

Scope

This application note describes the use of the Melexis TH71221 RF transceiver in a wireless sensing network (WSN) application.

A WSN is a network, consisting of spatially distributed autonomous modules (called nodes) using sensors to monitor physical or environmental conditions such as temperature, pressure or humidity. All these devices communicate wirelessly to a main sensor node which collects back all the measurements and sent it to a main station for further processing (e.g. a computer).

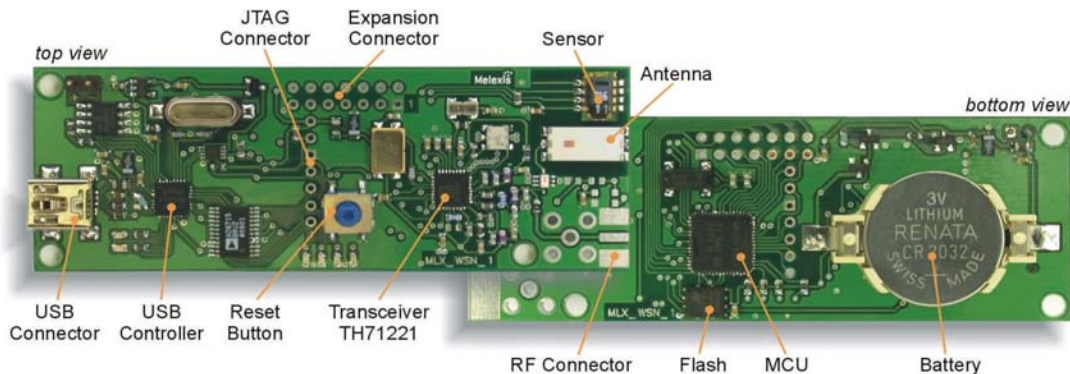


Figure 1: Melexis WSN Node

This application note describes how the TH71221 RF transceiver has been used with other external components like microcontroller and sensors to build a WSN node. The detailed application schematics of the TH71221 and the microcontroller will be provided as example as well as the complete bill of materials.

Applications

- Wireless sensing networks for temperature, humidity, light and RF field strength measurements.
- Home and building automation

Related Melexis Products

TH71221 - Multi-band, Multi-channel RF Transceiver

Theory of operation

The Melexis WSN Node (shown in figure 1) is composed of the TH71221 RF transceiver, a microcontroller type MSP430 to handle the network communication protocol, several on-board sensors for temperature, humidity, light and RF field strength measurements and a state-of-the-art USB interface for node control and programming.

The Melexis TH71221 RF transceiver supports all frequency bands ranging from 300 to 930 MHz. Its high input sensitivity enables large node distances. The MSP430 microcontroller and other peripheral devices offer ultra low-power operation to allow for long battery life time. A state-of-the-art USB interface supports secure and reliable programming of the node. Custom specific WSN solutions can be addressed through the on-board expansion connector.

Application schematic

The following two pictures show the complete application schematics of the TH71221 RF transceiver and the connection to the microcontroller.

The TH71221 transceiver is built with several components around it. The transmitting power amplifier is matched to the 50-ohm antenna with the components CTX0, CTX1, CTX2, CTX4, LTX0 and LTX1. For the reception, the input of the low noise amplifier (LNA) is matched with the capacitor CRX0 and the inductor LRX2. A tank circuit composed of L1 and C1 is built at the output of the LNA to provide sufficient gain at the desired frequency and to allow enough image frequency rejection. This tank circuit must be centred on the received frequency band. An external ceramic filter CERFIL provides the intermediate frequency (IF) filter on 10.7MHz. The TH71221 is used in FSK detection mode with an external ceramic discriminator CERDIS. Decoded data information is available for the microcontroller processing at the pin 8 of the device.

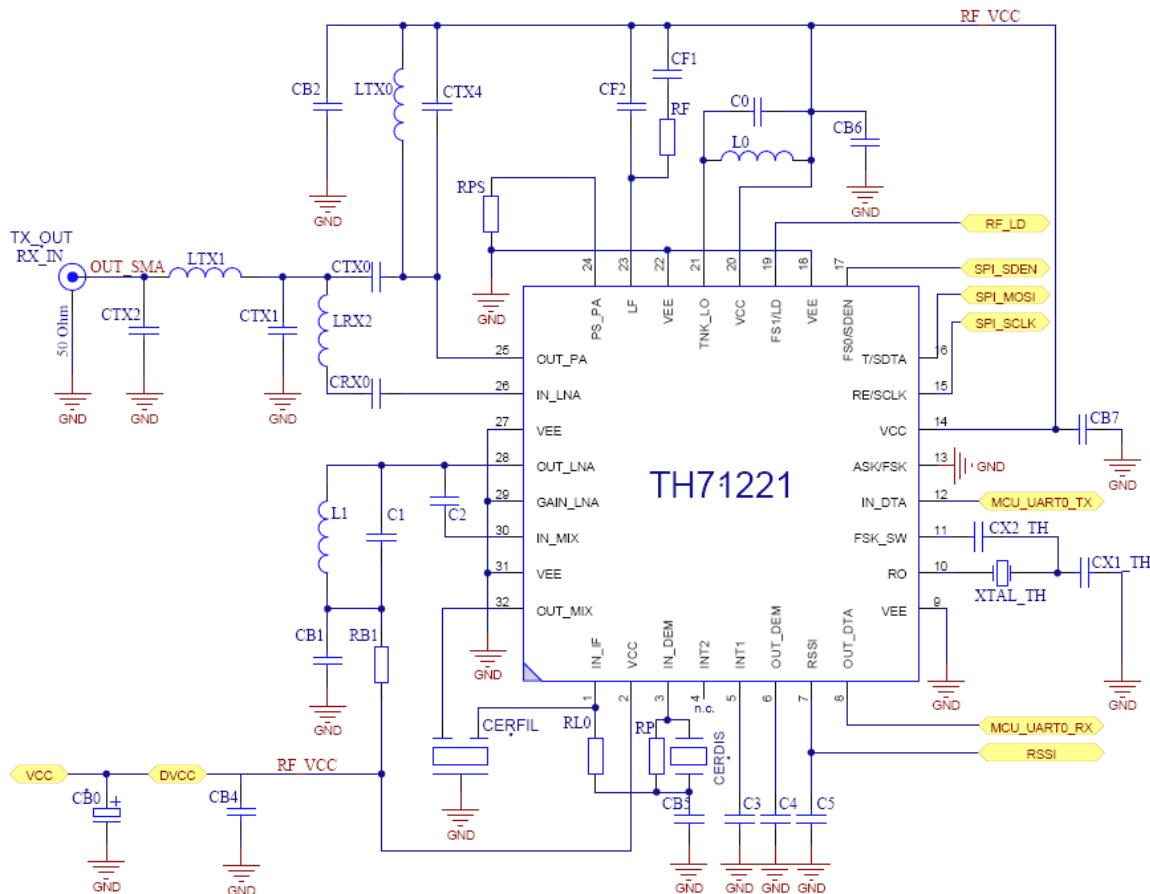


Figure 2: Transceiver TH71221 application schematic

To support the Network communication protocol and to interface the TH71221 device, an external microcontroller type MSP430 is used. After power ON reset, the microcontroller configures the TH71221 transceiver through its SPI connection (pins 23, 29 and 31). According to the pre-programmed software on the node, the Melexis WSN Node will act as a master or a slave in the communication. The RF information is sent to the UART of the microcontroller through the pins 32 and 33. To ensure a reliable RF communication, the PLL lock signal is always sensed by the microcontroller at the pin 24. The RSSI signal generated from the TH71221 transceiver can be measured by one channel of the ADC of the microcontroller. This can be used to easily implement a “listen before transmit” function.

The microcontroller communicates to a RS232/USB converter of type FTDI which allows easy USB connection.

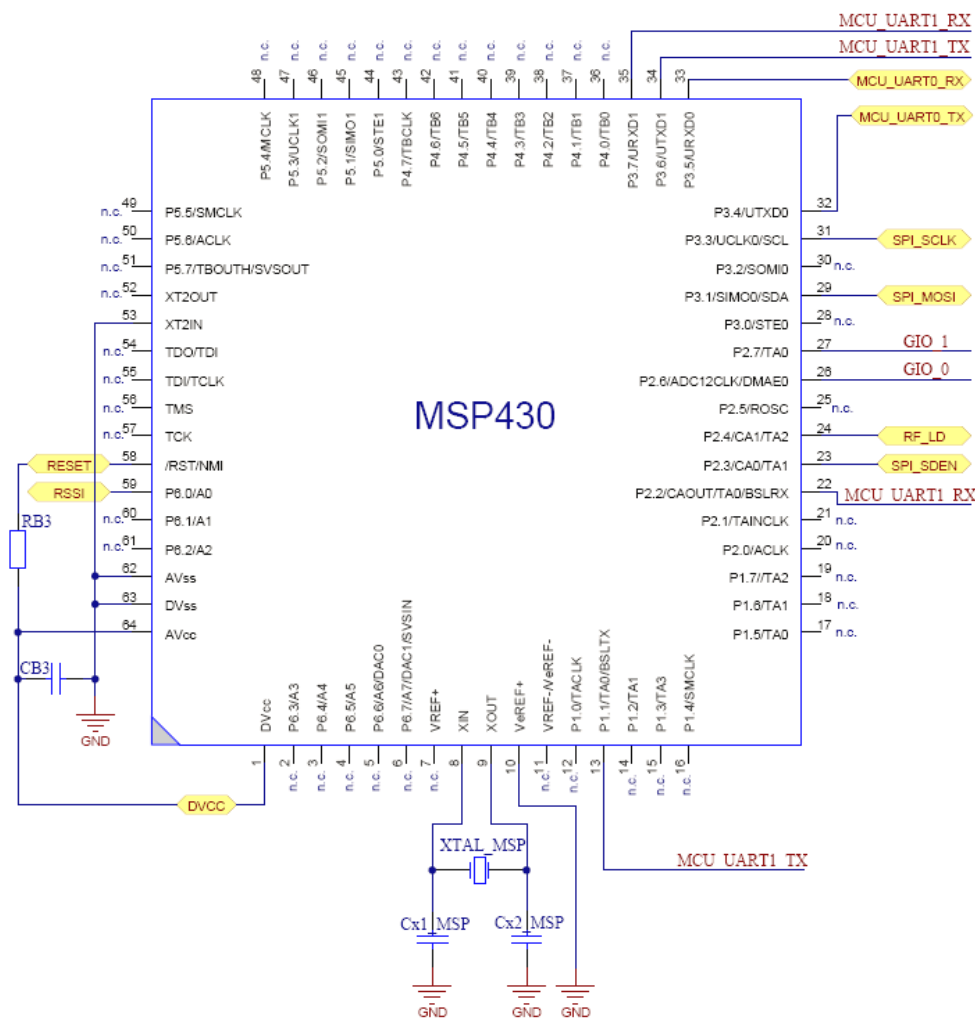


Figure 3: Microcontroller MSP430 application schematic

Component List

Component	Number/Board	Type / Specification	Distributor	Manufacturer	Remark
Transceiver	1	TH71221	various	Melexis	TH7221 (QFN32 5x5)
Microcontroller	1	MSP430 F1611	Mouser	Texas Instruments	MSP430 F1611 IRTDT (QFN64)
Crystals	1	XTAL_TH	Telcona	FCA	HKC 7.1505
	1	XTAL_MSP	Farnell	EPSON TOYOCOM	MC306-32.768KHz

Table 1: Component's list (active components)

Component	Number/Board	Type/ Specification	Distributor	Manufacturer	Remark
RB1	1	100 Ω	Farnell	various	
RB3	1	100 kΩ	Farnell	various	
RP	1	3.3 kΩ	Farnell	various	
RPS	1	33 kΩ	Farnell	various	
RL0	1	390 Ω	Farnell	various	R _L for Cerdis.
RF	1	33 kΩ	Farnell	various	
CB0	1	10 μF	Farnell	various	
CB1	1	10 nF	Farnell	various	
CB2	1	330 pF	Farnell	various	
CB3	1	100 nF	Farnell	various	
CB5	1	10 nF	Farnell	various	
CB6	1	100 pF	Farnell	various	
CB7	1	100 nF	Farnell	various	
C0	1	NIP	Farnell	various	VCOtank C
C1	1	1 pF	Farnell	various	
C2	1	10 pF	Farnell	various	
C3	1	10 nF	Farnell	various	
C4	1	330 pF	Farnell	various	
C5	1	1.5 nF	Farnell	various	
CX1_TH	1	12 pF	Farnell	various	
CX2_TH	1	15 pF	Farnell	various	
CX1_MSP	1	12 pF	Farnell	various	
CX2_MSP	1	12 pF	Farnell	various	
CF1	1	1 nF	Farnell	various	
CF2	1	NIP	Farnell	various	
CTX0	1	10 pF	Farnell	various	
CTX1	1	3.9 pF	Farnell	various	
CTX2	1	4.7 pF	Farnell	various	
CTX4	1	3.3 pF	Farnell	various	
CRX0	1	100 pF	Farnell	various	
L0	1	5.6 nH	Farnell	various	
L1	1	4.7 nH	Farnell	various	
LTX0	1	4.7 nH	Farnell	various	

Component	Number/ Board	Type/ Specification	Distributor	Manufacturer	Remark
LTX1	1	10 nH	Farnell	various	
LRX2	1	15 nH	Farnell	various	
CERDIS	1	10.7 MHz	Farnell	Murata	CDSCB 10M7 GA136
CERFIL	1	10.7 MHz	Farnell	Murata	SFEFCF 10M7 HA00

Table 2: Component's list (passive components)

Conclusion

With several components around , the TH71221 RF transceiver can be used in a low cost wireless sensing network application. The external microcontroller handles the network protocol of communication while the TH71221 is used to receive and transmit information over the wide frequency range of 300 to 930 MHz.

Reference and Related Documents

- TH71221 data sheet
- Evaluation Board for TH7122

For the latest version of this document, go to our website at:

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