



Underwriters
Laboratories UL Japan, Inc.

Test report No. : 27GE0320-HO-A
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Issued date : October 15, 2007
FCC ID : S6MWT11

RADIO TEST REPORT

Test Report No. : 27GE0320-HO-A

Applicant : SOKKIA CO., LTD.
Type of Equipment : WT11 Bluetooth Module
Model No. : WT11
FCC ID : S6MWT11
Test standard : FCC Part 15 Subpart C 2007
Section 15.207, Section 15.247
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 the above regulation.
4. The test results in this report are traceable to the national or international standards.

Date of test:

September 3 to October 5, 2007

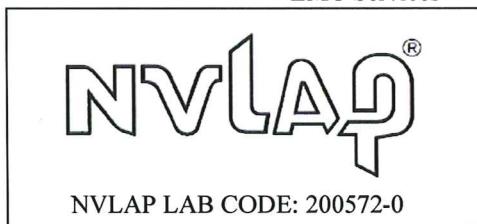
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SECTION 1: Client information

Company Name : SOKKIA CO., LTD.
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Contact Person : HITOSHI KOYAMA

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

2.1 Identification of E.U.T.

Type of Equipment : WT11 Bluetooth Module
Model No. : WT11
Serial No. : ES0001
Rating : DC3.3V
Country of Manufacture : JAPAN
Receipt Date of Sample : September 3, 2007
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No modification by the test lab.

2.2 Product Description

Model No: WT11 (referred to as the EUT in this report) is the WT11 Bluetooth Module.

Clock frequency(ies) in the system : 48MHz
Equipment Type : Transceiver
Frequency of Operation : 2402-2480MHz
Bandwidth & Channel Spacing : 1MHz &1MHz
Modulation : FHSS (GFSK, $\pi/4$ - DQPSK, 8DPSK)
Power Supply : DC 3.3V

	ANT.1	ANT.2
Antenna Type	lambda / 4 Dipole antenna	lambda / 2 Sleeve antenna
Model number	FLANT-004STD	1029-C17586
Connector Type	SMA MALE	U.FL
Antenna Gain	2.00dBi	2.14dBi

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C: 2007

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

FCC 15.31 (e)

The EUT has its own power supply regulation, which is integrated in chip Blue Core 4. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the host device in which the EUT is installed, and only professional can access it. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
1	Conducted emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC: Section 15.207		N/A	N/A*1)	N/A
		IC: RSS-Gen 7.2.2	IC: RSS-Gen 7.2.2				
2	Carrier Frequency Separation	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(a)(1)	Conducted	N/A		Complied
		IC: -	IC: RSS-210 A8.1 (b)				
3	20dB Bandwidth	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(a)(1)	Conducted	N/A		Complied
		IC: -	IC: RSS-210 A8.1 (a)				
4	Number of Hopping Frequency	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(a)(1)(iii)	Conducted	N/A		Complied
		IC: -	IC: RSS-210 A8.1 (d)				
5	Dwell time	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(a)(1)(iii)	Conducted	N/A	See data.	Complied
		IC: -	IC: RSS-210 A8.1 (d)				
6	Maximum Peak Output Power	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(b)(1)	Conducted	N/A		Complied
		IC: RSS-Gen 4.8	IC: RSS-210 A8.4 (2)				
7	Band Edge Compliance	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(d)	Conducted/ Radiated	N/A		Complied
		IC: -	IC: RSS-210 A8.5				
8	Spurious Emission	FCC: ANSI C63.4:2003 13. Measurement of intentional radiators	FCC: Section15.247(d)	Conducted/ Radiated	N/A	[Tx] 3.5dB 2537.0MHz Horizontal [Rx] 5.7dB 1626.355MHz Horizontal	Complied
		IC: RSS-Gen 4.9 RSS-Gen 4.10	IC: RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3				

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

*1) The test is not applicable since the EUT is a DC battery operated device.

*These tests were also referred to FCC Public Notice DA 00-705 "Guidance on Measurement for Frequency Hopping Spread Spectrum Systems".

*These tests were performed without any deviations from test procedure except for additions or exclusions.

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3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 4.6.1	-	Conducted	N/A	N/A	N/A

3.4 Uncertainty

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

Spurious Emission (Radiated)

The measurement uncertainty for this test using Biconical antenna is $\pm 4.59\text{dB}(3\text{m})$.

The measurement uncertainty for this test using Logperiodic antenna is $\pm 4.62\text{dB}(3\text{m})$.

The measurement uncertainty for this test using Horn antenna is $\pm 5.27\text{dB}$.

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

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

Other test except Conducted Emission and Spurious Emission (Radiated)

The measurement uncertainty for this test is $\pm 3.0\text{dB}$.

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3.5 Test Location

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	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	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	IC4247-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	IC4247-3	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	IC4247-4	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	4.75 x 5.4 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	-

* 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 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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

4.1 Operating Modes

The mode used for test :

Test	Operating mode	Tested frequency
Carrier Frequency Separation	Bluetooth Transmitting (Tx) (Hopping on) -BDR(DH5) -EDR(3DH5)	-
	- Inquiry	-
20dB Bandwidth Maximum Peak Output Power	Bluetooth Transmitting (Tx) (Hopping off) -BDR(DH5) -EDR(3DH5)	2402MHz 2441MHz 2480MHz
	- Inquiry	-
Number of Hopping Frequency	Bluetooth Transmitting (Tx) (Hopping on) -BDR(DH5) -EDR(3DH5) -Inquiry	-
Dwell time	Bluetooth Transmitting (Tx) (Hopping on) -BDR(DH1) -BDR(DH3) -BDR(DH5) -Inquiry -EDR(3DH1) -EDR(3DH3) -EDR(3DH5)	-
Spurious emission* (Radiated/ Conducted)	Bluetooth Transmitting (Tx), (Hopping off) -BDR(DH5) -EDR(3DH5)	2402MHz 2441MHz 2480MHz
	Bluetooth Receiving (Rx)	2441MHz
Band Edge compliance (Conducted)	Bluetooth Transmitting (Tx) (Hopping off) -BDR(DH5) -EDR(3DH5)	2402MHz 2480MHz
	Bluetooth Transmitting (Tx) (Hopping on) -BDR(DH5) -EDR(3DH5)	
(Radiated)	Bluetooth Transmitting (Tx) (Hopping off) -BDR(DH5) -EDR(3DH5)	2402MHz 2480MHz
99% Occupied Bandwidth	Bluetooth Transmitting (Tx) (Hopping on) -BDR(DH5) -EDR(3DH5)	-
	Bluetooth Transmitting (Tx) (Hopping off) -BDR(DH5) -EDR(3DH5)	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)

*Radiated Spurious emission test was performed with Ant 1 and Ant 2.

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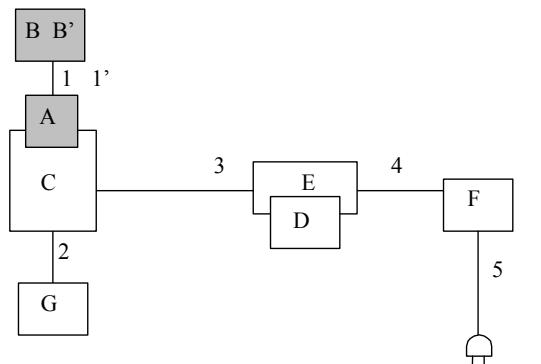
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Remarks: Test was not performed at AFH mode, because the decrease of number of channel (min: 20ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
However, the limit level 125mW of AFH mode was used due to the overlap of the bandwidth.

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4.2 Configuration and peripherals



AC120V/60Hz

* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	WT11 Bluetooth Module	WT11	ES0001	SOKKIA	EUT
B	lambda / 4 Dipole antenna	FLANT-004STD	1	SOKKIA	EUT (ANT.1)
B'	lambda / 2 Sleeve antenna	1029-C17586	1	SOKKIA	EUT (ANT.2)
C	Jig	-	-	SOKKIA	-
D	Note PC	FMV-S8230	R7200052	FUJITSU	-
E	Port replicator	CP281121	CP291121-01	FUJITSU	-
F	AC Adapter	FMV-AC322	06Y30528B	FUJITSU	-
G	DC Power Supply	PW18-1.3AT	08016530	KENWOOD TMI	-

*Radiated Spurious Emission test was performed with ANT.1 and ANT.2.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.08	Shielded	Shielded	ANT.1
1'	Antenna Cable	0.15	Shielded	Shielded	ANT.2
2	DC Cable	1.0	Unshielded	Unshielded	-
3	Serial Cable	1.8	Shielded	Shielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	1.0	Unshielded	Unshielded	-

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SECTION 5: Spurious Emission

[Conducted]

Test Procedure

The Out of Band Emission was measured with a spectrum analyzer connected to the antenna port.

Test data : APPENDIX 2

Test result : Pass

[Radiated]

Test Procedure

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane.

The Radiated Electric Field Strength intensity has been measured in a Semi Anechoic Chamber with a ground plane and at a distance of 3m(Below 10GHz) and 1m(Upper 10GHz).

The height of the measuring 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 with the Test Receiver, or the Spectrum Analyzer (in linear mode).

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.

*** Marker Delta Method (Measurement for Band-edge)**

STEP 1) Perform an in-band field strength measurement of the fundamental emission using the RBW table below.

STEP 2) Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span, and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission.

STEP 3) Subtract the delta measured in STEP 2) from the field strengths measured in STEP 1). The result is the field strength of band-edge.

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.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 2 of RSS-210 2.7 (IC) and outside the restricted band of FCC15.205 / Table 1 of RSS-210 2.7 (IC).

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver / Spectrum Analyzer	Spectrum Analyzer
Detector	QP: BW 120kHz(T/R)	PK: RBW:1MHz/VBW: 1MHz
IF Bandwidth	20dBc : RBW: 100kHz VBW: 300kHz (S/A)	AV: RBW:1MHz/VBW:10Hz 20dBc : RBW:100kHz/VBW:300kHz

- 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.

Test data : APPENDIX 2

Test result : Pass

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SECTION 6: Bandwidth

Test Procedure

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

Test data	: APPENDIX 2
Test result	: Pass

SECTION 7: Maximum Peak Output Power

Test Procedure

The Maximum Peak Output Power was measured with a power meter (tested bandwidth: 50MHz) connected to the antenna port.

Test data	: APPENDIX 2
Test result	: Pass

SECTION 8: Carrier Frequency Separation

Test Procedure

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

Test data	: APPENDIX 2
Test result	: Pass

SECTION 9: Number of Hopping Frequency

Test Procedure

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

Test data	: APPENDIX 2
Test result	: Pass

SECTION 10: Dwell time

Test Procedure

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

Test data	: APPENDIX 2
Test result	: Pass

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