Radio Set and Service Review

Bendix Model 847S "Facto Meter"

THE new Bendix Model 847S field test receiver—called the Facto Meter—is an 8-tube, a.c.-operated, FM-AM portable set. It is designed specifically as an aid to radio installation crews and servicemen making field-strength measurements on FM and standard AM broadcast bands.

Its tuning range is 540—1620 kc and 88—108 mc.

The set is enclosed in a metal cabinet 11 inches high, 17¾ inches wide, and 6¼ inches deep and features a large built-in tuning meter and a 33¼-inch telescopic antenna that may be used on FM and AM reception. This antenna can be connected to either the FM or AM antenna terminals by a switch on the side of the cabinet. A 300-ohm FM antenna and a single-wire broadcast antenna and ground can be connected to terminal strips on the rear of the chassis.

The tuning meter has two sensitivity ranges. The ratio between ranges is 5 to 1 on the AM band and 10 to 1 on the FM band. It has a linear scale calibrated 0 to 10. When the meter reads 5 or above on the high range, excellent FM reception is possible at the location where measurements are made. When the needle falls between 1 and 5, reception is good. On the low range, readings between 1 and 5 show poor reception, and above 5 shows good reception. The set should be tuned for maximum needle deflection on each station.

FM vs. AM propagation

There is considerable difference in the propagation characteristics of standard broadcast frequencies and the very high frequencies used for FM. The broadcast signal—1600 kc or lower—has a tendency to follow the earth's surface and may be received on the ground wave for distances of 400 miles or more under normal terrain and atmospheric conditions. Obtaining fair broadcast reception is no problem — even in remote locations—as the average broadcast set will pull in a number of stations if given a chance.

In steel-framed buildings, the structure may absorb the signal and cause dead spots and poor reception on sets with built-in aerials. Outdoor aerials improve reception, but there are times when they are not practical or their use is prohibited. In such cases the Facto Meter can be used to locate spots accurately where signal levels are highest, and sets will give best results within the building. Areas of maximum signal strength are located by extending the antenna of the field test receiver and moving it around the room or building while watching the meter. Meter deflection indicates spots where the signal is strongest.

FM signals—in the order of 100 mc—act very much like light rays and travel in straight lines with comparatively little bending. Best reception is usually obtained when the receiving location is in the service area—where receiving and transmitting antennas are in the *line of sight*. This distance may be calculated from the formula: $D1=1.4\sqrt{H}$. D1 is distance in miles, H is elevation of observation point in feet, and 1.4 is a constant use to allow for v.h.f. refraction. Fig. 1 is a comparison of broadcast and v.h.f. signals.

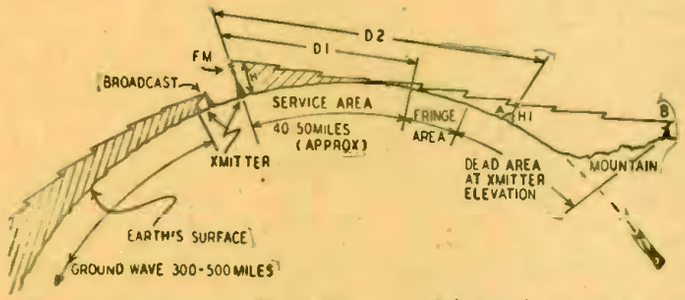
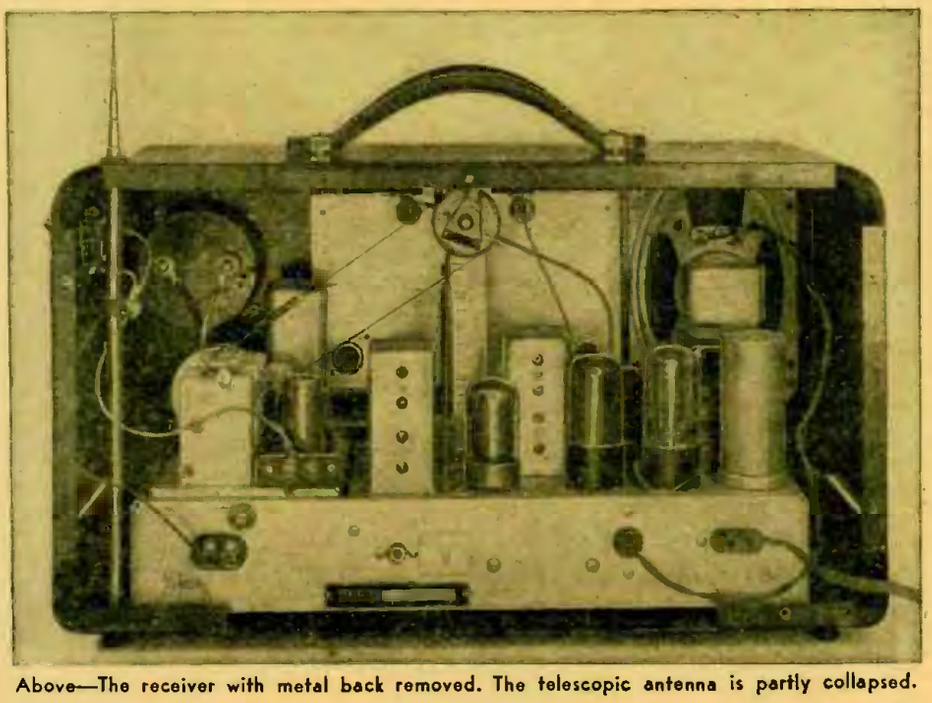


Fig. 1—A comparison of broadcast and v.h.f. signal propagation.

The service area of an FM station depends largely on the height of its antenna above surrounding terrain. The service area includes all the space within a radius of D1. H is the height of the transmitting antenna. Reception is possible in the fringe area where the receiving antenna is normally below the line of sight but signals are relatively weak. Best results are obtained when the receiving antenna is mounted as high as possible so as to extend the line-of-sight path between transmitting and receiving antennas. Signals may be received at any point A in the dead area if the receiving antenna is high enough. Its height may be found from the formula: $D.2=1.4\sqrt{H}+1.4\sqrt{H1}$. D.2 is the distance between transmitting and receiving locations, and H and H1 are heights of transmitting and receiving antennas in feet, respectively.

Good signals may be received atop the mountain at B—far beyond the service area—because the receiver is high enough for direct reception of the transmitted signal. (Antenna installation and orientation can become a problem normally requiring the services of two or more men.) The height, location, and orientation of the antenna and routing the transmission line are problems of particular importance.



Above—The receiver with metal back removed. The telescopic antenna is partly collapsed.

Field survey

The field test receiver, operated by one man, can answer these problems in a short time. Where installations are planned on a flat or otherwise easily accessible roof the Facto Meter can be carried about and the antenna installed

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at the spot where signal is strongest. The antenna is oriented by turning the set on its side so the telescopic antenna is horizontal. The set is given a quarter-turn in each direction and the meter reading noted. The dipole should be mounted parallel to the antenna of the set for maximum signal.

Fig. 2 shows how reflected and direct signals may aid and oppose each other at the receiving antenna. Each serrated section represents one wave length. The direct and reflected signals are in phase at A, and the signal is strongest. At B, they are out of phase—do not arrive at the antenna at the same time, as indicated by the unequal wave-length sections—and the signals cancel to create a dead spot or minimum-signal area. This condition is most serious in television, where it causes ghosts, but may have a decisive effect on FM reception.

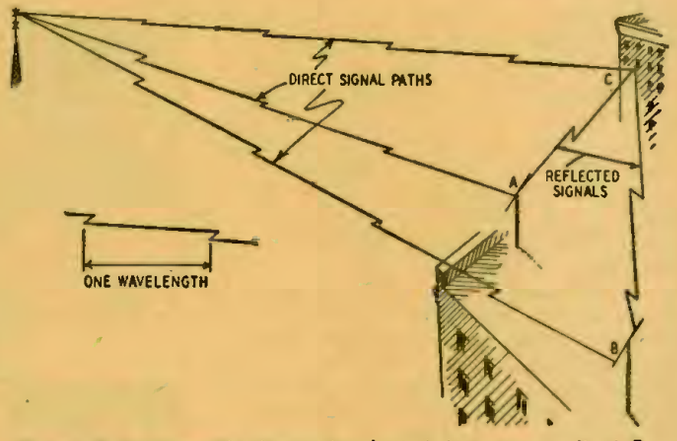

Fig. 2—Reflection aids direct signal at A but opposes it at B.

In areas where signals are generally weak, the serviceman can mount a good FM dipole on a 15- or 20-foot pole and connect it to the test receiver through a 300-ohm line. The antenna can then be moved about the roof to locate the best spot for installation.

Many FM tuners and receivers have built-in aerials. If outdoor aerials are prohibited—as they are in many apartment buildings and hotels—a serviceman should make a field strength survey inside the building to see if the signal is strong enough for good reception before completing the sale or making an installation.

While making the measurements, the test receiver should be moved around the room and the relative strength of signals from all stations in the vicinity noted. One station may come in strongest in one place in the room, and another station may be weakest at the same place. The set should be installed where it gives best reception from all stations. Loops are usually employed in sets with built-in antennas. These are often highly directional, and it is possible that the set may be placed so it will not receive desired signals with best results. The Facto Meter may be turned on end and rotated for maximum signal. The set when installed should then be so its loop is parallel to the telescopic antenna when in a position of best reception.

Fig. 3 shows how reflected and direct signals may aid or oppose inside a room. Signals may be reflected from the walls of the room just as they were from the building at C in Fig. 2. A and B have the same meaning in each drawing.

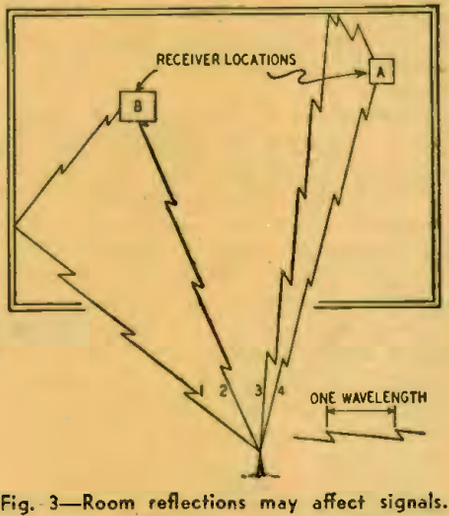

Fig. 3—Room reflections may affect signals.