MOBILE ANTENNAS FOR PORTABLE USE

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WHEN the mobile operator comes temporarily to rest in some portable or temporary location such as a hotel, motel, or a friend's house, he often likes to take the rig out of the car and operate.

He is then faced with the problem of an antenna. He can carry a trap dipole with him in the car, or possibly a long wire. If he uses the trap dipole he will need two supports, such as trees or masts in order to string his dipole. The long wire will probably only need one support, but he will need some sort of antenna matching unit as most mobile rigs will not operate happily into a long wire except for the band on which it offers a low impedance to the transmitter.

It seemed so tempting to take the mobile whip off the car and support it, somehow, outside the window. This was tried on a recent trip to Luxembourg and Austria. The outer conductor of the coax was grounded to a water pipe or radiator in the hotel bedroom with the hope of simulating the car. The results were frankly bad. We only worked a few locals and even these were at very poor signal strength compared with a long wire. No DX or even reasonably distant stations were worked.

Disappointing as these results were, they were not really surprising. The car is an integral part of the radiating system in a mobile installation. Some American mobile operators, I understand, carry a long length of coaxial cable and run this out from the motel bedroom to the car, using the mobile antenna still mounted on the car. While this may be an excellent system when operating from a motel with the car near at hand, it can be most inconvenient from a hotel bedroom several stories high at some distance from the car.

Mobile Antennas

There are at least two theories at present on the mode of operation of a mobile installation on the amateur bands. One theory sees the mobile whip operating as a ground plane, the car either providing the ground plane itself, or the capacity to real ground being adequate to provide the ground plane effect. The other theory sees the mobile whip and the car together operating as a dipole, and together resonating as a *half* wave length.

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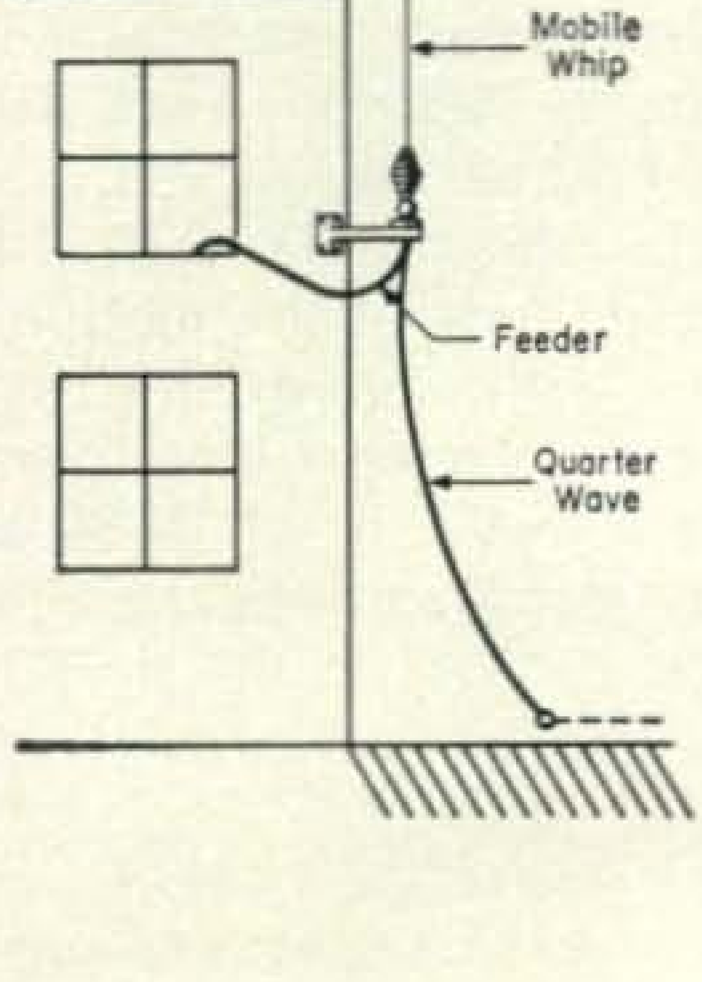

Fig. 1—Mobile whip used as a dipole for portable operations.

On 10 meters it is easy to envisage either effect. The car is quite large enough to provide a ground plane on 10 meters; equally, the car can be envisaged as providing the other quarter wave, so that the whole operates as a half wave length.

Similarly on 15-meters both solutions seem possible.

On 20-meters it is a little more difficult to envisage both theories, though the half wave theory is possible to explain in two ways.

1) That the whip is made essentially longer than a quarter wave to compensate for the absence of enough car to represent a quarter wave on 20 meters.

The electrical center need *not* necessarily be at the feed point. Erich Stöss, DL6UH, has done some experiments which would support the half wave theory and which seem to indicate that the feed point is not always the electrical center.

2) That owing to most cars containing large amounts of magnetic materials, the inductive effect of this makes it possible for a path of an electrical quarter wavelength to be found on the car even if this involves going round a few corners.

On 40, 80 and 160 meters both theories are more difficult to envisage. A car can hardly represent a quarter wave on 160 meters. Likewise the capacity to ground at these frequencies would have to be very large to support the ground plane theory, and with a car's ground clearance of, say, 5 inches from the surface of the ground, and probably many feet to *true* ground, it seems difficult to see that there is adequate capacity to real ground to support the ground plane theory.

Half Wave Operation

Turning these matters over in my mind and remembering the very poor results which we had obtained with the mobile whip working against a water pipe or radiator ground, I decided to try the *half wave* theory on 15 and 20 meters, by working the whip against a quarter wave of wire hung downwards from the window, while the whip itself stuck upwards. (See fig. 1)

The nature of the building will obviously affect the results, and it is necessary to give details. The building is a brick built cottage with metal window frames, and the usual amount of water pipes, electrical wiring, *etc.,* but no rain gutters.

The mobile whip used initially was a Mark Mobile HW3 Tribander suspended about two or three feet out from the window on the first floor, with the base of the whip approximately at the level of the bottom of the window, and about 12 or 13 feet above ground. The whip was driven from a Drake TR3 in the first instance running about 300 watts p.e.p. input and the whip was fed with 52 ohm coaxial cable.

As 15 meters was open I decided to try this. Results were good and I worked W3ABI, K9PPX, W2DAG, K3ITE, K2PEJ, WA2TAQ, all Q5 and varying between S3 and S9, as well as W6CCP at 3/3.

At first the Drake was *not* grounded in any way. Then I grounded the chassis of the TR3 to the water pipe. At once there was a drop in signal strength. I then replaced the coaxial feed with a balun and 72 ohm twin line. The results were the same as when the transmitter was *not* grounded but now the transmitter could be grounded to the water pipe without any effect on the signal strength.

Two Band Operation

Then I changed to 20 meters, by disconnecting the quarter wave for 15 meters and connecting a quarter wave for 20-meters instead.[1] I worked VE2BCT 5/5 and various other stations.

I then remembered that I was using a Triband mobile whip for 10, 15 and 20-meters in which the coils for 10, 15 and 20 meters were in circuit all the time, I decided to connect the quarter waves for 15 meters and 20 meters simultaneously. This worked excellently and I had a two band arrangement. I did not bother about 10 meters at this stage as the band was not open.

The operation of the Mark Mobile HW3 Tribander may shed some light on the mode of operation of mobile installations. In the HW3 the three small helical loading coils, one for 10 meters, one for 15 meters, and one for 20 meters, are in circuit all the time. The r.f. energy automatically selects the particular coil which is resonant, ignoring the other two coils since they present the wrong impedance. May it not be true on the h.f. bands that in some direction across the car there is a path which is resonant at the frequency on which one is transmitting? The r.f. energy selects the resonant path. At a different frequency the r.f. may choose another path which is resonant at that new frequency. So that on 10, 15 and 20 meters some path in the car can always be found which is resonant at the frequency being used.

The car, therefore, represents an infinitely adjustable quarter wave, and the r.f. will automatically choose whichever path over the car body, chassis, engine, *etc.,* presents the perfect resonant length for the frequency in question. This would go far to explain the very satisfactory results obtained from mobile installations and the advantage of excellent bonding between all parts to ensure that whichever happens to be the ideal path for the r.f. to find its resonant length, is free from all avoidable resistance losses.

Next day I connected the mobile whip with its two quarter waves (one for 20 and one for 15 meters) to the normal home rig, a KW Viceroy, plus KW 500 Linear running about 500 p.e.p. input and worked a number of stations. (I usually reduced power to 400 p.e.p. to avoid possible damage to the whip.)

On the normal fixed station little difference could be found whether the whip was fed with coax or through the balun with 72 ohm twin feeder at first. This was probably due to a longer feeder being used.

It seems reasonable that if a short feeder is used as can often be done when using an antenna just outside the window, grounding the chassis will also ground the outer of the coax, and with a short feeder this will ground one side of the radiating system, thus reducing the efficiency of the radiating system. If the feeder is a quarter of a wavelength long, the grounding effect will be lost, but can recur again when the feeder is half a wavelength long.

Later I connected a Webster Bandspanner instead of the Mark Mobile HW3 and used only one quarter wavelength wire at a time. The tests were carried out mainly on 20 meters and no noticeable difference could be found with the Bandspanner compared to the HW3.

I then did a long test with K1AQI, using first the coax feed; next I grounded the outer braid of the coax, and signals were slightly weaker; then I changed to the 72 ohm twin feed with the balun, and signals were definitely better than with the coax, whether it was grounded or not.

I did notice that the s.w.r. was slightly better with 72 ohm twin and the balun. The s.w.r. was usually quite good—1: 1.2 to 1.5 with the 72 ohm and the balun. Not enough tests have yet been made with coax and twin feed to make any definite assertion on this point. I have had better reports on the coax on some occasions, and better reports on twin feed on others. The changeover can never be instantaneous and the normal QSB is likely to lead to varying results. Only after a larger number of tests could one come to a more definite conclusion. My own impression to date is that the twin lead with the balun is slightly better.

It is hoped that this will give some idea of the capabilities of the mobile whip outside the window with a quarter wave hanging down. While the experiments were carried out on 15 and 20 meters with the Mark Mobile HW3 and the Webster Bandspanner, there is no reason to believe that similar results would not be obtained with many other mobile antennas. ■

[1]The 20 meter quarter wave had to be pulled out a little to prevent it from touching the ground.