## TV or FM antenna: which is best?

# Getting the best from your FM tuner

*Despite all the money that many of us spend on hifi equipment, the truth is that most of our music comes from one source, FM radio broadcasts. Unfortunately though, most tuners don't give their full sound potential. Here's how to get it.*

**by LEO SIMPSON**

There are good and sensible reasons why we rely on FM broadcasts as our main source of music. The FM stations have a far greater record selection than most of us can ever hope to own and it is much easier to tune to a station than to select your own music to suit your mood. If the music played at the moment does not suit your mood, it is easy to change stations.

With this in mind, it is perhaps surprising that more money is not spent on the tuner in most hifi systems. Typically, the FM tuner is one of the cheaper components in the installations. Even so, most tuners in the $200 to $300 bracket are capable of very good FM reception, even though their AM reception is woeful.

Unfortunately, most FM tuners do not go anywhere close to achieving the fine performance of which they are capable. They don't have a chance. Most simply operate from a bit of wire which is supplied at purchase and dignified by the description "simple dipole" or "folded dipole".

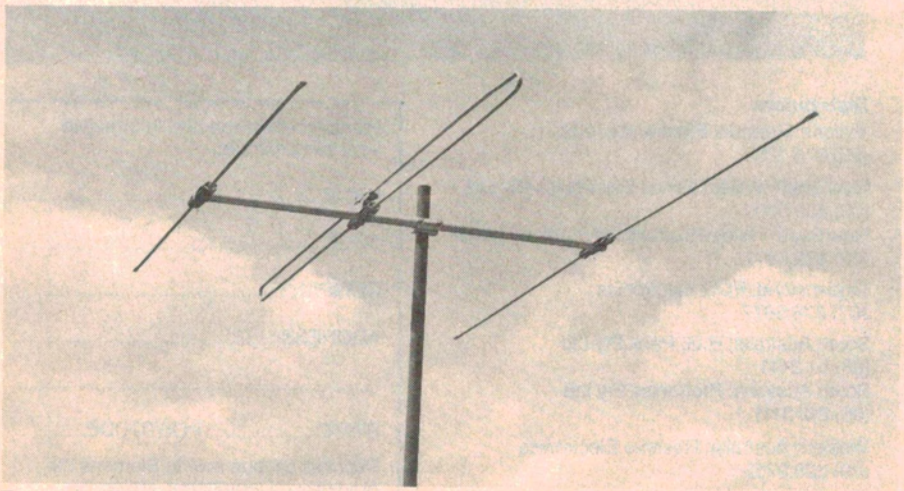
The owner's manual supplied with most tuners describes how this rudimentary antenna can be tacked up over a window or on a convenient wall. But most tuners don't even get the benefit of this. The wire is usually just dangled out the back of the unit in an untidy mess.

Actually, it would be better if this rudimentary wire antenna was not supplied at all. It does work but it is not much better than the proverbial "piece of wet string".

Much better results are possible from a correctly installed antenna. In fact, it is more important to have a good FM antenna than it is to have those expensive cables that so many people are now using to connect their loudspeakers. The audible benefits are much greater.

As an indication of this, the very finest FM tuners available today are capable of achieving a signal-to-noise ratio of 85dB or more, in stereo. That is better than the best FM broadcast transmitters are capable of and is only slightly worse than typical compact disc players. But to extract the best sound quality from the broadcast, these tuners need a good quality signal. If they are fed with that "bit of wire" their performance is likely to be no better than a $25 clock radio from your local supermarket.

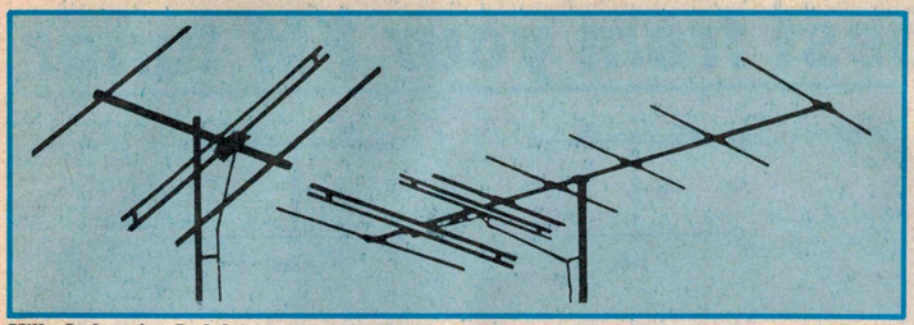
If you are serious about getting the best from your FM tuner, you must take the trouble to make sure it is fed with a good signal. After all, if you buy a new colour TV set, you don't expect to get a good picture with a length of cable hanging out the back. It's the same thing.



**For many listeners, this three-element Yagi antenna from Dick Smith Electronics will be the best and simplest installation for good FM reception.**

### FM antennas

There are two ways of obtaining a good signal for your FM tuner. The first and best is to install an antenna specially designed for FM signals. This will look very similar to a standard TV antenna but it will usually be about two-thirds the size. The signal from this antenna should be fed down to a wall



**Hills Industries Ltd have two antennas for FM reception, the Y3 FM, a conventional three-element Yagi and the 453 FM, a much higher gain eight-element Yagi for fringe-area reception.**

socket via good quality coax cable which stops interfering signals from being picked up by the cable itself.

There are a variety of antennas suitable for FM reception. A typical example is the Hills model Y3 FM shown above. This is a three element Yagi consisting of a folded dipole, one director and one reflector (behind the dipole). This will be adequate for the majority of installations which are within about 25km or so from the main transmitters, provided you have a reasonable "line of sight".

In a similar vein, any of the television antennas which have been made to receive both channels 3 and 4 will be suitable for metropolitan FM reception. An example of this is the Hills model 15A34 which is cut to suit channels 3, 4 and 5A.

If you live further away from the transmitter, you will need a higher gain antenna such as the Hills model 453 FM This is a much larger antenna with two folded dipoles, one reflector and five directors. It will give good FM reception at distances of 100km or more from metropolitan stations.

## What about your TV antenna?

Another possible way of obtaining a good FM signal is to use your existing TV antenna. Unless it is one of the category already mentioned above, it may or may not be good enough. The trouble with using the typical all-station Yagi TV antenna, which will have been cut to receive channels 0, 2, 7, 9 and 10, is that any FM signal received will be more by accident than by design.

Any signals they pick up will probably have "brute forced" their way into the antenna. The weaker stations probably won't be received at all.

The problem with these older Yagi-type designs, which have one long and one short dipole, is that they have a big "hole" in their pickup response between channels 2 and 7, ie, smack-bang where the FM stations are.

This means that not only will the antenna have very poor FM performance, any FM signals picked may also be subject to "multipath distortion" because the antenna's directional characteristics are less than ideal.

## Log periodic antennas

Log periodic antennas are a different kettle of fish altogether. If you live in a metropolitan area and have installed a new TV antenna in the last 10 years or so, it is more than likely that it is a log periodic type. Examples are the Hills EFC series (EFC1 to EFC4) and Hills Telray series (TL1, TL2, TL3 and TL4). The Hills EFC4 is shown below.

Because these are designed to have a flat response over all television channels from 0 to 11, they automatically give good coverage of the FM band. The same can be said for log periodic antennas by other manufacturers and for the new combined VHF/UHF arrays which use a high gain Yagi for the UHF bands and a log periodic section for the VHF bands. (See the article entitled "What to do about channel 0/28" in the December 1985 issue of EA.)

If you are not sure whether your antenna is of the log periodic type, there are a couple of visual clues. It may have a double-boom construction in the case of the Hills EFC range for example, or each of the elements will be connected to its neighbour by a series of crossed-over connections. This commonly has six or more elements, with the shortest at the front and then with each successive element progressively getting longer. They look rather like a flying wedge.

## Don't rob the TV set

There is one drawback to using your antenna as a source of FM signals and this can arise as follows. The standard way of connecting the one antenna to both your TV and FM tuner is to feed the signal to a splitter and thence to separate wall sockets. Or you might use one of the TV/FM wall plates which have splitter components wired on to the rear of the two sockets.

These do work but they introduce a significant loss in the signal fed to your TV set. If you live in a strong signal area this will not matter but if your reception is marginal, the insertion loss of the splitter can make the difference between an acceptable noise-free television picture and one that is plagued by snow.

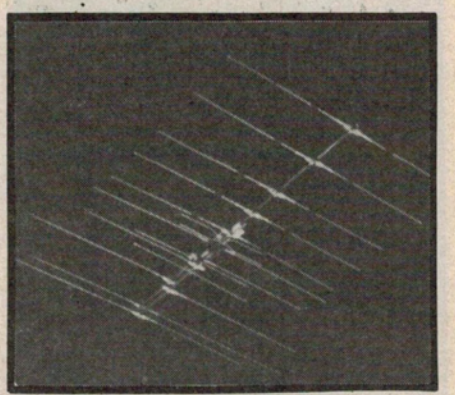
One way to ensure that this does not arise is to use the Hills TV/FM wall plate. Instead of incorporating a splitter with its attendant signal loss for both TV and FM signals, the Hills version has a directional coupler which causes negligible insertion loss to the TV signal although there is some reduction in the FM signal available.

Another way around the problem is to first couple the signal from the antenna to a splitter/amplifier such as one of the models made by Electrocraft. This combined unit allows for the signal loss and provides separate isolated 75Ω outputs for the TV and FM signals.

## How much signal is enough?

This is a good question which is not asked often enough by FM listeners. In order to be able to achieve the "ultimate signal-to-noise ratio" (this is a tuner specification, not a fancy turn of phrase), the large majority of tuners need a signal of at least one millivolt. The quieting curves of Fig.1 clearly show this. They apply to the new Playmaster AM/FM tuner which is currently being described in this issue.

Notice how the signal-to-noise ratio increases as the antenna signal increases, until, at a value of two millivolts, the signal-to-noise ratio flattens



**This is the Hills EFC4, a large log periodic designed for excellent colour TV reception but which also covers the FM band. Most log periodics do.**

# Getting the best from your FM tuner

out to its ultimate value of 70dB in stereo mode. In mono mode, the ultimate signal to noise ratio is better, at 75dB, for an input signal of one millivolt.

Clearly then, if the tuner in question receives much less than one millivolt of RF signal for all the wanted stations, its performance will be less than its full potential. And if the input signal is less than 100 microvolts, the reception will be obviously noisy in the stereo mode.

How can you be sure that your tuner is receiving a good signal? One indication is to look at the signal strength meters on your tuner. Ideally, they should be indicating a full scale signal.

Unfortunately though, the signal strength meters on most tuners are pretty useless, and may consist of only one or two LEDs. About all they tell you is that you have a signal but they don't give any clue as to whether it is sufficient. Even where the tuner has a conventional meter it will often indicate full scale for quite weak signals.

Ideally, the signal meter should indicate the signal level which the tuner needs to give its "ultimate signal to noise ratio".

So even if your tuner's signal strength meters are indicating the maximum, it is quite possible that you still aren't getting the strength of signal needed for best performance. You are still in the dark.

That leaves only your ears as a guide but they can give you a reasonable indication. What you need to do is to compare the background noise on programs when the tuner is in mono and stereo modes.

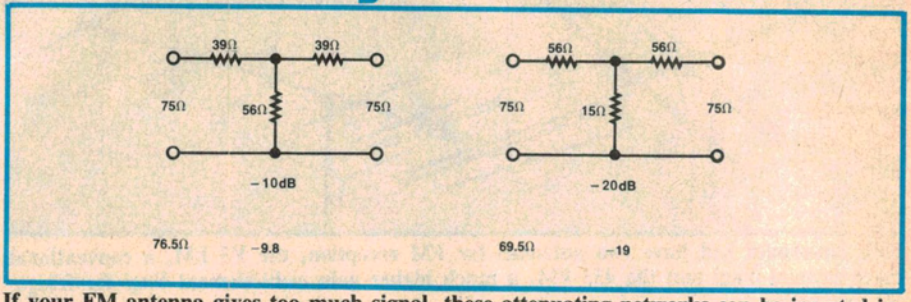
Tune to your favourite station and listen carefully for background hiss during the quiet times, when the announcer stops talking or when the music is soft. Get a good idea of the level of hiss and switch between mono and stereo (using the mono switch on your tuner). If your tuner is getting a good signal there will be very little difference in the hiss in the stereo and mono modes.

On the other hand, if you notice a big increase in background hiss when the tuner is switched to stereo, you could benefit by having a stronger signal from your antenna.

The reasoning behind this listening test is that if your tuner is receiving a strong signal, the noise level produced by the internal circuitry is likely to be less than that due to the transmitter and studio equipment. If your tuner is one of the better performers, its noise level in the stereo mode is still likely to be less than that produced by the station; ie, around 65dB or so.

Plainly, if this test indicates no difference in residual noise between mono and stereo signals, there is little point in having a stronger signal.

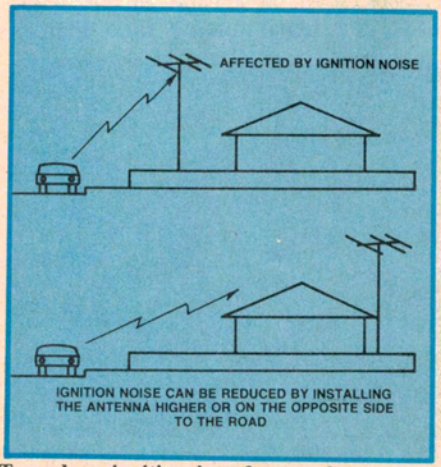
Even if you do receive a strong signal there may be a good reason to have a separate FM antenna installed. It is quite possible that even though your TV reception is quite satisfactory, its resultant FM reception could be plagued by "multipath" distortion. You may also find that for optimum FM reception, the antenna needs to be pointed in a different direction to that presently dictated for TV reception.



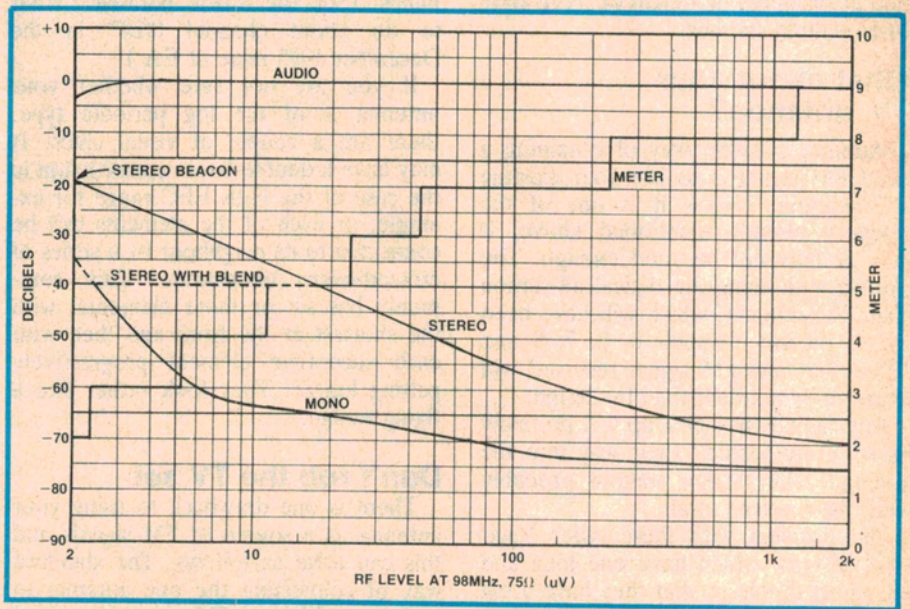

**If your FM antenna gives too much signal, these attenuating networks can be inserted in series with the antenna cable to give 10dB or 20dB reduction.**

## Antenna cable

Whether or not you decide to have a separate FM antenna installed, the cable bringing the signal down from the antenna should be the coaxial type. This is desirable whether you want a clean television picture or interference-free FM reception. Do not use ribbon cable. It may have a small advantage in having less signal loss than for coax cable but this is rarely significant for the fairly short cable runs of most installations.




**To reduce ignition interference from cars, install your antenna as far away from the road as possible.**




**These quieting curves show how an FM tuner becomes progressively quieter with more signal. For noise-free stereo you want 200μV or more.**

Offsetting the fact that it is cheaper and has a little less signal loss, ribbon cable can cause problems due to a signal pickup in the cable itself, causing the equivalent of TV ghosting: multipath distortion.

Before you decide to use the signal from your TV antenna, you should disconnect it from your TV, connect it to your FM tuner, and carry out the listening test described above.

## Installation

Having decided that you will have a separate FM antenna installed, a few notes are appropriate. In deciding where the antenna is to be installed, be aware that ignition noise from cars can be a problem, especially when listening to some of the weaker stations. To minimise this problem, keep the antenna as far away from the road as possible.

In other words, if a lot of traffic passes by the front of your dwelling, install the antenna at the rear, so that your home shields the antenna from the interference.

You still need to be sure that the antenna has a reasonable line of sight to the main transmitters of interest. It is also a good idea to mount the antenna as high as possible and well clear of surrounding metal-work such as guttering and metal roofs.

This is because any nearby metal structure can reduce the performance of an antenna, particularly its directional characteristics.

It is permissible to mount the FM antenna on the same mast as your TV antenna but keep the two as far apart as possible, say a metre at least. Ideally though, the vertical distance should be a minimum of two metres or more otherwise the performance of the TV antenna is likely to be prejudiced and ghosts may become a problem.

A final point which should be mentioned is that of signal overload. It is often ironic that people closest to the FM transmitter have the worst reception. This is not because of insufficient signal but too much, compounded by strong signal reflections which give rise to severe multipath distortion.

The way out of this problem is again to dispense with the simple dipole and install a standard three-element FM antenna. This will reduce the signal reflection problem but you then have the possibility of two much signal which will overload the tuner. This calls for an attenuator. Two such attenuators are shown in Fig. 2, for 10dB and 20dB signal reduction.