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Session 5
Spectrum: exactly what is 5G and what does it mean for the regulator?

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Chris, Dr Jesada, fellow speakers, distinguished guests, ladies and gentlemen,

The V*ision of 5G*

It is my pleasure to share with you today our thoughts on this very exciting topic: vision of 5G. To date, there hasn't been much discussion in the telecommunications sector about the development of 5G. A common question asked is: what benefits will 5G bring about. Higher speed? Lower latency? Massive deployment of Internet of Things ("IoT")? My answer is yes to all these questions, **but** the most important benefit, in my view, is that 5G will be the catalyst powering a super-connected society which fosters the creation of new value chains for economic growth and business opportunities, not just of benefit to the ICT industry but our entire community. Let me outline to you what we are doing in Hong Kong to prepare for the introduction of 5G services.

Hong Kong: A Thriving Mobile Market

2. First, context. Let me say a few words on the market landscape in Hong Kong in the current 4G era. Hong Kong is small, with an area of 1100 km square. We have a population of 7 million plus. We are served by four mobile network operators and 26 mobile virtual network operators, which offer together a wide range of affordable services to users. "Affordable" as 4G mobile service plans with 1 gigabytes and 6 gigabytes of data per month are available at as low as USD 19 and USD 32 respectively. Our mobile penetration rate stands at 228%. The mobile broadband usage per capita is about 2.9 gigabytes a month, and is 12 times higher than that of six years ago when 4G services were first commercially launched in Hong Kong. With the adoption of carrier aggregation technology by mobile operators, our 4G services can now achieve a maximum speed of 375 Mbps, and it is expected to increase further to 450 Mbps by the end of this year. The split between the number of 3G and 4G subscribers is about 55/45. The penetration rate of fixed household broadband services in Hong Kong is 84.6 percent, with about 87 % and 79 % of our households having access to respectively at least two and three self built networks respectively. Our high mobile penetration rate, especially in respect to high speed 4G services, provide a worthy alternative to fill service gap in areas with insufficient wired infrastructure.

3. Spurred by the continuous and robust growth in demand for mobile services, mobile operators in Hong Kong have every incentive to actively look into the potentials of 5G deployment to further increase their capacity to meet the appetite for data, to make connections faster and to expand into new markets of communications among people and things.

4. As the regulator of the communications industry in Hong Kong, we are conscious of our role in facilitating the development of our mobile market through efficient management of scarce radio spectrum resource, safeguarding an effective competition environment and keeping our regulatory regime conducive to innovation and investment. To ensure that our mobile market will continue to have healthy and vibrant development in the 5G era, I would like to highlight some of the major initiatives that we have been taking in this regard.

Spectrum Supply for 5G and Promoting Efficient Re-assignment and Utilization of Spectrum

5. Our first major challenge ahead is : how do we go about making available suitable frequency bands and sufficient amount of spectrum for commercial deployment of 5G services. Here in Hong Kong we have already assigned all the available 610 MHz of radio spectrum in the sub-3GHz band to the market, essentially through

auctions, for the provision of public mobile and wireless communications services. We are acutely aware of the need for new spectrum to meet the local as well as the global demands for the 5G services during the run up to 2020. In this regard, the next World Radiocommunication Conference scheduled for 2019 will look for higher frequencies in the range of 24 – 86 GHz for allocation to IMT-2020 (i.e. 5G) services. Meanwhile, several economies around the world are actively promoting 5G enabled technologies and conducting trials in different frequency bands available to them for 5G deployment. For example, the Federal Communications Commission has adopted new rules which open up a bandwidth of some 3.8 GHz in the 28 GHz, 37 GHz and 39 GHz bands and a bandwidth of 7 GHz in the unlicensed spectrum of the 64 – 71 GHz band for wireless broadband applications, so as to facilitate advancement to 5G networks and technologies in the United States. In Europe, the UK recently conducted 5G trials in the 71 – 86 GHz band. Asian economies including the Mainland of China, Japan and South Korea are also actively promoting 5G trials in, among other spectrum, the 3.5 GHz and 28 GHz bands. We will be keeping a close watch over developments and would make available the necessary spectrum timely so as to maintain Hong Kong's favourable position in terms of spectrum availability for early deployment of 5G services.

6. We will also actively engage relevant stakeholders in Hong Kong, including industry players, manufacturers, academics and interest groups through OFCA's advisory committees to solicit the industry's view on spectrum planning and other regulatory issues relating to the development of 5G. This is to ensure that what we do as a regulator best fits the market needs.

7. Pending the availability of new frequency bands, we would continue to promote efficient spectrum allocation and utilization, no less through spectrum re-assignment exercise. We seek to achieve this in a number of different ways.

8. First, in Hong Kong, we do not subscribe to the theory of perpetual spectrum assignments. Spectrum is assigned for a fixed term, mostly of 15 years. Assignees are advised from the start that they should not have any expectation that the spectrum would be re-assigned to them at end of term. They have therefore every commercial incentive to maximise the efficient use of their spectrum during the 15-year term of holding.

9. Once spectrum is assigned, under our technology-neutral policy, mobile operators are free to refarm their assigned spectrum for higher generation services based on their commercial considerations. There is absolutely no need for them to seek our prior approval. This is particularly important in providing the much

needed flexibility and agility for our operators to reap the market opportunity and provide higher speed services timely to meet the incessant market demands. Indeed, a large portion of the spectrum originally deployed for the provision of 2G and 3G services has already been refarmed for 4G services in Hong Kong. Our mobile operators may, apart from making use of any new spectrum to be assigned, refarm the spectrum they have in hand for 5G deployment timely.

10. As to the re-assignments arrangements, we have embodied, after public consultation, a strong element of auction, in our 3G spectrum re-assignment arrangements. Of the 118.4 MHz spectrum in 1.9 – 2.2 GHz band which is subject to re-assignment come end of this October, 49.2 MHz of which has been assigned through auction, 69.2 MHz of which through administrative means. We favour auction as we firmly believe that only through such a market-based mechanism could we ensure that spectrum, as a scarce public resource, would be assigned to those who value it the most and would hence put it to most efficient use.

11. We also make use of the re-assignment opportunity to re-design the band plan to maximize spectrum efficiency in the new term. A case in point is our upcoming exercise to re-assign 200 MHz of spectrum in our 900 and 1800 GHz bands, which were assigned in the 2000's to the mobile operators, upon the end of assignment in

2020. We are now embarking on a public consultation exercise on the proposed re-assignment arrangements and spectrum utilisation fees. As some of the spectrum was assigned in a fragmented manner and in various frequency block sizes which could not maximize spectral efficiency, we will take the opportunity to re-arrange the spectrum in these bands and re-assign them in frequency blocks of 2 x 5 MHz and 2 x 10 MHz so that spectrum assignees will be able to utilise it in a more spectrally efficient manner for the implementation of 5G.

12. Meanwhile, we note that there is a proposal by equipment manufacturers for the use of 4G LTE radio communications technology in unlicensed spectrum such as the 5 GHz band, so called LTE-U (where U stands for unlicensed band) or Licence Assisted Access ("LAA").[1] These unlicensed bands are currently used for Wi-Fi services in Hong Kong. If technology is available for co-existence of Wi-Fi and 4G and beyond services in these unlicensed bands, we are open to designating these unlicensed frequency bands for deployment of 4G and beyond services through shared use by mobile operators. If there is such spectrum harmonisation at international or regional level, we will make timely arrangements to effect its use in Hong Kong.

[1] LTE-U or LAA refers to the technologies proposed to make use of the 5 GHz unlicensed band for provision of 4G LTE services. They are being developed by different equipment manufacturers.

Promoting Efficient Assignment Of New Spectrum

13. As soon as suitable 5G spectrum is made available, the next important step is to release it to the market as soon as possible and in the most economically efficient manner. In Hong Kong, we have a well-established framework for releasing new spectrum, which is premised upon the principle of always adopting a market-based approach when there are competing demands from providers of non-Government services, unless there are overriding public policy reasons to do otherwise. Following this principle, new spectrum is inevitably assigned by way of auction and this approach has served us well to ensure, as in the re-assignment exercises, that only parties who value the spectrum most and are able to put it to the most effective use would be able to obtain the right to use the spectrum.

14. The new 5G spectrum will come from much higher frequency bands above 24 GHz. With the large bandwidth and short propagation distance, the room and indeed the merits of spectrum assignees sharing-use of the spectrum vastly increase. A challenge to the regulators is the corresponding need to review whether we should still stick to the present exclusive assignment of spectrum in the 5G era. Also, taking into account the huge investment needed for operators to construct an infrastructure of a dense cluster of small cells layered upon the conventional mobile network architecture so as

to deploy the 5G technology, it begs the question of whether the market-based spectrum utilization fee would impose too hefty a financial burden on mobile operators, to the effect of hindering investment and hence lessening consumers' access to and choices of advanced technology. All in all, we need to critically examine the value of this multiple GHz of the new spectrum as compared with that of the currently assigned spectrum in the sub-3 GHz band so as to peg the reserve price at an appropriate level, which would on the one hand, realize as far as possible its full market value, and, on the other hand, facilitate commercial deployment of 5G spectrum by our operators. All these culminate into the thought-provoking process of reviewing whether auction should be the most effective way of assigning 5G spectrum in the new era.

Making Available Numbers for Mobile Services

15. With the continuous development of telecommunications services, the demand for mobile subscriber numbers continues to rise. It has created pressure on our existing 8-digit numbering plan with finite number blocks left available for mobile services. To further cope with the possible surge of demand for mobile numbers arising from 5G services, we have recently revamped the existing numbering plan to make available additional 8-digit number resources for mobile numbers after consultation with the stakeholders and the general public.

16. The future 5G platform is expected to be used for the deployment of machine-to-machine ("M2M") and IoT communications devices. Since 2015, we have made available 12-digit numbers for assignment to these communications devices as an interim addressing solution alternative to the use of IPv6 over public mobile networks so as to facilitate deployment of M2M and IoT applications in Hong Kong.

Facilitating Rollout of Mobile Networks

17. We have, and would continue to facilitate our mobile operators to roll out their networks. Among others, we allow mobile operators to use public facilities like hill top radio sites, government buildings, and lamp posts on the public streets for installation of mobile base stations and assigning microwave links to connect these stations with the core networks.

18. In the implementation of 5G technologies, the deployment would involve a dense cluster of small cells layered upon the conventional mobile network architecture. To support the deployment for street level coverage, we have been facilitating mobile operators to set up small cells at public payphone kiosks for better localised coverage. We are also working with the relevant government department (i.e. Building Department) to move a

legislative amendment for simpler application procedures for mounting small cells on external walls of buildings.

19. Another type of small cell is femtocell which has been deployed by mobile operators for about five years in Hong Kong. Under our light-handed and facilitating regulatory policy, no approval for femtocell installation is needed and no licence fee on femtocell is imposed. At present, all mobile operators have already had a significant base of femtocells installed for providing services at customer premises in Hong Kong, rendering them more ready for 5G deployment.

20. To enable mobile operators to roll out their networks and services in a more cost effective manner, we allow various forms of mobile network sharing. They range from sharing of radio sites, sharing of radio access networks, antennas and poles, to sharing of network capacity through aggregation of component carriers from different network operators. We may also accede to any novel network sharing initiative put forth by mobile operators so long as it complies with our prevailing regulatory requirements.

Concluding Remarks

21. While our citizens will be better served by the future 5G platform capable of delivering all sorts of e-services and e-

applications in a more efficient manner, we would need to face a host of issues like cyber security, privacy, cross-border data transfer etc. Furthermore, with the increasing scope, scale and depth of a networked economy, we must be prepared to accommodate new models of doing business, delivering services, and in fact all kinds of interactions among businesses, consumers and government. We are prepared to face these challenges positively and will stand ready to work with all stakeholders, including other sector regulators, the industry and consumers to sort out how the regulatory regimes should be updated to make technologies deliver most for the well-being of the community.

22. It is expected that 5G services will be introduced as early as 2018. It is our job as regulators to make available the radio spectrum and fine tune our regulatory regimes timely to facilitate development of 5G services. I am really glad to share with you at this juncture on how we are preparing for the introduction of 5G in our local market in order to cope with foreseeable opportunities and challenges associated with this next wave of development in mobile broadband services, and as a result the far-reaching implications of transformation brought about by a more than ever networked society. I look forward to having a fruitful exchange with all of you in the remaining time of this session.

23. Thank you very much.

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