City Theatrical

WDS Mark II Transceiver Test Fixture User Manual

Rev 1.0

Functional Test Proposal

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1 Introduction

1.1 Purpose of Document

The purpose of this Manual is to outline the use of the WDS Mark II PCB Test Fixture ('Test Fixture').

2 Introduction

2.1 The Test Fixture

The Test Fixture is used for testing the printed circuit boards (PCBs). It is a roughly one foot cube box shaped jig, that clamps the PCB to register it in place with respect to electrical connections connected to the test circuitry located below the board. The test fixture is operated in conjunction with a computer running the test fixture software, to be described below. There are two versions of software; one is for testing product for the North American market, the other, for the European market. Only the North American version is talked about in this manual as the European version's only difference is the transmitter power is aligned to different values and everything in this manual is applicable to the European version.

2.2 Special Instructions

In this document where "press" is written with reference to a button on the computer screen, this can be taken to mean 'press' should there be a touch screen monitor displaying the software test program user interface and it can be taken to mean 'single-click with your mouse' in case there is no touch screen.

3 Installation of Test Fixture Software and Hardware

3.1 Installing the PCI serial card

1. Please refer to the “SERIAL INSTALLATION GUIDE.pdf” file included on the NI-Serial CD that was included with the serial card.

3.2 Installing the software

The following procedure will describe method to install the software application and associated drivers.

1. Insert CD labelled ``WDS MARKII Test Fixture Application Ver 2.1``
2. Follow directions……
3. Reboot PC
4. Double click the Setup_JLinkARM_V374f.zip included in the Drivers section of the CD and then run the Setup_JLinkARM_V374f.exe application to install the J-Link driver.
5. Run the Install AT91-ISP v1.9.exe included in the Drivers section of the CD.

3.3 Installing the hardware

The following procedure will describe the procedure for connecting the test fixture.

1. Plug the power cord into 120VAC mains.
2. Plug the USB cable into a USB2.0 socket on the PC.
3. Plug the serial cable labelled DUT into COM3 of the PCI serial card.
4. Plug the serial cable labelled Golden into COM4 of the PCI serial card.

3.4 Replacing the DAQ modules

Inside the test fixture are two USB Data Acquisition (DAQ) modules. They need to be configured as “Golden” and “DUT”. The test fixture will be delivered from PDE pre configured. If at some point the DAQ modules are replaced, the new DAQ modules need to be reconfigured.

The following is the procedure to replace the DAQ modules:

Note: Only replace 1 module at a time so as not to get them backwards.

1. Find on the Desktop an Icon named Measurement & Automation and double click it to open the National Instruments software application.
2. Remove old DAQ module by unplugging the USB followed by unplugging each of the terminal blocks. Remove DAQ module.

3. Using double sided tape, adhere the new DAQ module into the fixture and plug the terminal blocks and USB cable back in. Ensure the terminal blocks are inserted into the same side as the old module as one side is analog and the other is digital.
4. In Measurement & Automation on the left side of the main window is a tree menu. Select the arrow to expand the tree as in Figure 3-1.
5. Right click the newly installed DAQ and select rename.
6. Type the name of the DAQ module be replaced, “Golden” or “DUT”.
7. Click OK.
8. If replacing the other DAQ module then repeat the steps starting at step 2).
9.

3.5 Changing the firmware file

During the testing procedure the firmware for the microprocessor is programmed. If the firmware to be programmed is changed the test fixture software needs to be updated with the new file. The new firmware file needs to be added to the correct folder location and a script file needs to be edited.

1. Navigate to folder location “*C:\Program Files\CTI WDS MarkII\FLASH\”*
2. Remove old firmware file “*wdsII.bin*“
3. Add new firmware file to this folder

If the new firmware file has a different name than the old firmware file then, the script file needs to be edited or the new file needs to have its name changed to the old file name.

1. Right click “*ProgramFW.tcl” and select edit*
2. change the name of the new firmware file in these lines:

   send_file {Flash} "./wdsII.bin" 0x100000 0

   compare_file {Flash} "./wdsII.bin" 0x100000 0

   e.g.

   send_file {Flash} "./NEW_wdsII.bin" 0x100000 0

   compare_file {Flash} "./NEW_wdsII.bin" 0x100000 0
3. Save and close the file.

4 Calibration of Test Fixture

4.1 Introduction

The test fixture includes some RF cabling and a splitter. These items have loss that need to be calibrated out so that during the testing procedure the DUT may have the transmit power aligned accurately. The following is a procedure to perform this operation:

NOTE: The unit must be calibrated before the test fixture is used to test new devices. It is also recommended that the test fixture be calibrated at the beginning of every build cycle.

4.2 Starting the Software

Once the test fixture computer is powered on and the operating system has booted up, the test fixture Calibration software can be started. To do this runt the Calibration software from "Start menu->all programs->WDS Software->Calibration.exe". Using the mouse, click on this application to start the software. A window labeled "WDS MarkII Test Fixture Calibration V1.0" will then be opened. It appears as in Figure 4-1.

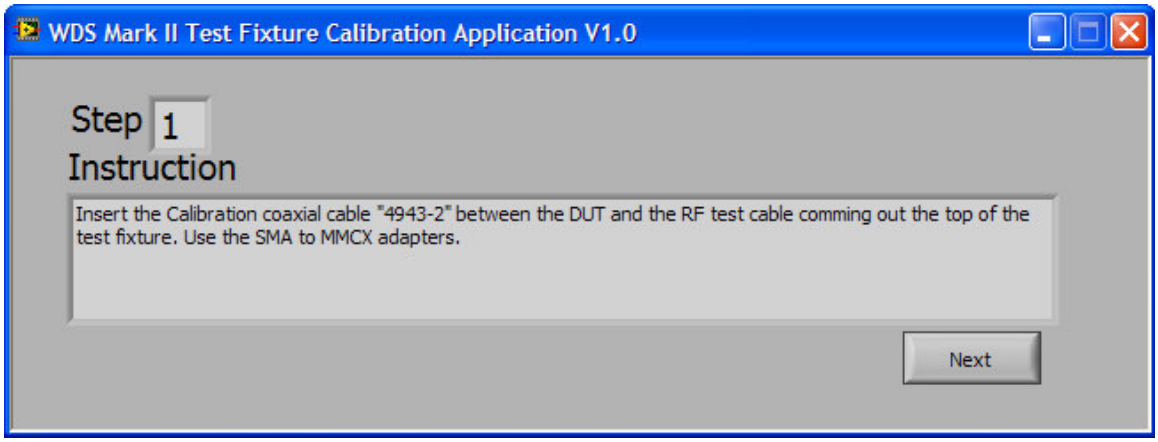

Figure 4-1 Screenshot of Calibration software.

Once the calibration application is running proceed through steps 1 through 8.

After the procedure is complete the test fixture loss is recorded to file for the test fixture application to include in the transmitter aligning phase.

5 Operation and Use of the Test Fixture

5.1 Starting the Test Software

Once the test fixture computer is powered on and the operating system has booted up, the test fixture software can be started. To do this find on the desktop of the computer the icon labeled, "WDS MarkII Test Fixture Application V1_0.exe". Using the mouse, double-click on this icon to start the software. A window labeled "City Theatrical WDS MarkII Test Fixture" will then be opened. It appears as in Figure 5-1.

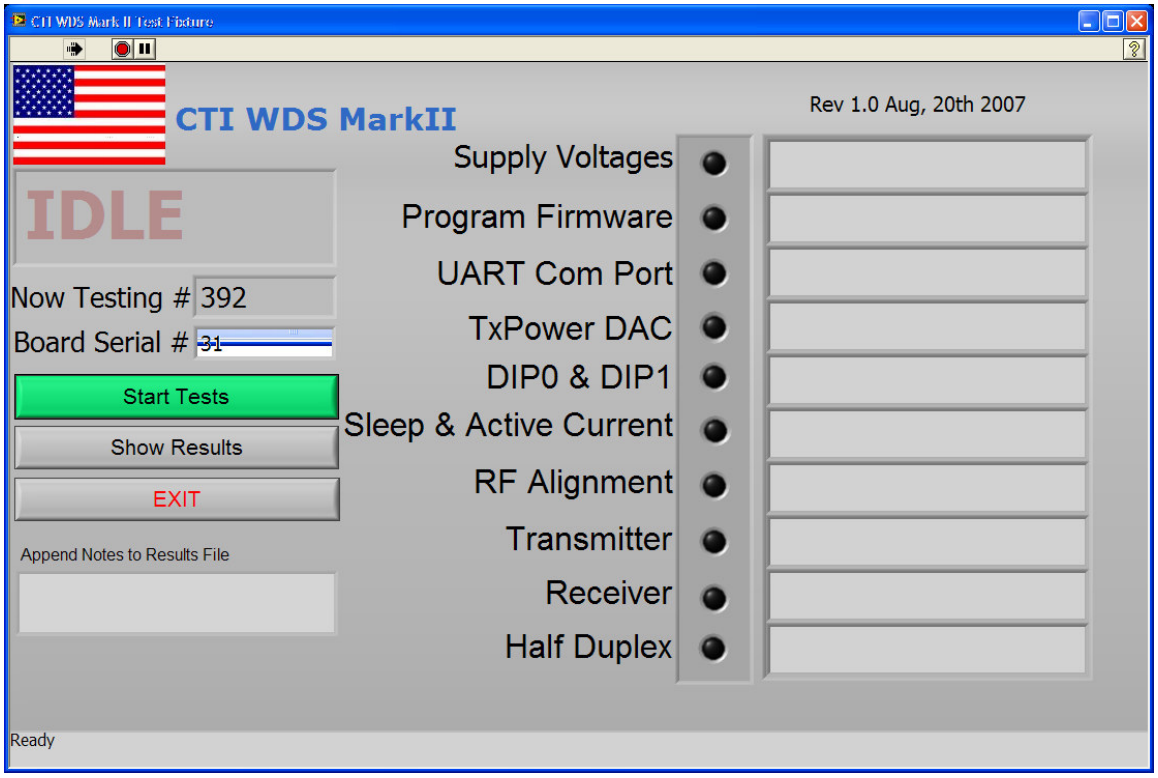

Figure 5-1 Starting window of the test fixture software.

The window displays the tests to be done in the middle column. The results of the specific tests come in the right most two columns as LED-like indicators of green for pass, red for fail or yellow for skipped and verbal descriptions. A space for entry of notes pertinent to the board is available at the bottom left of the screen labeled "Append Notes to Results File" once the tests have completed.

The leftmost column has the following items from top to bottom:

- A display box (IDLE in Figure 1) indicates the test status including the passed/failed status of the board.
- "Now Testing #:" this number represents the test and cannot be edited. This number is automatically generated by the test software.

- "Board Serial #:" This number is the serial number of the board as found on the quality control sticker to be applied to the board. The sticker will be applied and the person using the test software ('user') will type in the serial number here. The Number is automatically incremented every test but can be manually edited.
- "Start Tests": a button to start the tests.
- "Show Results": a button to open up and display a copy of a file indicating results of the testing to this point.
- "EXIT": a button to exit the test fixture software.

5.2 Board Insertion

To insert a board into the test fixture, perform the following steps:

a) Open the test fixture by raising the lever on the right hand side.
b) Remove any boards that are already inserted.
c) Connect RF cable to PCB.
d) Orient the PCB with component side upwards (shield up).
e) Place the PCB over the registration pins.
f) Close the cover of the test fixture.
g) Lower the lever on the right hand side to clamp the board in place while ensuring the RF cable is not pinched.

5.3 Testing the PCB

To test the board(s):

a) Insert the PCB as described in the "Board Insertion" section above.
b) Press the "Start Tests" button on the starting window. The display box will show "TESTING" and the LED-like indicators will light progressively from the top to bottom of the screen revealing the results of the tests as they happen. The "Testing" button will change to a "Click to write results to file" button. This button and the others will be grayed out and unavailable until the testing is finished. The screen appears as in Figure 5-2.

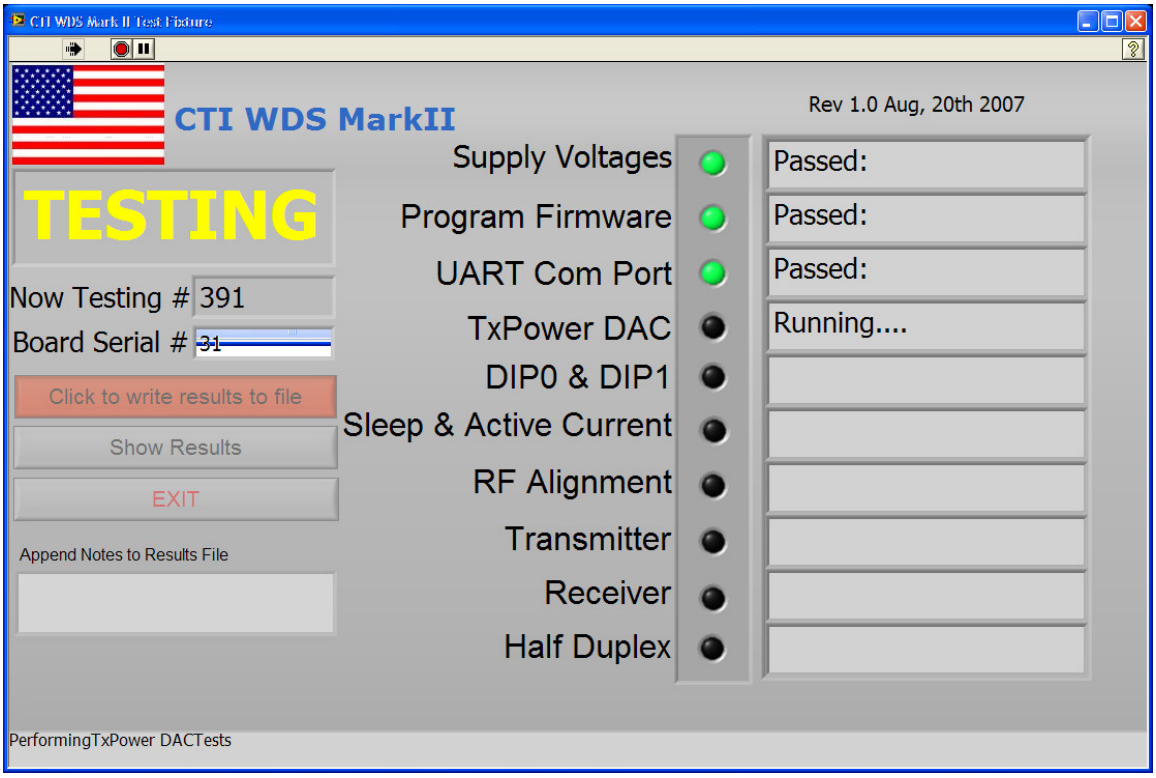

Figure 5-2 Testing program while running.

c) Supply voltages and load current are tested, the microprocessor is programmed, the UART, and TxPower Digital to Analog Converter and DIP switch inputs are verified. At this point the user will be asked to configure the spectrum analyzer to state 1 and measure the RF Transmit Power at Channel 2406MHz. This will be done through the dialog shown in Figure 5-3. Follow the instructions indicated in the dialog.

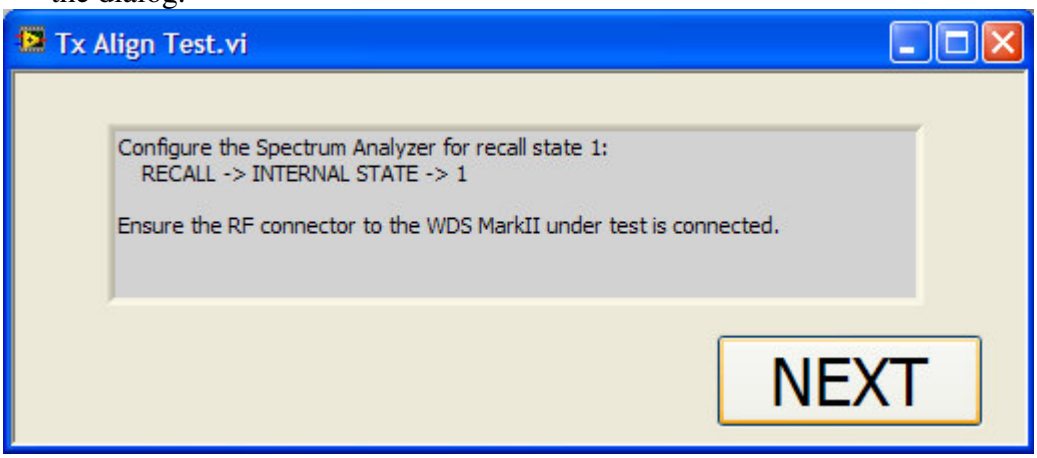

Figure 5-3 Spectrum Analyzer state 1.

d) A new dialog is opened as shown in Figure 5-4. This dialog instructs the user to align the transmit power for various transmit power configurations. The PCB first sets the transmit power to the default settings for the minimum transmit power setting. The user then needs to measure the transmit power. If the power is not

within specific limits the user can adjust the transmit power with the dial on the left. The user should make an attempt to try and align the transmit power to the target value. Once the transmit power is within specifications, the user presses the ``Next`` button to proceed to the next power setting and the process is repeated. Once all the preset transmit power settings have been aligned, the coefficients are programmed into the microprocessor and then the PCB is reset. If at some point the transmit power cannot be set to within the specification limits, the user can press the "Fail" button. This will abort the remaining parts of this procedure and a dialog in will appear indicating the failure notice to the user

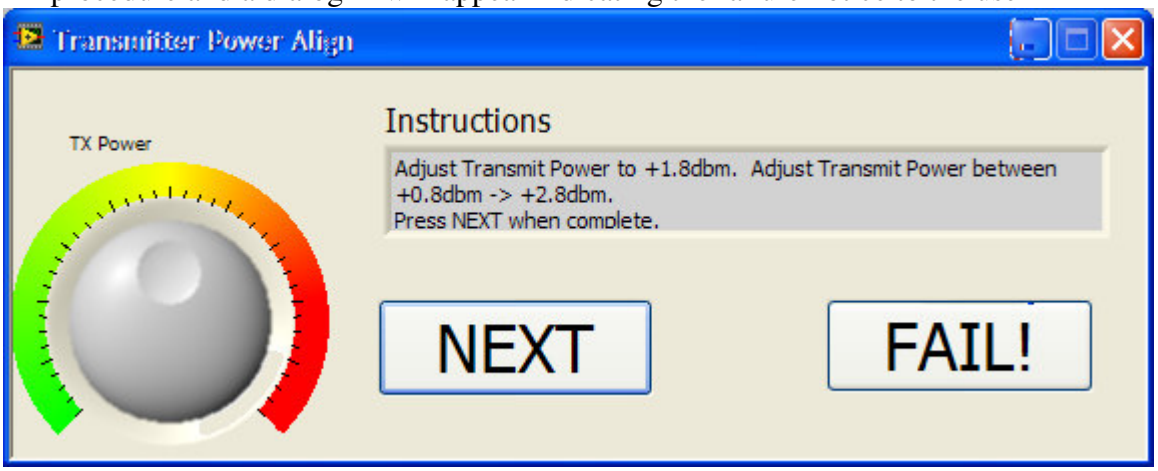

Figure 5-4 Screenshot of the transmitter aligning procedure..

e) The next procession of tests will test the DUT transmitter by completing three packet error rate (PET) tests at three different transmit powers: 5mW, 50mW and 125mW. For each PET the dialog in figure 5-5 will pop up. First a link is established. After a link is established a "FAIL!" button is visible as in figure 5-6. Then 100 packets are sent from the DUT to the Golden board. The packets received at the golden board are checked and counted. At any point the user may press the Fail button to abort the remaining tests and fail the pcb. If at least 95 packets are registered, then the test passed otherwise the test failed.

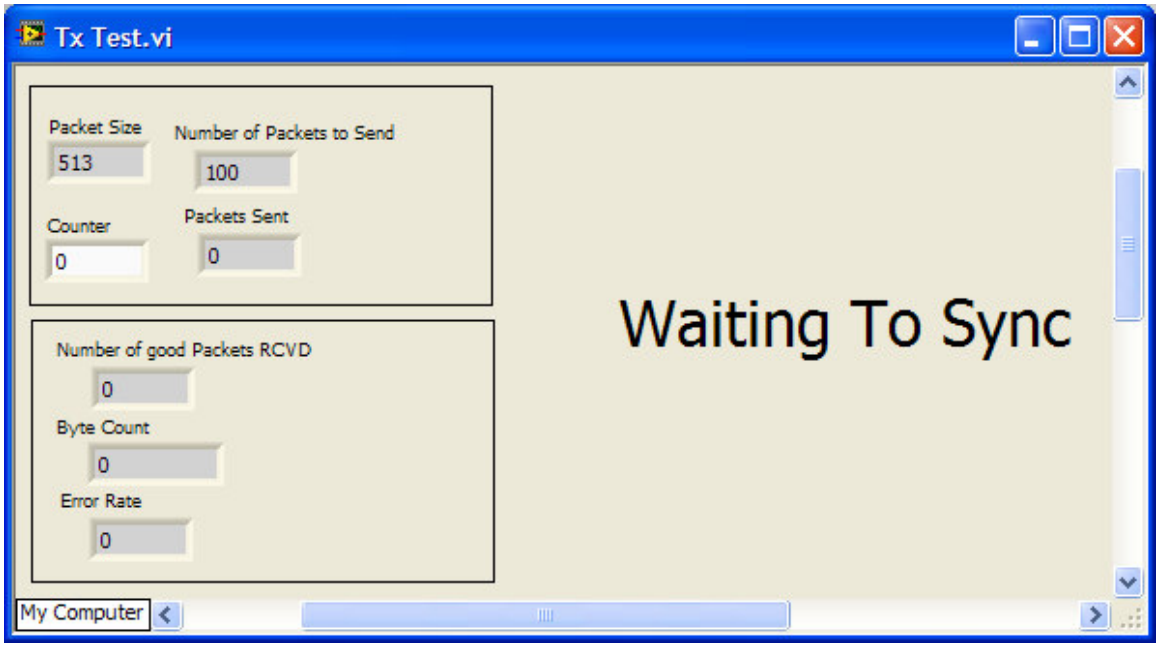

Figure 5-5 Screenshot of the transmit Packet Error Rate test waiting to syncronize.

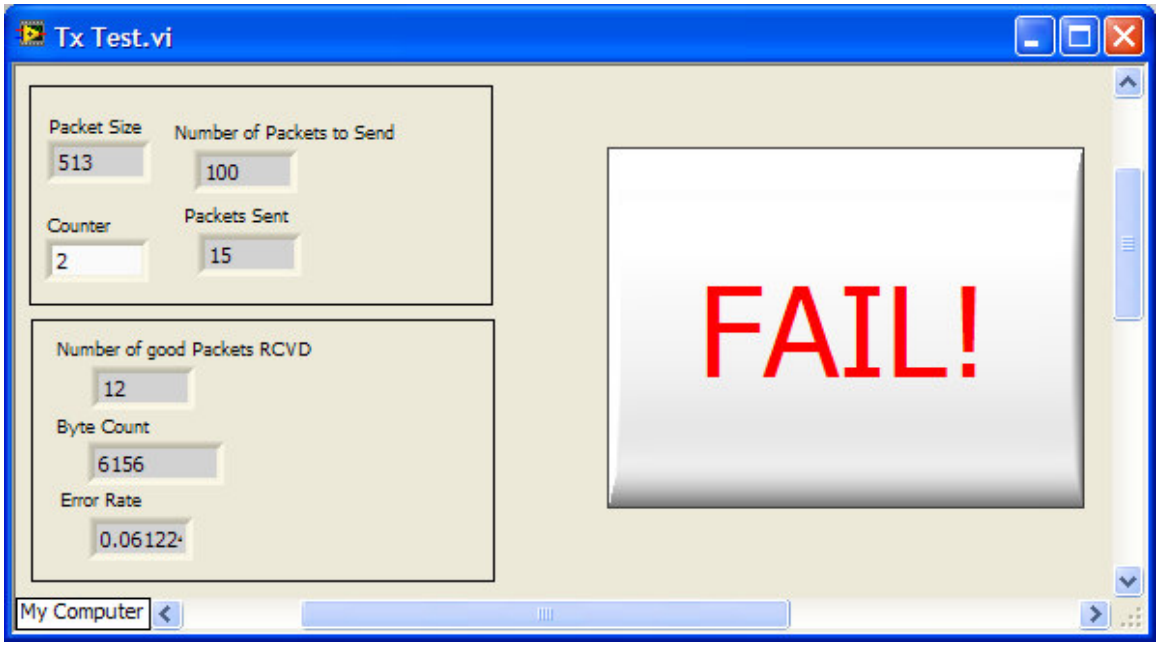

Figure 5-6 Screenshot of the transmit Packet Error Rate after synchronized.

f) After the board passes the PET tests the DUT transmitter frequency is measured for accuracy. The radio specification requires that the crystal clock accuracy be within 20ppm. This can be measured by measuring the transmission frequency. The Dialog in Figure 5-7 directs the user to switch the spectrum analyzer to state 2. Next, the user presses the Next button to continue. The user is directed to record the frequency measured from the spectrum analyzer in the input box as shown in Figure 5-8. The input is to be entered in KHz units and does not need any decimal points. For example if the measured frequency is 2.438013 Ghz then

2438013 is to be entered. Press next to continue testing or the "Fail!" button if for some reason the user cannot measure the frequency properly.

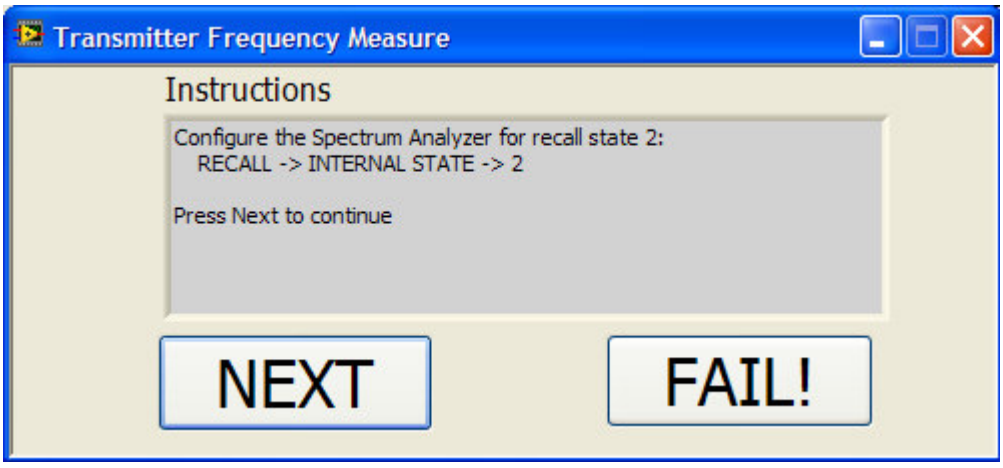

Figure 5-7 Screenshot of dialog instructing user to prepare spectrum analyzer for frequency measurement.

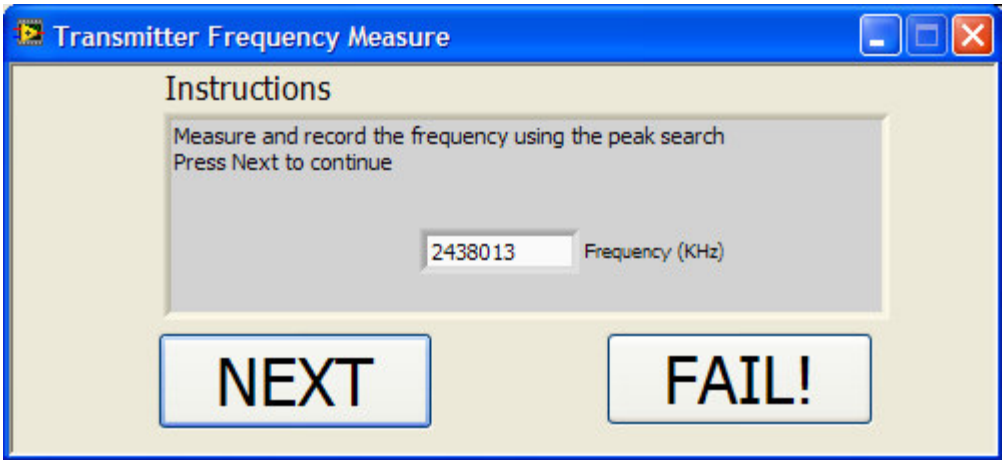

Figure 5-8 Screenshot of dialog with measured frequency input.

g) the DUT has one more transmitter test to complete which is to verify the transmission power flatness over the full band of 2406MHz-2477MHz. The dialog in figure 5-9 is presented to notify the user to configure the spectrum analyzer to facilitate this test. Once the user has configured the spectrum analyzer the user presses the Continue button. The DUT will then transmit at channel 2406 MHz, 2441 MHz and 2476MHz for 1 second intervals. The dialog box then makes two buttons ("PASS", "FAIL") visible. The user then need to measure the flatness over the passband and ensure that there is less than +/-2db deviation from the center channel and that the maximum transmit power on each band is less than the allowable Maximum for ETSI or FCC. The user then passes or fails the DUT by pressing the appropriate button.

h) The receiver of the DUT is then tested by conducting two PET as in the transmitter section but this time the Golden board is configured for transmission and the DUT is configured for reception. The first PET is conduced with a medium transmission power of around -50dbm at the receiver. Then the test is

repeated with a low transmission power of around -90dbm to ensure the DUT receiver sensitivity is within specification.

i) Finally, the Half-Duplex functionality is verified by repeating the PET with the Golden board configured as Server and the DUT as a Client. Each packet is transmitted from the server to the client, the computer then loop backs this packet and then relays this packet back to the Golden board. 50 packets are sent and the software counts packets at each end. If 95 or more packets are counted the test has passed otherwise the test has failed.

Failed Boards

Should the board fail the testing procedure; the testing program user interface will appear as in Figure 5-9. At this point the user should enter any notes in the "Append Notes to Results File" entry, enter the board serial number from the issued sticker into the "Board Serial #" entry, and then press the "Click to write results to file" button.

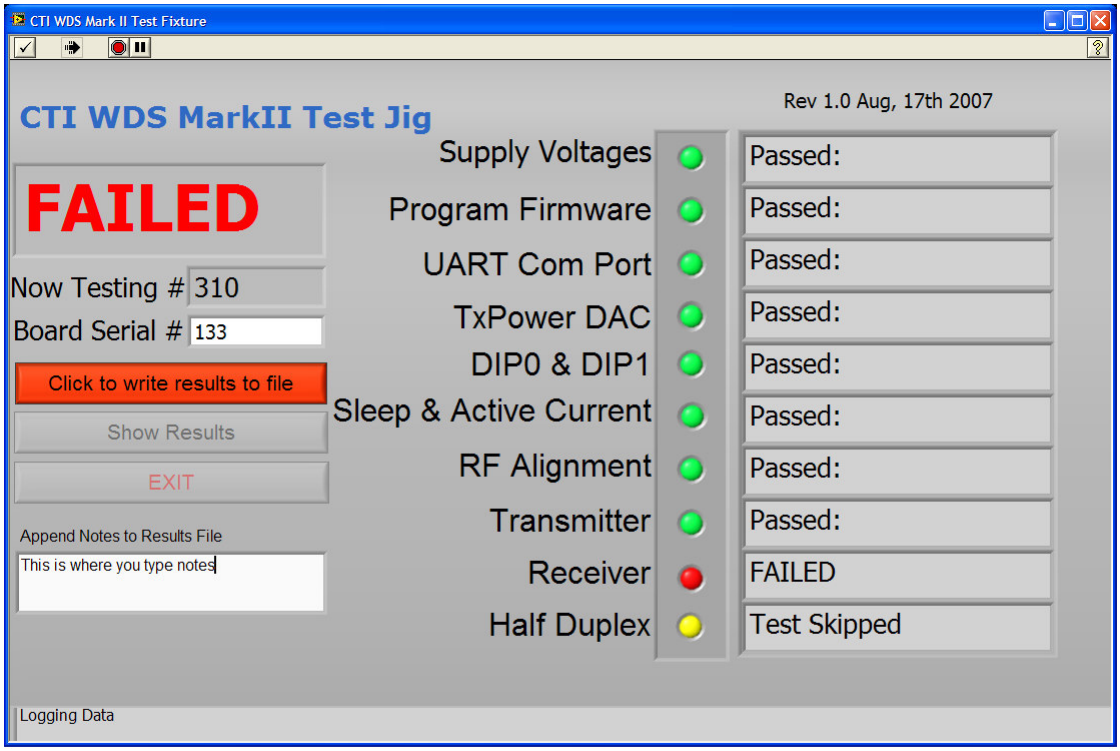

Figure 5-9 Screenshot of a failed board result.

The serial number sticker is applied to the PCB. The PCB is placed with the failed PCBs.

Passed Boards

Should the board pass the testing procedure; the testing program user interface will appear as in Figure 5-10. At this point the user should enter any notes in the "Append Notes to Results File", enter the board serial number from the issued sticker into the "Board Serial #" entry, and then press the "Click to write results to file" button.

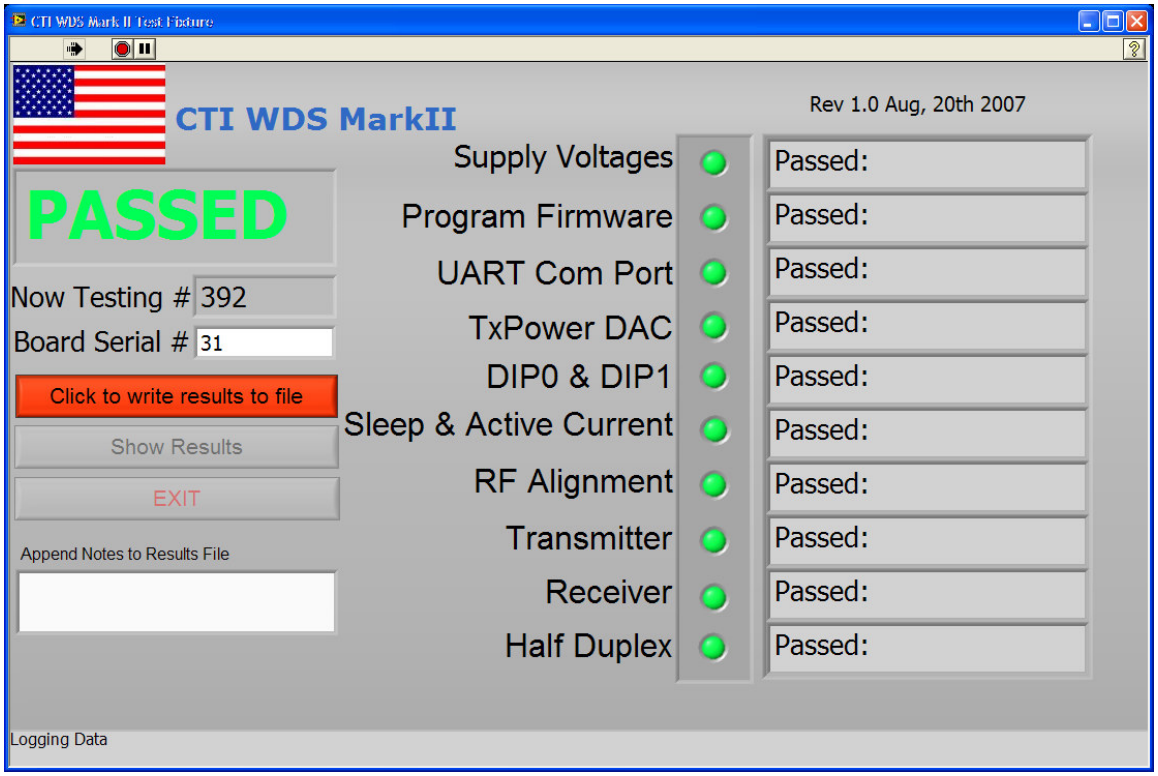

Figure 5-10 The passed results dialog.

The serial number sticker is applied to the PCB. The PCB is placed with the passed PCBs.

Displaying Results

The test results file can be displayed by pressing the "Show Results" button. This opens up a copy of the test results file with a text editor. Any edits made will not overwrite the original test results file. This file is tabbed delimited and easily opened in a spreadsheet such as Microsoft Excel.