Proposed spectrum re-allocation declaration for the 3.4 GHz and 3.7 GHz bands

TPG Telecom response

1. EXECUTIVE SUMMARY

TPG Telecom Ltd (**TPG Telecom**) welcomes the opportunity to provide input into the ACMA's consultation regarding the Proposed spectrum re-allocation declaration for the 3.4 GHz and 3.7 GHz bands (referred to as 'C-Band' spectrum in this submission).

This ACMA consultation addresses an array of topics including: frequency bands, licence types, geographic regions, and auction methodologies. Each topic is critical in the allocation of what will be a vital band for many existing and prospective technology operators.

TPG Telecom supports the submission on this same consultation from the Australian Mobile Telecommunications Association (AMTA) and has provided additional detail on areas of particular interest to our business.

Demand for spectrum licences in C-Band is likely to be driven by Mobile Network Operators (MNO). Generally, an MNOs requirement for additional C-Band spectrum is a direct function of compounding customer data usage growth. C-Band represents the primary spectrum resource both for 5G services today and well into the foreseeable future. This forecasted capacity requirement is driven by growth in the areas of both mobility and Fixed Wireless Access (FWA). MNOs will be required to balance these use cases closely to ensure network consumers are not disadvantaged by network congestion.

It is anticipated that there will be geographic variations to the demand for this spectrum. Traditionally, demand for spectrum licences in metropolitan areas is much greater than in regional areas due to higher population densities.

The shift to working from home, which was accelerated by the COVID-19 pandemic, highlighted the need for high quality 5G data services in residential areas. Delivering more C-Band to metropolitan residential areas is a challenge requiring a pragmatic approach to geographic boundaries. TPG Telecom considers the 3400-3475MHz Urban Excise Urban Excise product represents a missed opportunity to deliver important services to consumers in these areas. Licence conditions and metro boundaries that inhibit residential macro C-Band deployment both impact negatively on the utility of the proposed Urban Excise product.

TPG Telecom acknowledge the need for the Area Wide (Apparatus) Licences (AWL) and their co-existence with Spectrum Licences. The frequency and geographic boundary issues between AWL's and Spectrum Licence holders, such as MNOs, represent a challenging operational interference landscape. TPG Telcom consider that if the 3400-3800MHz band were to be fully reserved for Spectrum Licences, a better outcome for licensees will be realised; and ultimately result in a flow-on benefit to consumers. Given the similarities of the MNOs technology platforms, such an approach represents an efficient use of spectrum and results in a potential reduction of interference coordination and mitigation requirements.

Finally, long-duration licence terms, such as twenty years, coupled with commencement shortly after the spectrum auction, provide certainty and continuity required to support costly network infrastructure deployment.

2. Spectrum licences in the 3400–3475 MHz frequency range in Urban Excise areas

TPG Telecom's preference is for ACMA Option A in Urban Excise Areas.

TPG Telecom is of the view that in its proposed form and timing the 3400-3475MHz Urban Excise spectrum is severely limited in its utility.

The licence conditions attached to this spectrum significantly impact its viability. Existing NBN Co. fixed wireless technology impede deployment within what are already constrained geographical areas. With the details of any NBN Co upgrade uncertain, and any evolution potentially several years away, the viability of the Urban Excise spectrum product is reduced to either very low power applications such as In-Building Cells (IBC) or severely curtailed directional antenna deployments.

The COVID-19 pandemic brought pressures on MNOs to deliver high-capacity data service to residential areas more than ever. Coupled with existing residential demands of internet and streaming services organisations and government alike embraced the flexibility that working from the home has brought the community. This flexibility, however, is made possible by high quality data services delivered by macro sites to the locations where consumers reside.

A consequence of poor geographical spectrum boundaries in metro residential areas, such as those that comprise Urban Excise, is that the spectrum and deployment efficiencies aren't able to be realised, negatively impacting spectrum utility.

The ACMA's own Urban Excise coexistence studies in 2021 on macro site deployment found:

- *"Macro cell network may be possible in Canberra and possibility [sic] in parts of Sydney with some mitigation measures employed.*
- *Appears difficult to deploy a macro cell network in other capital cities without significant mitigation measures being employed – starts to approach a restricted cell model"* [1]

The outcomes of this ACMA study confirm the lack of utility of this product for macro deployment in the majority of capital cities, leaving MNOs to improve capacity by other means such as densification. Unfortunately, densification of the scale required is not feasible and represents a time-consuming undertaking, would draw the ire of residents, and aside of which, would be prohibitively expensive.

Given both limitations, the Urban Excise product is today not a viable substitute for the 3700-3800 MHz spectrum and given the uncertainty around NBN's Fixed Wireless network upgrade to 5G, TPG Telecom is of the view that the re-allocation of the 3400-3475 MHz part of the spectrum would be better if it were to be decoupled from the other bands and delayed by 2~3

[1] ACMA, "3.4 GHz urban excise coexistence studies." Australian Communications and Media Authority- TLG Presentation. 12 May 2021

years; and certainly only after NBN Co committed to the implementation of best-practice 5G platform.

3. Frequency planning options for 3400–3575 MHz and 3700–3800 MHz

TPG Telecom proposes an 'Option 4' which involves the 3400- 3800MHz band to be fully reserved for Spectrum Licences (except in Remote Australia).

The frequency planning and geographical configuration (see section 9) are intrinsically linked to overall spectrum utility and hence its value. TPG Telecom welcome the three ACMA options and consider that an Option 4 represents the ideal combination of elements of the other three options and some additional suggestions. The result would be an option with the potential to deliver a better frequency planning outcome for both the 3.4GHz and 3.7GHz bands. See 1 Figure 1 and Figure 2.

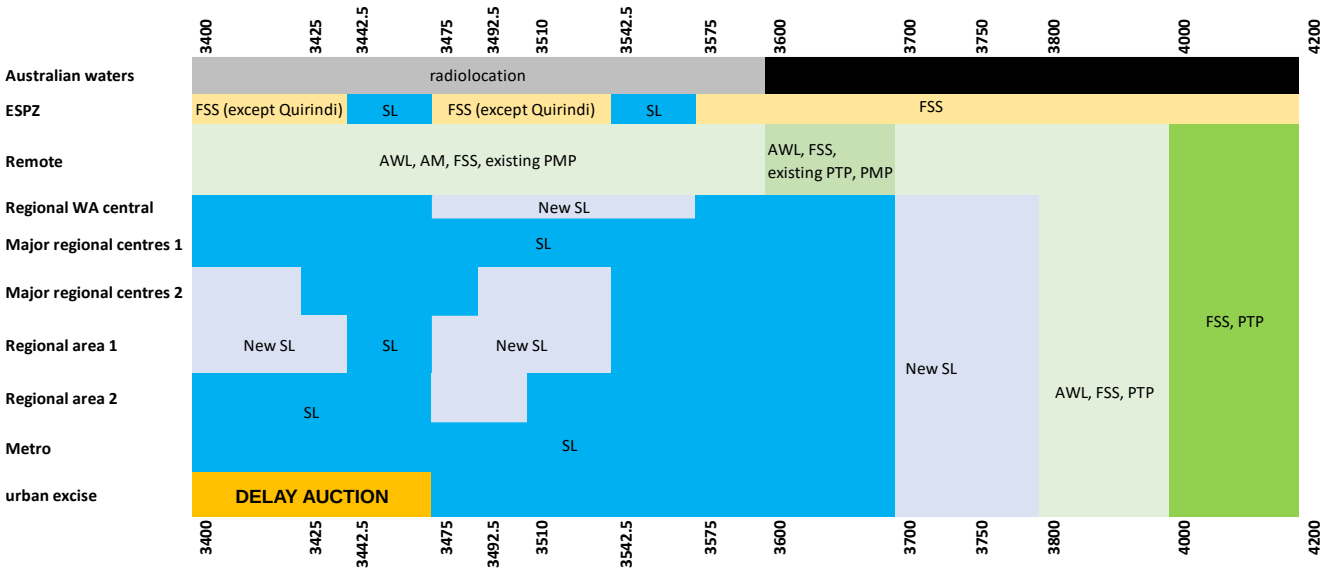

Figure 1 - TPG Telecom "Option 4" Proposal Summary

Note: Figure 1 still employs the Area Names as per ACMA proposal, however 3700-3800MHz as per TPG Telecom proposal doesn't follow those geographic definitions. Please refer to Figure 3 and Section 9 Lot configuration (Geography) for more details.

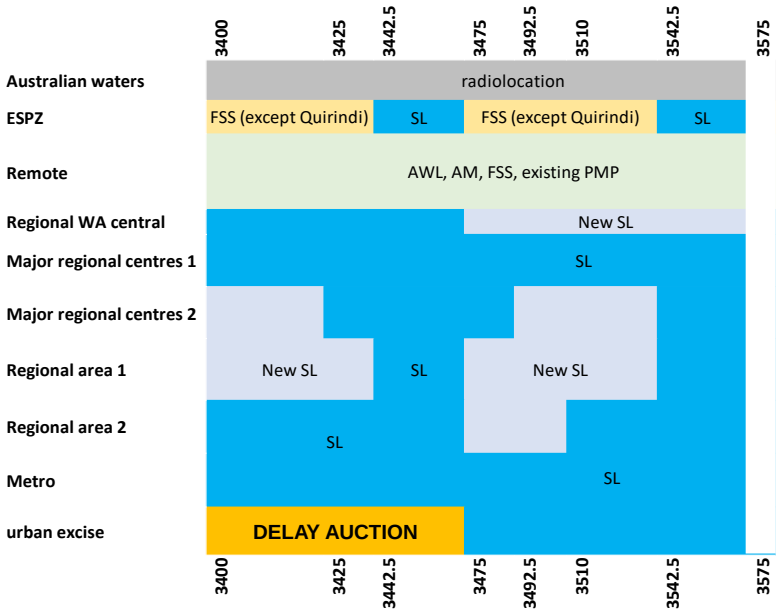

Figure 2 - Regional 3.4GHz Frequency Planning

While AWLs fulfil a niche in the market, TPG Telecom's recommendation for 3400-3800MHz Spectrum Licences is designed to better manage likely adjacent frequency interference. Managing interference with one or two other spectrum licence holders is preferable to doing so with a multitude of AWL holders (as would be the case in metro fringe areas under ACMA's Option 3). The MNO to AWL interference dynamic is often characterised by factors not present in MNO to MNO. Disparate technology types, privation of technical capacity, and an unwillingness to engage in a mutually beneficial solution, are all potential issues of the MNO-AWL interference management dynamic.

TPG Telecom finds that 3800-4000MHz for AWLs would be ample spectrum for smaller licensees, given their use cases would not necessarily overlap geographically and are typically less bandwidth-intensive than for large scale mobile and FWA networks.

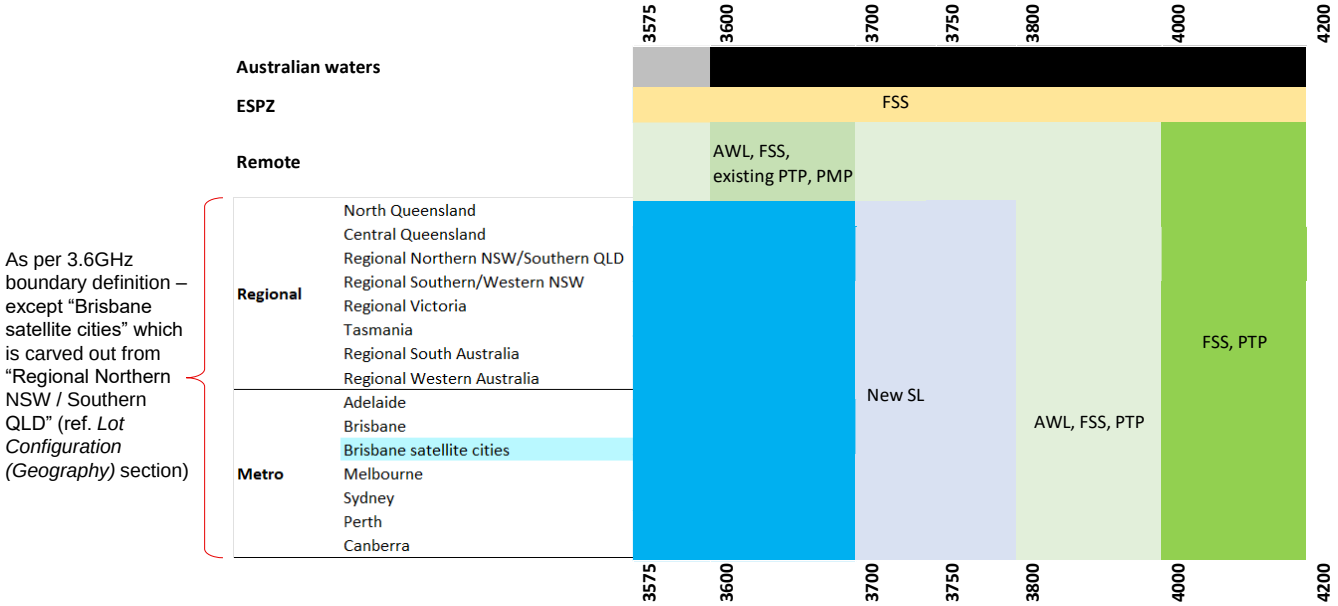

Figure 3 - 3700-3800MHz Frequency Planning

Should Option 4 be disagreeable to the ACMA, TPG Telecom's next preferred outcome would be ACMA Option 3, **but** with the modified 3.6GHz geographic boundary definitions still adopted for Metro **and** improvement applied as outlined in AMTA submission.

Simply having access to more C-Band holdings in more parts of the country provides benefit to consumers for both mobility and FWA use cases. Given the frequency positions of both bands under Option 4, and to a lesser extent under Option 3, existing C-Band licensees are afforded the opportunity to restack defragmented spectrum holdings from the 3.6GHz band; with the resulting coalesced spectrum block ideally suited to 5G technology implementation. See Figure 1.

In summary, the TPG Telecom recommendation constitutes a frequency planning arrangement that draws on the best features of the three ACMA options coupled with the implementation of a fully reserved 3400-3800 band of Spectrum Licences.

4. Licence Type

TPG Telecom supports Spectrum Licences for 3.4 GHz (including in regional areas and in urban excise areas) and 3.7 GHz bands.

Contiguous and consistent licence types and boundaries are essential to maximise spectrum utility. The ability to execute spectrum re-stacks coupled with the reduction in transmitter

dead-zones represent key advantages of Spectrum Licences. It is for the very same reasons that TPG Telecom consider that the currently unlicensed 3.4GHz ought to become subject to Spectrum License conditions. See Figure 2.

Finally, TPG Telecom's preference for a so-called "Option 4" (refer to Section 3) supports the argument to have consistent frequency boundaries between Spectrum Licences and AWLs across the country.

5. Parts of the spectrum

Refer to Section 3- Frequency Planning Options of this document.

6. Re-allocation period and deadline

TPG Telecom supports a 2-year re-allocation period.

The pressure to deliver fast 5th generation cellular services to consumers is acute. Demand is high in the areas where consumers live, work, socialise, and the transport corridors that connect these locations. Having access to adequate levels of C-Band spectrum is key to meeting the growing customer demands anticipated by 2025. TPG Telecom's view is that a re-allocation period of 5 years is too long, and a more appropriate re-allocation period of 2 years is preferred.

The reason for a shorter allocation period is in recognition of the very fast growth of 5G traffic levels. In particular C-Band 5G represents an important resource for FWA services for which the current holdings would, combined with mobility services, become exhausted before the end of the 5 year allocation period proposed by ACMA.

Additionally, it is TPG Telecom's experience that a small number of incumbents can have an outsized effect on deployment / spectrum activation. Having a shorter re-allocation would mitigate such issues.

If the ACMA does not deem a 2 year re-allocation period to be feasible, TPG Telecom suggests employing a tiered system similar to what was used in the 3.6GHz re-allocation. For example:

- 2 years for low incumbency areas (most Metro areas) or if the incumbents can re-tune their equipment, as was often the case in the 3.6GHz re-allocation.
- Longer re-allocation for areas where incumbents cannot re-tune (eg. to 3800-4000MHz) and have to relocate or replace their equipment.

7. Licence term and commencement

TPG Telecom supports a long-duration licence term of 20 years for the 3.7GHz spectrum band

In contrast, and for the reasons articulated below, **TPG Telecom supports a short-duration licence expiry on 13 December 2030 for the 3.4GHz spectrum band**

Furthermore, TPG Telecom supports commencement *"shortly"* after the auction. Under such an arrangement incumbent licensees could be protected from the effects of any interference until the re-allocation deadline.

Long-duration licence terms provide certainty and continuity required to support the large network infrastructure deployment costs. Long durations encourage defragmentation and better return on equipment investment, which ultimately translates into better outcomes for our consumers. It is for these reasons that a long-duration licence term of 20 years is suited to the high utility of the 3.7GHz spectrum band.

In contrast to 3.7GHz the 3.4GHz band has other relevant constraints. Most notable is the necessity of 3.4GHz in regional areas to align with 3.4GHz urban licence terms for there to be any prospect of a spectrum re-stack. TPG Telecom supports a short-duration licence expiry on 13 December 2030 for the 3.4GHz spectrum band.

8. Lot configuration (Frequency)

TPG Telecom supports a 5MHz lot configuration (Frequency)

A primary technical consideration of 5G network operation is channel width of a multiple of 10/20MHz. Channel widths that are not a multiple of 10/20MHz are difficult to fully exploit resulting in 'stranded/orphaned' fragments of spectrum holdings.

As all existing C-Band spectrum licence holders have spectrum indivisible by 10MHz TPG Telecom considers single 5MHz lots would better to minimise the risk of uneconomical spectrum net outcomes. 5MHz lots would allow existing C-Band licensees to top up their holdings and remedy the stranded 5MHz blocks of previous C-Band auctions. As such, TPG Telecom's preference is for 5MHz lots rather than the 10MHz preference of the ACMA.

9. Lot configuration (Geography)

TPG Telecom also supports disaggregated spectrum lots.

In the context of disaggregation vs nationwide lots, TPG Telecom would challenge the suggestion that the *"lots will be informed by potential bidders' expected use of the spectrum*". Having deployed networks nationally TPG Telecom holds the view that smaller disaggregated geographical lots provide flexibility; allowing bidders to focus their energies to specific geographical areas of forecast consumer demand and/or complement existing C-Band holdings rather than a blanket nationwide approach. This also leads to TPG Telecom's preference for separate products for each metropolitan area.

There are large disparities between existing C-Band holdings of MNOs in many cities across the country. For example, Sydney (where TPG for example holds 65MHz) and Adelaide (where TPG holds 90MHz). Without disaggregated lots there is a loss of spectrum utility as MNOs are forced to "top-up" a collective metro holding by the same quantum of spectrum. Much improved utilisation would result from being able to customise demand to each region to the level of top-up required. Importantly, this view is consistent with the overarching intent of Highest Value Use.

TPG Telecom supports geographical lot configuration boundaries consistent with those of the 3.6GHz spectrum nationally <u>but with a modification in South-East Queensland</u>; namely carving out a "*Brisbane Satellite Cities*" product that encompasses the combined Toowoomba, Sunshine Coast, Gold Coast and Far-Northern Rivers regions.

TPG Telecom's view is that the opportunity to design larger more effective metro C-band geographical boundaries was missed with earlier 3575-3700 MHz ('3.6GHz') spectrum allocation activities. Given the constraints of existing legacy boundaries, and a willingness to avoid further imposition of managing a different boundary, TPG Telecom could accept the 3.6GHz boundaries for the 3.7-3.8GHz spectrum band.

Mimicking the existing 3.6GHz boundaries allows licensees the potential to restack defragmented holdings down the track, and to realise the consumer benefits provided by contiguous 5G spectrum holdings. Introducing different boundaries would result in insurmountable commercial barriers to restacking which, notwithstanding the incentives, is already beset with challenges.

This principle cannot be understated as TPG believes restacking spectrum post allocation is a fundamental step that is almost inevitable. Where a spectrum restack is attempted and license holders negotiate to move to different parts of the band in order to consolidate previous and newly allocated holdings, it only becomes possible if the allocations concerned share the same geographic boundaries. Where boundaries differ for related products, a value discussion is forced due to holdings spectrum volumes that also differ. The value consideration is based upon primarily population differences between the overlapping products, and to a lesser extent coordination challenges and other factors, and if not already intuitive, in TPG's experience it is

impossible to converge on a common view of value in such discussions, as inevitably financial compensation from one license holder toward another is required for a “true up”. The magnitude of this problem is magnified when many license regions are considered and several license holders are involved.

Although the existing 3.6GHz geographic boundaries cater for most metropolitan population centres, TPG Telecom considers South-East Queensland (SEQ) the notable exception where the ability to restack can still be preserved. It is our view that the major metropolitan regions of the Toowoomba, Sunshine Coast, Gold Coast and Far-Northern Rivers regions, given their site density and population (both transitory and local), warrant a combined geographical product (ref. Table 1); and therefore, recommend carving them out of the Northern NSW and SEQ regional product.

SA4	Population	TPG sites
Gold Coast	646,938	157
Sunshine Coast	390,287	77
Richmond - Tweed	261,032	51
Toowoomba	163,029	25
Brisbane SA4's for comparison:		
Brisbane - East	247,191	51
Brisbane - North	231,164	59
Brisbane - South	384,862	85
Brisbane - West	199,057	37
Brisbane Inner City	293,900	130

Table 1 - Brisbane satellite city population & site statistics

Note: the Far Northern Rivers region is also included in the carve-out, referred to as “Richmond – Tweed” in Table 1. Please refer to Appendix A for further details on TPG Telecom’s proposal for the *Brisbane Satellite Cities* carve-out.)

It is noteworthy that the carve-out does create additional geographic boundaries. It is felt that the impost of managing additional boundaries, many of which are in less populated areas, is offset by improved localised disaggregated lots. Furthermore, if the SEQ/NNSW region is split as two exact substitutes to the original 3.6GHz region, then the ability to restack is retained from a commercial perspective.

Allowing Licensees to focus deployment activities to these emerging metropolitan regions will ultimately benefit consumers who both reside and visits these major tourist centres. As can be seen in Figure A.2 in Appendix A, the 3.4GHz boundaries have been followed where possible to keep spectrum re-stack options open in the future. However, while they are more inclusive than 3.6GHz boundaries, the 3.4GHz boundaries still do not include Sunshine Coast or the Far Northern Rivers, hence these have been added in the carve-out.

TPG recognises that the 3.6GHz boundaries cannot be applied to Regional 3.4GHz and hence support ACMA’s current proposal for this part of the spectrum. Having different boundaries

makes it extremely difficult for operators to agree to re-stack but TPG is of the opinion that re-stack within 3575-3800MHz is more feasible and hence more of a priority. Disparate boundaries between 3.4GHz and 3.7GHz may lessen substitutability between products, however TPG is of the view that product substitutability within the auction is a much lower priority than:

1) maximising re-stack potential,
2) having boundaries that maximise spectrum utility, and
3) having boundaries that cater for demand granularity.

10. Allocation methodology

TPG Telecom supports the use of 2-stage generic lots clock auction format.

TPG Telecom also proposes an automatic contiguity system for assignment, whereby:

- If a bidder acquires spectrum in the 3700-3800MHz band in a given region and they hold an existing 3695-3700MHz lot in the same region, then their newly acquired 3.7GHz holdings will be given priority assignment at the bottom of the 3.7GHz band (primarily concerns TPG Telecom and Optus).
- Ideally a similar scheme should be implemented for Regional 3.4GHz, however this will not be possible if the “leftover” 2.5/7.5MHz lots are tied to a certain position in the band, as is currently proposed by ACMA.

This would serve to ensure more contiguous spectrum holdings and hence higher spectrum utility.

11. Minimum spectrum requirement (MSR)

TPG Telecom supports the use of the Minimum Spectrum Requirement feature.

With TPG Telecom’s proposal of 5MHz lots, bidders may be left with holding sizes indivisible by 10MHz. The worst-case scenario of such cases would be a low-utility stranded 5MHz. This risk is mitigated by enabling MSR; hence striking the right balance between catering for granular demand and maximising spectrum utility.

Given all existing C-Band spectrum licence holders have spectrum indivisible by 10MHz, TPG Telecom considers two-lots of 5MHz (i.e. a 10MHz MSR) would better avoid uneconomical auction outcomes. Rather than the ACMA preference of two-lots of 10MHz (i.e. a 20MHz MSR)

Appendix A- Brisbane Satellite Cities

Toowoomba, Sunshine Coast, Gold Coast & Northern Rivers carve-out from Regional Northern NSW/Southern Queensland 3.6GHz boundaries (“Brisbane Satellite Cities”) as show in Figures A.1 and A.2 and HCIS in Table 2.

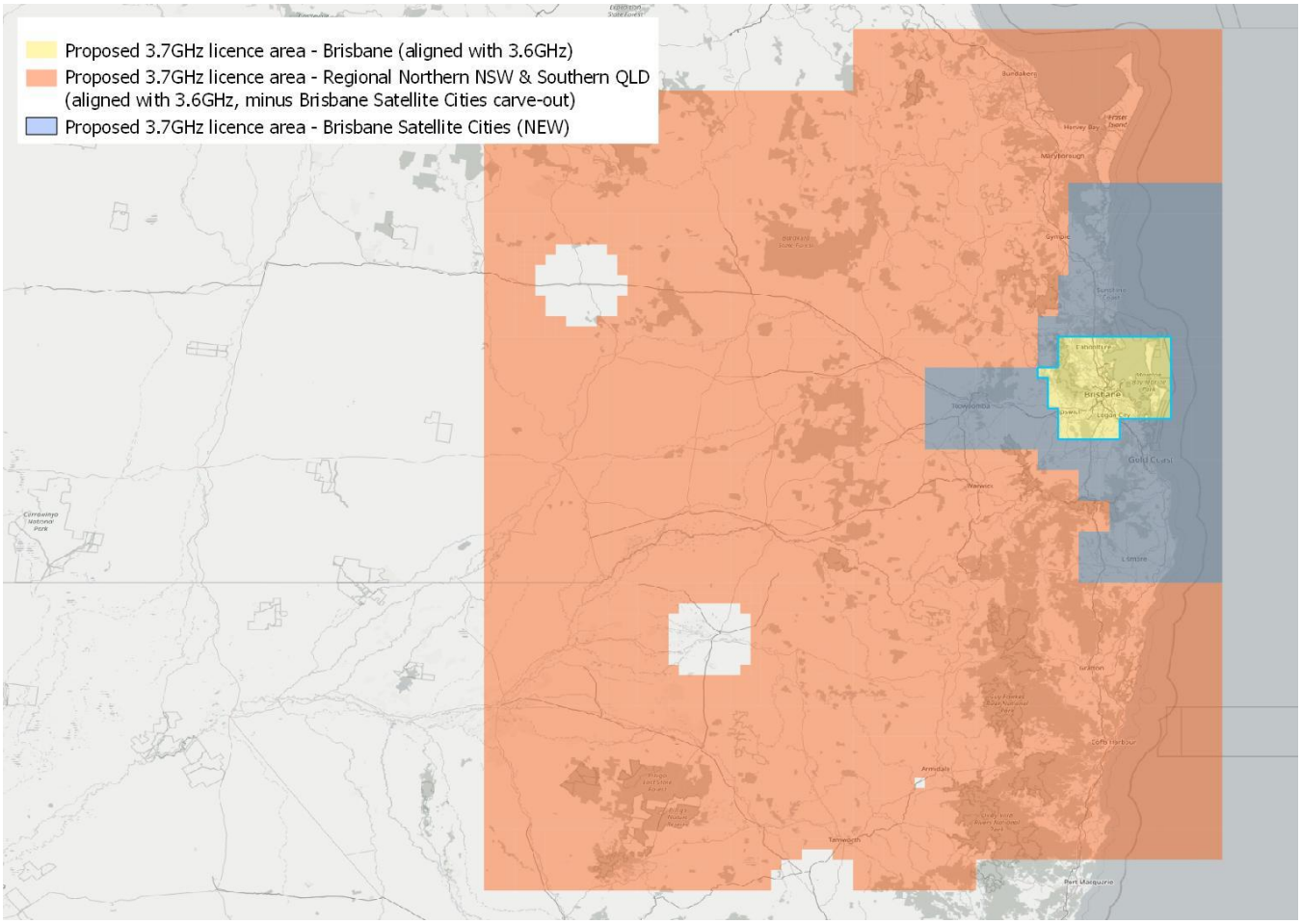

Figure A.1 – Brisbane Satellite Cities carve-out from Regional 3.7GHz

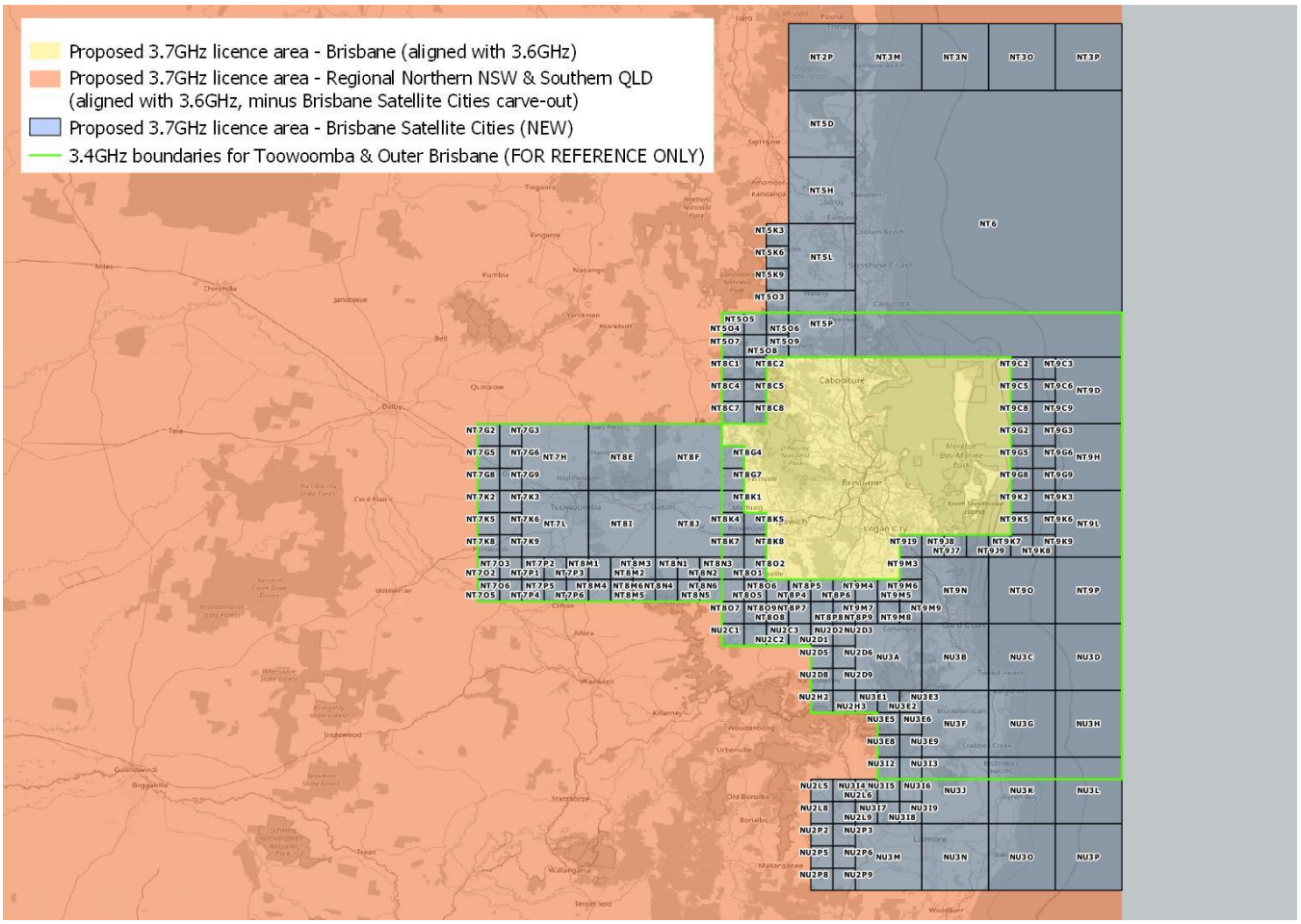

Figure A.2 - Close-up view of the Brisbane Satellite Cities carve-out

The *Brisbane Satellite Cities* HCIS are as follows:

Below HCIS to be separated out from the 3.6GHz Regional Northern NSW/Southern Queensland boundaries:	
Brisbane Satellite Cities	NT2P, NT3M, NT3N, NT3O, NT3P, NT5D, NT5H, NT5K3, NT5K6, NT5K9, NT5L, NT5O3, NT5O4, NT5O5, NT5O6, NT5O7, NT5O8, NT5O9, NT5P, NT6, NT7G2, NT7G3, NT7G5, NT7G6, NT7G8, NT7G9, NT7H, NT7K2, NT7K3, NT7K5, NT7K6, NT7K8, NT7K9, NT7L, NT7O2, NT7O3, NT7O5, NT7O6, NT7P1, NT7P2, NT7P3, NT7P4, NT7P5, NT7P6, NT8C1, NT8C2, NT8C4, NT8C5, NT8C7, NT8C8, NT8E, NT8F, NT8G4, NT8G7, NT8I, NT8J, NT8K1, NT8K4, NT8K5, NT8K7, NT8K8, NT8M1, NT8M2, NT8M3, NT8M4, NT8M5, NT8M6, NT8N1, NT8N2, NT8N3, NT8N4, NT8N5, NT8N6, NT8O1, NT8O2, NT8O4, NT8O5, NT8O6, NT8O7, NT8O8, NT8O9, NT8P4, NT8P5, NT8P6, NT8P7, NT8P8, NT8P9, NT9C2, NT9C3, NT9C5, NT9C6, NT9C8, NT9C9, NT9D, NT9G2, NT9G3, NT9G5, NT9G6, NT9G8, NT9G9, NT9H, NT9I9, NT9J7, NT9J8, NT9J9, NT9K2, NT9K3, NT9K5, NT9K6, NT9K7, NT9K8, NT9K9, NT9L, NT9M3, NT9M4, NT9M5, NT9M6, NT9M7, NT9M8, NT9M9, NT9N, NT9O, NT9P, NU2C1, NU2C2, NU2C3, NU2D1, NU2D2, NU2D3, NU2D5, NU2D6, NU2D8, NU2D9, NU2H2, NU2H3, NU2L5, NU2L6, NU2L8, NU2L9, NU2P2, NU2P3, NU2P5, NU2P6, NU2P8, NU2P9, NU3A, NU3B, NU3C, NU3D, NU3E1, NU3E2, NU3E3, NU3E5, NU3E6, NU3E8, NU3E9, NU3F, NU3G, NU3H, NU3I2, NU3I3, NU3I4, NU3I5, NU3I6, NU3I7, NU3I8, NU3I9, NU3J, NU3K, NU3L, NU3M, NU3N, NU3O, NU3P

Table 2 - Brisbane Satellite Cities product HCIS for 3.7GHz