High-bandwidth Digital Content Protection

Interface Independent Adaptation

Revision 2.2

Compliance Test Specification

Version 1.1

14 Jan 2014

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Revision History

04 Apr 2011 – Version 1.0. Publication on DCP, LLC website.

14 Jan 2014 – Version 1.1. Updates to HDCP 2.2 IIA Specification.

Table of Contents

Introduction

Purpose and Scope

This document specifies test procedures that will be used to test devices for compliance with the HDCP Specification Interface Independent Adaptation Revision 2.2.

Tests are specified for HDCP Source, HDCP Sink, and HDCP Repeater devices.

Normative References

Digital Content Protection, LLC, “High-bandwidth Digital Content Protection System – Interface Independent Adaptation”, Revision 2.2.

Definitions

Acronyms and Abbreviations

CDF	Capabilities Declaration Form. This is a questionnaire that the supplier of the DUT fills out prior to the testing phase. It provides additional information about the device, its modes, and its intended operation. The CDF will be maintained on the DCP Website (www.digital-cp.com/compliance).
DUT	Device Under Test
PCP	Product Capability Parameter
TE	Test Equipment
TRF	Test Results Form

Glossary of Terms

WARNING DUT’s operation did not meet expectations, but because this test only tests for compliance with recommendations, it cannot be treated as a failure.

PASS No error(s) were detected in the DUT’s operation, although the DUT may have WARNING item(s).

FAIL Error(s) were detected in the DUT’s operation.

Product Capability Parameters (PCP)

The PCP provides information about the behavior of the product under certain conditions and is requested from HDCP Adopters who wish to have their products tested. Information contained in the PCP is necessary to ensure accurate test reports.

Source Capability

Source_MultipleOutputs
Does the DUT support transmission of HDCP-protected content to more than one downstream device at the same time? (Y/N)

Source_LocalityPrecompute
Does the DUT support pre-computation of L during the locality check protocol. (Y/N)

Receiver Capability

Receiver_LocalityPrecompute
Does the DUT support pre-computation of L’ during the locality check protocol. (Y/N)

Repeater Capability

Repeater_MultipleOutputs
Does the DUT support transmission of HDCP-protected content to more than one downstream device at the same time? (Y/N)

Repeater_LocalityPrecomputeTx
Does the DUT’s downstream port support pre-computation of L during the locality check protocol. (Y/N)

Repeater_LocalityPrecomputeRx
Does the DUT’s upstream port support pre-computation of L’ during the locality check protocol. (Y/N)

HDCP Interface Independent Adaptation Compliance Test Specification

The HDCP Interface Independent Adaptation Compliance Test Specification uses Pseudo-sinks, Pseudo-repeaters and Pseudo-source TEs to test corresponding source, sink and repeater DUTs. The TEs simulate the behavior of sources, sinks and repeaters and can be configured to test the behavior of the DUTs under normal and error conditions.

1. Transmitter Test

Transmitter's (Source DUTs) are tested for compliance with the specification by connecting them to Receivers (TE pseudo-Sink) and Repeaters (TE pseudo-Repeater).

> Note: The source is required to play protected content; thus requiring HDCP to be enabled. The Content Stream to be played does not have any output restrictions (Type = 0).

1A. Downstream procedure with Receiver

In these tests, an HDCP Receiver (TE pseudo-Sink) is connected to the Transmitter (DUT).

1A-01. Regular Procedure – With previously connected Receiver (With stored k_m)

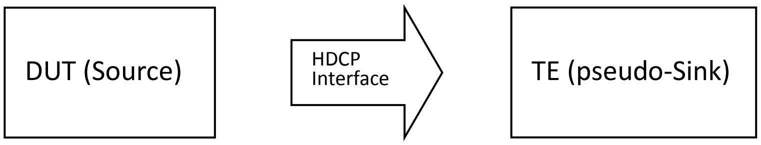
Test Objective

Verify the Transmitter's implementation of the HDCP protocol when an HDCP Receiver (that was previously connected) is attached.

Required Test Method

<Connection Setup>

☐ Connect TE (pseudo-Sink) to the downstream HDCP-protected Interface Port of DUT



Note: Upon initial connection, TE should authenticate and complete pairing with the DUT before proceeding

<Configuration of TE>

Message:	Parameter:	Value:
Authentication and Key Exchange		
AKE_Send_Cert	REPEATER	FALSE
	cert$_{rx}$	Valid
AKE_Receiver_Info	RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT	TRUE (within 100 ms timeout)
AKE_Send_rrx	r_{rx}	Valid (within 100 ms timeout)
AKE_Send_H_prime	H'	Valid (within 200 ms timeout)
Pairing		
AKE_Send_Pairing_Info	$E_{kh}\_k_m$	Valid (used only for first time)
Locality Check		
RTT_Ready		Valid
LC_Send_L_prime	L'	Valid (within 7 ms timeout)

<Test Case>

[Before Starting Authentication]

(STEP 1A-01-1)

- □ TE transmits Receiver Connected Indication
- □ DUT may begin transmitting low value, unencrypted signal with HDCP Encryption disabled
  - ➢ If DUT begins the Authentication and Key Exchange without sending unencrypted video signal, then WARNING (Ref-1A-1)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

[Authentication and Key Exchange]

(STEP 1A-01-2)

- □ DUT initiates authentication by transmitting AKE_Init
  - ➢ If DUT does not transmit AKE_Init within 10 seconds of TE transmitting Receiver Connected Indication, then FAIL (Ref-1A-2)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ DUT transmits AKE_Transmitter_Info
  - ➢ If DUT does not transmit AKE_Transmitter_Info within 100 ms of AKE_Init, then FAIL (Ref-1A-2)

  If Source_LocalityPrecompute = Y

  - ➢ If TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit of TRANSMITTER_CAPABILITY_MASK is not set, then FAIL (Ref-1A-3)

  If Source_LocalityPrecompute = N

  - ➢ If TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit of TRANSMITTER_CAPABILITY_MASK is set, then FAIL (Ref-1A-3)

(STEP 1A-01-3)

- □ TE sends AKE_Send_Cert message
- □ TE sends AKE_Receiver_Info message within 100 ms of AKE_Transmitter_Info
- □ DUT sends AKE_Stored_km message

  - ➢ If DUT sends AKE_No_Stored_km message, then NOTE ("DUT does not appear to implement persistent pairing for faster authentication")
  - ➢ If DUT does not send AKE_Stored_km message within 100 ms, then FAIL (Ref-1A-2)

- □ TE sends AKE_Send_rrx message
- □ TE computes *H'* and sends AKE_Send_H_prime message within the 200 ms timeout at the transmitter

[Locality Check]

(STEP 1A-01-4)

- □ DUT sends LC_Init message
  - ➢ If DUT does not send LC_Init message within 100 ms of transmission of AKE_Send_H_prime message, then FAIL (Ref-1A-5)

If Source_LocalityPrecompute = N

  - ➢ TE computes L' and sends LC_Send_L_prime message within the 7 ms timeout at the transmitter

If Source_LocalityPrecompute = Y

  - ➢ TE computes L' and sends RTT_Ready message
  - ➢ DUT transmits RTT_Challenge
    - If DUT does not send RTT_Challenge message within 5 seconds of transmission of RTT_Ready message, then FAIL (Ref-1A-5)
    - If least significant 128-bits of L do not match computed L', then FAIL (Ref-1A-5)
  - ➢ TE sends LC_Send_L_prime message within 7 ms timeout

[Session Key Exchange]

(STEP 1A-01-5)

- □ DUT sends SKE_Send_Eks message

  - ➢ If DUT does not send SKE_Send_Eks message within 100 ms of transmission of LC_Send_L_prime message, then FAIL (Ref-1A-6)

(STEP 1A-01-6)

- □ DUT enables HDCP encryption 200 ms after transmission of SKE_Send_Eks message
  - ➢ If DUT enables HDCP encryption in less than 200 ms, then FAIL (Ref-1A-6)
  - ➢ If DUT does not enable HDCP encryption within 10 seconds of transmission of SKE_Send_Eks message, then FAIL (Ref-1A-6)
- □ If DUT successfully completes the authentication process, then PASS.

1A-02. Regular Procedure – With newly connected Receiver (Without stored k_m)

Test Objective

Verify the Transmitter's implementation of the HDCP protocol when an HDCP Receiver (not previously connected) is attached.

Required Test Method

<Connection Setup>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m) except for following change:

□ TE utilizes *Receiver ID* not paired to DUT and does not complete pairing

<Test Case>

The steps described under [Before Starting Authentication] in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication and Key Exchange]

(STEP 1A-01-2) described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' is performed.

(STEP 1A-02-1)

□ TE sends AKE_Send_Cert message

□ TE sends AKE_Receiver_Info message within 100 ms of AKE_Transmitter_Info

□ DUT transmits AKE_No_Stored_km message

➢ If DUT does not transmit AKE_No_Stored_km message within 100 ms, then FAIL (Ref-1A-2)

➢ If DUT sends AKE_Stored_km message, then FAIL (Ref-1A-2)

➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

□ If DUT sends AKE_No_Stored_km message, then PASS

1A-03. Regular Procedure – Receiver disconnect after AKE_Init

Test Objective

Verify the Source DUT restarts authentication after the receiver is disconnected and reconnected following the write of AKE_Init with a new r_{tx} value.

Required Test Method

<Connection Setup>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication and Key Exchange]

> (STEP 1A-01-2) described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' is performed.

- □ TE transmits Receiver Disconnected Indication after AKE_Init message
- □ TE transmits Receiver Connected Indication (duration of disconnect is interface dependent)

(STEP 1A-03-1)

- □ DUT restarts Authentication and Key Exchange
  - ➢ If DUT does not restart Authentication and Key Exchange and complete (STEP 1A-01-2) as described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)', then FAIL (Ref-1A-7)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ If DUT re-starts Authentication and Key Exchange on detecting Receiver Connected Indication and performs (STEP 1A-01-2) as described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)', then PASS

1A-04. Regular Procedure – Receiver disconnect after k_m

Test Objective

Verify the Source DUT restarts authentication after the receiver is disconnected and reconnected following the exchange of k_m.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Authentication and Key Exchange]

(STEP 1A-01-2) and (STEP 1A-01-3) described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

- □ TE transmits Receiver Disconnected Indication after AKE_Stored_km message
- □ TE transmits Receiver Connected Indication (duration of disconnect is interface dependent)

(STEP 1A-04-1)

- □ DUT restarts Authentication and Key Exchange
  - ➢ If DUT does not restart Authentication and Key Exchange and complete (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then FAIL (Ref-1A-7)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ If DUT re-starts Authentication and Key Exchange on detecting Receiver Connected Indication and performs (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then PASS

1A-05. Regular Procedure – Receiver disconnect after locality check

Test Objective

Verify the Source DUT restarts authentication after the receiver is disconnected and reconnected after locality check is initiated.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Locality Check]

(STEP 1A-01-4) described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ is performed.

- □ TE transmits Receiver Disconnected Indication after LC_Init message
- □ TE transmits Receiver Connected Indication (duration of disconnect is interface dependent)

(STEP 1A-05-1)

- □ DUT restarts Authentication and Key Exchange
  - ➢ If DUT does not restart Authentication and Key Exchange and complete (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then FAIL (Ref-1A-7)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ If DUT re-starts Authentication and Key Exchange on detecting Receiver Connected Indication and performs (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then PASS

1A-06. Regular Procedure – Receiver disconnect after k_s

Test Case

Verify the Source DUT restarts authentication after the receiver is disconnected and reconnected following the exchange of k_s.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] through [Locality Check] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Session Key Exchange]

(STEP 1A-01-5) described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ is performed.

- □ TE transmits Receiver Disconnected Indication after SKE_Send_Eks message
- □ TE transmits Receiver Connected Indication (duration of disconnect is interface dependent)

(STEP 1A-06-1)

- □ DUT restarts Authentication and Key Exchange
  - ➢ If DUT does not restart Authentication and Key Exchange and complete (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then FAIL (Ref-1A-7)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ If DUT re-starts Authentication and Key Exchange on detecting Receiver Connected Indication and performs (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then PASS

1A-07. Irregular Procedure – Rx certificate not received

Test Objective

Verify the Source DUT considers it a failure of authentication when the certificate is not received from the Rx during AKE.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Authentication and Key Exchange]

> (STEP 1A-01-2) described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ is performed.

(STEP 1A-07-1)

- □ TE does not respond with AKE_Send_Cert
  - ➢ If DUT transmits AKE_No_Stored_km, then FAIL (Ref-1A-2)
  - ➢ If DUT transmits AKE_Stored_km, then FAIL (Ref-1A-2)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ If DUT aborts authentication, then PASS

1A-08. Irregular Procedure – Verify Receiver Certificate

Test Objective

Verify the Source DUT considers it a failure of authentication when verification of Receiver Certificate fails.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m) except for following change:

- TE provides invalid value for $cert_{rx}$

<Test Case>

The steps described under [Before Starting Authentication] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Authentication and Key Exchange]

> (STEP 1A-01-2) described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ is performed.

(STEP 1A-08-1)

□ TE provides invalid $cert_{rx}$ as part of AKE_Send_Cert

- ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- ➢ If DUT transmits AKE_No_Stored_km or AKE_Stored_km, then FAIL (Ref-1A-8)

□ If DUT aborts authentication, then PASS

1A-09. Irregular Procedure – SRM

Test Objective

Verify the Source DUT considers it a failure of authentication when the *Receiver ID* is on the revocation list.

Required Test Method

<Connection Setup>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication and Key Exchange]

(STEP 1A-01-2) described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' is performed.

(STEP 1A-09-1)

□ TE provides revoked *Receiver ID* as part of AKE_Send_Cert

- If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- If DUT transmits AKE_No_Stored_km or AKE_Stored_km, then FAIL (Ref-1A-8)

□ If DUT aborts Authentication and Key Exchange within 2 seconds of receipt of revoked *Receiver ID*, then PASS.

Note: DUT may alternatively re-start Authentication and Key Exchange and perform (STEP 1A-01-2) as described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)', by transmitting a new r_{tx} as part of AKE_Init.

1A-10. Irregular Procedure – Invalid H'

Test Objective

Verify the Source DUT considers it a failure of authentication if the Receiver provides a value for H' that does not match H, or does not respond with H' in the allotted time.

Required Test Method

<Connection Setup>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

- Exception in Test Case 3 – TE utilizes unpaired *Receiver ID*.

<Test Case>

The steps described under [Before Starting Authentication] in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication and Key Exchange]

> (STEP 1A-01-2) described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' is performed.
>
> Three test cases; all are performed

[Test Case 1 – Invalid H']

(STEP 1A-10-1)

- □ TE sends AKE_Send_Cert message (with previously paired *Receiver ID*)
- □ DUT sends AKE_Stored_km message
  - ➢ If DUT does not send AKE_Stored_km message, then NOTE ("DUT does not appear to implement persistent pairing for faster authentication")
- □ TE provides invalid *H'* as part of AKE_Send_H_prime
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

- ➢ If DUT transmits LC_Init, then FAIL (Ref-1A-8)

- □ If DUT aborts authentication, then PASS

[Test Case 2 – AKE_Send_H_prime timeout after AKE_Stored_km]

(STEP 1A-10-2)

- □ TE sends AKE_Send_Cert message (with previously paired *Receiver ID*)
- □ DUT sends AKE_Stored_km message
  - ➢ If DUT does not send AKE_Stored_km message, then NOTE ("DUT does not apprear to implement persistent pairing for faster authentication"); TE ends test
- □ TE does not respond with AKE_Send_H_prime within the 200 ms timeout at the transmitter
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
  - ➢ If DUT transmits LC_Init, then FAIL (Ref-1A-8)
- □ If DUT aborts authentication, then PASS

[Test Case 3 – AKE_Send_H_prime timeout after AKE_No_Stored_km]

(STEP 1A-10-3)

- □ TE sends AKE_Send_Cert message (with unpaired *Receiver ID*)
- □ DUT sends AKE_No_Stored_km message
  - ➢ If DUT does not send AKE_No_Stored_km message, then FAIL (Ref-1A-2)
- □ TE does not respond with AKE_Send_H_prime within 1 sec
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
  - ➢ If DUT transmits LC_Init, then FAIL (Ref-1A-8)
- □ If DUT aborts authentication, then PASS

1A-11. Irregular Procedure – Pairing Failure

Test Objective

Verify the Source DUT considers it a failure of authentication if the Receiver does not send AKE_Send_Pairing_Info.

Required Test Method

<Connection Setup>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m) except for following change:

- □ TE utilizes *Receiver ID* not paired to DUT

<Test Case>

The steps described under [Before Starting Authentication] in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication and Key Exchange]

> (STEP 1A-01-2) described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' is performed.

(STEP 1A-11-1)

- □ TE sends AKE_Send_Cert message
- □ DUT sends AKE_No_Stored_km message
  - ➢ If DUT does not transmit AKE_No_Stored_km message, then FAIL (Ref-1A-2)
  - ➢ If DUT sends AKE_Stored_km message, then FAIL (Ref-1A-2)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

(STEP 1A-11-2)

- □ TE sends AKE_Send_rrx message
- □ TE computes *H'* and sends AKE_Send_H_prime message within 1 sec

(STEP 1A-11-3)

- □ TE does not send AKE_Send_Pairing_Info message within 200 ms of the reception of AKE_Send_H_prime
- □ If DUT aborts authentication, then PASS

Note: TE does not complete pairing.

1A-12. Irregular Procedure – Locality Failure

Test Objective

Verify the Source DUT considers it a failure of authentication if the Receiver provides a value for L’ that does not match L, or does not respond with L’ in the allotted time.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Test Case>

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Locality Check]

(STEP 1A-01-4) described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ is performed.

Two test cases; both are performed.

[Test Case 1 – Invalid L’]

(STEP 1A-12-1)

1a - If Source_LocalityPrecompute = N

□ TE provides invalid *L’* as part of LC_Send_L_prime message

1b - If Source_LocalityPrecompute = Y

□ TE transmits RTT_Ready

□ DUT transmits RTT_Challenge

- ➢ If DUT does not send RTT_Challenge message within 100 ms, then FAIL (Ref-1A-5)

  - ➢ If least significant 128 bits of L do not match L’, then FAIL (Ref-1A-5)

- ☐ TE transmits incorrect MSBs of L’ in LC_Send_L_prime message

(STEP 1A-12-2)

- ☐ DUT reattempts locality check with the transmission of LC_Init

  - ➢ If DUT does not re-attempt locality check with the transmission of LC_Init 1023 additional times (for a total of 1024 trials), then NOTE (“Locality check failed, but DUT did not re-start authentication”) or (“Locality check failed, and DUT aborted authentication after XX attempts.”)

(STEP 1A-12-3)

- ☐ DUT aborts authentication

  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

- ☐ If DUT aborts authentication after 1024 unsuccessful attempts at Locality Check, then PASS

[Test Case 2 – LC_Send_L_prime message timeout]

(STEP 1A-12-4)

- ☐ TE does not respond with LC_Send_L_prime or RTT_Ready within 7 ms after transmission of LC_Init

(STEP 1A-12-5)

- ☐ DUT reattempts locality check with the transmission of LC_Init

  - ➢ If DUT does not re-attempt locality check with the transmission of LC_Init 1023 additional times (for a total of 1024 trials), then NOTE (“Locality check failed, but DUT did not re-start authentication”) or (“Locality check failed, and DUT aborted authentication after XX attempts.”)

(STEP 1A-12-6)

- ☐ DUT aborts authentication

  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

- ☐ If DUT aborts authentication after 1024 unsuccessful attempts at Locality Check, then PASS

1A-13. Regular Procedure – Locality Pre-Compute Support

Test Objective

Verify the Source DUT properly configures the TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT flag for non HDCP 2.2 devices.

Required Test Method

<Connection Setup>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m)

<Configuration of TE>

Same as ‘1A-01 Regular Procedure – With previously connected receiver (With stored k_m) except for following change:

- □ TE sets AKE_Receiver_Info.VERSION = 0x01; indicating HDCP 2.1 receiver

<Test Case>

Note: Only performed when Source_LocalityPrecompute = Y

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Locality Check]

(STEP 1A-13-1)

- □ DUT initiates authentication by transmitting AKE_Init
- □ DUT transmits AKE_Transmitter_Info with TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT = 0
  - ➢ If DUT does not transmit AKE_Transmitter_Info within 100 ms of AKE_Init, then FAIL (Ref-1A-5)
  - ➢ If DUT transmits AKE_Transmitter_Info with TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT = 1, then FAIL (Ref-1A-5)
- □ If DUT restarts Authentication and Key Exchange with TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT = 0, then PASS

1B. Downstream procedure with Repeater

In these tests, an HDCP Repeater (TE pseudo-Repeater) is connected to the Transmitter (DUT).

1B-01. Regular Procedure – With Repeater

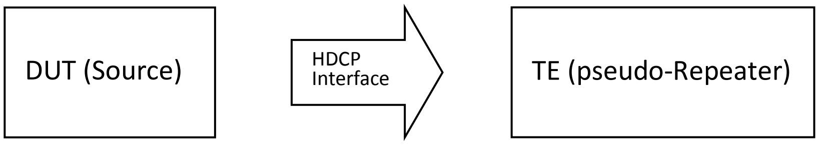
Test Objective

Verify the Source DUT works with a repeater attached under nominal circumstances

Required Test Method

<Connection Setup>

□ Connect TE to the downstream HDCP-protected Interface Port of DUT


DUT (Source)

HDCP Interface

TE (pseudo-Repeater)

<Configuration of TE>

Message:	Parameter:	Value:
Authentication and Key Exchange		
AKE_Send_Cert	REPEATER	TRUE
	cert_{rx}	Valid
AKE_Receiver_Info	Version	0x02
	Receiver_Capability_Mask	0x0001
AKE_Send_rrx	r_{rx}	Valid (within 100 ms timeout)
AKE_Send_H_prime	H’	Valid (within 200 ms timeout)
Pairing		
AKE_Send_Pairing_Info	$E_{kh}\_k_m$	Valid (used only for first time)
Locality Check		
LC_Send_L_prime	L’	Valid (within 7 ms timeout)
Authentication with Repeater		
RepeaterAuth_Send_ReceiverID_List	MAX_DEVS_EXCEEDED	FALSE
	MAX_CASCADE_EXCEEDED	FALSE
	DEVICE_COUNT	31
	DEPTH	4
	Receiver ID List	(DEVICE_COUNT * 5) bytes
	V’	Valid (within 3 second timeout)
	seq_num_V	Valid

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication with Repeaters]

(STEP 1B-01-1)

- □ TE clears MAX_CASCADE_EXCEEDED, MAX_DEVS_EXCEEDED, HDCP2_0_REPEATER_DOWNSTREAM, and HDCP1_DEVICE_DOWNSTREAM flags, sets DEPTH and DEVICE_COUNT to the configured values, initializes *seq_num_V* to 0, generates the ReceiverID_List and computes V'; sending the 128 most significant bits to the DUT in the RepeaterAuth_Send_ReceiverID_List message

- □ DUT transmits 128 least significant bits of V to TE in the RepeaterAuth_Send_Ack message

  - ➢ If DUT does not transmit RepeaterAuth_Send_Ack message within 1 second, then FAIL (Ref-1B-1)

  - ➢ If 128 least significant bits of V transmitted by DUT do not match the 128 least significant bits of V' computed by the TE, then FAIL (Ref-1B-4)

(STEP 1B-01-2)

Note: The Transmitter DUT must complete Content Stream Management at least 100 ms before transmitting the reference stream. Content Stream Management may be implemented in parallel with Authentication with Repeaters. The TE will support either method of Content Stream Management implemented in the DUT.

- □ DUT Transmits RepeaterAuth_Stream_Manage message

  - ➢ If DUT does not transmit RepeaterAuth_Stream_Manage message within 200 ms of TE receiving SKE_Send_Eks, then FAIL (Ref-1B-5)

- □ TE responds with RepeaterAuth_Stream_Ready message within 100 ms

(STEP 1B-01-3)

- □ DUT begins transmitting Content Stream within 10 seconds of completion of Content Stream Management and Authentication with Repeater.

  - ➢ If DUT begins transmitting Content Stream before 100 ms after completion of Content Stream Management, then FAIL (Ref-1B-5)

- □ If DUT successfully completes the authentication process, then PASS

1B-02. Regular Procedure – Authentication with HDCP 2.0 Repeater

Test Objective

Verify that the Source DUT correctly authenticates with a HDCP 2.0 capable repeater.

Required Test Method

<Connection Setup>

Same as ‘1B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘1B-01 Regular Procedure – With Repeater’ except for the following change:

- □ TE does not transmit AKE_Receiver_Info

<Test Case>

The steps under [Before Starting Authentication] described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

[Authentication and Key Exchange]

(STEP 1B-02-1)

- □ DUT initiates authentication by transmitting AKE_Init
  - ➢ If DUT does not transmit AKE_Init within 10 seconds of TE transmitting Receiver Connected Indication, then FAIL (Ref-1A-2)
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- □ DUT transmits AKE_Transmitter_Info
  - ➢ If DUT does not transmit AKE_Transmitter_Info within 100 ms of AKE_Init, then FAIL (Ref-1A-2)

  If Source_LocalityPrecompute = Y

  - ➢ If TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit of TRANSMITTER_CAPABILITY_MASK is not set, then FAIL (Ref-1A-3)

  If Source_LocalityPrecompute = N

- ➢ If TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit of TRANSMITTER_CAPABILITY_MASK is set, then FAIL (Ref-1A-3)

(STEP 1B-02-2)

- □ TE sends AKE_Send_Cert message
- □ TE sends does not send AKE_Receiver_Info message within 100 ms of AKE_Transmitter_Info
- □ DUT sends AKE_Stored_km message
  - ➢ If DUT sends AKE_No_Stored_km message, then NOTE ("DUT does not appear to implement persistent pairing for faster authentication")
  - ➢ If DUT does not send AKE_Stored_km message within 100 ms, then FAIL (Ref-1A-2)
- □ TE sends AKE_Send_rrx message
- □ TE computes *H'* and sends AKE_Send_H_prime message within the 200 ms timeout at the transmitter

[Locality Check]

(STEP 1B-02-3)

- □ DUT sends LC_Init message
  - ➢ If DUT does not send LC_Init message within 100 ms, then FAIL (Ref-1A-5)
- □ TE computes L' and sends LC_Send_L_prime message within the 7 ms timeout at the transmitter
  - ➢ If DUT sends RTT_Challenge message, then FAIL (Ref-1A-5)

[Session Key Exchange]

(STEP 1B-02-4)

- □ DUT sends SKE_Send_Eks message
  - ➢ If DUT does not send SKE_Send_Eks message within 100 ms, then FAIL (Ref-1A-6)

(STEP 1B-02-5)

□ DUT enables HDCP encryption 200 ms after transmission of SKE_Send_Eks message

- ➢ If DUT enables HDCP encryption in less than 200 ms, then FAIL (Ref-1A-6)
- ➢ If DUT does not enable HDCP encryption within 10 seconds of transmission of SKE_Send_Eks message, then FAIL (Ref-1A-6)

[Authentication with Repeaters]

(STEP 1B-02-6)

□ TE clears MAX_CASCADE_EXCEEDED, MAX_DEVS_EXCEEDED, sets DEPTH and DEVICE_COUNT to the configured values, generates the ReceiverID_List and computes V'; before sending the RepeaterAuth_Send_ReceiverID_List message

- ➢ If DUT transmits RepeaterAuth_Send_Ack message, then FAIL (Ref-1B-1)
- ➢ If DUT transmits RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)
- ➢ If DUT disables HDCP Encryption, then FAIL (Ref-1B-2)

□ If DUT successfully completes the authentication process, then PASS

1B-03. Regular Procedure – Re-authentication on Receiver Connected Indication

Test Objective

Verify that the Source DUT initiates re-authentication when a Receiver Connected Indication is received from the downstream repeater

Required Test Method

<Connection Setup>

Same as ‘1B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘1B-01 Regular Procedure – With Repeater’

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

The steps under [Authentication with Repeaters] described in ‘1B-01 Regular Procedure – With Repeater’ are performed.

(STEP 1B-03-1)

- □ TE transmits Receiver Connected Indication

(STEP 1B-03-2)

- □ DUT restarts Authentication and Key Exchange
  - ➢ If DUT does not restart Authentication and Key Exchange and complete (STEP 1A-01-2) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then FAIL (Ref-1A-7)
- □ If DUT re-starts Authentication and Key Exchange on detecting Receiver Connected Indication and performs (STEP 1A-01-1) as described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’, then PASS

1B-04. Irregular Procedure – Timeout of Receiver ID list

Test Objective

Verify the Source DUT considers it a failure of authentication if the downstream repeater does not respond with RepeaterAuth_Send_ReceiverID_List prior to expiration of watchdog timer

Required Test Method

<Connection Setup>

Same as '1B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '1B-01 Regular Procedure – With Repeater' except for the following change:

- □ TE does not respond with RepeaterAuth_Send_ReceiverID_List within the 3 second timeout of the receipt of SKE_Send_Eks

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

(STEP 1B-04-1)

- □ TE does not transmit RepeaterAuth_Send_ReceiverID_List within the 3 second timeout of reception of SKE_Send_Eks.
- □ DUT waits three seconds for the reception of RepeaterAuth_Send_ReceiverID_List

(STEP 1B-04-2)

- □ DUT disables HDCP encryption, if enabled, after the expiration of the three second timer
  - ➢ If DUT disables encryption, if enabled, before the timer expires, then FAIL (Ref-1B-3)
  - ➢ If DUT does not disable encryption, if enabled, after the timer expires, then FAIL (Ref-1B-3)
- □ If DUT aborts authentication, then PASS

1B-05. Irregular Procedure – Verify V’

Test Objective

Verify the Source DUT considers it a failure of authentication if the repeater provides a value for V’ that does not match V

Required Test Method

<Connection Setup>

Same as ‘1B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘1B-01 Regular Procedure – With Repeater’ except for the following change:

- □ TE provides an incorrect value for *V’*

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

Two test cases; both are performed

[Authentication with Repeaters]

[Test Case 1 – Incorrect value for most significant 128-bits of V’]

(STEP 1B-05-1)

- □ TE clears MAX_CASCADE_EXCEEDED, MAX_DEVS_EXCEEDED, HDCP2_0_REPEATER_DOWNSTREAM, and HDCP1_DEVICE_DOWNSTREAM flags, sets DEPTH and DEVICE_COUNT to the configured values, initializes *seq_num_V* to 0, generates the ReceiverID_List and computes V’; sending an incorrect value for the 128 most significant bits to the DUT in the RepeaterAuth_Send_ReceiverID_List message

[Test Case 2 – REAUTH_REQ = ‘true’]

(STEP 1B-05-2)

- □ TE clears MAX_CASCADE_EXCEEDED, MAX_DEVS_EXCEEDED, HDCP2_0_REPEATER_DOWNSTREAM, and HDCP1_DEVICE_DOWNSTREAM flags, sets DEPTH and DEVICE_COUNT to the configured values, initializes *seq_num_V* to 0, generates the ReceiverID_List and computes V'; sending the 128 most significant bits to the DUT in the RepeaterAuth_Send_ReceiverID_List message

□ DUT transmits 128 least significant bits to TE in the RepeaterAuth_Send_Ack message

- ➢ If DUT does not transmit RepeaterAuth_Send_Ack message within 1 second, then FAIL (Ref-1B-1)
- ➢ If 128 least significant bits of V transmitted by DUT do not match the 128 least significant bits of V' computed by the TE, then FAIL (Ref-1B-4)

□ TE transmits Receiver_AuthStatus message with REAUTH_REQ set 'true'

[All Test Cases]

(STEP 1B-05-3)

□ DUT disables HDCP encryption, if enabled, after receiving invalid *V'* or REAUTH_REQ = 'true'

- ➢ If DUT does not disable encryption, if enabled, , then FAIL (Ref-1B-4) and (Ref-1B-1)

□ If DUT aborts authentication, then PASS

1B-06. Irregular Procedure – MAX_DEVS_EXCEEDED

Test Objective

Verify the Source DUT considers it a failure of authentication if the repeater sets the MAX_DEVS_EXCEEDED bit in the RepeaterAuth_Send_ReceiverID_List message

Required Test Method

<Connection Setup>

Same as ‘1B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘1B-01 Regular Procedure – With Repeater’ except for the following change:

- □ TE sets MAX_DEVS_EXCEEDED to ‘TRUE’ in RepeaterAuth_Send_ReceiverID_List message

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in ‘1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)’ are performed.

(STEP 1B-06-1)

- □ TE clears MAX_CASCADE_EXCEEDED, DEPTH, DEVICE_COUNT, HDCP2_0_REPEATER_DOWNSTREAM, and HDCP1_DEVICE_DOWNSTREAM; sets MAX_DEVS_EXCEEDED to ‘TRUE’ and does not generate the ReceiverID_List or compute V’ in the RepeaterAuth_Send_ReceiverID_List message
- □ TE transmits RepeaterAuth_Send_ReceiverID_List message within the 3 second timeout of the receipt of SKE_Send_Eks

(STEP 1B-06-2)

- □ DUT disables HDCP encryption, if enabled, after receiving MAX_DEVS_EXCEEDED error
  - ➢ If DUT does not disable encryption, if enabled, after receiving MAX_DEVS_EXCEEDED error, then FAIL (Ref-1B-4)
- □ If DUT aborts authentication, then PASS

1B-07. Irregular Procedure – MAX_CASCADE_EXCEEDED

Test Objective

Verify the Source DUT considers it a failure of authentication if the repeater sets the MAX_CASCADE_EXCEEDED bit in the RepeaterAuth_Send_ReceiverID_List message

Required Test Method

<Connection Setup>

Same as '1B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '1B-01 Regular Procedure – With Repeater' except for the following change:

- □ TE sets MAX_CASCADE_EXCEEDED to 'TRUE' in RepeaterAuth_Send_ReceiverID_List message

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

(STEP 1B-07-1)

- □ TE clears MAX_DEVS_EXCEEDED, DEPTH, DEVICE_COUNT, HDCP2_0_REPEATER_DOWNSTREAM, and HDCP1_DEVICE_DOWNSTREAM; sets MAX_CASCADE_EXCEEDED to 'TRUE' and does not generate the ReceiverID_List or compute V' in the RepeaterAuth_Send_ReceiverID_List message
- □ TE transmits RepeaterAuth_Send_ReceiverID_List message within the 3 second timeout of the receipt of SKE_Send_Eks

(STEP 1B-07-2)

- □ DUT disables HDCP encryption, if enabled, after receiving MAX_CASCADE_EXCEEDED error
  - ➢ If DUT does not disable encryption, if enabled, after receiving MAX_CASCADE_EXCEEDED error, then FAIL (Ref-1B-4)
- □ If DUT aborts authentication, then PASS

1B-08. Irregular Procedure – Rollover of *seq_num_V*

Test Objective

Verify that the Source DUT initiates re-authentication when a rollover of *seq_num_V* is detected from the downstream repeater

Required Test Method

<Connection Setup>

Same as '1B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '1B-01 Regular Procedure – With Repeater'

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

The steps under [Authentication with Repeaters] described in '1B-01 Regular Procedure – With Repeater' are performed.

(STEP 1B-08-1)

- □ TE sets *seq_num_V* to 0xFFFFFFh
- □ TE simulates disconnect of an active downstream device by decrementing DEVICE_COUNT and adjusting the RecevierID_List and transmits RepeaterAuth_Send_ReceiverID_List message
- □ DUT transmits 128 least significant bits to TE in the RepeaterAuth_Send_Ack message
  - ➢ If DUT does not transmit RepeaterAuth_Send_Ack message within one second, then FAIL (Ref-1B-1)
  - ➢ If 128 least significant bits transmitted by DUT do not match the 128 least significant bits computed by the TE, then FAIL (Ref-1B-4)

(STEP 1B-08-2)

- □ TE sets *seq_num_V* to 0x000000h (indicating rollover of *seq_num_V*)

□ TE simulates connection of an active downstream device (same device that disconnected in STEP 1B-07-1) by incrementing DEVICE_COUNT and adjusting the RecevierID_List and transmits RepeaterAuth_Send_ReceiverID_List message

(STEP 1B-08-3)

□ DUT restarts Authentication and Key Exchange upon detecting rollover of *seq_num_V*

➢ If DUT does not restart Authentication and Key Exchange and complete (STEP 1A-01-2) as described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)', then FAIL (Ref-1B-4)

□ If DUT detects the rollover of *seq_num_V* as a failure of authentication, and re-starts Authentication and Key Exchange and performs (STEP 1A-01-2) as described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)', then PASS

1B-09. Irregular Procedure – Failure of Content Stream Management

Test Objective

Verify that the Source DUT re-attempts Content Stream Management following a failure of Content Stream Management

Required Test Method

<Connection Setup>

Same as '1B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '1B-01 Regular Procedure – With Repeater' except for following change:

- □ TE provides an incorrect value for *M'*

<Test Case>

The steps under [Before Starting Authentication] to [Session Key Exchange] described in '1A-01 Regular Procedure – With previously connected Receiver (With stored k_m)' are performed.

[Authentication with Repeaters]

(STEP 1B-01-1) described in '1B-01 Regular Procedure – With Repeater' is performed.

Two test cases; both are performed

[Test Case 1 – Incorrect value for *M'*]

(STEP 1B-09-1)

- □ DUT transmits RepeaterAuth_Stream_Manage message
  - ➢ If DUT does not transmit RepeaterAuth_Stream_Manage message within 200 ms of TE receiving SKE_Send_Eks, then FAIL (Ref-1B-5)
- □ TE responds with RepeaterAuth_Stream_Ready message within 100 ms with incorrect value for *M'*

(STEP 1B-09-2)

- □ DUT transmits RepeaterAuth_Stream_Manage message with incremented *seq_num_M*

- ➢ If DUT transmits content stream without resending RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)
- ➢ If DUT transmits RepeaterAuth_Stream_Manage message with same *seq_num_M*, then FAIL (Ref-1B-5)
- ➢ If DUT does not transmit new RepeaterAuth_Stream_Manage message, then WARNING (Ref-1B-5)

□ If DUT transmits new RepeaterAuth_Stream_Manage message after failure of *M’* comparison, then PASS

[Test Case 2 – Timeout of RepeaterAuth_Stream_Ready message]

(STEP 1B-09-3)

□ DUT transmits RepeaterAuth_Stream_Manage message

- ➢ If DUT does not transmit RepeaterAuth_Stream_Manage message within 200 ms of TE receiving SKE_Send_Eks, then FAIL (Ref-1B-5)

□ TE does not respond with RepeaterAuth_Stream_Ready message within 100 ms

(STEP 1B-09-4)

□ DUT transmits RepeaterAuth_Stream_Manage message with incremented *seq_num_M*

- ➢ If DUT transmits content stream without resending RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)
- ➢ If DUT transmits RepeaterAuth_Stream_Manage message with same *seq_num_M*, then FAIL (Ref-1B-5)
- ➢ If DUT does not transmit new RepeaterAuth_Stream_Manage message, then WARNING (Ref-1B-5)

□ If DUT transmits new RepeaterAuth_Stream_Manage message after timeout of 100 ms timer, then PASS

2. Receiver Tests

Receivers (Sink DUTs) are tested for compliance with the specification by connecting them to Transmitters (TE pseudo-Source).

2C. Upstream procedure with Transmitter

Receiver's upstream procedure with Transmitter is tested with an HDCP-capable Transmitter. Make sure that the DUT maintains "connection" during the test, unless "receiver disconnect" is needed during the test.

In these tests, an HDCP Transmitter (TE Pseudo-source) is connected to the Receiver (DUT).

2C-01. Regular Procedure – With transmitter

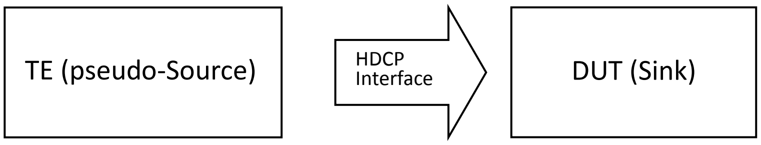
Test Objective

Verify the Receiver DUT works with an attached source under nominal circumstances

Required Test Method

<Connection Setup>

- □ Connect TE to the upstream HDCP-protected Interface Port of DUT



<Test Case>

[Before Starting Authentication]

(STEP 2C-01-1)

- □ TE detects Receiver Connected Indication
  - ➢ If DUT does not send Receiver Connected Indication within 10 seconds, then FAIL (Ref-2C-1)

[Authentication and Key Exchange]

(STEP 2C-01-2)

- □ TE begins sending unencrypted video signal with HDCP Encryption disabled
- □ TE transmits AKE_Init message
- □ TE transmits AKE_Transmitter_Info message with TRANSMITTER_LOCALITY_PRECOMPUTE = 1
- □ DUT transmits AKE_Send_Cert message
  - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
  - ➢ If AKE_Send_Cert:REPEATER is ‘TRUE’, then FAIL (Ref-2C-3)
  - ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

□ DUT transmits AKE_Receiver_Info message

- ➢ If DUT does not transmit AKE_Receiver_Info message within 100 ms of AKE_Transmitter_Info, then FAIL (Ref-2C-4)
- ➢ If AKE_Receiver_Info:VERSION is not 0x02h, then FAIL (Ref-2C-5)
- ➢ If Receiver_LocalityPrecompute = Y and AKE_Receiver_Info:RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT = 'false', then FAIL (Ref-2C-5)
- ➢ If Receiver_LocalityPrecompute = N and AKE_Recevier_Info:RECEIVER_LOCALITY_PRECOMPUTE_SUPPRT = 'true', then FAIL (Ref-2C-5)

Two test cases; both are performed

[Test Case 1 – Not previously connected *Receiver ID*]

(STEP 2C-01-3)

□ TE transmits AKE_No_Stored_km message

□ DUT transmits AKE_Send_rrx message

- ➢ If DUT does not transmit AKE_Send_rrx message within 100 ms, then FAIL (Ref-2C-2)

(STEP 2C-01-4)

□ DUT transmits AKE_Send_H_prime message

- ➢ If DUT does not transmit AKE_Send_H_prime within one second timeout, then FAIL (Ref-2C-2)
- ➢ If *H'* is not equal to *H*, then FAIL (Ref-2C-2)

[Pairing]

(STEP 2C-01-5)

□ DUT transmits AKE_Send_Pairing_Info message

- ➢ If DUT does not transmit AKE_Send_Pairing_Info message within 200 ms of AKE_Send_H_prime message, then FAIL (Ref-1A-4)

[Test Case 2 – Previously connected *Receiver ID*]

(STEP 2C-01-6)

☐ TE transmits AKE_Stored_km message

☐ DUT transmits AKE_Send_rrx message

- ➢ If DUT does not transmit AKE_Send_rrx message within 100 ms, then FAIL (Ref-2C-2)

(STEP 2C-01-7)

☐ DUT transmits AKE_Send_H_prime message

- ➢ If DUT does not transmit AKE_Send_H_prime within 200 ms timeout, then FAIL (Ref-2C-2)
- ➢ If *H'* is not equal to *H*, then FAIL (Ref-2C-2)
- ➢ If DUT transmits AKE_Send_Pairing_Info, then FAIL (Ref-1A-3)

[Both test cases]

[Locality Check]

(STEP 2C-01-8)

☐ TE transmits LC_Init message

If Receiver_LocalityPrecompute = Y

- ➢ DUT transmits RTT_Ready message
  - If DUT does not transmit RTT_Ready within 100 ms of LC_Init, then FAIL (Ref-2C-6)
- ➢ TE transmits RTT_Challenge message including correct value of least significant 128 bits of L

☐ DUT sends LC_Send_L_prime message

- ➢ If DUT does not transmit LC_Send_L_prime message within 7 ms of transmission of:

- LC_Init message for Receiver_LocalityPrecompute = N, then FAIL (Ref-2C-6)
- RTT_Challenge message for Receiver_LocalityPrecompute = Y, then FAIL (Ref-2C-6)

If Receiver_LocalityPrecompute = N

- ➢ If L’ does not match L, then FAIL (Ref-2C-6)

If Receiver_LocalityPrecompute = Y

- ➢ If most significant 128-bits of L’ do not match most significant 128-bits of L, then FAIL (Ref-2C-6)

[Session Key Exchange]

(STEP 2C-01-9)

☐ TE transmits SKE_Send_Eks message

☐ TE enables HDCP Encryption 200 ms after transmitting SKE_Send_Eks message

☐ TE transmits visible test pattern to DUT

☐ If DUT completes the authentication process and test pattern is viewed successfully, then PASS

2C-02. Irregular Procedure – New Authentication after AKE_Init

Test Objective

Verify the Receiver DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted right after the transmission of AKE_Init in the unauthenticated state

Required Test Method

<Connection Setup>

Same as '2C-01 Regular Procedure – With Transmitter'

<Test Case>

The steps described under [Before Starting Authentication] in '2C-01 Regular Procedure – With Transmitter' are performed.

[Authentication and Key Exchange]

(Step 2C-01-2) described in '2C-01 Regular Procedure – With Transmitter' is performed.

(STEP 2C-02-1)

□ TE transmits AKE_Init message

(STEP 2C-02-2)

□ DUT transmits AKE_Send_Cert message

- ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
- ➢ If AKE_Send_Cert:REPEATER is 'TRUE', then FAIL (Ref-2C-3)
- ➢ If DUT transmits AKE_Receiver_Info message, then FAIL (Ref-2C-4)
- ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

The steps under [Test Case 2 – Previously connected *Receiver ID*] described in '2C-01 Regular Procedure – With Transmitter' are performed.

□ If DUT successfully completes authentication with the new r_{tx} value provided in the second AKE_Init message, then PASS

2C-03. Irregular Procedure – New Authentication during Locality Check

Test Objective

Verify the Receiver DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted right after the reception of LC_Init

Required Test Method

<Connection Setup>

Same as '2C-01 Regular Procedure – With Transmitter'

<Test Case>

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] (for [Test Case 2 – Previously connected *Receiver ID*]) in '2C-01 Regular Procedure – With Transmitter' are performed.

[Locality Check]

(STEP 2C-03-1)

- □ TE transmits LC_Init message
- □ TE transmits AKE_Init message

(STEP 2C-03-2)

- □ DUT transmits AKE_Send_Cert message
  - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)

The steps under [Test Case 2 – Previously connected *Receiver ID*] described in '2C-01 Regular Procedure – With Transmitter' are performed.

- □ If DUT successfully completes authentication with the new r_{tx} value provided in the second AKE_Init message, then PASS

2C-04. Irregular Procedure – New Authentication after SKE_Send_Eks

Test Objective

Verify the Receiver DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted right after the reception of SKE_Send_Eks

Required Test Method

<Connection Setup>

Same as '2C-01 Regular Procedure – With Transmitter'

<Test Case>

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] (for [Test Case 2 – Previously connected *Receiver ID*]) and [Locality Check] in '2C-01 Regular Procedure – With Transmitter' are performed.

[Session Key Exchange]

(STEP 2C-04-1)

- □ TE transmits SKE_Send_Eks message
- □ TE transmits AKE_Init message

(STEP 2C-04-2)

- □ DUT transmits AKE_Send_Cert message
  - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)

The steps under [Test Case 2 – Previously connected *Receiver ID*] described in '2C-01 Regular Procedure – With Transmitter' are performed.

- □ If DUT successfully completes authentication with the new r_{tx} value provided in the second AKE_Init message, then PASS

2C-05. Irregular Procedure – New Authentication during Link Synchronization

Test Objective

Verify the Receiver DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted during Link Synchronization

Required Test Method

<Connection Setup>

Same as ‘2C-01 Regular Procedure – With Transmitter’

<Test Case>

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] (for [Test Case 2 – Previously connected *Receiver ID*]) and [Locality Check] in ‘2C-01 Regular Procedure – With Transmitter’ are performed.

[Session Key Exchange]

(STEP 2C-05-1)

□ TE transmits SKE_Send_Eks message

□ TE enables HDCP Encryption 200 ms after transmitting SKE_Send_Eks message

□ TE transmits AKE_Init message

(STEP 2C-05-2)

□ DUT transmits AKE_Send_Cert message

- If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)

The steps under [Test Case 2 – Previously connected *Receiver ID*] described in ‘2C-01 Regular Procedure – With Transmitter’ are performed.

□ If DUT successfully completes authentication with the new r_{tx} value provided in the second AKE_Init message, then PASS

2C-06. Irregular Procedure – Invalid L

Test Objective

Verify the Receiver DUT does not transmit LC_Send_L_prime message when an incorrect L value is received in the RTT_Challenge message.

Required Test Method

<Connection Setup>

Same as ‘2C-01 Regular Procedure – With Transmitter’

<Test Case>

The steps described under [Before Starting Authentication] and [Authentication and Key Exchange] (for [Test Case 2 – Previously connected *Receiver ID*]) in ‘2C-01 Regular Procedure – With Transmitter’ are performed.

[Locality Check]

(STEP 2C-06-1)

- □ TE transmits LC_Init message
    - ➢ DUT transmits RTT_Ready message
        - If DUT does not transmit RTT_Ready message within 100ms of LC_Init, then FAIL (Ref-2C-6)

(STEP 2C-06-2)

- □ TE transmits RTT_Challenge message including incorrect value of least significant 128-bits of L
    - ➢ If DUT transmits LC_Send_L_prime message, then FAIL (Ref-2C-6)
- □ TE’s locality check fails after 7ms watchdog timer expires. TE retries an additional 1023 times with incorrect RTT_Ready message.
    - ➢ If DUT does not respond to TE transmission of incorrect RTT_Challenge message for a total of 1024 tries, then PASS

3. Repeater Tests

Repeater DUTs are tested for compliance with the specification by connecting them to Receivers (TE pseudo-Sink), Repeaters (TE pseudo-Repeater) and Transmitters (TE pseudo-Source).

3A. Downstream Procedure with Receiver

In this test, a Receiver (TE pseudo-Sink) is connected to the downstream HDCP-protected Interface Port of the Repeater DUT. An HDCP Transmitter (providing HDCP-protected content) is connected to the upstream HDCP-protected Interface Port of the Repeater DUT.

3A-01. Regular Procedure – With previously connected Receiver (With stored k_m)

Test Objective

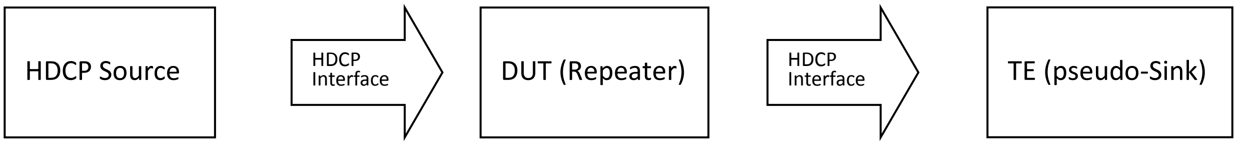
Verify the Repeater's implementation of the HDCP protocol when an HDCP Receiver (that was previously connected) is attached.

Required Test Method

<Connection Setup>

□ Connect an HDCP Source device to the upstream HDCP-protected Interface Port of DUT

□ Connect TE (pseudo-Sink) to the downstream HDCP-protected Interface Port of DUT



<Configuration of TE>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

<Test Case>

Same as '1A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

3A-02. Regular Procedure – With newly connected Receiver (Without stored k_m)

Test Objective

Verify the Repeater's implementation of the HDCP protocol when an HDCP Receiver (not previously connected) is attached.

Required Test Method

<Connection Setup>

Same as '3A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

<Configuration of TE>

Same as '1A-02 Regular Procedure – With newly connected Receiver (Without stored k_m)'

<Test Case>

Same as '1A-02 Regular Procedure – With newly connected Receiver (Without stored k_m)'

3A-03. Irregular Procedure – Rx certificate not received

Test Objective

Verify the Repeater DUT considers it a failure of authentication when the certificate is not received from the Rx during AKE.

Required Test Method

<Connection Setup>

Same as '3A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

<Configuration of TE>

Same as '1A-07 Irregular Procedure – Rx certificate not received''

<Test Case>

Same as '1A-07 Irregular Procedure – Rx certificate not received'

3A-04. Irregular Procedure – Verify Receiver Certificate

Test Objective

Verify the Repeater DUT considers it a failure of authentication when verification of Receiver certificate fails.

Required Test Method

<Connection Setup>

Same as '3A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

<Configuration of TE>

Same as '1A-08 Irregular Procedure – Verify Receiver Certificate'

<Test Case>

Same as '1A-08 Irregular Procedure – Verify Receiver Certificate'

3A-05. Irregular Procedure – Invalid H’

Test Objective

Verify the Repeater DUT considers it a failure of authentication if the Receiver provides a value for H’ that does not match H, or does not respond with H’ in the allotted time.

Required Test Method

<Connection Setup>

Same as ‘3A-01 Regular Procedure – With previously connected receiver (With stored k_m)’

<Configuration of TE>

Same as ‘1A-10 Irregular Procedure – Invalid H’’

<Test Case>

Same as ‘1A-10 Irregular Procedure – Invalid H’’

3A-06. Irregular Procedure – Pairing Failure

Test Objective

Verify the Repeater DUT considers it a failure of authentication if the Receiver does not send AKE_Send_Pairing_Info.

Required Test Method

<Connection Setup>

Same as '3A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

<Configuration of TE>

Same as '1A-11 Irregular Procedure – Pairing Failure'

<Test Case>

Same as '1A-11 Irregular Procedure – Pairing Failure'

3A-07. Regular Procedure – Locality Pre-Compute Support

Test Objective

Verify the Repeater DUT properly configures the TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT flag for non HDCP 2.2 devices.

Required Test Method

<Connection Setup>

Same as '3A-01 Regular Procedure – With previously connected receiver (With stored k_m)'

<Configuration of TE>

Same as '1A-13 Regular Procedure – Locality Pre-Compute Support'

<Test Case>

Same as '1A-13 Regular Procedure – Locality Pre-Compute Support'

3B. Downstream Procedure with Repeater

In this test, a Repeater (TE pseudo-Repeater) is connected to the downstream HDCP-protected Interface Port of the Repeater DUT. An HDCP Transmitter (providing HDCP-protected content) is connected to the upstream HDCP-protected Interface Port of the Repeater DUT.

3B-01. Regular Procedure – With Repeater

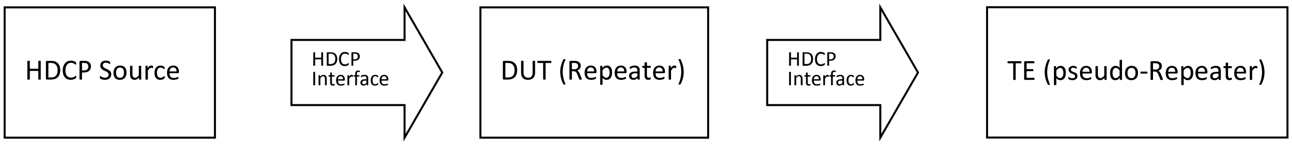
Test Objective

Verify the Repeater DUT works with a repeater attached under nominal circumstances

Required Test Method

<Connection Setup>

- □ Connect an HDCP Source device to the upstream HDCP-protected Interface Port of DUT
- □ Connect TE to the downstream HDCP-protected Interface Port of DUT



<Configuration of TE>

Same as ‘1B-01 Regular Procedure – With Repeater’ except for the following change

- RepeaterAuth_Send_ReceiverID_List:DEVICE_COUNT = 30
- RepeaterAuth_Send_ReceiverID_List:DEPTH = 3

<Test Case>

Same as ‘1B-01 Regular Procedure – With Repeater’

3B-02. Irregular Procedure – Timeout of Receiver ID list

Test Objective

Verify the Repeater DUT considers it a failure of authentication if the downstream repeater does not respond with RepeaterAuth_Send_ReceiverID_List prior to expiration of watchdog timer

Required Test Method

<Connection Setup>

Same as '3B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '3B-01 Regular Procedure – With Repeater' except for the following change:

- □ TE does not respond with RepeaterAuth_Send_ReceiverID_List within the 3 second timeout of the receipt of SKE_Send_Eks

<Test Case>

Same as '1B-04 Irregular Procedure – Timeout of Receiver ID list'

3B-03. Irregular Procedure – Verify V’

Test Objective

Verify the Repeater DUT considers it a failure of authentication if the repeater provides a value for V’ that does not match V

Required Test Method

<Connection Setup>

Same as ‘3B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘3B-01 Regular Procedure – With Repeater’ except for the following change:

- □ TE provides an incorrect value for V’

<Test Case>

Same as ‘1B-05 Irregular Procedure – Verify V’’

3B-04. Irregular Procedure – MAX_DEVS_EXCEEDED

Test Objective

Verify the Repeater DUT considers it a failure of authentication if the repeater sets the MAX_DEVS_EXCEEDED bit in the RepeaterAuth_Send_ReceiverID_List message

Required Test Method

<Connection Setup>

Same as ‘3B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘3B-01 Regular Procedure – With Repeater’ except for the following change:

- □ TE sets MAX_DEVS_EXCEEDED to ’TRUE’ in RepeaterAuth_Send_ReceiverID_List message

<Test Case>

Same as ‘1B-06 Irregular Procedure – MAX_DEVS_EXCEEDED’

3B-05. Irregular Procedure – MAX_CASCADE_EXCEEDED

Test Objective

Verify the Repeater DUT considers it a failure of authentication if the repeater sets the MAX_CASCADE_EXCEEDED bit in the RepeaterAuth_Send_ReceiverID_List message

Required Test Method

<Connection Setup>

Same as ‘3B-01 Regular Procedure – With Repeater’

<Configuration of TE>

Same as ‘3B-01 Regular Procedure – With Repeater’ except for the following change:

- □ TE sets MAX_CASCADE_EXCEEDED to ’TRUE’ in RepeaterAuth_Send_ReceiverID_List message

<Test Case>

Same as ‘1B-07 Irregular Procedure – MAX_CASCADE_EXCEEDED’

3B-06. Irregular Procedure – Rollover of *seq_num_V*

Test Objective

Verify the Repeater DUT initiates re-authentication when a rollover of *seq_num_V* is detected from the downstream repeater

Required Test Method

<Connection Setup>

Same as '3B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '3B-01 Regular Procedure – With Repeater'

<Test Case>

Same as '1B-08 Irregular Procedure – Rollover of *seq_num_V*'

3B-07. Irregular Procedure – Failure of Content Stream Management

Test Objective

Verify the Repeater DUT re-attempts Content Stream Management following a failure of Content Stream Management

Required Test Method

<Connection Setup>

Same as '3B-01 Regular Procedure – With Repeater'

<Configuration of TE>

Same as '1B-09 Irregular Procedure – Failure of Content Stream Management'

<Test Case>

Same as '1B-09 Irregular Procedure – Failure of Content Stream Management'

3C. Upstream Procedure with Transmitter

In this test, the Repeater DUT is tested under the following two connection setups:

- An HDCP Transmitter (TE pseudo-Source) is connected to the upstream HDCP-protected Interface Port and an HDCP Receiver (TE pseudo-Sink) is connected to the downstream HDCP-protected Interface Port of the Repeater DUT.
- An HDCP Transmitter (TE pseudo-Source) is connected to the upstream HDCP-protected Interface Port and an HDCP Repeater (TE pseudo-Repeater) is connected to the downstream HDCP-protected Interface Port of the Repeater DUT.

□ Repeater (DUT) Connected to Transmitter (TE pseudo-Source) and Receiver (TE pseudo-Sink)

In this test, an HDCP Transmitter (TE pseudo-Source) is connected to the upstream HDCP-protected Interface Port of the Repeater DUT. An HDCP Receiver (TE pseudo-Sink) is connected to the downstream HDCP-protected Interface Port of the Repeater (DUT).

3C-01. Regular Procedure – Transmitter – DUT – Receiver

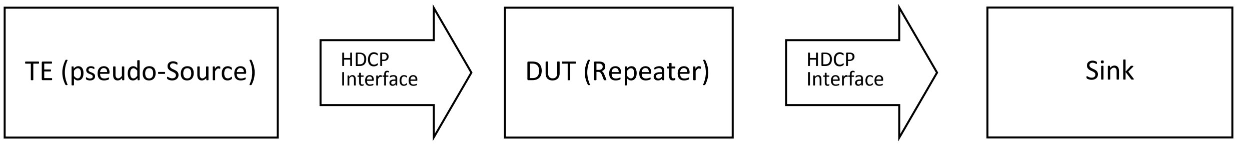
Test Objective

Verify the Repeater DUT's implementation of the HDCP Protocol when an HDCP Transmitter is connected to the upstream Repeater port and an HDCP Receiver is connected to the downstream Repeater port

Required Test Method

<Connection Setup>

- □ Connect TE (pseudo-Source) to the upstream HDCP-protected Interface Port of DUT
- □ Connect an HDCP Sink to the downstream HDCP-protected Interface Port of DUT



Note: A device that has already passed the compliance test is used as the Sink device

<Test Case>

The steps described under [Before Starting Authentication] in '2C-01 Regular Procedure – With Transmitter' are performed.

[Authentication and Key Exchange]

(Step 2C-01-2) described in '2C-01 Regular Procedure – With Transmitter' are performed, with the following changes:

- □ TE begins sending unencrypted video signal with HDCP Encryption disabled
- □ TE transmits AKE_Init message
- □ TE transmits AKE_Transmitter_Info message with TRANSMITTER_LOCALITY_PRECOMPUTE = 1
- □ DUT transmits AKE_Send_Cert message
  - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
  - ➢ If REPEATER is 'FALSE' in AKE_Send_Cert message, then FAIL (Ref-2C-3)
  - ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

□ DUT transmits AKE_Receiver_Info message

- ➢ If DUT does not transmit AKE_Receiver_Info message within 100 ms of AKE_Transmitter_Info, then FAIL (Ref-2C-4)
- ➢ If AKE_Receiver_Info:VERSION is not 0x02h, then FAIL (Ref-2C-5)
- ➢ If Receiver_LocalityPrecompute = Y and AKE_Receiver_Info:RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT = 'false', then FAIL (Ref-2C-5)
- ➢ If Receiver_LocalityPrecompute = N and AKE_Recevier_Info:RECEIVER_LOCALITY_PRECOMPUTE_SUPPRT = 'true', then FAIL (Ref-2C-5)

The remaining steps described in [Authentication and Key Exchange] (both test cases) and the steps described in [Pairing], [Locality Check], and [Session Key Exchange] in '2C-01 Regular Procedure – With Transmitter' are performed.

[Authentication with Repeaters]

(STEP 3C-01-1)

□ DUT transmits RepeaterAuth_Send_ReceiverID_List message

- ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List message within 3 second timeout of SKE_Send_Eks, then FAIL(Ref-1B-3)
- ➢ If RepeaterAuth_Send_ReceiverID_List:MAX_DEVS_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)
- ➢ If RepeaterAuth_Send_ReceiverID_List:MAX_CASCADE_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)
- ➢ If RepeaterAuth_Send_ReceiverID_List:DEPTH is not one, then FAIL(Ref-3C-2)
- ➢ If RepeaterAuth_Send_ReceiverID_List:DEVICE_COUNT is not one, then FAIL(Ref-3C-2)
- ➢ If RepeaterAuth_Send_Receiver_ID_List:HDCP2_0_REPEATER_DOWNSTREAM is one, then FAIL (Ref-3C-6)
- ➢ If RepeaterAuth_Send_Receiver_ID_List:HDCP1_DEVICE_DOWNSTREAM is one, then FAIL (Ref-3C-6)

- ➢ If RepeaterAuth_Send_Receiver_ID_List:V’ is not 128 bits, then FAIL (Ref-1B-4)

(STEP 3C-01-2)

☐ TE compares computed value of most significant 128 bits of V to 128 bits of V’ received in RepeaterAuth_Send_ReceiverID_list.

- ➢ If most significant 128 bits of V’ do not match the most significant 128 bits of V, then FAIL (Ref-1B-4)

(STEP 3C-01-3)

☐ TE transmits RepeaterAuth_Send_Ack message with valid least 128 bits of V within one second of receipt of RepeaterAuth_Send_ReceiverID_list

- ➢ If DUT sends Receiver_AuthStatus message with REAUTH_REQ = ‘TRUE’, then FAIL (Ref-1B-1)

(STEP 3C-01-4)

[Content Stream Managemet] – Two test cases; both are performed.

[Test Case 1 – Content Stream Management done in serial with propagation of topology information]

☐ TE transmits RepeaterAuth_Stream_Manage message within 200 ms after transmitting RepeaterAuth_Send_Ack message with Type set to 0

[Test Case 2 – Content Stream Management done in parallel with propagation of topology information]

☐ TE transmits RepeaterAuth_Stream_Manage message within 200 ms after successful completion of Locality Check with Type set to 0

[Both Test Cases]

☐ DUT transmits RepeaterAuth_Stream_Ready message

- ➢ If DUT does not transmit RepeaterAuth_Stream_Ready message within 100 ms of transmission of RepeaterAuth_Stream_Manage, then FAIL (Ref-1B-5)
- ➢ If the value of M’ received in the RepeaterAuth_Stream_Ready message does not match the TE’s calculated value of M, then FAIL (Ref-1B-5)

☐ TE Enables HDCP Encryption

(STEP 3C-01-5)

- □ If DUT completes the authentication process successfully, then PASS

3C-02. Regular Procedure – Receiver Disconnect Propagation when an Active Receiver is Disconnected Downstream

Test Objective

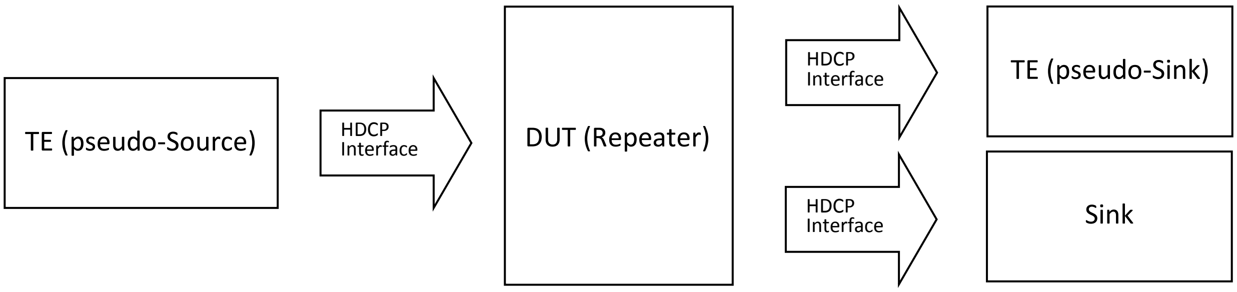
Verify the Repeater DUT sends an updated RepeaterAuth_Send_ReceiverID_List message when an active downstream Receiver is disconnected when HDCP Content is flowing.

Required Test Method

This test is performed if Repeater_MultipleOutputs = Y, otherwise SKIP

<Connection Setup>

- □ Connect TE (pseudo-Source) to the upstream HDCP-protected Interface Port of DUT
- □ Connect TE (pseudo-Sink) to the one downstream HDCP-protected Interface Port of DUT
- □ Connect HDCP Sink to another downstream HDCP-protected Interface Port of DUT



Note: A device that has already passed the compliance test is used as the Sink device

<Test Case>

The steps described under [Before Starting Authentication] in ‘2C-01 Regular Procedure – With Transmitter’ are performed.

The steps described under [Authentication and Key Exchange] in ‘3C-01 Regular Procedure – Transmitter – DUT – Receiver’ are performed.

The remaining steps described in [Authentication and Key Exchange] and the steps described in [Pairing], [Locality Check], and [Session Key Exchange] in ‘2C-01 Regular Procedure – With Transmitter’ are performed.

[Authentication with Repeaters]

(STEP 3C-01-1) described in '3C-01 Regular Procedure – Transmitter – DUT – Receiver' is performed with the following changes:

- □ DUT transmits RepeaterAuth_Send_ReceiverID_List message
    - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List message within 3 second timeout of SKE_Send_Eks, then FAIL(Ref-1B-3)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:MAX_DEVS_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:MAX_CASCADE_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:DEPTH is not one, then FAIL(Ref-3C-2)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:DEVICE_COUNT is not two, then FAIL(Ref-3C-2)

(STEP 3C-01-2) described in '3C-01 Regular Procedure – Transmitter – DUT – Receiver' is performed

[Disconnect of Downstream Sink]

(STEP 3C-02-1)

- □ TE (pseudo-Sink) sends Receiver Disconnect Indication
    - ➢ If DUT transmits Receiver Disconnect upstream, then FAIL (Ref-3C-3)

(STEP 3C-02-2)

- □ DUT transmits RepeaterAuth_Send_ReceiverID_List message
    - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List message within 3 second of TE (pseudo-Sink) disconnect, then FAIL(Ref-1B-3)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:MAX_DEVS_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:MAX_CASCADE_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)
    - ➢ If RepeaterAuth_Send_ReceiverID_List:DEPTH is not one, then FAIL(Ref-3C-2)

- ➢ If RepeaterAuth_Send_ReceiverID_List:DEVICE_COUNT is not one, then FAIL(Ref-3C-2)
- ➢ If content stream to remaining receiver is interrupted, then WARNING (Ref-3C-7)

□ If the DUT does not propagate Receiver Disconnect upstream when an active downstream Sink is disconnected, and transmits an updated RepeaterAuth_Send_ReceiverID_List message, then PASS

3C-03. Regular Procedure – Receiver Connected when an Active Receiver is Connected Downstream

Test Objective

Verify the Repeater DUT sends an updated RepeaterAuth_Send_ReceiverID_List message a new active downstream Receiver is connected and HDCP Content is flowing.

Required Test Method

This test is performed if Repeater_MultipleOutputs = Y, otherwise SKIP

<Connection Setup>

Same as '3C-02 Regular Procedure – Receiver Disconnect Propagation when an Active Receiver is Disconnected Downstream' with one exception:

- TE (pseudo-Sink) is in disconnected state

<Test Case>

The steps described under [Before Starting Authentication] to [Authentication with Repeaters] in '3C-02 Regular Procedure – Receiver Disconnect Propagation when an Active Receiver is Disconnected and Reconnected Downstream' are performed

[Connect Active Downstream Sink]

(STEP 3C-03-1)

□ TE (pseudo-Sink) sends Receiver Connect indication to DUT

➢ If DUT propagates Receiver Connect indication upstream, then FAIL (Ref-3C-7)

(STEP 3C-03-2)

□ DUT transmits RepeaterAuth_Send_ReceiverID_List message

➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List message within 3 second of TE (pseudo-Sink) connect, then FAIL(Ref-1B-3)

➢ If RepeaterAuth_Send_ReceiverID_List:MAX_DEVS_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)

➢ If RepeaterAuth_Send_ReceiverID_List:MAX_CASCADE_EXCEEDED is 'TRUE', then FAIL(Ref-3C-1)

- ➢ If RepeaterAuth_Send_ReceiverID_List:DEPTH is not one, then FAIL(Ref-3C-2)
- ➢ If RepeaterAuth_Send_ReceiverID_List:DEVICE_COUNT is not two, then FAIL(Ref-3C-2)
- ➢ If content stream to remaining receiver is interrupted, then WARNING (Ref-3C-7)

□ If the DUT transmits updated RepeaterAuth_Send_ReceiverID_List message upon connection of a new downstream HDCP Receiver, then PASS

3C-04. Irregular Procedure – New Authentication after AKE_Init

Test Objective

Verify the Repeater DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted right after the transmission of AKE_Init in the unauthenticated state

Required Test Method

<Connection Setup>

Same as ‘3C-01 Regular Procedure – Transmitter – DUT - Receiver’

<Test Case>

Same as ‘2C-02 Irregular Procedure – New Authentication after AKE_Init’ with the following changes:

(STEP 2C-01-2)

- □ TE begins sending unencrypted video signal with HDCP Encryption disabled
- □ TE transmits AKE_Init message
- □ DUT transmits AKE_Send_Cert message
  - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
  - ➢ If AKE_Send_Cert:REPEATER is ‘FALSE’, then FAIL (Ref-2C-3)
  - ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

The steps described under [Test Case 2 – Previously Connected Receiver ID] in ‘2C-01 Regular Procedure – With Transmitter’ are performed

- □ If DUT successfully completes authentication with new r_{tx} value provided in the second AKE_Init message, then PASS

3C-05. Irregular Procedure – New Authentication during Locality Check

Test Objective

Verify the Repeater DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted right after the reception of LC_Init

Required Test Method

<Connection Setup>

Same as '3C-01 Regular Procedure – Transmitter – DUT - Receiver'

<Test Case>

Same as '2C-03 Irregular Procedure – New Authentication during Locality Check' with the following changes:

(STEP 2C-01-2)

- □ TE begins sending unencrypted video signal with HDCP Encryption disabled
- □ TE transmits AKE_Init message
- □ DUT transmits AKE_Send_Cert message
  - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
  - ➢ If AKE_Send_Cert:REPEATER is 'FALSE', then FAIL (Ref-2C-3)
  - ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

The steps described under [Test Case 2 – Previously Connected Receiver ID] in '2C-01 Regular Procedure – With Transmitter' are performed

- □ If DUT successfully completes authentication with new r_{tx} value provided in the second AKE_Init message, then PASS

3C-06. Irregular Procedure – New Authentication after SKE_Send_Eks

Test Objective

Verify the Repeater DUT restarts authentication when a new AKE_Init and r_{tx} is transmitted right after the reception of SKE_Send_Eks

Required Test Method

<Connection Setup>

Same as '3C-01 Regular Procedure – Transmitter – DUT - Receiver'

<Test Case>

Same as '2C-04 Irregular Procedure – New Authentication after SKE_Send_Eks' with the following changes:

(STEP 2C-01-2)

- □ TE begins sending unencrypted video signal with HDCP Encryption disabled
- □ TE transmits AKE_Init message
- □ DUT transmits AKE_Send_Cert message
    - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
    - ➢ If AKE_Send_Cert:REPEATER is 'FALSE', then FAIL (Ref-2C-3)
    - ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

The steps described under [Test Case 2 – Previously Connected Receiver ID] in '2C-01 Regular Procedure – With Transmitter' are performed

- □ If DUT successfully completes authentication with new r_{tx} value provided in the second AKE_Init message, then PASS

3C-07. Irregular Procedure – New Authentication during Link Synchronization

Test Objective

Verify the Repeater DUT restarts authentication when a new AKE_Init and rtx is transmitted during Link Synchronization

Required Test Method

<Connection Setup>

Same as '3C-01 Regular Procedure – Transmitter – DUT - Receiver'

<Test Case>

Same as '2C-05 Irregular Procedure – New Authentication during Link Synchronization' with the following changes:

(STEP 2C-01-2)

- □ TE begins sending unencrypted video signal with HDCP Encryption disabled
- □ TE transmits AKE_Init message
- □ DUT transmits AKE_Send_Cert message
    - ➢ If DUT does not transmit AKE_Send_Cert message, then FAIL (Ref-2C-2)
    - ➢ If AKE_Send_Cert:REPEATER is 'FALSE', then FAIL (Ref-2C-3)
    - ➢ If DUT transmits AKE_Send_rrx message, then FAIL (Ref-2C-4)

The steps described under [Test Case 2 – Previously Connected Receiver ID] in '2C-01 Regular Procedure – With Transmitter' are performed

- □ If DUT successfully completes authentication with new r_{tx} value provided in the second AKE_Init message, then PASS

3C-08. Irregular Procedure – Rx Certificate invalid

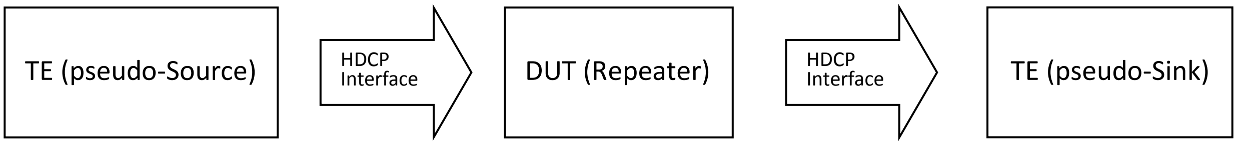
Test Objective

Verify the Repeater DUT considers it a failure of authentication and does not send RepeaterAuth_Send_ReceiverID_List message when the certificate received from the Receiver is invalid

Required Test Method

<Connection Setup>

- □ Connect TE (pseudo-Source) to the upstream HDCP-protected Interface Port of DUT
- □ Connect TE (pseudo-Sink) to the downstream HDCP-protected Interface Port of DUT



<Configuration of TE (pseudo-Sink)>

Same as ‘1A-08 Irregular Procedure – Verify Receiver Certificate’

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in ‘3C-01 Regular Procedure – Transmitter – DUT – Receiver’ are performed.

[Authentication with Repeaters]

(STEP 3C-08-1)

- □ DUT reads invalid certificate of downstream pseudo-Sink
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
  - ➢ If DUT transmits AKE_No_Stored_km or AKE_Stored_km, then FAIL (Ref-1A-8)

(STEP 3C-08-2)

- □ TE (pseudo-Source) waits for DUT to transmit RepeaterAuth_Send_ReceiverID_List message for a maximum time of 3 seconds
  - ➢ If DUT transmits RepeaterAuth_Send_ReceiverID_List message, then FAIL (Ref-3C-5)

□ If DUT treats invalid downstream certificate as an authentication failure and does not transmit RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-09. Irregular Procedure – Invalid H’

Test Objective

Verify the Repeater DUT considers it a failure of authentication and does not send RepeaterAuth_Send_ReceiverID_List message when the Receiver provides a value for H’ that does not match H; or does not respond with H’ in the allotted time

Required Test Method

<Connection Setup>

Same as ‘3C-08 Irregular Procedure – Rx Certificate invalid’

<Configuration of TE (pseudo-Sink)>

Same as ‘1A-10 Irregular Procedure – Invalid H’’

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in ‘3C-01 Regular Procedure – Transmitter – DUT – Receiver’ are performed.

[Authentication with Repeaters]

Two test cases; both are performed

[Test Case 1 – Invalid H’]

(STEP 3C-09-1)

☐ DUT reads invalid *H’* of downstream pseudo-Sink

- If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- If DUT transmits LC_Init, then FAIL (Ref-1A-8)

[Test Case 2 – AKE_Send_H_prime timeout after AKE_Stored_km]

(STEP 3C-09-2)

☐ TE (pseudo-Sink) does not provide AKE_Send_H_prime message within 200 ms timeout at the DUT

- If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)
- If DUT transmits LC_Init, then FAIL (Ref-1A-8)

[Both Test Cases]

(STEP 3C-09-3)

- □ TE (pseudo-Source) waits for DUT to transmit RepeaterAuth_Send_ReceiverID_List message for a maximum time of 3 seconds
    - ➢ If DUT transmits RepeaterAuth_Send_ReceiverID_List message, then FAIL (Ref-3C-5)
- □ If DUT treats invalid downstream H' or timeout of AKE_Send_H_prime as an authentication failure and does not transmit RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-10. Irregular Procedure – Locality Failure

Test Objective

Verify the Repeater DUT considers it a failure of authentication and does not send RepeaterAuth_Send_ReceiverID_List message when the Receiver provides a value for L' that does not match L; or does not respond with L' in the allotted time

Required Test Method

<Connection Setup>

Same as '3C-08 Irregular Procedure – Rx Certificate invalid'

<Configuration of TE (pseudo-Sink)>

Same as '1A-12 Irregular Procedure – Locality Failure'

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in '3C-01 Regular Procedure – Transmitter – DUT – Receiver' are performed.

[Authentication with Repeaters]

Two test cases; both are performed

[Test Case 1 – Invalid L']

(STEP 3C-10-1)

- □ DUT reads invalid *L'* of downstream pseudo-Sink
  - ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

[Test Case 2 – LC_Send_L_prime message timeout]

(STEP 3C-10-2)

- □ TE (pseudo-Sink) does not provide LC_Send_L_prime message within 7 ms timeout at the DUT
- □ DUT may reattempt locality check with the transmission of LC_Init
  - ➢ If DUT reattempts locality check for more than 1024 total attempts, then FAIL (Ref-1A-9)

- ➢ If DUT enables HDCP Encryption, then FAIL (Ref-1A-1)

[Both Test Cases]

(STEP 3C-10-3)

- □ TE (pseudo-Source) waits for DUT to transmit RepeaterAuth_Send_ReceiverID_List message for a maximum time of 3 seconds
  - ➢ If DUT transmits RepeaterAuth_Send_ReceiverID_List message, then FAIL (Ref-3C-5)
- □ If DUT treats invalid downstream L' or timeout of LC_Send_L_prime as an authentication failure and does not transmit RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-11. Irregular Procedure – Invalid L

Test Objective

Verify the Repeater DUT does not transmit LC_Send_L_prime message when an incorrect L value is received in the RTT_Challenge message.

Required Test Method

<Connection Setup>

Same as ‘3C-01 Regular Procedure – Transmitter – DUT – Receiver’

<Configuration of TE (pseudo_Sink)>

Same as ‘2C-06 Irregular Procedure – Invalid L’

<Test Case>

Same as ‘2C-06 Irregular Procedure – Invalid L’

□ Repeater (DUT) Connected to Transmitter (TE pseudo-Source) and Repeater (TE pseudo-Repeater)

In this test, an HDCP Transmitter (TE pseudo-Source) is connected to the upstream HDCP-protected Interface Port of the Repeater DUT. An HDCP Repeater (TE pseudo-Repeater) is connected to the downstream HDCP-protected Interface Port of the Repeater (DUT).

3C-12. Regular Procedure – Transmitter – DUT – Repeater (With stored km)

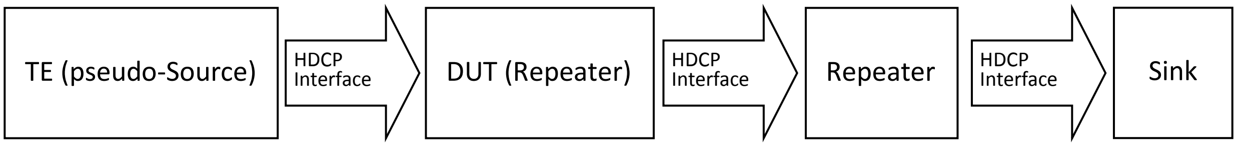
Test Objective

Verify the Repeater DUT's implementation of the HDCP Protocol when an HDCP Transmitter is connected to the upstream Repeater port and an HDCP Repeater is connected to the downstream Repeater port

Required Test Method

<Connection Setup>

- □ Connect TE (pseudo-Source) to the upstream HDCP-protected Interface Port of DUT
- □ Connect an HDCP Repeater and HDCP Sink to the downstream HDCP-protected Interface Port of DUT



Note: Devices that have already passed the compliance test are used as the Repeater and Sink devices

Note: Downstream Repeater and Sink need to be HDCP 2.2 compatible devices.

<Configuration of TE (pseudo-Repeater)>

Message:	Parameter:	Value:
Authentication and Key Exchange		
AKE_Send_Cert	REPEATER	TRUE
	cert_{rx}	Valid
AKE_Receiver_Info	Version	0x02
	Receiver_Capability_Mask	0x0001
AKE_Send_rrx	r_{rx}	Valid (within 100 ms timeout)
AKE_Send_H_prime	H'	Valid (within 200 ms timeout)
Pairing		
AKE_Send_Pairing_Info	$E_{kh}\_k_m$	Valid (used only for first time)
Locality Check		
LC_Send_L_prime	L'	Valid (within 7 ms timeout)
Authentication with Repeater		
RepeaterAuth_Send_ReceiverID_List	MAX_DEVS_EXCEEDED	FALSE
	MAX_CASCADE_EXCEEDED	FALSE

	DEVICE_COUNT	30
	DEPTH	3
	Receiver ID List	(DEVICE_COUNT * 5) bytes
	V’	Valid (within 3 second timeout)
	seq_num_V	Valid
	HDCP2_0_REPEATER_DOWNSTREAM	FALSE
	HDCP1_DEVICE_DOWNSTREAM	FALSE

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in ‘3C-01 Regular Procedure – Transmitter – DUT – Receiver’ are performed, with the following changes:

[Authentication with Repeaters]

(STEP 3C-01-1)

□ DUT transmits RepeaterAuth_Send_ReceiverID_List message

- If DUT does not transmit RepeaterAuth_Send_ReceiverID_List message within 3 second timeout of SKE_Send_Eks, then FAIL(Ref-1B-3)
- If RepeaterAuth_Send_ReceiverID_List:MAX_DEVS_EXCEEDED is ‘TRUE’, then FAIL(Ref-3C-1)
- If RepeaterAuth_Send_ReceiverID_List:MAX_CASCADE_EXCEEDED is ‘TRUE’, then FAIL(Ref-3C-1)
- If RepeaterAuth_Send_ReceiverID_List:DEPTH is not two, then FAIL(Ref-3C-2)
- If RepeaterAuth_Send_ReceiverID_List:DEVICE_COUNT is not two, then FAIL(Ref-3C-2)
- If RepeaterAuth_Send_ReceiverID_List:HDCP2_0_REPEATER_DOWNSTREAM is one, then FAIL (Ref-3C-6)
- If RepeaterAuth_Send_ReceiverID_List:HDCP1_DEVICE_DOWNSTREAM is one, then FAIL (Ref-3C-6)
- If RepeaterAuth_Send_ReceiverID_List:V’ is not 128 bits, then FAIL (Ref-1B-4)

The remaining steps including (3C-01-2) described in '3C-01 Regular Procedure – Transmitter – DUT – Receiver' are performed

- □ If DUT completes the authentication process successfully, then PASS

3C-13. Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag

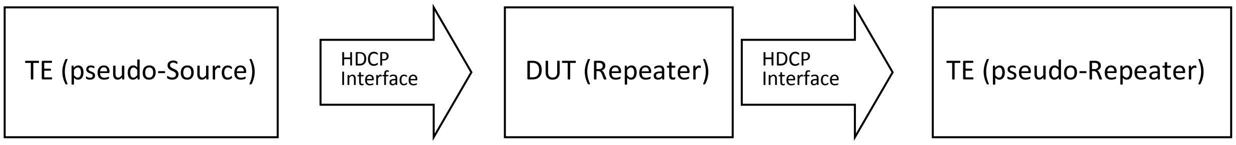
Test Objective

Verify the Repeater DUT propagates the HDCP2_0_REPEATER_DOWNSTREAM flag upstream when provided by the downstream repeater in RepeaterAuth_Send_ReceiverID_list message.

Required Test Method

<Connection Setup>

- □ Connect TE (pseudo-Source) to the upstream HDCP-protected Interface Port of DUT
- □ Connect TE (pseudo-Repeater) to the downstream HDCP-protected Interface Port of DUT



<Configuration of TE (pseudo-Repeater)>

Same as ‘3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored km)’ except for the following change:

- □ TE (pseudo-Repeater) sets HDCP2_0_REPEATER_DOWNSTREAM to ‘1’

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in ‘3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored k_m)’ are performed

[Authentication with Repeaters]

(STEP 3C-13-1)

- □ TE (pseudo-Repeater) sends RepeaterAuth_Send_ReceiverID_List

(STEP 3C-13-2)

- □ DUT transmits RepeaterAuth_Send_ReceiverID_List to TE (pseudo-Source)
  - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-5)

- ➢ If DUT does not report HDCP2_0_REPEATER_DOWNSTREAM = 1 in RepeaterAuth_Send_ReceiverID_list, then FAIL (Ref-3C-8)

□ If DUT propagates downstream indication of HDCP2_0_REPEATER_DOWNSTREAM status to upstream TE (pseudo-Source) as part of RepeaterAuth_Send_ReceiverID_List, then PASS

3C-14. Regular Procedure – Propagation of HDCP1_DEVICE_DOWNSTREAM flag

Test Objective

Verify the Repeater DUT propagates the HDCP1_DEVICE_DOWNSTREAM flag upstream when provided by the downstream repeater in RepeaterAuth_Send_ReceiverID_list message.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored km)' except for the following change:

- □ TE (pseudo-Repeater) sets HDCP1_DEVICE_DOWNSTREAM to '1'

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored k_m)' are performed

[Authentication with Repeaters]

(STEP 3C-14-1)

- □ TE (pseudo-Repeater) sends RepeaterAuth_Send_ReceiverID_List

(STEP 3C-14-2)

- □ DUT transmits RepeaterAuth_Send_ReceiverID_List to TE (pseudo-Source)
  - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-5)
  - ➢ If DUT does not report HDCP1_DEVICE_DOWNSTREAM = 1 in RepeaterAuth_Send_ReceiverID_list, then FAIL (Ref-3C-8)
- □ If DUT propagates downstream indication of HDCP1_DEVICE_DOWNSTREAM status to upstream TE (pseudo-Source) as part of RepeaterAuth_Send_ReceiverID_List, then PASS

3C-15. Regular Procedure – Content Stream Management

Test Objective

Verify the Repeater DUT propagates the Content Stream Management function as determined by the upstream source.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored km)'

<Test Case>

The steps described under [Before Starting Authentication] to [Authentication with Repeaters] in '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored k_m)' are performed

(STEP 3C-15-1)

□ TE (pseudo-Source) sends RepeaterAuth_Stream_Manage message

(STEP 3C-15-2)

□ DUT transmits RepeaterAuth_Stream_Ready message within 100ms

- If DUT does not transmit RepeaterAuth_Stream_Ready message within 100 ms, then FAIL (Ref-3C-5)
- If M' provided in RepeaterAuth_Stream_Ready message does not match TE's calculation of M, then FAIL (Ref-1B-5)

(STEP 3C-15-3)

□ DUT sends RepeaterAuth_Stream_Manage message to TE (pseudo-Repeater)

- If DUT does not transmit RepeaterAuth_Stream_Manage message at least 100 ms before transmitting the corresponding Content Stream, then FAIL (Ref-1B-5)

[Three test cases; all are performed]

[Test case 1 – Valid M']

(STEP 3C-15-4)

- □ TE responds with RepeaterAuth_Stream_Ready message within 100 ms with valid M'
- □ DUT transmits stream
  - ➢ If DUT does not transmit stream referenced in RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)
  - ➢ If DUT transmits Content Stream earlier than 100 ms after transmission of RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)

[Test case 2 –Invalid M']

(STEP 3C-15-5)

- □ TE responds with RepeaterAuth_Stream_Ready message within 100 ms with invalid M'
- □ DUT does not transmit stream
  - ➢ If DUT transmits stream referenced in RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)

[Test case 3 –Timeout of RepeaterAuth_Stream_Ready message]

(STEP 3C-15-6)

- □ TE does not respond with RepeaterAuth_Stream_Ready message within 100 ms
- □ DUT does not transmit stream
  - ➢ If DUT transmits stream referenced in RepeaterAuth_Stream_Manage message, then FAIL (Ref-1B-5)
- □ If DUT properly responds to confirmation or failure of RepeaterAuth_Stream_Ready message, then PASS

3C-16. Irregular Procedure – Timeout of Receiver ID list

Test Objective

Verify the Repeater DUT considers it a failure of authentication and does not send RepeaterAuth_Send_ReceiverID_List message when the downstream repeater fails to provide RepeaterAuth_Send_ReceiverID_List message prior to expiration of the watchdog timer.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored km)'

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored k_m)' are performed

[Authentication with Repeaters]

(STEP 3C-16-1)

□ DUT waits maximum of 3 seconds for downstream TE (pseudo-Repeater) to send RepeaterAuth_Send_ReceiverID_List

(STEP 3C-16-2)

□ DUT disables HDCP encryption, if enabled, after the expiration of the three second timer

- If DUT disables encryption before the timer expires, then FAIL (Ref-1B-3)
- If DUT does not disable encryption after the timer expires, then FAIL (Ref-1B-3)

(STEP 3C-16-3)

□ DUT does not transmit RepeaterAuth_Send_ReceiverID_List to TE (pseudo-Source)

- If DUT transmits RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-5)

□ If DUT treats timeout of watchdog timer for RepeaterAuth_Send_ReceiverID_List from downstream TE pseudo-Repeater as an authentication failure and does not transmit RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-17. Irregular Procedure – Verify V’

Test Objective

Verify the Repeater DUT considers it a failure of authentication and does not send RepeaterAuth_Send_ReceiverID_List message when the downstream repeater provides a value for V’ that does not match V.

Required Test Method

<Connection Setup>

Same as ‘3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag’

<Configuration of TE (pseudo-Repeater)>

Same as ‘1B-05 Irregular Procedure – Verify V’’

<Test Case>

Same as ‘1B-05 Irregular Procedure – Verify V’’

[Authentication with Repeaters]

(STEP 3C-17-1)

□ DUT does not transmit RepeaterAuth_Send_ReceiverID_List to TE (pseudo-Source)

- ➢ If DUT transmits RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-5)

□ If DUT treats the mismatch of V and invalid V’ from downstream TE pseudo-Repeater as an authentication failure and does not transmit RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-18. Irregular Procedure – DEVICE_COUNT

Test Objective

Verify the Repeater DUT asserts MAX_DEVS_EXCEEDED bit in RepeaterAuth_Send_ReceiverID_List message if the computed DEVICE_COUNT exceeds 31.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored km)' except for the following change:

- □ TE (pseudo-Repeater) sets DEVICE_COUNT = 31

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored k_m)' are performed

[Authentication with Repeaters]

(STEP 3C-18-1)

- □ TE (pseudo-Repeater) sends RepeaterAuth_Send_ReceiverID_List
- □ DUT disables HDCP encryption, if enabled, after computing DEVICE_COUNT
  - ➢ If DUT disables encryption before TE (pseudo-Repeater) transmits RepeaterAuth_Send_ReceiverID_List message, then FAIL (Ref-3C-1)
  - ➢ If DUT does not disable encryption after computing DEVICE_COUNT, then FAIL (Ref-3C-1)

(STEP 3C-18-2)

- □ DUT sets MAX_DEVS_EXCEEDED flag and transmits RepeaterAuth_Send_ReceiverID_List to TE (pseudo-source)
  - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-1)

- ➢ If MAX_DEVS_EXCEEDED is ‘FALSE’, then FAIL (Ref-3C-1)

□ If DUT considers it an authentication failure when topology maximums are exceeded and signals MAX_DEVS_EXCEEDED error in RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-19. Irregular Procedure – DEPTH

Test Objective

Verify the Repeater DUT asserts MAX_CASCADE_EXCEEDED bit in RepeaterAuth_Send_ReceiverID_List message if the computed DEPTH for it exceeds four.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored km)' except for the following change:

- □ TE (pseudo-Repeater) sets DEPTH = 4

<Test Case>

The steps described under [Before Starting Authentication] to [Session Key Exchange] in '3C-12 Regular Procedure – Transmitter – DUT – Repeater (With stored k_m)' are performed

[Authentication with Repeaters]

(STEP 3C-19-1)

- □ TE (pseudo-Repeater) sends RepeaterAuth_Send_ReceiverID_List
- □ DUT disables HDCP encryption, if enabled, after computing DEPTH
    - ➢ If DUT disables encryption before TE (pseudo-Repeater) transmits RepeaterAuth_Send_ReceiverID_List message, then FAIL (Ref-3C-1)
    - ➢ If DUT does not disable encryption after computing DEPTH, then FAIL (Ref-3C-1)

(STEP 3C-19-2)

- □ DUT sets MAX_CASCADE_EXCEEDED flag and transmits RepeaterAuth_Send_ReceiverID_List to TE (pseudo-source)
    - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-1)

  - ➢ If MAX_CASCADE_EXCEEDED is ‘FALSE’, then FAIL (Ref-3C-1)

- □ If DUT considers it an authentication failure when topology maximums are exceeded and signals MAX_CASCADE_EXCEEDED error in RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-20. Irregular Procedure – MAX_DEVS_EXCEEDED

Test Objective

Verify the Repeater DUT asserts MAX_DEVS_EXCEEDED bit in RepeaterAuth_Send_ReceiverID_List message when it receives a MAX_DEVS_EXCEEDED status from the downstream pseudo-Repeater.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '1B-06 Irregular Procedure – MAX_DEVICES_EXCEEDED'

<Test Case>

Same as '1B-06 Irregular Procedure – MAX_DEVICES_EXCEEDED'

[Authentication with Repeaters]

(STEP 3C-20-1)

□ DUT sets MAX_DEVS_EXCEEDED flag and transmits RepeaterAuth_Send_ReceiverID_List to TE (pseudo-source)

- ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-1)
- ➢ If MAX_DEVS_EXCEEDED is 'FALSE', then FAIL (Ref-3C-1)

□ If DUT treats the reception of MAX_DEVS_EXCEEDED from downstream TE pseudo-Repeater as an authentication failure and signals MAX_DEVS_EXCEEDED error in RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

3C-21. Irregular Procedure – MAX_CASCADE_EXCEEDED

Test Objective

Verify the Repeater DUT asserts MAX_CASCADE_EXCEEDED bit in RepeaterAuth_Send_ReceiverID_List message when it receives a MAX_CASCADE_EXCEEDED status from the downstream pseudo-Repeater.

Required Test Method

<Connection Setup>

Same as '3C-13 Regular Procedure – Propagation of HDCP2_0_REPEATER_DOWNSTREAM flag'

<Configuration of TE (pseudo-Repeater)>

Same as '1B-07 Irregular Procedure – MAX_CASCADE_EXCEEDED'

<Test Case>

Same as '1B-07 Irregular Procedure – MAX_CASCADE_EXCEEDED'

[Authentication with Repeaters]

(STEP 3C-21-1)

- □ DUT sets MAX_CASCADE_EXCEEDED flag and transmits RepeaterAuth_Send_ReceiverID_List to TE (pseudo-source)
  - ➢ If DUT does not transmit RepeaterAuth_Send_ReceiverID_List, then FAIL (Ref-3C-1)
  - ➢ If MAX_CASCADE_EXCEEDED is 'FALSE', then FAIL (Ref-3C-1)
- □ If DUT treats the reception of MAX_CASCADE_EXCEEDED from downstream TE pseudo-Repeater as an authentication failure and signals MAX_CASCADE_EXCEEDED error in RepeaterAuth_Send_ReceiverID_List to the upstream TE (pseudo-Source), then PASS

4. Reference

Refer to the High-bandwidth Digital Content Protection System – Interface Independent Adaptation, Revision 2.2.

Ref-1A. Downstream procedure with Receiver

Ref-1A-1

Reference	Requirement
State H1: Transmit Low-value Content Page 32	**State H1: Transmit Low-value Content.** In this state the transmitter should begin sending an unencrypted signal with HDCP Encryption disabled. The transmitted signal can be a low value content or informative on-screen display. This will ensure that a valid video signal is displayed to the user before and during authentication. At any time a Receiver Connected Indication received from the connected HDCP 2.0-compliant HDCP Repeater causes the transmitter to transition to this state.
Errata to HDCP Interface Independent Adaptation Specification Revision 2.2	Page 32, replace 3rd paragraph in Page 32 with the following: **State H1: Transmit Low-value Content.** In this state the transmitter may begin sending an unencrypted signal with HDCP Encryption disabled. The transmitted signal can be a low value content or informative on-screen display. If low-value content is transmitted, this will ensure that a valid video signal is displayed to the user before and during authentication. At any time a Receiver Connected Indication received from the connected HDCP 2.0-compliant HDCP Repeater causes the transmitter to transition to this state.
State A5: Authenticated Page 34	**State A5: Authenticated.** At this time, and at no prior time, the HDCP Transmitter has completed the authentication protocol. A periodic Link Synchronization is performed to maintain cipher synchronization between HDCP Transmitter and HDCP Receiver.

Ref-1A-2

Reference	Requirement
2.2 Authentication and Key Exchange Page 13	Authentication and Key Exchange (AKE) is the first step in the authentication protocol. Figure 2.1 and Figure 2.2 illustrates the AKE. The HDCP Transmitter (*Device A*) can initiate authentication at any time, even before a previous authentication exchange has completed. The HDCP Transmitter initiates a new HDCP Session by sending a new r_{tx} as part of the authentication initiation message, AKE_Init. Message formats are defined in Section 4.3. The HDCP Tranmitter

	• Initiates authentication by sending an initiation message, AKE_Init, containing a 64-bit pseudo-random value (r_{tx}) • Sends AKE_Transmitter_Info message to the HDCP Receiver before sending either AKE_No_Stored_km or AKE_Stored_km message to the receiver. Note: The HDCP Transmitter may use mechanisms outside the scope of the HDCP Specification to determine whether the HDCP Receiver is an HDCP 2.0-compliant Device. If the HDCP Transmitter determines, using mechanisms outside the scope of the HDCP Specification, that the HDCP Receiver is an HDCP 2.0-compliant Device, it need not send the AKE_Transmitter_Info message to the HDCP Receiver.
State A1: Exchange K_m Page 24	**State A1: Exchange K_m.** In this state, the HDCP Transmitter initiates authentication by sending AKE_Init message containing r_{tx} to the HDCP Receiver and sends AKE_Transmitter_Info message to the HDCP Receiver. It receives AKE_Send_Cert from the receiver containing REPEATER and $cert_{rx}$. If the HDCP Transmitter does not receive AKE_Receiver_Info message within 100 ms of the transmission of AKE_Transmitter_Info message, it indicates that the HDCP Receiver is an HDCP 2.0-compliant Device. If the HDCP Transmitter does not have k_m stored corresponding to the *Receiver ID*, it generates $E_{kpub}(km)$ and sends $E_{kpub}(km)$ as part of the AKE_No_Stored_km message to the receiver after verification of signature on $cert_{rx}$. It performs integrity check on the SRM and checks to see whether the *Receiver ID* of the connected HDCP Device is in the revocation list. It receives AKE_Send_rrx message containing r_{rx} from the receiver. It computes H, receives AKE_Send_H_prime message from the receiver containing *H'* within one second after sending AKE_No_Stored_km to the receiver and compares *H'* against H. If the HDCP Transmitter has k_m stored corresponding to the *Receiver ID*, it sends AKE_Stored_km message containing $E_{kh}(km)$ and *m* to the receiver, performs integrity check on the SRM, checks to see whether the *Receiver ID* of the connected HDCP Device is in the revocation list and receives r_{rx} as part of AKE_Send_rrx message from the receiver. It computes H, receives AKE_Send_H_prime message from the receiver containing *H'* within 200 ms after sending AKE_Stored_km to the receiver and compares *H'* against H. If the HDCP Transmitter does not have a k_m stored corresponding to the *Receiver ID*, it implements pairing with the HDCP receiver as explained in Section 2.2.1.

Ref-1A-3

Reference	Requirement
Table 4.23. TRANSMITTER_ CAPABILITY_MASK Parameter Page 66	**Description:** Bits 15:1:Reserved zeros. Bit 0: TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT. When this bit is set to one, it indicates that the HDCP Transmitter supports pre-computation of L during the locality check protocol.

Ref-1A-4

Reference	Requirement
2.2.1 Pairing Page 17	To speed up the AKE process, pairing must be implemented between the HDCP Transmitter and HDCP Receiver in parallel with AKE. When AKE_No_Stored_km message is received from the transmitter, it is an indication to the receiver that the transmitter does not have k_m stored corresponding to the receiver. In this case, after computing *H'*, the HDCP Receiver □ Computes 128-bit $\mathrm{k_h}$ = SHA-256(kpriv$_{rx}$)[127:0]. □ Generates 128-bit $E_{kh}(k_m)$ by encrypting k_m with $\mathrm{k_h}$ using AES as illustrated in Figure 2.3. □ Sends AKE_Send_Pairing_Info to the transmitter containing the 128-bit $E_{kh}(k_m)$. On receiving AKE_Send_Pairing_Info message, the HDCP Transmitter may persistently store *m* (which is r_{tx} concatenated with r_{rx}(r_{tx}||r_{rx}), k_m and $E_{kh}(k_m)$ along with *Receiver ID*. If AKE_Send_Pairing _Info is not received by the HDCP Transmitter within 200 ms of the reception of AKE_Send_H_prime, authentication fails and the authentication protocol is aborted. Note: The HDCP Transmitter may store in its non-volatile storage *m*, k_m, and $E_{kh}(k_m)$ along with corresponding *Receiver ID*s of all HDCP Receivers with which pairing was implemented by the HDCP Transmitter.

Ref-1A-5

Reference	Requirement
2.3 Locality Check Page 18	Locality check is performed after AKE and pairing. The HDCP Transmitter initiates locality check by sending a 64-bit pseudo-random nonce r_n to the downstream receiver. If AKE_Receiver_Info.VERSION = 0x01 and the HDCP Transmitter set its TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit to one in the

	AKE_Transmitter_Info message transmitted to the HDCP Receiver, the HDCP Transmitter must initiate re-authentication with the HDPC Receiver with the TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit set to zero. If the HDCP Receiver is HDCP 2.0-compliant or if the RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT bit received as part of the AKE_Receiver_Info message is set to zero or the transmitter has set the TRANSMITTER_LOCALTIY_PRECOMPUTE_SUPPORT bit to zero in its AKE_Transmitter_Info message, the HDCP Transmitter • Initiates locality check by sending LC_Init message containing a 64-bit pseudo-random nonce r_n to the HDCP Receiver. • Sets its watchdog timer to 7 ms. Locality check fails if the watchdog timer expires before LC_Send_L_prime message is received. • Computes L = HMAC-SHA256(r_n, $\mathrm{k_d}$ XOR r_{rx}) where HMAC-SHA256 is computed over r_n and the key used for HMAC is $\mathrm{k_d}$ XOR r_{rx}, where r_{rx} is XORed with the least-significant 64-bits of $\mathrm{k_d}$. • On receiving LC_Send_L_prime message, compares L and *L'*. Locality check fails if L is not equal to *L'*. If the RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT bit received as part of the AKE_Receiver_Info message is set to one and the transmitter has set the TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit to one in its AKE_Transmitter_Info message, the HDCP Transmitter • Initiates locality check by sending LC_Init message containing a 64-bit pseudo-random nonce r_n to the HDCP Receiver. • Computes 256-bit L = HMAC-SHA256($r_n \|\| r_n$, k_d XOR r_{rx}) where HMAC-SHA256 is computed over $r_n \|\| r_n$ and the key used for HMAC is k_d XOR r_{rx}, where r_{rx} is XORed with the least-significant 64-bits of k_d. All values are in big-endian order. • On receiving the RTT_Ready message from the receiver, the transmitter sends an RTT_Challenge message containing the least significant 128-bits of L. • Sets its watchdog timer to 7 ms. Locality check fails if the watchdog timer expires before LC_Send_L_prime message is received. • On receiving LC_Send_L_prime message, the HDCP Transmitter compares the received value with the most significant 128-bits of L and locality check fails if there is a mismatch. An HDCP Repeater initiates locality check on all its downstream HDCP-protected interface ports by sending unique r_n values to the connected HDCP Devices.

State A2: Locality Check Page 44	**State A2: Locality Check.** In this state, the HDCP Transmitter implements the locality check as explained in Section 2.3 with the HDCP Receiver.

Ref-1A-6

Reference	Requirement
2.4 Session Key Exchange Page 21	Successful completion of AKE and locality check stages affirms to HDCP Transmitter that the HDCP Receiver is authorized to receive HDCP Content. Session Key Exchange (SKE) is initiated by the HDCP Transmitter after a successful locality check. The HDCP Transmitter sends encrypted Session Key to the HDCP Receiver at least 200 ms before enabling HDCP Encryption and beginning the transmission of HDCP Content. HDCP Encryption may be enabled 200 ms after the transmission of the encrypted Session Key to the HDCP Receiver and at no time prior. Content encrypted with the Session Key k_s starts to flow between the HDCP Transmitter and HDCP Receiver. HDCP Encryption must be enabled only after successful completion of AKE, locality check and SKE stages. During SKE, the HDCP Transmitter • Generates a pseudo-random 128-bit session key k_s and 64-bit pseudo-random number r_{iv}. • Performs key derivation as explained in Section 2.7 to generate 128-bit dkey$_2$ where dkey$_2$ is the derived key when ctr=2. • Computes 128-bit $E_{dkey}(k_s)$ = k_s XOR (dkey$_2$ XOR r_{rx}), where r_{rx} is XORed with the least-significant 64-bits of dkey$_2$. • Sends SKE_Send_Eks message containing $E_{dkey}(k_s)$ and r_{iv} to the HDCP Receiver.
State A3: Exchange k_s Page 34	**State A3: Exchange k_s.** The HDCP Transmitter sends encrypted Session Key, $E_{dkey}(k_s)$, and r_{iv} to the HDCP Receiver as part of the SKE_Send_Eks message. It may enable HDCP Encryption 200 ms after sending encrypted Session Key. HDCP Encryption must be enabled only after successful completion of AKE, locality check and SKE stages.

Ref-1A-7

Reference	Requirement
Transition Any State: H0. Page 32	**Transition Any State: H0.** Reset conditions at the HDCP Transmitter or disconnect of the connected HDCP capable receiver cause the HDCP Transmitter to enter the No Receiver Attached state.
Transition H0:H1.	**Transition H0:H1.** The detection of a sink device (through Receiver Connected

Page 23	Indication) indicates to the transmitter that a sink device is connected and ready to display the received content. When the receiver is no longer active, the transmitter is notified through Receiver Disconnected Indication.

Ref-1A-8

Reference	Requirement
Transition A1:H1 Page 24	**Transition A1:H1.** This transition occurs on failure of signature verification on *cert*$_{rx}$, failure of SRM integrity check, if *Receiver ID* of the connected HDCP Device is in the revocation list or if there is a mismatch between H and *H'*. This transition also occurs if AKE_Send_H_prime message is not received within one second after sending AKE_No_Stored_km or within 200 ms after sending AKE_Stored_km to the receiver.
Transition A1:A2 Page 24	**Transition A1:A2.** The HDCP Transmitter implements locality check after successful completion of AKE and pairing.

Ref-1A-9

Reference	Requirement
2.3 Locality Check Page 21	In the case of a locality check failure due to expiration of the watchdog timer or due to mismatch of L and *L'* (or the most significant 128-bits of L and *L'*) at the HDCP Transmitter, locality check may be reattempted by the HDCP Transmitter for a maximum of 1023 additional attempts (for a maximum allowed 1024 total trials) with the transmission of an LC_Init message containing a new r_n. Failure of locality check on the first attempt and subsequent zero or more reattempts results in an authentication failure and the authentication protocol is aborted.
Transition A2: H1 Page 34	**Transition A2:H1**. This transition occurs on one or more consecutive locality check failures. Locality check fails when *L'* (or the most significant 128-bits of *L'*) is not received within 7 ms and the watchdog timer at the HDCP Transmitter expires or on a mismatch between L and *L'* (or the most significant 128-bits of *L'*).

Ref-1B. Downstream procedure with Repeater

Ref-1B-1.

Reference	Requirement
2.5.1 Upstream Propagation of Topology Information	On successful verification of Receiver ID list and topology information, i.e. if the values match, none of the reported *Receiver ID*s are in the current revocation list (in the case of the most upstream HDCP Transmitter), the HDCP

Page 24	Transmitter does not detect a roll-over of *seq_num_V*, the downstream topology does not exceed specified maximums (explained below) and the HDCP Repeater is not HDCP 2.0-compliant, the HDCP Transmitter (including downstream port of HDCP Repeater) sends the least significant 128-bits of *V* to the HDCP Repeater as part of the RepeaterAuth_Send_Ack message. Every RepeaterAuth_Send_ReceiverID_List message from the repeater to the transmitter must be followed by a RepeaterAuth_Send_Ack message from the transmitter to the repeater on successful verification of Receiver ID list and topology information by the transmitter. The RepeaterAuth_Send_Ack message must be received by the HDCP Repeater within one second from the transmission of the RepeaterAuth_Send_ReceiverID_List message to the HDCP Transmitter if the HDCP Transmitter is not HDCP 2.0-compliant and the downstream topology does not exceed specified maximums. A match between the least significant 128-bits of *V* and *V'* indicates successful upstream transmission of topology information. If a mismatch occurs or the RepeaterAuth_Send_Ack message is not received by the repeater within one second, the HDCP Repeater must send the Receiver_AuthStatus message with the REAUTH_REQ set to 'true' and must transition in to an unauthenticated state (See Section 2.10.3).

Ref-1B-2.

Reference	Requirement
Transition A7:A5. Page 34	**Transition A7:A5.** This transition occurs if the connected HDCP Repeater is HDCP 2.0-compliant, on successful verification of *V* and *V'*, none of the reported *Receiver ID*s are in the current revocation list, and the downstream topology does not exceed specified maximums.

Ref-1B-3.

Reference	Requirement
Section 2.5.1 Upstream Propagation of Topology Information Pg 24	After transmitting the SKE_Send_Eks message, the HDCP transmitter, having determined that REPEATER received earlier in the protocol is 'true', sets a three-second watchdog timer. If the RepeaterAuth_Send_ReceiverID_List message is not received by the HDCP Transmitter within a maximum-permitted time of three seconds ater transmitting SKE_Send_Eks message, authentication of the HDCP Repeater fails. With this failure, the HDCP Transmitter disables HDCP Encryption and aborts the authentication protocol with the HDCP Repeater.
Transition A6:H1	**Transition A6:H1**. The watchdog timer expires before the

Page 34	RepeaterAuth_Send_ReceiverID_List is received.

Ref-1B-4.

Reference	Requirement
Section 2.5.1 Upstream Propagation of Topology Information Pg 24	Whenever the RepeaterAuth_Send_ReceiverID_List message is received, the HDCP Transmitter verifies the integrity of the Receiver ID list by computing *V* and comparing either *V* and *V'* (if the connected HDCP Repeater is HDCP 2.0-compliant) or the most significant 128-bits of *V* and *V'* (if the connected HDCP Repeater is not HDCP 2.0-compliant). If the values do not match, authentication fails, the authentication protocol is aborted and HDCP Encryption is disabled.
Transition A7:H1 Page 34	**Transition A7:H1**. This transition is made if a mismatch occurs between *V* and *V'* (if the connected HDCP Repeater is HDCP 2.0-compliant) or the most significant 128-bits of *V* and *V'* (if the connected HDCP Repeater is not HDCP 2.0-compliant). This transition is also made if any of the *Receiver IDs* in the Receiver ID list are found in the current revocation list or if the HDCP Transmitter detects a roll-over of *seq_num_V* (if the repeater is not HDCP 2.0-compliant). A MAX_CASCADE_EXCEEDED or MAX_DEVS_EXCEEDED error also causes this transition.

Ref-1B-5.

Reference	Requirement
Section 2.5.2 Downstream Propagation of Content Stream Management Information Pg 28	The HDCP Transmitter must send the RepeaterAuth_Stream_Manage message specifying Type values assigned to the Content Streams, to the attached HDCP Repeater at least 100ms before the transmission of the corresponding Content Streams after HDCP Encryption. The HDCP Transmitter must only send the RepeaterAuth_Stream_Manage message corresponding to encrypted Content Streams it will transmit to the HDCP Repeater. The HDCP Transmitter initializes *seq_num_M* to 0 at the beginning of the HDCP Session i.e. after r_{tx} is sent. It is incremented by one after the transmission of every RepeaterAuth_Stream_Manage message.
State A9: Content Stream Management Page 35	**State A9: Content Stream Management**. This stage is implemented if Content Stream is to be transmitted and the connected HDCP Repeater is not HDCP 2.0-compliant. The HDCP Transmitter sends the RepeaterAuth_Stream_Manage message specifying Type values assigned to Content Streams, to the attached HDCP Repeater at least 100ms before the transmission of the corresponding Content Streams after HDCP Encryption. It must receive the RepeaterAuth_Stream_Ready message from the HDCP Repeater within 100ms

	after the transmission of RepeaterAuth_Stream_Manage message and verifies *M'*. This step fails if the RepeaterAuth_Stream_Ready message is not received within 100ms of if *M* is not equal to *M'*.

Ref-2. Receiver

Ref-2C. Upstream procedure with Transmitter

Ref-2C-1.

Reference	Requirement
Transition Any State:H0 Page 32	**Transition Any State:H0.** Reset conditions at the HDCP Transmitter or disconnect of the connected HDCP capable receiver cause the HDCP Transmitter to enter the No Receiver Attached state.
Transition H0:H1 Page 32	**Transition H0:H1.** The detection of a sink device (through Receiver Connected Indication) indicates to the transmitter that a sink device is connected and ready to display the received content. When the receiver is no longer active, the transmitter is notified through Receiver Disconnected Indication.

Ref-2C-2.

Reference	Requirement
State B1:Compute k_m Page 36	**State B1: Compute k_m.** In this state, the HDCP Receiver sends AKE_Send_Cert message in response to AKE_Init, sends AKE_Receiver_Info message to the transmitter if AKE_Transmitter_Info message is received from the transmitter, generates and sends r_{rx} as part of AKE_Send_rrx message. If AKE_No_Stored_km is received, it decrypts k_m with kpriv$_{rx}$, calculates *H'*. It sends AKE_Send_H_prime message immediately after computation of *H'* to ensure that the message is received by the transmitter within the specified one second timeout at the transmitter. If the HDCP Receiver does not receive AKE_Transmtter_Info message before the reception of AKE_No_Stored_km or AKE_Sotred_km message, it indicates that the HDCP Transmitter is an HDCP 2.0-compliant device. If AKE_Stored_km is received, the HDCP Receiver decrypts $E_{kh}(k_m)$ to derive k_m and calculates *H'*. It sends AKE_Send_H_prime message immediately after computation of *H'* to ensure that the message is received by the transmitter within the specified 200 ms timeout at the transmitter. If AKE_No_Stored_km is received, this is an indication to the HDCP Receiver that the HDCP Transmitter does not contain a k_m stored corresponding to its *Receiver ID*. It implements pairing with the HDCP Transmitter as explained in Section 2.2.1.
Transition H0:H1 Page 32	**Transition H0:H1.** The detection of a sink device (through Receiver Connected Indication) indicates to the transmitter that a sink device is connected and ready to display the received content. When the receiver is no longer active, the transmitter is notified through Receiver Disconnected Indication.

Ref-2C-3.

Reference	Requirement
Section 2.5 Authentication with Repeaters Page 22	The HDCP Transmitter executes authentication with repeaters after Session Key exchange and only when REPEATER is ‘true’, indicating that the connected HDCP Receiver is an HDCP Repeater. Authentication with repeaters stage is used for the upstream propagation of topology information and the downstream propagation of Content Stream management information as explained in Section 2.5.1 and Section 2.5.2 respectively. Authentication with repeaters may be implemented by the HDCP Transmitter in parallel with the flow of encrypted content and Link Synchronization. The Link Synchronization process is explained in Section 2.6.
Section 4.3.2 AKE_Send_Cert (Receiver to Transmitter) Page 60	The HDCP Receiver sets REPEATER to ‘true’ if it is an HDCP Repeater and ‘false’ if it is an HDCP Receiver that is not an HDCP Repeater. When REPEATER = ‘true’, the HDCP Receiver supports downstream connections as permitted by the Digital Content Protection LLC license.

Ref-2C-4.

Reference	Requirement
Section 2.2 Authentication and Key Exchange Page 16	The HDCP Receiver • Sends AKE_Send_Cert message in response to AKE_Init • If AKE_Transmitter_Info message is received, sends AKE_Receiver_Info message to the transmitter after sending the AKE_Send_Cert message to the transmitter. • Generates and sends 64-bit r_{rx} as part of the AKE_Send_rrx message immediately after receiving either AKE_No_Stored_km or AKE_Stored_km message from the transmitter.
Section 2.2 Authentication and Key Exchange Page 13	The HDCP Transmitter • Receives AKE_Receiver_Info message from the receiver if the receiver is not an HDCP 2.0-compliant Device. If AKE_Receiver_Info message is not received within 100 ms from the transmission of the AKE_Transmitter_Info message, it indicates to the HDCP Transmitter that the attached HDCP Receiver is an HDCP 2.0-compliant Device.

Ref-2C-5.

Reference	Requirement
Section 4.3.19 AKE_Receiver_Info	LENGTH parameter is the size of the AKE_Receiver_info message in bytes. An HDCP 2.2-compliant Receiver will set the LENGTH parameter equal to six bytes

(Receiver to Transmitter) Page 66	i.e. the combined size of the msg_id, LENGTH, VERSION and RECEIVER_CAPABILITY_MASK parameters. An HDCP 2.2-compliant transmitter that receives an AKE_Receiver_Info message with the LENGTH parameter greater than six bytes must read the msg_id, LENGTH, VERSION and RECEIVER_CAPABILITY_MASK parameters and must ignore the remaining parameters. The HDCP Receiver must set VERSION to 0x02.
Table 4.25 RECEIVER_ CAPABILITY_MASK Parameter	Bits 15:1:Reserved zeros. Bit 0: RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT. When this bit is set to one, it indicates that the HDCP Receiver supports pre-computation of *L′* during the locality check protocol.

Ref-2C-6.

Reference	Requirement
Section 2.3 Locality Check Page 20	If the HDCP Transmitter is HDCP 2.0-compliant or if the TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit received as part of the AKE_Transmitter_Info message is set to zero or if the receiver has set the RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT bit to zero in its AKE_Receiver_Info message, the HDCP Receiver • Computes a 256-bit value *L′* = HMAC-SHA256(r_n, k_d XOR r_{rx}) • Sends LC_Send_L_prime message containing 256-bit *L′* If the TRANSMITTER_LOCALITY_PRECOMPUTE_SUPPORT bit received as part of the AKE_Transmitter_Info message is set to one and the receiver has set the RECEIVER_LOCALITY_PRECOMPUTE_SUPPORT bit to one in its AKE_Receiver_Info message, the HDCP Receiver • Computes 256-bit *L′* = HMAC-SHA256(r_n, k_d XOR r_{rx}) if AKE_Transmitter_Info.VERSION = 0x01 • Computes 256-bit *L′* = HMAC-SHA256($r_n \| \| r_n$, k_d XOR r_{rx}) if AKE_Transmitter_Info.VERSION is not equal to 0x01 • Sends RTT_Ready message to the transmitter when *L′* calculation is complete and the receiver is ready for the RTT Challenge • On receiving the RTT_Challenge message from the transmitter, if the value received in the RTT_Challenge message matches the least significant 128 bits of *L′*, the receiver sends an LC_SEND_L_prime message containing the most significant 128-bits of *L′*.
State A2: Locality Check Page 34	**State A2: Locality Check.** In this state, the HDCP Transmitter implements the locality check as explained in Section 2.3 with the HDCP Receiver.

Transition A2:H1 Page 25	**Transition A2:H1.** This transition occurs on one or more consecutive locality check failures. Locality check fails when *L'* (or the most significant 128-bits of *L'*) is not received within 7 ms and the watchdog timer at the HDCP Transmitter expires or on a mismatch between L and *L'* (or the most significant 128-bits of *L'*).

Ref-3 Repeaters

Ref-3C Upstream Procedure with Transmitter

Ref-3C-1

Reference	Requirement
Section 2.5.1 Upstream Propagation of Topology Information Page 26	HDCP Repeaters must be capable of supporting DEVICE_COUNT values of up to 31 and DEPTH values of up to 4. If the computed DEVICE_COUNT for an HDCP Repeater exceeds 31, the error is referred to as MAX_DEVS_EXCEEDED error. The repeater sets MAX_DEVS_EXCEEDED = 'true' in the RepeaterAuth_Send_ReceiverID_List message. If the computed DEPTH for an HDCP Repeater exceeds four, the error is referred to as MAX_CASCADE_EXCEEDED error. The repeater sets MAX_CASCADE_EXCEEDED = 'true' in the RepeaterAuth_Send_ReceiverID_List message. When an HDCP Repeater receives a MAX_DEVS_EXCEEDED or a MAX_CASCADE_EXCEEDED error from a downstream HDCP Repeater, it must propagate the error to the upstream HDCP Transmitter and must not transmit *V'* (or the most significant 128-bits of *V'*), DEPTH, DEVICE_COUNT, Receiver ID list and if applicable, HDCP2_0_REPEATER_DOWNSTREAM and HDCP1_DEVICEE_DOWNSTREAM.

Ref-3C-2

Reference	Requirement
Section 2.5.1 Upstream Propagation of Topology Information Page 25	The HDCP Repeater propagates topology information upward through the connection tree to the HDCP Transmitter. An HDCP Repeater reports the topology status variables DEVICE_COUNT, and DEPTH. The DEVICE_COUNT for an HDCP Repeater is equal to the total number of connected downstream HDCP Receiver and HDCP Repeaters. The value is calculated as the sum of the number of directly connected downstream HDCP Receiver and HDCP Repeaters plus the sum of the DEVICE_COUNT received from all connected HDCP Repeaters. The DEPTH status for an HDCP Repeater is equal to the maximum number of connection levels below any of the downstream HDCP-protected Interface Ports. The value is calculated as the maximum DEPTH reported from downstream HDCP Repeaters plus one (accounting for the connected HDCP Repeater).

Ref-3C-3

Reference	Requirement
Transition C8:C5	**Transition C8:C5.** This transition occurs only if the upstream HDCP Transmitter

Page 47	is not HDCP 2.0-compliant and on detection of any changes to the topology. This transition occurs when a downstream port that was previously in the unauthenticated (State P1) or unconnected (State P0) state transitions to the authenticated (State F5) state. For example, the transition may occur when a new HDCP Receiver is connected to a downstream port, that previously had no receiver connected, and the downstream port completes the authentication protocol with the HDCP Receiver. This transition also occurs when a downstream port that was previously in an authenticated state transitions in to an unauthenticated or unconnected state. For example, the transition may occur when an active, authenticated HDCP Receiver attached to the downstream port is disconnected. Reception of a RepeaterAuth_Send_ReceiverID_List message on a downstream port from the connected HDCP Repeater also causes this transition.

Ref-3C-4

Reference	Requirement
Section 2.10 HDCP Repeater State Diagrams Page 37	Then the upstream HDCP-protected interface port of the HDCP Repeater is in an unauthenticated state, it signals the detection of an active downstream HDCP Receiver to the upstream HDCP Transmitter by propagating the Receiver Connected Indication to the upstream HDCP Transmitter. Whenever authentication is initiated by the upstream HDCP Transmitter by sending AKE_Init, the HDCP Repeater immediately initiates authentication on all its downstream HDCP-protected interface ports if its downstream ports are in an unauthenticated state. The HDCP Repeater may cache the latest Receiver ID list and topology information received from its downstream ports. Whenever authentication is attempted by the upstream transmitter by sending an r_{tx} value, the HDCP Repeater may propagate the cached Receiver ID list upstream without initiating a re-authentication on all its downstream ports.

Ref-3C-5

Reference	Requirement
Section 2.5 Authentication with Repeaters Page 22	HDCP Repeaters assemble the list of all connected downstream HDCP Receivers as the downstream HDCP-protected Interface Ports of the HDCP Repeater successfully complete the authentication protocol with connected HDCP Receivers. The list is represented by a contiguous set of bytes, with each *Receiver ID* occupying five bytes stored in big-endian order. The total length of the Receiver ID list is five bytes times the total number of connected and active

	downstream HDCP Devices, including downstream HDCP Repeaters, with which the HDCP Repeater has successfully completed the authentication protocol. This total number is represented in the RepeaterAuth_Send_ReceiverID_List message by the DEVICE_COUNT value. An HDCP-protected Interface Port with no active device connected adds nothing to the list. Also, the *Receiver ID* of the HDCP Repeater itself at any level is not included in its own Receiver ID list. An HDCP-protected Interface Port connected to an HDCP Receiver that is not an HDCP Repeater adds the *Receiver ID* of the connected HDCP Receiver to the list. HDCP-protected Interface Ports that have an HDCP Repeater connected add the Receiver ID list received from the connected downstream HDCP Repeater plus the *Receiver ID* of the connected HDCP Repeater itself.
Transition F1:P1 Page 41	**Transition F1:P1.** This transition occurs on failure of signature verification on $cert_{rx}$ or if there is a mismatch between H and *H'*. This transition also occurs if AKE_Send_H_prime message is not received one second after sending AKE_No_Stored_km or within 200 ms after sending AKE_Stored_km to the receiver.
Transition F2:P1 Page 41	**Transition F2:P1.** This transition occurs on one or more consecutive locality check failures. Locality check fails when *L'* (or the most significant 128-bits of *L'*) is not received within 7 ms and the watchdog timer at the downstream side expires or on a mismatch between L and *L'* (or the most significant 128-bits of *L'*).

Ref-3C-6

Reference	Requirement
4.3.11 RepeaterAuth_ Send_ReceiverID_List (Receiver to Transmitter) Page 62	The HDCP Repeater sets HDCP2_0_REPEATER_DOWNSTREAM = 'true' if an HDCP 2.0-compliant repeater is attached to any one of its downstream ports, else it sets HDCP2_0_REPEATER_DOWNSTREAM = 'false'. The HDCP Repeater sets HDCP1_DEVICE_DOWNSTREAM = 'true' if an HDCP 1.x-compliant Device i.e. an HDCP 1.x-compliant Receiver or an HDCP 1.x-compliant Repeater is attached to any one of its downstream ports, else it sets HDCP1_DEVICE_DOWNSTREAM = 'false'.

Ref-3C-7

Reference	Requirement
2.5.1 Upstream Propagation of Topology Information	When an HDCP Receiver (including HDCP Repeater) is connected to the HDCP Repeater or when a connected, active HDCP Receiver with which the HDCP Repeater has successfully completed the authentication protocol is

Page 24	disconnected from the HDCP Repeater and the upstream HDCP Transmitter is not HDCP 2.0-complaint, the HDCP Repeater must send the RepeaterAuth_Send_ReceiverID_List message to the upstream HDCP Transmitter which must include the Receiver IDs of all connected and active downstream HDCP Receivers with which the HDCP Repeater has successfully completed the authentication protocol. This enables upstream propagation of the most recent topology information after changes to the topology without interrupting the transmission of HDCP Content.

Ref-3C-8

Reference	Requirement
2.5.1 Upstream Propagation of Topology Information Page 24	When an HDCP Repeater receives HDCP2_0_REPEATER_DOWNSTREAM = ‘true’ or HDCP1_DEVICE_DOWNSTREAM = ‘true’ from a downstream HDCP Repeater, it must propagate this information to the upstream HDCP Transmitter by setting the corresponding values to ‘true’ in the RepeaterAuth_Send_ReceiverID_List message.