



The Right Antenna Makes All the Difference

Do you know your cell tower range? The average cell tower covers a 25-mile radius depending on terrain and interference. And with the right router and antenna solution, like the Cradlepoint R1900 mobility router and the Parsec Antennas Belgian Shepherd 8:1 antenna, even greater distance can be covered.

In the current cellular landscape, providers like ATT, Verizon, and T-Mobile all have active 5G networks in non-standalone mode. This means that a typical network connection has both an LTE anchor band and a 5G-NR band in an EN-DC connection. The LTE band is primarily used for control signaling and mobility management, while the 5G band is primarily used for data transmission. This is all part of the 3GPP release 15 standards. The Cradlepoint R1900 router is an X55-based 5G mobile router.

The antenna chosen for the R1900 router is the Parsec Belgian Shepard 8:1 cellular mobile antenna. (Parsec-t.com)

R1900



Parsec Antenna Belgian Shepherd



The effectiveness of a vehicle roof mount antenna should be tested in both an urban and rural area, to prove throughput and reach. In the testing shown, Parsec did a drive test from the north Dallas-Fort Worth area to northern New Mexico. Both urban and rural were encountered, as well as very rural areas. Using the Cradlepoint R1900 router with the Advanced Mobility feature set, Parsec was able to collect the cellular signal matrices summarized in the following table.



| Metrics | Speed DL/UL | Distance to Cell Tower | Average SINR |
|------------|-------------|------------------------|--------------|
| Urban | 302/50 Mbps | 1-3 Miles | 25 |
| Rural | 40/10 Mbps | 10-20 Miles | 12 |
| Very Rural | 14/7 Mbps | 25-36 Miles | 11.41 |

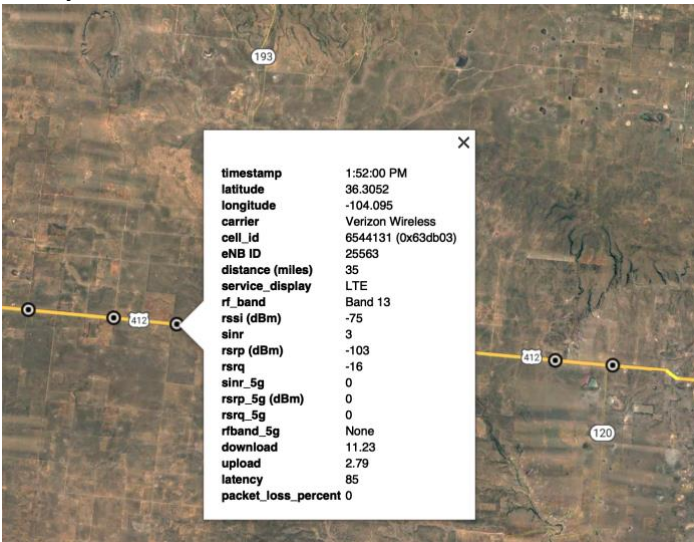
As an overview of the testing, see the map from start to finish. Data points were collected every three miles.

650+ miles trip through north Texas and New Mexico.

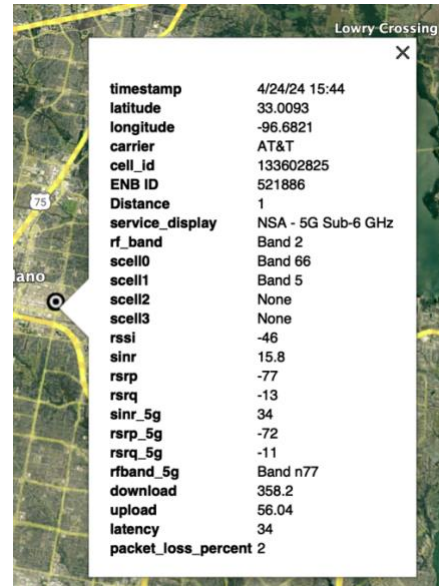


Each of the collected data points include the LTE band, 5G-NR band, distance to tower, and the signal quality (for example, Reference Signal Received Power (RSRP) and signal-to-interference-plus-noise ratio (SINR)).

Very Rural



Urban



While all this data is good, how does it relate to what was expected? Speed of throughput is directly related to the QAM supported by the cellular connection, and that QAM is directly related to the SINR level of the UE. During the drive test at a distance from 30–36 miles, SINR averaged 11, allowing for up to 64 QAM. This very specific and important signal level almost entirely relying on the quality of the antenna. Parsec’s RightPath Signal Technology™ was able to capture this signal because of its patented antenna technology. The design starts with a physically larger antenna with higher gain and higher efficiency, thus enabling the signal to have a better connection with lower latency. Parsec’s patented technology allows each 5G band to be pointed towards the cell tower unlike conventional antennas that scatter the signal in unusable directions. This new technology creates a stronger signal to the cell tower overcoming distance and interference issues. By having a larger antenna element more signal is absorbed in both the upload and download transmissions. Along with aerodynamic housing designs allowing for more antenna elements and proper antenna spacing to reduce interference, increase distance, and improve efficiency producing a reliable, higher quality signal.

As expected, the signals seen reaching up over 30 miles are known as coverage band signals, meaning lower frequency, usually in the 700 MHz range. Carriers are currently using the 700 MHz bands as anchor bands, as those bands reach the farthest with the best penetration. As the higher frequencies of C-band are rolled out, their distances are typically no farther than line of sight; expecting them to reach 36 miles is highly unlikely.

Overall speed can be influenced by network congestion, network backhaul, environmental interference, and the throughput at distances of greater than 25 miles is dependent upon the antenna. How well an antenna provides gain and isolation helps achieve maximum throughput in very rural areas.

Special thanks to the Parsec Drive Team:

