EM260 Zigbee TRANSCEIVER MODULES

User Manual

DESCRIPTION

The EM260 Zigbee modules provide a cost effective RF transceiver solution for 2.4GHz ZigBee and IEEE 802.15.4 data links and wireless networks.

The EM260 Zigbee modules is based on Ember's EM260 ZigBee network processor. Also onboard are a 100mW Power Amplifier and SPI-based microprocessor interface,providing you with the flexibility to choose an external microprocessor based on your application's needs.

The EM260 Zigbee modules provide over 4000 feet of range and are designed to deliver constant RF output power across the 2.1 to 3.6V voltage input, ensuring consistent performance over the entire life of the battery.

GENERAL FEATURES

- **1 – 100mW output power, software controlled**
- **Designed for *EmberZNet* networks**
- **Miniature footprint: 1.00" x 1.275"**
- **Integrated PCB trace antenna**
- **Optional MMCX connector for external antenna**
- **16 RF channels (Channel 26 operates at reduced power levels)**
- **Over 4000 feet of range**
- **Integrated hardware support for Ember InSight Development Environment**
- **Non-intrusive debug interface (SIF)**
- **AES 128 bit encryption**
- **Low power consumption**
- **Constant RF output power over 2.1–3.6V voltage range**
- **FCC and IC certified, CE certification in process**
- **Ember™ EM260 platform**
- **Integrated IEEE 802.15.4 PHY and MAC**
- **Dedicated network processor**
- **SPI or UART interface to application microcontroller**
- **Handles all ZigBee processing and timing intensive tasks**
- **RoHS compliant**

ABSOLUTE MAXIMUM RATINGS

Rating	Value	Unit
Power Supply Voltage	3.6	Vdc
Voltage on Any Digital Pin	VDD + 0.3,Max 3.6	Vdc
RF Input Power	+10	dBm
Storage Temperature Range	-45 to 125	°C

Note: Exceeding the maximum ratings may cause permanent damage to the module or devices

OPERATING CONDITIONS

Characteristic	Min	Typ	Max	Unit
Power Supply Voltage (VDD)	2.1	3.3	3.6	V
Input Frequency	2405		2480	MHz
Ambient Temperature Range	-40	25	85	°C
Logic Input Low Voltage	0		20% VDD	V
Logic Input High Voltage	80% VDD		VDD	V

ELECTRICAL SPECIFICATIONS *(@ 25°C, VDD = 3.3V unless otherwise noted)*

Parameter	Min	Typ	Max	Unit
General Charcteristics				
RF Frequency Range	2400		2483.5	MHz
RF Data Rate		250		kbps
Power Consumption				
Transmit Mode (100mW output)		170		mA
Receive Mode		37		mA
Standby Mode			6	μA
Transmitter				
Nominal Output Power		18		dBm
Programmable Output Power Range		32		dB
Error Vector Magnitude		15	35	%
Receiver				
Receiver Sensitivity (1% PER) – normal mode	-92	-96		dBm
Receiver Sensitivity (1% PER) – *boost mode**	-93	-97		dBm
Saturation (Maximum Input Level) (1% PER)	0			dBm
802.15.4 Adjacent Channel Rejection	35			dB
802.15.4 Alternate Channel Rejection	40			dB
802.11 g Rejection (±10 MHz)	30			dB
Control DC Characteristics				
Logic Input Low	0		0.2 x VDD	V
Logic Input High	0.8 x VDD		VDD	V
Logic Output Low	0		0.18 x VDD	V
Logic Output High	0.82 x VDD		VDD	V

Note1: ***Boost Mode*** is an optional software-selectable high performance mode designed to increase receiver sensitivity.

Note2: EM260 max output power setting is limited to -3dBm on channel11~25, it is limited to -23dBm on channel 26

Note3: Refer to Ember EM260 datasheets for additional details.

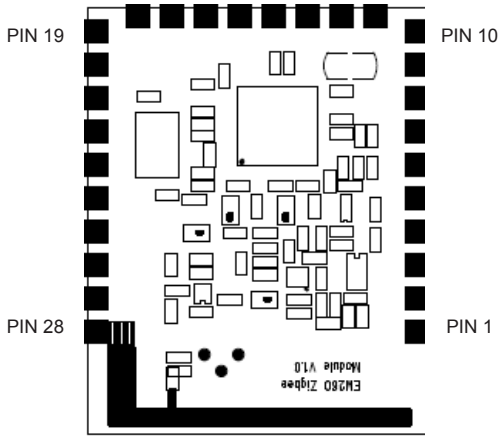


Figure 1(Top View)

PIN SIGNALS I/O PORT CONFIGURATION

The EM260 Zigbee modules have 28 edge I/O interfaces for connection to the user's host board. *Figure 1* shows the layout of the 28 edge castellations.

The EM260 Zigbee modules provide a connection to the Ember Serial API over the SPI allowing the application development to be completed on a host microprocessor of your choice. In addition to the SPI signals, two additional signals (nHOST_INT and nWAKE) provide a handshake mechanism. The module provides a slave device with all transactions initiated by the host. Please consult the EM260 datasheet for details on the SPI Protocol including:

- Physical Interface Configuration
- SPI Transactions
- SPI Protocol Timing Parameters & Waveforms
- Data Formatting
- SPI Commands & Responses
- Handling Resets and Power Cycling
- Transaction Examples

I/O pin assignments

Pin #	Name	Type	Description
1	GROUND	GND	Ground
2	GROUND	GND	Ground
3	GROUND	GND	Ground
4	GROUND	GND	Ground
5	VDD	PI	Power Supply Input
6	nRESET	DI	Reset, active low
7	MOSI	DI	SPI Data, Master Out/Slave In
8	MISO	DO	SPI Data, Master In/Slave Out
9	SCLK	DI	SPI Clock
10	VPA_EN	DI	active high
11	nRTS	DO	UART RTS
12	nSSEL_INT/nCTS	DI	SPI Slave Select /UART CTS
13	PTI_EN	DO	PTI Frame signal
14	PTI_DATA	DO	PTI Data signal
15	TXD	DO	UART TXD
16	nHOST_INT/RXD	DO/DI	Host Interrupt Signal or UART RXD
17	nWAKE	DI	Wake Interrupt Signal
18	GROUND	GND	Ground
19	SIF_CLK	DI	SIF Interface clock
20	SIF_MISO	DO	SIF Interface master in/slave out
21	SIF_MOSI	DI	SIF Interface master out/slave in
22	nSIF_LOAD	DI/DO	SIF Interface load strobe
23	SDBG	DO	Spare Debug Signal
24	LINK_ACTIVITY	DO	Link and Activity signal
25	GROUND	GND	Ground
26	GROUND	GND	Ground
27	GROUND	GND	Ground
28	GROUND	GND	Ground

Unused I/O pins should be left unconnected and the pin state set via the Host Protocol.

DI = Digital Input PI = Power Input
DO = Digital Output GND = Ground
AI = Analog Input AO = Analog Output

SIF INTERFACE

The EM260 modules provide access to the SIF module programming and debug interface. Consult the EM260 datasheets for further details on the following SIF features:

- Production Testing
- Firmware Download
- Product Control and Characterization
- XAP2b Code Development (APEX only)

POWER AMPLIFIER REGULATOR CONTROL LINE

The EM260 modules include a separate 1.8V regulator for a power amplifier bias that enables consistent module output performance over the wide 2.1 – 3.6V voltage range. To prevent excessive sleep currents, this regulator should be disabled when the module is in sleep mode. An external pull up resistor option is provided on each module (R13) that allows the regulator to be constantly enabled. This option increases the sleep current of the module to a point well above the specified values.

SPECIFICATIONS —VPA_EN

Parameter	Min	Typ	Max	Unit
Regulator enable voltage	2.0			V
Regulator disable voltage			0.4	V
Enable line current (VEN = 0)			0.1	µA
Enable line current (VEN = VDD)			0.5	µA

On the EM260 module the VPA_EN control must be provided by the host microprocessor. In normal operation, the VPA_EN line must be set high. It must be set low when the module is put into sleep mode in conjunction with putting the EM260 into deep sleep. Upon module wake-up, a 250µsec turn-on time must be provided prior to any transmission, allowing the module's regulator to settle. Note that this 250µsec requirement applies only to the external power amplifier, the wake-up time for the EM260 is separate from this value.

If the application does not put the module to sleep or if sleep current is not an issue, the power amplifier regulator may be permanently enabled by tying the control line high. In this setup, the sleep current will increase by 80µA over the 5µA Standby Current figure provided in Electrical Specifications.

ANTENNA

The EM260 modules include an integrated PCB trace antenna. An optional MMCX connector can be specified, enabling connection to a 50-ohm external antenna of the user's choice. See Ordering Information.

The PCB antenna employs an F-Antenna topology that is compact and supports an omni-directional radiation pattern.To maximize antenna efficiency, an adequate ground plane must be provided on the host PCB. If positioned correctly, the ground plane on the host board under the module can contribute significantly to antenna performance.

The position of the module on the host board and overall design of the product enclosure contribute to antenna perfor-mance. Poor design effects radiation patterns and can result in reflection, diffraction, and/or scattering of the transmitted signal.

Here are some design guidelines to help ensure antenna performance:

• Never place the ground plane or route copper traces directly underneath the antenna portion of the module.

• Never place the antenna close to metallic objects.

• In the overall design, ensure that wiring and other components are not placed near the antenna.

• Do not place the antenna in a metallic or metallized plastic enclosure.

• Keep plastic enclosures 1cm or more from the antenna in any direction.

AGENCY CERTIFICATIONS

FCC Part 15.247 Module Certified (Mobile)

The modules comply with Part 15 of the Federal Communications Commission rules and regulations.

To meet the FCC Certification requirements, the user must meet these regulations:

• The text on the FCC ID label provided with the module must be placed on the outside of the final product.

• The modules may only use the antennas that have been tested and approved with these modules:

— The on-board PCB trace antenna

— AsiaRF A-2408 antenna.

To meet the Section 15.209 emission requirements in the restricted frequency bands of Section 15.205, the transceiver transmitter power for the modules needs to be reduced from the typical maximum setting on the upper one channels (2480 MHz). Maximum values are -23dBm.

Per Section 2.109, the modules have been certified by the FCC for use with other products without additional certification. Any modifications to this product may violate the rules of the Federal Communications Commission and make operation of the product unlawful.

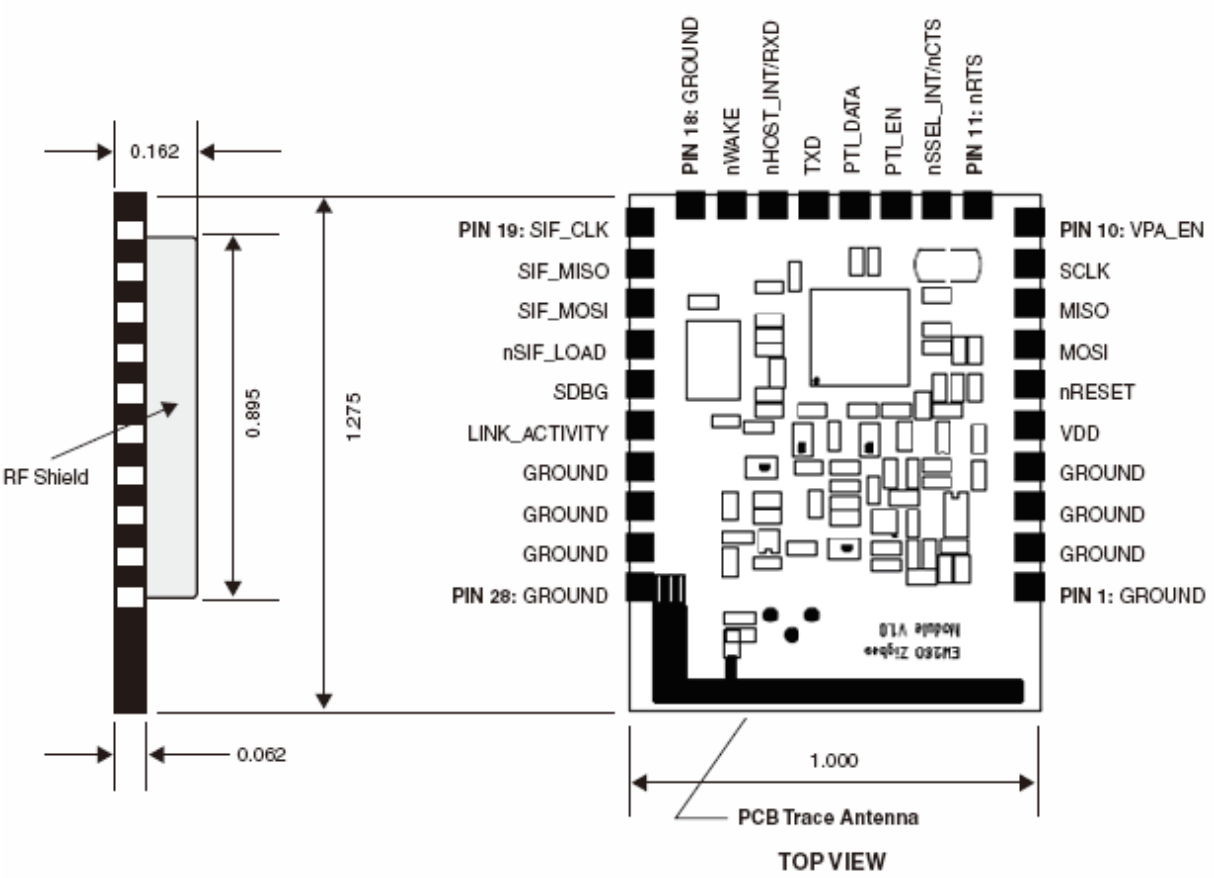
Per Sections 15.107 and 15.109, the user's end product must be tested for unintentional

radiators compliance.
Per Section 47 C.F.R. Sec.15.105(b), the modules are certified as mobile devices for the FCC radiation exposure limits set forth for an uncontrolled environment. The antennas used with these modules must be installed to provide a separation distance of at least 8 inches (20cm) from all persons. If the module is to be used in a handheld application, the user is responsible for passing additional FCC part 2.1091 rules (SAR) and FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, OET Bulletin and Supplement C.

FCC Approved Antennas

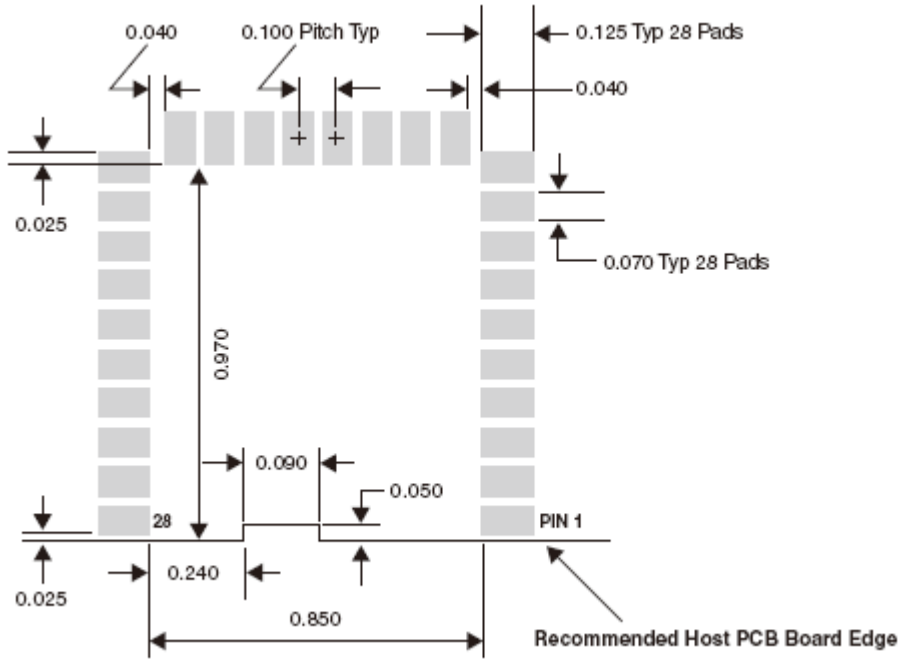
- **Integrated PCB trace antenna**
- **AsiaRF A-2408** A 2.4GHz Dipole antenna with a 6 inch cable and a right angle MMCX connector.

DIMENSIONS: *Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.*



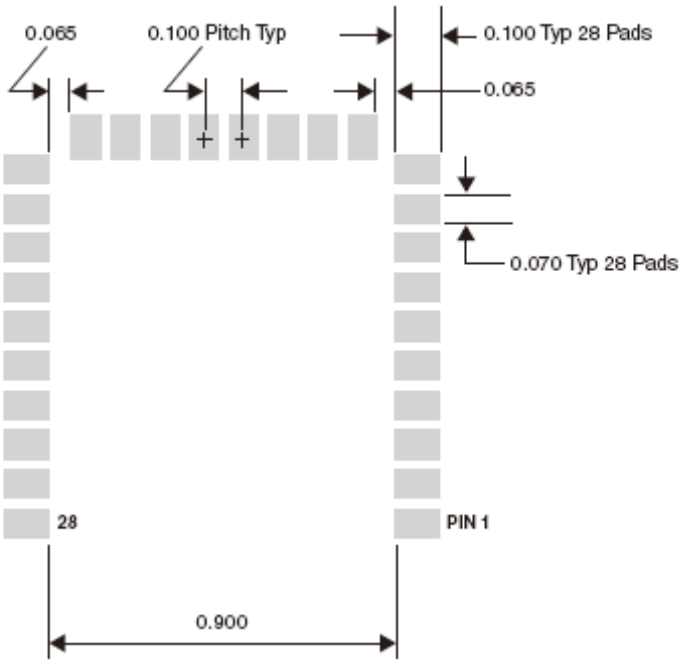
PCB COPPER PATTERN LAYOUT:

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



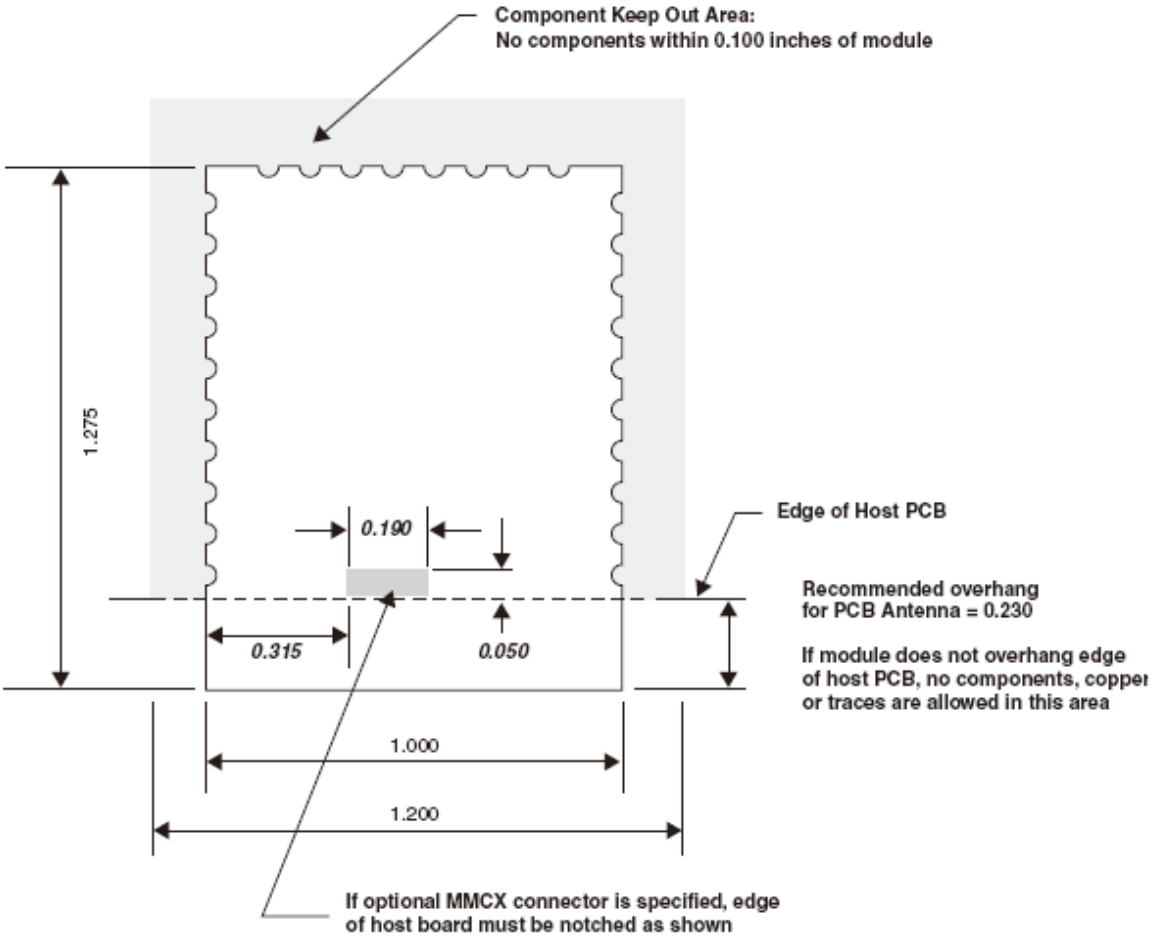
PCB PASTE STENCIL PATTERN:

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.



PCB Keep-outareas:

Dimensions in inches. Tolerances = +/-0.005" unless otherwise noted.


Component Keep Out Area:
No components within 0.100 inches of module
1.275
0.190
Edge of Host PCB
Recommended overhang
for PCB Antenna = 0.230
If module does not overhang edge
of host PCB, no components, copper
or traces are allowed in this area
0.315
0.050
1.000
1.200
If optional MMCX connector is specified, edge
of host board must be notched as shown

FCC ID: XZPMZG-9162

IMPORTANT REGULATORY INFORMATION

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 that is received, including any interference that may cause undesired operation.

Note:

The manufacturer is not responsible for ANY interference, for example RADIO or TV interference, caused by unauthorized modification to this equipment Such modifications could void the user’s authority to operate the equipment.