WHITE PAPER

RNv: Comparative Performance in Next-Generation Fixed Wireless Deployments

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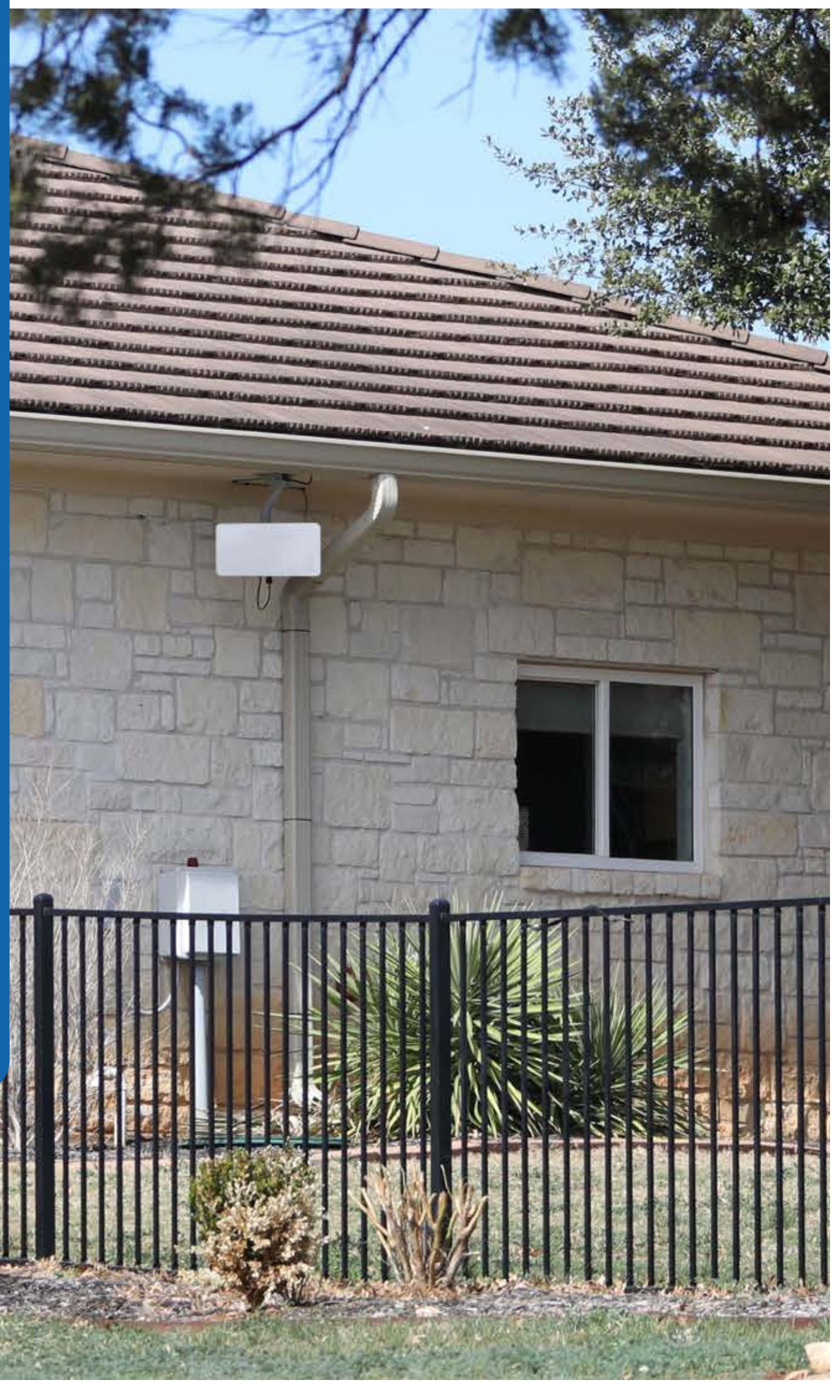
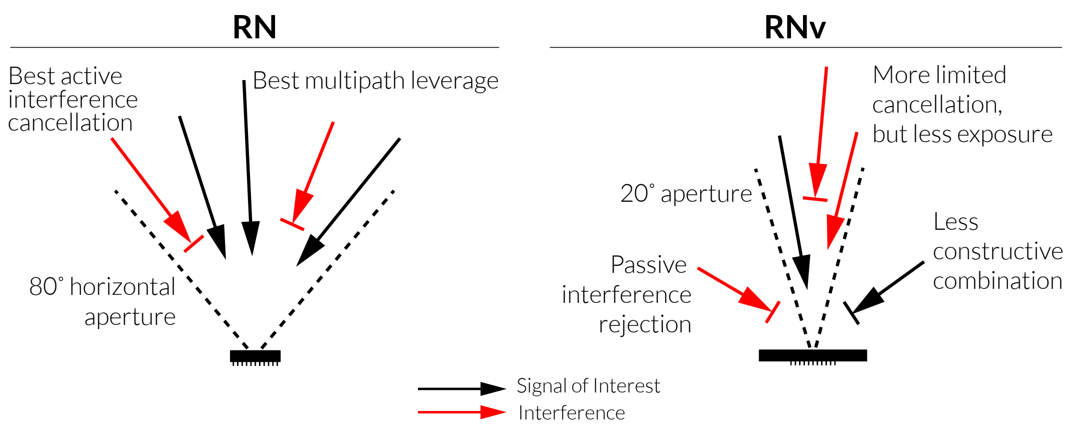


Introduction

Tarana's addition of the RNv model to its next-generation fixed wireless remote node portfolio aimed to reduce equipment costs per subscriber for delivering mainstream broadband access service, while minimizing compromises on ngFWA link and network performance. As illustrated in Figure 1 below, the value-engineered RNv design fulfills its cost-reduction objective primarily by using more passive and less active interference rejection than the baseline RN model, along with lower levels of multipath integration, through a combination of a 50% reduction in the number of independent Tx and Rx radio chains and a narrower (in azimuth) effective antenna aperture.

Figure 1

Principal differences in RN and RNv RF design



Beyond its leaner, lower-cost approach to RF, the RNv's physical components also reflect a fresh round of design improvements aligned with high-volume electronics manufacturing methods, to reduce overall cost further.

Leading indicators from the Tarana engineering team's thorough modeling and pre-launch prototype testing of the RNv's design yielded the expectation that its performance in commercial deployments would carry on Tarana's technology and performance leadership in the fixed wireless access category — but of course solid evidence from the challenging real world of RF in commercial installations was necessary to prove that the design had hit that mark. This evidence is now available and is the basis of this report.

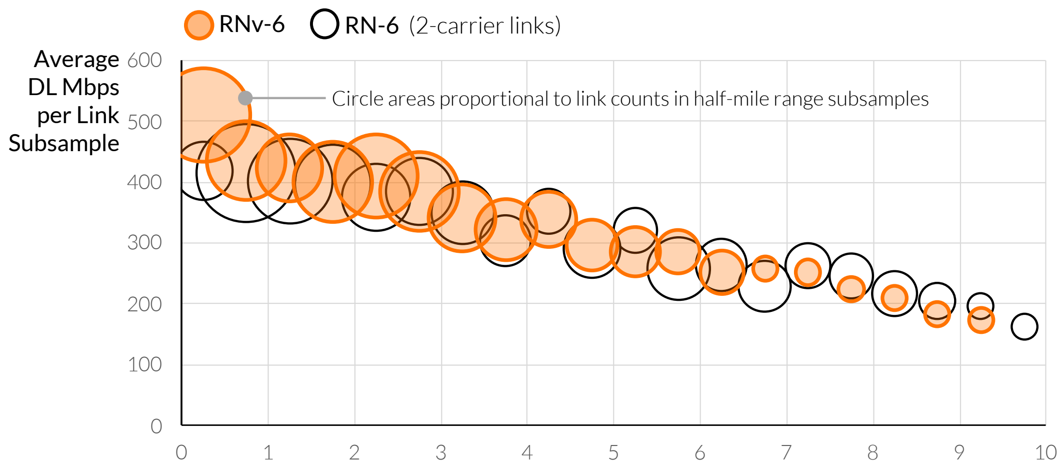
Real-World RNv Results

Tarana-powered service providers have deployed enough RNv links in commercial service this year to yield a robust sample of the new design's real-world performance across a wide range of operational contexts and the role it is playing in practice in their broadband toolkits. To provide a baseline for comparison, this profile also includes performance metrics from a comparably-sized sample of links served by the RN-6 CPE, chosen at random from the larger pool of current RN-6 installations.

This comparison shows that the RNv design performs quite well relative to the RN-6 across most common link distances.

Laying a foundation for relative performance comparison, Figure 2 below summarizes the speeds and distances achieved by samples of RNv and two-carrier RN-6 links. The plot shows on the horizontal axis the relative distribution of operating links as a function of their link length — grouped into half-mile subsamples — and the average downlink capacity of each subsample's links on the vertical axis. [Note that the samples' uplink values as a function of range are omitted for clarity, since they all deliver closely the 4.5 or 4:1 DL:UL ratios for which they're most commonly configured.]

Figure 2: **6 GHz ngFWA RN Performance Profile — Link Rates & Reach**

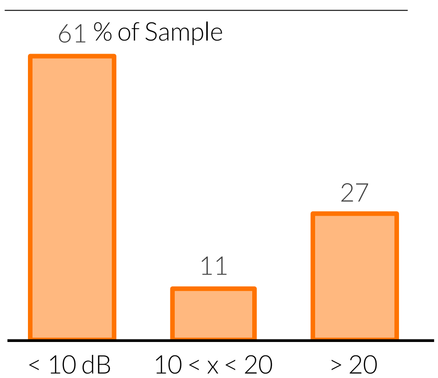


Source: Tarana Cloud Suite, reporting on samples of 600 RNv-6 and 1,000 2-carrier RN-6 links in commercial networks.

This summary shows clearly that service providers are taking advantage of the RNv's capabilities to deliver service speeds and link distances largely in line with those established with the RN-6 in its two-carrier mode.

Beyond the overall rate-reach relationship, it's also important to look at what ngFWA operators' deployment choices and results in 6 GHz reveal about the performance in practice of the RNv and RN-6 with respect to interference and obstructions.

Figure 3: RNv-6 Interference to Noise Ratios



As shown in Figure 3 at left, the RNv is seeing some degree of interference from external sources in practice, despite its narrower RF field of view. The performance profile in Figure 2 shows that its implementation of ngFWA asynchronous burst interference cancellation is working effectively to yield robust performance nonetheless.

Figure 4:

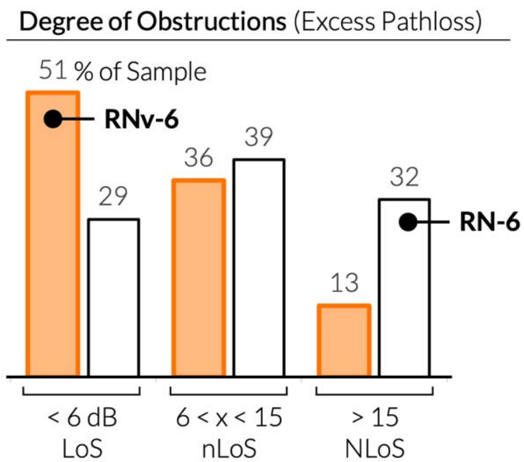


Figure 4 profiles the differences in operators' RNv deployment choices with respect to obstructions. The RNv's narrower antenna aperture and smaller number of independent radio chains present a limitation for "harvesting" multipath to work around obstructions, relative to the RN-6. As a result, as Figure 4 shows, operators' use of the RNv in practice is more biased toward LoS and nLoS links. Note that there is another factor driving these stats: in addition to the inherent limitations of its lower antenna element count and narrower physical aperture, anecdotal reports from operators deploying the RNv in volume indicate that RNv's are often used to upgrade existing links originally served by earlier generations of FWA equipment from other vendors, which were generally limited to line-of-sight operation — so that is the inherently simpler job to which many ngFWA RNv's have been assigned so far. Time will tell how this metric evolves as legacy gear replacement opportunities are tapped out.

Finally, there is one more consideration in the choice between the RN and RNv models, specifically failover. As noted at the outset here, the aperture of the 8-antenna RN is ~4x wider than that of the 4-antenna RNv. In more dense deployments where an RN is more likely to have potential alternative BNs available, the RNv will likely have fewer opportunities to take advantage of that failover option, as shown in Figure 5 below.

Figure 5:

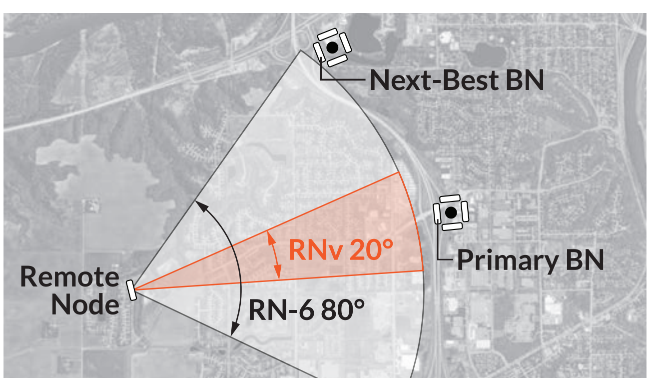


Illustration of RNv's more limited ability — relative to the wider-aperture, 8-antenna RN — to take advantage of "next-best" BNs for failover in more dense deployments

In Conclusion

A robust population of RNv-powered links is now in commercial operation, demonstrating clearly that they can reduce operators' deployment costs while still delivering the speeds and reliability required to reach the service metrics expected of ngFWA networks. Beyond its excellent raw performance, observations from operators' choices in deployment of the RNv have also highlighted the characteristics of the jobs it does best, in the context of the overall ngFWA product portfolio, summarized here:

ngFWA 6 GHz RN Features at a Glance	RNv-6	RN-6
Operation in ample free 6 GHz spectrum, across unique separable, independent 40 MHz channels	✔	✔
Industry-leading unlicensed-band interference cancellation	✔	✔
Lowest-cost entry point into ngFWA operation	✔	
Best upgrade for lower-speed links currently served by legacy FWA gear	✔	
Highest performance around significant obstructions		✔
Gigabit-class service via use of four (vs. two) 40 MHz channels		✔
Best network resiliency, with failover to alternate towers in more dense deployments		✔

It is reasonable to expect that broader familiarity with the RNv's combination of affordability and strong performance, both among its current users and across the ISP community in general, will accelerate its adoption, to the benefit of the many households still stuck on the wrong side of the digital divide.

For more details on ngFWA, the RNv, and how to connect with our team for further information and engagement, visit https://www.taranawireless.com.