



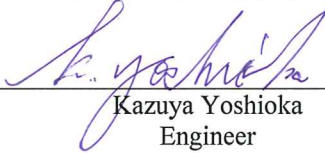
RADIO TEST REPORT


Test Report No. : 10229481H-B-R2

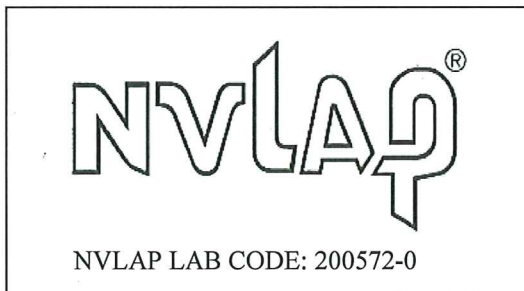
Applicant : Panasonic Corporation of North America
Type of Equipment : Wireless LAN Module
Model No. : WJ-VR3004
FCC ID : ACJ9TAWJ-VR3004
Test regulation : FCC Part 15 Subpart E: 2014
(Except for DFS test)
Test Result : Complied

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 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 report is a revised version of 10229481H-B-R1. 10229481H-B-R1 is replaced with this report.

Date of test: March 27 to May 14, 2014

Representative test engineer: 
Kazuya Yoshioka
Engineer
Consumer Technology Division

Approved by: 
Takahiro Hatakeda
Leader
Consumer Technology Division



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

REVISION HISTORY

Original Test Report No.: 10229481H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10229481H-B	May 20, 2014	-	-
1	10229481H-B-R1	May 26, 2014	P.5	Correction of FCC Part 15.203/212 Antenna requirement sentence
1	10229481H-B-R1	May 26, 2014	P.9	Correction of Cable name
1	10229481H-B-R1	May 26, 2014	P23, 24	-Correction of test data (Deleted antenna gain) -Addition of calculating formula
2	10229481H-B-R2	June 2, 2014	P.4	Change of radio specification from Antenna gain to Antenna gain with cable loss
2	10229481H-B-R2	June 2, 2014	P.8, 13, 20-22	Correction of test name from Maximum Peak Output Power to Maximum Conducted Output Power
2	10229481H-B-R2	June 2, 2014	P.20-22	Addition of test result (Cond.) in mW. Addition of "with cable loss" in calculation formula for Result (e.i.r.p.).
2	10229481H-B-R2	June 2, 2014	P.22, 23	Addition of test result in mW.

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	5
SECTION 4: Operation of E.U.T. during testing.....	8
SECTION 5: Conducted Emission.....	10
SECTION 6: Radiated Spurious Emission and Band Edge Compliance	11
SECTION 7: Antenna Terminal Conducted Tests.....	13
APPENDIX 1: Data of EMI test.....	14
Conducted Emission	14
26dB Emission Bandwidth and 99% Occupied Bandwidth.....	15
Maximum Conducted Output Power	20
Peak Power Spectral Density	23
Radiated Spurious Emission	32
Conducted Spurious Emission	36
Peak Excursion Ratio	37
APPENDIX 2: Test instruments	39
APPENDIX 3: Photographs of test setup.....	41
Conducted Emission	41
Radiated Spurious Emission	42
Worst Case Position	43

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

SECTION 1: Customer information

Company Name : Panasonic System Networks Co., Ltd.*
Address : 1-62, 4-chome, Minoshima, Hakata-ku, Fukuoka 812-853 Japan
Telephone Number : +81-50-3380-6162
Facsimile Number : +81-92-477-1487
Contact Person : Yukio Kaneko

* Panasonic System Networks Co., Ltd. is on behalf of the applicant: Panasonic Corporation of North America.

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

2.1 Identification of E.U.T.

Type of Equipment : Wireless LAN Module
Model No. : WJ-VR3004
Serial No. : Refer to Section 4, Clause 4.2
Rating : DC10.5V
Receipt Date of Sample : March 24, 2014
Country of Mass-production : Japan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

General Specification

Clock frequency(ies) in the system : 32.768kHz, 38.4MHz

Radio Specification

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

Equipment Type	Transceiver	
Frequency of Operation	2412-2462MHz	W53: 5280-5320MHz W58: 5745-5825MHz
Type of Modulation	DSSS, OFDM	OFDM
Antenna Type	Dual (Planar patch)	Dual (Inverted F)
Antenna connector type	Module side: Rectangular Coaxial Connector (SMT) Antenna side: RP-SMA	
Antenna Gain with cable loss	0.58dBi (2.4GHz)	-0.98dBi (5GHz)

[WLAN (IEEE802.11n-40)]

Equipment Type	Transceiver	
Frequency of Operation	2422-2452MHz	W53: 5310MHz W58: 5755-5795MHz
Type of Modulation	OFDM	OFDM
Antenna Type	Dual (Planar patch)	Dual (Inverted F)
Antenna connector type	Module side: Rectangular Coaxial Connector (SMT) Antenna side: RP-SMA	
Antenna Gain with cable loss	0.58dBi (2.4GHz)	-0.98dBi (5GHz)

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

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart E: 2014, final revised on May 1, 2014 and effective June 2, 2014

Title : FCC 47CFR Part15 Radio Frequency Device Subpart E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

* The revision on May 1, 2014 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 C63.4:2003	FCC: 15.407(b)(6) / 15.207	QP 18.6dB, 1.26018MHz, L AV 18.7dB, 1.26018MHz, L	Complied	-
	IC: RSS-Gen 7.2.4	IC: RSS-Gen 7.2.4			
26dB Emission Bandwidth	FCC :ANSI C63.4:2003 FCC KDB Publication Number 789033	FCC : 15.407(a)(1)(2)(3)	See data	N/A	Conducted
	IC: -	IC: -			
Maximum Conducted Output Power	FCC :ANSI C63.4:2003, FCC KDB Publication Number 789033	FCC : 15.407(a)(1)(2)(3)		Complied	Conducted
	IC: -	IC: RSS-210 A9.2(1)(2)(3)			
Peak Power Spectral Density	FCC :ANSI C63.4:2003, FCC KDB Publication Number 789033	FCC : 15.407(a)(1)(2)(3)		Complied	Conducted
	IC: -	IC: RSS-210 A9.2(1)(2)(3)			
Peak Excursion Ratio	FCC :ANSI C63.4:2003, FCC KDB Publication Number 789033	FCC : 15.407(a)(6)	Complied	Conducted	
	IC: -	IC: -			
Spurious Emission Restricted Band Edge	FCC: ANSI C63.4:2003	FCC : 15.407(b), 15.205 and 15.209	1.4dB 5350.000MHz, AV, Vert.	Complied	Conducted / Radiated
	IC: -	IC: RSS-210 A.9.2(1)(2)(3)			
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. For DFS tests, please see the test report number 10229481H-C issued by UL Japan, Inc.					

FCC 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC3.3/1.8V) through the regulator regardless of input voltage.

Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

The EUT has a unique coupling/antenna connector (Module side: Rectangular Coaxial Connector (SMT), Antenna side: RP-SMA).

Therefore the equipment complies with the requirement of 15.203/212.

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

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Band Width	RSS-Gen 4.6.1	RSS-210 A9.2 (1)(2)(3)	N/A	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

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.

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

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

	FCC Registration Number	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	313583	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	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	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	134570	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	2.4 x 3.4m	-

* 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.

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

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

4.1 Operating Modes

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 802.11a (11a)	12Mbps, PN9
IEEE 802.11n MIMO 20MHz BW (11n-20): 5GHz Band	MCS 13, PN9
IEEE 802.11n MIMO 40MHz BW (11n-40) : 5GHz Band	MCS 15, PN9
*The worst condition was determined based on the test result of Maximum Conducted Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; - Power settings: 12dBm - Software: Dut Wlan BT Labtool Version 1.0.8.1.6 *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.	

*Details of Operating mode(s):

Test Item	Operating Mode	Antenna	Tested Frequency		
			Low Band	Middle Band	Additional Band
Conducted emission	11n-20 Tx *1)	A+B	-	5320MHz	-
Spurious Emission (Radiated)	11n-20 Tx *2)	A+B	-	5280MHz 5300MHz 5320MHz	-
	11n-40 Tx			5310MHz	
26dB Emission Bandwidth, 99% Occupied Bandwidth *3)	11a Tx	A	-	5280MHz	-
	11n-20 Tx	B		5300MHz 5320MHz	
	11n-40 Tx	A		5310MHz	
Maximum Conducted Output Power, Peak Power Spectral Density	11a Tx	A, B	-	5280MHz	-
	11n-20 Tx	A, B, A+B		5300MHz 5320MHz	
	11n-40 Tx	A, B, A+B		5310MHz	
Spurious Emission (Conducted)(Below 30MHz)	11n-20 Tx *1)	B	-	5320MHz	-
Peak Excursion Ratio *3)	11a Tx	A	-	5280MHz	-
	11n-20 Tx	B			
	11n-40 Tx	A		5310MHz	

*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.

*2) Since 11a and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.

*3) After the comparison between Antenna A and Antenna B, test was performed with the antenna that had higher power as a representative.

UL Japan, Inc.

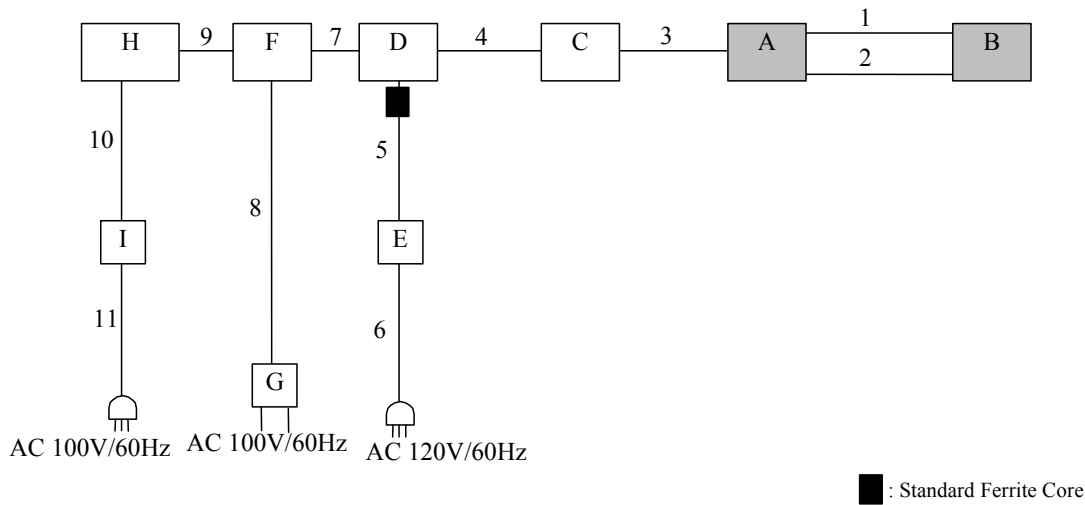
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
* No difference was confirmed with and without a standard ferrite core in Conducted emission test.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN Module	WJ-VR3004	ES2-8 *1)	Panasonic System Networks Co., Ltd.	EUT
			ES2-10 *2)		
B	AP-Double WiFi Antenna	APP-WW	-	Antenna Plus LLC	EUT
C	Jig board	-	-	-	-
D	Laptop PC	CF-31	OLKSA37565	Panasonic System Networks Co., Ltd.	-
E	AC Adaptor	CF-AA5713A	5713AM110808682A	Panasonic System Networks Co., Ltd.	-
F	Switching HUB	LAN-SW08/P	72L203004509B	Logitec	-
G	AC Adaptor	LA-6W7L	5106HB	Logitec	-
H	Laptop PC	ProBook 6560P	1673609	HP	-
I	AC Adaptor	PPP009L-E	WBGST0A4L0U2WT	HP	-

*1) Used except for Antenna Terminal Conducted Tests

*2) Used for Antenna Terminal Conducted Tests

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	5.6	Shielded	Shielded	-
2	Antenna Cable	5.6	Shielded	Shielded	-
3	USB Cable	0.4	Shielded	Shielded	-
4	USB Cable	2.0	Shielded	Shielded	-
5	DC Cable	1.8	Unshielded	Unshielded	-
6	AC Cable	1.9	Unshielded	Unshielded	-
7	LAN Cable	1.0	Unshielded	Unshielded	-
8	DC Cable	1.8	Unshielded	Unshielded	-
9	LAN Cable	1.0	Unshielded	Unshielded	-
10	DC Cable	1.8	Unshielded	Unshielded	-
11	AC Cable	1.8	Unshielded	Unshielded	-

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

SECTION 5: Conducted Emission

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 2.0m, 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 cable and AC 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 or a Measurement Room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

SECTION 6: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

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

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

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

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

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

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.

Below 1GHz

The result also satisfied with the general limits specified in section 15.209(a).

Above 1GHz

Inside of restricted bands(Section 15.205): Apply to limit in the Section 15.209(a).

Outside of the restricted bands: Apply to limit 68.2dBuV/m(-27dBm e.i.r.p. *)
in the Section 15.407(b)(1)(2)(3).

Restricted bandedge:

Apply to limit in the Section 15.209(a).

Since this limit is severer than the limit of the inside of restricted bands.

*Electric Field Strength to e.i.r.p. Conversion

$$E = \frac{1000000\sqrt{30P}}{3} \text{ (uV/m)} \quad :P \text{ is the e.i.r.p. (Watts)}$$

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

Test Antennas are used as below;

Frequency	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	Below 1GHz	Above 1GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	PK	AV
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	Method AD *1) RBW: 1MHz VBW: 3MHz Detector: Power Averaging (RMS) Duty factor was added to the results. Method VB *1) RBW: 1MHz When duty cycle \geq 98 percent (or duty cycle < 98 percent when a video trigger with the trigger level set to enable triggering only on full power pulse is used), VBW was set at 10Hz. Detector: Voltage Averaging
Test Distance	3m	3m (below 10GHz), 1m*2) (above 10GHz), 0.5m*3) (above 26.5GHz)	

*1) The test method was also referred to KDB 789033 D01 General UNII Test Procedures v01r03 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on April 8, 2013)".

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

*3) Distance Factor: $20 \times \log(3.0\text{m}/0.5\text{m}) = 15.6\text{dB}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT (Module and antenna) 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-40GHz
Test data : APPENDIX
Test result : Pass

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used and Test method
26dB Bandwidth	30MHz, 60MHz	Close to 1% of EBW	Greater than RBW	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to Display 20dB Bandwidth	Close to 1% of Span	Three times of RBW	Auto	Sample	Clear Write	Spectrum Analyzer
Maximum Conducted Output Power, Peak Power Spectral Density	25MHz, 47MHz	1MHz	3MHz	Auto	RMS Power Averaging (100 times)	Clear Write	SA-1
Peak Excursion Ratio	25MHz, 47MHz	1MHz	3MHz	Auto	Peak	Max Hold	Spectrum Analyzer
					RMS Power Averaging (100 times)	Clear Write	
Conducted Spurious Emission	9kHz-150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz-30MHz	9.1kHz	27kHz				

*The test method was also referred to KDB 789033 D01 General UNII Test Procedures v01r03 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E (Issued on April 8, 2013)".

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

Test data : **APPENDIX**

Test result : **Pass**

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 1: Data of EMI test

Conducted Emission

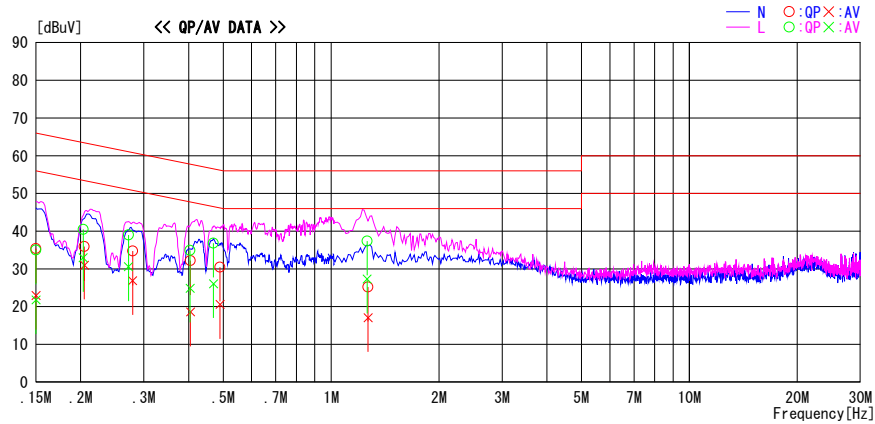
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.2 Semi Anechoic Chamber
 Date : 2014/04/01

Report No. : 10229481H
 Temp./Humi. : 23deg. C / 35% RH
 Engineer : Kazuya Yoshioka

Mode / Remarks : WLAN Tx 11n20 MCS13 MIMO 5320MHz

LIMIT : FCC15.207 QP
 FCC15.207 AV



Frequency [MHz]	Reading Level		Corr. Factor [dB]	Results		Limit		Margin		Phase	Comment
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dB]	AV [dB]		
0.15000	22.2	9.8	13.2	35.4	23.0	66.0	56.0	-30.6	33.0	N	
0.20471	22.7	17.8	13.2	35.9	31.0	63.4	53.4	27.5	22.4	N	
0.27915	21.5	13.7	13.2	34.7	26.9	60.8	50.8	26.1	23.9	N	
0.40511	19.0	5.4	13.2	32.2	18.6	57.7	47.7	25.5	29.1	N	
0.48940	17.3	7.4	13.2	30.5	20.6	56.2	46.2	25.7	25.6	N	
1.26810	11.8	3.7	13.4	25.2	17.1	56.0	46.0	30.8	28.9	N	
0.15000	21.8	8.6	13.2	35.0	21.8	66.0	56.0	31.0	34.2	L	
0.20315	27.3	19.8	13.2	40.5	33.0	63.5	53.5	23.0	20.5	L	
0.27210	25.8	17.4	13.2	39.0	30.6	61.1	51.1	22.1	20.5	L	
0.40391	21.7	11.7	13.2	34.9	24.9	57.8	47.8	22.9	22.9	L	
0.46945	23.6	12.9	13.2	36.8	26.1	56.5	46.5	19.7	20.4	L	
1.26018	24.0	13.9	13.4	37.4	27.3	56.0	46.0	18.6	18.7	L	

CHART: WITH FACTOR. Peak hold data. CALCULATION: RESULT=READING+C.F (L1SN LOSS + ATT LOSS + CABLE LOSS)
 Except for the above table : adequate margin data below the limits.

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

26dB Emission Bandwidth and 99% Occupied Bandwidth

Test place Ise EMC Lab. No.6 Shielded Room and No.11
Measurement Room
Report No. 10229481H
Date 03/31/2014 05/14/2014
Temperature/ Humidity 24deg.C. / 32% RH 24deg. C / 42% RH
Engineer Hironobu Ohnishi Takumi Shimada
Mode 11a / 11n-20 /11n-40 Tx

11a

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5280	20.097	16.6217	-
5300	20.220	16.7463	-
5320	20.244	16.5587	-

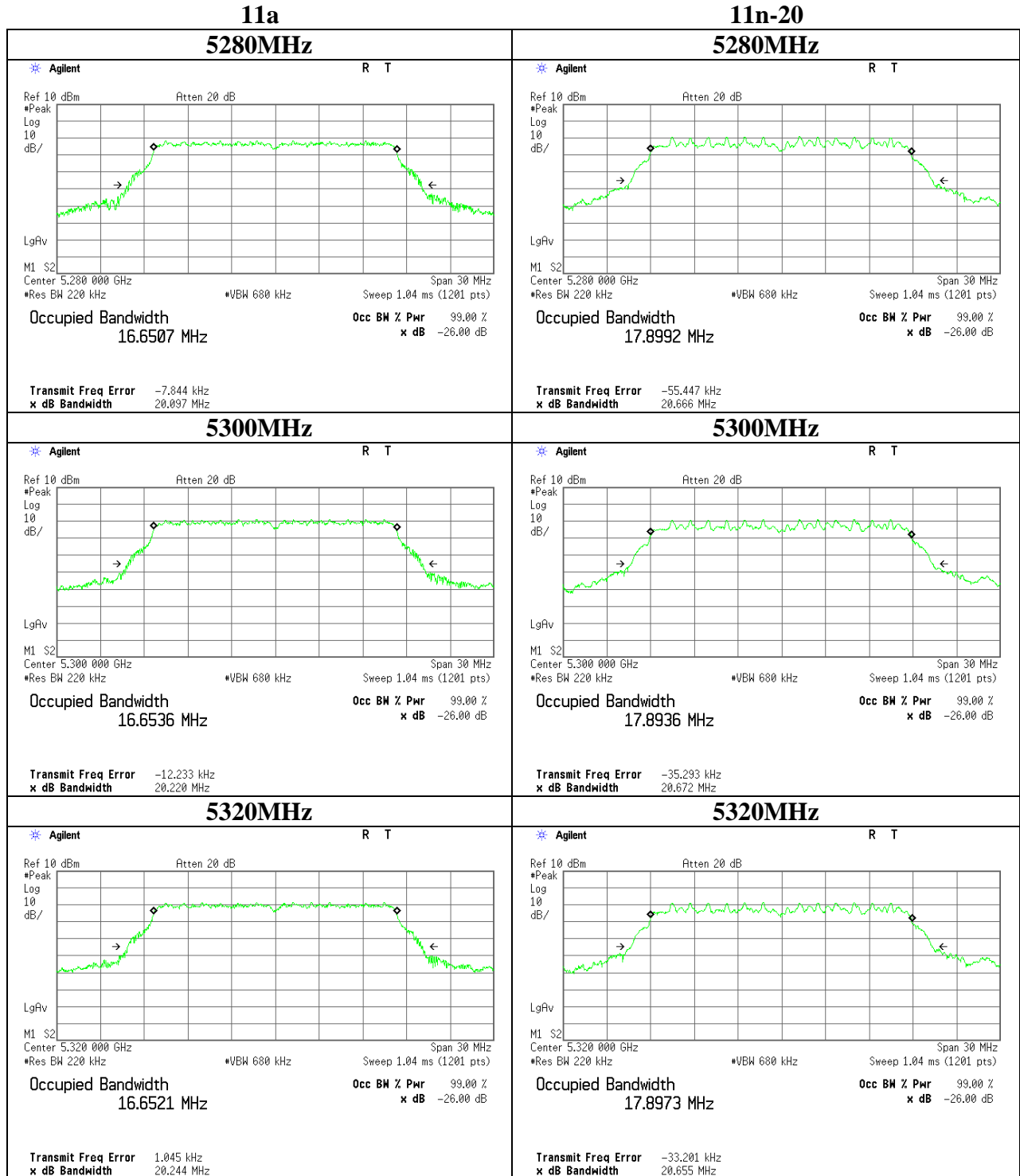
11n-20

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5280	20.666	17.7528	-
5300	20.672	17.8170	-
5320	20.655	17.8161	-

11n-40

Frequency [MHz]	26dB Emission Bandwidth [MHz]	99% Occupied Bandwidth [MHz]	Limit [MHz]
5310	41.819	36.4902	-

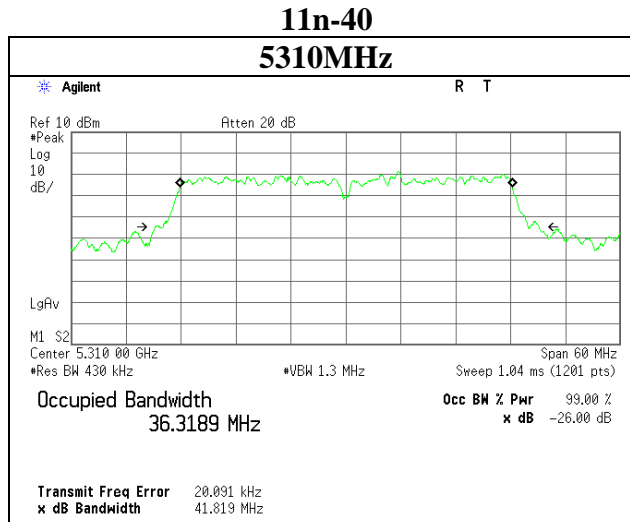
26dB Emission Bandwidth



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

26dB Emission Bandwidth



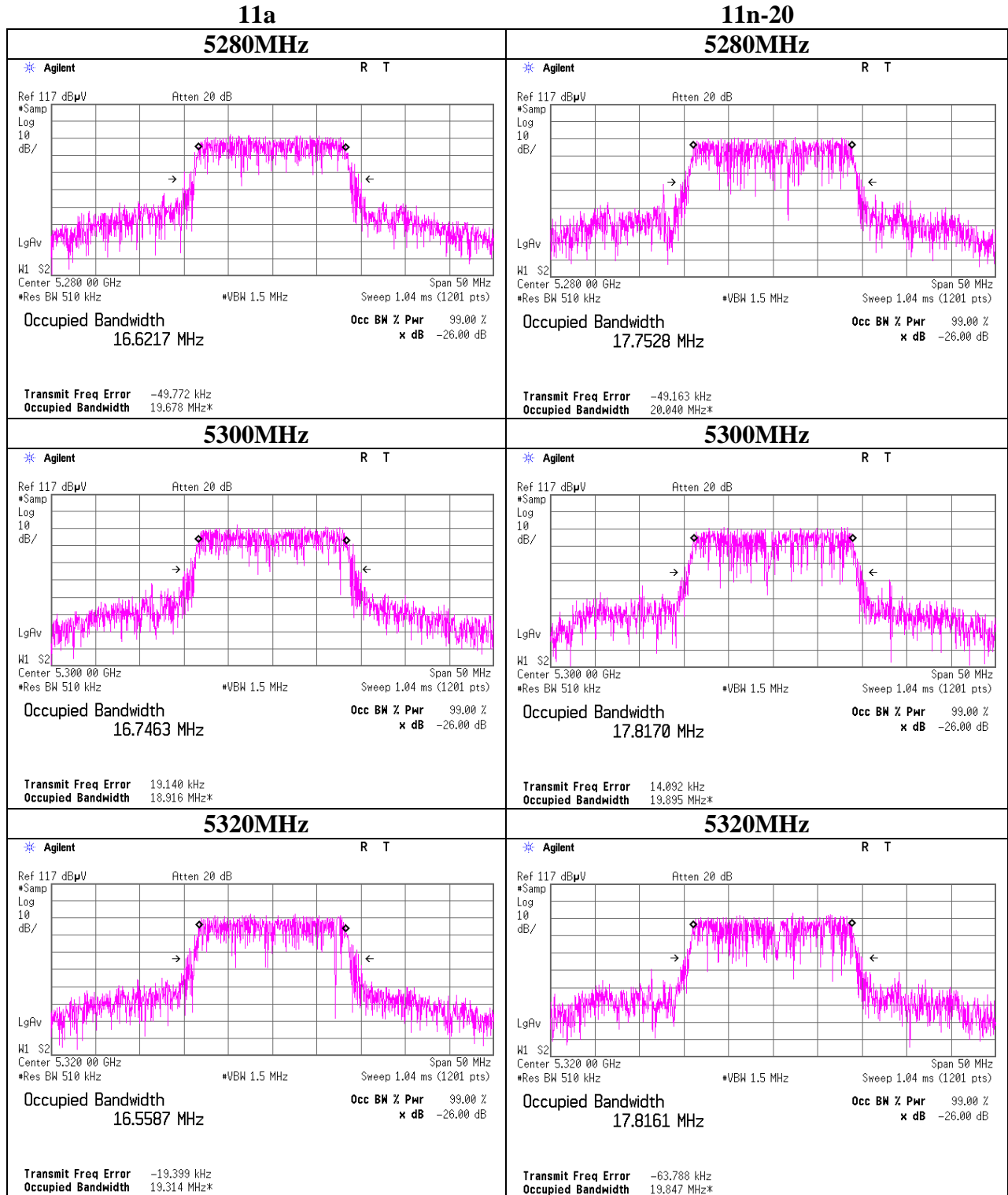
UL Japan, Inc.
Ise EMC Lab.

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

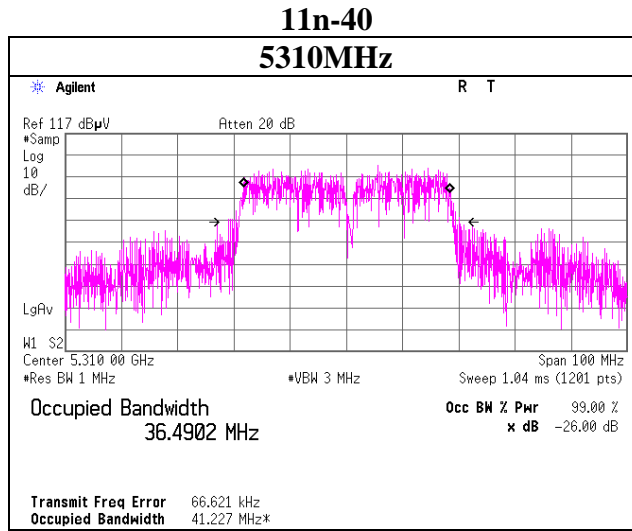
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99% Occupied Bandwidth



99% Occupied Bandwidth



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

Maximum Conducted Output Power

Test place : Ise EMC Lab. No.6 Shielded Room
 Report No. : 10229481H
 Date : 04/01/2014
 Temperature/ Humidity : 25deg.C. / 30% RH
 Engineer : Yutaka Yoshida
 Mode : 11a Tx

Method SA-1 Antenna A

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]
5280.0	1.55	1.20	10.03	-0.98	12.78	18.97	11.80	15.14	23.97	-	11.19
5300.0	2.42	1.20	10.03	-0.98	13.65	23.17	12.67	18.49	23.97	-	10.32
5320.0	2.24	1.20	10.03	-0.98	13.47	22.23	12.49	17.74	23.97	-	10.50

Result(Cond.) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten.Loss

Result(e.i.r.p.) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten.Loss + Antenna Gain with cable loss

15.407(a)(1) Limit(Cond.) = 16.98dBm(50mW) or 4 + 10log(26dB BW) dBm

15.407(a)(2) Limit(Cond.) = 23.97dBm(250mW) or 11 + 10log(26dB BW) dBm

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

Maximum Conducted Output Power

Test place : Ise EMC Lab. No.6 Shielded Room
Report No. : 10229481H
Date : 04/01/2014
Temperature/ Humidity : 25deg.C. / 30% RH
Engineer : Yutaka Yoshida
Mode : 11n-20 Tx

Method SA-1 Antenna A + B

Freq. [MHz]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5280.0	15.37	34.44	14.39	27.48	-	8.60	-
5300.0	15.53	35.76	14.55	28.54	-	8.44	-
5320.0	16.10	40.73	15.12	32.50	-	7.87	-

Method SA-1 Antenna A

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]
5280.0	1.16	1.20	10.03	-0.98	12.39	17.34	11.41	13.84	23.97	-	11.58
5300.0	1.84	1.20	10.03	-0.98	13.07	20.28	12.09	16.18	23.97	-	10.90
5320.0	2.40	1.20	10.03	-0.98	13.63	23.07	12.65	18.41	23.97	-	10.34

Method SA-1 Antenna B

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]
5280.0	1.10	1.20	10.03	-0.98	12.33	17.10	11.35	13.65	23.97	-	11.64
5300.0	0.67	1.20	10.03	-0.98	11.90	15.49	10.92	12.36	23.97	-	12.07
5320.0	1.24	1.20	10.03	-0.98	12.47	17.66	11.49	14.09	23.97	-	11.50

Result(Cond.) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten.Loss

Result(e.i.r.p.) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten.Loss + Antenna Gain with cable loss

15.407(a)(1) Limit(Cond.) = 16.98dBm(50mW) or 4 + 10log(26dB BW) dBm

15.407(a)(2) Limit(Cond.) = 23.97dBm(250mW) or 11 + 10log(26dB BW) dBm

Maximum Conducted Output Power

Test place : Ise EMC Lab. No.6 Shielded Room
Report No. : 10229481H
Date : 04/01/2014
Temperature/ Humidity : 25deg.C. / 30% RH
Engineer : Yutaka Yoshida
Mode : 11n-40 Tx

Method SA-1 Antenna A + B

Freq. [MHz]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]	Margin (e.i.r.p.) [dB]
5310.0	15.62	36.44	14.64	29.08	-	8.35	-

Method SA-1 Antenna A

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]
5310.0	2.11	1.20	10.03	-0.98	13.34	21.58	12.36	17.22	23.97	-	10.63

Method SA-1 Antenna B

Freq. [MHz]	S/A Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result (Cond.) [dBm]	Result (Cond.) [mW]	Result (e.i.r.p.) [dBm]	Result (e.i.r.p.) [mW]	Limit (Cond.) [dBm]	Limit (e.i.r.p.) [dBm]	Margin (Cond.) [dB]
5310.0	0.49	1.20	10.03	-0.98	11.72	14.86	10.74	11.86	23.97	-	12.25

Result(Cond.) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten.Loss

Result(e.i.r.p.) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten.Loss + Antenna Gain with cable loss

15.407(a)(1) Limit(Cond.) = 16.98dBm(50mW) or 4 + 10log(26dB BW) dBm

15.407(a)(2) Limit(Cond.) = 23.97dBm(250mW) or 11 + 10log(26dB BW) dBm

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

Peak Power Spectral Density

Test place : Ise EMC Lab. No.6 Shielded Room
Report No. : 10229481H
Date : 04/01/2014
Temperature/ Humidity : 25deg.C. / 30% RH
Engineer : Yutaka Yoshida
Mode : 11a / 11n-20 Tx

11a

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
5280.0	-10.25	1.20	10.03	-0.98	0.98	11.00	10.02
5300.0	-8.91	1.20	10.03	-0.98	2.32	11.00	8.68
5320.0	-8.49	1.20	10.03	-0.98	2.74	11.00	8.26

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

11n-20 Antenna A + B

Freq. [MHz]	Total Result [dBm]	Total Result [mW]	Limit [dBm]	Margin [dB]
5280.0	5.47	3.52	11.00	5.53
5300.0	5.03	3.18	11.00	5.97
5320.0	5.71	3.73	11.00	5.29

Antenna A

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [mW]	Limit [dBm]	Margin [dB]
5280.0	-8.66	1.20	10.03	2.57	1.81	11.00	8.43
5300.0	-8.69	1.20	10.03	2.55	1.80	11.00	8.46
5320.0	-8.14	1.20	10.03	3.09	2.04	11.00	7.91

Antenna B

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Result [mW]	Limit [dBm]	Margin [dB]
5280.0	-8.89	1.20	10.03	2.34	1.71	11.00	8.66
5300.0	-9.81	1.20	10.03	1.42	1.39	11.00	9.58
5320.0	-8.96	1.20	10.03	2.27	1.69	11.00	8.73

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

Total Result = 10Log(10^(Antenna A Result/10)+10^(Antenna B Result/10))

Peak Power Spectral Density

Test place : Ise EMC Lab. No.6 Shielded Room
 Report No. : 10229481H
 Date : 04/01/2014
 Temperature/ Humidity : 25deg.C. / 30% RH
 Engineer : Yutaka Yoshida
 Mode : 11n-40 Tx

11n-40 Antenna A + B

Freq.	Total Result	Total Result	Limit	Margin
[MHz]	[dBm]	[mW]	[dBm]	[dB]
5310.0	3.44	2.21	11.00	7.56

Antenna A

Freq.	Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5310.0	-9.60	1.20	10.03	1.63	1.45	11.00	9.37

Antenna B

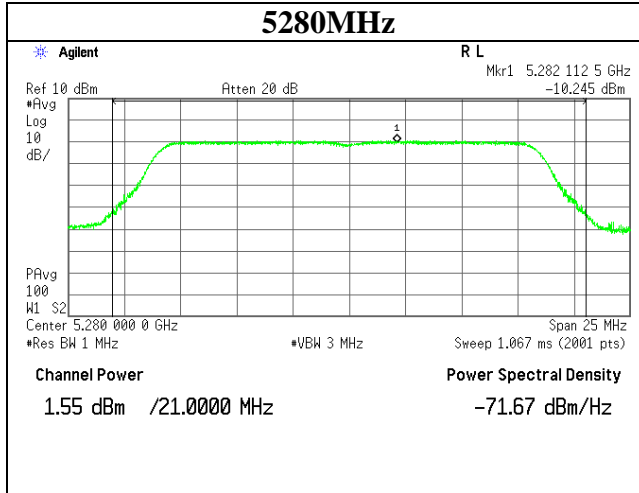
Freq.	Reading	Cable Loss	Atten. Loss	Result	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5310.0	-12.46	1.20	10.03	-1.23	0.75	11.00	12.23

Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator
 Total Result = $10\log(10^{Antenna\ A\ Result/10} + 10^{Antenna\ B\ Result/10})$

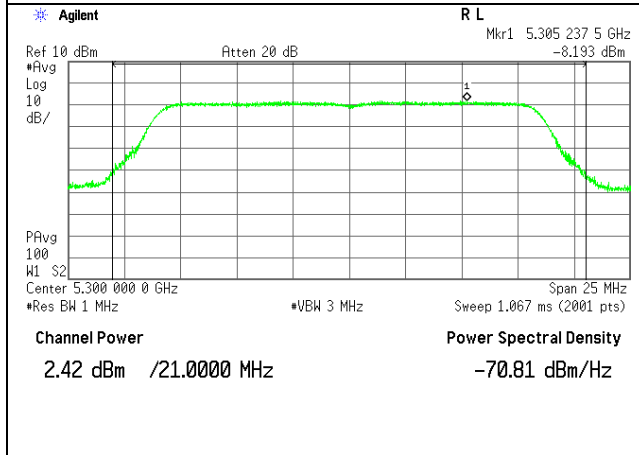
Maximum Conducted Output Power & Peak Power Spectral Density

11a

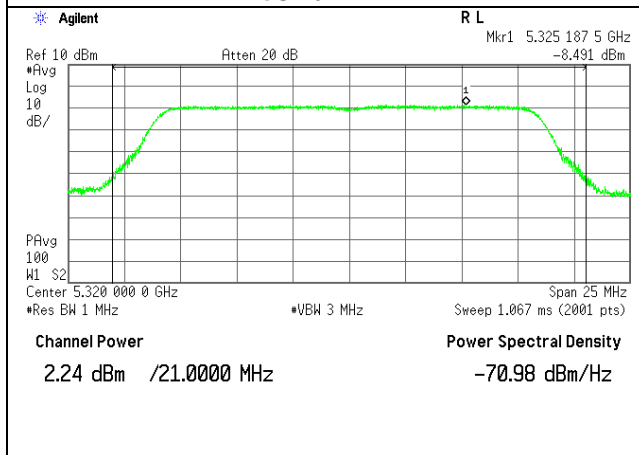
5280MHz



5300MHz



5320MHz



UL Japan, Inc.
Ise EMC Lab.

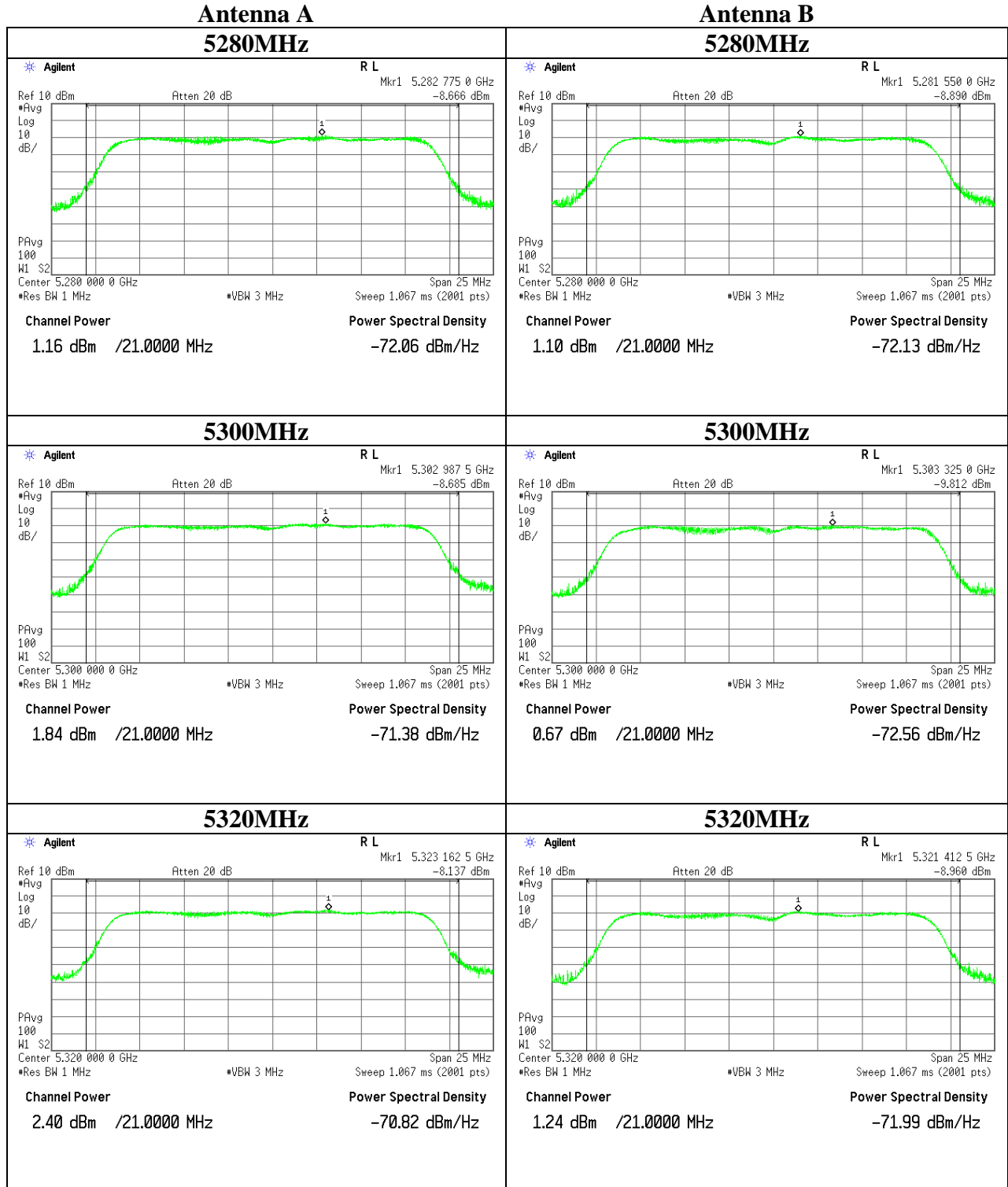
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Maximum Conducted Output Power & Peak Power Spectral Density

11n-20

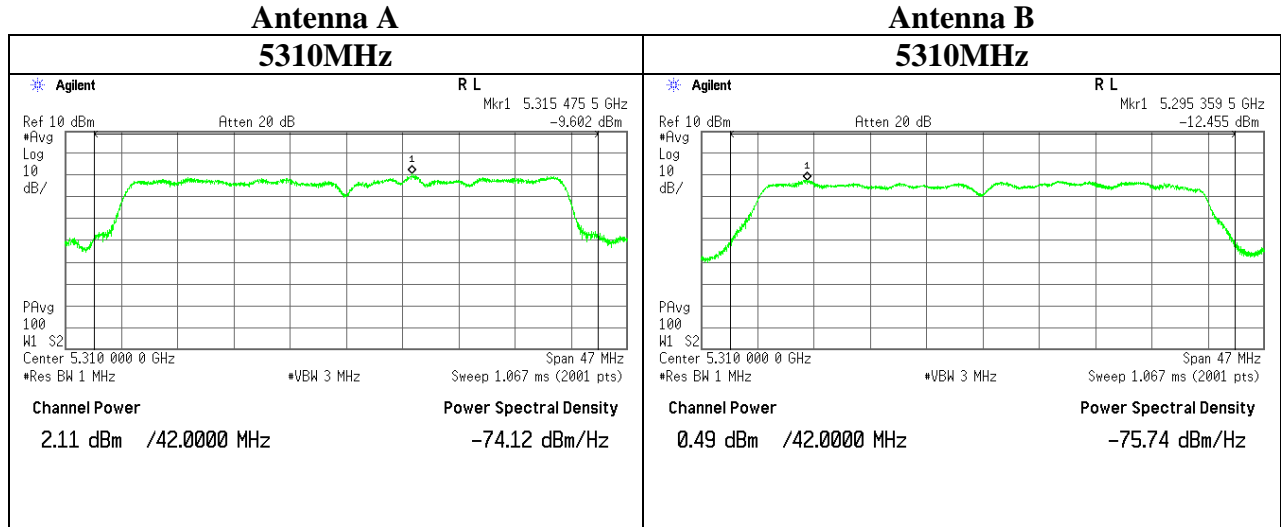


UL Japan, Inc.
Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
 Telephone : +81 596 24 8999
 Facsimile : +81 596 24 8124

Maximum Conducted Output Power & Peak Power Spectral Density

11n-40



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

Maximum Conducted Output Power & Peak Power Spectral Density
(Reference data : Worst data rate check)

Test place : Ise EMC Lab. No.3 Measurement Room
Report No. : 10229481H
Date : 03/27/2014
Temperature/ Humidity : 24deg.C. / 35% RH
Engineer : Yutaka Yoshida
Mode : 11a / 11n-20 / 11n-40 Tx

11a, 5280MHz

Data Rate [Mbps]	Antenna A	Antenna B	Ramark
	Reading S/A Average [dBm]	Reading S/A Average [dBm]	
6	1.35	-	
9	1.39	-	
12	1.62	0.70	*
18	1.38	-	
24	1.29	-	
36	1.33	-	
48	1.50	-	
54	1.29	-	

*Worst Rate

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

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

Maximum Conducted Output Power & Peak Power Spectral Density
(Reference data : Worst data rate check)

11n-20, 5280MHz

MCS Index	Antenna A	Antenna B	Total	Remark
	Reading S/A Average [dBm]	Reading S/A Average [dBm]	[dBm]	
0	1.81	-	-	
1	1.70	-	-	
2	1.87	-	-	
3	1.85	-	-	
4	1.88	-	-	
5	1.91	1.25	-	
6	1.46	-	-	
7	1.48	-	-	
8	1.54	0.22	3.94	
9	1.16	0.80	3.99	
10	1.80	0.47	4.20	
11	1.06	0.80	3.94	
12	1.47	0.40	3.98	
13	1.52	1.06	4.31	*
14	1.42	0.40	3.95	
15	1.51	1.05	4.30	

*Worst Rate

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

11n-40, 5310MHz

MCS Index	Antenna A	Antenna B	Total	Remark
	Reading S/A Average [dBm]	Reading S/A Average [dBm]	[dBm]	
0	1.97	-	-	
1	2.06	-	-	
2	2.18	-	-	
3	2.22	-	-	
4	2.28	-	-	
5	2.52	1.88	-	
6	2.50	-	-	
7	2.48	-	-	
8	1.16	-0.12	3.58	
9	1.10	0.80	3.96	
10	2.02	0.40	4.30	
11	1.68	1.41	4.56	
12	2.15	0.85	4.56	
13	2.01	1.30	4.68	
14	2.29	1.26	4.82	
15	2.19	1.52	4.88	*

*Worst Rate

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

UL Japan, Inc.

Ise EMC Lab.

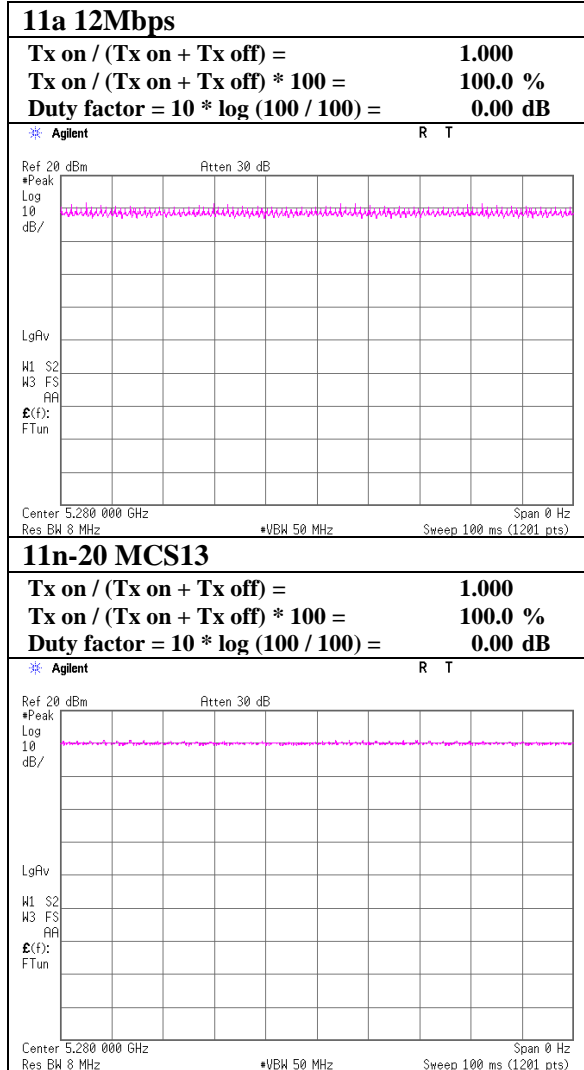
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

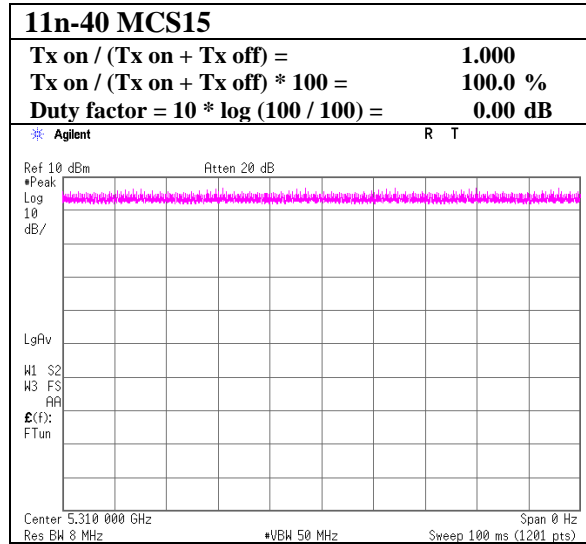
Duty cycle

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10229481H
Date	04/01/2014
Temperature/ Humidity	25deg.C. / 30% RH
Engineer	Yutaka Yoshida
Mode	11a / 11n-20



Duty cycle

Test place	Ise EMC Lab. No.6 Shielded Room
Report No.	10229481H
Date	04/01/2014
Temperature/ Humidity	25deg.C. / 30% RH
Engineer	Yutaka Yoshida
Mode	11n-40 Tx



UL Japan, Inc.
Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
 Telephone : +81 596 24 8999
 Facsimile : +81 596 24 8124

Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Anechoic Chamber
 Report No. 10229481H
 Date 03/31/2014 04/01/2014
 Temperature/ Humidity 23deg. C / 37% RH 23deg. C / 37% RH
 Engineer Kazuya Yoshioka Tsubasa Takayama
 (1-10GHz) (10-40GHz)
 Mode 11n20 Tx 5280MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Inside or Outside of Restricted Bands	Remark
Hori	5250.000	PK	45.0	32.2	3.8	33.8	47.2	68.2	21.0	Outside	
Hori	10560.000	PK	46.3	39.2	2.6	34.1	54.0	68.2	14.2	Outside	
Hori	15840.000	PK	46.1	38.8	5.5	33.3	57.1	73.9	16.8	Inside	
Hori	15840.000	AV	34.8	38.8	5.5	33.3	45.8	53.9	8.1	Inside	
Vert	5250.000	PK	48.3	32.2	3.8	33.8	50.5	68.2	17.7	Outside	
Vert	10560.000	PK	46.2	39.2	2.6	34.1	53.9	68.2	14.3	Outside	
Vert	15840.000	PK	45.8	38.8	5.5	33.3	56.8	73.9	17.1	Inside	
Vert	15840.000	AV	34.5	38.8	5.5	33.3	45.5	53.9	8.4	Inside	

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 have enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

*AV: Method AD

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

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

Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 Anechoic Chamber	
Report No.	10229481H	
Date	03/31/2014	04/01/2014
Temperature/ Humidity	23deg. C / 37% RH	23deg. C / 37% RH
Engineer	Kazuya Yoshioka	Tsubasa Takayama
	(1-10GHz)	(10-40GHz)
Mode	11n20 Tx 5300MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Inside or Outside of Restricted Bands	Remark
Hori	10600.000	PK	46.7	39.3	2.6	34.0	54.6	73.9	19.3	Inside	
Hori	15900.000	PK	46.3	38.6	5.5	33.3	57.1	73.9	16.8	Inside	
Hori	10600.000	AV	34.0	39.3	2.6	34.0	41.9	53.9	12.0	Inside	
Hori	15900.000	AV	34.3	38.6	5.5	33.3	45.1	53.9	8.8	Inside	
Vert	10600.000	PK	46.0	39.3	2.6	34.0	53.9	73.9	20.0	Inside	
Vert	15900.000	PK	45.7	38.6	5.5	33.3	56.5	73.9	17.4	Inside	
Vert	10600.000	AV	34.4	39.3	2.6	34.0	42.3	53.9	11.6	Inside	
Vert	15900.000	AV	34.3	38.6	5.5	33.3	45.1	53.9	8.8	Inside	

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 have enough margin (more than 20dB).

*The 10th harmonic was not seen so the result was its base noise level.

*AV: Method AD
 Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
 26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Test place Ise EMC Lab. No.2 Anechoic Chamber
Report No. 10229481H
Date 03/31/2014 04/01/2014 04/01/2014 night
Temperature/ Humidity 23deg. C / 37% RH 23deg. C / 37% RH 23deg. C / 35% RH
Engineer Kazuya Yoshioka Tsubasa Takayama Kazuya Yoshioka
(1-10GHz) (10-40GHz) (30-1000MHz)
Mode 11n20 Tx 5320MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Inside or Outside of Restricted Bands	Remark
Hori	187.389	QP	34.0	16.3	8.1	27.9	30.5	43.5	13.0	Outside	
Hori	205.821	QP	35.3	16.7	8.2	27.8	32.4	43.5	11.1	Outside	
Hori	244.731	QP	33.5	17.0	8.4	27.7	31.2	46.0	14.8	Inside	
Hori	247.096	QP	38.4	17.0	8.4	27.7	36.1	46.0	9.9	Inside	
Hori	250.001	QP	39.7	17.1	8.4	27.7	37.5	46.0	8.5	Inside	
Hori	875.024	QP	31.0	22.1	11.0	28.0	36.1	46.0	9.9	Outside	
Hori	5350.000	PK	45.7	32.2	3.8	33.7	48.0	68.2	20.2	Bandedge	
Hori	10640.000	PK	46.5	39.3	2.6	34.0	54.4	73.9	19.5	Inside	
Hori	15960.000	PK	46.7	38.4	5.7	33.3	57.5	73.9	16.4	Inside	
Hori	5350.000	AV	38.0	32.2	3.8	33.7	40.3	53.9	13.6	Bandedge	
Hori	10640.000	AV	34.5	39.3	2.6	34.0	42.4	53.9	11.5	Inside	
Hori	15960.000	AV	34.5	38.4	5.7	33.3	45.3	53.9	8.6	Inside	
Vert	187.391	QP	38.2	16.3	8.1	27.9	34.7	43.5	8.8	Outside	
Vert	205.823	QP	38.2	16.7	8.2	27.8	35.3	43.5	8.2	Outside	
Vert	244.728	QP	37.3	17.0	8.4	27.7	35.0	46.0	11.0	Inside	
Vert	247.099	QP	36.1	17.0	8.4	27.7	33.8	46.0	12.2	Inside	
Vert	250.001	QP	41.6	17.1	8.4	27.7	39.4	46.0	6.6	Inside	
Vert	875.024	QP	29.0	22.1	11.0	28.0	34.1	46.0	11.9	Outside	
Vert	5350.000	PK	50.1	32.2	3.8	33.7	52.4	68.2	15.8	Bandedge	
Vert	10640.000	PK	46.5	39.3	2.6	34.0	54.4	73.9	19.5	Inside	
Vert	15960.000	PK	46.3	38.4	5.7	33.3	57.1	73.9	16.8	Inside	
Vert	5350.000	AV	40.4	32.2	3.8	33.7	42.7	53.9	11.2	Bandedge	
Vert	10640.000	AV	34.6	39.3	2.6	34.0	42.5	53.9	11.4	Inside	
Vert	15960.000	AV	35.1	38.4	5.7	33.3	45.9	53.9	8.0	Inside	

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

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

*The 10th harmonic was not seen so the result was its base noise level.

*AV:

Method AD

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

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

UL Japan, Inc.

Ise EMC Lab.

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

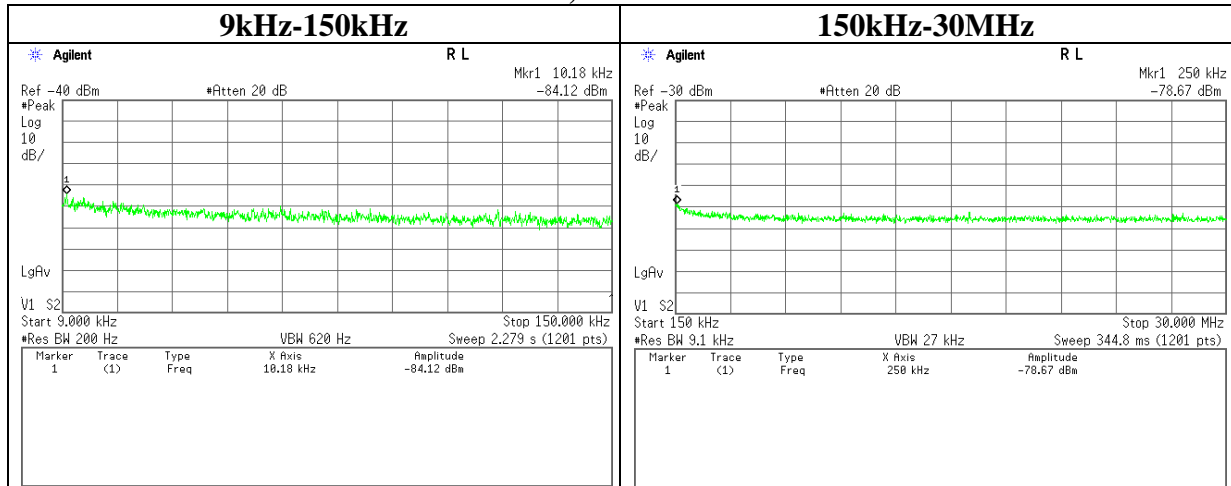
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.6 Shielded Room
 Report No. : 10229481H
 Date : 04/01/2014
 Temperature/ Humidity : 25deg.C. / 30% RH
 Engineer : Kazuya Yoshioka

11n-20, Tx 5320MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	RBW factor	Number of Chains	EIRP	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dB]		[dBm]	[dBm]	[dB]	
10.18	-84.12	0.40	9.98	2.00	36.99	2	-31.74	-27.00	4.74	
250.00	-78.67	0.40	9.98	2.00	20.41	2	-42.87	-27.00	15.87	

EIRP=Reading + Cable Loss + Attenuator + Antenna Gain + RBW factor + 10log(Number of Chains)

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

Peak Excursion Ratio

Test place Ise EMC Lab. No.6 Shielded Room
Report No. 10229481H
Date 04/01/2014
Temperature/ Humidity 25deg.C. / 30% RH
Engineer Yutaka Yoshida
Mode 11a / 11n-20 / 11n-40 Tx

11a

Frequency [MHz]	Peak Power Excursion [dB]	Limit [dB]
5280	7.318	13.00

11n-20

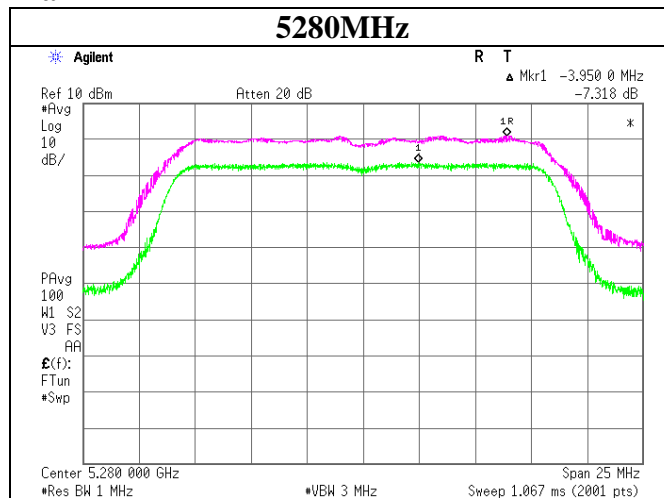
Frequency [MHz]	Peak Power Excursion [dB]	Limit [dB]
5280	6.951	13.00

11n-40

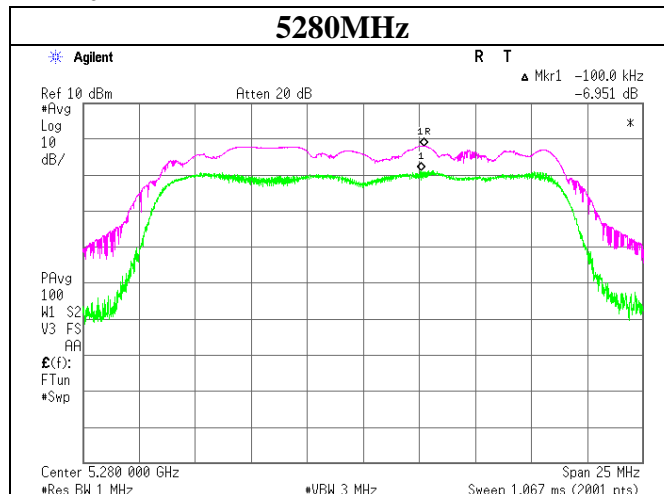
Frequency [MHz]	Peak Power Excursion [dB]	Limit [dB]
5310	8.045	13.00

Peak Excursion Ratio

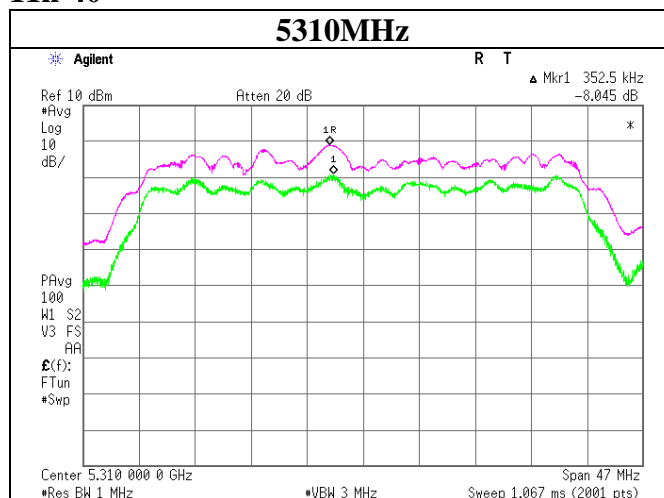
11a



11n-20



11n-40



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)
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2013/12/17 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	AT	2013/11/25 * 12
MAT-25	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71642	AT	2013/06/20 * 12
MCC-144	Microwave Cable	Junkosha	MWX221	1207S407	AT	2013/08/19 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2013/06/30 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2014/02/20 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2014/02/21 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2013/11/27 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2014/01/21 * 12
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2013/06/14 * 12
MHA-02	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	RE	2014/02/21 * 12
MHA-04	Horn Antenna 26.5-40GHz	EMCO	3160-10	1140	RE	2013/11/25 * 12
MCC-54	Microwave Cable	Suhner	SUCOFLEX101	2873(1m) / 2876(5m)	RE	2014/03/11 * 12
MHA-16	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170306	RE	2013/05/17 * 12
MCC-79	Microwave Cable 1G-26.5GHz	Suhner	SUCOFLEX104	278923/4	RE	2013/12/24 * 12
MPA-03	Microwave System Power Amplifier	Agilent	83050A	3950M00205	RE	2013/06/20 * 12
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2013/11/15 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE/CE	2013/06/11 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2013/10/13 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2013/10/13 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2014/02/20 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2013/11/26 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2013/09/12 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE/CE	2014/02/20 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(AE)	2014/01/27 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE(EUT)	2014/01/27 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2014/01/20 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2014/02/20 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2014/01/29 * 12

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

**The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.**

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

**Test Item: CE: Conducted Emission
RE: Radiated Emission
AT: Antenna Terminal Conducted test**