

1mW ZigBee Module

HT-MDL-Z-EM-2400-001-A-V3.0.0



Product Manual V1.0.0

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Version Control

| Date | Version | Notes |
|------------|---------|---------------------------------|
| 2009.09.30 | 1.0.0 | 1st Issue of Preliminary Manual |

* Holley reserves the right to make changes to the product specification at anytime without notice.

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1. Introduction

Holley 1mW ZigBee Module (HT-MDL-Z-EM-2400-001-A-V3.0.0) is a type of surface mounted module that enable users to implement ZigBee/IEEE 802.15.4 compliant solution which satisfies the needs of low-cost, low-power wireless sensor networks. The module is easy-to-use, save board space and provide reliable delivery of data between devices.

Holley 1mW ZigBee Module (HT-MDL-Z-EM-2400-001-A-V3.0.0) operates within the ISM 2.4GHz frequency band. The module's default configuration supports a wide range of data system applications. The module uses Ember's EM250 wireless microcontroller to provide a comprehensive solution.

1.1 Product Features

- State-of-art EM250 chip adopted
- Stable and reliable Ember protocol stack embedded
- Easy to implement ZigBee technology integration for hardware equipment manufacturers
- Wide communication range and high network reliability

2. Specifications

Table 2-01: Specifications of 1mW ZigBee Module (HT-MDL-Z-EM-2400-001-A-V3.0.0)
(PRELIMINARY)

| Specifications | |
|--|---|
| Maximum Transmit Range | 250m (line of sight) |
| Maximum Transmit Power Output | 4dBm |
| RF Data Rate | 250kbps |
| Serial Interface Data Rate (software selectable) | 1200-115200 bps |
| Receiver Sensitivity (1% packet error rate) | -95dBm |
| Supply Voltage | 2.7~3.6V DC |
| Operating Current (Transmit) | 35mA |
| Operating Current (Receive) | 35mA |
| Power-down Current | 0.6μA |
| Operating Frequency Band | ISM 2.405~2.480 GHz |
| Operating Temperature | -40 to 85°C |
| Antenna Interface | Edge mounted MMCX |
| Interface Features | 17 GPIO ports; 4 interrupt ports; 2 serial ports, UART/SPI/I2C supported; 4*12 bits A/D conversion |
| Supported Network Topologies | Point-to-point, Point-to-multipoint, Peer-to-peer & Mesh |
| Number of Channels (software selectable) | 16 Direct Sequence Channels |
| Dimensions | 36.3 x 22.9 mm |

3. Pin Configurations

3.1 Pin Signals

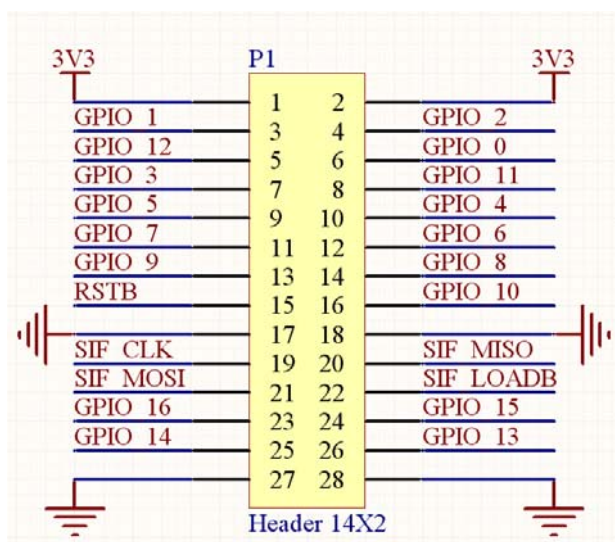


Figure 3-01: Pin Signals

3.2 Pin Assignment

Table 3-01: Pin Assignment

| Module Pin | Signal | Corresponding EM250 Pin | Pin Description |
|------------|--------|-------------------------|--|
| 1 | VDD | - | DC3.3V supply |
| 2 | VDD | - | DC3.3V supply |
| 3 | GPIO1 | 22 | Digital I/O SPI master data in of Serial Controller SC2 SPI slave data out of Serial Controller SC2 I2C data of Serial Controller SC2 Capture Input A of Timer 2 |
| 4 | GPIO2 | 24 | Digital I/O SPI master clock of Serial Controller SC2 SPI slave clock of Serial Controller SC2 I2C clock of Serial Controller SC2 Capture Input B of Timer 2 |
| 5 | GPIO12 | 20 | Digital I/O UART RTS handshake of Serial Controller SC1 Capture Input B for Timer 2 |
| 6 | GPIO0 | 21 | Digital I/O SPI master data out of Serial Controller SC2 SPI slave data in of Serial Controller SC2 Capture Input A of Timer 1 |

| | | | |
|----|-----------|----|---|
| 7 | GPIO3 | 25 | Digital I/O SPI slave select of Serial Controller SC2 Capture Input B of Timer 1 |
| 8 | GPIO11 | 19 | Digital I/O UART CTS handshake of Serial Controller SC1 SPI master clock of Serial Controller SC1 Capture Input A of Timer 2 |
| 9 | GPIO5 | 27 | Digital I/O ADC Input 1 Data signal of Packet Trace Interface PTI |
| 10 | GPIO4 | 26 | Digital I/O ADC Input 0 Frame signal of Packet Trace Interface PTI |
| 11 | GPIO7 | 30 | Digital I/O ADC Input 3 External regulator open collector output |
| 12 | GPIO6 | 29 | Digital I/O ADC Input 2 External clock input of Timer 2 External enable mask of Timer 1 |
| 13 | GPIO9 | 32 | Digital I/O UART transmit data of Serial Controller SC1 SPI master data out of Serial Controller SC1 I2C data of Serial Controller SC1 Capture Input A of Timer 1 |
| 14 | GPIO8 | 31 | Digital I/O ADC reference output External clock input of Timer 1 External enable mask of Timer 2 External interrupt source A |
| 15 | RSTB | 13 | Active low chip reset (internal pull-up) |
| 16 | GPIO10 | 33 | Digital I/O UART receive data of Serial Controller SC1 SPI master data in of Serial Controller SC1 I2C clock of Serial Controller SC1 Capture Input B of Timer 2 |
| 17 | GND | - | Ground |
| 18 | GND | - | Ground |
| 19 | SIF_CLK | 34 | Serial interface, clock (internal pull-down) |
| 20 | SIF_MISO | 35 | Serial interface, master in/slave out |
| 21 | SIF_MOSI | 36 | Serial interface, master out/slave in |
| 22 | SIF_LOADB | 37 | Serial interface, load strobe (open-collector with internal pull-up) |

| | | | |
|----|--------|----|--|
| 23 | GPIO16 | 40 | Digital I/O Waveform Output B of Timer 1 Capture Input B of Timer 2 External interrupt source D |
| 24 | GPIO15 | 41 | Digital I/O Waveform Output A of Timer 1 Capture Input A of Timer 2 External interrupt source C |
| 25 | GPIO14 | 42 | Digital I/O Waveform Output B of Timer 2 Capture Input B of Timer 1 External interrupt source B |
| 26 | GPIO13 | 43 | Digital I/O Waveform Output A of Timer 2 Capture Input A of Timer 1 |
| 27 | GND | - | Ground |
| 28 | GND | - | Ground |

3.3 Mounting Considerations

The Holley ZigBee module is designed to mount into a 28-pin receptacle and therefore does not require any soldering when mounting it to a board. The development kits contain the RS232 interface board which uses one 28-pin receptacle to receive module.

Appendix A: Mechanical Drawings

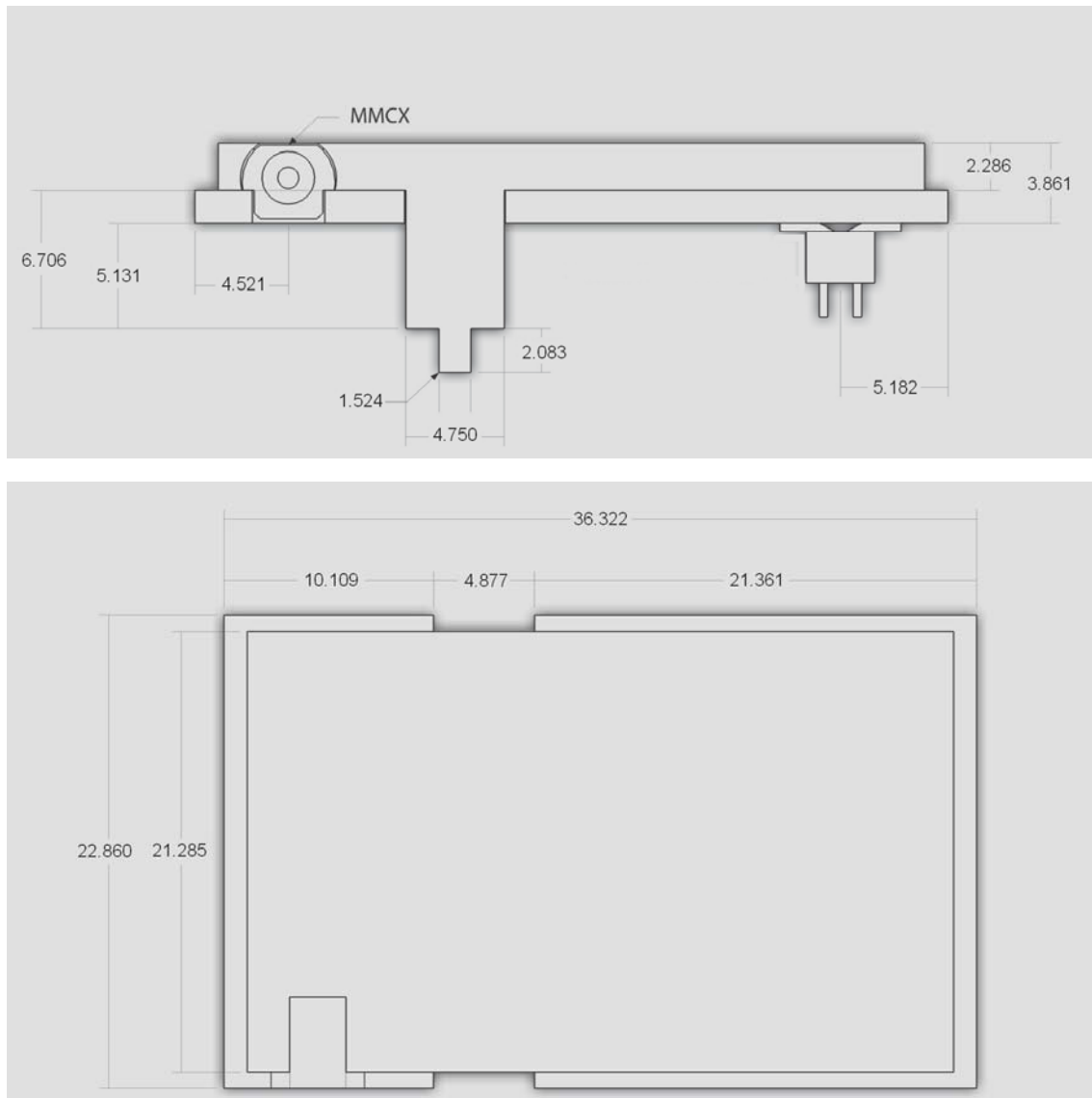


Figure A-01: 1mW ZigBee Module Outline Drawing

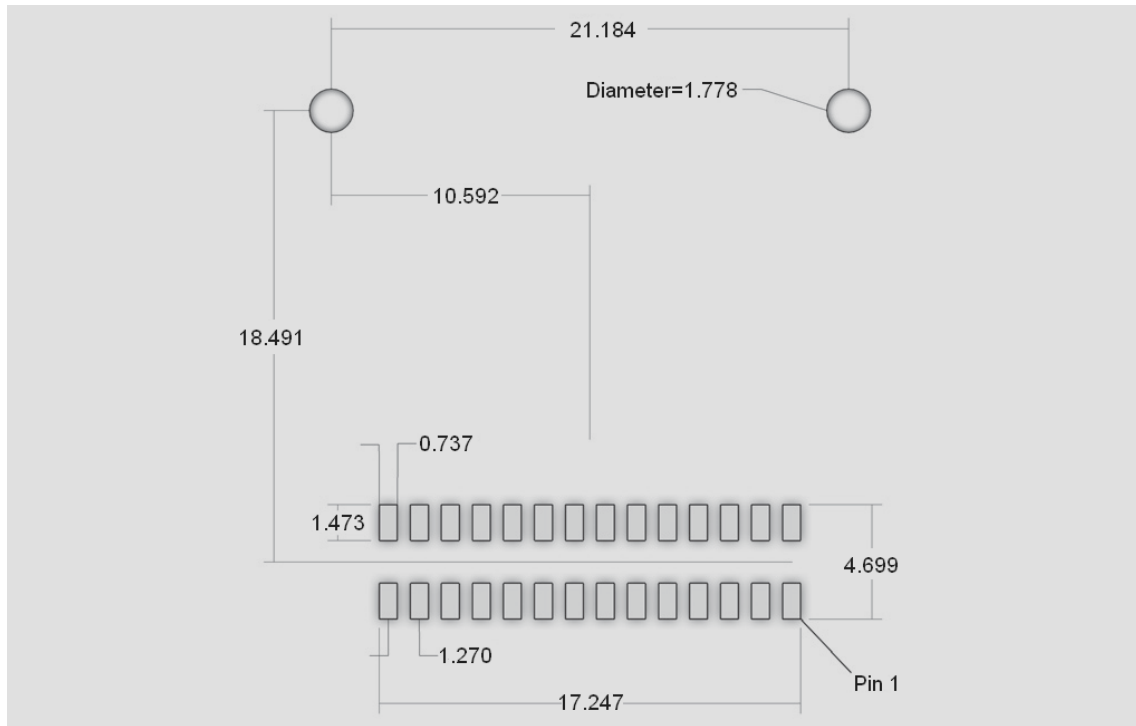
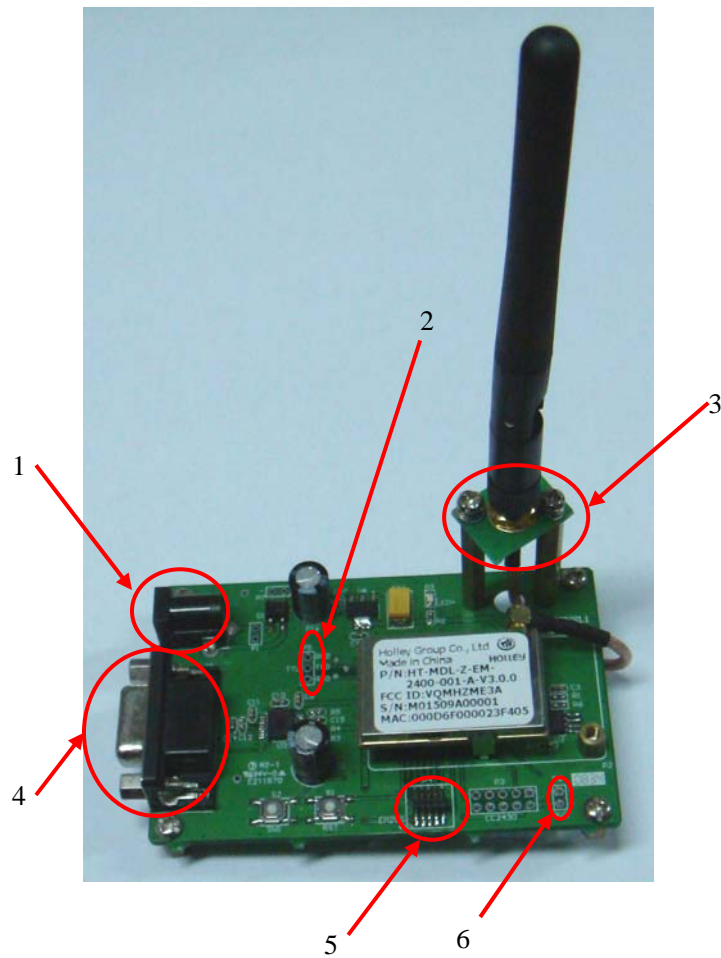


Figure A-02: 1mW ZigBee Module Footprint

Appendix B: Accessories



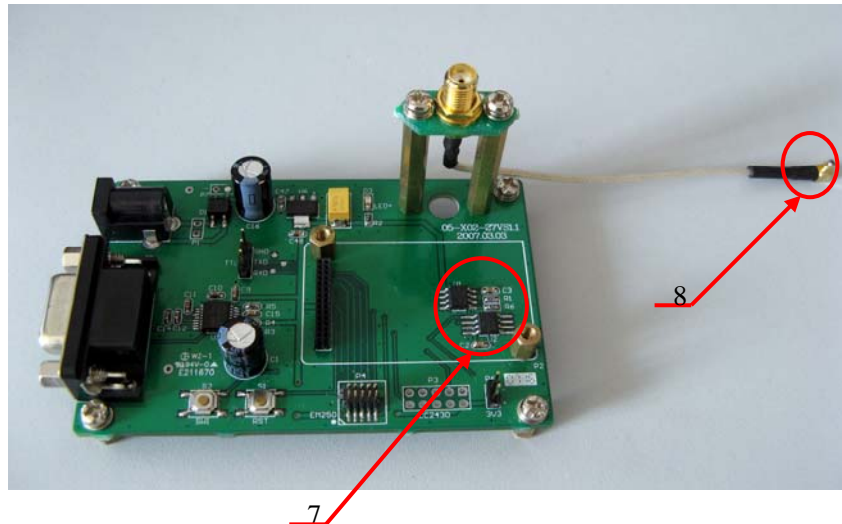


Figure B-01(a) (b) (c): Holley ZigBee Module Carry Board

1. Power supply, require DC9.0V.
2. UART TTL interface, connected to EM250's SC1 UART mode.
3. SMA antenna connector.
4. RS232 connect, DB9 female mode. This interface is derived from item 2 above, through a MAX3221 chip.
5. EM250's system SIF interface. This interface is necessary in downloading program and debugging (with Ember's Insight Adaptor).
6. DC3.3V power output/input port. If the board is powered by item 1, then this port provides a DC3.3V output. Or, the board could be powered by DC3.3V directly via this port.
7. Two 64Kbytes EPROM chips make up a total space of 128Kbytes, for sake of module's remote upgrade. The E²PROM are connected to EM250's SC2 I²C mode.
8. MMCX connector to the module.

Appendix C: Agency Certifications

FCC Certification

This equipment complies with Part 15 of the FCC rules and regulations.

To fulfill FCC Certification requirements, an OEM manufacturer must comply with the following regulations:

1. The modular transmitter must be labeled with its own FCC ID number, and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

**Example of label required for OEM product containing
HT-MDL-Z-EM-2400-001-A-V3.0.0 module**

Contains FCC ID: VQMHZME3A

The enclosed 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.

Any similar wording that expresses the same meaning may be used.

2. To be used with the HT-MDL-Z-EM-2400-001-A-V3.0.0 module, the external antennas have been tested and approved which are specified in *Approved Antenna List*. The HT-MDL-Z-EM-2400-001-A-V3.0.0 module may be integrated with other custom design antennas which OEM installer must authorize following the FCC 15.21 requirements.

WARNING: The Original Equipment Manufacturer (OEM) must ensure that the OEM modular transmitter must be labeled with its own FCC ID number. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. If the FCC ID is not visible when the equipment is installed inside another device, then the outside of the device into which the equipment is installed must also display a label referring to the enclosed equipment.

IMPORTANT: This equipment 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 15.19).

The internal/external antenna(s) used for this mobile transmitter must provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

IMPORTANT: Modifications not expressly approved by this company could void the user's authority to operate this equipment (FCC section 15.21).

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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 on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Approved Antenna List

HT-MDL-Z-EM-2400-001-A-V3.0.0 module has been tested and approved for use with the antennas listed in the table below. These two kinds of antennas comply with the requirements of FCC Part 15.203.

Table C-01: Approved Antenna List

| Part Number | Manufacturer | Description | Gain (dBi) |
|----------------|---------------|---|------------|
| HT-ANT-2400-2B | Off the shelf | Omni, with MMCX connector, frequency range 2.4-2.5 GHz | 2.1 |
| HT-ANT-2400-2E | | Omni, with MMCX connector, frequency range 2.4-2.5 GHz | 1.8 |

Appendix D: Ordering Information

Table D-01: Part Numbers: HT-MDL-Z-EM-2400-001-A-V3.0.0

| HT | -MDL | -Z | -EM | -2400 | -001 | -A | -V3.0.0 |
|--------------|----------------|-------------------|--------------------------|---------------------------|------------------------|-------------------|------------------|
| Company name | Module Product | ZigBee Compatible | RF Chip Provider (Ember) | Radio Frequency (2400MHz) | Output Power (0~4 dBm) | Antenna Interface | Hardware Version |

Appendix E: Contact Details

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