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Ms. Aileen Chia
Director General (Telecoms and Post)
Infocomm Media Development Authority of Singapore
10 Pasir Panjang Road
#10-01 Mapletree Business City
Singapore 117438

Fax: (65) 6211 2116

Re: IMDA CONSULTATION PAPER ON “5G MOBILE SERVICES AND NETWORKS”

Dear Madam,

Thuraya Telecommunications Company (Thuraya) wishes to thank the Info-communications Media Development Authority (IMDA) of Singapore for allowing the opportunity to comment on the “5G Mobile Services and Networks” consultation paper issued by IMDA. Thuraya is looking forward to responding to any future IMDA Discussion Papers on this matter and/or any other satellite related issues. Annex-1 to this document contains Thuraya response to this consultation paper.

Thuraya is a leading mobile satellite communications company that empowers people with tools to bring the organizations and communities they serve closer together for the purpose of saving and improving lives, by offering innovative, flexible and dependable technology that achieve the highest aspirations - facilitating reliable communications where and when it matters most.

Best regards,

Zahid Zaheer
Senior Director GMPCS Affairs
S&BD
Thuraya Telecommunications Company | P.O.Box
283333, Dubai, UAE
(T) +971 4 4488 650 | (F) +971 4 4488688
zahed.zaheer@thuraya.com

Annex-1

Thuraya comments on the “5G Mobile Services and Networks” consultation paper

Question 1: IMDA would like to seek views and comments on the estimated timeline for the deployment of 5G. Besides ensuring that spectrum is made available in a timely manner, what other regulatory measures could assist in facilitating the deployment of 5G technology and applications? What other use cases should IMDA take note of when developing the regulatory framework?

Answer 1: IMDA should give priority for implementing 5G to higher frequency bands (above 6 GHz) that are likely to get global harmonization based on bands identified by the ITU e.g. 32GHz band. This would ensure that spectrum can be readily and practically used for 5G deployment in a timely manner without significant constraints.

Question 2: To facilitate and understand potential spectrum requirements for IoT deployments in Singapore, IMDA would like to seek views on the following:

i) Based on the current spectrum allocated for mobile services in the sub-1 GHz frequency bands, are there further suitable spectrum resources that could be released to support both IoT and LTE services?

ii) How will future generations of mobile networks (e.g. high capacity, low latency) support the growth of IoT and what would be the spectrum requirements?

Answer 2: No comment

Question 3: IMDA would like to seek views and comments from industry on what they consider will be the key technologies for 5G and whether current regulatory frameworks sufficiently facilitate the deployment of such technologies.

Answer 3: No comment

Question 4: IMDA would like to seek views and comments on whether going forward, there is a need for further spectrum below 1 GHz to be identified and release for mobile services?

Answer 4: In case there is spectrum requirement, IMDA apart from using the bands already available (700 MHz and 900 MHz), may also consider the use of the 614 -694/698 MHz range for 5G.

Question 5: IMDA would like to seek views and comments on the following:

- i) *The frequency arrangement that is better suited for adoption in Singapore for the L band (i.e. SDL, TDD or FDD) and the supporting reasons; and*
- ii) *The timeline for access to the L band and the availability of the equipment (specifically whether it will be available earlier or later than 2020).*

Answer 5 :

- i) Thuraya does not have specific comments regarding the channel arrangement to be used. However any channel arrangement to be used should take into account compatibility studies with the MSS in the adjacent band. The band 1518-1559 MHz is allocated to the MSS systems in all three ITU Regions. Due to the low signal level of the MSS at the MES receiver, the implementation of IMT will impact not only the MSS in the band 1518-1525 MHz, but also the MSS terminals in the range 1525-1559 MHz will be affected. It worth noting the blocking characteristics of the MSS GMR-1 receivers is -70dBm in the range 1505 to 1579 MHz (see ETSI TS 101 376-5-5), which means that the IMT signal operating in the range 1505-1518 MHz have high potential to affect the MSS operating in the band above 1525 MHz. Currently, compatibility studies are being conducted in ITU WP 4C/5D in order to provide technical measures to ensure co-existence between MSS in the frequency bands above 1 518 MHz and IMT in the frequency band 1 492-1 518 MHz. Thuraya suggests for IMDA to wait until those studies are completed before taking further steps on L-band.
- ii) Due to different usage of the range 1427-1518 MHz in many countries around the world, hence the band is difficult to be harmonized worldwide. This is likely to delay the time for having access to the L band and the availability of equipment. However, when it comes to 5G it is noticed that there is not much support to study this specific band for 5G in different forums.

Question 6: Considering the spectrum bands within the range of 1-6 GHz to support the deployment of enhanced mobile broadband services, IMDA would like to seek views on whether all of the 91 MHz of spectrum in the L-band should be allocated for IMT to address Singapore's data demand and growth.

Answer 6: Due to the incompatibility between 5G operations and MSS in adjacent bands, the allocation of the complete 91 MHz of spectrum in the L-band would is not recommended as it would lead to interference with the MSS which carries many safety and security services. Furthermore, many MSS applications are meant for disaster relief and safety of life. Thuraya would not recommend full allocation of the band to IMT (especially the band from 1512 to 1518 MHz). If IMDA is considering to allocate/use parts of the 1427-1518 MHz band for IMT, it should ensure protection of MSS operations in the adjacent band 1518-1559 MHz.

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?

Answer 7: The migration of existing satellite users to other parts of C-band may not be feasible. It will depend on the application being used in the range 3.4-3.6 GHz, the availability of the 3.7-4.2 GHz band and the cost of the migration. Many satellite operators only have access to extended C-band for their operations and migration to other bands is not an option either due to the design of the system or due to the unavailability of other bands to the satellite operator for future generations. Satellites systems operate for at least 15 years.

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.

Answer 8: Taking into account the required separation distances/pfd limits to protect the FSS in the range 3.4-3.6 MHz and in the range 3.6-3.8 MHz, it will be difficult to mitigate interference across the borders and with the adjacent bands.

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.

Answer 9: 5G can be implemented in the ranges 1800 MHz, 2100 MHz, 2.3 GHz and 2.5 GHz. Furthermore bands such as 3.3-3.4 GHz and 4.8-4.99 GHz should also be studied for IMT 5G.

Question 10: IMDA would like to seek your views and comments on the following:

- i) *The role mmWave bands will play in delivering the vision of 5G, in particular, what services could not be delivered by alternative frequency bands and / or technologies;*
- ii) *The amount of spectrum required in the mmWave spectrum bands to meet 5G applications that will require higher bandwidths; and*
- iii) *The specific mmWave bands that you consider should be a priority in Singapore for IMT services and why?*

Answer 10:

- i) No comments
- ii) No comments
- iii) The frequency bands 26 GHz, 32 GHz, 66 GHz and 81 GHz should be considered as priority options to develop IMT in the mmWave bands, as it provides sufficient spectrum needed for 5G and will not have major impact on the satellite industry.

Question 11: Considering that there are 11 candidate bands under consideration at WRC-19, how would making available the 28 GHz band help in the deployment of 5G services in Singapore? Would this band play a significant role in achieving the targets set out for 5G (i.e. higher throughput, ultra-low latency)?

Answer 11: Thuraya believes that making available the 28 GHz band will not help in the deployment of 5G in Singapore, as it will be limited by the deployment of the satellite services in the 28 GHz within

the territory of Singapore and will receive interference from the FSS service in the neighboring countries. Furthermore, this band is not considered by the ITU for 5G deployment as a harmonized band.

Question 12: If the 28 GHz band is opened for IMT services in Singapore, would there be any future competing services that may be deployed in this band which may cause interference issues?

Answer 12: The FSS and FS in the neighboring countries will cause interference to the IMT service in the 28 GHz band.

Question 13: IMDA seeks views and comments on the estimated spectrum demand of 3360 MHz by 2025 and whether this estimate is realistic?

Answer 12: No comment.

Question 14: Noting that several regulators have made available mmWave bands for IMT services, IMDA would like your views and comments on whether access to the mmWave spectrum should be provided earlier than 2022 for commercial network deployment.

Answer 13: The availability of the spectrum is related to finalization of the sharing studies with other services. For the bands where there are no other services to be affected either within the territory of Singapore or in the neighboring countries or the studies are finalized showing the sharing possibility, the spectrum can be made available before 2022.

Question 15: Considering the current regulations/policies for licence-exempt use and the possibility of LTE-U interfering with Wi-Fi users, IMDA would like to seek views and comments on the following:

- i) The adoption of LBT to facilitate sharing of licence-exempt spectrum and whether there would be any implication arising from such a requirement;*
- ii) The need for further technical requirements and regulatory measures to facilitate the sharing of licence-exempt spectrum in an efficient and fair manner; and*
- iii) The need for companies with commercial LTE-U networks to upgrade to LAA once the software/hardware products are commercially available.*

Answer 15: No comment.

Question 16: During the interim period before regulations are finalised, IMDA plans to facilitate industry trials for LAA/LTE-U technologies. As such IMDA would like to seek views and comments on the following:

- i) Besides the information listed in Para 80, should MNOs/MVNOs interested in conducting LTE-U trials submit any further information for IMDA's assessment; and*
- ii) To minimise impact to Wi-Fi users, should IMDA limit LAA/LTE-U trials to parts of the 5 GHz licence-exempt spectrum?*

Answer 16: No comment.

Question 17: IMDA would like to seek views and comments on the following:

i) The possibility of deploying LAA and / or MuLTEfire in other frequency bands besides the licence-exempt 5 GHz band; and

ii) The regulatory and coexistence measures that should be adopted for MuLTEfire.

Answer 17: No comment.

Question 18: Considering that the LWA approach would not create coexistence issue with Wi-Fi users, would this approach be better suited for countries with extensive Wi-Fi usage?

Answer 18: No comment.

Question 19: IMDA would like to seek views on how the above approaches (i.e. LAA, MuLTEfire and LWA) would enhance the capacity of the mobile network in ways that Wi-Fi offloading is not able to achieve.

Answer 19: No comment.