RFM69(H)W Board and Shield

Introduction

Beside the fact that the Jeenode (see http://jeelabs.org), Moteino (see https://lowpowerlab.com), and Anarduino miniWireless69 (see http://www.anarduino.com/miniwireless/) are offering great solutions to develop wireless applications using the RFM69(CHW) transceivers, a dedicated RFM69 appliance board is interesting to have:

- For a flexible approach when using a generic development platform (see RFM69(H)W board)
- While building a powerful Etherenet-RFM69 gateway using the Arduino ATMEGA2560 platform (see RFM69(H)W shield).

Jeenode is using RFM12B and the compatible RFM69CW transceiver version while Anarduino MiniWireless, Moteino are using RFM69W and RFM69HW transceivers for FSK modulation.
However, while developing a wireless gateway is would be interesting to transmit OOK datagrams with the same transceiver.
Receiving OOK datagrams with the RFM69(H)W is another story (see http://members.home.nl/hilcoklaassen/). For the time being I see no interest nor utility to combine FSK and OOK receiver functions on the same transceiver.

This document describes the RFM69(H)W board and RFM69(H)W shield for ATMEGA2560.
It also shows how to modify the of Moteino and miniWireless69 hardware for OOK transmission..

OOK hardware configuration

RFM69 variants

Two variants of RFM69 are considered; RFM69W and RFM69HW. To simplify the configuration other versions such as the RFM69CW (hardware compatible with RFM12B) and RFM69HCW (hardware compatible with RFM22) are not scoped, we consider only the RFM69(H)W transceivers which are only available on Moteino / Moteino MEGA and Anarduino miniWireless69.

1. RFM69W, a new full function transceiver (not compatible with the RFM12B and RFM22)

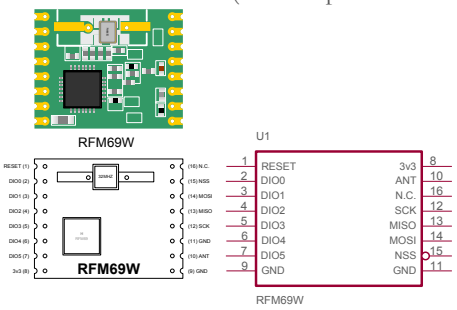


Figure 1: RFM69W Details

2. RFM69HW, a the high power version of the RFM69W

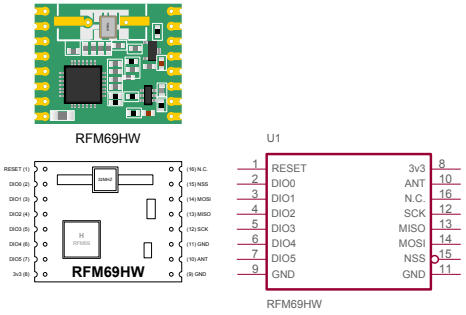


Figure 2: RFM69HW Details

RFM69(H)W Board and Shield

RFM69(H)W OOK hardware configuration.

Moteino and Anarduino are using a limited subset of the RFM69 pins for FSK modulation.

RMF69 Pin	RFM69 Function	Moteino Pin	Moteino Mega Pin	MiniWireless69 Pin	Function
1	Reset	N.A.	N.A.		
2	DIO0	D2	D2		INT0
3	DIO1	N.A.	N.A.		
4	DIO2	N.A.	N.A.		
5	DIO3	N.A.	N.A.		
6	DIO4	N.A.	N.A.		
7	DIO5	N.A.	N.A.		
8	VDD	3v3	3v3	3v3	3v3
9	GND	GND	GND	GND	GND
10	ANT	ANT	ANT	ANT	ANT
11	GND	N.A.	N.A.	GND	GND.
12	SCK	D13	D7	D13	SCK
13	MISO	D12	D6	D12	MISO
14	MOSI	D11	D5	D11	MOSI
15	NSS	D10	D4	D10	SS
16	N.C.	N.A.	N.A.	N.A.	

Table 1: RFM69(H)W pin mapping with different development platforms

For OOK, data exchanges (receive / transmit) occur via the Pin 4 - DIO2 of the RFM module, a small modification of the above modules allows to program the RFM69(H)W for OOK mode.
Here is the proposed connection to the existing development platforms.

RMF69 Pin	RFM69 Function	Moteino Pin	Moteino Mega Pin	MiniWireless69 Pin	Function
4	DIO2	D3	D11	D3	INT1

Table 2: RFM69(H)W OOK pin mapping with development platforms

Notes:
Pin 3 or INT1 is chosen for possible future extension to OOK datagram detection
A software configuration is necessary to activate the OOK mode; this configuration is described in another document (see RFM69W OOK Library vx.y.pdf).

RFM69(H)W and OOK

This modification of the Moteino and miniWireless69 hardware allows activating the OOK functions.

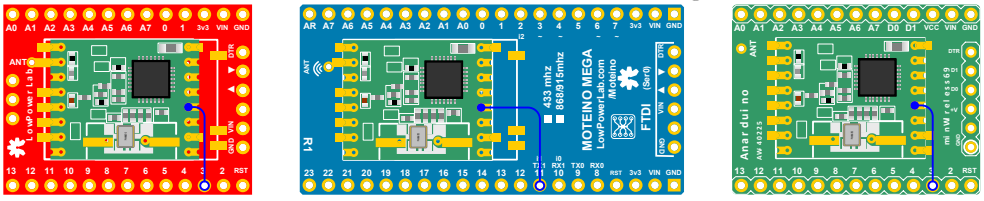


Figure 3: OOK hardware modification on development platforms (RFM69(H)W)

RFM69 Board

The easiest way to interface Arduino or other development platform with the RFM69(H)W module is to develop an RFM69 board.
This board is inspired by:

- http://jeelabs.net/projects/hardware/wiki/RFM12B_Board
- https://bitknitting.wordpress.com/2014/02/22/making-an-rfm69-breakout-board/

The board may be used with or without 3v3 LDO supply, the one with LDO is more appropriate for the RFM69HW model which is consuming up to 130 mA in transmission mode, because such amount of power may not be supplied by the processor platform LDO.

RFM69(H)W Board and Shield

Schematics

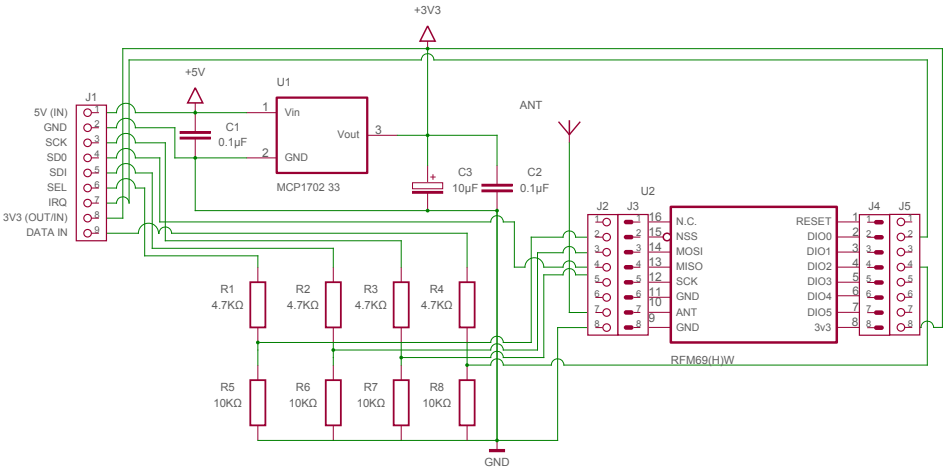


Figure 4: RFM69(H)W board with 3v3 LDO supply

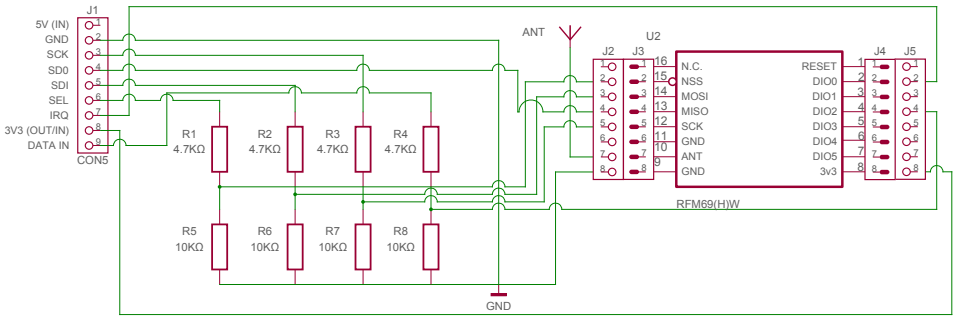


Figure 5: Simplified RFM69(H)W board without 3v3 LDO supply

Hardware

Parts

- J3,J4 = optional 8 positions male 2mm pitch socket header (for RFM69 module)
- J2,J5 = optional 8 positions female 2mm pitch socket header (for RFM69 board)
- J1 = 9 positions female 0,1 inch pitch socket header
- R1,R2,R3,R4 = 4,7 KΩ 1/8 W carbon resistors
- R5,R6,R7,R8 = 10 KΩ 1/8 W carbon resistors
- C1,C2 = 0,1µF ceramic capacitor (N.A. without LDO)
- C3 = 10µF electrolytic or tantalum capacitor (35V) (N.A. without LDO)
- U1 = MCP1702-33: 5V to 3V3 LDO (N.A. without LDO)
- U2 = RFM69W or RFM69HW transceiver module of appropriated frequency

Notes:
Do not connect / use 5V and 3v3 at the same time (i.e. chose one or the other depending of the usage of the LDO)
Usage of 2mm socket headers allows interchanging RFM69 modules of various power and frequency

Prototype

For those happy with a quick solution, here is the prototype version.

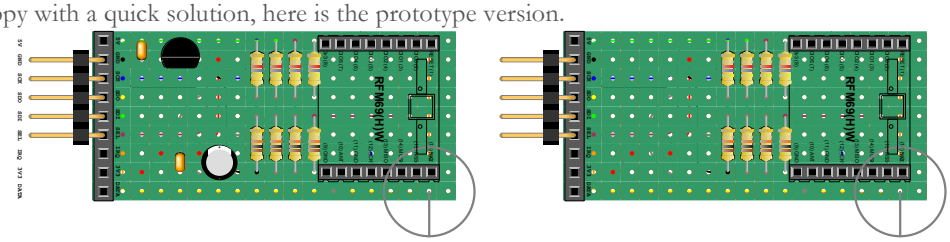


Figure 6: Top view RFM69(H)W board with and without 3v3 LDO supply

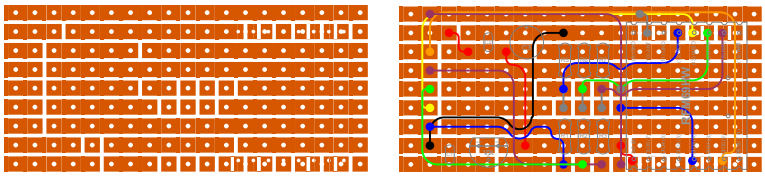


Figure 7: Circuit and cabling views of the RFM69(H)W board

Production version

For those who are ready to produce a more professional version.

Layout

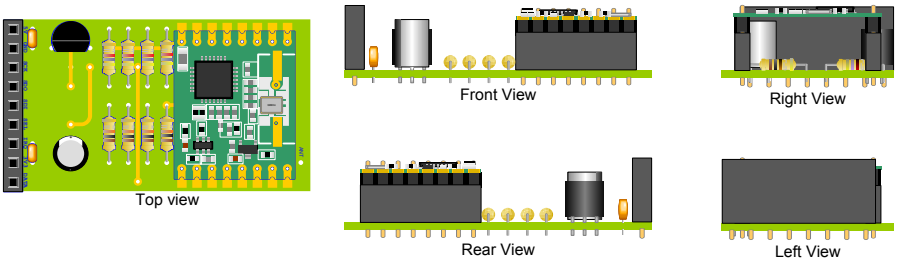


Figure 8: Physical views of the RFM69(H)W board

Printed Circuit

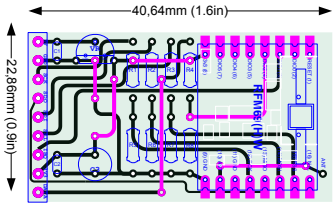
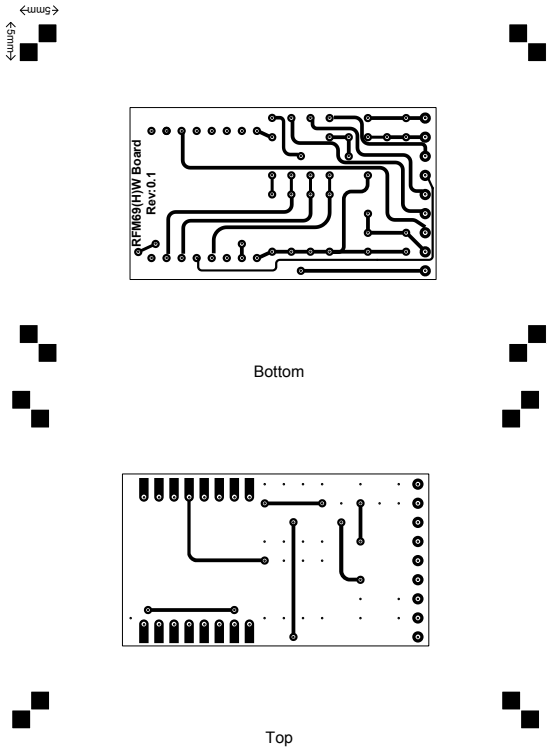
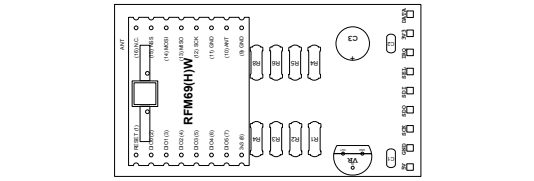


Figure 9: RFM69(H)W Board PCB Layout





Top silk

Figure 10: double sided PCB masks

Usage Example

Arduino Uno

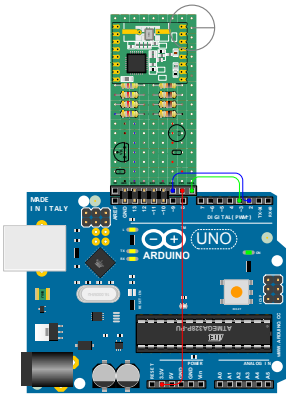


Figure 11: Arduino Uno with RFM69W Board

ATMEGA 2560

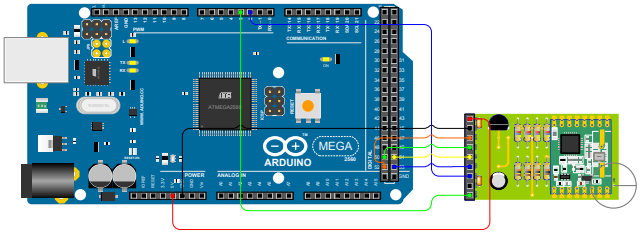


Figure 12: Arduino ATMEGA2560 with RFM69HW Board

Note: For Atmegaé560 pins are for: MISO(0), MOSI (51), SCK(52), SS (53) INT0 (2), INT1 (3)

RFM69(H)W ATMEGA 2560 Shield

As described above, the use of this shield is to create a powerful Ethernet-Wireless gateway. The RFM69(H)W shield is designed to fit on the ATMEGA2560 together with the Ethernet shield.

Ethernet-RFM69 gateway - Logical design

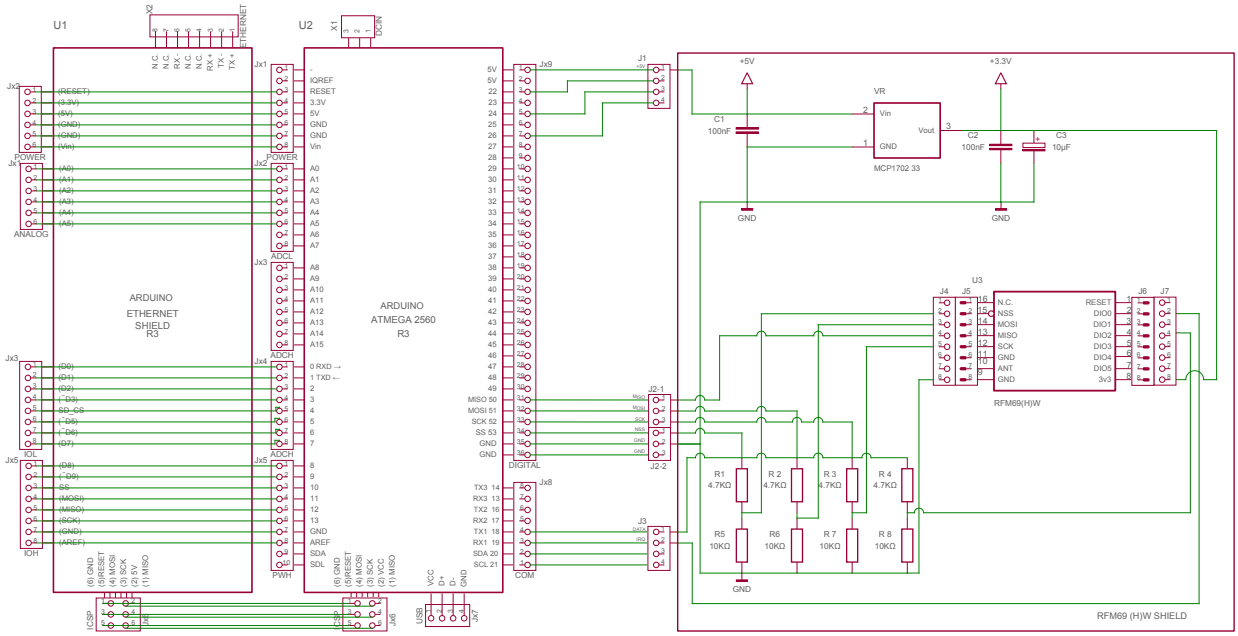


Figure 13: ATMEGA2560+EthernetShield+ RFM69(H)W shield

RMF69 Shield Pin	Function	ATMEGA 2560 Pin
J1-1	+5V	+5V
J1-2	N.U.	
J1-3	N.U.	
J1-4	N.U.	
J2-1	MISO	50
J2-2	MOSI	51
J2-3	SCK	52
J2-4	SS	53
J2-5	GND	GND
J2-6	GND	
J3-1	DATA (OOK)	3 (IRQ1)
J3-2	IRQ	2 (IRQ0)
J3-3	N.U.	
J3-4	N.U.	

Table 3: RFM Shield to ATMEGA 2560 connections

RFM69(H)W hardware parts

Parts

- J4,J5 = optional 8 positions male 2mm pitch socket header (for RFM69 module)
- J6,J7 = optional 8 positions female 2mm pitch socket header (for RFM69 board)
- J1, J3 = 4 positions female 0,1 inch pitch socket header (long pins:11,5mm)
- J2-1, J-2 = 3 positions female 0,1 inch pitch socket header (long pins:11,5mm)
- R1,R2,R3,R4 = 4,7 KΩ 1/8 W carbon resistors
- R5,R6,R7,R8 = 10 KΩ 1/8 W carbon resistors
- C1,C2 = 0,1µF ceramic capacitor
- C3 = 10µF electrolytic or tantalum capacitor (35V)
- U1 = MCP1702-33 5V to 3V3 LDO
- U2 = RFM69W or RFM69HW transceiver module of appropriated frequency

RFM69(H)W Shield Prototype

For those happy with a quick solution, here is the prototype version of the RFM69(H)W Shield is the following.

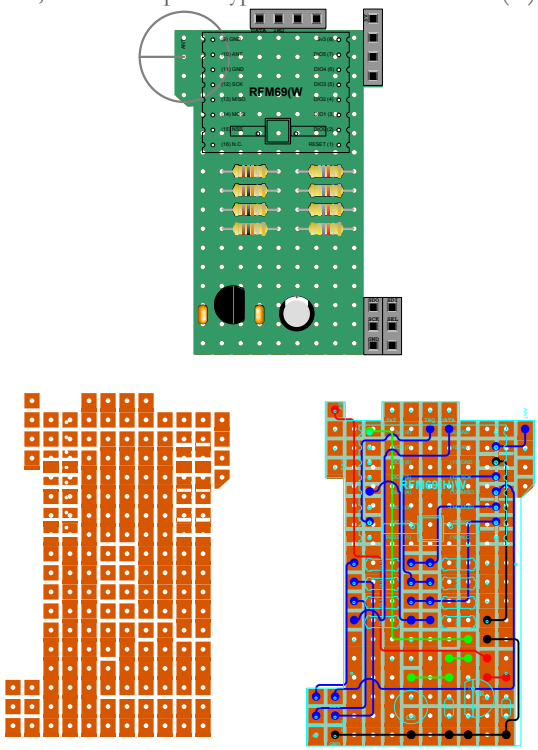
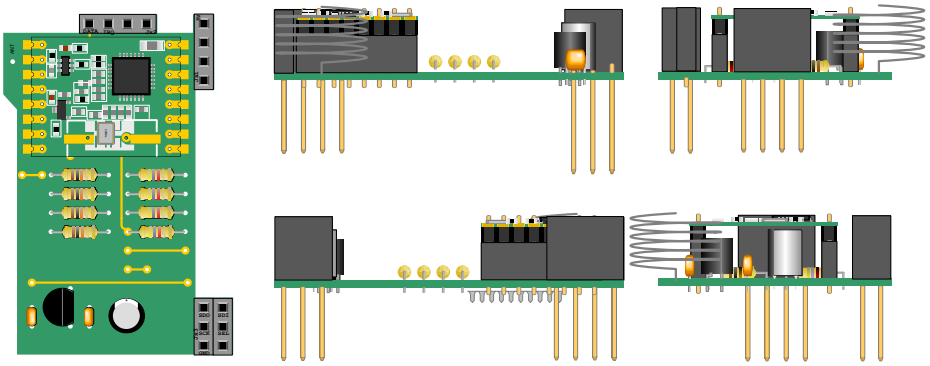


Figure 14: RFM69(H)W shield prototype

Production version

For those who are ready to produce a more professional version.

Layout



Printed Circuit

Figure 15: Physical views of the RFM69(H)W shield

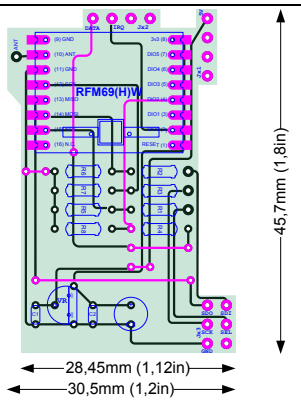


Figure 16: RFM69(H)W shield PCB Layout

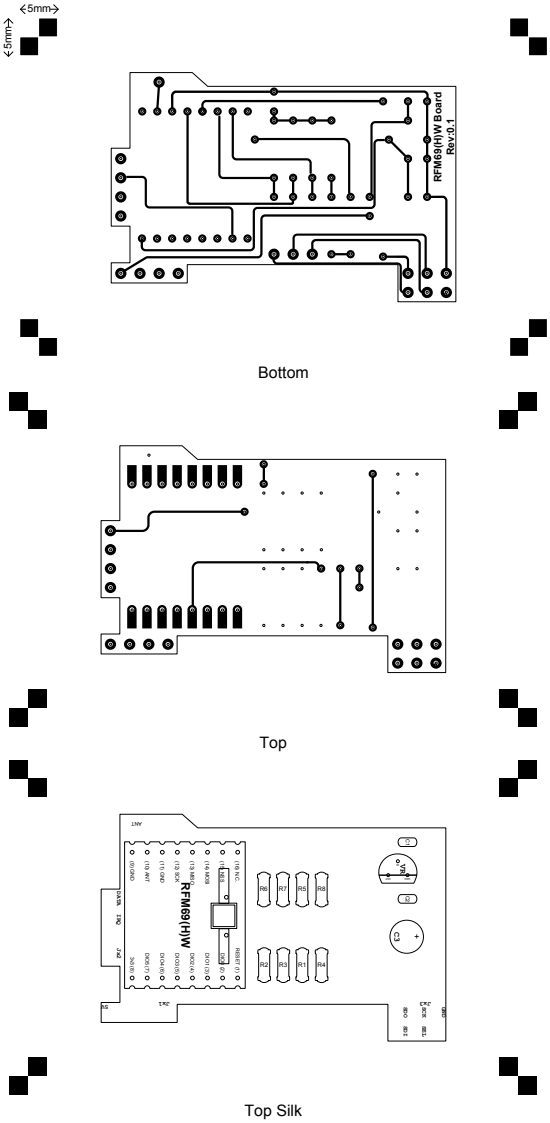


Figure 17: double sided PCB masks

Ethrernet-RFM69(H)W gateway example

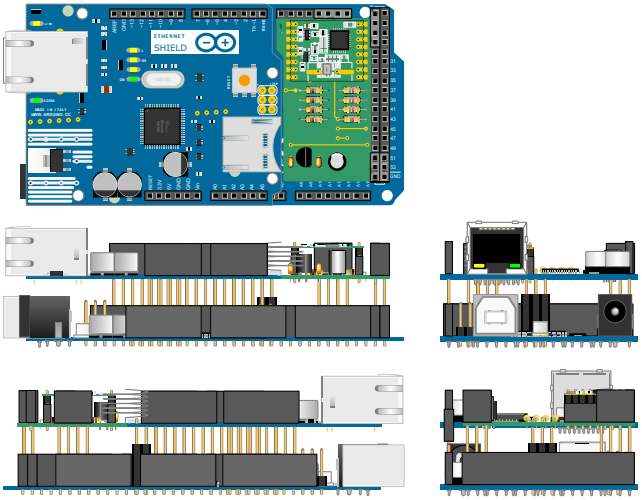


Figure 18: ATMEGA2560 with Ethernet and RFM69(H)W Shield

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