CyberRadio SOLUTIONS

Implementation of a Radio Testing Framework Using GNU Radio

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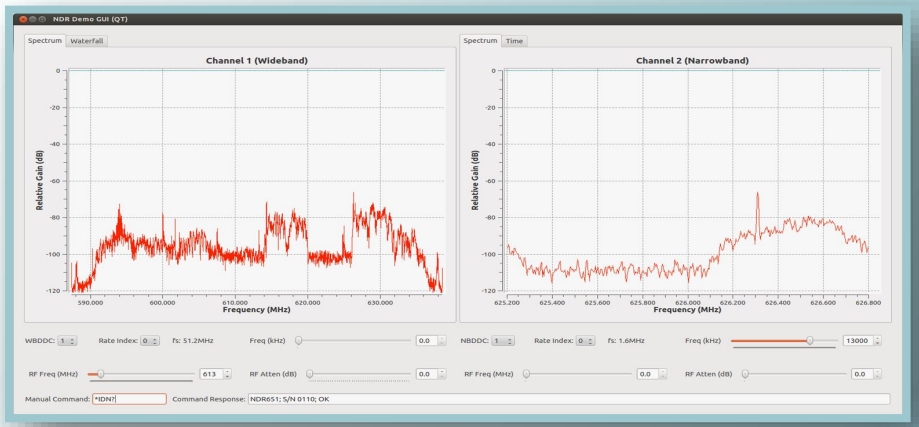
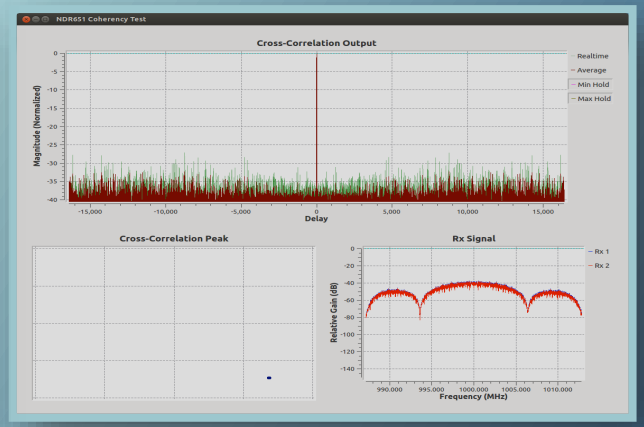
Introduction

- What does CyberRadio Solutions do?
  - CyberRadio's mission is to deliver cost-effective hardware solutions that combine high-end RF performance, embedded signal processing and standard network data interfaces
  - Our product line features:
    - Low-cost, high-performance tuners
    - Multichannel, phase-coherent receivers
    - Variety of general purpose and application-specific firmware loads
    - RF switching & distribution

How We Use GNU Radio

- Radio Test Applications
  - Interactive Radio Demonstration GUI
  - Transmit Streaming Testing
  - Transceiver Coherency Testing



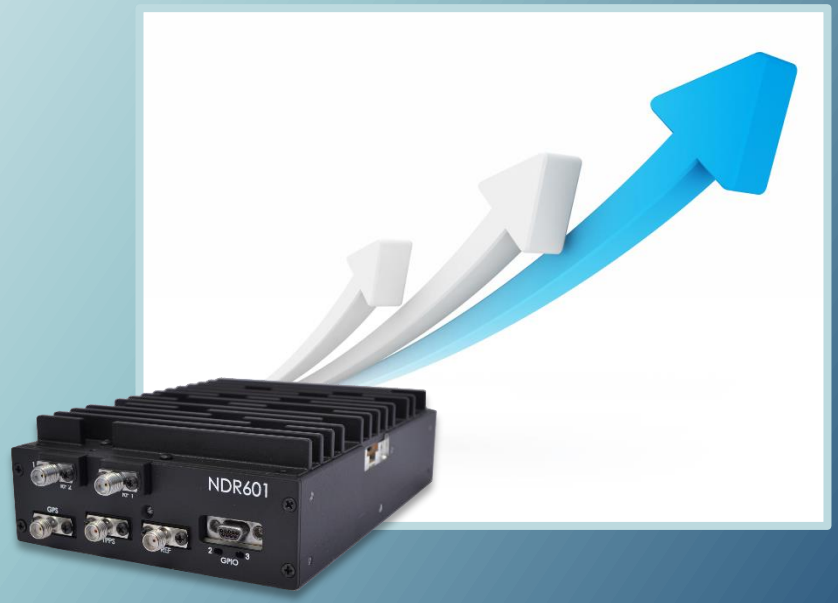


Why We Use GNU Radio

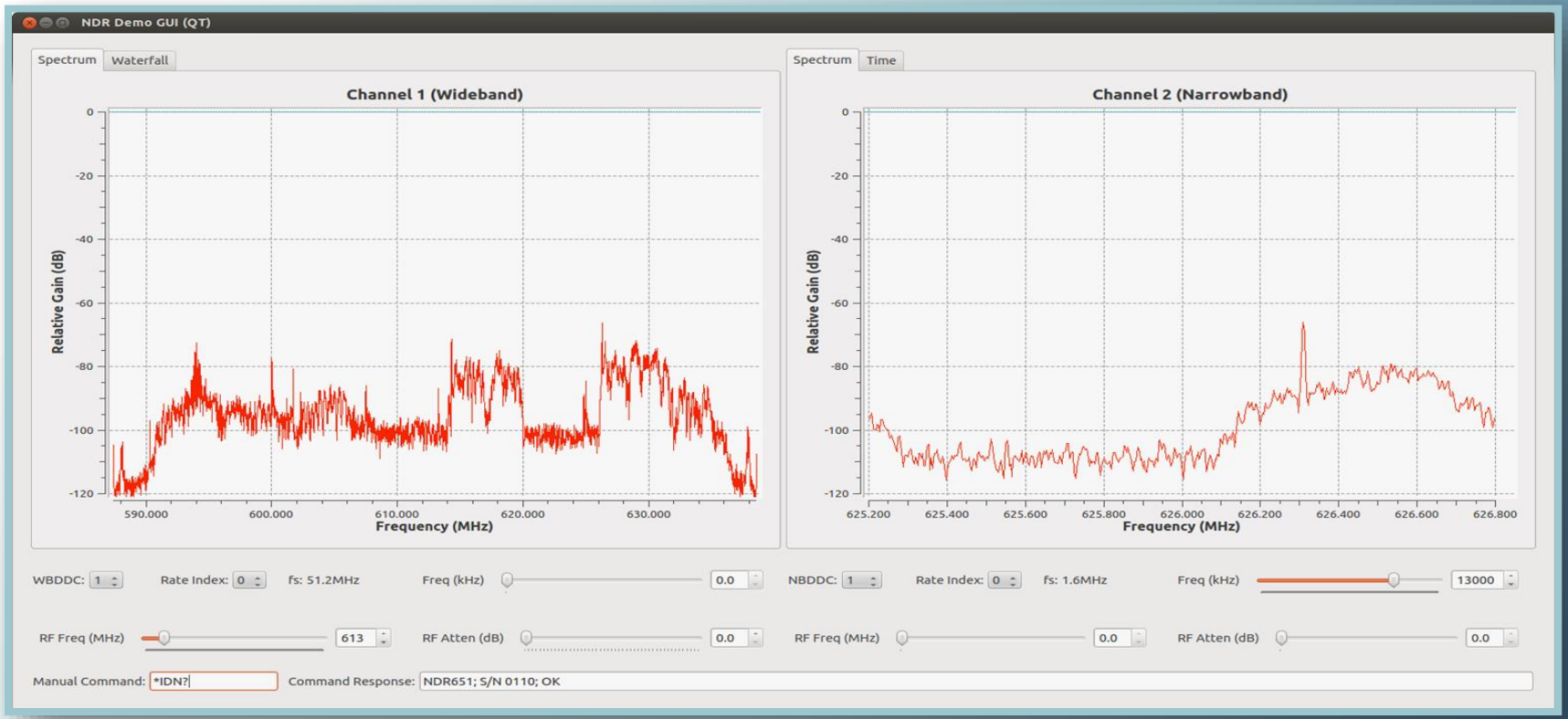
- The Problem:
  - We need to test our various radio models, both for design verification and final product testing
  - Early test applications:
    - Single-purpose and often customized for a single radio
    - Command line applications without a GUI
    - Used file-based data processing
- GNU Radio is the answer:
  - We implemented common radio control API and data sources
  - GUIs are easier and faster to implement
  - Allows for realtime data processing
  - GRC is a great tool for rapid development

Demo GUI

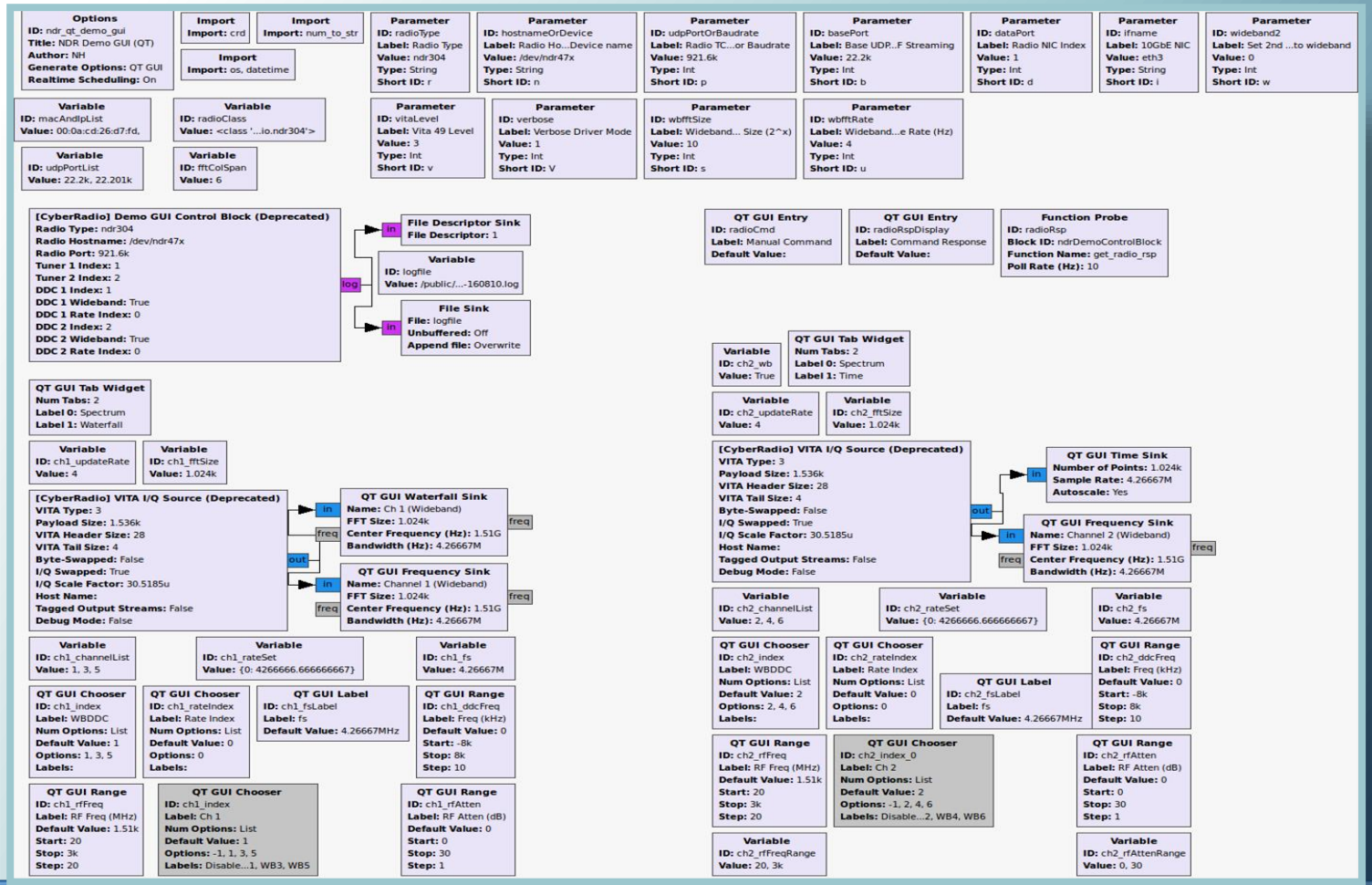
- Purpose:
  - We needed to provide utilities to accelerate customer evaluation of our radios without requiring software development on their part
  - Provides radio control examples for custom application development



Demo GUI



Demo GUI v2

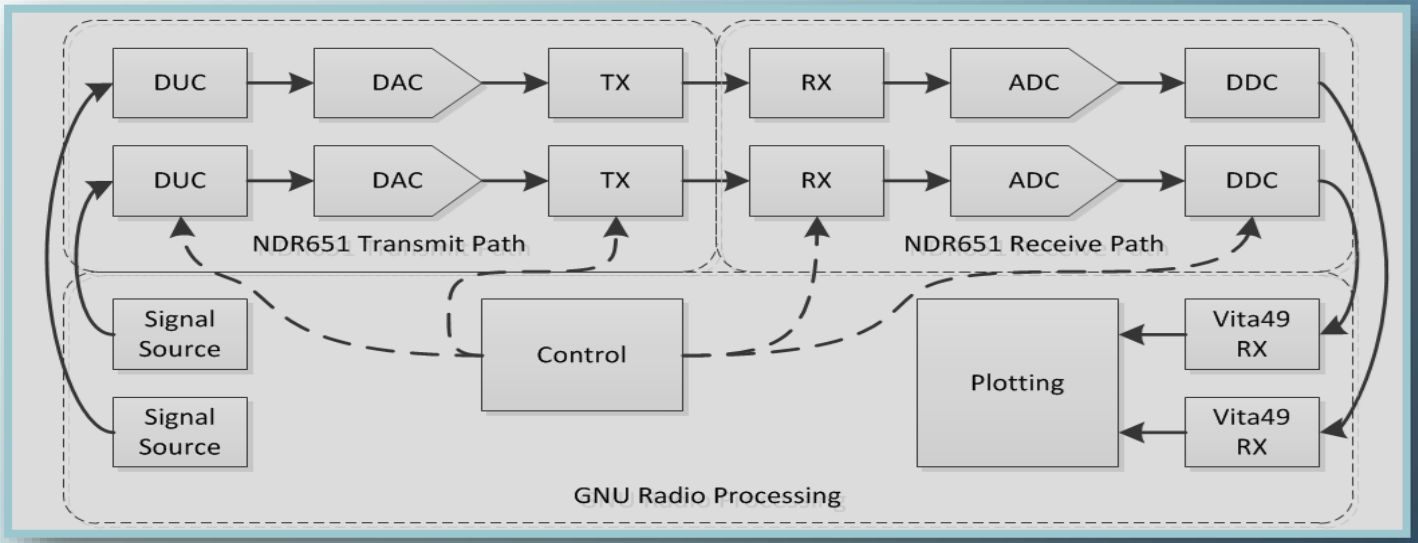


Demo GUI Implementation

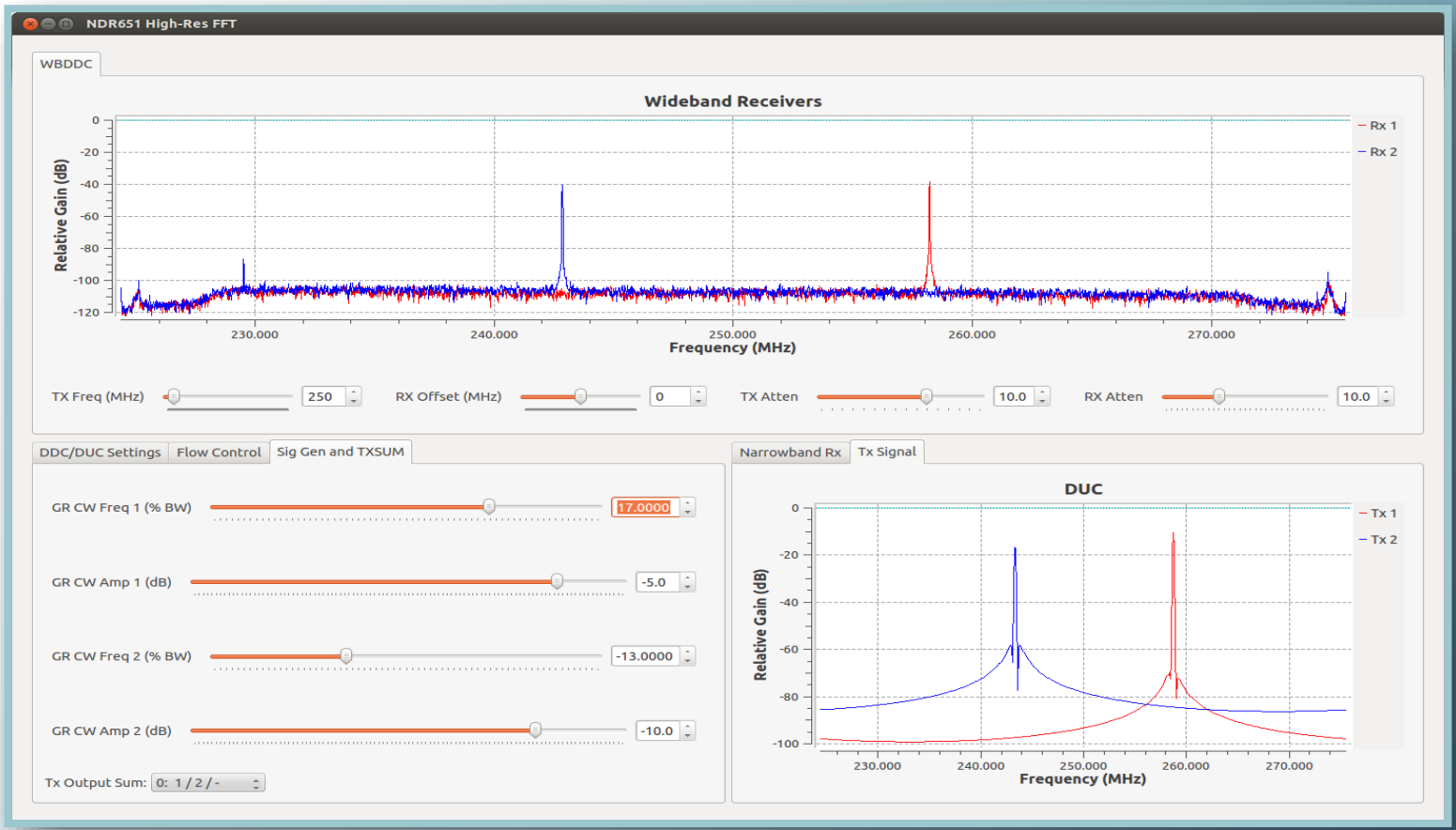
- Radio control implemented in custom block
  - Entire application implemented in GNU Radio Companion
- UDP Source Block
  - Used across our various radio types
  - Flexible Vita49 parsing
  - Stream tagging

Tx Streaming Control

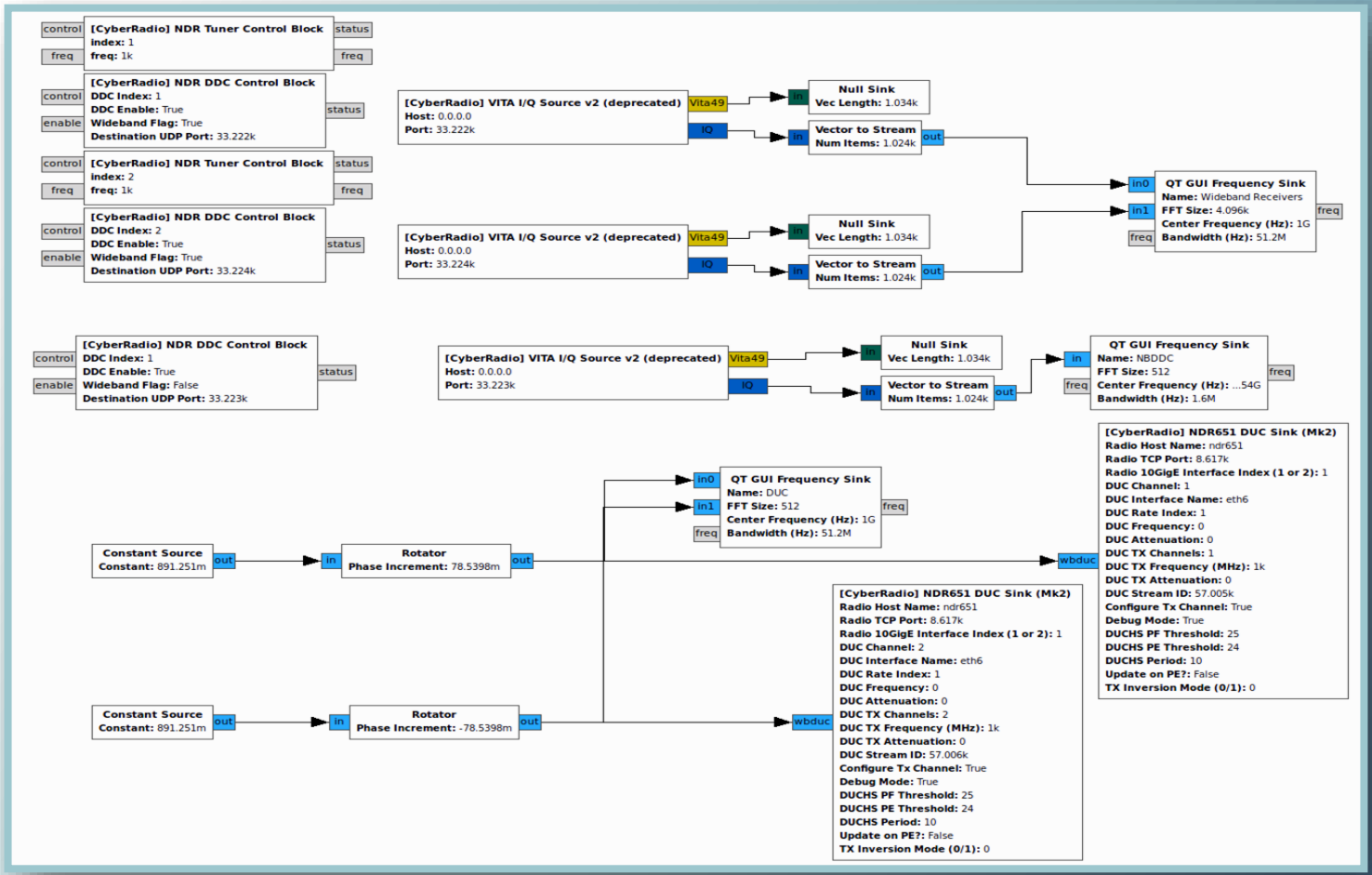
- Purpose:
  - Verify independent wideband transmit streaming integrity
    - Adjust flow control parameters to optimize throttling of transmit streams
    - Check for packet loss and buffer over/under runs
    - Signal integrity through digital and analog signal paths



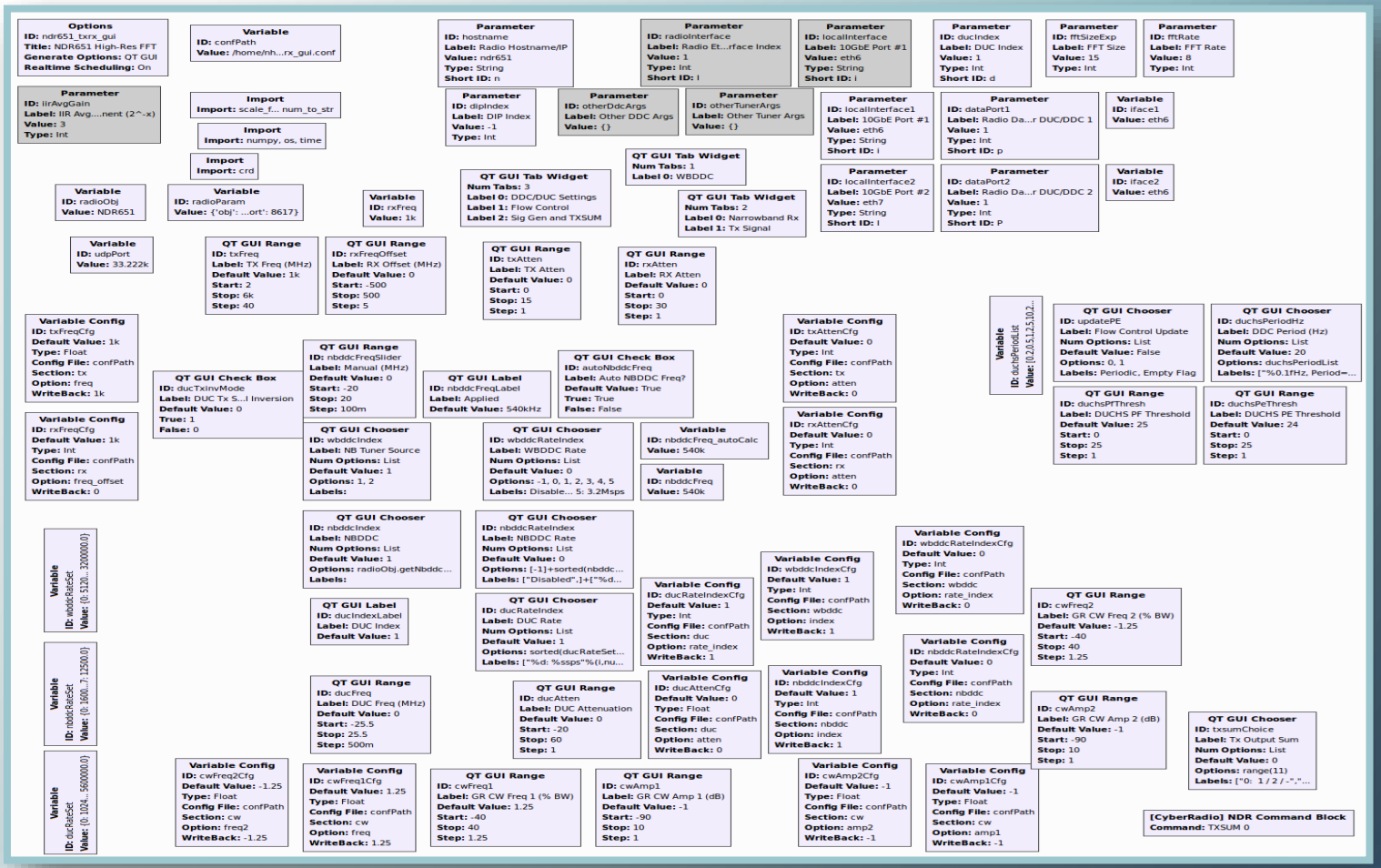
Tx Streaming Control



Tx Streaming – GRC Signal Flow



Tx Streaming – GRC GUI/Variable Blocks

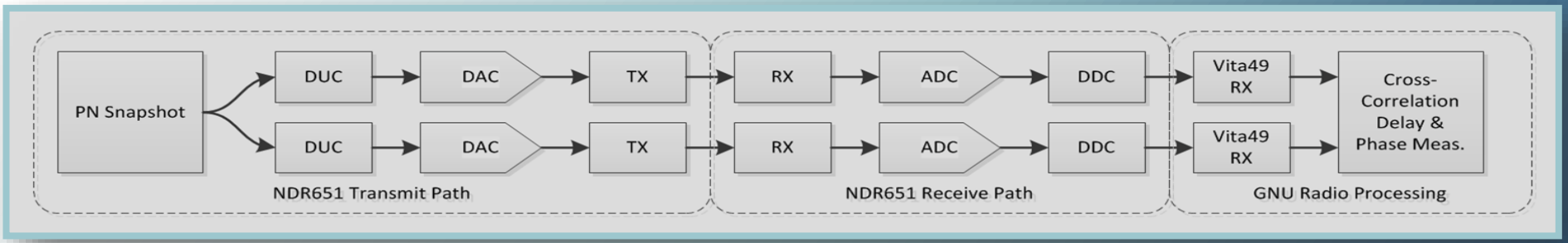


Tx Streaming Implementation

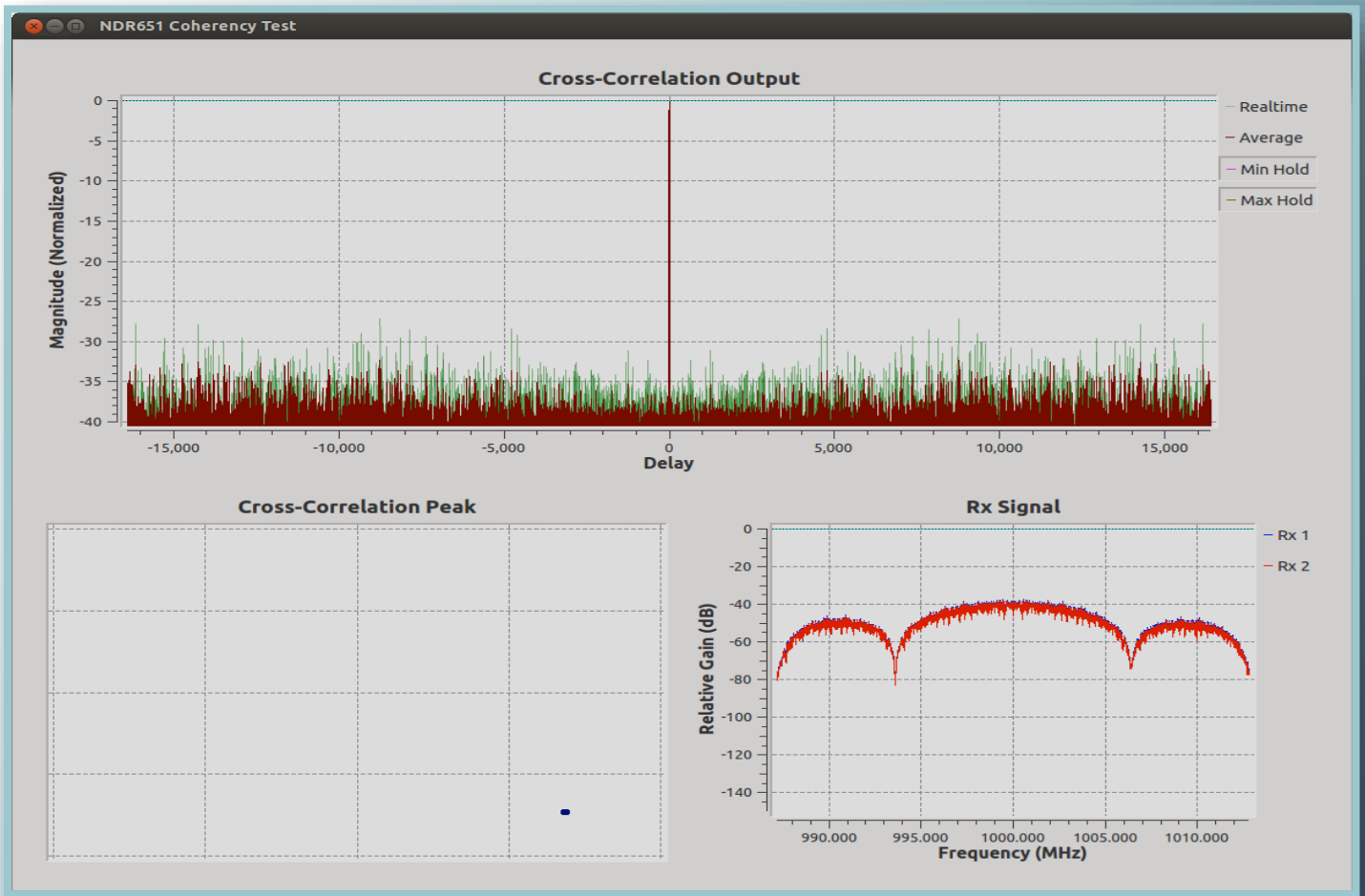
- Simple Signal Source
  - Signal Source block could not keep up @ 102.4Msps
  - Replaced with constant source & rotator
- Allows for tweaking flow control settings in real time
  - Periodic update rate
  - Full/Empty notifications
- Control-oriented more than signal processing
  - UDP Rx blocks feed QT Frequency Sink

Tx/Rx Coherency Test

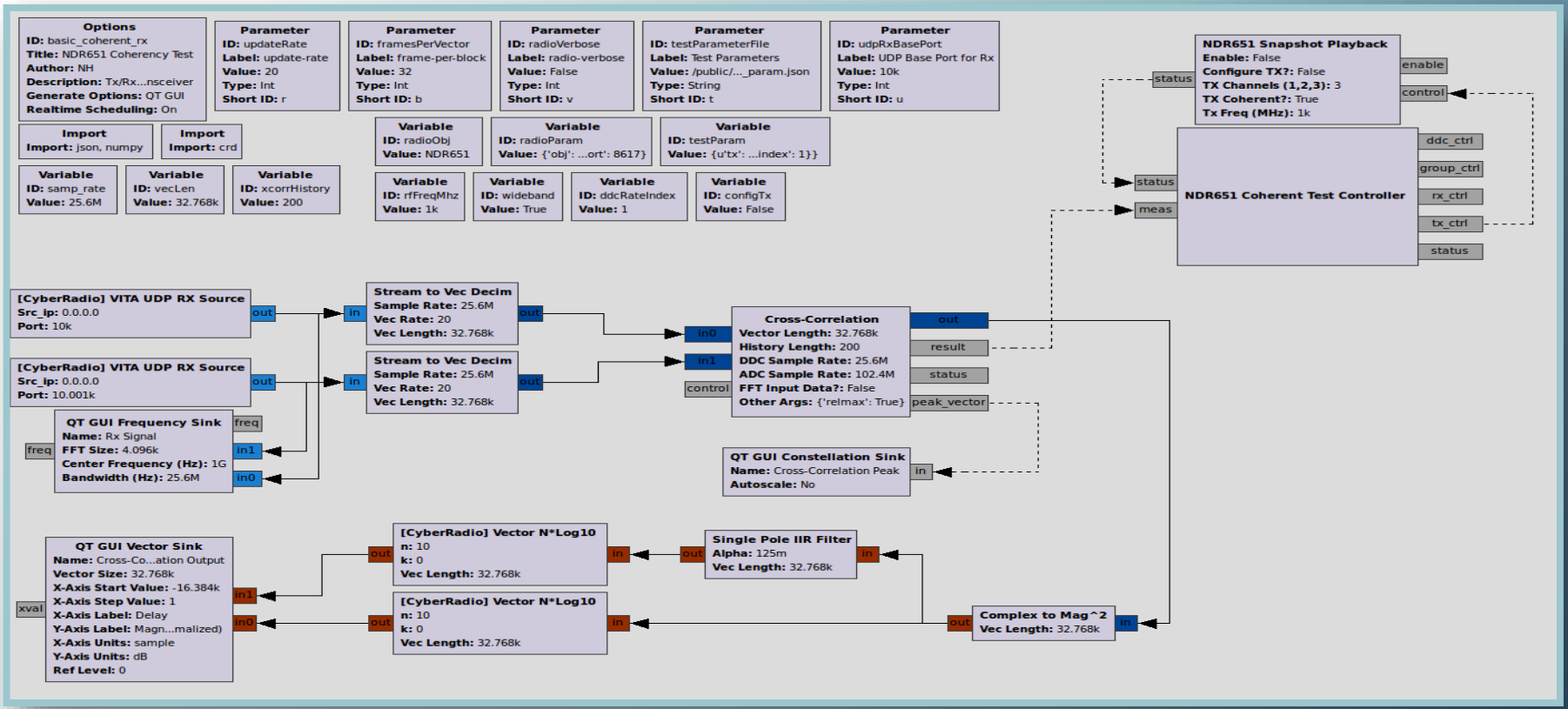
- Purpose:
  - Test receive and/or transmit coherency, i.e. measure constant phase offset between channels at a given frequency across tuning cycles



Tx/Rx Coherency – Application



Tx/Rx Coherency – GRC Design



Tx/Rx Coherency Implementation

- Entire application created using GNU Radio Companion
- Test management and data collection implemented in single block
- Async messaging w/ JSON content for measurement information and radio configuration
- Snapshot Transmit Block
  - Generates PN sequence, uploads to radio, and initiates looped playback

Further Development

- Refine and extend the coherency test approach to implement tests for:
  - Receiver gain
  - Noise figure
  - IIP3
  - Gain & NF optimization
- Production test suite

CyberRadio Software Components

- CyberRadioDriver
  - Unified Python API for all of our radios
- libcyberradio
  - Low-level C++ functions for radio data interfaces
- gr-cyberradio
  - Wrappers for CyberRadioDriver and libcyberradio functions
  - Additional GR blocks
- Available on github: https://github.com/CyberRadio/gr-cyberradio

SCAN IT

Questions?

NDR358
8 Channel Wideband Digital Tuner

NDR308
8 Channel Wideband Tuner

NDR551
4 Channel Wideband Digital Tuner

NDR154
Multi-Band RF Distribution Module

NDR155
Wideband RF Distribution Module