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Ms Aileen Chia
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Infocomm Media Development Authority (iMDA)
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Dear Ms Chia,

Re: Public Consultation on 5G Mobile Services and Networks - Singapore

ViaSat Inc. is a communications company based in Carlsbad, California, with additional operations across the United States and worldwide. As a global broadband services and technology company, ViaSat Inc. connects international communities and offer residential internet service; allow streaming of high-bandwidth applications and content on commercial, business or government aircraft and watercraft; and deliver and protect information when and where it is needed most with our trusted communications ground systems, infrastructure, and services.

ViaSat appreciate the opportunity provided by the iMDA to give its views on the 5G mobile services and network, and wish to make specific comments on regulatory measures pertaining to the deployment of 5G in the 28 GHz band.

INTRODUCTION

I. ViaSat's use of the Ka band and ViaSat-1

The constant increase in demand for more high-speed internet is undeniable. World use of bandwidth is doubling every two or three years. ViaSat high-capacity satellite systems are tailor-made to keep up with this increasing demand while improving connection speeds and making available more bandwidth to meet the demand of each customer of the network.

In 2012 we launched the new era of multi-beam satellite systems by launching ViaSat-1, which began by providing commercial services in North America. Today, it is still the 2nd highest capacity satellite in operation, but ViaSat-1 is only the first stage of our new system of high-speed satellites operating in the Ka band. The objective is a continued transformation of the economic viability and quality of high-speed satellite services.

ViaSat-1 presents the following advantages:

- Over ten times the speed of any satellite previously operating in the Ka band.
- The only system to provide multimedia internet.
- The cost per gigabyte is a fraction of the cost of other satellites.
- Competition with terrestrial services – about 40% of new subscribers have other alternatives.

II. ViaSat-2 – Breaking the trade-off between coverage and capacity

Launched on June 1, 2017, ViaSat-2 is designed to combine high-capacity bandwidth and a vast coverage area, and has the flexibility to dynamically allocate capacity to where demand is. In addition to having a coverage area seven times that of ViaSat-1 and technological upgrades to increase capacity, ViaSat-2 is designed to double the economic advantages of ViaSat-1, while also doubling the speed.

The next generation and ViaSat-3 – Bandwidth for everyone

The very high-capacity satellite constellation, ViaSat-3, will be composed of three ViaSat-3 satellites and network infrastructure on the ground. The first two satellites will cover the Americas, Europe, the Middle-East and Africa, with development underway for scheduled delivery in 2019. To provide a global service, a third satellite system is intended to cover the Asia-Pacific region (APAC), planned for 2021.

ViaSat-3 is the next stage of ViaSat's ambition to provide a high-speed world Internet network with enough capacity to meet growing demand while remaining affordable, rapid, and of high enough quality to provide streaming video services. Each ViaSat-3 class satellite will deliver more than the combined capacity of the more-than 400 commercial communication satellites in orbit today.

The ViaSat-3 constellation can meet more consumer demand by:

- Delivering a residential internet service of more than 100+ megabits per second (Mbit/s), making video streaming possible in very high definition (4K).
- Providing an in-flight connection of hundreds of Mbit/s for commercial flights, for private aircraft and for highly important governmental transport operations.
- Providing a connection at a speed of up to 1 gigabit per second (Gbit/s) for maritime and oceanic applications or for other enterprises such as petroleum platforms.
- Offering affordable Wi-Fi satellite connectivity to thousands of unconnected people in emerging markets.

ViaSat already provides in-flight service to the following companies: JetBlue, Virgin America, United, American, Icelandair EL AL, Qantas, SAS and Finnair. ViaSat also offers its services to US government VIP transport, including Air Force One.

ViaSat-3 services will be provided through many satellite access nodes (SAN), which will connect Viasat-3 to the internet backbone. These SANs will use the whole of the 17.7-20.2 GHz (space-to-Earth) and 27.5-30.0 GHz (Earth-to-space) frequency bands. The capacity of the ViaSat-3 satellites will be directly linked to the amount of spectrum available for multi-beam satellite systems.

If the use of the satellite service is limited to only the 29.5-30.0 GHz band and access to the 27.5-29.5 GHz band is denied due to being possibly assigned to 5G services, this would greatly reduce the capacity of the ViaSat-3 system throughout the world.

COMMENTS ON ESTABLISHING 5G IN THE 28 GHz BAND

III. Sharing between satellite services and fixed terrestrial services is possible under the present regulatory framework.

In Europe, studies are in progress to determine whether greater sharing between terrestrial Fixed Fervices (FS) and Fixed Satellite Services (FSS) is possible in the 27.5-29.5 GHz band. Recent advances in satellite technology, such as the use of narrow beams or the use of broad carriers (resulting in a low spectral power density) and cognitive radio communication techniques, may greatly improve sharing between FSS user terminals and fixed point-to-point microwave links. Such sharing might not be possible with uncoordinated 5G terminals at all locations. While studies are still underway, initial results have shown that increased sharing with stationary FS users is possible, with coordination distances often being less than 100 meters. ViaSat expects the ongoing CEPT studies to be completed and documented by the end of 2018. These studies are likely to show that co-existence between known FS and FSS locations can enable more intensive use of the 27.5-29.5 GHz band. This intensive use is unlikely to be feasible if mobile services are allowed in this band.

Given the very limited and uncertain roll-out of 5G in the 28 GHz band, and the focus on 26 GHz as a pioneer band worldwide, focus should be kept on international harmonization of 5G in the 26 GHz band.

IV. Regulatory context of the 28 GHz frequency band and its allocation to 5G

Singapore should not consider identification of 5G in the 28 GHz frequency band, since this has not been provided for by the international regulations. For example, Resolution 238[1] developed by WRC-15 concerning studies on IMT does not provide for study of the 28 GHz frequency band for IMT services. Neither is there any allocation for mobile services in the 28 GHz frequency band in the Singapore Spectrum Allocation Chart.[2]

V. The 27.5-30.0 GHz band is essential for satellite services

High-speed satellites may play a major part in deploying a high-speed network in areas that are poorly served or have access difficulties. The band is also essential for delivering super-fast broadband to mobile users, such as ships and aircraft. The CEPT has recognized this in its 5G Roadmap, which identifies the 27.5-29.5 GHz band as an essential band for satellite-based mobility services (ESIMs).[3]

The 27.5-30.0 GHz range is the only uplink band for high-speed satellites that is available commercially (the lower frequencies do not provide enough capacity for high-speed)..

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[1] The text of Resolution 238 concerning "*Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond"* is available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0014PDFE.pdf

[2] The Singapore Allocation Chart published by iMDA is available at : https://www.imda.gov.sg/~/media/imda/files/regulation%20licensing%20and%20consultations/frameworks%20and%20policies/spectrum%20management%20and%20coordination/spectrumchart.pdf?la=en

[3] https://cept.org/ecc/topics/spectrum-for-wireless-broadband-5g

Satellite service providers such as ViaSat have invested substantially in the 28 GHz band. Introducing 5G in this band would be contrary to reasonable expectations and would also run counter to those investments.

- In Europe, organisations such as the Radio Spectrum Policy Group (RSPG), European Conference of Postal and Telecommunications Administrations (CEPT) and International Telecommunication Union (ITU) have all ruled out use of the 28 GHz band by 5G.
- Although the US, Japan and South Korea are considering 28 GHz band for 5G, this is not a valid reason for Singapore to follow them; there are more suitable alternatives.
- Sharing between FS and FSS services is possible with the existing regulations. Introducing 5G into the 28 GHz may render the band unusable for both FS and FSS.

iMDA should not envisage allocating the 28 GHz band to the deployment of 5G without having first studied its impact on satellite services and on fixed services.

- A fundamental principle of the international coordination of frequencies is only to authorise new applications if they are capable of protecting existing services.
- In this respect, Resolution 238[4] states:
  - *Considering: "the need to protect existing services and to allow for their continued development when considering frequency bands for possible additional allocations to any service (…)"* (Paragraph l of the Resolution);
  - *Recognising: "that any identification of frequency bands for IMT should take into account the use of the bands by other services and the evolving needs of these services"* (Paragraph c of the Resolution); and
  - *Recognising: "there should be no additional regulatory or technical constraints imposed to services to which the band is currently allocated on a primary basis"* (Paragraph d of the Resolution).
- Resolution 238 insists on taking the needs of developing countries into account. Allocating 5G to the 28 GHz band has no benefits for these countries and instead limits the capabilities of a high-speed satellite network.

VI. Satellite systems have an important part to play in the implementation and realisation of the 5G vision

Satellites should be integral part of the 5G ecosystem and in its implementation. The 28 GHz frequency band used by FSS should be regarded as contributing to 5G as part of 5G's satellite component, rather than confined to terminals of mobile services. The objective of 5G is to provide ubiquitous access, but this is impossible to achieve without backhaul networks, particularly in the mmWave frequencies.
The 28 GHz band should be defined as a key element of the satellite component of 5G and make the following possible:

- Transmission and connection (backhaul network) to isolated base stations;
- Creating temporary 5G access, for example for concerts and sporting events;
- Delivery of content streaming services to 5G stations;
- Offering services to ships, aircraft and trains; and
- Rapid deployment of backhaul network in disaster and emergency situations.

[4] The text of Resolution 238 concerning: "*Studies on frequency-related matters for International Mobile Telecommunications identification including possible additional allocations to the mobile services on a primary basis in portion(s) of the frequency range between 24.25 and 86 GHz for the future development of International Mobile Telecommunications for 2020 and beyond"* is available at: https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0014PDFE.pdf

Owing to 5G's substantial need for backhaul networks, it is crucial to protect the 28 GHz frequency band for the reasons set out above. All 5G networks will have substantial backhaul network requirements, and in all the scenarios mentioned above, satellites represent the only viable solution for creating backhaul networks. Satellite infrastructure plays a crucial part in the deployment of 5G networks; as a result, allocating the 28 GHz band to 5G could limit the ability of future 5G deployments.

In the near future, 5G users will expect to be able to use 5G in flight, on board ship or in isolated locations. A robust continuous 5G service will also be crucial when natural disasters or interruptions of the terrestrial network occur. To overcome all these problems associated with the deployment of 5G, satellites remain the best solution.

Yours sincerely,

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