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Electric railway equipment –
Train bus –

Part 2:
Train communication network conformance testing

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC RAILWAY EQUIPMENT – TRAIN BUS –

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61375-2 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard is to be read in conjunction with IEC 61375-1, second edition.

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

FDIS	Report on voting
9/1014/FDIS	9/1034/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 parts of IEC 61375 series, published under the general title *Electric railway equipment – Train bus* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

Following the decision of the committee, some parts of the text and some figures of this publication are copied from the IEC 61375-1 for keeping the maximum of clarity.

A bilingual version of this standard may be issued at a later date.

INTRODUCTION

TCN is an International Standard with the aim of defining interfaces so as to achieve plug-in compatibility:

a) between equipment located in different vehicles, and

b) between equipment and devices located within the same vehicle.

One of the key success factors for deployment of any technology is the standardisation and the ensuring interoperability among various implementations. To facilitate interoperability a conformance test should be implemented.

In this part of IEC 61375, the TCN hierarchical structure deals with two levels of busses:

a) the train bus called the Wire Train Bus (WTB);

b) the vehicle bus called the Multifunction Vehicle Bus (MVB).

No other busses are taken into consideration even though they are foreseen by IEC 61375-1, see the note below.

WTB and MVB share the same real-time protocols, which offer two communication services:

a) process variables, a distributed, real-time database, periodically refreshed through broadcasting;

b) messages, transmitted on demand either as:

   0. unicast messages (point-to-point) or/and
   1. multicast messages.

WTB and MVB share a common network management, which allows debugging, commissioning and maintenance over the network.

NOTE TCN states that several vehicle busses may apply, provided that such busses are able to provide the services of Real_Time Protocols. However, this part of IEC 61375 is focused on MVB as vehicle bus, even if the conformance test may apply to other busses, the exact conformance test should be derived upon.

This standard is structured into 7 clauses and 2 annexes.

The clauses and annexes are listed and briefly described in the Table 1.

Table 1 – Document structure

Clause/sections	Description
1. General	This clause describes the scope of this standard and introduces basic terms and abbreviations not reported in IEC 61375-1.
2. Conformance test: approach, requirements and boundaries	This clause is an overview of the methods of TCN implementation verification that are available to the developer and regulatory personnel. Supplies information concerning the ICS and IXITpPro-forma(s).
3. Conformance test of an MVB device	This clause covers all tests on MVB devices that are grouped by classes, from Class 0 up to Class 4. The main contents are: the MVB PICS and PIXIT; the MVB test suites; the MVB test procedures.
4. Conformance test of a WTB device	Contents: All tests on WTB are classified by nodes related to WTB itself and MVB only. The main contents are: the WTB PICS and PIXIT; the WTB test suites; the WTB test procedures.
5 Conformance test of RTP	This clause lists the tests covered in Clauses 3 and 4 fulfilling the real time protocol.
6. Conformance test of a WTB-equipped vehicle	This clause covers the Physical Layer while the Services given by the WTB node are covered by the previous clauses. Application profiles are covered by other bodies, like UIC for profile UIC 556.
7 Conformance test of NM	Partially covered by Clauses 3 and 4. Remaining parts are not covered.
Annex A – Test laboratory role and client role	This annex is normative.
Annex B – Test instrumentation and dedicated test bed	This annex is informative.

ELECTRIC RAILWAY EQUIPMENT – TRAIN BUS –

Part 2: Train communication network conformance testing

1 General

1.1 Scope

This part of IEC 61375 applies to all equipment and devices implemented according to IEC 61375-1, i.e. it covers the procedures to be applied to such equipment and devices when the conformance should be proven.

The applicability of this standard to a TCN implementation allows for individual conformance checking of the implementation itself and is a pre-requisite for further interoperability checking between different TCN implementations.

NOTE 1 For a definition of TCN implementation see 1.3.

1.2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60571:*Electronic equipment used on rail vehicles*

IEC 60807, *Rectangular connectors for frequencies below 3 MHz*

IEC 61375-1: 2007, *Electric railway equipment – Train bus – Part 1: Train communication network*

ISO/IEC 9646-1:1994, *Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 1: General concepts* (Also available as ITU-T Recommendation X.290 (1995))

ISO/IEC 9646-7:1994, *Information technology – Open Systems Interconnection –Conformance testing methodology and framework – Part 7: Implementation Conformance Statements* (Also available as ITU-T Recommendation X.296 (1995))

UIC 556, *Information transmission in trains (train bus)*

1.3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 9646-1 and IEC 61375-1 apply.

2 Conformance test: approach, requirements and boundaries

2.1 The approach

This standard specifies a general methodology for testing the conformance to the TCN protocol standard of products in which the standard is claimed to be implemented.

This standard is organised into clauses structured into different phases of the conformance testing process, these phases being characterised by the following roles:

a) the specification of abstract test suites for particular TCN protocols according to ISO/IEC 9646-1;

b) the derivation of executable test suites and associated testing tools according to ISO/IEC 9646-7;

Annex A specifies the rules on clients and laboratory specifying:

c) the role of a client of a test laboratory, having an implementation of TCN protocols to be tested;

d) the operation of conformance testing, culminating in the production of a conformance test report which gives the results in terms of the test suite(s) used and the relevant documentation produced.

In all clauses of this standard, the scope is limited in order to meet the following objectives:

e) to achieve an adequate level of confidence in the tests as a guide to conformance;

f) to achieve comparability between the results of the corresponding tests applied in different places at different times;

g) to facilitate communication between the parties responsible for the roles described above.

Each objective involves the framework for development of TCN test suites, as listed hereinafter:

h) how they should relate to the various types of conformance requirement;

i) the types of test to be standardised and the types not needing standardisation;

j) the criteria for selecting tests for inclusion in a conformance test suite;

k) the notation to be used for defining tests;

l) the structure of a test suite.

Certification, an administrative procedure which may follow conformance testing, is outside the scope of this standard.

Requirements for procurement and contracts are outside the scope of this standard.

2.1.1 Requirements

2.1.1.1 General

In the context of TCN, a real system is said to exhibit conformance if it complies with the requirements of applicable TCN standard clauses in its communication with a reference system, i.e. the tester.

A TCN standard is a set of interrelated clauses which, together, define behaviour of TCN systems in their communication. Conformance of an IUT will, therefore, be expressed at two levels, conformance to each individual clause, and conformance to the set of clauses.

The following clauses define the conformance requirements and classify them according to attributes and into feasible groups. Attributes and grouping are defined from the general point of view with reference to a TCN specification itself and from the IUT point of view. In the second case, the requirement shall be declared in the appropriate PICS and PIXIT.

2.1.1.2 Conformance requirements

The conformance requirements can be:

a) mandatory requirements: these are to be observed in all cases;

b) conditional requirements: these are to be observed if the conditions, set out in the clause, apply;

c) options: these can be selected to suit the implementation, provided that any requirements applicable to the option are observed.

TCN essential functionality are mandatory requirements; additional functionality can be either conditional or optional requirements.

Furthermore, conformance requirements in a Part can be stated:

d) positively: they state what shall be done;

e) negatively (prohibitions): they state what shall not be done.

Finally, conformance requirements fall into two groups:

f) static conformance requirements;

g) dynamic conformance requirements;

these are discussed in 2.1.1.3 and 2.1.1.4, respectively.

2.1.1.3 Static conformance requirements

To facilitate interoperability static conformance requirements define the allowed minimum capabilities of an implementation. These requirements may be at a broad level, such as the grouping of functional units and options into protocol classes, or at a detailed level, such as a range of values that have to be supported for specific parameters of timers.

Static conformance requirements and options in TCN parts can be of two varieties:

a) those which determine the capabilities to be included in the implementation of the particular protocol;

b) those which determine multi-layer dependencies, for example those which place constraints on the capabilities of the underlying layers of the system in which the protocol implementation resides. These are likely to be found in upper layer parts (e.g. network management vs real time protocols).

All capabilities not explicitly stated as static conformance requirements are to be regarded as optional.

2.1.1.4 Dynamic conformance requirements

Dynamic conformance requirements are all those requirements (and options) which determine what observable behaviour is permitted by the relevant TCN part in instances of communication. They form the bulk of each TCN protocol document. They define the set of allowable behaviours of an implementation or real system. This set defines the maximum capability that a conforming implementation or real system can have within the terms of the TCN protocol document.

A system exhibits dynamic conformance in an instance of communication if its behaviour is a member of the set of all behaviours permitted by the relevant TCN protocol part in a way which is consistent with the PICS.

2.1.1.4.1 A conforming system

A conforming system or implementation is one which is shown to satisfy both static and dynamic conformance requirements, consistent with the capabilities stated in the PICS, for each protocol declared in the system conformance statement.

2.1.1.4.2 Interoperability and conformance

The primary purpose of conformance testing is to increase the probability that different implementations are able to inter-operate.