

## **Fiona Johnson**

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**To:** Meehan Paul, Mr  
**Subject:** RE: Preparing for 5G in NZ | [SEEMAIL] [Unclassified]

\*\*\* [SEEMAIL] This message may contain classified information \*\*\*

**Reference:** Discussion Paper dated March 2018.

### **INTRODUCTION**

In this submission NZDF provides some views on the questions outlined in “Preparing for 5G in New Zealand – Discussion Document” prepared by the Ministry. NZDF supports the initiative by the Ministry of Business, Innovation and Employment (the Ministry) to engage in consultation with interested parties on the future use of 5G in NZ.

The New Zealand Defence Force (NZDF) is a significant government user of radiocommunications and the frequency spectrum, both in terms of the wide diversity of radio applications employed and the amount of spectrum allocated for military activities. In particular; NZDF has an interest in the use of high density, high intensity, high range spectrum capability.

Spectrum has become a key enabler in providing NZDF capability for a variety of purposes including training, civil emergencies, and operational military tasks. Over the last few years NZDF has introduced a number of new technologies that rely on access to spectrum. NZDF is conscious of the responsibility to ensure all use of radio based systems are spectrally and spatially efficient within operational and economic constraints.

NZDF is and will continue to be highly reliant on access to spectrum for a range of applications such as:

- Voice and data communications for command and control functions.
- Navigation and radio-location, positioning and timing.
- Intelligence gathering, surveillance and reconnaissance activities.
- Weapons systems operation.

Established in-service capabilities and the requirements in Defence Capability Plans, are forcing an increased NZDF reliance on access to spectrum. Increase in the operational tempo of over the last decades have only compounded this need.

Given that spectrum is such a critical enabler for NZDF capabilities and operations, it is essential that spectrum considerations are included at all stages of the Capability Systems Lifecycle (CSLC) developed by NZDF. Further, it is critical that NZDF can “train as we fight” to ensure operational maturity is maintained.

### **5G - NZDF CONCERNS**

5G is the latest of a series of mobile network technologies that enable an increasing wide range of applications. Many of these applications are undoubtedly economically beneficial while others it may be argued are simply for entertainment. We recognise that the ministry seeks to strike a balance of benefits to New Zealanders and the NZ economy while enabling the advancement of technology to keep pace internationally. The concerns of NZDF are:

- Access to spectrum for military use

- Freedom from Interference
- Counter Terrorism

### **Access**

In regard to the use of UHF\SHF\EHF frequency bands, NZDF takes this opportunity to re-confirm the importance of access to frequency bands in order to meet its outputs to the New Zealand Government and citizens. National mobile network operators already hold management rights over significant portions of spectrum and as a group are a dominant spectrum user. NZDF have interest in each of the frequency bands indicated by the Ministry's proposal. In particular NZDF is interested in having access to some of the spectrum in the:

- 600 MHz band for enabling communications within mobile patrol elements
- 1.4 GHz and 3.5 GHz for enabling 'communication bubbles' for semi-static elements and the links between the elements.

### **Interference**

With high spectrum occupancy and high geographic power density there is significant opportunity for complex interference issues. From 2G onward complexity has increased and technology changes mask the root causes of problems. Even sub-optimal mobile networks can often still support some traffic. Faults can be difficult to trace yet create ongoing interference issues.

As mobile operators are progressively marketing-lead (rather than tech-lead) companies, their ability to understand and deal with these complexities is reducing. Their service companies have lost technical skill, and contractual focus has progressively moved more to the financial return and project completion rather than technical quality.

Overall, the ability of mobile operators to find and fix Electromagnetic Compatibility (EMC) and interference issues appears significantly reduced. The direct impact being that operation of NZDF radios, in legitimate channels, is at risk. The risk increases with proximity to mobile phone sites and cell phone jammers (i.e. prisons).

### **Counter Terrorism**

As the threat of global and domestic terrorism continues to grow, so do the technical communication conduits to these activities and, so do the complexities in countering these communication conduits. The volume of spectrum given over to publicly available networks, the ease of access to these networks, the anonymity these networks afford, all add to the complexity to countering any terrorist threat that may use these networks.

NZDF notes the responsibility of the ministry to ensure spectrum is employed to the benefit of New Zealand. NZDF anticipate that the ministry will carefully consider what conditions on the use of spectrum allocations are appropriate to minimise threats of physical and economic harm and ensure that network providers fully cooperate with public agencies to deal effectively and efficiently with threats as they may arise.

For reasons of counter terrorism and interference mitigation, it is necessary for NZDF to secure prior agreement, along with actuating mechanisms and procedures, to shutdown mobile services near a point of operations\exercise\incident. This is considered necessary where the NZDF has a requirement to protect NZDF communications, critical operations and/or the New Zealand public.

## **RESPONSES TO QUESTIONS**

### ***Q1. What will 5G be used for?***

A number of imperatives may be promoted for 5G in respect of applications that will respond to or may only be possible with high throughput, low latency, wide area coverage. These attribute gains are seen to be beneficial, and current examples of applications are:

- virtual reality
- remote car driving
- games
- smart cities (not one application)

NZDF understands that, given adequate 5G spectrum, gains are anticipated in the following attributes, with each expected to have an order of magnitude greater than 4G (LTE):

- high peak rates (20Gbps),
- high connection density,
- high reliability, and
- low latency

However NZDF consider that service provided by 3G and 4G networks show, that these improvements cannot normally all be provided together. While the 5G technology may provide for all of these gains, there are resource and physics constraints. These gains can generally be provided only where there is adequate power density in both the uplink and downlink, so having a base station close is important, the closer the better, otherwise more basic performance should be expected. Users located close to base stations may anticipate a high level of 5G service, while for those between base stations service will be compromised. Higher frequencies, wider bandwidth and higher power require significantly more network planning and management, not less. Interference management requires focus and coordination.

## **5G Benefits**

NZDF anticipates that reasons given for 5G may argue an advancement in social and economic benefits. Equally, we have seen that the trend over previous generations of mobile networks that have been premised on speed and ubiquity. When implemented however, use of the technology has been increasingly given over to social media, and video entertainment in something of an “all-you-can-eat” bandwidth-consuming digital feast. The imperative for next generation cellular radio may not be as great as purported.

Fixed and nomadic, as well as mobile solutions have been marketed using current generation networks to provide internet access in competition with fixed line fibre and copper access. This has been promoted as a solution for rural broadband and is arguably an economic delivery mechanism in low population density areas. However the weight of use may more reasonably be accounted for by urban users whether addressing suburban expansion, areas infrastructure rollout for the latest cable-based technology is behind, satisfying the migratory nature of the tenancy market, or sporadic use at holiday destinations – these are all large users of wireless broadband for internet access using mobile networks.

While there is nothing bad in itself about this use of technology, it does not necessarily represent the high value application of technology for the betterment of the NZ economy and society that may be promoted as a key driver for technology change and infrastructure investment. Nor does this use rely on the features of the new technologies per se. High mobility, truly wide reach, low latency, wide bandwidth required by any particular application do not tend to drive industry investment and change. Instead, the aggregation of the various mobile network applications available to the market, together consume the available bandwidth where coverage is provisioned by mobile operators. Highways and communities that have missed out on initial network establishment followed by coverage in-fill and government rural initiatives are slow to see any network investment due to competition or technology advance bringing coverage to them.

## **Spectrum Demand**

While 5G answers these needs also, many of these applications could live on the more modest bandwidth capabilities of earlier network technologies. Many 'mobiles' today, use 3G and 4G networks predominantly as a fixed service, either stationary or nomadically rather than mobile. For many applications, very short response times differ imperceptibly to more modest latencies.

Mobile operators already hold large blocks of spectrum. Economic benefits should be carefully considered by the ministry before adding more and significantly larger quantities of bandwidth to be consumed and locked into management rights for any significant period. The auction of spectrum rights to the highest bidder does not in itself represent benefit to the economy. Commercial pressures in a competitive mobile networks market may not translate to high levels of service, improved coverage, and significant fault reduction\network resilience. Rather, those pressures may largely drive commoditisation to sell minutes, data and text as is the case today. This rather lacks the aspirational and economic imperatives of high value mobile applications, self-driving vehicles, remote robotics, or smart cities.

A large swathe of spectrum is likely to be given over to 5G as a result. While the technology is expected to provide higher spectral efficiency, high base station power density can be anticipated to make these gains. Both higher base station density and higher base station power are likely vehicles to achieve increased power density. Not only will base stations become more prolific and powerful, their siting will become progressively user location centric. Human RF exposure aside, increased risk of interference in other bands is significant.

### ***Q2. Infrastructure Competition***

While MBIE has given some thought to shared base station infrastructure which might provide some respite to demand for spectrum, this is by no means a certain eventuality. If mobile operator companies continue to compete at this level rather than cooperate, then spectrum occupancy, operational coordination and interference complexity will be unlike anything yet witnessed in NZ. In any case, demand for spectrum would increase across the board.

NZDF considers that base station infrastructure must be very well coordinated and managed, in order to limit interference issues from occurring. That may naturally lead to the advent of network competition at a retail level only.

In the event, a suitable co-siting design would have to be created by\for mobile operators and there would be the usual arguments about who gets top spot but this would most likely yield the lowest cost, highest performing, lowest interfering radio access network within height and footprint bounds.

Of the spectrum obtained by mobile operators from 1G onwards, none has been willingly released. Mobile operators have continued to consume UHF spectrum holdings with each new technology generation, while TV has released it. 5G is set to accelerate this demand and now things are becoming tight.

Noting that spectrum rights normally last for 20 years, it's a long time before spectrum allocations of the nominated frequency blocks occur again. What is more, band planning is performed with technologies and use in mind. These tend to lock in bands until a technology falls into disuse, which is a significantly longer period especially when time needed to clear the band is taken into consideration. Analogue TV is an example.

### ***Q3 Regulatory Issues***

Each new generation of mobile network technology is increasing complex, with higher throughput, higher reliability and greater waveform resilience and reliability. NZDF considers that it is vital to ensure that mobile operators work together with NZDF, Police and Civil Defence at the right levels and pace to maintain critical communications systems and to manage civil threats.

#### **ECM – Electronic Counter Measures**

With the multitude and increasing complexity of new generation mobile networks, the ability of civil authorities to break or counter transmissions may become stretched. Similar to the case for interference, it may be vital to NZDF to secure prior agreement along with improved actuating mechanisms and procedures to shutdown mobile service near a point of operations\exercise\incident to urgently protect NZDF communications and\or prevent mobile network activity in an area \ from a set of mobiles.

There are a few methods NZDF could use to protect against service denial due to spectrum unavailability or interference.

1. The ministry may consider it administrative allocation as an option for NZDF. While this may not be preferred for commercial spectrum holders, it has been used pre-auction in the past to hold some spectrum aside within the band plan that accommodates new technology. 3G 2100 UMTS spectrum allocations are example of this.
2. Management rights conferred anew, for new right holders, new spectrum use, or for a renewed period, can have new conditions of use included. Such conditions should also include a standing right for NZDF or its agents to require service be suspended to one or more persons, or areas for a duration within a specific reaction time. This would be to provide for counter terrorism to protect against threats.

**Paul Meehan**

Head of CIS Policy and Plans, CIS Branch

**NEW ZEALAND DEFENCE FORCE**

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