SLOVENSKI STANDARD
SIST EN 13757-8:2023

01-december-2023

Komunikacijski sistemi za merilnike - 8. del: Prilagoditvena plast

Communication systems for meters - Part 8: Adaptation layer

Kommunikationssysteme für Zähler - Teil 8: Anpassungsschicht

Systèmes de communication pour compteurs - Partie 8 : Couche adaptation

Ta slovenski standard je istoveten z: **EN 13757-8:2023**

ICS:

33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)	Telecontrol. Telemetering
35.100.01	Medsebojno povezovanje odprtih sistemov na splošno	Open systems interconnection in general

SIST EN 13757-8:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 13757-8

September 2023

ICS 33.200; 35.100.01

English Version

Communication systems for meters - Part 8: Adaptation layer

Systèmes de communication pour compteurs - Partie 8 : Couche adaptation

Kommunikationssysteme für Zähler - Teil 8: Anpassungsschicht

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN 13757-8:2023 E

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European foreword

This document (EN 13757-8:2023) has been prepared by Technical Committee CEN/TC 294 “Communication systems for meters”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2024, and conflicting national standards shall be withdrawn at the latest by March 2024.

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Introduction

This document belongs to the EN 13757 series, which covers communication systems for meters. EN 13757-1 contains generic descriptions and a communication protocol. EN 13757-2 contains a physical and a Link Layer for twisted pair-based Meter-Bus (M-Bus). EN 13757-3 contains detailed description of the application protocols especially the M-Bus Protocol. EN 13757-4 describes wireless communication (often called wireless M-Bus or wM-Bus). EN 13757-5 describes the wireless network used for repeating, relaying and routing for the different modes of EN 13757-4. EN 13757-7 describes transport mechanism and security methods for data. The Technical Report CEN/TR 17167 contains informative annexes for EN 13757-2, EN 13757-3 and EN 13757-7.

The M-Bus protocol upper layers (Transport and Application) can be used with various lower layers (Network, Data Link and Physical) as described in EN 13757-1. Systems based on the M-Bus protocol stack are well established in the metering market in Europe. In parallel, other wireless communication networks known as LPWAN (Low Power Wide Area Networks) have been widely deployed and target metering applications as well. The OSI reference model enables the transport of M-Bus upper layers on top of LPWANs lower layers. To ensure a seamless transition of the legacy systems based on Wireless M-Bus to LPWAN, an M-Bus Adaptation Layer (MBAL), is needed to provide the necessary services and information to the upper layers via an adequate interface, to minimize the impact on their existing implementations.

1 Scope

This document describes the functionalities and specifies the requirements of an adaptation layer to be applied when transporting M-Bus upper layers using a wireless communication protocol other than wireless M-Bus. These alternative radio technologies developed outside CEN/TC 294 can be based on Internet Protocol or not and operate either in licensed or unlicensed frequency bands.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13757-1:2021, *Communication systems for meters — Part 1: Data exchange*

EN 13757-3, *Communication systems for meters — Part 3: Application protocols*

EN 13757-4:2019, *Communication systems for meters — Part 4: Wireless M-Bus communication*

EN 13757-5, *Communication systems for meters — Part 5: Wireless M-Bus relaying*

EN 13757-7:2018, *Communication systems for meters — Part 7: Transport and security services*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
core network
set of logical and physical entities providing the communication services between the HES and the end devices

3.2
downlink
transmission in the direction from a gateway or a Head End System to the end device

3.3
end device
communication end node

EXAMPLE A radio adapter, a meter or similar device.

3.4
frame
unit of transmission at the Data Link Layer

3.5
gateway
intermediate node in a data communication network, connected to two or more logical networks, where the protocols or modes used on the logical networks are different

3.6
Head End System
system responsible for the management, reading and data collection of end devices applications

3.7
Low Power Wide Area Network
wireless technologies with characteristics such as large coverage areas, low bandwidth, possibly very small packet and application-layer data sizes, and long battery life operation

3.8
L(n)
refers to layer level (n) in the OSI model

3.9
uplink
transmission in the direction from an end device to the gateway or Head End System

4 Abbreviations and symbols

4.1 Abbreviations

AES	Advanced Encryption System
AFL	Authentication and Fragmentation Layer
APL	M-Bus Application Protocol Layer
AS	Application Server
Cat NB	Narrow band LTE category 1 and 2
Cat M1	LTE category for Machine Type Communication
CBOR	Concise Binary Object Representation
CI	Control Information (field)
CIoT	Cellular IoT
CN	Core Network
CoAP	Constrained Application Protocol
COSE	CBOR Object Signing and Encryption
CSGN	CIoT Serving Gateway Node
DLL	Data Link Layer
DoNAS	Data over NAS
ECM	EPS Connectivity Management
ED	End Device

eDRX	extended Discontinuous Reception
ELL	Extended Link Layer
eNB	Evolved Node B
EPC	Evolved Packet Core
EPS	Evolved packet System
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
FUOTA	Firmware Update Over The Air
GPRS	General Packet Radio Service
GTP-U	GPRS Tunnelling Protocol – User Plane
GW	Gateway
HARQ	Hybrid Automatic Repeat Request
HES	Head End System
HTTP	Hyper Text Transfer Protocol
IoT	Internet of Things
IP	Internet Protocol
LLC	Logical Link Control
L*n*	Layer *n* according to OSI reference model definitions
LPWAN	Low Power Wide Area Network
LPWAN ID	LPWAN Unique Identifier
LTE	Long Term Evolution
MAC	Medium Access Control
MBAL	M-Bus Adaptation Layer
MCL	Maximum Coupling Loss
MME	Mobility Management Entity
MNO	Mobile Network Operator
NAS	Non-Access Stratum
NIDD	Non-IP Data Delivery
NWL	Network Layer
PCI	Protocol Control Information
PDCP	Packet Data Convergence Protocol
PDN	Packet Data Network
PDU	Protocol Data Unit

PGW	PDN Gateway
PHY	Physical Layer
PSM	Power Saving Mode
PTW	Paging Transmission Window
RAN	Radio Access Network
REST	Representational State Transfer
RF	Radio Frequency
RFU	Reserved for Future Use
RLC	Radio Link Control
RRC	Radio Resources Control
S1AP	S1 Application Protocol
SCTP	Stream Control Transmission Protocol
SDU	Service Data Unit
SGW	Serving Gateway
TAU	Tracking Area Update
TCP	Transmission Control Protocol
TPL	Transport Layer
UDP	User Datagram Protocol
UE	User Equipment

4.2 Symbols

Hexadecimal numbers are designated by a following “h”.

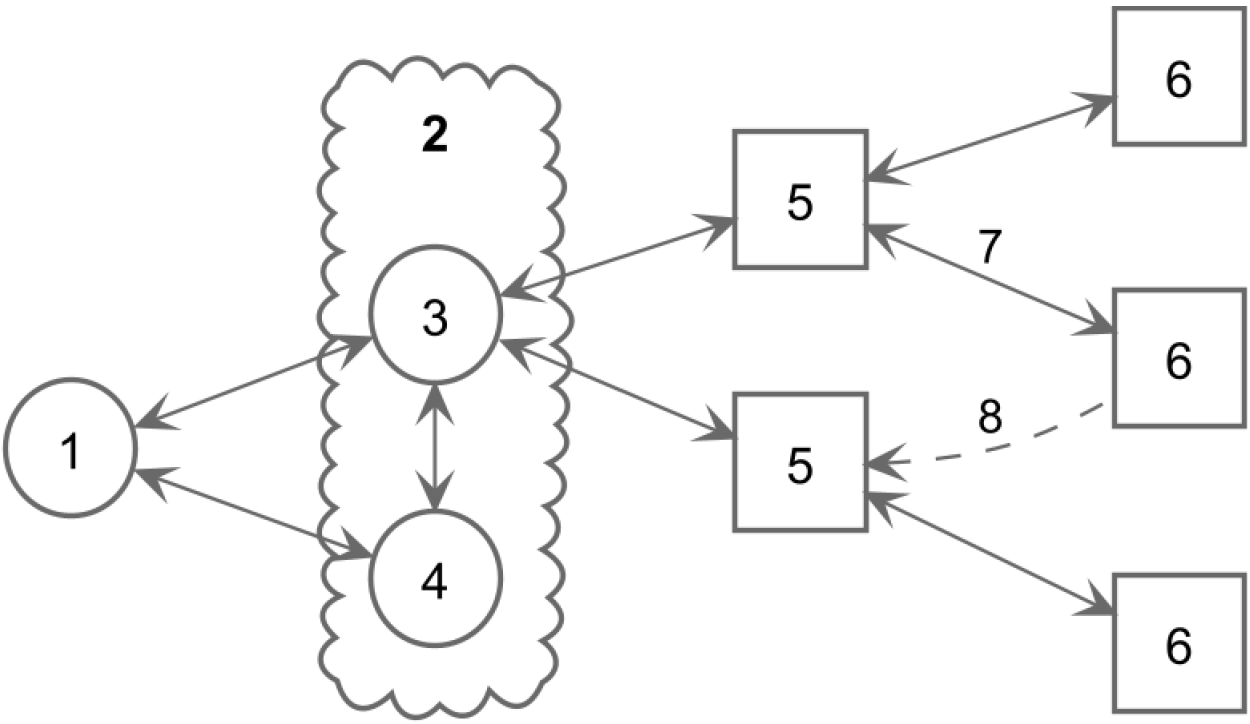
Binary numbers are designated by a following “b”.

Decimal numbers have no suffix.

5 Network architecture

5.1 Overview

The typical LPWAN network architecture is illustrated in Figure 1 showing the physical devices (as squares) and software instances (as circles).



Key

1	Head End System	5	Gateway
2	Core Network	6	End Device
3	Network Manager	7	Active Link
4	Security Server	8	Spare Link

Figure 1 — LPWAN network architecture overview

An overview of LPWAN technologies is given in Annex A.

5.2 General description of network entities

5.2.1 Head End System

The HES is deployed and managed by the metering service or application provider. HES, and its related components are responsible for handling TPL/AFL/APL layers. It can be built of several components each of which is dealing with a given set or subset of functionalities or services, typically fragmentation.

The HES is connected to the Core Network via dedicated interfaces and protocols and uses its services to exchange data messages with the end devices. It may also be connected to the security server to manage the communication security requirements.

5.2.2 Core network

5.2.2.1 Network manager

The Network Manager is responsible for managing communication links and infrastructure using Network, DLL, and MAC services according to the protocol specifications. It allocates the necessary resources to establish a communication between the HES and the end device. These services enable the configuration and setting of different communication parameters to optimize network and end devices resources usage and enforce wireless communication rules.

The network manager may communicate with the end devices through the gateways. Both elements can be under the control of the network manager. In order to secure the communication link, the network manager can be connected to the security server to retrieve the adequate security material.

5.2.2.2 Security server

The security server is responsible for managing the security services. It holds the necessary cryptographic keys and credentials of the end devices. It distributes those to the network server and the HES, via dedicated and secure interfaces, to achieve the required level of data confidentiality, integrity and authentication. These security materials are conveyed and stored in the security server in a way compliant with standard security policies.

5.2.3 Gateway

The gateway is a network element responsible for the transfer of RF frames between the network manager and the end device. Any frame transmitted to the end device via the gateway is called downlink frame. Reciprocally, any frame transmitted by the end device to network manager via the gateway is called uplink frame. One uplink frame can be received on several gateways while a downlink is transmitted by a single gateway (refer to element 7 and 8 in Figure 1).

A gateway is potentially capable of operating on different frequency bands and/or channels and transmitting or receiving multiple frames at the same time.

5.2.4 End device

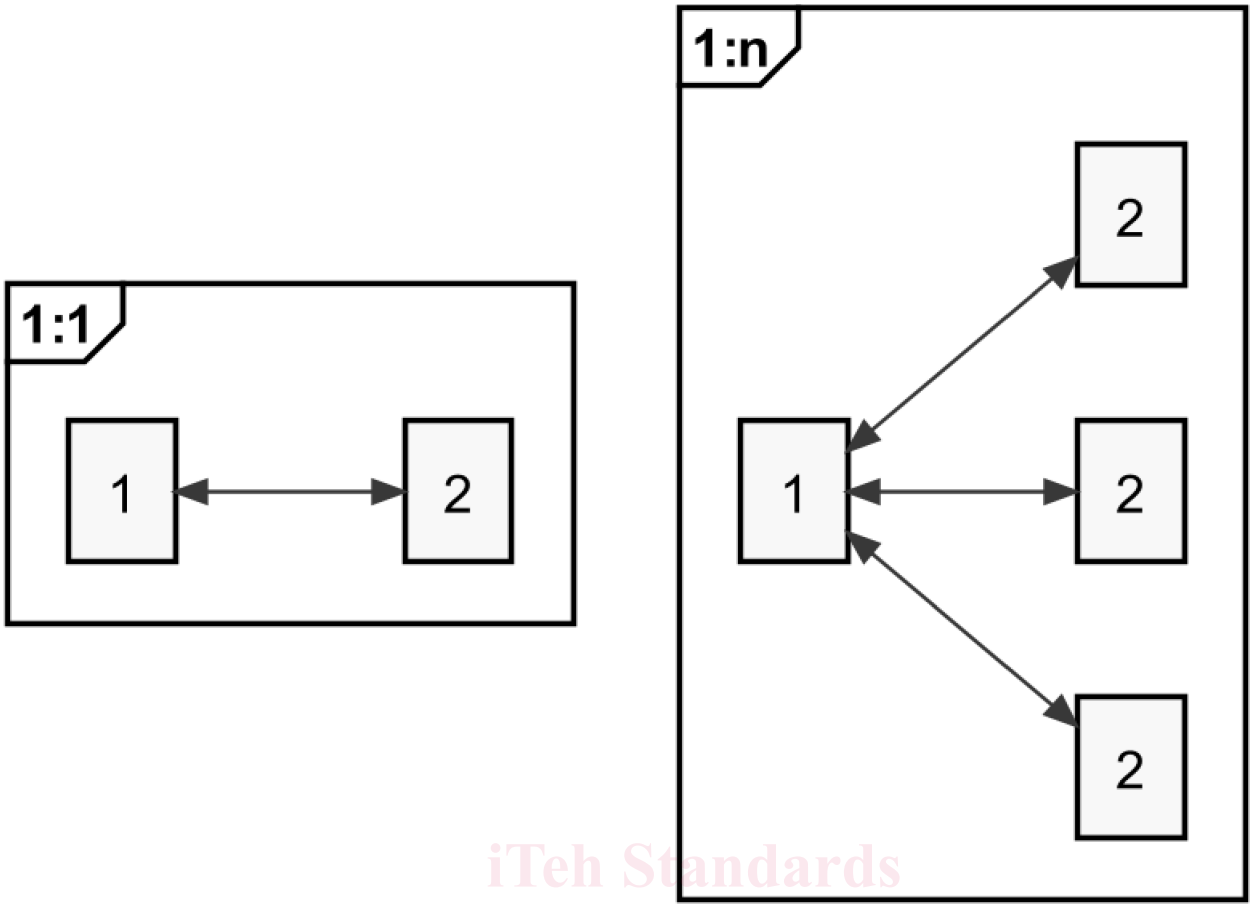
The end device is responsible for managing all layers. It communicates with the gateway on the LPWAN layers and with the HES on the upper layers (APL/TPL/AFL). An end device is potentially capable of running several applications using one or multiple LPWAN. The necessary security material is either stored in the end device's memory or conveyed from the security server.

Each end device has a unique identifier called LPWAN ID which is equivalent to the MAC address. The upper layers use the application address, contained in the TPL, to identify the end device when communicating with the HES.

Attention should be paid to the cases where multiple meters or sensors are served by a single end device acting as a radio adapter. In that case, the long header format of the TPL shall be used in each application message in both directions (ED <-> HES) while the end device uses its LPWAN ID at the lower layers.

To announce the relationship between the LPWAN ID and the application address, the latter shall be transmitted at least during the initialisation phase.

If there is a 1:1 relation between the LPWAN ID and the application address, then the transmission of the application address may be skipped in any later message transfers. Otherwise, the application address needs to be provided at any time. Both cases are illustrated in Figure 2.



Key

1 LPWAN module of the end device with a unique LPWAN identifier

2 End device application like a meter with a unique application address

Figure 2— End device LPWAN identifier and application address relations

6 General layer structure

6.1 Overview

This specification describes a mechanism, called M-Bus Adaptation Layer (MBAL), to be used to transport M-Bus datagrams over different wireless communication protocols, known as LPWAN, using the layered approach that has been defined in EN 13757-1:2021, 4.2 and the layer model structure specified in EN 13757-7:2018, 5.1. In the following parts, the upper layers will refer to APL, AFL and TPL that operate end-to-end while the lower layers refer to Network, Data Link and Physical layers as specified in the OSI basic reference model [1].

The MBAL is inserted between the M-Bus upper layers and the LPWAN lower layers as depicted in Table 1. Its goal is to keep the M-Bus data exchange principles effective while using wireless technologies defined outside of the EN 13757 series to minimize the impact to this transition and to ensure interoperability at the upper layers level. In this context of "M-Bus over LPWAN", the MBAL provides the necessary services to the upper layers as described in Clause 7 of this document.