

WIRELESS MICROPHONES

by Ray L. Fetterman, Markham, Illinois—Improved wireless pickup equipment can simplify the job which faces engineers on many remote productions.

Many situations requiring highly mobile audio-pickup equipment for radio, live television, and filmed productions have confounded broadcasters and cameramen for years. They have strung cables, suspended microphones from long, ungainly booms, and even tried a few wireless microphones, most of which have been only marginally useful, from time to time. Chances are, however (unless you've investigated wireless systems recently), you'd be surprised to learn that solid-circuit techniques and miniaturized components have made a quite a difference in the quality and reliability obtainable from FM-wireless microphones.

Experience gained in the motion-picture industry (where huge indoor sets and outdoor location scenes require highly sophisticated sound

techniques) has enabled a few manufacturers to perfect wireless-microphone equipment which can make production of special events a much simpler task. To do this, they had to overcome several problems which have slowed general acceptance of these special-purpose pickups.

Development

In earlier days, for example, a pickup apparently perfect in all respects would suddenly fade or suffer audio distortion far beyond that which the engineer could control from the mixer panel. One transmitter designed specifically for fully concealed wireless-microphone applications might function perfectly for one individual (on a certain day!) whether he hand-held the microphone or concealed it on his person; the same unit might fail

miserably when used by another individual due that old bugaboo . . . body capacitance! Other factors which create headaches for the wireless-microphone user are temperature and humidity variations (especially on location), static-producing high-tension lines, fluorescent lights, automobile - ignition noise, and RF interference from other transmitters. Temperature variations can detune an unstable transmitter unexpectedly; the other factors will, of course, interfere with the received signal.

Some early units transmitted in the standard broadcast band (540 kc to 1600 kc). These systems, quite understandably, didn't work out too well. Too often, a powerful AM station's signal would boom in over the system and completely block reception of the remote pickup. Soon after, however, most manufacturers switched to FM transmission in one of two bands: 25 to 45 megacycles or 88 to 108 megacycles (entertainment band). During the early development of wireless microphone transmitters, only Mil-Spec semiconductors and miniaturized components were of high enough quality to ensure success in applications where stringent size and stability requirements are paramount. Limited availability and the high cost of these components usually ruled out most of the more dependable ones. Today, however, the price and availability of semiconductors and other essential components lend themselves to the design of units which will provide fade-free, drift-free transmission of audio signals. The rapid development of microcircuitry is even more encouraging. Sizes of the concealed transmitters and of self-contained lavalier-style transmitter/



Fig. 1. Hand-held mike has integrally mounted telescoping antenna system.



Fig. 2. Setup of several receivers used for political or indoor sports coverage.

microphone packages can be reduced without sacrifice of operating performance.

Equipment Available

Most wireless-microphone transmitters are packaged within the body or case of a standard lavalier microphone, or in a separate unit which will accept plug-in pickups. A few of the separate-case models feature built-in microphones, but these are not recommended for professional service, except for nightclub entertainment use or public address.

Telecasts and radio broadcasts of most special events, news programs, panel shows, interviews and the like, do not require microphones which must be concealed. What they do require are units which have no cables to impede the movements of the newsmen, MC's, or guests. In these applications, the self-contained lavalier-type wireless microphone is the ideal solution. One well-known West Coast firm produces two versions of a self-contained microphone-transmitter unit. These units are FCC approved and operate at frequencies in the 25-mc to 45-mc band. Their standard model is a lavalier unit 1" in diameter and 5" long. The microphone itself is a dynamic type having an acoustic response of 80 cps to 14,000 cps. Complete with mercury battery, it weighs only seven and a half ounces. A neck cord and/or waist cord function also as the an-

tenna for efficient transmitter operation. Their hand-held wireless microphone (see Fig. 1) is $\frac{3}{8}$ " longer than its lavalier counterpart and has a telescoping whip antenna mounted integrally. If greater range is required, there is also available a helmet which has a longer whip antenna attached to the crown. Several versions of the hand-held and lavalier microphones may be seen, from time to time, on various telecasts. These units employ sensitive FM receivers (shown in operation in Fig. 2) to round out the system. Sensitivity is on the order of 1.5 microvolts, or better.

Many small microphones avail-

able today will meet the requirements of the recordist and the audio engineer. Most are of the dynamic type and are available in high-, low-, or adjustable-impedance types and cover the audio-frequency range demanded by the filming industry as well as by broadcasters. In some instances, ultra-small magnetic and crystal microphones have to be employed for the sake of maximum concealment. These units can be concealed in brooches, necklaces, or boutonnieres worn on the person of a performer. These types should be considered only where maximum concealment is required (in dramatic programs, for example), as their frequency-response range seldom exceeds 100 cps to 5000 cps.

The size of most separate-case wireless microphones approximates that of a pack of king-sized cigarettes. Fig. 3 shows a transmitter unit of this configuration which is satisfactory for many applications. Small as they are, these still present problems when it comes to concealment in tight-fitting costumes or athletic attire, or on the person of a woman. Faced with this problem, an independent motion-picture company in California has developed an ideal transmitter/battery-package unit. The transmitter case and the separate battery pack are each the size of a "flip-top" cigarette lighter, and yet there is no sacrifice in the quality of the audio signal

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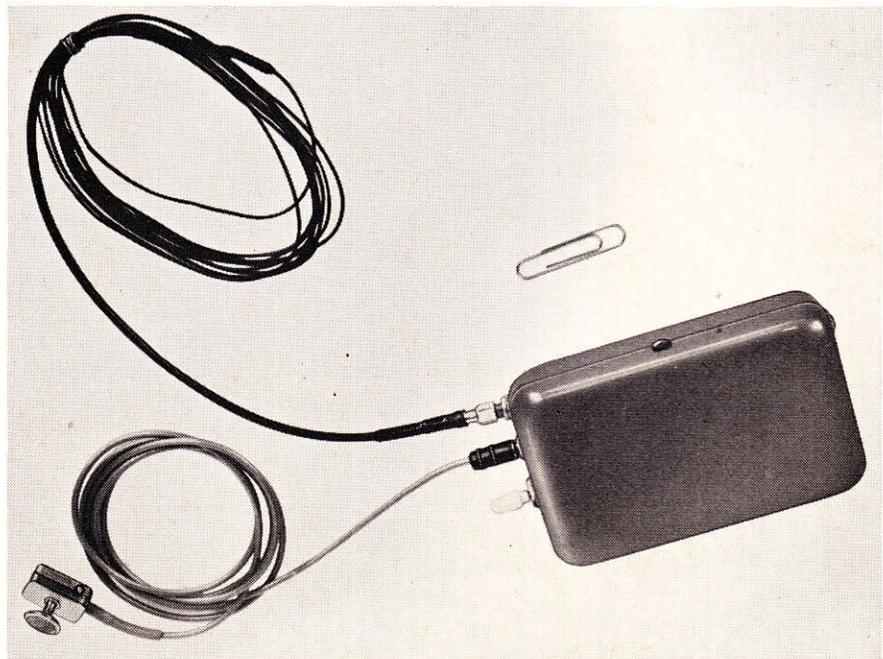


Fig. 3. Typical cigarette-pack-sized transmitter uses buttonhole microphone.

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obtained with this miniature unit. It is tuneable over the entire 88-mc-to-108-mc range and has jacks to accept microphone and antenna plugs. A belt-type antenna usually provides optimum signal fidelity, but, in instances where a directional pattern persists, the addition of an over-the-shoulder run of flexible wire cures the problem. The developers of this equipment lease a complete sound-recording package to TV and motion-picture studios, including an expert audio engineer and the closely guarded transmitter-receiver system. The cigarette-lighter size of transmitter case is, of course, ideal for concealment.

Extreme distances are not required for the majority of remote-pickup assignments. If the camera and sound crew can obtain good-quality audio at 200' without having to conceal cable-connected microphones, use boom microphones, or dub in the dialog at a later time, they'll be quite happy. Still, sensitive receivers are a necessity for several reasons. Due to the low power of the transmitters and the conditions under which they must operate most of the time, receiver sensitivity of 1.5 microvolts, or better, is generally required. With the combination of a top-quality FM receiver (either a modified commercial unit or one specifically designed for wireless-microphone service) and a stable, drift-free transmitter, almost all interference problems are eliminated. To say that all interference can be eliminated by superior equipment would be stretching a point, but a properly shielded ignition system, for example, will not be picked up by a first-class system. Some foreign cars set up a buzz that cannot be eliminated, as do some older domestic vehicles, but cars or trucks used in a major production can be quieted electrically so they can drive within inches of a wireless microphone without producing any interference. High-tension power lines will cause little trouble as long as the transmitter is kept within a nominal 300' range of the receiver. In extreme cases where action occurs more than approximately 300' from the mixer console and receiver, field-located

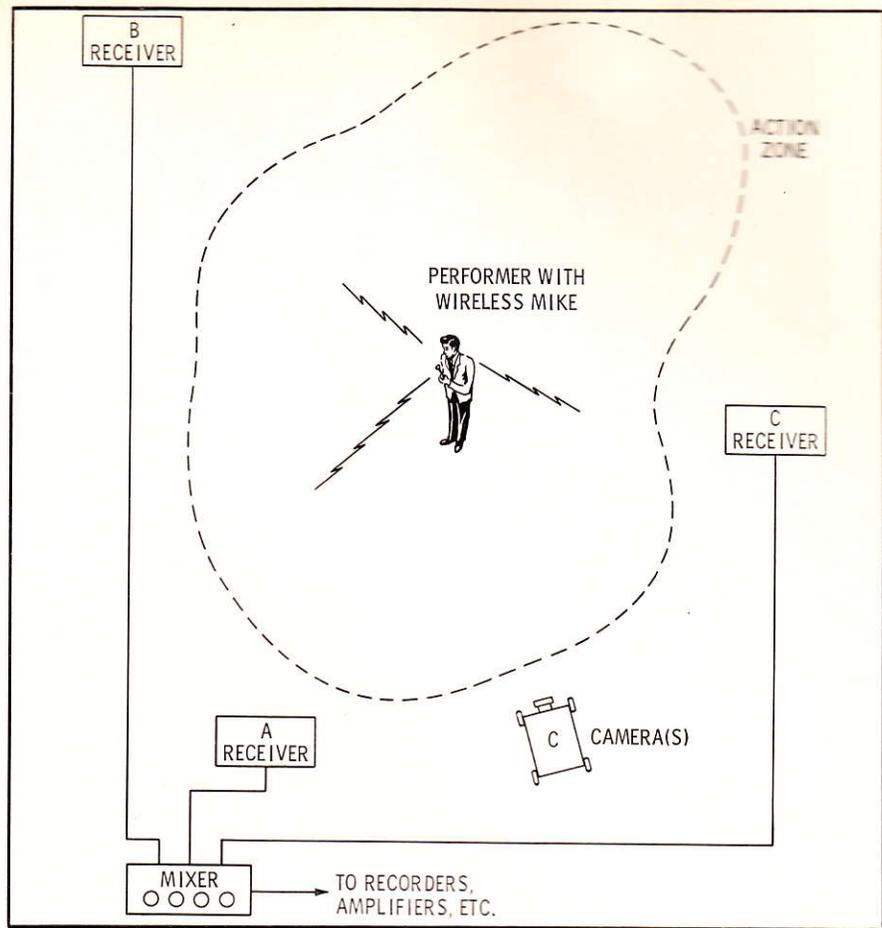


Fig. 4. Multiple-receiver setup requires an engineer with mixer to distribute audio.

receivers can be set up (see diagram in Fig. 4).

On sound stages or at other locations where FM transmission encounters difficulties (where objects impede line-of-sight transmission), auxiliary antennas should be employed. Ordinarily, the whip antenna which is a part of the microphone will do the job perfectly, but in a few cases another approach must be taken. One method is to run a loop of wire to the area in which the action will take place, with the wire directly on the ground when on location or hooked to the overhead beams in a sound stage.

Conclusion

Broadcasters and news cameramen can use the wireless microphone in many of their pursuits. Having such instruments, they can be on-the-spot without being obvious about it and capture the candid reactions of their subjects. A typical setup for reportage is illustrated in Fig. 5. The less expensive cigarette-pack-sized transmitters are an excellent tool for the roving reporter. The reporter may

cover the action with the transmitter unit while his receiver and tape recorder remain running safely in his car a few yards away. The remote-event broadcaster and newsman will find a wide variety of uses for wireless microphones and remote taping of varied events. Specifications demanded by broadcasters will help to overcome many of the faults encountered in wireless-pickup equipment now available, and we'll see rapid advances made in wireless pickup techniques. Even so, several units now available can be used to good advantage by many broadcasters. ▲

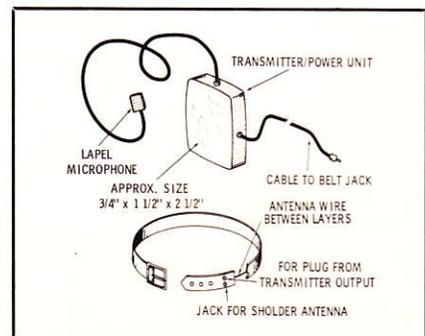


Fig. 5. Compact wireless setup has belt-type antenna for greatest concealment.