

**AVIA Response to
Consultation on Proposed Allocation of the 26 GHz and 28 GHz Bands to Mobile
Service and the Associated Arrangements for Spectrum Assignment and
Spectrum Utilisation Fee
jointly issued by the Secretary for Commerce and Economic Development
(SCED) and Communications Authority (CA) of Hong Kong**

About AVIA

The Asia Video Industry Association (AVIA) is the non-profit trade association for the video industry and ecosystem in Asia Pacific. Formerly known as CASBAA, AVIA is changing as the video industry adjusts to technological and commercial change, relying on traditional means as well as new forms of delivery to consumers. AVIA serves to make the video industry and other parts of the ecosystem – such as satellite transmission networks and technology support firms – stronger and healthier through promoting the common interests of its members. AVIA is the interlocutor for the industry with governments across the region, leads the fight against video piracy and provides insight into the video industry through reports and conferences aimed to support a vibrant video industry.

Introduction

AVIA welcomes the opportunity to provide comments and views in response to the public consultation on “Proposed Allocation of the 26 GHz and 28 GHz Bands to Mobile Service and the Associated Arrangements for Spectrum Assignment and Spectrum Utilisation Fee,” jointly issued by the Secretary for Commerce and Economic Development (SCED) and Communications Authority (CA) of Hong Kong.¹ The following are the main points raised in this response, all of which discussed in more detail hereinafter:

- Many satellite operators, including Hong Kong based satellite operators, either have satellites in orbit or scheduled to launch in the next two to three years covering Hong Kong as part of the wider Asia Pacific and Oceania regions. Some of these are already or will be using frequencies overlapping with those that SCED / CA is considering for terrestrial 5G mobile services – especially the 27.5-28.35 GHz (or “28 GHz” band).
- Satellite will be an important part of the future 5G ecosystem, just as it forms an important part of today’s 2G/3G/4G ecosystems. Thus, in spectrum planning for 5G, SCED / CA needs to consider not just the terrestrial mobile component of the 5G ecosystem, but also the satellite component, of which the Ka-band – especially the 28 GHz band – is a key band that is already being deployed for High Throughput Satellites (HTS) designs.

¹ Commerce and Economic Development Bureau and Office of the Communications Authority, “Proposed Allocation of the 26 GHz and 28 GHz Bands to Mobile Service and the Associated Arrangements for Spectrum Assignment and Spectrum Utilisation Fee” (26 July 2018) (“Consultation Paper”).

- WRC-19 is considering establishing Earth-Stations-in-Motion (ESIM) regulations in the 27.5-29.5 GHz band (Agenda Item 1.5), which means likely use of the 28GHz band by satellite antennas on vessels and aircraft with global circulation. The satellite operators respectfully suggest that SCED / CA also considers this aspect, given Hong Kong's position as a major maritime and aeronautical hub in the region. In addition to large numbers of foreign vessels/aircraft, ESIMs operating in the 29.5-30GHz spectrum are already installed on many Hong Kong vessels and are of interest to some Hong Kong airlines. ESIM terminals can also operate in portions of the 27.5-29.5 GHz band according also to the outcome of studies under WRC-19 Agenda Item 1.5 and the demand for ESIM applications is likely to require access to the 28 GHz band.
- The CA must bear in mind its statutory responsibility to foster an environment that “enhance[s] Hong Kong’s position as a communications hub in the region”², even if the use of satellite to complement 5G systems is not expected to be extensive within the territory of Hong Kong itself. The CA correctly recognises just two types of External Communications Services currently provided in Hong Kong: satellite and fibre cable³, A number of satellite operators – including Hong Kong-licensed satellite operators – are building HTS systems with Ka-band earth stations in Hong Kong to connect with locations outside Hong Kong. In other words, they are designing HTS networks that will very much make Hong Kong a “communications hub in the region.” The CA’s spectrum decisions on 5G should not preclude such systems, a number of which are already in advanced stages of construction.
- The proposed allocation of the 28 GHz band to mobile services, is of particular concern to AVIA and its members, due to: (1) its existing and rapidly growing use for fixed satellite service (FSS) applications, (2) very limited potential for current and planned FSS applications to share the band with mobile services; and (3) no potential for its global 5G harmonization, as it is not on the WRC-19 agenda for discussion. There is plenty of other spectrum for consideration under WRC-19 A.I. 1.13 that is not already in use by satellites, some of which is also much better suited to 5G high bitrate requirements, including in bands not shared with the FSS and even in some bands shared with the FSS in which there are comparatively fewer existing and planned FSS deployments than the 28 GHz.
- Deployment of 5G in the 28 GHz band is to be discouraged, given the existing and planned FSS deployments in the band for a wide variety of services. Any 5G deployments in this band, especially, should only be on strictly non-protected basis and appropriate limits should be applied to avoid interference to receiving space stations. Should 5G base stations encounter interference in the 28 GHz band, mechanisms should be implemented enabling the automatic switch to 24.25-24.65 GHz, 25.25-27 GHz or other bands where interference from FSS is not an issue.

² Communications Authority Ordinance [Cap. 616], s.4(4)(a).

³ See Communications Authority, *Telecommunications*, June 2018, at:

https://www.ofca.gov.hk/filemanager/ofca/en/content_113/telecommunications.pdf

- International studies are ongoing on the interference into receiving space stations due to aggregation of emissions from multiple 5G base stations in the 24.25-27.5 GHz (the “26 GHz” band) and other bands under WRC-19 Agenda Item 1.13. Minimum 5G base station down-tilt and EIRP density limits are required to reduce the probability of interference from 5G base stations and devices into receiving space stations, as well as protection measures to avoid 5G transmissions directly into FSS uplink earth station reflectors. Any identification for 5G by SCED / CA in the 26 GHz band as a minimum would need to adhere to internationally agreed limitations prescribed at or following WRC-19, or inherent in the international studies used to demonstrate compatibility between co-primary FSS and mobile services in the band.
- There are no comparable efforts concerning the impact of IMT on deployment of new FSS earth stations. The proposed first-come-first-served approach does not adequately preserve the future ability of FSS earth stations to continue deploying in the bands shared with IMT once IMT is licensed and deployed, and is thus incompatible with the co-primary allocation of the band to FSS. AVIA proposes an alternative approach that would allow 5G base stations and devices to be deployed without interference protection from co-primary FSS transmissions. The proposal requires the base stations and devices to intelligently switch to a vacant frequency (e.g. one not shared with FSS) when experiencing co-frequency interference from FSS. This will enable continued deployment of both the public mobile services and FSS earth stations in the future.
- Identifying the 27-27.5 GHz band for 5G is also to be discouraged, noting that this is allocated to FSS in ITU-R Regions 2 (Americas) and 3 (most of Asia Pacific and Oceania, excluding Middle East, Mongolia and former Soviet Union states). Should the SCED / CA nevertheless consider this band for 5G, it would need to be in a manner that would protect FSS space station receivers and not limit the ability to develop and deploy future transmitting earth stations in the band.
- The 24.65-25.25 GHz band is foreseen as being used primarily for broadcast satellite service (BSS) feeder links under a recent allocation made at WRC-12. It is envisaged that, in the future, the BSS bands and associated feeder link bands could be used to support terrestrial 5G networks by efficiently distributing common content to 5G base stations across a wide area. As a result, the ability to provide uplinks from Hong Kong teleports must be safeguarded in offering protection of receiving space stations, for which it is expected that 5G transmitters in this band would need to comply with ITU and other relevant standards and limits as these may be established.
- Satellites generally have regional or wider coverage. Assignment of spectrum to other services in parts of the coverage areas, without first ensuring compatibility, will create unforeseen and unfillable gaps in the coverage area. For services such as 5G terrestrial and satellite, global harmonization of spectrum is not only good practice, but an essential requirement for global inter-compatibility. AVIA strongly urges SCED / CA to adhere to these basic principles.

- If the Spectrum Utilisation Fee (“SUF”) is to be applied to administratively assigned spectrum in any frequency band, it should be applied to all users or assignees of the band and according to their specific characteristics and spectrum usage in a fair and reasonable manner.

Importance of 26 GHz and 28 GHz FSS Bands to the Satellite Industry

AVIA does not oppose allocations of spectrum for the provision of public mobile services, including fifth generation (5G) mobile services. Indeed, many of AVIA’s satellite operator members are actively involved in providing infrastructure that will be critical to the success of 5G. However, such spectrum allocations must not be, and need not be, at the expense of satellite services that have already been, or which are about to be, deployed in overlapping frequency bands.

In providing views and comments herein to the joint SCED / CA proposal, this response focuses in particular on the impact to the satellite services in overlapping frequencies as a consequence of the CA’s proposal to allocate spectrum for mobile services in the “26 GHz band” (24.25 – 27.5 GHz) and “28 GHz band” (27.5-28.35 GHz) respectively.

In ITU-R Region 3, as well as in Hong Kong’s table of frequency allocations, the 27-31 GHz band is allocated to the fixed satellite services (FSS) (Earth-to-space) on a primary basis. Numerous satellites, including those of Hong Kong satellite operators, already use the band or parts of it. Multi-million dollar investments are being made in major teleports in Hong Kong and have been for several years, for operational, licensed antennas, transmitting in this band. OFCA’s assertion that the 27-27.5 GHz and 27.5-28.35 GHz bands have not been occupied for FSS purposes is thus factually inaccurate.

Furthermore, there is a global trend to develop and deploy “High Throughput Satellites” (HTS) – in both geostationary and non-geostationary orbit – offering wideband connections to end users, including to both fixed terminals and mobile terminals – also known as Earth Station In Motion (ESIM) – through large numbers of small spot beams with extensive frequency re-use. These satellites will also be used to help deliver 5G applications to end users, as well as being instrumental in the future deployment of 5G. HTS systems are currently being developed by both Hong Kong and mainland Chinese satellite operators for launch in the coming years, as well as by multiple foreign satellite operators.

While the user terminals linked to Ka-band HTS satellites would typically transmit at frequencies within 29.5-30 GHz, their corresponding gateways would typically transmit within the 26 and 28 GHz bands. Innovative new non-geostationary HTS systems (such as the 16-satellite O3b constellation) are also deploying both gateways and customer earth stations throughout the 28 GHz band. The band is also increasingly being approved for use by ESIM terminals in many parts of the world. As more HTS satellites are deployed, there will be even greater activity in these bands. However, a proposal to deploy ubiquitous mobile devices in

overlapping bands would very rapidly jeopardise all of these very recent and very promising investments in HTS.

The 24.65-25.25 GHz frequencies are allocated to the FSS on a primary basis. In the Hong Kong table of frequency allocations, the 24.75-25.25 GHz portion of this range, i.e. the upper 500 MHz, is allocated to FSS on a primary basis. The 24.65-25.25 GHz frequency range is part of the 26 GHz band. This band is predominantly expected to be used for feeder links in the broadcasting satellite service (BSS) and particularly for BSS in the 21.4-22 GHz range. Since this band was given definitive procedures for use only by WRC-12, noting the fairly long design and construction schedule for satellites and their 15-20 year lifespan, there has been little time to develop and deploy satellites using these frequencies to date. It is however known that there are plans in the mainland to make use of these frequency bands in future satellites. Moreover, the satellite industry envisages the use of the BSS bands, and their associated feeder link frequencies, to complement terrestrial 5G networks by efficiently distributing frequently accessed content to 5G base stations – including broadcast and time shifted video content, mobile device system and application updates and local terrain and mapping data for connected and driverless vehicles.

Over time, one therefore should expect to see use of the 24.65-25.25 GHz spectrum for FSS increasing in Hong Kong as well, especially as a feeder link “hub” for content distribution via the BSS frequencies.

In considering terrestrial 5G in the 26 GHz and/or the 28 GHz band, it is also important to recognize the need to safeguard the evolution and growth of the satellite industry, including the satellite component of 5G, within Hong Kong as an essential part of the overall telecommunications infrastructure to serve its population and to enable Hong Kong to remain an Asia-Pacific regional telecommunications hub. This will attract investment by local, regional and international players, with jobs being created in Hong Kong and benefits to the Hong Kong economy.

As recognized by SCED and the CA, the forthcoming 2019 ITU World Radiocommunication Conference (WRC-19) is seeking to identify internationally harmonized frequency bands which can offer very large bandwidth for terrestrial 5G services in its Agenda Item 1.13. Considering its importance to FSS worldwide, the 28 GHz is NOT on the list of candidate bands. There are however several other frequency bands – more than 33 GHz in total of spectrum – on the list of candidate bands that could potentially be identified for IMT (5G) by WRC-19. It would be best for Hong Kong to aim for internationally harmonized bands in planning for deployment of 5G rather than opting for bands which are not harmonized.

The CA’s Responsibility to Enhance Hong Kong as a Communications Hub for the Region

Section 4(4)(a) of the Communications Authority Ordinance (Cap. 616) stipulates that the CA, in performing its functions, must have regard to the following matters which appear to the CA to be relevant in the circumstances:

- (a) the fostering of an environment that supports a vibrant communications sector to enhance Hong Kong's position as a communications hub in the region; ...⁴

5G mobile and fixed terrestrial services by their nature only enable purely domestic services, providing no international connection and hubbing functions. International connection and hubbing functions are currently only provided by satellite and fibre cable facilities. While Hong Kong can be proud of its position as a regional communications hub today, with its “open sky” policy and dozens of licensed external telecommunications facilities⁵, the decisions that it will make regarding the use of the 26 GHz and 28 GHz bands for 5G could jeopardize that position in the future if satellite spectrum use and requirements are not properly taken into account.

In the case of the 28 GHz, many satellite operators, including Hong Kong operators, have launched or have very advanced plans for latest-generation HTS systems that use the 28 GHz for (among other things) gateway frequencies to address spot beams serving the entire region. Many of these HTS systems propose or have the capability of operating those earth stations in Hong Kong itself, especially the systems of the Hong Kong satellite operators, for which Hong Kong is the natural locale for such hubs.

Ubiquitous deployment of 5G mobile devices and base stations in the 28 GHz could seriously inhibit future deployment of FSS earth stations in Hong Kong for these indigenous and regional HTS systems. Unless due consideration is given to safeguard current and future deployment of FSS earth stations within Hong Kong, the deployment of 5G in 28 GHz would be at the expense of HTS systems hubbed in Hong Kong and serving the broader region.

Consistent with its responsibility to “enhance Hong Kong's position as a communications hub for the region,” the CA should refrain from allocating the 28 GHz for terrestrial 5G systems, especially when there is ample other spectrum being studied for that purpose by the ITU and that such other spectrum is much more likely to be internationally harmonized. If it were to introduce 5G in the 28 GHz, it should take appropriate measures to ensure continued use of the band by the FSS, including the ability to deploy future earth stations even after terrestrial 5G is deployed.

A similar case can be made for caution regarding the 24.65-25.25 GHz portion of the 26 GHz band, which is currently designated as feeder link spectrum for the

⁴ Consultation Paper at para. 7; Communications Authority Ordinance [Cap. 616], s.4(4)(a).

⁵ See Communications Authority, *Telecommunications*, June 2018, at:

https://www.ofca.gov.hk/filemanager/ofca/en/content_113/telecommunications.pdf at 2 column a – “As at March 2018, there were 42 licensees permitted to operate either external cable or non-cable based facilities for the provision of external telecommunications services. ... Hong Kong adopts the open sky policy in regulating the provision of satellite services. Satellite-based telecommunications and television broadcasting services are provided via a multitude of satellites in the region with around 230 [licensed] satellite earth station antennas operated by a number of fixed carriers and broadcasters.”.

recently allocated 21.4-22.0 GHz BSS band. While there have been fewer deployments in this band, AVIA understands that mainland Chinese satellite operators are planning to deploy satellites in this band. By its nature, BSS feeder links earth stations are “hubs” from which content can be distributed broadly using the BSS bands. Such BSS bands can be used to support not just conventional direct-to-home (DTH) satellite services, but also future terrestrial 5G networks by efficiently distributing common content to 5G base stations. As a result, the CA should bear in mind its responsibility to “enhance Hong Kong’s position as a communications hub for the region” in making decisions about this band as well.

Answers to Specific Questions Raised in the Consultation

Regarding the specific questions raised in the consultation paper, AVIA takes this opportunity to offer its responses as follows:

Question 1: What are your views on the proposed allocation of the 26/28 GHz bands to mobile service and of the sub-band 24.25-24.45 GHz to fixed service on primary basis? What are your views on the protection of radio stations of co-primary users on a first-come-first-served basis?

Observations on the Proposed Allocations in 26/28 GHz Bands. AVIA notes with interest the proposal to widen the fixed service allocation to overlap with the entire 26 GHz and 28 GHz frequency bands in order to accommodate fixed wireless applications. Such applications would seem to be different in nature from those of the mobile 5G services, for which, according to this document, the CA is seeking spectrum. If “5G” deployments in the 26 and 28 GHz were to be limited to individually licensed fixed links (i.e. not ubiquitous mobile base stations and devices, nor area-licensed fixed wireless services), the prospect of co-existence with FSS earth stations would be greatly enhanced.

Regarding co-existence between FSS and mobile services, the SCED / CA consultation paper, at paragraph 14, refers to ITU studies states that “*preliminary study results show that subject to certain deployment constraints, IMT services are compatible with existing services in the 26 GHz band*”. In this regard it is worth noting that the ITU efforts are limited to studies on the interference into receiving space stations due to aggregation of emissions from multiple 5G base stations, and that they are not yet concluded or agreed. A minimum 5G base station down-tilt and limits on the EIRP density at which 5G base stations and devices can transmit are required to reduce the probability of interference into receiving space stations.

To date, the ITU has not and is not conducting any studies concerning the impact of IMT on deployment of new FSS earth stations, which may cause interference into IMT base stations and/or devices.

Should the next ITU WRC-19 decide to identify the 26 GHz band, or portions of it, for IMT, it is highly likely that this will be with certain conditions to facilitate compatibility with other primary services, including FSS. What these conditions might be are not yet known. AVIA is of the view that any identification for 5G by

SCED / CA in the 26 GHz band at a minimum would need to adhere to limitations prescribed by WRC-19, or at least those inherent in the studies that demonstrate compatibility of the mobile services with the FSS.

AVIA wishes to highlight the conclusions which appear to have been reached in the SCED / CA consultation paper at paragraph 14 to the effect that “*the ITU study results confirm the feasibility of introducing mobile service on top of the existing services in the two frequency bands*” (i.e. the 28 GHz as well as the 26 GHz). AVIA submits that this conclusion is not supported by the ITU studies. That is because the 28 GHz band is outside of the scope of the WRC-19 Agenda Item and related studies on spectrum for IMT-2020/5G. Relying on the 26 GHz studies for the 28 GHz band would fail to recognize the differences in the existing and planned levels of satellite deployment and the types of satellite applications in the 24.65-25.25 GHz band versus the 27-28.35 GHz band. The CA should be especially careful not to apply conclusions from studies of the 26 GHz band to the 28 GHz band because of these differences. One of the reasons the 28 GHz band was rejected for study as a potential 5G band is because it is already heavily used by satellite services, some of which will be part of the 5G ecosystem.

First-Come-First-Served. With regards to the proposed implementation of a first-come-first-served principle for protection of co-primary FSS and mobile services, AVIA is of the view that the foreseen widespread deployment of 5G, would severely limit satellite uplinks to the current uplink locations and frequency bands thereby prohibiting any evolution of the FSS, e.g. in conjunction with the operation of HTS satellites where there might be a need for customers to establish virtual networks using their own earth stations at their own premises.

AVIA submits that the proposed first-come-first-served approach is incompatible with the need for continuation and further development of FSS. Instead, AVIA would propose different mechanisms that would allow continued co-deployment of both services in the future, as described below for each the three bands: 24.65-25.25 GHz, 27-27.5 GHz and 27.5-28.35 GHz.

1. The 28 GHz band is a part of the 27.5-31 GHz globally allocated FSS band. As indicated earlier, several satellites, including those of Hong Kong satellite operators, already use the 27.5-28.35 GHz band. In the same vein, major teleports in Hong Kong have, and have had for several years, operational, licensed antennas, transmitting in this band. In Europe, the European Communications Commission (ECC) has assigned the 28 GHz band for satellite uplinks, and has excluded the band for 5G. Furthermore, it is notable given the importance of the band for FSS worldwide, that WRC-15 decided NOT to consider the 28 GHz band as a candidate band for IMT (5G) under WRC-19 Agenda Item 1.13. On the contrary, WRC-15 created WRC-19 Agenda Item 1.5 to study use of ESIMs operating in the 27.5-29.5 GHz uplink band (and the 17.7-19.7 GHz downlink band) to further expand the FSS applications for this band. Consequently, there will be no global trend to identify the 28 GHz band for 5G.

To enable FSS develop and evolve, e.g., to accommodate new HTS satellites that are currently being developed, AVIA would advise strongly against deployment of 5G in the 28 GHz band. Any such deployment should only be on strictly non-protected basis and appropriate limits should be applied to avoid interference to receiving space stations. Should 5G base stations encounter interference in the 28 GHz band, mechanisms should be implemented enabling the automatic switch to 24.25-24.65 GHz, 25.25-27 GHz or other bands where interference from FSS is not an issue.

2. The 27-27.5 GHz band, is allocated to FSS in ITU-R Regions 2 and 3. Earth stations in Hong Kong are also in operation and licensed to operate in this band. While this band is being considered for IMT (5G) by ITU, it provides a most valuable opening for GSO gateways and other earth stations in support of HTS networks in this region (see, for example, Australia's NBN HTS satellites, which use this spectrum).

Use of the band 27-27.5 GHz could prove essential in enabling sufficient uplink bandwidth for GSO HTS networks, particularly for gateway links. For this reason, AVIA would advise against identifying this band for 5G. Should the SCED / CA nevertheless consider this band for 5G, this would need to be in a manner that would not limit the ability to develop and deploy future transmitting earth stations in the band. For instance whereby 5G operating base stations on a strictly non-protected basis, encountering interference, would be required to switch to alternative frequencies where interference from FSS is not an issue (e.g. 24.25-24.65 GHz or 25.25-27 GHz). To provide the required protection of receiving space stations, 5G transmitters in the 27-27.5 GHz band should also adhere to ITU and other relevant standards and limits as may be established. To limit the interference area around transmitting earth stations, a reasonable minimum elevation angle, e.g. 20°, could be considered for earth stations in this band, reducing the emissions levels of earth stations towards the local horizon.

3. The 24.65-25.25 GHz band is foreseen as being used primarily for BSS feeder links. For this reason, the expected use may be limited to number of larger earth stations, e.g. larger than 3.5 m diameter antennas located at the Hong Kong teleports or at the premises of the BSS and pay TV providers located in Hong Kong. AVIA is of the view that the ability to provide uplinks from the Hong Kong teleports must be safeguarded. Moreover, should there be a later need to establish transmitting earth stations at other locations, e.g. at the premises of broadcasters or pay TV providers, a consultation process should be undertaken by which compatibility between 5G and the FSS uplink would be assessed and if necessary, adjustments to frequencies of affected 5G base stations would be considered.

To facilitate co-existence with terrestrial 5G systems and reduce the interference area around earth stations, minimum earth station antenna sizes, e.g. 3.5 m, and minimum earth station elevation angle, e.g. 20°, could be considered. Also, as recommended above, to offer protection of receiving

space stations in the 27-27.5 GHz band, 5G transmitters in this band would need to comply with ITU and other relevant standards and limits as these may be established. Non-protected operation of 5G base stations and devices in the band should also be considered in this band.

In the bands 24.65-25.25 GHz and 27-27.5 GHz, non-protected operation of 5G base stations and devices would not preclude widespread 5G deployment due to the fairly small areas around FSS earth stations and the relatively small numbers of earth stations. The use of highly directional FSS antennas and their orientation towards satellites in the sky, especially with a minimum elevation angle, would result in low power levels in the horizontal plane with as much as 60 dB attenuation – *i.e.* less than one millionth of the signal strength transmitted towards the satellite. Due to this and the attenuation provided by local factors such as terrain and buildings at these high frequencies, and also the potential gains by use of appropriate 5G deployment – including use of MIMO, sector disabling, indoor deployment or selective base station locations and cell shape/size – the spectrum used by FSS can be re-used by 5G throughout Hong Kong, even within relative close vicinity of FSS transmitting earth stations. AVIA believes this is a better approach for continued development of these co-primary services than the first-come-first-served proposed by the CA.

Question 2: Do you have any views on adopting an administrative assignments approach for the release of spectrum in the 26/28 GHz bands?

AVIA does not have any particular views on the approach for making spectrum for 5G available. However, for any methodology that is adopted, the current use of 28 GHz and portions of 26 GHz and its further development by the FSS must be safeguarded. AVIA also note the stated intention of SCED / CA to make spectrum for 5G available from April 2019. In this regard, AVIA would like to highlight the fact that under WRC-19 Agenda Item 1.13, the ITU will study international harmonization for 5G offering very wide bandwidths. WRC-19 will take place October/November 2019. The SCED / CA should be better placed to decide the appropriate frequency bands for use by 5G in Hong Kong after ITU has decided on which bands to harmonize internationally and the necessary conditions.

Question 3: Do you have any views on the proposed band plan with frequency slots of 100 MHz each?

AVIA does not have any particular views on the bandwidth to be used by 5G, but assumes that it might be beneficial to align this with international allocations. Agenda Item 1.13 for WRC-19 proposes more than 33 GHz for study for possible identification of spectrum for IMT systems (5G). It should be possible to find more than enough spectrum within this 33 GHz to meet any realistic projection of data consumption growth, and to identify sufficient blocks of spectrum that can accommodate various channel bandwidths. There is no pressing need to look at the 28 GHz band, which is not even included among the bands for discussion at WRC-19. In consideration of channels and use of channels by various 5G operators, different consideration would need to be given to use of those channels which are

not overlapping with satellite frequency bands and those that do overlap due to the need to protect the co-primary FSS.

Question 4: Do you have any views on the proposal of assigning (a) 3 300 MHz to 3 700 MHz of spectrum in the 26/28 GHz bands for the provision of large scale public 5G services and (b) the remaining 400 MHz to 800 MHz of spectrum in the two frequency bands to other entities for the provision of 5G services in specified locations on a shared basis?

As AVIA has submitted above, the 28 GHz band is unsuitable for 5G deployment due to the limitations that it could impose on the development and deployment of FSS. However, AVIA notes that there is up to 2 150 MHz of spectrum in the 26 GHz band (24.25-24.65 GHz and 25.25-27 GHz) which could be suitable for large scale public 5G services without raising any issues in respect of FSS. This is over half the bandwidth considered in this consultation. Moreover, there is 600 MHz of bandwidth (24.65-25.25 GHz) where 5G could be introduced on certain conditions necessary to protect the co-primary FSS (see the discussion under Question 1). These bands together could be considered to just about meet the desired spectrum for 5G in these bands. With them, a total of 2 750 MHz of the 4 100 MHz total – over 67% of the band considered in this Consultation – would be available for 5G.

Question 5: Do you have any views on the proposed caps of (a) 800 MHz of spectrum in the 26/28 GHz bands for spectrum designated for the provision of large scale public 5E services; and (b) 400 MHz of the Shared Spectrum designated for the provision of specified location services?

AVIA has no view on a possible cap on the spectrum assigned to each assignee or that may be made available for terrestrial “shared use”. The caps and the amount of shared spectrum may need to be adjusted (a) if the frequency bands for 5G exclude the 28 GHz band, as strongly recommended by AVIA, and (b) the conditions in bands shared with FSS vs. those not shared with FSS.

Question 6: What are your views on the proposed method of assigning spectrum in the 26/28 GHz band to qualified applicants for the provision of large scale public 5G services?

AVIA expresses no view on this question.

Question 7: Do you have any preference on the assignment of spectrum in either the 26 GHz or 28 GHz band?

As explained in the response to Question 4, frequencies for large-scale public 5G services should be selected within the 24.25-24.65 GHz or 25.25-27 GHz bands. Provided that the frequencies are selected from within these bands, AVIA has no particular view on how capacity within these bands is distributed between assignees.

Although some nations in very exceptional circumstances are considering the 28 GHz band (such as USA and Korea), those nations have unique domestic situations that alter their use of this band. For example, the USA has justified studying the 27.5-28.35 GHz band for 5G/IMT systems because terrestrial fixed services in that country (but not mobile services) were granted primary status in that band some years ago under a unique US domestic band plan. The USA is not considering the rest of the band 28.35-29.50 GHz for 5G, where FSS was designated primary.

AVIA does not expect many other countries to support the USA or Korea in studying the 28 GHz band because of the WRC-15 decision not to do so. The number of countries that are likely to allocate the 28 GHz for 5G will very much be in the minority. CEPT has clearly signaled its intent not to introduce 5G in the band, and Australia and mainland China are focusing on the 26 GHz band for 5G. Similarly, Brazil recently proposed to exclude terrestrial services from the 27.9-29.1 GHz band and limit that band's use only to Fixed Satellite Services (FSS). These developments recognize the fact that satellite use of the Ka-band for high-throughput, broadband applications has increased exponentially in the past few years. There is an unmet need for universal broadband connectivity that cannot be denied, and satellites are essential for truly ubiquitous coverage. Even if Hong Kong itself has less need for satellites than other countries, it can nevertheless participate in expanding global connectivity by serving as a satellite "communications hub for the region" – a factor that the CA has a statutory responsibility to consider when making its spectrum allocation decisions.

Question 8: What are your views on the proposed assignment method for the Shared Spectrum?

AVIA understands that when the SCED / CA consultation paper's reference to "shared spectrum", implies several terrestrial 5G operators sharing the spectrum, rather than 5G sharing the band with other services. AVIA expresses no view on the assignment method of shared spectrum among terrestrial 5G operators. As for sharing with the co-primary FSS in, e.g. the 24.65-25.25 GHz band, or portions of it, appropriate measures to ensure compatibility and future deployment of both services will be necessary as suggested in the response to Question 1.

Question 9: What are your views on the network and service rollout obligations proposed to be imposed on the use of spectrum assigned for the provision of large scale public 5G services?

As long as the 5G deployments are within the frequency bands and following the principles laid out in the responses to Questions 1 and 4, AVIA does not have any particular view on the timeline for rollout.

Question 10: What are your views on the proposed performance bond for guaranteeing compliance with the proposed network and service rollout obligations for using spectrum assigned for the provision of large scale public 5G services?

AVIA is of the view that the performance bond should be such that only serious operators are assigned frequencies for 5G. In addition to meeting the milestones of the rollout plan, there should be requirements for the assignees (including users of Shared Spectrum) to meet other requirements, e.g. technical requirements to ensure compatibility with other services, in order for the bond to be released.

Question 11: Do you have any views on the proposal for SUF as set out in paragraphs 45 to 50 above?

AVIA urges SCED / CA not to use SUF for profit, but rather to promote innovation. AVIA considers the example in footnote 13 to paragraph 42 of the Consultation to be highly contrived and technically incorrect, especially at these high frequencies. FSS and FS have coexisted for decades at lower frequencies, and the higher directionality of antennas transmitting at such frequencies means that the likelihood of specific individual FS links being affected is significantly reduced. In any event, at most a tiny fraction of FS links would be precluded. AVIA is of the view that if SUF is to be applied to administratively assigned spectrum in any frequency band, it should be applied to all assignees according to their specific characteristics and use in a fair and reasonable manner. However, there are several features the CA's proposed SUF scheme for 5G public mobile services that are unclear and puzzling, and which call into question its overall reasonableness and fairness. The CA's proposal also calls into question whether it will incentivize efficient use of the spectrum for 5G public mobile services.

1. The CA is proposing to apply a SUF of \$21,600 per MHz per annum to 5G public mobile services. This is the fee for exclusive assignments of spectrum to carrier licensees for fixed links and satellite uplinks. But if the 26 GHz and 28 GHz bands are co-primary throughout with the fixed service and co-primary in the 24.65-25.25 GHz and 27.5-28.35 GHz with the fixed satellite service, then shouldn't the non-exclusive or shared assignment fee apply instead? And shouldn't the level of fees be different in bands shared with two other services (e.g. FSS and FS) than when shared with one other service (e.g. FS)?
2. The CA is proposing to apply a SUF of \$1,080 per MHz per annum per 50 square kilometers for spectrum that is "shared" among terrestrial 5G operators. It is unclear where this number comes from, since the ordinance setting out the SUF for fixed and satellite uplinks specifies "shared" SUFs in a number of frequency bands, but not the 26 GHz or 28 GHz and none of them are set at a level of \$1,080 per MHz per annum per 50 square kilometers. Whatever the proper level of SUF for shared spectrum in these bands, should they not apply in all services in all parts of the band that are to be shared with 5G public mobile services?
3. For FSS earth stations in shared bands, AVIA submits that any area-based fee be based on a calculation of the denial area, i.e. the area in which other services may not be able operate because of interference from the FSS earth

stations. At millimeter wave frequencies, the denial area from FSS earth stations could be relatively small, especially if appropriate measures are imposed to enable continuing co-existence of FSS and other services in the band. For decades, FSS and FS have shared the satellite uplink spectrum successfully from separate albeit geographically close locations. This is possible due to the highly directive antennas used by FSS earth stations. Because of these highly directive antennas, relatively very little power will be directed towards around the horizontal plane. Typically, the signal in the horizontal plane will be more than 60 dB attenuated, *i.e.*, less than one millionth of the signal strength transmitted towards the satellite. Due to this and the attenuation provided by local factors such as terrain and buildings at these high frequencies, and also noting the potential gains by use of appropriate 5G deployment – including use of MIMO, sector disabling, indoor deployment or selective base station locations and cell shape/size – the spectrum used by FSS can be re-used by 5G throughout Hong Kong, even within relative close vicinity of FSS transmitting earth stations.

4. The CA is also proposing to charge the SUF for 5G public mobile services only if the band is “congested,” which is defined at 75% or greater occupancy. There are several concerns about such a scheme. First, it is not clear how this occupancy rate is to be determined, including whether each of the 26 and 28 GHz will be assessed separately, whether use of the band by other services will count, and whether only exclusive use vs. shared use will count (and how). Second, such a scheme would appear to create incentives to keep utilization of these bands below 75% – a prospect that is all the more likely because other bands are being made available and will be used for terrestrial 5G. Third, other services in these bands – and services in other frequency bands – do not appear to benefit from similar relief from lack of congestion, since they appear to be liable for the SUF regardless of the overall occupancy rate of the band.
5. AVIA has set out the reasons why the 28 GHz band is already used by satellite services today and is likely to be much more heavily used in the future, given the HTS systems that have been deployed and that are under construction today. If, notwithstanding AVIA’s strong recommendation to the contrary, the CA were to introduce 5G public mobile services in the 28 GHz band, then SUF pricing should definitely be chargeable to the terrestrial 5G licensees in the 28 GHz band due to the contested use.

The application of the SUF must be fair and reasonable across all services expected to be using a frequency band, and the CA’s proposals raise many questions as to whether they will in fact be fair or reasonable, or whether they will incentivize efficient use of spectrum for terrestrial 5G public mobile services. AVIA submits that a further round of consultation addressing in detail how the SUF will operate is warranted before such spectrum is allocated or assigned.