XTRX – SDR for the real world

12 September 2017
**Full stack** means from hardware to deployment from an SDR to connected users

**XTRX** - SDR for the real world deployments

Find us in person or visit Lime Microsystems booth to see XTRX

https://fairwaves.co
https://xtrx.io
Commodity time for SDR

• Not just a lab tool
• Not a toy
• Not a custom design for every new product
• Time to become an off-the-shelf commodity
What is XTRX

- Small, inexpensive, embeddable
- IoT/LTE/5G/drones/satellites targeted
- 2x2 to 16x16 MIMO and higher with multiple board synchronization
- miniPCIe form factor
- LMS7002M RFIC
  - 30MHz-3.7GHz
  - 0.2/2.5 to 160/640 MSPS Rx/Tx
- 2x PCIe (up to 10GT/s)
- Xilinx Artix 7 25T/35T/50T
- 100ppb TCXO + built-in GPSDO
- SIM card interface
- 4x GPIO
XTRX is your next SDR

When your current SDR is not enough. LOTS of features, but not for newcomers.
There should have been a demo here...

- We should have had final XTRX boards by GRCon, but...
- We selected a good fast turn CM in the SF Bay Area.
- We’ve sent this files to the CM for a quotation: xtrx_rev3_05.07.2017.zip
- And this file for the actual manufacturing run: xtrx_rev3_03.08.2017.zip
- And told them to manufacture the latest.
- Guess what happened!
Interfaces supported

- Native miniPCIe x1/x2 Gen2
- Native USB2 (planned)
- Adapter to PCIe x2 Gen2
- Adapter to USB3
- Adapter to Thunderbolt3
# Software support (as of Sept 12, 2017)

<table>
<thead>
<tr>
<th>Platform</th>
<th>PCIe/TB3</th>
<th>USB3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux x86_64</td>
<td>full</td>
<td>full</td>
</tr>
<tr>
<td>Linux i386</td>
<td>needs testing</td>
<td>needs testing</td>
</tr>
<tr>
<td>Linux arm (32bit)</td>
<td>needs testing</td>
<td>full</td>
</tr>
<tr>
<td>Linux Aarch64 (ARM 64bit)</td>
<td>needs testing</td>
<td>needs testing</td>
</tr>
<tr>
<td>Windows i386</td>
<td>planned</td>
<td>needs testing</td>
</tr>
<tr>
<td>Windows x86_64</td>
<td>planned</td>
<td>full</td>
</tr>
<tr>
<td>Other</td>
<td>no</td>
<td>no</td>
</tr>
</tbody>
</table>

- GNU Radio
  - Native gr-osmosdr
  - gr-osmosdr via SoapySDR
- gqrx (via gr-osmosdr)
- SoapySDR (limited features)
- osmo-trx
- Amarisoft LTE (only FDD for now)
- kalibrate
- srsUE/srsLTE (in progress)
## XTRX (planned) flavors

<table>
<thead>
<tr>
<th>Feature</th>
<th>Light</th>
<th>Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>0 – +75°C</td>
<td>-40°C – +85°C</td>
</tr>
<tr>
<td>GPSDO/GNSS</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>FPGA</td>
<td>Artix7 25T</td>
<td>Artix7 50T</td>
</tr>
<tr>
<td>DSP FPGA acceleration</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TCXO stability</td>
<td>0.5ppm</td>
<td>0.1ppm</td>
</tr>
<tr>
<td>GPSDO resolution</td>
<td>8ppb or 2ppb*</td>
<td>0.5ppb</td>
</tr>
<tr>
<td>PCIe speed</td>
<td>x2 Gen1 or Gen2*</td>
<td>x2 Gen2</td>
</tr>
<tr>
<td>Ext temperature sensor</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>RF screening</td>
<td>No*</td>
<td>Yes</td>
</tr>
<tr>
<td>Flash size</td>
<td>64/128Mbit*</td>
<td>256Mbit</td>
</tr>
<tr>
<td>External board sync</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Massive MIMO at home on the go

Ever wondered is there anything useful coming out of crypto mining?

8x PCIe hub ($232)
+ 8x XTRX
+ PCIe to TB3 converter ($290)
= a portable massive MIMO
Clock and time synchronization

- XTRX to XTRX - massive MIMO
  - Reference clock + isochronous 1pps
  - Works with and without GPS
- XTRX to PC - distributed MIMO
  - GPSDO with 0.5ppb accuracy
  - Low jitter PCIe interface
  - Linux KPPS interface (best source for time syncing)
**Why?**

- MiniPCIe slot ≠ PCIe support
- Many routers have miniPCIe with USB2 lanes only
- Not every application needs high bandwidth
- USB2 PHY is power efficient (~140mW during active transfer compared to ~500mW PCIe)

**Status**

- Supported in hardware, needs FPGA code
USB3 adapter

- Can’t support natively due to LFPS, no space for USB3 PHY
- USB3380 protocol converter for rescue
- + SIM card slot
- + high efficient DC/DC 5v → 3.3v+1.0v (1A)
- + 1pps+RefClk for multiple boards sync
- + no kernel mode driver
- - extra ~700mw of power consumption
- - 10-15% lower bandwidth than original PCIe
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