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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 11: 150-Mbit/s coaxial physical layer conformance test plan

Véhicules routiers — Système de transport axé sur les médias — Partie 11: Plan d'essais de conformité de la 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.

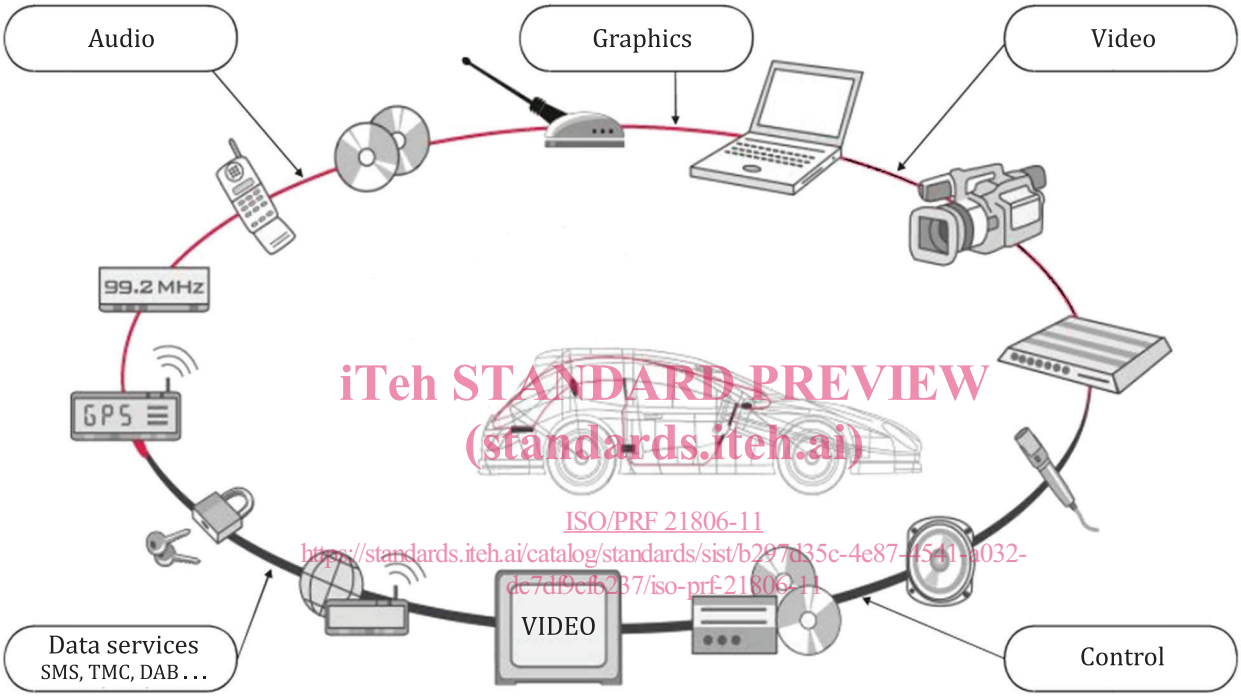

Figure 1 — MOST network example

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 an isochronous, 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.

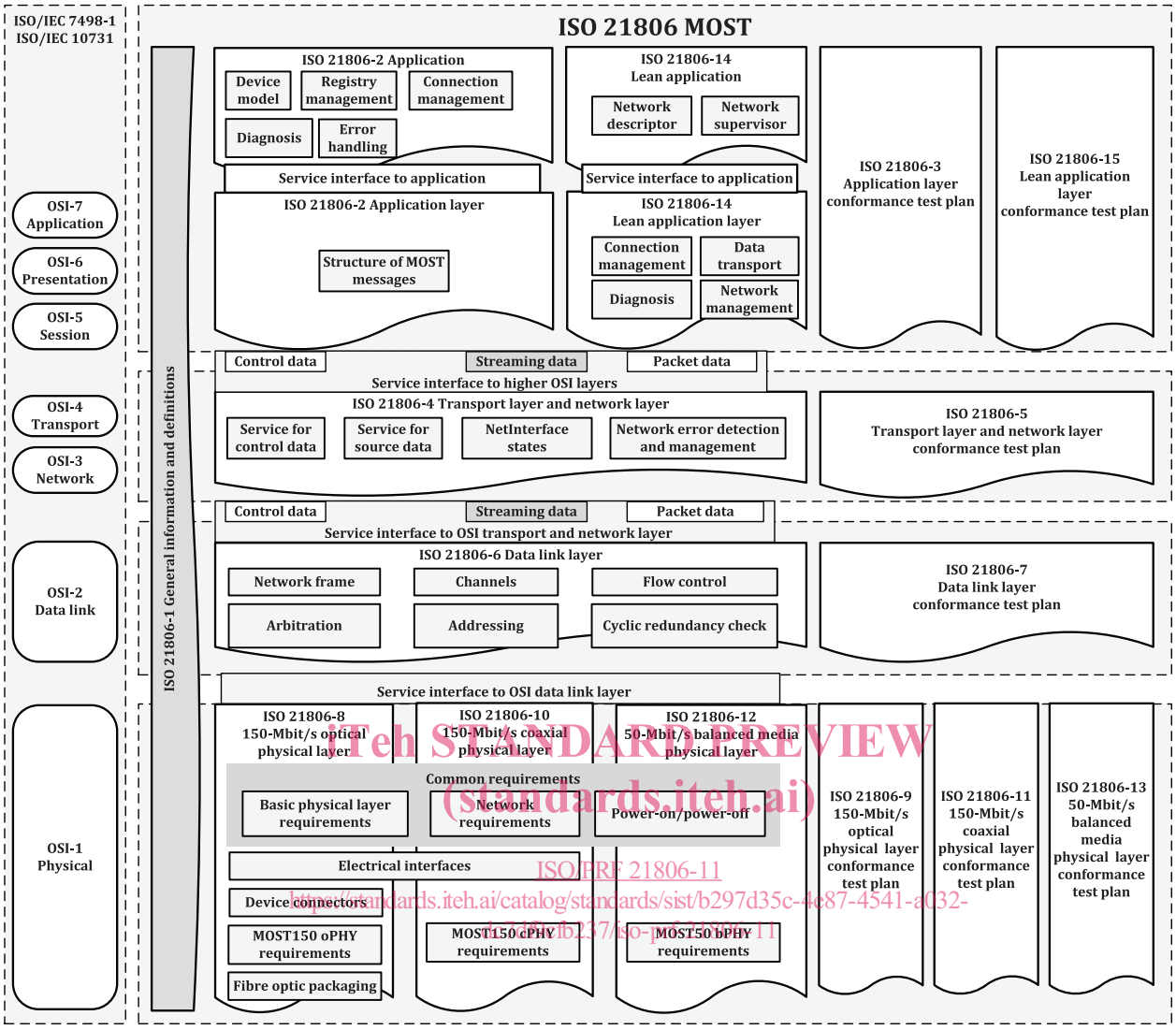

Figure 2 — The ISO 21806 series reference according to the OSI model

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Road vehicles — Media Oriented Systems Transport (MOST) —

Part 11:
150-Mbit/s coaxial physical layer conformance test plan

1 Scope

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

This document specifies the basic conformance test measurement methods, relevant for verifying compatibility of networks, nodes, and MOST components with the requirements specified in ISO 21806-10.

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*

ISO 21806-10, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 10: 150-Mbit/s coaxial physical layer*

ISO 20860-2, *Road vehicles — 50 ohms impedance radio frequency connection system interface — Part 2: Test procedures*

EN 50289-1-8, *Communication cables — Specifications for test methods — Part 1-8: Electrical test methods — Attenuation*

EN 50289-1-11, *Communication cables — Specifications for test methods — Part 1-11: Electrical test methods — Characteristic impedance, input impedance, return loss*

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, ISO 21806-10 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

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

3) Available at https://www.tiaonline.org/standards/.

— IEC Electropedia: available at http://www.electropedia.org/

3.1
intersymbol interference
disturbance due to the overflowing into the signal element representing a wanted digit of signal elements representing preceding or following digits

[SOURCE: IEC Electropedia 702-08-33]

4 Symbols and abbreviated terms

4.1 Symbols

---	empty table cell or feature undefined
A_{DC_loss}	DC attenuation
F	frequency
ρ_{Fs}	network frame rate
ρ_{BR}	bit rate
v_{RMS}	transferred jitter, calculated using the root-mean-square method
L_{RL}	return loss
t	time
T	temperature
T_A	ambient temperature
T_{Typ}	typical temperature
t_{SLS}	start of measurement time
t_{SLE}	end of measurement time

4.2 Abbreviated terms

AC	alternate current
AFE	analogue frontend
AJ	alignment jitter
BR	bit rate
BW	bandwidth
CEC	coaxial electrical converter
CEport	coaxial electrical port (combination of AFE and CEC)
Cfg	configuration
CTR	coaxial transceiver

DC	direct current
DSO	digital sampling oscilloscope
EMD	equilibrium mode power distribution
ECC	electrical coaxial converter
ECport	electrical coaxial port (combination of AFE and ECC)
IUT	implementation under test
MNC	MOST network controller
MTCM	MOST150 cPHY tester cable model
Mux	multiplexer
PCB	printed circuit board
PG	pattern generator
PHYSTT	physical layer stress test tool
PLL	phase lock loop
RMS	root mean square
SDA	serial data analyser
SLE	signal level end
SLS	signal level start
SMD	surface mount device
SP	specification point
TDR	time-domain reflectometer
TJ	transferred jitter
UI	unit interval
VCM	common mode voltage
VNA	vector network analyser

5 Conventions

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

6 Operating conditions and measurement tools, requested accuracy

6.1 Operating conditions

Temperature range for MOST components: T_A = -40 °C to +95 °C according to ISO 21806-10:2021, 11.3.

Voltage range for MOST components: V_{CCCN} and V_{CCSW}, with an operating range of 3,3 V ± 0,165 V according to ISO 21806-10:2021, Clause 10.

NOTE There are functional requirements for the ECC within an extended voltage supply range according to ISO 21806-10.

6.2 Apparatus — Measurement tools, requested accuracy

Apart from the measurement tools listed in this subclause, depending on the chosen test method and method to generate stimuli for the test, further equipment is necessary (e.g. electrical attenuator, discrete filter module to emulate cable transfer function, etc.). Performance requirements of such equipment depend on the use case.

The following list provides the measurement tools.

6.2.1 Oscilloscope

— digital sampling oscilloscope;

— sampling rate ≥ 10 gigasample/s;

— bandwidth ≥ 1,5 GHz;

— sampling memory ≥ 10 megasample;

— active probe (single-ended, differential).

6.2.2 VNA or TDR (TDR bandwidth ≥ 3,5 GHz).

6.2.3 Ampere meter

— accuracy ≤ 2 µA;

— trigger input (for timing measurements).

6.2.4 Pattern generator for generating MOST150 cPHY stress pattern[7]

— bandwidth 300 Mbit/s;

— trigger output (for timing measurements).

6.2.5 Directional coupler (for duplex set-ups only), the required performance levels are discussed in 10.4.2.

7 Electrical characteristics

7.1 Test according to LVDS

Testing of MOST devices or MOST components shall be performed according to the measurement methods and set-ups specified in TIA/EIA-644-A-2001. Parameters and their respective limits are also derived from TIA/EIA-644-A-2001, with the exception of common mode voltage (V_{CM}) as specified in ISO 21806-10:2021, 12.1.

7.2 Test according to LVTTL

Testing of MOST devices or MOST components shall be performed in accordance with JEDEC No. JESD8C.01.

8 Coaxial characteristics

8.1 High/low detection at SP2

To determine high/low levels, the MOST150 cPHY stress pattern[7] shall be used. At least 500 pulses (5 UI or 6 UI) shall be extracted out of the measured data. Extraction can be done by triggering on pulse width ranges or by software-based selection on a prior acquired waveform. The statistical mean of all amplitude samples lying in the slice between the start of measurement (t_{SLS}) and the end of measurement (t_{SLE}) for all acquired high pulses is defined as high. The statistical mean of all amplitude samples lying in the slice between t_{SLS} and t_{SLE} for all acquired low pulses is defined as low. t_{SLS} and t_{SLE} are defined in this document and shown in Table 1.

Table 1 — Signal level measurement interval

Measurement region	Value	Unit
t_{SLS}	1,00	UI
t_{SLE}	3,00	UI

The measured amplitudes (high and low) are an integral part of further measurements at SP2.

Figure 3 defines the high/low detection at SP2.

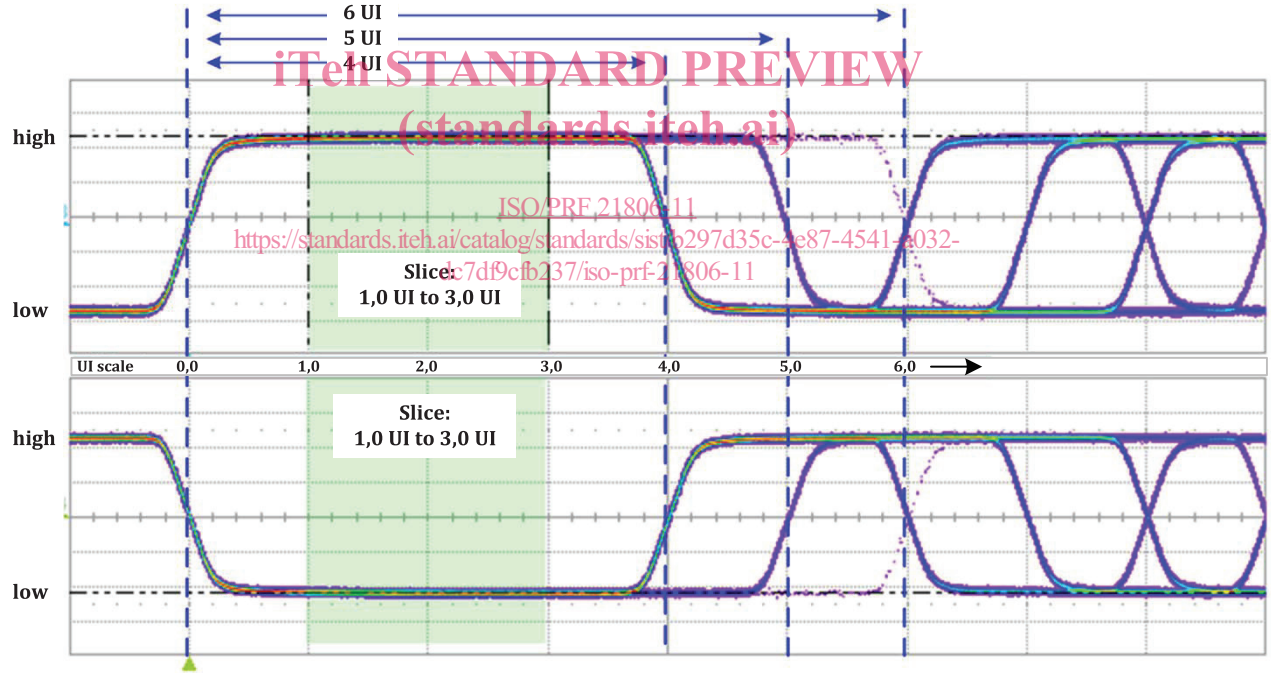


Figure 3 — High/low detection at SP2

8.2 Transition times at SP2

The transition times (rise and fall) are detected as the time of an edge when transitioning through the level range of 20 % and 80 % of the amplitude (high and low, see 8.1). Therefore, high/low detection shall be performed before transition times are determined.

To ensure non-ambiguous measurements the method described below is recommended and applied as a reference procedure in the case of discrepancies.

Formula (1) and Formula (2) define the amplitude threshold levels.

$$h_{20} = [(b_1 - b_0) \times 0,2] + b_0 \quad (1)$$

$$h_{80} = [(b_1 - b_0) \times 0,8] + b_0 \quad (2)$$

where

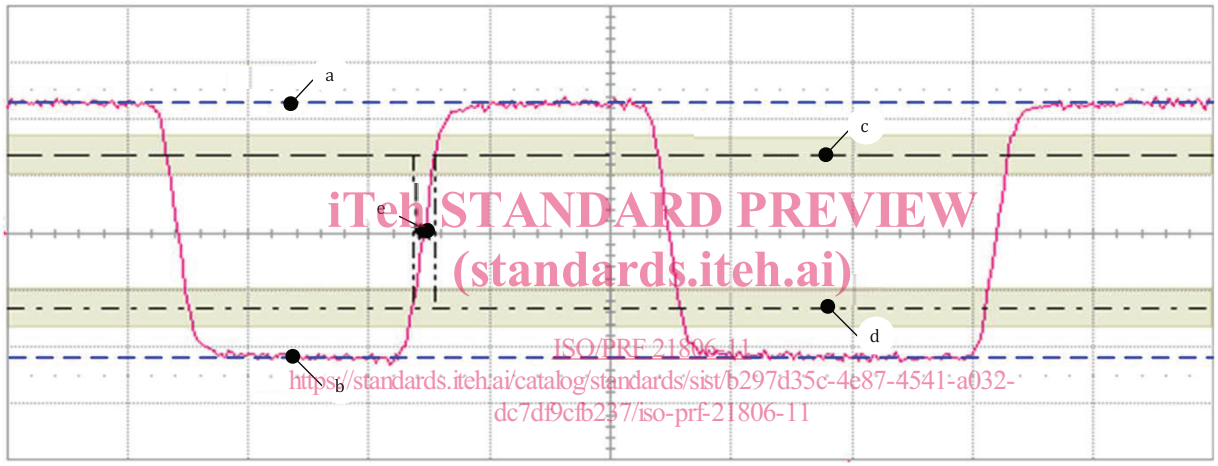
h_{20} is the 20 % threshold of the amplitude;

h_{80} is the 80 % threshold of the amplitude;

b_0 is the signal level when a logic 0 is being transmitted (low);

b_1 is the signal level when a logic 1 is being transmitted (high).

Figure 4 shows an example for the detection of rise-time.



a High.
b Low.
c 80 % threshold.
d 20 % threshold.
e Rise at trigger level.

Figure 4 — Example for detection of rise-time

Measured transition times are smaller than the specified limit in ISO 21806-10:2021, 9.4. MOST150 cPHY stress pattern[7] should be used as data signal.

8.3 Steady state amplitude at SP2

Following the method in 8.1, the steady state amplitude is the difference between high and low.

8.4 Attenuation of coaxial interconnect

8.4.1 General

ISO 21806-10 specifies the attenuation requirements for a coaxial interconnect, formed of one or more cables and the associated couplers and harness connectors. The maximum total length of the

interconnect is 15 m. The attenuation of such an interconnect is frequency dependent. ISO 21806-10 specifies an idealized, frequency dependent attenuation function with the coefficients A_{DC_loss} and F_{skin} in Formula (3)

$$A(F) = -A_{DC\_loss} - \sqrt{\frac{F}{F_{skin}}} \tag{3}$$

where

A is the attenuation;

A_{DC_loss} represents the DC attenuation;

F is the frequency;

F_{skin} represents the skin effect losses.

Attenuation requirements are limited to the frequency range between 1 MHz and 450 MHz and the absolute attenuation is allowed to vary, as long as specific requirements are met (see 8.4.5).

8.4.2 Coefficient values based on attenuation measurements

It is determined that the coefficient values calculated (as described below) based on attenuation measurements for the IUT are within the specified limits:

— $A_{DC\_loss} < 0{,}5$ dB;

— $F_{skin} > 9{,}2 \times 10^6$ Hz/dB^2.

8.4.3 Fitting of corridor

With the evaluated coefficients and the given attenuation function, an idealized attenuation curve can be constructed, which approximates the characteristics of the measured interconnect. ISO 21806-10:2021, 9.4.1 mandates that the difference between data-points of the constructed and the measured attenuation curve (residues) is smaller than ±1 dB.

Attenuation requirements described above apply to the complete temperature range, automotive environmental conditions, and lifetime.

NOTE Although attenuation always reduces signal strength, attenuation in MOST150 cPHY is specified with positive values (e.g. $A_{DC\_loss} < 0{,}5$ dB).

8.4.4 Attenuation test set-up

Figure 5 specifies the attenuation test set-up.