

R&D & University Test Kits

A portable spectrum receiver with an open API, built so labs and classrooms can teach, prototype, and publish from one bench to a whole cohort.



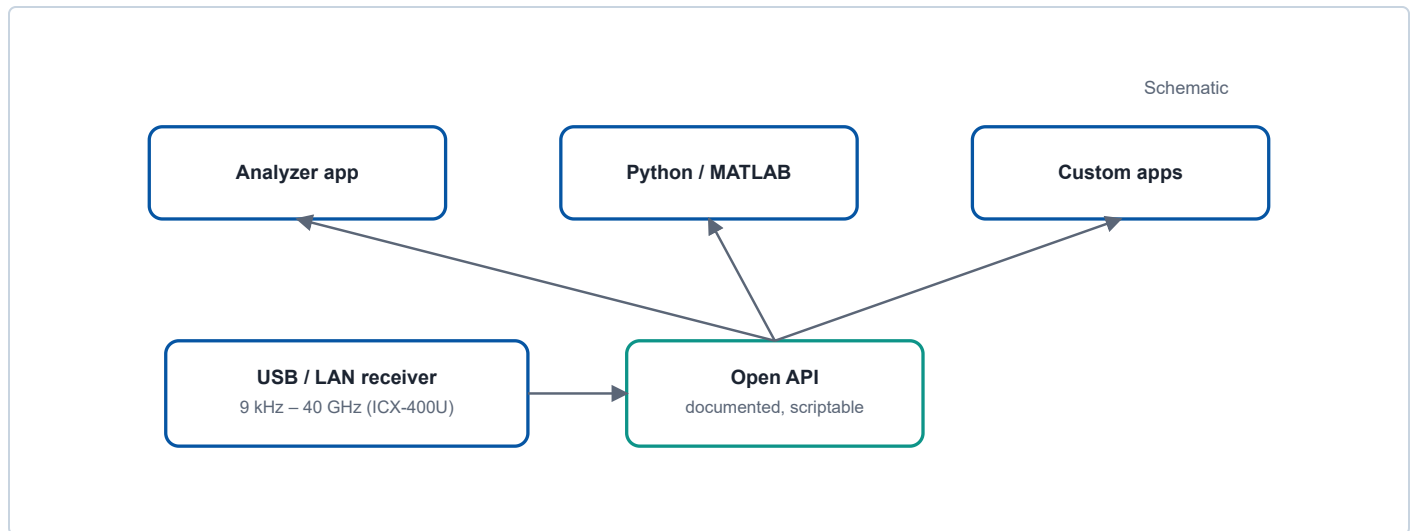
APPLICATION BRIEF · ICX-FIELDHAWK · dc-62022201

R&D & University Kits

Research labs and university programs share a problem that has little to do with physics. They need real instruments, and they need many of them, on budgets that rarely stretch to a rack of high-end analyzers. A single benchtop unit can serve one bench at a time. A class of twenty students cannot learn modulation, sampling, or detection theory by taking turns at one screen.

Portability is the second constraint. Equipment moves between a teaching lab, a research office, a field demonstration, and the occasional conference table. Gear that needs a cart and a mains outlet stays put, and gear that stays put gets used less. The instrument that travels in a backpack is the one that gets used.

The deepest requirement is openness. A teaching tool that hides its internals teaches nothing about how the measurement is made. Researchers need to script the instrument, pull raw data into their own code, and build experiments the vendor never imagined. A closed box with a fixed front panel is the wrong shape for research. The right tool is programmable to the core.



■ **SCHEMATIC** **Figure 1.** The receiver's open API sits between the hardware and everything a lab or classroom builds on it, from the supplied analyzer application to Python and MATLAB coursework to student projects.

How the ICX-FieldHawk line solves it



■ PHOTO Figure 2. ICX-400U USB/LAN module, 9 kHz to 40 GHz (render)

The **ICX-Series** USB receiver is built as a lab instrument rather than a sealed appliance. It draws power and data over a single Type-C connection to a laptop, so a full real-time receiver fits in a bag and runs anywhere there is a host computer, and a department can specify one per bench rather than one per lab.

What sets it apart for research is the breadth of the open API: C/C++, C#, Python, MATLAB, Qt and LabVIEW on Windows and Linux, with SCPI for instrument-style control. With the -SDR option the receiver also registers as a SoapySDR device and runs as a source block in GNU Radio 3.9 or later with its calibration applied. A student can drive it from a Python notebook, a controls course can script it from LabVIEW, and a communications lab can stream calibrated IQ straight into a GNU Radio flowgraph. The instrument meets each user in the language they already work in, so the learning curve is the subject, not the tool.

For automated test and integration with existing setups, the receiver speaks SCPI for command and control, records IQ at up to 125 MSPS into 128 Mbyte of memory, and shares one API across the handheld, IP68 tablet and USB/LAN forms, so it drops into scripted benches and the same code moves between form factors. Teach with it, automate with it, and publish from it.

Which models and accessories fit



■ PHOTO Figure 3. ICX-400U USB/LAN module, 9 kHz to 40 GHz

For teaching and benchtop research, the recommended model is the **ICX-Series**. Its USB form factor and open API make it the natural choice for departments outfitting multiple stations or a portable demonstration kit. Buy several and a lab gains hands-on coverage for an entire cohort, with each receiver identical and scriptable.

For courses or projects that also study antenna behavior, gain, and direction finding, add the **RFA-3100-N** directional antenna. It turns an abstract lecture on radiation patterns and bearing into a measurement students can run themselves, and it supports research into angle-of-arrival techniques. Where a program needs a field-capable instrument alongside the bench units, the ICX-FieldHawk handheld provides a self-contained display, and the ICX-FieldHawk-R IP68 receiver suits outdoor field exercises.

The common thread is that every model shares the same SpectraCore software and interfaces. Code written against a USB unit in the lab carries over to the handheld and IP68 receivers without rework, so a research method developed on the bench transfers to the field.

Table 1.

Use	Recommendation
Teaching lab and benchtop research	ICX-Series USB receiver
Antenna and direction-finding study	RFA-3100-N directional antenna
Field exercises and outdoor labs	ICX-FieldHawk handheld / ICX-FieldHawk-R IP68
Programming environments	C/C++, C#, Python, MATLAB, Qt, LabVIEW; SCPI; GNU Radio and SoapySDR with the -SDR option

Recommended configuration

A practical teaching kit is a set of **ICX-Series** receivers, one per student bench, each paired with a laptop running SpectraCore and the API bindings for your curriculum, whether Python, MATLAB, LabVIEW, or GNU Radio through the -SDR option. Add one or two **RFA-3100-N** antennas for the antenna and direction-finding modules. The result is a portable, open lab that scales with class size and grows into research use.

Building a teaching or research kit?

Volume configurations, software bindings, and curriculum support can be tailored to your program. Contact a Berkeley Nucleonics applications engineer at info@berkeleynucleonics.com or 800-234-7858 to scope an ICX-Series kit for your lab.

For a quick question, chat with an engineer at berkeleynucleonics.com.

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Application Brief

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