Got a few minutes? Here's an unusual and inexpensive solution to a perennial problem for SW monitors:

Reduce Interference in your Portable Receiver

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INTRODUCTION

The popularity of shortwave broadcasting brings with it both good and bad. The good is that there are hundreds, if not thousands, of station on the air at any given time. The bad is that all these stations, crammed into shortwave's 1100 channels, leads to a certain amount of interference. Most annoying can be the "bleed over" that comes from a station on an adjacent channel.

There is a way to reduce interference from stations on adjoining channels. It's by nulling out or reducing the signal strength of the unwanted station.

Just about anyone who has handled a portable mediumwave (AM) radio has noticed that if you rotate the radio, stations can be made to fade out.

This article describes an accessory for portable shortwave radios which can do the same thing -- weaken interfering signals, either distant or local, with little affect on the desired broadcast. It can often restore program clarity and understandability when reception is degraded by troublesome co- or adjacent-channel interference. The arrangement consists of a turntable, a metal plate and a replacement-type whip antenna.

The system is good for separating interfering stations in different locations and the "directivity" of the receiver can act to reduce interference when the desired and the interfering signals are coming from different directions. Construction is straightforward and can be done with readily available mechanical components. No modifications to the radio are required for installation.

There is some loss in sensitivity, but the radio's normal tuning adjustments are unaffected. The arrangement is easily portable and works both indoors and outdoors.

Method of Operation

The device makes reception poor in one or more directions although it remains nearly normal in most others. Radio and accessories are rotated on the turntable until the interfering signal is in the poor-reception direction. If interfering and desired stations are adequately separated in bearing, rotation should cause only a small change in the strength of the desired signal.

Requirements

1. Signals of normal but not excessive strength.
2. Interference and desired signal must come from significantly different directions.
3. Radio must be compact and battery powered. Use of external connections such as headphones or tape recorder will cause performance degradation and are not recommended.
4. The assembly must not be placed on anything metallic. Suitable supports are wooden tables or cardboard boxes.
5. For best results, the assembly should be spaced by one or two meters (three to six and a half feet) from large metal objects including wires. Except when changing stations, the listener's body should be no closer than half a meter or so.

Features

1. Easy construction -- can be home-built.
2. Compact in size -- can be moved easily.
3. Dimensions not critical.
4. Little or no adjustments -- except for antenna direction -- required when changing stations or bands.
5. Functions indoors although better outdoors.

Materials Needed

1. One turntable with tray made of wood or plastic, diameter equal to or larger than that of the receiver. Metal ballrace is okay.
2. One flat piece of any kind of metal, same size or somewhat smaller than the area of the radio itself. Exact dimensions are uncritical, but performance degrades if the plate size is greater than that of the radio.
3. A standard replacement-type telescoping whip antenna. Maximum length should be somewhat longer than the radio's.

Assembly Instructions

1. The additional whip needs to be mounted vertically at one end of the horizontal metal plate. The plate's end can be bent upward to provide a support. See Figures 1a and 1b. The whip should be mounted in a position which makes it diagonally opposite the set's own whip, wherever that may happen to be. See Figure 1c.
2. The radio is placed on the plate in the orientation shown in Figure 1. Its weight and that of the plate itself will usually stabilize the whip. If the radio has a ground terminal, it should be connected to the plate. If not, connection can usually be made to the outside of sockets into which recorder jacks are plugged. If the ground connection is omitted, performance will be only slightly degraded.
3. Plate and radio rest on the turntable and are rotated together. See Figure 2.

Operation

1. Select the desired channel in the normal way.
2. Extend the radio's own whip to roughly its maximum length. Adjust the additional whip to be about 20 percent longer.
3. Rotate the assembly, touching the plastic only, avoid the metal, until the interfering signal is weaker than the desired signal. There may be two positions where this is true. Choose whichever position is most satisfactory.
4. For the greatest interference reduction, adjust the length of the radio's whip with respect to the external whip, or vice versa.

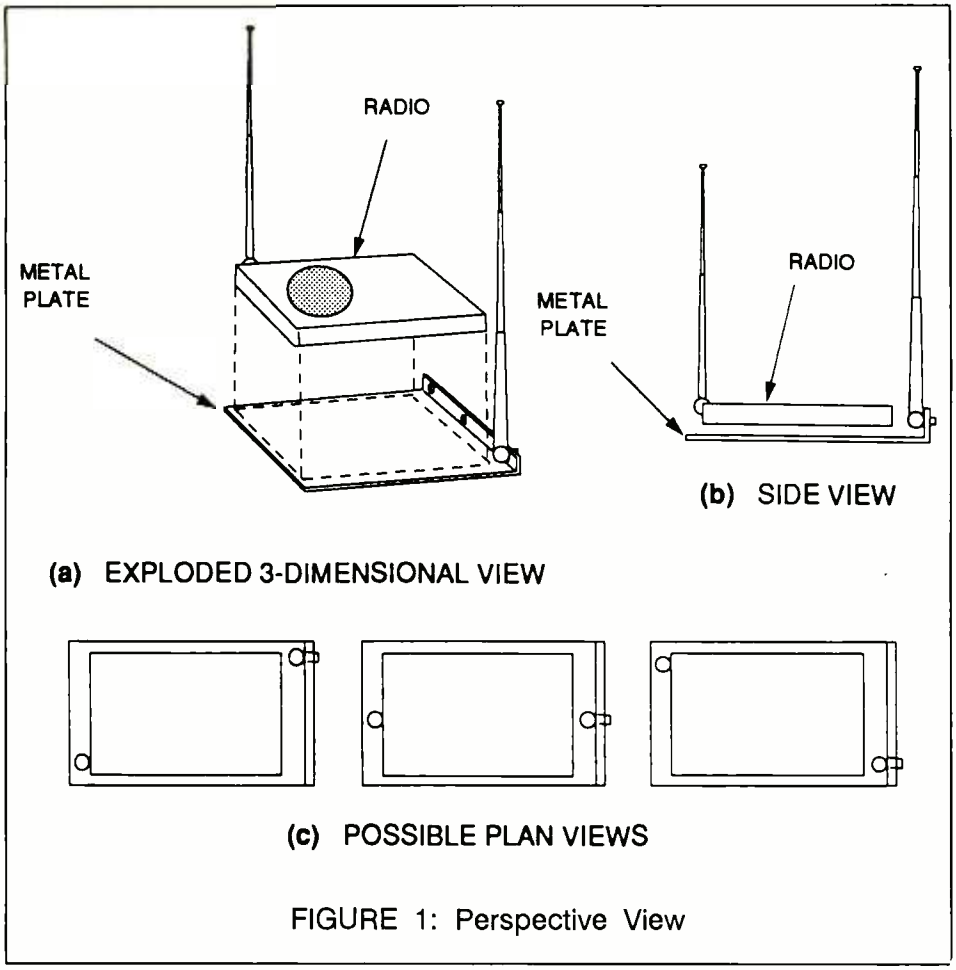

FIGURE 1: Perspective View

Best results are usually obtained when the external whip is slightly longer than the radio's whip.

5. If signals are very strong, it may help to shorten both whips proportionately in order to prevent overloading.
6. When a deep null is achieved, the position of the listener's body may affect its depth. This is particularly noticeable when the listener stands close to the antenna in the direction of the station. The effect is much less when the listener is so located that each whip is equally distant from the center of his body. When the listener is half a meter or more from the whips, the effect of body capacity can normally be ignored.
7. Shortwave signals of distant origin normally vary in strength with time at a comparatively slow rate. This effect, called fading, can make finding nulls difficult. The easiest way to find the true minimum-strength direction(s) is to swing the turntable back and forth reasonably rapidly on either side of a suspected null position. The confusing effect of fading is reduced because the natural signal-strength changes are usually slower than the rotation-caused ones.

Performance

1. Under good conditions, the arrangement should produce nulls that will reduce signals by as much as 20 dB. There may be some variability in null depth with time, especially indoors. If the null fills in, a slight change in turntable position will usually restore its depth.
2. Do not expect this simple device to indicate actual station directions accurately, especially indoors. It is designed to minimize one interfering signal at a time by directive action without consideration of signal bearing. However, it often does indicate approximate bearing, especially when an average is taken.
3. At any given time, there will be some sky-wave interfering broadcasting stations which cannot be significantly reduced in strength by antenna directivity of this sort. A higher fraction of nearby or ground-wave interfering signals can be reduced, however.

Troubleshooting

1. If observed directionality is poor, the problem may be a result of propagation and/or transmitter beam heading, and nothing much can be done about it. But if the problem appears to be at the receiver, try moving the assembly to a new location. A wooden stool makes an excellent portable support. Unexpectedly poor results may sometimes be caused by concealed metal -- for example, wooden tables reinforced with a metal frame, metal mesh inside stucco walls, etc.
2. Sometimes when a given station has a null in a given direction, other stations in the same band also have nulls in the same direction no matter what their true bearing. The result is that interference is reduced by the same amount as the desired signal, just as if the source of the interference were in the same direction as the desired signal. This effect is usually encountered indoors and results from the presence of nearby metal conductors which happen to reradiate strongly.

   It can usually be reduced by moving the assembly a few feet to a different indoor location. However, in extreme cases it may be necessary to move outdoors. The effect is worst in buildings of reinforced-concrete construction.

Two Ways to Verify Normal Operation

1. With the direction of the assembly adjusted to null a given station, touching either antenna should make the received signal sharply increase in amplitude, and by roughly the same amount.
2. Remove the external whip and the supporting metal plate, leaving the receiver on the turntable with its whip in the normal vertical position. Rotating the turntable should now have little or no effect on signal strength. If there is a marked change, the radio is very likely in a region where there are too many nearby reflecting objects, and station separation is likely to be poor. Try moving to another location.

Possible Substitutions

1. The metal plate can be aluminum foil, if there is some other means for supporting the whip. Foil and whip should definitely be connected and foil and radio should also, if possible.
2. The "whip" can be any kind of conductor, although length adjustability is a great convenience. For example, it could consist of hookup wire supported by a wooden dowel.

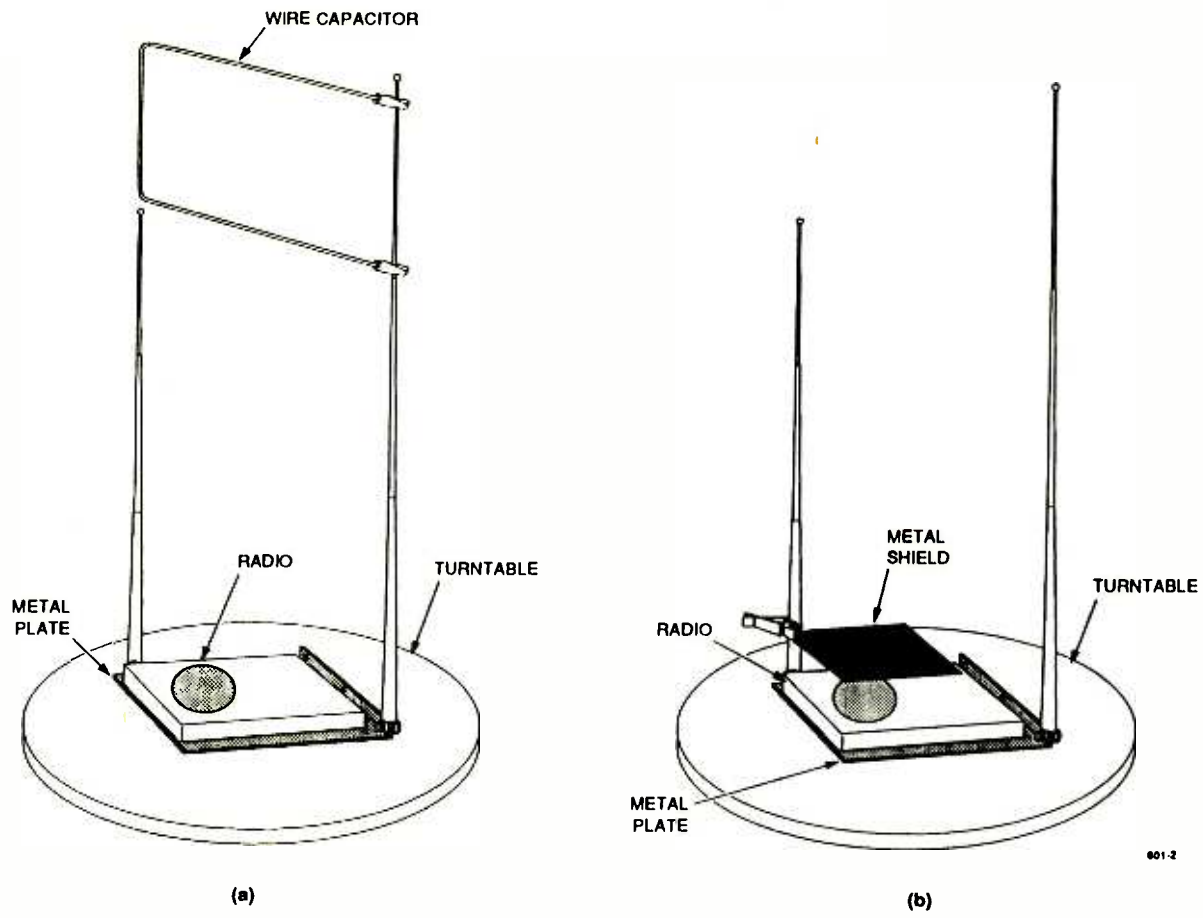

FIGURE 2: Two schemes which may possibly improve performance

3. A turntable is quite desirable because of adjustment ease. However, an acceptable substitute is a flat slippery surface which can be covered if needed with sheets of plastic or slick magazine covers. Radio and its whips could then be supported on a nonconducting tray.
4. A whip or metal strip that is too short can easily be extended by wrapping a length of soft copper wire around its upper end.

Operation Outside the SW Range

1. The above arrangement works at all frequencies which the radio receives through its whip. This is normally from 2 to 108 MHz. In the FM band, signals must be kept weak to prevent the limiter from smoothing out changes in amplitude. This can be done by detuning the receiver and/or retracting the whips until the background noise becomes audible. Changes in noise level are then an indicator of signal strength.
2. Adding an extra whip as above does not help in the mediumwave (AM) broadcast band because virtually all radios receive via built-in ferrite loops. However, the polar pattern of these loops also contains nulls much like those of the whips discussed here. Interference can sometimes be reduced by tilting as well as rotating the radio. The problem is how to support the radio in the reduced-interference position, which is usually not horizontal. Soft pillows have been used as adjustable supports.

Modifications

The detailed behavior of the basic scheme described above depends on the location. When the initially obtained null depth is inadequate, the modifications shown in Figure 2 may help.

Figure 2a shows a piece of hookup wire bent as shown and attached to the end of the added whip by any convenient means -- for example, standard small-size alligator clips. The wire loop should be in the plane of the two whips. It behaves as an extension of the added whip and modifies the behavior of the radio's whip.

Note the distance between the top of the radio's whip and the lowest part of the added wire. There is a best spacing between these two, which makes the null deepest and the off-null response greatest. The length of either whip can be adjusted for this purpose.

Figure 2b shows a piece of metal, adjustable in position, which effectively adds capacity. It is made of aluminum or metal foil attached to the radio's whip, and held in place an inch or so above the top of the radio by a small clip. The clip permits it to be swung out of the way when adjusting the radio.

In many, but not all, situations, these additions have been found to improve null depth when used singly or both at a time. Of the two, the wire is the more helpful. Because of the variation in radio shapes, and the characteristics of typical locations, the improvement cannot be guaranteed, but it may be well worthwhile.

Commercial Availability

A related device called the Channel Cleaner, also developed by SRI, is being marketed by Palomar Engineers, P.O. Box 455, Escondido, California 92029.