SystemReady ES Test and Certification Guide

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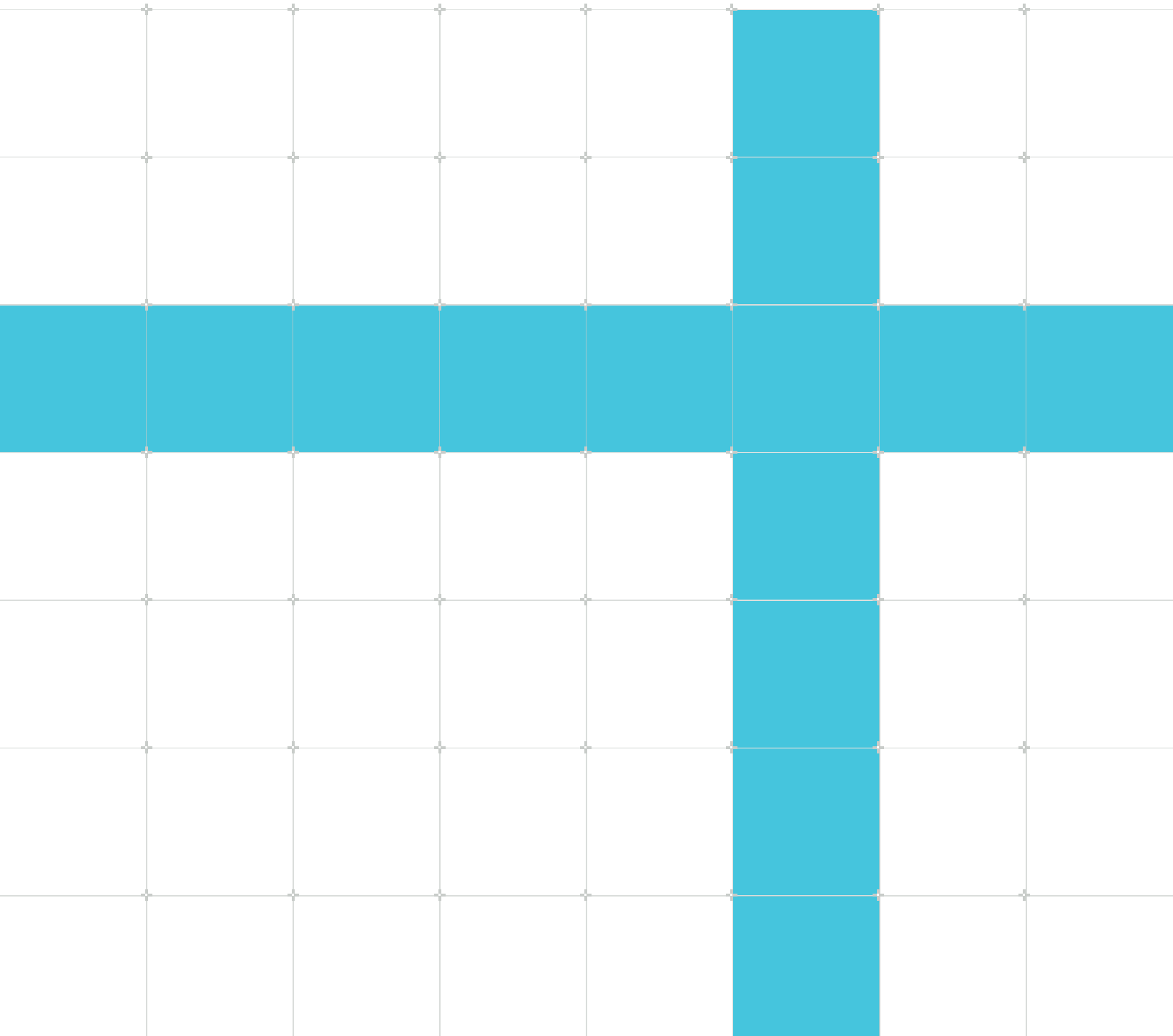

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Release information

Document history

Issue	Date	Confidentiality	Change
0100-01	18 October 2021	Non-Confidential	First release

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110 Fulbourn Road, Cambridge, England CB1 9NJ.

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Contents

1. Overview

This guide provides an overview of the Arm SystemReady certification and test process. By the end of this guide, you will understand the steps required to certify your system with Arm SystemReady certification in the ServerReady (SR) or Embedded Server (ES) bands.

Arm SystemReady is a set of standards and a compliance certification program that enables interoperability with generic, off the shelf operating systems and hypervisors. The Arm SystemReady certification program encompasses a broad set of devices from cloud to IoT edge.

Compliant systems that adhere to the Arm SystemReady terms and conditions are issued with a compliance certificate and can use the Arm SystemReady certified stamp logo.

The Arm SystemReady specifications consist of a generic Base System Architecture (BSA), which contains the minimum requirements to deploy an operating system. SystemReady also includes supplementary specifications, such as the Server Base System Architecture (SBSA) for the server market.

The Base Boot Requirements (BBR) specification provides boot recipes that accommodate the different standards. The specification also provides the boot firmware implementations that are used by a broader range of operating systems and hypervisors.

For more information about the Arm SystemReady certification program, see Arm SystemReady Certification Program.

This guide provides guidance for the SystemReady ES and SystemReady SR bands only.

2. What is SystemReady certification?

The SystemReady certification program ensures the highest possible standards for systems supporting off the shelf operating systems and hypervisors. To help you navigate the process, Arm provides the following support:

- This guide, which explains how to get SystemReady certification in a requested band.
- The Arm SystemReady Compliance team helps evaluate your system for certification, and provides feedback and guidance.
- Arm provides checklists, forms, and report templates to ensure necessary information is submitted with your certification request.
- The Arm SystemArchAC mailing list. Contact the Arm SystemReady Certification Program for further information.

2.1 How the SystemReady certification process works

The following steps describe the SystemReady certification process:

1. Sign a SystemReady Program legal agreement. The certification request goes in a certification backlog to be reviewed.
2. Submit a SystemReady firmware readiness checklist to the SystemReady compliance team. When you provide the system hardware and firmware, the compliance team performs a certification readiness evaluation.
3. Arm provides feedback, including an estimate of the effort to achieve certification, and asks you to fix any readiness issues. This step is repeated until all issues have been addressed in the firmware and the formal certification process begins.
4. Run ACS certification tests, including OS installs, when the compliance team indicates the system is ready for formal certification. You submit the ACS test logs with the SystemReady Readiness evaluation report, and any errata and waiver justification to Arm for review.
5. Arm reviews the submission and provides feedback on any issues that prevent certification. You then debug issues, make firmware fixes as necessary, respond to the failure analysis, and prepare any additional waiver requests.
6. Run the ACS tests again and submit the forms, logs, waiver requests, and errata to the compliance team for review. This step is repeated until all issues have been addressed. The certification request is then submitted to the Arm Architects for final review and approval. Currently, Arm sends drafts of the certification documents to you for review.
7. Arm marketing issues the official certificate, waivers, and certification logo when the Arm architects approve the certification.
8. Submit the SystemReady Compliance List (SCL) entry form so that the system can be added to the SystemReady Certification list on the Arm website.

3. Provide certification information

When you submit a request for SystemReady Certification, you must provide forms, reports, and logs to ensure the request can be evaluated. This section tells you about the information required for a certification request.

Arm provides a readiness checklist, forms, and report templates to ensure that all required inputs are provided throughout the certification process.

3.1 Submit the firmware readiness checklist

The SystemReady firmware readiness checklist is submitted before the initial certification evaluation. This checklist ensures you supply the following information:

- Company, system, and SoC information
- The SystemReady band for which you are requesting certification
- Hardware and firmware availability and U-Boot or EDK information
- Arm Base System Architecture (BSA) compliance state
- OS boot, ACS compliance, and security compliance sniff test information

3.2 Submit the readiness evaluation report

The SystemReady readiness evaluation report is submitted when you request formal certification. You must complete the following information in the report:

- General, company, and system information
- Space for the ACS logs
- An area for pictures of the system, setup, and any relevant screenshots such as the firmware boot and menus
- An overall SystemReady evaluation summary and space to report the individual ACS, UEFI sniff test, and OS boot tests

3.3 Submit the SystemReady Certification List form

The SystemReady Certification List (SCL) form is submitted after certification has been granted. The SCL form contains the information needed to list the system on the Arm SCL web page.

3.4 Requesting waivers

In some circumstances, waivers to the SystemReady standards are granted by the Arm architects and the Arm SystemReady compliance team. Waivers must be requested and justification provided when you submit the certification request.

Arm can consult with Independent Software Vendors (ISV) if necessary. If a waiver cannot be granted, feedback is provided by Arm. To develop fixes or workarounds, you can consult the silicon partner (SiP) or independent BIOS vendor (IBV). The certification request can then be resubmitted for further evaluation.

4. Test SystemReady ES compliance

The Arm SystemReady Architecture Compliance Suite (ACS) is a set of tests that ensure architectural compliance across different implementations and variants of the architecture. ACS is delivered in source form with a build environment. The output of the build is a bootable live OS image containing a collection of test suites. This output is collectively known as the BSA and BBR ACS which tests compliance against the BSA and BBR specifications for SystemReady ES certification.

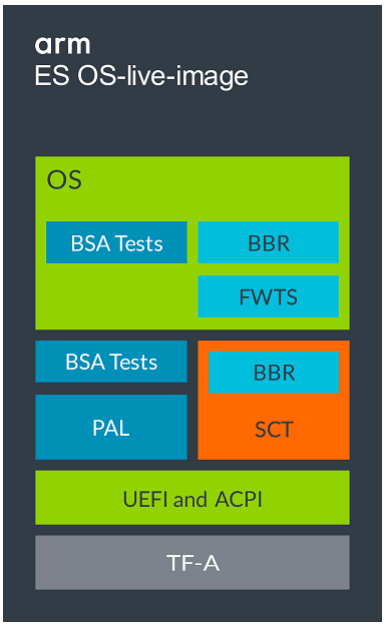
Arm recommends that you sign off architectural implementations against the ACS to prove compliance with these specifications.

4.1 ACS overview

The ACS for SystemReady certification is delivered through a live OS image, which enables the basic automation to run the BSA and BBR tests. The OS image is a set of UEFI applications on UEFI shell and Linux kernel with BusyBox integrated with the Firmware Test Suite (FWTS). The FWTS is a package hosted by Canonical which provides tests for Device tree and UEFI. The FWTS test is customized to run only UEFI tests.

The following diagram shows the different ACS components:

Figure 4-1: ACS components



4.2 BSA-ACS

The BSA test suites check for compliance against the Arm Base System Architecture (BSA) specification. The tests are delivered through two suites:

- BSA tests on UEFI Shell. These tests are written on top of Validation Adaption Layers (VAL) and Platform Adaptation Layers (PAL). The abstraction layers provide the tests with platform information and runtime environment to enable execution of the tests. In Arm deliveries, the VAL and PAL are written on top of UEFI.
- BSA tests on the Linux command line. These tests consist of the Linux command-line application `bsa` and the kernel module `bsa_acs.ko`.

4.3 BBR-ACS

The BBR test suites check compliance against the Arm Base Boot Requirements (BBR) specification. For SystemReady ES certification, firmware is tested against the SBBR recipe of BBR.

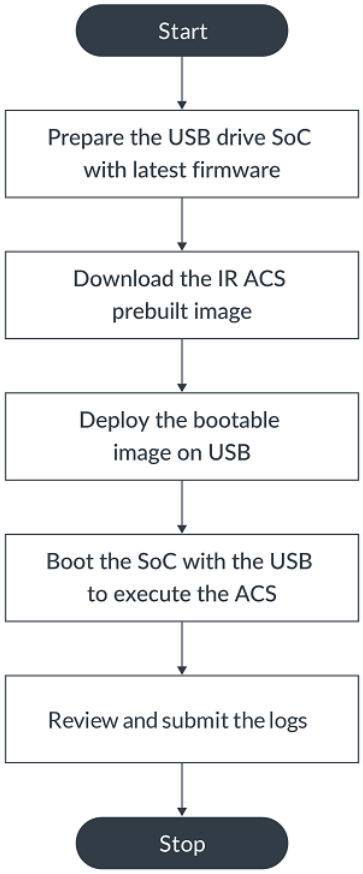
These tests are delivered through two bodies of code:

- SBBR tests contained in UEFI Self Certification Tests (SCT) tests. UEFI implementation requirements which are tested by SCT.
- SBBR based on FWTS. The Firmware Test Suite (FWTS) is a package hosted by Canonical that provides tests for ACPI and UEFI. The FWTS tests are customized to run only UEFI tests.

4.4 ACS test process

The following diagram shows the overall ACS test process:

Figure 4-2: ACS test process



4.5 ACS prerequisites

The prerequisites to run the ACS tests are as follows:

- Prepare a USB device with a minimum of 1GB of storage. This USB is used to boot and run the ACS and to store the execution results.

  Note

  We recommend you use a USB disk enclosure with a fast SSD drive.

- Prepare the SUT (System Under Test) machine and a host machine

- Prepare the SUT machine with the latest firmware loaded, a host machine for console access, then collect the results

4.6 Set up the test environment

To set up the USB device, use the following procedure:

1. Download the prebuilt ACS image for SystemReady ES certification to a local directory on Linux.

   The pre-built ACS image for SystemReady ES certification is available on GitHub at the following location:

   ```
   https://github.com/ARM-software/arm-systemready/tree/main/ES/prebuilt_images/
        <release tag>/es_acs_live_image.img.xz
   ```

   For information on the latest release and release tags, see the SystemReady ES ACS README.
2. Uncompress and deploy the image to the USB disk.

   Use a utility such as `xz` on Linux or 7-Zip on Windows to uncompress the `es_acs_live_image.img.xz` file.
3. On the Linux host machine, write the ES ACS bootable image to the USB disk using the following commands:

   ```
   $ lsblk
   $ sudo dd if=/path/to/es_acs_live_image.img of=/dev/sdX
   $ sync
   ```

   In this code, replace `/dev/sdX` with the name of your USB device. Use the `lsblk` command to display the USB device name.

4.7 Run the tests

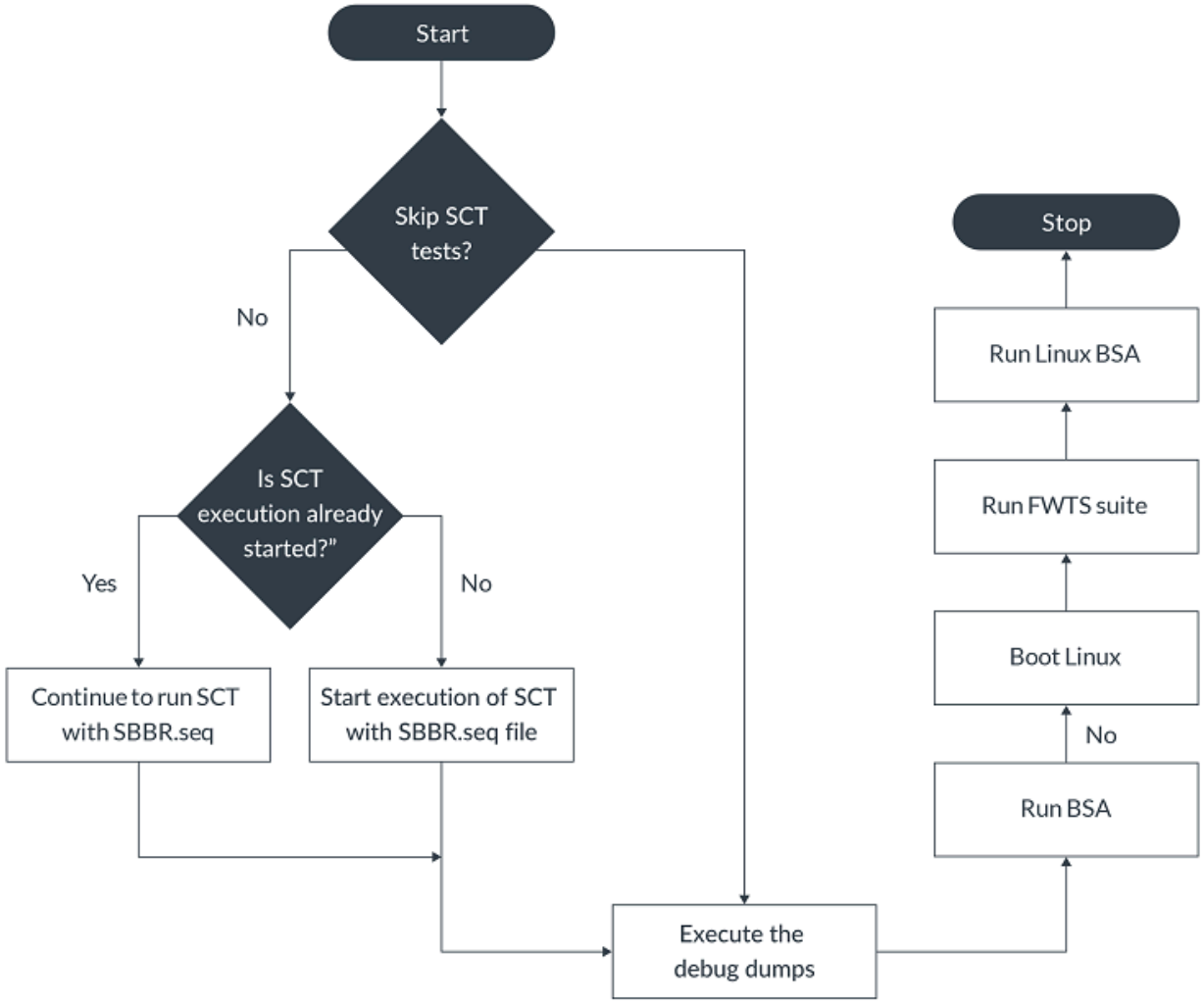
To execute the ACS ES prebuilt image, do the following:

1. Choose the **Boot from USB** option on the SoC.
2. Insert the USB in one of the USB slots and start a power cycle.

   The live image boots and runs the ACS automatically.

The following diagram shows the complete process of ACS execution through the ES ACS live image:

Figure 4-3: Test execution process



Note

To skip the debug and test steps shown in the diagram, press any key within five seconds.

As shown in the flowchart, there are two main modes of execution:

- Fully automated mode
- Normal mode

The following sections describe these modes in more detail.

4.8 Run tests in automated mode

If no option in GRUB is chosen and no tests are skipped, tests are run in fully automated mode.

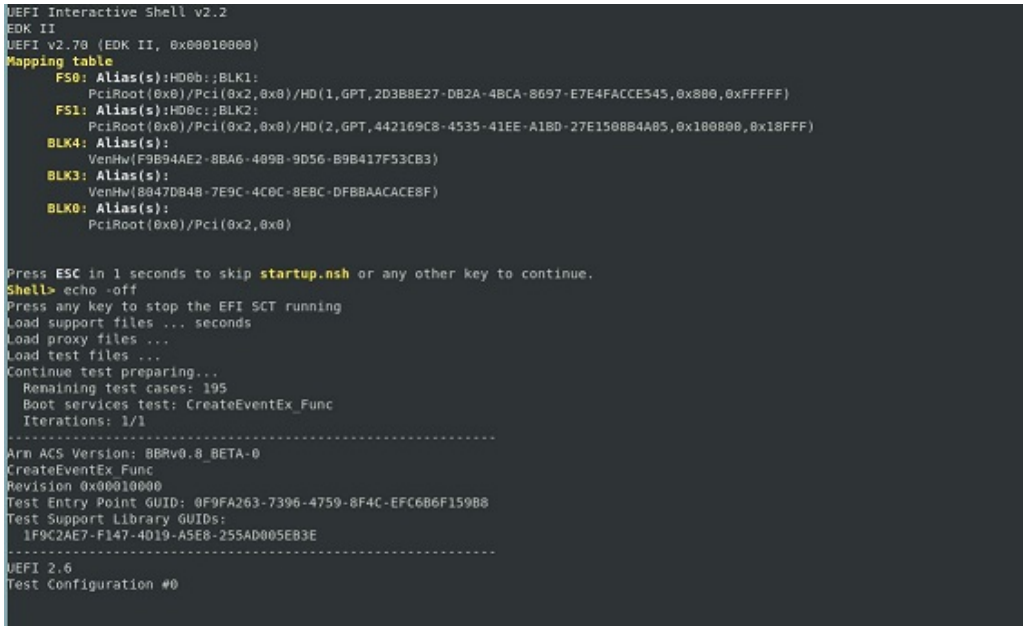
The following screenshot shows the GRUB bootloader options screen:

Figure 4-4: GRUB bootloader options

After a few seconds, the image executes the ACS process in the following order:

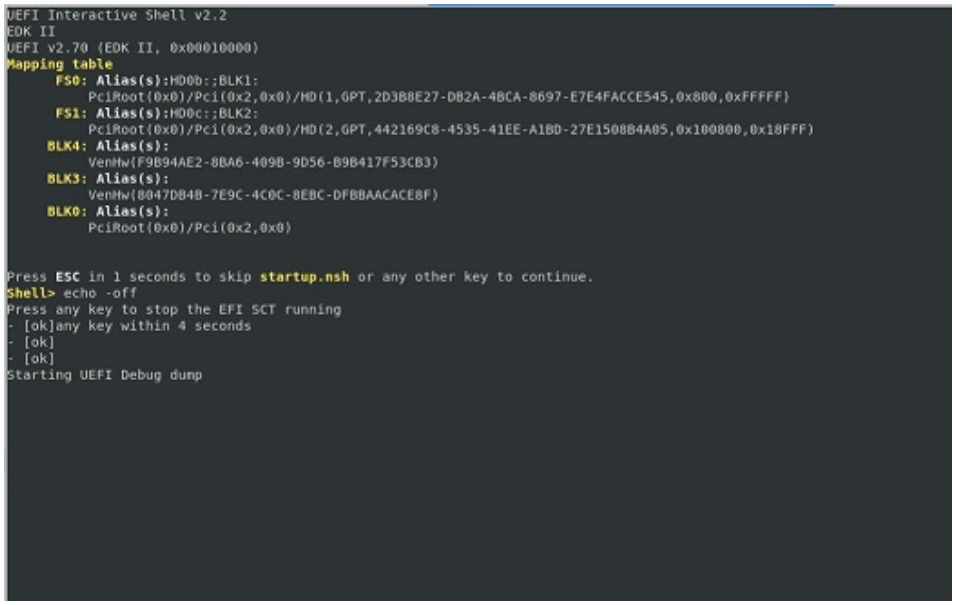
1. SCT tests:

   Figure 4-5: SCT tests



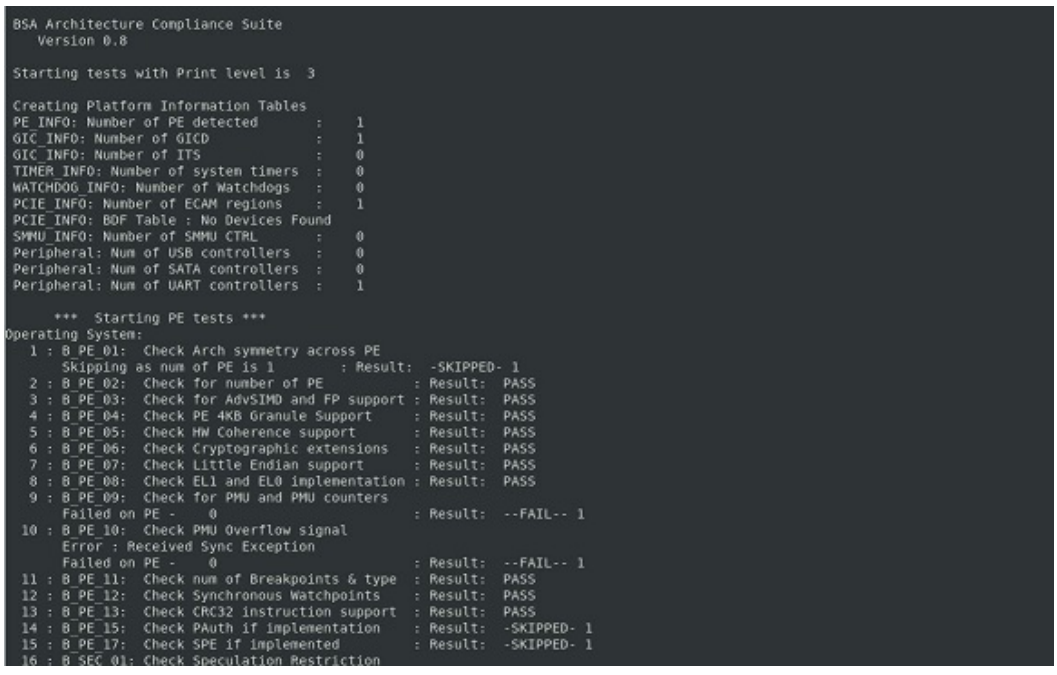
2. UEFI debug dumps:

Figure 4-6: UEFI debug dumps



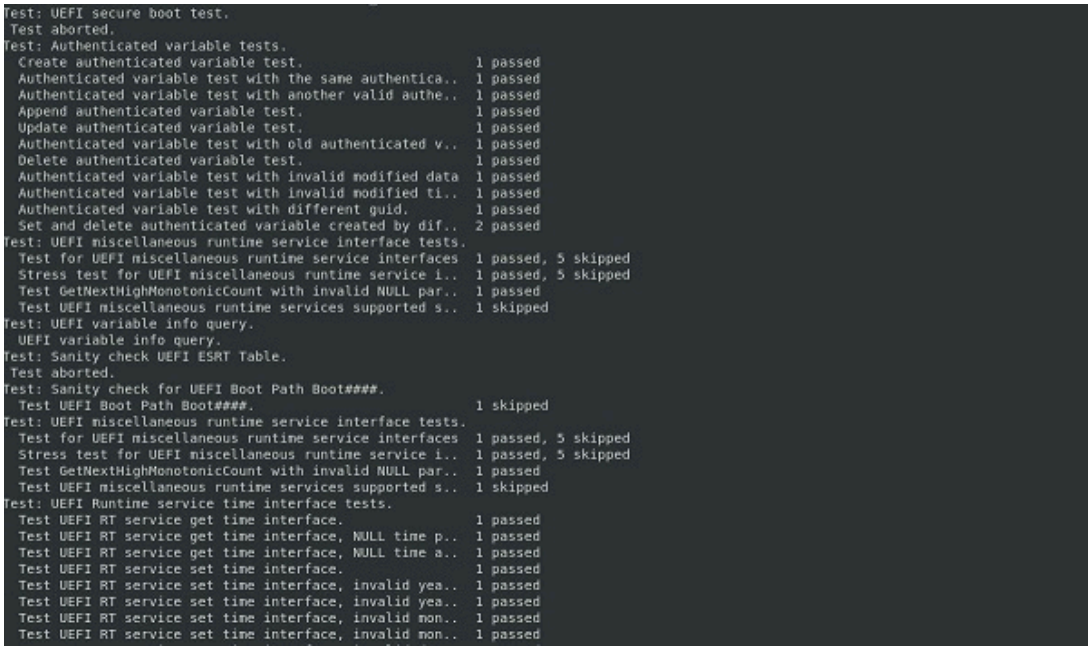
3. BSA ACS:

Figure 4-7: BSA ACS



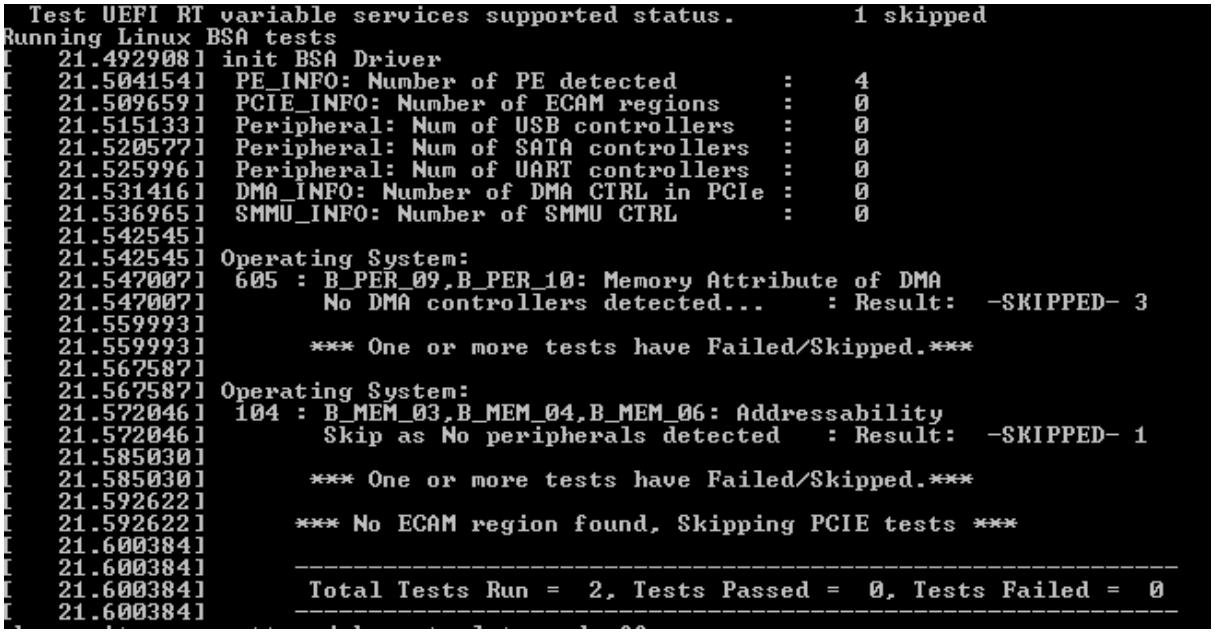
4. FWTS tests:

Figure 4-8: FWTS tests



5. Linux BSA test:

Figure 4-9: Linux BSA test



After these tests are executed, the control returns to a Linux prompt.

4.9 Run tests in normal mode

When the image boots, choose one of the following GRUB options to specify the test automation:

- Linux BusyBox to boot Linux and execute FWTS and Linux BSA
- BBR or BSA to execute the tests in the same sequence as fully automated mode

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Note

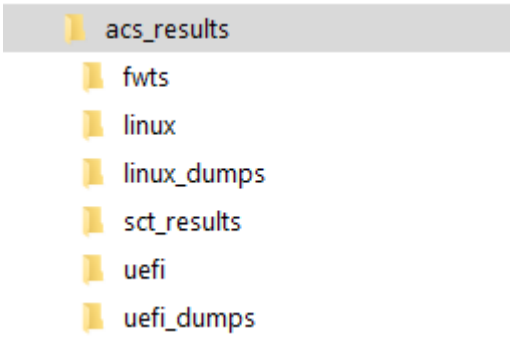
You can also skip individual test stages by pressing a key at the appropriate point, as shown in the process flowcharts above.

4.10 Review the ACS test result logs

The logs are stored in a separate partition within the image called `acs-results`.

The following diagram shows the logs directory structure:

Figure 4-10: ACS results directory



After the tests finish, the `acs_results` results partition is mounted on `/mnt`. Navigate to `acs_results` to view the logs.

Extract the logs from the USB disk to view the logs on the host machine later.

After mounting the `acs_results` directory, check that the logs shown in the following table were generated:

Log number	ACS	Path	Running time	Notes
1	BSA (UEFI)	`acs_results/uefi/BsaResults.log`	Less than 2 minutes	

Log number	ACS	Path	Running time	Notes

2	BSA (Linux)	`acs_results/uefi/BsaResults.log`
		
		`acs_results/linux/BsaResultsKernel.log`
			Less than 2 minutes	

3	SCT	`acs_results/sct_results/Summary.log`	1-6 hours Note: To execute SCT tests faster, use an SSD in a USB enclosure	`Summary.log` contains the summary of all tests run. Individual SCT test suite logs are in the same path.
4	FWTS	`acs_results/fwts/results.log`	Less than 2 minutes	

5	Debug Dumps	`acs_results/linux_dumps`
		
		`acs_results/uefi_dumps`
			Less than 2 minutes	Contains output from commands including: `acpiview`, `smbiosview`, `lspci`, `drivers`, `devices`, and `memmap`.

If any logs are missing, run the suite manually and report the error to your Arm Certification Partner.

Mount the `RESULT` partition to copy the logs to a local directory, then submit the logs in the `acs_results` directory in the `RESULT` partition to your Arm Certification Partner.

5. Related information

Here are some resources related to material in this guide:

- Base System Architecture (BSA) specification
- Arm Base Boot Requirements
- Arm Community
- Arm SystemReady Certification Program
- Arm SystemReady Requirements Specification
- Introduction to SystemReady
- SystemReady IR

The following GitHub repositories are related to this guide:

- arm-systemready repository
- bsa-acs repository
- Arm Base System Architecture Compliance User Guide
- Arm Base System Architecture Compliance Validation Methodology

6. Next steps

In this guide, you learned how to prepare for SystemReady certification and perform the tasks needed for the compliance program.

At the end of the guide, you are ready to follow the process to certify your system as compliant with the Arm SystemReady specifications in the SR (ServerReady) or ES (Embedded Server) bands. You know how to run the ACS tests and submit the required forms, logs, waiver requests, and errata to the compliance team for review.

For more information about certification registration, go to Arm SystemReady Certification Program.

For support, please send an email to `support-systemready-acs@arm.com`.