HKT

Arrangements for the Frequency Spectrum in the 2.5/2.6 GHz Band upon Expiry of the Existing Assignments for the Provision of Public Mobile Services and the Related Spectrum Utilisation Fee

Response to Consultation Paper

10 November 2020

INTRODUCTION

1. Hong Kong Telecommunications (HKT) Limited ("**HKT**") welcomes the opportunity to provide its views and comments in response to the proposals put forward by the Communications Authority ("**CA**") and the Secretary for Commerce and Economic Development ("**SCED**") in the consultation paper issued on 23 September 2020 regarding *Arrangements for the Frequency Spectrum in the 2.5/2.6 GHz Band upon Expiry of the Existing Assignments for the Provision of Public Mobile Services and the Related Spectrum Utilisation Fee* ("**Consultation Paper**").

2. This Consultation Paper deals with the re-assignment arrangements for 90 MHz of spectrum in the frequency range 2500 – 2515 MHz paired with 2620 – 2635 MHz and 2540 – 2570 MHz paired with 2660 – 2690 MHz when the current assignment period expires in March 2024 (the "**2024 Spectrum Blocks**").

3. The 2024 Spectrum Blocks are currently assigned to three mobile operators, namely China Mobile Hong Kong Company Limited ("**CMHK**"), Genius Brand Limited ("**GBL**")[1] and HKT (collectively the "**Three Incumbent Spectrum Assignees**").

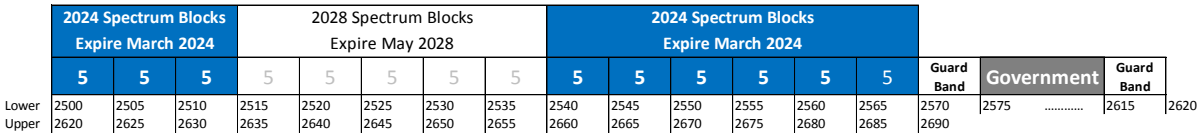
4. Not forming part of this consultation, but nonetheless relevant to a consideration of the proposals put forward in this spectrum re-assignment exercise is the 50 MHz of spectrum in the frequency range 2515 – 2540 MHz paired with 2635 – 2660 MHz sitting in the middle of the 2024 Spectrum Blocks whose assignment period expires some four years later in May 2028 (the "**2028 Spectrum Blocks**").

5. In addition, there is a 50 MHz block of spectrum consisting of spectrum currently assigned for Government use (2575 – 2615 MHz) plus 2 x 5 MHz guard bands located in the duplex gap, i.e. the frequency

[1] GBL is a 50:50 joint venture between HKT and Hutchison Telephone Company Limited ("**Hutchison**"). The spectrum in the 2024 Spectrum Blocks and 2028 Spectrum Blocks assigned to GBL is divided equally between HKT and Hutchison for the purposes of any analysis in this submission.

range that separates the uplink channels from the downlink channels for the paired blocks of spectrum in the 2.5/2.6 GHz band.

***Figure 1**: Current Set Up in 2.5/2.6 GHz Band*



Key Points

6. As a matter of fundamental importance, HKT considers it necessary for the CA not to simply look at the re-assignment of the 2024 Spectrum Blocks in isolation, but to consider these frequency blocks along with the 2028 Spectrum Blocks which are located in the same band but expiring around four years later. There are significant benefits to re-assigning all of the available spectrum in the 2.5/2.6 GHz band (i.e. the 2024 Spectrum Blocks and the 2028 Spectrum Blocks) in one single exercise.

7. To do so, the CA would need to extend the current assignment period for the 2024 Spectrum Blocks in order to coincide with the expiry date of the assignment period for the 2028 Spectrum Blocks.[2] This alignment of expiry dates would serve several purposes as described in the following section.

Facilitate assignment of larger contiguous spectrum blocks in the 2.5/2.6 GHz band

8. Making available a continuous band of spectrum (2500 – 2570 MHz paired with 2620 – 2690 MHz) totaling 140 MHz would enable larger, contiguous blocks of spectrum to be assigned to each mobile operator, thereby making the most efficient use of the 2.5/2.6 GHz

[2] Extending the assignment period for spectrum has been done by the CA before. Refer to the original 2G spectrum awarded to the Public Radiocommunications Service Licensees and the more recent extension of expiry date for the 900 MHz band in respect of Hutchison and SmarTone Mobile Communications Limited ("**SmarTone**" or "**SMT**").

band. In fact, unless the CA takes deliberate steps to synchronize the assignment expiry dates of the 2024 Spectrum Blocks and the 2028 Spectrum Blocks, there will always be an inconvenient "gap" sitting within the 2024 Spectrum Blocks and the continued risk of operators ending up with disjointed spectrum assignments each time the 2024 Spectrum Blocks and the 2028 Spectrum Blocks are separately re-assigned via auction.

9. While there was no previous opportunity open to the CA to align the assignment date of the 2024 Spectrum Blocks and the 2028 Spectrum Blocks there is now a golden opportunity to rectify this misalignment and the CA should find the policy support to do so.

10. HKT would note that promoting the efficient use of radio spectrum as a public resource of Hong Kong is one of the CA's obligations under Section 32G of the Telecommunications Ordinance as well as one of the four public policy objectives cited in the Radio Spectrum Policy Framework promulgated by the Government in 2007 ("**SPF**").

Reinforce the objectives of the CMHK-HKT Spectrum Swap

11. In January 2016, the CA approved a frequency swap between CMHK and HKT whereby 10 MHz of HKT's spectrum (2550 – 2555 MHz paired with 2670 – 2675 MHz, with expiry date March 2024) was swapped with an equivalent amount of CMHK's spectrum (2530 – 2535 MHz paired with 2650 – 2655 MHz, with expiry date May 2028) ("**CMHK Block**"). The purpose of this swap was to:

> *[…] remove the fragmentation of CMHK's assigned spectrum in the 2600 MHz band and as a result, they would derive technical benefits, including a more flexible use of the spectrum, increased spectral efficiency, improved service quality to customers, and reduced technical complexity for network deployment.*[3]

[3] Refer to paragraph 3 of the CA's Statement on *Frequency Swap between China Mobile Hong Kong Company Limited and Hong Kong Telecommunications (HKT)*

12. If the spectrum swap were not effected, the CMHK Block originally acquired by CMHK at auction would have been left "stranded" as it is located on its own amongst blocks of spectrum which are assigned to other mobile operators.

13. Were the CA not to extend the assignment period for the 2024 Spectrum Blocks, the CMHK Block would need to revert back to CMHK in 2024 as the block originally swapped with HKT expires in March 2024 and hence needs to be surrendered by HKT. However, should this happen, the CMHK Block would be stranded once more and the technical complexities would re-appear, thereby defeating the purpose and benefits of the original swap as advocated by the CA.

***Figure 2**: Before the CMHK Block reverts back to CMHK (Current Use)*

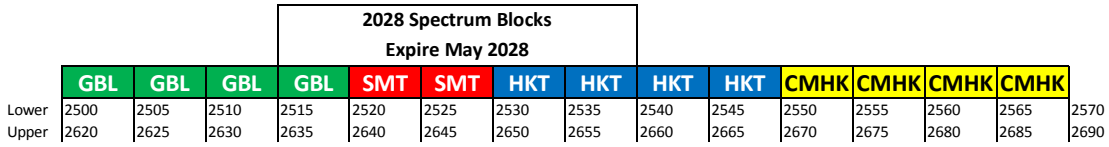
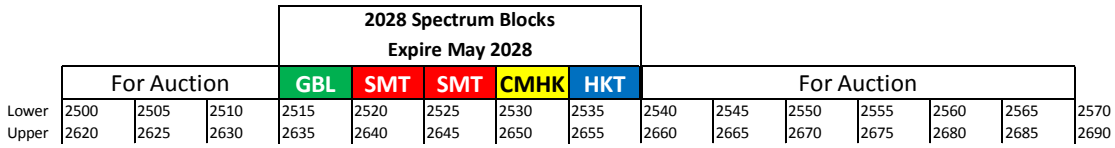


***Figure 3**: After the CMHK Block reverts back to CMHK*



14. This further reinforces the point that, in the interests of spectral efficiency and for the benefit of customers, the assignment period for the 2024 Spectrum Blocks should be extended (and the CMHK-HKT Spectrum Swap continued) until May 2028 so that operators' use of the contiguous blocks of spectrum per Figure 2 above is preserved until the entire 2.5/2.6 GHz band is re-assigned in one single exercise.

Pave the way for a possible switch from FDD to TDD

15. Extending the assignment period of the 2024 Spectrum Blocks would allow more time for the industry to observe market

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Limited in the 2600 MHz Band issued on 19 January 2016 ("**CMHK-HKT Spectrum Swap**").

developments in the use of Time Division Duplex ("**TDD**") systems[4] in the 2.5/2.6 GHz band instead of the Frequency Division Duplex ("**FDD**") systems[5] currently being deployed in this band to provide 4G services in Hong Kong.[6]

16. If it is decided that the 2.5/2.6 GHz band should adopt the TDD mode of operation in Hong Kong after May 2028 then the spectrum re-assignment exercise to be conducted at that time can be organized on this basis.

17. On the contrary, if a separate re-assignment exercise is to be conducted for the 2024 Spectrum Blocks in the near future, it is likely that operators will continue to adopt the FDD mode of operation when the spectrum is re-assigned to them. In fact, this is the scenario envisaged by the CA in the Consultation Paper, i.e. spectrum to be re-assigned in paired blocks. However, given that the 2028 Spectrum Blocks sit right in the middle of the 2024 Spectrum Blocks, this means that the 2028 Spectrum Blocks would then also be required to continue adopting the FDD mode of operation when they are re-assigned in 2028. As a result, Hong Kong will have lost a golden opportunity in 2028 to change from FDD to TDD in the 2.5/2.6 GHz band to provide 5G services – an opportunity which will not arise again until 2043 at the earliest (since spectrum is normally assigned for a 15 year period) even if other administrations, including the Mainland, have already adopted the TDD mode of operation in this band during this time.

18. HKT notes that this issue was discussed and considered by the industry and OFCA at a meeting of the Radio Spectrum and Technical Standards Advisory Committee ("**SSAC**") held in January 2020. At this meeting, it was concluded that the FDD mode of operation in the 2.5/2.6 GHz band should be continued in Hong Kong until expiry of the spectrum

[4] In TDD systems, spectrum is assigned in single, unpaired frequency blocks.

[5] In FDD systems, spectrum is assigned in paired frequency blocks.

[6] Note that in the Mainland, the 2515 – 2675 MHz band has already been assigned for 5G services using the TDD mode of operation hence there is currently interference being experienced by 4G services using the FDD mode of operation in Hong Kong along the areas bordering Shenzhen.

assignment period for the 2024 Spectrum Blocks or expiry of the assignment period for the 2028 Spectrum Blocks. OFCA also promised to take into account the views of the mobile operators on this matter when making its recommendations to the CA arising from this consultation exercise.

Save administrative cost and effort

19. Postponing any auction or re-assignment exercise for the 2024 Spectrum Blocks and combining the exercise with the re-assignment of the 2028 Spectrum Blocks would save both the Government and the industry administrative costs and effort as only one single auction exercise needs to be organized instead of two separate auctions.

20. In fact, if the CA is minded to extend the assignment period for the 2024 Spectrum Blocks and carry out an overall spectrum re-assignment exercise for the whole 2.5/2.6 GHz band when the 2028 Spectrum Blocks reach their expiry date, HKT would also suggest that the Government take the opportunity to critically review its use of the spectrum with which it is currently assigned (2575 – 2615 MHz) to determine whether it is able to vacate this band so that the full stretch of spectrum in the 2.5/2.6 GHz band from 2500 – 2690 MHz, i.e. a total of 190 MHz may be re-assigned to operators for the provision of more valuable mobile services. The Government should, in particular, vacate the band if it is decided to change the mode of operation of the entire 2.5/2.6 GHz band from FDD to TDD.[7]

21. In the following sections of this submission, HKT provides its comments in response to each of the specific questions contained in the Consultation Paper.

[7] This matter was also discussed at the SSAC meeting held in January 2020.

DEMAND FOR THE AVAILABLE SPECTRUM

22. In the Consultation Paper, the CA outlines the following reasons for concluding that there is competing demand for the 2024 Spectrum Blocks:

- The 2024 Spectrum Blocks have already been fully deployed by the Three Incumbent Spectrum Assignees for the provision of 4G services. 4G services are currently the most popular generation of mobile services in Hong Kong and will continue to grow in the future. In fact, 4G services are expected to still prevail by the time the 2024 Spectrum Blocks are due for re-assignment;

- There is good potential for the 2024 Spectrum Blocks to be refarmed for future 5G services given that the 2.5/2.6 GHz band has been specified by 3GPP as one of the frequency bands that can be deployed for 5G services; and

- The 2.5/2.6 GHz band is an attractive frequency band for 5G services due to its longer range propagation characteristics compared to spectrum above the 6 GHz range, and its wider bandwidth compared to the sub-1 GHz bands. On this basis, mobile operators should find the 2024 Spectrum Blocks desirable as they enable cost effective provision of mobile broadband services when both coverage and capacity requirements are considered.

23. HKT, however, considers that the existence of competing demand for spectrum cannot be truly ascertained until operators fully understand the terms, conditions and pricing of the relevant spectrum and then react to these. In practical terms, this means the real demand for spectrum cannot be assessed until operators are presented with the details of the spectrum and are required to express their demand for the spectrum. Depending on the amount of spectrum required by each operator and the amount of spectrum available, the CA should then have a more realistic idea as to whether competing demand exists.

24. Accordingly, HKT would suggest that, as a matter of general procedure, the CA undertake a more stringent assessment before

concluding there is competing demand for any spectrum blocks to be released. At the very least, the CA could invite the industry and other interested parties to express their interest in using the spectrum blocks in question, similar to the exercise conducted for the 26/28 GHz band in December 2017.

25. Nevertheless, for the purposes of responding to this submission, HKT will adopt the CA's assumption that competing demand does exist for the 2024 Spectrum Blocks.

PROPOSED RE-ASSIGNMENT APPROACH

26. The CA has concluded in the previous section that there is likely to be competing demand for the spectrum. On this basis, in accordance with the **SPF**, a market-based approach is to be used for re-assignment of the spectrum unless there are overriding public policy reasons to depart from such an approach.

27. In the past, for spectrum in existing use which is being re-assigned, the CA has used spectrum auctions as its preferred "market-based approach" after first offering the incumbent spectrum assignees a Right-of-First-Refusal ("**RFR**") on part of the spectrum they currently hold.[8]

28. The offer of an RFR has been justified by the CA for previous spectrum re-assignment exercises after considering the following four policy objectives: (i) ensuring customer service continuity; (ii) efficient spectrum utilisation; (iii) promotion of effective competition; and (iv) encouragement of investment and promotion of innovative services ("**Four Policy Objectives**"). These same policy objectives are considered by the CA in this current exercise. In brief, the CA provides the following analysis:

(i) Ensuring customer service continuity

The CA considers that customer service continuity is not affected by re-assignment of the 2024 Spectrum Blocks given that the total amount of spectrum to be re-assigned (90 MHz) is not significant.[9] Hence, if any of the Three Incumbent Spectrum Assignees fails to re-acquire their current spectrum holding to maintain provision of their 4G services, they can still use the spectrum they hold in the 2028 Spectrum Blocks as well as other frequency bands to ensure service continuity.

[8] Refer to the previous spectrum re-assignment exercises for the 1.9 – 2.2 GHz band and the 900 MHz and 1800 MHz bands.

[9] The spectrum only accounts for 8% to 16% of the total amount of sub-6 GHz spectrum held by each of the Three Incumbent Spectrum Assignees

In this regard, the CA notes that other frequency bands have already been refarmed by the operators to provide 4G services and the Three Incumbent Spectrum Assignees actually make more use of these other frequency bands (not the 2024 Spectrum Blocks) to provide their 4G services.

Furthermore, with the development of 5G services, the CA expects that a portion of the 4G traffic will be absorbed by 5G networks by the time the 2024 Spectrum Blocks are due for re-assignment, thereby alleviating the demand for 4G services from the Three Incumbent Spectrum Assignees.

(ii) Efficient spectrum utilisation

As there are currently significant variations in the amount of spectrum held by the mobile operators in the 2.5/2.6 GHz band, this re-assignment exercise will provide an opportunity for each operator to acquire more spectrum in this frequency band to enhance network capacity/transmission speed or increase spectral efficiency by forming contiguous spectrum blocks of wider bandwidth.

(iii) Promotion of effective competition

Re-assigning the spectrum using a market-based approach would encourage mobile operators to value their newly acquired frequency blocks and make good use of the spectrum to improve their mobile services thereby promoting further competition to the ultimate benefit of consumers.

(iv) Encouragement of investment and promotion of innovative services

This spectrum re-assignment exercise provides an opportunity for mobile operators to acquire new spectrum blocks. This is likely to require new investment in network infrastructure to enable the frequency bands to be used effectively. Service innovation is expected to result from operators acquiring the right mix of spectrum from the spectrum re-assignment exercise.

29. Accordingly, the CA suggests that it is not necessary to depart from the market-based approach for re-assignment of the spectrum (i.e. there is no need to offer an RFR for the spectrum being considered under this exercise) and that all of the 2024 Spectrum Blocks should be re-assigned via auction.

Question 1:	*Do you agree with the use of a market-based approach for re-assignment of the Available Spectrum pursuant to the Spectrum Policy Framework?*

30. As a matter of principle, HKT only considers it appropriate to adopt an auction approach for new releases of spectrum. The re-assignment of spectrum which is in existing use by operators needs to take into account practical considerations, such as service continuity and the network investment already made by the incumbent spectrum holders, and hence cannot be treated in exactly the same way as spectrum which is being made available for the first time.

31. HKT considers that the re-assignment exercise for the 2024 Spectrum Blocks needs to be combined with that of the 2028 Spectrum Blocks. On that basis, HKT does not object to the use of an auction process to effect re-assignment of the entire 2.5/2.6 GHz frequency band in one go so as to enable the creation of contiguous spectrum blocks.

32. HKT's rationale for a combined auction of the 2024 Spectrum Blocks and 2028 Spectrum Blocks is fully explained in the Introduction section of this submission. In fact, the CA's Four Policy Objectives fully support HKT's proposal to extend the assignment period for the 2024 Spectrum Blocks and combining the re-assignment exercise with the 2028 Spectrum Blocks, as explained in the following section.

Ensuring customer service continuity

33. Allowing the Three Incumbent Spectrum Assignees to continue using their assigned 2024 Spectrum Blocks for a further (roughly) four years until end of the assignment period for the 2028 Spectrum Blocks would ensure customer service continuity for the mobile services being

offered by the Three Incumbent Spectrum Assignees during this extended period.

34. HKT does not agree with the CA's analysis that there are no customer service continuity concerns which need to be taken into account. The spectrum being considered is a re-assignment of spectrum which is currently being used to provide mobile services to customers. There are therefore valid public policy reasons to justify the CA extending the current assignment term for the 2024 Spectrum Blocks, particularly in view of the fact that the frequency band is currently being fully utilized. Indeed, in paragraph 8 of the Consultation Paper, the CA recognizes that the 2024 Spectrum Blocks are:

> *[…] currently fully deployed by the spectrum assignees for the provision of 4G services using the 4G Long Term Evolution technology […]*

and that 4G services are:

> *[…] expected to remain prevailing by the time the [2024 Spectrum Blocks are] due for re-assignment in 2024.*[10]

35. In the analysis presented by the CA in Table 1 of the Consultation Paper, the CA asserts that any of the Three Incumbent Spectrum Assignees who fail to re-acquire their current holding in the 2024 Spectrum Blocks can always make use of their holding in the 2028 Spectrum Blocks to maintain service continuity. However, given that the amount of spectrum held by the Three Incumbent Spectrum Assignees in the 2028 Spectrum Blocks is only one-third of the amount of spectrum they hold in the 2024 Spectrum Blocks, it is clear that it would not be possible for these operators to make use of their holdings in the 2028 Spectrum Blocks to compensate for the loss of their holdings in the 2024 Spectrum Blocks.

[10] According to the Consultation Paper, even today, the vast majority of customers are subscribing to 4G services. Per footnote 6, as at end March 2020, around 80% of mobile subscriptions in Hong Kong are for 4G services.

36. On this basis, it is imperative that the Three Incumbent Spectrum Assignees be allowed to continue using their 2024 Spectrum Blocks. In fact, as the following table shows, the only party not at risk of maintaining service continuity in 2024 is the operator who currently holds no spectrum in the 2024 Spectrum Blocks, i.e. SmarTone.

***Figure 4**: Possible Impact on Operator's spectrum holding in the 2.5/2.6 GHz Band*

Operator		Holding in 2024 Spectrum Blocks (MHz)	Holding in 2028 Spectrum Blocks (MHz)	Total Holding (MHz)	% Drop if 2024 Spectrum Holding not retained
CMHK		30	10	**40**	(75%)
GBL	HKT (50%)	45	15	**60**	(75%)
	Hutchison (50%)	15	5	**20**	(75%)
SmarTone		0	20	**20**	No Change
Total (MHz)		**90**	**50**	**140**	

The potential loss that can be suffered by each of the Three Incumbent Spectrum Assignees is therefore very real, hence the CA should take particular note of the views expressed by the current holders of the spectrum in this consultation.

37. The CA is too simplistic in its analysis of impact of the existing spectrum holders losing part or all of their holding in the 2024 Spectrum Blocks. Even if the amount of spectrum being considered is not significant overall, there will still be substantial customer service disruption in indoor and underground locations (e.g. MTR) where Integrated Radio Systems (IRS) are needed to provide mobile coverage and capacity to customers. At these locations, any change in spectrum assignment will immediately impact the level of service and this cannot be compensated by the use of other frequency bands without substantial investment and a long lead time.

38. In addition, the 2024 Spectrum Blocks are presently being used to serve 4G customers in the MTR where the 5G spectrum bands cannot yet be deployed. By the time the assignment period ends for the 2024 Spectrum Blocks, it is likely that this band will be the main band for 4G

services[11], hence it is critical for the mobile operators to be able to continue using this spectrum in order to ensure 4G service continuity for customers using this band.

39. Furthermore, the CA assumes that with the development of 5G services, a portion of the current 4G traffic will be migrated onto 5G networks thereby negating the need for the Three Incumbent Spectrum Assignees to retain a significant amount of spectrum in the 2024 Spectrum Blocks. However, this scenario assumes customers adapting quickly to 5G services and a willingness to upgrade their service plans to 5G which, as we have learned from the experience of migrating users from 3G to 4G, is not always as quick or easy a process as one would hope.

40. It is also important to note that, where 5G services are being provided in Non-Standalone (NSA) mode (which is the mode currently being adopted in Hong Kong), a dual connection to both 4G and 5G networks is required in order to achieve optimal peak data speeds. In other words, user (data) traffic needs to be carried over 5G spectrum bands (3.5 GHz/ 4.9 GHz/ 2100 MHz) and 4G spectrum bands (1800 MHz/ 2.6 GHz) together in order to achieve the top peak data speed. If an operator no longer has access to its 4G spectrum bands then a much lower peak data speed would be experienced by its 5G customers.

41. If, despite the above considerations, the CA still decides to allow the assignment period of the 2024 Spectrum Blocks to expire in March 2024 and to treat the 2024 Spectrum Blocks separately to the 2028 Spectrum Blocks, HKT sees no reason why the Three Incumbent Spectrum Assignees should not be granted an RFR prior to any spectrum being offered for auction. Indeed, an RFR has been offered to incumbent spectrum holders in previous spectrum re-assignment exercises and was used specifically to address the problem of customer service continuity in the MTR.[12] This would then at least provide some

[11] The other spectrum bands previously used for 4G services (e.g. 1800 MHz, 2100 MHz) will be refarmed for 5G use.

[12] Refer to the RFR spectrum granted by the CA in respect of the previous exercises to re-assign spectrum in the 1.9-2.2 GHz band and the 900/1800 MHz band. In the re-assignment of the 900/1800 MHz band, incumbent spectrum holders were

degree of assurance over service continuity for the Three Incumbent Spectrum Assignees after the assignment period for the 2024 Spectrum Blocks expire in March 2024.

Efficient spectrum utilisation

42. The CA suggests that an auction of the 2024 Spectrum Blocks would give operators the opportunity to acquire additional spectrum and form contiguous blocks of wider bandwidth in order to gain higher spectral efficiency.

43. It is clear, however, that conducting a combined auction of the 2024 Spectrum Blocks and 2028 Spectrum Blocks and making available a continuous, unbroken stretch of 2 x 70 MHz in one sitting would provide the greatest opportunity for operators to acquire the largest contiguous blocks of spectrum compared to carrying out two separate auctions. This is the only way to truly maximize spectral efficiency.

Promotion of effective competition

44. In addition to the above, if operators are able to acquire larger contiguous frequency blocks, this will allow them to make optimal use of their spectrum holdings in order to improve coverage, data speed and product offerings at more affordable prices and hence promote further competition that will benefit consumers.

Encouragement of investment and promotion of innovative services

45. Conducting a combined auction of the 2024 Spectrum Blocks and the 2028 Spectrum Blocks is likely to lead to spectrum changing hands amongst the incumbent spectrum holders in the same way that would result from carrying out separate spectrum auctions. The CA's objective of encouraging operators to invest in network infrastructure to enable deployment of their newly acquired spectrum would therefore similarly be achieved (if not bettered) by combining the re-assignment exercise for the 2024 Spectrum Blocks with that of the 2028 Spectrum Blocks.

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offered an RFR of 2 x 10 MHz in the 1800 MHz band to address concerns about customer service continuity in relation to 4G services in the MTR.

46. In fact, it could be that the acquisition of larger contiguous spectrum blocks (which would only be possible under a combined spectrum auction) necessitates even greater investment by the operators and hence provides even greater opportunity for service innovation.

PROPOSED RE-ASSIGNMENT ARRANGEMENTS

Band Plan

47. The 2.5/2.6 GHz band is currently deployed in Hong Kong for 4G services using the FDD mode of operation. This means that the spectrum is required to be assigned to operators in paired blocks (uplink/downlink) in order to enable the provision of 4G services in this band.

48. In a meeting of the Radio Spectrum and Technical Standards Advisory Committee ("**SSAC**") held in January 2020 between OFCA and the mobile operators, it was noted that the 2515 – 2675 MHz band had been assigned for 5G services in the Mainland using the TDD mode of operation (i.e. unpaired blocks), and that the difference in mode of operation between Hong Kong and the Mainland for this band was causing mutual radio interference in the border areas between Hong Kong and the Mainland (i.e. Shenzhen).[13]

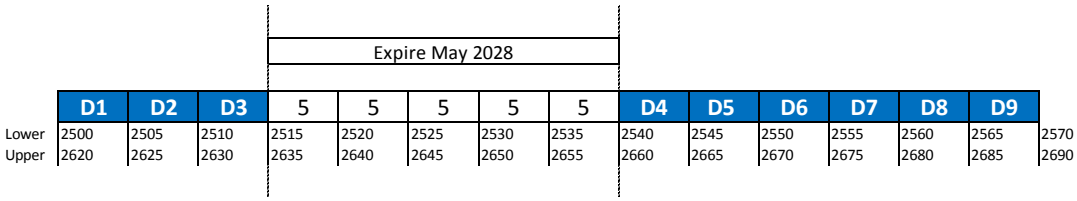
49. While measures have been put in place to control overspill signals from both sides, this has resulted in sub-optimal use of the spectrum band. Higher spectral efficiency would only be achievable if the same mode of operation (i.e. TDD) were to be used by both Hong Kong and the Mainland.

50. The mobile operators considered that more time should be allowed to observe market developments before deciding on any switch over from FDD to TDD for the 2.5/2.6 GHz band. The SSAC therefore concluded that the FDD mode of operation should continue to be used in Hong Kong until expiry of the assignment period for the 2024 Spectrum Blocks or expiry of the assignment period for the 2028 Spectrum Blocks.

[13] A similar problem arises in Macau where FDD is used in the 2.6 GHz band and TDD is deployed in the same band across the border with the Mainland in Zhuhai. Severe radio signal interference has been reported, effectively rendering the use of FDD in the 2.6 GHz band impossible in Macau.

51. Based on these comments, the CA now proposes that the 2024 Spectrum Blocks should continue to adopt the FDD mode of operation and the band plan for the spectrum should be split into 9 paired blocks of 2 x 5 MHz[14] each numbered D1 to D9 in the following diagram:

***Figure 5**: The CA's proposed Band Plan*

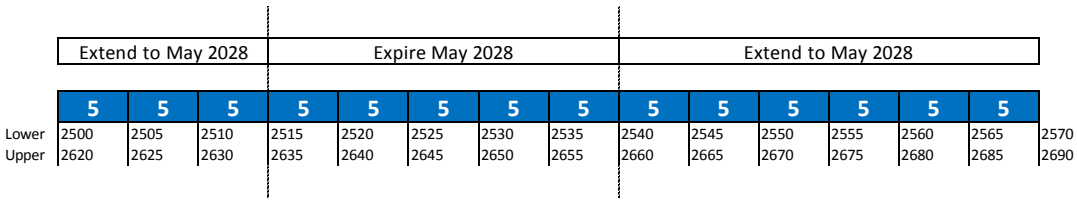


52. The CA claims that adopting such a band plan would enable bidders to acquire and aggregate multiple blocks to form carriers of larger bandwidth and also facilitate the future refarming of the spectrum for the provision of 5G services.

Question 2:	*Do you have any views on the proposal that the Available Spectrum be divided into nine paired frequency blocks with a bandwidth of 2 x 5 MHz each?*

53. HKT has already suggested that, in the interests of spectral efficiency, it would be appropriate to re-assign all the available spectrum in the 2.5/2.6 GHz band in one go so that larger contiguous blocks of spectrum can be formed. This means combining the auction of the 2024 Spectrum Blocks with the 2028 Spectrum Blocks so that a total of 140 MHz is being re-assigned.

***Figure 6**: HKT Proposed Combined Re-Assignment Exercise*

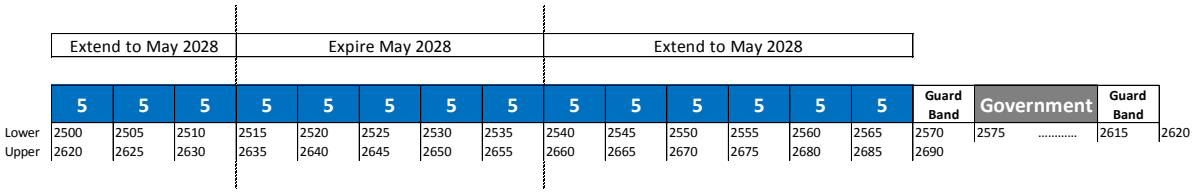


[14] 2 x 5 MHz is the minimum allowable channel bandwidth for 4G services using FDD-LTE as specified by 3GPP.

54. If the CA accedes to this request, the assignment period of the 2024 Spectrum Blocks would be extended by some 4 years. This should then permit OFCA and the industry more time to observe the developments of the FDD and TDD modes of operation in this band in the Mainland as well as worldwide, so that by the time the whole 2.5/2.6 GHz band is to be re-assigned in 2028, a more informed decision can be made by the CA as to the most appropriate band plan for the spectrum, i.e. whether the band should adopt the FDD or TDD mode of operation in the new assignment term and the size of the spectrum blocks.

55. In fact, if the entire frequency range from 2500 – 2570 MHz paired with 2620 – 2690 MHz (i.e. the 2024 Spectrum Blocks plus the 2028 Spectrum Blocks) is to be re-assigned in one single exercise, then HKT would suggest that the Government also take the opportunity to examine its utilisation of the 2575 – 2615 MHz frequency range (which sits between the currently assigned uplink and downlink paired spectrum blocks in the 2.5/2.6 GHz band) to see if it is able to vacate this band in order to make available an additional 50 MHz of spectrum (including guard bands) for mobile use.

***Figure 7**: Location of Government Use Spectrum*



56. This would make even more sense if it is decided to adopt the TDD mode of operation after 2028 since this would then enable an uninterrupted stretch of spectrum to be made available for assignment to the mobile operators.

57. If, on the other hand, the CA decides to proceed with its proposal to re-assign the 2024 Spectrum Blocks separately upon expiry of the current term then, given the currently available information, HKT sees no other practical option than to continue adopting the FDD mode of operation based on the CA's proposed paired blocks of 2 x 5 MHz.

58. However, if the CA adopts this approach then the FDD mode of operation would then need to be maintained for the entire length of the assignment period (normally 15 years from the date of assignment) despite any changes in the use of this band worldwide and, given that the 2028 Spectrum Blocks are located right in the middle of the 2024 Spectrum Blocks, this would also require the 2028 Spectrum Blocks to adhere to the same mode of operation and block size as the 2024 Spectrum Blocks when the 2028 Spectrum Blocks are re-assigned in 2028. In effect, the FDD mode of operation cannot be changed until after 2043.

Spectrum Cap

59. After taking into account the existing spectrum holdings of the incumbent mobile operators, the CA proposes to set a cap for each bidder at 2 x 25 MHz (i.e. 50 MHz) out of a total of 2 x 45 MHz (i.e. 90 MHz) being re-assigned. This would permit an existing holder of the spectrum to re-acquire at least the same amount of spectrum it is currently holding in the 2024 Spectrum Blocks.

60. The CA regards such a cap as being sufficient to prevent an undue concentration of spectrum in the hands of a single mobile operator and hence avoid giving rise to any competition concerns.

Question 3:	*Do you have any views on the proposed spectrum cap of 2 x 25 MHz to be imposed on each bidder for the re-assignment of the Available Spectrum?*

61. Firstly, as a matter of principle, HKT is not in favour of imposing spectrum caps unless there is a need to address a clearly identified competition concern. Restricting the amount of spectrum that can be acquired by a single operator is effectively preventing that operator from achieving economies of scale in using the spectrum with its equipment.

62. In paragraph 24 of the Consultation Paper, the CA explains that with a cap of 50 MHz in place, the maximum amount of spectrum which an operator would be able to acquire would be limited to 56% of the

total spectrum in the 2024 Spectrum Blocks (i.e. 90 MHz). As a result, no competition concerns would arise since each of the major mobile operators has already been assigned hundreds of MHz of spectrum across various frequency bands.

63. In particular, the CA suggests that even if the operator who currently holds the largest amount of spectrum (i.e. HKT) were to acquire the maximum permitted 50 MHz of spectrum from the 2024 Spectrum Blocks, that operator's share of the total sub-6 GHz spectrum available for mobile services would only increase slightly from 30.5% to 31.0%, hence this would unlikely risk any adverse impact on effective competition in the mobile telecommunications market, especially since the CA intends to release more spectrum in different frequency bands in the future.

64. However, the CA has not explained why it is necessary to impose any spectrum cap at all. There is no analysis or consideration of whether anti-competitive effects would result even if the operator who currently holds the largest amount of spectrum were permitted to, and subsequently acquires, the majority (if not all) of the 2024 Spectrum Blocks. Specifically, the CA has failed to carry out an evaluation to determine (based on a rigorous analysis of the market) what level of spectrum holding needs to be attained by a single operator before there can be said to be competition concerns and what these competition concerns might be. Without such an analysis, it is difficult to see how any spectrum caps can be justified.

65. Secondly, the CA has not demonstrated that there is a clear adverse relationship between the amount of spectrum held by an operator (which is merely one of the inputs enabling an operator to provide mobile services) and the state of competition in the mobile services market. The CA assumes, without any explanation or analysis, that a significant spectrum holding in the hands of an individual market player will automatically lead to an adverse impact on effective competition in the mobile services market.

66. Technically speaking, an operator who does not possess sufficient spectrum to meet its required capacity to supply mobile services can, to

a certain extent, compensate for this by installing more cell sites. Also, holding large stocks of spectrum alone does not guarantee an increase in the number of subscribers for an operator or automatically bring about a higher market share. The operator still needs to attract customers to subscribe to its services. It is therefore difficult to see how an over-concentration of spectrum alone would be sufficient to raise competition concerns.

67. Thirdly, it is pertinent to note that the CA had, on a previous occasion, decided it unnecessary to impose a spectrum cap on bidders even when the total amount of spectrum available represented 9% of the existing pool of assigned spectrum for mobile services.[15] In this present case, since the amount of spectrum available merely amounts to 4% of the total spectrum already assigned to mobile operators[16], there should be even less of a need to set a spectrum cap.

68. Lastly, even if the CA does set a spectrum cap, it is unreasonable for the same cap to apply to all mobile operators regardless of their market share, i.e. the number of customers served by the operator using its holding of spectrum. This would unfairly discriminate against larger players who need more spectrum to support their larger customer base. Logically, the greater the number of customers sitting on an operator's network, the more spectrum that operator needs to continue providing its mobile services or offer new services to its customers. An operator with a large customer base should not be unduly restricted by the amount of spectrum it can acquire particularly if it can demonstrate a high customer-to-spectrum ratio as compared with other operators holding lower amounts of spectrum. Spectrum caps, if they are to be used, should only be imposed after the CA has evaluated each operator's customer-to-spectrum ratio (to determine whether an operator is using

[15] Refer to paragraph 33 of the CA's Statement on *Assignment of the Available Radio Spectrum in the 2.5/2.6 GHz Band for Wireless Broadband Services* issued on 4 July 2012.

[16] 90 MHz/2133.4 MHz = 4%. The total assigned spectrum figure of 2133.4 MHz is made up of 933.4 MHz of spectrum in the sub-6 GHz band (as per Table 1 in the Consultation Paper) plus 1200 MHz of spectrum already assigned to mobile operators in the 26/28 GHz band.

its spectrum effectively) and then also take into account the relative market share (based on number of customers) of each mobile operator.

69. If, despite the above, the CA still decides to proceed with its proposed spectrum cap of 50 MHz per bidder, HKT considers that this limit should be applied to the total *effective* amount of spectrum acquired by each bidder. In other words, an operator should be permitted to acquire spectrum directly and, in addition, through any associated parties as long as the resulting total spectrum *accessible* by the operator amounts to 50 MHz or less.[17]

70. In this regard, HKT considers it appropriate to allow "connected" bidders to participate in the spectrum auction alongside each other as long as the spectrum cap is not circumvented. If the purpose of prohibiting "connected" bidders from participating in the same auction is to prevent any spectrum caps from being circumvented, then HKT's proposal of applying the spectrum caps to total effective amount of spectrum acquired would also address this concern.

71. For the 2024 Spectrum Blocks, in particular, the CA should permit both GBL and HKT to participate in the auction so that they are given the opportunity to regain their current respective spectrum holdings as envisaged in paragraph 24 of the Consultation Paper:

> *[…] The proposed spectrum cap enables MNOs which provide 4G services with the use of the Available Spectrum to acquire the similar amount of the spectrum they are currently using in the coming re-assignment exercise if they so wish.*

72. In fact, preventing GBL and HKT from participating in the auction together is tantamount to the CA requiring GBL to be divested between HKT and Hutchison (on a 50:50 basis) before HKT can be permitted to take part in the auction. This is clearly unreasonable.

[17] For instance, in the case of GBL and HKT participating in the spectrum auction, if GBL acquires 40 MHz, HKT should be permitted to acquire 30 MHz on its own because HKT's effective holding is (50% x 40 MHz acquired by GBL) + 30 MHz = 50 MHz.

Eligible Bidders

73. As in past spectrum auctions, the CA proposes to impose minimal requirements on interested bidders in order to qualify for participation in the auction, namely the lodging of a deposit and the ability to demonstrate technical and financial capability to provide service in accordance with the licence to be issued in respect of the spectrum.

74. All interested parties, including the Three Incumbent Spectrum Assignees, would be permitted to apply for participation in the auction.

Question 4:	*Do you have any views on re-assigning the Available spectrum by allowing all interested parties to apply for participation in the auction?*

75. Placing no restrictions on who may participate in the auction (as long as they satisfy the minimal requirements) would be consistent with the application arrangements for previous spectrum auctions and hence HKT has no objection.

76. HKT would, nevertheless, urge the CA to impose more stringent "minimal requirements", particularly on new entrants, in order to ensure that successful bidders of the spectrum are able to make the most valuable use of the frequency bands and avoid a repeat of the issues which arose with 21 ViaNet who, following the 2012 auction of spectrum in the 2.3 GHz band, failed to make use of the spectrum it acquired at the auction to provide mobile services. HKT notes that 21 ViaNet has only recently amended its licence to enable the provision of mobile services using the spectrum.

Auction Format

77. The CA proposes to use a Simultaneous Multiple-Round Ascending ("**SMRA**") format auction to assign the spectrum on the basis that this type of auction was mostly used in auctions conducted in the past and is a type of auction with which the industry is familiar. The SMRA format was, in fact, used to originally assign the 2024 Spectrum Blocks and the 2028 Spectrum Blocks.

Question 5:	*Do you have any views on the adoption of the SMRA auction format for the re-assignment of the Available Spectrum?*

78. An SMRA auction format would be appropriate if the 2024 Spectrum Blocks are to be auctioned off separately to the 2028 Spectrum Blocks given that there will be a "gap" in the middle of the spectrum being made available in the auction.

79. On the other hand, if the CA accedes to HKT's request and conducts a single auction of the combined 2024 Spectrum Blocks and 2028 Spectrum Blocks, this would make a continuous stretch of 2 x 70 MHz available and hence render it possible to adopt a clock auction format. Clock auctions have been used by the CA in the past and facilitate the assignment of contiguous spectrum blocks.

LICENSING ARRANGEMENTS

Licensing and Validity Period

80. As with previous spectrum assignments, the CA proposes to assign the 2024 Spectrum Blocks for a period of 15 years. Bidders who successfully acquire the spectrum at auction will be granted a new Unified Carrier Licence ("**UCL**") which will be coterminous with the 15 year spectrum assignment period. Incumbent licensees may apply to the CA to combine their existing UCL with the new licence.

Restriction on Frequency Swap

81. The CA proposes to prohibit successful bidders from swapping any of the blocks they have acquired within the 2024 Spectrum Blocks until after all the available spectrum in the entire 2.5/2.6 GHz has been re-assigned in May 2028. This is intended to facilitate competitive bidding and allow the full market value of the spectrum to be realized at auction.

Technology Neutrality

82. As per (almost all of) the previous spectrum assignments, the CA intends to impose no requirements on the technology that can be used with the spectrum as long as it is based on widely recognized standards and does not cause any harmful interference to other legitimate services. In this particular case, the CA proposes that the 2024 Spectrum Blocks adopt the FDD mode of operation as stipulated in the relevant 3GPP standards.

Network and Service Rollout Obligations

83. Consistent with past spectrum auctions, the CA intends to impose network and service rollout obligations on the successful bidder of the spectrum in order to prevent spectrum hoarding and to ensure timely provision of mobile services to the public.

84. Given that the 2.5/2.6 GHz band has good radio propagation characteristics that facilitate the provision of broad geographical coverage in an economic way, and the existing extensive coverage of networks already using the 2.5/2.6 GHz band, the CA suggests it appropriate to set a network/service rollout obligation whereby spectrum assignees are required to make use of the frequency blocks to provide a minimum coverage of 90% of the population of Hong Kong within 5 years of the spectrum being assigned.

Performance Bond for Rollout Obligations

85. In order to ensure compliance with the network and service rollout obligations described above, the CA intends to require successful bidders of the spectrum to provide a performance bond, the amount of which will be specified when the details of the auction are announced.

86. As the 2024 Spectrum Blocks are already in use by the Three Incumbent Spectrum Assignees, should any of these operators successfully re-acquire any of the spectrum blocks they are currently using then the CA is prepared to waive the performance bond in respect of these blocks if the operator is able to provide network coverage figures demonstrating that it has already met the proposed 90% minimum population coverage requirement.

Question 6:	*Do you have any views on the proposed licensing arrangements as specified in paragraphs 28 – 34 above? In particular, do you have any views on the network and service rollout obligations proposed to be imposed on the successful bidders of the Available Spectrum, and the associated performance bond or network coverage statistics as the case may be proposed for ensuring compliance?*

87. Paragraphs 28 to 30 of the Consultation Paper describe the CA's proposals in respect of the: (i) licensing and validity period; (ii) restriction on frequency swap; and (iii) technology neutrality as described above. Paragraphs 31 to 34 of the Consultation Paper deal with the CA's proposals to impose network and service rollout obligations as well as an

associated performance bond to guarantee fulfillment of the rollout obligations. HKT has the following comments:

Licensing and validity period

88. In principle, HKT supports longer spectrum assignment/licence terms in order to allow operators sufficient time to recoup their investment (i.e. price paid for the spectrum as well as the network rollout costs). Accordingly, an assignment/licence term of at least 20 to 25 years would make more commercial sense. Indeed, across the globe, some major markets have already moved towards longer licence terms, unlimited licence terms and an expectation of renewal, so Hong Kong appears to be lagging behind in this area.

Restriction on frequency swap

89. As a matter of principle, HKT disagrees with the imposition of any ban on spectrum swapping. Spectrum swapping allows operators to make the most efficient use of their spectrum resources by combining spectrum blocks exchanged with other operators in order to achieve contiguous frequency bands and hence minimize costs arising from carrier aggregation.

90. By imposing an initial moratorium on spectrum swapping, this increases operators' costs compared to allowing spectrum swapping right from the very start. Increased costs means less funding available for network rollout and service improvement. In fact, it is difficult to see the rationale behind the CA imposing such a restriction other than to maximize the Government's revenues derived from the spectrum auction.

Technology neutrality

91. HKT supports a technology neutral approach. In fact, HKT considers that any technology restrictions that are currently being applied to any of the spectrum assigned to the mobile operators should be abolished immediately.

Network and service rollout obligations & performance bond for rollout obligations

92. Generally speaking, given the competitive conditions in the Hong Kong mobile market, operators who have been successfully assigned spectrum would be keen to roll out their network and service as quickly as possible, so there is little incentive for operators to hoard spectrum or delay provisioning service. Accordingly, as a matter of principle, HKT does not consider it necessary to impose network and service rollout obligations or require spectrum assignees to provide a performance bond to guarantee fulfillment of such obligations. The funds could more productively be put towards investment in network rollout.

93. Nevertheless, if the CA considers it necessary to impose network and service rollout obligations and to provide a performance bond as a precondition for assignment of the spectrum then, in the interests of consistency, these should be benchmarked against the network and service rollout obligations and performance bonds that were previously imposed for spectrum bands with similar characteristics.

94. In this regard, HKT would note that both the 2024 Spectrum Blocks and 2028 Spectrum Blocks were originally assigned with a network and service rollout obligation to cover a minimum of 50% of the population in Hong Kong within 5 years. The 3.5 GHz band was also assigned with a minimum population coverage requirement of less than 50%.[18] HKT would therefore suggest it appropriate to adopt the same minimum coverage requirements (i.e. 50% population coverage within 5 years) for the 2024 Spectrum Blocks when they are re-assigned in the new term.

95. It would only be appropriate to apply the higher 90% coverage requirement for sub-1 GHz spectrum, as in the case of the previous assignment exercise for the 900/1800 MHz band and the proposed assignment of the 600/700 MHz and 850 MHz bands, given the much

[18] The 3.5 GHz band was assigned via auction in October 2019 with a minimum population requirement of 45% within 5 years. A reduction of 5% off the normal 50% coverage was given due to the existence of Restriction Zones.

better radio propagation and indoor penetration characteristics of frequency bands in the sub-1 GHz range.

96. In any case, HKT agrees with the proposal put forward by the CA to waive the requirement for a spectrum assignee to provide a performance bond in respect of any spectrum blocks for which it can demonstrate already having met the prescribed network and service rollout requirements.

SPECTRUM UTILISATION FEE

97. While the exact level of the SUF for the 2024 Spectrum Blocks will be determined by auction, the initial reserve price to kick start the bidding is to be set by the SCED.

98. As per the recent spectrum auctions, the SCED proposes to allow spectrum assignees to pay their SUF either in one lump sum upfront (which is the SUF amount determined at auction), or in 15 annual instalments, with the first instalment being the SUF determined at auction divided by 15, and each subsequent instalment being calculated as the previous year's instalment increased by a fixed percentage in order to reflect the time value of money to the Government.

Question 7:	*Do you have any views on the proposal in relation to the setting and collection of SUF as specified in paragraphs 35 – 36 above?*

99. HKT, along with the other mobile operators in the industry, have all along urged the SCED to set minimal reserve prices for spectrum auctions, as the reserve price is merely intended to be an opening price to kick start the bidding process. The reserve price should allow ample room for the bidding process to discover the true market price for the spectrum and hence should not be set with reference to any assumed current market price for the spectrum. Setting the reserve price at too high a level will simply hinder the bidding process.

100. In the previous set of spectrum auctions held in 2019 (i.e. for assignment of spectrum in the 3.3 GHz, 3.5 GHz and 4.9 GHz bands), HKT is pleased to note that the SCED heeded the call of the industry and set minimal reserve prices for each of these auctions.[19]

101. Accordingly, HKT would once again urge the SCED to set a minimal reserve price in respect of the auction of the 2024 Spectrum Blocks, particularly given the impact on operators' cash flow caused by the ongoing impact of COVID-19 on the local economy. It would be rational

[19] The auction reserve prices previously set were as follows: (i) 3.3 GHz band at $2m per MHz; (ii) 3.5 GHz band at $4m per MHz; and (iii) 4.9 GHz band at $3m per MHz.

for the SCED to set the opening price for the auction at a level which is no higher than the range of the last set of reserve prices.

102. If the CA is minded to extend the current assignment period for the 2024 Spectrum Blocks (to coincide with the expiry date of the 2028 Spectrum Blocks) then HKT considers it reasonable for SUF to be payable for this extended period of around 4 years from March 2024 to May 2028. Under these circumstances, the SUF could be computed (on a pro rata basis) using the original amounts paid by the spectrum assignees for the 2024 Spectrum Blocks when they were awarded back in 2009.

103. To further ease the pressure on operators' cash flow, HKT supports the option to allow SUF payments to be made by instalment instead of in one lump sum upfront. This would be consistent with the approach taken in recent spectrum auctions. Nevertheless, in view of the decreasing cost of funds, the SCED could consider reducing the pre-set fixed percentage which is currently being applied to uplift each annual SUF instalment.

Submitted by
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