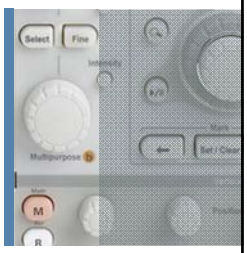
HDMI Solution



U N Vasudev - u.n.vasudev@tek.com
Strategic Product Planner

Tektronix

Agenda

- HDMI Overview and updates
- Additional resources

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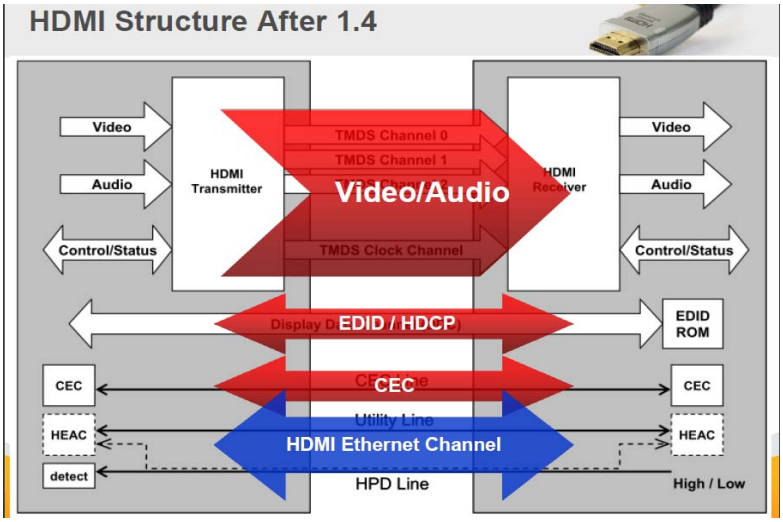
HDMI –High Definition Multimedia Interface

Overview of HDMI

- From 2003 till date and looking ahead…
  - Tek only solution provide for HDMI from 2003 to 2007
  - Contributor of SoftCRU method to the Specification
  - Innovative Sink solution leveraging Direct Synthesis method of AWG
- Hdmi 1.0 ---- 1.65GBps
- Hdmi 1.4—3.4GBps
- Hdmi 2.0….. 6GBps

HDMI Basics



Tektronix HDMI 1.4b Solution- Approved in CTS 1.4b

DPO/DSA/MSO
Real Time Oscilloscopes

AWG5K/B or AWG7K/B
Arbitrary Waveform Generators

DSA8200 Sampling Scope
with i-connect software

Common Set of test equipment for HDMI and HEAC

HDMI Fixtures:

1. Type A(TF-HDMI-TPA-S/-STX)
2. Type C(TF-HDMIC-TPA-S/-STX)
3. Type D(TF-HDMID-TPA-P/-R)
4. Type E(TF-HDMIE-TPA-KIT)
5. HEAC Fixtures(TF-HEAC-TPA-KIT)

Probes and Accessories

HDMI Probes
HEAC Probes
HDMI Accessory Kit

GAME Changer - HDMI Protocol Analyzer

Changes in HDMI Standards Body

- Due to the HDMI Specifications's overwhelming success, the HDMI Founders created an organization where interested companies can participate in the future development of the HDMI Specification.
- On October 25, 2011, the HDMI Founders announced the launch of the HDMI Forum

Source: HDMI Forum

Tektronix and HDMI Forum

- 89 companies in the HDMI forum as of date. Source HDMI Forum
- Tektronix is member of this HDMI Forum. Actively participating in weekly/monthly calls and face-face meetings
- **Tektronix's U.N.Vasudev is co-chair for HDMI forum test subgroup**
- HDMI Forum has released the HDMI specifications 2.0 version 1.0 on 4th Sept 2013
  - Target
    - CTS 2013 Q4

HDMI 2.0 features

- Uses same Cat 2 Cable and HDMI 1.4b connector
- Support 4K 2K 4:4:4 60/50 Hz – 594Mcsc(Mega Characters per Second per Channel
- Support 4K 2K 4:2:0 – 297Mcsc
- 3D; 21: 9 ; Audio
- Low level Bit error rate testing
- Scrambling is introduced and mandatory for rates >340Mcsc.

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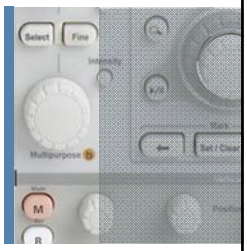
System Recommendation for HDMI 2.0 for Source Measurement



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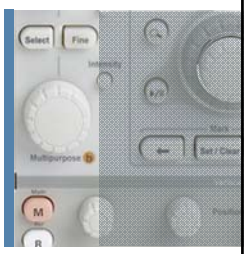
HDMI 2.0 Source Testing Equipment Needs

- 16GHz BW scope will give 1% error and hence is recommended for HDMI 2.0 testing.
  - HDMI 2.0 RT/FT (20%-80%) data signals is 42.5ps
- P7313SMA probes (same used in HDMI 1.4b)
- Option HDM and HDM-DS
- HDMI 2.0 Fixture set

Note- We shall also support a 12.5GHz BW scope which would result in appx. 10% inaccuracy in RT/FT results .

HDMI 2.0 Source Testing

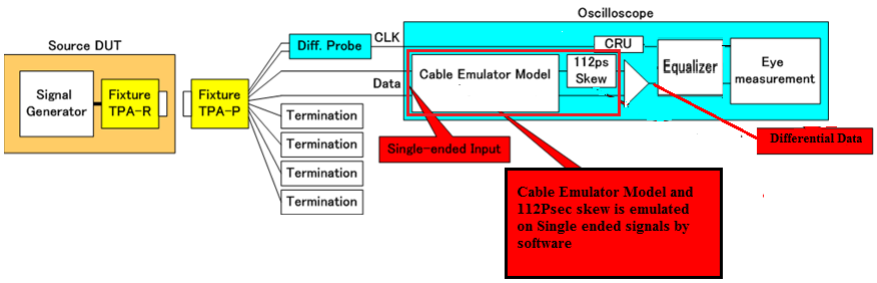


Source Testing 1.4b Vs 2.0

- Eye Diagram and Clock Jitter test is now performed at TP2
- Rest of the tests is same as HDMI 1.4b
- 1.4b CTS test is a pre-requsite for HDMI 2.0
- Min 8GHz scope to 16GHz scope
- New Fixtures
- Same Probes
- HDM and HDM-DS Software

Source Testing

- Source Eye Diagram test is measured at TP2_EQ.
- TP2 is the signal after passing along a worst cable.
  - Worst cable has worst attenuation and skew of 112ps.



Source Electrical Tests

Test ID HF1-1: Source TMDS Electrical – 340-600Mcsc – V_L

Test ID HF1-2: Source TMDS Electrical – 340-600Mcsc – T_{RISE}, T_{FALL}

Test ID HF1-3: Source TMDS Electrical – 340-600Mcsc – Inter-Pair Skew

Test ID HF1-4: Source TMDS Electrical – 340-600Mcsc – Intra-Pair Skew

Test ID HF1-5: Source TMDS Electrical – 340-600Mcsc – Differential Voltage

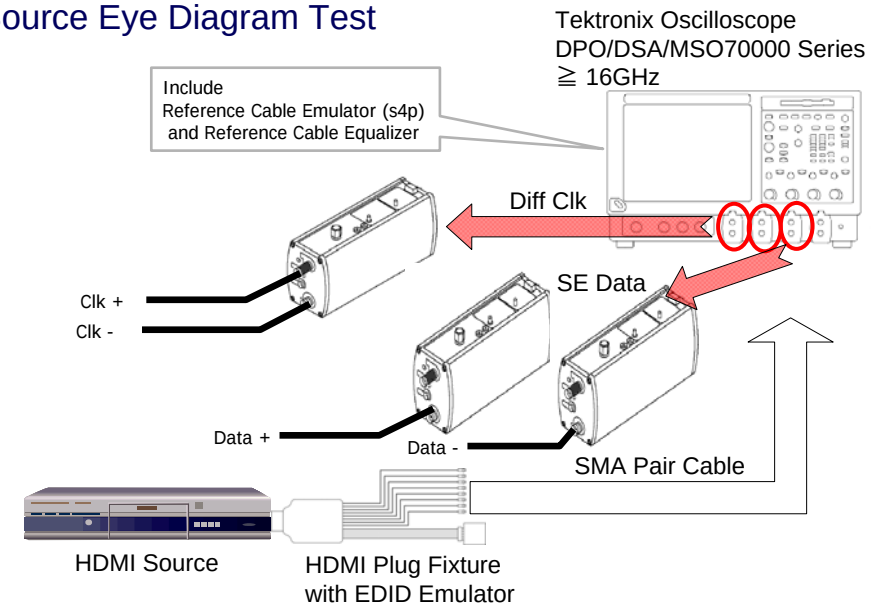
Test ID HF1-6: Source TMDS Electrical – 340-600Mcsc – Clock Duty Cycle

Test ID HF1-7: Source TMDS Electrical – 340-600Mcsc – Clock Jitter

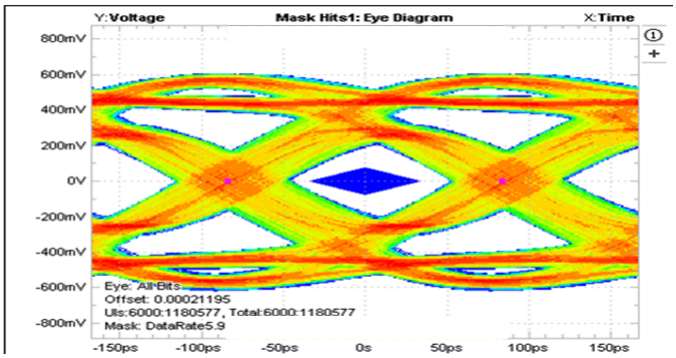
Test ID HF1-8: Source TMDS Electrical – 340-600Mcsc – Data Eye Diagram

Test ID HF1-9: Source TMDS Electrical – 340-600Mcsc – Differential Impedance (to be performed using sampling scope)

Source Eye Diagram Test

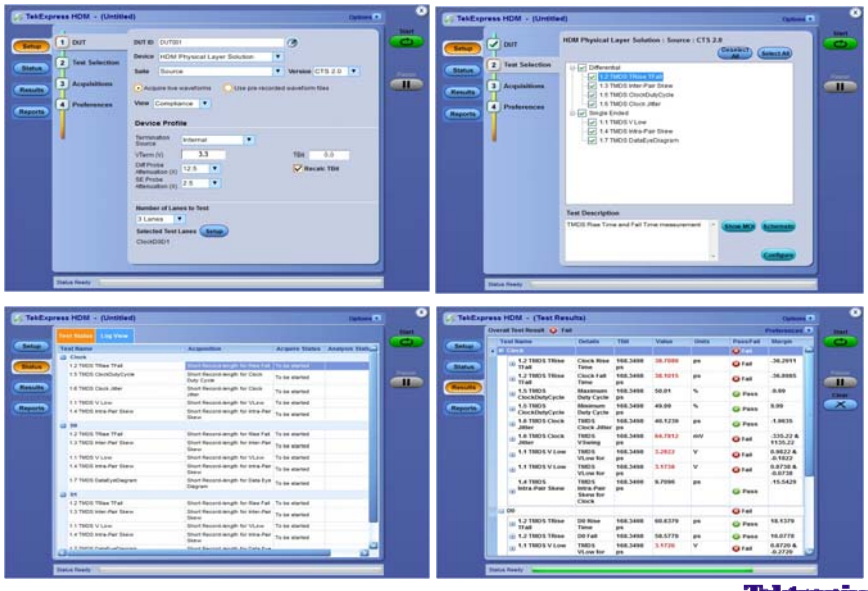


TP2 Source Eye for HDMI 2.0 6G Signal

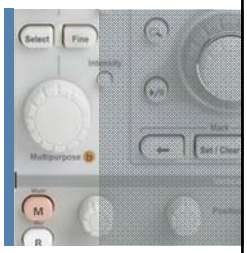


Single End Input eye rendered at Tek lab

HDMI 2.0 Tx Compliance Software



HDMI 2.0 Sink Testing



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HDMI 2.0 Sink testing Equipment needs

- 16GHz BW scope will give 1% error and hence is recommended for HDMI 2.0 Sink testing for Jitter Verification/Calibration/Controller.
- P7313SMA probes
- Option HDM and HDM-DS
- HDMI 2.0 Fixture set
- 2# AWG7122C with Opt 01,02 or 06, 08 for **HDMI 2.0 Compliance only setup**.

OR

- 2# AWG70002A with Opt 01,03 and 225 for **HDMI 2.0 Compliance and Margin Test setup.(Margin test feature will be available later and is part of roadmap)**

Note- We shall also support a 12.5GHz BW scope which would result in appx. 10% inaccuracy in RT/FT results .

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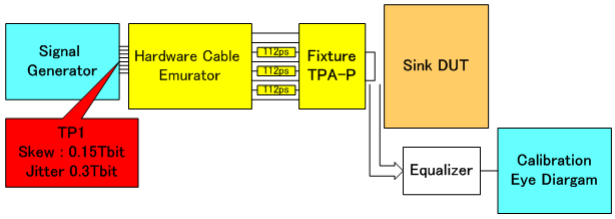
Requirement for Signal Generation

Cable Emulation and Skew by Hardware



Hardware Skew and Software Cable Emulation

Sink Electrical tests

Test ID HF2-1: Sink TMDS Electrical – 340-600Mcsc – Min/Max Differential Swing Tolerance

Test ID HF2-2: Sink TMDS Electrical – 340-600Mcsc – Intra-Pair Skew

Test ID HF2-3: Sink TMDS Electrical – 340-600Mcsc – Jitter Tolerance

Test ID HF2-4: Sink TMDS Electrical – 340-600Mcsc – Differential Impedance (performed using sampling scope)

HDMI 2.0 Rx solution positioning statement

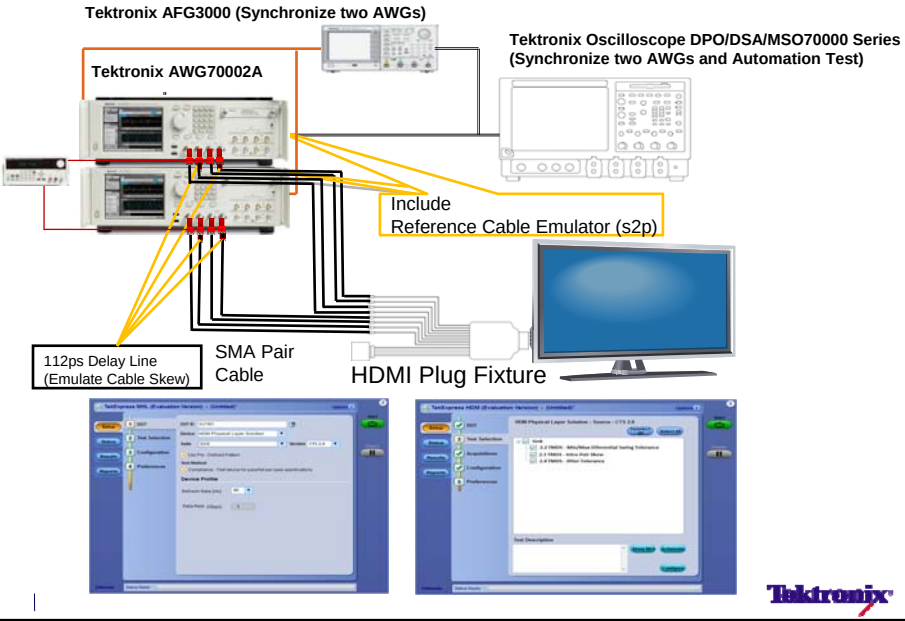
- Tektronix will support HDMI 2.0 Sink Electrical and protocol tests using either AWG7122C (w/ Opt 01,02/06,08) AND AWG70002A (W/ Opt 01,03 ,225)
- Solution Positioning:
  - **Compliance solution** for HDMI 2.0 Rx
    - 2# AWG7122C with opt 01, 02/06 and 08
    - 1# AFG3102/C

    Customers can use common test setup for HDMI 1.4b and HDMI 2.0 giving value for their investment in Tektronix HDMI 1.4b Rx solution.

  - **Compliance and Margin solution** for HDMI 2.0 Rx
    - 2# AWG70002A with Opt 01,03 and 225.
    - 1# AFG3102/C

    Customers can use common test setup for HDMI 1.4b and HDMI 2.0 giving value for their investment in Tektronix HDMI 1.4b Rx solution

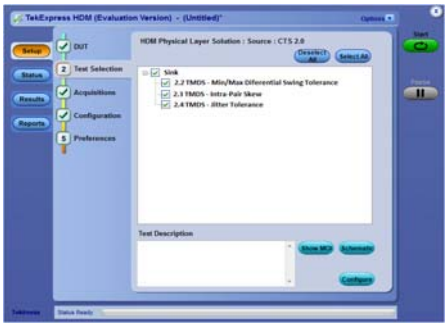
HDMI 2.0 Sink Test Setup



Sink Testing 1.4b Vs 2.0

- Jitter Tolerance test needs +ve and –ve lanes tested with 112ps delay line
- Rest of the tests is similar to HDMI 1.4b tests
- 1.4b CTS test is a pre-requsite for HDMI 2.0
- Need AWG 70002A for HDMI 2.0 Compliance and Margin needs while AWG7122C is suitable for HDMI 2.0 Compliance testing only..
- Min 8GHz scope to 16GHz scope
- Fixtures and Probes
- HDM and HDM-DS Software

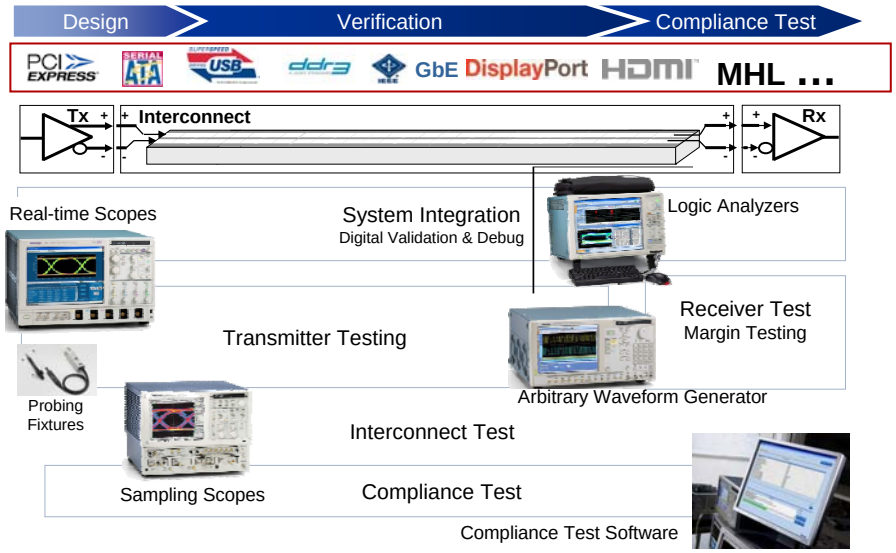
HDMI 2.0 Rx Compliance Software



Tektronix HDMI 2.0 Solution

- Tektronix HDMI 2.0 Solution will be available aligned to the CTS announcement from the new HDMI Forum.
- Full Source Test Solution including probes, Fixtures.
- Phased Rx Electrical solution- ensuring regular engagement with customers with pattern support added to solution.(between Dec 2013 to June 2014)
  - Release 1 HDMI 2.0 Sink Electrical tests HF2-1; HF2-2 and HF2-3 with the following VIC supported: (Dec MOI)
    - VIC 96,VIC97, VIC 101, VIC 102 ,VIC 106, VIC 107
  - Release 1 Sink Protocol test HF2-23 supported (Dec MOI)
  - Release 2 – 1H CY14 – remaining VICs for electrical tests- Target for next MOI approval event (Q1 CY14)
  - Final Release - Phased Rx Protocol solution- ensuring regular engagement with customers with pattern support added to solution.(starting by Q1 CY14 and complete by end 2014)
- Support for HDMI 1.4b CTS is a pre-requiste for HDMI 2.0 testing.
- Contact local Tektronix sales team for early interaction on our HDMI 2.0 solution.

High-Speed Serial Data Test Solutions



THANK YOU