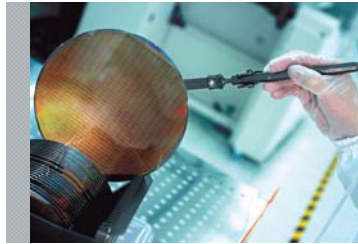# Tektronix MHL 2.1 Solution

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Agenda

- Presentation – 1 hour

  - Technology Overview

  - Tektronix MHL Solution

  - Tektronix Solution Value Proposition

  - Summary

Tektronix MHL Solution:
Complete Solution for CTS 2.1 needs

- Tektronix MHL Physical Layer Tx test setups are easy to use and automated
  - Simple test setups common for most tests
  - Vterm provided by scope itself
  - MHL Fixtures available from our Fixture partner Wilder Technologies
- Tektronix MHL Physical Layer Rx test setups are easy to use.
  - TRUE MHL SIGNAL Generation as there is no need for external combiners/Filters
  - No need for external ISI boards as we leverage our AWG direct Synthesis Capability with common setups for Sink and Dongle testing
- Tektronix introduces an innovative combined solution for Physical Layer Testing and Protocol Testing:
  - Providing seamless link between PHY and Link layer testing
  - An economical MHL test solution
    - ONE BOX solution for PHY and Protocol testing
  - Easy access to legacy P/A/V data format
- Tektronix also offers complete MHL solution with:
  - DSA8200 or Equivalent Sampling scope with 80E03/04 and I-connect Software for MHL Cable testing (performed manually using MOIs)
  - Low Bandwidth Oscilloscopes
  - Keithley Source Meter (Now part of Tektronix)
  - Programmable Power Supply and
  - Digital Millimeter

Tektronix

MHL Technology Update

Tektronix

MHL – An Introduction

- Why MHL interface?
  - Connector agnostic….

- Application

Source: MHL.org

MHL Introduction

Source: MHL.org

- Mobile HD Link (MHL) technology is a low pin count HD audio and video interface that connects portable electronics devices such as mobile phones, digital cameras, camcorders and portable media players, to HDTVs.

- The technology allows mobile devices to output digital 1080 Full HD resolution via the existing mobile connector without the real estate and cost of another dedicated video connector.

- Together with an MHL-to-HDMI bridge, the MHL-enabled mobile device becomes a fully compliant HDMI source and can connect to the television's standard HDMI input port.

MHL Introduction

- MHL Consortium was formed in Sept 2009 with the following founding members:
  - NOKIA
  - SAMSUNG
  - Silicon Image
  - Sony
  - Toshiba

- The Specification 1.1 version was announced in Q12011 , Specification 1.2 in Dec 2011, Specification 2.0 in Feb 2012 and Specification 2.1 NOW.

The Consortium released CTS 1.1 version in June 2011, CTS 1.2 in Jan 2012, CTS 2.0 in Sept 2012 and CTS 2.1 is just announced.

COMPLETE TEKTRONIX SOLUTION APPROVED in CTS1.1 , CTS 1.2 , CTS 2.0 and CTS 2.1 solution

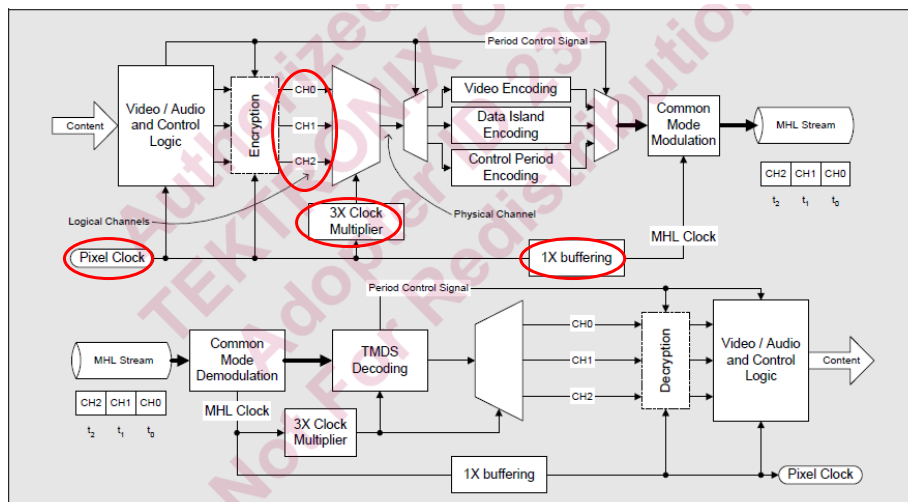- Tektronix is a **Contributor adopter** and actively involved in defining the CTS 2.1.
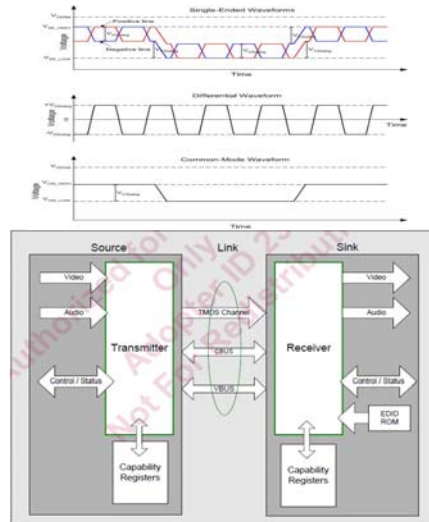
Source: MHL 1.2 specification document

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MHL Encoder/Decoder Overview – 24 bit mode

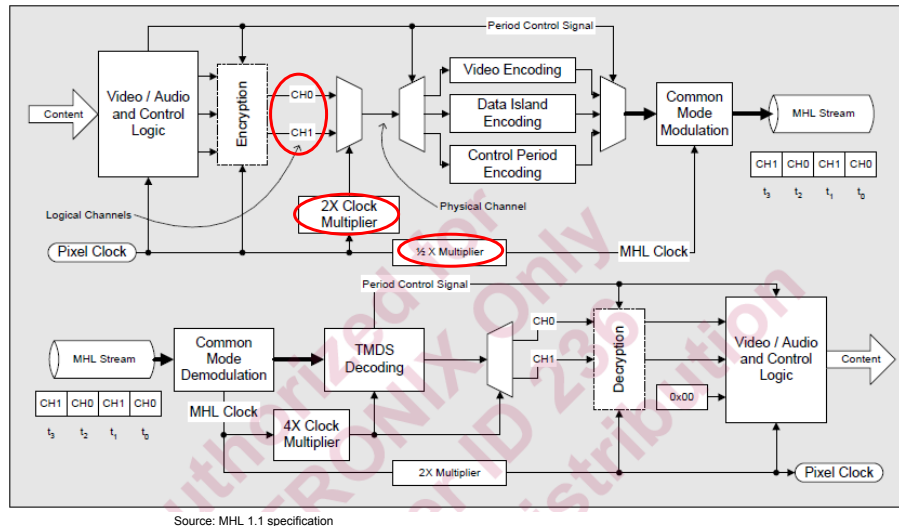Source: MHL 1.1 specification

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MHL Encoder/Decoder Overview – PackedPixel mode

Source: MHL 1.1 specification

MHL – 2.1

- MHL Consortium and Tektronix has worked together on the 2.1version MHL specifications.
  - Data rate does not change from 3Gbps.
  - Packed Pixel implementation does not change
  - 3D capability does not change
  - New test procedure introduced for Source Clock Jitter and Data Eye Diagram
    - These tests will now be Single ended tests and will have worst case skew filters in the path of the signals before we analyze.
  - Sink Jitter Tolerance now needs to be tested with and without cable emulator
  - New Cable Electrical introduced
    - Minimum CLK Swing Test
    - Eye Diagram Test
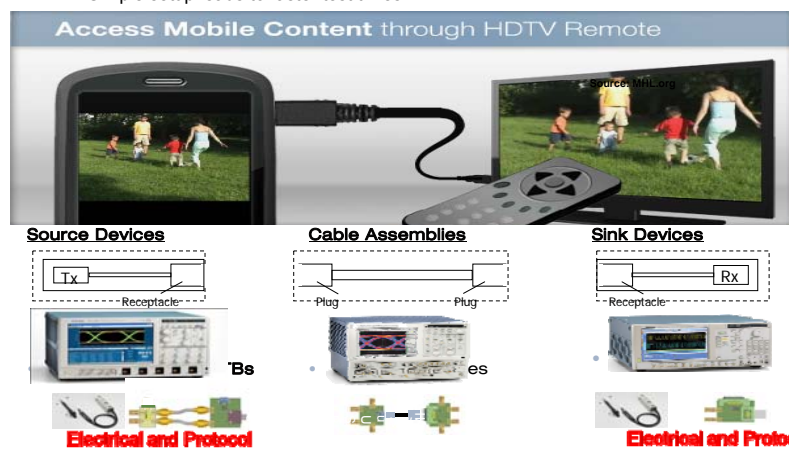 - Support for Direct Attach Source and Sink devices

Tektronix MHL Solution

Tektronix

MHL Ecosystem and Tektronix Solution

- Tektronix Offers Complete MHL 2.1 Solution.
- Industry's first 1 BOX solution for Physical and Protocol testing.
  - Seamless transition between Protocol and Phy layer
  - Simple setup leads to faster test times

Access Mobile Content through HDTV Remote

Source: MHL.org

Source Devices

Tx
Receptacle

Bs

Electrical and Protocol

Cable Assemblies

Plug   Plug

es

Sink Devices

Rx
Receptacle

Electrical and Protocol

Tektronix

Tektronix MHL Transmitter Solution

Tektronix

Tektronix MHL 2.1 Solution

- Tektronix has worked closely with MHL consortium to define the next CTS version 2.1 and MHL 2.1 TX SW.

CTS 1.x   CTS 2.0   CTS 2.1
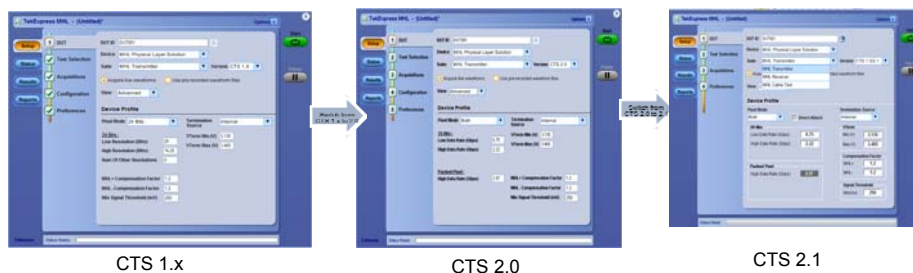
- MHL Protocol Analyzer SW is MHL 2.1 version available
- MHL 2.1 Sink Patterns for Direct Attach Device testing is available
- MHL 2.1 Cable Electrical testing patterns are available
- **No changes in test gear for MHL 2.1 only new feature support.**
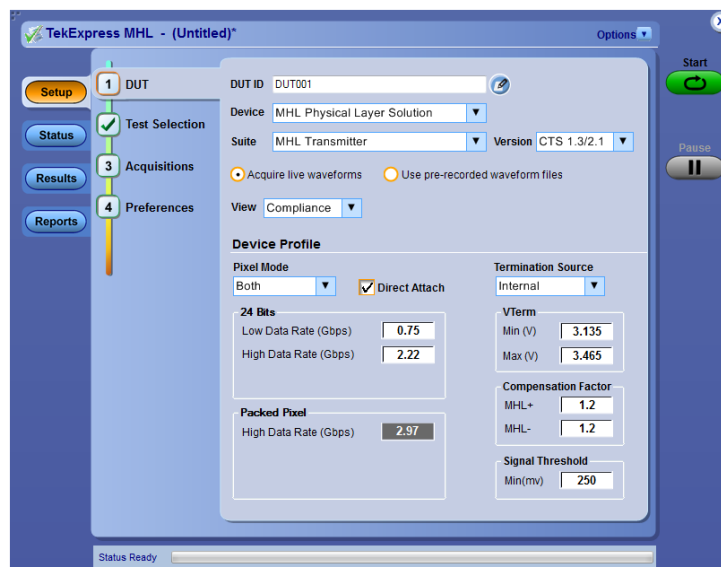
Tektronix

Tektronix MHL 2.1 Solution

- DPO/DSA/MSO 70804B/C Series Real Time Oscilloscope with BW ⩾ 8GHz

- MHL Compliance Software – Option MHD

- Innovative MHL Protocol Software from Third party – TEK-PGY-MHL-PA-SW

- Probes – P7313SMA (two) and P7240 (one)

- MHL Test Fixture including Direct Attach Fixture – Available from Tektronix.

- AWG7122C with Opt 01,02 or 06 and 08 for the innovative direct Synthesis based MHL Rx/Dongle testing.

- C-Bus Sink and Source board is needed and is available from Tektronix

- DSA8200 or Equivalent with 80E03/80E04 and I-Connect Software for MHL cable testing (performed manually using MOIs)

Please contact local Tektronix account managers for further details.

Tektronix

Tektronix MHL 2.1 Tx Solution
with Direct Attach test support

Tektronix
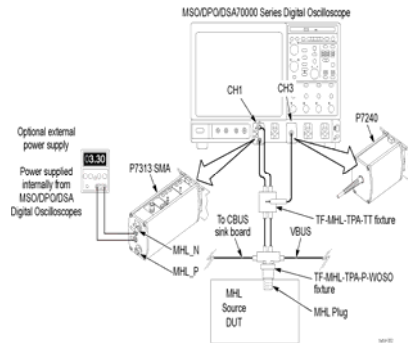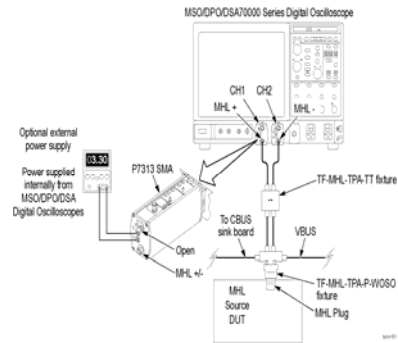
Tektronix MHL Tx Setup

**MHL Differential and CM Test Setup
6 tests**
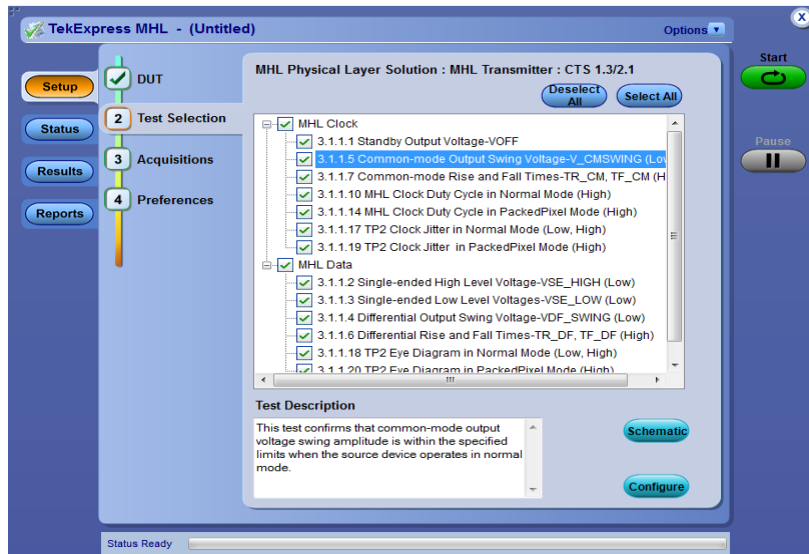
**Single Ended and Intra Pair Skew Test Setup
6Tests**

Also same setup is used for MHL Protocol Testing

** C-Bus Sink and Source Board is needed for hand shaking and is available from Tektronix

---

MHL 2.1 Compliance Software for Automated Tx Tests: Option MHD

MHL 2.0 Tests –
Detailed Information on MHL 2.0 TX Tests

Physical Layer Tests
MHL Transmitter Tests

- 3.1.1.1 Standby Output Voltage V_{OFF}
- 3.1.1.2 Single-ended High-level Voltage V_{SE_HIGH}
- 3.1.1.3 Single-ended Low-level Voltage V_{SE_LOW}
- 3.1.1.4 Differential Output Swing Voltage $V_{DFSWING}$
- 3.1.1.5 Common Mode Output Swing Voltage $V_{CMSWING}$
- 3.1.1.6 Differential Rise and Fall Times T_{R_DF}, T_{F_DF}
- 3.1.1.7 Common Mode Rise and Fall Times T_{R_CM}, T_{F_CM}
- 3.1.1.8 Differential Intra Pair Skew T_{SKEW_DF}
- 3.1.1.10 MHL Clock Duty Cycle in Normal mode
- 3.1.1.11 MHL Clock Jitter in Normal mode   (not needed as per CTS 2.1)
- 3.1.1.12 MHL Data Eye Diagram in Normal mode   (not needed as per CTS 2.1)
- 3.1.1.14 MHL Clock Duty Cycle in PackedPixel mode
- 3.1.1.15 MHL Clock Jitter in PackedPixel mode   (not needed as per CTS 2.1)
- 3.1.1.16 MHL Data Eye diagram in Packed Pixel mode   (not needed as per CTS 2.1)
- 3.1.1.17 TP2 Clock Jitter in Normal Mode   (new in CTS 2.1)
- 3.1.1.18 TP2 Eye Diagram in Normal Mode (new in CTS 2.1)
- 3.1.1.19 TP2 Clock Jitter in PackedPixel Mode (new in CTS 2.1)
- 3.1.1.20 TP2 Eye Diagram in PackedPixel Mode (new in CTS 2.1)

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Innovative MHL Protocol Analyzer Solution
Introducing Tektronix' MHL Protocol Solution

Tektronix

Tektronix MHL Protocol Analysis Solution

- MHL Protocol Analysis software running on the Tektronix REAL TIME Oscilloscope
  - Unique value proposition as the same real time scope is used for both Physical layer testing and Protocol testing.
  - Gives the seamless transition from Phy layer to Protocol.
  - Cost effective solution.
- Features
  - Multi View support
    - Bus Analysis
    - Frame Viewer
    - Event Viewer
    - Protocol Viewer
    - Linked to the analog waveform
- Tektronix Nomenclature – TEK-PGY-MHL-PA-SW

Protocol Tests for CTS 1.1/1.2/2.0 (See http://prodigytechno.com for more details)

Source Protocol Tests in both Normal mode and PackedPixel mode
- Legal Codes
- Basic Protocol
- Packet Types

Source Video Tests in both Normal mode and PackedPixel mode
- Video Formats Test
- Pixel Encoding Test
- Video Quantization Ranges
- AVI Info Frame

MHL Customer Presentation

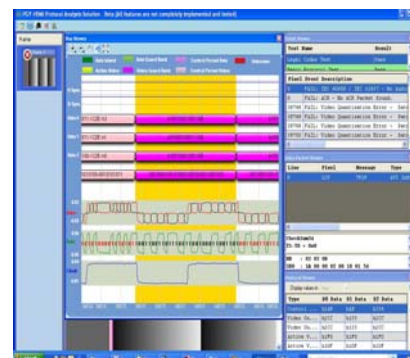# Tektronix MHL Protocol Analyzer: Seamless PHY and Link Layer Testing

SELECT

CONFIGURE

MULTI VIEW

BUS ANALYSIS-Physical Layer to Link Layer

REPORT

MHL Customer Presentation

MHL Compliance Test Analysis

- All the tests pass/ fail depends on one frame data or maximum of two continuous frame data at a time.

- So with multiple acquisitions, the protocol analyzer can produce the same result as 2 sec data as per CTS requirement.

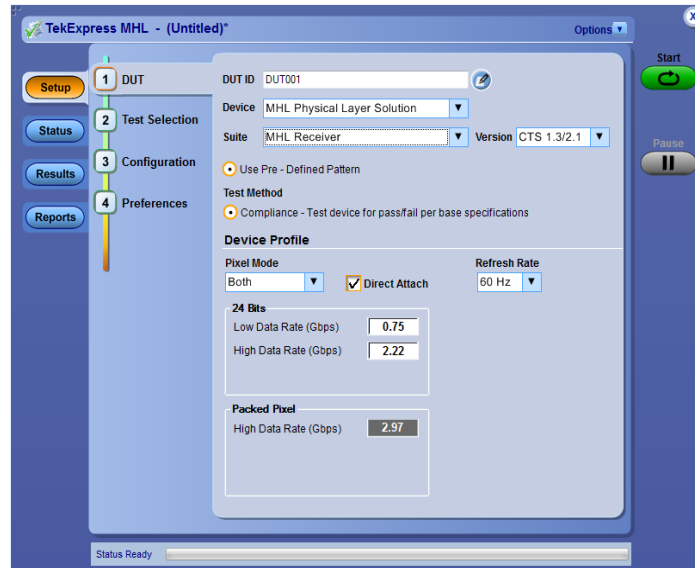| Source Protocol Tests	Source Video Test	Source Audio	Sink Protocol Tests
• Legal Codes • Basic Protocol • Packet Types	• Required Video Formats • Optional Video Formats • Required Pixel Encoding • Optional Pixel Encoding • Video Quantization Ranges • AVI Infoframe	• IEC 60958/IEC 61937 • Audio Clock Regeneration • Audio InfoFrame	• Supported by AWG MHL patterns

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Tektronix MHL Receiver Solution -Electrical and Protocol tests

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Tektronix MHL 2.1 Rx Solution with Direct Attach Test Support

MHL Compliance Software for Automated Rx Tests: Option MHD

CTS 1.x   CTS 2.0   CTS 2.1

- MHL 2.1 SW version available
- MHL 2.1 Sink Protocol Patterns for Direct Attach Device testing is available
- CTS 2.1 mandates Sink Jitter Tolerance testing to be performed with and without Cable emulator.

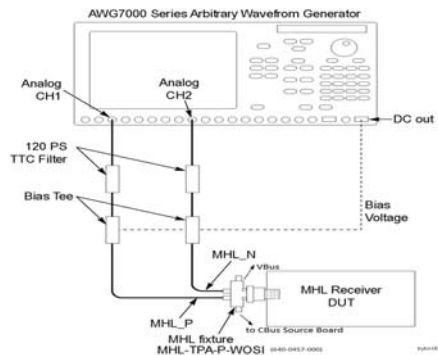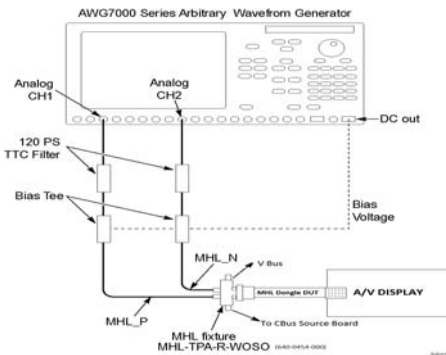- **No changes in test gear for MHL 2.1 only new feature support.**

Tektronix MHL Solution Setup: Simple and Easy Sink and Dongle Testing (all tests except Min/Max test)-1

Setup based on Direct Synthesis Capability of AWG7122C Series
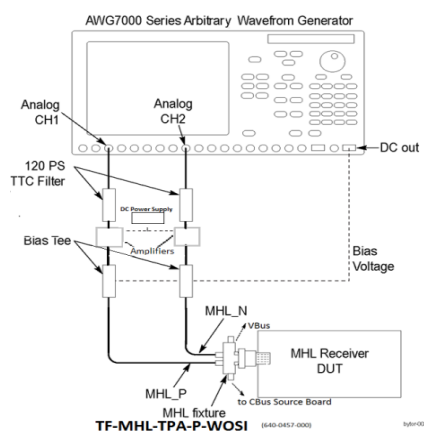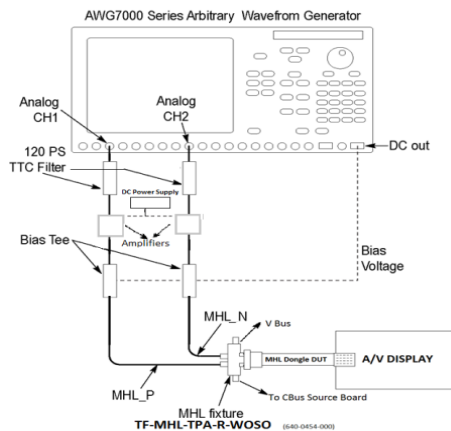
Tektronix MHL Solution Setup: Simple and Easy Sink and Dongle Min/Max Testing -2

Setup based on Direct Synthesis Capability of AWG7122C Series

MHL 2.1 tests –
Detailed Information on Sink/Dongle Electrical Tests

Physical Layer Tests

MHL Receiver Tests
- 4.1.1.2 Input Signal DC Voltage Level Tolerance
- 4.1.1.3 Input Signal Minimum and Maximum Swing Voltage Level Tolerance
- 4.1.1.4 Intra Pair Skew Tolerance
- 4.1.1.5 Jitter Tolerance in Normal mode
- 4.1.18 Jitter Tolerance in PackedPixel mode

MHL Dongle Tests
- 5.1.1.1 Input Signal Single-ended Voltage Level Tolerance
- 5.1.1.2 Input Signal Minimum and Maximum Swing Voltage Level Tolerance
- 5.1.1.3 Intra Pair Skew Tolerance
- 5.1.1.4 Jitter Tolerance in Normal mode
- 4.1.1.9 Jitter Tolerance in PackedPixel mode

The CTS 2.1 mandates Sink Jitter Tolerance
test to be performed with and without
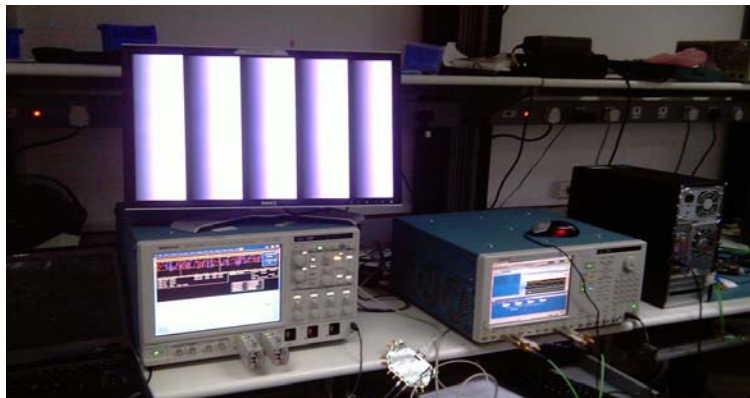Cable emulator.

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Tektronix Actual Sink and Dongle Setup: Simple and Easy
A Snapshot

Setup based on real-time oscilloscope and Direct Synthesis capability of AWG7122C Series.

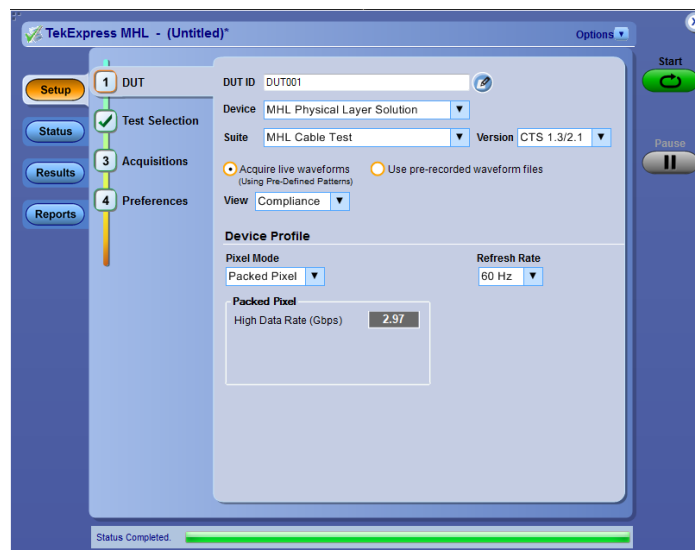1 BOX RX solution for Electrical and Protocol Testing

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Tektronix MHL 2.1 Cable Test Solution-Electrical

Tektronix

Tektronix MHL 2.1 Cable Electrical Test

Tektronix

Tektronix MHL 2.1 Cable Electrical Test Selection
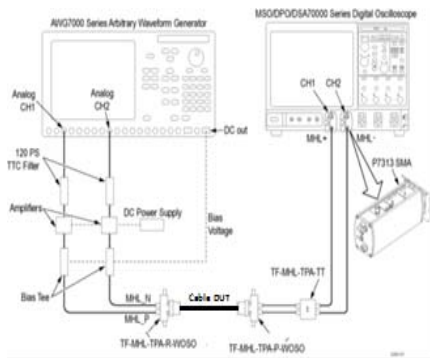
MHL Fixture Kits:

Wilder P/N	Wilder Model #	Tektronix nomenclature	Description
640-0475-000	MHL-TPA-TEK(Complete MHL Fixture kit w Cbus Board)	TF-MHL-TPA-TEK(Complete MHL Fixture kit w Cbus board)	MHL Test Kit includes 640-0452-000 thru 640-0459-000 and 640-0485-000 with associated power cords per country code
		TF-MHL-TPA-TEK A0	North America Power Cord Option - 640-0485-100
		TF-MHL-TPA-TEK A1	Universal EURO Power Cord Option - 640-0485-110
		TF-MHL-TPA-TEK A2	United Kingdom Power Cord option - 640-0485-120
		TF-MHL-TPA-TEK A5	Switzerland Power cord option - 640-0485-130
		TF-MHL-TPA-TEK A6	Japan Power cord option - 640-0485-140
		TF-MHL-TPA-TEK A10	China Power cord Option - 640-0485-150
		TF-MHL-TPA-TEK A12	Brazil Power cord option - 640-0485-160
		TF-MHL-TPA-TEK A11	India Power cord option - 640-0485-170
640-0476-000	MHL-TPA-TEK-SO(Source Fixture Only Kit)	TF-MHL-TPA-TEK-SO(Source Fixture Only Kit)	MHL Source Test Kit includes 640-00452 and 640-0453-000
640-0477-000	MHL-TPA-TEK-SI(Sink Fixture kit)	TF-MHL-TPA-TEK-SI(Sink Fixture kit)	MHL Sink Test Kit includes 640-0452-000, 640-0456-000, 640-0457-000
640-0478-000	MHL-TPA-TEK-DG(Dongle Fixture Kit)	TF-MHL-TPA-TEK-DG(Dongle Fixture Kit)	MHL Dongle Test Kit includes 640-0452-000, 640-0453-000, 640-0454-000
640-0479-000	MHL-TPA-TEK-CB(Cable Fixture Kit)	TF-MHL-TPA-TEK-CB(Cable Fixture Kit)	MHL Cable Test Kit includes 640-0455-000, 640-0456-000
640-0480-000	MHL-TPA-TEK-RSEN(RSEN Kit)	TF-MHL-TPA-TEK-RSEN(RSEN Kit)	MHL Rx Sense Kit includes 640-0458-000 and 640-0459-000

MHL Individual Fixtures :
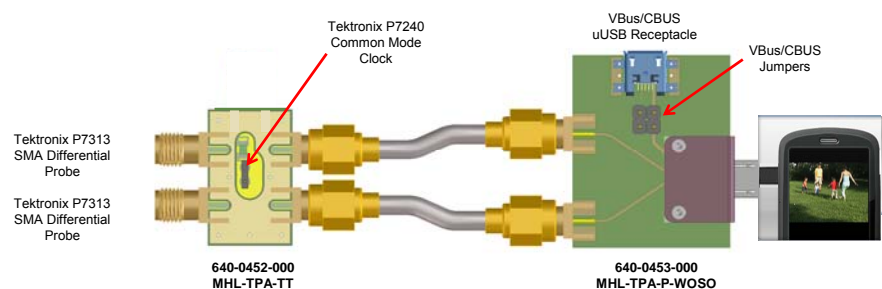
Wilder P/N	Wilder Model #	Tektronix nomenclature	Description
640-0452-000	MHL-TPA-TT	TF-MHL-TPA-TT	MHL Termination Board
640-0453-000	MHL-TPA-P-WOSO	TF-MHL-TPA-P-WOSO	MHL Source Test Board Plug without Termination
640-0454-000	MHL-TPA-R-WOSO	TF-MHL-TPA-R-WOSO	MHL Dongle Test Board Receptacle without Termination
640-0455-000	MHL-TPA-R-WOC	TF-MHL-TPA-R-WOC	MHL Cable Test Board Receptacle without Termination
640-0456-000	MHL-TPA-R-WOSI	TF-MHL-TPA-R-WOSI	MHL Sink Calibration Test Board Receptacle without Termination
640-0457-000	MHL-TPA-P-WOSI	TF-MHL-TPA-P-WOSI	MHL Sink Test Board Plug without Termination
640-0458-000	MHL-TPA-R-SO-RSEN	TF-MHL-TPA-R-SO-RSEN	MHL Source RxSense Test Board Receptacle
640-0459-000	MHL-TPA-R-SI-RSEN	TF-MHL-TPA-R-SI-RSEN	MHL Sink and Dongle RxSense Test Board Receptacle
640-0481-000	MHL-TPA-TEK-CBC	TF-MHL-TPA-CBC	MHL Cable Calibration Adapter Unit
110-1063-000	MHL-TPA-R-WOSOD	MHL-TPA-R-WOSOD	MHL Direct Attach Fixture

Tektronix

Wilder Fixtures:
Tektronix MHL Source Testing Setup

Tektronix P7240 Common Mode Clock

VBus/CBUS uUSB Receptacle

VBus/CBUS Jumpers

Tektronix P7313 SMA Differential Probe

Tektronix P7313 SMA Differential Probe

640-0452-000 MHL-TPA-TT

640-0453-000 MHL-TPA-P-WOSO

Tektronix

Wilder Fixtures:
Tektronix MHL Sink Testing Setup

VBus/CBUS
HDMI Receptacle

VBus/CBUS
Jum

MHL+

Stressed
Waveform
Input

MHL-

640-0457-000
MHL-TPA-P-WOSI
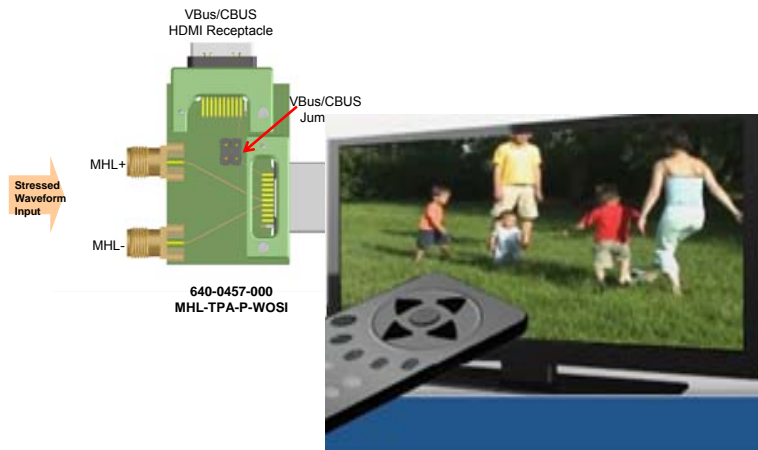
Tektronix

Wilder Fixtures:
Tektronix MHL Dongle Testing Setup

MHL-

Stressed
Waveform
Input

MHL+

VBus/CBUS
Jumpers

VBus/CBUS
HDMI Receptacle

640-0454-000
MHL-TPA-R-WOSO
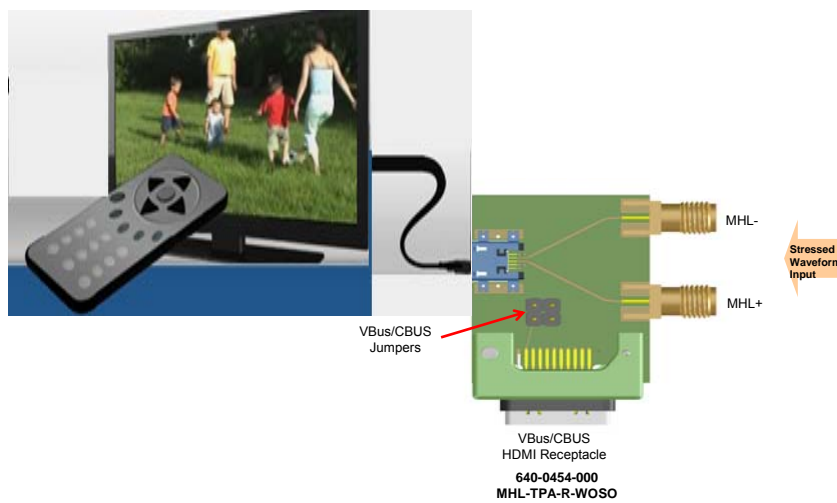
Tektronix

Wilder Fixtures for Tektronix MHL Testing

Direct Attach fixture
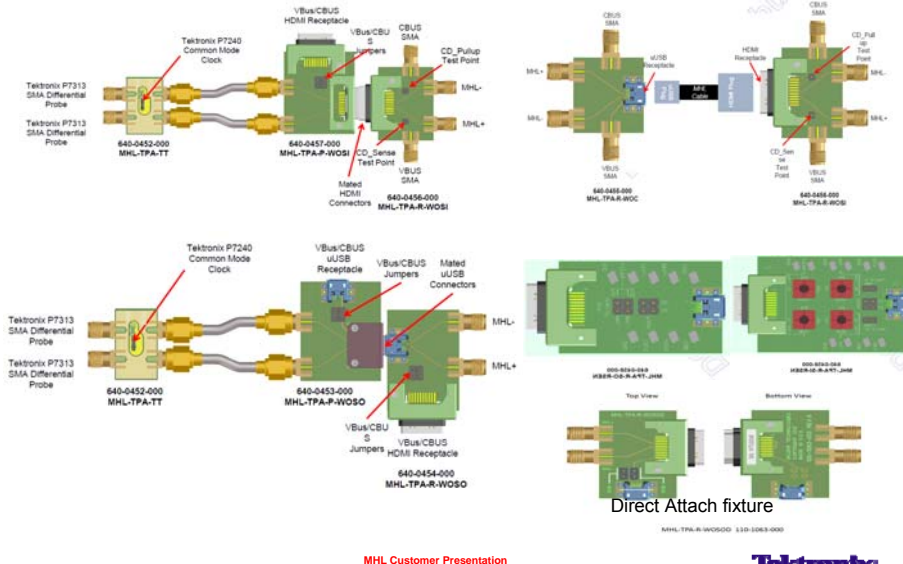
Wilder Fixtures for Tektronix MHL Testing

- Source Sink Board- A low cost alternative to C-Bus analyzer (TF-MHLCBS2-SOSI)
  - The low cost SOSI board can be used for the following :
    - Source tests Electrical. 3.1.1.1 to 3.1.1.12**(excluding 3.1.1.13)**
    - Source System Tests: 3.2.2.1 to 3.2.2.3 ; 3.2.3.1 to 3.2.3.4 ; 3.2.4.1 to 3.2.4.3
    - Sink Tests Electrical: 4.1.1.1 to 4.1.1.6(**excluding 4.1.1.7**)
    - Sink System tests: 4.2.1.1 to 4.2.1.2; 4.2.2.1 to 4.2.2.3; 4.2.3.1 to 4.2.3.2
    - Dongle tests: 5.1.1.1 to 5.2.1.2 (**excluding 5.1.1.7 and 5.1.1.8**) ; 5.2.2.1 to 5.2.2.3; 5.2.3.1 to 5.2.3.2

  - **This low cost board cannot be used for C-Bus tests: id 3.3.x.x and 4.3.x.x.**
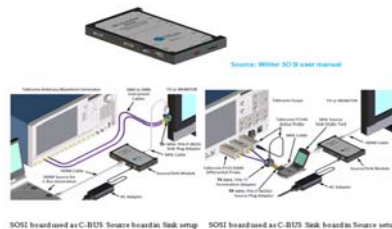
- Cable Calibration Fixture - TF-MHL-TPA-CBC

Tektronix MHL Solution:
Complete Solution for CTS 2.1 needs

- Tektronix MHL Physical Layer Tx test setups are easy to use and automated
  - Simple test setups common for most tests
  - Vterm provided by scope itself
  - MHL Fixtures available from our Fixture partner Wilder Technologies
- Tektronix MHL Physical Layer Rx test setups are easy to use.
  - TRUE MHL SIGNAL Generation as there is no need for external combiners/Filters
  - No need for external ISI boards as we leverage our AWG direct Synthesis Capability with common setups for Sink and Dongle testing
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  - An economical MHL test solution
    - ONE BOX solution for PHY and Protocol testing
  - Easy access to legacy P/A/V data format
- Tektronix also offers complete MHL solution with:
  - DSA8200 or Equivalent Sampling scope with 80E03/04 and I-connect Software for MHL Cable testing (performed manually using MOIs)
  - Low Bandwidth Oscilloscopes
  - Keithley Source Meter (Now part of Tektronix)
  - Programmable Power Supply and
  - Digital Millimeter

MHL Customer Presentation

Tektronix

Tektronix MHL Solution

- DPO/DSA/MSO 70000 B/C Series Real-time Oscilloscope with **BW ≥8GHz**
- MHL Compliance software – **Option MHD**
- Innovative MHL Protocol Software – **TEK-PGY-MHL-PA-SW**
- Probes- **Qty.2 - P7313SMA** and **Qty.1 – P7240**
- MHL Test fixture- **Available from Tektronix**.
- AWG7122C with Opt 01,02 or 06 and 08 for the innovative direct Synthesis based MHL Rx/Dongle testing
- C-Bus Sink and Source Board is needed and is available from Simplay Labs. Look out for new C-Bus Source Sink board from Tek.
- DSA8200 or Equivalent with 80E03/80E04 and I-Connect Software for MHL cable testing (performed manually using MOIs)
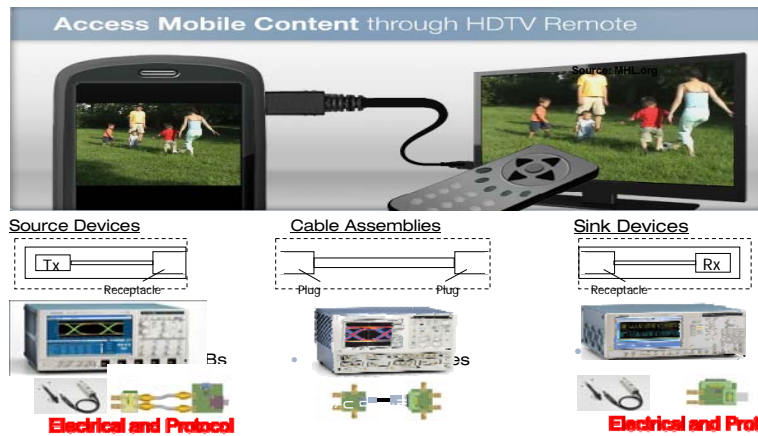
For Demos and Placing Orders - Contact Local Tektronix Account Managers

MHL Customer Presentation

Tektronix

Tektronix MHL 2.1 Solution

- Tektronix Offers Complete MHL 2.0 Solution.
- Industry's first 1BOX solution for Physical and Protocol testing.
  - Seamless transition between Protocol and Phy layer
  - Simple setup leads to faster test times

Source Devices   Cable Assemblies   Sink Devices

Electrical and Protocol   Electrical and Protocol

THANK YOU