
**Road vehicles — Media Oriented
Systems Transport (MOST) —**

**Part 13:
50-Mbit/s balanced media physical
layer conformance test plan**

iTeh STANDARD PREVIEW
(standards.iteh.ai)
*Véhicules routiers — Système de transport axé sur les médias —
Partie 13: Plan d'essais de conformité de la couche physique en milieu
équilibré à 50-Mbit/s*

ISO 21806-13:2021

<https://standards.iteh.ai/catalog/standards/sist/4f4923ec-49fa-4005-af24-71981a8304f7/iso-21806-13-2021>



iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 21806-13:2021

<https://standards.iteh.ai/catalog/standards/sist/4f4923ec-49fa-4005-af24-71981a8304f7/iso-21806-13-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	2
4.1 Symbols	2
4.2 Abbreviated terms	2
5 Conventions	3
6 Operating conditions and measurement tools, requested accuracy	3
6.1 Operating conditions	3
6.2 Apparatus — Measurement tools, requested accuracy	3
7 Electrical characteristics	4
8 Balanced media characteristics	4
8.1 Threshold for detection of alignment and transferred jitter	4
8.2 RMS signal amplitude	4
8.3 PSD of SP2 output signal	5
8.4 Attenuation of electrical interconnect	7
8.4.1 General	7
8.4.2 Test procedure general	8
8.4.3 Example set-up test procedure	8
8.4.4 Test procedure for data acquisition	8
8.4.5 Impact of attenuation on the data signal	9
8.5 Characteristic impedance of balanced media	10
8.6 RL of PCB interfaces	13
8.7 Receive tolerance	15
8.7.1 General	15
8.7.2 Pattern generator	15
8.7.3 Arbitrary signal generator	16
8.7.4 Cable assembly or its analogue representation	16
8.7.5 Stimulus creation for SP3	16
9 Measurement of phase variation	18
9.1 General	18
9.2 Measuring alignment jitter	20
9.3 Measuring transferred jitter	23
10 Test set-ups	26
10.1 General	26
10.2 Set-ups for SP2 link quality	26
10.3 Set-ups for SP3 link quality	28
10.4 Set-ups for SP3 receive tolerance	30
11 Power-on and power-off	31
11.1 General	31
11.2 Measuring EBC parameters	32
11.2.1 Measuring EBC parameters – Test set-up	32
11.2.2 Measuring EBC parameters – Signal charts	33
11.2.3 Measuring EBC parameters – Test sequences	33
11.3 Measuring BEC parameters	35
11.3.1 Measuring BEC parameters – Test set-up	35
11.3.2 Measuring BEC parameters – Signal chart	37
11.3.3 Measuring BEC parameters – Test sequences	37

12	Detecting bit rate (frequency reference)	40
13	System performance	41
13.1	General	41
13.2	SP3 receiver tolerance	41
13.3	TimingMaster delay tolerance	41
14	Conformance test of 50-Mbit/s balanced media physical layer	44
14.1	Location of interfaces	44
14.2	Control signals	44
14.3	Limited access to specification points	45
14.4	Parameter overview	45
15	Limited physical layer conformance	45
15.1	Overview	45
15.2	Test set-up	46
15.3	Generating test signals for the IUT input section SP3	47
15.4	Analysis of test results	47
15.5	Test flow overview	47
15.6	Measurement of SP3 input signal of the IUT	48
15.7	Measurement of SP2 output signal of the IUT	49
15.8	Measurement of RL	49
15.9	Functional test of wake-up and shutdown	49
16	Direct physical measuring accuracy	50
Annex A (informative)	Limited physical layer conformance for development tools	51
Annex B (normative)	SP3 stress conditions	52
Annex C (informative)	Test fixture	53
Annex D (informative)	Overview on test modes	56
Bibliography	https://standards.iteh.ai/catalog/standards/sist/4f4923ec-496a-4005-af24-71981a8304f7/iso-21806-13-2021	57

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).

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).

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.

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, MOST¹⁾ 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.

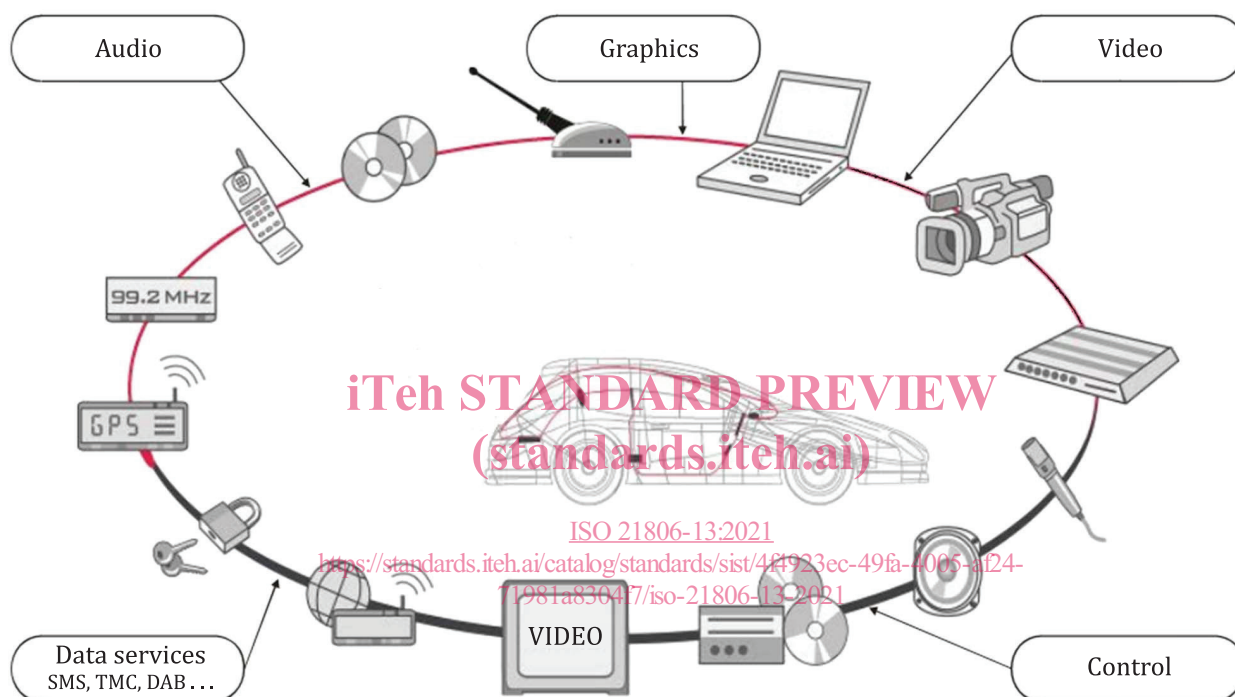


Figure 1 — MOST network example

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.

(standards.iteh.ai)

ISO 21806-13:2021
<https://standards.iteh.ai/catalog/standards/sist/4f4923ec-49fa-4005-af24-71981a8304f7/iso-21806-13-2021>

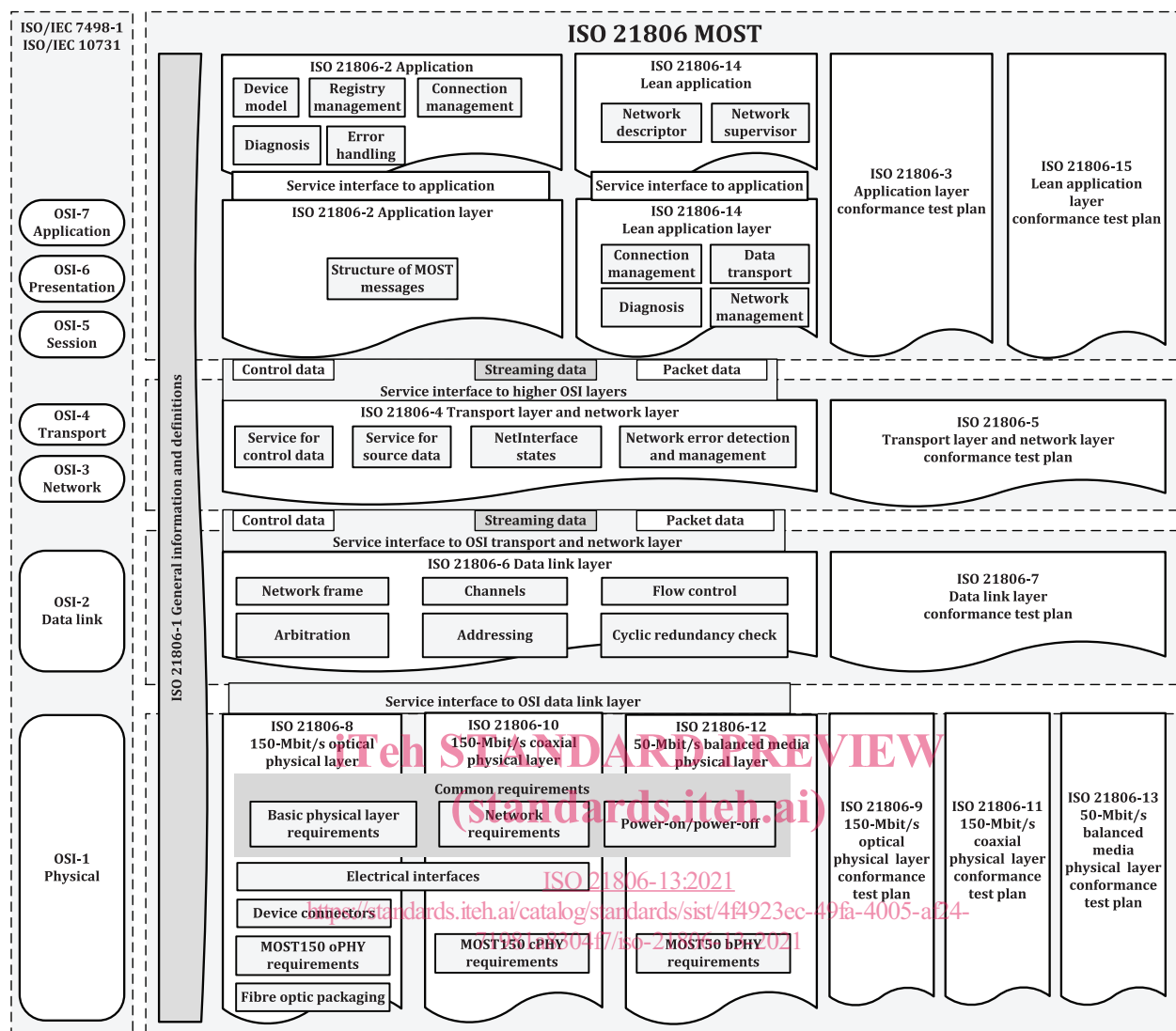


Figure 2 — The ISO 21806 series reference according to the OSI model

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from the patent database available at www.iso.org/patents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. ISO shall not be held responsible for identifying any or all such patent rights.

Road vehicles — Media Oriented Systems Transport (MOST) —

Part 13: 50-Mbit/s balanced media physical layer conformance test plan

1 Scope

This document specifies the conformance test plan for the 50-Mbit/s balanced media physical layer for MOST (MOST50 bPHY), 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 21806-12.

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 21806-13:2021
<https://standards.iteh.ai/catalog/standards/sist/44925ec-491a-4005-af24-71981a8304f7/iso-21806-13-2021>

ISO 21806-12, *Road vehicles — Media Oriented Systems Transport (MOST) — Part 12: 50-Mbit/s balanced media physical layer*

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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21806-1, ISO 21806-12 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/>

2) Available at <https://www.jedec.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
ϵ_r	relative permittivity
F	frequency
ρ_{BR}	bit rate
ρ_{Fs}	network frame rate
t	time
T	temperature
T_A	ambient temperature
T_{Typ}	typical temperature

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 21806-13:2021](https://standards.iteh.ai/catalog/standards/sist/4f4923ec-49fa-4005-af24-71981a8304f7/iso-21806-13-2021)

4.2 Abbreviated terms

AFE	analogue frontend
AJ	alignment jitter
BALUN	balanced-unbalanced
BEC	balanced media to electrical converter
BR	bitrate
BTR	balanced media transceiver
BW	bandwidth
Cfg	configuration
CH	channel
DC	direct current
DSO	digital sampling oscilloscope
EBC	electrical to balanced media converter
FFT	fast Fourier transformation
IUT	implementation under test

MNC	MOST network controller
PG	pattern generator
PLL	phase lock loop
PSD	power spectral density
RBW	resolution bandwidth
RMS	root mean square
SP	specification point
TDR	time-domain reflectometer
TJ	transferred jitter
UI	unit interval
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

ISO 21806-13:2021

<https://standards.iteh.ai/catalog/standards/sist/4f4923ec-49fa-4005-af24-71981af39477/iso-21806-13-2021>

Temperature range for MOST components: $T_A = -40\text{ °C}$ to $+105\text{ °C}$ according to ISO 21806-12:2021, 11.3.

Voltage range for MOST components: V_{CCCN} and V_{CCSW} , with an operating range of $3,3\text{ V} \pm 0,165\text{ V}$ according to ISO 21806-12:2021, Clause 10.

NOTE There are functional requirements for the EBC within an extended voltage supply range according to ISO 21806-12.

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). 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 ≥ 5 gigasample/s;
- bandwidth ≥ 1 GHz;
- sampling memory ≥ 10 megasample;
- active probe (single-ended, differential).

6.2.2 VNA or TDR (TDR bandwidth $\geq 3,5$ GHz).

6.2.3 Ampere meter

- accuracy $\leq 2 \mu\text{A}$;
- trigger input (for timing measurements).

6.2.4 Pattern generator for generating MOST50 bPHY stress pattern

- bandwidth 100 Mbit/s;
- trigger output (for timing measurements).

7 Electrical characteristics

LVTTL testing of MOST devices or MOST components shall be performed according to JEDEC No. JESD8C.01.

8 Balanced media characteristics

8.1 Threshold for detection of alignment and transferred jitter

All jitter measurements are based on detection of edges in the data stream. The threshold for detecting edges is set to 0 V of the differential signal (zero-crossing). DC offset in the measurements shall be minimized as it may indirectly compromise timing parameter results, see [10.2](#) and [10.3](#).

8.2 RMS signal amplitude

In ISO 21806-12:2021, 9.2, output signal power boundaries for SP2 and minimum input signal power at SP3 are defined as RMS voltage.

A waveform, signal voltage over time, is acquired on an oscilloscope. The RMS voltage V_{RMS} is calculated according to [Formula \(1\)](#).

$$V_{\text{RMS}} = \sqrt{\frac{1}{N} \sum_{i=1}^N V(i)^2} \quad (1)$$

where

- V_{RMS} is the root-mean-square signal voltage;
- N is the number of time steps with equidistant time interval;
- V is the voltage amplitude at a specific time step;
- i is the index of summation.

RMS signal voltage amplitude gives a representation of the average signal power P_{av} as specified in [Formula \(2\)](#).

$$P_{\text{av}} = \frac{V_{\text{RMS}}^2}{R} \quad (2)$$

where

- P_{av} is the average signal power in [W];
- V_{RMS} is the root-mean-square signal voltage.
- R resistance of 100 Ω .

In order to get to a representative average value, it requires a long-term observation. Depending on the chosen SP2 and applied channel losses, intersymbol interference impact affects the signal to be measured. It may lead to locally distributed RMS minima and maxima when choosing only short snippets of the signal. The acquired waveform shall have a minimum length of 125 μs (125 μs equals six frames with a frame rate of 48 kHz).

DC offset in the measurements shall be minimized as it may indirectly compromise RMS signal voltage amplitude results, see [10.2](#) and [10.3](#).

8.3 PSD of SP2 output signal

PSD as specified in ISO 21806-12:2021, 9.2 is used as a link quality criterion at SP2. The main purpose is to limit pulse shape variations and inherently limit the transmitted signal bandwidth.

Several measurement options are available to perform spectral signal analysis. A method using time-domain data acquisition followed by FFT post-processing is given for reference. Other measurement methods are permitted. In the case of discrepancies, the reference method shall be used.

PSD shall be measured with an RMS detector and using an effective RBW of 500 kHz. Besides directly measuring PSD with 500 kHz resolution bandwidth, this can be achieved by using lower RBW setting and averaging spectral results in the amount n of overlapping groups of the lower RBW bands to produce the effect of 500 kHz RBW sliding window (linear scale), (i.e. measurement with RBW 10 kHz, averaged in overlapping groups of fifty bands, therefore $n = 50$). To achieve statistical representation, the spectral density results of multiple trace segments are averaged to form the final result. The number of trace segments contributing to the averaged spectrum equals the sweep time.

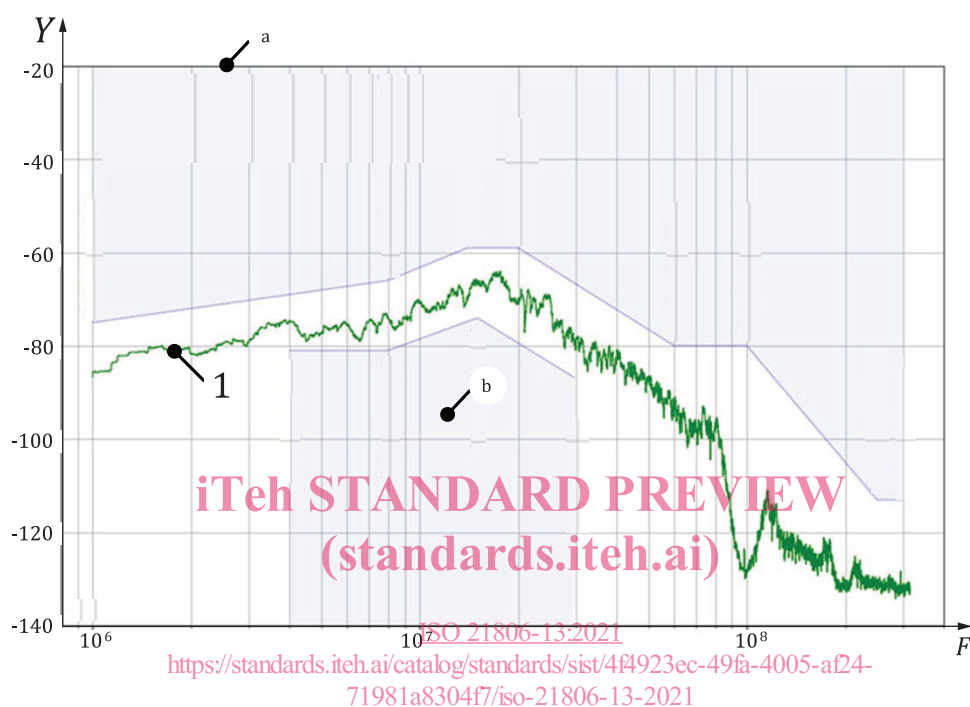
The following is an example procedure for measuring PSD.

- The IUT transmitter sends multiple MOST50 bPHY PSD patterns.
- Differential signal at terminated SP2 is measured with a differential probe. Other methods to measure a single ended representation of the differential signal are acceptable (e.g. use BALUN or use test fixture with matched length 50 Ω coaxial cables, measured with 2 channels and mathematical combination).
- An oscilloscope acquires the SP2 signal. To reduce noise in the measurement channel, it is recommended to use an averaging technique for time domain data acquisition. Selecting oscilloscope sampling rate and acquisition length leads to the inherent RBW for the acquisition, which is the reciprocal of the acquired duration time. The appropriate duration can be achieved by adjusting horizontal oscilloscope settings accordingly or by acquiring longer traces and slice the trace into appropriate trace segments for the further processing.
- For further post-processing, FFT algorithm can be applied on the oscilloscope or via processing per external script on a PC. In frequency domain, PSD is then formed as a moving average (linear scale) of n consecutive samples of the inherent RBW bands.
- To achieve statistical representation, the spectral density results of multiple trace segments are averaged to form the final result. The number of trace segments contributing to the averaged spectrum equals the sweep time.
- Described procedure provides spectral density for consecutive 500 kHz bands in the relevant frequency range and can be directly compared with the limit lines.

Configuration for a measurement example:

- acquisition length of 1 megasample with sampling rate 10 GHz results in a duration of 100 μ s or inherent RBW of 10 kHz,
- this results in an overlap of $n = 50$ inherent RBW bands to form effective RBW of 500 kHz,
- 100 iterations lead to a sweep time of 10 ms.

Figure 3 shows the example measurement for PSD.



Key

Y PSD [dBm/Hz]

F frequency [Hz]

1 example PSD

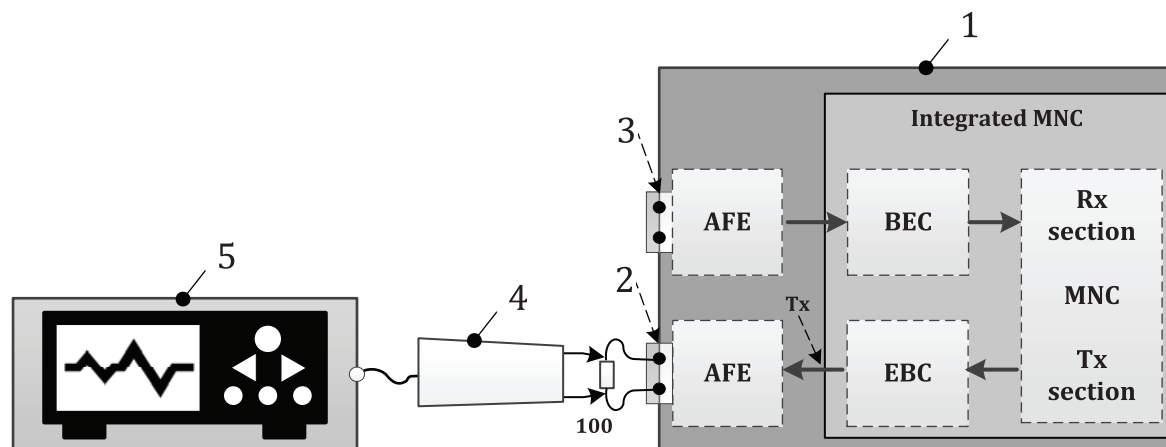
a This is the upper limit of the PSD mask.

b This is the lower limit of the PSD mask.

Figure 3 — Example measurement for PSD

PSD analysis may also be performed with a spectral analyser. The number of data points can also be lower and not produce gapless data in the specified frequency range. Settings are applied that fit the above described processing.

Figure 4 shows the test set-up for measuring PSD with an oscilloscope.



Key

- 1 MOST device
- 2 SP2
- 3 SP3
- 4 differential probe
- 5 oscilloscope

Figure 4 — Test set-up for measuring PSD with an oscilloscope

8.4 Attenuation of electrical interconnect

8.4.1 General

ISO 21806-13:2021

<https://standards.iteh.ai/catalog/standards/sist/4f4923ec-49fa-4005-af24-7011a1155108/iso-21806-13-2021>

MOST50 bPHY limits the maximum attenuation for an electrical interconnect, formed of one or more cable pieces 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 21806-12:2021, 9.3 specifies the maximum tolerable attenuation with a limit line in the frequency range of 1 MHz to 66 MHz.

Figure 5 shows the test set-up for measuring attenuation of an electrical interconnect.