QUALCOMM®
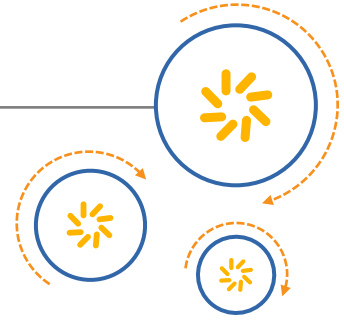
Qualcomm Atheros, Inc.

Use QDART Connectivity to Test QCA9984/QCA9994/QCA9886/QCA95XX

Application Note

80-Y8050-46 Rev. G

February 29, 2016

Revision history

Revision	Date	Description
A	June 2015	Initial release
B	July 2015	Numerous updates were made to the document.
C	October 2015	Added the details related to QCA9886. QCA9886 is a 2x2 QCA9994 like product.
D	October 2015	Updated Section 2.6 to include the details related to QCA9531 and QCA9561 products.
E	December 2015	Minor changes throughout document
F	January 2016	IQxel 160 connection with QCA9984 update
G	February 2016	▪ Updated Section 1, Introduction: Added Figure 4 ▪ Added Section 3, IQxel EVM Test Notes

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1 Introduction

The QCA99xx with VIVE™ 802.11ac technology is a highly integrated WLAN System-on-Chip (SoC) for 5 GHz 802.11ac or 2.4/5 GHz 802.11n WLAN applications. The QCA9984/ QCA9994/ QCA9886 dual-synthesizer WLAN radio supports 160 MHz and 80+80 MHz, while the QCA9980/QCA9990 single-synthesizer WLAN radio supports 80 MHz.

The 160 MHz or 80+80 MHz signal comes from two separate RF ports, with one 80 MHz coming from chain 1 the other from chain 2. A cable connection for the single stream test uses a 4-to-1 combiner between 4 RF connectors on CUS239 and the single RF test port of the tester. The QCA9886 only supports a 2x2 RF test port; its cable connection for a single stream test uses a 2-to-1 combiner between two RF connectors on the QCA9886 and a single RF test port on the tester.

Two testers are needed for the 2-stream test. Use a 2-to-1 combiner to combine the 2 RF ports for 1-stream and connect to one tester. Use another 2-to-1 combiner to combine the remaining two RF ports for the second stream, and then connect to the second tester.

Figure 1-1 shows the DUT in the test setup: CUS239 PCIE module, PCIE adapter board for 3.3V/5V power source and PCIE BUS.
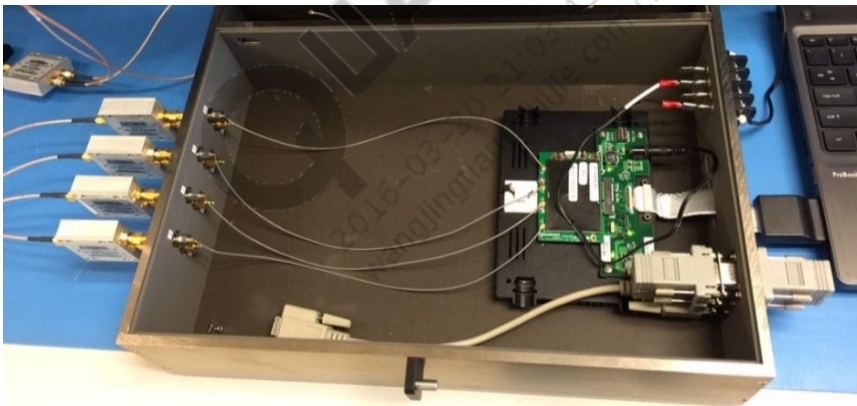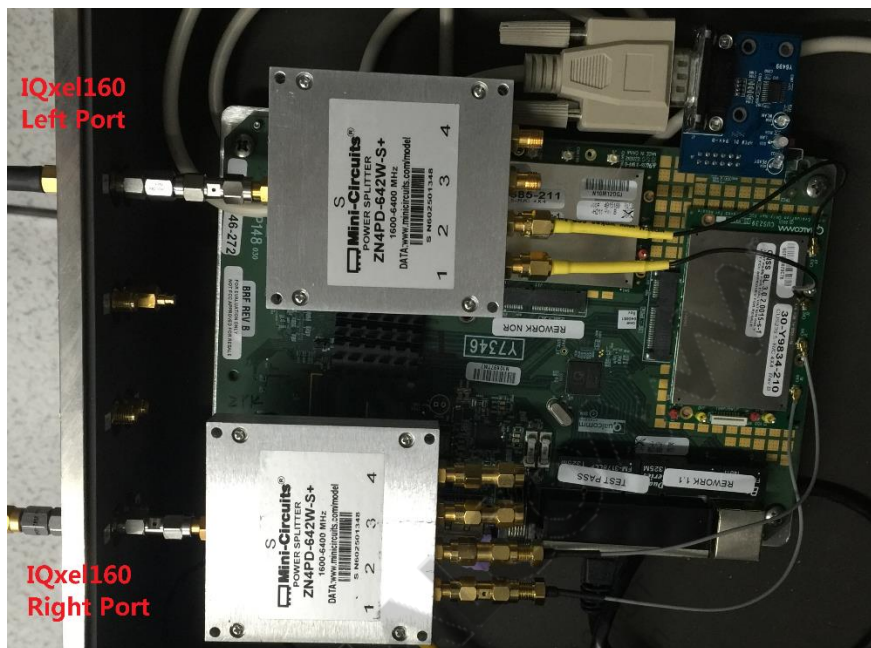

Figure 1-1 DUT: Wi-Fi module plugged in PC

Figure 1-2 shows the DUT plugged into the access point

Figure 1-2 DUT: Wi-Fi module plugged in AP

To get better EVM for 80+80MHz, Litepoint suggests that the correct connection should be set up as shown in Figure 1-3:

Figure 1-3 QCA9984: Wi-Fi module connection with IQxel160

Information in this document can be used to convert the QCA9980/QCA9990 (80 MHz) test setup to the QCA9984/QCA9994/QCA9886 (160 MHz or 80+80 MHz) test setup. The DUT is CUS239 PCIE module. Use these documents to get started if you do not have a test setup for QCA9980/QCA9990.

80-Y8050-1	*QCA99xx QDART Connectivity User Guide*
80-Y8050-17	*QCA99XX QDART Connectivity Laptop Setup And Checklist Application Note*
80-Y8050-19	*QCA9980/QVA9984 QSPR Calibration Process Application Note*
80-Y8924-54	*QCA99xx QDART-CONN Training*

2 Changing the QCA9980/QCA9990 test setup to QCA9984/QCA9994

This section describes the steps to change the QCA9980/QCA9990 test setup to QCA9984/QCA9994.

2.1 Prepare the PC

Change the PC to test mode:

1. Right-click on the Command prompt, then click Run as administrator.

2. In the Command prompt window, enter the command

   `Bcdedit.exe -set TESTSIGNING ON`

3. Close the Command prompt window.

4. Restart the computer. After restart, *Test Mode* should be displayed in the bottom right of the screen.

2.2 Prepare the tester

The Wi-Fi RF test vendors (Litepoint, National Instrument, Anritsu, and Keysight) can be contacted directly for the latest status about the capability of their Wi-Fi tester and the technical support to have tester configured correctly for 802.11AC 160 MHz. This section uses Litepoint IQxel as an example for QCA9984/QCA9886 Wi-Fi test.

Change tester from Litepoint IQxel_80Mhz to Litepoint IQxel_160MHz. Upgrade Litepoint IQxel_160MHz with the latest firmware. Use Chrome browser to access IQxel web-based setup interface, such as 192.168.100.254. (Other browsers like IE and Firefox might find it difficult to load the library file.) Use these instructions to update library and upload new waveforms:

1. Clean old library.

   a. Go to Tools > SCPI Console and type command:

      `TFC:LIBR:MEM:LIBR:USER:PREL:LIST?`

      If response is "none", it means no previous installed library. If response shows a name of library, uninstall it before installing a new one.

   b. To uninstall old library, go to Tools > SCPI Console and type command:

      `TFC:LIBR:UPR:UNIN:ALL.`

   c. Power cycle tester.

      After power cycle, use command `TFC:LIBR:MEM:LIBR:USER:PREL:LIST?` to make sure no library is installed.

2. Upload library file to tester.

    a. Open tester's GUI in browser and go to File > File Browser > LIBRARY > Upload. Choose LitePoint_QTI_Scpi_Library.js as shown in Figure 4.
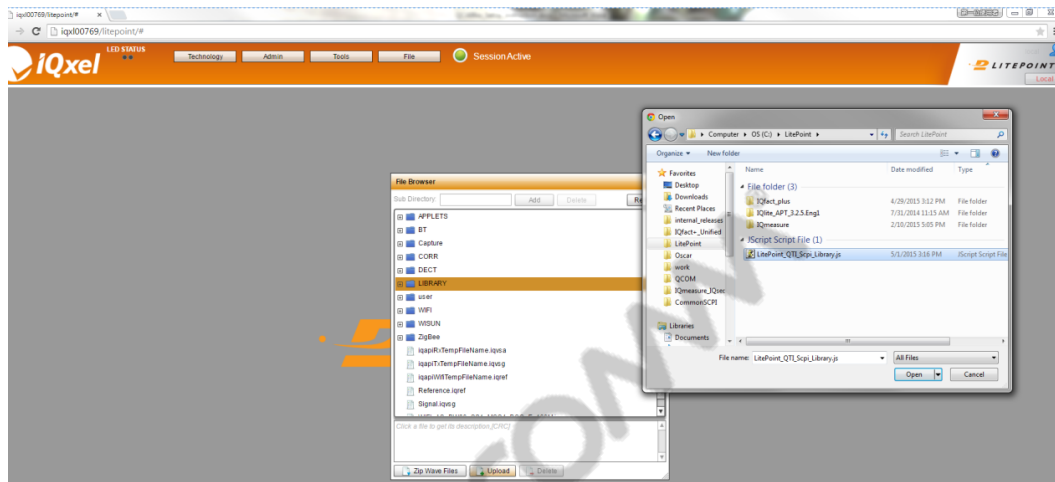
Figure 4 Upload library file

3. Install library
    a. Go to Tools > SCPI Console
        In SCPI Console, type command:
   `TFC:LIBR:UPR:INST:ENCR "LitePoint_QTI_Scpi_Library.js"`
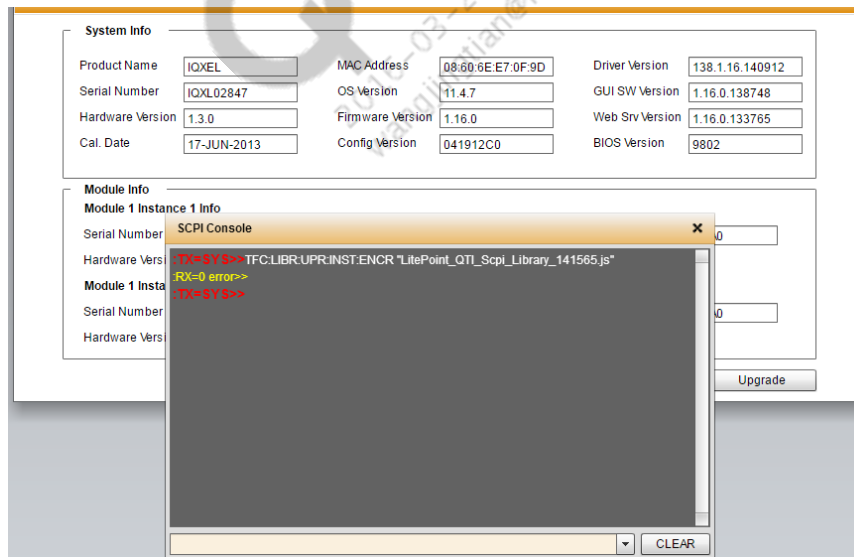
    b. Power cycle tester

4. Check if library is installed successfully.
    a. Go to Tools > SCPI Console.

5. In the SCPI Console, type command: `TFC:LIBR:MEM:LIBR:USER:PREL:LIST?`
    a. If response is "LITEPONT QTI SCPI LIBRARY", the library is installed successfully.
    b. In SCPI Console, type command `LITEpoint:LIBRary:VERSion?` to make sure library version is the one that you installed.

6. Upload waveforms

a. Go to File > File Browser > user > Upload and choose all waveforms in iqvsg folder in the package. This step will upload selected waveforms to the user folder in tester's memory.
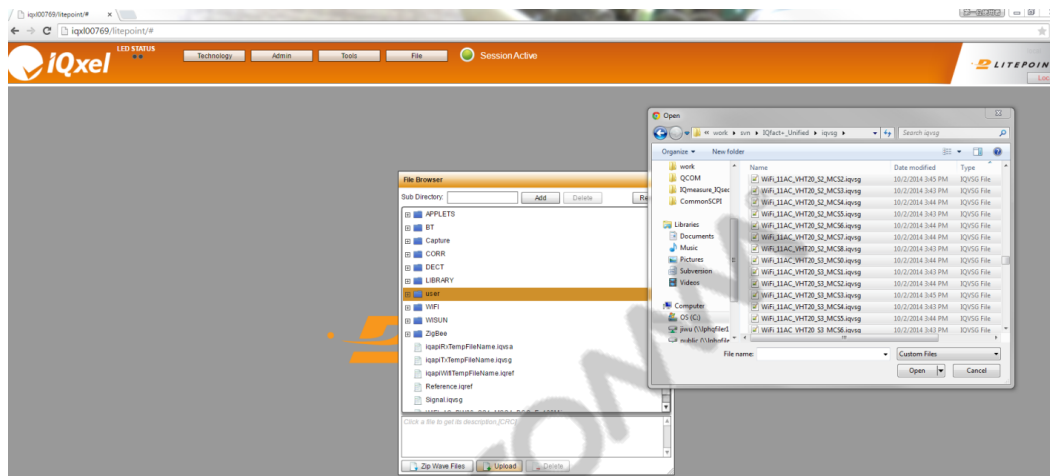
2.3 Set the DUT with the correct driver

DUT can be a Wi-Fi module plugged in PC with Windows OS or AP (Access Point) with Linux OS.

2.3.1 DUT with FTM Windows driver

Delete old QCA9980/QCA9990 FTM Window driver to install QCA9984/QCA9994 FTM Windows driver. Before installing QCA9984/QCA9994 driver and QCA9980/QCA9990 driver has been installed already.

1. Plug QCA9980/QCA9990 card, go to Device Manager > Network adapter > QC99xx property and click uninstall.

2. From command prompt, regedit go to HKEY_LOCAL_MACHINE > SYSTEM > CurrentControlSet\services, then delete qcamain entry, reboot the system.

3. Install FTM driver.

4. Copy firmware and BDF.
   Copy utf_AR9984.bin, utf_AR9984_codeswap.bin, otp_AR9984.bin and fakeBoadData_AR9984.bin to **C:\Windows\System32\drivers**.

5. Plug QCA9984/QCA9994 card.

NOTE: For any Qualcomm® certificate issue, copy \FTM-Driver\Qca9900x64.sys to C:\Windows\System32\drivers unplug and re-plug.

2.3.2 DUT with Linux driver

IPQ8064.ILQ.3.0 release will include driver for QCA9984 driver. For example, AP161 has QCA9984-based reference boards CUS239/CUS260 plugged in. Firmware and BDF for Wi-Fi is located under /lib/firmware/QCA9984/hw.1 inside AP file system.

QCA9886.ILQ.1.0 release will include driver for QCA9886 driver. For example, AP147/AP151/AP152 has QCA9886 mounted on board. Firmware and BDF for Wi-Fi is located under /lib/firmware/QCA9888/hw.1 inside AP file system.

2.4 Install the RF test tool with the control PC

Delete old QDART and QDART Connectivity. Install the latest QDART Connectivity.

1. Uninstall any existing QDART.

2. Remove or rename two folders: C:\Program Files (x86)\Qualcomm and C:\Qualcomm.

3. Install QDART_CONN.WIN.1.0 Installer.

2.5 Run the latest test tree for QCA9984/QCA9994/QCA9886

The notebook and tester are ready for RF test.

If DUT plugged in PC, power on DUT, Wi-Fi device should be shown under device manager as a network device. If DUT plugged in AP, follow the below commands to get DUT ready:

`/etc/init.d/qcmbr start`

After above the command there will be two Qcmbr process appear by 'ps'if two radios been inserted or one Qcmbr process if one radio been inserted as the following.

`/usr/sbin/Qcmbr -instance 0 -pcie 0`
`/usr/sbin/Qcmbr -instance 1 -pcie 1`

Run QSPR and load test tree for CUS239.

Load the tester configure file for 160 MHz model as shown:
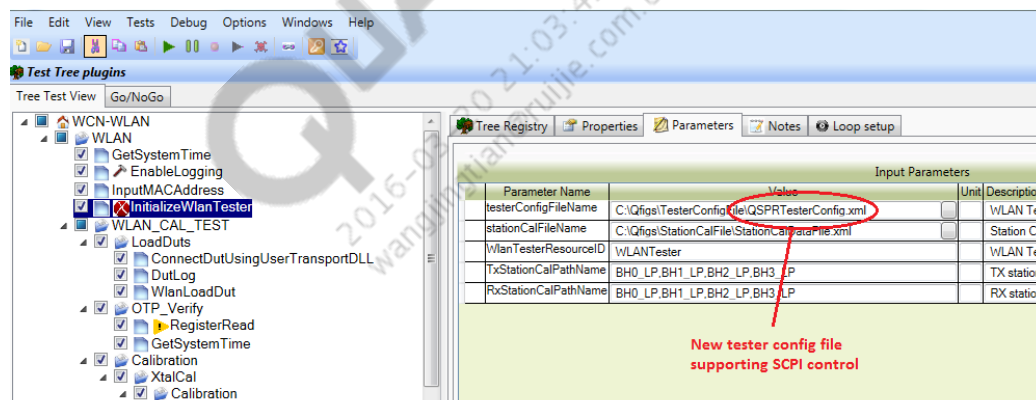
Modify DUT port as 127.0.0.1 if DUT plugged in PC, and change the port to 192.168.1.1:2390 if plugged in an AP first PCIE slot with IP 192.168.1.1.
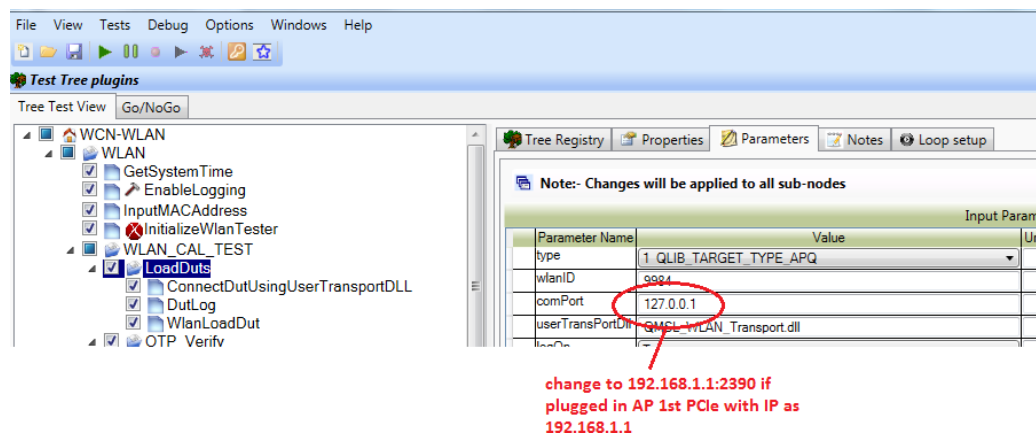
These screen shots are from a sample test tree with 160 MHz Tx settings.

This figure shows the Tx signal from spectral analyzer with 160 MHz band width:

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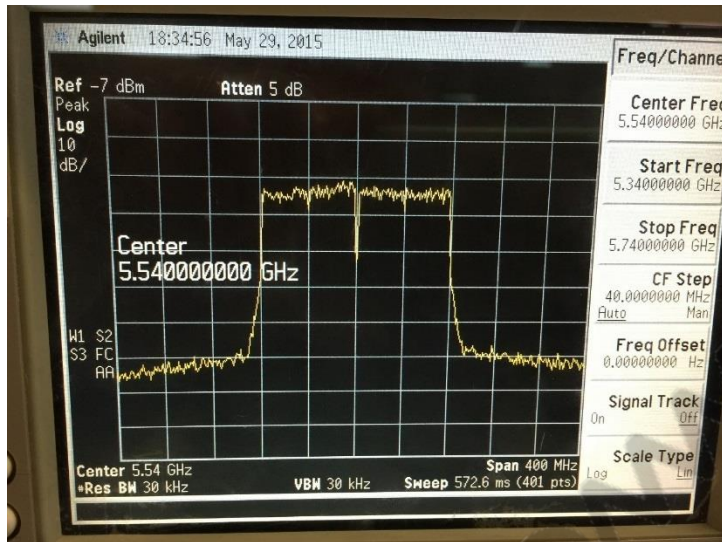
NOTE: When CUS239/CUS260 are tested with AP161, driver for Wi-Fi will be the part of AP image. Test tree will have DUT with port as 192.168.1.1:2390 or 192.168.1.1:2391 (take the AP IP address 192.168.1.1 for an example), instead of 127.0.0.1 for the PCIE module.

2.6 Run the latest test tree

In a QCA9886 release (for example, QCA9886.ILQ.1.x), QCA9886 is the onboard 802.11ac 5 GHz radio and QCA9531/QCA9561 acts as 2 GHz radio.

Use the details in this section to run the test tree on QCA9531/QCA9561.

Preparation

1. Make sure the AP firmware is up-to-date by latest QSDK release build
   a. After flashing the image and system boot up, type command below in platform console to run the NART program on DUT:
      /etc/init.d/art start
   b. The nart.out process appears after using the command **ps**:
      /usr/sbin/nart.out -instance 0 -console

2. On the PC side:
   a. Install the latest QDART Connectivity
   b. Install the latest QDART_WPSP.WIN.1.0

3. **QcmbrNart.exe** installs in the directory **c:\Program Files (x86)\Qualcomm\QDART\bin**; the program translates the Qcmbr command to a NART command

4. Go to the reference design folder:
   □ (QCA9531) **20-Y5935-H4**
   □ (QCA9561) **20-Y7402-H4**

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5. Go to the test tree for the hardware reference HDK:

    □ (QCA9531) **AP.HB03.1-Honeybee+Besra_IQxel_date.xtt**

    □ (QCA9561) **AP.DF03.1-Dragonfly+Besra_IQxel_date.xtt**

    a. Copy this downloaded reference design folder to
   **C:\Qualcomm\WCN\ProdTests\refDesigns** and assign the path in test tree item
        WlanLoadDut accordingly.
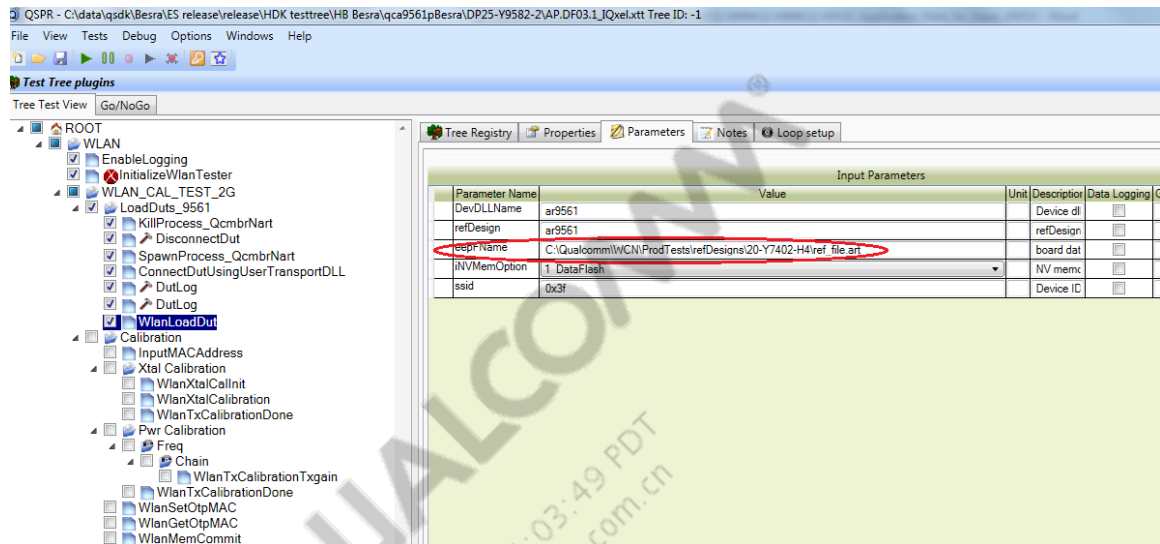
   b. Assign comPort IP 127.0.0.1 to the test item **ConnectDutUsingUserTransportDLL**.
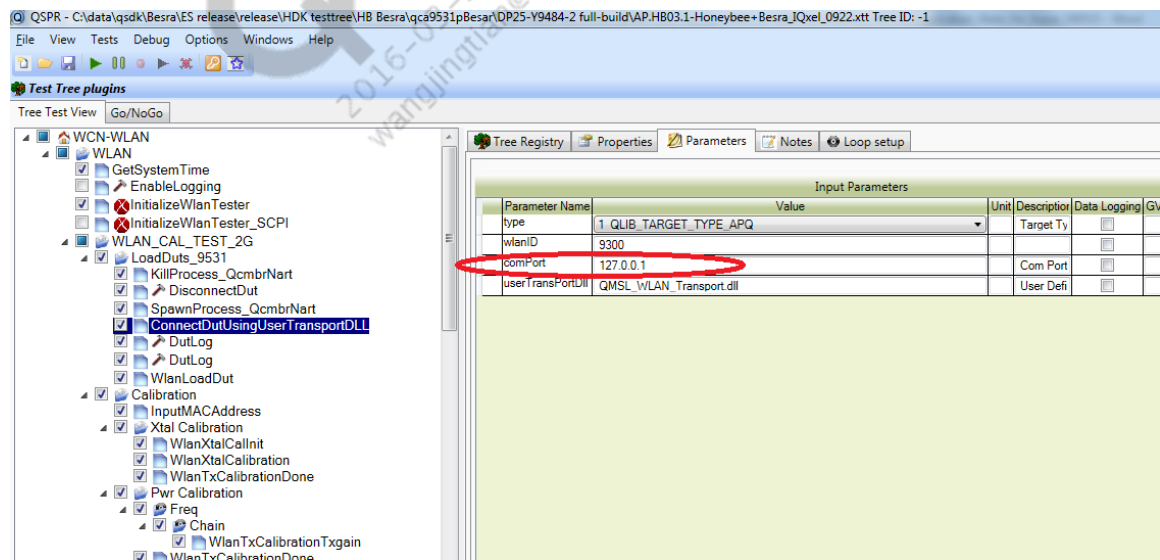
    c. Assign these attributes to the test item **SpawnProcess_QcmbrNart**:

        ● Set file name to **QcmbrNart.exe**

        ● Set the directory to C:\Program Files (x86)\Qualcomm\QDART\bin, where
           QcmbrNart.exe is located

        ● Set the argument to **-dutIP 192.168.1.1:2390**, where dutIP is the IP address of the DUT
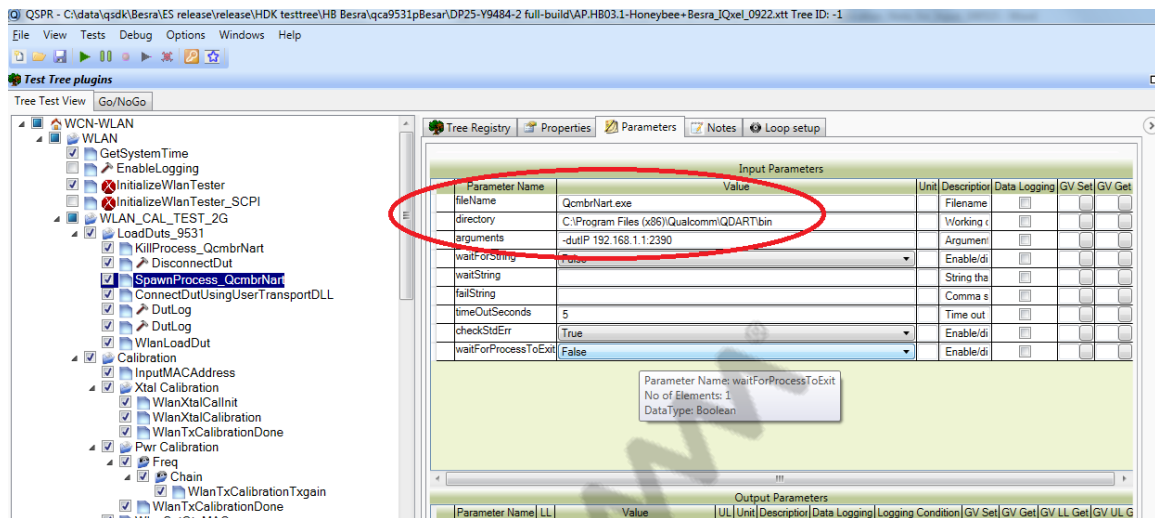
6. Go to the reference design folder:
   □ (QCA9531) **20-Y5935-H4**
   □ (QCA9561) **20-Y7402-H4**

7. Go to the test tree for the hardware reference HDK:
   □ (QCA9531) **AP.HB03.1-Honeybee+Besra_IQxel_date.xtt**
   □ (QCA9561) **AP.DF03.1-Dragonfly+Besra_IQxel_date.xtt**

8. Start test tree run. Check the icon is as shown:
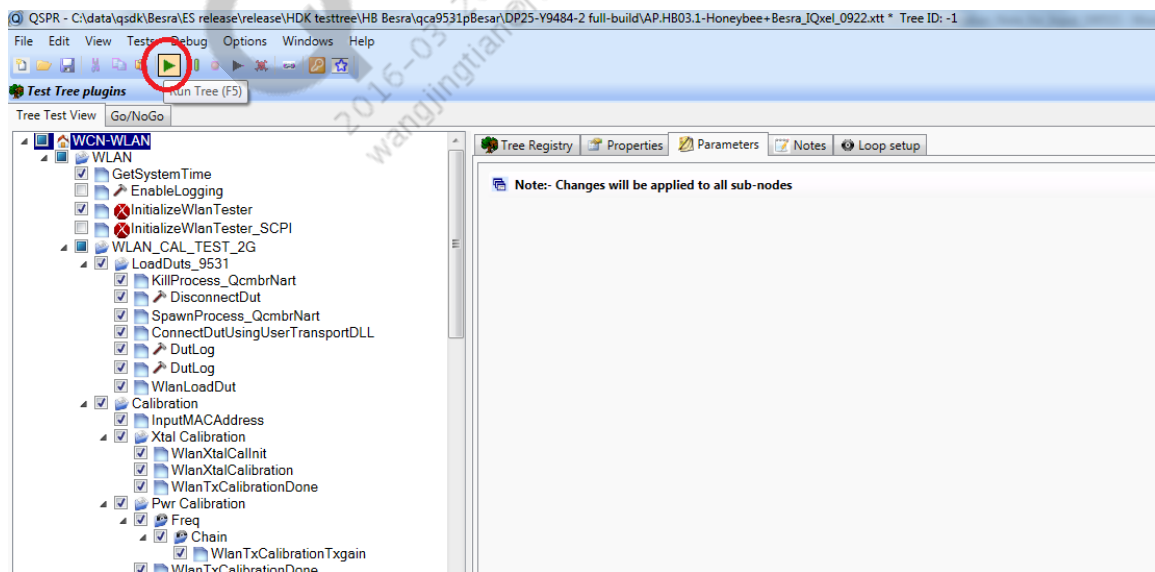
3 IQxel EVM Test Notes

EVM results are affected by non-calibrated IQxel:

These figures were taken from the same DUT with two different LPs: past calibration due date (bad) and with valid calibration (good). The EVM floor is ~1.5 dB worse on the bad tester than on the good tester.

A sticker is placed on each Litepoint tester showing the due date for calibration. For example, when testing in February 2016:

If the due date is Oct, 2014 then the tester will show bad EVM (see Figure 3-1). In this case the tester should be sent to Litepoint for recalibration.

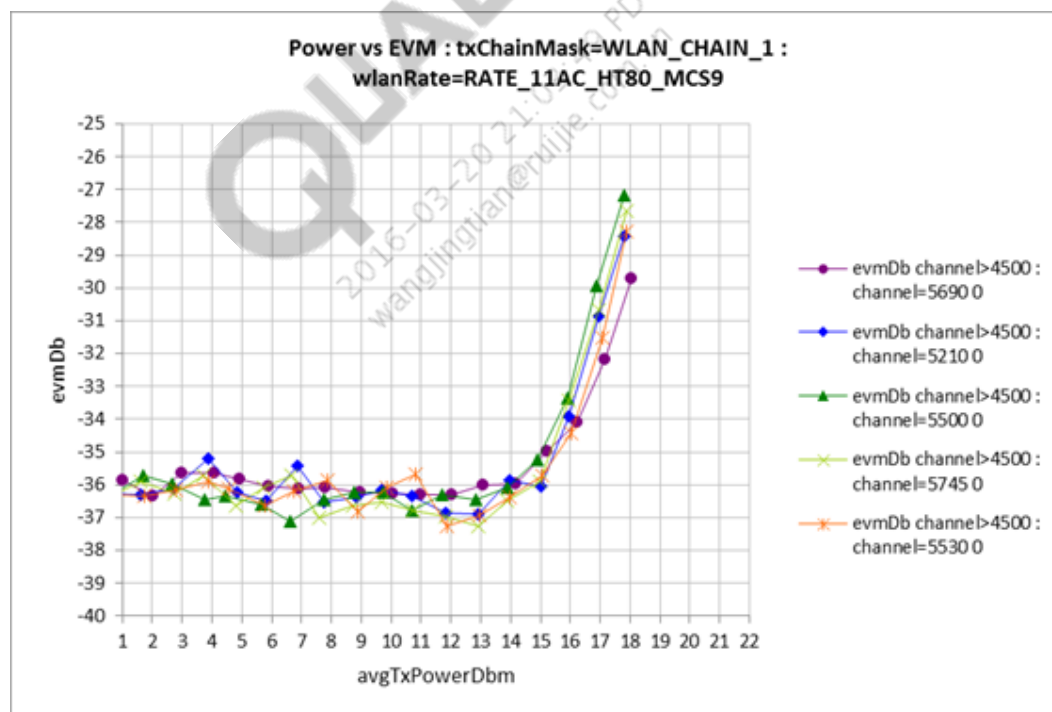If the due date is May, 2016, then the tester is good (see Figure 3-2) for use with the TX EVM test.

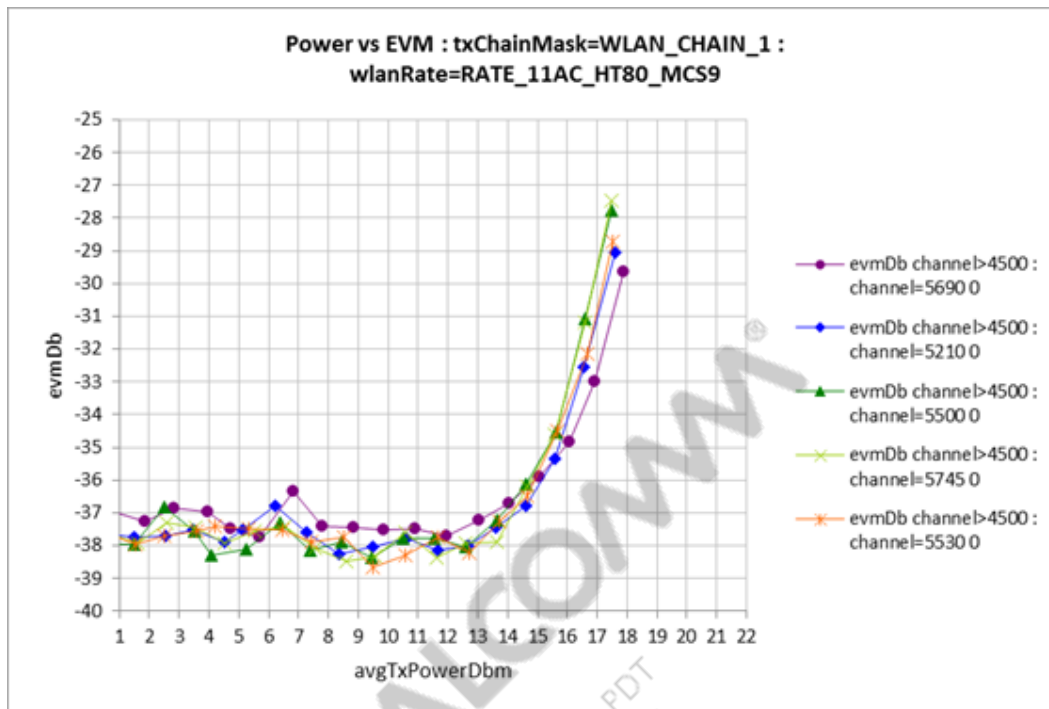**Figure 3-1 LP calibration out of date**

Figure 3-2 LP calibration in good range

EVM is affected by the different cable connection:

After some experiment and clarification with Litepoint. The following is the only recommend connection for the case using one IQxel-160 to test 80+80MHz mode.
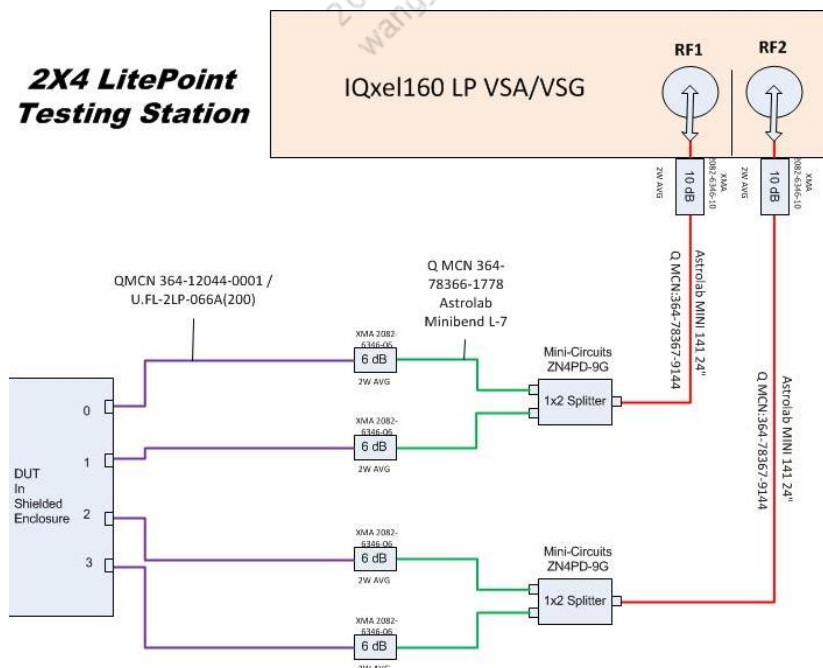

Figure 3-3 EVM is affected by the different cable connection

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