Product Manual
527602

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Revision History

Index	Date	Name	Comments
1	18.6.2009	C. Groves	Initial Release

Subject to change without notice.

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Table of Contents

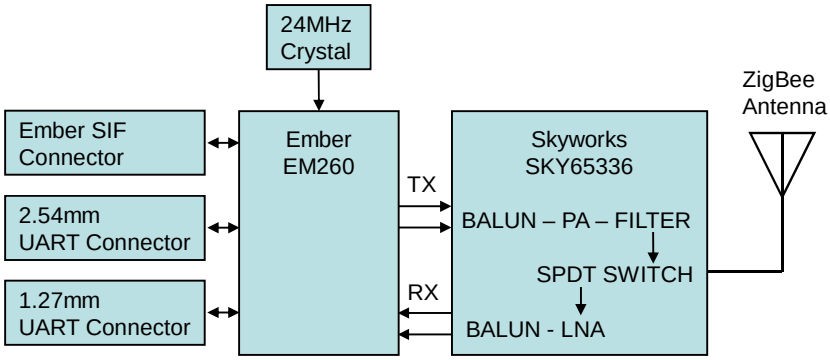
1 Abbreviations

BPF	Band Pass Filter
CFR	Code of Federal Regulations
FCC	Federal Communications Commission
LNA	Low Noise Amplifier
LPF	Low Pass Filter
OTA	Over the Air
PA	Power Amplifier
RF	Radio Frequency
RX	Receive
SPDT	Single Pole Double Throw
TBC	To Be Confirmed
TX	Transmit
UL	Underwriters Laboratories

2 Introduction

This document describes the 527602 ZigBee module, which has been design to be integrated into host equipment to provide wireless mesh networking at 2.4GHz. The module is based on Ember's EM260 ZigBee Co-Processer and uses the UART communication to be interfaced with the host micro-controller.

2.1 Module Block Diagram



All ICs are supplied with 3.3V unless otherwise specified

3 Product Approvals

3.1 FCC Approvals

The 5276 ZigBee Module conforms to FCC CFR 47 part 15.

This device complies with Part 15 of the 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.

FCC ID : ROV-ZIG527602

When the 5276 ZigBee Module is integrated inside another device then the outside of this device must also display a label referring to the enclosed module. This exterior label can use wording such as "Contains Transmitter Module FCC ID : ROV-ZIG527602" or "Contains FCC ID : ROV-ZIG527602"

This module complies with the USA SAR requirements and is not intended to be operated within 20cm of the body. The following statement must be included as a CAUTION statement in manuals for OEM product to alert users on FCC RF exposure compliance:

"WARNING: To satisfy FCC RF exposure requirement for mobile transmitting device, a separation distance of 20cm or more should be maintain between the antenna of this device and the persons during operation. To ensure compliance, operations at closer distances than this are not recommended."

Any modification or changes to this module may invalidate the certification and the user's authority to operate the equipment in the USA.

3.2 European Approvals

The module has been designed to meet the following European approvals:

Electromagnetic Compatibility Radio Spectrum Matters; Short Range Devices; Radio Equipment to be used in the 25 MHz to 1,000 MHz Frequency Range with Power Levels Ranging up to 500mW; Part 1: Technical Characteristics and Test Methods	EN 300 328 V1.7.1
Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2,4 GHz wideband transmission systems and 5GHz high performance RLAN equipment.	EN 301 489-17 V1.2.1
Information technology equipment. Safety. General requirements	IEC 60950-1:2001 (including amendment 11:2004)

3.3 Maximum Allowable Power Levels

The maximum allowable power levels are restricted by the relevant regulatory body for target country of deployment. In order to comply with these appropriate approvals the EM260 and Skyworks devices must be configured in software to transmit within these limits. The following table shows the MAXIMUM allowable transmission levels allow according to the relevant approval body.

These levels must be set by the OEM equipment.

Approval Body	EM260 Channel 26 Power Level	EM260 Channel 25 Power Level	EM260 All Other Channels Power Level	Skyworks Power Level Mode
FCC	-20 dBm	-3 dBm	+3 dBm	HIGH
R&TTE	0 dBm	0 dBm	0 dBm	LOW

Please check with the design team for the latest information.

4 Hardware Description

The 5276 ZigBee Module contains the EM260 from Ember, a 24MHz crystal reference and the SKY65336 Front End Module (FEM) from Skyworks. It has an integrated printed inverted F antenna matched to the FEM for optimum performance.

4.1 EM260

The Ember EM260 Co-Processor solution provides a wireless ZigBee mesh networking capabilities with other ZigBee enabled devices. The EM260 is a 2.4GHz IEEE 802.15.4 compliant radio transceiver with a 16-bit microprocessor. IEEE802.15.4 uses Offset Quadrature Phase Shift Keying (O-QPSK) Modulation Scheme. The EM260 comes in a 6mm x 6mm, 40 pin QFN package. Further information on the EM260 device, including how to correctly interface with the host device can be found at www.ember.com.

4.2 SKY65336

The Skyworks front end module, SKY65336, will be used to provide a PA and LNA gain stage with fully integrated impedance matching and filtering. This FEM comes in an 8mm x 8mm 28 pin MCM package.

4.3 Crystal

There is a highly accurate 24MHz crystal fitted to the PCB. This is because the initial tolerance, temperature stability and ageing directly correspond to life that a transceiver pair can communicate. The crystal used in this design will have a maximum tolerance of ±40ppm, including initial, ageing (5 year prediction) and temperature tolerance. Calibration of the crystal would further improve the lifetime of the communication system.

4.4 RF Shield

There is an RF shield fitted to the module.

4.5 Antenna

The antenna is an integrated printed ¼ wave inverted F antenna. This has a theoretical maximum peak gain of 5.15dBi.

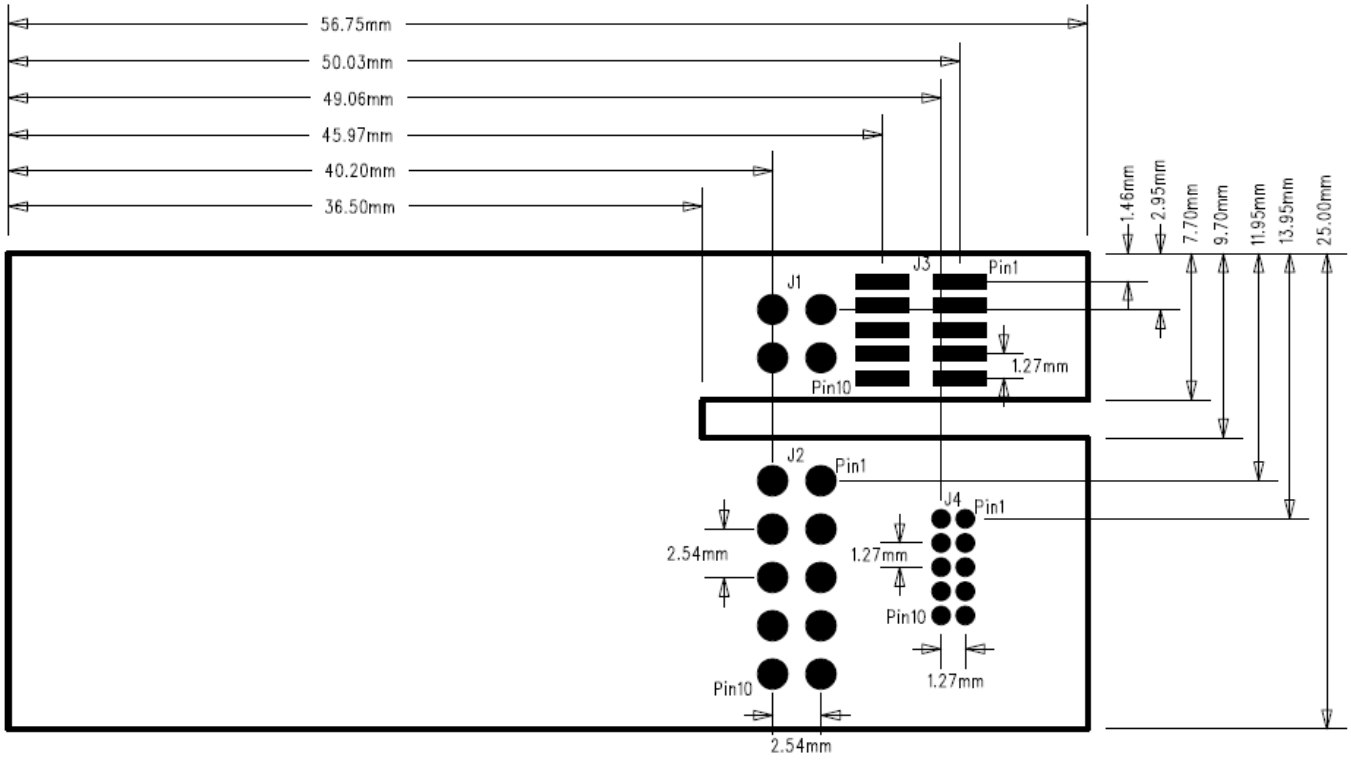
4.6 Test Points

Due to the compact nature of the design and to maintain optimal RF performance no test points have been added to the main circuitry on the ZigBee module.

For programming debug and bootloading the J2 and J3 connectors should be used. For Production RF testing, TP11 should e used to measure the conducted RF output.

For RF Development and antenna matching TP12 may be used. If TP12 is used R19 should be a zero ohm link. In all other instances, including production, R19 must not be fitted.

5 Mechanical Drawing



Top View

Notes:

J3 may be accessed from both sides of the PCB, however to avoid a crossover connector, i.e. direct connection, to Ember development or production equipment it should be accessed from layer 4 (bottom or no component side). Otherwise a crossover connector will be required.

6 Connections

6.1.1 UART Connector (J2 and J4)

Note J2 and J4 are duplicate connectors

Connector	10 way connector
Format	2 x 5 way double row
Pitch	2.54mm or 1.27mm
Suggested Connector	Samtec TSW-105-25-L-D-RA or TSM-105-04-x-DV-M

Name	Pin	Description
+3V3	1	Supply for circuitry
P2_TX_SCL	2	UART Data TX
P2_RX_SDA	3	UART Data RX
P2_Aux1	4	Power Mode – high or Low Power
P2_CTS	5	UART Flow control CTS
SYSRST	6	Reset (Active Low)
P2_RTS	7	UART Flow control RTS
FORCE_BOOT	8	Force Bootloader (Hold Low during Reset)
OPTION_CARD_ID	9	Analogue voltage to identify card type
0V	10	Ground

6.1.2 M Bus Connector (J1)

Connector	4 way connector
Format	2 x 2 way double row
Pitch	2.54mm
Suggested Connector	Not Required

Name	Pin	Description
NC	1,2, 3,4	No Connection

6.1.3 Ember SIF Connector (J3)

Connector	10 way connector
Format	5 x 2 way double row
Pitch	0.05 inch
Suggested Connector	Samtec FTSH-105-01-F-DV-K (connected to layer 4 of PCB)

Name	Pin	Description
VBRD	1	Supply for circuitry (+3V3 recommended)
SIF_MISO	2	Serial Interface (Master Input, Slave Output)
SBDG	3	Debug Signal
SIF_MOSI	4	Serial Interface (Master Output, Slave Input)
GND	5	Ground
SIF_CLK	6	Serial Interface (Clock)
nSIF_LOAD	7	Serial Interface (Load Strobe)
nRESET	8	EM260 Reset (Active Low)
PTI_EN	9	Packet Trace Frame Signal
PTI_DATA	10	Packet Trace Data Signal (500kbps)

6.2 UART Connector Detailed Description

6.2.1 Overview

This section provides a detailed description of the connections between the ZigBee module and the host MCU.

Name	Host Micro Function	EM260 Function	EM260 Pin #
P2_TX	UART Transmitted Data	UART Received Data	26
P2_RX	UART Received Data	UART Transmitted Data	25
P2_CTS	UART CTS	UART RTS	16
P2_RTS	UART RTS	UART CTS	15
SYSRST	EM260 RESET	EM260 RESET	11
FORCE_BOOT	Force EM260 Bootloader	Force EM260 Bootloader	23

6.2.2 P2_TX and P2_RX

Transmitted and received serial data between the host micro and the ZigBee module. The signal lines are connected directly to the EM260.

P2_TX Transmitted data on host MCU.
Received data on the EM260 (pin 26).

P2_RX Received data on host MCU.
Transmitted data on the EM260 (pin 25).

6.2.3 P2_CTS and P2_RTS

The UART hardware flow control lines between the host micro and the ZigBee module. The signal lines have been connected directly to the EM260.

P2_CTS Clear To Send on the host MCU.
Ready To Send on the EM260 (pin 16).

P2_RTS Ready To Send on host MCU.
Clear To Send on EM260 (Pin 15).

6.2.4 FORCE_BOOT

This line can force the EM260 into bootloader mode should the software bootloader command fail. This gives the host micro a fail safe recovery method for bootloading the EM260. Consideration should be given to bootloading recovery method should the over the air system fail, for example if the EM260 is corrupted. Bootloader can be activated by pulling FORCE_BOOT low during a RESET.

This line is connected to PTI_DATA on the EM260 (Pin 23) via a 330 Ohm limiting resistor. It has been connected to PB12 (pin 51) on the host micro. Please refer to EM260 documetation for correct implementation of hardware bootloader.

6.2.5 SYSRST

This line will force the EM260 into reset (active low). It is connected to nRESET line of the EM260 (pin 11) and PE10 (pin 41) on the host micro.

6.2.6 P2_AUX1

This line will control the power level of the Skyworks FEM. It is connected to pin 26 of the Skyworks FEM. The following logic levels have been implemented.

P2_AUX1 Voltage Level	Description
High	High Power Mode (+20dBm)
Low	Low Power Mode (+10dBm)

6.2.7 OPTION_CARD_ID

This signal is provided as a method for the host micro to identify the type of card that has been fitted to the host equipment. This pin should be connected to an A2D on the host micro and used by the software to determine the functionality of the card installed. For ZigBee with EM260 the following analogue voltage level will be used on pin 9 of J2 and J4.

	Min	Typ	Max	Units	Description
Type 2	0.73	0.83	0.93	V	ZigBee with EM260

7 Electrical Specification

7.1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Supply Voltage (Vcc)	-0.3	3.6	V
Voltage on IO	-0.3	Vcc+0.3	
RF Input Power, Antenna Port		+10	dBm
Storage Temperature	-40	+125	°C

7.2 Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Voltage (Vcc)	2.7	3.3	3.6	V
Data Rate			256	kbps
Operating Temperature	-40		+85	°C

7.3 Electrical Specification

Parameter	Symbol	Operating Condition	Min	Typ	Max	Units
Operating Frequency Range	F_0		2405		2480	MHz
Transmitter Section						
Saturated Output Power (Conducted Measurement) Low Power Mode High Power Mode	 P_{SAT_LP} P_{SAT_HP}	V_{IN} = 3.3V	 +8.3 +19.7	 +10 +20		 dBm dBm
Peak Transmit Current Low Power Mode High Power Mode	 $I_{TX\_PK\_LP}$ $I_{TX\_PK\_LP}$	V_{IN} = 3.3V			 120 190	 mA mA
Receiver Section (Frequency = 2445MHz)						
Receive Current Low Power Mode High Power Mode	 $I_{RX\_AV\_LP}$ $I_{RX\_AV\_LP}$	V_{IN} = 3.3V		 45 45		 mA mA
Sensitivity (1% PER, 20 byte packet defined by IEEE 802.15.4)		V_{IN} = 3.3V		-107	-99	dBm

Notes:

This is the maximum power the module is capable of transmitting, local regulations may limit the output power. Please check allowable transmission power for destination country of deployment in section 3.3 or with the design team.