

Interfacing **BiPOM** MINI-MAX  
Microcontroller Boards  
with **RF DIGITAL**'s  
2.4 GHz RF Transceiver Modules

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## Overview

BiPOM's microcontroller boards are a set of small size, low-cost, low-power, yet powerful single board computers (SBC's) with applications ranging from industrial, medical, home automation to automotive. [MINI-MAX](#) series boards host the most popular microcontrollers today in AVR, PIC, MSP430, 8051, 68XX, ARM7, ARM9 and STAMP series.

RFD21733 and RFD21735 from RF Digital Corporation are complete 2.4 GHz RF Transceiver Modules with Built-In RFDP8 Application Protocol. These tiny transceivers are easy to use, low-cost, low-power and have a range of up to 300 feet outdoors ( 100 feet indoors ).

Combination of RF Digital transceivers and MINI-MAX Microcontroller boards opens up many possibilities for embedded data acquisition, monitoring and control.



## Theory of Operation

RFD21733 has 8 different modes of operation that are selected with 3 digital input pins:

- MODE SELECT 0
- MODE SELECT 1
- MODE SELECT 2

Depending on the selected mode, RFD21733 can operate as an RFID device, as a simple digital input state transmitter, a wireless UART, as an output logic switch receiver and many easy-to-use addressable network modes.

For more details of the modes of operation of RFD21733, please refer to the “RFDP8 RF Modules Manual” on RF Digital website:

[www.rfdigital.com/pdf/RFDP8.RF.Modules.Manual.pdf](http://www.rfdigital.com/pdf/RFDP8.RF.Modules.Manual.pdf)

One of the simplest modes is where the transmitter is configured in Mode 1 as a 3 Input Logic Switch Transmitter. The receiver is configured in Mode 7 as a 3 Output Logic Switch Network Receiver as shown in Figure 1 below:

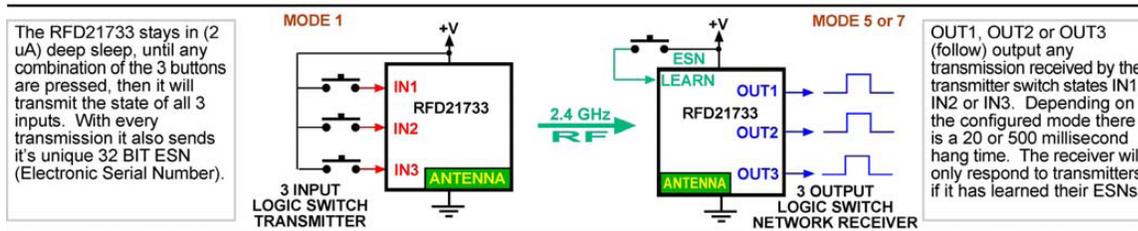


Figure 1

In this setup, transmitter is a remote sensor, away from MINI-MAX. Receiver is directly wired to digital inputs of MINI-MAX.

The transmitter is in deep sleep ( drawing only 2uA of current ) until one of the buttons that are connected to the transmitter’s digital inputs is pressed. At that instance, the transmitter transmits over the air the state of the 3 buttons along with the transmitter’s 32-bit unique electronic serial number (ESN).

Upon receiving the message from the transmitter, the receiver activates its outputs for a period of 500 milliseconds.

MINI-MAX detects the change in state and acts upon it ( for example, it may log this event or activate a controlled device ).

Subsequent sections of this document describe how to set up and program various MINI-MAX boards for use with RFD21733 transceivers.



### Example 1: Sensing remote switches using MINI-MAX/ARM-E

In this example, OUT1 digital output on RFD21733 receiver is connected to a digital input of MINI-MAX/ARM-E. When the remote RFD21733 transmitter detects a change of state on its IN1 input ( reed switch closed ) , the RFD21733 receiver changes the state of its OUT1 output which in turn changes the digital input of MINI-MAX/ARM-E. MINI-MAX/ARM-E senses this change and displays a message on the LCD242-BK display.

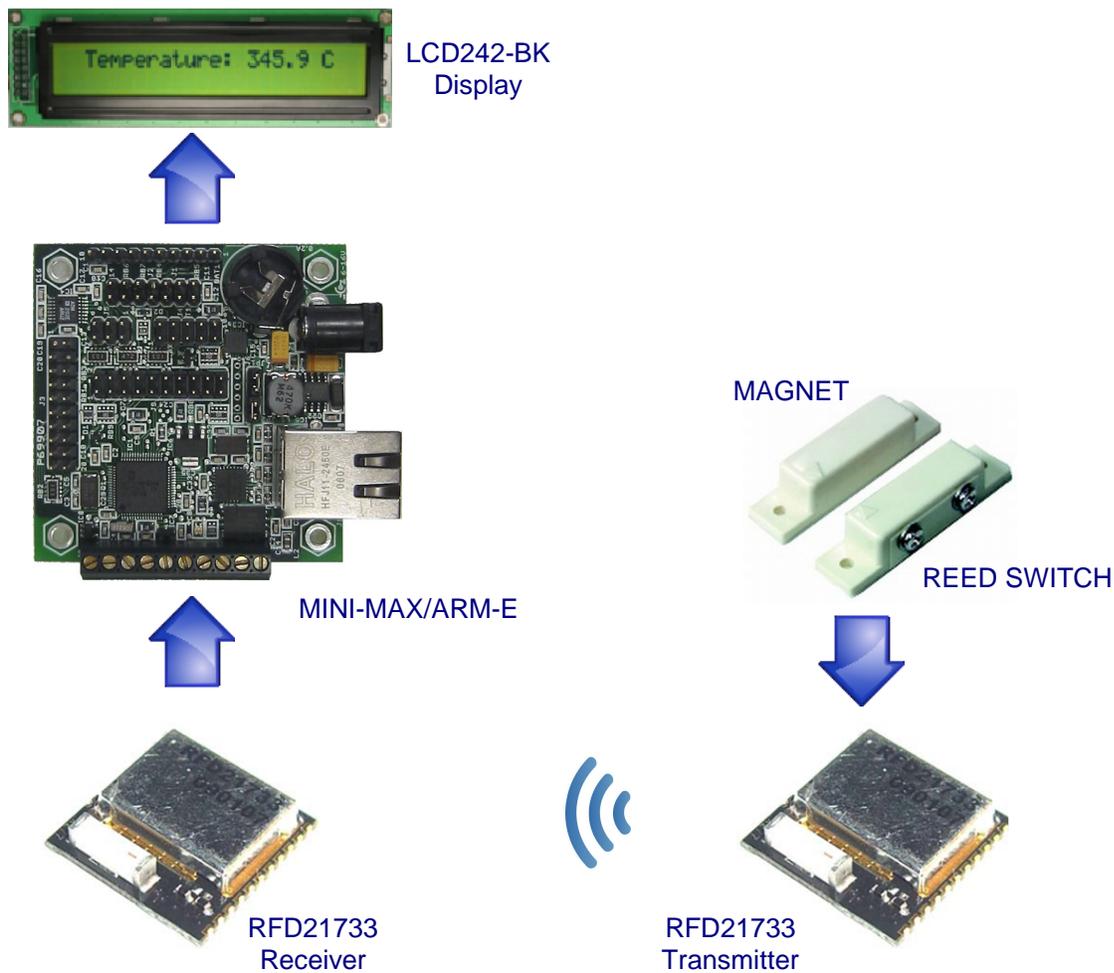


Figure 2



The easiest way to connect RFD21733 to MINI-MAX/ARM-E is through the Analog input terminal block (J8) on the MINI-MAX/ARM-E. Although this terminal block is intended for analog inputs, it is convenient for RFD21733 because there is a 3.3 Volt power supply ( analog supply ) and 3.3 Volt compatible digital inputs on this terminal block ( analog inputs can also act as digital inputs ).

Figure 3 shows the detailed wiring of RFD21733 to Analog Input terminal block. In this diagram, RFD21733 has been programmed to operate in Mode 7 ( Receiver with Logic Output [Network] 20ms hang-time ).

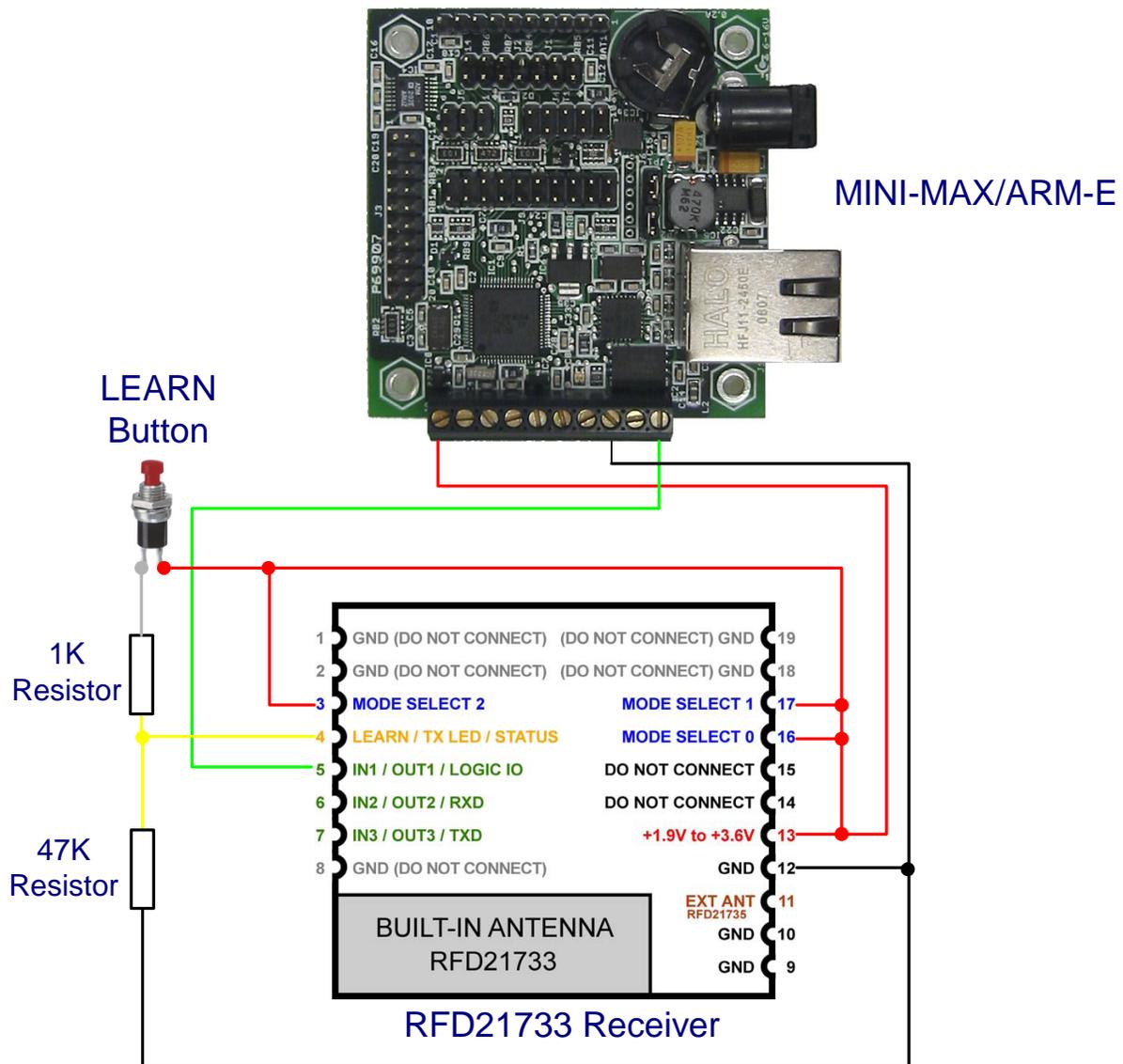


Figure 3



Figure 4 shows the same detailed wiring as Figure 3 while using the photo of RFD21733 for further clarity.

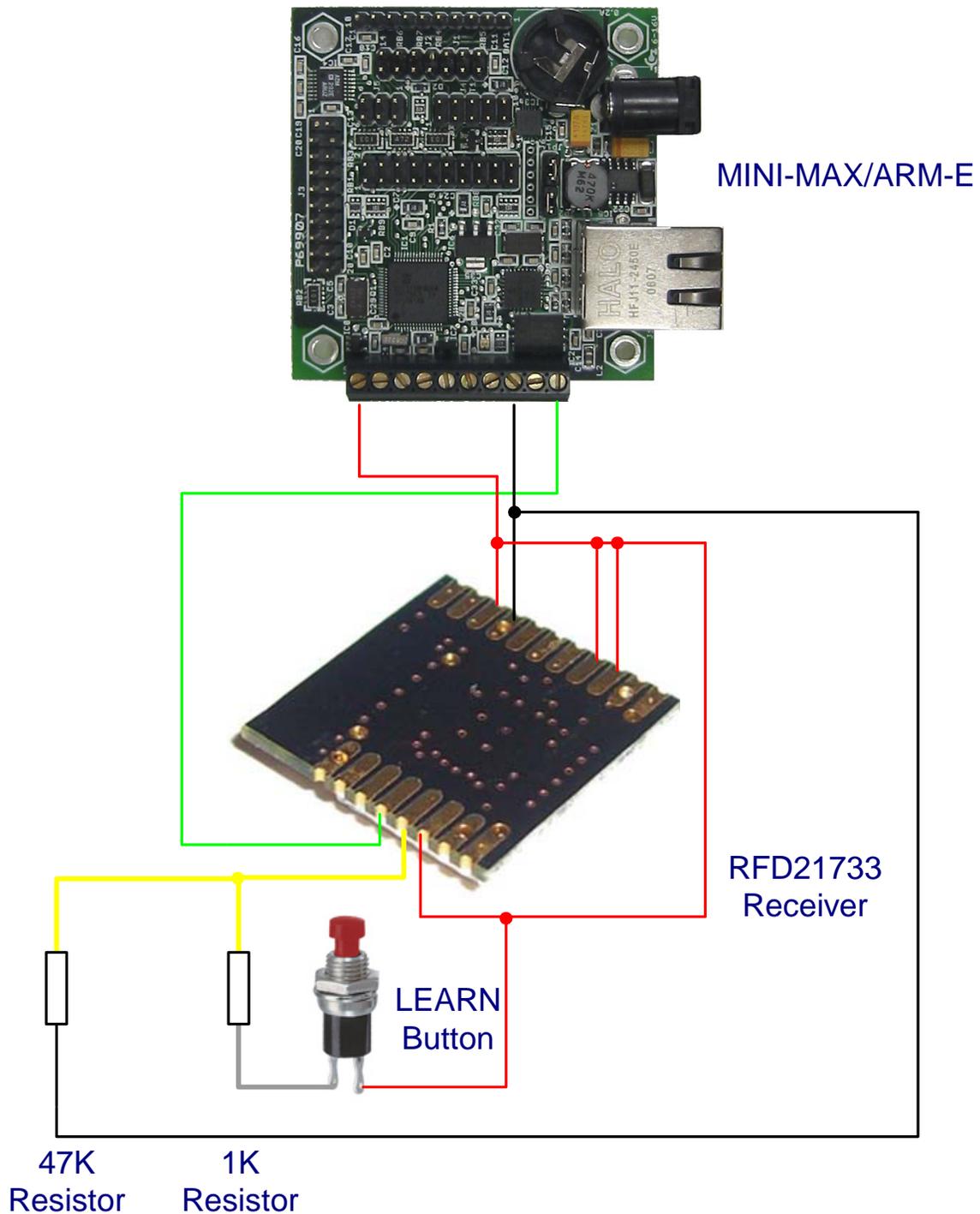


Figure 4



Figure 5 shows wiring of the transmitter side. RFD21733 is powered from a 3 Volt lithium coin cell. The battery is installed in a coin cell holder for ease of replacement. When the magnet is placed near the

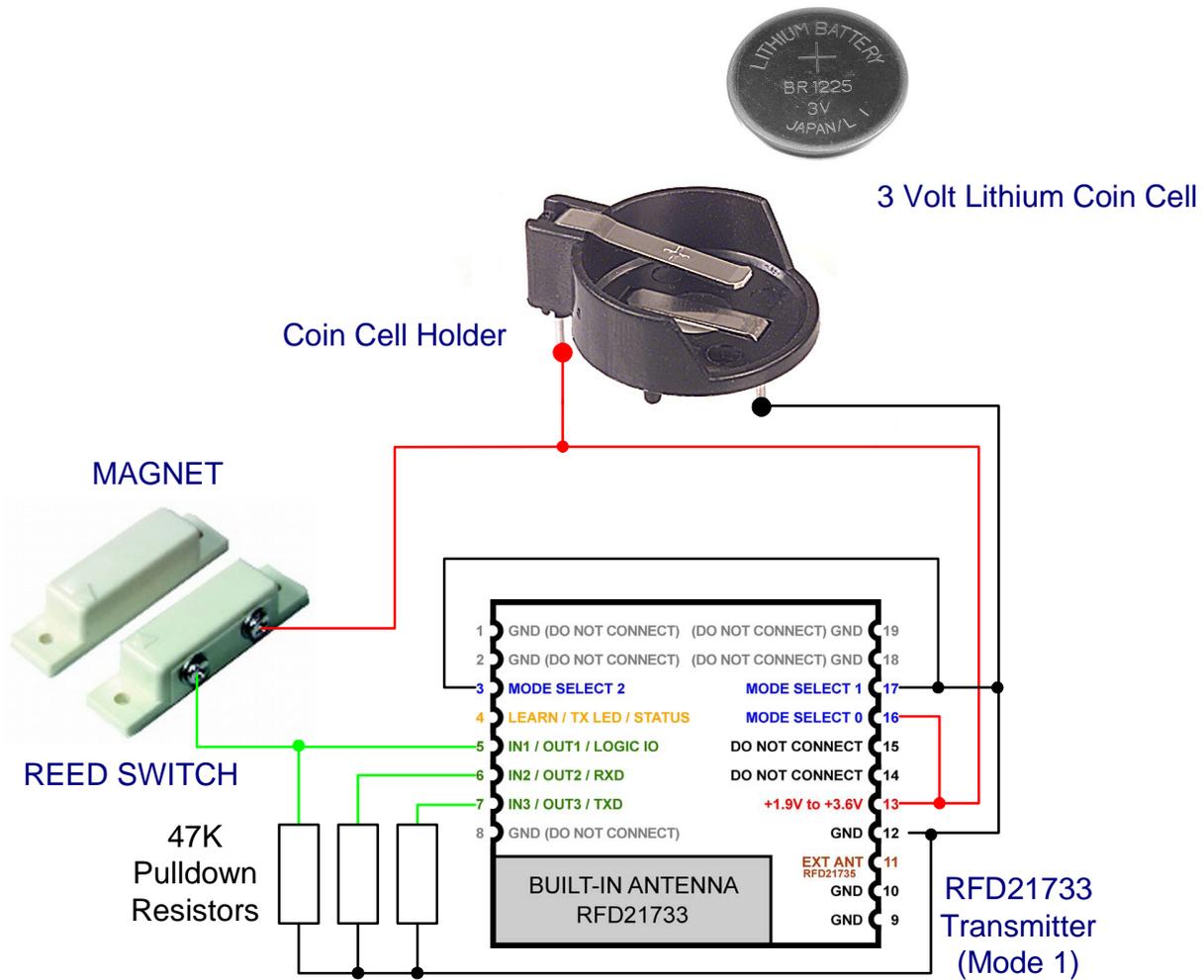


Figure 5



**Example 2: Using MINI-MAX/ARM-E, a remote switch activates a local relay.**

In this example, OUT1 digital output on RFD21733 receiver is connected to a digital input of MINI-MAX/ARM-E. When the remote RFD21733 transmitter detects a change of state on its IN1 input ( reed switch closed ) , the RFD21733 receiver changes the state of its OUT1 output which in turn changes the digital input of MINI-MAX/ARM-E. MINI-MAX/ARM-E senses this change and activates the corresponding relay(s) on the RELAY-4 peripheral board. Figure 6 shows the diagram of the complete setup.

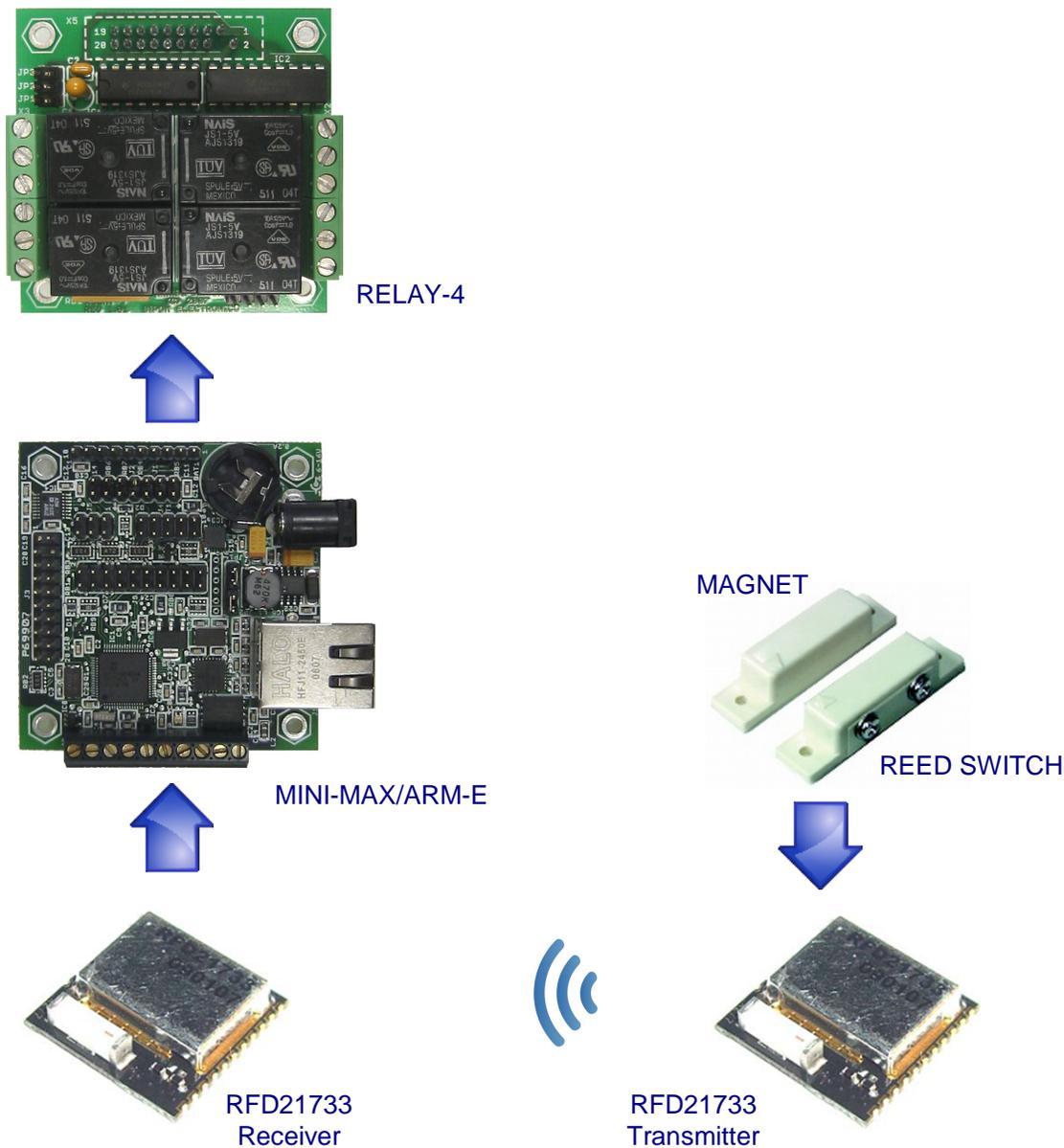


Figure 6



### Example 3: Using MINI-MAX/ARM-E, a remote switch triggers a phone call.

In this example, OUT1 digital output on RFD21733 receiver is connected to a digital input of MINI-MAX/ARM-E. When the remote RFD21733 transmitter detects a change of state on its IN1 input (reed switch closed), the RFD21733 receiver changes the state of its OUT1 output which in turn changes the digital input of MINI-MAX/ARM-E. MINI-MAX/ARM-E senses this change and dials a preconfigured phone number using a low-cost Sony-Ericsson T300 phone (Other cell phones could easily be adapted). Figure 7 shows the diagram of the complete setup.

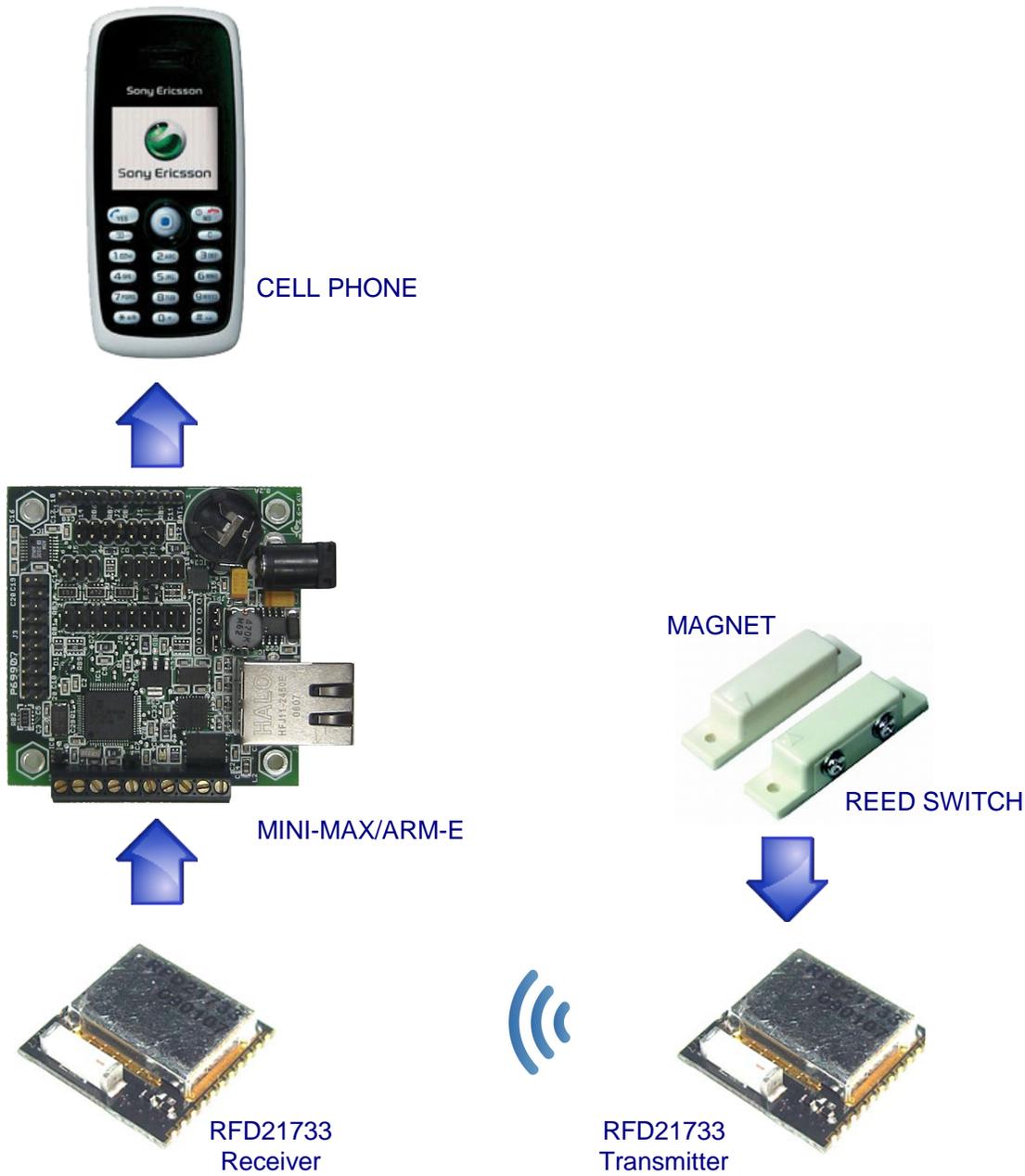


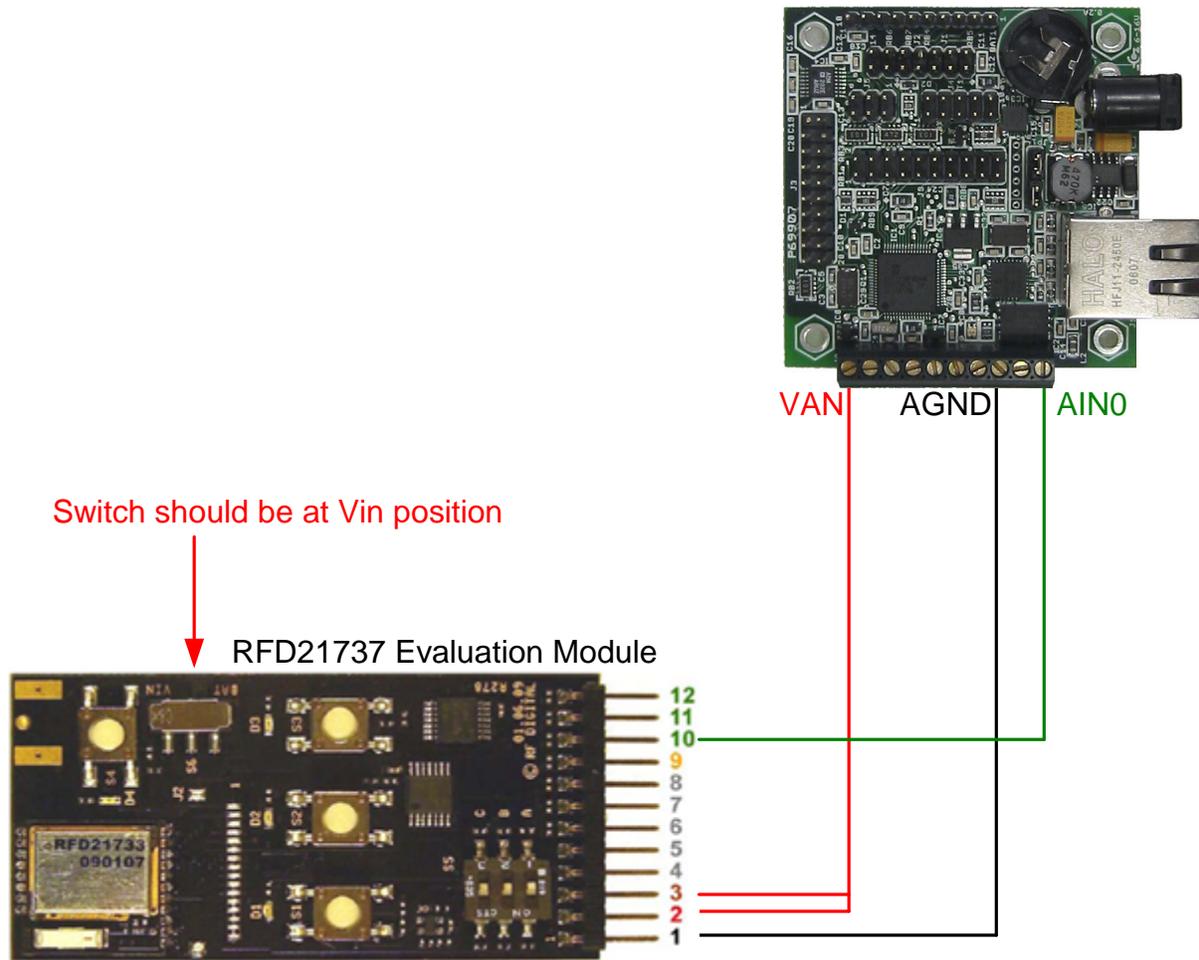
Figure 7



### Connecting RFD21737 Evaluation Module to MINI-MAX/ARM-E

RFD21737 is an Evaluation Module that houses an RFD21733 transceiver and other circuitry such as the Learn button, Mode DIP switches, LED's, push buttons and battery.

Figure 8 shows how to connect the RFD21737 Evaluation Module to MINI-MAX/ARM-E.



Note: When powering the board from MINI-MAX, the power switch on the board should be on VIN position (NOT on BAT position).

Figure 8