QUALCOMM®
CDMA Technologies

WCN1320™ User Guide

80-VT321-1 B

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1 Introduction

1.1 Purpose

The purpose of this document is to provide information to customers evaluating Qualcomm reference designs and software based on the WCN1320™ chipset. This document provides information relating to the installation, upgrade, configuration, and testing of WCN1320-based reference designs. This document covers both Access Points (APs) and Wi-Fi Stations (STAs), and can be used by customers that receive either or both types of WCN1320-based reference designs.

1.2 Scope

This document is intended for those who are responsible for installing and testing the Qualcomm WCN1320 evaluation kits, which typically include an AP router and at least one STA. These evaluation kits are intended to allow customers to evaluate the core wireless functionality of the Qualcomm WCN1320-based 802.11n solution, and are not intended to represent complete products (i.e., no web UI is provided for AP or STA configuration, most router functionality — NAT, etc. — is not supported, no GUI-based client configuration utility is provided, etc.). Only Open mode (no security) is covered in this guide.

1.3 Conventions

Function declarations, function names, type declarations, and code samples appear in a different font, e.g., `#include`.

Code variables appear in angle brackets, e.g., `<number>`.

Commands and command variables appear in a different font, e.g., `copy a:*.* b:`.

1.4 Revision history

The revision history for this document is shown in Table 1-1.

Table 1-1 Revision history

Version	Date	Description
A	Jul 2009	Initial release
B	Sep 2009	Updated for regulatory information

1.5 References

Reference documents, which may include QUALCOMM®, standards, and resource documents, are listed in Table 1-2. Reference documents that are no longer applicable are deleted from this table; therefore, reference numbers may not be sequential.

Table 1-2 Reference documents and standards

Ref.	Document	
Qualcomm		
Q1	*Application Note: Software Glossary for Customers*	CL93-V3077-1

1.6 Technical assistance

For assistance or clarification on information in this guide, submit a case to Qualcomm CDMA Technologies at https://support.cdmatech.com/.

If you do not have access to the CDMATech Support Service website, register for access or send email to support.cdmatech@qualcomm.com.

1.7 Acronyms

For definitions of terms and abbreviations, refer to [Q1].

2 STA

This chapter provides information regarding STA software and hardware compatibility.

2.1 STA configuration tools

Qualcomm WCN1320 STA evaluation kits currently support Wireless Extension (WEXT) only. The STA can be configured using the following applications based on a Command-Line Interface (CLI):

- iwconfig
- iwpriv
- wpa_cli

Qualcomm recommends using the wpa_cli application for standard STA configuration and using iwpriv for configuring Qualcomm proprietary parameters.

2.2 STA hardware

One device in your hardware kit should be clearly labeled as STA.

This release supports the reference designs listed in Table 2-1.

Table 2-1 Supported STA hardware

Common name	Part number	Description
STA	DC544D_1	Router with 4x4 WLAN PCIe daughter card and STA software
STA	EA544D_1	4x4 WLAN Ethernet adapter card and STA software

2.3 Connecting to STA

You can control the STA by connecting an Ethernet cable to one of its four LAN ports on the AP router or to a single LAN port on a dongle STA.

The CLI-based applications are run from the shell on the STA. The shell is accessible through any of the four LAN ports using telnet. The LAN ports' default IP address is 192.168.1.253 with a subnet mask of 255.255.255.0.

Telnet login is "root" with no password.

2.3.1 Wireless network connectivity

The Qualcomm STA will bridge packets between the wired LAN ports and the wireless interface after the STA clones the Agent PC's Ethernet MAC address.

Follow the procedure below to clone the Agent PC's Ethernet MAC address on the STA:

1. Telnet into the STA from the Agent PC:

   # iwpriv wlan0 set_clone_addr <Agent PC MAC Address>

   For example, *# iwpriv wlan0 set_clone_addr 00:de:ad:be:ef:00*

2. Use the following command to confirm if the cloned MAC address was configured correctly:

   # iwpriv wlan0 get_clone_addr (this will list the cloned MAC address)

3. All configurations on the STA can be saved by issuing the following command:

   # wext-conf save all

The Qualcomm STA will automatically configure itself with the saved configuration if rebooted.

3 AP

This chapter provides information regarding AP software and hardware compatibility.

3.1 AP configuration tools

The Qualcomm WCN1320-based evaluation AP runs on Linux 2.6.25 and is based on an AMCC processor. The AP can be configured using aniSdkTool, a CLI-based utility application. Note that many common broadband gateway functions are not included in this release (NAT, firewall, etc.).

3.2 AP hardware

One device in your hardware kit should be clearly labeled as AP.

This release supports the reference designs listed in Table 3-1.

Table 3-1 Supported AP hardware

Common name	Part number	Description
AP	DC544D_2	Router with 4x4 WLAN PCIe daughter card and AP software
AP	DC544D_3	Router with 4x4 WLAN PCIe daughter card and AP software
AP	EA544D_2	4x4 WLAN Ethernet adapter card and AP software
AP	EA544D_3	4x4 WLAN Ethernet adapter card and AP software

3.3 Connecting to the AP

You can control the AP by connecting an Ethernet cable to one of its four LAN ports on the AP router or to a single LAN port on a dongle AP.

The CLI-based application, aniSdkTool, is run from the shell on the AP. The shell is accessible through any of the four LAN ports using telnet. The LAN ports' default IP address is 192.168.1.254 with a subnet mask of 255.255.255.0.

Telnet login is "root" with no password.

4 Feature Configuration

This chapter provides information related to configuring the client and AP for performance testing.

4.1 Configuring the AP

AP configuration is accomplished via a telnet and CLI.

To telnet into the AP, use following commands at the Windows command prompt on the Agent PC:

1. Telnet 192.168.1.254.

2. The login is "root" (no password is required).

aniSdk Tool is a CLI that uses the Application Programming Interface (API) provided with the AP SDK. The format of aniSdkTool commands is as follows:

- For global commands – *aniSdkTool –x cmd {arguments}*

- For radio-specific commands – *aniSdkTool –x cmd {radioId} {arguments}* (where x is either an "s" for set or a "g" for get)

aniSdkTool –s cga (commit global all) must be issued before configuration set (-s) commands can be applied to the system.

When logged in, the commands listed in Table 4-1 are useful.

Table 4-1 Useful commands while logged in to the AP

Command	Description
aniSdkTool –g ver	Provides build version information
aniSdkTool –a rstdef	Restores the default WLAN configuration; default WLAN configuration is stored in the firmware image
qctPersist	Commits the current WLAN configuration to nonvolatile memory, allowing the current configuration to be retained across reboots and power cycles
aniSdkTool –s cga	Issues commit all; required to make any aniSdkTool –s command take effect
aniSdkTool –s ssid XYZ	Sets the current SSID to XYZ
aniSdkTool –g ssid	Provides current SSID

Command	Description
aniSdkTool –g rad	Provides current channel and bandwidth information
aniSdkTool –s chn 0 X Y[1]	Sets the channel; channel X is the primary channel and Y is the secondary channel. Channel Y must equal X +/- 4; the primary channel will be used in 20 MHz mode, and for beacons and management traffic in 40 MHz modes. In 40 MHz mode, the signal will be centered at (X+Y)/2
aniSdkTool –s bond 0 0	Turns off 40 MHz mode; the "aniSdkTool –s rte 0 X" command shall be issued after this command
aniSdkTool –s bond 0 1	Turns on 40 MHz mode; the "aniSdkTool –s rte 0 X" command shall be issued after this command
aniSdkTool	Lists all available API configuration commands; if you have any questions about commands not mentioned above, contact your Qualcomm support personnel

1

NOTE No aniSdk Tool –s command takes effect until an aniSdk Tool –s cga command has been issued.

2

NOTE The output of aniSdkTool –g only accurately reflects the state of the system after an aniSdkTool –s cga has been issued. Prior to the issuance of aniSdkTool –s cga, the result of aniSdkTool –g may reflect settings that are pending but have not yet taken effect.

3

4 4.2 Configuring the STA

5 The client driver is based on WEXT.

6 When logged in, the commands listed in Table 4-2 are useful.

7 **Table 4-2 Useful commands while logged in to the STA**

Command	Description
wpa_cli –iwlan0 status	Provides status of wlan0
wpa_cli -iwlan0 remove_network 0	Removes your default network
wpa_cli -iwlan0 add_network 0	Adds a network (0) to connect to
wpa_cli -iwlan0 set_network 0 ssid '"your_ssid"'	Sets your network's SSID
wpa_cli -iwlan0 set_network 0 proto WPA	Sets your network's security protocol to WPA
wpa_cli -iwlan0 set_network 0 key_mgmt NONE	Sets your network to open (no security)
wpa_cli -iwlan0 enable_network 0	Enables your default network
iwpriv set_clone_addr 00:de:ad:be:ef:00	Clones Agent PC's MAC address to STA
iwpriv get_clone_addr	Gets cloned MAC address
wext-conf save all	Saves and persists the configuration on the STA

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[1] The available channels are governed by regulatory law. The STA hardware contains an ISO country code programmed into EEPROM which defines the operational channels for a given regulatory domain. For operation in countries governed by FCC regulations, operation in the 5150 to 5250 MHz band is limited to indoor use.

Command	Description
wext-conf default all	Sets the current configuration to factory default configuration
wpa_cli –help	Lists all the options available in wpa_cli

1

2

4.3 Making the connection

The AP and STA both come configured with Open mode security (no security) and SSID set to Qualcomm. The user has to only clone MAC address of the device connected to the Qualcomm STA in order to get the link up and running:

1. On STA – *iwpriv set_clone_addr <Agent_PC_MAC_ADDRESS>*

   For example, *iwpriv set_clone_addr 00:de:ad:be:ef:00*

2. On STA – *wpa_cli -iwlan0 status* (this should list the BSSID and SSID of the AP you are connected to)

3. On STA – *wext-conf save all* (this will save current configuration)

4. On AP – *aniSdkTool -g sta* (this should list the MAC address of the STA's Agent PC indicating that STA is connected)

5. At this point you are ready to send and receive pings from both the Agent PCs.

If you would like to use a different SSID, use the appropriate commands to set the SSID on the AP and then set the default network on the STA with that particular SSID in order to make the connection.

4.4 Creating a new network on the STA

If you change the SSID on the AP, then create a new network on the STA by doing the following on the STA in order to make the association:

 # wpa_cli -iwlan0 remove_network 0

 # wpa_cli -iwlan0 add_network 0

 # wpa_cli -iwlan0 set_network 0 ssid '"your_ssid"'

 # wpa_cli -iwlan0 set_network 0 proto WPA

 # wpa_cli -iwlan0 set_network 0 key_mgmt NONE

 # wpa_cli -iwlan0 enable_network 0

NOTE SSID has to be in format '"your_ssid"', i.e., open single quote, followed by open double quote, followed by your ssid, followed by end double quote, and finally end single quote.

Make sure the MAC address of your Agent PC is cloned to your STA by issuing:

 # iwpriv wlan0 get_clone_addr

Now you can check association status:

 # wpa_cli -iwlan0 status

Save the configuration by issuing:

#wext-conf save all

5 Performance Test Configuration

This chapter provides some guidelines for throughput performance testing of Qualcomm WCN1320-based reference designs.

5.1 Qualcomm recommendations for best performance

TCP/IP settings on systems sourcing and syncing data may impact throughput performance. For example, on PCs loaded with Windows XP, Qualcomm recommend the following TCP/IP settings:

■ TcpMaxDupAcks-2

■ TcpWindowSize-256960 or greater

These TCP settings can be done using Windows registry or a GUI-based tool like TCPOptimizer available free on the Internet.

Qualcomm has observed in its performance testing that to completely saturate the wireless link it may be required to use 10 or more TCP/UDP streams when using test tools like Chariot or IPerf.

5.2 Interference

As with all other 802.11-based equipment, interference (802.11 and non-802.11-based interference from outside sources and ambient noise from PC platforms) impacts throughput performance. In many environments, it may be necessary to use the 5 GHz band to find an interference free channel for performance testing. Note that because of differences in propagation characteristics between 2.4 and 5 GHz, maximum range in the 5 GHz band will typically be less than maximum range in 2.4 GHz.

In an environment with heavy interference, better throughput results may be obtained using a 20 MHz mode instead of a 20/40 MHz mode. In an interference free environment, 20/40 MHz mode produces better throughput results.

5.3 Connecting wired device to AP and STA

The typical throughput test configuration is to have one wired device connected to the AP and one to the STA, and measure throughput between the two wired devices. These devices can be PCs, STBs, etc.

Figure 5-1 shows how to connect the wired device to the AP and STA.
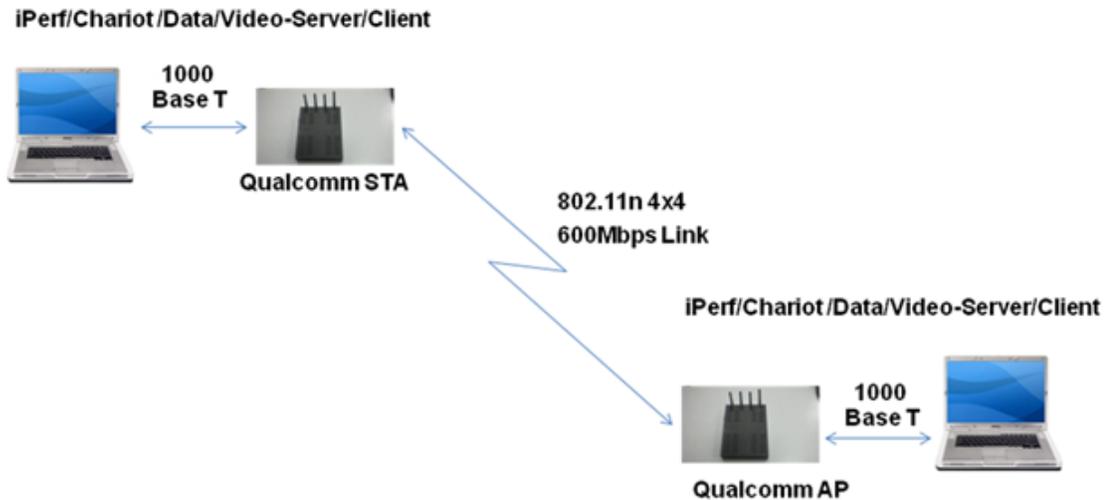
Figure 5-1 Connecting wired device to AP and STA

Qualcomm WCN1320-based AP and STA reference designs are equipped with four 1000Base-T LAN ports on an AP router or a single port on a dongle AP/STA. Using these ports on the AP and STA and a PC equipped with a 1000Base-T will yield the best throughput results.

5.4 Throughput performance test tools

There are a multitude of throughput performance test tools available that can be used to characterize throughput performance over a Qualcomm WCN1320-based wireless link. Qualcomm tests extensively with two of these tools: Chariot (available for purchase from Ixia) and IPerf (free). Configuration considerations for each are provided below.

5.4.1 Ixia Chariot

When using Chariot, a Chariot endpoint must be installed on any PC that will source or sink traffic (PC1 and PC2, in this case). A Chariot console is required on any PC that has IP connectivity to PC1 and PC2 (it can be on PC1, PC2, or a third PC with IP connectivity).

To obtain maximum throughput results, the following configuration options Chariot are recommended:

- Select the High Performance Throughput script.

- Run bidirectional traffic with at least 10 endpoint pairs in each direction of traffic (i.e., 10 endpoint pairs from PC1 to PC2 and 10 endpoint pairs from PC2 to PC1).

- Tests can be run in Batch mode (as opposed to Real-Time) to prevent Chariot control traffic from loading the wireless link; however, the impact of running in Real-Time mode is negligible.

- Take a look at Qualcomm's recommendation for best performance in Section 5.1.

5.4.2 IPerf

When using IPerf, one PC must be configured as the client and one must be configured as the server. For maximum performance, we recommend configuring two servers on PC2, and two clients on PC1, and running a bidirectional throughput test between each client server pair.

An example command-line configuration is:

- On PC1:
  ```
  iperf –c 192.168.1.101 –p 6000 –w 128k –i .5 –d –t 30 –P 10
  iperf –c 192.168.1.101 –p 6001 –w 128k –i .5 –d –t 30 –P 10
  ```
- On PC2:
  ```
  iperf –s -p 6000 –w 128k –i .5
  iperf –s –p 6001 –w 128k –i .5
  ```

6 Regulatory

6.1 FCC certifications

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

6.2 Caution

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

6.3 FCC Radiation Exposure Statement

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment, and users must follow specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other transmitter or antenna.