INTELSAT RESPONSE
TO THE IMDA CONSULTATION PAPER ON
"5G MOBILE SERVICES AND NETWORKS"

I. INTRODUCTION

Intelsat would like to hereby submit the following comments on the "5G Mobile Services and Networks" consultation paper issued by the Info-communications Media Development Authority (IMDA) of Singapore.[1] In these comments on the IMDA Consultation Paper, we explain the important role that satellites services and, in particular, C-band services will play in the 5G ecosystem. Thus, IMDA should consider C-band satellite networks as part of the 5G ecosystem when making spectrum decisions.

The 3400 – 4200 MHz C-band downlink spectrum has been a cornerstone of many satellite services for decades. In addition to its key function in providing connectivity to areas of high rain fall, where other available bands are inappropriate, C-band is used for a number of critical commercial and government communications functions. Although mobile data traffic is increasing, mobile operators should be encouraged to first improve the network density and efficiency within their existing spectrum before seeking additional spectrum which is already extensively used by other services. In the Asia-Pacific region, in particular, the use of C-band spectrum is growing due to its superior propagation characteristics in overcoming rain fade.

Spectrum compatibility is also an important issue as IMDA considers IMT access to additional spectrum bands. Satellite receivers are extremely sensitive devices because they are designed to receive extremely low-power signals from satellites located in space 36,000 kilometres above the equator. Satellite services have co-existed with terrestrial microwave links from fixed points for many years, primarily because of microwave's use of highly directional antennas which can avoid high power interfering signals in the direction of an earth station. Ubiquitous high-power terrestrial base stations and mobile terminals, however, present a far more challenging sharing environment that could effectively preclude the operation of co-frequency receive earth stations. Nonetheless, IMDA should consider whether reasonable measures can be implemented in the 3400-3600 MHz band could preserve satellite access to the spectrum for gateway earth station operations.

Beyond the 3400-3600 MHz band, the satellite industry is counting on continued access to the 3600 – 3800 MHz in future satellite deployments to satisfy increasing demand for satellite services. If this additional band is opened to IMT services, there may be insufficient capacity to satisfy local and regional demand and it would be very difficult if not impossible for satellite service providers to use alternative spectrum.

[1] IMDA Consultation Paper, *5G Mobile Services and Networks* (May 2017), *available at* https://www.imda.gov.sg/regulations-licensing-and-consultations/consultations/consultation%20papers/2017/public-consultation-on-5g-mobile-services-and-networks (hereinafter "IMDA Consultation Paper").

One potential option to preserve essential C-band satellite is to implement adequate measures to protect incumbent services, thereby ensuring the continued provision of high-quality reliable services to customers and guarantying long-term stability within this band for satellite operators. The band 3400-3600 MHz is an opportunity to put this vision into effect, allowing the FSS to continue operating in the band by ensuring sufficient geographical separation with new services, possibly supplemented by mitigation techniques based on a coordinated effort with the new comer.

II. THE ROLE OF SATELLITE IN THE 5G ECOSYSTEM

The dividing lines between satellite and terrestrial networks are softening, with these networks integrating and supporting broadband mobility applications. Synergies between these networks and services are influencing the prospects for both terrestrial and satellite services, and as the satellite HTS market becomes more established and customers gain confidence in the systems, enterprise broadband usage is expected to increase significantly in most regions driven by increased customer requirements Intelsat's position on the opportunities for satellite systems and 5G is driven by these new developments.

Satellite-enabled services have been present in the daily life of millions of people around the globe for decades, from broadcasting events to enabling maritime communications helping business operate in locations unserved by terrestrial options. The satellite industry is therefore interested in fostering regulatory decisions today that will shape the future of 5G mobile services and related networks. Indeed, 5G will be a network of networks - an ecosystem - with multiple technologies supporting a global infrastructure: satellite, Wi-Fi/ WiGig, small cells, and traditional mobile wireless networks, among others. Satellites have a particularly important role to play bringing 5G services to users quickly, regardless of terrain or location.

Another key role played by satellite is supporting enterprise networks with broadband connectivity – helping business operate in remote locations unserved by terrestrial options. Intelsat is the leader of the FSS industry, has undertaken a profound transformation of its infrastructure capabilities and go-to-market strategy, exemplified by the commitment in investment into the NGSO operator OneWeb. Intelsat's truly global satellite system and its new initiatives will play an important role bringing communications services to users quickly, no matter where they are located.

III. INTEGRATING SATELLITES INTO 5G SPECTRUM DECISIONS

With recent technological advances both on the satellite payload and ground terminals, this has significantly increased throughput where the satellite sector is poised to meet a variety of business segments to meet the growing demand for broadband connectivity – anytime and anywhere to complement the 5G revolution. Satellite broadband services will support new bandwidth-heavy, cloud-based applications, as well as enable new applications such as the Internet of Things ("IoT"), Machine-to-Machine ("M2M" operations, etc.

Intelsat is already involved in various areas related to 5G/IoT and communications on the move including land,based earth stations in-motion (e.g., the connected car and train). Satellite broadband promises fast, flexible internet access from anywhere in the world with next-generation Intelsat Epic satellites with high data throughputs. Pairing these broadband satellite capabilities with terrestrial 5G networks is the next logical extension of Intelsat's communication services offering.

IV. SPECTRUM FOR FSS USE

The radiocommunication regulatory community is currently focusing on 5G as a main topic of inquiry for the foreseeable future. In the current stage of research, most of the technical aspects are about 5G spectrum availability and usage. As noted above, Intelsat considers that the satellite industry requires stable access to frequency bands allocated by the ITU on a primary basis to FSS to protect billions of dollars in global infrastructure and serve a growing customer base. At the same time, the industry is innovating and creating new satellite service applications to enable the development of new systems and services, including 5g services. International regulatory certainty and stable spectrum access is a necessity to enable ongoing investments in new satellite systems and services that can connect the unconnected globally.

Intelsat also believes that sharing between satellite services and ubiquitous 5G is generally very difficult in the same frequency band. In particular, high-power base station transmissions communicating with terrestrial mobile terminals can effectively overwhelm sensitive earth station receivers in satellite downlink bands. However, it may be possible to facilitate spectrum sharing for certain applications in certain frequency bands using appropriate criteria and regulatory constraints. ITU WRC-2015 via Resolution 238 identified specific frequency bands for consideration by ITU-WRC-2019 for a potential IMT identification to accommodate 5G systems. We hold the common view that WRC-2019 should only consider the frequency bands defined in Resolution 238 for potential identification and allocation for IMT, provided that sharing is feasible, and not to look in any bands outside the scope of this agenda item.

As a sensible outcome, Intelsat thinks future IMT-2020 spectrum requirements can still be accommodated in existing already ITU identified frequency bands for IMT in bands below 3.6 GHz and every step should be taken to promote efficient use of spectrum to governments and regulatory bodies as an appropriate basis for enabling the long-term sustainable development of both satellite services and terrestrial IMT services in C-band, Ku-band and Ka-band.

V. CONCLUSION

While no one disputes that mobile data traffic is increasing, the same is true for satellite services. For this reason, Intelsat would encourage IMDA to first improve mobile network density and efficiency within existing spectrum before seeking additional spectrum which is already extensively used by other services.

While the 3400-3600 MHz band may be lightly used in Singapore, neighbouring countries have launched a number of satellites that make use of this band more extensively and measures will have to put in place to ensure cross-border protection of co-frequency satellite earth stations. Deployments in Singapore would need to be limited to small cells (and possibly limited to indoor use) to ensure that cross-border PFD limits are met. It remains to be seen whether it is practicable for Singapore satellite users in the 3400-3600 MHz band to migrate to higher bands given capacity and other constraints.

Intelsat would finally like to highlight that the satellite industry is counting on continued access to C-band spectrum at 3800-4200 MHz in future satellite deployments due to continued demand for satellite services. In particular, if more C-band spectrum is opened for IMT, it would be very difficult to provide effective and efficient services, and very costly if not impossible for satellite services to relocate to alternative bands. Furthermore, IMDA would find it very difficult to protect neighboring countries using this band because of its superior propagation characteristics.