UM2455COB-0

Low Power 2.4GHz Transceiver Module

Application Note

AN-2455-03

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1. Introduction

The UM2455COB-0 is a low cost, highly integrated 2.4GHz transceiver module designed for low power wireless applications. This module is intended for short-range communications and control operating at the ISM band (2.405 – 2.483.5GHz).The module integrates UM2455 and necessary components and GSG (ground-signal-ground) port to transmit and receiver RF signals. The UM2455 features extensive hardware support of TX/RX FIFO, CSMA-CA, Security engine, MAC functions, clear channel assessment, link quality indication, and wake up trigger by an MCU or a register.

The main operating parameters and the 128 bytes transmit/receive FIFOs of the UM2455 can be controlled via the SPI/I^2C interface. In typical applications, the UM2455 will be used together with a microcontroller and few external passive components.

2. Applications

- ❑ Baby Finder and Tracker
- ❑ Home Automation Control
- ❑ Interactive Toy
- ❑ Wireless Sensor Network
- ❑ PC Peripherals
- ❑ Medical Equipment
- ❑ Remote Controller

3. Features

RF/Analog

- ❑ ISM band 2.405~2.480 GHz operation
- ❑ -92 dBm sensitivity and 3 dBm maximum input level
- ❑ 0 dBm typical output power and 36 dB TX power control range
- ❑ Integrated 100 kHz internal oscillator circuit

- ❑ High receiver and RSSI dynamic range
- ❑ Support power saving modes
- ❑ Low current consumption: 20 mA in RX and 23 mA in TX mode
- ❑ 2 uA deep sleep mode
- ❑ Data rates of 250 and 625kbps respectively

MAC/Baseband

- ❑ O–QPSK modulation (DSSS baseband)
- ❑ Hardware CSMA-CA, automatic ACK response and FCS check
- ❑ Up to 8 nodes supported

- ❑ Four low power operation modes
- ❑ Support all CCA modes and RSSI/LQI
Simple four-wire SPI interface

4. Pin Configuration
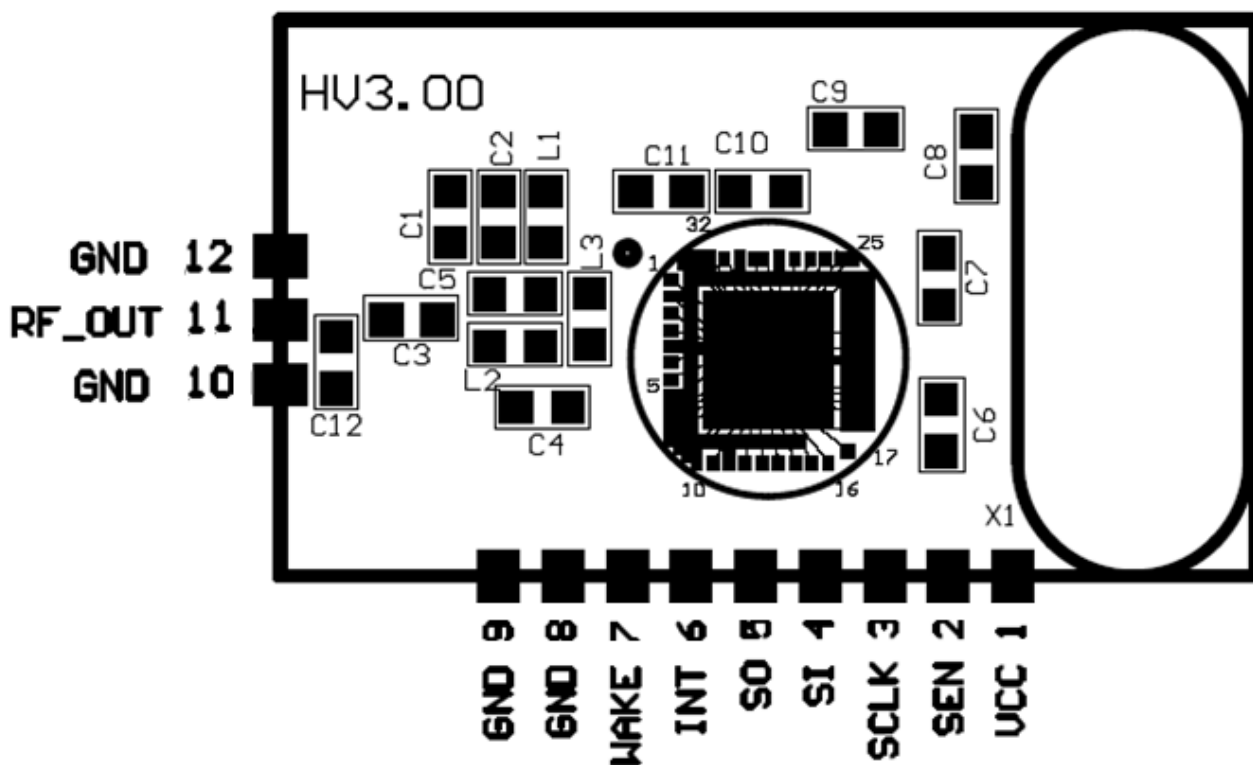
4.1. Device Pin Assignments

Figure 1. Pin Assignments (top view)

4.2. Device Pin Descriptions

Pin type abbreviation: A = Analog, D = Digital, I = Input, O = Output

Table 1. Pin Descriptions

Pin	Symbol	Type	Description
1	VCC	Power	The RF power supply. Bypass with a capacitor as close to the pin as possible.
2	SEN	DI	The enabled pin of a serial interface.
3	SCLK	DI	The clock of a serial interface.
4	SI	DIO	The serial interface data input to the module
5	SO	DIO	The serial interface data output from the module
6	INT	DO	The interrupt pin to the micro-processor.
7	WAKE	DI	The external wake up trigger.
8	GND	Ground	Ground.
9	GND	Ground	Ground.
10	GND	Ground	Ground.
11	RF_OUT	AIO	RF input/output
12	GND	Ground	Ground

* **Caution**: ESD sensitive. Please refer to Section 2.5 for more information.

4.3. PCB Dimension and Crystal Via Hole

UM2455COB-0 adopts the DIP type crystal and via holes for the underneath PCB are required.
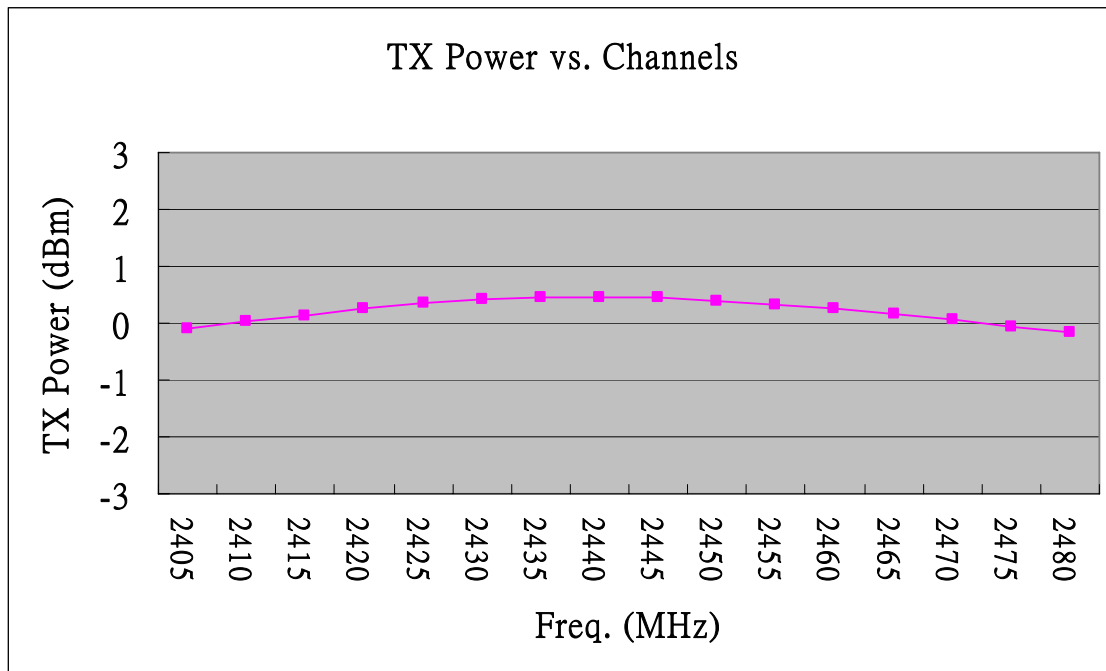

unit: mm

4.4. Meander Antenna Dimension
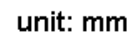
There is no antenna provided for M2455COB-0. However, UBEC provides a copy-righted PCB antenna for customer's use as shown below.

Unit : mm

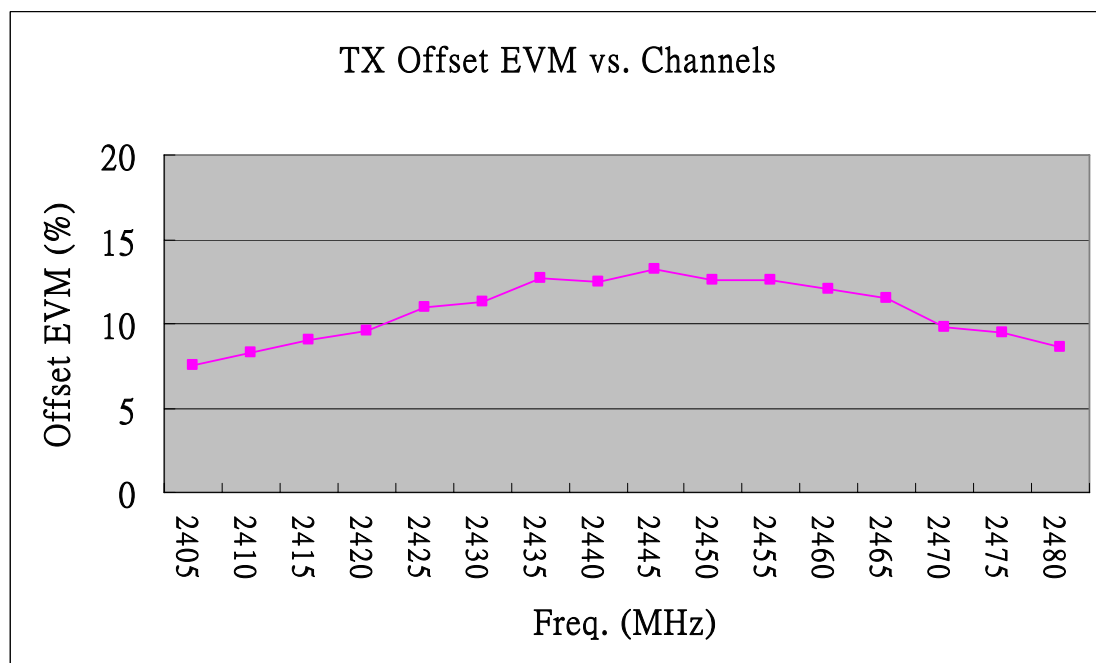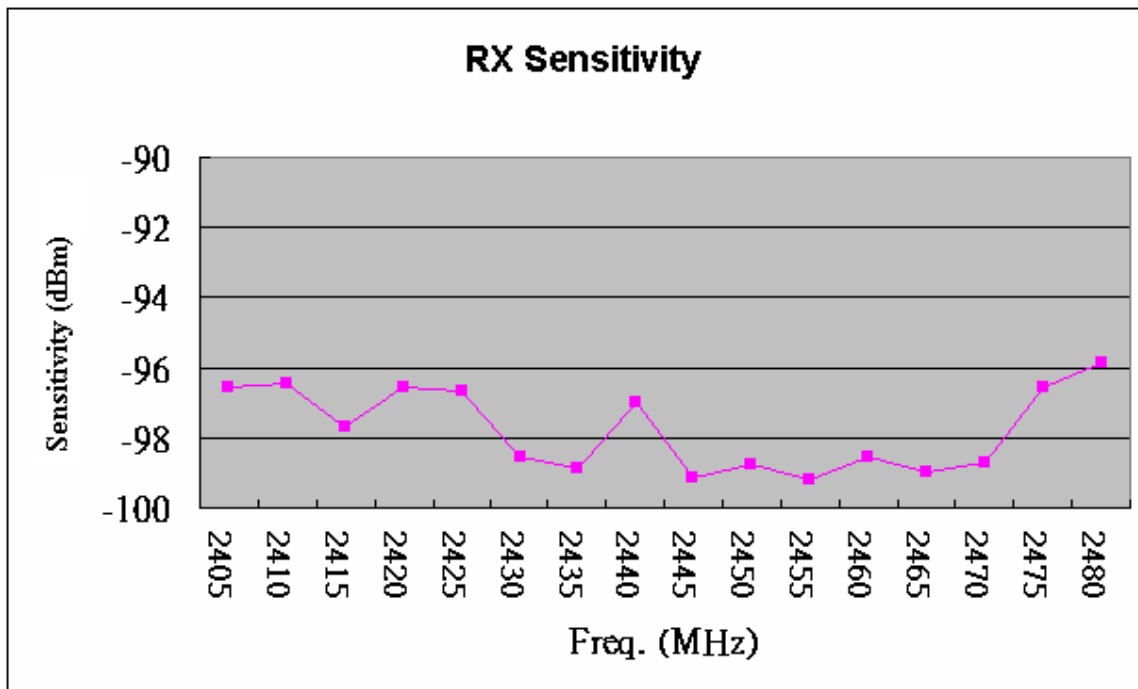# 5. Electrical Characteristics

5.1. TX Output Power

TX Power vs. Channels

A chart plotting TX Power (dBm) on the y-axis (range -3 to 3) versus Freq. (MHz) on the x-axis (range 2405 to 2480). The curve peaks around 0.5 dBm near 2440 MHz.

5.2. TX EVM

TX Offset EVM vs. Channels

A chart plotting Offset EVM (%) on the y-axis (range 0 to 20) versus Freq. (MHz) on the x-axis (range 2405 to 2480). The curve rises from about 7.5% at 2405 MHz to a peak around 13.5% near 2445 MHz, then decreases.

5.3. RX Sensitivity

5.4. Radio Frequency DC Characteristics

Test conditions: T_A = 25°C, VDD = 3 V

Table 2. DC Electrical Characteristics

| Chip Mode	Condition	Min	Typ	Max	Unit
IDLE	RF in reset mode. Regulator, Oscillator, and digital circuits are on.		7.6		mA
STANDBY	All circuits are powered off; only the 100 kHz oscillator is still on.		3.5		uA
DEEP SLEEP	All circuits are powered off.		2		uA
ACTIVE: TX	At 0 dBm, the output power		23		mA
ACTIVE: RX			20		mA

5.5. Peripheral Characteristics

The UM2455COB-0 has both the slave mode SPI and the I^{2}C interfaces. They can be used by MCU host to access the UM2455 registers and FIFOs. The 4-wire SPI (SEN, SCLK, SI, SO) provides a high speed interface up to 8 MHz on the SCLK pin.

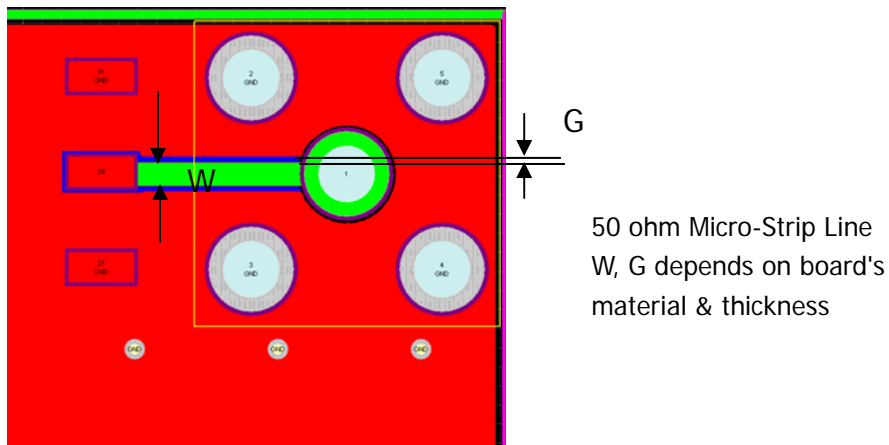**Caution! Hot air gun should not be used after finishing the COB.**

6. Antenna Topology

(1) Antenna should be placed on the edge of the system.

(2) Be sure that there is no obstacle (component or ground) present in the radiation direction.

(3) No ground plane or circuit should be put beneath the antenna region of the system boards.

System Board

Radiation Direction

Good Location

System Board

System Board

System Board
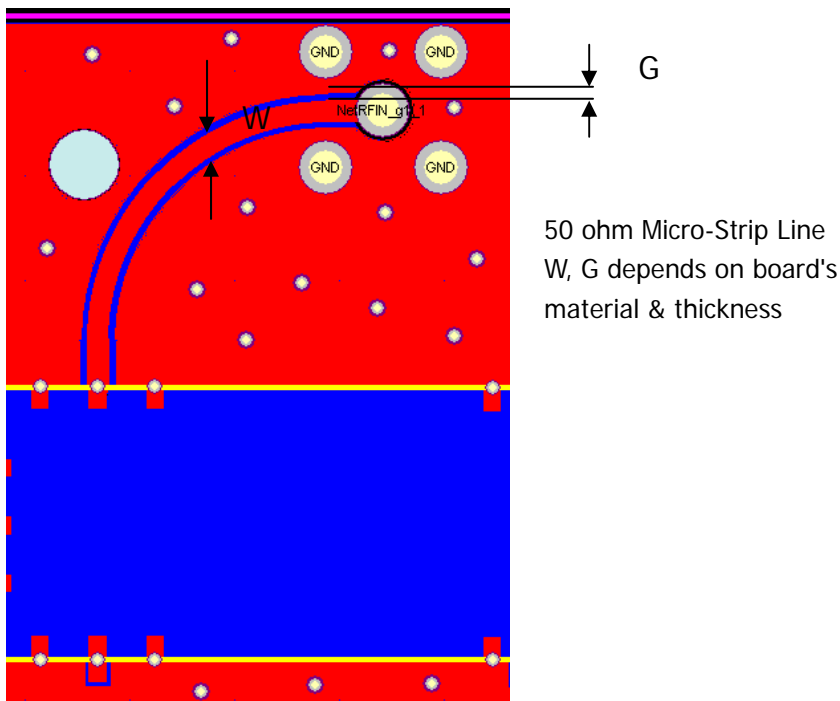

Poor Location
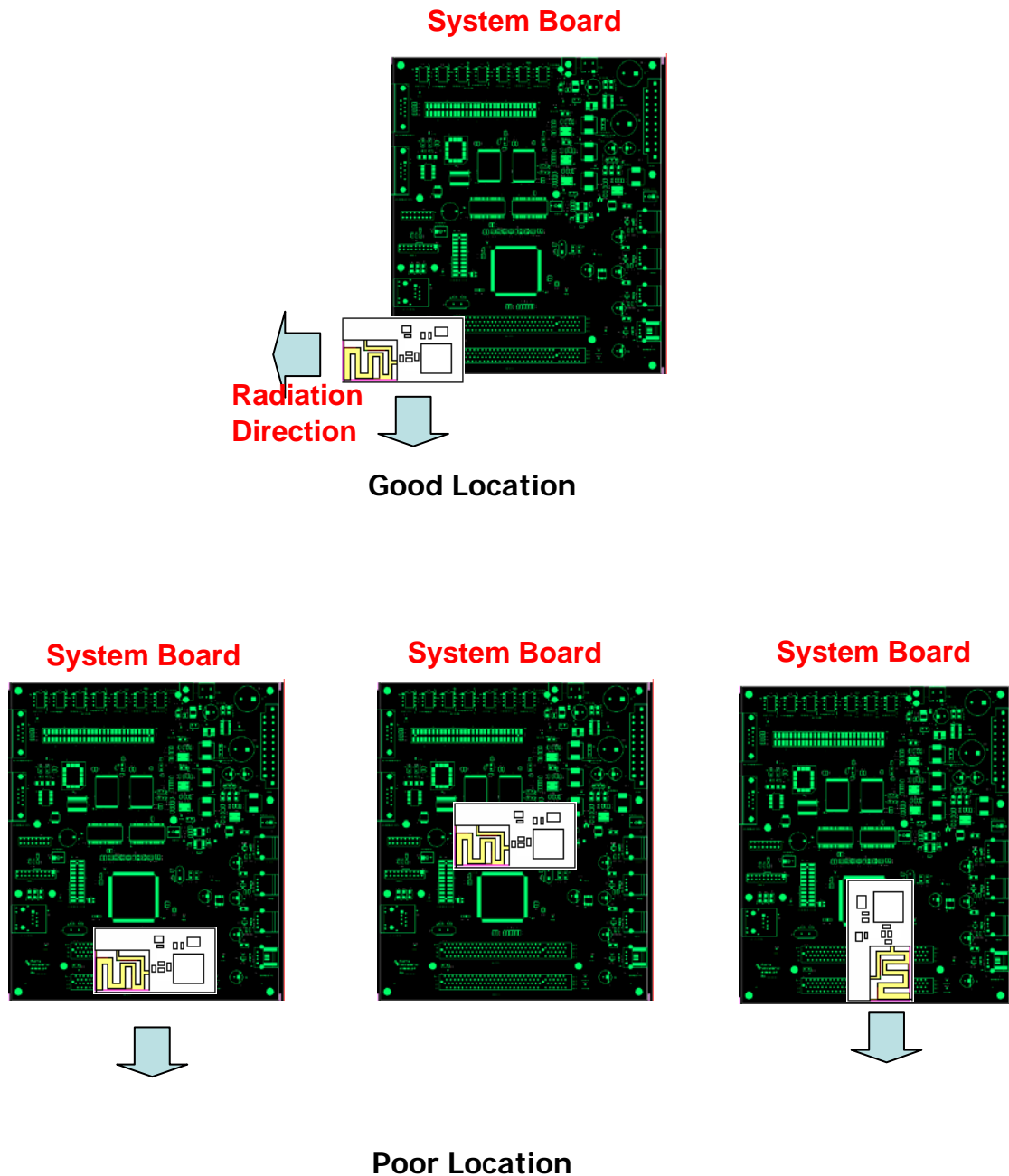
7. Ground-Signal-Ground (GSG) Interface Design

To prevent huge RF power loss from the GSG to the system board, the rules of laying micro-strip on a PCB should be obeyed. Please refer to AN-PCB1-01.

7.1. 4-layer PCB for system

G

W

50 ohm Micro-Strip Line
W, G depends on board's
material & thickness

7.2. 2-layer PCB for system

G

W

50 ohm Micro-Strip Line
W, G depends on board's
material & thickness

Revision History

Revision	Date	Description of Change
0.0	2008/7/17	Version 0.0 released.

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