

The Problem with Software Defined Radio

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There's a problem with software defined radio. It's not that everyone needs to re-learn what TEMPEST shielding is, and it's not that Bluetooth is horribly broken. SDR's biggest problem is one of bandwidth and processing. With a simple USB TV Tuner, you can listen in on aircraft, grab Landsat images from hundreds of miles up, or sniff the low-power radios used in Internet of Things things. What you can't do is make your own WiFi adapter, and you can't create your own LTE wireless network. This is simply a problem of getting bits from the air to a computer for processing.

At HOPE last weekend, the folks behind the very capable [LimeSDR](https://www.crowdsupply.com/lime-micro/limesdr) and a new company working with Lime's hardware laid out the possibilities of what software defined radio can do if you make a link to a computer very fast, and add some processing on the SDR itself.

The key feature of the LimeSDR, and all boards derived from Lime Micro's tech is the LMS7002M. It's a Field Programmable RF transceiver with coverage from 100kHz to 3.8GHz, a programmable IF filtering from 600kHz to 80MHz, and this one is important; on-chip reconfigurable signal processing; and a fast USB 3.0 interface to a computer.



The image shows a small, rectangular circuit board, likely the LimeSDR. It has a green PCB with various electronic components, including a large black integrated circuit (the LMS7002M), several smaller chips, and a USB connector on one side. The board is shown against a dark background.

Aside from the Lime, another company was also at HOPE showing off the latest SDR wares they have to offer. [Fairwaves](https://fairwaves.co/) was there with the [XTRX](https://xtrx.io/), a software defined radio built around the same Lime Micro LMS7002M chip in a miniPCIe form factor.

This tiny card uses the same tech found in the LimeSDR with one key difference. Instead of a USB 3.0 port, the XTRX connects to a computer

through the PCI bus, sending data to RAM at 8Gb/s. That's fast.

The miniPCIe form factor also has another interesting application. The folks at Fairwaves are working on putting this device in a miniPCIe to PCIe x1 adapter; that makes sense, it's all the same signals, just a different form factor.

This also means you can run four XTRX boards with a yet-to-be-designed PCIe 16x adapter. Putting four of these SDRs in a single card means phased array antennas, 8x8 MIMO, and other techniques that make this massive SDR very interesting. The Fairwaves team only had a handful of these boards assembled, but when this goes on sale, you'll be able to build a rig that blows the roof off the price/performance ratio of any other SDR.

In the talk presented at HOPE (not available independently of other talks yet, but <http://livestream.com/internetsociety3/hopeconf/videos/130824120> starting 1:46:12 into this live recording), the folks behind the LimeSDR talked about the possible applications of this hardware. In a year or two, you'll be able to build a portable 3G or 4G base station for about \$2500. That's an incredible advancement in the state of the art, and something that's only possible because of on-chip processing and very fast access to a computer's memory.

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