

Cambium Networks

Wireless broadband in the 26 GHz band

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# Executive Summary

The Cambium Networks team in Australia, appreciates the opportunity to submit a response to the Discussion paper in ‘*Options for wireless broadband in the 26 GHz band*’.

Cambium Networks, is a leading vendor of Fixed Wireless products, that supplies Point to Multipoint and Point to Point products that support the 900MHz, 2.4GHz, 3.3 GHz to 3.8, 4.9 GHz to 5.9 GHz for Broadband Wireless Access (BWA), 6-38 GHz for PTP Fixed Microwave band, narrowband IoT SCADA solutions and Cloud Managed Wi-Fi and Ethernet Switches Current PMP products are all TDD based whilst our PTP products are available as TDD or FDD.

Cambium Networks continues innovate and we have identified the 26 GHz band (24.25–27.5 GHz) as a band to commit to research and development for a Fixed Wireless solution. Our radio solutions will be ultra-wide band covering from 24 GHz to 29.5 GHz. We are in early stages of development and are targeting mid 2020 for product supply. Cambium Networks also recognizes the 26 GHz band as a pioneer 5G band.

Our response to this Options paper is based on our knowledge and experience gained over the past seven and half years working with network operators and enterprise customers building networks, delivering Fixed Point to Multipoint and PTP BWA services. We have seen the significant and positive impact that those services have had. We have also actively promoted the importance, availability and use of licensed and will as class licensed spectrum; and the use of Fixed Wireless network architectures to deliver broadband services to underserved areas and to provide reliable connectively for mission critical applications. Our response is hence based on our domain knowledge of the industry in Australia and on a global basis, and specifically Fixed Wireless technology and how it can be effectively used to connect the unconnected – people, places and things.

# Introduction

## Introduction to Cambium Networks

At Cambium Networks, we support the communications of life for millions of people around the world and connect enterprise networks where other options cannot. No matter what the conditions or locations, wherever people or networks need to be connected, our wireless broadband solutions deliver clear voice, data and video communications people and networks can rely on.

Our Mission is Connecting the Unconnected and delivering solutions and technology that Bridge the Digital Divide.

Cambium Networks provides professional grade fixed wireless broadband, microwave, narrowband IoT and more recently Wi-Fi solutions. Our solutions are deployed in thousands of networks in over 150 countries, with our innovative technologies providing reliable, secure, cost-effective connectivity that’s easy to deploy and proven to deliver outstanding performance metrics. To date Cambium Networks has delivered over eight million radio devices, a count that continues to accelerate year-over-year.

Cambium Networks are proven, respected leaders in the wireless broadband industry. We design, deploy and deliver innovative data, voice, and video connectivity solutions, through a qualified channel of distributors, Wireless Internet Service Providers, Telecommunications Companies, Value Added Resellers and System Integrators. Our solutions enable and ensure the communications of life, empowering personal, commercial, and community growth virtually everywhere in the world.

Following ten-years as a business unit within Motorola Solutions, Inc. Cambium Networks was established in 2011 following divesture from Motorola Solutions.

## What is Fixed Wireless?

Key to understanding the value of Fixed Wireless, is understanding how it is different from and should not be confused with Mobile Broadband (MBB).

Mobile Broadband is synonymous with the networks that support mobile UE and are designed and built with that in mind.

Whilst similar in many respects, our Fixed Wireless broadband solutions, are optimised to provide the best results for delivery of fixed data services using harmonized RF bands. The typical application for Fixed Wireless is to provide a fixed data service using RF, when the use of fiber or copper are not possible, suitable, available or affordable.

# Response to Questions Specific to Options presented.

## Does the three-type model constitute an appropriate high-level representation of potential usage of the 26 GHz band? If not, are there any use cases that should be included, excluded or omitted?

It is recognized that this higher mmWave band will provide more localized, higher capacity services. Although the full scope and definition of 5G is yet to be ratified, what we do know for certain is that 5G will promise increased wireless capacity and speeds, Sub-1ms latency and massive bandwidth.

The four major components of IMT2020 are characterized by Enhanced Mobile Broadband services, Ultra low latency, M2M and Fixed Wireless Access. These components will drive research and development efforts from vendors through the adoption for multi-tiered services from both Mobile and Fixed Wireless microwave operators.

Complex beamforming will be adopted for both Urban Macro (UMa) and Urban Micro (UMi) in this band for Mobile and Fixed applications. For UMa fixed access applications, indoor UE will not likely be sufficient in most cases and outdoor UE will be more effective.

This is why operators delivering Fixed Wireless Access are equally important as Mobile providers.

The Type 1 model will be more suited toward Mobile operators’ UMi deployments characterized by high number of multipath components. The Type 2 model would rather not be limited, but enhanced and complemented by FWA operators delivering high capacity services in a UMa deployment. Coincidently, enterprise, utility, education, mining/minerals (and other non-operator models) will appreciate the Type 3 model.

We believe that this certainly an appropriate level representation of the three-type model.

## What are the implications for 26 GHz wireless broadband in Australia of the Electronic Communication Committee of CEPT (ECC) decision on emission limits to protect passive EESS?

Cambium Networks will monitor developments with respect to emission and protection limits as determined by ACMA and other global regulators. Co-existence is important to protect critical EESS. Propagation characteristics of this band along with beamforming and OFDM components will minimize impact to adjacent services. The antenna beam (-formed) elevation requirements in both UMa and UMi instances will minimize impact.

## Are the proposed defined geographic areas for wide-area licensing appropriate?

The 26 GHz band will be very valuable to the WISP community to deliver BWA services and well as enterprises looking to deploy IoT applications for Industrial and Smart City applications. Its availability should be made non-exclusive and available under an Apparatus Licensing model and coordinated with Mobile UMi applications. Metropolitan and other high-density Urban environments will benefit massively by having this access to services delivered by Fixed Wireless Operators. The utility of mm-Wave bands is vast and has been largely ignored with little knowledge about propagation in densely populated urban indoor and outdoor environments. Mm-Waves enable an order of magnitude increase in bandwidth to greater than 1 GHz but are subject to higher attenuation due to factors such as rain fade, atmospheric effects, oxygen absorption and building penetration. For this reason it would be remise to consider this applicable to only 1 licensing model.

UMa and UMi research campaigns conducted globally have concluded that the mmWave channel model is significantly contrasted due to BS and UE positions. Small-cell coverage at street level vs macro coverage (rooftop) Fixed applications require different licensing models.

Strong consideration should be given to the use of a Dynamic Spectrum Licensing Model.

## What is the expected proliferation of—or demand for—services deployed under type 2 (apparatus-licensed) and/or 3 (class-licensed) models ?

We expect there to be large growth for fixed wireless services. Largely due to the limitations on wire-line and the flexibility that Fixed Wireless offers.

There remains an increasing need for Licensed spectrum for Fixed Wireless operations delivered under Apparatus-licensed models to support the WISP industry, IIoT (Mining), SMART City (CCTV) and ITS applications.

Licensed spectrum is important, useful and valuable for SMART Cities. It is vital that the use and allocation of apparatus-licensed spectrum is afforded for the best use and value in Australia.

Making the 26 GHz spectrum available as a licensed band will enable harmonized use through coordination and enable the scope of 5G mmWave bands to be fully reached. We recognized the importance of 5G we are heavily committed to developments in this space.

FWA operators in Australia have been delivering broadband services to Australians successfully by enabling a proven and well-respected solution for bridging the digital divide. The number of WISP around the country is growing as is the need for delivering interference free broadband services.

The 5G use cases for great potential include Homes/Business for FWA, Data Centre connectitity, IoT, Video Streaming (now 4K is becoming reality across networks) and industrial automation.

## Comment is sought on preferred option(s) for configuring and licensing the 26 GHz band.

We feel that the most appropriate licensing model for the 26 GHz band is Option 3 - Combination of spectrum and apparatus licensing. This will offer the greatest support and utility of the potential of the band. Apparatus and Spectrum licenses could be ‘shared’ in the Metro areas whilst outside of these high density metro areas, Apparatus license will apply. Alternatively, this could be an ideal band to apply a Dynamic Spectrum licensing model to ensure maximum and applicable use.

## If options 3 or 5 (all variants ) are preferred, how much of the band should be available for spectrum licensing and apparatus licensing?

As proposed for the 26 GHz band, there will be >3GHz of spectrum available. Mobile operators are likely to access 400 MHz based on the current largest channel size of 3GPP 38.104. Qualcomm suggests this may be up to 800 MHz. This will allow significant parts of the band to be available for both Spectrum and Apparatus licensing in Metro areas. The remaining regions will have then benefit of significant spectrum being available for FWA services delivered under Apparatus licensing.

With the current relatively ‘light’ use of the band (shown in Table 3 of the paper), there is opportunity for usage arrange with little impact. It could be suggested that

1. Within metro and high density urban areas
   1. the upper part of the band (25.25 GHz – 27.5 GHz) be available as Spectrum Licensing model; and
   2. the lower part (24.25 GHz – 25.25 GHz) be available under Apparatus Licensing model.
2. For regional and other areas
   1. The entire band be made available and coordinated under Apparatus licensing model

## If options 4 or 5 (all variants) are preferred, how much of the band should be available for class licensing?

No comment. Option 3 is preference.

## If options 4 or 5 (all variants) are preferred, what conditions should be applied to a class licence to protect co-frequency spectrum-licensed operations (in defined areas)? Would it be appropriate to define a means of making class-licensed use visible (for example, through a form of voluntary device registration)?

No comment. Option 3 is preference.

## Are there any other replanning options that should be considered?

None at this stage.

## Is there likely to be sufficient demand for type 1 services in regional centres outside metropolitan areas, and if so, what centres (either explicitly listed or by population threshold) should be included in the expanded licence areas?

The below Figure 1 shows atmospheric attenuation at different frequencies and illustrates the negligible atmospheric absorption at 26 GHz/28 GHz and 38 GHz (0.06 dB/km and 0.08 dB/km, respectively). By using highly directional antennas in small urban microcells, rain attenuation at 28 GHz and 38 GHz will also be negligible, allowing portions of the mm-Wave spectrum to be used for backhaul and last mile connectivity. This makes the 26 GHz band an ideal candidate band to deploy Fixed Wireless Access services in Regional centres outside of Metropolitan areas. Applications such as ITS, Mining, Security and Smart Cities.

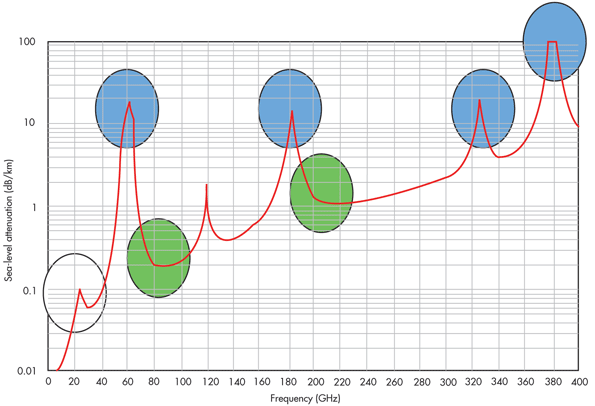


Figure Air attenuation at different frequency bands

# Applicable Fixed Wireless use case

New mmWave bands have the potential to provide significant economic benefit to Australia, including potential new delivery and business models. To maximise the potential benefit we feel that a range of spectrum and regulatory options to support both Fixed and Mobile solutions for metro and rural markets are required.

In the IMT-2020 evaluation criteria (<https://www.itu.int/md/R15-SG05-C-0057/en>) at 30 GHz, the UE is assumed to be a 32 element array of 5 dBi elements, i.e. maximum gain of 20 dBi. This is reasonable for the biggest application, i.e. mobile handsets, but underestimates the potential cell performance when UEs with much higher gains are professionally installed. For example, a 20 dB improvement in link budget may be achieved comprising 15 dB extra antenna gain by using a 35 dBi antenna and a 5 dB reduction in excess path loss using a professionally installed UE at eave or roof height.

The extra link budget can be used to improve the spectrum efficiency, range, data rate and increase the rain fade margin for longer links. Increased cell sizes in turn improve the business case for lower density regions.

The below Figure 2 and Figure 3 show, as an example, a virtual deployment of our 28 GHz PMP system in Sydney and Melbourne. Using the ITU model for rain, Base Station (BS) and a Customer Premises Equipment (CPE) have been plotted to show aggregate throughput as a function of the link range for the case of no rain as well as the case of a 99.99% availability (52mins outage per year) due to rain. The EIRP are assumed to be 58dBm and 53dBm for the BS and CPE respectively. For the BS, there are 3 groups of curves corresponding to the level of MU-MIMO grouping that can be achieved. We have assumed 1 (no MU-MIMO grouping, no throughput increase due to MU-MIMO), as well as a MU-MIMO grouping of 3 and 6. Looking closer at the number, the top rate data rate is about 400 Mbps without MU-MIMO gain, and thus 1200 and 2400 Mbps with MU-MIMO gain of 3 and 6 respectively. These numbers are for a single sector (either 90 or 120 degrees) Base Station.

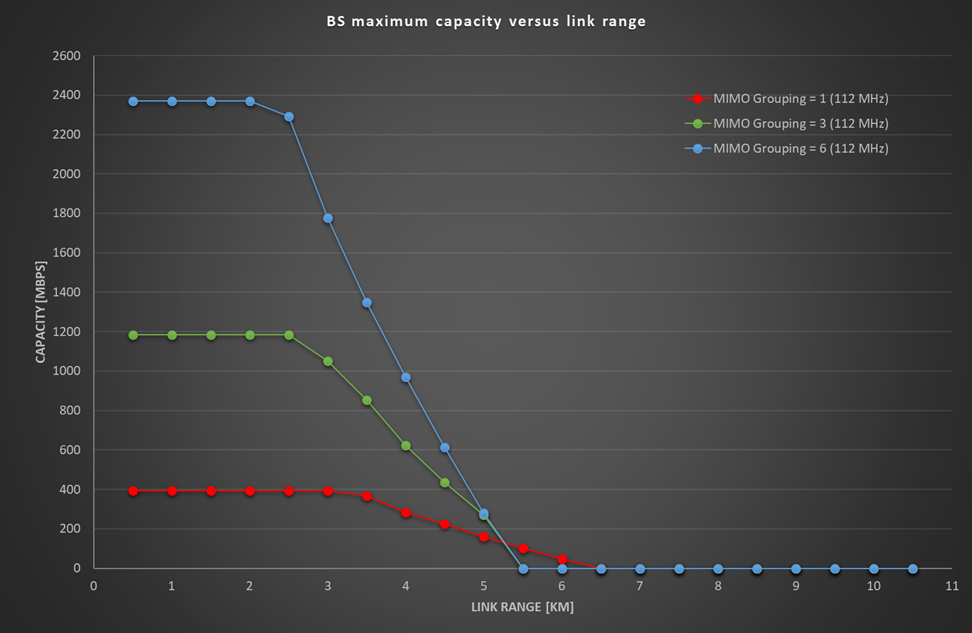
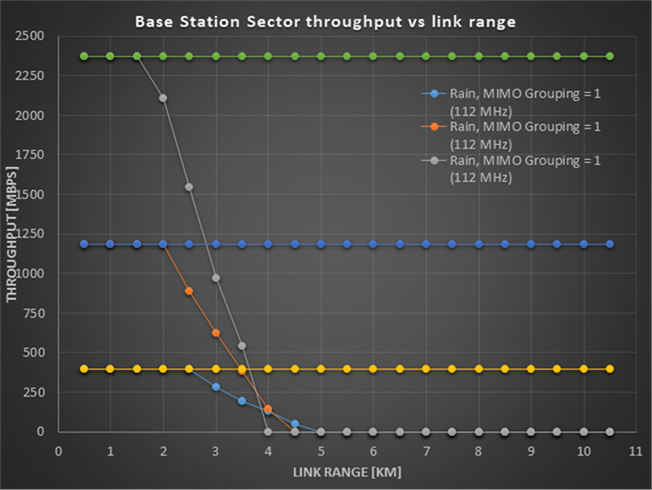


Figure Base Station aggregate throughput vs Link Range in Sydney region

Figure Base Station aggregate throughput vs Link Range in Melbourne region

A similar approach is already used for service providers in low density areas with < 6 GHz spectrum (Large Italian and US WiSPs) and is already used by an Italian ISP at 28 GHz. This scenario is not considered by IMT-2020 but is an important system approach that Cambium will be addressing to enable broader usage of mmWave spectrum in lower density regions.

Cambium Networks would like to suggest that the ACMA consideration in the regulatory framework for 26GHz to support this important Fixed Wireless use case.