

Australian Standard[®]

**Siting of radiocommunications
facilities**

**Part 2: Guidelines for fixed,
mobile and broadcasting services
operating at frequencies above
30 MHz**

This Australian Standard was prepared by Committee RC/5, Radiocommunications—Infrastructure. It was approved on behalf of the Council of Standards Australia on 5 January 1998 and published on 5 April 1998.

The following interests are represented on Committee RC/5:

AirServices Australia
Australasian Railway Association
Australian Broadcasting Authority
Australian Broadcasting Corporation
Australian Communications Authority
Australian Electrical and Electronic Manufacturers Association
Australian Subscription Television and Radio Association
Community Broadcasting Association of Australia
Consumer Electronics Suppliers Association
Department of Communications and the Arts
Department of Defence
Electronic Services Industry Association
Federation of Australian Commercial TV Stations
Ministry of Commerce, New Zealand
National Transmission Agency
Optus Communications
Special Broadcasting Service
Telstra Corporation
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee RC/5, Radiocommunications—Infrastructure, and is the result of a consensus among the Australian and New Zealand representatives on the Joint Committee that it be produced as an Australian Standard.

This Standard is Part 2 of a series of Standards on the subject of siting radiocommunications facilities. The other Standards in the series are the following:

AS

3516 Siting of radiocommunications facilities

3516.1 Part 1: LF, MF and HF transmitting and HF receiving facilities

3516.3 Part 3: Fixed location satellite earth stations

The objective of this Standard is to recommend good practice for, and to set out the process by which, radiocommunications sites should be planned, sited, constructed and operated to meet the communications objectives of the facility. It particularly addresses the sharing of radiocommunications sites.

This Standard is intended primarily for new sites and additions to, or extensions to, existing sites. It is not intended to apply, retrospectively, to existing approved sites, although guidance to make improvements to such (or help alleviate problems which may have arisen) is contained in it.

Poorly planned, constructed and maintained sites can result in interference problems for users of those sites, particularly as the number of services at such sites increases. Hence, it is in the interest of site users to pay regard to the recommendations of this Standard.

The Standard addresses a wide range of factors considered to influence the siting of radiocommunications facilities. It also takes into account the interaction with other radiocommunications sources, the effect of interference caused to radiocommunications and broadcast reception in the vicinity, and the general effect of such facilities on the environment.

The Standard is intended to provide information to Federal, State and local government authorities, facilities planners, site planners, 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, and vice versa. However, it is not intended as a substitute for consultation between relevant authorities and concerned parties on the impact of the facilities on the community, and should be applied with reference to the parties concerned.

The Standard is of an advisory nature and 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.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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STANDARDS AUSTRALIA

Australian Standard

Siting of radiocommunications facilities

Part 2: Guidelines for fixed, mobile and broadcasting services operating at frequencies above 30 MHz

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard provides guidance for the siting, installation and operation of radiocommunications facilities for fixed, mobile and broadcasting services, in the range of 30 MHz to 3 GHz.

NOTE: 3GHz is a nominal upper limit.

It is intended to assist government departments and instrumentalities at Federal, State and local government levels with the planning, construction, installation, operation and maintenance of radiocommunications and 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 and operational staff, of the siting of radiocommunications and broadcasting facilities. It also provides information on the effects that existing or planned developments (in the vicinity of those facilities) could be expected to have on the operations of such facilities, and vice versa.

NOTE: Regulatory, planning and environmental authorities and bodies are listed in Appendices A and B. Appendix C lists organizations involved in the radiocommunications/broadcasting industry. These lists may not be exhaustive. Users of this Standard should consult appropriate directories including the World Wide Web (Australian Government entry point address <http://www.nla.gov.au/oz/gov/>) for up-to-date listings.

This Standard does not cover radiofrequency (RF) radiation exposure limits and methods of measurement. These are addressed in AS 2772.1 and 2772.2.

1.2 APPLICATION Operation of radiocommunications transmitters requires a licence from the Australian Communications Authority (ACA) or the Australian Broadcasting Authority (ABA). Compliance with this Standard does not imply that the licence requirements for radiocommunications transmitters have been fully met.

Compliance with the technical planning guidelines (TPG) published by the ABA is a condition of the transmitter licence issued to commercial and community broadcasting services under the Radiocommunications Act 1992. Similar guidelines may be applied to transmitter licences of national and 'open narrowcasting' broadcasting services.

The observance of this Standard does not absolve a person or organization from consulting other parties likely to be affected by the planning, construction or extension of new works in the vicinity of existing radiocommunications facilities. The Telecommunications Act 1997 has provisions applying to telecommunications carriers in relation to their telecommunications and radiocommunications infrastructure which do not apply to other radiocommunications site operators. In accordance with these provisions carriers may engage in practices that differ from those recommended in this Standard.

It should be emphasised 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. For this reason the Standard should not be applied without reference to the parties concerned.

This Standard is not intended to cover compact, short range, inconspicuous facilities and the like.

1.3 REFERENCED AND RELATED DOCUMENTS

1.3.1 Referenced documents The following documents are referred to in this Standard:

AS

- 1170 Minimum design loads on structures (known as the SAA Loading Code)
- 1170.1 Part 1: Dead and live loads and load combinations
- 1170.2 Part 2: Wind loads
- 1188 Radio transmitters and similar equipment—Safe practices
- 1596 LP Gas—Storage and handling
- 1596 Supplement 1: LP Gas—Storage and handling—Siting of LP Gas automotive retail outlets
- 1768 Lightning protection
- 1940 The storage and handling of flammable and combustible liquids
- 2209 Timber—Poles for overhead lines
- 2676 Guide to the installation, maintenance, testing and replacement of secondary batteries in buildings
- 2772 Radiofrequency radiation
- 2772.1 Part 1: Maximum exposure levels—100 kHz to 300 GHz
- 2772.2 Part 2: Principles and methods of measurement—300 kHz to 100 GHz
- 3000 Electrical installations—Buildings, structures and premises (known as the SAA Wiring Rules)
- 3000 Supplement 1: Electrical installations—Buildings, structures and premises—Cable and conductor tables (imperial units)
- 3009 Electrical installations—Emergency power supplies in hospitals
- 3011 Electrical installations—Secondary batteries installed in buildings
- 3011.1 Part 1: Vented cells
- 3011.2 Part 2: Sealed cells
- 3116 Approval and test specification—Electric cables—Elastomer insulated—For working voltages up to and including 0.6/1 kV
- 3147 Approval and test specification—Electric cables—Thermoplastic insulated—For working voltages up to and including 0.6/1 kV
- 3584 Diesel engine systems for underground coal mines
- 3600 Concrete structures
- 3600 Supplement 1: Concrete structures—Commentary
- 3995 Design of steel lattice towers and masts
- 4065 Concrete poles for overhead lines and street lighting
- 4100 Steel structures
- 4100 Supplement 1: Steel structures—Commentary

AS/NZS

- 4360 Risk management

SAA

- HB4 Register of Australian Standards referenced in State and Commonwealth Legislation

ABA (Australian Broadcasting Authority)

Technical Planning Guidelines Radiocommunications Act 1992

1.3.2 Related documents Attention is drawn to the following related documents:

AS

1170 Minimum design loads on structures (known as the SAA Loading Code)

1170.4 Part 4: Earthquake loads

1170.4 Supplement 1: Earthquake loads—Commentary

2121 The design of earthquake-resistant buildings (known as the SAA Earthquake Code)

MPT 1331 Code of Practice For Radio Site Engineering

IE Aust Environmental Principles For Engineers

S E C T I O N 2 M A N A G E M E N T

2.1 GENERAL The establishment and use of a radiocommunications site generally moves through the following phases:

- (a) Planning and design.
- (b) Construction and installation.
- (c) Commissioning.
- (d) Operation.
- (e) Decommissioning.

A process should be established to ensure that the functions of site management, including responsibility for the site and compliance with this Standard, are achieved. The process should clearly establish the responsibility for management of the site during each of the phases outlined above.

This Standard follows the approach of using a position of site manager. However, other means may be employed.

2.2 SHARED SITES Where sites are to be shared, an agreement between all relevant parties should be made at the outset. This agreement, regardless of its nature, should meet the objectives of this Standard.

2.3 SITE TECHNICAL COORDINATION A ‘site technical coordination process’ should be prepared, which includes identification of a technically competent person as the ‘site technical manager’ for each of the phases identified in Clause 2.1. At shared sites this role is particularly important.

Site technical coordination should ensure that the following functions are addressed and adequately managed:

- (a) Determine compatibility of proposed installations with on-site equipment.
- (b) Coordinate technical work on the site.
- (c) Resolve on-site interference issues amongst the operators.
- (d) Represent, technically, the site operators in resolving off-site interference issues.
- (e) Coordinate the sharing of common facilities.
- (f) Ensure that accurate, up-to-date documentation is maintained.

2.4 SITE DOCUMENTATION Appropriate documentation should be prepared and maintained to identify the following:

- (a) The name of the site manager, and contact details.
- (b) On-site radiation details.
- (c) Facilities and equipment layout.
- (d) List of sharers and the resources or facilities that are shared.
- (e) Layout of all RF cabling or associated labelling details.
- (f) Licensed operating frequencies and maximum output powers of all transmitters.
- (g) Logs for work on, or changes made at, the site, on radiocommunications facilities.
- (h) Sharing agreements or relevant parts thereof.

- (i) Equipment that is remotely controlled.
- (j) A 24-hour contact number for each operator.

This documentation should be readily available to authorized personnel visiting the site, and, where practicable, key documentation should be retained on the site.

2.5 CONSTRUCTION AND INSTALLATION A technically competent person or expert group should be identified as the project manager who has to ensure that—

- (a) site technical logs are started (and where practicable kept on site), which record details of all work performed;
- (b) necessary permits are obtained, and recorded in the technical log;
- (c) work done complies with this Standard; and
- (d) a site plan is prepared showing the location of all facilities and equipment installed.

2.6 COMMISSIONING Commissioning is the acceptance into operational service of the facility. Before the construction phase is finished the site technical manager should ensure that—

- (a) the site technical logs contain details of work done during construction;
- (b) the necessary permits have been obtained;
- (c) test transmissions have been conducted over a reasonable period and reported anomalies adequately addressed; and
- (d) the site plan is accurate and complete.

2.7 OPERATION During operation, the site management process should ensure that responsibility is taken for ensuring that—

- (a) Occupational Health and Safety legislation is adhered to;
- (b) environmental requirements pertinent to the site are adhered to;
- (c) the site technical logs are properly maintained and that all maintenance visits and details of technical work done are recorded;
- (d) the requirements of all necessary permits are adhered to;
- (e) all technical work done complies with the relevant Standards;
- (f) the site plan is properly maintained;
- (g) interference issues are identified and
 - (i) on-site interference problems are resolved; and
 - (ii) liaison with other parties as detailed in Section 9 of this Standard, to resolve off-site interference, is commenced without delay; and
- (h) for remotely controlled sites, a record is kept of changes made from any control point.

2.8 DECOMMISSIONING Due consideration should be given to the decommissioning of sites that are no longer required. The site agreement may stipulate the process of rehabilitation if a new use for the site has not been found.

Radiocommunications licences should also be cancelled.

SECTION 3 PLANNING AND SITING

3.1 GENERAL The siting of a transmitting station requires careful consideration and planning before the facility can be built. It would be preferable to apply usual project management techniques, and good engineering practice should be followed at all stages of the project.

The selection of a suitable site for radiocommunications or broadcasting should, initially, fulfil the prime objective of the project, namely, establishing a communication link between locations, or achieving the target area coverage of the transmitted signal.

Considerations in the selection of the site include—

- (a) environmental, visual and social impact (see Section 8);
- (b) safety, including radiation safety (see Clause 3.8.1);
- (c) electromagnetic interference and electromagnetic compatibility;
- (d) availability of capacity at existing sites;
- (e) availability of power and other utilities;
- (f) ease of access;
- (g) electrical noise and interference;
- (h) proximity to airports or airfields;
- (i) likely urban development; and
- (j) economic viability.

Typically a number of candidate sites will be evaluated against the above considerations.

Consideration of environmental impact assessment criteria could prove to be a useful tool in site selection.

3.2 PROPAGATION The propagation distance for signals at VHF and UHF is essentially governed by line of sight from the antenna at the transmitting site. Therefore, the higher the antenna the greater will be the propagation distance from the facility.

For broadcasting and other wide-area radiocommunications applications Table 1 may be used as a guide to the approximate theoretical distance that can be achieved from various effective antenna heights.

To obtain the required effective antenna height, use can be made of features such as hills, ridges, towers or buildings, or combinations of these. Generally, the antenna should be mounted so that it is clear of local obstructions such as trees, buildings and hills. Tower heights usually vary from 3 m to 100 m, or more in some cases.

Obstructions such as hills or buildings may reduce the propagation distances. Although diffraction or reflection may extend the distances beyond the line of sight, the distance will be considerably less than if the obstruction is not there. For this reason, it is often necessary to increase the height of an antenna above that specified in Table 1, to ‘see’ over the obstruction, or reduce the loss associated with it. If increasing the height is impractical, then a different site may be required.

When siting a new mast or tower in close proximity to existing masts or towers, care should be taken to ensure that the new structure does not impact on the signals from existing facilities, either by attenuating the signals or by causing the signals to be reflected. Such reflections, in the case of a television service, can result in permanent ghosting of the picture for large numbers of viewers. Multistorey buildings within the area served by a radiocommunications or broadcasting facility may also have the same effect,

particularly if the external cladding of the buildings is metallic. Hence, planners of such constructions should give consideration to this effect when planning the height and orientation of the building and when selecting an external cladding material.

TABLE 1
INDICATIVE ‘RADIO HORIZON’

Effective antenna height m	‘Radio horizon’ km
10	13
50	29
200	58
500	92

NOTES:

- 1 An equation for calculating the indicative ‘radio horizon’ is shown in Appendix D.
- 2 The above Table bears no relationship to network development or planning considerations relating to point-to-point and point-to-multipoint fixed services and mobile cellular telephony networks.

3.3 INPUT SIGNALS The signal to be transmitted by most radiocommunications services needs to be delivered by some method to the site. Where land-lines are to be used for providing input signals to a site, consideration should be given to means of access, proximity of carrier line plant and the method by which such lines would be connected to the site (overhead on poles, trenched, fibreoptic cables with or without repeaters, etc.). If this input signal is to be delivered by means of radiocommunications, then, in selecting the site for the station, consideration should be given to whether this is practical. A site that could achieve the primary communications objective could be ruled out of further consideration if it is not possible or practical to obtain input signals.

Three main forms of radiocommunications can be used to input signals to a site. These are—

- (a) receiving ‘off-air’;
- (b) fixed links; and
- (c) satellite links.

The following illustrate the main siting considerations for each form of radiocommunications input:

- (i) A broadcast station may need to be sited so that an adequate signal may be picked up directly ‘off-air’ from the station originating the signal.
- (ii) A cellular base station may need to be sited so that a fixed link has clear line of sight to another base station or switching station.
- (iii) Stations using signals fed from satellites generally have fewer siting constraints. However, the view of the satellite from the station must not be obstructed by terrain, buildings or vegetation.

3.4 SITE SHARING It is desirable to consider sharing a site when the primary communications objective can be achieved. However, before a decision is made, the following should be considered:

- (a) Establishment cost.
- (b) Operating frequencies of receivers, and operating frequencies and output power levels of transmitters on the site.