

# **FCC Part 15 Subpart C Transmitter Certification**

**Direct Sequence Spread Spectrum Transmitter**

## **Test Report**

**FCC ID: HSW-ZMN2400HP**

**FCC Rule Part: 15.247**

**ACS Report Number: 05-0453-15C**

Manufacturer: Cirronet, Inc.  
Model: ZMN2400HP

## **User Guide**



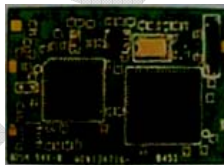
CIRRONET™

# ZMN2400 Radio Module

**High Power**



**Low Power**



**Manual**

**Preliminary**

**Cirronet, Inc.**

## Important Regulatory Information

**Cirronet Zigbee High Power - FCC ID: HSW-ZMN2400HP  
IC: 4492A-ZMN2400H**

**Cirronet Zigbee Low Power - FCC ID: HSW-ZMN2400  
IC: 4492A-ZMN2400**

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 UNDESIRE OPERATION.

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

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

### FCC User Information

“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.”

Warning: Changes or modifications to this device not expressly approved by Cirronet Inc. could void the user's authority to operate the equipment.

### RF Exposure

In accordance with FCC requirements of human exposure to radiofrequency fields, the radiating element shall be installed such that a minimum separation distance of 20cm shall be maintained from the user and/or general population.

### Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. 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. Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

## Hardware Specifications

### Radio Specifications

|                        |                                                       |
|------------------------|-------------------------------------------------------|
| Operating Band         | 2400-2475 MHz                                         |
| Radio Type             | Direct Sequence (DTS), IEEE 802.15.4 PHY layer        |
| Channel Bit Rate       | 250 Kbps                                              |
| Channel Chipping Rate  | 2 Mcps                                                |
| Modulation             | MSK with Raised Cosine Filtering                      |
| Certification Type     | DTS device per FCC 15.247 and ETS 300-328             |
| RF power               | +18 dBm typical, +15 dBm minimum                      |
| Receiver Sensitivity   | -98 dBm typical, -95 dBm minimum                      |
| Link Margin            | 110 dB (approximately 3 Km Line of Sight propagation) |
| Adjacent Ch. Rejection | >39 dB with jammer @ 5 MHz offset                     |
| Spurious Output        | Per FCC 15.247 and ETS 300-328                        |

### General

|                      |                                                      |
|----------------------|------------------------------------------------------|
| Input Voltage        | 5.5 volts minimum, 6 volts nominal, 15 volts maximum |
| Current Consumption  | 70 mA typical operating, 180 mA peak (transmit)      |
| Operating Temp Range | -40 C to + 70 C                                      |
| Humidity             | 95% Non-condensing                                   |
| RF Connector         | Reverse SMA                                          |
| Host Connector       | Male DB-9 (Amp 747840-3)                             |
| Power Connector      | CUI Stack PJ-002A                                    |

## Theory of Operation

The Cirronet ZMN2400 Series radio modules utilizes the IEEE 802.15.4 standard ZigBee Physical layer hardware for wireless low data rate monitoring and control applications. The application of the ZMN2400 Series in a wireless network for data collection in industrial monitoring and control.

### Block Diagram in Figure 1

The ZMN2400 Series radio modules consist of an RF transceiver and a microprocessor.

The RF transceiver receives data and commands from the microprocessor as well as the clock required by the RF transceiver.

The Block diagrams in Figure 1 shows both the ZMN2400 (Low Power) and the ZMN2400HP (High Power). They are the same with the exception of T/R switches and a PA (Power Amp) and a LNA (Low Noise Amp) in the high power version. The output power is +16 dBm for the high power and 0 dBm for the low power ZigBee Transceivers.

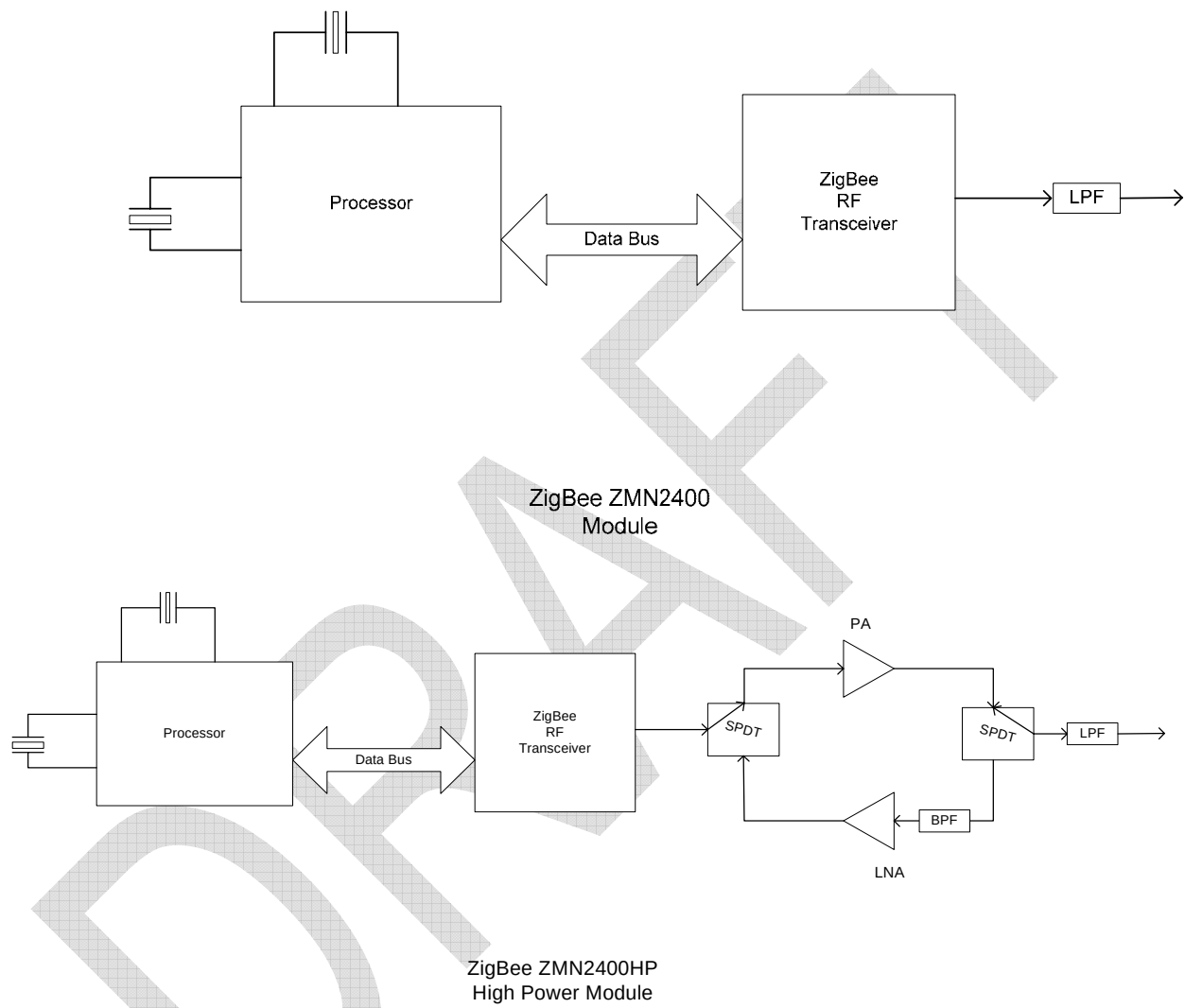


Figure 1

## ZMN2400 Frequency Selection

The ZMN2400 is not frequency agile during run-time, but it can select an unoccupied portion of the spectrum at startup.

The ZMN-2400 series uses a set of channels as defined by the IEEE 802.15.4 / ZigBee standards which span a range from 2405 to 2480 MHz with 5 MHz spacing between channels:

| Center Frequency (MHz) | Nominal Occupied BW | ZigBee Channel Designator |
|------------------------|---------------------|---------------------------|
| 2405                   | 2402.5-2407.5       | 11                        |
| 2410                   | 2407.5-2412.5       | 12                        |
| 2415                   | 2412.5-2417.5       | 13                        |
| 2420                   | 2417.5-2422.5       | 14                        |
| 2425 (default)         | 2422.5-2427.5       | 15                        |
| 2430                   | 2427.5-2432.5       | 16                        |
| 2435                   | 2432.5-2437.5       | 17                        |
| 2440                   | 2437.5-2442.5       | 18                        |
| 2445                   | 2442.5-2447.5       | 19                        |
| 2450                   | 2447.5-2452.5       | 20                        |
| 2455                   | 2452.5-2457.5       | 21                        |
| 2460                   | 2457.5-2462.5       | 22                        |
| 2465                   | 2462.5-2467.5       | 23                        |
| 2470                   | 2467.5-2472.5       | 24                        |
| 2475                   | 2472.5-2477.5       | 25                        |
| 2480 NOT USED          | 2477.5-2482.5       | 26                        |

The *channel mask* is the name used to describe the list of frequency channels that a ZMN-2400 can use. The default channel mask for client radios allows them to operate on any frequency from 2405 to 2475 (channel 2480 is reserved for manufacturing test purposes and therefore not included).