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INTERNATIONAL STANDARD

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Electricity metering data exchange – The DLMS/COSEM suite – Part 8-3: Communication profile for PLC S-FSK neighbourhood networks

Échange des données de comptage de l'électricité – La suite DLMS/COSEM – Partie 8-3: Profil de communication pour réseaux de voisinage CPL S-FSK

IEC 62056-8-3:2013

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

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FOREWORD

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DLMS[1] User Association
Zug/Switzerland
www.dlms.ch

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[1] Device Language Message Specification.

International Standard IEC 62056-8-3 has been prepared by technical committee 13: Electrical energy measurement, tariff- and load control.

The text of this standard is based on the following documents:

FDIS	Report on voting
13/1526/FDIS	13/1544/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 62056 series, published under the general title *Electricity metering data exchange – The DLMS/COSEM suite*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 8-3: Communication profile for PLC S-FSK neighbourhood networks

1 Scope

This part of IEC 62056 specifies the DLMS/COSEM PLC S-SFK communication profile for neighbourhood networks.

It uses standards established by IEC TC 57 in the IEC 61334 series, *Distribution automation using distribution line carrier systems* and it specifies extensions to some of those standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at http://www.electropedia.org)

IEC 61334-4-1:1996, *Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 1: Reference model of the communication system*

IEC 61334-4-32:1996, *Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 32: Data link layer – Logical link control (LLC)*

IEC 61334-4-511:2000, *Distribution automation using distribution line carrier systems – Part 4-511: Data communication protocols – Systems management – CIASE protocol*

IEC 61334-5-1:2001, *Distribution automation using distribution line carrier systems – Part 5-1: Lower layer profiles – The spread frequency shift keying (S-FSK) profile*

IEC/TR 62051:1999, *Electricity metering – Glossary of terms*

IEC/TR 62051-1:2004, *Electricity metering – Data exchange for meter reading, tariff and load control – Glossary of terms – Part 1: Terms related to data exchange with metering equipment using DLMS/COSEM*

IEC 62056-46:2002, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC protocol*
Amendment 1:2006

IEC 62056-5-3:—, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*[2]

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[2] To be published simultaneously with this part of IEC 62056.

IEC 62056-6-2:—, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*[3]

ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

NOTE See also the Bibliography.

3 Terms, definitions and abbreviations

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC/TR 62051 and IEC/TR 62051-1 and the following apply.

Where there is a difference between the definitions in the glossary and those contained in product standards produced by TC 13, then the latter shall take precedence in applications of the relevant standard.

3.1 Terms and definitions

3.1.1
initiator
user-element of a client System Management Application Entity (SMAE). It uses the CIASE and xDLMS ASE and it is identified by its system title

[SOURCE: IEC 61334-4-511:2000, 3.8.1, modified]

3.1.2
active initiator

initiator, which issues or has last issued a CIASE Register request when the server is in the unconfigured state

[SOURCE: IEC 61334-4-511:2000, 3.9.1]

3.1.3
new system
server system, which is in the unconfigured state: its MAC address equals "NEW-address"

[SOURCE: IEC 61334-4-511:2000, 3.9.3]

3.1.4
new system title
system-title of a new system

Note 1 to entry: This is the system title of a system, which is in the new state.

[SOURCE: IEC 61334-4-511:2000, 3.9.4, modified]

3.1.5
registered system
server system, which has an individual, valid MAC address

Note 1 to entry: Therefore, this MAC address is different from "NEW Address", see IEC 61334-5-1: Medium Access Control.

[SOURCE: IEC 61334-4-511:2000, 3.9.5, modified]

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[3] To be published simultaneously with this part of IEC 62056.

3.1.6
reporting system
server system, which issues a DiscoverReport

[SOURCE: IEC 61334-4-511:2000, 3.9.6, modified]

3.1.7
sub-timeslot
the time needed to transmit two bytes by the physical layer

Note 1 to entry: Timeslots are divided to sub-slots in the RepeaterCall mode of the physical layer.

3.1.8
timeslot
the time needed to transmit a physical frame

Note 1 to entry: As specified in IEC 61334-5-1:2001, 3.3.1, a physical frame comprises 2 bytes preamble, 2 bytes start subframe delimiter, 38 bytes PSDU and 3 bytes pause.

3.2 Abbreviations

.cnf	.confirm service primitive
.ind	.indication service primitive
.req	.request service primitive
.res	.response service primitive
AA	Application Association
AARE	A-Associate Response – an APDU of the ACSE
AARQ	A-Associate Request – an APDU of the ACSE
ACSE	Association Control Service Element
AES	Advanced Encryption Standard
AL	Application Layer
AP	Application Process
APDU	Application Layer Protocol Data Unit
ASE	Application Service Element
ASO	Application service Object
A-XDR	Adapted Extended Data Representation
CIASE	Configuration Initiation Application Service Element
CI-PDU	CIASE PDU
Client	A station, asking for services. In the case of the 3-layer, CO HDLC based profile it is the master station
COSEM	Companion Specification for Energy Metering
DA	Destination Address
DLMS	Device Language Message Specification
DLMS UA	DLMS User Association
FCS	Frame Check Sequence
GCM	Galois/Counter Mode, an algorithm for authenticated encryption with associated data
HCS	Header Check Sequence
HDLC	High-level Data Link Control
HES	(Metering) Head End System
ISO	International Organization for Standardization

LLC	Logical Link Control (Sublayer)
LN	Local Network
LNAP	Local Network Access Point
L-SAP	LLC sublayer Service Access Point
LSDU	LLC Service Data Unit
LV	Low voltage
MAC	Medium Access Control (sublayer)
MPDU	MAC Layer Protocol Data Unit
MSC	Message Sequence Chart
NN	Neighbourhood Network
NNAP	Neighbourhood Network Access Point
NS	Number of subframes (S-FSK MAC sublayer)
OSI	Open System Interconnection
PDU	Protocol Data Unit
PhL	Physical Layer
PLC	Power Line Carrier
PSDU	Physical Layer Service Data Unit
RDR	Reply Data on Request (used in IEC 61334-4-32)
RLRE	A-Release Response – an APDU of the ACSE
RLRQ	A-Release Request – an APDU of the ACSE
SA	Source Address
SAP	Service Access Point
SDN	Send Data Non-acknowledged (used in IEC 61334-4-32)
SDU	Service Data Unit
SMAE	Systems Management Application Entity
SMAP	Systems Management Application Process
SNRM	Set Normal Response Mode (a HDLC frame type)

4 Targeted communication environments

The DLMS/COSEM PLC S-FSK communication profile is intended for remote data exchange on Neighbourhood Networks (NN) between Neighbourhood Network Access Points (NNAP) *and* Local Network Access Points (LNAPs) or End Devices using S-FSK power line carrier technology over the low voltage electricity distribution network as a communication medium. The functional reference architecture is shown in Figure 1.

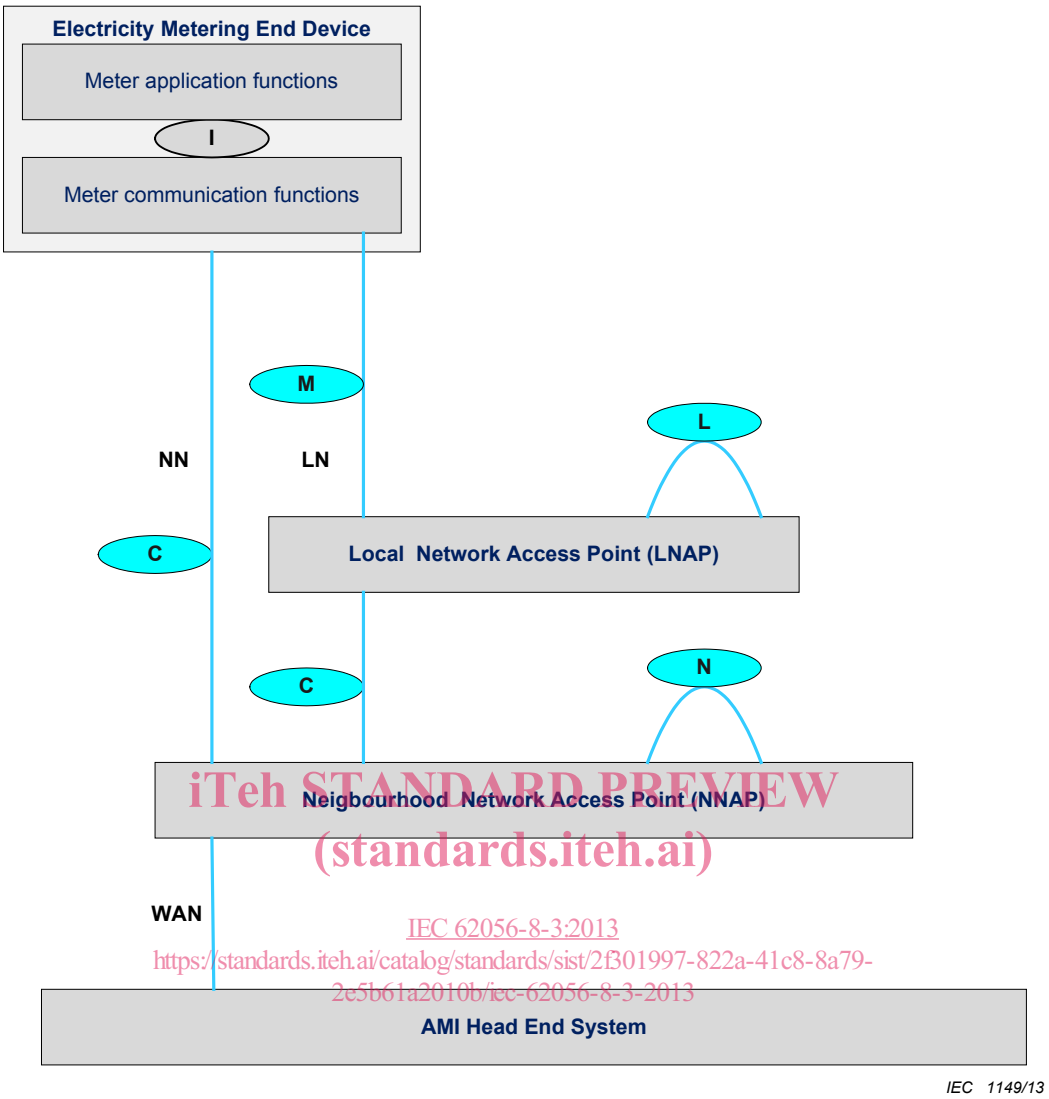

Figure 1 – Communication architecture

End devices – typically electricity meters – comprise application functions and communication functions. They may be connected directly to the NNAP via the C interface, or to an LNAP via an M interface, while the LNAP is connected to the NNAP via the C interface. The LNAP function may be co-located with the metering functions.

A NNAP comprises gateway functions and it may comprise concentrator functions. Upstream, it is connected to the Metering Head End System (HES) using suitable communication media and protocols.

End devices and LNAPs may communicate to different NNAPs, but to one NNAP only at a time. From the PLC communication point of view, the NNAP acts as an initiator while end devices and LNAPs act as responders.

NNAPs and similarly LNAPs may communicate to each other, but this is out of the scope of this standard, which covers the C interface only.

When the NNAP has concentrator functions, it acts as a COSEM client. When the NNAP has gateway functions only, then the HES acts as a COSEM client. The end devices or the LNAPs act as COSEM servers.

5 Reference model

NOTE This clause is partly based on IEC 61334-4-1:1996, Clause 3.

The reference model of the *DLMS/COSEM PLC S-FSK communication profile is* shown in Figure 2. It is based on a simplified – or collapsed – three-layer OSI architecture. The layers are the *physical layer*, the *data link layer* and the *application layer*. The data link layer is split to the *MAC sublayer* and the *LLC sublayer*.

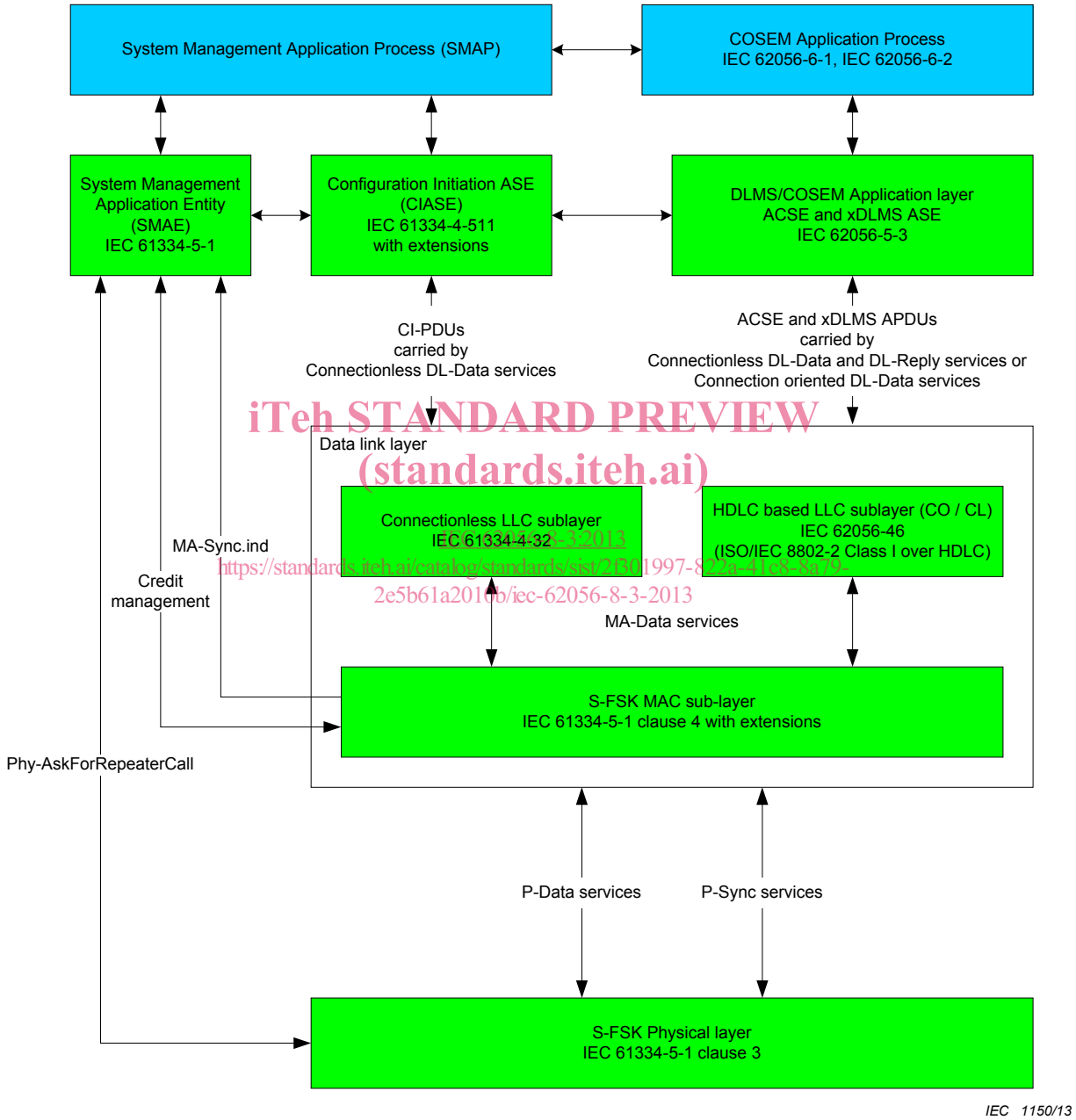

Figure 2 – The DLMS/COSEM S-FSK PLC communication profile

6 The physical layer (PhL)

The PhL provides the interface between the equipment and the physical transmission medium that is the distribution network. It transports binary information from the source to the destination.

The PhL in this profile is as specified in IEC 61334-5-1:2001, Clause 3. It provides the following services to its service user MAC sublayer:

- P-Data services to transfer MPDUs to (a) peer MAC sublayer entity(ies) using the LV distribution network as the transport medium;
- P-Sync services to allow the MAC sublayer entity to ask for a new synchronization and to be informed of a change in the synchronization state of the PL. These services are used locally by the MAC sublayer.

See IEC 61334-5-1:2001, 3.4.

7 The data link layer

7.1 General

The data link layer consists of two sublayers: the Medium Access Control (MAC) and the Logical Link Control (LLC) sublayer.

The MAC sublayer handles access to the physical medium and provides physical device addressing. The decision to access the medium is made by the initiator, directly for its own MAC sublayer, or indirectly for other MAC sublayers that are requested to transmit a response to a request sent previously by the initiator.

The LLC sublayer controls the logical links.

There are two LLC sublayer alternatives available:

- the connectionless LLC sublayer, as specified in IEC 61334-4-32;
- the LLC sublayer using the HDLC based data link layer, as specified in IEC 62056-46.

7.2 The MAC sublayer

The MAC sublayer of the DLMS/COSEM S-FSK PLC communication profile is as specified in IEC 61334-5-1:2001, Clause 4. It provides the following services to its service user LLC sublayer:

- the MA-Data services. These services allow the LLC sublayer entity to exchange LLC data units with peer LLC sublayer entities. See IEC 61334-5-1:2001, 4.1.3.1;
- the MA-Sync.indication service. This allows the SMAE entity to be informed of the synchronization and configuration status of the device. See IEC 61334-5-1:2001, 4.1.3.2.

7.3 The connectionless LLC sublayer

The connectionless LLC sublayer is as specified in IEC 61334-4-32. It is derived from ISO/IEC 8802-2 – similar to Class III operation – and it performs the following functions:

- addressing of application entities within the equipment;
- sending data with no acknowledgement (SDN);
- reply data on request (RDR).

It provides the following services:

- DL-Data services for transporting CI-PDUs, ACSE APDUs and client-server type xDLMS APDUs;
- DL-Reply services for asking the remote LLC sublayer entity to send a previously prepared LSDU;
- DL-Update-Reply services to prepare the LSDUs to be transferred using the DL-Reply services.

For more details, see IEC 61334-4-32:1996, 2.1.

7.4 The HDLC based LLC sublayer

The HDLC based LLC sublayer is as specified in IEC 62056-46.

As explained in IEC 62056-46:2002, 4.1 and 4.2, this sublayer can also be divided to two sublayers:

- the LLC sublayer based on ISO/IEC 8802-2. Here, it is used in an extended Class I operation. The only role of this sublayer is to select the DLMS/COSEM Application layer by using a specific LLC address. The LLC services are provided by the HDLC based MAC sublayer;
- the MAC sublayer, based on the HDLC protocol. It provides addressing of application entities within the equipment.

NOTE In this profile, there are two MAC sublayers. The HDLC MAC sublayer provides reliable LLC data transport and segmentation. The Medium Access Control functionality is provided by the S-FSK MAC sublayer specified in 7.2.

The HDLC based LLC sublayer provides the following services:

- DL-Connect services to connect and to disconnect the data link layer;
- connectionless DL-Data services for transporting CI-PDUs, ACSE APDUs and xDLMS APDUs;
- connection oriented DL-Data services for transporting ACSE APDUs and xDLMS APDUs. These services provide reliable data transport and support segmentation to carry long messages, in a transparent manner for the application layer.

7.5 Co-existence of the connectionless and the HDLC based LLC sublayers

The frames of the connectionless LLC sublayer and the HDLC based LLC sublayer can be distinguished from each other as shown in Figure 3. This allows systems using the two profiles to co-exist on the same network.

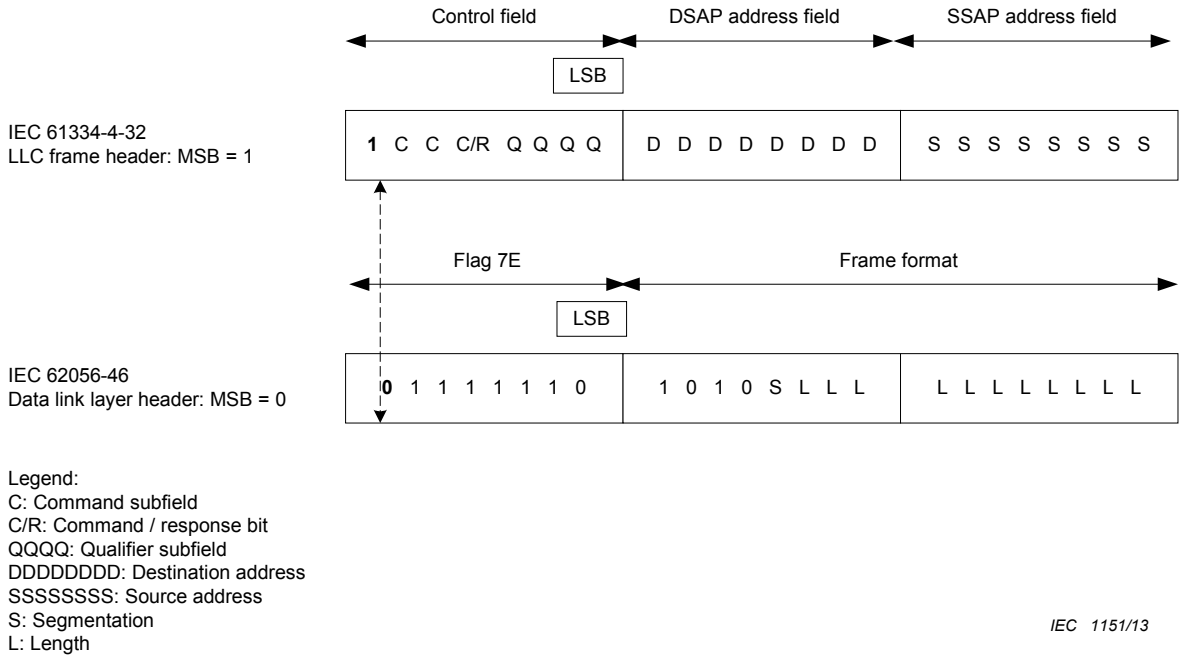

Figure 3 – Co-existence of the connectionless and the HDLC based LLC sublayers