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 Utilisation Fee

Consultation Paper

3 February 2016

FOREWORD

This paper seeks views and comments of the telecommunications industry and other affected persons on the arrangements for re-assignment of the frequency spectrum in the 900 MHz and 1800 MHz bands upon expiry of the existing assignments between November 2020 and September 2021. This paper also seeks views and comments on the methods for setting the related spectrum utilisation fee ("SUF").

The Communications Authority ("CA") and the Secretary for Commerce and Economic Development ("SCED") plan to conduct two rounds of public consultation on the arrangements for the spectrum re-assignment and the related SUF, with a view to making their respective decisions on the way forward by November 2017. For the avoidance of doubt, all the information given and views expressed in this consultation paper are for the purpose of discussion and consultation only. Nothing in this consultation paper represents or constitutes any decision made by the CA or the SCED. The consultation contemplated by this consultation paper is without prejudice to the exercise of the powers by the CA and the SCED under the Telecommunications Ordinance (Cap. 106) ("TO") or any subsidiary legislation thereunder.

Any person wishing to respond to the public consultation should do so on or before 18 April 2016. The CA and the SCED may publish all or part of the views and comments received, and disclose the identity of the source in such manner as they see fit. Any part of the submissions considered commercially confidential should be clearly marked. The CA and the SCED would take such markings into account in making the decision as to whether or not to

disclose such information. Submissions should be sent to –

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29/F., Wu Chung House
213 Queen's Road East
Wan Chai
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An electronic copy of the submission should be provided by e-mail to the e-mail address indicated above.

INTRODUCTION

Hong Kong has one of the most competitive mobile telecommunications markets in the world, with four mobile network operators ("MNOs") serving a population of 7.3 million, through the use of 552 MHz of frequency spectrum[1] in the 800/900 MHz, 1800 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz bands. The entire spectrum available for the provision of public mobile telecommunications services has been assigned.

2. A total of 198.6 MHz of spectrum, comprising 49.8 MHz in the 900 MHz band (890.0 – 904.0 MHz paired with 935.0 – 949.0 MHz and 904.1 – 915.0 MHz paired with 949.1 – 960.0 MHz) and another 148.8 MHz in the 1800 MHz band (1710.5 – 1784.9 MHz paired with 1805.5 – 1879.9 MHz), was assigned to MNOs in 2005/6 and 2009[2]. These spectrum assignments are due to expire between 19 November 2020 and 29 September 2021.

3. According to the Statement issued by the former Telecommunications Authority ("TA") in January 2008 (on minimum notice periods to be given for variation or withdrawal of spectrum assignments upon and before their expiry), insofar as it is practicable in the circumstances, the decision of the CA on whether to renew the frequency assignments with different frequencies assigned, or not to renew the assignments at all upon their expiry, should be notified to the incumbent spectrum assignees at least three years in advance[3]. Accordingly, the intention of the CA is to make its decision and inform the concerned parties on the arrangements for re-assignment of the above 198.6 MHz of spectrum in the 900 MHz and 1800 MHz bands by November 2017.

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[1] The 552 MHz of spectrum deployed for the provision of public mobile telecommunications services does not include (a) 8 MHz of spectrum in 678 – 686 MHz assigned in 2010 for the provision of broadcast-type mobile television service; (b) 20 MHz of unpaired spectrum in the 1.9 – 2.2 GHz band, as it has been left idle since the assignment in 2001 and will be put back to reserve upon expiry of the existing assignments in October 2016; and (c) 9.7 MHz of unpaired spectrum in 2010 – 2019.7 MHz for the provision of pubic mobile telecommunications services that was put out for auction in February/March 2011 but with no interested bidder. This 9.7 MHz of spectrum has since been put back to reserve, and the CA will review the demand for this band from time to time.

[2] Of the 198.6 MHz of spectrum, 49.8 MHz in the 900 MHz band and 139.2 MHz in the 1800 MHz band was re-assigned in 2005/06 through the offer of the right of first refusal to the then incumbent spectrum assignees, and 9.6 MHz in the 1800 MHz band was assigned to MNOs in 2009 by way of auction.

[3] The TA Statement on minimum notice periods for variation or withdrawal of spectrum assignments is available at: http://tel_archives.ofca.gov.hk/en/tas/others/ta20080131.pdf.

4. Apart from the 198.6 MHz of spectrum in the 900 MHz and 1800 MHz bands as set out above which is subject to re-assignment, another 2 x 0.1 MHz of spectrum in the 900 MHz band (904.0 – 904.1 MHz paired with 949.0 – 949.1 MHz) and 2 x 0.6 MHz of spectrum in the 1800 MHz band (1710.0 – 1710.5 MHz paired with 1805.0 – 1805.5 MHz and 1784.9 – 1785.0 MHz paired with 1879.9 – 1880.0 MHz) is currently vacant. From a spectrum efficiency angle, the CA is minded to consider the assignment of such vacant spectrum together with the re-assignment of the 198.6 MHz of spectrum in the 900 MHz and 1800 MHz bands currently in use. In sum, the arrangements for re-assignment/assignment of a total of 200 MHz of spectrum, comprising 50 MHz in the frequency ranges of 890 – 915 MHz paired with 935 – 960 MHz and 150 MHz in the frequency ranges of 1710 – 1785 MHz paired with 1805 – 1880 MHz (hereafter collectively referred to as the "Re-assignment of the 900/1800 MHz Spectrum") upon the expiry of the existing assignments will be considered in the present consultation with a view to promoting more efficient allocation and use of spectrum.

5. As of today, the CA has assigned a total of 552 MHz of spectrum to the industry for the provision of public mobile telecommunications services. The 198.6 MHz of 900/1800 MHz Spectrum accounts for 36% of the total spectrum assignment. All the four MNOs, namely China Mobile Hong Kong Company Limited ("CMHK"), Hong Kong Telecommunications (HKT) Limited ("HKT"), Hutchison Telephone Company Limited ("Hutchison") and SmarTone Mobile Communications Limited ("SmarTone"), have been assigned spectrum in the 1800 MHz band, whilst three of them (not including CMHK) hold spectrum also in the 900 MHz band. According to currently available information, no new spectrum would be made available for the provision of public mobile telecommunications services until after the switching off of the analogue terrestrial television services. The Government's working target for this is 2020[4].

6. As depicted in Table 1 below, HKT, Hutchison and SmarTone are each assigned equal amounts of 16.6 MHz of spectrum in the 900 MHz band. The amounts of spectrum respectively held by the MNOs in the 1800 MHz band are different: Hutchison has the smallest holding of 23.2 MHz, CMHK and SmarTone hold 26.4 MHz each, and HKT has the largest holding of

[4] Please see press release of the Government on "*Working target for analogue switch-off changed to 2020*" dated 9 December 2014, which is available at: http://www.info.gov.hk/gia/general/201412/09/P201412090656.htm.

72.8 MHz. Taken together, the spectrum in these two frequency bands which is due for re-assignment upon expiry of the current assignments in 2020/21 accounts for 23% – 46% of the total spectrum holdings of individual MNOs.

Table 1: Distribution of spectrum among MNOs (post-October 2016)

			Spectrum due for re-assignment in 2020/21			
	Overall total (MHz)	Share in total	900 MHz (MHz)	1800 MHz (MHz)	Total (MHz)	Share in MNO's total
CMHK	116.0	21%		26.4	26.4	23%
HKT	194.0	35%	16.6	72.8	89.4	46%
Hutchison	129.4	23%	16.6	23.2	39.8	31%
SmarTone	112.6	20%	16.6	26.4	43.0	38%
Total	**552.0**	**100%**	**49.8**	**148.8**	**198.6**	**36%**

7. In terms of spectrum deployment, the 900/1800 MHz Spectrum was initially used for the provision of second generation ("2G") mobile services with voice-centric application. Under the technology-neutral approach the CA adopts towards the management of spectrum, MNOs have been free to deploy this spectrum to higher generation mobile services. At present, part of the spectrum in the 900 MHz band has been deployed by MNOs to provide third generation ("3G") and fourth generation ("4G") mobile services, while a substantial proportion of the spectrum in the 1800 MHz band has been deployed by MNOs to provide 4G services.

LEGISLATIVE AND POLICY FRAMEWORK

8. Under section 32G(1) of the TO, the CA has the statutory duty to promote the efficient allocation and use of the radio spectrum as a public resource of Hong Kong. Sections 32H(2) and 32I(1) of the TO empower the CA to assign radio frequencies and to designate which of them shall be subject to the payment of SUF following consultation with the telecommunications industry and other affected persons. Sections 32I(2) and 32I(4) of the TO empower the SCED to prescribe the method for determining the SUF and to specify the minimum fee of the SUF (i.e. the auction reserve price). Before exercising the respective statutory powers conferred on them by the TO, the

CA and the SCED jointly initiate the present public consultation to solicit views on the arrangements for re-assignment and the related SUF of the 900/1800 MHz Spectrum.

9. Section 4(4) of the Communications Authority Ordinance (Cap. 616) stipulates that the CA, in performing its functions, must have regard to the following matters which appear to the CA to be relevant in the circumstances: (a) the fostering of an environment that supports a vibrant communications sector to enhance Hong Kong's position as a communications hub in the region; (b) the encouragement of innovation and investment in the communications market; (c) the promotion of competition and adoption of best practices in the communications market for the benefit of the industry and consumers; and (d) acting in a manner consistent with the provisions of the Hong Kong Bill of Rights Ordinance (Cap. 383).

10. The Radio Spectrum Policy Framework ("Spectrum Policy Framework") promulgated by the Government in April 2007 identifies the policy objectives and the guiding principle in spectrum management which the CA should take into account in discharging its spectrum management responsibilities under the TO[5]. By his Statement issued in April 2007, the former TA explained that, in exercising his statutory powers under the TO, he would, in addition to all relevant considerations as required by law, give due regard to the Spectrum Policy Framework to the extent that there would be no inconsistency with the objectives and provisions of the TO[6].

11. According to the Spectrum Policy Framework, the policy inclination is that a market-based approach will be used in spectrum management wherever the 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. It makes clear that there is no legitimate expectation that there will be any right of renewal or right of first refusal upon the expiry of a spectrum assignment under the TO. The Spectrum Policy Framework also explains that a decision on whether to grant a new spectrum assignment, with the same or varied radio frequencies, would be made and notified to the spectrum assignee within a reasonable time before the

[5] The Spectrum Policy Framework is available at: http://www.cedb.gov.hk/ctb/eng/legco/pdf/spectrum.pdf.

[6] The TA Statement on radio spectrum policy framework is available at: http://tel_archives.ofca.gov.hk/en/tas/others/ta20070424.pdf.

expiry of its spectrum assignment. As mentioned in paragraph 3 above, insofar as it is practicable in the circumstances, the CA intends to notify the incumbent spectrum assignees at least three years in advance of the expiration of their respective assignments of its decision on whether to renew the frequency assignments with the same or different frequencies, or not to renew the assignments at all upon their expiry.

OBJECTIVES IN SPECTRUM RE-ASSIGNMENT

12. This is the second occasion, since the promulgation by the Government of the Spectrum Policy Framework in 2007, on which the CA has to consider the options for the re-assignment of spectrum assigned for the provision of public mobile telecommunications services upon the expiry of the existing assignments. The first occasion was in November 2013 when, after two rounds of public consultation, and having taken into account all relevant factors, the CA decided to adopt a hybrid option between the administratively-assigned and market-based approaches in the re-assignment of the spectrum in the 1.9 – 2.2 GHz band ("3G Spectrum") upon expiry of the existing assignments in October 2016[7].

13. In order to maximise the benefits to be derived from the valuable but scarce spectrum resource, the Spectrum Policy Framework states that Hong Kong's spectrum policy aims to –

(a) facilitate the most economically and socially efficient use of spectrum with a view to attaining maximum benefit for the community;

(b) achieve technically efficient use of spectrum to facilitate the introduction of advanced and innovative communications services and strengthen Hong Kong's position as a telecommunications and broadcasting hub;

(c) fulfil Hong Kong's regional and international obligations relating to the use of spectrum;

[7] Please see the joint statement of the SCED and the CA on arrangements for the frequency spectrum in the 1.9 – 2.2 GHz band upon expiry of the existing assignments for the provision of 3G mobile services and the spectrum utilisation fee, which is available at: http://www.coms-auth.hk/filemanager/statement/en/upload/237/ca_statements20131115_en.pdf.

(d) strengthen Hong Kong's strategic position as a world city and the gateway between the Mainland of China and the world by facilitating the provision of key services in Hong Kong which are deployed, or will be deployed, globally or in the Mainland of China; and

(e) ensure that necessary spectrum is reserved for services to be provided by or on behalf of the Government.

14. Having regard to this statement of policy, the CA has decided to evaluate the options for the Re-assignment of the 900/1800 MHz Spectrum according to the extent to which they satisfy the following policy objectives[8] –

(a) ensuring customer service continuity;
(b) efficient spectrum utilisation;
(c) promotion of effective competition; and
(d) encouragement of investment and promotion of innovative services.

The CA will choose the option that would best meet the four multiple objectives in spectrum re-assignment.

Ensuring customer service continuity

15. Table 2 depicts the application of the 552 MHz of the spectrum assigned for the provision of public mobile telecommunications services in Hong Kong. Of this, a total of 493 MHz of spectrum is being used for the provision of mobile broadband services, i.e. 3G and 4G services. Only 154.6 MHz of this 493 MHz falls within the 900 MHz and 1800 MHz frequency bands due for re-assignment, i.e. less than one-third of the total spectrum being deployed for mobile broadband services. Accordingly, 338.4 MHz of the assigned spectrum, which is more than two-thirds of the existing spectrum deployed for mobile broadband services, falls within other frequency bands including the 850/900 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz bands.

[8] These are the same multiple objectives that the CA adopted for the re-assignment of the 3G Spectrum upon expiry of the existing assignments in October 2016.

Table 2: Application of radio spectrum in the provision of public mobile telecommunications services

	Types of mobile services				
Frequency band	2G (MHz)	3G (MHz)	4G (MHz)	CDMA 2000 (MHz)	Total (MHz)
800 MHz				15.0	15.0
850/900 MHz		20.0			20.0
900 MHz	15.2	18.6	16.0		49.8
1800 MHz	28.8		120.0		148.8
1.9 - 2.2 GHz		118.4			118.4
2.3 GHz			60.0		60.0
2.5/2.6 GHz			140.0		140.0
Total	**44.0**	**157.0**	**336.0**	**15.0**	**552.0**

16. Spectrum for the provision of 3G and 4G services has been extensively deployed for outdoor service coverage. In so far as indoor service coverage is concerned, the Mass Transit Railway ("MTR") stations/lines are high data traffic areas in town with the highest density of mobile data users at most times. The CA notes that there is now full 3G service coverage at all MTR stations and along all lines, and spectrum in the 2.5/2.6 GHz band is being deployed progressively in the newly built MTR stations and lines to provide 4G services[9]. MNOs are also arranging with the MTR Corporation to use the 2.3 GHz and 2.5/2.6 GHz spectrum in the existing railway stations and along railway lines for the provision of 4G services, with priority given to the stations where there are high passenger flows. It is expected that there will be significant progress in the deployment of spectrum in the 2.3 GHz and 2.5/2.6 GHz bands for 4G services to meet the demand for mobile broadband services at these high data traffic areas during the coming five to six years leading up to the Re-assignment of the 900/1800 MHz Spectrum in 2020/21[10]. Against this background, the CA considers that the continuity of 3G and 4G services in indoor areas, including those at MTR stations and along MTR lines, is unlikely to be an area of concern when assessing the options for the Re-assignment of the 900/1800 MHz Spectrum in 2020/21.

[9] Spectrum in the 2.5/2.6 GHz band has already been deployed in the three newly built MTR stations of the West Island Line.

[10] The 140 MHz of spectrum in the 2.5/2.6 GHz band was assigned through the two auctions conducted in January 2009 and March 2013 respectively. Therefore, by the time when the 900/1800 MHz Spectrum is re-assigned in 2020/21, the spectrum in the 2.5/2.6 MHz band would have run into the 11th/12nd or at least the 7th/8th year of their existing 15-year assignment terms.

17. In comparison, ensuring the continuity of **mobile voice services** to customers using 2G handsets may be an area of consideration in the CA's assessment of the options, as these handsets can only support MNOs' 2G networks operating with the 900/1800 MHz Spectrum. As at November 2015, there were 3.1 million 2G services subscribers among the 16.6 million mobile service subscribers in Hong Kong, accounting for 19% of the total number. As to the likely future demand from users of 2G handsets, the CA notes the growing popularity of mobile services enabled by 3G/4G technologies, the launch of the voice over LTE ("VoLTE") services by MNOs which may potentially replace 2G services in the future, and the increasing tendency of mobile customers to replace their 2G handsets with more advanced 3G/4G-enabled models. Nevertheless, the CA cannot preclude the possibility that come 2020/21, when the 900/1800 MHz Spectrum is due for re-assignment, there would remain a portion of mobile subscribers who would prefer to access mobile voice services with 2G handsets, and therefore, their likely service needs may have to be considered by CA when assessing the options for the Re-assignment of the 900/1800 MHz Spectrum.

18. The extent of the need to provide inbound roaming services for visitors to Hong Kong using 2G handsets will also need to be considered. Visitors from the Mainland, for instance, at about 46 million, accounted for 77% of the total number of visitors to Hong Kong in 2015. There are still hundreds of millions of 2G services subscribers in the Mainland and the Mainland operators have not indicated that they intend to switch off their 2G networks in the coming five to six years. The other major sources of visitors to Hong Kong, such as Taiwan and the United States still have subscribers for 2G services. The **Annex** shows the current use of 2G services, and plans for phasing out 2G services, if known, in some of these economies.

19. The CA will continue to adopt its technology-neutral approach when considering the views of the industry on the technology to be adopted in the provision of public mobile telecommunications services, as well as the types of mobile services to be provided using the radio spectrum which may be assigned to the MNOs. Accordingly, the CA considers that the decision on whether, and if so when, the 2G networks will be switched off in Hong Kong should be determined by the MNOs based on their assessment of the demand for 2G services, so long as they ensure that the impact on the affected customers would be kept to the minimum through reasonable transitional arrangements and affordable migration plans. In this context, the CA wishes

to hear the views of the public and the industry as to whether there is likely to be a need to ensure the continuity of 2G services beyond 2020/21.

Efficient spectrum utilisation

20. As the 900/1800 MHz Spectrum at the times of assignment was for the provision of 2G services, the frequency blocks are in the multiples of 2 x 0.2 MHz, which is the bandwidth of a carrier for 2G services. As shown in Table 2, although as much as 44 MHz of this spectrum is presently deployed for the provision of 2G services, from the perspectives of engineering and efficient use of radio spectrum, the bandwidth actually required for the carriage of voice services could in fact be much smaller than that. The fragmented spectrum holdings by individual MNOs in the range from 2 x 0.8 MHz to 2 x 3.2 MHz in the 900 MHz and 1800 MHz bands is not conducive to optimal utilisation of spectrum. The fragmentation inhibits the refarming of spectrum for the provision of 3G services which requires carriers to employ a larger bandwidth of at least 2 x 5 MHz; or for the provision of 4G services which requires carriers to employ a range of bandwidths of 1.4, 3, 5, 10, 15 or 20 MHz pairs. Spectral efficiency is higher where carriers employ larger bandwidths. Accordingly, with a view to achieving more efficient spectrum utilisation, the CA considers it important to ensure that the re-assignment arrangements should permit consolidation of the 900/1800 MHz Spectrum **prior to** re-assignment. With carriers employing spectrum of at least 2 x 5 MHz, MNOs will be able to refarm the spectrum they are re-assigned and/or to aggregate carriers to attain higher spectral efficiency and service speed post 2020/21.

Promotion of effective competition, encouragement of investment and promotion of innovative services

21. The mobile telecommunications market in Hong Kong had operated with four or more MNOs for decades[11], with competition contributing

[11] The number of MNOs was reduced from five to four after a merger of two MNOs in 2014. In December 2013, HKT Limited, the parent company of HKT, a fixed and mobile carrier licensee, submitted an application to the CA seeking its prior consent to its proposed acquisition of CSL New World Mobility Limited, the parent company of CSL Limited ("CSL"), a mobile carrier licensee, pursuant to section 7P of the TO. After careful consideration of all available evidence before it, including but not limited to representations received from the public consultation on the proposed transaction, the CA decided in April 2014 to give consent to the proposed transaction, with conditions imposed that HKT and CSL, as carrier licensees concerned, should take certain necessary actions to eliminate or avoid the identified effect of substantially lessening competition, including the divestment by HKT of part of its 3G Spectrum.

to low service charges, high service quality, and a full range of choices for service users. Spectrum assignment exercises provide opportunities for further stimulation of competition in the market. The auction of the 90 MHz of frequency spectrum in the 2.3 GHz band in 2012, for instance, led to an additional operator joining the Hong Kong telecommunications market. Bearing in mind that the Re-assignment of the 900/1800 MHz Spectrum involves a sizable 200 MHz of spectrum, and that there will unlikely be any new spectrum available for release for the provision of public mobile telecommunications services before this re-assignment, the current exercise provides a good opportunity to attract new entrants and investments in the Hong Kong telecommunications market. Having said that, consistent with the longstanding market-driven approach to regulation of the telecommunications sector, the CA considers that the optimal number of MNOs to meet demand for mobile telecommunications services in Hong Kong should be determined by market forces.

OPTIONS FOR SPECTRUM RE-ASSIGNMENT AND THEIR EVALUATION AGAINST THE IDENTIFIED MULTIPLE OBJECTIVES

22. There are in essence three options for re-assigning radio spectrum, viz. a full-fledged administratively-assigned approach that re-assigns, through the offer of a right of first refusal, all the spectrum to the incumbent spectrum assignees; a full-fledged market-based approach that re-assigns all the spectrum typically by way of auction; or a hybrid of the two.

23. Pursuant to the Spectrum Policy Framework, wherever the CA considers that there are likely to be competing demands for the spectrum from providers of non-Government services, a market-based approach in spectrum management will be used, unless there are overriding public policy reasons to do otherwise.

24. Over the past couple of years, the mobile telecommunications market in Hong Kong has grown by leaps and bounds. According to statistics of the Office of the Communications Authority, there was a more than ten-fold increase in the volume of mobile data traffic between 2010 and 2015, with the monthly mobile data usage per customer rising from 296 MBytes at end 2010 to 1.4 GBytes in November 2015. This growth trend is expected to continue.

The combination of dynamism in the development of technologies and innovative services in the mobile telecommunications market, and the fact it is unlikely that new spectrum will be available in the near future for assignment to meet the ever-increasing demand for data capacity by the incumbent and new network operators, strongly indicates there will likely be competing demands for the 900/1800 MHz Spectrum when the current assignments expire.

25. Apart from the sustained robust growth in mobile data traffic which fuels the general demand for spectrum, the characteristics of the 900/1800 MHz Spectrum also lead to a high demand for it. Spectrum in the 900 MHz band in particular is technically well suited for providing wide area coverage as well as indoor penetration, making it more cost effective for operators to establish and maintain a territory-wide mobile network, as compared with that of a network using spectrum in the higher frequency bands. The 1800 MHz band currently hosts the largest number of 4G networks worldwide, and there is a wide spectrum of choices of 4G-enabled mobile equipment and user devices supporting the band, making it more economical for deployment of 4G services. **All in all, the CA considers that there are likely to be competing demands for the 900/1800 MHz Spectrum.**

26. In accordance with the Spectrum Policy Framework, since the CA considers that there are likely to be competing demands for the 900/1800 MHz Spectrum from MNOs and from potential new entrants to the market, it follows that **a market-based approach should be used for the assignment of the 900/1800 MHz Spectrum unless there are overriding public policy reasons to do otherwise**.

27. The CA proceeds now to evaluate the spectrum re-assignment options against the multiple objectives for spectrum re-assignment which it identified above.

Option 1: Full-fledged administratively-assigned approach

28. Under this option, the four MNOs will be offered a right of first refusal to acquire their current holdings of spectrum in the 900 MHz and 1800 MHz bands ("RFR Spectrum"), subject to their payment of SUF to be specified by the SCED and agreement to the licence conditions to be imposed by the CA. If any incumbent spectrum assignee decides not to exercise the

right of first refusal, the spectrum which then becomes available will be put to auction.

Pros and Cons Analysis

29. An important issue to be considered by the CA when assessing whether there are overriding public policy reasons to justify **not** adopting a market-based approach for the Re-assignment of the 900/1800 MHz Spectrum and in favouring a full-fledged administratively-assigned approach (as opposed to e.g. a hybrid approach) is whether there is likely to be a need to ensure the continuity of 2G services beyond 2020/21. The CA would wish to listen to the views and comments on this issue from the industry and affected persons.

30. A relevant consideration is that the MNOs would only require a small portion of the 900/1800 MHz Spectrum in order to operate their 2G services, assuming the outcome of the consultation indicates that there will likely be a continuation of 2G services beyond 2020/21. The current inclination of the CA is that this does not amount to a sufficient public policy reason, let alone an overriding one, to support a full-fledged administrative approach to re-assign, through the offer of a right of first refusal, **all** the 900/1800 MHz Spectrum to the incumbents upon the expiry of the existing term of assignment.

31. Indeed, in the CA's views, the full-fledged administratively-assigned approach is likely to have quite a number of unacceptable effects. First, it will effectively maintain the status quo in the spectrum holdings of MNOs in the 900 MHz and 1800 MHz bands, and thus would not provide an incentive for the spectrum assignees to strive for higher spectral efficiency in the next 15-year term of spectrum assignment. Of equal if not greater importance is that the adoption of this option would be inconsistent with the CA performing its statutory duty to ensure efficient allocation and utilisation of spectrum, through consolidation of the 900/1800 MHz Spectrum **before** re-assignment to achieve the efficiencies described above. In addition, the full-fledged administratively-assigned approach would not promote more effective competition as it would preclude the possibility, in the next 15 years of the assignment period post 2020/21, of new players entering the market and introducing a wider range of mobile services.

32. The main pro of adopting this option, and maintaining the status quo, would be to provide the incumbent spectrum assignees with a stable environment for their operations and further investment.

33. All in all, the current view of the CA is that there is no public policy reason, let alone any overriding one, supporting the full-fledged administratively-assigned approach to the Re-assignment of the 900/1800 MHz Spectrum. The CA also notes that the cons of the option are likely to far outweigh the pros, making it the least capable of meeting the multiple objectives of spectrum assignment the CA has identified for the re-assignment exercise.

Question 1:	*Given the CA's views that there are likely to be competing demands for the 900/1800 MHz Spectrum, is there any overriding public policy reason for the CA to consider not adopting a market-based approach pursuant to the Spectrum Policy Framework and to favour the full-fledged administratively-assigned approach (Option 1) for the Re-assignment of the 900/1800 MHz Spectrum?*

Question 2:	*What are your views on whether the full-fledged administratively-assigned approach (Option 1) would achieve the four identified objectives in the Re-assignment of the 900/1800 MHz Spectrum?*

Option 2: Full-fledged market-based approach

34. Under Option 2, all the 200 MHz of the 900/1800 MHz Spectrum would be re-assigned by auction prior to the expiry of the existing assignments in 2020/21. It would be open to the incumbent spectrum assignees to participate in the auction to obtain frequency spectrum which may be more than, less than, or similar to their current spectrum holdings. Likewise, those who would like to enter the mobile telecommunications market may compete for the spectrum by participating in the auction.

Pros and Cons Analysis

Ensuring customer service continuity

35. As explained in paragraphs 15 to 16 above, the continuity of 3G and 4G services should not be a concern in considering the re-assignment arrangements of the 900/1800 MHz Spectrum.

36. As regards the continuity of 2G mobile voice services, the CA notes that MNOs would need only a small amount of spectrum to continue the provision of 2G services, if it is necessary to do so. Nevertheless, the revenue generated from the 2G voice services is very attractive when one takes into account revenue generated from the lucrative inbound roaming business. Information in the public domain shows that non-data roaming services contributed to about 16% of MNOs' revenue from mobile services[12].

37. Whether there will be similar commercial incentives five or six years down the road for MNOs to provide 2G services beyond 2020/21 will hinge on the then market demands, which will depend on factors such as the number of 2G services subscribers remaining in Hong Kong, the number of inbound roamers using only 2G handsets, as well as the MNOs' plans, if any, to replace the 2G voice services by 3G voice or VoLTE services using their 3G/4G networks.

38. If the MNOs consider that there is likely to be sufficient market demands for 2G services from local users and inbound roamers come 2020/21, they would be motivated to actively bid for, and strive to succeed in securing the necessary amount of 900/1800 MHz Spectrum to enable them to continue to maintain their 2G networks. Service continuity of 2G services beyond 2020/21 would thus be achieved.

39. In circumstances where MNOs decide to phase out their 2G networks and replace 2G voice services by 3G voice or VoLTE services over their 3G/4G networks, there would be commercial incentives for them to migrate their 2G customers to the 3G/4G platform and rely on a single mobile broadband network to provide their full range of mobile voice and data services. If MNOs are successful in seamlessly migrating their 2G users to the 3G/4G platform by 2020/21, then the continuity of 2G services for local users beyond then would not be an issue. This approach however would not address the demand for 2G services from inbound roamers using 2G handsets.

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[12] Hutchison Telecommunications Hong Kong Holdings Limited reported in its Annual Report 2014 at http://www.hthkh.com/en/ir/reports/ar2014/ar2014.pdf that 16% of its mobile service revenue for the year was derived from non-data roaming services.

40. Service continuity could be a concern if, despite active bidding, MNOs are unable to secure at auction the spectrum they need to support the continuous development of their mobile broadband services. They may then need to evaluate their spectrum needs, and this may lead them, as a result of being left with a smaller spectrum holding than before, to scrap their 2G networks altogether and to deploy the precious spectrum they have secured for their 3G/4G platform.

41. Another possible scenario could be that by 2020/21, there may remain some demands for 2G services from local subscribers (e.g. the elderly) and from inbound roamers still using 2G handsets, but they do not collectively present sufficient commercial incentives to justify the continued maintenance of 2G networks. A wholesale switch off of 2G services by all the MNOs would be bound to have an adverse impact upon the local and visiting 2G service users.

42. In a number of scenarios set out above therefore, continuity of 2G services beyond 2020/21 could be at risk under the full-fledged market-based mechanism.

Question 3: Do you have any concerns about the continuity of customer services, in particular as regards the provision of 2G voice services, to local users and inbound visitors if the full-fledged market-based approach (Option 2) were to be adopted for the Re-assignment of the 900/1800 MHz Spectrum?

Efficient utilisation of spectrum

43. Re-assigning the 900/1800 MHz Spectrum through the market-based approach should promote technical and allocation efficiencies in utilising the spectrum. The relatively large amount of 900/1800 MHz Spectrum currently deployed for the provision of 2G services is probably due to the fragmented nature of the spectrum assignments which render it difficult, if not impossible, for spectrum to be refarmed for more efficient uses. Option 2 will enable the CA to redesign the band plans for the entire 2 x 25 MHz of spectrum in the 900 MHz band and 2 x 75 MHz of spectrum in the 1800 MHz band to achieve more efficient utilisation, say on the basis of paired frequency blocks of 5 MHz or 10 MHz each, and thus meet the demands of the existing 3G/4G technologies and the potential development of

the fifth generation ("5G") technology during the next term of the assignments from 2020/21 to 2035/36. So doing would contribute to the technical efficiency in spectrum utilisation over the long term.

44. In terms of achieving efficiency of spectrum allocation, assignments by way of auction provide the maximum flexibility for MNOs to optimise their overall spectrum holdings, taking into account their spectrum holdings in the other frequency bands, their own business considerations and the prevailing market situation. Auction is the best mechanism to ensure that the scarce spectrum resource will be assigned to the parties who value it the most and who will be most likely to put it to the most efficient use.

Promotion of effective competition, encouragement of investment and promotion of innovative services

45. Putting as much as 200 MHz of spectrum out for auction under Option 2 provides an opportunity for interested parties to enter the local mobile telecommunications market. With successful bidders striving to make the most effective and economical use of the spectrum, effective competition should be promoted. Consumers could expect to benefit in terms of competitive pricing, quality services and more service choices.

46. In order to excel in a keenly competitive market for mobile services, MNOs have to continue to invest in network infrastructure to meet market demand and provide a quality service to attract and retain customers. Also, having paid the full market value for the spectrum acquired through auction, MNOs need to make further investments to put the spectrum to the best use in order to justify what they have paid for the spectrum. This effect is demonstrated by what happened shortly after the acquisition of an additional 2 x 5 MHz slot in the 2.5/2.6 GHz band in May 2013 by individual MNOs with original holdings of 2 x 15 MHz of such spectrum. Some promptly invested to expand the channel bandwidth to 2 x 20 MHz so as to offer 4G services with a higher download speed of 150 Mbps. If all the 900/1800 MHz Spectrum were to be re-assigned by way of auction, MNOs could be expected (subject to the spectrum cap as discussed in paragraphs 79 to 85 below) to bid for amounts of spectrum which would enable them to build up contiguous frequency slots to unleash the full potential of 4G technology and more advanced technologies in the future.

Question 4: What are your views on the full-fledged market-based approach (Option 2) in achieving the four identified objectives in the Re-assignment of the 900/1800 MHz Spectrum?

Option 3: Hybrid administratively-assigned cum market-based approach

47. Under Option 3, a right of first refusal for a small part of the 900/1800 MHz Spectrum would be offered to the incumbent spectrum assignees (i.e. RFR Spectrum) for their continued provision of 2G services beyond 2020/21, while the remaining much larger portion will be re-assigned through auction. If any incumbent spectrum assignee decides not to exercise the right of first refusal, the spectrum becoming available will be pooled together with the non-RFR Spectrum to be released by the incumbent spectrum assignees and put to auction (collectively "Auctioned Spectrum").

48. Option 3 is put forward as an alternative to the full-fledged market-based approach under Option 2, on the basis that the outcome of this consultation indicates that there will likely be a continuation of 2G services post 2020/21 to meet the service needs of local users and inbound roamers until 2G services are phased out from Hong Kong altogether.

49. Bearing in mind that MNOs would only require a small amount of 900/1800 MHz Spectrum to enable them to continue with the provision of 2G services, the CA, in formulating this option, is minded to set aside as RFR Spectrum only the minimum amount of spectrum which the incumbent MNOs may need to help tide them over in case they fail to acquire any 900/1800 MHz Spectrum at auction, so that they may continue to maintain their 2G networks post 2020/21.

50. Considering that the 2G Global System for Mobile Communications or GSM technology requires a carrier bandwidth of only 2 x 0.2 MHz and using a standard re-use factor of 12 for network planning, 2 x 2.4 MHz is in theory the minimum quantity of spectrum required to provide extensive 2G coverage. Accordingly, 2 x 2.4 MHz of 900/1800 MHz Spectrum per MNO is the minimum which would be required to enable them to provide the necessary capacity for 2G voice services, particularly as the number of 2G services subscribers is expected to reduce significantly from the existing figures by 2020/21. However, spectrum assignment based on frequency slots of size 2 x 5 MHz is more efficient technically as they can be

supported by the existing 3G/4G technologies and have the potential to be used for more advanced technologies in the future. Therefore, the CA proposes that the RFR Spectrum under Option 3 be set at 2 x 5 MHz, in either the 900 MHz and/or 1800 MHz band, for each MNO. The RFR Spectrum would amount to 2 x 20 MHz in total for the four incumbent MNOs.

51. In line with its technology-neutral policy, the CA does not intend to restrict the use of the RFR Spectrum for the provision of 2G services only throughout the new term of assignment. The incumbent spectrum assignees which have taken up the RFR Spectrum must continue to provide 2G services during a three-year transitional period counting from the commencement of the new spectrum assignment term in 2020/21. After the transitional period, they may, on the basis of their own commercial considerations, decide whether or not to maintain the provision of 2G services, provided that they are in compliance with the requirements to provide a good, efficient and continuous service under the licence and that satisfactory arrangements are in place for phasing out the 2G services.

Question 5: What are your views on the hybrid approach (Option 3) in achieving the four identified objectives in the Re-assignment of the 900/1800 MHz Spectrum?

Question 6: Would you consider the proposed arrangement to set aside 2 x 5 MHz of the 900/1800 MHz Spectrum as the RFR Spectrum for each of the four MNOs to ensure continuous provision of 2G services during the first three years of the new spectrum assignment term too much, too little or about right? Is there any arrangement other than the provision of RFR Spectrum to each of the four MNOs would also ensure continuity of 2G services for a reasonable period of time in the new 15-year spectrum assignment term?

Pros and Cons Analysis

52. With 2 x 20 MHz of spectrum proposed to be set aside as the RFR Spectrum under Option 3, and if all of the incumbent spectrum assignees exercise the right of first refusal to acquire it, 2 x 80 MHz of the 900/1800 MHz Spectrum would be available for auction. This means that 80% of the spectrum would be assigned through a market-based approach.

Similar benefits to those associated with the full-fledged market-based approach for spectrum re-assignment as described above would also be realised here, namely (a) by appropriate alignment of the RFR Spectrum with the remaining 900/1800 MHz Spectrum, the currently fragmented spectrum holdings can be consolidated to promote higher spectral efficiency; (b) MNOs could optimise their spectrum holdings through exercise of the right of first refusal and bidding in the auction to meet market demand and business opportunities, thus maximising the efficiency of spectrum use; and (c) making at least 160 MHz of the spectrum available through auction can potentially facilitate new market entry, promote effective competition in the market for mobile services, and thus stimulate investment and the provision of innovative services.

53. The hybrid approach would not only bring forth the benefits described above but also help to ensure continuity of the 2G services post 2020/21 to meet service needs if the conclusion of the consultation is that they are likely to remain material at least in the short to medium term.

Variants of Option 3

54. If the above hybrid approach is to be adopted, the CA has identified four variants, depending on which part of the spectrum is to be designated as the RFR Spectrum, i.e. whether it should be in the 900 MHz or 1800 MHz band. The four options are set out below.

Option 3A – All Four Slots of 2 x 5 MHz of RFR Spectrum to be in the 1800 MHz Band

55. Under Option 3A, all of the incumbent spectrum assignees will be offered a right of first refusal to be re-assigned 2 x 5 MHz of spectrum in the 1800 MHz band. This option could potentially minimise the need for network reconfiguration by the MNOs, as all of them currently hold spectrum in the 1800 MHz frequency band. As HKT, Hutchison and SmarTone also deploy spectrum in the 900 MHz band for providing mobile broadband services, they may have to adjust their existing radio planning by e.g. building more base stations in the wide areas in order to maintain service coverage, if they fail to acquire any Auctioned Spectrum in the 900 MHz band. With this option, all the 900 MHz spectrum can be re-assigned by way of auction, and this can maximise efficiency in the allocation of the more valuable sub-1 GHz spectrum.

Option 3B – Three Slots of 2 x 5 MHz of RFR Spectrum to be in the 900 MHz Band and the Remaining Slot to be in the 1800 MHz Band

56. Under Option 3B, HKT, Hutchison and SmarTone will each be offered a right of first refusal to be re-assigned 2 x 5 MHz of spectrum in the 900 MHz band, and for CMHK, 2 x 5 MHz of spectrum in the 1800 MHz band. Similar to Option 3A, this option could also potentially minimise the need for network reconfiguration by all MNOs, as the RFR Spectrum is specified in such a way that the MNOs are re-assigned the spectrum in the frequency band in which they currently hold spectrum. RFR Spectrum at the 900 MHz band is conducive to the maintenance of good network coverage by HKT, Hutchison and SmarTone in their provision of 2G voice services. In the case of CMHK, there is no similar assurance on its possible access to the sub-1 GHz spectrum through exercising its right of refusal under this option, as it does not hold any spectrum in the 900 MHz band.

Option 3C – All Four Slots of 2 x 5 MHz of RFR Spectrum to be in the 900 MHz Band

57. Under Option 3C, all the incumbent spectrum assignees will be offered a right of first refusal to be re-assigned 2 x 5 MHz of spectrum in the 900 MHz band. Since HKT, Hutchison and SmarTone would be re-assigned basically the spectrum in the frequency band in which they currently hold spectrum, the option potentially minimises their need for network reconfiguration. As for CMHK, it is also assured access to 2 x 5 MHz of spectrum in the sub-1 GHz band, in which it currently has no spectrum holding, if it exercises the right of first refusal. As CMHK is not currently holding any 900 MHz spectrum, there is a need under Option 3C for it to incur additional cost in reconfiguring its network.

Option 3D – Individual MNOs Can Choose the Frequency Band of their RFR Spectrum

58. Option 3D essentially allows individual MNOs to choose the frequency band, whether 900 MHz or 1800 MHz band, of their RFR Spectrum.

Question 7: Among the four hybrid sub-options, what is your preference and why? Do you have any other variants to the hybrid option you would like to suggest, and if so, what are the details and the justifications?

SPECTRUM UTILISATON FEE

59. The Spectrum Policy Framework promulgated by the Government in 2007 stipulates that SUF will in principle be applicable to all non-government use of spectrum.

60. Pursuant to section 32I(1) of the TO, the CA may by order designate the frequency bands in which the use of spectrum is subject to the payment of SUF by the users of the spectrum, subject to the consultation requirement under section 32G(2) of the TO. The entire 900 MHz band (i.e. spectrum in the frequency range of 890 – 915 MHz paired with 935 – 960 MHz) and frequency bands 1710.5 – 1784.9 MHz paired with 1805.5 – 1879.9 MHz in the 1800 MHz band are already designated under the Telecommunications (Designation of Frequency Band subject to Payment of Spectrum Utilization Fee) Order (Cap. 106Y) as frequency bands in which the use of spectrum is subject to the payment of SUF. As mentioned in paragraph 4, the 2 x 0.5 MHz of spectrum in the frequency range of 1710.0 – 1710.5 MHz paired with 1805.0 – 1805.5 MHz and 2 x 0.1 MHz of spectrum in the frequency range of 1784.9 – 1785.0 MHz paired with 1879.9 – 1880.0 MHz at the margins is not currently assigned, and is not so designated under Cap. 106Y as frequency bands subject to the payment of SUF. The CA proposes therefore to designate this 2 x 0.6 MHz of spectrum in the 1800 MHz under Cap. 106Y as frequency bands in which the use of spectrum is subject to the payment of SUF.

61. Section 32I(2) of the TO stipulates that the SCED may by regulation prescribe the level of SUF or the method for determining SUF. Section 32I(3) of the TO further provides that SUF may be calculated on the basis of a royalty or any other basis that includes an element in excess of the simple recovery of the cost of providing a service by the CA.

62. Given that frequency spectrum is a scarce public resource, it is incumbent upon the Government to ensure that the SUF of spectrum is set to

reflect as close as possible its full market value so that spectrum assignees, which run their commercial operations in a fully liberalised market, would put the spectrum so acquired to its most efficient use.

63. The SCED notes that the sub-1 GHz spectrum possesses more superior propagation characteristics to achieve better geographical coverage and indoor penetration, and its market value is therefore normally higher. It follows that there should be two sets of SUF and the one in respect of the 900 MHz spectrum will be set at a level higher than that of the 1800 MHz spectrum. It should also be noted that, according to currently available information, until the implementation of analogue switch-off, which is planned to take place in the end of 2020, no new spectrum would be available for public mobile telecommunications services. Furthermore, with the advent of future generation mobile services such as the Internet of Things and 5G mobile services, the increasing demand for mobile telecommunications services would likely drive up the demand for spectrum as well as its market value.

Option 1

64. Under Option 1, the spectrum will be re-assigned to the incumbent spectrum assignees if they exercise the right of first refusal. Although the relevant spectrum is not released through market mechanism, to ensure efficient spectrum utilisation, it is incumbent upon the SCED to set the SUF at a level that would reflect as far as possible the full market value of the spectrum, i.e. a level as if it were determined through market means.

65. In determining the relevant SUF which will be two fixed prices, the SCED will make reference to the levels of SUF of spectrum in the frequency bands with similar propagation characteristics as determined by auctions conducted in recent years. For example, the level of SUF of spectrum in the 850/900 MHz band as determined by the auction conducted in March 2011 shall be used as reference in determining the fixed price for the 900 MHz spectrum; whereas those in the 2.5/2.6 GHz and 1.9 – 2.2 GHz bands as determined by the auctions conducted in March 2013 and December 2014 respectively shall be used as reference in determining the fixed price for the 1800 MHz spectrum. The SCED will also consider other relevant factors including but not limited to those mentioned in paragraph 63 above.

66. Under Option 1, all the 900/1800 MHz Spectrum will be offered to

the incumbent spectrum assignees through the right of first refusal. If all the incumbents exercise the right of first refusal in full, an auction would not take place. Hence, there would be no auction results against which the SUF for the spectrum assigned administratively could be benchmarked. The situation is different from that under Option 3 below.

67. If any of the incumbent spectrum assignees decides not to exercise the right of first refusal for any spectrum, the SUF of the spectrum becoming available would be determined through auction in which the auction price would reflect the full market value. The SCED will set the auction reserve prices after all the incumbent spectrum assignees have made their decisions on whether to exercise the right of first refusal. This would enable the SCED to take into consideration, amongst other relevant factors, the latest market conditions and the amount of spectrum put to auction, when determining the reserve prices. The SCED also proposes that the reserve prices should be set at levels which would minimise the possibility of an unreasonably low SUF due to strategic bidding behaviour of the operators.

Option 2

68. The SUF under Option 2 should be determined through auction whereby the bidders would determine the level of their bids based on clear information on the supply of spectrum and their assessment of the business opportunities. The auction price would reflect the full market value of the spectrum.

69. It would be necessary to set reserve prices for the spectrum put to auction. Similar to the re-assignment arrangements for the 3G Spectrum, the SCED proposes that the reserve prices should be set at levels which would minimise the possibility of an unreasonably low SUF due to strategic bidding behaviour of the operators. The final SUF would of course be left to market force to decide in the competitive auction.

70. In determining the auction reserve prices, the SCED will make reference to the levels of SUF of spectrum in the frequency bands with similar propagation characteristics as determined by auctions conducted in recent years. He will also consider other relevant factors including but not limited to those mentioned in paragraph 63 above.

Option 3

SUF of the Auctioned Spectrum

71. Similar to Option 2, the SUF of the Auctioned Spectrum under Option 3 should be determined through auction, subject to the reserve prices to be set by the SCED.

SUF of the RFR Spectrum

72. Similar to Option 1, the SUF in respect of the RFR Spectrum under Option 3 should be set at a level that would reflect as far as possible the full market value of the spectrum. While the incumbent spectrum assignees will be offered right of first refusal of all the spectrum in the 900/1800 MHz bands under Option 1, only 20% of the spectrum will be offered to the incumbents under Option 3 and the remaining 80% will be put to auction.

73. As there will certainly be an auction under Option 3 vis-à-vis Option 1, the SCED considers that the outcome of the auction in respect of the Auctioned Spectrum should naturally be the best available indicator of the full market value of the RFR Spectrum for the next assignment term because the market value of different parts of the spectrum in the same frequency band should be very close to, if not the same as, each other. The SCED therefore proposes that the SUF of the RFR Spectrum in each of the 900 MHz and 1800 MHz bands should be set at the average SUF of the Auctioned Spectrum of the same band, subject to the considerations as set out in paragraphs 74 to 75 below.

Cap

74. In the exercise to re-assign the 3G Spectrum, to address the concern expressed over the lack of certainty in terms of cost as a result of tagging the SUF of the then RFR Spectrum to the unknown outcome of the Auctioned Spectrum at the time of exercising the right of first refusal, the SCED placed a cap on the SUF of the RFR Spectrum. Along a similar facilitative vein, the SCED is of the view that a cap should each be placed on the SUF of the RFR Spectrum in the 900 MHz and 1800 MHz bands. In determining the levels of the caps, the SCED will consider various factors including, but not limited to, the estimated market prices of the spectrum to be re-assigned, and the need to provide a level playing field for incumbent

spectrum assignees and the successful bidders of the Auctioned Spectrum.

Minimum SUF in Respect of RFR Spectrum

75. On the other hand, in line with the exercise to re-assign the 3G Spectrum, the SCED proposes that two minimum prices should be set for exercising the right of first refusal in respect of the spectrum in the 900 MHz and 1800 MHz bands respectively, and that the levels of such minimum prices should be set higher than the reserve prices for the Auctioned Spectrum in the respective bands. The incumbent spectrum assignees will then have to make their commercial decision on whether to exercise their right of first refusal. If they should exercise the right, they may run the risk of paying a higher SUF (in the event that the SUF of the Auctioned Spectrum is lower than the minimum price), but will enjoy the certainty of price and the first refusal opportunity. Alternatively, they may choose not to accept the RFR Spectrum offered by the CA (the spectrum thus becoming available will be put back to the pool of Auctioned Spectrum) and compete with other bidders in the auction in the hope that they may pay a lower SUF (in the event that the SUF of the Auctioned Spectrum is lower than the minimum price), and choose their own desired frequency bands. The setting of minimum prices will mitigate against incumbent spectrum assignees from adjusting their bids for the Auctioned Spectrum with a view to paying a lower SUF for the RFR Spectrum while enjoying the right of first refusal.

Question 8: What are your views and comments on the principles and methods of setting the SUF as proposed in paragraphs 64 to 75 above?

Payment method of SUF

76. In line with recent spectrum assignments, the SCED considers it appropriate to require the assignees in the coming assignment exercise to pay the lump sum SUF upfront (instead of paying the SUF by annual installments).

PROPOSED ARRANGEMENTS FOR SPECTRUM RE-ASSIGNMENT

Band plans

77. A major consideration in the Re-assignment of the 900/1800 MHz

Spectrum is to consolidate, prior to the re-assignments, the currently fragmented band plans to promote the efficient utilisation of spectrum. In view of the rising demand for high speed and innovative mobile broadband services, and taking into account the trend in technological developments, the CA proposes to re-design the band plans so as to incorporate as many as possible frequency slots of 2 x 10 MHz each, together with a number of slots of 2 x 5 MHz in the 1800 MHz band. Frequency slots of this size would afford bidders the opportunity to bid for spectrum in such combinations as would achieve contiguous frequency up to 2 x 20 MHz, which is the maximum carrier bandwidth supported by the 4G technology. Spectrum assignees may aggregate carriers from different frequency bands to attain even higher transmission speeds. As to the 900 MHz band, due to the scarcity of the spectrum and the good performance already of a 2 x 5 MHz slot in providing coverage, the band plan will be restructured into frequency slots of 2 x 5 MHz each.

Question 9: Do you agree that in devising the band plan, priority should be given to frequency slots of 2 x 10 MHz each for spectrum in the 1800 MHz band? Do you agree that the band plan in the 900 MHz band should be restructured into frequency slots of 2 x 5 MHz each?

Eligible bidders

78. The auction to be conducted for the 900/1800 MHz Spectrum will be open to all interested parties, including the incumbent spectrum assignees and any new entrants to the local mobile telecommunications market. In particular, if Option 1 or Option 3 were adopted, irrespective of whether or not an incumbent spectrum assignee has exercised the right of first refusal to acquire the RFR Spectrum offered to it, it may participate in the auction to compete with other interested parties for all the spectrum put out for auction, subject to any spectrum cap to be imposed on each of the assignees as discussed below.

Question 10: Do you agree that the Auctioned Spectrum should be open for bidding by all interested parties, including the incumbent spectrum assignees and new entrants?

Spectrum cap

79. The amount of spectrum to be put out for auction will range from nil to 200 MHz, depending on which option for re-assignment is adopted, and whether or not the incumbent spectrum assignees will exercise the right of first refusal to acquire the RFR Spectrum. This is equivalent to, at most, 36% of the total spectrum assigned for the provision of public mobile telecommunication services, which is the largest amount of spectrum ever offered for auction through a single exercise in Hong Kong.

80. In the unlikely circumstance of all the Auctioned Spectrum being acquired by the MNO which holds the largest amount of spectrum other than the 900/1800 MHz Spectrum, the spectrum holding of that MNO will become 3.4 times that of the MNO with the second largest holding of spectrum. This underlines the need for a spectrum cap to limit the total amount of spectrum that may be acquired by each individual bidder in the auction and thus avoid the possibility of a highly disproportionate distribution of spectrum among MNOs and help to ensure the maintenance of effective competition in the long term.

81. As to the level of the spectrum cap to be imposed, the CA would have regard to the spectrum divestment condition it has imposed on the merged entity in the context of the merger between HKT and the former CSL in 2014 (see footnote 11 above). In view of the concern about concentration of spectrum in the hands of the merged entity having the effect of substantially lessening competition in the retail mobile telecommunications market, as one of the conditions underpinning the CA's approval for the merger, HKT was directed to divest 29.6 MHz of its 3G Spectrum holding upon expiry of the existing assignment in October 2016. As no material change is apparent in the competitive landscape of Hong Kong's mobile telecommunications market since the merger, consideration of the appropriate level of spectrum cap to be set in any auction of spectrum needs to take into account the respective holdings of spectrum of MNOs as of October 2016 as a starting point. The CA proposes to impose a spectrum cap of 90 MHz for the total amount of 900/1800 MHz Spectrum that may be acquired by an independent party or its associated parties, whether the spectrum is acquired in the 900 MHz or 1800 MHz bands or in both. Such a level of spectrum cap would not preclude any of the incumbent MNOs from acquiring at least the same amount of the 900/1800 MHz Spectrum that it currently holds (see Table 1 above) if there

were to be an auction.

82. The 90 MHz spectrum cap is proposed to apply irrespective of which option is finally adopted for this spectrum re-assignment exercise, and it will limit the total amount of 900/1800 MHz Spectrum which may be acquired through exercise of right of first refusal, and through auction, whether by an independent party or its associated parties. For example, if an incumbent spectrum assignee has exercised the right of first refusal under Option 3 to acquire the 10 MHz RFR Spectrum, this will be counted towards the 90 MHz spectrum cap, and it may bid for a maximum of 80 MHz of spectrum in the auction. The same level of spectrum cap is proposed to be applied to both incumbent spectrum assignees and new entrants to the local mobile telecommunications market.

Question 11: What are your views on the proposal to impose a spectrum cap and the proposed cap level of 90 MHz?

83. A further consideration is whether or not a sub-cap for the holding of spectrum in the 900 MHz band within the overall spectrum cap of 90 MHz should be imposed.

84. Of the spectrum to be put out for auction, a minimum of 10 MHz of spectrum (under the hybrid Option 3C assuming all the RFR Spectrum is taken up by exercise of the rights of first refusal) to a maximum of 50 MHz of spectrum (under the full-fledged market-based Option 2 and the hybrid Option 3A) would be in the 900 MHz band. Given the superb propagation characteristic of the sub 1-GHz spectrum, the CA sees the need for a sub-cap to limit the total amount of spectrum in the 900 MHz band that may be acquired by each individual bidder in the auction and thus avoid the possibility of a highly disproportionate distribution of spectrum among MNOs.

85. The preliminarily view of the CA is that it should set a sub-cap of 20 MHz for spectrum holding in the 900 MHz band, which would enable a minimum of three MNOs (two with 2 x 10 MHz and one with 2 x 5 MHz) and a maximum of five MNOs (each with 2 x 5 MHz) to be assigned this spectrum. This would mean that following the spectrum re-assignment, there would be no fewer assignees of the sub-1 GHz spectrum than at present. For the avoidance of doubt, the proposed spectrum cap will not take into account the spectrum in the 800 MHz and 850/900 MHz bands currently held by some of

the MNOs[13], as the assignment dates and conditions for those spectrum assignments are different, and when the MNOs bid for such spectrum, they would not have expected there to be a cap for the sub-1 GHz spectrum holding.

Question 12: Do you consider it necessary to introduce a sub-cap for the 900 MHz spectrum within the overall spectrum cap of 90 MHz? If the answer is yes, is the proposed sub-cap at 20 MHz suitable?

LICENSING ARRANGEMENTS

Spectrum assignment periods

86. The successful bidders will each be granted a new unified carrier licence ("UCL"), under which the frequency assignment upon commencement of the new term will be effected, authorising the spectrum assignee to provide fixed, mobile and/or converged services. According to Schedule 2 of the Telecommunications (Carrier Licences) Regulation (Cap. 106V), UCLs are issued with a period of validity of 15 years from the day on which they are issued. The validity period of the frequency assignment will last for 15 years and be coterminous with the term of the newly issued licence. If the successful bidder for spectrum in any auction is an existing licensee, the licensee may request to merge its existing UCL with the new UCL to be issued for the newly acquired spectrum. The same arrangements will also apply to the assignments of spectrum through right of first refusal to the incumbent spectrum assignees.

87. Of the 2 x 24.9 MHz of spectrum in the 900 MHz band currently assigned to HKT, Hutchison and SmarTone, the expiry dates of the individual spectrum assignments span over a period of 53 days, that is, between 19 November 2020 and 11 January 2021. To facilitate a smooth handover of spectrum among the incumbent spectrum assignees and any new spectrum assignees, the CA proposes to align the new spectrum assignment periods for

[13] HKT currently holds 2 x 7.5 MHz of spectrum in the 800 MHz band (825 – 832.5 MHz paired with 870 – 877.5 MHz) acquired through the auction conducted in 2007 for the provision of mobile service based on the CDMA2000 standard, and the spectrum assignment will last until 2023. SmarTone and Hutchison respectively hold 2 x 5 MHz of spectrum in 850 MHz band (832.5 - 837.5 MHz paired with 877.5 - 882.5 MHz) and 900 MHz band (885 - 890 MHz paired with 930 - 935 MHz) acquired through the auction conducted in 2011 and the spectrum assignment will last until 2026.

all spectrum in the 900 MHz band so that they would all commence on 12 January 2021. This will effectively involve an administrative extension of the existing frequency assignment in the 900 MHz band for Hutchison by 53 days and that for SmarTone by eight days, subject to their payments of SUF for the use of the spectrum during the extended assignment periods. The proposed arrangement will simplify future administrative and licensing arrangements and facilitate smooth handover of any spectrum in the 900 MHz band from one operator to another. Accordingly, the 15-year term of the new assignments for the 2 x 25 MHz of spectrum in the 900 MHz band will be from 12 January 2021 to 11 January 2036.

88. The SCED proposes that the SUF for the extended period of assignments shall be equal to the royalty payment for the year just before the expiry of the existing assignments proportionate to the number of days of the extended period. For illustration purposes, assuming that the Appropriate Fee (fixed at HK$1,450 for every 1 kHz or part thereof of the spectrum assigned for use by the licensee) is higher than 5% multiplied by the Network Turnover[14], Hutchison and SmarTone will have to pay a SUF of about $3.50 million and $0.53 million respectively for the extended assignment periods.

89. Regarding the existing assignments of the 2 x 74.4 MHz of spectrum in the 1800 MHz band, they will all expire on the same day on 29 September 2021. The CA does not consider it necessary to align the new assignment period for the spectrum in the 1800 MHz band with that for the spectrum in the 900 MHz band. Therefore, the 15-year term of the new assignments for the 2 x 75 MHz of spectrum in the 1800 MHz band will be from 30 September 2021 to 29 September 2036.

Question 13: What are your views on the proposed arrangements to align the 15-year term of the new assignments for the spectrum in the 900 MHz band to commence on 12 January 2021, and to have the new 15-year assignment term for the spectrum in the 1800 MHz band to commence on 30 September 2021?

[14] For details on the setting the SUF of the 900/1800 MHz Spectrum under the existing term of assignment, please refer to section 4B of the Telecommunications (Level of Spectrum Utilization fees) (Second Generation Mobile Services) Regulation (Cap. 106AA).

Question 14: Do you agree that the SUF for the extended period of assignments shall be determined in accordance with the method as set out in paragraph 88 above?

Network and service rollout obligations

90. In order to prevent spectrum hoarding and to ensure that the newly assigned spectrum will be timely deployed for the provision of advanced telecommunications services for the benefit of the general public, network and service rollout obligations are in general imposed on the successful bidders of the radio spectrum in auctions.

91. In view of the extensive coverage of existing mobile networks using the 900/1800 MHz Spectrum and the superb radio propagation of spectrum in the 900 MHz and 1800 MHz bands which facilitates the provision of broad geographical coverage in an economic way, the CA considers it appropriate to impose a more stringent network and service rollout requirement on the 900/1800 MHz Spectrum than that for spectrum in the other frequency bands. It is proposed to require the spectrum assignees to provide a minimum coverage of 90% of the population of Hong Kong in the case of mobile services, or to provide a minimum coverage of 200 commercial and/or residential buildings and to establish and maintain a minimum of 50 hubs in the case of fixed services, within five years from the date of the spectrum re-assignment.

92. However, since all of the 900/1800 MHz Spectrum is deployed by the MNOs for the provision of public mobile telecommunications services, there are good reasons to trust that their mobile networks would have met, if not exceeded, the 90% minimum population coverage requirement already. The CA will request existing MNOs to provide the coverage figures of their networks operating with the 900/1800 MHz Spectrum. If their existing networks have already met the proposed 90% minimum population coverage requirement, the CA proposes to impose the network and service obligations only on those successful bidders which have newly acquired spectrum in the 900 MHz or 1800 MHz band, or the existing MNOs that acquire the RFR Spectrum and/or the Auctioned Spectrum they do not currently hold. Otherwise, the incumbent spectrum assignees, which are re-assigned the 900/1800 MHz Spectrum currently used by them but have not met the proposed 90% minimum population coverage requirement, will also be subject

to the same network and service rollout obligations as the new spectrum assignees.

Performance bond for rollout obligations

93. The CA proposes to require only the successful bidders which have newly acquired spectrum in the 900 MHz and 1800 MHz bands, or the existing MNOs that are assigned the RFR Spectrum and/or the Auctioned Spectrum that they do not currently hold, as well as the incumbent spectrum assignees which are re-assigned the 900/1800 MHz Spectrum currently used by them but whose networks have not reached the proposed 90% minimum population coverage requirement, to each lodge a performance bond as a guarantee of their compliance with the network and service rollout obligations proposed by the CA above. The amount of the performance bond will be determined by the CA in offering the RFR Spectrum to the incumbent spectrum assignees and/or specified in the information memorandum to be issued for the auction of the Auctioned Spectrum.

Question 15: What are your views on the network and service rollout obligation and performance bond requirement proposed to be imposed on the assignees of the 900/1800 MHz Spectrum in their provision of public mobile telecommunications services under the new term of frequency assignments?

PROPOSAL FOR THE RE-ASSIGNMENT OF SOME OF THE 900/1800 MHZ SPECTRUM FOR COVERAGE IN COUNTRY PARKS AND REMOTE AREAS

94. Of the 900/1800 MHz Spectrum, 2 x 4 MHz in the frequency range of 1780.9 – 1784.9 paired with 1875.9 – 1879.9 MHz has been assigned to three MNOs (viz. CMHK, HKT and SmarTone) for the provision of mobile coverage in country parks and remote areas specified as the designated areas[15], and no SUF is payable for such purpose. The above assignments will expire on the same date as the other spectrum assignments in the 1800 MHz band, i.e. 29 September 2021.

[15] The concerned country parks and remote areas were specified by the former TA as designated areas in the gazette notice G.N.2068 of 2009.

95. In order to ensure continuous provision of mobile service coverage in the designated areas particularly for the support of emergency communications, the CA proposes to administratively re-assign such spectrum currently used by MNOs in the designated areas for another 15 years until 29 September 2036, i.e. the same as the new term of assignments for the spectrum in the 1800 MHz band, and to apply the existing policy of charging no SUF to such assignments. Following the decision of the CA on the arrangements for the Re-assignment of the 900/1800 MHz Spectrum, MNOs will be invited to apply for such an administrative re-assignment, with a plan showing the use of the frequencies in the next term of the assignments, for consideration by the CA.

96. The arrangements for this frequency spectrum outside the designated areas will not be affected by the intended re-assignment of the spectrum for use in the designated areas as set out above. This means that the concerned spectrum in this frequency range may be offered as RFR Spectrum to any of the incumbent spectrum assignees, or put to auction for bidding by any interested parties, but the assigned spectrum shall be used for the provision of public mobile telecommunications services outside the designated areas, unless otherwise approved by the CA and specified in the relevant schedule attached to the UCLs to be granted to the new spectrum assignees. In view of the remoteness of the designated areas, the arrangements for the use of spectrum in the designated areas are not expected to have much impact on the value of the same frequency spectrum deployed for use outside the designated areas.

Question 16: What are your views on the proposal in paragraph 95 concerning the re-assignment of spectrum for the provision of mobile coverage in the country parks and remote areas?

WAY FORWARD

97. The CA and the SCED will carefully consider the views and comments received in response to this consultation, and put forward a more concrete proposal for further views and comments of the telecommunications industry and other affected persons in the second public consultation. The CA and the SCED will insofar as it is practicable in the circumstances endeavour to announce around November 2017 their respective decisions on

the arrangements for Re-assignment of the 900/1800 MHz Spectrum and the related SUF, thereby giving sufficient advance notice to the incumbent spectrum assignees on any possible variation to their existing spectrum assignments.

Commerce and Economic Development Bureau
(Communications and Creative Industries Branch) and
Office of the Communications Authority
3 February 2016

Annex

Status of the Provision of 2G Mobile Services in Other Economies

Mobile network operators ("MNOs") around the world provide mobile telecommunications services based on second generation ("2G"), third generation ("3G") and/or fourth generation ("4G") mobile technologies. In light of the declining demand for the voice-centric 2G services and the opportunity to refarm the concerned spectrum for the provision of 3G/4G services, MNOs in some economies are embarking upon the phasing out of their legacy 2G services at different paces.

2. Hong Kong is one of the top destinations for tourists and businesses alike. Visitors come from all over the world. If 2G services are being offered in an economy, visitors from that economy may bring with them their 2G handsets for inbound roaming services during their stay in Hong Kong. As such, provision of 2G roaming services to these incoming visitors is a factor to be taken into account when assessing the need or otherwise for the continued provision of 2G services in Hong Kong post 2020/21.

3. According to the Hong Kong Tourism Board[1], the top five countries/territories of residence for incoming visitors to Hong Kong are Mainland China, Taiwan, South Korea, the United States of America ("USA"), and Japan, with detailed breakdown as shown in Table 1 below –

Table 1: Source of visitors to Hong Kong in 2015

Country / territory residence	Number	Share in total
Mainland China	45,842,360	77.3%
Taiwan	2,015,797	3.4%
South Korea	1,243,293	2.1%
USA	1,181,024	2.0%
Japan	1,049,272	1.8%
Others	7,975,850	13.4%
Total	**59,307,596**	**100.0%**

4. Plans for the continued provision or otherwise of 2G services in the top five economies in terms of the number of incoming visitors to Hong Kong are set out below.

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[1] Please refer to http://partnernet.hktb.com/filemanager/intranet/ViS_Stat/ViS_Stat_E/ViS_E_2015/Tourism_Statistics_10_2015_0.pdf.

Mainland China

5. Two MNOs (i.e. China Mobile and China Unicom) are providing 2G services based on the Global System for Mobile Communications ("GSM") technology to a total of 508 million service subscribers[2]. We are not aware of any announcement by these two MNOs of their plans to switch off their 2G networks. Another MNO (i.e. China Telecom) adopts the Code Division Multiple Access ("CDMA") technology for its 2G network. Its 2G services subscribers when visiting Hong Kong may roam to the CDMA2000 network in operation here[3].

Taiwan

6. Three MNOs are providing 2G, 3G and 4G services, while the rest provide only 3G and 4G services. The 2G services are provided based on the GSM technology. According to the National Communications Commission ("NCC"), the telecommunications regulator in Taiwan, there were 1.37 million of 2G services subscribers in October 2015, accounting for 4.6% of the total mobile subscription. As the licences granted for the provision of 2G services will expire by June 2017, NCC conducted an auction in September/October in 2013 to re-assign all the spectrum in the 900 MHz and 1800 MHz bands. Based on the technology-neutral principle, it would be a commercial decision of the MNOs as to whether they will continue to provide 2G services or higher generation services using the spectrum obtained from auction. In other words, the concerned spectrum will not be designated for the provision of 2G GSM-based services after June 2017[4].

South Korea

7. South Korea adopted the CDMA technology in the provision of 2G services. Following an approval by the court in December 2011, the last 2G

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[2] Please refer to http://www.chinamobileltd.com/sc/ir/operation.php?section=number&year=2015 and http://stock.10jqka.com.cn/20150921/c581973892.shtml.

[3] Hong Kong Telecommunications (HKT) Limited currently provides CDMA2000 roaming service in Hong Kong using spectrum assigned to it through the auction conducted in 2007.

[4] Please see the press release of the Ministry of Transportation and Communications in May 2011 concerning the handling of the GSM licences upon expiry at: http://www.motc.gov.tw/post/home.jsp?id=281&parentpath=0,267&mcustomize=multimessages_view.jsp&dataserno=201112200004&aplistdn=ou=hotnews,ou=chinese,ou=ap_root,o=motc,c=tw&toolsflag=Y&imgfolder=.

operator in South Korea has already begun switching off its 2G network.

USA

8. Two MNOs (i.e. AT&T and T-mobile) are providing 2G services based on the GSM technology. As of the second quarter 2015, there were about 9 million of 2G services subscribers. AT&T has announced its plan to switch off its 2G network by end of 2016. T-Mobile planned to upgrade its 2G network operating in the 1900 MHz band with the use of the 4G technology within 2015, while still keeping sufficient bandwidth to support its 2G traffic. Other MNOs in the USA provide 2G services based on the CDMA technology and their 2G services subscribers when visiting Hong Kong may roam to the CDMA2000 network in operation here.

Japan

9. 2G services were based on the Personal Digital Cellular and CDMA technologies. By July 2012, all the MNOs have already switched off their 2G networks with all the subscribers migrated to 3G/4G networks.