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**Road vehicles — In-vehicle Ethernet —**  
**Part 10:**  
**Transport layer and network layer**  
**conformance test plans**

*Véhicules routiers — Ethernet embarqué —*

*Partie 10: Plans de test de conformité des couches transport et réseau*



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CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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# Contents

Page

<b>Foreword</b>	<b>v</b>
<b>Introduction</b>	<b>vi</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>1</b>
<b>4 Symbols and abbreviated terms</b>	<b>2</b>
4.1 Symbols	2
4.2 Abbreviated terms	2
<b>5 Conventions</b>	<b>4</b>
<b>6 CTP test system set-up and CTC structure</b>	<b>4</b>
6.1 General	4
6.2 Test system set-up	5
6.3 CTC definition	6
6.4 Terminology used in CTCs	7
6.5 IUT prerequisites – TCP/IP TestStub	7
6.5.1 General	7
6.5.2 TCP/IP TestStub service primitives	7
6.5.3 Result codes	8
<b>7 Network and transport layers CTCs</b>	<b>8</b>
7.1 NL – Address resolution protocol (ARP)	8
7.1.1 General	8
7.1.2 Referenced specification	8
7.1.3 Test system topology – NL – ARP	8
7.1.4 Test system topology and related CTC configuration	9
7.1.5 CTC ARP overview	9
7.1.6 ARP parameters used in CTCs	10
7.1.7 ARP CTCs	11
7.2 NL – Internet control message protocol version 4 (ICMPv4)	42
7.2.1 General	42
7.2.2 Referenced specification	42
7.2.3 Test system topology – NL – ICMPv4	42
7.2.4 Test system topology and related CTC configuration	43
7.2.5 ICMPv4 parameters used in CTCs	43
7.2.6 ICMPv4 CTCs	44
7.3 NL – Internet protocol version 4 (IPv4)	54
7.3.1 General	54
7.3.2 Referenced specification	54
7.3.3 Test system topology – NL – IPv4	54
7.3.4 Test system topology and related CTC configuration	55
7.3.5 IPv4 parameters used in CTCs	55
7.3.6 IPv4 CTCs	56
7.4 NL – Dynamic configuration of IPv4 link local address	82
7.4.1 General	82
7.4.2 Referenced specification	82
7.4.3 Test system topology – NL – Dynamic configuration of IPv4 link local address	82
7.4.4 Test system topology and related CTC configuration	83
7.4.5 Dynamic configuration of IPv4 parameters and constants used in CTCs	83
7.4.6 IPv4 autoconf CTCs	84
7.5 TL – User datagram protocol (UDP)	117
7.5.1 General	117
7.5.2 Referenced specification	117

7.5.3	Test system topology – TL – UDP .....	118
7.5.4	Test system topology and related CTC configuration .....	118
7.5.5	UDP parameters used in CTCs .....	118
7.5.6	UDP CTCs .....	119
7.6	TL – Transmission control protocol (TCP) .....	137
7.6.1	General .....	137
7.6.2	Referenced specification .....	138
7.6.3	Test system topology – TL – TCP .....	138
7.6.4	Test system topology and related CTC configuration .....	138
7.6.5	TCP parameters used in CTCs .....	138
7.6.6	TCP CTCs .....	139
<b>Bibliography .....</b>		<b>205</b>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

A list of all parts in the ISO 21111 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The ISO 21111 series includes in-vehicle Ethernet requirements and test plans that are disseminated in other International Standards and complements them with additional test methods and requirements. The resulting requirement and test plans are structured in different documents following the Open Systems Interconnection (OSI) reference model and grouping the documents that depend on the physical media and bit rate used.

In general, the Ethernet requirements are specified in ISO/IEC/IEEE 8802-3. The ISO 21111 series provides supplemental specifications (e.g. wake-up, I/O functionality), which are required for in-vehicle Ethernet applications. In road vehicles, Ethernet networks are used for different purposes requiring different bit-rates. Currently, the ISO 21111 series specifies the 1-Gbit/s optical and 100-Mbit/s electrical physical layer.

The ISO 21111 series contains requirement specifications and test methods related to the in-vehicle Ethernet. This includes requirement specifications for physical layer entity (e.g. connectors, physical layer implementations) providers, device (e.g. electronic control units, gateway units) suppliers, and system (e.g. network systems) designers. Additionally, there are test methods specified for conformance testing and for interoperability testing.

Safety (electrical safety, protection, fire, etc.) and electromagnetic compatibility (EMC) requirements are out of the scope of the ISO 21111 series.

The structure of the specifications given in the ISO 21111 series complies with the Open Systems Interconnection (OSI) reference model specified in ISO/IEC 7498-1<sup>[1]</sup> and ISO/IEC 10731<sup>[2]</sup>.

ISO 21111-1 defines the terms which are used in this series of standards and provides an overview of the standards for in-vehicle Ethernet including the complementary relations to ISO/IEC/IEEE 8802-3, the document structure, type of physical entities, in-vehicle Ethernet specific functionalities and so on.

ISO 21111-2 specifies the interface between reconciliation sublayer and physical entity including reduced gigabit media independent interface (RGMI), and the common physical entity wake-up and synchronized link sleep functionalities, independent from physical media and bit rate.

ISO 21111-2 specifies supplemental requirements to a physical layer capable of transmitting 1-Gbit/s over plastic optical fibre compliant with ISO/IEC/IEEE 8802-3, with specific application to communications inside road vehicles, and a test plan for physical entity conformance testing.

ISO 21111-4 specifies the optical components requirements and test methods for 1-Gbit/s optical invehicle Ethernet.

ISO 21111-5 specifies, for 1-Gbit/s optical in-vehicle Ethernet, requirements on the physical layer at system level, requirements on the interoperability test set-ups, the interoperability test plan that checks the requirements for the physical layer at system level, requirements on the device-level physical layer conformance test set-ups, and device-level physical layer conformance test plan that checks a set of requirements for the OSI physical layer that are relevant for device vendors.

ISO 21111-6 specifies advanced features of an ISO/IEC/IEEE 8802-3 in-vehicle Ethernet physical layer (often also called transceiver), e.g. for diagnostic purposes for in-vehicle Ethernet physical layers. It specifies advanced physical layer features, wake-up and sleep features, physical layer test suite,

physical layer control requirements and conformance test plan, physical sublayers test suite and physical sublayers requirements and conformance test plan.

ISO 21111-7 specifies the implementation for ISO/IEC/IEEE 8802-3:2021, which defines the interface implementation for automotive applications together with requirements on components used to realize this Bus Interface Network (BIN). ISO 21111-7 also defines further testing and system requirements for systems implemented according to the system specification. In addition, ISO 21111-7 defines the channels for tests of transceivers with a test wiring harness that simulates various electrical communication channels.

ISO 21111-8 specifies the transmission media, the channel performance and the tests for ISO/IEC/IEEE 8802-3 in-vehicle Ethernet.

ISO 21111-9 specifies the data link layer requirements. It specifies the requirements for devices and systems with bridge functionality.

This document specifies the transport layer and network layer requirements and conformance test plans. It specifies the conformance test plans for devices and systems that include functionality related with OSI layers from 4 and 3.

ISO 21111-11 specifies the application layer to session layer requirements and conformance test plans. It specifies the conformance test plans for devices and systems that include functionality related with OSI layers from 7 to 5.

Figure 1 shows the parts of the ISO 21111 series and the document structure.

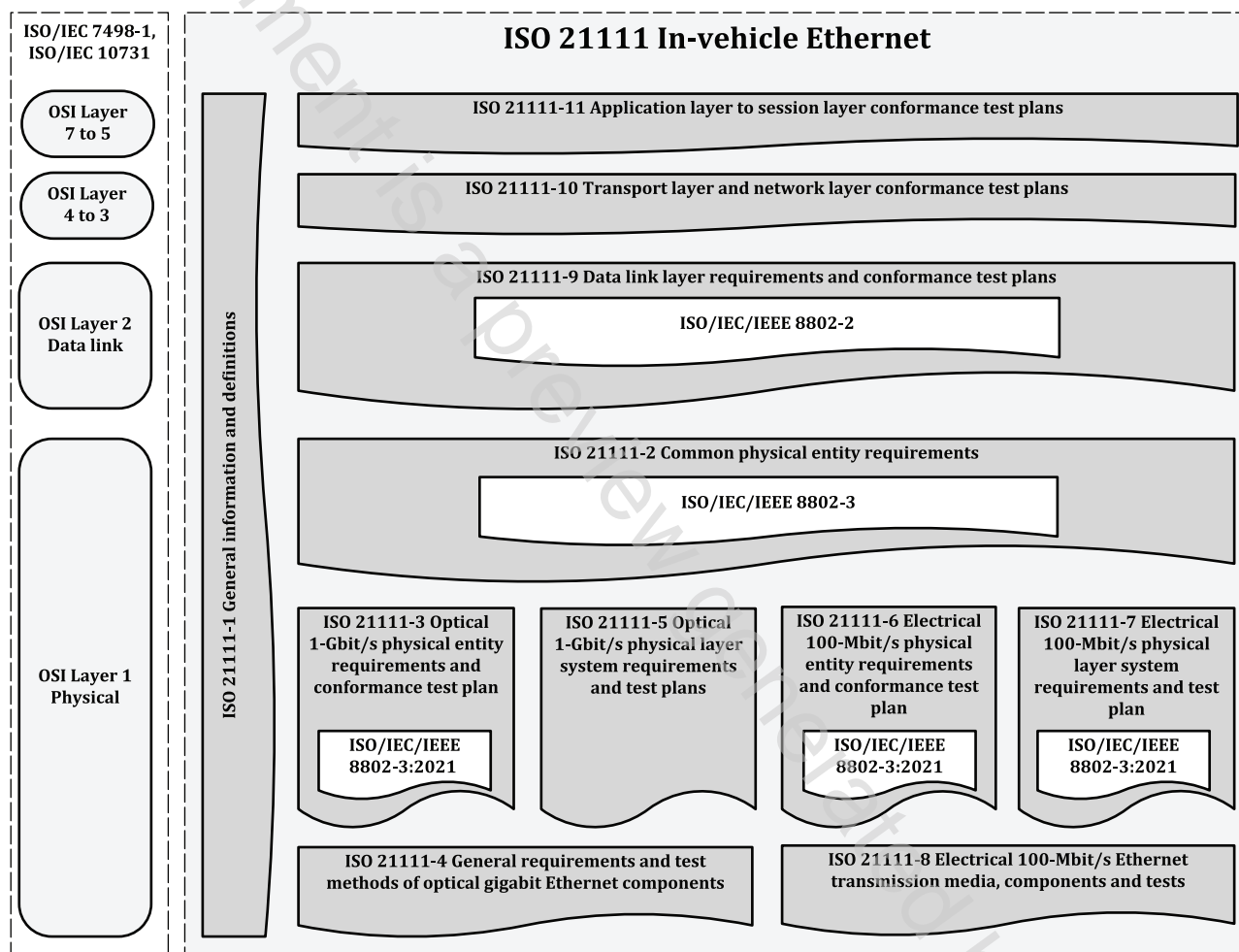


Figure 1 — In-vehicle Ethernet documents reference according to OSI model





# Road vehicles — In-vehicle Ethernet —

## Part 10:

## Transport layer and network layer conformance test plans

### 1 Scope

This document specifies in-vehicle Ethernet transport layer and network layer conformance test plans (CTP) for electronic control units (ECUs). This document is a collection of all conformance test cases which are recommended to be considered for automotive use and should be referred by car manufacturers within their quality control processes.

The document includes conformance test plans for the address resolution protocol, Internet control message protocol version 4, Internet protocol version 4, Internet protocol version 4 auto configuration, user datagram protocol, transport control protocol, and dynamic host configuration protocol version 4.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO/IEC 9646-1, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 1: General concepts*

ISO 21111-1, *Road vehicles — In-vehicle Ethernet — Part 1: General information and definitions*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21111-1, ISO/IEC 9646-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

#### 3.1

##### **REPEAT**

pseudo code command for an iteration

#### 3.2

##### **full-sized segment**

segment with size equal to the effective send MSS

#### 3.3

##### **result code**

value attributed to a result

#### 3.4

##### **generic result code**

specific and universal value attributed to a result