



# RADIO TEST REPORT

Test Report No.: 31AE0037-HO-09-A

**Applicant** : Ricoh Company, Ltd.  
**Type of Equipment** : Option(s) for Radiocommunications  
**Model No.** : R-BT21A  
**FCC ID** : BBP-BT21A01  
**Test regulation** : FCC Part15 Subpart C: 2010  
**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 limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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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.

**Date of test:** September 24 to October 6, 2010

**Representative  
test engineer:**

Shinichi Takano  
Engineer of EMC Service

**Approved by :**

Go Ishiwata  
Assistant Manager of EMC Service

- The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.  
 There is no testing item of "Non-accreditation".



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## **SECTION 1: Customer information**

Company Name : Ricoh Company, Ltd.  
Address : 810 Shimoimaizumi, Ebina-Shi, Kanagawa-ken, 243-0460, Japan  
Telephone Number : +81-46-292-6870  
Facsimile Number : +81-3-6673-4430  
Contact Person : Taku Matsuyama

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

### **2.1 Identification of E.U.T.**

Type of Equipment : Option(s) for Radiocommunications  
Model Number : R-BT21A  
Serial Number : See Section 4.2  
Rating : DC5V  
Country of Mass-production : Japan  
Condition of EUT : Production prototype  
(Not for Sale: This sample is equivalent to mass-produced items.)  
Receipt Date of Sample : September 16, 2010  
Modification of EUT : No modification by the test lab.

### **2.2 Product description**

Model: R-BT21A (referred to as the EUT in this report) is a Option(s) for Radiocommunications.

Clock frequencies: 26MHz

<Radio part>

Equipment type : Transceiver  
Frequency of operation : 2402-2480MHz  
Bandwidth : Hopping off 1MHz / Hopping on 79MHz / Adaptive Frequency Hopping (AFH) on 20 to 79MHz  
Channel spacing : 1MHz  
Type of modulation : FHSS GFSK,  $\pi/4$  DQPSK, 8DPSK  
Antenna type : Monopole  
Antenna connector type : U.FL  
Antenna gain : 1.8dBi  
ITU code : F1D, G1D  
Operation temperature range : -40 to +85 deg.C.

FCC 15.31 (e)

The equipment provides the Bluetooth transmitter with stable power supply (DC3.3V , DC3.0V and DC1.8V), therefore, the equipment complies with the requirement.

FCC Part 15.203

The equipment and its antenna comply with this requirement since this antenna is built in the equipment and it cannot be replaced by end users.

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## **SECTION 3: Test specification, procedures & 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

### **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 Section 15.207	-	N/A	15.8dB Freq.: 0.15000MHz Detector: QP Phase: N, Mode: Tx 2441MHz (3DH5)	Complied
Carrier frequency separation	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)	Conducted	N/A	*See data.	Complied
20dB bandwidth	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)	Conducted	N/A		Complied
Number of hopping frequency	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)(iii)	Conducted	N/A		Complied
Dwell time	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (a)(1)(iii)	Conducted	N/A		Complied
Maximum peak output power	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (b)(1)	Conducted	N/A		Complied
Band edge compliance & Spurious emission	FCC Public Notice DA 00-705 & ANSI C63.4:2003 13. Measurement of intentional radiators	FCC Section15.247 (d) Section15.209	Conducted/ Radiated	N/A		5.0dB Freq.: 1602.405MHz Detector: Average Polarization: Horizontal, Mode: Tx 2402MHz (3DH5)
Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.						

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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

Note: UL Japan's EMI Work Procedures No.QPM05 and QPM15.

\* 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 <sup>*1</sup> /SR <sup>*2</sup> (±)	No.2 SAC/SR (±)	No.3 SAC/SR (±)
Conducted emission (AC Mains) AMN/LISN	9kHz-150kHz	3.7 dB	3.1 dB	3.5 dB
	150kHz-30MHz	3.0 dB	2.6 dB	3.1 dB
Radiated emission (Measurement distance: 3m)	9kHz-30MHz	3.4 dB	2.7 dB	3.4 dB
	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 test report has enough margin, more than site margin.

#### Antenna port conducted test

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

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

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

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

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

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

	FCC Registration No.	IC Registration No.	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
<input type="checkbox"/> No.1 Semi-anechoic chamber	697847	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input type="checkbox"/> No.2 Semi-anechoic chamber	697847	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10m
<input checked="" type="checkbox"/> No.3 Semi-anechoic chamber	697847	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5m
<input type="checkbox"/> No.4 Full-anechoic chamber	-	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
<input type="checkbox"/> No.1 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input type="checkbox"/> No.2 shielded room	-	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
<input checked="" type="checkbox"/> No.3 shielded room	-	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
<input type="checkbox"/> No.4 shielded room	-	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
<input checked="" type="checkbox"/> No.5 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
<input type="checkbox"/> No.6 shielded room	-	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-

### 3.6 Test setup, Data of EMI & Test instruments

Refer to Appendix 1 to 3.

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

### **4.1 Operating mode**

The EUT exercise program used during testing was designed to exercise the various system components in a manner similar to typical use.

<b>Test item</b>	<b>Operating mode</b>	<b>Tested frequency</b>
Carrier frequency separation	Transmitting Hopping ON (DH5/3DH5)/Inquiry, Payload: PRBS9	-
20dB bandwidth	Transmitting Hopping OFF (DH5/3DH5)/Inquiry, Payload: PRBS9	2402MHz, 2441MHz, 2480MHz
Number of hopping frequency	Transmitting Hopping ON (DH5/3DH5)/Inquiry, Payload: PRBS9	-
Dwell time	Transmitting (Hopping ON) -DH1, -DH3, -DH5 -3DH1, -3DH3, -3DH5 -Inquiry	-
Maximum peak output power	Transmitting Hopping OFF (DH5/2DH5/3DH5) Payload: PRBS9	2402MHz, 2441MHz, 2480MHz
Band edge compliance & Spurious emission (Conducted)	Transmitting (DH5/3DH5), Payload: PRBS9 -Hopping ON -Hopping OFF	Band edge compliance: 2402MHz, 2480MHz
(Radiated)	Transmitting (DH5/3DH5), Payload: PRBS9	Spurious emission: 2402MHz, 2441MHz, 2480MHz
99% occupied bandwidth	Transmitting Hopping ON / Hopping OFF(DH5/3DH5) / Inquiry Payload: PRBS9	2402MHz, 2441MHz, 2480MHz

\*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload (except Dwell time test)

\*Remarks: Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.

As this device had AFH mode and frequency separation could not meet the requirement of over 20dB BW without 2/3 relaxation, 125mW power limit was applied to it.

\*EUT has the power settings by the software as follows;

Power settings: BDR: 46  
EDR: 83

Software: CSR BlueSuite BtCliCtrl Version 2.3.0.15

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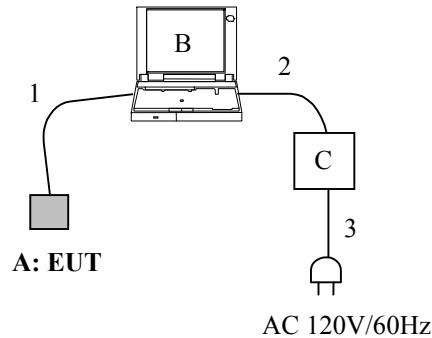
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#### 4.2 Configuration of tested system



\* Test data was taken under worse case conditions.

#### Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Option(s) for Radiocommunications	R-BT21A	65*1) 70*2)	FUJITSU COMPONENT LIMITED	EUT
B	Laptop computer	ThinkPad T43 (2668-D59)	L3YHTEL	IBM	-
C	AC adaptor	02K6750	11S02K6750Z1Z2UP2990S2	IBM	-

\*1)Used for Radiated Emission Test and Conducted Emission test.

\*2)Used for other tests.

#### List of cables used

No.	Cable	Length (m)	Shield-Cable	Shield-Connector	Remarks
1	USB	3.0	Shielded	Shielded	-
2	DC	1.75	Unshielded	Unshielded	-
3	AC	0.8	Unshielded	Unshielded	-

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



## **SECTION 5: Conducted emission**

### **5.1 Operating environment**

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

### **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's host device 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. I/O cables that were connected to the peripherals were bundled in center. 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. Each EUT current-carrying power lead was individually connected through a LISN to the input power source. Photographs of the set up are shown in Appendix 1.

### **5.3 Test conditions**

Frequency range : 0.15 - 30MHz  
EUT position : Table top  
EUT operation mode : Refer to SECTION 4.1

### **5.4 Test procedure**

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT within a Shielded 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 detection of the test receiver.

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

### **5.5 Results**

Summary of the test results : Pass  
Refer to APPENDIX 2

## **SECTION 6: Radiated emission**

### **6.1 Operating environment**

The test was carried out in No.3 Semi-Anechoic Chamber.

Temperature : See test data (APPENDIX 2)  
Humidity : See test data (APPENDIX 2)

### **6.2 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. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. Photographs of the set up are shown in Appendix 1.

### **6.3 Test conditions**

Frequency range : 30MHz to 25GHz  
Test distance : 3m(below 13GHz) / 1m(above 13GHz)  
EUT position : Table top  
EUT operation mode : Refer to SECTION 4.1

### **6.4 Test procedure**

The Radiated Electric Field Strength intensity has been measured on a semi-anechoic chamber with a ground plane and at a distance of 3m(below 13GHz) / 1m(above 13GHz) (Refer to Figure 1). Measurements were performed with quasi-peak, peak and average detector. 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. The radiated emission measurements were made with the following detection of the test receiver.

<u>Frequency</u>	:	<u>30-1000MHz</u>	<u>1000-25000MHz</u>	
Detection Type	:	Quasi-Peak	Peak	* Average
IF Bandwidth	:	120kHz	RBW:1MHz/VBW:1MHz	RBW:1MHz/VBW:10Hz RBW:1MHz/VBW:300Hz *1)

\*1) Used for the band edge of the carrier and the harmonics that can be measured. The VBW is based on the inverse of the duty cycle (Refer to the data).

\* 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(Refer to the data).

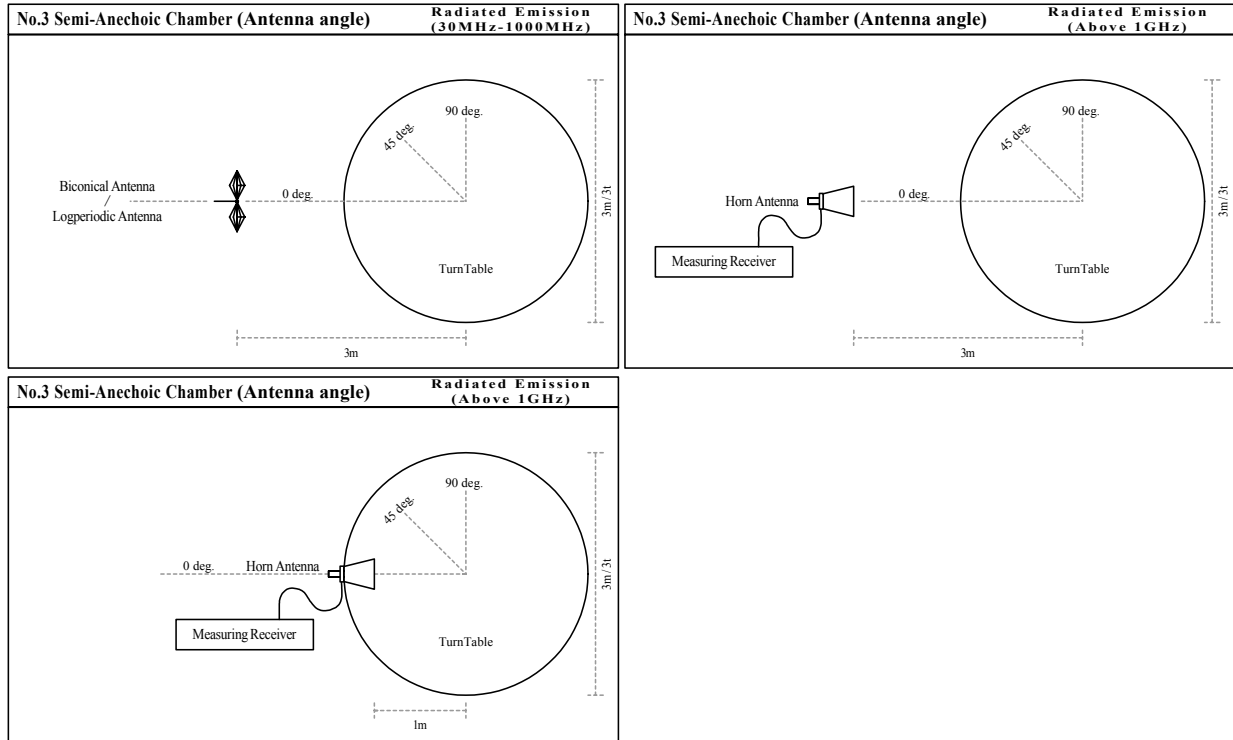
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Figure 1. Antenna angle



## 6.5 Band edge

Band edge level at 2399.517MHz(DH5) , and 2400MHz(3DH5) is less than 20dB of peak point of the carrier. Refer to the data of Out of Band Emissions . Band edge level at 2390MHz, 2483.5MHz, 2484.471MHz(DH5 Horizontal), 2484.475MHz(DH5 Vertical), and 2483.938MHz(3DH5), is below the limits of FCC 15.209. Refer to the data of Radiated emission.

## 6.6 Results

Summary of the test results : Pass \*No noise was detected above the 5<sup>th</sup> order harmonics.  
 Refer to APPENDIX 2

## **SECTION 7: 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 conducted measurement.

Summary of the test results: Pass  
Refer to APPENDIX 2

## **SECTION 8: Carrier frequency separation**

### **Test procedure**

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 2

## **SECTION 9: 20dB bandwidth & Occupied bandwidth (99%)**

### **Test procedure**

The bandwidth was measured with a spectrum analyzer connected to the antenna port. The channel separation in Hopping mode and Inquiry mode was separated by 25kHz and 2/3 of the 20dB bandwidth.

Summary of the test results: Pass  
Refer to APPENDIX 2

## **SECTION 10: Number of hopping frequency**

### **Test procedure**

The Number of Hopping Frequency was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 2

## **SECTION 11: Dwell time**

### **Test procedure**

The Dwell time was measured with a spectrum analyzer connected to the antenna port.

Summary of the test results: Pass  
Refer to APPENDIX 2

## **SECTION 12: 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  
Refer to APPENDIX 2

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