Australian
Broadcasting
Authority

Technical Planning Guidelines

FOR THE PLANNING OF INDIVIDUAL SERVICES

THAT USE THE BROADCASTING SERVICES BANDS

Australian Broadcasting Authority

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FOREWORD

Section 33 of the *Broadcasting Services Act 1992* requires the Australian Broadcasting Authority (ABA) to develop in writing guidelines for the technical planning of individual services that use the broadcasting services bands as a means of delivery.

By reason of sections 108A(1)(d), 109(1)(e) and 109A(1)(f) of the *Radiocommunications Act 1992*, the licensee of a transmitter licence issued to the holder of a commercial radio or television broadcasting licence issued under Part 4 of the *Broadcasting Services Act 1992*, or a community radio or television broadcasting licence issued under Part 6 of the *Broadcasting Services Act 1992*, or the licensee of a temporary community broadcasting licence issued under Part 6A of the *Broadcasting Services Act 1992*, or the holder of a datacasting transmitter licence issued under section 100 of the *Radiocommunications Act 1992*, or any authorised person, must comply with these guidelines.[1]

Note: Transmitter licences for National Broadcasting Services issued under sections 100 or 100B or narrowcasting licences issued under section 100 of the *Radiocommunications Act 1992*, may also include a licence condition requiring compliance with specified guidelines or parts of these guidelines.

The guidelines set down procedures that must be followed and limits that must be observed by licensees when planning of new transmission facilities or making alterations to existing transmission facilities.

In the case of transmitter licences that are subject to Licence Area Plans (LAPs), by reason of section 109(1)(d) of the *Radiocommunications Act 1992*, the transmitter licence is also subject to a condition that the licensee, and any authorised person, must not operate, or permit operation of a transmitter other than in accordance with any relevant technical specifications determined by the ABA in the LAP under subsection 26(1) of the *Broadcasting Services Act 1992*.

Nothing in the application of these guidelines should compromise the integrity of the LAP.

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[1]The reference to a licence issued under Part 4 or Part 6 of the *Broadcasting Services Act 1992* includes a licence which continues in force pursuant to the provisions of section 5(1) of the *Broadcasting Services (Transitional Provisions and Consequential Amendments) Act 1992* as if the licence had been allocated under Part 4 or Part 6 of the *Broadcasting Services Act 1992*. i.e. a commercial or community licence under the *Broadcasting Act 1942*.

In the case of transmitter licences that are subject to Digital Channel Plans, the transmitter licence is also subject to a condition that the licensee, and any authorised person, must not operate, or permit operation of a transmitter other than in accordance with the relevant technical specifications determined by the ABA in the digital channel plans (DCPs) made under the *Commercial Television Conversion Scheme 1999* made under subclause 6(1) of Schedule 4 of the *Broadcasting Services Act 1992*.

Nothing in the application of these guidelines should compromise the integrity of the DCPs.

In addition to the mandatory requirements, licensees are reminded that it is their responsibility to obtain all necessary approvals for planning and environmental matters from relevant Federal, State/Territory and local government authorities.

Licensees are advised that, by the end of 2001, the Australian Communications Authority (ACA) intends to increase the current scope of the *Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard 1999* (amended 2000) to include all radiocommunications transmitters including broadcasting transmitters. Licensees are therefore advised to keep abreast of developments in the ACA's mandatory arrangements at http://www.aca.gov.au/standards/emr.htm. In the meantime, licensees may use AS/NZS *2772.1(Int):1998, Radiofrequency Radiation, Maximum exposure levels – 3 kHz to 300 GHz* to provide general guidance on this issue. This document is available from Standards Australia as an "available superseded standard".

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1. These guidelines commence on the day of their determination.

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2. These guidelines apply to broadcasting licensees and all datacasting licensees.

LICENCE AREA PLAN

3. Where they relate to analog broadcasting services these guidelines complement, and are to be read in conjunction with, the technical specifications of any relevant LAP prepared pursuant to section 26 of the *Broadcasting Service Act 1992*. To the extent that those technical specifications are inconsistent with pre-existing transmitter licence conditions, the LAP specifications will prevail.

4. The technical operating specifications of a transmitter shall comply with the technical specifications of the relevant LAP.

DIGITAL CHANNEL PLAN

4A. Where they relate to digital television broadcasting and datacasting services these guidelines complement, and are to be read in conjunction with, the technical specifications of any relevant DCP prepared pursuant to the *Commercial Television Conversion Scheme 1999* made under subclause 6(1) of Schedule 4 of the *Broadcasting Services Act 1992*.

4B. The technical operating specifications of a transmitter shall comply with the technical specifications of the relevant DCP unless those technical specifications are revised in an approved Implementation Plan, in which case the technical specifications of the approved Implementation Plan will be applied.

THE BROADCASTING SERVICES BANDS

5. The Minister, under subsection 18(3) of the *Radiocommunications Act 1983*, assigned certain parts of the radiofrequency spectrum designated as primarily for broadcasting (the broadcasting services bands) to the Australian Broadcasting Authority (ABA) for planning. Under section 4 of the *Radiocommunications (Transitional Provisions and Consequential Amendments) Act 1992* this assignment is deemed to be spectrum referred to the ABA under section 31 of the *Radiocommunications Act 1992*.

6. The broadcasting services bands are:

- 526.5 – 1606.5 kHz in the medium frequency band of the radiofrequency spectrum. AM radio services are allocated frequencies in this range.

- 45 – 52 MHz and 56 – 70 MHz (Band I) in the very high frequency band. Analog television services are allocated frequencies in this range.

- 85 – 108 MHz (Band II) in the very high frequency band. Analog television services were allocated frequencies in this range, however 87.5 – 108 MHz has been set aside, internationally, for FM radio and the ABA will consider, as part of the public planning process, future clearance of television services occupying this area. No new television services will be allocated to Band II.

- 137 – 144 MHz (channel 5A) in the very high frequency band. Analog television services were allocated frequencies in this range, however no new assignments will be made.

- 174 – 230 MHz (Band III) in the very high frequency band. Analog and digital television services are allocated frequencies in this range.

- 520 – 820 MHz (Bands IV and V) in the ultra high frequency band. Analog and digital television services are allocated frequencies in this range.

AUSTRALIAN BROADCASTING AUTHORITY PLANNING HANDBOOKS

7. Detailed advisory information about methods for planning analog broadcasting services is contained in the *Technical Planning Parameters and Methods for Terrestrial Broadcasting* which were published in 1992 by the Department of Transport and Communications, and which were reprinted as Part 2 of the ABA's *Australian Interim Broadcasting Planning Handbook.* It provides, inter alia, information on acceptable methods of computing field strengths, and other parameters for determining compliance with the guidelines and any other specifications of the transmitter licence.

7A. For digital television and datacasting services, the information in the *Technical Planning Parameters and Methods for Terrestrial Broadcasting* is supplemented by the ABA's *Digital Terrestrial Television Broadcasting Planning Handbook.*

DEFINITIONS

(Wherever possible the definition of terms given below have been made consistent with the *ITU Radio Regulations*. Unless defined hereunder, any word used shall have the meaning given to it by the *Radiocommunications Act 1992* or the *Broadcasting Services Act 1992* or the *ITU Radio Regulations* as appropriate)

8. In these guidelines, unless the contrary intention appears:

'ABA' means the Australian Broadcasting Authority established under section 154 of the *Broadcasting Services Act 1992*;

'ACA' means the Australian Communications Authority established under the *Australian Communications Authority Act 1997*;

'AM radio' means medium frequency, amplitude modulated radio services located in the frequency range 526.5 – 1606.5 kHz, with each channel designated by its nominal carrier frequency and with 120 AM channels being spaced at 9 kHz intervals in the range 531 kHz to 1602 kHz inclusive;

'analog reference television receiving system' see definition contained under 'reference television receiving system';

'analog television' means television services using analog modulation techniques located in the frequency ranges 45 MHz to 230 MHz and 520 MHz to 820 MHz ;

'analog television service' includes an analog television broadcasting service, an analog national television broadcasting service, and an analog television narrowcasting service;

'authorised person' means a person authorised under Division 4 of Part 3.3 of the *Radiocommunications Act 1992*;

'broadcasting licensee' means any holder of an apparatus licence issued under section 101A, 102 or 102A of the *Radiocommunications Act 1992*;

'broadcasting service' means a service that delivers television programs or radio programs in the broadcasting services bands, using a transmitter licence issued under section 101A, 102 or 102A of the *Radiocommunications Act* 1992;

'Broadcasting Services Bands' has the meaning set out in clause 6 of these guidelines;

'channel' means a band of frequencies for the transmission and reception of electromagnetic signals over a specified path;

'CMF' means cymomotive force which is the product formed by multiplying the electric field strength at a given point in space, due to a transmitting station, by the distance of the point from the antenna. CMF can only be calculated if the distance from the transmitting antenna is sufficient for reactive effects to be negligible; moreover, the finite conductivity of the ground is presumed to have no effect on propagation. CMF is expressed in volts and corresponds numerically to the field strength, in mV/m, at a distance of 1 km;

'datacasting licensee' means any holder of a datacasting transmitter licence;

'datacasting service' has the meaning given in subsection 6(1) of the *Broadcasting Services Act 1992*, where it uses a datacasting transmitter licence issued under the *Radiocommunications Act* 1992;

'datacasting service area' means the geographical area in which the ABA has made available a channel for use by a datacasting service, as described in the relevant determination made under section 34 of the *Broadcasting Services Act 1992;*

'device' has the meaning given to it in section 9(1) of the *Radiocommunications Act* 1992;

'Digital Channel Plan or DCP" means an instrument, developed by the ABA under the *Commercial Television Conversion Scheme 1999* made under subclause 6(1) of Schedule 4 of the *Broadcasting Services Act 1992* that determines which channels are to be allotted in each area, the technical limitations and characteristics of those channels, and the channel assignments - either to broadcasters or as "unassigned" channels;

'digital reference television receiving system' see definition contained under 'reference television receiving system';

'digital television' means television services using digital modulation techniques located in the frequency ranges 174 MHz to 230 MHz and 520 MHz to 820 MHz;

'digital television service' includes a digital television broadcasting service and a digital national television broadcasting service;

'effective radiative power (ERP)' (in a given direction) is the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction;

'EMC calculations' refer to calculations that detail the ability of a transmitter to operate without causing interference to another radiocommunications service. EMC calculations must take into account possible interference occurrences due to intermodulation, harmonic products, local oscillator radiation and co-channel and adjacent channel services;

Note Radiocommunications services include inter alia, broadcasting services, national broadcasting services and datacasting services.

'FM radio' means very high frequency, frequency modulated radio services located in the frequency range 87.5 MHz to 108 MHz;

Note Each channel is designated by its nominal carrier frequency and channels are spaced at intervals of 200 kHz from 87.7 MHz up to and including 107.9 MHz. The channel includes, where necessary, a carrier frequency offset of ±100 kHz specified by the ABA in order to optimise channel allotments.

'guidelines' means these technical planning guidelines developed by the ABA pursuant to section 33 of the *Broadcasting Services Act 1992*;

'implementation plan' means one or more plans related to the implementation of digital television transmission under clause 9 of Schedule 4 of the *Broadcasting Services Act 1992;*

'interference' means: (i) in relation to radiocommunications - interference to, or with, radiocommunications that is attributable, whether wholly or partly and whether directly or indirectly, to an emission of electromagnetic energy by a device; or (ii) in relation to the uses or functions of devices - interference to, or with, those uses or functions that is attributable, whether wholly or partly and whether directly or indirectly, to an emission of electromagnetic energy by a device;

Note Further clarifications on the level of interference that may be allowed to analog or digital television or datacasting services is given in parts 5 and 6 of this document.

'licence area' means an area designated by the ABA under section 29 or 40 of the *Broadcasting Services Act 1992*;

Note For the purpose of the guidelines, the licence area for national broadcasting services, unless otherwise stated in the a LAP or DCP, is assumed to be equivalent to the signal reception area: within the 0.5 mV/m ground wave contour for AM radio services; within the 54 dBμV/m contour for FM radio services; and within the corresponding field strength contour as defined by Table 5.1 for analog television services or Table 6.1 for digital television services.

'licence area plan or LAP' means a licence area plan prepared by the ABA pursuant to section 26 of the *Broadcasting Services Act 1992*;

'licensee' means either a 'broadcasting licensee' or a 'datacasting licensee';

'low power narrowcasting service' means an open or subscription narrowcasting service under section 17 or 18 of the *Broadcasting Services Act 1992* with effective radiated power not exceeding 1 watt (W) in a residential area and effective radiated power not exceeding 10 W in a non-residential area;

'national broadcasting service' means an AM or FM radio or analog or digital television broadcasting service provided by the Australian Broadcasting Corporation or the Special Broadcasting Service Corporation;

'nominal site' means the site specified as the nominal site in a LAP or DCP;

'reference television receiving system' means a television receiving system comprising a receiver and an antenna system. For analog television systems the reference television receiver is defined in Attachment 5C.BB of *Technical Planning Parameters and Methods for Terrestrial Broadcasting.* For digital television systems the reference television receiver is defined in Attachments B and D of the ABA's *Digital Terrestrial Television Broadcasting Planning Handbook* and is supplemented by data on antenna directivity discrimination and orthogonal wave polarisation discrimination from Attachment 5C.BB of *Technical Planning Parameters and Methods for Terrestrial Broadcasting;*

'related licence' means the licence allocated or deemed to have been allocated under Part 4, Part 6 or Part 6A of the *Broadcasting Services Act 1992* to which the transmitter licence issued pursuant to section 101A, 102 or 102A of the *Radiocommunications Act 1992* relates;

'residential area' means an area designated as a locality or urban centre in the *Census Dictionary 1996* prepared by the Australian Bureau of Statistics;

‘single frequency network (SFN)’ means a network comprising two or more transmitters that operate on the same frequency and transmit identical data streams with controlled timing between the transmitters;

‘technical operating specifications’ of a transmitter include all the characteristics of the transmitter in operation, including site, height of transmitting antenna, ERP, frequency, and radiation pattern;

‘transmitter’ means anything designed or intended for radio emission or any other things, irrespective of its use or function or the purpose of its design, that is capable of radio emission. In the AM radio part of this document, it refers to a transmitter authorised to transmit an AM radio service. In the FM radio part of this document, it refers to a transmitter authorised to transmit a FM radio service. In the analog television part of this document, it refers to a transmitter authorised to transmit an analog television service. In the digital television part of this document, it refers to a transmitter authorised to transmit a digital television or datacasting service;

‘unwanted’, in the context of an unwanted signal or unwanted service, means the signal or service that may cause interference under the specified circumstances or conditions;

‘urban centre’ means a population cluster of 1000 or more people. Each urban centre is bounded (i.e. a boundary for it is clearly defined) and composed of one or more whole collection districts (CDs);

‘wanted’, in the context of a wanted signal or wanted service, means the signal or service that may experience, or suffer from, interference under the specified circumstances or conditions.

9. All field strength predictions and measurements are to be assumed to be made at a height of 10 metres above ground at the measurement location. Any specified field strength shall be predicted on the basis that the field strength would be exceeded at more than 50% of locations for more than 50% of the time.

10. Headings in these guidelines are for convenient reference only and have no effect in limiting or extending the language of the guidelines to which they refer;

11. Words in the singular number include the plural and words in the plural number include the singular.

PART 1: START UP PROCEDURE

12. The following procedure shall be followed by a licensee (except a licensee to which part 7 applies) or any authorised person when:

(a) planning to establish a transmitter to transmit a broadcasting service or datacasting service;

(b) planning to change the technical operating specifications of a transmitter which is authorised for transmitting a broadcasting service or datacasting service (other than a change of transmission site– see Part 2 Change of Transmission Site Procedure);

13. The procedure is as follows:

(a) A licensee or any authorised person is required to place advertisements in newspapers circulating within the licence area of the licence at least seven days prior to the commencement of test transmissions. The advertisement should state that members of the public should contact the licensee or authorised person if the broadcast causes interference to other radiocommunications. The advertisement must detail the date and time of the test transmissions, the frequency being used and the appropriate person's contact details including the address and telephone number of the person responsible for the tests.

(b) A licensee or any authorised person shall advise:

i) the ABA; and

ii) the local ACA office; and

iii) other broadcasting licensees and national broadcasting licensees that provide services within the licence area or datacasting service area; and

iv) datacasting licensees that provide services within the licence area or datacasting service area, and,

v) other broadcasting licensees and national broadcasting licensees that provide services within adjacent licence areas or adjacent datacasting service areas; and

vi) datacasting licensees that provide services within adjacent licence areas or adjacent datacasting service areas,

of the date and proposed technical operating specifications of the test transmissions at least seven days prior to the commencement of test transmissions and provide contact details including the address and telephone numbers of the person responsible for the tests.

(c) Test transmissions shall include regular voice announcements, or, in the case of an analog television broadcasting service, voice or visual information, identifying the licensee or any authorised person and providing sufficient details for members of the public to contact the licensee or person if the broadcast causes interference to other radiocommunications.

(d) A licensee or any authorised person shall undertake test transmissions in accordance with this procedure for a period of at least seven (7) days.

(e) The licensee shall, for a period of at least seven (7) days, conduct test transmissions in accordance with the technical operating specifications that the licensee intends to apply to the transmissions after the test procedure is complete.

(f) The licensee or any authorised person is required to undertake any necessary further planning so as to eliminate or minimise interference identified during the test transmissions.

Note In all cases, a licensee or any person so authorised shall also comply with the condition of the transmitter licence to adjust, or fit devices to, receivers in order to eliminate or minimise the interference.

(g) All interference caused by the transmissions in guideline 13(e) should be eliminated or minimised before the test transmission procedure is completed.

(h) Interference assessment reports and documentation of any relevant calculations are to be made available on request to the ABA or the ACA. Information on interference assessment investigations shall also be provided on request to any person claiming to be adversely affected due to interference as a result of the operation of the licensee's transmitter during the period of the test transmissions.

PART 2: CHANGE OF TRANSMITTER SITE PROCEDURE

14. The following procedure shall be followed by a licensee or any authorised person when proposing to locate a transmitter at a site which is not at the current location or the nominal location described in the technical specifications, or is to be located at a site not included in the technical specifications, of a LAP or DCP (or an approved implementation plan).

15. The procedure is as follows:

(a) the licensee or an authorised person shall cause appropriate electromagnetic compatibility (EMC) calculations to be performed by a person competent to carry out such calculations;

Note For services described in a LAP or DCP that have not commenced transmission, calculations should be performed assuming that the transmitter is sited at the nominal location with maximum ERP specifications as set out in the LAP or DCP.

(b) the licensee or an authorised person shall then provide to the ABA the EMC calculations together with a completed application for a test transmission licence;

Note The conditions attaching to this licence will be substantially similar to the guidelines for Start Up Procedure (see part 1 of these Guidelines).

(c) if the ABA is satisfied that:

(i) the EMC calculations indicate that operation from the alternate site will not cause interference to radiocommunications services, including any existing broadcasting services, national broadcasting services or datacasting services or any service described in a LAP or DCP and;

(ii) the relevant guidelines will be sufficiently complied with

then the ABA will allocate a test transmission licence;

(d) the licensee or an authorised person may then conduct test transmissions in accordance with the terms of the test transmission licence;

(e) the licensee or an authorised person shall then provide to the ABA the results of the test transmissions including any interference assessment reports and details of any complaints of interference received during the conduct of the tests together with a completed application form seeking a variation of the broadcasting service licence, national broadcasting service licence or datacasting transmitter licence;

(f) if the ABA is satisfied that:

(i) the results of the tests demonstrate that operation from the alternative site will not cause interference to radiocommunications services including any existing broadcasting, national broadcasting or datacasting service or any service described in a LAP or DCP and;

(ii) all other relevant guidelines will be complied with upon commencement of transmissions from the new site

then the ABA or the ACA will vary the conditions attaching to the transmitter licence.

16. Interference assessment reports and documentation of any relevant EMC calculations are to be made available on request to the ABA or the ACA. Information on interference assessment investigations shall also be provided on request to any person claiming to be adversely affected due to interference as a result of the operation of the licensee's transmitter during the period of the test transmissions.

PART 3: AM RADIO

APPLICATION

17. This part of the guidelines applies to all licensees or any authorised person who intends to change a technical operating specification of an AM radio broadcasting service occupying 526.5 – 1606.5 kHz in the radiofrequency spectrum.

LOCATION OF TRANSMITTER SITE

18. The transmitter site shall be within the licence area of the related licence, unless otherwise stated in the technical specifications of the relevant LAP.

CYMOMOTIVE FORCE (CMF)

19. Regardless of the location of the transmitter site, the CMF in any direction shall not exceed that specified in the LAP.

20. If no LAP has yet been determined, the CMF of a transmission shall not exceed that specified in the technical conditions of the licence.

Note This guideline does not preclude a person seeking a variation of the relevant licence condition.

MINIMUM LEVEL OF SERVICE REQUIREMENTS

21. Persons operating transmitters at the nominal location are required to provide a minimum level of service within the licence area of the related licence by operating at a minimum CMF no more than 5 dB below the specified maximum CMF for the specific service towards any urban centre in the licence area of the related licence. For a directional radiation pattern, the CMF is to be within 5 dB below the specified maximum CMF for at least 60 per cent of each specified arc.

22. Transmitters operating from a site other than the nominal location shall at least provide a minimum level of service to those urban centres in the licence area of the related licence that would have received a service from a transmitter operating from the nominal location at the above mentioned minimum CMF requirements.

Note: The requirement to operate at a CMF within 5 dB of the specified maximum CMF only applies to transmissions from the nominal location. The CMF of transmissions from a site other than the nominal location shall be appropriately chosen so as to meet the minimum level of service requirements as specified by guideline 23 while still conforming to guidelines 19 and 20 by not exceeding the maximum specified CMF limits.

23. Unless otherwise stated in the LAP, the minimum level of service in any urban centre is achieved if the received median ground wave field strength is at least 54 dBμV/m.

MAXIMUM FIELD STRENGTH WITHIN THE LICENCE AREA

24. Within the licence area, a transmitter shall be located so that not more than 1 per cent of the total population of the licence area resides in an area which has a field strength greater than 1000 mV/m.

MAXIMUM FIELD STRENGTH BEYOND THE LICENCE AREA

25. Unless otherwise specified in the LAP, the median ground wave field strength of the transmission in any urban centre beyond the licence area boundary, shall not exceed 2.5 mV/m during day or night time.

26. If no LAP has yet been determined and the median ground wave field strength of the transmission in any urban centre beyond the licence area boundary already exceeds 2.5 mV/m, that field strength shall not exceed the level it was at 10 August 1995.

INTERFERENCE TO OTHER SERVICES

27. A licensee shall not cause interference to another broadcasting service.

28. A licensee shall not cause interference to another radiocommunications service.

29. Licensees shall comply with the maximum CMF limits specified in the LAP to limit interference caused by sky wave propagation to other AM broadcasting services.

Note The ABA is obliged to plan for AM broadcasting services in accordance with the requirements of the *Final Acts of the Regional Administrative LF/MF Broadcasting Conference 1975*. Additional or alternative requirements considered appropriate by the ABA in planning of AM broadcasting services will be reflected in the LAP.

30. A licensee or any authorised person, shall, in consultation with affected parties, resolve complaints of interference, which occur within its 1000 mV/m field strength contour.

RADIATED SIGNAL CHARACTERISTICS

31. Radiated signal characteristics shall comply with the *Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service* (see Appendix 1).

PART 4: FM RADIO

APPLICATION

32. This part of the guidelines applies to all licensees or any authorised person who intends to change a technical operating specification of a FM radio broadcasting service occupying 85 – 108 MHz in the radiofrequency spectrum.

LOCATION OF TRANSMITTER SITE

33. The transmitter site shall be within the licence area of the related licence, unless otherwise stated in the technical specifications of the relevant LAP.

REQUIRED FIELD STRENGTH BETWEEN ADJACENT FREQUENCIES

34. The licensee shall ensure that if a transmitter is not located at the nominal location and is authorised to transmit on a frequency that is separated by 800 kHz from another frequency authorised for use by another transmitter located at the nominal location, then unless otherwise specified in the LAP, the actual or anticipated difference in received field strength between the two services, shall be less than 24 dB in any residential area that is within the licence area of either service.

35. If no LAP has yet been determined and the difference in received field strength between the actual two services, is more than 24 dB in any residential area that is within the licence area of either service, that difference in field strength shall not exceed the difference in received field strength it was at 10 August 1995.

EFFECTIVE RADIATED POWER

36. Regardless of the location of the transmitter site, the ERP of a transmission shall not exceed that specified in the LAP.

37. If no LAP has yet been determined, the ERP of an existing transmission shall not exceed that specified in the technical conditions of the licence.

Note This guideline does not preclude a person seeking a variation of the relevant licence condition.

MINIMUM LEVEL OF SERVICE REQUIREMENTS

38. Persons operating transmitters sited at the nominal location, except for those transmitters operated pursuant to transmitter licences issued under a community broadcasting licence or temporary community broadcasting licence (TCBL), are required to provide a minimum level of service within the licence area of the related licence by operating at a minimum ERP of 5 dB below the specified maximum ERP for the specific service towards any urban centre in the licence area of the related licence. For a directional radiation pattern, the ERP is to be no more than 5 dB below the specified maximum ERP for at least 60 per cent of each specified arc.

39. Transmitters operating from a site other than the nominal location shall provide a minimum level of service to those urban centres in the licence area of the related licence that would have received a service from a transmitter operating from the nominal location at the above mentioned minimum ERP requirements.

Note The requirement to operate at an ERP within 5 dB of the specified maximum ERP only applies to transmissions from the nominal location. The ERP of transmissions from a site other than the nominal location shall be appropriately chosen so as to meet the minimum level of service requirements as specified by guideline 40 while still conforming to guidelines 36 and 37 by not exceeding the maximum specified ERP limits.

40. Unless otherwise stated in the LAP, the minimum level of service in any urban centre is achieved if the received median field strength is at least 54 dBμV/m.

40A. Unless otherwise specified in the LAP or transmitter licence conditions, persons operating transmitters issued pursuant to a community broadcasting licence or temporary community broadcasting licence (TCBL) are required to provide a minimum level of service within the licence area of the related licence by operating at an ERP of no more than 5 dB below the specified maximum level of ERP for the specific service towards any urban centre in the licence area of the related licence.

MAXIMUM ANTENNA HEIGHT

41. If a licensee sites a transmitter at the nominal location described in the technical specifications of the LAP, the licensee shall ensure that the height above ground to the electrical centre of the transmitting antenna does not exceed the maximum height specified in the LAP.

Note The LAP specifies the maximum antenna height above ground at the nominal location. To calculate the equivalent maximum antenna height above Australian Height Datum, the maximum antenna height specified in the LAP needs to be added to the height above Australian Height Datum of the nominal location.

42. If no LAP has yet been determined, the maximum height shall not exceed that specified in the technical conditions of the licence.

Note This guideline does not preclude a person seeking a variation of the relevant licence condition.

43. If a licensee sites a transmitter at a location other than the nominal location described in the technical specifications of the LAP, the licensee shall ensure that the height of the

electrical centre of the transmitting antenna above Australian Height Datum at the new location does not exceed the maximum height of the electrical centre of the transmitting antenna above Australian Height Datum at the nominal location permitted by the LAP.

MAXIMUM FIELD STRENGTH WITHIN THE LICENCE AREA

44. Within the licence area, a transmitter shall be located so that not more than 1 per cent of the total population of the licence area resides in an area which has a field strength greater than 110 dBμV/m.

45. A transmitter shall not be sited so that a significant part of the population to be served receives a field strength of more than 120 dBμV/m (1 V/m). One tenth of one per cent (0.1 per cent) of the population, or 100 persons, whichever is less, constitutes a 'significant part'.

MAXIMUM FIELD STRENGTH BEYOND THE LICENCE AREA

46. Unless otherwise specified in the LAP, the median field strength of the transmission in any urban centre beyond the licence area boundary, shall not exceed 54 dBμV/m.

47. If no LAP has yet been determined and the median field strength of the transmission in any urban centre beyond the licence area boundary exceeds 54 dBμV/m the level of that field strength shall not exceed its existing level.

INTERFERENCE TO OTHER SERVICES

48. A licensee shall not cause interference to another broadcasting service.

49. A licensee shall not cause interference to another radiocommunications service**.**

50. Unless otherwise specified, the LAP should provide protection against interference from other broadcasting services so long as the minimum level of median field strength of an FM service in its licence area is at least 54 dBμV/m.

RADIATED SIGNAL CHARACTERISTICS

51. Radiated signal characteristics of a transmitter shall comply with the *Emission Standard for the Australian Frequency Modulation Sound Broadcasting Service* (see Appendix 2).

SUB-CARRIER SIGNALS

52. Information supplementary to the main sound broadcasting program of an FM radio broadcast service may be transmitted on sub-carriers located above the *M* (mono) and *S* (stereo) signals. Standards relating to sub-carrier signal characteristics are specified in Appendix 2.

PART 5: ANALOG TELEVISION

APPLICATION

53. This part of the guidelines applies to all licensees or any authorised person who intends to implement, or change a technical operating specification of, an analog television broadcasting service occupying any channels in the 45 – 52 MHz, 56 – 70 MHz, 85 - 108 MHz, 137 – 144 MHz, 174 - 230 MHz, or 520 – 820 MHz bands in the radiofrequency spectrum.

LOCATION OF TRANSMITTER SITE

54. The transmitter site shall be located within the licence area of the related licence, unless otherwise stated in the technical specifications of the LAP.

Note The transmitter should desirably be located so that, for a particular broadcasting band, viewers within population centres of the licence area of the service are able to receive all television services licensed to serve that area by means of a single outdoor antenna.

EFFECTIVE RADIATED POWER

56. Regardless of the location of the transmitter site, the ERP of a transmission shall not exceed that specified for the service in the LAP.

57. If no LAP has yet been determined, the ERP of a transmission shall not exceed that specified in the technical conditions of the licence.

Note This guideline does not preclude a person seeking a variation of the relevant licence condition.

MINIMUM LEVEL OF SERVICE REQUIREMENTS

58. Persons operating transmitters sited at the nominal location are required to provide a minimum level of service within the licence area of the related licence by operating at an ERP no more than 5 dB below the specified maximum ERP for the specific service towards any urban centre in the licence area of the related licence. For a directional radiation pattern, the ERP is to be no more than 5 dB below the specified maximum ERP for at least 60 per cent of each specified arc.

59. Transmitters operating from a site other than the nominal location shall at least provide a minimum level of service to those urban centres in the licence area of the related

licence that would have received a service from a transmitter operating from the nominal location at the above-mentioned minimum ERP requirements.

Note The requirement to operate at an ERP within 5 dB of the specified maximum ERP only applies to transmissions from the nominal location. The ERP of transmissions from a site other than the nominal location shall be appropriately chosen so as to meet the minimum level of service requirements as specified by guideline 60 while still conforming to guidelines 56 and 57 by not exceeding the maximum specified ERP limits.

60. Unless otherwise stated in the LAP, the minimum level of service in any urban centre is achieved if the received median field strength is in accordance with field strength figures set out in Table 5.1.

Table 5.1: Minimum Median Field Strength Figures for Analog Television Planning

(50% of locations, 50% of the time, measured at 10 metres above ground level – see guideline 9)

TV Transmission Band	*Frequency Range (MHz)*	*Field Strength (dBµV/m)*
I	45 - 70	50
II	85 - 108	50
III	137 - 230	50
IV	520 - 582	62
V	582 - 820	67

MAXIMUM ANTENNA HEIGHT

61. If a licensee sites a transmitter at the nominal location described in the technical specifications of the LAP, the licensee shall ensure that the height of the electrical centre of the transmitting antenna above ground does not exceed the maximum height specified in the LAP.

Note The LAP specifies the maximum antenna height above ground at the nominal location. To calculate the equivalent maximum antenna height above Australian Height Datum, the maximum antenna height specified in the LAP needs to be added to the height above Australian Height Datum of the nominal location.

62. If no LAP has yet been determined, the maximum height of the electrical centre of the antenna above ground shall not exceed that specified in the technical conditions of the licence.

Note This guideline does not preclude a person seeking a variation of the relevant licence condition.

63. If a licensee sites a transmitter at a location other than the nominal location described in the technical specifications of the LAP, the licensee shall ensure that the height of the electrical centre of the transmitting antenna above Australian Height Datum at the new location does not exceed the permitted maximum height of the electrical centre of the

transmitting antenna above Australian Height Datum at the nominal location permitted by the LAP.

MAXIMUM FIELD STRENGTH WITHIN THE LICENCE AREA

64. Within the licence area, a transmitter shall be located so that not more than 1 per cent of the total population receiving at least the minimum median field strength value indicated in Table 5.1 resides in an area which has a field strength greater than 110 dBμV/m.

Note The height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with this guideline.

65. A transmitter shall not be sited so that a significant part of the population receiving at least the minimum median field strength value indicated in Table 5.1 receives a field strength of more than 120 dBμV/m (1 V/m). One tenth of one per cent (0.1 per cent) of the population, or 100 persons, whichever is less, constitutes a 'significant part'.

Note The height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with this guideline.

MAXIMUM FIELD STRENGTH BEYOND THE LICENCE AREA

66. Unless otherwise specified in the relevant LAP, the median field strength of the transmission in any urban centre beyond the licence area boundary, shall not exceed the corresponding field strength figure set out in Table 5.1.

67. If no LAP has yet been determined and the median field strength of the transmission in any urban centre beyond the licence area boundary exceeds the corresponding field strength figure set out in Table 5.1, the level of that field strength shall not exceed the existing level.

INTERFERENCE TO OTHER SERVICES

68. A licensee of an analog television service shall not cause unacceptable interference to another analog television services that is:

operating within the terms of the relevant LAP or transmitter licence conditions, or national broadcasting service transmitter licence conditions, as appropriate; and

a) being received within its licence area; and

b) being received with field strengths in compliance with, or greater than, field strengths specified in Table 5.1.

68A For the purpose of application of guideline 68, it is assumed that analog television services are being received using a television receiving system that has equivalent

performance to the analog reference television receiving system. Where receiving systems are employed which have inferior performance to that of the analog reference television receiving system, or where their performance exceeds the performance of the analog reference television receiving system in ways that make them more sensitive to interference, interference protection will only be afforded to the level provided by the analog reference television receiving system.

68B. For the purpose of application of guideline 68, "unacceptable interference" means degradation in the ratio of wanted to unwanted signals at the receiver input terminals of an analog reference television receiving system of 2 dB or more due to the unwanted service, where the resulting ratio of wanted to unwanted signals is 40 dB or lower.

68C. A licensee of an analog television broadcasting service shall not cause unacceptable interference to a digital television service or a datacasting service that:

a) commenced operation prior to that analog service; and

b) is operating within the terms of the relevant DCP (or approved implementation plan) or datacasting transmitter licence, as appropriate; and

c) is being received within its licence area or datacasting service area, as applicable; and

d) is being received with field strengths in compliance with, or greater than, field strengths specified in Table 6.1.

68D. For the purpose of application of guideline 68C, it is assumed that digital television services or datacasting services are being received using a television receiving system that has equivalent performance to the digital reference television receiving system. Where receiving systems are employed which have inferior performance to that of the digital reference television receiving system, or where their performance exceeds the performance of the digital reference television receiving system in ways that make them more sensitive to interference, interference protection will only be afforded to the level provided by the digital reference television receiving system.

68E. For the purpose of application of guideline 68C, "unacceptable interference" means degradation in the ratio of the wanted to unwanted signals at the receiver input terminals of a digital reference television receiving system of 1 dB or more due to the unwanted service, where the resulting ratio of wanted to unwanted signals is 3 dB or lower.

69. In addition to the conditions of guidelines 68 to 68E (which relate to analog television services and digital television services), a licensee shall not cause interference to any other radiocommunications service that is operating within the conditions of its licence.

70. Unless otherwise specified, the LAP and DCPs will provide protection against interference from other broadcasting services, national broadcasting services, or datacasting services as long as the minimum level of median field strength of the analog television service in its licence area is at least at the level set out in Table 5.1.

70A. Where the same set of services can be received from more than one transmission site with signal levels above the minimum levels given in Table 5.1, these guidelines shall ensure that the reception of at least one of the sets of services, but not necessarily all of the sets of the same services, is protected against interference from the unwanted service. Similarly, where multiple transmissions of the same service can be received from a single transmission site with signal levels above the minimum levels given in Table 5.1, these guidelines shall ensure that the reception of at least a UHF transmission is protected against interference from the unwanted service.

RADIATED SIGNAL CHARACTERISTICS

71. Radiated signal characteristics of a transmitter shall comply with the *Emission Standard for the Australian Terrestrial Television Services* (see Appendix 3).

PART 6: DIGITAL TELEVISION

APPLICATION

72. This part of the guidelines applies to all licensees or any authorised person who intends to implement, or change the technical operating specification of, a digital television broadcasting service or datacasting service occupying any channels in the 174 - 230 MHz, or 520 – 820 MHz bands of the radiofrequency spectrum.

LOCATION OF TRANSMITTER SITE

73. The transmitter site shall be located within the licence area of the related licence, or the datacasting service area for a datacasting service, unless otherwise stated in the technical specifications of the DCP (or approved implementation plans).

Note The transmitter should desirably be located so that, for a particular broadcasting band, viewers within population centres of the licence area of the service are able to receive all television services licensed to serve that area by means of a single outdoor antenna.

EFFECTIVE RADIATED POWER

74. If a licensee locates a transmitter intended to serve a particular area at a site other than the site specified to serve that area in a DCP, the ERP of the transmission from the alternative site shall not be greater than that specified for the nominal site in the DCP.

Note 1 This guideline does not preclude a licensee from making an application to vary a DCP where operation at higher ERP levels is required.

Note 2 Guidelines 93 and 94 deal with situations where licensees propose to operate transmitters additional to those included in a DCP.

MINIMUM LEVEL OF SERVICE REQUIREMENTS

75. Under the policy objectives given in 6(3) (f) of Schedule 4 of the *Broadcasting Services Act 1992*, ".. as soon as is practicable after the start of the simulcast period for a licence area, and throughout the remainder of that period, the transmission of a commercial television broadcasting service in SDTV digital mode in that area should achieve the same level of coverage and potential reception quality as is achieved by the transmission of that service in analog mode in that area". The DCPs provide the ERP levels expected to meet this objective, and where applicable, any ERP restrictions that need to be applied to protect specified analog television services from interference.

Note Clause 6(1)(f) of Schedule 4 to the Broadcasting Services Act 1992 contains an objective that the transmission of a commercial television broadcasting service in digital mode should achieve the same level of coverage and potential reception quality as achieved by that service in analog mode. The Broadcasting

Services Amendment (Digital Television and Datacasting) Act 2000 amends clause 6(1)(f) by deleting the words "digital mode" and substituting the words "SDTV digital mode". The amendment is due to take effect on, or before, 3 February 2001.

76. After the simulcast period mentioned in guideline 75, transmitters providing digital television broadcasting services (i.e. not datacasting services) which operate from a site, or sites, other than the nominal location(s) specified in the DCP shall at least provide a minimum level of service to those urban centres in the licence area of the related licence that would have received a service from a transmitter (or transmitters) operating from the nominal location(s).

77. After the simulcast period mentioned in guideline 75, the minimum level of service to be provided by a digital television broadcasting licensee in any urban centre is achieved if the received median field strength is in accordance with field strength figures set out in Table 6.1.

Note No 'minimum level of service' requirements are applicable to datacasting services. However, protection of the datacasting service against interference from other services will only be provided on the basis that the datacasting service provides the minimum levels of service defined in Table 6.1 (see guideline 82).

78. In applying guidelines 75, 76 and 77, changes to sites or operating parameters of transmitters after the simulcast period should not cause a reduction in the level of service that was being provided during the simulcast period.

Table 6.1: Minimum Median Field Strength Figures for Digital Television Planning

(50% of locations, 50% of the time, measured at 10 metres above ground level – see guideline 9)

TV Transmission Band	*Frequency Range (MHz)*	*Field Strength (dBµV/m)*
III	174- 230	44
IV	520 - 582	50
V	582 - 820	54

MAXIMUM FIELD STRENGTH WITHIN THE LICENCE AREA

79. A transmitter shall be located so that not more than 1 per cent of the total population receiving at least the minimum median field strength value indicated in Table 6.1 resides in an area which has a field strength greater than 110 dBµV/m.

Note The height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with this guideline.

80. A transmitter shall not be sited so that a significant part of the population receiving at least the minimum median field strength value indicated in Table 6.1 receives a field strength of more than 120 dBµV/m (1 V/m). One tenth of one per cent (0.1 per cent) of the population, or 100 persons, whichever is less, constitutes a 'significant part'.

Note The height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with this guideline.

MAXIMUM FIELD STRENGTH BEYOND THE LICENCE AREA

81. Unless otherwise specified in the relevant DCP (or approved implementation plan) or datacasting transmitter licence, the median field strength of the transmission in any urban centre beyond the licence area boundary, or datacasting service area boundary, shall not exceed the corresponding field strength figure set out in Table 6.1.

INTERFERENCE TO OTHER SERVICES: GENERAL CONDITIONS

82. Unless otherwise specified, the DCP should provide digital television services or datacasting services with protection against interference from other analog television services, digital television services and datacasting services as long as the minimum level of median field strength of a digital television service in its licence area, or datacasting service in its datacasting service area, is at least at the level set out in Table 6.1 and the service in question is operated in accordance with the technical specifications in the DCP.

83. Digital television broadcasting services or datacasting services shall not cause unacceptable interference to analog television services that are:

a) operating within the terms of the relevant LAP or transmitter licence conditions, or national broadcasting service transmitter licence conditions, as appropriate; and

b) being received within its licence area; and

c) being received with field strengths in compliance with, or greater than, field strengths specified Table 5.1.

84. For the purpose of application of guideline 83, it is assumed that analog television services are being received using a television receiving system that has equivalent performance to the analog reference television receiving system. Where receiving systems are employed which have inferior performance to that of the analog reference television receiving system, or where their performance exceeds the performance of the analog reference television receiving system in ways that make them more sensitive to interference, interference protection will only be afforded to the level provided by the analog reference television receiving system.

85. For the purpose of application of guideline 83 with respect to co-channel interference, “unacceptable interference” means degradation in the ratio of the wanted to unwanted signals at the receiver input terminals of an analog reference television receiving system of 2 dB or more due to the unwanted service, where the resulting ratio of wanted to unwanted signals is 41 dB or lower.

86. Where the same service can be received from more than one transmission site with signal levels above the minimum levels given in Table 5.1, these guidelines shall only be applied to protect one of the signals against interference from unwanted services.

87. Digital television broadcasting services or datacasting services shall not cause unacceptable interference to other digital television services or datacasting services that are:

a) operating within the terms of the relevant DCP (or approved implementation plan) or datacasting transmitter licence, as appropriate; and

b) being received within its licence area, or datacasting licence area, as appropriate; and

c) being received with field strengths in compliance with, or greater than, field strengths specified Table 6.1.

88. For the purpose of application of guideline 87, it is assumed that digital television services or datacasting services are being received using a television receiving system that has equivalent performance to the digital reference television receiving system. Where receiving systems are employed which have inferior performance to that of the digital reference television receiving system, or where their performance exceeds the performance of the digital reference television receiving system in ways that make them more sensitive to interference, interference protection will only be afforded to the level provided by the digital reference television receiving system.

89. For the purpose of application of guideline 87, "unacceptable interference" means degradation in the carrier-to-noise-plus-interference ratio at the receiver input terminals of a digital reference television receiving system of 1 dB or more due to the unwanted service, where the resulting co-channel carrier-to-noise-plus-interference ratio is 20 dB or lower.

90. Where the same service can be received from more than one transmission site with signal levels above the minimum levels given in Table 6.1, these guidelines shall ensure that the reception of at least one of the signals is protected against interference from unwanted services (see also guideline 100).

91. In addition to the conditions of guidelines 83 to 90, digital television broadcasting services or datacasting services shall not cause interference to any other radiocommunications services operating within the conditions of their licences.

SINGLE FREQUENCY NETWORKS AND ADDITIONAL CO-CHANNEL TRANSMITTERS

Note 1 The ABA's planning responsibility is limited to determining channels, nominal transmitter sites and radiation pattern envelope ERP specifications. Detailed design and implementation of SFNs is the responsibility of licensees. The ABA does not determine the detailed design and implementation of SFNs in terms of relative ERP levels and the relative timing relationships between signals from each of the transmitters within the SFN.

Note 2 Through its DCPs the ABA has defined a set of channels, transmission sites and radiation pattern envelope ERP specifications that will permit digital television and datacasting services to be provided. Where digital television or datacasting licensees propose to deploy additional transmitters on the same channel as an existing channel allotment within a DCP (i.e. transmitters in addition to those shown in the technical specifications associated with the DCP) they will be responsible to: ensure that these guidelines, which *inter alia* deal with interference to other services, are complied with; and, to design and site the additional transmitters to avoid co-channel or adjacent channel interference from other services within the intended coverage area of the additional transmitter.

92. Licensees of digital television broadcasting services or datacasting services may configure co-frequency transmitters whose technical specifications are included in a DCP, into an SFN. However, licensees are responsible for the detailed implementation and management of internal self-interference within the SFN.

93. Licensees of datacasting services are permitted to add additional digital transmitters within their datacasting service area on the same channel as their existing channel allotment for that datacasting service area (which may, or may not be operated in an SFN arrangement), without going through a DCP variation process, under the following conditions:

a) the characteristics of the additional transmitter shall comply with these guidelines; and

Note These guidelines cover matters which include maximum field strength beyond the licence area, interference to other services, and co-channel and adjacent channel interference to other services.

b) licence applications relating to these additional transmitters shall be submitted to the ABA.

94. Broadcasting licensees of digital television services may be permitted to add additional digital transmitters on the same channel as an existing channel allotment within a DCP assignment (which may, or may not be operated in an SFN arrangement), without going through a DCP variation process, under the following conditions:

a) the characteristics of the additional transmitter shall comply with these guidelines; and

Note These guidelines cover matters which include maximum field strength beyond the licence area, interference to other services, and co-channel and adjacent channel interference to other services.

b) licence applications relating to these additional transmitters shall be submitted to the ABA.

CO-CHANNEL INTERFERENCE TO OTHER SERVICES

95. The *Interim Australian Broadcasting Planning Handbook* and the *Digital Terrestrial Television Broadcasting Planning Handbook* define the planning processes that are to be employed in planning new television and datacasting services that have co-channel relationships with existing analog television or digital television or datacasting services. Normally, additional co-channel transmitters would be planned through the process of a

DCP variation. However, additional digital transmitters on the same frequency as an existing channel allotment within a DCP may be added provided that:

a) the area(s) that they cover is not adequately served by transmitters operating in accordance with DCP technical specifications; and

Note Guidelines 75 to 77 define the Minimum Level of Service requirements for digital television broadcasting and datacasting services.

b) the characteristics of the additional transmitter comply with these guidelines. In particular the additional transmitter shall comply with guideline 81 (maximum field strength beyond the licence area), guidelines 82 to 91 (interference to other services), guidelines 96 to 100 (adjacent channel interference to other services) and guideline 95 (co-channel interference to other services); and

c) they comply with the interference conditions set out in guidelines 83 to 86 in respect of interference to analog television services; or that the interfering field strength from the proposed additional co-channel transmission is at least 6 dB below the root-sum-squared value of any existing potential interferers; and

d) they comply with the interference conditions set out in guidelines 87 to 90 in respect of interference to digital television broadcasting services or datacasting services; or that the interfering field strength from the proposed additional co-channel transmission is at least 10 dB below the root-sum-squared value of any existing potential interferers; and

e) they comply with interference conditions set out in guideline 91 in respect of interference to other radiocommunication services;

ADJACENT CHANNEL INTERFERENCE TO OTHER SERVICES

Note Where adjacent channel services are not effectively co-sited, or where adjacent channel services operate with significantly disparate ERP levels, it may be difficult to prevent interference to the adjacent channel service. The following guidelines apply to situations where the service potentially suffering adjacent channel interference is within its licence area and where it is providing the minimum field strength as defined in Table 5.1 or 6.1, as appropriate. They define the conditions necessary to establish whether or not adjacent channel operation of a digital television or datacasting service is permissible.

96. For the purpose of application of guideline 83 with respect to adjacent channel interference, “unacceptable interference” means that the digital television broadcasting service or datacasting service occupies a channel that is adjacent to an analog television service and the relative level of the unwanted digital signal is more than 5 dB above the level of the wanted analog signal when measured at the receiver input terminal of an analog reference television receiver. This value applies equally for upper or lower adjacent channel combinations.

97. Practical application of guideline 96 should take account of variable factors affecting the relative levels of adjacent channel transmissions. Where adjacent channel transmissions are provided from a common antenna an allowance of 5 dB shall be applied

(i.e. a ratio of wanted to unwanted signals of 0 dB). Cases involving transmissions from different antennas require case-by-case consideration.

98. Where a digital television broadcasting services or datacasting service occupies a channel that is adjacent to a digital television or datacasting service the relative level of the unwanted digital signal shall be no more than 30 dB above the level of the wanted digital signal when measured at the receiver input terminal of a digital reference television receiver. This value applies equally for upper or lower adjacent channel combinations.

99. Practical application of guideline 98 should take account of variable factors affecting the relative levels of adjacent channel transmissions. Where adjacent channel transmissions are provided from a common antenna an allowance of 5 dB shall be applied (i.e. a ratio of wanted to unwanted signals of 25 dB). Cases involving transmissions from different antennas require case-by-case consideration.

100. If a digital television broadcasting services or datacasting service either, does not operate from a transmission site included in a DCP technical specification, or operates from an alternative site, its protection against interference from adjacent channel services included in the DCP will be based upon the assumption that it is operating from the nominal transmission site(s) included in the DCP.

RADIATED SIGNAL CHARACTERISTICS

101. Radiated signal characteristics of a transmitter shall comply with clause 4.8.2 (Aus) of Section 3 of *Australian Standard AS4599-1999 Digital Television – Terrestrial Broadcasting – Characteristics of digital terrestrial television transmissions* (see Appendix 4).

102. *Australian Standard AS4599-1999 Digital Television – Terrestrial Broadcasting – Characteristics of digital terrestrial television transmissions* provides for a range of options relating to modulation, code rate and guard interval. While other operating modes are not excluded, the ABA will apply a Reference Modulation for Planning Purposes which is: modulation = 64-QAM; code rate = 2/3; and, guard interval = 1/8. This leads to a minimum C/N requirement of 20 dB for receivers operating in Ricean channels. Operation with other parameters will only be protected to the extent provided by the Reference Modulation for Planning Purposes.

PART 7: INTERFERENCE MANAGEMENT SCHEME FOR DIGITAL TELEVISION

APPLICATION OF PART 7

103. This part applies to a licensee (a ***digital licensee***) that is licensed to provide a television service, or a datacasting service, in digital mode.

DEFINITIONS

104. In this part:

'analog licensee' means a licensee that is licensed to provide a television service in analog mode;

'ancillary device' means a device that:

(a) is used in conjunction with a television receiver; and

(b) generates a radiofrequency signal in the broadcasting services bands;

Some examples
1 A games console.
2 A subscription television set-top box.
3 A VCR.

Note on ancillary and other devices:

This part does not apply to several types of devices that currently share the broadcasting spectrum. These devices include medical telemetry devices and wireless microphones.

Ancillary devices do not radiate radiofrequency signals, and are not licensed to use the radiofrequency spectrum in any way. This part does not apply to ancillary devices.

With the introduction of digital television services, ancillary devices and other types of devices may experience interference and require retuning, reconnection or replacement to operate on available spectrum. Except where otherwise specified, the digital licensee should not bear the cost of rectifying the interference or interruption of service if the interference is to these types of devices.

Digital licensees are not responsible for the costs involved with retuning, reconnection and replacement of devices and ancillary devices to which this part does not apply.

'authorised person', in relation to a digital licensee, means a person that is authorised by that licensee to operate radiocommunications devices under an apparatus licence that relates to the digital licensee's licence;

Note A digital licensee is also the licensee of an apparatus licence under the *Radiocommunications Act 1992*. The authorisation procedure mentioned in the definition is set out in Division 4 of Part 3.3 of that Act.

'complaint' means a complaint of unacceptable interference as a result of a transmission in digital mode;

'digital licensee' means a licensee that is mentioned in guideline 103 of these guidelines;

'digital transmission' means the transmission of a television or a datacasting service in digital mode;

'ERP' means effective radiated power;

'interference hotline' means the telephone facility that is described in guideline 119 of these guidelines;

'interference study' means an investigation of interference that may include (but is not limited to):

(a) measuring the field strength of transmissions; and

(b) assessing the interference; and

(c) making observations about the potential causes of the interference;

'notification area', for a transmission, means an area that is described in guideline 106, 107, 108 or 109 of these guidelines as applying to the transmission;

'obligation period' means the period that is described in guidelines 131 to 134 of these guidelines;

'postcode population threshold' has the meaning set out in guideline 105 of these guidelines;

'predicted interference' means unacceptable interference that is described in paragraph 144 (a) of these guidelines;

'unacceptable interference' means interference:

(a) that is caused to an analog service described in guideline 83 of these guidelines; and

(b) to which guidelines 84, 85, 86 and 96 of these guidelines can be applied;

'unpredicted interference' means unacceptable interference that is described in paragraph 144 (b) of these guidelines;

'VCR' means an ancillary device that can be used by a person:

(a) to record a television program transmitted by a broadcaster in analog mode; or

(b) to play a program.

POSTCODE POPULATION THRESHOLD

105. In this part:

(a) a place is in a 'metropolitan postcode area', for a commercial television broadcasting licence, if:

(i) the licence area of the licence includes the GPO of Sydney, Melbourne, Brisbane, Adelaide or Perth; and

(ii) either:

(A) the place is in that licence area; or

(B) the postcode of the place is the same as the postcode of any place in that licence area; and

(b) a 'postcode population threshold' exists for a place in a metropolitan postcode area if:

(i) there are unresolved complaints regarding unacceptable interference that is caused by digital transmission; and

(ii) the number of complaints is equal to at least 1% of households in the area; and

(c) a place is in a 'non-metropolitan postcode area', for a commercial television broadcasting licence, if paragraph (a) does not apply; and

(d) a 'postcode population threshold' exists for a place in a non-metropolitan postcode area if:

(i) there are unresolved complaints regarding unacceptable interference that is caused by digital transmission; and

(ii) the number of complaints is equal to at least 0.1% of households in the area.

NOTIFICATION AREAS

106. For a transmission made using broadcasting services bands frequency in the range 520–820 MHz, an area that receives the transmitted signal at a field strength of at least 41dBμV/m from the transmitter is a notification area.

107. Each of the following areas is a notification area for a digital transmission made using any channel (the proposed channel) and VHF Band III:

(a) an area that:

(i) is capable of receiving the transmitted signal at a field strength of at least 44dBμV/m; and

(ii) is also capable of receiving a signal from a television service in analog mode, on a channel adjacent to the proposed channel, at a field strength of at least 50dBμV/m;

(b) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is less than 300W, an area in that sector that:

(i) is not more than 100 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 50dBμV/m;

(c) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 300W but less than 3kW, an area in that sector that:

(i) is not more than 170 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 50dBμV/m;

(d) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 3kW but less than 30kW, an area in that sector that:

(i) is not more than 270 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 50dBμV/m;

(e) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 30kW but less than 300kW, an area in that sector that:

(i) is not more than 400 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 50dBμV/m;

(f) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 300kW, an area in that sector that:

(i) is not more than 500 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 50dBμV/m.

Note The same area may be described in more than one of these paragraphs.

108. Each of the following areas is a notification area for a digital transmission made using any channel (the proposed channel) and UHF Band IV:

(a) an area that:

(i) is capable of receiving the transmitted signal at a field strength of at least 50dBμV/m; and

(ii) is also capable of receiving a signal from a television service in analog mode, on a channel adjacent to the proposed channel, at a field strength of at least 62dBμV/m;

(b) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is less than 300W, an area in that sector that:

(i) is not more than 50 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 62dBμV/m;

(c) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 300W but less than 3kW, an area in that sector that:

(i) is not more than 90 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 62dBμV/m;

(d) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 3kW but less than 30kW, an area in that sector that:

(i) is not more than 140 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 62dBμV/m;

(e) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 30kW but less than 300kW, an area in that sector that:

(i) is not more than 200 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 62dBμV/m;

(f) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 300kW, an area in that sector that:

(i) is not more than 300 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 62dBμV/m.

Note The same area may be described in more than one of these paragraphs.

109. Each of the following areas is a notification area for a digital transmission made using any channel (the proposed channel) and UHF Band V:

(a) an area that:

(i) is capable of receiving the transmitted signal at a field strength of at least 54dBμV/m; and

(ii) is also capable of receiving a signal from a television service in analog mode, on a channel adjacent to the proposed channel, at a field strength of at least 67dBμV/m;

(b) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is less than 300W, an area in that sector that:

(i) is not more than 50 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as to the proposed channel, at a field strength of at least 67dBμV/m;

(c) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 300W but less than 3kW, an area in that sector that:

(i) is not more than 90 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 67dBμV/m;

(d) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 3kW but less than 30kW, an area in that sector that:

(i) is not more than 140 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 67dBμV/m;

(e) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 30kW but less than 300kW, an area in that sector that:

(i) is not more than 200 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 67dBμV/m;

(f) if the maximum ERP of the transmitter specified in the digital channel plan, for any sector, is at least 300kW, an area in that sector that:

(i) is not more than 300 kilometres from the transmitter; and

(ii) is capable of receiving a signal from a television service in analog mode, on the same channel as the proposed channel, at a field strength of at least 67dBμV/m.

Note The same area may be described in more than one of these paragraphs.

AGREEMENTS BETWEEN LICENSEES

110. This part applies to each digital licensee.

111. However, nothing in this part prevents a digital licensee that is required to take action in accordance with this part from:

(a) making an agreement with an analog licensee that is licensed to transmit services in analog mode that the other licensee will take the necessary action; or

(b) making an agreement with 1 or more licensees or other persons to comply with a requirement under this part on a collective basis; or

(c) relying on an agreement, with the effect described in paragraph (a) or (b), that was made before this guideline commences.

Example for paragraph (b)
Providing a single telephone number for an interference hotline.

112. If a digital licensee makes, or relies on, an agreement for guideline 111 of these guidelines:

(a) any obligation of the licensee under this part is taken to be fulfilled by the licensee if the obligation is fulfilled by a person acting in accordance with the agreement; but

(b) the agreement does not relieve the licensee of the obligation if the obligation is not fulfilled by the licensee personally, or a person acting in accordance with the agreement.

START UP PROCEDURE

113. If a digital licensee plans to do an act that is mentioned in guideline 12 of these guidelines:

(a) the digital licensee shall comply with the requirements in guidelines 114 to 125 of these guidelines; and

(b) the digital licensee shall not comply with the requirements in guideline 13 of these guidelines.

Note Guideline 12 mentions the following acts:

- planning to establish a transmitter to transmit a broadcasting or datacasting service;
- planning to change the technical operating specifications of a transmitter which is authorised for transmitting a broadcasting or datacasting service (other than a change of transmission site).

114. **Advertisements**. At least seven days before the first test transmission, the digital licensee or an authorised person shall place advertisements in each newspaper that has the highest circulation in each urban centre in the notification area of at least 2 500 persons. The advertisement should:

(a) include the address and telephone number of the person responsible for the tests; and

(b) give details of the date of each proposed test transmission and the frequency to be used; and

(c) state that members of the public should contact the licensee or authorised person if a test transmission causes interference to other radiocommunications; and

(d) include the contact details of an appropriate person; and

(e) state that the information mentioned in paragraph 116 (a) of these guidelines is available, free of charge, in the ways that the licensee has chosen for the purposes of guideline 117 of these guidelines.

The digital licensee or authorised person shall give the ABA a copy of the advertisement as soon as practicable after publishing it.

115. **Advance notification.** At least seven days before the first test transmission, the licensee or an authorised person shall advise the following persons of the date and proposed technical operating specifications of each test transmission:

(a) the Minister;

(b) the ABA;

(c) the ACA office for the notification area;

(d) a person that:

(i) provides services using VHF Band III or UHF; or

(ii) is a licensed operator of a retransmission facility that is to provide services using VHF Band III or UHF;

(e) each broadcasting licensee that provides services within the notification area;

(f) each datacasting licensee that provides services within the notification area;

(g) each licensee for a subscription broadcasting service that provides services within the notification area;

(h) each Member of the Commonwealth Parliament who represents an electorate that includes a part of the notification area;

(i) each Member of the Parliament of a State or Territory who represents an electorate that includes a part of the notification area;

(j) each local government body that has responsibility for the notification area;

(k) the chief executive officer, or similar person, of each hospital that is in the notification area;

(l) the Minister of the State or Territory who is responsible for health services.

The digital licensee or authorised person shall also include the address and telephone number of the person responsible for the tests, the contact details of an appropriate person, information about the interference hotline, and the written information mentioned in guideline 116 of these guidelines.

116. **Written information.** At least seven days before the first test transmission, the digital licensee shall have completed arrangements to provide written information that:

(a) explains interference issues in the form of:

(i) statements or replies to ‘frequently asked questions’; and

(ii) statements about why interference might be a problem in the area; and

(iii) statements about common solutions for resolving interference; and

(b) gives contact details of the licensee (including a phone number and email address).

117. The arrangements shall include:

(a) the publication of the information:

(i) in a brochure or pamphlet in which all of the pages are bound or joined together (rather than being in a loose-leaf format); or

(ii) on a sheet of printed material; and

(b) the publication of the information on a website maintained by or for the digital licensee; and

(c) making the information available for use, on request, as part of the interference hotline; and

(d) making the information available in at least one of the following ways:

(i) as an insert or advertisement in at least 2 publications that display a schedule of television programs to be shown in the notification area;

(ii) by delivering the publication mentioned in paragraph (a) to each household in the notification area;

(iii) as a 'crawler' that:

(A) forms part of a television program transmitted by the broadcaster in analog mode; and

(B) is run as part of a transmission during prime time at intervals not more than 25 minutes apart over a period of 1 month from the commencement of digital transmissions; and

(C) is run at other times that the digital licensee chooses; and

(D) provides the information in summary form (including information about the existence of the interference hotline and the availability of the publication mentioned in paragraph (a) to callers to the hotline); and

(iv) as an advertisement that:

(A) forms part of a television program transmitted by the broadcaster in analog mode; and

(B) is run as part of a transmission during prime time at intervals not more than 25 minutes apart over a period of 1 month from the commencement of digital transmissions; and

(C) is run at other times that the digital licensee chooses.

Note The brochure or pamphlet shall be available to the public at all times during the obligation period: see guideline 135 of these guidelines.

118. The digital licensee shall ensure that the information is available from the day of the first transmission.

119. **Interference hotline.** At least seven days before the first test transmission, the digital licensee or an authorised person shall have established a telephone number that can be used to make complaints about interference from the transmission of digital television or datacasting services. The digital licensee or authorised person shall decide whether to establish the number for use by making freephone calls or local rate calls.

Note The interference hotline shall be available to the public at all times during the obligation period: see guideline 136 of these guidelines.

120. **Media releases.** At least seven days before the first test transmission, the digital licensee or an authorised person shall have completed the publication and distribution of media releases for media organisations that operate in the notification areas. A media release should include:

(a) a summary of the information that is mentioned in guidelines 114 to 119 of these guidelines; and

(b) the technical operating specifications of the transmitter (as defined in these guidelines).

121. If arrangements have been made in accordance with guidelines 114 to 120 of these guidelines, test transmissions may be made. Test transmissions shall be conducted for at least seven days.

122. The digital licensee shall, for at least seven days, conduct test transmissions in accordance with the technical operating specifications that the licensee intends to apply to the transmissions after the testing procedure is complete.

123. The digital licensee or an authorised person shall undertake any necessary further planning so as to eliminate or minimise unacceptable interference that is identified during a test transmission.

Note The digital licensee or authorised person shall also comply with the condition of the transmitter licence to adjust, or to fit devices to, receivers in order to eliminate or minimise the interference.

124. All interference caused by a test transmission described in guideline 122 of these guidelines should be eliminated or minimised before the test transmission procedure is completed.

125. Interference assessment reports, and documentation of any relevant calculations, shall be made available on request to the ABA and the ACA.

LOG OF TECHNICAL OPERATING SPECIFICATIONS

126. A digital licensee shall make and keep a log of technical operating specifications that outlines temporary and long term changes to the operating conditions of transmitters.

127. The digital licensee shall record in the log of technical operating specifications any change to the technical operating specifications of a transmitter, including:

(a) the date on which the change was made; and

(b) the original technical operating specifications; and

(c) the new technical operating specifications; and

(d) the nature of the change; and

(e) the reason for making the change.

128. The ABA may, by written notice given to a digital licensee, require the licensee:

(a) to make the log of technical operating specifications available for inspection by a member of the staff of the ABA; and

(b) to permit that member to make copies of anything in the log.

Note The ABA may give to the ACA the information in a log of technical specifications.

INTERFERENCE COMPLAINTS: TEST TRANSMISSIONS AND OTHER TRANSMISSIONS

129. Complaints from viewers about unacceptable interference from a digital transmission may be made using the interference hotline.

130. It is also possible that a person who is mentioned in a paragraph of guideline 115 of these guidelines will receive a complaint about unacceptable interference from a digital transmission.

(a) If the person forwards the complaint to the digital licensee, and includes the matters that are required in the register of complaints, the digital licensee shall treat the complaint as a complaint from the viewer.

(b) If the person forwards the complaint to the digital licensee, but does not include all of the matters that are required in the register of complaints, the digital licensee is not required to treat the complaint as a complaint from the viewer.

Note A person who is mentioned in a paragraph of guideline 108 of these guidelines will be given information about the complaints process, but is under no obligation to forward a complaint or to refer a viewer to the interference hotline.

OBLIGATION PERIOD

131. For a period of 12 months after the commencement of digital transmission, the digital licensee that is responsible for the transmission shall:

(a) investigate complaints about unacceptable interference; and

(b) identify and rectify any unacceptable interference that has occurred as a result of the digital transmission.

This period is the obligation period for the digital licensee.

132. The ABA may, in writing, extend an obligation period for a digital licensee. The ABA:

(a) may extend the period more than once; but

(b) may extend the period only if the period has not already expired.

An obligation period for a digital licensee cannot end later than 18 months after the commencement of digital transmission by the digital licensee, unless the obligation period is a new period created in accordance with paragraph 134 (a) or 134 (c) of these guidelines.

133. If the ABA proposes to extend an obligation period for a digital licensee, the ABA shall notify the digital licensee before the end of the current obligation period.

134. An obligation period is affected as follows by changes to the technical operating specifications of a transmitter:

(a) if:

(i) there is a change to the technical operating specifications of a transmitter; and

(ii) the change is made to comply with a requirement of these guidelines —

a new obligation period of 12 months starts from the day of the change;

(b) if:

(i) there is a change to the technical operating specifications of a transmitter; but

(ii) the specifications are, within a reasonable period, returned to specifications that are the same as all of the previous technical operating specifications —

the obligation period returns to the period that was in force immediately before the change;

(c) if:

(i) there is a change to the technical operating specifications of a transmitter; and

(ii) paragraphs (a) and (b) do not apply to the change —

a new obligation period of 12 months starts from the day of the change.

Note Changes to the technical operating specifications of a transmitter regularly occur as a part of standard broadcasting practice and maintenance, and it is not intended that every change to technical operating specifications will incur a new obligation period.

Standard maintenance often includes a temporary deviation from the original technical operating specifications followed by a return to the original specifications.

135. A digital licensee, or an authorised person, that is mentioned in guideline 117 of these guidelines shall ensure that the brochure or pamphlet that is mentioned in the guideline is available to the public at all times during the obligation period.

136. A digital licensee, or an authorised person, that is mentioned in guideline 119 of these guidelines shall ensure that the interference hotline is maintained at all times during the obligation period, either by a human operator or by the availability of a recorded message service. The licensee or person is not required to have personnel in attendance, to answer calls, at all times.

REGISTER OF COMPLAINTS

137. A digital licensee shall make and keep a register, during the obligation period, of interference complaints that the digital licensee has received.

138. The register shall include the following information for each complaint:

(a) the date on which the complaint was received;

(b) the name and address of the complainant;

(c) the postcode of the complainant;

(d) the nature of the complaint;

(e) any action taken, including evidence showing that:

(i) the action was taken; and

(ii) the action was an appropriate response;

(f) whether the complaint has been resolved.

139. The digital licensee shall not disclose information in the register to another person, other than the ABA or the ACA, unless the disclosure is required as part of the resolution of the complaint.

140. The ABA may, by written notice given to a digital licensee, require the person:

(a) to make the register available for inspection by a member of the staff of the ABA; and

(b) to permit that member to make copies of anything in the register.

Note The ABA may give to the ACA the information in a register.

PREDICTED AND UNPERDICTED INTERFERENCE TO ANALOG TRANSMISSIONS: BACKGROUND

141. The Conversion Schemes require the ABA to identify digital channels to be available in an area. This is achieved through the Digital Channel Plan (DCP) process. In formulating a DCP, the engineering work conducted by the ABA identifies unacceptable interference that is likely to occur to the direct reception of a television program transmitted by a broadcaster in analog mode if a particular channel is used. The DCP then allots the channel with ERP restrictions to overcome this problem until the digital licensee can rectify it.

Note The direct reception of the television program transmitted by the digital licensee may be achieved by means of a television set, or a television tuner within a VCR (see the definition of 'analog reference television receiving system' in guideline 8 of these guidelines).

142. For guideline 141 of these guidelines, interference caused by or to an ancillary device is not interference to direct reception.

143. However, the DCP may not identify all potential interference issues. Therefore, while some channels are allotted without ERP restrictions, unacceptable interference may still be caused by transmissions using those channels.

Note Due to time constraints imposed on the ABA in developing DCPs, the ABA has listed only situations where unacceptable interference is likely to occur. It is possible that while a DCP has predicted situations of unacceptable interference, interference that has not been predicted may occur to other analog services.

If the ABA has predicted interference in the DCP, operation at a reduced power may resolve the predicted interference issues, but there could still be an issue relating to unpredicted interference

144. The ABA distinguishes between:

(a) *predicted interference,* which is interference that has been anticipated in a DCP; and

(b) *unpredicted interference*, which is interference that has not been anticipated in a DCP.

Note A licensee that uses a frequency that is subject to predicted interference has licence conditions placing ERP restrictions on transmissions. Therefore, it is not expected that further unacceptable interference will occur. If further unacceptable interference does occur, this would be treated as unpredicted interference.

The ABA has foreshadowed in its DCPs the possibility that, if predicted interference is eliminated, the ERP restrictions would be removed.

MANAGEMENT OF PREDICTED INTERFERENCE

145. A digital licensee that uses a frequency that is subject to predicted interference shall:

(a) conduct an interference study to determine the scope of the interference; and

(b) make arrangements with each analog licensee that is identified as a recipient of the interference to resolve any issues relating to the interference; and

(c) either:

(i) apply to the ABA to have the ERP restriction that relates to the predicted interference removed when the interference issues are resolved; or

(ii) if it possible to transmit without the ERP restriction, in accordance with the arrangements under paragraph (b), transmit without the restriction.

Note Under the Act, a digital licensee is also required to comply with the conditions on the licensee's licence.

146. For the purpose of subparagraph 145 (c) (ii) of these guidelines, the digital licensee shall:

(a) notify the ABA, before transmitting without the ERP restriction, that it is possible for the licensee to transmit without the restriction; and

(b) give the ABA a copy of the arrangements with evidence that the analog licensee has endorsed or agreed to the arrangements.

147. For the purpose of conducting the interference study that is mentioned in paragraph 145 (a) of these guidelines, the digital licensee:

(a) may conduct test transmissions, without ERP restrictions, for not more than two hours in total on a day; but

(b) shall not conduct any test transmissions between 6.30 pm and 9.30 pm.

148. In considering an application to remove an ERP restriction, the ABA intends to consider:

(a) the extent to which the digital licensee has tried to rectify the interference; and

(b) any relevant results from the interference study that is mentioned in paragraph 145 (a) of these guidelines; and

(c) any arrangement between the digital licensee and an analog licensee that is identified as a recipient of the interference for the purposes of paragraph 145 (b) of these guidelines.

MANAGEMENT OF UNPREDICTED INTERFERENCE: HANDLING COMPLAINT

149. A digital licensee shall investigate:

(a) each unresolved complaint that it receives from its interference hotline; and

(b) each complaint that is referred to it in accordance with paragraph 130 (a) of these guidelines; and

(c) each complaint that the digital licensee chooses to treat as a complaint in accordance with paragraph 130 (b) of these guidelines;

to determine the whether there is any unacceptable interference and, if so, the action that is required to resolve the complaint in accordance with guideline 157 of these guidelines.

150. Subject to guideline 151 of these guidelines, if the digital licensee determines that the interference that was experienced by the complainant is not unacceptable interference, the licensee shall:

(a) notify the complainant to that effect; and

(b) provide evidence in support of the licensee's determination.

151. If the digital licensee determines that the interference that was experienced by the complainant is caused by a digital transmission, but is not unacceptable interference because the digital transmission is not of a kind to which guidelines 68 and 68A of these guidelines apply, the digital licensee shall:

(a) notify the complainant of the cause of the interference; and

(b) refer the complaint to the ACA; and

(c) refer the complainant to another person if it is identified that the interference is caused by that person's transmissions.

Note Part 7 of these guidelines is concerned mainly with interference that is caused by digital transmissions. However, interference can be caused by sources other than digital transmissions (for example, analog television transmissions or the use of radiocommunications devices). See guidelines 68, 68A and 144 of these guidelines for other causes of interference to analog services

152. If the digital licensee determines that the interference that was experienced by the complainant is unacceptable interference that is caused by a source other than the digital licensee's digital transmissions, the digital licensee shall:

(a) notify the complainant of the cause of the interference and

(b) refer the complaint to the ACA; and

(c) refer the complainant to another person if it is identified that the interference is caused by that person's transmissions.

153. If a complaint is referred to the ACA under guideline 151 or 152 of these guidelines, the digital licensee shall provide evidence in support of the licensee's determination.

154. If the ACA determines that the unacceptable interference identified in a complaint referred to the ACA under guideline 151 or 152 of these guidelines is caused by a digital licensee's digital transmissions, it shall refer the complaint to that licensee. The licensee may be the licensee who referred the complaint to the ACA.

155. If the digital licensee determines that the interference that was experienced by the complainant is unacceptable interference caused by the digital licensee's digital transmissions, but is being caused to an ancillary device, or to another device or service to which this part does not apply, the digital licensee shall resolve the complaint by giving the complainant advice about:

(a) retuning ancillary devices; and

(b) appropriate cabling methods for connecting televisions and ancillary devices; and

(c) the contact information of persons who may be able to assist with these tasks.

The digital licensee shall also notify licensees for subscription broadcasting services that provide services within the notification area about the advice, and invite them to comment on it.

156. If the digital licensee determines that the interference that was experienced by the complainant:

(a) is unacceptable interference; and

(b) is caused by the digital licensee's digital transmissions; and

(c) is not being caused to an ancillary device —

the digital licensee shall resolve the complaint as soon as practicable.

MANAGEMENT OF UNPREDICTED INTERFERENCE: RESOLUTION OF COMPLAINT (GENERAL)

157. A complaint is resolved only in one of the following ways:

(a) the complainant is satisfied;

(b) the digital licensee reduces the unpredicted interference to a level that does not make it unacceptable interference (including a reduction by the use of equipment such as a filter on a transmitter);

(c) the digital licensee:

(i) provides reception equipment to the complainant that reduces the unpredicted interference to a level that does not make it unacceptable interference (for example, a new antenna); or

(ii) adjusts or fits a device to the receiver in order to eliminate or minimise the interference;

(d) a transmitter is modified to reduce the unpredicted interference to a level that does not make it unacceptable interference;

(e) for a complaint to which guideline 155 of these guidelines applies, the digital licensee gives the advice that is mentioned in that guideline.

158. The digital licensee shall:

(a) provide reception equipment; or

(b) adjust or fit a device to the receiver in order to eliminate or minimise interference —

at no cost to the complainant.

159. If a digital licensee that is investigating an interference complaint has made a change to the technical operating specifications of a transmitter as part of the investigation (whether or not the transmitter is controlled by the digital licensee), the digital licensee shall notify the complainant of the changes to the technical operating specifications.

Note The change to the specifications is an act to which guideline 113 of these guidelines applies.

MANAGEMENT OF UNPREDICTED INTERFERENCE: RESOLUTION OF COMPLAINT (POST CODE POPULATION THRESHOLD)

160. If the number of unresolved complaints relating to a digital licensee reaches a postcode population threshold, the digital licensee shall:

(a) comply with guidelines 162 to 165 of these guidelines within fourteen days after the day on which the number of unresolved complaints reaches the threshold; and

(b) comply with guidelines 166 to 170 of these guidelines.

The period of fourteen days is the resolution period.

161. If the ABA believes that it is in the public interest for a digital licensee to comply with guidelines 162 to 165 of these guidelines, even though the number of unresolved complaints relating to a digital licensee has not reached the postcode population threshold:

(a) the ABA may notify the digital licensee to that effect; and

(b) if the ABA notifies the digital licensee, the digital licensee shall:

(i) comply with guidelines 162 to 1165 of these guidelines within fourteen days after the day on which the notification is received; and

(ii) comply with guidelines 166 to 170 of these guidelines.

The period of fourteen days is the resolution period.

162. The digital licensee shall:

(a) conduct an interference study; and

(b) determine the cause of the interference; and

(c) take action to resolve the complaints.

163. The digital licensee shall, if practicable, rectify the interference, without lowering the ERP, before the end of the resolution period.

164. If it is not practicable for the digital licensee to rectify the interference, without lowering the ERP, before the end of the resolution period, the digital licensee shall lower the ERP to the extent that a sufficient number of complaints can be resolved to reduce the number of unresolved complaints to less than the postcode population threshold.

Note A complaint that cannot be resolved after actions taken in accordance with these guidelines is an unresolved complaint: see guideline 157 of these guidelines.

165. The digital licensee shall notify the ABA, and each complainant who has an unresolved complaint, that:

(a) the number of unresolved complaints has reached the threshold; and

(b) the digital licensee is in the process of investigating the cause of the interference in accordance with these guidelines.

166. At the conclusion of the resolution period, the digital licensee shall notify the ABA, and each complainant, in writing, of:

(a) the results of the interference study; and

(b) the action taken by the digital licensee to resolve the complaints, including evidence showing that:

(i) the action was taken; and

(ii) the action was an appropriate response.

Note Ways of resolving a complaint are explained in guideline 157 of these guidelines.

167. If the digital licensee has not lowered the ERP as part of the action taken to resolve the complaints, the digital licensee shall also give empirical evidence to the ABA in support of the reasons why it is not necessary.

Example
The digital licensee has rectified the problem by installing a filter on the transmitter.

168. If:

(a) the report of the interference study states that the ERP should be lowered to avoid interference; or

(b) the ABA has not received the report by the end of the resolution period;

the ERP of the digital licensee's transmitter shall be reduced sufficiently to reduce the number of unresolved complaints relating to the digital licensee to less than the postcode population threshold.

169. If the ERP of a digital licensee's transmitter has been lowered, the ERP shall not be increased unless:

(a) the digital licensee has notified the ABA that the digital licensee intends to transmit at the new ERP; and

(b) the digital licensee has given the ABA the report of a new interference study; and

(c) the measurements of the field strength of transmissions that are included in the new interference study were taken at the same sites that were used in the original interference study; and

(d) the digital licensee has given the ABA a report of the actions taken (including evidence); and

(e) the ABA is satisfied that the digital licensee has taken action to ensure that unacceptable interference will not occur.

170. For the purpose of preparing the report that is mentioned in paragraph 169 (b) of these guidelines, the digital licensee:

(a) may conduct test transmissions, without ERP restrictions, for not more than two hours in total on a day; but

(b) shall not conduct any test transmissions between 6.30 pm and 9.30 pm.

APPENDIX 1:

EMISSION STANDARD FOR THE AUSTRALIAN AMPLITUDE MODULATION SOUND BROADCASTING SERVICE

The purpose of the emission standard for the Australian Amplitude Modulation Sound Broadcasting Service is to define the parameters to be used for sound broadcasting in the frequency band 526.5 – 1606.5 kHz. This emission standard supersedes the *Draft Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service* prepared by the Department of Transport and Communications in 1992. Provision is made for stereophonic as well as monophonic program transmission.

The standard follows international practice and is based on relevant parts of ITU-R Recommendations 598 and 639.

In general, tolerances are not specified as this standard is intended to define the nominal values for the transmitted signal. Where tolerances are specified, they relate to parameters that would influence the potential of the installation to interfere with other services or are needed to meet the technical operating conditions determined for the particular service.

This standard does not encompass technical equipment performance, measurement methods or operational procedures.

The ABA may impose special conditions in the likelihood of interference to other licensed services resulting from operation of the broadcasting station (e.g. out-of-band emissions below 526.5 kHz or above 1606.5 kHz).

In the planning of the Australian Amplitude Modulation Sound Broadcasting Service the following factors are important:

(a) channel assignments for AM services will be made to satisfy the protection ratios specified by the ABA's *Australian Broadcasting Planning Handbook*. Assigned channels will have a carrier separation of at least 45 kHz when populations served overlap by 80 per cent or more and a carrier separation of at least 27 kHz shall be used in areas with up to 20 per cent overlap between populations served;

(b) channel assignments will be made on the further assumptions that the receiver intermediate frequency is 455 kHz ±2.5 kHz and that the local oscillator frequency is above that of the received carrier.

DEFINITIONS

(Unless defined hereunder, any word used shall have the meaning given to it by the *Radiocommunications Act 1992* or the *Broadcasting Services Act 1992* or the *ITU Radio Regulations* as appropriate)

1. In this standard the following definitions apply:

'channel' - for an AM broadcasting service means a bandwidth of 18 kHz within the licence area of the broadcasting station;

'C-QUAM' means compatible quadrature amplitude modulation;

'*M* signal' means a signal equal to the sum of the left hand signal (*L*) and the right hand signal (*R*). This signal forms the compatible monophonic signal used to amplitude modulate the carrier;

'necessary bandwidth' means, for a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions;

'occupied bandwidth' means; the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage $\beta/2$ of the total mean power of a given emission. Unless otherwise specified by the ITU-R for the appropriate class of emission, the value of $\beta/2$ should be taken as 0.5 per cent;

'out-of-band emission' means emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions;

'pilot signal' means a sinusoidal signal used to phase modulate the carrier of a stereo transmission to indicate to the receiver the presence of a (C-QUAM) stereo transmission;

'*S* signal' means a signal equal to the difference between the left hand signal (*L*) and the right hand signal (*R*). This signal forms the stereo difference signal used to phase modulate the carrier;

'spurious emission' means emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions;

'unwanted emissions' consist of spurious emissions and out of-band emissions.

RADIATED SIGNAL CHARACTERISTICS

Channels

2. The necessary radio frequency bandwidth shall be nominally 18 kHz.

3. The channel spacing shall be 9 kHz with the lowest channel centre frequency being 531 kHz and the highest channel centre frequency being 1602 kHz. Note, however that no new assignments will be made on the frequencies of 531 kHz and 1602 kHz.

4. Unless otherwise specified, the frequency of the carrier shall be maintained within ±10 Hz.

Note Reference: *Radio Regulations*, Appendix 7, Table of Transmitter Frequency Tolerances in the band 535 kHz to 1605.5 kHz.

5. In particular instances, the carrier frequency of a transmitter may be required to be maintained within a nominated narrower tolerance to provide, for example, for synchronised transmissions or to assist in controlling interference.

Main carrier location and modulation

6. The carrier shall be centrally located in the channel and shall be amplitude modulated to a maximum of 125 per cent positive and 100 per cent negative modulation by the sum signal (*L*+*R*). For stereo transmissions, the carrier shall also be phase modulated to a maximum of ±1.26 radians by the combination of the difference signal (*L*-*R*) and a 25 Hz pilot signal.

Polarisation of the radiated signals

7. Only vertical polarisation shall be used except possibly for temporary operation. (Temporary operation could result from main antenna system failure or new antenna installation work, for example.)

Out-of-band and spurious outputs

8. The maximum level of radiated emissions shall be at or below the level of the mask described in guideline 20 below.

9. Spurious emissions shall be quoted with respect to the carrier level and shall be measured at any point at a distance of one kilometre from the antenna system. Spurious emissions shall not exceed 200 μV/m (see guideline 20 below.)

10. In particular instances, at frequencies removed from the carrier by more than 45 kHz and which fall outside the AM broadcasting band, further attenuation than that indicated above may be required to reduce interference to other spectrum users.

PROGRAM SIGNAL CHARACTERISTICS

Monophonic transmission

11. The signal shall be double sideband amplitude modulation. Modulation depth is not to exceed 125 per cent for positive modulation and 100 per cent for negative modulation.

The instantaneous amplitude, E_c, shall satisfy the expression:

$$E_c = A_c(1+M)\cos\omega_c$$

where

A_c = amplitude of the unmodulated carrier
$\omega_c = 2\pi f_c$
f_c = frequency of carrier
$M = L + R$ such that $|M| \leq 1$

Stereophonic transmission

12. The compatible quadrature amplitude modulation (C-QUAM) system shall be employed for the transmission of stereophonic signals.

13. The radiated signal consists of a carrier which is amplitude modulated by the monophonic sum signal (*L*+*R*) and phase modulated by the stereophonic difference signal (*L*–*R*). The pilot signal must be included in stereo transmissions.

14. Amplitude modulation depth shall not exceed 125 per cent for positive modulation and 100 per cent for negative modulation.

15. Phase modulation shall not exceed ±1.26 radians including the pilot signal.

16. The instantaneous amplitude E_c shall satisfy the expression:

$$E_c = A_c(1+M)\cos(\omega_c t + \phi)$$

where

A_c, M and ω_c are defined above;

and

$\phi = \arctan\left[\dfrac{(S+P)}{(1+M)}\right] \leq 1.26$ radians;
$P = 0.05\sin(50\pi t)$, i.e. a 25 Hz sine wave; and
$S = L - R$ and $|S| \leq 1$ (see following note and guideline 20 below).

Note: In the presence of modulation processing, the gamut of *M* and *S* signals must be constrained. The magnitude of the *S* signal must be limited in the presence of high negative amplitude modulation. See guideline 21 'Gamut of Sum and Difference Modulation'. (This particular limiting is normally implemented in the C-QUAM modulator.)

Pilot tone

17. The pilot tone (denoted above by *P*) must be included with all transmissions in the stereo mode. The frequency of the tone shall be 25 Hz ±0.1 Hz and it shall phase modulate the carrier to 0.05 ±0.01 radians of deviation in the absence of (*L*–*R*) channel signal. This is equivalent to approximately 4 ±1 per cent (where 1.26 radians equals 100 per cent).

AUDIO FREQUENCY RESPONSE

18. The steady state audio frequency response shall be nominally flat over the range of 50 Hz to 7 kHz. Above that frequency range and with respect to the response at 7 kHz, the input to the transmitter shall not exceed the response set out in Table A1.1:

Note The specified audio frequency response is provisional for mono transmissions.

Table A1.1: Transmitter Input Limits at Frequencies Above 7 kHz

Frequency in kHz	***Level in dB (with respect to that at 7 kHz)***
7	0
8	-1
8.5	-3
9	-15
9.5	-30
10	-40
Above 15 kHz	Below -50 dB

(see guideline 21. 'Gamut of Sum and Difference Modulation' below.)

Note: Performance parameters are not specified in this standard. However, to obtain good monophonic reception from stereophonic broadcasts, the relative delay of *L* and *R* signals originating from the same source needs to be within acceptable limits on arrival at the modulator input, otherwise cancellation may take place in the *M* signal matrix. Such delays may occur in any section of the system where *L* and *R* signals follow separate routes - such as in tape recorders and relay circuits, or in the acoustic paths to spaced microphones. Consequently, relative signal delay needs careful attention in program production and system engineering.

NECESSARY RADIO FREQUENCY BANDWITH

19. The purpose of the bandwidth specification is to minimise interference by controlling the occupied bandwidth of Medium Frequency stations.

As a result of practical performance limitations, the 'occupied bandwidth' will be greater than the 'necessary bandwidth'.

In order to comply with the necessary bandwidth requirements and to ensure that the occupied bandwidth is not significantly greater than 18 kHz, it will be essential to restrict the audio bandwidth of the signal delivered to the transmitter.

Appropriate and carefully designed audio low pass filters in the final filtering prior to modulation can be used to implement this specification. This standard requires such filtering in all transmitters.

The reduction of second adjacent channel interference resulting from the use of audio low pass filters should facilitate the use of wide band receivers.

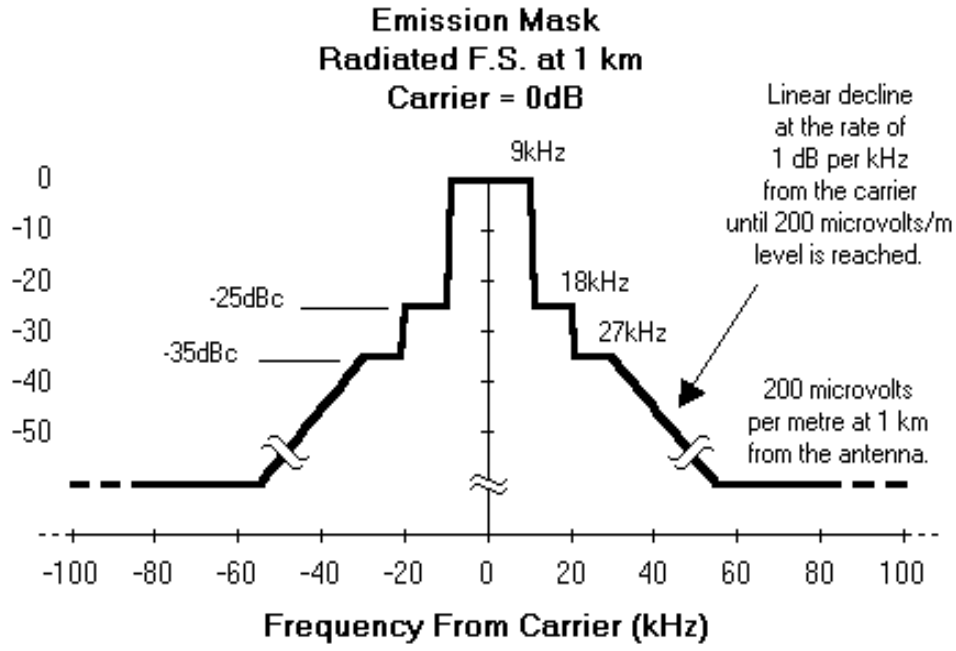


Figure A1.1: Emission Mask for Radiated Field Strength

EMISSION MASK FOR RADIATED FIELD STRENGTH

20. Among other things, the radiated field strength emission mask shown in Figure A1.1 is designed to protect the second adjacent channel from excessive interference.

It should be noted that the level of high frequency modulation must not be too great in order to comply with this emission mask. At frequencies above about 4 kHz, modulating signal levels in left or right channel only (and difference signal levels) should not be excessive. This is only of any practical significance if high level, high frequency test tones are being applied to the modulator. Normally, voice and music program material will not produce spectral energy beyond the above mask in a properly operating transmitter.

Where there is interference to other spectrum users who are outside the AM broadcasting band and more than 45 kHz from the broadcaster's carrier, additional attenuation of unwanted emissions from the broadcast transmitter than that indicated above may be required.

GAMUT OF SUM AND DIFFERENCE MODULATION

21. As a result of applying modulation processing separately to the sum (*M*) and difference (*S*) signals, unnatural combinations of *M* and *S* signals become possible. That is, *M* and *S* signals may be generated in combinations which are not realisable in natural sound fields.

The maximum permissible phase deviation of the carrier is not more than 1.26 radians and the instantaneous carrier amplitude must not be reduced to zero with phase modulation simultaneously present. Hence the C-QUAM modulator must apply limits to the level of difference signals (i.e. the *S* signal magnitude) during high instantaneous negative amplitude modulation (i.e. negative values of the *M* signal) or vice versa.

Figure A1.2 represents the gamut of *M* and *S* signals (normalised so that *M* lies between +1.25 and −1 and *S* lies between +1 and −1) which result in permissible levels of amplitude and phase modulation of the carrier.

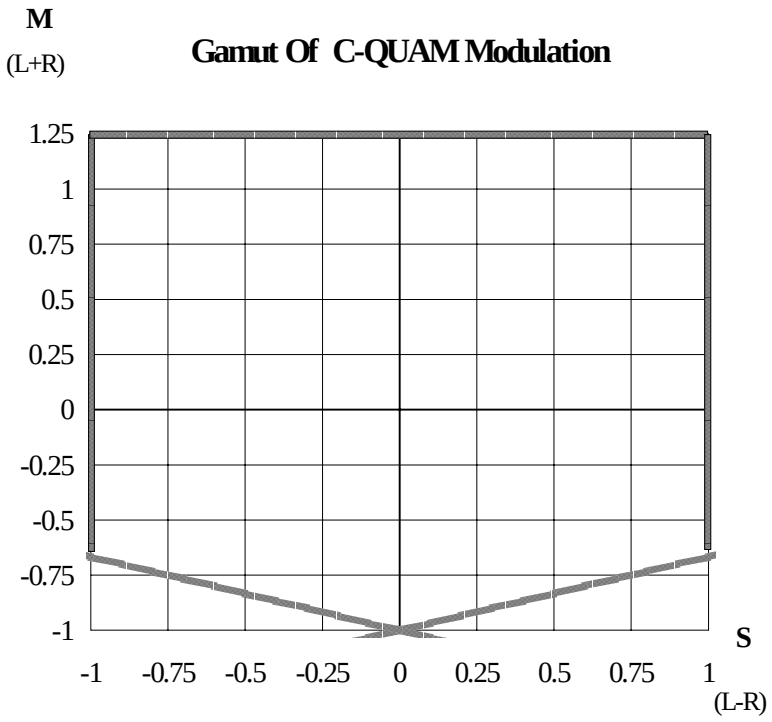


Figure A1.2: Gamut of C-QUAM Modulation

It will be observed that the limit on the *S* signal amplitude while the *M* signal is close to −1 is not a severe practical constraint. The long term average of normal stereo program material forms an ellipse on the above diagram with the major semi axis coinciding with the *M* axis. The ratio of major to minor axes of this ellipse is normally greater than 2:1.

APPENDIX 2:

EMISSION STANDARD FOR THE AUSTRALIAN FREQUENCY MODULATION SOUND BROADCASTING SERVICE

The purpose of the emission standard for the Australian Frequency Modulation Sound Broadcasting Service is to define the parameters to be used for sound broadcasting in the frequency band 87.5 – 108 MHz. This standard supersedes the *Emission Standard for the Australian Frequency Modulation Sound Broadcasting Service*, published by the Department of Transport and Communications, July 1992. Provision is made for stereophonic as well as monophonic program transmission.

The standard for transmission of the main sound program follows international practice and is based on the pilot-tone system specified in ITU-R Recommendation 450-1.

The preferred standard for the transmission of an ancillary communications service (ACS) is that developed by the Department of Communications and the Arts following field and laboratory tests. It is based on a 67 kHz sub-carrier frequency. The scope of the ACS standard has been expanded to include specifications under which alternative ACS sub-carrier frequencies may be used.

In general, tolerances are not specified as these standards are intended to define the nominal values for the transmitted signal. Note, however, guideline 20 below regarding the importance of compatible monophonic reception of stereophonic transmissions.

In the planning of the Australian Frequency Modulation Sound Broadcasting Service the following factors are dominant:

(a) channel assignments will be made to satisfy the protection ratios specified by the ABA's *Australian Broadcasting Planning Handbook* for FM stereophonic and monophonic transmissions respectively. Channels assigned for service to any one area will, in general, have a carrier separation of not less than 800 kHz and, in adjacent areas, a separation of not less than 400 kHz;

(b) channel assignments will be made on the further assumptions that the receiver intermediate frequency is 10.7 MHz and that the local oscillator frequency is above that of the received carrier.

DEFINITIONS

(Unless defined hereunder, any word used shall have the meaning given to it by the *Radiocommunications Act 1992* or the *Broadcasting Services Act 1992* or the *ITU Radio Regulations* as appropriate)

1. In this standard, the following definitions apply:

'ancillary communication service' means a separate supplementary information service on a modulated sub-carrier;

'baseband' means the composite modulating signal applied to produce frequency modulation of the main carrier. In the case of monophonic transmission without an ancillary communications service, this is the audio signal;

'channel' means a band of frequencies for the transmission and reception of electro-magnetic signals over a specified path. For the purposes of this standard this is nominally a 200 kHz bandwidth within the licence area of a service in the VHF broadcast FM band;

'*M* signal' means a signal equal to one half the sum of the left hand signal (*L*) and the right hand signal (*R*). This signal forms the compatible monophonic component of the stereophonic baseband signal;

'main carrier' means the VHF signal modulated by the baseband signal;

'maximum deviation' means the maximum value permitted for deviation of the carrier frequency from its unmodulated frequency.

'pilot signal' means an unmodulated sine wave signal forming part of the stereophonic baseband signal used to regenerate the suppressed sub-carrier, or to permit detection of suppressed sub-carrier modulation;

'pre-emphasis' means a process whereby the level of audio signals is increased with increase in frequency prior to encoding or modulating the main carrier. Complementary de-emphasis at the receiver reduces the level of upper audio frequency noise components in the reproduced signals. Pre-emphasis can be applied to either the *L* and *R* signals or to the *M* and *S* signals;

'*S* signal' means a signal equal to one half of the difference between the left hand signal (*L*) and the right hand signal (*R*). This signal forms the difference signal used to amplitude modulate the 38 kHz (suppressed) sub-carrier;

'sub-carrier' means a carrier which is applied as a component of the baseband signal to modulate the main carrier;

'stereophonic signal' means the baseband or modulating signal which comprises: the *M* signal; sidebands of the *S* signal amplitude modulated 38 kHz suppressed sub-carrier; and the pilot signal of frequency 19 kHz. This composite signal has a spectrum width of 53 kHz;

RADIATED SIGNAL CHARACTERISTICS

Channels

2. The radio frequency channel width shall be nominally 200 kHz.

3. The channel spacing shall be 200 kHz , but a carrier frequency offset of ±100 kHz may be specified. The lowest carrier frequency shall be 87.7 MHz and the highest shall be 107.9 MHz.

Note For low power narrowcasting services a carrier frequency of 87.6 MHz may be used with the approval of the ABA or ACA.

4. Unless otherwise specified, the frequency of the unmodulated carrier shall be maintained within ±1000 Hz for a transmitter fed with a baseband signal or ±2000 Hz for a transmitter fed with a signal derived from another transmitter by frequency conversion (i.e. not demodulation).

5. In particular instances, the unmodulated carrier frequency of either type of transmitter may be required to be maintained within a nominated narrower tolerance to assist, for example, in controlling interference.

6. Channels allocated for the Australian frequency modulation sound broadcasting service are shown in table A2.1.

Main carrier location and modulation

7. The main carrier shall be centrally located in the channel and shall be frequency modulated by the baseband signal.

8. The maximum frequency deviation of the main carrier shall not exceed ±75 kHz. A positive value of the baseband signal (i.e. when the signal crosses the time axis with a positive slope) shall correspond to a positive frequency deviation of the main carrier.

Polarisation of the radiated signals

9. The polarisation of the radiated signals shall be as specified by the ABA.

Out-of-band and spurious outputs

10. The necessary bandwidth is deemed to extend 120 kHz from the carrier frequency.

11. Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive, shall be attenuated by at least 25 dB below the level of the unmodulated carrier. Any output appearing on a frequency removed from the carrier by more than 240 kHz up to and including 600 kHz shall be attenuated by at least 35 dB

below the level of the unmodulated carrier. Any output appearing on a frequency removed from the carrier by more than 600 kHz shall be attenuated by at least 43 + 10log *P* dB (where *P* is transmitter power in watts) below the level of the unmodulated carrier, or 80 dB whichever is the lesser attenuation.

12. In particular circumstances, attenuation of spurious outputs in excess of these values may be required. Where such emissions fall outside the broadcast band and are removed from the main carrier by more than 2 MHz, attenuation in excess of 80 dB may be specified.

13. Measurements shall be made via a directional coupler placed in the transmission line to the antenna system.

MAIN PROGRAM SIGNAL CHARACTERISTICS

Monophonic transmission

14. The baseband signal shall comprise audio frequency components of the program signal within the band 30 Hz to 15 kHz. Pre-emphasis of the audio signal shall be as shown in figure A2.4 in accordance with the admittance/frequency characteristic of a parallel combination of a capacitance and a resistance having a time constant of 50 microseconds.

15. For monophonic transmission, without pilot sub-carrier, the deviation of the main carrier by the *M* signal shall not exceed ±75 kHz.

Stereophonic transmission

16. The pilot-tone system shall be employed for the transmission of stereophonic signals. In this system the baseband signal consists of:

(a) a compatible signal, *M*, which shall produce a deviation of the main carrier of not more than ±67.5 kHz;

(b) a double sideband, amplitude modulated, suppressed sub-carrier signal generated by the modulating signal *S*. This signal shall produce a frequency deviation of the main carrier not exceeding ±67.5 kHz when *L* and *R* signals are equal and of opposite phase; and

(c) a pilot signal which shall have a frequency equal to one half of that of the sub-carrier, and shall produce a frequency deviation of the main carrier of not less than ±6 kHz and no more than ±7.5 kHz.

For stereophonic transmission, under all conditions of modulation by the composite baseband signal, the maximum instantaneous carrier frequency deviation shall not exceed ±75 kHz.

SUB-CARRIER FREQUENCY

17. The frequency of the (suppressed) sub-carrier shall be 38,000 ±4 Hz.

SUB-CARRIER SUPPRESSION

18. The residual sub-carrier shall not produce a deviation of the main carrier of more than ±750 Hz.

AUDIO FREQUENCY RESPONSE

19. The *M* and *S* channels shall substantially pass audio frequency components in the band 30 Hz to 15 kHz.

PRE-EMPHASIS

20. Pre-emphasis of the signal *S* shall be identical with that of the compatible signal *M* and shall be the same as that for monophonic transmission. The pre-emphasis characteristic of the sound signal shall be identical to the admittance/frequency curve of a parallel resistance/capacitance circuit having a time constant of 50 microseconds (see figure A2.4 below).

MODULATION POLARITY

21. The relative phase of the pilot signal and the sub-carrier is such that, when the transmitter is modulated by a multiplex signal for which *L* is positive and $R = -L$, this signal crosses the time axis with a positive slope each time the pilot signal has an instantaneous value of zero. The phase of the pilot signal should not differ by more than 3 degrees from the above state. Moreover, a positive value of the multiplex signal corresponds to a positive frequency deviation of the main carrier.

Note To obtain good monophonic reception from stereophonic broadcasts, the relative delay of *L* and *R* signals originating from the same source needs to be within acceptable limits on arrival at the encoder input, otherwise cancellation may take place in the *M* signal matrix. Such delays may occur in any section of the system where *L* and *R* signals follow separate routes - such as in tape recorders and relay circuits, or in the acoustic paths to spaced microphones. Consequently, relative signal delay needs careful attention in program production and system engineering.

ANCILLARY COMMUNICATIONS SERVICES

Sub-carrier signals

22. When authorised, information supplementary to the main sound broadcasting program may be transmitted on sub-carriers located above the *M* and *S* signals. In this standard, three classes of sub-carrier are considered:

(a) 67 kHz sub-carrier;

(b) 57 kHz sub-carrier; and

(c) other sub-carriers below 95 kHz.

ACS sub-carriers may be used singly or in combination subject to the condition that the use of such sub-carriers shall not cause interference to or degradation of the main channel or other channels.

Main carrier deviation shall not exceed ±75 kHz when modulated with the total baseband signal.

The deviation of the main carrier by any ACS sub-carrier alone shall not exceed ±7.5 kHz.

Sub-carrier frequencies other than 57 kHz or 67 kHz may be used subject to the establishment of approved operating conditions on a case-by-case basis. Sub-carrier frequencies below 57 kHz and above 95 kHz shall not be used.

67 kHz sub-carrier ACS

23. The sub-carrier frequency shall be 67 kHz ±100 Hz.

PEAK DEVIATION (SUB-CARRIER)

24. Program and tone signals: peak deviation of the sub-carrier shall be dependent on the highest frequency modulating the sub-carrier in accordance with figure A2.1 (for program) and figure A2.2 (for audio frequency shift keyed data).

25. Direct FSK modulation: peak deviation of the sub-carrier shall be dependent on the injection level of the sub-carrier in accordance with figure A2.3 when it is directly modulated with data signals.

PRE-EMPHASIS

26. Pre-emphasis to a time constant of 150 microseconds may be applied to an analog music or speech signal modulating the sub-carrier (see figure A2.4).

SIDEBAND PRODUCTS

27. Sideband products in the baseband resulting from modulation of the sub-carrier shall not degrade the main channel *L* and *R* (or *M* and *S*) signals. Additionally, such products shall be attenuated to the extent necessary to meet the maximum out-of-band and spurious outputs requirements of this standard (see guidelines 9 to 12 above). This may require attenuation of such products, when averaged in a 3 kHz bandwidth of baseband frequencies below 53 kHz and above 81 kHz, to at least 60 dB below the level of the unmodulated sub-carrier.

57 kHz sub-carrier ACS

RADIO DATA SYSTEM (RDS)

28. The 57 kHz sub-carrier is primarily intended for use with systems complying with the specification for the Radio Data System (RDS) as published in CENELEC EN50076:1990

(December 1990) with the enhancements proposed in the EBU document SPB 482 (June 1990).

USE OF RDS SIGNALS

29. Elements of the RDS data signal intended to carry information about main program content shall be reserved for use by the broadcaster of the main sound broadcasting program service. Non-program related data capacity of the RDS signal may be used for the transmission of supplementary information.

NON-RDS USE

30. 57 kHz ACS services, not complying with the EN 50076 specification, may be authorised provided that they do not cause false operation of any receivers equipped with decoders for the reception of RDS signals conforming with EN 50076.

Other sub-carriers below 95 kHz

AUTHORISATION

31. The use of a sub-carrier frequency other than 57 kHz or 67 kHz may be authorised subject to the establishment of approved operating conditions on a case-by-case basis.

SIDEBAND PRODUCTS

32. Sideband products in the baseband resulting from modulation of the sub-carrier shall not degrade the main channel *L* and *R* (or *M* and *S*) signals. Additionally, such products shall be attenuated to the extent necessary to meet the maximum out-of-band and spurious outputs requirements of this standard (see guidelines 9 to 12 above). This may require attenuation of such products, when averaged in a 3 kHz bandwidth of baseband frequencies below 53 kHz and above 99 kHz, to at least 60 dB below the maximum level of the sub-carrier.

Multiple sub-carriers

AUTHORISATION

33. Any combination of 57 kHz and frequencies in the range 65 – 95 kHz may be authorised on a case-by-case basis subject to the provisions relating to ancillary communications services above.

MAIN CARRIER MODULATION LEVEL

34. The deviation of the main carrier due to the entire baseband signal, including all ACS signals, shall not exceed ±75 kHz.

35. The injection level of any one ACS sub-carrier shall not exceed 10 per cent (i.e. ±7.5 kHz deviation). If an ACS sub-carrier is added to the composite baseband signal, a corresponding reduction must be made to the levels of both the main program sum (*M*) and difference (*S*) signals to ensure that the maximum deviation specification is complied with.

SIDEBAND PRODUCTS

36. Sideband products in the baseband resulting from modulation of the sub-carriers (used singly or in combination) shall not degrade the main channel *L* and *R* (or *M* and *S*) signals. Additionally, such products shall be attenuated to the extent necessary to meet the maximum out-of-band and spurious outputs requirements of this standard (see guidelines 9 to 12 above). This may require attenuation of such products, when averaged in a 3 kHz bandwidth of baseband frequencies below 53 kHz and above 99 kHz, to at least 60 dB below the maximum level of one sub-carrier.

Table A2.1: Frequency limits of Australian FM channels

Frequency in MHz		
87.6 - 87.8	94.4 - 94.6	101.2 -101.4
87.8 - 88.0	94.6 - 94.8	101.4 -101.6
88.0 - 88.2	94.8 - 95.0	101.6 -101.8
88.2 - 88.4	95.0 - 95.2	101.8 -102.0
88.4 - 88.6	95.2 - 95.4	102.0 -102.2
88.6 - 88.8	95.4 - 95.6	102.2 -102.4
88.8 - 89.0	95.6 - 95.8	102.4 -102.6
89.0 - 89.2	95.8 - 96.0	102.6 -102.8
89.2 - 89.4	96.0 - 96.2	102.8 -103.0
89.4 - 89.6	96.2 - 96.4	103.0 -103.2
89.6 - 89.8	96.4 - 96.6	103.2 -103.4
89.8 - 90.0	96.6 - 96.8	103.4 -103.6
90.0 - 90.2	96.8 - 97.0	103.6 -103.8
90.2 - 90.4	97.0 - 97.2	103.8 -104.0
90.4 - 90.6	97.2 - 97.4	104.0 -104.2
90.6 - 90.8	97.4 - 97.6	104.2 -104.4
90.8 - 91.0	97.6 - 97.8	104.4 -104.6
91.0 - 91.2	97.8 - 98.0	104.6 -104.8
91.2 - 91.4	98.0 - 98.2	104.8 -105.0
91.4 - 91.6	98.2 - 98.4	105.0 -105.2
91.6 - 91.8	98.4 - 98.6	105.2 -105.4
91.8 - 92.0	98.6 - 98.8	105.4 -105.6
92.0 - 92.2	98.8 - 99.0	105.6 -105.8
92.2 - 92.4	99.0 - 99.2	105.8 -106.0
92.4 - 92.6	99.2 - 99.4	106.0 -106.2
92.6 - 92.8	99.4 - 99.6	106.2 -106.4
92.8 - 93.0	99.6 - 99.8	106.4 -106.6
93.0 - 93.2	99.8 -100.0	106.6 -106.8
93.2 - 93.4	100.0 -100.2	106.8 -107.0
93.4 - 93.6	100.2 -100.4	107.0 -107.2
93.6 - 93.8	100.4 -100.6	107.2 -107.4
93.8 - 94.0	100.6 -100.8	107.4 -107.6
94.0 - 94.2	100.8 -101.0	107.6 -107.8
94.2 - 94.4	101.0 -101.2	107.8 -108.0

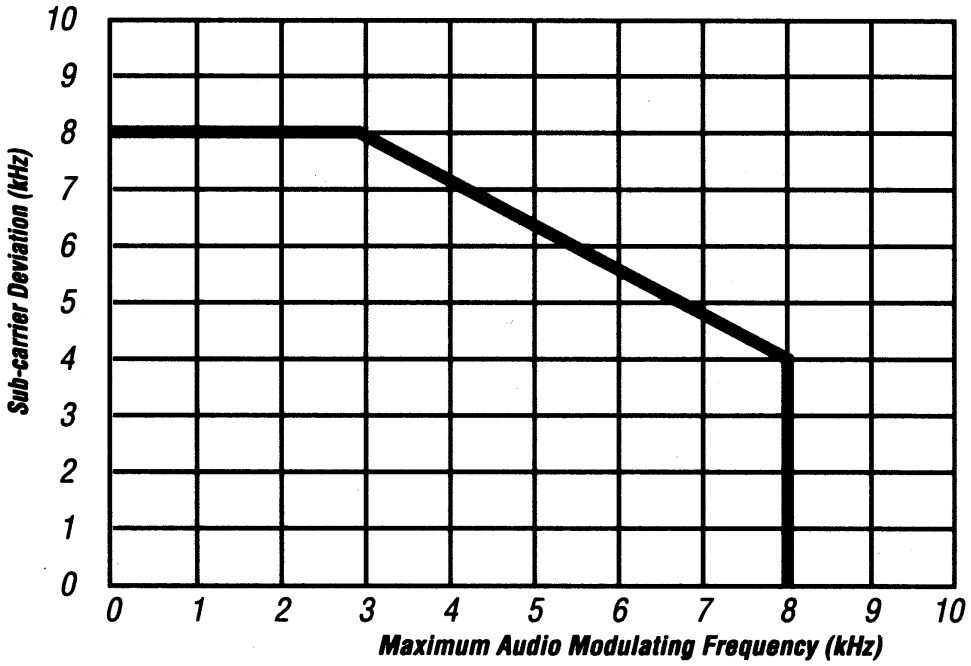


Figure A2.1: Maximum Deviation of 67 kHz ACS Sub-carrier Versus Audio Modulated Frequency for Music and Voice

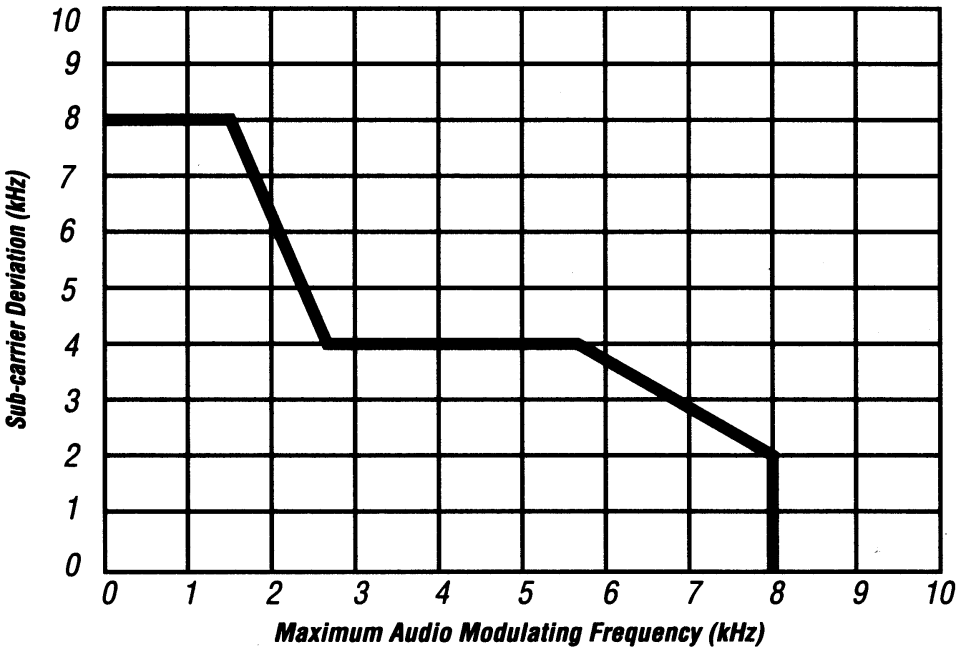


Figure A2.2: Maximum Deviation of 67 kHz ACS Sub-carrier Versus Audio Modulating Frequency for Audio FSK

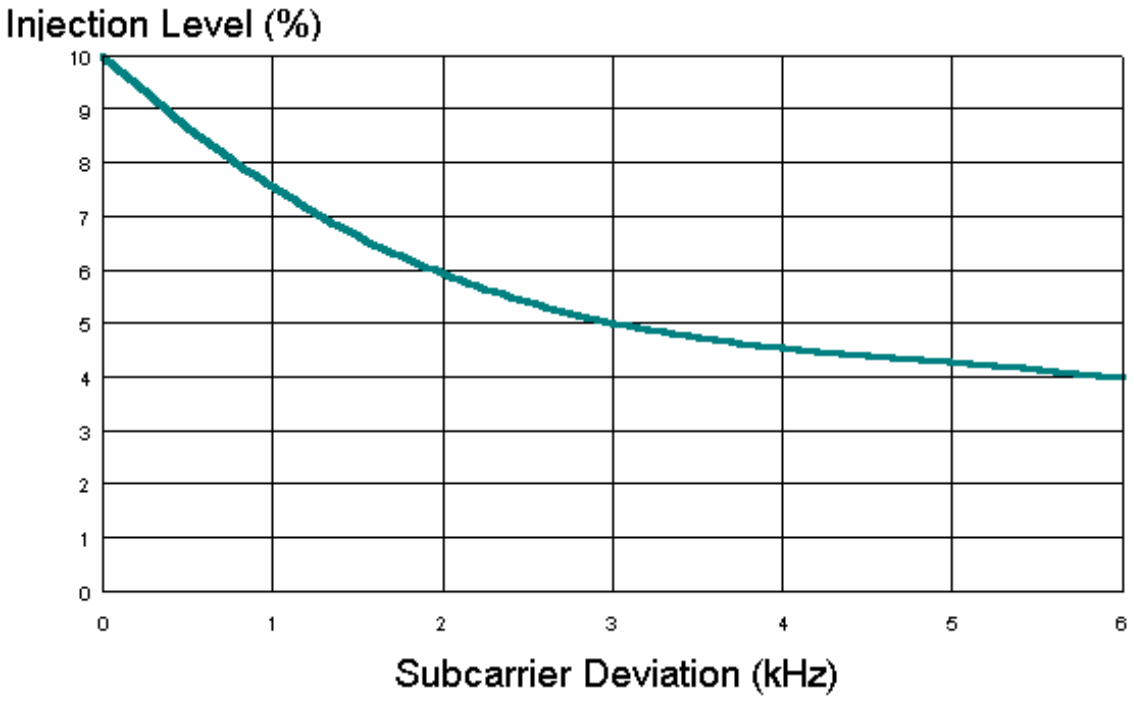


Figure A2.3: Maximum Deviation Versus Injection for Direct FSK of 67 kHz ACS Sub-carrier

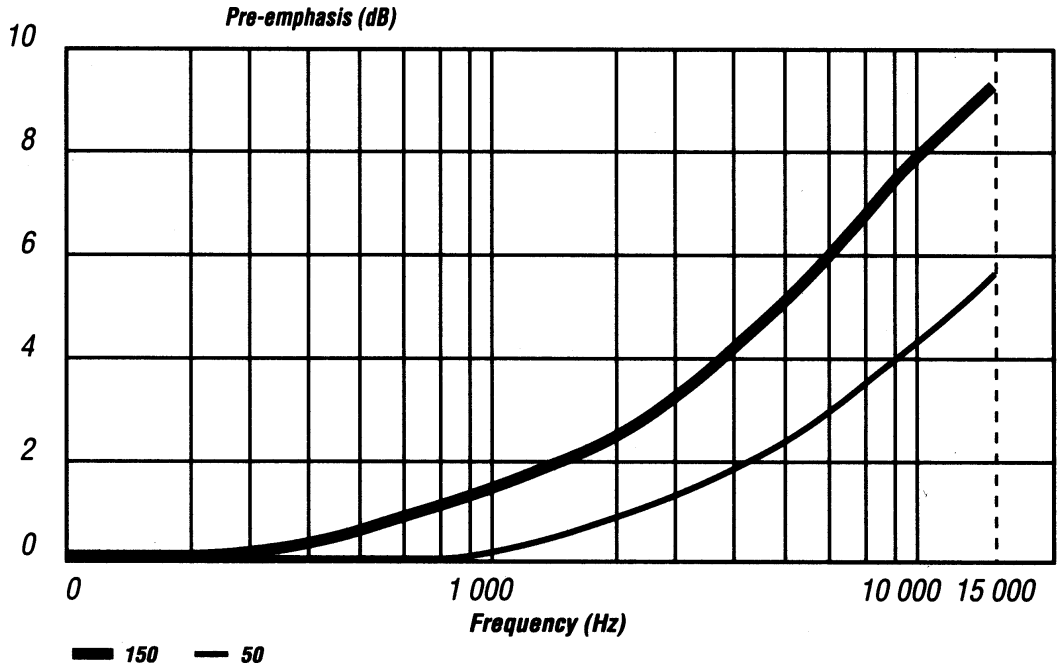


Figure A2.4: Audio Frequency Pre-emphasis Characteristics for 50 and 150 Microsecond Time Constant (in dB)

APPENDIX 3:

EMISSION STANDARD FOR THE AUSTRALIAN TERRESTRIAL TELEVISION SERVICE

This standard defines the parameters to be used for the Australian Terrestrial Television Service defines the parameters to be used for terrestrial broadcasting of television. This standard supersedes the *Emission Standard for the Australian Terrestrial Television Service* - Sixth Edition (Department of Transport and Communications, March 1989).

The standard is a variant of the PAL-B system described in ITU-R BT.470-2 (Characteristics of Television Systems), and ITU-R BS.707-1 (Transmission of Two or More Sound Programmes or Information Channels in Television).

The standard incorporates changes to channel numbering consequent to the adoption of 7 MHz channel spacing in Bands IV and V; specifications for the dual channel sound system; and line allocations in the vertical blanking interval for Teletext and closed caption data transmission.

The following characteristics are at variance with the PAL-B standard:

- depth of vision modulation (see guideline 3);
- use of lines in the vertical blanking interval (see guideline 18);
- group delay pre-correction (see figure A3.7).

DEFINITIONS

(Unless defined hereunder, any word used shall have the meaning given to it by the *Radiocommunications Act 1992* or the *Broadcasting Services Act 1992* or the *ITU Radio Regulations* as appropriate)

In this standard, the following definitions apply:

‘necessary bandwidth’ means, for a given class of emission, the width of the frequency band which is just sufficient to ensure the transmission of information at the rate and with the quality required under specified conditions;

‘out-of-band emission’ means emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions;

'spurious emission' means emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions;

RADIATED SINGAL CHARACTERISTICS

Television Channels

1. The width of the television channel shall be 7 MHz. Channel arrangements for Australian television services are shown in table A5.1.

Location of carriers within the channel

2. The nominal vision carrier frequency shall be 1.25 MHz above the lower frequency limit of the channel. The frequency of the unmodulated sound carrier for single sound carrier operation, or the lower frequency sound carrier of a dual sound carrier channel shall be 5.5 MHz ±500 Hz above the vision carrier frequency. The frequency of the unmodulated second sound carrier of a dual sound carrier channel shall be 15.5 times the line frequency (242.1875 kHz) above the frequency of the first unmodulated sound carrier. Figure A3.5 details the location of the carriers and sidebands within the channels.

The tolerance on the frequency of the radiated signals shall comply with the requirements of the *ITU Radio Regulations* Appendix 7 (1982 edition, 1985 revision) unless otherwise prescribed by the ABA. The ABA may also specify frequency offsets from the nominal vision carrier frequency.

Vision carrier modulation

3. The vision carrier shall be amplitude modulated by the video signal. Negative modulation shall be employed, that is a decrease in brightness shall cause an increase in the vision carrier amplitude.

Modulation levels of the vision carrier

4. Black and blanking levels shall be equal in amplitude and correspond to 76 per cent of the peak vision carrier amplitude. Reference white level shall correspond to 20 per cent of the peak vision carrier amplitude.

Sound carrier modulation

5. The sound carrier or carriers shall be frequency modulated by the audio signal. The peak deviation of the emitted signal shall be 50 kHz.

Polarisation of the radiated signals

6. The polarisation of the radiated signals from both sound and vision transmitters shall be the same and shall be specified by the ABA.

Vision to sound power ratio

7. The nominal ratio of the root-mean-square value of the vision carrier power at the sync pulse tips to the mean power output of the sound carrier or carriers shall be:

(a) 10 dB where the station transmits a single sound channel only;

(b) 13 dB and 20 dB for the first and second sound carriers respectively where the station transmits dual sound signals.

Limits on out-of-band spectrum and spurious emissions

8. The maximum permitted spurious emission power levels shall not exceed those specified in the *ITU Radio Regulations*, Appendix 8 (1982 edition, 1985 revision) unless otherwise prescribed by the ABA.

VIDEO CHARACTERISTICS

Scanning

ASPECT RATIO

9. The aspect ratio of the television picture shall be four units horizontally to three units vertically.

SCANNING SEQUENCE

10. During active scanning intervals the scene shall be scanned from left to right horizontally, and from top to bottom vertically, at uniform velocities.

NUMBER OF LINES AND INTERLACE

11. The number of scanning lines per picture shall be 625 interlaced two to one.

PICTURE AND FIELD FREQUENCIES

12. The nominal picture and field frequencies shall be 25 Hz and 50 Hz respectively, and equal to the appropriate sub-multiples (625 and 312.5 respectively) of the line frequency.

COLOUR SUB-CARRIER AND LINE FREQUENCIES

13. The colour sub-carrier frequency (f_{sc}) shall be 4433618.75 Hz ±5 Hz and the relationship between f_{sc} and the line frequency shall be:

$$f_{sc} = \left(\frac{1135}{4} + \frac{1}{625}\right) f_H$$

Video Signal

14. The video signal comprises the synchronising information occurring alternately on a time division basis with the picture signal as shown in figure A3.1. The picture signal comprises the luminance component together with the chrominance components if present. The nominal synchronising pulse amplitude shall be $^3/_7$ of the blanking to reference white amplitude. Table A3.2 specifies the timing intervals of the video signal and figure A3.2 illustrates this relationship.

Colour Picture Signal

15. Coding of the colour information shall be in accordance with the Phase Alternation Line (PAL) system. In this system the colour picture signal, E_M, contains a luminance component E'_Y, and also simultaneous chrominance components $E'_U \sin(2\pi f_{sc}t)$ and $E'_V \cos(2\pi f_{sc}t)$ with the phase of the latter component being changed by 180° on alternate lines. The equation of the colour picture signal is:

$$E_M = E'_Y + E'_U \sin(2\pi f_{sc}t) \pm E'_V \cos(2\pi f_{sc}t)$$

where:

(a) the luminance component

$$E'_Y = 0.299E'_R + 0.587E'_G + 0.114E'_B$$

(b) the chrominance modulation signals

$$E'_U = 0.493(E'_B - E'_Y) \text{ and}$$

$$E'_V = 0.877(E'_R - E'_Y)$$

(c) the colour difference signals

$$E'_B - E'_Y = -0.299E'_R - 0.587E'_G + 0.886E'_B$$

$$E'_R - E'_Y = +0.701E'_R - 0.587E'_G - 0.114E'_B$$

E'_R, E'_G, E'_B are, respectively, the red, green and blue gamma corrected voltages required for tristimulus matching. The value of the exponent for this correction shall be related to a display tube gamma of 2.8, and shall be consistent with optimum colour fidelity.

The sign of the term $E'_V \cos(2\pi f_{sc} t)$ is positive during odd lines of the first and second fields and during even lines of the third and fourth fields (see figure A3.4).

As a consequence of the choice of colour difference signals the chrominance components both disappear in the absence of colour.

The resulting video signal for fully saturated primary and complementary colours at full luminance is shown in figure A3.2.

Bandwidth of colour difference signals

16. The colour difference signals shall be limited in bandwidth prior to modulation of the colour sub-carriers by a circuit having an approximate Gaussian response, with an attenuation of not more than 3 dB at 1.3 MHz, but greater than 20 dB at and above 4.0 MHz.

Colour synchronisation

17. A burst of 10 cycles of the colour sub-carrier frequency shall occur during each line blanking period, commencing nominally 5.6 microseconds after the half amplitude point of the leading edge of the line synchronising pulse. At the point of encoding the peak to peak amplitude of the sub-carrier burst shall be $^3/_7$ of the blanking to reference white signal amplitude and thereafter the amplitude and phase of the burst shall be preserved relative to the chrominance signal. The envelope of the sub-carrier burst signal shall have a build-up time consistent with the bandwidth restriction of the colour difference signals.

The sub-carrier burst shall be omitted for nine consecutive lines starting at or before the beginning of each field blanking interval in a four field sequence as illustrated by figure A3.4. The phase sequence of the colour sub-carrier burst is also detailed in figure A3.4.

The phase of the sub-carrier burst relative to the $+E'_U$ signal reference phase axis shall be +135° on odd lines of the first and second fields and on even lines of the third and fourth fields and –135° on even lines of the first and second fields and on odd lines of the third and fourth fields (see figure A3.3).

During the transmission of monochrome signals the colour burst may be suppressed.

Special signals in the vertical blanking interval

18. Lines 10 to 22 and lines 323 to 335 may be transmitted for such purposes as control of equipment, source identification, data transmission and circuit performance testing.

Lines 17, 18, 330 and 331 are preferred for circuit performance testing purposes.

Teletext signals on lines 21 and 334 shall be restricted to closed caption services.

Lines 22 and 335 are preferred for the measurement of noise, ie. only blanking level should be transmitted on these lines.

Detailed specifications on Teletext and closed caption data transmissions are given in the Teletext System Standard, issued by the former Department of Transport and Communications.

The line numbering sequence is detailed in figure A3.4.

PRIMARY COLOUR SIGNALS

19. Spectral response of the optical section in the colour picture signal source, together with any matrix of the three sensor outputs, shall be such that the E'_R, E'_G, E'_B signals will reproduce an image with optimum colour fidelity on a colour picture tube having phosphors with the following CIE*15 chromaticity coordinates, and balance for a white chromaticity of CIE Illuminant D_{65}, shown in table A3.1. [* Colorimetry, International Commission on Illumination (Comité Internationale d'Éclairage)]

Table A3.1: CIE*15 Chromaticity Coordinates, and Balance for a White Chromaticity of CIE Illuminant D_{65}

	Chromaticity Coordinates	
	X	***Y***
Red phosphor	0.64	0.33
Green phosphor	0.29	0.60
Blue phosphor	0.15	0.06
Illuminant D_{65}	0.313	0.329

* Colorimetry, International Commission on Illumination (Comité Internationale d'Éclairage)

VISION SIGNAL CHARACTERISTICS

Characteristics of the vision transmitter

20. Vestigial sideband transmission shall be used. The response at the television channel limits shall be reduced by at least 20 dB, relative to the response at 1.5 MHz above the vision carrier.

Group delay/frequency response

21. The vision transmitter shall incorporate group delay correction so that the overall group delay/frequency response of the transmitter and standard vestigial sideband

demodulator shall be flat to 5 MHz. The group delay characteristic shall be in accordance with figure A3.7.

SOUND SIGNAL CHARACTERISTICS

Characteristics of the sound transmitter

22. The sound transmitter or transmitters shall be capable of operating with audio modulating frequencies between 40 Hz and 15 kHz. The audio modulating signal shall be pre-emphasised, as shown in figure A3.6, in accordance with the impedance/frequency characteristic of a series resistance-inductance network having a time constant of 50 microseconds.

First or single sound carrier modulation

23. For a single sound carrier system the carrier shall be modulated by the audio signal. The modulation of the first sound carrier of a dual sound system for the various transmission modes shall be in accordance with the following:

(a) monophonic transmission - the carrier shall be modulated by the audio signal;

(b) stereophonic transmission - the carrier shall be modulated by the compatible monophonic, or sum, component of the stereophonic audio signal, $(L+R)/2$;

(c) separate sound signal transmission - the carrier shall be modulated by the monophonic signal of the first sound channel.

Second sound carrier modulation

24. The modulation of the second sound carrier of a dual sound system for the various transmission modes shall be in accordance with the following:

(a) monophonic transmission - the carrier shall be modulated by the same audio signal as the first sound carrier;

(b) stereophonic transmission - the carrier shall be modulated by the audio signal arriving from the right hand signal source (R);

(c) separate sound signal transmission - the carrier shall be modulated by the monophonic signal of the second sound channel.

Identification of Transmission Mode

25. To identify the type of signal being transmitted, the second sound carrier shall be frequency modulated to a deviation of ±2.5 kHz ±500 Hz by a sub-carrier of 3.5 times the line frequency (ie. 54.6875 kHz) This sub-carrier shall be:

(a) unmodulated for monophonic transmission;

(b) 50 per cent amplitude modulated with 117.5 Hz (line frequency divided by 133) for stereophonic transmission; and

(c) 50 per cent amplitude modulated with 274.1 Hz (line frequency divided by 57) for separate sound signal transmission.

Table A3.2: Timing Intervals of the Video Signal

Duration (measured between half amplitude points)	***Microseconds Nominal Value***	***Tolerance***
Field period (V)	20000	
Line period (H)	64	
Line blanking interval	12	+0.0, –0.3
Front porch interval	1.5	+0.3, –0.0
Line synchronising pulse interval	4.7	±0.2
Field blanking interval	25 H + 12	+0, –0.3
Duration of field synchronising pulse sequence	2.5 H	
Duration of pre-equalising pulse sequence	2.5 H	
Duration of post-equalising pulse sequence	2.5 H	
Duration of equalising pulse	2.35	±0.1
Interval between field synchronising pulses	4.7	±0.2
Colour sub-carrier burst		
- start, from leading edge of line synchronising pulse	5.6	±0.1
- duration (nominally 10 cycles)	2.25	±0.25
- duration of burst blanking pulse (per field)	9 H	
Build-up time (10 to 90 per cent amplitude points) Edges of		
- blanking pulses	0.3	±0.1
- synchronising signals	0.3	±0.1

Table A3.3: Colour Sub-carrier Amplitudes and Phases for Fully Saturated Primary and Complementary Colours

Colour	*Luminance*	*Peak to Peak Chrominance*			*Chrominance Angle*[2]	
	E'_Y	$2E'_U$	$2E'_V$	$2S$[1]	*Line n*[3]	*Line n+1*
White/Reference	100.0					
Yellow	88.6	87.4	20.0	89.6	167.1°	192.9°
Cyan	70.1	29.5	123.0	126.4	283.5°	76.5°
Green	58.7	57.9	103.0	118.1	240.7°	119.3°
Magenta	41.3	57.9	103.0	118.1	60.7°	299.3°
Red	29.9	29.5	123.0	126.4	103.5°	256.5°
Blue	11.4	87.4	20.0	89.6	347.1°	12.9°
Burst	0	30.3	30.3	42.9	135.0°	225.0°
Reference black	0					

Notes: (1) $G = (E'_U{}^2 + E'_V{}^2)^{½}$ $E'_U = 0.493(E'_B - E'_Y)$ $E'_V = 0.877(E'_R - E'_Y)$

(2) The chrominance angles are measured anti-clockwise from the E'_U axis.

(3) Line n corresponds to the odd numbered lines of the first and second fields & the even numbered lines of the third and fourth fields.

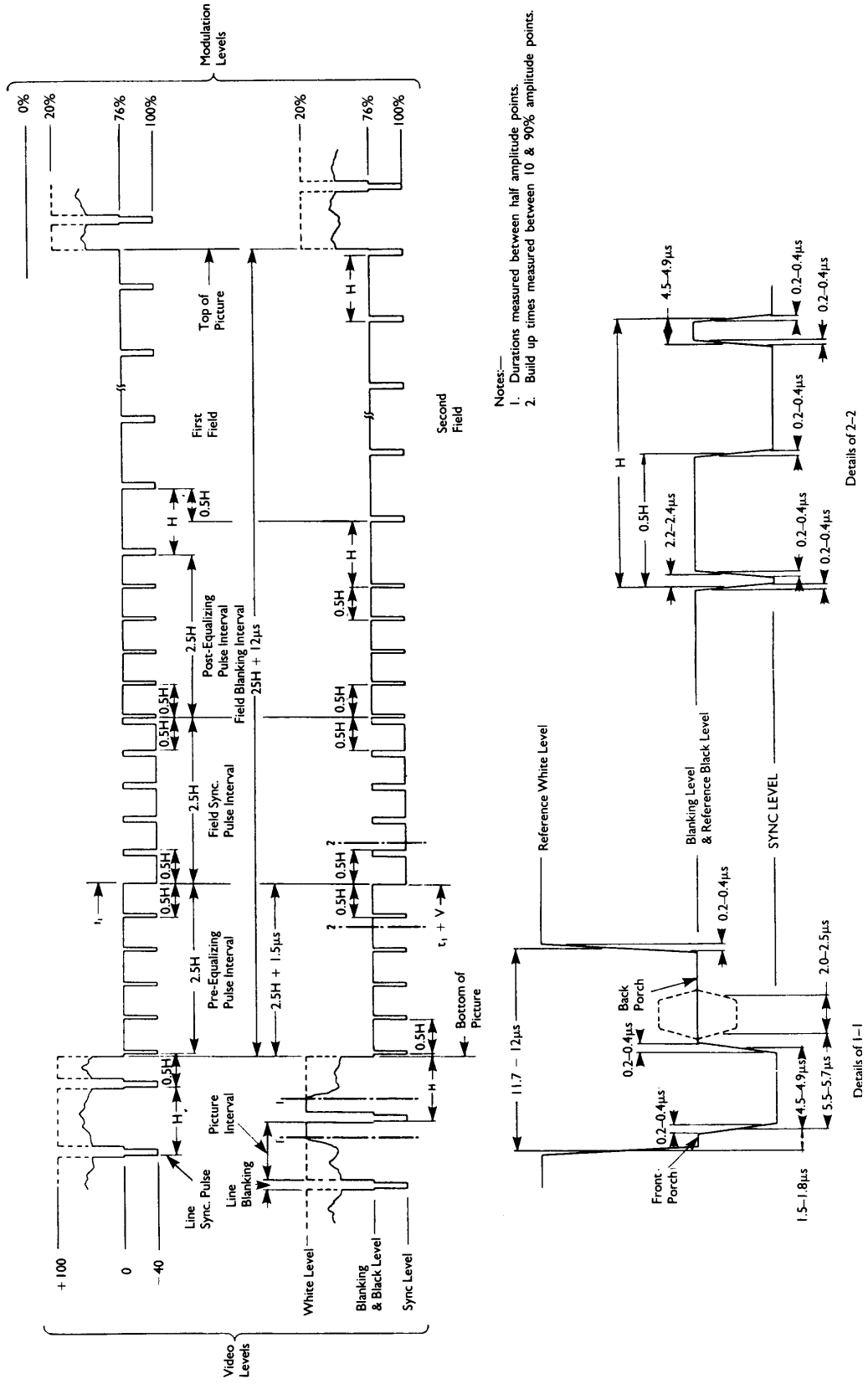


Figure A3.1: Video Signal

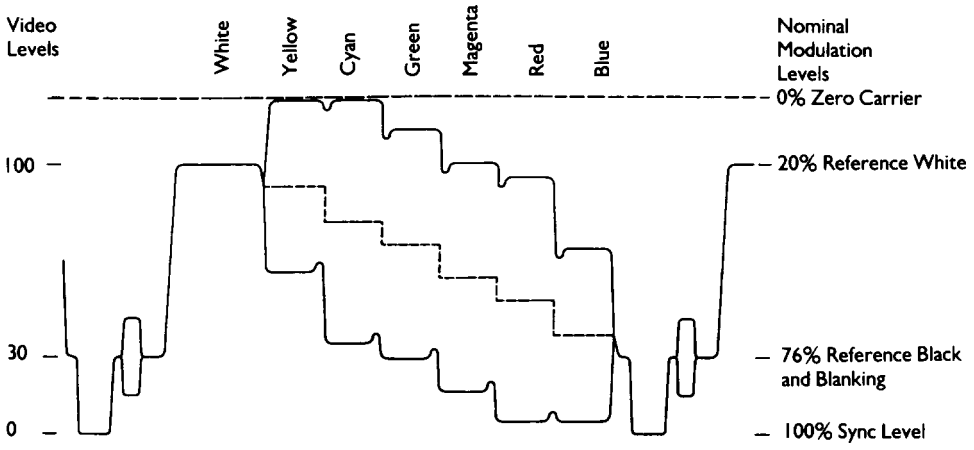
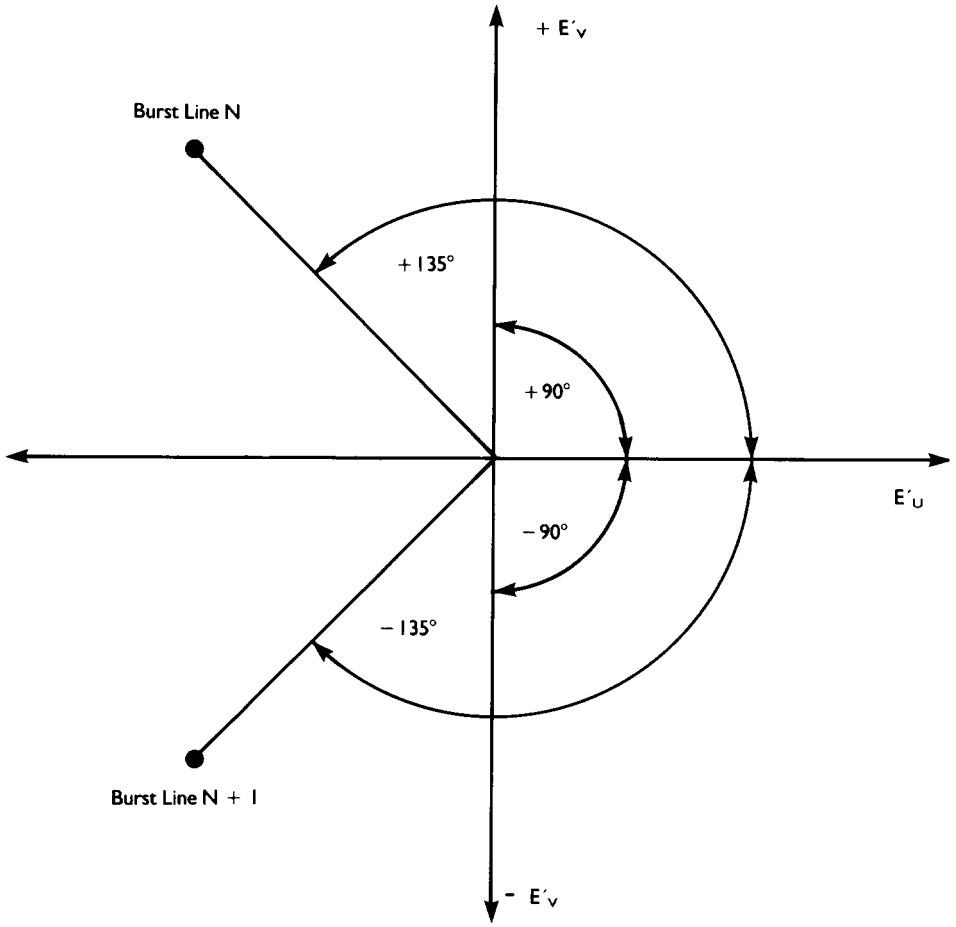
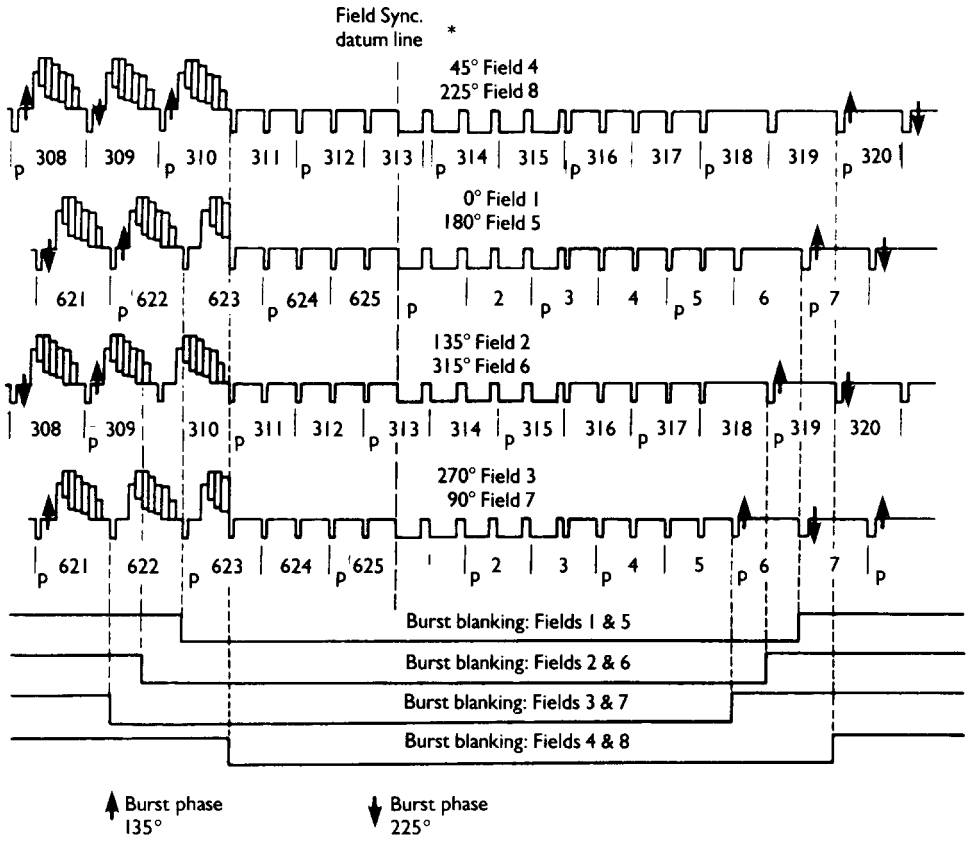


Figure A3.2: Video Signal Corresponding to Fully Saturated Colours



Line n: Odd lines of the 1st & 2nd fields
Even lines of the 3rd & 4th fields

Figure A3.3: Phase of Burst E'_U & E'_V Signals



* The subcarrier phases shown correspond to the EBU definition of the preferred Sc-H phase for video signals recorded on tape:
$\varnothing E'_U = 0°$

Note P indicates a line where E'_V is not inverted

Figure A3.4: Four Field Sequence of Burst Blanking and Subcarrier Phase

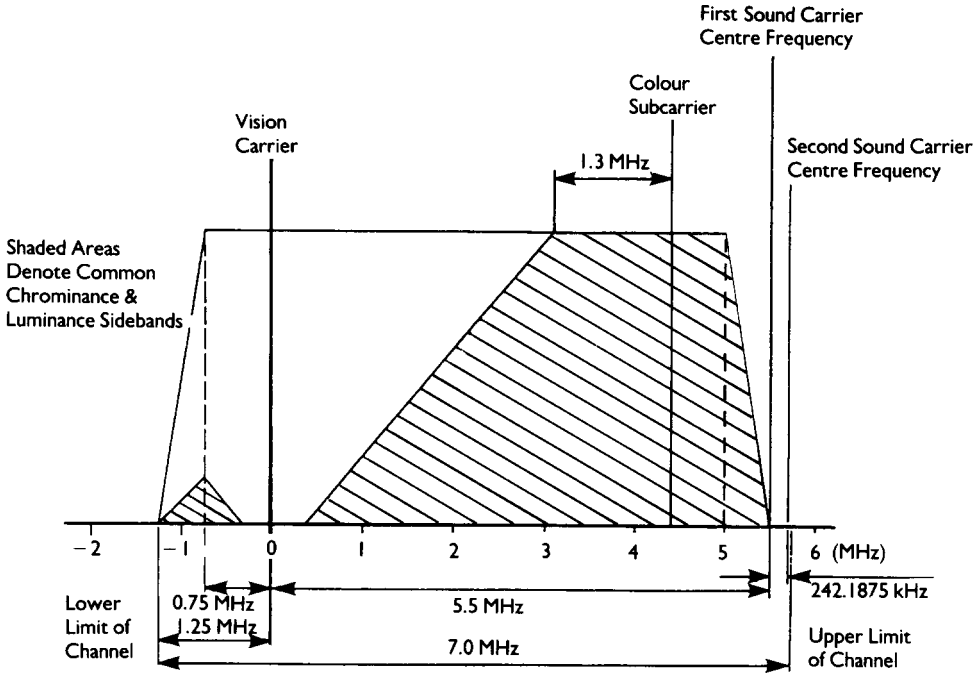


Figure A3.5: Location of Carriers and Sidebands within the Channel

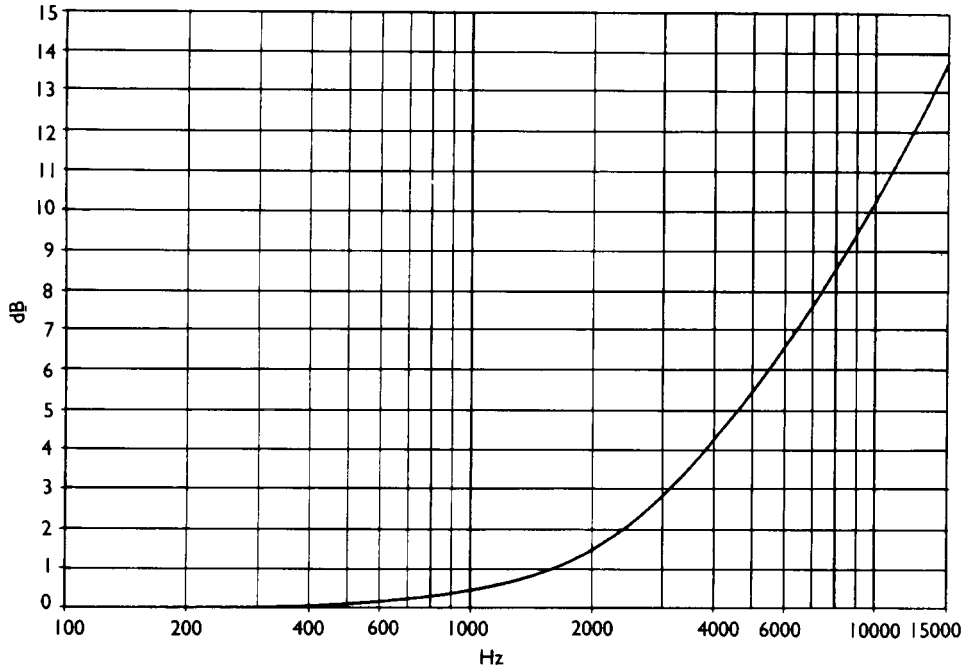


Figure A3.6: Sound Transmitter, Modulating Signal Pre-emphasis

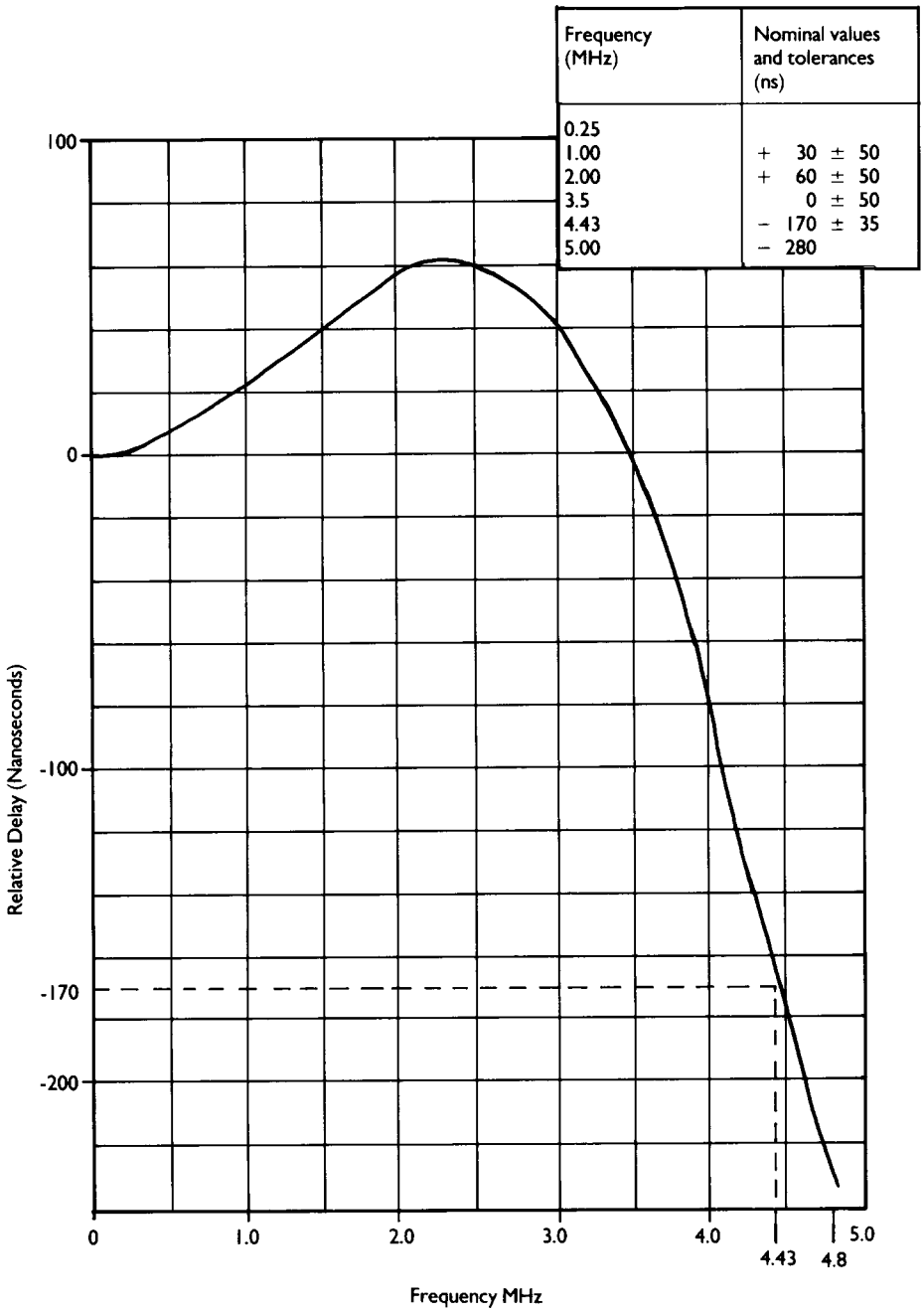


Figure A3.7: Nominal Group Delay Precorrection Characteristic

APPENDIX 4:

STANDARDS FOR THE AUSTRALIAN DIGITAL TERRESTRIAL TELEVISION SERVICE

Standards relevant to the Australian digital television broadcasting and datacasting services are listed below. These standards have been made by Standards Australia and may be adopted by broadcasters and datacasters according to their own requirements.

Aside from the radiated signal spectrum mask clause, clause 4.8.2 (Aus) of Section 3 of *AS4599-1999* that is mandatory under guideline 101, these standards are recommended by the ABA only and are not mandatory under these Guidelines.

Transmission standard

Australian Standard *AS4599-1999 Digital Television – Terrestrial Broadcasting – Characteristics of digital terrestrial television transmissions*

Receiver Standard

Australian Standard *AS4933.1-2000 Digital Television – Requirements for receivers Part 1: VHF/UHF DVB-T television broadcasts*

Channels

Channels that may be used for Australian digital television broadcasting and datacasting services are listed in Appendix 5.

APPENDIX 5:

CHANNELS FOR THE AUSTRALIAN TERRESTRIAL TELEVISION SERVICE

Table A5.1: Channels for the Australian Terrestrial Television Service

VHF		*UHF*			
BAND I[1]		**BAND IV**		47	659-666 MHz
0	45- 52 MHz	27 [5]	520-526 MHz	48	666-673 MHz
1	56-63 MHz	28	526-533 MHz	49	673-680 MHz
2	63-70 MHz	29	533-540 MHz	50	680-687 MHz
		30	540-547 MHz	51	687-694 MHz
		31	547-554 MHz	52	694-701 MHz
BAND II [1]		32	554-561 MHz	53	701-708 MHz
3	85-92 MHz	33	561-568 MHz	54	708-715 MHz
4	94-101 MHz	34	568-575 MHz	55	715-722 MHz
5	101-108 MHz	35	575-582 MHz	56	722-729 MHz
				57	729-736 MHz
		BAND V		58	736-743 MHz
BAND III		36	582-589 MHz	59	743-750 MHz
5A [2]	137-144 MHz	37	589-596 MHz	60	750-757 MHz
6	174-181 MHz	38	596-603 MHz	61	757-764 MHz
7	181-188 MHz	39	603-610 MHz	62	764-771 MHz
8	188-195 MHz	40	610-617 MHz	63	771-778 MHz
9	195-202 MHz	41	617-624 MHz	64	778-785 MHz
9A [3]	202-209 MHz	42	624-631 MHz	65	785-792 MHz
10 [4]	208-215 MHz (superseded)	43	631-638 MHz	66	792-799 MHz
	209-216 MHz (current)	44	638-645 MHz	67	799-806 MHz
11 [4]	215-222 MHz (superseded)	45	645-652 MHz	68 [6]	806-813 MHz
	216-223 MHz (current)	46	652-659 MHz	69 [6]	813-820 MHz
12 [3]	223-230 MHz				

Note 1 Television Band I (Channels 0, 1 & 2) and Band II (Channels 3, 4 & 5) are not being considered for new analog television services or for the introduction or ongoing transmission of digital television services.

Note 2 VHF Channel 5A is currently within the Broadcasting Services Bands (BSB) and has been recommended for clearance by the ABA and ACA to allow for the introduction of Low Earth Orbiting (LEO) satellites. Channel 5A is not being considered for new analog television services or for the introduction or ongoing transmission of digital television services.

Note 3 Clearance of radiocommunication services from 202-208 MHz and from 222-230 MHz has allowed a revised channel arrangement to be implemented. The current channel arrangement has two new channels (channels 9A and 12). To accommodate channel 9A, channels 10 and 11 were shifted up in frequency 1 MHz.

Note 4 The majority of existing services on channels 10 and 11 were assigned using the superseded channel arrangement. Services on channels 10 and 11 may be required to shift in frequency to align with the current channel arrangement. Any such requirement will be considered on a case-by-case basis. New services on channels 10 and 11 will be assigned according to the current channel arrangement i.e. channel 10 (209-216 MHz) and channel 11 (216-223 MHz)

Note 5 UHF Television Channel 27 has a bandwidth of 6 MHz and therefore is not currently suitable for digital television services. The ABA and ACA are considering ways of making use of channel 27 as a 7 MHz channel.

Note 6: The ABA and ACA are considering spectrum that may be re-allocated for non-broadcasting purposes due to the increased spectral efficiency with Digital Television. In particular the use of part, or the entire frequency band 806-820 MHz is under consideration. Where practicable the ABA will endeavour to avoid the use of channels 68 and 69.

Note 7 Offsets from these nominal channel frequencies may be applied. In the case of digital television offsets of +125 kHz and –125 kHz may be applied.

EXPLANATORY NOTES

INTRODUCTION

Under section 33 of the *Broadcasting Services Act 1992*, the ABA is required to prepare Technical Planning Guidelines (TPGs) for radio and television services using the broadcasting services bands. Despite their name, the TPGs contain mandatory technical requirements to be met by all commercial and community broadcasting licensees using the broadcasting services bands when planning and operating new transmission facilities or changes to existing facilities.

By reason of sections 108A(1)(d), 109(1)(e) and 109A(1)(f) of the *Radiocommunications Act 1992*, the licensee of a transmitter licence issued to the holder of a commercial radio or television broadcasting licence issued under Part 4 of the *Broadcasting Services Act 1992,* or a community radio or television broadcasting licence issued under Part 6 of the *Broadcasting Services Act 1992*, or the licensee of a temporary community broadcasting licence issued under Part 6A of the *Broadcasting Services Act 1992*, or the holder of a datacasting transmitter licence issued under section 100 of the *Radiocommunications Act 1992*, or any authorised person, must comply with these guidelines.[2]

Note that transmitter licences for National Broadcasting Services issued under sections 100 or 100B or narrowcasting licences issued under section 100 of the *Radiocommunications Act 1992*, may also include a licence condition requiring compliance with specified guidelines or parts of these guidelines.

These explanatory notes are designed to help broadcasters and others in industry involved with broadcasting to understand how the TPGs apply to the planning and operation of transmitters using the broadcasting services bands.

BACKGROUND - PLANNING BEFORE THE BROADCASTING SERVICES ACT 1992

Planning under the former Broadcasting Act 1942, was carried out by the appropriate Government Department on a site specific basis with detailed engineering specifications of the transmitting antenna radiation performance.

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[2]The reference to a licence issued under Part 4 or Part 6 of the *Broadcasting Services Act 1992* includes a licence which continues in force pursuant to the provisions of section 5(1) of the *Broadcasting Services (Transitional Provisions and Consequential Amendments) Act 1992* as if the licence had been allocated under Part 4 or Part 6 of the *Broadcasting Services Act 1992*. i.e. a commercial or community licence under the *Broadcasting Act 1942*.

Guidance to broadcasters was provided through a document known as the draft Planning Guidelines (also known as GS1 through GS4) developed around 1982. These were never given status other than draft because of some technical legal debate as to what head of power was appropriate for such documents and what force they might have. In 1992, GS1 through GS4 were restructured into a single document and the Technical Planning Parameters and Measurement Methods for Terrestrial Broadcasting (the TPPs) were published by the Station Planning Branch of the Department of Transport and Communications in June 1992.

The TPPs were developed in consultation with the industry and its engineering consultants and included all of the essential requirements plus a great deal of advisory information which could be used by facilities planners and were based on the relevant International Telecommunications Union (ITU) Radiocommunications Bureau (formerly the CCIR) Reports and Recommendations and on planning methods and best practices developed in the USA, the UK and Europe as broadcasting planning techniques and planning parameters developed in Australia.

The TPPs did not have the force of law but rather were detailed planning arrangements which if applied to proposals by licence applicants would generally be acceptable planning methods and yield answers most likely to meet the requirements of the planners.

Transmitter specifications issued as a result of this planning process (a licence warrant under the former Act) had the force of law, and essentially required even slight changes to the antenna system to be approved by the Department (on behalf of the Minister) even though such changes may have no impact on other users of the spectrum or the public at large. The planning process, while spelt out in the Draft Guidelines and later the TPPs did not provide clear guidance as to how licensees should interpret them, and there was no widely available public database of Australia wide frequency planning against which licensees could plan changes. As a result even small changes to specifications required considerable dialogue between the applicant and the planners, with attendant high resource costs, a risk of somewhat arbitrary decisions, and time delays.

OVERVIEW OF PLANNING UNDER THE BROADCASTING SERVICES ACT 1992

The *Broadcasting Services Act 1992,* moved the focus on service planning by the regulator to one of establishing a strategic framework of frequency assignments and licence and technical specifications for services throughout the country, leaving the detailed implementation of the specifications for transmitting facilities to the licensee.

First, the ABA determined through a public consultation process, the *Planning Priorities,* that is, the priority in which various services and areas of Australia would be planned; the Planning Priorities were determined in September 1993. This was followed by the determination of the frequency Allotment Plan which identifies the channel capacity that is to be planned for all broadcasting services and outlines the known Ministerial Reservations for national and community broadcasting services. The FAP, while it outlines the number of services that are to be planned in each area, does not contain specific frequencies. The FAP was first determined in August 1994 and is varied from time to time. The third and final stage of planning is the determination of *Licence Area Plans* which contain the

licence areas, characteristics and technical specifications for all broadcasting services in each area of Australia.

Technical Specifications and Licence Area Plans

In licence area planning, the approach taken by the ABA is to establish technical specifications for transmitters in a way which provides a performance envelope within which the transmitter and its associated transmitting antenna or radiating system must operate. In some instances the tolerance provided by the envelope may be very small, especially where frequency planning is very tight. In other instances, especially in areas where there are no existing services, greater tolerance might be available.

In determining the technical specifications for each service in the LAP, the frequency planning is highly dependent upon the physical location of the transmitter and the height of its antenna. The location of the transmitter relative to the licence area to be served determines the radiated power required in various directions, called the radiation pattern. However, the requirement to reuse many channels in other places means that there is an upper limit of ERP that might be permitted in certain directions in order to provide substantially interference free service for other users of the same or adjacent channels in neighbouring licence areas.

The LAP gives the nominal transmitting site and provides the performance envelope within which transmitters must operate; licensees, in implementing these specifications, are required to take account of the mandatory requirements of the TPGs in developing their detailed transmitting facilities design.

Compliance with Technical Specifications of a Licence and the TPGs

The licensee, having established the transmission facilities, must always be able to provide evidence of appropriate engineering and interference analysis having been conducted and be able to demonstrate that the operating transmitting arrangements will comply with the technical specifications in the LAP and with the TPGs issued by the ABA under s.33 of the Broadcasting Services Act. Such evidence, provided it appears *prima facie* to meet this requirement, will be accepted at face value but will remain a matter of record in the event of the specifications subsequently being found non-compliant for any reason.

In other words, responsibility for compliance rests squarely with the licensee, not only for the initial design of the transmitting facility, but also for continuing surveillance of the installation to maintain compliance. In respect of continuing compliance, the licensee should maintain adequate records of inspections conducted, the technical competence of the testing engineer, and of the particular types of tests conducted as evidence of due diligence in the event that the ABA or the ACA is called upon to investigate a complaint, or discovers some non-compliance in its routine, random monitoring of transmitters and interference between services.

Thus the *Broadcasting Services Act* 1992 moves responsibility for detailed planning of a service to the licensee, who always had the obligation under the previous legislation, but who was assisted by detailed procedures under which the regulator established all elements of the specification, and conducted regular station inspections. The licensee had to do

nothing more than implement the specification and maintain compliance with it. If a compliant service caused interference or had coverage problems the responsibility lay with the regulator who established the specifications.

The ABA and/or the ACA, in discharging their responsibilities, may at any time, and without notice, conduct or commission spot checks of proposals and actual operating services to confirm compliance with or without complaints. In the event that problems were discovered, the ABA would bring the matter to the attention of the licensee and give the licensee an opportunity to provide relevant material indicating all reasonable steps had been taken to comply and to ensure continued compliance with the licence specifications. The licensee would still be required to take appropriate action to restore the service to compliance. These arrangements assume licensees will take all reasonable steps to comply and that non-compliance is more likely to be the result of technical failure of part of the transmission system rather than blatant disregard for the specifications.

The ABA and/or the ACA will take appropriate action under the relevant Acts in the event of blatant or reckless disregard for the specifications.

Variations to Technical Specifications in LAPS or DCPs

For a licensee to operate outside the limits of performance specified in a LAP or DCP or allowed under the TPGs, a formal variation of the LAP or DCP must be made before the change can be approved. If on the other hand, the licensee wants to make a change of site for example, which falls within the limits provided for by the technical specification in the LAP or DCP or the tolerance permitted within the TPGs, then no change to the LAP or DCP will be required.

Note that commercial disagreement about the price of access to sites (especially where there is no alternative) will not of itself be regarded as a sound basis for seeking a LAP or DCP variation. The ABA has provided wide opportunity for potential licensees to explore and propose alternatives during the public consultation process that establishes the LAP or DCP. In so far as is practical the ABA has endeavoured to avoid creating situations which force the use of a particular site and hence potentially escalate the entry price. However, on some particularly sensitive sites there may be no alternative and the cost of use of the site has to be accepted as a price of entry and operation of the service.

OUTLINE OF THE TECHNICAL PLANNING GUIDELINES

The TPGs are divided into a number of sections, covering issues which are common to all broadcasting services, and sections covering issues specifically related to AM radio, FM radio, analog television or digital television, including the emission standards for these broadcasting services.

The Introduction

The introduction outlines the relevance of the TPGs to the LAP or DCP, it details the broadcasting services bands and gives the definition for terms used in the TPGs.

Essentially, the TPGs *are* to be read in conjunction with the technical specifications of the relevant LAP or DCP.

The TPGs give guidance as to how the technical specifications in a LAP or DCP must be interpreted in order to preserve the interference protection and spectrum productivity parameters designed into the LAPs or DCPs.

They require broadcasters to site their transmitters within a specified tolerance of the nominal transmission site and for transmitters to not exceed the maximum effective radiated power specified in the LAP or DCP. Operators of transmitters are also required to provide a minimum effective radiated power and hence minimum signal strength to urban communities within their licence area. This is to ensure that a licensee provides an adequate signal in communities of 1000 people or more, and not just to the larger population centre in a licence area.

There is provision for some of these parameters to be varied by exception in the LAP or DCP where this is necessary, for instance, the minimum level of protected field strength for a stereo FM service is normally 54 dBμV/m in rural areas, but in an urban area the minimum protected signal level might be specified as 66 dBμV /m, in the LAP.

Start-up Procedure

As development and expansion of the broadcasting services proceeds at a fairly rapid rate, the density of transmitters leads to circumstances where existing services might be subject to interference as new services start. Often this is because the environment has changed and better engineering practices are needed at existing, often quite old, sites to allow more services to operate free from interference, and within the LAP or DCP.

The start-up procedures require anyone planning to establish a new transmitter, or to change the specifications of an existing transmitter for a commercial or community broadcasting service or datacasting service to follow a specified procedure to confirm that the transmitter is operating in compliance with the approved specifications and the TPGs, and that it does not cause interference to other services.

Analog radio and television licensees are required to advertise in the newspapers circulating in the licences area of the approved service at least seven days before starting test transmissions, to advise the ABA, the ACA and other broadcasters within the licence area of the date and proposed technical operating specifications for the test transmissions, and make regular announcements during the test transmissions identifying the licensee and providing sufficient information for members of the public to contact the licensee if the broadcast causes interference. For digital television services, the start-up procedures differ to those for analog services although they share many of the above mentioned requirements. The requirements for digital television services are specified in Part 7 – Interference Management Scheme for Digital Television.

Change of Transmitter Site Procedure

The TPGs include some flexibility in the choice by licensees of the transmitting site. Where a licensee proposes to use a transmitting site which is not located at the nominal

transmitting site specified in the LAP, the licensee must complete appropriate electromagnetic compatibility calculations for the alternative site to show that no interference will be caused to other services. The licensee must provide the EMC calculations to the ABA with an application for a test transmission licence and if the ABA is satisfied that the EMC calculations prove that operation from the alternative site will not cause interference and the relevant guidelines are complied with, the ABA will allocate a test transmission licence. The licensee must then conduct test transmissions in accordance with the terms of the test transmission licence.

On completion of the test transmission, the licensee must provide to the ABA the results of the test transmissions including any interference assessment reports and details of any complaints of interference made during the tests with a completed application form seeking variation of the relevant transmitter licence. If the ABA is satisfied that operation of the transmitter from the alternative site, then it will vary the conditions attaching to the transmitter licence issued under relevant provisions of the *Radiocommunications Act 1992.*

AM Radio

The section on AM radio gives guidance on the location of the transmitter within the licence area, the maximum power (in terms of cymomotive force (CMF)) permitted, and minimum level of service which permits some tolerance in site location but requires the service to perform as if it is located at the nominal site. The minimum level of service is specified so as to ensure that all communities within the licence area receive a service, the minimum level is to be within 5 dB of the maximum specified radiated power.

The TPGs also specify the maximum level of field strength that is permitted within population centres - this is a requirement that restricts the level of signal within the community being served to a maximum level of 1 volt per metre so that receivers are not overloaded by extra strong signals. The maximum field strength beyond the licence area is also specified, at 2.5 mV/m in any urban community outside the licence area intended to be served, so that over spill of service from one licence area to another is minimised.

The TPGs require that licensees ensure that their AM broadcasting service transmissions comply with the *Emission Standard for the Australian AM Sound Broadcasting Service,* which is at Appendix l to the TPGs.

FM Radio

The FM radio section of the TPGs gives guidance on the location of the transmitter in terms of the nominal site specified in the LAP.

It includes advice on the minimum field strength required between adjacent services, that is 800 kHz apart, in the same licence area. This advice permits licensees to locate their transmitting facilities away from the nominal transmitter site specified in the LAP; the difference between FM services at 800 kHz spacing is not to exceed 24 dB at receivers anywhere within residential areas in the relevant licence area. Separate advice is given elsewhere in the TPGs on the procedure licensees are to follow in seeking an alternative to *the* nominal transmission site.

As with the AM section of the TPGs, advice is given regarding the maximum effective radiated power (ERP) permitted for FM transmissions, as well as advice on the minimum level of service requirement, again the latter is for licensees to transmit a minimum level of ERP which is no more than 5 dB below the maximum ERP specified in the LAP.

Guidance is given on the maximum antenna height permitted if a licensee uses an alternative to the nominal transmitting site; the antenna height is specified in terms of the Australian Height Datum (AHD), the reference height for the area; the transmitting antenna is not to exceed the specified AHD for the nominal site.

The TPGs also specify the maximum field strength allowed within a licence area, as well as beyond the licence area. The maximum field strength within a licence area is determined so that receivers do not suffer overload from excessive signal strengths, and the maximum field strength beyond the licence area is specified so as to minimise signal over spill in adjacent licence areas.

Unless otherwise specified in the LAP, the median field strength of the transmission in any urban centre beyond the licence area boundary, shall not exceed 54 dBμV /m, measured at a height of 10 metres above ground. This is an acknowledgment that the ABA may in some cases specify in a LAP a higher signal level in some cases than the TPGs normally permit, and that in those cases the LAP will take precedence.

Licensees are not to cause interference to other services, and their transmissions must comply with the *Emission Standard for the Australian FM Sound Broadcasting Service*, which is at Appendix 2 to the TPGs.

Information and applicable standards for transmission of ancillary communications services supplementary to the main sound broadcasting service is also included in this section and in the emission standard for FM services.

Analog Television

For analog terrestrial television services using the VHF or UHF television broadcasting services bands the guidance given in the TPGs is very similar to that given for FM radio.

The exception relates to transmitter siting, as it is desirable that a television transmitter should be located so that, for a particular band, ie. VHF or UHF, viewers within population centres of the licence area of the service should receive all television services, licensed to serve that area, from a single direction. The need for viewers to install multiple same band antennas can reduce the protection from interference assumed in the original planning for the area as product of the antenna discrimination protection provided by a single antenna. The ABA may require licensees not following this principle to correct interference problems that may arise or to change site.

The TPGs also give advice on maximum field strength within the licence area and beyond the licence area. There is a requirement that licensees are not to cause interference to other services.

The radiated signal characteristics of television services are to comply with the *Emission Standard for the Australian Terrestrial Television Service,* which is at Appendix 3 to the TPGs.

Digital Television

The guidelines related to digital television broadcasting and datacasting services follow a generally similar approach to those of analog television. There are, however some different or additional considerations due to, for example, the possibility of single frequency network operation and its implications for adjacent channel services. Some further explanatory notes on aspects of digital television are given in Annex C.

EMISSION STANDARDS FOR BROADCASTING TRANSMITTERS

The TPGs contain the standards applicable to broadcasting transmitters, and include appendices outlining the emission standards for AM and FM radio, and for analog television broadcasting transmitters that operate in the terrestrial broadcasting services bands. The emission standards for analog radio and television services are substantially the same as the emission standards published by the Department of Transport and Communications in the period 1989-92.

References to relevant digital television standards are provided in Appendix 4. The TPGs do not mandate compliance with these industry developed standards for digital television, other than to require compliance with an emission mask.

Each analog emission standard includes figures and tables relating to the channels that may be used in each service, a description of the radiated signals to be transmitted for each service and the relationships between sub-carriers where appropriate.

The Emission Standard for the Australian AM Sound Broadcasting Service

The AM emission standard is based on the draft Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service published as a draft standard by the Department of Transport and Communications in 1992.

The 1992 draft standard was based on an earlier publication, “Standards for the Technical Equipment and Operation of Medium Frequency Broadcasting Stations” determined by the Australian Broadcasting Control Board pursuant to the *Broadcasting and Television Act* 1942 - 1967, and published in the second edition in June 1968. The standard follows international practice and is based on relevant parts of International Telecommunications Union -Radio communications Bureau (ITU-R) Recommendations 598 and 639.

The AM emission standard outlines the channel assignments for the AM radio broadcasting service, the radiated signal characteristics, the pro gram signal characteristics for both mono and stereo transmissions, the audio frequency response at input to the AM transmitter, the necessary RF bandwidth and the emission mask for the radiated field strength for the AM transmission

The Emission Standard for the Australian FM Sound Broadcasting Service

The FM Radio emission standard is a reprint without changes of the "Emission Standard for the Australian Frequency Modulation Sound Broadcasting Service" determined by the Minister for Transport and Communications pursuant to s.125D of the *Broadcasting Act* 1942, and published by the Department of Transport and Communications in July 1992.

The emission standard covers the radiated signal characteristics including the Australian FM broadcasting channels, main program signal characteristics for both mono and stereo transmission, and characteristics for ancillary communications services carried as sub carriers on the main program FM carrier.

The Emission Standard for the Australian Terrestrial Television Service

The television emission standard is a reprint of the sixth edition of the *Emission Standard for the Australian Terrestrial Television Service* determined by the Minister of Transport and Communications pursuant to s.125D of the *Broadcasting Act* 1942, and published by the Department of Transport and Communications in March 1989. The last reprint of the sixth edition was in August 1993.

This emission standard outlines the radiated signal characteristics including the Australian television channels, the video characteristics, primary colour signals, vision signal characteristics and the sound signal characteristics for the Australian television service.

The emission standard does not include the standard for teletext services provided on the television transmission.

APPLICATION TO EXISTING COMMERCIAL AND COMMUNITY BROADCASTING SERVICES

The TPGs must be complied with if any significant change is made to the technical specifications of an existing transmitter. In some cases where an existing transmitter would otherwise exceed field strength limitations specified in the TPGs, the TPGs contain special exemptions effectively protecting the existing field strength and coverage in the event the technical conditions need to be varied. This is intended to provide 'grandfathered' protection to an existing licensee wishing to change the technical specifications of its transmitters.

The exemption deals with the problem that some existing services have a field strength in urban centres outside of the licence area that exceeds the limit specified in the TPGs except in cases where a different figure is specified in the relevant licence area plan. To enable these services to undertake fresh technical planning without being required to reduce their existing coverage area, the TPGs provide that the existing field strength can remain as long as it does not get any higher.

The exemption only applies to services for which a licence area plan has not been determined. Once LAP planning commences, the ABA will examine on a case by case basis existing field strength levels that are greater than the TPG specified limits, and where appropriate those higher field strength limits will be specified in the licence area plan as

exceptions to the TPG limit. In general, existing coverage areas of services are unlikely to be reduced during the licence area planning process. Any requirement to reduce signal level outside a licence area for existing services would be exceptional and the ABA would be unlikely to propose such changes of its own initiative.

This means that transmitters which were licensed to operate before the determination of the TPGs may continue to operate in accordance with their approved licence specifications. Their operation will be, pending completion of the relevant LAP, "grandfathered" and will be addressed in the relevant LAP.

Change to Existing Specifications

The ABA cannot make substantive changes to vary existing specifications except by way of production of a new LAP or DCP or formal variation of an existing LAP or DCP, unless such changes fall within the envelope provided for in a LAP or DCP. In the latter case, the change is more likely to have been initiated by the licensee seeking a revised transmitter licence for some reason (such as a site change, frequency change or power increase).

Production of or variation to a LAP requires wide public consultation in accordance with section 27 of the Act. This will include consultation with all affected parties and the simple suggestion by an adjacent licensee that the signals of an existing service should be reduced to limit over spill would alone not be sufficient reason for the ABA to consider a change to the status quo.

Production of or variation to a DCP requires consultation in accordance with section 10 of the Commercial Television Conversion (CTC) Scheme or section 10 of the National Television Conversion (NTC) Scheme.

Within the TPGs the ABA has established boundary conditions relating to transmitter site tolerance and signal over spill. Where appropriate, higher levels of over spill may be permitted where so authorised by the specifications contained in the LAP, but these will be either the result of "grand fathering" existing arrangements, or the result of consideration of all relevant factors including practical engineering constraints of available sites and the practicality of limiting over spill (particularly over unobstructed paths). The ABA will make such decisions after consideration of detailed submissions from affected parties.

Where a major relocation of a transmitter necessitates an increase in over spill levels beyond those covered in the LAP, the proposal would be processed through wide public consultation as a variation to the LAP so that affected parties would have an opportunity to comments as they would for any new specifications developed within the LAP.

TOLERANCE APPLICABLE TO THE NOMINAL SITE SPECIFIED IN THE LICENCE AREA PLAN

Operation at the nominal transmitting site

For licensees wishing to operate their transmitters from the nominal transmitter site in the licence area plan, the transmitter licence can be issued showing the details as published in

the licence area plan. The site shown on the licence will be the nominal site described in the appropriate licence area plan

The licensee may then proceed to plan and construct the necessary transmitting facilities and to conduct the test transmissions in accordance with the TPGs before starting the permanent broadcasting service.

Operation of a transmitter away from the nominal site

The TPGs provide some flexibility for licensees wishing to use an alternative to the nominal site published in the licence area plan.

The TPGs contain the criteria the ABA will use when considering whether to approve alternative sites. The criteria are designed to ensure that the use of an alternative site would not cause interference to radio communications services, or to existing or planned broadcasting services shown in the licence area plan. The licensee must also continue to comply with the other technical specifications in the licence area plan.

It is the licensee's responsibility to complete the necessary checks and calculations to determine that use of the alternative site will be satisfactory. The licensee must show to the ABA's satisfaction that the channel capacity of the licence area plan is not adversely affected and that use of the alternative site would not otherwise cause interfere to radio communications .

To gain approval for a new site, the licensee must complete the necessary engineering and interference calculations for its proposed site, apply to the ABA for a transmitter licence for test transmissions from the proposed site and afterwards provide the ABA with a report proving that operation from the proposed site is satisfactory within the bounds of the licence area plan and the TPGs.

Once the ABA is satisfied the requirements have been met, it will grant a s.102 transmitter licence showing the actual site of the transmitter. In cases where a s.102 licence has already been granted showing the transmitter at the nominal site, then the ABA will vary the existing licence.

The broadcaster may then begin to provide services from the new licensed transmitting facility.

In reality, site tolerance (the distance a licensee is able to locate its transmitter away from the nominal site) will vary widely from case to case, depending on factors such as the location of other transmission facilities and the channel spacing between the licensee's frequency and the frequencies used by other broadcasting services in the area.

It is important to note that the technical specifications set out in LAPS are not negotiable after the relevant LAP has been finalised. If the nominal site proposed *in a draft licence area plan does not suit you, it is important to raise the issue before the LAP is finalised.*

Notwithstanding the new relative freedom from regulatory intervention, the ABA, and ACA must know precisely where transmitters are located and their characteristics so that they can be taken into account in planning and interference analysis. Hence, before

transmissions at any site can commence an appropriate transmitter licence (which will specify the exact site and primary radiation parameters) must be obtained and test transmissions must be conducted.

Site Approvals - Planning and Development Approvals from Local Government and Other Authorities

The issue of a transmitter licence on the basis of an application received or against a nominal site shall not absolve the applicant from the need to obtain relevant local government and other approvals prior to construction.

In general, the ABA would expect licence applicants to have obtained or be reasonably certain of obtaining approval before lodging the application so as to avoid unnecessary double handling and attendant delays in seeking a licence variation. Note that if it becomes impossible to establish any facility which meets the LAP specifications, as a consequence of approvals being withheld through environmental or planning grounds, then the ABA can consider making a variation to the LAP under the "Change of Transmitter Site" procedures outlined in the TPGs. This should be a rare occurrence given the ABA has endeavoured to the greatest practicable extent to specify nominal sites which would be available without planning complications.

TPPS AND AUSTRALIAN BROADCASTING PLANNING HANDBOOKS

Because they are legally binding, the TPGs include only the mandatory requirements from the Technical Planning Parameters (TPPs). The remaining advisory information, and planning and measurement methods contained in the TPPs was retained and is included as Part 2 of the "Interim Australian Broadcasting Planning Handbook". That information was a reprint, without change, of the TPPs published by the Department of Transport and Communications in June 1992. The revision of the TPGs in December 2000 resulted in the *Interim Australian Broadcasting Planning Handbook* being superceded. The TPGs and TPPs will henceforth be made available separately.

The TPPs are based on international broadcasting planning parameters and methods of measurement, the ITU's Radiocommunications Bureau Recommendations, and Reports, as well as best practices developed in Australia, New Zealand, North America, Europe and Britain over many years.

The TPPs are intended to be used by broadcasters, planning engineers and operators of broadcasting facilities in implementing the TPGs in their detailed design of AM radio and FM radio and VHF/UHF television broadcasting transmitting facilities.

Advice is provided on many topics including propagation mechanisms and calculation models for planning Medium Frequency (MF) and VHF/UHF services, coverage criteria, interference calculation methods, transmitting antenna calculations, reference receivers, and siting of transmitters. Advice is also given on how the ABA determines channel separations for services and determines required adjacent channel and co-channel protection ratios. The TPPs include copies of ITU Radiocommunications Bureau nomograms and propagation curves used by planners and designers of practical

broadcasting facilities which are useful in making propagation predictions and interference calculations and setting coverage and minimum signal requirements.

The material in the TPPs which has not been incorporated into TPGs is advisory. It was compiled over many years by the Department of Communications in consultation with industry and is provided by the ABA as an aid to consultants and broadcasting engineers involved in the detailed design of broadcasting transmitting facilities and the implementation of the technical specifications, approved in the ABA's LAPs.

The TPPs set out planning methods which are acceptable (generally best practice) engineering methods for assessing compliance with the TPG requirements. Alternative methods may be used but facilities planners using those methods would need to be in a position to demonstrate that the method being used yielded results compliant with the methods set out in the TPGs.

In respect of such alternative methods, which might include various computer based models, system designers need to be aware that no model is an exact replication of real propagation phenomena at the normal frequencies used by broadcasting. The type of terrain and other factors make some models fit better in some circumstances than others, and the probabilistic nature of radio frequency propagation requires statistical methods of prediction. The methods set out in the TPPs represent best international practice and include statistical allowances based on many years and many different field measurements of propagation in all parts of the world.

The ABA produced the "Digital Terrestrial Television Broadcasting Planning Handbook" which complements the TPPs in the case of planning of digital television broadcasting and datacasting services.

Comments and suggestions for amendment of the TPPs or the "Digital Terrestrial Television Broadcasting Planning Handbook" are welcome and should be addressed to the:

Director Engineering,
Planning and Licensing Branch
Australian Broadcasting Authority
PO Box 34
BELCONNEN ACT 2616

THE RELATIONSHIP BETWEEN THE TPGS, FAPS, LAPS, THE BROADCASTING SERVICES AND RADIOCOMMUNICATIONS ACTS

Technical Planning Guidelines.

The Broadcasting Services Act 1992, requires the ABA to develop technical planning guidelines (TPGs) for the technical planning of individual services that use the broadcasting services bands as a means of delivery. The TPGs set out the mandatory requirements that are to be met by licensees when completing the detailed planning of broadcasting transmitting facilities and are to be read in conjunction with the technical specifications contained in the LAP.

The TPGs include the emission standards for AM, FM and television broadcasting transmitters, and are applied to commercial and community broadcasting service transmitters through the powers contained in the Radiocommunications Act 1992. They may also be applied to national broadcasting transmitters and to narrow casting services that use the broadcasting services bands, as special conditions attached to transmitter licences issued under the powers contained in the Radiocommunications Act.

The Frequency Allotment Plan.

The frequency allotment plan (FAP) was prepared by the ABA through wide public consultation and determined the number of channels that are to be available in particular areas of Australia to provide broadcasting services that use the broadcasting services bands. The FAP outlines the capacity that is to be available for AM radio, FM radio and VHF/UHF television services throughout Australia.

The FAP apportions broadcasting services bands in particular parts of Australia to accommodate existing and future radio and television services. It ensures that planning for individual services in particular areas has proper regard to the potential effect on channel capacity allotted to other parts of Australia. The FAP is the basis for planning for all broadcasting services and was determined in August 1994.

Licence Area Plans.

A LAP details the number and characteristics of AM and FM radio and VHF/UHF television broadcasting channels that are available within a specified area. The characteristics of each service include the service's licence area, its carrier frequency, transmitter site and technical specifications, including maximum effective radiated power in all directions.

The detailed design of transmitting facilities for the implementation of the technical characteristics (specifications) for each service contained in a LAP depends on compliance with the TPGs and is assisted by reference to the TPPs.

The LAP is based on the FAP; if there are any consequential changes to the FAP arising from the determination of a LAP, the relevant FAP is varied to reflect those changes.

The determination of a LAP follows wide public consultation and is based on the preparation of a draft LAP, to allow comment by affected communities and broadcasters, before finalisation.

HOW TO OBTAIN A BROADCASTING SERVICE LICENCE AND THE RELEVANT TRANSMITTER LICENCE

While these notes generally explain the relevance of the TPGs, it is also of interest to understand how a potential operator might get a licence for a broadcasting service, and how the TPGs might apply to those licences.

For commercial and community broadcasting services, the completion of the planning process for an area makes capacity available for new broadcasting services, and describes the type of services and the licence specifications applicable to those services in the LAP.

In order to get a broadcasting service licence for one of these services, the ABA must advertise the availability of spectrum capacity and invite applications for a licence for a service(s). For new commercial broadcasting services, the ABA will conduct a price based allocation process to determine which applicant(s) are to be granted the licence(s) on offer. For new community broadcasting services, the ABA will invite applications and will conduct an allocation process to determine which of the applicants will be granted a licence.

With the issue of a broadcasting service licence comes an automatic entitlement to a Radiocommunications apparatus licence (ie. transmitter licence) to operate the broadcasting transmission facilities to provide the service.

For more information about applying for a transmitter licence for new commercial or community broadcasting services, please refer to the ABA fact sheet “How to apply for a transmitter licence?”

Licence Specifications set out in Licence Area Plans are not negotiable.

The transmitter licence application form must specify the precise location of the transmitter and must confirm that the transmitter is to operate in compliance with the specifications given in the relevant LAP. Once the LAP is determined, the specifications given in that plan are not negotiable. The transmitter must operate as if it is located at the nominal transmission site specified in the LAP.

However, as noted earlier, in the discussion about the use of an alternative site to the nominal transmission site specified in the LAP, there is some flexibility built in to the LAP and the TPGs. Where a successful applicant for a broadcasting service licence wishes to operate a transmitter at an alternative site to the nominal transmission site specified in the LAP, the applicant must be able to prove as a matter of record, that the transmitter will not interfere with any other radio communications or broadcasting services and that it will not alter the LAP in terms of channel capacity for the area or adjacent areas; that is, it must perform as if it was located at the nominal transmission site in terms of the LAP and the TPGs.

Alternative uses of the broadcasting services bands.

Where there is planned spectrum capacity which is not used for broadcasting services, that capacity may be used for alternative uses, such as open narrow casting, subscription narrow casting, etc. These services may operate under the Class licence provisions of the Broadcasting Services Act. Each service will need a Radiocommunications apparatus licence, which requires an application, again on ABA Form 12, for the necessary transmitter to operate the narrow casting service. Allocation of the rights to use spectrum capacity for narrow casting may also entail a price based allocation process similar to that used for allocation of broadcasting service licences for commercial broadcasting services.

The TPGs may be applied to transmitter licences for these services as a condition of the transmitter licence in addition to the licensed technical specification for the service.

ANNEX A:

POLICY ASSUMPTIONS USED IN PLANNING

The policy assumptions used in analog and digital broadcasting planning are now contained in the following separate documents:

- General Approach to Analog Planning; and
- General Approach to Digital Planning.

ANNEX B:
TECHNICAL ASSUMPTIONS USED IN ANALOG PLANNING

Note The General and Technical assumptions used in digital television planning are published separately in the Digital Terrestrial Television Broadcasting Planning Handbook, first published in July 1999, and as revised from time to time.

1. The Technical Planning Parameters

Since 1982, the planning of analog radio and television services in Australia has been carried out based upon technical planning assumptions detailed in a document entitled, "*Technical Planning Parameters and Methods for Terrestrial Broadcasting, 1992"* (henceforth referred to as "the TPPs") which was published by the Department of Transport and Communications in 1992. That document consolidates previous Department Planning Guidelines (GS1, GS2, and GS3/4) published in October 1982. The TPGs and TPPs been used by the ABA in preparation of LAPs pursuant to section 26 of the *Broadcasting Services act* 1992 (the Act) since 1995.

The TPPs cover such technical matters as: minimum channel spacing for services in the same area; co-channel interference; notional transmitters sites; notional radiation pattern; notional market areas; reference television receiving system; upper and lower adjacent channel interference.

Information on the major issues relevant to the planning of radio and television service transmitting facilities as dealt with in the TPPs and the way they were dealt with by the ABA in its LAP determination are explained below.

2. Transmitter system emission standards

The analog emission standards are now included in the TPGs. They contain information on radiated signal characteristics, for example channels, carrier location and modulation and polarisation, main pro gram signal characteristics (modulation system, sub-carrier frequencies) and any ancillary communication services.

Characteristics of radio and television broadcasting transmission systems in Australia were previously defined in the *Emission Standard for the Australian Terrestrial Frequency Modulation Sound Broadcasting Service,* the *Emission Standard for the Australian Terrestrial Television Service,* and the draft *Emission Standard for the Australian Amplitude Modulated Sound Broadcasting Service,* published by the Department of Transport and Communications.

Channelling Arrangements

The channelling arrangements for the Australian AM and FM radio and the television broadcasting services are found in appropriate appendices to the TPGs.

Minimum median field strength

The minimum median field strength for adequate reception quality in the absence of interference from other services are outlined in the TPPs. Minimum field strengths have been adopted for urban, suburban and rural areas to allow for the normal generation of electrical interference by domestic and industrial equipment and for random variations in the level of location of broadcasting receivers.

The concept of minimum median field strength was adopted to overcome electrical noise in the absence of interference. Urban areas, which attract the highest median field strength are characterised by high buildings, lifts, machines, computers, cars, electrical lighting and other noise sources. Suburban areas, corresponding to the next level, include household electrical noise, some factory noise and some car noise. The rural service contour encompasses the areas of low industrial noise, and are typically isolated small communities and a small concentrations of vehicles.

Co-channel Interference (and adjacent channel interference)

Because of the need for broadcasting receivers to be able to distinguish between services on the same channel, but in different locations, it is necessary to separate the transmitters by enough distance to ensure that signals from the unwanted service are not strong enough to interfere with reception of the wanted service. This is called co-channel protection. The further away another service on the same channel is, the less the protection required to avoid co-channel interference. Generally the distance between broadcasting stations using the same channel, (the re-use distance), is determined by the transmitter power of each station, the location and height of the transmitting antenna, the radiating pattern of the transmitting antenna and the intervening terrain.

Typically, two analog 200 kW VHF (or 600 kW UHF) television stations on the same channel using the same polarisation are separated by about six hundred kilometres to avoid interference within each other’s licence area. In some circumstances, co-channel television services can be located closer together if opposite polarisation are used and/or if each channel is off-set from the other, that is, their frequencies are changed slightly from the standard channel frequencies.

Similarly, analog services operating on adjacent channels must be removed from each other by a minimum distance, or may employ frequency offsets, to ensure that the selectivity of the receiver is adequate to distinguish between adjacent services on adjacent channels.

Existing transmitter sites

The ABA has assumed that any new FM or television services determined in the planning process would be provided in a manner consistent with the TPPs and the TPGs. This would include, for example co-location on existing FM radio or television transmitter sites.

The location of existing sites and the technical operating conditions of transmitters located at these sites is a significant factor in determining the number of channels that will be available. This is because many elevated locations in Australia are sites already have an existing transmission infrastructure with radio communications and broadcasting

transmitters and antennas, and any new transmission facilities must work in harmony with this infrastructure, from a cost and environmental perspective.

In addition, use of a common transmitter site for broadcasting services has the following advantages:

- It maximises the number of services available in that area by maximising spectrum productivity.

- It reduces interference to other broadcasting.

- It is preferable to co-locate a number of single service sites for economic reasons. This is because it is cheaper to use an existing transmitter site rather than establishing a new one.

- It is preferable to co-locate a number of single service sites for environmental reasons. This is because it is less likely to disturb the environment if an existing transmitter site is used and because use of existing transmitter sites which are generally located in less populous areas means that fewer people are subject to very high field strengths which can cause reception difficulties.

- It is more convenient for viewers. Multiple sites may mean viewers would require multiple antennas.

Minimum channel spacing for services in the same area

The TPPs provide advice on minimum spacing for analog services in the same area, with particular reference to each medium, ie AM or FM radio or to analogtelevision. For analog television services with substantially similar coverage, the receiver cannot distinguish between services on adjacent channels. For this reason VHF channels are usually assigned on an “N + 2 basis”. This means there is at least one channel between any two analog channels planned for the same area. Similarly for wide coverage FM radio services in the same licence area, the minimum channel spacing is 800 kHz.

UHF analog television channels are assigned on an “N+3 basis” that is, at least two channels separate each service planned to serve the same area. Use of the “N+3” basis for UHF analog television planning avoids the potential for image and local oscillator interference between analog television services.

Analog Reference receiver

As there is a wide variation in the technical performance of current radio and analog television receivers available in the Australia as evidenced in the studies conducted by the Communications Laboratory of the Department of Transport and Communications, a concept of a ‘reference’ receiving system was used by the ABA. This means that planning has been based upon an assumption that the transmitted signals will satisfy at least 75 per cent of receivers currently available to the public. The ABA used 75 per cent as the benchmark because:

- For television receivers. the 75% bench mark was used for the Australian Television Receiver Standard produced by Standards Australia

- It accorded with international practice.

- It was in accordance with the parameters in the TPPs.

- It is the technical judgement of the ABA that this standard will lead to the most efficient use of spectrum and provides the best guarantee that the public will be able to receive the services.

Note: It should not be concluded from this that 25% of the population would obtain poor television reception, or would not meet the ABA's planning targets. The 25% figure only has meaning when the combination of: an actual reception situation; the receiver performance; and the actual channels allotted in a particular area; create the necessary interference condition. The conjunction of the condition will occur in much less than 25% of cases.

This approach received support in the public consultation conducted by the ABA in 1994 when determining the frequency allotment plan.

ANNEX C:
EXPLANATORY NOTES RELATED TO DIGITAL TELEVISION

Minimum level of service requirements

Some DCPs include channel allotments which have directional ERP restrictions on some services that will apply until certain analog television services cease transmission. Notwithstanding the legislative requirement to achieve "same level of coverage" as soon as practicable, these limits may mean, in some instances, that it will not practicable to achieve this until the concerned analog transmission ceases.

Maximum antenna height requirements

The digital television section does not include guidelines relating to maximum antenna height. The "maximum field strength beyond licence area", "minimum level of service requirements" and guidelines relating to not causing interference to other services more directly address the ABA's concerns than would a restriction on antenna height.

A nominal antenna height specification is included in the technical specifications associated with the DCP for information. This nominal height is used by the ABA in performing interference predictions as part of its channel planning process.

Adjacent channel and SFN operation

Planning for digital television and datacasting services has made use of adjacent channel operation (either between two digital services on adjacent channels, or between a digital service and an analog service on adjacent channels) on the assumptions that: the adjacent channel transmissions are effectively co-sited; and the ratio of adjacent channel ERP levels is constrained to be within an appropriate range.

When applying the guidelines related to adjacent channel interference, account may need to be taken of the frequency dependencies and other variability in transmitted signal levels, which result from factors such as the differences in transmitter radiation patterns, frequency dependence of receiving antenna system performance and differences in the actual transmission sites. Until better information is available, a value of 5 dB has been applied to the basic protection ratio values for sites where the adjacent services are transmitted from common antennas. (i.e. if nominal assumptions are used for transmitter and receiver performance, the ratios of unwanted adjacent channel signals to the wanted signal should be no more than 0 dB or 25 dB as appropriate). Other cases will require more detailed case-by-case examination.

Where additional transmission sites are being added to an SFN, it may prove extremely difficult to satisfy the necessary adjacent channel protection requirements in cases where transmitters are not effectively co-sited, and/or in cases where widely different ERP levels are used by the adjacent channel services.

Recognising this constraint, guideline 87 has been written to ensure that digital services operating in accordance with the DCP are protected.

In the particular case of potential adjacent channel interference between two digital services where one, or both, of the proposed digital services is not included in a DCP, it may be possible to satisfy the adjacent channel interference conditions through negotiation between the operators of the adjacent channel services. The required end result is that, in each area where adjacent channel interference could arise, the transmitters providing the adjacent channel services should be effectively co-sited and their relative ERP levels should be co-ordinated to ensure that the conditions of part 6 of the Technical Planning Guidelines covering adjacent channel interference are satisfied.

Levels of allowable interference

Whenever any new service is added into an existing service arrangement there will be some increase, even if it is very small, in the interference received by the pre-existing services. In assessing whether the general objective that "there should be no noticeable increase in interference to other services" is satisfied in terms of practical engineering, the task is to set guidelines that ensure that any increase in interference is constrained to a level that would not cause adverse impact on existing services. These guidelines have quantified the amounts of interference that would be allowable for the cases of (i) interference to analog television services, and (ii) interference to digital television services. The signal degradation characteristics of analog and digital television systems have been taken into account in determining these limits.

No attempt has been made to quantify levels of interference that would be allowable for other radiocommunications services (including broadcasting services other than analog and digital television). This is because: (i) unlike the case of television-to-television interference mechanisms where the characteristics of the device potentially suffering the interference can be fairly readily defined, potential interference mechanisms between television and services other than television are much less amenable to detailed specification because the range of devices that could hypothetically suffer interference is very large and very diverse. This problem is particularly complex when potential interference mechanisms between services operating in different bands of the radiocommunication spectrum are considered; and, (ii) the current interference management processes which is complaints based and is based on the incoming service not causing interference to existing services, or if such interference occurs the incoming service would take action to resolve it, appear to have worked adequately without the need for inclusion of such detailed definitions within the TPGs.

For analog television where the ratio of wanted to unwanted signals is 41 dB or lower, a degradation of no more than 2 dB in the carrier-to-noise ratio measured at the receiver input terminals has been permitted. This 2 dB degradation value is based on the interfering signal causing no more than 0.5 grades of degradation on a 5-grade impairment scale. The

basis for this is that the human perception descriptors applicable to impairments to planned television reception (grade 5 – imperceptible; grade 4 – perceptible, but not annoying; grade 3 – slightly annoying) are fairly closely spaced it seems reasonable to assume that defining a 0.5 grade change as an allowance for interference will not be perceived as having a noticeable impact on the level of interference to the signal. The relationship between subjective impairment gradings and carrier-to-noise (or unweighted video-signal-to-noise) ratio is given in texts such as ITU-R Recommendation BT.654. or Hutson, G.H. – *Colour Television: system principles, engineering practice, and applied technology, 2nd Ed, McGraw Hill 1990*

For digital television where the received carrier-to-noise-plus-interference ratio is 20 dB or lower, a degradation of no more than 1 dB in the carrier-to-noise ratio measured at the receiver input terminals has been permitted. This 1 dB degradation value was suggested in the report of the sub-group on "same level of coverage and potential reception quality" (Appendix B of *Digital Terrestrial Television Broadcasting Planning Handbook*). The allowable value for digital television was chosen to be more stringent than for the comparable analog case. This was done in recognition of the concern that viewers in a marginal reception situation for a digital service could suffer a complete loss of service with a small increase in interference whereas in a marginal analog reception situation a slight increase in interference would cause a slight increase in visible and/or audible noise.

Measurement and assessment of interference

The carrier-to-noise plus interference ratio limits discussed above specify levels that are measured at the input terminals of a reference receiver. While this definition is closely tied to the receiver performance degradation due to interference it does present difficulties in relating these values to field strength measurements.

Field strength measurements can be subject to considerable variability. Even when measured at 10 metres above the ground, field strength may vary considerably with small changes in location or frequency, this is particularly so if the environment is subject to clutter. Field strength measurements can also be subject to short term and seasonal time variations. Variations in the field strengths of wanted and interfering signals will not necessarily be well correlated. Ideally, to obtain reliable, repeatable median field strength measurements it would be necessary to collect a large set of measurements of wanted and interfering signal field strength measurements. Notwithstanding time and cost considerations, in many situations terrain or access considerations would make this difficult or impractical. Experienced field strength surveyors may however be able to select representative sites, where clutter and other confounding effects are minimised and where reasonably reproducible field strength measurements can be produced from a limited number of measurements.

Calculated field strength predictions do not suffer the variability of measured field strength values. However, as with any mathematical or empirical model, the accuracy of predicted field strength values depends on how well the prediction model represents the real situation. Predicted field strength values can be a convenient method by which to assess claims about potential interference but their use should be tempered by knowledge of how well the prediction model fits the actual situation. Predictions can be used with greatest confidence where there are supported by field strength measurements from nearby areas.

In the final analysis judgements may need to be made based on the combination of data that is available. This could include whatever field strength measurements are available, comparative measurements made when the suspected interfering source is cycled on and off, or reduced in power by a known number of dB, and field strength prediction calculations for wanted and unwanted signals (especially where these predictions have been validated by field measurements in nearby areas). It is noted that while cycling of power of suspected digital interference sources could be a very useful technique for investigation of interference during the start up period, it may be more difficult to apply this technique for high power digital services once they commence normal operation.