There are two things which must be addressed to clear as much as possible any case of Radio Frequency Interference (RFI) in any radio installation in a vehicle:-

1. What is the source of the interference?
2. How is it getting into the radio system?

Generally in a vehicle, the primary cause is sparking electrical contacts, the most troublesome being the contact breaker in the distributer on older vehicles. Newer vehicles with electronic ignition systems have improved that situation but problems with the grounding and shielding of these systems can lead to trouble.

Sparking contacts can often be cured by fitting a suppressor across the contacts which not only tend to reduce the sparking by the action of what's known as "Spark Quench" but also by preventing the interference from being radiated by the wiring of the associated circuitry. Electric motors can also give rise to interference, particularly those with brushes running on a commutator. They can be thought of as similar to sparking contacts and treated in the same way with a suppressor.

Another trouble source not seen so often on older vehicles with the old dynamo charging system is the alternator. The alternator generates an AC current which is immediately rectified to DC suitable for powering the vehicle's electrical system. That AC generated can cause a whining or screeching sound as the interfering signal. This whining will change with the changes in engine speed.

There were some other strange conditions in earlier days, such as tyre noise but that has been largely eliminated due to the increase in carbon added to the recipe for the rubber compound used in modern tyres. However, locating any source of interference in a motor vehicle is still just a matter of steadily working through all the possible offenders.

So, how is the interference getting into the radio system?

There are just two ways into a radio system:

1. Up the power feed line
2. Down the aerial

Up the power line. This is probably the easier condition to solve. If it's a case of "alternator whine" the usual method of dealing with it is to install a small "whine filter" in the power line. It's essentially just a small inductor or choke which has the effect of reducing the high frequency changes imposed on the DC voltage by the AC created in the alternator. In the very worst cases, it might also be necessary to fit an additional capacitor immediately after the whine filter. A "clip-on" ferrite choke can stop a radio frequency current flowing on a wire but is not usually suitable for treating whine created by the alternator where a larger value of inductance is required.

Another method to try in the case of really stubborn interference is to ensure that the vehicle body is not considered as a part of the supply circuit. In other words, take both the positive and negative supply lines directly back to the battery, of course utilising the appropriate size of cable and rating of fuse inline and placed as close to the battery as is practicable. If possible both of the power leads should be twisted together and run by such a route as to keep the leads away from possible sources

of interference. If the user wishes, the power line could be switched by a relay so that the circuit can be integrated into the normal operation of the vehicle.

Down the aerial. Air borne interference is a slightly more difficult interference to deal with. Again there are at least two ways that interference can get into the system, it can either be picked up on the receiving element or picked up on the braid or outer of the coaxial cable aerial feeder.

Interference picked up on the receiving element can only be dealt with at the source of the interference (see "Sparking Contacts" above). The other source of interference on the receiving element is due to poor or intermittent connection of the centre wire of the coaxial cable feeder, either at the aerial mounting or the plug on the back of the radio.

Even in modern vehicles employing contactless electronic ignition systems, the high tension lines to the spark plugs can be a source of radiated interference, to the point that some manufacturers have made available screened H.T. leads and spark plug covers in an effort to reduce or eliminate radiated energy from these sources. Radiation from ignition leads could even be due to internal damage to the conductor; in early high tension cables the conductor was actually copper wire, but modern leads tend to be a carbon fibre or filament which can easily be cracked by sharp bends, those cracks can give rise to a radiated interference source.

Every effort should be made to mount the aerial as far away from such sources of possible interference. Mounting the aerial above the windscreen is preferable to mounting on the front wing, but mounting the aerial towards the rear of the roof is better than above the windscreen. For "ground plane" reasons, the middle of the roof is best, but with the presence of a sunroof that isn't always possible.

In very rare cases, it could be due to damage to the coax feeder at some point along the route between the radio and the aerial mount. This is especially so if the coax feeder has been joined at some point along its length. Crackling on a received signal can sometimes be traced to the aerial coaxial cable being damaged by rubbing through the outer insulation and the braided wires inside touching on the bodywork of the vehicle.

Interference picked up on the outer braid is unusual but it can raise its head, especially in the case of GRP or Fibreglass bodywork. It's often due to a poor or missing connection of the outer braid or screen of the coax at the base of the aerial mounting. In extreme cases, double screened coaxial cable can be purchased which can be tried in an effort to resolve particularly stubborn interference picked up on the screen.

Fibreglass bodywork can be made suitable for whip type aerials by sticking a sheet of aluminium foil on the inside of the fibreglass panel where the aerial is to be mounted to serve as the ground plane. This is a method that I have seen employed by a number of fire services when they have fire appliances with fibreglass cab bodywork. This method could also be useful when applied to small boats operating a radio set on the marine VHF channels.

Another type of interference which must be considered especially in the modern vehicle employing more and more electronic circuits is that of the radio transmission causing interference to one or more electronic control units, which can cause unusual and possibly even dangerous behaviour in affected circuits while the transmitter is active. In professional installations, "hardened" ECU's are

available with extra interference prevention measures included, but these systems are horrendously expensive. The only way that the individual owner can try to avoid such interference is by careful positioning of external leads, power and aerial and paying particular attention to making firm and proper connections of any such leads. Properly tuned aerials will go some way towards reducing the amount of radiated energy inside the vehicle.