# amatis™

## THE ENERGY OF THINGS

# IPPAN (Peter)

# Installation Manual

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# 1.0  OVERVIEW

Thank you for choosing the IPPAN (or Peter) module by Amatis Controls. This Installation Manual will guide you through the process of installing the module.

IPPAN embeds wireless IPv6-based communication into each Amatis or host device, and uses wireless mesh networking technology to connect to the internet. Each IPPAN module has a unique IPv6 address and "smart" functionality which enables wireless data gathering, communication, and control of the host device.
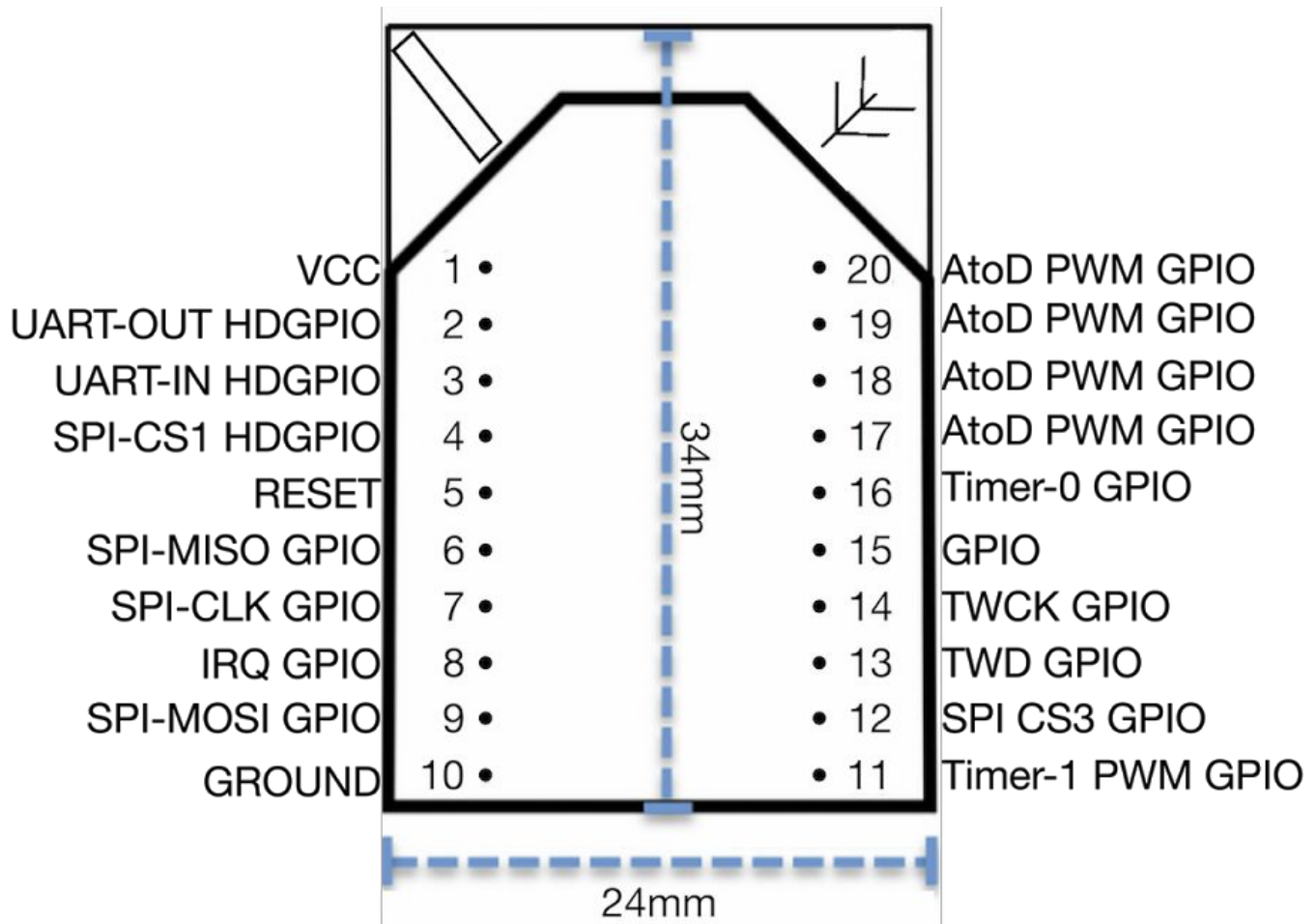
The IPPAN module is designed to be a self contained IEEE® 802.15.4 compliant wireless interface to be employed in conjunction with a variety of daughter boards that must provide a stable 3.0-3.3Vdc supply, and provides a diverse set of I/O options which include serial interface or general purpose I/O. IPPAN is comprised of a microcontroller, transceiver, amplifier, and two antennas.

# 2.0  IPPAN MODULE

## 2.1  SPECIFICATIONS

| Specification | IPPAN |
|---|---|
| Performance | |
| Tuning Range | internally calibrated for the selected IEEE channel |
| Data Rate | 250kb/s |
| Max Radio Output Power | 5.0 dbm |
| Receiver Sensitivity | -101dBm |
| Power Requirements | |
| VCC | 3.0 - 3.3Vdc, 0.3A |
| General | |
| Dimensions | 8.7 x 25.0 x 32.6 mm (H x W x D) |
| Operating Temperature | -30° C to +60° |
| Humidity | 90% RH (max), non-condensing |
| Agency Approval | |
| United States (15.247) | 2ADDY-P1 |
| Industry Canada (IC) | 20256-P1 |

## 2.2  PIN SIGNALS

| | | |
|---|---|---|
| VCC | 1 • | • 20 AtoD PWM GPIO |
| UART-OUT HDGPIO | 2 • | • 19 AtoD PWM GPIO |
| UART-IN HDGPIO | 3 • | • 18 AtoD PWM GPIO |
| SPI-CS1 HDGPIO | 4 • | • 17 AtoD PWM GPIO |
| RESET | 5 • | • 16 Timer-0 GPIO |
| SPI-MISO GPIO | 6 • | • 15 GPIO |
| SPI-CLK GPIO | 7 • | • 14 TWCK GPIO |
| IRQ GPIO | 8 • | • 13 TWD GPIO |
| SPI-MOSI GPIO | 9 • | • 12 SPI CS3 GPIO |
| GROUND | 10 • | • 11 Timer-1 PWM GPIO |

34mm

24mm

| PIN NUMBER | NAME | DESCRIPTION |
| --- | --- | --- |
| 1 | VCC | Voltage Supply |
| 2 | UART-OUT HDGPIO | Serial Uart Out or High Drive General Purpose Input/Output |
| 3 | UART-IN HDGPIO | Serial Uart In or High Drive General Purpose Input/Output |
| 4 | SPI-CS1 HDGPIO | SPI Chip Select 1 or High Drive General Purpose Input/Output |
| 5 | RESET | Module Inverted Reset |
| 6 | SPI-MISO GPIO | SPI Master Input → Slave Output or General Purpose Input/Output |
| 7 | SPI-CLK GPIO | SPI Clock or General Purpose Input/Output |
| 8 | IRQ GPIO | External Interrupt or General Purpose Input/Output |
| 9 | SPI-MOSI GPIO | SPI Master Output → Slave Input or General Purpose Input/Output |
| 10 | GROUND | Ground |
| 11 | Timer-1 PWM GPIO | Timer Counter or Pulse Width Modulation or General Purpose Input/Output |
| 12 | SPI CS3 GPIO | SPI Chip Select 1 or General Purpose Input/Output |
| 13 | TWD GPIO | Two Wire Data or General Purpose Input/Output |
| 14 | TWCK GPIO | Two Wire Clock or General Purpose Input/Output |
| 15 | GPIO | General Purpose Input/Output |
| 16 | Timer-0 GPIO | Timer Counter or General Purpose Input/Output |
| 17 | AtoD PWM GPIO | Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output |
| 18 | AtoD PWM GPIO | Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output |
| 19 | AtoD PWM GPIO | Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output |
| 20 | AtoD PWM GPIO | Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output |

## 2.3  Antennas

IPPAN's antennas are integrated into the pcb and to meet fcc regulations cannot be modified. The ceramic antenna has a gain less than 2.2 dBi, and the monopole (whip) antenna has a gain of less than 5.19 dBi. IPPAN uses spatial diversity and a proprietary algorithm to select the antenna with the best performance characteristics.

## 2.4  Operating Channels

IPPAN provides a wide range of channels listed below

| IEEE 802.15.4 Operating Channels | Operating Frequency [GHz] |
|---|---|
| 13 | 2.415 |
| 14 | 2.420 |
| 15 | 2.425 |
| 16 | 2.430 |
| 17 | 2.435 |
| 18 | 2.440 |
| 19 | 2.445 |
| 20 | 2.450 |
| 21 | 2.455 |
| 22 | 2.460 |
| 23 | 2.465 |
| 24 | 2.470 |

# 3.0  Modes of Operation

The final use and application of IPPAN is dependent on the firmware pre-installed at the factory. However, all applications have common modes of operations that can summarized as follows**:**

### Idle Mode
IPPAN enters into idle mode of operation whenever the device is not in transmit, or receive mode, or when there is no data to process.

### Data Processing Mode
When an interrupt, timer, frame reception, or frame transmission event occurs IPPAN moves out of idle mode and into data processing mode. In this mode IPPAN can processes information and act on data accordingly.

### Receive Mode
When a 802.15.4 compliant message is received by the transceiver and it's either addressed for IPPAN or broadcast the device can be said to be in receive mode. In receive mode IPPAN validates data and address before accepting the message for processing.

### Transmit Mode
In this mode IPPAN generates an 802.15.4 compliant message that can be sent directly to another IPPAN or broadcast to all other IPPAN modules within radio range. Transmission mode is preceded by user interaction, a data logging event, a network maintenance message or as a response to a message acknowledgement request.

# 4.0  INSTALLATION

## Design Guidelines

IPPAN will come pre programed from the manufacture, and in many cases pre-installed in a device. If you have elected to install IPPAN in house, it is important to understand the it's proper installation.

- The IPPAN Module is designed to mount into a 20 pin socket.
  - Samtec P/N: MMS-110-01-L-SV.
  - Samtec P/N: SMM-110-02-SM-S.
- No soldering is required when installing the Module.
- Standard electrostatic discharge precautions should be taken when handling the module.
- The socket should be designed in a manner where the radiating structures (antenna) are away from other sensitive electronics
- The monopole antenna should stand perpendicular to the module (see FIG 4.0).
- No antenna modifications can be made (see section 5.0)
- FCC labeling guidelines must be maintained (see section 5.0)
- All stated electrical maximum and minimum values must be met (see section 2.1)

## End User Guidelines

The module is designed to be used in fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is maintained between the transmitter's radiating structures and the body of the user or nearby persons.

If the end user experiences communication problems it is recommended to move the transceivers closer to one another or purchase a repeater.

Objects including, but not limited to, steel reinforced walls, metal electrical boxes, water, and snow may degrade the working distance between transceivers, and if possible should be avoided. IPPAN is designed to operate in a mesh network, and in most cases adding nodes can help overcome any communication issues.

FCC requires specific text to be placed within user's manual or operator instruction guide for the final commercial product. Specific details on this text can be found in the IPPAN Module Integration Instructions.(see section 5.0)
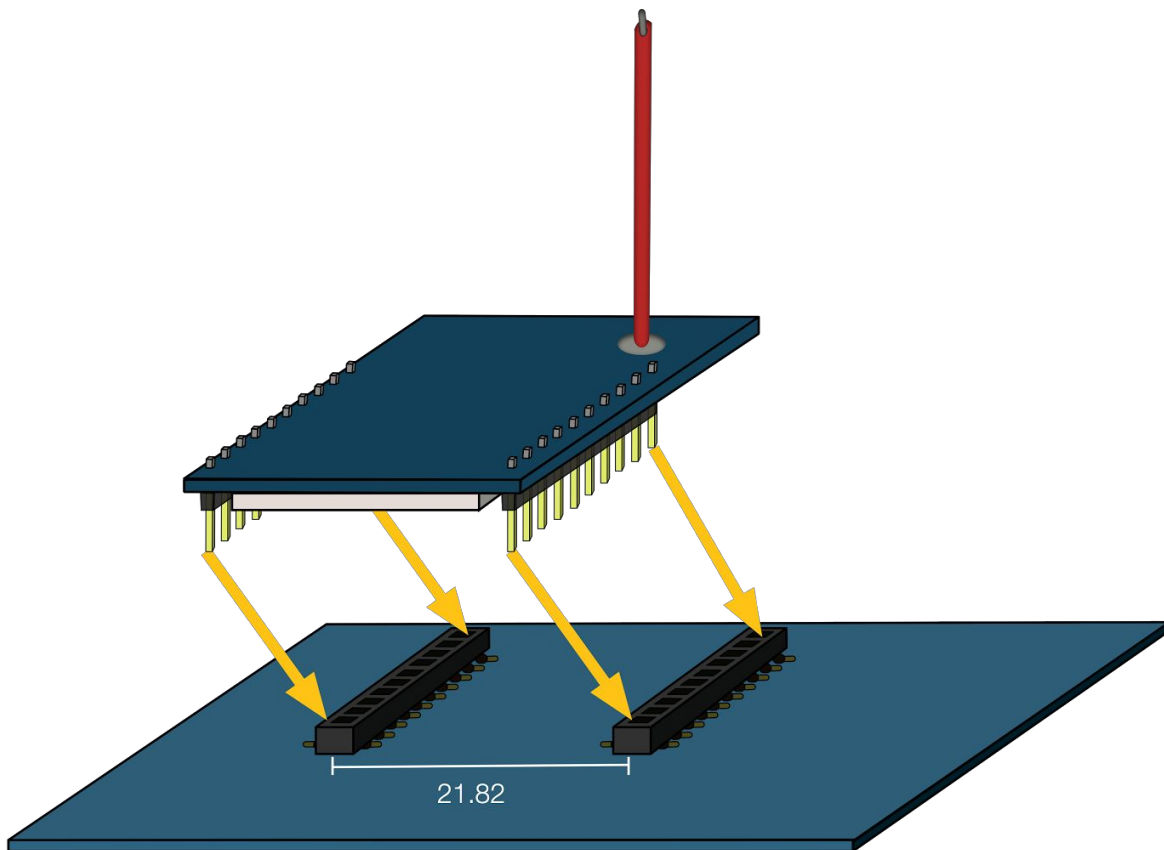
FIG 4.0

# 5.0  AGENCY CERTIFICATIONS

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**Operating Requirements and Conditions**

The design of *IPPAN* complies with Part 15 of the U.S. Federal Communications Commission guidelines respecting safety levels of radio frequency (RF) exposure for Mobile devices.

**Mobile Device RF Exposure Statement**

RF Exposure - This device is only authorized for use in a mobile application. At least 20cm of separation distance between the *IPPAN* device and the user's body must be maintained at all times.

**Caution Statement for Modifications**

CAUTION: Any changes or modifications not expressly approved by *Amatis Controls, LLC* could void the user's authority to operate the equipment.

**FCC Notices**

IPPAN 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 an 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 IPPAN off and on the user is encouraged to try to correct the interference by one or more of the following measures:
- 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 for help.

**OEM Labeling Requirements**

**WARNING!** The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below.

**FCC:**

Contains FCC ID: 2ADDY-P1

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

**CANADA (IC):**

Contains Model IPPAN P1, IC:20256-P1

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