

UZ2400

U-Force Module User Manual

Application Note

AN-2400-12

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1. General Information

The U-Force module is an IEEE 802.15.4 ZigBee™ compliant solution that satisfies the requirements of low-cost, low-power wireless sensor network (WSN) applications. It provides a flexible and reliable module for users to develop solutions for their applications. Its small form factor minimizes the amount of RF tuning required and saves the valuable board spaces. The modules are easy to use, consume a minimal power and provide a reliable delivery of critical data between the devices. The features of U-Force module are compatible to those of U-Stamp module except that it provides more flexibility in the interface definition.

The U-Force module operates within the ISM 2.4 – 2.5 GHz frequency band and contains UBEC's UZ2400 and other necessary components such as crystal oscillator, inductors and capacitors. The 802.15.4 compliant transceiver within the UZ2400 features a maximum of 5 MHz serial interface SPI bus for control and data transfer. It is a simple SPI interface slave device consisting of a 4-wire bus (SCLK, SI, SO, and SEN) that provide accesses to various subunits such as MAC/BB/RF control/status registers, TXFIFOs, RXFIFOs and security key table.

2. Features

- 2.4GHz IEEE 802.15.4 and ZigBee™ Compliant
- 2.4~3.6V operation
- Sleep current: 2μA
- Effective distance : more than 100 meters Range (Environment dependent)
- PCB Antenna
- Receiver Sensitivity: -95dBm
- Tx output Power : 0dBm
- Tx Current consumption: 25mA
- Rx Current consumption: 20mA
- Additional GSG (ground-signal-ground) interfaces provided
- Module (PCB) Size: 28.5mmx14mm

* ZigBee™ is a trade mark of ZigBee Alliance.

3. PCB of U-Force Module

Figure 1 shows the top view of a U-Force Printed Circuit Board (PCB) with a printed circuit antenna. The PCB size is 28.5mm x 14mm.

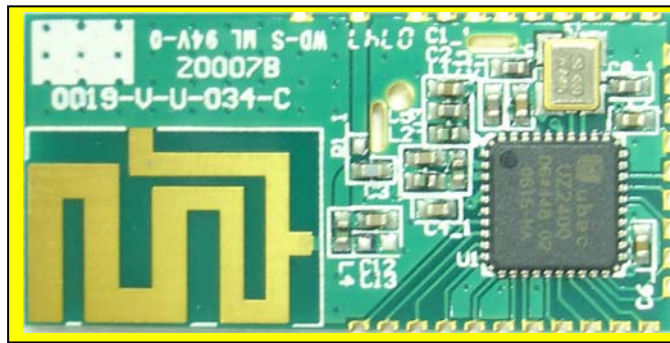


Figure 1. UZ2400 U-Force Printed Antenna Module

4. U-Force Pin Configuration

UZ2400 U-Force module pin assignments and their functions are described below.

Pin Number	Pin Name	Type	Description
1	GPIO0	DIO	General purpose digital I/O, also used as an external PA enable
2	GPIO1	DIO	General purpose digital I/O, also used as an external TX/RX switch control
3	GPIO5	DIO	General purpose digital I/O
4	GPIO4	DIO	General purpose digital I/O
5	GPIO2	DIO	General purpose digital I/O, also used as an external TX/RX switch control
6	GPIO3	DIO	General purpose digital I/O
7	RESETN	DI	Global hardware reset pin, active low
8	WAKE	DI	External wake up trigger, active high / low can be programmable.
9	INT	DO	Interrupt pin to micro-processor : Level trigger, Hi / Low programmable
10	SO	DIO	Serial interface data output from UZ2400 or I2C clock
11	SI	DIO	Serial interface data input to UZ2400 or I2C data in/out
12	SCLK	DI	Serial interface clock
13	SEN	DI	Serial interface enable
14	CLKOUT	DIO	20/10/5/2.5 MHz Clock output
15	XTAL32N	AI	32 kHz Crystal input (-) for internal RTC used
16	XTAL32P	AI	32 kHz Crystal input (+) for internal RTC used
17	GND	Ground	Ground

18	VCC	Power	3V
19	VCC	Power	3V
20	GND	Ground	Ground
21-31	NC		No connection

The connecting pin names of U-Force module and pin number allocation map are shown in Figure 2. The module's interface can connect with other devices, such as a sensor, an LED, a host controller, a push button, a joystick or power relays through the GPIO signals.

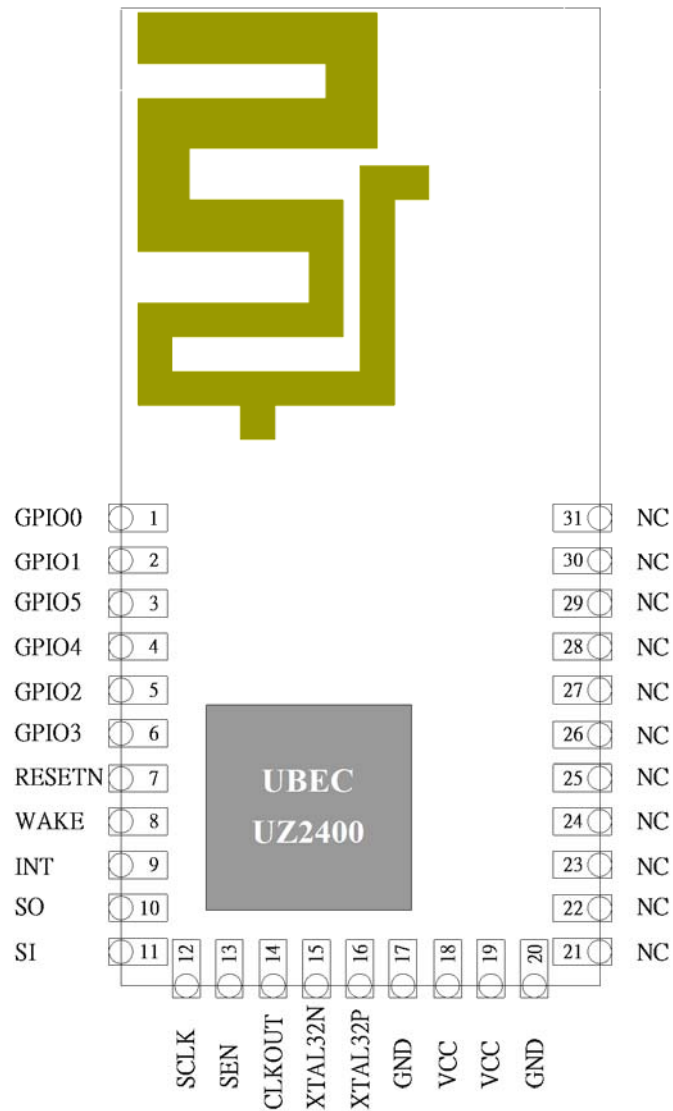


Figure 2. U-Force module pin names and location map

5. Electrical Specifications

Item	Specification	Unit
Frequency range	ISM band 2.4 – 2.5	GHz
Input voltage	3	V
Current consumption	TX 25 RX 20	mA
TX Output power	0 (Typ.)	dBm
TX EVM	13%	%
RX sensitivity	-95 (Typically)	dBm

For detailed functional descriptions and electrical characteristics of the UZ2400 chip, please refer to UZ2400 datasheet.

5.1. U-Force RF Module TX Output Power

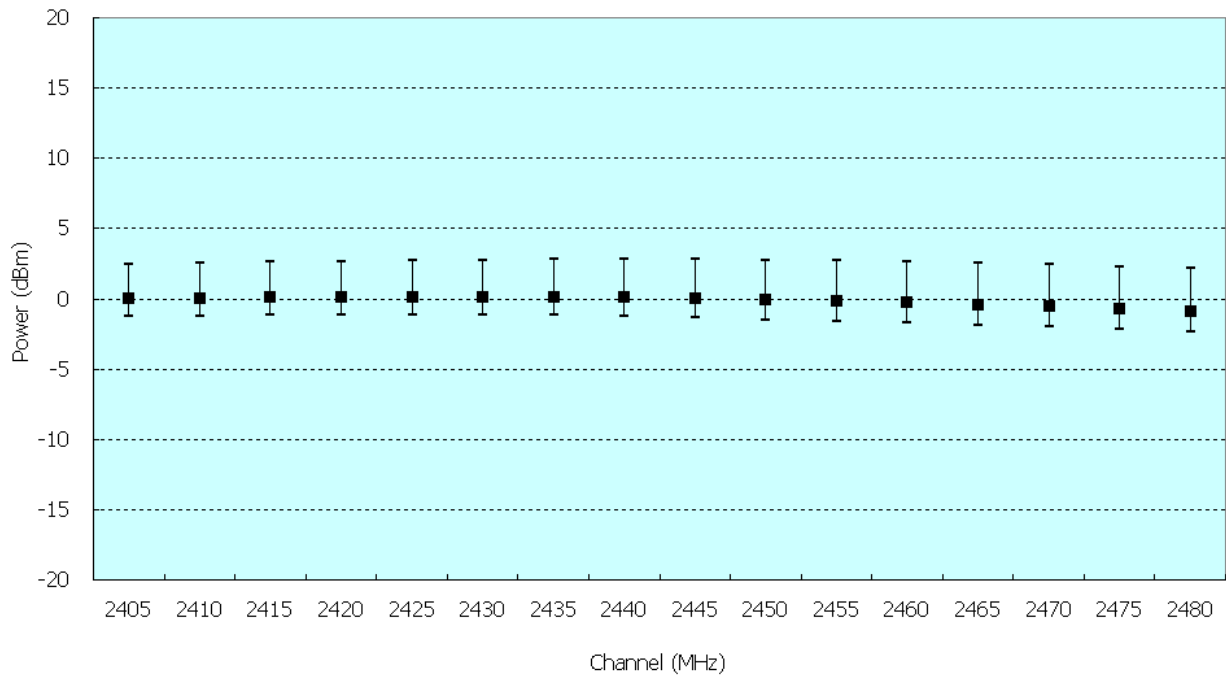


Figure 3. Typical U-Force RF module TX output power test results

5.2. TX EVM

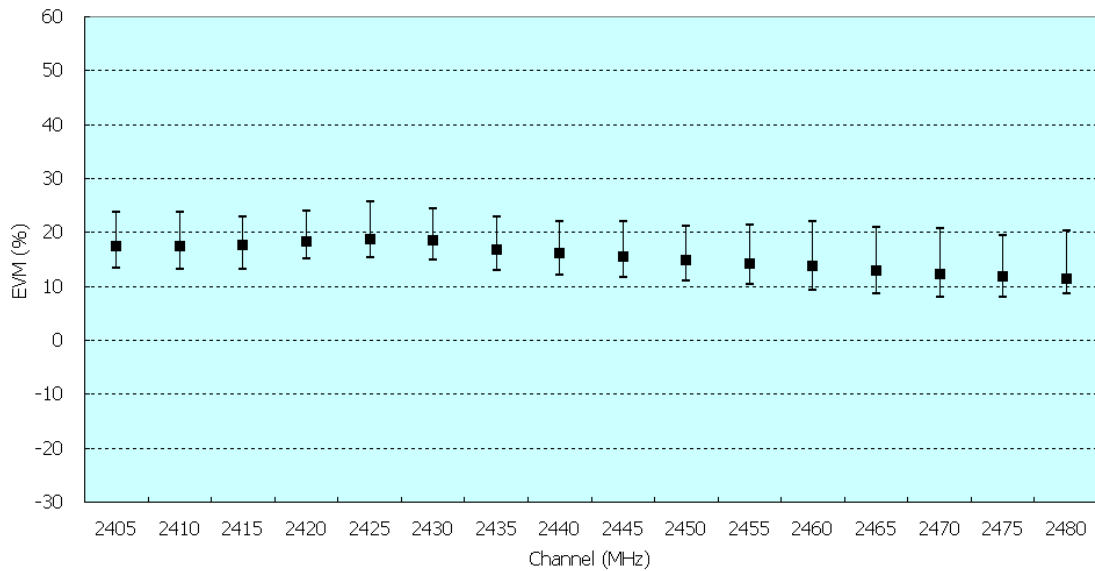


Figure 4. Typical U-Force RF module TX EVM test results

5.3. RX Sensitivity

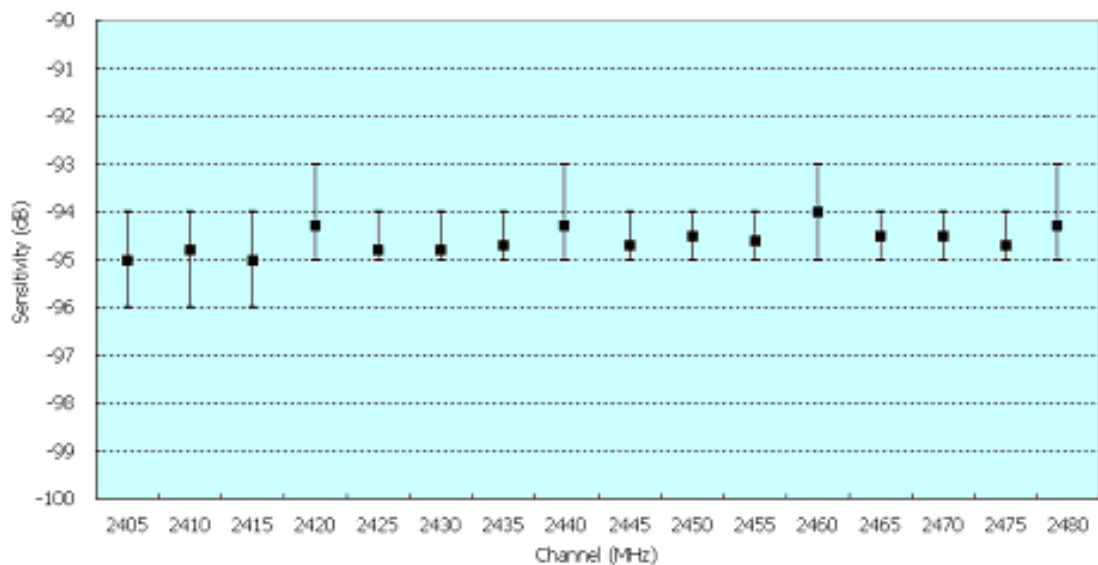


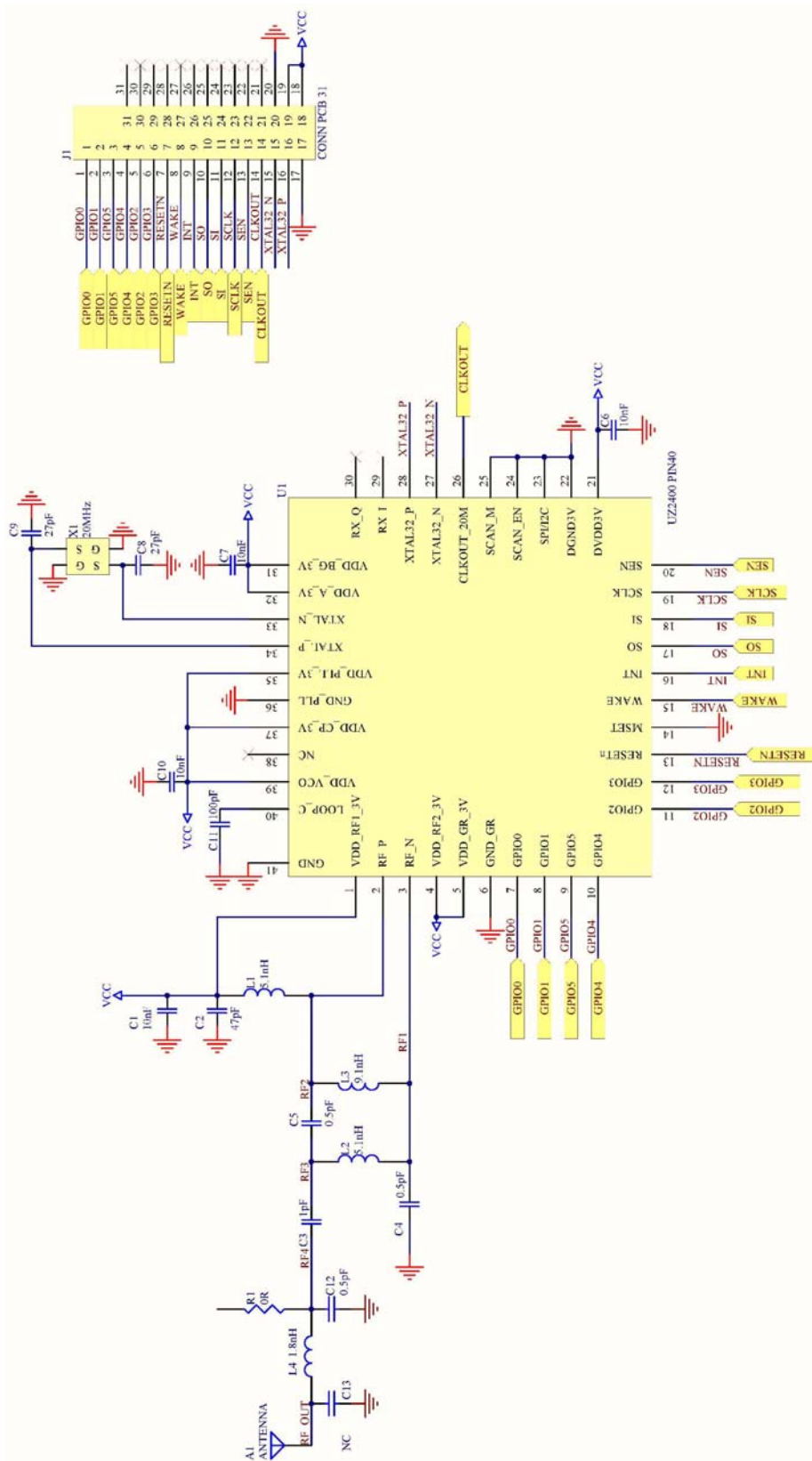
Figure 5. Typical U-Force RF module RX sensitivity test results

6. Bill Of Material

6.1. U-Force Printed Antenna Module

	Part Name	Footprint	Tolerance	Manufacturer	Vendor Part No.	Q'ty	
1	1nH	0402	±0.3nH	L chip Murata (台灣村田)	LQG15HN1N0S02	1	L4
2	5.1nH	0402	±0.3nH	L chip Murata (台灣村田)	LQG15HN5N1S02	2	L1 L2
3	9.1nH	0402	±5%	L chip Murata (台灣村田)	LQG15HN9N1J02	1	L3
4	0.5pF	0402	50V C0G ±0.25pF	C chip Murata (台灣村田)	GRM1555C1HR50CZ0 1	3	C4 C5 C12
5	1pF	0402	50V C0G ±0.25pF	C chip Murata (台灣村田)	GRM1555C1H1R0CZ0 1	1	C3
6	27pF	0402	50V C0G ±5%	C chip Murata (台灣村田)	GRM1555C1H270JZ01	2	C8 C9
7	47pF	0402	50V C0G ±5%	C chip Murata (台灣村田)	GRM1555C1H470JZ01	1	C2
8	100pF	0402	50V C0G ±5%	C chip Yageo (國巨)	GRM1555C1H101JZ01	1	C11
9	10nF	0402	50V Y5V -20~+80%	C chip Murata (台灣村田)	GRM155F51H103ZA01	4	C1 C6 C7 C10
10	X'tal 20MHz	5032	16pF/10ppm/80oh m/-10 ~+70C/3.2*2.5*0.7 5mm	eCERA (亞陶)	FL2000006	1	X1
11	UZ2400-40PIN	TQFP40		UBEC		1	U1

7. Schematic



8. Mechanical Dimension Drawing

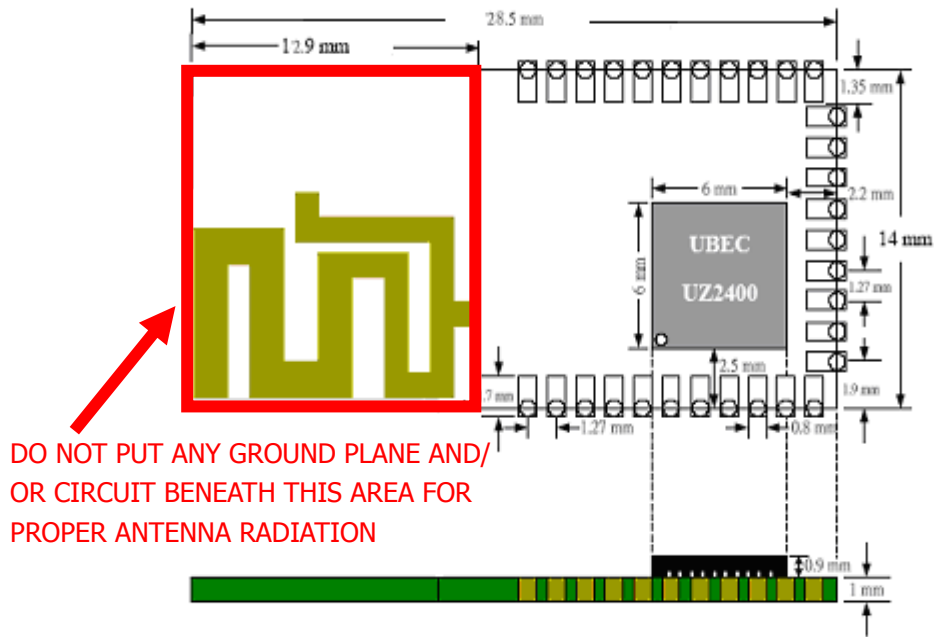


Figure 6. Printed Antenna Module Dimensions

9. U-Force Antenna Topology

Notice:

- (1) Antenna should be put on the edge of the system.
- (2) Be sure that there is no obstacles (components and ground) in the radiation direction
- (3) Do not put any ground plane and/or circuit beneath the antenna region for the system boards.

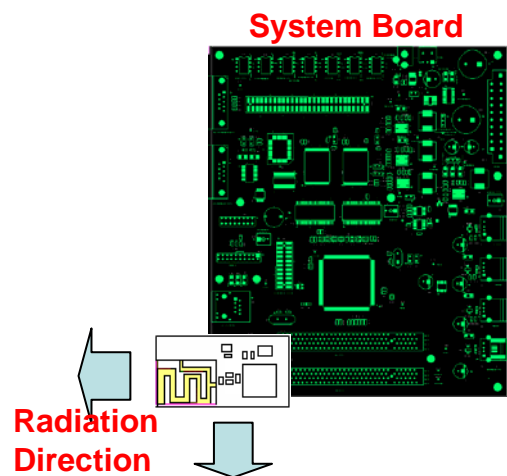


Figure 7. Recommended Antenna Location

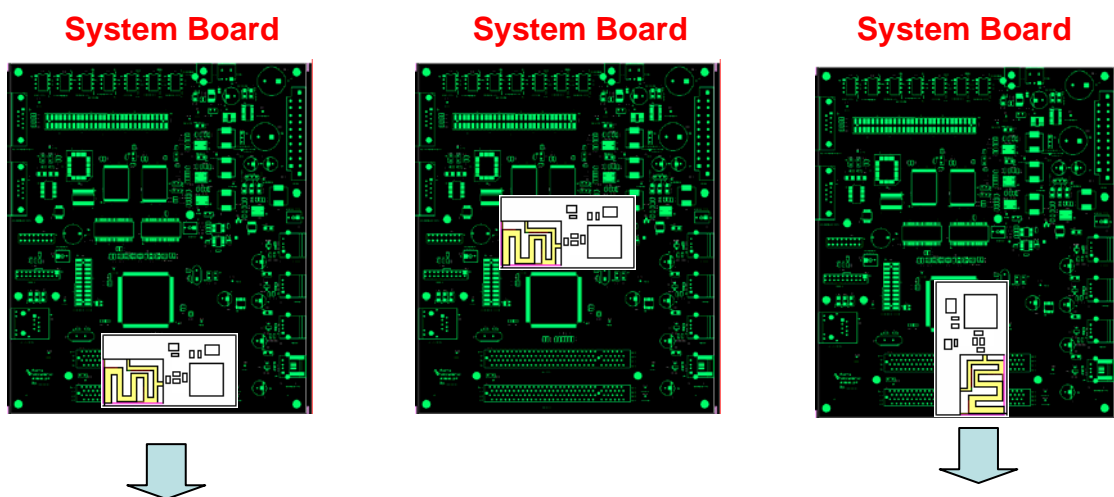
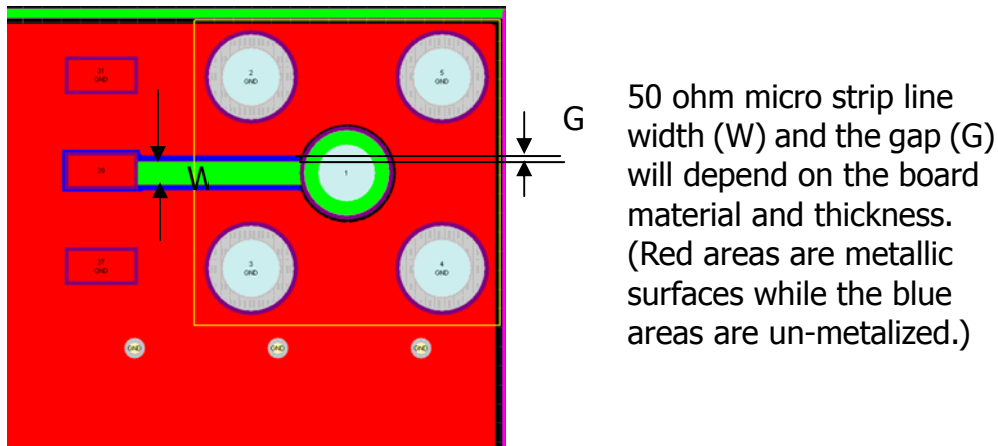


Figure 8. Examples of Poor Antenna Location

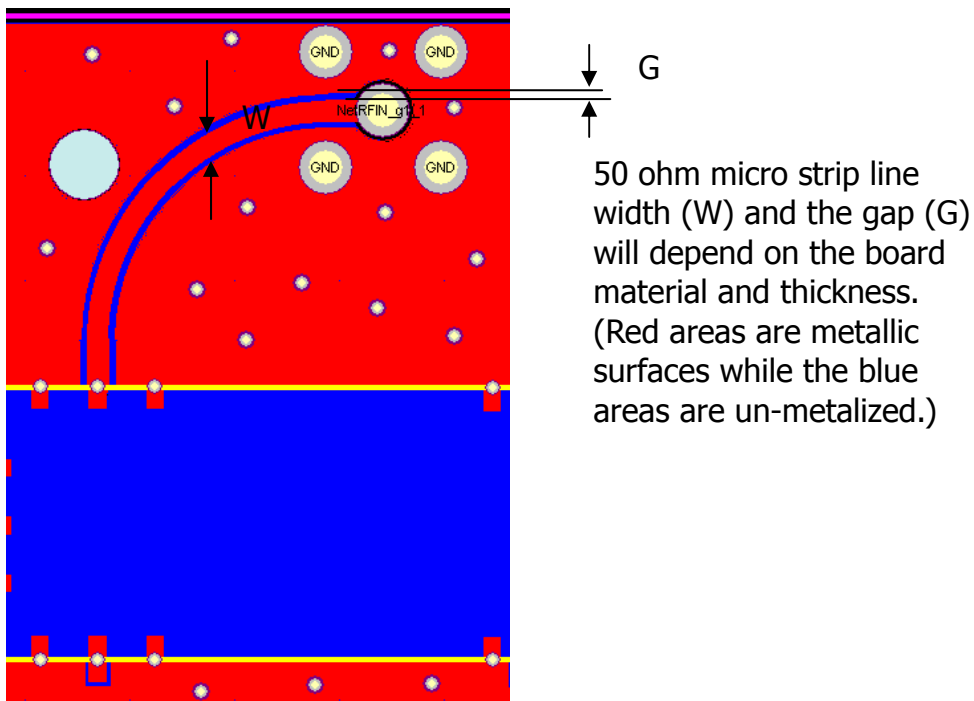
10. Ground-Signal-Ground (GSG) Interface Design

To prevent a huge RF power loss from the GSG to the system board, the recommended rules for laying the micro-strip lines should be obeyed. Please refer to UBEC's Application Note: AN-PCB1-01.

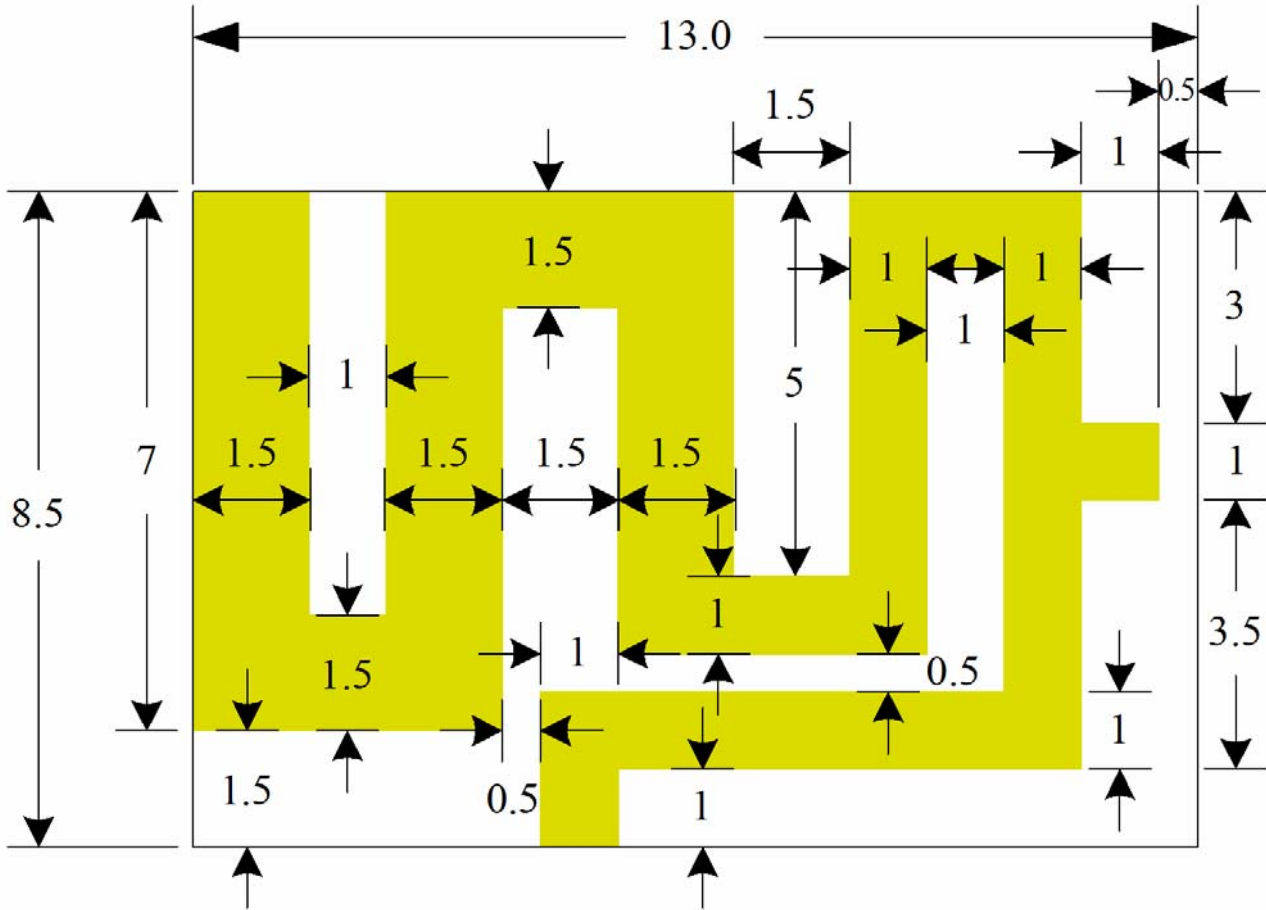
10.1. For 4-Layer PCB



10.2. For 2-Layer PCB



11. Meander Antenna



Unit : mm

Figure 9. Meander Antenna Pattern and Dimensions

Revision History

Revision	Date	Description of Change
0.0	2007/10/30	Initial release.
0.1	2008/7/28	Update schematic.

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