

Mains communications systems — Protocol and data integrity and interfaces

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the CENELEC REPORT title page, pages 2 to 31 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 January 1998

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English version

Mains communication systems Protocol and data integrity and interfaces

This CENELEC Report has been prepared by CENELEC SC 205A, Mains communicating systems, of Technical Committee CENELEC TC 205, Home and Building Electronic Systems (HBES). It was approved by CENELEC on 1995-11-28.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Introduction

This CENELEC Technical Report was originally drafted to form part of EN 50065 to give physical layer and MAC layer specifications for mains signalling equipment operating in the band 125 kHz to 140 kHz and using the low-voltage electrical network for signalling in consumer's premises. It has been found to be unsuitable as a standard because the protocols described do not accord with the upper layer requirements under development by TC 205 — Home and Building Electronic Systems. However, CENELEC SC 205A considers that the information should be published to make it available to other workers in the field.

This report describes specifications for protocols for Mains Communication Equipment Systems (MCES), sometimes known as power line carrier systems (PLC). It gives guidance to implementation using « X-3000 » and « EHS » as examples. Further examples added in due course.

OSI layers 1 and 2a are described in accordance with ISO 7498 (EN 27498)

Descriptions of the relevant physical layers and MAC layers are given under clauses 5 to 8 of the report.

1 Scope

This CENELEC report describes the requirements for the Physical and MAC layers of two current MCES implementations. Other examples may be added in due course.

2 Definitions

The terms in this report are defined by the International Electrotechnical Vocabulary IEC 50.

Other terms not covered by the IEC will be defined in EN 50065.

3 Medium characteristics

3.1 Topology

The physical topology of the transmission medium is that of the existing power distribution network, for example, star, bus, ring or any combination. Mains Communication Equipment/Systems (MCES) are assumed to operate in any topology.

3.2 Medium Aspects

3.2.1 Coupling Characteristics

Several coupling modes are possible: series and parallel injection or any other method permitted by the safety rules applying to the different media, especially when bridges, routers, phase couplers or gateways are used.

Regulations often prohibit the use of the protective conductor for signalling.

Coupling devices shall not disturb the operation of electrical safety/protective devices, for instance, residual current circuit breakers.

3.2.2 Impedance

The values of the impedance at each connection point may vary considerably, lying within a range of less than 1 ohm to more than 50 ohm according to the types of connected load.

Additional components may need to be connected to increase the impedance presented to the system or reduce the noise emission of connected loads. The impedance of the MCES itself shall conform to the standard currently in preparation by CENELEC SC 205A.

3.2.3 Filters

If filters are used they shall conform to the standard currently in preparation by CENELEC subcommittee SC 205A.

4 Basic transmission characteristics

The transmission requirements shall comply with EN 50065-1 standard and are characterised as follows:

BASIC TRANSMISSION CHARACTERISTICS TABLE		
Parameters	X 3000	EHS
Frequency	132,5 kHz $\pm$ 0,5 %	Central 132,5 kHz $\pm$ 0,2 %
Modulation type	ASK ON-OFF keying	MSK deviation: $\pm$ 600 Hz
Data 0	Carrier ON	Highest frequency
Data 1	Carrier OFF	Lowest frequency
Synchronisation to the main	None	None
coding	NRZ	NRZ
Synchronisation Data	by bytes on start bit (Asynchronous)	on each bit (Synchronous) and on Header field
Access protocol	CSMA/CD Compliant EN 50065-1	CSMA Compliant EN 50065-1
Data rate	600	2 400 bps
Data format format	1 Start bit, 8 data bits 1 Odd parity, 1 Stop bit	Data: 8 bits 6 Redundancy bits
Packet Type	— a variable length telegram format — a telegram acknowledge format	— a variable length datagram — a datagram acknowledge — two escape datagram
Preamble	00h	AAAAh
House Address	16 bit random with check	16 bit random
Destination Address	Individual Addressing Group Addressing	8 bits Individual or Group Addressing, 4 bits address extension
Source Address	16 bit Addressing Individual number	16 bit Addressing, 4 bits address extension

5 X 3000 Physical layer specifications

5.1 Signalling

The **PHYSICAL** layer has three functions:

- emission of streams of serialised bits
- reception of streams of serialised bits
- observation of the channel

* The emission of bits occurs when the **MAC** layer transmits a primitive **PHY_DAT.Request** supporting the octet to be transmitted. This octet is transmitted bit by bit, least significant bit first.

* The reception of bits is restored in Octets, this octet is transmitted to the **MAC** layer by the primitive **PHY_DAT.Indic.**, the parity is controlled by the Physical layer. The Physical layer takes charge of the encapsulation or decapsulation of the start and stop bits.

* Observation of the channel is carried out by the positioning of different parameters transmitted to the **MAC** layer by the primitive **PHY_STAT.Indic.**

5.1.1 Carrier

Power-line signalling equipment will interface to local power line systems with the following characteristics:

A.C. single phase

50 Hz – 10 % to 60 Hz + 10 %

The signal connection will be made between the live and neutral wires. It is possible to use it on triple phase systems with the use of couplers.

5.1.2 Frequency

The frequency is 132,5 kHz ($\pm 0,5$ %).

5.1.3 Modulation type

The modulation type is Amplitude Shift Keying (ASK), modulation all or nothing, also called ON-OFF Keying (OOK).

5.1.4 Coding

The coding type is Non-Return-To-Zero (NRZ).

5.1.5 Data Transmission mode

Transmission is asynchronous. Synchronisation is done by start bit.

5.1.6 Data rate (bit timing)

The data rate is 600 bit/s.

The bit timing is 1,66 ms ($\pm 0,5$ %)

- “Data 0” (*Low*) is a period carrier ON
- “Data 1” (*High*) is a period carrier OFF

5.2 Data format

5.2.1 General synoptic

The general synoptic of a station is represented below (Figure 1):

