

No Ground Plane? No Problem.

Our up-to-5 port Gar vehicular antenna performs where others struggle, with consistent connectivity even without a ground plane. Here's how.

The Gar Antenna – Excellent in No-Ground-Plane Installations

In-vehicle connectivity is a logistical challenge that demands unique, custom-engineered solutions like our multi-port Gar vehicular antenna. That's because in-vehicle connectivity can be highly complex, requiring many communications protocols to work simultaneously without interference, such as GNSS, LTE/Cellular, and Wi-Fi. Our Gar antenna fits all of this and more into a compact, attractive form factor that services as many as 5 communications ports at once.



The Gar antenna is a formidable antenna for these applications, with a few additional advantages that put it ahead of its competition. In this blog post, we'll explore two of the Gar antennas key strengths: compact form factor, and its unique performance in the absence of a ground plane, a key differentiator with competing antenna solutions.

Multi-Protocol Connection in a Tidy, Compact Enclosure

In many in-vehicle applications, data transmission is becoming just as important as voice communication. That data transmission is via multi-protocol radio units that support many connections with many antenna ports all at once. And especially in public safety applications, each of those connections is not just important, it's critical to minimizing response times and improving outcomes in an emergency.

As mentioned, that can mean four or five concurrent connections over multiple wireless protocols, each requiring an antenna connection that routes external to the vehicle for connectivity. It's not just a challenge from an RF perspective, it's a logistical challenge: collocated radio connections require their own wired connection, many cables, through-holes to be drilled into the vehicle, and fitting those antenna connections on the surface of the vehicle.

It's here that the Gar antenna provides an attractive, carefully-engineered solution that fits all of these into a single aesthetically-pleasing enclosure that's only 48mm (1.69") tall, yet doesn't compromise on performance. Our precisely designed IP67 radome allows a single mount point, a single through-hole, and a single cable braid to run from the exterior to the interior of the vehicle, reducing failure points for ingress of water and dust, and simplifying the integration of complex multi-port wireless connectivity to a vehicle.

Furthermore, we've also made available an [installation kit](#) for unique on-ridge and between-ridge integrations like those found on the roof of vehicles such as the Ford Explorer Interceptor. These kits

help ensure a watertight installation that ensures the long-term reliability of the Gar antenna and the interior of the vehicle.

Ground-Plane Independent Performance

The Gar antenna achieves something unique among competing antenna solutions by providing significant gain and performance even without a ground plane. In antenna design, a ground plane is a common requirement in order to act as a reflective surface for antenna radiation and contributes to a higher degree of performance for a wireless connection.

In many cases, if a ground plane is not available, a specifically-engineered non-ground plane antenna must be used in order to achieve the desired RF performance. But the best situation occurs when an antenna is developed to provide good performance on both metallic vehicles, as well as non-metallic vehicles (or other structures). This is beneficial because the system integration team developing communications networks for a fleet of vehicles will be able to specify and source a single antenna, such as the GAR, for any vehicle in their fleet. Many vehicles do not have metallic roofs, and transit buses, ambulances, metros and more are often made of fiberglass or other non-metallic materials.

The Gar antenna is engineered such that it still provides sufficient gain, even in these non-metallic mount locations. An example is provided below for the [VFP69383x22JN](#) 5-Port vehicular MIMO antenna. In each of its six denoted frequency ranges, the figures for average and maximum gain are shown with a ground plane and without a ground plane (in brackets). At some bands the gain is actually higher in a no-ground plane condition, whereas other times the antenna gain drops when used without a ground plane. It's also important to look at the gain plots for a specific frequency of interest to see if the directivity of the gain is where it's most needed. Laird Connectivity provides full datasheets that list gain patterns both with and without ground plane on the [Gar antenna product page](#).

	2x- 3G/4G/5G/ISM/CBRS (LTE/CELL)				2x- Wi-Fi (WIFI)	
	698-806	824-894	880-960	1690-3800	2400-2500	4900-6000
Avg. Peak Gain* (dBi) – Gnd. Plane [No Gnd. Plane]	0.4 [1.5]	0.8 [2.1]	1.2 [1.7]	4.0 [1.8]	2.6 [0.4]	6.6 [3.8]
Max Peak Gain* (dBi) – Gnd. Plane [No Gnd. Plane]	1.6 [2.5]	1.4 [2.8]	1.5 [2.0]	7.2 [4.8]	3.1 [1.7]	7.5 [4.9]

The Gar's performance is typically strongest with a ground plane at higher frequencies, but even without one it delivers strong gain in both average and maximum terms. In this way, the Gar antenna outclasses its competitors for a variety of installation environments.

Laird Connectivity – A Trusted Partner With Exceptionally Engineered Solutions

The [Gar multiport MIMO vehicular antenna](#) is just one of Laird Connectivity's broad portfolio of antennas that outperform the competition in terms of aesthetics, size, and performance in difficult installs. Our decades of experience in RF engineering and our full-service design and test labs make us a trusted, highly-capable partner for solving your connectivity problems and speeding your integration. And all of our antenna products are backed by our best-in-industry support and 5-year warranty.

To learn more about how Laird Connectivity can bring your wireless applications to life, visit our [RF antennas page](#) and our broad portfolio of RF antennas.

This article previously published at <https://www.lairdconnect.com/resources/blog/no-ground-plane-no-problem>.