amatis™

THE ENERGY OF THINGS

IPPAN2
Installation Manual

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1.0 OVERVIEW

Thank you for choosing the IPPAN2 module by Amatis Controls, LLC. This manual will guide you through the process of installing the module.

IPPAN2 embeds wireless IPv6-based communication into each Amatis or host device, and uses wireless mesh networking technology to connect to the internet. Each IPPAN2 module has a unique IPv6 address and "smart" functionality which enables wireless data gathering, communication, and control of the host device.

The IPPAN2 module is designed to be a self-contained IEEE® 802.15.4 and BLE compliant wireless interface to be employed in conjunction with a variety of daughter boards that maintain a stable 2.1-3.3Vdc supply. IPPAN2 provides a diverse set of I/O options such as serial interface or general purpose I/O. IPPAN2 is comprised of a microcontroller, transceiver, amplifier, and three antennas.

2.0 IPPAN2 MODULE

FIG 1.0

2.1 SPECIFICATIONS

Specification	IPPAN2
Performance	
Tuning Range	Internally calibrated for the selected IEEE channel
Data Rate	250kb/s
Max 802.15.4 Radio Output Power	16.4dBm
Max BLE Radio Output Power	2.0dBm
802.15.4 Receiver Sensitivity	-101dBm
BLE Receiver Sensitivity	-96 dBm
Power Requirements	
VCC	2.0 - 3.3Vdc, 0.3A
General	
Dimensions	5.7 x 24.3 x 33 mm (H x W x D)
Operating Temperature	-30° C to + 60° C
Humidity	90% RH (max), non-condensing
Agency Approval	
United States (FCC, 15.247)	2ADDY-P2
Industry Canada (IC)	20256-P2

FIG 2.0

2.2 PIN SIGNALS

IPPAN2 NORDIC PINS

3v3	P01	PWR		ADC	P32	PO.05/AIN3
AIN7/DOUT/PO.31	P02	SER		ADC	P31	PO.04/AIN2
AIN5/DIN/PO.29	P03	SER		ADC	P30	PO.03/AIN1
PO.27	P04	DIO		ADC	P29	PO.02/AIN0
RESET/PO.21	P05	RST		DIO	P28	PO.20
MISO/PO.13	P06	SPI		DIO	P27	PO.22
SCLK/PO.17	P07	SPI		I2C	P26	PO.23/SCL
PO.16	P08	DIO		I2C	P25	PO.26/SDA
MOSI/PO.14	P09	SPI		SPI	P24	PO.24/CS
GND	P10	GND		ADC	P23	PO.28/AIN4
XL1/PO.00	P11	RTC?		DIO	P22	PO.25
XL2/PO.01	P12	RTC?		PRG	P21	SWDIO
SCLK/PO.12	P13	iSPI		PRG	P20	SWCLK
MOSI/PO.09	P14	iSPI		RAD	P19	SC/AMP_BYPASS
MISO/PO.10	P15	iSPI		RAD	P18	PO.08/RADIO_RESET
RADIO_CS/PO.06	P16	iSPI		RAD	P17	PO.15/RADIO_IRQ

FIG 3.0

PIN #	NAME	DESCRIPTION
1	VCC	Voltage Supply
2	UART-DOUT HDGPIO	Serial Uart Out or High Drive General Purpose Input/Output
3	UART-DIN 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	GPIO-1	General Purpose Input/Output
12	GPIO-2	General Purpose Input/Output
13	SPI-CLK GPIO	SPI Clock or General Purpose Input/Output
14	SPI-MOSI GPIO	SPI Master Output → Slave Input or General Purpose Input/Output
15	SPI-MISO GPIO	SPI Master Input → Slave Output or General Purpose Input/Output
16	RADIO-SLEEP	Radio sleep control or General Purpose Input/Output
17	RADIO-IRQ	Radio interrupt control or General Purpose Input/Output
18	RADIO-RESET	Radio reset control or General Purpose Input/Output
19	AMP-BYPASS	Radio low power mode control
20	SWCLK	General Purpose Input/Output
21	SWDIO	General Purpose Input/Output
22	P0.25	General Purpose Input/Output
23	Timer-1 PWM GPIO	Timer Counter or Pulse Width Modulation or General Purpose Input/Output
24	SPI CS3 GPIO	SPI Chip Select 1 or General Purpose Input/Output
25	TWD GPIO	Two Wire Data or General Purpose Input/Output
26	TWCK GPIO	Two Wire Clock or General Purpose Input/Output
27	GPIO-3	General Purpose Input/Output
28	Timer-0 GPIO	Timer Counter or General Purpose Input/Output
29	AtoD PWM GPIO	Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output
30	AtoD PWM GPIO	Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output
31	AtoD PWM GPIO	Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output
32	AtoD PWM GPIO	Analog to Digital Converter or Pulse Width Modulation or General Purpose Input/Output

FIG 4.0

2.3 Antennas

The antennas on IPPAN2 are integrated into the PCB and to meet FCC regulations cannot be modified. The two ceramic antennas have a gain less than 0.5dBi, and the helical antenna has a gain of less than 3dBi. IPPAN2 uses spatial diversity and a proprietary algorithm to select between one ceramic antenna and the helical antenna, to choose the one with the best performance characteristics. There is only one ceramic antenna for BLE transmissions.

2.4 Operating Channels

IPPAN2 provides a wide range of channels listed below

IEEE 802.15.4 Operating Channels	Operating Frequency [GHz]
11	2.405
12	2.410
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
25	2.475

FIG 5.0

3.0 Modes of Operation

The final use and application of IPPAN2 is dependent on the firmware pre-installed at the factory. However, all applications have common modes of operations that can be summarized as follows for both the IEEE® 802.15.4 and BLE radios**:**

NOTE: IEEE® 802.15.4 can be used only when BLE is not in use.

Idle Mode
IPPAN2 enters 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 IPPAN2 moves out of idle mode and into data processing mode. In this mode IPPAN2 can processes information and act on data accordingly.

Receive Mode
When a 802.15.4, or BLE, compliant message is received by the transceiver and it's either addressed for IPPAN2 or broadcast the device can be said to be in receive mode. In receive mode IPPAN2 validates data and address before accepting the message for processing.

Transmit Mode
In this mode IPPAN2 generates an 802.15.4, or BLE, compliant message that can be sent directly to another IPPAN2 or broadcast to all other IPPAN2 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

IPPAN2 will come pre-programed from the manufacture, and in many cases pre-installed in a device. If you have elected to install IPPAN2 in house, it is important to understand how to handle, instal, and use properly.

4.1   DESIGN GUIDELINES

- The IPPAN2 Module is designed either to be surface mounted or to mount into a standard 20 pin footprint using the following sockets:
  - Samtec P/N: MMS-110-01-L-SV
  - Samtec P/N: SMM-110-02-SM-S
- 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
- No antenna modifications can be made (see section 5.0)
- FCC labeling guidelines must be maintained (see section 5.0)
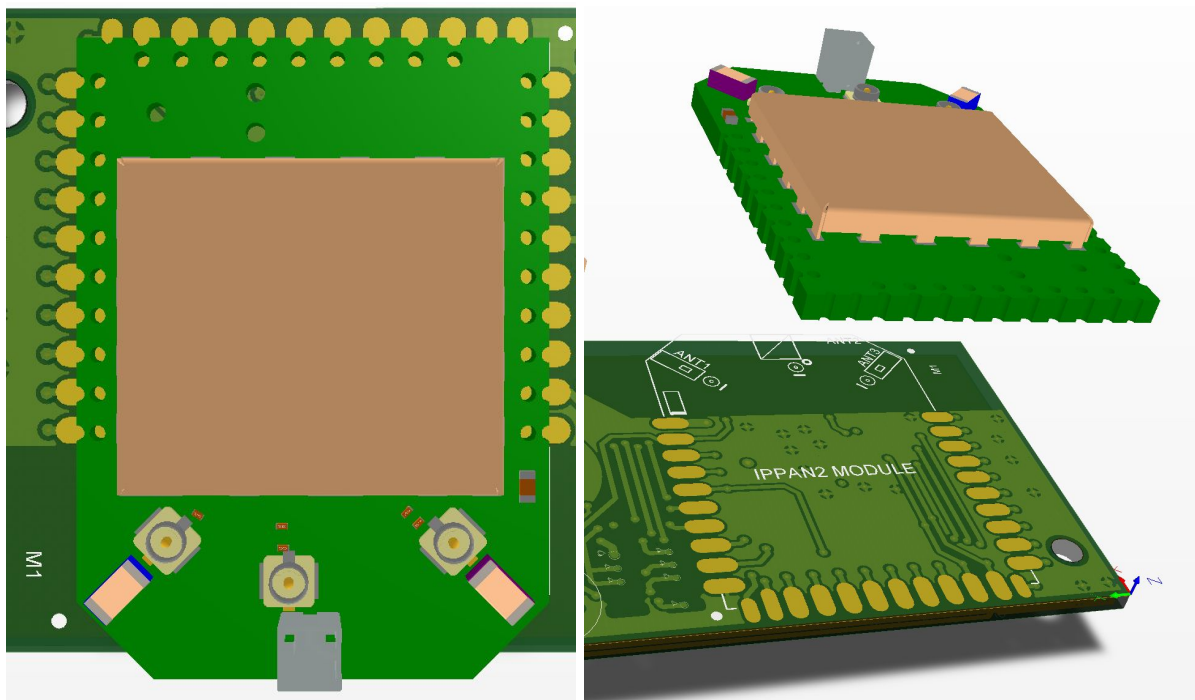- All stated electrical maximum and minimum values must be met (see section 2.1)

FIG 6.0

4.2 END USER GUIDELINES

The module is designed to be used in fixed locations. 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 should be avoided. IPPAN2 is designed to operate in a mesh network, and in most cases adding nodes can help overcome 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 section 5.0.

5.0 AGENCY CERTIFICATIONS

Operating Requirements and Conditions
The design of IPPAN2 complies with FCC and IC 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 20 cm of separation distance between the IPPAN2 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
IPPAN2 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 IPPAN2 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.

You must include the following text in final commercial product manual:

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

Exigences et conditions de fonctionnement:
La conception de IPPAN2 est conforme aux limites d'exposition aux Frequences Radio définies par les normes IC et FCC pour les appareils mobiles.⬚

Déclaration d'exposition aux fréquences radio d'appareil mobile
Exposition fréquences radio - Cet appareil est seulement conçu pour usage mobile. Au moins 20 cm de séparation doit être maintenue à tout instant entre l'appareil IPPAN2 et l'utilisateur.

Déclaration de mise en garde concernant les modifications
ATTENTION: Tous changements ou modifications qui ne sont pas expressément approuvés par *Amatis Controls, LLC* sont susceptibles de révoquer les droits d'utilisation de cet équipement.

Avis IC
IPPAN2 a été testé et entre dans la catégorie des appareils numériques de Classe B, selon la Section 15 de la réglementation de la IC. Ces limites ont été conçues pour protéger les installations domestiques contre les interférences néfastes. Cet équipement génère, utilise et émet de l'énergie sous forme de fréquences radio et, en cas de non-respect des instructions d'installation et d'utilisation, risque de provoquer des interférences radio. Il n'existe cependant aucune garantie contre ces interférences.

En cas d'interférences radio ou télévisuelles, pouvant être vérifiées en allumant, puis en éteignant l'équipement, l'utilisateur est invité à essayer de résoudre le problème de l'une des façons suivantes :
- Eloigner l'équipement du poste de réception ;
- Brancher l'équipement sur une prise appartenant à un circuit différent de celui du récepteur ;
- Demander de l'aide auprès du revendeur ou d'un technicien radio/TV

6.0 OEM Labeling Requirements

WARNING! The Original Equipment Manufacturer (OEM) must ensure that FCC/IC 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-P2

IC:

    Contains IC:20256-P2

Exigences en matière d'étiquetage OEM :

ATTENTION! Le fabricant d'équipement d'origine (OEM) doit veiller à ce que les exigences en matière d'étiquetage de la FCC / IC soient respectées. Cela comprend une étiquette clairement visible sur l'extérieur de l'enceinte du produit final qui affiche le contenu ci-dessous.

FCC:

    Contient FCC ID: 2ADDY-P2

IC:

    Contient IC:20256-P2

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