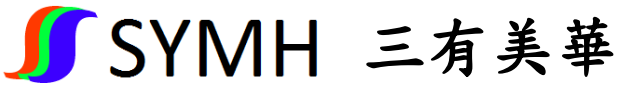

# Tools for DisplayPort™ Testing

Juha Saarinen, Unigraf

Ping Wang, SYMH Technology Inc
Unigraf Support Center in Taiwan



# Agenda

- Unigraf DisplayPort CTS test HW & SW tools

- LL CTS testing for DisplayPort Sources
- AUX Channel Monitor
- LL CTS testing for DisplayPort Sinks

- Link level debugging tools at RD level
- Testing at video & audio level

- Accessories for PHY Testing using Agilent TE
- Full test automation capabilities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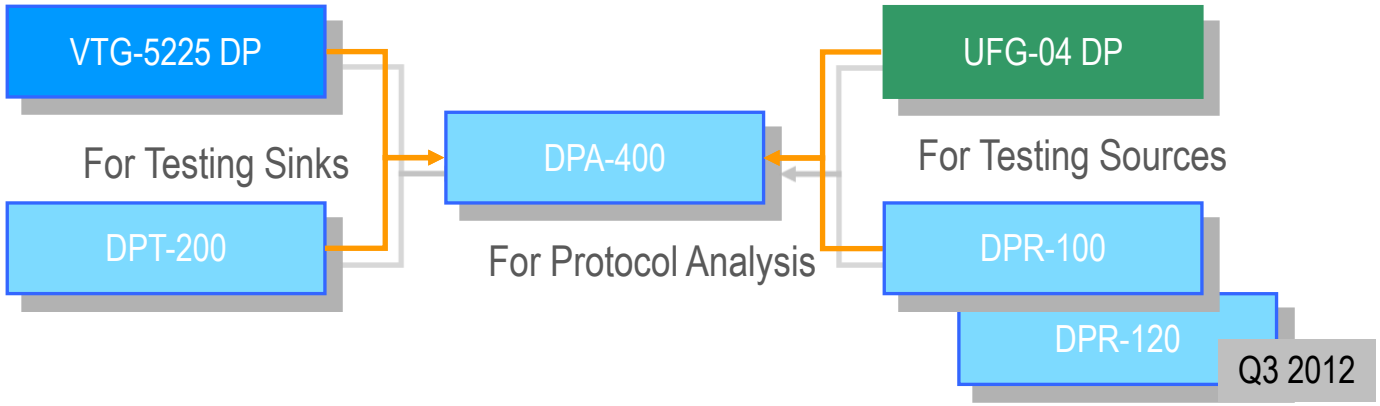
# Unigraf DisplayPort HW set




- VTG-5225 DP: Reference Source w/ full featured PG
- DPT-200: Compact sized Reference Source
- UFG-04 DP: Reference Sink w/ full featured grabber
- DPR-100: Compact sized Reference Sink
- DPA-400: DP AUX channel monitor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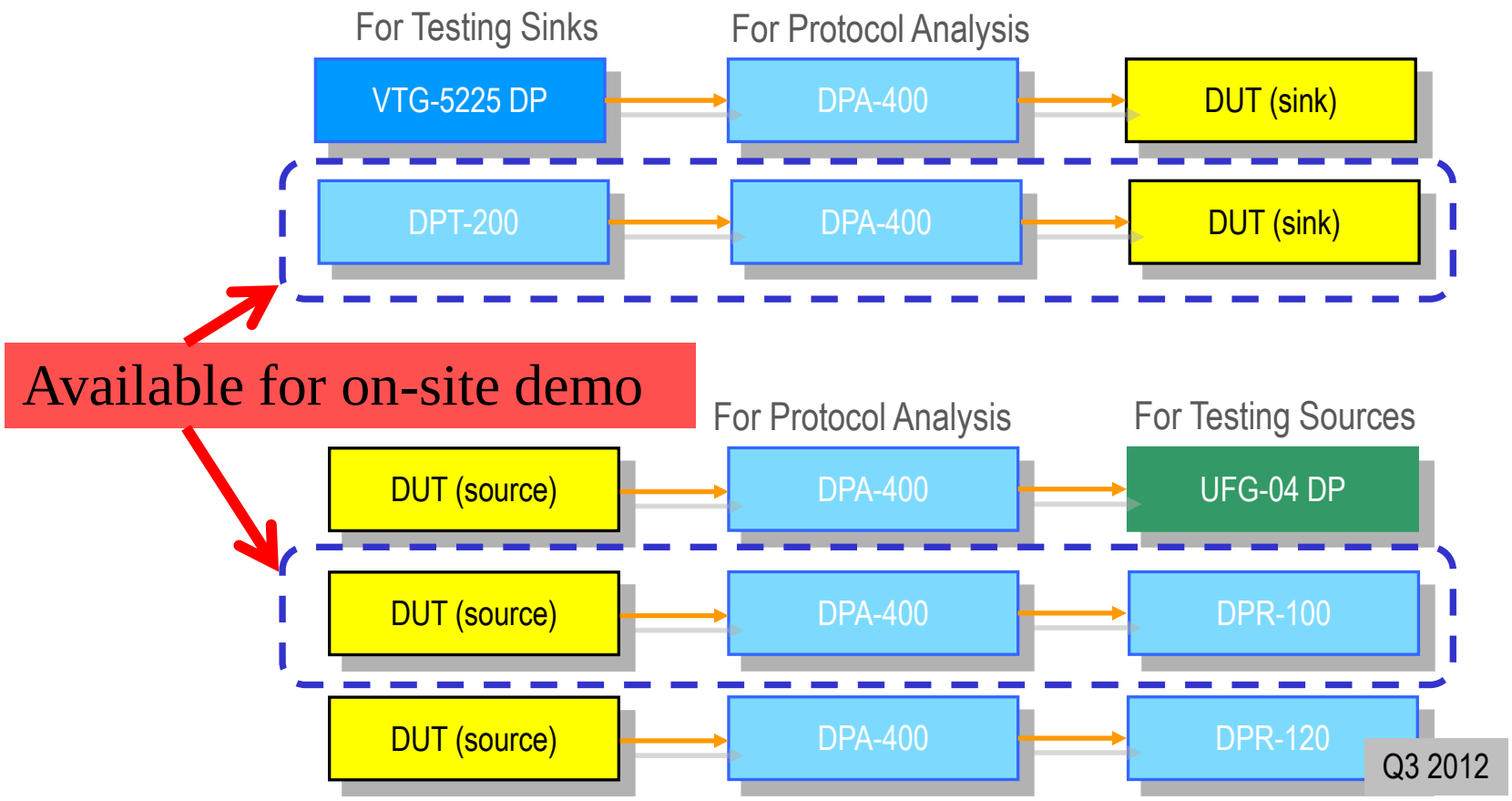
# Unigraf DisplayPort HW set

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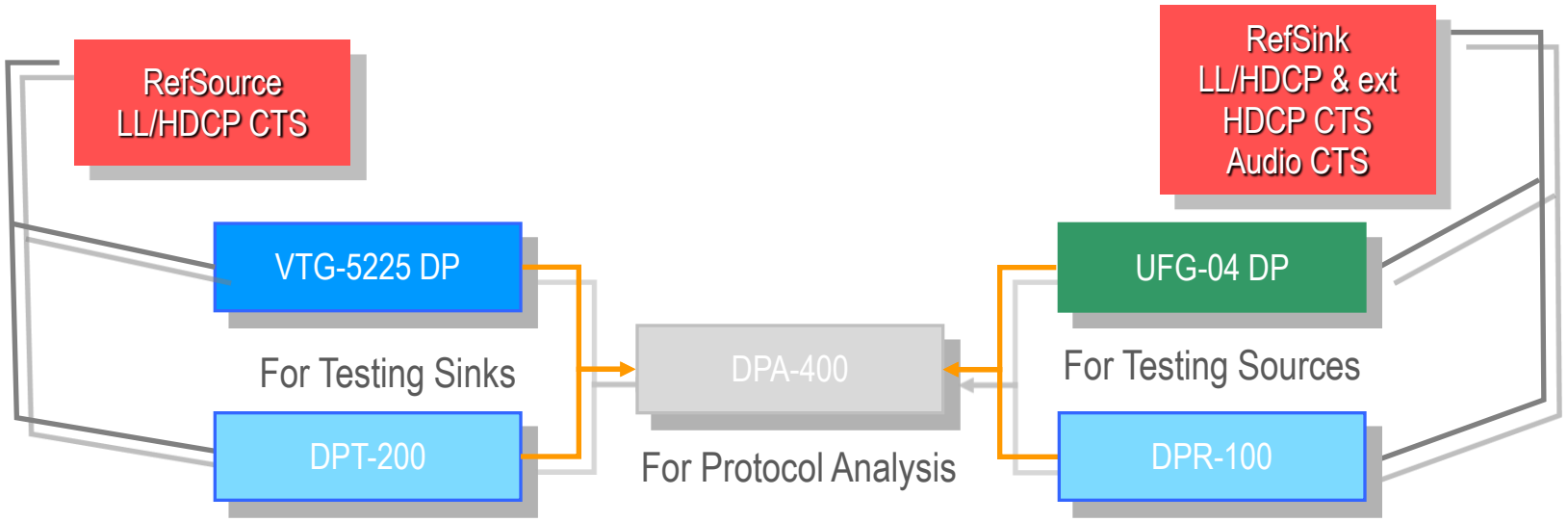
# Available CTS




- RefSource LL / HDCP CTS Tool (VTG-5225 and DPT-200)
- RefSink LL / HDCP CTS Tool (UFG-04 and DPR-100)
- RefSink Extended HDCP CTS Tool for repeater devices (UFG-04 and DPR-100)
- **Certified for ATC (Authorized Test Center)**

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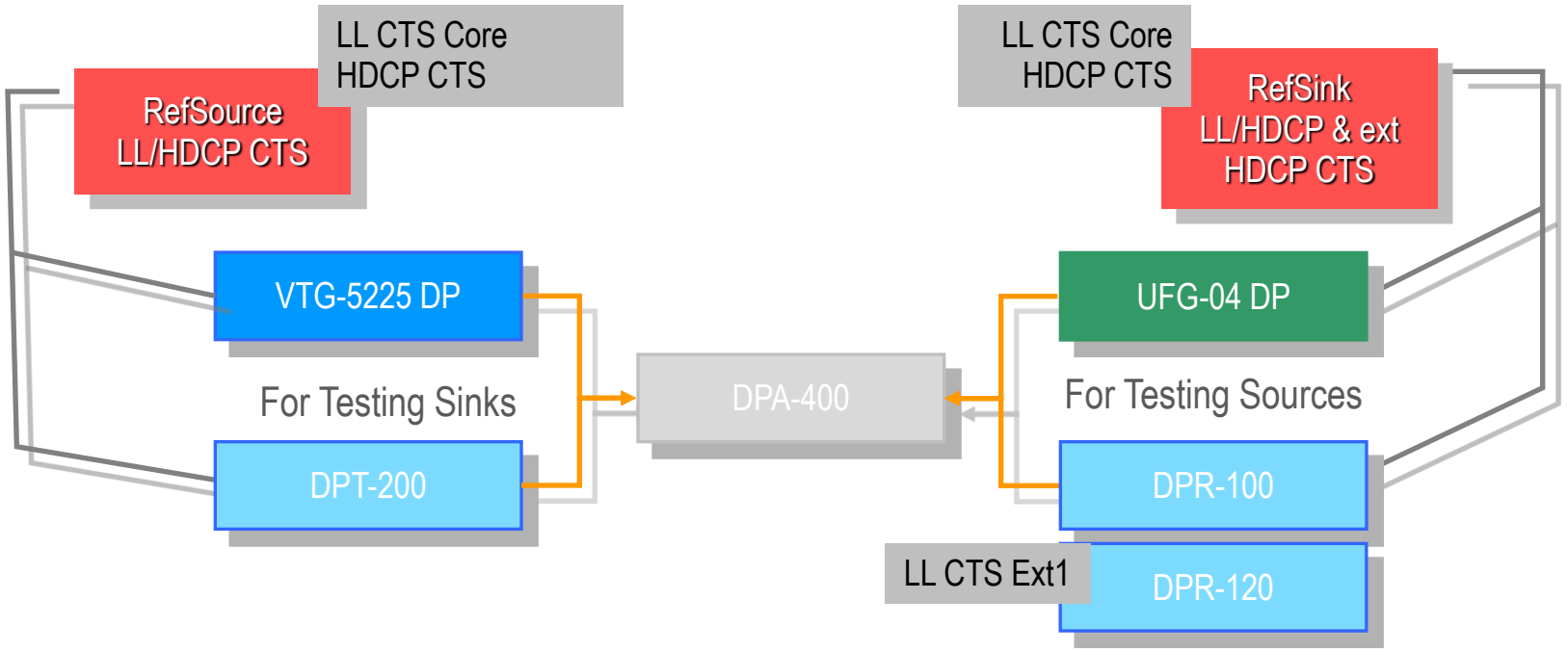
# Roadmap for DP 1.2 CTS




- Existing HW and SW will be used with DP 1.2 LL CTS Core tests
- Existing HW and SW will be used with DP 1.2 HDCP tests
- DP 1.2 RefSink CTS Ext 1 available Q4 2012

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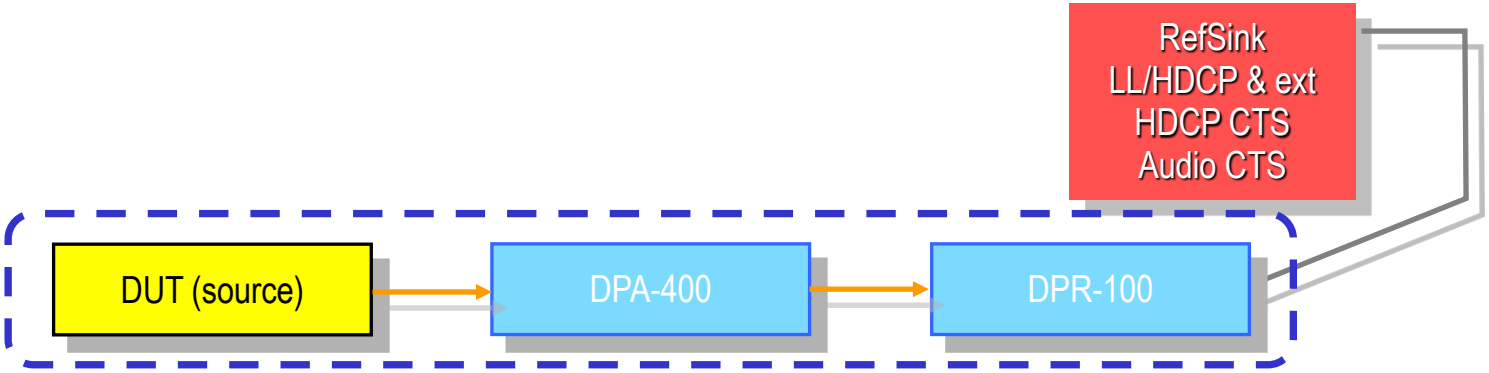
# Link Layer Testing for DisplayPort Sources




- A series of tests that check EDID, Link Training, Video and Audio
- Application is automated, may run all or selected tests
- Summary and details are in a single report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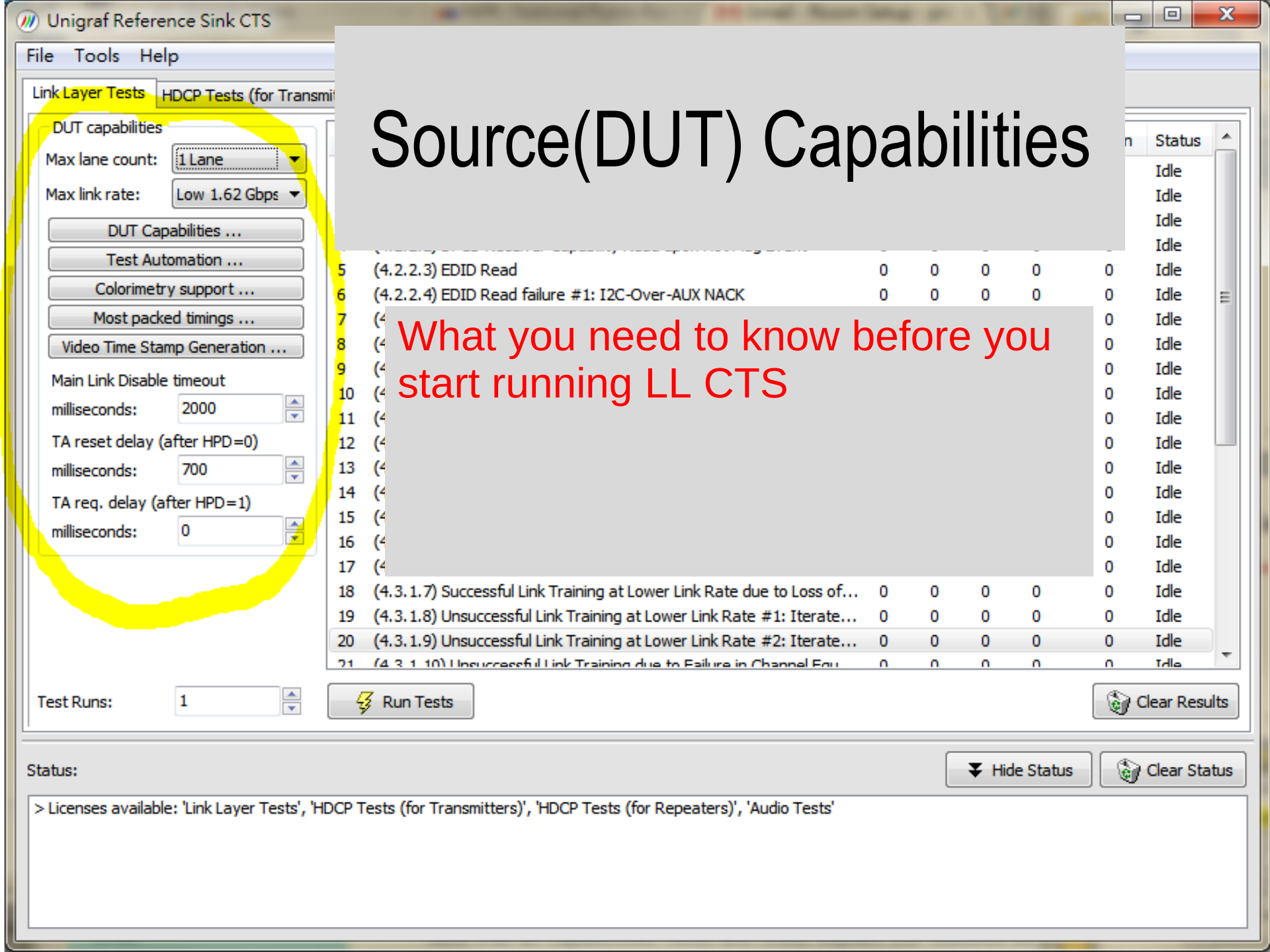
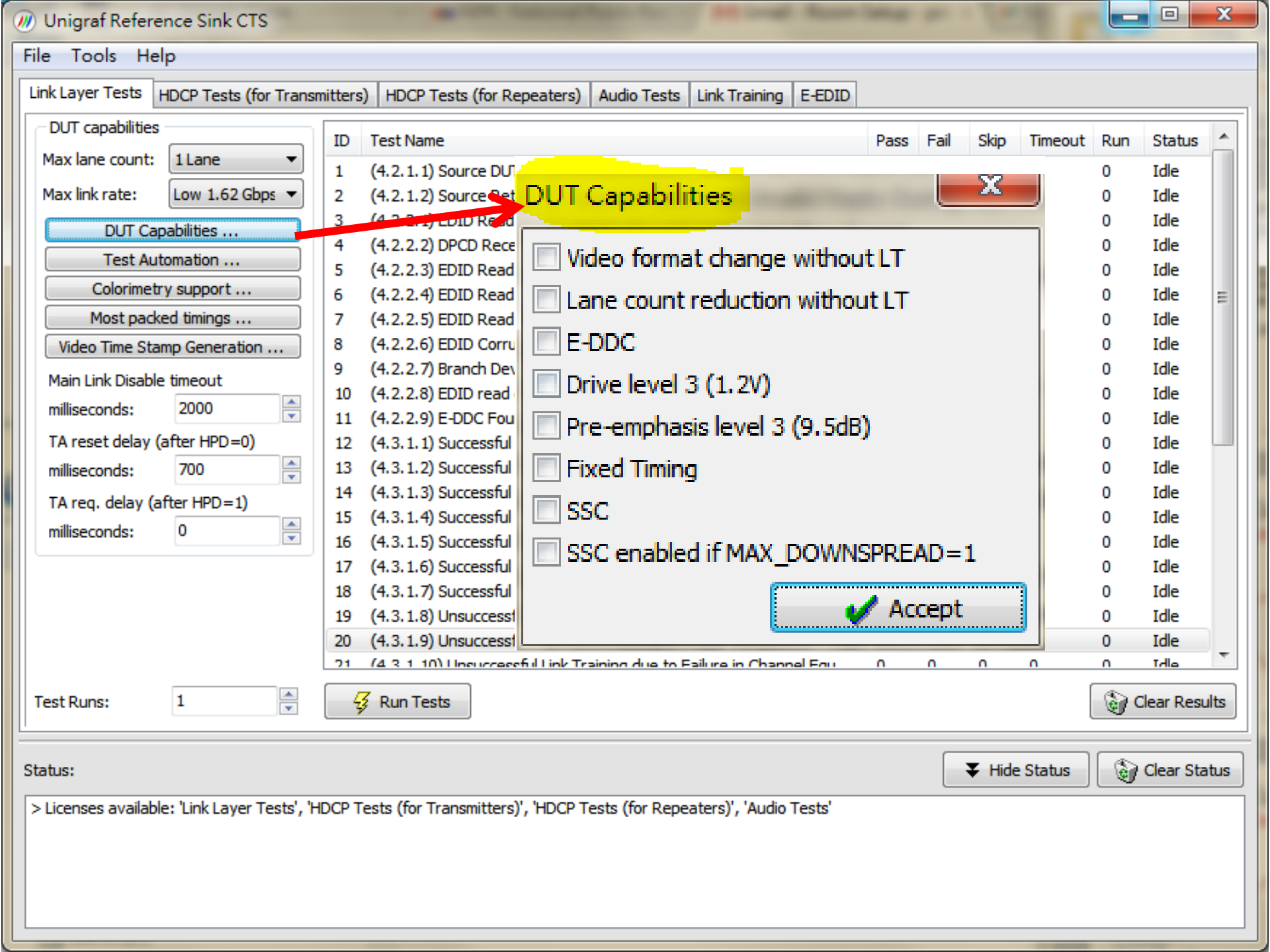
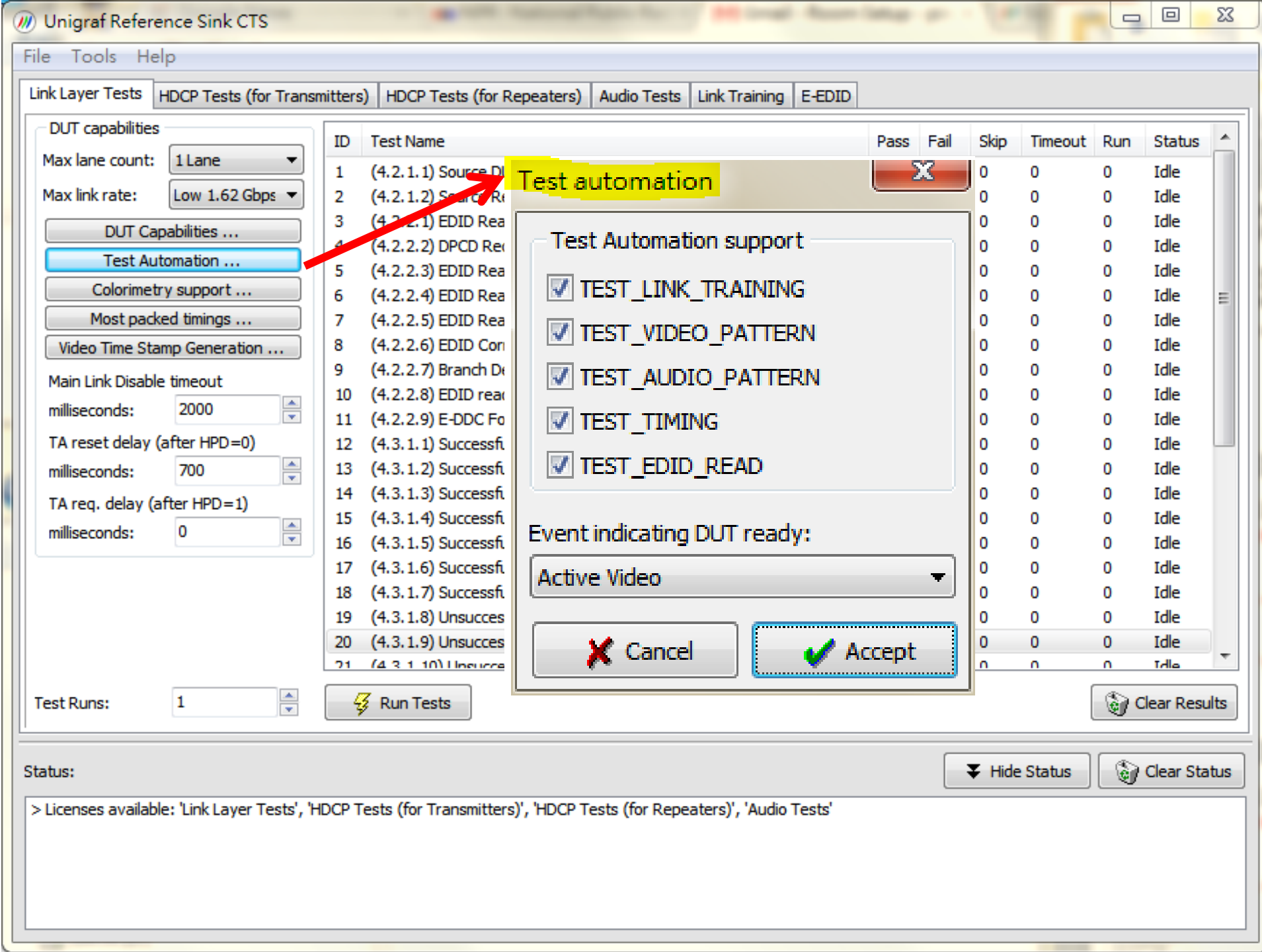



# Source(DUT) Capabilities

What you need to know before you start running LL CTS


Unigraf Reference Sink CTS
File
Tools
Help
Link Layer Tests
HDCP Tests (for Transmitters)
HDCP Tests (for Repeaters)
Audio Tests
Link Training
E-EDID
DUT capabilities
Max lane count:
1 Lane
Max link rate:
Low 1.62 Gbps
DUT Capabilities ...
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds:
2000
TA reset delay (after HPD=0)
milliseconds:
700
TA req. delay (after HPD=1)
milliseconds:
0
ID
Test Name
Pass
Fail
Skip
Timeout
Run
Status
1 (4.2.1.1) Source DUT 0 Idle
2 (4.2.1.2) Source Det 0 Idle
3 0 Idle
4 (4.2.2.2) DPCD Rece 0 Idle
5 (4.2.2.3) EDID Read 0 Idle
6 (4.2.2.4) EDID Read 0 Idle
7 (4.2.2.5) EDID Read 0 Idle
8 (4.2.2.6) EDID Corru 0 Idle
9 (4.2.2.7) Branch Dev 0 Idle
10 (4.2.2.8) EDID read 0 Idle
11 (4.2.2.9) E-DDC Fou 0 Idle
12 (4.3.1.1) Successful 0 Idle
13 (4.3.1.2) Successful 0 Idle
14 (4.3.1.3) Successful 0 Idle
15 (4.3.1.4) Successful 0 Idle
16 (4.3.1.5) Successful 0 Idle
17 (4.3.1.6) Successful 0 Idle
18 (4.3.1.7) Successful 0 Idle
19 (4.3.1.8) Unsuccessf 0 Idle
20 (4.3.1.9) Unsuccessf 0 Idle
21 (4.3.1.10) Unsuccessful Link Training due to Failure in Channel Equ 0 0 0 0 Idle
DUT Capabilities
Video format change without LT
Lane count reduction without LT
E-DDC
Drive level 3 (1.2V)
Pre-emphasis level 3 (9.5dB)
Fixed Timing
SSC
SSC enabled if MAX_DOWNSPREAD=1
Accept
Test Runs:
1
Run Tests
Clear Results
Status:
Hide Status
Clear Status
> Licenses available: 'Link Layer Tests', 'HDCP Tests (for Transmitters)', 'HDCP Tests (for Repeaters)', 'Audio Tests'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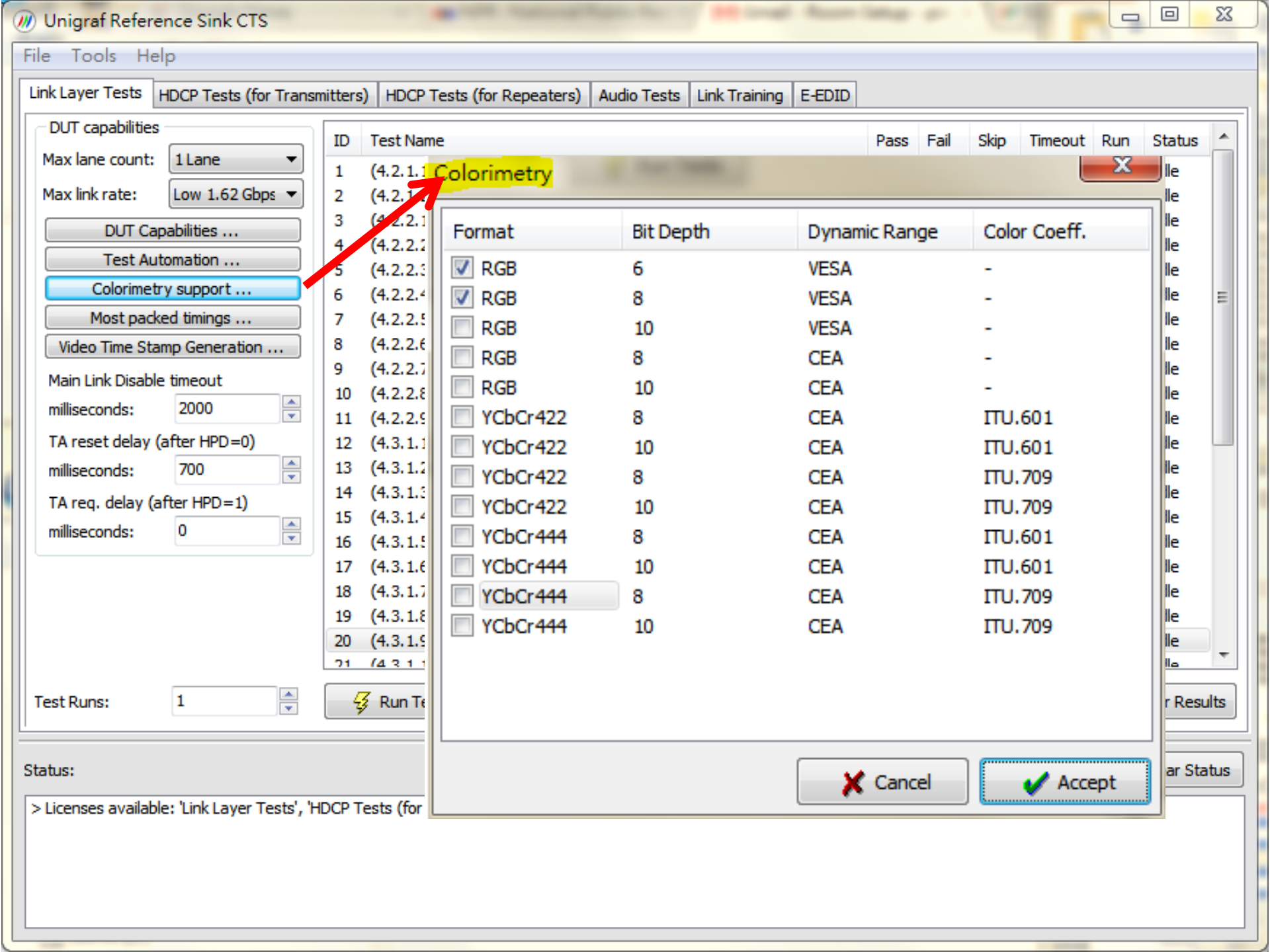
Main Link Disable timeout
milliseconds:
2000
TA reset delay (after HPD=0)
milliseconds:
700
TA req. delay (after HPD=1)
milliseconds:
0
ID
Test Name
Pass
Fail
Skip
Timeout
Run
Status
Test automation
Test Automation support
TEST_LINK_TRAINING
TEST_VIDEO_PATTERN
TEST_AUDIO_PATTERN
TEST_TIMING
TEST_EDID_READ
Event indicating DUT ready:
Active Video
Cancel
Accept
Test Runs:
1
Run Tests
Clear Results
Status:
Hide Status
Clear Status
> Licenses available: 'Link Layer Tests', 'HDCP Tests (for Transmitters)', 'HDCP Tests (for Repeaters)', 'Audio Tests'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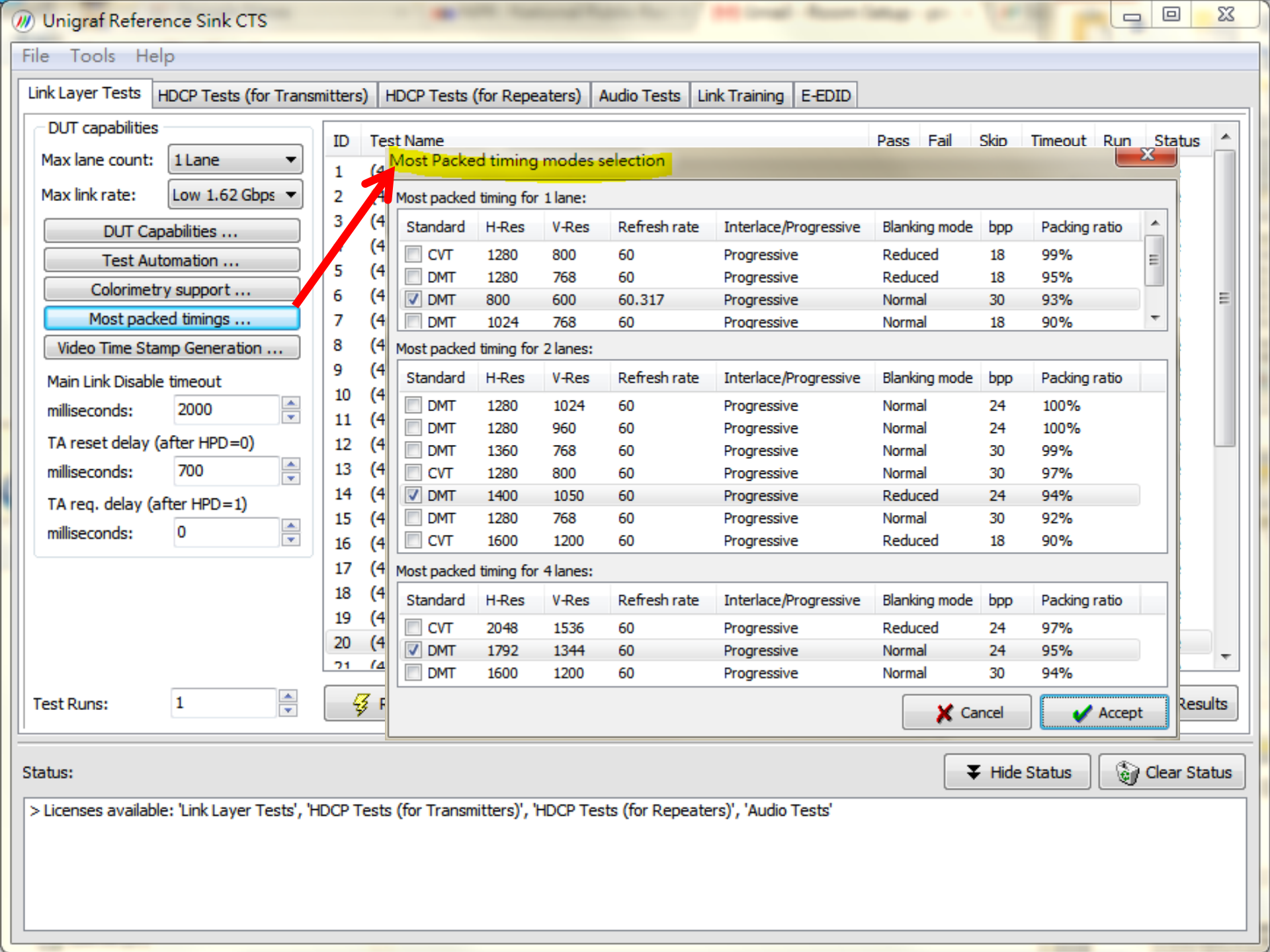
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds:
2000
TA reset delay (after HPD=0)
milliseconds:
700
TA req. delay (after HPD=1)
milliseconds:
0
Test Runs:
1
Run Te
ID
Test Name
Pass
Fail
Skip
Timeout
Run
Status
Colorimetry
Format
Bit Depth
Dynamic Range
Color Coeff.
RGB 6 VESA -
RGB 8 VESA -
RGB 10 VESA -
RGB 8 CEA -
RGB 10 CEA -
YCbCr422 8 CEA ITU.601
YCbCr422 10 CEA ITU.601
YCbCr422 8 CEA ITU.709
YCbCr422 10 CEA ITU.709
YCbCr444 8 CEA ITU.601
YCbCr444 10 CEA ITU.601
YCbCr444 8 CEA ITU.709
YCbCr444 10 CEA ITU.709
Cancel
Accept
Status:
> Licenses available: 'Link Layer Tests', 'HDCP Tests (for


Unigraf Reference Sink CTS
File Tools Help
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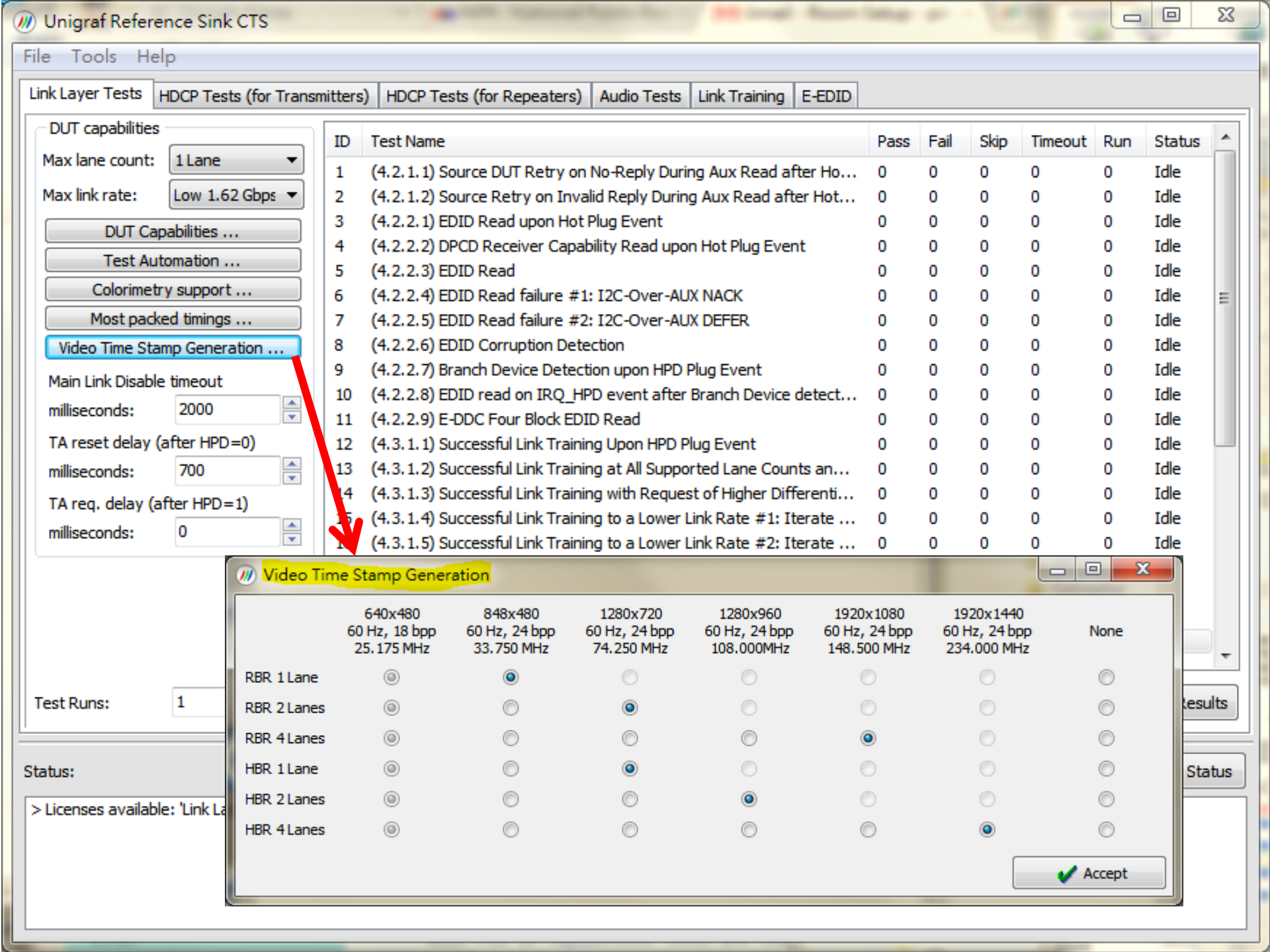
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds: 2000
TA reset delay (after HPD=0)
milliseconds: 700
TA req. delay (after HPD=1)
milliseconds: 0
Test Runs: 1
ID
Test Name
Pass
Fail
Skip
Timeout
Run
Status
Most Packed timing modes selection
Most packed timing for 1 lane:
Standard H-Res V-Res Refresh rate Interlace/Progressive Blanking mode bpp Packing ratio
CVT 1280 800 60 Progressive Reduced 18 99%
DMT 1280 768 60 Progressive Reduced 18 95%
DMT 800 600 60.317 Progressive Normal 30 93%
DMT 1024 768 60 Progressive Normal 18 90%
Most packed timing for 2 lanes:
Standard H-Res V-Res Refresh rate Interlace/Progressive Blanking mode bpp Packing ratio
DMT 1280 1024 60 Progressive Normal 24 100%
DMT 1280 960 60 Progressive Normal 24 100%
DMT 1360 768 60 Progressive Normal 30 99%
CVT 1280 800 60 Progressive Normal 30 97%
DMT 1400 1050 60 Progressive Reduced 24 94%
DMT 1280 768 60 Progressive Normal 30 92%
CVT 1600 1200 60 Progressive Reduced 18 90%
Most packed timing for 4 lanes:
Standard H-Res V-Res Refresh rate Interlace/Progressive Blanking mode bpp Packing ratio
CVT 2048 1536 60 Progressive Reduced 24 97%
DMT 1792 1344 60 Progressive Normal 24 95%
DMT 1600 1200 60 Progressive Normal 30 94%
Cancel
Accept
Results
Status:
Hide Status
Clear Status
> Licenses available: 'Link Layer Tests', 'HDCP Tests (for Transmitters)', 'HDCP Tests (for Repeaters)', 'Audio Tests'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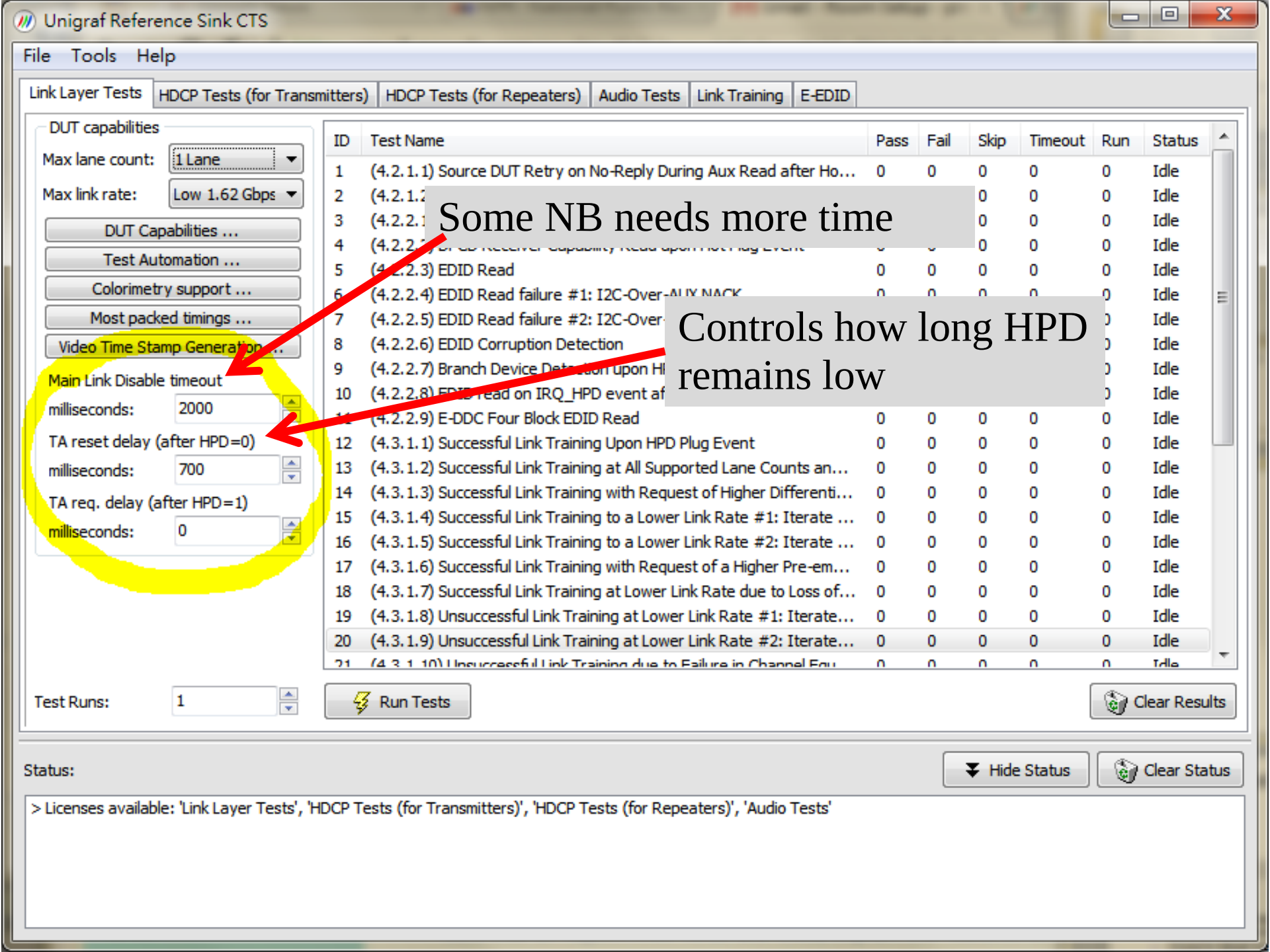
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds: 2000
TA reset delay (after HPD=0)
milliseconds: 700
TA req. delay (after HPD=1)
milliseconds: 0
Test Runs: 1
ID Test Name Pass Fail Skip Timeout Run Status
1 (4.2.1.1) Source DUT Retry on No-Reply During Aux Read after Ho... 0 0 0 0 0 Idle
2 (4.2.1.2) Source Retry on Invalid Reply During Aux Read after Hot... 0 0 0 0 0 Idle
3 (4.2.2.1) EDID Read upon Hot Plug Event 0 0 0 0 0 Idle
4 (4.2.2.2) DPCD Receiver Capability Read upon Hot Plug Event 0 0 0 0 0 Idle
5 (4.2.2.3) EDID Read 0 0 0 0 0 Idle
6 (4.2.2.4) EDID Read failure #1: I2C-Over-AUX NACK 0 0 0 0 0 Idle
7 (4.2.2.5) EDID Read failure #2: I2C-Over-AUX DEFER 0 0 0 0 0 Idle
8 (4.2.2.6) EDID Corruption Detection 0 0 0 0 0 Idle
9 (4.2.2.7) Branch Device Detection upon HPD Plug Event 0 0 0 0 0 Idle
10 (4.2.2.8) EDID read on IRQ_HPD event after Branch Device detect... 0 0 0 0 0 Idle
11 (4.2.2.9) E-DDC Four Block EDID Read 0 0 0 0 0 Idle
12 (4.3.1.1) Successful Link Training Upon HPD Plug Event 0 0 0 0 0 Idle
13 (4.3.1.2) Successful Link Training at All Supported Lane Counts an... 0 0 0 0 0 Idle
14 (4.3.1.3) Successful Link Training with Request of Higher Differenti... 0 0 0 0 0 Idle
15 (4.3.1.4) Successful Link Training to a Lower Link Rate #1: Iterate ... 0 0 0 0 0 Idle
16 (4.3.1.5) Successful Link Training to a Lower Link Rate #2: Iterate ... 0 0 0 0 0 Idle
Status:
> Licenses available: 'Link La
Video Time Stamp Generation
640x480 60 Hz, 18 bpp 25.175 MHz
848x480 60 Hz, 24 bpp 33.750 MHz
1280x720 60 Hz, 24 bpp 74.250 MHz
1280x960 60 Hz, 24 bpp 108.000MHz
1920x1080 60 Hz, 24 bpp 148.500 MHz
1920x1440 60 Hz, 24 bpp 234.000 MHz
None
RBR 1 Lane
RBR 2 Lanes
RBR 4 Lanes
HBR 1 Lane
HBR 2 Lanes
HBR 4 Lanes
Accept


Unigraf Reference Sink CTS
File Tools Help
Link Layer Tests
HDCP Tests (for Transmitters)
HDCP Tests (for Repeaters)
Audio Tests
Link Training
E-EDID
DUT capabilities
Max lane count: 1 Lane
Max link rate: Low 1.62 Gbps
DUT Capabilities ...
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds: 2000
TA reset delay (after HPD=0)
milliseconds: 700
TA req. delay (after HPD=1)
milliseconds: 0
Some NB needs more time
Controls how long HPD remains low
ID Test Name Pass Fail Skip Timeout Run Status
1 (4.2.1.1) Source DUT Retry on No-Reply During Aux Read after Ho... 0 0 0 0 0 Idle
5 (4.2.2.3) EDID Read 0 0 0 0 0 Idle
9 (4.2.2.7) Branch Device Detection upon HI 0 0 0 0 0 Idle
10 (4.2.2.8) EDID Read on IRQ_HPD event af 0 0 0 0 0 Idle
11 (4.2.2.9) E-DDC Four Block EDID Read 0 0 0 0 0 Idle
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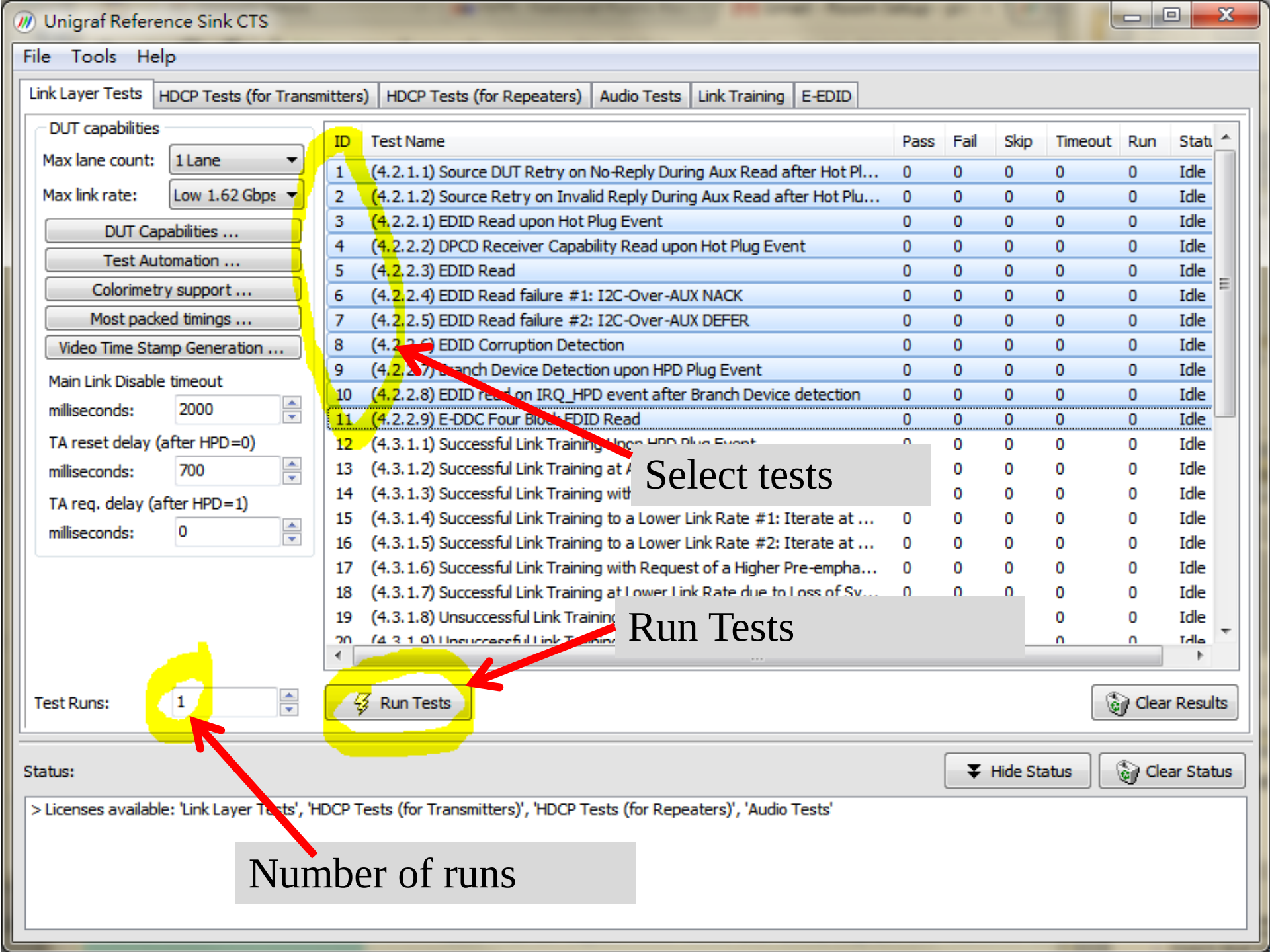
16 (4.3.1.5) Successful Link Training to a Lower Link Rate #2: Iterate ... 0 0 0 0 0 Idle
17 (4.3.1.6) Successful Link Training with Request of a Higher Pre-em... 0 0 0 0 0 Idle
18 (4.3.1.7) Successful Link Training at Lower Link Rate due to Loss of... 0 0 0 0 0 Idle
19 (4.3.1.8) Unsuccessful Link Training at Lower Link Rate #1: Iterate... 0 0 0 0 0 Idle
20 (4.3.1.9) Unsuccessful Link Training at Lower Link Rate #2: Iterate... 0 0 0 0 0 Idle
Test Runs: 1
Run Tests
Clear Results
Status:
Hide Status
Clear Status
> Licenses available: 'Link Layer Tests', 'HDCP Tests (for Transmitters)', 'HDCP Tests (for Repeaters)', 'Audio Tests'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File Tools Help
Link Layer Tests
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Link Training
E-EDID
DUT capabilities
Max lane count: 1 Lane
Max link rate: Low 1.62 Gbps
DUT Capabilities ...
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds: 2000
TA reset delay (after HPD=0)
milliseconds: 700
TA req. delay (after HPD=1)
milliseconds: 0
ID Test Name Pass Fail Skip Timeout Run Stati
1 (4.2.1.1) Source DUT Retry on No-Reply During Aux Read after Hot Pl... 0 0 0 0 0 Idle
2 (4.2.1.2) Source Retry on Invalid Reply During Aux Read after Hot Plu... 0 0 0 0 0 Idle
3 (4.2.2.1) EDID Read upon Hot Plug Event 0 0 0 0 0 Idle
4 (4.2.2.2) DPCD Receiver Capability Read upon Hot Plug Event 0 0 0 0 0 Idle
5 (4.2.2.3) EDID Read 0 0 0 0 0 Idle
6 (4.2.2.4) EDID Read failure #1: I2C-Over-AUX NACK 0 0 0 0 0 Idle
7 (4.2.2.5) EDID Read failure #2: I2C-Over-AUX DEFER 0 0 0 0 0 Idle
8 (4.2.2.6) EDID Corruption Detection 0 0 0 0 0 Idle
9 (4.2.2.7) Branch Device Detection upon HPD Plug Event 0 0 0 0 0 Idle
10 (4.2.2.8) EDID read on IRQ_HPD event after Branch Device detection 0 0 0 0 0 Idle
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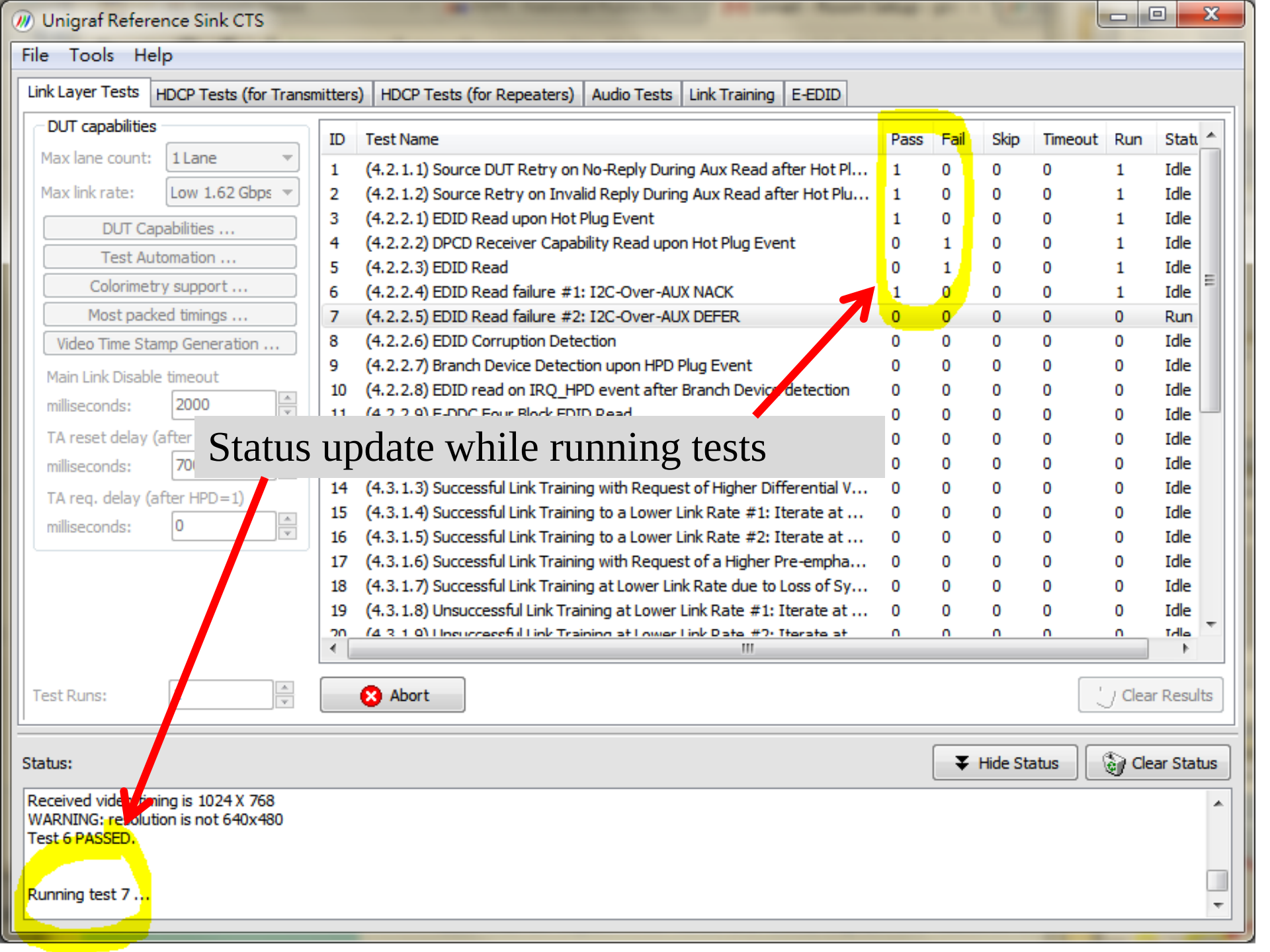
12 (4.3.1.1) Successful Link Training Upon HPD Plug Event 0 0 0 0 Idle
13 (4.3.1.2) Successful Link Training at A 0 0 0 0 Idle
14 (4.3.1.3) Successful Link Training with 0 0 0 0 Idle
15 (4.3.1.4) Successful Link Training to a Lower Link Rate #1: Iterate at ... 0 0 0 0 0 Idle
16 (4.3.1.5) Successful Link Training to a Lower Link Rate #2: Iterate at ... 0 0 0 0 0 Idle
17 (4.3.1.6) Successful Link Training with Request of a Higher Pre-empha... 0 0 0 0 0 Idle
18 (4.3.1.7) Successful Link Training at Lower Link Rate due to Loss of Sy... 0 0 0 0 Idle
19 (4.3.1.8) Unsuccessful Link Training 0 0 Idle
20 (4.3.1.9) Unsuccessful Link Training 0 0 Idle
Select tests
Run Tests
Test Runs: 1
Run Tests
Clear Results
Status:
Hide Status
Clear Status
> Licenses available: 'Link Layer Tests', 'HDCP Tests (for Transmitters)', 'HDCP Tests (for Repeaters)', 'Audio Tests'
Number of runs


Unigraf Reference Sink CTS
File Tools Help
Link Layer Tests
HDCP Tests (for Transmitters)
HDCP Tests (for Repeaters)
Audio Tests
Link Training
E-EDID
DUT capabilities
Max lane count: 1 Lane
Max link rate: Low 1.62 Gbps
DUT Capabilities ...
Test Automation ...
Colorimetry support ...
Most packed timings ...
Video Time Stamp Generation ...
Main Link Disable timeout
milliseconds: 2000
TA reset delay (after
milliseconds: 70
TA req. delay (after HPD=1)
milliseconds: 0
Test Runs:
ID Test Name Pass Fail Skip Timeout Run Statu
1 (4.2.1.1) Source DUT Retry on No-Reply During Aux Read after Hot Pl... 1 0 0 0 1 Idle
2 (4.2.1.2) Source Retry on Invalid Reply During Aux Read after Hot Plu... 1 0 0 0 1 Idle
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7 (4.2.2.5) EDID Read failure #2: I2C-Over-AUX DEFER 0 0 0 0 0 Run
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13 0 0 0 0 0 Idle
14 (4.3.1.3) Successful Link Training with Request of Higher Differential V... 0 0 0 0 0 Idle
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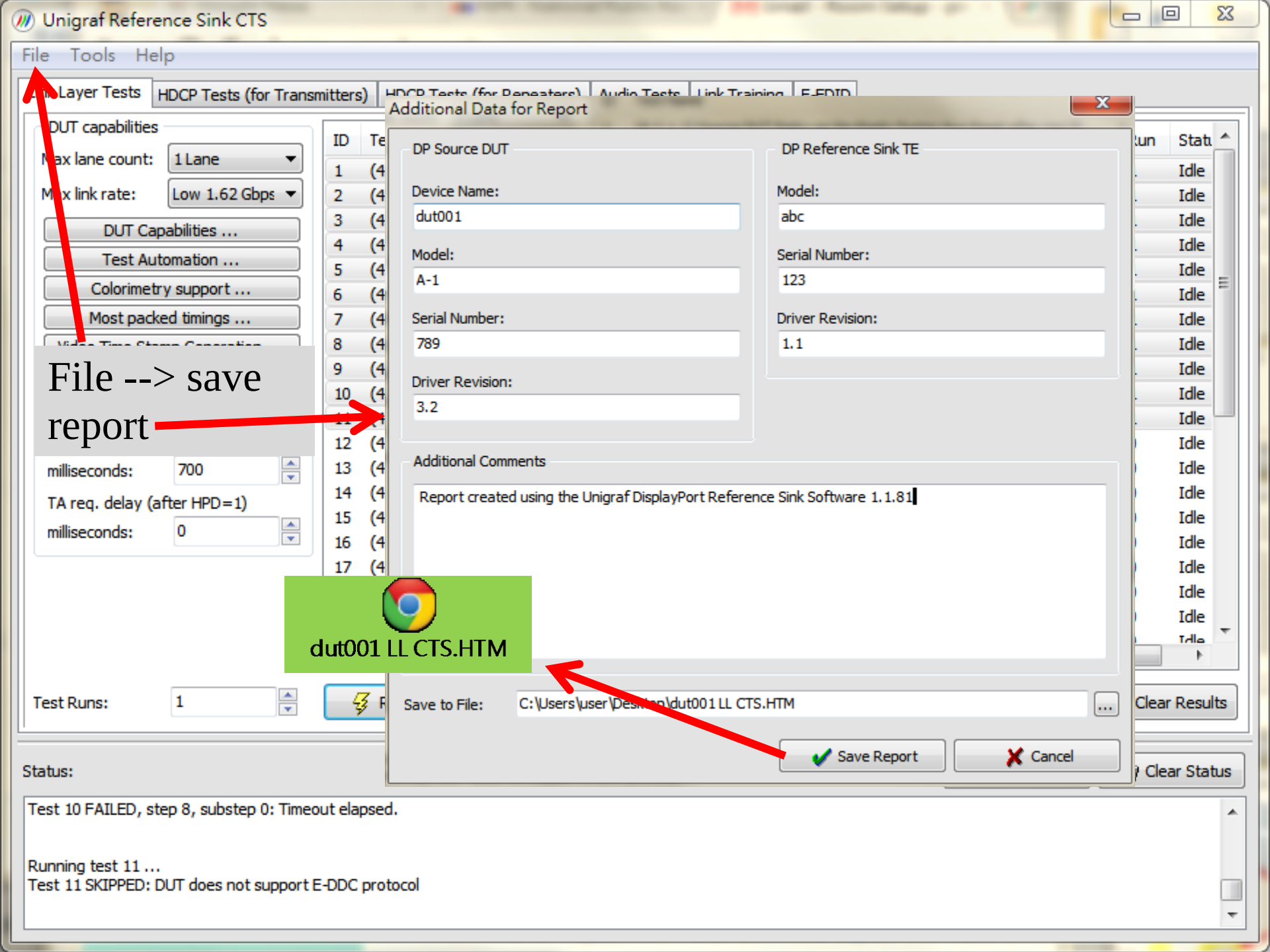
19 (4.3.1.8) Unsuccessful Link Training at Lower Link Rate #1: Iterate at ... 0 0 0 0 0 Idle
20 (4.3.1.9) Unsuccessful Link Training at Lower Link Rate #2: Iterate at 0 0 0 0 0 Idle
Abort
Clear Results
Status update while running tests
Status:
Hide Status
Clear Status
Received video timing is 1024 X 768
WARNING: resolution is not 640x480
Test 6 PASSED.
Running test 7 ...


Unigraf Reference Sink CTS
File Tools Help
Layer Tests
HDCP Tests (for Transmitters)
DUT capabilities
Max lane count:
1 Lane
Max link rate:
Low 1.62 Gbps
DUT Capabilities ...
Test Automation ...
Colorimetry support ...
Most packed timings ...
File --> save report
milliseconds:
700
TA req. delay (after HPD=1)
milliseconds:
0
Test Runs:
1
ID
Idle
Additional Data for Report
DP Source DUT
Device Name:
dut001
Model:
A-1
Serial Number:
789
Driver Revision:
3.2
DP Reference Sink TE
Model:
abc
Serial Number:
123
Driver Revision:
1.1
Additional Comments
Report created using the Unigraf DisplayPort Reference Sink Software 1.1.81
dut001 LL CTS.HTM
Save to File:
C:\Users\user\Desktop\dut001 LL CTS.HTM
Save Report
Cancel
Clear Results
Status:
Clear Status
Test 10 FAILED, step 8, substep 0: Timeout elapsed.
Running test 11 ...
Test 11 SKIPPED: DUT does not support E-DDC protocol

# DisplayPort Source Compliance Test Report

**CONTENTS**



**View details by test**



Printer Friendly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Click item to see details

## TEST SUMMARY

| TEST | PASSED | FAILED | TIMED OUT | SKIPPED |
|---|---|---|---|---|
| 1 - (4.2.1.1) Source DUT Retry on No-Reply During Aux Read after Hot Plug Event | 1 | 0 | 0 | 0 |
| 2 - (4.2.1.2) Source Retry on Invalid Reply During Aux Read after Hot Plug Event | 1 | 0 | 0 | 0 |
| 3 - (4.2.2.1) EDID Read upon Hot Plug Event | 1 | 0 | 0 | 0 |
| 4 - (4.2.2.2) DPCD Receiver Capability Read upon Hot Plug Event | 0 | 1 | 0 | 0 |
| 5 - (4.2.2.3) EDID Read | 0 | 1 | 0 | 0 |
| 6 - (4.2.2.4) EDID Read failure #1: I2C-Over-AUX NACK | 1 | 0 | 0 | 0 |
| 7 - (4.2.2.5) EDID Read failure #2: I2C-Over-AUX DEFER | 1 | 0 | 0 | 0 |
| 8 - (4.2.2.6) EDID Corruption Detection | 0 | 1 | 0 | 0 |
| 9 - (4.2.2.7) Branch Device Detection upon HPD Plug Event | 1 | 0 | 0 | 0 |
| 10 - (4.2.2.8) EDID read on IRQ_HPD event after Branch Device detection | 0 | 1 | 0 | 0 |
| 11 - (4.2.2.9) E-DDC Four Block EDID Read | 0 | 0 | 0 | 1 |

DUT conditions

Testing steps & results

**TEST DETAILS**

**8 - (4.2.2.6) EDID Corruption Detection**

**PASSED 0** **FAILED 1** **TIMED OUT 0** **SKIPPED 0**

**Test 8; "8 - (4.2.2.6) EDID Corruption Detection" - Run 1**
Started 2012-04-28, 14:15.55

Max lane count: 1 Lane, Max link rate: Low 1.62 Gbps
TEST_LINK_TRAINING: Yes, TEST_VIDEO_PATTERN: Yes, TEST_TIMING: Yes, TEST_EDID_READ: Yes
TEST_AUDIO_PATTERN: Yes, Event indicating DUT ready: Active Video
Video format change without re-training: No, Lane count reduction without re-training: No,
E-DDC: No, Drive level 3 (1.2V): No, Pre-emphasis level 3 (9.5dB) No,
Fixed Timing No, Spread Spectrum: No, SSC enabled (if MAX_DOWNSPREAD=1): No
Main link disable timeout: 2000ms, TA reset delay (after HPD=0): 700ms, TA req. delay (after HPD=1): 0ms
---
De-asserting HPD
Setting TEST_EDID_READ=1
Asserting HPD
Setting 5 s timeout
Waiting for EDID read request
128 byte EDID read detected
Setting 5 s timeout
Waiting for active video with fail-safe timing
Active video detected
Received video timing is 1024 X 768
**Test FAILED, step 7, substep 0: Resolution is not 640x480.**

Search for 4.2.2.6

## Check Link CTS manual.

Result: The device fails if the Source DUT does not read the entire EDID block through AUX CH before transmission of the main video stream, test timeout or interrupt by test operator. It also fails if the Source DUT does not transmit the main video using the fail-safe mode.

## TEST DETAILS

### 11 - (4.2.2.9) E-DDC Four Block EDID Read

| PASSED 0 | FAILED 0 | TIMED OUT 0 | SKIPPED 1 |
|---|---|---|---|

**Test 11; "11 - (4.2.2.9) E-DDC Four Block EDID Read" - Run 1**
Started 2012-04-28, 14:16.09

Max lane count: 1 Lane, Max link rate: Low 1.62 Gbps
TEST_LINK_TRAINING: Yes, TEST_VIDEO_PATTERN: Yes, TEST_TIMING: Yes, TEST_EDID_READ: Yes
TEST_AUDIO_PATTERN: Yes, Event indicating DUT ready: Active Video
Video format change without re-training: No, Lane count reduction without re-training: No,
E-DDC: No, Drive level 3 (1.2V): No, Pre-emphasis level 3 (9.5dB) No,
Fixed Timing No, Spread Spectrum: No, SSC enabled (if MAX_DOWNSPREAD=1): No
Main link disable timeout: 2000ms, TA reset delay (after HPD=0): 700ms, TA req. delay (after HPD=1): 0ms
---
**Test SKIPPED: DUT does not support E-DDC protocol**

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Unigraf Reference Sink CTS

File Tools Help

Link Layer Tests | HDCP Tests (for Transmitters) | HDCP Tests (for Repeaters) | Audio Tests | Link Training | E-EDID

DUT capabilities

- CP_IRQ used for R0' read
- CP_IRQ used for READY read
- Output when DEVICE_COUNT=0
- Encryption enable bootstrapping

Authentication start timeout seconds: 10.0

HDCP Authentication status

| ID | Test Name | Pass | Fail | Skip | Timeout | Run | Status |
|---|---|---|---|---|---|---|---|
| 1 | (1A-01) Regular Procedure: With Receiver | 0 | 0 | 0 | 0 | 0 | Idle |
| 2 | (1A-02) Regular Procedure: HPD After Writing Aksv | 0 | 0 | 0 | 0 | 0 | Idle |
| 3 | (1A-03) Regular Procedure: HPD During Link Integrity Check Stage | 0 | 0 | 0 | 0 | 0 | Idle |
| 4 | (1A-04) Irregular Procedure: (First Part of Authentication) Failure t... | 0 | 0 | 0 | 0 | 0 | Idle |
| 5 | (1A-05) Irregular Procedure: (First Part of Authentication) Verify B... | 0 | 0 | 0 | 0 | 0 | Idle |
| 6 | (1A-06) Irregular Procedure: (First Part of Authentication) Verify R0? | 0 | 0 | 0 | 0 | 0 | Idle |
| 7 | (1A-07) Irregular Procedure: (Link Integrity Check) Link Integrity F... | 0 | 0 | 0 | 0 | 0 | Idle |
| 8 | (1A-08) Irregular Procedure: SRM | 0 | 0 | 0 | 0 | 0 | Idle |
| 9 | (1A-09) Regular Procedure: Encryption Disable Bootstrapping | 0 | 0 | 0 | 0 | 0 | Idle |
| 10 | (1B-01) Regular Procedure: With Repeater | 0 | 0 | 0 | 0 | 0 | Idle |
| 11 | (1B-02) Irregular Procedure: Spurious CP_IRQ Interrupt | 0 | 0 | 0 | 0 | 0 | Idle |
| 12 | (1B-03) Regular Procedure: HPD After Reading R0' | 0 | 0 | 0 | 0 | 0 | Idle |
| 13 | (1B-04) Irregular Procedure: (Second part of Authentication) Time... | 0 | 0 | 0 | 0 | 0 | Idle |
| 14 | (1B-05) Irregular Procedure: (Second part of Authentication) Verify V' | 0 | 0 | 0 | 0 | 0 | Idle |
| 15 | (1B-06) Irregular Procedure: (Second part of Authentication) MAX_... | 0 | 0 | 0 | 0 | 0 | Idle |
| 16 | (1B-07) Irregular Procedure: (Second part of Authentication) MAX_... | 0 | 0 | 0 | 0 | 0 | Idle |

Test Runs: 1

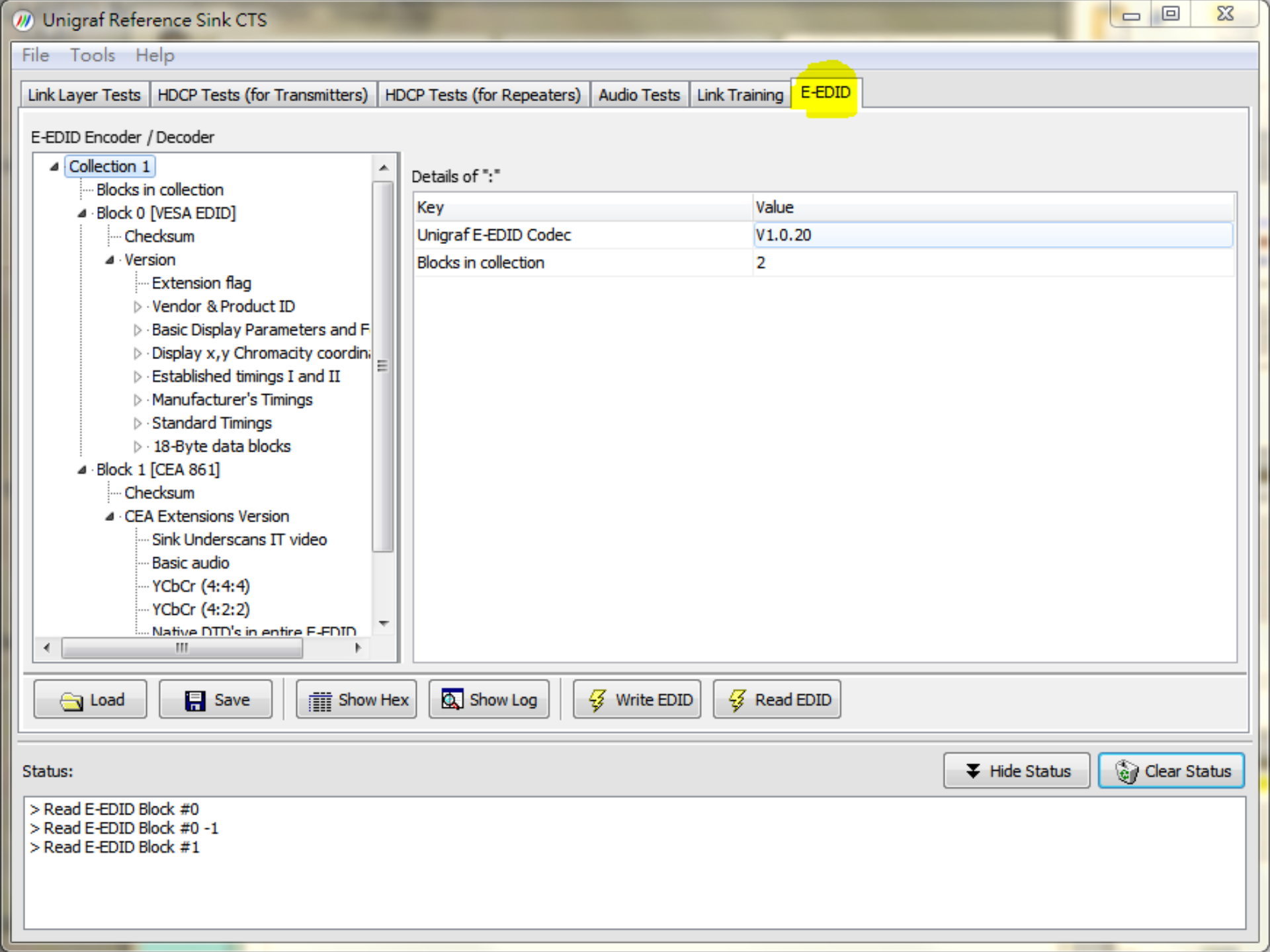
Run Tests

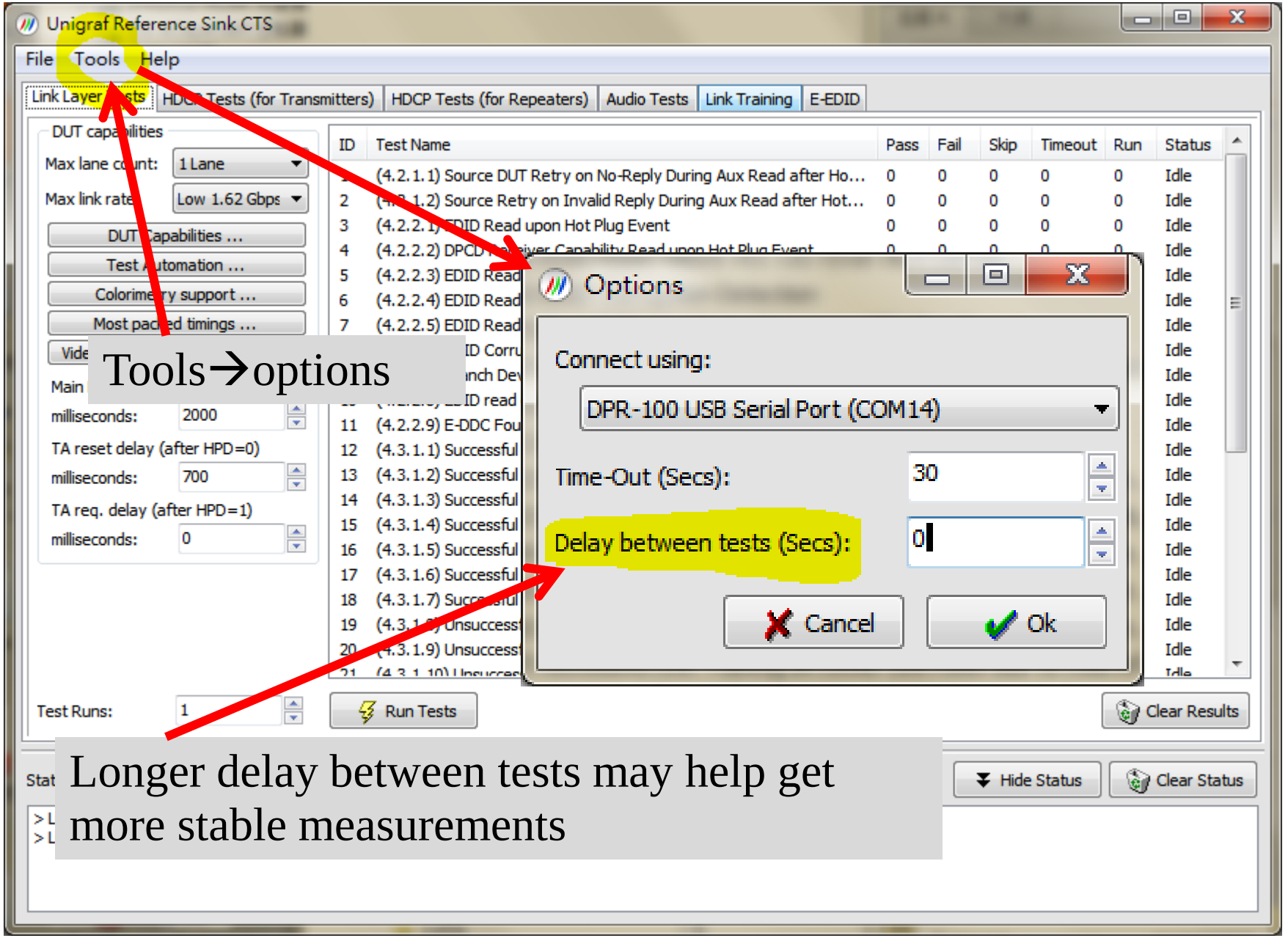
Clear Results

Status:

Hide Status | Clear Status

> Licenses available: 'Link Layer Tests', 'HDCP Tests (for Transmitters)', 'HDCP Tests (for Repeaters)', 'Audio Tests'


Unigraf Reference Sink CTS
File
Tools
Help
Link Layer Tests
HDCP Tests (for Transmitters)
HDCP Tests (for Repeaters)
Audio Tests
Link Training
E-EDID
E-EDID Encoder / Decoder
Collection 1
Blocks in collection
Block 0 [VESA EDID]
Checksum
Version
Extension flag
Vendor & Product ID
Basic Display Parameters and F
Display x,y Chromacity coordin
Established timings I and II
Manufacturer's Timings
Standard Timings
18-Byte data blocks
Block 1 [CEA 861]
Checksum
CEA Extensions Version
Sink Underscans IT video
Basic audio
YCbCr (4:4:4)
YCbCr (4:2:2)
Native DTD's in entire E-EDID
Details of ":"
Key
Value
Unigraf E-EDID Codec
V1.0.20
Blocks in collection
2
Load
Save
Show Hex
Show Log
Write EDID
Read EDID
Status:
Hide Status
Clear Status
> Read E-EDID Block #0
> Read E-EDID Block #0 -1
> Read E-EDID Block #1





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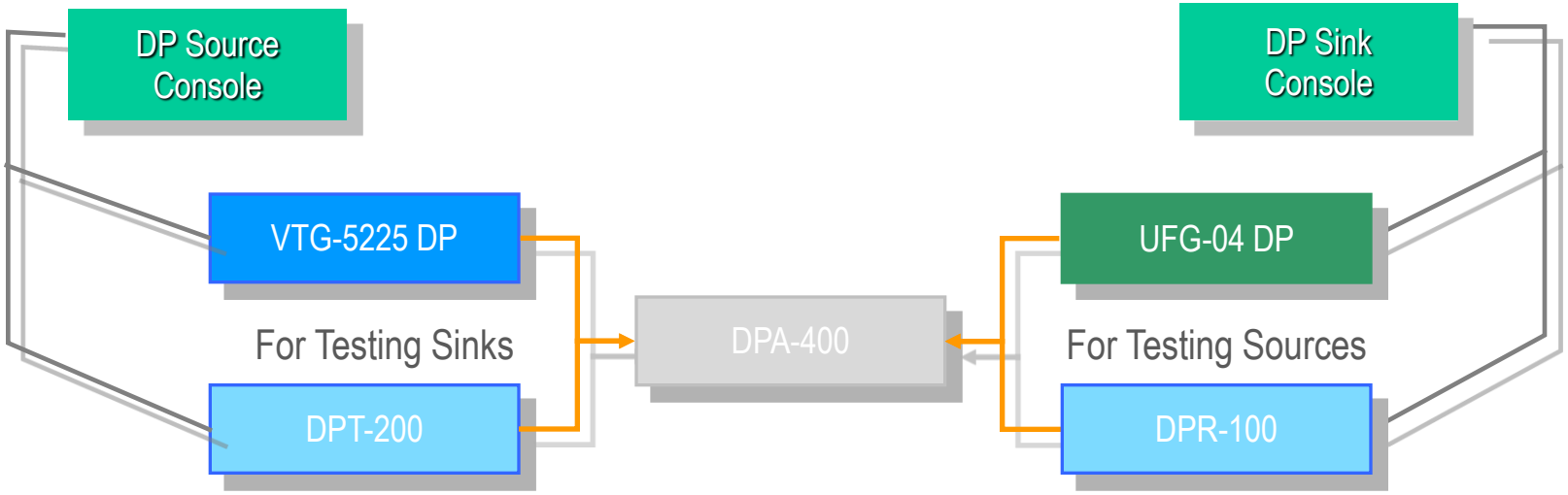
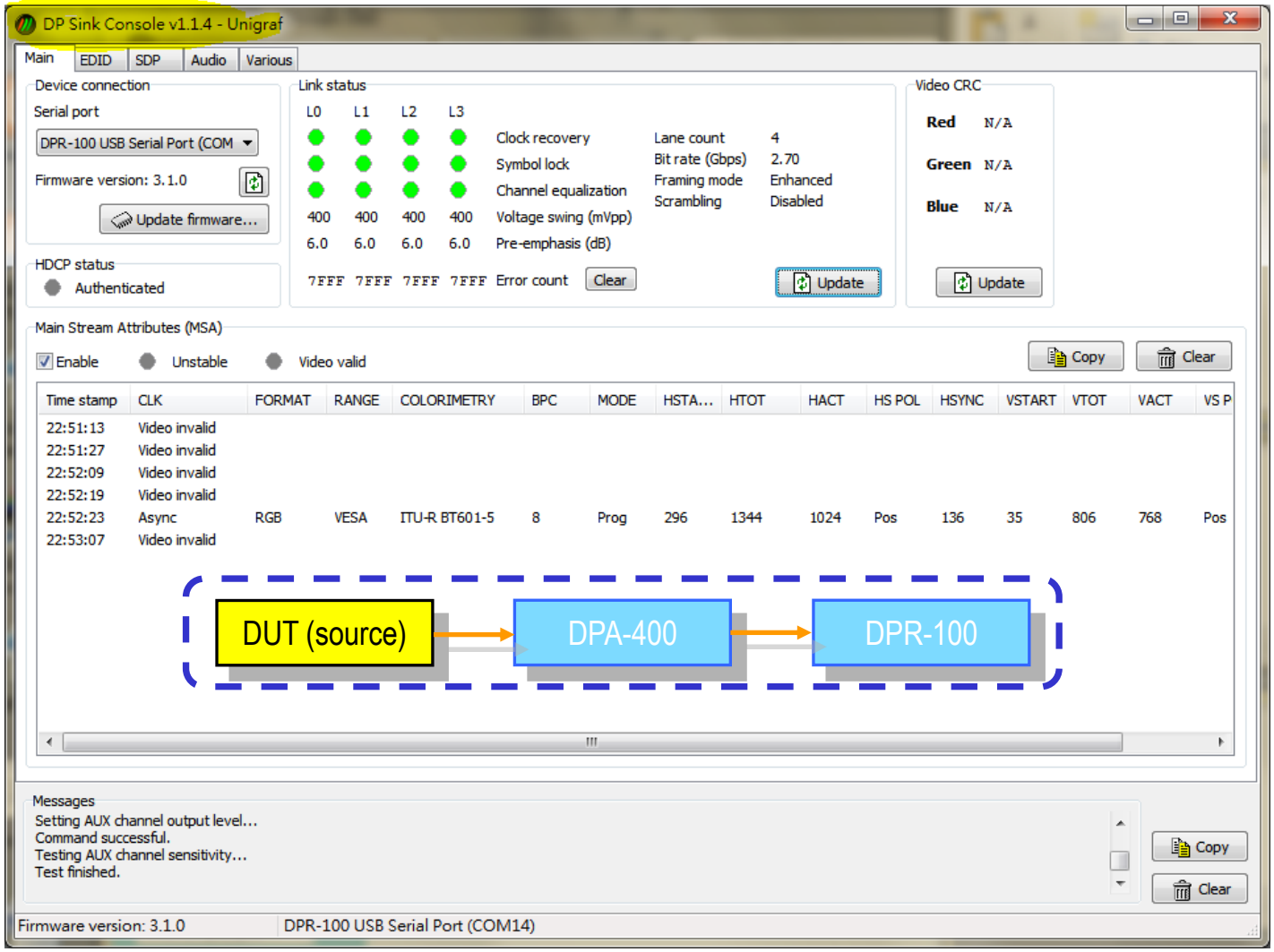
# R&D Link Level Debugging Tools




- Source and Sink Consoles for Link Level debug
- Complete status monitoring of the DP interface
- Allows for manual ”tweaking” of the DP link parameters
- User friedly GUI and computer interface

# Sink Console for helping debug

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DP Sink Console v1.1.4 - Unigraf

Main | EDID | SDP | Audio | Various

**Sink capabilities**

**Maximum lane count**

1 2 4

**Maximum link rate (Gbps)**

1.62 2.70

**Framing mode**

Normal Enhanced

Set

**Hot plug detect (HPD) pulse**

**Duration (ms)**

1000

Pulse HPD

**AUX channel output level**

**Voltage swing (mVpp)**

200 270 400

600 800 1200

Set

**AUX Channel Sensitivity Test**

**Start value (mVpp)**

1000

**Stop value (mVpp)**

50

**Decrement (mVpp)**

30 50 100

Test

```
Testing 400 mVpp... OK
Testing 300 mVpp... OK
Testing 200 mVpp... OK
Testing 100 mVpp... OK
Testing 50 mVpp... FAILED
Test finished.
```

Copy to clipboard

**DPCD access**

Source/target address (hex): Read

Data (hex): Write

Previous action: None

**Messages**

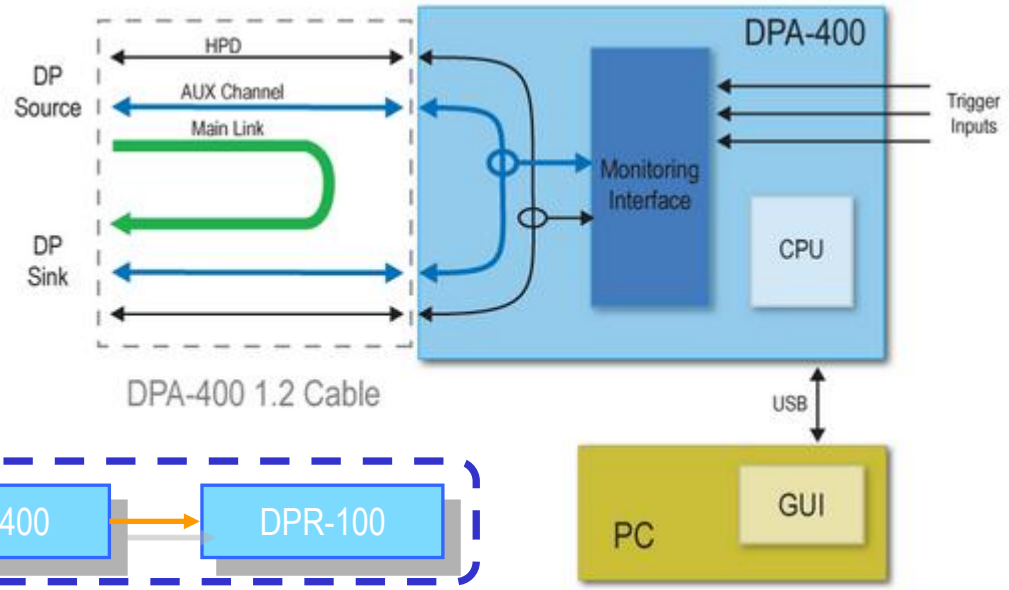
```
Setting AUX channel output level...
Command successful.
Testing AUX channel sensitivity...
Test finished.
```


Copy

Clear

Firmware version: 3.1.0 | DPR-100 USB Serial Port (COM14)

# AUX Channel Monitor



- Full DP AUX cannel traffic analysis
- Each message time stamped, raw data and decoded information available
- Set trigger points and data filters for evaluating specific events
- Record and trigger HPD and external inputs

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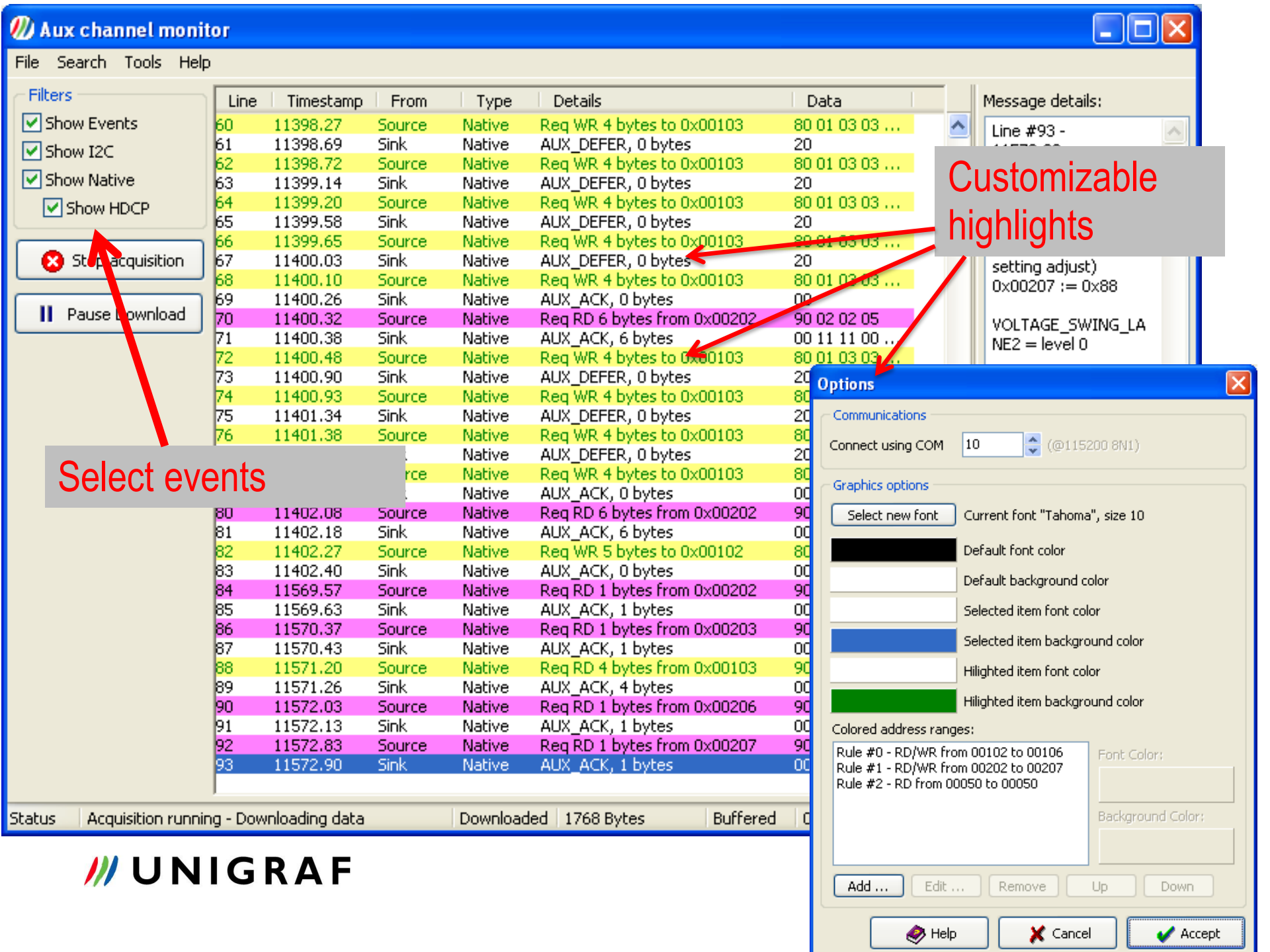
Aux channel monitor
File Search Tools Help
Filters
Show Events
Show I2C
Show Native
Show HDCP
Stop acquisition
Pause Download
Line Timestamp From Type Details Data
60 11398.27 Source Native Req WR 4 bytes to 0x00103 80 01 03 03 ...
61 11398.69 Sink Native AUX_DEFER, 0 bytes 20
62 11398.72 Source Native Req WR 4 bytes to 0x00103 80 01 03 03 ...
63 11399.14 Sink Native AUX_DEFER, 0 bytes 20
64 11399.20 Source Native Req WR 4 bytes to 0x00103 80 01 03 03 ...
65 11399.58 Sink Native AUX_DEFER, 0 bytes 20
66 11399.65 Source Native Req WR 4 bytes to 0x00103
67 11400.03 Sink Native AUX_DEFER, 0 bytes 20
68 11400.10 Source Native Req WR 4 bytes to 0x00103 80 01 03 03 ...
69 11400.26 Sink Native AUX_ACK, 0 bytes
70 11400.32 Source Native Req RD 6 bytes from 0x00202 90 02 02 05
71 11400.38 Sink Native AUX_ACK, 6 bytes 00 11 11 00 ..
72 11400.48 Source Native Req WR 4 bytes to 0x00103 80 01 03 03 ...
73 11400.90 Sink Native AUX_DEFER, 0 bytes
74 11400.93 Source Native Req WR 4 bytes to 0x00103
75 11401.34 Sink Native AUX_DEFER, 0 bytes
76 11401.38 Source Native Req WR 4 bytes to 0x00103
Native AUX_DEFER, 0 bytes
Native Req WR 4 bytes to 0x00103
Native AUX_ACK, 0 bytes
80 11402.08 Source Native Req RD 6 bytes from 0x00202
81 11402.18 Sink Native AUX_ACK, 6 bytes
82 11402.27 Source Native Req WR 5 bytes to 0x00102
83 11402.40 Sink Native AUX_ACK, 0 bytes
84 11569.57 Source Native Req RD 1 bytes from 0x00202
85 11569.63 Sink Native AUX_ACK, 1 bytes
86 11570.37 Source Native Req RD 1 bytes from 0x00203
87 11570.43 Sink Native AUX_ACK, 1 bytes
88 11571.20 Source Native Req RD 4 bytes from 0x00103
89 11571.26 Sink Native AUX_ACK, 4 bytes
90 11572.03 Source Native Req RD 1 bytes from 0x00206
91 11572.13 Sink Native AUX_ACK, 1 bytes
92 11572.83 Source Native Req RD 1 bytes from 0x00207
93 11572.90 Sink Native AUX_ACK, 1 bytes
Message details:
Line #93 -
setting adjust)
0x00207 := 0x88
VOLTAGE_SWING_LA
NE2 = level 0
Customizable highlights
Select events
Status Acquisition running - Downloading data Downloaded 1768 Bytes Buffered
Options
Communications
Connect using COM 10 (@115200 8N1)
Graphics options
Select new font Current font "Tahoma", size 10
Default font color
Default background color
Selected item font color
Selected item background color
Hilighted item font color
Hilighted item background color
Colored address ranges:
Rule #0 - RD/WR from 00102 to 00106
Rule #1 - RD/WR from 00202 to 00207
Rule #2 - RD from 00050 to 00050
Font Color:
Background Color:
Add ... Edit ... Remove Up Down
Help Cancel Accept

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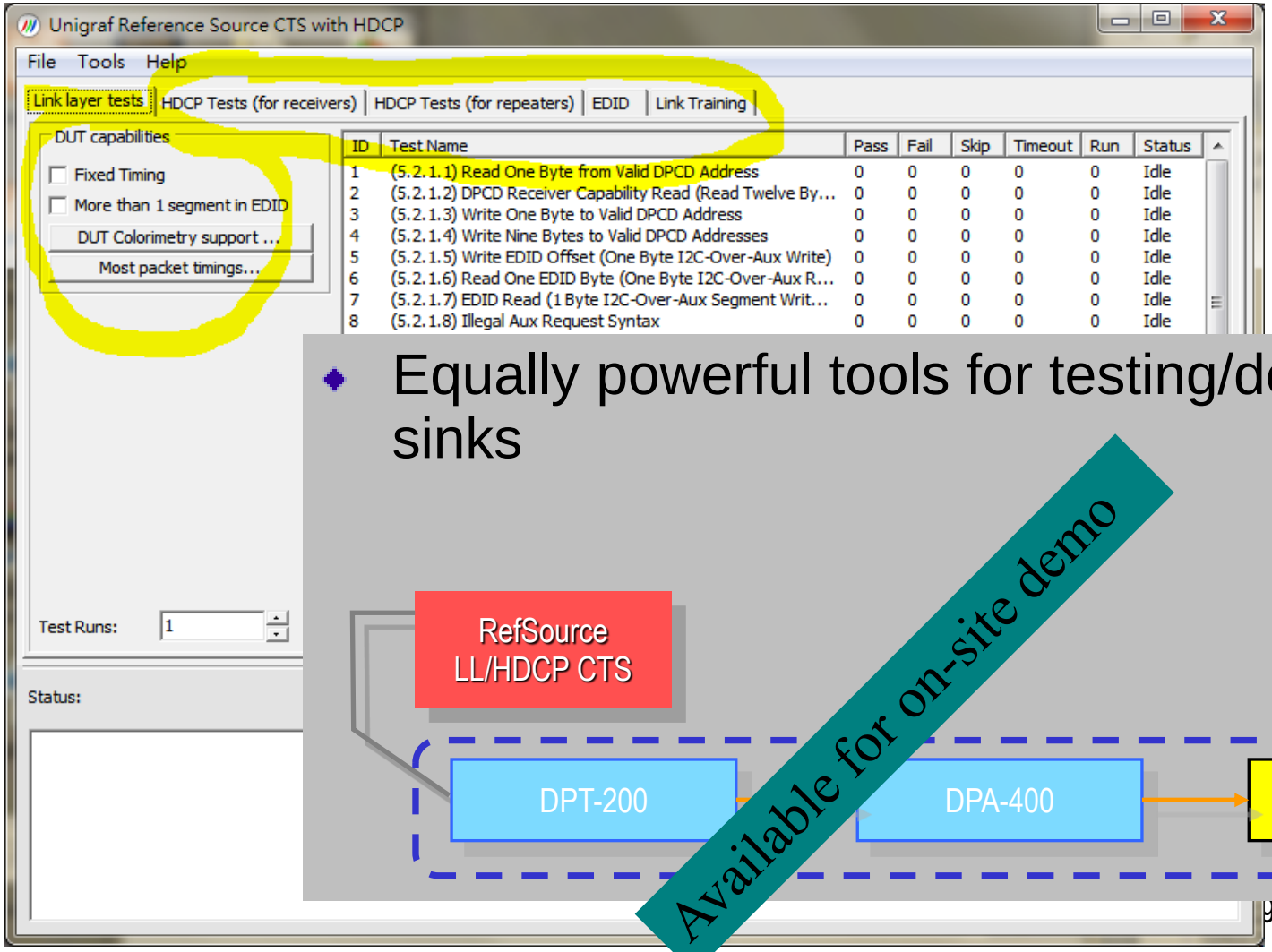
# Link Layer Testing for DisplayPort Sinks




- Equally powerful tools for testing/debugging DP sinks

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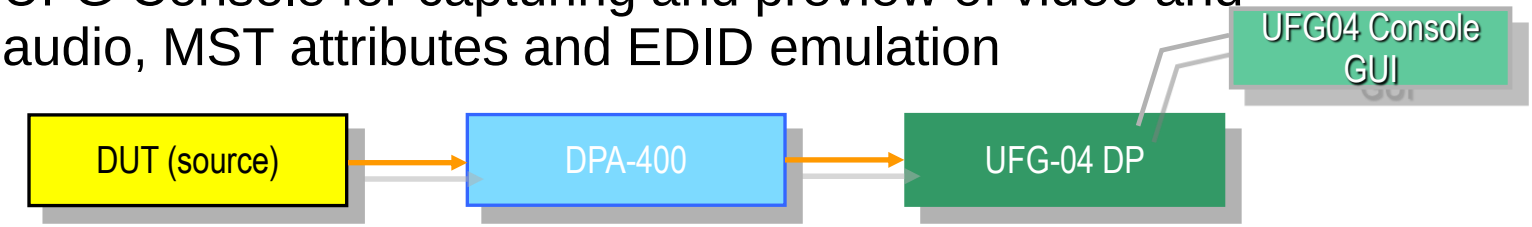
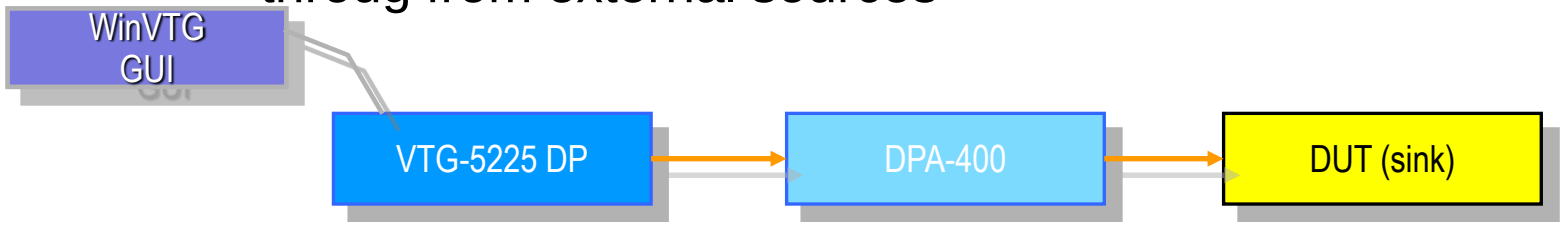
# Testing at Video and Audio Level

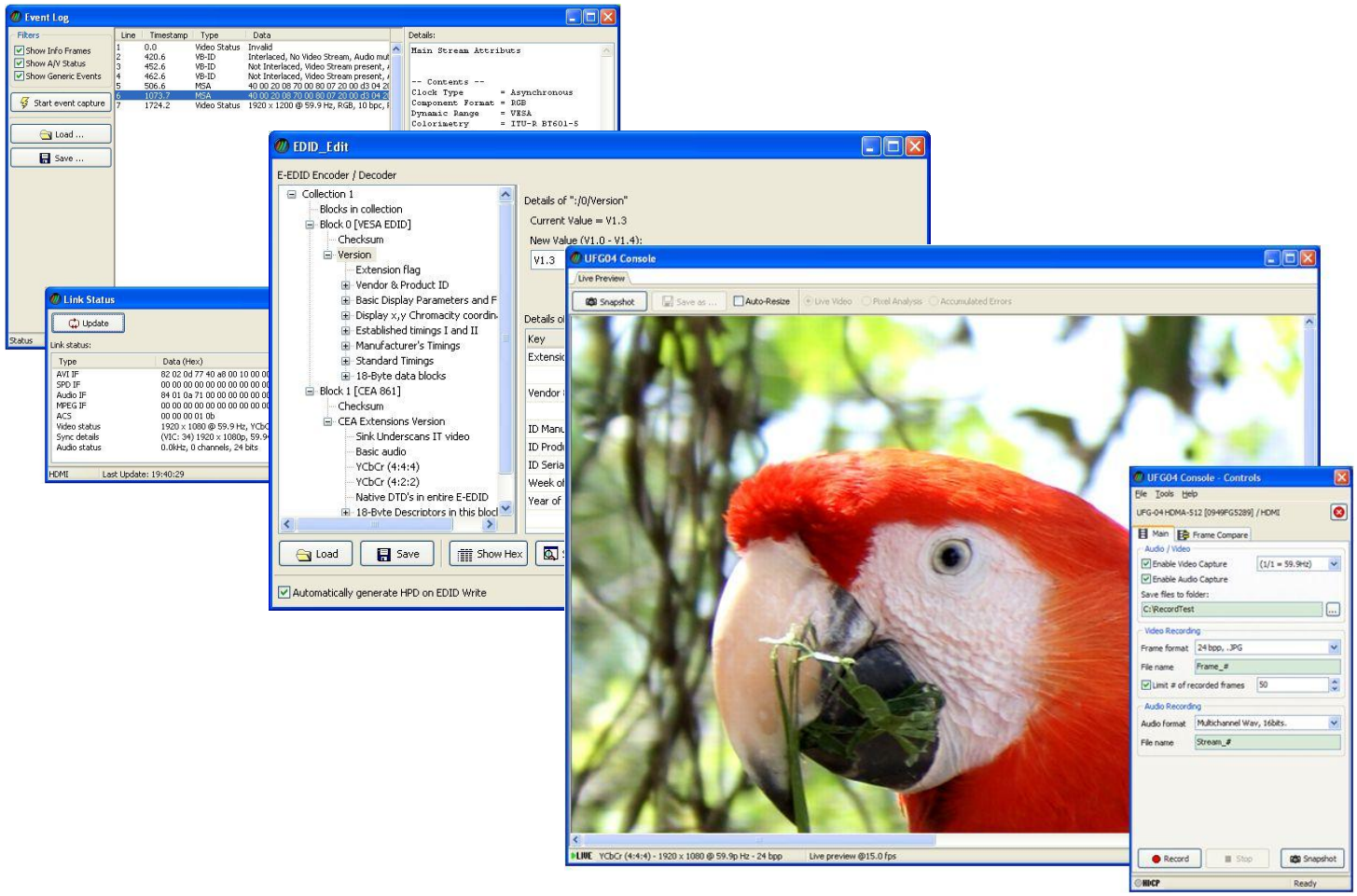
- UFG Console for capturing and preview of video and audio, MST attributes and EDID emulation




- WinVTG for full control of the video timing, audio pass throug from external sources



# UFG Console





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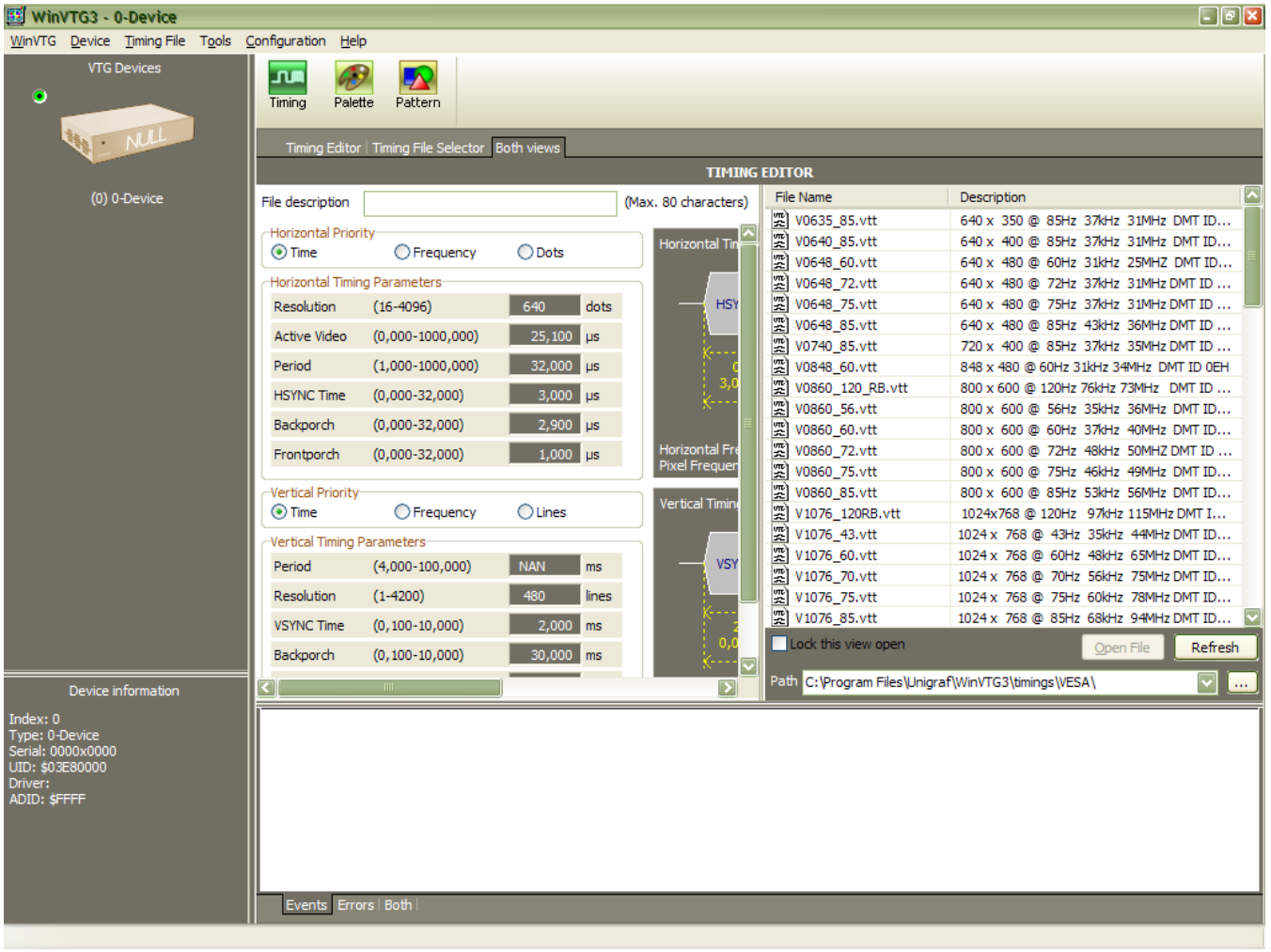
# WinVTG







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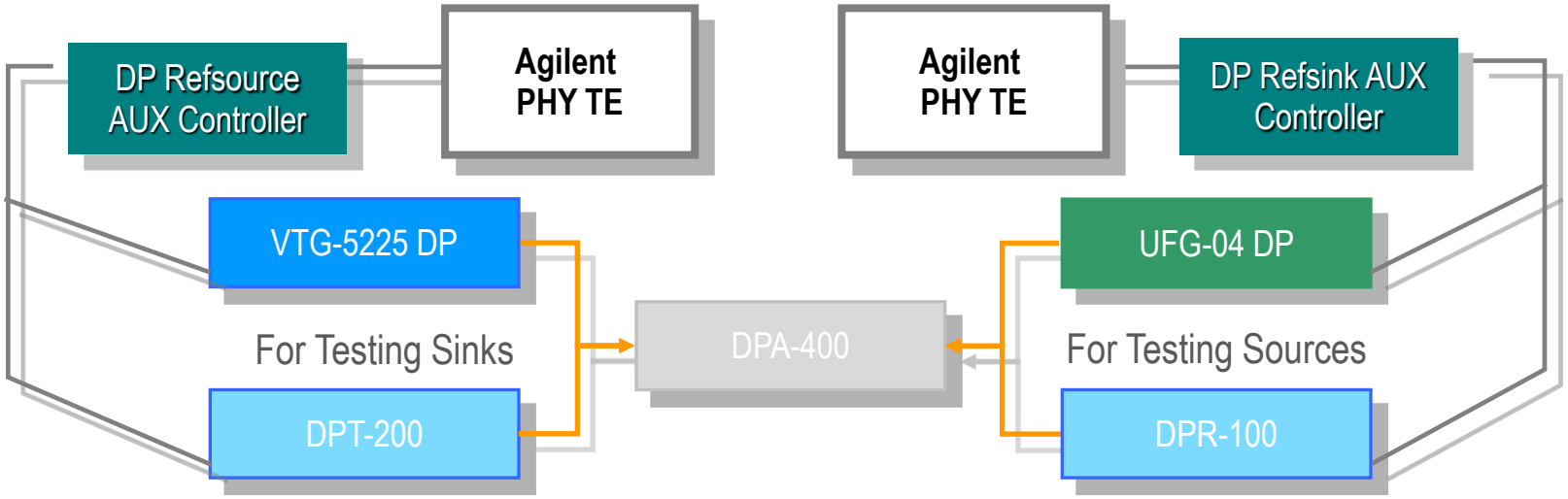
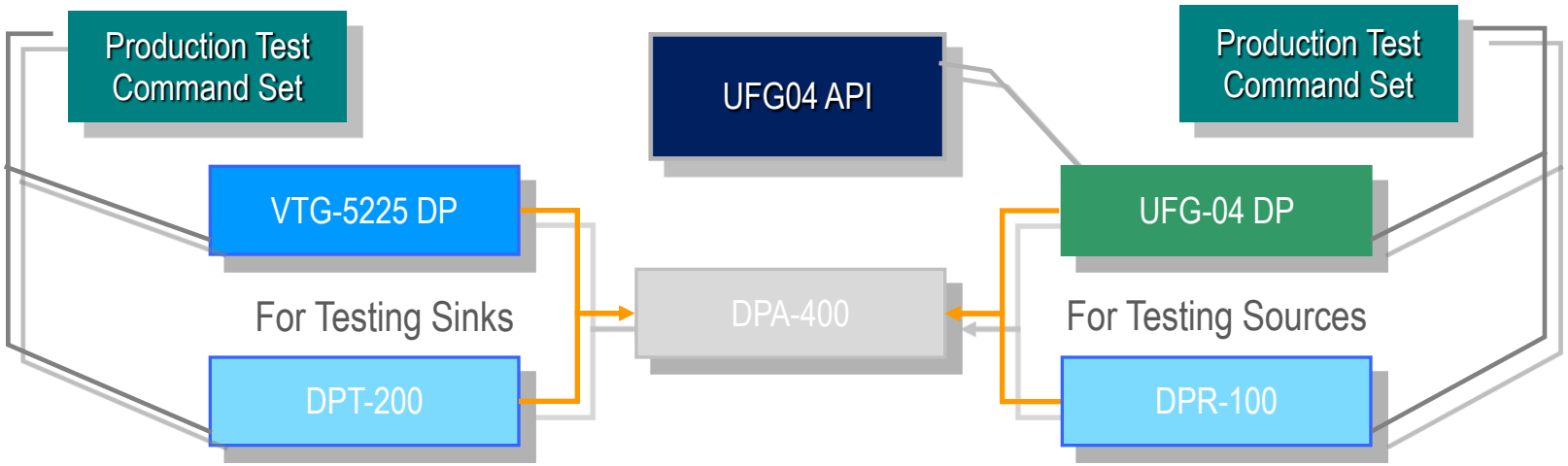
# Accessories for PHY Testing




- DP RefSource and RefSink provide full compatibility for automated testing with Agilent DSO90000A series oscilloscopes and the J-BERT N4903B using the U7232B and N5990A test automation software packages.
- Can be used with all Unigraf RefSinks or RefSources

# Full Test Automation Capabilities




- Production Test Command Set (PTC) for both RefSource and RefSink devices
  - Communication over USB / RS232
- UFG SDK for UFG-04 DP
  - Application Interface API (DLL)
  - Ready to use application examples for C++, Python, VB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# Summary

- Unigraf has a full set of HW, CTS tools and AUX Channel monitor
- DP Console GUI for sinks and sources allows RD debugging at Link Level
- Knowing your DUT capabilities and referencing CTS manual can greatly help passing CTS
- Unigraf products also enable production test automation to reduce production costs for OEM

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