speedcast

THE CRITICAL COMMUNICATIONS COMPANY | Communications | IT Solutions | Consulting

Ms. Aileen Chia, Director General (Telecoms and Post)
Infocomm Media Development Authority of Singapore
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July 20, 2017

Re: Comments of SpeedCast International Ltd and its Affiliates in Response to IMDA Consultation Paper regarding 5G Mobile Services and Networks

Dear Ms. Chia:

SpeedCast International Ltd and its affiliates, including SpeedCast Singapore Pte Ltd (collectively "SpeedCast"), welcome the opportunity to address certain spectrum issues raised in the recently published Info-communications Media Development Authority ("IMDA") consultation paper, *5G Mobile Services and Networks* (the "Consultation Paper").[1] These comments focus, in particular, on IMDA's questions regarding possible creation of an allocation of the extended C-band frequencies at 3400-3600 MHz for terrestrial 5G International Mobile Telecommunications ("IMT") wireless services.

As described in more detail below, SpeedCast has extensive C-band gateway earth station operations in Singapore that support essential commercial communications services in Singapore and the Asia-Pacific region for customers in the maritime, energy and remote mining, telecommunications, and government sectors. In addition, SpeedCast supports video and television distribution services in Singapore, facilitating the delivery of international content and information to customers of a Singaporean telecommunications service provider.

In these comments, SpeedCast explains that authorization of terrestrial 5G services in the extended C-band downlink frequencies create a substantial risk of:

- Displacing fixed-satellite service ("FSS") services out of the extended C-band (and potentially core C-band frequencies as well) in Singapore and across the region;

- Creating interference risks impacting the use of C-band uplink frequencies; and

[1] Available at: Consultation Document.pdf?la=en (published 23 May 2017).

- Stranding enormous Singaporean and international investment in C-band infrastructure throughout the region.

Thus, SpeedCast urges IMDA to ensure that reliable C-band FSS services can continue to be supported from Singapore by fully protecting gateway earth station sites from harmful interference from future 5G deployment.

If IMDA finds that it must allocate additional spectrum for 5G terrestrial services, SpeedCast urges IMDA to (i) do so using C-band uplink frequencies, as it recently did for Intelligent Transportation Systems ("ITS"), where sharing between terrestrial and satellite users may be substantially easier to manage;[2] and (ii) to adopt requirements and develop a process through which terrestrial 5G IMT operators must reimburse incumbent FSS operators for their costs in relocating their services to new frequencies, as well as moving, modifying, and upgrading earth station equipment, as necessary, to mitigate interference from these newly authorized terrestrial users.

A. Background

SpeedCast, a global provider of satellite-based communication services, has a substantial presence in Singapore, delivering critical satellite communication services to customers in the enterprise, energy and maritime industries. In fact, Singapore is a strategic hub for SpeedCast and is considered an essential operational location supporting SpeedCast's commercial activities throughout the Asia-Pacific region. SpeedCast operates approximately two dozen C-band gateway earth stations, as well as numerous Ku-band gateways, from its Toh Guan Road teleport facility in Singapore, providing a variety of FSS services ranging from connectivity to remote mining platform communications to TV Receive-Only ("TVRO") feeder links.[3] SpeedCast recently confirmed the commissioning of two additional C-band gateways that will promote continued growth in the region.

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[2] *Regulatory Framework And Standards for Intelligent Transport Systems ("ITS") in the 5.9 GHz (5.875-5.925 GHz) Frequency Band,* Decision Issued by the Info-Communications Media Development Authority (6 February 2017), at ¶ 16.

[3] SpeedCast also notes that it also recently acquired the Harris CapRock teleport facility at Loyang Offshore Supply Base, which include five C-band gateway earth stations. SpeedCast is in the process of migrating all legacy Harris CapRock circuits to the Toh Guan Road facility. Full migration of the Loyang circuits is expected to be completed by the end of 2017. SpeedCast's acquisition of ST Teleport and its established teleport at Toh Guan Road, and the consolidation of legacy Harris CapRock facilities at that location, is a deliberate strategy to position SpeedCast as a leading provider of satellite services in Singapore and throughout the Asia-Pacific region.

SpeedCast anticipates that its use of the C-band will increase over time due to new operational imperatives and commercial opportunities. For example, SpeedCast's C-band gateway operations not only support remote terminal operations throughout Asia, but also provide a source signal for StarHub – a leading telecommunications operator in Singapore – for its CATV head-end system, allowing it to distribute content to its users in Singapore. SpeedCast therefore agrees with the IMDA that, "the use of C-band satellite capacity has been fast growing [across Asia]"[4] and believes that continued satellite access to C-band frequencies is essential to meet the expanding communications needs of the region, particularly if Singapore is to remain a central hub for providing such communication services.

SpeedCast appreciates IMDA's deliberation of the important spectrum issues in the Consultation Paper. Although SpeedCast's comments are directed at extended C-band issues, some of the regulatory and technical spectrum sharing principles set forth herein may have implications for FSS/5G sharing in other subject bands. In all cases, SpeedCast urges the IMDA to preserve existing FSS operations and impose on new 5G services appropriate conditions to protect the ability of incumbent FSS satellite and earth station operators to maintain and expand their services in Singapore and throughout the Asia-Pacific region.

B. Discussion of IMDA's Proposed Allocation of the 3400-3600 MHz Band for Terrestrial 5G IMT Services

Below, SpeedCast addresses certain specific questions posed by IMDA in the Consultation Paper regarding the allocation of frequency bands between 1 – 6 GHz for terrestrial mobile services. It is SpeedCast's position that IMDA should maintain the continued, uninterrupted use of extended C-band downlink frequencies by FSS hub earth stations in Singapore in order to protect and foster critical satellite service offerings and promote, not hinder, competition between terrestrial and satellite-based broadband communication services throughout the Asia-Pacific region.

1. Part III, Question 7: *If it is only the extended C-band that is considered for IMT, would the migration of existing satellite users to the other parts of the C-band (i.e. 3.7-4.2 GHz) impact their service provisioning?*

Yes. The migration of existing extended C-band satellite users to other parts of the C-band would have a negative impact on the provisioning of satellite services to, from, and within Singapore. Migration upwards towards the conventional downlink C-band allocation (i.e., 3700-4200 MHz) would have significant technical implications given the need for protecting earth station

[4] IMDA, *5G Mobile Services and Networks* (23 May 2017), ¶ 41.

receive operations from in-band and out-of-band interference from high-power terrestrial transmit operations, and there are important commercial and operational implications of migration that would impair the ability of FSS service providers to reliably serve customers.

C-band satellite systems are generally designed with hard frequency pairings, meaning that they cannot transmit on certain C-band uplink frequencies if the signals cannot be received in the paired C-band downlink frequencies. Thus, terrestrial IMT transmissions in the 3400-3600 MHz downlink band will effectively preclude use of the paired C-band uplink. Similarly, even if a gateway earth station in Singapore does not receive communications traffic in the extended C-band, it must still monitor transmissions in the band sent to remote terminals outside of Singapore. The inability for gateways to access the extended C-band in Singapore would effectively preclude them from monitoring and diagnosing communications traffic issues. This would have an immediate impact on SpeedCast's day-to-day operations and will make it difficult to effectively provide commercial services in this band throughout the region. IMDA recognizes that "any disruption to the C-band services may have a severe impact for countries relying on satellite services for their communication needs,"[5] and SpeedCast agrees that any decision limiting FSS access to the extended C-band will have effects in Singapore and beyond. IMDA should consider these significant additional impacts in its decision-making.

Moreover, high-power terrestrial IMT transmissions anywhere in the C-band downlink could effectively prevent the entire band from being used for satellite operations because they can overwhelm the ability of the earth station to receive low-power satellite transmissions anywhere in the band, cause intermodulation effects, and create other interference issues. High power terrestrial 5G IMT transmissions in any portion of the band would risk saturation of the low noise block ("LNB") downconverter across the entire C-band, effectively preventing reception of downlink transmissions from C-band satellites anywhere in the band. It is not at all certain that such impacts can be effectively addressed through interference mitigation measures, such as filtering, RF screening, and imposition of power limits around receive earth station sites. Rather, in order to maintain performance in the remaining portion of the band, it would likely be necessary in many cases to completely replace the LNB downconverter with one that receives only the remaining FSS-only frequencies. FSS service providers would incur substantial implementation costs associated with either approach, such as costs of equipment, labor and downtime for earth station equipment modification, and ongoing impacts on service performance and flexibility. These costs must be addressed.

[5] *Id.* ¶ 41.

Migration to other parts of the C-band downlink spectrum also would require existing satellite service providers to revisit long-term commercial arrangements with space station operators. Generally, a teleport earth station operator enters into a long-term lease agreement with a satellite operator to utilize fixed bandwidth frequency channels on the satellite. Rarely does an earth station have unfettered access to the entire uplink or downlink band, but rather it is permitted to use certain frequencies or transponders for the provisioning of services, which must be coordinated on a regional basis, given the large footprint of C-band downlink signals. Migration to other parts of the C-band could require extensive renegotiation between service provides and satellite operators. There is no guarantee that this time-consuming and costly process will identify alternative C-band capacity, which may result in lapses in or full termination of services to customers.

SpeedCast therefore agrees with the IMDA's conclusion in the Consultation Paper that "co-channel operations of both IMT and FSS (downlink) services may not be possible."[6] Indeed, the mitigation measured discussed above – such as filtering, screening, and other measures – are aimed primarily at removing C-band FSS services from the 3400-3600 MHz extended C-band frequencies. Those measures would degrade C-band services and reduce the operational flexibility that the extended C-band was intended to create, and are likely to be in areas where terrestrial 5G IMT services will be heavily deployed.

SpeedCast believes that a better approach would be for the IMDA to pursue more targeted approaches to enable 5G deployment. Only a limited number of existing C-band gateway sites in Singapore must be protected and future extended C-band earth station deployment could be permitted pursuant to appropriate siting guidelines. Accordingly, IMDA should not pursue wholesale FSS migration to other parts of the C-band and instead should find more appropriate spectrum for terrestrial IMT services, or should develop effective regulatory measures to prevent interference to existing C-band satellite services in Singapore. Specifically, as discussed below SpeedCast believes that the FSS uplink bands present a far more promising case for terrestrial 5G IMT and FSS services to coexist on a non-interference basis.

If the IMDA pursues introduction of terrestrial 5G IMT service in the downlink frequencies of the extended C-band, it should also adopt regulatory measures to ensure that any new terrestrial IMT operators in the band fully compensate incumbent licensees for their costs of addressing the resulting interference issues. Relocating services and equipment to other frequencies (and potentially other geographic sites) would create significant transition costs for FSS service providers, as well as affecting existing long-term commercial agreements with satellite operators and customers. These financial burdens

[6] *Id.* ¶ 43.

should not be borne by the incumbent satellite service providers, but by the new terrestrial 5G IMT entrants. Thus, the IMDA should also create a body or framework for administering the transition and reimbursement process. For example, in the United States, the U.S. Federal Communications Commission created a Transition Administrator to facilitate compensation to incumbent licensees associated with the reconfiguration of the 800 MHz band.[7]

2. **Part III, Question 8:** ***Considering the challenges of co-channel deployment of FSS and IMT services in the extended C-band, IMDA would like to seek views and comments on the coexistence measures for adjacent bands and cross border operations.***

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   Part III, Question 9: ***IMDA would like to seek views and comments on whether there are other frequency bands in the 1-6 GHz frequency band that IMDA should consider for IMT / 5G.***

To the extent there is actual need for additional spectrum for 5G IMT applications in Singapore (and IMDA should ensure that this has been adequately established), IMDA may wish to consider permitting 5G operations in FSS uplink spectrum, rather than the downlink bands proposed in the Consultation Paper. FSS uplink bands – particularly those involving relatively few gateway earth station sites and other services – are likely to present an easier and more straightforward spectrum sharing scenario with 5G IMT applications.[8]

Whereas ubiquitous, high-power 5G base station transmissions in extended C-band frequencies would effectively overwhelm FSS receive operations across the entire C-band because they can saturate sensitive earth station receivers, 5G base stations can be deployed around FSS uplink sites to minimize interference into terrestrial 5G operations. Measures to accommodate FSS uplink operations are localized around a relatively small number of sites and, given the billions of

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[7] *See Improving Public Safety Communications in the 800 MHz Band*, WT Docket No. 02-55, Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order, FCC 04-168, 19 FCC Rcd 14969 (2004), at ¶ 191, *available at:* https://apps.fcc.gov/edocs_public/attachmatch/FCC-04-168A1.pdf.

[8] SpeedCast observes that spectrum allocations for fixed point-to-point services spanning several FSS uplink bands between 5925 – 8500 MHz already exist. Infocomm Development Authority of Singapore, *Radio Spectrum Master Plan*, v. 2.7 (Aug. 2014) at 5. The IMDA should examine existing utilization of that allocation, including appropriate sharing criteria between fixed and mobile terrestrial services, as well as whether the bands could be repacked or otherwise partitioned between these two terrestrial uses.

Singapore dollars invested in satellite and earth station facilities serving the Asia-Pacific region, new 5G services can justifiably be required to bear the burden of sharing spectrum with incumbent FSS operations. While issues such as aggregate interference into satellite receivers must be considered, FSS uplink spectrum presents less interference concerns and a more realistic opportunity for co-existence between terrestrial IMT and satellite services.[9]

While SpeedCast emphasizes the importance of grandfathering incumbent C-band satellites operations under their existing allocation, regardless of the band that IMDA ultimately chooses, it recognizes that regulatory and technical mechanisms may be beneficial as a means to protect existing C-band satellite services and preserve future C-band deployments. Moreover, the technical standards for mobile 5G services have not been developed and it is unclear what the power requirements for future 5G IMT base stations will be, making such mechanisms largely speculative. Still, through appropriate rules, IMDA can preserve opportunity for future C-band deployments and facilitate long-term co-frequency operations. For example, implementation of earth station power flux density limits and elevation and siting requirements have shown to be generally effective in other regions of the world.[10]

Because the earth stations would be transmitting in the uplink band, rather than receiving, interference from terrestrial IMT services would not a factor. Earth stations transmitting in this band are also less likely to interfere with future terrestrial IMT operations because FSS earth stations transmit at high elevation angles upwards toward the GSO arc, with little energy radiated horizontally. This geometry sharply reduces the risk that FSS transmissions would interfere with or obstruct horizontal, point-to-point terrestrial IMT transmissions. Thus, given this much lower interference potential, if IMDA decides to move forward with an additional allocation for IMT, the preferable candidate for sharing between FSS and IMT is the FSS uplink band.

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[9] Indeed, the IMDA has already recognized as much in creating an ITS allocation in the FSS uplink band. *See Regulatory Framework And Standards for Intelligent Transport Systems ("ITS") in the 5.9 GHz (5.875-5.925 GHz) Frequency Band,* Decision Issued by the Info-Communications Media Development Authority (6 February 2017), at ¶ 16 (stating that, "IMDA has assessed that it would be very unlikely for the new ITS applications to interfere with the existing satellite users, considering that this band is used by satellite services for satellite uplink, where the transmission would be of higher power than that from ITS applications").

[10] *See, e.g.,* 47 C.F.R. § 25.136 (defining U.S. co-frequency operational criteria for FSS and terrestrial mobile services in portions of the Ka-band, but currently subject to reconsideration proceedings).

3. Conclusion

SpeedCast urges IMDA to maintain the allocation of extended C-band frequencies (3400-3600 MHz) exclusively for satellite-based communication services. The extended C-band is an essential frequency allocation for satellite services based in Singapore and gives FSS service providers a vital mechanism for meeting the growing communications needs of the entire Asia-Pacific region.

Migration of satellite receive services out of the extended C-band would effectively make the paired extended C-band uplink unusable and impose significant operational and financial burdens on incumbent service providers. In addition, IMT operations in satellite downlink frequencies would create interference challenges that could effectively preclude satellite service providers from reliably utilizing any portion of the C-band, unless they incur substantial costs. It is essential that impact on existing operations be minimized and the costs of mitigation be borne by new terrestrial 5G IMT entrants.

To the extent there is actual need for additional spectrum for terrestrial IMT service in Singapore, IMDA may wish to consider permitting IMT operations in FSS uplink spectrum rather than downlink spectrum. New IMT systems can be designed around the relatively few incumbent gateway earth station sites in Singapore, and appropriate regulations can facilitate expanded earth station operations in the future while protecting satellite receivers from aggregate interference concerns.

Please do not hesitate to contact me should you have any questions.

Respectfully submitted,

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