



RADIO TEST REPORT

Test Report No. : 10589156H

Applicant : KYOCERA Document Solutions Inc.
Type of Equipment : Communication Module
Model No. : LBWA1ZZ1CA
Test standard : EN 300 328 V1.8.1: 2012-06
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 standard(s).
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: December 2, 2014 to January 13, 2015

**Representative
test engineer:**

T. Shimada

Takumi Shimada

Engineer

Consumer Technology Division

Approved by :

Takayuki Shimada

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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

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

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 10589156H

[illegible]

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SECTION 1: Customer information

Company Name : KYOCERA Document Solutions Inc.
Address : 2-28 1-Chome Tamatsukuri Chuo-Ku, Osaka, Japan 540-8585
Telephone Number : +81-6-6764-3333
Facsimile Number : +81-6-6764-3493
Contact Person : Yukio Okajo

***Remarks:**

Murata Manufacturing Company, Ltd. designates KYOCERA Document Solutions Inc. as manufacturer of the product (Communication Module).

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

2.1 Identification of E.U.T.

Type of Equipment : Communication Module
Model No. : LBWA1ZZ1CA
Serial No. : Refer to Section 4, Clause 4.2
Rating : VBAT Typ. 3.3V, Min. 3.0V, Max. 3.6V
PAVDD Typ. 3.3V, Min.3.0V, Max.3.6V
VIO Typ.3.3V, Min.3.0V, Max.3.63V
(This doesn't influence the RF Characteristic.)
Receipt Date of Sample : December 2, 2014
Country of Mass-production : China, Japan, Vietnam
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 20MHz

Specification of WLAN (IEEE802.11b/g/n)

Type of radio	Wireless LAN (IEEE802.11b/g)	Wireless LAN (IEEE802.11n) 2.4G Band SISO (20M Band)
Equipment Type	Transceiver	
Frequency of Operation	2412MHz - 2472MHz	
Bandwidth & Channel spacing	Bandwidth : 20MHz Ch spacing : 5MHz	
Type of Modulation	11b: DSSS 11g: OFDM	OFDM
Antenna Type / Antenna Gain	Monopole Pattern Antenna: 1.9dBi	
Power Supply (inner)	DC 3.3V	
Operating temperature range	0 to +80 deg. C	

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Radio : EN 300 328 V1.8.1:2012-06

Title : Electromagnetic compatibility and Radio spectrum Matters (ERM);
Wideband transmission systems; Data transmission equipment operating
in the 2.4GHz ISM band and using wide band modulation techniques;
Harmonized EN covering the essential requirements of article 3.2 of the
R&TTE Directive

Purpose of test : Compliance with the R&TTE directive 1999/5/EC.

3.2 Procedures and results

No.	Item	Test Procedure	Limit	Remarks	Worst margin	Exclusions	Results
1	RF output power	Clause 5.3.2	Clause 4.3.2.1	Conducted	-	N/A	Complied
2	Power Spectral Density	Clause 5.3.3	Clause 4.3.2.2	Conducted	-	N/A	Complied
3	Duty cycle, Tx-sequence, Tx-gap	Clause 5.3.2	Clause 4.3.2.3	Conducted	-	N/A	N/A *1)
4	Medium Utilisation (MU) factor	Clause 5.3.2	Clause 4.3.2.4	Conducted	-	N/A	N/A *1)
5	Adaptivity (adaptive equipment using modulations other than FHSS)	Clause 5.3.7	Clause 4.3.2.5	Conducted	-	N/A	Complied
6	Occupied Channel Bandwidth	Clause 5.3.8	Clause 4.3.2.6	Conducted	-	N/A	Complied
7	Transmitter unwanted emissions in the out-of-band domain	Clause 5.3.9	Clause 4.3.2.7	Conducted	-	N/A	Complied
8	Transmitter unwanted emissions in the spurious domain	Clause 5.3.10	Clause 4.3.2.8	Radiated	22.2dB 4944.00MHz, Vertical	N/A	Complied
9	Receiver Spurious emissions	Clause 5.3.11	Clause 4.3.2.9	Radiated	No signal detected	N/A	Complied
10	Receiver Blocking	Clause 5.3.7	Clause 4.3.2.10	Conducted	-	N/A	Complied
Note: UL Japan, Inc. 's EMI Work Procedure 13-EM-W0420.							
*1) The test is not applicable since the EUT is an adaptive equipment and does not operate in a non-adaptive mode.							

3.3 Additions or deviations to standards

No addition, exclusion nor deviation has been made from the standard.

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3.4 Uncertainty

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

RF output power	(+) 1.5dB
Power Spectral Density and Unwanted Emissions	(+) 1.7dB
Time and Duty Cycle	(±) 0.012%

Transmitter unwanted emissions in the spurious domain and Receiver Spurious emissions

Spurious Emission (EUT height: 1.5m) (+dB)	
Measurement Distance 3m	
30MHz-300MHz	5.5dB
300MHz-1000MHz	3.9dB
1GHz-12.75GHz	4.6dB

[Transmitter unwanted emissions in the spurious domain]

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

[Receiver spurious emissions]

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

3.5 Test Location

UL Japan, Inc. Ise EMC Lab. *NVLAP Lab. code: 200572-0
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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	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

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

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

Refer to APPENDIX.

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Facsimile : +81 596 24 8124

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

4.1 Operating Mode(s)

Mode	Remarks*
IEEE 802.11b (11b)	5.5Mbps, PN9
IEEE 802.11g (11g)	6Mbps, PN9
IEEE 802.11n (11n-20)	MCS 7, PN9
<p>*The worst condition was determined based on the test result of RF Output power. *EUT has the power settings by the software as follows; Power settings: 11b: 15.5dBm, 11g: 13dBm, 11n-20: 13dBm Software: 1.42 RC0.0/ 6.10.198.69 This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.</p>	

Details of Operating Mode(s)

Test item	Operating mode	Tested frequency
RF output power, Power Spectral Density	Transmitting (Tx) IEEE 802.11b/g/n-20	2412MHz 2442MHz 2472MHz
Occupied channel bandwidth, Transmitter unwanted emissions in the out-of-band domain, Transmitter unwanted emissions in the spurious domain	Transmitting (Tx) IEEE 802.11b/g/n-20	2412MHz 2472MHz
Adaptivity, Receiver blocking,	Communication IEEE 802.11b/g/n-20	2412MHz 2472MHz
Receiver spurious emissions	Receiving (Rx) IEEE 802.11b/g/n-20	2412MHz 2472MHz

Extreme test condition	
Temperature	0deg. C to +80deg. C
Voltage	VBAT: Vnom: DC 3.3V, Vmin: DC 3.0V, Vmax: DC 3.6V PAVDD: Vnom: DC 3.3V, Vmin: DC 3.0V, Vmax: DC 3.6V

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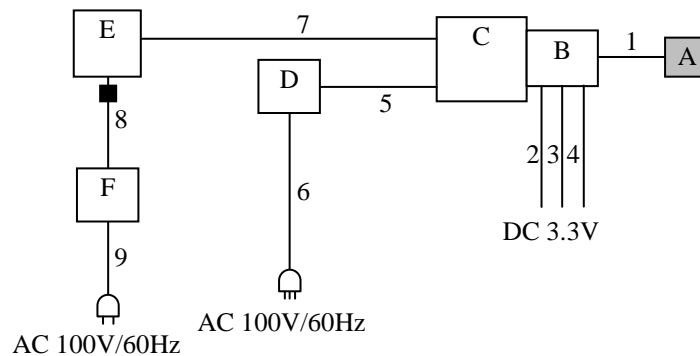
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Facsimile : +81 596 24 8124

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	Communication Module	LBWA1ZZ1CA	12 for RE* 11 for AT*	Murata Manufacturing Company, Ltd.	EUT
B	Jig	-	-	Murata Manufacturing Company, Ltd.	-
C	Jig	-	-	Murata Manufacturing Company, Ltd.	-
D	DC Power Supply	PW18-1.3AT	08016530	KENWOOD	for Jig
E	Laptop PC	1952	41V9539JS	lenovo	-
F	AC Adapter	92P1156	11S92P1156Z1ZD XN12ED9Z	lenovo	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.1	Unshielded	Unshielded	-
2	DC Cable	3.0	Unshielded	Unshielded	-
3	DC Cable	3.0	Unshielded	Unshielded	-
4	DC Cable	3.0	Unshielded	Unshielded	-
5	DC Cable	3.0	Unshielded	Unshielded	-
6	AC Cable	2.0	Unshielded	Unshielded	-
7	RS-232C Cable	2.5	Shielded	Shielded	-
8	DC Cable	1.8	Unshielded	Unshielded	-
9	AC Cable	1.0	Unshielded	Unshielded	-

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

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SECTION 5: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Instrument used	Remark
RF Output Power	Power Meter	Normal and Extreme conditions
Power Spectral Density	Spectrum Analyzer	Normal condition
Adaptivity	Spectrum Analyzer	Normal condition
Occupied Channel Bandwidth	Spectrum Analyzer	Normal condition
Transmitter unwanted emissions in the out-of band domain	Spectrum Analyzer	Normal and Extreme conditions - Detector mode: AV - Band power was used on behalf of the time domain power function. - Filter mode: Gaussian Filter Since the data in this test report has enough margin
Receiver Blocking	Spectrum Analyzer	Normal condition

The test results are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0.0dB of the data sheets.

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SECTION 6: Transmitter unwanted emissions in the spurious domain and Receiver spurious emissions

Test Procedure

- 1) EUT was placed on a urethane plate form of nominal size, 0.5m by 0.5m raised 1.5m above the conducting ground plane.
The Radiated Electric Field Strength intensity has been measured in semi anechoic chamber at a distance of 3m.
The measuring antenna height was varied between 1 to 4m and the turn table 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.
- 2) Exchanged the EUT to the Substitution Antenna, the measurement was set for the same height 1.5m as the EUT. The frequency below 1GHz of the Substitution Antenna was used the Half wave dipole Antenna, which was tuned the measured frequency in 1).
The frequency above 1GHz of the Substitution Antenna was used Horn Antenna.
The Substitution Antenna was connected to the Signal Generator, and the polarized electromagnetic radiation of the Substitution Antenna was matched with the one of the measuring Antenna, which was set with the Signal Generator to the measured frequency in 1). Then, we set with the Output power (CW) of the Signal Generator where the measuring electromagnetic field strength is equal to the measured value in 1) by means of varying the measuring antenna height between 1 to 4m to obtain maximum receiving level.
Its Output power of Signal Generator was recorded.
- 3) Below 1GHz:
Effective radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the Signal Generator and the Substitution Antenna from the Output power of the Signal Generator recorded in 2).
For the usage of the Antenna (Horn Antenna) except for the Half wave dipole Antenna (2.15dBi) for the Substitution Antenna, the Effective radiated power was calculated by compensating the finite difference in the Antenna gain of the Half wave dipole Antenna, and Substitution Antenna.
Above 1GHz:
Equivalent isotropic radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the signal generator and the substitution antenna from the output power of the signal generator recorded in 2).
For the usage of the antenna (horn antenna) for the substitution antenna, the equivalent isotropic radiated power was calculated by compensating the finite substitution antenna.

Pre-check scan setting

Frequency	Below 1GHz	Above 1GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer
IF Bandwidth	Peak, RBW: 100kHz/VBW: 300kHz	Peak, RBW: 1MHz/VBW: 3MHz
Trace mode	Max hold	Max hold

Measured setting

Frequency	Below 1GHz	Above 1GHz
Instrument used	Spectrum Analyzer	Spectrum Analyzer
IF Bandwidth	RMS, RBW: 100kHz/VBW: 300kHz	RMS, RBW: 1MHz/VBW: 3MHz
Span / sweep time	Wide enough to capture each individual emission identified / auto	Wide enough to capture each individual emission identified / auto

- 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 are rounded off to one decimal place, so some differences might be observed.

Test data : **APPENDIX**
Test result : **Pass**

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APPENDIX 1: Data of EMI test

RF Output Power

Test place : Ise EMC Lab. No.6 and 11 Measurement Room
Report No. : 10589156H
Date : 12/04/2014 12/05/2014 01/13/2015
Temperature/ Humidity : 20 deg. C / 52% RH 23 deg. C / 30% RH 24 deg. C / 42% RH
Engineer : Tomohisa Nakagawa Tomohisa Nakagawa Takumi Shimada
Mode : Tx 11b/g

11b

Test Condition Temp.	Volt.	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
nom	nom	2412.0	3.91	1.78	10.08	1.90	17.67	20.00	2.33
		2442.0	3.95	1.78	10.08	1.90	17.71	20.00	2.29
		2472.0	3.91	1.79	10.08	1.90	17.68	20.00	2.32
min	min	2412.0	4.23	1.78	10.08	1.90	17.99	20.00	2.01
		2442.0	4.18	1.78	10.08	1.90	17.94	20.00	2.06
		2472.0	4.27	1.79	10.08	1.90	18.04	20.00	1.96
min	max	2412.0	4.25	1.78	10.08	1.90	18.01	20.00	1.99
		2442.0	4.12	1.78	10.08	1.90	17.88	20.00	2.12
		2472.0	4.25	1.79	10.08	1.90	18.02	20.00	1.98
max	min	2412.0	3.73	1.78	10.08	1.90	17.49	20.00	2.51
		2442.0	3.78	1.78	10.08	1.90	17.54	20.00	2.46
		2472.0	3.91	1.79	10.08	1.90	17.68	20.00	2.32
max	max	2412.0	3.82	1.78	10.08	1.90	17.58	20.00	2.42
		2442.0	3.99	1.78	10.08	1.90	17.75	20.00	2.25
		2472.0	3.84	1.79	10.08	1.90	17.61	20.00	2.39

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

11g

Test Condition Temp.	Volt.	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
nom	nom	2412.0	1.56	1.78	10.08	1.90	15.32	20.00	4.68
		2442.0	1.56	1.78	10.08	1.90	15.32	20.00	4.68
		2472.0	1.55	1.79	10.08	1.90	15.32	20.00	4.68
min	min	2412.0	1.79	1.78	10.08	1.90	15.55	20.00	4.45
		2442.0	1.74	1.78	10.08	1.90	15.50	20.00	4.50
		2472.0	1.72	1.79	10.08	1.90	15.49	20.00	4.51
min	max	2412.0	1.77	1.78	10.08	1.90	15.53	20.00	4.47
		2442.0	1.86	1.78	10.08	1.90	15.62	20.00	4.38
		2472.0	1.97	1.79	10.08	1.90	15.74	20.00	4.26
max	min	2412.0	1.59	1.78	10.08	1.90	15.35	20.00	4.65
		2442.0	1.55	1.78	10.08	1.90	15.31	20.00	4.69
		2472.0	1.62	1.79	10.08	1.90	15.39	20.00	4.61
max	max	2412.0	1.66	1.78	10.08	1.90	15.42	20.00	4.58
		2442.0	1.87	1.78	10.08	1.90	15.63	20.00	4.37
		2472.0	1.53	1.79	10.08	1.90	15.30	20.00	4.70

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

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RF Output Power

Test place	Ise EMC Lab. No.6 and 11 Measurement Room		
Report No.	10589156H		
Date	12/04/2014	12/05/2014	01/13/2015
Temperature/ Humidity	20 deg. C / 52% RH	23 deg. C / 30% RH	24 deg. C / 42% RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa	Takumi Shimada
Mode	Tx 11n-20		

11n-20

Test Condition Temp.	Volt.	Freq. [MHz]	P/M(AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
nom	nom	2412.0	1.39	1.78	10.08	1.90	15.15	20.00	4.85
		2442.0	1.47	1.78	10.08	1.90	15.23	20.00	4.77
		2472.0	1.47	1.79	10.08	1.90	15.24	20.00	4.76
min	min	2412.0	1.67	1.78	10.08	1.90	15.43	20.00	4.57
		2442.0	1.65	1.78	10.08	1.90	15.41	20.00	4.59
		2472.0	1.68	1.79	10.08	1.90	15.45	20.00	4.55
min	max	2412.0	1.85	1.78	10.08	1.90	15.61	20.00	4.39
		2442.0	1.88	1.78	10.08	1.90	15.64	20.00	4.36
		2472.0	1.76	1.79	10.08	1.90	15.53	20.00	4.47
max	min	2412.0	1.54	1.78	10.08	1.90	15.30	20.00	4.70
		2442.0	1.41	1.78	10.08	1.90	15.17	20.00	4.83
		2472.0	1.41	1.79	10.08	1.90	15.18	20.00	4.82
max	max	2412.0	1.63	1.78	10.08	1.90	15.39	20.00	4.61
		2442.0	1.63	1.78	10.08	1.90	15.39	20.00	4.61
		2472.0	1.66	1.79	10.08	1.90	15.43	20.00	4.57

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

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RF Output Power
(Worst Rate Check)

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10589156H
Date	12/04/2014
Temperature/ Humidity	20 deg. C / 52% RH
Engineer	Tomohisa Nakagawa
Mode	Tx 11b/g/n-20

11b 2442MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	3.82	
2	3.92	
5.5	3.95	*
11	3.93	

*: Worst Rate

11g 2442MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	1.56	*
9	1.45	
12	1.48	
18	1.52	
24	1.51	
36	1.53	
48	1.54	
54	1.45	

*: Worst Rate

11n-20 2442MHz

MCS	Reading	Remark
	[dBm]	
0	1.31	
1	1.32	
2	1.37	
3	1.42	
4	1.37	
5	1.36	
6	1.33	
7	1.47	*

*: Worst Rate

Sample Calculation:

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

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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Power Spectral Density

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10589156H
Date	12/04/2014
Temperature/ Humidity	20 deg. C / 52% RH
Engineer	Tomohisa Nakagawa
Mode	Tx 11b/g/n-20

11b

Test Condition Temp.	Volt.	Ch Freq.	S/A Maximum Reading	S/A Total Power Reading	RF Output Power	Result	Limit	Margin
		[MHz]	[dBm/MHz]	[dBm]	[dBm]	[dBm/MHz]	[dBm/MHz]	[dB]
nom	nom	2412.00	-0.71	7.11	17.67	9.85	10.00	0.15
		2442.00	-0.73	7.09	17.71	9.89	10.00	0.11
		2472.00	-0.92	6.95	17.68	9.81	10.00	0.19

Result [dBm/MHz] = S/A Maximum Reading [dBm/MHz] - S/A Total Power Reading [dBm] (*1) + RF Output Power [dBm] (*2)

(*1) Integrated value of 2400MHz to 2483.5MHz

(*2) Refer to RF Output Power

11g

Test Condition Temp.	Volt.	Ch Freq.	S/A Maximum Reading	S/A Total Power Reading	RF Output Power	Result	Limit	Margin
		[MHz]	[dBm/MHz]	[dBm]	[dBm]	[dBm/MHz]	[dBm/MHz]	[dB]
nom	nom	2412.00	-5.85	4.36	15.32	5.11	10.00	4.89
		2442.00	-5.74	4.37	15.32	5.21	10.00	4.79
		2472.00	-5.82	4.39	15.32	5.12	10.00	4.88

Result [dBm/MHz] = S/A Maximum Reading [dBm/MHz] - S/A Total Power Reading [dBm] (*1) + RF Output Power [dBm] (*2)

(*1) Integrated value of 2400MHz to 2483.5MHz

(*2) Refer to RF Output Power

11n-20

Test Condition Temp.	Volt.	Ch Freq.	S/A Maximum Reading	S/A Total Power Reading	RF Output Power	Result	Limit	Margin
		[MHz]	[dBm/MHz]	[dBm]	[dBm]	[dBm/MHz]	[dBm/MHz]	[dB]
nom	nom	2412.00	-6.30	4.08	15.15	4.77	10.00	5.23
		2442.00	-6.42	4.02	15.23	4.79	10.00	5.21
		2472.00	-6.39	4.05	15.24	4.80	10.00	5.20

Result [dBm/MHz] = S/A Maximum Reading [dBm/MHz] - S/A Total Power Reading [dBm] (*1) + RF Output Power [dBm] (*2)

(*1) Integrated value of 2400MHz to 2483.5MHz

(*2) Refer to RF Output Power

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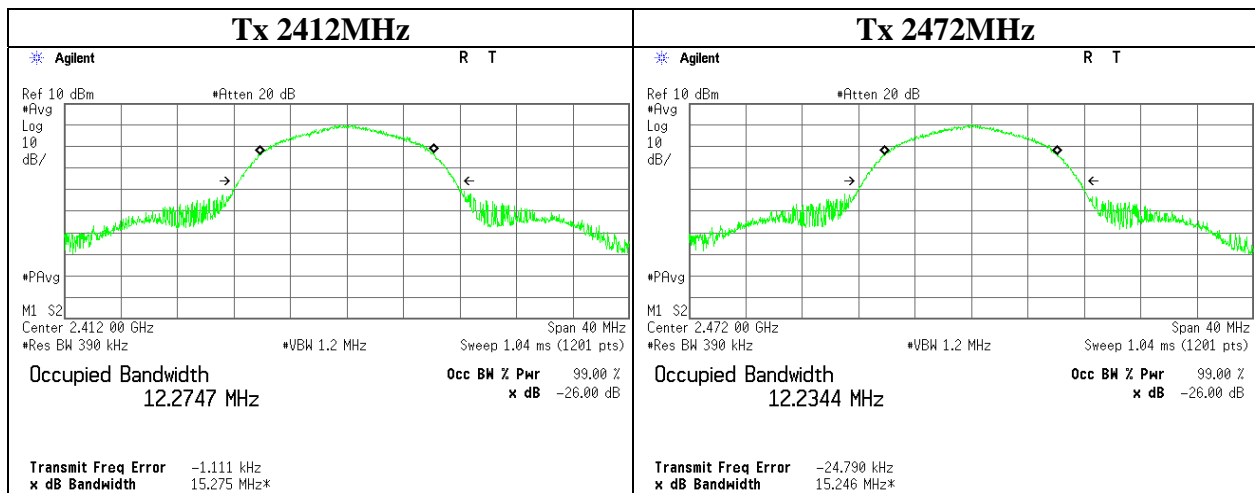
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Occupied Channel Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10589156H
Date	12/04/2014
Temperature/ Humidity	20 deg. C / 52% RH
Engineer	Tomohisa Nakagawa
Mode	Tx 11b

Frequency [MHz]	Bandwidth [MHz]	Result [MHz]	Limit [MHz]
2412	12.2747	2405.8627	> 2400
2472	12.2344	2478.1172	< 2483.5



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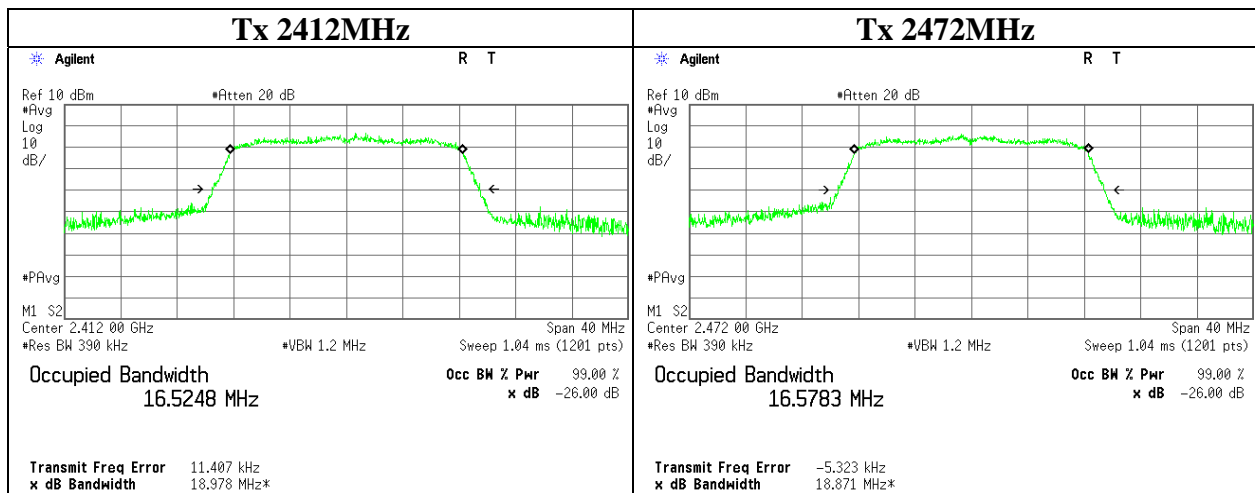
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Occupied Channel Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10589156H
Date 12/04/2014
Temperature/ Humidity 20 deg. C / 52% RH
Engineer Tomohisa Nakagawa
Mode Tx 11g

Frequency [MHz]	Bandwidth [MHz]	Result [MHz]	Limit [MHz]
2412	16.5248	2403.7376	> 2400
2472	16.5783	2480.2892	< 2483.5



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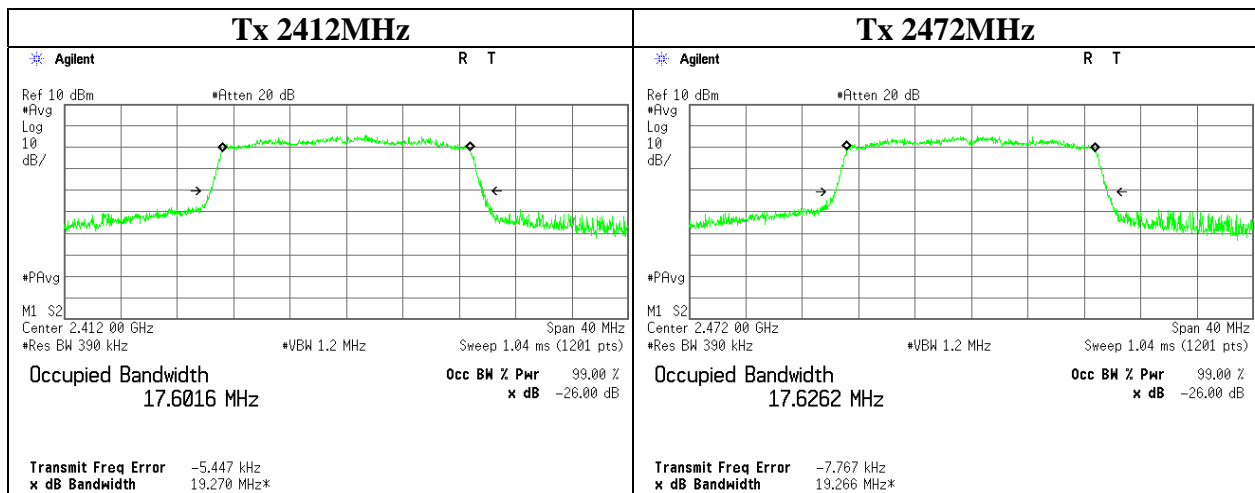
Telephone : +81 596 24 8999

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Occupied Channel Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10589156H
Date 12/04/2014
Temperature/ Humidity 20 deg. C / 52% RH
Engineer Tomohisa Nakagawa
Mode Tx 11n-20

Frequency [MHz]	Bandwidth [MHz]	Result [MHz]	Limit [MHz]
2412	17.6016	2403.1992	> 2400
2472	17.6262	2480.8131	< 2483.5



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Facsimile : +81 596 24 8124

Transmitter unwanted emissions in the out-of-band domain

Test place	Ise EMC Lab. No.6 and 11 Measurement Room		
Report No.	10589156H		
Date	12/04/2014	12/05/2014	01/13/2015
Temperature/ Humidity	20 deg. C / 52% RH	23 deg. C / 30% RH	24 deg. C / 42% RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa	Takumi Shimada
Mode	Tx 11b		

11b

Test Condition		Frequency	S/A(AV)	Cable	Atten.	Antenna	Result	Limit	Margin	Remarks
Temp.	Volt.	[MHz]	Reading [dBm/MHz]	Loss [dB]	Loss [dB]	Gain [dBi]	[dBm/MHz]	[dBm/MHz]	[dB]	
nom	nom	2386.2	-67.74	1.78	10.08	1.90	-53.98	-20.00	33.98	Lowest ch 2400MHz- 2BW
		2398.5	-49.24	1.78	10.08	1.90	-35.48	-10.00	25.48	Lowest ch 2400MHz- BW
		2485.0	-47.08	1.79	10.08	1.90	-33.31	-10.00	23.31	Highest ch 2483.5MHz + BW
		2496.2	-66.96	1.79	10.08	1.90	-53.19	-20.00	33.19	Highest ch 2483.5MHz + 2BW
min	min	2387.2	-67.55	1.78	10.08	1.90	-53.79	-20.00	33.79	Lowest ch 2400MHz- 2BW
		2398.5	-47.73	1.78	10.08	1.90	-33.97	-10.00	23.97	Lowest ch 2400MHz- BW
		2486.0	-46.62	1.79	10.08	1.90	-32.85	-10.00	22.85	Highest ch 2483.5MHz + BW
		2497.2	-66.19	1.79	10.08	1.90	-52.42	-20.00	32.42	Highest ch 2483.5MHz + 2BW
min	max	2387.2	-66.00	1.78	10.08	1.90	-52.24	-20.00	32.24	Lowest ch 2400MHz- 2BW
		2397.5	-48.94	1.78	10.08	1.90	-35.18	-10.00	25.18	Lowest ch 2400MHz- BW
		2485.0	-45.90	1.79	10.08	1.90	-32.13	-10.00	22.13	Highest ch 2483.5MHz + BW
		2496.2	-65.51	1.79	10.08	1.90	-51.74	-20.00	31.74	Highest ch 2483.5MHz + 2BW
max	min	2387.2	-67.48	1.78	10.08	1.90	-53.72	-20.00	33.72	Lowest ch 2400MHz- 2BW
		2398.5	-46.49	1.78	10.08	1.90	-32.73	-10.00	22.73	Lowest ch 2400MHz- BW
		2486.0	-47.56	1.79	10.08	1.90	-33.79	-10.00	23.79	Highest ch 2483.5MHz + BW
		2496.2	-66.63	1.79	10.08	1.90	-52.86	-20.00	32.86	Highest ch 2483.5MHz + 2BW
max	max	2387.2	-66.76	1.78	10.08	1.90	-53.00	-20.00	33.00	Lowest ch 2400MHz- 2BW
		2398.5	-49.36	1.78	10.08	1.90	-35.60	-10.00	25.60	Lowest ch 2400MHz- BW
		2486.0	-47.08	1.79	10.08	1.90	-33.31	-10.00	23.31	Highest ch 2483.5MHz + BW
		2496.2	-65.52	1.79	10.08	1.90	-51.75	-20.00	31.75	Highest ch 2483.5MHz + 2BW

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

*Above test result was maximum value on each 1BW.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Transmitter unwanted emissions in the out-of-band domain

Test place	Ise EMC Lab. No.6 and 11 Measurement Room		
Report No.	10589156H		
Date	12/04/2014	12/05/2014	01/13/2015
Temperature/ Humidity	20 deg. C / 52% RH	23 deg. C / 30% RH	24 deg. C / 42% RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa	Takumi Shimada
Mode	Tx 11g		

11g

Test Condition		Frequency	S/A(AV) Reading	Cable Loss	Atten. Loss	Antenna Gain	Result	Limit	Margin	Remarks
Temp.	Volt.	[MHz]	[dBm/MHz]	[dB]	[dB]	[dBi]	[dBm/MHz]	[dBm/MHz]	[dB]	
nom	nom	2383.0	-59.17	1.78	10.08	1.90	-45.41	-20.00	25.41	Lowest ch 2400MHz- 2BW
		2398.5	-48.64	1.78	10.08	1.90	-34.88	-10.00	24.88	Lowest ch 2400MHz- BW
		2484.0	-51.57	1.79	10.08	1.90	-37.80	-10.00	27.80	Highest ch 2483.5MHz + BW
		2503.6	-61.04	1.79	10.08	1.90	-47.27	-20.00	27.27	Highest ch 2483.5MHz + 2BW
min	min	2383.0	-59.59	1.78	10.08	1.90	-45.83	-20.00	25.83	Lowest ch 2400MHz- 2BW
		2399.5	-49.07	1.78	10.08	1.90	-35.31	-10.00	25.31	Lowest ch 2400MHz- BW
		2484.0	-51.33	1.79	10.08	1.90	-37.56	-10.00	27.56	Highest ch 2483.5MHz + BW
		2500.6	-60.84	1.79	10.08	1.90	-47.07	-20.00	27.07	Highest ch 2483.5MHz + 2BW
min	max	2381.0	-59.83	1.78	10.08	1.90	-46.07	-20.00	26.07	Lowest ch 2400MHz- 2BW
		2398.5	-49.48	1.78	10.08	1.90	-35.72	-10.00	25.72	Lowest ch 2400MHz- BW
		2485.0	-49.11	1.79	10.08	1.90	-35.34	-10.00	25.34	Highest ch 2483.5MHz + BW
		2500.6	-61.55	1.79	10.08	1.90	-47.78	-20.00	27.78	Highest ch 2483.5MHz + 2BW
max	min	2380.0	-59.83	1.78	10.08	1.90	-46.07	-20.00	26.07	Lowest ch 2400MHz- 2BW
		2399.5	-46.20	1.78	10.08	1.90	-32.44	-10.00	22.44	Lowest ch 2400MHz- BW
		2485.0	-50.52	1.79	10.08	1.90	-36.75	-10.00	26.75	Highest ch 2483.5MHz + BW
		2503.6	-60.89	1.79	10.08	1.90	-47.12	-20.00	27.12	Highest ch 2483.5MHz + 2BW
max	max	2382.0	-59.46	1.78	10.08	1.90	-45.70	-20.00	25.70	Lowest ch 2400MHz- 2BW
		2398.5	-48.10	1.78	10.08	1.90	-34.34	-10.00	24.34	Lowest ch 2400MHz- BW
		2484.0	-50.17	1.79	10.08	1.90	-36.40	-10.00	26.40	Highest ch 2483.5MHz + BW
		2500.6	-61.55	1.79	10.08	1.90	-47.78	-20.00	27.78	Highest ch 2483.5MHz + 2BW

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

*Above test result was maximum value on each 1BW.

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

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Facsimile : +81 596 24 8124

Transmitter unwanted emissions in the out-of-band domain

Test place	Ise EMC Lab. No.6 and 11 Measurement Room		
Report No.	10589156H		
Date	12/04/2014	12/05/2014	01/13/2015
Temperature/ Humidity	20 deg. C / 52% RH	23 deg. C / 30% RH	24 deg. C / 42% RH
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa	Takumi Shimada
Mode	Tx 11n-20		

11n-20

Test Condition		Frequency	S/A(AV)	Cable	Atten.	Antenna	Result	Limit	Margin	Remarks
Temp.	Volt.	[MHz]	Reading [dBm/MHz]	Loss [dB]	Loss [dB]	Gain [dBi]	[dBm/MHz]	[dBm/MHz]	[dB]	
nom	nom	2381.9	-60.72	1.78	10.08	1.90	-46.96	-20.00	26.96	Lowest ch 2400MHz- 2BW
		2399.5	-49.41	1.78	10.08	1.90	-35.65	-10.00	25.65	Lowest ch 2400MHz- BW
		2486.0	-50.73	1.79	10.08	1.90	-36.96	-10.00	26.96	Highest ch 2483.5MHz + BW
		2505.6	-60.73	1.79	10.08	1.90	-46.96	-20.00	26.96	Highest ch 2483.5MHz + 2BW
min	min	2379.9	-59.55	1.78	10.08	1.90	-45.79	-20.00	25.79	Lowest ch 2400MHz- 2BW
		2398.5	-49.50	1.78	10.08	1.90	-35.74	-10.00	25.74	Lowest ch 2400MHz- BW
		2485.0	-52.29	1.79	10.08	1.90	-38.52	-10.00	28.52	Highest ch 2483.5MHz + BW
		2501.6	-61.31	1.79	10.08	1.90	-47.54	-20.00	27.54	Highest ch 2483.5MHz + 2BW
min	max	2381.9	-60.71	1.78	10.08	1.90	-46.95	-20.00	26.95	Lowest ch 2400MHz- 2BW
		2399.5	-51.00	1.78	10.08	1.90	-37.24	-10.00	27.24	Lowest ch 2400MHz- BW
		2484.0	-49.72	1.79	10.08	1.90	-35.95	-10.00	25.95	Highest ch 2483.5MHz + BW
		2502.6	-60.97	1.79	10.08	1.90	-47.20	-20.00	27.20	Highest ch 2483.5MHz + 2BW
max	min	2380.9	-58.63	1.78	10.08	1.90	-44.87	-20.00	24.87	Lowest ch 2400MHz- 2BW
		2399.5	-45.79	1.78	10.08	1.90	-32.03	-10.00	22.03	Lowest ch 2400MHz- BW
		2484.0	-50.98	1.79	10.08	1.90	-37.21	-10.00	27.21	Highest ch 2483.5MHz + BW
		2503.6	-60.71	1.79	10.08	1.90	-46.94	-20.00	26.94	Highest ch 2483.5MHz + 2BW
max	max	2381.9	-60.11	1.78	10.08	1.90	-46.35	-20.00	26.35	Lowest ch 2400MHz- 2BW
		2398.5	-49.89	1.78	10.08	1.90	-36.13	-10.00	26.13	Lowest ch 2400MHz- BW
		2485.0	-51.82	1.79	10.08	1.90	-38.05	-10.00	28.05	Highest ch 2483.5MHz + BW
		2501.6	-60.64	1.79	10.08	1.90	-46.87	-20.00	26.87	Highest ch 2483.5MHz + 2BW

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

*Above test result was maximum value on each 1BW.

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Facsimile : +81 596 24 8124

Adaptivity and Receiver blocking tests

Test place Ise EMC Lab. No.3 Measurement Room
Report No. 10589156H
Date 12/16/2014 12/17/2014
Temperature/ Humidity 24 deg. C / 33% RH 24 deg. C / 31% RH
Engineer Takumi Shimada Kazuya Yoshioka
Mode Communication mode 11b

Declared q	Maximum Channel Occupancy Time (=13/32*q) [ms]
32	13.00

Declared CCA Time [usec]	Extended CCA Time [usec]		Measured idle period [usec]	Measured Channel Occupancy Time [msec]
34	Min	Max	91.25	12.47
	34	1088		

Interference Detection Threshold

Freq.	RF output power	Antenna Gain	Cable loss	CCA threshold level
[MHz]	[dBm]	[dBi]	[dB]	[dBm]
2412.0	17.99	1.90	0.50	-65.59
2472.0	18.04	1.90	0.50	-65.64

CCA threshold level = -70 [dBm/MHz] + 20 - RF output Power [dBm] + EUT Antenna Gain [dBi]

Interference

Freq.	Measured Stop time	Limit	Results
[MHz]	[ms]	[ms]	
2412	0.533	13.00	Pass
2472	0.495	13.00	Pass

Stop time = (End of Transmission) - (Start of Interference signal)

Interference with blocking

Freq.	Results
[MHz]	
2412	Pass
2472	Pass

*No transmission signal was detected except short control signal after interference signal was added.
After the application of blocking signal, transmission signal was continuously stopped.

Short Control Signalling Transmissions

Freq.	Measured ON time *1)	Duty cycle *2)	Limit	Results
[MHz]	[ms]	[%]	[%]	
2412	0.000	0.00	10	Pass
2472	0.000	0.00	10	Pass

*1)Measured ON Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

*2)Duty cycle = (Measured ON time / 50msec) * 100

The signal monitoring equipment consists of a spectrum analyzer with the capacity to display 8001 bins on the horizontal axis.

A time-domain resolution of 0.0075 msec/bin is achievable with a 60.27 millisecond sweep time.

Measured ON time is calculated by multiplying the number of bins during an observation period by the dwell time per bin, with the analyzer set to peak detection.

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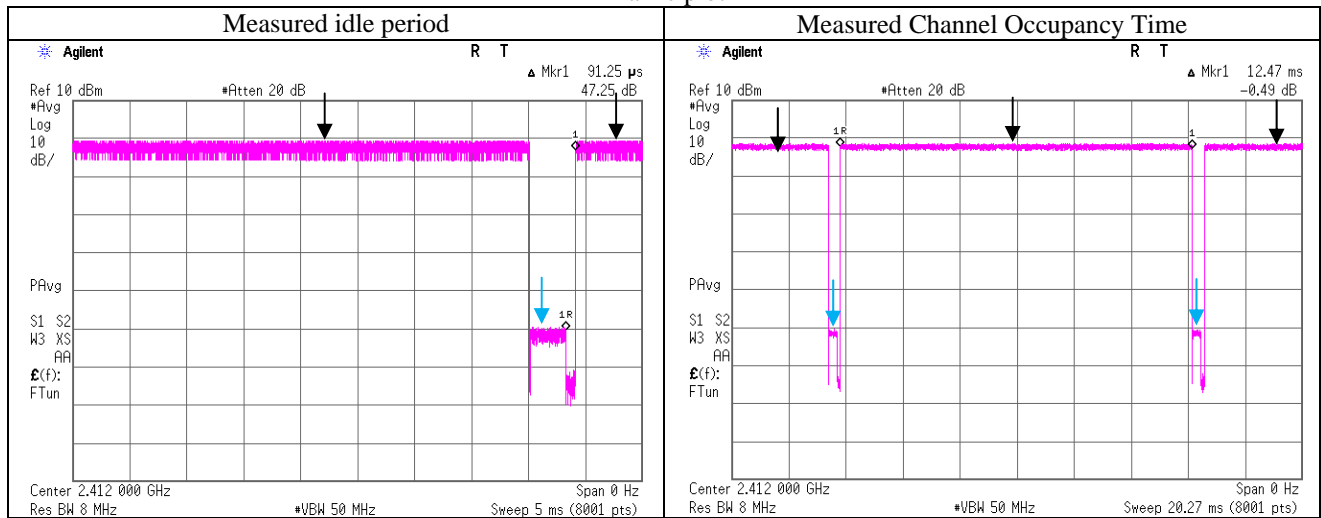
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

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Adaptivity and Receiver blocking tests

Traffic plot



 : Traffic from EUT
 : Traffic from Companion device

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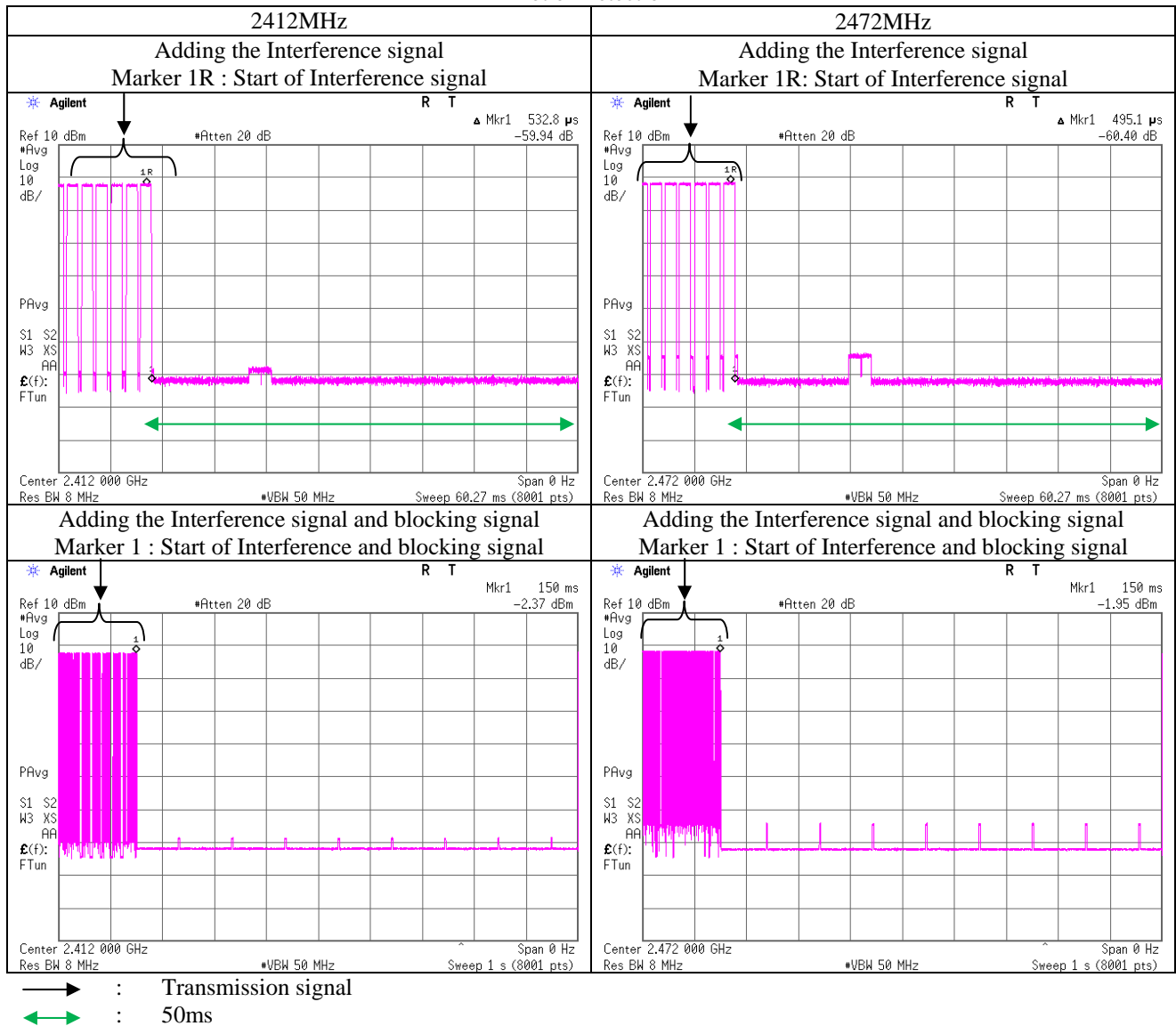
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Adaptivity and Receiver blocking tests

Plot of Detection



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

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Adaptivity and Receiver blocking tests

Test place	Ise EMC Lab. No.3 Measurement Room	
Report No.	10589156H	
Date	12/16/2014	12/17/2014
Temperature/ Humidity	24 deg. C / 33% RH	24 deg. C / 31% RH
Engineer	Takumi Shimada	Kazuya Yoshioka
Mode	Communication mode 11g	

Declared q	Maximum Channel Occupancy Time (=13/32*q) [ms]
32	13.00

Declared CCA Time [usec]	Extended CCA Time [usec]		Measured idle period [usec]	Measured Channel Occupancy Time [msec]
34	Min	Max	96.75	2.07
	34	1088		

Interference Detection Threshold

Freq. [MHz]	RF output power [dBm]	Antenna Gain [dBi]	Cable loss [dB]	CCA threshold level [dBm]
2412.0	15.55	1.90	0.50	-63.15
2472.0	15.74	1.90	0.50	-63.34

CCA threshold level = -70 [dBm/MHz] + 20 - RF output Power [dBm] + EUT Antenna Gain [dBi]

Interference

Freq. [MHz]	Measured Stop time [ms]	Limit [ms]	Results
2412	0.134	13.00	Pass
2472	0.151	13.00	Pass

Stop time = (End of Transmission) - (Start of Interference signal)

Interference with blocking

Freq. [MHz]	Results
2412	Pass
2472	Pass

*No transmission signal was detected except short control signal after interference signal was added.
After the application of blocking signal, transmission signal was continuously stopped.

Short Control Signalling Transmissions

Freq. [MHz]	Measured ON time *1) [ms]	Duty cycle *2) [%]	Limit [%]	Results
2412	0.000	0.00	10	Pass
2472	0.000	0.00	10	Pass

*1)Measured ON Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

*2)Duty cycle = (Measured ON time / 50msec) * 100

The signal monitoring equipment consists of a spectrum analyzer with the capacity to display 8001 bins on the horizontal axis.
A time-domain resolution of 0.0075 msec/bin is achievable with a 60.27 millisecond sweep time.

Measured ON time is calculated by multiplying the number of bins during an observation period by the dwell time per bin, with the analyzer set to peak detection.

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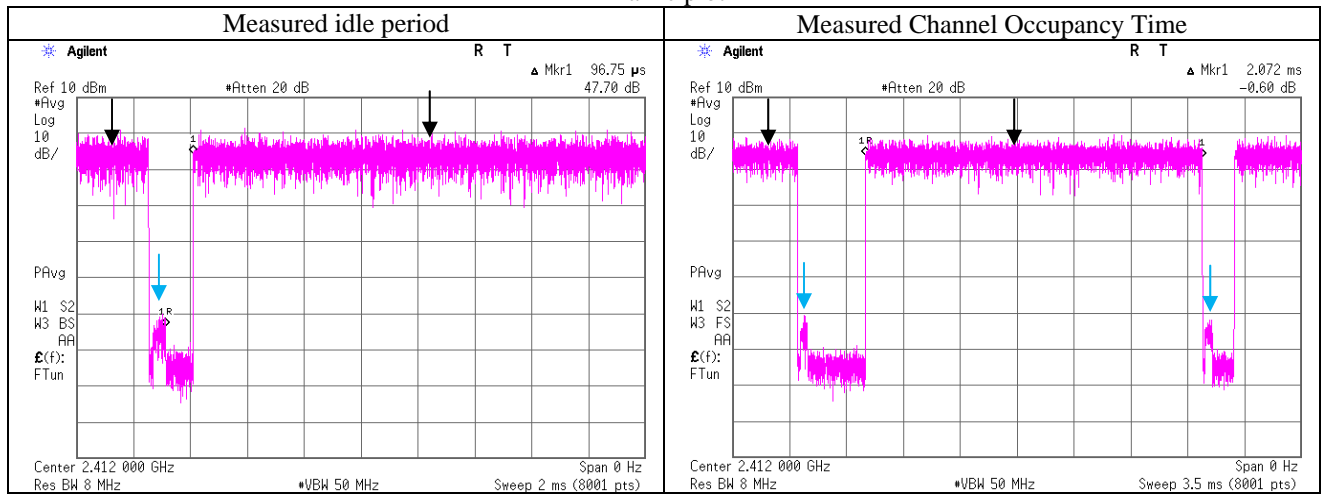
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

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Adaptivity and Receiver blocking tests

Traffic plot



 : Traffic from EUT
 : Traffic from Companion device

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Ise EMC Lab.

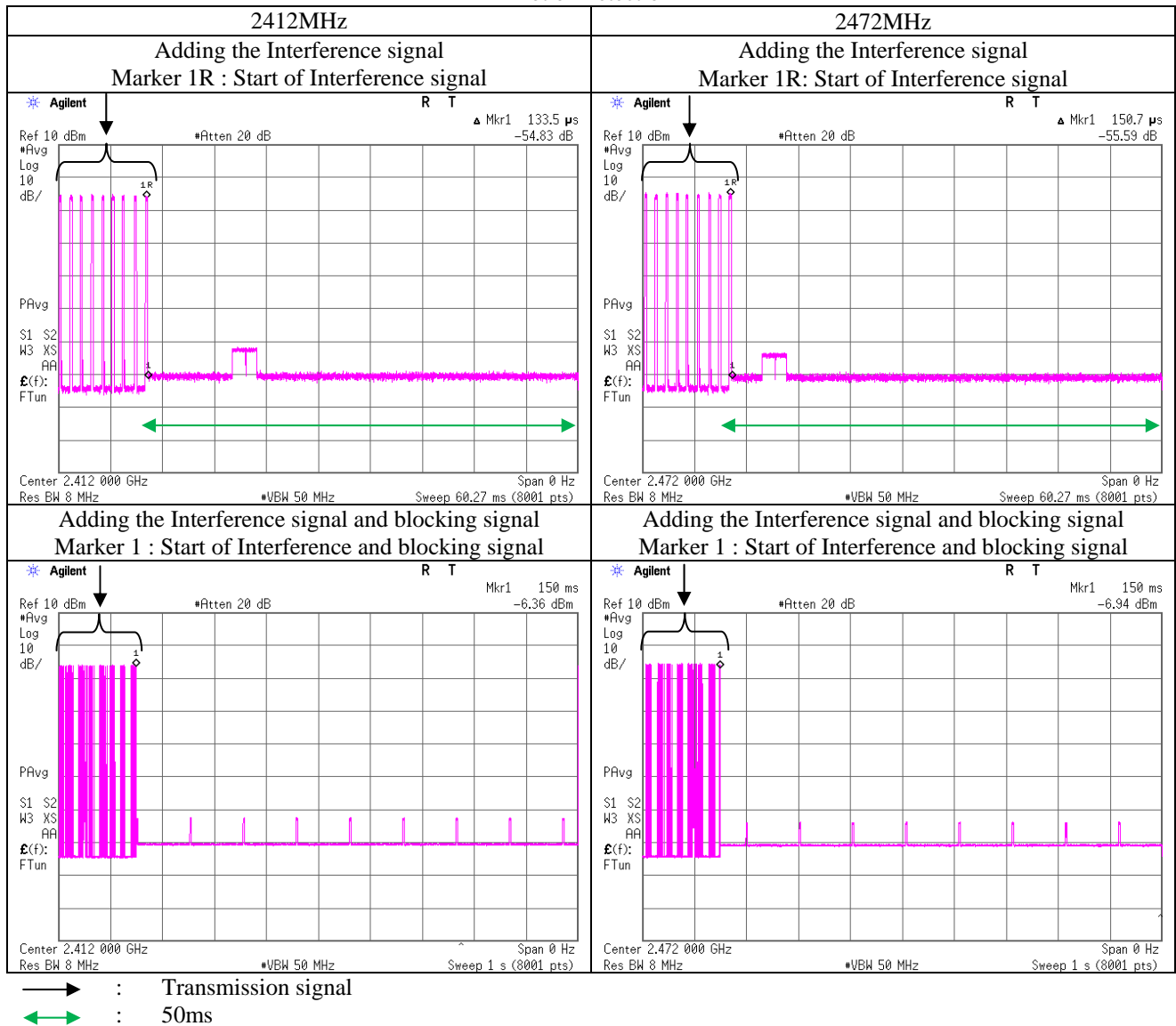
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Adaptivity and Receiver blocking tests

Plot of Detection



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Adaptivity and Receiver blocking tests

Test place	Ise EMC Lab. No.3 Measurement Room	
Report No.	10589156H	
Date	12/16/2014	12/17/2014
Temperature/ Humidity	24 deg. C / 33% RH	24 deg. C / 31% RH
Engineer	Takumi Shimada	Kazuya Yoshioka
Mode	Communication mode 11n-20	

Declared q	Maximum Channel Occupancy Time (=13/32*q) [ms]
32	13.00

Declared CCA Time [usec]	Extended CCA Time [usec]		Measured idle period [usec]	Measured Channel Occupancy Time [msec]
34	Min	Max	80.00	7.62
	34	1088		

Interference Detection Threshold

Freq. [MHz]	RF output power [dBm]	Antenna Gain [dBi]	Cable loss [dB]	CCA threshold level [dBm]
2412.0	15.61	1.90	0.50	-63.21
2472.0	15.53	1.90	0.50	-63.13

CCA threshold level = -70 [dBm/MHz] + 20 - RF output Power [dBm] + EUT Antenna Gain [dBi]

Interference

Freq. [MHz]	Measured Stop time [ms]	Limit [ms]	Results
2412	0.111	13.00	Pass
2472	0.134	13.00	Pass

Stop time = (End of Transmission) - (Start of Interference signal)

Interference with blocking

Freq. [MHz]	Results
2412	Pass
2472	Pass

*No transmission signal was detected except short control signal after interference signal was added.
After the application of blocking signal, transmission signal was continuously stopped.

Short Control Signalling Transmissions

Freq. [MHz]	Measured ON time *1) [ms]	Duty cycle *2) [%]	Limit [%]	Results
2412	0.000	0.00	10	Pass
2472	0.000	0.00	10	Pass

*1)Measured ON Time = (Number of analyzer bins showing transmission) * (dwell time per bin)

*2)Duty cycle = (Measured ON time / 50msec) * 100

The signal monitoring equipment consists of a spectrum analyzer with the capacity to display 8001 bins on the horizontal axis.
A time-domain resolution of 0.0075 msec/bin is achievable with a 60.27 millisecond sweep time.

Measured ON time is calculated by multiplying the number of bins during an observation period by the dwell time per bin, with the analyzer set to peak detection.

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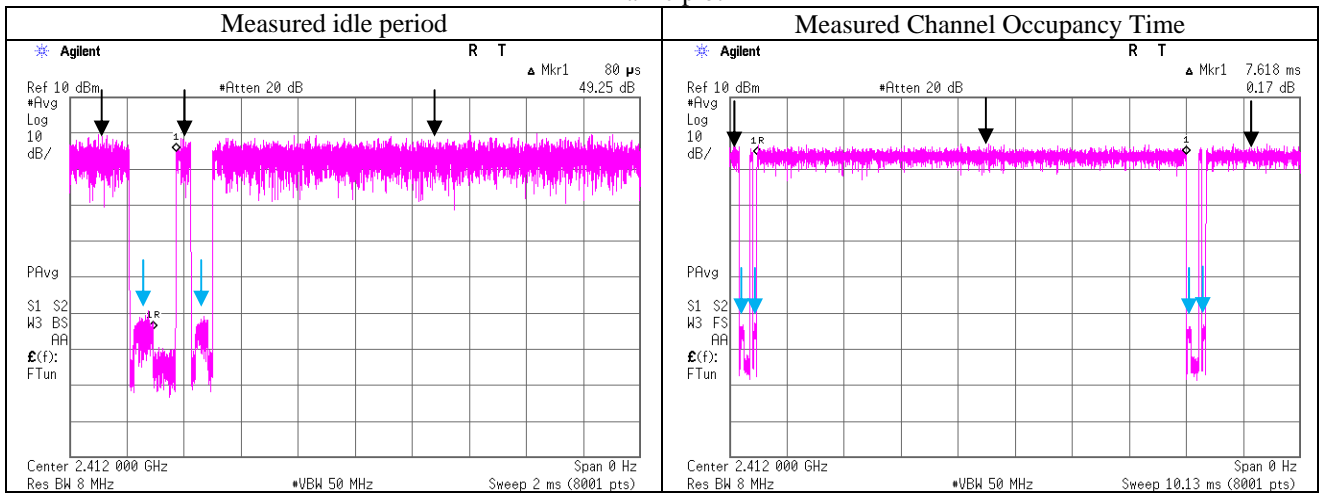
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Adaptivity and Receiver blocking tests

Traffic plot



→ : Traffic from EUT
→ : Traffic from Companion device

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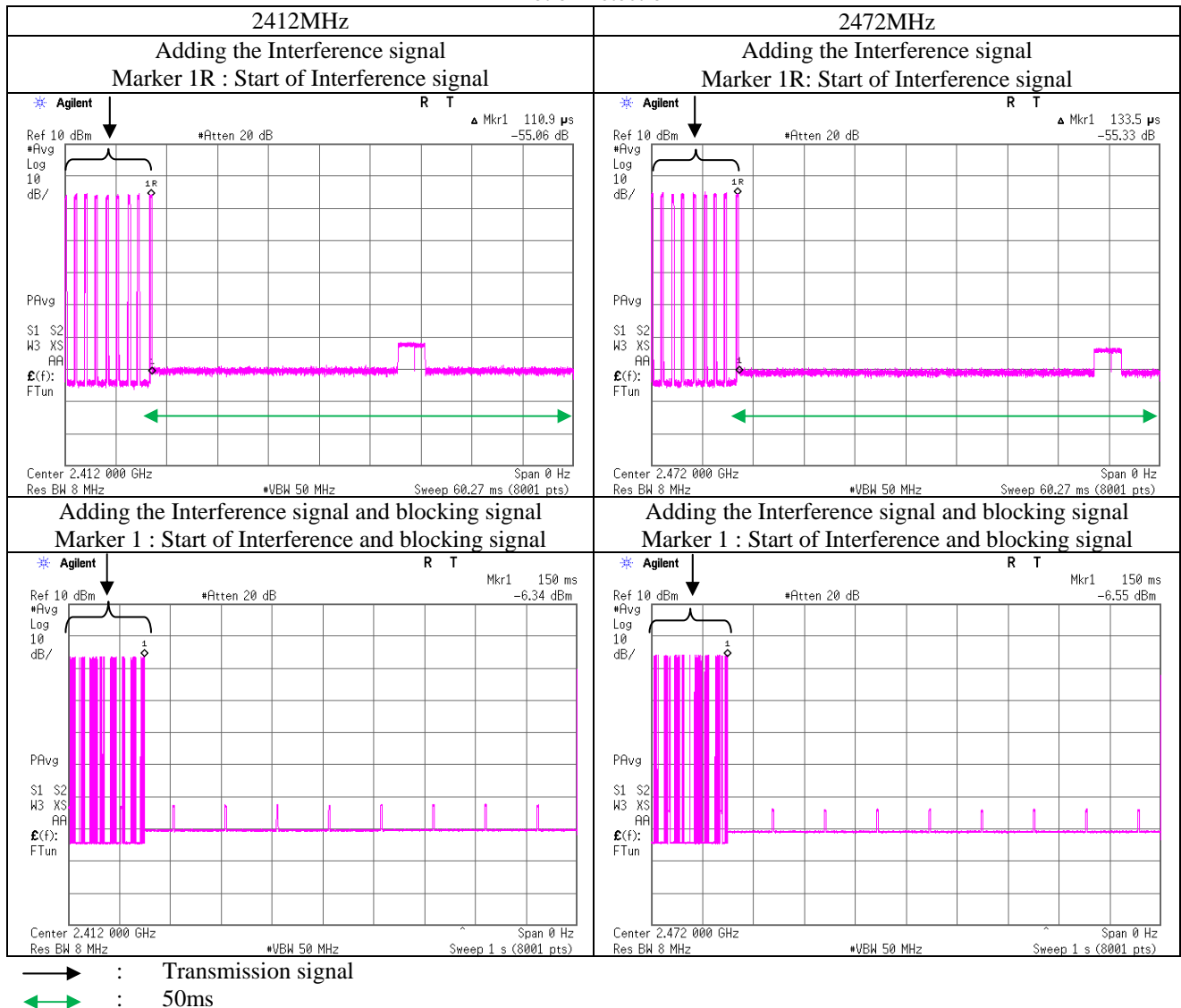
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Adaptivity and Receiver blocking tests

Plot of Detection



UL Japan, Inc.

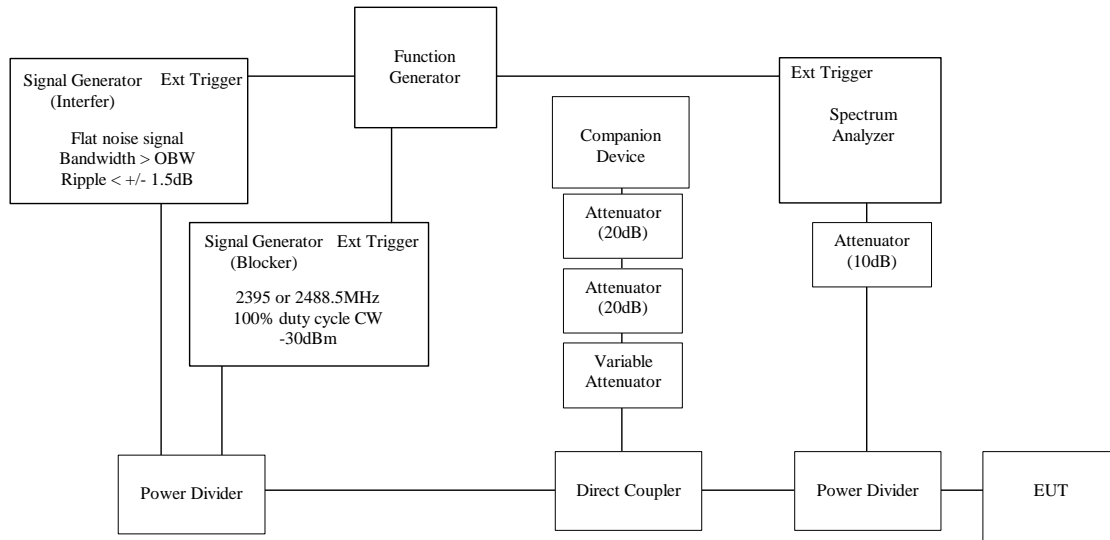
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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

CONDUCTED METHODS SYSTEM BLOCK DIAGRAM of Adaptivity and Receiver Blocking



***Signal Generator and Spectrum Analyzer were started at the same time by Function Generator. Interference signal and Blocking signal are added to EUT simultaneously as it does not change the test result phenomenologically.**

Transmitter unwanted emissions in the spurious domain (Radiated)

Report No. 10589156H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date 12/02/2014 12/03/2014
Temperature / Humidity 24deg. C / 59% RH 25deg. C / 30% RH
Engineer Satofumi Matsuyama Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode Tx 11b

2412MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	(ERP) <=1GHz, (EIRP) >1GHz [dBm]		(ERP) <=1GHz, (EIRP) >1GHz [dBm]	[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER				HOR	VER		HOR	VER					
4824.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
7236.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9648.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12060.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,

Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Spectrum Analyzer RMS AV(RBW:100kHz/VBW:300kHz)

Above 1GHz: Spectrum Analyzer RMS AV(RBW:1MHz/VBW:3MHz)

2472MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	(ERP) <=1GHz, (EIRP) >1GHz [dBm]		(ERP) <=1GHz, (EIRP) >1GHz [dBm]	[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER				HOR	VER		HOR	VER					
4944.00	46.4	45.3	-59.3	-62.2	5.8	13.0	0.0	-52.2	-55.1	-30.0	22.2	25.1	100	0	153	130	
7416.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9888.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12360.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,

Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Spectrum Analyzer RMS AV(RBW:100kHz/VBW:300kHz)

Above 1GHz: Spectrum Analyzer RMS AV(RBW:1MHz/VBW:3MHz)

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

Transmitter unwanted emissions in the spurious domain (Radiated)

Report No. 10589156H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date 12/02/2014 12/03/2014
Temperature / Humidity 24deg. C / 59% RH 25deg. C / 30% RH
Engineer Satofumi Matsuyama Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode Tx 11g

2412MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz (EIRP) >1GHz [dBm]	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	HOR	VER		[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER							HOR	VER					
4824.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
7236.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9648.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12060.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,

Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Spectrum Analyzer RMS AV(RBW:100kHz/VBW:300kHz)

Above 1GHz: Spectrum Analyzer RMS AV(RBW:1MHz/VBW:3MHz)

2472MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result (ERP) <=1GHz, (EIRP) >1GHz		Limit (ERP) <=1GHz, (EIRP) >1GHz	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss	Ant. Gain	Atten. Loss	[dBm]			[dB]		Rx Ant.	Turn	Rx Ant.	Turn	
	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	Height [cm]	Table [deg]	Height [cm]	Table [deg]	
4944.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
7416.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9888.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12360.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,

Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Spectrum Analyzer RMS AV(RBW:100kHz/VBW:300kHz)

Above 1GHz: Spectrum Analyzer RMS AV(RBW:1MHz/VBW:3MHz)

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

Transmitter unwanted emissions in the spurious domain (Radiated)

Report No.	10589156H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	12/02/2014	12/03/2014
Temperature / Humidity	24deg. C / 59% RH	25deg. C / 30% RH
Engineer	Satofumi Matsuyama (Above 1GHz)	Takumi Shimada (Below 1GHz)
Mode	Tx 11n-20	

2412MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz (EIRP) >1GHz [dBm]	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	HOR	VER		[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER													
4824.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
7236.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9648.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
12060.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,
Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss
Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)
Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).
NS : No signal detect.
Detector : Below 1GHz: Spectrum Analyzer RMS AV(RBW:100kHz/VBW:300kHz)
Above 1GHz: Spectrum Analyzer RMS AV(RBW:1MHz/VBW:3MHz)

2472MHz

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading		Reading		Cable	Ant.	Atten.	(ERP) <=1GHz,	(ERP) <=1GHz,	[dB]	[dB]	Rx Ant.	Turn	Rx Ant.	Turn		
	[dBuV]		[dBm]		Loss	Gain	Loss	>1GHz	>1GHz			Height	Table	Height	Table		
	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	[dBm]	[dBm]			HOR	VER	[cm]	[deg]	[cm]	
[MHz]																	
4944.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
7416.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
9888.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
12360.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,
Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss
Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)
Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)
Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).
NS : No signal detect.
Detector : Below 1GHz: Spectrum Analyzer RMS AV(RBW:100kHz/VBW:300kHz)
Above 1GHz: Spectrum Analyzer RMS AV(RBW:1MHz/VBW:3MHz)

Receiver spurious emissions (Radiated)

Report No. 10589156H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date 12/02/2014 12/03/2014
Temperature / Humidity 24deg. C / 59% RH 25deg. C / 30% RH
Engineer Satofumi Matsuyama Takumi Shimada
(Above 1GHz) (Below 1GHz)
Mode Rx 11b/g/n-20

2412MHz

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result (ERP) <=1GHz, (EIRP) >1GHz [dBm]		Limit (ERP) <=1GHz, (EIRP) >1GHz [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	HOR	VER		HOR	VER	Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER													
2412.00	NS	NS	-	-	-	-	-	-	-	-47.0	-	-	-	-	-	-	-

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,

Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Spectrum Analyzer RMS A V(RBW:100kHz/VBW:300kHz)

Above 1GHz: Spectrum Analyzer RMS A V(RBW:1MHz/VBW:3MHz)

2472MHz

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading		Reading		Cable Loss	Ant. Gain	Atten. Loss	(ERP) <=1GHz, (EIRP) >1GHz		(ERP) <=1GHz, (EIRP) >1GHz		Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table		
	[dBuV]		[dBm]					[dBm]								[dBm]	
	[MHz]	HOR	VER	HOR				VER	HOR								
2472.00	NS	NS	-	-	-	-	-	-	-	-47.0	-	-	-	-	-	-	

Below 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15,

Above 1GHz: Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Spectrum Analyzer RMS A V(RBW:100kHz/VBW:300kHz)

Above 1GHz: Spectrum Analyzer RMS A V(RBW:1MHz/VBW:3MHz)

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

APPENDIX 2: Test instruments

EMI Test Equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2014/02/20 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2014/02/20 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12
MHF-06	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	RE	2014/05/21 * 12
KSG-05	Signal Generator	Rohde & Schwarz	SMR40	100137	RE	2014/07/23 * 12
MCC-130	Microwave Cable(1-30GHz)	HUBER+SUHNER	SF103/11PC3.5-31/11PC3.5-31/8.0m	54308/3	RE	2014/01/20 * 12
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2014/05/16 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	14015723	AT	2014/08/06 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2014/02/20 * 12
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	AT	2014/02/28 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2014/10/16 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2014/10/15 * 12
MCC-138	Microwave cable	HUBER+SUHNER	SUCOFLEX 102	37953/2	AT	2014/10/02 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2014/03/13 * 12
MOS-12	Thermo-Hygrometer	Custom	CTH-180	1201	AT	2014/01/14 * 12
MRENT-116	Spectrum Analyzer	Agilent	E4440A	MY46187620	AT	2014/03/05 * 12
MRENT-117	Signal Genelator	Agilent	N5182B	MY51350370	AT	2014/04/16 * 12
MSG-14	Signal Genelator	Rohde & Schwarz	SMC100A	1411.4002k02	AT	2014/04/24 * 12
MFG-02	Function Generator	Agilent	33250A	MY40012914	AT	2014/06/16 * 12
MADP-01	Adaptivity Test Set	UL Japan	-	1	AT	Pre Check
MCC-67	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	AT	2014/04/14 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item:

AT: Antenna Terminal Conducted test

RE: Radiated emission test

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

APPENDIX 3: Photographs of test setup

Radiated emission

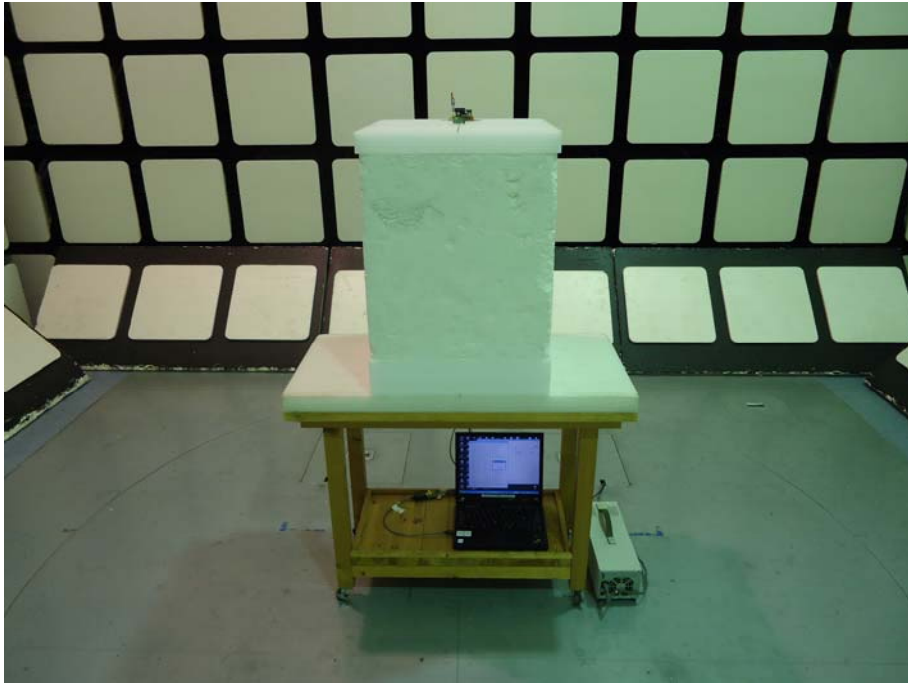


Photo 1

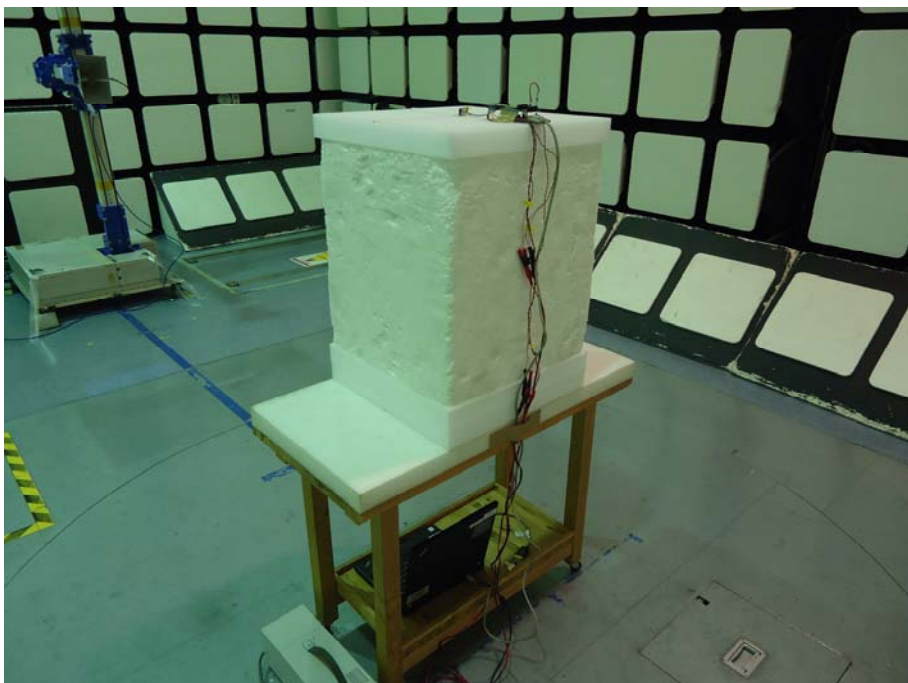


Photo 2

UL Japan, Inc.

Ise EMC Lab.

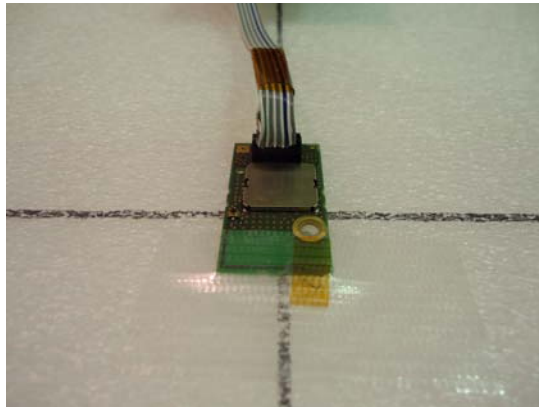
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

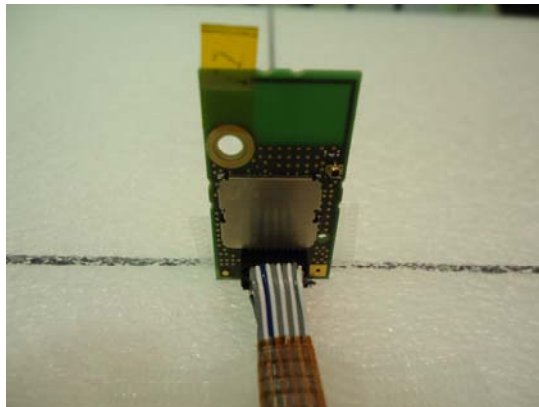
Facsimile : +81 596 24 8124

Worst Case Position
(Horizontal: Z-axis / Vertical: Y-axis)

X-axis



Y-axis



Z-axis



End of Report