

WFA certification guide

About this document

Scope and purpose

This document describes the certification types, setup, and processes for Wi-Fi Alliance (WFA) certification testing for Linux-based platforms using Infineon AIROC™ chips.

Additionally, this document helps you to decide the certification approach with the Infineon AIROC™ chip.

Intended audience

This document is intended to individuals seeking to obtain WFA certification for specific products using Infineon AIROC™ chips.

Document construction

This document is divided into two sections:

- The first section (Section 1 and 2) explains the WFA Certification types and helps the selection of which certification program to choose based on the customer specification.
- The second section (Sections 3, 4, and 5) explains on the detailed description, setup, and procedure to run the various certifications.

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Introduction

1 Introduction

WFA is focused on ensuring a high level of interoperability among products that implement Wi-Fi Protected Access 3 (WPA3) and support the IEEE 802.11a/b/g/n/ac/ax standards. The objective is to promote the utilization of this technology in both consumer and business markets, all the while ensuring smooth interoperability between products from various manufacturers. To achieve this, the WFA has developed a comprehensive interoperability test suite that is performed on vendor products in collaboration with authorized test labs.

1.1 Types of certifications

Wi-Fi certification for a product can be obtained via the Derivative, QuickTrack, or FlexTrack pathways.

- Derivative

This certification process is designed for product portfolios that use the same Wi-Fi design across multiple end products. For example, multiple television models that use the same Wi-Fi module or appliances that are designed by one vendor but distributed by other vendors under their own brands. By applying for derivative product certification, members can get their products certified without having to complete the testing process.

- QuickTrack

QuickTrack is a certification path aimed at expediting and reducing the cost of certification testing for end products that are based on qualified solutions having undergone Wi-Fi Core and Conformance testing. This latest certification path from WFA enables targeted modifications to Wi-Fi components and functionality. With only a subset of tests required, these can be completed at a customer's MCTL or ATL.

Additionally, any changes related to Wi-Fi components (including firmware, driver, or OS) requires a variant QuickTrack certification approach.

- FlexTrack

FlexTrack is a certification path that is specifically designed for highly differentiated products that are designed from the ground up. It offers extensive flexibility to product designers, allowing them to customize and optimize the Wi-Fi functionality of their products. This certification path is not required for end products that are based on qualified solutions.

How to choose the certification type

2 How to choose the certification type

Table 1 Choosing the certification

Certification program	What is this about ?	Prerequisites for certification	Where to test - ATL/inhouse
QuickTrack	Leveraging of FlexTrack certification	CID generated by STL for WLAN chipset.	ATL or inhouse[MCTL] – provided setup is approved by WFA
Flex Track	Legacy approach of certification programs	- Product which does not have valid CID. - Features that are not covered in QuickTrack.	ATL
Derivative	Certification based on the existing certified product	- New product derived from existing certified product. - No change in Wi-Fi component(firmware, driver, RF architecture) or certification programs.	No need of certification – Can be applied through WFA portal.

For prerequisites, see the [Prerequisites](#) section.

You can go for a relevant certification program based on the changes in the following mentioned software, hardware, or programs changes.

Changes	Flex certification	QuickTrack	Derivative
No Change		✓ (Done at MCTL)	
Change in Operating System		✓ (Done at MCTL)	
Change in Operating System Version			✓ (Done at MCTL)
Change in Wi-Fi firmware**		✓ (Done at STL/MCTL)	
Change in Wi-Fi Driver/suppliant**		✓ (Done at STL/MCTL)	
Product Model Variant			✓ (Done at MCTL)
No Change		✓ (Done at MCTL)	
Change in Operating System		✓ (Done at MCTL)	

** Based on the changes performed in firmware / Driver the decision for QuickTrack Certification generation can be derived for the execution process.

[Figure 1](#) shows the certification process. The scope of the testing depends on the extent of changes to the Wi-Fi CC.

How to choose the certification type

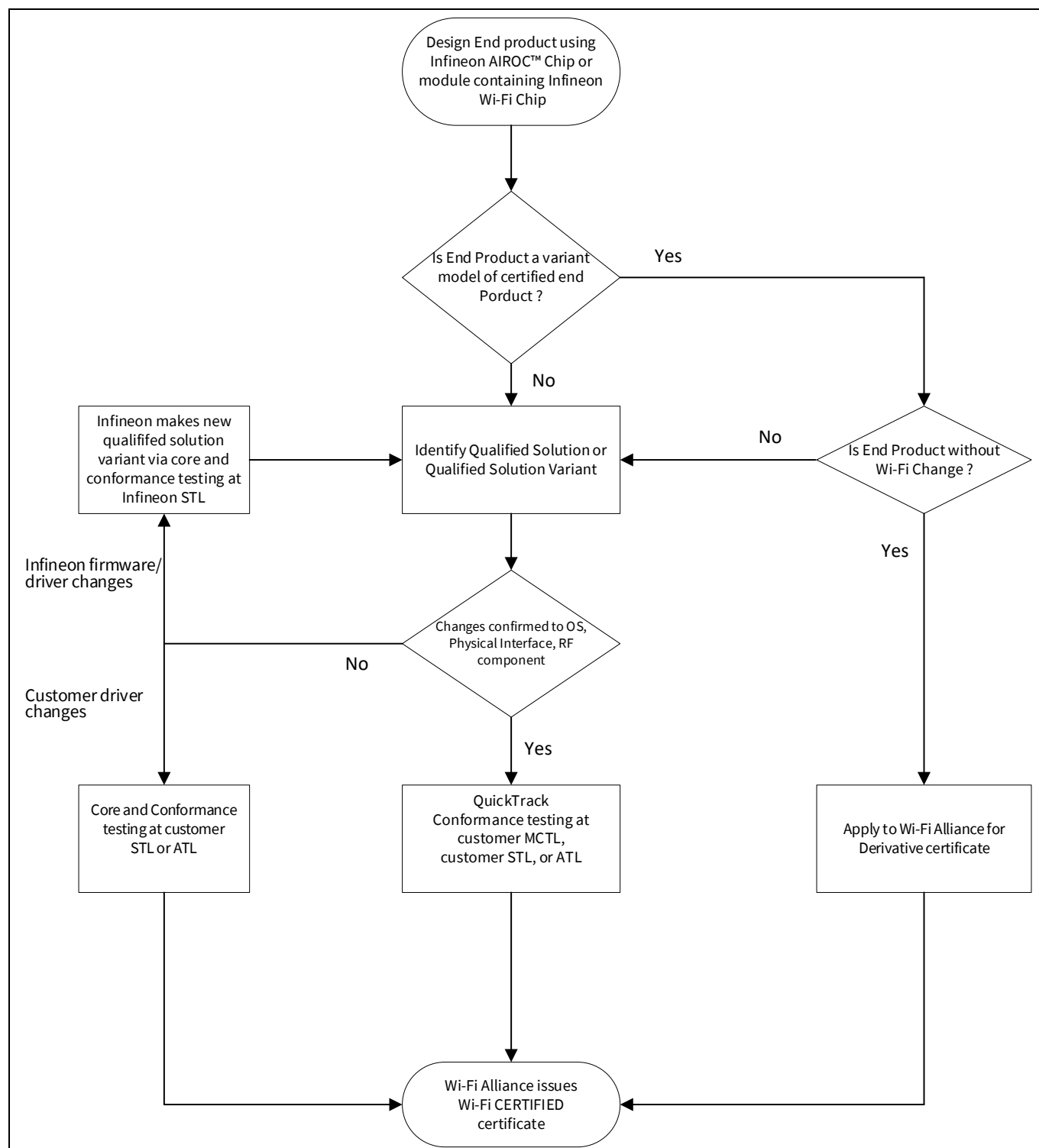


Figure 1 Certification process

3 QuickTrack certification

3.1 Prerequisites

- Valid CID generated by STL for WLAN chipset.
- Certified Qualified Solution testbed, approved from WFA.

3.2 Introduction

QuickTrack is a new certification path where members may base, product development on components that have already completed full Wi-Fi functionality testing as qualified solution, providing a time saving and cost-effective path to certification.

When the End Product requires minimal changes to the qualified solution's Wi-Fi capabilities, the necessary testing will depend on the component altered. In such cases, either QuickTrack Conformance testing or Core and Conformance testing (Variant QuickTrack) will be required.

If the changes are limited to the operating system, physical interface, RF components, or antenna, QuickTrack Conformance testing is sufficient. This testing can be conducted at the customer's MCTL, the customer's STL, or an ATL.

However, if changes are made to the firmware or driver, Core and Conformance testing might be necessary. The testing must be performed at the customer's STL or an ATL. Depending on the extent of the changes, only a subset of the Core testing may be applicable.

3.3 Setup

This section contains the recommended environment setup. Users can change IP addresses based on their network environment to ensure that all devices reach each other via IP connections.

For more information on the QuickTrack test tool, see the following:

- [QuickTrack test tool getting started guide](#)
- [QuickTrack test tool user manual](#)

QuickTrack certification

3.3.1 APUT test topology

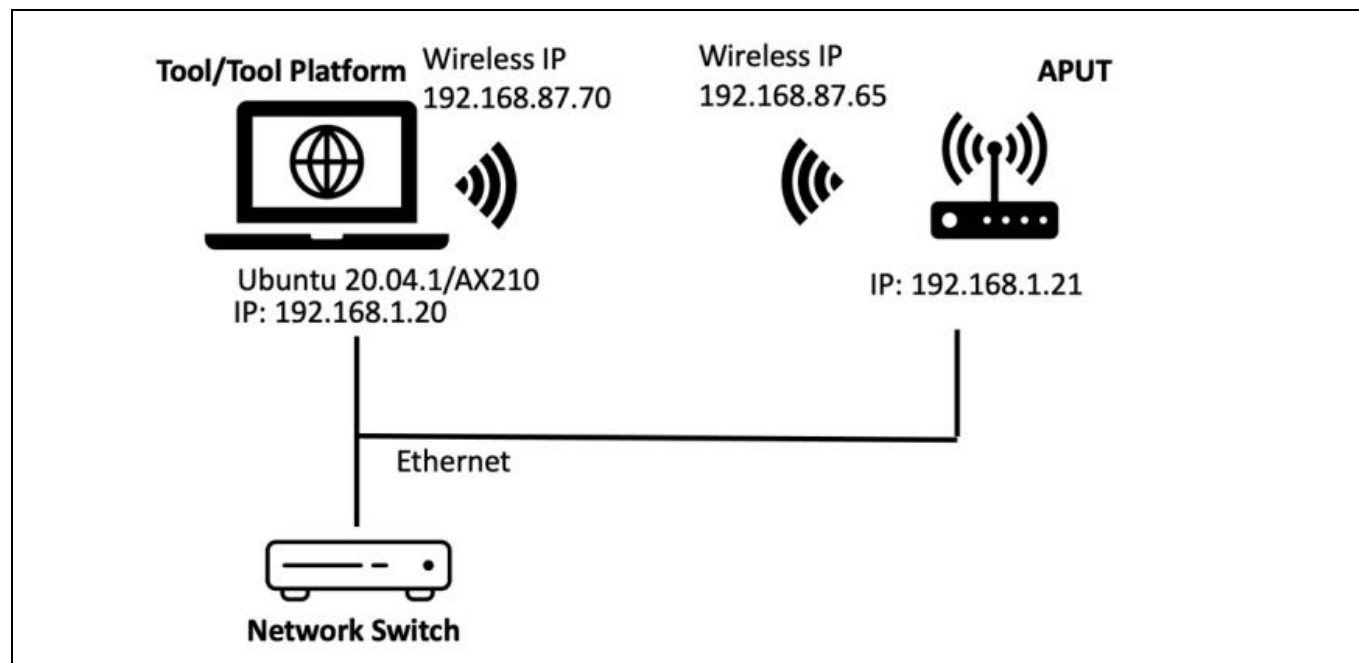


Figure 2 APUT test topology

3.3.2 STAUT test topology

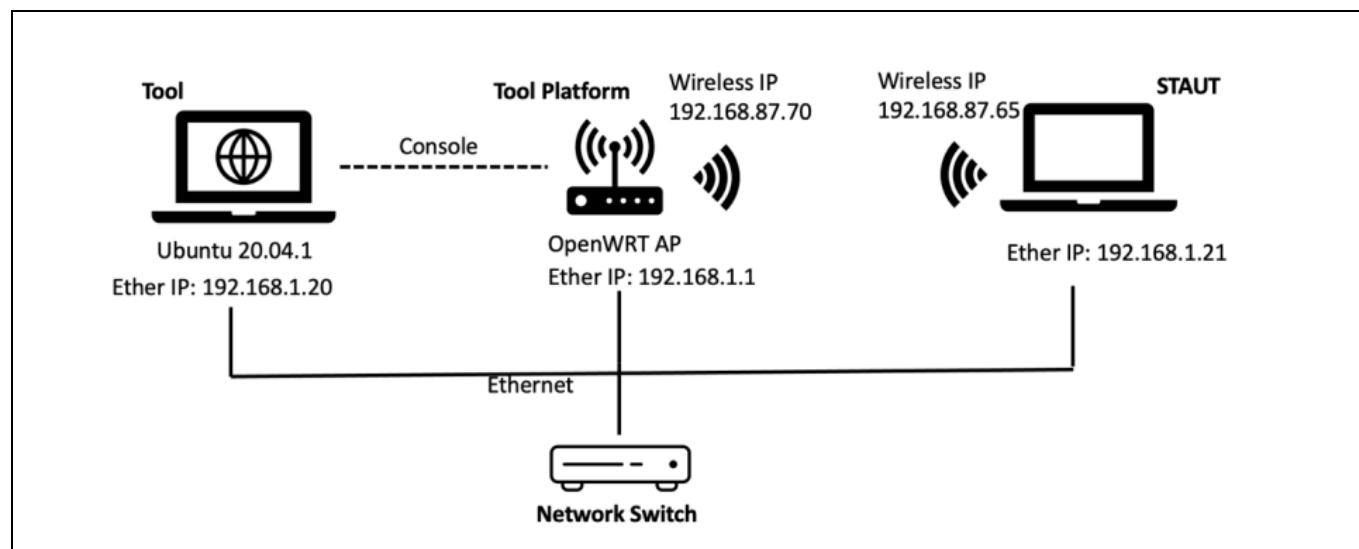


Figure 3 STAUT test topology

This Ubuntu laptop also controls both the QuickTrack Test Tool platform OpenWRT AP (center) and DUT (station card inserted into another laptop) via Ethernet.

QuickTrack certification

3.4 Setting up the QuickTrack Test Tool package

This section contains hardware requirements and software instructions for the QuickTrack Test Tool installation.

3.4.1 Hardware prerequisites

Table 2 Hardware prerequisites

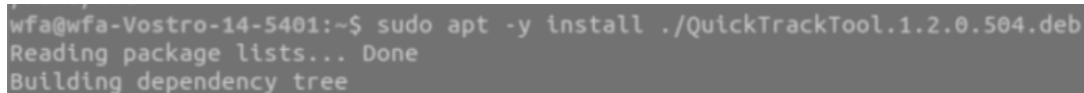
Hardware	Hardware requirements
Laptop (Controller)	Laptop with x86 processor 2 GB storage space minimum 8 GB memory minimum, 16 GB recommended OS: Ubuntu 20.04.1/22.04.2 and kernel
Qualcomm CA-650YC633-1000 OpenWRT AP	AP Platform
Qualcomm CA-YE079-HE OpenWRT AP	AP Platform (recommended)
Intel AX210	STA Platform

3.4.2 Software installation process

Download the latest version of *QuickTrackTool_version.deb* located on the [certification resources](#) page.

1. Ensure that the laptop has an internet connection.
2. Open a terminal window and navigate to the folder with the Debian file.
3. Install the .deb file using the following command (see [Figure 4](#)):

```
sudo apt -y install ./<filename>.deb
```



```
wfa@wfa-Vostro-14-5401:~$ sudo apt -y install ./QuickTrackTool.1.2.0.504.deb
Reading package lists... Done
Building dependency tree
```

Figure 4 Example Debian file installation

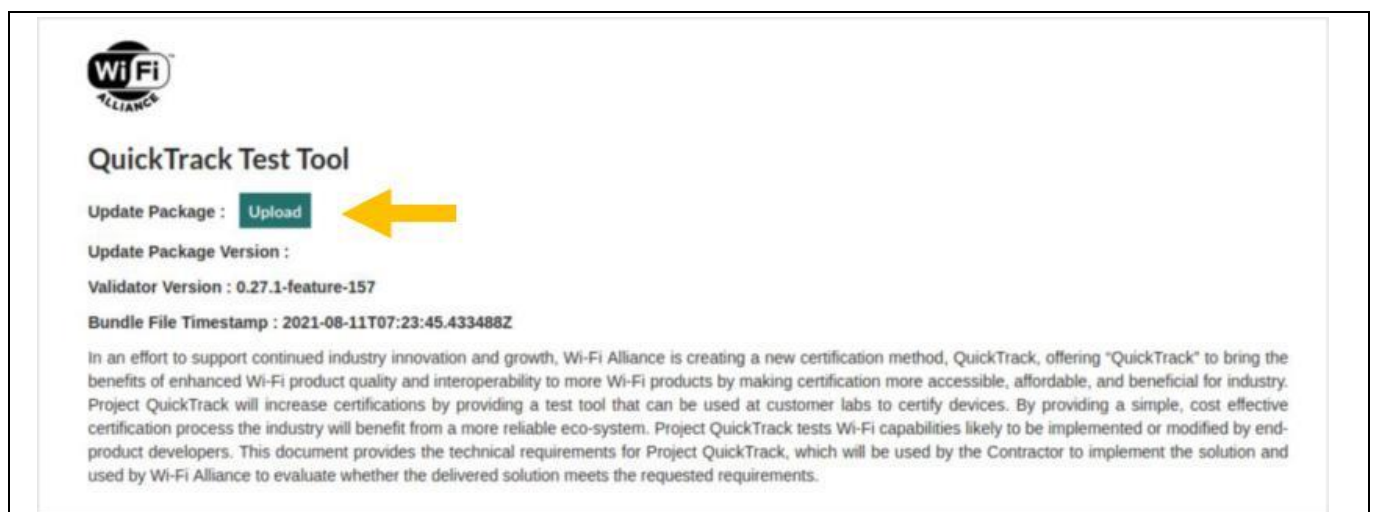


Figure 5 Installer package

QuickTrack certification

1. Click the **Install Update** button as shown in [Figure 6](#).



Figure 6 Upgrade tool

2. Click **Yes** to start the upgrade process as shown in [Figure 7](#).

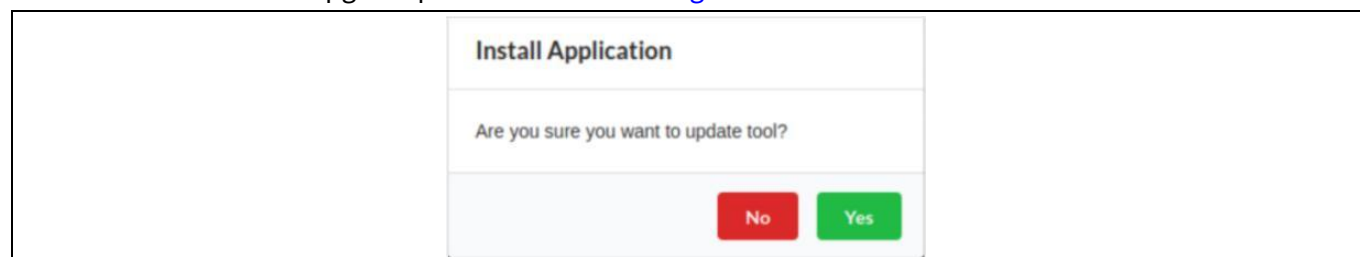


Figure 7 Install application

3. After finishing the upgrade process, the QuickTrack test tool will shut down automatically.
4. Manually restart the QuickTrack test tool to return to normal operation.

QuickTrack certification

3.5 Execution procedure

This section provides information on setting up the QuickTrack test tool.

The Test Setup Configuration is shown in [Figure 8](#). It is recommended to scroll through each entry and note system settings. Information for adjusting any of these settings is provided below.

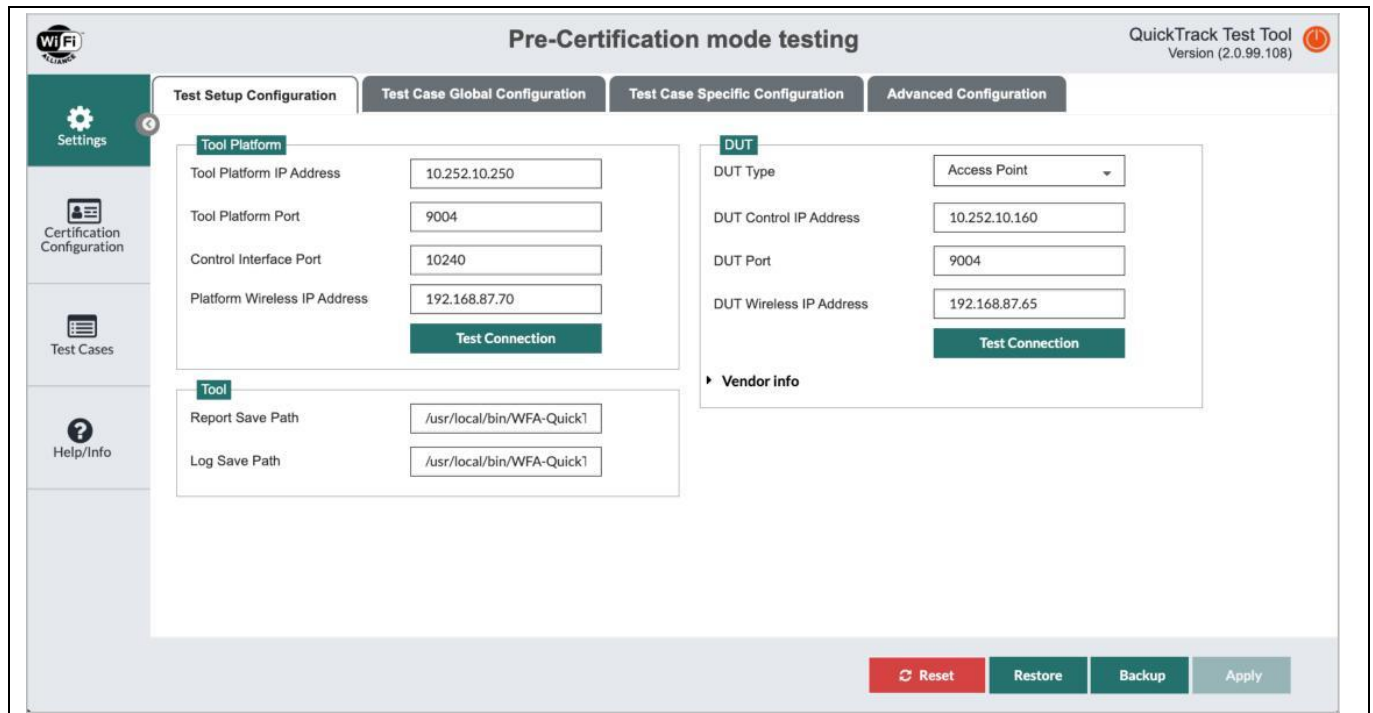


Figure 8 Test Setup Configuration

This screen is divided into three windows with information for each as follows:

Tool platform

- Enter the Ethernet IP address, port, and wireless IP address of the Quick Track test tool platform as shown in [Figure 8](#).
- The Control Interface Port can usually be left at default
- Click the **Test Connection** button to check the Ethernet connection

DUT

- DUT Type should be set to Station for STAUT and Access Point for an APUT
- For an Ethernet interface, enter the Ethernet IP address, port, and wireless IP address of the DUT
- Click the Test Connection button to check the Ethernet connection
- Additional information about the DUT can be entered under the Vendor info dropdown

Tool

- These settings determine where the reports and logs are saved

The global configuration settings used by most test cases as shown in the following figure.

QuickTrack certification



Settings

Certification Configuration

Test Cases

Help/Info

Pre-Certification mode testing

QuickTrack Test Tool
Version (2.0.99.108)

Test Setup Configuration

Test Case Global Configuration

Test Case Specific Configuration

Advanced Configuration

Tool Mode

Pre-Certification

Band Selection

5GHz

6 GHz Band Support

False

Debug Log Level

BASIC

U-NII-2 Band Support

False

2.4 GHz Channel Preferred

6

5 GHz Channel Preferred

36

6 GHz Channel Preferred

37

SSID *

QuickTrack_ky_

API Retry Count *

1

Data Packet Type

UDP

Packet Time Interval (seconds)*

1

Packet Payload Size (bytes)*

1000

Manual DUT Mode

False

Reset

Restore

Backup

Apply

Figure 9 Test Case Global Configuration

The test-specific settings describes how to specify DUT capabilities using the screen shown in [Figure 10](#).

Settings

Certification Configuration

Test Cases

Help/Info

Test Setup Configuration

Test Case Global Configuration

Test Case Specific Configuration

Advanced Configuration

Test Case Specific

Role

Station

Priv Capabilities

Wi-Fi 5

Wi-Fi 4

Wi-Fi 6

Security Capabilities

WPA2-PMF

WPA3-Personal

RSN

☒ Trigger unicast protected disconnect from GUI
☒ PMK Caching support when disconnect triggered from STAUT
☐ Support WEP default key 0 simultaneously with a pairwise key in a TSN network
☐ Support Joint Multi-band RSN
☐ Support PeerKey handshake
☐ Support signaling and payload protected (SPP) A-MSDU's transmission and reception
☐ Only allow SPP A-MSDU's transmission and reception
☐ Support protected block ack agreement capability (PBAC)
☐ Support Extended Key ID for individually addressed frames
☐ Support operating channel validation
☐ Support protected WUR
☐ Support secure LTF

Require MFP for preassociation ranging

No

☐ Support protected block ack agreement capability (PBAC) as defined after 802.11-2020
☐ Support signaling and payload protected (SPP) A-MSDU transmission and reception as defined after 802.11-2020

WPA3 Supported DH Groups

19

☐ Support STA Label PIN

STA Label PIN Code

12345670

☒ Support STA Keypad PIN
☒ Support STA Physical Display PIN
☐ Support STA Physical Pushbutton
☐ Support STA Virtual Display PIN
☒ Support STA Virtual Pushbutton

P2P WSC Method

Display Keypad PushButton

Additional Capabilities

Wi-Fi Direct

Wi-Fi Protected Setup

3.6 Sample test logs

Pre-Certification mode testing

QuickTrack Test Tool
Version (2.2.1.4)

Settings

Certification Configuration

Test Cases

Help Info

DUT Type : Station

Certification and Capability Selection

2.4 GHz Spectrum Capabilities - [vR1: 2023-12-14] x 5 GHz Spectrum Capabilities - [vR1: migrated] x
 WPA2™-Personal - [v2023-01: 2023-06-30] x WPA3™-Personal - [v2023-12: 2023-12-14] x

AES - [2023-06-30] x WPA2-Personal mixed mode - [2023-05-18] x SAE - [2023-12-14] x
 RSN - [2023-12-09] x WPA3-Personal transition mode - [2023-05-18] x
 Transition Disable Indicator - [2023-12-14] x

Search

Test case selection - 1/65

- ✓ SAE - Mandatory
 - ✗ Test Group : Default - (2.4 GHz Spectrum Capabilities || 5 GHz Spectrum Capabilities)
 - CT_Security_WPA3Personal_STA_NoAssociation-NoSecurityMode_10155_1 ✓
 - CT_Security_WPA3Personal_STA_NoAssociation-WEP_10162_1 ✓
 - CT_Security_WPA3Personal_STA_NoAssociation-WPA2Personal_10165_1 ✓
 - CT_Security_WPA3Personal_STA_RejectionImproperElements-InvalidElem_10221_1 ✓
 - CT_Security_WPA3Personal_STA_RejectionImproperElements-InvalidOrder_10224_1 ✓
 - CT_Security_WPA3Personal_STA_RejectionImproperElements-OneScalar_10223_1 ✓
 - CT_Security_WPA3Personal_STA_RejectionImproperElements-ZeroScalar_10222_1 ✓
 - CT_Security_WPA3Personal_STA_RejectionInsulatedDHGroups_10248_1 ✓
 - CT_Security_WPA3Personal_STA_DoS-AttackResponse_10117_2 ✓
 - CT_Security_WPA3Personal_STA_DoS-AttackResponse-HnPandH2E_10364_1 ✓
 - CT_Security_WPA3Personal_STA_HnPandH2E-auth-H2Eonly_10362_1 ✓
 - CT_Security_WPA3Personal_STA_HnPandH2E-auth-HnPandH2E_10363_1 ✓
 - CT_Security_WPA3Personal_STA_HnPandH2E-auth-HnOnly_10361_1 ✓
 - CT_Security_WPA3Personal_STA_SAEConfirmationExchangeVariation_10371_2 ✓
 - CT_Security_WPA3Personal_STA_PMK-caching_10202_2 ✓
 - CT_Security_WPA3Personal_STA_Reflection-AttackResponse_10214_2 ✓
 - > Test Group: 6 GHz - (6 GHz Spectrum Capabilities)
 - > Test Group: DH Groups - (WPA3™-Personal && (DH group: 15 || DH group: 20 ||
 - > Test Group: DHGroup20 - (DH group: 20 && (2.4 GHz Spectrum Capabilities || 5
- ✗ RSN - Mandatory
 - ✗ Test Group: Default - Always
 - CT_Securin RSN STA CapabilitiesVerification-ReservedBits-31_10603_1 ✓

Pass (48/50)
Failed (2/50)
Incomplete (0/50)

Next step(s) (0/50)
Validate Error (0/50)

Measurement	Description	Value	Result
2.4GHz			
SAE_CONFIRM_TX	STAUT transmits SAE Confirm message upon receiving incorrect SAE Commit message from AP	false	✓
RECONF_CONNECT	STAUT connection status with the AP	true	✓

↑ [DUT x] [TOOL x] Auto scroll Search

100 Executing 'VERIFY_STAUT_CONNECTED' command on tool.

Execution paused for 5 seconds. Wait for STAUT connection

DUT Sending 'GET_MAC_ADDR' QuickTrack API command to DUT.

CT_Security_WPA3Personal_STA_Reflection-AttackResponse_10214_2 :

Name	Value	Description
SAE_CONFIRM_TX	False	STAUT transmits SAE Confirm message upon receiving incorrect SAE Commit message from AP
RECONF_CONNECT	True	STAUT connection status with the AP

DUT Sending 'DEVICE_RESET' QuickTrack API command to DUT.

100 Sending 'AP_STOP' QuickTrack API command to test platform.

DUT Sending 'STA_DISCONNECT' QuickTrack API command to DUT.

Application note

Derivative certification

4 Derivative certification

4.1 Introduction

This Wi-Fi Alliance (WFA) certification process is where a new product that is a replicate of a WFA certified source product and has no changes to Wi-Fi Component Combination or Certification programs, Members may apply for certification of derivative products without additional testing requirements.

Wi-Fi component combination:

- Chip ID
- Operating System
- Wi-Fi software: Firmware, Driver

For more details, see the [How to choose the certification type](#) section.

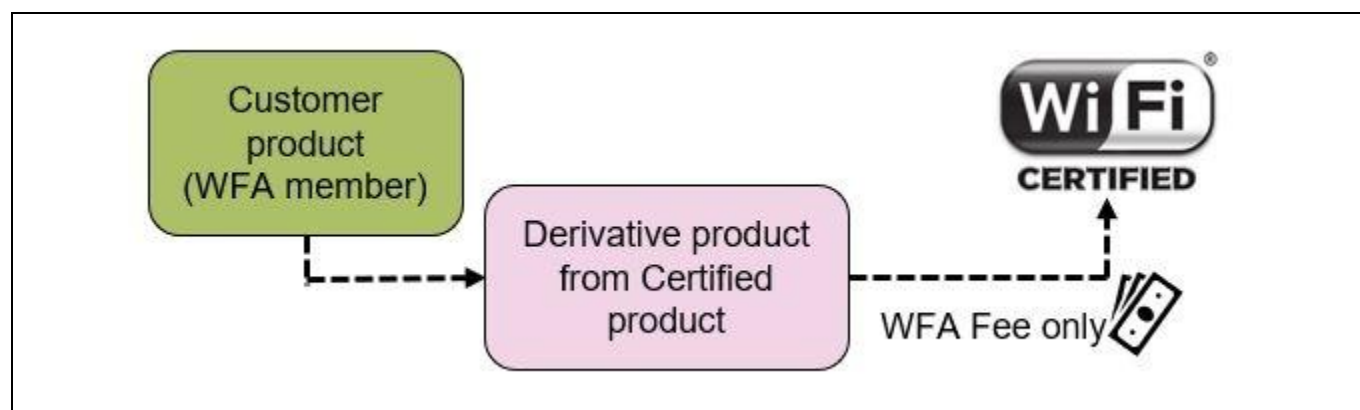


Figure 12 Derivative application process

Flex certification

5 Flex certification

5.1 Introduction

Wi-Fi Alliance (WFA) has various certification programs such as 11ax, 11ac, 11n, WPS, and Wi-Fi Direct. It has station (STA) and access point (AP) modes. As shown in Figure 13, the major components of the test setup are the test controller, testbed APs, testbed STAs, sniffer, and device under test (DUT).

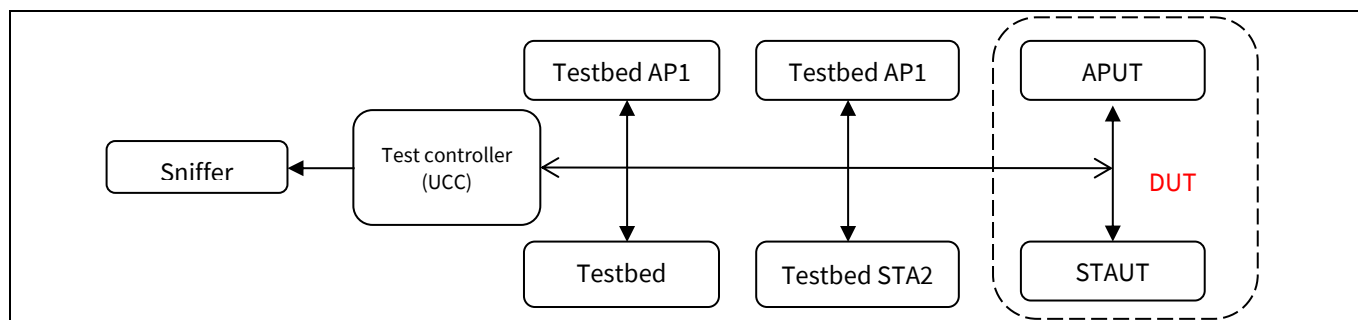


Figure 13 Typical WFA certification setup

5.1.1 Prerequisites

Table 3 Prerequisites for certification of 11n/ac/ax and P2P

Certified test suites	Certified mandatory test suites
11AX	11AC WPA3,MBO,OWE,11N
11AC	PMF 11N
11N	WPA3,FFD,Security
P2P	11N WPS

5.1.2 Unified control API console (UCC)

WFA provides the necessary software for the test controller in the form of a Wi-Fi test suite (WTS). The test controller is called the “unified CAPI console (UCC)” in the WTS. The UCC uses the sigma control API (CAPI), a fundamental command language for device management, test configuration, and test execution within WTS.

The UCC core is architected and designed to encapsulate the complexity of test automation and control. It acts as a command interpreter taking the extended CAPI commands to drive test execution. Its job consists of CAPI interpretation, command delivery, and information handling that devices send back for use in subsequent commands.

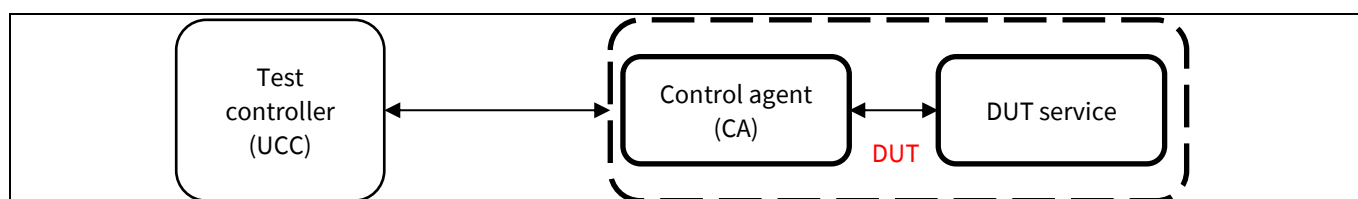


Figure 14 UCC-DUT setup

Flex certification

5.1.3 Control agent (CA)

A control agent (CA) is a proxy in which a CAPI control command is received for the device. As shown in [Figure 14](#), you can run control agents inside the DUT, but some DUTs run these control agents outside of the DUT. The control agent typically opens a passive TCP socket on a selected port and waits for the UCC to connect to it. The UCC is configured to perform an active TCP socket to the control agent. The control agent collects the necessary information from the DUT service and returns it to the UCC.

5.1.4 DUT service

The DUT service processes the commands received from the control agent by executing commands on the DUT and sends the results back to the control agent.

The DUT is further classified into two categories: If the station is tested, it is called “STAUT”. If the AP is tested, it is called “APUT”.

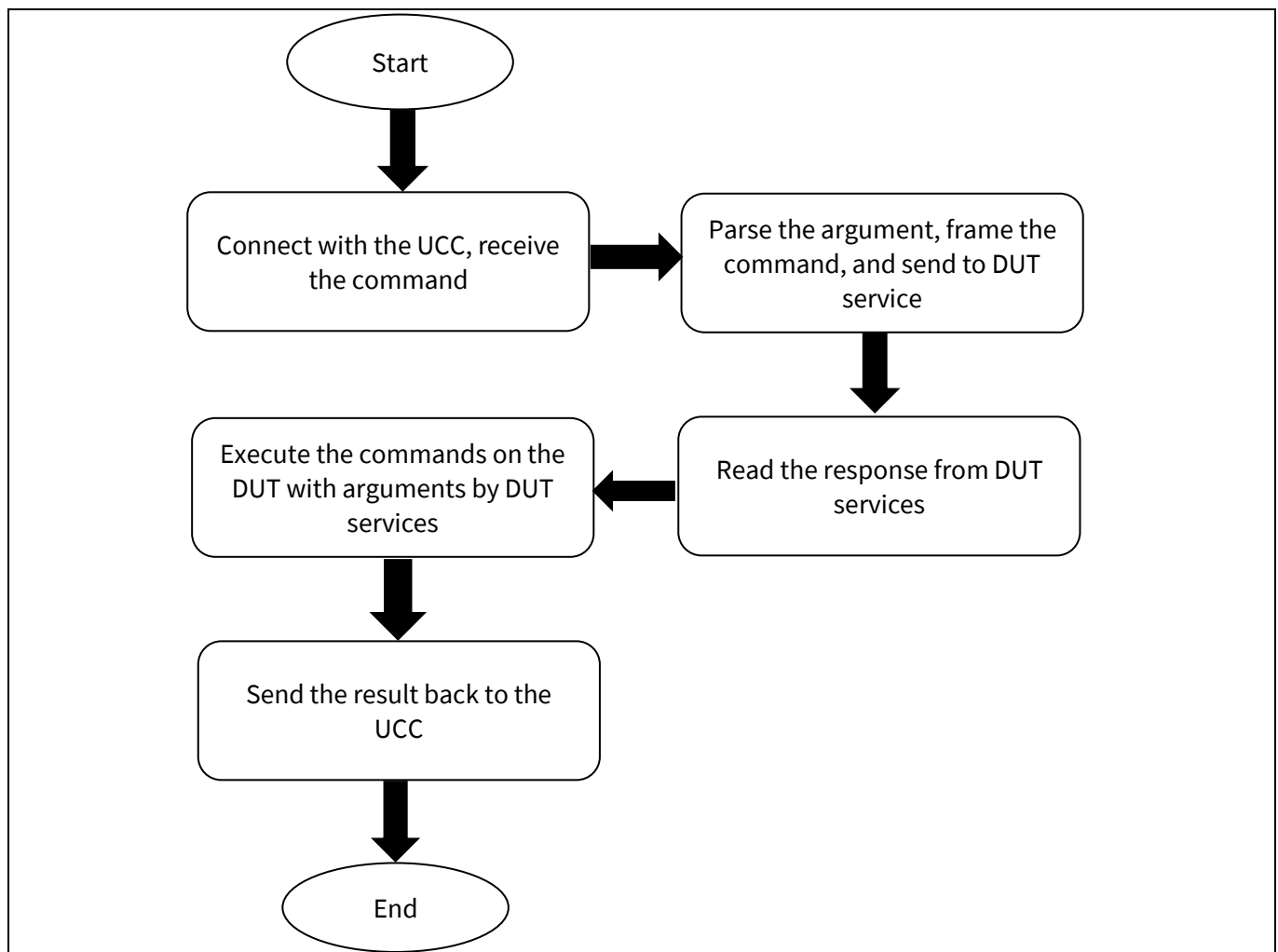


Figure 15 Flowchart for the WFA setup

Note: WFA uses different software, such as traffic generator and PC endpoint, to run the data between two devices. See the [WFA website](#) for more information.

Flex certification

5.2 Testing tool and setup

5.2.1 Wi-Fi test suite (WTS)

The WTS tool provides configuration, test control, traffic generation, and result analysis services. The test plan, in its entirety, can be executed in a fully automated manner through the WFA-distributed WTS command scripts and the WTS unified CAPI console.

5.2.2 Sniffer

Sniffers are required to capture and decode the 802.11 a/b/g/n/ac/ax frames and packets. It can be wired or wireless. The most commonly used wireless sniffer tool is [Wireshark](#).

5.2.3 Authentication server

Some PC-based servers perform the authentication server function on 802.1x ports. It is a client/server-based protocol that runs on the application layer and uses UDP. In this case, the client is an AP (also known as the authenticating agent) and the STA is a supplicant.

The authentication server checks the credentials of the supplicant on behalf of the client (authenticating agent) and it responds to the authenticating agent whether the supplicant is authorized to access the services.

5.2.4 Typical WTS configuration setup

Figure 16 shows the typical test configuration infrastructure for WTS.

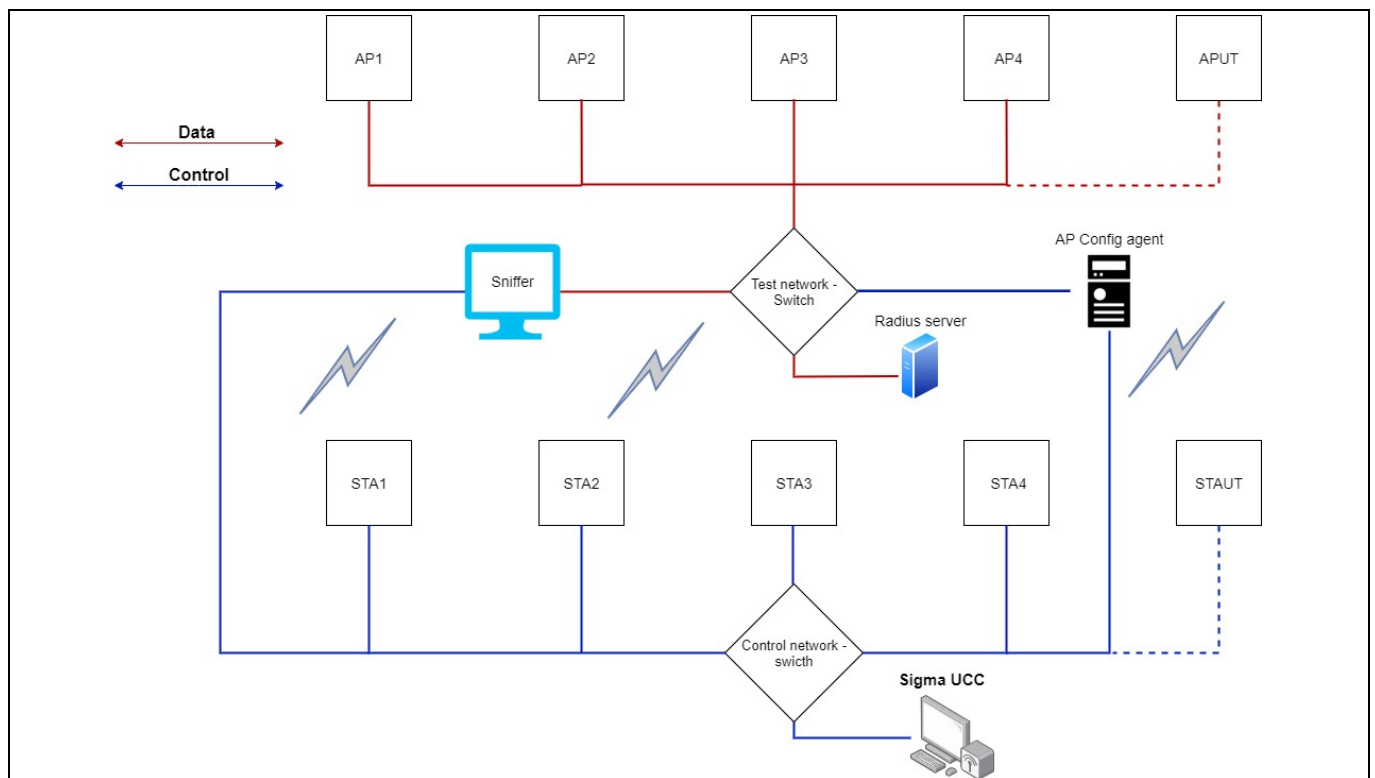


Figure 16 Wi-Fi test suite configuration

Flex certification

5.3 Setting up the WTS package

This section explains on setting up WTS, DUT, and Sniffer.

5.3.1 Edit the Windows UCC-side configuration file for certification

Open the configuration file. For example, *ALLInitConfig_n.txt* for 11n, *ALLInitConfig_VHT.txt* for 11ac, *ALLInitConfig_HE.txt* for 11ax, and *init_p2p.txt* for P2P.

1. Set \$DUT to \$APUT.
2. Set the DUT control agent IP address and port number in the *Modify AllInitConfig_x.txt* file.

Example:

```
#wfa_control_agent_dut!ipaddr=192.168.250.50,port=9000!
```

3. Set the DUT wireless IP address in the *Modify AllInitConfig_x.txt* file.

Example:

```
#dut_wireless_ip!192.165.100.50!
```

4. Modify *DUTInfo.txt* according to the device capabilities.

Example:

```
#DUTType!WPA2-Enterprise!
```

```
or
```

```
#DUTType!WPA2-Personal!
```

```
or
```

```
#P2P_Invitation_Procedure_Support!1! (for P2P certification only)
```

5. Set the PC endpoint IP address to the DUT's IP address (for SoftAP certification only) in the *Modify AllInitConfig_x.txt* file.

Example:

```
#wfa_console_ctrl!ipaddr=192.168.250.50,port=9000!
```

6. Set the traffic generator IP address to the DUT's wireless IP address (for SoftAP certification only) in the *Modify AllInitConfig_x.txt* file.

Example:

```
#wfa_console_tg!192.165.100.50!
```

Note: All the test-bed devices must be WTS-compliant.

Flex certification

5.3.2 Run WFA tests

1. Run the SoftAP certification test.

```
#cd Wi-FiTestSuite_UCC-Windows_vX.X.X\bin
#wts.exe -p <Program name> -t <testcase number>
```

For example,

- 11N: wts.exe -p N -t N-4.2.2
- 11AC: wts.exe -p VHT -t VHT-4.2.25
- 11AX: wts.exe -p HE -t HE-5.2.2
- P2P: wts.exe -p P2P -t P2P-5.1.14

5.4 Test setup configurations

5.4.1 Edit the Windows UCC-side configuration file for certification

1. Open the configuration file. For example, *ALLInitConfig_n.txt* for 11n, *ALLInitConfig_VHT.txt* for 11ac, *ALLInitConfig_HE.txt* for 11ax, and *init_p2p.txt* for P2P.
2. Set \$DUT to \$APUT.
3. Set the DUT control agent IP address and port number in the *Modify AllInitConfig_x.txt* file.

Example:

```
#wfa_control_agent_dut!ipaddr=192.168.250.50,port=9000!
```

4. Set the DUT wireless IP address in the *Modify AllInitConfig_x.txt* file.

Example:

```
#dut_wireless_ip!192.165.100.50!
```

5. Modify DUTInfo.txt according to the device capabilities

Example:

```
#DUTType!WPA2-Enterprise!
```

or

```
#DUTType!WPA2-Personal!
```

or

```
#P2P_Invitation_Procedure_Support!1! (for P2P certification only)
```

6. Set the PC endpoint IP address to the DUT's IP address (for SoftAP certification only) in the *Modify AllInitConfig_x.txt* file.

Example:

```
#wfa_console_ctrl!ipaddr=192.168.250.50,port=9000!
```

7. Set the traffic generator IP address to the DUT's wireless IP address (for SoftAP certification only) in the *Modify AllInitConfig_x.txt* file.

Example:

```
#wfa_console_tg!192.165.100.50!
```

Flex certification

Note: All the test-bed devices must be WTS-compliant.

5.4.2 Run WFA tests

Run the SoftAP certification test:

```
#cd Wi-FiTestSuite_UCC-Windows_vX.X.X\bin
#wts.exe -p <Program name> -t <testcase number>
```

- Example for 11N: `wts.exe -p N -t N-4.2.2`
- Example for 11AC: `wts.exe -p VHT -t VHT-4.2.25`
- Example for 11AX: `wts.exe -p HE -t HE-5.2.2`
- Example for P2P: `wts.exe -p P2P -t P2P-5.1.14`

5.5 WFA certification test

5.5.1 Prerequisites

Download and install the following software in the DUT device (STAUT or APUT) to run the test:

- **Tcl-Tk:** Download from <https://www.tcl.tk/>
- **Iptables:** Download from <https://www.netfilter.org/projects/iptables/downloads.html>

5.5.2 Software package for certification

You can download the WTS package from the WFA website. Infineon provides the necessary modifications for the CA and DUT services and releases the WTS package, which include only the modifications. Therefore, you need to use both the WTS packages downloaded from the WFA website and the package provided by Infineon.

The Infineon WTS package contains the following:

Table 4 Package information

Package content	Description
AP_SIGMA_REL_X_X	Tcl-based sigma agent package for supplicant-based SoftAP certification evaluation.
P2P_SIGMA_REL_X_X	Tcl-based sigma agent package for supplicant-based P2P certification evaluation.
STA_SIGMA_REL_X_X	C-based sigma agent package for supplicant-based STA certification evaluation.

5.5.3 Compile the services

You need to compile CA (`wfa_ca`) and DUT (`wfa_dut`) services for the Infineon WLAN platform. Because each device mode has different requirements of `wfa_ca` and `wfa_dut`, you need different `wfa_ca` and `wfa_dut` for different modes.

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5.5.4 11n/ac/ax STAUT

1. Enter the following commands to compile `wfa_ca` and `wfa_dut`:

```
#cd STA_SIGMA_REL
#make
```

2. Update the `PATH` variable in `ca.sh`.

- For non-FMAC:
 - Specify `DRIVER_PATH` to the path where all WLAN binaries (`bcmdhd.ko`, `rtecdc.bin`, `nvrnm.txt`, and `clm_blob`) and conf files are stored.
 - Specify `BIN_PATH` to the path where all WLAN binaries (`wl`, `wpa_supplicant`, and `wpa_cli`) and conf files are stored.
- For FMAC:
 - Specify `DRIVER_PATH` to the path where all WLAN binaries (`brcmfmac.ko`, `brcmutil.ko`, `rtecdc.bin`, `nvrnm.txt`, and `clm_blob`) and conf files are stored.
 - Specify `BIN_PATH` to the path where all WLAN binaries (`wl`, `wpa_supplicant` and `wpa_cli`) and conf files are stored.
- Keep all certificates in `BIN_PATH`.
- Store the private key in `BIN_PATH` with the name `wifiuser.pfx/wifiuser.pem`.
- Store `ca_cert` in `BIN_PATH` by the name `cas.pem`.
- Store Client cert in `BIN_PATH` with the name `wifiuser.pem`.
- Set the identity in `CERTIFICATES_IDENTITY`.
- Set the private key password in `CERTIFICATES_PRIVATE_KEY_PASSWD`.

5.5.5 11n/ac/ax APUT

Get the `Wi-FiTestSuite_DUT_Code-Linux_vX.Y.Z` package from the original WFA WTS package because Infineon does not provide changes in `wfa_dut` and `wfa_ca` for AP mode.

Enter the following commands in the APUT:

Code listing 1 APUT commands

```
#cd Wi-FiTestSuite_DUT_Code-Linux_vX.Y.Z
#cd lib
#make
#cd ../dut
#make
#cp wfa_dut AP_SIGMA_REL/tcl/linux/bin/
#cp wfa_dut AP_SIGMA_REL/C/dut/gcc
#cd ../ca
#make
#cp wfa_ca AP_SIGMA_REL/tcl/linux/bin/
#cp wfa_ca AP_SIGMA_REL/C/ca/gcc
```

Flex certification

5.5.6 P2P DUT

Enter the following commands in the DUT:

Code listing 2 P2P DUT commands

```
#cd Wi-FiTestSuite_DUT_Code-Linux_vX.Y.Z
#cd lib
#make
#cd ../dut
#make
#cp wfa_dut P2P_SIGMA_REL
#cd ../ca
#make
#cp wfa_ca P2P_SIGMA_REL
```

5.6 Starting the CA and DUT services

5.6.1 11n/11ac/11ax STA

Run the scripts provided by Infineon to start wfa_dut and wfa_ca in the STAUT as follows:

```
#cd STA_SIGMA_REL
#killall wfa_dut
#killall wfa_ca
#sh -x ca.sh
```

For example, #sh -x ca.sh

Table 5 Chip-based control agent commands

Chip	Chip ID	Bus	Usage
AIROC™ CYW89359 Automotive Wi-Fi & Bluetooth® combo chip	89359	PCIe	sh -x ca.sh tclsh xyz.tcl linux 89359pcie
AIROC™ CYW89359 Automotive Wi-Fi & Bluetooth® combo chip	89359	SDIO	sh -x ca.sh tclsh xyz.tcl linux 89359sdio
AIROC™ CYW89373 Automotive Wi-Fi & Bluetooth® combo chip	89373	PCIe	sh -x ca.sh tclsh xyz.tcl linux 89373pcie
AIROC™ CYW89373 Automotive Wi-Fi & Bluetooth® combo chip	89373	SDIO	sh -x ca.sh tclsh xyz.tcl linux 89373sdio
AIROC™ CYW89335 Automotive Wi-Fi & Bluetooth® combo chip	89335	SDIO	sh -x ca.sh tclsh xyz.tcl linux 89335
AIROC™ CYW89570 Automotive Wi-Fi & Bluetooth® combo chip	55560	PCIe	sh -x ca.sh tclsh xyz.tcl linux 55560pcie

Flex certification**5.6.2 11n/ac/ax AP**

Commands in the following sections must be run in superuser mode. Before running the DUT script, you must clear the firewall.

1. Run the following commands to clear the firewall. You may need to add a delay of 1 second in between these commands.

```
#iptables -F
#iptables -P INPUT ACCEPT
#iptables -P FORWARD ACCEPT
#iptables -P OUTPUT ACCEPT
```

2. Run the following commands to execute `wfa_ca` and `wfa_dut`:

```
#cd STA_SIGMA_REL
#killall wfa_dut
#killall wfa_ca
#sh -x ca.sh
```

For example, `#sh -x ca.sh`

3. Run the tcl script from the DUT control agent.

```
#cd AP_SIGMA_AGENT/tcl/VHT
#tclsh vht_softap_dut.tcl linux <CHIPID>
```

See for the value of `<CHIPID>`.

For example, `#tclsh vht_softap_dut.tcl linux 89373sdio`

5.6.3 P2P

1. Before running the DUT script, run the following commands to clear the firewall:

```
#iptables -F
#sleep 1
#iptables -P INPUT ACCEPT
#sleep 1
#iptables -P FORWARD ACCEPT
#sleep 1
#iptables -P OUTPUT ACCEPT
```

2. Run the following commands to load the driver and supplicant manually:

```
#cd P2P_SIGMA_REL
#tclsh main.tcl 9000
```

Note: *wfa_ca and wfa_dut are not required for P2P tests because there are no throughput-related validations*

Flex certification

5.6.4 Sample test logs

5.6.4.1 Test case information

The following logs show the information of the test case that is being run:

```
INFO - WiFiTestSuite Version [10.20.0]
INFO - Logging started in file - ./log/N-5.2.31_Feb-28-2022__17-57-24/log_N-5.2.31.log
INFO - -----
INFO - Test Info
INFO - -----
INFO - Test Prog Name      : N
INFO - Test ID            : N-5.2.31
INFO - Test Usermode       : precert
INFO - Test CmdPath        : ../cmds\WTS-11n
INFO - Test InitFile       : AllInitConfig_N.txt
INFO - Test TB File        : \802.11n-Testbed-APs.txt
INFO - Test Start Time     : 2022-02-28 17:57:24
INFO - -----
```

Note: The WiFiTestSuite version continues updating.

5.6.4.2 Logs showing sample CAPI commands

The following logs show some sample CAPI commands that are passed and the information received:

```
INFO - ~~~~~ [ Getting TB STA Version Info ] ~~~~~
INFO - realtek11n (<IP:Port>) ---> ca_get_version
INFO - realtek11n (<IP:Port>) <-- status,COMPLETE,version,WIN7_WIN8_DUT-vX.Y.Z
INFO - realtek11n (<IP:Port>) ---> device_get_info
INFO - realtek11n (<IP:Port>) <-- status,COMPLETE,vendor,Realtek,model,RTL8812BU,version,10.9.1222.2016
```

5.6.5 Sample sniffer logs

The following logs show some sample sniffer logs:

Code listing 3 Sample sniffer logs

```
SNIFFER CHECKS LOG - Testcase: N-5.2.31

SNIFFER ---> sniffer_get_info,
SNIFFER <-- status, COMPLETE, WfaSnifferVersion, SnifferSTA, Other,
SwInfo, Unknown_2.6.39.4, WiresharkVersion, 1.6.2, MapConfVersion,
SNIFFER ---> sniffer_control_start, filename, SnifferTrace_N-5.2.31,
channel, 6
SNIFFER <-- status,COMPLETE
SNIFFER ---> sniffer_control_stop,
SNIFFER <-- status,COMPLETE
```

Flex certification

5.6.6 Final test results

The following logs show the final test result

Code listing 4 Final test results

```

INFO - -----SUMMARY-----
INFO - | Phase1 (Bytes) | Phase2 (Bytes)
INFO - -----
INFO - RTP1_BestEffort [IP:Port1-->IP:Port2]
      | 14233000      | 14161000
INFO - RTP2_Video      [IP:Port1-->IP:Port2]
      | 1809000        | 822000
INFO - RTP3_BestEffort [IP:Port1-->IP:Port2]
      |              | 763000
INFO - -----RESULT-----
INFO - Expected  <= 115 %
INFO - Actual   - 107.73 %
INFO - TEST RESULT ---> PASS
INFO - -----
INFO - -----RESULT-----
INFO - Expected  <= 115 %
INFO - Actual   - 5.8046 %
INFO - TEST RESULT ---> PASS
INFO - -----
INFO - SNIFFER (IP:Port) ---> sniffer_frame_check, name, wireShark_wlan,
      filename, N-5.2.31_4, srcmac, xx:xx:xx:xx:xx:xx, bssid,
      yy:yy:yy:yy:yy:yy, frameName, anydata, type, AC_Video, Present, No

INFO - SNIFFER (IP:Port) <-- status, COMPLETE, CheckResult, SUCCESS
INFO - FINAL TEST RESULT ---> PASS
INFO - END: TEST CASE [N-5.2.31]
INFO - PASS
INFO - Execution Time [554.64] seconds

```

6 Appendix: Recommendations from Infineon

See the WFA sigma documentation provided by Infineon as a reference, and it aligns with the WFA requirements. You can follow Infineon's recommendations and use the concurrent operation of 2.4 GHz and 5 GHz bands for automotive infotainment and telematics applications.

6.1 Getting support for your certification process

Do the following to get support from Infineon to debug test failures on your platforms:

- Rule out issues related to test bed configuration and setup:
 - Run the failed test cases on the WFA test bed platform replacing the DUT with a third-party WFA-certified device.
 - Ensure that the changes that you make to the scripts, driver, and supplicant conform to your product design. The scripts and tools provided by Infineon are based on the Infineon reference platform.
 - Ensure that device configurations provided by Infineon are used: *Sample.conf* files are provided in the release packages.
 - Verify that configuration files are not being modified by the device.
- Tune the host platform software for optimal performance for throughput-related test cases. Infineon sigma release documentation provides host-tuning parameters on the reference platform for Linux as a guide.

Follow these steps if the WFA test cases fail:

- Raise a support ticket with Infineon and provide all UCC and DUT device log files.
- In the support ticket, confirm that you have complied with the steps mentioned in this section. Infineon provides log files showing the 'Pass' status for these tests on an Infineon platform; use these to compare with the results obtained from your tests.

Glossary

Glossary

AP

Access Point

Application

The information provided by a member for both Qualified Solution and Wi-Fi CERTIFIED candidates. This includes new Products and Variants.

APUT

Access Point Under Test

ATL

Authorized Test Laboratories

Independent testing laboratories authorized by Wi-Fi Alliance to perform FlexTrack and QuickTrack testing.

CID

Certification Identification number

A unique tracking number that is assigned to a certification application for record keeping. A product has only one CID even though it can be certified at different times for different programs.

Control App

Control software that is integrated into the Device Under Test (DUT) to allow testing with QuickTrack or FlexTrack.

Core and Conformance

Full suite of interoperability and conformance testing necessary for Qualified Solutions or Wi-Fi CERTIFIED products.

Derivative

A new product that is replicated from a Source Product and has no changes to the Wi-Fi Component Combination or certifications.

DUT

Device Under Test

A manufactured product undergoing testing.

End Product

Products or devices that contain Wi-Fi functionality that are typically sold to consumers, integrators, service providers, and network deployers.

Glossary

FlexTrack

Interoperability and conformance methodology to test and certify member's end products using Wi-Fi Alliance test plans and test beds.

ISC

Internet Systems Consortium

A non-profit corporation that supports the infrastructure of the Internet by developing and maintaining core production-quality software, protocols, and operations

MCTL

Member Conformance Test Laboratory

A Wi-Fi Alliance Member's internal laboratory that uses QuickTrack Test Tool to test their own End Product.

P2P

Point to Point (Wi-Fi Direct)

PMF

Protected management frame

Product

For the purpose of the certification program, products are 802.11 devices, wireless products, or equipment that has or will test for Wi-Fi Alliance certification programs.

Qualified Solution

A product consisting of a collection of qualified components that serves as the basis for creating and certifying other products through the QuickTrack methodology and can also be certified itself.

Qualified Solution Variant

A new version of a Qualified Solution that includes a Solution Provider's change to the Wi-Fi component combination and/or certifications.

QuickTrack

Wi-Fi Alliance conformance testing methodology to certify End Products based on a Qualified Solution.

RTOS

Real-time operating system

An operating system that reacts to input within a specific period of time. A real-time deadline can be so small that system reaction appears instantaneous.

Glossary

SAE

Simultaneous Authentication of Equals

A secure key establishment protocol between devices to provide stronger protection for users against password guessing attempts by third parties.

Solution Provider

A company that has demonstrated the ability to produce and maintain a Qualified Solution. Solution

STA

Station

STAUT

Station Under Test

A Wi-Fi Station undergoing testing.

STL

Solution Test Laboratory

The laboratory of a Solution Provider that has been accredited by Wi-Fi Alliance to create, test, and validate Qualified Solutions and Wi-Fi CERTIFIED products.

Variant

A new version of a previously Wi-Fi CERTIFIED product that includes a change to the Wi-Fi Component Combination or Wi-Fi capabilities and maintains Wi-Fi interoperability.

Wi-Fi CC

Wi-Fi Component Combination

A unique combination of hardware and software that provides the Wi-Fi capabilities within a product.

WPA

Wi-Fi Protected Access

WPS

Wi-Fi Protected setup

Revision history**Revision history**

Document revision	Date	Description of changes
**	2021-12-07	Initial release
*A	2022-11-15	Modified test setup configuration Added Abbreviations section
*B	2024-01-08	Added support for 11ax
*C	2024-03-26	Added QuickTrack certification details
*D	2024-04-11	Publishing the document to public by changing access mode.

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