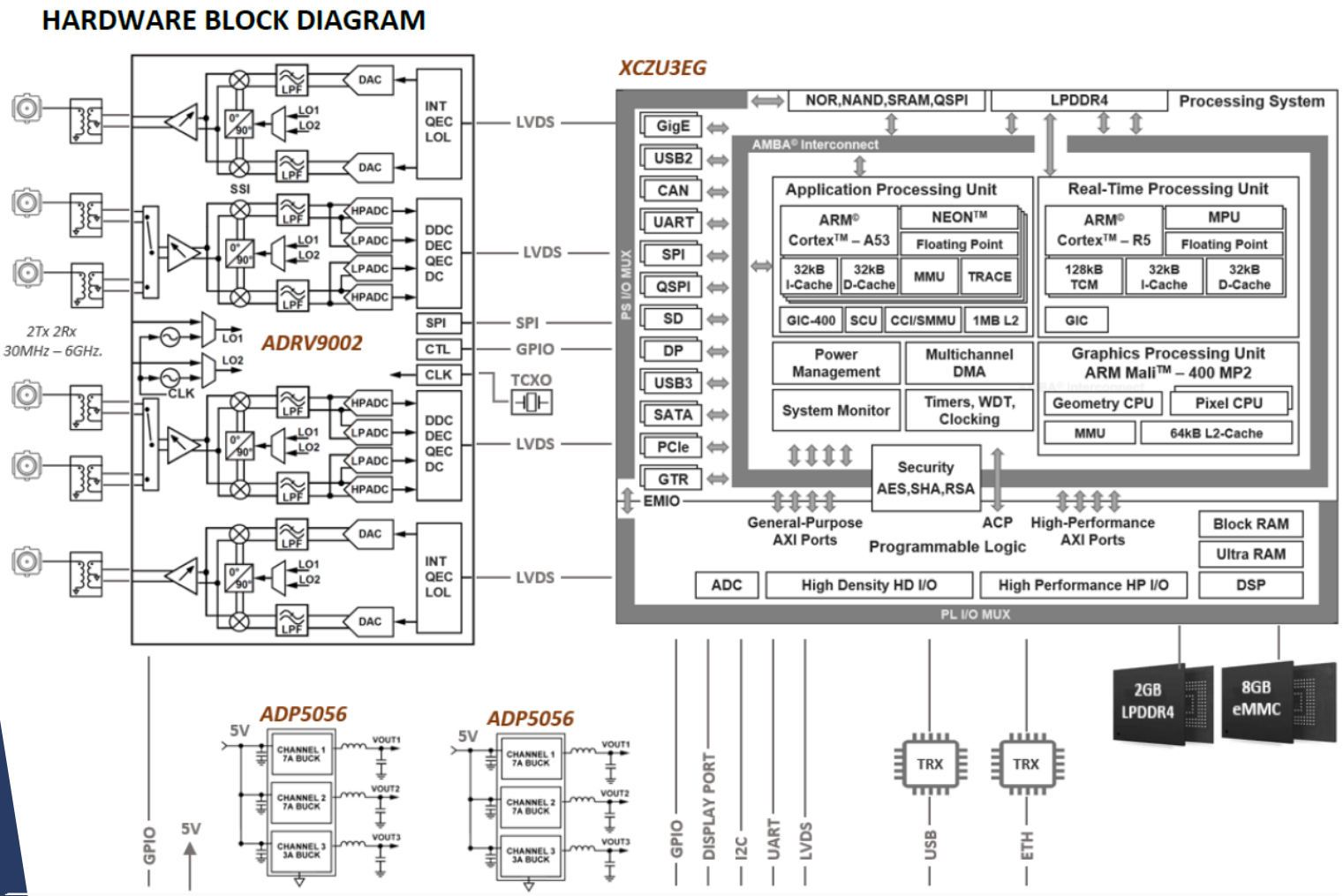
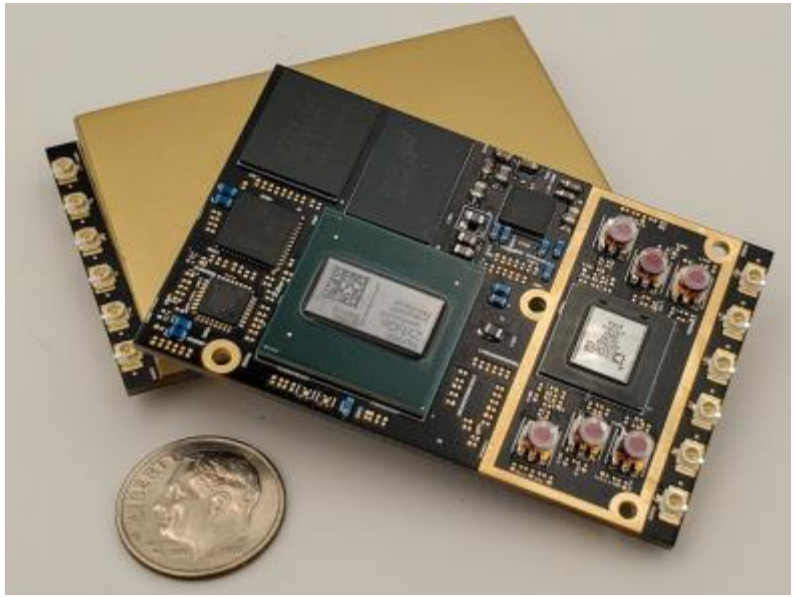
BytePipe Toolbox for MATLAB and Simulink

NextGen
RF DESIGN

BytePipe: 0.03-6 GHz Transceiver with FPGA SoM (ADI ADRV9002 / Xilinx XCU3EG/ XCZU2CG)





Design Environment, Libraries

External Interface / Breakout Board

BytePipe SOM

ADRV9002 — LVDS — Xilinx XCU3EG/ XCZU2CG

- LNA
- microSD Card
- Display Port
- SATA Connector
- Gigabit Ethernet
- USB 3.0
- Serial Port
- JTAG Connector

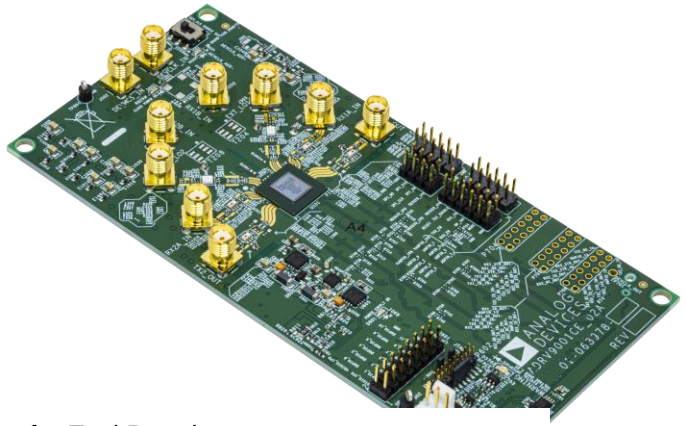
Navassa Family

ADRV9002 – Full Featured Device
- **2T 2R** includes DPD

ADRV9003 – Single Channel Device
- **1T 2R** or **1T 1R** Configurations
- Part does not include DPD

ADRV9004 – Dual Channel Device
- **2T 2R** Configurable
- Part does not include DPD

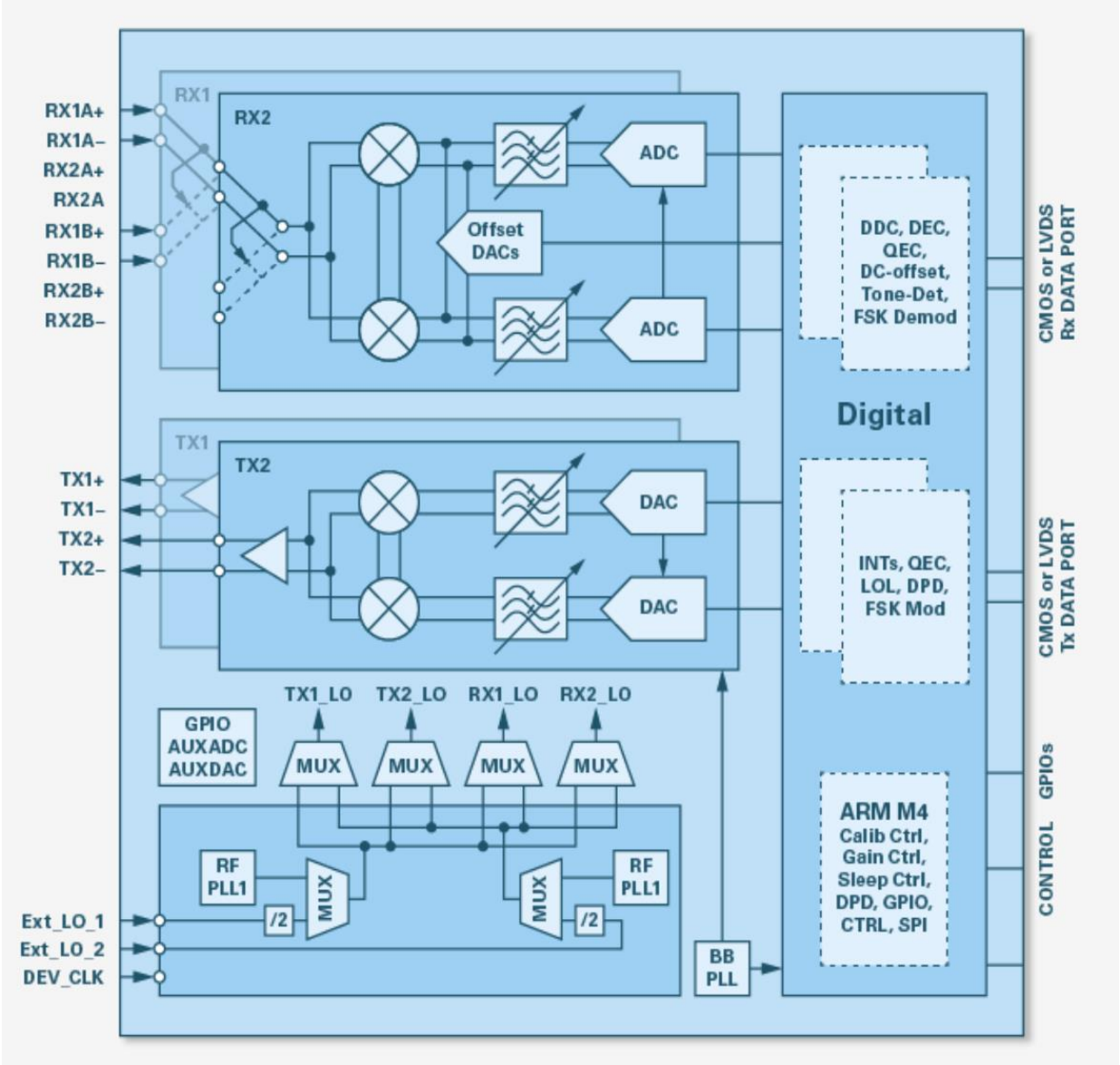
- ADRV9001 Family
  - All parts supported by **one TES SW, EVAL board and User Guide** found on Analog.com product pages
    - analog.com/en/products/adrv9003.html
  - All parts support **30MHz to 6GHz** operation and **12KHz to 40MHz** radio bandwidths
  - All parts offer the same RF performance specifications
  - All parts in the same package **12 x 12 and pin configuration**
  - Any additional future devices will support the same Frequency/Bandwidths and RF performance but may differ in system features



Part Numbers for Eval Boards
- **ADRV9002NP/W1/PCBZ** (30MHz to 3000MHz)
- **ADRV9002NP/W2/PCBZ** (3GHz to 6GHz)

Introduction to the ADRV9002/3/4 (AKA Navassa)

- Highly Integrated Transceiver (RF to Digital)
  - **Dual channel Transceiver (2Tx 2Rx shown ADRV9002)**
  - Dual flexible fully integrated RF LOs on chip
  - Direct conversion, IF Architecture, Tx direct modulation modes supported
- Operating Frequency Bands
  - 30MHz to 6GHz Operating frequency bandwidth
  - 12.5KHz to 40MHz Programmable radio signal bandwidths
- Digital Functions
  - Integrated digital downconverter (DDC) for NB IF operation
  - 128 taps Rx/Tx programmable FIR filters
  - Automatic and manual gain control
  - Digital Pre-Distortion (DPD)
  - Correction algorithms for RX QEC, Tx QEC/LOL, DC offset
- Interface Modes
  - Flexible multi-protocol data interface, LVDS / CMOS SSI digital interface
  - SPI, AuxDAC, AuxADC, GPIO, Tx/Rx enable control
- System functions
  - Auxiliary monitor functions
  - Fast profile switching
  - Frequency hopping
  - PA ramp control and PA protection
  - Monitor mode (autonomous RSSI monitoring)
  - Flexible power vs. performance modes

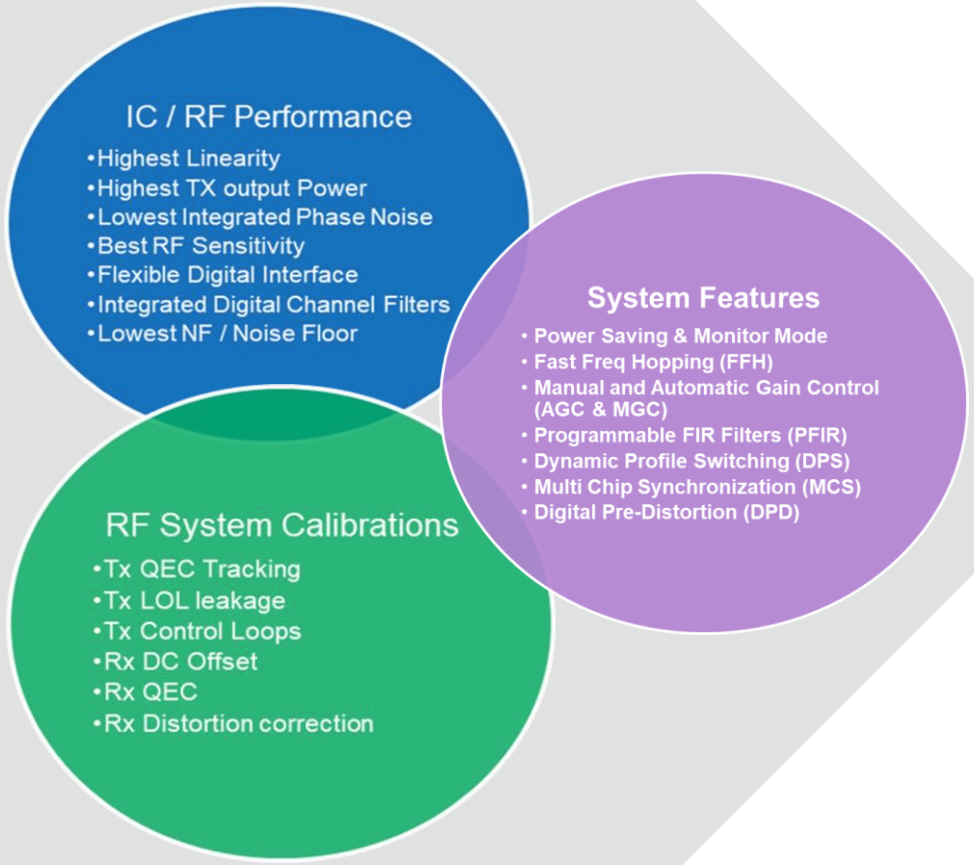


ADRV9002/3/4 RF System Value / Features

High performance RF Agile SDR Transceivers provide user configurability

More than Silicon and Beyond Silicon

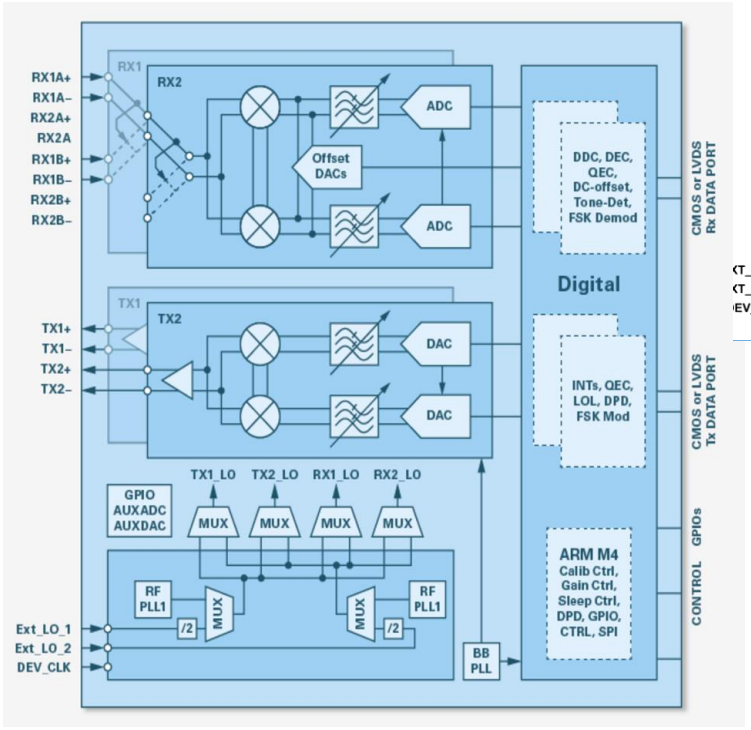
- First broad market transceiver design for **mission critical communications NB / WB operation**
- **Best in class RF performance**
  - Highest Receiver dynamic range 150dBc/Hz
  - Highest Transmitter offers highest output linearity
- Offers exceptional dynamic range to absorb the signal and blocker **minimizes the need for analog IF and base band filtering**
- Latest technology for **optimum power Vs performance** with integrated radio signal processing
- Unique flexible solution agile, cognitive, **fully programable SDR**
- High level of Integration, **System Features, Digital Features, Calibrations**
- Advance system features **Monitor mode, MCS, DPS, FH, PA DPD**
- **Small packaged 12 x 12 mm BGA package**



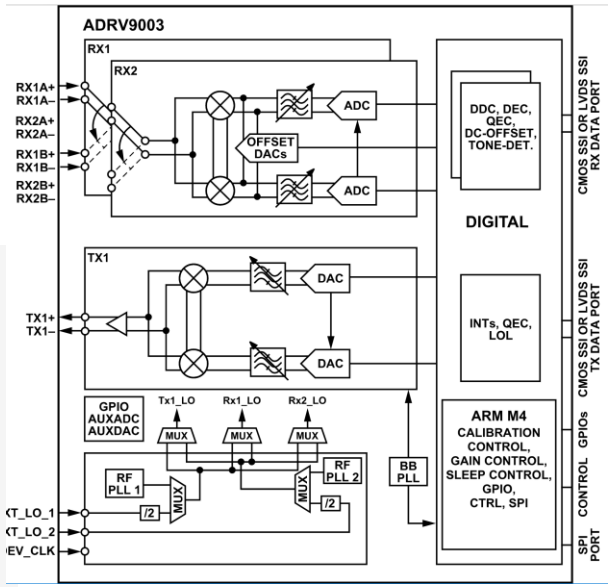
RF Agile Software-Defined Radio (SDR) Transceivers

Narrow-band to Wideband, High Dynamic Range, Low Power

- **Narrow band to Wideband Integrated RF Agile Transceiver**
  - Freq of operation 70MHz to 6000MHz
  - Independent Wideband / Narrow band 12KHz to 40MHz RX and TX Channels
- **Direct conversion, offset IF, direct modulation operation**
  - High dynamic range and integrated digital baseband filtering
  - Removes the need for RF / IF filtering with advance sigma-delta, ΣΔ Converters
- **Power Vs Performance, High dynamic TRX for battery powered applications**
  - Each RX and TX chain can be switched power up /down as needed
  - Advance system power savings with Monitor Mode
- **Agility of operation with integrated independent PLL/VCO circuits**
  - FDD or TDD operation
  - Operation with external VCO / LO
  - Flexibility routed to any RX or TX
- **Integrated digital signal processing / filtering to baseband**
  - filtering for each channel
  - FSK modulation and demodulation
  - Correction algorithms



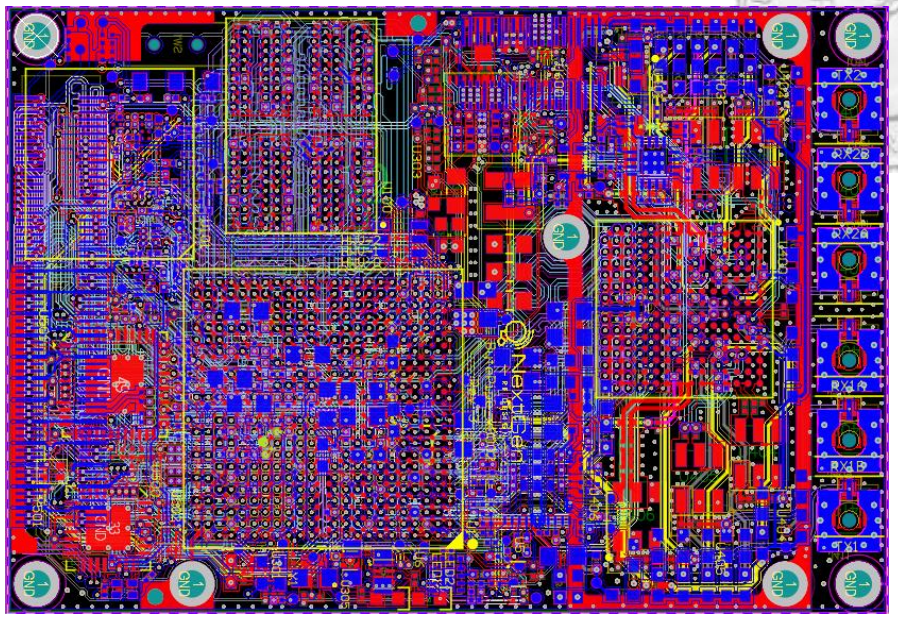
ADRV9002 2Tx 2Rx

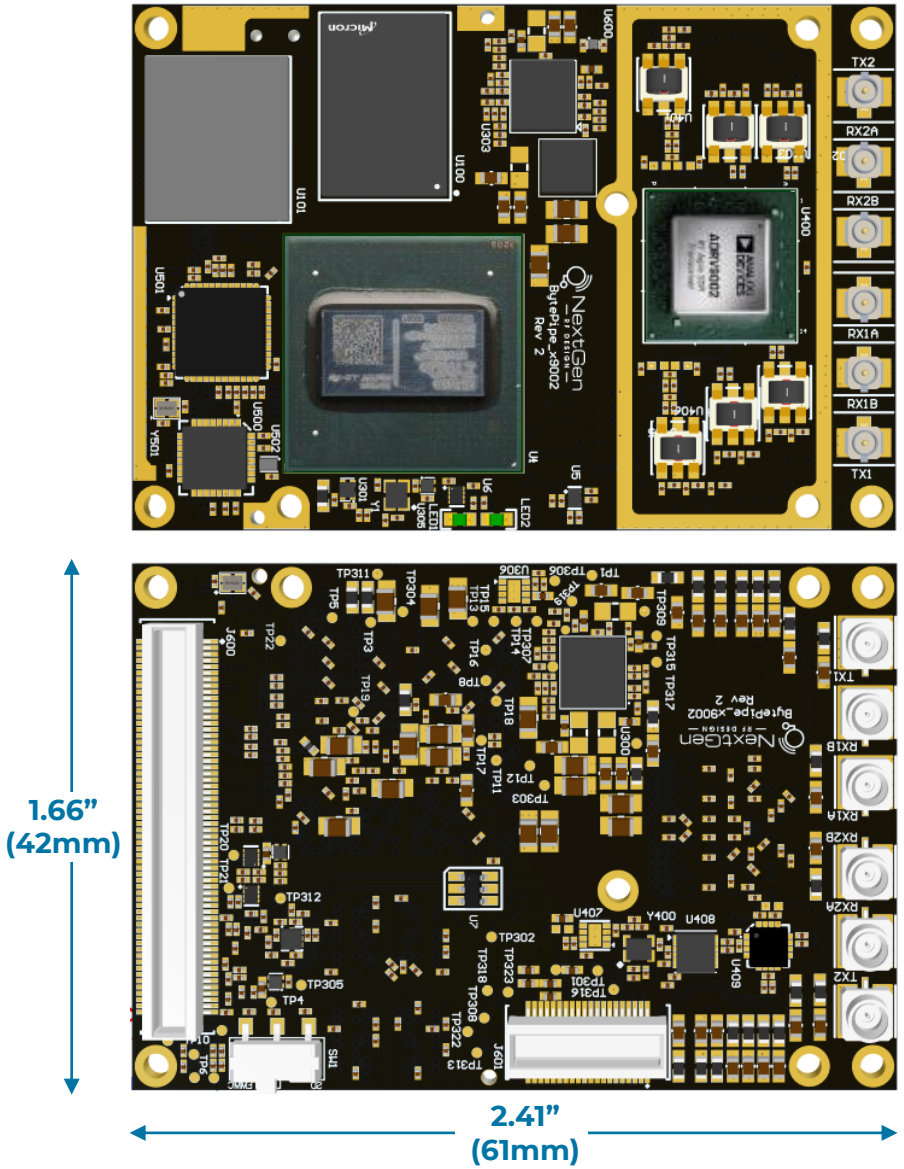


ADRV9003 1Tx 2Rx

Hardware Design

Facilitating lower cost and shorter time to market.





NextGen RF DESIGN

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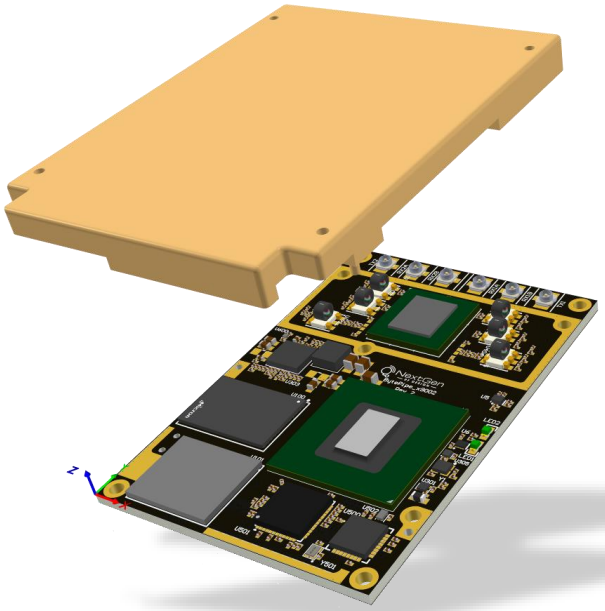
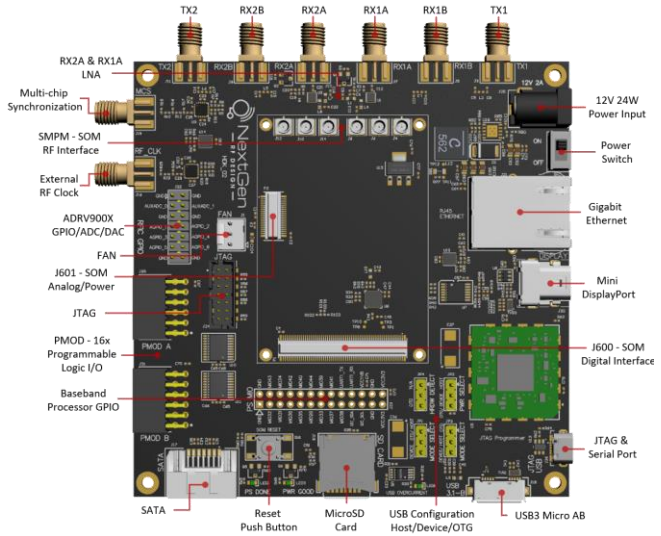
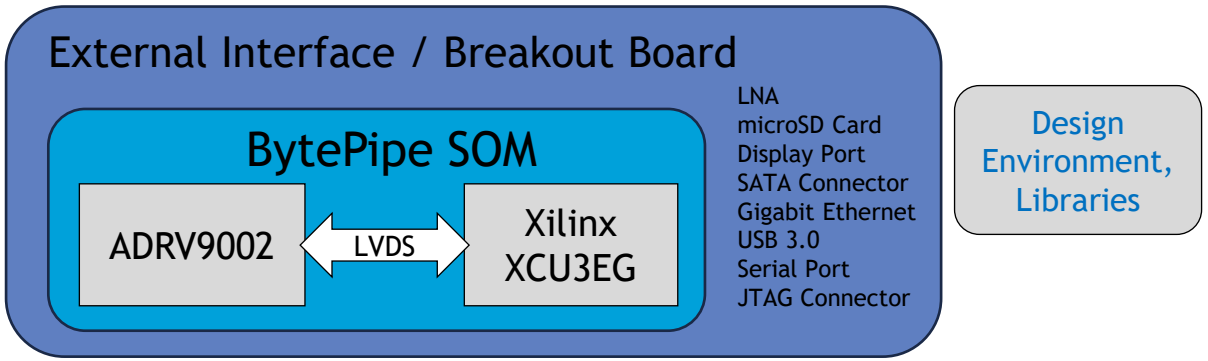
BytePipe: 0.03-6 GHz Transceiver with FPGA SoM (ADI ADRV9002 / Xilinx XCU3EG/ XCZU2CG)

- Quad Core Cortex A53 Application Processor
- Dual Core Cortex R5 Realtime Processor
- Optional ARM Mali-400 Graphics Processor
- Programmable Logic with up to 360 DSP slices and 154,000 logic cells
- 8GB eMMC / 2GB LPDDR4
- Synchronizable
- 36.8mm x 61mm Dimensions

- Production ready: design time cut by 6 months
- Market specific RFFE's available
- Support for Third Party Tools
  - MATLAB, Simulink, Gnu Radio
- Breakout board available with
  - LNA for RX, 4x GTR, USB3, Gigabit Ethernet, PCIe, DisplayPort, SGMII, GPIO, SPI, UART, I2C, CAN, SD
- NextGen RF Customization supported







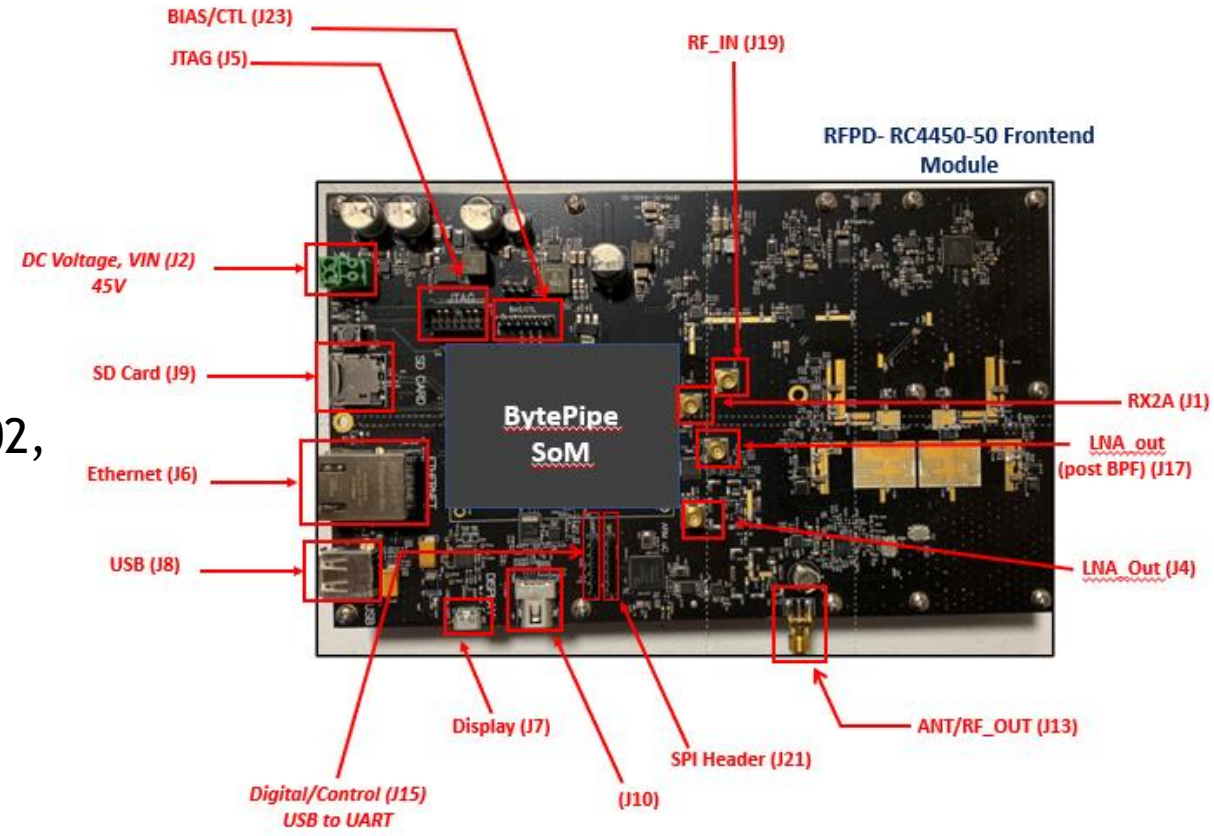
NextGen RF DESIGN

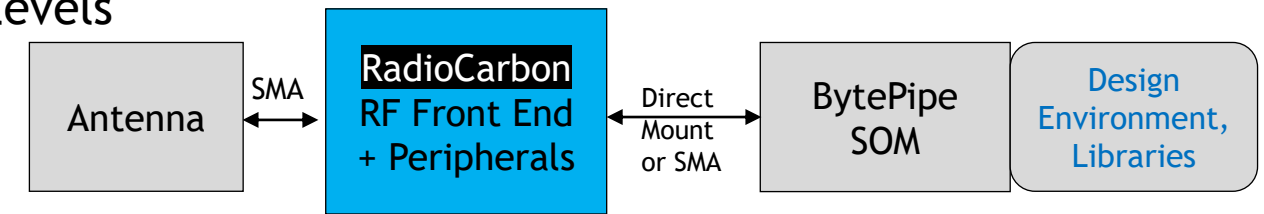
Software Defined Radio with RF Front End

Radiocarbon Design accelerator platform with design services

Features

- Single Channel Transmitter and Receiver
- Prototyping Platform for BytePipe SoM
  - Alternative to Eval kit
  - BytePipe mounts directly to carrier board
- Standalone software/GUI
  - Use with any ADI Transceiver with DPD (ADRV9002, AD9375, etc)
    - RF Board connections (SMA, MCX)
- Three integrated RF Front End (RFFE) options
  - DC power generation and PA bias
  - Small Footprint
  - Reference design for Military comms, Satellite, Troposcatter, NLOS backhaul, 5G
  - Modifiable to support other bands and power levels
  - BOM, schematic, and layout available





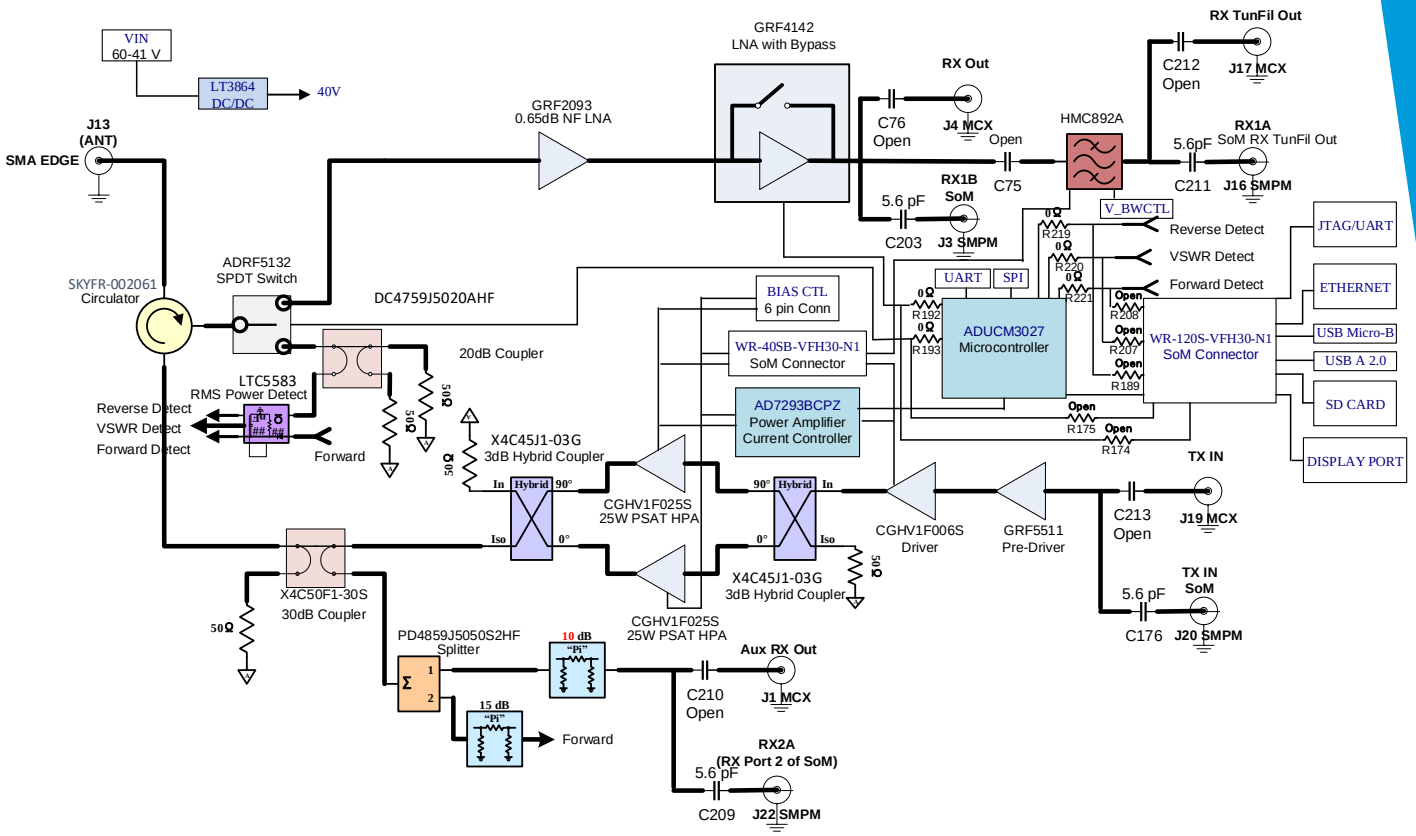
RFPD-RC-4450-50: 4.4-5 GHz, 2W Linear Front-End

Radiocarbon Design accelerator platform with design services

Technical overview

- TX
  - 33 dBm avg at antenna,
    - 44.5 dBm PSAT
  - -50 dBc ACPR (9 dB PAR, BytePipe DPD)
  - 42 dB Gain
  - TX 27% PAE (PSAT)
- RX
  - 2.1 dB NF
  - 23 / 6 dB Gain
- 42-60V Vin

RFPD-RC-4450-50
4400 – 5000 MHz



NextGen RF DESIGN

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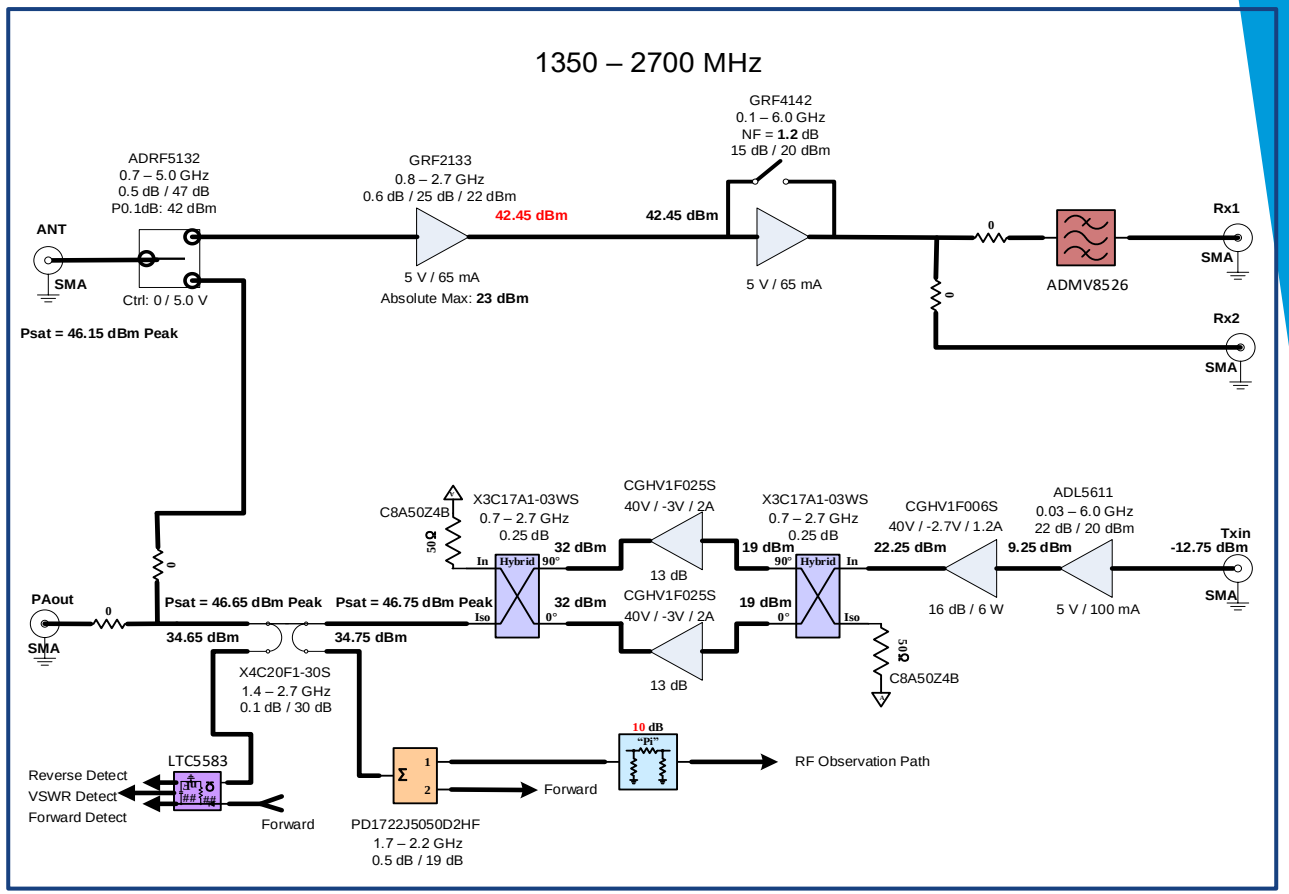
RFPD-RC-1327-50: 1.35-2.7 GHz, 2W Linear Front-End

Radiocarbon Design accelerator platform with design services

Release 2H22

Technical overview

- TX
  - 33 dBm avg at antenna, 44.5 dBm PSAT
  - -50 dBc ACPR (9 dB PAR, BytePipe DPD)
  - 42 dB Gain
  - TX 27% PAE (PSAT)
- RX
  - 1.9 dB NF
  - 23 / 6 dB Gain
- 42-60V Vin



Available 4Q21

NextGen RF DESIGN

RichardsonRFPD An Arrow Company

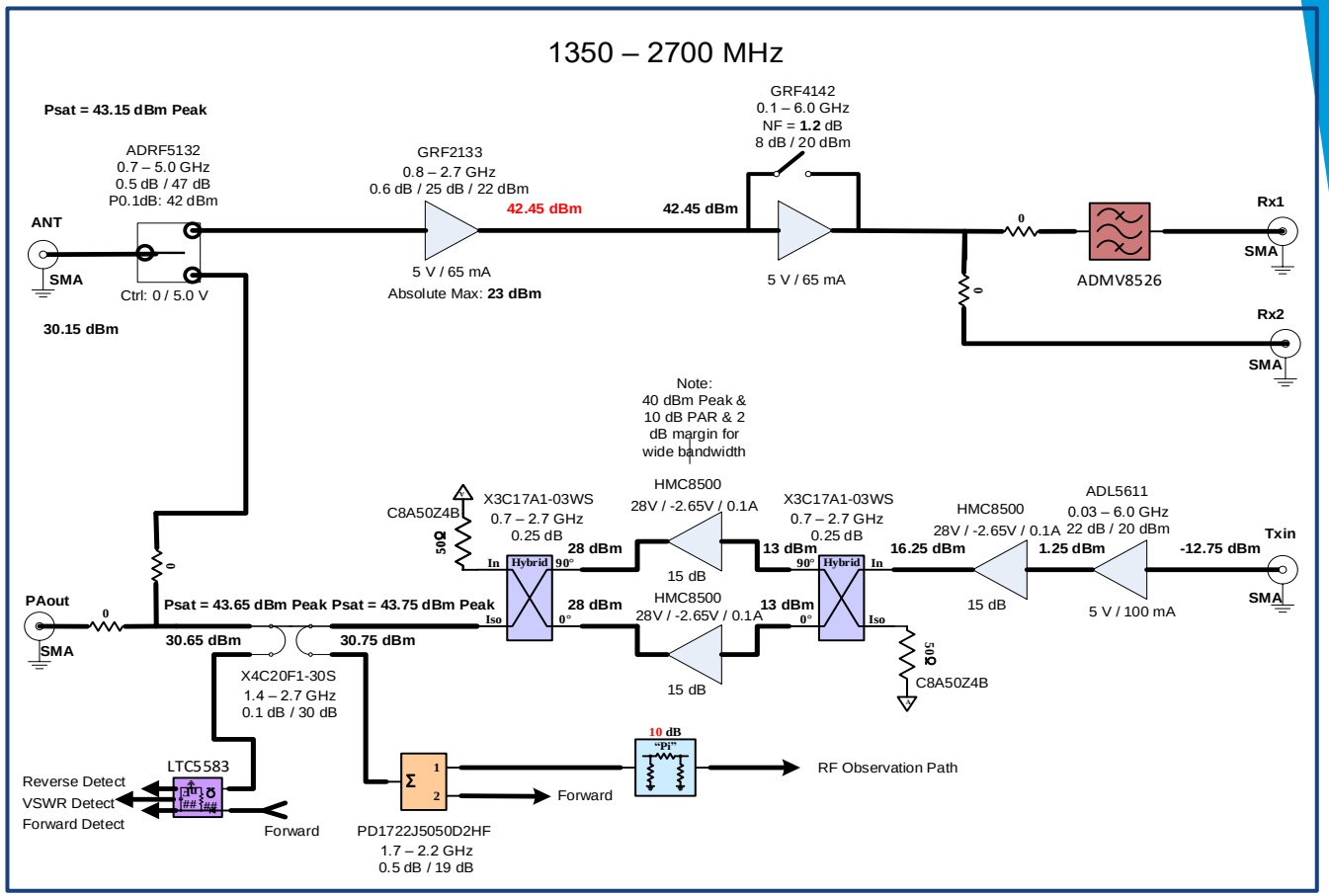
RFPD-RC-1327-20: 1.35-2.7 GHz, 1W Linear Front-End

Radiocarbon Design accelerator platform with design services

Paper Design

Technical overview

- TX
  - 30 dBm avg at antenna, 43 dBm PSAT
  - -50 dBc ACPR (10 dB PAR, BytePipe DPD)
  - 51 dB Gain
  - TX 27% PAE (PSAT)
- RX
  - 1.9 dB NF
  - 23 / 6 dB Gain
- 42-60V Vin



NextGen RF DESIGN

RichardsonRFPD An Arrow Company

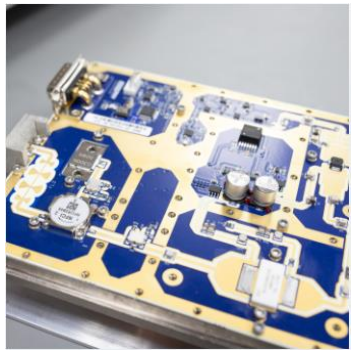
Agenda

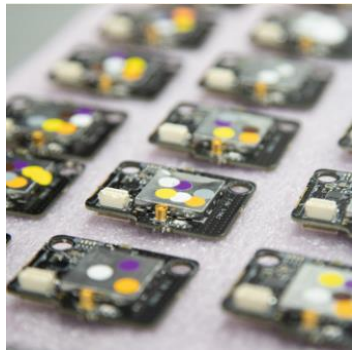
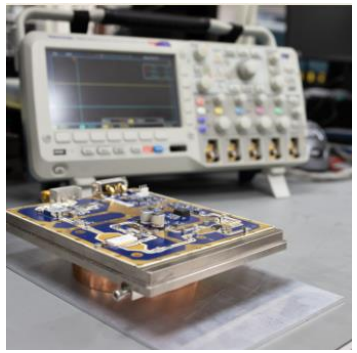
- NextGen RF Design
- BytePipe Overview
- Transceiver Evaluation Software
- RadioCarbon DPD Demo
- BytePipe Toolbox for MATLAB
- HDL Coder Example

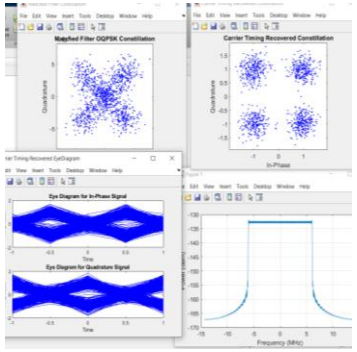

NextGen
RF DESIGN
We know design.
Proven expertise for tough
challenges from start to finish.

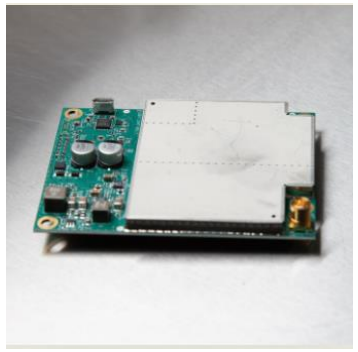
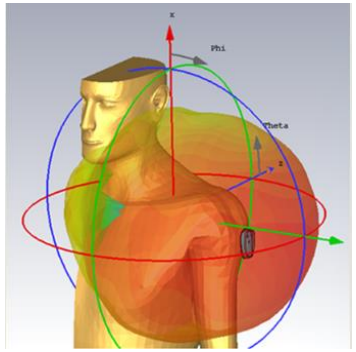
About NextGen RF Design

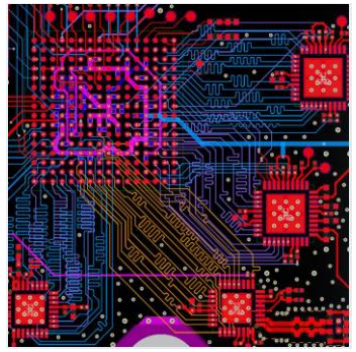
NextGen
RF DESIGN





https://www.nextgenrf.com/

RichardsonRFPD
An Arrow Company

Design Expertise

RF/WIRELESS

- Discrete Design, Chip Down or Module/Modem
- High Power Amplifiers & Linearization
- Narrowband, High Performance or Wideband, High Data Rate Designs
- RF Range Optimization

EMBEDDED DESIGN

- Software Defined Radio
- Embedded Control Systems Using Microcontrollers/ Microprocessors, FPGAs, SoCs
- RTOS & Baseband Stack Development
- Custom Modulation Schemes

ANTENNAS

- Design Simulation (CST)
- Custom PCB Antenna Designs – Monopole, Dipole, Patch, Inverted F
- MIMO & Diversity System Design
- 3-Axis Pattern Measurement
- Matching and Optimization
- Pattern Steering

DIGITAL & ANALOG

- Communications Interfaces – SPI, I2C, UART, Ethernet, USB and Parallel Address/Data Busses
- Power Supply Designs and Charging Systems
- ADC/DAC
- High Speed Memory
- Voltage & Waveform Generation
- Motor Control Circuit Design

PCB DESIGN

- Specialists for RF Design Layouts, RF Grounding and Shielding
- High Speed Digital, High Power, EMI/EMC Expertise
- 3D Modeling of PCBs and Components
- Altium, Mentor Graphics, OrCAD, Solidworks

TEST FIXTURES & ATS

- Specialized in RF/Wireless Functional Test Fixtures
- Single-Up & Multi-Up Designs
- Custom Bed-of-Nails and RF Interfaces
- Automated Test Systems
- LabVIEW Certified Programmers

BytePipe SDK

https://github.com/NextGenRF-Design-Inc/bytepipe_sdk

Linux
Quad Core Cortex A53

Dual Core Cortex R5

FreeRTOS

ANALOG DEVICES

NextGen RF DESIGN

Programmable Logic

MATLAB SIMULINK

Xilinx SoC Baseband Processor

+

NextGen RF DESIGN

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github.com/NextGenRF-Design-Inc/bytepipe_sdk

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Code Issues 8 Pull requests Discussions Actions Projects Security Insights Settings

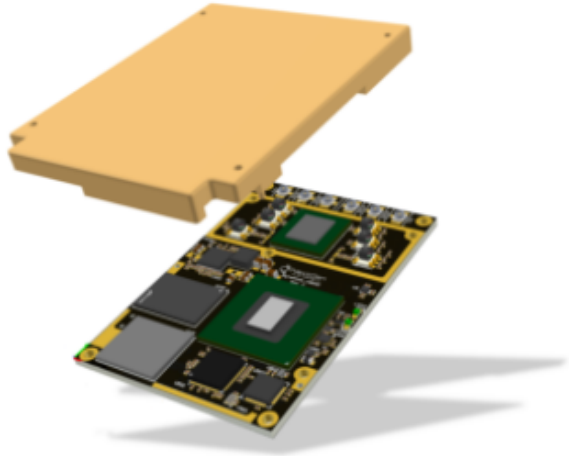
main 1 branch 9 tags Go to file Add file Code

enelson83 updating rflan dynamic profile support to include single json file an... d0ac085 on Mar 4 148 commits

docs	adding docs	9 days ago
src	latest	1 minute ago
.gitignore	latest	1 minute ago
DISCLAIMER.md	starting over	8 days ago
LICENSE	starting over	8 days ago
README.md	starting over	8 days ago

README.md

NextGen RF DESIGN



About

BytePipe Software Development Kit

Readme
GPL-3.0 License
0 stars
3 watching
3 forks

Releases 9

v02.16.22 Latest
on Feb 26

+ 8 releases

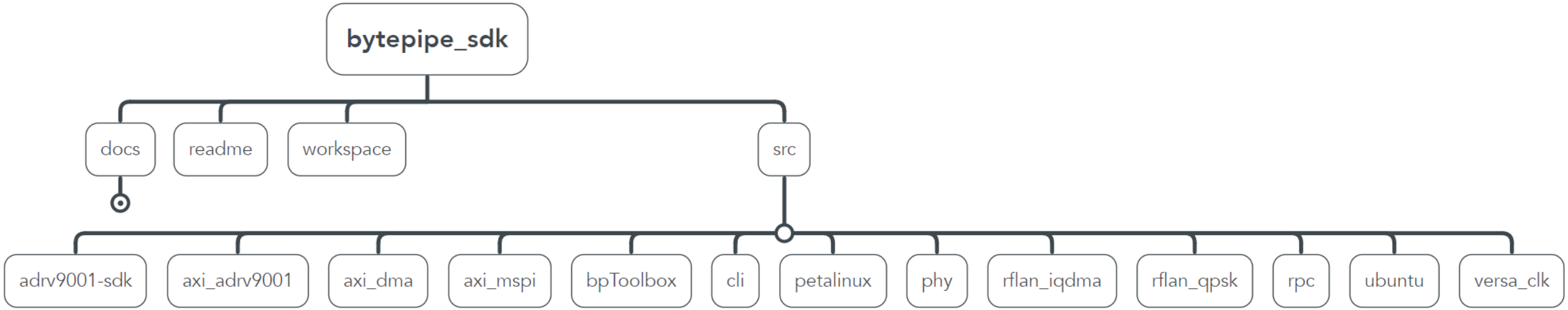
Packages

No packages published
Publish your first package

Contributors 3

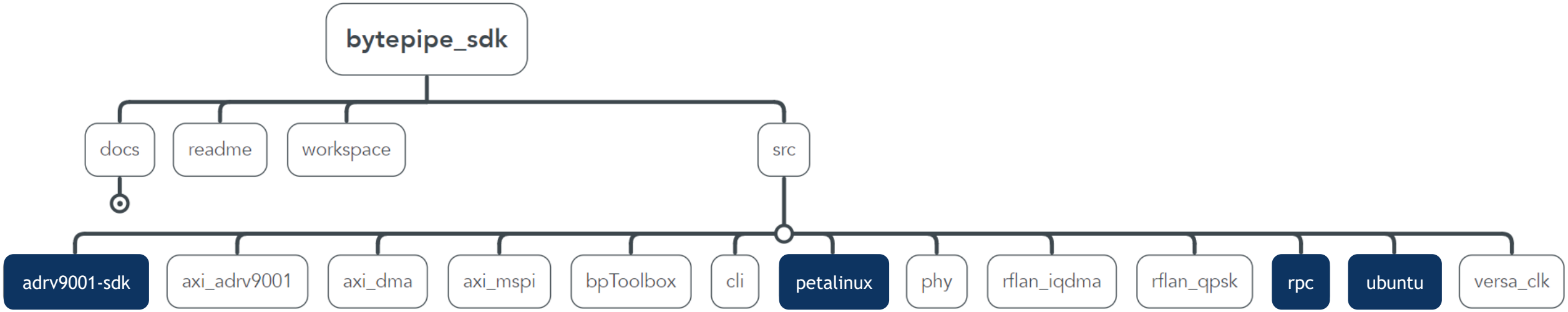
enelson83
g-anderson
CharlesViel Charles Viel

BytePipe SDK

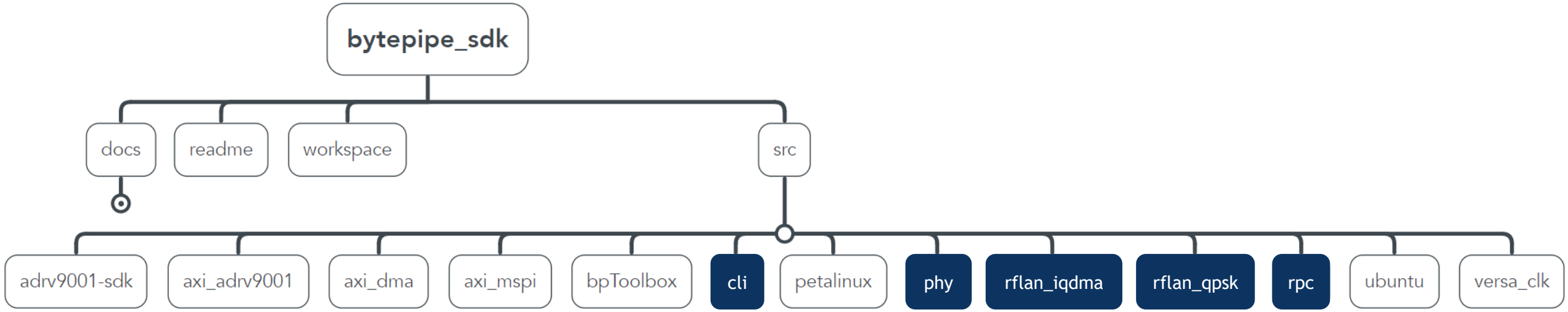


https://github.com/NextGenRF-Design-Inc/bytepipe_sdk

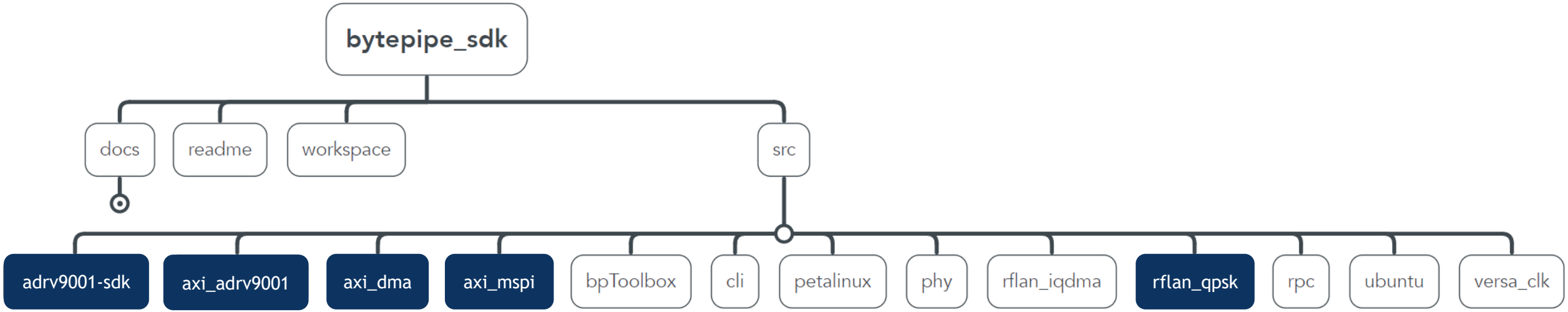
Application Processing Unit



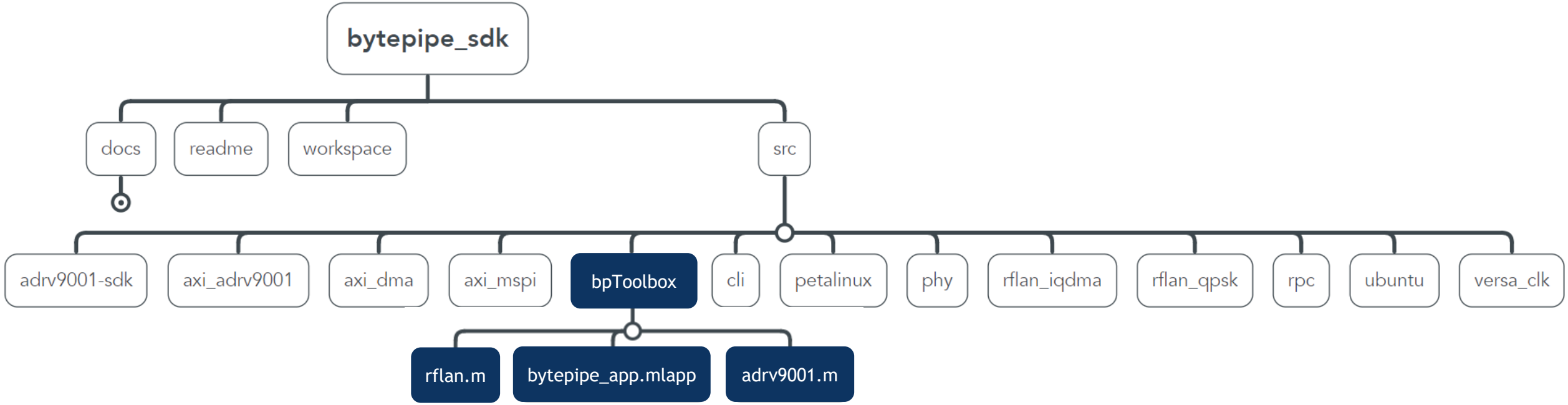
Real-time Processing Unit



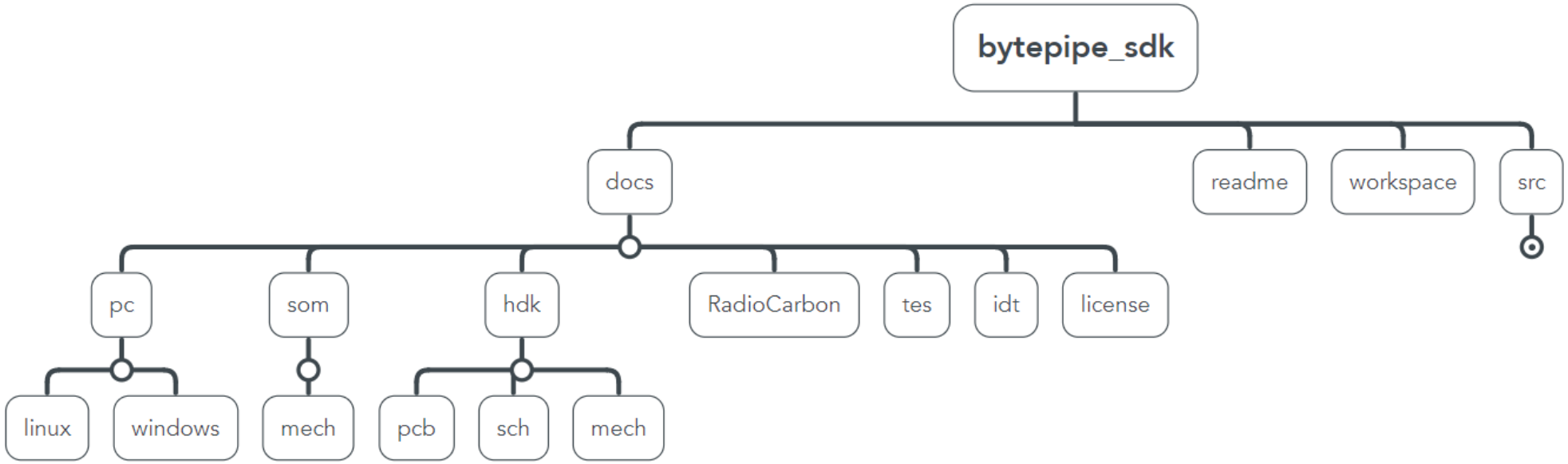
Programmable Logic



BytePipe Toolbox



Documentation



BytePipe
Transceiver Evaluation Software

NextGen
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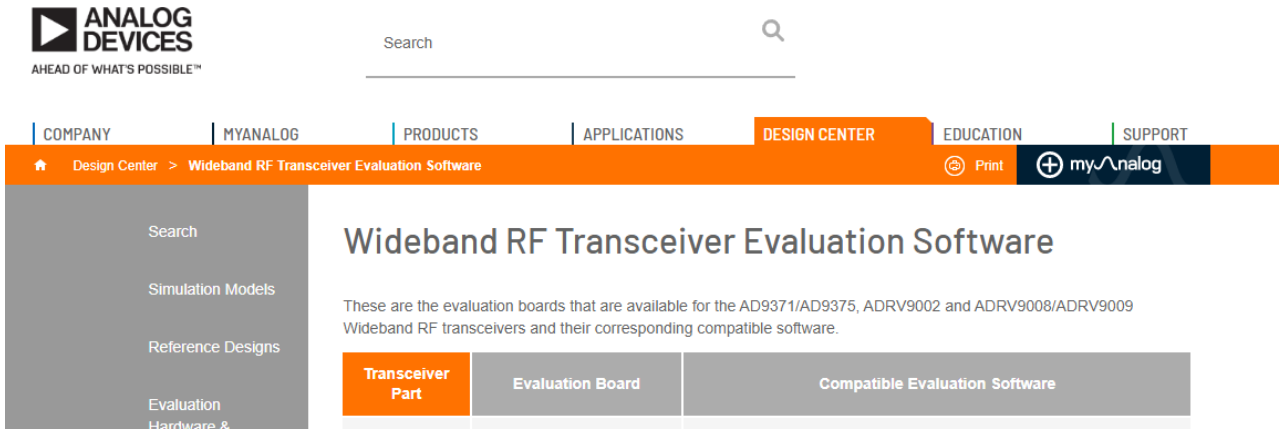
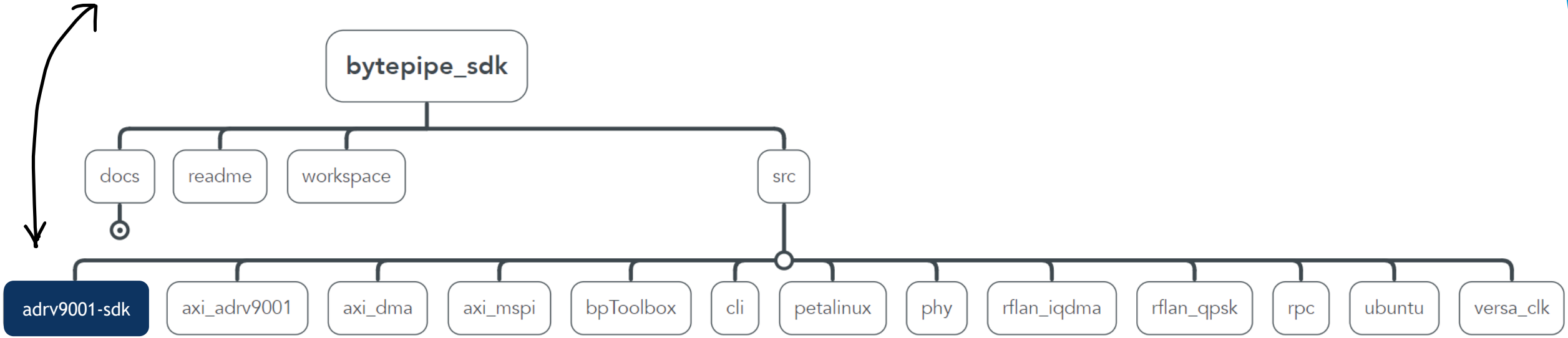
Connecting RF Engineers to the Right Technology

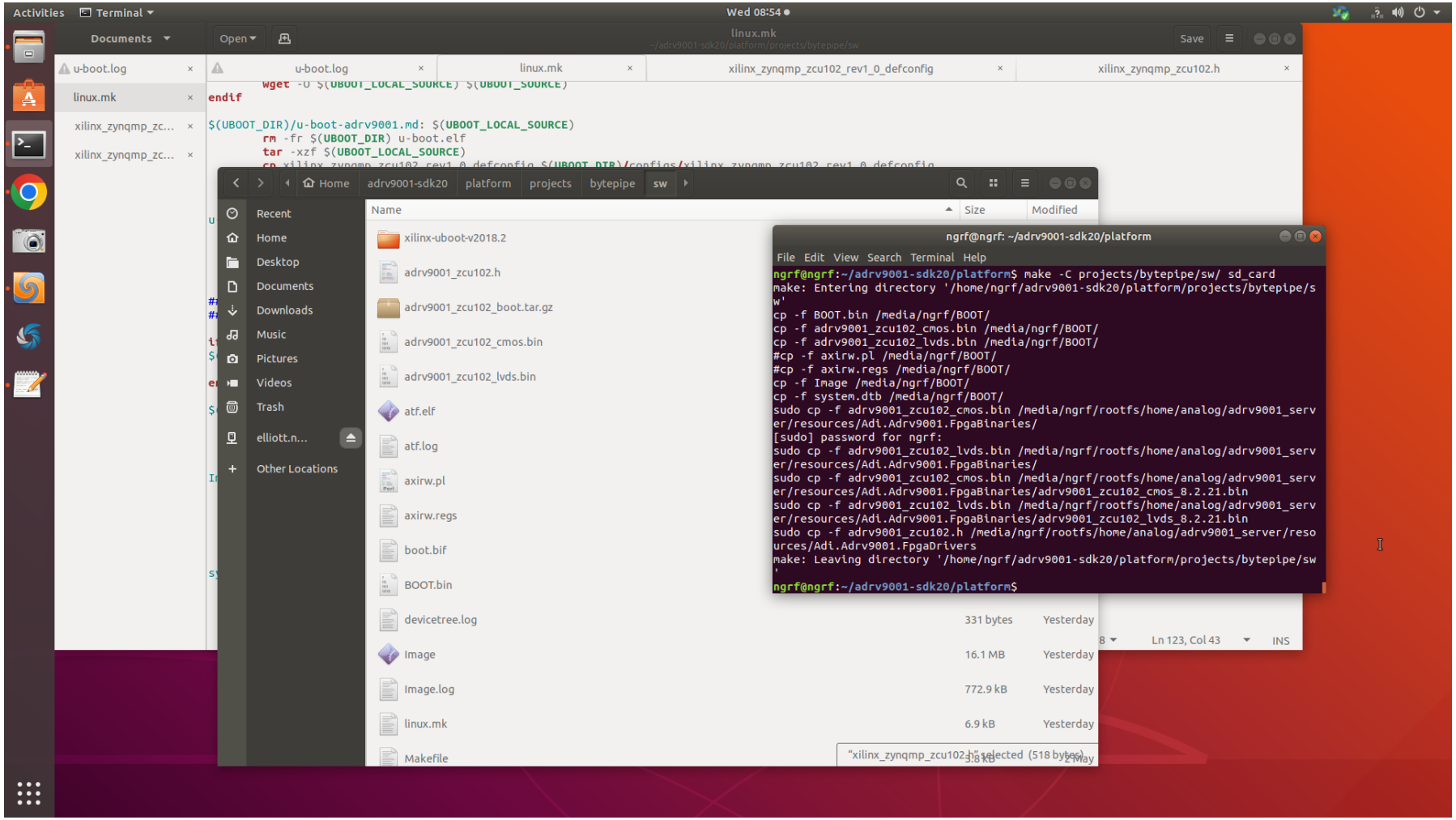
Analog Devices RF Transceiver Evaluation Software



https://www.analog.com/media/en/evaluation-boards-kits/evaluation-software/adrv9001-sdk-eval-software.zip



Live Demo - Building Software



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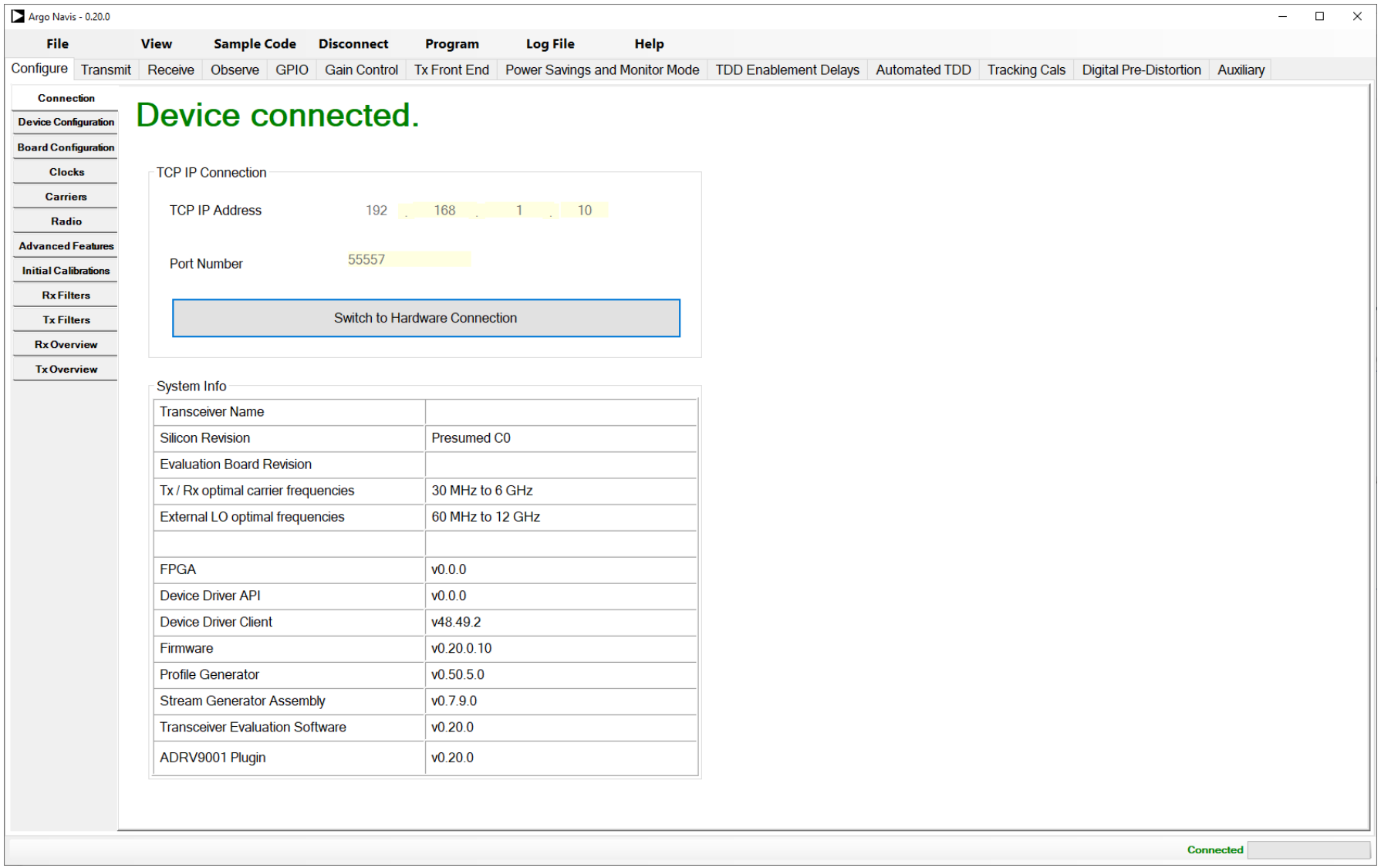
Live Demo – Using TES



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Radio Carbon DPD

NextGen RF DESIGN

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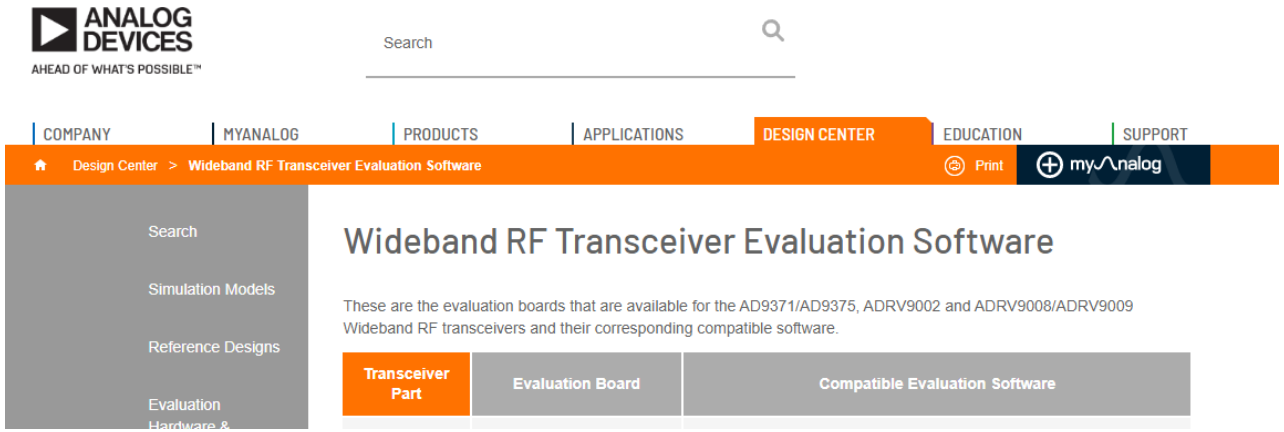
Connecting RF Engineers to the Right Technology

Analog Devices RF Transceiver Evaluation Software



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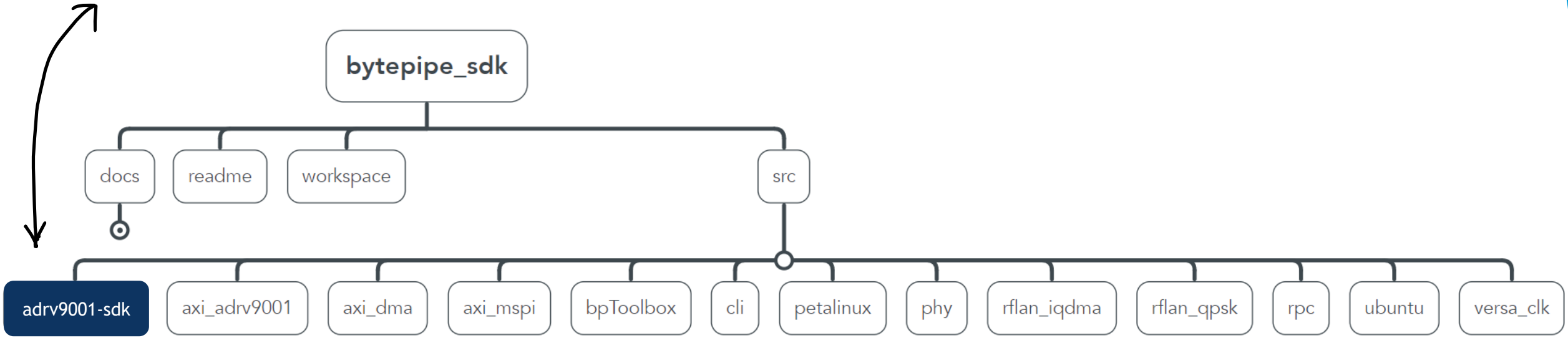
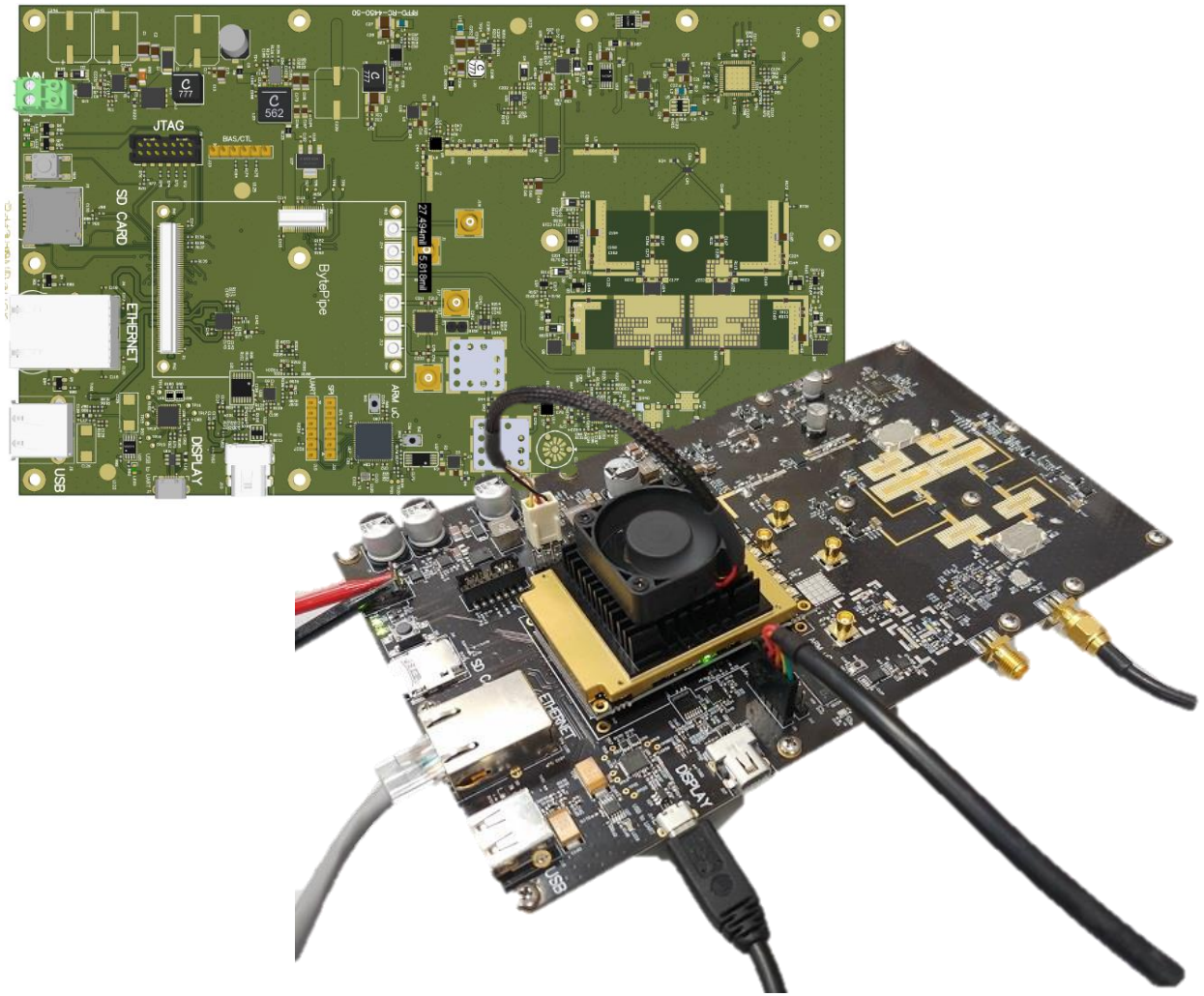
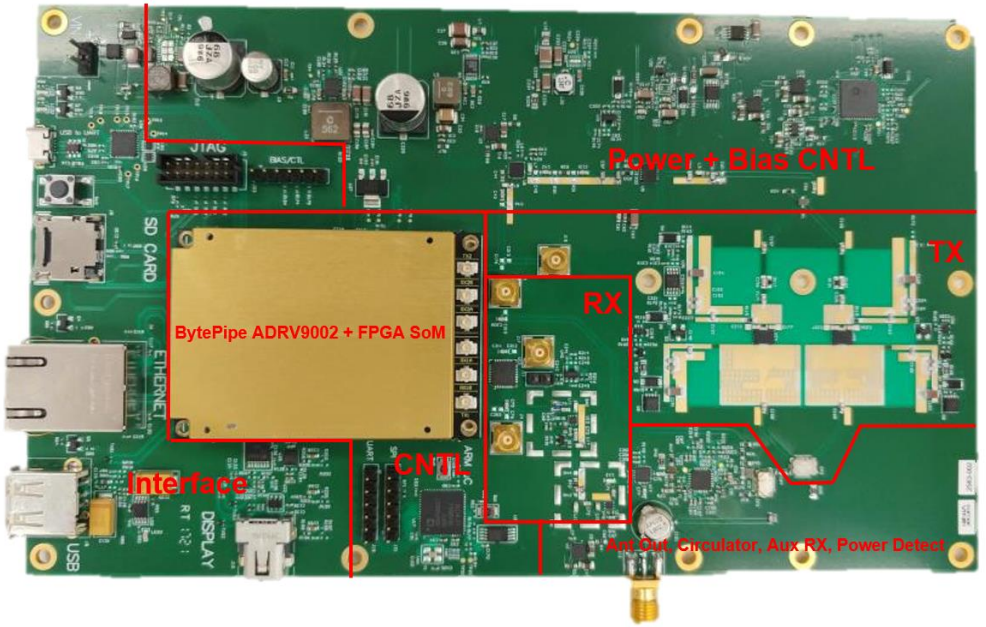
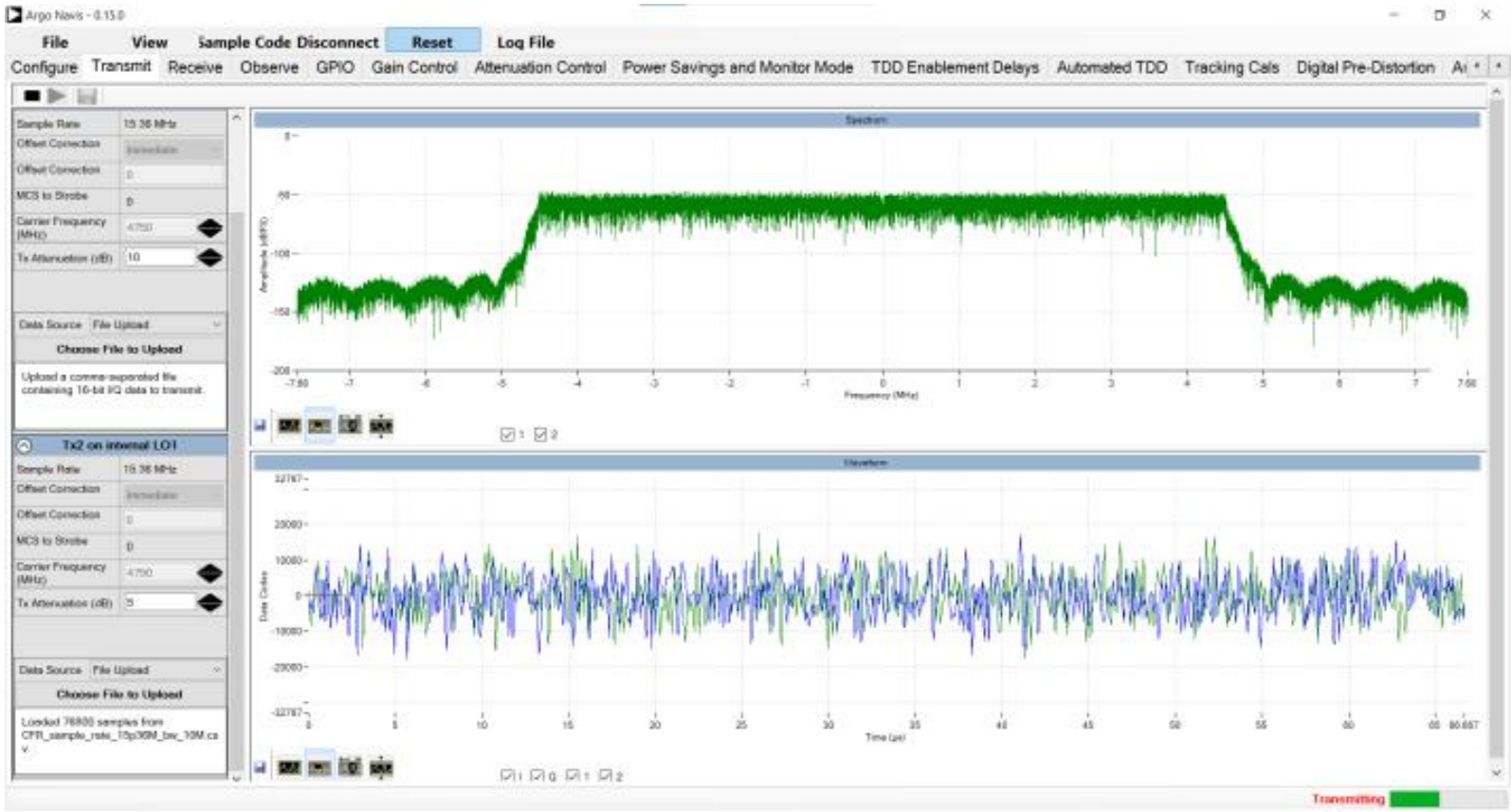


Live Demo – Hardware Setup

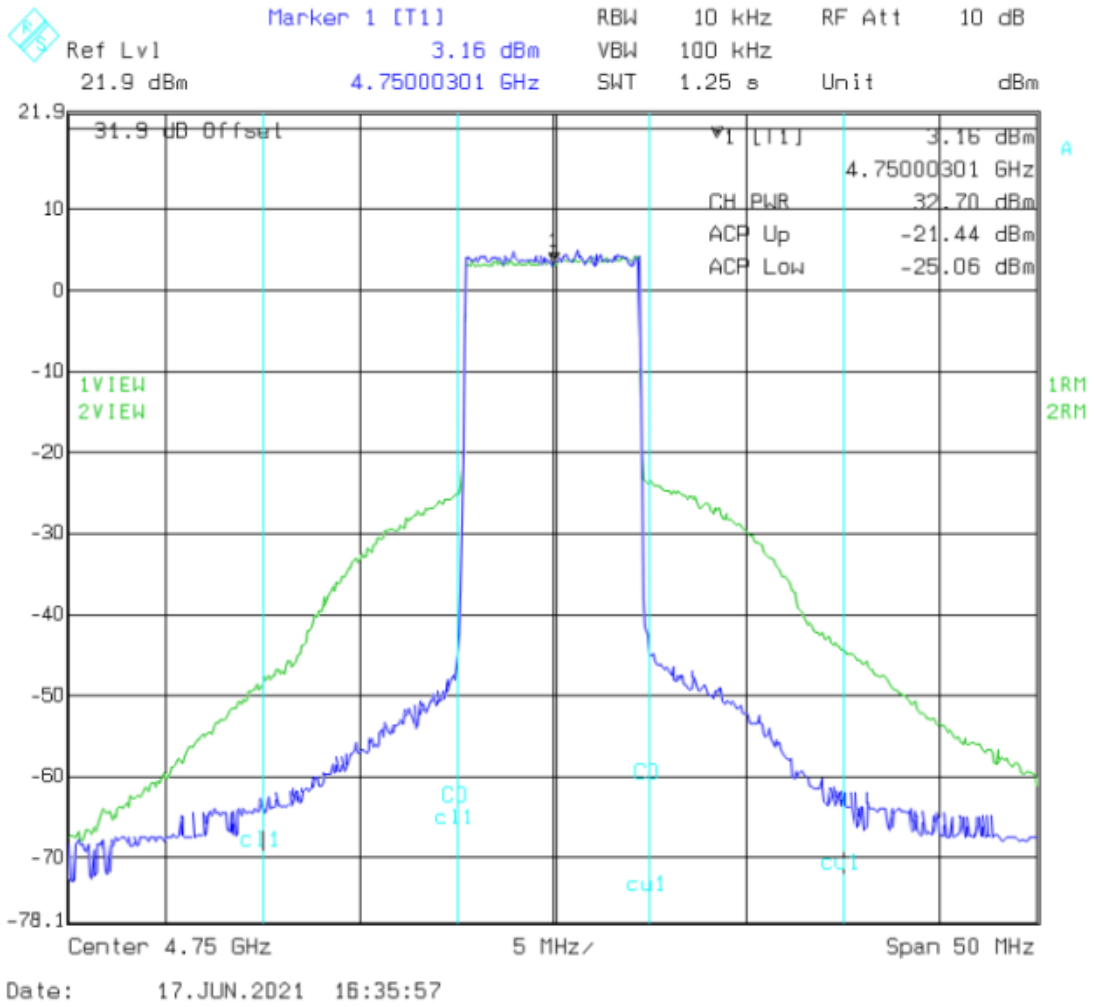




Live Demo – Using TES



Live Demo - Testing



NextGen RF DESIGN

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BytePipe Toolbox

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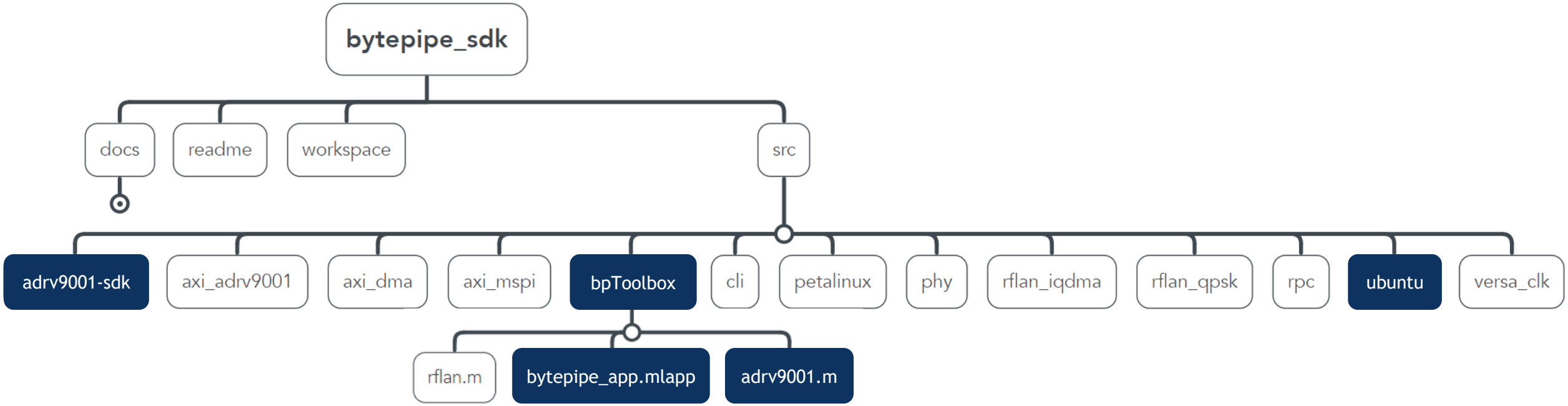
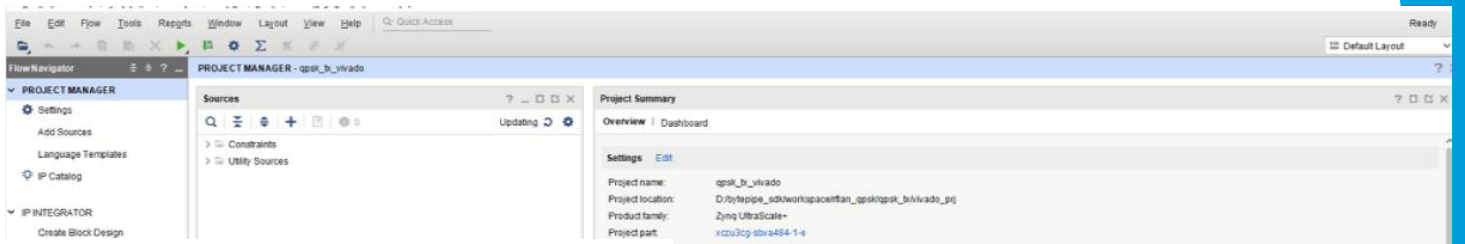
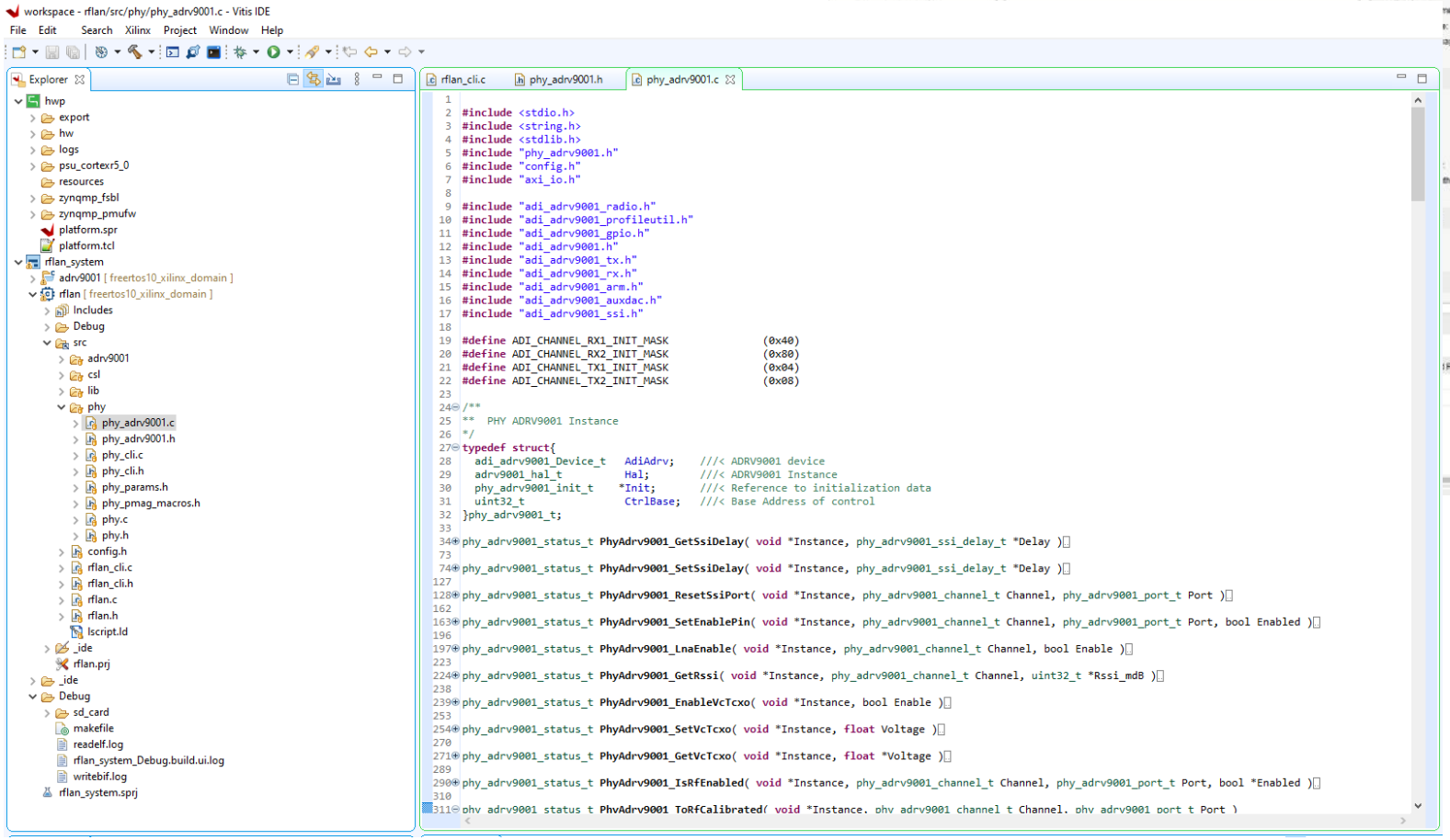
BytePipe Toolbox – Adrv9001 Server



Live Demo - Building Software





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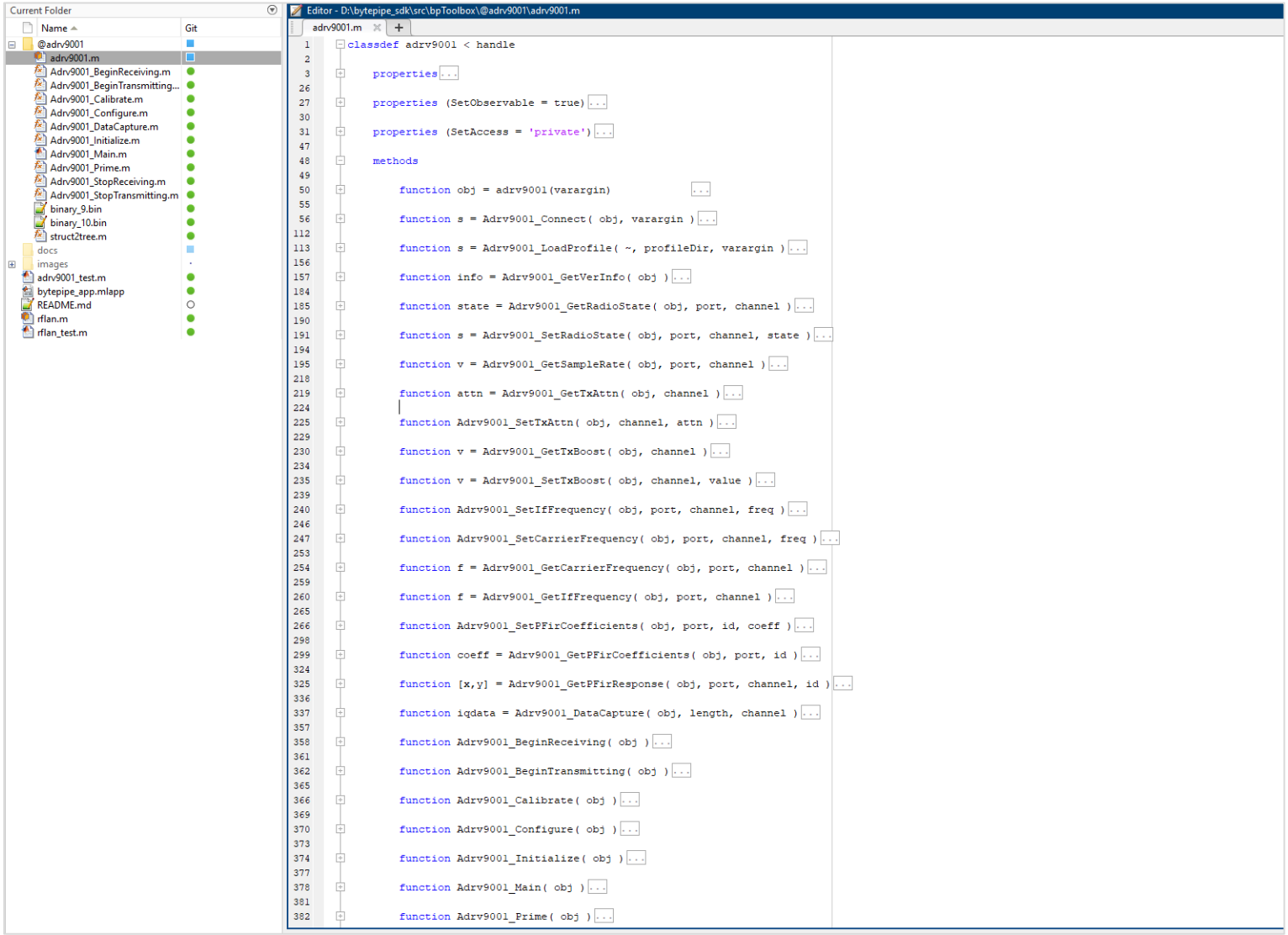
Live Demo - adrv9001.m



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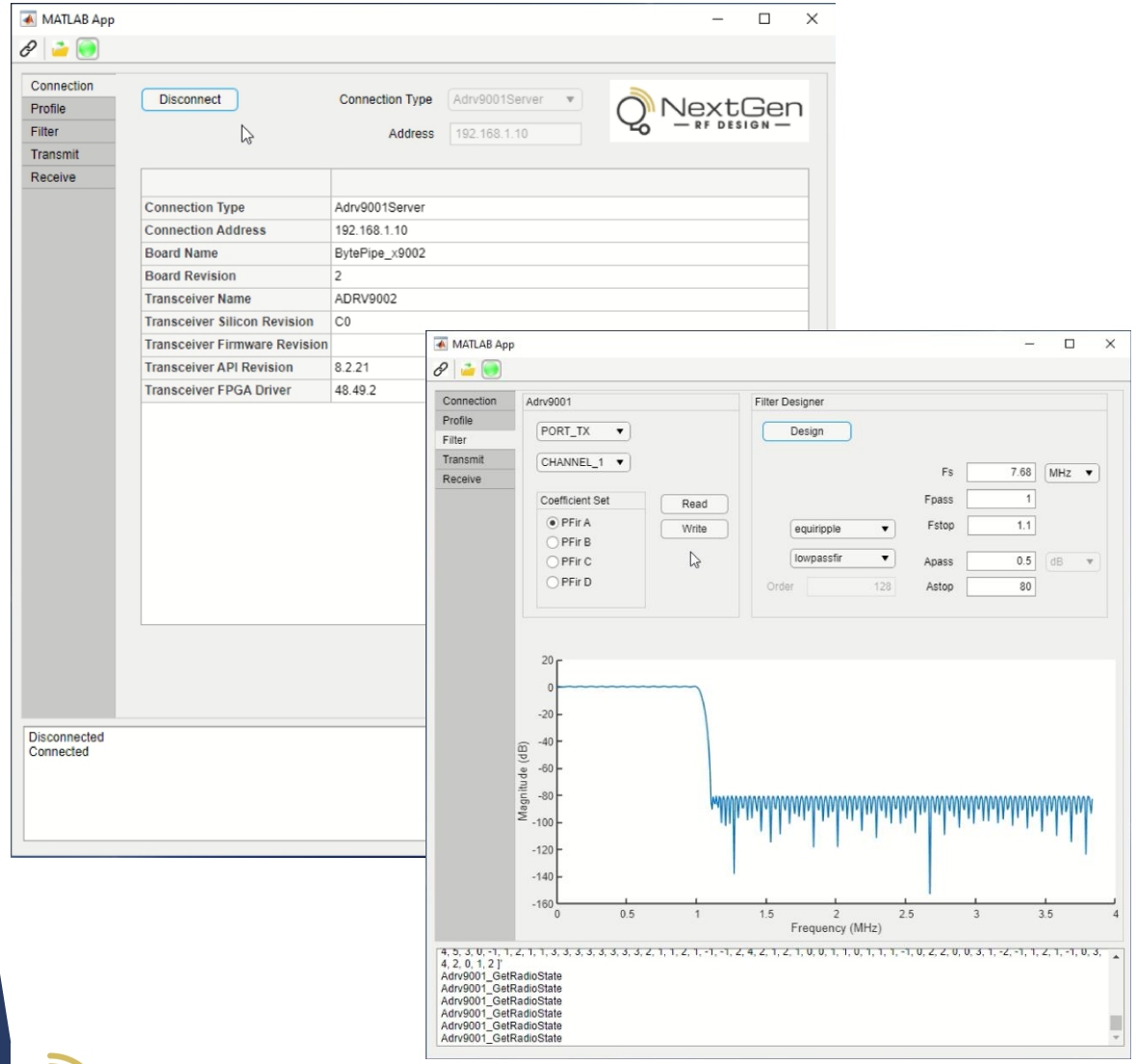
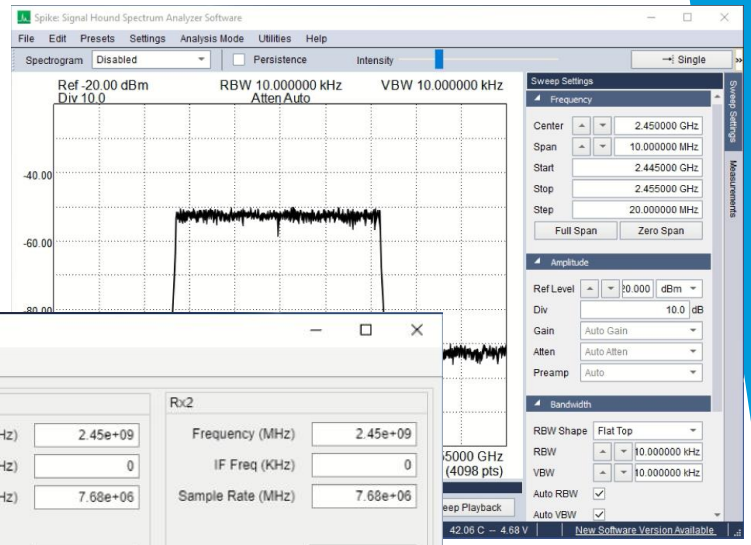
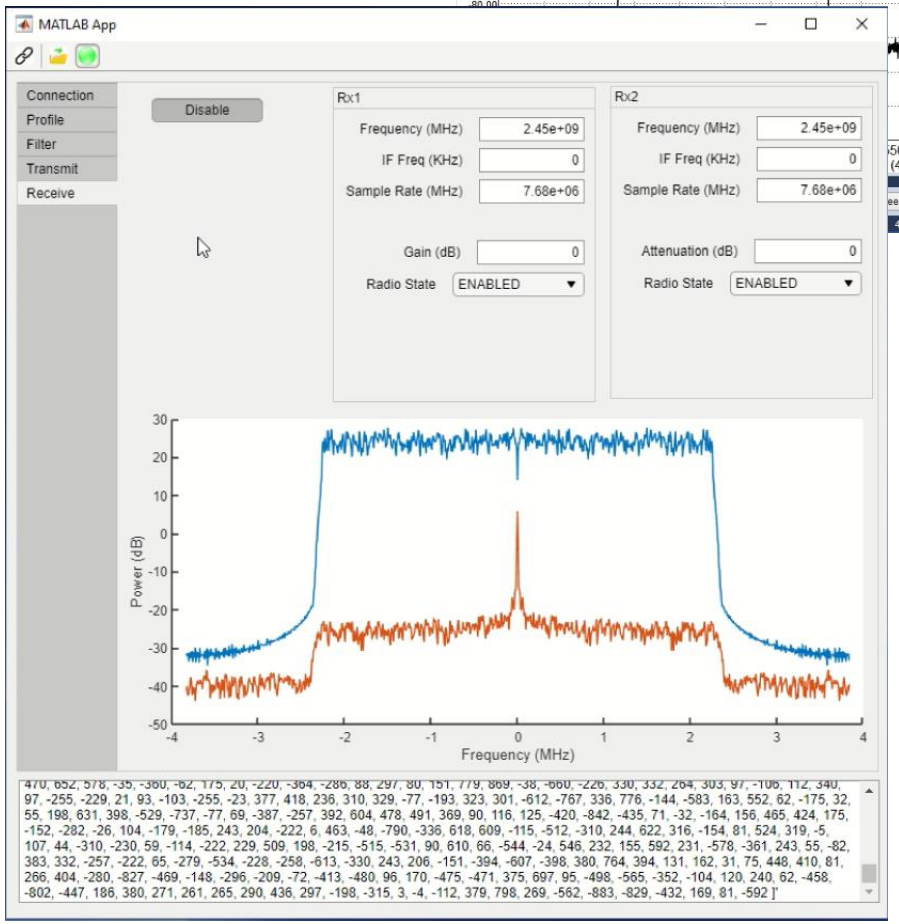
Live Demo - bytepipe_app







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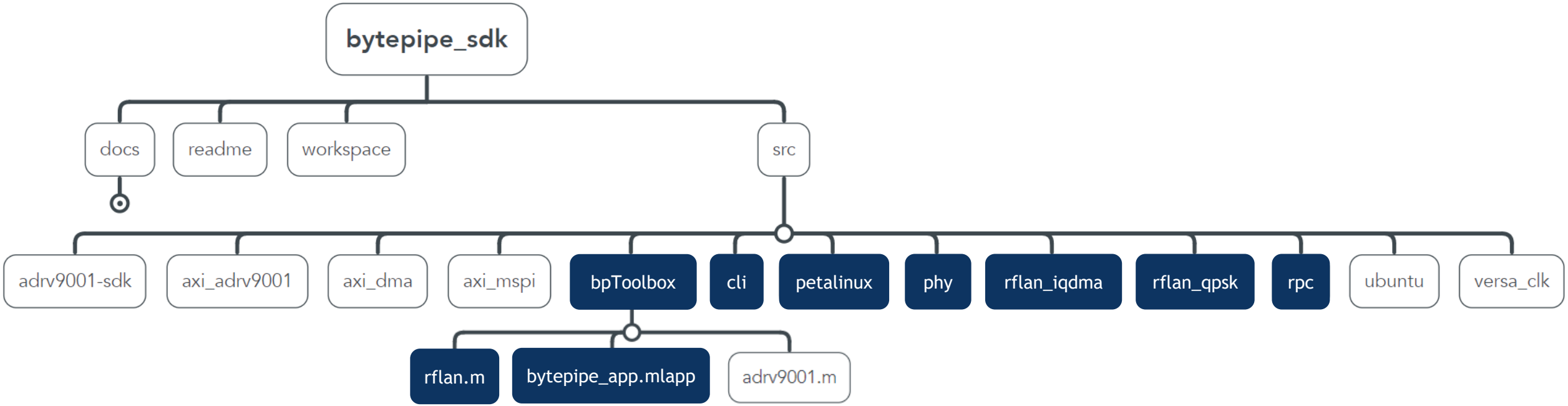
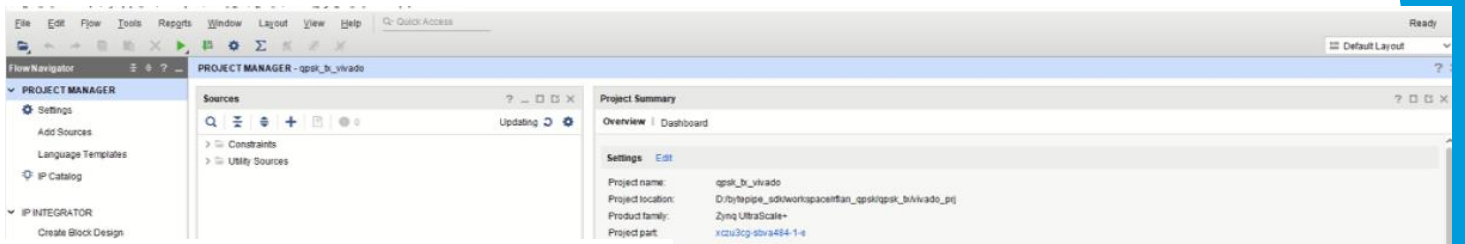
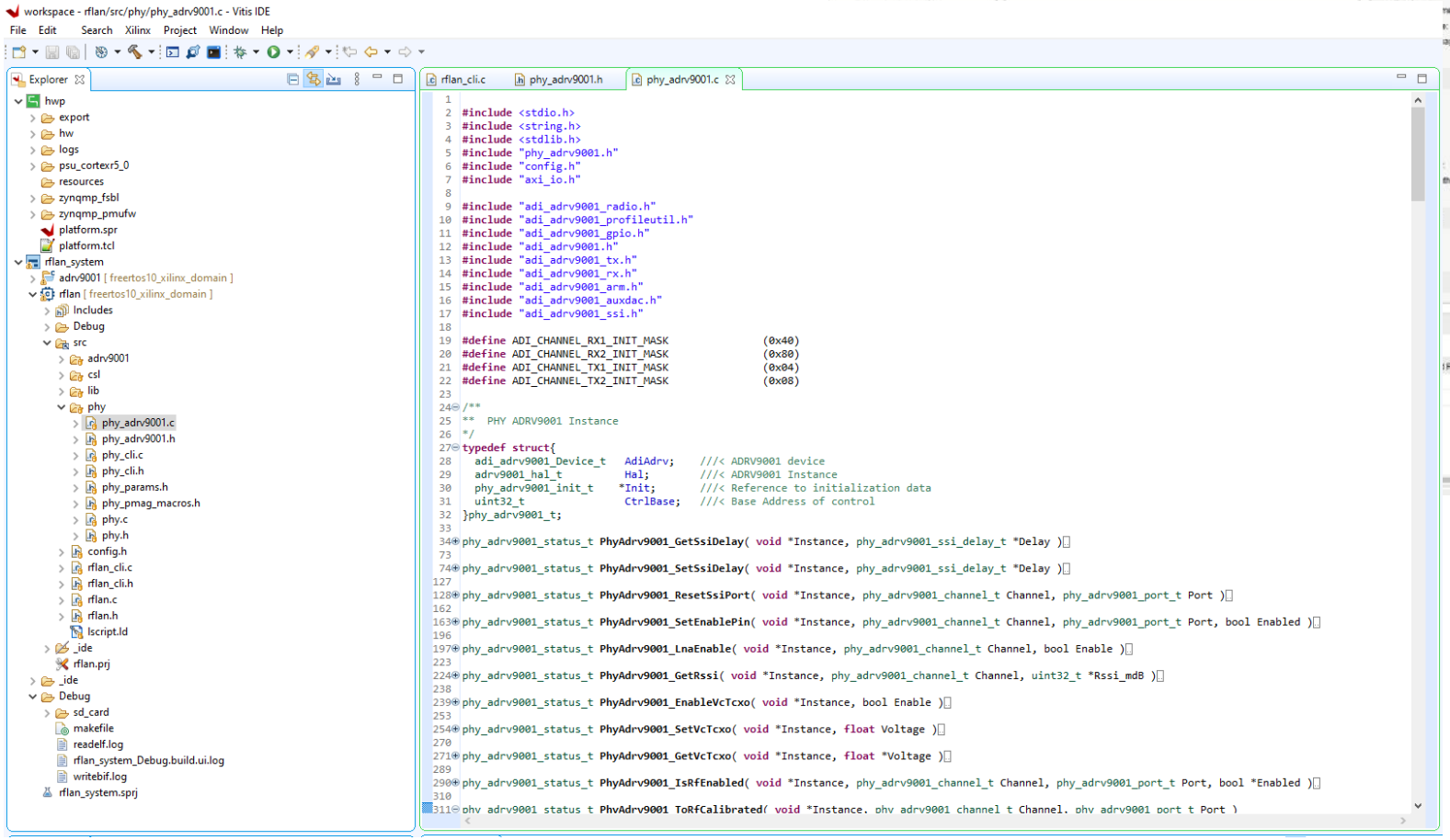
BytePipe Toolbox – Rflan Server



Live Demo - Building Software





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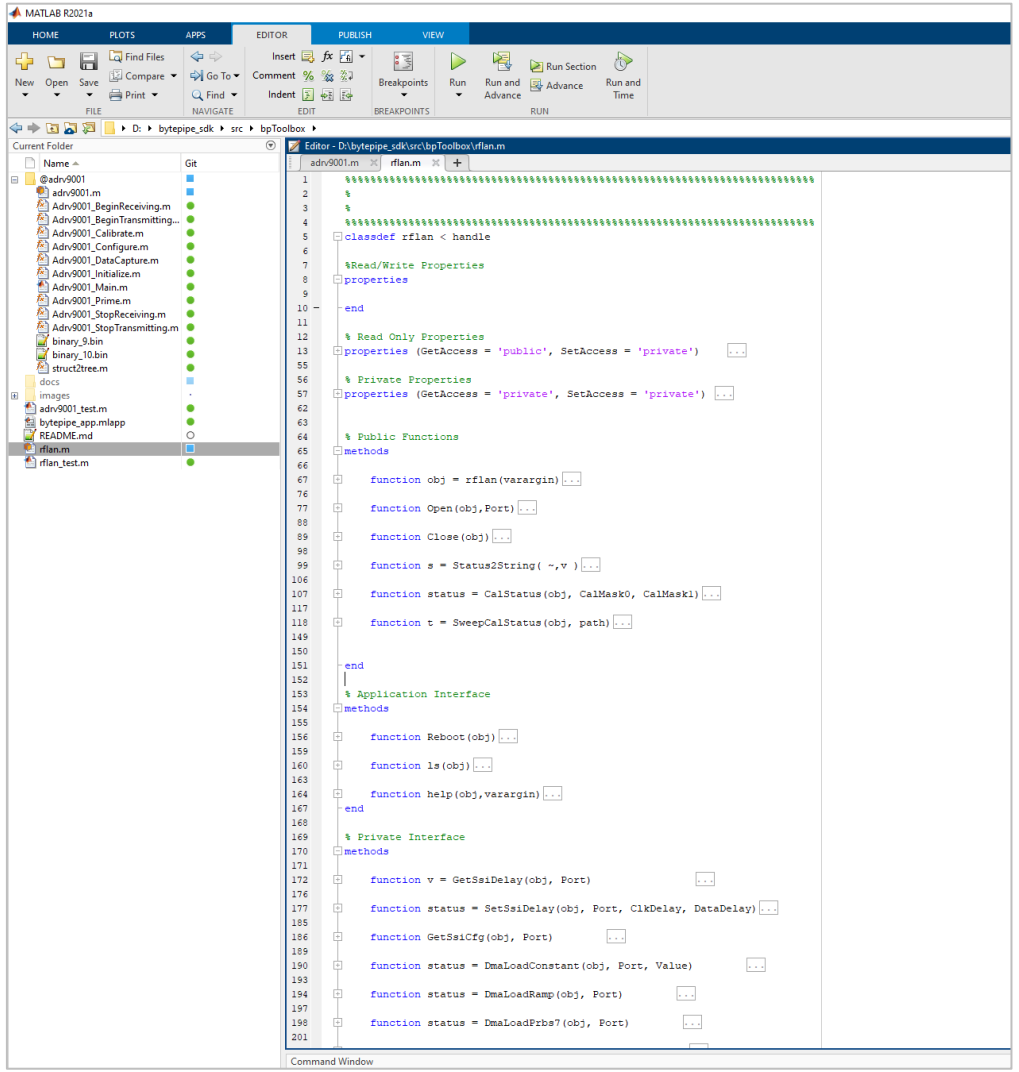
Live Demo - rflan.m



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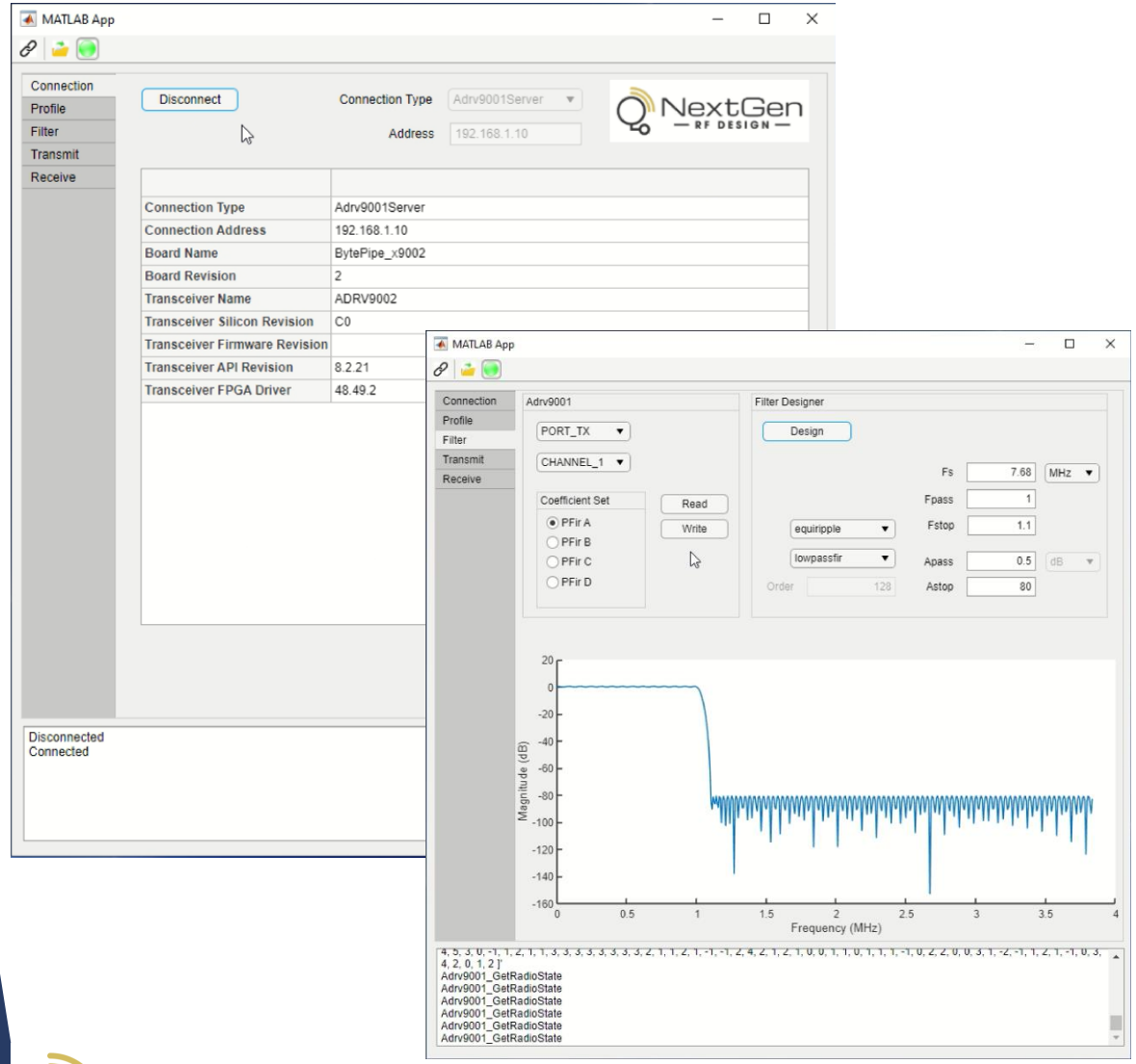
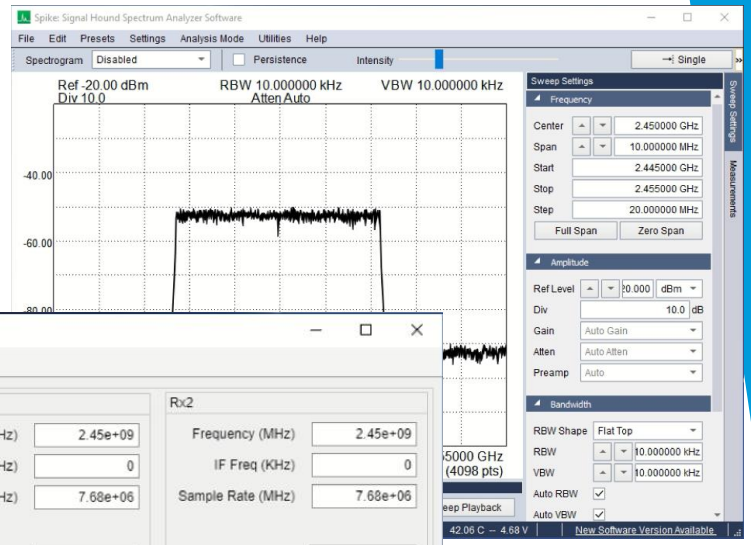
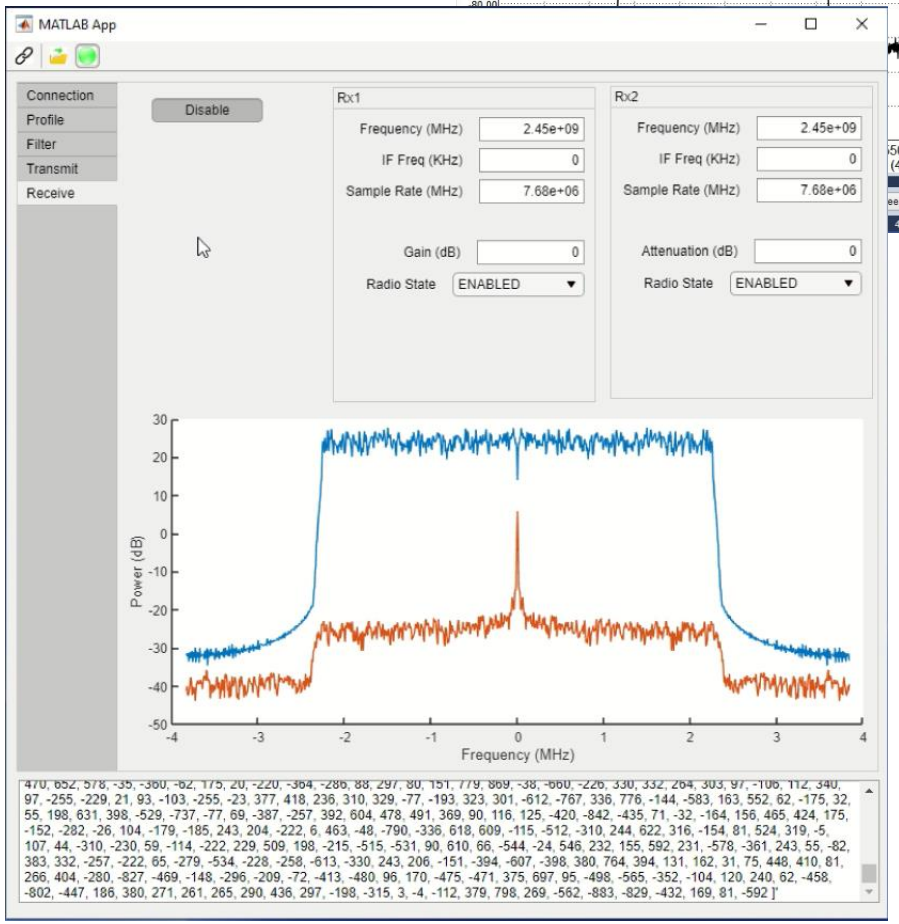
Live Demo - bytepipe_app







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BytePipe HDL Coder

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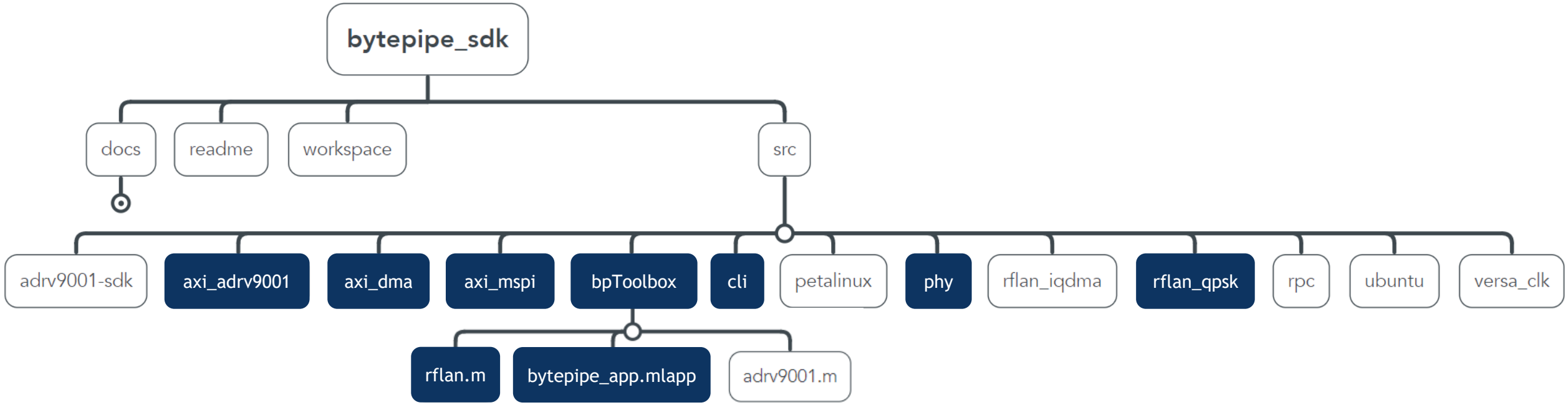
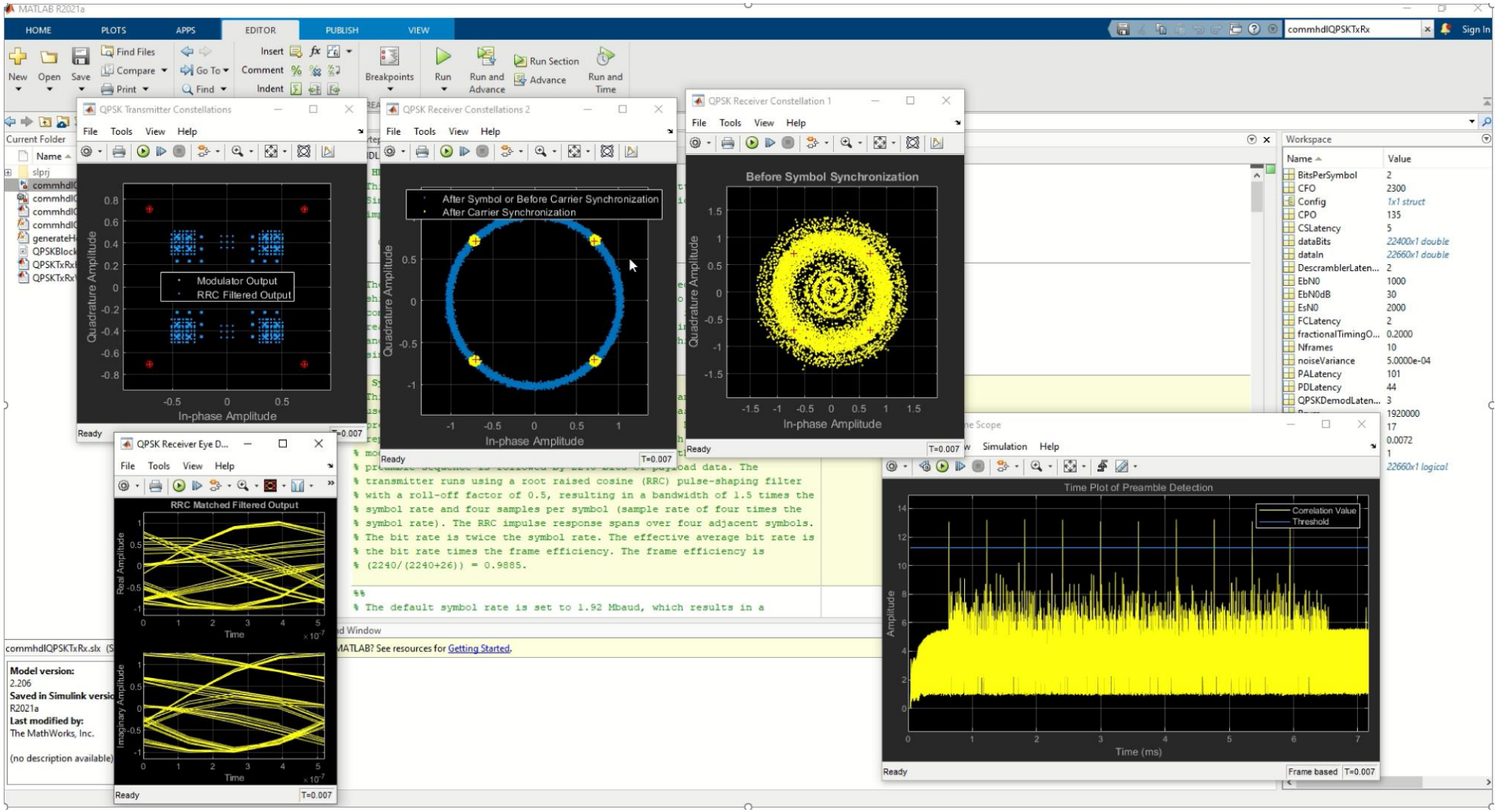
Connecting RF Engineers to the Right Technology

BytePipe Toolbox - rflan_qpsk



Live Demo – Simulating Model



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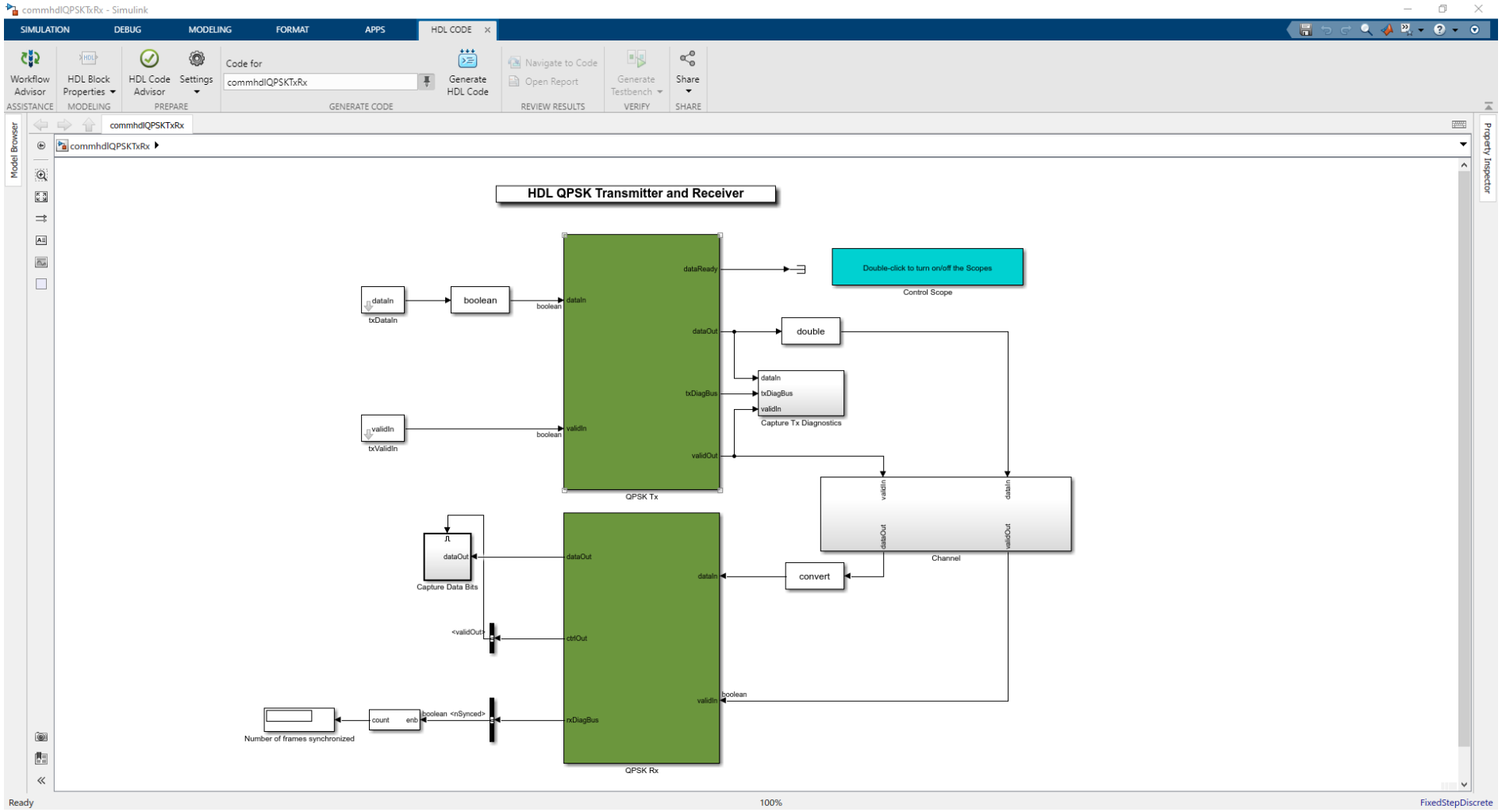
Live Demo - Building HDL



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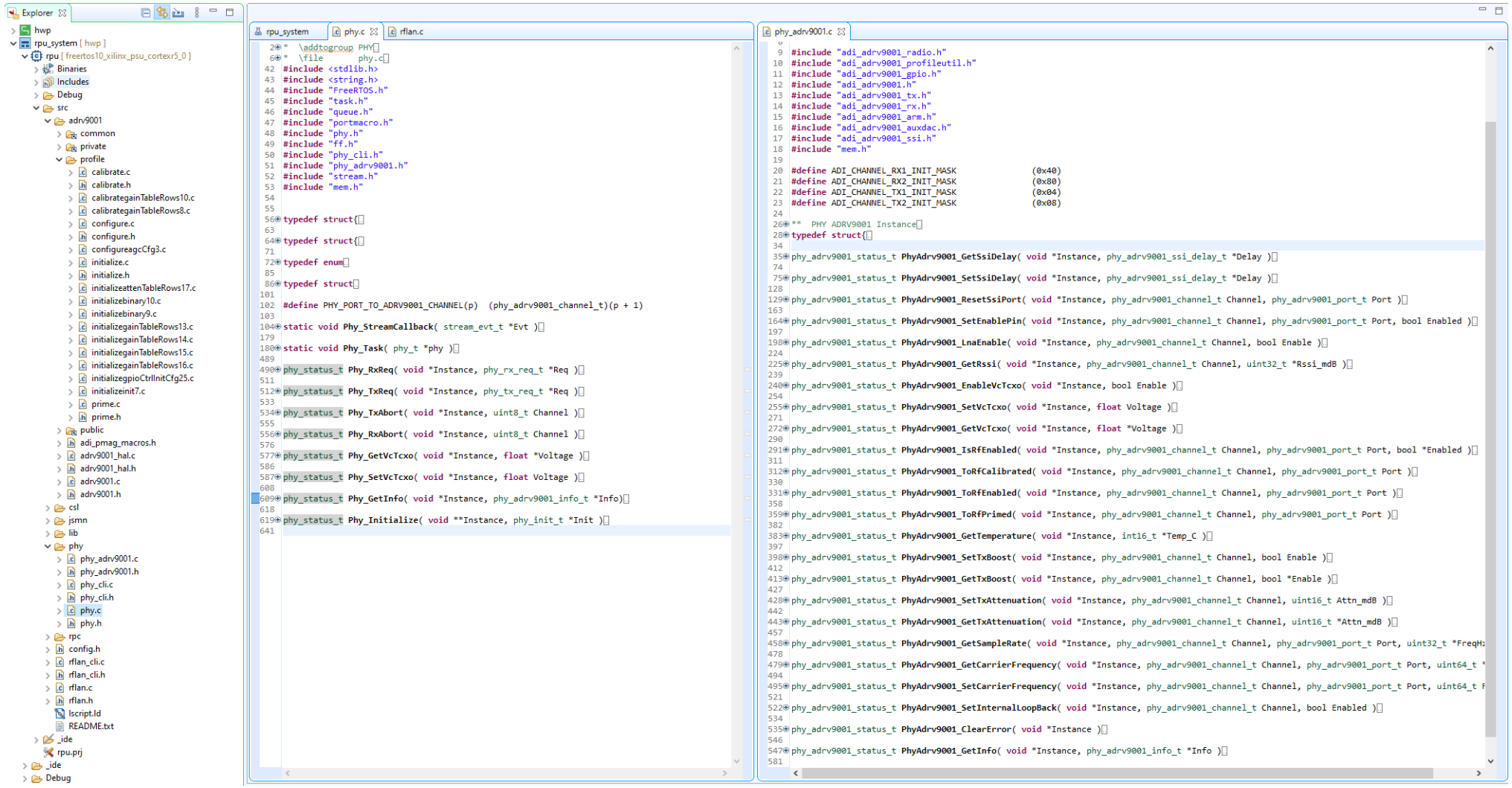
Live Demo - Building Software



Live Demo – Simulating HDL

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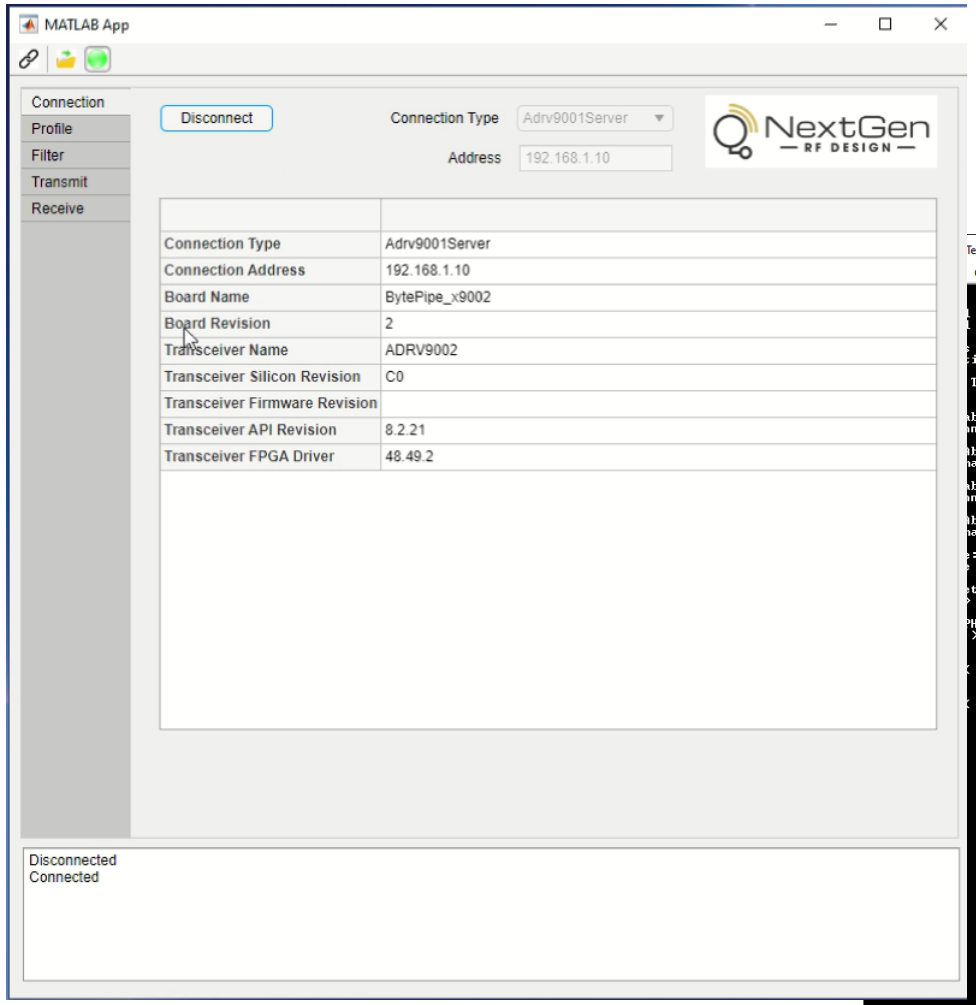
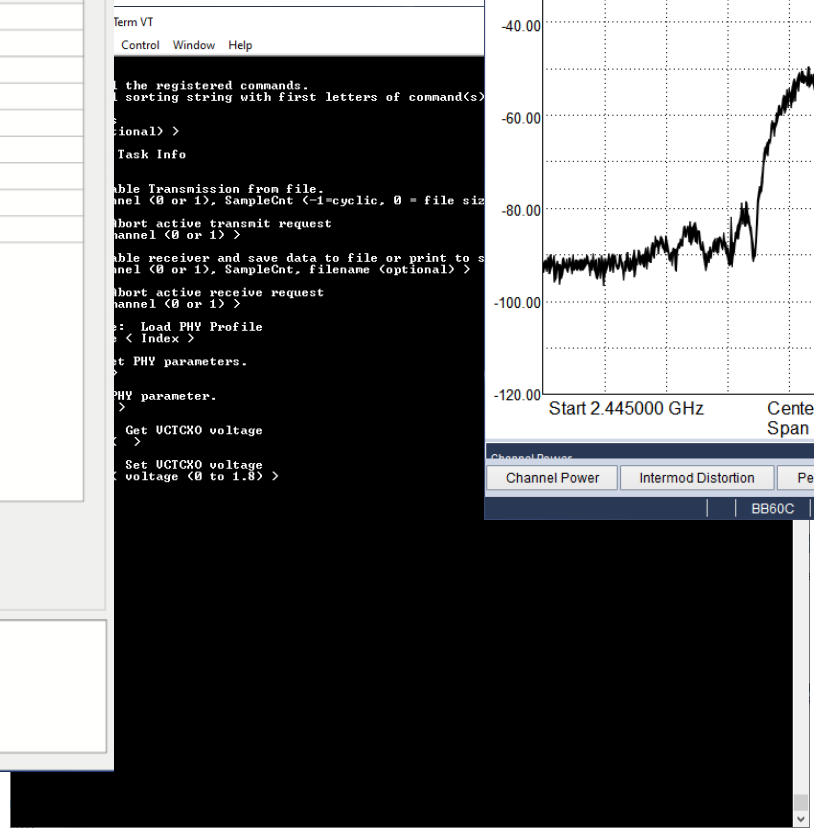
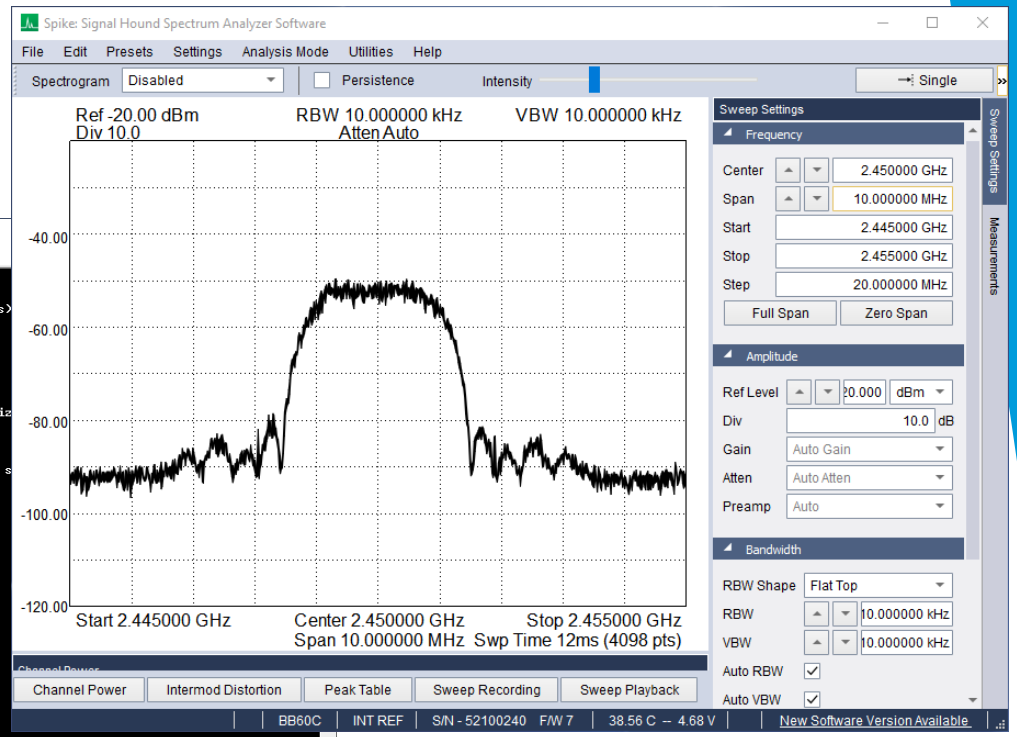
Live Demo - Testing







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