
QorIQ P1020 AP/WLAN Wi-Fi

Reproducibility Document

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- 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.

Reminding

1. The installed antennas must not be located in a manner that allows exposure of the general population at a distance of less than 23cm.

2. Mount the antennas in a manner that prevents any personnel from entering the area within 23cm from the central position of the antenna.

This device has been designed to operate with the attached antennas, and having a maximum gain of 2.5dBi. Antennas not identical as that or having a gain greater than 2.5dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

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1 Introduction

This document describes the steps to reproduce AP/WLAN WiFi performance solution using Atheros XB114 card across QorIQ P10XX (P1020RDB, P1020WLAN etc, P20XX etc). All the test configurations and environments are covered. Each site can follow this document to do the performance test that will make comparison data more reasonable.

1.1 Hardware Equipment Requirements

- Wireless Station:
 - The first one Atheros XB114 wifi can be to mPCIe slot.
 - If you need to add a second Atheros XB114 wifi card for higher bandwidth, you need to use the mPCIe to PCIe adapter card to plug onto the PCIe slot on the PCB.
- Test PC
 - A PC x86 with 2GHz above, 4GB DDR2 memory with speed greater than 667MHz or better (PC5300 or better) and a large hard drive to accommodate for data storage, Giga Ethernet, Broadcom NetXtreme 57xx Gigabit Controller, Win7.
 - Six TrendNet TEW-AID86DB antennas. The directional antennas will result more reproducibility performance than omnidirectional antenna.



Figure 1 - Test PC With External Antenna (7dB)

* The Antenna in picture is **TRENDnet TEW-AI86DB Antenna** Stand and Cables. This particular model is directional antenna and the position points to each other directly with clear of sight. Users should find high power Antennas themselves.

- Test house
 - open area is between P1020RDB to each client PC

NOTE

1. For open area, choose these place:
 - Open space with clear line of sight,
 - No barrier within 5 meters,
 - No strong electromagnetic interference, and
 - the antennas have to be in the center of room and away from the corner.
2. Search for available Wi-Fi signals in range. Make sure that the test environment is good enough.

2 Test Environments for Atheros Wi-Fi XB114 Card

This section describes the test environment for reproducing the XB114 Wi-Fi performance results.

2.1 Hardware Platform Identification

This section describes hardware platform requirements for reproducing the performance numbers.

2.1.1 Description of P1020RDB Device Under Test (DUT)

- DUT:
 - P1020RDB Board, P1020WLAN or P10XX, P20XX platforms



Figure 2 - P1020RDB Board without Antenna

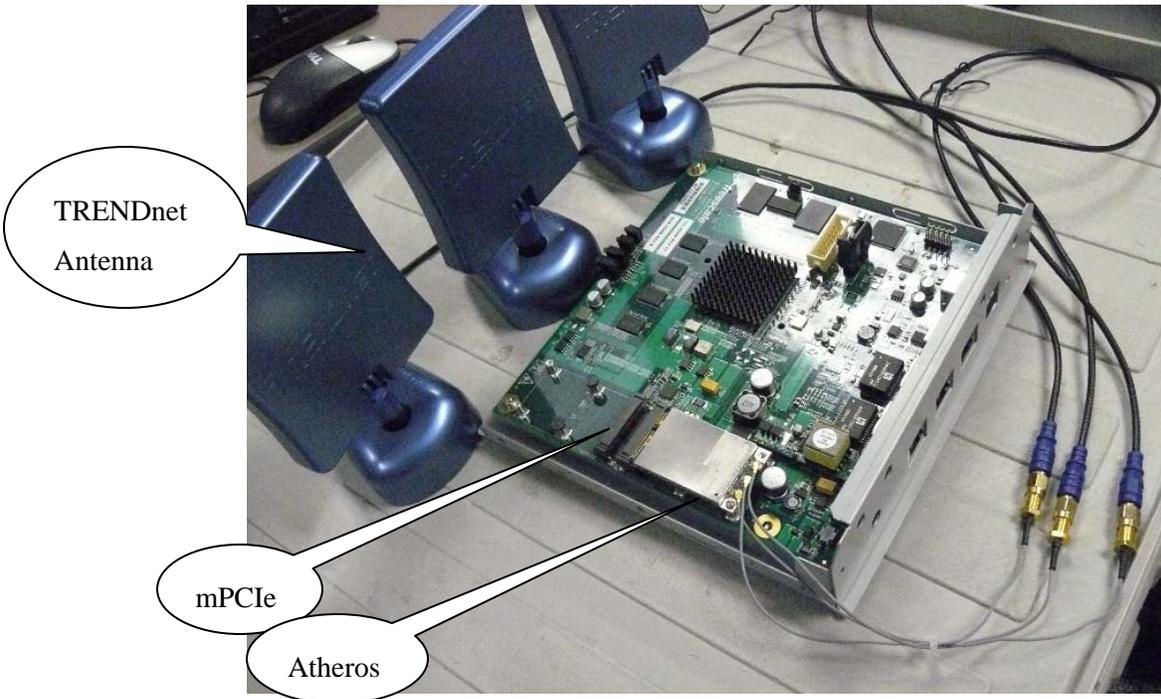


Figure 3 - P1020WLAN Board with Antenna

- **Atheros Wi-Fi card used: XB114**
For Atheros chipset technology, please refer to following link
http://www.atheros.com/pt/wlan_core.htm
- **Perform the following assembly instructions to install Wi-Fi card with three antennas**
 1. Remove the screw in the two red circles shown in the image below.
 2. Insert the Wi-Fi card at 45 degree.
 3. Push down and tighten the Wi-Fi card by the screw.
 4. Connect antenna cables as shown in picture.

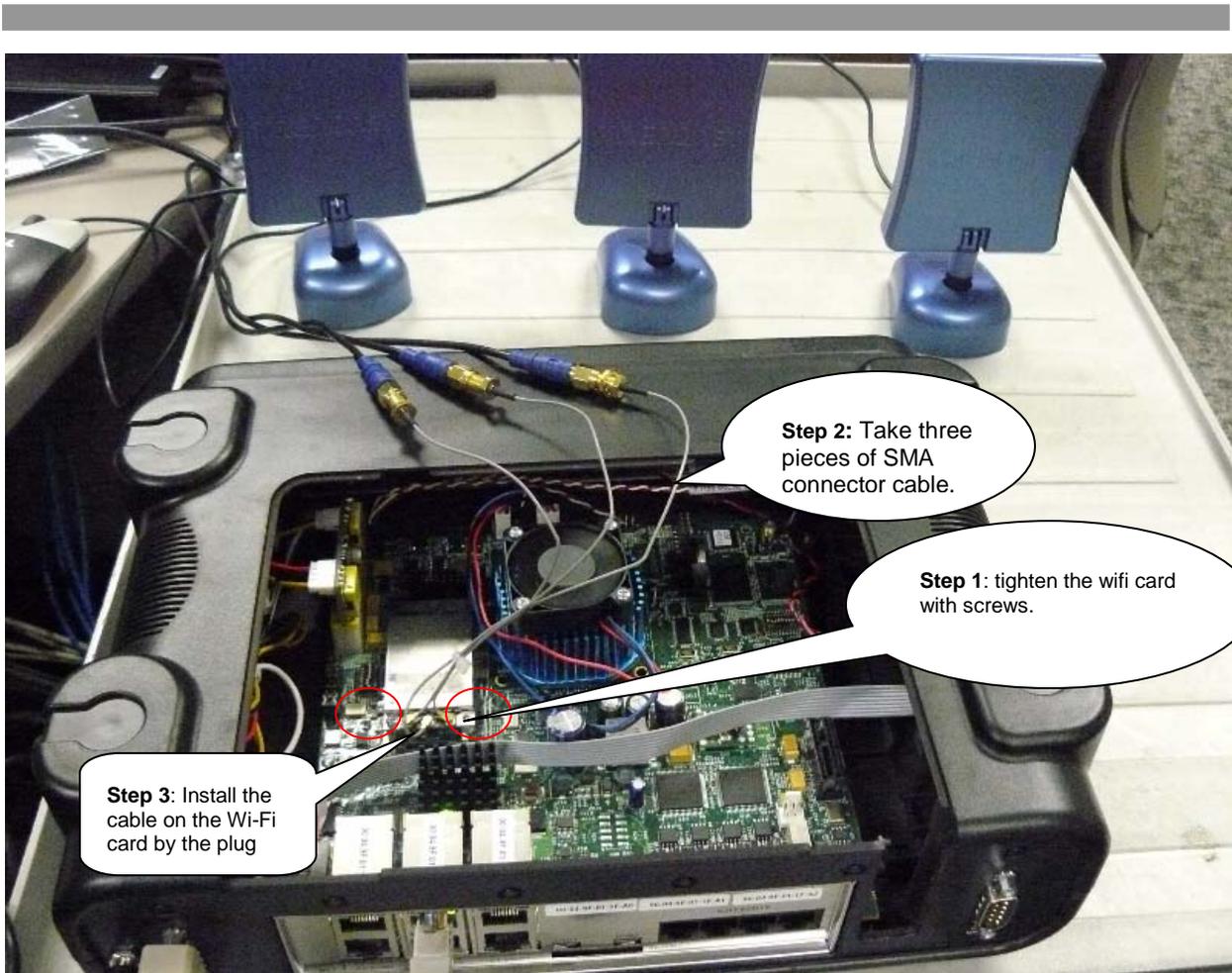


Figure 4 - P1020RDB Box with Atheros on mPCIe

2.2 Software Platform Identification

This section describes the software platform requirements for reproducing the Wi-Fi performance.

2.2.1 Firmware Version

- P1020 EWLAN V4.2.2
 - U-boot version: 2009.11-00019-g87ce628 (May 05 2010 - 15:05:09)
 - Kernel version: 2.6.32

2.2.2 Test tools

- Test software
 -  Ixchariot, V7.1 (should support at least 16 pairs)
 -  Endpoint 7.0
- Script: High_Performance_Throughput.scr

- Running duration: 5 minutes

NOTE

Throughput must be measured after the Wi-Fi link is stable and test should be done for three iteration after sample of test carried for better results.

3 Test Procedures for Atheros Wi-Fi Card

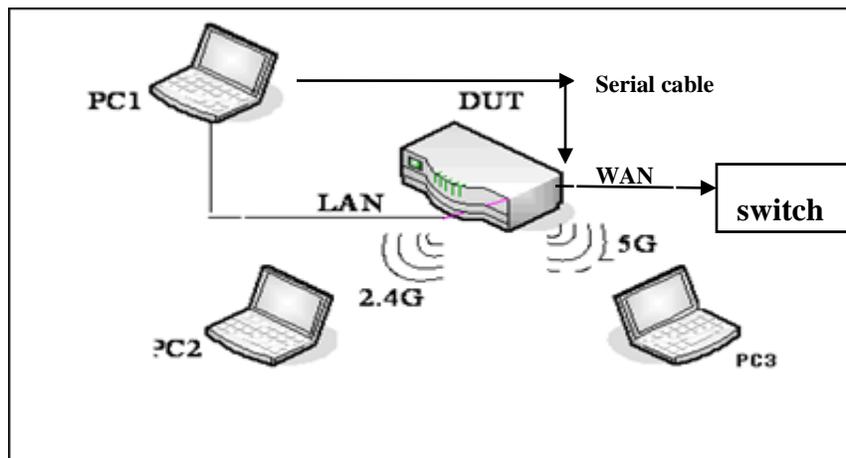
This section describes how the system test bed is prepared. Figures or diagrams are used for the purpose of illustration and may not reflect the specifics of other setups. Please download the P10XX Atheros image, Win 7 Atheros driver, tftpsrv.exe, flash memory flashing_script and WLANMON.exe from the following link:

<http://compass.freescale.net/go/P1020RDBAP>

then go to Software(Image & ISO) subfolders to download the PC applications for Wireless Network Monitor.

3.1 Test Setup Description

The DUT is P1020RDB, which has mPCIe, and PCIe interfaces. One can directly plug in the Atheros Wi-Fi card to the mPCIe slot or use the mPCIe to PCIe interface card for testing. The PC1 is connected to the DUT via CAT6 Gigabit Ethernet cables. PC2 and PC3 is connected to 2.4G Wi-Fi and 5G Wi-Fi separately through wireless. Please note that PC2 and PC3 can reside on the same PC. The PC2 or PC3 should consist of at least a 2GHz CPU, 4GB DDR2 or DDR3 with speed greater than 667MHz or better (PC5300) and prefer to be desktop rather than notebook.



3.2 P1020 Access Point (AP) Wi-Fi Performance Test Procedures

1. On PC1, start Teraterm which uses PC RS232 serial port with 115000 bps, no parity, 1 stop bit.
2. On PC1, set up IP address as 192.168.1.54 by following the instructions given below:

- On Windows XP, select **Start > Settings > Network Connections > Local Area Connection**.
 - Now, select **Internet Protocol (TCP/IP)** and click **Properties** button.
 - Click **Use the following IP address** radio button and type IP address as 192.168.1.54, and subnet mask as 255.255.255.0
 - Click OK.
 - Click OK.
3. Power up the DUT P1020 , you should see some messages scrolling on Teraterm on your PC.
 - The u-boot starts executing.
 4. On Teraterm, when the message stop and '='>'is on, type '**pri**' to check for the environment variables. Make sure that the server IP is 192.168.1.54, Gateway is 192.168.1.1, and the IP address is 192.168.1.6.
 5. On PC1, open Windows Explorer, go to the directory consisting P1020 images and tftpsrv.exe code, run the tftpsrv.exe by double-clicking it.
 6. On Tereterm, when the message stop and '='>'is on, run the giving macro script to flash the system
 7. It will take a minute or so to boot up P1020.
 8. When P1020 booting is done, the wifi cards should already be initialized and ready to use. Go to GUI to change channel and PHY mode.
 9. For the command line mode, one can run following command to establish 5GHz communication

```
>ath_mod down
```

```
>ez_start Example5G 40:11NAHT40MINUS:0
```

Please see appendix [4.1 Atheros Wi-Fi User Guide](#) for 2.4G setting.

10. You will see messages scrolling again.
11. When messages stop, go to the other PC2/3 that has the Atheros client and connect to SSID of Example5G.
12. On the client PC2/3, run c:/download/wlan/32bit/WLANMON.bat to show the status of connection and other available channels.
13. The WLANMON program is optional, skip the above step if you don't have Win7. Use the equivalent WiFi Monitor Application such as IntelPro Wireless monitor. See following link http://www.intel.com/network/connectivity/products/wireless/proset/tools_software.htm.
14. Enter PING 192.168.x.x to ensure fast response of 1ms or 2ms . The delay should be < 3ms and no long delay.
15. If there is long delay, do reboot and reset the system to get a better ping response time.

3.3 Detailed Configuration of the Ixchariot

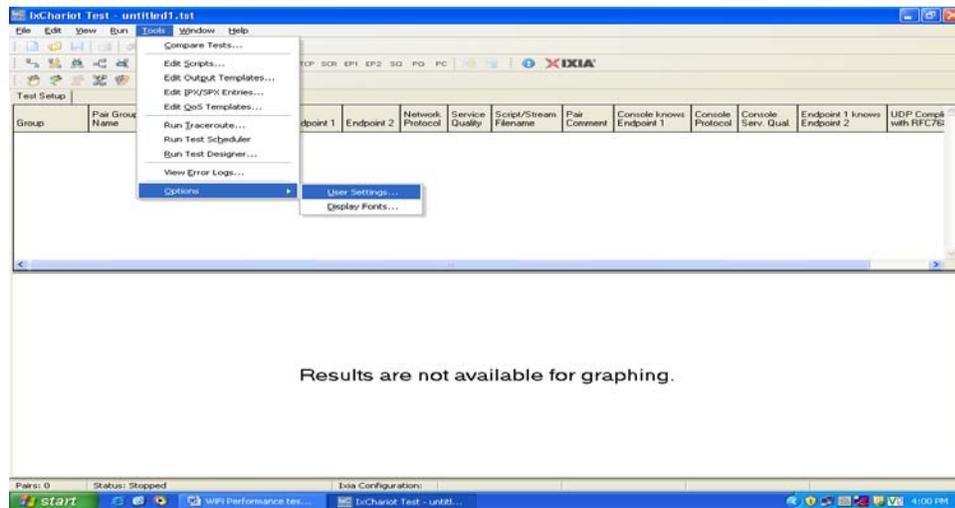
In the above figure, setup is done as listed below:

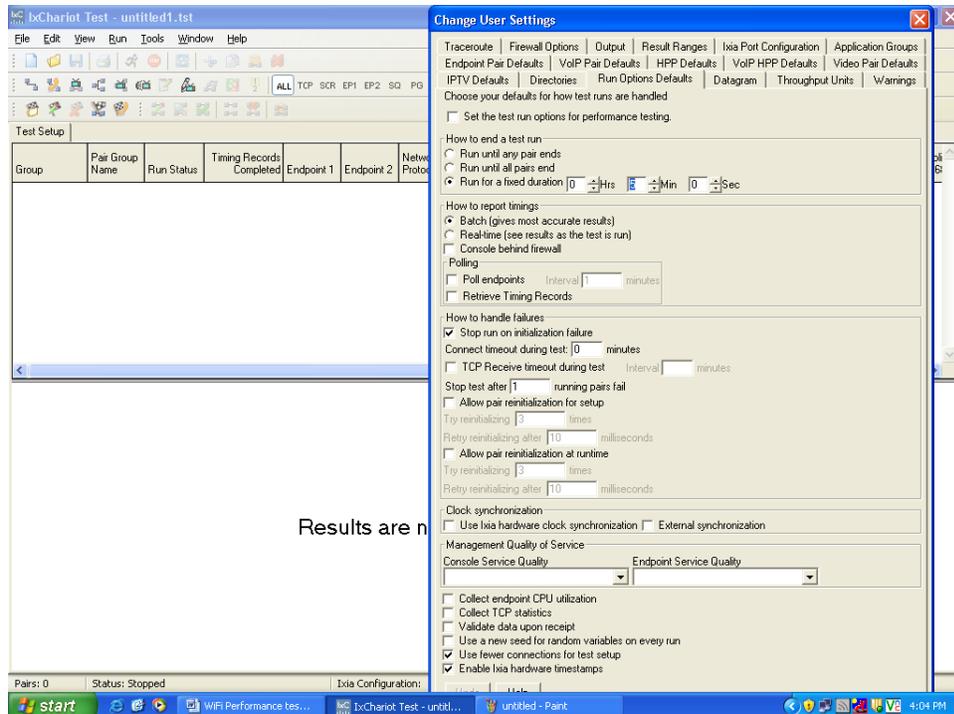
1. **PC1** LAN 1000Mbps is connected to LAN port of the DUT (P1020RDB) via CAT6 Gigabit Ethernet cables. IxChariot  should be installed in the host system.
2. DUT (P1020RDB) LAN is connected to **PC1** and WAN is connected to the Ethernet switch.
3. **PC2** is connected to the DUT (P10220RDB) via Wi-Fi 2.4G. IxChariot Endpoint  should be executed before testing. (Ethernet cable should be removed from PC2 if any before testing).
4. **PC3** is connected to the DUT (EWLAN) via Wi-Fi 5G. IxChariot Endpoint  should be executed before testing (Ethernet cable should be removed from PC2 if any before testing).

Note that PC2 and PC3 can reside on same PC.

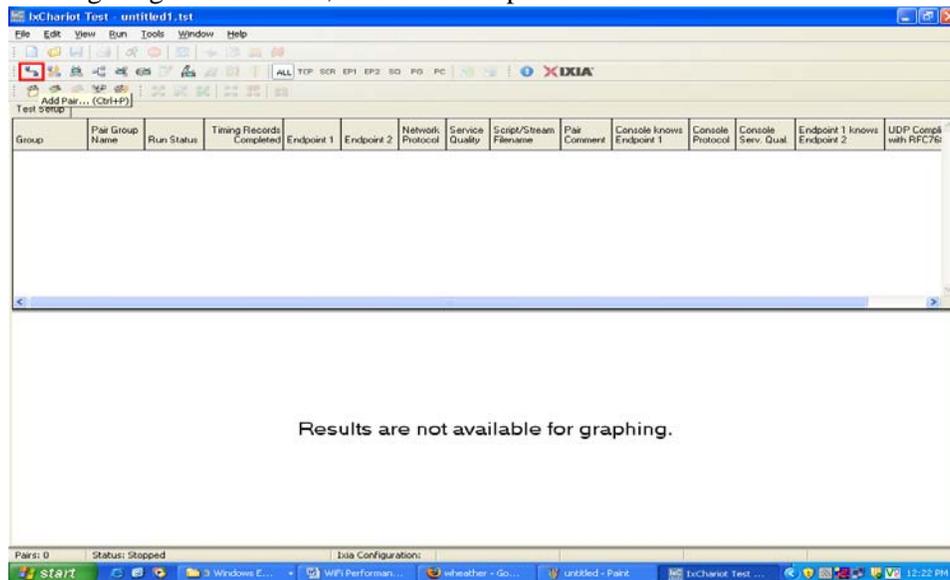
Once the setup is done, we can start configuring the IxChariot running in the host system PC1. Perform the steps given below to configure the IxChariot:

1. Run the IxChariot application by clicking the icon  in the desktop.
2. In open wrt, check for the IP address for each PC connected to the DUT (P1020RDB). **Network->DHCP.**
3. Identify the IP address for the HOST system. (System in which DUT (P1020RDB) LAN is connected).
4. The entire test performed is of 5min duration.
5. To configure your IxChariot and to run each test for 5min,perform the following steps:
 - From menu bar, select **Tools > Options> User** settings. A **Change User Settings** dialog box appears.
 - From the dialog box, select **Run Options Default** tab.
 - In the **How to end a test run** list select **Run for a fixed duration** and change the duration for 5min and click OK.

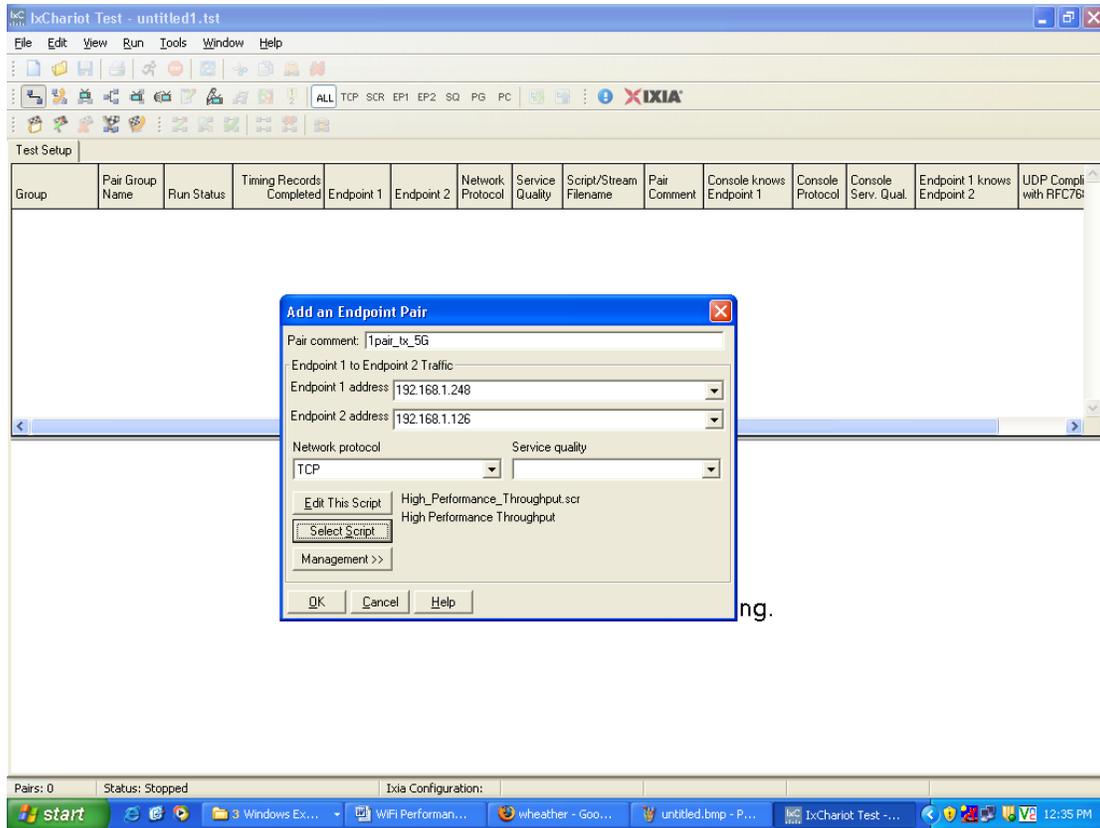




6. After configuring the IxChariot, select the add pair button.

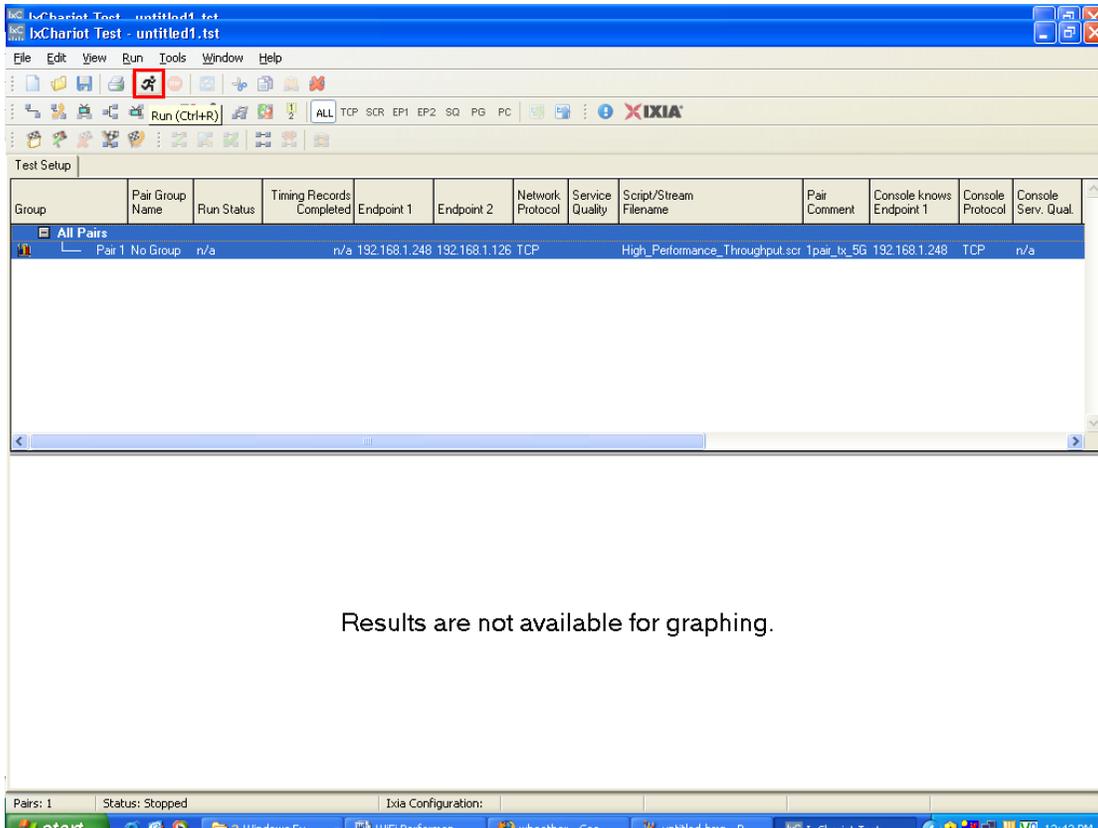


7. Once the add pair button is clicked the **Add an endpoint pair** dialog box appears.
 - a) Fill the **pair comment** with reasonable comment. Ex. **1pair_tx_5G**, which represents 1pair transmits in 5G mode.
 - b) Fill the **Endpoint 1 address** tab with **host IP address** for transmit and client address for receive.
 - c) Fill the **Endpoint 2 address** tab with **host IP address** for receive and client address for transmit.
 - d) Select the **Network protocol** as **TCP** and by clicking the **select script** button select the **High performance.scr** and click **ok** button.

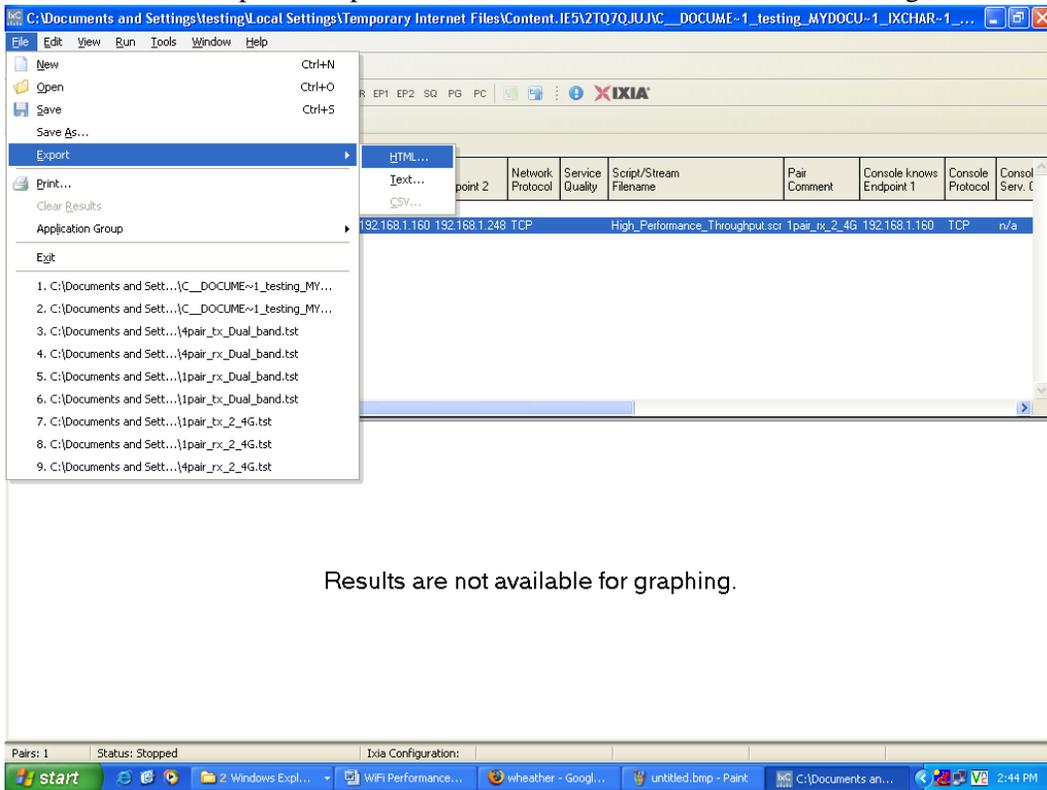


In this example, PC with IP address **192.168.1.248** is my host PC with which my DUT (P1020RDB) is connected in LAN port and IxChariot is installed. IP address **192.168.1.126** given in Endpoint 2 address tab is my PC2, which is connected with Wi-Fi 2.4G client.

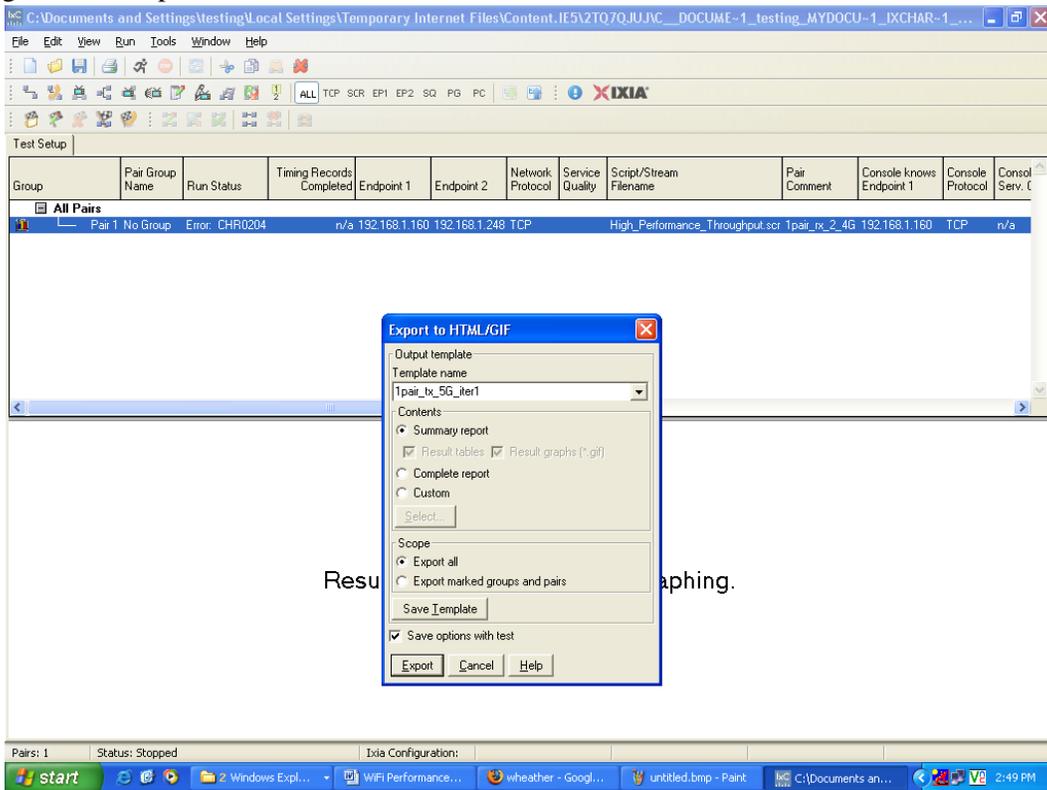
- Once the configuration is done click the **run** button to start the test.

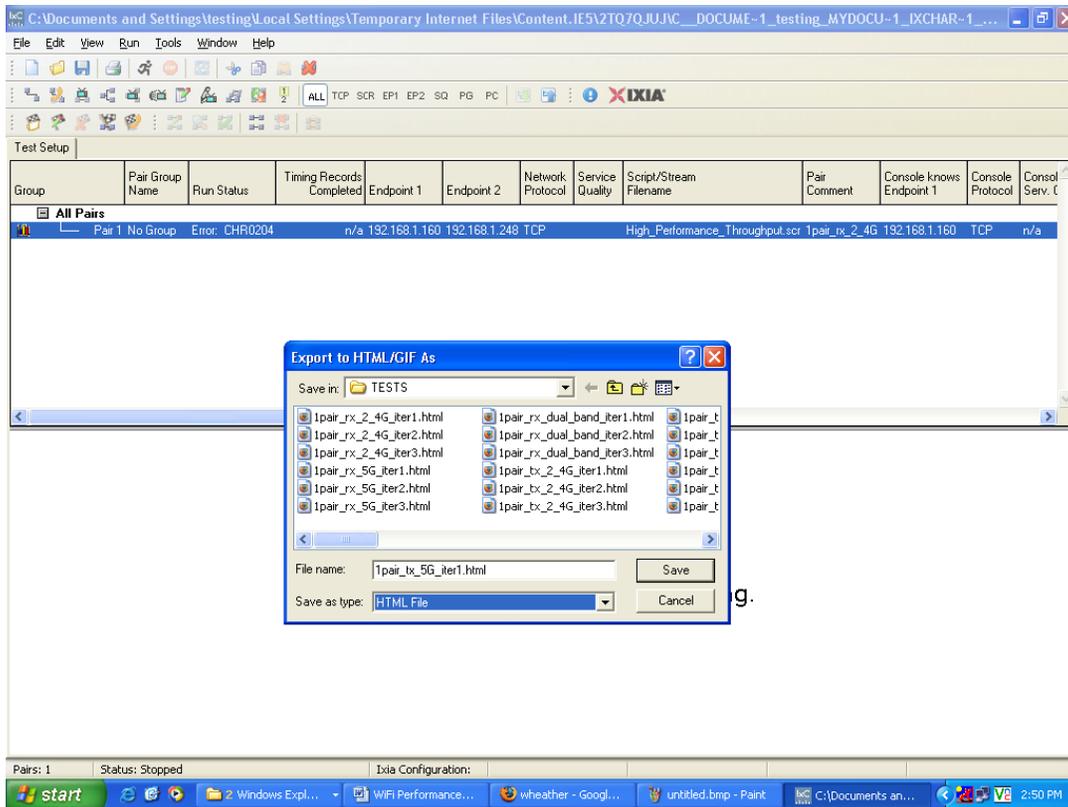


- Once the test is completed Export the file to HTML format as shown in the figure.



- Once we select **File->Export->HTML** an Export to HTML/GIF dialog box appears, enter the Template name field and click export to save the HTML file. Save the HTML file by the name given in Template name field.





3.4 Test Case Definition

Test case 1	Single band Wi-Fi performance (2.4G)
Test purpose	To Verify single band Wi-Fi Performance
<p>Test steps:</p> <ol style="list-style-type: none"> 1. Configure DUT to AP mode with Wi-Fi Card1 to 2.4G open 2. Connect EWALN LAN port to PC1 via CAT6 Gigabit Ethernet cables 3. Connect Wi-Fi client(Atheros XS114B) to PC2, connect PC2 to EWLAN 4. Running one pair setup (described on step5) 5. Setup a throughput test between PC1 and PC2 <p>(one endpoint pair for each direction: case1: PC1->PC2 (TX), case2: PC1<-PC2 (RX), case3 bi-direction: PC1<->PC2(TX+RX))</p> <ol style="list-style-type: none"> 6. After that, running four pairs setup(described on step7) 7. Setup a throughput test between PC1 and PC2 <p>(four endpoint pairs for each direction: case1: PC1->PC2 (TX),</p>	

case2: PC1<-PC2 (RX), case3 bi-direction: PC1<->PC2(TX+RX))		
Expected results:		
Test result:		
Test duration:	Tester:	Test location:

Test case 2	Single band Wi-Fi performance (5G)	
Test purpose	To Verify single band Wi-Fi Performance	
<p>Test steps:</p> <ol style="list-style-type: none"> 1. Configure DUT to AP mode with Wi-Fi Card2 to 5G open 2. Connect EWALN LAN port to PC1 via CAT6 Gigabit Ethernet cables 3. Connect WiFi client(Atheros XS114B) to PC3, connect PC3 to EWLAN 4. Running one pair setup (described on step5) 5. Setup a throughput test between PC1 and PC3 (one endpoint pair for each direction: case1: PC1->PC3 (TX), case2: PC1<-PC3 (RX), case3 bi-direction: PC1<->PC3(TX+RX)) 6. After that, running four pairs setup(described on step7) 7. Setup a throughput test between PC1 and PC3 (four endpoint pairs for each direction: case1: PC1->PC3 (TX), case2: PC1<-PC3 (RX), case3 bi-direction: PC1<->PC3(TX+RX)) 		
Expected results:		
Test result:		
Test duration:	Tester:	Test location:

Test case 3	Dual card dual band Wi-Fi performance	
Test purpose	To Verify dual card dual band Wi-Fi Performance	

Test steps:

1. PC1020RDB with 2 Wi-Fi Card installed
2. Configure DUT to AP mode with Wi-Fi Card1 to 2.4G open and Wi-Fi Card2 to 5G open
3. Connect EWALN LAN port to PC1 via CAT6 Gigabit Ethernet cables
4. Connect Wi-Fi client(Atheros XS114B) to PC2, connect PC2 to WiFi card1
5. Connect Wi-Fi client(Atheros xs114B) to PC3, connect PC3 to WiFi card2
6. Running one pair setup(described on step7)
7. Setup a throughput test between PC1 and PC2 , PC1 and PC3
(one endpoint pair for each direction:
case1:PC1->PC2(TX), PC1->PC3(TX), running simultaneously,
case2:PC1<-PC2 (RX), PC1<-PC3 (RX), running simultaneously,
case3 bi-direction:PC1<->PC2(TX+RX) , PC1<->PC3(TX+RX), running simultaneously,)
8. After that, running four pairs setup(described on step9)
9. Setup a throughput test between PC1 and PC2
(four endpoint pairs for each direction:
case1:PC1->PC2(TX), PC1->PC3(TX), running simultaneously,
case2:PC1<-PC2 (RX), PC1<-PC3 (RX), running simultaneously,
case3 bi-direction:PC1<->PC2(TX+RX) , PC1<->PC3(TX+RX), running simultaneously,)

Expected results:

Test result:

Test duration:

Tester:

Test location:

NOTE

1. In the GUI's Network Wireless page , set the channel for 2.4G as 4 or other channel such as 7, and 48 or other channels such as 153 for 5G mode. The user must replace these channels by actual unused channels with high connection speed as shown by WLANMON that the user installed on the PC.
2. Adjust your antennas position and find the best performance position.

4 Appendices

4.1 Atheros Wi-Fi User Guide

From serial window, hit any key to stop autoboot, then run ramboot (download atheros module from tftp server).

Directions:

Run the “ez_start” script, which has a format like this:

```
./ez_start <SSID> <Channel_Str>
```

The <SSID> is a 32 character string

The <Channel_str> has a format of <channel:mode:interface>

Where,

- **channel** is the IEEE channel number,
- **mode** is the phy mode, some examples of valid data are 11NGHT20, 11NAHT20, 11NGHT40PLUS, 11NGHT40MINUS, 11NAHT40PLUS, 11NAHT40MINUS, etc. Using mode 40 is preferred since it can allow high link speed attained e.g. 450Mbps.
- **interface** represents the physical interface. If you have only single device then this value will always be 0. If you have two devices then the values map out as follows on the current BSP:

0 = (wifi0) is the device in the PCIe slot

1 = (wifi1) is the device in the mPCIe slot

For example:

```
./ez_start ExampleStart2G 1:11NGHT20:0
```

This will start the interface on channel 1 in HT20 mode in the 2G band, advertising the SSID of ExampleStart2G.

User must assign actual channels that are unused channels with high connection speed as indicated by the WLANMON PC software application installed by the user

If you have dual systems you need to run it again for the other interface, for example:

```
./ez_start ExampleStart5G 48:11NAHT40MINUS:1
```

This will start the interface on channel 1 in HT40 mode in the 5G band (channel 48 = control & 44 = extension), advertising the SSID of ExampleStart5G

Ethernet Bridging:

All the Ethernet devices (eth0, eth1 & eth2) are members of a single bridge (br0)

IP Addressing:

The IP address of the AP is 192.168.1.2. It does support a DHCP server.

4.2 Symptoms and Solutions

Symptoms	Solutions
No ping between P1020RDB and PC through ethernet cable	1.Check P1020RDB serverip 2.Set PC IP to match serverip
No file transfer while run ramboot	Make sure running the tftpsrv.exe in the image directory
Wifi Card not boot	Correct mPCIe or PCIe connection sitting position.