High Performance
Software Defined Radio

Alex LP/HP Filter Board Testing
September 2011

Scotty Cowling, WA2DFI

2011 TAPR/ARRL
Digital Communications Conference

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Alexiares RF Bandpass Filters

- Alpha 1 boards funded by developers, August 2007
- Alpha 2 boards funded by T APR, January 2008
- Alpha 3 board funded by T APR, March 2008
- All pre-production testing complete, March 2011
- PCBs fabricated and delivered April 2011
- Cables, enclosure and custom panels done, May 2011
- Production run complete, July 2011
- Testing complete, September 2011

**Status:**

Fully assembled/tested and bare PCBs, enclosure, cables, silk screened end panels available from TAPR now

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Alex TX-LPF Board

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Alex RX Testing – Test Fixture

ALEX RX

TEST FIXTURE

BIT0 is LSB (first serial data bit)
BIT15 is MSB (last serial data bit)
Bits are all active HIGH to engage relay or light LED

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Alex RX
Testing

Test Fixture
Alexiares RF Bandpass Filters

Alex RX Testing – Test Setup

NOTE: MAGISTER AND PC CONNECTION NOT SHOWN

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Alex RX Testing

Test Setup

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Alexiares RF Bandpass Filters
Alex RX Testing - Test Station
Alexiarest RF Bandpass Filters
Alex TX Testing - Test Station
Alex uses a single SPI interface for both RX and TX boards

One select pin for Alex-RX and a different one for Alex-TX

Since the test fixture is made from the same board as the board under test, both boards use the same select pin!
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Alex RX Testing – Filter Selection

Solution:

Cut-and-jump the test fixture board to use the opposite select line.

Alex-RX test fixture now uses TX select pin
Alex-TX test fixture now uses RX select pin

This allows use of a standard control cable
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Alex RX Testing – Filter Selection

Problem:
Mercury selects filters based on frequency.

- But -

For some tests, we want to select the wrong filter on purpose to test the filter’s stop-band response

We also need to activate relays on the test fixture board which is masquerading as an opposite -type board

Other relays (such as the T/R relay) are directly operated by the PC software

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Alex RX Testing – Filter Selection

Solution:
Modify the Mercury FPGA firmware to:

Ignore all direct relay commands

Set all relays based on the bottom 7 bits of the frequency

Beware the decimal to hex conversion!
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Alex RX Testing – Software

**Problem:**
There are LOTS of boards to test
Do you really want to manually sweep *each one*?
The answer would be **NO**!

Repetitive tasks are best done with?
A computer!

We're in luck, since we have one or two of those!
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Alex RX Testing – Software

Solution:

Coerce encourage someone else to write a test program

John Melton G0ORX/N6LYT graciously took on the task,

and provided us with many revisions and fixes

throughout the testing phase.
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Alex RX Testing – Software

Alextest:

- Separate tests for RX and TX
- Allows stepping (for debug)
- Allows pause (for 6M trimmer adjustment)
- Test sequence and timing are directed by a text file
- Color-coded pass/fail results on screen
- Compiled for Ubuntu 10.10
- **Fast** execution!
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Alex Testing – Summary

- Test fixtures built from modified production boards
  - No custom test fixture required
- Parallel connect-disconnect using BNC F/F, SMB
  - Fast setup with minimal cable connections
- Custom Mercury FPGA image to select filters
  - Flexible approach simplifies test software design
- Custom software for fast and repeatable test results
  - Text config file eliminates compiles to change test parameters
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Alex Testing – Summary

- Color-coded pass/fail results on screen
  - Simple, unambiguous results
- Compiled for Ubuntu 10.10
  - Supported and readily available PC platform
- **Fast** execution!
  - Prevents hair loss (too late!)
Alexiares RF Bandpass Filters
Alex Final Test
Alexiares RF Bandpass Filters
Alex Final Test, Action Photo!
Alexiares RF Bandpass Filters

The Moral is?

Rooster Sez:
Don’t let a simple task get your goat!
Thank you!

Alex Designer: Graham, KE9H

Test Software: John, G0ORX/N6LYT

Boards available at: www.tapr.org