MOST

Media **O**riented **S**ystems **T**ransport

Multimedia and Control
Networking Technology

MOST150 cPHY Tester Cable Model Requirements
Rev. 1.1
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Contents

Document References

All documents, which are referenced by this MOST document are listed here with the actual revision this document is referring to.

Number	Document	Revision
[1]	MOST Physical Layer Basic Specification	1.0
[2]	MOST150 cPhy Automotive Physical Layer Sub-Specification	1.1
[3]	MOST150 cPhy Compliance Verification Procedure	1.0

Document History

Change Ref.	Section	Changes
V1.1_000	-	Initial published revision.

Glossary

Term	Definition
API	Application Programming Interface
ATE	Automated Test Equipment
DUT	Device Under Test
MNC	MOST Network Controller
MOST	Media Oriented System Transport
OEM	Original Equipment Manufacturer
PhLSTT	Physical Layer Stress Test Tool
TO	Test Operator
MTCM	MOST150 Tester Cable Model
AWG	Arbitrary Waveform Generator
DC	Directional Coupler

1 Introduction

For conformance testing of MOST150 coax based devices the MOST150 cPhy Compliance Verification Procedure [3] defines a set of setups for measuring specific parameters as defined in MOST150 cPhy Automotive Physical Layer Sub-Specification [2]. Parts of these setups are:

- The MOST150 component to be tested, named “Device Under Test” (DUT)” for the scope of this document,
- A set of state-of-the-art - electrical test equipment (such as: oscilloscope, vector network analyzer, directional coupler, multi-meter, programmable power supply, temp. chamber, etc.) as defined in the corresponding test and
- A custom tool, named “MOST 150 Tester Cable Model (MTCM)” which represents the tool described within this document.

The MTCM is used in Dual Simplex and in Full Duplex.

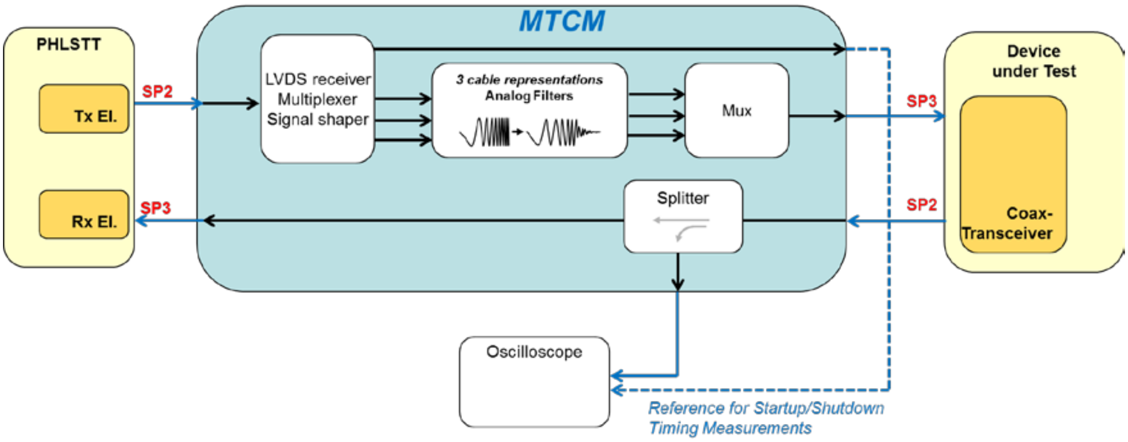

Figure 1-1: Generalized Test Setup for Dual Simplex Applications

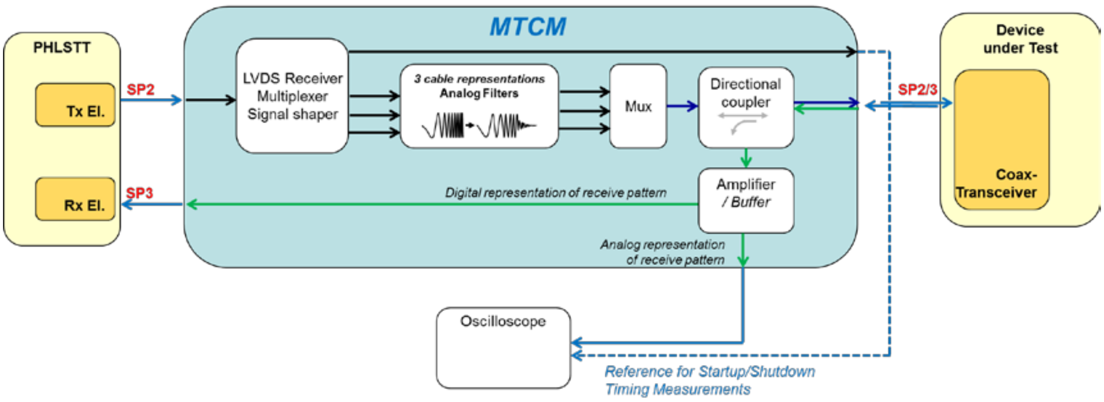

Figure 1-2: Generalized Test Setup for Duplex Applications

The main purpose of the MTCM is to emulate a transfer function as defined in [2] (which represents a coax interconnect) on a MOST150 stress pattern, created by the PhLSTT and feed it to the DUT. In combination with PhLSTT ability to compare incoming and outgoing pattern, this can be used to check Data consistency with A DUT under Stress conditions. At time of creation of this document no state-of-the-art tools are known to exist, that incorporate all the features required for the tool described herein. E.g., a state-of-the-art signal generator cannot be directly synchronized to the MOST network of the DUT and cannot compare the incoming data stream to reference one.

The MTCM's primary usage is the limited physical layer compliance testing process at an accredited MOST Compliance Test House, but also for pre-testing or as a development support tool at an OEM.

The tool shall be realized as a standalone custom-made tool.

2 Description

Fig. 2.1 depicts a basic functional block diagram of the MTCM.

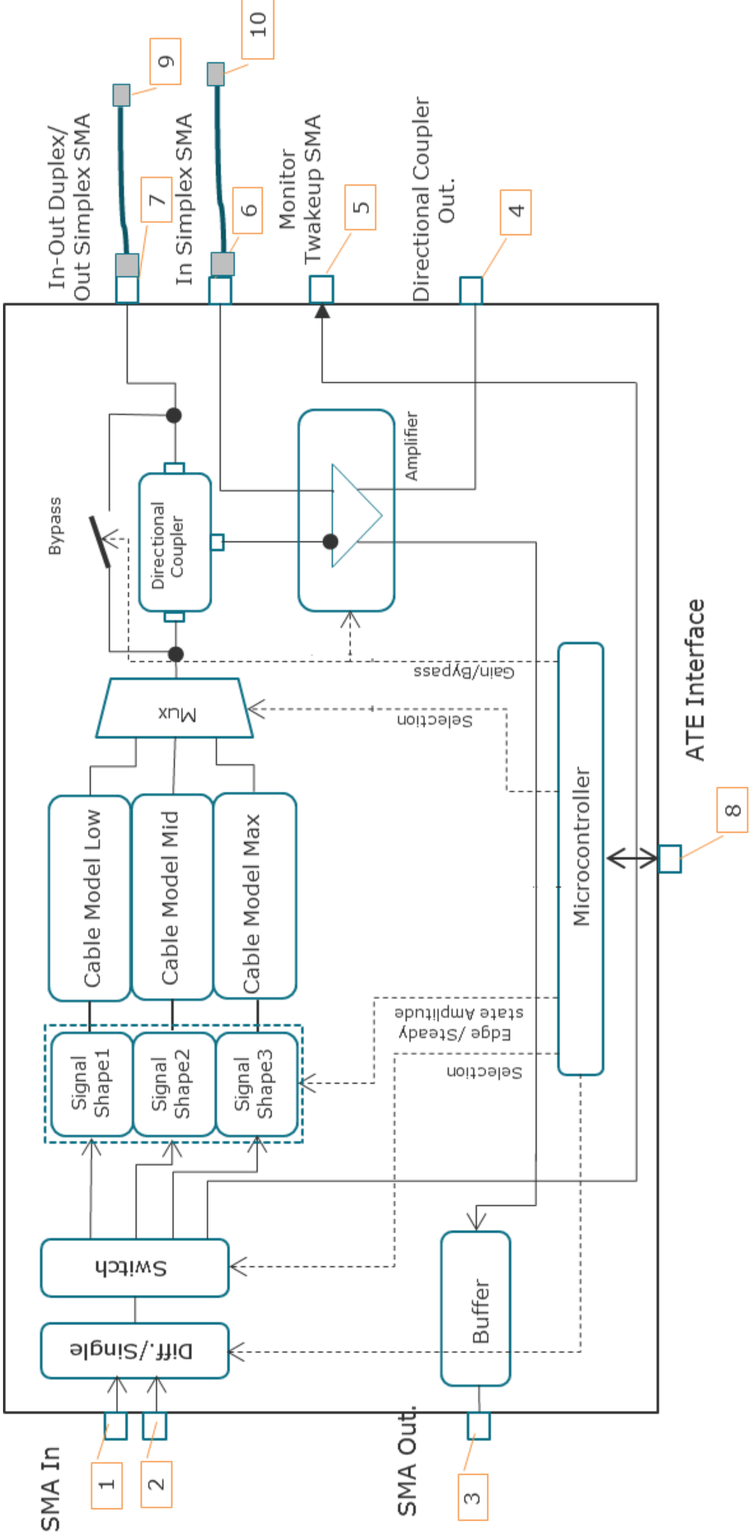

Figure 2-1: MTCM Basic Functional Block Diagram

Main functionality of the MTCM is the emulation of various cable characteristics.
This is the functionally of the different operation:

- Implement Filters, representing 3 three Cable Characteristics, Low, Mid, Max attenuation.
- Steady State Amplitude (V_{ss}) on the input of the Filters shall be adjustable
- Rise/Fall time shall be adjustable.
- Testing of Simplex or Duplex DUT.
- Directional Coupler shall be implemented (to close communication loop and allow measurement of signal integrity).
- Provide reference signal for measurement of r t_{Wakeup}, $t_{schutdown.}$.
- Provide bypass for the Directional Coupler for Simplex application (and for Startup/Shutdown test, in case the directional coupler does not cover the whole required bandwidth range).
- Signal Input in MTCM shall be selectable, either as Differential or Single ended.
- Selectable Gain of the Amplifier in the out-couple path of the Directional Coupler Output.

The operation of the MTCM is supervised and controlled by a microcontroller, which is also providing interface to the Test Operator (TO) or the Automated Test Equipment (ATE) by means of an industry established communication interface.

2.1 Cable Model Overview

Figure 2-2 depicts an overview of the Cable Characteristic. The tool must be able to emulate the 3 Cable models as described in Table 2-1. (for more details see Specification in [2])

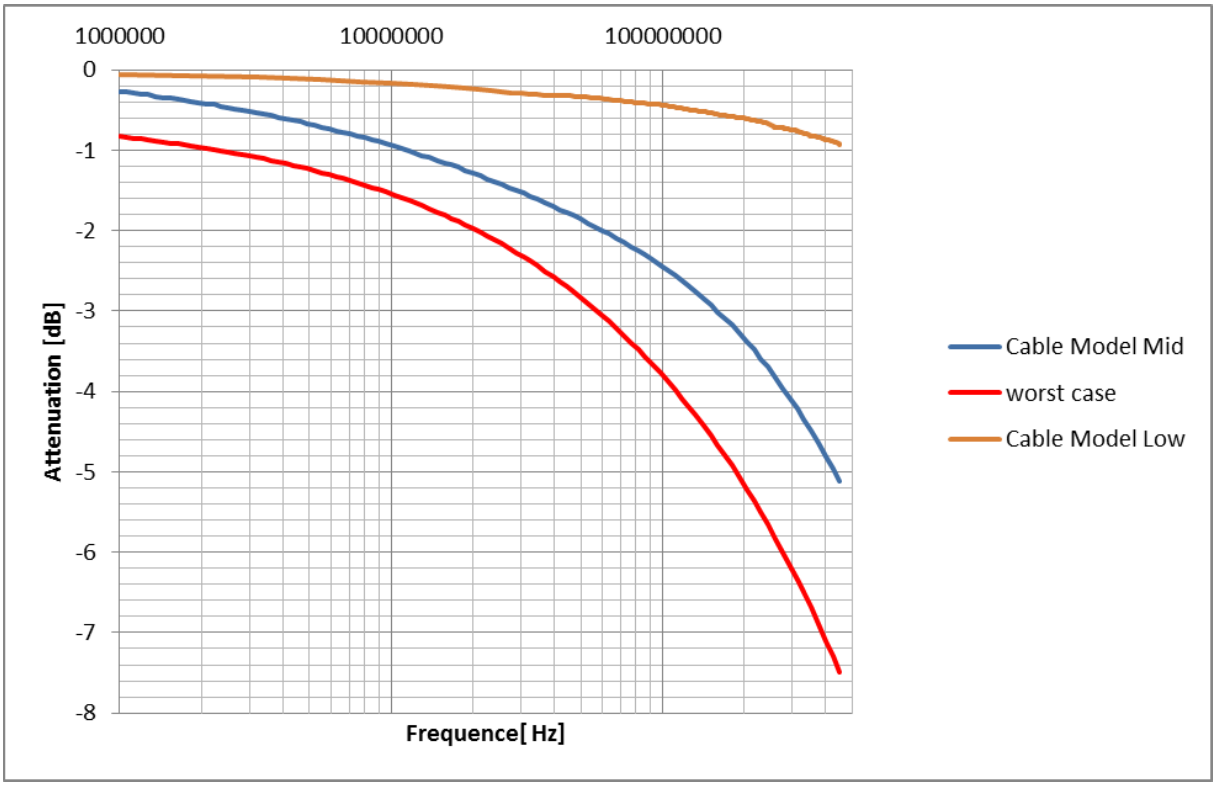

Figure 2-2: Cable Characteristic Overview

Cable model	**DC Loss [dB]**	**FSkin** [Hz/dB^2]	**Attenuation Conformance Corridor [dB]**	**Input V_{ss} [mV] into Cable model**
Cable Model Low	low loss test cable	low loss test cable	±1	420 (- 30)
Cable Model Mid	0.1 (+0.1; - 0)	$15x10^6$ ($\pm 1x10^6$)	±1	360 (±15)
Cable Model High	0.5 (+0; - 0.1)	$9.2x10^6$ ($+1x10^6$; -0)	±1	300 (+ 30)

Table 2-1: Cable Characteristics

Note:
Coefficients for DC_{Loss} and F_{skin} in Table 2-1 represent freely chosen cables, while V_{ss} is freely chosen amplitude for an SP2-output. Deviations from target values for the coefficients (within specified parameter range for coefficients), might be adapted in a newer version of this document. Attenuation conformance must be met.

Table 2-1 includes the properties of The MTCM and the low loss test cable (1.5 m) to the DUT.

Properties of low loss test cable:

Length: 1.5 m
Temperature range: -50°C to 105°C
The characteristics of the low loss test cable must be documented in detail in the MTCM product description to enable replacement.

2.2 Feature List

2.2.1 Mandatory Features

2.2.1.1 Functional Requirements

- Possibility to Select Input as differential or single Ended.

  Depending on the signal source (PhLSTT, AWG or SP2 of real MOST node) the input shall be selectable:

  - Differential (Default)
  - Single ended.

- Possibility to test Simplex and Duplex DUT

The corresponding mode shall be set by the tool operator or by the setup depending on the type of the DUT being tested. The function implies that the MTCM is able to switch from Simplex (unidirectional) Link to Duplex (bidirectional) Link.

- Possibility to emulate cable model

  - Cable model (Low) attenuation short cable,
  - Cable model (Mid) attenuation cable.
  - Cable model (Max) attenuation Worst Case Cable.

- Equivalent signal shaper output variation of steady state amplitude

  - Adjust the equivalent Steady State Amplitude range of 300mV to 420mV.
  - Individual Steady State Amplitude requirement for each cable model (see Table 2-1)
  - The variation shall be realized with a step size of 10 mV.

- Rise/Fall time variation target values

  - Set the Min Rise/Fall time Value of 700ps (+ 100ps) (= Default)
  - Set the Max Rise/Fall time Value of 1400ps (-200ps)

  ATE allows selection of these 3 value only, the variance shall be within 50 ps for all MTCMs.

- Reference signal for measurement of T_{wakeup} and $T_{shutdown}$

  An unfiltered version of the PhLSTT input signal is delivered to an output of the MTTM. This signal can be used to trigger Startup/ Shutdown measurements

  - Adjustable Gain to compensate coupling losses of the directional coupler

    - Set the Gain to 10 dB (= Default)
    - Set the Gain to 7 dB

  - Possibility to bypass the directional coupler

    - For Simplex, signals shall fully bypass the directional coupler

- For some test scenarios in DUPLEX Startup/Shutdown, the Directional Coupler should be bypassed.

- ATE interface

  The ATE interface shall have open protocol (respectively open driver API) allowing integration of the tool in custom automated setups. Example GUI is beneficial, but not mandatory.

  After the test the following information shall be available through the ATE interface:

  - Status Input :
    - Differential
    - Single
  - Status Interconnect :
    - Simplex
    - Duplex
  - Status Signal path Cable attenuation
    - Low attenuation Cable 1
    - Mid attenuation Cable 2
    - Max attenuation Cable 3
  - Status Steady State Amplitude
    - Low amplitude
    - High amplitude
  - Rise/Fall time
    - Fast Edge
    - Slow Edge
  - Gain Amplifier
    - 7 dB
    - 10 dB
  - Bypass
    - Inactive
    - Active
  - Variance of values for all MTMs shall be considered.

2.2.1.2 Physical Requirements

- Operating conditions

The tool should be designed for laboratory use, therefore limited temperature and humidity range are required:
  - o Operating Temperature: 20°C to 30 °C
  - o Operating Relative Humidity: 15% to 80%

Calibration is to be done prior to test session.

SP3 calibration:
The calibration should be done by connecting a PhLSTT output to MTCM input {1} and to MTCM input {2} or a standard AWG output to MTCM input {1} and/or {2}.

The MTCM output level (SP3) should be checked on the MTCM Output {9}, by selecting the Cable Model Low, Mid, Max and steady state amplitude (min/max), transition time (min/max)
The steady state amplitude defined in 2.2.1.1 is adjusted as real compensation due to the Insertion Loss in the transmit path of the board and the test cable to the device (MTCM {9}).

The compensation factors required to achieve proper SP3 performance at MTCM {9} shall be stored in MTCM.

The pulse shape (fast and slow edge) should be checked by selecting with the parameter in the API. Two values are possible Low and Max.

Directional Coupler Output calibration:
Coupling Loss from Out MTCM {4} due to the Directional Coupler is partly compensated internally with an analog Amplifier with fixed gain (about 10dB). Further compensation may be needed to fully recover the DUT's output signal amplitude. This is done per rescaling on the oscilloscope (multiplication with correction factor). The correction factor as well as setup-description to validate the parameter is part of the MTCM's manual.

Coupling Loss from Out MTCM {4} due to the Directional Coupler is compensated internally via the analog Amplifier gain 10dB. In case of Duplex DUT a reference signal is applied via the test cable to the connector In/Out duplex MTCM {9} and measured on the directional coupler output MTCM {4}.
In case of Simplex DUT a reference signal is applied via the test cable to the connector input Simplex MTCM {10} and measured on the directional coupler output MTCM {4}.

In case of correction due to the High Level of the Amplifier Gain a correction of -3dB is possible.

- Appearance

The tool can be implemented as:
  - o A standalone custom-made tool

- Interfaces
  - o TO / ATE interface MTCM {8}

MTCM should have a means (interface) to communicate to Test Operator or Automated Test Equipment though a low complexity bidirectional interface RS232 (for sending commands and read back the result).

- Electrical signal Input/output Duplex MTCM {7} (direction MTCM → DUT)

  SMA 3.5mm output – 50 Ω, RL ≥ 30 dB, suitable for direct interface to the DUT. Coaxial connectors must have a return loss as specified in Table 6-4 [2].

- Electrical signal Input Simplex {6} (direction DUT → MTCM)

  SMA 3.5mm output – 50 Ω, RL ≥ 30 dB, suitable for direct interface to the DUT. Coaxial connectors must have a return loss as specified in Table 6-4 [2].

- Monitor t_{Wakeup} (Electrical Trigger output) MTCM {5}

  SMA 3.5mm output – 50 Ω, RL ≥ 30 dB, Electrical signal, which pulses event and monitored the Signal activity.

- Electrical input (Direction SP3 Stimuli, PhLSTT → MTTM {1}, {2}

  SMA 3.5mm Input female AC coupled differential input – 100 Ω terminated and Single Ended 50 Ohm, RL ≥ 30 dB, suitable for direct interface to the PhLSTT or AWG.

- Electrical Output (Direction MTCM SP3 Stimuli → PhLSTT) MTCM {3}

  SMA 3.5mm Input female – 50 Ω, RL ≥ 30 dB, suitable for direct interface to the PhLSTT.

- Directional Coupler
  - Insertion Loss 2 dB
  - Coupling Loss 10 to 20 dB
  - Return Loss as low as possible
  - Directivity = 30dB

  Value for the Directional Coupler as orientation.

2.2.1.3 Signal Requirements

- Input signals

  The MTCM input should be able to successfully implement the cable model.

  - Electrical signal compliant with all specifications for SP3 according to [2]

- Output signals

  The MTCM should produce at its output:

  - Electrical signal compliant with all specifications for SP2 (or better) according to [2]

3 Appendix A: List of Figures

Notes:

