



Broadcasting Services (Technical Planning) Guidelines 2007

Broadcasting Services Act 1992

The AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY makes these Guidelines under section 33 of the *Broadcasting Services Act 1992*.

Dated 6th July 2007

CHRIS CHAPMAN
Chair

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Deputy Chair

Technical Planning Guidelines

FOR THE PLANNING OF INDIVIDUAL SERVICES THAT USE THE BROADCASTING SERVICES BANDS

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FOREWORD

Section 33 of the Broadcasting Services Act requires the Australian Communications and Media Authority (ACMA) 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 paragraphs 108A (1) (d), 109 (1) (e) and 109A (1) (f) of the Radiocommunications Act, the licensee of a transmitter licence issued to the holder of a temporary community broadcasting licence issued under Part 6A of the Broadcasting Services Act, or a commercial radio or television broadcasting licence issued under Part 4 of the Broadcasting Services Act, or a community radio or television broadcasting licence issued under Part 6 of the Broadcasting Services Act, or the holder of a datacasting transmitter licence issued under Part 3.3 of the Radiocommunications Act, or any authorised person, must comply with these Guidelines.¹

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, 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 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 paragraph 109 (1) (d) of the Radiocommunications Act, 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 ACMA in the LAP under subsection 26 (1) of the Broadcasting Services Act.

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

In the case of transmitter licences that are subject to Digital Channel Plans (DCPs), 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

¹ The reference to a licence issued under Part 4 or Part 6 of the Broadcasting Services Act includes a licence which continues in force pursuant to the provisions of subsection 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. i.e. a commercial or community licence under the *Broadcasting Act 1942*.

accordance with the relevant technical specifications determined by ACMA² in the DCPs made under the *Commercial Television Conversion Scheme 1999* (as amended) formulated under subclause 6 (1) of Schedule 4 of the Broadcasting Services Act.

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

In addition to the mandatory requirements detailed in these guidelines, licensees are reminded of their responsibility to obtain all necessary approvals for planning and environmental matters from relevant Federal, State/Territory and local government authorities. Licensees must also ensure compliance with ACMA regulatory requirements dealing with human exposure to Electromagnetic Radiation (EMR), which are applicable to broadcasting transmitters. Further information on EMR regulatory arrangements can be obtained from the ACMA website (www.acma.gov.au).

² This also includes DCPs made by the Australian Broadcasting Authority (ABA).

CONTENTS

INTRODUCTION	1
Name of guidelines	1
Commencement	1
Revocation	1
Application	1
Licence area plan	1
Digital channel plan	1
The broadcasting services bands	2
Planning handbooks	2
Definitions	3
PART 1: START UP PROCEDURE	8
Application of Part 1	8
Start up procedure	8
PART 2: CHANGE OF TRANSMITTER SITE PROCEDURE	10
Application of Part 2	10
Change of transmitter site procedure	10
PART 3: AM RADIO	12
Application of Part 3	12
Location of transmitter site	12
Cymomotive Force (CMF)	12
Minimum level of service requirements	12
Maximum field strength within the licence area	13
Maximum field strength beyond the licence area	13
Interference to other services	13
Radiated signal characteristics	14
PART 4: FM RADIO	15
Application of Part 4	15
Location of transmitter site	15

Required field strength between adjacent frequencies	15
Effective radiated power	15
Minimum level of service requirements	15
Maximum antenna height	16
Maximum field strength within the licence area	16
Maximum field strength beyond the licence area	16
Interference to other services	17
Radiated signal characteristics	17
PART 5: ANALOG TELEVISION	18
Application of Part 5	18
Location of transmitter site	18
Effective radiated power	18
Minimum level of service requirements	18
Maximum antenna height	19
Maximum field strength within the licence area	19
Maximum field strength beyond the licence area	20
Interference to other services	20
Radiated signal characteristics	21
PART 6: DIGITAL TELEVISION	22
Application of Part 6	22
Location of transmitter site	22
Effective radiated power	22
Minimum level of service requirements	22
Maximum field strength within the licence area or datacasting service area	23
Maximum field strength beyond the licence area or datacasting service area	23
Interference to other services	24
Single frequency networks and additional co-channel transmitters	27
Radiated signal characteristics	28
PART 7: INTERFERENCE MANAGEMENT SCHEME FOR DIGITAL TELEVISION	30
Application of Part 7	30
Definitions	30
Postcode population threshold	31

Notification areas	32
Agreements between licensees	36
Start up procedure	36
Log of technical operating specifications	39
Interference complaints: test transmissions and other transmissions	40
Obligation period	40
Register of complaints	41
Predicted and unpredicted interference to analog transmissions: background	42
Management of predicted interference	43
Management of unpredicted interference: handling complaint	43
Management of unpredicted interference: resolution of complaint (general)	45
Management of unpredicted interference: resolution of complaint (post code population threshold)	45
Appendix 1: Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service	48
Definitions	48
Radiated signal characteristics	49
Program signal characteristics	50
Audio frequency response	51
Gamut of sum and difference modulation	51
Appendix 2: Emission Standard for the Australian Frequency Modulation Sound Broadcasting Service	53
Definitions	53
Radiated signal characteristics	54
Main program signal characteristics	55
Ancillary communications services	56
Appendix 3: Emission Standard for the Australian Analog Terrestrial Television Service	62
Definitions	62
Radiated signal characteristics	63
Video characteristics	64
Primary colour signals	66
Vision signal characteristics	66
Sound signal characteristics	66

Appendix 4: Transmission Standard for the Australian Digital Terrestrial Television Service	75
Transmission standard	75
Channels	75
Other relevant standards	75
Appendix 5: Channels for the Australian Terrestrial Television Service	76
Explanatory Notes	78
Introduction	78
Planning before the Broadcasting Services Act	78
Overview of planning under the Broadcasting Services Act	79
Outline of the Technical Planning Guidelines	82
Emission standards for broadcasting transmitters	85
TPGs and Planning handbooks	86
Relationship between the TPGs, FAP, LAPs, the Broadcasting Services Act and the Radiocommunications Act	87
How to obtain a broadcasting service licence and the relevant transmitter licence	88
Annex A: Policy Assumptions used in Planning	90
Annex B: Explanatory Notes related to Digital Television	91
Minimum level of service requirements	91
Maximum antenna height requirements	91
Adjacent channel and SFN operation	91
Levels of allowable interference	93
Measurement and assessment of interference	94

TABLES

Table 5.1:	Planned minimum field strength figures for analog television	19
Table 6.1:	Planned minimum field strength figures for digital television	23
Table A2.1:	Frequency limits of Australian FM channels	59
Table A3.1:	CIE*15 Chromaticity coordinates and balance for a white chromaticity of CIE illuminant D ₆₅	66
Table A3.2:	Timing intervals of the video signal	68
Table A3.3:	Colour sub-carrier amplitudes and phases for fully saturated primary and complementary colours	69
Table A5.1:	Channels for the Australian Terrestrial Television Service	76

FIGURES

Figure A1.1:	Emission mask for radiated field strength	50
Figure A1.2:	Gamut of C-QUAM modulation	52
Figure A2.1:	Maximum deviation of 67 kHz ACS sub-carrier versus audio modulated frequency for music and voice	60
Figure A2.2:	Maximum deviation of 67 kHz ACS sub-carrier versus audio modulating frequency for audio FSK	60
Figure A2.3:	Maximum deviation versus injection for direct FSK of 67 kHz ACS sub-carrier	61
Figure A2.4:	Audio frequency pre-emphasis characteristics for 50 and 150 microsecond time constant	61
Figure A3.1:	Video signal	70
Figure A3.2:	Video signal corresponding to fully saturated colours	71
Figure A3.3:	Phase of burst E' _U & E' _V signals	71
Figure A3.4:	Four field sequence of burst blanking and subcarrier phase	72
Figure A3.5:	Location of carriers and sidebands within the channel	73
Figure A3.6:	Sound transmitter modulating signal pre-emphasis	73
Figure A3.7:	Nominal group delay precorrection characteristic	74

INTRODUCTION

Name of guidelines

1. These guidelines are the *Broadcasting Services (Technical Planning) Guidelines 2007*.

Commencement

- 1A. These guidelines commence on the day after they are registered.

Revocation

- 1B. The *Australian Broadcasting Authority Technical Planning Guidelines 2003* are revoked.

Application

2. These guidelines apply to broadcasting licensees and 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 Services Act. 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:
 - (a) the *Commercial Television Conversion Scheme 1999* (as amended) formulated by the ABA under subclause 6(1) of Schedule 4 to the Broadcasting Services Act; and
 - (b) the *National Television Conversion Scheme 1999* (as amended) formulated by the ABA under subclause 19(1) of Schedule 4 to the Broadcasting Services Act.
- 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* and subitem 12 (3) of Schedule 4 to the *Australian Communications and Media Authority (Consequential and Transitional Provisions) Act 2005* this assignment is taken to be a referral to ACMA under subsection 31 (1) of the Radiocommunications Act.
6. The broadcasting services bands are:
 - 526.5 to 1606.5 kHz in the medium frequency band of the radiofrequency spectrum. AM radio services are allocated frequencies in this range.
 - 45 to 52 MHz and 56 to 70 MHz (Band I) in the very high frequency band of the radiofrequency spectrum. Analog television services are allocated frequencies in this range.
 - 85 to 108 MHz (Band II) in the very high frequency band of the radiofrequency spectrum. Analog television services were allocated frequencies in this range, however 87.5 to 108 MHz has been set aside internationally for FM radio and ACMA will consider, as part of the public planning process, future clearance of television services occupying this part of the spectrum. No new television services will be allocated Band II frequencies.
 - 137 to 144 MHz (channel 5A) in the very high frequency band of the radiofrequency spectrum. Analog television services were allocated frequencies in this range, however no new assignments will be made of these frequencies.
 - 174 to 230 MHz (Band III) in the very high frequency band of the radiofrequency spectrum. Analog and digital television services are allocated frequencies in this range.
 - 520 to 820 MHz (Bands IV and V) in the ultra high frequency band of the radiofrequency spectrum. Analog and digital television services are allocated frequencies in this range.

Planning handbooks

7. Detailed information on methods for planning of analog broadcasting services is contained in the Technical Planning Parameters and Methods for Terrestrial Broadcasting. It provides, inter alia, information on ACMA planning practices and assumptions, including acceptable methods of computing field strengths and other parameters for compliance with these guidelines and other specifications of the transmitter licence.
- 7A. For digital television and datacasting services, the information in Technical Planning Parameters and Methods for Terrestrial Broadcasting is supplemented by the Digital Terrestrial Television Broadcasting Planning Handbook.

Note The documents mentioned in guidelines 7 and 7A are available from ACMA's website (www.acma.gov.au).

Definitions

Note Wherever possible the definitions of terms below are consistent with the Broadcasting Services Act, the Radiocommunications Act and the ITU Radio Regulations. Unless defined below, words shall have the same meanings as in the Broadcasting Services Act, or the Radiocommunications Act, or the ITU Radio Regulations, as appropriate.

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

ABA means the Australian Broadcasting Authority that was established under section 154 of the Broadcasting Services Act.

Note On 1 July 2005 ACMA took over the functions that had previously been performed by the ABA.

ACA means the Australian Communications Authority that was established under the *Australian Communications Authority Act 1997*.

Note On 1 July 2005 ACMA took over the functions that had previously been performed by the ACA.

ACMA means the Australian Communications and Media Authority established under the *Australian Communications and Media Authority Act 2005*.

AM radio means medium frequency, amplitude modulated radio services located in the frequency range 526.5 to 1606.5 kHz.

AM radio service includes an AM radio broadcasting service, an AM radio national broadcasting service, and an AM radio narrowcasting service.

analog reference television receiving system — see the definition of **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 television national 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.

broadcasting licensee means a holder of an apparatus licence authorising the operation of a transmitter under section 101A, 102 or 102A of the Radiocommunications Act.

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.

Broadcasting Services Act means the *Broadcasting Services Act 1992*.

broadcasting services bands has the meaning set out in guideline 6.

channel means part of the radiofrequency spectrum intended to be used for an emission and which may be defined by two specified limits, or by its centre frequency and associated bandwidth, or by an equivalent indication.

Note Channel arrangements applicable to AM radio, FM radio, analog television and digital television are described in the respective emission standards, set out in the appendices to these guidelines.

cymomotive force (CMF) 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 means a service that is, or a number of services together that are, delivered under the authority of a datacasting transmitter licence issued under the Radiocommunications Act.

datacasting service area means the geographical area in which ACMA 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.

datacasting transmitter licence has the same meaning as in the Radiocommunications Act.

device has the same meaning as in subsection 9 (1) of the Radiocommunications Act.

Digital Channel Plan (DCP) means an instrument developed by ACMA under:

- (a) the *Commercial Television Conversion Scheme 1999* (as amended) formulated under subclause 6 (1) of Schedule 4 to the Broadcasting Services Act; or
- (b) the *National Television Conversion Scheme 1999* (as amended) formulated under subclause 19 (1) of Schedule 4 to the Broadcasting Services Act;

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 the definition of *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 radiated power (ERP) in a specified direction is the product of the power supplied to the antenna and its gain relative to a half-wave dipole in the specified direction.

EMC calculations means calculations that detail the ability of a transmitter to operate without causing interference to other services provided by radiocommunications licensees. 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 Services provided by radiocommunications licensees include 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.

FM radio service includes an FM radio broadcasting service, an FM radio national broadcasting service, and an FM radio narrowcasting service (other than a low power open narrowcasting service).

guidelines means the technical planning guidelines set out in this document (and its appendices), as developed by ACMA pursuant to section 33 of the Broadcasting Services Act.

implementation plan means one or more plans related to the implementation of digital television transmission under clause 9 or 20 of Schedule 4 to the Broadcasting Services Act. The processes for the lodgement and variation of implementation plans are described in the *Commercial Television Conversion Scheme 1999* and the *National Television Conversion Scheme 1999*.

interference means:

- (a) 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
- (b) 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 This is a general definition that applies to all interference mechanisms. In the particular cases of co-channel, first adjacent channel and image channel interference to analog and digital television and datacasting, clarifications on the level of interference allowed are given in Parts 5 and 6 of these guidelines.

licence area means an area designated by ACMA under section 29, 40 or 92G of the Broadcasting Services Act.

licence area plan (LAP) means a licence area plan prepared by ACMA pursuant to section 26 of the Broadcasting Services Act.

licensee means either a broadcasting licensee or a datacasting licensee.

locality means an area designated by the Australian Bureau of Statistics as a locality at the 2001 Census.

Note In broad terms, a locality corresponds to a population cluster of between 200 and 999 people.

low power open narrowcasting service means an open narrowcasting service operating with an effective radiated power not exceeding 1 watt (W) in a residential area and an effective radiated power not exceeding 10 W in a non-residential area.

narrowcasting service means a subscription or open narrowcasting service under section 17 or 18 of the Broadcasting Services Act.

narrowcasting service area means the geographical area in which ACMA has made available a channel for use by a narrowcasting service, as described in the LAP or transmitter licence.

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.

national signal reception area means the signal reception area of a national broadcasting service. Unless otherwise specified in the LAP, DCP or transmitter licence conditions, the signal reception area of a national broadcasting service is defined as:

- (a) for AM radio — the area in which the ground wave median field strength is equal to, or greater than, 0.5 mV/m; and
- (b) for FM radio — the area in which the median field strength is equal to, or greater than, 54 dB μ V/m; and
- (c) for analog television — the area in which the median field strength is equal to, or greater than, the field strength for the frequency band of operation specified in table 5.1; and
- (d) for digital television — the area in which the median field strength is equal to, or greater than, the field strength for the frequency band of operation specified in table 6.1.

nominal location means the location of the transmitter specified in a LAP or DCP.

planned minimum field strength means the minimum median field strength planned for a service and for which protection is afforded against interference. Unless otherwise specified in the LAP, DCP or transmitter licence conditions, the planned minimum field strength is defined as:

- (a) for AM radio — 0.5 mV/m; and
- (b) for FM radio — 54 dB μ V/m; and
- (c) for analog television — the field strength, for the frequency band of operation, specified in table 5.1; and
- (d) for digital television — the field strength, for the frequency band of operation, specified in table 6.1.

Note A higher median field strength may be specified for some broadcasting services. For example, an interference limited service, or a service intended to serve an area for which protection to the median field strength levels noted above is not required. An example of such a service could be a translator that serves several suburbs with deficient coverage but whose coverage area is enclosed within that of a much higher powered transmitter that covers most of a much larger metropolitan area.

Radiocommunications Act means the *Radiocommunications Act 1992*.

radiocommunications licensee has the same meaning as a licensee under the Radiocommunications Act.

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 3C.BB of Technical Planning Parameters and Methods for Terrestrial Broadcasting. For digital television systems the reference television receiver is defined in Appendices B and E of the Digital Terrestrial Television Broadcasting Planning Handbook, supplemented by data on antenna directivity discrimination and orthogonal wave polarisation discrimination in Attachment 3C.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 to which the transmitter licence issued pursuant to section 101A, 102 or 102A of the Radiocommunications Act relates.

residential area means the area within 20 km of the boundary of an urban centre or locality.

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 the transmitting antenna, frequency and radiation pattern.

transmitter means, subject to guideline 8A:

- (a) anything designed or intended for radio emission; or
- (b) any other thing, irrespective of its use or function or the purpose of its design, that is capable of radio emission.

transmitter licence includes a broadcasting service transmitter licence, a national broadcasting service transmitter licence, a narrowcasting service transmitter licence and a datacasting transmitter licence.

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 an area designated by the Australian Bureau of Statistics as an urban centre at the 2001 Census.

Note In broad terms, an urban centre corresponds to a population cluster of 1,000 or more people.

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.

- 8A. A reference to a **transmitter** in the following Parts of these guidelines applies only to a transmitter of the kind specified in relation to that Part:
- (a) in Part 3 — a transmitter authorised to transmit an AM radio service;
 - (b) in Part 4 — a transmitter authorised to transmit an FM radio service;
 - (c) in Part 5 — a transmitter authorised to transmit an analog television service;
 - (d) in Part 6 — a transmitter authorised to transmit a digital television or datacasting service.

9. All field strength predictions and measurements are to be made at a receive height of 10 metres above ground. 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.

Note At VHF and UHF frequencies, location variability is typically quoted for an area represented by a square with a side of 100 metres to 200 metres.

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

Application of Part 1

12. The following procedure shall be followed by a licensee (except a licensee to which Part 7 applies) or authorised person when:
 - (a) planning to establish a transmitter to transmit a broadcasting service or datacasting service; or
 - (b) planning to change the technical operating specifications of a transmitter which is authorised for transmitting a broadcasting service or datacasting service.

Note Where a change of transmission site is proposed, Part 2 of these guidelines should also be followed.

Start up procedure

13. The start up procedure is as follows:
 - (a) a licensee or an authorised person is required to place advertisements in newspapers circulating within the licence area or datacasting service area of the licence at least seven days prior to the commencement of test transmissions. The advertisement is to advise members of the public to contact the licensee or authorised person if the broadcast causes interference to other services provided by radiocommunications licensees. The advertisement must detail the date and time of commencement of the test transmissions, the duration 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 an authorised person shall advise:
 - (i) the local ACMA office; and
 - (ii) other broadcasting licensees and national broadcasting licensees that provide services within the licence area or datacasting service area; and
 - (iii) datacasting licensees that provide services within the licence area or datacasting service area; and
 - (iv) narrowcasting (except low power open narrowcasting) licensees that provide services within the licence area or datacasting service area; and
 - (v) other broadcasting licensees and national broadcasting licensees that provide services in areas adjacent to the licence area or datacasting service area; and
 - (vi) datacasting licensees that provide services in areas adjacent to the licence area or datacasting service area; and

-
- (vii) narrowcasting (except low power open narrowcasting) licensees that provide services in areas adjacent to the licence area or datacasting service area;

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;

Note ACMA may require the licensee or authorised person to submit copies of press advertisements or other notifications mentioned in paragraph (a) and (b) of guideline 13.

- (c) where practicable, test transmissions should include regular voice announcements, or, in the case of an analog television broadcasting service, voice or visual information, identifying the licensee or authorised person and providing sufficient details for members of the public to contact the licensee or authorised person if the broadcast causes interference to other services provided by radiocommunications licensees;
- (d) a licensee or an 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 an authorised person is required to undertake any necessary further planning so as to eliminate or minimise interference identified during the test transmissions;
- (g) all interference caused to services provided by radiocommunications licensees by the transmissions in guideline 13 (e) above 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 ACMA. 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

Application of Part 2

14. The following procedure shall be followed by a licensee or authorised person when proposing to locate a transmitter at a site that is not at:
- the current location; or
 - the location specified in the technical conditions of the transmitter licence; or
 - the location specified in the technical specifications of a LAP or DCP (or an approved implementation plan).

Note Where a digital licensee proposes to add an additional transmitter at a site that is not specified in a technical specification in a DCP (or an approved implementation plan), this Part will apply in addition to Part 7.

Change of transmitter site procedure

15. The change of transmitter site procedure is as follows:
- 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, calculations are to be performed assuming maximum ERP specifications as set out in the LAP or DCP.

- the licensee or an authorised person shall then provide to ACMA the EMC calculations together with a completed application for a test transmission licence;
- if ACMA is satisfied that:
 - the EMC calculations indicate that operation from the alternate site will not cause interference to services provided by radiocommunications licensees, including any existing broadcasting services, national broadcasting services, narrowcasting (except low power open narrowcasting) services or datacasting services, or any service described in a LAP or DCP; and
 - the relevant guidelines will be sufficiently complied with;then ACMA will allocate a test transmission licence;

Note The licensee must comply with all relevant guidelines at the new location. ACMA may request the licensee or authorised person to submit supplementary information to demonstrate compliance with relevant requirements included in these guidelines.

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

Note Relevant guidelines from Parts 1 and 7 will be attached to the test transmission licence.

- (e) the licensee or an authorised person shall then provide to ACMA 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 transmitter licence;
 - (f) if ACMA is satisfied that:
 - (i) the results of the tests demonstrate that operation from the alternative site will not cause interference to services provided by radiocommunications licensees, including any existing broadcasting services, national broadcasting services, narrowcasting (except low power open narrowcasting) services or datacasting services, or any service described in a LAP or DCP; and
 - (ii) all other relevant requirements of these guidelines will be complied with upon commencement of transmissions from the new site;then ACMA 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 ACMA. 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 of Part 3

17. This Part of the guidelines applies to a licensee or an authorised person who intends to implement, or change the technical operating specification of, an AM radio broadcasting service occupying a channel in the 526.5 to 1606.5 kHz band of the radiofrequency spectrum.

Location of transmitter site

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

Cymomotive Force (CMF)

19. Regardless of the location of the transmitter site, the CMF of the transmission in any given direction shall not exceed the maximum CMF specified in the LAP.
20. If there is no technical specification specified in a LAP for a transmitter, the CMF of the transmission in any given direction shall not exceed that specified in the technical conditions of the transmitter licence.

Note 1 Guideline 20 does not preclude a licensee seeking a variation of the relevant licence condition.

Note 2 The maximum CMF is defined in terms of an envelope specification for all azimuth angles in the horizontal plane. CMF limits may also be specified in the vertical plane where this is necessary to limit skywave interference to other AM radio services.

Minimum level of service requirements

21. Unless otherwise specified in the LAP or transmitter licence conditions, a licensee is required to provide a minimum level of service within the licence area. If a transmitter is sited at the nominal location and an omnidirectional pattern is specified for the transmitter in the LAP, the CMF of the transmission is to be no more than 5 dB below the maximum CMF specified in the LAP. If a transmitter is sited at the nominal location and a directional radiation pattern is specified for the transmitter in the LAP, the CMF of the transmission is to be no more than 5 dB below the maximum CMF specified in the LAP, over at least 60 per cent of each defined arc. The licensee must ensure that the CMF of the transmission in the direction of any urban centre within the licence area is no more than 5 dB below the maximum CMF specified in the LAP.

Note ACMA in considering whether to exercise its discretion in relation to the minimum power of a service will have regard to the fact that operation at power levels below that planned for the service may result in interference to the service. ACMA's planning framework will not generally protect services from interference in these circumstances.

22. If a transmitter is not sited at the nominal location, the licensee shall provide at least a minimum level of service to those urban centres in the licence area that would have received a service from a transmitter operating from the nominal location at the minimum CMF requirements specified in guideline 21.

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23. For the purpose of application of guideline 22, the minimum level of service in an urban centre is achieved if the received median ground wave field strength is equal to, or greater than, the planned minimum field strength.

Maximum field strength within the licence area

24. A transmitter shall be sited so that not more than 1 per cent of the total population of the licence area reside in areas with received field strengths greater than 1000 mV/m.

Note Guideline 24 deals with potential interference and/or degradation in receiver performance due to excessive signal levels at the input terminals of the AM radio receiver.

Maximum field strength beyond the licence area

25. If a transmitter is sited at a location other than the nominal location, the licensee must ensure that the median ground wave field strength of the transmission in any urban centre beyond the licence area boundary does not exceed the greater of:
- (a) the level that would be received if the transmitter was operating from the nominal location; or
 - (b) 2.5 mV/m.
26. If there is no technical specification specified in a LAP for a transmitter, the median ground wave field strength of the transmission in any urban centre beyond the licence area boundary must not exceed 2.5 mV/m unless otherwise specified in the transmitter licence conditions.

Interference to other services

27. If the operation of a transmitter causes interference to an AM radio service, the licensee must (at the licensee's own expense) adjust, or fit devices to, the transmitter or the affected receivers, or undertake other measures in order to eliminate or minimise the interference.
28. For the purpose of application of guideline 27, an AM radio service will be afforded protection against interference if:
- (a) operating within the terms of the relevant LAP or transmitter licence conditions, as appropriate; and
 - (b) is being received within its licence area, national signal reception area or narrowcasting service area, as applicable; and
 - (c) is being received with median ground wave field strengths equal to, or greater than, the planned minimum field strength.
29. In addition to guidelines 27 and 28 (which relate to AM radio services), a licensee shall, in consultation with affected parties, resolve complaints of interference to other services provided by radiocommunications licensees where that interference is caused by operation of the transmitter pursuant to the licensee's AM radio broadcasting service.
30. A licensee shall, in consultation with affected parties, resolve complaints of interference in areas where the received field strength exceeds 1000 mV/m.

Note ACMA is obliged to plan for AM broadcasting services in accordance with the Final Acts of the Regional Administrative LF/MF Broadcasting Conference (Regions 1 and 3) Geneva, 1975. Additional or alternative requirements necessary for compliance with the Geneva 75 Plan will be reflected in the LAP or technical conditions of the transmitter licence.

Radiated signal characteristics

31. The radiated signal characteristics of a transmitter shall comply with the Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service (see Appendix 1).

PART 4: FM RADIO

Application of Part 4

32. This Part of the guidelines applies to a licensee or an authorised person who intends to implement, or change the technical operating specification of, an FM radio broadcasting service occupying a channel in the 87.5 to 108 MHz band of the radiofrequency spectrum.

Location of transmitter site

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

Required field strength between adjacent frequencies

34. If:
- (a) a transmitter (the *first transmitter*) is not sited at the nominal location; and
 - (b) the frequency specified in the LAP for the transmitter is separated by 800 kHz from a frequency specified for use by another transmitter at the nominal location of the first transmitter;

then, unless otherwise specified in the LAP or transmitter licence conditions, the licensee must ensure that the difference in received field strength between signals from the transmitters does not exceed 24 dB in any urban centre or locality that is within the licence area of either service.

Effective radiated power

36. Regardless of the location of the transmitter site, the ERP of the transmission in any given direction shall not exceed the maximum ERP specified in the LAP.
37. If there is no technical specification specified in a LAP for a transmitter, the ERP of the transmission in any given direction shall not exceed that specified in the technical conditions of the transmitter licence.

Note Guideline 37 does not preclude a licensee seeking a variation of the relevant licence condition.

Minimum level of service requirements

38. Unless otherwise specified in the LAP or transmitter licence conditions, a licensee is required to provide a minimum level of service within the licence area. If a transmitter is sited at the nominal location and an omnidirectional pattern is specified for the transmitter in the LAP, the ERP of the transmission is to be no more than 5 dB below the maximum ERP specified in the LAP. If a transmitter is sited at the nominal location and a directional radiation pattern is specified for the transmitter in the LAP, the ERP of the transmission is to be no more than 5 dB below the maximum ERP specified in the LAP, over at least 60 per cent of each defined arc. The licensee must ensure that the ERP of the transmission in the direction of any urban centre within the licence area is no more than 5 dB below the maximum ERP specified in the LAP.

Note ACMA in considering whether to exercise its discretion in relation to the minimum power of a service will have regard to the fact that operation at power levels below that planned for the service may result in interference to the service. ACMA's planning framework will not generally protect services from interference in these circumstances.

39. If a transmitter is not sited at the nominal location, the licensee shall provide at least a minimum level of service to those urban centres in the licence area that would have received a service from a transmitter operating from the nominal location at the minimum ERP requirements specified in guideline 38.
40. For the purpose of application of guideline 39, the minimum level of service in an urban centre is achieved if the received median field strength is equal to, or greater than, the planned minimum field strength.

Maximum antenna height

41. If a transmitter is sited at the nominal location, 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.
42. If there is no technical specification specified in a LAP for a transmitter, the height of the electrical centre of the transmitting antenna above ground shall not exceed that specified in the technical conditions of the transmitter licence.

Note Guideline 42 does not preclude a licensee seeking a variation of the relevant licence condition.

43. If a transmitter is sited at a location other than the nominal location, the licensee shall ensure that the height of the electrical centre of the transmitting antenna above Australian Height Datum does not exceed the maximum antenna height above Australian Height Datum at the nominal location permitted by the LAP.

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

Maximum field strength within the licence area

44. A transmitter shall be sited so that not more than 1 per cent of the total population of the licence area reside in areas with received field strengths greater than 110 dB μ V/m.
45. A transmitter shall not be sited so that a significant part of the population of the licence area resides in areas with received field strengths greater than 120 dB μ V/m (1 V/m). For the purpose of this guideline, 0.1 per cent of the population or 100 persons, whichever is less, constitutes a 'significant part'.

Note 1 Guidelines 44 and 45 deal with potential interference and/or degradation in receiver performance due to excessive signal levels at the input terminals of the FM radio receiver.

Note 2 Subject to guidelines 41 to 43, the height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with guidelines 44 and 45.

Maximum field strength beyond the licence area

46. If a transmitter is sited at a location other than the nominal location, the licensee must ensure that the median field strength of the transmission in any urban centre beyond the licence area boundary does not exceed the greater of:
 - (a) the level that would be received if the transmitter was operating from the nominal location; or

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- (b) 54 dB μ V/m.
47. If there is no technical specification specified in a LAP for a transmitter, the median field strength of the transmission in any urban centre beyond the licence area boundary must not exceed 54 dB μ V/m unless otherwise specified in the transmitter licence conditions.

Interference to other services

48. If the operation of a transmitter causes interference to an FM radio service, analog television service, digital television service or datacasting service, the licensee must (at the licensee's own expense) adjust, or fit devices to, the transmitter or the affected receivers, or undertake other measures in order to eliminate or minimise the interference.
49. For the purpose of application of guideline 48, an FM radio service, analog television service, digital television service or datacasting service will be afforded protection against interference if:
- (a) operating within the terms of the relevant LAP, DCP (or approved implementation plan) or transmitter licence conditions, as appropriate; and
 - (b) is being received within its licence area, national signal reception area, narrowcasting service area or datacasting service area, as applicable; and
 - (c) is being received with median field strengths equal to, or greater than, the planned minimum field strength.
50. In addition to guidelines 48 and 49 (which relate to FM radio services, analog television services, digital television services and datacasting services), a licensee shall, in consultation with affected parties, resolve complaints of interference to other services provided by radiocommunications licensees where that interference is caused by operation of the transmitter pursuant to the licensee's FM radio broadcasting service.

Radiated signal characteristics

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

PART 5: ANALOG TELEVISION

Application of Part 5

53. This Part of the guidelines applies to a licensee or an authorised person who intends to implement, or change the technical operating specification of, an analog television broadcasting service occupying a channel in the 45 to 52 MHz, 56 to 70 MHz, 85 to 108 MHz, 137 to 144 MHz, 174 to 230 MHz, or 520 to 820 MHz bands of 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 appropriate for that band.

Effective radiated power

56. Regardless of the location of the transmitter site, the ERP of the transmission in any given direction shall not exceed the maximum ERP specified in the LAP.
57. If there is no technical specification specified in a LAP for a transmitter, the ERP of the transmission in any given direction shall not exceed that specified in the technical conditions of the transmitter licence.

Note Guideline 57 does not preclude a licensee seeking a variation of the relevant licence condition.

Minimum level of service requirements

58. Unless otherwise specified in the LAP or transmitter licence conditions, a licensee is required to provide a minimum level of service within the licence area. If a transmitter is sited at the nominal location and an omnidirectional pattern is specified for the transmitter in the LAP, the ERP of the transmission is to be no more than 5 dB below the maximum ERP specified in the LAP. If a transmitter is sited at the nominal location and a directional radiation pattern is specified for the transmitter in the LAP, the ERP of the transmission is to be no more than 5 dB below the maximum ERP specified in the LAP, over at least 60 per cent of each defined arc. The licensee must ensure that the ERP of the transmission in the direction of any urban centre within the licence area is no more than 5 dB below the maximum ERP specified in the LAP.

Note ACMA in considering whether to exercise its discretion in relation to the minimum power of a service will have regard to the fact that operation at power levels below that planned for the service may result in interference to the service. ACMA's planning framework will not generally protect services from interference in these circumstances.

59. If a transmitter is not sited at the nominal location, the licensee shall provide at least a minimum level of service to those urban centres in the licence area that would have received a service from a transmitter operating from the nominal location at the minimum ERP requirements specified in guideline 58.

60. For the purpose of application of guideline 59, the minimum level of service in an urban centre is achieved if the received median field strength is equal to, or greater than, the planned minimum field strength given in Table 5.1.

Table 5.1: Planned minimum field strength figures for analog television

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

<i>TV Transmission Band</i>	<i>Frequency Range (MHz)</i>	<i>Planned Minimum Field Strength (dBμV/m)</i>
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 transmitter is sited at the nominal location, 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.
62. If there is no technical specification specified in a LAP for a transmitter, the height of the electrical centre of the transmitting antenna above ground shall not exceed that specified in the technical conditions of the transmitter licence.

Note Guideline 62 does not preclude a licensee seeking a variation of the relevant licence condition.

63. If a transmitter is sited at a location other than the nominal location, the licensee shall ensure that the height of the electrical centre of the transmitting antenna above Australian Height Datum does not exceed the maximum antenna height above Australian Height Datum at the nominal location permitted by the LAP.

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

Maximum field strength within the licence area

64. A transmitter shall be sited so that not more than 1 per cent of the total population receiving at least the planned minimum field strength reside in areas with received field strengths greater than 110 dB μ V/m.
65. A transmitter shall not be sited so that a significant part of the population receiving at least the planned minimum field strength reside in areas with received field strengths greater than 120 dB μ V/m (1 V/m). For the purpose of this guideline, 0.1 per cent of the population or 100 persons, whichever is less, constitutes a 'significant part'.

Note 1 Guidelines 64 and 65 deal with potential interference and/or degradation in receiver performance due to excessive signal levels at the input terminals of the analog television receiver.

Note 2 Subject to guidelines 61 to 63, the height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with guidelines 64 and 65.

Maximum field strength beyond the licence area

66. If a transmitter is sited at a location other than the nominal location, the licensee must ensure that the median field strength of the transmission in any urban centre beyond the licence area boundary does not exceed the greater of:
 - (a) the level that would be received if the transmitter was operating from the nominal location; or
 - (b) the field strength, for the frequency band of operation, specified in table 5.1.
67. If there is no technical specification specified in a LAP for a transmitter, the median field strength of the transmission in any urban centre beyond the licence area boundary must not exceed the field strength for the frequency band of operation specified in table 5.1 unless otherwise specified in the transmitter licence conditions.

Interference to other services

68. A licensee of an analog television broadcasting service shall not cause unacceptable interference to an analog television service that is:
 - (a) operating within the terms of the relevant LAP or transmitter licence conditions, as appropriate; and
 - (b) being received within its licence area, national signal reception area or narrowcasting service area, as applicable; and
 - (c) being received with median field strengths equal to, or greater than, the planned minimum field strength.
69. 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.
70. For the purpose of application of guideline 68 to co-channel interference, **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 co-channel ratio of wanted to unwanted signals is 40 dB or less.
71. 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, national signal reception area or datacasting service area, as applicable; and

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- (d) is being received with median field strengths equal to, or greater than, the planned minimum field strength.
72. For the purpose of application of guideline 71, 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.
73. For the purpose of application of guideline 71 to co-channel interference, ***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 co-channel ratio of wanted to unwanted signals is 3 dB or less.
74. If the operation of a transmitter causes unacceptable interference to an analog television service, digital television service or datacasting service, the licensee must (at the licensee's own expense) adjust, or fit devices to, the transmitter or the affected receivers, or undertake other measures in order to reduce the interference to a level that is no longer unacceptable interference.
75. In addition to the conditions of guidelines 68 to 74 (which relate to analog television services, digital television services and datacasting services), a licensee shall, in consultation with affected parties, resolve complaints of interference to other services provided by radiocommunications licensees where that interference is caused by operation of the transmitter pursuant to the licensee's analog television broadcasting service.
76. Where the same set of analog television services can be received from more than one transmission site with signal levels above the planned minimum field strength, application of 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 analog television service can be received from a single transmission site with signal levels above the planned minimum field strength, these guidelines shall ensure that the reception of at least a UHF transmission is protected against interference from the unwanted service.
77. Where the same digital television service or datacasting service can be received from more than one transmission site with signal levels above the planned minimum field strength, application of these guidelines shall ensure that the reception of at least one of the signals is protected against interference from the unwanted service.

Radiated signal characteristics

78. The radiated signal characteristics of a transmitter shall comply with the Emission Standard for the Australian Analog Terrestrial Television Service (see Appendix 3).

PART 6: DIGITAL TELEVISION

Application of Part 6

79. This Part of the guidelines applies to a licensee or an authorised person who intends to implement, or change the technical operating specification of, a digital television broadcasting service or datacasting service occupying a channel in the 174 to 230 MHz, or 520 to 820 MHz bands of the radiofrequency spectrum.

Location of transmitter site

80. Unless otherwise specified in the technical specifications of the DCP (or approved implementation plan), the transmitter site shall be located within the licence area of the related licence or within the datacasting service area of the datacasting service, whichever is applicable.

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

Effective radiated power

81. If a transmitter intended to serve a particular area is not sited at the nominal location, the ERP of the transmission in any given direction from the alternative site shall not exceed that specified for the nominal location in the DCP.

Note 1 Guideline 81 does not preclude a licensee from making an application to vary a DCP where operation at higher ERP levels is required.

Note 2 Guideline 106 deals with the situation where a licensee proposes to operate transmitters additional to those included in a DCP.

Minimum level of service requirements

82. Under the policy objectives given in paragraph 6 (3) (f) of Schedule 4 to the Broadcasting Services Act, '... 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.
83. After the simulcast period mentioned in guideline 82, 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).

84. For the purpose of application of guideline 83, the minimum level of service in an urban centre is achieved if the received median field strength is equal to, or greater than, the planned minimum field strength given in Table 6.1.

Note No Minimum Level of Service Requirements are applicable to datacasting services. However, protection of a datacasting service against interference from other services will only be provided on the basis that the datacasting service provides a median field strength equal to, or greater than, the planned minimum field strength.

Table 6.1: Planned minimum field strength figures for digital television

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

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

85. In applying guidelines 82, 83 and 84, 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.

Maximum field strength within the licence area or datacasting service area

86. A transmitter shall be sited so that not more than 1 per cent of the total population receiving at least the planned minimum field strength reside in areas with received field strengths greater than 110 dB μ V/m.
87. A transmitter shall not be sited so that a significant part of the population receiving at least the planned minimum field strength reside in areas with received field strengths greater than 120 dB μ V/m (1 V/m). For the purpose of this guideline, 0.1 per cent of the population or 100 persons, whichever is less, constitutes a ‘significant part’.

Note 1 Guidelines 86 and 87 deal with potential interference and/or degradation in receiver performance due to excessive signal levels at the input terminals of the digital television receiver.

Note 2 The height of the antenna above ground level and/or the vertical radiation pattern may be altered to assist in complying with guidelines 86 and 87.

Maximum field strength beyond the licence area or datacasting service area

88. If a broadcasting transmitter is sited at a location other than the nominal location, the broadcasting licensee must ensure that the median field strength of the transmission in any urban centre beyond the licence area boundary does not exceed the greater of:
- the level that would be received if the transmitter was operating from the nominal location; or
 - the field strength, for the frequency band of operation, specified in table 6.1.

89. If there is no technical specification specified in a DCP for a transmitter, the median field strength of the transmission in any urban centre beyond the licence area boundary must not exceed the field strength for the frequency band of operation specified in table 6.1 unless otherwise specified in the transmitter licence conditions.
- 89A. In the case of datacasting services guidelines 88 and 89 do not apply, but transmitters intended to serve a particular datacasting service area must be located within the datacasting service area boundary.
- 89B. Except where a datacasting service is provided in accordance with a technical specification included in a DCP, where a datacasting licensee provides signals that extend beyond a datacasting service area boundary, coverage beyond the datacasting service area boundary is only permitted on a 'no interference, no protection from interference' basis.

Interference to other services

90. A licensee of a digital television broadcasting service or datacasting service shall not cause unacceptable interference to an analog television service that is:
- operating within the terms of the relevant LAP or transmitter licence conditions, as appropriate; and
 - being received within its licence area, national signal reception area or narrowcasting service area, as applicable; and
 - being received with median field strengths equal to, or greater than, the planned minimum field strength.
91. For the purpose of application of guideline 90, 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.
92. For the purpose of application of guideline 90 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 co-channel ratio of wanted to unwanted signals is 41 dB or less.
93. For the purpose of application of guideline 90 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 receiving system. This value applies equally for upper or lower adjacent channel combinations.

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94. Practical application of guideline 93 should take account of variable factors affecting the relative levels of the received adjacent channel transmissions. To account for variable factors including multipath effects, frequency dependent differences in receive and transmit antenna patterns and antenna gain across the channels an allowance of 5 dB shall be applied (i.e. a ratio of wanted to unwanted signals of 0 dB).

Note Where wanted and unwanted signals emanate from the same antenna, this condition can be readily interpreted as a power ratio of the two signals applied to the antenna. However, where the wanted and unwanted signals emanate from different antennas a more complex calculation is needed. It is necessary to calculate the wanted and unwanted field strength levels at all locations where the wanted service can be received with a median field strength higher than the planned minimum field strength. The field strength predictions will need to take account of the following factors: ERP of both services; location and site height of both sites; effective antenna height of both antennas; horizontal and vertical radiation patterns of the antennas at both sites; polarisation of both transmissions; a terrain model that covers the area of interest; if available, that model should include information about the clutter layer above the basic terrain; and, an appropriate propagation model.

- 94A. For the purpose of application of guideline 90 to image channel interference, ***unacceptable interference*** means that the digital television broadcasting service or datacasting service occupies a channel that is 10 or 11 channels above an analog television service and the relative level of the unwanted digital signal is more than 18 dB above the level of the wanted analog signal when measured at the receiver input terminal of an analog reference television receiving system.
- 94B. Practical application of guideline 94A should take account of variable factors affecting the relative levels of the received image channel transmissions. To account for variable factors including multipath effects, frequency dependent differences in receive and transmit antenna patterns and antenna gain across the channels an allowance of 5 dB shall be applied (i.e. a ratio of wanted to unwanted signals of -13 dB).

Note For situations where the wanted and unwanted signals emanate from different antennas, see the note to guideline 94.

95. Where the same set of analog television services can be received from more than one transmission site with signal levels above the planned minimum field strength, application of 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 analog television service can be received from a single transmission site with signal levels above the planned minimum field strength, these guidelines shall ensure that the reception of at least a UHF transmission is protected against interference from the unwanted service.
96. A licensee of a digital television broadcasting service or datacasting service shall not cause unacceptable interference to a digital television service or datacasting service that is:
- operating within the terms of the relevant DCP (or approved implementation plan) or datacasting transmitter licence, as appropriate; and
 - being received within its licence area, national signal reception area or datacasting service area, as applicable; and
 - being received with median field strengths equal to, or greater than, the planned minimum field strength.

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97. For the purpose of application of guideline 96, 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.
98. For the purpose of application of guideline 96 to co-channel interference, **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 less.
99. For the purpose of application of guideline 96 to adjacent channel interference, **unacceptable interference** means that the digital television broadcasting service or datacasting service occupies a channel that is adjacent to a digital television or datacasting service and the relative level of the unwanted digital signal is more than 30 dB above the level of the wanted digital signal when measured at the receiver input terminal of a digital reference television receiving system. This value applies equally for upper or lower adjacent channel combinations.
100. Practical application of guideline 99 should take account of variable factors affecting the relative levels of the received adjacent channel transmissions. To account for variable factors including multipath effects, frequency dependent differences in receive and transmit antenna patterns and antenna gain across the channels an allowance of 5 dB shall be applied (i.e. a ratio of wanted to unwanted signals of -25 dB).
- Note* For situations where the wanted and unwanted signals emanate from different antennas, see the note to guideline 94.
- 100A. For the purpose of application of guideline 96 to image channel interference, **unacceptable interference** means that the digital television broadcasting service or datacasting service occupies a channel that is 10 or 11 channels above a digital television service and the relative level of the unwanted digital signal is more than 40 dB above the level of the wanted digital signal when measured at the receiver input terminal of a digital reference television receiving system.
- 100B. Practical application of guideline 100A should take account of variable factors affecting the relative levels of the received image channel transmissions. To account for variable factors including multipath effects, frequency dependent differences in receive and transmit antenna patterns and antenna gain across the channels an allowance of 5 dB shall be applied (i.e. a ratio of wanted to unwanted signals of -35 dB).
- Note* For situations where the wanted and unwanted signals emanate from different antennas, see the note to guideline 94.

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101. If the operation of a transmitter causes unacceptable interference to a digital television service or datacasting service, the licensee must (at the licensee's own expense) adjust, or fit devices to, the transmitter or the affected receivers, or undertake other measures in order to reduce the interference to a level that is no longer unacceptable interference.

Note Part 7 of these guidelines deals with the digital licensee's responsibilities in the event of interference to an analog television service.

102. Where the same digital television service or datacasting service can be received from more than one transmission site with signal levels above the planned minimum field strength, application of these guidelines shall ensure that the reception of at least one of the signals is protected against interference from the unwanted service.
103. If a digital television broadcasting service or datacasting service:
- does not provide a service from a transmission site included in a DCP technical specification; or
 - operates at an alternative site from that specified in the DCP technical specification; or
 - operates from an additional site not included in a DCP technical specification (see guideline 106), then;
- the service will be afforded protection against interference from other digital television services or datacasting services included in the DCP based on the assumption that it is operating from the nominal location(s) included in the DCP.
104. In addition to the conditions of guidelines 90 to 103 (which relate to analog television services, digital television services and datacasting services), a licensee shall, in consultation with affected parties, resolve complaints of interference to other services provided by radiocommunications licensees where that interference is caused by operation of the transmitter pursuant to the licensee's digital television broadcasting service or datacasting service.

Single frequency networks and additional co-channel transmitters

Note 1 ACMA's planning responsibility is limited to determining channels, nominal transmitter sites and radiation pattern envelope specifications. Detailed design and implementation of Single Frequency Networks (SFNs), including determination of relative ERP levels and timing relationships between signals from each of the transmitters within an SFN, is the responsibility of individual licensees.

Note 2 Through its DCPs ACMA has defined a set of channels, transmission sites and radiation pattern envelope specifications that will permit digital television and datacasting services to be provided. Where a digital television or datacasting licensee proposes 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), it is the licensee's responsibility 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 transmitters.

105. A licensee of a digital television broadcasting service or datacasting service may configure co-channel transmitters whose technical specifications are included in a DCP, into an SFN. However, the licensee is responsible for the detailed implementation and management of internal self-interference within the SFN.

106. A licensee of a digital television broadcasting service or datacasting service may be permitted to establish additional digital transmitters on the same channel as an existing channel allotment within a DCP assignment for that service (which may, or may not, be operated in an SFN arrangement), without requiring a variation to the DCP, subject to the following conditions:

- (a) the area to be covered is not adequately served by transmitters operating in accordance with the DCP technical specifications unless the service is a datacasting service that is used for mobile television delivery; and

Note 1 Guidelines 82 to 84 define the Minimum Level of Service Requirements for digital television broadcasting services. For the purpose of application of paragraph 106 (a) to a datacasting service intended for reception by a domestic digital television receiver, an area may be considered under served if the received median field strength is less than the planned minimum field strength.

Note 2 For the purpose of application of paragraph 106 (a), an area may also be considered under served if an existing co-channel allotment determined in a DCP does not allow sufficient coverage due to self-interference.

Note 3 A mobile television service may have a considerably higher minimum field strength requirement than that required for reception using a domestic digital television receiver.

- (b) transmitter licence applications relating to the additional transmitters are submitted to ACMA; and
- (c) the licensee is responsible for managing self-interference arising from the additional co-channel transmitters, and for resolving co-channel or adjacent channel interference from other services within the intended coverage area of the additional transmitters; and
- (d) the characteristics of the additional transmitters comply with guidelines 80 (Location of Transmitter Site), 86 and 87 (Maximum Field Strength within the Licence Area or Datacasting Service Area), 89, 89A and 89B (Maximum Field Strength beyond the Licence Area or Datacasting Service Area), 90 to 104 (Interference to other Services), 107 (Radiated Signal Characteristics) and with Part 7 (Interference Management Scheme for Digital Television) of these guidelines; and
- (e) in addition to the interference conditions set out in guidelines 90, 91, 92 and 95 in respect of co-channel interference to analog television services, where the ratio of wanted to unwanted signals due to existing interferers is 41 dB or less, the interfering field strength from the proposed additional transmission is at least 6 dB below the root-sum-squared value of the existing co-channel interferers; and
- (f) in addition to the interference conditions set out in guidelines 96, 97, 98 and 102 in respect of co-channel interference to digital television services or datacasting services, where the ratio of wanted to unwanted signals due to existing interferers is 20 dB or less, the interfering field strength from the proposed additional transmission is at least 10 dB below the root-sum-squared value of the existing co-channel interferers.

Radiated signal characteristics

107. The radiated signal characteristics of a transmitter shall comply with clause 6.2.8 of Australian Standard *AS 4599.1-2007 Digital television – Terrestrial broadcasting – Part 1: Characteristics of digital terrestrial television transmissions* (see Appendix 4).

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108. Australian Standard *AS 4599.1-2007 Digital television – Terrestrial broadcasting – Part 1: 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, ACMA will apply a Reference Modulation for planning purposes based on modulation of 64-QAM, code rate of 2/3 and guard interval of 1/8. This leads to a minimum C/N requirement of 20 dB (including implementation margin) for receivers operating in Ricean channels. Operation with other parameters will only be protected to the extent provided by the Reference Modulation.

PART 7: INTERFERENCE MANAGEMENT SCHEME FOR DIGITAL TELEVISION

Application of Part 7

109. 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

110. 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.

Examples

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

Note:

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. 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 109 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 125 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 112, 113, 114 or 115 of these guidelines as applying to the transmission.

obligation period means the period that is described in guidelines 137 to 140 of these guidelines.

postcode population threshold has the meaning set out in guideline 111 of these guidelines.

predicted interference means unacceptable interference that is described in paragraph 150 (a) of these guidelines.

unacceptable interference means interference:

- (a) that is caused to an analog service described in guideline 90 of these guidelines; and
- (b) to which guidelines 91, 92, 93, 94, 94A and 95 of these guidelines can be applied.

unpredicted interference means unacceptable interference that is described in paragraph 150 (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

111. 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

- 112. For a transmission made using broadcasting services bands frequency in the range 520 to 820 MHz, an area that receives the transmitted signal at a field strength of at least 41dB μ V/m from the transmitter is a notification area.
- 113. 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 44dB μ V/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 50dB μ V/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) either:
 - (A) 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 50dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 44dB μ V/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) either:
 - (A) 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 50dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 44dB μ V/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) either:
 - (A) 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 50dB μ V/m; or

- (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 44dB μ V/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) either:
 - (A) 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 50dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 44dB μ V/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) either:
 - (A) 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 50dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 44dB μ V/m.

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

114. 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 50dB μ V/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 62dB μ V/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) either:
 - (A) 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 62dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 50dB μ V/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) either:
 - (A) 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 62dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 50dB μ V/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) either:
 - (A) 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 62dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 50dB μ V/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) either:
 - (A) 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 62dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 50dB μ V/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) either:
 - (A) 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 62dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 50dB μ V/m.

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

115. 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 54dB μ V/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 67dB μ V/m;

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- (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) either:
 - (A) 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 67dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 54dB μ V/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) either:
 - (A) 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 67dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 54dB μ V/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) either:
 - (A) 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 67dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 54dB μ V/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) either:
 - (A) 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 67dB μ V/m; or
 - (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 54dB μ V/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) either:
 - (A) 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 67dB μ V/m; or

- (B) is capable of receiving a signal from a television service in digital mode, on the same channel as the proposed channel, at a field strength of at least 54dB μ V/m.

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

Agreements between licensees

116. This Part applies to each digital licensee.
117. 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.

118. If a digital licensee makes, or relies on, an agreement for guideline 117 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

119. 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 120 to 131 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:

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

Advertisements

120. 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 services provided by radiocommunications licensees; and
- (d) include the contact details of an appropriate person; and
- (e) state that the information mentioned in paragraph 122 (a) of these guidelines is available, free of charge, in the ways that the licensee has chosen for the purposes of guideline 123 of these guidelines.

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

Note Where, over a period of time, a digital licensee is proposing to establish multiple transmitters in relation to a notification area, the digital licensee may place a single advertisement dealing with the matters listed in guideline 120 for those transmitters.

Advance notification

121. 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 ACMA office for the notification area;
 - (c) 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;
 - (d) each broadcasting licensee that provides services within the notification area;
 - (e) each datacasting licensee that provides services within the notification area;
 - (f) each licensee for a subscription broadcasting service that provides services within the notification area;
 - (g) each Member of the Commonwealth Parliament who represents an electorate that includes a part of the notification area;
 - (h) each Member of the Parliament of a State or Territory who represents an electorate that includes a part of the notification area;
 - (i) each local government body that has responsibility for the notification area;
 - (j) the chief executive officer, or similar person, of each hospital that is in the notification area;
 - (k) 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 122 of these guidelines.

Note Where, over a period of time, a digital licensee is proposing to establish multiple transmitters in relation to a notification area, the digital licensee may make a single notification to the persons listed in guideline 121 for those transmitters.

Written information

122. 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).
123. 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);
 - (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 1 The brochure or pamphlet shall be available to the public at all times during the obligation period: see guideline 141 of these guidelines.

Note 2 Where, over a period of time, a digital licensee is proposing to establish multiple transmitters in relation to a notification area, the digital licensee may:

- (a) under subparagraph 123 (d) (i), place a single advertisement in each of the two publications mentioned; or

(b) under subparagraph 123 (d) (ii), make a single delivery of the publication mentioned in paragraph 123 (a);
for those transmitters.

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

Interference hotline

125. 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 142 of these guidelines.

Media releases

126. 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 120 to 125 of these guidelines; and
- (b) the technical operating specifications of the transmitter (as defined in these guidelines).

Note Where, over a period of time, a digital licensee is proposing to establish multiple transmitters in relation to a notification area, the digital licensee may issue a single media release for each media organisation dealing with the matters listed in guideline 126 for those transmitters.

Test Transmissions

127. If arrangements have been made in accordance with guidelines 120 to 126 of these guidelines, test transmissions may be made. Test transmissions shall be conducted for at least seven days.
128. 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.
129. 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.
130. All interference to services provided by radiocommunications licensees caused by a test transmission described in guideline 128 of these guidelines should be eliminated or minimised before the test transmission procedure is completed.
131. Interference assessment reports, and documentation of any relevant calculations, shall be made available on request to ACMA.

Log of technical operating specifications

132. 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.

133. 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.
134. ACMA 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 ACMA; and
 - (b) to permit that ACMA staff member to make copies of anything in the log.

Interference complaints: test transmissions and other transmissions

135. Complaints from viewers about unacceptable interference from a digital transmission may be made using the interference hotline.
136. It is also possible that a person who is mentioned in a paragraph of guideline 121 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 121 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

137. 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.

138. ACMA may, in writing, extend an obligation period for a digital licensee. ACMA:
- (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 140 (a) or 140 (c) of these guidelines.

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139. If ACMA proposes to extend an obligation period for a digital licensee, ACMA shall notify the digital licensee before the end of the current obligation period.
140. 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.

141. A digital licensee, or an authorised person, that is mentioned in guideline 123 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.
142. A digital licensee, or an authorised person, that is mentioned in guideline 125 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

143. A digital licensee shall make and keep a register, during the obligation period, of interference complaints that the digital licensee has received.
144. 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.
145. The digital licensee shall not disclose information in the register to another person, other than ACMA, unless the disclosure is required as part of the resolution of the complaint.
146. ACMA 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 ACMA; and
 - (b) to permit that ACMA staff member to make copies of anything in the register.

Predicted and unpredicted interference to analog transmissions: background

147. The Conversion Schemes require ACMA 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 ACMA 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 a television program transmitted by a broadcaster in analog mode may be achieved by means of a television set, or a television tuner within a VCR.

148. For guideline 147 of these guidelines, interference caused by or to an ancillary device is not interference to direct reception.
149. 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 In developing DCPs ACMA has identified only situations where unacceptable interference is likely to occur. It is possible that while a DCP has predicted situations of unacceptable interference to some analog services, interference that has not been predicted may also occur to other analog services.

If ACMA 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.

150. ACMA 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 DCPs foreshadow the possibility that, if predicted interference is eliminated, the ERP restrictions would be removed.

Management of predicted interference

151. 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 ACMA 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 Radiocommunications Act, a digital licensee is also required to comply with the conditions on the licensee's licence.

152. For the purpose of subparagraph 151 (c) (ii) of these guidelines, the digital licensee shall:
- (a) notify ACMA, before transmitting without the ERP restriction, that it is possible for the licensee to transmit without the restriction; and
 - (b) give ACMA a copy of the arrangements with evidence that the analog licensee has endorsed or agreed to the arrangements.
153. For the purpose of conducting the interference study that is mentioned in paragraph 151 (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, local time.
154. In considering an application to remove an ERP restriction, ACMA 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 151 (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 151 (b) of these guidelines.

Management of unpredicted interference: handling complaint

155. 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 136 (a) of these guidelines; and

- (c) each complaint that the digital licensee chooses to treat as a complaint in accordance with paragraph 136 (b) of these guidelines;
to determine whether there is any unacceptable interference and, if so, the action that is required to resolve the complaint in accordance with guideline 163 of these guidelines.
156. Subject to guideline 157 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.
157. If the digital licensee determines that the interference that was experienced by the complainant is not caused by a digital transmission, the digital licensee shall:
- (a) notify the complainant of the cause of the interference; and
 - (b) refer the complaint to ACMA; 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 television transmissions (for example, analog television transmissions or the use of radiocommunications devices used for purposes other than television transmission).
158. 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 ACMA; and
 - (c) refer the complainant to another person if it is identified that the interference is caused by that person's transmissions.
159. If a complaint is referred to ACMA under guideline 157 or 158 of these guidelines, the digital licensee shall provide evidence in support of the licensee's determination.
160. If ACMA determines that the unacceptable interference identified in a complaint referred to ACMA under guideline 157 or 158 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 ACMA.
161. 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.

162. 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)

163. 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 161 of these guidelines applies, the digital licensee gives the advice that is mentioned in that guideline.
164. 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.
165. 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 119 of these guidelines applies.

Management of unpredicted interference: resolution of complaint (post code population threshold)

166. If the number of unresolved complaints relating to a digital licensee reaches a postcode population threshold, the digital licensee shall:
- (a) comply with guidelines 168 to 171 of these guidelines within fourteen days after the day on which the number of unresolved complaints reaches the threshold; and
 - (b) comply with guidelines 172 to 176 of these guidelines.

The period of fourteen days is the resolution period.

167. If ACMA believes that it is in the public interest for a digital licensee to comply with guidelines 168 to 171 of these guidelines, even though the number of unresolved complaints relating to a digital licensee has not reached the postcode population threshold:
- (a) ACMA may notify the digital licensee to that effect; and
 - (b) if ACMA notifies the digital licensee, the digital licensee shall:
 - (i) comply with guidelines 168 to 171 of these guidelines within fourteen days after the day on which the notification is received; and
 - (ii) comply with guidelines 172 to 176 of these guidelines.

The period of fourteen days is the resolution period.

168. 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.
169. The digital licensee shall, if practicable, rectify the interference, without lowering the ERP, before the end of the resolution period.
170. 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 163 of these guidelines.

171. The digital licensee shall notify ACMA, 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.
172. At the conclusion of the resolution period, the digital licensee shall notify ACMA, 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 163 of these guidelines.

173. 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 ACMA 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.

174. If:
- (a) the report of the interference study states that the ERP should be lowered to avoid interference; or

-
- (b) ACMA 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.
175. 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 ACMA that the digital licensee intends to transmit at the new ERP; and
 - (b) the digital licensee has given ACMA 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 ACMA a report of the actions taken (including evidence); and
 - (e) ACMA is satisfied that the digital licensee has taken action to ensure that unacceptable interference will not occur.
176. For the purpose of preparing the report that is mentioned in paragraph 175 (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, local time.

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 to 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.

The standard follows international practice and is based on relevant parts of ITU-R Recommendations BS.598 and BS.639. Provision is made for stereophonic as well as monophonic program transmission.

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.

Definitions

Note Unless defined below, words shall have the same meanings as in the Broadcasting Services Act, or the Radiocommunications Act, or the ITU Radio Regulations, as appropriate.

1. In this standard the following definitions apply:

channel means an AM broadcasting channel that is described in guidelines 2 and 3.

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.

out-of-band emission means an 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 an 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 signal characteristics

Channels

2. The width of the radio frequency channel shall be 9 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.
4. Unless otherwise specified, the frequency of the carrier shall be maintained within ± 10 Hz.

Note Reference: ITU Radio Regulations (2001 edition), Appendix 2, Table of Transmitter Frequency Tolerances.

Main carrier location and modulation

5. 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 signal

6. The polarisation of the radiated signal shall be as specified by ACMA.

Out-of-band and spurious emissions

7. The necessary bandwidth of the radio frequency emission is deemed to extend 9 kHz from the carrier frequency.
8. Any emission on a frequency removed from the carrier by more than 9 kHz, and up to and including 18 kHz, shall be attenuated at least 25 dB below the level of the carrier. Any emission on a frequency removed from the carrier by more than 18 kHz, and up to and including 27 kHz, shall be attenuated at least 35 dB below the level of the carrier. For frequencies removed from the carrier by more than 27 kHz, the level of any emission shall be further attenuated at a rate of 1 dB per kHz, or shall not exceed a level of 200 $\mu\text{V/m}$, whichever is less stringent. The emission mask of the radiated signal is shown in figure A1-1.
9. Out-of-band and spurious emissions shall be quoted with respect to the carrier level and shall be measured at a distance of one kilometre from the antenna system.

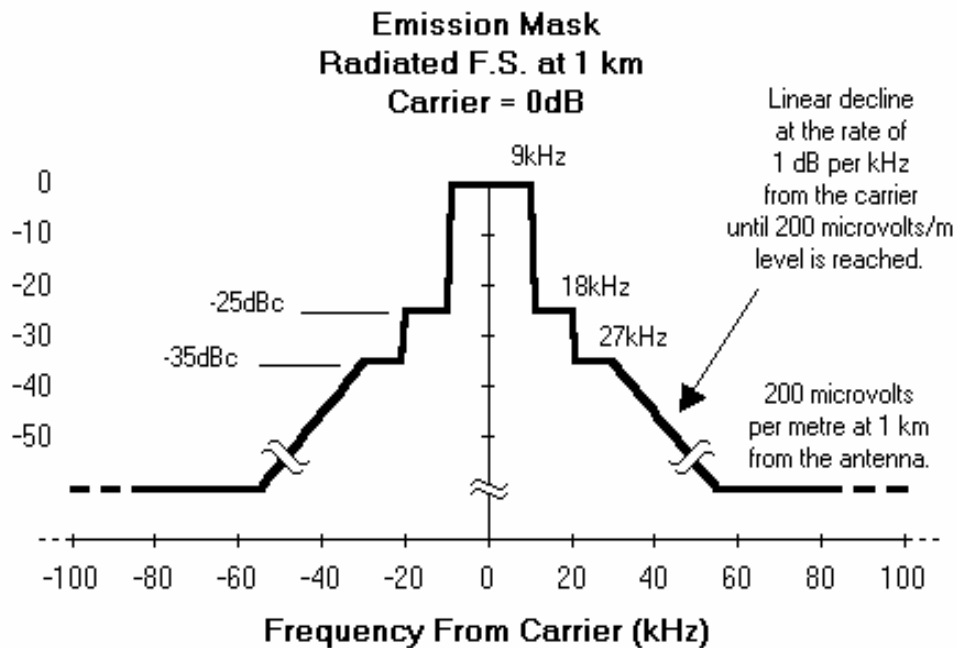


Figure A1.1: Emission mask for radiated field strength

Program signal characteristics

Monophonic transmission

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

The instantaneous amplitude of the modulated carrier shall satisfy the expression:

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

where

$E_c(t)$ = amplitude of modulated carrier as a function of time (t)

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

11. The compatible quadrature amplitude modulation (C-QUAM) system shall be employed for the transmission of stereophonic signals.
12. The radiated signal shall consist of a carrier, 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.

13. Amplitude modulation depth shall not exceed 125 per cent for positive modulation and 100 per cent for negative modulation.
14. Phase modulation shall not exceed ± 1.26 radians including the pilot signal.
15. The instantaneous amplitude of the modulated carrier shall satisfy the expression:

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

where

$E_c(t)$, A_c , M and ω_c are defined above

and

$$\phi = \arctan\left[\frac{(S + P)}{(1 + M)}\right] \leq 1.26 \text{ radians}$$

where

$P = 0.05 \sin(50\pi t)$, i.e. a 25 Hz sine wave

$S = L - R$ and $|S| \leq 1$.

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 18 'Gamut of Sum and Difference Modulation'. This limiting is normally implemented in the C-QUAM modulator.

Pilot tone

16. 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.

Audio frequency response

17. The steady state audio frequency response shall be nominally flat over the range of 50 Hz to 7 kHz.

Note 1 Appropriate audio filtering may be required at the input to the transmitter in order to meet the out-of-band and spurious emission requirements of guideline 8.

Note 2 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.

Gamut of sum and difference modulation

18. 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) that result in permissible levels of amplitude and phase modulation of the carrier.

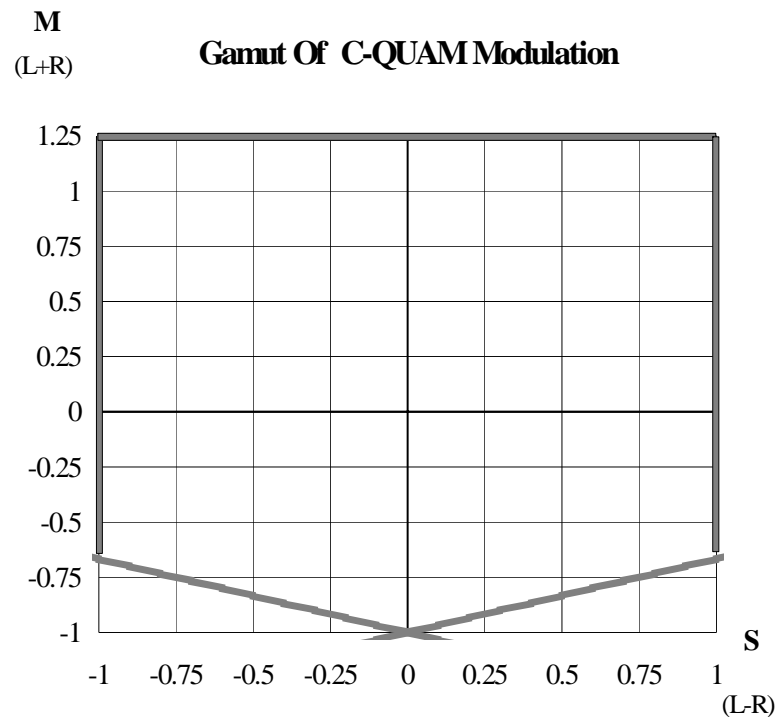


Figure A1.2: Gamut of C-QUAM modulation

Note 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 to 108 MHz. This standard supersedes the Emission Standard for the Australian Frequency Modulation Sound Broadcasting Service, published by the Department of Transport and Communications in 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 BS.450.

The preferred standard for the transmission of an ancillary communications service (ACS) is that developed by the then 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 this standard is intended to define the nominal values for the transmitted signal.

Definitions

Note Unless defined below, words shall have the same meanings as in the Broadcasting Services Act, or the Radiocommunications Act, 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 an FM broadcasting channel that is described in guidelines 2 and 3.

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.

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 an emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

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.

spurious emission means an 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.

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 width of the radio frequency channel shall be 200 kHz.
3. The channel spacing shall be 200 kHz with the lowest channel centre frequency being 87.7 MHz and the highest channel centre frequency being 107.9 MHz. A carrier frequency offset of ± 100 kHz may be specified.
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. Channels allocated for the Australian Frequency Modulation Sound Broadcasting Service are shown in table A2.1.

Main carrier location and modulation

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

8. The polarisation of the radiated signal shall be as specified by ACMA.

Out-of-band and spurious emissions

9. The necessary bandwidth of the radio frequency emission is deemed to extend 120 kHz from the carrier frequency.
10. Any emission on a frequency removed from the carrier by more than 120 kHz, and up to and including 240 kHz, shall be attenuated at least 25 dB below the level of the unmodulated carrier. Any emission on a frequency removed from the carrier by more than 240 kHz, and up to and including 600 kHz, shall be attenuated at least 35 dB below the level of the unmodulated carrier. Any emission on a frequency removed from the carrier by more than 600 kHz shall be attenuated at least $43 + 10\log P$ dB (where P is transmitter power in watts) below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

Main program signal characteristics

Monophonic transmission

11. 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 in accordance with the admittance/frequency characteristic of a parallel resistance-capacitance circuit having a time constant of 50 microseconds (see figure A2.4).
12. For monophonic transmission, without pilot sub-carrier, the deviation of the main carrier by the M signal shall not exceed ± 75 kHz.

Stereophonic transmission

13. 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; and
 - (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

14. The frequency of the (suppressed) sub-carrier shall be $38,000 \pm 4$ Hz.

Sub-carrier suppression

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

Audio frequency response

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

Pre-emphasis

17. 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 audio signal shall be in accordance with the admittance/frequency characteristic of a parallel resistance-capacitance circuit having a time constant of 50 microseconds (see figure A2.4).

Modulation polarity

18. 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

19. 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; and
 - (b) 57 kHz sub-carrier; and
 - (c) other sub-carriers below 95 kHz.
20. Ancillary Communications Service (ACS) sub-carriers may be used singly or in combination on condition that:
 - (a) the use of such sub-carriers shall not cause interference to or degradation of the main channel or other channels; and
 - (b) the deviation of the main carrier due to the entire baseband signal, including all ACS signals, shall not exceed ± 75 kHz; and
 - (c) the deviation of the main carrier by any one ACS sub-carrier alone shall not exceed ± 7.5 kHz.

Sub-carrier frequencies below 57 kHz and above 95 kHz shall not be used.

*67 kHz ACS sub-carrier**Sub-carrier frequency*

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

Peak deviation (sub-carrier)

22. For audio program and tone signals the peak deviation of the sub-carrier shall be dependent on the highest frequency modulating the sub-carrier in accordance with figure A2.1 (for audio program) and figure A2.2 (for audio frequency shift keyed data).
23. For direct FSK modulation the 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

24. 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

25. 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 out-of-band and spurious emission requirements of this standard (see guideline 10). 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 ACS sub-carrier**Radio data system (RDS)*

26. 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 EN50076:1998.

Use of RDS signals

27. 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

28. 57 kHz ACS services, not complying with the EN 50076 specification, may operate provided they do not cause false operation in receivers equipped with decoders for the reception of RDS signals conforming with EN 50076.

*Other sub-carriers below 95 kHz**ACS frequency*

29. An ACS sub-carrier frequency, other than 57 kHz or 67 kHz, may be used subject to the provisions in guideline 20.

Sideband products

30. 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 out-of-band and spurious emission requirements of this standard (see guideline 10). 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**ACS frequencies*

31. Any combination of 57 kHz and frequencies in the range 65 to 95 kHz may be used subject to the provisions in guidelines 19 to 30.

Sideband products

32. 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 out-of-band and spurious emission requirements of this standard (see guideline 10). 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

<i>Frequency in MHz</i>		
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

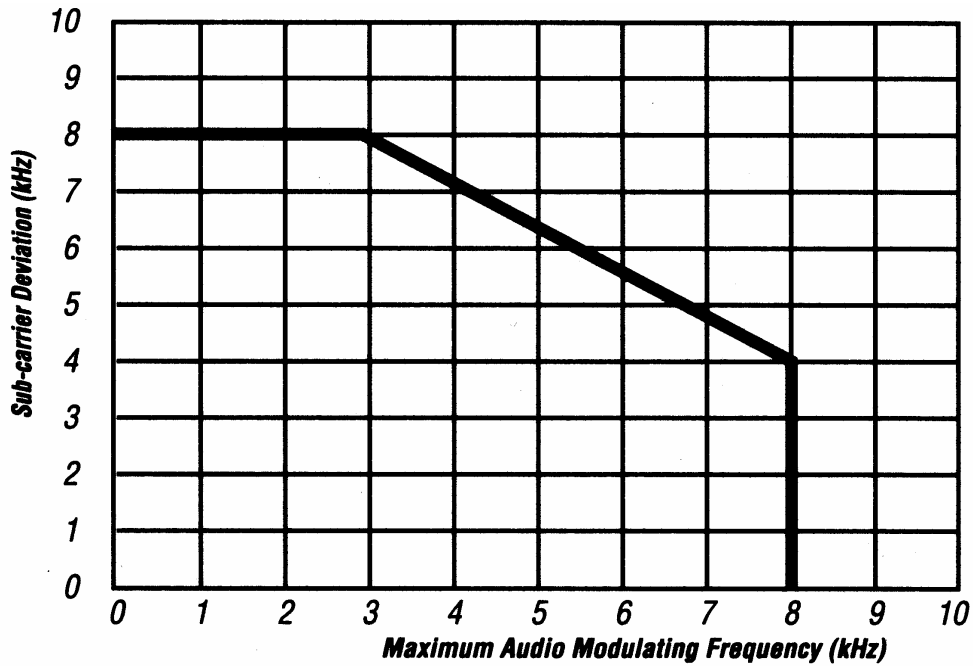


Figure A2.1: Maximum deviation of 67 kHz ACS sub-carrier versus audio modulated frequency for music and voice

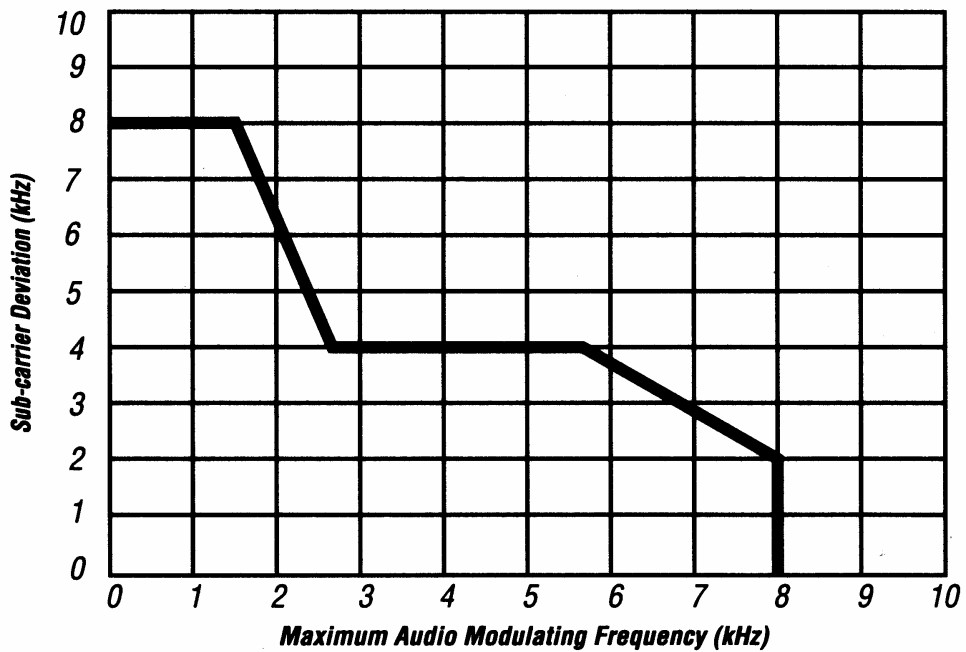


Figure A2.2: Maximum deviation of 67 kHz ACS sub-carrier versus audio modulating frequency for audio FSK

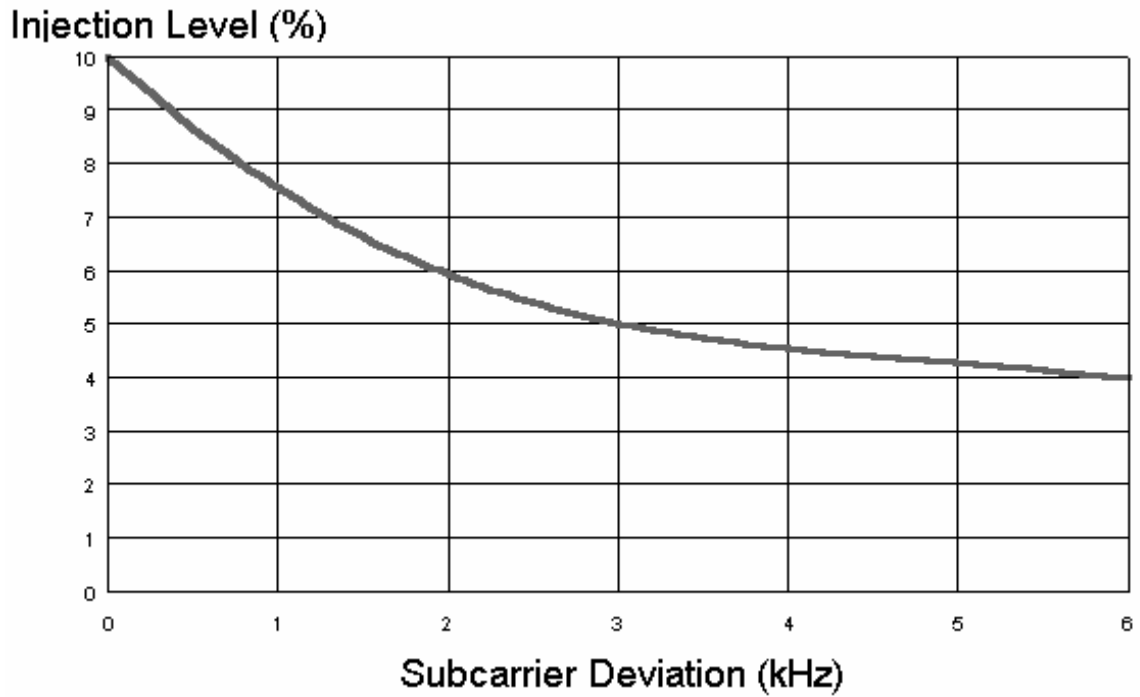


Figure A2.3: Maximum deviation versus injection for direct FSK of 67 kHz ACS sub-carrier

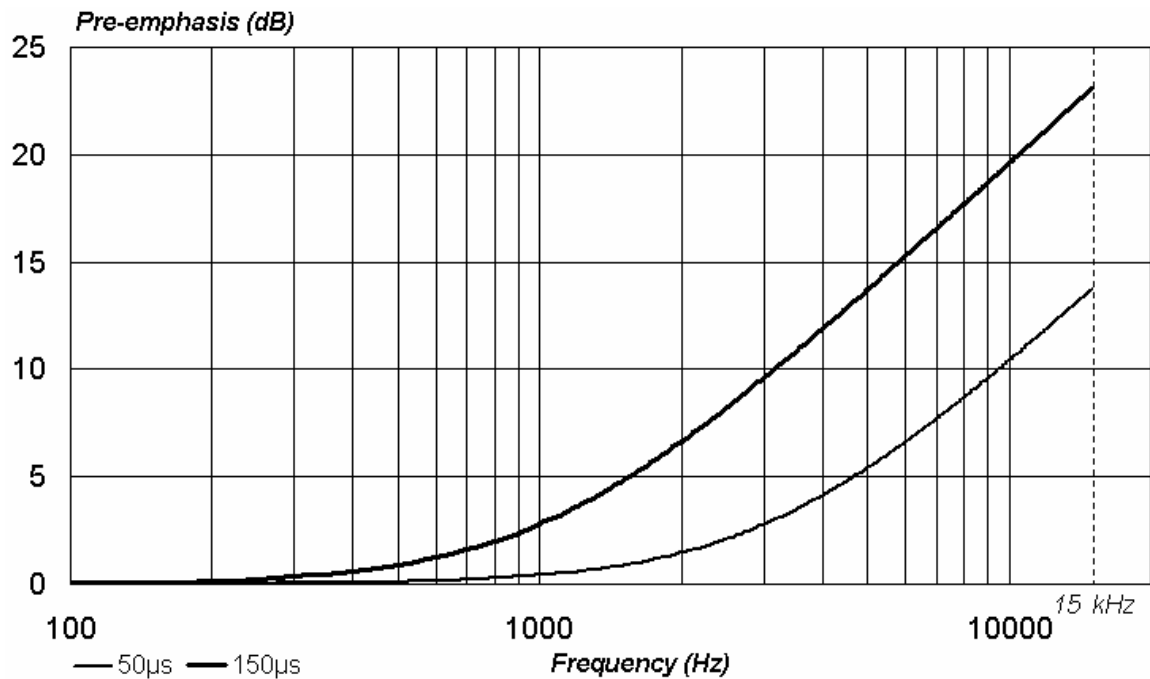


Figure A2.4: Audio frequency pre-emphasis characteristics for 50 and 150 microsecond time constant

Appendix 3: Emission Standard for the Australian Analog Terrestrial Television Service

The purpose of the emission standard for the Australian Analog Terrestrial Television Service is to define the parameters to be used for terrestrial broadcasting of analog 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 Recommendations BT.1700, BT.1701 and BS.707.

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:

- (a) depth of vision modulation (see guideline 5); and
- (b) use of lines in the vertical blanking interval (see guideline 19); and
- (c) group delay pre-correction (see figure A3.7).

Definitions

Note Unless defined below, words shall have the same meanings as in the Broadcasting Services Act, or the Radiocommunications Act, or the ITU Radio Regulations, as appropriate.

1. In this standard, the following definitions apply:

channel means an analog television broadcasting channel that is described in guideline 2.

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 an emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

spurious emission means an 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 signal characteristics

Television channels

2. The width of the television channel shall be 7 MHz. Channel arrangements for the Australian Analog Terrestrial Television Service are shown in table A5.1 (see Appendix 5).

Location of carriers within the channel

3. 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 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 nominal location of the carriers and sidebands within the channel.

Unless otherwise specified, the frequency tolerance of the vision and sound carriers shall be maintained within ± 500 Hz. ACMA may specify frequency offsets from the nominal vision carrier frequency.

Note Reference: ITU Radio Regulations (2001 Edition), Appendix 2, Table of Transmitter Frequency Tolerances.

Vision carrier modulation

4. 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

5. 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

6. 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

7. The polarisation of the radiated sound and vision signals shall be the same and shall be as specified by ACMA.

Vision to sound power ratio

8. The nominal ratio 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; or
 - (b) 13 dB and 20 dB for the first and second sound carriers respectively where the station transmits dual sound signals.

Limits on spurious emissions

9. The level of any spurious emission shall not exceed that specified in the ITU Radio Regulations (Appendix 3, 2001 edition).

Video characteristics

Scanning

Aspect ratio

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

Scanning sequence

11. 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

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

Picture and field frequencies

13. 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

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

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

Video signal

15. 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 $\frac{3}{7}$ 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

16. 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

17. 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

18. 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 $\frac{3}{7}$ 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 $+135^\circ$ 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

19. 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.

Note Closed caption signals are transmitted on page 801 of the teletext magazine.

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

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

Note Current Australian teletext and closed caption transmissions conform with the full presentation level 1 facilities defined in the *Enhanced Teletext Specification* given in European Standard (Telecommunications Series) ETSI EN 300 706 V1.2.1 (2003-04).

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

Primary colour signals

20. 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.

Table A3.1: CIE*15 Chromaticity coordinates and balance for a white chromaticity of CIE illuminant D_{65}

	<i>Chromaticity</i>	
	<i>X</i>	<i>Y</i>
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

21. 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

22. 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

23. 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

24. 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

25. 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

26. 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; and
 - (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

<i>Duration (measured between half amplitude points)</i>	<i>Microseconds Nominal Value</i>	<i>Tolerance</i>
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

<i>Colour</i>	<i>Luminance</i>	<i>Peak to Peak Chrominance</i>			<i>Chrominance Angle</i> ⁽²⁾	
	E'_Y	$2E'_U$	$2E'_V$	$2S^{(1)}$	<i>Line n</i> ⁽³⁾	<i>Line n+1</i>
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					

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

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

Note 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.

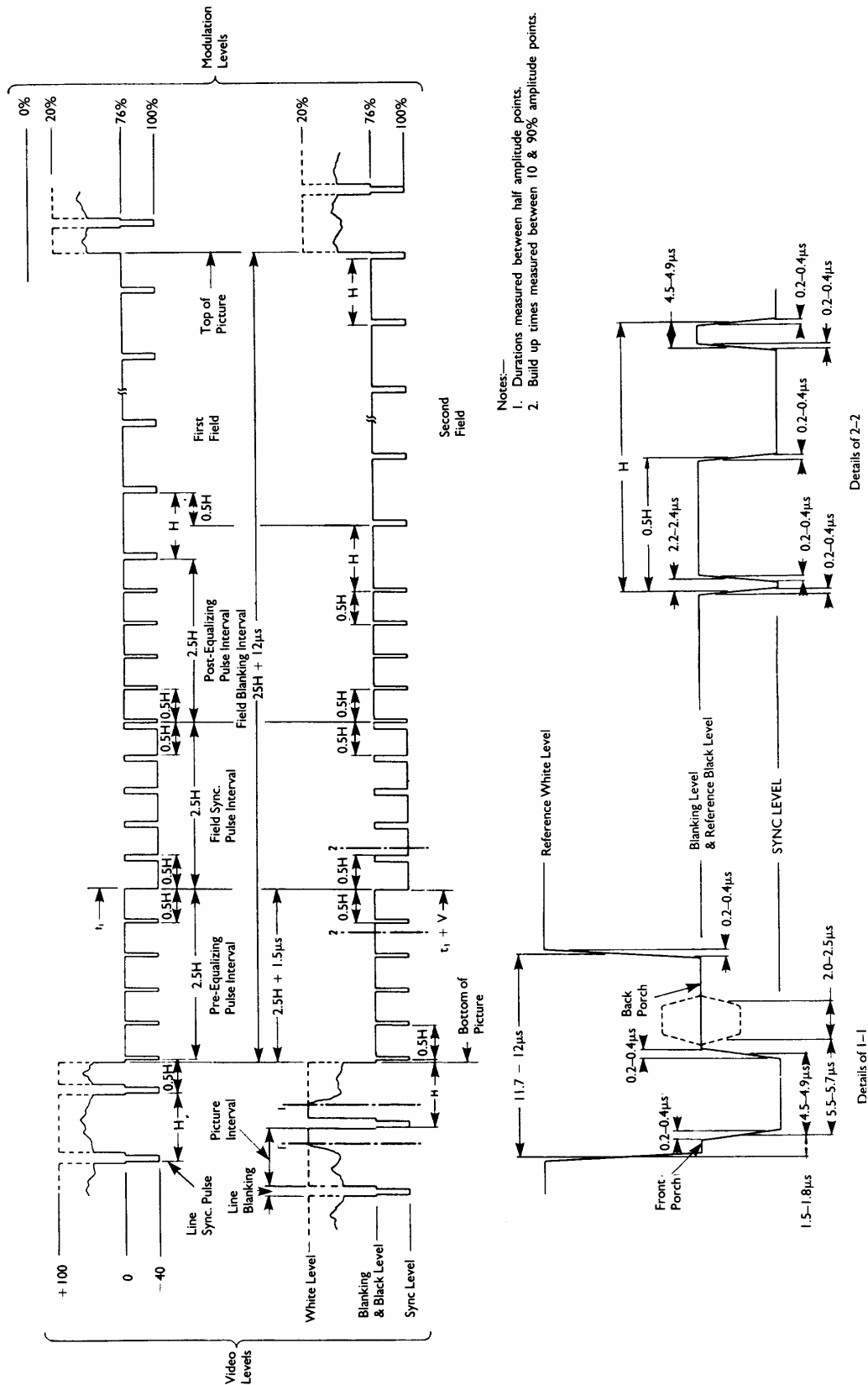


Figure A3.1: Video signal

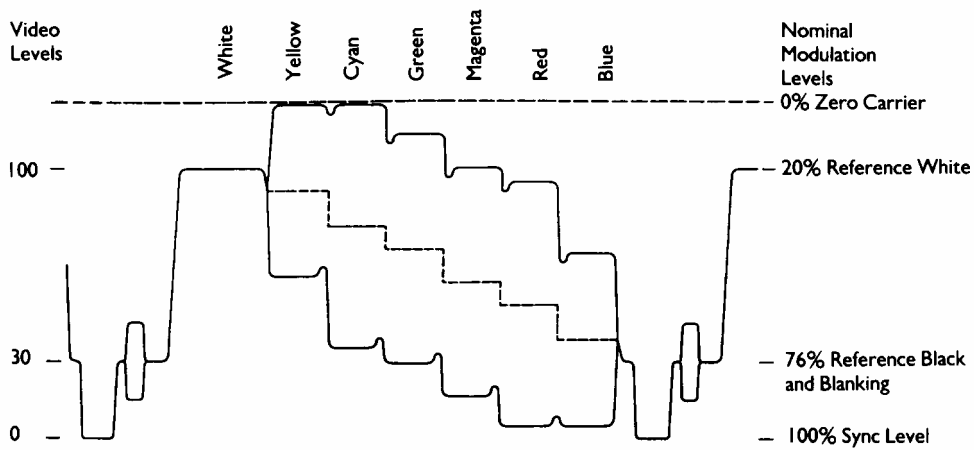
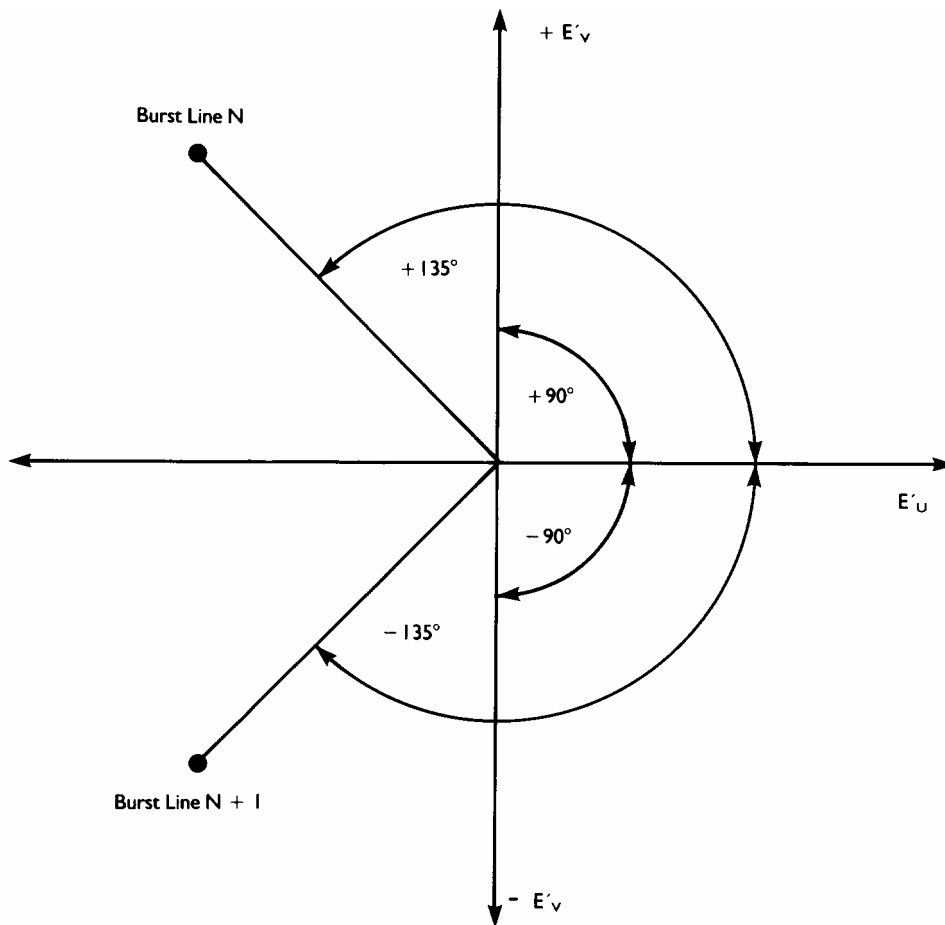
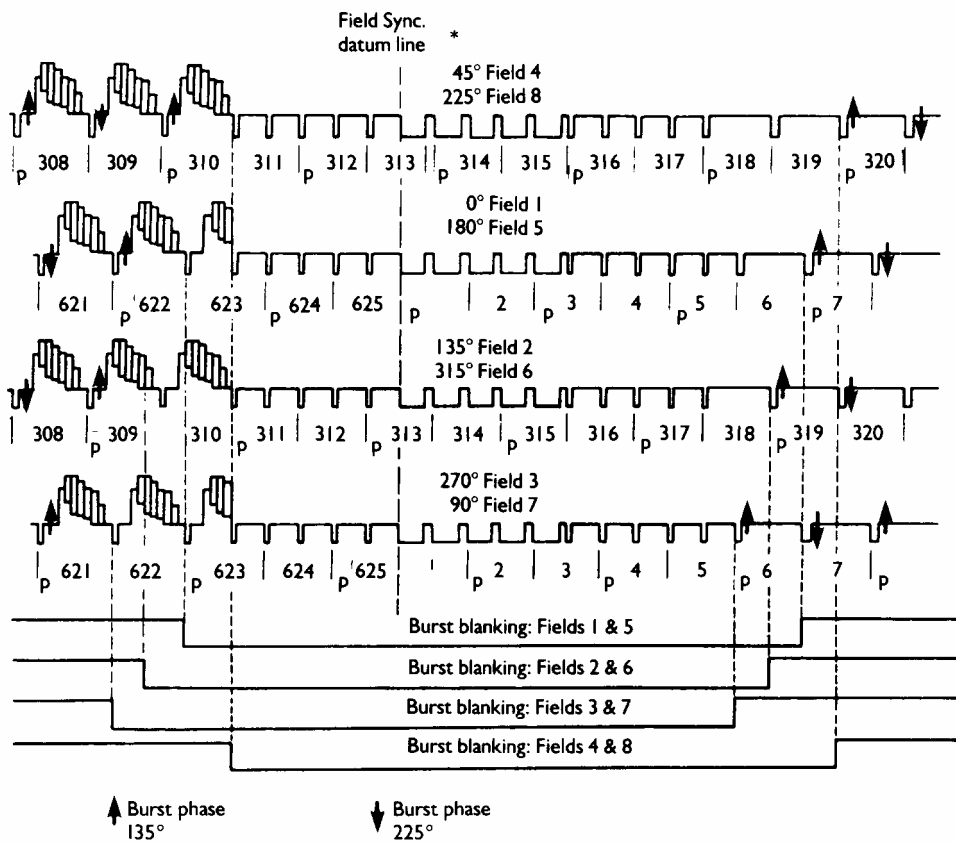


Figure A3.2: Video signal corresponding to fully saturated colours



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:
 $\angle E'_U = 0^\circ$

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

Figure A3.4: Four field sequence of burst blanking and subcarrier phase

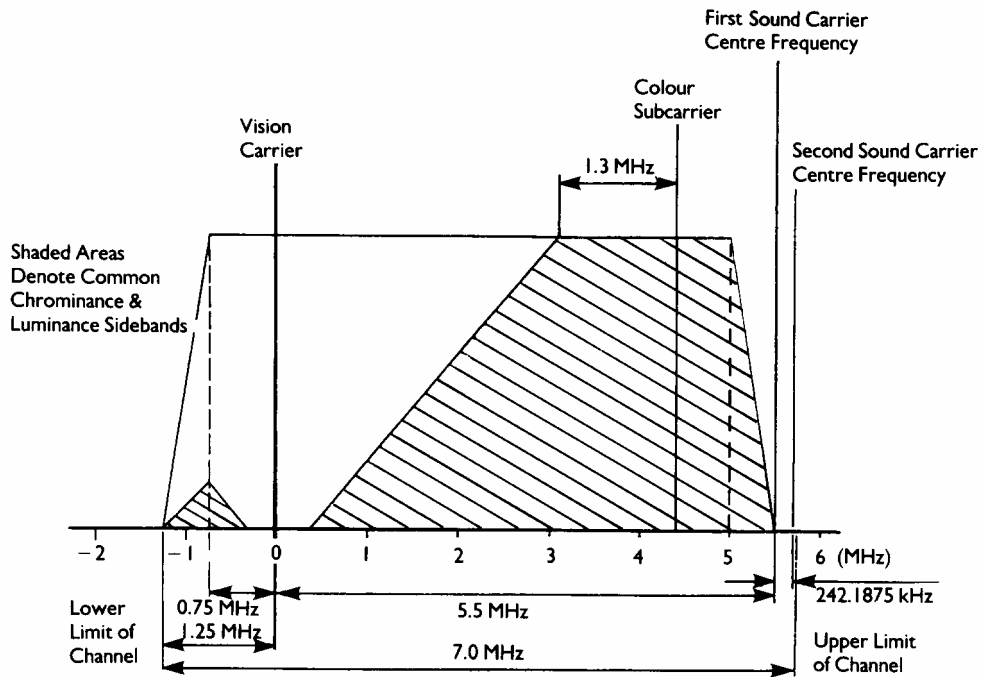


Figure A3.5: Location of carriers and sidebands within the channel

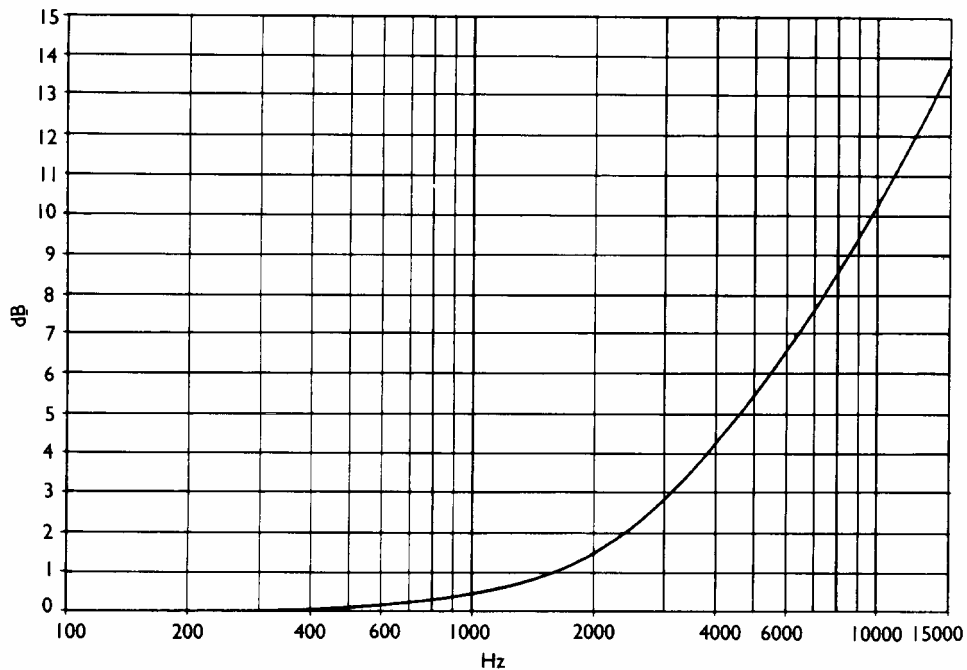


Figure A3.6: Sound transmitter modulating signal pre-emphasis

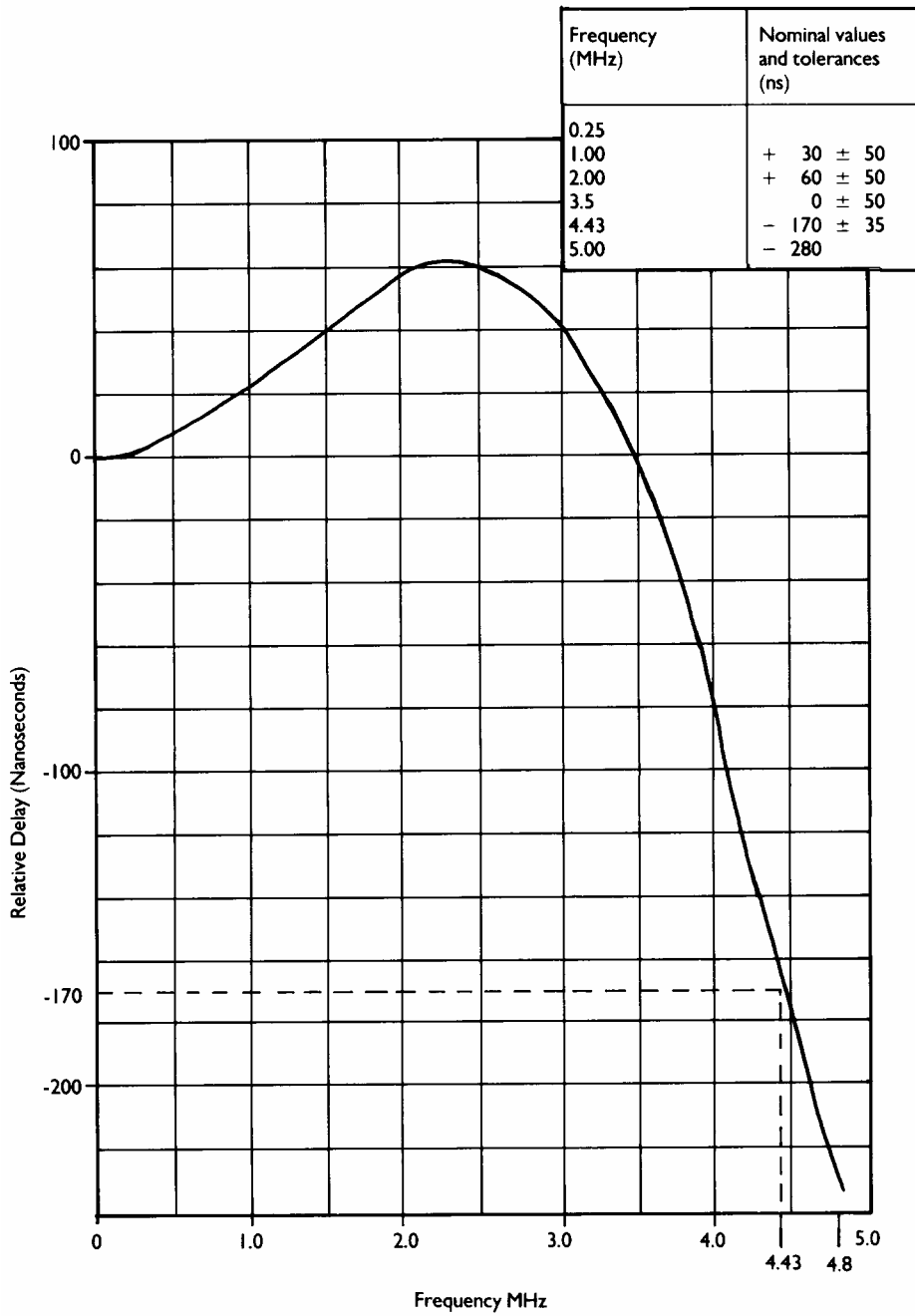


Figure A3.7: Nominal group delay precorrection characteristic

Appendix 4: Transmission Standard for the Australian Digital Terrestrial Television Service

The transmission standard applicable to Australian digital television broadcasting and datacasting services is identified below. The standard has been prepared by Standards Australia and may be adopted by broadcasters and datacasters according to their own requirements.

Transmission standard

1. Aside from clause 6.2.8, which is mandatory under guideline 107, Australian Standard *AS 4599.1-2007 Digital television – Terrestrial broadcasting – Part 1: Characteristics of digital terrestrial television transmissions* is recommended by ACMA only and is not mandatory under these guidelines.

Channels

2. Channels that may be used for the Australian Digital Terrestrial Television Service are shown in table A5.1 (see Appendix 5).

Other relevant standards

3. Under subsection 130A(1) of the Broadcasting Services Act, ACMA has made the *Broadcasting Services (Digital Television Format – Audio Component – Transmissions in SDTV Digital Mode) Technical Standard 2007*, which sets a requirement that if a television or datacasting service that is transmitted in SDTV digital mode has an audio component, the component must be capable of being decoded by a receiver that has only MPEG-1 Layer 2 audio decoding capability.

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
		32	554-561 MHz	53	701-708 MHz
BAND II ⁽¹⁾		33	561-568 MHz	54	708-715 MHz
3	85-92 MHz	34	568-575 MHz	55	715-722 MHz
4	94-101 MHz	35	575-582 MHz	56	722-729 MHz
5	101-108 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 ACMA 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. ACMA is considering ways of making use of channel 27 as a 7 MHz channel.

Note 6: ACMA is 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, ACMA 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, ACMA is required to prepare technical guidelines for the planning of individual radio and television services that use the broadcasting services bands. Despite their name, the Technical Planning Guidelines (TPGs) contain mandatory technical requirements to be met by commercial, community (including temporary community) broadcasting licensees and datacasting licensees using the broadcasting services bands when planning and operating new transmission facilities or proposing changes to existing facilities.

By reason of paragraphs 108A (1) (d), 109 (1) (e) and 109A (1) (f) of the Radiocommunications Act, the licensee of a transmitter licence issued to the holder of a temporary community broadcasting licence issued under Part 6A of the Broadcasting Services Act, or a commercial radio or television broadcasting licence issued under Part 4 of the Broadcasting Services Act, or a community radio or television broadcasting licence issued under Part 6 of the Broadcasting Services Act, or the holder of a datacasting transmitter licence issued under Part 3.3 of the Radiocommunications Act, or any authorised person, must comply with these guidelines.¹

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, may also include a licence condition requiring compliance with specified guidelines or parts of these guidelines.

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

Planning before the Broadcasting Services Act

Planning under the *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.

Guidance to broadcasters was provided through a document known as the draft Planning Guidelines (also known as GS1 through GS4). These guidelines were never given status other than draft because of uncertainty 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 published as the Technical

¹ The reference to a licence issued under Part 4 or Part 6 of the Broadcasting Services Act includes a licence which continues in force pursuant to the provisions of subsection 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. i.e. a commercial or community licence under the *Broadcasting Act 1942*.

Planning Parameters and Methods for Terrestrial Broadcasting (the TPPs) by the then Department of Transport and Communications.

The TPPs were developed in consultation with the industry and its engineering consultants and included all of the essential planning requirements, plus a great deal of advisory information to assist facilities planners. The TPPs were based on relevant Reports and Recommendations of the International Telecommunications Union (ITU) and on planning methods and practices developed in North America, United Kingdom and Europe, as well as broadcasting planning techniques and planning parameters developed in Australia.

The TPPs did not have the force of law but rather were detailed planning guides based on generally accepted planning methods, which if applied to proposals by licence applicants, were likely to meet the requirements of the regulator.

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, although 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 assignments against which licensees could plan changes. As a result even small changes to specifications required considerable dialogue between the applicant and the regulator, with attendant high resource costs, a risk of somewhat arbitrary decisions, and time delays.

Overview of planning under the Broadcasting Services Act

The Broadcasting Services Act moved the focus on service planning by the regulator to one based on establishment of 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 individual licensees.

Under the Broadcasting Services Act, the ABA was first required to determine 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 by the ABA in September 1993. This was followed by determination of the *Frequency Allotment Plan (FAP)*, which identifies the channel capacity that is to be planned for 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 the planning process is the determination of *Licence Area Plans*. Licence area plans specify the number and characteristics, including technical specifications, of broadcasting services to be made available in each area of Australia.

ACMA was created on 1 July 2005. Amongst other things ACMA has responsibility for functions previously undertaken by the ABA and the ACA. This includes administration of the Broadcasting Services Act and the Radiocommunications Act.

Technical specifications and licence area plans (LAPs)

In licence area planning, the approach taken by ACMA is to establish technical specifications for transmitters in a way that provides a performance envelope within which the transmitter and its associated transmitting antenna or radiating system must operate.

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, commonly referred to as the radiation pattern. However, the requirement to reuse channels in other areas means there is an upper limit on the radiated power that might be permitted in certain directions in order to provide a substantially interference free service for other users of the same or adjacent channels in neighbouring licence areas.

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

Compliance with technical specifications of a licence and the TPGs

The licensee, having established the transmission facilities, must be able to provide evidence of appropriate engineering and interference analysis having been conducted and be able to demonstrate that the operating transmitting arrangements comply with the technical specifications in the LAP and with the TPGs. 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 transmitter's operating specifications subsequently being found non-compliant.

ACMA, in discharging their responsibilities, may at any time, and without notice, conduct or commission spot checks of operating services to confirm compliance with licence specifications. In the event that problems are discovered, ACMA will bring the matter to the attention of the licensee and provide the licensee with an opportunity to provide relevant material indicating all reasonable steps have been taken to comply and to ensure continued compliance with the licence specifications. The licensee will 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 equipment failure or misalignment, rather than blatant disregard for the specifications.

ACMA 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 digital channel plans (DCPs)

ACMA cannot make substantive changes to existing specifications in a LAP or Digital Channel Plan (DCP) except by way of production of a new LAP or DCP, or formal variation of the existing LAP or DCP. In the latter case, the change is more likely to be initiated by a licensee seeking a variation to the transmitter licence (such as a 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 potentially affected parties.

Production of 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*. In varying a DCP under section 14 of the CTC Scheme or section 13 of the NTC Scheme, ACMA must decide whether it is appropriate to invite comments on the variation.

Broadcasting licensees and datacasting licensees should note that commercial disagreement on the cost of access to a site (especially where there is no alternative) would not, of itself, be regarded as a sound basis for seeking a LAP or DCP variation. ACMA has provided wide opportunity for potential licensees to explore and propose alternative sites during the LAP or DCP public consultation process. Consistent with broadcast planning objectives, and the desire to use established sites for both economic and environmental reasons, ACMA has endeavoured to avoid creating situations that force the use of a particular site and hence may potentially escalate the entry price. However, in some situations 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.

Transmitter operation away from the nominal location

The TPGs provide some flexibility for licensees wishing to use an alternative transmitter site to the nominal location specified in the LAP or DCP.

The TPGs contain the criteria ACMA will use when considering whether to approve an alternative site. The criteria are designed to ensure, amongst other things, that use of the alternative site will not cause interference to licensed radiocommunication services, or to existing or planned broadcasting services shown in the LAP or DCP. The licensee must continue to comply with the other technical specifications contained in the LAP or DCP, as well as all applicable requirements of the TPGs.

Notwithstanding this new relative freedom, ACMA 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 alternative site can commence an appropriate transmitter licence (which will specify the exact site and primary radiation parameters) must be obtained.

The procedure to be followed by a broadcasting licensee or datacasting licensee seeking to locate a transmitter at an alternative site is further explained below, under *Change of Transmitter Site Procedure*.

Planning and development approvals from other Authorities

In addition to the requirements of the LAP or DCP technical specifications and the TPGs, licensees are reminded of their responsibility to obtain all necessary approvals for site planning and environmental matters from the relevant Federal, State/Territory and local government authorities. Licensees must also comply with ACMA regulatory arrangements for human exposure to Electromagnetic Radiation (EMR), which are applicable to broadcasting transmitters. Further information on ACMA's EMR

regulatory arrangements can be obtained from the ACMA website (www.acma.gov.au).

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.

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.

It should be noted that there is provision for some of the parameters specified in the TPGs to be varied by exception in the LAP or DCP or transmitter licence, as appropriate. For instance, the planned minimum field strength for an FM service in rural areas is normally 54 dB μ V/m, however a higher median field strength may be specified in the LAP for a service that is only planned to serve suburban or urban areas.

Part 1: Start-up procedure

With development and expansion of broadcasting services, the density of transmitters leads to circumstances where existing services might be subject to interference as new services commence. Often this is because the radiocommunications environment has changed and better engineering practices are needed at existing sites to allow more services to operate free from interference.

The start-up procedures require anyone seeking to establish, or to change the technical operating specifications of, a transmitter for a commercial, community (including temporary 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.

Radio, analog television and datacasting licensees are required to: advertise in the newspapers circulating in the licence area or datacasting service area of the approved service at least seven days before commencing test transmissions; to advise ACMA and other broadcasters within, and adjacent to, the licence area or datacasting service area of the date and time of commencement of the test transmissions, the duration of the test transmissions and proposed technical operating specifications of the test transmissions; and, where practicable, to 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.

The start-up procedures for television or datacasting services provided in digital mode differ to those for analog services, although they share many of the above-mentioned

requirements. The requirements for digital television are specified in Part 7 (Interference Management Scheme for Digital Television) of the TPGs.

Part 2: Change of transmitter site procedure

The TPGs include some flexibility in the choice of transmitting site. Where a licensee does not propose to site a transmitter at the nominal location specified in the LAP or DCP, 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 submit the EMC calculations to ACMA, together with an application for a test transmission licence. If ACMA is satisfied that the EMC calculations prove that operation from the alternative site will not cause interference and that relevant guidelines of the TPGs will be complied with, ACMA 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 ACMA the results of the test transmissions including any interference assessment reports, and details of any complaints of interference made during the tests, together with a completed application form seeking variation of the relevant transmitter licence. If ACMA is satisfied that operation of the transmitter from the alternative site will not cause interference to other services provided by radiocommunications licensees and that relevant guidelines of the TPGs will be complied with upon commencement of transmissions from the new site, then it will vary the conditions attaching to the transmitter licence issued under the relevant provisions of the Radiocommunications Act.

Part 3: AM radio

This Part of the TPGs applies to a licensee (or authorised person) who intends to implement, or change the technical operating specification of, an AM radio broadcasting service.

Under this Part the AM licensee is required to site the transmitter within the licence area of the broadcasting service, unless otherwise permitted by the LAP. The radiated power of the transmission (in terms of cymomotive force or CMF), in any given direction, must also not exceed the maximum power specified by the LAP.

Unless otherwise specified in the LAP or transmitter licence, the licensee is required to provide a minimum CMF to urban centres within the licence area. This is to ensure that an adequate level of service is provided to all communities of significance, and not just to the larger population centres in the licence area.

The TPGs specify a maximum field strength that is permitted within population centres. The purpose of this requirement is to avoid excessive signal levels that may interfere with, or degrade the performance of, receivers.

The LAP process will normally ensure the location and corresponding transmission characteristics specified for the service are sufficient to achieve adequate coverage of population centres within the licence area, while ensuring any signal overspill in to adjacent areas is minimised. Where a licensee proposes to site a transmitter away from the nominal location specified in the LAP, the TPGs require that the field

strength of the transmission, in any urban centre beyond the licence area boundary, not exceed that which would be received from a transmitter operating at the nominal location, or a specified maximum field strength, whichever is greater. Therefore, licensees seeking to operate away from the nominal location must have particular regard to signal overspill into adjacent areas.

The TPGs also require that operation of the transmitter not cause interference to other AM radio services or licensed radiocommunication services. In the event of interference to an AM service the licensee is required (at the licensee's expense) to fit devices to the transmitter or the affected receivers, or undertake other measures necessary to eliminate or minimise the interference. The licensee must ensure the AM broadcasting service transmission complies with the *Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service*, which is at Appendix 1 of the TPGs.

Part 4: FM radio

This Part applies to a licensee (or authorised person) seeking to implement, or change the technical operating specification of, an FM radio broadcasting service.

The FM licensee must ensure the transmitter is sited within the licence area of the broadcasting service, unless otherwise permitted by the LAP. The radiated power of the transmission (expressed in terms of the effective radiated power or ERP), in any given direction, must also not exceed the maximum power specified in the LAP.

To minimise the possibility of interference to receivers, the TPGs impose constraints on the permitted discrepancy in received field strength between adjacent FM services separated in frequency by 800 kHz. This requirement is only applicable to licensees who propose to site their transmitting facilities away from the nominal location specified in the LAP.

A minimum level of service requirement is also specified for FM services in order to ensure all communities of significance within the licence area are adequately served.

FM licensees are required to ensure the height of the transmitting antenna does not exceed the maximum height specified in the LAP. Where the transmitter is sited at a location other than the nominal location specified in the LAP, the licensee must ensure the antenna height, when specified in terms of the Australian Height Datum (AHD), does not exceed the maximum antenna height above AHD at the nominal location permitted by the LAP.

The TPGs also specify the maximum field strength permitted within the licence area, as well as beyond the licence area boundary. The maximum field strength within a licence area is determined so that receivers do not suffer overload from excessive signal levels, while the maximum field strength beyond the licence area is specified so as to minimise overspill of the signal into adjacent areas.

The licensee must ensure the FM broadcasting service transmission complies with the *Emission Standard for the Australian Frequency Modulation Sound Broadcasting Service*, which is at Appendix 2 of the TPGs.

Part 5: Analog television

The requirements for analog terrestrial television services using the VHF or UHF television broadcasting services bands are very similar to those for FM radio.

One notable exception relates to transmitter siting. It is desirable that a television transmitter be located so that, for a particular band, ie. VHF or UHF, viewers within population centres of the licence area of the service receive all television services, licensed to serve that area, from a single direction. The need for viewers to install multiple same band antennas reduces the protection from interference assumed in the licence area planning process.

The radiated signal characteristics of analog television services are required to comply with the *Emission Standard for the Australian Analog Terrestrial Television Service*, which is at Appendix 3 of the TPGs.

Part 6: 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 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 provided in Annex B.

The radiated signal characteristics of digital television services are required to comply with clause 6.2.8 of Australian Standard *AS 4599.1-2007 Digital television – Terrestrial broadcasting – Part 1: Characteristics of digital terrestrial television transmissions* (see Appendix 4).

Part 7: Interference management scheme for digital television

Part 7 contains the Interference Management Scheme for digital television. This scheme applies to digital television broadcasting and datacasting transmitter licensees and is designed to ensure that a viewer's analog television service is protected from interference from digital transmissions, and where such interference does occur, that resolution is achieved in a timely manner.

Emission standards for broadcasting transmitters

The TPGs also contain the standards applicable to broadcasting transmitters that operate in the terrestrial broadcasting services bands. The emission standards for radio and analog television services are substantially the same as those published by the former Department of Transport and Communications in the period 1989-92.

Reference to the relevant digital television standard is provided in Appendix 4. This standard has been prepared by Standards Australia and may be adopted by broadcasters and datacasters according to their own requirements. Aside from the radiated signal spectrum mask of Australian Standard *AS 4599.1-2007*, which is mandatory under guideline 107, the standard is recommended by ACMA only and is not mandatory under the TPGs.

It should however be noted that the *Broadcasting Services (Digital Television Format — Audio Component — Transmissions in SDTV Digital Mode) Technical*

Standard 2007 sets a requirement that if a television or datacasting service that is transmitted in SDTV digital mode has an audio component, the component must be capable of being decoded by a receiver that has only MPEG-1 Layer 2 audio decoding capability.

Emission standard for the Australian Amplitude Modulation Sound Broadcasting Service

The AM emission standard is based on the *Draft Emission Standard for the Australian Amplitude Modulation Sound Broadcasting Service* published by the former Department of Transport and Communications in 1992.

The standard follows international practice with provision for stereophonic program transmission based on the C-QUAM system.

The emission standard details the channel assignments for the AM radio broadcasting service, program signal characteristics for mono and stereo transmission and the radiated signal characteristics of the AM transmission.

Emission standard for the Australian FM Sound Broadcasting Service

The FM radio emission standard is based on 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 former Department of Transport and Communications in July 1992.

The emission standard covers the radiated signal characteristics of the transmission, nominal channel assignments for the FM radio broadcasting service, main program signal characteristics for both mono and stereo transmission, and includes requirements for ancillary communications services carried as subcarriers on the main FM carrier.

Emission standard for the Australian Analog Terrestrial Television Service

The analog television emission standard is based on the *Emission Standard for the Australian Terrestrial Television Service* determined by the Minister of Transport and Communications pursuant to section 125D of the *Broadcasting Act 1942*, and published by the former Department of Transport and Communications in March 1989.

The emission standard details the channelling arrangements for the analog television service as well as the video, vision and sound signal characteristics of the transmission.

The emission standard does not include the standard for teletext services provided in conjunction with the television transmission.

TPGs and Planning handbooks

Because they are legally binding, the TPGs include only the mandatory requirements to be met by broadcasters in planning and operating new transmission facilities, or in seeking changes to existing facilities. Supporting information on suitable analog planning and measurement methods is contained separately in Technical Planning

Parameters and Methods for Terrestrial Broadcasting (TPPs), first published by the Department of Transport and Communications in June 1992.

The TPGs and TPPs were included as Parts 1 and 2 respectively of the *Interim Australian Broadcasting Planning Handbook* until December 2000, when the Handbook was superseded. The TPGs and TPPs are now included in the *Broadcasting Planning Manual* (BPM) – a new publication which brings together all planning related documents, as well as additional reference material, in to a single publication. Copies of the TPGs, TPPs and other documents that form part of the Broadcasting Planning Manual are available from the ACMA website (www.acma.gov.au).

The TPPs are based on broadcasting planning parameters and methods of measurement defined in Recommendations and Reports of the International Telecommunications Union (ITU), as well as planning practices developed in Australia, North America, Europe and Britain over many years.

The TPPs are intended for broadcasters, planning consultants and operators of broadcasting facilities involved in detailed design of broadcasting transmitting facilities or in the preparation of planning submissions to ACMA.

The planning values and methods set out in the TPPs are generally consistent with international practice. Alternative method(s) may be used but facilities planners would need to be in a position to demonstrate that the alternative method(s) yield results comparable with those set out in the TPPs.

In respect of such alternative method(s), which may include various computer based prediction models, system designers need to be aware that no model is an exact replication of real propagation phenomena. The type of terrain and other variable factors make some models 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 accepted international practice and include statistical allowances based on many years and many different field measurements of propagation in different parts of the world.

For planning of digital television and datacasting services, the information contained in the TPPs is also supplemented by the *Digital Terrestrial Television Broadcasting Planning Handbook*. This Handbook is also available from the ACMA website.

Relationship between the TPGs, FAP, LAPs, the Broadcasting Services Act and the Radiocommunications Act

Technical planning guidelines

The Broadcasting Services Act requires ACMA 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, community (including temporary

community) broadcasting licensees and datacasting licensees through the powers contained in the Broadcasting Services Act. The TPGs may also be applied to national broadcasting transmitters and to narrowcasting services that use the broadcasting services bands, through Licence Conditions Determinations or special conditions attached to transmitter licences issued under the powers contained in the Radiocommunications Act.

Frequency allotment plan

The Frequency Allotment Plan (FAP) determines the number of channels that are to be available in particular areas of Australia to provide broadcasting services using the broadcasting services bands. The FAP identifies the capacity that is to be available for AM radio, FM radio and VHF/UHF television services.

The FAP apportions broadcasting services bands in particular parts of Australia to accommodate existing and future radio and television services. The FAP was determined by the ABA in August 1994, following wide public consultation, and is varied from time to time.

Licence area plans

A LAP details the number and characteristics of the broadcasting services that are to be made available within particular areas of Australia. The characteristics of each service include the service's licence area, category, carrier frequency(s), transmitter site(s) and technical conditions, including maximum effective radiated power in each direction from the transmitter site.

If there are changes to the number of available channels 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, as well as broadcasters and other interested parties, before finalisation.

How to obtain a broadcasting service licence and the relevant transmitter licence

For commercial and community broadcasting services, completion of the LAP process for an area makes capacity available for new broadcasting services. The LAP will describe the type of services to be made available and the technical specifications applicable to those services.

ACMA will advertise the availability of spectrum capacity and invite applications for a broadcasting service licence. For new commercial broadcasting services, ACMA 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, ACMA will invite applications and will conduct a merit-based allocation process to determine which of the applicants will be granted a licence.

With the issue of a broadcasting service licence comes an entitlement to a radiocommunications apparatus licence (i.e. 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 ACMA web site (www.acma.gov.au).

Alternative uses of the broadcasting services bands

Where planned spectrum capacity is not used for broadcasting services, that capacity may be made available for alternative uses, such as open narrowcasting. Allocation of rights to use the available spectrum capacity may entail a price based allocation process similar to that used for allocation of commercial broadcasting service licences.

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 by ACMA in analog and digital broadcasting planning are contained in the following documents:

- *The ABA's General Approach to Analog Planning*; and
- *The ABA's General Approach to Digital Terrestrial Television Broadcasting Planning*.

These documents can be obtained from ACMA's website (www.acma.gov.au).

Annex B: Explanatory Notes related to Digital Television

Minimum level of service requirements

The DCPs specify the ERP levels expected to meet the ‘same level of coverage’ objectives given in paragraph 6 (3) (f) of Schedule 4 of the Broadcasting Services Act. However, some DCPs include channel allotments with directional ERP restrictions on some services that apply until certain analog television services cease transmission. Notwithstanding the legislative requirement, these limits may mean, in some instances, that it will not be practicable to achieve the same coverage goal until the concerned analog transmission ceases.

Maximum antenna height requirements

The digital television section does not include guidelines relating to maximum antenna height. The guidelines relating to maximum field strength beyond the licence area or datacasting service area, minimum level of service and not causing interference to other services more directly address ACMA’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 ACMA 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 adjacent digital services, or between a digital service and an adjacent analog service) 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 should be taken of variable factors affecting the relative levels of received adjacent channel transmissions, such as differences in transmitter radiation patterns (in both the horizontal and vertical planes), frequency dependency 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.

Where additional transmission sites are proposed, it may prove 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 96 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.

Where digital licensees wish to locate transmitters at sites that are significantly separated from planned LAP or DCP sites, where the effective co-siting assumption does not hold¹, viewers may face a situation where they are trying to receive a distant, low level signal in the presence of a high level interfering signal from a nearby transmitter. This places a much greater onus on the digital licensee at the non-DCP site to carefully plan and engineer the site to ensure that the required protection ratios are achieved and interference to nearby receivers is avoided. This is most important when a digital service is adjacent to a wanted analog service. However, other potential interference mechanisms also need to be considered.

The interference mechanism of next greatest concern is image channel interference from a digital service to analog television reception. Image channel interference is an artefact of superheterodyne television receiver design². It may occur if a high level signal exists on a channel that is 10 or 11 channels above the wanted channel³. The susceptibility of receivers to image channel interference is dependent on the design of the radio frequency input stages of the receiver. Available information on wanted-to-unwanted image channel protection ratios is that a digital image channel causing interference to an analog television service will usually present a higher interference risk than a first adjacent channel digital-to-digital case.

After co-channel, first adjacent channel and image channel interference, other potential interference mechanisms (eg. second adjacent channel interference) are less important and are also possibly subject to greater variation between different receiver makes and models. Therefore specific limits for those potential interference mechanisms have not been specified. However, if the ratio of unwanted signal to wanted signal is high enough, interference management issues may still arise. The requirement for interference management in these cases is captured by the general onus on licensees not to cause interference and to resolve interference problems if

¹ For example, this may occur if a channel B datacasting licensee wishes to establish large numbers of additional sites to achieve a good level of mobile TV coverage.

² In 2007 all, or nearly all, consumer analog and digital receivers used superheterodyne receiver architectures.

³ Australian standard analog receivers use a local oscillator frequency that is 36.875 MHz above the wanted vision carrier frequency. In this case most of the potential image channel interference is generated by signals in the channel that is 10 channels above the wanted channel. However in the Australian market there are significant numbers of non-standard receivers that use a local oscillator frequency that is 38.9 MHz above the wanted vision carrier frequency. In that case most of the potential image channel interference is generated by signals in the channel that is 11 channels above the wanted channel.

they occur (see paragraphs 13 (e) to (g) and guidelines 128 to 130) rather than in specific guidelines within Part 6.

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 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 adversely 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 licensed radiocommunication services (including broadcasting services other than analog and digital television). Unlike television-to-television interference mechanisms where the characteristics of the device potentially suffering 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 and characteristics of the devices that could potentially suffer interference is large and diverse. This problem is particularly complex when potential interference mechanisms between services operating in different bands of the radiocommunication spectrum are considered. The current interference management process, which is complaints based and prefaced on the incoming service resolving any interference to existing services, appears 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 (digital) signals is 41 dB or lower, a degradation of no more than 2 dB in the co-channel 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 and 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 co-channel 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 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 ground, the 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 and repeatable results it would be necessary to perform a large set 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 reproducible results can be obtained from a limited number of field strength 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 they 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.