2.4GHz RF Modem User's Manual

Version 1.0

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Revision History

Date	Revision	Description	Author
02/08/2007	1.0	Document Creation	Szabolcs Zigovszki

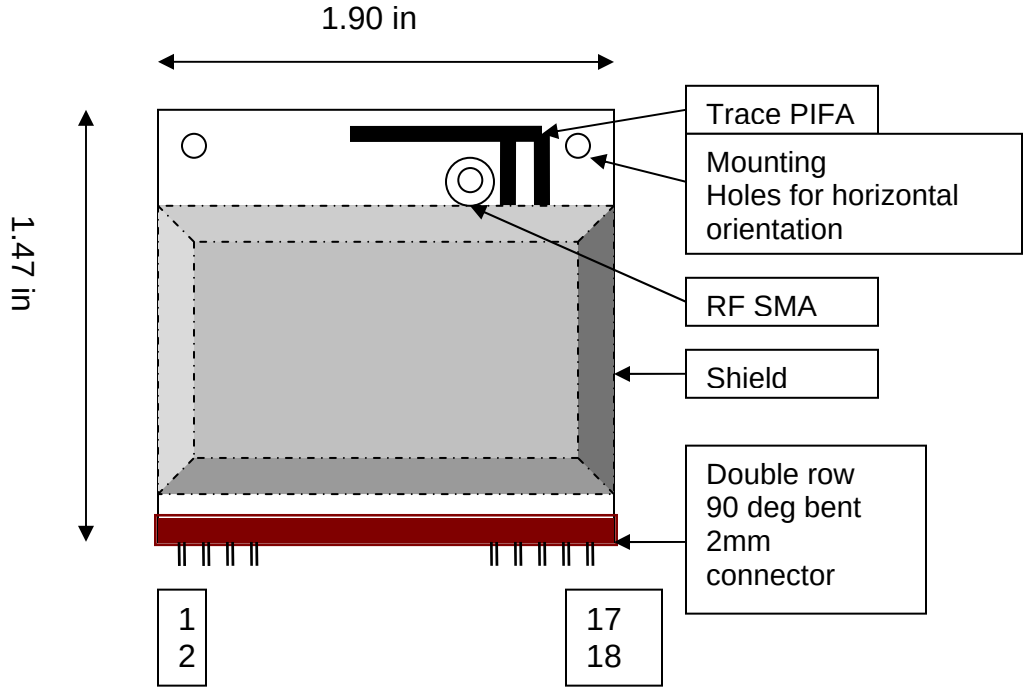
Table of Contents

1. Purpose of Document

This document was created in order to provide to the user clear guidelines regarding the usage of the Nivis RF-P9-06-01-01 modem.

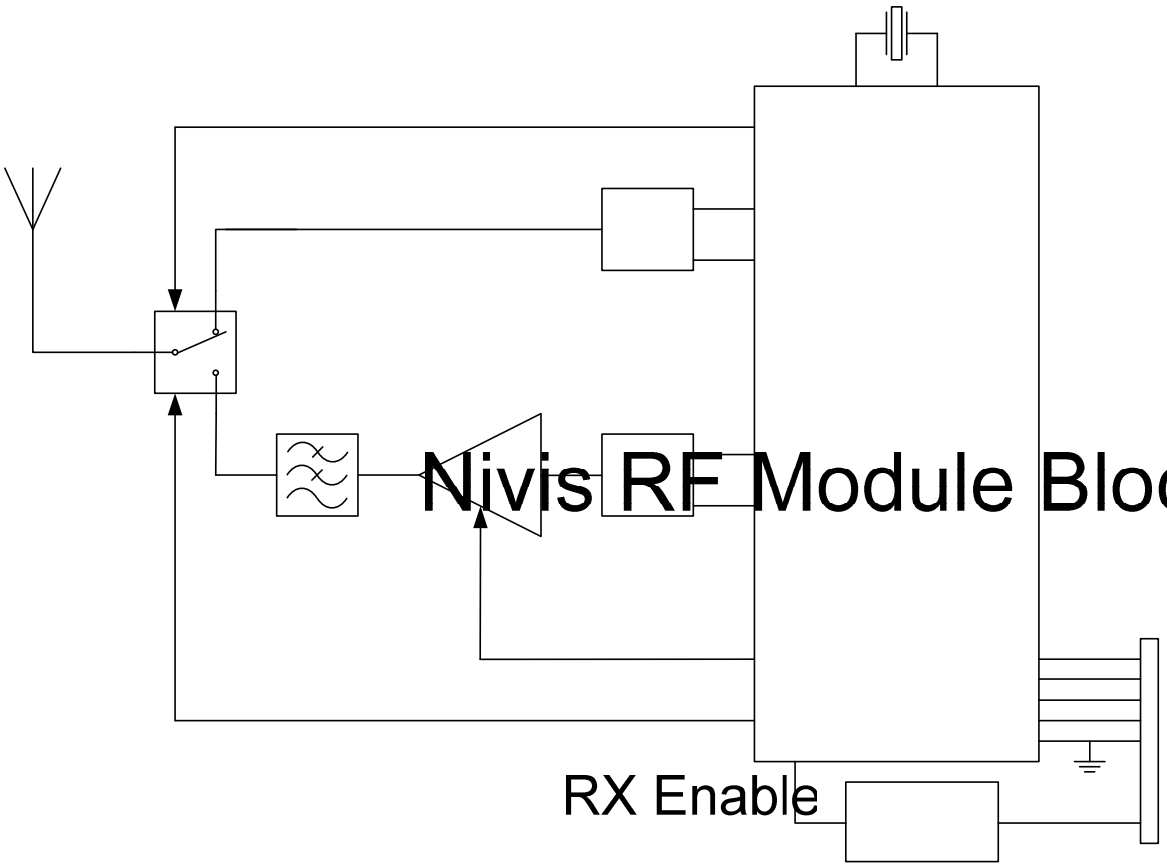
2. Overview of the Radio Modem Hardware

The 2.4GHz Nivis Radio modem is an 802.15.4 wireless module that allows wireless communication using a standard asynchronous serial data stream. The pin-out of the Nivis radio modem is presented in the figure below.



The radio modem consists of three functional entities:

1. Transceiver section – processor, RF transceiver
2. RF section – BALUNs,RF PA, RF filter, RF switch
3. Non-volatile storage – Eeprom



Power is supplied to the modem through pins 1 and 2.
Pin 1 must be supplied with 3.3 Volts and powers the digital and RF functional entities of the modem. The modem has internal filtering circuitry to smooth out the supply voltage but it has no onboard regulators.
All of the remaining pins of the modem are I/O lines of the processor.
The voltage on any of the I/O lines should never exceed 3.3 V.

Pins 13 and 14 are the TX and RX pins of UART 1, pins 11 and 12 are the TX and RX of UART2. If connecting to the serial port of a PC, a level-shifting transceiver must be employed in order to provide the appropriate voltage levels on the RX and TX lines.

A table of the radio modem pins is provided below, describing the purpose and functionality of the pins and the max voltage range on the pins.

Pin number	Pin name	Function of pin	Nominal voltage	Max voltage
1	VCC	Voltage supply	3.3 V	3.6 V
2	GND	Ground pin	0 V	0 V
3	RST	RESET, active low	3.3V	3.6V
4	BKGD	DEBUG line	3.3 V	3.6 V
5	KBD5	PTA5, GPIO1, Interrupt capable	3.3 V	3.6 V
6	VREFH	Voltage reference pin	2.5V	3.3 V
7	KBD7	PTA7, GPIO3, Interrupt capable	3.3 V	3.6 V
8	KBD6	PTA6, GPIO2, Interrupt capable	3.3 V	3.6 V
9	SCL	SCL line of I2C bus	3.3 V	3.6 V
10	SDA	SDA line of I2C bus	3.3 V	3.6 V
11	TXD2	TX line of UART 2	3.3 V	3.6 V
12	RXD2	RX line of UART 2	3.3 V	3.6 V
13	TXD1	TX line of UART 1	3.3 V	3.6 V
14	RXD1	RX line of UART 1	3.3 V	3.6 V
15	ADC2	PTB2, ADC input	3.3 V	3.6 V
16	ADC3	PTB3, ADC input	3.3 V	3.6 V
17	ADC1	PTB1, ADC input	3.3 V	3.6 V
18	ADC0	PTB0, ADC input	3.3 V	3.6 V

3. Operation of the Nivis Radio Modem

Communication with the NIVIS radio modem happens through serial port 2. The baudrate is set to be 19200, 8N1.

3.1. Getting started

Open a terminal software on a serial port with the above settings and connect to the RF modem. Any command is single line followed by enter command. Format of command is: command param1 param2 … <enter>
At startup pushing the enter key a few times is necessary until the reception of the prompt string.

PTS Commands description:

1. **Clear screen**
   a. **Description**: clear screen
   b. **Command name**: “cls”
   c. **Parameters:** None
   d. **Ex:** cls<enter>

2. **Help**
   a. **Description**: display commands list and a short description of each command
   b. **Command name**: “help”
   c. **Parameters:** None
   d. **Ex:** help<enter>

3. **Read ADC (ATD) channels**
   a. **Description**: read and display ADC channels values
   b. **Command name**: “getadc”
   c. **Parameters:** None
   d. **Ex:** getadc<enter>

4. **Get Modem SPI Register**
   a. **Description**: get value for a modem register (from page0)
   b. **Command name**: “getreg”
   c. **Parameters: 1**

- register ID: hex format

d. **Ex:** getreg 00<enter>

5. **Set Modem SPI Register**
   a. **Description**: set value for a modem register (from page0)
   b. **Command name**: “setreg”
   c. **Parameters: 2**
      - register ID: hex format
      - register vlaue: hex format
   d. **Ex:** setreg 20 80FF<enter>

6. **Set Power Amplification value**
   a. **Description**: set value for a modem PA power (not persistent value)
   b. **Command name**: “setpa”
   c. **Parameters: 1**
      - PA value: hex format
   d. **Ex:** setpa FC<enter>

7. **Set Modem Channel**
   a. **Description**: set value for a modem channel (not persistent value)
   b. **Command name**: “setch”
   c. **Parameters: 1**
      - channel number: **decimal format**
   d. **Ex:** setch 0<enter>

8. **Set red LED value**
   a. **Description**: set red LED on or off
   b. **Command name**: “setredled”
   c. **Parameters: 1**
      - Red led: 0 or 1
   d. **Ex:** setredled 0<enter>

9. **Set green LED value**
   a. **Description**: set green LED on or off
   b. **Command name**: “setgreenled”
   c. **Parameters: 1**
      - Green led: 0 or 1
   d. **Ex:** setgreenled 0<enter>

10. **Put modem in IDLE state**
    a. **Description**: put modem in IDLE state
    b. **Command name**: “idle”
    c. **Parameters: None**
    d. **Ex:** idle<enter>

11. **Put modem in PULSE state**
    a. **Description**: put modem in pulse PRBS9 state
    b. **Command name**: “pulse”
    c. **Parameters: None**
    d. **Ex:** pulse<enter>

12. **Put modem in RX state**
    a. **Description**: put modem in RX state
    b. **Command name**: “rx”
    c. **Parameters: None**
    d. **Ex:** rx<enter>

13. **Put modem in RX echo state**
    a. **Description**: put modem in RX echo state (used for message success rate)
    b. **Command name**: “rxecho”
    c. **Parameters: 1 (but can missing)**
        - Msg signature: hex format, default value 0xFF
    d. **Ex:** rxecho<enter>

14. **Calculate the TX message success rate**
    a. **Description**: Calculate message success rate
    b. **Command name**: “txmsg”
    c. **Parameters: 4 (but can missing)**
        - Packet no: **decimal format**, default 100
        - Delay (in ms): **decimal format**, default 100
        - Packet len: **decimal format**, default 125
        - Msg signature: hex format, default value 0xFF
    d. **Ex:** txmsg 10<enter>

15. **Put modem in TX not modulated state**
    a. **Description**: put modem in continuous TX not modulated state
    b. **Command name**: “txnomod”
    c. **Parameters: None**

d. **Ex:** txnomod<enter>

16. Put modem in TX modulated state

a. **Description**: put modem in continuous TX modulated state
b. **Command name**: “txmod”
c. **Parameters: None**
d. **Ex:** txmod<enter>

17. Read main info stored on EEPROM

a. **Description**: displays SN, max PA power, and VRef stored on EEPROM
b. **Command name**: “iic_read”
c. **Parameters: None**
d. **Ex:** iic_read<enter>

18. Clear EEPROM (except main info)

a. **Description**: Clear EEPROM except main info
b. **Command name**: “iic_erase”
c. **Parameters: None**
d. **Ex:** iic_erase<enter>

19. Write device SN on EEPROM

a. **Description**: Set device SN on EEPROM and clear rest of EEPROM
b. **Command name**: “iic_setsn”
c. **Parameters: 1**
   - Device SN: hex format, up to 16 digits (8 bytes)
d. **Ex:** iic_setsn 4FC0<enter>

20. Write VRef on EEPROM

a. **Description**: Set VRef on EEPROM
b. **Command name**: “iic_setvref”
c. **Parameters: 1**
   - Value VRef: **decimal format** (between 2450 and 2550)
d. **Ex:** iic_sevref 2500<enter>

21. Write max PA on EEPROM

a. **Description**: Set max PA on EEPROM
b. **Command name**: “iic_setpa”
c. **Parameters: 1**

- Max power hex format

d. **Ex:** iic_setpa FF<enter>

22. Set output pin in lo

a. **Description**: Set a pin as output and in lo state
b. **Command name**: “outlo”
c. **Parameters: 1**
   - Pin definition: string: port and bit
d. **Ex:** outlo A5<enter>

23. Set output pin in hi

a. **Description**: Set a pin as output and in hi state
b. **Command name**: “outhi”
c. **Parameters: 1**
   - Pin definition: string: port and bit
d. **Ex:** outhi A5<enter>

4. RF Exposure Limit Warning

To comply with FCC’s RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

5. Compliance Statement (Part 15.19)

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.

6. OEM Responsibility to the FCC Rules and Regulations

The Nivis RF Module 6.0 has been certified per FCC Part 15 rules for integration into products without further testing or certification. To fulfill the FCC certification requirements the OEM of the Nivis RF Module must ensure that the information provided on the Nivis RF Module 6.0 Label is placed on the outside of the final product. The Nivis RF Module 6.0 is labeled with its own FCC ID Number. If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:

"Contains Transmitter Module FCC ID: xxx-xxxxxxxx"
or
"Contains FCC ID: xxx-xxxxxxxx"

The OEM of the Nivis RF Module 6.0 must only use the approved antenna, which has been certified with this module.

The OEM of the Nivis RF Module 6.0 must test their final product configuration to comply with Unintentional Radiator Limits before declaring FCC compliance per Part 15 of the FCC rules.

7. Warning (Part 15.21)

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