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ESL Team

Australian Communications and Media Authority

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To the ESL Team,

Thank you for requesting follow-up information about some of the suggested use cases for Expiring Spectrum Licences in rural and remote Australia.

I hope this brief document can suffice to further illustrate the benefits that a Use-It-Or-Share-It framework could bring to Australia.

[redacted]

I believe the fundamental need has been covered in the previous submission as well as the call - I'll focus instead on this submission on practical use cases, as well as reasonable-to-expect flow on effects.

The focus of my submission will be on Rural Australia, and the use cases specific to our property.

Use Cases - Summary:

- Alternative & Private networks on pastoral stations

Other foreseeable use cases (not covered in this document):

- Alternative public networks/ISPs in smaller towns and rural areas
- Dedicated government networks: Police, Fire, Emergency
- Mining Networks
- Indigenous owned community networks

Alternative & Private networks on pastoral stations:

Mobile networks are continually getting easier to roll out, with open source software becoming more robust over time, and the technical barriers of entry being reduced. Collaborative communities sharing practical documentation and information on private and fledgling LTE(4G) networks are thriving, and what was once a gate kept industry is fast opening up globally[1][2].

Standards compliant, writable sims can be acquired from a number of vendors across the globe[3]. High quality, tier-1 second hand RAN equipment is continually flooding onto the market, with platforms such as eBay offering anyone the ability to purchase some of the best RAN equipment available, for a fraction of the retail cost[4][5]. Reverse logistics companies have caught onto the trend, and many companies have started to offer the same. Companies such as TXO, Zone Global, 1Com and Golden Gate Communications will happily sell to anyone interested.

With the associated software and hardware becoming more available over time and the barrier to entry being lower than it ever has, one of the last challenges left for a prospective operator is spectrum availability.

Use Case #1 - Our own:

[redacted]

[redacted]

Currently, the only mobile communications we have are those that we manage ourselves. UHF CB, and private LTE band 3. There is no mobile handset coverage available via any other carrier anywhere on our property, or any neighbouring properties.

A recurring challenge for us is getting information from across the property to make decisions on what to do on a given day. We need to deal with predators and pests, ensure fencing is adequate, manage grazing pressure by how much feed we have on the ground (grass & herbage), keep roads maintained and ensure that our livestock has plenty of water, especially in summer.

Some of these things we'll use a combination of methods to manage, however one repetitive task in particular is well suited for automation; Checking waters.

[redacted] These watering points need to be checked on a regular basis. In summer, depending on which paddocks our cattle and sheep are in, we'll need to check up to [redacted] as well as any associated bores. In real terms, we'll drive between 55 - 160 km on a given summer's day checking waters. On an average month in summer, between 1650 and 4800 km will be travelled to determine two things:

- Is there water at that watering point, and
- Are the livestock there ok? (Do any look sick / injured, are they bogged in the dam?)

To do this, we'll average ~240 - 720L of diesel burnt, and 45 - 80 hours worth of time per month.

A typical summer's day out here will sit above 40 celsius, with some reaching closer to 50. A couple of days without water in these temperatures will cause serious health problems for both sheep, cattle and goats, leading to death if not hydrated. To add to the problem, the reality is that things break from time to time. Pumps fail, pipes burst, cattle fight and damage infrastructure, float valves clog or get stuck, windmill buckets lose their seal, dams go dry, cane toads die in water and leach poison and smaller animals can get bogged (stuck) in wet muddy dams.

It's why it's imperative to ensure the animals we care for have plenty of clean, good quality water to drink. And to do that, we need to constantly know what's going on at those watering points, and we have to be certain - there's no room for error.

In my experience, the only fault-proof means of getting this information remotely is via photos or video. Sensors can fail, and when they do fail - they may give a false positive; telling you everything is fine when in fact it isn't. If you've got a photo or video; you'll see what's there.

If your remote camera isn't working, you know something's wrong with it; so you'll drive to the watering point to check normally - No big deal. But you'll never have a photo showing a trough full of water when it's in fact empty. Cameras don't lie.

Protocol Suitability

There are two generally available wireless protocols today that are capable of transmitting images over distance, WiFi and Cellular (3G/4G/5G).

802.11 (WiFi) provides the available bandwidth, however lacks the requisite output power in commercially-available devices to cover large areas in a PTMP scenario. Furthermore, the lowest frequency available ~2.4GHz is much too high to provide effective NLOS (Non line of sight - where you can't physically see the tower) coverage to fringe areas.

PTP (Point-to-Point) links to each site can be built, but it's not practical nor economical to maintain [redacted]

Cellular however, checks all the boxes. LTE provides well-established bands on commonly-available devices with frequencies as low as 452.5 MHz (Band 31). We don't use Band 31 in Australia, however we have made extensive use of a neighbouring band, Band 28 (703 – 748 MHz & 758 – 803MHz). Commercially available macro radios offer RF output power from 20 to 80 watts in the lower frequency ranges, with some models offering even more. With sufficient EIRP and a low-enough frequency, adequate NLOS coverage can be achieved, from a single point.

Currently, we use apparatus-licenced LTE Band 3 to provide coverage to the flat, open & easier-to-reach parts of the property. This, combined with some of the solar powered 4G cameras that are available today are giving us a clear path forward. It's still early days, and we're still trialling different models of cameras, but the setup is working and it's making things *better*.

LTE cameras save us significant amounts of time and fuel, and let us check-in on our livestock in real time.

Looking forward - future cellular use within the rural sector:

Agricultural drones are available today with 4G dongles and when used by an operator who holds a CASA ReOC licence with a BVLOS endorsement, can be used lawfully to perform inspection, search and rescue operations and even mustering[6]. Their available operating range is extended greatly when using low-band cellular (700MHz) compared to the built-in WiFi on the controllers.

Livestock locating is another burgeoning technology that will be of great benefit as it matures, and most of the commercial providers today are utilising 3 technologies; satellite, LoRa, and cellular. Up until recently, there's been no real way to know where your livestock are. You'd hope they're not being stolen and not being attacked by predators, or jumping through a hole in the fence.

But, you don't know until the next time you drive to check. Fences get broken, cattle get lost (or stolen), and sheep & goats get killed by wild dogs. If you're running significant quantities of cattle (especially as they do on larger stations, further inland) - you might not notice a couple hundred go missing. [redacted] Counting happens when animals are mustered to the yards, a few times a year.

Low-band cellular offers great NLOS coverage, perfect for use with solar-powered collars and tags.

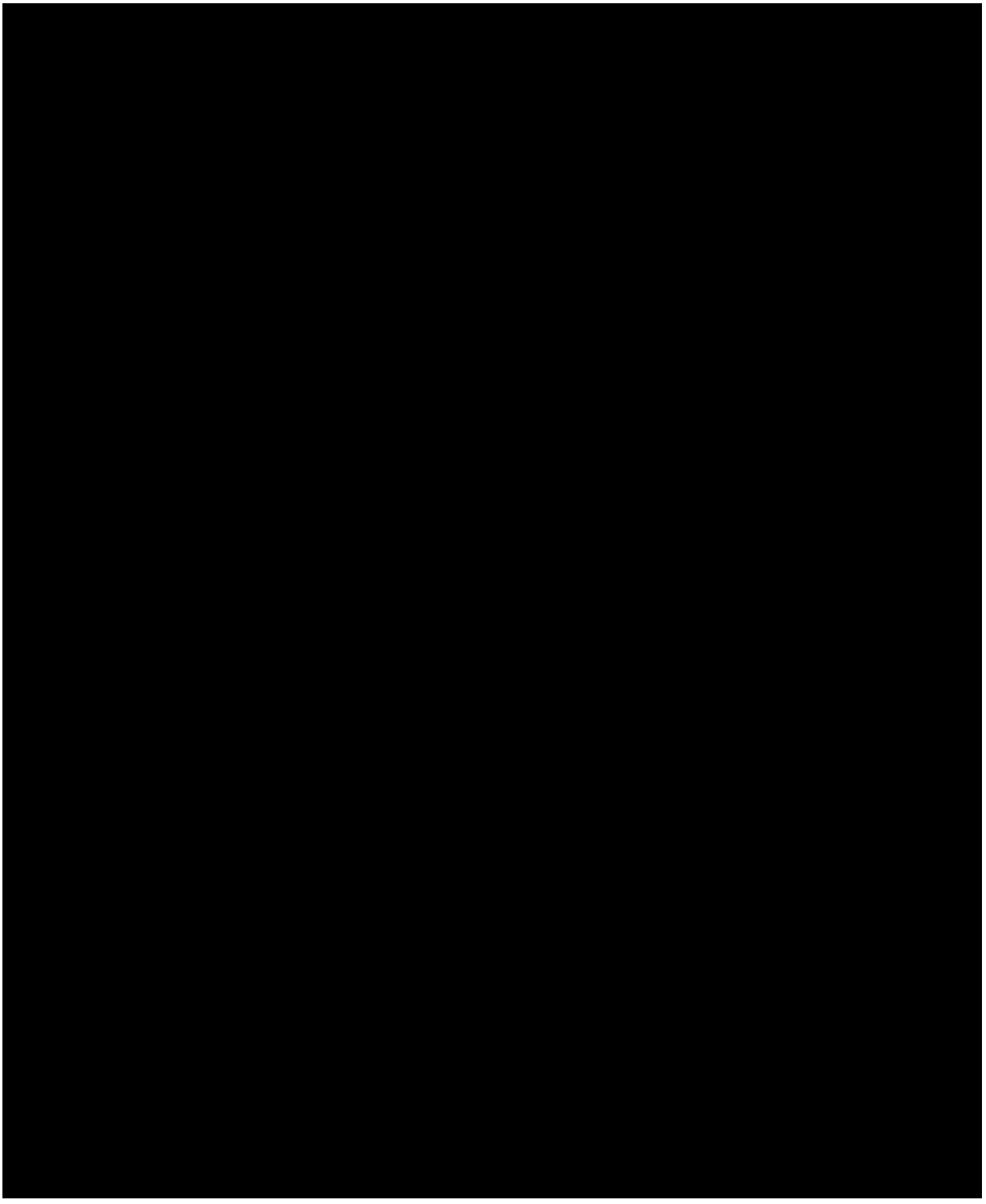
I can only speak to my own exposure to the grazing industry - I've got little experience with the other side of agriculture, which is growing crops. But you can look online today and find a plethora of agritech companies trying new things: crop and soil analysis, machinery control, and automating new things all the time. There's a whole other side to the agricultural industry with its own challenges, but a lot of their challenges overlap with ours. Large, open spaces, long distances between anything, stressing about water and a lack of cellular coverage.

Practical Access to spectrum

As it stands today, my only lawful option for access to band 28 (700MHz) is to reach out to a carrier, hoping they respond and can mobilise themselves internally to action the request, and to provide an economical quote. I've not had success in my dealings with any incumbent operators. The closest I've been able to get was to be quoted an eye watering amount for a small cell (5 watt, limited coverage as well), and then be required to pay the regular monthly fee after funding said carrier to expand their own network on our property.

We would have to pay them to build their own product, then pay them again to use it, after we'd funded it.

I can sympathise with their situation - Telstra is a managed network, offloaded to Ericsson; the largest mobile telecommunications service provider in the world. Optus is managed by Nokia, the second largest provider. Their costs can't be insignificant. And it wouldn't be profitable to serve a small cattle station based on subscription fees alone. Nevertheless, they hold the exclusive rights to use the spectrum across Australia. They've certainly paid for the rights, after all. But who else could afford to participate?



We're in an economic dead zone, from a telecommunications perspective. I need to find a way to provide coverage to [redacted] of unforgiving terrain, consisting of [redacted] It will never be economical to provide a commercial service where we are, having the costs that the large telcos do. If we don't build the infrastructure, no one else will.

To that end, the entire private LTE base station on our property has cost less than $10,000. Our costs are low. I've been able to purchase second hand mobile equipment that would otherwise end up in landfill, and can use it for a positive outcome. [redacted]

Our only ongoing costs are those of basic physical maintenance. And if access to Band 28 becomes available, I've got 3 [redacted] Band 28 radios sitting in storage ready to go.

[redacted]

Access to 10MHz in Band 3 is a game changer. I’m able to provide coverage to almost one third of our property - where before, we had nothing. One of the remaining thirds of the property would be additionally served with 700MHz, leaving only the furthest eastern corners left. The potential benefit from the difference in coverage is enough to go through the effort to try and help open up access. Ultimately, low-frequency spectrum utilising cellular is the right tool for the job.

There are hundreds of cattle stations across Australia, and thousands if not tens of thousands of smaller rural properties, all facing similar (and many with their own unique) problems. Each station has their own unique geographic topology, but a lot of the benefits that we're beginning to enjoy as a result of this work can be shared across the rest of the country, through providing the information on how this can be set up.

Alternatively, I could very easily see MOCN/MORAN style deployments utilising existing infrastructure once a basic model for a rural private cellular site is put together. Whether participated in by incumbent operators, smaller emerging operators or even industry specific co-operatives (Eg. a 'BushNet', if you will).

What happens will remain to be seen, but the door will be opened for others to innovate, and just as the NBN created a whole ecosystem of smaller ISPs, opening access to low-frequency spectrum will see a positive outcome.

Note on Starlink / LEOs:

Low earth orbit satellite operators have been causing a lot of noise across the industry for the last couple of years. Projects such as Starlink, Amazon's Kuiper, OneWeb and Telesat are all offering groundbreaking services, bandwidth previously unheard of to remote areas. And from what I've seen, they work - at least Starlink does. Starlink provides one of our uplinks at home. We average 250/50mbps, with latencies rivalling fibre. Starlink have made their intentions clear that they're planning to offer LEO direct to handset mobile services; I think that's a great thing, especially for emergency scenarios. And as someone who is fortunate enough to write mobile core software for a living, I'm watching with great curiosity to see how it will perform.

As long as the frequencies are available however, I'll continue with my efforts on the ground. I'm a strong proponent of locally built solutions for local problems. Given every opportunity, I'm of the opinion that it's better for us as a country to build and maintain our own communications infrastructure, instead of becoming dependent on another country's (USA/Starlink).

References:

[1]: https://open5gs.org/

[2]: https://github.com/ravens/awesome-telco

[3]: https://shop.sysmocom.de/SIM/

[4]: https://www.ebay.com.au/itm/195953316130

[5]: https://www.ebay.com.au/itm/373606677253

[6]: https://www.skykelpie.com/