

RADIO TEST REPORT

Test Report No.: 30GE0098-YK-F-R1

Applicant : RICOH COMPANY, LTD.
Type of Equipment : Option(s) for Radiocommunications
Model No. : R-WL54M1GN
FCC ID : BBP-WLRW54G2
Test regulation : FCC Part15 Subpart C: 2010
Test result : Complied

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6. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
7. This report is a revised version of 30GE0098-YK-F. 30GE0098-YK-F is replaced with this report.

Date of test: February 18, 24, 25 and March 2-4, 2010

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1 Applicant information

Company Name : RICOH COMPANY, LTD.
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2 Equipment under test (E.U.T.)

2.1 Product description

At applicant's sole responsibility, that the differences among the subjected two models, [R-WL54C1GN] and [R-WL54M1GN] are as shown below.

	Model name	Antenna type	Frequency band
FCC ID: BBP-WLRWL542 IC: 144D-WLRWL542	R-WL54C1N	chip	2400-2483.5MHz 5150-5350MHz
	R-WL54M1N	monopole	2400-2483.5MHz 5150-5350MHz
FCC ID: BBP-WLRW54G2 IC: 144D-WLRW54G2	R-WL54C1GN	chip	2400-2483.5MHz
	R-WL54M1GN	monopole	2400-2483.5MHz

The model [R-WL54M1GN] and [R-WL54C1GN] are prohibited 5GHz band from operating, and it never causes affect on the characteristic of 2.4GHz.

There is no difference among these four models other than that mentioned above.

Therefore, we will use the test data of [R-WL54C1N] for [R-WL54C1GN], and the test data of [R-WL54M1N] for [R-WL54M1GN] in this application.

So we can deem the description of [R-WL54C1N] or [R-WL54M1N] to be [R-WL54C1GN] or [R-WL54M1GN] after this section.

2.2 Identification of E.U.T.

Type of Equipment : Option(s) for Radiocommunications
Model No. : R-WL54M1N
Serial No. : 91290017
Rating : DC3.3V
Antenna gain : max +3dBi
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 : February 17, 2010

FCC 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC3.3V, 2.9V, 2.8V, and 1.2V) through its own regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

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.

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3 Test specification, procedures and results

3.1 Test specification

Test specification : FCC Part 15 Subpart C: 2010, final revised on January 22, 2010 and effective March 1, 2010
 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

*The revision on January 22, 2010 does not affect the test specification applied to the EUT.

FCC Part 15 Subpart B: 2010, final revised on January 22, 2010 and effective March 1, 2010.

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	5.4dB (15.51250MHz, AV, 11g 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	-	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	0.2dB (6431.955MHz, Vertical, AV, 11g Tx 2412MHz)	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	-	Complied

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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-13GHz	3.9 dB	3.9 dB	4.0 dB
Radiated emission (Measurement distance: 1m)	13GHz-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

Conducted Emission Test

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

Radiated Emission Test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

Conducted emissions, Power Density Measurement (below 1GHz) uncertainty for this test was: (±) 1.1dB

Conducted emissions, Power Density Measurement (1G-3GHz) uncertainty for this test was: (±) 1.2dB

Conducted emissions, Power Density Measurement (3G-18GHz) uncertainty for this test was: (±) 2.9dB

Conducted emissions Measurement (18G-26.5GHz) uncertainty for this test was: (±) 3.4dB

Power Measurement uncertainty above 1GHz for this test was: (±) 0.8dB

Bandwidth Measurement uncertainty for this test was: (±) 5.4%

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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.

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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)	11Mbps, PN9
IEEE 802.11g (11g)	6Mbps, 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	11b Tx	2412MHz
6dB Bandwidth	11g Tx	2437MHz
Occupied Bandwidth (99%)		2462MHz
Maximum Peak Output Power		
Peak Power Spectral Density		
Out of Band Emissions		

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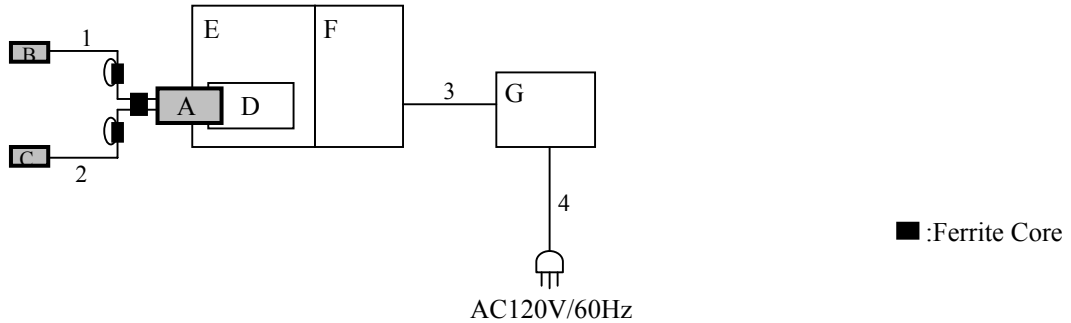
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4.2 Configuration and peripherals



* Test data was taken under worst case conditions.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	FCC ID (Remark)
A	Option(s) for Radiocommunications	R-WL54M1N	91290017	RICOH	BBP-WLRWL542 (EUT)
B	Antenna 1	ANT0602-	D3775683	NISSEI ELECTRIC	(EUT)
C	Antenna 2	WMFW/N-AB			
D	Extension board1	ABN105623	30590003	RICOH	(Jig)
E	Controller board	Type-DC1S	612S0038	RICOH	(Jig)
F	Extension board2	WBG226714	60690035	RICOH	(Jig)
G	PSU	MPT-400	2301219567	RICOH	(Jig)

List of cables used *1)

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	Antenna cable	1.0	Shielded	Shielded	(for antenna 1)
2	Antenna cable	1.0	Shielded	Shielded	(for antenna 2)
3	DC cable	0.7	Unshielded	Unshielded	-
4	AC cable	2.5	Unshielded	Unshielded	-

*1) All cables used for the measurement are exclusive use or marketed.

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5 Conducted emission

5.1 Operating environment

The test was carried out in No.1 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 2m, 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 peripherals was 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) and excess AC cable was bundled in center. 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 : March 3, 2010

Test engineer : Tatsuya Arai

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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 : March 3, 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 : February 18, 2010

Test engineer : Akio Hayashi

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 : March 4, 2010

Test engineer : Tatsuya Arai

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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 urethane platform of nominal size, 0.5m by 0.5m, raised 80cm above the conducting ground plane. 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: 1MHz, AV RBW: 1MHz VBW: 10Hz (No pulse emission detected)
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 equipment was previously checked at each position of three axes X, Y and Z. The position in which the maximum noise occurred was chosen to put into measurement. See the photographs in appendix.

9.5 Band edge

Band edge level at 2400MHz is less than 20dB of peak point of the carrier. Refer to the data of Out of Band Emissions (Antenna Port Conducted). 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

Date : February 24, 25 and March 2, 2010

Test engineer : Akio Hayashi and Makoto Hosaka

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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 : March 3, 2010

Test engineer : Tatsuya Arai

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APPENDIX 1: Photographs of test setup

Page 14	:	Conducted emission
Page 15	:	Radiated emission
Page 16	:	Pre-check of the worst position

APPENDIX 2: Test data

Page 18 - 23	:	Conducted emission
Page 24 - 25	:	6dB bandwidth
Page 26	:	Maximum peak output power
Page 27 - 32	:	Out of band emissions (Radiated)
Page 33 - 39	:	Out of band emissions (Antenna port conducted)
Page 40 - 41	:	Peak power density
Page 42	:	Occupied bandwidth

APPENDIX 3: Test instruments

Page 43	:	Test instruments
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