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Australian Communications and Media Authority

Regulation impact statement

Lot configuration for the digital dividend auction

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Executive summary

In April 2013, the Australian Communications and Media Authority (the ACMA) will be reallocating radiofrequency spectrum in the 700 MHz and 2.5 GHz bands by auction (the digital dividend auction).

To prepare for the digital dividend auction, the ACMA must make a number of legislative instruments, referred to as the 'allocation instruments'. These include:

- an allocation determination under section 60 of the *Radiocommunications Act 1992* (the Act), that outlines the auction rules and procedures; and
- two marketing plans (one for each band) under section 39A of the Act, that specify, amongst other things, how the spectrum will be configured into lots for sale at auction. This is known as 'lot configuration'.

The reallocation process is explained in more detail in Chapter 1 (Background and Context). This chapter also describes the two dimensions to lot configuration— frequency bandwidth and geographic area.

The primary problem being addressed by the ACMA in this regulation impact statement (RIS) is how to configure the spectrum so as to promote its efficient allocation and use. In addressing this problem, the ACMA needs to ensure that the lot configuration does not limit or dictate market outcomes or hinder competition between auction participants. The ACMA also needs to consider the likely future uses of digital dividend spectrum. This is discussed in detail in Chapter 2 (Identifying the problem).

Chapter 3 (Objectives for lot configuration) sets out the objectives the ACMA is guided by in managing radiofrequency spectrum. One of the ACMA's primary objectives is to maximise the overall public benefit derived from use of the spectrum, by ensuring its efficient allocation and use[1]. The way lots in each band are configured will have a significant impact on the value that bidders place on the spectrum at auction, and influence the future use of the spectrum. The chosen lot configuration will therefore have a significant role in promoting an efficient outcome for the auction, and is a critical element of each marketing plan.

Chapter 4 (Options for achieving the objective) identifies the options available to the ACMA for the configuration of spectrum for the digital dividend auction. The ACMA has identified three options for the configuration of the frequency bandwidth, namely 2x5 MHz lots, 2x10 MHz lots, and 2x15 MHz. Five options for configuring the geographic area are examined, ranging from national market area lots to disaggregated metropolitan, regional and remote market area lots.

Chapter 5 (Impact analysis) provides an analysis of the costs, benefits and risks associated with each of these lot configuration options. In considering the optimum lot configuration, the ACMA has taken into account a wide range of technical, commercial and policy factors that are likely to affect the overall benefit to the community derived from reallocating the spectrum. For the configuration of digital dividend spectrum, the choice of lot configuration is a question of which option is best, relative to the other options considered.

In terms of lot configuration, a minimum frequency bandwidth of 2x5 MHz lots appears to be ideal because it is consistent with international standards for LTE, and can be aggregated into 2x20 MHz licences, which allows maximum spectral efficiency. It also allows the two bandwidths to be divided into equally sized lots, and promotes competition in the auction.

[1] Paragraph 3(a) of the Radiocommunications Act 1992

Generally speaking, geographic disaggregation minimises the risk that spectrum in any single geographic region would lie idle. However, increased disaggregation also increases the chances that there may be utility loss zones in which no services can be provided. This occurs when different parties own spectrum licences that share a boundary. Due to the propagation characteristics of the two bands, spectrum utility loss zones are likely to be far larger for the 700 MHz band than the 2.5 GHz band. Furthermore, the propagation characteristics of spectrum in the 2.5 GHz band lends itself to providing capacity in densely populated areas, while the 700 MHz band can be used to transmit signals over greater distances. This suggests that there would be benefit in geographic disaggregation for the 2.5 GHz band, while the 700 MHz band is better suited to providing national coverage.

The ACMA has undertaken extensive public consultation on the issue of lot configuration, and has received a broad range of feedback from stakeholders. This feedback is discussed in detail in Chapter 6 (Consultation).

In summary, the majority of stakeholders preferred a national market area in the 700 MHz band, stating that the propagation characteristics of the spectrum allow for service coverage over large geographic areas. They also favoured a national area because it accommodates the layout of a national mobile network. They favoured minimum frequency lots of 2x5 MHz, stating that frequency lots smaller than this were inappropriate for the operation of either 3G or 4G technologies.

Stakeholder views differed on the preferred lot configuration for the 2.5 GHz band. Some stakeholders expressed a preference for national lots, and others for disaggregated lots. There were also mixed views as to the most appropriate frequency bandwidth for the lots.

Chapter 7 (Conclusion and recommended approach) outlines the ACMA's proposed approach to lot configuration for the digital dividend auction. This is summarised as follows:

Band	**Frequency (of each lot)**	**Geography (of each lot)**
700 MHz	5 MHz paired (2x5 MHz)	National market areas
2.5 GHz	5 MHz paired (2x5 MHz)	11 disaggregated market areas: > eight metropolitan areas > ACT, Adelaide, Brisbane, Darwin, Hobart, Melbourne, Perth, Sydney > two regional areas: > Regional Eastern Australia, Regional Western Australia > one remote area

This RIS sets out the basis on which the above lot configuration is recommended. The marketing plans, which include details of the lot configuration of each band, will be presented to the Authority for final approval in November 2012. If the Authority makes the marketing plans, they will be registered on the Federal Register of Legislative Instruments in November 2012.

As explained in Chapter 8 (Implementation and review), the ACMA will conduct a full review of the digital dividend auction upon completion. It will also monitor the use of the 700 MHz and 2.5 GHz spectrum bands by taking action in response to any complaints received, to make sure that licensees comply with the conditions of their licence.

1. Background and context

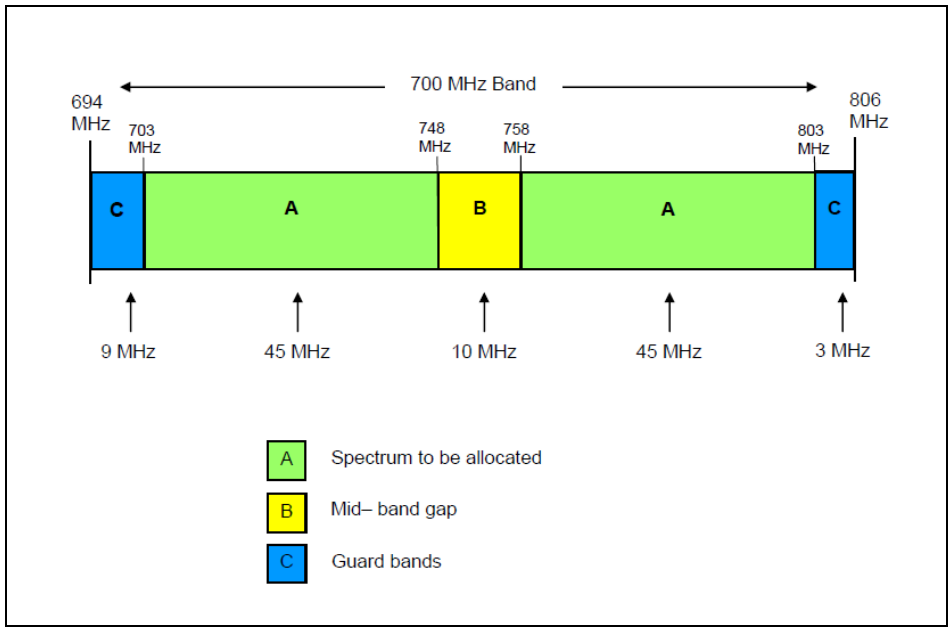
1.1. Reallocating radiofrequency spectrum

On 1 November 2011, the Minister for Broadband, Communications and the Digital Economy (the minister) made two spectrum reallocation declarations: *Radiocommunications (Spectrum Re-allocation) Declaration No.1 of 2011* and *Radiocommunications (Spectrum Re-allocation) Declaration No.2 of 2011*, declaring that parts of 700 MHz and 2.5 GHz radiofrequency spectrum bands are to be reallocated as spectrum licences. The declarations set out that:

- the frequency bands 703–748 and 758–803 MHz in the 700 MHz band are to be reallocated nationwide as spectrum licences (with the exception of an excised region in central Western Australia)[2]
- the frequency bands 2500–2570 and 2620–2690 MHz in the 2.5 GHz band are to be reallocated nationwide as spectrum licences (with the exception of an excised region in central Western Australia).[3]

The ACMA has responsibility for the reallocation of this spectrum: a total of 90 MHz in the 700 MHz band and 140 MHz in the 2.5 GHz band. The spectrum to be reallocated is illustrated in Figures 1 and 2 below.

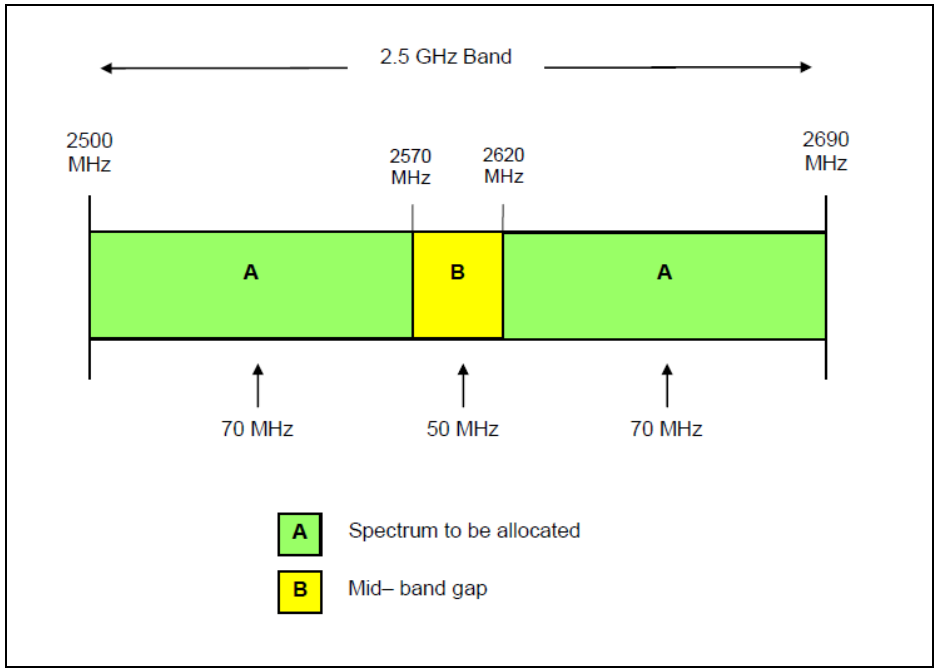
Figure 1 Spectrum to be reallocated in the 700 MHz band



[2] The spectrum reallocation declaration for the 700 MHz band can be viewed at the Comlaw website.

[3] The spectrum reallocation declaration for the 2.5 GHz band can be viewed at the Comlaw website.

Figure 2 Spectrum to be reallocated in the 2.5 GHz band



1.1.1. Spectrum licences

The ACMA manages access to radiofrequency spectrum through licensing arrangements. Under the Act, there are three licensing regimes that can authorise the operation of radiocommunications:

- apparatus (typically authorising the operation of a specific device or service)
- class (which allows users to operate particular radiocommunications equipment in designated segments of spectrum on an uncoordinated and shared basis)
- spectrum.

Spectrum licensing

The minister has declared that spectrum in the 700 MHz and 2.5 GHz bands will be reallocated as spectrum licences. A spectrum licence gives the licensee authority to operate radiocommunications devices within a 'spectrum space' defined by bandwidth and geographic area for a specified period of time. Licensees can operate any type of equipment for any purpose under the licence, provided they comply with the licence conditions and technical frameworks designed to manage the risk of unacceptable interference to other users. Under the Act, spectrum licences may be issued for any period up to 15 years.

1.1.2. Digital dividend auction

The ACMA has chosen to reallocate the spectrum subject to the minister's spectrum reallocation declarations by a single auction (the digital dividend auction). The digital dividend auction will provide an opportunity for parties to acquire spectrum licences in the 700 MHz and 2.5 GHz bands, and will be conducted using the combinatorial clock auction methodology (CCA).

Before the reallocation of spectrum by auction, the ACMA must prepare legislative instruments that set out the auction rules and procedures and define the spectrum 'products' that will be available to bidders. These instruments are collectively referred to by the ACMA as the 'allocation instruments'. They include an allocation

determination, made under section 60 of the Act, and a marketing plan for each band, made under section 39A of the Act.

The allocation determination will set out the auction process. This includes:

> auction rules and procedures
> application and registration requirements
> fees and payments associated with the auction.

The marketing plans will provide details of the products on offer at auction, including:

> the spectrum products that will be available in each band
> the method by which the spectrum products will be allocated
> the conditions that will apply to the spectrum licences issued.

The ACMA is preparing separate marketing plans for the 700 MHz and the 2.5 GHz bands, to recognise the distinct characteristics of each band and the likely differences in the way that they will be used.

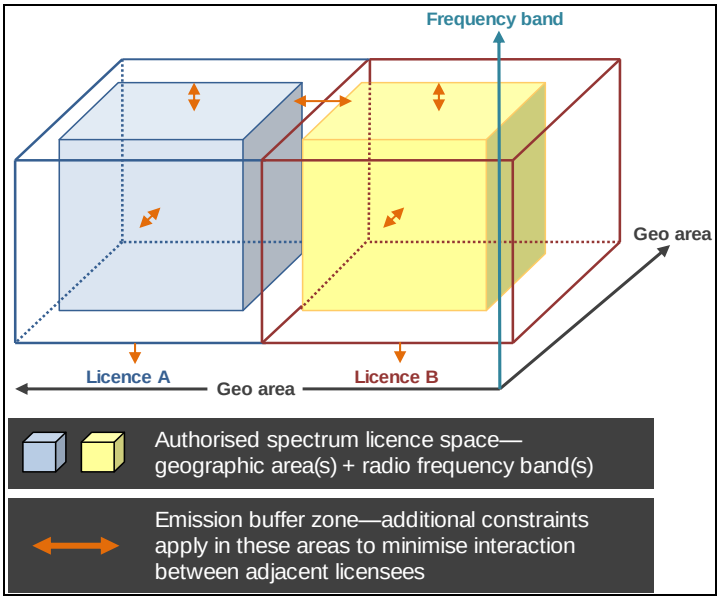
1.2. Lot configuration

One of the key issues for consideration in preparing each marketing plan is how the spectrum subject to reallocation will be configured for auction. Configuring spectrum is the process of breaking down spectrum into smaller parcels, or 'lots'. These lots will be the products available for sale at auction. This process, also referred to as 'lot configuration', is an essential step in preparing for the digital dividend auction because:

> lots offered at auction will form the basis of future spectrum licences
> lot configuration may influence the future use of the spectrum, and in some cases may affect what services can be provided using the spectrum
> lot configuration may affect the efficient allocation of the spectrum by influencing bidder demand for the spectrum. Spectrum should be configured in a way that is attractive to potential bidders.

There are two dimensions to lot configuration—frequency bandwidth and geographic area—as illustrated in Figure 3 below:

Figure 3 Spectrum space



For the configuration of lots in each band, the ACMA needs to set the:

> geographic 'market area', which refers to the geographic area of each lot

> bandwidth, which refers to the amount of radiofrequency spectrum included in a lot.

It is possible to configure the 700 MHz and 2.5 GHz bands in a number of ways. For instance, the geographic dimension of a lot may consist of a market area covering all of Australia. Alternatively, the ACMA could offer the spectrum in lots that cover smaller regions that collectively cover the whole of Australia (referred to as disaggregated geographic market areas). The ACMA also has discretion as to the bandwidth size of individual lots. The optimum bandwidth size will mainly depend on the characteristics of the spectrum to be allocated and the likely future use of the spectrum band. The more finely partitioned the frequency and geographic dimensions of the bands, the greater the number of lots.

With the CCA method to be used in the digital dividend auction, participants will be able to bid on packages of lots in order to acquire the spectrum combinations that best meet their business needs. The total number of lots won by a participant at auction will be packaged together to form the spectrum licence/s issued to them.

The lot configuration will be included as part of the marketing plans for each band of spectrum. The final marketing plans are scheduled to be registered on the Federal Register of Legislative Instruments in November 2012 as part of a package of allocation instruments for the digital dividend auction.

2. Identifying the problem

2.1. The problem

In determining the lot configuration for the digital dividend auction, the ACMA is guided by the objectives set out in section 3 of the Act, in particular, the need '*to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum'*.

Before spectrum in the 700 MHz and 2.5 GHz bands can be reallocated by auction, the product for sale must be broken down into individual 'lots'. These lots are the product offerings that participants in the auction will be bidding on. There are a number of ways in which lots can be configured, according to frequency and geographic area.

The primary problem being addressed by the ACMA in this RIS is how to configure the spectrum so as to promote its efficient allocation and use. In addressing this problem, the ACMA needs to ensure that the lot configuration does not limit or dictate market outcomes or hinder competition between auction participants.

Further details of the digital dividend auction are provided below, to highlight the importance of lot configuration in the context of the auction.

2.1.1 The digital dividend auction

The digital dividend auction is a highly anticipated event, as it is one of the largest releases of radiofrequency spectrum in a decade. Spectrum is a scarce resource, and is essential for the provision of many wireless communications services. In this auction, a total of 230 MHz of spectrum (2x45 MHz in the 700 MHz band and 2x70 MHz in the 2.5 GHz band) will be on offer.

The digital dividend auction presents an opportunity for the telecommunications industry to compete for valuable spectrum which is highly suited to supporting mobile telecommunications services.

The auction is expected to result in significant economic gain for Australia. Spectrum in the 700 MHz band is projected to be worth between US$7 billion and US$10 billion.[4] This estimation takes into account the parameters of productivity improvement, new business activity, jobs created, gross domestic product impact and tax revenues.

2.1.2 Likely future use and different characteristics of the 700 MHz and 2.5 GHz band

The characteristics of the 700 MHz and 2.5 GHz band spectrum make it ideal for supporting wireless access services (WAS). The term WAS refers to the variety of ways in which telecommunications service providers deliver a radio connection to an end-user from a core network, such as a public internet network.

Auction participants are likely to want a combination of spectrum from both the 700 MHz and 2.5 GHz bands, due to the different and complementary characteristics of each band. The 700 MHz band is likely to be used for coverage, due to its capacity to support wireless communications over long distances. The 2.5 GHz band is likely to be used to provide capacity and international roaming, as it is able to carry a large amount of data over short distances and is internationally harmonised to support WAS.

[4] Data from Communications Day article '*Australia to reap up to US$10bn in economic benefits from mobile services in 700MHz*' 10 July 2012, www.commsday.com.

2.1.3 Future spectrum needs

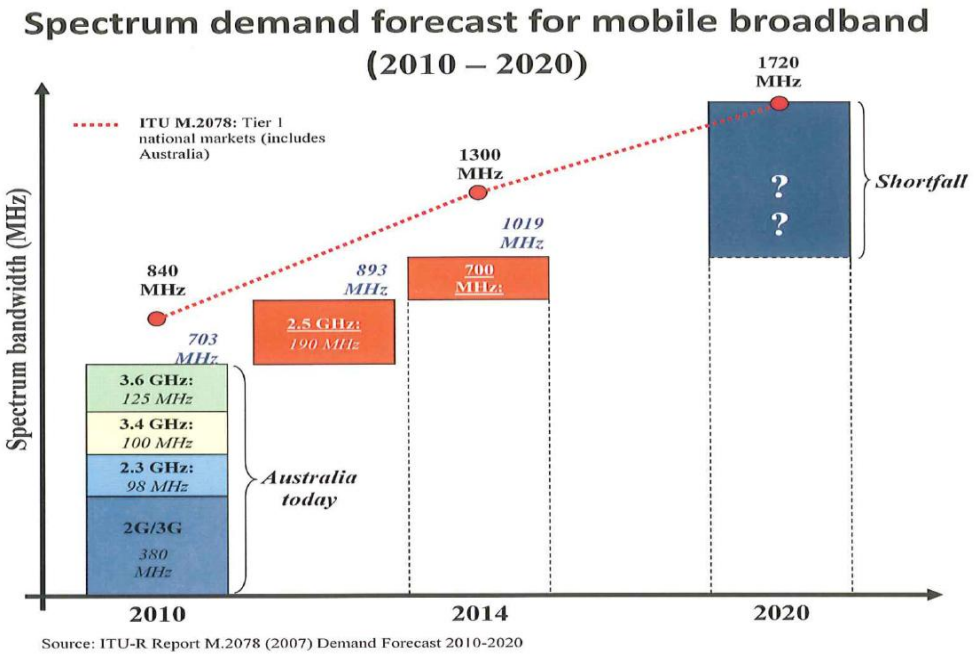
There is significant demand for spectrum to support WAS. The ACMA estimates that data requirements will grow 30-fold between 2007 and 2014.[5] Global mobile data traffic is also growing, predicted to increase 18-fold between 2011 and 2016.[6] This growth is already placing significant pressure on existing mobile networks, and will necessitate continued network deployments in the future.

Mobile telecommunications operators in Australia report that their current networks are under increasing pressure, and state that increased demand can be attributed to an overall increase in the volume of data downloaded as a result of greater consumer use and machine to machine interactions.[7]

Consumer demand for WAS is increasing at an extremely rapid rate, and this is projected to continue. One of the key issues highlighted in the annual *Communications report 2008–09* in January 2010 is the increasing level of consumer demand for access to broadband applications in fixed, nomadic and mobile environments.[8] This trend is also observed in the ACMA's 2009–10 communications report series.[9]

Data from the International Telecommunications Union (ITU) suggests that demand for spectrum in Australia to support WAS will continue to rise. Figure 4 demonstrates a growing demand for spectrum bandwidth required to provide WAS.

Figure 4 Spectrum demand forecast for mobile broadband (2010–2020)[10]



[5] This data is from the ACMA paper, *Towards 2020—Future spectrum requirements for mobile broadband*, 2011, further information at www.acma.gov.au.

[6] These figures can be found in the Cisco White Paper, www.cisco.com.

[7] This data is from the ACMA paper, *Towards 2020—Future spectrum requirements for mobile broadband.*

[8] The ACMA 2008–09 communications report series is available at www.acma.gov.au.

[9] The ACMA 2009–10 communications report series is available at www.acma.gov.au.

[10] Chart used by AMTA at the ACMA's International Training Program 2010 in the presentation *Mobile broadband: Industry requirements and regulatory inputs*, 7 December 2010.

2.1.4 Geographic spread of spectrum demand

Representations from stakeholders suggest demand for both the 700 MHz and 2.5 GHz bands will primarily come from mobile telecommunications operators. Telecommunications operators have expressed an interest in replicating the coverage of current networks, and rolling out additional coverage where people work, live or travel.[11] Market research on mobile telecommunications carriers in Australia reports that Australia's current terrestrial mobile network covers roughly 99 per cent of the population and 20 per cent of the nation's landmass.[12]

The ACMA's paper *Towards 2020—Future spectrum requirements for mobile broadband* states that the highest spectrum demand for WAS exists in populated areas along Australia's east coast and in the metropolitan cities.[13]

As well as indicating demand for spectrum in the more densely populated areas of Australia, feedback from the mobile telecommunications industry, equipment manufacturers and the energy industry indicates demand for digital dividend spectrum being made available Australia-wide.[14]

2.1.5 Spectrum currently used for WAS

There are a number of spectrum frequency bands that are currently, or soon will be, available for WAS in Australia. These bands are made available to the market through participation in an allocation process or via a trade or third party authorisation (lease) arrangement. Table 1 (on page 10) sets out details of these frequency bands.

[11] This feedback was provided in response to the *Spectrum reallocation in the 700 MHz digital dividend band* discussion paper, released October 2010.

[12] Mobile Telecommunications Carrier in Australia Industry Report, 2011, IBISWorld, www.ibisworld.com.au.

[13] This data is from the ACMA paper, *Towards 2020—Future spectrum requirements for mobile broadband.*

[14] This feedback was in response to the *Spectrum re-allocation in the 700 MHz digital dividend band* discussion paper.

Table 1 Frequency bands that are, or soon to be, made available for WAS

Band	Spectrum	Type	Existing usage
694–820 MHz	2x45 MHz	To be spectrum licensed	Analog/Digital TV to be cleared to realise digital dividend
825–845 and 870–890 MHz	2x20 MHz	Spectrum licence	Mobile telephony (3G—WCDMA/HSPA)
890–915 and 935–960 MHz	2x25 MHz	Apparatus	Mobile telephony (2G—GSM900 and 3G—WCDMA/HSPA)
1710–1785 and 1805–1880 MHz	2x75 MHz	Spectrum licence	Mobile telephony (GSM1800). Licensed for Australia-wide use (restricted to the lower 2x15 MHz in regional areas)
1900–1920 MHz	20 MHz 20 MHz	Spectrum licence Apparatus	3G services. Licensed in capital cities only Broadband. Licensed in regional and remote areas only
1920–1980 and 2110–2170 MHz	2x60 MHz 2x40 MHz/ 2x60 MHz	Spectrum licence Apparatus	3G mobile telephony and broadband. Licensed in capital cities and regional areas (restricted to the upper 20 MHz) 3G mobile telephony and broadband. Licensed in regional (2x40 MHz) and remote areas (2x60 MHz)
2302–2400 MHz	98 MHz	Spectrum licence	Broadband. Licensed in capital cities and regional areas
2500–2690 MHz	2x70 MHz 50 MHz	To be Spectrum licence Spectrum licence	Band currently under review to allow for new services such as mobile telephony and wireless broadband in 2x70 MHz Technology flexible framework underpinning ENG operation in 50 MHz
3425–3442.5 and 3475–3492.5 MHz	2x17.5 MHz	Spectrum licence	Fixed wireless access, broadband. Licensed in capital cities and major regional centres
3442.5–3475 and 3542.5–3575 MHz	2x33.5 MHz	Spectrum licence	Broadband. Licensed in capital cities and regional areas
3575–3700 MHz	Up to 30 MHz	Apparatus	Fixed wireless access, broadband to coordinate with fixed links and Earth stations. Licensed in regional and remote areas
Total bandwidth	**890 MHz**		

2.1.6 The importance of 700 MHz and 2.5 GHz spectrum to future WAS requirements

The additional spectrum offered in the digital dividend auction is likely to satisfy, at least in part, forecast demand for WAS.

The recent boom in data-intensive services (highlighted in Figure 4) is likely to continue, such that overall data demand will continue to grow. Satisfying this level of demand without additional spectrum will either be infeasible or excessively costly for mobile telecommunications operators.

700 MHz and 2.5 GHz spectrum is important for the rollout of new WAS technologies such as Long Term Evolution (LTE—otherwise known as 4G).[15] While it is technically feasible for mobile telecommunications operators to rollout LTE using current spectrum holdings, it may be more economical to roll out LTE in the 700 MHz and 2.5 GHz bands. These spectrum bands are optimised for frequency division duplex (FDD) LTE technology, and have been identified internationally for these technologies.[16] The global identification of the 700 MHz and 2.5 GHz bands for LTE is resulting in large-scale development of equipment to support LTE. As such, mobile telecommunications operators will be able to take advantage of the improved economies of scale and lower equipment costs of rolling out LTE in the 700 MHz and 2.5 GHz bands, as equipment optimised for use in these bands is expected to be readily available.

2.1.7 Ensuring a competitive mobile telecommunications industry

Lot configuration for the digital dividend auction will play an essential role in promoting an efficient and competitive wireless telecommunications market structure in Australia. Lot configuration seeks to break down the total reallocated spectrum into smaller parcels. These parcels of spectrum will be offered through a market-based allocation process. Competition is most likely to be enhanced by offering spectrum in this way, rather than offering the spectrum in one parcel for one potential licensee.

Competition is further enhanced by the implementation of competition limits. Subsection 60(10) of the Act gives the minister the power to direct the ACMA to impose limits on the total amount of spectrum that a person or specified group of persons can be licensed to use.

On 9 February 2012, the minister exercised this power and directed the ACMA to impose competition limits for the allocation of spectrum in the 700 MHz and 2.5 GHz bands. These limits are set out in the following directions (the spectrum licence limits directions):

- *Radiocommunications (Spectrum Licence Limits) Direction No. 1 of 2012*
- *Radiocommunications (Spectrum Licence Limits) Direction No.2 of 2012*.

Competition limits direct the ACMA to determine procedures in the allocation determination that ensure that, as a result of the allocation of spectrum licences, no person or specified group of persons may use more than the amount of spectrum specified by the minister in those directions (a total of 2x20 MHz of spectrum in the 700 MHz band and 2x40 MHz in the 2.5 GHz band).[17]

2.2. Factors for consideration in developing lot configuration

The ACMA has had regard to a number of factors in deciding on the recommended lot configuration for the digital dividend auction. These factors form the baseline criteria the ACMA has used to ensure a systematic and robust decision-making process. The relevant factors are:

---

[15] LTE is a mobile broadband technology, which is the next step beyond the current 3G standard. LTE targets capacity and data rate speed, to support new services and features requiring higher levels of capability and performance.

[16] FDD is a method of duplex communications where the transmitter and receiver signals operate at different carrier frequencies, using separate frequency bands of the same size. FDD systems operate on the principle of 'paired frequencies', with a frequency separation between the upper and lower parts of a spectrum band. Accordingly, the ACMA has suggested paired frequency lots in all lot configuration scenarios.

[17] The Department of Broadband, Communications and the Digital Economy completed a Regulatory Impact Statement on the competition limits on the sale of the digital dividend (700 MHz) and 2.5 GHz spectrum.

- the likely future use of the 700 MHz and 2.5 GHz bands
- internationally harmonised spectrum arrangements and standards
- technical and demographic considerations
- views of external stakeholders (particularly potential bidders)
- auction format implications and constraints
- competition limits imposed by the minister.

2.2.1. Likely future use of the 700 MHz or 2.5 GHz bands

The likely future use of the 700 MHz and 2.5 GHz bands will influence the choice of lot configuration for both bands, primarily affecting the choice of frequency bandwidth.

The size of frequency bandwidths will depend on the proposed use of the band, the likely technologies to be deployed and equipment systems proposed to support those technologies.

As noted above, it is expected that the most likely use for spectrum in the 700 MHz and 2.5 GHz bands will be WAS using frequency FDD LTE technology. A review of relevant technical standards (conducted by 3GPP[18]), supported by stakeholder feedback, indicates that while smaller bandwidths are technically possible, the efficiency of an FDD LTE service would be compromised if this service was to operate in spectrum blocks of less than 2x5 MHz lots.

The technical efficiency of FDD LTE technology increases significantly with the availability of more spectrum bandwidth up to approximately 20 MHz in paired blocks. The 3GPP standards identify paired 20 MHz blocks as being the optimal bandwidth for deploying FDD LTE networks. In its RIS for competition limits for the digital dividend auction, the Department of Broadband, Communications and the Digital Economy (DBCDE) note that larger blocks of spectrum provide operators with the ability to organise networks for greater efficiency, enabling greater peak data rates and data traffic-carrying capacity. If spectrum can be used to increase capacity rather than additional base stations, costs can be reduced.[19]

The choice of bandwidth size of individual lots takes into account feedback received through the ACMA's Technical Liaison Group (TLG)[20], and wider consultation processes undertaken in the development of allocation instruments for the digital dividend allocation.

The bandwidth of lots will be detailed in the 2.5 GHz and 700 MHz marketing plans, as well as the digital dividend auction guide.

2.2.2. Internationally harmonised spectrum arrangements

Internationally harmonised spectrum arrangements will be taken into account in determining the frequency bandwidth, and whether lots will consist of paired blocks of spectrum. Harmonised spectrum arrangements refer to the allocation of spectrum for

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[18] 3GPP is an international body made up of six telecommunications standard development organisations. For more information, go to www.3gpp.org/

[19] *Competition limits on the sale of digital dividend (700 megahertz) and 2.5 gigahertz spectrum* www.ris.finance.gov.au, page 7.

[20] A Technical Liaison Group is a temporary advisory body convened by the ACMA as the forum for consultation between the ACMA, industry and other stakeholders on the development of technical rules regarding the operation of radiocommunications devices and services under the spectrum licence. The outcomes of the TLG process are reflected in the technical instruments subsequently developed by the ACMA.

common services across multiple markets, and offer important benefits in terms of equipment availability, roaming and economies of scale.

The frequency boundaries set out in the minister's spectrum reallocation declarations for the 700 MHz and 2.5 GHz bands each align with internationally harmonised spectrum arrangements. The frequency boundaries set for the 2.5 GHz band are aligned with the channel defined in ECC Decision (05)05 on the harmonised utilisation of spectrum for IMT/UMTS systems operating within the 2.5 GHz band (the decision defines 5 MHz channels).[21] The 700 MHz band frequency boundaries are harmonised with the regional framework agreed by the Asia-Pacific Telecommunity Wireless Group (AWG) which forms part of a draft revision of Recommendation ITU-R M.1036-3 on *Frequency Arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)*.[22] Both of these international spectrum frameworks are designed to enable the use of FDD technologies, and provide for paired blocks of spectrum.

The frequency bandwidth component of the lot configuration for Australian 700 MHz and 2.5 GHz bands will be considered with reference to the use of FDD LTE technology and the international spectrum frameworks with which Australian spectrum arrangements are aligned.

2.2.3. Technical and demographic considerations

Technical engineering considerations and demographic factors (primarily population distribution) are important considerations for determining the geographic market area component of lot configuration.

For example, if the lot configuration includes a range of disaggregated lots, the issue of spectrum licence geographic boundary conditions needs to be considered. Key factors to be considered in determining where these geographic boundaries are to be placed include:

- the population distribution across potential licence boundaries
- the propagation characteristics of the bands in question.

When considering where to impose a spectrum licence boundary, the ACMA needs to take into account expected population growth. This is to avoid creating boundaries that geographically divide areas of significant population.

The overall objective is to remove or minimise the impact of 'utility loss zones', where due to technical sharing constraints for spectrum licensing, there are restrictions on deploying systems near to geographic boundaries—thereby affecting the utility of the spectrum and the provision of services for the population within those areas.

The 700 MHz and 2.5 GHz bands have different propagation characteristics, which will have implications for the placements of boundaries in each band. Propagation characteristics refer to the distance a radiofrequency signal can be transmitted and how well it can travel through physical obstacles.

The 700 MHz band can be used to transmit signals over greater distances than higher frequencies such as the 2.5 GHz band. Because of this, utility loss zones are likely to

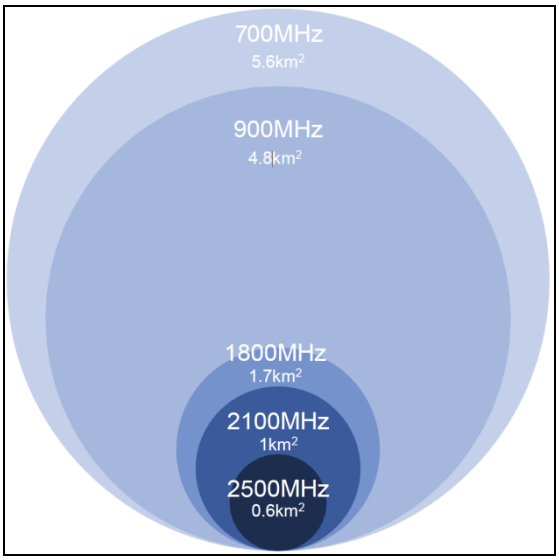
[21] European Conference of Postal and Telecommunications Administrations (CEPT), Electronic Communications Committee (ECC) reference ECC/DEC/(05)05; and the Commission of the European Communities decision of 13 June 2008 reference 2008/477/EC.

[22] APT Wireless Group, *APT Report On Harmonised Frequency Arrangements For The Band 698-806 MHz*, September 2010.

be far larger for 700 MHz than 2.5 GHz. A disaggregated lot structure would be better suited for the 2.5 GHz band, because the risk of utility loss zones can be better managed.

The propagation characteristics of various spectrum bands are illustrated in Figure 5.

Figure 5 Propagation characteristics of various spectrum bands



National market areas offer access to spectrum Australia-wide. A national market area would provide a national spectrum licence, with no geographic limitation on where licensees could roll out services. This would avoid the need for licensees to manage potential interference with adjoining geographical market areas authorised for use by another licensee. It would also remove the risk of utility loss zones arising near licence area boundaries, thereby restricting the deployment of services.

A disaggregated market area would offer access to spectrum in specific areas (for example; capital city, metropolitan, regional or remote areas). Smaller market areas may be beneficial for operators who may only wish to deploy a service in discrete markets.

2.2.4. Views of external stakeholders (particularly potential bidders)

The views of external stakeholders, particularly potential auction participants, are a critical element in determining lot configuration for the auction. A lot configuration which is closely aligned to the views of the majority of these stakeholders will increase the likelihood of an efficient allocation and use of the spectrum.

The ACMA has undertaken extensive public consultation on the issue of lot configuration, and has received a broad range of feedback from stakeholders.These submissions have identified potential bidders' preferences for specific bandwidths and market areas. Further discussion on consultation conducted on lot configuration is detailed in Chapter 6 Consultation.

2.2.5 Auction format implications and constraints

The CCA, which is the chosen auction format for the digital dividend auction, enables multiple items to be sold simultaneously in a single auction process. A key feature of this auction format is the facilitation of package bidding, which will also be taken into consideration when developing lot configuration for the auction.

Package bidding provides bidders with the flexibility to bid on multiple lots at the same time to make up the 'package' of spectrum that they desire. The benefit of package bidding in a CCA is that bidders can be certain that if they are successful in the auction, they will win one of the packages of lots that they have bid on in its entirety. Bidders will not be at risk of only winning some of the lots they require for their business plan to be viable.

An example of how this flexibility would work in practice is given by the following example. If the spectrum was broken down and offered as regional lots, a bidder that wanted to focus on operating a network in particular parts of the country could bid on packages limited to the regions that they were interested in. Alternatively, bidders who wish to operate a national network could bid on packages comprising each regional lot to effectively bid on, and seek to acquire, a 'national' lot.

The use of the CCA, however, does mean that there are limits on the number of different lot configuration types that can be auctioned. Where a high number of market areas and small frequency lot sizes are used, and depending on the number of bidders, the computational complexity of determining winning bids can exceed the technical capacity of the auction system. In addition, bidding is made substantially more complex if bidders are required to choose from a large number of possible packages.

Geographic disaggregation beyond a certain level may result in a level of computational complexity that the auction system cannot solve within a reasonable timeframe, and may hinder the ACMA's ability to verify the auction results.

In addition, the use of the CCA does not guarantee that all regional lots in a package bid will align geographically across a common frequency assignment. An example of this limitation is given by the following example. If the spectrum was offered as regional lots, as noted in the example above, a bidder interested in access to spectrum nationwide can bid on packages comprising each regional lot to effectively bid on a 'national' lot. However, there is no guarantee that this bidder will be able to secure the same frequency assignment for each of the regional lots.

Auction rules can be developed to manage the risk of geographic fragmentation. The ACMA is working with auction format and software experts to determine the optimal lot configuration for the auction and to develop rules to mitigate risks such as geographic fragmentation.

Further information on the CCA can be found at www.engage.acma.gov.au.

2.2.6 Competition limits imposed by the minister

Competition limits, imposed by the minister, are an important consideration in determining the minimum frequency bandwidth component of lot configuration.

As discussed above, competition limits direct the ACMA to restrict the amount of spectrum a new licensee is authorised to use. They have the effect that a person or bidding party cannot, as a result of the auction, acquire more than 2x20 MHz of spectrum in the 700 MHz band, and 2x40 MHz of spectrum in the 2.5 GHz band.

The minimum frequency bandwidth of an individual lot will need to allow bidders to bid up to the spectrum limit applicable to either the 700 MHz or 2.5 GHz band. A minimum lot frequency that does not take this factor into account may restrict the choice of lots that bidder could bid on and acquire. This may distort the auction result, producing an inefficient allocation of spectrum.

3. Objectives for lot configuration

3.1 Objectives

In determining lot configuration for the auction, the ACMA will be guided by the following objectives:

- to maximise, by ensuring the efficient allocation and use of the spectrum, the overall public benefit derived from using the radiofrequency spectrum (section 3(a) of the Act)
- to enable the spectrum to move to its highest value use
- to provide a responsive and flexible approach to meeting the needs of users of the spectrum (section 3(c) of the Act)
- to encourage the use of efficient radiocommunications technologies so that a wide range of services of an adequate quality can be provided (section 3(d) of the Act)
- to promote a competitive bidding environment
- to support the communications policy objectives of the Commonwealth Government (section 3(f) of the Act).

4. Options for achieving the objective

4.1. Options for consideration

The Act requires the ACMA to determine, in writing, a marketing plan for issuing spectrum licences that authorise the operation of radiocommunications devices at frequencies and geographic areas within parts of the 700 MHz and 2.5 GHz band subject to reallocation. The marketing plan will include the lot configuration of each band, which details the lots available for sale at auction.

The following section sets out the options available to the ACMA for the lot configuration of each band. The options have been split into geographic market area options and minimum frequency bandwidth options.

4.2 Geographic market area options

In determining the most appropriate geographic market areas for lot configuration in the digital dividend auction, the ACMA has considered five potential options:

1. national geographic market area lots covering all of Australia
2. aggregated metropolitan and regional lots, and one remote lot
3. disaggregated metropolitan, regional and remote lots
4. disaggregated state/territory based lots (with minor changes to borders to avoid populated areas)
5. further disaggregated metropolitan, regional and remote lots.

For a map of each of these options, see Attachment A.

4.2.1. Option one (the recommended option for the 700 MHz band)—national geographic market area lots covering all of Australia

Option one consists of a single geographic market area covering all of Australia.

4.2.2. Option two—aggregated metropolitan and regional lots, and one remote lot

This option consists of two large geographic market areas:

- one aggregated metropolitan and regional area
- one remote area.

4.2.3. Option three (the recommended option for the 2.5 GHz band)—disaggregated metropolitan, regional and remote lots

Option three consists of 11 disaggregated geographic market areas based on the population density of Australia:

- eight (8) metropolitan areas: Adelaide, the Australian Capital Territory, Brisbane, Darwin, Hobart, Melbourne, Perth, Sydney
- two (2) regional areas: Regional Eastern Australia, Regional Western Australia
- one (1) remote area.

4.2.4. Option four—disaggregated state/territory based lots

This option consists of eight disaggregated market areas based on state and territory boundaries:

- the Australian Capital Territory
- New South Wales
- Northern Territory
- Queensland
- South Australia
- Tasmania
- Victoria
- Western Australia.

Boundaries based simply on state and territory borders are likely to divide some areas of significant population density, such as the Gold Coast and Albury/Wodonga areas. In the event that option four is selected, the ACMA would work with stakeholders to ensure the boundaries are in the optimal position to minimise the risk of inefficiencies arising at the geographic boundary of the spectrum licence area.

4.2.5. Option five—further disaggregated metro, regional and remote lots

This scenario would consist of 15 geographic market areas based on the population density of Australia. Similar to option three, there would be three tiers of geographic regions comprising metropolitan, regional and remote areas:

- six (6) metropolitan areas: Adelaide, Brisbane, Darwin, Melbourne, Perth, Sydney
- five (5) regional market areas: Regional North East, Regional Central East, Regional South East, Regional South Australia, Regional Western Australia
- four (4) remote geographic areas: Remote Queensland, Remote New South Wales, Remote Central, Remote Western Australia.

4.3 Minimum frequency bandwidth options

In determining the most appropriate minimum frequency bandwidth for lot configuration, the ACMA has considered three options:

1. 2x5 MHz frequency lots
2. 2x10 MHz frequency lots
3. 2x15 MHz frequency lots.

4.3.1. Option one (the recommended option for both bands)—2x5 MHz frequency lots

This option provides a total of nine 2x5 MHz lots in the 700 MHz band and 14 2x5 MHz lots in the 2.5 GHz band. Multiple 5 MHz lots may be aggregated by licensees to form 10, 15 or 20 MHz bandwidths which are supported by FDD LTE.

4.3.2. Option two—2x10 MHz frequency lots

This option provides a total of seven 2x10 MHz lots in the 2.5 GHz band. Option two is not appropriate for the 700 MHz band, as 2x10 MHz lots do not fit equally within the total amount of spectrum that is offered in this band (2x45 MHz—a total of 90 MHz).

4.3.3. Option three—2x15 MHz frequency lots

This option provides a total of three 2x15 MHz lots in the 700 MHz band. Option three is not appropriate for the 2.5 GHz band, as 2x15 MHz lots do not fit equally within the 140 MHz of spectrum offered in the 2.5 GHz band.

5. Impact analysis

5.1 Overview

This section provides an analysis of the types of costs, benefits and risks associated with the lot configuration options considered for the digital dividend auction. This section also discusses the likelihood of costs or benefits arising in each lot configuration option.

Cost-benefit analysis typically involves assessing the expected impact of alternatives relative to one clear counterfactual, where the status quo is often used as the counterfactual. In this case, there is no single counterfactual because the digital dividend spectrum is being allocated to new uses. The choice of lot configuration is a question of which option best facilitates moving digital dividend spectrum to its highest value use, relative to the other options considered.

The first part of this Chapter outlines the types of costs and benefits associated with geographic configuration options; the following part discusses the costs and benefits associated with bandwidth configuration options.

5.2 Geographic configuration

5.2.1 Benefits of increasing the level of geographic disaggregation

The benefits of geographic disaggregation of spectrum lots will depend upon:

- the geographic scope of potential bidders' current and expected future operations, and their capacity to provide services to the public through the use of digital dividend spectrum.
- the ease with which subsequent allocations of digital dividend spectrum can occur, to minimise the risk of unused spectrum in the longer term.

These benefits are inter-related. The overarching consideration relates to providing products (based on the configuration of lots) that are consistent with future spectrum needs (as outlined at 2.1.3 of this RIS) and able to satisfy market demand. This will ensure that the spectrum is attractive to potential bidders, and can be used efficiently. With this in mind, an optimal lot configuration should facilitate a wide range of uses.

5.2.1.1 Geographic scope of potential bidders' business needs

Representations from stakeholders suggest demand for both the 700 MHz and 2.5 GHz band spectrum may come from mobile telecommunications operators, internet service providers, energy distribution companies and mining companies.[23]

International experience and the ACMA's interactions with stakeholders in Australia indicate that telecommunications network operators value the spectrum in the two bands more highly than other industries. Telecommunications network operators are considered to be the parties most likely to participate in the auction and acquire spectrum in these bands.

Mobile telecommunications network operators in Australia each operate nationwide networks. Feedback from these businesses has indicated a preference for 'national' market areas which cover all of Australia for the 700 MHz band (consistent with option

[23] See the submissions to the *Consultation on the configuration and allocation of digital dividend spectrum* discussion paper, www.acma.gov.au.

one), with some support for disaggregation of metro/regional or metro/regional/remote areas in the 2.5 GHz band (consistent with options three, four and five).

If the spectrum is configured in a manner that is consistent with the business plans of mobile telecommunications network operators, it is likely that consumers will benefit. By making spectrum available in a configuration that enables telecommunications operators to deliver the latest mobile technologies, the ACMA can help to promote a competitive mobile telecommunications market, leading to positive outcomes for consumers. These positive outcomes may include access to the latest technologies (e.g. WAS), and the potential for lower prices if competition increases.

Geographic configuration in a single national area covering all of Australia (option one) would enable telecommunications network operators to deliver the latest technologies to their customers on a national basis.

Generally speaking, an increased level of geographic disaggregation (options two, three, four and five) would enable an operator to focus their demand on the areas where they require spectrum to roll out services to the public, in accordance with their business plans. For example, a provider may require additional spectrum to roll out services in a particular area.

Geographic disaggregation minimises the risk that spectrum in any single geographic region would lie idle. Smaller telecommunications networks may want to roll out services to regional areas only. Allowing bidders to purchase spectrum only in select regions may encourage new market entrants to compete against national players in these geographic regions. Increased competition in regional areas could in turn benefit consumers by way of decreased prices for telecommunications services.

In making a recommendation on lot configuration, the ACMA has also considered the potential spectrum needs of other stakeholders. Even if these stakeholders do not bid at auction, this will be relevant in the event that spectrum in the 700 MHz and 2.5 GHz bands becomes available for allocation in the future (for example, if there is unallocated spectrum remaining after the auction).

Many fixed wireless internet service providers have a stronger presence in some geographic locations than others. Some internet service providers and telecommunications device manufacturers have suggested that 2.5 GHz spectrum will be more valuable in metropolitan areas. They have therefore suggested market areas should be based on population density, with separate lots offered for metropolitan, regional and remote areas (such as options three and five).

The propagation characteristics of spectrum in the 2.5 GHz band lends itself to providing capacity in densely populated areas. This suggests that there would be benefit in geographic disaggregation for the 2.5 GHz band because it would allow fixed wireless internet service providers to improve the quality of service they provide to their customers in metropolitan areas.

Energy distribution companies tend to operate on a state-by-state basis. In submissions to the ACMA's consultation on the digital dividend in October 2010[24], energy distribution companies showed support for spectrum lots defined on a state or regional basis (consistent with options four and five).

It should be noted however, that despite various public comments by electricity distribution network operators about the benefits of obtaining spectrum for smart grid

[24] *Spectrum re-allocation in the 700 MHz digital dividend band*

infrastructure, none have made submissions to the ACMA's consultation on lot configuration.

Mining companies appear to be interested in spectrum in remote areas. One stakeholder from the mining industry provided a submission on the proposed lot configuration in the 700 MHz and 2.5 GHz bands, indicating that it would primarily be interested in spectrum in remote areas.

Stakeholders from the mining industry have asserted that a single remote lot (as noted in options two and three), is unlikely to engender efficient use of the 700 MHz and 2.5 GHz bands, as individual companies may wish to access spectrum to build their own networks in the localities where they operate. They suggest an alternative approach of offering apparatus licences in remote regions. However, under section 153P of the Act, once a set of frequencies is subject to a reallocation declaration, the ACMA must not allocate apparatus licences, except in special circumstances.[25]

5.2.1.2 Subsequent allocations

Lot configuration for the digital dividend auction may also affect a party's ability to obtain access to spectrum in certain areas in the future. This would, in turn, affect its ability to offer a service to the public in a particular geographic area.

If only national lots are offered, some spectrum may be left unused by the winning bidders. This may occur where a geographic area falls outside their business plans, for example, because it is not sufficiently profitable to deliver a service in that area. This would result in an inefficient allocation of spectrum because although spectrum in the geographic area is covered by a licence, the spectrum is not being used by the licensee to provide any benefit to the public.

Past experience in Australia suggests that in regional and remote areas with relatively low populations, less spectrum is required to deliver services. The services that *are* delivered in these regions are often provided using alternative technologies (such as satellite provision of communications services). If a disaggregated geographic lot structure is chosen, lower demand in regional and remote areas may result in some unsold lots in those areas. This means that any unsold lots could be made available to other parties once the auction is completed. It is likely that post-auction demand for spectrum in the 700 MHz and 2.5 GHz bands will come from organisations interested in providing services to consumers in specific geographic locations to meet demands in these areas, rather than on a nationwide basis.

The impact of adopting a disaggregated lot structure on these organisations' ability to acquire access to spectrum in the future depends, in part, on whether it would be simpler and quicker for these parties to acquire spectrum rights from the ACMA or through the secondary market (either by spectrum trading or by licensees allowing third parties to use their authorised spectrum space (third party authorisations)).

Trading of spectrum licences has occurred in the past, but the characteristics of that market may mean that some trades do not occur even when a trade could benefit both the buyer and the seller.[26] There is also evidence of third party authorisations occurring, but these appear to be less likely if the party seeking authorisation is looking to deploy a relatively wide area service, or if the service will compete with the spectrum licensee. This suggests it may be easier and faster for a party to obtain

[25] Or except in other circumstances not presently relevant.

[26] See *Spectrum Trading: Consultation on trading and third party authorisations of spectrum and apparatus licences*, 2008 for a discussion of the characteristics of these markets. Available at www.acma.gov.au.

rights to the spectrum in the future from the ACMA, rather than from a spectrum licensee.

The proposed marketing plan and allocation instruments for the auction will provide the ACMA with a broad discretion to determine how best to allocate any unsold lots.

5.2.2 Costs of increasing the level of geographic disaggregation

The costs of geographic disaggregation will depend upon the extent to which geographic disaggregation:

- is supported by the auction format and auction software
- gives rise to technical inefficiencies associated with licence boundaries, which relates to the propagation characteristics of the spectrum
- increases the administration costs for the ACMA.

5.2.2.1 The extent to which disaggregation is supported by the auction format and software

A disaggregated lot structure can create complexity for either the auction manager or bidders.

As the number of lots increases, so does the complexity of determining the winners, the prices winning bidders must pay, and the complexity associated with bidding and tracking prices of desired lots.

Choosing a geographic disaggregation beyond a certain level may result in a level of computational complexity that the auction system cannot solve within a reasonable timeframe, and may hinder the ACMA's ability to verify the auction results.

The relevant question is whether any of the options considered result in an excessive level of bidder or computational complexity.

In feedback received to date, stakeholders have asserted that there are likely to be costs borne by bidders associated with complexity. The main driver in the costs for bidders, associated with an increasingly disaggregated lot structure, is the ease with which they can interact with the auction software.

The problem of complexity has been considered, and the ACMA has worked closely with expert advisors to determine whether all the options being considered could be presented in a way that will assist bidders to participate effectively. Analysis suggests that there would be significant complexity if both bands were offered as disaggregated lots. If only one of the bands is disaggregated, the lot configuration options two, three and four are likely to result in an acceptable level of computational complexity.

However, option five (the most disaggregated lot structure) is materially more complex than the other options, and poses a considerable risk to the operation of the auction. For this reason it is not a recommended option for the digital dividend auction.

5.2.2.2 The technical inefficiencies associated with boundaries

Where there are boundaries between spectrum licences owned by separate licensees, there may be utility loss zones in which no services can be provided. This denies access to these services for the population within those areas.

Where possible, boundaries will be positioned away from populated areas to minimise the risk of utility loss zones occurring in areas where there is a demand for services. For example, boundaries should not be positioned so as to cut through the Gold Coast or Albury/Wodonga areas. The geographic option most at risk of imposing boundaries that cut through populated areas is option five. If this option was adopted, the ACMA

would need to conduct further research to ensure that boundaries are in the optimal position.

As highlighted in Chapter 2, due to the propagation characteristics of the two bands, spectrum utility loss zones are likely to be far larger for the 700 MHz band than the 2.5 GHz band. If a disaggregated lot configuration is chosen, any risks associated with boundaries (such as utility loss zones) can be better managed in the 2.5 GHz band than the 700 MHz band.

In considering the risk of boundary issues arising from disaggregated lots, one key issue is that lots sold in a spectrum auction may be different to the spectrum licences which are issued after the auction. This means that if one bidder wins geographically contiguous lots, they may be grouped together as one licence. As a result, there is little or no risk of inefficiency resulting from lot boundaries if the spectrum is won by a single party.

Alternatively, if two separate parties win geographically contiguous lots, the clear implication is that the two parties winning the lots value the two lots more than one party winning the two lots. The costs associated with the spectrum utility loss zones (that is, the inability to rollout networks in those regions) would need to be considered by the bidders in determining their value of the lot.

There may also be a risk that technical inefficiencies associated with boundaries may increase over the term of the licence as population changes. If licence boundaries do not accommodate population growth over the period of the spectrum licence, there are likely to be costs associated with utility loss zones.

5.2.3 Summary—applicability of these costs and benefits to each band

700 MHz band

Of all the options reviewed for geographic configuration for the 700 MHz band, the ACMA considers that option one, national geographic market area lots, is best suited and has a number of tangible benefits.

One of the primary benefits of option one is that it is broadly preferred by mobile telecommunications network operators seeking to deploy a national service. These stakeholders have indicated their interest in spectrum in the 700 MHz band, and have been highly involved in all consultation on lot configuration. Providing potential bidders with spectrum that covers a national geographic area is likely to benefit the public by allowing operators to deliver the latest mobile technologies to consumers nationwide.

Another benefit of option one is that it does not impose any lot boundaries. If a disaggregated option was chosen instead, with various lot boundaries, there would be a risk of utility loss zones cutting through populated areas. Due to the propagation characteristics of the bands, the utility loss zones associated with lot boundaries are likely to be much larger for communication networks rolled out in the 700 MHz band than in the 2.5 GHz band.

There is also a benefit in having one of the two bands offered as national lots, as this will simplify the auction markedly. By limiting the number of lots to bid on at auction, bidders will find it easier to interact with the auction software, ultimately increasing the efficiency of allocation.

2.5 GHz band

Based on the ACMA's assessment of costs and benefits and the applicability of these to the 2.5 GHz band, the preferred option is option three—disaggregated metropolitan, regional and remote market areas.

One of the key benefits of this approach is the flexibility it will provide for bidders at auction.

Feedback from stakeholders has shown support for a disaggregated geographic configuration in the 2.5 GHz band. However, there has also been some support for national geographic market areas. By implementing option three, bidders will be able to select either disaggregated or national parcels of spectrum according to their own business needs. The ACMA considers that this option is likely to promote moving spectrum to its highest value use because bidders can purchase spectrum only in the areas where they intend to roll out services to the public.

Implementing a disaggregated lot structure may introduce utility loss zones. However, the utility loss zones would be much smaller in the 2.5 GHz band than the 700 MHz band. This is due to the propagation characteristics of the 2.5 GHz band, which support communications over shorter distances. The cost of technical inefficiencies would be much easier to manage in the 2.5 GHz band, and by placing geographic boundaries away from highly populated areas, the service provided to the public by a licensee should not be greatly affected.

Option two is the simplest of all the disaggregated options, and has the benefit of providing a more straightforward model for the operation of the auction format and software. However, this option would not accommodate bidders with spectrum requirements in discrete metropolitan regions.

Option four may benefit potential bidders with a preference for spectrum in specific state/ territories, such as stakeholders from the energy industry. However, these stakeholders have not engaged in any formal or informal consultation with the ACMA. No other stakeholders have favoured this lot configuration.

Option five may accommodate bidders with a preference for a disaggregated region in central Australia. However, with 15 discrete regions this option is considered too complex for the auction system and format, and any gains from this disaggregation would be countered by the increased costs of complexity.

Option three offers an intermediate level of disaggregation and limits the computational complexity for the auction system and bidders. Option three is preferred over other disaggregated options (two, four and five) because it would be able to cater to a larger potential bidding market, while not compromising the operation of the auction format and software.

Table 2 (below) presents the estimated level of impact that the groups of costs and benefits are likely to have if the level of disaggregation in the 2.5 GHz band varies, while the 700 MHz band is offered as national lots.

Table 2 Options for geographic configuration of the 2.5 GHz band, with national lots for the 700 MHz band

No	Option	Benefits		Costs	
		Fit with potential bidders' business plans	Subsequent allocations	Complexity	Technical inefficiencies
1	National lots (1 lot)	✓	✓	X	X
2	Aggregated metro and regional lots (2 lots)	✓	✓	X	X
3	Metropolitan regional and remote lots (11 lots)	✓✓✓	✓✓	XX	XX
4	State/territory based lots (8 lots)	✓✓	✓✓	XX	XX
5	Metro, regional and remote lots further disaggregated (15 lots)	✓✓✓	✓✓	XXX	XXX

5.3 Configuration of bandwidth within each band

The analysis of the costs and benefits of each bandwidth option can be found in summary form in Table 3. The choice of appropriate lot size is driven by several factors, including:

1. the technical characteristics and the likely uses of the 700 MHz and 2.5 GHz bands
2. ensuring the lots fit equally within the total quantity of spectrum available in the band
3. promoting competition in the auction.

As with geographic configuration, configuration within the band is crucial to ensure spectrum is useful and attractive to potential bidders. Enabling parties to acquire smaller bandwidths enables bidders with lower liquidity to purchase spectrum. As such, smaller lots are likely to promote competition.

5.3.1 The 700 MHz band

The majority of submissions to the ACMA's October 2010 discussion paper suggested that the characteristics of digital dividend spectrum were highly attractive for use in the deployment of LTE networks, particularly for mobile communications services. As discussed in Chapter 2, a minimum frequency bandwidth of 2x5 MHz lots appears to be ideal because it is consistent with international standards for LTE, and can be aggregated from bandwidths up to 2x20 MHz licences for maximum spectral efficiency.

Feedback provided to the ACMA in response to informal consultation on lot configuration noted that if bidders are able to aggregate lots, the use of 2x5 MHz lots would permit a greater combination of frequency lots for prospective bidders who desire flexibility. This fits particularly well with the most likely technology to be deployed in the band, which operates in 5, 10, 15 or 20 MHz bandwidths.

The 2x10 MHz option is not appropriate for the 700 MHz band, as 2x10 MHz lots would not fit equally within the 2x45 MHz of spectrum available. To avoid the use of different combinations within the same band, only the 2x5 MHz and the 2x15 MHz options are feasible in the 700 MHz band.

The efficiency of the auction is optimised if all parties can bid effectively for their preferred packages of spectrum. It is possible that one 2x5 MHz lot is consistent with the business plans of one of the potential bidders. It is also possible that a party may want to acquire either 2x10 MHz lots or 2x20 MHz lots. None of these options would be possible if lot sizes of 2x15 MHz lots were chosen.

In addition, lots of 2x5 MHz fit evenly within the spectrum competition limits, and would enable bidders to acquire spectrum up to the 2x20 MHz limit in the 700 MHz band. These limits have been structured to provide a level playing field for the bidders most likely to participate in the auction, while not precluding any new entrants in the process.[27]

Spectrum lots of 2x5 MHz are considered to be the most appropriate size in the 700 MHz band given they are consistent with international standards for LTE, and fit equally within the total quantity of spectrum offered in the band. This option will also provide greater flexibility for parties to acquire spectrum consistent with their business plans, which is likely to promote competition in the auction and in the downstream markets for services delivered via the spectrum.

5.3.2 The 2.5 GHz band

The 2.5 GHz band is well suited for high data capacity for LTE services in more densely populated, high demand areas. The 2.5 GHz band is most likely to be used to provide support/capacity for the delivery of LTE services, rather than to provide coverage for a national LTE network.

There is a total of 2x70 MHz of spectrum available in the 2.5 GHz band. The total amount of spectrum cannot be divided equally into lots of 2x15 MHz or 2x20 MHz, suggesting that the lots offered for sale should be either 2x10 MHz or 2x5 MHz.

[27] Explanatory Statement, Radiocommunications (Spectrum Licence Limits) Direction No.1 of 2012 www.comlaw.gov.au.

Similar to the minimum frequency proposed for the 700 MHz band, 2x5 MHz and 2x10 MHz lots fit within the minister's competition limits, and would enable bidders to bid/acquire spectrum up to the 2x40 MHz limit in the 2.5 GHz band. This minimum frequency size will not unnecessarily distort or reduce competition in the auction.

It is unclear whether a single 2x5 MHz lot is going to be consistent with the business plans of potential bidders. However, it is possible there will be demand for a 2x15 MHz lot in the 2.5 GHz band. With this in mind, the option of a 2x10 MHz bandwidth size may inhibit the efficient purchase of spectrum in this band. Based on this analysis, 2x5 MHz lots are also considered appropriate for the 2.5 GHz band.

5.3.3 Configuration of bandwidth within each band

Table 3 presents the ratings of the different lot configurations according to the three criteria outlined.

Table 3 Configuration of bandwidth within each band

	2x5 MHz	**2x10 MHz**	**2x15 MHz**
700 MHz			
Consistent with the technical characteristics of the likely uses of the band?	✓✓✓	✓✓	✓✓
Do the lots sum equally to the total quantity of spectrum available?	✓✓✓	X	✓✓✓
Promotion of competition in the auction and in related markets for services?	✓✓✓	✓✓	✓
2.5 GHz			
Consistent with the technical characteristics of the likely uses of the band?	✓✓✓	✓✓	✓✓
Do the lots sum equally to the total quantity of spectrum available?	✓✓✓	✓✓✓	X
Promotion of competition in the auction and in related markets for services?	✓✓✓	✓✓	✓

5.3.4 Summary— recommended bandwidth configuration

For the 700 MHz band, the recommended bandwidth configuration is 2x5 MHz, as this:

- is consistent with the technical characteristics of the band
- is likely to be consistent with the competitive characteristics of bidders
- fits equally within the total quantity of spectrum available.

For the 2.5 GHz band, the recommended bandwidth is 2x5 MHz, as this allows bidders the flexibility to aggregate bandwidth according their business plans. For example, 2x10 MHz cannot aggregate to 2x15 MHz, a lot size consistent with potential bidders' demand. As such, 2x5 MHz lots in the 2.5 GHz band are likely to generate the greatest net benefits.

6. Consultation

6.1. Previous consultations

The ACMA has undertaken extensive public consultation on the issue of lot configuration. The purpose of this consultation has been to assist the ACMA in developing and refining its thinking on lot configuration for the digital dividend auction.

Some of the consultation undertaken by the ACMA has sought feedback on the reallocation of spectrum in the 700 MHz and 2.5 GHz bands generally, including the issue of lot configuration. Other consultation has sought more targeted feedback on lot configuration.

Consultation conducted on this issue is as follows:

- *Review of the 2.5 GHz band and long term arrangements for ENG* discussion paper in January 2010
- *Spectrum reallocation in the 700 MHz digital dividend band* discussion paper in October 2010
- preliminary informal engagement on the 700 MHz and 2.5 GHz lot configuration in November 2011
- the *Digital dividend auction tune-up 2011* (an industry event) in November 2011
- preliminary engagement on proposed lot configuration—700 MHz and 2.5 GHz bands in February 2012
- consultation on the draft legislative instruments for the digital dividend auction in April 2012
- consultation on revised draft legislative instruments for the digital dividend auction in July 2012.
- final consultation on draft legislative instruments for the digital dividend auction in August 2012

6.2 Review of the 2.5 GHz band and long term arrangements for ENG discussion paper

On 12 January 2010, the ACMA released the discussion paper *Review of the 2.5 GHz band and long-term arrangements for ENG* for public consultation (copies of public submissions can also be found on this website). This paper provided background information on the 2.5 GHz band review process, and highlighted key issues that the ACMA was considering as part of its review. The ACMA received 42 submissions in response to the paper. Copies of public submissions are available on the ACMA website.

The submissions received relating to lot configuration can be categorised according to the issues raised in the discussion paper, as follows:

6.2.1 How metropolitan, regional and remote areas might be most appropriately defined for licensing in the 2.5 GHz band

Feedback from members of the telecommunications industry stated their preference for large or national spectrum licences, where possible. There were other suggestions from the telecommunications industry, including that the ACMA should consider disaggregated metropolitan, outer metropolitan and regional spectrum licences, or adopt the same boundaries used for spectrum licensing in the 1.8 GHz and 2.1 GHz bands.

6.2.2 Whether a ‘national licence’ should be made available via spectrum licensing

There was broad support for FDD spectrum to be licensed on a national basis amongst members of the telecommunications industry. However, some industry stakeholders also noted that 2.5 GHz spectrum would be more valuable in metropolitan areas and areas of higher population density.

Telecommunications device manufacturers stated their position that 2.5 GHz spectrum would be more valuable in metropolitan areas, while the 700 MHz band would be of more value in rural and regional areas.

6.3. Spectrum reallocation in the 700 MHz digital dividend band discussion paper

On 20 October 2010, the ACMA released the discussion paper *Spectrum reallocation in the 700 MHz digital dividend band* for public consultation (copies of public submission can also be found at this link). This paper provided background information on the digital dividend allocation process and highlighted the key issues that the ACMA was considering as it planned for the configuration and allocation of the digital dividend.

The submissions received which relate to lot configuration can be categorised according to feedback received on geographic lot dimensions and frequency lot dimensions.

6.3.1. Geographic lot dimensions

Members of the telecommunications industry and telecommunications equipment manufacturers stated an intention to deploy FDD LTE broadband services across Australia, and generally only supported national lots.

Members of the electricity distribution industry stated that spectrum lots should be defined on either a state-by-state basis or a regional basis. Other stakeholders noted that large geographic areas and blocks of spectrum were likely to be the most attractive to potential auction bidders.

6.3.2. Frequency lot dimensions

There was general support for the deployment of LTE-based wireless broadband services in the 700 MHz band, either mobile or fixed, as most stakeholders saw this as representing the highest value use for the spectrum.

Mobile telecommunications operators stated that the minimum bandwidth required for LTE technology is 5 MHz (paired for FDD); however, efficiency significantly increases with increased contiguous bandwidth of 2x10 MHz, and 2x20 MHz allocations. Most stakeholders also supported paired configuration of the spectrum.

6.4. Preliminary engagement on the 700 MHz and 2.5 GHz lot configuration

In November 2011, the ACMA conducted preliminary engagement with stakeholders on the most appropriate lot configuration for the digital dividend auction. This process was undertaken in advance of the first consultation on the draft allocation instruments in April 2012.

The material provided as part of the engagement process gave background information on lot configuration, lot configuration 'scenarios' and a series of questions for stakeholder consideration relating to the lot configuration scenarios.[28]

The ACMA received three submissions, all from members of the telecommunications industry, in response to this preliminary consultation process. These submissions highlighted stakeholders' preferred lot configuration for the 700 MHz and 2.5 GHz spectrum. A summary of the submissions is detailed below:

6.4.1 700 MHz band lot configuration

All submitters preferred a national lot structure for spectrum in the 700 MHz band; comprising of 2x5 MHz frequency lots and a national market area covering all of
Australia.

The reasons put forward by submitters in support of this approach were:

- frequency lots of 2x5 MHz are considered an optimal size, as larger lot sizes of 2x10 MHz would not fit into the 700 MHz band plan
- frequency lots sizes of less than 5 MHz are inappropriate for the operation of either 3G or 4G technologies.

[28] It was noted that the scenarios presented were not exhaustive, and should not be taken to represent an ACMA view as to its preferred configuration.

For the geographic market area, submitters noted that a national market area was preferred as it would provide the best foundation for a national mobile network.

6.4.2. 2.5 GHz band lot configuration

Stakeholder views on the preferred lot configuration for the 2.5 GHz band differed. One stakeholder favoured national market areas, expressing the view that the Australian market was not conducive to deploying regional mobile networks and that a disaggregated lot structure would unnecessarily complicate the auction. This stakeholder argued that disaggregated lots could lead to 'cherry picking' of desirable areas, and may not generate new competition in remote areas.

However, other stakeholders supported a disaggregated geographic lot structure. These stakeholders said that the 2.5 GHz band was more likely to be used to provide capacity and support for the delivery of mobile telecommunications services, rather than to provide the foundation of a national mobile communications network.

One stakeholder preferred a geographic disaggregation of market areas with eight metropolitan areas, two regional areas and one remote market area—the Scenario 2 configuration.

Another stakeholder proposed a different geographic configuration than those presented in consultation, preferring a structure comprising individual metropolitan areas, and an aggregated regional/remote market area.

Opinions also differed on the preferred minimum frequency bandwidth of lots in the 2.5 GHz band. While one stakeholder indicated a preference for 2x10 MHz lots, there was also support for lots with a minimum size of 2x5 MHz. The stakeholder who preferred 2x5 MHz minimum frequency size stated that this option would provide added flexibility for bidders who want to acquire 2x5 MHz or 2x15 MHz in the 2.5 GHz band.

6.5. Digital dividend auction tune-up

On 4 November 2011, the ACMA held the *Digital dividend auction tune-up 2011* in Melbourne.

This industry-focussed event provided an opportunity for stakeholders to hear from the ACMA, the Department of Broadband, Communications and the Digital Economy (DBCDE) and the Australian Competition and Consumer Commission (the ACCC) on work being undertaken in preparation for the digital dividend auction. The tune-up also provided stakeholders with an insight into the ACMA's preliminary thinking around the development of auction rules and processes, such as lot configuration.

6.6 Preliminary engagement on the proposed lot configuration for the 700 MHz and 2.5 GHz bands

In February 2012, the ACMA conducted further preliminary engagement with stakeholders on lot configuration for the 700 MHz and 2.5 GHz bands.

For this engagement process, the ACMA provided a summary of the feedback received from external parties from previous engagement on lot configuration, and highlighted the ACMA's preferred approach on the issue. The ACMA also sought input on the most suitable geographic boundaries of the market areas in the 2.5 GHz lot configuration.

The ACMA received six submissions in response to this preliminary consultation process. A summary of the submissions is below:

6.6.1 700 MHz band lot configuration

Three submitters preferred a national lot structure for spectrum in the 700 MHz band; comprising 2x5 MHz frequency lots and a national market area covering all of Australia.

Other submitters had concerns about the proposed 700 MHz band lot configuration. These submitters preferred larger lot sizes, noting that the proposed lot size of 2x5 MHz was too small. These submitters also raised concerns about geographic market areas. There was a suggestion that disaggregated remote market areas

could be split into multiple regions. It was stated that this would enable individual companies to access spectrum to build their own networks in the localities where they operate. It was further suggested that this approach should be applied to both the 700 MHz and the 2.5 GHz band.

6.6.2 2.5 GHz band lot configuration

There were a number of comments from submitters about the ACMA's proposal for the 2.5 GHz band lot configuration. Three submitters raised concerns about the proposed 2x5 MHz frequency bandwidth, noting that it would cause unnecessary lot fragmentation. One submitter said that lots of 2x5 MHz would increase complexity of the auction, while another stated that this configuration would diminish the future availability of broadband services.

Three submitters also had concerns about the proposed disaggregated geographic market area boundaries. One noted that disaggregated market areas increase the risk of gaps in roaming coverage on national networks. Another submitter questioned the need to partition remote areas from regional areas.

As noted above, one submitter made the suggestion that disaggregated remote market areas could be split into multiple regions.

Two submitters provided feedback on the 2.5 GHz market areas boundaries. One submitter suggested the market area boundaries should align with the geographic boundaries of the 1800 MHz spectrum licences. They stated this would allow operators to take advantage of the potential synergies between the deployment of mobile infrastructure in the 1800 MHz and 2.5 GHz bands.

The other submitter stated that its initial investigation had identified that the proposed geographic boundaries go through, or near, 'a number of significant towns'. This submitter stated that this poses a risk to the utility of the 2.5 GHz spectrum acquired in those areas, and the ability of successful bidders to comply with their licence conditions in those areas. It recommended the ACMA conduct further investigation into the potential issues that may arise and consider if the proposed boundaries could be altered.

6.7. April 2012 consultation on the draft allocation instruments for the digital dividend auction

In April 2012, the ACMA conducted consultation on the draft allocation instruments for the digital dividend auction. The allocation instruments presented were:

- two marketing plans (one for the 700 MHz band and one for the 2.5 GHz band), to be made under section 39A of the Act
- an allocation determination, to be made under section 60 of the Act.

The lot configuration proposed in the 700 MHz band marketing plan was option one for the geographic market area and option one for the minimum frequency bandwidth. The lot configuration proposed in the 2.5 GHz band marketing plan was option three for the geographic market area, and option one for the minimum frequency bandwidth.

Four submissions were received on the 700 MHz lot configuration and five submissions provided on the 2.5 GHz lot configuration. A summary of the submissions is detailed below:

6.7.1 700 MHz band lot configuration

Three submitters endorsed the proposed national lot structure for the 700 MHz band with nine frequency lots of 2x5 MHz paired configuration. Stakeholders noted their support for this configuration, stating that these lots are consistent with the network deployment decisions of licence holders in other similar band frequencies, and highly suited to the propagation characteristics of the 700 MHz band.

One submitter recommended a disaggregated structure for both the 700 MHz and 2.5 GHz bands with remote Australia broken down into smaller regions. This stakeholder noted its dissatisfaction with national spectrum licensees who only roll out services to high density metropolitan and medium density country areas of Australia. The submitter stated that this leaves remote Australia without services, and without the ability for entities to buy spectrum to operate their own network.

6.7.2 2.5 GHz band lot configuration

The ACMA received varied responses on the proposed lot configuration for the 2.5 GHz band.

Three submitters recommended changes to the region boundaries, and the regions on offer in the 2.5 GHz band. Stakeholders who wanted changes to region boundaries sought to include specific cities, move region boundaries so not to cut through populated areas and submitted that generally region boundaries should be expanded to cater to a growing customer base in Australian metropolitan areas. Stakeholders also suggested changes to the regions on offer, recommending the creation of additional regions to accommodate areas of operation in central Australia and (as noted above) in remote Australia.

One submitter was opposed to the disaggregated structure, noting its concerns with geographic contiguity and whether package bidding will ensure geographically contiguous lots. This stakeholder also had concerns about the operation of the auction format in light of the 11 regions on offer, stating that it would unnecessarily complicate the auction.

Another submitter supported the disaggregated structure, stating that it would provide the flexibility to bid on lots in discrete regions across Australia, without excessively fragmenting the band. However, this stakeholder noted concerns with the operation of the auction with 5 MHz paired frequency lots offered across 11 regions in the 2.5 GHz band.

6.8 July 2012 consultation on revised draft legislative instruments for the digital dividend auction

In July 2012 the ACMA sought comment on revised drafts of the s.60 Allocation Determination and 700 MHz Marketing Plan. The ACMA did not seek feedback on the draft section 39A Marketing Plan for the 2.5 GHz band at this time, as it was still considering the 2.5 GHz band lot configuration.

The lot configuration proposed in the 700 MHz band marketing plan was option one for the geographic market area and option one for the minimum frequency bandwidth.

The ACMA received six submissions in response to this consultation process. Three of these submission included feedback on lot configuration.

Feedback on the 2.5 GHz lot configuration was provided from two submitters, even though it was outside the scope of the consultation. One submitter reiterated its previous suggestion to amend the 2.5 GHz region configuration, to add another region in central Australia, and extend the boundaries of the geographic lot offered in Adelaide. Another submitter raised concerns with the proposed 2.5 GHz lot configuration, noting this model increases the risk of a geographically fragmented allocation for bidders.

One submitter commented on the 700 MHz band national region, noting that it passes very close to the coastline in some places, such as the Whitsunday Islands in Queensland. This submitter noted that this may constrain service provision in these areas, and asked the ACMA to amend boundaries.

6.9 August 2012 consultation on draft legislative instruments for the digital dividend auction (final consultation)

In August 2012, the ACMA conducted a final round of consultation on the draft allocation instruments for the digital dividend auction. The draft allocation instruments available for comment were:

- two marketing plans (one for the 700 MHz band and one for the 2.5 GHz band), to be made under section 39A of the Act
- an allocation determination, to be made under section 60 of the Act.

The lot configuration proposed in the 700 MHz band marketing plan was option one for the geographic market area and option one for the minimum frequency bandwidth. The lot configuration proposed in the 2.5 GHz band

marketing plan was option three for the geographic market area, and option one for the minimum frequency bandwidth.

The ACMA received six submissions in response to this consultation process. Three of these submission included feedback on lot configuration.

Two submitters agreed with the changes to the metropolitan areas boundaries in the 2.5 GHz band. One submitter reiterated their belief that a Central Australian Region should be defined in this band. Another submitter again stated that a nationwide product is the most appropriate approach. None of the submissions objected to the proposed lot configuration for the 700 MHz band.

6.10 Consideration of stakeholder views in the formation of the digital dividend lot configuration

The ACMA has considered stakeholder feedback in developing a proposed approach to lot configuration. The ACMA was primarily focused on the feedback received through preliminary consultation on the lot configuration and consultation conducted on the digital dividend allocation instruments.

6.10.1 700 MHz band

The recommended lot configuration for the 700 MHz band (consisting of national geographic lots, with 2x5 MHz minimum frequency lots) was widely supported by the majority of stakeholders. Submitters preferred a national market area stating that the propagation characteristics of spectrum in the 700 MHz band allow for service coverage over large geographic areas. They also favoured a national area because it accommodates the layout of a national mobile network. They favoured minimum frequency lots of 2x5 MHz, stating that frequency lots smaller than this were inappropriate for the operation of either 3G or 4G technologies.

One submitter had concerns with the national outer boundary proposed for the 700 MHz band, noting that it passes very close to the coastline in some places, such as the Whitsunday Islands in Queensland. In this instance the ACMA could not amend the region boundaries, as they replicate the outer boundaries of the Spectrum Reallocation Declaration for the 700 MHz band, as set by the minister.

However, the ACMA proposes to amend the licence conditions so that licensees will not be constrained by conditions limiting operation close to a region boundary, where the operation does not cross the geographic area of another licence in the 700 MHz band. This change to the licence conditions is considered appropriate, as the area adjacent to the 700 MHz boundary would not be occupied by other licensees in the 700 MHz band.

For the minimum frequency of lots, research undertaken by the ACMA initially considered a lot configuration of national lots at 2x5 MHz was a viable option for the 700 MHz band, and consultation has confirmed that this is the preferred approach for stakeholders.

6.10.2 2.5 GHz band

Stakeholder views differed on the preferred lot configuration for the 2.5 GHz band. In light of the lot preferences expressed by stakeholders, the ACMA considers a disaggregated lot structure would be preferable as it can accommodate all stakeholders. A disaggregated structure would allow bidders to package together metropolitan, regional and remote lots to acquire a ‘national lot’ in the 2.5 GHz band. It would also give other bidders the flexibility to acquire lots in smaller market areas if that best suits their business model.

Stakeholders also provided feedback on the disaggregated region boundaries in the 2.5 GHz band. It was suggested that metropolitan region boundaries should be amended to cater to a growing customer base in Australian metropolitan areas. In response to these submissions, the ACMA conducted further analysis on metropolitan region boundaries in the 2.5 GHz band. This analysis included reviewing stakeholder feedback, locations of mobile telecommunications sites and population data.

The population data used in the draft marketing plans was drawn from 2006 census data. More recently, the ACMA has been provided with census data from 2011. The comparison of this census data has allowed the ACMA to review population trends and areas of growth around the metro region boundaries.

Following this analysis, all metro region boundaries were made larger to accommodate a growth in population around metropolitan centres in Australia. The amended boundaries also avoid mobile telecommunications sites, which will allow greater versatility of spectrum acquired in metro regions, and ultimately an efficient allocation of spectrum in these areas.

Another area for concern for stakeholders was the risk of geographically fragmented allocation in the 2.5 GHz band. As noted in Chapter 2, there is a risk with multiple regions of failing to achieve geographically contiguous lots. The ACMA has worked closely with auction experts on this issue, and has developed auction rules to manage the risk of geographic fragmentation.

For the minimum frequency of lots, it is considered that the smaller 2x5 MHz lots in the 2.5 GHz band would give bidders the flexibility to obtain their desired amount of spectrum.

7. Conclusion and recommended option

The recommended options for the lot configuration in the 700 MHz and 2.5 GHz band are listed below. The recommended options are considered most likely to maximise the public benefit derived from use of the radiofrequency spectrum by ensuring the efficient allocation and use of the spectrum. By structuring auction lots in a way that is attractive to potential bidders, the ACMA is aiming to foster a competitive bidding environment and maximise the efficiency of the auction outcome.

The proposed lot configurations have been incorporated into the 700 MHz and 2.5 GHz marketing plans for the digital dividend auction.

7.1 Lot configuration for the 700 MHz band

The recommended approach to lot configuration in the 700 MHz band is:

A. Geographic market area—a national market area

A national market area is considered most likely to result in the efficient allocation and use of the 700 MHz band. This recommendation takes into account the propagation characteristics of this band, and further costs associated with auction complexity if both the 700 MHz and 2.5 GHz bands are disaggregated. A national market area in the 700 MHz band is supported by potential auction bidders.

B. Minimum frequency bandwidth—2x5 MHz lots

The recommended frequency bandwidth for the 700 MHz band is 2x5 MHz lots. As noted in Chapter 6, preliminary engagement on lot configuration in the 700 MHz and 2.5 GHz bands revealed stakeholders' preference for 2x5 MHz frequency lots in the 700 MHz band.

It is expected that 2x5 MHz frequency lots will facilitate a competitive bidding environment, as the CCA will provide bidders with the flexibility to package together lots to meet their specific spectrum requirements. Frequency lots of 2x5 MHz also align with harmonised spectrum arrangement for FDD technologies requiring paired spectrum configuration, and provide sufficient bandwidth to support either 3G or 4G technologies.

7.2 Lot configuration for the 2.5 GHz band

The recommended approach to lot configuration in the 2.5 GHz band is:

A. Geographic market area—disaggregated metropolitan, regional and remote lots

Disaggregated metropolitan, regional and remote market areas are recommended for the 2.5 GHz band. The disaggregated market areas would include:

- eight (8) metropolitan areas:
  - Adelaide, the Australian Capital Territory, Brisbane, Darwin, Hobart, Melbourne, Perth, Sydney
- two (2) regional areas:
  - Regional Eastern Australia, Regional Western Australia
- one (1) remote area.

Disaggregated market areas are primarily recommended due to the flexibility this option will provide to bidders at auction, and to any interested parties in the post auction market.

Feedback from stakeholders on the geographic market areas for the 2.5 GHz band has been mixed. For example, preliminary stakeholder engagement on lot configuration in the 700 MHz and 2.5 GHz bands revealed that one submitter preferred a national geographic market area, while two other stakeholders favoured disaggregated market areas.

The recommended geographic market areas in the 2.5 GHz band will provide bidders with flexibility to acquire individual lots in disaggregated market areas that will best meet their business needs. This will also enable other

prospective auction participants to package together metropolitan, regional and remote lots to acquire a 'national lot' in the 2.5 GHz band.

B. Minimum frequency bandwidth—2x5 MHz lots

The recommended frequency bandwidth for the 2.5 GHz band is 2x5 MHz lots. It is unclear whether there will be demand for a single 2x5 MHz lot at auction. However, it is possible that there will be demand for a 2x15 MHz lot. For this reason, the option of 2x10 MHz lots may inhibit the efficient purchase of spectrum. Based on this analysis, 2x5 MHz lots are also considered most appropriate for the 2.5 GHz band. With this frequency bandwidth, bidders will be able to package together individual 2x5 MHz frequency lots in order to obtain their desired amount of spectrum.

In addition, this approach allows for the practical operation and use of spectrum in the 2.5 GHz band; that is, an individual 2x5 MHz frequency lot will provide sufficient bandwidth to support 3G and 4G technologies. This approach also aligns with internationally harmonised spectrum arrangements for FDD technologies requiring paired spectrum configurations.

The recommended lot configuration for the 2.5 GHz band will provide a responsive and flexible approach to meeting the needs of a wide range of potential bidders, without creating any significant computational complexities for the auction system.

8. Implementation and review

8.1 Timeframes and implementation stages

The recommended lot configuration for each band will be included in two separate marketing plans (one for the 2.5 GHz band and one for the 700 MHz band), which will be presented to the Authority for final approval in November 2012. If the Authority makes the marketing plans, they will be registered on the Federal Register of Legislative Instruments in November 2012.

The ACMA will also make the marketing plans available on the ACMA's website, and provide them to prospective bidders in a package of information to assist auction participants in their preparation for the digital dividend auction.

8.2 Assessing the effectiveness of the ACMA's options

The ACMA will conduct a full review of the digital dividend auction upon completion. As part of the review, the ACMA's auction services provider will conduct a critical evaluation of the auction processes. This evaluation will assess elements including (but not limited to) the effectiveness of the auction methodology, auction rules and product design. In addition, the auction results will be verified by an independent third party.

The ACMA will monitor the use of the 700 MHz and 2.5 GHz spectrum bands once new licences have commenced, to make sure that licensees comply with the conditions of their licence. The ACMA will do this by taking action in response to any complaints received. This is in line with normal ACMA practice.

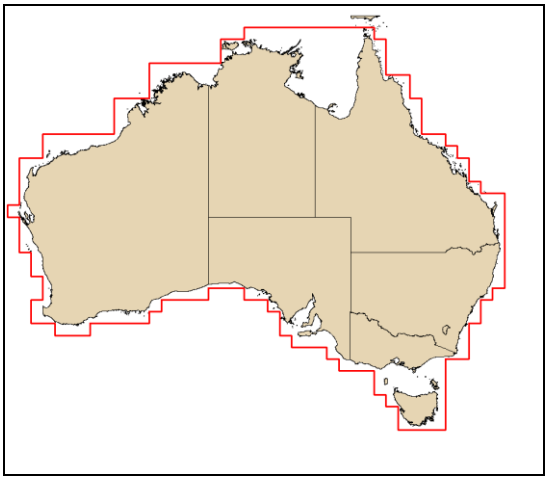
The ACMA also conducts a five-year spectrum outlook and review (the Outlook) on a yearly basis. The Outlook provides demand analysis across ten different radiocommunication service areas, including WAS, and sets out the ACMA's planned spectrum management work for the short, medium and long term. The purpose of the Outlook is to provide an avenue for meaningful discussions with stakeholders about emerging pressures for the radiofrequency spectrum.[29]

[29] The latest version of the Outlook, The *Five-year spectrum outlook 2011–2015,* can be found at www.acma.gov.au.

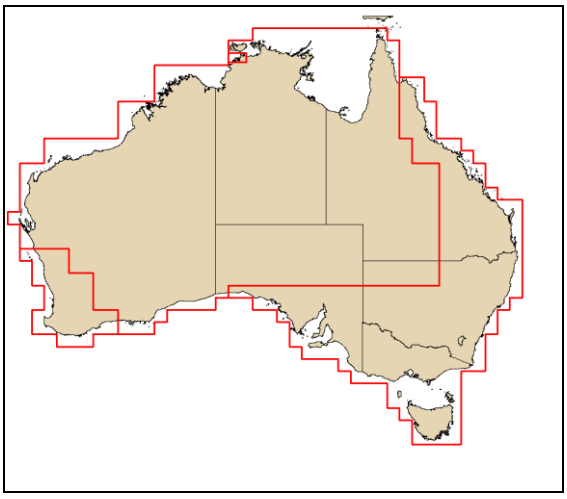
9. Attachments

Attachment A—Maps of geographic market area options

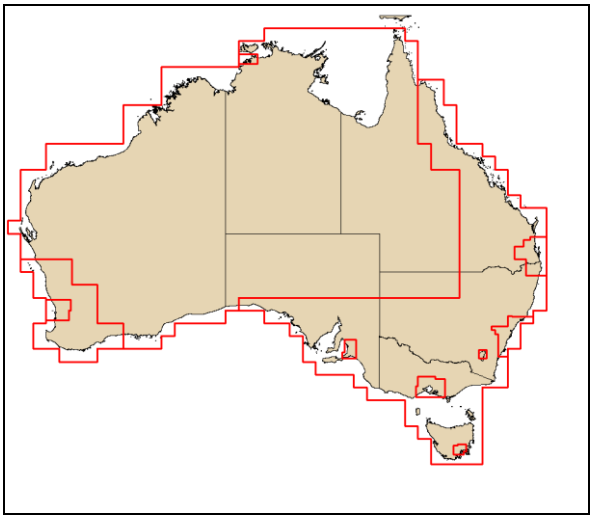
Option one: National geographic market area lots covering all of Australia



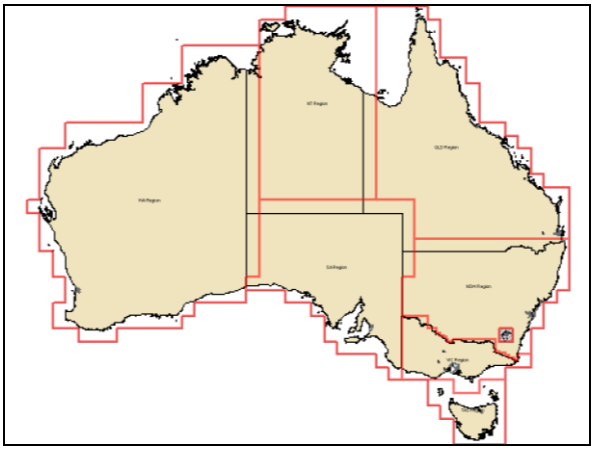
Option two: Aggregated metropolitan and regional lots, and one remote lot



Option three: Disaggregated metropolitan, regional and remote lots



Option four: Disaggregated state/territory based lots



Option five: Further disaggregated metro, regional and remote lots