

nRF8002 Development Kit

User Guide.v1.0

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Revision History

Date	Version	Description
February 2012	1.0	

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1 Introduction

The nRF8002 Development Kit provides a complete solution for quick evaluation and prototyping of proximity tags based on the nRF8002 device. Integrating a PWM-controlled piezoelectric buzzer, three LEDs, two buttons, and a coin cell battery holder, the nRF8002 module (nRF2748) provides out-of-the box hardware implementation of a *Bluetooth*® low energy proximity tag.

By uploading the default configuration in nRFgo Studio, a nRF8002 Development Kit can be used to demonstrate nRF8002 features using the µBlue Master Emulator and the Proximity Demo application provided with this kit. The kit also allows you to track and control the traffic between the nRF8002 device and a master.

nRF8002 can be configured to respond to different pin pattern inputs and to issue different pattern outputs depending on activity in the embedded *Bluetooth* low energy services. Use the nRF8002 configuration tool in nRFgo Studio to change and upload new configurations to adjust the nRF8002 behavior to match your application needs. For further HW development, the nRF8002 I/O pins can be accessed through the nRF2748 or by plugging nRF8002 into a nRFgo Motherboard (sold separately with the nRFgo Starter Kit) and using the prototyping and development features offered.

This User Guide provides descriptions of the hardware provided with the Kit and explains how you can set up the hardware to test with Direct Test Mode.

1.1 Who should read this user guide?

Anyone developing a *Bluetooth* product using nRF8002 should read this User Guide.

To fully understand this User Guide, a background in software development and/or electronic engineering is required and you will need knowledge of the *Bluetooth* low energy specification and terminology.

1.2 Minimum requirements

- Computer with 1 USB port (2 USB ports are recommended)
- Windows XP, Windows Vista, Windows 7
- nRFgo Studio v1.12 or later

1.3 Required reading

The nRF8002 Preliminary Product Specification contains all background information on nRF8002 and you should read the nRF8002 Getting Started Guide before using this.

1.4 Writing Conventions

This product specification follows a set of typographic rules that makes the document consistent and easy to read. The following writing conventions are used. The requirements specified here will most likely be identical to the requirements cited in the Getting Started Guide for this same kit.

- Commands are written in `Courier New`.
- File names and User Interface components are written in **bold**.
- Cross references are [underlined and highlighted in blue](#).

2 Development Kit content

The nRF8002 Development Kit consists of hardware and software components, and a Proximity Demo application.

2.1 Hardware content

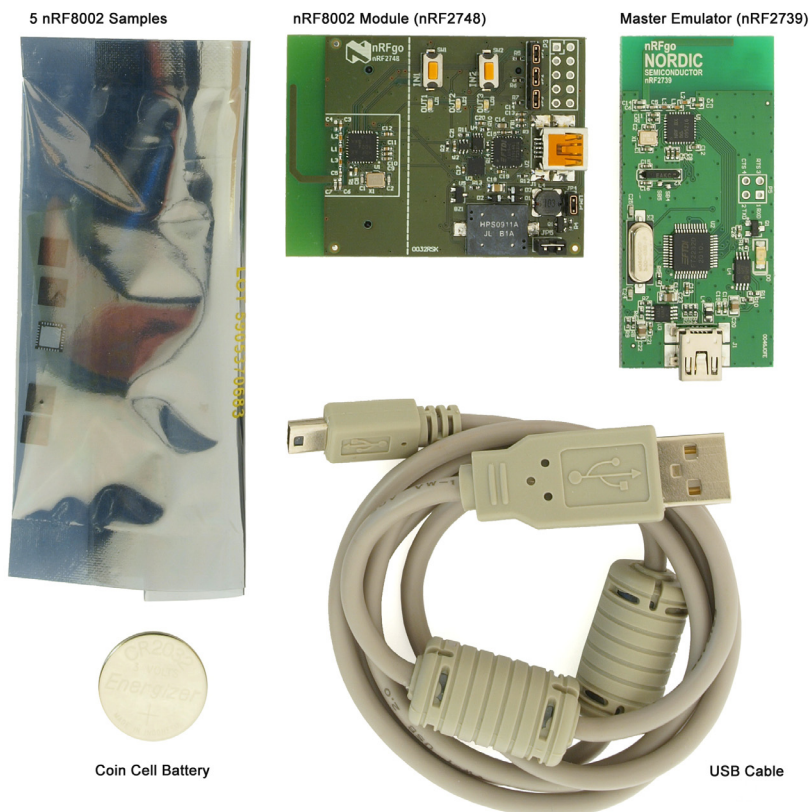


Figure 1. Hardware Content

2.1.1 nRF8002 module (nRF2748)

The nRFready nRF8002 (nRF2748) includes:

- Fully functional *Bluetooth* low energy proximity tag
- Buzzer
- LEDs
- Buttons

2.1.2 µBlue Master Emulator (nRF2739)

The µBlue Master Emulator (nRF2739) is a dongle that enables you to run the Proximity Demo application.

2.2 Software content

From the www.nordicsemi.com website you can download the nRF8002 Proximity Demo installation file and the nRFgo Studio.

2.3 Documentation

Documentation for this Kit can be downloaded from www.nordicsemi.com and includes:

- This User Guide
- Getting Started Guide
- Tutorial available in nRFgo Studio

3 Test RF parameters using Direct Test Mode (DTM)

3.1 Setting up the hardware for testing with DTM

Follow these steps in order to start DTM:

1. Connect the nRF8002 module (nRF2748) to your PC using a USB cable.
2. Start the nRFgo Studio application.
3. In the **Features** pane underneath **Bluetooth**, click **Direct Test Mode**.

3.2 Testing the physical layer on your product

nRF8002 can only enter DTM before it has been configured with a setup. This means that in order to test your own product, leave nRF8002 unconfigured and go to the **Features** pane in nRFgo Studio, select **Bluetooth** and then select **Direct Test Mode**.

The DTM must be available on your product so that it can be qualified as a *Bluetooth* low energy product. This means that your design must have a way to connect to the UART interface.

Note: A nRF8002 in test mode draws considerable battery power. To avoid rapidly draining the on board coin cell battery, a module in DTM should not be disconnected from the USB cable for prolonged periods of time.

4 Hardware description

This chapter describes the nRF8002 (nRF2748) module and the µBlue Master Emulator (nRF2739).

nRF8002 can be configured to respond to different pin pattern input and to issue different pattern output depending on activity in the embedded *Bluetooth* low energy services and profiles. Use nRFgo Studio to change and upload new configurations to adjust the nRF8002 behavior.

4.1 nRF8002 module (nRF2748)

The nRF8002 module (nRF2748) provides an out-of-the-box solution for quick evaluation and prototyping of *Bluetooth* low energy. Integrated features like those listed below in “Key features” help you get started on your *Bluetooth* PCB design.

4.1.1 Key features

- *Bluetooth* low energy radio
- Coin cell battery powered
- On-board buttons, LEDs, and Buzzer
- Input/output availability on pin header for extended usage
- nRF6310 Motherboard integration (nRFgo)
- USB (UART emulator) configuration interface

4.1.2 nRF8002 module (nRF2748)

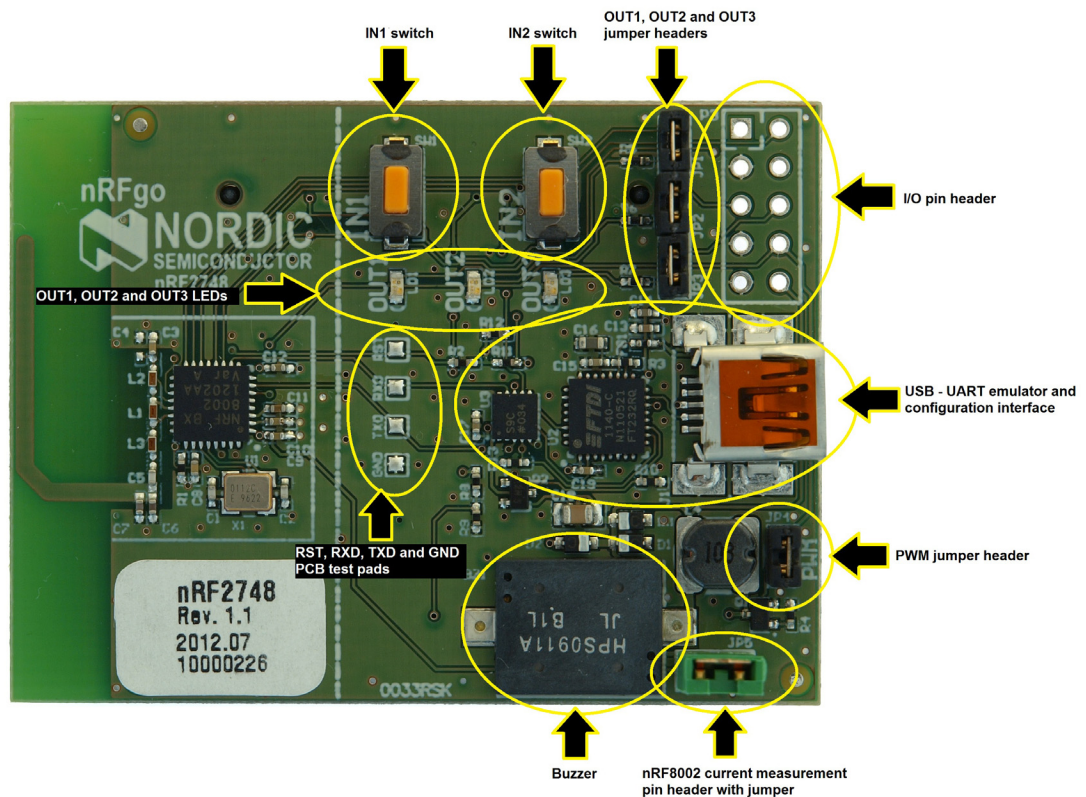


Figure 2. nRF2748 top view

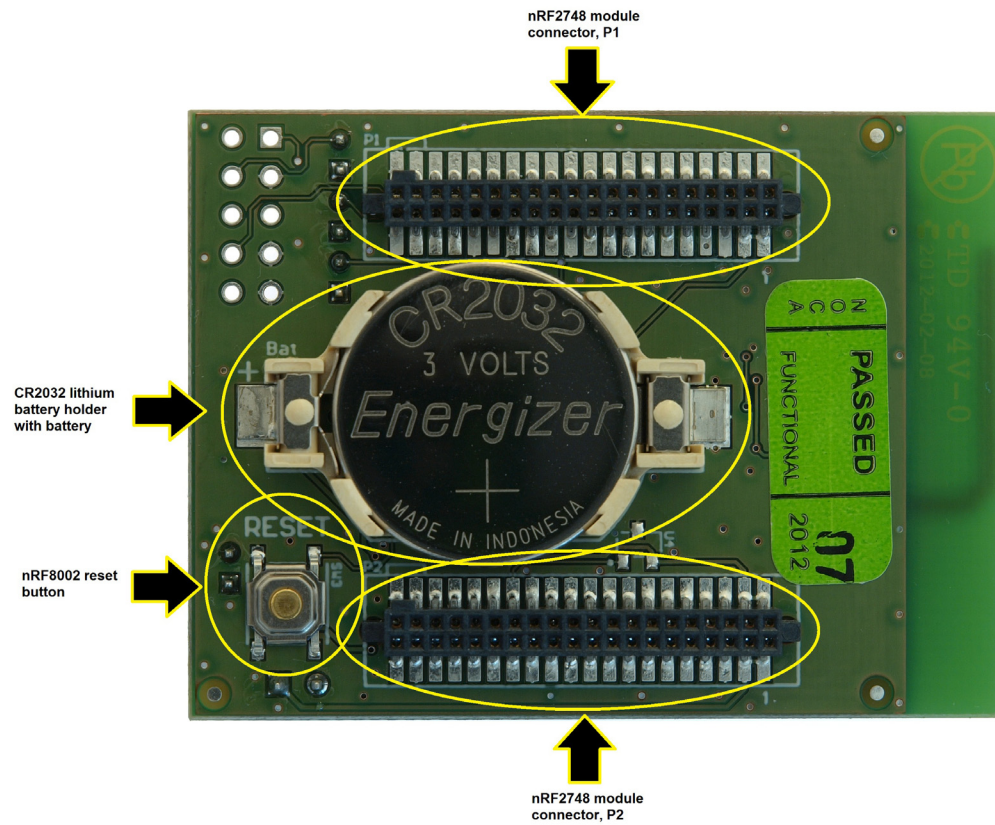


Figure 3. nRF2748 bottom view

4.1.3 Inputs and Outputs

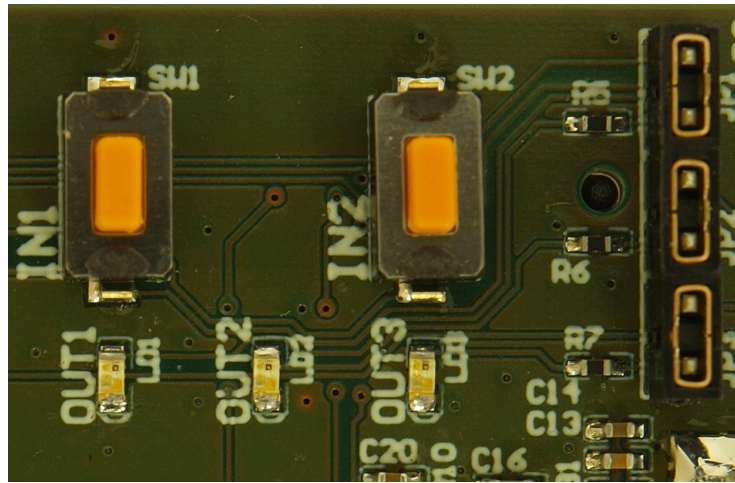


Figure 4. LEDs and buttons

nRF8002 has the following input signals:

- The button SW1 is routed to signal IN1
- The button SW2 is routed to IN2

In addition, nRF8002 has three digital outputs and a PWM output. The three digital output signals are routed to three LEDs in the following way:

- OUT1 is routed to the LED LD1
- OUT2 is routed to the LED LD2
- OUT3 is routed to the LED LD3

JP1, JP2, and JP3 disconnects the output LEDs LD1, LD2, and LD3 respectively. When using external LEDs through either the I/O pin header or the motherboard, it's a good idea to disconnect onboard LEDs by removing these jumpers.

The PWM output is described in the following section.

4.1.4 Buzzer (PWM output) and nRF8002 current measurement

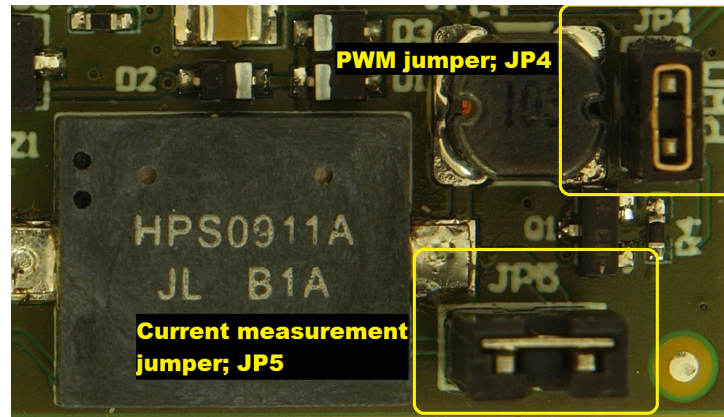


Figure 5. Buzzer connected to PWM through a jumper

nRF2748 is populated with a buzzer, shown in [Figure 5](#). The PWM signal from nRF8002 goes to the buzzer driver (transistor Q1) via jumper **JP4**. This jumper must be fitted in order for you to use the onboard buzzer. Removing this jumper will disconnect the onboard buzzer. You can also use an external buzzer with the PWM signal.

[Figure 5](#) also shows the current measurement pin header with jumper **JP5**. You can measure the current drawn by nRF8002. Since nRF8002 current consumption appears in short pulses and varies significantly depending on activity, a normal ampere meter will not give you an accurate picture. Replace this jumper with a 5-10 ohm resistor and use an oscilloscope to measure nRF8002 current consumption. See the nRF Performance Test Guidelines (nWP-006) on our website for details on how to measure dynamic current. You can download nRF8002 Development Kit hardware schematics and PCB layout files from www.nordicsemi.com.

4.1.5 I/O pin header

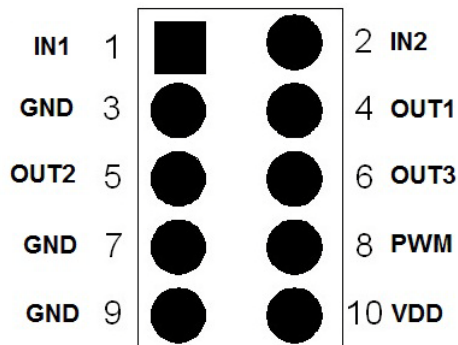


Figure 6. I/O expansion pin header for inputs and outputs

Pin	Label	Description
1	IN1	Input pin 1, nRF8002
2	IN2	Input pin 2, nRF8002
3	GND	Ground
4	OUT1	Output pin 1, nRF8002
5	OUT2	Output pin 2, nRF8002
6	OUT3	Output pin 3, nRF8002
7	GND	Ground
8	PWM	PWM output, nRF8002
9	GND	Ground
10	VDD	VDD supply (same voltage level as the nRF8002)

Table 1. Pinouts for I/O header P3

To directly access the I/O pins of the nRF8002 device, an optional pin header **P3** (not mounted) is available. This pin header is populated with all of the inputs, outputs, and the PWM signal available on the nRF8002.

Note: To access the nRF8002 output pins through this header without conflicts, Jumper JP1 to JP4 must be removed.

4.1.6 nRFgo Starter Kit Motherboard (nRF6310) extension connectors

nRF2748 can be used with the nRFgo Starter Kit by connecting the **P1** and **P2** connectors to the nRFgo Starter Kit Motherboard extension connectors.

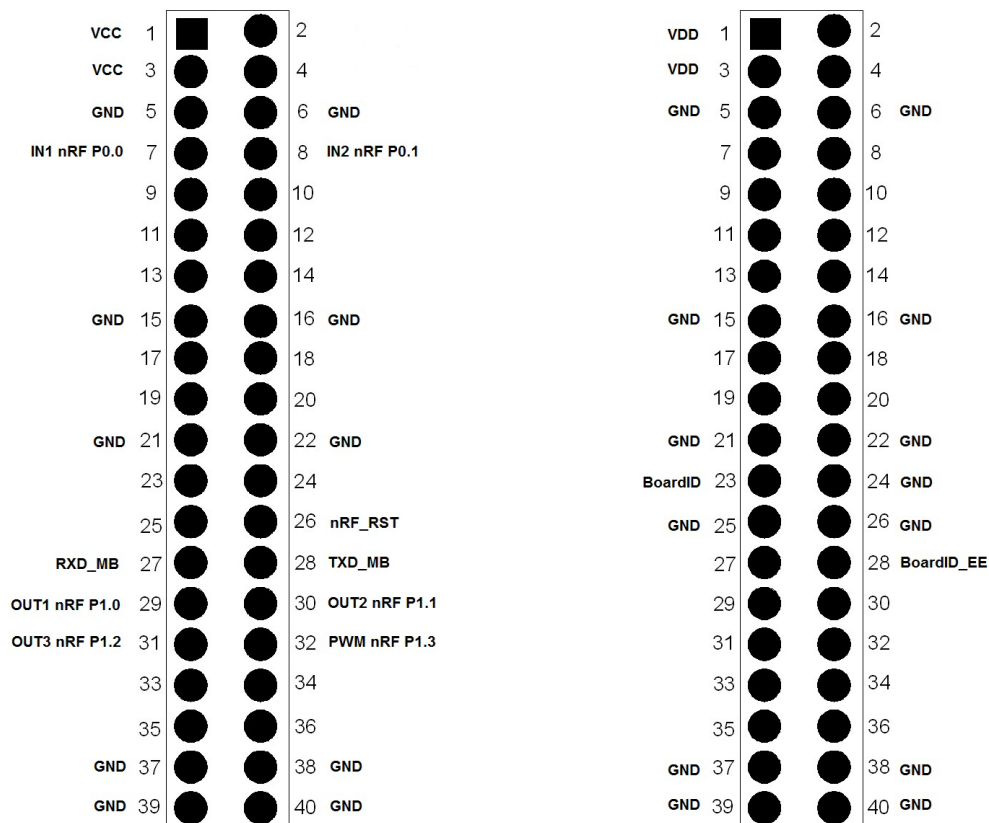


Figure 7. Pinouts for the nRF2748 module connector, P1 (Left) and P2 (Right)

The two figures above show the pinouts for these connectors. Only the used pins in the nRF6310 are described in these figures.

Note: Only P1 carries the input and output resources to nRF2748. P2 carries only the power support and the BoardID interface. You can download nRF8002 Development Kit hardware schematics and PCB layout files from www.nordicsemi.com.

4.2 μ Blue Master Emulator (nRF2739)

The μ Blue Master Emulator (nRF2739) is a dongle that enables you to use the Proximity Demo Application with nRF8002. The μ Blue Master Emulator is a peer device for nRF8002 allowing you to set up the wireless connection.

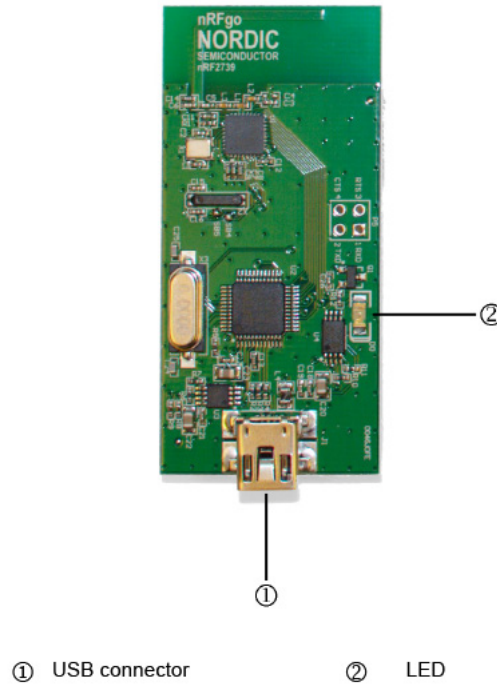


Figure 8. μ Blue Master Emulator

Note: The LED is lit when nRF2739 is connected and ready.

4.2.1 Module schematics and PCB layouts

You can download nRF8002 Development Kit hardware schematics and PCB layout files from www.nordicsemi.com.

4.2.2 Block diagram

Figure 9. is a block diagram and description of the main parts of nRF8002 including the radio, configuration interface, Starter Kit Motherboard (nRF6310) integration, and pin header for extended I/O usage.

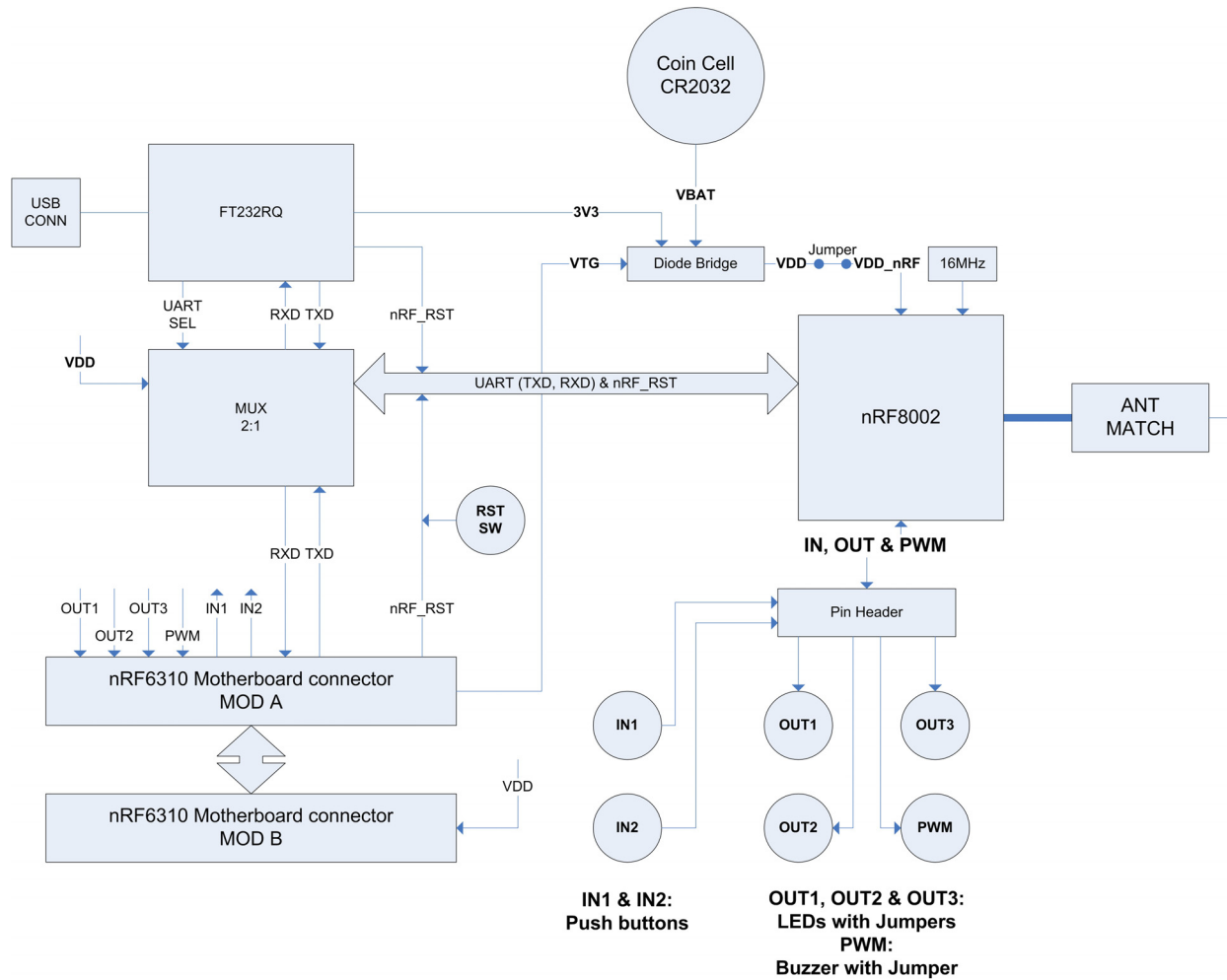


Figure 9. nRF8002 Block diagram

5 Troubleshooting

The nRF8002 on the SoC module (nRF2748) does not respond when I try to contact it. What has happened?

Verify that the jumper **JP5** is connected.

LED D0 on the µBlue Master Emulator (nRF2739) does not light up when I plug in the USB cable. What has happened?

Verify that the Master Emulator (nRF2739) has been plugged into a USB port on your computer.