RADIO TEST REPORT

Test Report No.: 31AE0180-SH-01-A

Applicant	:	**RICOH COMPANY, LTD.**
Type of Equipment	:	**Wireless LAN Module**
Model No.	:	**TDPWLAN02**
FCC ID	:	**BBP-WLRGL01**
Test regulation	:	**FCC Part15 Subpart C: 2010**
Test result	:	**Complied**

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Date of test:

December 21, 2010 – January 20, 2011

Representative test engineer:

Tatsuya Arai
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Ichiro Isozaki
Leader of WiSE Japan,
UL Verification Service

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JAB Testing RTL02610

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1 Applicant information

Company Name	:	RICOH COMPANY, LTD.
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Contact Person	:	Hiroshi Terui

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless LAN Module
Model No.	:	TDPWLAN02
Serial No.	:	PJ2b-WLAN01
Rating	:	DC3.3V, DC1.8V
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.
Receipt Date of Sample	:	December 20, 2010

2.2 Product description

Model: TDPWLAN02 (referred to as the EUT in this report) is a Wireless LAN Module.

Equipment type	:	Transceiver
Frequency of operation	:	11b,11g: 2412-2462MHz
Clock frequency	:	38.4MHz
Bandwidth & channel spacing	:	11b,11g Bandwidth : 20MHz Channel spacing : 5MHz
Type of modulation	:	11b: DSSS 11g: OFDM
Antenna model & condition	:	ANCG12G44SAA129 Condition 1-80 (Refer to the Technical Data Sheet)
Antenna type	:	Chip Antenna
Antenna gain with cable loss	:	1.0dBi
Antenna connector type	:	None
ITU code	:	D1D, G1D
Operation temperature range	:	+5 to +80 deg.C.

FCC Part15.31 (e)
The Wireless LAN Module is provided with stable power supply DC 3.3V and DC1.8V from the host device , therefore, the equipment complies power supply regulation.

FCC Part15.203 Antenna requirement
The antenna is not removable from the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3 Test specification, procedures and results

3.1 Test specification

Test specification : FCC Part 15 Subpart B:2010, final revised on December 6, 2010 and effective January 5, 2011

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.209 Radiated emission limits, general requirements
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures & Results

Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
Conducted Emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC 15.207	-	N/A	18.0dB (0.19195MHz, QP, 11b Tx 2437MHz)	Complied
6dB Bandwidth	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (a)(2) & 15.209	Conducted	N/A	See data	Complied
Maximum Peak Output Power	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (b)(3) & 15.209	Conducted	N/A		Complied
Out of Band Emission & Restricted Band Edges	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.109, 15.247 (d) & 15.209	Conducted / Radiated	N/A	4.7dB (19496MHz, Vertical, AV, 11g Tx 2437MHz)	Complied
Power Density	"Guidance on Measurement for Digital Transmission Systems Section 15.247" & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC 15.247 (e)	Conducted	N/A	See data	Complied

3.3 Addition to standard

Item	Test Procedure	Specification	Remarks	Worst Margin	Results
Occupied bandwidth (99%)	ANSI C63.4:2003 13. Measurement of intentional radiators RSS-Gen 4.6.1	RSS-Gen 4.6.1	Conducted	-	Complied

* Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

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

Item	Frequency range	No.1 SAC*1/SR*2 (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	150kHz-30MHz	3.0 dB	2.6 dB	3.1 dB
Radiated emission (Measurement distance: 3m)	30MHz-300MHz	4.6 dB	4.5 dB	4.9 dB
	300MHz-1GHz	4.5 dB	4.6 dB	5.1 dB
	1GHz-10GHz	3.9 dB	3.9 dB	4.0 dB
Radiated emission (Measurement distance: 1m)	10GHz-18GHz	4.8 dB	4.8 dB	4.8 dB
	18GHz-40GHz	4.2 dB	4.2 dB	4.2 dB

*1: SAC=Semi-Anechoic Chamber
*2: SR= Shielded Room is applied besides radiated emission

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

Conducted emissions, Power Density Measurement (below 1GHz) uncertainty (with a 95% confidence level) for this test was: (±) 1.1dB
Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty (with a 95% confidence level) for this test was: (±) 1.2dB
Conducted emissions, Power Density Measurement (3G-18GHz) uncertainty (with a 95% confidence level) for this test was: (±) 2.9dB
Conducted emissions Measurement (18G-26.5GHz) uncertainty (with a 95% confidence level) for this test was: (±) 3.4dB

Power Measurement uncertainty above 1GHz (with a 95% confidence level) for this test was: (±) 0.8dB
Bandwidth Measurement uncertainty (with a 95% confidence level) for this test was: (±) 5.4%

3.5 Test location

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JAB Accreditation No. : RTL02610

No.1/ No.2/ No.3 anechoic chamber has been fully described in a report submitted to FCC office, and accepted on April 17, 2009 (Registration No.: 697847).
IC Registration No. : 2973D-1 (No1 anechoic chamber)
2973D-2 (No2 anechoic chamber)
2973D-3 (No3 anechoic chamber)

Test room	Width x Depth x Height (m)	Test room	Width x Depth x Height (m)
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.1 Shielded room	6.8 x 4.1 x 2.7
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65 Maximum measurement distance: 10m	No.2 Shielded room	6.8 x 4.1 x 2.7
No.3 Semi-anechoic chamber	12.7 x 7.7 x 5.35 Maximum measurement distance: 5m	No.3 Shielded room	6.3 x 4.7 x 2.7
No.4 Full-anechoic chamber	8.1 x 5.1 x 3.55	No.4 Shielded room	4.4 x 4.7 x 2.7
		No.5 Shielded room	7.8 x 6.4 x 2.7
		No.6 Shielded room	7.8 x 6.4 x 2.7

3.6 Test setup, Data of EMI & Test instruments
Refer to Appendix 1 to 3.

4 System test configuration

4.1 Justification

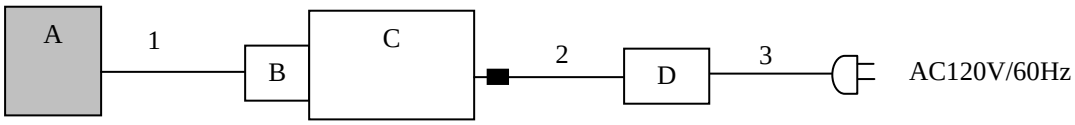
The system was configured in typical fashion (as a customer would normally use it) for testing.

Mode	Remarks*
IEEE 802.11b (11b)	2Mbps, PN9
IEEE 802.11g (11g)	48Mbps, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Low Channel)	

Test Item	Operating Mode	Tested frequency
Conducted Emission Spurious Emission 6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx	2412MHz 2437MHz 2462MHz

*EUT has the power settings by the software as follows;
Power settings: IEEE 802.11b: 10
IEEE 802.11g: 10
Software: Labtool Version 1.2.10

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Wireless LAN Module	TDPWLAN02	PJ2b-WLAN01	RICOH	EUT
B	Test jig	076006R	076006R-2	TOSHIBA	-
C	PC	2371	KV-BWF93	IBM	-
D	AC Adaptor	02K6808	-	IBM	-

List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	Ribbon Cable	0.1	Unshielded	Unshielded
2	DC Cable	1.8	Unshielded	Unshielded
3	AC Cable	0.9	Unshielded	Unshielded

5 Conducted emission

5.1 Operating environment

The test was carried out in No.3 shielded room.

Temperature : See test data
Humidity : See test data

5.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT was aligned and was 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 LISN. They were folded back and for the forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.
Photographs of the set up are shown in Appendix 1.

5.3 Test conditions

Frequency range : 0.15 - 30MHz
EUT position : Table top

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT within a screened room.
The EUT was connected to a Line Impedance Stabilization Network (LISN).
An overview sweep with peak detection has been performed.
The measurements had been performed with a quasi-peak detector and if required, an average detector.
The conducted emission measurements were made with the following detector of the test receiver.

Detector Type : Quasi-Peak/ Average
IF Bandwidth : 9kHz

5.5 Results

Summary of the test results : Pass

Date : December 21, 2010 Test engineer : Takahiro Suzuki

6 6dB bandwidth & Occupied bandwidth (99%)

Test procedure
The bandwidth was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass
Date : December 21, 2010 Test engineer : Tatsuya Arai

7 Maximum peak output power

Test procedure
The Maximum Peak Output Power was measured with a power meter connected to the antenna port.

Summary of the test results: Pass
Date : January 19, 2011 Test engineer : Shinichi Takano

8 Out of band emissions (Antenna port conducted)

Test procedure
The Out of Band Emissions was measured with a spectrum analyzer connected to the antenna port.
In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

Summary of the test results: Pass
Date : January 19, 2011 Test engineer : Shinichi Takano

9 Out of band emissions (Radiated)

9.1 Operating environment

The test was carried out in No.3 anechoic chamber.

9.2 Test configuration

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.
The table is made of Styrofoam and covered with polyvinyl chloride. That has very low permittivity.
Photographs of the set up are shown in Appendix 1.

9.3 Test conditions

Frequency range : 30MHz - 26GHz

9.4 Test procedure

The Radiated Electric Field Strength intensity has been measured with a ground plane and at a distance of 3m(below 13GHz) and 1m(above13GHz).
The measuring antenna height was varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization. Measurements were performed with QP, PK, and AV detector.
The radiated emission measurements were made with the following detector function of the test receiver.

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer *1)
Detector IF Bandwidth	QP: BW 120kHz	PK: RBW: 1MHz/VBW: 3MHz, AV RBW: 1MHz/VBW: 10Hz
Measuring antenna	Biconical (30-300MHz) Logperiodic (300MHz-1GHz)	Horn
Test distance	3m	3m(below 13GHz) 1m(above 13GHz)

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

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.

Combinations of the worst case

Model	Worst position	
	Below 1GHz	Above 1GHz
EUT	Horizontal: X, Vertical: X	Horizontal: X, Vertical: Z (Fundamental) Horizontal: X, Vertical: Z (below 18GHz) Horizontal: Y, Vertical: Z (above 18GHz)

9.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier. Band edge level at 2390MHz and 2483.5MHz is below the limits of FCC 15.209. Refer to the data of Radiated emission.

9.6 Results

Summary of the test results : Pass

10 Peak power density

Test procedure

The peak power density was measured with a spectrum analyzer connected to the antenna port.

Instrument used : Spectrum Analyzer *1)
RBW / VBW : 30kHz / 100kHz *2)

*1) PSD Option 1 of " Measurement of Digital Transmission Systems Operating under Section 15.247".

*2) The test was not performed at RBW：3kHz that was stated in the Regulation.
However, the measurement value with RBW: 3kHz is less than the value of RBW: 30kHz and the test data met the limit with RBW: 30kHz.

Summary of the test results: Pass
Date : January 19, 2011 Test engineer : Shinichi Takano

APPENDIX 1: Photographs of test setup

APPENDIX 2: Test data

APPENDIX 3: Test instruments