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ISO/IEC 8882-1

Second edition
1996-09-15

Information technology — Telecommunications and information exchange between systems — X.25 DTE conformance testing —

Part 1: General principles

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Essais de conformité X.25 DTE —

Partie 1: Principes généraux

Reference number
ISO/IEC 8882-1:1996(E)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee ISO/IEC JTC 1, *Information technology*. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

International Standard ISO/IEC 8882-1 was prepared by ISO/IEC JTC 1, Subcommittee 6, *Telecommunications and information exchange between systems*.

This second edition cancels and replaces the first edition (ISO/IEC 8882-1:1993) of which it constitutes a technical revision.

ISO/IEC 8882 consists of the following parts, under the general title *Information technology — Telecommunications and information exchange between systems — X.25-DTE conformance testing:*

— *Part 1: General principles*

— *Part 2: Data link layer conformance test suite*

— *Part 3: Packet layer conformance test suite*

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Introduction

ISO/IEC 8882 specifies a set of tests to evaluate Data Terminal Equipment (DTE) conformance to International Standards ISO/IEC 7776 or ISO/IEC 8208, or both. ISO/IEC 7776 and ISO/IEC 8208 allow for a DTE to interface with a Data Circuit-Terminating Equipment (DCE) conforming to CCITT Recommendation X.25 (1980, 1984, 1988) or to another DTE conforming to ISO/IEC 7776 or ISO/IEC 8208 or both. The implementations of ISO/IEC 7776 and ISO/IEC 8208 are tested independently.

CCITT Recommendations X.25(1980), X.25(1984) and X.25(1988) are written from the perspective of a DCE and therefore do not explicitly specify the DTE operation. However, recommended operation of DTEs is included by implication because of the need to communicate with X.25 DCEs. Tests within ISO/IEC 8882–2 and ISO/IEC 8882–3 pertaining to X.25 (1980, 1984) are based on the DTE operational characteristics implied by CCITT X.25. There are no test cases within ISO/IEC 8882–2 and ISO/IEC 8882–3 for the extra functions and facilities added in X.25(1988).

This part of ISO/IEC 8882 specifies the framework in which the other parts of ISO/IEC 8882 may be understood and the principles to be applied. The notation used in ISO/IEC 8882–2 and ISO/IEC 8882–3 is TTCN as defined in ISO/IEC 9646–3.

ISO/IEC 8882–2 presents the Data Link Layer aspects for evaluating conformance to ISO/IEC 7776 while ISO/IEC 8882–3 presents the Packet Layer aspects for evaluating conformance to ISO/IEC 8208

The conformance tests are designed for use by

— test evaluators (responsible for analysing results and determining whether conformance has been achieved);

— test suite designers or implementors (for determining what tests are required and what results can and should be anticipated by the test device); and

— users implementing ISO/IEC 7776 or ISO/IEC 8208 or DTEs interfacing to DCEs that implement CCITT X.25 (1980, 1984 or 1988) (for determining the functionality required of their implementations to be considered in conformance).

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Information technology — Telecommunications and information exchange between systems — X.25–DTE conformance testing —

Part 1:
General principles

1 Scope

ISO/IEC 8882 defines the testing of a DTE operating at the Data Link Layer and at the Packet Layer when accessing, by means of a dedicated path connection, switched or permanent, a public or private packet-switched network conforming to CCITT Recommendation X.25 or another DTE conforming to ISO/IEC 7776 and ISO/IEC 8208.

The tests will test the conformance of an implementation by observing its external behaviour. The conformance tests will not test the DTE performance characteristics, the diagnostic and maintenance functions, the correctness of the protocol itself, or DTE internal implementation, or the full capabilities as stated in the PICS.

This part of ISO/IEC 8882

- provides a general introduction;
- refers to those applicable International Standards;
- defines terms applicable to X.25–DTE conformance testing;
- states the test case derivation and description; and
- states the test methodology.

ISO/IEC 8882–1 contains no statement of conformance. Specific statements of conformance are given in ISO/IEC 8882–2 and ISO/IEC 8882–3.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 8882. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 8882 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 7498-1 : 1994, *Information technology — Open Systems Interconnection — Basic Reference Model : The Basic Model.*

ISO/IEC 7776 : 1995, *Information technology — Telecommunications and information exchange between systems — High-level data link control procedures — Description of the X.25 LAPB-compatible DTE data link procedures.*

ISO/IEC 8208 : 1995, *Information technology — Data communications — X.25 Packet Layer Protocol for Data Terminal Equipment.*

NOTE — ISO/IEC 8208 : 1995 supersedes ISO/IEC 8208 : 1990. However, when this part of ISO/IEC 8882 was under development, the previous edition was valid and this part of ISO/IEC 8882 is therefore based on that edition, which is listed below.

ISO/IEC 8208 : 1990, *Information technology — Data communications — X.25 Packet Layer Protocol for Data Terminal Equipment.*

ISO/IEC 8882-2 : 1995, *Information technology — Telecommunications and information exchange between systems — X.25 DTE conformance testing — Part 2: Data link layer conformance test suite.*

ISO/IEC 8882-3 : 1995, *Information technology — Telecommunications and information exchange between systems — X.25 DTE conformance testing — Part 3: Packet layer conformance test suite.*

ISO/IEC 9646-1 : 1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 1: General concepts. (See also CCITT Recommendation X.290 (1992)).*

ISO/IEC 9646-2 : 1994, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 2: Abstract Test Suite specification. (See also CCITT Recommendation X.291 (1992)).*

ISO/IEC 9646-3 : 1992, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 3: The Tree and Tabular Combined Notation (TTCN).*

CCITT Recommendation X.25 (1980), *Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode on Public Data Networks.*

CCITT Recommendation X.25 (1984), *Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit.*

CCITT Recommendation X.25 (1988), *Interface between Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit.*

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3 Definitions

3.1 Reference model definitions

This part of ISO/IEC 8882 makes use of the following term defined in ISO/IEC 7498–1:

(N)-protocol-data-unit (N)-PDU

3.2 Conformance testing definitions

This part of ISO/IEC 8882 makes use of the following terms defined in ISO/IEC 9646–1:

a) Abstract Test Case

b) Conformance Test Suite

c) Conformance Testing

d) Implementation Under Test

e) Inopportune PDU

f) Lower Tester

g) Protocol Implementation Conformance Statement

h) Protocol Implementation eXtra Information for Testing

i) Remote Single Layer Test Method

j) System Under Test

k) Test Group

l) Test Step

m) Test Suite

3.3 X.25 DTE conformance testing definitions

For the purposes of this part of ISO/IEC 8882, the following definitions apply.

3.3.1 improper PDU: The (N)-PDU whose syntax does not conform to the format specifications of ISO/IEC 7776 or ISO/IEC 8208 or CCITT X.25.

3.3.2 proper PDU: The (N)-PDU whose syntax conforms to the format specification of CCITT X.25, ISO/IEC 7776 or ISO/IEC 8208 and is acceptable to the state or phase of the interface.

3.3.3 tester: Refer to Lower Tester.

3.3.4 test case: Refer to Abstract Test Case.

3.3.5 test selection: Test selection is the process of choosing test cases according to the specific criteria based on the IUT's PICS and PIXIT in order to constitute a conformance test suite for the IUT.

3.3.6 test subgroup: A set of test cases that share a common characteristic, such as testing for proper, improper, or inopportune PDUs. A test subgroup is the smallest testable set of test cases that can be selected.

3.3.7 sub-function: A subset of the PDUs and functional capabilities of the protocol level above the IUT that are needed to allow data transfer testing to be accomplished.

4 Abbreviations

The following abbreviations are used in this part of ISO/IEC 8882:

DCE Data Circuit-Terminating Equipment

DTE Data Terminal Equipment

DXE DTE or DCE

IUT Implementation Under Test

PDU Protocol Data Unit

PICS Protocol Implementation Conformance Statement

PIXIT Protocol Implementation eXtra Information for Testing

RS Remote Single Layer

SUT System Under Test

TPDU Transport Protocol Data Unit

TTCN Tree and Tabular Combined Notation

5 Test notation

The test notation used in ISO/IEC 8882–2 and ISO/IEC 8882–3 is TTCN as defined in ISO/IEC 9646–3.

6 Test suite structure

The test suite structure used in ISO/IEC 8882–2 and ISO/IEC 8882–3 is defined in ISO/IEC 9646–2 and is illustrated below.

Test Suite Structure

Test Group

Test Subgroup 1 (Proper PDUs)
Test Case No.101
Test Case No.102
.
.
.
Test Case No.1nn

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Test Subgroup 2 (Improper PDUs)
Test Case No.201
Test Case No.202
.
.
.
Test Case No.2nn

Test Subgroup 3 (Inopportune PDUs)
Test Case No.301
Test Case No.302
.
.
.
Test Case No.3nn

7 Testing methodology

The testing methodology is based on the OSI Conformance Testing Methodology and Framework. The test method used is the Remote Single layer (RS) method. To employ the RS method effectively, the concept of using sub-functions of higher layer protocols is introduced. Sub-functions are a subset of the PDUs and functional capabilities of the protocol layer above the IUT that are needed to allow data transfer testing to be accomplished. The required properties of the sub-functions used are:

a) That the number and sequence of data-PDUs received from the IUT after receiving a data-PDU from the tester is predictable, and that the number received from the IUT is greater than zero.

b) That the reactions of the IUT upon receipt of these data-PDUs are known.

c) That the sub-function allows either the tester or IUT to initiate transmission of the data-PDUs.

d) That the sub-function allows for the exchange of data-PDUs by the layer under test with minimal interference from other functions of the protocol layer(s) above the IUT (e.g., PDU retransmission, error recovery, etc.).

Examples of data transfer configurations are shown for the Data Link Layer and the Packet Layer in figures 1 and 2 respectively.

NOTE — The requirements on underlying protocols are specified in ISO/IEC 8208, clause 3.

7.1 Test principles

The testing of the Data Link and the Packet Layer protocols is done separately. The data link layer is normally tested first since the packet layer requires the correct operation of the data link layer. The RS method is the selected test method since it cannot be assumed that a tester will be able to test completely each level as a separate entity. The RS method requires that the tester shall recognize and respond to a PDU received from the higher level protocols. The specific PDUs which shall be accepted are defined in ISO/IEC 8882-2 and ISO/IEC 8882-3.

7.2 Data transfer

The sub-function chosen by the IUT provider should create an alternating exchange of data-PDUs between the IUT and the tester. This exchange will be repeated until the sequence numbers of the layer under test have been rotated. The sub-function chosen shall be defined in the PIXIT of the IUT, and shall include the sequence and contents of the user data fields required for the test. Two examples of the use of a sub-function to accomplish data transfer testing are shown in figures 3 and 4.

A more detailed explanation of data transfer testing is provided in ISO/IEC 8882-2 and ISO/IEC 8882-3. These explanations also address the data transfer testing of send-only and receive-only IUTs.

It is recognized that an IUT provider may not be able to accomplish data transfer testing by this means. In such instances the data transfer tests are not selected.

7.3 Other user data fields

When necessary, the content of user data fields in other than data-PDUs shall be provided to the tester by the owner of the IUT in order to execute successfully the conformance test suite. In this

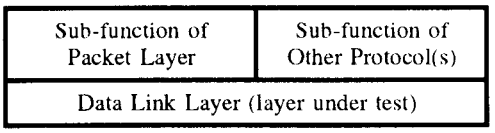

Figure 1 — Data Link Layer Data Transfer Configuration

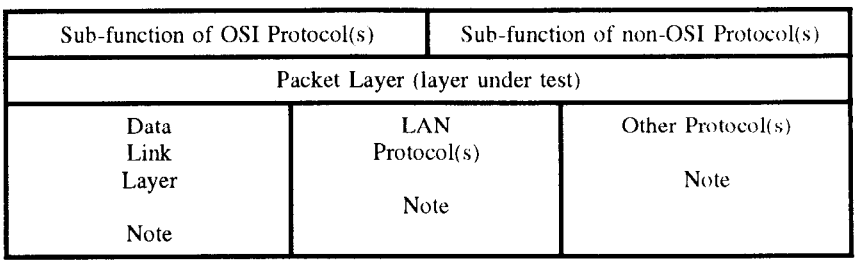

Figure 2 — Packet Layer Data Transfer Configuration

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case, the IUT requires the tester to transmit user data fields in accordance with higher level protocols which are operating above the IUT. For example, user data fields of call set-up, clearing, and interrupt packets of the Packet Layer may be affected.

The content of such user data fields shall be provided by the IUT owner in the PIXIT.

7.4 Testing configuration

The SUT is connected to the tester, point-to-point, when participating in active testing. The points of observation and control for each test sequence are within the tester.

ISO/IEC 8882-2 and ISO/IEC 8882-3 include PIXIT proformas which, when completed, describe the dynamic conformance test environment.

7.5 Operational consideration

Testing is done in a controlled environment. It is not the intent of this document to define the operational characteristics of test devices used to achieve DTE Conformance Testing. However, it is highly desirable that the device be capable of segregating IUT test activity from normal operation of underlying layers. At a minimum, the tester should be capable of distinguishing between I-frame retransmission at the data link layer (due to T1 expiration) and a packet layer retransmission. Some recommended functions of the tester include:

a) Detection of failures of the physical layer.

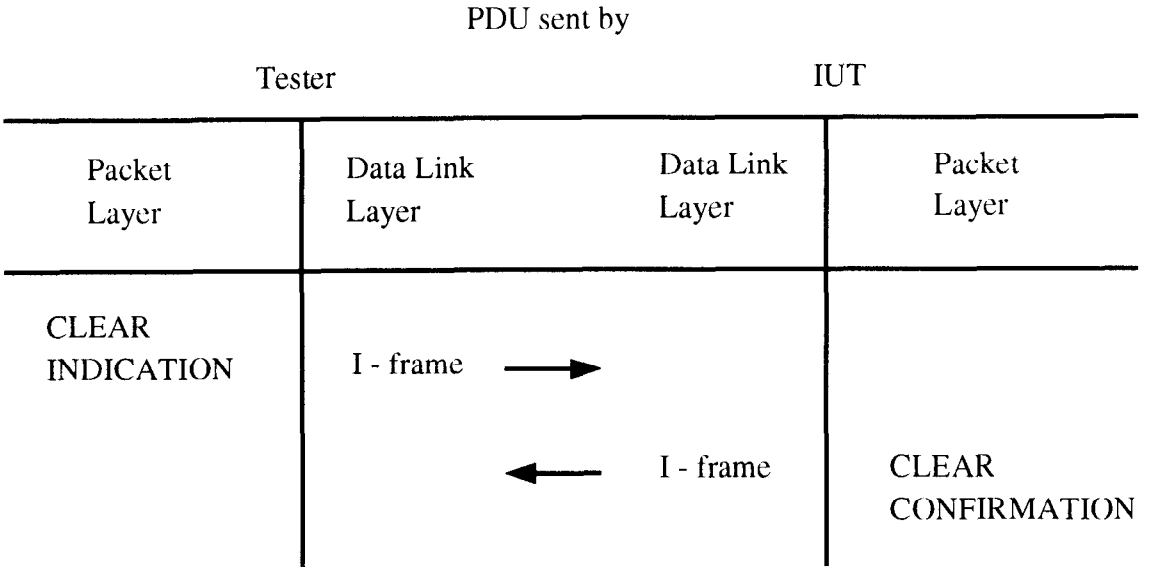

Figure 3 — Example of the use of a Packet Layer Sub-function

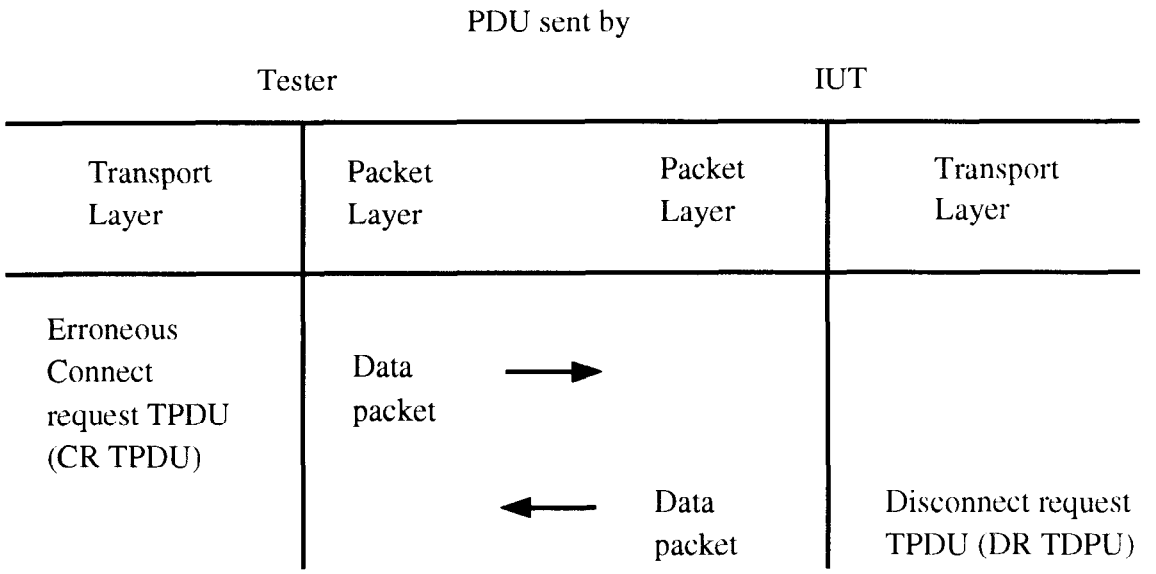

Figure 4 — Example of the use of a Transport Layer Sub-function directly over ISO/IEC 8208 (i.e. OSI Network Layer)

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b) The ability to respond transparently to timeout conditions at the data link layer.

c) Timely data link layer acknowledgement (to avoid retransmissions) when performing packet layer testing.

d) In the instance where an I-frame is retransmitted, the tester should properly acknowledge the frame and not pass it on to the packet layer. The tester shall be sensitive to failures that interfere with the tests, and when such a condition is detected, the tester should abort the test.

e) The tester shall recognise the possibility of receiving unexpected PDUs which do not affect the results of the test case. These specific PDUs for each layer are defined in ISO/IEC 8882-2 and ISO/IEC 8882-3. In addition, other unexpected PDUs may be received which do affect the results of a test case. These PDUs will require further analysis and potentially, re-execution of the test case. Receipt of such PDUs may be due to interference from sources outside the realm of the X.25 environment (e.g. the IUT operating system, IUT operator).

7.6 DTE initiated actions

Generally the tester forces the IUT to transmit a particular PDU. However, in order to execute some test groups, it is required that the IUT initiate the transmission of particular PDUs. When a DTE-initiated action is required, it is specified in the appropriate test group. Direct control of such actions may not be feasible for the IUT owner. In such instances these tests are not selected.

7.7 Timing considerations

There are two types of timing considerations which should be taken into account — timing considerations for the tester and timing considerations for the SUT.

a) Tester Considerations: The tester shall allow for the time required by the IUT to progress from one test case to the next. This timing consideration should be accommodated for in the test preamble.

   For example, the time required by the IUT to initiate a CALL REQUEST after completing a CALL CLEARING operation, and the time required by the IUT to re-establish the data link after completing a disconnect operation. The precise timing requirements of the IUT shall be specified in the PIXIT, as defined in ISO/IEC 8882-2 and ISO/IEC 8882-3.

b) SUT Considerations: Where the protocol standard identifies a need for timers, values for those timers shall be those stated in the PIXIT.

7.8 Optional facility testing

Full testing of optional facilities is not possible because

a) optional facilities may be managed by levels above X.25; and

b) multiple combinations of optional facilities may be required depending on the applications running above X.25.

Optional facilities are tested individually. Where the IUT cannot support this method of testing these tests are not selected.

7.9 Transient states

It is recognized that for those IUTs that process PDUs sequentially, certain states are not realizable. Specifically, the testing of the IUT during the DXE defined states (for example, for the packet layer, r3 — Restart Indication, p3 — Incoming Call, p7 — Clear Indication, and d3 — Reset indication) may result in the testing of some other states (p1 — Ready, p4 — Data Transfer, d1 — Flow Control Ready). For example, to test the response to an error packet (inopportune or improper packet) in the DXE Restart Indication (r3) state, the tester will send a Restart Indication, immediately followed by the error packet. The tester expects the IUT to discard the error packet and then send a Restart Request in response to the error packet. However, the IUT generally responds immediately to the Restart Indication with a Restart Confirmation and processes the next packet from the packet level state r1. When these states are not observable in the IUT, transient test cases are not selected. The specific handling of transient state testing is described in ISO/IEC 8882-2 and ISO/IEC 8882-3.

8 Structure of other parts of ISO/IEC 8882

In order to ensure consistency between ISO/IEC 8882-2 and ISO/IEC 8882-3 the following items shall be included in those standards.

a) A PIXIT pro forma

b) A statement of Acceptable Unexpected responses.

c) A statement of Tester Timing Considerations.

d) Test case selection expression definitions.

e) A definition of the test cases.

f) A statement of conformance.

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