HDMI Certification

User Guide

Issue **03**

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About This Document

Purpose

This document describes the required test operations for the high-definition media interface (HDMI) Authorized Test Center (ATC) certification and high-bandwidth digital content protection (HDCP) certification.

Related Versions

The following table lists the product versions related to this document.

Product Name	Version
Hi3798M	V1XX
Hi3798C	V1XX
Hi3796C	V1XX
Hi3796M	V1XX
Hi3716M	V31X
Hi3798C	V2XX
Hi3716M	V41X
Hi3716M	V42X

Intended Audience

This document is intended for:

- Technical support engineers
- Software development engineers

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Change History

Changes between document issues are cumulative. Therefore, the latest document issue contains all changes made in previous issues.

Issue 03 (2015-05-06)

This issue is the third official release, which incorporates the following changes:

Hi3798C V200, Hi3716M V420, and Hi3716M V410 are supported.

Issue 02 (2014-12-25)

This issue is the second official release, which incorporates the following changes:

Chapter 3 Operation Instance

Section 3.2.1 is modified, and sections 3.2.8, 3.2.9, and 3.2.10 are added.

Issue 01 (2014-11-25)

This issue is the first official release.

Issue 00B01 (2014-02-20)

This issue is the first draft release.

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1 Overview

1.1 Introduction

The HDMI is the audio/video transmission interface on the HD multimedia devices. Products with the HDMI interface must pass the HDMI ATC certification test. This document provides guidance concerning the HDMI ATC certification to help the HiSilicon HD chips pass the certification.

1.2 Test Preparations

Do as follows before the HDMI tests:

- Know about the HDMI and HDCP protocols.
- Verify the output of the STB to be tested repeatedly.
- Provide the configuration method for each test.
- Prepare two STBs to be tested. Burn the HDCP to only one STB.

NOTE

Provide one STB to be tested to HiSilicon if possible because some tests can be simulated in the HiSilicon laboratory.

1.3 Reference Documents

The reference documents for the HDMI certification are listed as follows:

- HDMI Specification1_4b.pdf
- EIA-CEA-861-D.pdf
- HDCP_Specification20Rev1_3[1].pdf
- HDMI_CTS_1_4b.pdf
- HDCPSpecificationComplianceTest Specification1_2.pdf
- HDCP Key User Guide.pdf

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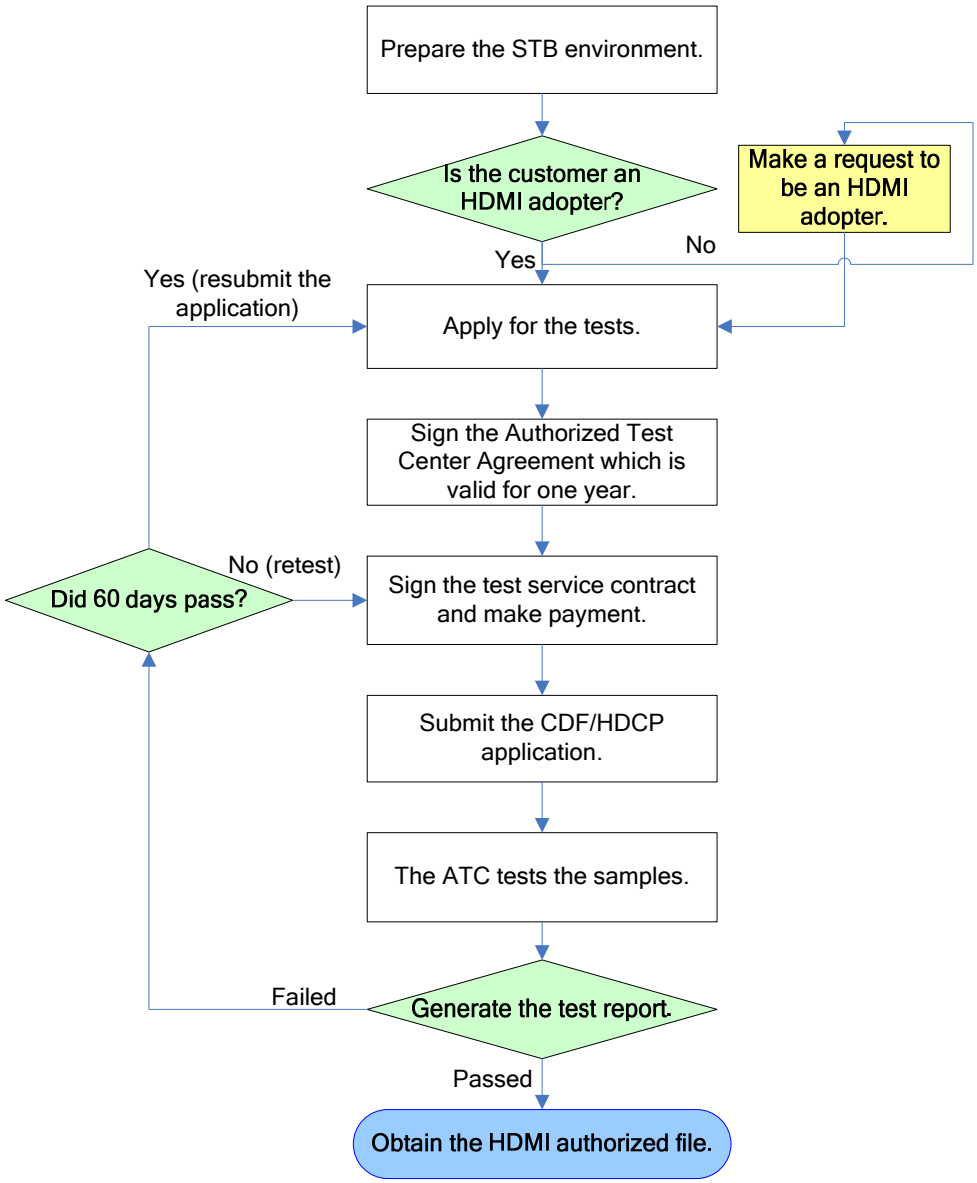
1.4 Certification Process

Figure 1-1 shows the HDMI certification process.

Figure 1-1 HDMI certification process



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2 Test Description

2.1 Test Content

The purpose of the HDMI ATC tests is to ensure that hardware specifications and input/output signals of an HDMI device comply with HDMI standards. Tests for each device include two parts: hardware tests and software protocol tests. The devices include the following:

- HDMI transmit device (source)
- HDMI cable
- Repeater
- Receive device (sink)

NOTE

The following uses the Hi37*XXX* series chips as an example. Tests of other chips are similar.

The test items when the chip acts as the source include electronic specifications, protocols, audio/video formats, digital visual interface (DVI) compatibility, and HDCP tests.

For details about the definitions of test items, see **HDCPSpecificationComplianceTestSpecification1_2.pdf** and chapter 7 in **HDMI_CTS_1_4b.pdf**.

The following are the standard test devices:

- Agilent DSO81034B: oscilloscope (test device for the CTS electronic specifications)
- Agilent 5998A/QuantumData 980: HDMI protocol analyzer (test device for the CTS function test)
- Panasonic UITA2000/QuantumData 882E: video signal generator (test device for the HDCP certification tests)

The following describes HDMI test subitems.

2.1.1 HDMI Tests

- Test ID 7-1: EDID-related behavior

  This item tests HPD event handling and whether the device can read and parse two or four extended display identification data (EDID) blocks. The I^2C analyzer monitors the entire process that the source reads the EDIDs but does not detect whether the source parses the read EDIDs.
- TestID 7-2, TestID 7-4, and TestID 7-6 to TestID 7-10: Eye pattern and hardware features

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The oscilloscope (Agilent DSO81034B) is used to test the eye pattern. The test items are as follows:

- Test ID 7-2: TMDS - V_L (VL voltage)
- Test ID 7-4: TMDS - T_{RISE}, T_{FALL} (rising and falling time)
- Test ID 7-6: TMDS - Inter-pair skew (of the TMDS)
- Test ID 7-7: TMDS - Intra-pair skew (of the TMDS)
- Test ID 7-8: TMDS - Clock duty cycle (of the TMDS)
- Test ID 7-9: TMDS - Clock jitter
- Test ID 7-10: TMDS - Data eye diagram (eye pattern test)

Tests for the preceding items can be simulated in the HiSilicon laboratory by using the HiSilicon oscilloscope.

- Test ID 7-3: TMDS - V_{OFF} (standby voltage of the TMDS)

  V_{OFF} must be AV_{CC}±10 mV and less than 10 mV.
- Test ID 7-5: Reserved

  This item is not tested currently.
- Test ID 7-11: 5 V power

  The source must transmit 5 V level signals during data transmission. The level must fall within 4.8–5.3 V.
- Test ID 7-12: Hot plug detection

  Requirements on the voltage of the HDPD pin during hot plugging are described as follows:
  - The level of this pin ranges from 2.0 V to 5.3 V in high-voltage state (when the television is powered on or outputs data).
  - The level of this pin ranges from 0 V to 0.8 V in low-voltage state (when the television is powered off or in standby mode).
- Test ID 7-13: DDC/CEC capacitance and voltage

  Requirements:
  - The I^2C specifications must be met, and the I^2C working voltage is 5 V.
  - The SDA and SCL capacitance is less than or equal to 50 pF. The test fails if VSDA is less than 4.5 V or greater than 5.5 V.
  - The maximum CEC line capacitance is 150 pF. The test fails if VCEC falls between 0.6 V and 2.5 V or VCEC is greater than 3.6 V.
- Test ID 7-14: CEC line connectivity

  This test item is tested to verify that multiple HDMIs are available on the test device. This item does not need to be tested.
- Test ID 7-15: CEC line degradation

  The maximum CEC pin current degradation value must be less than 1.8 μA. Requirements on the test environment are listed as follows:
  - Vcec1: 0–0.1 V or 2.88–3.63 V
  - Vcec1.5: 3.3 V±10%
  - Vcec2: 0.12 V±12% or 0.196–0.274 V
- Test ID 7-16: Legal codes

  The HDMI transmits data in only three modes:
  - Video data period

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  - Data island period
  - Control period
- Test ID 7-17: Basic protocols

  Requirements:
  - The HDCP must be disabled to test the preamble (before video data period and data island period).
  - Video leading guard band
  - Data island period: leading guard band trailing guard band
  - Minimum duration control period: 12 Tpixels
- Test ID 7-18: Extended control period

  The maximum interval between extended control periods is 50 ms, and the minimum interval is 32 Tpixels.
- Test ID 7-19: Packet types

  This item is tested to verify that the source transmits only data packets with the packet header of 0x00–0x06 or 0x81–0x85; otherwise, the test fails.
- Test ID 7-20: Reserved
- Test ID 7-21: Minimum format support

  One of the following video formats must be supported: 640x480p@59.94/60 Hz, 720x480p@59.94/60 Hz, and 720x576p@50 Hz.
- Test ID 7-22: Additional format support

  You can select one of the following video formats defined in EIA-CEA-861-D for the test: 1280x720p@59.94/60 Hz, 1920x1080i@59.94/60 Hz, 720x480p@59.94/60 Hz, 1280x720p@50 Hz, 1920x1080i@50 Hz, 720x576p@50 Hz, 720x576i@50 Hz, and 720x480i@50 Hz.
- Test ID 7-23: Pixel encoding - RGB to RGB-only sink (pixel encoding: RGB and YCbCr)

  If the sink device supports only RGB video signals, the EDID includes only the RGB4:4:4 input format and the source must transmit RGB video signals.
- Test ID 7-24: Pixel encoding - YCbCr to YCbCr sink (pixel encoding: RGB and YCbCr)

  If the sink device supports only YCbCr video signals, the EDID includes the YCbCr4:4:4/4:2:2 input format and the source must transmit YCbCr video signals.
- Test ID 7-25: Video format timing

  This item is tested to check whether parameters in various video formats comply with specifications defined in IA-CEA-861-D by using the HDMI protocol analyzer.

  This test can be simulated by using QuantumData882 in the HiSilicon laboratory.
- Test ID 7-26: Pixel repetition

  If the source is claimed to support the video format 720x576i@50 Hz or 720x480i@60 Hz, the supported video format must be specified in the PR flag of the AVI information frame.
- Test ID 7-27: AVI InfoFrame

  This item is tested to verify the validity of the parameters in the AVI information frame in various video formats. For details, see section 2.9.2 "Video Information Frame Parameters."
- Test ID 7-28: IEC 60958/IEC 61937

  The tested items are listed as follows:
  - Basic 32/44.1/48 kHz dual-channel PCM

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  - 88.2/96/176.4/192 kHz dual-channel PCM
  - 32/44.1/48 kHz multi-channel PCM
  - 88.2/96/176.4/192 kHz multi-channel PCM
  - SPDIF channel of compressed audio streams (AC3/DDPLUS, DTS)
- Test ID 7-29: Audio clock regeneration (ACR)

  The N, CTS, and audio sampling rate are verified to certify the ACR mechanism.
- Test ID 7-30: Audio sample packet jitter

  This item is tested to check whether the audio packet jitter falls within the specified range.
- Test ID 7-31: Audio InfoFrame

  This item is tested to check whether the audio information frame is set based on HDMI requirements. The parameters except for the output channel (which needs to be configured) are set to the default value 0. For details, see the stream header.
- Test ID 7-32: Audio sample packet layout

  The tested items are as follows:
  - Audio sample packet
  - Audio data packetization
  - Audio identification information
- Test ID 7-33: Interoperability with DVI

  This item is tested to check whether the source is compatible with DVI 1.0. If the source transmits DVI signals, the video guard band and data island cannot be transmitted.
- Test ID 7-34: Deep color (optional)

  The HiSilicon solution supports deep color mode outputs in various video standards. If the deep color mode is used, the general control packet must be correctly configured.
- Test ID 7-35: Gamut Metadata (xvYCC) transmission (optional)

  If the video source transmits videos in the xvYCC format, the HDMI must transmit the Gamut metadata packet.
- Test ID 7-36: High-bit-rate audio (optional)

  If the audio sampling rate is greater than or equal to 192 kHz, the high-bit-rate audio transmission mode must be used.
- Test ID 7-37: One bit audio

  This item is not supported.
- Test ID 7-38: 3D video format timing

  If a 3D video is transmitted, the 3D timing as well as the corresponding AVI infoframe and vendor specific infoframe must be transmitted.
- Test ID 7-39: 4K x 2K Video format timing

  This item is not supported.
- Test ID 7-40: Extended colorimetry transmission (without xvYCC)

  This item is not supported.

2.1.2 HDCP Tests

The 480p60 timing and RGB output are required, and the HDCP must be enabled.

Transmit test: 1A downstream procedure with a receiver (downstream device)

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- 1A-01 (1A: Source --> Sink) regular procedure: with HDMI-capable receiver

  Verify that the authentication process is normal when the source directly connects to the sink, and the HDCP can be enabled.

- 1A-02 regular procedure: HPD after writing Aksv

  Verify the following process: After the source transmits the Aksv data, the hot-plug-detect (HPD) signal changes. The authentication process is terminated, and the authentication is performed again.

- 1A-03 regular procedure: HPD after starting third part of authentication

  Verify the following process: After authentication succeeds, the HPD signal changes, and authentication is performed again.

- 1A-04 irregular procedure: (first part of authentication) HDCP port access

  Verify the following process: During the authentication, after the source receives the HPD signal, it transmits data based on the authentication protocol. If the sink has no response, the source performs authentication again.

- 1A-05 irregular procedure: (first part of authentication) verify Bksv

  Verify that when the source receives invalid Bksv data during authentication, the authentication is terminated, and the source performs authentication again.

- 1A-06 irregular procedure: (first part of authentication) verify R0'

  Verify that when the source receives invalid R0' data during authentication, the authentication is terminated, and the source performs authentication again.

- 1A-07 irregular procedure: (first part of authentication) verify Ri'

  Verify that when the source receives invalid Ri' data, the HDCP is disabled, and the source performs authentication again.

- 1A-08 irregular procedure: system renewability message (SRM)

  Verify whether the source can identify invalid HDCP keys if it can read the DVD.

  This item is not tested for the Hi37*XXX* because it cannot read the DVD.

- 1A-09 regular procedure: with DVI receiver

  Verify that the HDCP authentication process is normal in DVI mode.

Transmit Test: 1B downstream procedure with a repeater (downstream device)

- 1B-01 regular procedure: with repeater

  Verify that the HDCP authentication is successful when the source and the sink are connected by using a repeater.

- 1B-02 regular procedure: HPD after reading R0'

  Verify that when the source and the sink are connected by using a repeater, if the HPD signal is received after the HDCP authentication succeeds, the source performs authentication again.

- 1B-03 irregular procedure: (second part of authentication) timeout of KSVlist ready

  Verify that when the source and the sink are connected by using a repeater, if the time period for waiting the KSVlist Ready state exceeds 5s, the source performs authentication again.

- 1B-04 irregular procedure: (second part of authentication) verify V'

  Verify that when the source and the sink are connected by using a repeater, if V and V' are inconsistent, the source performs authentication again.

- 1B-05 irregular procedure: (second part of authentication) MAX_DEVS_EXCEEDED

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Verify that when the source and the sink are connected by using a repeater, if **Max_DEVS_EXCEEDED** of Bstatsu is **1** (indicating that the number of connected HDMI devices exceeds 127), the source performs authentication again.

- 1B-06 irregular procedure: (second part of authentication) MAX_CASCADE_EXCEEDED

  Verify that when the source and the sink are connected by using a repeater, if **MAX_CASCADE_EXCEEDED** of Bstatsu is **1** (indicating that the connection hierarchy of the HDMI exceeds 7), the source performs authentication again.

2.2 Test Cases

For details about the test cases and tables, see the related documents for the Hi37*XXX*.

The HDMI ATC test cases are stored in **sdk/sample/hdmi_tsplay** and **sdk/sample/esplay**.

- **hdmi_tsplay** contains all the tests except the compressed audio format tests.
- **esplay** contains the compressed audio format tests.

The test application forms are as follows:

- Hi37*XXX*_HDMI_CDF_1.4_source.xls
- Hi37*XXX*_HDCP Application_source.doc

For details about test instructions, see chapter 3 "Operation Instance."

2.3 Application Forms

2.3.1 Application Forms for the HDMI Tests

Before filling in HDMI test application forms, note the following:

- The company applying for the HDMI ATC tests must be an HDMI adopter first. For details about how to be an HDMI adopter, see http://www.hdmi.org.
- The HDMI test application form version must be 1.4b or later and the company name must be DCP, LLC adopter.

There are two application forms:

- HDMI_CDF_1.4_source.xls
- source_HDCP Application.doc

Note the following when filling in the forms:

- The items marked with "Y" in the HiSilicon application forms indicate those that have passed the test. You can select those items as required. The items marked with "N" indicate those that have not been tested. You are advised not to select the items that have not been tested. If these items are required, contact HiSilicon engineers before you select these items.
- Source_Video_Format

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If you select the 1440x576i/50 Hz 4:3/16:9 or 1440x480i/60 Hz 4:3/16:9 video format, you need to set PR0–PR2 correctly in the AVI information frame. This configuration is mature in the HDMI driver. You are advised not to select the preceding video formats.

- Source_3D_Video_Formats

  For the 3D test, the Hi3*7XXX* series chips support three 3D modes: frame packing, side-by-side, and top-and-bottom.

- Source_xvYCC

  This test item is used to check whether the HiSilicon STB can transmit the Gamut metadata packet, which can be tested by Test ID 7-35 Gamut metadata (xvYCC) transmission. However, the current chip does not transmit valid xvYCC data. You are advised not to select this test item.

- Source_Deep_Color

  The Hi37*XXX* supports the deep color mode in various video formats. If you select the deep color mode, the eye pattern test is conducted in deep color mode. If 1080p@50/60 Hz is supported, the maximum TMDS transmission rate is 225 MHz.

- Audio test items

  Audio tests are conducted at the highest TMDS transmission rate. If the 1080p@60 Hz video format is supported, all audio tests are conducted in 1080p@60 Hz mode. If the deep color mode is also supported, all audio tests are conducted in 1080p@60 Hz+deep color mode.

  - Supports 32–192 kHz 2/8-channel PCM transmission.
  - Supports the compressed AC3, DDPLUS, and DTS transmission.
  - Supports the high-bit-rate DDPLUS/DTS transmission.
  - Does not support one-bit audio transmission. Therefore, you cannot select Source_One_Bit_Audio.

- CEC test

  The HiSilicon HDMI driver integrates only the CEC channel but not the full functions. It may be completed during follow-up development.

2.3.2 Application Forms for the HDCP Tests

Note the following:

- Set **Source_Max_KSV** to a value ranging from 1 to 127. 127 is recommended.
- Set **Source_Authe_Count** to **1**.
- Set **Source_CP&EDID_HPD** to **N**.

One of the following video formats must be supported for the HDCP test: 640x480p@59.94/60 Hz, 720x480p@59.94/60 Hz, and 720x576p@50 Hz. You need to specify the video format.

2.4 HDMI Eye Pattern Test

The HDMI eye pattern tests are conducted only at the highest and lowest TMDS transmission rates. If both 1080p@60 Hz and 480p@60 Hz are supported, the HDMI eye pattern tests are conducted in these two video output states. If the deep color mode is supported, the highest TMDS transmission rate test must be conducted in this mode.

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CAUTION

HDCP must be disabled during the eye pattern tests. You can provide two test machines, one of which is dedicated to the eye pattern test.

2.5 HDMI Driver

The HDMI driver contained in the SDK has the HDMI ATC test environment.

If an application is to be tested, the parameter **enForceMode** in the HDMI initialization function HI_UNF_HDMI_Open() must be modified.

- During the ATC test, you are advised to set **enForceMode** to **HI_UNF_HDMI_FORCE_HDMI**.
- The HDMI driver runs based on test requirements strictly when this parameter is set.
- During actual application, **enForceMode** can be set to **HI_UNF_HDMI_FORCE_DVI** or **HI_UNF_HDMI_FORCE_HDMI** based on the scenarios.

2.6 HDCP Test

You need to purchase the HDCP key from the DCP, LLC organization first. Each HDCP key package is a binary file containing 10,000/100,000/1,000,000 independent keys. Figure 2-1 shows the structure of this file.

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Figure 2-1 HDCP key file structure

HDCP Signing Facility User's Guide

File Format

The order file consists of a 4-byte Order Format, followed by an array of *n* Device Key Set Records. There is one Device Key Set Record representing each Device Key Set in the Device Key Set Package.

Size (bytes):	Description:
4	"Order Format." This value equals 1 for transmitter Device Key Sets and 2 for receiver Device Key Sets. All other values are undefined.
308*n*	This is an array of Device Key Set Records.

Each Device Key Set Record in the array is formatted like so:

Size (bytes):	Description:
8	"Key Selection Vector." The most significant 3 bytes of this 64-bit field are zeros.
280	"Device Keys." Each private device key is 7 bytes long, for a total of 40 private device keys, or 280 bytes.
20	"SHA-1." This is an integrity hash consisting of a SHA-1 hash of the previous 288 bytes of this Device Key Set Record. *Note: The SHA-1 value is in big-endian format.*

2.6.2 Writing the HDCP Key

The SDK contains the **sdk/sample/sethdcp** test cases. There are two burning modes:

- Burning the original HDCP key
- Burning the HDCP key encrypted by HiSilicon

You are advised to burn the original HDCP key. For details about how to generate the HDCP key encrypted by HiSilicon, see the *HDCP Key User Guide*.

The split tool is stored in **sdk/tools/windows/HdcpTools**.

2.6.3 Enabling the HDCP Key

Set **bHDCPEnable** in the function HI_UNF_HDMI_SetAttr() to **HI_TRUE** or **HI_FALSE** to enable or disable the HDCP key by following the instructions in **sdk/sample/hdmi_tsplay**.

2.7 Querying the HDMI Output Information

When the HDMI outputs data normally, run **cat /proc/msp/hdmi0** to query the HDMI output information. Compare the queried information with the standard parameters. If they are inconsistent, the output configuration is incorrect.

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2.8 Hot-plugging

It is required that signals output by the HDMI do not change when the HDMI cable is removed and then inserted into the test machine. If exceptions occur, compare HDMI output information with standard parameters.

2.9 Video Standard Parameters

2.9.1 Video Timing Parameters

Table 2-1 describes video standard parameters. For details about the definitions of the parameters, see the CEA-861D protocol.

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Table 2-1 Video timing parameters

Video Format	1920x1080p 60 16:9	1920x1080p 50 16:9	1920x1080p 30 16:9	1920x1080p 25 16:9	1920x1080p 24 16:9	1920x1080i 60 16:9	1920x1080i 50 16:9	1280x720p 60 16:9	1280x720p50 16:9	720x576p50 4:3	720x480P60 4:3	1440x576I50 16:9	1440x480i 60 4:3	640x480p 60
Pixel rate	148.511	148.513	74.257	74.258	74.258	74.257	74.258	74.257	74.257	27.005	27.005	27.005	27.005	25.204
Link	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single
Horizontal Total	2200	2640	2200	2640	2750	2200	2640	1650	1980	864	858	1728	1716	800
Horizontal Active	1920	1920	1920	1920	1920	1920	1920	1280	1280	720	720	1440	1440	640
Horizontal Pulse Delay	88	528	88	528	638	88	528	110	440	12	16	24	38	16
Horizontal Pulse Width	44	44	44	44	44	44	44	40	40	64	62	126	124	96
Horizontal Pulse Polarity	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	negative	negative	negative	negative	negative
Horizontal Rate	67505	58254	33753	28127	27002	33753	28128	45004	37504	31256	31474	15628	15737	31256
Vertical Total	1125	1125	1125	1125	1125	1125	1125	750	750	625	525	625	525	525
Vertical Active	1080	1080	1080	1080	1080	1080	1080	720	720	576	480	576	480	480

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Video Format	1920x1080p 60 16:9	1920x1080p 50 16:9	1920x1080p 30 16:9	1920x1080p 25 16:9	1920x1080p 24 16:9	1920x1080i 60 16:9	1920x1080i 50 16:9	1280x720p 60 16:9	1280x720p50 16:9	720x576p50 4:3	720x480P60 4:3	1440x576I50 16:9	1440x480i 60 4:3	640x480p 60
Vertical Pulse Delay	4	4	4	4	4	2 lines (field 0), 2.5 lines (field 1)	2 lines (field 0), 2.5 lines (field 1)	5	5	5	9	2 lines (field 0), 2.5 lines (field)	4 lines (field 0), 4.5 lines (field)	10
Vertical Pulse Width	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	5 lines, 0 pixels	6 lines, 0 pixels	3 lines, 0 pixels	3 lines, 0 pixels	2 lines, 0 pixels
Vertical Pulse Polarity	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Negative	Negative	Negative	Negative	Negative
Vertical rate	60.00444 Hz	50.0037 Hz	30.00283 Hz	25.00226 Hz	24.00226 Hz	30.00283 Hz	25.00236 Hz	60.00646 Hz	50.00471 Hz	50.00926 Hz	59.95116 Hz	25.00463 Hz	29.97558 Hz	59.53571
Scan Type	Progressive	Progressive	Progressive	Progressive	Progressive	Interlace	Interlace	Progressive	Progressive	Progressive	Progressive	Interlace	Interlace	Progressive
Horizontal to Vertical Delay	0	0	0	0	0	Field 0 Hleads V by 0 pels, field 1 H leads V by 1100 pels	Field 0 Hleads V by 0 pels, field 1 H leads V by 1320 pels	0	0	0	0	Field 0 Hleads V by 0 pels, field 1 H leads V by 864 pels	Field 0 Hleads V by 0 pels, field 1 H leads V by 868pels	0

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Video Format	1920x1080p 60 16:9	1920x1080p 50 16:9	1920x1080p 30 16:9	1920x1080p 25 16:9	1920x1080p 24 16:9	1920x1080i 60 16:9	1920x1080i 50 16:9	1280x720p 60 16:9	1280x720p50 16:9	720x576p50 4:3	720x480P60 4:3	1440x576I50 16:9	1440x480i 60 4:3	640x480p 60
Color Depth	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component	8/10/12 bits per component

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2.9.2 Video Information Frame Parameters

```
1920x1080@60 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x67,0x50,0xa8,0x00,0x10,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1920x1080p@50 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x58,0x50,0xa8,0x00,0x1f,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1920x1080p@50 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x58,0x50,0xa8,0x00,0x1f,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1920x1080i@60 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x72,0x50,0xa8,0x00,0x05,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1920x1080i@50 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x63,0x50,0xa8,0x00,0x14,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1280x720p@60 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x73,0x50,0xa8,0x00,0x04,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,
```


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```
1280x720p@50 Hz
AVI Inforframe:
0x82,0x02,0x0d,0x64,0x50,0xa8,0x00,0x13,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

720x576p@50 Hz
AVI Inforframe:
0x82,0x02,0x0d,0xb6,0x50,0x58,0x00,0x11,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

720x480p@60 Hz
AVI Inforframe:
0x82,0x02,0x0d,0xc5,0x50,0x58,0x00,0x02,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1440x576i@50 4:3
AVI Inforframe:
0x82,0x02,0x0d,0xb1,0x50,0x58,0x00,0x15,0x01,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

1440x480i@50 4:3
AVI Inforframe:
0x82,0x02,0x0d,0xb1,0x50,0x58,0x00,0x15,0x01,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,

640x480@60 Hz
AVI Inforframe:
0x82,0x02,0x0d,0xfe,0x10,0x58,0x08,0x01,0x00,0x00,0x00,0x00,0x00,0x00,0x0
0,0x00,0x00,
AUD Inforframe:
0x84,0x01,0x0a,0x70,0x01,0x00,0x00,0x00,0x00,
```


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3 Operation Instance

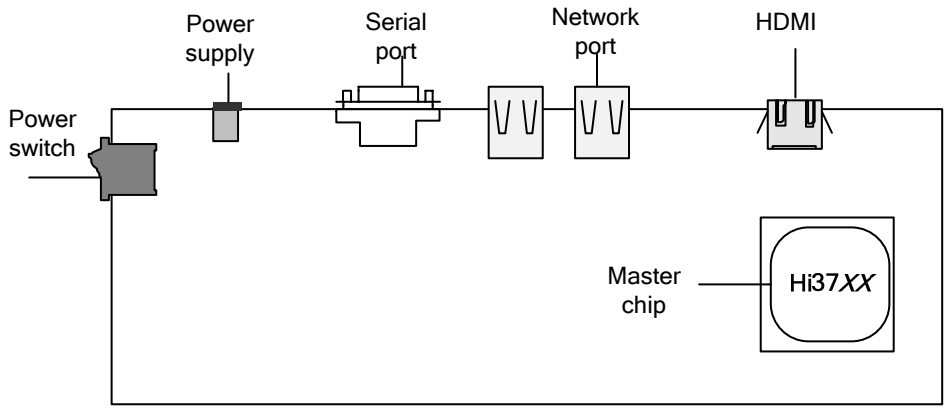
3.1 Preparations

This document is provided for the ATC test engineers for testing the Hi37*XXX* series chips.

Check for the following three components when you obtain the Hi37*XXX* development board:

- One Hi37*XXX* development board
- One 12 V external power supply
- One RS232 serial cable

Figure 3-1 Hi37XXX STB structure



Connect the development board to a PC by using a serial cable, and configure the COM on the PC end as follows:

- Bit per second (B): 15200
- Data bit (D): 8
- Parity check (P): none
- Stop bit (S): 1
- Data stream control (F): none

Connect the hyper terminal and perform the following steps:

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Step 1 Insert the HDMI cable to the HDMI interface of the Hi3716 development board.

Step 2 Connect the output end of the external power supply to the input port of the power board on the right of the Hi37*XXX* development board.

Step 3 Connect the 220 V 50 Hz AC power, and press the power button (S15) of the power board on the right of the Hi37*XXX* development board.

After power-on, LEDs D26 and D29 are turned on, and boot information is output over the serial port.

----End

3.2 Test Guide for the Linux Version

3.2.1 Running Programs

Find the corresponding drivers and streams first. The main streams and files are as follows:

- EncryptedKey_332bytes.bin
- Ghost.MLP
- PCM8_96Khz_pcm7.1.m2ts
- afraic.ac3
- ccitt_mux_32K.ts
- dada_192KHz_8ch_16bit.wav
- hd_dts_orchestra_long_lossless_dtshd_ma.dts
- sample_esplay
- sample_hdmi_tsplay
- sample_localplay
- serenity_english_5_1_1536.ddp

Audio streams are not required for the Hi3716M V310 series. If certification is required, the corresponding audio libraries need to be loaded.

where:

- **sample_hdmi_tsplay** is the main test program used to test the eye pattern, electronic specifications, and all other test items except compressed audio and multi-channel PCM transmission.
- **sample_esplay** is used to test compressed audio transmission (such as compressed transmission of AC3/DDPLUS/DTS).
- **sample_localplay** is used to test multi-channel audio PCM transmission (for example, 96 kHz 8-channel PCM transmission at 1440x480i60 and 192 kHz 8-channel PCM transmission).
- **ccitt_mux_32K.ts** is the audio and video TSs.
- **Ghost.MLP** is the MLP audio stream.
- **afraic.ac3** is the AC3 audio streams.
- **serenity_english_5_1_1536.ddp** is the DDPLUS audio streams.
- **hd_dts_orchestra_long_lossless_dtshd_ma.dts** is the DTS audio streams.

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- **PCM8_96kHz_pcm7.1.m2ts** is the 96 kHz 8-channel PCM audio streams.
- **dada_192kHz_8ch_16bit.wav** is the 192 kHz 8-channel PCM audio streams.
- **EncryptedKey_332bytes.bin** is the encrypted HDCP key.

The following uses **sample_hdmi_tsplay** as an example to describe the operation commands. You can obtain the following command by pressing **Ctrl+C**.

Command input mode:

```
./sample_hdmi_tsplay TS_stream Videotiming
```

Command description:

- **sample_hdmi_tsplay**: executable program
- **TS_stream**: TSs stored in the flash memory, which can be **ccitt_mux_32K.ts**.
- **Videotiming**: video timing format, which can be:
  - 1080P_60
  - 1080P_50
  - 1080i_60
  - 1080i_50
  - 720P_60
  - 720P_50
  - 576P_50
  - 480P_60

For other formats such as 1080P_30, 1080P_25, 1080P_24, 576i_50, 480i_60, and 640x480p_60, you need to configure them by using the **hdmi_video_timing** command after the program runs.

To test compressed audio and multi-channel audio PCM (AC3, DDPLUS, DTS), run the following commands:

```
sample_esplay null null AudioESStream AudioType
sample_localplay stream Videotiming
```

The file paths may vary according to the chip. Take Hi3716M V310 as an example:

- Sample files are stored in the **\sample\hdmi_tsplay** directory.
- Stream files are stored in the **\stream** directory.
- Key-related files are stored in the **\sample\hdmi_tsplay** directory.

3.2.2 Exiting Programs

After the program sample_hdmi_tsplay runs properly, enter **q** and press **Enter** to exit the program. Then you can run other test cases.

You can exit the other two programs in a similar way.

NOTE

If any exception occurs during operation, press the power button to reset the STB directly.

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3.2.3 Eye Pattern Test

The following sections describe the commands for testing the maximum and minimum transmission rates of the HiSilicon HDMI STB. For details about how to configure other video timings, see section 3.2.5 "Video Timing Output Configuration." Configure the board by running the following commands before testing the eye pattern:

- 480p_60 Hz

  Test command:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  480P_60
  ```

- 1080p_60 Hz

  Test command:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  ```

- 1080p_60 Hz DeepColor36bit

  hdmi_deepcolor indicates **deepcolor** in the functional subcommand.

  Test command:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_deepcolor 2
  ```

3.2.4 CEC Line Degradation

CAUTION

When testing this item, you need to test the power-on parameters after the program sample_hdmi_tsplay runs properly.

After the program sample_hdmi_tsplay runs properly, press **Enter**. The prompt information **hdmi_cmd >** is displayed. Enter **h** or **help** and press **Enter**. The functional test subcommands are displayed.

3.2.5 Video Timing Output Configuration

After the HDMI test program runs, you can change the current video output format by running the following hdmi_video_timing subcommands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing xxx          //xx is the enumeration of video formats.
You can view the formats by running the help command.
```

- Set the video output format to 1920x1080p/60 Hz 16:9.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing  0         //Set 1920x1080p/60 Hz 16:9
  ```

- Set the video output format to 1920x1080p/50 Hz 16:9.

  Test commands:

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```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  1          //Set 1920x1080p/50 Hz 16:9
```

- Set the video output format to 1920x1080p/30 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  2          //Set 1920x1080p/30 Hz 16:9
```

- Set the video output format to 1920x1080p/25 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  3          //Set 1920x1080p/25 Hz 16:9
```

- Set the video output format to 1920x1080p/24 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  4          //Set 1920x1080p/24 Hz 16:9
```

- Set the video output format to 1920x1080i/60 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  5          //Set 1920x1080i/60 Hz 16:9
```

- Set the video output format to 1920x1080i/50 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  6          //Set 1920x1080i/50 Hz 16:9
```

- Set the video output format to 1280x720p/60 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  7          //Set 1280x720p/60 Hz 16:9
```

- Set the video output format to 1280x720p/50 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  8          //Set 1280x720p/50 Hz 16:9
```

- Set the video output format to 720x576p/50 Hz 4:3.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  9          //Set 720x576p/50 Hz 4:3
```

- Set the video output format to 720x576p/50 Hz 16:9.
  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing  9          //Set 720x576p/50 Hz 4:3
hdmi_apectrate  1              //Set 720x576p/50 Hz 16:9
```

- Set the video output format to 720x480p/60 Hz 4:3.

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Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 10          //Set 720x480p/60 Hz 4:3
```

- Set the video output format to 720x480p/60 Hz 16:9.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 10          //Set 720x480p/60 Hz 4:3
  hdmi_apectrate  1              //Set 720x480p/60 Hz 16:9
  ```

- Set the video output format to 1440x576i/50 Hz 4:3.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 11          //Set 1440x576i/50 Hz  4:3
  ```

- Set the video output format to 1440x576i/60 Hz 16:9.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 11          //Set 1440x576i/50 Hz 4:3
  hdmi_apectrate  1           //Set 1440x576i/50 Hz 16:9
  ```

- Set the video output format to 1440x480i/60 Hz 4:3.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 12          //Set 1440x480i/60 Hz  4:3
  ```

- Set the video output format to 1440x480i/60 Hz 16:9.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 12          //Set 1440x576i/50 Hz 4:3
  hdmi_apectrate  1           //Set 1440x576i/50 Hz 16:9
  ```

- Set the video output format to 640x480p/60 Hz 4:3.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 13          //Set 640x480p/60 Hz  4:3
  Note that hdmi_video_timing is the configuration of video timing in
  the functional subcommand.
  ```

- Set the video output format to DeepColor 30Bit.

  After the HDMI test program runs, you can change the current video output format by running the following hdmi_video_timing subcommands: You can also use hdmi_deepcolor to change the deep color mode.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 0           //Set 1080p_60. You can also use other
  standards.
  hdmi_deepcolor 1             //Set 1080p_60 && deepcolor 30bit
  ```


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```
Note that hdmi_deepcolor is the configuration of DeepColor in the
functional subcommand.
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 10          //Set 480p_60. You can also use other
standards.
hdmi_deepcolor 1             //Set 480p_60 && deepcolor 30bit
```

- Set the video output format to DeepColor 36Bit.

  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 0           //Set 1080p_60. You can also use other
standards.
hdmi_deepcolor 2             //Set deepcolor 36bit
Note that hdmi_deepcolor is the configuration of DeepColor in the
functional subcommand.
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 10          //Set 480p_60. You can also use other
standards.
hdmi_deepcolor 2             //Set deepcolor 36bit
Note that hdmi_deepcolor is the configuration of DeepColor in the
functional subcommand.
Cancel the DeepColor configuration
hdmi_deepcolor 0             //Cancel the deepcolor mode and use the
normal 24-bit transmission mode.
Note that hdmi_deepcolor is the configuration of DeepColor in the
functional subcommand.
```

- Forcibly set the RGB444 video output mode.

  (All video standards support the RGB444 output.)

  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 0           //Set 1080p_60. You can also use other
standards.
hdmi_color_mode 0            //Set RGB444 output
```

- Forcibly set the YCbCr444 video output mode.

  Test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 0           //Set 1080p_60. You can also use other
standards.
hdmi_color_mode 2            //Set YCbCr444 output.
```

  Only 640x480i@60 supports this output mode.

  If the sink device supports the YCbCr output mode, use YCbCr444 as its preferred output mode.

- Set the YC FullRange mode.

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Test commands:

```
/sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 0          //Set 1080p_60. You can also use other
standards.
hdmi_color_mode 2           //Set YCbCr444 output.
hdmi_ycbcrfullrange 2         //Set YCbCr FullRange
Cancel the YC FullRange configuration.
```

After testing the FullRange mode, cancel the FullRange configuration by running the following command:

```
hdmi_ycbcrfullrange 0        //Cancel the RGB FullRange configuration.
```

- Set the RGB FullRange mode.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 0          //Set 1080p_60. You can also use other
  standards.
  hdmi_color_mode 0           //Set RGB444 output.
  hdmi_rgbfullrange 2           //Set RGB FullRange
  Cancel the RGB FullRange configuration.
  ```

  After testing the RGB FullRange mode, cancel the RGB FullRange configuration by running the following command:

  ```
  hdmi_rgbfullrange 1             //Cancel the RGB FullRange
  configuration.
  ```

- Set the Source_Alt_Colorimety mode.

  For 1920x1080i@60:

  ```
  /sample_hdmi_tsplay ccitt_mux_32K.ts  1080i_60
  hdmi_video_timing 5          //Set 1080i_60. You can also use other
  standards.
  hdmi_reversecolor 1           //Set the reverse color space (601)
  ```

  For 7200x480i@60:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  480P_60
  hdmi_video_timing 10          //Set 1080i_60. You can also use other
  standards.
  hdmi_reversecolor 1           //Set the reverse color space (709)
  Cancel the Source_Alt_Colorimety configuration.
  hdmi_reversecolor 0             //Cancel the Alt Colormetry
  configuration.
  ```

- Set the xvYCC mode.

  Test commands:

  ```
  ./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
  hdmi_video_timing 0          //Set 1080p_60. You can also use other
  standards.
  hdmi_deepcolor 2            //Set deepcolor 36bit
  ```


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```
hdmi_xvycc 1                //Set the xvYCC mode
./sample_hdmi_tsplay ccitt_mux_32K.ts  1080P_60
hdmi_video_timing 10          //Set 480p_60. You can also use other
standards.
hdmi_deepcolor 2             //Set deepcolor 36bit
hdmi_xvycc 1                //Set the xvYCC mode
```

Note that hdmi_xvycc is the configuration of the xvYCC mode in the functional subcommand.

- To cancel the xvYCC mode, run the following command:

  Test command:

  ```
  hdmi_xvycc 0            //Cancel the hdmi_xvycc mode and use the
  normal component transmission mode.
  ```

  Note that hdmi_xvycc is the configuration of the xvYCC mode in the functional subcommand.

  - Set the 3D-FramePacking mode (support only 1080P_24/720P_50/720P_60).

    ```
    ./sample_hdmi_tsplay ccitt_mux_32K.ts 1080P_24
    hdmi_set_disp_3d 1
    ```

  - Set the 3D-SidebySide half mode (support only 1080i_50/1080i_60).

    ```
    ./sample_hdmi_tsplay ccitt_mux_32K.ts 1080i_50
    hdmi_set_disp_3d 2
    ```

  - Set the 3D-TopAndBottom mode (support only 1080P_24/720P_50/720P_60).

    ```
    ./sample_hdmi_tsplay ccitt_mux_32K.ts 720P_50
    hdmi_set_disp_3d 3
    ```

  - Disable the 3D mode.

    ```
    hdmi_set_disp_3d 0
    ```

3.2.6 HDCP Test

To test the HDCP encrypted transmission, run the following commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  480p_60
hdmi_color_mode 0
hdmi_hdcp 1
```

3.2.7 Functional Subcommands for Testing Compressed and Multi-Channel Audio

After the program sample_esplay runs properly, you can detect the output of compressed audio by using the audio amplifier (YAMAHA).

At this time, the default video output is the blue background at 1280x720p_50 Hz.

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CAUTION

When testing the pass-through and PCM 8-channel outputs of the HDMI, ensure that the EDID of the sink device has the corresponding capability.

- Set the AC3 compressed audio output (2:AC-s) at 48 kHz.

  Test command:

  ```
  ./sample_esplay null null afraic.ac3 ddp
  ```

- Set the DTS compressed audio output (7:DTS) at 192 kHz.

  Test command:

  ```
  ./sample_esplay null null hd_dts_orchestra_long_lossless_dtshd_ma.dts
  dts
  ```

- Set the Dolby Digital compressed audio output (10:Dolby Digital+) at 192 kHz.

  Test command:

  ```
  ./sample_esplay null null serenity_english_5_1_1536.ddp ddp
  ```

- Set the HBR audio mode and DTS-HD compressed audio output (11:DTS-HD) at 192 kHz.

  Test commands

  ```
  ./sample_esplay null null hd_dts_orchestra_long_lossless_dtshd_ma.dts
  dts 1080p_60
  ./sample_esplay null null hd_dts_orchestra_long_lossless_dtshd_ma.dts
  dts 1080p_50
  ```

- Set the HBR audio mode and MAT compressed audio output (for example, MLP, Dolby HrueHD) at 192 kHz.

  Test commands:

  ```
  ./sample_esplay null null Ghost.MLP truehd  1080p_60
  ./sample_esplay null null Ghost.MLP truehd  1080p_50
  ```

- Set the 480i60 96 kHz 8-channel PCM outputs.

  Test commands:

  ```
  ./sample_localplay PCM8_96Khz_pcm7.1.m2ts –f ntsc
  set hdmi
  ```

- Set the 1080p60 192 kHz 8-channel PCM output.

  Test commands:

  ```
  ./sample_localplay dada_192KHz_8ch_16bit.wav –f 1080p_60
  set hdmi
  ```

- Set the 1080p50 192 kHz 8-channel PCM output.

  Test commands:

  ```
  ./sample_localplay dada_192KHz_8ch_16bit.wav –f 1080p_50
  set hdmi
  ```


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3.2.8 Instrument Configurations

The following describes the instrument configuration procedures by using the quantumdata 980B as an example:

Step 1 Start the quantumdata 980B and choose **Compliance Tests** > **HDMI source CTS 1.4b**.

Step 2 Set **CDF Entry**.

CDF Entry is a test specifications option.

Step 3 Set **Test Selections**.

Test Selections specifies the test item.

Step 4 Choose **Test Options/Preview** > **Execute Tests** to conduct the test.

----End

3.2.9 Test Procedures

This section describes the test procedures by taking Hi3716M V310 as an example.

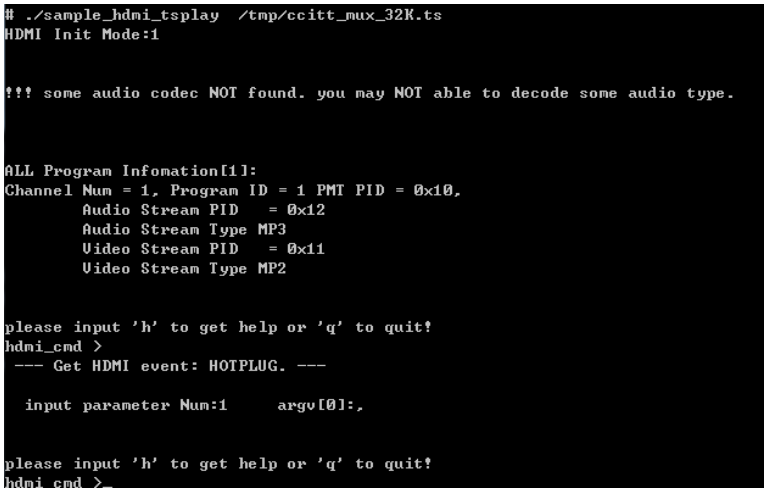
3.2.9.1 Test Items 7.16, 7.17, 7.18, 7.19, 7.21, 7.22, and 7.23

The test procedures for items 7.16, 7.17, 7.18, 7.19, 7.21, 7.22, and 7.23 are as follows:

Step 1 Run **./sample_hdmi_tsplay ccitt_mux_32K.ts** on Linux.

Change the stream name if other test streams are used. Running this command displays the HDMI command interaction interface. "hdmi_cmd" is displayed.

Figure 3-2 Hi3716M V310 HDMI interaction interface



Step 2 Enter the **hdmi_video_timing**+*corresponding standard ID* command in the interaction interface based on the standard indicated by the test instrument, and select timing.

For example, to output the 480p video, enter **hdmi_video_timing 10**.

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NOTE

The preceding example assumes that the ID of 480p is 10. You need to select the ID corresponding to the standard. To check the standard ID, enter **hdmi_video_timing** in the HDMI command-line interface.

For details about how to set the standard, see section 3.2.5 "Video Timing Output Configuration."

Figure 3-3 Command for selecting a standard

```
hdmi_cmd >hdmi_video_timing 10
  input parameter Num:2     argv[0]:hdmi_video_timing,     argv[1]:10,

     hdmi_video_timing u32TimingIndex:10
     From EDID, sink can receive this format!!!
     change DISP Timing to u32TimingIndex:10
     Set 720X480P_60000 u32TimingIndex:0xa

please input 'h' to get help or 'q' to quit!
hdmi_cmd >
```

Figure 3-4 Selecting a standard

```
hdmi_cmd >hdmi_video_timing
  input parameter Num:1     argv[0]:hdmi_video_timing,

    Usage:hdmi_video_timing timeingmode
        timemode:00   1080P_60
        timemode:01   1080P_50
        timemode:02   1080P_30
        timemode:03   1080P_25
        timemode:04   1080P_24
        timemode:05   1080i_60
        timemode:06   1080i_50
        timemode:07   720P_60
        timemode:08   720P_50
        timemode:09   576P_50
        timemode:10   480P_60
        timemode:11   576i_50 PAL
        timemode:12   PAL_N
        timemode:13   PAL_Nc
        timemode:14   480i_60 NTSC
        timemode:15   NTSC_J
        timemode:16   NTSC_M
        timemode:17   SECAM_SIN
        timemode:18   SECAM_COS
        timemode:19   640x480p_60
        timemode:20   800x480
        timemode:21   1024x768
        timemode:22   1280x720
        timemode:23   1280x800
        timemode:24   1280x1024
        timemode:25   1360x768
        timemode:26   1366x768
        timemode:27   1400x1050
        timemode:28   1440x900
        timemode:29   1440x900_RB
        timemode:30   1600x900
        timemode:31   1600x1200
        timemode:32   1680x1050
        timemode:33   1920x1080
        timemode:34   1920x1200
        timemode:35   2048x1152

please input 'h' to get help or 'q' to quit!
hdmi_cmd >_
```


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Step 3 Set the color space to RGB444 by running the following command:

```
hdmi_color_mode 0
```

----End

3.2.9.2 Test Items 7.24, 7.25, and 7.26

The test procedures for items 7.24, 7.25, and 7.26 are as follows:

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Select the standard indicated by the test instrument.

For details about how to set the standard, see section 3.2.5 "Video Timing Output Configuration."

Step 3 Set the color space to YCbCr444 by running **hdmi_color_mode 2**.

Step 4 Set the quantization range to limitation by running **hdmi_ycbcrfullrange 1**.

----End

3.2.9.3 Test Item 7.27

The test procedures for item 7.27 are as follows:

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration."

Step 3 Set the color space to YCbCr444 by running **hdmi_color_mode 2**.

Step 4 Set the quantization range to limitation by running **hdmi_ycbcrfullrange 1**.

Step 5 Select the 4:3 or 16:9 mode.

- Iter 01: (1) 640x480p@60 Hz 4:3, known content AR
- Iter 02: (2) 720x480p@60 Hz 4:3, known content AR
- Iter 06: (6) 720(1440)x480i@60 Hz 4:3, known content AR
- Iter 09: (17) 720x576p@50 Hz 4:3, known content AR
- Iter 13: (21) 720(1440)x576i@50 Hz 4:3, known content AR

Select the 4:3 mode for the preceding standards by running **hdmi_apectrate 1**.

- Iter 03: (3) 720x480p@60 Hz 16:9, known content AR
- Iter 04: (4) 1280x720p@60 Hz 16:9, known content AR
- Iter 05: (5) 1920x1080i@60 Hz 16:9, known content AR
- Iter 07: (7) 720(1440)x480i@60 Hz 16:9, known content AR

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- Iter 08: (16) 1920x1080p@60 Hz 16:9, known content AR
- Iter 10: (18) 720x576p@50 Hz 16:9, known content AR
- Iter 11: (19) 1280x720p@50 Hz 16:9, known content AR
- Iter 12: (20) 1920x1080i@50 Hz 16:9, known content AR
- Iter 14: (22) 720(1440)x576i@50 Hz 16:9, known content AR
- Iter 15: (31) 1920x1080p@50 Hz 16:9, known content AR

Select the 16:9 mode for the preceding standards by running **hdmi_apectrate 0**.

----End

3.2.9.4 Test Items 7.28, 7.29, 7.30, 7.31, and 7.32

The test procedures for items 7.28, 7.29, 7.30, 7.31, and 7.32 are as follows:

Step 1 Add the related audio libraries. The audio libraries are stored in **/usr/lib** of the board.

Step 2 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 3 Select the standard indicated by the test instrument.

For details about how to set the standard, see section 3.2.5 "Video Timing Output Configuration."

Step 4 Select the deep color mode indicated by the test instrument.

- 24-bit: hdmi_deepcolor 0
- 30-bit: hdmi_deepcolor 1
- 36-bit: hdmi_deepcolor 2

The 36-bit deep color mode is used only for item 7.29 Iter 2. Select the 24-bit mode by running **hdmi_deepcolor 0** if the instrument does not provide information about the required deep color mode.

----End

3.2.9.5 Test Item 7.33

The test procedures for item 7.33 are as follows:

Iter 01: Any supported format, DVI

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration." You can select any standard for this test item.

Step 3 Select the DVI mode by running **hdmi_dvi_force**.

----End

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Iter 02: Any supported format, HDMI VSDB = 5

Iter 03: Any supported format, HDMI VSDB > 5

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Select the HDMI mode by running **hdmi_hdmi_force**.

Step 3 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration." You can select any standard for this test item.

Step 4 Set the color space to YCbCr444 by running **hdmi_color_mode 2**.

----End

3.2.9.6 Test Item 7.34

The test procedures for item 7.34 are as follows:

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration." You can select any standard for this test item.

Step 3 Set the color space to YCbCr444 by running **hdmi_color_mode 2**.

Step 4 Set the quantization range to limitation by running **hdmi_ycbcrfullrange 1**.

Step 5 Set the deep color mode to the 36-bit mode by running **hdmi_deepcolor 2**.

----End

3.2.9.7 Test Item 7.35

The test procedures for item 7.35 are as follows:

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration." You can select any standard for this test item.

Step 3 Set the color space to YCbCr444 by running **hdmi_color_mode 2**.

Step 4 Set the quantization range to limitation by running **hdmi_ycbcrfullrange 1**.

Step 5 Set the deep color mode to the 36-bit mode by running **hdmi_deepcolor 2**.

Step 6 Enable xvycc by running **hdmi_xvycc 1**.

----End

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3.2.9.8 Test Item 7.36

The TrueHD item needs to be tested for chips that support TrueHD.

CAUTION

Hi3716M V310 does not support TrueHD.

The test procedures for item 7.36 are as follows:

Step 1 Load the corresponding TrueHD audio library.

Step 2 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 3 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration." You can select any standard for this test item.

----End

3.2.9.9 Test Item 7.38

The test procedures for item 7.38 are as follows:

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Set the resolution by running **hdmi_video_timing**.

For details, see section 3.2.5 "Video Timing Output Configuration." You can select any standard for this test item.

Step 3 Select a 3D mode or disable the 3D mode based on the test item.

- Select a 3D mode for Iter 01 to Iter 08.

  Select a 3D mode by running one of the following commands as required:

  - **hdmi_3d_enable 6** for top-and-bottom mode
  - **hdmi_3d_enable 8** for the side-by-side mode
- Disable the 3D mode for Iter 09 to Iter 19by running **hdmi_3d_disable**.

----End

3.2.9.10 Test Item 7.39

The 4K certification item needs to be tested for chips that support 4K.

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CAUTION

Hi3716M V310 does not support the 4K x 2K resolution. Currently only the Hi3798M and Hi3798C series support the 4K x 2K resolution.

Step 1 Play the stream **./sample_hdmi_tsplay ccitt_mux_32K.ts**.

Skip this step if you have entered the hdmi_cmd interface.

Step 2 Run the **hdmi_video_timing**+*standard indicated by the test instrument* command in the interaction interface, and select timing to output the corresponding 4K x 2K timing.

----End

3.2.9.11 HDCP-Related Test Items

Set the HDCP encrypted transmission by running the following test commands:

```
./sample_hdmi_tsplay ccitt_mux_32K.ts  480p_60
hdmi_color_mode 0
hdmi_hdcp 1
```

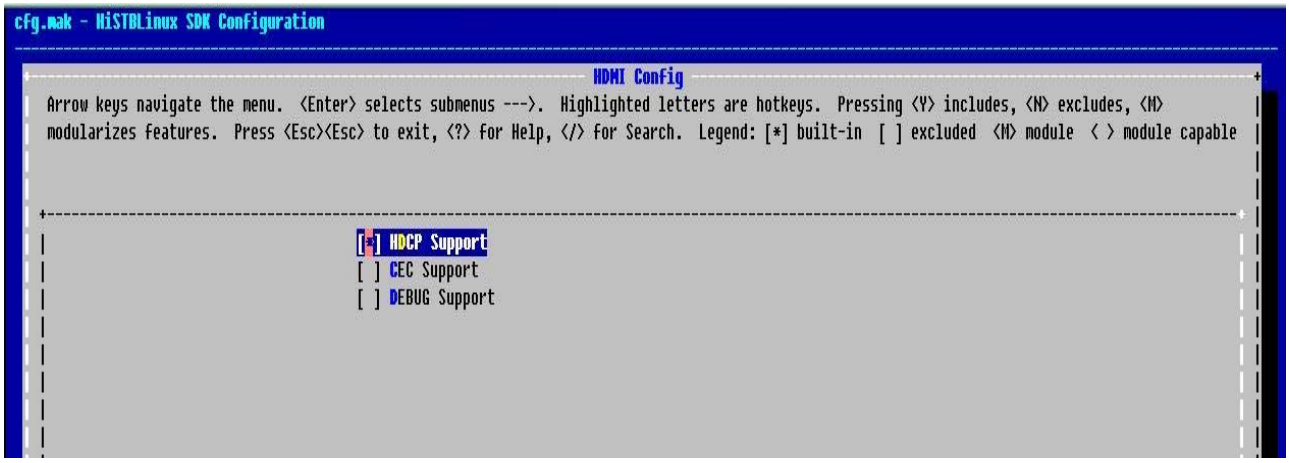
3.2.10 Burning the HDCP Key

3.2.10.1 Enabling the HDCP Function

To enable the HDCP function, perform the following steps:

Step 1 Run **make menuconfig** in the SDK root directory, choose **MSP** > **HDMI Config**, and select **HDCP Support** by pressing the space key.

Figure 3-5 Selecting HDCP Support



Step 2 Enable the HDCP in the sample. Enable the HDCP macro in **/sample/common/hi_adp_hdmi.c** of the SDK.

```
#define HI_HDCP_SUPPORT
```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```
Compile and reburn the kernel and then compile the sample by running the
following command:make linux_install
make sample
```

----End

3.2.10.2 Generating the HDCP Key

To generate the HDCP key, perform the following steps:

Step 1 Generate an HDCP key **org_xxxxx.bin** by using **HDCP_Key.exe** of HiSilicon.

> **CAUTION**
>
> **org_xxxxx.bin** is a single HDCP 1.x key generated by using **HDCP_Key.exe** of HiSilicon. For details about how to use **HDCP_Key.exe**, see the *HDCP Key User Guide* in the SDK.

Step 2 Encrypt **org_xxxxx.bin** by using the HDCP sample:

```
./sample_encryptHdcpKey 1 org_xxxx.bin
```

The encrypted HDCP key file **EncryptedKey_332bytes.bin** is generated.

Step 3 Assign read and write properties to **EncryptedKey_332bytes.bin**:

```
chmod 777 EncryptedKey_332bytes.bin
```

Step 4 Save **EncryptedKey_332bytes.bin** to **/sample/hdmi_tsplay** of the SDK.

Step 5 Save the TSs to be played to **/sample/hdmi_tsplay** of the SDK.

Step 6 Run **./sample_hdmi_tsplay stream.ts 480p_60**.

Step 7 Enter **hdmi_hdcp 1** to initiate the HDCP handshake process.

----End

3.3 Test Guide for the Android Version

3.3.1 Preparations

Prepare the following items:

- An Android board
- An HDMI cable
- Quantumdata 980B

3.3.2 Test Procedures

The test procedures are as follows:

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Step 1 Start the quantumdata 980B and choose **Compliance Tests** > **HDMI source CTS 1.4b**.

Step 2 Set **CDF Entry**.

CDF Entry is a test specifications option.

Step 3 Set **Test Selections**.

Test Selections specifies the test item.

Step 4 Choose **Test Options/Preview** > **Execute Tests** to perform the test.

----End

3.3.3 Configurations of Test Items

CAUTION

If information indicating that parameters are incorrect is displayed during tests, reconfigure the test parameters based on the current parameter values.

3.3.3.1 Test Items 7.16, 7.17, 7.18, 7.19, 7.21, 7.22, and 7.23

Perform the test based on the information in Table 3-1.

Table 3-1 Debugging UI information (1)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard based on the format information.
	hdmi_color_mode	RGB444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled

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Stream	Parameter	Configuration
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	EDID information. This parameter does not need to be specified.

3.3.3.2 Test Item 7.24

Perform the test based on the following:

Iter 01: (1) 640x480p@60 Hz, YCbCr pixel encoding content

The test procedures are as follows:

Step 1 Set **hdmi_ycbcrfullrange** to full page mode. Note the following:

hdmi_reversecolor is automatically set to **Reverse Range**.

hdmi_rgbfullrange is automatically set to **Normal Range**.

Step 2 Set **hdmi_ycbcrfullrange** to **Limitation Range**.

Step 3 Start the test.

----End

Table 3-2 Debugging UI information (2)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard based on the format information.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	Reverse Range
	hdmi_rgbfullrange	Normal Range
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range

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Stream	Parameter	Configuration
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	EDID information. This parameter does not need to be specified.

For other specifications, perform the test based on Table 3-3.

Table 3-3 Debugging UI information (3)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard based on the format information.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	EDID information. This parameter does not need to be specified.

3.3.3.3 Test Items 7.25 and 7.26

Perform the test based on the information in Table 3-4.

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Table 3-4 Debugging UI information (4)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard based on the format information.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.4 Test Item 7.27

- Iter 01: (1) 640x480p@60 Hz 4:3, known content AR
- Iter 02: (2) 720x480p@60 Hz 4:3, known content AR
- Iter 06: (6) 720(1440)x480i@60 Hz 4:3, known content AR
- Iter 09: (17) 720x576p@50 Hz 4:3, known content AR
- Iter 13: (21) 720(1440)x576i@50 Hz 4:3, known content AR

Perform the test based on the information in Table 3-5.

Table 3-5 Debugging UI information (5)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.

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Stream	Parameter	Configuration
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	4:03
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

- Iter 03: (3) 720x480p@60 Hz 16:9, known content AR
- Iter 04: (4) 1280x720p@60 Hz 16:9, known content AR
- Iter 05: (5) 1920x1080i@60 Hz 16:9, known content AR
- Iter 07: (7) 720(1440)x480i@60 Hz 16:9, known content AR
- Iter 08: (16) 1920x1080p@60 Hz 16:9, known content AR
- Iter 10: (18) 720x576p@50 Hz 16:9, known content AR
- Iter 11: (19) 1280x720p@50 Hz 16:9, known content AR
- Iter 12: (20) 1920x1080i@50 Hz 16:9, known content AR
- Iter 14: (22) 720(1440)x576i@50 Hz 16:9, known content AR
- Iter 15: (31) 1920x1080p@50 Hz 16:9, known content AR

Perform the test based on the information in Table 3-6.

Table 3-6 Debugging UI information (6)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	16:09

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Stream	Parameter	Configuration
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.5 Test Item 7.28

Iter 01: (2,3) 720x480p@60 Hz, basic audio

Perform the test based on the information in Table 3-7.

Table 3-7 Debugging UI information (7)

Stream	Parameter	Configuration
afraic.ac3	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	Reverse Range
	hdmi_rgbfullrange	Normal Range
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off

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Stream	Parameter	Configuration
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

Iter 02: Any supported format, PCM Audio, max sampling rate (192 kHz), max channels (8)

Perform the test based on the information in Table 3-8.

Table 3-8 Debugging UI information (8)

Stream	Parameter	Configuration
hd_dts_orchestra_long_lossless_dtshd_ma.dts	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

Iter 03: Any supported format, HBRA

Table 3-9 Debugging UI information (9)

Stream	Parameter	Configuration
hd_dts_orchestra_long_lossless_dtshd_	HI_UNF_SND_Mode	RAW
	hdmi_video_timing	1080P50

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Stream	Parameter	Configuration
ma.dts	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.6 Test Item 7.29

Iter 01: (2,3) 720x480p@60 Hz, basic audio

Table 3-10 Debugging UI information (10)

Stream	Parameter	Configuration
afraic.ac3	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled

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Stream	Parameter	Configuration
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

Iter 02: (2,3) 720x480p@60 Hz, deep color 36 bpp, basic audio

Table 3-11 Debugging UI information (11)

Stream	Parameter	Configuration
afraic.ac3	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	36 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.7 Test Item 7.30

Iter 01: (6,7) 720(1440)x480i@60 Hz, 96 kHz 3 or more channel PCM audio

Table 3-12 Debugging UI information (12)

Stream	Parameter	Configuration
PCM8_96Khz_pcm7.1.m2ts	HI_UNF_SND_Mode	RAW
	hdmi_video_timing	Select the corresponding standard.

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Stream	Parameter	Configuration
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

Iter 02: (2,3) 720x480p@60 Hz, 48 kHz 2 channel PCM or compressed audio

Table 3-13 Debugging UI information (13)

Stream	Parameter	Configuration
afraic.ac3	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D

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Stream	Parameter	Configuration
	hdmi_display_edit	-

3.3.3.8 Test Item 7.31

Iter 01: (2,3) 720x480p@60 Hz, basic audio

Table 3-14 Debugging UI information (14)

Stream	Parameter	Configuration
afraic.ac3	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

Iter 02: Any supported format, greater than 2-channel PCM audio

Table 3-15 Debugging UI information (15)

Stream	Parameter	Configuration
dada_192KHz_8ch_16bit.wav	HI_UNF_SND_Mode	RAW
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.

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Stream	Parameter	Configuration
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.9 Test Item 7.32

Iter 01: Any supported format, basic audio

Table 3-16 Debugging UI information (16)

Stream	Parameter	Configuration
afraic.ac3	HI_UNF_SND_Mode	PCM
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

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Iter 02: Any supported format, greater than 2-channel PCM audio

Table 3-17 Debugging UI information (17)

Stream	Parameter	Configuration
PCM8_96Khz_pcm7.1.m2ts	HI_UNF_SND_Mode	RAW
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.10 Test Item 7.33

Iter 01: Any supported format, DVI

Table 3-18 Debugging UI information (18)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	RGB444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually

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Stream	Parameter	Configuration
		specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	DVI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

Iter 02: Any supported format, HDMI VSDB = 5

Iter 03: Any supported format, HDMI VSDB > 5

Table 3-19 Debugging UI information (19)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off

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Stream	Parameter	Configuration
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.11 Test Item 7.33

Table 3-20 Debugging UI information (20)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.12 Test Item 7.34

Table 3-21 Debugging UI information (21)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.

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Stream	Parameter	Configuration
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	36 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.13 Test Item 7.35

Table 3-22 Debugging UI information (22)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.

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Stream	Parameter	Configuration
	hdmi_mode	HDMI
	hdmi_deepcolor	36 bits
	hdmi_xvycc	Enabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

3.3.3.14 Test Item 7.36

Table 3-23 Debugging UI information (23)

Stream	Parameter	Configuration
hd_dts_orchestra_long_lossless_dtshd_ma.dts	HI_UNF_SND_Mode	RAW
	hdmi_video_timing	1080P50
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	2D
	hdmi_display_edit	-

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3.3.3.15 Test Item 7.38 and 7.39

Table 3-24 Debugging UI information (24)

Stream	Parameter	Configuration
ccitt_mux_32K.ts	HI_UNF_SND_Mode	This parameter can be set to any value and can be ignored.
	hdmi_video_timing	Select the corresponding standard.
	hdmi_color_mode	YCbCr444
	hdmi_apectrate	This parameter can be automatically configured by software or manually specified.
	hdmi_reversecolor	This parameter can be automatically configured by software or manually specified.
	hdmi_rgbfullrange	This parameter can be automatically configured by software or manually specified.
	hdmi_mode	HDMI
	hdmi_deepcolor	24 bits
	hdmi_xvycc	Disabled
	hdmi_ycbcrfullrange	Limitation Range
	hdmi_hdcp	Off
	hdmi_set_disp_3d	Select the corresponding 3D format.
	hdmi_display_edit	-

3.3.4 HDCP Certification for the Android Version

3.3.4.1 Preparations

Perform the following steps:

Step 1 Prepare an Android board, an HDMI cable, and a quantumdata 882B.

Step 2 Burn the key.

1. Prepare an HDCP 1.x key file **org_xxxxx.bin** (apply for the key from LLC).
2. Generate the encrypted HDCP 1.x key file **EncryptedKey_332bytes.bin** and store it to a directory on the board, for example, **/system/bin/EncryptedKey_332bytes.bin**.

   To generate **EncryptedKey_332bytes.bin**, go to **/system/bin/**, run **./sample_otp_sethdcprootkey** to burn the HDCP root key, and then run **./sample_encryptHdcpKey 1 org_xxxxx.bin**. The generated key is stored in the current directory.

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3. Assign write and read properties to **EncryptedKey_332bytes.bin** by running **chmod 777 EncryptedKey_332bytes.bin**, and copy **EncryptedKey_332bytes.bin** to **/system/etc/**.

CAUTION

The encrypted key is stored in the path (for storing encrypted the HDCP key) defined in **device\hisilicon\bigfish\frameworks\hidisplaymanager\hal\hi_adp_hdmi.c**.

Step 3 Enable the HDCP function.

Enable the macro definition **#define HI_HDCP_SUPPORT** in **device\hisilicon\bigfish\frameworks\hidisplaymanager\hal\hi_adp_hdmi.c**, and recompile the **hidisplay.bigfish.so** library to replace the **hidisplay.bigfish.so** library in **/system/lib/hw/** of the board. Then restart the board for the configurations to take effect.

```
//#define HI_HDCP_SUPPORT
#ifdef HI_HDCP_SUPPORT
HI_U32 g_HDCPFlag       = HI_TRUE;
#else
HI_U32 g_HDCPFlag       = HI_FALSE;
```

----End

3.3.4.2 Test Procedures

The test procedures are as follows:

Step 1 Start the application HardwareTest, and select **APK**.

Step 2 Select **HDMI**.

Step 3 Play the stream **ccitt_mux_32K.ts**.

Step 4 Press the **Menu** key and set the standard to (2,3) 480p60.

----End

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