We Measure, We Control, We Record

NOVUS Air – IEEE 802.15.4 module

INSTRUCTIONS MANUAL V0.2

Hardware Version: V4A
Firmware Version: 0.4.106

1. INTRODUCTION

NOVUS Air IEEE 802.15.4 module is a low energy microcontrolled RF transceiver solution for 2.4 GHz IEEE 802.15.4 protocol. The device was developed to complement Novus Automation Inc. solutions, providing a modular wireless communication interface to its products. Anny application protocol based on the IEEE 802.15.4 standard may be implemented. The module is intended to operate integrated in industrial automation solutions provided by Novus Automation Inc. and its partners and is not intended to be sold separately.
The physical interface is implemented through the transceiver Atmel AT86RF233, controlled by the ATSML21 chip, a 32-bit Arm Cortex-M0 microcontroller which implements the MAC layer of IEEE 802.15.4 stack and the AT commands to be used in the application firmware. NOVUS Air can be controlled and configured by sending AT commands from a host microcontroller through UART interface.

2. BLOCK DIAGRAM

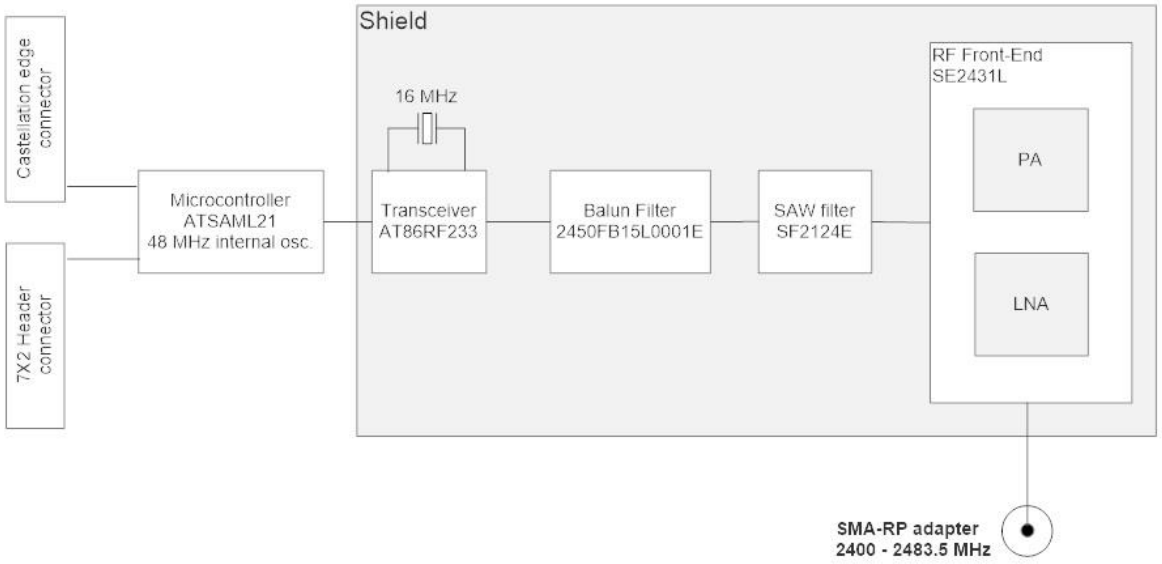

Figure 1: NOVUS Air Block diagram

3. SPECIFICATIONS

Table 1: Specifications

Model	NOVUS Air IEEE 802.15.4 Module
Power	3.3V
Communication	IEEE 802.15.4
Communication Frequency	2400.0 to 2483.5 MHz

Modulation	O-QPSK
Data Rate	250 kbps
Channels	15
Peak RF Output Power	20.10 dBm
Dimensions	49 x 32.5 x 13 mm + Antenna 105 mm.
Operating Temperature	-10 to 70ºC
Firmware Version	0.4.106

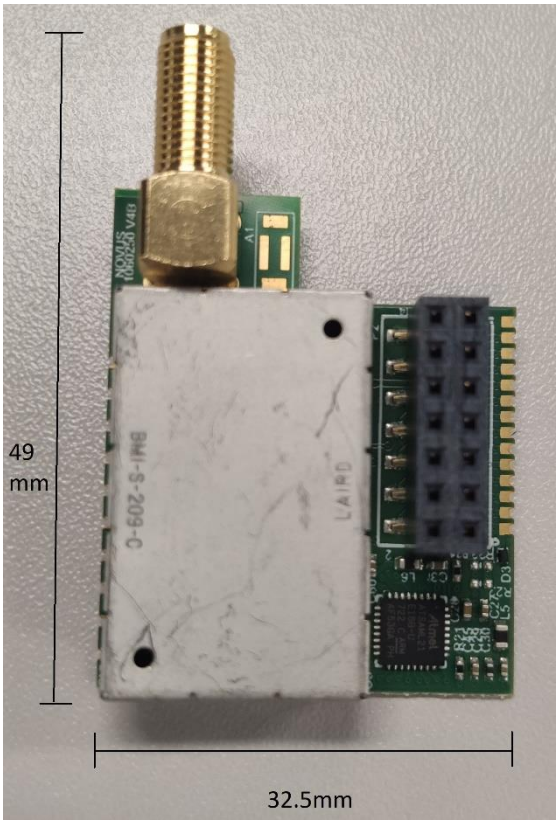

Figure 2 NOVUS Air external construction

4. PIN DESCRIPTION

Table 2: Pin description

Pin	Name	Description
1	VCC	3.3V
2	GPIO_1	General Purpose Input/Output
3	GPIO_2	General Purpose Input/Output
4	SWDIO	Serial Wire debug Data Input/Output
5	GPIO_3	General Purpose Input/Output
6	SWCLK	Serial Wire Clock
7	WAKEUP_STM32L4	Wake external microcontroller

8	RST_IEEE_802_15_4	Reset IEEE 802.15.4 Module
9	GPIO_ 4	General Purpose Input/Output
10	WAKE_IEEE_802_15_4	Reset IEEE 802.15.4 Module
11	GPIO_5	General Purpose Input/Output
12	USART_STM32L4_TX	External microcontroller UART TX
13	USART_STM32L4_RX	External microcontroller UART RX
14	GND	Ground

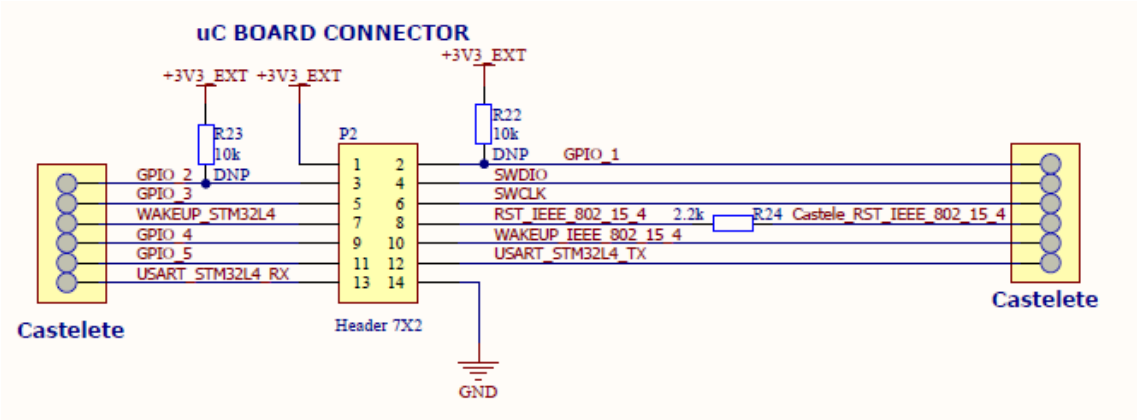

Figure 3: Conector schematics

5. ANTENNA CHARACTERISTICS

Table 3: Antenna characteristics

Model	AR0035EW0119N
Antenna Type	Omni-directional
Average Gain	2 dBi
Peak Gain (2400 Hz)	2.54 dBi
Directivity (2400 Hz)	3.64 dBi
Efficiency (2400 Hz)	-1.1 dB

For more detailed information, please refer to the Wellshow AR0035EW0119N antenna datasheet.

6. CONNECTION AND INSTALLATION

6.1 MECHANICAL INSTALLATION

NOVUS Air is designed to be integrated to NOVUS Automation Inc. products for industrial applications, which have their own enclosure. A distance of 20 cm shall be maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna

6.2 ELECTRICAL INSTALLATION

NOVUS Air has power supply connectors and supports the Universal Asynchronous Receiver/Transmitter (UART) interface, which allows interaction with the host microcontroller. Pin map is presented in Figure 3, while more detailed description of pin functionalities is provided in Table 2.

7. AT COMMANDS

NOVUS air supports the Universal Asynchronous Receiver/Transmitter (UART) interface. A set of AT commands to control and configure wireless communication is already implemented in the embedded firmware, guaranteeing that all data will be treated as input by the IEEE 802.15.4 application firmware.
The default configuration for accessing the UART interface of novus Air is mentioned below:

- Baud rate: 115200
- Data: 8 bit
- Parity: None
- Stop bit: 2 bit
- Flow control: None

The list of all implemented AT commands is available as an appendix of this document.
To apply each configuration, you need to send the commands in the sequence: at + pibconfstore and at + armreset. Check that each command gives an OK confirmation. If not, repeat the command.

8. POWER LEVEL

The transceiver power level can be set by the AT command “at+ PLEVEL=<>”. Possible Transceiver Power Level values are <4, 3, 2, 1, 0, -1 , -2, -3, -4, -6, -8, -12 or -17> in dbm.
PA can be enabled by sending the command “at+PASTATE1”, what provides a +20 dBm gain. The maximum Transmission Power of the module is 20 dBm, what implies that when PA is enabled the transceiver power level is limited to a maximum of 0 dBm by the firmware.

Note on RF Output Power Setting: In order to comply with FCC requirements, the NOVUS AIr module has the following power shaping requirements implemented:

- Limit to power level -8 when PA is active (plevel= -8 and PASTATE1) for channels 25 with channel 26 being disabled.

9. POWER CONSUMPTION

The following table presents current consumption (in Amperes) related to different power levels. PLEVEL is the selected transceiver power level, while Plevel is the power level of the device. The 20 dBm summed between PLEVEL and Plevel is due to the 20 dBm gain of the on-board PA.

Table 4: Power consumption with PA enabled

PLEVEL	Plevel	PTX (A)	RX (A)
0	20	0,135	0,01542
-1	19	0,127	0,01542
-2	18	0,118	0,01542
-3	17	0,104	0,01542

-4	16	0,094	0,01542
-6	14	0,079	0,01542
-8	12	0,065	0,01542
-12	8	0,048	0,01542
-17	3	0,039	0,01542

10. AGENCY CERTIFICATIONS

10.1 FCC

FCC ID: 2AXVW-NOVUSAIR

The NOVUS Air module has been certified under FCC part 15 Subpart C "Intentional Radiators" single-modular approval in accordance with Part 15.212 Modular Transmitter approval. Single-modular transmitter approval is defined as a complete RF transmission sub-assembly, designed to be incorporated into another device.

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.

The NOVUS Air module has been certified by the FCC for use with other products without additional certification. Any modifications to this product may violate the rules of the Federal Communications Commission and make operation of the product unlawful.
Per Sections 15.107 and 15.109, the end product must be tested for unintentional radiators compliance.

RF Exposure: A distance of 20 cm shall be maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna.

RF Output Power Setting: In order to comply with FCC requirements, the NOVUS AIr module has the following power shaping requirements implemented:

- Limit to power level -8 when PA is active (plevel= -8 and PASTATE1) for channels 25 with channel 26 being disabled.

Approved Antenna Types: To maintain modular approval in the United States, only the antenna types that have been tested shall be used. It is permissible to use different antenna provided the same antenna type and antenna gain (equal to or less than) is used. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
The NOVUS Air modules has been tested with Wellshow AR0035EW0119N antenna.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

LABELING INSTRUCTIONS

NOVUS Air has been labeled with its own FCC ID number and, if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must display a label referring to the enclosed module. This exterior label should use the following wording:

Contains FCC ID: 2AXVW-NOVUSAIR

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 undesired operation.

10.2 ANATEL

This device does not provide protection against harmful interference and may not cause interference in a properly authorized system.
For more information, see ANATEL's website: www.anatel.gov.br.