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**Electronic railway equipment – Train communication network (TCN) –
Part 2-2: Wire Train Bus conformance testing**

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**Matériel électronique ferroviaire – Réseau embarqué de train (TCN) –
Partie 2-2: Bus de Train Filaire – Essais de conformité**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRONIC RAILWAY EQUIPMENT –
TRAIN COMMUNICATION NETWORK (TCN) –**

Part 2-2: Wire Train Bus conformance testing

FOREWORD

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International Standard IEC 61375-2-2 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This first edition cancels the clauses of IEC 61375-2, first edition, published in 2007, relevant to the specification of WTB conformance testing and constitutes a technical revision.

It was prepared taking into account IEC 61375-2-1, first edition.

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

FDIS	Report on voting
9/1643/FDIS	9/1667/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, under the general title *Electronic railway equipment – Train communication network (TCN)*, can be found on the IEC website.

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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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 consists, and
- b) between equipment and devices located within the same consist.

One of the key success factors for the deployment of any technology is the standardisation and 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 the train bus called the Wire Train Bus (WTB).

No other busses are taken into consideration even though they are foreseen by IEC 61375.

WTB has real-time protocols, which offer two communication services:

- c) process variables, a distributed, real-time database, periodically refreshed through broadcasting;
- d) messages, transmitted on demand either as:
 - 0. unicast messages (point-to-point) or/and
 - 1. multicast messages.

WTB has a network management, which allows debugging, commissioning and maintenance over the network.

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This standard is structured into 8 clauses and 2 annexes.

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

Table 1 – Document structure

Clause	Description
1 Scope	This clause describes the scope of this standard..
2 Normative references	This clause lists the normative references.
3 Terms and definitions, abbreviations, conventions	This clause introduces basic terms and abbreviations not reported in IEC 61375-2-1.
4 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 IXITpProforma(s).
5 Conformance test of a WTB node, WTB trunk cable, WTB jumper cables, WTB extension cables	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.
6 Conformance test of RTP	This clause lists the tests covered in Clauses 3 and 4 fulfilling the real time protocol.
7 Conformance test of a WTB-equipped consist	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 communication profile as described in UIC CODE 556.
8 Conformance test of NM	Partially covered by Clauses 3 and 4. Remaining parts are not covered.
Annex A – Test laboratory and client role	This annex is normative.
Annex B – Test suites standard instrumentation	This annex is informative.

ELECTRONIC RAILWAY EQUIPMENT – TRAIN COMMUNICATION NETWORK (TCN) –

Part 2-2: Wire Train Bus conformance testing

1 Scope

This part of IEC 61375 applies to all equipment and devices implemented according to IEC 61375-2-1, 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 For a definition of TCN implementation see IEC 61375-2-1,1.3.

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 60571: *Electronic equipment used on rail vehicles*
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IEC 60807(all parts), *Rectangular connectors for frequencies below 3 MHz*

IEC 61375-2-1: *Electronic railway equipment – Train Communication Network (TCN) – Part 2-1: Wire Train Bus (WTB)*

ISO/IEC 7498 (all parts): *Information technology – Open Systems Interconnection – Basic Reference Model*

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 CODE 556, *Information transmission in the train (train-bus)*

3 Terms and definitions, abbreviations, conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 9646-1 and IEC 61375-2-1 apply.

3.2 Abbreviations

AVI	Application Variables Interface, the definition of the Process Variable services
BR	Bit Rate, the rate of data throughput on the medium expressed in bits per second (bit/s) or in hertz (Hz), whichever is appropriate
BT	Bit Time, the duration of the transmission of one bit, expressed in μs
CUT	Consist under Test
DMM	Digital Multi Meter
ITU	International Telecommunication Union, the international standardisation body for telecommunications based in Geneva
IUT	Implementation Under Test
IEC	International Electrotechnical Commission, Geneva
ISO	International Standard Organisation, Geneva
LLC	Logical Link Control, a sub-layer within the Link Layer ruling the data exchange
LME	Layer Management Entity, the entity in charge of supervising a layer on behalf of Network Management
MAU	Medium Attachment Unit, the part of a Node which interfaces electrically to the bus and which provides/accepts binary logic signals
MOT	Mean of Test
MVB	Multifunction Vehicle Bus, a Consist network
MS	Mapping Server, defined in UIC CODE 556
OSI	Open System Interconnection, a universal communication model defined in the ISO/IEC 7498
PCTR	Protocol Conformance Test Report, defined in ISO/IEC 9646
PICS	Protocol Implementation Conformance Statement, defined in ISO/IEC 9646
PIXIT	Protocol Implementation Extra Information for Testing
RTP	Real-Time Protocols, the common communication protocols for process data and message data
TCN	Train Communication Network, a set of communicating consist and Train Busses
TDR	Time Domain Reflectometry, tool for analyzing single-ended and differential transmission lines
TNM	Train Network Management
UIC	International Union of Railways, the international railways operators association
WTB	Wire Train Bus

4 Conformance test: approach, requirements and boundaries

4.1 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.

4.1.1 Requirements

4.1.1.1 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.

4.1.1.2 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 4.1.1.3 and 4.1.1.4 respectively.

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4.1.1.3 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.

4.1.1.4 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.