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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 10: 150-Mbit/s coaxial physical layer

Véhicules routiers — Système de transport axé sur les médias — Partie 10: Couche coaxiale physique à 150-Mbit/s

PROOF/ÉPREUVE

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Foreword

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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 21806 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.

Introduction

The Media Oriented Systems Transport (MOST) communication technology was initially developed at the end of the 1990s in order to support complex audio applications in cars. The MOST Cooperation was founded in 1998 with the goal to develop and enable the technology for the automotive industry. Today, MOST[1)] enables the transport of high quality of service (QoS) audio and video together with packet data and real-time control to support modern automotive multimedia and similar applications. MOST is a function-oriented communication technology to network a variety of multimedia devices comprising one or more MOST nodes.

Figure 1 shows a MOST network example.

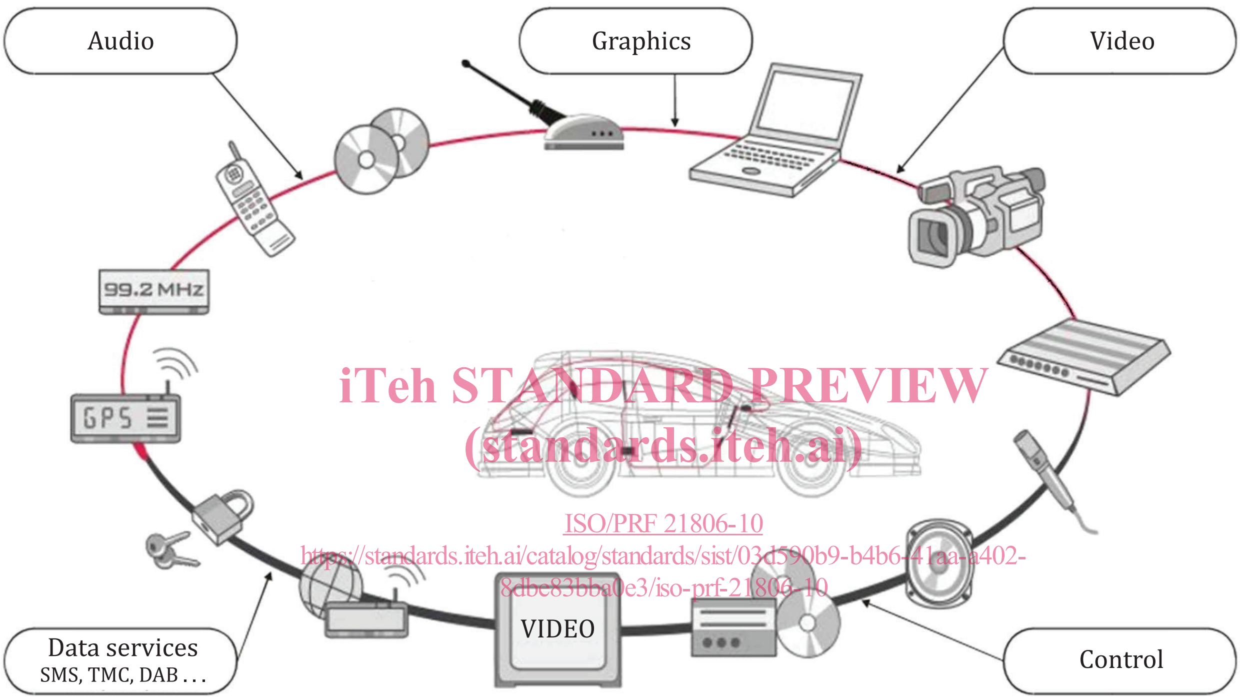

Figure 1 — MOST network example

The MOST communication technology provides:

— synchronous and isochronous streaming,

— small overhead for administrative communication control,

— a functional and hierarchical system model,

— API standardization through a function block (FBlock) framework,

— free partitioning of functionality to real devices,

— service discovery and notification, and

— flexibly scalable automotive-ready Ethernet communication according to ISO/IEC/IEEE 8802-3[2].

MOST is a synchronous time-division-multiplexing (TDM) network that transports different data types on separate channels at low latency. MOST supports different bit rates and physical layers. The network clock is provided with a continuous data signal.

1) MOST® is the registered trademark of Microchip Technology Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO.

Within the synchronous base data signal, the content of multiple streaming connections and control data is transported. For streaming data connections, bandwidth is reserved to avoid interruptions, collisions, or delays in the transport of the data stream.

MOST specifies mechanisms for sending anisochronous, packet-based data in addition to control data and streaming data. The transmission of packet-based data is separated from the transmission of control data and streaming data. None of them interfere with each other.

A MOST network consists of devices that are connected to one common control channel and packet channel.

In summary, MOST is a network that has mechanisms to transport the various signals and data streams that occur in multimedia and infotainment systems.

The ISO Standards Maintenance Portal (https:/standards.iso.org/iso/) provides references to MOST specifications implemented in today's road vehicles because easy access via hyperlinks to these specifications is necessary. It references documents that are normative or informative for the MOST versions 4V0, 3V1, 3V0, and 2V5.

The ISO 21806 series has been established in order to specify requirements and recommendations for implementing the MOST communication technology into multimedia devices and to provide conformance test plans for implementing related test tools and test procedures.

To achieve this, the ISO 21806 series is based on the open systems interconnection (OSI) basic reference model in accordance with ISO/IEC 7498-1[1] and ISO/IEC 10731,[3] which structures communication systems into seven layers as shown in Figure 2. Stream transmission applications use a direct stream data interface (transparent) to the data link layer.

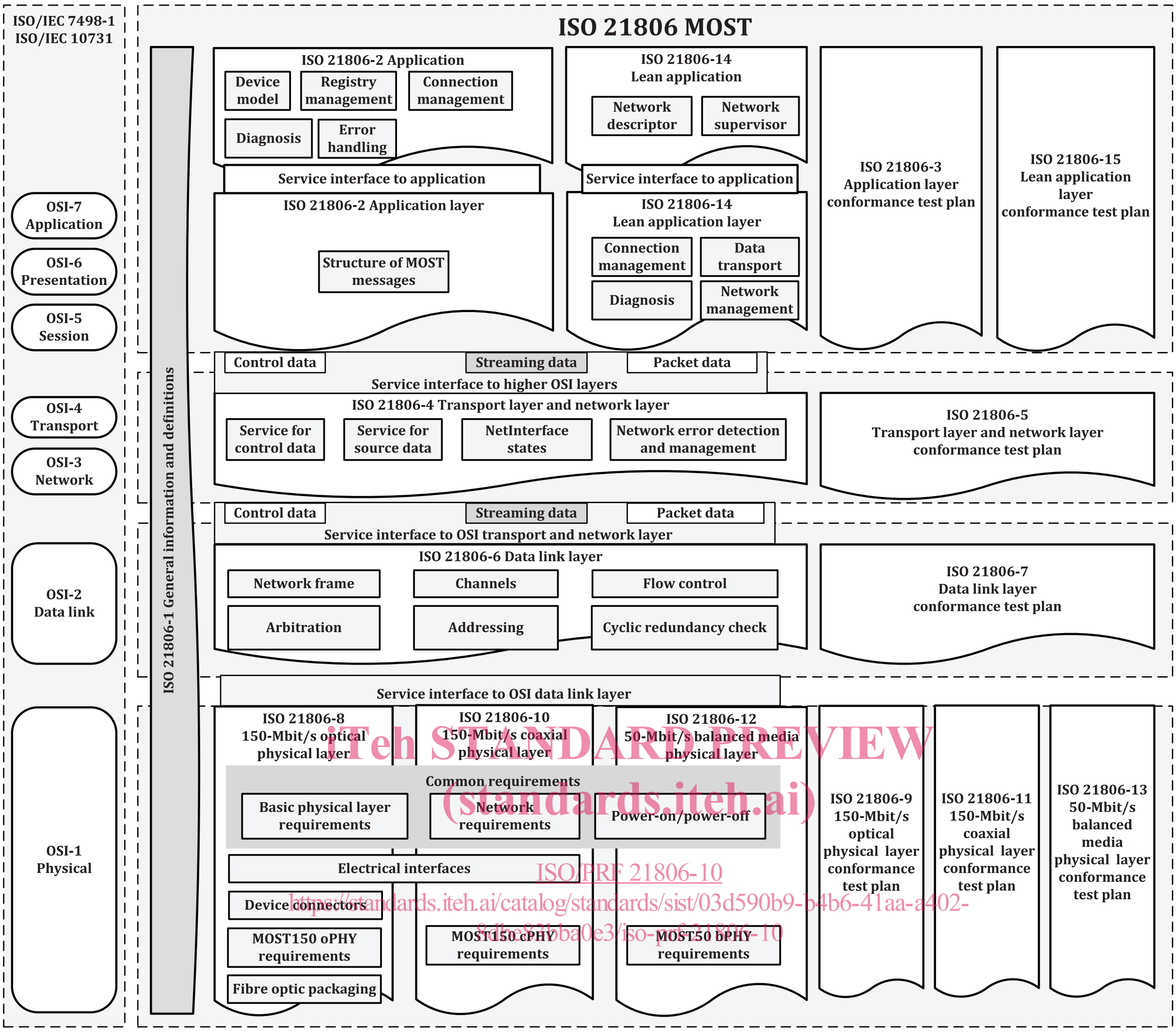

Figure 2 — The ISO 21806 series reference according to the OSI model

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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 10:
150-Mbit/s coaxial physical layer

1 Scope

This document specifies the 150-Mbit/s coaxial physical layer for MOST (MOST150 cPHY), a synchronous time-division-multiplexing network.

This document specifies the applicable constraints and defines interfaces and parameters, suitable for the development of products based on MOST150 cPHY. Such products include coaxial links, coaxial receivers, coaxial transmitters, electrical to coaxial converters, and coaxial to electrical converters.

This document also establishes basic measurement techniques and actual parameter values for MOST150 cPHY.

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 21806-1, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 1: General information and definitions*

No JEDEC JESD8C.01,[2)] *Interface Standard for Nominal 3 V/3,3 V Supply Digital Integrated Circuits*

TIA/EIA-644-A-2001,[3)] *Electrical Characteristics of Low Voltage Differential Signaling (LVDS) Interface Circuits*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21806-1 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 http://www.electropedia.org/

3.1
ECC
electrical to coaxial converter
MOST component that converts an electrical signal into a coaxial signal

2) Available at http://www.jedec.org/.

3) Available at https://wwwt.aonline.org/itandards/.

3.2
CEC
coaxial to electrical converter
MOST component that converts a coaxial signal into an electrical signal

4 Symbols and abbreviated terms

4.1 Symbols

---	empty table cell or feature undefined
A_C	attenuation conformance
A_{DC_loss}	DC attenuation
J_{tr}	transferred jitter (RMS)
L_{RL}	return loss
N_{BPF}	number of bits per frame
ρ_{BR}	bit rate
ρ_{Fs}	network frame rate
ν_{RMS}	transferred jitter, calculated using the root-mean-square method
σ	standard deviation
T_A	ambient temperature
t_{MDT}	TimingMaster delay tolerance
t_{UI}	unit interval
V_{OH}	output high voltage
V_{OL}	output low voltage

4.2 Abbreviated terms

AC	alternating current
AFE	analogue frontend
BER	bit error rate
BR	bit rate
Cd[n]	condition
CEC	coaxial to electrical converter
cPHY	coaxial physical layer
CTR	coaxial transceiver
DC	direct current

DCA	DC adaptive
DDJ	data-dependant jitter
DLL	data link layer
DSV	digital sum value
ECC	electrical to coaxial converter
ECU	electronic control unit
EMC	electromagnetic compatibility
EMI	electromagnetic interference
LVDS	Low-Voltage Differential Signalling
MNC	MOST network controller
N/A	not applicable
PCB	printed circuit board
PDF	probability density function
PHY	physical layer
PLL	phase locked loop
RL	return loss
RMS	root mean square
Rx data	encoded digital bit stream being received
SP[n]	specification point [n]
Tx data	encoded digital bit stream being transmitted

5 Conventions

This document is based on OSI service conventions as specified in ISO/IEC 10731[3].

6 Physical layer service interface to OSI data link layer

6.1 Overview

The physical layer (PHY) service interface specifies the abstract interface to the OSI data link layer (DLL), see ISO 21806-6[5].

6.2 Data type definitions

The data type `Enum` is defined as an 8-bit enumeration.

6.3 Event indications and action requests

6.3.1 P_EVENT.INDICATE

The PHY shall use `P_EVENT.INDICATE` to indicate the occurrence of an event to the DLL.

```
P_EVENT.INDICATE{
    PHY_Event
}
```

6.3.2 P_ACTION.REQUEST

`P_ACTION.REQUEST` shall trigger the execution of a request.

```
P_ACTION.REQUEST {
    PHY_Request
}
```

6.4 Parameters

6.4.1 PHY_Event

Table 1 specifies the `PHY_Event` parameter, which notifies the DLL about events.

Table 1 — Parameter passed from PHY to DLL

Parameter	Data type	Description

`PHY_Event`	`Enum {`
	`PHY_Output_Off,`
	`PHY_Network_Activity`
	`}`
		An event that is reported to the DLL.

Table 2 specifies the parameter values for the `PHY_Event Enum`.

Table 2 — PHY_Event Enum values

Enum value	Description
`PHY_Output_Off`	MNC transmit terminal is switched off.
`PHY_Network_Activity`	Network activity is detected at the MNC receive terminal.

6.4.2 PHY_Request

Table 3 specifies the `PHY_Request` parameter, which is passed from DLL to PHY.

Table 3 — Parameter passed from DLL to PHY

Parameter	Data type	Description

`PHY_Request`	`Enum {`
	`cmd_Output_Off,`
	`cmd_Output_On,`
	`cmd_Open_Bypass,`
	`}`
		A request from the DLL

Table 4 specifies the parameter values for the `PHY_Request Enum`.

Table 4 — PHY_Request Enum values

Enum value	Description
`cmd_Output_Off`	Switching off the MNC transmit terminal is requested. By default, it is off.
`cmd_Output_On`	Switching on the MNC transmit terminal is requested. By default, it is off.
`cmd_Open_Bypass`	Opening the bypass is requested. By default, the bypass is closed.

7 Basic physical layer requirements

7.1 Logic terminology

7.1.1 Single-ended low-voltage digital signals

For the parameters provided in JEDEC No. JESD8C.01, Table 5 defines the corresponding terms for single-ended signals used in this document. These terms are used to describe the logic states of signals /RST and STATUS.

Table 5 — Terms for single-ended signals

Term	Corresponding JEDEC parameter
Low	V_{OL} (output low voltage)
Logic 0	
High	V_{OH} (output high voltage)
Logic 1	

7.1.2 Differential LVDS signals

TIA/EIA-644-A-2001 uses the labels A and B for the device output terminals; this document uses P and N, respectively. Table 6 specifies the terms for LVDS signals. The terms correspond to the TIA/EIA-644-A-2001 specification.

Table 6 — Terms for LVDS signals

Term	Corresponding JEDEC parameter
Low	The P terminal shall be negative with respect to the N terminal for a binary 0 state.
Logic 0	
High	The P terminal shall be positive with respect to the N terminal for a binary 1 state.
Logic 1	

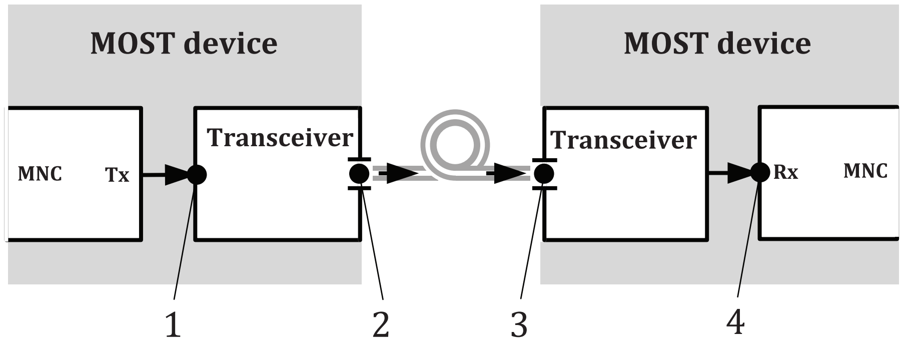
Since some of the MOST devices specified in this document use a tri-state LVDS interface, Table 7 specifies the terms for LVDS bus states.

Table 7 — Terms for LVDS bus states

Term	Corresponding TIA/EIA description
Disabled	The P and N terminals are in a high impedance state. If small leakage currents exist, they might cause an indeterminate voltage on the line/load.
Off	
Enabled	The P and the N terminals are driving the line/load. The outputs are at valid LVDS logic levels provided the input data is valid.
On	
Valid LVDS signal	Data or LVDS 0, according to LVDS voltage levels.

7.2 Specification points (SPs)

A physical connection of two MOST devices is called a link. Measurements are taken at specific locations along a link. These locations are called SPs. The location of the SPs is shown in Figure 3.



Key

1 SP1

2 SP2

3 SP3

4 SP4

Figure 3 — Location of SPs along a link

SPs define interfaces that are boundaries between a transmitting and a receiving MOST component. For each of those interfaces, a set of requirements and properties is defined (e.g. signal timing, signal amplitude, connector interface drawings). SP1 and SP4 are located between a MOST network controller (MNC) and the corresponding transceiver. SP2 and SP3 are located between transceivers and a wiring harness.

For MOST components that are located between two adjacent SPs, requirements and properties can be derived. The definitions of the second SP of the pair specify the component's output performance to be achieved, considering input conditions as defined in the first SP. For example, a transmit converter component specification can be derived from SP1 and SP2. Receive converter component requirements are covered by SP3 and SP4. Wiring harness requirements can be derived from SP2 and SP3.

In addition to the definitions of the SPs for a point-to-point link, this document defines requirements covering the stability of the MOST network. Examples are requirements regarding jitter transfer through MOST devices, jitter accumulation through the MOST network, and power state transitions.

The specified parameters in this document are minimum values to ensure functionality of the MOST network in a wide range of environmental conditions.

7.3 Phase variation

7.3.1 General

Data stream timing and distortion cause phase variation.

7.3.2 Wander

Wander consists of any phase variation from 0 Hz to 10 Hz. All active MOST components in the MOST network create wander. Wander is a function of the temperature drift and propagates from node to node. Typically, wander does not affect alignment jitter eye masks.

NOTE Wander might impact the TimingMaster.

7.3.3 Jitter

Jitter is any phase variation of frequencies above 10 Hz. Every MOST component and the transmission medium create jitter in the MOST network. Jitter is correlated or uncorrelated. The dominant jitter sources in the MOST network consist of PLL noise, link-induced DDJ, sensitivity-induced CEC noise, crosstalk, or phenomena such as power supply coupling. Data scrambling is used to eliminate DDJ correlation between nodes.

There are two jitter categories as shown in Figure 4.

— Alignment jitter: jitter that affects the reception of data by degrading the receiver eye diagram with horizontal closure (influences eye diagram measurement); it has impact only on a link as data recovery is performed by the MNC.

— Transferred jitter: jitter that is accumulated over all links (does not influence eye diagram measurement); the TimingMaster jitter tolerance shall be determined accordingly.

As the jitter on the measured signal increases, the eye closes more and more. A keep-out mask is specified to detect possible error traces. If the eye does not hit the mask then data recovery is ensured. Mask design depends on the required receiver margin and the characteristics of the channel.

Figure 4 shows the phase variation measurements.

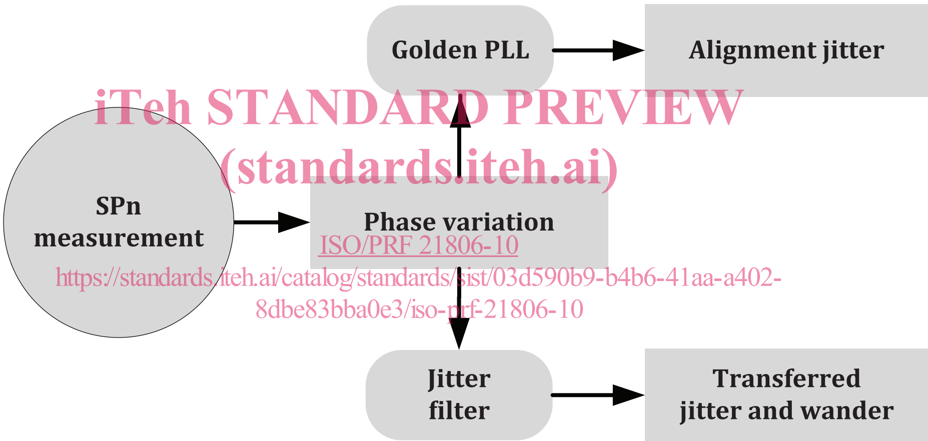


Figure 4 — Phase variation measurements

7.3.4 Clock recovery and reference clock

7.3.4.1 General

Phase variation can be measured directly on a data stream. To view alignment jitter and transferred jitter independently, special tools are required.

All MOST networks contain one device that implements the TimingMaster, which creates the reference clock. This clock is embedded within the data stream. All other MOST devices contain TimingSlaves that recover the clock from the data stream. Therefore, clock recovery is a basic functionality of an MNC. MOST components add phase variation to the data stream. This degrades the reference clock.

Receiver jitter tolerance and jitter transfer are basic operation properties of any MNC. Alignment jitter is measured by means of an eye diagram formed with a Golden PLL. Transferred jitter is measured with a jitter filter.

Figure 5 illustrates clock recovery and data recovery in an MNC. Therefore, there is a need for a Golden PLL model and a jitter filter model. Together they reflect the required jitter behaviour of an MNC.