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Winter and road service area maintenance equipment – Data acquisition and transmission - Part 1: In vehicle data acquisition

Winterdienst- und Straßenbetriebsdienstausstattung - Datenerfassung und -übertragung - Teil 1: Datenerfassung im Fahrzeug

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Matériels de viabilité hivernale et d'entretien des dépendances routières - Acquisition et transmission des données - Partie 1 : Acquisition des données véhiculaires

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Ta slovenski standard je istoveten z: **EN 15430-1:2015**

ICS:

35.240.60	Uporabniške rešitve IT v transportu in trgovini	IT applications in transport and trade
43.160	Vozila za posebne namene	Special purpose vehicles

SIST EN 15430-1:2015 **en,fr,de**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

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Winter and road service area maintenance equipments - Data acquisition and transmission - Part 1: In-vehicle data acquisition

Matériels de viabilité hivernale et d'entretien des dépendances routières - Acquisition et transmission des données - Partie 1 : Acquisition des données véhiculaires

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This European Standard was approved by CEN on 28 May 2015.

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European foreword

This document (EN 15430-1:2015) has been prepared by Technical Committee CEN/TC 337 "*Road operation equipment and products*", the secretariat of which is held by AFNOR.

This document supersedes EN 15430-1:2007+A1:2011.

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of an identical text or by endorsement, at the latest by February 2016, and conflicting national standards shall be withdrawn at the latest by February 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

The following changes haves been implemented in this new edition:

— Modify variable no.127 in Table 12 by adding the sentence in bold:

  Spreader mode (0=Idle or Transport, 1=Spreading or Spraying, 2=Unload Hopper, 3=Spreading and Spraying, 4 = Spreading, 5 = Spraying)

— Modify variable no.137 in Table 12 by adding the following remark:

  NOTE For spraying and spreading (SprMode=3), the value applies to the brine percentage of the spreading dosage only.

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Introduction

This protocol is meant to be used for data acquisition in fleet management applications in the field of municipal vehicles. The purpose of the protocol is to define how data of a vehicle or equipment is generated, stored and transferred to a board-computer system in the vehicle and from the board-computer to the software application in the office (refer to Figure 1). On the equipment or vehicle the data is generated by a “Data generator”. This data is stored, if present, into a buffer-memory. The “Data transmission handler” will send the data present in the buffer-memory to the “Board-computer” or “Data Acquisition System”. The buffer-memory is there to ensure that data does not get lost in case there is no transmission possible. The size or type of the buffer is not defined in this proposal. If there is no buffer or the buffer is too small to store new data, data will get lost.

To synchronise time-stamps of the vehicle/equipment with the Board-computer, a special record for time synchronisation is defined.

In this part the data acquisition and communication from vehicle/equipment to the Board-computer is defined.

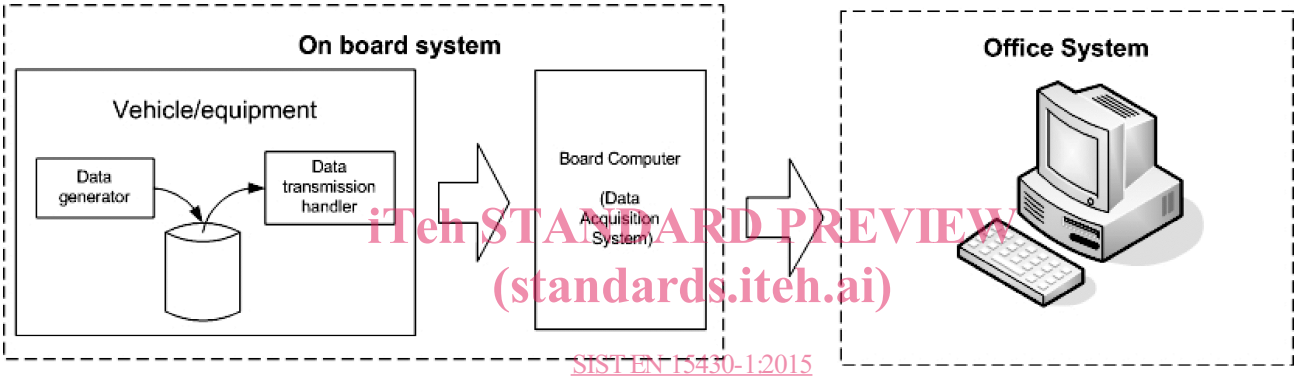

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Figure 1 — Architecture

In general, the data is a semi-colon (“;”) separated ASCII text for separation of record codes and values of variables. CR+LF is used for separation of records (one record is one line of text).

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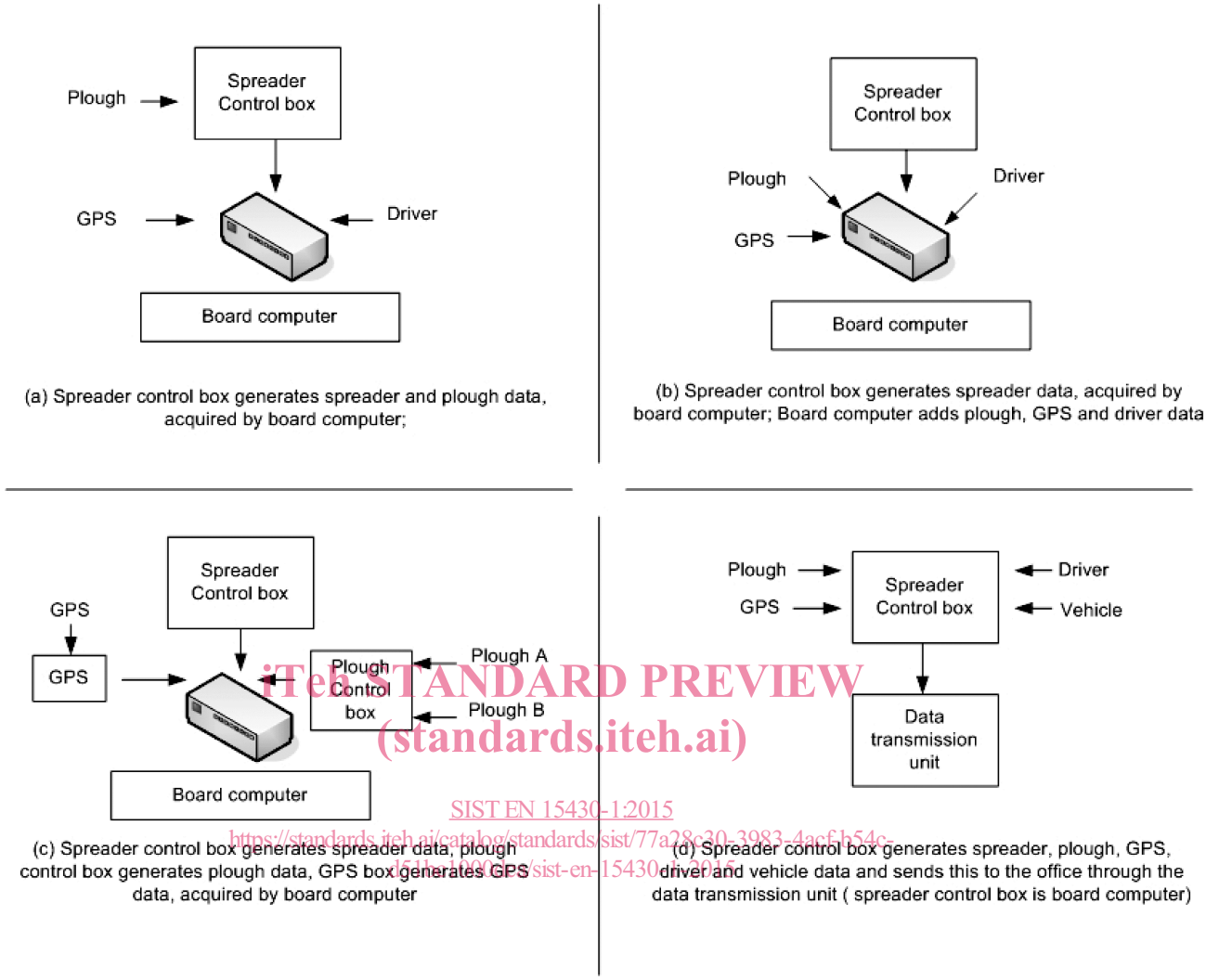
Examples of an on-board system configuration.



(a) Spreader control box generates spreader and plough data, acquired by board computer;

(b) Spreader control box generates spreader data, acquired by board computer; Board computer adds plough, GPS and driver data

(c) Spreader control box generates spreader data, plough control box generates plough data, GPS box generates GPS data, acquired by board computer

(d) Spreader control box generates spreader, plough, GPS, driver and vehicle data and sends this to the office through the data transmission unit (spreader control box is board computer)

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Figure 2 — Diagram of possible connections

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1 Scope

This European Standard specifies a standardized protocol for downloading data from the equipment control box to an in-vehicle board computer to ensure interchangeability between a vehicle and different equipment that the same vehicle can carry.

It specifies the interface connection as well as variables, records and reports which permit standardized protocol to cover applications with the greatest possible variety of equipment for performing winter maintenance and road service area maintenance.

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.

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

NMEA 0183, *Interface Standard*

TIA-232-F, *Interface between data terminal equipment and data circuit-terminating equipment employing serial binary data interchange (RS232)*

SAE J1939/71, *Recommended practice for serial control and communications vehicle network — Vehicle application layer*

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3 Abbreviations

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ACK	Acknowledge (ASCII control code 06_h)
ASCII	American national Standard Code for Information Interchange
Bps	Bits per second
CRC-16	Cyclic Redundancy Code with 16 bits
CRC-32	Cyclic Redundancy Code with 32 bits
CR	Carriage Return (ASCII control code $0D_h$)
EOT	End Of Transmission (ASCII control code 04_h)
$_h$	Number before h is in hexadecimal notation
IEEE	Institute of Electrical and Electronics Engineers
LF	Line Feed (ASCII control code $0A_h$)
NAK	Negative acknowledge (ASCII control code 15_h)
SOH	Start Of Header (ASCII control code 01_h)
TBD	To Be Defined
↲	CR + LF (carriage return + line feed)

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4 Communication between vehicle/equipment and board-computer

4.1 General

The data exchange between vehicle/equipment “Data transmission handler” and the “Board-computer” shall follow at least one of the communication standards described in the present document version or future release. Until now, only the RS232 standard (TIA-232-F) is defined as a communication standard so that means that at the present a compliant EN 15430 “Data transmission handler” has to supply a RS232 interface , if in the future other standard interfaces will be defined (e.g. CAN BUS, USB ...) a compliant EN 15430 future “Data transmission handler” will have to supply at least one of the communication standard until that time is defined.

4.2 Communication through RS232

4.2.1 RS232 interface on vehicle/equipment “Data transmission handler”

— Connector: SUB-D 9p female

  — Pin 2 = Transmit Data

  — Pin 3 = Receive Data

  — Pin 5 = Signal Ground

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— Baud rate: 1 200 Bps...115 200 Bps, default 9 600 Bps. Rate can be programmable (optional) Remark: the baud rate shall be sufficient for a worst case amount of data to be send with retries.

— Data bits: 8

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— Stop bits: 1

— Parity: No

— Data format: according to ISO/IEC 8859-1 (ASCII)

— Handshaking: by software with ACK, NAK ASCII control codes, refer to 4.2.3

— Transmission control by SOH and EOT ASCII control codes, refer to 4.2.3

— Data validity check: CRC-16/CCITT, refer to 4.2.3

4.2.2 RS232 interface on “Board-computer”

— Connector: SUB-D 9p male

  — Pin 2 = Receive Data

  — Pin 3 = Transmit Data

  — Pin 5 = Signal Ground

— Baud rate: 1 200 Bps...115 200 Bps, default 9 600 Bps. Rate *shall* be programmable or automatically detected (autobaud)

— Data bits: 8

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— Stop bits: 1

— Parity: No

— Data format: according to ISO/IEC 8859-1 (ASCII)

— Handshaking: by software with ACK, NAK ASCII control codes, refer to 4.2.3

— Transmission control by SOH and EOT ASCII control codes, refer to 4.2.3

— Data validity check: CRC-16/CCITT, refer to 4.2.3

4.2.3 Communication protocol

Transmission of a record.

In this definition a message to be communicated consists of one record. Records are terminated by CR+LF (a record is one line of text). In general, a message is sent by the sender (e.g. the “Data transmission handler” of a spreader) and received by the receiver (e.g. the Board-computer). After power up, communication is always started by the vehicle/equipment “Data transmission handler” sending its first message (this is the time synchronisation record). Refer to Figure 4 for flow charts of the sender and receiver algorithms.

The receiver will check the validity of a message by testing if the CRC-16 value corresponds to the data in the message received. If the data is valid, the receiver sends an ACK. The sender can now send a new message. If the data is invalid, the receiver sends a NAK. Then, the sender will try to send the same message again for a maximum of 2 times. If the message still fails, the message is considered to be lost. Preferably, a notification is given to the user (operator) that data has been lost by the sender and/or the receiver.

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NOTE 1 The receiver sends an ACK or a NAK as a single character without other data. The ACK or NAK refers to the latest message sent by the sender. To avoid record synchronisation problems between sender and receiver, the sender has to ignore any ACK or NAK received during the transmission of a message until the last byte is sent (EOT character). Also, the receiver is not allowed to send an ACK or NAK during the reception of a message until the last byte is received (EOT character).

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NOTE 2 Numerical values have to be transmitted with ASCII characters in decimal code.

Calculation of the CRC-16 value.

The CRC value is calculated according to the CCITT definition. The CRC value is calculated over all record bytes, starting with the record code, ending with CR+LF. The polynomial used is $x^{16} + x^{12} + x^5 + x^0 = 11021_h$ (i.e. XOR mask 1021_h) and initial value $FFFF_h$.

NOTE 3 The value is written in ASCII characters in hexadecimal code with capitals (0..9,A..F).

Calculation of the CRC-32 value.

The CRC-32 value is calculated according to the CCITT definition. The CRC-32 value is calculated over all record bytes, starting with the record code, ending with CR+LF. The polynomial used is
$x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^8 + x^7 + x^5 + x^4 + x^2 + x + 1$

NOTE 4 The value is written in ASCII characters in hexadecimal code with capitals (0..9,A..F).

Sender without receiving options for handshaking.

For old vehicle/equipment “Data transmission handlers”, it may be impossible to receive data. In this case the sender cannot respond to an ACK or NAK, i.e. there is no handshaking feature. Hence, the sender will send a new message. This may cause in the result that data gets lost, e.g. in case the Board-computer was not

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started up yet or if transmission failed. It is up to the user to handle this problem (for example to connect power supply such that power-up is always at the same time for sender and transmitter).

Synchronisation of communication.

To synchronise communication between sender and receiver, a message always starts with an SOH and ends with an EOT. If the receiver is not synchronised yet but the sender is already transmitting a message (e.g. when the Board-computer starts up while the spreader “Data transmission handler” is sending), all data before the first SOH will be ignored. If the receiver is synchronised but detects an SOH before an EOT, the previous, unfinished message is ignored.

Time synchronisation between sender and receiver.

In general, the sender system time and the receiver system time are not equal. To synchronise messages to the system clock of the receiver, a time synchronisation record is introduced. This Time Sync record (refer to 5.5.2) contains the actual system time of the sender at the start of record transmission (with a maximum error of ± 0,5 s). The receiver shall record its system time at the moment of reception of a message. In case of the reception of a Time Sync record, the receiver can calculate the difference between its own system clock and the system clock of the sender. Now, the receiver can time-synchronise every message received from the sender and thereby synchronise this data to other data generated by other sources. The board computer shall contain a real time clock which runs even if the board computer has no power. The electronic system on the vehicle/equipment shall have a real time clock which runs even when this system has no power, or, a software clock shall be implemented which starts at date 1-1-2000 and time 00:00:00 and is updated every second.

A Time Sync record, is sent by the sender:

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— as the first message starting the communication;

— after 10 s if the receiver does not respond to a message with an ACK or a NAK; after a successful transmission of this record, the latest message before the time synchronisation record is transmitted again;

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— if the system clock of the sender is adjusted, reset or set to any value which would cause a jump in time.

Loss of data.

Data will get lost in case of:

— a “Data transmission handler” without handshaking feature which is sending while reliable communication is not possible;

— an overflow of the buffer-memory;

— 2 unsuccessful retransmissions after a NAK.

In case the “Data transmission handler” supports handshaking, it is mandatory sending the header record as the first record of a report (note: the Time Sync record is not part of the report). i.e. the header record may not get lost.

Example of a message is shown in graphical form:

Start (1 byte)	Data (codes + values, “;” separated) (x bytes)	CR+LF (2 bytes)	CRC-16 (2 bytes)	End (1 byte)
SOH	1;10;1602048;0461021;5;Abc;Equip1;;;	CR LF	66D9	EOT

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ASCII characters in hexadecimal notation:

01	31 3B 31 30 3B 31 36 30 32 30 34 38 3B 30 34 36 31 30 32 31 3B 35 3B 41 62 63 3B 45 71 75 69 70 31 3B 3B 3B	0D 0A	36 36 44 39	04

Communication example:

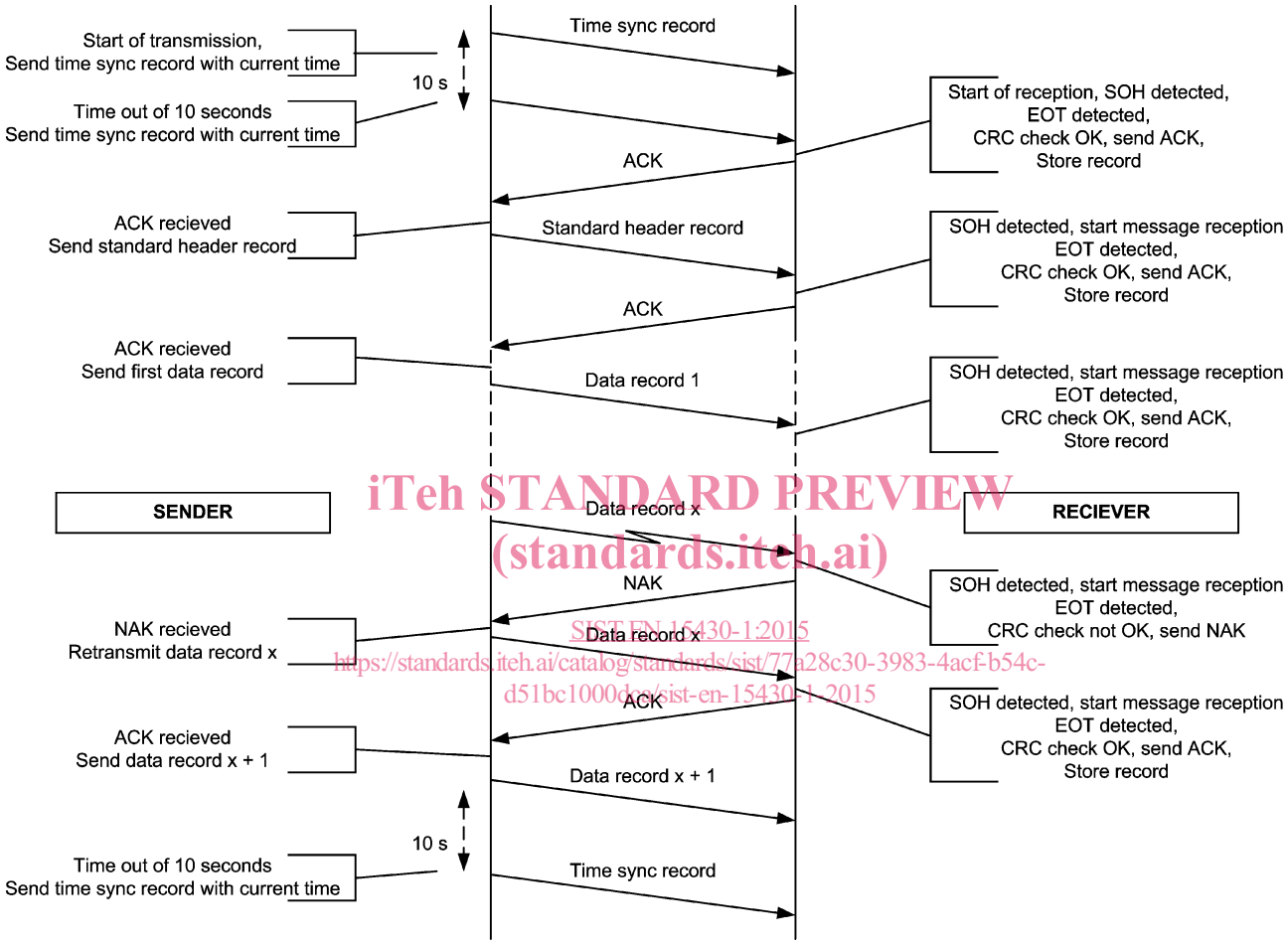

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Figure 3 — Flow diagram

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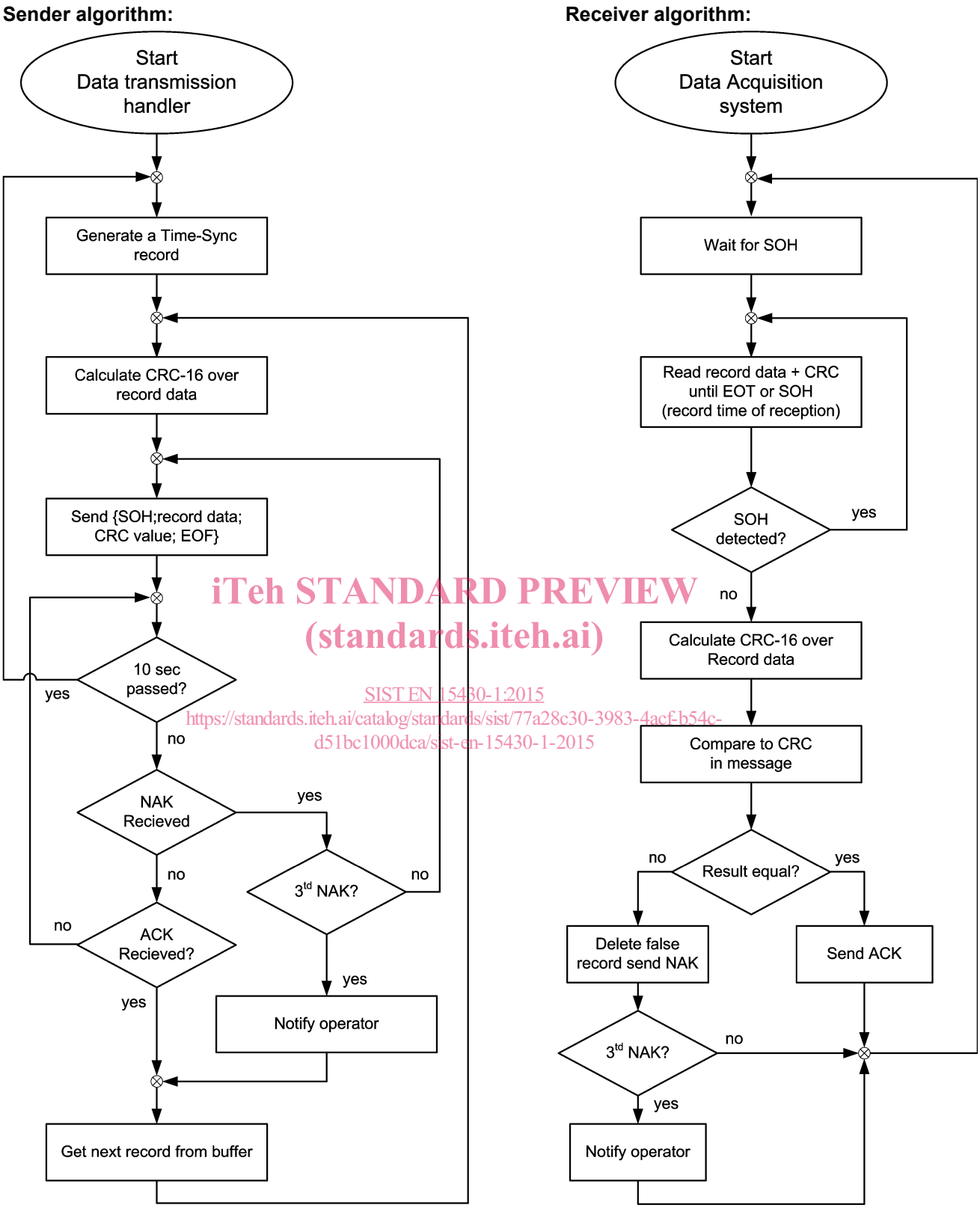

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Figure 4 — Flow chart