

Qblox QRM-RF: Where Quantum Meets RF

By Barry Manz

Quantum systems are gaining traction in many defense programs. The QRM-RF Qubit Readout Module from [Qblox](#) is a clear example of how RF and microwave engineering is becoming the critical path for quantum sensing applications, including navigation, underground mapping, and submarine detection. The QRM-RF is useful for bench instrumentation in research labs funded by DARPA, ONR, and AFRL, all of which have active quantum development programs.

The readout layer is one of the biggest bottlenecks to scaling quantum systems. Every qubit requires its own dedicated microwave control and readout channel operating with high fidelity and sub-nanosecond timing. As qubit counts grow, noise, crosstalk, and latency limit how accurately qubit states can be discriminated and how reliably quantum operations can be executed. The QRM-RF addresses this across a frequency range of 2 to 18.5 GHz, which conveniently overlaps with many of the frequencies used by radars and EW systems.

The QRM-RF integrates multiplexed resonator readout, RF-reflectometry, and spectroscopy into a single unit, with onboard up- and down-conversion, six Q1 sequencers (Qblox's proprietary low-latency signal processors), and digital attenuators at the input and output. Each sequencer has its own dedicated waveform generator and acquisition paths, enabling pulse generation and the simultaneous multiplexed readout of up to six qubits on a single channel.

Results are distributed to other modules in the Qblox Cluster via the company's LINQ interconnect in under 400 nsec, supporting low-latency feedback across the full control stack.

A single cluster can control approximately 20 qubits, which is a tiny fraction of what any operational quantum system would require, but it's extremely useful when evaluating performance in a research environment.

The QRM-RF is not a defense product per se, and Qblox does not position it as one. But for engineers and scientists in defense-funded research labs, it is a useful instrument for developing systems such as quantum magnetometers based on nitrogen-vacancy centers in diamond – a qubit platform that operates at room temperature and requires no cryogenic infrastructure.

Those magnetometers have funded defense applications, such as detecting diesel-electric submarines running silently on batteries, which produce minimal acoustic signatures and are increasingly difficult to track with conventional sonar; enabling navigation in GPS-denied or GPS-degraded environments by mapping local variations in Earth's magnetic field; and detecting buried ordnance and vehicles. The QRM-RF is a reminder that RF and microwave technology plays a key role in developing operational quantum defense systems in the future.