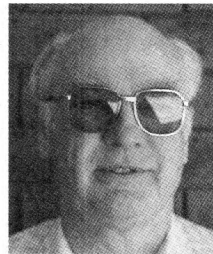


VINTAGE RADIO

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Improving AM broadcast reception; Pt.1

Interference and poor set design have combined to give AM radio a “low quality” image. However, there are lots of things you can do to reduce interference and boost signal quality.

There are new FM broadcast radio stations appearing regularly throughout Australia. Conversely, AM broadcast radio is out of favour, with a reduction in the number of AM stations operating. However, many people only listen to AM radio stations, either because they are the only ones available to them, or they carry the programs that they wish to listen to, or because they only have AM radios in the household.

Most FM stations transmit in stereo and some AM stations do too. Both AM and FM transmissions are of high technical quality, with wide audio frequency response and low distortion, etc. The highest audio frequency

quency allocation. Typically, stations are spaced at least 45kHz apart and usually more than 100kHz apart.

This means that even in the most closely spaced parts of the spectrum in Sydney, it is not difficult for the average AM radio to discriminate between the stations.

Interference

Even so, interference from stations on adjacent channels can be a problem. This usually occurs at night when stations some distance away are received along with the “local” stations. This causes “monkey chatter” and 9kHz beats between stations only 9kHz apart and these beats will be heard on

particularly in summer and towards the equator. Unfortunately, there are no easy methods that can be used to eliminate this type of interference, although noise limiters can provide some relief.

In summary, AM radio suffers from various interference problems and this is why it has lost popularity, particularly for night-time reception. However, some listeners like to log as many distant AM broadcast stations as possible (DX) and these articles, although not specifically aimed at such listeners, will provide ideas that will assist them too.

AM tuner quality

In most developed countries, there has been a definite swing to FM broadcasting and AM has been relegated to the position of the poor relation. If a check is made of the specifications of an AM/FM receiver/tuner, it will be noticed that the FM section is usually extremely good in all areas. Conversely, the specifications of the AM section will be markedly inferior to those for the FM section.

But that’s not all – the AM section will generally be inferior to the sets produced in Australia from the late 1930s to the 1960s. These include both valved sets and the later Australian-made transistor receivers. These sets were very sensitive and capable of receiving stations hundreds of kilometres away in daylight. And some were designed to have quite reasonable fidelity as well.

In short, the sensitivity, bandwidth, AGC characteristics, detector distortion, etc, of the average imported set is almost sure to be inferior to the best of those old receivers. The average AM receiver is really quite a poor performer these days and its inability to reject interference has given AM

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broadcast by FM transmitters is 15kHz, while the corresponding figure for AM transmitters is at least 10kHz.

Many people hold the mistaken belief that AM broadcast transmitters are restricted to a maximum audio frequency of 4.5kHz, to minimise the possibility of interference between stations on adjacent 9kHz channels. Instead, adjacent channel interference is reduced by keeping the radio stations in any particular geographical area well separated in terms of fre-

the better quality receivers if they don’t have a 9kHz notch filter.

If more than one station is assigned to the same channel, the more distant ones can interfere too, even taking over the channel for a short time in some cases. It can be intriguing to listen as several stations fade in and out on the one channel but it’s frustrating for anyone trying to listen to just one of those stations.

Electrical storms also often cause interference to AM radio reception,

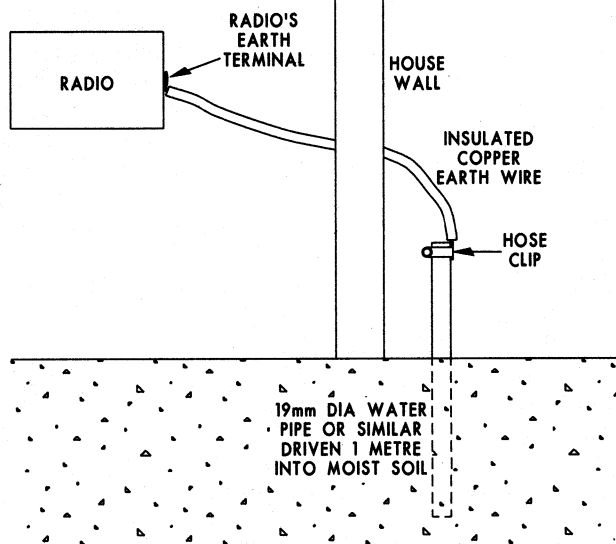


Fig.1: AM reception can often be improved by running a separate earth lead from the radio's earth terminal (if it has one) to a metal stake driven into the ground. Note that a $.001\mu\text{F}$ - $.01\mu\text{F}$ capacitor may need to be inserted in series with the lead at the set's earth terminal – see text.

stations that listeners may wish to receive are not all that strong (I listen in daylight to 5CK which is 750km away from Benalla) and hence even weak interference is annoying.

Part of the problem is that we belong to the "portable" society, where everything has to be easily transportable. The concept of "portability" is equally applied to radios and so radios designed for the domestic market are generally not provided with an external antenna connection. And if they were provided with one, the design inadequacies would soon become obvious.

The most convenient place to put the radio is on the refrigerator, a kitchen bench or on a workshop bench. Unfortunately, these are usually the worst locations for interference in our homes. The "quietest" place is out in the backyard, away from all power sources, cars in the street, lawn mowers, etc. A few really electrically quiet locations are at the beach, in a row boat at sea or in the outback away from it all.

Modern homes are often worse than older dwellings for radio reception. For example, they may have metallised insulation paper in the walls, while the floor and sometimes the ceiling (especially in units) can be a reinforced concrete slab. This forms a very effective radio frequency (RF) shield, which means radio signals have a hard job getting into the dwelling, except through breaks in the shield and via the electrical power mains. For this reason, placing the radio near a window or near power wiring often improves reception.

Interference sources that affect radios within this RF shield include computers, fluorescent lights (particularly the electronic types), food mixers, TV receivers, light dimmers, shavers, electric drills and touch lamps, etc. The interference generated by these sources is easily picked up directly by the radio. Some of it also travels along the mains wiring in the home and then radiates into the radio. It can also travel via the mains and interfere with the radio reception in neighbouring houses or units.

Another source of interference is from high-voltage power lines. The interference can be due directly to problems on the mains (eg, arcing in wet weather) or generated by an electrical appliance.

broadcast radio a reputation for poor quality – which is really not true.

Australia no longer has a consumer broadcast receiver manufacturing industry, so most of our domestic receivers are imported from Asia, Europe or North America. Because of their population densities, they can afford to have many FM broadcast stations to serve their needs, as only relatively short distances need to be covered. The same goes for AM broadcasts.

In short, the emphasis in these countries is on FM and in any case, the distance to the nearest FM or AM stations will be quite small. For this reason, the AM sections are designed for urban use only and have low RF/IF gain, indifferent IF selectivity and usually poor overload characteristics. These sets also have poor RF selectivity (with no RF stage) and an autodyne oscillator/converter which produces significant oscillator harmonics. This in turn can result in considerable breakthrough of shortwave stations into the broadcast band at times.

In Australia, the distance between AM broadcast transmitters is generally greater due to our low population density. As a result, these imported sets perform poorly in regional areas and on city margins. The only thing going for them is that they are cheap compared to the good AM transistor

radios that were produced in Australia.

There are other reasons why people listen mainly to local stations, apart from the fact that the receivers now available are poor distance performers. One of the bugbears of AM radio reception is man-made interference. Electrical interference of various sorts is predominantly an amplitude variable phenomena which is readily reproduced by AM receivers. Properly designed FM receivers respond to frequency variations and reject amplitude variations. As a result, they reject most forms of interference, whether natural or man-made.

Interference reduction

Electrical interference from power lines and various electrical/electronic devices can be minimised or even eliminated by employing one or more of the techniques described in this and the following article. AM reception can be poor due to the use of mediocre AM receivers, ineffective aerial/antenna systems and the high level of interference in some locations. However, many of the problems can be resolved or at least minimised so that good AM radio reception can be achieved.

Interference does not have to be as strong as the station being monitored to be annoying. Many of the broadcast

to the set via the external antenna must be much stronger than the signal picked up by the usual loop stick antenna in the set, otherwise interference may still be a problem.

Antenna types

Two types of external antenna can be used: (1) a loop antenna which responds to the magnetic field component of the radio signal; or (2) a "long" wire antenna which responds to the electrostatic/electric field component of the radio signal. The loop antenna is a little more awkward to install but its advantage is that the near field intensity of interference from the magnetic field is much lower than that from the electric field at the same location.

In practical terms, this means that the interference level picked up by a loop antenna is much lower than when using a "long" wire antenna – particularly if the antenna cannot be located in a noise-free area.

Portable transistor receivers use a loop antenna so they will do a better job of receiving signals in a noisy environment compared to sets using a wire antenna run around the skirting board. However, the loop in the transistor receiver cannot eliminate all interference or intercept radio signals if they are almost non-existent.

A good earth

It is also very important to have a good earth system, to improve the strength of radio signals and to minimise interference. This is more important with the long wire antennas, although some loop antennas will also benefit from an earth system.

It is well known that the earth wire of a 3-pin power socket goes to an earth stake via the switchboard. This earth lead may be up to 30 metres long, or more. However, AC mains sets which have a 3-core lead and an earthed chassis do not seem to generally benefit from having an additional earth fitted when an external antenna is used.

In some cases, however, a noticeable improvement in reception quality can be obtained by installing an independent earth system as close as practical to the radio (assuming that the radio has a separate earth terminal). The reason for this is that the mains earth lead is encapsulated with other mains leads and these may have

interference on them. This interference will be capacitively and inductively coupled into the earth lead. Therefore, the mains earth cannot be assumed to be free of interference and usually isn't. An independent earth can help eliminate this interference.

A independent radio earth can consist of a pipe driven into moist soil for a distance of at least a metre. An electrician's mains earth clamp is used to attach a reasonably heavy insulated wire (such as an electrical mains earth lead) to the pipe and the wire is taken by the shortest practical route to where the radio is located. Make sure that the pipe, clamp and cable (where it is stripped at the ends) are free of corrosion. Paint the junction of the cable and pipe to slow corrosion effects.

The earth wire should be insulated over its entire length (except at the ends), so that it does not touch other metallic objects; eg, a metallic insulation sheet in the house wall. If it touches these sheets, interference may be produced due to the minute voltage differences between the sheet and the wire.

For best performance, the radio should be located near an outside wall so that the earth lead can be kept as short as possible. The longer the earth lead, the less effective it becomes at reducing interference.

To eliminate low-frequency earth currents through the set, you can insert a capacitor of between .001 μ F and .01 μ F between this lead and the radio's earth terminal. Fig.1 shows how the earth is arranged (capacitor not shown). In my case, I have a radio earth in my workshop which almost eliminates fluorescent light noise. Another one in the kitchen reduces a myriad of electrical noises that had previously marred reception.

Next month

A variety of loop and long-wire antennas have been developed over the years and these will be described next month. Some are conventional while others are noise/interference reducing types.

One device – the "Radio Reception Booster" (a tuned inductive coupler) – can be used with any of the described antennas and markedly improves the performance of sets using loop-stick antennas. No modifications are required to sets that have no external antenna/earth terminals. **SC**

Because of the effects described above and because they don't know how to overcome interference problems, most listeners give up and listen only to the local stations. However, there are a number of ways that the interference can be dealt with. The source of the interference can be suppressed or ways can be found to minimise the effect of the interference and increase the radio signal into the bargain.

The easiest approach (apart from moving the receiver) is to improve the signal so that it overrides any interference or set noise. One approach is to site an antenna (preferably a noise-reducing type) in a relatively noise-free environment and where there is good signal strength. This will usually involve using an outside antenna in the backyard, at least five metres away from any building or electrical catenary wiring. The signal is then fed to the radio receiver via a cable that does not pick up any signals or any interference as it passes through what may be an electrically noisy area.

Either a coaxial cable or some form of twin cable can be used. The signal