert	2412.000	PK	104.5	27.0	3.5	34.7	100.3	-	-	Carrier
Vert	2400.000	PK	56.7	27.0	3.5	34.7	52.5	80.3	27.8	
Vert	9648.000	PK	44.1	38.1	8.1	34.4	55.9	80.3	24.4	

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. : 10517044H
Date : 12/22/2014 12/24/2014
Temperature/ Humidity : 22 deg. C / 38% RH 22 deg. C / 30% RH
Engineer : Satofumi Matsuyama Tomohisa Nakagawa
(1-10GHz) (Above 10GHz)
Mode : External Antenna 11b Tx 2437MHz

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	53.1	32.0	5.9	33.9	-	57.1	73.9	16.8	
Hori	7311.000	PK	42.5	35.8	7.1	33.8	-	51.6	73.9	22.3	Floor Noise
Hori	9748.000	PK	46.1	38.3	8.1	34.5	-	58.0	73.9	15.9	
Hori	12185.000	PK	43.4	39.5	-2.0	33.5	-	47.4	73.9	26.5	Floor Noise
Hori	14622.000	PK	44.2	41.0	-1.6	32.6	-	51.0	73.9	22.9	Floor Noise
Hori	17059.000	PK	44.8	40.8	-0.8	32.5	-	52.3	73.9	21.6	Floor Noise
Hori	4874.000	AV	45.1	32.0	5.9	33.9	0.2	49.3	53.9	4.7	
Hori	7311.000	AV	34.6	35.8	7.1	33.8	-	43.7	53.9	10.2	Floor Noise
Hori	9748.000	AV	37.6	38.3	8.1	34.5	0.2	49.7	53.9	4.3	
Hori	12185.000	AV	33.8	39.5	-2.0	33.5	-	37.8	53.9	16.1	Floor Noise
Hori	14622.000	AV	34.2	41.0	-1.6	32.6	-	41.0	53.9	12.9	Floor Noise
Hori	17059.000	AV	35.0	40.8	-0.8	32.5	-	42.5	53.9	11.4	Floor Noise
Vert	4874.000	PK	54.5	32.0	5.9	33.9	-	58.5	73.9	15.4	
Vert	7311.000	PK	42.7	35.8	6.3	33.8	-	51.0	73.9	22.9	Floor Noise
Vert	9748.000	PK	47.3	38.3	8.1	34.5	-	59.2	73.9	14.7	
Vert	12185.000	PK	43.0	39.5	-2.0	33.5	-	47.0	73.9	26.9	Floor Noise
Vert	14622.000	PK	43.9	41.0	-1.6	32.6	-	50.7	73.9	23.2	Floor Noise
Vert	17059.000	PK	44.3	40.8	-0.8	32.5	-	51.8	73.9	22.1	Floor Noise
Vert	4874.000	AV	47.4	32.0	5.9	33.9	0.2	51.6	53.9	2.3	
Vert	7311.000	AV	34.6	35.8	7.1	33.8	-	43.7	53.9	10.2	Floor Noise
Vert	9748.000	AV	38.7	38.3	8.1	34.5	0.2	50.8	53.9	3.2	
Vert	12185.000	AV	33.7	39.5	-2.0	33.5	-	37.7	53.9	16.2	Floor Noise
Vert	14622.000	AV	35.1	41.0	-1.6	32.6	-	41.9	53.9	12.0	Floor Noise
Vert	17059.000	AV	35.1	40.8	-0.8	32.5	-	42.6	53.9	11.3	Floor Noise

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

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

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

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 and No.3 Semi Anechoic Chamber
Report No. 10517044H
Date 12/22/2014 12/23/2014 Night 12/24/2014
Temperature/ Humidity 22 deg. C / 38% RH 24deg. C / 31% RH 22 deg. C / 30% RH
Engineer Satofumi Matsuyama Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) (Below 1GHz) (Above 10GHz)
Mode External Antenna 11b Tx 2462MHz

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	54.4	26.9	3.5	34.7	-	50.1	73.9	23.8	
Hori	4924.000	PK	52.8	32.1	5.9	33.9	-	56.9	73.9	17.0	
Hori	7386.000	PK	43.8	35.8	7.1	33.8	-	52.9	73.9	21.0	Floor Noise
Hori	9848.000	PK	42.8	38.5	8.1	34.5	-	54.9	73.9	19.0	Floor Noise
Hori	12310.000	PK	43.8	39.5	-1.9	33.4	-	48.0	73.9	25.9	Floor Noise
Hori	14772.000	PK	44.3	41.1	-1.6	32.7	-	51.1	73.9	22.8	Floor Noise
Hori	17234.000	PK	44.4	42.3	-0.7	32.5	-	53.5	73.9	20.4	Floor Noise
Hori	2483.500	AV	46.5	26.9	3.5	34.7	0.2	42.4	53.9	11.6	*1)
Hori	4924.000	AV	44.8	32.1	5.9	33.9	0.2	49.1	53.9	4.8	
Hori	7386.000	AV	34.8	35.8	7.1	33.8	-	43.9	53.9	10.0	Floor Noise
Hori	9848.000	AV	34.2	38.5	8.1	34.5	-	46.3	53.9	7.6	Floor Noise
Hori	12310.000	AV	34.9	39.5	-1.9	33.4	-	39.1	53.9	14.8	Floor Noise
Hori	14772.000	AV	35.2	41.1	-1.6	32.7	-	42.0	53.9	11.9	Floor Noise
Hori	17234.000	AV	35.3	42.3	-0.7	32.5	-	44.4	53.9	9.5	Floor Noise
Vert	2483.500	PK	54.4	26.9	3.5	34.7	-	50.1	73.9	23.8	
Vert	4924.000	PK	55.1	32.1	5.9	33.9	-	59.2	73.9	14.7	
Vert	7386.000	PK	43.6	35.8	7.1	33.8	-	52.7	73.9	21.2	Floor Noise
Vert	9848.000	PK	45.0	38.5	8.1	34.5	-	57.1	73.9	16.8	
Vert	12310.000	PK	43.6	39.5	-1.9	33.4	-	47.8	73.9	26.1	Floor Noise
Vert	14772.000	PK	44.5	41.1	-1.6	32.7	-	51.3	73.9	22.6	Floor Noise
Vert	17234.000	PK	44.2	42.3	-0.7	32.5	-	53.3	73.9	20.6	Floor Noise
Vert	2483.500	AV	45.7	26.9	3.5	34.7	0.2	41.6	53.9	12.4	*1)
Vert	4924.000	AV	46.4	32.1	5.9	33.9	0.2	50.7	53.9	3.2	
Vert	7386.000	AV	34.8	35.8	7.1	33.8	-	43.9	53.9	10.0	Floor Noise
Vert	9848.000	AV	36.4	38.5	8.1	34.5	0.2	48.7	53.9	5.3	
Vert	12310.000	AV	34.6	39.5	-1.9	33.4	-	38.8	53.9	15.1	Floor Noise
Vert	14772.000	AV	35.4	41.1	-1.6	32.7	-	42.2	53.9	11.7	Floor Noise
Vert	17234.000	AV	35.2	42.3	-0.7	32.5	-	44.3	53.9	9.6	Floor Noise

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

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

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

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

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10517044H
Date 12/22/2014 12/24/2014
Temperature/ Humidity 22 deg. C / 38% RH 22 deg. C / 30% RH
Engineer Satofumi Matsuyama Tomohisa Nakagawa
(1-10GHz) (Above 10GHz)
Mode External Antenna 11n-20 Tx 2412MHz

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	69.5	27.0	3.5	34.7	-	65.3	73.9	8.6	
Hori	4824.000	PK	51.9	31.9	5.8	33.9	-	55.7	73.9	18.2	
Hori	7236.000	PK	46.8	35.7	6.3	33.8	-	55.0	73.9	18.9	Floor Noise
Hori	9648.000	PK	42.7	38.1	8.1	34.4	-	54.5	73.9	19.4	Floor Noise
Hori	12060.000	PK	44.2	39.5	-2.0	33.6	-	48.1	73.9	25.8	Floor Noise
Hori	14472.000	PK	44.4	40.8	-1.8	32.5	-	50.9	73.9	23.0	Floor Noise
Hori	16884.000	PK	45.0	40.1	-0.8	32.6	-	51.7	73.9	22.2	Floor Noise
Hori	2390.000	AV	55.8	27.0	3.5	34.7	0.3	51.9	53.9	2.0	*1)
Hori	4824.000	AV	41.5	31.9	5.8	33.9	0.3	45.6	53.9	8.3	
Hori	7236.000	AV	35.1	35.7	7.1	33.8	-	44.1	53.9	9.8	Floor Noise
Hori	9648.000	AV	34.7	38.1	7.2	34.4	-	45.6	53.9	8.3	Floor Noise
Hori	12060.000	AV	34.1	39.5	-2.0	33.6	-	38.0	53.9	15.9	Floor Noise
Hori	14472.000	AV	34.3	40.8	-1.8	32.5	-	40.8	53.9	13.1	Floor Noise
Hori	16884.000	AV	34.8	40.1	-0.8	32.6	-	41.5	53.9	12.4	Floor Noise
Vert	2390.000	PK	69.4	27.0	3.5	34.7	-	65.2	73.9	8.7	
Vert	4824.000	PK	51.2	31.9	5.8	33.9	-	55.0	73.9	18.9	
Vert	7236.000	PK	46.5	35.7	7.1	33.8	-	55.5	73.9	18.4	Floor Noise
Vert	9648.000	PK	45.6	38.1	8.1	34.4	-	57.4	73.9	16.5	Floor Noise
Vert	12060.000	PK	43.4	39.5	-2.0	33.6	-	47.3	73.9	26.6	Floor Noise
Vert	14472.000	PK	44.6	40.8	-1.8	32.5	-	51.1	73.9	22.8	Floor Noise
Vert	16884.000	PK	44.3	40.1	-0.8	32.6	-	51.0	73.9	22.9	Floor Noise
Vert	2390.000	AV	56.0	27.0	3.5	34.7	0.3	52.1	53.9	1.8	*1)
Vert	4824.000	AV	40.8	31.9	5.8	33.9	0.3	44.9	53.9	9.0	
Vert	7236.000	AV	35.1	35.7	7.1	33.8	-	44.1	53.9	9.8	Floor Noise
Vert	9648.000	AV	36.6	38.1	8.1	34.4	-	48.4	53.9	5.5	Floor Noise
Vert	12060.000	AV	34.2	39.5	-2.0	33.6	-	38.1	53.9	15.8	Floor Noise
Vert	14472.000	AV	34.8	40.8	-1.8	32.5	-	41.3	53.9	12.6	Floor Noise
Vert	16884.000	AV	35.0	40.1	-0.8	32.6	-	41.7	53.9	12.2	Floor Noise

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

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

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

*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	100.8	27.0	3.5	34.7	96.6	-	-	Carrier
Hori	2400.000	PK	70.5	27.0	3.5	34.7	66.3	-	10.3	
Vert	2412.000	PK	100.7	27.0	3.5	34.7	96.5	-	-	Carrier
Vert	2400.000	PK	70.4	27.0	3.5	34.7	66.2	-	10.3	

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 and No.3 Semi Anechoic Chamber
Report No. 10517044H
Date 12/22/2014 12/23/2014 12/24/2014
Temperature/ Humidity 22 deg. C / 38% RH 24 deg. C / 31% RH 22 deg. C / 30% RH
Engineer Satofumi Matsuyama Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) (Below 1GHz) (Above 10GHz)
Mode External Antenna 11n-20 Tx 2437MHz

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	79.548	QP	30.3	6.3	7.8	32.1	-	12.3	40.0	27.7	
Hori	99.762	QP	31.5	10.0	8.0	32.2	-	17.3	43.5	26.2	
Hori	133.002	QP	31.6	13.9	8.4	32.1	-	21.8	43.5	21.7	
Hori	660.001	QP	31.3	20.1	12.1	32.0	-	31.5	46.0	14.5	
Hori	690.002	QP	35.1	20.4	12.3	32.1	-	35.7	46.0	10.3	
Hori	750.002	QP	28.9	21.4	12.6	31.7	-	31.2	46.0	14.8	
Hori	4874.000	PK	55.3	32.0	5.9	33.9	-	59.3	73.9	14.6	
Hori	7311.000	PK	54.2	35.8	7.1	33.8	-	63.3	73.9	10.6	
Hori	9748.000	PK	45.2	38.3	8.1	34.5	-	57.1	73.9	16.8	Floor Noise
Hori	12185.000	PK	43.4	39.5	-2.0	33.5	-	47.4	73.9	26.5	Floor Noise
Hori	14622.000	PK	44.2	41.0	-1.6	32.6	-	51.0	73.9	22.9	Floor Noise
Hori	17059.000	PK	44.5	40.8	-0.8	32.5	-	52.0	73.9	21.9	Floor Noise
Hori	4874.000	AV	45.4	32.0	5.9	33.9	0.3	49.7	53.9	4.2	
Hori	7311.000	AV	41.2	35.8	7.1	33.8	0.3	50.6	53.9	3.3	
Hori	9748.000	AV	34.1	38.3	8.1	34.5	-	46.0	53.9	7.9	Floor Noise
Hori	12185.000	AV	34.1	39.5	-2.0	33.5	-	38.1	53.9	15.8	Floor Noise
Hori	14622.000	AV	34.1	41.0	-1.6	32.6	-	40.9	53.9	13.0	Floor Noise
Hori	17059.000	AV	35.0	40.8	-0.8	32.5	-	42.5	53.9	11.4	Floor Noise
Vert	79.556	QP	43.6	6.3	7.8	32.1	-	25.6	40.0	14.4	
Vert	99.754	QP	39.4	10.0	8.0	32.2	-	25.2	43.5	18.3	
Vert	133.008	QP	34.8	13.9	8.4	32.1	-	25.0	43.5	18.5	
Vert	690.002	QP	33.0	20.4	12.3	32.1	-	33.6	46.0	12.4	
Vert	750.004	QP	32.0	21.4	12.6	31.7	-	34.3	46.0	11.7	
Vert	780.001	QP	32.0	21.9	12.7	31.6	-	35.0	46.0	11.0	
Vert	4874.000	PK	59.0	32.0	5.9	33.9	-	63.0	73.9	10.9	
Vert	7311.000	PK	57.8	35.8	7.1	33.8	-	66.9	73.9	7.0	
Vert	9748.000	PK	45.4	38.3	8.1	34.5	-	57.3	73.9	16.6	Floor Noise
Vert	12185.000	PK	43.2	39.5	-2.0	33.5	-	47.2	73.9	26.7	Floor Noise
Vert	14622.000	PK	44.0	41.0	-1.6	32.6	-	50.8	73.9	23.1	Floor Noise
Vert	17059.000	PK	44.2	40.8	-0.8	32.5	-	51.7	73.9	22.2	Floor Noise
Vert	4874.000	AV	47.4	32.0	5.9	33.9	0.3	51.7	53.9	2.2	
Vert	7311.000	AV	42.4	35.8	7.1	33.8	0.3	51.8	53.9	2.1	
Vert	9748.000	AV	34.5	38.3	8.1	34.5	-	46.4	53.9	7.5	Floor Noise
Vert	12185.000	AV	34.0	39.5	-2.0	33.5	-	38.0	53.9	15.9	Floor Noise
Vert	14622.000	AV	34.8	41.0	-1.6	32.6	-	41.6	53.9	12.3	Floor Noise
Vert	17059.000	AV	35.1	40.8	-0.8	32.5	-	42.6	53.9	11.3	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

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

Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10517044H
Date : 12/22/2014 12/24/2014
Temperature/ Humidity : 22 deg. C / 38% RH 22 deg. C / 30% RH
Engineer : Satofumi Matsuyama Tomohisa Nakagawa
(1-10GHz) (Above 10GHz)
Mode : External Antenna 11n-20 Tx 2462MHz

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	69.1	26.9	3.5	34.7	-	64.8	73.9	9.1	
Hori	4924.000	PK	45.5	32.1	5.9	33.9	-	49.6	73.9	24.3	Floor Noise
Hori	7386.000	PK	44.3	35.8	7.1	33.8	-	53.4	73.9	20.5	Floor Noise
Hori	9848.000	PK	42.7	38.5	8.1	34.5	-	54.8	73.9	19.1	Floor Noise
Hori	12310.000	PK	43.8	39.5	-1.9	33.4	-	48.0	73.9	25.9	Floor Noise
Hori	14772.000	PK	44.1	41.1	-1.6	32.7	-	50.9	73.9	23.0	Floor Noise
Hori	17234.000	PK	44.4	42.3	-0.7	32.5	-	53.5	73.9	20.4	Floor Noise
Hori	2483.500	AV	54.1	26.9	3.5	34.7	0.3	50.1	53.9	3.8	*1)
Hori	4924.000	AV	33.7	32.1	5.9	33.9	-	37.8	53.9	16.1	Floor Noise
Hori	7386.000	AV	34.9	35.8	7.1	33.8	-	44.0	53.9	9.9	Floor Noise
Hori	9848.000	AV	34.7	38.5	8.1	34.5	-	46.8	53.9	7.1	Floor Noise
Hori	12310.000	AV	34.6	39.5	-1.9	33.4	-	38.8	53.9	15.1	Floor Noise
Hori	14772.000	AV	35.0	41.1	-1.6	32.7	-	41.8	53.9	12.1	Floor Noise
Hori	17234.000	AV	35.2	42.3	-0.7	32.5	-	44.3	53.9	9.6	Floor Noise
Vert	2483.500	PK	70.4	26.9	3.5	34.7	-	66.1	73.9	7.8	
Vert	4924.000	PK	46.6	32.1	5.9	33.9	-	50.7	73.9	23.2	Floor Noise
Vert	7386.000	PK	42.7	35.8	7.1	33.8	-	51.8	73.9	22.1	Floor Noise
Vert	9848.000	PK	42.8	38.5	8.1	34.5	-	54.9	73.9	19.0	Floor Noise
Vert	12310.000	PK	43.6	39.5	-1.9	33.4	-	47.8	73.9	26.1	Floor Noise
Vert	14772.000	PK	44.2	41.1	-1.6	32.7	-	51.0	73.9	22.9	Floor Noise
Vert	17234.000	PK	44.2	42.3	-0.7	32.5	-	53.3	73.9	20.6	Floor Noise
Vert	2483.500	AV	55.5	26.9	3.5	34.7	0.3	51.5	53.9	2.4	*1)
Vert	4924.000	AV	35.5	32.1	5.9	33.9	-	39.6	53.9	14.3	Floor Noise
Vert	7386.000	AV	34.5	35.8	7.1	33.8	-	43.6	53.9	10.3	Floor Noise
Vert	9848.000	AV	33.2	38.5	8.1	34.5	-	45.3	53.9	8.6	Floor Noise
Vert	12310.000	AV	34.5	39.5	-1.9	33.4	-	38.7	53.9	15.2	Floor Noise
Vert	14772.000	AV	35.2	41.1	-1.6	32.7	-	42.0	53.9	11.9	Floor Noise
Vert	17234.000	AV	35.4	42.3	-0.7	32.5	-	44.5	53.9	9.4	Floor Noise

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

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

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

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

Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10517044H
Date 12/22/2014 12/24/2014
Temperature/ Humidity 22 deg. C / 38% RH 22 deg. C / 30% RH
Engineer Satofumi Matsuyama Tomohisa Nakagawa
(1-10GHz) (Above 10GHz)
Mode Internal Antenna 11b Tx 2412MHz

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	56.3	27.0	3.4	34.7	-	52.0	73.9	21.9	
Hori	4824.000	PK	54.3	31.9	5.8	33.9	-	58.1	73.9	15.8	
Hori	7236.000	PK	42.9	35.7	6.9	33.8	-	51.7	73.9	22.2	Floor Noise
Hori	12060.000	PK	44.1	39.5	-2.0	33.6	-	48.0	73.9	25.9	Floor Noise
Hori	14472.000	PK	44.3	40.8	-1.8	32.5	-	50.8	73.9	23.1	Floor Noise
Hori	16884.000	PK	45.7	40.1	-0.8	32.6	-	52.4	73.9	21.5	Floor Noise
Hori	2390.000	AV	48.3	27.0	3.4	34.7	0.2	44.2	53.9	9.8	*1)
Hori	4824.000	AV	46.6	31.9	5.8	33.9	0.2	50.6	53.9	3.4	
Hori	7236.000	AV	34.0	35.7	6.9	33.8	-	42.8	53.9	11.1	Floor Noise
Hori	12060.000	AV	34.1	39.5	-2.0	33.6	-	38.0	53.9	15.9	Floor Noise
Hori	14472.000	AV	34.5	40.8	-1.8	32.5	-	41.0	53.9	12.9	Floor Noise
Hori	16884.000	AV	35.0	40.1	-0.8	32.6	-	41.7	53.9	12.2	Floor Noise
Vert	2390.000	PK	54.0	27.0	3.4	34.7	-	49.7	73.9	24.2	
Vert	4824.000	PK	54.5	31.9	5.8	33.9	-	58.3	73.9	15.6	
Vert	7236.000	PK	42.8	35.7	6.9	33.8	-	51.6	73.9	22.3	Floor Noise
Vert	12060.000	PK	43.5	39.5	-2.0	33.6	-	47.4	73.9	26.5	Floor Noise
Vert	14472.000	PK	44.2	40.8	-1.8	32.5	-	50.7	73.9	23.2	Floor Noise
Vert	16884.000	PK	44.4	40.1	-0.8	32.6	-	51.1	73.9	22.8	Floor Noise
Vert	2390.000	AV	45.0	27.0	3.4	34.7	0.2	40.9	53.9	13.1	*1)
Vert	4824.000	AV	47.3	31.9	5.8	33.9	0.2	51.3	53.9	2.7	
Vert	7236.000	AV	34.2	35.7	6.9	33.8	-	43.0	53.9	10.9	Floor Noise
Vert	12060.000	AV	34.7	39.5	-2.0	33.6	-	38.6	53.9	15.3	Floor Noise
Vert	14472.000	AV	35.2	40.8	-1.8	32.5	-	41.7	53.9	12.2	Floor Noise
Vert	16884.000	AV	35.6	40.1	-0.8	32.6	-	42.3	53.9	11.6	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
*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	106.9	27.0	3.5	34.7	102.7	-	-	Carrier
Hori	2400.000	PK	55.4	27.0	3.5	34.7	51.2	82.7	31.5	
Hori	9648.000	PK	35.8	38.1	8.1	34.4	47.6	82.7	35.1	
Vert	2412.000	PK	102.7	27.0	3.5	34.7	98.5	-	-	Carrier
Vert	2400.000	PK	53.5	27.0	3.5	34.7	49.3	78.5	29.2	
Vert	9648.000	PK	44.0	38.1	8.1	34.4	55.8	78.5	22.7	

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. 10517044H
Date 12/22/2014 12/24/2014
Temperature/ Humidity 22 deg. C / 38% RH 22 deg. C / 30% RH
Engineer Satofumi Matsuyama Tomohisa Nakagawa
(1-10GHz) (Above 10GHz)
Mode Internal Antenna 11b Tx 2437MHz

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	53.8	32.0	5.8	33.9	-	57.7	73.9	16.2	
Hori	7311.000	PK	43.2	35.8	7.0	33.8	-	52.2	73.9	21.7	Floor Noise
Hori	9748.000	PK	43.0	38.3	7.7	34.5	-	54.5	73.9	19.4	Floor Noise
Hori	12185.000	PK	43.6	39.5	-2.0	33.5	-	47.6	73.9	26.3	Floor Noise
Hori	14622.000	PK	44.1	41.0	-1.6	32.6	-	50.9	73.9	23.0	Floor Noise
Hori	17059.000	PK	45.0	40.8	-0.8	32.5	-	52.5	73.9	21.4	Floor Noise
Hori	4874.000	AV	46.4	32.0	5.8	33.9	0.2	50.5	53.9	3.5	
Hori	7311.000	AV	34.0	35.8	7.0	33.8	-	43.0	53.9	10.9	Floor Noise
Hori	9748.000	AV	34.5	38.3	7.7	34.5	-	46.0	53.9	7.9	Floor Noise
Hori	12185.000	AV	33.9	39.5	-2.0	33.5	-	37.9	53.9	16.0	Floor Noise
Hori	14622.000	AV	34.4	41.0	-1.6	32.6	-	41.2	53.9	12.7	Floor Noise
Hori	17059.000	AV	34.9	40.8	-0.8	32.5	-	42.4	53.9	11.5	Floor Noise
Vert	4874.000	PK	55.2	32.0	5.8	33.9	-	59.1	73.9	14.8	
Vert	7311.000	PK	43.0	35.8	7.0	33.8	-	52.0	73.9	21.9	Floor Noise
Vert	9748.000	PK	43.9	38.3	7.7	34.5	-	55.4	73.9	18.5	
Vert	12185.000	PK	42.9	39.5	-2.0	33.5	-	46.9	73.9	27.0	Floor Noise
Vert	14622.000	PK	43.8	41.0	-1.6	32.6	-	50.6	73.9	23.3	Floor Noise
Vert	17059.000	PK	44.2	40.8	-0.8	32.5	-	51.7	73.9	22.2	Floor Noise
Vert	4874.000	AV	47.4	32.0	5.8	33.9	0.2	51.5	53.9	2.5	
Vert	7311.000	AV	34.2	35.8	7.0	33.8	-	43.2	53.9	10.7	Floor Noise
Vert	9748.000	AV	36.4	38.3	7.7	34.5	0.2	48.1	53.9	5.9	
Vert	12185.000	AV	34.0	39.5	-2.0	33.5	-	38.0	53.9	15.9	Floor Noise
Vert	14622.000	AV	35.3	41.0	-1.6	32.6	-	42.1	53.9	11.8	Floor Noise
Vert	17059.000	AV	35.0	40.8	-0.8	32.5	-	42.5	53.9	11.4	Floor Noise

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

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

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

Radiated Spurious Emission

Test place Ise EMC Lab. No.2 and No.3 Semi Anechoic Chamber
Report No. 10517044H
Date 12/22/2014 12/23/2014 Night 12/24/2014
Temperature/ Humidity 22 deg. C / 38% RH 24deg. C / 31% 22 deg. C / 30% RH
Engineer Satofumi Matsuyama Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) (Below 1GHz) (Above 10GHz)
Mode Internal Antenna 11b Tx 2462MHz

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	56.0	26.9	3.5	34.7	-	51.7	73.9	22.2	
Hori	4924.000	PK	54.2	32.1	5.8	33.9	-	58.2	73.9	15.7	
Hori	7386.000	PK	43.6	35.8	7.0	33.8	-	52.6	73.9	21.3	Floor Noise
Hori	9848.000	PK	43.0	38.5	7.7	34.5	-	54.7	73.9	19.2	Floor Noise
Hori	12310.000	PK	43.7	39.5	-1.9	33.4	-	47.9	73.9	26.0	Floor Noise
Hori	14772.000	PK	44.1	41.1	-1.6	32.7	-	50.9	73.9	23.0	Floor Noise
Hori	17234.000	PK	44.3	42.3	-0.7	32.5	-	53.4	73.9	20.5	Floor Noise
Hori	2483.500	AV	48.3	26.9	3.5	34.7	0.2	44.2	53.9	9.8	*1)
Hori	4924.000	AV	47.0	32.1	5.8	33.9	0.2	51.2	53.9	2.8	
Hori	7386.000	AV	34.4	35.8	7.0	33.8	-	43.4	53.9	10.5	Floor Noise
Hori	9848.000	AV	34.5	38.5	7.7	34.5	-	46.2	53.9	7.7	Floor Noise
Hori	12310.000	AV	34.8	39.5	-1.9	33.4	-	39.0	53.9	14.9	Floor Noise
Hori	14772.000	AV	35.1	41.1	-1.6	32.7	-	41.9	53.9	12.0	Floor Noise
Hori	17234.000	AV	35.6	42.3	-0.7	32.5	-	44.7	53.9	9.2	Floor Noise
Vert	2483.500	PK	52.0	26.9	3.5	34.7	-	47.7	73.9	26.2	
Vert	4924.000	PK	53.8	32.1	5.8	33.9	-	57.8	73.9	16.1	
Vert	7386.000	PK	42.7	35.8	7.0	33.8	-	51.7	73.9	22.2	Floor Noise
Vert	9848.000	PK	42.8	38.5	7.7	34.5	-	54.5	73.9	19.4	
Vert	12310.000	PK	43.5	39.5	-1.9	33.4	-	47.7	73.9	26.2	Floor Noise
Vert	14772.000	PK	44.3	41.1	-1.6	32.7	-	51.1	73.9	22.8	Floor Noise
Vert	17234.000	PK	44.1	42.3	-0.7	32.5	-	53.2	73.9	20.7	Floor Noise
Vert	2483.500	AV	43.6	26.9	3.5	34.7	0.2	39.5	53.9	14.5	*1)
Vert	4924.000	AV	46.6	32.1	5.8	33.9	0.2	50.8	53.9	3.2	
Vert	7386.000	AV	34.4	35.8	7.0	33.8	-	43.4	53.9	10.5	Floor Noise
Vert	9848.000	AV	34.8	38.5	7.7	34.5	0.2	46.7	53.9	7.3	
Vert	12310.000	AV	34.5	39.5	-1.9	33.4	-	38.7	53.9	15.2	Floor Noise
Vert	14772.000	AV	35.5	41.1	-1.6	32.7	-	42.3	53.9	11.6	Floor Noise
Vert	17234.000	AV	35.3	42.3	-0.7	32.5	-	44.4	53.9	9.5	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty Factor
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

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

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

Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10517044H
Date : 12/24/2014 12/24/2014
Temperature/ Humidity : 23 deg. C / 31% RH 22 deg. C / 30% RH
Engineer : Tsubasa Takayama Tomohisa Nakagawa
(1-10GHz) (Above 10GHz)
Mode : Internal Antenna 11n-20 Tx 2412MHz

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	70.8	27.0	2.8	34.7	-	65.9	73.9	8.0	See 20dBc Data Sheet
Hori	2400.000	PK	72.4	27.0	2.8	34.7	-	67.5	73.9	6.4	
Hori	3216.080	PK	48.4	28.5	3.2	34.3	-	45.8	73.9	28.1	
Hori	3456.317	PK	48.3	29.0	3.4	34.1	-	46.6	73.9	27.3	
Hori	4824.000	PK	52.4	31.9	5.3	33.9	-	55.7	73.9	18.2	
Hori	7236.000	PK	43.4	35.7	6.5	33.8	-	51.8	73.9	22.1	
Hori	9648.000	PK	47.5	38.1	7.6	34.4	-	58.8	73.9	15.1	
Hori	12060.000	PK	43.9	39.5	-2.0	33.6	-	47.8	73.9	26.1	
Hori	14472.000	PK	44.2	40.8	-1.8	32.5	-	50.7	73.9	23.2	
Hori	16884.000	PK	44.4	40.1	-0.8	32.6	-	51.1	73.9	22.8	
Hori	2390.000	AV	55.4	27.0	2.8	34.7	0.3	50.8	53.9	3.1	*1)
Hori	3216.080	AV	41.2	28.5	3.2	34.3	-	38.6	53.9	15.3	Floor Noise
Hori	3456.317	AV	43.3	29.0	3.4	34.1	-	41.6	53.9	12.3	
Hori	4824.000	AV	42.8	31.9	5.3	33.9	0.3	46.4	53.9	7.5	
Hori	7236.000	AV	34.5	35.7	6.5	33.8	0.3	43.2	53.9	10.7	
Hori	9648.000	AV	37.8	38.1	7.6	34.4	0.3	49.4	53.9	4.5	
Hori	12060.000	AV	34.7	39.5	-2.0	33.6	-	38.6	53.9	15.3	
Hori	14472.000	AV	35.0	40.8	-1.8	32.5	-	41.5	53.9	12.4	
Hori	16884.000	AV	35.6	40.1	-0.8	32.6	-	42.3	53.9	11.6	
Hori	16884.000	AV	35.6	40.1	-0.8	32.6	-	42.3	53.9	11.6	
Vert	1800.000	PK	49.4	27.1	2.4	35.0	-	43.9	73.9	30.0	See 20dBc Data Sheet
Vert	2390.000	PK	68.5	27.0	3.4	34.7	-	64.2	73.9	9.7	
Vert	2400.000	PK	70.3	27.0	3.4	34.7	-	66.0	73.9	7.9	
Vert	3216.080	PK	50.7	28.5	4.0	34.3	-	48.9	73.9	25.0	
Vert	3456.317	PK	51.2	29.0	4.1	34.1	-	50.2	73.9	23.7	
Vert	4824.000	PK	52.6	31.9	5.3	33.9	-	55.9	73.9	18.0	
Vert	7236.000	PK	44.5	35.7	6.5	33.8	-	52.9	73.9	21.0	
Vert	9648.000	PK	46.5	38.1	7.6	34.4	-	57.8	73.9	16.1	
Vert	12060.000	PK	43.9	39.5	-2.0	33.6	-	47.8	73.9	26.1	
Vert	14472.000	PK	44.3	40.8	-1.8	32.5	-	50.8	73.9	23.1	
Vert	16884.000	PK	44.5	40.1	-0.8	32.6	-	51.2	73.9	22.7	
Vert	1800.000	AV	44.3	27.1	3.0	35.0	-	39.4	53.9	14.5	*1)
Vert	2390.000	AV	54.7	27.0	3.4	34.7	0.3	50.7	53.9	3.2	
Vert	3216.080	AV	45.7	28.5	3.2	34.3	-	43.1	53.9	10.8	
Vert	3456.317	AV	46.5	29.0	3.4	34.1	-	44.8	53.9	9.1	
Vert	4824.000	AV	44.3	31.9	5.3	33.9	0.3	47.9	53.9	6.0	
Vert	7236.000	AV	34.5	35.7	6.5	33.8	0.3	43.2	53.9	10.7	
Vert	9648.000	AV	39.2	38.1	7.6	34.4	0.3	50.8	53.9	3.1	
Vert	12060.000	AV	34.6	39.5	-2.0	33.6	-	38.5	53.9	15.4	
Vert	14472.000	AV	35.1	40.8	-1.8	32.5	-	41.6	53.9	12.3	
Vert	16884.000	AV	35.3	40.1	-0.8	32.6	-	42.0	53.9	11.9	

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

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

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

*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	103.5	27.0	2.8	34.7	98.6	-	-	Carrier
Hori	2400.000	PK	72.4	27.0	2.8	34.7	67.5	78.6	11.1	
Vert	2412.000	PK	101.2	27.0	3.4	34.7	96.9	-	-	Carrier
Vert	2400.000	PK	70.3	27.0	3.4	34.7	66.0	76.9	10.9	

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 and No.3 Semi Anechoic Chamber
Report No. 10517044H
Date 12/24/2014 12/23/2014 12/24/2014
Temperature/ Humidity 23 deg. C / 31% RH 24 deg. C / 31% RH 22 deg. C / 30% RH
Engineer Tsubasa Takayama Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) (Below 1GHz) (Above 10GHz)
Mode Internal Antenna 11n-20 Tx 2437MHz

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	79.542	QP	30.1	6.3	7.8	32.1	-	12.1	40.0	27.9	
Hori	99.760	QP	31.4	10.0	8.0	32.2	-	17.2	43.5	26.3	
Hori	133.000	QP	32.2	13.9	8.4	32.1	-	22.4	43.5	21.1	
Hori	660.008	QP	31.7	20.1	12.1	32.0	-	31.9	46.0	14.1	
Hori	690.005	QP	33.6	20.4	12.3	32.1	-	34.2	46.0	11.8	
Hori	750.000	QP	28.5	21.4	12.6	31.7	-	30.8	46.0	15.2	
Hori	3249.321	PK	50.3	28.6	3.3	34.2	-	48.0	73.9	25.9	
Hori	3455.935	PK	50.9	29.0	3.4	34.1	-	49.2	73.9	24.7	
Hori	4874.000	PK	57.8	32.0	5.4	33.9	-	61.3	73.9	12.6	
Hori	7311.000	PK	45.3	35.8	6.6	33.8	-	53.9	73.9	20.0	
Hori	9748.000	PK	50.4	38.3	7.7	34.5	-	61.9	73.9	12.0	
Hori	12185.000	PK	43.4	39.5	-2.0	33.5	-	47.4	73.9	26.5	Floor Noise
Hori	14622.000	PK	43.6	41.0	-1.6	32.6	-	50.4	73.9	23.5	Floor Noise
Hori	17059.000	PK	44.8	40.8	-0.8	32.5	-	52.3	73.9	21.6	Floor Noise
Hori	3249.321	AV	41.5	28.6	3.3	34.2	-	39.2	53.9	14.7	
Hori	3455.935	AV	43.4	29.0	3.4	34.1	-	41.7	53.9	12.2	
Hori	4874.000	AV	48.9	32.0	5.4	33.9	0.3	52.7	53.9	1.2	
Hori	7311.000	AV	34.5	35.8	6.6	33.8	0.3	43.4	53.9	10.5	
Hori	9748.000	AV	39.0	38.3	7.7	34.5	0.3	50.8	53.9	3.1	
Hori	12185.000	AV	34.7	39.5	-2.0	33.5	-	38.7	53.9	15.2	Floor Noise
Hori	14622.000	AV	35.1	41.0	-1.6	32.6	-	41.9	53.9	12.0	Floor Noise
Hori	17059.000	AV	35.6	40.8	-0.8	32.5	-	43.1	53.9	10.8	Floor Noise
Vert	79.522	QP	43.8	6.3	7.8	32.1	-	25.8	40.0	14.2	
Vert	99.762	QP	38.8	10.0	8.0	32.2	-	24.6	43.5	18.9	
Vert	133.002	QP	35.3	13.9	8.4	32.1	-	25.5	43.5	18.0	
Vert	690.006	QP	32.5	20.4	12.3	32.1	-	33.1	46.0	12.9	
Vert	750.005	QP	31.7	21.4	12.6	31.7	-	34.0	46.0	12.0	
Vert	780.002	QP	31.8	21.9	12.7	31.6	-	34.8	46.0	11.2	
Vert	1800.000	PK	49.2	27.1	2.4	35.0	-	43.7	73.9	30.2	
Vert	3249.321	PK	52.2	28.6	3.3	34.2	-	49.9	73.9	24.0	
Vert	3455.935	PK	51.5	29.0	3.4	34.1	-	49.8	73.9	24.1	
Vert	4874.000	PK	57.9	32.0	5.4	33.9	-	61.4	73.9	12.5	
Vert	7311.000	PK	45.3	35.8	6.6	33.8	-	53.9	73.9	20.0	
Vert	9748.000	PK	48.0	38.3	7.7	34.5	-	59.5	73.9	14.4	
Vert	12185.000	PK	43.0	39.5	-2.0	33.5	-	47.0	73.9	26.9	Floor Noise
Vert	14622.000	PK	43.9	41.0	-1.6	32.6	-	50.7	73.9	23.2	Floor Noise
Vert	17059.000	PK	44.3	40.8	-0.8	32.5	-	51.8	73.9	22.1	Floor Noise
Vert	1800.000	AV	43.5	27.1	2.4	35.0	-	38.0	53.9	15.9	
Vert	3249.321	AV	45.3	28.6	3.3	34.2	-	43.0	53.9	10.9	
Vert	3455.935	AV	46.7	29.0	3.4	34.1	-	45.0	53.9	8.9	
Vert	4874.000	AV	47.2	32.0	5.4	33.9	0.3	51.0	53.9	2.9	
Vert	7311.000	AV	34.9	35.8	6.6	33.8	0.3	43.8	53.9	10.1	
Vert	9748.000	AV	35.6	38.3	7.7	34.5	0.3	47.4	53.9	6.5	
Vert	12185.000	AV	34.1	39.5	-2.0	33.5	-	38.1	53.9	15.8	Floor Noise
Vert	14622.000	AV	35.2	41.0	-1.6	32.6	-	42.0	53.9	11.9	Floor Noise
Vert	17059.000	AV	35.1	40.8	-0.8	32.5	-	42.6	53.9	11.3	Floor Noise

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

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

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

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Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
 Report No. 10517044H
 Date 12/24/2014 12/24/2014
 Temperature/ Humidity 23 deg. C / 31% RH 22 deg. C / 30% RH
 Engineer Tsubasa Takayama Tomohisa Nakagawa
 (1-10GHz) (Above 10GHz)
 Mode Internal Antenna 11n-20 Tx 2462MHz

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	73.2	26.9	2.8	34.7	-	68.2	73.9	5.7	
Hori	3282.734	PK	50.0	28.6	3.3	34.2	-	47.7	73.9	26.2	
Hori	3455.971	PK	50.2	29.0	3.4	34.1	-	48.5	73.9	25.4	
Hori	4924.000	PK	53.4	32.1	5.4	33.9	-	57.0	73.9	16.9	
Hori	7386.000	PK	45.3	35.8	6.6	33.8	-	53.9	73.9	20.0	
Hori	9848.000	PK	44.5	38.5	7.7	34.5	-	56.2	73.9	17.7	
Hori	12310.000	PK	43.4	39.5	-1.9	33.4	-	47.6	73.9	26.3	Floor Noise
Hori	14772.000	PK	43.7	41.1	-1.6	32.7	-	50.5	73.9	23.4	Floor Noise
Hori	17234.000	PK	44.4	42.3	-0.7	32.5	-	53.5	73.9	20.4	Floor Noise
Hori	2483.500	AV	54.5	26.9	2.8	34.7	0.3	49.8	53.9	4.1	*1)
Hori	3282.734	AV	42.8	28.6	3.3	34.2	-	40.5	53.9	13.4	
Hori	3455.971	AV	43.5	29.0	3.4	34.1	-	41.8	53.9	12.1	
Hori	4924.000	AV	42.9	32.1	5.4	33.9	0.3	46.8	53.9	7.1	
Hori	7386.000	AV	34.8	35.8	6.6	33.8	0.3	43.7	53.9	10.2	
Hori	9848.000	AV	35.6	38.5	7.7	34.5	0.3	47.6	53.9	6.3	
Hori	12310.000	AV	34.7	39.5	-1.9	33.4	-	38.9	53.9	15.0	Floor Noise
Hori	14772.000	AV	35.1	41.1	-1.6	32.7	-	41.9	53.9	12.0	Floor Noise
Hori	17234.000	AV	35.6	42.3	-0.7	32.5	-	44.7	53.9	9.2	Floor Noise
Vert	1800.000	PK	49.5	27.1	2.4	35.0	-	44.0	73.9	29.9	
Vert	2483.500	PK	70.7	26.9	2.8	34.7	-	65.7	73.9	8.2	
Vert	3282.734	PK	50.6	28.6	3.3	34.2	-	48.3	73.9	25.6	
Vert	3455.971	PK	51.9	29.0	3.4	34.1	-	50.2	73.9	23.7	
Vert	4924.000	PK	52.9	32.1	5.4	33.9	-	56.5	73.9	17.4	
Vert	7386.000	PK	45.4	35.8	6.6	33.8	-	54.0	73.9	19.9	
Vert	9848.000	PK	45.6	38.5	7.7	34.5	-	57.3	73.9	16.6	
Vert	12310.000	PK	43.3	39.5	-1.9	33.4	-	47.5	73.9	26.4	Floor Noise
Vert	14772.000	PK	44.3	41.1	-1.6	32.7	-	51.1	73.9	22.8	Floor Noise
Vert	17234.000	PK	44.3	42.3	-0.7	32.5	-	53.4	73.9	20.5	Floor Noise
Vert	1800.000	AV	44.3	27.1	2.4	35.0	-	38.8	73.9	35.1	
Vert	2483.500	AV	53.4	26.9	2.8	34.7	0.3	48.7	53.9	5.2	*1)
Vert	3282.734	AV	43.5	28.6	3.3	34.2	-	41.2	53.9	12.7	
Vert	3455.971	AV	48.0	29.0	3.4	34.1	-	46.3	53.9	7.6	
Vert	4924.000	AV	43.2	32.1	5.4	33.9	0.3	47.1	53.9	6.8	
Vert	7386.000	AV	34.3	35.8	6.6	33.8	0.3	43.2	53.9	10.7	
Vert	9848.000	AV	36.2	38.5	7.7	34.5	0.3	48.2	53.9	5.7	
Vert	12310.000	AV	34.0	39.5	-1.9	33.4	-	38.2	53.9	15.7	Floor Noise
Vert	14772.000	AV	34.9	41.1	-1.6	32.7	-	41.7	53.9	12.2	Floor Noise
Vert	17234.000	AV	35.2	42.3	-0.7	32.5	-	44.3	53.9	9.6	Floor Noise

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

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

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

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

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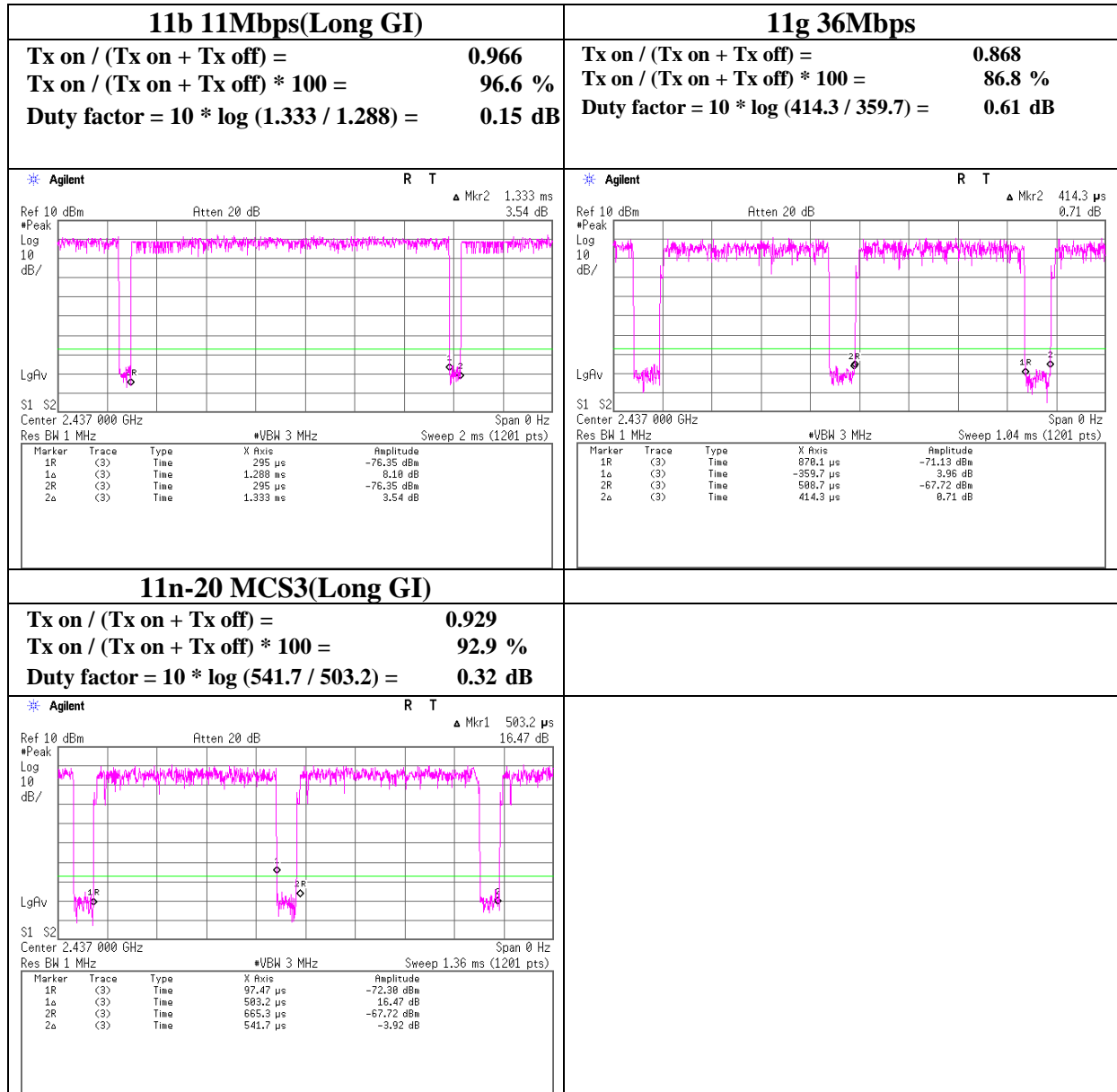
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Burst rate confirmation

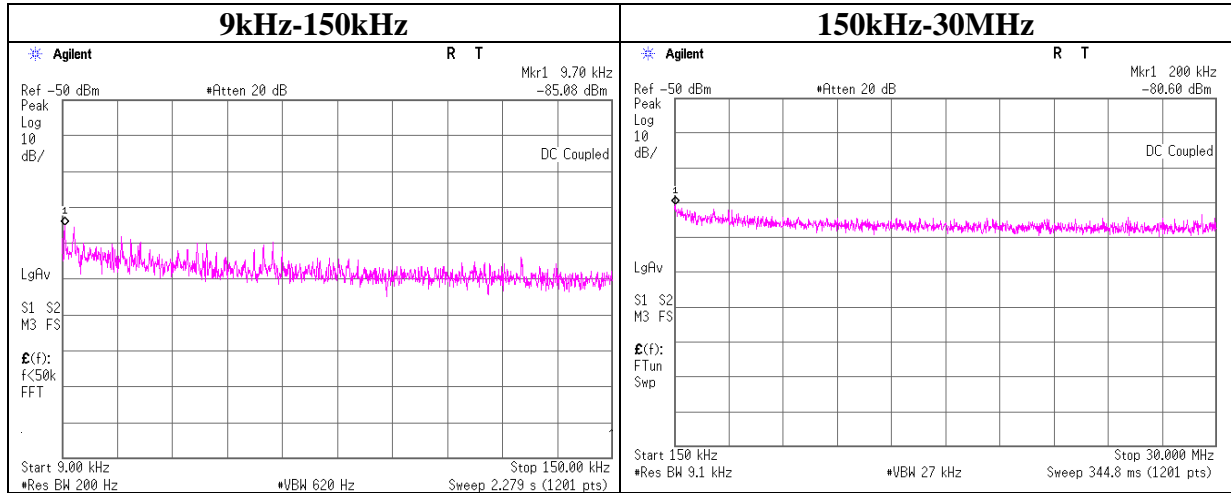
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10517044H
Date	11/28/2014
Temperature/ Humidity	21 deg. C / 46% RH
Engineer	Satofumi Matsuyama
Mode	11b Tx / 11g Tx / 11n-20 Tx



Conducted Spurious Emission

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10517044H
Date	11/26/2014
Temperature/ Humidity	22 deg. C / 47% RH
Engineer	Kazuya Yoshioka
Mode	11n-20 Tx

11n-20 Tx 2437MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]
9.70	-85.1	0.01	10.0	2.0	-73.1	300	6.0	-11.8	67.8	79.6
200.00	-80.6	0.01	10.0	2.0	-68.6	300	6.0	-7.3	41.5	48.8

$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain} + 10 * \log(N)$

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Power Density

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10517044H
Date 01/06/2015
Temperature/ Humidity 20 deg. C / 50% RH
Engineer Kenshi Shimomura
Mode 11b Tx / 11g Tx / 11n-20 Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-21.14	0.77	10.04	-10.33	8.00	18.33
2437.00	-22.73	0.77	10.04	-11.92	8.00	19.92
2462.00	-22.87	0.77	10.04	-12.06	8.00	20.06

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.07	0.77	10.04	-13.26	8.00	21.26
2437.00	-22.42	0.77	10.04	-11.61	8.00	19.61
2462.00	-25.88	0.77	10.04	-15.07	8.00	23.07

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-23.47	0.77	10.04	-12.66	8.00	20.66
2437.00	-20.51	0.77	10.04	-9.70	8.00	17.70
2462.00	-27.14	0.77	10.04	-16.33	8.00	24.33

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

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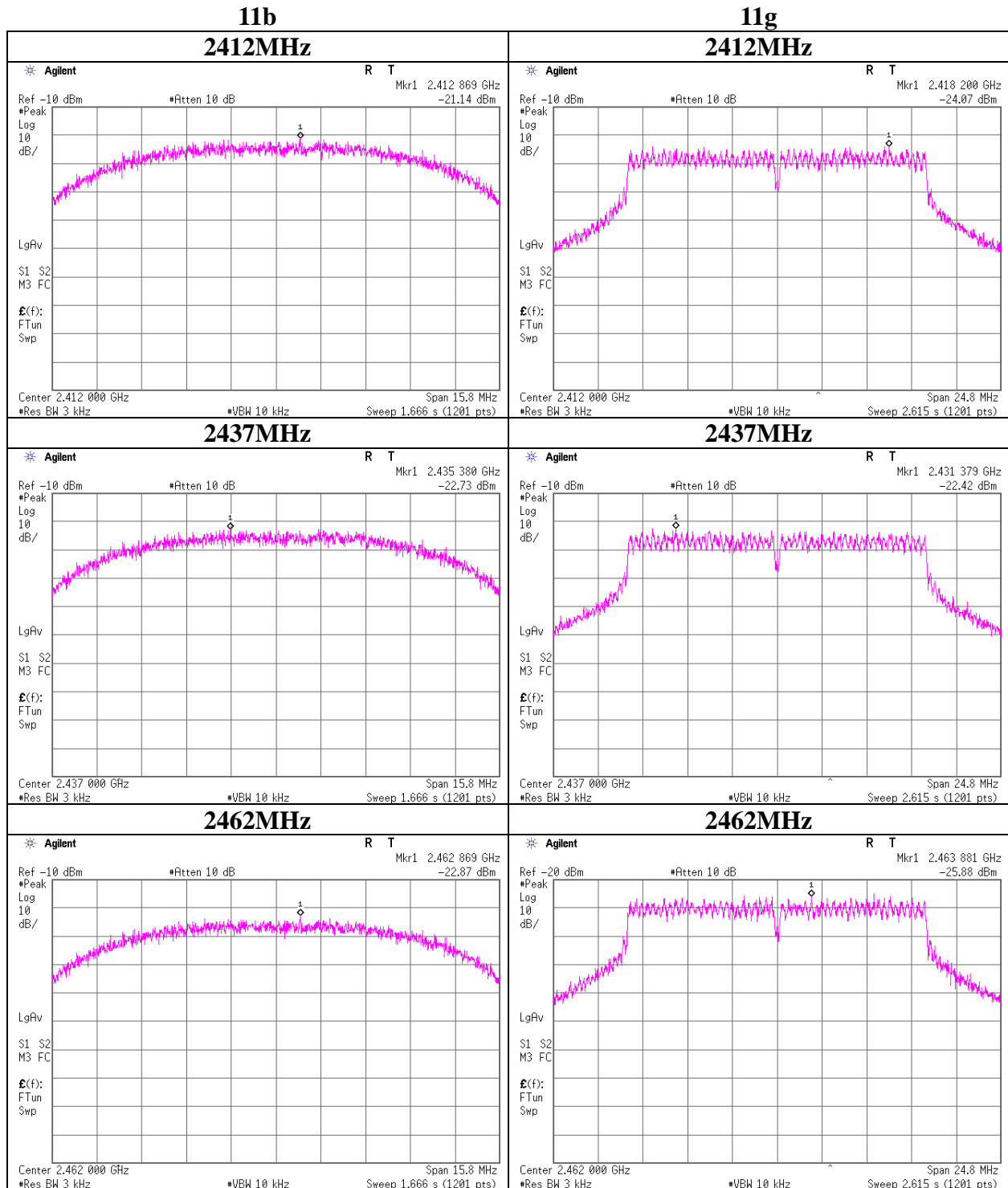
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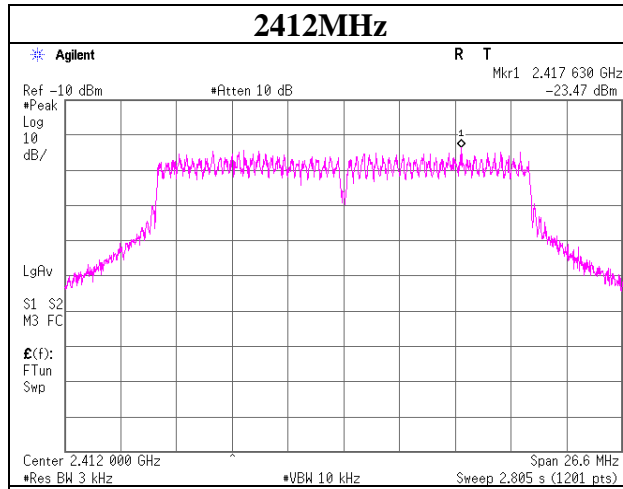
Power Density



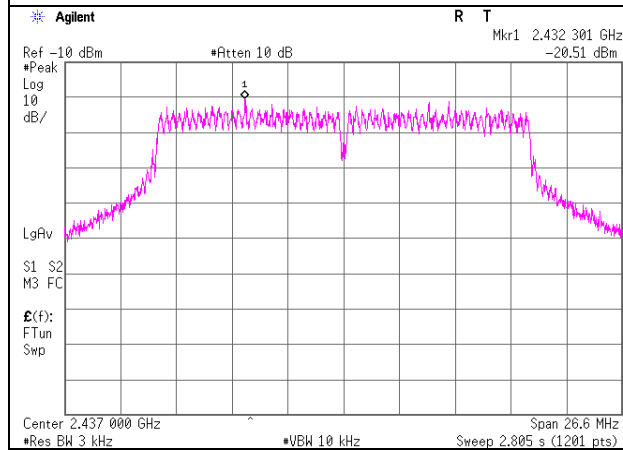
Power Density

11n-20

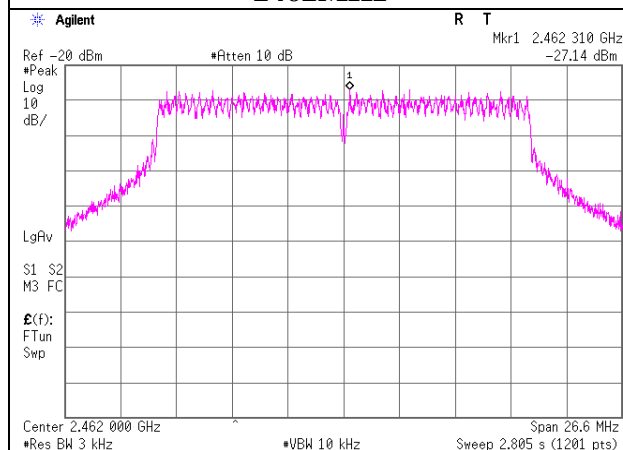
2412MHz



2437MHz



2462MHz



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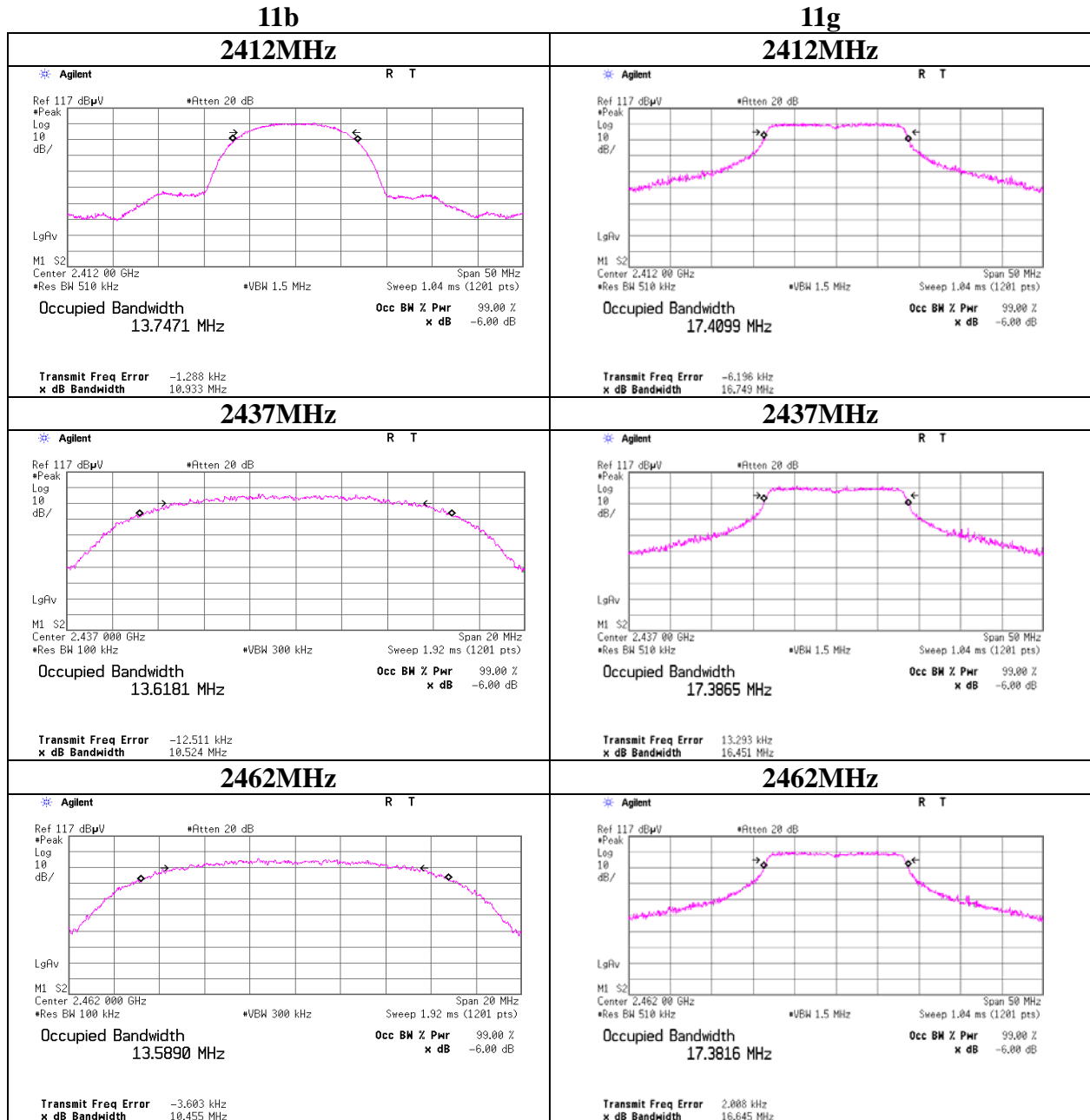
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99%Occupied Bandwidth

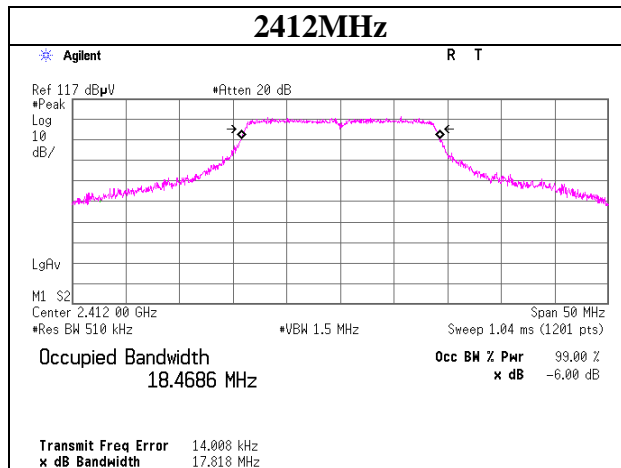
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10517044H
Date	11/26/2014
Temperature/ Humidity	22 deg. C / 47% RH
Engineer	Kazuya Yoshioka
Mode	11b Tx / 11g Tx



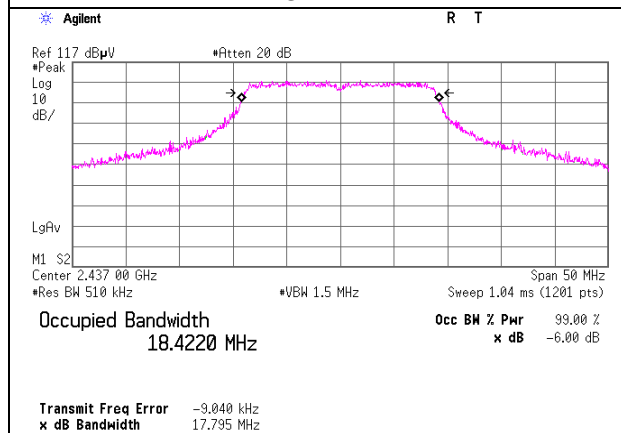
99% Occupied Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10517044H
Date	11/26/2014
Temperature/ Humidity	22 deg. C / 47% RH
Engineer	Kazuya Yoshioka
Mode	11n-20 Tx

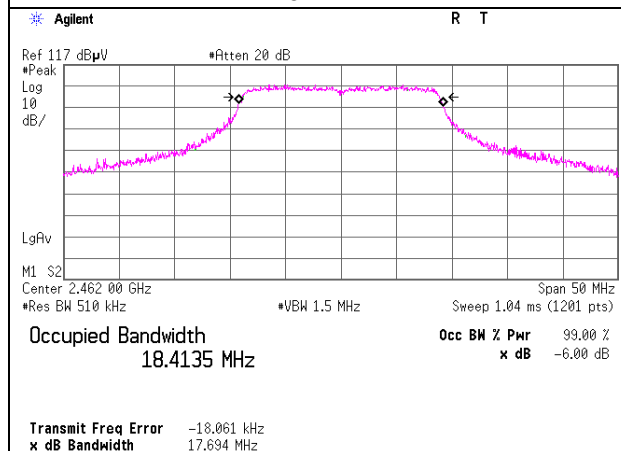
11n-20



2437MHz



2462MHz



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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2014/11/11 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2014/11/11 * 12
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2014/04/14 * 12
MCC-102	Microwave Cable	Hirose Electric	U.FL-2LP-066J1-A(200)	-	AT	2014/06/12 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2014/02/20 * 12
MDPS-05	DC Power Supply	KENWOOD TMI	PW8-3ATP	09067054	AT	Pre Check
MAT-25	Attenuator(10dB)(above 1G Hz)	Agilent	8493C	71642	AT	2014/06/12 * 12
MCC-36	Microwave Cable	Hirose Electric	U.FL-2LP-066-A-(200)	-	AT	2014/09/12 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
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
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2014/02/20 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2014/09/24 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2014/02/27 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2014/02/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	RE/AT	2014/02/28 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2014/08/19 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2014/10/18 * 12
MLA-03	Logperiodic Antenna	Schwarzbeck	USLP9143	174	RE	2014/10/18 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2014/07/14 * 12
MAT-70	Attenuator(6dB)	Agilent	8491A-006	MY52460153	RE	2014/04/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2014/03/14 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2014/02/21 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2014/05/21 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE/AT	2014/11/12 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	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
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	AT	2014/11/11 * 12
MAT-58	Attenuator(10dB)	Suhner	6810.19.A	-	AT	2014/01/15 * 12
MCC-35	Microwave Cable	Hirose Electric	U.FL-2LP-066-A-(200)	-	AT	2014/09/12 * 12

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**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
RE: Radiated Emission
AT: Antenna Terminal Conducted test**