

HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.



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CERTIFICATE OF COMPLIANCE

FCC Part 15C Certification

NURI Telecom Co., Ltd.

B-10F Woolim Lion's Valley 371-28 Gasan-dong
Geumcheon-gu, Seoul, Korea, 153-803

Date of Issue : July 16, 2005
Test Report No.: HCT-RF05-0701
Test Site: HYUNDAI CALIBRATION & CERTIFICATION
TECHNOLOGIES CO., LTD.
FRN: 0005-8642- 21

FCC ID	:	TGBSCU-Z101
APPLICANT	:	NURI Telecom Co., Ltd.

EUT Type:	ZigBee Module
Tx Frequency:	2405 MHz — 2475 MHz
Rx Frequency:	2405 MHz — 2475 MHz
RF Output Power:	50mW
Trade Name:	NURI Telecom Co., Ltd.
Model No.:	SCU-Z101
FCC Classification:	Part 15 Spread Spectrum Transmitter(DSSS)
Application Type:	Certification
FCC Rule Part(s):	FCC Part 15 Subpart C Subclause 15.247

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in § 2.947.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

The results in this report apply only to the sample tested.

Hyundai C-Tech Co., Ltd. Certifies that no party to this application has been denied FCC benefits pursuant to section 5301 of the Anti- Drug Abuse Act of 1998, 21 U.S. C. 853(a)

Report prepared by : Ki-Soo Kim

Manager of Product Compliance Team

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.

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SECTION 1: Client information

Company name : NURI Telecom Co., Ltd.
Address : B-10F Woolim Lion's Valley 371-28 Gasan-dong
Geumcheon-gu, Seoul, Korea, 153-803
Trade name : NURI Telecom Co., Ltd.
Address : B-10F Woolim Lion's Valley 371-28 Gasan-dong
Geumcheon-gu, Seoul, Korea, 153-803
Telephone Number : +82-2-781-0612
Facsimile Number : +82-2-781-0704
Contact Person : Mr. Soonsik Kwon, Assistant Manager
(inch12@nuritelecom.com)

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

Type of Equipment : ZigBee Module
Model No. : SCU-Z101
Serial No. : Z101200507001
Rating : DC 5V
Other Clock Frequency : 16 MHz
Manufacture : NURI Telecom Co., Ltd.
Address : B-10F Woolim Lion's Valley 371-28 Gasan-dong
Geumcheon-gu, Seoul, Korea, 153-803
Receipt Date of Sample : June 30, 2005

2.2 Product Description

Model: SCU-Z101 ZigBee Module

They are referred to as the EUT in this report.

Frequency Characteristics : 2405MHz-2475MHz
Conducted RF output Power 50mW
Channel Characteristics : 15channels selectable by 5MHz spacing.
Modulation : OQPSK(Offset QPSK)
Spread Method : DSSS (Direct Sequence Spread Spectrum)

SECTION 3: Test specification, methods & procedures

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
Title : FCC 47CFR Part15 Radio Frequency Device
Subpart C Intentional Radiators
Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz
and 5725-5850MHz

3.2 Methods & Procedures

No.	Item	Test Procedure	Specification	Remarks
1	Antenna and ground system	ANSI C63.4:1992	Subclause 2.1033(b)	-
2	Conducted Emission	ANSI C63.4:1992	Subclause 15.207	-
3	6dB Bandwidth	ANSI C63.4:1992	Subclause 15.247(a)(2)	Conducted
4	Maximum Peak Output Power	ANSI C63.4:1992	Subclause 15.247(b)	Conducted / Radiated
5	Out of Band Emissions & Band Edge	ANSI C63.4:1992	Subclause 15.205 Subclause 15.209 Subclause 15.247(c)	Conducted / Radiated
6	Power Spectral Density	ANSI C63.4:1992	Subclause 15.247(d)	Conducted

*These tests were also referred to FCC 97-114 "Guidance on Measurement for Direct Sequence Spread Spectrum Systems."

*These tests were performed without any deviations from test procedure except for the following exclusions.

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

4.1 Operating Modes

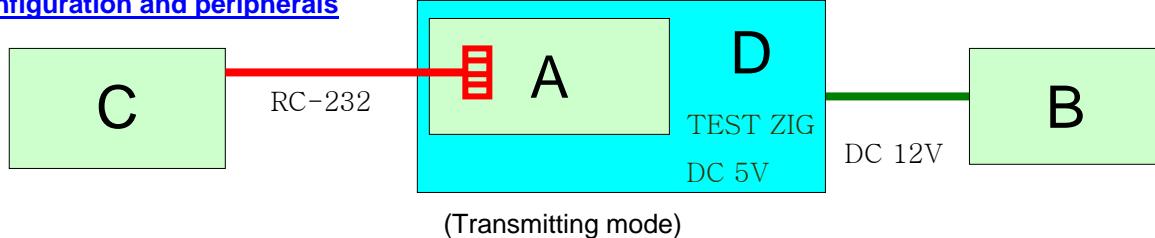
The EUT exercise hyper-terminal program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to typical use.

The operating mode/system were as follows:

Operation mode is as follows;

- Transmitting mode (ch1: 2405MHz, ch6: 2440MHz, ch11: 2475MHz)

4.2 Configuration and peripherals



Description of EUT

No.	Item	Model number	Serial number	Manufacturer	FCC ID
A	ZigBee Module	SCU-Z101	Z101200507001	NURI Telecom Co., Ltd.	TGBSCU-Z101
B	DC power supply (AC/DC 12V adapter)	FSP040-1ADF03A	-	HYUNDAI IMAGEQUEST	-
C	Controller (Note Book)	PSA50K-04W007	94045130P	TOSHIBA CORPORATION	-
D	Test ZIG (DC 5V supply)	-	-	NURI Telecom Co., Ltd.	-

*B is intended to EUT power supply (For Conducted emission and Radiated emission)

List of cables used

No.	Name	Length (m)	Shield	Remark
1	AC Power Cable	1.8	N	-
2	USB-to-Serial Cable	0.6	Y	Connect Controller to EUT

4.3 Verification of the frequency and channel

The following table verifies the frequency pairs.

CHANNEL	FREQUENCY(GHz)
*1	2.405
2	2.410
3	2.415
4	2.420
5	2.425
6	2.430
7	2.435
*8	2.440
9	2.445
10	2.450
11	2.455
12	2.460
13	2.465
14	2.470
*15	2.475

*Tested channel

1. This is for sure that all frequencies are in 2.405GHz to 2.475GHz for ZigBee Module
2. Section 15.31(m): Measurements on intentional radiators or receivers shall be performed at three frequencies for operating frequency range over 10 MHz. (The locations of these frequencies one near the top, one near the middle and one near the bottom.)
3. So all the items as followed in testing report are need to test these three frequencies:

For EUT communicating with Direct Spread Spectrum System

Top: Channel – 1; Middle: Channel – 8; Bottom: Channel – 15.

SECTION 5: Summary of test results

5.1 Test results

No.	Item	Test Procedure	Specification	Remarks	Result
1	Conducted Emission	ANSI C63.4:1992	Subclause 15.207	-	Complied
2	6dB Bandwidth	ANSI C63.4:1992	Subclause 15.247(a)(2)	Conducted	Complied
3	Maximum Peak Output	Power ANSI 63.4:1992	Subclause 15.247(b)	Conducted / Raidated	Complied
4	Out of Band Emissions & Band Edge	ANSI C63.4:1992	Subclause 15.205 Subclause 15.209 Subclause 15.247(c)	Conducted / Radiated	Complied
5	Power Spectral Density	ANSI C63.4:1992	Subclause 15.247(d)	Conducted	Complied

5.2 Uncertainty

Conducted Emission Test

The measurement uncertainty (with a 95% confidence level) for this test was ± 3.08 dB.

Radiated Emission Test

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is ± 4.66 dB.

The measurement uncertainty (with a 95% confidence level) for this test using Log periodic antenna is ± 4.30 dB.

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is ± 5.8 dB.

5.3 Test Location

Hyundai C-Tech. EMC Lab. / Icheon, Kyounki-Do, KOREA

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1, Maekok-Ri, Hobup-Myun, Ichon-Si, Kyoungki-Do, 467-701, KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated July 24,2000(Confirmation Number: EA90661)

5.4 Test instruments

Refer to Appendix 1.

5.5 TEST PLOTS

Refer to ATTCHMENT D

5.6 FCC Label & Location

Refer to ATTCHMENT E

5.7 Test Setup Photographs

Refer to ATTCHMENT F

5.8 External Photographs

Refer to ATTCHMENT G

5.9 Internal Photographs

Refer to ATTCHMENT H

5.10 Block Diagram

Refer to ATTCHMENT I

5.11 Circuit Diagram

Refer to ATTCHMENT J

5.12 Part list

Refer to ATTCHMENT K

5.13 Operational Description

Refer to ATTCHMENT L

5.14 User's Manual

Refer to ATTCHMENT M

5.15 MPE REPORT

Refer to ATTCHMENT N

SECTION 6: Conducted Emissions , Subclause 15.207

Test Procedure

EUT was placed on a platform of nominal size, 1.0m by 1.0m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT was aligned and flushed with rear of tabletop. All other surfaces of tabletop was at least 80cm from any other grounded conducting surface. AC cables and DC cables 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. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the input power source. All unused 50 ohm connectors of the LISN were resistively terminated in 50 ohm when not connected to the measuring equipment. The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT on a shielded room. The EUT was connected to a Line Impedance Stabilization Network (LISN). The Wireless Transmit Unit was tested under transmitting mode. An overview sweep with peak detection has been performed. The measurements have been performed with a CISPR quasi-peak detector(IF BW 9kHz) . The frequency range measured is 150kHz to 30MHz.

Test data :	Page A1 to A5 (APPENDIX D)
Photographs of test setup :	Page 2 (APPENDIX F)
Test result :	Pass
Test instruments :	SA-01, LS-02

SECTION 7: 6dB Bandwidth (Conducted), Subclause 15.247(a)(2)

Test Procedure

The minimum 6dB bandwidth was measured with a spectrum analyzer connected to the antenna port.

Test data :	Page A7 to A9 (APPENDIX D)
Test result :	Pass
Test instruments :	SA-02, AT-01

SECTION 8: Maximum Peak Output Power (Conducted), Subclause 15.247(b)

Test Procedure

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

The maximum peak output power shall not exceed 1 watt (30 dBm). If directional transmitting antennas with a gain of more than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. Both the base and handset have a maximum power output of less than +30 dBm. Power was measured by disconnecting the antennas and measuring across a 50 ohm load as recommended by the manufacturer using a Peak & Average Power Meter model E4416A(support by 5MHz Bandwidth power measurement) The power output was measured at three places in the band highest is reported below.

POWER OUTPUT LIMIT: +30 dBm or 1 Watt.

Test data :	Page A10 to A13 (APPENDIX D)
Test result :	Pass
Test instruments :	PM-1, AT-01

SECTION 9: Out of Band Emissions (Radiated), Subclause 15.247(c)

Test Procedure

EUT was placed on a platform of nominal size, 1m by 1m, raised 80cm above the conducting ground plane.

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization.

The Radiated Electric Field Strength intensity has been measured on an open test site with a ground plane and at a distance of 3m.

The measuring antenna height was varied between 1 to 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.

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage carried between 85% and 115% of the nominal rated supply voltage.

The Wireless Transmit Unit was also previously checked at each position of three axes X, Y and Z to find the worst position. The position in which the maximum noise occurred was chosen to put into measurement. Worst cases are referred to following page.

Below 1GHz, measured with radiated emission(30MHz ~4GHz) connect Band rejection filter(2400~2483.5MHz) and
Above 1GHz, measured with radiated emission(3.3GHz ~ 18GHz,18GHz~26GHz) connect High pass filter(3.3~18GHz)
for avoid receiver saturation

It was operated under transmitting mode.

The field strength is calculated by adding the Antenna Factor, Cable factor, Band rejection filter insert loss & preamplifier.

The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor + Filter insert loss – Preamplifier Factor

Radiated Spurious emissions

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. The result was also satisfied the general limits specified in Sec.15.209(a).

Measurement range : 30MHz to 1000MHz CISPR QP Detector and AV Detector, IF BW 120kHz

: 1GHz to 25GHz PK Detector(RBW=VBW=1MHz) and AV Detector (RBW=1MHz,VBW=10Hz)

Test data : **Page A6 , A14 to A22 (APPENDIX D)**

Photographs of test setup : **Page 3~6 (APPENDIX F)**

Test result : **Pass**

Test instruments : **SA-01, BL-01, BL-02, FL-01, FL-02, FL-03, LA-01, HA-01, HA-02, HCT-01, HCT-02**

SECTION 10: Out of Band Emissions (Conducted), Subclause 15.247(c)

Test Procedure

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

At RBW=100KHz, VBW=300KHz, spurious emission in the frequency range 30MHz-25GHz which was out of 2400-2483.5MHz was lower 20 dB than radio frequency power.

It was operated under transmitting mode.

Test data : **Page A23 to A26 (APPENDIX D)**

Test result : **Pass**

Test instruments : **SA-02, AT-01**

SECTION 11: Power Spectral Density (Conducted), Subclause 15.247(d)

Test Procedure

The Power Spectral Density was measured with a spectrum analyzer connected to the antenna port.

At RBW=3KHz, VBW=10KHz, SPAN=3MHz, Sweep time = (SPAN/3KHz) = 1000sec

It was operated under transmitting mode.

Test data : **Page A27 to A29 (APPENDIX D)**

Test result : **Pass**

Test instruments : **SA-02, AT-01**

APPENDIX 1: Test instruments

Control No.	Instrument	Model No.	Test	Due to Calibration
SA-01	Spectrum Analyzer(20Hz~40GHz)	ESI40	R/E, C/E	November 06
SA-02	Spectrum Analyzer(100Hz~26.5GHz)	R3273	C/E	April 06
SG-01	Signal Generator(10MHz~20GHz)	HP8373ED	R/E	July 06
SG-02	Signal Generator(250KHz~4GHz)	E4437B	R/E,C/E	March 06
PM-01	Power Meter(50MHz~18GHz)	E4416A	C/E	January 06
PA-01	Power Amp(0.8~2.5GHz)	A0825-4343-R	R/E	September 06
PA-02	Power Amp(0.1~18GHz)	AMF-6D-001180-35-20P	R/E	April 06
PA-03	Power Amp(18~26.5GHz)	AMF-4D-180265-26-10P	R/E	February 06
PA-04	Power Amp(26GHz~40GHz)	AMF-4D-260400-26-10P	R/E	February 06
FL-01	Band rejection filer (2400~2483.5MHz/DC~4GHz)	WRCJ2400/2483.5- 2370/2500-60/14SS	R/E	September 06
FL-02	High Pass Filter(3.3~18GHz)	WHF3.3/18G-10EF	R/E	April 06
FL-03	High Pass Filter(18~26GHz)	H18G26G1	R/E	November 06
AT-01	Fixed Attenuator(DC~26.5GHz)	74-30-12	C/E	January 06
BL-01	Bi-Log Antenna(30MHz~1GHz)	VULB9160	R/E	April 06
BL-02	Bi-Log Antenna(30MHz~1GHz)	VULB9160	R/E	May 06
HA-01	Horn Antenna(1GHz~18GHz)	BBHA 9120D	R/E	June 06
HA-02	Horn Antenna(1GHz~18GHz)	BBHA 9120D	R/E	March 06
HA-03	Horn Antenna(18GHz~40GHz)	BBHA 9170	R/E	February 06
LS-01	LISN	3825/2	C/E	July 06
LS-02	LISN	ESH2-Z5	C/E	July 06
HCT-01	Open Test Site	10m	R/E	-
HCT-02	Turn Table	1060-06	R/E	-

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

Test Item:

C/E: Conducted Emission

R/E: Radiated Emission

ATTACHEMENT D : TEST PLOTS

Page A1-A5: Conducted emission

Page A6: Radiated emission (30MHz~25GHz)

Page A7-A9: 6dB Bandwidth (Conducted)

Page A10-A13: Maximum peak output power (Conducted)

Page A14-A22: Out of band emissions & Band Edge (Radiated)

Page A23-A26: Out of band emissions & Band Edge (Conducted)

Page A27-A29: Power Spectral Density (Conducted)