

## IEEE802.15.4 / ZigBee PIFA High Power Module Family

**Overview**

This MD-120AC-5148A ZigBee PIFA Module is a surface mount module with 100mW output power that enables users to implement IEEE802.15.4 or ZigBee PRO networking applications with minimum time to market and at the lowest cost. They remove the need for expensive and lengthy development of custom RF board designs and test suites. The modules provide a comprehensive solution with high radio performance and all RF components included. All that is required to develop and manufacture wireless control or sensing products is to connect a power supply and peripherals such as switches, actuators and sensors, considerably simplifying product development.

**Benefits**

- Microminiature module solutions
- Ready to use in products
- Minimizes product development time
- No RF test required for systems
- Compliant with FCC part 15 rules, IC Canada

**Applications**

- Robust and secure low power wireless applications
- ZigBee PRO networks
- Home and commercial building automation
- Home networks
- Toys and gaming peripherals
- Industrial systems
- Telemetry and utilities (e.g. AMR)

**Features: Module**

- 2.4GHz IEEE802.15.4 & ZigBee PRO Compatible
- 2.7 -3.6V for SOC
- Sleep Current ( with Active Sleep Timer ) 2.6μA
- Receiver Sensitivity -98dBm
- TX Power +20dBm
- PIFA Antenna Gain +3.5dBi
- TX Current 130mA
- RX Current 30mA
- Dimension : 30 \*18\*3.5mm
- Weight : 2.5g

**Features: Microcontroller**

- 32-Bit RISC CPU, up to 32MIPs with low power
- 128KB RAM, 128KB ROM
- 4Mbit serial flash for program code and data
- On chip OTP efuse
- JTAG debug interface
- 4-input 12-bit ADC, 2 12-Bit DACs, 2 Comparators
- 3 Application Timer / Counters, 3 System Timers
- 2 UARTs (One for In-System Debug)
- SPI Port with 5 Selects
- 2-Wire Serial Interface
- 4-wire digital audio interface
- Watchdog timer
- 19 GPIO

**Temperature Range**  
-40°C to +85°C

**Humidity**  
10 to 95% RH

| Revised History |          |                          |
|-----------------|----------|--------------------------|
| Date            | Revision | Description              |
| 2012/03/20      | 1.0      | 1 <sup>st</sup> Released |
|                 |          |                          |
|                 |          |                          |

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## **1. Introduction**

This MD-120AC-5148A ZigBee PIFA Module built is a surface mount module with 100mW output power that enables users to implement IEEE802.15.4 or ZigBee PRO networking applications with minimum time to market and at the lowest cost. They remove the need for expensive and lengthy development of custom RF board designs and test suites. The modules provide a comprehensive solution with high radio performance and all RF components included. All that is required to develop and manufacture wireless control or sensing products is to connect a power supply and peripherals such as switches, actuators and sensors, considerably simplifying product development.

### **1.1 Key Features**

#### **1.1.1 Module**

- 2.4GHz IEEE802.15.4 & ZigBee PRO Compatible
- 2.7 -3.6V for SOC
- Sleep Current ( with Active Sleep Timer ) 2.6 $\mu$ A
- Receiver Sensitivity -98dBm
- TX Power +20dBm
- PIFA Antenna Gain +3.5dBi
- TX Current 130mA
- RX Current 30mA
- Dimension : 30\*18\*3.5mm
- Weight : 2.5g

#### **1.1.2 Microcontroller**

- 32-Bit RISC CPU
- 128KB RAM, 128KB ROM
- 4-input 12-bit ADC, 2 12-Bit DACs, 2 Comparators
- 3 Application Timer / Counters, 3 System Timers
- 2 UARTs
- SPI Port with 5 Selects
- 2-Wire Serial Interface
- 4-Wire digital audio interface
- 19 GPIO

## **1.2 Applications**

- Robust and secure low power wireless applications
- ZigBee PRO networks
- Home and commercial building automation
- Home networks
- Toys and gaming peripherals
- Industrial systems
- Telemetry and utilities (e.g. AMR)

## 2. Specifications

VDD=3.0V @ +25°C

| Typical DC Characteristics                                                |                 | Notes                                                  |
|---------------------------------------------------------------------------|-----------------|--------------------------------------------------------|
| Deep Sleep Current                                                        | 1.3uA           |                                                        |
| Sleep Current                                                             | 2.6uA           | With active sleep timer                                |
| Radio Transmit Current                                                    | 110mA           | CPU in doze, radio transmitting                        |
| Radio Receive Current                                                     | 30mA            | CPU in doze, radio receiving                           |
| Centre Frequency Accuracy                                                 | ±20ppm          | Additional ±20ppm allowance for temperature and ageing |
| Typical RF Characteristics                                                |                 | Notes                                                  |
| Receive Sensitivity                                                       | -98dBm          | Nominal for 1% PER, as per 802.15.4 section 6.5.3.3    |
| Maximum Transmit Power (without PIFA Antenna)                             | +18.5dBm        |                                                        |
| Total Transmit Current                                                    | 110mA           |                                                        |
| Total Receive Current                                                     | 30mA            |                                                        |
| Maximum Input Signal                                                      | -5dBm           | For 1% PER, measured as sensitivity                    |
| RSSI Range                                                                | -105 to -20 dBm |                                                        |
| RF Port Impedance -PIFA Antenna                                           | 50 ohm          | 2.4 - 2.5GHz                                           |
| VSWR (Max)                                                                | 2:1             | 2.4 - 2.5GHz                                           |
| Peripherals                                                               |                 | Notes                                                  |
| Master SPI Port                                                           | 3 selects       | 250kHz - 16MHz                                         |
| Slave SPI Port                                                            | ✓               | 250kHz - 8MHz                                          |
| Two UARTs                                                                 | ✓               | 16550 compatible                                       |
| TwoWire Serial I/F (Compatible with SMBus & I <sup>2</sup> C)             | ✓               | Up to 400kHz                                           |
| Two Programmable Timer/Counters with Capture/Compare Facility, Tick Timer | ✓               | 16MHz clock                                            |
| Two Programmable Sleep Timers                                             | ✓               | 32kHz clock                                            |
| Digital IO Lines (Multiplexed with UARTs, Timers and SPI Selects)         | 19              |                                                        |
| Four Channel Analogue-to-Digital Converter                                | ✓               | 12-bit, up to 100ks/s                                  |
| Two Channel Digital-to-Analogue Converter                                 | ✓               | 12-bit, up to 100ks/s                                  |
| Two PProgrammable Analogue Comparators                                    | ✓               | Ultra low power mode for sleep                         |
| Internal Temperature Sensor and Battery Monitor                           | ✓               |                                                        |

VDD=2.7V @ +25°C

| Typical RF Characteristics                    |                 | Notes                                               |
|-----------------------------------------------|-----------------|-----------------------------------------------------|
| Receive Sensitivity                           | -98dBm          | Nominal for 1% PER, as per 802.15.4 section 6.5.3.3 |
| Maximum Transmit Power (without PIFA Antenna) | +17.5dBm        |                                                     |
| Total Transmit Current                        | 100mA           |                                                     |
| Total Receive Current                         | 30mA            |                                                     |
| Maximum Input Signal                          | -5dBm           | For 1% PER, measured as sensitivity                 |
| RSSI Range                                    | -105 to -20 dBm |                                                     |
| RF Port Impedance - PIFA Antenna              | 50 ohm          | 2.4 - 2.5GHz                                        |
| VSWR (Max)                                    | 2:1             | 2.4 - 2.5GHz                                        |

**VDD=3.6V @ +25°C**

| Typical RF Characteristics                       |                 | Notes                                               |
|--------------------------------------------------|-----------------|-----------------------------------------------------|
| Receive Sensitivity                              | -98dBm          | Nominal for 1% PER, as per 802.15.4 section 6.5.3.3 |
| Maximum Transmit Power<br>(without PIFA Antenna) | +20dBm          |                                                     |
| Total Transmit Current                           | 130mA           |                                                     |
| Total Receive Current                            | 30mA            |                                                     |
| Maximum Input Signal                             | -5dBm           | For 1% PER, measured as sensitivity                 |
| RSSI Range                                       | -105 to -20 dBm |                                                     |
| RF Port Impedance<br>- PIFA Antenna              | 50 ohm          | 2.4 - 2.5GHz                                        |
| VSWR (Max)                                       | 2:1             | 2.4 - 2.5GHz                                        |



### **3. FCC Statement**

#### **Federal Communication Commission Interference Statement**

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

#### **IMPORTANT NOTE:**

##### **FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.



**IMPORTANT NOTE:**

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

**USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

**LABEL OF THE END PRODUCT:**

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: XNNMD120AC ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.



## **4. IC Statement**

### **This Class B digital apparatus complies with Canadian ICES-003.**

Cet appareil numérique de la classe B conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

*Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

### **IMPORTANT NOTE:**

IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the IC RSS-102 radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

### **USERS MANUAL OF THE END PRODUCT:**

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. IC statement is required to be available in the users manual: This Class B digital apparatus complies with Canadian ICES-003. 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.

### **LABEL OF THE END PRODUCT:**

The final end product must be labeled in a visible area with the following " Contains TX  
IC :8520A-MD120AC





## **5. Contact Information**

### **Headquarter(Taiwan)**

#### **JOYMAX ELECTRONICS CO., LTD.**

No. 5, Dong Yuan Rd.2,  
Jhongli Industrial Park,  
Jhongli City, Taoyuan 32063,  
Taiwan, R.O.C.

Tel: +886-3-433-5698

Fax: +886-3-433-5798

E-mail: [info@joymax.com.tw](mailto:info@joymax.com.tw)

website: <http://www.joymax.com.tw>

<http://www.joymax-antenna.com>

### **Europe**

#### **Joymax Europe GmbH**

Buettgenbachstr. 10  
D-40549 Duesseldorf  
Germany

Tel : 49-211-984 937

Fax : 49-211-984 9399

E-mail : [info@joymax.de](mailto:info@joymax.de)

<http://www.joymax.de>

### **U.S.A.**

#### **Nearson Inc.**

7432 Alban Station Blvd. Suite B226  
Springfield, VA 22150  
U.S.A.

Tel : 1-703-9135552

Fax : 1-703-9135553

E-mail : [sales@nearson.com](mailto:sales@nearson.com)

<http://www.nearson.com>

