WICED™ Development System

Revision History

Revision	Date	Change Description
WICED-MFG202-R	August 20, 2013	Added iscan command Updated for WICED-SDK-2.4.0
WICED-MFG201-R	April 19, 2013	Updated for WICED-SDK-2.3.0
WICED-MFG200-R	December 14, 2012	Updated for WICED-SDK-2.2.0
WICED-MFG100-D3	March 7, 2012	Draft 3 Release; Mfg test app included with WICED-SDK-1.2
WICED-MFG100-D2	November 23, 2011	Draft 2 Release; Mfg test app is now provided as a standalone installer together with WICED SDK Added notes about antenna selection
WICED-MFG100-D1	November 14, 2011	Initial Draft Release

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1   About this Document

1.1   Purpose and Scope

This document provides an overview of the Manufacturing Test application available for use with the Wireless Internet Connectivity for Embedded Devices (WICED; pronounced "wicked") Software Development Kit. The document describes the purpose of this application and how to use it.

It is assumed that users of this guide have read the *WICED Quick Start Guide* document, *WICED-QSG2xx-R* [1]*,* and have previously used the WICED SDK and Evaluation Board on a development computer. Users should also be familiar with the features of the WICED Evaluation Board described in the *WICED Evaluation Board User Guide, WICED-EUM2xx-R [4]*.

For the purposes of manufacturing test, the WICED Evaluation Board may be referred to as the device under test (DUT).

This document applies to **WICED-SDK-2.4.x**.

1.2   Acronyms and Abbreviations

In most cases, acronyms and abbreviations are defined on first use. For a comprehensive list of acronyms and other terms used in Broadcom documents, go to the URL below:

http://www.broadcom.com/press/glossary.php

1.3   Document Conventions

The following conventions may be used in this document:

Convention	Description
Bold	Buttons, tabs, lists and other GUI items
Monospace	Command lines and application outputs: `test.mfg_test-FreeRTOS-LwIP-BCM943362WCD4-SDIO download`
< >	Placeholders for *required* elements: <WICED-SDK>
' '	Application Names, Configuration Parameters: 'YOUR_AP_SSID'

1.4   References

The references in this section may be used with this document.

Note : Broadcom provides customer access to technical documentation and software through the WICED website (http://broadcom.com/wiced). Additional restricted material may be provided through the Customer Support Portal (CSP) and Downloads.

For Broadcom documents, replace the 'xx' in the document number with the largest number available to ensure you have the most current version of this document.

Document (or Item) Name	Number	Source
[1] WICED Quickstart Guide	WICED-QSG2xx-R	WICED website
[2] WL Tool for Embedded 802.11 Systems	802.11-TI2xx-R	CSP
[3] WLAN Client Utility Command Set	802.11-TI3xx-R	CSP
[4] WICED Evaluation Board User Guide	WICED-EUM2xx-R	WICED website

1.5 Technical Support

Broadcom provides customer access to a wide range of information, including technical documentation, schematic diagrams, product bill of materials, PCB layout information, and software updates through its customer support portal. For a CSP account, contact your Broadcom® Sales or Engineering support representative.

General WICED support is available on the Broadcom forum at the URL shown below. Sign-up is a two-step process: Firstly, sign up to the general Broadcom support forum, then apply to be a member of the WICED User Group. Be sure to identify yourself to the forum moderator, access to the WICED forum is restricted to bona-fide WICED customers only.

http://forum.broadcom.com/forum.php

2   Demonstration Requirements

To demonstrate and use the WICED manufacturing test application, a computer with various software applications, as well as radio (RF) test equipment, is required. A description of how to setup individual tests using RF test equipment is not included in this document.

2.1   Computer

A computer, with at least one USB port, is required to attach to the WICED Evaluation Board and run the WICED SDK. The Broadcom wireless LAN test utility may be run on various operating systems, but Broadcom typically supports Windows® or Linux for manufacturing test. The commands in this document assume the computer runs the Windows® operating system.

2.2   RF Test Equipment

RF Test equipment assists in taking measurements resulting from executing commands using the application. Equipment such as spectrum analyzers, signal analyzers, signal generators, power supplies, RF cables, etc., are required to effectively test the DUT.

3   Manufacturing Test Application

3.1   Overview

The manufacturing test application is used to test the radio performance of the DUT and to assist with regulatory certification.

The application works in conjunction with a Broadcom supplied wireless LAN manufacturing test utility, known as 'wl'.

The wl utility is provided with the manufacturing test application as part of the WICED SDK.

The utility reads packetized IOCTL commands from the PC via a serial UART and forwards the commands to the Broadcom Wi-Fi device on the WICED module. Responses to the IOCTL's from the Wi-Fi device are returned over the UART to the PC.
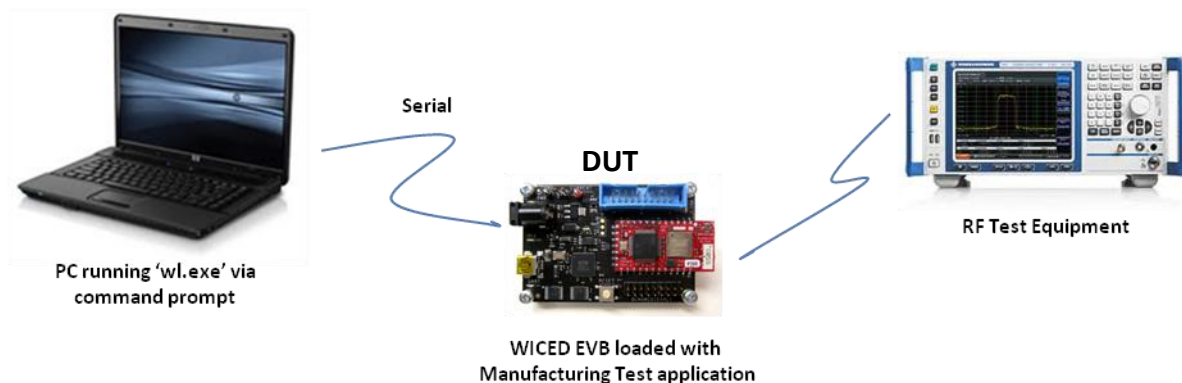

Figure 1. WICED Manufacturing Test Setup

3.2   Creating a Build Target

Similar to other WICED SDK example applications, the build target for the WICED manufacturing test application is constructed from a number of build components. The components used for the manufacturing test application are shown in Table 2.

Component	Available Options
Application Name	test.mfg_test
RTOS	FreeRTOS, ThreadX
Network Stack	LwIP, NetX, NetX_Duo
Platform	BCM943362WCD4, etc.
Interface	SDIO, SPI
Build type	debug

<div align="center">**Table 1. Example Manufacturing Test Application Build Target Components**</div>

The following is an example manufacturing test build target:

<div align="center">`test.mfg_test-FreeRTOS-LwIP-BCM943362WCD4-SDIO`</div>

Refer to the WICED Quickstart Guide [1] for a complete description of how to build an application and download the firmware image to the DUT.

3.3   'wl' PC application

The manufacturing test application running on the DUT interacts via a serial communications interface with the Broadcom wireless LAN manufacturing test utility running on a Windows® PC. The wl utility is provided with the WICED Manufacturing Test SDK and is located in the `<WICED-SDK>\Apps\test\mfg_test\src\wl\exe` sub-directory.

For further information about wl, see [2].

3.3.1 Rebuilding wl (ONLY IF REQUIRED!)

NOTE : IT IS **NOT NECESSARY** TO REBUILD WL ON MOST WINDOWS® SYSTEMS

- Install MinGW from http://www.mingw.org/
- Open a MinGW shell and navigate to the following subdirectory
    `<WICED-SDK>\Apps\test\mfg_test\src\wl\exe`
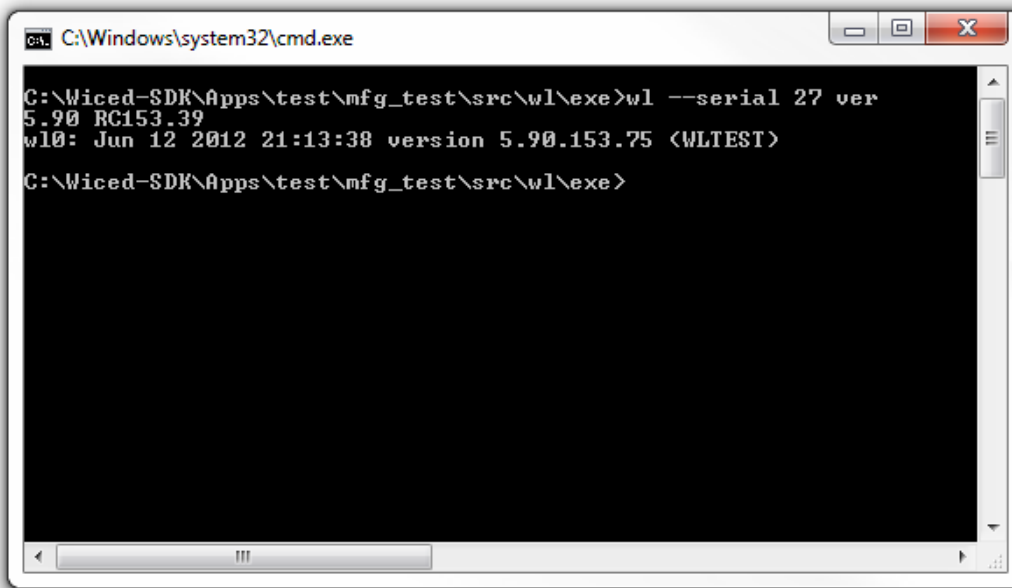- Type: `make`

3.4   Using the Application

The following steps describe how to use the manufacturing test application.

1. Ensure that the WICED Evaluation board is connected to the PC and loaded with the WICED manufacturing test application, then press the reset button.

2. Using Windows® Device Manager, look in the section "Ports (COM & LPT)" and note the COM port in use by the WICED EVB (e.g. COM99).

3. Open a command prompt and navigate to the following directory

   `<WICED-SDK>\Apps\test\mfg_test\src\wl\exe`

4. Verify that the application is working by entering the following command at the command prompt (where `99` corresponds to the COM port number of the DUT).

   `<WICED-SDK>\Apps\test\mfg_test\src\wl\exe> wl --serial 99 ver`

   Figure 2 shows an example response to the version command.

Figure 2. Example Manufacturing Test Output

A list of available commands is displayed using the command : `wl --serial 99 cmds`

Detailed help is available by entering the command : `wl --serial 99 -h`

Note: The wl utility was originally designed to work with high performance host processors that have access to megabytes of memory. Accordingly, a very small subset of wl commands (the general `scan` command, for example) may not work on a microcontroller with a very limited amount of RAM.

For a detailed description of the Broadcom wl manufacturing test utility, please refer the following documents:

- 802.11-TI2xx-R, WL Tool for Embedded 802.11 Systems [2]
- 802.11-TI3xx-R, WLAN Client Utility Command Set [3]

4 Example Commands

This section provides example command sequences with appropriate wl commands that may be used to test basic Wi-Fi transmit and receive functionality of the DUT. These commands are provided as scripts at the following location <WICED-SDK>/Apps/test/mfg_test/scripts

Table 2 provides a brief description of commands used in the manufacturing test scripts.

Table 2. Brief description of manufacturing test commands

Command	*Brief Description*
ampdu	Enables ampdu transmission. Used to maximize transmit duty cycle
antdiv	Used with `txant` command to control antenna selection
band	Sets radio band
bi	Sets beacon interval
channel	Sets radio channel
chanspec	Sets channel using chanspec. `chanspec -c 1 -b 2 -w 20 -s 0` sets channel=1, bandwidth=2.4GHz, chan bandwidth=20MHz, lower sideband
counters	Returns packet counter statistics (use `reset_cnts` to reset statistics)
country	Selects country specific power and channel restrictions
disassoc	Disassociates the WLAN device (if associated)
down	Brings the wireless interface down
frameburst	Used to maximize transmit duty cycle
iscanresults	Returns results of the last iscan
iscan_c	Continues an incremental scan
iscan_s	Initiates an incremental scan
fqacurcy	Used to control continuous wave (CW) transmission
mpc	Sets minimum power consumption mode
nrate	Sets band specific rate override. `nrate -m 7 -s 0` sets MCS=7, SISO PHY
phy_watchdog	Controls 802.11 PHY recalibration
pkteng_start	Starts transmission of a continuous stream of packets
pkteng_stop	Stops packet transmission
rateset	Returns or sets the supported basic 802.11 rates
scansuppress	Suppress 802.11 scanning functionality
reset_cnts	Reset packet counter statistics
txant	Used with `antdiv` command to control antenna selection
txpwr1	Sets transmit power output

Command	Brief Description
up	Brings the wireless interface up

4.1   Transmit Testing

For 802.11b transmit testing, an example command sequence is shown in Table 3.

Table 3. Manufacturing Test Application: 802.11b Tx Test Commands

```
wl --serial 99 down
wl --serial 99 country ALL
wl --serial 99 band b
wl --serial 99 chanspec -c 1 -b 2 -w 20 -s 0
wl --serial 99 mpc 0
wl --serial 99 ampdu 1
wl --serial 99 bi 65000
wl --serial 99 frameburst 1
wl --serial 99 rateset 11b
wl --serial 99 up
wl --serial 99 txant 0
wl --serial 99 antdiv 0
wl --serial 99 nrate -r 11
wl --serial 99 phy_watchdog 0
wl --serial 99 disassoc
wl --serial 99 txpwr1 -1
sleep 3
wl --serial 99 pkteng_start 00:90:4c:aa:bb:cc tx 40 1000 0

To stop transmitting:
wl --serial 99 pkteng_stop tx
```

For 802.11g transmit testing, an example command sequence is shown in Table 4.

Table 4. Manufacturing Test Application: 802.11g Tx Test Commands

```
wl --serial 99 down
wl --serial 99 country ALL
wl --serial 99 band b
wl --serial 99 chanspec -c 6 -b 2 -w 20 -s 0
wl --serial 99 mpc 0
wl --serial 99 ampdu 1
wl --serial 99 bi 65000
wl --serial 99 frameburst 1
wl --serial 99 rateset 11b
wl --serial 99 up
wl --serial 99 txant 0
wl --serial 99 antdiv 0
wl --serial 99 nrate -r 54
wl --serial 99 phy_watchdog 0
wl --serial 99 disassoc
wl --serial 99 txpwr1 -1
sleep 3
wl --serial 99 pkteng_start 00:90:4c:aa:bb:cc tx 40 1000 0

To stop transmitting:
wl --serial 99 pkteng_stop tx
```

For 802.11n transmit testing, an example command sequence is shown in Table 5.

Table 5. Manufacturing Test Application: 802.11n Tx Test Commands

```
wl --serial 99 down
wl --serial 99 country ALL
wl --serial 99 band b
wl --serial 99 chanspec -c 11 -b 2 -w 20 -s 0
wl --serial 99 mpc 0
wl --serial 99 ampdu 1
wl --serial 99 bi 65000
wl --serial 99 frameburst 1
wl --serial 99 rateset 11b
wl --serial 99 up
wl --serial 99 txant 0
wl --serial 99 antdiv 0
wl --serial 99 nrate -m 7 -s 0
wl --serial 99 phy_watchdog 0
wl --serial 99 disassoc
wl --serial 99 txpwr1 -1
sleep 3
wl --serial 99 pkteng_start 00:90:4c:aa:bb:cc tx 40 1000 0

To stop transmitting:
wl --serial 99 pkteng_stop tx
```

4.2   Receive Testing

For receive testing, an example command sequence is shown in Table 6.

Table 6. Manufacturing Test Application: 802.11 Rx Test Commands

```
wl --serial 99 down
wl --serial 99 mpc 0
wl --serial 99 country ALL
wl --serial 99 scansuppress 1
wl --serial 99 channel 1
wl --serial 99 bi 65535
wl --serial 99 up
sleep 10
wl --serial 99 counters
```

4.3   Carrier Wave

To transmit a carrier wave, an example command sequence is shown in Table 7.

Table 7. Manufacturing Test Application: Carrier Wave Commands

```
wl --serial 99 down
wl --serial 99 country ALL
wl --serial 99 band b
wl --serial 99 mpc 0
wl --serial 99 up
wl --serial 99 out
wl --serial 99 fqacurcy 6

[To stop transmitting]
wl --serial 99 fqacurcy 0
wl --serial 99 down
wl --serial 99 up
```

4.4   Antenna Selection

Antenna selection and diversity is controlled using the `txant` and `antdiv` commands as shown in Table 8.

Table 8. Manufacturing Test Application: Antenna Selection

```
[Select antenna 0]
wl --serial 99 txant 0
wl --serial 99 antdiv 0

[Select antenna 1]
wl --serial 99 txant 1
wl --serial 99 antdiv 1

[Enable antenna diversity]
wl --serial 99 txant 3
wl --serial 99 antdiv 3
```

Note: The `txant` and `antdiv` commands will not have any effect unless the nvram (Wi-Fi variable image) and Wi-Fi firmware image are enabled for diversity.

4.5 Other

Listed below are other commands that may be useful.

- To perform a scan for an Access Point with an SSID = YOUR_AP_SSID

  ```
  >wl --serial 99 iscan_s YOUR_AP_SSID
  ```

- To retrieve iscan_s results

  ```
  >wl --serial 99 iscanresults
  ```

- To get the MAC address of the WICED module, use:

  ```
  >wl --serial 99 cur_etheraddr
  ```

- To associate with an open Access Point, use:

  ```
  >wl --serial 99 join <SSID_OF_AP>
  ```

- To verify association status, use:

  ```
  >wl --serial 99 status
  ```

- To get the received signal strength (RSSI) after association, use:

  ```
  >wl --serial 99 rssi
  ```

- To disassociate from Access Point, use:

  ```
  >wl --serial 99 disassoc
  ```

- To set the transmit power to +15dBm, use:

  ```
  >wl --serial 99 txpwr1 -d 15
  ```

- To read the contents of the NVRAM, use:

  ```
  >wl --serial 99 nvram_dump
  ```

Note: After executing the `wl --serial 99 mpc 0` command, ensure that a subsequent `wl --serial 99 up` command is issued. To verify that the device is up, a value of `1` is returned when a `wl --serial 99 isup` command is executed.

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BROADCOM CORPORATION

5300 California Avenue
Irvine, California, 92677

Phone: 949-926-5000
Fax: 949-926-5203
E-mail: info@broadcom.com
Web: www.broadcom.com

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