

**SCU-Z101**

**Series registration application**



NuriTelcom Co.,Ltd.

## 1. Introduction of product

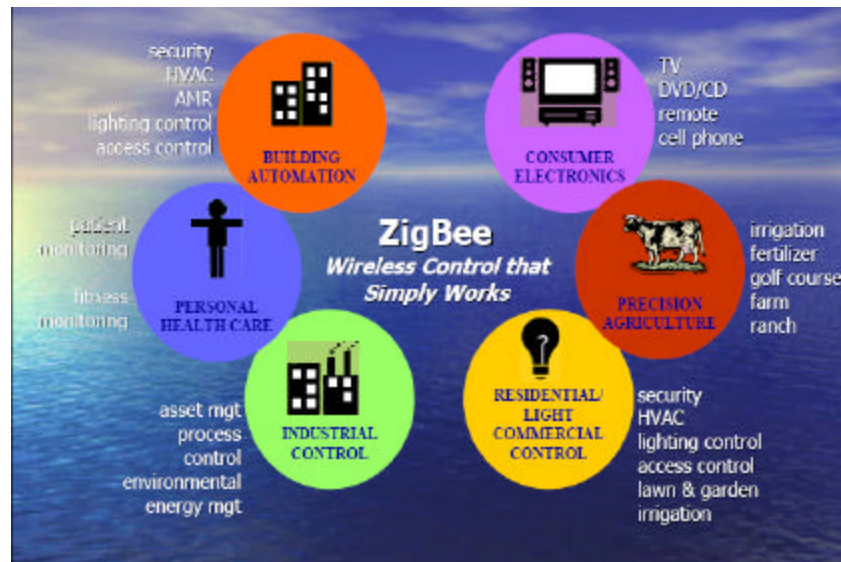
SCU-Z101 is a wireless device that uses 2405 ~ 2475MHz frequency waves of spread spectrum expansion method developed and designed with smallest and latest parts to attain small and light weighted final product. SCU-Z101 has developed for short-distance wireless communication module, occupied bandwidth of each channel of frequency wave is 2.5 MHz and provide up to 250 kbps speed. Also, each channel can configure 250 or less wireless networks for wide coverage and CSMA-CA wireless connection technology has adapted to minimize conflicts to increase efficiency of each channel.

ZigBee protocol has used to configure Ad-hoc network for star and mesh topology to guarantee fast and accurate data transmissions. Also, security feature has added to overcome vulnerability caused due to characteristic of wireless network by using AES-128 algorithm of ZigBee standard.

Low cost and low energy consumption of ZigBee application markets are expected to be massive and will establish a standard of short-distance wireless communication of next generation low cost and energy consumption.

SCU-Z101 has developed to be incorporated with all communication devices used in households and offices to configure wireless network (wireless piconet, ad hoc scatternet etc) to integrate with any wired/wireless networks. Therefore, when a wireless network is configured using this module, flexible data exchanges can be guaranteed among communication devices (especially, remote meter reading, home gateway, notebook, PDA, mobile terminal and electronic appliances with communication capabilities) and even Information of Internet of desktop computer can be delivered to hand of user by using current optical cables, ADSL and modem with Internet bridge. In other word, it can be regarded as completion of ultimate objective of wireless device- "Exchange of any

types of data regardless of time, place and people "



<Figure 1> Example of applied industries of SCU-Z101

SCU-Z10 can be applied for various monitoring and automation industries including disaster management by recognizing causes of disaster and locations, toys and game industries, remote control of electronic appliances, transportation industry for tire pressure sensor, miniature badges and entrance tags and agriculture industry for humidity sensor for soil and management of agricultural chemicals and weeding.

However, largest applied industries are expected to be home automations and home networking. SCU-Z101 can be utilized and widely used with wireless mouse, keyboard, joystick, PDA and games as peripheral devices of personal computer and with traditional electronic appliances such as radio, TV, VCR, CD, DVD and remote controller as well as remote meter reading, heating, ventilation, air-conditioning, security, lighting controls, locking system and toys and games.

## 2. Specification

### 2.1 Mechanical specification

- 1) Size: 30(Width) x 37.5(length) x 4.5(height) (Unit: mm)
- 2) Weight: ?
- 3) Connector: AXK6F60345J (Matsushita) 60PIN SMD Male Type
- 4) Power supply cable: MCB ST00 – SMA Female, length (80mm)
- 5) PCB thickness: 0.8mm (FR -4)

### 2.2 Electrical specification

This product has designed to provide DC and has embedded constant voltage circuit to provide electricity to critical operation parts.

#### 1) Input DC voltage

Minimum	Normal	Maximum
3.3V	5V	8V

#### 2) Voltage consumed

Operation Mode	Transmit(25mW below)	Receive
Voltage consumed	180mA (Below)	50mA (Below)

#### 3) Assigned frequency per channel

Channel	0	1	2	3	4	5	6
Frequency MHz	2,405	2,410	2,415	2,420	2,425	2,430	2,435

Channel	7	8	9	A	B	C	D	E
Frequency	2,440	2,445	2,450	2,455	2,460	2,465	2,470	2475

MHz							
-----	--	--	--	--	--	--	--

#### 4) Characteristics of transmission part

- ? Transmission frequency: 2405~2475MHz
- ? Output of power: 50mW (Approx. 17dBm) below
- ? SPURIOUS: -39dbc below
- ? Occupied Bandwidth: 2.5MHz below
- ? Communication protocol: DSSS
- ? Alternation method: OQPSK
- ? Number of channels: 15 channels
- ? Channel interval: 5MHz
- ? Frequency stability:  $\pm 5$  PPM below
- ? Impedance: 50ohm

#### 5) Characteristics of receiving part

- ? **Receive frequency:** 2405~2475MHz
- ? Receiving sensitivity: -104dBm below (Based on PER)
- ? Number of channels: 15 channels
- ? Channel interval: 5MHz
- ? Frequency stability:  $\pm 5$ PPM below
- ? Impedance: 50 ohm

#### 2.3 Working environment

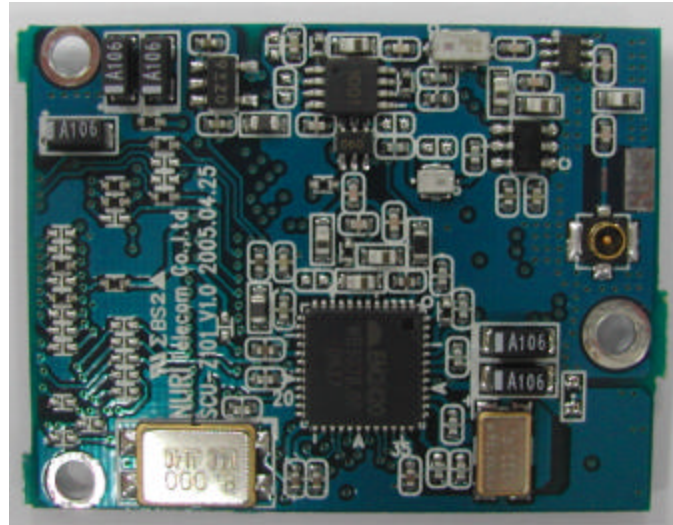
- 1) Keeping temperature: -35? ~ +70?
- 2) Operation temperature: -20? ~ +60?
- 3) Operation humidity: 10% ~ 90%
- 4) Operation vibration: 5Hz ~500Hz since wave 1.5G
- 5) Descent: No damage occurs if dropped from 1 meter height to concrete floor.

### 3. Configuration

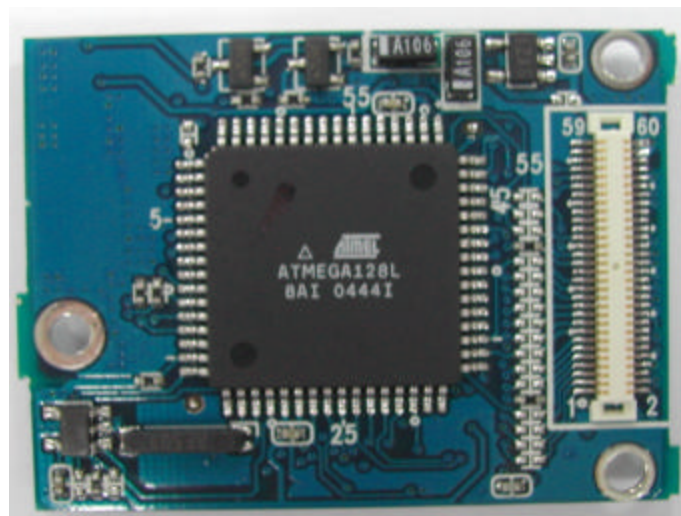
Main configuration parts of 2405 ~2475 MHz of wireless short-distance data communication module SCU-Z101 are follows:

### 3.1 Basic configuration part

#### A. RF PART (Top)

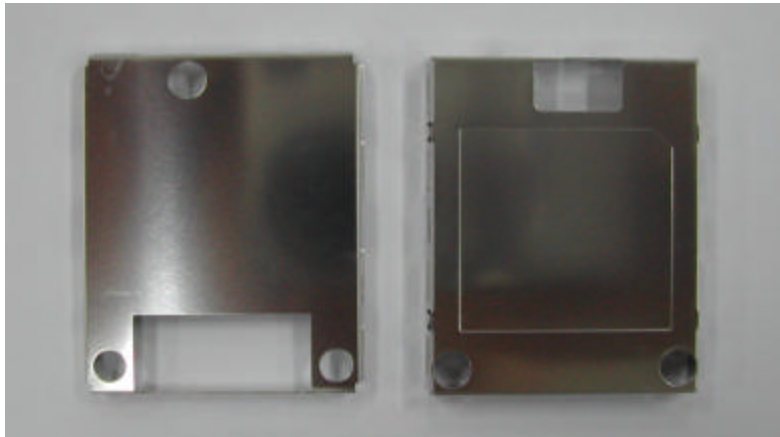


#### B. LOGIC PART (Bottom)



### 3.2 Other configuration parts

#### 1) Case



2) ANT Connector



# **Hardware Integration Guide**

**SCU- Z101**

**Integrated Zigbee Wireless Modem**

Version 0.1

Date: 2005-07-01



# Purpose

The information provided in this document is preliminary and provided for design reference only. All the information contained in this document is subject to change without prior notice.

NURI Telecom reserves the rights to make changes to any products herein to improve functioning or design

## 1. Overview

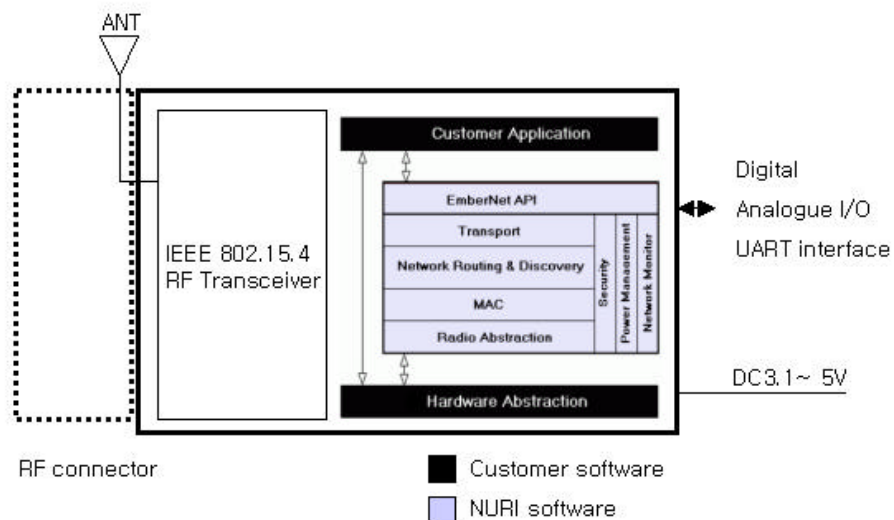
### I) Applications Descriptions

- ? Home Control and industrial automation
- ? OEM equipment

### II) Features

- ? Zigbee ready / IEEE 802.15.4 compliant PHY and MAC
- ? Atmega128L MCU Use
- ? On- board Real Time Clock(+/- 20ppm) → 32.768KHz
- ? MCU and on- board RTC support ultra low power modes.
- ? Conforms with MIC

### III) Block Diagram

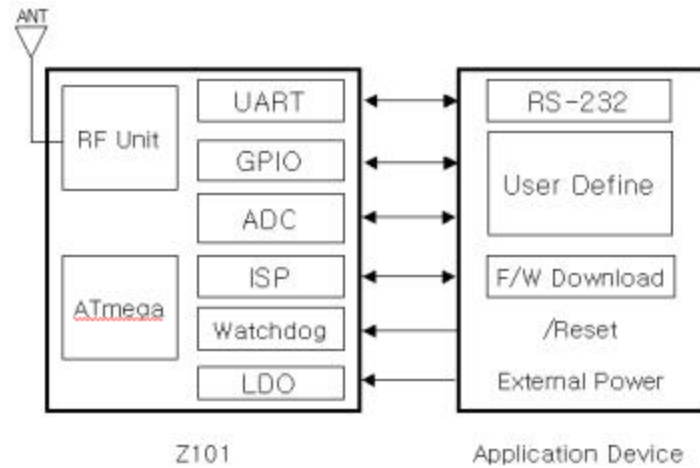


## 2 Technical Specifications

### I) Network Specifications

ITEM	SPECIFICATION
Network	Self-organizing and Self-healing Network
Topology	Mesh, Star & Superstar Topology
Security	AES-128 (Symmetric key)
MAC	IEEE 802.15.4
HOP	Max 6

## II) Interface Diagram



## III) I/O Description Parameters

SYMBOL	DESCRIPTIONS
<b>I</b>	<b>Input</b>
<b>OUT</b>	<b>Output</b>
<b>VCC</b>	<b>Power</b>
<b>GND</b>	<b>Ground</b>

## IV) PIN Names

PIN#	NAME / MPU NAME	TYPE	DESCRIPTION
1	GPIO 2 / PD0(INT0)	IN / OUT	
2	GPIO 3 / PD1(INT1)	IN / OUT	
3	GPIO 16 / PC7(A15)	IN / OUT	
4	GPIO 15 / PC6(A14)	IN / OUT	
5	GPIO 18 / PA7(AD7)	IN / OUT	
6	GPIO 17 / ALE	IN / OUT	
7	GPIO 1 / PB4	IN / OUT	
8	GPIO 14 / PC5(A13)	IN / OUT	
9	HEARTBEAT / PE2	OUT	MPU Status
10	GND	GND	Ground
11	GPIO 10 / PC1(A9)	IN / OUT	
12	GPIO 11 / PC2(A10)	IN / OUT	

13	GPIO 12 / PC3(A11)	IN / OUT	
14	GPIO 7 / /WR	IN / OUT	
15	GPIO 8 / /RD	IN / OUT	
16	AVCC / AVCC		Analog VCC
17	AGND / AGND		Analog GND
18	AREF / AREF		Analog Reference
19	GPIO 33/ADC0	IN / OUT	
20	GPIO 32/ADC1	IN / OUT	
21	GPIO 31/ADC2	IN / OUT	
22	GPIO 30/ADC3	IN / OUT	
23	GPIO 29/ADC4	IN / OUT	
24	GPIO 28/ADC5	IN / OUT	
25	GPIO 27/ADC6	IN / OUT	
26	GPIO 26/ADC7	IN / OUT	
27	GPIO 9 / PC0(A8)	IN / OUT	
28	+3V_DIG / PE6(INT6)		Special Use
29	GND		Ground
30	GPIO 19 / PA6(AD6)	IN / OUT	
31	GPIO 4/RXD1(INT2)	IN	Asyn Input
32	GPIO 5/TXD1(INT3)	OUT	Asyn Output
33	GPIO 20/PA5(AD5)	IN / OUT	
34	GPIO 21/PA4(AD4)	IN / OUT	
35	GPIO 23/PA2(AD2)	IN / OUT	
36	GPIO 24/PA1(AD1)	IN / OUT	
37	GPIO 25/PA0(AD0)	IN / OUT	
38	GND		Ground
39	NC		
40	NC		
41	GND	GND	Ground
42	NC		
43	GPIO 13/PC4(A12)	IN / OUT	
44	GND	GND	Ground
45	NC		

46	DEBUG_SCK / PB1(SCK)		ISP
47	NC		
48	GPIO 22 / PA3(AD3)	IN / OUT	
49	AVR_PDI / RXD0(PE0)	IN	ISP
50	NC		
51	AVR_PDO / TXD0(PE1)	OUT	ISP
52	ACTIVITY / PE3	OUT	Wireless Tx/Rx Status
53	/RESET	INPUT	External Reset
54	GPIO 6(T1)	IN / OUT	
55	GND	GND	Ground
56	VCC	VCC	VCC
57	GND	GND	Ground
58	VCC	VCC	VCC
59	GND	GND	Ground
60	VCC	VCC	VCC

Note 1: UART Interface: Pin 31(RXD1), Pin 32(TXD1)

Note 2: ISP Interface: Pin 46(SCK), Pin 49(PDI), Pin 51(PDO), Pin 53(/RESET)

## V) Pinouts

GPIO 2	1	2	GPIO 3
GPIO 16	3	4	GPIO 15
GPIO 18	5	6	GPIO 17
GPIO 1	7	8	GPIO 14
HEARTBEAT	9	10	GND
GPIO 10	11	12	GPIO 11
GPIO 12	13	14	GPIO 7
GPIO 8	15	16	AVCC
AGND	17	18	AREF
GPIO 33	19	20	GPIO 32
GPIO 31	21	22	GPIO 30
GPIO 29	23	24	GPIO 28
GPIO 27	25	26	GPIO 26
GPIO 9	27	28	+3V_DIG
GND	29	30	GPIO 19
RXD1	31	32	TXD1
GPIO 20	33	34	GPIO 21
GPIO 23	35	36	GPIO 24
GPIO 25	37	38	GND
NC	39	40	NC
GND	41	42	NC
GPIO 13	43	44	GND
NC	45	46	DEBUG_SCK
NC	47	48	GPIO 22
AVR_PDI	49	50	NC
AVR_PDO	51	52	ACTIVITY
/RESET	53	54	GPIO 6
GND	55	56	VCC
GND	57	58	VCC
GND	59	60	VCC

## VI) Interface Description

### ? UART

- Support TXD1, RXD1 Signal Pin

### ? GPIO (General Purpose Input Output) Interface

- User Programmable Input/Output

### ? ADC Interface

- AGND
- AVCC
- AREF
- ADC

### ? ISP(In System Programming) Interface

- /RESET, DEBUG\_SCK, AVR\_PDI, AVR\_PDO

### ? Status Indication LED

- Activity
- Heartbeat

### ? External Reset Input

- Active Low

### ? GND, VCC

- Must use Output On/Off Control LDO Regulators.

### 3 Electrical Specifications



Caution ! ESD sensitive device.  
Precaution should be used when handling  
the device in order to prevent permanent  
damage.

#### I) Absolute Maximum Ratings

PARAMETER	MIN	MAX	UNITS
Storage Temperature	- 30	+ 70	°C
Voltage on Any Input or Output Pin	- 0.3	+ 3.5	V
Supply Voltage		+ 7.0	V
Input RF level		10	dBm

Note 1: Under no circumstances the absolute maximum rating given above should be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.

#### II) RF Electrical Specifications

PARAMETER	MIN	TYP	MAX	UNITS
Operating frequency	2405		2475	Mhz
Number of channels		15		
Channel spacing		5		Mhz
Input/Output impedance		50		Ohm
Data rate		250		Kbit/s
DSSS chip rate		2		Mc/s
Frequency stability			+/- 5	ppm
Transmit Power			17	dBm
Sensitivity		- 103		dBm

Note 1: If decrease Transmit Power then satisfy Operating Frequency is 2405~2475Mhz and 15 Channel

Note 2: Sensitivity: 1% PER, 20-byte packet

#### III) MCU Specifications

PARAMETER	MIN	TYP	MAX	UNITS
MCU Flash Memory		128		Kbyte
MCU RAM		4		KB
MCU EEPROM		4		KB

MCU Clock Frequency	8		Mhz
MCU low Frequency	32.768		Khz
ADC Resolution	10		bit

Note 1: MPU: Atmega128L-8AI

#### IV) Recommended Operating Conditions

PARAMETER	MIN	MAX	UNITS
Supply Voltage	3.1	5	V
Operating Temperature	- 20	60	°C
Operating Humidity	95%(50°C) Relative Humidity		

#### V) Port Electrical Specifications

PARAMETER	MIN	MAX	UNITS
Input High Voltage	+2.0	+3.0	V
Input Low Voltage	- 0.5	+0.8	V
Output High Voltage	+3.0		V
Output Low Voltage		+0.4	V

Note 1: Digital All Pin, VCC=3.0V

#### VI) Power Consumption

	COMMUNICATION MODE	
Power Down	RX Mode	TX Mode
35uA	50mA	180mA ~ 190mA

Note 1: VCC= 3.0V

Note 2: Output power settings and typical current consumption

TX mode(+ 17dBm) Ch1 180mA to Ch 14 190mA

? When you install the ZigBee Module(SCU-Z101) in a device, you should keep 20cm interval from its body.

#### Ex)

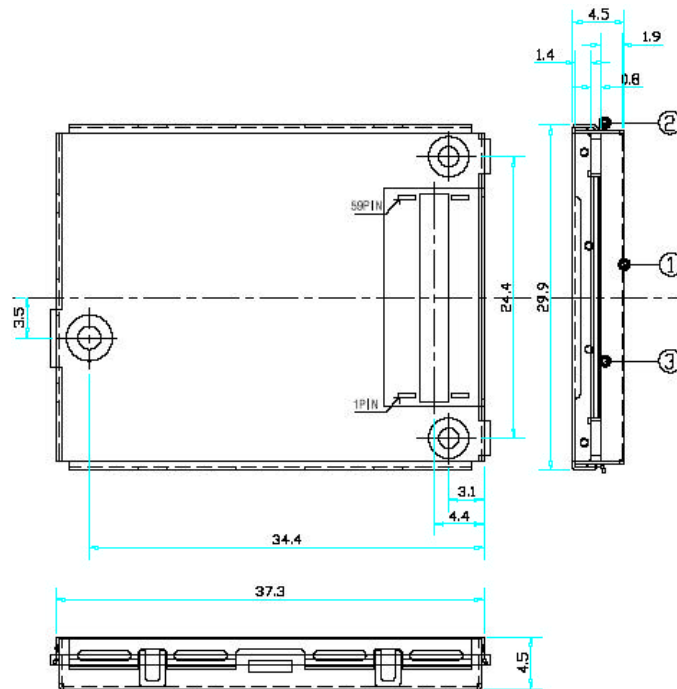
We have achieved the fully automated meter reading system without human intervention by embedding the ZigBee Module(SCU-Z101) in a meter.

Therefore, it can protect the problems arising from the manual meter reading method.

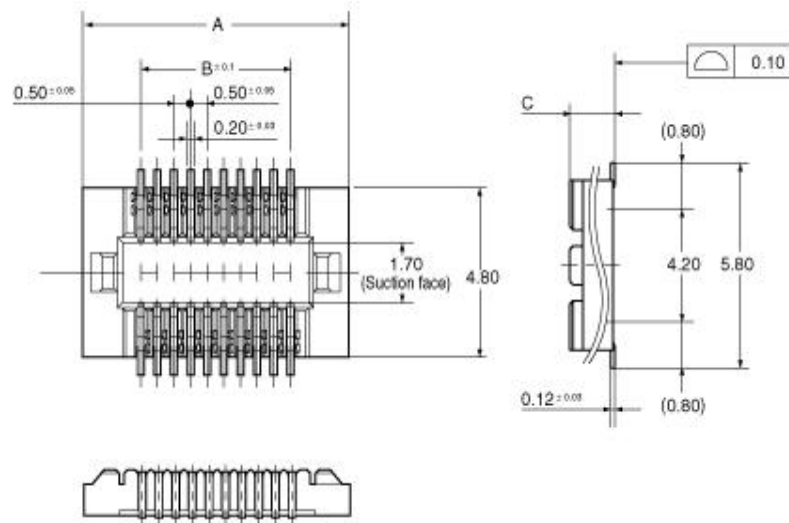


## 4 Mechanical Dimensions

### I) Mechanical Dimensions



- ? Dimension: 37.3(H) × 29.9(W) × 4.5(T) mm
- ? Weight: 10 Grams
- ? Mated connector Part number: AXK5F60545J



Note 1: A=18.00, B=14.50

# **Safety Information**

## **1 . SAFETY INFORMATION FOR FIXED WIRELESS TERMINALS**

### **POTE NTIALLY EXPLOSIVE ATMOSPHERES**

Turn your ZigBee Module OFF when in any area with a potentially explosive atmosphere and obey all signs and instructions. Sparks in such areas could cause an explosion or fire resulting in bodily injury or even death.

.

### **INTERFERENCE TO MEDICAL DIVICES**

Certain electronic equipment may be shielded against RF signal from your wireless phone. (pacemakers, Hearing Aids, and so on) Turn your ZigBee Module OFF in health care facilities when any regulations posted in these areas instruct you to do so.

RF signals may affect improperly installed or inadequately shielded electronic system in motor vehicles.

### **EXPOSURE TO RF ENERGY**

Use only the supplied or an approved replacement antenna.

Do not touch the antenna unnecessarily when the ZigBee Module is in use.

Do not move the antenna close to, or touching any exposed part of the body when making a call.

# **SAFETY INFORMATION FOR RF EXPOSURE**

## **IMPORTANT NOTE:**

### **FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20cm is maintained between the antenna and users;  
and
2. The transmitter module may not be co-located with any other transmitter or antenna.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

## **End Product Labeling**

This transmitter module is authorized only for use in devices where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in visible area with the following:

**“Contains TX FCC ID: TGBSCU-Z101”**

## **End Product Manual Information**

The user manual for end users must include the following information in a prominent location:

“IMPORTANT NOTE:

To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.”

**U.S.A.**

**U.S.FEDERAL COMMUNICATIONS COMMISSION**

**RADIO FREQUENCY INTERFERENCE STATEMENT**

**INFORMATION TO THE USER**

NOTE : This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful Interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if Not installed and used in accordance with the instructions, may cause harmful Interference to radio communications. However, there is no guarantee that interference will not occur in a particular Installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet of a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for assistance.

Changes or modification not expressly approved by the party responsible for Compliance could void the user's authority to operate the equipment. Connecting of peripherals requires the use of grounded shielded signal cables.

**FCC Compliance Information**

This device complies with Part 15 of FCC Rules.

Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received, including interference that may cause undesired operation.