

### Implementing with RC1180-MBUS Wireless M-Bus module

by Ø. Nottveit

#### Introduction

Wireless M-Bus (EN 13757-4:2005) is the only wireless standard specifically targeting the reading of electricity, gas-, water-, heat-meters and heat allocators. The RC1180-MBUS module is dedicated to these specific applications and is the world's first Wireless M-Bus module.

#### Wireless M-Bus history

Wireless M-Bus has its root in the wired M-Bus user group that were very active in the 90's. Initially they created the wired M-Bus standard for meter reading. Later that standard became part of the European standard EN1434 for reading heat energy meters.

The M-Bus specification was later enhanced and Wireless M-Bus was introduced. This standardization work was transferred to Cenelec, technical committee (TC) 294, that created the new European standard EN 13757 "Communication system for meters and remote reading of meters". That standard currently consists of:

- EN13757-1:2002 Data exchange
- EN13757-2:2004 Physical and link layer
- EN13757-3:2004 Dedicated application layer
- EN13757-4:2005 Wireless meter readout
- prEN13757-5:2007 Relaying
- prEN13757-6:2007 Data exchange

As seen, the -4 variant introduced the wireless meter reading that will be discussed in this document. Wireless M-Bus is a radio and data link specification. The application messages transferred are specified in EN 13757-3.

#### Wireless M-Bus basic

Wireless M-Bus specifies a *meter* device and an "*other*" device. The "other" is often referred to as a concentrator.

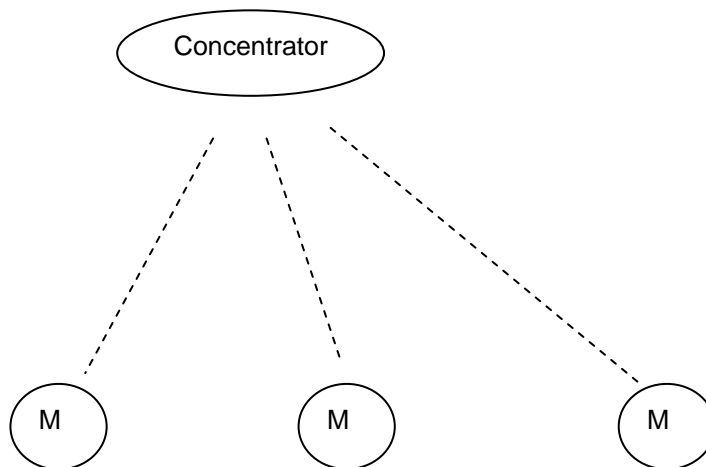


Figure 1 Wireless M-Bus system with 3 meters

The EN13757-4 specifies the physical layer and the data link layer for communication between the meter and the concentrator. This includes:

- Radio parameters
- Packet frame format
- Access method

The Wireless M-Bus specification has several options for the radio parameters. 3 different data rates are specified, and both one-way and two-way communication are included. See Table 1.

Data-rate from meter	One-way	Two-way communication
4.8kb/s	(not specified)	R2
32.768 kb/s	S1/S1m	S2
100kb/s	T1	T2

**Table 1. Modes in Wireless M-Bus**

All the modes are specified to use the 868 MHz license free ISM band for Europe, but each of the different modes has its own radio requirement such as the specific channel, frequency accuracy, data rate tolerances etc.

One of the key features for Wireless M-Bus is battery operated meters. Gas and water meters are normally not connected to mains power and therefore have limited energy available. In addition, the replacements of meters are costly so the battery lifetime should be several years. Actual lifetime requirements may vary from country to country, typically 10 – 20 years.

To handle the battery lifetime requirements, the radio in the meters will be in sleep mode most of the time, and transmit only in small timeslots. The concentrator can never initiate any communication as the meter will be in sleeping mode most of the time.

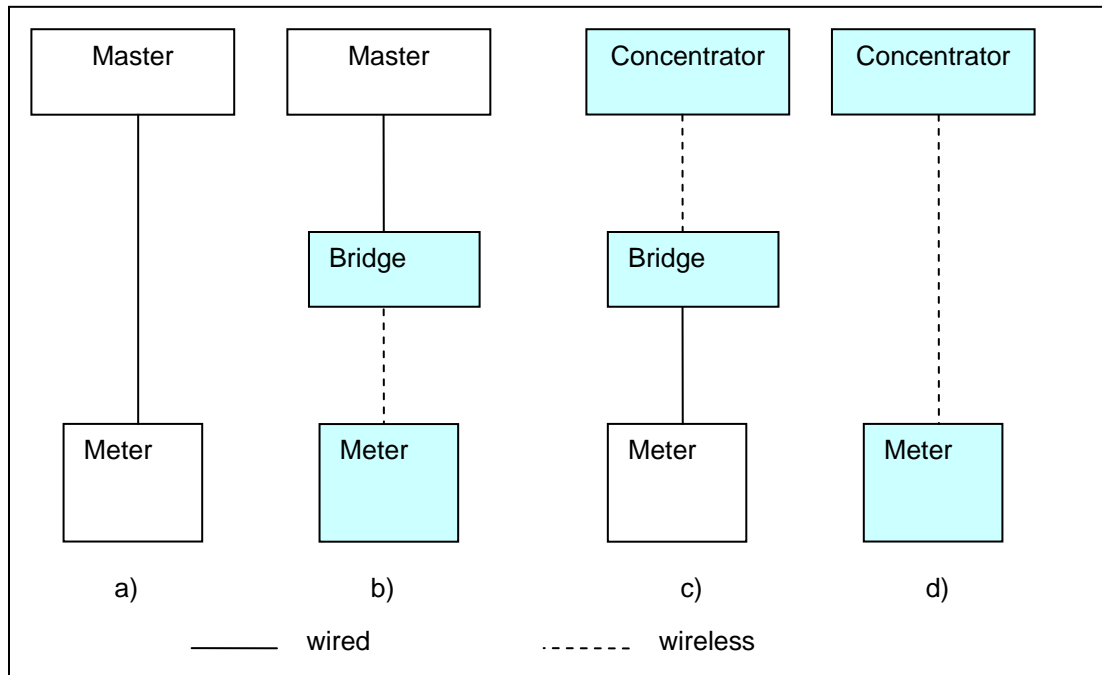
The two-way communication is enabled by the meter going into receive mode for a short time after transmission, thereby allowing the concentrator to send messages at these specific timeslots. The timing is different for different modes and the timing is specified in the standard.

The addressing scheme in Wireless M-Bus is a legacy from wired M-Bus. It is only the meters that have addresses, and the meter address is used both when transmitting to, and from, the meter. Hence, the concentrator must have an overview/table of the meters that is connected to it. These meters will be registered at the concentrator during the installation phase.

RC1180-MBUS is capable of handling all the radio modes specified in EN13757-4.

### System solution

Normally a Wireless M-Bus system (Figure 2 d)) is a completely alternative system to the wired M-bus (a). But there are cases where the two technologies can be combined in one system. Those options are shown as b) and c). Alternative b) is treated in detail in Application Note AN010.



**Figure 2. Different M-Bus and/or Wireless M-Bus system**

### Modem or complete application

The RC1180-MBUS module can be used in several ways in the following devices:

- Concentrator
- Bridge
- Meter

The basic version on the standard RC1180-MBUS module comes with modem functionality. In this case most of the control is done in the host controller, and the module is used as a communication port.

But the RC1180-MBUS module platform is a powerful device and is offered with many options. It is up to the end user to decide how much functionality to put into the module and what should be handled externally. Radiocrafts will customize the module functionality to fit the customers' application. Some of the options are discussed below.

### Standard Wireless M-Bus Modem

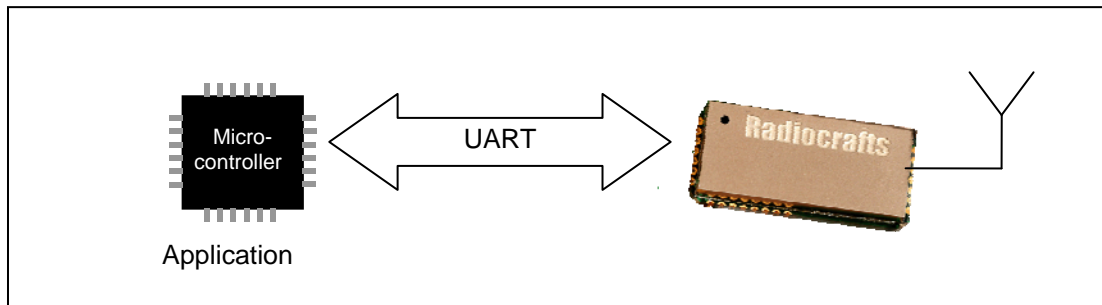
One way to use the RC1180-MBUS is to use it as a wireless modem. This means that the application messages are generated in an external controller and transferred to the module via UART (See Figure 3).

The module will handle the TX/RX timing for two-way communication, but other than that the decision for when to transmit from the meter is controlled externally. The external controller will also control when the module is in sleep, receive mode etc.

Via the same UART interface the application can configure the module to the desired mode.

- S2, T2, etc
- Output power
- Meter or concentrator functionality
- Channel
- Address

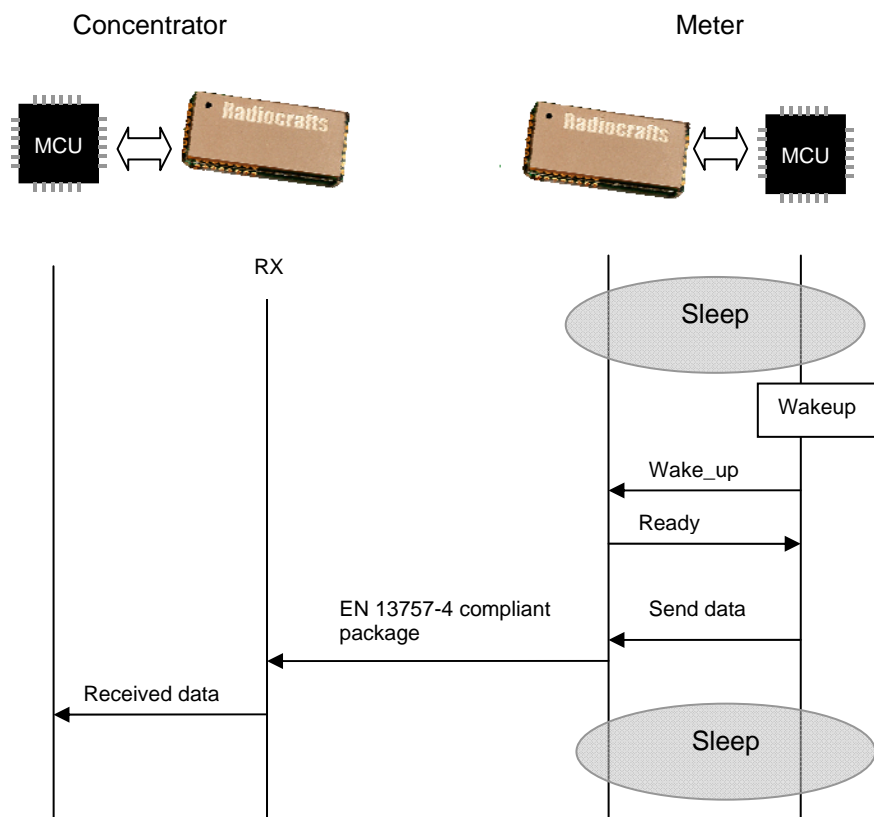
Even though most of the application is done by the external controller, there might be some application functions that are best handled by the module. Encryption is such a function that should be put in the module.



**Figure 3 Using the RC1180-MBUS as a modem**

For concentrator that normally has a lot of processing power this will be a good approach.

Figure 4 shows the basic principle for how the RC1180MBUS can be used as a modem in both the concentrator and meter. One-way communication (T1/S1) is shown here for simplicity, but similar, more complex sequence charts might be done for two-way communication as well. Set-up/configuration and installation must be done prior to operation.



**Figure 4. Conceptual use of the RC1180-MBUS in one-way communication**

### Module with Application Functionality

The basic standard RC1180-MBUS modem uses only a part of its capabilities. There are more powerful features in the module that can be used to handle the complete meter reading application. These options can be added in a customisation of the module. The options and features include:

- Encryption, AES-128
- Real Time Clock (RTC)
- Sleep timers waking up at controlled time intervals
- Reading the meter main index (serial or other)
- Store variables like meter reading , encryption key etc in non-volatile memory
- Generate complete application message based on data above
- Send message encrypted and listen for feedback
- Take action (valve control, thermostat control) based on messages received over radio
- RTC update

The module also has I/O pins that can be configured as

- Pulse input counting
- Output for valve control
- Installation button
- Tampering alarm

A complete application within the module will have to be tailored to the specific application. Please contact sales@radiocrafts.com for more info on tailoring application.

### National tailoring

The EN 13757-4 is an open standard and includes a lot of different options and possibilities. In order to get a standard for interoperability within a region, the standard must be tailored locally by limiting options and possibly adding capabilities. This has been done in the Netherlands, and similar work is ongoing in several other countries.

### The Netherlands (NTA 8130)

The NTA 8130 is the standard for Smart Meters in the Netherlands and RC1180-MBUS complies with that standard.

NTA 8130 - P2 standard interface	RC1180-MBUS
T1/T2	Excellent T1/T2 radio. Pout = 9 dBm typical Sensitivity 100kb/s = -101 dBm Sensitivity 100kb/s = -102 dBm
AES 128 bits encryption	YES
Dongle (Bridge to wired M-Bus)	Can be used in Dongle
Max 4 meters per concentrator	YES
Hourly transmission, with battery lifetime > lifetime expectancy of meter	YES (10-20)
Installation procedure / Encryption key exchange	YES

### Disclaimer

This document describes the capabilities within RC1180-MBUS. Some of the capabilities described in this document are already embedded in the module and will always be available. Other will be added later or can be added on request. Please read the datasheet and release notes to understand what is currently included and please contact [sales@radiocrafts.com](mailto:sales@radiocrafts.com) for the other options.

### Document Revision History

Document Revision	Changes
1.0	First release

### Contact Information

Web site: [www.radiocrafts.com](http://www.radiocrafts.com)

Email: [radiocrafts@radiocrafts.com](mailto:radiocrafts@radiocrafts.com)  
[sales@radiocrafts.com](mailto:sales@radiocrafts.com)  
[support@radiocrafts.com](mailto:support@radiocrafts.com)

Address:

**Radiocrafts AS**  
Sandakerveien 64  
NO-0484 OSLO  
NORWAY

Tel: +47 4000 5195

Fax: +4 22 71 29 15