Mobile antennas: fact and fiction

Your CB radio isn't worth a plugged nickel without a good antenna to squirt the signal into the air. It can be a real head scratcher, sorting through confusing claims for antenna performance. Here's a complete easy-to-understand explanation of CB antennas for cars, trucks and RVs.

by Bill Orr, W6SAI

OK SPORT FANS, let's talk about mobile antennas for two-wheelers, RVs and eighteen-wheelers. (For the uninitiated, that means automobiles, campers/trailers and tractor-trailer rigs.)

Radio transmission and reception from moving vehicles is nothing new, radio hams were doing it in the early "twenties" and Detroit, Michigan had radio equipped Bears (patrol cars) in the early "thirties". But it is only in the past few years that mobile CB radio has really caught the attention of the American public. Some observers of society say that the big growth and interest in CB radio came about as a result of the trucker's strike in the fall of 1975. Who knows?

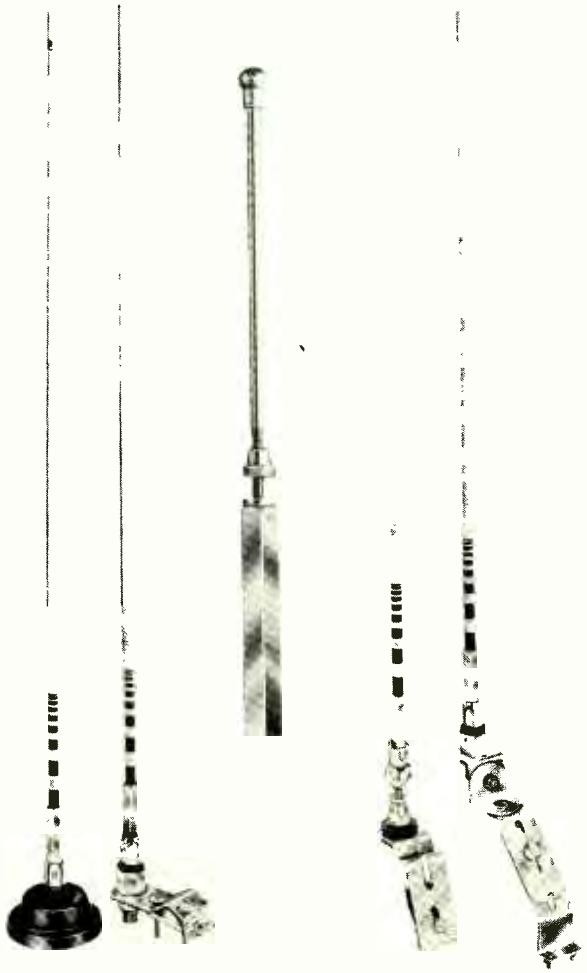

Fig. 1—Whips, whips, whips! They come in a variety of sizes with a variety of mounts. Which is best for you depends on what you want your antenna to do.

But the end result is that today there is more interest than ever in CB radio and a big proportion of the interest is in mobile operation.

In magazines and on TV "commercials" you'll see the advantages of mobile CB radio extolled—just the thing for highway emergencies, or to inform the little woman that you'll be late for dinner, or for the better half to tell you to stop and pick up some extra canned beans for dinner! This is great stuff, and very thrilling, if it works.

However, many CB service centers report that a vast number of CBers experience trouble with their mobile rig, and that the trouble usually centers around the antenna installation! It would seem, then, that the mobile antenna is the weak link in the communication chain which can drastically impair your enjoyment of CB two-way communication. God knows there are enough mobile antennas on the market! A quick glance through S-9 will convince you that whatever type of mobile antenna you desire, it is available, and in quantity. What, then, is the big hang-up? Why do so many CBers experience difficulties getting the CB rig from the shipping carton, and into action in their vehicle?

Well, before we examine the action, a word of advice from this Old Timer—advice that applies to CB equipment of all types, antennas included: too many CBers think the instruction manual, or sheet, is something to be thrown away with the shipping carton. As a last resort, before you panic, *read the instructions!* The manual, or instruction sheet, is included with the equipment for a very good reason. *Read it and save it!* Now, having gotten that bit of folk wisdom off my chest, let's get the show on the road.

What is the mobile antenna—and why?

The usual CB mobile antenna is a vertical metal whip of some sort mounted on the body of the vehicle. The whip is made stainless steel, or other conducting material, and is insulated from the body of the vehicle by a support structure made of nonconducting mate-

rial. Thus, there's no electrical connection between the antenna, as such, and the body of the vehicle.

By tradition, and because of ease of mounting, the mobile antenna is placed in a vertical position and for best results the antenna length bears a definite relationship to the length of the CB radio wave. The "work horse" antenna for CB mobile service is the *vertical whip,* shown in various versions by figure 1. The most popular whip is flexible, quarter-wavelength long tapered stainless steel rod having a threaded base fitting. (Better antennas use stainless steel for the whip assembly to reduce corrosion and rust). The top end of the whip should have a steel or plastic ball on it to prevent you from putting your eye out when installing it on your car. In addition, the ball insulates the tip and prevents the build-up of static electricity on the antenna, as often happens in a fast-moving vehicle in dry weather. Static electricity can cause a crackling, frying noise in the receiver that makes reception extremely difficult and has even been known to burn out the sensitive transistors in the input circuits of a receiver!

Whip antennas come in all sizes, price ranges and performance values, so let's discuss some of the more popular models.

The 102 whip

The so-called "102 whip" is 102 to 106 inches long, or nearly one-quarter electrical wavelength (Figure 2). Actually, a quarter-wavelength is closer to 106 inches, but part of the antenna length may be included in the mounting fixture and, as a result, manufactured whips take this into account and usually run only about 102 inches from top to bottom. Many 102 whips have a base section having a special ⅜" x 24 threaded post to fit most mounting devices.

Some whips are demountable, that is, the whip is held in position in the threaded post by a threaded coupling or by an *allen* set-screw (Figure 3). The user can quickly loosen the whip with an *allen* wrench and remove it for storage in the car, so that it won't be ripped off!

Generally speaking, whip length is not critical within two or three inches, and most whips are "fine tuned" by cutting one end, a half-inch at a time, until the antenna is tuned to the channel desired.

Fig. 2—The quarter-wavelength whip antenna. This so-called "102 whip" is made by a variety of manufacturers. The whip may be stainless steel, or steel coated with fiberglass. A small ball is placed at the tip of the whip to prevent you from putting your eye out when installing it on your car. The tip ball also helps to reduce build-up of static electricity on the whip. The base of the whip is threaded to fit into a spring mount and swivel ball. The split ball permits mounting the whip on a surface which is at an odd-angle to the ground.

Fig. 3—This base loaded whip is quickly removable from the mount. A threaded fitting permits the whip to be taken off with a few turns. Some whips can be locked into position with an *allen* set screw to prevent them from being stolen. It is a good idea to remove the whip when the vehicle is parked in a public place so that it won't attract attention to the radio equipment in the car!

Everything else being equal, the 102 whip is just about the best mobile antenna from the point of view of overall efficiency. All of the antenna is radiating as part of it is not wound up into a coil which does no radiating. However, the 102 whip is not without its problems. First of all, it is an unwieldy device, capable of striking your garage entrance, and long enough to bang into overhead tree limbs when you drive down the street. In addition, under high speeds the 102 whip tends to bend backwards in the wind, and flop about, which often adds a very objectionable "flutter" to the signal.

Some CBers try to remedy these faults. The whip is mounted very low on the vehicle (usually on the rear bumper) so that it will not strike overhead objects, and the whip is braced to the car body with nylon cord to keep it from moving about when the vehicle is in motion.

These are not bad ideas, but when the whip is mounted low on the vehicle, the body of the vehicle tends to "shield" the antenna in certain directions and

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radiation from the antenna is not the same in all directions from the vehicle.

Short, loaded miniature whip antennas are becoming increasingly popular among mobile CBers. These whips are from 18 inches to 80 inches long, with the missing portion of the whip that is required for a full quarter wavelength system being wound up in a *loading coil* placed in series with the whip. The coil may be either at the base of the whip (Figure 4), or in the middle of it. Since a portion of the normal, full-size antenna is missing (wound up in the coil to conserve height), the efficiency of the whip suffers to a degree.

Fig. 4—The base loaded whip. This compact whip antenna is about 42 inches high and is designed for roof or rear deck mount. The missing portion of the whip is wound up into a loading coil, which may be seen at the base of the whip, just below the flexible spring. Whips of this general type may be obtained having an overall length of 18 to 80 inches. The longer whips have greater efficiency than the shorter ones. Some models of the mini-whip can be adjusted to frequency by trimming the whip length an inch at a time.

Fig. 5—The center loaded whip. The efficiency of a short whip can often be improved by moving the loading coil from the base to the center of the antenna. This 28 inch high mini-whip is designed to mount on the rain gutter. A special clamp permits quick and easy attachment to the rain gutter of a vehicle. Make sure that thes base clamp penetrates the paint of the vehicle to make a good metal-to-metal contact for grounding purposes.

Very short mini-whips (18" to 36") that have the loading coil at the base seem to average about ten to twenty percent as efficient as a full size whip, with the greater portion of the transmitter power wasted in the form of heat in the coil. Longer mini-whips, of course, have higher efficiency.

The mini-whip antenna

Many CBers are willing to accept the trade-off of antenna efficiency for convenience, and whip lengths of 48" to 80" are becoming very popular. Because the mini-whip is shorter, it can be mounted higher on the vehicle, atop the roof and atop the rear turnk area being two convenient mounting places. Some antenna manufacturers state that the loss in efficiency brought about by the use of a mini-whip antenna is more than compensated for by the ability to mount the whip antenna at a higher point on the car—and they may very well be right. Since not everyone drives the same kind of car, RV or truck, it is difficult to make specific comments, and observers such as myself are reduced to generalities which are based upon common sense. Here are a few such generalities:

1—Longer antennas are more efficient than shorter ones. Use the longest whip antenna (up to a quarter-wavelength) that you can.

2—Mount the whip as high on the vehicle as you can.

3—Don't let the body of the vehicle cast a "shadow" on the whip. (One of the worst installations is to mount a whip on the rear bumper of a station wagon, as the body of the wagon is very close to the whip and creates a radio "shadow" around the whip).

Mini-whips make use of an inductor called a *loading coil* to establish the *electrical* length near resonance, or about 102 inches. As I said before, the portion of the antenna wound up in the coil doesn't do anything as far as radiating the signal goes. Theoretically, it is possible to place the loading coil at any point in the antenna. Placing the coil at the base of the mini-whip makes a physically strong assembly that has very little wind resistance. Antenna efficiency, however, can be raised an appreciable amount by placing the loading coil near the center of the whip (Figure 5), rather than at the base. Raising the coil beyond the center of the antenna does not "buy" much, and tends to make the antenna top heavy and makes adjustment more critical.

Once again, the user is confronted with a trade-off in values. Which is more important, antenna efficiency or wind resistance? Is it more aesthetic to use an antenna with a base loading coil, or to use one with a (relatively) unattractive loading coil in the center of the antenna?

Some manufacturers place the loading coil near the mid-point of the mini-whip in order to boost antenna efficiency, and then cut down the length and diameter of the coil to decrease wind resistance. The improvement in efficiency in such circumstances is doubtful.

The problem confronting the manufacturer, seller and end user of any mobile antenna is that it is extremely difficult to determine the overall efficiency of the antenna, especially when it is to be mounted on a vehicle of the user's choice. Measurements of antenna efficiency and performance are costly and difficult to perform. Some of the larger manufacturers have an "antenna range" where measurements may be made under controlled conditions. On a typical range, the antenna under test is placed in the middle of a large sheet of metal and readings of the signal strength from the antenna are taken at various points around the compass, several hundred feet away from the antenna. In some instances, the antenna may be actually mounted on a vehicle, or truck.

Sad to say, performance of a given antenna varies greatly from vehicle to vehicle and from truck to truck.

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The irregular body of the vehicle distorts the antenna pattern so that reception and transmission varies greatly, depending upon the direction from the vehicle the measurement is being taken.

This is little comfort for the CB buyer. He would have to have a whole room full of expensive instruments, and a large "antenna range" in order to make comparisons between mobile antennas, and the results he would get from these measurements would vary from vehicle to vehicle. And it is asking too much for Yours Truly to state that one antenna, or type of antenna, is better for your vehicle than another. In the last analysis, the one that works *best for you* is the best one for you!

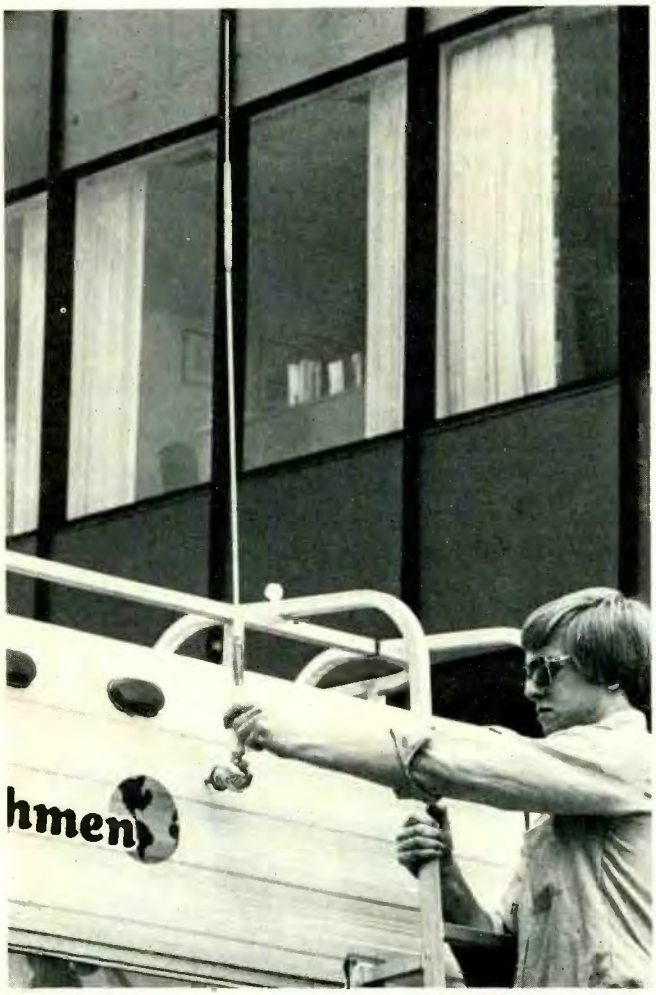

Fig. 6—A few mobile antennas such as this Breaker Corp. Model 10-500 are specially designed for use on fiberglass-bodied RV's, campers and sports cars.

When all the smoke dies away, is there a real difference between an unloaded, full-length whip, a bottom-loaded mini-whip and a center loaded mini-whip? I asked a friend of mine that question. He's an antenna engineer for a very large antenna company that makes mobile antennas for CBers, radio hams and the military. Here's his reply:

"Well, the full length, 102 inch whip is a great antenna. If you use a super-stiff spring in the mount you can keep it upright at normal highway speeds. But it tends to bend over at high speeds. And if you hit a tree with it—that's all, brother!

"Center-loaded mini-whips tend to be a bit better as far as efficiency goes than base-loaded whips, but they sway about in the wind and the motion detunes the whip, imparting a flutter to the signal unless the whip is very rigidly made. The bottom loaded mini-whip is very stable under all road speeds and has very little bending action at high speeds. It's more durable because it is quite short and can't be battered about by trees. But the base-loaded whip has less overall efficiency than the other two types. Also, it can be detuned easily by nearby objects. Even walking close to the body of a vehicle with a base-loaded mini-whip can detune the whip.

"My advice to the CBer is to keep his eyes and ears open. See what the other CBers are using in the way of antennas. See who has the best and most consistent mobile signal. Examine the whip antennas at your local CB outlet. Look at the antenna of your choice. Is it well made? Corrosion resistant? You can tell a lot by merely eyeballing the antenna.

"Don't forget that the automobile forms the ground system for the whip antenna. Some vehicles with a fiberglass body—such as the Corvette—don't provide a very good ground system. In this case, the best thing to do is to cover the inside of the rear of the vehicle with self-adhesive, aluminized tape. The tape is put everywhere you can reach on the inside and then connected to the ground connection at the base of the antenna by a very short piece of wire. Some antenna manufacturers sell a ground kit for this problem (*the Antenna Specialists Co.*, 12435 Euclid Ave., Cleveland, Ohio 44106. Ask for Ground Kit M-262)."

The final wrap-up

Look through the pages of S-9 and read all the advertisements for CB antennas. You can get catalogs of many of these outfits at your local CB store, or you can write directly to the manufacturer for his catalog. I'll bet you would make him happy if you enclosed 50¢ postage, too, as a lot of the catalogs are quite weighty and costly to produce and mail. Spend an evening reading the literature, and when you finish, you'll have a good working knowledge of mobile antennas. Don't let the exotic antenna names "snow" you; antenna manufacturers have the same weakness prevalent in the automotive field—that of giving exotic names to rather mundane products!

Next, examine your vehicle, catalogs in hand. Where can you mount the antenna? How much overhead can you afford? Once you answer these two questions, you'll have come a long way in deciding what type of mobile antenna is best suited for your particular installation.

Next month's column will discuss antenna mounts and how to mount the mobile antenna on a number of vehicles. Until then, may all your signals be wall-to-wall and tree-top-tall!