Meeting the Wideband Challenge in Today’s Most Difficult RF Environments

Modern RF environments are becoming increasingly difficult to understand. Spectrum congestion continues to grow, signals of interest are often weak, agile, or fleeting, and high-power emitters from cellular, broadcast, and other sources can complicate the job of finding and analyzing the signals that matter.

For defense, intelligence, public safety, and spectrum-monitoring organizations, the challenge is no longer simply gaining access to more spectrum. Systems must be able to observe wide portions of the RF environment while maintaining the performance needed to detect signals in the presence of strong interferers. They must also support increasingly sophisticated missions, including spectrum awareness, signal intelligence, direction finding, and counter-UAS operations, while minimizing size, weight, and power (SWaP) demands on the host platform.

Epiq Solutions designed the **NDR684** software-defined radio (SDR) to address these challenges. The four-channel, wideband SDR combines frequency coverage from **1 MHz to 18 GHz**, as much as **2 GHz of total product bandwidth**, phase-coherent multi-channel operation, and high-speed digital data streaming in a compact, ruggedized platform.

Wideband Visibility Without Sacrificing RF Performance

Wide instantaneous bandwidth can provide operators with greater visibility into the spectrum, but bandwidth alone does not solve the RF sensing problem. In real-world environments, receivers may need to detect relatively weak signals while powerful nearby emitters occupy adjacent portions of the

spectrum.

Receiver architecture, therefore, becomes critical.

The **NDR684** uses four high-performance receive channels, each providing up to **500 MHz of instantaneous bandwidth**. Its super-heterodyne RF architecture is designed to reject unwanted signals while preserving high instantaneous dynamic range in band.

Together, the four channels provide up to **2 GHz of total product bandwidth**, giving systems the ability to observe significant portions of the RF spectrum simultaneously.

That combination can be especially valuable for missions in which operators do not know precisely where or when a signal will appear. Instead of relying solely on narrow monitoring windows, systems can maintain broader spectrum awareness and respond when activity of interest is detected.

Four Channels, Multiple Mission Option

The **NDR684**‘s four receive channels can be tuned independently or operated coherently.

This flexibility allows a single RF platform to support multiple operating concepts. Depending on the mission, users can stare at one or more frequency ranges, sweep through the spectrum, or use coherent channels to support antenna arrays and direction-finding workflows.

The receiver provides **80+ dB of dynamic range** and a **100-microsecond tune time**, helping it respond to demanding RF environments and rapidly changing spectrum activity.

Turn Wideband Data Into Actionable Information

Streaming four channels at maximum bandwidth can generate substantial amounts of digital information. Sending all of that data through a system regardless of mission requirements

can consume networking, storage, and processing resources unnecessarily.

The NDR684 addresses this with configurable wideband digital down converters (DDCs). Users can select bandwidths of **500, 250, 125, 62.5, or 31.25 MHz**, with support for as many as **48 selectable DDCs**, depending on configuration and available 100 GbE offload capacity.

This gives system designers greater control over how RF data moves through the processing chain.

A system might, for example, monitor a broad portion of spectrum to maintain situational awareness while simultaneously extracting narrower channels containing signals of interest. Those channels can then be directed to downstream resources for recording, analysis, classification, or exploitation.

Rather than forcing every mission into a fixed-bandwidth architecture, configurable DDCs allow data rates and processing requirements to be matched more closely to the operational need.

Moving High-Performance RF Closer to the Antenna

RF performance is only part of the equation. For airborne, vehicle-mounted, fixed-site, and distributed sensing applications, the physical location of the receiver can have a significant impact on overall system design.

At approximately **6.45 x 9.45 x 1.9 inches and 5.4 pounds**, the NDR684 brings multi-channel wideband capability into a relatively compact package. The ruggedized metal enclosure incorporates cold-plate thermal management and ruggedized front-panel connectors for deployment in challenging platform environments.

Its compact design also creates opportunities to locate the

SDR closer to antenna arrays. Doing so can help reduce RF losses that occur before digitization. Once the signal has been digitized, IQ data can be transported over fiber through the unit's **100 GbE interface using VITA 49**.

For system architects, this can enable more flexible distributed RF architectures in which high-performance receivers are positioned where they are most effective while processing and exploitation resources reside elsewhere on the platform or network.

Supporting the Next Generation of Spectrum Missions

RF sensing requirements are continuing to evolve. Counter-UAS systems may need to identify diverse and rapidly changing signals. Electronic intelligence and communications intelligence systems must operate across increasingly crowded spectrum. Direction-finding systems need coherent multi-channel data. Distributed monitoring architectures need to move large amounts of digitized spectrum efficiently between sensors and processing resources.

These applications place competing demands on RF hardware: wider bandwidth, greater dynamic range, more channels, faster data movement, flexible signal processing, and lower SWaP.

The NDR684 brings those capabilities together in a single platform, including:

- Four high-performance receive channels
- 1 MHz to 18 GHz frequency coverage
- Up to 500 MHz instantaneous bandwidth per channel
- Up to 2 GHz total product bandwidth
- 80+ dB dynamic range
- Independent or phase-coherent channel operation
- 100-microsecond tuning
- Up to 48 selectable DDCs
- VITA 49 digital IF streaming over 100 GbE
- A compact, ruggedized 5.4-pound enclosure

For teams developing next-generation **RF sensing, direction finding, counter-UAS, ELINT, COMINT, and distributed spectrum-monitoring systems**, the ability to combine wideband spectrum access with coherent multi-channel operation and deployable SWaP can simplify system architecture while expanding mission capability.

As RF environments become more congested and contested, the question is not simply how much spectrum a receiver can capture. The more important question is whether it can capture the right spectrum, with the required performance, and deliver that data where it needs to go

The NDR684 was designed with that challenge in mind.

Sponsored by Epiq Solutions. Epiq Solutions develops software-defined radio and RF solutions for mission-critical applications. Learn more about the NDR684 and Epiq Solutions' portfolio of RF platforms at epiqsolutions.com.