Certification Testing Guidelines for Wi-Fi Alliance® System Interoperability Test Plans – MCP

The purpose of this document is to ensure readiness of TI's customers for the certification process of the Wi-Fi Alliance® (WFA).

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1 Background

The goal of the WFA is to ensure interoperability among IEEE 802.11a/b/g/n products that support the extended security features of Wi-Fi-Protected Access 2 (WPA2™) from multiple manufacturers and to promote this technology within both the business and consumer markets. The WFA has developed an interoperability test suite. Working in conjunction with an authorized test lab, these tests are performed on vendor products.

This document concerns the following certifications:

- WMM-PS (WMM-Powersave_testplan_v2-1-6.pdf)
- TGn (TGnInteropTP_2.11.pdf)
- WPS (Wi-Fi_Protected_Setup_Test_Plan_v2.0.16.pdf)
- Wi-Fi® Direct (wfa_wifi_direct_interoperability_test_plan_version_1.4.pdf)

1.1 Definition of the Device Under Test

A precise selection of the definition for device under test (DUT) impacts the WFA test plans. A slow or weak host processor can impact on the performance of the device. In such cases, an application specific device (ASD) document is required.

1.1.1 Define Your Access Points Under Test

For example, the access points under test (APUT) is a mobile Wi-Fi AP that supports both 2.4-GHz and 5-GHz bands with 20-MHz channel width on 2.4 GHz and 40 MHz on 5 GHz. The APUT only supports personal authentication.

1.1.2 Define Your Station Under Test

For example, the station under test (SUT) is a Wi-Fi station that supports 2.4-GHz and 5-GHz bands with 40-MHz channel width in 5 GHz.

The SUT can be categorized according to the following types of devices:

- Cellular
- Audio
- Terminal audio
- Network camera
- PDA
- DLNA multimedia adapter
- VOIP phone
- Wi-Fi phone
- Converged cellphone
- DVD player
- Tablet PC

1.2   Basic System Test Configuration

Figure 1 shows the basic test configuration for infrastructure tests and a physical connection diagram (there are two logical networks to separate chariot traffic from configuration traffic).
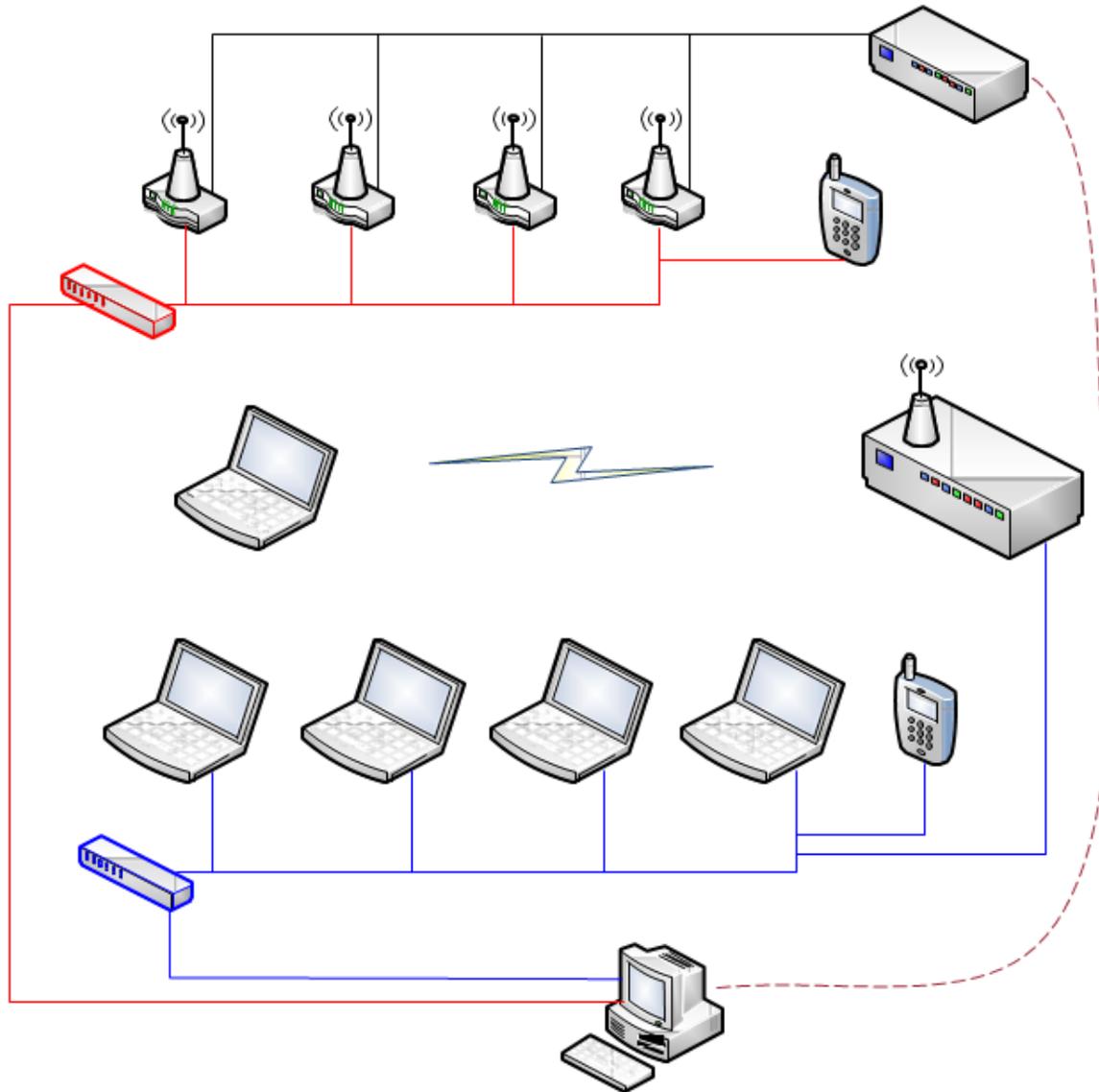

Figure 1. Chariot Basic System Test Configuration

The stations and the IxChariot™ server operate as IxChariot endpoints, with the tests configured and controlled from the IxChariot console. The IxChariot console and three RADIUS™ servers can run on the same machine. The DEVICESCAPE™ runs on a Linux® OS machine. WLAN stations (STAs) run on Windows XP® with SP2. In Figure 1, the RADIUS servers are DEVICESCAPE, HostAPd, Radiator, and Microsoft®. When a DUT is tested in a station mode, only the SUT is typically present. When the DUT is tested in the AP mode, only the APUT is typically present. Use the Wi-Fi Test Suite (WTS) approach as an alternative test bed arrangement to automate the certification tests. Figure 2 shows the standard configuration of the unified CAPI console (UCC).
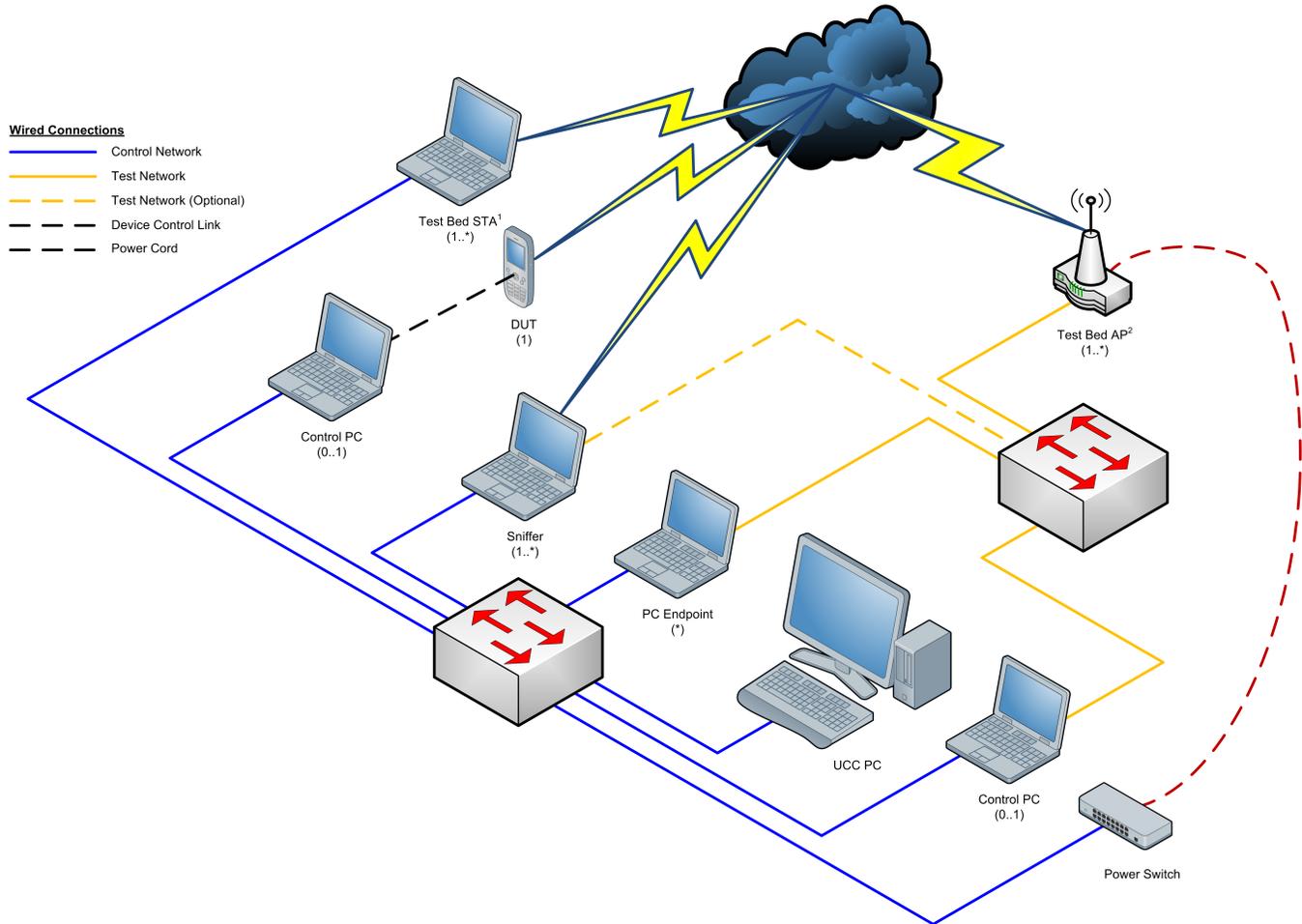
A   A Test Bed STA may also be a converged, nonconverged voice or other device with or without a control PC.

B   If used, the control PC uses the Test Network as a Control Network for Test Bed APs before and after testing

C   Multiplicity Notation

- (*) 0 or more
- (0.1) 0 or 1
- (1) 1
- (1 *) 1 or more

For example: The UCC PC connects directly to the DUT or through a control PC; each control PC connects to 1 and only 1 device.

Figure 2. WTS System Test Configuration

2 How to Prepare the DUT for WFA Certification

The following sections describe the testing methodology and guidelines for preparing the product.

2.1 Recommendations from TI

- Read this document before to externally certifying.
- Perform precertification testing on the DUT of the customer.

2.2 WFA Certification Process

To perform WFA certification, do as follows:

1. Register as a WFA member at https://www.wi-fi.org/about/become-member.
2. Select an authorized lab for testing and certifying your product from http://www.wi-fi.org/authorized_labs.php.
3. Choose the testing programs (STA, AP, or p2p) for your device according to its capabilities and purpose (for example, a p2p device must run Wi-Fi TGn for STA, WPS for STA, Wi-Fi Direct, and can skip AP testing programs and STA-WMM-PS certification).
4. Ensure you mark the capabilities of the DUT because this impacts the optional tests that must be executed like siso, mimo, 20 MHz, 20/40 MHz, enterprise security, and 5 GHz. (If your DUT supports 20/40 MHz in 2.4 GHz, test 5.2.48 must be executed.)

2.3 Preparation Process for Certifying the DUT

2.3.1 Prerequisites for Certification

- The DUT must be fully functional.
- The performance of the DUT must be similar to what TI publishes in the test results.
- The DUT must pass precertification tests (if there are modifications to the software or hardware due to TI configuration [host processor, major code changes, and so forth], this step is mandatory).
- The correct device category most be chosen (this impacts on the TP threshold).
- The DUT file system must be ready to read and write (the file system must save modifications after reboot so the customer or lab engineer can download files to it with ftp, tftp, sdcard or any other procedure).

2.3.2 Applications Required for Certification

- WTS—Download the WTS files from www.ti.com.

  NOTE: The WTS must be adapted to the platform environment of the customer.

- IxChariot Endpoint—Download from www.ixiacom.com (not required).
- IW—Download IW from an open source community and compile it to the environment of the customer.
- Busybox—Download Busybox from an open source community and compile it to the environment of the customer.

2.3.3 DUTs at the WFA Lab

If you must ship two DUTs to the WFA lab, ensure that those are tested devices.

Include operation instructions when sending the devices to the lab.

TI recommends supporting the WFA lab during the certification process (during the initial phase).

3 The Testing Tools, Methodology, and Approach

This section defines tools, methodology, and approach for testing during WFA certification.

3.1 IxChariot Software

IxChariot software from IXIA can be used. The IxChariot includes a large set of standard, editable scripts that can be used to define a particular traffic flow between two endpoints. The IxChariot console (a separate machine from the units under test) manages the definition, test configuration, test execution, and results reporting of the scripts.

Unless otherwise specified, use default parameters. Typically, tests run for 1.5 minutes.

3.1.1 IxChariot Scripts

Change the scripts used during the testing as follows:

- Change the buffer size to 1456 bytes.
- Change the data rate (throughput) according to the ASD document (if it exists).
- Change the packet size in the InquiryL.scr script to 1000B to align with the definition of WTS.

3.1.2 Environment Preparation on DUT

The MCP driver can run on Linux OS and QNX OS. Linux OS Certification can run using WTS or Chariot. QNX OS does not support chariot endpoint, thus only WTS can be used.

To prepare the Linux environment, do as follows:

1. Upload the IxChariot file and extract (perform once and skip if already done).

    cd /home/root/chariot

    tftp -g -r endpoint.tar 20.1.1.10

    tar –xvf endpoint.tar

2. Start IxChariot Endpoint (after every reboot).

    cd /home/root/chariot

    ./endpoint &

3.2 WTS Software

As an alternative to IxChariot, the WTS automation suite can be used. This tool suite provides configuration, test control, traffic generation, and results analysis services. The test plan can be automated through the WFA-distributed WTS command scripts and the WTS-unified CAPI console. Additional information is available on the test tools pages at http://www.ti.com/tool/WILINK8-WIFI-MCP8 (WILINK8-WIFI-SIGMA is the section).

3.2.1 Environment Preparation on DUT

The files follow:

For p2p certification: WTS9dut_mcp_p2p.tar

For TGn and WMM-PS certifications: WTS9dut_mcp_tgn_and_wmmps.tar

To prepare the environment, do as follows:

1. Create a directory on the DUT to hold the package files (perform once and skip if already done).

    For example:

    mkdir/home/root

    cd/home/root

2. Upload the WTS file to the directory (use ftp/tftp/sdcard).

    For example: tftp -g -r WTS9dut_mcp_xxxx.tar 20.1.1.10

3.   Extract ti_WTS_files.tar.

    tar -xvf WTS9dut_mcp_xxxx.tar

    NOTE: This operation create a test_engine folder with the WTS files.

---

4. For MCP, start the WTS on the DUT (perform after every reboot).

    cd /home/root

    ifconfig eth0 <ethernet ip address> up

    cd /home/root/test_engine

    killall wfa_ca

    killall wfa_dut

    ./wfa_dut eth0 8000 &

    export WFA_ENV_AGENT_IPADDR=<ethernet ip address>

    export WFA_ENV_AGENT_ PORT=8000

    ./wfa_ca eth0 9000 &

5. For QNX:

    cd /home/root

    slay wfa_ca

    slay wfa_dut

    cd /home/root/test_engine

    ifconfig en0 <ethernet ip address> netmask 255.255.255.0 up

    ./wfa_dut en0 8000 &

    export WFA_ENV_AGENT_IPADDR=<ethernet ip address>

    export WFA_ENV_AGENT_PORT=8000

    ./wfa_ca en0 9000 &

4   TGn SUT Certification

4.1   Basics

Test Plan: TGnInteropTP_2.11.pdf

ASD document number: None

Testing tool: WTS and chariot are available.

4.1.1   SUT Role Start

To start the SUT role, do as follows:

1. Start the driver on the DUT (perform after every reboot).

   cd /home/root

   sh ./load_drv

   sh ./start_sta

2. Configure current date (perform after every reboot).

   For Linux OS:

   Date <MMDDHHMMYYYY> (example: date 110712252011 for 07Nov2011 12:25)

   For QNX OS:

   Date <YYYYMMDDHHHH> (example: date 201111071225 for 07Nov2011 12:25)

4.2   Special Instructions

- General approvals from WFA regarding the 802.11n certification:

  Update the following parameters under init802.11n.txt with the following values (according to the DUT capabilities):

  – max_throughput!35!
  – payloadValue!1460!

- Test 5.2.14 Multicast traffic

  Add the multicast route to the SUT:

  route add –net 224.0.0.1 <tiw_sta0 IP address> netmask 240.0.0.1

- Test 5.2.15 Pre-authentication

  Add background scan in the network configuration profile:

  wpa_cli -itiw_sta0 set_network 0 bgscan '"learn:5:-65:5"'

- Test 5.2.24 (test 2)

  The maximal configurable clock for STAUT is 01/01/2038.

5   TGn APUT Certification

5.1   Basics

Test Plan: TGnInteropTP_2.11.pdf

ASD document number: None

Testing tool: WTS and chariot are available.

5.1.1   APUT Role Start

Start the driver on the DUT (perform after every reboot).

cd /home/root

sh ./load_drv

sh ./start_sta

5.2   WTS Preparations

5.2.1   Setup Topology

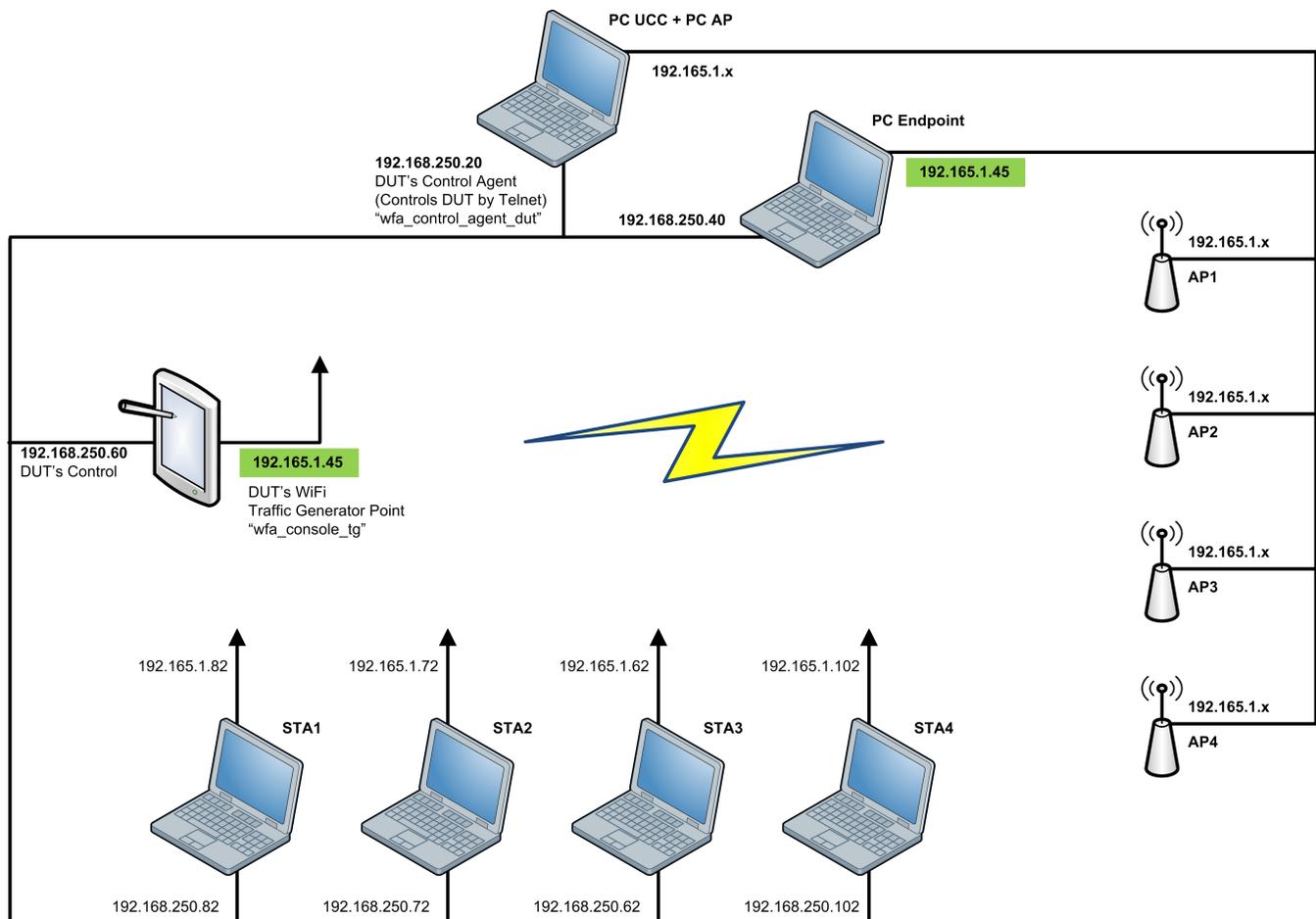Figure 3 shows the topology of the setup.

Figure 3. Setup Topology

The APUT is running as traffic generator.

Update init_802.11n.txt accordingly:

######### PC Endpoint (WFA traffic generator console) #####

info!Connecting to PC Endpoint!

Control IP Address for Console

wfa_console_ctrl!ipaddr= **APUT's ETH IP**,port=9000!

Traffic generator IP Address for Console

wfa_console_tg!**APUT's WLAN IP**!

5.2.2   AP Configuration Agent Changes

- TIWilinkAPInfo.tcl
    1. Place this file in CA PC under include\AP.
    2. Update the Control IP address (eth0) and Power Switch port of the DUT.
    3. If the device has login and password (through telnet), update it:
        (a) Set TIWiLinkAPLogin root (through telnet the password is root).
        (b) Set the TIWiLinkAPPassword password.
- TIWilinkAPCLI.tcl
    1. Place this file in CA PC under src\DevSpec\AP.
    2. Change the path in TIWiLinkAPCommands array to the location of the DUT WTS files on your device:

        array set TIWiLinkAPCommands { \

        CFGKEY "cd /home/root/test_engine/; sh ./ap_cfgkey.sh "\

        DELKEY "cd /home/root/test_engine/; sh ./ap_delkey.sh "\

        ADDTOKEY "cd /home/root/test_engine/; sh ./ap_addtokey.sh "\

        DELFROMKEY "cd /home/root/test_engine/; sh ./ap_delfromkey.sh "\

        RECONFIG "cd /home/root/test_engine/; sh ./ap_reconfig.sh "\

        MISC ""

        }

Update the following control agent files under Wi-FiTestSuite_APConfigurationAgent-Windows_v9.0.0\AP_ControlAgent\include \DUTInfo.tcl your DUT mode (A/B/G).

1. Add the following line to the APs list under Wi-FiTestSuite_APConfigurationAgent-Windows_v9.0.0\AP_ControlAgent\src\CLI.tcl:source [file join $path "src\\DevSpec\\AP\\" TIWiLinkAPCLI.tcl]

2. Add the following line to the APs list under Wi-FiTestSuite_APConfigurationAgent-Windows_v9.0.0\AP_ControlAgent\src\Common.tcl: source [file join $path "include\\AP\\" TIWilinkAPInfo.tcl]

3. Add the following line under Wi-FiTestSuite_APConfigurationAgent-Windows_v9.0.0\AP_ControlAgent\src\TelnetLib.tcl: TIWiLinkAP 0\

4. Add 11b configuration for Atheros AP: UnderWi-FiTestSuite_APConfigurationAgent-Windows_v9.0.0\AP_ControlAgent\src\ DevSpec\AP\AtherosAPCLI.

5. Search for # *check the 11n wireless.*

6. Replace the *if* with the following:

    if { [regexp -nocase "NA" $Value match]} {

    set channelInfo "11NAHT"

    } elseif {[regexp -nocase "NG" $Value match]} {

    set channelInfo "11NGHT"

    } elseif {[regexp -nocase "11B" $Value match]} {

```
set channelInfo "11B"
} elseif {[regexp -nocase "11b" $Value match]} {
set channelInfo "11B"
} elseif {[regexp -nocase "11G" $Value match]} {
set channelInfo "11G"
} elseif {[regexp -nocase "11a" $Value match]} {
set channelInfo "11A"
}
```

5.3   Special Instructions

The APUT is configured through hostapd text configuration file hostapd.conf. Use editor *vi* to change the values of the parameters: vi /home/root/hostapd.conf.

Security configuration options:

Open – no security:

#wep_default_key=0

wpa=0

WEP40:

wep_default_key=0

wep_key0=9876543210

WPA2-PSK:

wpa=2

wpa_passphrase=12345678

wpa_key_mgmt=WPA-PSK

rsn_pairwise=CCMP

Mixed WPA+WPA2:

wpa=3

wpa_passphrase=12345678

wpa_key_mgmt=WPA-PSK

wpa_pairwise=TKIP

rsn_pairwise=CCMP

• Test 4.2.10: Multicast traffic
    – Add the multicast route to the APUT as follows:
        route add -net 224.0.0.1 <tiw_sap0 IP address> -netmask 240.0.0.1
        route add default tiw_sap0
• Tests 4.2.9, 4.2.31, and 4.2.32
    Because of limitations of using APUT as a traffic generator for the stream of APUT and external devices stream. Traffic must be generated by chariot or Iperf in these tests. For test 4.2.9, run this test manually.

6   Wi-Fi Direct Certification

6.1   Basic Information

Test Plan: WFA Wi-Fi Direct Interoperability Test Plan Version 1.4.pdf

ASD document number: None

Testing tool: WTS

6.1.1   DEVUT (P2P) Role Start

*   The Dynamic IP address is required for Wi-Fi direct connections.
    1. Configure the DHCP server with range of IP addresses in the udhcpd.conf file.
    2. Align the WTS script of the DUT that starts the DHCP server for the GO role with the DHCP server on your platform.

NOTE:	The files to edit follow:
	test_engine/p2p_dhcp_server.sh
	test_engine/p2p_dhcp_client.sh
	test_engine/udhcpd_p2p.conf

    3. After establishing a P2P connection, verify that the DEVUT receive an IP from DHCP server.
*   Start the driver on the DUT (perform after every reboot):

cd /home/root sh

sh ./load_drv

sh ./start_p2p

7   WMM-PS SUT Certification

7.1   Basics

Test Plan: WMM_Power_Save_Testplan_V_2-1-6.pdf

ASD document number: None

Testing tool: WTS

7.1.1   SUT Role Start

Start the driver on the DUT (perform after every reboot):

cd /home/root

sh ./load_drv

sh ./start_sta

7.2   Special Instructions

WTS removes power save configuration after connection.

1. Modify the following connection scripts:
    *   STA-Config-WMMPS-STAUT-VoVi.txt
    *   STA-Config-WMMPS-STAUT.txt
    *   STA-Config-WMMPS-WPA2-STAUT.txt
    *   STA-Config-WMMPS-STAUT_Cap_Asso.txt

NOTE: In these files mark the command that turns off Power Save and add a command that turns it on:

wfa_control_agent_dut!sta_set_pwrsave,interface,$1,mode,on!DEFAULT

---

2. Turn on APs manually.
3. For the Cisco AP, delete SSID profiles before running a test.
4. Change the band of tests L.1, M.K, and M.W to match the test plan for the MasterTestInfo.xml.

For detailed instructions, see Sigma WMM-PS beta release v1_0_8.

8 WPSv2 SUT Certification

8.1 Basics

Test Plan: Wi-Fi Protected Setup Test Plan_v2-0-16.pdf

ASD document number: None

Testing tool: Manual

8.2 Device Preparation

8.2.1 SUT Role Start

- Start the driver on the DUT (perform after every reboot).
  cd /home/root
  sh ./load_drv
  sh ./start_sta
- Set a static IP address on the wireless interface.
  ifconfig tiw_sta0 X.X.X.X netmask X.X.X.X

8.3 Special Instructions

- If your DUT has a UI, Wi-Fi requires that WPS testing occurs through UI.
- The wpa_supplicant configuration utility wpa_cli includes several commands used for WPS tests:
  – wpa_cli -itiw_sta0 wps_pin any – to start WPS PIN method
  – wpa_cli -itiw_sta0 wps_pbc – to start WPS Push Button Configuration

9 WPSv2 APUT Certification

9.1 Basics

Test Plan: Wi-Fi Protected Setup Test Plan_v2-0-16.pdf

ASD document number: None

Testing tool: Manual

If your device is MAPUT, run tests mandatory for Mobile-APUT.

If your device is APUT, run tests that are mandatory for APUT. See .

9.2 Device Preparation

9.2.1 APUT Role Start

1. Start the driver on the DUT (perform after every reboot).
   cd /home/root
   sh ./load_drv
   sh ./start_ap
2. Set a static IP address on the wireless interface.
   ifconfig tiw_sap0 X.X.X.X netmask X.X.X.X

9.3   Special Instructions

- If your DUT has a UI, Wi-Fi requires that WPS testing occur though UI.
- The APUT is configured through hostapd configuration file hostapd.conf. Use editor *vi* to change value of parameters:

  vi /home/root/hostapd.conf
- Security configuration options:

  Open – no security:

  wpa=0

  WEP40:

  wep_default_key=0

  wep_key0=9876543210

  WPA2-PSK:

  wpa=2

  wpa_passphrase=12345678

  wpa_key_mgmt=WPA-PSK

  rsn_pairwise=CCMP

  Mixed WPA+WPA2:

  wpa=3

  wpa_passphrase=12345678

  wpa_key_mgmt=WPA-PSK

  wpa_pairwise=TKIP

  rsn_pairwise=CCMP
- Restart the APUT to get the new parameters:

  sh ./stop.ap

  sh ./start.ap
- The hostapd configuration utility hostapd_cli includes several commands that can be used for WPS tests:

  hostapd_cli -itiw_sap0 wps_pbc

  hostapd_cli -itiw_sap0 wps_pin any
- Test 4.1.13

  hostapd_cli -itiw_sap0 wps_pin <enrolee's UUID> <PIN> 300 <enrolee's MAC Address>
- Tests 4.2.1, 4.2.2, 4.2.4– PIN's integrity:

  Incorrect PIN

  – hostapd_cli -itiw_sap0 wps_check_pin <abnormal PIN>

  Correct PIN

  – hostapd_cli -itiw_sap0 wps_pin any <correct PIN>

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