

Australian Standard[®]

**SITING OF RADIOCOMMUNICATIONS
FACILITIES**

**Part 1—LF, MF AND HF
TRANSMITTING AND HF
RECEIVING FACILITIES**

This Australian Standard was prepared by Committee TE/14/4, Siting of Radiocommunications Equipment. It was approved on behalf of the Council of the Standards Association of Australia on 28 October 1987 and published on 4 January 1988.

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Australian Broadcasting Corporation
Australian Electrical and Electronic Manufacturers Association Ltd
Confederation of Australian Industry
Consumer Electronics Suppliers Association
Department of Arts, Sport, the Environment, Tourism and Territories
Department of Defence
Department of Industry, Technology and Commerce
Department of Transport & Communications (Commonwealth)
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PREFACE

This Standard was prepared by the Association's Committee TE/14, Radio Communication, through the subcommittee on siting of radiocommunication facilities.

The purpose of this Standard is to prepare a document based on the Interdepartmental Code of Practice for the Installation of Power, Telephone and Remote Control Cables near Ground Radio Stations*. It attempts to embrace the wide range of factors considered to influence the siting of radiocommunications facilities. It takes account of all forms of interference to such facilities from domestic or industrial sources, interaction with other radiocommunication sources, electrical generating equipment, electrical and telephone distribution systems and electrical traction systems. The effect of interference caused by radiocommunications facilities on broadcast reception in the vicinity has also received consideration, as has the general effect of such facilities on the environment.

Similarly the Standard is intended to provide information to State and Local Government Authorities, organizations and members of the public on the effects that existing or planned developments could be expected to have on the operation of such facilities. The Standard is not however, intended as a substitute for consultation between relevant authorities and concerned parties on the impact of the facilities on the community. The Standard therefore, should not be applied without reference to the parties concerned.

The Standard is not a text book but some information of a technical nature is developed in appendices to provide background information for concerned parties who are not expert in the field of radiocommunications. Then in Appendix C information on interference standards published as at 1987, is collated and the relationship between peak and quasi-peak measurements explored on an empirical basis. This information leads to a series of graphs which develop separation distances from sources of interference, which ideally should be adopted for the optimum performance of the radiocommunications facilities. This becomes the basis for the discussions between the planned performance and its realization in a specific community,

The Standard is not intended to be imposed on a community but to be used as the basis for discussion by all interested parties in the expectation of achieving the best possible solution.

* Authorized by the Australian Government Inter-departmental Telecommunications Advisory Committee (TAC) 4 February 1977.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

SITING OF RADIOCOMMUNICATIONS FACILITIES

PART 1—LF, MF AND HF TRANSMITTING AND HF RECEIVING FACILITIES

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE AND APPLICATION. This Standard sets out requirements for the siting of LF, MF and HF transmitting facilities and HF receiving facilities at specific geographic locations. The Standard is concerned with potential interference to the intended activities of the transmitting and receiving facilities and, in addition, certain aspects of the impact which the wanted radiation might have on the adjacent communities.

It provides guidance to Government Departments and instrumentalities at Federal, State and Local Government levels concerned with the planning, construction, installation and maintenance of telecommunication and radio broadcasting services, electric power generation and distribution systems. It provides information and guidance for organizations and the public from the viewpoint of the impact on the general public of the siting of radio-communications facilities and information on the effects of existing or planned developments in the vicinity of those facilities that could be expected to have on the operations of such facilities.

The Standard is not intended as a substitute for consultation between the authority involved and concerned parties but as a basis from which meaningful discussions may proceed.

It should be emphasized that the Standard cannot specify the practical requirements at every site due to the wide variety in types of service intended, geographical and environmental situations and the interaction which may occur and for this reason the Standard should not be applied without reference to the parties concerned.

NOTE: The observance of the requirements of this Standard does not absolve an authority of one type from consulting other authorities likely to be affected by the planning, construction or extension of new works in the vicinity of existing facilities.

1.2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

- | | |
|-----------|---|
| AS 1044 | Limits of Electromagnetic Interference from Electrical Appliances and Equipment. |
| AS 1052.2 | Electromagnetic Interference Measuring Equipment
Part 2: Equipment for the Frequency Range 0.15 MHz to 1000 MHz. |
| AS 1053 | Radio Interference Limits and Measurements for Television and Radio Receivers. |
| AS 1054 | Electromagnetic Interference Limits and Measurements for Semiconductor Control Devices. |

- | | |
|---------|---|
| AS 2064 | Limits of Electromagnetic Interference Generated by Industrial, Scientific, Medical and Similar Radio Frequency Equipment. |
| AS 2344 | Limits of Electromagnetic Interference from Overhead AC Power Lines. |
| AS 2557 | Electromagnetic Interference Limits and Measurements Spark Ignition Systems Used in Motor Vehicles and Other Similarly Powered Devices. |
| AS 2772 | Maximum Exposure Levels—Radio Frequency Radiation—300 kHz to 300 GHz. |
| BS 6656 | Prevention of Inadvertent Ignition of Flammable Atmospheres by RF Radiation. |
| BS 6657 | Prevention of Inadvertent Initiation of Electro-explosive Devices by RF Radiation. |

CCIR Report 258-4 Man-made Radio Noise.

CCIR Recommendation 368-4 Ground-wave Propagation Curves for Frequencies between 10 kHz and 30 MHz.

CCIR Report 322 World Distribution and Characteristics of Atmospheric Radio Noise.

IEC 50 (60) International Electrotechnical Vocabulary Chapter 60 Radiocommunications.

IRPA Guidelines on Limits of Exposure to Radio Frequency Electro-magnetic Fields in the Frequency Range from 100 kHz to 300 GHz.

Although not referred to in this Standard, the following are recommended for further reading:

1. IFRB Handbook on Recommended Techniques for Better Utilization and Reduction of Congestion of the High Frequency Radio Spectrum, 1 August 1973.
2. National Bureau of Standards Technical Note 139—Siting Criteria for HF Communication Centers, April 1962.
3. CCIR Handbook for Monitoring Stations, ITU, Geneva, 1968.

1.3 DEFINITIONS. For the purpose of this Standard the definitions of IEC 50(60) apply. In addition the following International Telecommunications Union (ITU) designations explain the meanings given to the frequency ranges used in this Standard.

NOMENCLATURE OF THE FREQUENCY AND WAVELENGTH BANDS USED IN RADIO-COMMUNICATION.

The Radio Regulations, Geneva 1959, Art. 2, No. 112 state that in the nomenclature of the frequency and wave bands used in radio communications, the radio spectrum shall be subdivided into nine frequency bands and these shall be designated by progressive whole numbers in accordance with the Table 1 below. Frequencies shall be expressed in

— kilohertz (kHz) up to and including 3000 kHz;

— megahertz (MHz) thereafter up to and including 3000 MHz;

— in gigahertz (GHz) thereafter up to and including 3000 GHz, 3 THz.

However, where adherence to these provisions would introduce serious difficulties, for example in connection with the notification and registration of frequencies, the list of frequencies and related matters, reasonable departures may be made.

TABLE 1

Band number	Frequency range (lower limit exclusive)	Corresponding metric
4	3 kHz to 30 kHz	Myriametric waves
5	30 kHz to 300 kHz	Kilometric waves
6	300 kHz to 3000 kHz	Hectometric waves
7	3 MHz to 30 MHz	Decametric waves
8	30 MHz to 300 MHz	Metric waves
9	300 MHz to 3000 MHz	Decimetric waves
10	3 GHz to 30 GHz	Centimetric waves
11	30 GHz to 300 GHz	Millimetric waves
12	300 GHz to 3000 GHz (3 THz)	Decimillimetric wave

NOTES:

- 'Band number N' extends from 0.3×10^N to 3×10^N Hz.
- Abbreviations:
Hz = hertz;
k = kilo (10^3), M = mega (10^6), G = giga (10^9), T = tera (10^{12}).
- Abbreviations for adjectival band designations:
Band 4 = VLF Band 8 = VHF
Band 5 = LF Band 9 = UHF
Band 6 = MF Band 10 = SHF
Band 7 = HF Band 11 = EHF

SECTION 2. BASIC SYSTEM PROPAGATION NEEDS

2.1 GENERAL PROPAGATION CHARACTERISTICS. For LF, MF and HF transmissions, two modes of propagation are considered:

- (a) Propagation along the earth's surface by ground wave or direct wave.
- (b) Propagation by reflection using the ionized layers of the upper atmosphere, in other words, by a sky wave or indirect wave.

The loss in strength (attenuation) of a radio signal transmitted by ground wave depends on the electrical characteristics of the ground and on the frequency of the wave. This attenuation is smaller for surfaces with a high conductivity, such as the sea. At very low frequencies, ground waves are propagated over long distances. As frequency increases, attenuation of the ground wave also increases to the point where, in the HF band, the ground wave is only usable over short distances.

Even though sky wave propagation can occur in the LF and MF bands it is not generally the wanted mode of propagation. For the case of the HF band however, both ground wave and sky wave propagation are possible, with sky wave propagation being the predominant mode. The existence of a sky wave depends on the degree of ionization of the layers of the upper atmosphere and the frequency used.

Both modes of propagation are discussed in more detail in Appendix A.

2.2 ANTENNA CHARACTERISTICS.

2.2.1 General characteristics. Antenna characteristics should be chosen to achieve communications over the desired path or area of interest with maximum efficiency and minimum interference to or from the associated environment.

2.2.2 LF antennas. LF broadcast antennas are generally top-loaded monopoles characterized by their very large size. This type of antenna results in a vertically polarized omnidirectional radiation pattern. Supporting towers may be of the order of 200 m high and generally require large ground areas (in the order of 400 m radius) for their guying systems and buried earth radial systems.

As LF transmitters are used for long distance communications and because the antennas generally have low efficiencies, very high powers are used (typically 50 kW up to 200 kW). Associated radiation hazards are discussed in Section 5.

2.2.3 MF antennas. MF broadcast antennas generally have the same physical characteristics as LF broadcast antennas, that is, up to 200 m high with a large area of ground required for the buried earth radial system.

Typical MF transmitter powers range between 50 W and 50 kW. MF broadcast antennas can be directional in order to reduce radiation in unwanted directions, e.g., to protect other communications facilities. This may increase the power in other directions. Associated radiation hazards are discussed in Section 5.

2.2.4 HF antennas. HF antennas for the transmission and reception of ground-waves are vertically polarized and may be directional or omnidirectional. The physical height of an antenna can vary up to about 100 m, depending on the type of antenna.

HF antennas for the transmission and reception of sky waves are generally horizontally polarized and directional. Antennas for point-to-point or point-to-area communications have a main beam aimed appropriately in the horizontal plane (azimuth) and about the best angle of elevation for the distance over which transmission is required. The angle of elevation may vary from around 4 degrees for a very long transmission path to as high as 90 degrees. The sine of the angle of elevation varies in inverse proportion to the effective electrical height of the antenna above the ground and the frequency used. The antenna height and/or the frequency must therefore, increase to decrease the angle of elevation. Typical physical heights of antennas can range from 6 m to 100 m depending on the above factors.

At HF transmitting and receiving facilities many directional antennas may be installed at different angles in the horizontal plane to increase the area of coverage. Transmit powers can be in commonly 20 kW (although up to 300 kW is in use). With directional antennas the effective power can be significantly increased in the direction of propagation. Associated radiation hazards are discussed in Section 5. A very low man-made noise level is generally required for the satisfactory operation of HF receiving systems. HF receiving site buffer-zone criteria are discussed in Section 4.

2.3 TERRAIN REQUIREMENTS.

2.3.1 Selection. The selection of a site with regard to the surrounding terrain is particularly important for the transmission and reception of ground waves or low-angle sky waves. Specific terrain requirements to be considered are detailed in the following clauses.

In addition, because some sites which meet the following criteria will result in adverse visual impacts or otherwise be environmentally sensitive, the environmental consequences at each potential site shall be carefully evaluated.

2.3.2 Ground surface. For LF, MF and HF sites a largely flat surface, free of obstructions, is usually desirable, e.g. expanses of water such as sea, rivers or marshy land. Coastal sites are suitable, except where the tidal range is very large. Conversely, advantage can sometimes be taken of terrain roughness or elevations in unwanted directions to minimise interference from external sources.

It should be noted that salty environments cause more rapid corrosion of antenna hardware, leading to generation of interference and higher maintenance costs.

2.3.3 Reflecting surface (HF).

2.3.3.1 General. For a considerable distance in front of an HF antenna, the earth surface plays an important part in the vertical-plane radiation pattern by acting as a reflecting surface.



2.3.3.2 Reflection zone. The reflection zone (related to the first Fresnel Zone) is the area required in front of an antenna for the wanted ground reflection of the radiated wave, and should be free of roughness or obstructions. A diagram of the reflection zone for a simple antenna is given in Figure B1 in Appendix B. Also included are equations for such antennas for calculating the maximum width of the zone and the distances from the antenna base to its near and far ends. Typical limits for these distances are:

- (a) Near distance 0 m to about 350 m.
- (b) Far distance 80 m to about 5 km.
- (c) Width . . . 50 m to 500 m for a directional antenna.

2.3.3.3 Horizon. The horizon profile in the direction of transmission or reception should not extend to interfere in the communication. Therefore it is desirable that no features or structures subtend an angle greater than $\theta/2$ degrees measured from within the reflection zone, where θ degrees is the angle of arrival or departure of the transmission relative to the ideal horizon. This would be modified for directional antennas where it may be possible for features or structures to extend beyond $\theta/2$ degrees in unimportant directions.

2.3.4 Soil constants. The suitability of any portion of the surface of the earth involved in the propagation of radio waves is determined partly by the electrical properties of the surface. Conductivity and dielectric constant are the properties most indicative of the suitability of the surface. Soil structure, moisture

content (including water-table level) and salinity affect the values of the soil constants in any particular area and can vary markedly from region to region.

Soil of uniformly high conductivity to an extensive depth approaches the ideal ground plane for radio reception and transmission. Moist soil, marshy land or water surfaces make the best reflecting surfaces as they show much higher values of conductivity and dielectric constant than does a chalky or very dry type of soil. As soil constants depend upon moisture content, seasonal changes may be anticipated for a given locality. Representative values of soil constants are tabulated in Table 2. Measurement of actual values is normally necessary in making a choice between alternative sites for radiocommunication facilities.

TABLE 2
REPRESENTATIVE VALUES OF SOIL
CONDUCTIVITY

Type of surface	Relative dielectric constant	Conductivity S/m*
Sea water	80	5
Good ground (pastoral land with good soil)	30	1×10^{-2}
Hilly country, moderate vegetation, urban districts	4 to 5	1×10^{-3}

* S/m = Siemens per metre

SECTION 3. ECONOMICS OF CHOICE

3.1 CHOICE OF SITE. The choice of a site for transmitting or receiving is a compromise between the various technical, environmental and economic considerations. The major economic considerations are outlined in the following paragraphs.

3.2 SITE CLEARANCE. Site clearance costs will vary according to the conditions and vegetation of the land.

3.3 ACCESS ROAD. All weather access roads are needed for the movement of staff and heavy equipment to and from the site. The need to upgrade existing roads and/or provide a new road can result in one of the largest single item costs for a site.

3.4 POWER. Sites are usually serviced by mains power. Costs associated with connection to mains power depend on the location and capacity of existing power transmission lines. Power lines may need to be buried as they approach an LF, MF or HF transmitting site according to restrictions discussed in Clause 4.2.3. For the case of HF receiving sites the power lines should be buried according to the buffer zone criteria discussed in Clause 4.3.4.2.

3.5 BEARERS. Microwave links, land lines, etc., are required to provide communications to and from the site. The distance to be traversed and the intervening terrain are factors to be considered when deciding on a particular link and hence impact on the subsequent cost. Land lines may need to be buried as they approach an LF, MF or HF transmitting site according to the restrictions discussed in Clause 4.2.3. For an HF receiving site, land lines should be buried according to the buffer zone criteria discussed in Clause 4.3.4.2.

3.6 LAND COST. Land costs can vary considerably depending on factors such as proximity to urban development and zoning.

3.7 VULNERABILITY TO ENVIRONMENTAL PHENOMENA. Buildings and towers in areas with a high vulnerability to environmental phenomena such

as cyclones, flooding, extreme cold, earthquakes and lightning may require special grounding, extra strength components, and special foundations, which will add to the overall project cost.

3.8 CONSTRUCTIONAL ASPECTS. Remote site location, undesirable soil characteristics and adverse seasonal weather conditions can all increase the cost of constructing buildings and towers.

3.9 MAINTENANCE ASPECTS AND MEAN TIME TO REPAIR (MTTR) REQUIREMENTS. For sites which require manning, the location of maintenance staff is very important. Costs can increase substantially if the site is a considerable distance from areas of residential development or existing staff accommodation. New accommodation close to the site or special travel arrangements are generally required.

The proximity of maintenance staff to sites which do not require manning will have a direct impact on the MTTR.

3.10 ENVIRONMENTAL ACCEPTABILITY. If a site is environmentally sensitive the costs of the necessary environmental measures, e.g., safeguards to mitigate environmental impacts, and the costs of satisfying the environmental legislation of the Commonwealth and/or relevant State need to be taken into account. Accordingly developers of proposals for new facilities or changes to existing facilities which could be environmentally significant shall be responsible for contacting the appropriate authority (either Commonwealth, State or Territory) responsible for environmental matters as listed in Appendix D.

3.11 FUTURE PLANNING. Local planning authorities should be consulted regarding future plans for the region. Factors such as the re-direction of roads and powerlines planned for the area and future urban development could increase costs for all authorities concerned. The costs of acquisition for any land necessary for use as a buffer zone of adequate size, should be taken into account.

SECTION 4. IMPACT OF EXTERNAL AND ON-SITE RADIO INTERFERENCE

4.1 GENERAL. This Standard is concerned only with LF, MF and HF transmitting facilities and HF receiving facilities, hence only communications facilities at specific geographic locations will be considered. Where transmitting and receiving facilities are co-sited, reference should be made to Clause 4.2 for the case of the transmitting facility, and Clause 4.3 for the case of the receiving facility.

4.2 LF, MF AND HF TRANSMITTING FACILITIES.

4.2.1 General interference. There are two main types of interference which affect LF, MF and HF transmitting facilities. These are mutual interference with other transmitting facilities, and modification of the antenna characteristics due to metallic structures acting as re-radiators.

4.2.2 Other transmitting facilities. The required separation distances between transmitting facilities to reduce the possibility of mutual interference can only be determined on a case-by-case basis by the authorities concerned and will depend on the —

- (a) attenuation characteristics of the intervening terrain;
- (b) maximum level of all radiation from the transmitter;
- (c) performance characteristics of the antenna systems; and
- (d) likely future growth of interference.

4.2.3 Re-radiators. Metallic structures and conductive cables within a certain distance of the antennas may modify the antenna characteristics to an unacceptable degree. Actual separation distances will depend on the antenna characteristics and the transmit power and should be determined on a case-by-case basis.

4.3 HF RECEIVING FACILITIES.

4.3.1 General. Radio interference to HF receiving facilities including, for the purposes of this Standard, 'noise', can be divided into two categories depending on whether it originates in the receiving system (internal) or externally to the antenna.

The internal noise is generated in the receiver itself.

It has the characteristics of thermal noise, and, in many cases, its effects on signal reception can be determined mathematically with a high degree of precision.

External noise can be divided into several types, each having its own characteristics. The most usual types are of atmospheric, galactic and man-made origin.

4.3.2 Atmospheric noise. Atmospheric noise is produced mostly by lightning discharges in thunderstorms. The noise level therefore depends on frequency, time of day, weather, season and geographical location. Subject to variations due to local stormy areas, atmospheric noise generally decreases with increasing latitude on the surface of the globe. Atmospheric noise generally predominates in quiet locations at frequencies below about 20 MHz. CCIR Report 322 gives the distribution of atmospheric radio noise throughout the world at frequencies between 0.01 MHz and 100 MHz. In this report, the expected value of radio noise is based on measurements made with a short vertical antenna over a perfectly conducting ground. The use of directive

receiving antennas may modify the level of received noise considerably.

4.3.3 Galactic noise. Galactic noise at radio frequencies is caused by disturbances originating outside the earth or its atmosphere. The chief sources of such radio noise are the sun, celestial radio-sky background radiation concentrated along the galactic plane, and a large number of discrete, cosmic sources distributed chiefly among the galactic plane. Galactic noise reaching the surface of the earth is of most significance at higher frequencies e.g. above 15 MHz.

4.3.4 Man-made noise.

4.3.4.1 General. Man-made noise is radiated from equipment as a by-product of its normal function, e.g. electric power lines, welders, motors, domestic appliances and scientific and electromedical equipment.

Man-made radio noise, like any other radio-frequency energy, can be propagated by ground wave or by reflection from the ionosphere. The effect of noise propagated by the ionosphere is spread fairly constantly over distances up to hundreds of kilometres. It can be of the same magnitude as atmospheric noise, and is generally not a factor in the choice of sites within a locality.

Man-made noise which is radiated directly or by ground wave however, is of prime importance in the selection and subsequent protection of communications sites. Man-made noise can be divided into two categories: that generated external to the site and that generated on the site.

4.3.4.2 External man-made noise. External man-made noise is considered as follows:

- (a) *System classification.* Radio communications receiving systems in the HF band can be classified into two main divisions: 'long distance' and 'short distance'. The relatively high field strengths associated with the reception of short-distance signals make short distance systems generally more tolerant to man-made noise. The protection required is generally moderate and should be established on a case-by-case basis. As a consequence, only long distance systems will be considered.
- (b) *Categories of HF receiving stations.* The required minimum field strength which is necessary for proper reception of a radio signal can vary depending on the primary purpose of the receiving station. HF receiving stations may therefore be divided into three broad categories. These categories, together with representative acceptable levels of man-made noise according to the strength of the signals which they are required to receive, are as follows:
 - (i) *Category A.* Stations required to maintain communications during periods of extremely weak signals (such as may occur with defence communications). Man-made noise level should be typically less than – 30 dB $\mu\text{V/m}$ (r.m.s./kHz).
 - (ii) *Category B.* Stations required to maintain communications during periods of weak signals (such as may occur with military/civil

aircraft and shipping operating at long ranges). Some stations may operate at a man-made noise level as high as $-5 \text{ dB } \mu\text{V/m}$ (r.m.s./kHz) without significantly affecting operational efficiency.

- (iii) *Category C.* Other receiving stations where desired signals are usually of moderate to high strength, or where an occasional break in communication can be tolerated during periods of weak signals. These stations can generally operate in areas where the man-made noise level is greater than $-5 \text{ dB } \mu\text{V/m}$ (r.m.s./kHz).
- (c) *Separation from sources of man-made noise.* In order to select a site with a suitably low level of man-made noise, and to subsequently protect that site against the degradation of this noise level due to the subsequent location of sources of man-made noise in the vicinity of the site, certain separation distance criteria should be adhered to. The noise figures given Item (b) above should generally be considered as the maximum acceptable level for the given category of station. Appendix C contains an analysis of sources of man-made radio noise and shows that there should be three zones of interest around an HF receiving facility. As different HF receiving facilities will have varying site noise levels these zones and other separation distances are based on allowing no more than a 1 dB increase in the site noise. Of course, where the site is already degraded because of noise then the site separation distance recommendations will need to be appropriately varied. The zones are as follows:
 - (i) *Zone A.* No sources of man-made radio noise.
 - (ii) *Zone B.*
 - A. No industrial, scientific, medical (ISM) or other radio frequency equipment such as used by industry, research facilities or hospitals.
 - B. All domestic and other non-radio frequency appliances shall comply with AS 1044.
 - C. No electric traction systems.
 - (iii) *Zone C.*
 - A. All ISM equipment shall comply with AS 2064.
 - B. No electric traction systems.

Further, separation distances for roads and overhead power lines within Zones B and C should be based on traffic volume and power line voltage, as detailed in Item (d) below.

- (d) *Typical zone sizes and separation distances.* Typical zone sizes and separation distances for overhead power lines and roads, based on existing site noise, are shown in Figures 1 to 4. Figures 2 and 3 show the recommended separation distances between HF receiving and DF facilities and overhead power lines. In Figure 4.2, the classification 'up to 11 kV' includes telephone and remote control conductors. The distances in Figures 2 and 3 are subject to the following restrictions:

- (i) For HF receiving facilities, no overhead conductors are allowable within 275 m of the site boundary. Further, they should not extend above a vertical angle $\theta/2$ degrees as viewed from all parts of the reflection zone where θ degrees is the angle of signal arrival; and
- (ii) No overhead conductors are allowable within 500 m of the centre of a direction-finding (DF) array. Further, they should not extend above a vertical angle greater than 2 degrees measured from the centre of the array at ground level.

Figure 4 shows the recommended separation distances between HF receiving and DF facilities and roads and other sources of internal combustion engine noise.

The distances shown in Figures 1 to 4 should be considered a basis for negotiation. In determining actual separation distances for particular sites, factors such as the following should be considered in a technical assessment jointly conducted by the affected authorities:

- A. Required or existing site noise based on regular noise monitoring.
- B. Level to which the intervening terrain attenuates the noise.
- C. Presence of overhead power and telephone lines which could act as carriers of noise.
- D. Performance characteristics of the antenna system.
- E. Limit to which it is practicable for the communications operator to control sources of man-made noise in the near vicinity of the site.
- F. Ability of the receiving system to reject interference.
- G. Degree of previous site degradation due to the location of noise and interference sources.
- H. Likely future growth of noise sources.

Possible relaxation of Zone A criteria is discussed in Clause 4.3.4.3.

4.3.4.3 On-site and Zone A noise and interference.

Separation distances for individual sources of man-made noise within Zone A are shown in Figures 5 to 8. Location of man-made noise sources within Zone A is allowable only if it is practicable for the use of these noise sources to be strictly controlled by the communications operator. In determining actual separation distances, the factors outlined in Clause 4.3.4.2(c) should be considered.

Certain measures shall be taken to reduce sources of on-site man-made noise and these include:

- (a) ensuring that equipment is kept in good condition;
- (b) the addition of suppressive components or alteration of the equipment design to prevent the generation of radio noise (including motor vehicles);
- (c) if necessary, placing the equipment in a properly constructed and sealed metal cage (e.g. Faraday cage), which acts as a barrier to radio noise; and
- (d) connection of the equipment to a suitable earthing system.

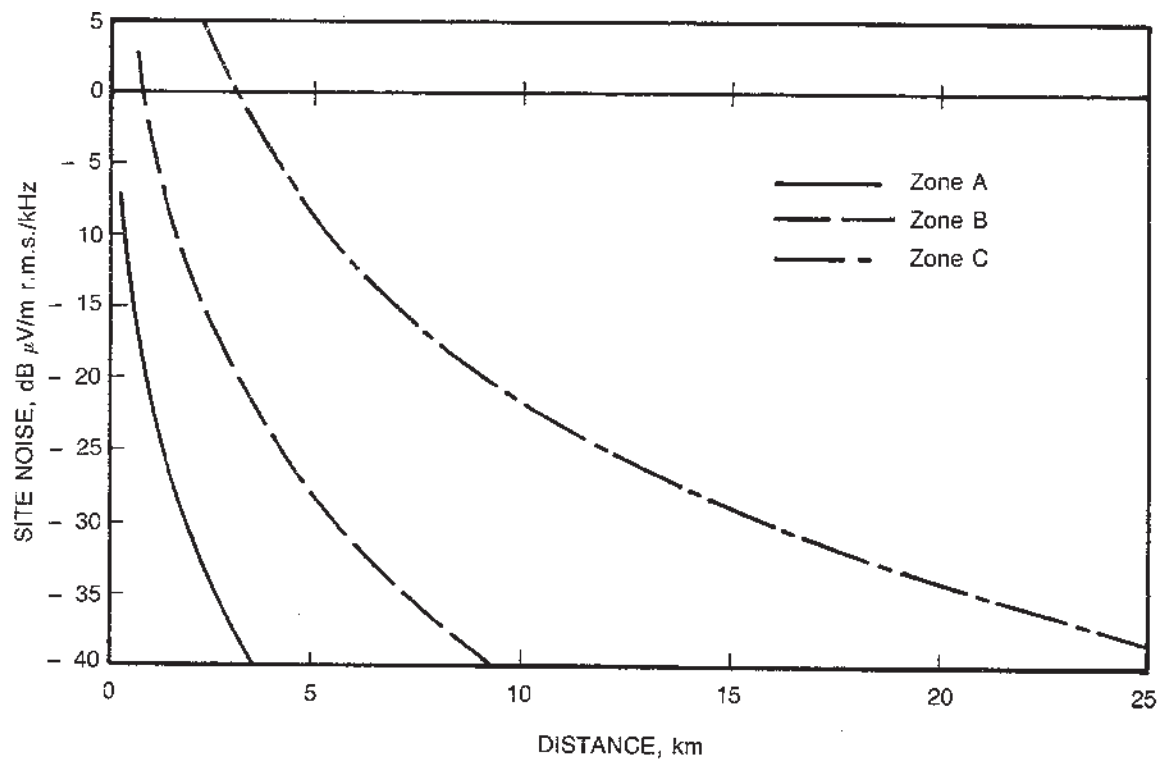


FIGURE 1. REQUIRED ZONES AROUND HF RECEIVING AND DF FACILITIES

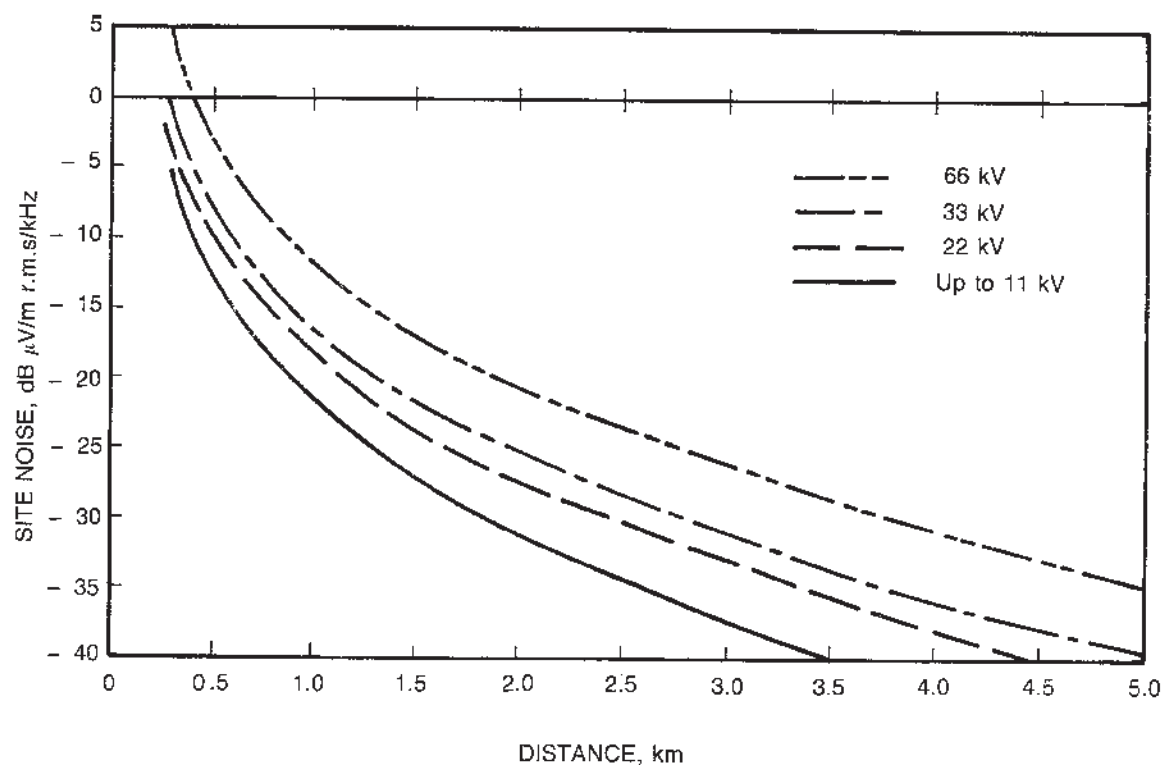


FIGURE 2. SEPARATION DISTANCES FOR OVERHEAD POWER LINES UP TO 100 kV

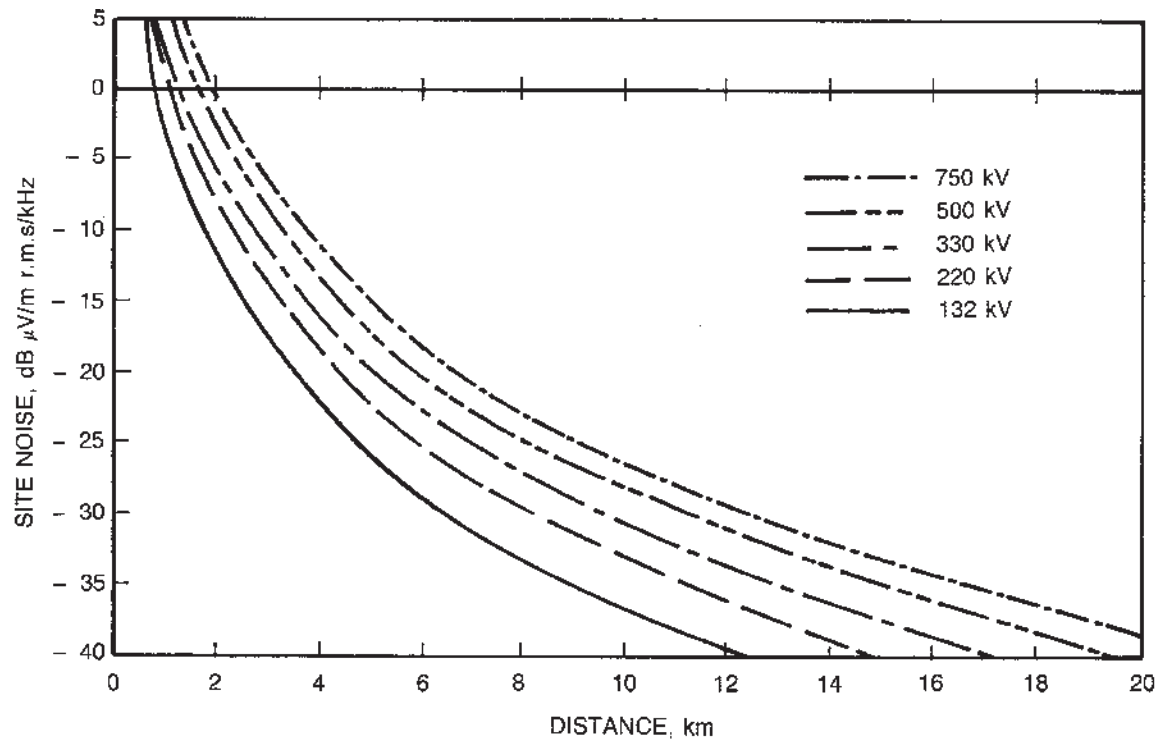
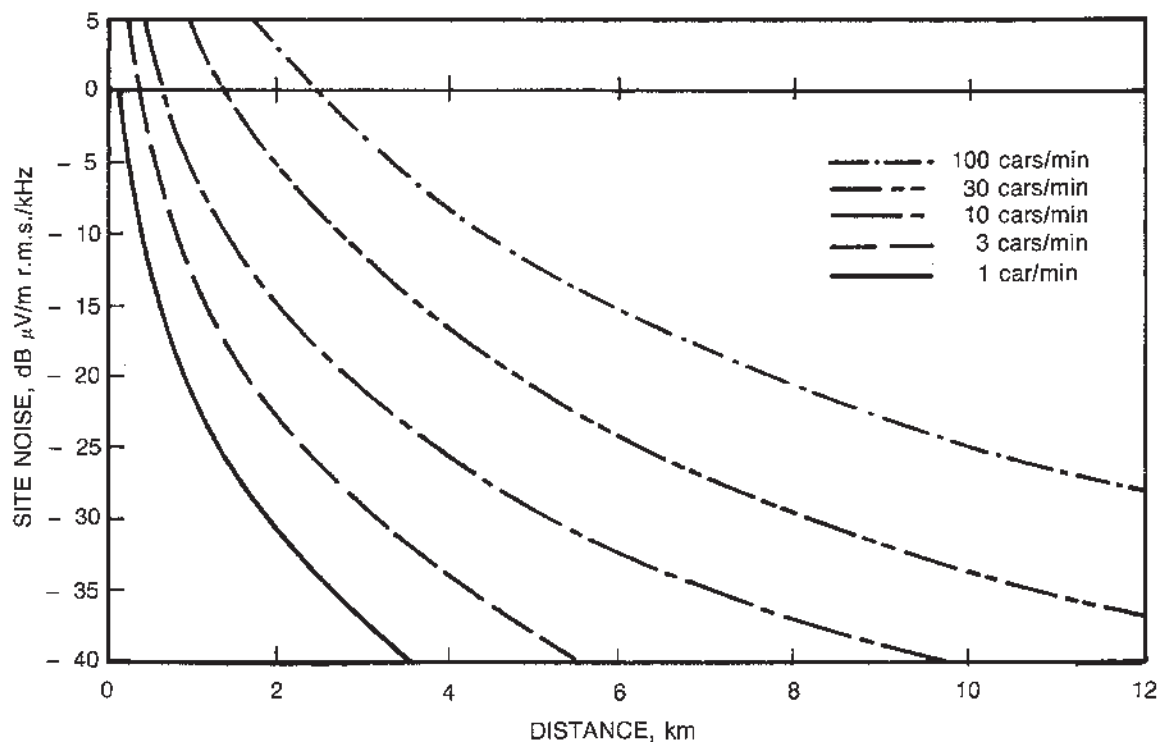


FIGURE 3. SEPARATION DISTANCE FOR OVERHEAD POWER LINES ABOVE 100 kV



NOTE: 1 car/min should be used for other sources of internal combustion noise.

FIGURE 4. SEPARATION DISTANCES FOR ROADS AND OTHER SOURCES OF INTERNAL COMBUSTION NOISE

4.3.5 Distant Systems. Experience has shown that it is hard to control cross-modulation effects in receiving systems for interfering field strengths from radio transmitters operating in any part of the spectrum which exceed 10 mV/m. Further, spurious radiation often occurs on a frequency or frequencies outside the allocated frequencies of transmission and can cause interference to HF receiving and DF facilities. Spurious radiation includes harmonics, parasitic emissions and intermodulation products. Acceptable limits of spurious radiation are specified in the International Telecommunications Union (ITU) Radio Regulations to which Australia is a signatory.

The actual separation distances from transmitting stations can only be determined on a case-by-case basis and will depend on the following:

- (a) Attenuation characteristics of the intervening terrain.
- (b) Maximum level of all radiation from the transmitter.
- (c) Performance characteristics of the antenna systems.
- (d) Ability of the receiving system to reject interference.
- (e) Likely future growth of interference.

Further, in many cases where a transmitting station is located within tens of kilometres from a receiving site, the level of spurious radiation from the transmitting station may exceed the levels of man-made noise at the receiving site. Consultation will then be necessary between the authorities concerned if spurious radiation appears to be a problem at the frequencies of use at a receiving site.

4.3.6 Site noise measurements.

4.3.6.1 Existing levels of noise. When selecting a new receiving site or when protecting an existing receiving site, it is important to conduct regular measurements to determine the existing level of man-made noise at the site.

4.3.6.2 Frequency of measurement. Measurements should be made at regular intervals (at least four times per year), so that an accurate record of site noise levels may be maintained.

4.3.6.3 Time of measurement. Measurements should be made between 9.00 a.m. and 12.00 noon local time. This time-period represents the time of least atmospheric noise as well as the time when industry, business, or farm machinery, should be in full operation.

4.3.6.4 Method of measurement. Measurements should be made in the r.m.s. mode and the bandwidth should be converted to 1 kHz (– 6 dB). However, until a suitable Australian Standard for measurements is developed, measurements made with quasi-peak sets conforming to AS 1052.2, are acceptable. For such measurements a quasi-peak to r.m.s./kHz ‘conversion’ of – 16.5 dB will apply.

4.3.6.5 Records. The communications operator should keep a full record of all noise measurements. This record should include information regarding the location of new sources of man-made noise around the site and what effect, if any, these have had on the site noise. The record should be used when negotiating the required separation distances for further sources of man-made noise.