RADIO TEST REPORT

Test Report No. : 10662332H-A-R1

Applicant	:	**Murata Manufacturing Company, Ltd.**
Type of Equipment	:	**Communication Module**
Model No.	:	**LBEE5ZZ1CK**
FCC ID	:	**VPYLB1CK**
Test regulation	:	**FCC Part 15 Subpart C: 2015**
Test Result	:	**Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. 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 10662332H-A. 10662332H-A is replaced with this report.

Date of test: January 5 to July 9, 2015

Representative test engineer:
Takumi Shimada
Engineer
Consumer Technology Division

Approved by:
Takayuki Shimada
Engineer
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://japan.ul.com/resources/emc_accredited/

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

REVISION HISTORY

Original Test Report No.: 10662332H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10662332H-A	July 13, 2015	-	-
1	10662332H-A-R1	July 28, 2015	P.6	Correction of FCC Part 15.203/212 Antenna requirement sentence

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

CONTENTS **PAGE**

SECTION 1: Customer information....4
SECTION 2: Equipment under test (E.U.T.)....4
SECTION 3: Test specification, procedures & results....6
SECTION 4: Operation of E.U.T. during testing....9
SECTION 5: Conducted Emission....12
SECTION 6: Radiated Spurious Emission....13
SECTION 7: Antenna Terminal Conducted Tests....15
APPENDIX 1: Data of EMI test....16
Conducted Emission....16
6dB Bandwidth....17
Maximum Peak Output Power....20
Radiated Spurious Emission....24
Band Edge confirmation....33
Conducted Spurious Emission....35
Power Density....36
99%Occupied Bandwidth....39
APPENDIX 2: Test instruments....41
APPENDIX 3: Photographs of test setup....43
Conducted Emission....43
Radiated Spurious Emission....44
Worst Case Position (Horizontal: X-axis/ Vertical:X-axis)....45

SECTION 1: Customer information

Company Name	:	Murata Manufacturing Company, Ltd.
Address	:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-6736
Facsimile Number	:	+81-75-955-6634
Contact Person	:	Motoo Hayashi

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

2.1 Identification of E.U.T.

Type of Equipment	:	Communication Module
Model No.	:	LBEE5ZZ1CK
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	VBAT: Typ. 3.6V, Min. 3.2V, Max. 4.4V VIO: Typ. 1.8V, Min. 1.71V, Max. 1.89V (This doesn't influence the RF Characteristic.)
Receipt Date of Sample	:	December 26, 2014
Country of Mass-production	:	China, 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

General Specification

Clock frequency(ies) in the system	:	37.4MHz
Operating temperature	:	-20deg. C to +80deg. C

Radio Specification

Radio Type : Transceiver
Power Supply (inner) : DC 1.35 V / DC 3.3 V

Specification of Wireless LAN (IEEE802.11b/g/a/n-20/n-40/ac-20/ac-40/ac-80)

Type of radio	**IEEE802.11b**	**IEEE802.11g/n**	**IEEE802.11a/n/ac (20 M band)**	**IEEE802.11n/ac (40 M band)**	**IEEE802.11ac (80 M band)**
Frequency of operation	2412-2462MHz *1)	2412-2462MHz *1)	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5190-5230MHz 5270-5310MHz 5510-5670MHz 5755-5795MHz	5210MHz 5290MHz 5530-5610MHz 5775MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5MHz		20MHz	40MHz	80MHz
Antenna type	Pattern Antenna				
Antenna Gain	2.4GHz: 0.0dBi 5GHz: 0.7dBi				

*1) 2.4GHz Band is applied to this test report.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C: 2015, final revised on June 12, 2015 and effective July 13, 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 June 12, 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	**FCC:** Section 15.207	**QP** 16.3dB, 20.25778MHz, L **AV** 6.3dB, 20.25778MHz, L	Complied	-
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
6dB Bandwidth	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r03	**FCC:** Section 15.247(a)(2)	See data.	Complied	Conducted
	IC: -	**IC:** RSS-247 5.2(1)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r03	**FCC:** Section 15.247(b)(3)		Complied	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.4(4)			
Power Density	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r03	**FCC:** Section 15.247(e)		Complied	Conducted
	IC: -	**IC:** RSS-247 5.2(2)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 DTS Meas Guidance v03r03	**FCC:** Section15.247(d)	2.5dB 2390.000MHz, AV, Horizontal	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	**IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			
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 v03r03 12.2.7.					

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

FCC Part 15.31 (e)

The RF Module has own regulator.
The RF Module is constantly provided voltage (DC 1.35 V / DC 3.3 V) through own regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203/212.

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.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

	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)	18Mbps, PN9
IEEE 802.11n 20MHz 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: 17dBm, 11g: 14dBm, 11n-20: 13dBm Software: mfgtest RC37.32.31 *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.	

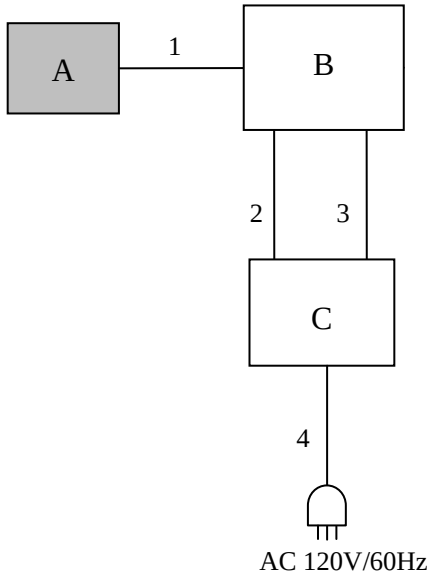
*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	11g Tx *1)	2462MHz *1)
Radiated Spurious Emission	11b Tx 11g Tx	2412MHz 2437MHz 2462MHz
	11n-20 Tx *2)	2412MHz 2462MHz
Conducted Spurious Emission	11g Tx *1)	2462MHz *1)
6dB Bandwidth Maximum Peak 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) Only band edge was tested on this mode according to "Section 1 of 6 802.11 a/b/g/n testing- Managing Complex Regulatory Approvals - " of TCB Council Workshop October 2009, as the 11g Tx mode had the higher power at antenna terminal test.

4.2 Configuration and peripherals

Conducted Emission test only



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

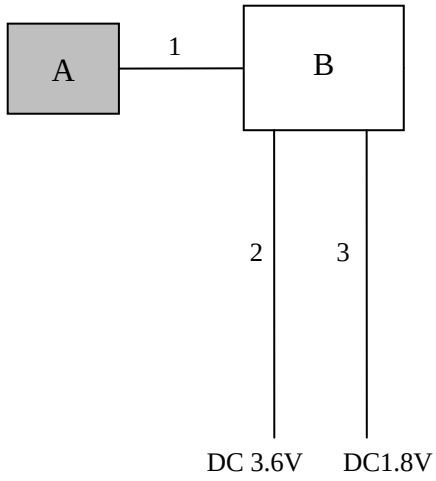
Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Communication Module	LBEE5ZZ1CK	Conducted No.1	Murata Manufacturing Company, Ltd.	EUT
B	Jig	-	-	Murata Manufacturing Company, Ltd.	-
C	DC Power Supply	PL330QMD	48943	Thurlby Thandar	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Flat Cable	0.1	Unshielded	Unshielded	-
2	DC Cable	1.5	Unshielded	Unshielded	-
3	DC Cable	1.5	Unshielded	Unshielded	-
4	AC Cable	1.5	Unshielded	Unshielded	-

Other than Conducted Emission test



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remark
A	Communication Module	LBEE5ZZ1CK	Conducted No.1 for AT* Radiated No.1 for RE*	Murata Manufacturing Company, Ltd.	EUT
B	Jig	-	-	Murata Manufacturing Company, Ltd.	-

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Flat Cable	0.1	Unshielded	Unshielded	-
2	DC Cable	1.5	Unshielded	Unshielded	-
3	DC Cable	1.5	Unshielded	Unshielded	-

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

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**

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 v03r03".

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.

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 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: WLAN: 12.2.5.2 RBW: 1MHz VBW: 3MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results.	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 "KDB 558074 D01 DTS Meas Guidance v03r03".
*2) Distance Factor: 20 x log (3.0m/1.0m) = 9.5dB

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

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

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

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 *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: 50MHz BW)
Peak 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				
Band Edge confirmation	40 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)

*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 v03r03".
*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

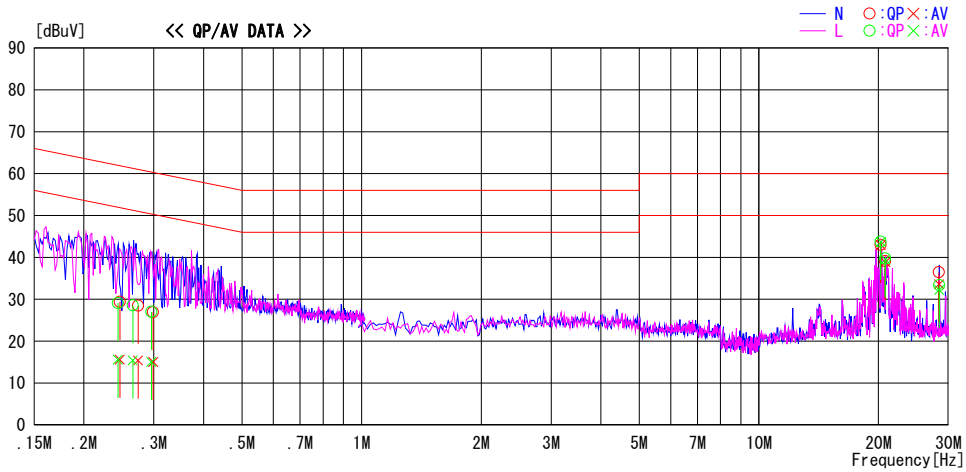
UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
Date : 2015/02/10

Report No. : 10662332H

Temp./Humi. : 21deg. C / 34% RH
Engineer : Takafumi Noguchi

Mode / Remarks : Tx 11g 2462Hz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.24627	16.1	2.3	13.3	29.4	15.6	61.9	51.9	32.5	36.3	N	
0.27362	15.2	2.1	13.3	28.5	15.4	61.0	51.0	32.5	35.6	N	
0.29857	13.6	1.8	13.3	26.9	15.1	60.3	50.3	33.4	35.2	N	
20.25808	27.8	27.8	15.2	43.0	43.0	60.0	50.0	17.0	7.0	N	
20.80834	23.9	23.7	15.2	39.1	38.9	60.0	50.0	20.9	11.1	N	
28.38404	20.7	17.8	15.8	36.5	33.6	60.0	50.0	23.5	16.4	N	
0.24365	15.8	2.3	13.3	29.1	15.6	62.0	52.0	32.9	36.4	L	
0.26540	15.3	2.1	13.3	28.6	15.4	61.3	51.3	32.7	35.9	L	
0.29590	13.7	1.8	13.3	27.0	15.1	60.4	50.4	33.4	35.3	L	
20.25778	28.5	28.5	15.2	43.7	43.7	60.0	50.0	16.3	6.3	L	
20.80608	24.5	24.3	15.2	39.7	39.5	60.0	50.0	20.3	10.5	L	
28.43184	17.6	16.4	15.8	33.4	32.2	60.0	50.0	26.6	17.8	L	

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

6dB Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/07/2015
Temperature/ Humidity	23 deg. C / 44% RH
Engineer	Kazuya Yoshioka
Mode	11b/g/n-20 Tx

11b

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	7.148	>500
2437	7.562	>500
2462	6.763	>500

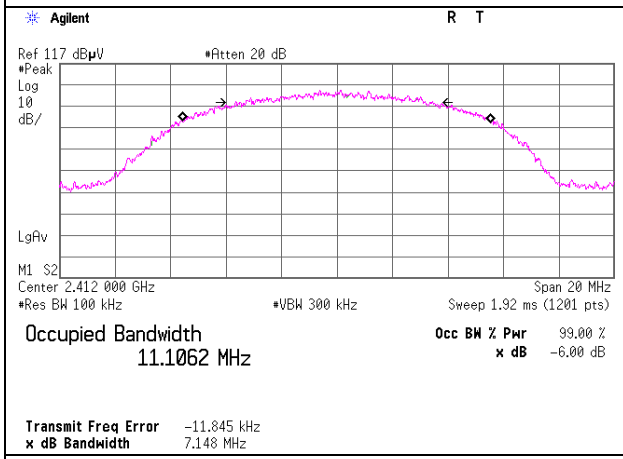
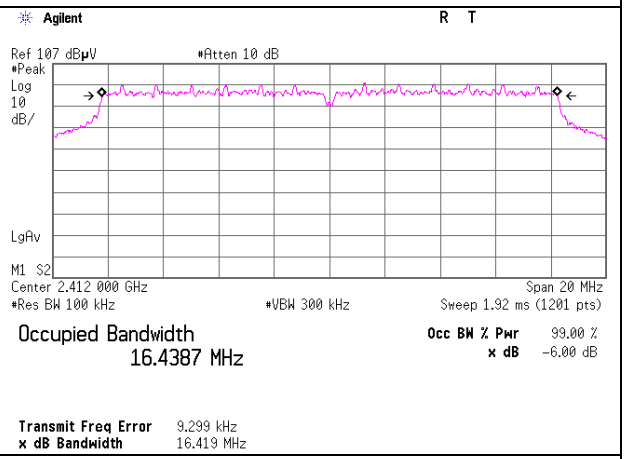
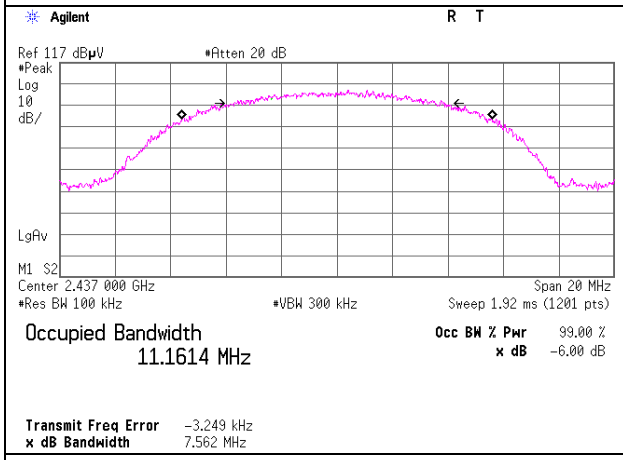
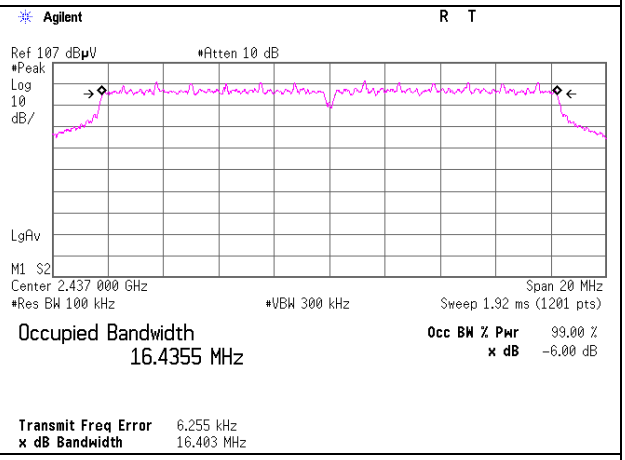
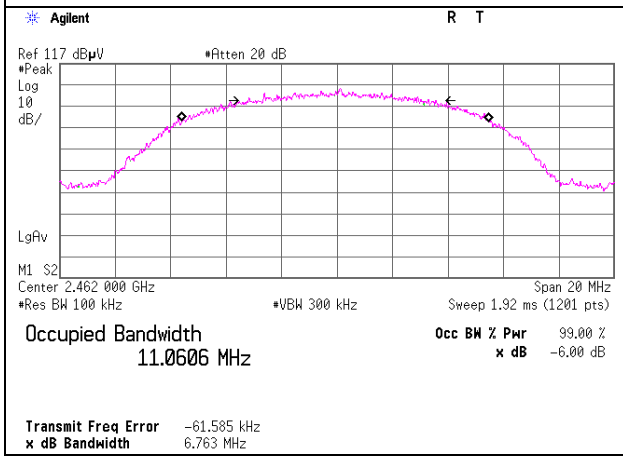
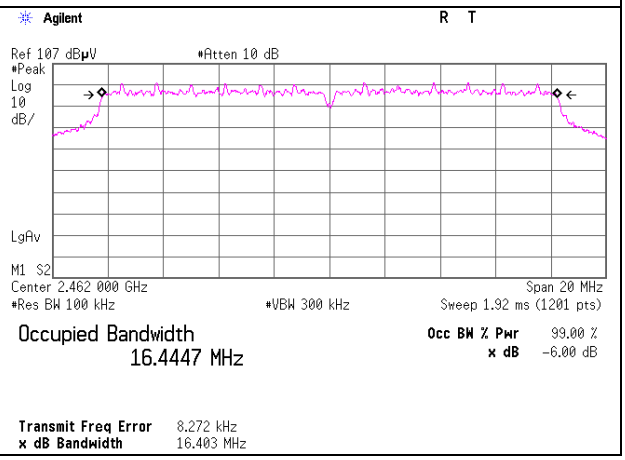
11g

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	16.419	>500
2437	16.403	>500
2462	16.403	>500

11n-20

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2412	17.743	>500
2437	17.750	>500
2462	17.738	>500

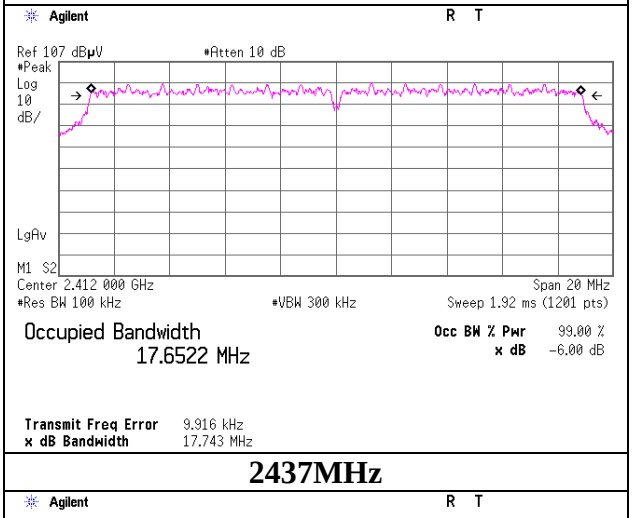
6dB Bandwidth

11b	11g
2412MHz	**2412MHz**
	
2437MHz	**2437MHz**
	
2462MHz	**2462MHz**
	

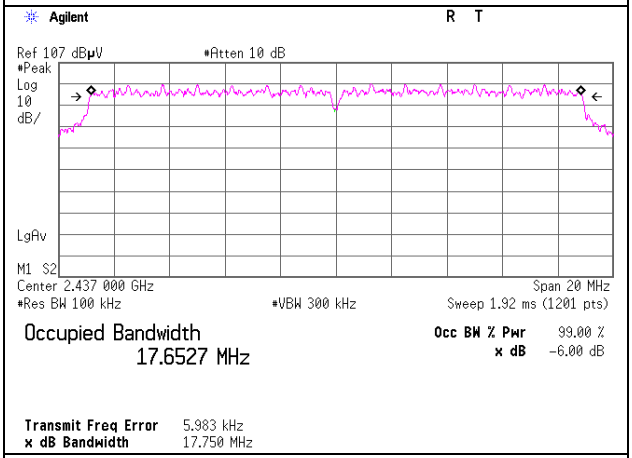
6dB Bandwidth

11n-20

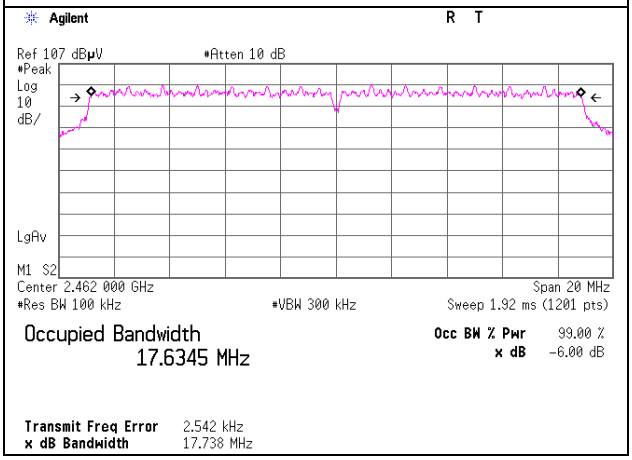
2412MHz



2437MHz



2462MHz



Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/05/2015
Temperature/ Humidity	23 deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b Tx

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	9.46	0.95	10.00	20.41	109.90	30.00	1000	9.59
2437	9.42	0.95	10.00	20.37	108.89	30.00	1000	9.63
2462	9.51	0.95	10.00	20.46	111.17	30.00	1000	9.54

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

2412MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	8.97	
2	9.13	
5.5	9.30	
11	9.46	*

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.
*The equipment and cables were not used for factor 0.0dB of the data sheets.

Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/05/2015
Temperature/ Humidity	23 deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11g Tx

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	12.53	0.95	10.00	23.48	222.84	30.00	1000	6.52
2437	12.57	0.95	10.00	23.52	224.91	30.00	1000	6.48
2462	12.60	0.95	10.00	23.55	226.46	30.00	1000	6.45

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

2412MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	12.11	
9	12.23	
12	12.46	
18	12.53	*
24	11.93	
36	12.26	
48	12.45	
54	11.85	

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.
*The equipment and cables were not used for factor 0.0dB of the data sheets.

Maximum Peak Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/05/2015
Temperature/ Humidity	23 deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11n-20 Tx

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	12.12	0.95	10.00	23.07	202.77	30.00	1000	6.93
2437	12.19	0.95	10.00	23.14	206.06	30.00	1000	6.86
2462	12.25	0.95	10.00	23.20	208.93	30.00	1000	6.80

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

2412MHz

MCS	Reading	Remark
	[dBm]	
0	12.04	
1	12.07	
2	12.06	
3	12.05	
4	11.95	
5	11.90	
6	12.12	*
7	11.98	

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.
*The equipment and cables were not used for factor 0.0dB of the data sheets.

Average Output Power

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/05/2015
Temperature/ Humidity	23 deg. C / 48% RH
Engineer	Takumi Shimada
Mode	11b/g/n-20 Tx

[AV]

11b **11Mbps**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	5.38	0.95	10.00	16.33	42.95	30.00	1000	13.67
2437	5.48	0.95	10.00	16.43	43.95	30.00	1000	13.57
2462	5.51	0.95	10.00	16.46	44.26	30.00	1000	13.54

11g **18Mbps**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	1.94	0.95	10.00	12.89	19.45	30.00	1000	17.11
2437	1.97	0.95	10.00	12.92	19.59	30.00	1000	17.08
2462	2.04	0.95	10.00	12.99	19.91	30.00	1000	17.01

11n-20 **MCS6**

Freq.	Reading	Cable Loss	Atten.	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	1.35	0.95	10.00	12.30	16.98	30.00	1000	17.70
2437	1.47	0.95	10.00	12.42	17.46	30.00	1000	17.58
2462	1.49	0.95	10.00	12.44	17.54	30.00	1000	17.56

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

Radiated Spurious Emission

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya (1-10GHz)	Takumi Shimada (10-26.5GHz)
Mode	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	53.8	26.8	3.2	32.7	-	51.1	73.9	22.8	
Hori	4824.000	PK	41.0	30.6	5.3	31.8	-	45.1	73.9	28.8	Floor Noise
Hori	7236.000	PK	42.2	35.9	6.6	32.7	-	52.0	73.9	21.9	Floor Noise
Hori	9648.000	PK	43.7	38.5	7.0	33.4	-	55.8	73.9	18.1	Floor Noise
Hori	2390.000	AV	44.4	26.8	3.2	32.7	0.4	42.1	53.9	11.8	*1)
Hori	4824.000	AV	33.5	30.6	5.3	31.8	-	37.6	53.9	16.3	Floor Noise
Hori	7236.000	AV	34.7	35.9	6.6	32.7	-	44.5	53.9	9.4	Floor Noise
Hori	9648.000	AV	36.7	38.5	7.0	33.4	-	48.8	53.9	5.1	Floor Noise
Vert	2390.000	PK	50.3	26.8	3.2	32.7	-	47.6	73.9	26.3	
Vert	4824.000	PK	40.9	30.6	5.3	31.8	-	45.0	73.9	28.9	Floor Noise
Vert	7236.000	PK	42.2	35.9	6.6	32.7	-	52.0	73.9	21.9	Floor Noise
Vert	9648.000	PK	44.1	38.5	7.0	33.4	-	56.2	73.9	17.7	Floor Noise
Vert	2390.000	AV	41.1	26.8	3.2	32.7	0.4	38.8	53.9	15.1	*1)
Vert	4824.000	AV	33.0	30.6	5.3	31.8	-	37.1	53.9	16.8	Floor Noise
Vert	7236.000	AV	34.7	35.9	6.6	32.7	-	44.5	53.9	9.4	Floor Noise
Vert	9648.000	AV	35.3	38.5	7.0	33.4	-	47.4	53.9	6.5	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)

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	103.1	26.8	3.2	32.7	100.4	-	-	Carrier
Hori	2400.000	PK	59.8	26.8	3.2	32.7	57.1	80.4	23.3	
Vert	2412.000	PK	102.7	26.8	3.2	32.7	100.0	-	-	Carrier
Vert	2400.000	PK	56.7	26.8	3.2	32.7	54.0	80.0	26.0	

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

UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya (1-10GHz)	Takumi Shimada (10-26.5GHz)
Mode	11b Tx 2437MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	40.9	30.7	5.3	31.7	45.2	73.9	28.7	Floor Noise
Hori	7311.000	PK	42.6	35.9	6.5	32.7	52.3	73.9	21.6	Floor Noise
Hori	9748.000	PK	43.2	38.7	7.1	33.4	55.6	73.9	18.3	Floor Noise
Hori	4874.000	AV	32.7	30.7	5.3	31.7	37.0	53.9	16.9	Floor Noise
Hori	7311.000	AV	34.1	35.9	6.5	32.7	43.8	53.9	10.1	Floor Noise
Hori	9748.000	AV	35.3	38.7	7.1	33.4	47.7	53.9	6.2	Floor Noise
Vert	4874.000	PK	39.9	30.7	5.3	31.7	44.2	73.9	29.7	Floor Noise
Vert	7311.000	PK	42.1	35.9	6.5	32.7	51.8	73.9	22.1	Floor Noise
Vert	9748.000	PK	42.9	38.7	7.1	33.4	55.3	73.9	18.6	Floor Noise
Vert	4874.000	AV	33.8	30.7	5.3	31.7	38.1	53.9	15.8	Floor Noise
Vert	7311.000	AV	35.4	35.9	6.5	32.7	45.1	53.9	8.8	Floor Noise
Vert	9748.000	AV	35.9	38.7	7.1	33.4	48.3	53.9	5.6	Floor Noise

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

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

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

Radiated Spurious Emission

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya (1-10GHz)	Takumi Shimada (10-26.5GHz)
Mode	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	53.1	26.9	3.2	32.7	-	50.5	73.9	23.4	
Hori	4924.000	PK	40.8	30.8	5.3	31.7	-	45.2	73.9	28.7	Floor Noise
Hori	7386.000	PK	42.5	35.9	6.5	32.7	-	52.2	73.9	21.7	Floor Noise
Hori	9848.000	PK	42.6	38.8	7.1	33.5	-	55.0	73.9	18.9	Floor Noise
Hori	2483.500	AV	46.1	26.9	3.2	32.7	0.4	43.9	53.9	10.0	*1)
Hori	4924.000	AV	32.8	30.8	5.3	31.7	-	37.2	53.9	16.7	Floor Noise
Hori	7386.000	AV	33.9	35.9	6.5	32.7	-	43.6	53.9	10.3	Floor Noise
Hori	9848.000	AV	34.8	38.8	7.1	33.5	-	47.2	53.9	6.7	Floor Noise
Vert	2483.500	PK	53.4	26.9	3.2	32.7	-	50.8	73.9	23.1	
Vert	4924.000	PK	41.0	30.8	5.3	31.7	-	45.4	73.9	28.5	Floor Noise
Vert	7386.000	PK	41.7	35.9	6.5	32.7	-	51.4	73.9	22.5	Floor Noise
Vert	9848.000	PK	43.1	38.8	7.1	33.5	-	55.5	73.9	18.4	Floor Noise
Vert	2483.500	AV	45.9	26.9	3.2	32.7	0.4	43.7	53.9	10.2	*1)
Vert	4924.000	AV	33.9	30.8	5.3	31.7	-	38.3	53.9	15.6	Floor Noise
Vert	7386.000	AV	34.9	35.9	6.5	32.7	-	44.6	53.9	9.3	Floor Noise
Vert	9848.000	AV	34.4	38.8	7.1	33.5	-	46.8	53.9	7.1	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

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya (1-10GHz)	Takumi Shimada (10-26.5GHz)
Mode	11g 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	65.0	26.8	3.2	32.7	-	62.3	73.9	11.6	
Hori	4824.000	PK	40.5	30.6	5.3	31.8	-	44.6	73.9	29.3	Floor Noise
Hori	7236.000	PK	41.3	35.9	6.6	32.7	-	51.1	73.9	22.8	Floor Noise
Hori	9648.000	PK	42.5	38.5	7.0	33.4	-	54.6	73.9	19.3	Floor Noise
Hori	2390.000	AV	53.3	26.8	3.2	32.7	0.8	51.4	53.9	2.5	*1)
Hori	4824.000	AV	33.1	30.6	5.3	31.8	-	37.2	53.9	16.7	Floor Noise
Hori	7236.000	AV	33.7	35.9	6.6	32.7	-	43.5	53.9	10.4	Floor Noise
Hori	9648.000	AV	35.0	38.5	7.0	33.4	-	47.1	53.9	6.8	Floor Noise
Vert	2390.000	PK	60.7	26.8	3.2	32.7	-	58.0	73.9	15.9	
Vert	4824.000	PK	41.1	30.6	5.3	31.8	-	45.2	73.9	28.7	Floor Noise
Vert	7236.000	PK	41.3	35.9	6.6	32.7	-	51.1	73.9	22.8	Floor Noise
Vert	9648.000	PK	42.7	38.5	7.0	33.4	-	54.8	73.9	19.1	Floor Noise
Vert	2390.000	AV	49.8	26.8	3.2	32.7	0.8	47.9	53.9	6.0	*1)
Vert	4824.000	AV	32.2	30.6	5.3	31.8	-	36.3	53.9	17.6	Floor Noise
Vert	7236.000	AV	33.9	35.9	6.6	32.7	-	43.7	53.9	10.2	Floor Noise
Vert	9648.000	AV	35.2	38.5	7.0	33.4	-	47.3	53.9	6.6	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	96.8	26.8	3.2	32.7	94.1	-	-	Carrier
Hori	2400.000	PK	58.0	26.8	3.2	32.7	55.3	74.1	18.8	
Vert	2412.000	PK	92.6	26.8	3.2	32.7	89.9	-	-	Carrier
Vert	2400.000	PK	53.6	26.8	3.2	32.7	50.9	69.9	19.0	

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

Radiated Spurious Emission

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya (1-10GHz)	Takumi Shimada (10-26.5GHz)
Mode	11g Tx 2437MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	4874.000	PK	40.4	30.7	5.3	31.7	44.7	73.9	29.2	Floor Noise
Hori	7311.000	PK	42.0	35.9	6.5	32.7	51.7	73.9	22.2	Floor Noise
Hori	9748.000	PK	41.9	38.7	7.1	33.4	54.3	73.9	19.6	Floor Noise
Hori	4874.000	AV	32.2	30.7	5.3	31.7	36.5	53.9	17.4	Floor Noise
Hori	7311.000	AV	33.7	35.9	6.5	32.7	43.4	53.9	10.5	Floor Noise
Hori	9748.000	AV	34.4	38.7	7.1	33.4	46.8	53.9	7.1	Floor Noise
Vert	4874.000	PK	40.9	30.7	5.3	31.7	45.2	73.9	28.7	Floor Noise
Vert	7311.000	PK	41.7	35.9	6.5	32.7	51.4	73.9	22.5	Floor Noise
Vert	9748.000	PK	42.4	38.7	7.1	33.4	54.8	73.9	19.1	Floor Noise
Vert	4874.000	AV	32.2	30.7	5.3	31.7	36.5	53.9	17.4	Floor Noise
Vert	7311.000	AV	33.7	35.9	6.5	32.7	43.4	53.9	10.5	Floor Noise
Vert	9748.000	AV	34.7	38.7	7.1	33.4	47.1	53.9	6.8	Floor Noise

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

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

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

Radiated Spurious Emission

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya (1-10GHz)	Takumi Shimada (Below 1GHz,10-26.5GHz)
Mode	11g 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	81.104	QP	46.0	6.5	7.9	32.1	-	28.3	40.0	11.7	
Hori	97.404	QP	45.6	9.6	8.1	32.1	-	31.2	43.5	12.3	
Hori	129.860	QP	46.5	13.7	8.5	32.0	-	36.7	43.5	6.8	
Hori	256.067	QP	41.7	17.5	9.6	31.9	-	36.9	46.0	9.1	
Hori	305.355	QP	44.4	17.2	9.9	31.9	-	39.6	46.0	6.4	
Hori	324.161	QP	47.1	17.4	10.1	31.9	-	42.7	46.0	3.3	
Hori	2483.500	PK	64.1	26.9	3.2	32.7	-	61.5	73.9	12.4	
Hori	4924.000	PK	39.9	30.8	5.3	31.7	-	44.3	73.9	29.6	Floor Noise
Hori	7386.000	PK	41.1	35.9	6.5	32.7	-	50.8	73.9	23.1	Floor Noise
Hori	9848.000	PK	42.4	38.8	7.1	33.5	-	54.8	73.9	19.1	Floor Noise
Hori	2483.500	AV	48.4	26.9	3.2	32.7	0.8	46.6	53.9	7.3	*1)
Hori	4924.000	AV	33.2	30.8	5.3	31.7	-	37.6	53.9	16.3	Floor Noise
Hori	7386.000	AV	34.5	35.9	6.5	32.7	-	44.2	53.9	9.7	Floor Noise
Hori	9848.000	AV	34.6	38.8	7.1	33.5	-	47.0	53.9	6.9	Floor Noise
Vert	81.082	QP	51.3	6.5	7.9	32.1	-	33.6	40.0	6.4	
Vert	97.319	QP	54.8	9.6	8.1	32.1	-	40.4	43.5	3.1	
Vert	129.696	QP	44.3	13.6	8.5	32.0	-	34.4	43.5	9.1	
Vert	256.322	QP	42.6	17.5	9.6	31.9	-	37.8	46.0	8.2	
Vert	307.665	QP	44.1	17.3	10.0	31.9	-	39.5	46.0	6.5	
Vert	324.157	QP	42.2	17.4	10.1	31.9	-	37.8	46.0	8.2	
Vert	2483.500	PK	63.1	26.9	3.2	32.7	-	60.5	73.9	13.4	
Vert	4924.000	PK	39.6	30.8	5.3	31.7	-	44.0	73.9	29.9	Floor Noise
Vert	7386.000	PK	41.8	35.9	6.5	32.7	-	51.5	73.9	22.4	Floor Noise
Vert	9848.000	PK	43.2	38.8	7.1	33.5	-	55.6	73.9	18.3	Floor Noise
Vert	2483.500	AV	48.0	26.9	3.2	32.7	0.8	46.2	53.9	7.7	*1)
Vert	4924.000	AV	32.5	30.8	5.3	31.7	-	36.9	53.9	17.0	Floor Noise
Vert	7386.000	AV	33.8	35.9	6.5	32.7	-	43.5	53.9	10.4	Floor Noise
Vert	9848.000	AV	34.4	38.8	7.1	33.5	-	46.8	53.9	7.1	Floor Noise

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

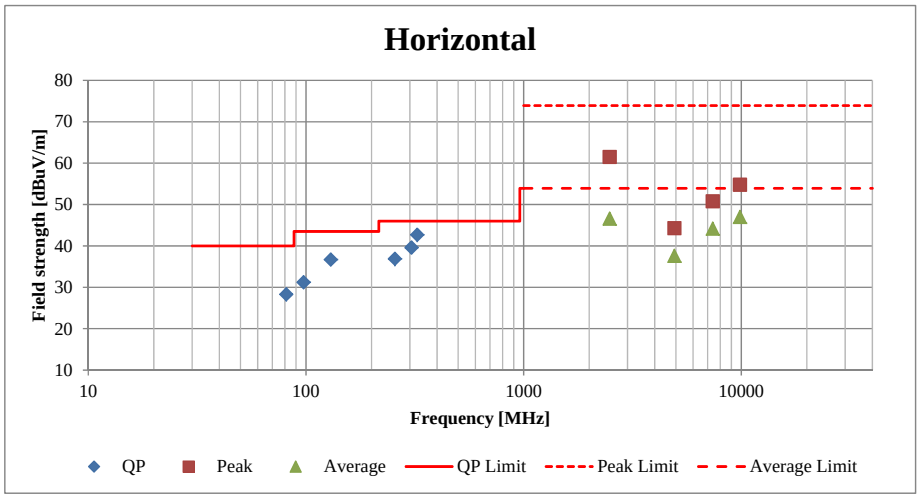
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

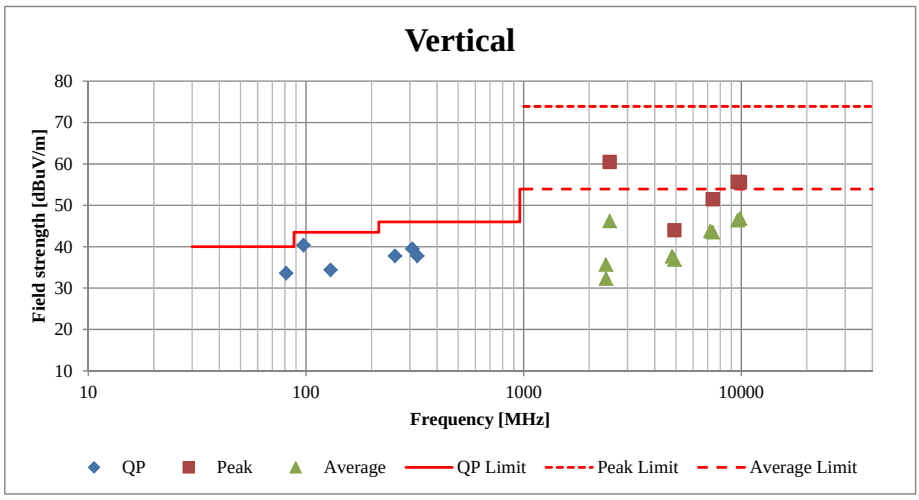
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	10662332H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	01/08/2015	01/22/2015
Temperature/ Humidity	25 deg. C / 36% RH	24 deg. C / 36% RH
Engineer	Yuta Moriya	Takumi Shimada
	(1-10GHz)	(Below 1GHz,10-26.5GHz)
Mode	11g Tx 2462MHz	





UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	10662332H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	01/22/2015
Temperature/ Humidity	24 deg. C / 36% RH
Engineer	Takumi Shimada
	(1-10GHz)
Mode	11n-20 Tx 2412MHz / 2462MHz

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	65.7	27.4	3.2	32.8	-	63.5	73.9	10.4	
Hori	2390.000	AV	49.5	27.4	3.2	32.8	0.4	47.7	53.9	6.2	*1)
Vert	2390.000	PK	66.3	27.4	3.2	32.8	-	64.1	73.9	9.8	
Vert	2390.000	AV	50.1	27.4	3.2	32.8	0.4	48.3	53.9	5.6	*1)

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

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

*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	95.8	27.4	3.2	32.8	93.6	-	-	Carrier
Hori	2400.000	PK	57.1	27.4	3.2	32.8	54.9	73.6	18.7	
Vert	2412.000	PK	95.4	27.4	3.2	32.8	93.2	-	-	Carrier
Vert	2400.000	PK	57.8	27.4	3.2	32.8	55.6	73.2	17.6	

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

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	69.5	27.6	3.3	32.7	-	67.7	73.9	6.2	
Hori	2483.500	AV	51.8	27.6	3.3	32.7	0.4	50.4	53.9	3.5	*1)
Vert	2483.500	PK	65.1	27.6	3.3	32.7	-	63.3	73.9	10.6	
Vert	2483.500	AV	48.8	27.6	3.3	32.7	0.4	47.4	53.9	6.5	*1)

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

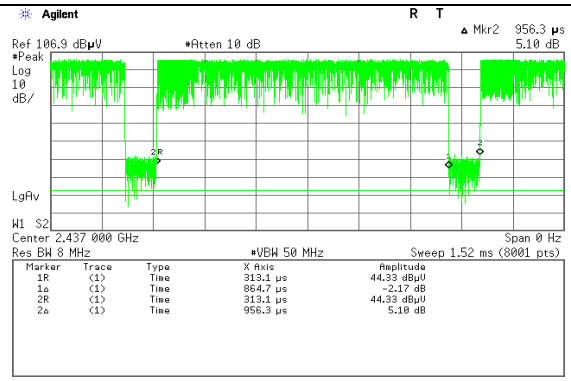
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

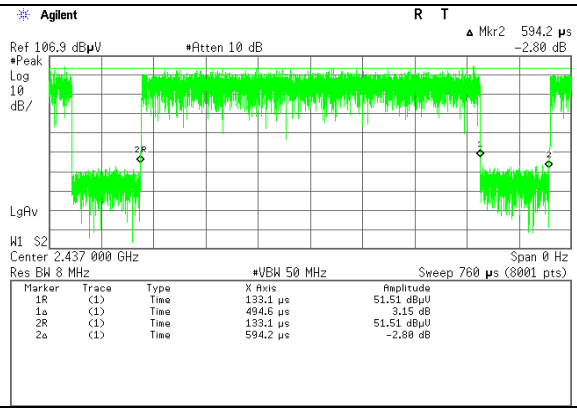
*1) Not Out of Band emission (Leakage Power)

Burst rate confirmation

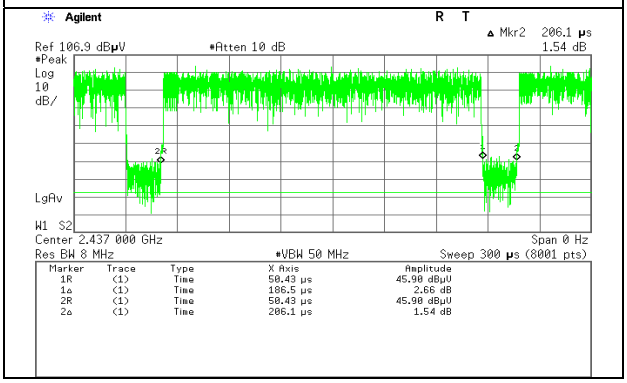
Test place	Ise EMC Lab. No.3 Semi Anechoic Chamber
Report No.	10662332H
Date	01/08/2015
Temperature/ Humidity	25 deg. C / 36% RH
Engineer	Yuta Moriya
Mode	11b/g/n-20 Tx

11b 11Mbps		11g 18Mbps	
Tx on / (Tx on + Tx off) =	**0.904**	**Tx on / (Tx on + Tx off) =**	**0.832**
Tx on / (Tx on + Tx off) * 100 =	**90.4 %**	**Tx on / (Tx on + Tx off) * 100 =**	**83.2 %**
Duty factor = 10 * log (0.9563 / 0.8647) =	**0.44 dB**	**Duty factor = 10 * log (0.5942 / 0.4946) =**	**0.80 dB**





11n-20 MCS6	
Tx on / (Tx on + Tx off) =	**0.905**
Tx on / (Tx on + Tx off) * 100 =	**90.5 %**
Duty factor = 10 * log (0.2061 / 0.1865) =	**0.43 dB**



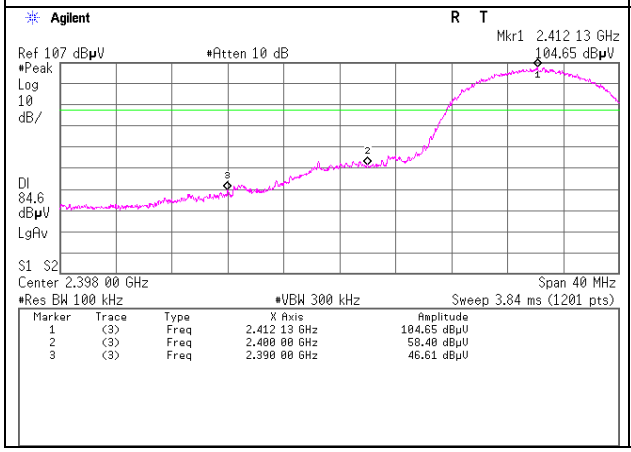
UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Band Edge confirmation

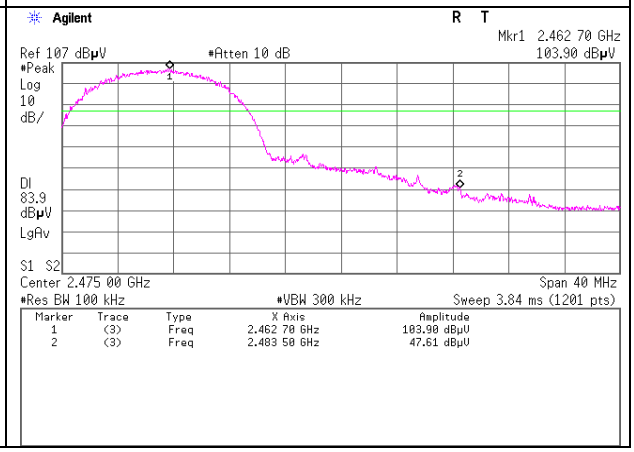
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10662332H
Date	07/09/2015
Temperature / Humidity	24 deg. C / 67 % RH
Engineer	Keisuke Kawamura
Mode	Tx 11b / 11g

11b

2412 MHz

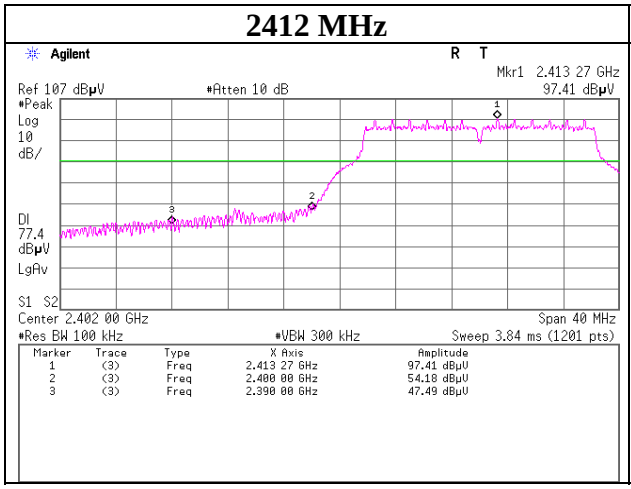


2462 MHz

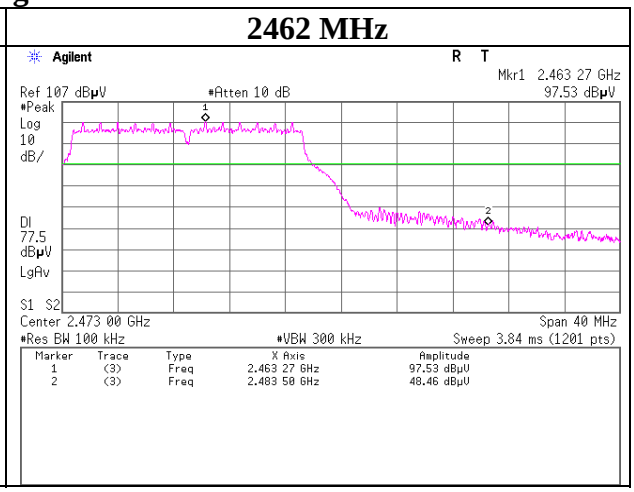


11g

2412 MHz



2462 MHz



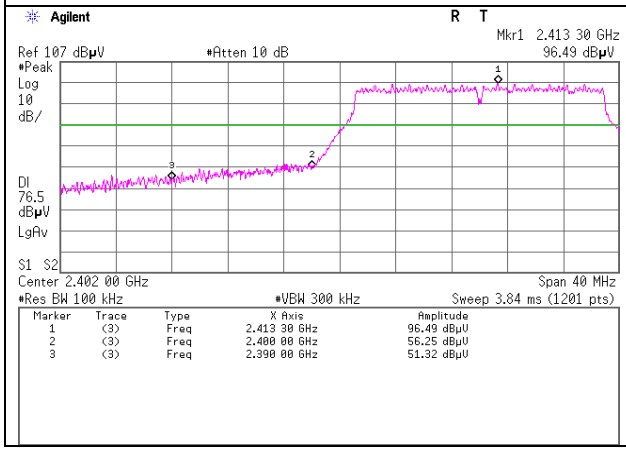
* Final result of band edge was measured as radiated spurious emission. Refer to Radiated Spurious Emission's pages.

Band Edge confirmation

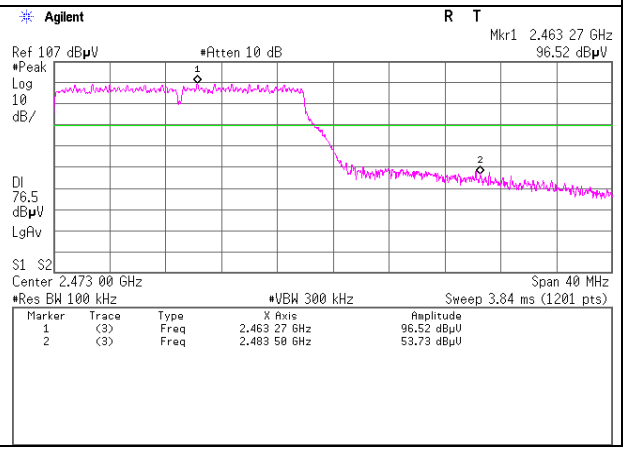
Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10662332H
Date	07/09/2015
Temperature / Humidity	24 deg. C / 67 % RH
Engineer	Keisuke Kawamura
Mode	Tx 11n-20

11n-20

2412 MHz



2462 MHz



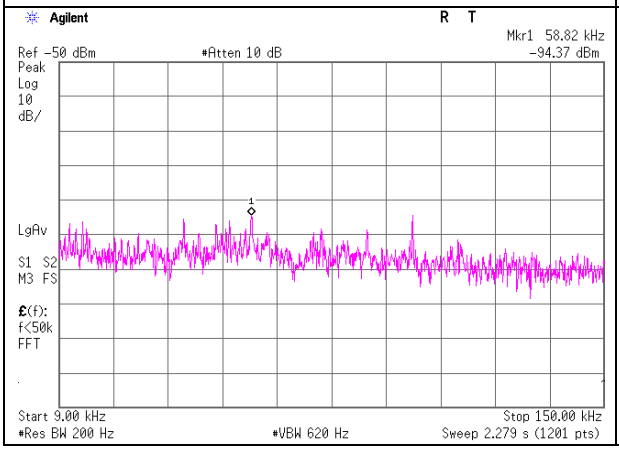
* Final result of band edge was measured as radiated spurious emission. Refer to Radiated Spurious Emission's pages.

Conducted Spurious Emission

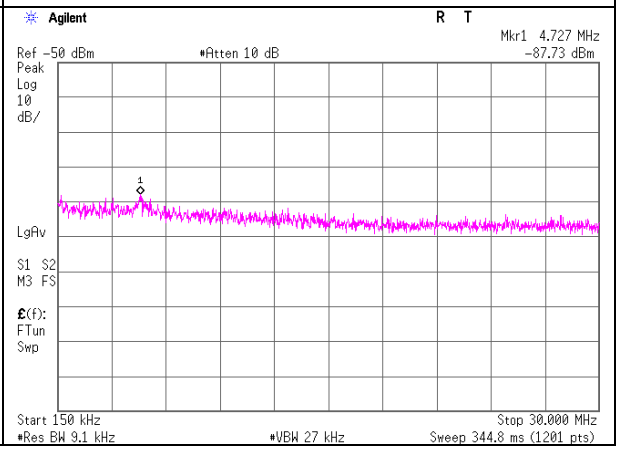
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	02/07/2015
Temperature/ Humidity	25 deg. C / 40% RH
Engineer	Takumi Shimada
Mode	Tx 11g

11g Tx 2462MHz

9kHz-150kHz



150kHz-30MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator [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
58.82	-94.4	0.01	10.0	2.0	1	-82.4	300	6.0	-21.1	52.2	73.3	
4727.00	-87.7	0.01	10.0	2.0	1	-75.7	30	6.0	5.5	29.5	24.0	

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss+Attenator+Antenna Gain+10*log(N)

Power Density

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/07/2015
Temperature/ Humidity	23 deg. C / 44% RH
Engineer	Kazuya Yoshioka
Mode	11b/g/n-20 Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-17.75	1.81	10.00	-5.94	8.00	13.94
2437.00	-18.16	1.82	10.00	-6.34	8.00	14.34
2462.00	-18.01	1.82	10.00	-6.19	8.00	14.19

11g

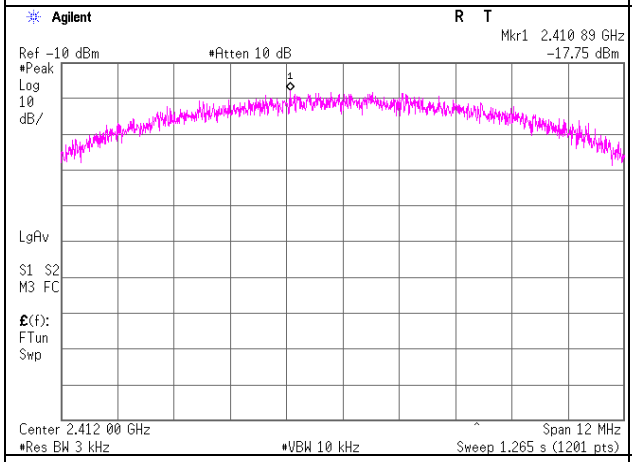
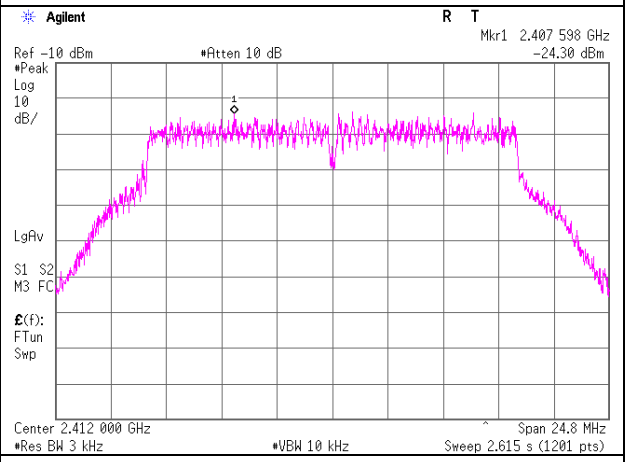
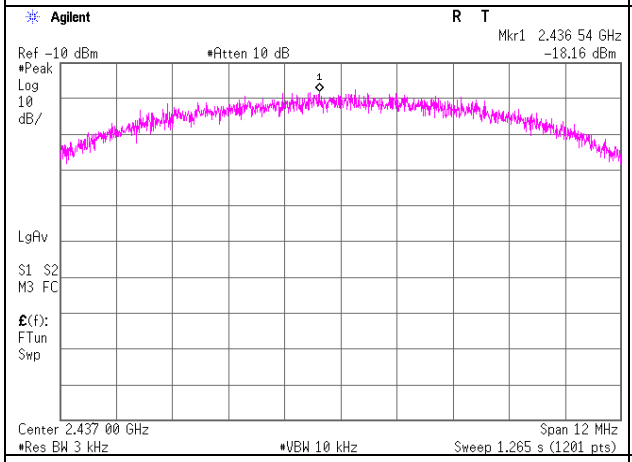
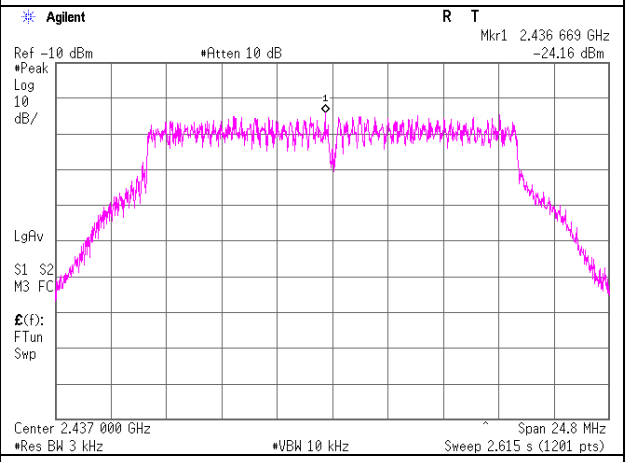
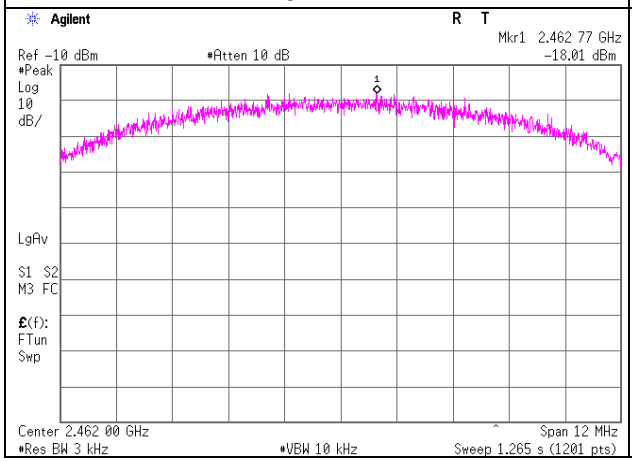
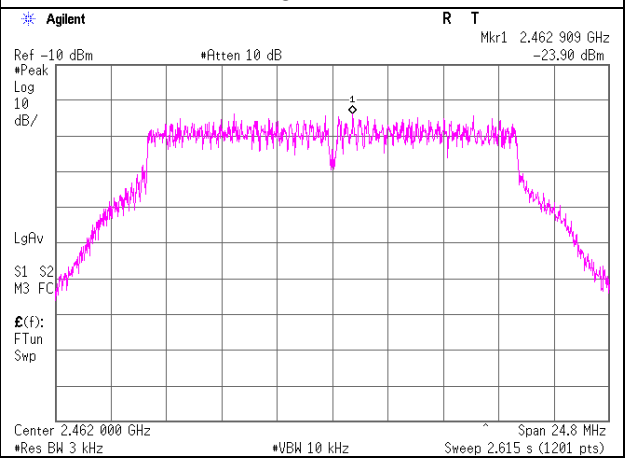
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.30	1.81	10.00	-12.49	8.00	20.49
2437.00	-24.16	1.82	10.00	-12.34	8.00	20.34
2462.00	-23.90	1.82	10.00	-12.08	8.00	20.08

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.29	1.81	10.00	-12.48	8.00	20.48
2437.00	-23.89	1.82	10.00	-12.07	8.00	20.07
2462.00	-24.73	1.82	10.00	-12.91	8.00	20.91

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

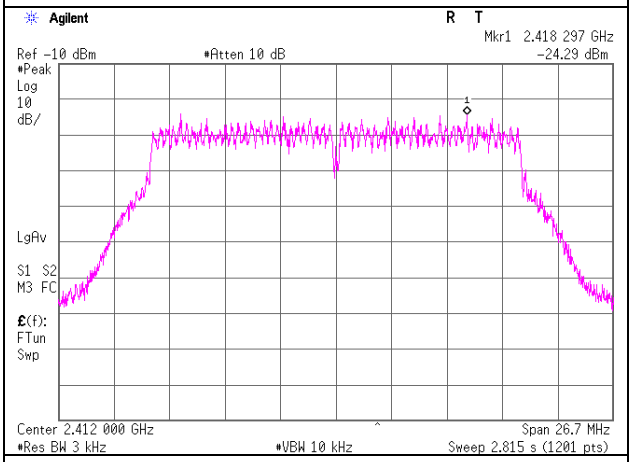
Power Density

11b	11g
2412MHz	**2412MHz**
	
2437MHz	**2437MHz**
	
2462MHz	**2462MHz**
	

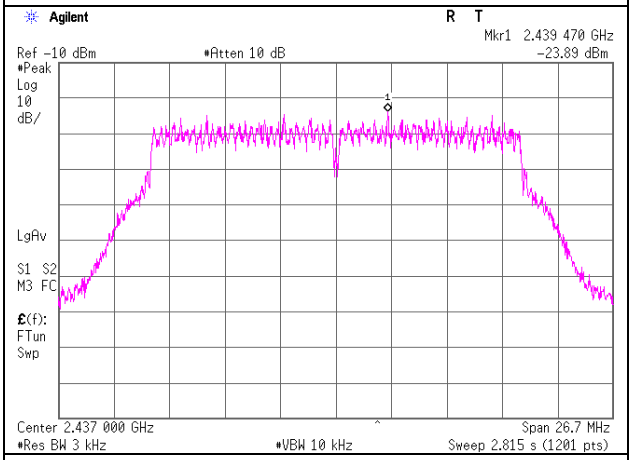
Power Density

11n-20

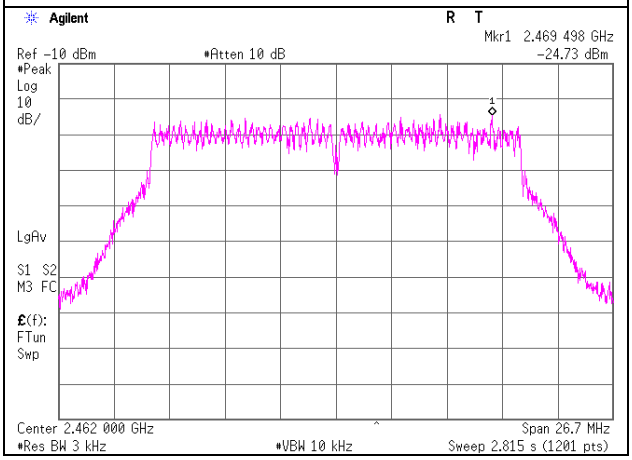
2412MHz



2437MHz



2462MHz

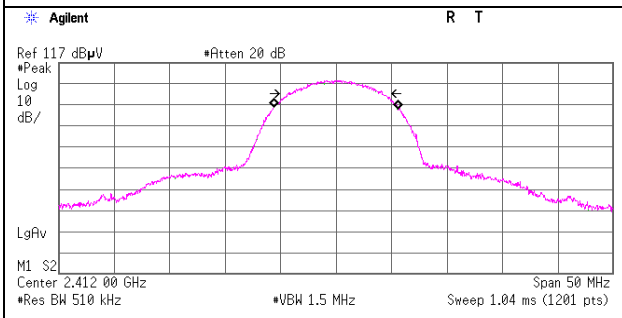


99%Occupied Bandwidth

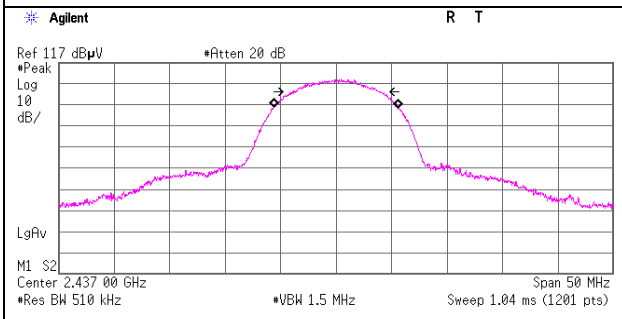
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/07/2015
Temperature/ Humidity	23 deg. C / 44% RH
Engineer	Kazuya Yoshioka
Mode	11b/g Tx

11b

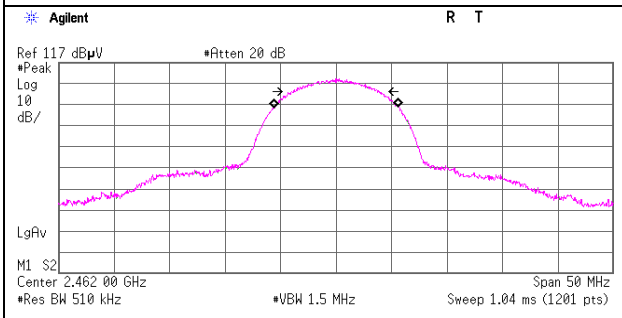
2412MHz



2437MHz

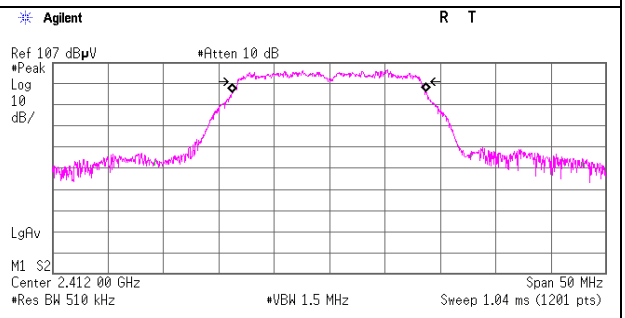


2462MHz

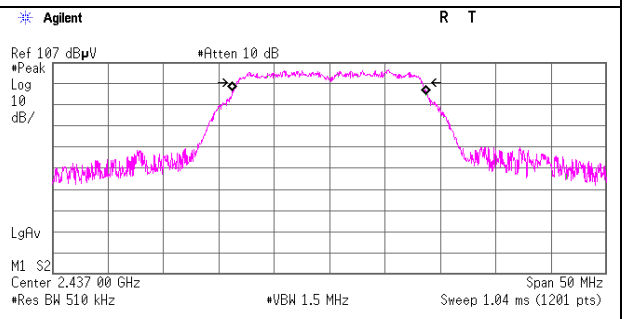


11g

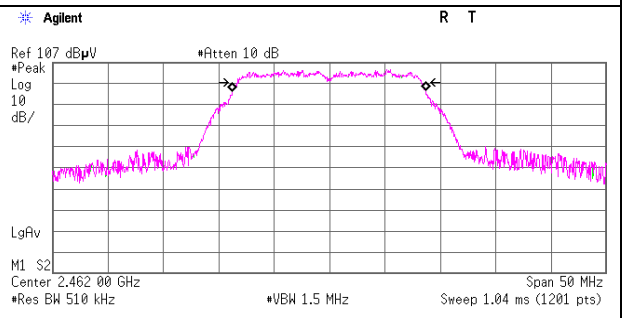
2412MHz



2437MHz



2462MHz



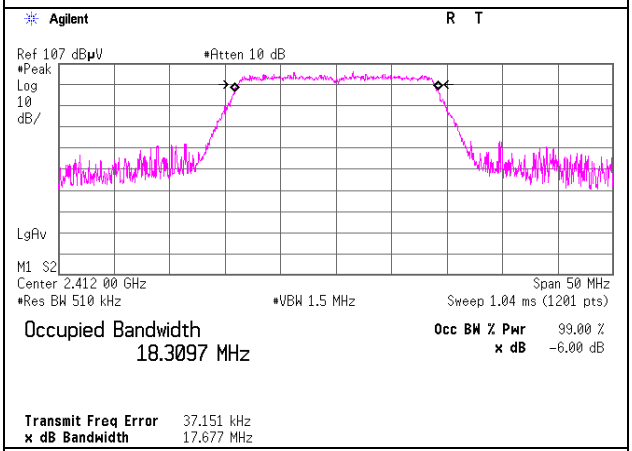
UL Japan, Inc.
Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

99% Occupied Bandwidth

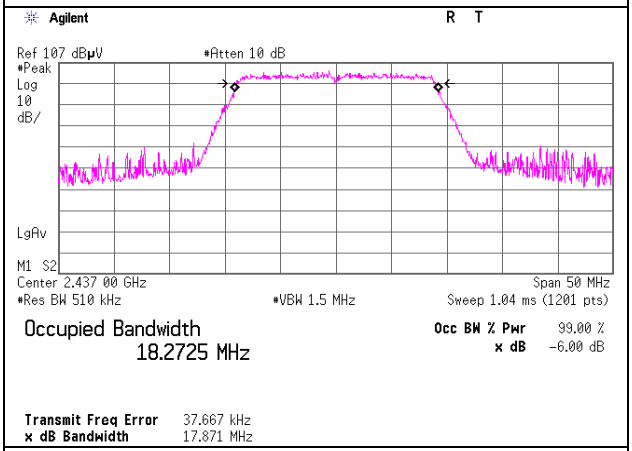
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10662332H
Date	01/07/2015
Temperature/ Humidity	23 deg. C / 44% RH
Engineer	Kazuya Yoshioka
Mode	11n-20 Tx

11n-20

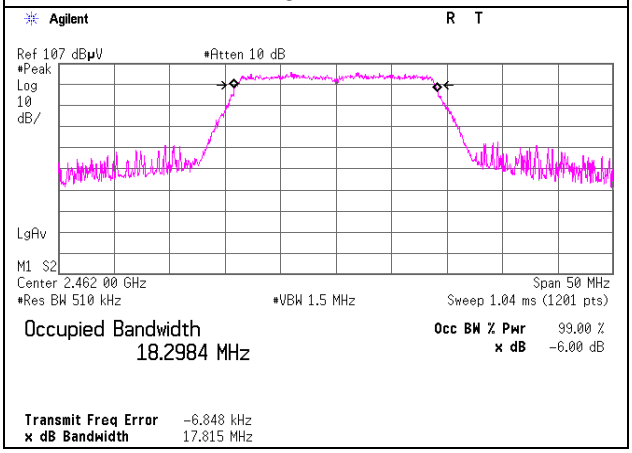
2412MHz



2437MHz



2462MHz



APPENDIX 2: Test instruments

EMI test equipment(1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	CE	2014/09/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	CE	2015/01/13 * 12
MJM-21	Measure	KOMELON	KMC-36	-	CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	CE/RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	CE	2014/06/06 * 12 *1)
MLS-25	LISN(AMN)	Schwarzbeck	NSLK8127	8127-731	CE	2014/07/09 * 12
MTA-30	Terminator	TME	CT-01	-	CE	2015/01/19 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m)/RF M-E421(Switcher)	-/01068(Switcher)	CE	2014/09/12 * 12
MAT-64	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2014/02/27 * 12 *1)
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2014/02/20 * 12 *1)
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	RE/AT	2015/02/16 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2014/05/26 * 12 *1)
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2014/05/26 * 12 *1)
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2014/03/24 * 12 *1)
MHF-25	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	RE	2014/09/22 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2014/11/12 * 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 *1)
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2014/02/20 * 12 *1)
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 12 *1)
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2014/10/16 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2014/10/15 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2014/12/22 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2015/01/13 * 12
MTW-06	Torque wrench	HUBER+SUHNER	74 Z-0-0-21	72536	AT	2015/03/05 * 36
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/13 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2014/10/02 * 12

EMI test equipment(2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2014/02/28 * 12 *1)
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2014/11/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2014/11/22 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2014/11/22 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2014/06/02 * 12 *1)
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2014/03/14 * 12 *1)
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2014/04/08 * 12 *1)
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2014/08/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2014/06/11 * 12 *1)
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2014/03/11 * 12 *1)
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2014/06/11 * 12 *1)
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2014/09/24 * 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