LoRaWAN Meter Protocol Version 1.3a

Version of this document V1.3a

This document describes an application protocol to be used by electricity meters that use LoRaWAN for the radio link.

Requirement 1:

For the transmission of meter data the LoRaWAN protocol has to be used. In the remainder of this document the application level protocol is specified. That is, the messages defined in this document are the payload of a LoRaWAN packet (FRMPayload).
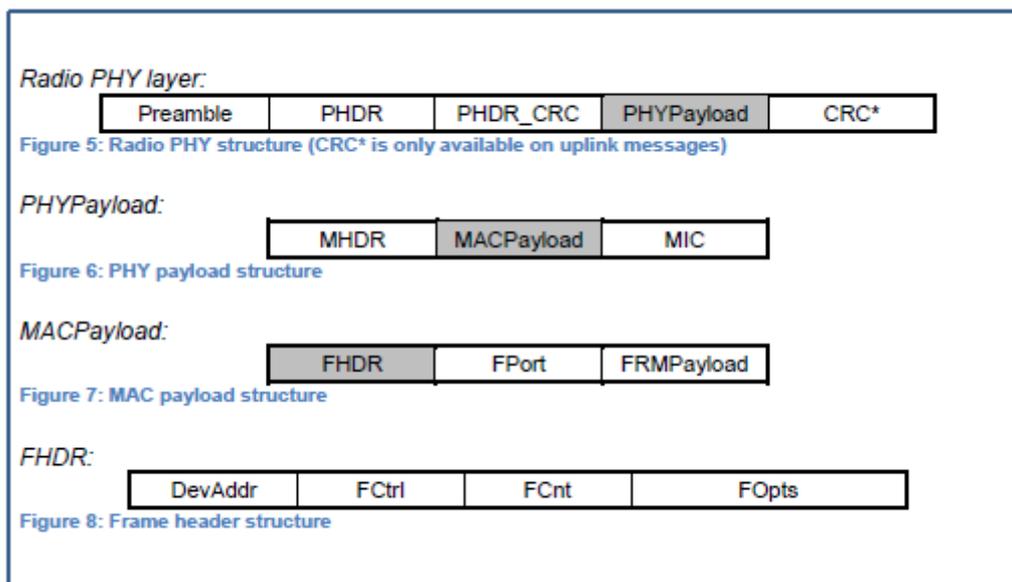
Figure 1: LoRaWAN message format

Requirement 2:

Each protocol message has to fit in a single LoRaWAN message with spreading factor 12 (SF12), thus the maximum payload is 51 bytes.

Requirement 3:

The meter has to periodically send the meter readings for every energy register it has. The meter readings have to be taken regularly at the end of a configured interval and send immediately. There is no need for a random offset for the sending of the values, because the random delay for the join request (Req. 4), will be sufficient to distribute the sending.

Requirement 4:

When the meter receives a message with a new sending period, this new period starts immediately at the time the message is received.

Requirement 5:

The meter has to send the readings using unconfirmed messages (no acknowledgment). Every x messages the readings are to be send using confirmed messages. If any message is not acknowledged, the meter has to retry y times. x and y are to be set by a control message send to the meter.

Requirement 6:

Since the meter serial number and the DevEUI of the meter are both fixed, the meter serial number will not be send.

Definition of message formats

There are two messages in the protocol "Meter Reading Message" (MRM) to be send by the meter and "Meter Control Messages" (MCM) to be received by the meter.

Meter Reading Message

Size (bytes)	1	[0..n]
Part	MRMHDR	Register values, 5 bytes each

The Meter Reading Message Header is defined as:

Bit#	7..6	5..1	0
Part	Version	Qualifier	Status

Version

Version bits	Description
00	LoRaWAN Meter Protocol V1
01..11	RFU

Qualifier

Qualifier bits	Description
00000...00110	None
00111	Meter address and Version
01000	1.8.0+1.8.1+1.8.2+2.8.0+2.8.1+2.8.2+...
00111…11111	RFU

The sequence of the registers in the payload is the same as the sequence of registers defined in the column "Description" for each qualifier.
RFU: Reserved for Future Use

Status

Status bits	Description
00	Not ok, i.e. fatal error within metrological part of the meter

01	Meter operation Ok

"Not ok" is only to be sent, whenever a meter reading has to be send, but is not accessible.

Register values

The register values as defined in the qualifier bits are each 40 bit unsigned big-endian integer interpreted as kilowatt hours (Wh) .
E. g. 0000 0000 0000 FFFF is interpreted as 65535 Wh = 65535 Wh

Qualifier bits：00111

Register List	Description
Meter address	14 bytes
Meter version	3 bytes
Meter crc	2 bytes
Module version	4 bytes
Module crc	2 bytes

Qualifier bits：01000

Register List	Description
Forward energy	5 bytes
Forward energy rate 1	5 bytes
Forward energy rate 2	5 bytes
Reverse energy	5 bytes
Reverse energy 1	5 bytes
Reverse energy 2	5 bytes
Active power	3 bytes
Active power A	3 bytes
Active power B	3 bytes
Active power C	3 bytes
Status	4 bytes
Second index	4 bytes

Status

Bit0-Bit31	Description
Bit0-Bit7	00000100
Bit8	Started
Bit9	Magnetic influence
Bit10	Open lead seal button
Bit11	Total energy direction
Bit12	L1 phase energy direction
Bit13	L2 phase energy direction
Bit14	L3 phase energy direction
Bit15	Phase sequence
Bit16	Reverse cutoff
Bit17	Measurement error
Bit18	L1 voltage
Bit19	L2 voltage
Bit20	L3 voltage
Bit21-Bit31	Reserve

Meter Control Message

Size (bytes)	1	[4]	[4]	[1]
Part	MCMHDR	Interval unconfirmed	Interval confirmed	Max Retries

The Meter Control Message Header is defined as:

Bit#	7...6	5	4...0
Part	Version	RFU	Qualifier

Version

Version bits	Description
00	LoRaWAN Meter Protocol V1
01..11	RFU

Qualifier

Qualifier bits	Description
00000...00110	None (if only Status is send)
00111	Meter address and Version
01000	1.8.0+1.8.1+1.8.2+2.8.0+2.8.1+2.8.2+...
00111…11111	RFU

RFU: Reserved for Future Use

Interval unconfirmed

4 byte unsigned big-endian integer denoting the multiple of 1 minutes long interval, at which the Meter Readings Message should be send as an unconfirmed message (not awaiting an acknowledgement).
A value of "0x00000000" means: do not send unconfirmed messages.
Default is 0x0000000F (which is every 15 minutes).

Interval confirmed

4 byte unsigned big-endian integer denoting the multiple of 1 minutes long interval, at which the Meter Readings Message should be send as an confirmed message (awaiting an acknowledgement and retrying if no acknowledgment is received).
A value of "0" means: do not send confirmed messages.
A value of decimal "0x00002760" means: do send once a week (7*24*60=10080).
Default is 0x00002760(once a week).

Max retries

1 byte unsigned big-endian integer denoting the maximum number of retries if no acknowledgement for a confirmed message is received.
Default is 3.