

Agilent HDMI™ Compliant Jitter Tolerance Test Solution for Cable and RX Test with ParBERT 81250

Application Note

Preliminary Version

Introduction

The High-Definition Multimedia Interface (HDMI) is an industry-supported, uncompressed, all-digital audio/video interface. HDMI provides a connection between any compatible digital audio/video sources, such as a set-top box, DVD player, and A/V receiver and a compatible digital audio and/or video monitor, such as a digital television (DTV) [1].

HDMI is the dominant worldwide standard for Digital Connectivity. HDMI is used by over 300 vendors for consumer electronics and products.

HDMI supports standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable. It is independent of the various DTV standards such as ATSC, DVB(-T,-S,-C), as these are encapsulations of the MPEG data streams, which are passed off to a decoder, and sent to the output as uncompressed video data, which can be high-definition.

The video data is then encoded with a 'TMDS' (Transition Minimized Differential Signalling), for digital transmission over HDMI. HDMI also includes support for 8-channel uncompressed digital audio. HDMI version 1.2 supports up to 8 channels of one-bit audio. One-bit audio is used on Super Audio CDs.

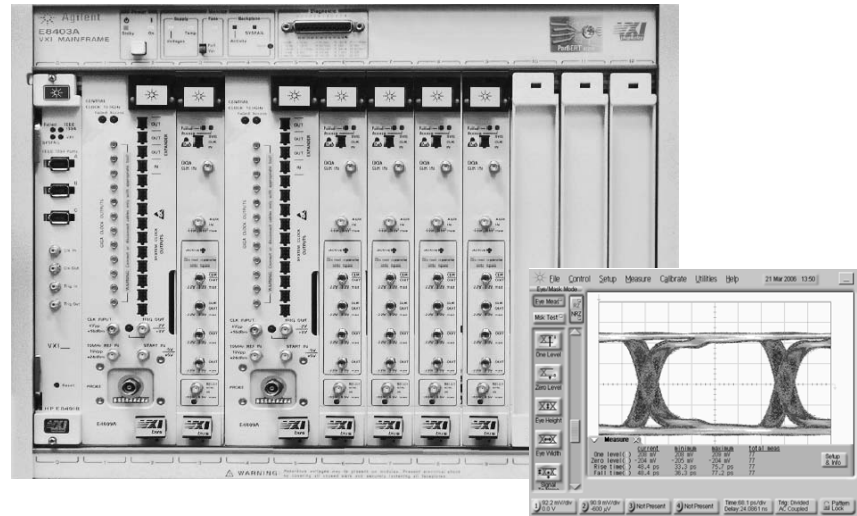


Figure 1: ParBERT RX jitter tolerance

The standard Type A HDMI connector has 19 pins. The higher resolution Type B with 29 pins has been defined to support resolutions higher than 1080p, although it is not yet in common use. Type A HDMI is backward-compatible with the single-link Digital Visual Interface (DVI) used in modern computer monitors and graphics cards. This means that a DVI source can drive an HDMI monitor, or vice versa, by means of a suitable adapter or cable, but the audio and remote control features of HDMI will not be available.

HDMI To Achieve Deep Color, Higher Speed and Greater PC Convergence

In January 2006 HDMI licensing LLC, which represents the seven HDMI founder companies announced capabilities under development for the next version of the HDMI. These capabilities will include support for deep color, higher speed and easier integration into personal computers. Using one cable to deliver crystal-clear, all-digital audio and video, HDMI will simplify cabling to give customers the best home theater experience [2].



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ParBERT 81250 with Jitter Modulation for Cable and RX Tolerance Testing

As HDMI moves to the area of gigabit speed, the physical layer parameters like jitter become more and more important. Not only the jitter budget of the data transmitter outputs has to be measured, but the jitter tolerance of the receiver inputs too. Jitter tolerance stimulates the receiver input with adjustable jitter and checks for compliance or actual performance.

R&D and Test Engineers Use Key Features for HDMI Testing:

- Free and flexible configuration up to 7 Gb/s
- Best in class signal performance up to 7 Gb/s with low intrinsic jitter
- TMDS signal leveling
- Jitter modulation
- Data sequence editor for HDMI video frames

TMDS Data and Clock Channels

The Multi.Channel Agilent ParBERT 81250 provides data channels D0, D1 and D2 to cover the three colors green, red, blue.

The fourth channel D- is used as Intra-pair skew channel to provide additional skew testing between normal and complementary data transmission. This is defined in the HDMI standard. A clock signal is also provided.

Jitter Modulation for Clock and Data

HDMI requires test modes to modulate Jitter for clock and data in a synchronous and non-synchronous test mode. The help of two individual clock groups, the non-synchronous clock versus data jitter modulation can be freely adjusted with the Signal Generator E4438C and the Jitter Injection Studio E4438C SP1 via remote control.

Compliant Jitter Tolerance Test Solution

Agilent's ParBERT 81250 enables a complete jitter tolerance test on HDMI. The jitter tolerance test checks the input sensitivity of the RX with jitter modulation and measures the BER as a result. The jitter tolerance compliant test requires different Jitter Stress Modulation tests up to 1.5 UI at a max. frequency up to 10 MHz.

Video Framed Data

The ParBERT 81250 generates video framed data with the help of a sequencer. The sequencer is shown in Figure 2. In this example a 740 x 480 video frame is generated and repeated infinitely. The sequencer helps to structure the video data in blocks for efficient use of ParBERT memory. It creates the proper bit flow by providing the bit flow control.

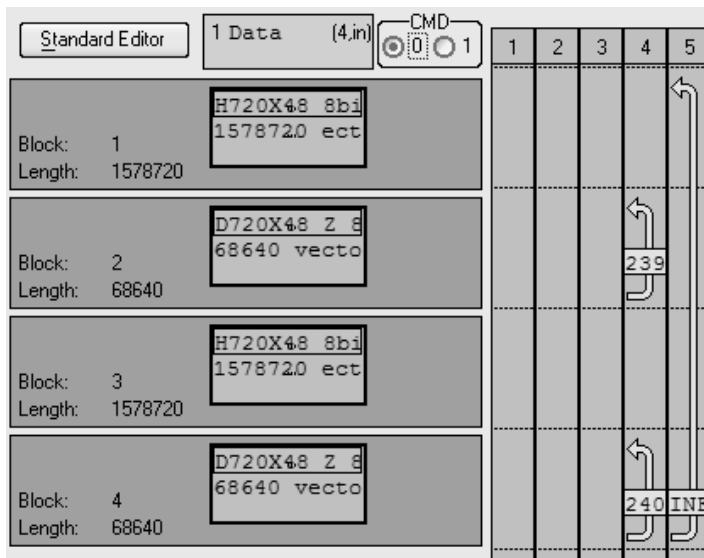


Figure 2: Sequencing for video format

ParBERT configuration and ordering:

81250

- opt 149 VXI frame
- opt 013 Firewire
- opt 015 Laptop
- 1 x E4875A Control SW

Entry configuration up to 3.3 Gb/s:

- 2 x E4808A clock module
- 3 x E4861B 3.3G data module
- 5 x E4862B 3.3G generator front-end

High Performance configuration up to 7 Gb/s:

- 2 x E4809A clock module
- 5 x N4874A 7 Gb/s generator module

Recommended additional equipment:

- 2 x E4438C SP1 signal generator

Table 1: Choosing the right ParBERT setup

	ParBERT 3.3 Gb/s	ParBERT 7 Gb/s
Data rate	20 Mb/s - 3.35 Gb/s	620 Mb/s - 7 Gb/s
Simultaneous clock/data modulation	Delay control input up to 500 ps	Delay control input up to 200 ps
Simultaneous independent clock/data modulation	—	Multiple unit interval via signal generator

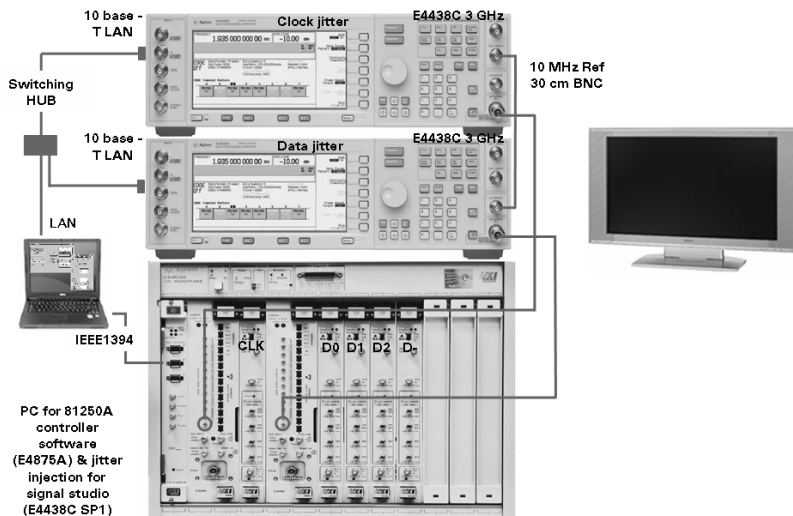


Figure 3: ParBERT 81250 application scheme

Software Solution

Agilent provides standard software solutions for HDMI that complement the hardware portfolio, such as automated sink tests and a HDMI frame generator software. The test automation software platform N5990A controls e.g. ParBERT and the jitter sources to conduct characterization and compliance tests. Customization and integration services such as racking are provided by the Agilent partner BitifEye Digital Test Solutions [3].

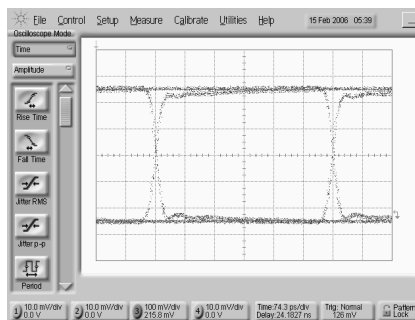


Figure 4: Signal quality for non jitter modulation

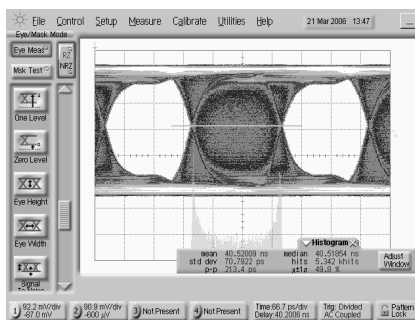


Figure 5: Signal quality for 50 % periodic jitter modulation

References

- [1] High-Definition Multimedia Interface, Wikipedia, the free encyclopedia
[2] Press release: HDMI To achieve deep color, higher speed and greater PC convergence, Las Vegas, January 3, 2006
http://www.hdmi.org/press/pr/pr_20060103.asp
[3] www.bitifeye.com

Related Literature	Publication Number
Second Generation PCI EXPRESS with the J-BERT N4903A	5989-4087EN
Jitter Fundamentals: Jitter Tolerance Testing with 81250 ParBERT	5989-0223EN
Next Generation I/O Bus PCI-Express BER Test Solution	5989-2690EN
Physical Layer Testing of Passive Optical Network (PON) Modules	5989-3298EN
Jitter Fundamentals: ParBERT 81250 Jitter Injection and Analysis Capabilities	5988-9756EN

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For more information about HDMI, go to www.hdmi.org

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