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Response to:

Radio Spectrum Management: 3.3 GHz Regional & non-national use in New Zealand - Discussion document dated August 2021

Following consideration of the discussion document, my responses to the specific questions listed therein are as follows:

Q1. Do you agree that the 10 MHz between 3.40 – 3.41 GHz should be included with the 3.4 - 3.8 GHz band (the 3.5 GHz band) that will be made available for national use?

From a spectrum allocation perspective, it is logical to include the 3.40 – 3.41 GHz band into the segment allocated for national use. This will have negative impacts on other spectrum users, but the compromise is probably necessary.

Q2. What is your view on using the 3.3 - 3.4 GHz band for regional broadband and/or private networks? Are there other use cases of this band that should be considered?

The use of the 3.3 – 3.4 GHz band for the provision of regional broadband and private networks has merit. The Wireless Internet Service Provider (WISP) community has a need for spectrum to ensure the provision of reliable and adequate broadband services to rural communities. This is a public service that deserves a fair allocation of spectrum, and the 3.3 – 3.4 GHz band is highly suitable for the provision of this service. The utility community (local and regional councils, energy companies, etc) also needs spectrum to support their networking requirements to ensure the reliable operation of their critical infrastructure such as for water, waste and energy management. Both of these user groups, need certainty of spectrum availability on a regional and local geographic basis to deliver the services required. This band would provide spectrum to meet the needs of these users, if properly allocated and managed.

There are certain to be other potential use cases for this band, but the above two use cases are well defined and are known to deliver value to the public of New Zealand. Hence they deserve to be at the front of the list for the allocation of this spectrum. It would be highly desirable to allocate some spectrum below 3.3 GHz for the Amateur Radio Service as it is likely that the secondary use in the 3.3 – 3.4 GHz band will become interference limited with the new proposed allocations.

Q3. Do you agree with our assessment of current spectrum use and potential impacts?

The Radio Spectrum Management (RSM) assessment of current use of the 3.3 - 3.41 GHz spectrum is appropriate and provides a useful baseline for impact analysis. The identified impacts on current users are almost certainly not as fully developed as many user groups would claim. Hence it is most likely that the potential impacts are understated. On the other hand, in order to utilise this band efficiently in the future, it does suggest that change is both necessary and appropriate.

Q4. Do you agree with the assessment that regional and local use will not be able to coexist in the same geographic area on the same frequency. If not, why?

The answer to this question depends on the method that will be used to allocate the spectrum to users. If the spectrum is allocated under a GURL type license with no constraints, then it would be certain that regional and local use will not be able to co-exist in the same geographic area on the same frequency. On the other hand, if a minimum set of constraints are applied to the allocation of this spectrum, then much more flexibility would be possible. It is this latter approach that should be encouraged.

The other consideration that needs to be understood in addressing this question is the type of applications that the spectrum is going to be used for. Some applications will be resilient in the face of some interference while others will not. Some of the utility applications for example will be sensitive to infrastructure damage and possible service disruption, if interference interrupts communication. At the extreme end of the risk continuum, health and safety may be compromised. Hence there will need to be some ability for users to distinguish between spectrum for critical applications vs spectrum for less critical applications. In the case of critical applications, it may not be possible for regional and local use of the same spectrum in the same geographic area.

Q5. Do you agree that both regional and indoor use as well as local and indoor use could be manageable in the same geographic area on the same frequency? If not, why?

Not in general. Without some controls being applied it would not be possible in general to ensure satisfactory operation of regional/local use with indoor use of the same spectrum in the same geographic area. The controls that would need to apply would relate to the following parameters:

- Equivalent isotropic radiated power (EIRP) constraints (including the use of directional antennas),
- Transmit/receive synchronisation,
- Frame synchronisation.

It is considered that the only circumstances under which regional/local and indoor use would be manageable on the same frequency and in the same geographic area is when the indoor service provider is also the regional and/or local service provider so that proper interference coordination can be implemented. If the indoor service provider is independent of the regional or local service provider operating in the same geography, then there will always be situations where the two service providers can and will interfere with one another. This will lead to significant regulatory challenges which are not desirable for any party.

Q6. Do you agree that the most effective way to manage spectrum in this band is to have contiguous services with a common frame structure and timing (synchronisation)? If not, why not?

Agreed. These are necessary requirements but may not be sufficient in all situations. It is considered that some constraints on effective radiated power will also be required.

At these frequencies it is possible to deploy low-cost, high gain, directional antennas to ensure that radiation is constrained to well defined directions. Antennas with gain as high as 20dBi or more and beamwidths of 20 degrees or less are readily available for use in this band at low cost. Other technologies such as Multiple-input Multiple-output (MIMO) and beam steering could also be used to minimise the potential for interference. These capabilities should be used to best advantage to ensure that the spectrum can be used most efficiently to support the maximum number of users.

These capabilities can be readily reflected into the EIRP constraints as indicated above and should be a key requirement for operation in this band.

Q7. What are your preferred options for a band plan for the 3.3 - 3.4 GHz band, are there other options we should consider, if so please explain what these are?

The proposed band plan options assume the provision of indoor uses are independent of any regional and local service providers. As identified above, this approach reduces the potential for spectrum sharing dramatically. It is also uncertain as to the need for this type of indoor use as there is plenty of other spectrum at 5GHz which is much better suited to this type of operation.

If the independent allocation of spectrum for indoor use is excluded from the mix of requirements, then the band plan can be arranged in much more efficient ways. It is proposed that an efficient band plan would divide the 100MHz as follows:

- 4 x 20MHz bands for broadband TDD communication for regional use,
- 4 x 5MHz bands for more narrowband TDD communication for local use.
- The 4 x 5MHz bands could be aggregated into 2 x 10MHz bands for some applications, where interference can be appropriately managed.

The narrowband local area channels would be best suited to many utility type applications such as SCADA – where bandwidth is not an essential requirement, but resiliency is of prime concern. The broadband channels would be available for allocation to regional users including both WISPs and private entities (including utilities).

In order to maximise the efficient allocation of any of these allocations within the overall band, it would be essential to have minimum requirements on the following three parameters:

- EIRP constraints (including the use of directional antennas),
- Transmit/receive synchronisation,
- Frame synchronisation.

It would be expected that the application of constraints on these three parameters would ensure that multiple users could co-exist on both a regional and local geographic area basis without undue licensing complexity (see below).

Q8. How much spectrum is required for regional and uses and how much is needed for local Use?

As identified above, it is proposed that 4 x 20MHz or 80MHz in total be allocated for regional broadband use and 4 x 5MHz or 20MHz be allocated for local use. These allocations would ensure the best use of the available technology to maximise the utility of this spectrum for WISP and utility type applications.

Q9. What equipment options and standards should we consider for the 3.30 – 3.30 GHz band? If we adopt multiple standards how should we manage potential interference issues between the technologies while minimising inefficient use of spectrum?

Equipment options should not be specified. Rather generic co-existence interference management requirements only should be specified to enable the maximum possible range of equipment to be adopted. As indicated previously the key parameters which need to be specified are as follows:

- EIRP constraints (including directional antennas and antenna arrays),
- Transmit/receive synchronisation,

- Frame synchronisation.

The synchronisation requirements should minimise interference between all forms of TDD users operating in the same band and in adjacent geographical areas. However, on its own this will not be sufficient and so it is recommended that the EIRP constraints be introduced to ensure that directive antennas of all types are used by all users, unless radiated power is very low.

These requirements should apply to both regional and local users of the spectrum. It is because the application of these requirements (especially the EIRP constraints) will be challenging in indoor environments that it is essential for indoor implementations to be operated by regional or local service providers within the same geographic area, to ensure proper coordination can be achieved.

Q10. Do you agree that we should seek to permit all three use cases, indoor, local and regional uses in the 3.3 GHz band? Do you agree with our mix of use? If not which cases should we permit?

All three use cases should be permitted to operate in the 3.3 – 3.4 GHz band, but only under the conditions as described above. For clarity the conditions must be as follows:

- EIRP constraints (including directional antennas and antenna arrays),
- Transmit/receive synchronisation,
- Frame synchronisation,
- Indoor uses must be fully coordinated with regional and/or local users operating within the same band and geographic area.

Any relaxation of these requirements will reduce the utilisation of the spectrum and lead to higher regulatory costs.

Q11. What authorisation mechanisms should we use for indoor, local and regional use cases non-national access in the 3.3 – 3.4 GHz band? Are there any other mechanisms that should be considered?

To ensure maximum utilisation of this valuable spectrum, it is essential that the authorisation mechanisms enable as many users as possible to access the spectrum. This would suggest the implementation of a GURL type of authorisation mechanism. Unfortunately, the GURL approach as applied previously would lead to a very poor outcome, with the spectrum becoming interference limited very rapidly.

On the other hand, a spectrum management rights regime would also lead to a poor outcome. Defining the rights in a manner which is readily managed involving regional and local users would be challenging, and the result would almost certainly involve a few large players (with large pockets) gaining access to most of the spectrum and minimising access by smaller players. The potential for perverse behaviours including spectrum denial, hoarding and speculating of licenses would be very high. Under this approach, spectrum management costs could well become exorbitant.

The best approach is the develop a light management GURL approach. Under this approach, any user can access the spectrum in any geographic area, provided all users operate within the defined constraints as follows:

- EIRP constraints (including the use of directional antennas and antenna arrays),
- Transmit/receive synchronisation,
- Frame synchronisation,

- Indoor uses must be fully coordinated with regional and/or local users operating within the same band and geographic area.

Under this Light Management (LMGURL) type of license, the users would operate on a first in highest priority basis so that subsequent users operating in the same band and geography would need to coordinate with the first in user of the spectrum. Providing the constraints as listed above are adhered to by all users of the spectrum, then the subsequent users of the spectrum should be able to coordinate sharing with reasonable ease and little need for regulatory intervention. This Light Management approach should lead to the highest possible utilisation of the band while delivering a low regulatory overhead and hence cost for all parties.

Q12. What are sort of rules should be applied to the authorisation mechanisms to ensure compatibility and fair access?

The rules as outlined under the response to Q11 should be applied. This requires the introduction of a Light Management GURL type authorisation regime. For clarity, the key requirements for this regime to work satisfactorily are as follows:

- EIRP constraints (including the use of directional antennas and antenna arrays),
- Transmit/receive synchronisation,
- Frame synchronisation,
- Indoor uses must be fully coordinated with regional and/or local users operating within the same band and geographic area.

Q13. How should we prevent spectrum denial / hoarding/ speculating of licenses? Should we adopt one of the existing models that RSM already employs or what new model should we use in the 3.3 GHz band?

If the regime as outlined under my response to Question 11 are applied, then the ability for any user of the spectrum to exercise these perverse behaviours will be minimised. Furthermore, this approach should also minimise the need for regulatory intervention.