WCN1320 Regulatory DFS User Guide

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Revision history

Revision	Date	Description
A	Sep 2009	Initial release
B	Dec 2009	Updated for readability
C	Feb 2010	Update for dual (AP/client) boot

1 Introduction

1.1 Purpose

The purpose of this document is to provide information to engineers engaged in DFS testing of QUALCOMM WCN1320-based reference designs and software. This document provides information relating to installation, upgrade, and configuration.

1.2 Scope

This document is intended for those who are responsible for installing and testing the QUALCOMM® WCN1320 AP reference design for DFS regulatory requirements. Therefore, not all available commands are documented herein.

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:`**.

Parameter types are indicated by arrows:

- → Designates an input parameter
- ← Designates an output parameter
- ↔ Designates a parameter used for both input and output

Shading indicates content that has been added or changed in this revision of the document.

1.4 References

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 Reference documents that are no longer applicable are deleted from this table; therefore, reference numbers may not be sequential.

Table 1-1 Reference documents and standards

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

1.5 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.

1.6 Acronyms

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

2 Requirements and Setup

This chapter enumerates the hardware and software requirements for DFS testing the setup for same.

2.1 Requirements

1. LP1: Laptop with a USB 2.0 slot (IBM T43) – Acts as a client device with an installed USB 802.11n wireless adapter. FCC specified Video codec and player must be installed on this laptop. If a third party client card is used, make sure that 11h is enabled on the device.

2. LP2: Laptop with Ethernet port and USB slot (HP Compaq 6710b) – Ethernet connected to the AP (Master) for streaming the video; serially connect to the AP via a USB to serial adapter for console printing. FCC specified video file must be saved on the hard drive of this laptop. This PC is an agent for the WCN1320-based AP.

3. WCD: Wireless adapter to use on the client side (Linksys WUSB600N).

4. AP: Access Point (DUT) or Master device. Qualcomm WCN1320-based 65-VN780-P2 PCIe AP / Qualcomm WCN1320-based 65-VN663-P2 Ethernet AP with DFS software.

1

2

3
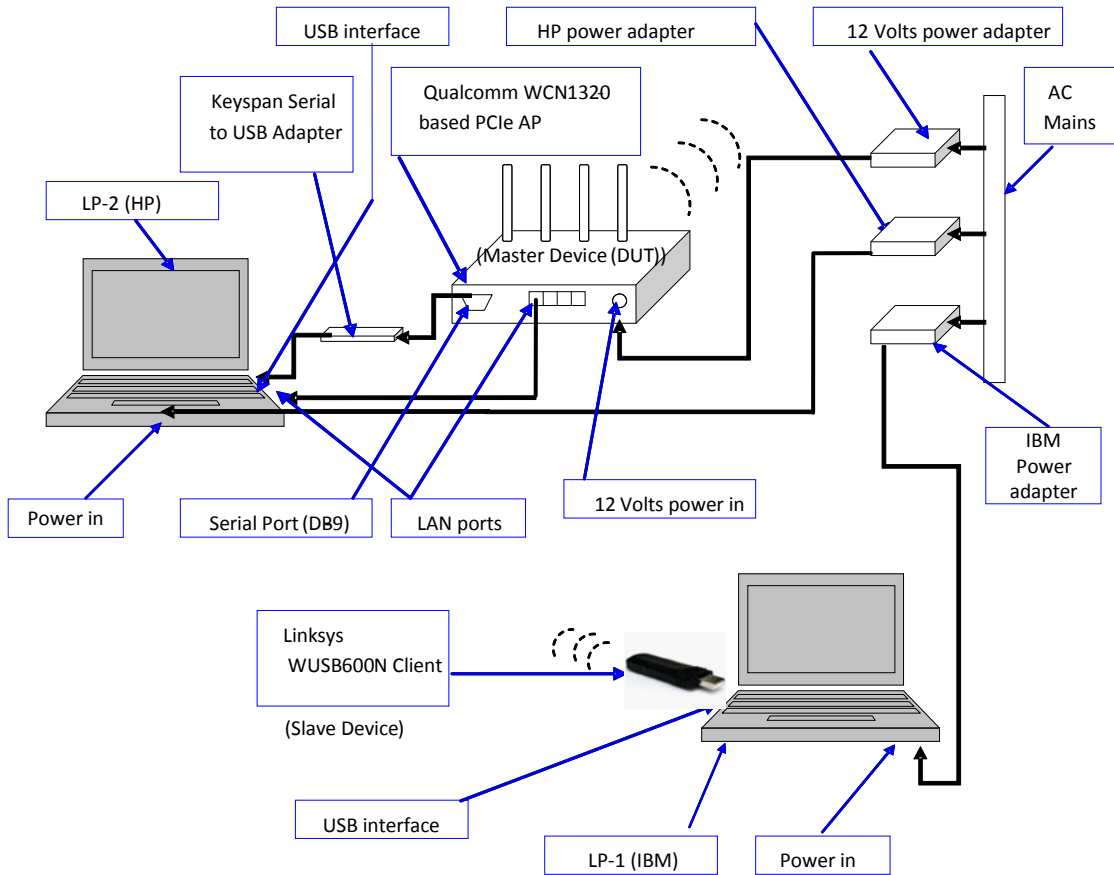
Figure 2-1 Basic DFS test setup diagram for WCN1320 PCIe-based AP

USB interface

HP power adapter

5 Volts power adapter

Keyspan Serial
to USB Adapter

Qualcomm WCN1320
based Ethernet
AP

AC
Mains

LP-2 (HP)

(Master Device (D

IBM
power
adapter

Serial Port (DB9)

LAN ports

5 Volts power in

Power in

Linksys
WUSB600N Client

(Slave Device)

USB interface

LP-1 (IBM)
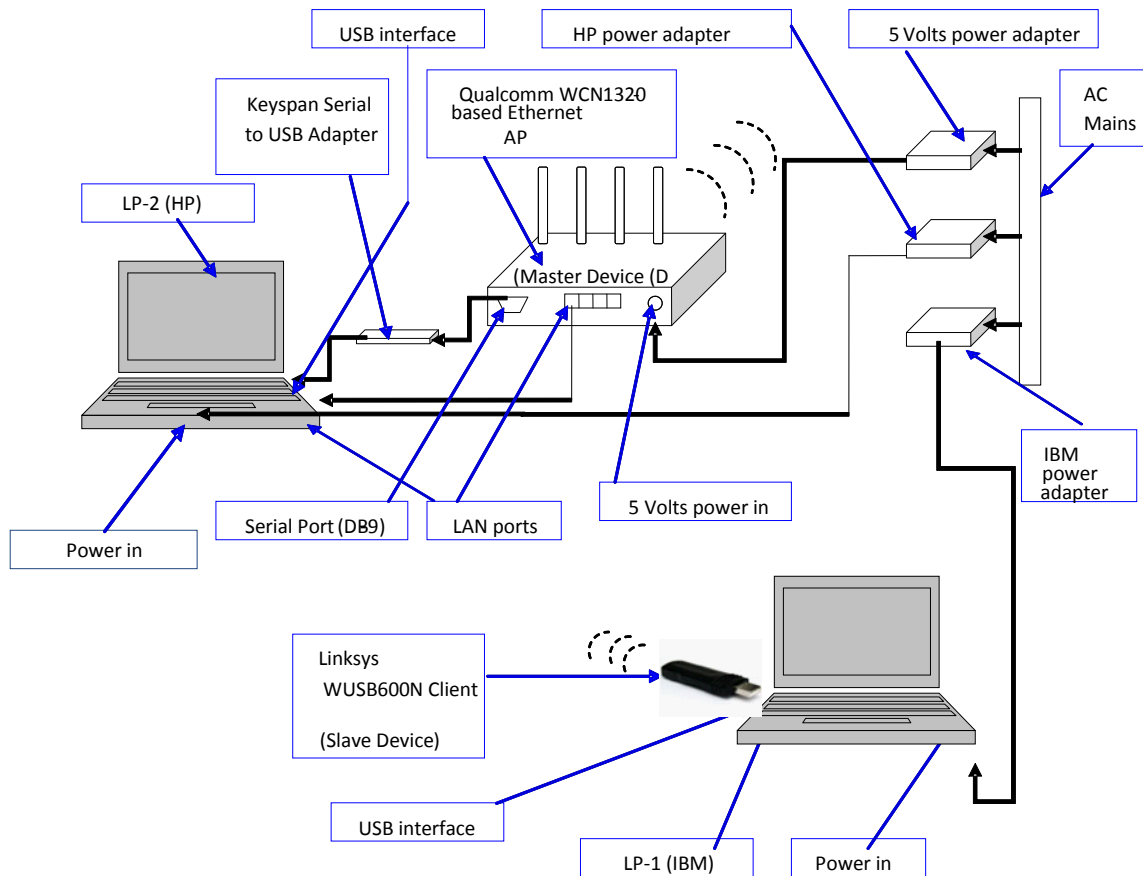
Power in

Figure 2-2 Basic DFS test setup diagram for WCN1320 Ethernet-based AP

2.2 AP and client setup

2.2.1 Qualcomm AP setup

1. After powering ON both the laptops and the Qualcomm Master device, connect USB connector of Keyspan adapter to USB interface of LP2.

2. Wait for 3 to 4 seconds, the LP2 will give a sound indication for the USB device detection.

3. Open the "Tera Term Pro" console application from desktop of LP2.

4. Configure the port as COM2 from Tera Term Pro -> Setup->Port.

5. If Qualcomm Master Device is a **PCIe AP/Router** then configure / set the baud rate to **115200** from Tera Term Pro -> Setup->Baud rate. If Qualcomm Master Device is an **Ethernet AP** then configure / set the baud rate to **38400** from Tera Term Pro -> Setup->Baud rate.

6. Connect the serial connector of Keyspan adapter to serial port of Qualcomm Master Device.

2.2.2 Client (slave) setup

1. Confirm that the Qualcomm Master Device is configured and running.

2. Insert the Linksys USB600N client to any USB 2.0 interface of LP1.

3. Confirm that the Linksys WUSB600N client has automatically associated with the Qualcomm Master device.

NOTE: The Qualcomm Master device (DUT) has the default network name (SSID) of *QUALCOMM_FCC*.

The association of Linksys WUSB600N client to Qualcomm Master Device can be confirmed by issuing the following command to Qualcomm Master Device through Tera Term Pro console on LP2:

```
Command: aniSdkTool -g sta
Output: MAC address of the associated client device
--- Station parameters ---
ifIndex: 8
MAC: 00:1c:10:eb:00:cb

Total: 1
```

LP1: IBM T43
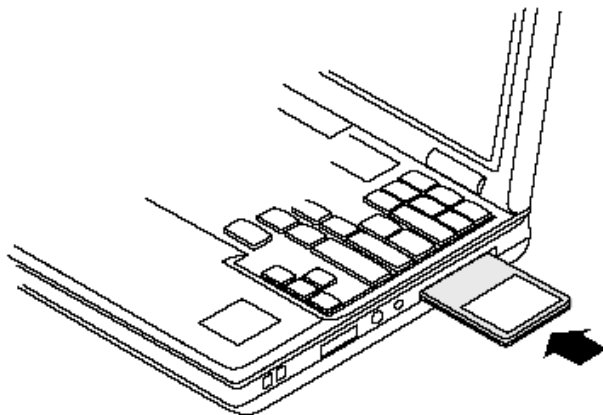
Figure 2-3 Client setup

2.3 DFS test setup configuration

1. Follow the steps below to confirm the WCN1320 test setup is ready to use:

a) Confirm the connections of all the devices as shown in the figures above.

b) Confirm that unique static IP addresses have been assigned for LP2 (192.168.1.102).

c) Insure that the IP address is set for the slave device is 192.168.1.100 on LP1 and not for any other network devices on the laptop.

d) Launch Tera Term Pro on LP2 and confirm messages appear when the AP is powered on.

e) Confirm the TeraTerm serial port configuration on LP2 for the Master device:

Port: COM2

Baud Rate: 115200 for PCIe-based AP (DUT)

                    38400 for Ethernet-base AP (DUT)

Data: 8bit

Parity: None

Stop: 1bit

Flow Control: None

2. To access the video file on LP2 from LP1:

a) On LP1, go to Start>Run>

b) In the Run box type `\\192.168.1.102\DFS`

c) When prompted for the user name and password, enter:

`SCLWLSW` for the user name and `Airgonet1` for the password.

NOTE: The video file in the DFS folder on LP2 is *TestFile.mpg*.

3. Enabling the video file

a) Start running the video file from LP1 by simply double clicking the video file or we may choose the "open with" option to select the required media player.

b) Video should now be streaming from LP2 to LP1 over the air.

c) Restart the video whenever needed and each time the AP is rebooted. The video will be stopped automatically when the AP is rebooted.

NOTE: The `aniSdkTool -s cga` command must be issued after any `aniSdkTool -s` command to have the `aniSdkTool -s` command take effect.

As each test is completed, it is recommended to reboot the AP with the default settings before beginning the next test by issuing the following command:

`Reboot`

NOTE: Before issuing any command on the console, `prints` on the console shall be disabled.

NOTE: On Ethernet AP prints can be disabled by issuing the `dmesg -n 1` command and can be enabled by `dmesg -n7` command.

NOTE: On PCIe AP, `prints` can be disabled by killing `tail -f`
`/proc/net/drivers/wlan0/sirDump` application. To enable prints for PCIe AP again, enter
`/config/prints`.

2.3.1 View the DFS configuration

To view the complete active DFS configuration on the AP, use the following command:

```
aniSdkTool -g dfs 0
```

2.3.2 Data Density configuration

Data density will need to be modified for the intended bandwidth mode. Data density is modified by issuing the commands below on Tera Term Pro console of LP2. There are two separate commands for data density modifications, one for 40MHz bandwidth mode and one for 20MHz bandwidth mode:

Commands for setting data density at 27 Mbps (40MHz bandwidth mode):

```
dump 188 0
dump 181 2 82 82 82
```

Commands for setting data density at 26 Mbps (20MHz bandwidth mode):

```
dump 188 0
dump 180 2 66 66 66
```

Output: The data density will be increased and the increased data density can be observed on RF spectrum analyzer which is capturing the traffic activities of Qualcomm Master Device.

2.3.3 Frequency/channel selection

By default, the Qualcomm Master device will boot up in 40MHz mode on primary channel 100 and secondary channel 104. The center frequency will be at 5510MHz.

For conducting the FCC radar tests, the DUT must be set on certain specific frequencies. The IEEE 802.11n protocol does not allow operation on all the frequencies in 40MHz mode.

Only certain pairs of primary and secondary channels are allowed in 40MHz as shown in the table below. For example when the primary channel is selected at 40, the secondary channel of 44 cannot be selected.

Table 2-1 40 MHz channel pairs

Primary	Secondary
36	40
40	36
44	48
48	44
52	56

Primary	Secondary
56	52
60	64
64	60
100	104
104	100
108	112
112	108
132	136
136	132
149	153
153	149
157	161
161	157

The DFS commands to set the frequency are as follows:

```
aniSdkTool -s dfs 0 2 {prim}
aniSdkTool -s dfs 0 8 1 (force the AP to select the configured channel)
aniSdkTool -s cga (configure the AP to the selected channel)
```

Specify the primary {prim} channel and the secondary will be selected automatically based on the combinations shown in the table above.

2.3.3.1 Channel to frequency/frequency to channel conversion

The command `aniSdkTool -g rad` shows the radio status of AP. If 40MHz bandwidth mode is enabled, this command will show both primary and secondary channels and if 20MHz bandwidth mode is enabled, it will show only the primary channel as there is no secondary channel in this mode.

Frequency to channel: frequency: (frequency-5000)/5

Example: (5180-5000)/5 = channel 36 and (5600-5000)/5 = channel 120

Channel to frequency: ((channel*5)+5000)

Example: ((36*5)+5000) = frequency 5180 and ((48*5)+5000) = frequency 5240

If primary is 44 and secondary is 48, the central frequency would be at channel 46 in 40MHz mode (channel bonding enabled). If in 20MHz mode, the operating frequency would be at channel 44 (primary channel).

2.3.4 Channel bonding configuration (40 MHz mode)

The commands to enable channel bonding are as follows:

```
aniSdkTool -s bond 0 1
aniSdkTool -s cga
```

The commands to disable channel bonding (i.e. set to 20 MHz mode) are as follows:

```
aniSdkTool -s bond 0 0
aniSdkTool -s cga
```

2.3.5 Radar probability test mode configuration

To enable the AP for probability test mode, the following command is used:

```
dump 19 1
```

To disable probability test mode and allow the AP to switch channels upon radar detection, the following command is used:

```
dump 19 0
```

In radar probability test mode, the AP will not switch the channel upon detecting radar; instead the AP remains on the same channel and prints a message on the console upon detecting radar pulses. This allows the tester to continuously issue radar pulses without reconfiguring the AP with the target frequency multiple times.

When in test mode, the output on the console of LP2 will be similar to the following:

```
halIsFalseRadarTrigger: 402: AGC_RDET_RADAR_DETECTED_REG : 7
********** Detected a genuine radar, radarPW=110, NumPulse=4 ************
halRadar_ProcessDetectInd: 513: Radar interrupt testing in progress...
```

2.3.5.1 Radar parking control (Channel Availability Check Control)

To avoid the channel availability check (i.e. disable radar parking), use the following commands:

```
aniSdkTool -s dfs 0 9 0
aniSdkTool -s cga
```

To enable radar parking, use the following commands:

```
aniSdkTool -s dfs 0 9 1
aniSdkTool -s cga
```

When DFS selects a radar channel, it parks on that channel for 60 seconds before starting the AP to insure that the channel is radar free. Sometimes this delay might be a nuisance when performing DFS testing.

2.3.6 Choosing persistency of the radar channel information

Disable persisting radar channel, use the following commands:

```
aniSdkTool -s dfs 0 7 0
```

```
aniSdkTool -s cga
```

Enable persisting radar channel, use the following commands:

```
aniSdkTool -s dfs 0 7 1
aniSdkTool -s cga
```

During normal operation of the AP with DFS turned on, when radar is detected on the current operating channel, DFS is triggered to select another channel to avoid interfering with the radar signals. When selecting another channel DFS will record or `persist` the channel on which radar was detected and will not allow the AP to operate in this radar affected channel for another 30 minutes per FCC requirements.

During DFS testing it might be required to utilize the same radar affected channel in spite detected radar.

2.3.7 Deleting the history file

To decrease testing time, the radar detection history file can be deleted on the Qualcomm Master device so that channels where radar was detected previously, may be reused.

To delete the radar history file on the Qualcomm Master (DUT), use the following commands:

```
rm /config/wsmSavedRadarDetectList
aniSdkTool -s cga
```

2.4 Configuring the AP for DFS tests - Examples

This section describes the steps required to configure the AP for each of the FCC DFS tests.

2.4.1 Radar probability test

Commands to configure the radar probability test in channel 120 (20MHz):

```
aniSdkTool -s bond 0 0
aniSdkTool -s dfs 0 2 120
aniSdkTool -s dfs 0 8 1
aniSdkTool -s cga
```

After the AP is fully booted with the new settings, issue the following command to put AP into probability test mode:

```
dump 19 1
```

2.4.2 Channel move time test

Commands to configure the AP for testing channel move time:

```
aniSdkTool -s dfs 0 2 120
aniSdkTool -s dfs 0 8 1
aniSdkTool -s cga
```

After AP is fully booted with new settings, issue the following command to insure that the AP is not in probability test mode.

```
dump 19 0
```

2.4.3 Channel availability test

Commands to configure the channel availability test on channel 120:

```
aniSdkTool -s dfs 0 2 120
aniSdkTool -s dfs 0 8 1
aniSdkTool -s cga
```

2.5 Avoiding false detection

When configuring the AP to start on a potential radar channel, there is a slight probability of false detection caused due to the highly sensitive antenna either during channel availability check or after AP is up. False detection can result in a channel switch to another channel and hence slowing down the test process. To avoid the channel switch due to false detection, it is always better to put the AP into probability test mode whenever not testing channel move time or some other test where a channel switch is not required.

To do this, issue the command `dump 19 1` right after rebooting the AP.

2.6 Summary DFS related commands

The table below is a summary of DFS related commands.

Table 2-2 DFS command summary

#	Summary	Commands	Details	Default Value
1.	Setting preferred 2.4 GHz channels	`aniSdkTool -s dfs 0 1 {prim} {secd}`	Preferred 2.4 GHz channels to be selected by DFS algorithm. Channel spacing should be 4 between primary and secondary.	6, 2
2.	Setting preferred 5 GHz channels	`aniSdkTool -s dfs 0 2 {prim}`	Preferred 5 GHz channels to be selected by DFS algorithm. Secondary channel would be selected automatically.	36, 40
3.	Setting preferred UNII bands	`aniSdkTool -s dfs 0 3 {low 1/0} {mid 1/0} {high 1/0}`	UNII bands from which DFS can select channels. 1 – Enabled, 0 –Disable, at least one band should be enabled.	Low and High
4.	Setting preferred band	`aniSdkTool -s dfs 0 4 {5GHz}`	Preferred band of operation for DFS when the AP is configured to operate in any band. 1 – 5GHz, 0 – DFS selected.	5 GHz
5.	Setting weight margin	`aniSdkTool -s dfs 0 5 {percentage}`	Minimum percentage difference in weight between weight of the current operating channel and the weight of the DFS selected channel.	20%

#	Summary	Commands	Details	Default Value
6.	Setting CB threshold	`aniSdkTool -s dfs 0 6 {Threshold}`	Maximum threshold weight above which DFS will turn off the channel bonding.	6000000
7.	Enable/Disable Persisting radar channel into flash	`aniSdkTool -s dfs 0 7 {1/0}`	Enable or disable persisting the radar channel into flash.	Enabled
8.	Enable/Disable force channel select	`aniSdkTool -s dfs 0 8 {1/0}`	Enable or disable forcing DFS to pick a preferred channel, provided no radar history is present in those channels.	Disabled
9.	Enable/Disable radar parking	`aniSdkTool -s dfs 0 9 {1/0}`	Enable or disable parking "channel availability check" for 60 seconds when radar channel is selected.	Enabled
10.	Setting potential radar channel weight	`aniSdkTool -s dfs 0 10 {weight}`	Setting a minimum weight to be assigned to potential radar channels giving more priority to non-potential radar channels.	10
11.	Show DFS parameters	`aniSdkTool -g dfs 0`	Get all the DFS parameters.	-

1