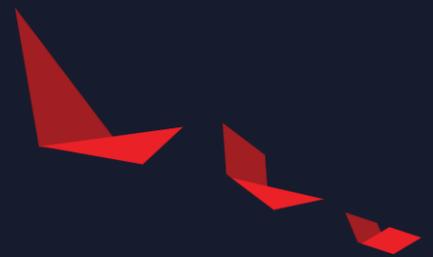


RFSoc 2x2 Project; Next steps

Patrick Lysaght
Senior Director, Xilinx research labs

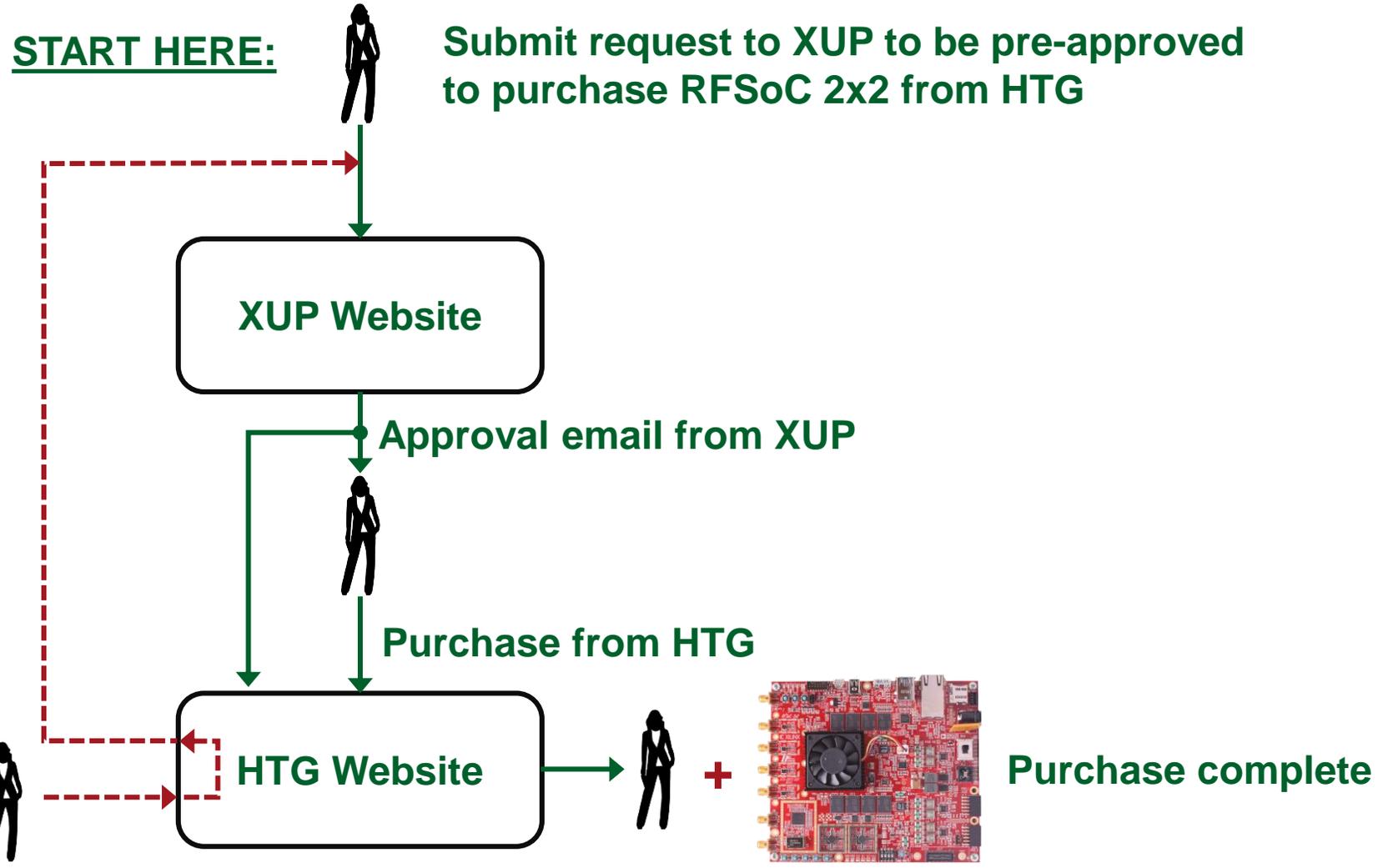
FPGA21 RFSoc PYNQ Tutorial





**We invite you to join
the RFSoc 2x2 community**

RFSoc 2x2 Purchase Process



NOT RECOMMENDED:

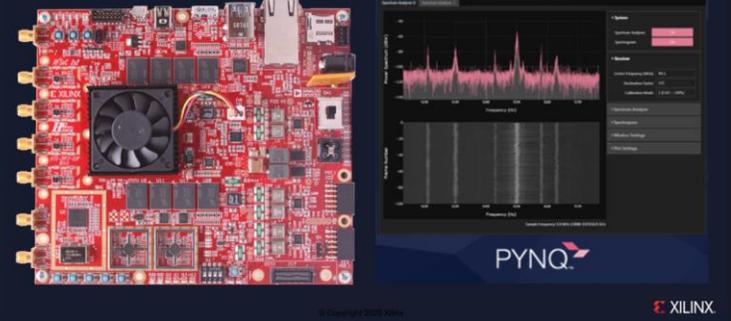
Buyer instructed to go to XUP website first to submit pre-approval request

XUP Website: <https://www.xilinx.com/support/university.html>

The image shows two overlapping browser windows from the Xilinx website. The left window displays the 'Xilinx University Program' page, featuring a large banner for the 'New Low-Cost RFSoc Teaching and Research Platform' with an image of the RFSoc 2x2 board and a software interface. Below the banner is a section for 'Xilinx Adaptive Compute Clusters' with a list of bullet points. To the right are sections for 'What's New', 'Events', 'Videos', and 'Resources'. The right window shows the 'RFSoc 2x2 Kit' product page, which includes a navigation menu (Overview, Hardware, Tools & IP, Docs & Designs, Purchase), a product image with a 'Click to expand' button, and a detailed list of features and included items. A 'Feedback' button is visible in the bottom right corner of the right window.

Xilinx University Program

New Low-Cost RFSoc Teaching and Research Platform



Xilinx Adaptive Compute Clusters

- Support novel research in adaptive compute acceleration for high performance computing (HPC)
- Clusters are strategically located to provide access to the worldwide researchers
- Equipped with latest Alveo hardware and Vitis software technologies

What's New

XUP RFSoc 2x2 Board available to academics at an affordable price

Events

- XUP at Conferences
- Design Contests
- Workshops Schedule

Videos

- Digilent Basys 3 Introduction
- Getting Started with Vivado and Digilent Basys3

Resources

- Donation Program

RFSoc 2x2 Kit

Overview Hardware Tools & IP Docs & Designs Purchase

RFSoc 2x2 Kit

Xilinx's Radio Frequency System-on-Chip (RFSoc) devices have created a new class of integrated circuit architecture for the communications and instrumentation markets. RFSoc's combine high-accuracy ADCs and DACs operating at Giga samples per second with programmable heterogeneous compute engines.

XUP is offering the **RFSoc 2x2 kit** exclusively for academic customers. The kit features:

- Affordable price of \$1,899 available only to academic customers
- RFSoc 2x2 board with 2 RF DAC and 2 RF ADC channels
- PYNQ framework with Jupyter Lab for exceptional ease-of-use
- Open-source resources including teaching materials, notebooks, and design examples
- Complete end-to-end reference designs including spectrum analyzers and software defined radios
- Dedicated project webpage at rfsoc-pynq.io
- GitHub-hosted repositories of all project materials
- Online community support forum

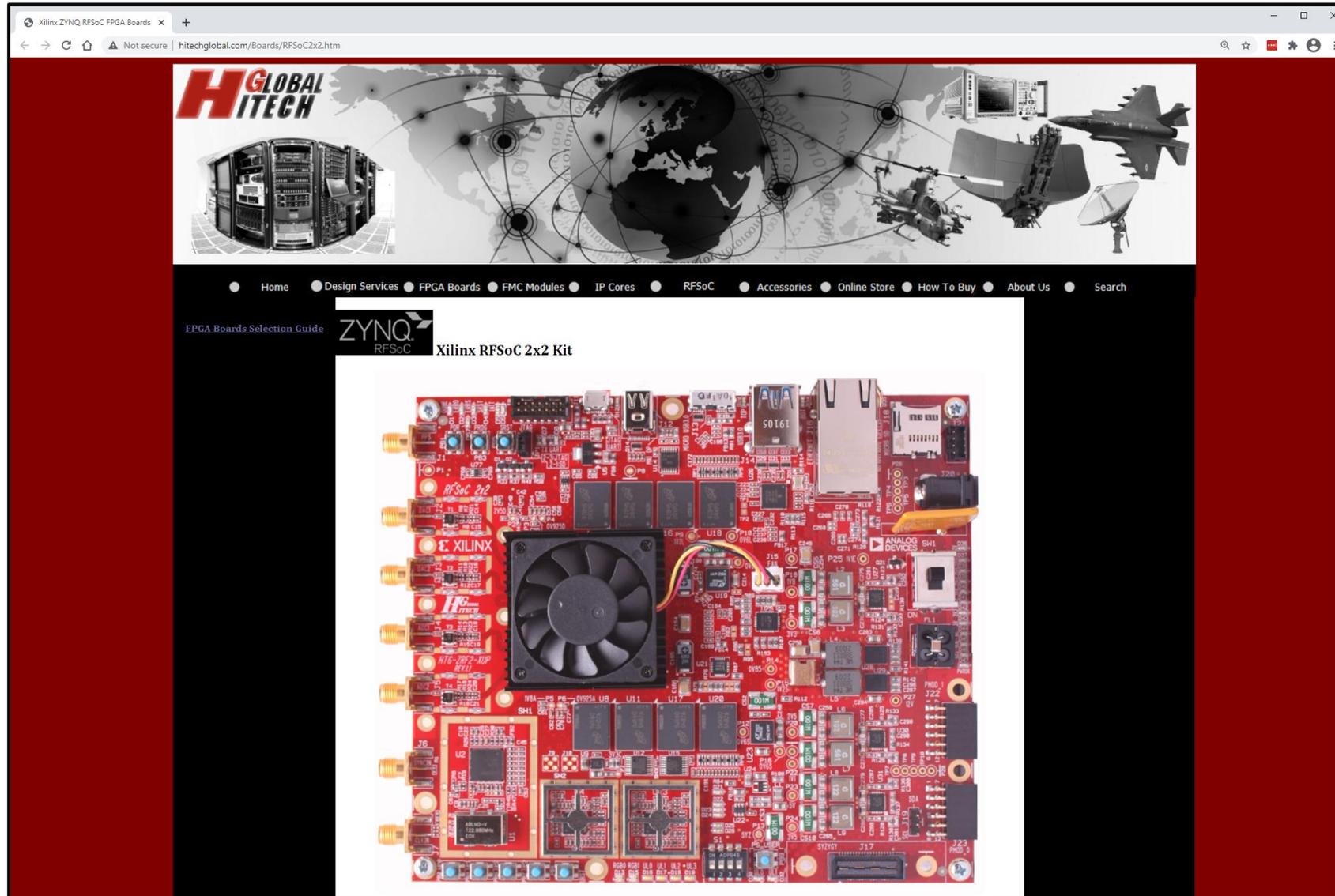
Register with XUP as academic to purchase ?

What is included?

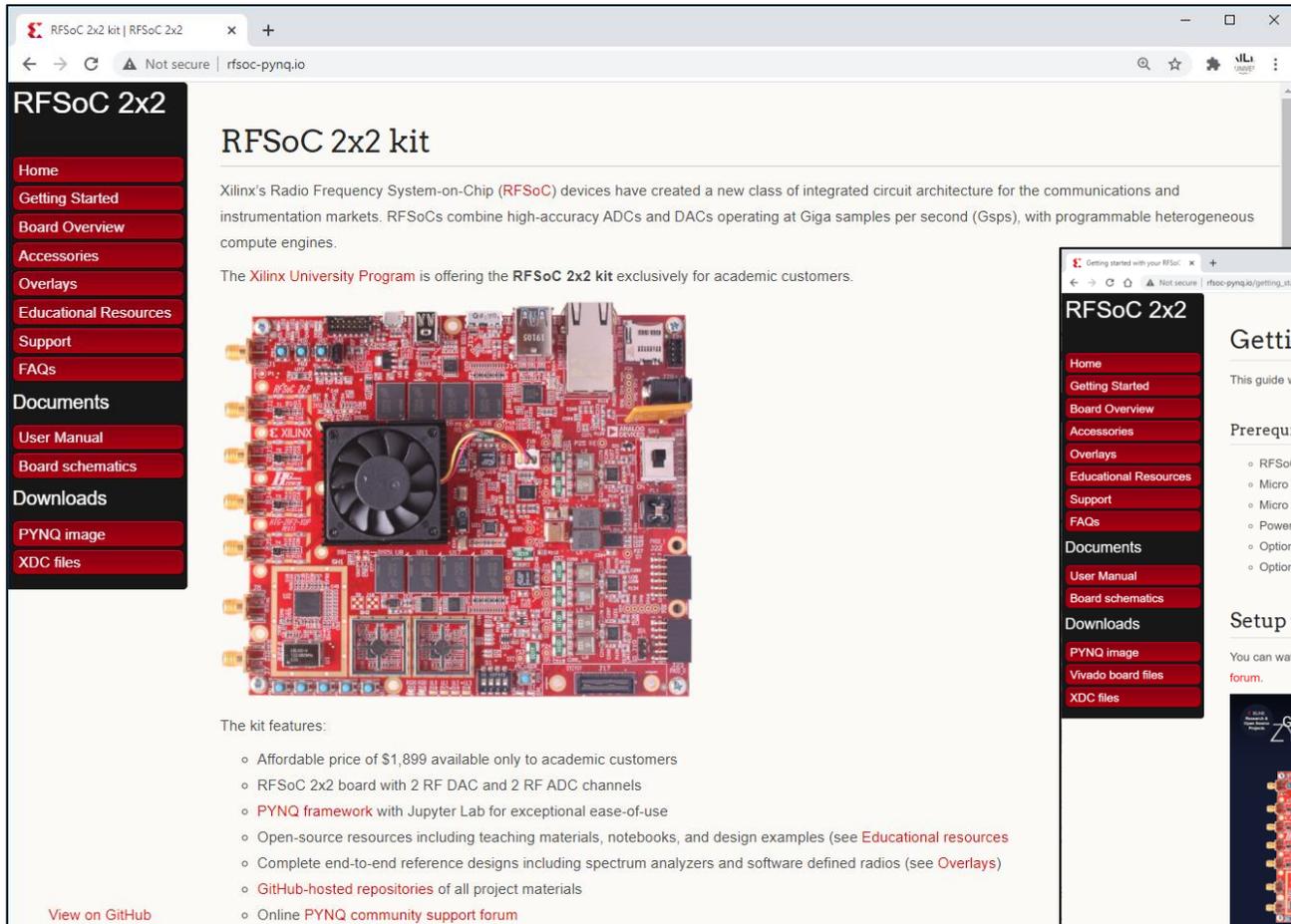
- RFSoc 2x2 Board
- 12V 72W power supply unit
- USB 3.0 A to Micro B Cable
- 2 RF cables with SMA connectors
- 16 GB MicroSD card with pre-loaded Linux and PYNQ image

Feedback

High Tech Global: <http://www.hitechglobal.com/>



Project Website: rfsoc-pynq.io

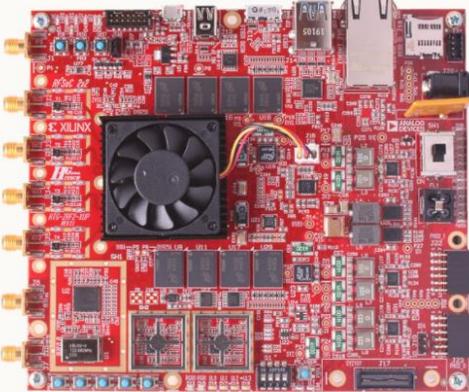


RFSoc 2x2

RFSoc 2x2 kit

Xilinx's Radio Frequency System-on-Chip (RFSoc) devices have created a new class of integrated circuit architecture for the communications and instrumentation markets. RFSocs combine high-accuracy ADCs and DACs operating at Giga samples per second (Gsp/s), with programmable heterogeneous compute engines.

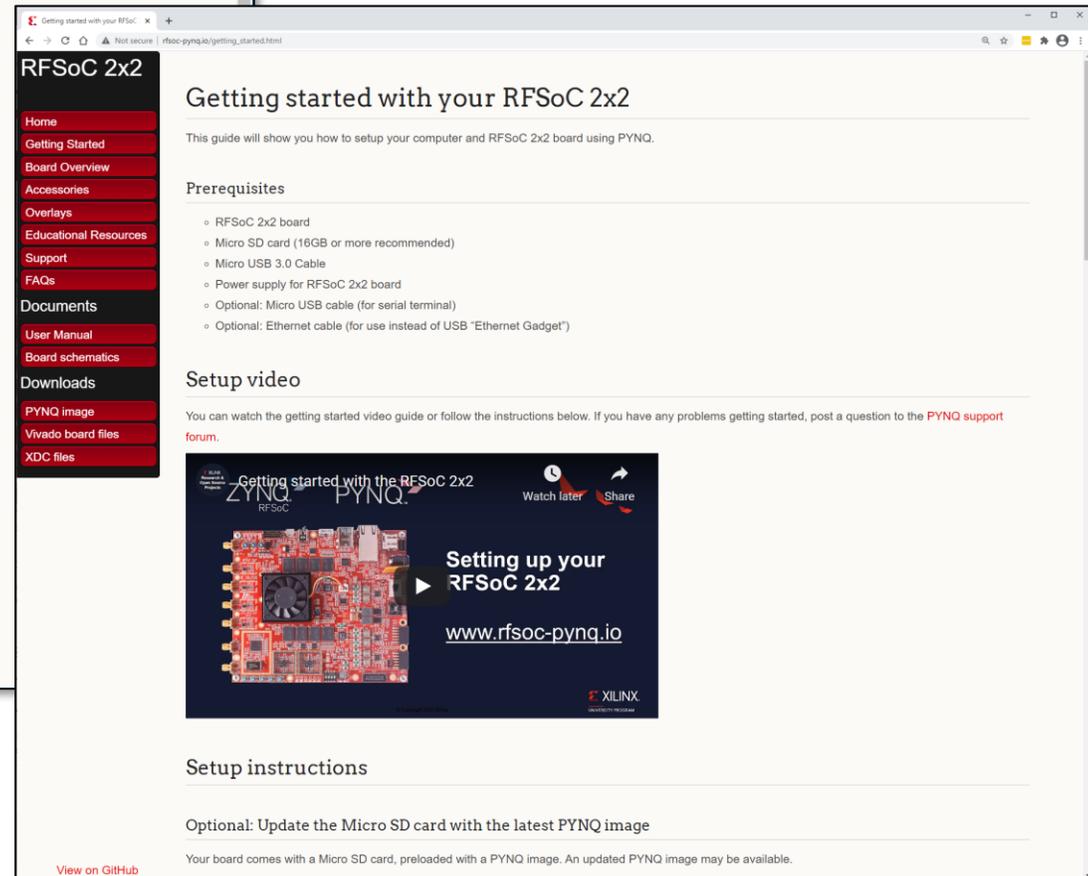
The [Xilinx University Program](#) is offering the **RFSoc 2x2 kit** exclusively for academic customers.



The kit features:

- Affordable price of \$1,899 available only to academic customers
- RFSoc 2x2 board with 2 RF DAC and 2 RF ADC channels
- **PYNQ framework** with Jupyter Lab for exceptional ease-of-use
- Open-source resources including teaching materials, notebooks, and design examples (see [Educational resources](#))
- Complete end-to-end reference designs including spectrum analyzers and software defined radios (see [Overlays](#))
- [GitHub-hosted repositories](#) of all project materials
- Online PYNQ community support forum

[View on GitHub](#)



Getting started with your RFSoc 2x2

This guide will show you how to setup your computer and RFSoc 2x2 board using PYNQ.

Prerequisites

- RFSoc 2x2 board
- Micro SD card (16GB or more recommended)
- Micro USB 3.0 Cable
- Power supply for RFSoc 2x2 board
- Optional: Micro USB cable (for serial terminal)
- Optional: Ethernet cable (for use instead of USB "Ethernet Gadget")

Setup video

You can watch the getting started video guide or follow the instructions below. If you have any problems getting started, post a question to the [PYNQ support forum](#).



Setup instructions

Optional: Update the Micro SD card with the latest PYNQ image

Your board comes with a Micro SD card, preloaded with a PYNQ image. An updated PYNQ image may be available.

[View on GitHub](#)

RFSoc 2x2 Overlays



RFSoc 2x2 overlays | RFSoc 2x2 x +
Not secure | rfsoc-pynq.io/overlays.html

RFSoc 2x2

- Home
- Getting Started
- Board Overview
- Accessories
- Overlays
- Educational Resources
- Support
- FAQs

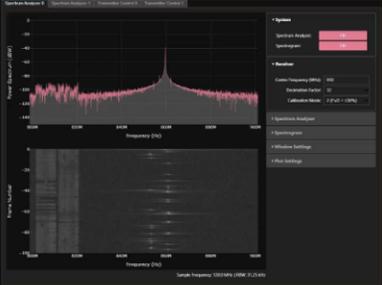
RFSoc 2x2 overlays

Base Overlay

The base overlay is included in the PYNQ image for the RFSoc 2x2 board and will be available for you to use from the first time you start your board. The purpose of the base overlay design is to allow you to start exploring your board with PYNQ out-of-the-box. See the [RFSoc 2x2 base overlay](#) page for more details.

Spectrum Analyzer

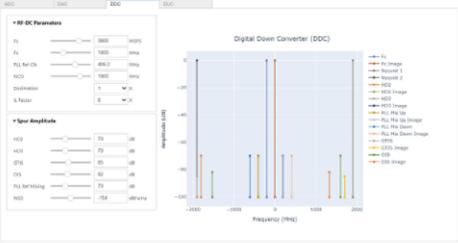
An RFSoc spectrum analysis tool is available on your RFSoc 2x2 from the first time you start your board. The spectrum analyzer was developed by the University of Strathclyde Software Defined Radio (SDR) research laboratory. You can use the spectrum analyzer tool to explore your surrounding RF spectrum.



You can follow this [link to the RFSoc Spectrum Analyzer GitHub page](#), where you can update your spectrum analyzer tool, contribute to the project, or post questions and feedback using the issue tracker.

RFSoc Frequency Planner

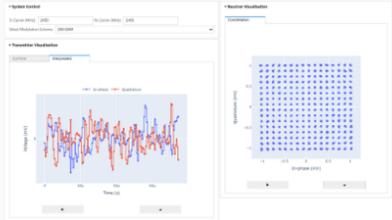
An RFSoc frequency planning tool created using Python is available to download and install on your RFSoc 2x2 development board. This frequency planning tool is based on the original RFSoc frequency planner that can be downloaded [here](#).



The Python based frequency planner uses widgets that allow the user to dynamically change system properties. You can follow this [link to the RFSoc Frequency Planner GitHub page](#), where you can download the frequency planner tool, contribute to the project, or post questions and feedback using the issue tracker.

RFSoc OFDM Demonstrator

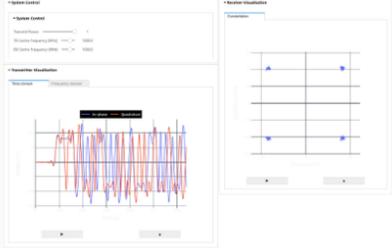
This overlay demonstrates the implementation of an Orthogonal Frequency Division Multiplexing (OFDM) transceiver on the RFSoc 2x2 board. PYNQ is used to control the underlying modulation scheme of the OFDM sub-carriers and for visualisation of data at various stages in the transmit/receive chain, such as the received constellations.



The OFDM demonstrator can transmit and receive up to 1024-QAM. You can follow this [link to the RFSoc OFDM demonstrator GitHub page](#), where you can download and contribute to the project, or post questions and feedback using the issue tracker.

RFSoc QPSK Demonstrator

The QPSK demonstrator was the first University of Strathclyde RFSoc introspection system. The design is a full QPSK transceiver, which transmits and receives randomly-generated pulse-shaped symbols with full carrier and timing synchronisation. PYNQ is used to visualise the data at both the RF DAC and RF ADC, as well as visualising various DSP stages throughout the transmit and receive signal path.



The QPSK and PYNQ design has since been published in [IEEE Access](#). You can download and contribute to the project, or post questions and feedback from the GitHub repository, [RFSoc QPSK Demonstrator](#).

RFSoc BPSK Demonstrator

This overlay presents a BPSK transceiver radio design for RFSoc platforms. The radio is capable of transmitting and receiving BPSK modulated waveforms in loopback, or between RFSoc development boards running the same design. A simple "hello world" example is presented demonstrating that transmitted BPSK waveforms can be received, synchronised, and the payload extracted for analysis.



You can download and contribute to this project, or post questions and feedback from the GitHub repository, [RFSoc BPSK Radio Demonstrator](#).

Project Resources



RFSoc 2x2

- Home
- Getting Started
- Board Overview
- Accessories
- Overlays
- Educational Resources**
- Support
- FAQs

Documents

- User Manual
- Board schematics

Downloads

- PYNQ image
- XDC files

Educational Resources

The following educational material to support the Zynq RFSoc, and the RFSoc2x2 has been developed by the University of Strathclyde in partnership with Xilinx.

RFSoc Introduction Notebooks

There are a collection of RFSoc introductory notebooks specifically for your RFSoc2x2 development board. The RFSoc notebooks consist of the following topics:

- An Introduction to RFSoc
- The RF Data Converters
- Software Defined Radio and the RFSoc

You can obtain a copy of the RFSoc introductory notebooks from the following GitHub repository, [RFSoc Notebooks](#).

Digital Signal Processing Notebooks

Additional material has been developed by the University of Strathclyde to support teaching of fundamental concepts and techniques for digital signal processing design for wireless communications. The material consists of Jupyter notebooks that can be run on Jupyter on your computer, or on any PYNQ enabled board. These notebooks present introductory material for the following.

Core Topics:

- Sampling and Quantisation
- The Frequency Spectrum
- Modulation and Demodulation
- Baseband Modulation
- Digital Filters

Specialised Topics:

- Machine Learning for Communication Systems
- OFDM Fundamentals

You can obtain a copy of these notebooks from the following GitHub repository, [DSP Notebooks](#).

PYNQ Community Support Forum: discuss.pynq.io



The screenshot shows the homepage of the PYNQ Community Support Forum. At the top, there is a pink banner with the text "PYNQ: PYTHON PRODUCTIVITY" and an image of a PYNQ board. Below the banner is a navigation menu with links for Home, Get Started, Boards, Community, Source Code, and Support. The main content area features a "Categories" section with a dropdown menu set to "all categories". The categories listed are:

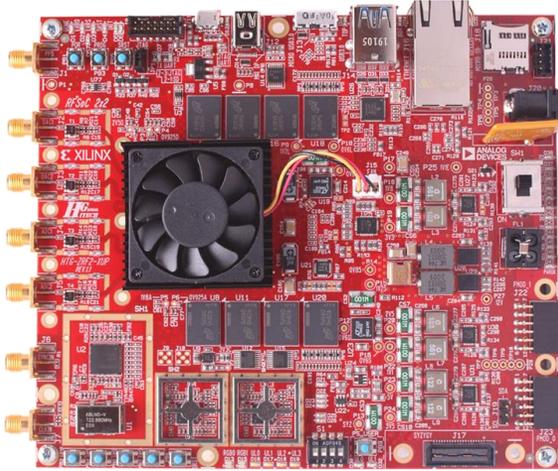
- Announcements**: 1 / month. A place for sharing announcements about PYNQ.
- Support**: 35 / month. Post questions related to software framework, hardware/boards and overlays.
- Community corner**: 29. Place to interact with fellow PYNQ developers. Share your projects, introduce yourself to the community, and discuss things that you are interested in with PYNQ.
- Learn**: 2 / month. This is the place to share and curate tutorials, workshop material, guides, books, videos and more that might help others learn about PYNQ.

To the right of the categories is a "Latest" section showing a list of recent posts:

- 🔒 Welcome to the new PYNQ community forum! (3 replies, May '19)
- M Is opencv being updated? (0 replies, 6h, Support)
- D Custom built Pynq - Ethernet fails (0 replies, 1d, Support)
- V Which Ebook Is Best for Python? (1 reply, 2d, Learn)
- C DMA output buffer does not fill up (2 replies, 3d, Support)
- M Specific Register read from a address through AxilIC (2 replies, 3d, Support)

The URL in the browser's address bar is <https://discuss.pynq.io/c/announcements/19>.

RFSoc 2x2 Complements ZCU111 Evaluation Kit



The RFSoc 2x2 kit is designed to complement the ZCU111 kit

- All the resources created for the RFSoc 2x2 are available for the ZCU111
- For example, there is a 4-channel spectrum analyzer for the ZCU111
- Both academia and industry can use the ZCU111 and the open-source resources



Thank You



Xilinx Mission

**Building the Adaptable,
Intelligent World**

