

# HAN ZIGBEE MODULE

The HAN ZigBee<sup>®</sup> Module connects to, and is powered by a host device, but contains its own processor, RF circuitry, and integral antenna. It transmits and receives digital data, such as device status or consumption. The HAN ZigBee Module is designed to be a universal solution for adding RF capability to a variety of Aclara Intelligent End Devices (IEDs).

The Ember EM260 radio IC in the HAN ZigBee Module utilizes the IEEE 802.15.4 physical layer protocol for the 2.4 GHz Industrial, Scientific and Medical (ISM) radio band. This protocol provides for 16 channels at 5 MHz intervals within the 2405 MHz to 2480 MHz range. Modulation is accomplished by Offset Quadrature Phase Shift Keying (OQPSK), and no subcarrier is used.

The HAN ZigBee Module transmits data at a rate of 250 kilobits per second, with an occupied bandwidth of 2 MHz, and a carrier frequency stability of  $\pm 40$  ppm (98 kHz for a 2450 MHz carrier frequency).

A voltage regulator on the HAN ZigBee Module controls the PA IC supply voltage, and consequently, the transmitter output power. This regulator is calibrated and set at the time of manufacture.

In accordance with the FCC antenna requirements of section 15.203 and 15.204(c), the HAN ZigBee Module shall not be used with any antenna aside from the approved internal antenna installed at the time of production. Likewise, the HAN ZigBee Module is not to be co-located or used in conjunction with any other antenna or transmitter.

The HAN ZigBee Module is not intended for, and shall not be used in a handheld or body worn device. The installation of the HAN ZigBee Module must provide a minimum of 20 centimeters separation between the module and the body of the user during normal operating conditions.

The PIC24FJ256 microchip controller controls the transmission or reception mode and channel selection of the radio. It also serves as the data transfer interface between the radio chip and the outside device in which the HAN ZigBee module is installed. The PIC implements the network layer protocol used with the 802.15.4 PHY layer. This network layer may either be the ZigBee protocol or a proprietary network protocol.

## REGULATORY DATA

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:

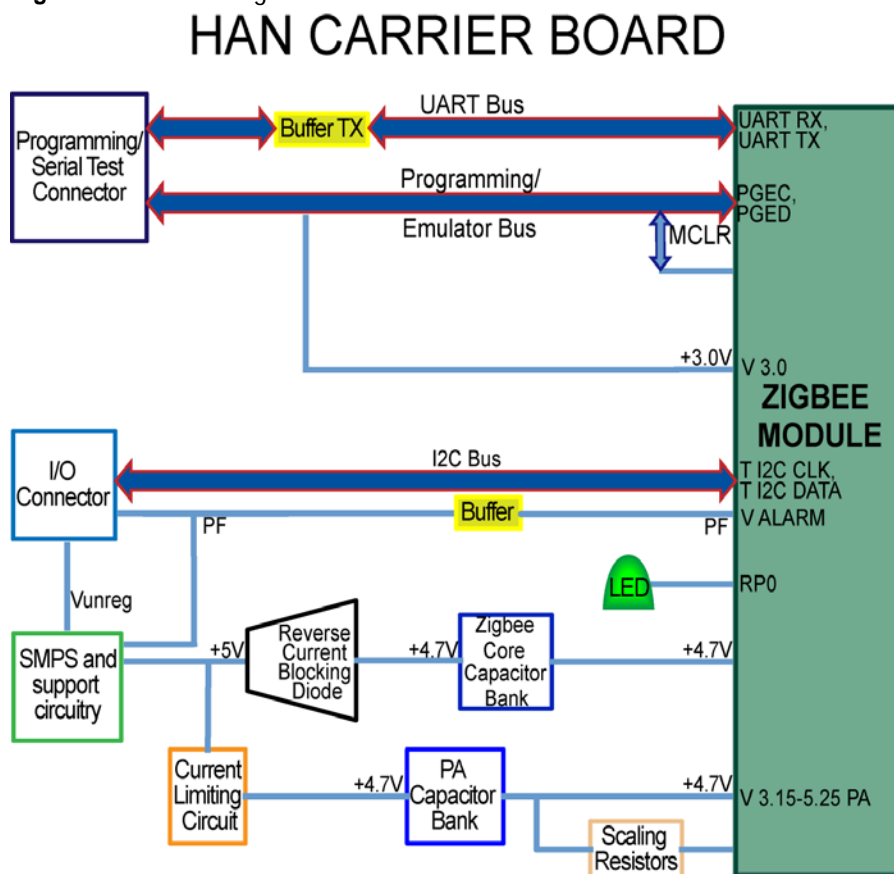
- reorient or relocate the receiving antenna
- increase the separation between the equipment and receiver
- connect the equipment into an output on a circuit different from that to which the receiver is connected
- consult the dealer or an experienced radio/TV technician for help

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. Changes not expressly approved by Aclara, could void the user's authority to operate the equipment.

This product complies with FCC OET Bulletin 65 radiation exposure limits set forth for an uncontrolled environment.

The following block diagram summarizes the interfaces and communications between the system components.

Figure 1.1 Block diagram



# SPECIFICATIONS

The HAN ZigBee<sup>®</sup> Module was designed in accordance with the IEEE 802.15.4 protocol. This section contains general, electrical, environmental, and physical specifications for the HAN ZigBee Module.

## Electrical Specifications

**Table 1.1** HAN ZigBee Module Electrical ratings

Parameter	Rating
Input Voltage	3.3 - 5V DC
Quiescent Power	≤ 50 mW
Current while transmitting RF	210 mA
Power Supply	DC energy is provided by the host.

## Compliance Specifications

**NOTE** Unless otherwise indicated, ANSI C12.1-2001 is the referring standard for tests listed in tables *Table 1.2*, *Table 1.3*, and *Table 1.4*.

**Table 1.2** HAN ZigBee Module Compliance specifications

Test Title	Applicable Specification
EMI/RFI Emission Conducted/Radiated	CFR 47 Part 15, Class B. (See also ANSI C63.4). Test No. 27
Effect of External Magnetic Field	Test No. 18
Occupied Bandwidth	2 MHz
RF Output Power	100 mW, +20 dBm or less. Meets FCC section 15.247 for field strength of emissions.
Carrier Frequency Stability	Carrier frequency is crystal controlled. Accuracy is ± 40 ppm or about ± 98 kHz.

**NOTE** Per Measurement Canada, Specifications/Standards LMG-EG-07 & PS-E-09-E are used to verify compliance with Canadian criteria.

## Environmental Specifications

**Table 1.3** HAN ZigBee Module Environmental specifications

Thermal	
Effect of Operating Temperature	Test No. 30 (-40°C - + 70°C)
Humidity	
Effect of Relative Humidity	Test No. 31 (60°C, 95% non-condensing)

# Physical Specifications

**Table 1.4** HAN ZigBee Module Physical specifications

Parameter	Specification
Approximate Weight	< 1.0 oz. (28.3 g.)
Dimensions (Diameter & Total Length)	0.9" x 1.5"

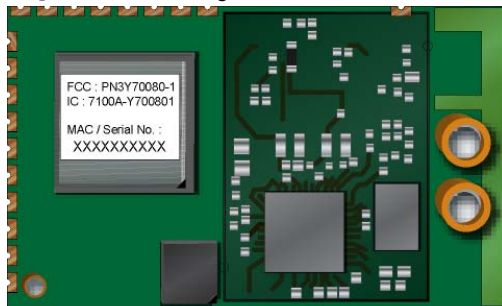
# Additional Regulatory Data

**Table 1.5** HAN ZigBee Module Labeling requirements

Labeling Requirements
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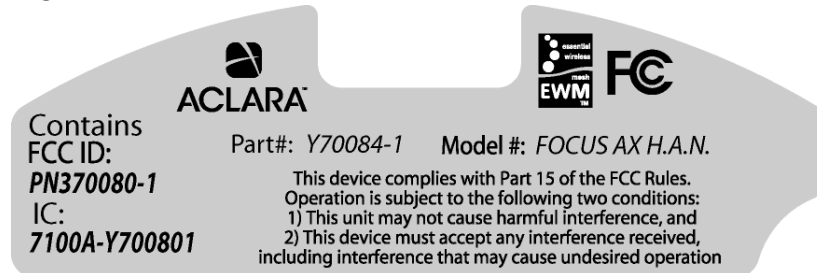
The FCC ID and IC ID numbers are located on the module label as shown in *Figure 1.1*. The Aclara serial number, which is also the MAC address, is also displayed on this label. The label shown in *Figure 1.2* must be affixed to the exterior of the host device as shown in

**Figure 1.1** HAN ZigBee Module label

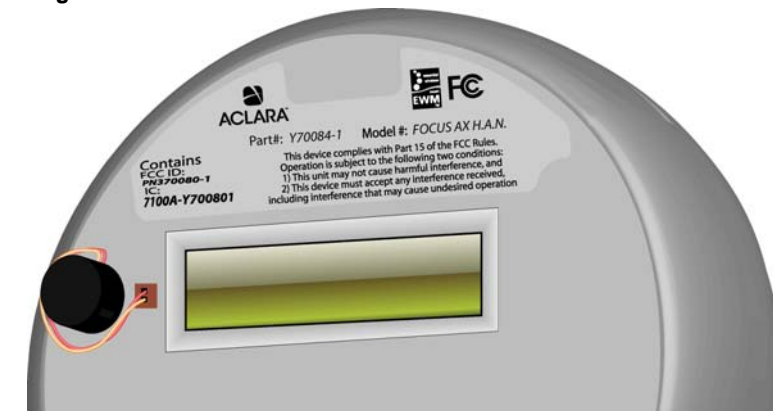


Example of label as it appears on module. Refer to Drawing Y70122-1-DWG for actual label image.

**Figure 1.2** Host device label



**Figure 1.3** Exterior HAN Module label



The following is a tabulation of regulatory data found elsewhere in this manual and is required by the regulatory agencies of some countries.

**Table 1.6** HAN ZigBee Regulatory Data

Parameter	Specification
Disclaimer noting that operation of the device is subject to conditions and that the device may not cause harmful interference and device must accept any interference received.	Regulatory Data note on page 1.
Principles of device operation	<i>HAN ZigBee Module</i> on page 1
Block diagram	<i>Block diagram</i> on page 2
Operating frequency	2400 - 2483.5 MHz,
Channeling	16 channels
Mode of transmission	Narrow Band FSK
Internal/External data source	External;
Type(s) of modulation	OQPSK (Offset quadrature phase-shift keying);
Subcarrier modulation	No.
Type of information transmitted	Equipment control
Occupied bandwidth	2 MHz,
RF output power	100 mW, +20 dBm or less. Meets FCC section 15.247 for field strength emissions
Carrier frequency stability	Crystal controlled, $\pm 40$ ppm or $\pm 98$ kHz,

**NOTE** No subcarrier is used to modulate the carrier. Refer to paragraph 2, on page 1 for more information.

