RF Modem User's Manual

Version 1.1

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Revision History

Date	Revision	Description	Author
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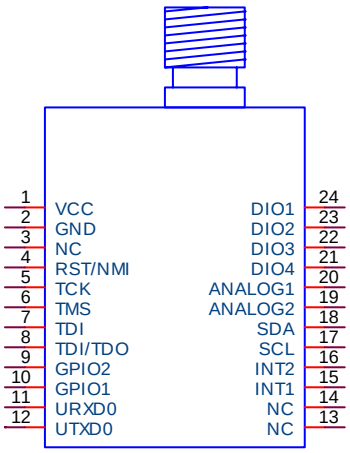
1. Purpose and Scope of Document

This document was incepted in order to provide to the user clear guidelines regarding the usage of the Nivis RF-P9-06-01-01 modem.
The scope of this document is limited to the first revision of the Nivis Amplified Radio Modem, part number RF-P9-06-01-01.

2. Overview of the Radio Modem Hardware

The Nivis Radio modem RF-P9-06-01-01 is a frequency-hopping wireless module that allows wireless communication using a standard asynchronous serial data stream. The half-duplex transmission of the modem can sustain a continuous data stream at the specified data rate of 9600 bps.
The pin-out of the Nivis radio modem is presented in the figure below.



The radio modem consists of three functional entities:

1. Digital section – processor, EEPROMs, Power-on-reset circuitry
2. RF section – Chipcon RF transceiver and LNA
3. Power amplification section – MAX2235 power amplifier

Power is supplied to the modem through pins 1 and 2.
Pin 1 must be supplied with 3.6 Volts and powers the digital and RF functional entities of the modem. The modem has two internal 3.3 V LDOs which are powered through this pin. The LDOs require a dropout voltage of 200 mV.

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 11 and 12 are the TX and RX pins of UART 1. 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	3.6 V	3.6 V
2	GND	Ground pin SDA line of external I2C bus	3.3 V	3.6 V
3	NC	N/A	N/A	N/A
4	RST/NMI	Reset line of the processor	3.3 V	3.6 V
5	TCK	JTAG line	3.3 V	3.6 V
6	TMS	JTAG line	3.3 V	3.6 V
7	TDI	JTAG line	3.3 V	3.6 V
8	TDI/TDO	JTAG line	3.3 V	3.6 V
9	GPIO2	General purpose digital line of the processor	3.3 V	3.6 V
10	GPIO1	General purpose digital line of the processor	3.3 V	3.6 V
11	URXD0	RX line of UART 0	3.3 V	3.6 V
12	UTXD0	TX line of UART 0	3.3 V	3.6 V
13	NC	N/A	N/A	N/A
14	NC	N/A	N/A	N/A
15	INT1	Interrupt – digital line of processor	3.3 V	3.6 V
16	INT2	Interrupt – digital line of processor	3.3 V	3.6 V

17	SCL	SCL line of external I2C bus – analog input to ADC	3.3 V	3.6 V
18	SDA	SDA line of external I2C bus – analog input to ADC	3.3 V	3.6 V
19	AIN2	General purpose digital line of the processor – analog input to ADC	3.3 V	3.6 V
20	AIN1	General purpose digital line of the processor – analog input to ADC	3.3 V	3.6 V
21	DIO4	General purpose digital line of the processor – analog input to ADC	3.3 V	3.6 V
22	DIO3	General purpose digital line of the processor – analog input to ADC	3.3 V	3.6 V
23	DIO2	General purpose digital line of the processor – analog input to ADC	3.3 V	3.6 V
24	DIO1	General purpose digital line of the processor – analog input to ADC	3.3 V	3.6 V

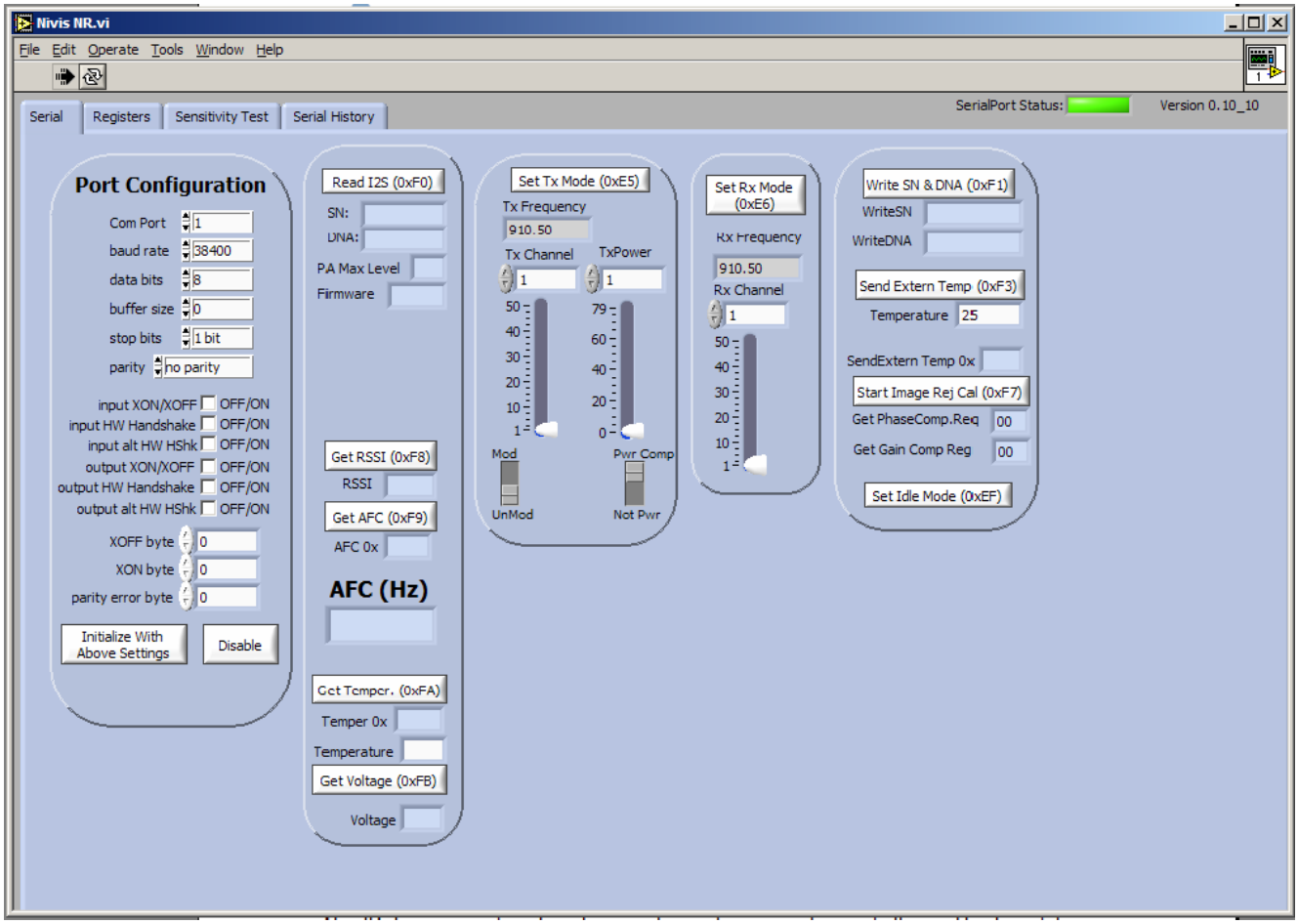
3. Operation of the Nivis Radio Modem

The NivisLink application was developed in order to exercise the features of the Nivis Radio modem. The NivisLink application is software application composed of a firmware hex file which is to be loaded onto the modem and a GUI that controls various features of the modem.

3.1. Getting started

Install the NivisLink GUI on a PC and connect the serial port of the PC to the Nivis radio modem evaluation board RFB-01-01.
Load the radio modem with the NivisLink hex file provided.

The figure below depicts the “Serial” tab of the NivisLink GUI.



3.2 Read Calibration EEPROm

Note: The following procedure assumes that the modem used has already undergone the calibration procedure. For tune-up and calibration procedure consult the “Tune-up Procedure” document.

The SN, DNA, PA Max level, temperature sensor calibrtation value and other calibration data necessary for the operation of the Nivis radio modem is stored in the calibration EEPROM.
By pressing the “READ I2S” button the content of the calibration EEPROM is displayed in the tabs provided for various parameters.

The following parameters will be displayed

- Serial Number – unique identifying ID of the modem
- DNA – network identification number
- Power Amplifier max level – maximum value of the power amplifier gain
- Firmware version

3.3 Transmission

In order to set the modem in transmit mode the “SET TX MODE” button must be employed. The transmit tab will allow the user to select the TX frequency channel on which the transmission should take place. 50 frequency channels can be employed starting with the 910.5 MHz channel and than incrementing by 330 kHz up to 927.5 MHz.
The user can also select the output power of the modem by employing the TX Power knob.
The MOD and UNMOD knob permits the user to select if the transmitted signal is modulated or un-modulated (carrier).

3.4 Reception

In order to set the modem in reception the “SET RX MODE” button must be pressed. The mode will enter reception on the frequency channel selected in the adjacent tab.

3.5 Modify Register Values

The NivisLink application also gives the user the flexibility to directly control the functional registers of the CC1020 transceiver. This gives the user complete control over every aspect of the RF functionality of the modem.
These register should only be overwritten by users that are knowledgeable of the CC1020 transceiver.
For a list and explanation of each CC1020 register consult the datasheet of the CC1020 transceiver.

3.6 Additional Features

The NivisLink application also permits the user to view various other parameters of the radio modem.

- GET RSSI tab – displays the value present in the Received Strength Indicator register of the CC1020 transceiver
- GET AFC - displays the value present in Automatic Frequency Correction register of the CC1020 transceiver
- GET TEMPERATURE tab – displays the temperature value indicated by the internal temperature sensor of the MSP430F149 processor
- GET VOLTAGE – displays the supply voltage of the processor as read by an internal analog line of the MSP430F149 processor

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: SQB-NIVISP9060101"
or
"Contains FCC ID: SQB-NIVISP9060101"

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.