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Qspark DPD test guide

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Contents

Revision History

Version v01r01
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Initial version

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Package contents

The package contains the following files and folders:

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|- instructions.pdf              this file
|- dpd_test                      tested version of LimeSuite
  |- dpd_test/build/bin/Ban1Setup.ini   LMS7 configuration file for DPD tests
  |- dpd_test/build/bin/Band1C.ini2     RF-qSpark v1.0 configuration file for DPD tests
  |- dpd_test/build/bin/lms7suite_wfm/wcdma_scale_075.wfm waveform file
|- gateware                      Gateware files
  |-bitstreams                   Compiled bitstrem files
  |-project                      Quartus Prime 16.1 project archive
|fx3                             FX3 MCU files
  |-drivers                      FX3 drivers
  |-firmvare_img                 Compiled image
  |-software                     CyControl software to program FX3
```

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Required PCB modifications

1. Required **RF-qSpark v1.0** PCB Modifications:
   1.1. Change IC68, IC69 to NCV59152DSADJR4G
   1.2. Remove R234 and solder R249 (2.2k, can be used removed resistor).
   1.3. Add 10 k pull up for FPGA_SPI0_POT1_SS_5P0 line. Solder this resistor to IC19 pin 1 and 14.
   1.4. Solder R177 resistor (0 OHM).
   1.5. Solder R317 resiztor (0 OHM).
   1.6. Remove R319 resistor.

2. Required modifications to connect external DAC to LMS1:
   2.1. R208, R212, R216, R220, R211, R215, R219, R222 resistors has to be removed.
   2.2. R207, R210, R214, R218, R209, R213, R217, R221 resistors (0 OHM) has to be fitted.

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Board programming

1. FX3 has to be programmed first:
   1.1. Connect USB3.0 cable
   1.2. Remove “FX3 FLASH BOOT” jumper J31.
   1.3. Reset FX3 MCU with “FX3 RST” button SW1
   1.4. Place “FX3 FLASH BOOT” jumper J31.
   1.5. Open \fx3\software\CyControl.exe
   1.6. Select Cypress USB BootLoader
   1.7. Program .img file from \fx3\firmware_img directory by selecting Programm→FX3→SPI Flash
   1.8. Reset FX3 MCU with “FX3 RST” button SW1.

2. Program FPGA using Quartus Programmer and JTAG cable with .sof or .jic file (Option A):
   2.1. From Quartus software select Tools→Programmer
   2.2. Click “Add File...” button, select .sof or .jic file from \gateware\bitstreams location
   2.3. Click “Start button”

3. Program FPGA using LimeSuiteGUI (Option B):
   3.1. Connect to 'qSpark v1.0' board. In menu bar select 'Options→Connection Settings'. Pop-up dialog should appear.
   3.2. Select the device 'USB 3.0 RF-qSpark' in both LMS7 control and Stream Board dialogs. Click at 'Connect' button.
   3.3. Select 'Modules→ Programming'
   3.4. Select Device: Altera FPGA, Programming mode: Bitstream to Flash
   3.5. Open **.rpd** file from \gateware\bitstreams location, click program.

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LimeSuiteGUI installation

1. Use source code provided in 'dpd_test' folder.
2. Follow instruction provided in LMS7002 GUI compilation guide, which is located in dpd_test/docs/lms7suite_compilation_guide.pdf'

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Running DPD test on qSpark v1.0 board

1. Connect the LMS7002#1 output port TXRF1_A to **qSpark v1.0** on-board Skywork amplifier input named PA1 IN1

2. Connect the on-board **qSpark v1.0** power amplifier output PA1 OUT to power 20 dB coupler input connected to spectrum analyzer input

3. Run LMS7002 GUI with administrator privileges.
   sudo ./lms7suite

4. Connect to '**qSpark v1.0**' board:
   4.1. In menu bar select 'Options→Connection Settings'. Pop-up dialog should appear.
   4.2. Select the device 'USB 3.0 RF-qSpark' in both LMS7 control and Stream Board dialogs. Click at 'Connect' button.

5. Configure '**qSpark v1.0**' board:
   5.1. In menu bar select 'Modules→QSpark'. 'QSpark Controls' dialog should appear.
   5.2. In 'Controls', press 'Read settings', the file select dialog box is opened, then select 'Band1C.ini2' file that comes with this package, containing the **qSpark v1.0** settings
   5.3. Click 'Configure'.
   5.4. Calibrate the chip LMS7002#1 changing the 'Correctors' edit fields

6. Click 'Open' button to select LMS7 configuration file and choose 'Ban1Setup.ini' that comes with this package.

7. Load the waveform file 'Modules→FPGA Controls' . Choose the following file 'lms7suite_wfm/wcdma_scale_075.wfm' that comes with this package. Press button 'Custom' to load file.

8. View DPD test graphs:
   8.1. In LMS7002 GUI, navigate to 'Modules → DPD Test'
   8.2. Press 'Start' to start DPD
   8.3. Choose 'Continuous' option with checked 'Train'
   8.4. Press 'End' to stop DPD working, then you can change the DPD parameters such as N (memory), M (non-linearity), ND (delay), load new waveforms, etc.
   8.5. To calibrate ND (delay) load first the waveform 'lms7suite_wfm/sinc.wfm' that comes with this package. Change ND value. Then press 'Start'. Choose 'One step' option in DPD test dialog. Press also 'One step → Reset coefficients' to reset the DPD coefficients, if they have not been reset before. Go to next step.
   8.6. Press 'One step → Read'. The y_I and u_I signals in the plot should match when ND is calibrated. Otherwise, press 'End', change ND value again, then press 'Start' and repeat this step until the ND is calibrated.