



**SUBMISSION TO THE RADIO SPECTRUM MANAGEMENT, POLICY AND PLANNING BRANCH OF
THE MINISTRY OF BUSINESS, INNOVATION AND EMPLOYMENT ON THE MANAGED SPECTRUM
PARK TECHNICAL PARAMETERS CONSULTATION**

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INTRODUCTION

TeamTalk Ltd would like to thank the Radio Spectrum Management division of MBIE for the opportunity to comment on the MSP Technical Parameters Document, our response is on behalf of the TeamTalk group of companies.

We would also like to thank Bob Vernall (ARE 007) whom TeamTalk have regularly contracted for RF engineering advice in the Managed Spectrum Park and providing drafting notes to our submission.

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BACKGROUND

TeamTalk

TeamTalk Ltd is a publically listed company on the New Zealand Stock Exchange. It comprises of the following businesses:

TeamTalk Mobile Radio - NZ's leading national two-way mobile radio network provider.

TeamTalk owns and operates a national digital microwave backbone as well as operating at more than 250 "high site" radio transmission facilities. It is the leading Mobile Radio Network Provider in NZ. It has a significant investment program using Fixed/Wireless Broadband technology focused on the Rural/Provincial markets of NZ.

BayCity Communications Ltd (trading as Farmside) - NZ's leading Rural Broadband specialist.

Farmside is NZ's leading Direct to Home (DTH) satellite Internet provider. Farmside is rural New Zealand's leading telecommunications company, providing fast broadband via Satellite, RBI Fixed Wireless and Fixed Line solutions.

Citylink - The pioneering Wellington based fibre provider and operator of NZ's main Internet Exchange Points (IXP).

Citylink has Metropolitan Fibre Network Assets in Wellington and Auckland and has led the way in terms of urban fibre networking since the 1990's. It plays a key role in the telecommunications sector by operating the Internet Exchange Points in Auckland, Wellington, Hamilton, Palmerston North and Christchurch.

Araneo - An independent national wireless broadband and wireless wholesale network.

Araneo focuses on providing rural and provincial wireless IP connectivity solutions from a customer's door to a retail service provider via TeamTalk Group transmission assets. It provides wholesale ethernet backhaul from remote and rural locations to over a dozen Retail Service Providers around the country.

Across the four companies, the TeamTalk group is the 7th highest contributor to the Telecommunications Development Levy for the period July 2012-June 2013.

TeamTalk Ltd would like to thank the Ministry for the opportunity to make this brief submission.

EXECUTIVE SUMMARY

In general Teamtalk disagrees with many of the proposed changes which are largely centred around changes in technical parameters. These changes in our view are primarily motivated by the objective of minimising interference and maximising the use of the spectral resource. This is laudable.

However you will see from our response that our view generally is to promote the concept of rightsholders working together and communicating with each other to resolve issues on a more dynamic, less prescriptive basis.

In part, what is required to improved access to information and the ease of access or use of that information. In some respects the information provided by rightsholders needs to be improved to aid in resolving issues but this improvement in the information itself will be less useful if accessing it easily is not improved.

We would welcome Radio Spectrum Management convening a regular forum where it acts as a facilitator between rightsholders so that they can resolve issues and collectively improve the way that the managed spectrum park is used and managed. It will also provide an opportunity for Managed Spectrum Park rightsholders to share the different techniques that are used resolve issues and improve use in different areas of the park. The attendance to the forum could be mandatory for Rightsholders and a condition of the licence.

Additional technical licensing constraints within the Managed Spectrum Park is not the way to achieve that. It is a blunt instrument which will unnecessarily stifle the utility of the MSP in some areas and not adequately deal with the matters in others. In some cases the changes might be effective but this is at the cost of places where it is not.

The consultation document under-emphasises the role of rightsholder and over-emphasises the role of approved radio engineer (ARE). The rightsholder is the party who funds the commercial operation, manages the overall operation of services and negotiates with one or more rightsholders in adjacent TLA districts to develop suitable deployment plans.

1. RESPONSES TO EACH OF THE SEVEN RSM PROPOSALS

Bullet point proposals are numbered for the purposes of presenting responses.

Proposal 1

*PIB 39 should provide a **default MPIS value of 34 dB μ V/m** for receivers with isotropic antennas, and should indicate how to adjust that for systems with antenna gain and feeder loss.*

Response

This is meddling with the established definition of MPIS, which is: “The MPIS level is defined at a point in front of the receive antenna on the boresight, and is expressed as the field strength spectral density”*. MSP applications use antennas with significant net gain, as do almost any point-to-multipoint fixed system. 16 dB μ V/m is a popular “MPIS default value” with registered MSP licences. 16 dB μ V/m on boresight for an 18 dBi net gain antenna gives parity with 34 dB μ V/m and an isotropic antenna, so there is nothing to be gained from referencing MPIS to an isotropic antenna that no MSP application uses. The question is: why deviate from the established MPIS definition with a variation for MSP situations?

In any case an MPIS value based on unwanted signal that raises the thermal noise floor by 1 dB is most likely too low for MSP practical spectrum sharing. This is best discussed between affected rightholders for optimising spectrum sharing, where wanted to unwanted signal ratio is the “bottom line” rather than an absolute level of unwanted signal.

* Quoted from a submission by the Consultation Report author in 1998 (and updated in 2001) whilst employed by Kordia.

Proposal 2

*AREs should be required to observe a **minimum receive signal level of -89 dBm** at the input of the receiver to define the edge of coverage. It is anticipated that this would prevent unreasonably low MPIS values being set that inhibit spectrum sharing. Where more accurate information is available from the manufacturer, such information could be used instead of -89 dBm.*

Response

The actual limit of useful service is a commercial decision for a rightholder, who could select a higher gain antenna or other higher performance hardware for a subscriber with difficult circumstances, as a way to produce a viable result.

MSP service has receivers at base stations as well as at customer premises. Some cases of service optimisation involved different signal levels at each end of a path.

There is dimensional inequality in units used. MPIS values are in field strength (equipment independent) whereas terminated signal in dBm depends on antenna net gain. This figure assumes a receiver with a nominal +17 dBi antenna gain.

Spectrum sharing is best resolved by **discussion between respective rightholders** and most likely the solution is to **apply wanted to unwanted signal ratios** rather than prescriptive regulatory rules with set limits for transmission parameters.

Proposal 3

*AREs should be required to observe a **minimum field strength of 40 dB μ V/m** for determining the edge of coverage. This figure allows for a receiver with a nominal +17 dBi antenna gain*

Response

The proposal is excessively prescriptive as to where customers could have an engineered solution and what antenna a rightsholder could allocate to a given customer.

When a rightsholder has multiple base stations there are multiple edges of coverage and it is up to the rightsholder to decide transmission parameters and customer loading per base station.

Proposal 4

*AREs should be required to limit the **maximum radiated power of base stations to +10 dBW eirp**. It is anticipated that this would avoid unnecessarily high overspill into neighbouring area.*

Response

10 dBW is too low for a power cap for an MSP base station where the TLA boundary and customer distribution is a long distance away, such as for rural coverage and/or where trees are present. Given that many customer premises radios have an EIRP in the order of 20-27dBW, a reduction of 17dB at the high site base station is too much. At most a high site base station EIRP could be reduced by approximately 3-6dB (e.g. 21-24 dBW) which is the typical difference between base station receive sensitivity and CPE receive sensitivity. This would ensure link budgets are generally symmetric.

Control of overspill to an adjacent TLA is a tension for both rightsholders aspiring to have customers that happen to live near a TLA boundary. As covered in counter proposals, co-channel sharing either side of a TLA boundary is unlikely to work, but using adjacent channels would work. So the solution is to split bandwidth between rightsholders rather than cap radiated power or MPIS. Capping EIRP or making changes to MPIS would lead to patchy or substandard service quality for both rightsholders.

Proposal 5

AREs should include on the licence, detailed information about transmitter and receiver equipment configurations, including receiver antenna details, and actual frequencies or channels to be used. It is anticipated that this would enable good co-ordination with subsequent systems and hence increase the efficiency of spectrum use in the MSP.

Response

Such rules would require amendment of a licence each and every time there is a change in delivery plan or when an antenna is replaced with a different type or a change in sector angle. This increases the administrative cost of operating MSP spectrum. Minimum but sufficient is to have an omnidirectional full bandwidth licence and leave sharing outcomes and updating plans to liaison between rightsholders.

We submit that the Register of Radio Frequencies (SMART) needs a large number of improvements to aid rightsholders in resolving interference management issues before it would be useful even with the proposed additional information.

Proposal 6

When using antennas with gain, the corresponding beam width should be clearly identified on licences and should be used for co-ordination.

Response

Disagree. Co-ordination is best carried out by liaison between rightsholders. In any case, beamwidth is not the key information, it is the full specification of radiation pattern envelope (RPE) and it may even need cross-polar and downtilt information. It is a waste of resource to compulsorily require this to be part of a licence when it can easily be exchanged between rightsholders. In the case of when antennas are changed to a different type a rightsholder would be open to receiving an infringement notice unless the change was made

on the day a prior filed Form 8 specified a date for when the modification was to apply (and it could transpire there was a bad storm that day).

If rightsholders are not willing to co-operate then the Crown manager could act as an administrative pivot for exchange of relevant information between parties.

Proposal 7

AREs should not use a single licence for all of the sectors of a base station when individual sectors or sets of sectors use separate frequency sub bands. Each sub band should have a separate licence showing the frequency range and aggregate HRP of the set of sectors. It is anticipated that this will identify the antenna nulls in each sub band to facilitate efficient spectrum use through better technical co-ordination with subsequent systems

Response

Agreed but as per response to Proposal 5 we suggest improvements to the systems that share information need to be improved before this delivers a benefit.

3.0 FURTHER COMMENTS

Rightsholders and relationship to AREs

The consultation document under-emphasises the role of rightsholder and over-emphasises the role of approved radio engineer (ARE). The rightsholder is the party who funds the commercial operation, manages the overall operation of services and negotiates with one or more rightsholders in adjacent TLA districts to develop suitable deployment plans.

All affected parties need to co-operate

Registering a spectrum licence is basically a **singular function** initiated by a prospective rightsholder. Optimisation of MSP coverage must involve liaison between affected rightsholders, with mutual agreement as to deployment that suits both parties. In some cases there are more than two rightsholders involved (like up to two in each TLA) but the basic point is unchanged that all affected parties need to engage in how to share MSP bandwidth. Trying to achieve sharing via licensing documentation is cumbersome and incapable of taking heed of new ideas by another rightsholder, or a new party deciding to apply for an MSP licence that they consider would co-ordinate with existing MSP licences.

In a network where a rightsholder has multiple base stations they would be “sharing with themselves” and optimising the network for service delivery. In general service quality within a given network is set by wanted to unwanted signal ratios and not thermal noise floor, and MPIS is ignored as having less relevance to meeting wanted to unwanted signal ratio at base stations as well as customers.

TLA boundaries can be a poor match to natural UHF coverage

The way MSP areas are allocated by TLA leads to artificial difference between administrative boundaries and limits of practical UHF coverage. Some TLAs have jagged boundary lines and there is no choice for an MSP rightsholder to echo a similar jagged line just inside the TLA boundary, and that is called a protection area. Any rightsholder aspires to maximise their service market and it applies to rightsholders each side of a TLA boundary. So in general some signal “over-spill” is an unavoidable reality, especially when a TLA boundary is on fairly flat land.

Where TLA boundaries are on populated flat land then the design of allocation of rights by TLA district is a setup that guarantees sharing difficulties either side of the boundary.

Counter proposals

We disagree with most of the proposals in the RSM discussion. This is because we disagree with an overly prescriptive format for spectrum licensing which could involve additional burden to maintain licence details when respective MSP networks develop and have planned changes to transmission, and alone does little to resolve co-channel spectrum sharing between rightsholders in adjacent TLAs.

The Goodwin consultation is good background as to the range of constraints for sharing between different networks near a TLA boundary. However we differ in that we view co-channel sharing is impractical through the adjustment of nation wide licencing parameters. In practice our experience has been that rightsholders agreeing to adjacent channels has worked.

It is application of radio physics that seals the fate and no amount of tinkering with rules will change the underlying radio physics and avoid equally unhappy rightsholders wanting to achieve some coverage near TLA boundaries where they have customer aspirations.

Our view is that the alternative is for affected rightsholders to each be a share of the net bandwidth, so they can each proceed with “normal” transmission parameters while they explore and negotiate possible increased sharing.

TDD with asynchronous transmission between different networks has a significant limitation of unwanted signal from a Network A base station transmission to a Network B base station receiver, and vice versa. The

following table has been copied from the Goodwin report and the column of interest is the right hand side, being the minimum ratio of wanted to unwanted signal as the criteria for interference threshold. That is the “bottom line” criteria for radio performance.

Base Station Type	Equivalent Modulation Order	User Terminal Type	Minimum receive signal level for BER 10^{-6} (dBm)	Minimum field strength for isotropic antennas (dB(μ V/m))	S:I for 1 dB threshold degradation (dB)
FDMA	2	FDMA	-89	56.5	24
	3	FDMA	-86	59.5	27
	4	FDMA	-82	63.5	30
TDMA	2	2Mbit/s	-88	57.5	23
		4Mbit/s	-85	60.5	23
	4	8Mbit/s	-79	66.5	23
TDMA/ OFDM	2	Any	-88.5	57.0	23
	4	Any	-80.5	65.0	30
	6	Any	-74.5	71.0	37
OFDMA/ TDD	2	OFDMA/ TDD	-91	54.5	17

As well, wanted signal should be taken as faded, whereas unwanted signal is taken as unfaded, which effectively increases the threshold protection ratio by a system fade margin.

The path between base stations either side of a TLA boundary is likely clear line of sight and path length only an octave or so longer than the distance to each set of customers. Free space signal has a 6 dB per octave reduction with distance. For base station sectors “facing each other” the only useful protection factors are differential down tilt and polarisation discrimination. VRP (vertical radiation pattern) difference from declination to the furthest customer to declination or inclination to the other base station is unlikely to be more than a few dB. Polarisation discrimination is limited by scatter or foreground reflections from slanted surfaces despite base station antennas having high specification for polarisation purity and being installed with spirit level accuracy for mechanical setting.

For the above reasoning, it can be appreciated that the default situation for MSP base stations with line of sight paths across a TLA boundary should assume that co-channel operation is impractical. Adjacent channel operation between different networks is generally possible as there is typically of the order of 30 dB interference reduction factor between co-channel and adjacent channel operation.

Liaison between rightsholders is the way to develop deployment plans for affected rightsholders.

Rightholders can employ appropriate technical staff to carry out sharing assessments and work out what sub-areas of each planned network could operate with co-channel sharing and identify the sub-areas that would be interference limited if services were co-channel. In the interference limited sub-areas there can be agreement on splitting bandwidth and what sectors to apply this to. Alternatively they could agree to some exclusive bandwidth and some shared bandwidth, or choosing fully synchronous operation, it is up to them to reach a mutually acceptable way to develop. Ongoing liaison between rightsholders is needed to cater for maturing networks.

MPIS applies only to co-channel scenarios, so agreement to apportion bandwidth and deploy adjacent channels does not violate a stated MPIS limit on a licence, and there won't be any complaints of co-channel interference between networks that use agreed adjacent channels.

In a few cases there could be adjacent channel limitations within a same area where different rightsholders co-locate or are near sited. A small guard band may be a suitable way to cater for the combination of transmitter unwanted emissions and receiver adjacent channel selectivity limitations. This may lead to offset channels but is of no consequence as each rightsholder can easily manage coverage within their network.

Suggestions for Crown manager intervention

The existing process for applying for a new MSP licence includes "send an interference risk notice to the affected licensee" and I have yet to know of a case where that has happened.

The term "interference risk notice" should be changed to "frequency sharing impact report" so that it is more neutral regarding conclusions. Rather than leave judgement and action to a prospective applicant, the Crown manager should be the pro-active party to ask for a written "frequency sharing impact report" and distribute it to MSP rightholders in all TLAs that have a line of sight path with any new proposed base station. If an MSP applicant or existing rightholder refuses to negotiate then the Crown manager will need to impress an effective way of moving forward, noting that an arbitration process is available.

As high altitude base stations have potential to cause interference at long distances and limit MSP utilisation in other TLAs, then there should be an early process to subject a high altitude siting proposal to scrutiny of potentially affected rightholders in surrounding districts. The proposer of a high altitude MSP base station should prepare a written "frequency sharing impact report" for distribution by the Crown manager, for distribution to rightholders from all surrounding districts with line of sight to some part of a TLA where they hold MSP licences. The Crown manager to consider responses from rightholders before accepting or declining the high altitude base station proposal.

Similarly for an MSP base station proposal close to a TLA boundary, the proposer to prepare a written report and the Crown manager seek responses before accepting or declining the proposed siting.

New MSP licences should be issued with a starting bandwidth of 10 MHz selected by the Crown manager, pending development of sharing agreements with other MSP rightholders, including those in other TLAs. Modification of licences to full bandwidth can follow the lodging of sharing agreements of affected parties, including those in another TLA.