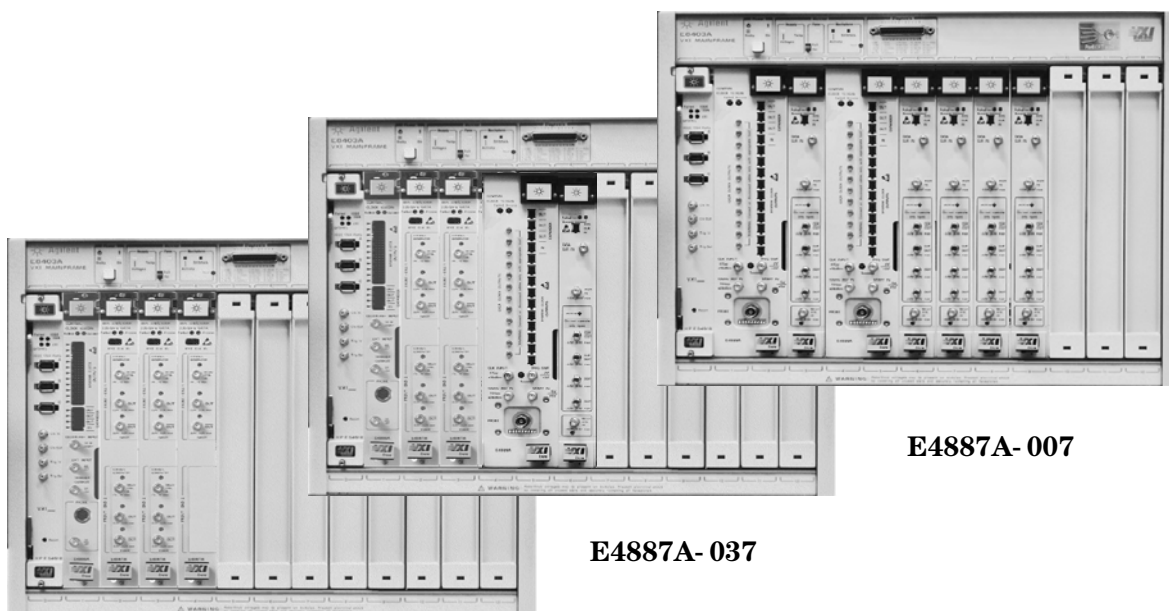
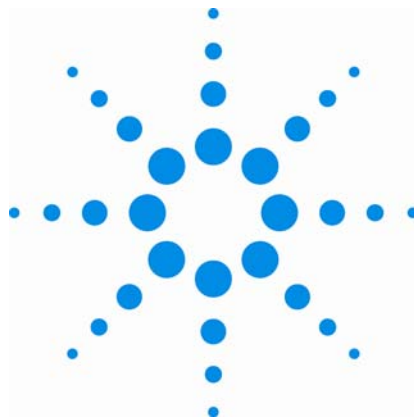


# Agilent E4887A HDMI TMDs Signal Generator Platform

Data Sheet

Version 1.9 Preliminary



**E4887A-003**

**E4887A-037**

**E4887A-007**

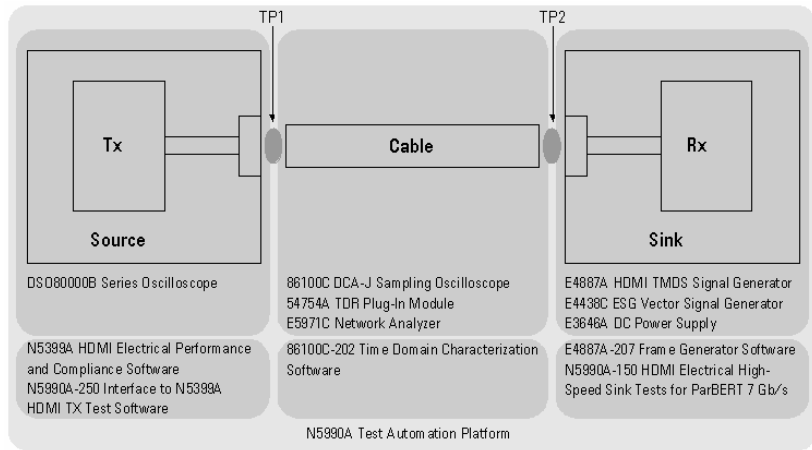


**Agilent Technologies**

## Convenient Compliance Testing and Characterization of HDMI 1.3 Devices

The High-Definition Multimedia Interface (HDMI) specification ensures the interoperability of all-digital audio and video devices. Agilent offers solutions for testing HDMI sources, cables and sinks. The instruments of each solution provide outstanding performance, ideal for characterizing HDMI devices. The special HDMI test automation software controls the instruments and simplifies HDMI source and sink compliance testing.

Figure 1: Agilent provides solutions for each HDMI test.



### Source test solution

The DSO80000 Series Oscilloscope is the core of Agilent's source test solution. The high bandwidth, low noise and excellent probing solutions of these real-time oscilloscopes show clear eye diagrams and the real margin of your HDMI sources. The N5399A software guides you confidently through most compliance source tests.

### Cable test solution

The E5971C network analyzer and the 86100C DCA-J, with its TDR modules and software, provide impedance, intra- and inter-pair skew measurements for HDMI cables.

### Sink test solution

The E4887A HDMI TMDS Signal Generator Platform provides parallel signals with low intrinsic jitter and fast edges. The HDMI Frame Generator Software is ideal for manual testing and debugging. It configures the generator with a wide variety of HDMI video frames. The software controls up to two E4438C Vector Signal Generators or 33250A Arbitrary Waveform Generators as well as the TMDS Signal Generator for defined jittered signals for jitter tolerance testing.

### High performance connections

Agilent offers various fixtures for HDMI testing. The N1080A test point access adapters (TPAs) provide SMA to plug, or receptacle to SMA connections with very low loss and high bandwidth. The N5404A transmitter test fixture is especially developed for HDMI source testing.

### Test automation

The N5990A Test Automation Platform enables HDMI compliance testing and systematic, in-depth characterization with high data quality and throughput. The software controls all related instruments and directs you step by step through the tests. All test results are documented in Microsoft® Excel format.

### E4887A HDMI TMDS Signal Generator Platform

The core of the Agilent HDMI sink test solution is the E4887A HDMI TMDS Signal Generator Platform and offers a choice of three configurations:

**E4887A-007:** High resolution HDMI TMDS Signal Generator

**Target Audience:** ATC, chip vendors

- In-depth characterization beyond today's required test needs up to 7 Gb/s including separate and combined jitter tolerance characterization for all data rates
- Highest signal performance with low intrinsic jitter and fast transition times
- Fast automated CTS compliant test routines

**E4887A-037:** Standard compliant and characterisation test

**Target Audience:** R&D labs for Audio, Video, TV requiring compliance pass/fail and high speed characterization

- CTS based compliant pass/fail testing on all data rates
- Combined jitter tolerance compliance and characterization testing on all data rates
- Separate jitter tolerance compliance and characterization starting at 74 MHz pixel clock
- Upgrade to E4887A-007

**E4887A-003:** Economic high speed tester up to 3.4 Gb/s

**Target Audience:** HDMI related development for economic device characterisation.

- Covers most critical HDMI test starting at 74 MHz pixel clock
- Combined and separate jitter tolerance characterization and compliance testing starting at 74 MHz pixel clock
- Upgrade to E4887A-037
- Ideal test solution for debug and stimulus in R&D

### E4887A and N5990A Platform combination

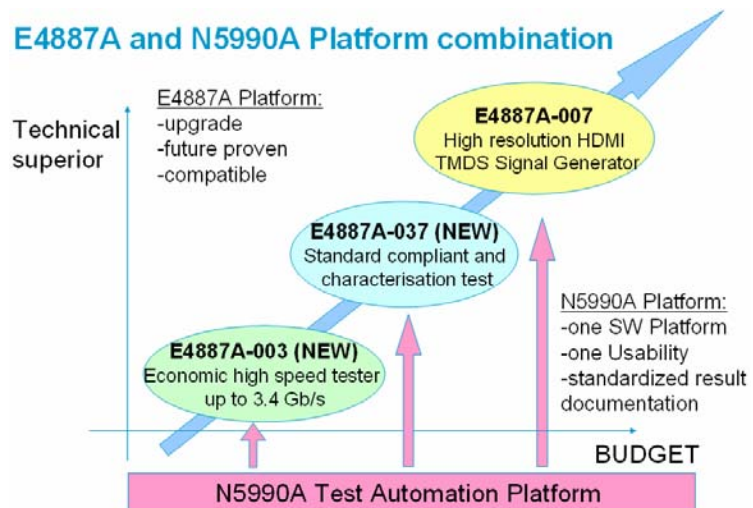


Figure 2: E4887A and N5990A Platform combination

### **High quality signals for clock and data signals**

Clean signals with fast transition times and very low jitter are necessary for device characterization. The E4887A HDMI TMDS Signal Generator Platform is based on Agilent's ParBERT 81250, which provides industry best signal performance for high speed characterization.

### **TMDS signal generator for independent jitter injection on the clock signal and data signals**

In combination with the E4438C Vector Signal Generator or the 33250A Arbitrary Waveform Generator, the E4887A HDMI TMDS Signal Generator Platform offers linear clock and data jitter injection compliant to HDMI CTS 1.3. Especially designed for jitter tolerance device characterization, it lets you stress your device with independent jitter components on the clock and data signal for in-depth sink characterization.

### **Easy to use with many video formats**

You can choose from a vast variety of video formats. The frame generator software set up the TMDS Signal Generator with the chosen format. The jitter injection is also conveniently controlled using the frame generator software.

### **Integrated into compliance test software**

The N5990A Test Automation Software integrates the E4887A TMDS Signal Generator Platform and the DSO80000 Series Real-Time Oscilloscope. This HDMI sink test solution provides calibrated jitter injection for accurate jitter tolerance characterization, and compliance tests with a high test throughput.

### **Future proof with data rates up to 7 Gb/s**

The high resolution version of the E4887A-007 HDMI TMDS Signal Generator is able to generate signals up to 7 Gb/s and protects your investment for future device characterization.

### **Cable emulators designed for HDMI 1.3**

A set of different cable emulators especially designed for HDMI 1.3 are offered to match CAT 1 and CAT 2 reference cables.

## E4887A HDMI Platform Jitter Tolerance Capabilities

Enabling highspeed on most recent HDMI devices is the most critical and important requirement for in-depth characterization. The E4887A TMDS Signal Generator Platform is exactly addressing this test-need through all individual configurations. Paired with excellent signal performance, the test engineer has got the highest benefit for true and exact device characterization.

### E4887A-007 High resolution HDMI TMDS Signal Generator

| Jitter Tolerance testing<br>Frequency | D_Jitter on TMDS_Clock<br>E4887A- 007 |           | D_Jitter on TMDS_Data<br>E4887A- 007 |           |
|---------------------------------------|---------------------------------------|-----------|--------------------------------------|-----------|
|                                       | Comp.                                 | Charact.  | Comp.                                | Charact.  |
| 27 MHz TMDS Clock                     | ✓                                     | >2.5 TBit | ✓                                    | >2.5 TBit |
| 74.25 MHz TMDS Clock                  | ✓                                     | >2.5 TBit | ✓                                    | >2.5 TBit |
| 148.5 MHz TMDS Clock                  | ✓                                     | >2.5 TBit | ✓                                    | >2.5 TBit |
| 222.75 MHz TMDS Clock                 | ✓                                     | >2.5 TBit | ✓                                    | >2.5 TBit |
| 297 MHz TMDS Clock                    | ✓                                     | >2.5 TBit | ✓                                    | >2.5 TBit |
| 340 MHz TMDS Clock                    | ✓                                     | >2.5 TBit | ✓                                    | >2.5 TBit |

Table 1: E4887A—007 jitter tolerance capabilities

### E4887A-037 Standard compliant and characterisation tester

| Jitter Tolerance testing<br>Frequency | D_Jitter on TMDS_Clock<br>E4887A- 037 |           | D_Jitter on TMDS_Data<br>E4887A- 037 |            |
|---------------------------------------|---------------------------------------|-----------|--------------------------------------|------------|
|                                       | Comp.                                 | Charact.  | Comp.                                | Charact.   |
| 27 MHz TMDS Clock                     | ✓                                     | >2.5 TBit | -                                    | -          |
| 74.25 MHz TMDS Clock                  | ✓                                     | >2.5 TBit | ✓                                    | -          |
| 148.5 MHz TMDS Clock                  | ✓                                     | >2.5 TBit | ✓                                    | 0.74 TBit  |
| 222.75 MHz TMDS Clock                 | ✓                                     | >2.5 TBit | ✓                                    | 1.11 TBit  |
| 297 MHz TMDS Clock                    | ✓                                     | >2.5 TBit | ✓                                    | 1.485 TBit |
| 340 MHz TMDS Clock                    | ✓                                     | >2.5 TBit | ✓                                    | 1.7 TBit   |

Table 2: E4887A-037 jitter tolerance capabilities

### E4887A-003 Economic high speed tester up to 3.4 Gb/s

| Jitter Tolerance testing<br>Frequency | D_Jitter on TMDS_Clock<br>E4887A- 003 |            | D_Jitter on TMDS_Data<br>E4887A- 003 |            |
|---------------------------------------|---------------------------------------|------------|--------------------------------------|------------|
|                                       | Comp.                                 | Charact.   | Comp.                                | Charact.   |
| 27 MHz TMDS Clock                     | -                                     | -          | -                                    | -          |
| 74.25 MHz TMDS Clock                  | ✓                                     | -          | ✓                                    | -          |
| 148.5 MHz TMDS Clock                  | ✓                                     | 0.74 TBit  | ✓                                    | 0.74 TBit  |
| 222.75 MHz TMDS Clock                 | ✓                                     | 1.11 TBit  | ✓                                    | 1.11 TBit  |
| 297 MHz TMDS Clock                    | ✓                                     | 1.485 TBit | ✓                                    | 1.485 TBit |
| 340 MHz TMDS Clock                    | ✓                                     | 1.7 TBit   | ✓                                    | 1.7 TBit   |

Table 3: E4887A—003 jitter tolerance capabilities

## High Resolution Characterization and Compliance Tester E4887A-007 TMD5 Signal Generator up to 7 Gb/s

E4887A-007 TMD5 Signal Generator configuration for independent jitter injection on TMD5 clock and TMD5 data lane allow the in-depth characterization of HDMI sink devices from 270 Mb/s up to any future bitrate of 7 Gb/s. For compliance testing of any HDMI device, this setup also provides jitter injection of clock and data jitter components on the TMD5 clock only. Data generator bit rates up to 7 Gb/s help to protect your investment.

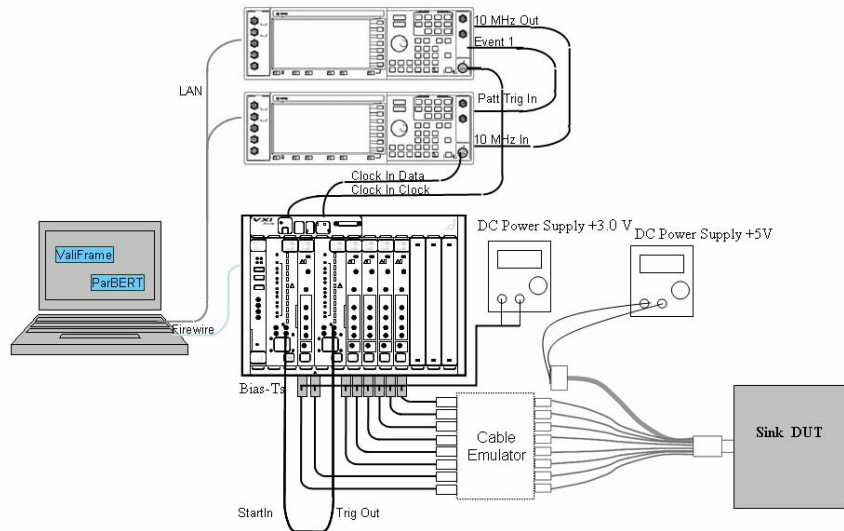


Figure 3: Characterization Setup

### Instruments

1x E4887A-007  
2x E4438C

HDMI TMD5 Generator max. bit rate 7 Gb/s  
ESG Vector Signal Generator with options see ordering instructions page 15  
DC Power Supply, dual output, dual range

1x E3646A

### Software

1x E4887A-207

HDMI Frame Generator Software for E4887A

### Accessories

Agilent Technologies:

1x E4887A-308

Accessory and cable kit for E4887A-007

1x N1080A-H01

Test point access adapter plug

1x N1080A-H02

Test point access adapter receptacle

2 units needed for cable test

1x N1080A-H03

Low frequency control board

BitifEye Digital Test Solutions ([www.bitifeye.com](http://www.bitifeye.com)):

1x BIT-HDMI-BTK-0001

Bias tee kit for E4887A-007, required

For additional accessories, see the E4887A ordering instructions on page 17.

### For automated compliance sink and source testing

1x DSO80000

Real-time Oscilloscope

1x N5399A

HDMI software package for DSO80000

1x N5990A

Test Automation Platform with options -010, -150, -250, and -001 recommended

For more details on the cable emulators and accessories see pages 15 and 16.

| <b>E4887A-007</b>                       |   |
|---|---|
| <b>Frequency range</b>                  | 620 Mb/s to 7 Gb/s<br>internal clock mode <sup>1)</sup><br><br>620 Mb/s to 6 Gb/s<br>ESG E44838C with opt. 506 used as clock source<br><br>620 Mb/s to 4 Gb/s<br>ESG E44838C with opt. 504 used as clock source |
| <b>Skew between data channels</b>       | 20 ps typ. <sup>2)3)5)</sup>  |
| <b>Delay = start delay + fine delay</b> | Can be specified as leading edge delay in fraction of bits in each channel  |
| <b>Start delay range</b>                | 0 ns to 100 ns  |
| <b>Fine delay range</b>                 | ±1 period <sup>4)</sup>   |
| <b>Delay resolution</b>                 | 100 fs  |
| <b>Delay accuracy</b>                   | ±10 ps ±20 ppm relative to zero-delay placement <sup>3)5)</sup>   |
| <b>Relative delay accuracy</b>          | ±2 ps ±2% typ. <sup>3)</sup>  |

Table 3: TMDS Signal Generator: timing specifications

- 1) E4438C ESG Vector Signal Generator needed for jitter injection
- 2) After cable deskewing at customer levels and unchanged system frequency.
- 3) @ 25 °C to 40 °C ambient temperature
- 4) Can be changed without stopping the system
- 5) For N4910A cable set (2.4 mm connector, 24" matched pair)

| <b>E4887A-007</b>                    |   |
|--------------------------------------|---|
| <b>Output</b>                        | Differential or single ended, 2.4 mm(f) <sup>1)</sup>   |
| <b>Impedance</b>                     | 50 Ω typ.   |
| <b>Output amplitude / resolution</b> | 0.1 Vpp to 1.8 Vpp / 5 mV   |
| <b>Output voltage window</b>         | -2 V to +3 V; for higher outputs use recommend Bias Tee 5542-211 from Picosecond Pulse Labs <sup>2)</sup> |
| <b>Data formats</b>                  | NRZ, DNRZ   |
| <b>Transition times 20% to 80%</b>   | <20 ps <sup>4)</sup>  |
| <b>Intrinsic jitter</b>              | 9 ps peak to peak typ. <sup>3)4)</sup>  |

Table 4: TMDS Signal Generator: output specifications

- 1) In single ended mode, the unused output must be terminated with 50 Ω to GND
- 2) Voltage window direct at module output is -2 V to +3 V; DC power supply needed with Bias Tee.
- 3) Clock out to data out of same module. NRZ data format
- 4) For N4910A cable set (2.4 mm connector, 24" matched pair)

| <b>E4887A-007</b>                           |  |
|---|--|
| <b>PRBS / PRWS</b>                          | 2 <sup>n</sup> -1<br>n = 7, 9, 10, 11, 15, 23, 31              |
| <b>Errored PRBS / PRWS</b>                  | 2 <sup>n</sup> -1<br>n = 7, 9, 10, 11, 15                      |
| <b>Extended ones or zeroes</b>              | 2 <sup>n</sup> -1<br>n = 7, 9, 10, 11, 15                      |
| <b>User definable memory based patterns</b> | Up to 64 Mbit  |
| <b>Video formats</b>                        | See table 4, requires E4887A-207 HDMI frame generator software |

Table 5: TMDS Signal Generator: pattern and video formats

## Standard Compliant and Characterization Tester E4887A-037 TMDs Signal Generator up to 3.4 Gb/s

The E4887A-037 TMDs Signal Generator offers fastest compliance testing based on CTS requirements including characterization capabilities up to 3.4 Gb/s.

Jitter Tolerance capabilities are provided:

- Combined jitter tolerance compliance and characterization on all data rates
- Separate jitter tolerance compliance start at 74 MHz pixel clock.
- Separate jitter tolerance characterization starting at 148 MHz pixel clock

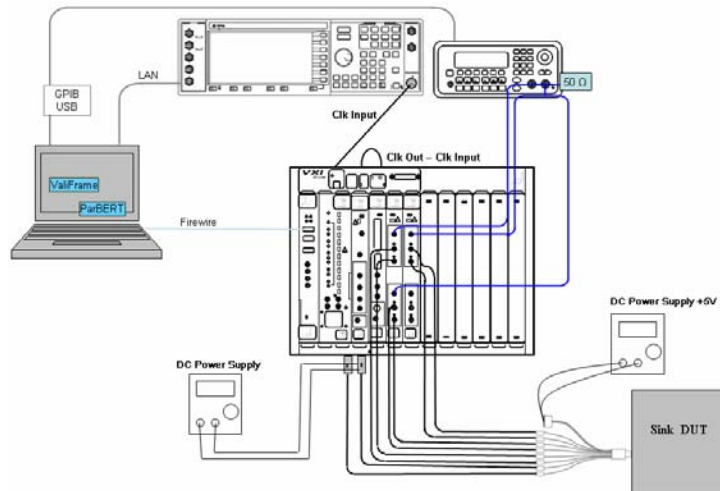


Figure 4: Characterization Setup up to 3.4Gb/s

### Instruments

1x E4887A-037  
1x E4438C  
1x 33250A  
1x E3646A

HDMI TMDs Generator max. bit rate 3.4 Gb/s  
ESG Vector Signal Generator with options see page 18.  
Arbitrary Waveform Generator up to 80 MHz  
DC Power Supply, dual output, dual range

### Software

1x E4887A-207

HDMI Frame Generator Software for E4887A

### Accessories

Agilent Technologies:

1x E4887A-309

Accessory and cable kit for E4887A-037

1x N1080A-H01

Test point access adapter plug

1x N1080A-H02

Test point access adapter receptacle

2 units needed for cable test

1x N1080A-H03

Low frequency control board

BitifEye Digital Test Solutions ([www.bitifeye.com](http://www.bitifeye.com)):

1x BIT-HDMI-BTK-0004

Bias Tee kit for E4887A-007, required

For additional accessories, see the E4887A ordering instructions on page 18.

### For automated compliance sink and source testing

1x DSO80000

Real-time Oscilloscope

1x N5399A

HDMI software package for DSO80000

1x N5990A

Test Automation Platform with options -010, -150, -250, and -001 recommended

For more details on the cable emulators and accessories see pages 9 and 10.



| <b>E4887A-037</b>                       |  |
|---|--|
| <b>Frequency range</b>                  | 20.843 Mb/s to 3.4 Gb/s (E4861B/E4862B)<br>internal clock mode <sup>1)</sup><br><br>620 Mb/s to 6 Gb/s (N4874A)<br>ESG E44838C with opt. 506 used as clock source <sup>2)</sup><br><br>620 Mb/s to 4 Gb/s (N4874A)<br>ESG E44838C with opt. 504 used as clock source |
| <b>Skew between data channels</b>       | 50 ps typ. <sup>3)4)</sup>   |
| <b>Delay = start delay + fine delay</b> | Can be specified as leading edge delay in fraction of bits in each channel   |
| <b>Start delay range</b>                | 0 ns to 200 ns   |
| <b>Fine delay range</b>                 | ±1 period <sup>5)</sup>  |
| <b>Delay resolution</b>                 | 1 ps   |
| <b>Delay accuracy</b>                   | ±25 ps ±50 ppm relative to zero-delay placement <sup>3)</sup>  |

Table 6: TMDS Signal Generator: timing specifications

- 1) 33250A Arbitrary Waveform Generator needed for jitter injection
- 2) E4438C ESG Vector Signal Generator needed for jitter injection
- 3) After cable deskewing at customer levels and unchanged system frequency.
- 4) @ 25 °C to 40 °C ambient temperature
- 5) Can be changed without stopping the system

| <b>E4887A-037 (E4861B/62B)</b>       |   |
|--------------------------------------|---|
| <b>Output</b>                        | Differential or single ended, 3.5 mm(f)   |
| <b>Impedance</b>                     | 50 Ω typ.   |
| <b>Output amplitude / resolution</b> | 0.05 Vpp to 1.8 Vpp / 10 mV   |
| <b>Output voltage window</b>         | -2 V to +3.5 V; for higher outputs use recommend Bias Tee 5542-211 from Picosecond Pulse Labs <sup>1)</sup> |
| <b>Data formats</b>                  | NRZ, DNRZ   |
| <b>Transition times 20% to 80%</b>   | <75 ps  |
| <b>Intrinsic jitter</b>              | <30 ps peak to peak typ. <sup>2)</sup>  |

Table 7: TMDS Signal Generator: output specifications

- 1) Voltage window direct at module output is -2 V to +3.5 V; DC power supply needed with Bias Tee. For output voltage > 3 V the termination voltage > 3 V needs to be applied
- 2) Measured with E4808A Clock Module, spec as intra channel jitter

| <b>E4887A-037</b>                           |  |
|---|--|
| <b>PRBS / PRWS</b>                          | 2 <sup>n</sup> -1<br>n = 7, 9, 10, 11, 15, 23, 31              |
| <b>Errored PRBS / PRWS</b>                  | 2 <sup>n</sup> -1<br>n = 7, 9, 10, 11, 15                      |
| <b>Extended ones or zeroes</b>              | 2 <sup>n</sup> -1<br>n = 7, 9, 10, 11, 15                      |
| <b>User definable memory based patterns</b> | Up to 16 Mbit  |
| <b>Video formats</b>                        | See table 4, requires E4887A-207 HDMI frame generator software |

Table 8: TMDS Signal Generator: pattern and video formats

## Economic High Speed Test up to 3.4 Gb/s E4887A-003 Signal Generator

The economic E4887A-003 Signal Generator provides compliant HDMI sink testing for HDMI devices from 740 Mbit up to 3.4 Gb/s and does fully follow the test requirements of the HDMI CTS specification. Independent jitter injection on TMDS clock and TMDS data is provided as well as jitter injection of clock and data jitter components on the TMDS clock.

Jitter Tolerance capabilities are provided:

- Combined and separate Jitter tolerance compliance starting at 74 MHz pixel clock
- Combined and separate Jitter tolerance characterization starting at 148 MHz pixel clock

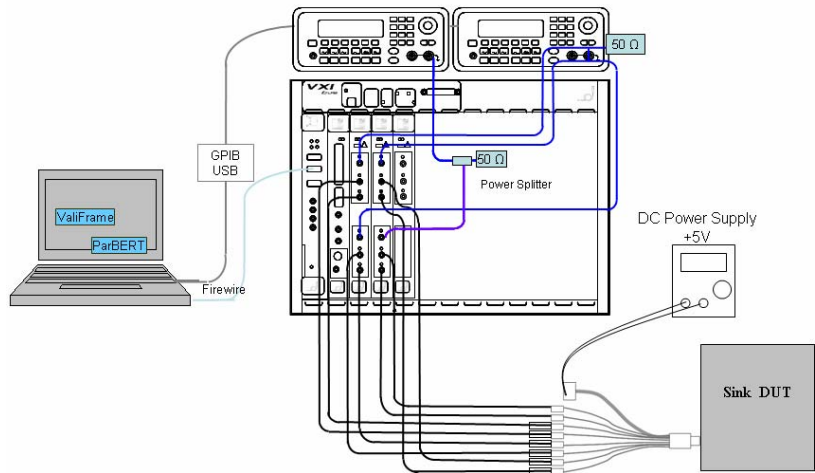


Figure 5: Test Setup up to 3.4Gb/s

### Instruments

1x E4887A-003  
2x 33250A  
1x E3646A

HDMI signal generator max. bit rate 3.4 Gb/s  
Arbitrary Waveform Generator up to 80 MHz  
DC power supply, dual output, dual range

### Software

1x E4887A-207

HDMI frame generator software for E4887A

### Accessories

Agilent Technologies:

1x E4887A-303

Accessory and cable kit for E4887A-003

1x N1080A-H01

Test point access adapter plug

1x N1080A-H02

Test point access adapter receptacle

2 units needed for cable test  
Low frequency control board

1x N1080A-H03

BitifEye Digital Test Solutions ([www.bitifeye.com](http://www.bitifeye.com)):

1x BIT-HDMI-BTK-0003

Bias Tee kit for E4887A-007, required

For additional accessories, see the E4887A ordering instructions on page 19.

### Additional for compliance sink and source testing

1x DS080000

Real-time Oscilloscope

1x N5399A

HDMI software package for DS080000

1x N5990A

Test Automation Platform with options-010, -150, -250, and -001 recommended

For more details on the cable emulators and accessories see pages 15 and 16

| <b>E4887A-003</b>                       |  |
|---|--|
| <b>Frequency range</b>                  | 20.843 Mb/s to 3.4 Gb/s (E4861B/E4862B) internal clock mode <sup>1)</sup>  |
| <b>Skew between data channels</b>       | 50 ps typ. <sup>2)3)</sup>   |
| <b>Delay = start delay + fine delay</b> | Can be specified as leading edge delay in fraction of bits in each channel |
| <b>Start delay range</b>                | 0 ns to 200 ns   |
| <b>Fine delay range</b>                 | ±1 period <sup>4)</sup>  |
| <b>Delay resolution</b>                 | 1 ps   |
| <b>Delay accuracy</b>                   | ±25 ps ±50 ppm relative to zero-delay placement <sup>3)</sup>              |

Table 9: 3.4 Gb/s Signal Generator: timing specifications

- 1) 33250A Arbitrary Waveform Generator needed for jitter injection
- 2) After cable deskewing at customer levels and unchanged system frequency.
- 3) @ 25 °C to 40 °C ambient temperature
- 4) Can be changed without stopping the system

| <b>E4887A-003</b>                    |   |
|--------------------------------------|---|
| <b>Output</b>                        | Differential or single ended, 3.5 mm(f)   |
| <b>Impedance</b>                     | 50 Ω typ.   |
| <b>Output amplitude / resolution</b> | 0.05 Vpp to 1.8 Vpp / 10 mV   |
| <b>Output voltage window</b>         | -2 V to +3.5 V; for higher outputs use recommend Bias Tee 5542-211 from Picosecond Pulse Labs <sup>1)</sup> |
| <b>Data formats</b>                  | NRZ, DNRZ   |
| <b>Transition times 20% to 80%</b>   | <75 ps  |
| <b>Intrinsic jitter</b>              | <30 ps peak to peak typ. <sup>2)</sup>  |

Table 10: 3.4 Gb/s Signal Generator: output specifications

- 1) Voltage window direct at module output is -2 V to +3.5 V; DC power supply needed with Bias Tee. For output voltage > 3 V the termination voltage > 3 V needs to be applied
- 2) Measured with E4808A clock module, spec as intra channel jitter

| <b>E4887A-003</b>                           |  |
|---|--|
| <b>PRBS / PRWS</b>                          | 2 <sup>n-1</sup><br>n = 7, 9, 10, 11, 15, 23, 31               |
| <b>Errored PRBS / PRWS</b>                  | 2 <sup>n-1</sup><br>n = 7, 9, 10, 11, 15                       |
| <b>Extended ones or zeroes</b>              | 2 <sup>n-1</sup><br>n = 7, 9, 10, 11, 15                       |
| <b>User definable memory based patterns</b> | Up to 16 Mbit  |
| <b>Video formats</b>                        | See table 4, requires E4887A-207 HDMI frame generator software |

Table 11: 3.4 Gb/s Signal Generator: pattern and video formats

## E4887A-203 HDMI Frame Generator Software

Select from a comprehensive variety of video modes. The HDMI Frame Generator software sets up the HDMI TMDS Signal Generator with the selected video frame and color depth in one click. It offers DVI compliant modes too.

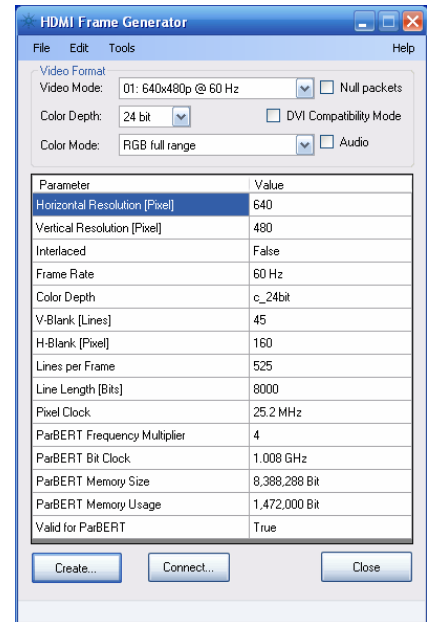
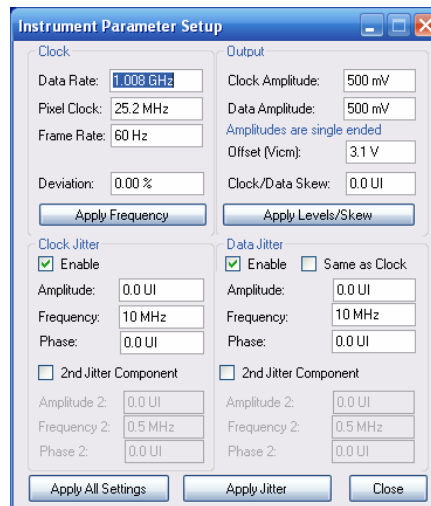


Figure 6: Push button video frame selection .



Control the TMDS Signal Generator conveniently from the instrument parameter screen of the frame generator software. Define clock and data swing or change the data rate. Select the jitter mix you need for your device.

Figure 7: Easy control of whole TMDS Signal Generator .

Create your own color scheme with the HDMI Frame Generator Software. Define start and end value for red, green and blue and look at the result with the preview screen, or simply select the compliance gray-scale scheme.

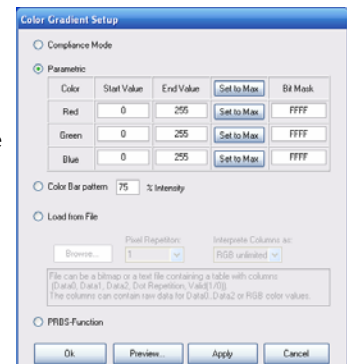


Figure 8 and 9: Compliant grayscale or colorful? Change the color scheme and look at the preview.

## Supported Video Modes by E4887A-207 (I)

| CEA Video Code | Format     | Frame Rate | Picture Aspect Ratio | 24 bit | 30 bit | 36 bit | 48 bit |
|----------------|------------|------------|----------------------|--------|--------|--------|--------|
| 1              | 640x480p   | 60 Hz      | 4:3                  | X      | X      | X      | X      |
| 2              | 720x480p   | 60 Hz      | 4:3                  | X      |        | X      | X      |
| 3              | 720x480p   | 60 Hz      | 16:9                 | X      |        | X      | X      |
| 4              | 1280x720p  | 60 Hz      | 16:9                 | X      |        | X      | X      |
| 5              | 1920x1080i | 60 Hz      | 16:9                 | X      | 3G     | X      | X      |
| 6              | 1440x480i  | 60 Hz      | 4:3                  | X      |        | X      | X      |
| 7              | 1440x480i  | 60 Hz      | 16:9                 | X      |        | X      | X      |
| 8              | 1440x240p  | 60.115 Hz  | 4:3                  | X      | X      | X      | X      |
| 9              | 1440x240p  | 59.886 Hz  | 16:9                 | X      | X      | X      | X      |
| 10             | 2880x480i  | 60 Hz      | 4:3                  | X      |        | X      | X      |
| 11             | 2880x480i  | 60 Hz      | 16:9                 | X      |        | X      | X      |
| 12             | 2880x240p  | 60.115 Hz  | 4:3                  | X      | X      | X      | X      |
| 13             | 2880x240p  | 59.886 Hz  | 16:9                 | X      | X      | X      | X      |
| 14             | 1440x480p  | 60 Hz      | 4:3                  | X      |        | X      | X      |
| 15             | 1440x480p  | 60 Hz      | 16:9                 | X      |        | X      | X      |
| 16             | 1920x1080p | 60 Hz      | 16:9                 | X      |        | X      | X      |
| 17             | 720x576p   | 50 Hz      | 4:3                  | X      | X      | X      | X      |
| 18             | 720x576p   | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 19             | 1280x720p  | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 20             | 1920x1080i | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 20             | 1920x1080i | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 21             | 1440x576i  | 50 Hz      | 4:3                  | X      | X      | X      | X      |
| 22             | 1440x576i  | 50 Hz      | 4:3                  | X      | X      | X      | X      |
| 23             | 1440x288p  | 50.08 Hz   | 4:3                  | X      | X      | X      | X      |
| 24             | 1440x288p  | 49.761 Hz  | 16:9                 | X      | X      | X      | X      |
| 24             | 1440x288p  | 50.92 Hz   | 16:9                 | X      | X      | X      | X      |
| 25             | 2880x576i  | 50 Hz      | 4:3                  | X      | X      | X      | X      |
| 26             | 2880x576i  | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 27             | 2880x288p  | 50.08 Hz   | 4:3                  | X      | X      | X      | X      |
| 28             | 2880x288p  | 49.761 Hz  | 16:9                 | X      | X      | X      | X      |
| 28             | 2880x288p  | 49.92 Hz   | 16:9                 | X      | X      | X      | X      |
| 29             | 1440x576p  | 50 Hz      | 4:3                  | X      | X      | X      | X      |
| 30             | 1440x576p  | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 31             | 1920x1080p | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 32             | 1920x1080p | 23.976 Hz  | 16:9                 | X      |        |        | X      |
| 32             | 1920x1080p | 24 Hz      | 16:9                 | X      |        |        | X      |
| 33             | 1920x1080p | 25 Hz      | 16:9                 | X      | X      | X      | X      |
| 34             | 1920x1080p | 29.976 Hz  | 16:9                 | X      | X      | X      | X      |
| 34             | 1920x1080p | 30 Hz      | 16:9                 | X      | X      | X      | X      |
| 35             | 2880x480p  | 60 Hz      | 4:3                  | X      |        | X      | X      |
| 36             | 2880x480p  | 60 Hz      | 4:3                  | X      |        | X      | X      |
| 37             | 2880x576p  | 50 Hz      | 4:3                  | X      | X      | X      | X      |
| 38             | 2880x576p  | 50 Hz      | 4:3                  | X      | X      | X      | X      |

Table 12: E4887A-207 Frame Generator Software: available video formats

„X“ -> This video mode is supported by E4887A-007; -037; -003

„3G“ -> This video mode is supported by E4887A-003; -037

## Supported Video Modes by E4887A-207 (II)

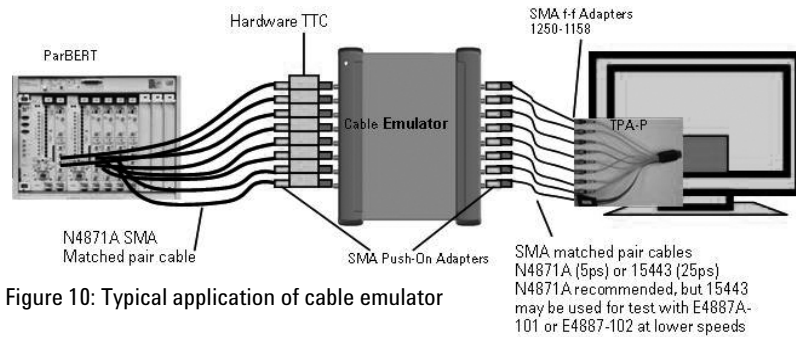
| CEA Video Code | Format     | Frame Rate | Picture Aspect Ratio | 24 bit | 30 bit | 36 bit | 48 bit |
|----------------|------------|------------|----------------------|--------|--------|--------|--------|
| 39             | 1920x1080i | 50 Hz      | 16:9                 | X      | X      | X      | X      |
| 40             | 1920x1080i | 100 Hz     | 16:9                 | X      | X      | X      | X      |
| 41             | 1280x720p  | 100 Hz     | 16:9                 | X      |        | X      | X      |
| 42             | 720x576p   | 100 Hz     | 4:3                  | X      | X      | X      | X      |
| 43             | 720x576p   | 100 Hz     | 16:9                 | X      | X      | X      | X      |
| 44             | 1440x576i  | 100 Hz     | 4:3                  | X      | X      | X      | X      |
| 45             | 1440x576i  | 100 Hz     | 16:9                 | X      | X      | X      | X      |
| 46             | 1920x1080i | 119.88 Hz  | 16:9                 | X      |        | X      | X      |
| 46             | 1920x1080i | 120 Hz     | 16:9                 | X      |        | X      | X      |
| 47             | 1280x720p  | 119.88 Hz  | 16:9                 | X      |        |        | X      |
| 47             | 1280x720p  | 120 Hz     | 16:9                 | X      |        |        | X      |
| 48             | 720x480p   | 119.88 Hz  | 4:3                  | X      |        | 3G     | X      |
| 48             | 720x480p   | 120 Hz     | 4:3                  | X      |        | 3G     | X      |
| 49             | 720x480p   | 119.88 Hz  | 4:3                  | X      |        | 3G     | X      |
| 49             | 720x480p   | 120 Hz     | 4:3                  | X      |        | 3G     | X      |
| 50             | 1440x480i  | 119.88 Hz  | 4:3                  | X      |        | 3G     | X      |
| 50             | 1440x480i  | 120 Hz     | 4:3                  | X      |        | 3G     | X      |
| 51             | 1440x480i  | 119.88 Hz  | 4:3                  | X      |        | 3G     | X      |
| 51             | 1440x480i  | 120 Hz     | 4:3                  | X      |        | 3G     | X      |
| 52             | 720x576p   | 200 Hz     | 4:3                  | X      | X      | X      | X      |
| 53             | 720x576p   | 200 Hz     | 16:9                 | X      | X      | X      | X      |
| 54             | 1440x576i  | 200 Hz     | 4:3                  | X      | X      | X      | X      |
| 55             | 1440x576i  | 200 Hz     | 4:3                  | X      | X      | X      | X      |
| 56             | 720x480p   | 240 Hz     | 4:3                  | X      |        |        | X      |
| 57             | 720x480p   | 240 Hz     | 16:9                 | X      |        |        | X      |
| 58             | 1440x480i  | 240 Hz     | 4:3                  | X      |        |        | X      |
| 59             | 1440x480i  | 240 Hz     | 16:9                 | X      |        |        | X      |

Table 13: E4887A-207 Frame Generator Software: available video formats

„X“ -> This video mode is supported by E4887A-007; -037; -003  
 „3G“ -> This video mode is supported by E4887A-003; -037

## E4887A-10x Series Cable Emulator

The E4887A-10x series will offer different cable emulators for compliant jitter tolerance testing. Each cable emulator is packaged and has 3.5 mm (f) connectors for TMDS clock and all three TMDS data lanes. Each lane is differential and matched in length.



The cable emulators are offered in 3 versions:

E4887A-101 CTS 1.3 low frequency  $\leq 74.25$  MHz

E4887A-102 CTS 1.3 high frequency  $> 74.25$  MHz

E4887A-104 CTS 1.3 compliant passive EQ cable emulator

The -101 emulates a CAT 1 reference cable, while -102 emulates a CAT 2 reference cable.



Figure 11: Cable Emulator

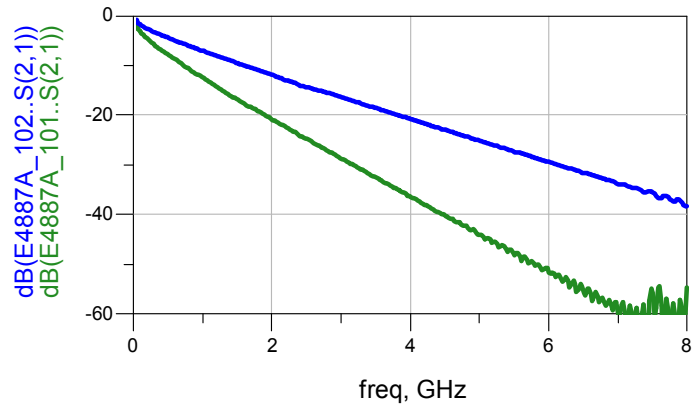


Figure 12: Frequency characteristics of average trace

Table 14: Detailed specification

|                           | <b>E4887A-101 *</b> | <b>E4887A-102 **</b> |
|---------------------------|---------------------|----------------------|
| <b>Intra-Pair Skew</b>    | ≤ 50 ps             | ≤ 15 ps              |
| <b>Inter-Pair Skew</b>    | < 250 ps            | < 100 ps             |
| <b>Amplitude matching</b> | < 2%                | < 2 %                |
| <b>Amplitude accuracy</b> | < 5 %               | < 7 %                |

\* measured at 742.5 Mb/s using 1-0 pattern

\*\* measured at 3400 Mb/s using 1-0 pattern



## E4887A-007 Ordering Instructions

### High resolution HDMI TMDS Signal Generator

620 Mb/s to 7 Gb/s

Includes: 2x E4809A; 5x N4874A; 1x E4875A;  
1x 81250A-149; 1x 81250A-013; 1x E4809A-001;  
1x 81250A-015

**E4887A-007**

### Vector signal generator for jitter injection

ESG Vector Signal Generator

250 kHz to 6 GHz, require option –UNJ

250 kHz to 4 GHz

Internal baseband generator

Enhanced phase noise

**E4438C**

**E4438C-506**

**E4438C-504**

**E4438C-601**

**E4438C-UNJ**

### Frame generator software

For TMDS Signal Generator E4887A-007

**E4887A-207**

### Accessories and cables

Agilent Technologies:

Accessory and cable kit for E4887A-007

**E4887A-308**

Includes: 11x N4912A; 5x N4871A; 2x 15442A; 1x1250-2015; 1x 8710-1582  
2x 1250-1744; 8x 83059B; 2x 8120-1839; 1x 1250-2206; 3x 1250-1698

CTS 1.3 low frequency cable emulator

**E4887A-101**

CTS 1.3 high frequency cable emulator

**E4887A-102**

Passive equalizer cable emulator (8pieces)

**E4887A-104**

HDMI test point access, plug

**N1080A-H01**

HDMI test point access, receptacle

**N1080A-H02**

HDMI Low Speed Board

**N1080A-H03**

BitifEye Digital Test Solutions ([www.bitifeye.com](http://www.bitifeye.com)):

Bias Tee kit for E4887A-007

**BIT-HDMI-BTK-0001**

Transition time converter kit for E4887A-007

**BIT-HDMI-TTC-0002**

Test automation cable kit for E4887A-007

**BIT-HDMI-TAK-0001**

Snap-on connector kit for E4887A-007

**BIT-HDMI-SCK-0003**

Low speed connector kit for N1080A-H03

**BIT-HDMI-LSK-0001**

### DC-Power supply

Dual output, 0-8V and 0-20V / 1.5A, 60W, GPIB

**E3646A**

### For HDMI compliance testing:

Real-Time Oscilloscope

**DSO80000 or higher**

Differential probes and probe heads

**1169A, N5380A**

HDMI software package for DSO80000

**N5399A**

Test automation platform

**N5990A-010**

HDMI sink test

**N5990A-150**

Interface to N5399A HDMI software

**N5990A-250**

Recommended: Data base interface

**N5990A-001**

### Specification assumptions

The specifications in this data sheet describe the instrument's warranted performance. Non-warranted values are stated as typical (typ.).

All specifications are valid from 10 °C to 40 °C ambient temperature after a 30 minute warm-up phase, with outputs and inputs terminated with 50 Ω to ground at ECL levels if not specified otherwise.

## E4887A-037 Ordering Instructions

### Standard compliant and characterisation tester

20.834 Mb/s to 3.4 Gb/s Data **E4887A-037**  
620Mb/s to 7Gb/s Clock  
Includes: 1xE4808A; 2x E4861B; 4x E4862B;  
1x E4809A; 1x N4874A; 1x E4875A;  
1x 81250A-149; 1x 81250A-013; 1x E4809A-001;  
1x 81250A-015

### Signal generator for jitter injection

ESG Vector Signal Generator **E4438C**  
250 kHz to 6 GHz, require option –UNJ **E4438C-506**  
250 kHz to 4 GHz **E4438C-504**  
Internal baseband generator **E4438C-601**  
Enhanced phase noise **E4438C-UNJ**

Arbitrary Waveform Generator **33250A**

### Frame generator software

For TMDs Signal Generator E4887A-037 **E4887A-207**

### Accessories and cables

Agilent Technologies:

Accessory and cable kit for E4887A-037 **E4887A-309**

Includes: 2x N4912A; 5x N4871A; 3x 15442A; 1x 1250-1744;  
8x 83059B; 2x 1250-2015; 6x 1250-1698; 2x 1250-2206; 1x 8710-1582

CTS 1.3 low frequency cable emulator **E4887A-101**

CTS 1.3 high frequency cable emulator **E4887A-102**

Passive equalizer cable emulator (8pieces) **E4887A-104**

HDMI test point access, plug **N1080A-H01**

HDMI test point access, receptacle **N1080A-H02**

HDMI Low Speed Board **N1080A-H03**

BitifEye Digital Test Solutions ([www.bitifeye.com](http://www.bitifeye.com)):

Bias Tee kit for E4887A-037 **BIT-HDMI-BTK-0004**

Transition time converter kit for E4887A-037 **BIT-HDMI-TTC-0004**

Test automation cable kit for E4887A-037 **BIT-HDMI-TAK-0004**

Snap-on connector kit for E4887A-037 **BIT-HDMI-SCK-0004**

Low speed connector kit for N1080A-H03 **BIT-HDMI-LSK-0001**

### DC-Power supply

Dual output, 0-8V and 0-20V / 1.5A, 60W, GPIB **E3646A**

### For HDMI compliance testing:

Real-Time oscilloscope **DSO80000 or higher**

Differential probes and probe heads **1169A, N5380A**

HDMI software package for DSO80000 **N5399A**

Test automation platform **N5990A-010**

HDMI sink test **N5990A-150**

Interface to N5399A HDMI software **N5990A-250**

Recommended: Data base interface **N5990A-001**

### Specification assumptions

The specifications in this data sheet describe the instrument's warranted performance. Non-warranted values are stated as typical (typ.).

All specifications are valid from 10 °C to 40 °C ambient temperature after a 30 minute warm-up phase, with outputs and inputs terminated with 50 Ω to ground at ECL levels if not specified otherwise.

## E4887A-003 Ordering Instructions

### Economic high speed tester up to 3.4Gb/s

20.834 Mb/s to 3.4 Gb/s Data + Clock  
Includes: 1xE4808A; 3x E4861B; 5x E4862B;  
1x E4875A; 1x 81250A-149; 1x 81250A-013;  
1x 81250A-015; 1x E4809A-001

**E4887A-003**

### Signal generator for jitter injection

Arbitrary Waveform Generator

**33250A**

### Frame generator software

For TMD5 Signal Generator E4887A-003

**E4887A-207**

### Accessories and cables

Agilent Technologies:

Accessory and cable kit for E4887A-003 **E4887A-303**  
Includes: 5x N4871A; 3x 15442A; 8x 83059B; 1x 8710-1582  
1x 11636B; 3x 1250-2015; 6x 1250-1698; 2x 1250-2206

CTS 1.3 low frequency cable emulator **E4887A-101**  
CTS 1.3 high frequency cable emulator **E4887A-102**  
Passive equalizer cable emulator (8pieces) **E4887A-104**  
HDMI test point access, plug **N1080A-H01**  
HDMI test point access, receptacle **N1080A-H02**  
HDMI Low Speed Board **N1080A-H03**

BitifEye Digital Test Solutions ([www.bitifeye.com](http://www.bitifeye.com)):

Bias Tee kit for E4887A-003 **BIT-HDMI-BTK-0003**<sup>2)</sup>  
Transition time converter kit for E4887A-003 **BIT-HDMI-TTC-0003**  
Test automation cable kit for E4887A-003 **BIT-HDMI-TAK-0003**  
Snap-on connector kit for E4887A-003 **BIT-HDMI-SCK-0003**  
Low speed connector kit for N1080A-H03 **BIT-HDMI-LSK-0001**

### DC-Power supply

Dual output, 0-8V and 0-20V / 1.5A, 60W, GPIB

**E3646A**

### For HDMI compliance testing:

Real-Time oscilloscope **DSO80000**  
HDMI software package for DSO80000 **N5399A**  
Test automation platform **N5990A-010**  
HDMI sink test **N5990A-150**  
Interface to N5399A HDMI software **N5990A-250**  
Test automation data base interface **N5990A-001**

### Specification assumptions

The specifications in this data sheet describe the instrument's warranted performance. Non-warranted values are stated as typical (typ.).

All specifications are valid from 10 °C to 40 °C ambient temperature after a 30 minute warm-up phase, with outputs and inputs terminated with 50 Ω to ground at ECL levels if not specified otherwise.

<sup>2)</sup> for 1.2 V swing amplitude in test 8-5



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### Related Literature

### Pub. No.

|  |                    |
|--|--------------------|
| ParBERT 81250<br>Product Overview                        | <b>5968-9188E</b>  |
| HDMI Jitter Tolerance<br>Testing<br>Application Note     | <b>5989-4959EN</b> |
| E4438C ESG Vector<br>Signal Generator<br>Data Sheet      | <b>5988-4039EN</b> |
| E364xA DC Power<br>Supplies<br>Data Sheet                | <b>5968-7355EN</b> |
| N5990A Test Auto-<br>mation Software<br>Data Sheet       | <b>5989-5483EN</b> |
| Infiniium 8000 Series<br>Oscilloscopes<br>Data Sheet     | <b>5989-1487EN</b> |
| N5399A HDMI Electri-<br>cal Performance SW<br>Data Sheet | <b>5989-3047EN</b> |

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