

## Overview

The ATM2-MOD-A Module includes ATM2202 which is part of the family of extreme low-power Bluetooth® 5 system-on-a-chip (SoC) solutions. This Bluetooth Low Energy SOC integrates a Bluetooth 5.0 compliant radio with ARM® Cortex® M0 application processor, 1 MB embedded Flash, 128 KB Random Access Memory (RAM), 256 KB Read Only Memory (ROM), 4 KB One-Time-Programmable (OTP) memory, and state-of-the-art power management. Please refer to the ATM2202 datasheet.

The extremely low power ATM2 series SoC with 1 mA active Rx and 2.5 mA active Tx is designed to extend battery life for the Internet-of-Things (IoT). Support for low duty cycle operation allows systems to run for significantly longer time periods without battery replacement.

## Features

- Compliant with Bluetooth 5.0 standard
- Supports Bluetooth 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
- SoC typical power consumption with 3 V battery including PMU
  - Active Rx @ -95 dBm: 1.0 mA
  - Active Tx @ 0 dBm: 2.5 mA
  - Retention @ 32 KB RAM: 2  $\mu$ A
  - Hibernation with Wakeup Receiver: 0.95  $\mu$ A
  - Hibernate: 0.8  $\mu$ A
  - Soc Off: 300 nA
- CPU: 16 MHz ARM Cortex M0 processor, programmable interrupt router
- Memory: 1 MB embedded Flash, 256 KB ROM, 128 KB RAM, and 4 KB OTP
- Retention RAM configuration: 16 KB to 128 KB in 16 KB step sizes
- RF Wakeup Receiver
- Interfaces: I2C, SPI, UART, PWM, GPIO
- 10-bit application ADC
- Digital microphone Input (PDM)
- 32.768 kHz/16 MHz crystal oscillator
- SWD for interactive debugging
- AES 128 hardware
- True random number generator (TRNG)
- Sensor Hub
- Keyboard matrix controller (KSM)
- Quadrature decoder for mouse input (QDEC)
- 32.768 kHz/16 MHz crystal oscillator
- 1.1 V to 3.3 V battery input voltage with integrated Power Management Unit (PMU)
- Module Dimensions
  - 10.5mm x 20.2mm x 2.4mm (Width x Length x Height)

# 1 Revision History

Date	Version	Description
Mar. 22, 2021	1.00	Updated BLE SIG certification information in <a href="#">7.4 Bluetooth® SIG Qualification</a> Update Packing Information in <a href="#">8. Packing Information</a> Update Ordering Information in <a href="#">9. Part Ordering</a>
Apr. 6, 2021	1.01	Modified Packing Information in <a href="#">8. Packing Information</a>
Aug. 2, 2021	1.02	Updated Figure 5.2-1 in <a href="#">5.2 Recommended PCB Footprint</a> Updated Canada/ISED ID Number in <a href="#">7. Certification</a>
Sep. 23, 2022	1.03	Updated Company information

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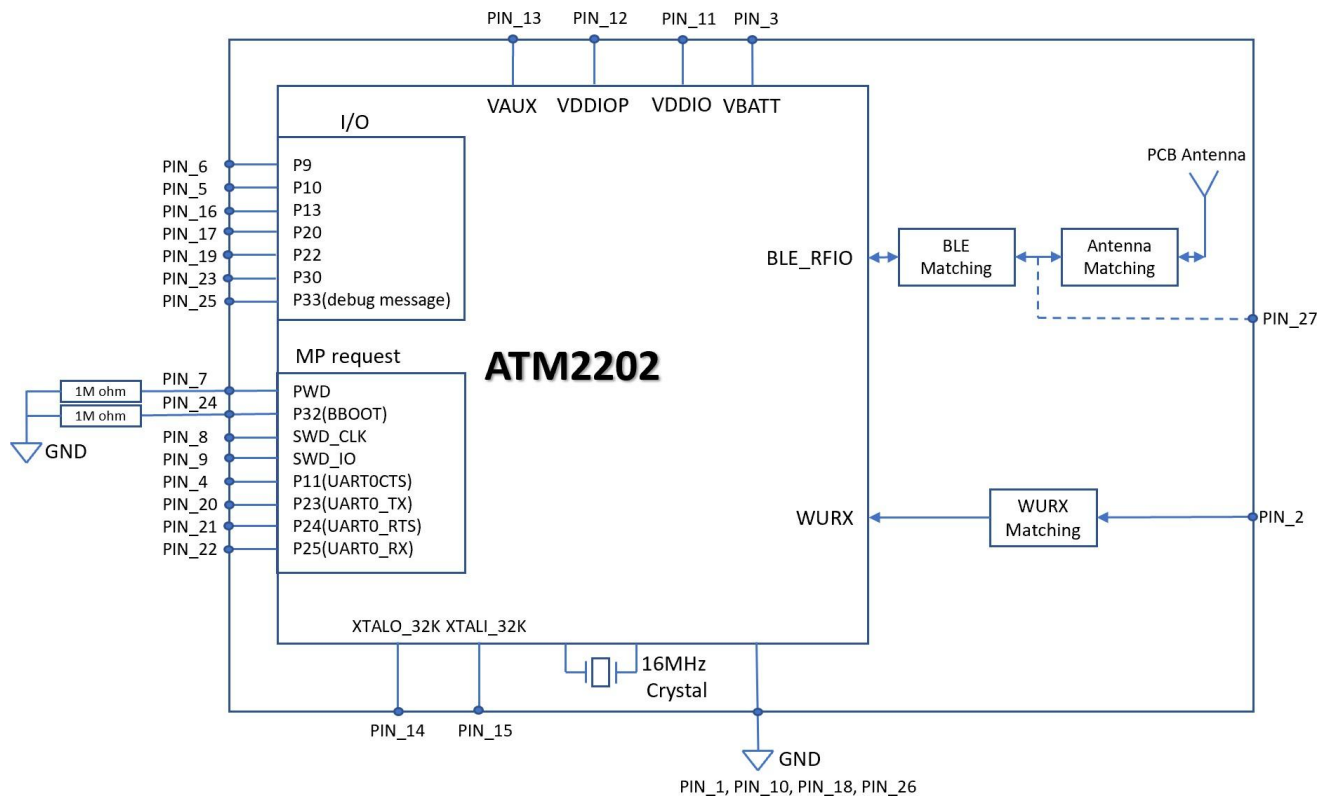
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## 2 Functional Description

The ATM2-MOD-A Module is based on the ATM2202 SoC, which includes a Bluetooth® 5 solution and an RF wakeup receiver. The block diagram of the ATM2-MOD-A module is shown in Figure 2-1.

**Figure 2-1** Module Block Diagram



## 2.1 Power Management

The power management unit provides I/O power supplies to the ATM2 module. PMU generates power supply outputs: VDDIOP, and an auxiliary supply VAUX used internally by the PMU. The PMU External Pins table is shown in [Table 2.1-1](#).

**Table 2.1-1 PMU External Pins**

PIN	Description
VBATT	Battery input. Battery voltages from 1.1 V to 3.3 V can be used. Must be connected to a battery or external supply.
VDDIOP	VDDIOP is PMU generated 1.8 V IO supply output.
VAUX	Auxiliary supply output of typical value 3.2 V, used internally by the PMU.
VDDIO	Power supply input for digital and analog IO circuits.

The PMU provides multiple brownout interrupts to enable more reliable operation.

### PMU configurations

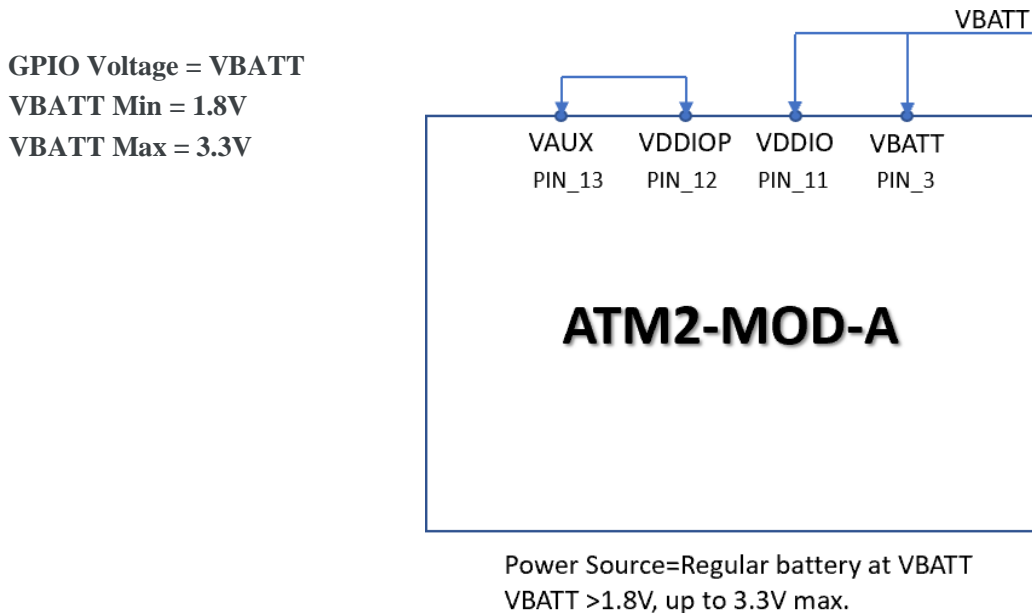
The PMU must be configured correctly to ensure correct operation. The following modes of operation are supported by the PMU:

(a) One external power supply or battery with external IO supply:

For applications that cannot support fixed 1.8 V IO supply. See [Figure 2.1-1](#).

- Connect VBATT to VDDIO
- Connect VAUX to VDDIOP
- Disable IO supply generation

**Figure 2.1-1 Regular Battery, External IO Supply**

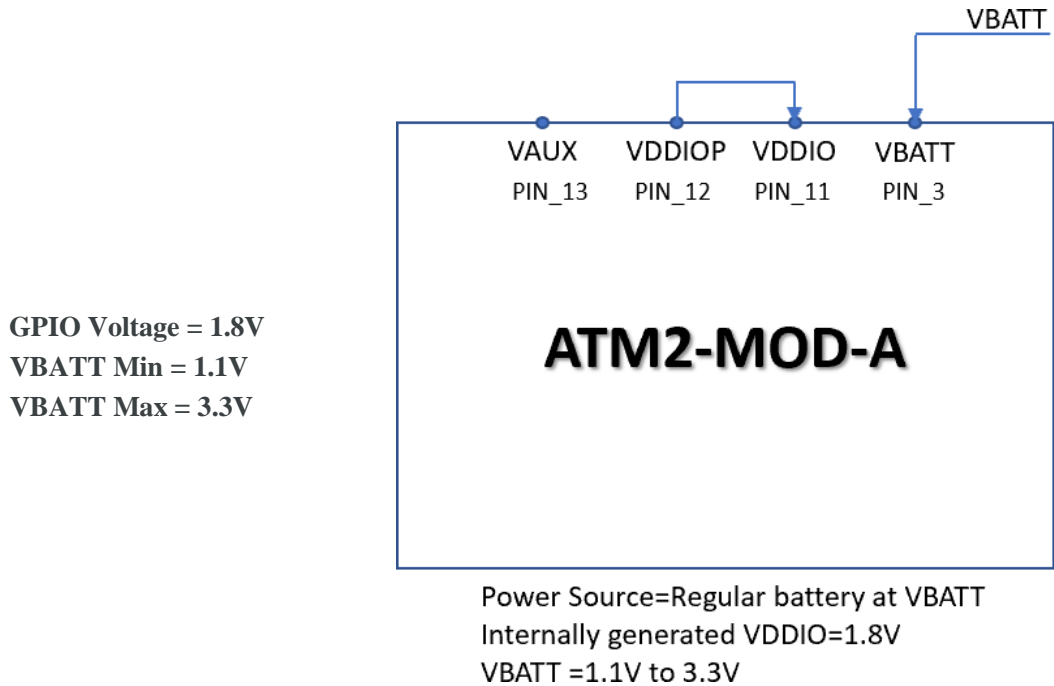


(b) One external power supply or battery with internally generated IO supply:

For applications that can use a fixed 1.8 V IO supply for better power consumption or VBATT <= 1.8 V. See [Figure 2.1-2](#).

- Connect VDDIOP to VDDIO

**Figure 2.1-2 Regular Battery, Internal IO Supply**



### 3 Electrical Specification

All parameters are based on 3 V supply at 25 °C unless otherwise specified.

**Table 3-1 Maximum Electrical Ratings**

Maximum Ratings					
Symbol	Parameter	Min	Typ	Max	Unit
VBATT	Battery supply <sup>1</sup>	-0.2		3.4	V
VDDIO	I/O supply	-0.2		3.4	V
VIO	I/O pin	-0.2		3.4	V
T <sub>STORE</sub>	Storage Temperature	-40		125	°C

**Table 3-2 Recommended Operating Conditions**

Recommended Operating Conditions					
Symbol	Parameter	Min	Typ	Max	Unit
VDDIO	I/O supply	1.7	1.8	3.3	V
VBATT	Battery supply	1.1 <sup>2</sup>		3.3	V
VPP25	OTP Programming Voltage <sup>3</sup>	2.3	2.5	2.7	V
VIO	I/O pin	-0.2		VDDIO+0.2	V
	Crystal Osc - 32.768 kHz	-500		500	ppm
T <sub>J</sub>	Operating Junction Temperature	-40	25	85	°C

<sup>1</sup> VBATT minimum slew rate is 0.3 V/ms

<sup>2</sup> VBATT minimum supply after boot is 1.0 V

<sup>3</sup> VPP25 is physically connected to VDDIO. Set VDDIO to within VPP25 range when programming the OTP.



**Table 3-3 GPIO Characteristics**

<b>GPIO Characteristics</b>					
<b>Parameter</b>	<b>Conditions</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Input VIH		VIO-0.5	VIO	VIO	V
Input VIL		-0.2	0	0.2	V
Output VOH	2 mA Load		VIO-0.2		V
Output VOL	2 mA Load		0.2		V

**Table 3-4 Power Consumption**

<b>Power Consumption</b>					
VBATT current at 3 V with internally generated IO supply					
<b>Parameter</b>	<b>Conditions</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Active RX	Sensitivity at -95 dBm		1		mA
Active TX @ 4 dBm	Output power at 4 dBm		4		mA
Active TX @ 0 dBm	Output power at 0 dBm		2.5		mA
Active TX @ -10 dBm	Output power at -10 dBm		1.4		mA
Retention (32 KB RAM)			2		μA
Hibernation			0.8		μA
Hibernation with Wakeup Receiver			0.95		μA
SoC Off			300		nA

## 4 Pin Assignments

### 4.1 ATM2-MOD-A Module Pinout

Figure 4-1 Module Pin Definition

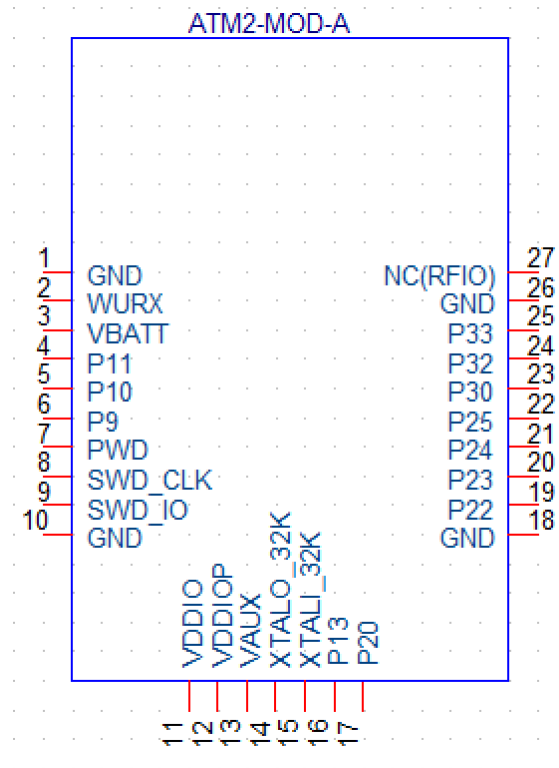


Table 4-1 Pin Type Definitions

Pin Type Definitions	
Pin Type	Definition
I/O	Signal Input Output
RF	Radio Frequency
PWR	Power supply
A	Analog
NC	No connection, must be open
GND	Ground

Table 4-2 ATM2-MOD-A Module Pin Description

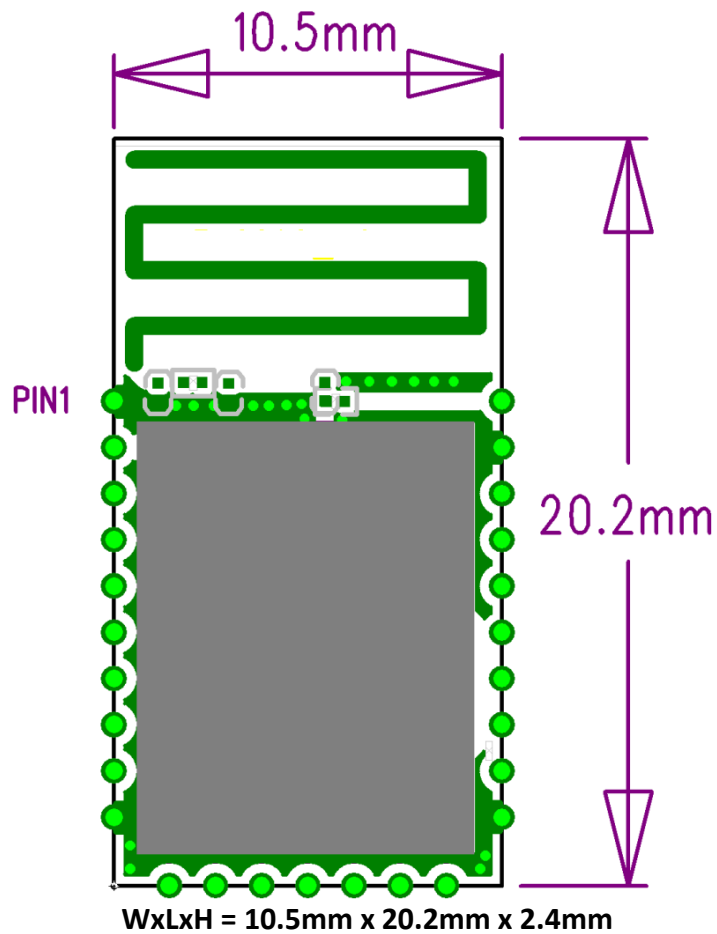
ATM2-MOD-A Module Pin Description			
Pin Number	Name	Type	Description
1	GND	PWR	Ground reference
2	WURX	RF	Wakeup receiver RF input
3	VBATT	PWR	Battery supply
4	P11	I/O	Programmable Digital I/O ADC Input The default definition is UART0_CTS.
5	P10	I/O	Programmable Digital I/O ADC Input The default definition is SPIO_CS.
6	P9	I/O	Programmable Digital I/O ADC Input The default definition is I2C0_SCK.
7	PWD	I/O	Power Down Input (Active High) Must connect to a 1 M $\Omega$ pull-down resistor.
8	SWD_CLK	I/O	Serial wire debug clock
9	SWD_IO	I/O	Serial wire debug data
10	GND	PWR	Ground reference
11	VDDIO	PWR	Digital I/O power supply input
12	VDDIOP	PWR	1.8 V I/O power supply output generated by switcher, connected to VAUX if unused
13	VAUX	PWR	Reserved for switching regulator internal use
14	XTALO_32k	A	32.768 kHz crystal oscillator output
15	XTALI_32k	A	32.768 kHz crystal oscillator input
16	P13	I/O	Programmable Digital I/O The default definition is SPIO_MISO.
17	P20	I/O	Programmable Digital I/O The default definition is SPIO_CLK.
18	GND	PWR	Ground reference
19	P22	I/O	Programmable Digital I/O The default definition is SPIO_MOSI.
20	P23	I/O	Programmable Digital I/O The default definition is UART0_TX.
21	P24	I/O	Programmable Digital I/O The default definition is UART0_RTS.
22	P25	I/O	Programmable Digital I/O The default definition is UART0_RX.
23	P30	I/O	Programmable Digital I/O The default definition is I2C0_SDA.

24	P32	I/O	Programmable Digital I/O BBoot , must connect to a 1 MΩ pull-down resistor.
25	P33	I/O	Programmable Digital I/O The default definition is UART1_TX, to provide SW debug message output
26	GND	PWR	Ground reference
27	NC (RFIO)	NC	No connection Reserved for 2.4 GHz Single-ended RF I/O for Bluetooth radio external antenna connection (50 Ω).

## 5 Mechanical Drawing

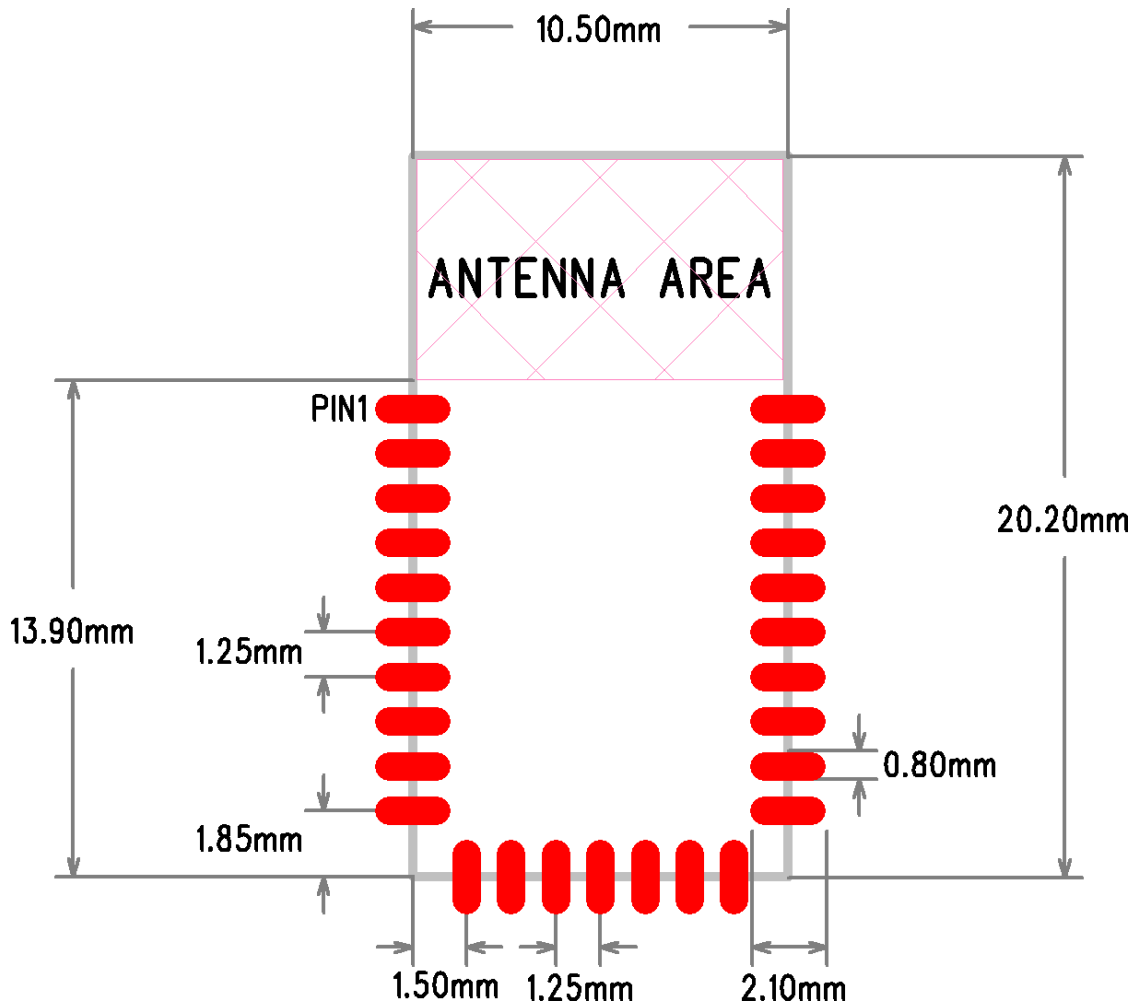
### 5.1 Module Dimensions

Figure 5.1-1 ATM2-MOD-A Module with Antenna Dimensions



## 5.2 Recommended PCB Footprint

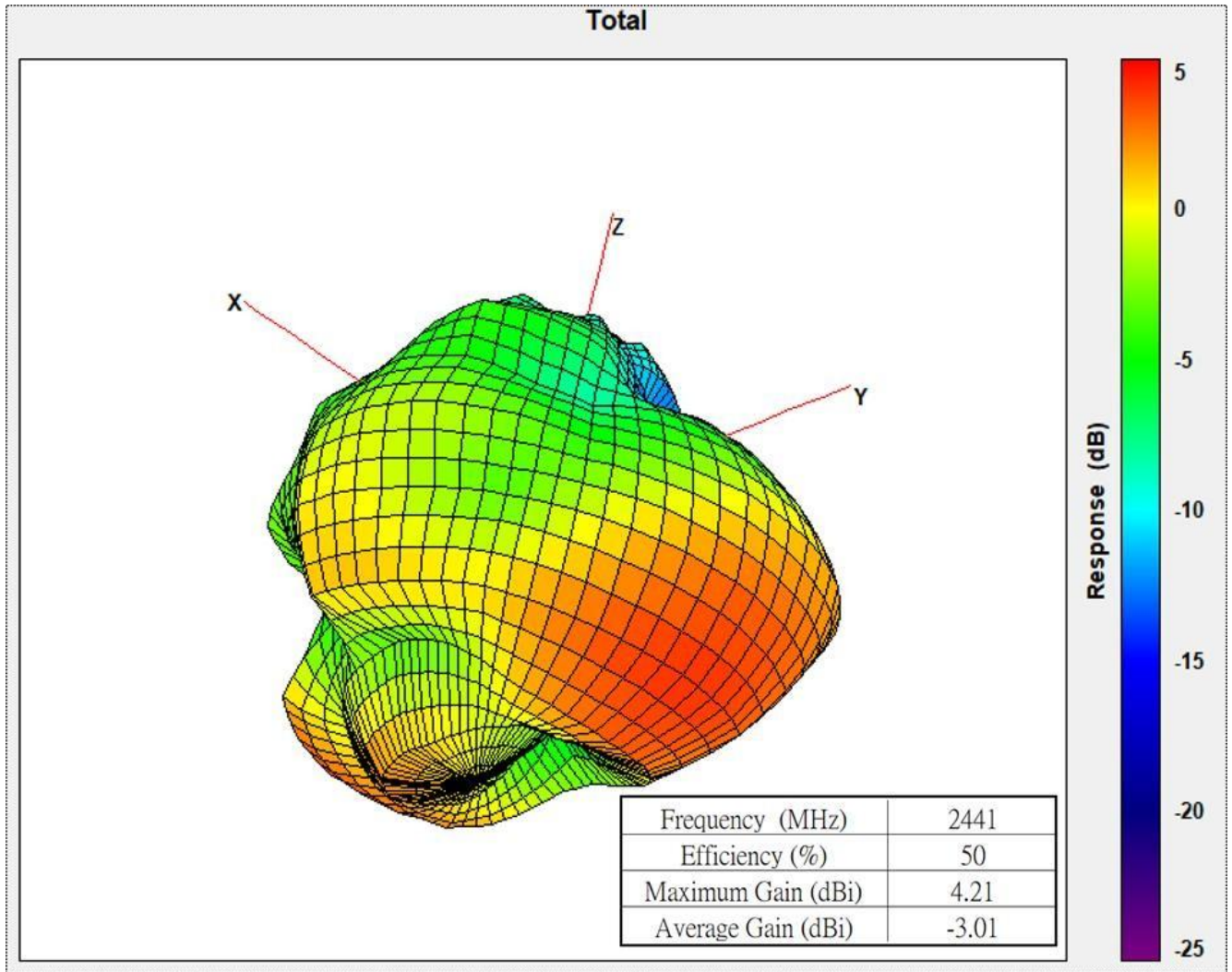
Figure 5.2-1 ATM2-MOD-A Module Recommended PCB Footprint



- The PCB board below the antenna area must be kept empty on all PCB layers to avoid affecting the antenna impedance.

## 6 PCB Antenna Performance

Figure 6-1 ATM2-MOD-A PCB Antenna Radiation Pattern and Characteristics



## 7 Certification

The ATM2-MOD-A module has been approved by the following regulations:

- United States/FCC
  - FCC ID: 2AXI2-ATM2-MOD-A-00
- Canada/ISED
  - IC ID: 26472-ATM2MODA000
- Europe/CE
- Bluetooth® SIG Qualification

### 7.1 FCC (U.S.A)

ATM2-MOD-A gets single modular approval. This device complies with Part 15 of the FCC Rules. The module has been tested for Radio, MPE and EMC. The applicable standards of ATM2-MOD-A module are:

- Radio: 47 CFR FCC Part 15.247
- MPE: 47 CFR FCC Part 2.1091
- EMI: 47 CFR FCC Rules and Regulations Part 15 Subpart B Class B Digital Device

### 7.2 ISED (Canada)

ATM2-MOD-A complies with RSS-102, Issue 5 (March 2015) and RSS-Gen, Issue 5 (March 2019). The module has been tested for Radio, MPE and EMC. The applicable standards of ATM2-MOD-A module are:

- Radio: IC RSS-247 Issue 2, 2017-02 and RSS-Gen Issue 5, 2018-04
- MPE: RSS-102 Issue 5
- EMI: ICES-003, Issue 6 Class B

### 7.3 CE (Europe)

The ATM2-MOD-A Module is a Radio Equipment Directive assessed radio(RED) that is CE marked. The module has been manufactured and tested with the intention of being a sub assembly to a final product. The module has been tested for Radio, MPE and EMC. The applicable standards of ATM2-MOD-A module are:

- Radio: EN 300 328 V2.2.2 (2019-07)
- MPE: EN 62479:2010 and EN 50663:2017
- EMC: EN 301 489-1 v2.1.1, EN 301 489 v3.1.1

### 7.4 Bluetooth® SIG Qualification

Declaration ID	QDID	Products
D051903	158417 135477 136087	OPTO-SENSOR BLE 5.0 Module, ATMx-MOD
D046477	136087	ATM2202 ATMxxxx BLE 5.0 Host Subsystem
D046476	135477	ATM2202 ATMxxxx BLE 5.0 Controller Subsystem



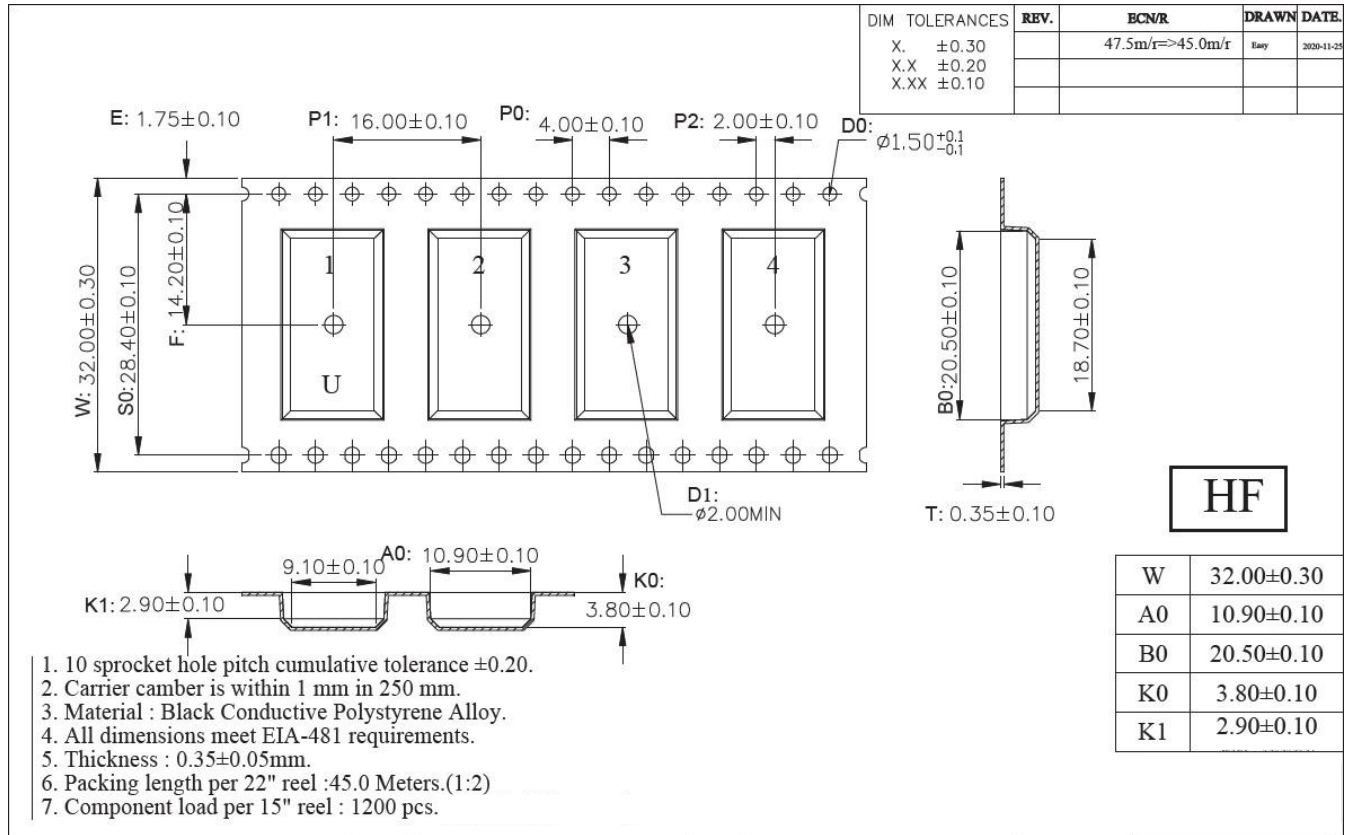
## 8 Packing Information

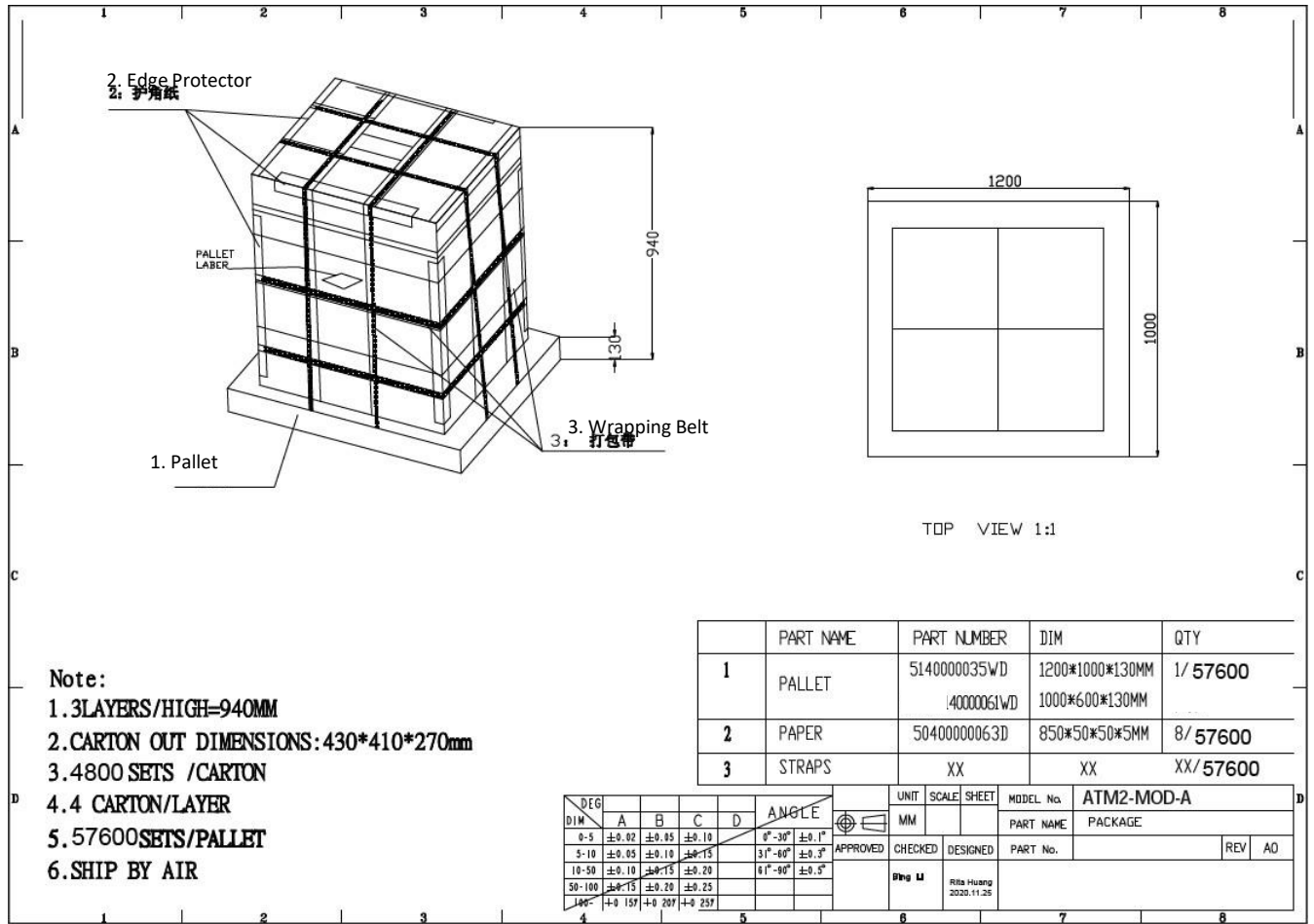
Do not put the module in the top 70 pcs and the last of 70 pcs by one reel

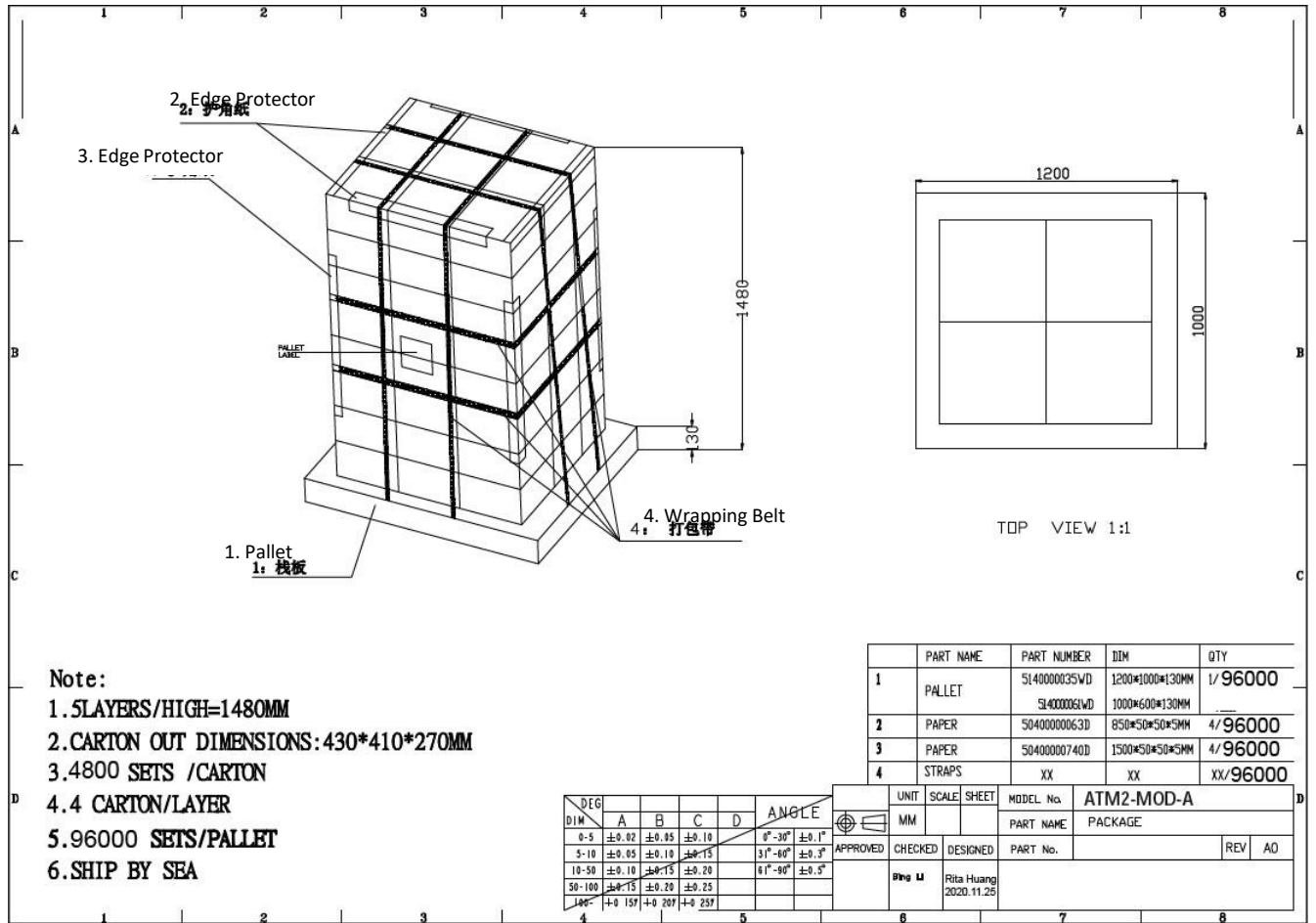
ITEM	P/N	DESCRIPTION	QTY
1	***	Product	1
2	5252000046KD	32MM Tape Reel	22.5m/1200
3	5253000004KD	32 MM Reel cover	500m/26400
4	5250000001KD	Reel Disc 15	2/1200
5	5251000004KD	32 MM Reel Axes	1/1200
6	MM12561890D	Reel bag label	3/1200
7	701A000008YD	30 G Dryer	1/1200
8	515300099437	10%-60% Humidity Indicator Card	1/1200
9	5230000651ZD	32 Plastic strip	1/1200
10	5011000102ZD	AL Bag Anti-Static	1/1200
11	50910009513D	Caution. label 72H	1/1200
12	50910009253D	ESD caveat	1/1200
13	50300008621D	Pizza box	1/1200
14	50300008341D	Carton	1/4800
15	MM1084TC50D	Carton Label	1/4800
	5220000003ED	Tape	3.67/4800

A3	UN I I	SCALE	SHEET	MODEL No.	ATM2-MOD-A	
	MM	FREE	1 of 1	PART NAME	DUMMY PACKAGE	
APPROVED	CHECKED	DESIGNED	PART No.		REV	A1
	Bing Li	Rita Huang				
		2020.12.24				

DEG DIM	A	B	C	D	ANGLE
0-5	±0.02	±0.05	±0.10		0°-30° =0.1°
5-10	±0.05	±0.10	±0.15		31°-60° =0.3°
10-50	±0.10	±0.15	±0.20		61°-90° =0.5°
50-100	±0.15	±0.20	±0.25		
100	+0.15	+0.20	+0.25		







## 9 Part Ordering

Part Number	Product Line	Description
ATM2-MOD-A	Extreme Low Power Bluetooth 5.0 SoC Module	ATM2202 Bluetooth 5.0 SoC Module with 1 MByte embedded flash, Tape and Reel, 32mm Tape



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