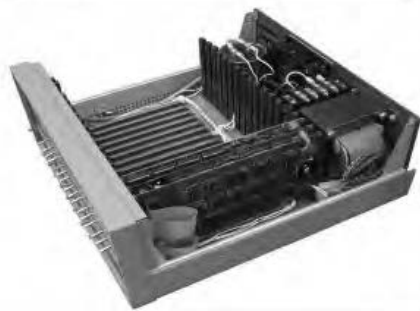
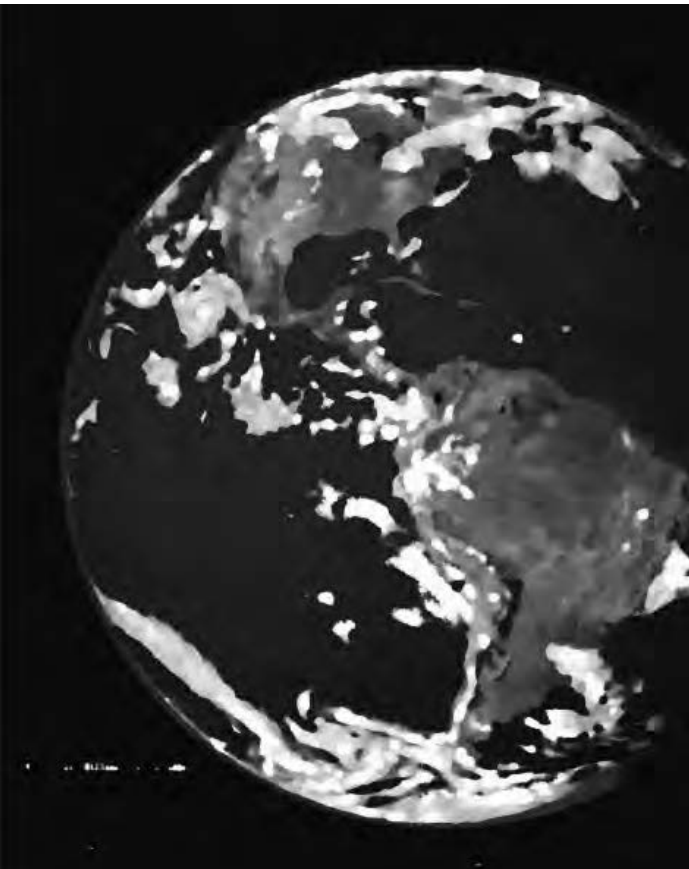


whitebox Handheld Software Radio Kit

Chris Testa, KD2BMH
TAPR DCC 2013

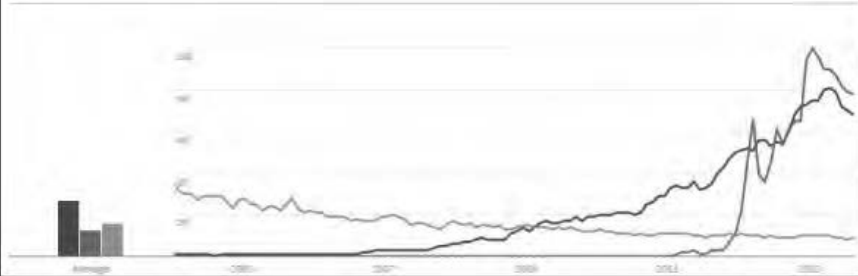




Interest over time

The number 100 represents the peak search interest

News headlines Forecast



- arduino: 70
- raspberry pi: 79
- ham radio: 8



**PIPA & SOPA?
HOW ABOUT
NO PA!**



Tesia Wardencllyffe Project Archive



WIRELESS DATA GROWTH LEADS TO SPECTRUM DEFICIT



Project Goals

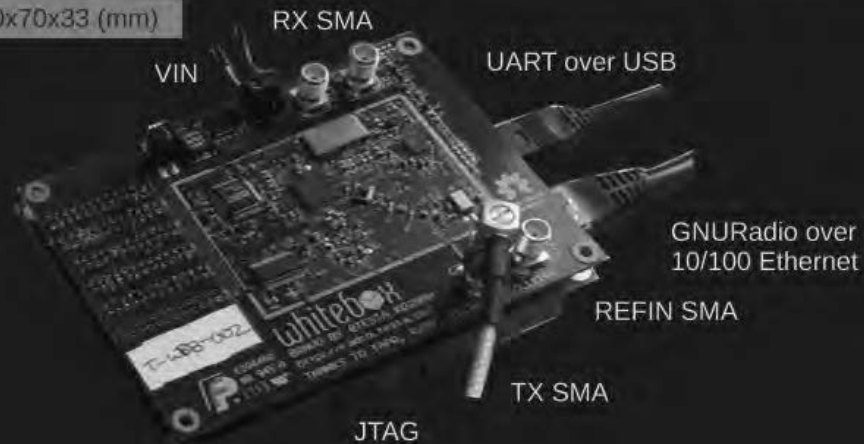


- Software Radio
- Small & Low Power
- Covers 2m / 440MHz
- Open Source Hardware

Whitebox Bravo

Microcontroller	Actel SmartFusion	Power	USB or 3.7V+
Processor	ARM Cortex M3	Standby Power	150mW
Speed	80MHz	Transceiving Power	3W
RAM	16 Mbytes		
Flash	16 Mbytes	Frequency Range	50MHz – 1000MHz
OS	uClinux 2.6, BusyBox	Bandwidth	1MHz
FPGA Gates	500k	Ports (SMA)	RX, TX, REFIN

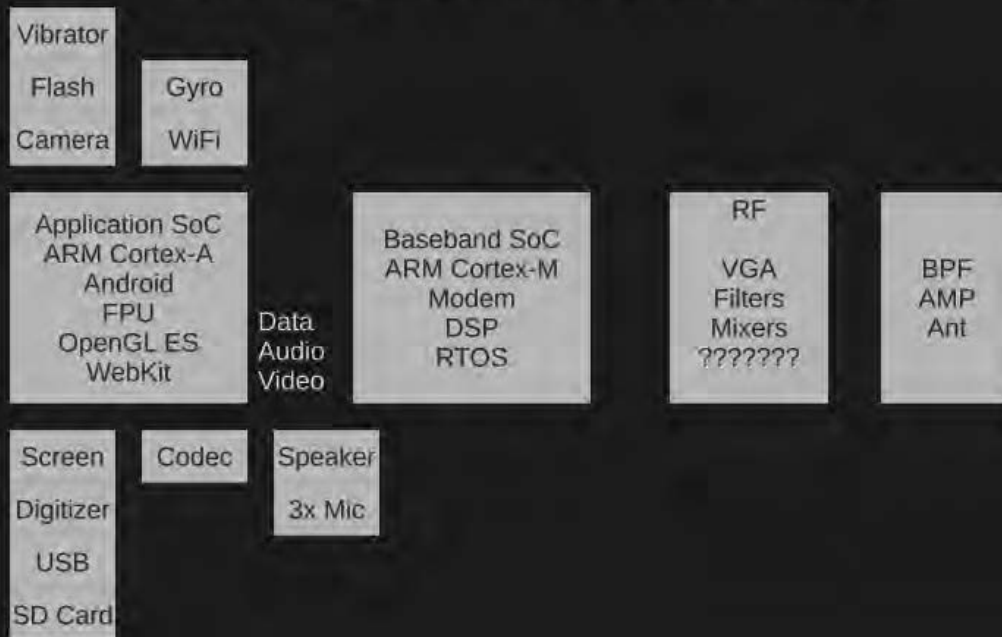
W x D x H 100x70x33 (mm)



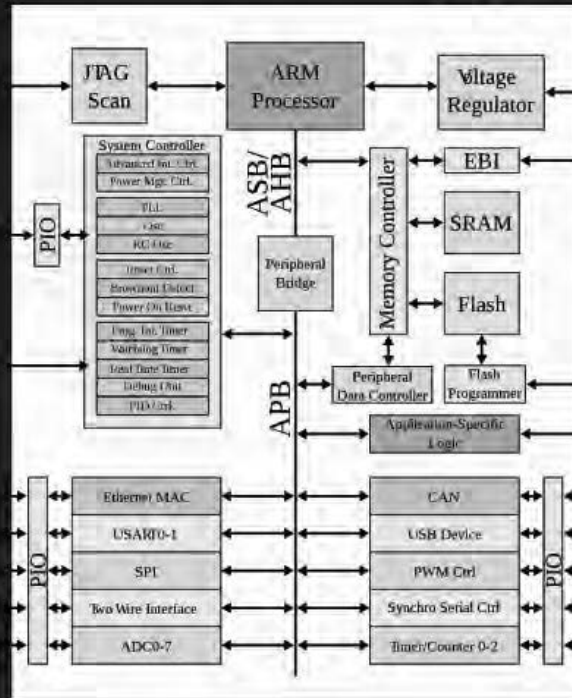
Smartphone Anatomy



Smartphone Architecture



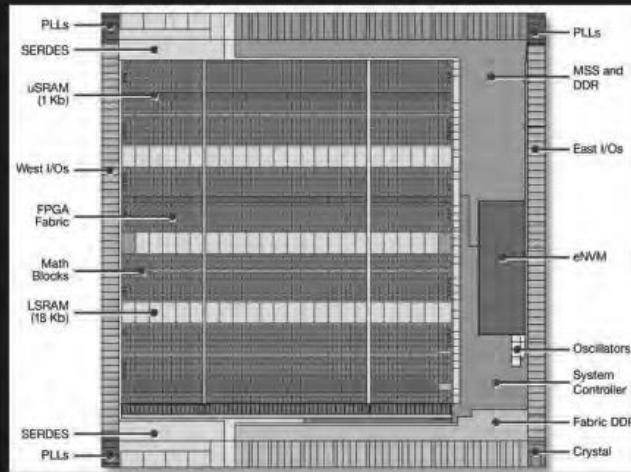
System on a Chip (SoC)



Classic Software Radio Architecture

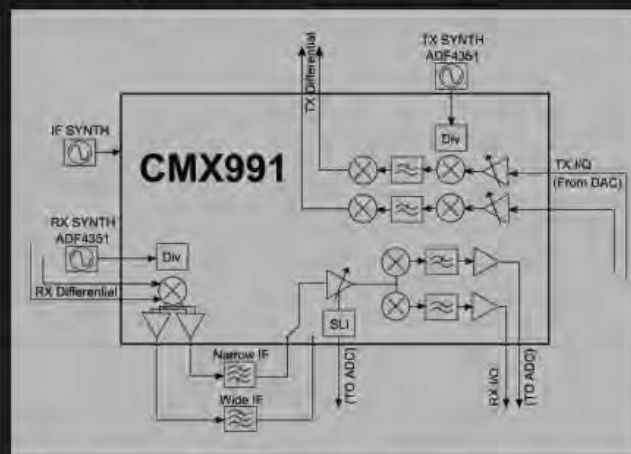


FPGA SoC



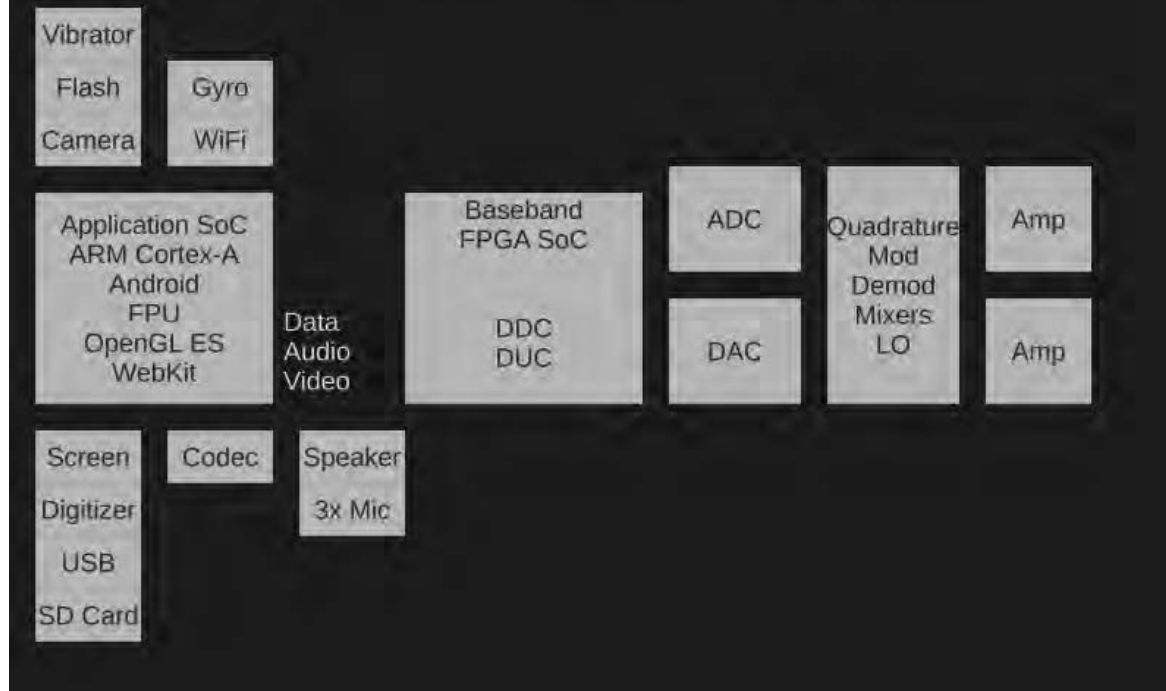
Mfg	Series	Cores	Flavor	MMU	FPU	SIMD	MACC
Actel	SmartFusion	Cortex M3	Flash				
Actel	SmartFusion2	Cortex M3	Flash				Y
Altera	Cyclone V	2x Cortex A9	SRAM	Y	Y	Y	Y
Altera	Arria V	2x Cortex A9	SRAM	Y	Y	Y	Y
Xilinx	Zynq 7000	2x Cortex A9	SRAM	Y	Y	Y	Y

I/Q Transceiver IC

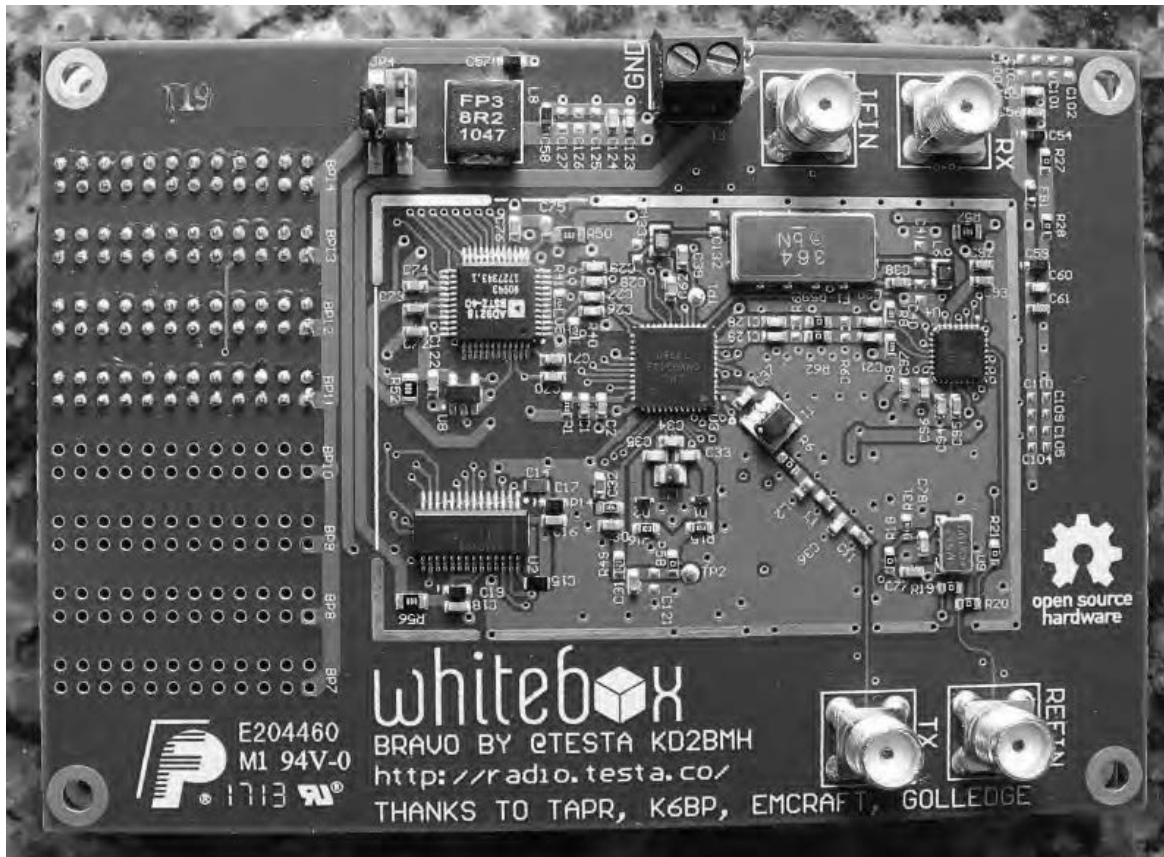
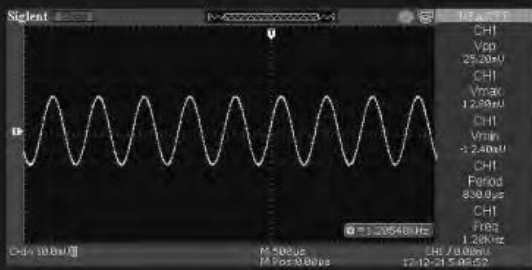


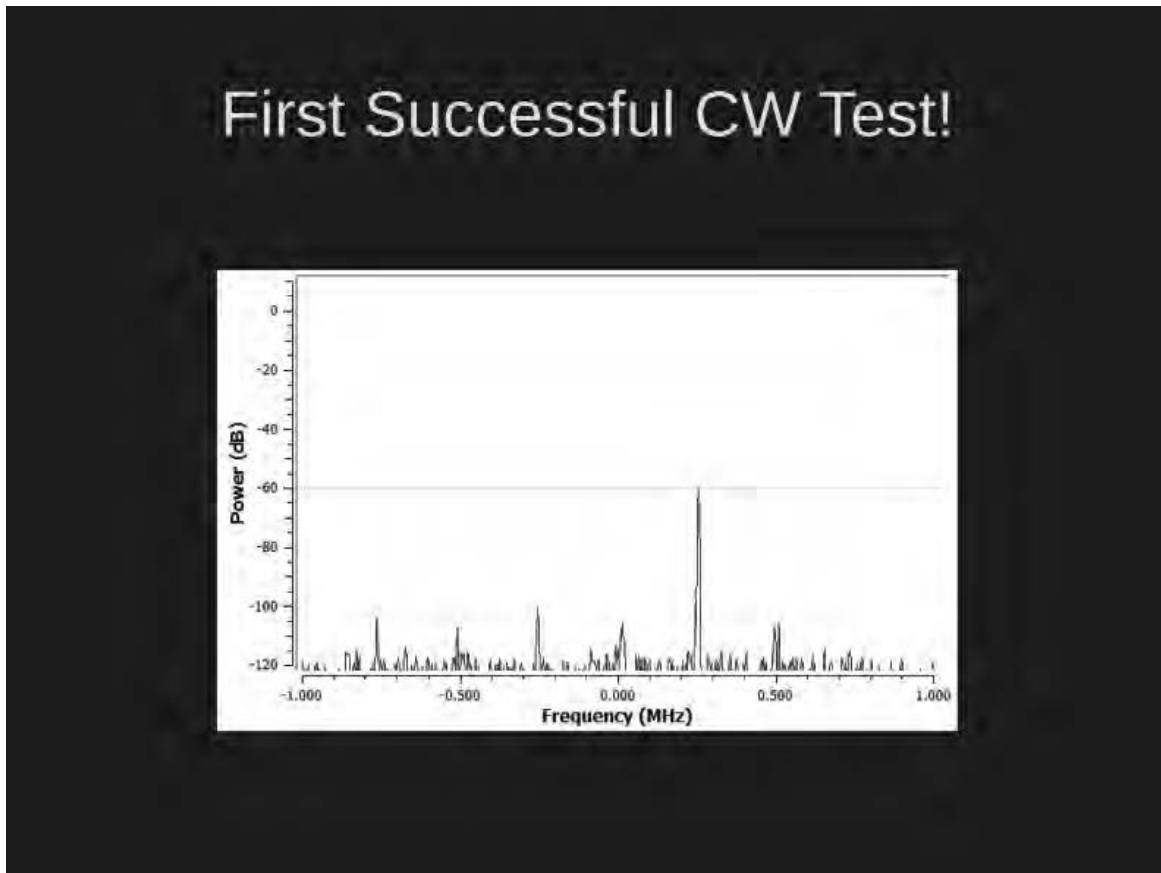
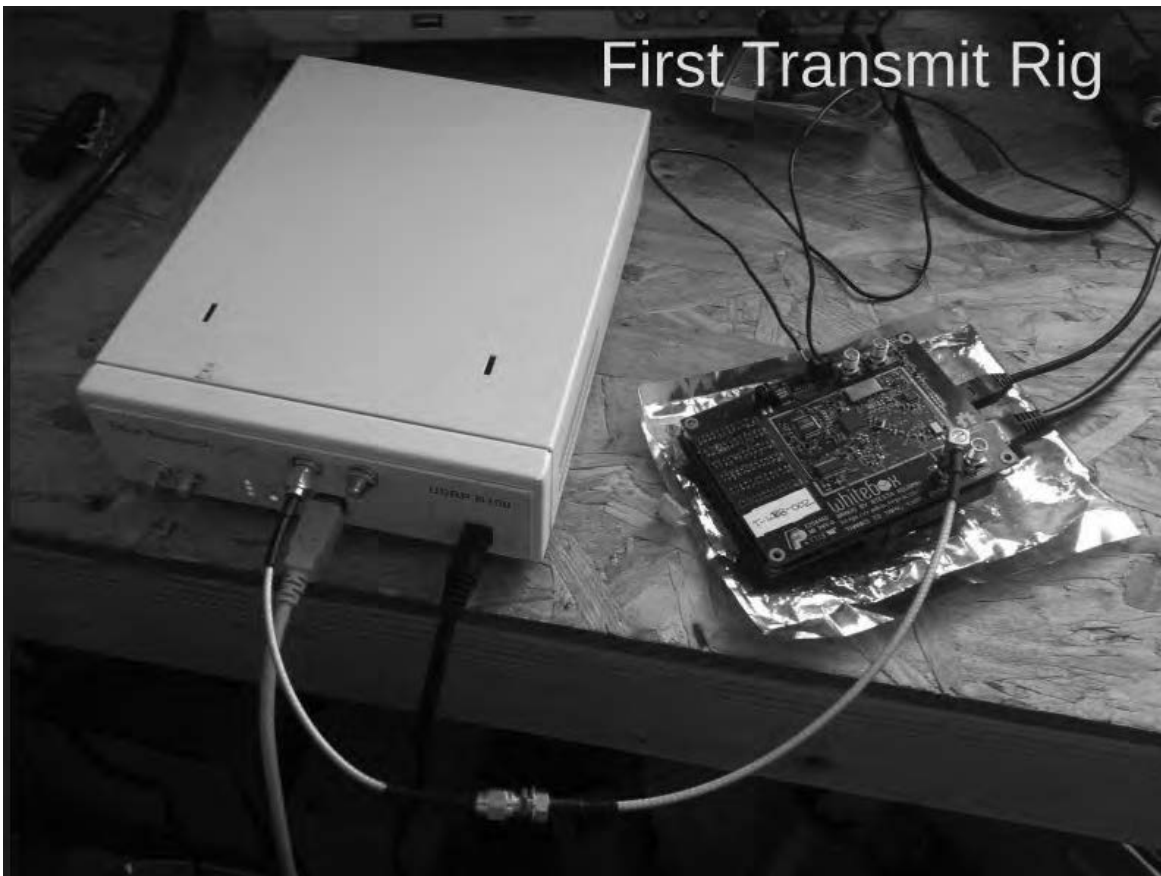
Mfg	Part #	Fmin MHz	Fmax MHz	ADC	DAC	LO	Amps	Ant
CML	CMX991	100*	1000			Y		
Lime	LMS6002D	300	4800	12-bit	12-bit	Y		
Maxim	MAX2813	2400	2500			Y	Y	Y

Smart Software Radio Device

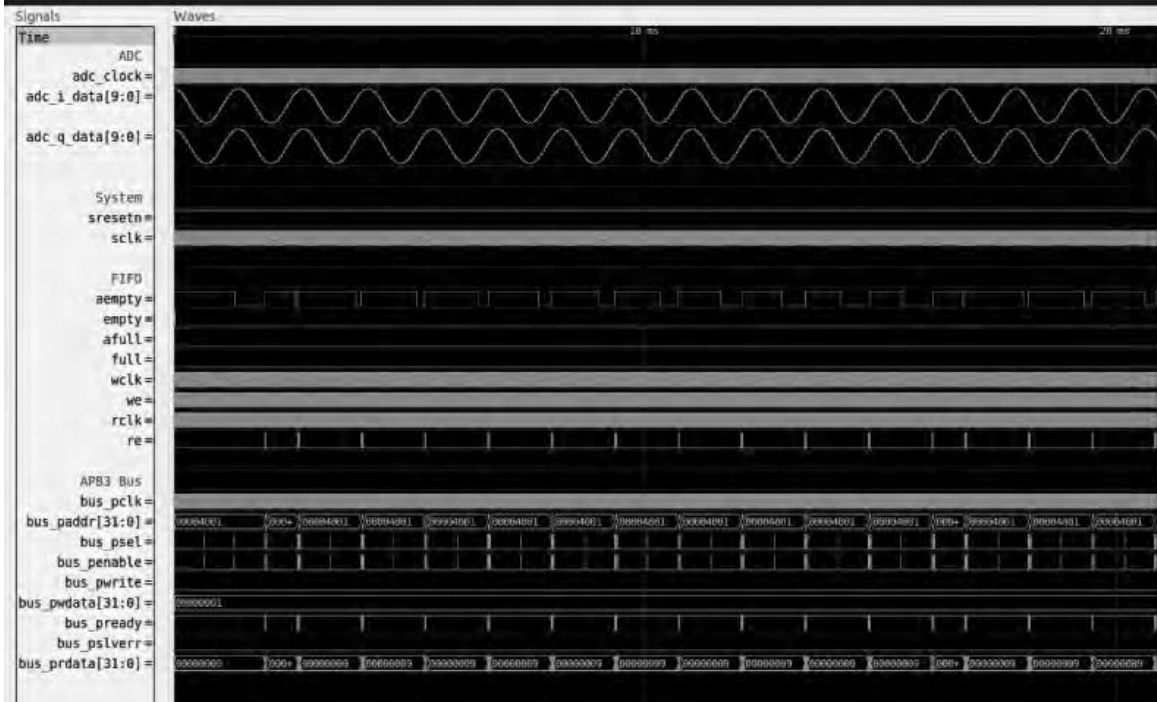


Alpha Results, Issues





Receiver Simulations



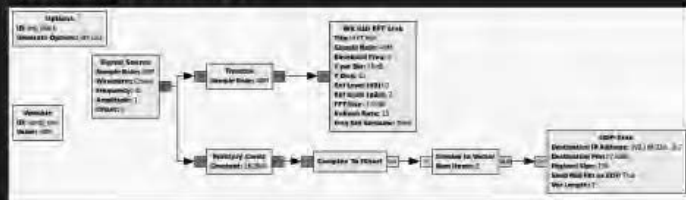
Code & Schematics Released

<http://github.com/testaco/whitebox>

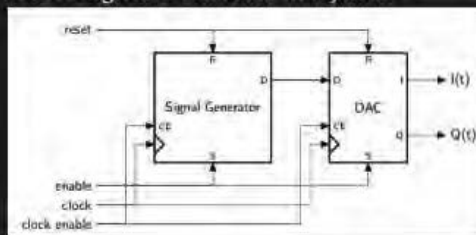
Change Log:

- * Kernel Drivers
- * 10MHz REFIN Option
- * 50MHz – 1000 MHz
- * IF SAW Filter
- * 10-bit ADC/DAC
- * DAC Low Pass
- * ADC/DAC DC Offset
- * Impedance Match
- * USB Power Option
- * Plug Compatible w/ SmartFusion2

GNURadio over UDP



HDL Signal Generator in Python



Thank You!

TAPR (Steve & John) <http://tapr.org/>
Emcraft Systems <http://emcraft.com/>
Golledge <http://golledge.com/>

University of Michigan – Prabal Dutta, Ye-Sheng Kuo
University of Utah – Thomas Schmid
University of Maryland – Aaron Schulman

Bruce Perens, John Klingelhoefter, Pat Ryan, Justin Kuhn,
Eric Pinson, Bob McDonough Jr.

EEVBlog, Signal Path Blog, The Artists Way

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