OPTUS

Submission in response to ACCC Discussion Paper

Spectrum Allocation Limits – 26 GHz Band

Public Version

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EXECUTIVE SUMMARY

1. Optus welcomes the opportunity to comment on the allocation limits that apply for the upcoming 26 GHz spectrum auction. The 26 GHz band is the first millimetre wave (mmWave) band to be released in Australia for 5G technology.

2. This auction will release 2,400 MHz of spectrum into the market, enabling Australian mobile networks to deliver peak throughputs of more than 20 Gbps – true 5G. The history of the Australian mobile market demonstrates that new technology disrupts incumbent operators and brings the potential of new competition. But success in the market ultimately depends on access to spectrum – we must ensure that the 26 GHz spectrum cannot be monopolised by any one operator.

3. MmWave spectrum has unique propagation characteristics which makes it well suited to specific use-cases, especially in the downstream enterprise market. The deployment of ultra-high bandwidth, in excess of 20 Gbps, will enable the development of many use-cases not yet identified, including advanced manufacturing and remote robotics. It is anticipated that the deployment of mmWave networks will underpin the fourth industrial revolution.

4. While much is unknown about the possible future service made possible through mmWave application, what we can say at this early stage is that mmWave spectrum is unlikely to be used to supply wide area mobile networks; its propagation characteristics simply make this uneconomic. Rather, mmWave will be targeted to specific users and ultra-high bandwidth applications, most likely in the enterprise market.

5. Optus submits that access to mmWave spectrum will enable wireless enterprise services that could challenge the incumbent dominant provider of enterprise services – finally opening this market to competition. But the success of this new technology to disrupt existing markets will depend on the ability of operators other than Telstra to acquire sufficient 26 GHz spectrum.

6. Optus submits that the long-term interest of end-users (LTIE) would be best achieved by setting an allocation limit of 800 MHz for all geographic areas. An allocation limit of 800 MHz will allow networks to deliver peak speeds greater than 20 Gbps, consistent with ITU 5G specifications; while ensuring the market would see at least three mmWave networks. Importantly, it would ensure that no single operator can be dominant in the deployment and establishment of 5G services in this band.

THE ROLE OF MMWAVE ON 5G AND IMPACT ON MARKETS

7. Access to mmWave spectrum will open up a new avenue for 5G use cases. It will enable the release of large contiguous bandwidths within a single frequency band that have not previously been possible. However, the deployment of mmWave spectrum also comes with both significant deployment costs and the challenges arising from its propagation characteristics.

8. In practical terms, this will mean that unlike other spectrum bands (sub-6 GHz), 5G deployments using mmWave will be targeted and localised. The potential use cases and markets impacts would likely differ to those utilising sub-6 GHz spectrum.

9. This section discusses:

   (a) The current state of development of 5G technology;

   (b) Impact of 5G on downstream markets; and

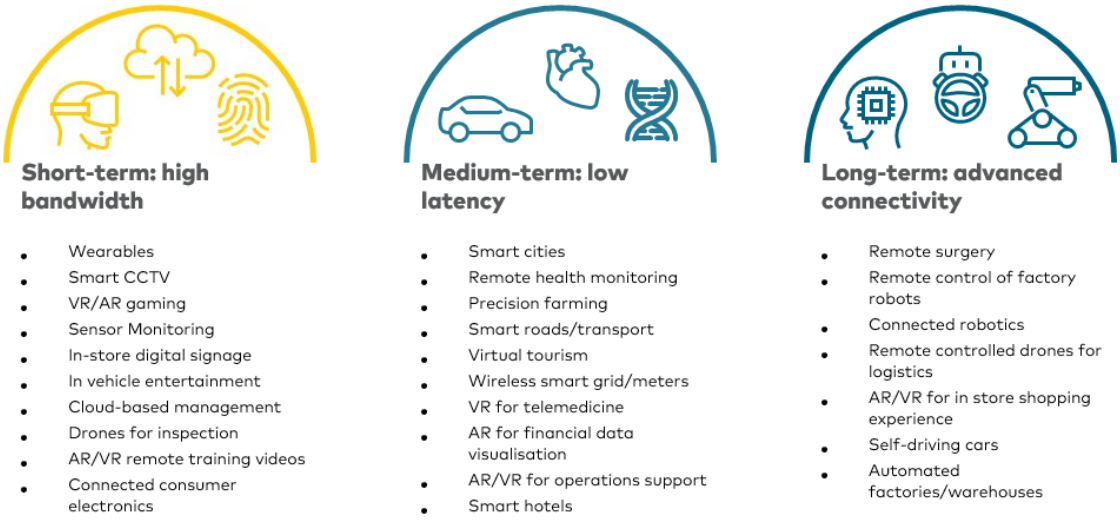
   (c) Supporting deployment, and competition, in the 5G market.

5G use cases continue to be developed

10. The next generation 5G mobile network technology has the potential to create an age of boundless connectivity and intelligent automation, changing the nature of communications for consumers, businesses and governments alike. It will be faster, more flexible, with more computing power. 5G will connect devices, sensors and machines to one another – and to people – leading to significant growth in the industrial IoT and transforming how we interact with the world.

11. As shown in Figure 1 below, the potential 5G use cases are vast but will vary by location and the 5G frequency band and bandwidth used.

Figure 1 Potential use cases across all 5G bands



Source: Optus

12. For example, Optus currently offers both 5G in the home, with Optus 5G Home, as well as 5G Mobile with a range of 5G compatible smartphones. However, this is being deployed within the 5G mid-band frequencies, such as the 3.5 GHz band.

13. Each of the main carriers are already working with equipment vendors in testing the applications and limits of the technology, especially in new mmWave bands such as 26 GHz. However, definitive conclusions about the future use of 5G, particularly in the mmWave frequency ranges, cannot yet be made. Optus observes that:

    (a) It is too early to assess the benefits across the full suite of possible 5G services and applications enable by use of mmWave spectrum. Many use cases are still only in the development phase and have yet to be tested outside lab conditions.

    (b) It is too early to lock in the definitive observations on 5G technical specifications, as the 5G standards continue to develop. An area that has not yet been locked down is the maximum channel bandwidth, which currently resides at the 400 MHz carrier. RAN1 agreed to a maximum channel bandwidth of 400 MHz in 3GPP Release 15, with the following listed for further study – e.g. above 1 GHz channel sizes, and possibility to support maximum channel bandwidth with carrier aggregation. In particular, "*Carrier aggregation allows for the use of spectrum that is larger than the maximum channel bandwidth. This is of particular interest for mmWave where there are 800 MHz- and 1.2 GHz-wide channels available for use.*" [1]

    (c) Different operator and equipment vendor relationships continue to develop testing the application and limits of the technology. This work is continually being strengthened and evidenced by constant announcements of new 5G firsts being demonstrated around the world.

    (d) Finally, while 5G technologies are expected to deliver improvements to spectral efficiency, 5G will also require radically different network designs if it is to achieve successful deployment in Australia. In other words, 5G network deployments will need significant network investment – especially given the large number of small cell sites needed to deliver ultra-high speeds over mmWave.

MmWave spectrum differs from sub-6 GHz spectrum

14. One of the key enablers for 5G is the availability of suitable radio spectrum. Low frequency bands (sub-1 GHz) offers long-distance wireless signal coverage, augmented with mid band 3.6 GHz which provides higher bandwidths but is effective over a shorter distance. By comparison, the 26 GHz band will have the shortest effective range but the potential for the fastest speeds given the large bandwidth available in the band.

15. The key advantage that mmWave has over low and mid frequency bands currently used for mobile is the large amount of bandwidth available. Higher bandwidth increases cell capacity and supports higher speeds, and also allows the use of transmission techniques that reduce network latency, thereby improving network responsiveness.

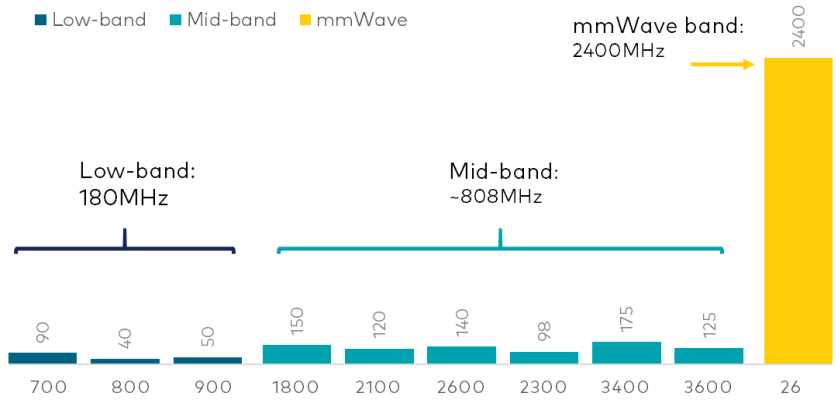
16. This can be clearly demonstrated through the quantum of spectrum available in each of the spectrum licensed bands – low-band[2], mid-band and future mmWave band. Figure 2

[1] See: IEEE Spectrum, "3GPP Release 15 Overview," https://spectrum.ieee.org/telecom/wireless/3gpp-release-15-overview [accessed 12/2/20]

[2] While the 900 MHz band is currently apparatus licensed, it has been included in this context given its significance to the low band spectrum already deployed.

shows the total amount of spectrum being allocated in the 26 GHz band is significantly greater than the aggregate MHz already allocated in the sub-6 GHz ranges.

Figure 2 Spectrum licensed bands in Australia



Source: Optus

17. Despite the advantage that arise from signals at lower frequency propagating over longer distances, a clear limitation is the size of the available bandwidth in each spectrum band. This forms natural limits to the channel sizes that can be deployed, even with carrier aggregation.

18. The key advantage of mmWave spectrum is the ability to access very large amounts of contiguous bandwidths and the ability for larger channel sizes 5G technologies deployed at 26 GHz will provide very high capacity, lower latency and higher reliability than previous mobile technologies. However, higher frequency spectrum is also subject to higher signal losses due to reduced propagation through physical obstacles such as walls, buildings, trees and terrain. Cell coverage for sites at these frequencies will also be limited and often needs to be line of sight.

19. As such, one of the main downsides of mmWave compared to mid- and low-band spectrum, is that to provide the same amount of coverage as for these lower bands, significantly more infrastructure must be deployed, increasing infrastructure costs amongst other externalities. Maximising the benefits to the economy will also require regulatory focus addressing the direct and indirect infrastructure costs for 5G deployment.

Downstream markets impacted by mmWave 5G

20. Competition in mobile markets is important to ensure the economy can achieve the full benefits from new networks and new spectrum allocations. To that end, we support the continual use of allocation limits to ensure no one MNO is able to acquire dominance in spectrum assets to the detriment of competition.

21. The history of the Australian mobile market demonstrates that new technology disrupts the incumbent operators and brings the potential of new competition. But success in the market ultimately depends on access to spectrum. This can be seen by how the introduction of 3G disrupted the market. In the period prior to 2010, the deployment of 3G disrupted the market and Telstra's market share fell to less than 40%. However, Telstra was subsequently able to refarm its spectrum assets (which it was granted prior to privatisation) from 2G to 3G and it recouped these losses. This demonstrates that benefits of technology disruption can quickly be overcome without access to sufficient spectrum.

22. With regards the national mobile market, access to low band spectrum has proven to be a key driver of competition in the Australian market. While the roll-out of 5G presents a new opportunity to disrupt incumbent operators, the ability to do so will be hampered by a concentration of ownership in low band spectrum. Optus remains concerned that low band spectrum remains too concentrated amongst too few operators. There is a total of 180 MHz of spectrum available for use across all sub-1 GHz bands. Currently 130 MHz is licensed for use in the form of spectrum licences; of which Telstra owns 60 MHz; VHA-TPG own 50 MHz and Optus own just 20 MHz.

23. In the enterprise market, it is a similar story. Optus remains concerned that the ability of the roll-out of a new generation mobile technology to disrupt incumbents and bring competitive to an otherwise uncompetitive market, could be limited should any one party be able to acquire a dominant share of mmWave spectrum assets.

24. In general, Optus submits that the downstream markets for mmWave 5G will likely differ from the 5G FWA available today due to the different technical characteristics of the 26 GHz spectrum. Optus is of the view that services reliant on mmWave spectrum are unlikely to represent a national market for downstream broadband services for two important reasons:

    (a) First, the proposed award of spectrum licences in the 26 GHz band is only being allocated in 29 defined areas. These include each of the major metropolitan and some larger regional centres, and which represents approximately 80% of the national population.

    (b) Second, the technical limitations of the spectrum frequency and availability of supported equipment will also impose constraints on the ability to deploy and use the spectrum.

25. As such, mmWave 5G is unlikely to support key mobility and coverage use cases in the same way as traditional mobile technologies. Instead, this will likely support targeted and localised use cases which rely on ultra-fast throughput, to both complement and supplement the provision of services and uses in the different downstream markets.

26. The ACCC considers that the relevant downstream markets are likely to be:

    (a) The national retail mobile services market;

    (b) The fixed broadband market; and

    (c) The enterprise market.

27. Optus agrees these three markets are the key ones to look at, but we further note that services enabled by mmWave spectrum will impact these markets in different ways. Optus' views are outlined below.

Enterprise market

28. The 5G technology standards for mmWave are being designed to support applications that require very low latency, high reliability and the ability to connect large numbers of devices to the network. These features make the technology suitable for enabling automation of factories and warehouses, as well as enabling improvements to the reliability and control of communications in offices, hospitals, education institutions and other similar sites.

29. At this stage, the market typically expects mmWave to enable services primarily designed for enterprises uses. Optus submits that a proper understanding of the current

market environment is vital to understand how access to mmWave could enhance or detract future competition.

30. Optus agrees that the enterprise market for 5G is nascent but continues to evolve as 5G deployment progresses. As noted by the ACCC, the large potential for enterprise markets is the ability for mmWave 5G to facilitate and support connectively to industry verticals for delivery of a range of services and applications.

31. Current market expectation is for incremental 5G revenue to be focused in the enterprise market. Optus notes comments from Government highlighting the lack of competition in the enterprise and the continual dominance of Telstra[3] – and whilst these comments are made in the context of NBN entering the enterprise market, the same comments equally apply to enterprise and mobility.

32. However, the enterprise market has never been subject to a review by competition regulators or policy makers. For example, the 2018 ACCC Communications Sector Market Study, explicitly excluded enterprise market issues from the study.[4]

33. Optus has been, and continues to be, concerned by the level of concentration in the government and enterprise space.

34. Telstra remains dominant in the Government sector. For example, Optus understands Telstra hold approximately 90% market share across several State Governments.

35. Telstra also remains the dominant enterprise network provider. Telstra Enterprise is responsible for revenue of $8.2 billion, around 30% of Telstra's overall revenue. This compares to $1.4 billion of revenue for Optus Business, $758 million for TPG Enterprise, and $710 million of revenue for Vocus' enterprise services. Telstra has an enterprise revenue market share of around 74%.

36. Telstra's advantage in the enterprise market is largely due to its ownership of the legacy monopoly ubiquitous fixed line network. As a result, Telstra has the most extensive reach of fibre tail-ends into corporate buildings. Optus, and other challenger brands, rely heavily on access to Telstra's wholesale business services to compete against Telstra in the enterprise market – many of which remain unregulated.

37. Telstra recently stated that its fibre network extends to over 250,000 km and has 60,000 connected buildings. This compares to Optus with an estimated 48,000 km of fibre and 18,000 connected buildings;[5] TPG has over 27,000 km of metropolitan and inter-capital fibre, with an estimated 1,500 connected buildings; and Vocus has more than 5,500 lit buildings, 15,020 km of inter-capital fibre and 9,500 km of metropolitan and regional fibre in major centres.[6]

38. Telstra has more than three times the number of connected fibred buildings than the next largest provider; and more than 12 times the third largest. Moreover, given the overlap of competitive fibre builds in key CBD and business areas, Telstra's network represents an effective monopoly outside the major business centres.

39. It should therefore not be surprising that Telstra has a commanding lead in the enterprise market. While there is infrastructure competition in CBD and main corporate centres, typically covering only thousands of business premises; business providers, such as Optus, are unable to offer services to national enterprises without purchasing

[3] Minister Fletcher, Speech to CEDA's 40th State of the Nation - The NBN and Productivity, 19 September.
[4] ACCC, 2018 Communications Sector Market Study, p.14
[5] Telstra, 2019, Investor Day
[6] Vocus, Annual Report 2019, p.4

wholesale services from Telstra. Many of these services are not effectively regulated and it is difficult to compete with Telstra Retail on accounts that require a large input of Telstra Wholesale services.

40. Access to mmWave spectrum and the delivery of enterprise services through wireless networks provides an opportunity to challenge Telstra's continuing historic dominance.

National retail mobile services market

41. Optus agrees that the retail mobile services market is a national market for similar but differentiated service served by a combination of MNOs and MVNOs. This will continue to be the case, even with the deployment of mmWave 5G.

42. Optus does not expect mmWave spectrum to materially impact services supplied in the national retail mobile services market. We expect that services (both 4G and 5G) relevant to the national mobile market will continue to be delivered through low- and mid-band spectrum, largely due to the propagation factors explained above. For example, the propagation of 26 GHz spectrum makes it unattractive for mobile services due to small cells size requiring frequent intercell handover, plus the very high investment required to provide sufficient contiguous coverage. Further, the benefits of 26 GHz – ultra-high bandwidth – may not be required for residential mobile services.

43. Another factor that limits the utility of 26 GHz to the national retail mobile market is the geographically limited licence areas. By virtue of the allocation process, operators will not have access to national spectrum licences in the 26 GHz band. As such, it is unlikely that mmWave 5G will result in a national mobile service offering based on mobility use cases, particularly given the technical propagation challenges.

44. That is not to say that the development of mmWave networks and associated services will not impact the national retail mobile market. As noted above, current expectation is that incremental 5G revenue is likely to be achieved through the enterprise market. Any dominance in the enterprise market would likely be transferred through to the competitive national mobile market.

45. For example, while the vast majority of consumer services will continue to be supplied over spectrum other than 26 GHz, we anticipate consumer markets could be impacted through:

    (a) Marketing perceptions created by dominance in the provision of enterprise mmWave services. For example, marketing claims associated with the ultra-high bandwidth available through mmWave spectrum.

    (b) Consumer services supplied by enterprises that acquire mmWave services from the dominant enterprise provider. It is anticipated that consumer services will first develop in focused areas requiring ultra-high bandwidth. Some examples include connected stadiums, airports, shopping precincts, education and tourism centres. It may develop that enterprise owners of these locations offer exclusive access to the retail customers of the dominant enterprise provider that supply the enterprise mmWave service to the business.

Fixed broadband market

46. An early use case for 5G includes fixed wireless access (FWA), which is one technology solution for the provision of fixed broadband services. As noted by industry and the ACCC, FWA will continue to play a limited but important role in this market.

47. Optus notes that NBN Co assumes a certain level of wireless bypass in its corporate plans, typically between 15-25%. Optus sees no immediate reason why the provision of FWA services utilising 5G technology will exceed these expectations.

48. Currently, 5G FWA is provided using mid-band spectrum (currently utilising the 3.5 GHz and 2.3 GHz bands). We expect these mid-band spectrum assets will continue to deliver FWA to the mass market. Optus does not expect mmWave to be a key driver of this market – especially the residential aspects of the market. It is not yet clear whether it would be commercially viable to utilise mmWave for residential FWA given the propagation challenges explained above.

49. Moreover, it is also not clear that the ultra-high bandwidth that flow from mmWave are required in the residential FWA market. Optus observes that our 5G FWA customers, utilising the 3.5 GHz band, are achieving average download speeds around 150 Mbps, with peak speeds of 400 Mbps. As the technology develops, these throughputs are expected to increase.

50. While there may be limited direct impact to the fixed wireless market of FWA, consistent with the above observation on the retail mobile market, we expect there could be indirect impacts. These indirect impacts would flow from the dominance of the enterprise market, and the ability of the dominant enterprise provider to leverage this dominance across related markets (of which fixed broadband market could be one).

SETTING ALLOCATION LIMITS THAT PROMOTE THE LTIE

51. The deployment of 5G will require a mix of different spectrum bands to meet different scenarios relating to coverage, connectivity and latency.[7] As outlined above, mmWave spectrum has niche application initially focused primarily on enterprise uses. The 26 GHz band has been identified as the initial 5G band for mmWave deployments taking place in 2021. The allocation of this spectrum would likely provide significant first mover advantages, especially in the enterprise market.

52. Optus supports the introduction of allocation limits to ensure the development of a competitive 5G market in Australia. As per previous spectrum auctions, the use of allocation limits would prevent the monopolisation of this important mmWave band.

53. Optus submits that an allocation limit that best promotes the LTIE balances the need for sufficient operators while at the same time allowing bandwidths large enough for operators to take advantage of the benefits of mmWave spectrum.

54. The above section discusses the related markets in which services supplied over mmWave spectrum are likely to be utilised. It is noted that the most important related market – the enterprise market – is dominated by one operator which has a dominant and enduring 74% revenue market share. We also note that there is a probability that this dominance, if allowed to continue into the 5G ecosystem, could be used to limit competition in other related markets.

55. The efficient use of the spectrum must also be considered, with any allocation limit still allowing operators to acquire sufficient bandwidth to utilise the spectrum efficiently. As described above, the benefit of the 26 GHz spectrum band is the ability to deploy large bandwidths of contiguous spectrum.

[7] Department of Communications and the Arts, 5G – Enabling the future economy, October 2017, p.7

56. In this section we discuss:

(a) The spectrum that will be made available in the upcoming 26 GHz auction;

(b) Optimal channel size to enable ultra-fast 5G services; and

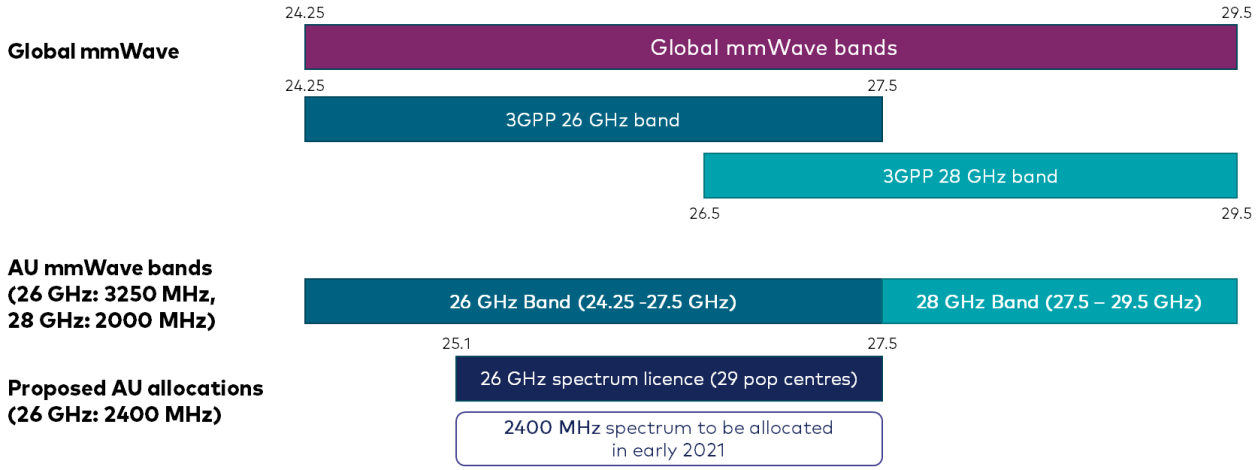
(c) That the optimal allocation limit for this auction is 800 MHz.

Spectrum on offer in this 26 GHz auction

57. The upcoming 26 GHz spectrum auction relates to spectrum that lies within the global 26 GHz band. This will be the first of the mmWave bands to be allocated in Australia. The upcoming auction will allocate a total of 2,400 MHz in the 26 GHz band across each geographic area within the frequency range 25.1-27.5 GHz. The ACMA is still consulting on the geographic lot sizes to be adopted.

58. The interaction of the global band, and Australian allocation is shown below in Figure 3.

Figure 3 Overview of the 26/28 GHz band



Source: Optus

59. Outside the large population centres, access to spectrum in the 26 GHz band will be in the form of apparatus licensing arrangements, including area-wide licences. However, MNOs expect that for efficient allocation and utilisation, the spectrum licences awarded will retain priority within the overall licensing hierarchy. That is, spectrum licence, apparatus licence then class licence.

Optimal carrier size

60. The efficiency of any competition limit adopted for the 26 GHz auction will be impacted by consideration of the optimal 5G new radio (NR) carrier size at that frequency range. The Australian 26 GHz band falls within the global mmWave band that includes spectrum spanning from 24.25 GHz to 29.5 GHz, as well as spectrum in the 37 GHz to 43.5 GHz bands.

61. While 5G equipment and handset availability is still limited, early results suggest that mmWave 5G will utilise carriers with a minimum bandwidth of 50 MHz. For example, 5G NR channels sizes are currently supported at the base station level in the following bandwidth channel sizes, up to 400 MHz channel size for spectrum within the global 24/26/28 GHz band. While 3GPP supports a minimum carrier size of 50 MHz, the technology is not optimised for this bandwidth. Higher bandwidths are expected to be

used in actual deployed networks. By comparison, 4G LTE can support 1.3 MHz carriers but is optimised for 20 MHz carriers.

Figure 4 Supported 5G NR channel sizes

			FR2 NR band (>6 GHz) / SCS / BS Channel BW				
NR band	**Duplex mode**	**Aust Band**	**SCS kHz**	**50 MHz**	**100 MHz**	**200 MHz**	**400 MHz**
n258	TDD	26 GHz	60				
			120				
n257	TDD	28 GHz	60				
			120				

Adapted from: 3GPP Release 16

62. The ability to deploy carrier sizes greater than 100 MHz is one of the main advantages for 5G NR above 6 GHz bands. It is the greater carrier size and ability to access larger contiguous bandwidths of spectrum which enables 5G technology to deliver higher throughput and lower latency.

63. The 5G standards allow up to 400 MHz channel sizes for 26 GHz spectrum. 400 MHz channel sizes would enable minimum average cell throughput of 3 Gbps per channel,[8] and would enable peak data rate of 12 Gbps.[9] Optus notes that an aggregate 800 MHz bandwidth is required in order for mmWave spectrum to support the minimum 5G peak data rate of 20 Gbps required in 5G standards. The spectrum needs to be contiguous to avoid spectral inefficiency and coexistence issues.

64. In addition to larger carrier sizes, technology advances over the next few years should also include developments like 'massive multiple-input and multiple output (MIMO)', which allows for the transmitting and receiving of more than one signal over the same channel. These developments will allow greater speeds, improve latency, and increase the number of devices able to be simultaneously connected to each cell.

Optimal allocation limit is 800 MHz

65. Optus submits that an allocation limit of 800 MHz best balances the need to ensure spectral efficiency and ultra-high throughput with the need to ensure competition can be delivered in important downstream markets. Specifically, an:

    (a) 800 MHz limit allows deployment of multiple 400 MHz channels, thereby ensuring that Australian operators can deliver 5G services exceeding the minimum specifications required by the ITU;

    (b) 800 MHz limit is consistent with the growing number of overseas markets, thereby enabling international consistency and scale;

    (c) 800 MHz should ensure that the full spectrum band is likely to be acquired by companies that are able to deploy 5G services, thereby ensuring that spectrum is not left idle; and that

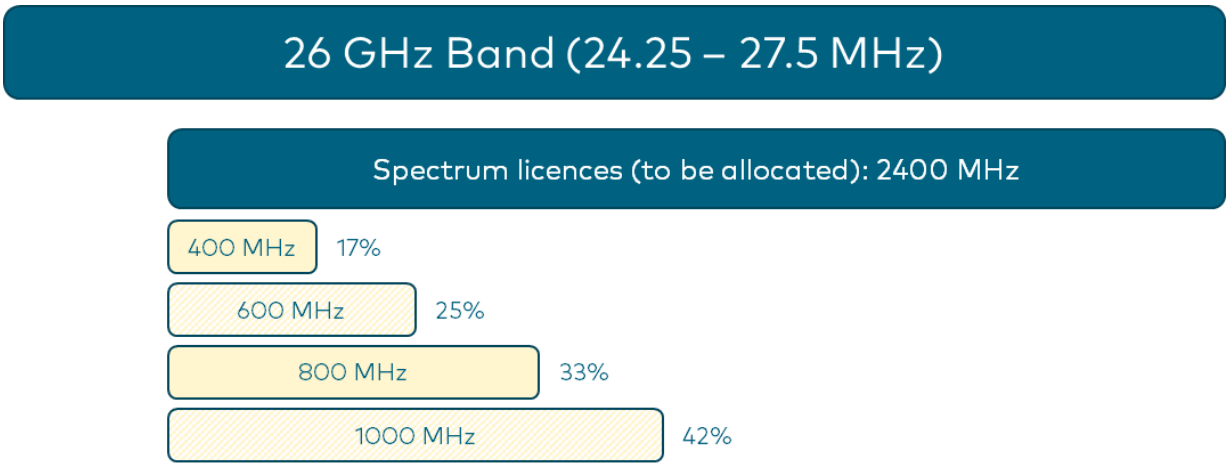
    (d) Any limit greater than 800 MHz poses a material risk that mmWave will be dominated by one or two firms to the detriment of Australian consumers and businesses.

[8] 5G specifications require a minimum average spectral efficiency of 7.8 bps/Hz in dense urban means cell capacity of 3 Gbps per cell for a 400 MHz carrier.

[9] 5G specifications require a minimum peak spectral efficiency of 30 bps/Hz in dense urban

66. Figure 5 below shows the distribution of viable 5G NR channel sizes across the 2,400 MHz of spectrum to be auctioned. This clearly illustrates the trade-off between the number of operators that can be supported in the band, and ability to acquire larger blocks. The larger the block allocated to one operator, the lower the number of operators the band will be able to support overall.

Figure 5 Overview of spectrum licences to be awarded in the 26 GHz band



Source: Optus

67. For example, an allocation limit set at 800 MHz represents 33% of the total 2,400 MHz on offer in any given geographic area, providing an opportunity for two additional operators to deploy an 800 MHz channel. This can be compared to higher competition limits (e.g. 1,000 MHz) which would effectively preclude another operator from deploying a channel size sufficient for optimal 5G services.

68. There have been limited allocations of spectrum in the 26/28 GHz bands in other jurisdictions. However, where it has been allocated – spectrum allocation limits and/or eventual allocation outcomes have generally seen successful operators being awarded with no more than 800 MHz of mmWave spectrum.

69. For example, in Hong Kong the regulator decided to impose a spectrum cap of 800 MHz for the amount of Non-shared Spectrum in the 26/28 GHz bands[10] which may be held by an assignee for providing large scale public mobile services[11] on the basis that:

> *While 400 MHz is the maximum channel bandwidth currently allowed by the 5G technical standard specifications, a bandwidth of 800 MHz (by aggregating multiple 100 MHz slots based on the band plan adopted by the CA for the 26/28 GHz bands) is required for providing the peak downlink speed of 20 Gbps targeted by ITU for the 5G eMBB services.* [12]

[10] In this context, the 26 GHz band (24.25-27.5 GHz) and the 28 GHz band (27.5-28.35 GHz) are collectively referred to as the 26/28 GHz bands. The Communications Authority also made a decision that within these bands, 3700 MHz spectrum as Non-Shared Spectrum for provision of large scale public mobile services; and 400 MHz of spectrum as Shared Spectrum for provision of localised wireless services including fixed services.

[11] Joint Statement of the Communications Authority and the Secretary for Commerce and Economic Development, 2018, Allocation of the 26 GHz and 28 GHz Bands to Mobile Service and the Associated Arrangements for Spectrum Assignment and Spectrum Utilisation Fee, 13 December, p.10

[12] See Annex, p.15 to Joint Statement of the Communications Authority and the Secretary for Commerce and Economic Development, 2018, Allocation of the 26 GHz and 28 GHz Bands to Mobile Service and the Associated Arrangements for Spectrum Assignment and Spectrum Utilisation Fee, 13 December

70. Optus considers there is sufficient spectrum available to support at least three operators in the 26 GHz band, but more importantly it provides an opportunity for each of the three operators to acquire 800 MHz; and deploy two 400 MHz carriers. This is an important consideration, as the economic cost of unused spectrum is extremely high.

71. An 800 MHz allocation limit does not prevent there being more entrants into the market, and indeed the more participants in the auction with an 800 MHz allocation limit, the stronger the bidding tension. Optus observes market expectations that over-the-top providers have indicated interest in mmWave spectrum, and we note that previous 5G auctions have seen non-MNO companies acquire spectrum.

72. Furthermore, there is currently no substitutable mmWave spectrum bands, therefore allowing an operator to gain more than 800 MHz risks monopolising the available spectrum with one operator, while potentially reducing the spectrum utilisation and efficiency of use of the same spectrum by other spectrum licensees.

73. Allowing only two operators to obtain more than 800 MHz at auction risks monopolising the spectrum asset and will potentially stymie future investment in the mmWave bands. Further, as observed above, the deployment of a new generation of mobile technology brings along the ability of challenger and new entrant networks to challenge incumbent providers. The history of the Australian mobile market shows the importance of each new mobile generation to competition and how equitable access to spectrum is key to ensure sustainable competition.

Allocation limits across the 26 GHz Band should apply to all areas

74. The upcoming 26 GHz band auction also proposes to allocate spectrum across 29 geographic areas, with the exception of Perth and Bunbury, the full 2400 MHz will be allocated in the 26 defined areas. For Perth/Bunbury, 1900 MHz will be available on a combined basis, with additional 500 MHz to be allocated to Perth and Bunbury on an individual basis.

75. In setting allocation limits for the 26 GHz auction, there are several key observations from previous auctions that should continue to apply:

    (a) Allocation limits are generally set at a level to ensure a level playing field across all potential bidders, while still providing some auction tension to ensure price discovery; and

    (b) Where bidders already held spectrum in the same spectrum range through other allocation processes, the allocation limit would combine these holdings with the current auction to determine the total holdings.

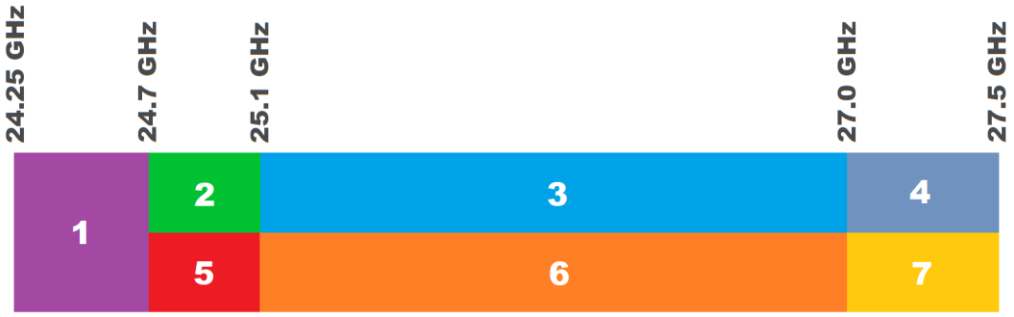
76. The case for an 800 MHz allocation limit is also supported in consideration of the Perth and Bunbury geographic areas, which will ensure that at least two operators can acquire sufficient spectrum to deploy efficient 5G services and will have the opportunity to deploy an 800 MHz channel.

77. Optus recommends that the efficient outcome for the auction would be best achieved by setting allocation limit at 800 MHz in all areas, to support the opportunity for at least three operators. As shown above, absent an allocation limit, the ability for operators to obtain sufficient spectrum to deploy efficient 5G services and still support competition in the band is increasingly diminished.

Other available spectrum in the 26 GHz and 28 GHz bands

78. The ACMA's 26 GHz band planning decision outlines the proposed licensing arrangements to be applied in the band (see Figure 6). In addition to the award of spectrum licences, use of the spectrum outside the defined spectrum licensed areas will also be made available through apparatus and class licensing arrangements.

Figure 6 Planned arrangements for wireless broadband service in the 26 GHz band



1 Class-licensing for indoor use (Australia-wide).

2 Class-licensing for indoor and outdoor use (Australia-wide).

3 Spectrum licensing defined areas. Includes additional conditions to protect SRS earth stations.

4 Spectrum licensing with additional FSS coexistence conditions within certain areas.

5 Apparatus licensing (Australia-wide).

6 Apparatus licensing (Australia-wide, except defined areas). Includes additional conditions to protect SRS earth stations.

7 Apparatus licensing with additional conditions to protect FSS uplinks (Australia-wide except defined areas). New FSS earth stations will also be permitted, on a first-in-time coordinated basis with apparatus licensed wireless broadband services.

Source: ACMA

79. The ACMA as part of its TLG process has also consulted on the apparatus licence technical framework for the 28 GHz band (27.5 – 29.5 GHz), given the potential complementarities in the apparatus licensing that would be issued in the 26 GHz band. Specifically, within the same defined areas as the 26 GHz band to be spectrum licensed, the ACMA notes that:

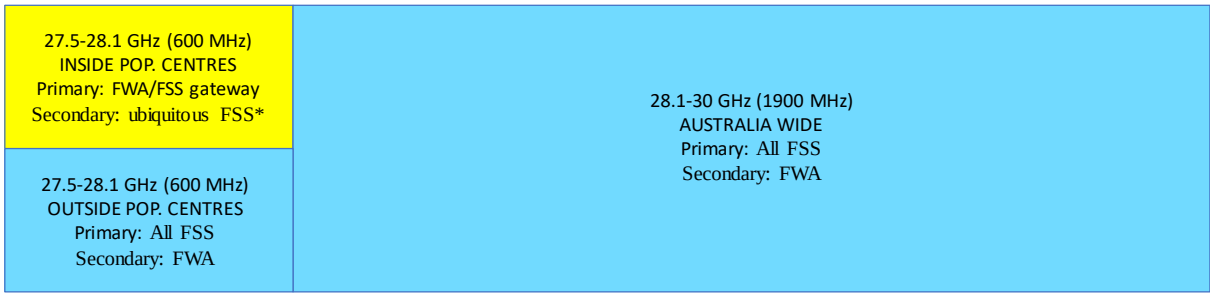
> *In the frequency range 27.5–28.1 GHz and inside large population centres, FWA services will operate on a co-primary basis with apparatus licensed FSS earth stations and will be afforded protection from ubiquitous FSS.*[13]

80. The ACMA's 28 GHz band planning decision outlines the proposed apparatus licensing arrangements to be applied in the band (see Figure 7). Notably, the ACMA considers the implementation of apparatus licensing arrangements for FWA services in the 28 GHz band to operate on a no protection basis from FSS services Australia-wide (with the exception of the defined areas in the frequency range 27.5-28.1 GHz); and to operate on

[13] ACMA, 2019, Future of the 28 GHz band: Planning decisions and preliminary views, September, p.15

a first-in-time coordinated basis with respect to other FWA stations all areas and frequencies.

Figure 7 Proposed arrangements for the 28 GHz band



** The possibility of this, including any restrictions on use, will be further investigated*

Source: ACMA

81. It follows that while there may be complementarities in the potential use and issue of apparatus licences across the two bands (26 GHz and 28 GHz), this should not be the forum to discuss any future restrictions on the take up or award of these non-spectrum licence types.

82. While we acknowledge this raises the potential for a single licensee to 'hoard' significantly large bandwidths of the available apparatus licences, there remains insufficient evidence to support the imposition of any allocation limits for these licence types at this stage.

Spectrum licences retain primacy of rights in the licensing hierarchy

83. Optus remains strongly of the view that the hierarchy of licence types should be clearly defined and respected. Spectrum licences should ensure that property rights of spectrum licensees are not compromised. Tenure and ability to use spectrum as purchased should be upheld.

84. In terms of whether allocation limits should be considered outside the spectrum licensed areas, i.e. the areas subject to apparatus licences, Optus considers that this falls outside the scope of this consultation.

85. Apparatus licences are complementary to spectrum licences. They operate in areas, which may be co- or adjacent-channel to the defined areas available for wide-area spectrum licensing where users are expected to deploy wireless broadband services (as the primary service). As noted in the ACMA's 26 GHz band decision paper, the ACMA formed the preliminary view that:

> *… defined areas should consist of towns/cities with a population over 50,000 as well as smaller towns/cities which, due to them being either holiday locations or having university campuses, are expected to require the deployment of high-density wireless broadband services.*[14]

86. The ACMA also acknowledged that wireless broadband services would also be authorised by apparatus licences outside of defined areas.

[14] ACMA, 2019, Future use of the 26 GHz band: Planning decisions and preliminary views, April, p.5

87. Specifically, the ACMA was cognisant of the scope for multiple authorisation regimes to be made available in the 26 GHz band. As such, *"this mix of spectrum, apparatus and class licensing provides not only for the protection of incumbent users, but also provides for the appropriate mix of potential wireless broadband network types."*[15]

88. Optus supports this position to the extent that the spectrum licensing hierarchy is not compromised, and that spectrum licences retain primacy of property rights in the spectrum licensing framework.

[15] ACMA, 2019, Future use of the 26 GHz band: Planning decisions and preliminary views, April, p.12