

# KNX-RF radio module



The KNX RF module RC1180-KNX from Radiocrafts, comes with different firmware feature sets, based on one standard hardware platform. The form factor, pin-out and interface are the same for all firmware versions. The Radiocrafts KNX feature set is compliant with S, A and E modes and the KNX-RF Multi specification. Custom versions can also be delivered on request using I/O interface or different features.

## KNX-RF Multi – RF redundancy for Home Automation

- ✓ **Frequency agility – 5 channels**
- ✓ **Fast link acknowledgement**
- ✓ **Binding up to 64 receivers**
- ✓ **Automatic Retransmission**
- ✓ **Multi-hop retransmitters**
- ✓ **Listen Before Talk (LBT)**

- Embedded KNX RF protocol with KNX-RF Multi specification
- Backward compliant with KNX-RF v1.1 and KNX Ready
- Supports unidirectional and bidirectional devices
- Received Signal Strength Information (RSSI)
- Automatic battery supervision
- Completely Shielded
- Designed for EX compliance
- Wide supply voltage range, 2.0 – 3.9 V
- Conforms with EU R&TTE directive (EN 300 220, EN 301 489, EN 60950)
- Confirms with EN 50090 (ISO/IEC 14543-3)
- Ultra low power modes for extended battery lifetime
- 12.7 x 25.4 x 3.3 mm compact module for SMD mounting



**2 pins for data, 2 pins for power and 1 pin for antenna!**

## RC1180-KNX RF module series

The RC1180-KNX is a compact RF Module with embedded wireless KNX RF protocol and CE marking.

Parameter	RC1180-KNX	Unit
Frequency bands	868.0 – 870.0	MHz
Nr of channels Ready/Multi	1/5 (12)	ch.
Max nr of channels in module	12	ch.
Max bindings pr device	64	nodes
Data rate	32.768	kchip/s
Max output power	10	dBm
Sensitivity	-102	dBm
Supply voltage	2.0 – 3.9	Volt
Current consumption, RX / TX	24 / 37	mA
Current consumption, SLEEP	Typ 0.3	uA
Temperature range	-40 to +85	°C

### KNX1

Basic KNX-RF features according to EN 50090  
 Supports S, A and E modes, flexible solution  
 RSSI signal and automatic battery supervision  
 Serial nr. addressing and domain addressing  
 Embedded internal KNX-RF packet handler  
 Listen Before Talk to reduce collisions

### KNX 2

Embedded KNX RF Multi protocol  
 All KNX1 features and backward compatible  
 Multichannel for frequency agility, 5 channels  
 Automatic retransmission for extended range

## Feature sets

The RC1180-KNX modules are easy to use and significantly reduce time-to-market. All the communication according to the KNX RF standard EN50090 is embedded into the module. Future feature sets will support sensors, actuators, gateways and media couplers. Contact Radiocrafts for options.

Radiocrafts is a  
 member of the  
 KNX Association.



## The world's smallest KNX-RF module for building automation

The compact module, RC1180-KNX1, being the smallest available in the market, is designed for Home and Building Automation systems using the wireless KNX protocol as defined by the KNX Association. The embedded protocol supports KNX-RF 1.1 and KNX Ready, and can be used for unidirectional and bidirectional devices, also in battery operated systems. It conforms to EN 50090 (ISO/IEC 14543-3). KNX is the only open international standard for Home and Building Control, used in Smart Home, Building Automation and Building Management Systems.



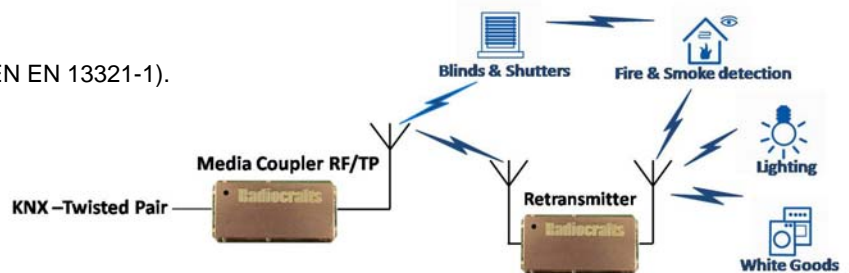
KNX is one of the leading standards for home and building control. The interest for such systems is increasing, meeting the demands for energy saving technology. Studies have shown up to 50% energy savings using KNX technology. Radiocrafts is considered as one of the leaders in Wireless M-Bus technology, and Radiocrafts is now also a member of the KNX Association. With the new KNX product series, Radiocrafts gives the customers an easy transition to KNX with compatible products. Interoperation between Wireless M-Bus and KNX-RF is also possible using the new module.

The module operates in the 868 MHz band, using Listen Before Talk (LBT) to reduce collisions. One receiver can be linked with up to 64 transmitters, enabling very large RF networks. It can be used with S, A and E modes of installation. Among other features, the module offers automatic battery supervision and signal strength information. The KNX1 is the first feature set in a family of KNX products that will also include RF repeaters and media couplers.

The new RC1180-KNX is a surface-mounted high performance transceiver module measuring only 12.7 x 25.4 x 3.3 mm, and can easily be integrated into any sensor or actuator. A UART interface is used for serial communication and configuration. An antenna is connected directly to the RF pin. The RC1180-KNX1 module is certified for operation under the European radio regulations for license-free use. When used with quarter-wave antennas a line-of-sight range of 800 meter can be achieved.

### KNX is approved as:

- European Standard (CENELEC EN 50090 and CEN EN 13321-1).
- International Standard (ISO/IEC 14543-3).
- Chinese Standard (GB/Z 20965).
- US Standard (ANSI/ASHRAE 135).



## Installation modes

KNX has defined a set of installation or configuration modes. Some of the KNX products support more than one configuration mode, e.g. both S- as well as E-Mode.

### S-Mode – System Mode

S-mode access refers to the configuration of devices with a central management unit (e.g. the ETS). S-mode access to devices on RF is modified compared to the other media. The configuration procedure of the S-mode has the steps device individualisation, parameter download, and device linking.

### A-Mode – Automatic Mode

This configuration mechanism is especially intended for end-user applications, e.g. household appliances or customer installation add-ons, sold via the end-user sales channels. The A-mode components support automatic configuration mechanisms that adapt their communication links to other A-mode components in the network. Each component contains a fixed setting of parameters and a library of instructions how to communicate with other A-mode components.

### E-Mode – Easy Mode

“E-mode” compatible products offer limited functions compared to S-Mode. E-Mode components are already pre-programmed and loaded with a default set of parameters. With a simple configurator, each component (mainly its parameter settings and communication links) can be partly reconfigured.

#### Push button

In the Push-button mode no tools or external devices (e.g. PC, Controller, Supervisor, ETS etc.) are needed for configuration. The assignment of individual addresses and group addresses is done by the devices itself and also the creation of the links. To handle this, the devices contain procedures for the configuration and the link management.

#### Controller mode

The controller uses the same management procedures as the management client in S-mode. The controller shall be able to derive the group addresses from the information contained in device descriptor 2. Therefore in controller mode only those channel codes shall be used which allows to conclude the presence of all objects (including non-active objects).

## Retransmitter

If the communication between two or more devices is blocked due to attenuation of the RF signal, one or more retransmitters can be introduced between these devices. These retransmitters receive all frames originating from a sender and resend them. In order to avoid an avalanche of frames sent by various retransmitters, which would block the communication channel, the following mechanism avoids multiple re-sending of a single frame by a retransmitter. This is done with the use of a history list in the retransmitters. Additionally a frame shall be able to pass only a limited number of retransmitters in order to limit the channel load. This is controlled by the routing counter. KNX2 includes the retransmitter functionality.

## KNX RF Multi – RF reliability

The KNX RF Multi is an important new part of the KNX standard to improve RF reliability and achieve better radio link. The KNX RF Multi solution is switching between 5 different channels. For improved radio quality, the system has built in Listen Before Talk to reduce collisions.

### KNX RF Multi – 5 channels

KNX-Multi can use up to 5 RF channels, respectively the fast channels F1, F2, F3 and the slow channels S1 and S2. The scanning sequences are handled by the RC1180-KNX radio module.

- 3 fast channels intended to be used with human controlled applications i.e. lights, shutters, etc.
- 2 slow channels intended to be used with NPRM (non permanent reception mode) devices for automatic applications like sensors, heat control, etc.
- NPRM devices sleep when not scanning for KNX packets. In that way they are intended to be battery operated. PRM devices should be mains powered since they are always scanning for KNX frames when not receiving or transmitting.
- The reception and scanning sequences depends on the receiver capabilities.

### Physical Layer

**Fast channels** have a data rate of 16.384 kbps and a preamble length of approximately 15ms.

**Slow channels** have a data rate of 8.192 kbps and a preamble length of approximately 500ms.

All channels use Manchester coding.

- A device can use all the 5 RF channels, but mainly uses either the fast channels or the slow channels.
- By using more than one channel the devices can switch to an escape channel if the main channel is busy, improving efficiency and reliability.

Hardware and protocol according to the KNX RF standard EN50090 is all included in the RC1180-KNX module as an off-the-shelf component. It allows uni- and bidirectional implementations, very low power consumption, and all size of installations. Retransmitters functionality is included in the embedded protocol. KNX RF radio modules from Radiocrafts has embedded RSSI signal and automatic battery supervision. The protocol uses serial number addressing and domain addressing and has embedded internal KNX-RF packet handler.

## KNX-RF Message Structure – embedded packet handler

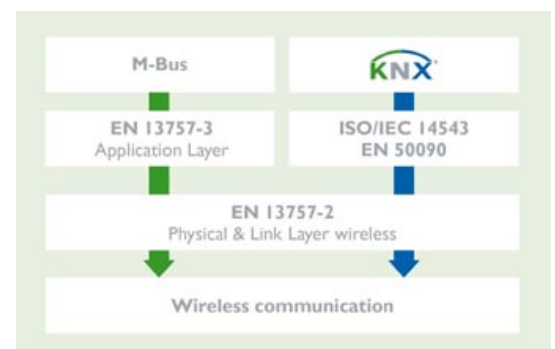


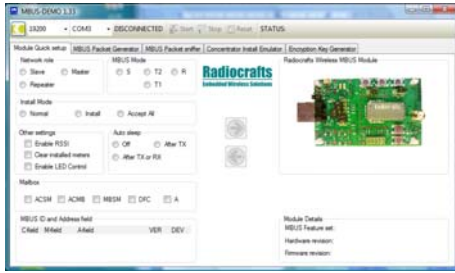
The KNX-RF frame format follows the FT3 block format, using two CRC bytes for every 16 data bytes. This ensures the high integrity of the data link. The first block of 10 bytes contains the transmitter address. This address is unique for each unit. Compared to the KNX frame used for wired communication like twisted pair, an extended address is used. This is to avoid conflicts between two adjacent networks. The Group addresses (source and destination address) is coded in the second block, and is followed by the application data.

The internal packet handler in the RC1180-KNX module will take care of the packet format and is adding the fields marked in dark grey in the illustration above: preamble, CRC and postamble.

## KNX RF and Wireless M-Bus

The Wireless M-Bus in accordance with EN 13757-4 is also an associated KNX-standard, which was described in Vol. 10 part 3. Vol. 7 part 60 of the KNX standard describes the mapping of M-Bus metering information to the KNX. The physical layer and the link layer are designed as KNX metering in compliance with the respective parts of EN 13757. Rules for the exchange of information between EN13757 and KNX at the application layer are currently under preparation. A data exchange at the physical level is already possible. On this basis it is now possible to make a KNX product that can receive both M-Bus telegrams (EN13757) as well as KNX telegrams with a single receiver like the RC1180-KNX.

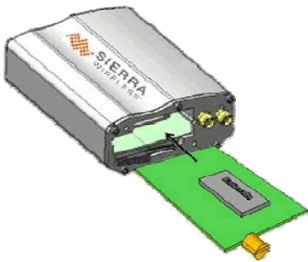




## KNX-RF: PC Tools, packet sniffer and Demo Kit

The KNX-DEMO software is a part of Radiocrafts' RC Tools PC suite tailored for use with Radiocrafts' RF Modules. Radiocrafts has developed KNX-DEMO, which is designed to demonstrate a KNX-RF system using the RC1180-KNX module. The software gives an easy introduction to KNX-RF messages and how to communicate between sensors, actuators, gateways and media couplers. The KNX PCTools works together with the Radiocrafts Demo Boards and communicate via USB.

## Radiocrafts RF + Sierra Wireless AirLink GSM



Radiocrafts module portfolio is available for the Sierra Wireless AirLink GPRS/GSM/EDGE modem. Sierra Wireless is the leading provider of M2M modems. The combination of Radiocrafts' RF modules and Sierra Wireless GPRS modems makes an easy to use out-of-the-box gateway solution with full TCP/IP capability and processing power for extensive embedded applications. The Xtend directly connects to Radiocrafts I/O on the internal IESM card. The Open AT IDE is easy to use and the development tools are free of charge with extensive application support inside the Open-AT Software Suite. This will give a cost competitive, high performance combination. The slot-in-card works with all types of Radiocrafts modules. From Radiocrafts it is available a free Radio Test Gateway (RTG) software for local connection to the RS232 port of the modem or for enabling transparent GPRS connection via AT-commands.

[www.sierrawireless.com](http://www.sierrawireless.com)

## High Speed Flashing and Testing

Radiocrafts has implemented a unique solution for high speed volume production. This is an innovative test system for high volume flashing, RF testing and taping of radio modules.. This machine combines all our experience and expertise in radio modules and have the capacity of testing large volumes.

### Radiocrafts is testing the following parameters on the RC1180-KNX radio module before shipping:

- Freq accuracy (ppm)
- Output power (dBm)
- 2nd harmonic (dBm)
- 3rd harmonic (dBm)
- Spurious emission (freq/max level, dBm)
- RX sensitivity
- TX supply current (mA)
- RX supply current (mA)
- Idle supply current (mA)
- Sleep supply current (uA)
- Program memory verification
- UART communication

Testing of all these parameters will make further detailed testing unnecessary, and only functional testing needs to be done to ensure that the total application is working properly.

### Spurious measurements – important vs CE qualification

We have experienced customers and competition which are making radio solutions with unknown compliance status versus CE regulations. This is often based on a lack of knowledge about the different CE regulations and not enough control of process variation. We know by experience it is difficult to confirm to regulations with certain chips and SoC's. This is one of the reasons why we ALWAYS test our radio modules 100% before shipping to customers.



Radiocrafts ATS – Automatic Test Station – module boards

### Benefits of 100% test coverage:

- Little or no variations on delivered product
- Avoid yield problems, and costs
- Ensure regulations compliancy for every radio module
- No extensive testing needed at later stage

## One form factor – pin compatible – Different radio technologies

Radiocrafts offer full flexibility for manufacturers who is looking for different radio solutions. It is now possible to make one PCB design and combine several radio technologies, by only changing the radio module and the antenna. Only minor adjustments in the host controller firmware are necessary to swap between different firmware. The footprint compatible KNX-RF, Wireless M-Bus solution and the new high power IEEE 802.15.4 ZigBee, Smart Energy and RF4CE radio module gives a unique flexibility for metering applications.

