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**Panel on Information Technology and Broadcasting**

**Meeting on 10 May 2019**

**Background brief on spectrum assignment and the fifth generation  
mobile services**

**Purpose**

This paper provides background information on spectrum assignment and the fifth generation mobile ("5G") services. It also summarizes the views and concerns expressed by Members during the relevant discussions.

**Background**

Spectrum Management Policy

2. Under the Telecommunications Ordinance (Cap. 106), the Communications Authority ("CA") has the statutory duty to promote the efficient allocation and use of the radio spectrum as a public resource. Cap. 106 also empowers CA to allocate and assign radio frequencies and to designate those which should be subject to the payment of spectrum utilization fee ("SUF") following consultation with the telecommunications industry and other affected parties.

3. The Administration promulgated the Radio Spectrum Policy Framework ("Spectrum Policy Framework") in April 2007,<sup>1</sup> which sets out the spectrum policy objectives, guiding principles in spectrum management, spectrum rights, supply of spectrum, spectrum for government services and

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<sup>1</sup> See the Radio Spectrum Policy Framework (<https://www.cedb.gov.hk/ccib/eng/legco/pdf/spectrum.pdf>).

spectrum pricing.<sup>2</sup>

### Spectrum assignment for non-government services

4. In accordance with the policy guidance set out in the Spectrum Policy Framework, spectrum assignment has been made using a market-based approach whenever CA considers that there are likely to be competing demands from providers of non-government services, unless there are overriding public policy reasons to do otherwise.<sup>3</sup>

### *Spectrum assignment by auction*

5. Newly available spectrum for public mobile telecommunications services has usually been assigned through auctions as the demand for such spectrum has been high. Mobile network operators ("MNOs") accordingly pay SUF as determined by the auctions. Spectrum assignments are typically for a term of 15 years. Upon expiry of the 15-year term, the spectrum concerned is generally re-assigned by CA through adopting a hybrid arrangement embodying an auction element as well as administrative arrangement. Between 2007 and 2017, CA (and the former Telecommunications Authority) successfully conducted a total of seven auctions for mobile spectrum assignment/re-assignments to meet MNOs' needs.

### *Administrative approach*

6. For spectrum where CA considers that there are not likely to be competing demands, such spectrum will be assigned to licensees administratively upon application. Radio spectrum for non-government services required for overriding public policy grounds are also assigned administratively.

7. SUF will be charged if the concerned frequency bands become congested (i.e. 75% or more occupied) and are anticipated to become more congested in the future). SUF will not be charged where the uses of spectrum

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<sup>2</sup> The former Telecommunications Authority explained in his statement issued in April 2007 that, in exercising his statutory powers under the Telecommunications Ordinance (Cap. 106), he would, in addition to all relevant considerations as required by law, give due regard to the Radio Spectrum Policy Framework to the extent that there would be no inconsistency with the objectives and provisions of Cap. 106.

<sup>3</sup> Spectrum to be used by or on behalf of government (e.g. communications systems of emergency services, radars for detecting aircraft locations and movement) are managed administratively that the market-based approach will not be applied. The efficiency of the use of those spectrum is reviewed by the Communications Authority every three years.

carry significant public interest. These include terrestrial broadcasting service and public mobile service provision in country parks. SUF also does not apply to the use of frequencies designated as a common resource which can be accessed by anyone subject to certain rules, and rely on users of a spectrum to come up with their own solutions to resolve potential interference problem.

### Means to enhance spectrum utilization

#### *Technology-neutral regulatory approach*

8. CA in general adopts a technology-neutral regulatory approach in spectrum management under which MNOs may choose to upgrade their networks with more advanced and efficient technologies within the spectrum assignment periods without the need to seek CA's approval. This enables MNOs to make more efficient use of the spectrum and provides them with the flexibility to introduce innovative services in a timely manner.

#### *Spectrum swap and spectrum trading*

9. To enhance the efficient use of spectrum, a MNO may apply to CA for spectrum swap with another MNO if they can prove, inter alia, that the proposed swap will bring about technical benefits (such as reduction of radio interference, improvement in spectral efficiency, or introduction of new or innovative services) and that no monetary exchange is involved between the concerned parties. CA has so far approved two spectrum swap applications.

10. There has been discussion between the Administration and the telecommunication sector on whether spectrum trading should be introduced, so that a spectrum assignee may, through bilateral negotiations, transfer all or part of the spectrum it holds to another party for the duration of spectrum assignment. In June 2018, the Administration, having taken into account the findings of a consultancy study on the relevant subject, concluded that there was no justifiable case for introducing spectrum trading in Hong Kong in the short and medium term.

### **5G mobile services**

11. In March 2017, CA published a Work Plan for making available additional radio spectrum to meet the demand for public mobile services, including 5G services, towards 2020 and beyond.

## Releasing spectrum for 5G mobile services

12. The Chief Executive ("CE") mentioned in her 2018 Policy Address that the Government has made advance planning to release a total of 4 500 MHz<sup>4</sup> in various frequency bands for assignment to MNOs in phases in 2019. The Administration considered that the radio spectrum should be sufficient in enabling MNOs to plan ahead and launch 5G services as soon as possible. The Secretary for Commerce and Economic Development and CA subsequently announced in December 2018 after public consultations:

- (a) to administratively assign in April 2019 at the earliest the first batch of 4 100 MHz of spectrum in the 26 GHz and 28 GHz bands (including 3 700 MHz of spectrum for the provision of large scale public mobile services across the territory and the remaining 400 MHz of spectrum for the provision of localized innovative 5G services to specific groups of users on a geographically sharing basis) that could be used for 5G services; and
- (b) to auction by batches in mid-2019 a total of 380 MHz of spectrum which include (i) 200 MHz of spectrum in the 3.5 GHz band (which will be used by both the existing satellite services and the new mobile services); (ii) 100 MHz of spectrum in the 3.3 GHz band (which can be used for enhancing 5G indoor coverage in conjunction with spectrum in other frequency bands); and (iii) 80 MHz of spectrum in the 4.9 GHz band (which has the advantage of being able to support deployment of 5G services in any locations in Hong Kong).

## Installation of base stations and cell stations for 5G communications network

13. The roll-out of 5G networks will involve installing a larger number of base stations. Network operators may have difficulties in building the necessary infrastructure. To tackle the issue, CE announced in her 2018 Policy Address that the Government would proactively open up suitable government premises and roof-tops for the installation of base stations by the industry. In March 2019, a list of around 1 000 government premises was provided at low rental for the operators' selection, and the application procedures were streamlined to speed up the application and approval process to facilitate the operators in establishing 5G networks.

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<sup>4</sup> It represents more than eight times the existing amount of 552 MHz of spectrum being used for second generation ("2G"), third generation ("3G") and fourth generation ("4G") services in Hong Kong. The application of radio spectrum in the provision of various generations of mobile services is in **Appendix I**.

14. Besides, the multi-functional smart lampposts (being one of the three key infrastructure projects for smart city development announced in the 2017 Policy Address) are also suitable street furniture for MNOs to install cell stations for 5G communications networks, and to provide free Wi-Fi services for the public and tourists.<sup>5</sup>

#### Application of 5G mobile services as smart city infrastructure

15. CE mentioned in her 2018 Policy Address that the 5G communications technology will not only upgrade telecommunications, innovation and technology infrastructure, but also open up high value-added markets and industries, boost efficiency and competitiveness and revolutionize mobile user experience, bringing vast potential for various commercial services and smart city applications.

16. The Administration anticipates that the future will be moving from a network of dedicated telecommunications equipment and devices (e.g. land-line telephones, fax machines, mobile handsets) in the pre-5G era, to a ubiquitously networked environment - everything in the daily life, from small wearable gadgets (e.g. wrist watches and goggles) to large home apparatus (e.g. refrigerators) and vehicles can potentially be equipped with telecommunications functions. They can be connected to and communicate with one another to form a network of things.

#### **Previous discussions**

17. The Administration briefed the Panel on Information Technology and Broadcasting ("the Panel") on 11 June 2018 on spectrum trading. The Panel also discussed 5G-related issues at the Panel meeting on 12 March 2018 and the policy briefing on 23 October 2018.

#### Development of 5G mobile communications

18. At the meeting on 23 October 2018, members sought details on the timetable of the launch of 5G services. The Administration advised that it would assign the identified spectrum in the 26 GHz and 28 GHz bands, which formed the bulk of the entire 5G, in 2019 and targeted to catch up the work of

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<sup>5</sup> The pilot Multi-functional Smart Lampposts scheme will be launched at selected urban locations to support the building of a smart city with city-wide coverage of data and network. The smart lampposts will also provide convenient data services and collect various real-time city data, enhance city and traffic management.

the International Telecommunication Union by 2020.

19. The Administration also advised that it had made preparations for the 5G era in four respects. Firstly, the assignment arrangements of spectrum for 5G services was expected to be completed in 2019 so that MNOs could build their networks earlier. Secondly, the Administration would open up around 1 000 government premises for MNOs to build base stations. Thirdly, the subsidy scheme to extend fibre-based networks to villages in remote locations would facilitate the development of 5G services. Also, CA had issued over 10 permits to MNOs to conduct 5G trials. The Administration expected that the 5G services could be launched between 2019 and 2020 for commercial use.

*Releasing spectrum for 5G mobile services*

20. At the meeting on 11 June 2018, some members were concerned about the development of the mobile market after the launch of 5G services. The Administration advised that a large amount of 5G spectrum would be available for assignment. On the other hand, the demand for 5G spectrum was likely to be high, as 5G technology had wide applications not only in mobile telecommunications but also in the Internet of Things ("IoT") and smart city development. The implications of 5G services on the mobile market were rather uncertain at the current stage.

21. Some members considered that the future demand for 5G spectrum would likely be substantial as 5G technology would be an enabler in several areas including financial technology, IoT, smart city and virtual banking. They asked if the 5G spectrum would be assigned either administratively, by way of auction or through other arrangements similar to those practised in other jurisdictions. In the case of assignment by way of auction, members were concerned if the price of spectrum would be pushed up and the cost of 5G services would pass on to consumers.

22. The Administration informed the Panel that the International Telecommunication Union had identified 11 candidate frequency bands (within 24.25 GHz to 86 GHz) for 5G services. As a result, about 33 GHz of spectrum would be available following the spectrum harmonization at the World Radiocommunications Conference to be held in 2019. The Administration had invited interested parties to express interest in using the first batch of 5G spectrum in the higher frequency bands. The feedback indicated that the demand could be fully accommodated by the available spectrum. If there was no competitive demand for the 5G spectrum, it would be assigned administratively according to the principle laid down in Spectrum Policy Framework. Otherwise, the spectrum could be assigned through auctions and would then be subject to SUF.

23. The Administration further advised that the total SUF per year of all spectrum assigned for second generation ("2G"), third generation ("3G") and fourth generation ("4G") services constituted only 3% to 4% of the operating costs of the service providers. Any increase in spectrum price due to the competitive process in auction should not significantly affect their operation. As evident in previous spectrum auctions, significant increase in the fees of communications services was not observed. Based on the previous seven auction exercises, the Administration had not observed that there were service providers who had managed to monopolize the spectrum.

24. Some Panel members enquired whether the assignment would be conducted in phases, whether the current assignees of 2G to 4G spectrum would be given priority and whether they could swap their spectrum for 5G spectrum. Members also asked what charges would be collected in relation to the assignment of the spectrum, and whether the charges would be set at a level to recover the cost of the administration of the spectrum.

25. The Administration advised that a public consultation exercise would be conducted in July 2018, and, in the light of the views received, CA would determine the assignment arrangements for the first batch of 5G spectrum in the higher frequency bands in accordance with Spectrum Policy Framework. While SUF might or might not be payable for administratively assigned spectrum, a spectrum management fee would be charged, as part of the licence fee payable to the Office of the Communications Authority ("OFCA"), for recovery of OFCA's administrative costs in managing the spectrum.

*Opening up of government premises for mobile network operators to install base stations*

26. At the meeting on 23 October 2018, regarding the Administration's plan to launch a pilot scheme to open up 1 000 government premises for MNOs to build base stations, some members were concerned that it would take around 18 months for application and approval. They asked when the Administration would share the list of available premises with the industry.

27. Members also sought clarification on whether such pilot scheme would be opened to 4G services as well in order to enhance the 4G services. They commented that the Administration only focused on the supply of 4 500 MHz frequency spectrum but avoided to mention the lack of supply of spectrum in the high frequency bands.

28. The Administration advised that the pilot scheme to open up 1 000 government premises would mainly involve premises under management of the

Leisure and Cultural Services Department, Food and Environmental Hygiene Department and Government Property Agency. The Administration planned to compile a list of the government premises by end of 2018 and would compress the duration for application and approval procedures by half. The scheme would target at 5G services but 4G services could also benefit from the scheme.

### *Multi-functional smart lampposts*

29. At the meeting on 12 March 2018, members enquired whether the smart lampposts to be installed under the pilot Multi-functional Smart Lampposts scheme would help improve the accuracy of global positioning systems in the urban areas and whether more smart lampposts would be used to support the provision of 5G telecommunications technology.

30. The Administration advised that microcell antennas could be installed in smart lampposts to support 5G telecommunications services and improve global positioning systems. The Administration would monitor the technology trend and utilize the latest technology for the long-term use of smart lampposts.

31. Some Panel members considered the target to complete installation of 350 smart lampposts by 2022 was too slow given the priority placed by the Administration in developing Hong Kong into a smart city. The Administration advised that initially, 50 smart lampposts were planned to be installed by mid-2019, with a view to expanding the facilities to four selected regions in Hong Kong. The Administration aimed to have the main urban areas of Hong Kong covered by smart lampposts as infrastructure for a smart city.

### Spectrum trading

32. At the meeting on 11 June 2018, some members asked whether the Administration would introduce spectrum trading in the long term. They asked whether the Administration would consider providing some sort of trading mechanism for spectrum below the 3.5 GHz frequency bands which could be used for provision of 3G/4G as well as 5G services.

33. The Administration advised that, in the light of the latest consultancy study, it had concluded that there was no justifiable case for introducing spectrum trading in the next five to 10 years. The Administration was of the view that the long term need for spectrum trading would depend on the demand and supply of spectrum following the emergence of 5G services.

34. The Administration further explained that the demand for spectrum of low frequency bands (such as those in frequency bands of 3 to 3.5 GHz or below) was high because such spectrum had shorter wavelengths and could be

transmitted over a longer distance. Services using these frequency bands could achieve a wider coverage without having to install many base stations. However, existing operators (except one) using spectrum in these bands were not keen to have a spectrum trading regime. Without supply of spectrum in the second hand market, the Administration considered that there seemed no justifiable reason to set up a spectrum trading regime.

35. On the other hand, spectrum in the high frequency bands (such as those in the frequency bands of 26 GHz or above) could carry a large volume of information although the signals could only transmit over a relatively short distance. Such spectrum was suitable for 5G services and the supply of spectrum in these frequency bands was large vis-à-vis the demand. There was no need for a second-hand trading platform because operators could apply to OFCA for assignment of such high frequency spectrum.

36. At the same meeting, some members were concerned that the demand for low frequency spectrum would decrease when 2G to 4G services were eventually phased out. They commented that the Administration should consider how these resources should be used and allocated. The Administration advised that despite the launch of 5G services, 2G to 4G services would not immediately become obsolete and such services and technologies would co-exist for some time. The Administration would, however, keep in view developments to adjust the spectrum assignment arrangements to meet the changing needs of the market.

### **Council question**

37. At the Council meeting of 20 June 2018, Mr Charles Peter MOK raised an written question in relation to the spectrum for provision of 5G services. He noted that in order to avoid radio interference with the existing earth stations for telemetry, tracking and control of satellites in orbit ("TT&C Stations"), CA had decided to set up restriction zones in Tai Po and Stanley, in which the installation of mobile base stations of public mobile services operating in 3.5 GHz band was forbidden. Concerning that the setting up of such restriction zones would render members of the public residing and working in the restriction zones unable to use 5G service in future, Mr MOK enquired whether CA had studied the option for relocating the existing TT&C Stations.

38. The Administration advised that the coverage of 5G services would be available in the restriction zones in future as 5G services would be provided through a number of frequency bands, instead of relying on the 3.5 GHz band alone. Besides, in accordance with the technology neutral principle, operators may refarm their existing 2G/3G/4G spectrum for 5G services.

39. The Administration further advised that there was no legal basis for CA to unilaterally request satellite operators to relocate their existing TT&C Stations which were legally set up, invested and put to use. The TT&C Stations concerned had been in operation for more than 20 years. The satellite operators had indicated that the relocation of TT&C Stations would not only involve substantial investment, but would also disrupt their operation.

40. Mr Charles MOK raised another question on 5G development on 3 April 2019. Details of the question and the Administration's reply are given in the hyperlink in **Appendix II**.

### **Latest position**

41. The Administration will brief the Panel on 10 May 2019 on the latest progress of assignment of spectrum in various frequency bands for the provision of 5G services.

### **Relevant papers**

42. A list of the relevant papers is set out in **Appendix II**.

**Application of radio spectrum in the provision of public mobile telecommunications services**

Frequency band	<u>Type of mobile services (Note)</u>				Total (MHz)
	2G (MHz)	3G (MHz)	4G (MHz)	CDMA 2000 (MHz)	
850/900 MHz		20.0		15.0	35.0
900 MHz	15.2		34.6		49.8
1800 MHz	28.8		120.0		148.8
1.9 - 2.2 GHz		98.6	19.8		118.4
2.3 GHz			60.0		60
2.5/2.6 GHz			140.0		140.0
<b>Total</b>	<b>44.0</b>	<b>118.6</b>	<b>374.4</b>	<b>15.0</b>	<b>552.0</b>

Note

The type of mobile services supported by each individual frequency bands refers to the highest order of use that the corresponding frequency band is being deployed for. In the case where the reform of a certain frequency slot has not yet been completed, it may still be used for the provision of the type of mobile services before reform at certain locations, and for the provision of the reformed services at the other locations.

*(Extracted from the statement of the Communications Authority and the Secretary for Commerce and Economic Development dated 19 December 2017 in relation to the arrangements for the frequency spectrum in the 900 MHz and 1800 MHz bands upon expiry of the existing assignments for public mobile telecommunications services and the spectrum utilization fee.)*

## Appendix II

### List of relevant papers

Issued by	Meeting date	Paper
Panel on Information Technology and Broadcasting	12 March 2018	Administration's paper on key infrastructure projects for smart city development <a href="#">LC Paper No. CB(4)701/17-18(03)</a>  Minutes of meeting <a href="#">LC Paper No. CB(4)1197/17-18</a>
Special Finance Committee	18 April 2018 / 19 April 2018	Administration's reply to Members' initial written questions <a href="#">(Reply Serial Nos. CEDB(CCI)039; ITB006, ITB039 and ITB254)</a>
Panel on Information Technology and Broadcasting	11 June 2018	Administration's paper on spectrum trading <a href="#">LC Paper No. CB(4)1200/17-18(05)</a>  Minutes of meeting <a href="#">LC Paper No. CB(4)1607/17-18</a>
Council	20 June 2018	Question No. 19 on installation of mobile base stations of public mobile services operating in the 3.5 GHz band affected by the setting up of restriction zones raised by Mr Charles Peter MOK <a href="#">(Hansard)</a> (page 12825 – 12828)
	3 April 2019	Question No. 4 raise by Mr Charles Peter MOK <a href="#">Development of 5G mobile network and services</a>