Australian Government

Australian Communications Authority

Better Television and Radio Reception

Identifying your interference problem

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The Australian Communications Authority (ACA) wishes to thank the Australian Broadcasting Corporation (ABC) and Special Broadcasting Service (SBS) for their assistance in compiling this booklet.

The images and descriptions in this booklet identify only generic forms of interference to television and radio broadcasts and should not be associated with any particular television network, radio station or other organisation.

No liability is or will be accepted by the Minister for Communications, Information Technology and the Arts, the Australian Communications Authority, the Commonwealth of Australia, or its officers, servants, or agents for any loss suffered, whether arising directly or indirectly, due to the accuracy or contents of this booklet.

Important advice before you start

Well over half of all reception problems are caused by deficiencies in receivers, inadequate or faulty antenna installations or by attempting to receive broadcasting services that are too far away for reception to be reliable. Many interference complaints investigated could be resolved in the home by the viewer or listener themselves or with the help of a service technician.

WARNING: For safety's sake, any repairs or modifications to equipment of any kind must be carried out by a suitably qualified person.

DISCLAIMER: The information in this booklet is a general explanation of interference issues. Expert assistance may need to be obtained prior to taking any action.

This brochure is designed to assist in resolving reception problems in the home. It provides illustrations and descriptions that will help identify the most likely cause of the interference and suggests appropriate steps to remedy the problem.

Getting started

Refer to the contents page and turn to the particular section covering the type of interference that you suspect is causing the reception problem.

In each section there are illustrations and descriptions of common reception problems. Compare the symptoms of the reception problem with the illustrations and descriptions. Each description concludes with advice on what to do. If you have any doubts about the problem's diagnosis you may need to consult a service technician.

If you need further assistance after following the advice in the reception problem section, see page 22 for contact details of organisations that may assist you.

A section of more technical information is provided to help you understand some of the more commonly used terms found in the television and radio industry.

Basic details of antenna installation procedures are also included.

Choosing a technician

Rectifying many interference problems will require the assistance of qualified tradespeople, particularly where mains voltages or working at heights is involved. If you require their services, you should be aware of the skills of the tradespeople you plan to employ. Contact details for relevant industry associations can be found in your local services telephone directory.

Contents

Important advice before you start 3

Television reception

Reception problems 6
- Ghosting 6
- Weak signal 7
- Co-channel interference 7

Radiofrequency interference 7
- AM broadcast transmitter interference 7
- FM broadcast transmitter interference 8
- Domestic equipment and appliances that may cause radiofrequency interference . . .8
- Two-way radio interference 8
- Masthead amplifier interference 9
- Power supply interference 10
- Computer equipment interference 10

Electrical interference 11
- Power line interference 11
- Street lighting interference 11

Electrical appliance interference 12
- Thermostat interference 12
- Electric motor interference 12
- Domestic equipment and appliances that can cause electrical appliance interference . . .12

Digital television transmission interference 13

Antennas and masthead and distribution amplifiers

Choosing the correct antenna 14

Installing a television antenna 14
- Ancillary equipment for television antenna systems 15
- Antenna availability: channel groups 15
- Polarisation 15
- Major antenna characteristics 15

Pointing the television antenna in the correct direction 16

Correct antenna direction 16
- How multipath reception or ghosting occurs .16
- Commonly used terms 16

Masthead and distribution amplifiers 17
- Amplifier malfunction 17

Amplifier overload 17

Radio reception

Electrical interference to AM broadcast radio . . .18
- Power line interference 18
- Street lighting interference 18

Electrical appliance interference to AM broadcast radio 19
- Electric motor interference 19
- Thermostat interference 19
- Switching and relay interference 19
- Electrical interference 19

Interference to FM broadcast radio 20
- Electrical interference 20
- Multipath reception 20
- Aviation transmitter interference 20

Two-way radio interference 20

Locating electrical appliance interference

A test procedure for technically qualified persons 21
- The portable radio method 21
- Precursors to testing 21
- Appliances and equipment that may cause interference to television and radio reception 21
- Procedure 21

Additional assistance

Interference investigation service 22

Information about interference from CB and amateur transmitters 22

ACA regional offices 23

Television reception

Reception problems

Ghosting

Ghosting is caused by a condition known as multipath reception, which occurs when the signal received at the television antenna is made up of more than just the direct signal from a television transmitter. The signal received is a composite, comprising the direct signal and at least one signal reflected from a large body such as a mountain, hill or building in the area. See page 16 for more information about ghosting.

What to do

- Check that your outdoor antenna, cable and connections to the television set are in good condition.
- Alter the direction the television antenna is pointing, particularly if you live in an area where the potential for reflections from buildings or similar obstructions is high.
- As the type and placement of the television antenna can make a substantial difference to reception, you may need advice from an antenna specialist to resolve ghosting problems.
- See page 14 for more information about antenna operation and installation.

Weak signal

Weak signal reception looks 'snowy'. It can occur if you are too far away from a television transmitter or if your television or antenna is faulty. Obstructions, both nearby and far away, can cause a weak signal, particularly on UHF channels.

What to do

- Check that your television controls are correctly adjusted.
- Make sure you have an outdoor antenna that is in good condition and is suitable for your area.
- Make sure that the antenna is pointing towards the television transmitter.
- Make sure the problem is not being caused by in-line equipment, such as a video cassette recorder (VCR), pay TV decoder or electronic games console. You can do this by connecting the antenna cable directly to the television receiver.
- If the problem stops, check that the cables connecting the VCR to your television are in good condition. If they are, have the VCR checked by a service technician.
- If the problem persists, seek advice from a service technician and consider using a masthead amplifier.

Co-channel interference

Co-channel interference to television reception is caused by two different television signals being received at the same time. The signals are transmitted from two different television transmitters at different locations on the same channel. This effect occurs generally during unusual weather conditions and is only a temporary problem. It will disappear when normal weather conditions return.

What to do

- Generally there is no practical solution to this problem because it is due to naturally occurring weather or atmospheric conditions.
- If co-channel interference occurs regularly, then a different type of receive antenna may improve reception. Ask for advice from a local antenna specialist or the ACA.

Radiofrequency interference

Radiofrequency interference is caused by anything that radiates radio signals, whether intentionally or unintentionally. The source of the radiofrequency signals could be a nearby two-way radio transmitter, radio or television broadcast transmitters or domestic electronic equipment.

This interference often causes patterning on the screen that can be constant or intermittent. Interference from (two-way radio, amateur or citizen band (CB) stations will generally appear and disappear as the transmitter button is operated. Interference from broadcast transmitters or faulty masthead or distribution amplifiers (boosters) is usually continuous.

AM broadcast transmitter interference

AM broadcast transmitter interference occurs when an AM radio station's transmitter is located near the affected receiver. The interference may be introduced to the television receiver via the mains lead, antenna cable or the receiver's internal wiring or components.

What to do

- Fitting filters to the antenna cable or mains lead may help.
- Assistance and advice from a service technician should be sought for repairs or modifications involving the internal circuitry of a television receiver or mains lead.

FM broadcast transmitter interference

FM broadcast transmitter interference occurs when an FM radio station's transmitter is nearby and overloads the affected TV receiver. It may also occur when watching a distant TV station on channels 3, 4 or 5.

What to do

- A suitable in-line FM filter or trap fitted to the television antenna cable at the input to the television receiver may resolve the problem. If the problem continues, it may be necessary to install a filter at the antenna or input to the masthead amplifier, if you have one fitted. If this is the case, advice from a service technician is recommended.

Domestic equipment and appliances that may cause radiofrequency interference

Computers, security alarms, electric clocks, VCRs, fax machines, masthead amplifiers, radios and TV receivers may cause interference.

WARNING: Under no circumstances should you attempt to repair or modify any electrical equipment unless you are qualified to do so.

Two-way radio interference

Two-way radio transmitter interference occurs when unwanted transmissions (signals) from a nearby CB, amateur or (two-way radio station are picked up by a television receiver or entertainment equipment connected to it. This interference may occur because the television receiver or ancillary equipment is unable to reject the operating frequencies of local CB, amateur or two-way radio transmissions.

The interference will last for varying periods of time but will be consistent with when the two-way radio operator is using the transmitter (talking). The operator's voice may be heard through the television's audio system.

What to do

- Disconnect any equipment attached to the television receiver to determine if the problem is being introduced via the attached equipment.
- If the interference clears, reconnect the equipment one piece at a time. This may identify which piece is responsible for the problem.
- Relocation of the piece of equipment may resolve the problem, otherwise filtering will be necessary, which will probably require the assistance of a service technician.
- An appropriate in-line filter attached to the antenna cable at the input to the television or VCR may cure the problem. However, if a masthead amplifier is being used in the antenna system, then the filtering will probably be required at the amplifier and the assistance of a service technician is recommended.

More information

Information about resolving interference from CB or amateur radio stations is in the ACA brochure *Interference from CB and Amateur Transmitters* (see page 22).

Masthead amplifier interference

A television masthead amplifier, commonly called a booster, is normally used in areas where only a very weak level of television signal is available.

A television distribution amplifier is used where the television signal is adequate but an amplifier is required to boost the signal to serve a number of outlets within a building. Masthead and distribution amplifiers may cause interference to television reception by either malfunctioning or being overloaded by nearby transmission equipment.

The interference appears as bands of herringbone patterning or Ss on the screen. Occasionally, the interference may be accompanied by a buzzing noise in the audio. The interference can be intermittent or continuous and generally affects just one television channel.

REMEMBER to ask for your neighbours' assistance. However, they do not have to agree to cooperate with you. DO NOT switch off the electricity to any appliance without permission of the owner.
DO NOT trespass or otherwise interfere with your neighbours' property.

What to do

- A malfunctioning masthead amplifier can radiate its interfering signal for several hundred metres, with the potential to cause interference to many nearby television receivers.
- Locating a defective amplifier can be difficult and you may need to seek professional advice. As a first step, carry out the simple checks in the following section, identifying the source of the interference.
- If these checks fail to identify the interference source, then you may need help from your local antenna installation company or an ACA office.
- The owner of a faulty amplifier installation is legally responsible for its operation and must rectify the problem once officially advised by the ACA.
- Malfunctioning installations should be inspected and repaired by a television or antenna service company.

Identifying the source of the interference

In the first instance, check whether your neighbours are having the same problem. If they are, and agree to carry out one or two simple tests, carry out the following procedure:

- Tune your neighbour's television set to the affected television channel and confirm that the interference is occurring. While your neighbour watches the interference, switch off your masthead amplifier. After 10 or 20 seconds, switch the amplifier on again.
- Repeat the sequence.
- If your neighbour's interference stops and then recurs in sequence with you switching your amplifier on and off, your amplifier or antenna system may be the source of the problem. Your system should be inspected by a suitably qualified technician.
- If there is no change to your neighbour's interference, you can assume your antenna system is operating correctly. If this is the case, carry out the same checks but with your neighbour switching their amplifier system off and on.
- If these checks fail to identify the problem amplifier, carry out the switching tests with the cooperation of your other neighbours.

Power supply interference

Television receivers use power supplies to provide the necessary voltages required for normal operation. A form known as a switch mode power supply can cause interference in weak signal areas.

The interference usually affects channels 0 to 3 and is often seen as a pattern of dots or short dashes (sometimes coloured) diagonally across the television screen. The interference may also affect AM radio receivers.

What to do

- This form of interference can be minimised by ensuring that the television signal strength is as high as possible and the interfering signal from the switch mode power supply is as low as possible.
- Ensure that your outdoor antenna is in good condition.
- Ensure that your antenna is pointed towards the television transmitter.

WARNING: Under no circumstances should you attempt to repair or modify any electrical equipment unless you are qualified to do so.

- Ensure that your antenna's coaxial cable is of good quality and connections are sound and in good condition.
- Use a commercially available 'mains filter' between the power point and the mains power lead of the television receiver.
- Consult a service technician for advice.

Computer equipment interference

Computers, fax machines, printers and other equipment that use microprocessors can interfere with television reception. Radiofrequency interference can radiate directly into the television receivers and antenna systems from computers, their ancillary equipment and/or their equipment interface cables. One or more television channels may be affected.

What to do

- Ensure that the television antenna is an outdoor model and is in good condition.
- Make sure that the antenna cable and connections are in good condition.
- As the location and proximity of the computer and its associated peripheral equipment can affect the level of introduced interference, maximise the distance between the computer, computer equipment and the television receiver and the antenna system.
- High quality coaxial antenna cable should always be used for the antenna system.
- Shielding on the computer interface cables will assist in reducing radiation from the cables.

More information

Information about reducing this form of interference is available in computer handbooks and from television service technicians.

Electrical interference

Power line interference

Power line interference occurs near high voltage power lines. It appears on the television screen as two or more horizontal, speckled bands, which can drift up and down the screen. Normally, the channels most affected are channels 0 to 3, although the higher television channels can be affected in severe cases of power line interference.

The interference most commonly occurs during hot, dry and windy weather when sparking between insulators and metal locating brackets generates the described interference.

A similar problem occurs in the evenings as dew forms on built up dust, salt or industrial pollution that has collected on the insulators and brackets of the power line, again causing sparking.

In both instances, the interference generally clears after rainfall. If the interference continues after rain, then the power line may be physically faulty.

WARNING: Do not attempt to rectify any suspected faults on power poles, power lines or street lighting. It is essential that your local electricity supply authority be contacted if problems occur with power or lighting utilities.

What to do

- Watch local television services. Low signal strength worsens the problem.
- Ensure that your outdoor antenna and cabling is in good condition.
- Persistent power line interference should be reported to the local electricity supply company or authority responsible for rectifing the interference problem. Your latest electricity account or local phone book will provide contact details.

Street lighting interference

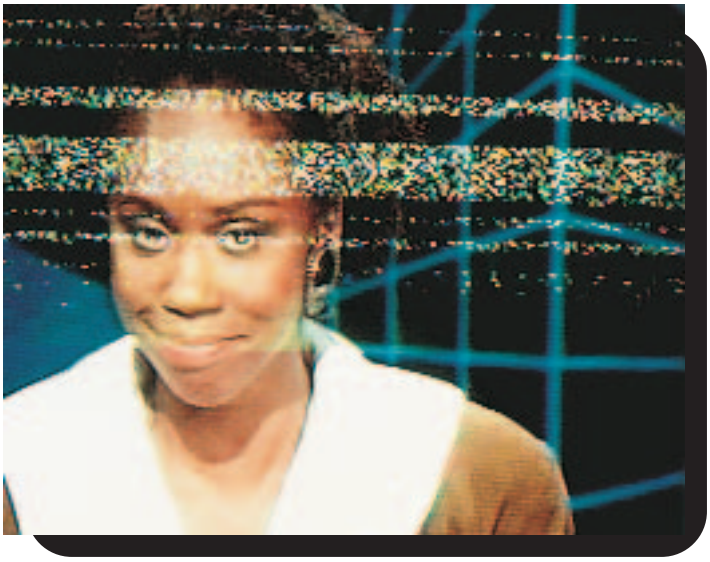
Street lighting interference, like power line interference, will generally affect a large number of homes. The interference starts when the street lighting turns on or coincides with it flashing on and off during the day or night.

What to do

- Report this interference to the local electricity supply company or authority (see your phone book for contact details).

Electrical appliance interference

Thermostat interference



Thermostat interference can be caused by a variety of appliances that use thermostatic control in their operation.

The interference is caused by arcing between the electrical contacts of the thermostat switch. It can affect AM radio, FM radio and television reception. If the interference is strong enough to affect FM radio and television reception, the problem appliance is likely to be within the household or immediate property (garages, garden sheds etc).

What to do

- Keep a record of the time and duration of the interference.
- Once a pattern of interference has been established, switch each appliance on and off that uses (or you suspect uses) a thermostat until the interference stops or changes its timing characteristics.
- Consult a qualified electrician to repair or replace the problem thermostat.

Electric motor interference

Various appliances can cause electric motor interference. If the interference is strong enough to affect radio and television reception, the problem appliance is likely to be within the household or immediate property (garages, garden sheds etc).

What to do

- Check individual household appliances by turning each appliance on and off until the interference stops.
- Move the appliance as far away from the television receiver as possible. If the problem persists, consult a qualified electrician to fit mains filters or repair the problem appliance.

WARNING: Under no circumstances should you attempt to repair or modify any electrical equipment unless you are qualified to do so.

Domestic equipment and appliances that can cause electrical appliance interference

Thermostat controlled hot water systems, refrigerators, waterbed heaters, fish tank heaters, pool chlorinators and electric blankets can cause electrical appliance interference. Electric motor-based appliances, typically food processors, hair dryers, vacuum cleaners, electric shavers, washing machines, swimming pool pumps and power tools can also cause this type of interference.

Digital television transmission interference

The introduction of digital television transmissions in Australia has introduced interference problems in some instances. Digital television transmission interference can affect both analogue televisions and VCRs.

Generally, digital television transmission interference to analogue television reception appears as a 'snowy' or fuzzy picture and, on occasion, generates unwanted noises on the audio.

Various mechanisms may cause the interference, including co-channel interference, adjacent channel interference, masthead amplifier overload or faulty antenna systems.

More information may be obtained from the television industry free hotline telephone **1800 016 009** or from the following websites:

Digital Broadcasting Australia
www.dba.org.au

Australian Broadcasting Authority
www.aba.gov.au

What to do

- Check that your television antenna and cabling is in good condition.
- Check that ancillary entertainment equipment cabling is in good condition.
- Remove individual pieces of equipment to determine if any one piece is introducing the interference into your television receiver.
- If the VCR seems to be introducing the interference, try changing the VCR's output channel. You may need to refer to the VCR and television owner manuals to make the change.
- If a piece of equipment is found to be susceptible to this form of interference, circuit modifications may be necessary. It is recommended that you obtain the services of a qualified technician for this work.

Antennas and masthead and distribution amplifiers

While do-it-yourself antenna installations can be easily and satisfactorily undertaken in strong signal strength areas, the use of a professional antenna installer can save much time and effort. If the installation is to be carried out in an area of problem reception, then the assistance of a professional antenna installer is highly recommended.

Choosing the correct antenna

Choosing the correct antenna for the reception needs of a particular area can be a difficult, and sometimes confusing, undertaking. Once again, it is best achieved with the assistance of a professional antenna installer who will know the specific antenna requirements of the local area or region.

The major factors involved with antenna selection and installation are:

- What channels will be watched?
- What signal strength is available in a given area?
- What, if any, reception problems exist in the area?
- What polarisation is required?
- Are there any local government restrictions on antenna placements?
- Will a masthead amplifier be necessary?
- Will separate VHF and UHF antennas be necessary for the best antenna system?

The most efficient and effective method of obtaining good television reception is by using an outdoor antenna.

WARNING: The installation must be kept well clear of power lines.

Installing a television antenna

When installing any type of outdoor antenna, certain basic elements must be taken into account. The installation must be solid and secure. If guy wires are to be used, sufficient area for their installation and solid anchor points are essential. If mounting brackets are used, the fascia, wall or roof must be physically able to support the combined weight of the bracket and antenna and be able to secure the fixture as a whole.

Having assessed these basic considerations, choose a suitable location for the antenna installation on your property.

The location should give as clear a 'line of sight' to the transmitter, because possible and local obstructions such as trees and rooftops should be avoided where practical.

Ensure that the antenna supporting mast or bracket allows sufficient clearance to enable multiple antenna installation, if required. Make sure also that it enables the antenna installation to operate without being affected by the roof, supporting guy wires or other material that may influence the performance of the antenna system. The mast or bracket should be 'grounded' with an earth rod and heavy gauge earthing cable.

Before you install an antenna:

Check with your **local government** regulations for possible mast height restrictions.

Check with a local **antenna supply company** for the appropriate antenna, its orientation and direction.

Once the antenna bracket or mast is securely installed, mount the antenna(s) on to the bracket or mast, normally with the UHF antenna above the VHF antenna. Coaxial cable should be connected to the antenna(s) and then to the television receiver via a diplexer, if necessary.

The cable weight should be supported by strapping the cable firmly to the mast or bracket. It is important to ensure that the coaxial cable is strapped tightly enough to prevent movement, but not so tight as to crush the cable.

It is essential that the coaxial cable is not stretched or damaged during installation, because any damage to the cable can affect its operating parameters and possibly the quality of the signal received.

Ancillary equipment for television antenna systems

Balun—an impedance-matching device used to connect the coaxial feeder to an antenna.

Coaxial cable, feeder—a 75Ω low loss coaxial feeder should be used to connect the antenna to the television receiver.

Diplexer—combines the output of two different antennas into a single cable to connect to the television receiver.

Distribution amplifier—distributes a received signal to a large number of outlets within a building.

Filters—used to improve the radiofrequency immunity of television, radio or other domestic entertainment equipment. All filters work on the basis of rejecting unwanted frequencies, but are selective in the way they work.

Masthead amplifier—also known as a booster, a masthead amplifier is used where the available signal for satisfactory television reception is very low. The amplifier increases the signal level to overcome signal losses due to the distance from the transmitter or losses that are intrinsic to the antenna and distribution system.

Splitter—divides the signal from the antenna system to enable two or more outputs to operate from the one antenna system. Some signal strength losses can be expected if a splitter is used.

Antenna availability: channel groups

VHF only

Low band (channels 0–3)
High band (channels 6–12)
Combination high and low band (channels 0–12)
Combination of various channels (channels 2, 7, 9, 10)

UHF only

Band 4 (channels 28–35)
Band 5 (channels 39–69)
Combined band 4 and band 5 (channels 28–69)

Combined VHF and UHF

All VHF channels plus Band 4 and Band 5
UHF channels
All VHF channels plus Band 4 UHF channels
All VHF channels plus Band 5 UHF channels
Selected VHF channels plus Band 4 UHF channels
Selected VHF channels plus Band 5 UHF channels

Polarisation

Horizontal—antenna elements parallel to the ground.

Vertical—antenna elements at right angles to the ground (see page 16 for diagrams).

Major antenna characteristics

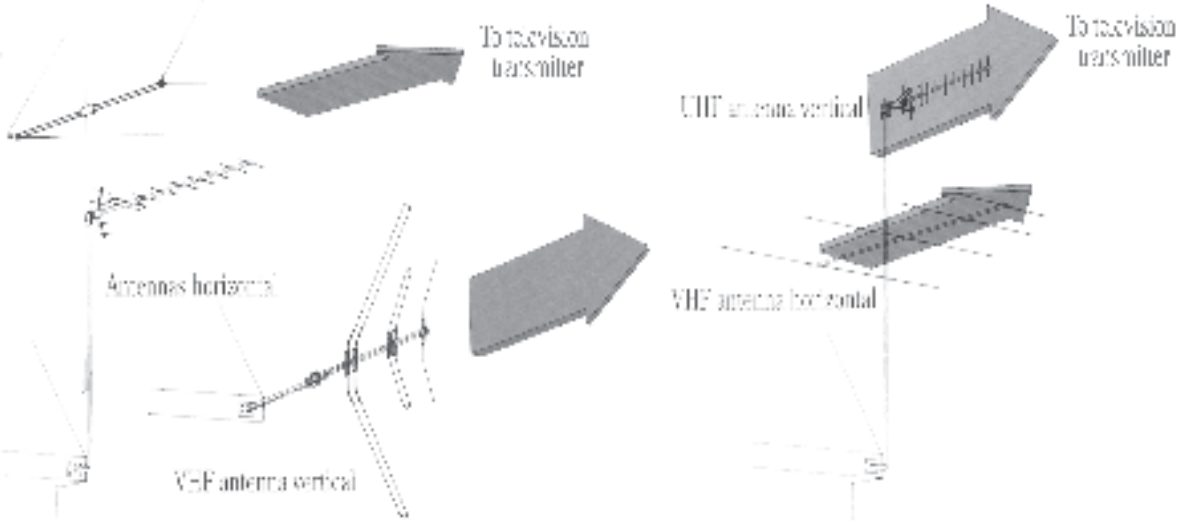
Gain—the ability of an antenna to collect signals; the weaker the signal in the area, the higher the gain of an antenna must be to deliver a useable signal to the television receiver.

Beamwidth—related to the gain of an antenna; the useful ability of an antenna to reject unwanted reflected signals that occur outside the main direct signal path.

Front to back ratio—the ability of an antenna to reject signals arriving at the antenna from behind.

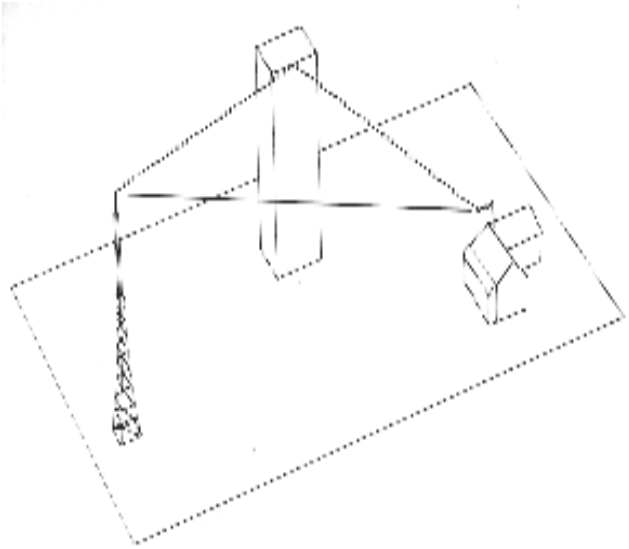
Pointing the television antenna in the correct direction

Antenna polarisation—antennas in the vertical and horizontal plane pointing toward the television transmitting station.



Correct antenna direction

For a multi-element antenna, the shorter elements must point toward the television transmitting station. If the elements are **V** shaped, the open end of the **V** should point toward the television transmitting station. Always check with the antenna supplier where the local transmitting stations are and how to correctly point and orientate the antenna.



How multipath reception or ghosting occurs

The diagram shows transmission paths from transmitter to television or radio receiver via the direct path and a reflecting body.

Commonly used terms

AFC—automatic fine tuning control is used on various types of receiver to automatically tune for the best response to a broadcast signal.

Antenna elements—the metal crossbars of an antenna, attached to the body or boom of the antenna but insulated from it.

Line of sight—the direct line (path) between a transmitting station and a receiving antenna. The higher the frequency, for example, UHF, the more important this is to the efficiency of transmission and reception systems.

Service area—the geographical area that must be served by a licensed television or radio broadcaster.

Translator—transmitter used to rebroadcast radio or television signals received from a parent transmitting station to extend the service area of a broadcaster. The output transmission frequency is always different to that of the parent station.

VHF—very high frequency—television channels 0–12

UHF—ultra high frequency—television channels 28–69

VCR—video cassette recorder.

Masthead and distribution amplifiers

A television masthead amplifier or booster is generally used by viewers in areas where only very weak television signals are available. The television signal may be weak due to intervening terrain, vegetation, buildings or due to the large distance between the broadcast transmitter and a viewer's television antenna.

As the name suggests, the amplifier is installed at, or very close to, the antenna and amplifies the signal received by the antenna before cabling the signal to a television receiver. Because the amplifier is outdoors, it has to be housed in a weatherproof enclosure.

A television distribution amplifier is used where an adequate level of television signal is available and it is necessary to distribute the signal to a large number of television receivers within a building.

Typically, an antenna system output is connected to a distribution amplifier, which in turn amplifies the signal before distributing it to outlet points and then to television receivers.

Unlike the masthead amplifier, a distribution amplifier is installed within the building in which it operates, normally within the roof area. Distribution amplifiers are used in hotels, motels, blocks of units and similar high occupancy buildings.

Many interference problems investigated by the ACA involve masthead and distribution amplifiers. The interference can be categorised as either amplifier overload or amplifier malfunction.

Amplifier malfunction

A malfunctioning amplifier can cause interference problems to many households in a given area. In some instances, the problem amplifier may be hundreds of metres from affected television receivers.

This form of interference generally affects only one channel and appears as 'S' patterning covering the whole picture or in bands across the screen. An accompanying buzz may be audible.

If several channels are affected on one specific television receiver, particularly if one channel is 'blacked out', it may indicate that the amplifier associated with that specific television receiver is the faulty amplifier.

The interference is caused by the amplifier becoming **unstable** and generating radiofrequency energy on a frequency close to the affected broadcast frequency. The amplifier in effect becomes a transmitter and radiates the interfering frequency on a transmission pattern based on the receive pattern of the antenna being used. The interference can be intermittent or continuous.

In certain cases, the amplifier itself may not be faulty and simply changing the amplifier will not resolve the interference problem. In these cases, the interference being generated may be caused by **cable damage** or **poor cable connections**. Cable and connector condition should be carefully checked before changing the amplifier. Corrosion of components and cabling, from salt or other corrosive substances, may also introduce amplifier instability.

Amplifier overload

If a masthead or distribution amplifier is used in a situation where it is subjected to strong radiofrequency signals, then the television receiver connected to that amplifier may be susceptible to interference (see page 9).

This interference usually appears as herringbone patterning and may be accompanied by interference to the sound. It may affect more than one channel. The interference will only be apparent when the radio signal is being transmitted.

Radio signals that can cause this problem may emanate from nearby amateur or CB radio operators, two-way radio services (for example, taxi, plumber, police) or radio broadcast transmitters.

Interference of this kind occurs because of the response of the affected amplifier to the strong radiofrequency signal, that is, the ability of the amplifier to reject such signals is inadequate. In this situation, providing the transmitter service is operating within its specified operating conditions, the onus of rectification lies with the owner of the affected amplifier.

In many situations, the installation of a filter between the antenna and the amplifier will resolve the problem. Assistance from a local antenna specialist or television technician should be sought in obtaining the appropriate filters and installing them.

Radio reception

Electrical interference to AM broadcast radio

A large percentage of reception difficulties are faults or deficiencies in AM radio receivers. Before you contact the ACA or electricity supply company, make every effort to determine the serviceability of a radio affected by interference.

A very effective and simple method of checking the reliability of a radio is by substituting it.

If the second radio has the same problem as the first (particularly if it is battery-operated and independent of the mains voltage), it is reasonable to assume that the problem is interference.

Electrical interference from **various sources** can cause interference to AM radio reception. Power line arcing, street lighting and electrical appliance interference are the **major sources** of reception degradation.

WARNING: Do not attempt to rectify any suspected faults on power poles, power lines or street lighting. It is essential that your local electricity supply authority be contacted if problems occur with power or lighting utilities.

Conversely, if the second radio exhibits no problem, it is reasonable to assume that the problem affecting the original radio is a fault within the radio and should be checked by a technician.

Power line interference

Power line interference is normally heard as a harsh, rasping buzz that affects both mains and battery operated radios. It will often affect a large number of homes. The interference may also simultaneously affect television reception (see page 11).

The interference most commonly occurs during hot, dry and windy weather when it is generated by sparking between insulators and metal securing brackets.

A similar problem occurs in the evenings as dew forms on built up dust, salt or industrial pollution that has collected on the insulators and brackets of the power line, again causing sparking.

In both instances the interference generally clears after rainfall. If the interference continues after rain, it may indicate physical damage to the power line.

What to do

- Listen to local radio services. Low signal strength worsens the problem.
- Persistent power line interference should be reported to your local electricity authority. It is their responsibility to rectify the problem. (See to your local phone book for contact details).

Street lighting interference

Street lighting interference, like power line interference, will generally affect a large number of homes. The interference starts when the street lighting turns on or coincides with it flashing on and off during the day or night.

What to do

- Report this interference to the local electricity supply company or authority (see your phone book for contact details).

Electrical appliance interference to AM broadcast radio

As mentioned in the television section of this booklet, domestic electrical appliances can generate interference (see page 12). AM radio is very susceptible to interference from appliances that use electric motors, switches and relays or thermostats during their operation.

Appliances that can cause electric motor interference—food mixers, power tools, sewing machines, electric shavers, vacuum cleaners and hair dryers.

Appliances that can cause thermostat interference—hot water systems, refrigerators, waterbed heaters and fish tank water heaters, swimming pool and spa bath chlorinators.

Appliances that can cause switching interference —washing machines, clothes driers and older appliances with cyclic operational characteristics.

Appliances that can cause other forms of electrical interference—television receivers, fluorescent lights and light dimmers.

Electric motor interference

Electric motor interference causes a whine or buzz in the radio that varies in pitch with the speed of the motor in the appliance, and can be readily identified because it only occurs when an appliance is used.

What to do

- The appliance causing the problem may need mains filtering or repair.
- Contact a qualified electrician or technician to repair or modify the appliance.

Thermostat interference

Thermostat interference can generally be identified by a harsh buzz that occurs for a regular period of time and is repeated regularly.

What to do

- Keep a record of the occurring interference.
- When you are confident that you know the interference pattern, switch individual appliances operating in the house on and off. Check garages and sheds as well.
- If you find an appliance that affects the established pattern of interference, it should be repaired or modified by a qualified electrician or technician.

Additional technical information for qualified electrical tradespeople is on page 21.

WARNING: Under no circumstances should you attempt to repair or modify any electrical equipment unless you are qualified to do so.

Switching and relay interference

Switching and relay interference can be identified by 'clicks and plops' heard on the radio receiver as the cycling operation of an appliance occurs.

What to do

- Keep a record of the occurring interference.
- When you are confident that you know the interference pattern, switch individual appliances operating in the house on and off. Check garages and sheds as well.
- When you find an appliance that affects the established pattern of interference, it should be repaired or modified by a qualified electrician or technician.

Electrical interference

Electrical interference can also be caused by pieces of equipment other than those mentioned and these are just as capable of causing reception problems. Once again, determining the equipment causing interference can be achieved by noting the pattern of occurrence and switching on and off lights or equipment in and around the affected property. Again, once the problem is isolated, the services of a qualified electrician or technician should be sought to rectify the situation.

Interference to FM broadcast radio

Electrical interference

FM signals are more immune to electrical interference and consequently provide better quality reception than AM. If the quality of reception is marred, the problem is possibly a fault within the FM radio receiver or deficiencies within your entertainment system.

As with good television reception, good FM radio reception generally depends on using an **appropriate outdoor antenna**. The antenna should be installed correctly, connected to the radio receiver with good quality coaxial cable and should **point towards the FM transmitter** station.

What to do

- Substitute the affected receiver with another radio. If the problem no longer exists, you can assume that the original radio receiver has a fault and should be checked and repaired by a qualified technician.
- If the problem continues in the second radio, check the antenna installation for damage or faults and repair if necessary.
- If the interference continues, obtain advice from an antenna specialist.

Multipath reception

Multipath reception can be identified as sharp or harsh sibilance (audio distortion) to the reproduced sound, often accompanied by the 'stereo light' flashing on the FM radio receiver. The problem is similar to ghosting on television and is caused by the same conditions. The transmitted FM signal is received over two or more paths, a direct signal from the FM transmitting station and at least one reflected signal coming from a large reflective body such as a mountain, hill or building in the area. See page 16 for a diagram of multipath reception.

What to do

- Substitute another radio for the affected one. If the second radio is not affected, the problem is most likely in the original receiver. If the second radio is affected, check the condition and installation of the antenna.
- If you are not using an outdoor antenna, you should install one.
- If the problem continues, carefully check the direction the antenna is pointing. Finely adjust the direction for the best quality radio reception.
- If the interference continues, consult an antenna specialist for advice.

Aviation transmitter interference

Aviation transmitter interference can affect some FM radio receivers. The problem arises because the FM radio receiver cannot reject unwanted signals.

What to do

- A simple filter can be installed in the radio to suppress the unwanted signals. This modification should be carried out by a qualified service technician.

Two-way radio interference

Both AM and FM radio receivers can sometimes pick up unwanted transmissions from two-way radio, CB and amateur radio services. Hearing voices other than those on the radio program you want to listen to identifies this form of interference. Very often, the problem arises because the broadcast radio receiver cannot reject the operating frequencies used by CB, amateur or two-way radio transmissions.

What to do

Rectifying this kind of problem usually involves modifying the receiver to improve its radiofrequency immunity, which may be costly. The problem may be transitory, only occurring when a mobile station (taxi cab, courier or mobile CB) is near the affected radio, and may not need further action. If you decide to modify the radio, consult a qualified technician about appropriate filtering or modification.

More information

Additional information about resolving interference from CB or amateur radio stations is available in the ACA brochure *Interference from CB and Amateur Transmitters* (see page 22).

Locating electrical appliance interference

A test procedure for technically qualified persons

The portable radio method

A battery-operated portable radio can be used successfully as a tool for locating electrical appliance interference. Various forms of appliance interference can affect AM radio reception. By using the following procedure, the source of interference can be readily localised and the offending faulty appliance identified.

Permission of the building owner or manager must be obtained before switching off mains power. Do not trespass.

Devices connected to a building's electrical service may be adversely affected by mains switching. Care should be taken to ensure that such devices are turned off appropriately before undertaking the test procedure.

Individuals working or living in or around the building(s) under scrutiny should be made aware of the proposed test procedures and be warned not to interfere with electrical equipment during the testing period. These tests should not be carried out if medical equipment or procedures are used or undertaken in the premises.

Precursors to testing

Check that the offending interference is occurring. Identify the nature of interference (a buzz, a hum, rasp or whistle) and whether the interference is continuous or intermittent. Be aware of the location of the fuse box(es) associated with the investigation locale. Ensure all occupants of the premises to be tested are aware of the exercise and that the mains power will be switched on and off, possibly several times.

Appliances and equipment that may cause interference to television and radio reception

Air conditioners; alarm systems; aquarium water heaters; computers and video games; calculators; cash registers; ducted heating temperature controllers; electric blankets; heater controls; electric fences; electric toys; electronic low voltage lighting transformers; fans; light dimmers; fluorescent lights; hair dryers; loose fuses; neon signs; power tools; refrigerator door switches; sewing machines; sun lamps; smoke detectors; television and radio booster amplifiers; television sets; toaster ovens; touch-controlled lamps; ultrasonic pest controls (bug zappers); vehicle ignition noise; washing machines; and waterbed heaters.

WARNING: The following suggested test procedure should be carried out by appropriately qualified electrical trades personnel only.

Procedure

Step 1
Turn the portable radio on, select the AM band and check that the identified offending interference can be heard. Normally, the interference will be heard across the AM band. Tune the radio so that the interference can be clearly heard. This will generally be between radio stations.

Step 2
Hold the radio near the fuse box.

Step 3
While the interference is occurring, turn the mains power switch OFF. If the interference stops at the time the mains switch is operated, the interference is within the property boundaries. If the interference continues, then the interference is coming from a source outside the boundaries of the property.

Step 4
Turn the mains power ON. The interference will generally return. If it does, individual electrical equipment within the property should be switched off until the interference stops to identify the problem piece of equipment. (See notes below).

Notes
Often, the repeating pattern of interference will change after the mains power has been removed from an interfering piece of equipment.

Care and time should be taken when reassessing the interference patterns or levels after mains switching has occurred, because the pattern and duration of the interference parameters may have changed.

If a large number of circuits are provided for operating equipment within a property under investigation for interference, the circuit-breakers or fuses can be switched OFF and ON (extracted and inserted) to isolate the circuit that supports the interfering equipment.

As with the mains switching method, when the interference is occurring, switch off individual circuit breakers or remove fuses. When the interference ceases, the offending equipment will be found on this circuit. The final identification of the interfering equipment can be made by following Step 4 in the above procedure.

Additional assistance

Interference investigation service

The ACA can provide advice as well as an investigation service. Assistance to investigate and diagnose reception problems can be obtained from the ACA by:

- indicating on the *Request for Interference Investigation* form that the reception problem is one affecting the community;
- indicating on the *Request for Interference Investigation* form that you have independently engaged a maintenance and repair company (technician) on your own accord, who has determined that the source of interference is other than in your home or premises, is not power line interference and is beyond your ability to control; or
- paying the appropriate fee to the ACA to investigate and diagnose the reception problem. This fee may be non-refundable. More information about payment for investigation services is on the *Request for Interference Investigation* form.

Please note

A community reception problem is defined as 'the same or similar' poor quality reception affecting at least four separate neighbouring households or premises.

The ACA offers an investigatory and diagnostic service only. The repair or replacement of faulty or interference-susceptible equipment is the responsibility of the owner of the equipment.

All ACA fees include the Goods and Services Tax.

The ACA provides a **diagnostic** and **advisory** service only. Resolution of **interference problems** is the responsibility of the affected parties, except where there are breaches of the *Radiocommunications Act 1992* and *Telecommunications Act 1997*.

Rectifying many interference problems will require the assistance of **qualified tradespeople**, particularly where mains voltages or working at heights is involved. If you require their services, you should be aware of the skills of the tradespeople you plan to employ.

Contact details for relevant industry associations can be found in your local services telephone directory.

More information is on the following websites sites:

- Australian Communications Authority—**www.aca.gov.au**
- Australian Broadcasting Authority—**www.aba.gov.au**
- Digital Broadcasting Australia—**www.dba.org.au**

To **contact** your electricity supply company or authority, look at your latest **electricity account** or **local phone book** for the address or phone number.

Information about interference from CB and amateur transmitters

The ACA's *Interference from CB and Amateur Transmitters* brochure has information about resolving interference problems between television or radio receivers and CB or amateur transmitters. The brochure is on the ACA website at www.aca.gov.au/publications/brochure, or call or write to the ACA regional office nearest to you (see page 23).

ACA regional offices

New South Wales Region (including Canberra, Coffs Harbour and Newcastle Operations Centres)
Level 2, 55 Clarence Street, Sydney
GPO Box 5295, SYDNEY NSW 2001
Tel: 1300 850 115,
Fax: (02) 9245 4099
Email: nswro@aca.gov.au

Southern Australia Region (including Adelaide, Hobart and Albury/Wodonga Operations Centres)
Level 44, 360 Elizabeth Street, Melbourne
PO Box 13120 Law Courts, MELBOURNE VIC 8010
Tel: 1300 850 115,
Fax: (03) 9963 6989
Email: saro@aca.gov.au

Northern Australia Region (including Cairns, Darwin, Rockhampton and Townsville Operations Centres)
424 Upper Roma Street, Brisbane
PO Box 288, RED HILL QLD 4059
Tel: 1300 850 115,
Fax: (07) 3247 7100
Email: naro@aca.gov.au

Western Australia Region
12th Floor, Septimus Roe Square
256 Adelaide Terrace, Perth
PO Box 6189, EAST PERTH WA 6892
Tel: 1300 850 115,
Fax: (08) 9461 2100
Email: waro@aca.gov.au

www.aca.gov.au

The Australian Communications Authority is a government regulator of telecommunications and radiocommunications