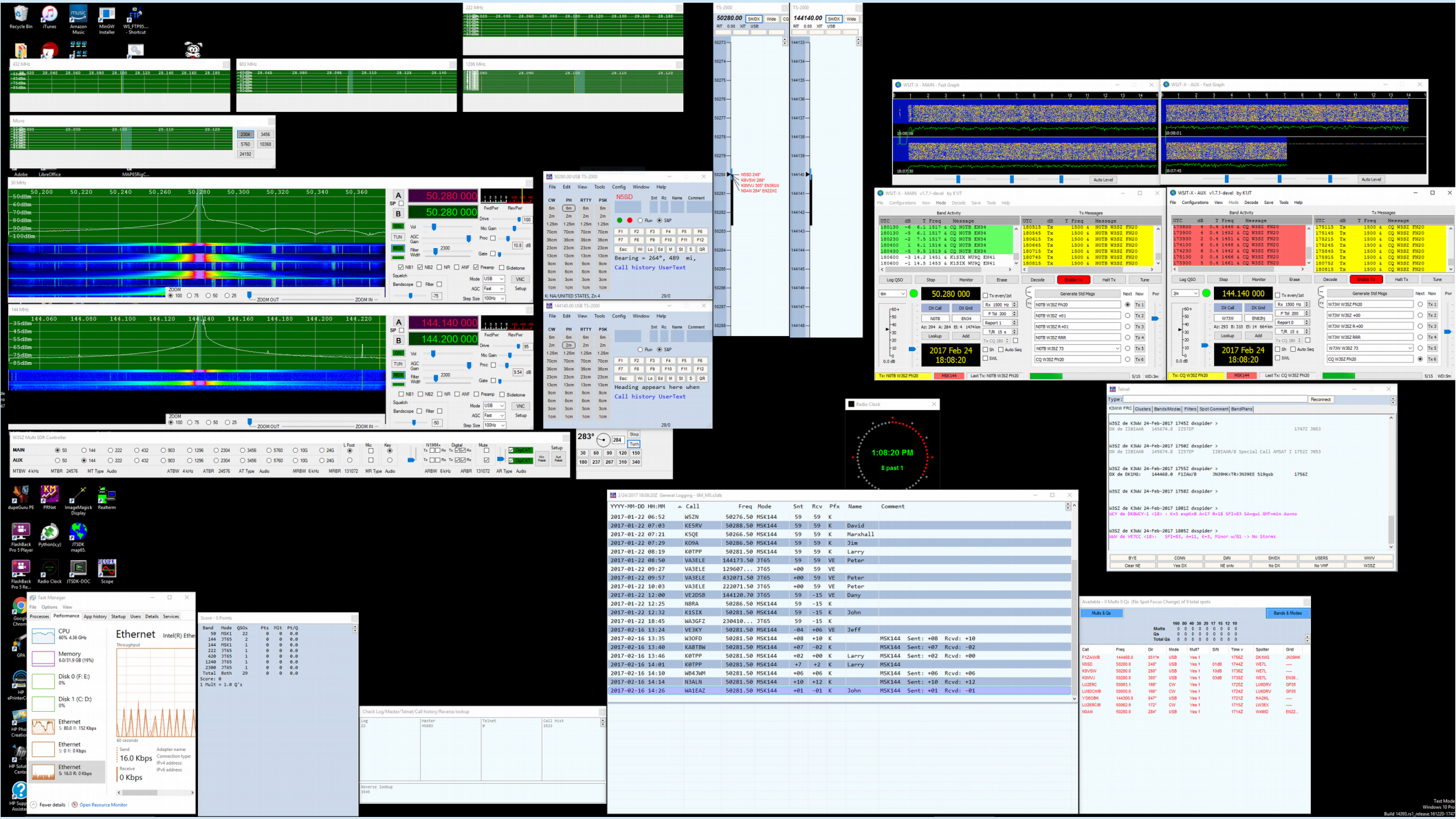
Station Automation
--W3SZ



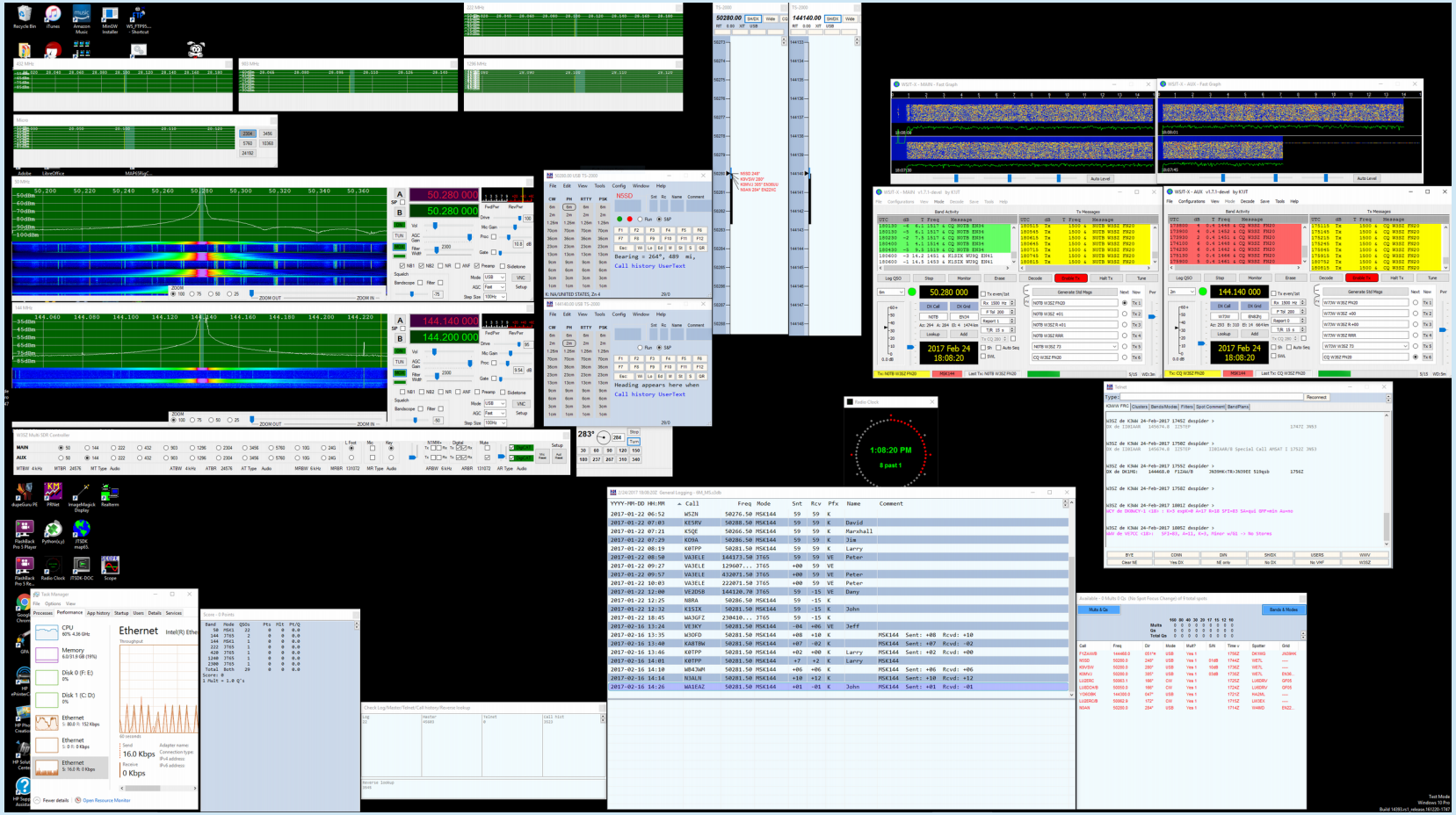
The Future

- “Do Everything in Software” so that only mechanical connections to radio are for:
  - power
  - Ethernet
  - RF In/Out (to preamp, PA)
  - T/R control for preamp, PA
  - 10 MHz GPS-locked signal for frequency locking
- One Radio for 50 MHz thru 10 GHz
  - Just add mast-mounted preamps and PA for each band
  - No need for transverters

The Future

Where are we today with these goals?

Do Everything in Software



Do Everything in Software - DONE

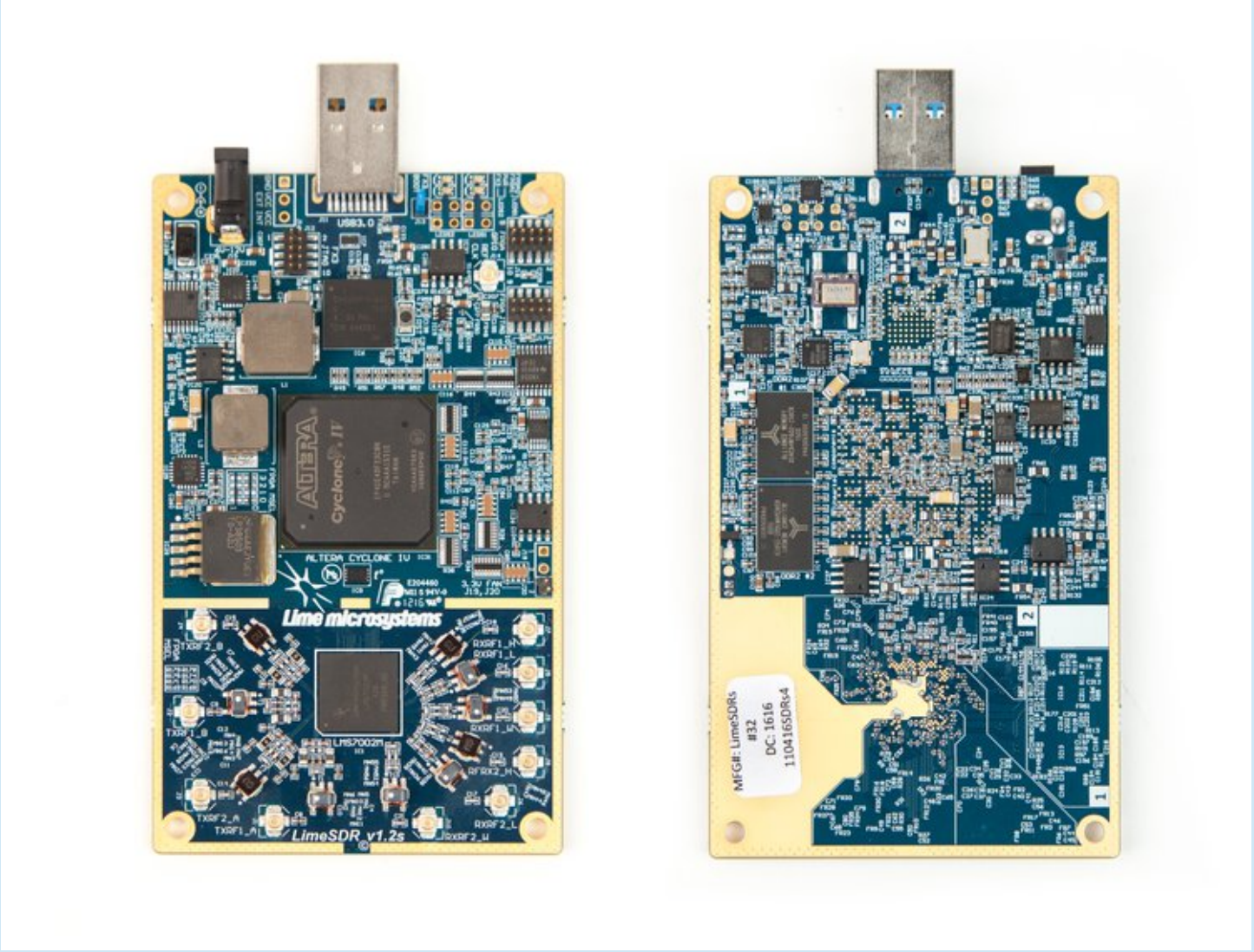
- Virtual CAT ports connect to N1MM, WSJTX
- Mic and headphones are USB headset plugged into USB port on computer
- CW keying is via USB port
- PTT is via USB port and/or software PTT
- All frequency / mode / other radio parameter changes are made via N1MM and radio software interface
- No knobs on radios, which are not even at operating position
  - Radios connected by ethernet to computer
  - Remote operation is no different than local operation
- http://www.nitehawk.com/w3sz/CSharpsdrclientANDserverVersion2pt0.html

One Radio for 50 MHz thru 10 GHz In Progress

- LOOKS like one radio to N1MM
- OPERATES like one radio
- But...


VUCC Award
Roger Rehr, W3SZ
January VHF Contest
W3SZ
ARRL VHF/UHF CONTEST AWARD
W3SZ
First Place
2010
1st Place
United States and Canada
2007 ARRL AUGUST UHF CONTEST
ARRL VHF QSO PARTY
W3SZ MULTI SDR CONTROLLER

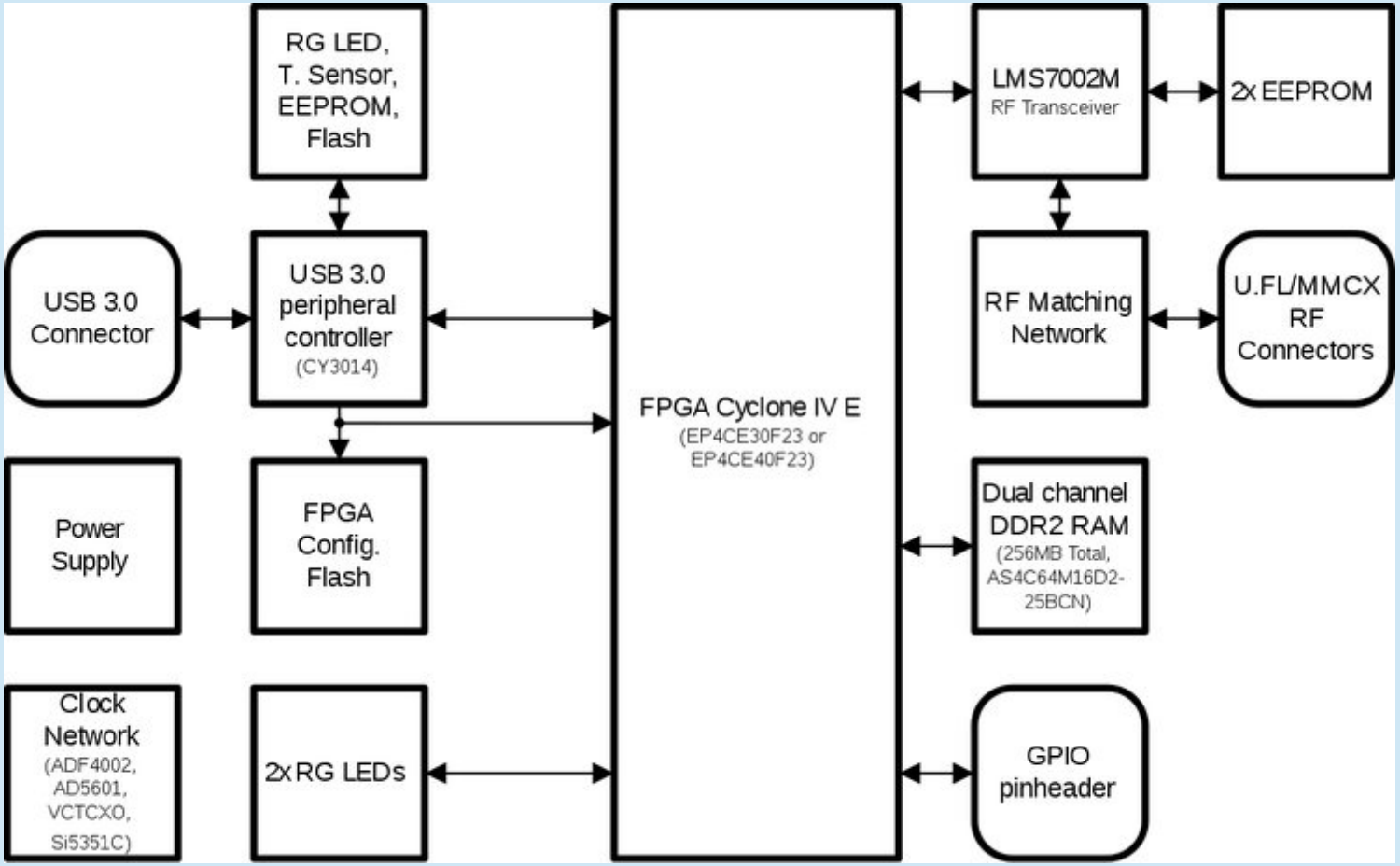
One Radio for 50 MHZ thru 10 GHz
Getting Closer:
LimeSDR



One Radio for 50 MHZ thru 10 GHz Getting Closer: LimeSDR

- Current board covers 100 kHz – 3.8 GHz
  - https://www.crowdsupply.com/lime-micro/limesdr
- New chip LMS8001+ → 100 kHz -12 GHz coverage
  - Missed first delivery promise (March 2017)
  - Will be available as add-on to current board
  - RF bandwidth 120 MHz
  - ADC sampling rate 160 Msps
  - DAC sampling rate 640 Msps
  - https://discourse.myriadrf.org/t/lms8001-100-khz-to-12-ghz-transceiver-schedule-info/1020/4

LimeSDR


RG LED, T. Sensor, EEPROM, Flash
LMS7002M RF Transceiver
2x EEPROM
USB 3.0 Connector
USB 3.0 peripheral controller (CY3014)
FPGA Cyclone IV E (EP4CE30F23 or EP4CE40F23)
RF Matching Network
U.FL/MMCX RF Connectors
Power Supply
FPGA Config. Flash
Dual channel DDR2 RAM (256MB Total, AS4C64M16D2-25BCN)
Clock Network (ADF4002, AD5601, VCTCXO, Si5351C)
2x RG LEDs
GPIO pinheader

LimeSDR

- Features & Specifications
- RF Transceiver: Lime Microsystems LMS7002M MIMO FPRF
- FPGA: Altera Cyclone IV EP4CE40F23 - also compatible with EP4CE30F23
- Memory: 256 MBytes DDR2 SDRAM
- USB 3.0 controller: Cypress USB 3.0 CYUSB3014-BZXC
- Continuous frequency range: 100 kHz – 3.8 GHz
- Bandwidth: 61.44 MHz
- RF connection: 10 U.FL connectors (6 RX, 4 TX)
- Power Output (CW): up to 10 dBm
- Full Duplex
- Power: micro USB connector or optional external power supply
- Status indicators: programmable LEDs
- Dimensions: 100 mm x 60 mm

LimeSDR

	HackRF One	Ettus B200	Ettus B210	BladeRF x40	RTL-SDR	LimeSDR
Frequency Range	1MHz-6GHz	70MHz-6GHz	70MHz-6GHz	300MHz-3.8GHz	22MHz-2.2GHz	100kHz-3.8GHz
RF Bandwidth	20MHz	61.44MHz	61.44MHz	40MHz	3.2MHz	61.44MHz
Sample Depth	8 bits	12 bits	12 bits	12 bits	8 bits	12 bits
Sample Rate	20MSPS	61.44MSPS	61.44MSPS	40MSPS	3.2MSPS	61.44MSPS (Limited by USB 3.0 data rate)
Transmitter Channels	1	1	2	1	0	2
Receivers	1	1	2	1	1	2
Duplex	Half	Full	Full	Full	N/A	Full
Interface	USB 2.0	USB 3.0	USB 3.0	USB 3.0	USB 2.0	USB 3.0
Programmable Logic Gates	64 macrocell CPLD	75k	100k	40k (115k avail)	N/A	40k
Chipset	MAX5864, MAX2837, RFFC5072	AD9364	AD9361	LMS6002M	RTL2832U	LMS7002M
Open Source	Full	Schematic, Firmware	Schematic, Firmware	Schematic, Firmware	No	Full
Oscillator Precision	+/-20ppm	+/-2ppm	+/-2ppm	+/-1ppm	?	+/-1ppm initial, +/-4ppm stable
Transmit Power	-10dBm+ (15dBm @ 2.4GHz)	10dBm+	10dBm+	6dBm	N/A	0 to 10dBm (depending on frequency)
Price	$299	$686	$1,119	$420 ($650)	~$10	$299 ($289 pre-order)

LimeSDR
Growing Pains

- Reduced sensitivity below 400 MHz due to input network design
  - Removing tiny SMD inductor improves sensitivity
- Limited software support at present
  - Simon Brown adding LimeSDR support to SDR-Radio Version 3.
- Mike, N1JEZ leading the charge

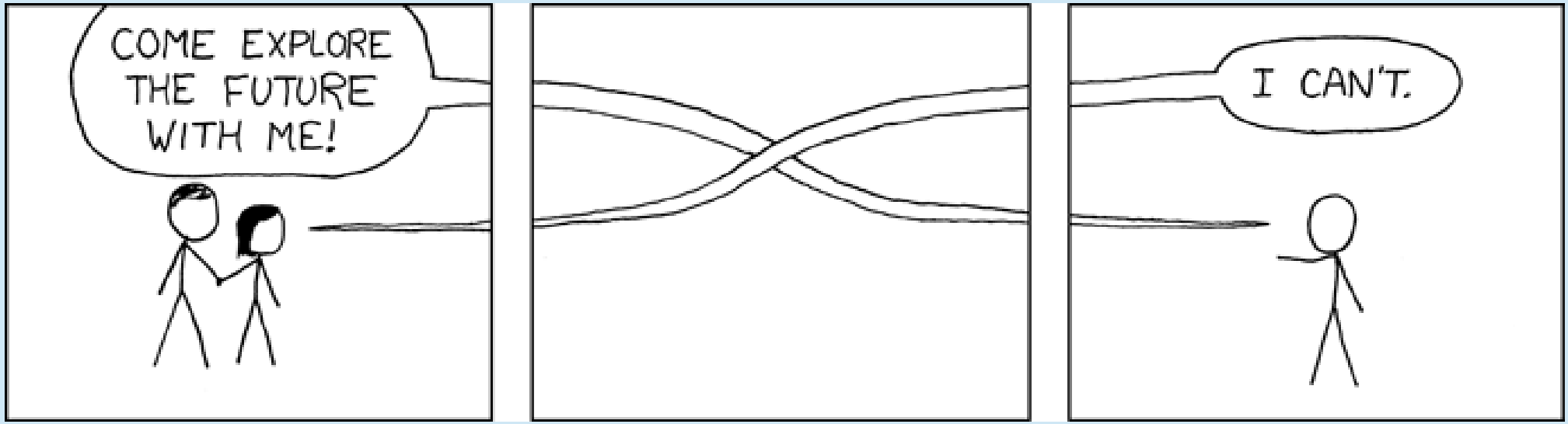
LimeSDR Limitations

- Would prefer Ethernet connectivity over USB
  - Could then put everything at tower and just run power and CAT6A back to operating position
  - Remote operation without need for local computer
- Receive Sensitivity issues not fully resolved
- Currently no Windows OS transmit solution
- 12 GHz capability remains vaporware


QSL?

What Now?

- Pick a Project
- Choose “best” device for project
- Use Google and code examples from this seminar to get started and write the code
- Have fun!


COME EXPLORE THE FUTURE WITH ME!
I CAN'T.