

**For discussion
on 13 March 2017**

**Legislative Council Panel on
Information Technology and Broadcasting**

**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**

Purpose

This paper briefs Members on the second round of public consultation jointly launched by the Secretary for Commerce and Economic Development (“SCED”) and the Communications Authority (“CA”) on 14 February 2017 on the proposed arrangements for the 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 and the proposed methods for setting the related spectrum utilisation fee (“SUF”) (a copy of the Second Consultation Paper¹ is at **Appendix A**).

Background

2. The CA has assigned to four mobile network operators (“MNOs”) in Hong Kong all the available 552 MHz of spectrum² in the 850/900 MHz, 1800 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz

¹ The Second Consultation Paper (English version only) is also available at: http://www.coms-auth.hk/filemanager/en/content_711/cp20170213_e.pdf and http://www.cedb.gov.hk/ccib/eng/paper/pdf/900_1800MHz_Spectrum_second_consultation.pdf.

² 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) 30 MHz of unpaired spectrum in the 2.3 GHz band assigned in 2012 and deployed for the provision of wireless fixed broadband services; (c) 20 MHz of unpaired spectrum in the 1.9 – 2.2 GHz band assigned in 2001, which was left idle throughout the assignment period of 15 years and was put back to reserve at the end of the assignment term in October 2016; and (d) 9.7 MHz of unpaired spectrum in 2010 – 2019.7 MHz for the provision of public mobile telecommunications services that was put out for auction in 2011 but was leftover because of no interested bidder.

bands for the provision of the second, third and fourth generation (“2G”, “3G” and “4G”) public mobile telecommunications services.

3. 198.6 MHz of this 552 MHz of spectrum, comprising 49.8 MHz in the 900 MHz band and 148.8 MHz in the 1800 MHz band, is subject to re-assignment in 2020/2021. The 49.8 MHz of spectrum in the 900 MHz band is currently assigned to three MNOs, namely Hong Kong Telecommunications (HKT) Limited (“HKT”), Hutchison Telephone Company Limited (“Hutchison”) and SmarTone Mobile Communications Limited (“SmarTone”). The 148.8 MHz of spectrum in the 1800 MHz band is assigned also to China Mobile Hong Kong Company Limited (“CMHK”) in addition to the above three MNOs.

4. Together with 0.2 MHz of spectrum in the 900 MHz band and 1.2 MHz of spectrum in the 1800 MHz band which is currently vacant, a total of 200 MHz of spectrum, comprising 50 MHz in the 900 MHz band and 150 MHz in the 1800 MHz band (“900/1800 MHz Spectrum”), is under consideration in this assignment/re-assignment exercise (hereafter collectively referred to as “Re-assignment of the 900/1800 MHz Spectrum”).

Legal and Policy Frameworks

5. Sections 32H(2) and 32I(1) of the Telecommunications Ordinance (Cap. 106) (“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).

6. In formulating the possible arrangements for the Re-assignment of the 900/1800 MHz Spectrum upon the expiry of the existing assignments, the CA is guided by the principles in spectrum management as stipulated in the Radio Spectrum Policy Framework (“Spectrum Policy Framework”)³ (at **Appendix B**) promulgated by the Government in April 2007, including in particular the following –

³ The Spectrum Policy Framework is available at:
<http://www.cedb.gov.hk/ccib/eng/legco/pdf/spectrum.pdf>.

- (a) 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;
- (b) 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; and
- (c) the decision on whether a new spectrum assignment, with the same or varied radio frequencies, should be given to the spectrum assignee would be made and notified to the spectrum assignee within a reasonable time before the expiry of its spectrum assignment. 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) further stipulates that, insofar as it is practicable in the circumstances, the decision would be notified to the incumbent spectrum assignees at least three years in advance⁴.

7. Pursuant to the above legal and policy frameworks, the SCED and the CA have jointly launched the first round of public consultation on the Re-assignment of the 900/1800 MHz Spectrum on 3 February 2016⁵, and the second round of public consultation on 14 February 2017, to solicit the views of the telecommunications industry and other affected persons before making their respective decisions on the arrangements for re-assignment of the concerned spectrum and the methods for setting the related SUF.

First Round of Public Consultation

8. In accordance with the Spectrum Policy Framework, the CA has established in the First Consultation Paper that there are likely to be competing demands for the 900/1800 MHz Spectrum from MNOs and potential new entrants upon expiry of the existing assignments, in view of

⁴ 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.

⁵ The First Consultation Paper (English version only) is available at: http://www.coms-auth.hk/filemanager/en/content_711/cp20160203_e.pdf and http://www.cedb.gov.hk/ccib/eng/paper/pdf/900_1800MHz_Spectrum_first_consultation.pdf.

the keen demand for spectrum which is fuelled by the sustained robust growth in mobile data usage in Hong Kong and the superb radio propagation characteristics and technical compatibility of the spectrum under re-assignment for provision of territory-wide network coverage.

9. Having regard to the principles for spectrum management as set out in the Spectrum Policy Framework as well as the multiple objectives for spectrum re-assignment, viz. (a) ensuring customer service continuity; (b) efficient spectrum utilisation; (c) promotion of effective competition; and (d) encouragement of investment and promotion of innovative services⁶, the CA identified in the First Consultation Paper the following three options for the Re-assignment of the 900/1800 MHz Spectrum –

- Option 1 – a full-fledged administratively-assigned approach that re-assigns all the spectrum to the incumbent spectrum assignees through the offer of a right of first refusal;
- Option 2 – a full-fledged market-based approach that re-assigns all the spectrum by auction; and
- Option 3 – a hybrid administratively-assigned cum market-based approach that re-assigns a proposed amount of 40 MHz or 20% of the 900/1800 MHz Spectrum to the incumbent spectrum assignees through the offer of a right of first refusal (“RFR Spectrum”) with the remaining spectrum to be re-assigned by auction (“Auctioned Spectrum”).

10. The CA is of the view that there is no overriding public policy reason supporting a complete deviation from the market-based approach thus justifying adoption of Option 1 (i.e. the full-fledged administratively-assigned approach) for the Re-assignment of the 900/1800 MHz Spectrum. The analysis set out in the First Consultation Paper, that the cons of Option 1 far outweigh the pros, makes it the least capable of meeting the multiple objectives that the CA has identified for the re-assignment exercise. In reaching this view, the CA notes in particular that, even if the incumbent spectrum assignees were unable to obtain any of the 900/1800 MHz Spectrum upon expiry of the existing assignments, they can rely on the 338.4 MHz of spectrum assignments in the

⁶ These are the same multiple objectives that the CA adopted for the re-assignment of the spectrum in the 1.9 – 2.2 GHz band upon the expiry of the assignments in October 2016.

850/900 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz bands for the provision of 3G and 4G services.

11. The CA is concerned whether 2G service continuity would be maintained under Option 2 (i.e. the full-fledged market-based approach), given that the existing 2G services are supported solely by the 900/1800 MHz Spectrum. If the incumbent spectrum assignees are not assured of any assignment in the two frequency bands in the new term, the continuity of 2G services for local users and inbound roamers using 2G handsets would be at risk.

12. Taking into consideration the above, the CA proposed Option 3 (i.e. the hybrid approach), with a right of first refusal to be offered to each of the four incumbent spectrum assignees for the re-assignment of 2 × 5 MHz of the 900/1800 MHz Spectrum, on the condition that they will continue to provide 2G services during a three-year transitional period from the commencement of the new spectrum assignment term. This option was put forward upon the basis that the outcome of the first consultation would support the 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.

13. The SCED proposed in the First Consultation Paper the principles of methods for setting the SUF of the 900/1800 MHz Spectrum. In particular, the SCED set out that 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.

Views Received

14. By the close of the consultation on 18 May 2016, a total of 325 submissions were received from the four MNOs, one mobile virtual network operator (“MVNO”), other commercial firms, two tourism organisations, a Legislative Council Member, and 299 members of the public. This is the largest number of submissions ever received in a public consultation on telecommunications matters.

15. The four MNOs expressed divisive views in regard to the choice between the full-fledged administratively-assigned approach under Option 1 and the hybrid approach under Option 3, with HKT and

Hutchison supporting the former and CMHK and SmarTone the latter. Option 2 was supported by a MVNO. The MNOs submitted that the continuity of 3G/4G services was equally if not more important than the continuity of 2G services. The service continuity problem was considered particularly acute for mobile data services enabled by 3G/4G technologies in the Mass Transit Railway (“MTR”) stations and tunnels, as the progress of the deployment of the 2.3 GHz and 2.5/2.6 GHz spectrum for support of 4G services at MTR premises had been slow and time consuming due to engineering constraints. The total amount of the RFR Spectrum proposed by them ranged from 110 MHz to 160 MHz or 55% to 80% of the 900/1800 MHz Spectrum. There were also a large number of submissions (most of them having only a few lines of comments) from individuals expressing support for Option 1, on the grounds that it would be able to provide a stable business environment for MNOs and minimise disturbance to mobile service users. On the other hand, submissions from the two tourism organisations emphasised the importance of maintaining the provision of 2G services post 2020/21, as the possibility of incoming visitors to Hong Kong, particularly those from Mainland China, continuing to rely on 2G services after then could not be ruled out.

16. On the level of SUF, HKT, Hutchison, several commercial firms and a number of individuals held the view that this should not be set at a high level, while CMHK considered that the level of SUF should be set to reflect the full market value of spectrum. As regards the proposed methods for setting the SUF under Option 3, the MNOs in general supported the setting of a cap for the SUF of the RFR Spectrum, but objected to the proposal to set the minimum price for the RFR Spectrum at a level higher than the auction reserve price.

17. A summary of the views and comments received as well as the responses of the CA and the SCED are given at the Annex to the Second Consultation Paper at **Appendix A**.

Second Round of Public Consultation

Consultancy Study of Impact on Service Quality

18. During the course of conducting the first round of public consultation, the CA through the Office of the Communications Authority appointed a consultant (“Consultant”) to conduct an independent and objective assessment of the impact on service quality arising from the

various spectrum re-assignment options proposed in the First Consultation Paper (“Study”). The concern over the need to maintain 2G service continuity⁷, and the MNOs’ views over 3G/4G service continuity especially in the MTR stations and adjoining tunnel areas were also examined in detail in the Study.

19. The outcome of the quantitative assessment of the Study indicates that the Re-assignment of the 900/1800 MHz Spectrum is not expected to exert any adverse impact on the service quality of the territory-wide network and that in high traffic areas for all 2G, 3G and 4G services under all the ten study scenarios. The technical analysis of the Study in regard to the impact on the provision of mobile services at the MTR premises however reveals an issue of concern for the provision of 4G services at certain MTR stations which rely on the use of legacy integrated radio systems (“IRS”) equipment operating in the 1800 MHz band for the provision of 4G services and which is not yet upgraded with frequency agile functionality to cater efficiently for spectrum reshuffling among MNOs in the 1800 MHz band. To mitigate the problem, the Consultant therefore suggests the offer of 2×10 MHz of RFR spectrum in the 1800 MHz band to each of the four incumbent spectrum assignees. Details of the results of the Study are set out in paragraphs 31 – 43 of the Second Consultation Paper⁸.

Proposed Arrangements for Spectrum Re-assignment: Revised Option 3 and Offer of RFR Spectrum in the 1800 MHz Frequency Band

20. Having carefully considered the submissions received in the first round of public consultation, the analysis and recommendation of the Consultant in the Study, and having conducted a pros and cons evaluation of the three options against the multiple objectives in spectrum re-assignment, the CA proposes in the Second Consultation Paper to adopt a hybrid administratively-assigned cum market-based approach under Option 3, comprising the following elements, for further consultation with the industry and other affected persons concerning the Re-assignment of the 900/1800 MHz Spectrum, viz. –

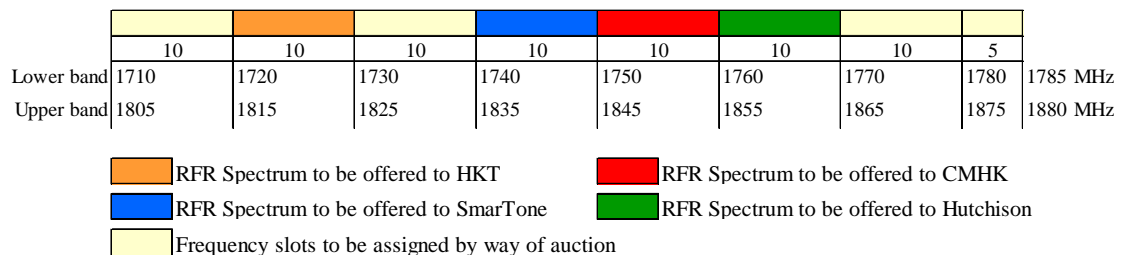
⁷ As at December 2016, there were 1.65 million 2G service subscribers among the 17.23 million mobile service subscribers in Hong Kong, accounting for 9.6% of the total number.

⁸ The report of the Study entitled “*Technical Study in relation to the Re-assignment of Spectrum in the 900 MHz and 1800 MHz Bands upon Expiry of the Existing Assignments*” (English version only) is available at:
http://www.ofca.gov.hk/filemanager/ofca/common/reports/consultancy/cr_201702_01_en.pdf.

- (a) 2×10 MHz of spectrum in the 1800 MHz band to be re-assigned to each of the four incumbent spectrum assignees through the offer of a right of first refusal, i.e. a total of 2×40 MHz or 40% of the 900/1800 MHz Spectrum to be re-assigned as the RFR Spectrum;
- (b) the remaining 2×35 MHz of spectrum in the 1800 MHz band and all the 2×25 MHz of spectrum in the 900 MHz band to be assigned by way of auction, i.e. a total of 2×60 MHz or 60% of the 900/1800 MHz Spectrum to be auctioned; and
- (c) any spectrum which may become available arising from the decision of any incumbent spectrum assignee to not take up the RFR Spectrum under (a) above will be pooled together with the spectrum mentioned in (b) above to form the Auctioned Spectrum.

21. The offer of the RFR Spectrum proposed in the Second Consultation Paper, at 2×10 MHz for each of the incumbent spectrum assignees, represents an upward adjustment from the 2×5 MHz as proposed in the First Consultation Paper. The 2×10 MHz of RFR Spectrum would be able to safeguard the 4G service continuity for all MNOs at the MTR premises on the one hand and to support the continued provision of 2G services in Hong Kong on the other. With the RFR Spectrum located in the 1800 MHz band, and to align it with the spectrum currently deployed by MNOs for the provision of 4G services at MTR premises as shown in Figure 1 below, it will obviate or minimise the need for reconfiguring the IRS equipment post spectrum re-assignment from 2021 onwards thus avoiding prolonged impact on 4G services being supported by the 1800 MHz band in many MTR stations during the reconfiguration works.

Figure 1: Proposed Band Plan for the 1800 MHz Frequency Band



For more details about the band plans proposed to be adopted for the 900/1800 MHz Spectrum in the new assignment term, please see paragraphs 103 – 106 of the Second Consultation Paper.

Proposed Methods for Determining the Spectrum Utilisation Fee

22. The SCED considers that as a matter of policy, a market-based approach in spectrum management will be used wherever the CA considers that there are likely to be competing demands from providers of non-Government services for the spectrum. A SUF that reflects the full market value of the spectrum through a competitive bidding process seeks to ensure that the spectrum, being a scarce public resource, is put into the hands of the MNOs which value it the most and which will consequently put it to the most efficient use.

23. Having regard to the above policy, the views received in the first public consultation and the CA's proposal to adopt the hybrid approach (see paragraph 20 above), the SCED proposes in the Second Consultation Paper that the SUF of the Auctioned Spectrum should naturally be determined by auction, subject to an auction reserve price. The SUF for the RFR Spectrum in the 1800 MHz band should be set at the average SUF of the Auctioned Spectrum in the same band, subject to a minimum price and a cap.

Auction Reserve Price

24. In relation to the auction reserve price which should be set at a level that represents the minimum base value of the spectrum for kick-starting the competitive bidding process, the SCED proposes to make reference to the auction reserve prices for the two most recent auctions in respect of the spectrum in the 2.5/2.6 GHz and 1.9 – 2.2 GHz bands conducted in 2013 and 2014 respectively. The auction reserve price for both 900 MHz Spectrum and 1800 MHz Spectrum may be set between \$19 million per MHz and \$54 million per MHz, and the present inclination is that the final value would be closer to the higher end⁹.

⁹ Given the following considerations, the auction of spectrum in the 1.9 – 2.2 GHz band (whose auction reserve price is \$54 million per MHz at 2021 price level) carries a relatively greater reference value than that of the 2.5/2.6 GHz band (whose auction reserve price is \$19 million per MHz at 2021 price level) –

- (a) both the 900/1800 MHz Spectrum and spectrum in the 1.9 – 2.2 GHz band have been used for the provision of public mobile telecommunications services in the whole territory including all stations along the MTR lines, whereas spectrum in the 2.5/2.6 GHz band has yet to be fully deployed along the MTR lines; and
- (b) the auction of spectrum in the 1.9 – 2.2 GHz band was conducted more recently.

Minimum Price and Cap in respect of RFR Spectrum

25. As regards the RFR Spectrum, the minimum price, which represents the estimated market value of the spectrum, should be close to the value of spectrum in frequency bands with similar propagation characteristics as determined in the two most recent assignments (i.e. the value of spectrum in the 2.5/2.6 GHz and 1.9 – 2.2 GHz bands as determined in 2013 and 2014 respectively). As such, the SCED proposes that the minimum price may be set between \$38 million per MHz and \$67 million per MHz and the present inclination is that the final value would be closer to the higher end¹⁰. As for the cap, the SCED proposes that it should be set at around 30% to 40% higher than the minimum price.

Method of Payment

26. On the method of payment, taking into account the large quantum of spectrum available for competitive bidding and thus the potentially substantial amount of SUF involved in the current re-assignment exercise, the SCED proposes that the spectrum assignees will be given a choice to pay the SUF either by lump sum payment upfront or annual installments.

27. For more details about the proposed methods for setting the SUF, please see paragraphs 91 – 102 of the Second Consultation Paper.

Revised Proposal for Safeguarding the Provision of 2G Services

28. The CA remains of the view that there is a need to safeguard the continued provision of 2G services so long as there are demands for such services. Nevertheless, taking into account the feedback of the MNOs on the matter, the CA decides to dispense with the fixed three-year timeline in 2G service provision post spectrum re-assignment as proposed in the First Consultation Paper, and instead proposes to introduce a new licence condition for the MNOs (see paragraph 118 of the Second Consultation Paper), upon their exercise of the right to take up the RFR Spectrum, and/or their successful bidding of any frequency slot in the Auctioned Spectrum, requiring them to seek the prior consent of the CA and to make satisfactory arrangements for the affected customers before it

¹⁰ For reasons stated in footnote 9 above, the assignment of spectrum in the 1.9 – 2.2 GHz band (whose SUF determined is \$67 million per MHz at 2021 price level) carries a relatively greater reference value than that of the 2.5/2.6 GHz band (whose SUF determined is \$38 million per MHz at 2021 price level)

moves on to phase out the provision of 2G services. The same requirement will also be applicable to various generations of mobile services and to any new entrants.

Proposals for Other Matters

29. The CA's proposals for other matters as set out in the Second Consultation Paper include the following –

- (a) Eligible bidders in auction: The auction will be open to all interested parties, including the incumbent spectrum assignees and any new entrants to the local mobile telecommunications market (see paragraph 108 of the Second Consultation Paper);
- (b) Auction format: the Simultaneous Multiple Round Ascending auction format, which has been adopted by the CA and the former TA in all the applicable auctions of frequency spectrum since 2009, will be used for the assignment of the Auctioned Spectrum (see paragraph 109 of the Second Consultation Paper);
- (c) Spectrum cap in auction: An overall spectrum cap will be applied to all the bidders such that each of them may acquire up to 90 MHz of the 900/1800 MHz Spectrum, including the 20 MHz of RFR Spectrum if acquired by the incumbent spectrum assignee, together with a sub-cap of 20 MHz applicable to spectrum in the 900 MHz band (see paragraphs 111 – 112 of the Second Consultation Paper);
- (d) Spectrum assignment periods: The new 15-year term of assignments for the spectrum in the 900 MHz band will be from 12 January 2021 to 11 January 2036, and that for the spectrum in the 1800 MHz band will be from 30 September 2021 to 29 September 2036 (see paragraphs 113 – 115 of the Second Consultation Paper);
- (e) Network and service rollout obligations and performance bond: Network and service rollout obligations will be imposed on all spectrum assignees, and where applicable, they will be required to lodge a performance bond to ensure compliance (see paragraphs 119 – 121 of the Second Consultation Paper); and

- (f) Re-assignment of spectrum used for coverage in country parks and remote areas: 2×4 MHz of spectrum in the 1800 MHz band will be re-assigned administratively to the incumbent spectrum assignees free of SUF for the provision of mobile coverage in the country parks and remote areas upon expiry of the existing assignees for another 15 years until 29 September 2036, i.e. the same as the new term of assignments for all the spectrum in the 1800 MHz band (see paragraphs 122 – 123 of the Second Consultation Paper).

Way Forward

30. The second consultation will last for 10 weeks until 24 April 2017. The SCED and the CA will carefully consider the views and comments received in response to the Second Consultation Paper, and insofar as it is practicable in the circumstances shall endeavour to announce by around the end of 2017 their respective decisions on the arrangements for the Re-assignment of the 900/1800 MHz Spectrum and the methods for setting the related SUF, thereby giving a three-year advance notice to the incumbent spectrum assignees of any possible variation to their existing spectrum assignments.

**Communications and Creative Industries Branch
Commerce and Economic Development Bureau
and
Office of the Communications Authority
March 2017**

**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**

Second Consultation Paper

14 February 2017

FOREWORD

This paper (“Second Consultation Paper”) seeks further views and comments of the telecommunications industry and other affected persons on the arrangements for the 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. It also seeks further views and comments on the methods for setting the related spectrum utilisation fee (“SUF”).

Having carefully considered the views and comments received in response to the first consultation paper issued on the subject on 3 February 2016 (“First Consultation Paper”)¹ and the findings of the consultancy study on the impact on service quality arising from the various spectrum re-assignment options set out in the First Consultation Paper, the Communications Authority (“CA”) proposes in the Second Consultation Paper for further consultation the hybrid option of the administratively-assigned cum market-based approach for the re-assignment of the frequency spectrum in the 900 MHz and 1800 MHz bands.

The Secretary for Commerce and Economic Development (“SCED”) has also carefully considered the responses to the First Consultation Paper on issues relating to the methods for setting the SUF. The SCED proposes in the Second Consultation Paper the methods for setting the SUF of the administratively-assigned spectrum and the minimum fee of the SUF in auction, and invites views and comments from the industry and other affected persons.

¹ The First Consultation Paper is available at:
http://www.coms-auth.hk/filemanager/en/content_711/cp20160203_e.pdf.

For the avoidance of doubt, 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 Second Consultation Paper should do so on or before 24 April 2017. 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 –

Office of the Communications Authority
29/F., Wu Chung House
213 Queen’s Road East
Wan Chai
Hong Kong
(Attention: Head, Regulatory 2)

Fax: 2803 5112

E-mail: consult-900-1800MHz@ofca.gov.hk

An electronic copy of the submission should be provided by e-mail to the e-mail address indicated above.

INTRODUCTION

In Hong Kong, 552 MHz of frequency spectrum² in the 850/900 MHz, 1800 MHz, 1.9 – 2.2 GHz, 2.3 GHz, and 2.5/2.6 GHz bands has been assigned to mobile network operators (“MNOs”) for the provision of public mobile telecommunications services. The spectrum under consideration for re-assignment comprises 49.8 MHz of spectrum in the 900 MHz band and 148.8 MHz of spectrum in the 1800 MHz band, which constitutes 36% of the total spectrum assignment. The above 198.6 MHz of spectrum in the 900 MHz and 1800 MHz bands is deployed for the provision of second, third and fourth generation (“2G”, “3G” and “4G”) mobile services. The existing assignments of this spectrum are due to expire between 19 November 2020 and 29 September 2021.

2. The 49.8 MHz of spectrum in the 900 MHz band is assigned to three MNOs, namely Hong Kong Telecommunications (HKT) Limited (“HKT”), Hutchison Telephone Company Limited (“Hutchison”) and SmarTone Mobile Communications Limited (“SmarTone”). The 148.8 MHz of spectrum in the 1800 MHz band is assigned also to China Mobile Hong Kong Company Limited (“CMHK”) in addition to the above three MNOs. The distribution of spectrum in the two frequency bands among the four MNOs is depicted in Table 1 below.

² The 552 MHz of spectrum assigned 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) 30 MHz of unpaired spectrum in the 2.3 GHz band assigned in 2012 and deployed for the provision of wireless fixed broadband services; (c) 20 MHz of unpaired spectrum in the 1.9 – 2.2 GHz band assigned in 2001, which was left idle throughout the assignment period of 15 years and was put back to reserve at the end of the assignment term in October 2016; and (d) 9.7 MHz of unpaired spectrum in 2010 – 2019.7 MHz for the provision of public mobile telecommunications services that was put out for auction in 2011 with no interested bidder. The CA will consider releasing the spectrum in (c) and (d) above should there be market demand.

Table 1: Distribution of Spectrum among MNOs

	Spectrum due for re-assignment in 2020/21					Share in MNO's total
	Overall total (MHz)	Share in total	900 MHz (MHz)	1800 MHz (MHz)	Total (MHz)	
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%

3. Taking account also of the 0.2 MHz of spectrum in the 900 MHz band and 1.2 MHz of spectrum in the 1800 MHz band which is currently vacant, a total of 200 MHz of spectrum, comprising 2 x 25 MHz in the frequency ranges of 890 – 915 MHz paired with 935 – 960 MHz³, and 2 x 75 MHz in the frequency ranges of 1710 – 1785 MHz paired with 1805 – 1880 MHz⁴ (“900/1800 MHz Spectrum”) will be considered in this assignment/re-assignment exercise (hereafter collectively referred to as “Re-assignment of the 900/1800 MHz Spectrum”).

4. Exercising their respective statutory powers relating to spectrum management and SUF under sections 32G, 32H and 32I of the TO⁵, the CA and the SCED jointly published the First Consultation Paper on 3 February 2016 to solicit the views and comments of the industry and other affected persons on

³ The 2 x 25 MHz of spectrum to be assigned/re-assigned in the 900 MHz band comprises 2 x 24.9 MHz of spectrum in the frequency ranges of 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 which is currently in use, and 2 x 0.1 MHz of spectrum in the frequency range of 904.0 – 904.1 MHz paired with 949.0 – 949.1 MHz which is currently vacant.

⁴ The 2 x 75 MHz of spectrum to be assigned/re-assigned in the 1800 MHz band comprises 2 x 74.4 MHz of spectrum in the frequency range of 1710.5 – 1784.9 MHz paired with 1805.5 – 1879.9 MHz which is currently in use, and 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 which is currently vacant.

⁵ For details about the legislative and policy framework relating to the assignment of frequency spectrum and setting of the SUF, please refer to paragraphs 8 – 11 of the First Consultation Paper.

the possible arrangements for the Re-assignment of the 900/1800 MHz Spectrum and the methods for setting the related SUF.

5. At the close of the consultation on 18 May 2016 (extended from the original deadline of 18 April 2016), a total of 325 submissions were received from 299 individuals and the 26 parties listed below (in alphabetical order) –

MNOs/Mobile Virtual Network Operator (“MVNO”)

- CMHK
- China Unicom International Limited (“China Unicom”)
- HKT
- Hutchison
- SmarTone

Other Commercial Firms

- Brocade Communications Systems H.K. Limited (“Brocade”)
- Cisco Systems (HK) Limited (“Cisco”)
- Comba Telecom Limited (“Comba”)
- Expert Systems IVR (Asia) Company Limited
- Galaxy Communication (H.K.) Limited (“Galaxy”)
- H3C Technologies Company Limited (“H3C”)
- Hewlett-Packard HKSAR Limited (“HP”)
- Huawei International Company Limited (“Huawei”)
- HUBER+SUHNER (Hong Kong) Limited (“H+S”)
- King Tin Engineering & Transportation Limited
- Macroview Telecom Limited (“Macroview”)
- Nokia Solutions and Networks HK Limited (“Nokia”)
- NTT DOCOMO INC (“NTT”)
- nwStor Limited (“nwStor”)
- Prime Creation Technology Limited (“Prime Creation”)
- Top Express Communications Limited (“Top Express”)
- WiseSpot Company Limited
- Yau Nam Kee Construction Company Limited

Member of Legislative Council

- Hon Charles Mok

Tourism Organisations

- Hong Kong Tourism Board (“HKTB”)
- Travel Industry Council of Hong Kong (“TIC”)

A summary of the views and comments received as well as the responses of the CA and the SCED are at the **Annex**.

FIRST ROUND OF PUBLIC CONSULTATION

6. The First Consultation Paper starts off by outlining the legislative and policy framework governing spectrum management in Hong Kong. It sets out the statutory duties and functions of the CA in this regard. It then explains that according to the Radio Spectrum Policy Framework (“Spectrum Policy Framework”)⁶ promulgated by the Government in April 2007, a market-based approach should be adopted for spectrum re-assignment 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. The First Consultation Paper then sets out the four objectives that the CA adopts in evaluating the options for the Re-assignment of the 900/1800 MHz Spectrum, viz. (a) ensuring customer service continuity; (b) efficient spectrum utilisation; (c) promotion of effective competition; and (d) encouragement of investment and promotion of innovative services⁷.

7. The three spectrum re-assignment options identified in the First Consultation Paper are –

- Option 1 – a full-fledged administratively-assigned approach that re-assigns all the spectrum to the incumbent spectrum assignees through the offer of a right of first refusal;
- Option 2 – a full-fledged market-based approach that re-assigns all the spectrum by auction; and

⁶ The Spectrum Policy Framework is available at:
<http://www.cedb.gov.hk/ccib/eng/legco/pdf/spectrum.pdf>.

⁷ These are the same multiple objectives that the CA adopted for the re-assignment of the spectrum in the 1.9 – 2.2 GHz band upon expiry of the previous assignments in October 2016.

- Option 3 – a hybrid administratively-assigned cum market-based approach that re-assigns part of the spectrum to the incumbent spectrum assignees through the offer of a right of first refusal (“RFR Spectrum”) with the remaining spectrum to be re-assigned by auction.

The remaining spectrum, together with any spectrum that may become available arising from the decision of any incumbent spectrum assignee to not exercise their right of refusal to take up the RFR Spectrum, will be put to auction (collectively “Auctioned Spectrum”).

The CA makes it clear in the First Consultation Paper that it will choose the option that would best meet the four objectives in spectrum management.

8. In accordance with the Spectrum Policy Framework, the CA has established in the First Consultation Paper that there are likely to be competing demands for the 900/1800 MHz Spectrum from MNOs and potential new entrants upon expiry of the existing assignments, in view of the keen demand for spectrum which is fuelled by the sustained robust growth in mobile data usage in Hong Kong and the superb radio propagation characteristics and technical compatibility of the spectrum under re-assignment for provision of territory-wide network coverage.

9. The CA is of the further view that there is no overriding public policy reason supporting a complete deviation from the market-based approach thus justifying adoption of the full-fledged administratively-assigned approach under Option 1 for the Re-assignment of the 900/1800 MHz Spectrum. The analysis set out in the First Consultation Paper, that the cons of Option 1 far outweigh the pros, makes it the least capable of meeting the multiple objectives that the CA has identified for the re-assignment exercise. In reaching this view, the CA notes in particular that, even if the incumbent spectrum assignees were unable to obtain any of the 900/1800 MHz Spectrum upon expiry of the existing assignments, they can rely on the spectrum assignment in the 850/900 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz bands as shown in Table 2 below for the provision of 3G and 4G services.

Table 2: Application of Radio Spectrum in the Provision of Public Mobile Telecommunications Services

Frequency band	Type of mobile services				Total (MHz)
	2G (MHz)	3G (MHz)	4G (MHz)	CDMA 2000 (MHz)	
850/900 MHz		20.0		15.0	35.0
900 MHz	15.2	9.0	25.6		49.8
1800 MHz	28.8		120.0		148.8
1.9 – 2.2 GHz		98.6	19.8		118.4
2.3 GHz			60.0		60.0
2.5/2.6 GHz			140.0		140.0
Total	44.0	127.6	365.4	15.0	552.0

10. The CA is concerned whether 2G service continuity would be maintained under the full-fledged market-based approach of Option 2, given that the existing 2G services are supported solely by the 900/1800 MHz Spectrum. If the incumbent spectrum assignees are not assured of any assignment in the two frequency bands in the new term, the continuity of 2G voice services for local users and inbound roamers using 2G handsets would be at risk.

11. Taking into consideration the above, the CA proposes a hybrid approach under Option 3, with a right of first refusal to be offered to each of the four incumbent spectrum assignees for the re-assignment of 2 x 5 MHz of the 900/1800 MHz Spectrum, on the condition that they will continue to provide 2G services during a three-year transitional period from the commencement of the new spectrum assignment term. This option is put forward upon the basis that the outcome of the first consultation supports the 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.

MAJOR VIEWS OF THE RESPONDENTS ON THE PROPOSALS IN THE FIRST CONSULTATION PAPER

12. On the spectrum re-assignment options, there are diverging views among MNOs, with HKT and Hutchison supporting the full-fledged

administratively-assigned approach under Option 1; CMHK and SmarTone favouring the hybrid approach under Option 3.

13. HKT and Hutchison considered Option 1 to be the best option for achieving the four objectives in spectrum re-assignment, their major reason being that the option would ensure the continuity of customer services. In their views, given the shortage of spectrum and keen competition in the mobile telecommunications market, MNOs would ensure efficient spectrum utilisation and make necessary investment for network rollout and service innovations. The two MNOs considered that, in contrast, spectrum auction might result in further fragmentation of the 900/1800 MHz Spectrum and bring in ineffective entrants. Aside from HKT and Hutchison, there is also a large number of submissions (most of which contain a few lines of comments) from individuals expressing support for Option 1, on the grounds that it would be able to provide a stable business environment for MNOs and minimise disturbance to mobile service users.

14. The other two MNOs, CMHK and SmarTone, supported Option 3, as they considered that the option would, apart from ensuring customer service continuity, provide an opportunity for MNOs and new entrants to acquire spectrum to satisfy their business needs and this would stimulate investment and innovations.

15. As to the full-fledged market-based approach under Option 2, while China Unicom, Comba and a member of the public indicated their support, all the four MNOs opposed this option, regarding it as posing a substantial risk to service continuity, in the event that they were not able to acquire through auction any of their existing spectrum holdings. According to the MNOs, the problem would be particularly acute for mobile data services in the Mass Transit Railway (“MTR”) stations and tunnels, as the progress of their deployment of the 2.3 GHz and 2.5/2.6 GHz spectrum at MTR premises for the provision of 4G services had been slow and time-consuming due to engineering constraints. CMHK and SmarTone were concerned that if the specific frequencies used by individual MNOs at MTR premises needed to be altered after re-assignment, a long lead time would be required for modifying the points of interconnection (“POI”) on the integrated radio systems (“IRS”) in MTR stations and this would cause disruption to mobile services at the concerned locations.

16. In response to the concern of the CA on the continuity of 2G services to support mobile service users using 2G handsets after the Re-assignment of the 900/1800 MHz Spectrum, the four MNOs considered the continuity of 3G/4G services as equally if not more important than 2G services, as a substantial proportion of the spectrum under re-assignment had already been reformed for the provision of 3G/4G services, and the number of 2G services subscribers had been decreasing and would continue to fall substantially by 2020/21. From the usage point of view, members of the public in general were also concerned more about the continuity of 3G/4G than 2G services. MNOs were also of the view that mandating the provision of 2G services as a condition of the assignment of the RFR Spectrum was not in line with the technology-neutral approach adopted by the CA for spectrum management, and that they should not be restricted from deploying the spectrum for more efficient uses. On the other hand, submissions from the two tourism organisations emphasized the importance of maintaining the provision of 2G services post 2020/21, as the possibility of incoming visitors to Hong Kong, particularly those from Mainland China, continuing to rely on 2G services after then could not be ruled out.

17. MNOs held different views on the amount of the 900/1800 MHz Spectrum to be re-assigned to the incumbent spectrum assignees to ensure customer service continuity through the offer of the RFR Spectrum under Option 3, ranging from 55% to 80% in total of the spectrum under re-assignment. HKT and SmarTone suggested that the RFR Spectrum to be offered to each incumbent spectrum assignee should fall within its existing frequency holdings.

18. HKT, which holds the largest portion of the 900/1800 MHz Spectrum among the MNOs (viz. 89.4 MHz), considered that as in the re-assignment of the spectrum in the 1.9 – 2.2 GHz band (“3G Spectrum”), at least two-thirds of the 900/1800 MHz Spectrum should be re-assigned to the incumbent spectrum assignees as the RFR Spectrum, with the proportion to be adjusted upwards to take into account the exponential growth in mobile data traffic and the prospect of the 900/1800 MHz Spectrum continuing to be the core bands for 4G services and likely also for fifth generation (“5G”) services in the future. HKT also considered that the amount of the RFR Spectrum to be offered to each MNO should correspond with the number of subscribers and size of its current holdings of the 900/1800 MHz Spectrum.

19. For the other three MNOs, SmarTone submitted that the amount of the RFR Spectrum in each frequency band should be made uniform for each incumbent spectrum assignee, and that making available 2 x 5 MHz of spectrum in the 900 MHz band and 2 x 10 MHz in the 1800 MHz band would ensure that mobile broadband services, especially those at MTR premises, would not be affected. CMHK suggested that the RFR Spectrum should be offered in both frequency bands and to all MNOs, i.e. 2 x 5 MHz in the 900 MHz band and 2 x 10 MHz in the 1800 MHz band. Hutchison was of a similar view with CMHK except that it considered 2 x 15 MHz in the 1800 MHz band should be offered as the RFR Spectrum.

20. On the level of SUF, HKT, Hutchison, several company respondents and a number of individuals held the view that this should not be set at a high level, with some submissions also incorporating the view that the SUF in this re-assignment exercise should not be benchmarked against the results of one or two auctions held locally earlier on. More specifically, HKT and Hutchison objected to our proposal to make reference to the SUF of spectrum in the 850/900 MHz band as determined by the auction conducted in March 2011 as that auction produced “exceptionally high” or “record-high” prices. HKT also suggested the SUF should be benchmarked more broadly by looking at overseas spectrum auctions. CMHK agreed that the level of SUF should be set to reflect the full market value of spectrum.

21. As regards whether there should be two sets of SUF for spectrum in the 900 MHz band (“900 MHz Spectrum”) and that in the 1800 MHz band (“1800 MHz Spectrum”) respectively, SmarTone stated that there was a paucity of empirical and reliable data to establish the precise relative band values between the two bands in the Hong Kong context.

22. On the level of the reserve price for the Auctioned Spectrum, SmarTone stated that since the final SUF for such spectrum would be decided in a competitive auction, they did not see how operators could possibly manipulate or control the bidding results so as to produce an unreasonably low SUF. They held the view that the determining factor in a competitive bidding was market forces.

23. The MNOs in general supported the setting of a cap for the SUF of the RFR Spectrum if Option 3 were to be adopted. However, they objected to

the proposal to set the minimum price for the RFR Spectrum at a level higher than the auction reserve price. HKT considered that such a minimum price was not necessary and the SUF of the RFR Spectrum could simply be the average SUF fetched for the Auctioned Spectrum. SmarTone was of the view that the proposal of setting the minimum price for the RFR Spectrum higher than the reserve price of the Auctioned Spectrum would unduly discriminate against the incumbent spectrum assignees taking up the RFR Spectrum. CMHK expressed that the minimum price should be set as low as possible.

24. On the method of payment of SUF, the submissions received indicated that the operators were concerned about the tax deductibility of the SUF. HKT considered it more appropriate for the SUF to be paid on an annual basis to reflect the fact that the expenditure was revenue (rather than capital) in nature, but in the case the lump sum payment method was adopted, the Government should discuss with, and seek agreement from, the Inland Revenue Department (“IRD”) that lump sum SUF payments were revenue in nature and hence tax deductible. Hutchison was of the view that SUF payments should be tax deductible regardless of the method of payment, and it did not object to paying the SUF in a lump sum so long as it is tax deductible. SmarTone requested the Government to obtain confirmation from IRD that any SUF, whether payable on annual basis or as a lump sum, would be regarded as revenue expenditure and hence tax deductible. CMHK did not express any views in this regard.

CONSIDERATIONS AND RESPONSES OF THE CA AND THE SCED

25. In this section, the CA will respond to the major views of the respondents in regard to meeting the multiple objectives in spectrum management and the proposed options for Re-assignment of the 900/1800 MHz Spectrum. This will be followed by the responses of the SCED to the views received on the methods for setting the SUF.

Ensuring Customer Service Continuity

26. The CA acknowledges the views of the four MNOs and other respondents on the importance of ensuring the continuity of 3G/4G mobile data services, which is indispensable to the everyday life of the general public and

business activities these days. While the mobile industry worldwide is making headway towards the development of the 5G technologies, they are still under trials with the common standards yet to be worked out, and spectrum yet to be harmonised. It is envisaged that customer service provision would continue to rely on the existing 3G/4G networks during the period leading to the Re-assignment of the 900/1800 MHz Spectrum in 2020/2021 and beyond.

27. The CA however does not agree with the position of some respondents that the need to ensure the continuity of 3G/4G services justifies the adoption of the full-fledged administratively-assigned approach under Option 1 for the Re-assignment of the 900/1800 MHz Spectrum to the incumbent assignees. After all, the majority of the spectrum currently deployed extensively for the provision of 3G services and 4G services across the territory will not be affected at all by the present spectrum re-assignment exercise.

28. Having considered the submissions received from the MNOs, the CA is of the view that a valid consideration in relation to service continuity in this re-assignment exercise pertains specifically to the provision of 4G services in those MTR stations and adjoining tunnel areas where (a) 4G services are, and will continue to be provided primarily using spectrum in the 900 MHz and 1800 MHz frequency bands all the way to 2020/21; and (b) the IRS are yet to be upgraded to cover the 2.3 GHz and/or 2.5/2.6 GHz bands and they do not have frequency agile functionality to cater efficiently for spectrum reshuffling among MNOs. Please refer to paragraphs 39 – 42 below for details. As such, the continuity of 4G services at the concerned MTR premises could be a matter of concern depending on the outcome of this spectrum re-assignment exercise.

29. In any event, given the CA's concern over the need to maintain 2G service continuity, and the MNOs' views over 3G/4G service continuity especially in the concerned MTR stations and adjoining tunnel areas, the CA is mindful of the need to examine the impact of the Re-assignment of the 900/1800 MHz Spectrum on the continuity and service quality of all generations of mobile services.

30. In this regard, the CA has through the Office of the Communications Authority ("OFCA") appointed a consultant ("Consultant") to conduct an independent and objective assessment of the impact on service quality arising

from the various spectrum re-assignment options proposed in the First Consultation Paper (“Study”). The assessment methodology adopted by the Consultant and the major findings of the Study are summarised in the section below. A public version of the Study report is published along with this Second Consultation Paper on OFCA’s website⁸.

Study of the Impact on Service Quality Arising from the Re-assignment of the 900/1800 MHz Spectrum

31. The Consultant has developed an assessment model to analyse the demand for and supply of mobile traffic capacity before and after the Re-assignment of the 900/1800 MHz Spectrum, with a view to quantifying any impact on the quality of mobile services offered by: (a) all MNOs as a whole; and (b) individual MNOs, up to 2023, i.e. two years post the re-assignment. The Consultant has conducted the Study with cooperation and input from the relevant stakeholders, including all the four MNOs and the MTR Corporation (“MTRC”).

32. In the assessment model, the projected traffic demand is largely based on the traffic forecasts provided by MNOs, with adjustments by the Consultant to reflect its own traffic forecasts and those of international bodies. Overall, mobile data traffic⁹ is projected to grow on average by 26% per annum between 2016 and 2023, and the average monthly data usage per subscriber to rise from 2 GB in 2016 to 9 GB in 2023. 4G traffic is expected to take up 97% of the mobile network traffic in 2023 and 3G traffic would account for the remaining 2%. The volume of 2G traffic will become negligible at that time. As for the supply side, network information provided by MNOs, including the present and projected number of base stations and sectors in the outdoor and indoor areas, size of spectrum holdings and plans for spectrum refarming, coupled with the trend in technology evolution over the years are used by the Consultant to determine the capacity of the mobile networks in each year up to 2023.

⁸ The report of the Study entitled “*Technical Study in relation to the Re-assignment of Spectrum in the 900 MHz and 1800 MHz Bands upon Expiry of the Existing Assignments*” is available at : http://www.ofca.gov.hk/filemanager/ofca/common/reports/consultancy/cr_201702_01_en.pdf

⁹ In the Study, “mobile data traffic” includes voice traffic translated into equivalent data stream.

33. The Study makes quantitative evaluation of the impact on the quality of mobile services by comparing the projected traffic demand and the estimated network capacity using a metric called the Demand Capacity Overage (“DCO”), which is a measure of the percentage demand that exceeds the normal loading capacity of the network. A DCO value greater than zero indicates potential problems of traffic congestion or service degradation. The Study calculates the DCO for the territory-wide network and for the high traffic areas¹⁰, analysed also by individual MNOs and by different generations of mobile services.

34. In order to assess the impact on service quality stemming from the Re-assignment of the 900/1800 MHz Spectrum, a total of ten possible spectrum re-assignment scenarios were postulated by the Consultant in consultation with the MNOs, making reference to the three spectrum re-assignment options identified in the First Consultation Paper. In the first five scenarios, i.e. Scenarios 1 – 5, it is assumed that there will not be any new entrant into the Hong Kong mobile telecommunications market through participating in any subsequent auction of the 900/1800 MHz Spectrum. The other five scenarios, i.e. Scenarios 6A – 6E, are based upon the assumption that there would be a new market player which has successfully acquired some spectrum through the auction. Details of the ten scenarios used in the Study are set out in chapter 3 of the Study report.

35. The Study results indicate that for all MNOs as a whole, there is no adverse impact under all the ten scenarios on the service quality (a) of the territory-wide network and (b) in the high traffic areas for all 2G, 3G and 4G services. The estimated DCOs are all zero in these scenarios.

36. Regarding individual MNOs, the service quality of their 2G, 3G and 4G networks on a territory-wide basis will also not be affected by the spectrum re-assignment under Scenarios 1 – 5 (where there would not be a new entrant).

37. As to the other five scenarios (i.e. Scenarios 6A – 6E) where there would be a new entrant, for 4G services, it is only in two specific scenarios that the 4G networks of two MNOs in high traffic areas are expected to respectively experience slight or marginal service degradation in 2023 (the DCOs are 15%

¹⁰ In the Study, high traffic areas refer to the top 20% of the cell sites of individual MNOs in terms of traffic volume, which together carry around 60% of the network traffic.

and 4% respectively). The Consultant considers that the slight/marginal service degradation could be effectively mitigated by the concerned MNOs through increasing the number of 4G sectors and/or offloading more 4G traffic to the Wi-Fi networks. For 3G services, the Consultant's assessment is that there may potentially be some service degradations in the 3G network of a particular MNO in 2021 in high traffic areas under all scenarios, and in such case all the DCOs are marginally above zero, at 4%. Again, the Consultant's assessment is that the concerned MNO should be able to resolve or alleviate the marginal service degradation, by increasing the number of 3G sectors, offloading more 3G traffic to the Wi-Fi networks, migrating more 3G traffic to 4G, etc. For 2G services, no service impact is identified for any individual MNOs under all scenarios.

38. On top of the quantitative evaluation of the impact on the quality of mobile services, the Consultant has also conducted a technical analysis in regard to the impact on the provision of mobile services at MTR premises. This is considered an important element of the Study, given the background and expected developments summarised below.

39. By way of background, at present, mobile services in most of the MTR stations and adjoining tunnel areas are provided through the use of the IRS, i.e. radio signal distribution systems, which are shared among MNOs. According to available information, among the 94 MTR stations in service as at the date of issue of the Second Consultation Paper, mobile services in 70 of them are being provided by the IRS, as depicted in Table 3 below. Overall, these MTR stations are generally served by legacy IRS supporting the frequency bands of 900 MHz, 1800 MHz and 1.9 – 2.2 GHz, but not 2.3 GHz and 2.5/2.6 GHz bands for the provision of 4G services. In effect, MNOs predominantly rely on the 120 MHz of spectrum in the frequency range of 1720 – 1780 MHz paired with 1815 – 1875 MHz within the 1800 MHz band¹¹ to provide 4G services in many MTR stations and adjoining tunnel areas.

¹¹ In conducting the Study, the Consultant has taken into account the likely development that MNOs may progressively deploy part of their assigned spectrum in the 1.9 – 2.2 GHz band, originally the core band for 3G services, for the provision of 4G services at MTR premises. The CA notes that this reform plan has been put into motion in recent months. Notwithstanding this, it is expected that all MNOs will continue to primarily rely on the 1800 MHz band as the core band for the provision of 4G services at MTR premises, given that there is still a substantial number of 3G customers to serve in the years to come, and hence the prospects and pace of the future refarming of the spectrum in the 1.9 – 2.2 GHz band for the provision of 4G services are not entirely clear and will be subject to market developments.

40. The MNOs have been working closely with the MTRC with a view to upgrading the IRS at MTR premises to support additional frequency bands and easier system re-configuration using frequency agile equipment. Apart from the nine MTR stations recently brought into service, which have been installed with new IRS, the MNOs have made arrangements with the MTRC to upgrade the IRS in 18 prime MTR stations¹² with high passenger flows, to include the 2.3 GHz and 2.5/2.6 GHz bands as the additional spectrum for provision of 4G services by 2019, and install the frequency agile equipment which enables more flexible and efficient system reconfiguration in case of variations in frequency assignments. There is however not yet any agreement between MNOs and MTRC about the upgrade of the IRS in the remaining 43 MTR stations and adjoining tunnel areas (“Remaining MTR Stations”). Hence, it is technically unlikely that the upgrade of the IRS to the Remaining MTR Stations, or a significant portion of them, will be completed by 2020/21, when the 900/1800 MHz Spectrum is re-assigned. Detailed breakdown is in Table 3 below.

Table 3: Provision of Mobile Services in Existing MTR Stations

Status of MTR Stations	Number of MTR stations	
MTR stations with new/upgraded IRS by 2019		27
New MTR stations opened in 2016	9	
Existing MTR stations with planned IRS upgrade by 2019	18	
Remaining MTR Stations using legacy IRS		43
MTR stations without IRS and/or supported by nearby outdoor base stations		24
Total		94

41. For those IRS which are not yet equipped with frequency agile functionality, re-shuffling of spectrum assignments among MNO users of these IRS is not possible until after completion of the modification of the IRS hardware, which would take time. Bearing in mind that 4G services in many MTR stations and adjoining tunnel areas rely primarily on the 120 MHz of spectrum in the 1800 MHz band, the Study reveals an issue of concern in relation to the provision of 4G services in those MTR stations and adjoining

¹² Among these 18 prime MTR stations, part of the Mei Foo Station on the Tsuen Wan Line and the remaining part on the West Rail Line are counted separately as two stations for the purpose of the IRS upgrade plan.

tunnel areas where (a) the 4G traffic is primarily carried by spectrum in the 1800 MHz band and (b) the IRS equipment is not yet upgraded with frequency agile functionality to cater efficiently for spectrum reshuffling among MNOs.

42. Should the outcome of the Re-assignment of the 900/1800 MHz Spectrum in the new term be such that the MNOs are unable to retain the part of their respective spectrum holdings in the 1800 MHz band which is used for the provision of 4G services at MTR premises, the continuity of 4G services in the Remaining MTR Stations will be at risk, and service users will be adversely affected during the long-lead time required to complete the reconfiguration of the IRS in these stations, either to dovetail with the frequency re-assignments in the 1800 MHz band or to support the 2.3 GHz and/or 2.5/2.6 GHz bands. The length of such lead time, i.e. the transitional period, will depend on the scope of system reconfiguration or upgrade work required, ranging from three months to up to three years if full system upgrade is needed.

43. To mitigate the above problem, the Consultant suggests the offer of 2 x 10 MHz of the RFR Spectrum in the 1800 MHz band to each of the incumbent spectrum assignees based on the following reasons –

- (a) each of the four MNOs is currently deploying at least 2 x 10 MHz of spectrum in the 1800 MHz band for the provision of 4G services at MTR premises;
- (b) offering each MNO up to 2 x 10 MHz of the RFR Spectrum would obviate the need for, or minimise modification to the existing IRS and thus lower the risk to 4G service continuity in the Remaining MTR Stations following the Re-assignment of the 900/1800 MHz Spectrum; and
- (c) compared with spectrum in the 900 MHz band which has limited bandwidth and is mainly deployed by MNOs for the provision of 2G or 3G services at MTR premises, the offer of the RFR Spectrum in the 1800 MHz band is a more practical and effective solution to address the issue of 4G service continuity at MTR premises.

44. The CA has considered the findings of the Consultant as regards the impact of the re-assignment arrangements on service continuity. It agrees that

in mapping out the re-assignment arrangements, there is a need to address the 4G service continuity in the Remaining MTR Stations, which is also a matter of concern outlined in the submissions of the MNOs. The CA is ready to take on board the Consultant's suggestion in proposing the way forward in the Second Consultation Paper.

Continuity of 2G Services

45. The CA notes the views of the two tourism organisations on the importance of maintaining the provision of 2G services in the new term of frequency assignments, so as to cater for the service need of incoming visitors still using 2G handsets by that time. The CA also notes that while the four MNOs shared the concern over the continuity of 2G services, they objected to the proposed three-year transitional period during which those incumbent spectrum assignees which take up the RFR Spectrum must continue to provide 2G services.

46. The CA would like to make it clear that it sees no inconsistency between its proposal in the First Consultation Paper of offering 2 x 5 MHz of the RFR Spectrum for the continued provision of 2G services with the technology-neutral approach it generally adopts for spectrum management. This is so as the CA has not proposed, and has no intention to restrict the use of the RFR Spectrum for the provision of 2G services only in the new term of assignment. The CA also does not agree that making the proposed offer of the RFR Spectrum conditional upon the continued provision of 2G services for a transitional period of the first three years of the new assignment term would prevent the MNOs from re-farming the spectrum to provide higher generation services. As a matter of fact, at the time when the CA considered the issue in the context of the First Consultation Paper, 2G service continuity was the primary justification for the proposed offer of the RFR Spectrum to the incumbent spectrum assignees under Option 3. It is therefore not unreasonable for those spectrum assignees taking up the RFR Spectrum to be required to continue to provide 2G services for at least a certain minimum period in the new assignment term, as proposed in the First Consultation Paper.

47. Having taken also into account the submissions from the two tourism organisations, the CA remains of the view that due regard has to be given to the provision of 2G services post spectrum re-assignment as they are

supported only by the 900/1800 MHz Spectrum. Considering the fact that only a relatively small amount (2 x 2.4 MHz) of spectrum is needed for the provision of 2G services, compared with the 2 x 10 MHz of spectrum in the 1800 MHz band which it may be assumed to be re-assigned as the RFR Spectrum to the incumbent spectrum assignees as per the Consultant's recommendation in order to safeguard the provision of 4G services in the Remaining MTR Stations, the burden to be imposed on MNOs is minimal especially as it is only for a short period.

48. Having considered the feedback of MNOs, that whether to continue to provide 2G services should be driven by their commercial considerations, the CA proposes to dispense with the fixed three-year timeline in 2G service provision as set out in the First Consultation Paper. To safeguard the interest of 2G service users in the years ahead, the CA proposes to introduce a new special condition ("SC") for incorporation into the Unified Carrier Licence ("UCL") of MNOs upon their exercise of the right to take up the RFR Spectrum, and/or their successful bidding of any frequency slot in the Auctioned Spectrum, requiring them to seek the prior consent of the CA and make arrangements for the affected customers to the satisfaction of the CA, before the phasing out of 2G services.

49. The CA also intends to impose this same requirement on the phasing out of any generation of mobile services in the future. Details of the new SC will be discussed in paragraph 118 below.

Efficient Spectrum Utilisation

50. The CA does not disagree with the views of HKT and Hutchison that the scarcity of spectrum and keen competition in the mobile telecommunications market contribute to efficient spectrum utilisation. The CA however finds it necessary to point out that the likelihood of keen service competition in the market **post** spectrum assignment does not undermine the compelling case for assignment of the scarce spectrum resource through a market-based approach as it remains the most effective means to ensure efficient spectrum utilisation. It is the latter but not the former which can ensure that the spectrum will be put into the hands of MNOs or new entrants which will value it the most and hence will put it to the most efficient use during the term of assignment.

51. Spectrum re-assignment upon expiry of the existing assignments does provide an opportunity for further enhancing the efficiency in spectrum utilisation. As mentioned by CMHK, the 900/1800 MHz Spectrum, which was first assigned in the 1990s, may not be able to cope with the market growth and developments over the past two decades. The CA is of the view that by adopting either the full-fledged market-based approach under Option 2 or the hybrid approach under Option 3 with all or a majority of the spectrum under re-assignment put to auction, MNOs will be given an opportunity to review their existing spectrum holdings across different frequency bands, their deployment and their network setup, and to acquire from the auction the amount of spectrum they actually need to fulfil their own business plans. A perpetual assignment of spectrum as envisaged under Option 1 does not afford MNOs any such opportunity.

52. The re-assignment exercise also provides an opportunity for the currently fragmented spectrum assignments to be consolidated prior to re-assignment. Generally speaking, MNOs can achieve higher spectral efficiency with carriers of larger bandwidths. To this end, defragmentation of the 900/1800 MHz Spectrum at the juncture of spectrum re-assignment is in the interest of ensuring efficient use of spectrum in the new 15-year term. The CA does not agree with HKT's argument that elimination of spectrum fragmentation could also be achieved even under Option 1, which is no more than a perpetual re-assignment of the currently fragmented 900/1800 MHz Spectrum. In this regard, an open, fair and transparent assignment process under the market-based mechanism as provided under Option 2 or Option 3 is preferred to the administrative-based assignment process under Option 1, in ensuring that individual frequency slots will be put into the hands of those operators which value them the most, and which would make the most efficient use of the spectrum. Further, taking into account the ever increasing demand for additional spectrum to meet the sustained increase in mobile data traffic, and the uncertainty as to whether any new spectrum will become available for the provision of public mobile telecommunications services before the Re-assignment of the 900/1800 MHz Spectrum in 2020/21, it is all the more important for the CA and the operators to work together to optimise the use of the existing spectrum. A perpetual assignment of spectrum as envisaged under Option 1 does not afford the CA and the MNOs this same opportunity.

Promotion of Effective Competition

53. HKT and Hutchison, and to a lesser extent CMHK cast doubts about the contribution that any new entrants may make to promoting effective competition in the mobile telecommunications market. They were also concerned about the possibility of a spectrum auction bringing in inefficient entrants. The CA is of the view that in a free market with no artificial and arbitrary restrictions like the telecommunications market in Hong Kong, the optimal number of players to serve the service users should be left to the market to decide. With such a sizeable amount of spectrum proposed to be made available through auction in the Re-assignment of the 900/1800 MHz Spectrum, the possibility of the emergence of new entrants should not be ruled out. By allowing all interested parties, including the incumbent spectrum assignees and potential new entrants, to vie for the spectrum that is put out for auction, market forces will determine the optimal distribution of spectrum among the market players. From this angle, Option 2 and Option 3 will be more conducive than Option 1 to the introduction of new competing players in the local mobile telecommunications service market.

54. If part of the 900/1800 MHz Spectrum is acquired by a new entrant, its spectrum deployment to service provisioning will be governed by the network and service rollout obligations as imposed in the UCL granted to it. The new spectrum assignee itself will also have every incentive to put the spectrum to effective use in order to recoup its investment. In fact, even without the entry of new players, competition among the incumbent spectrum assignees themselves will be enhanced in the long term through efficient re-distribution of the spectrum on a periodic basis upon expiry of spectrum assignments using the market-based approach. The business development of market players would not be constrained by the lack of spectrum, as they may bid for additional spectrum in the spectrum re-assignment process, which is not possible under Option 1 or the perpetual spectrum assignment scheme as advocated by HKT and Hutchison.

Encouragement of Investment and Promotion of Innovative Services

55. The CA notes the views of HKT and Hutchison that competition already obliges MNOs to continue to invest and innovate. As a matter of fact, competition has been a cornerstone for the success of Hong Kong's

telecommunications market and has proved to be an effective catalyst for new technologies and services over the years. The CA will not lose sight of the benefits of adopting a competitive approach in spectrum re-assignment, with the aim to ensure effective competition in the market.

56. By assigning all or part of the 900/1800 MHz Spectrum through auction, the incumbent MNOs which successfully acquire spectrum on top of their current level of holdings will invest to put the spectrum to effective use and to apply the spectrum for the provision of innovative services, as per the submissions of CMHK and SmarTone. If part of the re-assigned spectrum is taken up by new entrants, they will need to make investment to build the networks from scratch and put the spectrum to use in a timely manner. Besides, new entrants may also be potentially more innovative and act as the maverick in their business offerings in order to make early inroads into the keenly competitive mobile telecommunications market. From this angle, Option 2 and Option 3 will be more conducive than Option 1 to stimulating additional investments and developments of innovative telecommunications services in the local market.

Offer of the RFR Spectrum

57. Should the hybrid approach under Option 3 be adopted, MNOs hold different views on the amount and location of the RFR Spectrum which may be offered to the incumbent spectrum assignees.

58. The CA's view is that the amount of the RFR Spectrum should be no more than what is required to meet the need for which a public policy reason has been identified in the particular exercise to justify deviation from the market-based approach in spectrum re-assignment as required under the Spectrum Policy Framework. Hence, the amount of RFR Spectrum, which may be offered as part of any re-assignment arrangement, will have to be justified by and be dependent on the specific facts and circumstances of each case.

59. Given the analysis under the section on “**Ensuring Customer Service Continuity**” above, the CA's offer of the RFR Spectrum to MNOs in the current re-assignment exercise is intended primarily to safeguard the 4G service continuity for all MNOs in the Remaining MTR Stations on the one hand and to support the continued provision of 2G services on the other. The

proposed offer of the RFR Spectrum is not intended to help ensure general service quality of individual MNOs. MNOs should seek to achieve this through, for example, bidding for the necessary spectrum in the auction. Accordingly, the amount of RFR Spectrum should be no more than is needed to achieve the spectrum re-assignment objective of ensuring 4G service continuity in the Remaining MTR Stations and the continued provision of 2G services.

60. The request by HKT to mechanically follow the procedure for the re-assignment of the 3G Spectrum by adopting the proportion of at least two-thirds of the current spectrum holding as the RFR Spectrum is inappropriate, as it ignores the significant differences in the circumstances of the two re-assignments and in the respective justifications for the offer of RFR Spectrum. Also, the CA is mindful not to perpetuate the existing distribution of the 900/1800 MHz Spectrum among MNOs through such administrative means as, for example, setting the offer of RFR Spectrum at levels based on the MNO's respective current share of 900/1800 MHz Spectrum or their subscriber base.

61. Under the hybrid arrangements as envisaged in Option 3, the MNOs may, subject to the spectrum cap, acquire the optimal amount of spectrum through auction having regard to their commercial considerations, the size and mix of their customers, their frequency holdings in other bands and their individual business plans, rather than relying on an offer of a substantial block of the RFR Spectrum by the CA. In reality, MNOs which intend to maintain or improve the quality of their existing services will have every incentive to bid for additional spectrum and this will promote more efficient spectrum utilisation and effective competition. The CA therefore finds it neither appropriate nor necessary to make the offer of the RFR Spectrum correspond with the MNOs' current share of 900/1800 MHz Spectrum or subscriber numbers as suggested by HKT.

62. As to the exact location of the RFR Spectrum if Option 3 is adopted, the CA tends to agree with HKT and SmarTone that it should fall within the existing assignments of MNOs in the 900 MHz and 1800 MHz bands. By re-assigning to the four MNOs respectively those parts of their current spectrum holdings which coincide with the frequency ranges of their current spectrum deployment for the provision of 4G services at MTR premises, the offer of RFR Spectrum in this way will enable them, if taking up the offer, to continue to provide the 4G services in particular at MTR premises seamlessly

when the Re-assignment of the 900/1800 MHz Spectrum takes effect, thus achieving the spectrum re-assignment objective of ensuring customer service continuity.

Spectrum Utilisation Fee

63. Some respondents to the First Consultation Paper held the view that the SUF should not be set at a high level. Section 32I(2) of the TO stipulates that the SCED may by regulation prescribe the level of SUF or the method for determining the SUF. As a matter of policy and as enshrined in the Spectrum Policy Framework, a market-based approach in spectrum management will be used wherever the CA considers that there are likely to be competing demands from providers of non-Government services for the spectrum. More specifically, a market-based approach for spectrum management means methods relying on market forces to ensure the efficient use of spectrum as a scarce public resource. A SUF that reflects the full market value of the spectrum, as determined by the market through a competitive process, is important in ensuring that the spectrum resource is put into the hands of the MNOs which value it the most and which will consequently put it to the most efficient use. This market-based approach in determining SUF is well-trying out in Hong Kong for well over a decade.

64. The specific act of “setting” the SUF is primarily relevant in the context of Option 1 where a full-fledged administratively-assigned approach is proposed. In addition, there is also a need to set the SUF in relation to the RFR Spectrum (i.e. the minimum price) under Option 3 (i.e. the hybrid approach). Where the spectrum is assigned by way of auction in full under Option 2 or for the Auctioned Spectrum under Option 3, the SUF is so determined and the need to set the SUF falls away.

65. The SCED notes the responses to the proposal of setting two sets of SUF for the 900 MHz Spectrum and 1800 MHz Spectrum respectively (see paragraph 21 above). Admittedly, recent overseas experience indicates that one cannot be conclusive that the value of 900 MHz Spectrum as determined by auction is higher than that of 1800 MHz Spectrum¹³. This phenomenon may be better understood in the context of technological developments, in that

¹³ In Germany and Taiwan, the SUF fetched in the auctions conducted in June 2015 and November 2015 respectively for 1800 MHz Spectrum was higher than that for 900 MHz Spectrum; whereas in Thailand, the SUF fetched in the auction conducted in November 2015 for 900 MHz Spectrum was higher than that for 1800 MHz Spectrum.

in this day and age, radio propagation characteristic is not the sole factor that determines the market value of spectrum. To date, the 900 MHz Spectrum and 1800 MHz Spectrum may be equally or similarly attractive to the industry technically speaking given the good radio propagation characteristic of the 900 MHz Spectrum on the one hand and the common availability of equipment and user devices supporting the 1800 MHz band for the provision of 4G services on the other. Hence, it would no longer be appropriate to rely on the presumption that the 1800 MHz Spectrum should necessarily be subject to a lower SUF than that of the 900 MHz Spectrum.

66. In relation to the levels of SUF for the 900/1800 MHz Spectrum, the comments received in response to the First Consultation Paper notwithstanding, the SCED maintains the view that it would be more relevant and appropriate to set the SUF based on Hong Kong's past market benchmarks which were arrived at through the market after taking into account local factors (such as local business environment and the associated cost of building and maintaining a mobile network locally) rather than with reference to overseas spectrum auctions. By way of background, given the small geographical size of the territory and the high population density, the network rollout cost on a per customer basis in Hong Kong should be much lower than that in most other economies. Besides, the high mobile penetration rate of above 230% in Hong Kong contributes positively to operators' revenue. The levels of SUF as determined by auctions conducted in the past have the unique benefit of factoring in the local circumstances and as such should provide a highly relevant, if not the most relevant basis for the setting of SUF in the coming re-assignment exercise.

67. As regards the SUF for the RFR Spectrum under Option 3, the SCED notes that the submissions in general supported the setting of a cap for the SUF in respect of the RFR Spectrum. On the minimum level of the SUF of the RFR Spectrum, there were objections to the proposal to peg it at a level above the reserve price for the Auctioned Spectrum. There were suggestions that setting such a minimum level was not required and that the relevant SUF should be worked out simply by averaging the SUF fetched for the Auctioned Spectrum.

68. The above suggestion is fraught with difficulties, both in point of principle and also as a matter of practical consideration. First, in principle,

the minimum price for RFR Spectrum and the auction reserve price are two separate concepts and serve different purposes. The former is the minimum fee an incumbent spectrum assignee is required to pay in order to be entitled, and to be able to exercise the right of first refusal to be re-assigned part of its current spectrum holdings with certainty (i.e. without the risk of entering into any competitive bidding process), whereas the latter represents the minimum base value of the relevant spectrum for the purpose of kick-starting a competitive bidding process. In practical terms, the basis for calculating the two prices, viz. the amounts of RFR Spectrum and Auctioned Spectrum in question, is also different. The certainty in respect of spectrum re-assignment that is afforded the incumbent spectrum assignees without the need for any of them to go through the competitive bidding process explains why the minimum SUF for the RFR Spectrum should be set at a level different from, and in fact should in all circumstances above, the auction reserve price of the Auctioned Spectrum, upon which rounds of competitive biddings would be based. There is little justification therefore to artificially mix up the two concepts and the two basis and link the minimum level of the SUF for RFR Spectrum arbitrarily with whatever fractions of the SUF of the Auctioned Spectrum.

69. Practically speaking also, the timing and sequence of the exercise of the RFR and the conduct of the auction is also an important concern. The exercise of the RFR would take place well before the auction so as to provide certainty to all bidders, incumbents and new entrants alike, as to the amount of spectrum that would become available for assignment through the subsequent auction. This certainty is needed since with competitive spectrum demands, the quantum of spectrum available for auction would have a significant bearing on the ultimate auctioned prices, and leading on to that, the budgetary considerations of individual MNOs and their competitive bidding strategy and behavior. And yet, unless the incumbent spectrum assignees are advised of the necessary pricing information of the RFR Spectrum (including both the minimum and maximum levels as proposed by the SCED in the First Consultation Paper) at the time when they are required to take a decision on whether to take up the CA's offer of the RFR Spectrum, the incumbents would have, as they had unequivocally put forward in the context of the last spectrum re-assignment exercise, grave difficulties in making commercially sensible and rational decisions on the offer of RFR Spectrum. Against this analysis, the suggestion of linking the SUF for the RFR Spectrum, for consideration and decision by incumbents on the RFR Spectrum at a time prior to the auction,

with the SUF for the Auctioned Spectrum, which would only become known at a much later time upon completion of the auction, simply does not work. The failure of the incumbents to take decisions on the RFR Spectrum because of the uncertainty over the SUF would in turn lead to knock on effect on the auction due to the uncertainty over the total amount of spectrum that is available for competitive bidding. Such double uncertainties may well jeopardise the whole re-assignment exercise.

70. All things considered, the SCED holds the view that the minimum price for being offered and being able to exercise the relevant right of first refusal should be set above the reserve price. The incumbent spectrum assignees would be free to take their commercial decision on whether to exercise their right of first refusal. If they should exercise the right, they will enjoy the certainty of being re-assigned part of their current spectrum holding prior to their taking part in the subsequent competitive bidding process, albeit the possibilities that they may end up paying, for such re-assigned spectrum, a level of SUF higher than that in respect of the spectrum acquired through auction (i.e. in the event that the SUF of the Auctioned Spectrum is lower than the minimum price of the RFR Spectrum) do exist. If they are not prepared to take that commercial risk, the option is always open for them to not accept the RFR Spectrum offered by the CA and instead choose to compete with other bidders in the auction in the hope that they may be able to secure their desired spectrum at a lower SUF through the bidding process. The RFR Spectrum not taken up by the incumbent assignees will then constitute part of the Auctioned Spectrum. All bidders could then formulate their bidding strategies in line with their budgetary considerations with the full knowledge of the amount of Auctioned Spectrum available for bidding.

71. As to the issue of tax deductibility of SUF, this is fundamentally a matter of tax policy independent of the SCED's setting of the levels of SUF. In their submissions, HKT, Hutchison and SmarTone have asked for clarification with the IRD on the issue. The IRD has advised that our tax law generally allows deduction of revenue expenditure for profits tax purpose, but disallows deduction of capital expenditure unless such deduction is explicitly provided for in the tax law. Given that SUF payment is meant to cover the acquisition of the spectrum utilisation right for a term of 15 years, it would create an enduring benefit for the MNOs. For this reason, the IRD considers that SUF will be regarded as capital expenditure and therefore not tax

deductible irrespective of the method of payment (i.e. either in form of lump sum payment or annual installments). If MNOs have further enquiries on this issue, they should seek the advice of their own tax advisors and take such advice into consideration when making decisions relating to their investment in the upcoming spectrum re-assignment exercise.

PROS AND CONS OF THE THREE OPTIONS AGAINST THE MULTIPLE POLICY OBJECTIVES IN SPECTRUM RE-ASSIGNMENT

72. To recap, in accordance with the Spectrum Policy Framework, a market-based approach should be adopted for spectrum re-assignment 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. The CA has received no submission which challenges the preliminary view it reached in the First Consultation Paper, that there are likely to be competing demands for the 900/1800 MHz Spectrum, and thus it affirms this view in the Second Consultation Paper.

73. The CA expressed its concern in the First Consultation Paper over the need to ensure continuity in the provision of 2G services in the new spectrum assignment term to meet service demand. Having considered the submissions received and outcome of the Study, the CA accepts that in formulating the re-assignment arrangements, there is a need for the CA to also address the issue of 4G service continuity at the Remaining MTR Stations.

74. To facilitate its consideration of the way forward in light of the submissions received and the findings of the Study, the CA has evaluated the extent to which the three re-assignment options proposed in the First Consultation Paper may meet the multiple objectives in spectrum re-assignment, as detailed in the following paragraphs.

Ensuring Customer Service Continuity

75. From the perspective of customer service continuity, Option 1 has the merit in ensuring the continuity of 2G, 3G and 4G services, both territory-wide and in indoors areas such as the MTR premises.

76. As for Option 2, the CA's concern regarding 2G service continuity raised in the First Consultation Paper is shared by the two tourism organisations and acknowledged by the MNOs. As for 3G and 4G services, while the Consultant's assessment is that there is no issue of service degradation in general on a territory-wide basis, the continuity of 4G services in the Remaining MTR Stations is an issue of concern. The full-fledged market-based approach under Option 2 is the least effective of all options for ensuring 4G service continuity in the Remaining MTR Stations.

77. Under Option 3, the matter of 4G service continuity in the Remaining MTR Stations can be effectively addressed by re-assigning a minimum required amount of spectrum (i.e. 2 x 10 MHz of spectrum in the 1800 MHz band as per the recommendation of the Consultant in paragraph 43 above) to the MNOs through the offer of a right of first refusal. The spectrum so administratively assigned could also be used to cater for the territory-wide provision of 2G services so long as there is still demand from customers of the MNOs and inbound roamers for such services. The provision of 3G services would not in any case be affected by the present spectrum re-assignment exercise, as the amount of spectrum in the 900 MHz and 1800 MHz bands used for provision of 3G services (9 MHz) account for only 7% of the spectrum currently deployed for such service provision (see Table 2). Accordingly, Option 3 can be just as effective in meeting the objective of ensuring service continuity as Option 1.

Efficient Spectrum Utilisation

78. Option 1 will preserve the status quo of the present fragmented spectrum assignments and is the least likely of the options to ensure efficient spectrum utilisation as it will merely perpetuate the assignments of the 900/1800 MHz Spectrum for another 15-year term. Option 1 is thus the least effective among the three options in meeting the objective of ensuring efficient use of spectrum.

79. Option 2 affords the greatest flexibility for consolidating and re-organising the band plans for the 900/1800 MHz Spectrum before re-assignment. The market-based approach is also likely to ensure that spectrum, the scarce public resource, is assigned to those which value it the most, and hence could be expected to put it to its most efficient use.

Accordingly, this option should effectively ensure efficient spectrum utilisation in the new term.

80. Option 3 is likely to be just as effective as Option 2 in ensuring efficient utilisation of spectrum in the 900 MHz band, as all the 50 MHz, following consolidation into 2 x 5 MHz slots, would be re-assigned by way of auction. As to the spectrum in the 1800 MHz band, if the Consultant's recommendation is followed and a maximum of 2 x 40 MHz will be re-assigned to the incumbent MNOs through the offer of the right of first refusal, this will not prevent the consolidation of the currently fragmented assignments at the two ends of the band plan before an auction takes place. At least 2 x 35 MHz of spectrum in frequency slots of 2 x 5 MHz or 2 x 10 MHz will remain available for competitive bidding. These factors should effectively ensure efficient spectrum utilisation in the new assignment term.

81. In addition, both Option 2 and Option 3 are likely to contribute to more efficient spectrum utilisation by allowing MNOs the opportunity to optimise their respective spectrum holdings, by adding to their holdings of the 900/1800 MHz Spectrum through the auction or reducing them, taking into account their spectrum holdings in other frequency bands so as to support their business plans. Further, any new entrant acquiring some of the 900/1800 MHz Spectrum from the auction is likely to make efficient use of the spectrum to provide new services to consumers.

Promotion of Effective Competition

82. Option 1 maintains the status quo, and amounts to a de facto perpetuation of the existing assignments and distribution of the 900/1800 MHz Spectrum among MNOs in the new 15-year term and effectively rules out the possibility of a new entrant. It is the least effective in stimulating competition in the local mobile telecommunications market in the new assignment term.

83. Option 2, which would put out all the 200 MHz of 900/1800 MHz Spectrum for auction, will provide the greatest opportunity for existing spectrum assignees to bid for the spectrum they need to compete effectively for customers in the new term of assignment. It also affords new entrants the opportunity to enter the market by acquiring the necessary spectrum.

84. To the extent that there will be at least 2 x 60 MHz or 60% of the 900/1800 MHz Spectrum available for auction under Option 3, it would be more effective than Option 1, and should not be materially less effective than Option 2 from the perspective of stimulating competition. It is notable that the 120 MHz of spectrum which may be released by auction would be one of the largest lot of spectrum to be released via a single auction through competitive bidding by all interested parties¹⁴.

85. In a fully liberalised and keenly competitive telecommunications market as in Hong Kong, the optimal number of players would best be left to the market to decide. This could be achieved under Option 2 and Option 3, but not Option 1.

Encouragement of Investment and Promotion of Innovative Services

86. Option 1 may arguably provide a greater certainty of spectrum holdings for the incumbent assignees and thus be more conducive to a stable business environment for their investment, in comparison with Option 2 or Option 3, where they may need to participate in an auction for the Re-assignment of the 900/1800 MHz Spectrum and the outcome is uncertain. Under Option 1 however, MNOs are subject to considerably less competitive pressure posed by, for example, new entrants and this would not be conducive to innovation in service packaging and provision. While the CA acknowledges that the currently keen competition in the telecommunications market already encourages MNOs to continue to invest and innovate, the adoption of a market-based approach to spectrum re-assignment under Option 2 and Option 3 would nevertheless serve to encourage investment and promote innovative services by existing operators and new entrants alike, something which Option 1 is not capable of achieving.

87. In contrast, Option 2 can arguably best achieve the benefits of bringing in new player(s) which can be expected to readily invest in innovative solutions for customers in order to compete for market share with the incumbent MNOs. However, this option was generally regarded by the MNOs as creating a business environment which would not be conducive to

¹⁴ There have been two auctions conducted by the former Telecommunications Authority releasing more than 120 MHz of spectrum for competitive bidding at a time. They were the auctions for 138.4 MHz of spectrum in the 1.9 – 2.2 GHz band in 2001 and another for 195 MHz of spectrum in the 2.3 GHz and 2.5/2.6 GHz bands in 2009.

investment, as there would be uncertainty as to the exact spectrum holdings they may end up with after the spectrum auction as mentioned above.

88. In between Option 1 and Option 2, a suitably constructed Option 3 would strike a balance between the need for a level of certainty for investment and the achievement of other objectives in spectrum re-assignment. Under Option 3, the incumbent MNOs, having been offered the RFR Spectrum, can continue to invest to most effectively utilise this spectrum and/or aggregate it with spectrum in the other frequency bands for better service provision. Once the auction to be conducted for the Re-assignment of the 900/1800 MHz Spectrum is completed which will be at least two years prior to the expiry of the existing assignments, the incumbent and any new spectrum assignees will have certainty as to the exact spectrum holdings they will have. This will enable them to invest effectively in the new assignment term. The creation of a more competitive mobile telecommunications environment under both Option 2 and Option 3, as compared to Option 1, will also facilitate the introduction of innovative services.

SPECTRUM RE-ASSIGNMENT OPTION THAT BEST MEETS THE MULTIPLE OBJECTIVES IN SPECTRUM ASSIGNMENT

89. Having carefully considered the submissions received in the first round of public consultation, the analysis and recommendation of the Consultant in the Study, the pros and cons evaluation of the three options against the multiple objectives in spectrum re-assignment as outlined above, and in particular the need to safeguard the provision of 4G services in the Remaining MTR Stations and to ensure the provision of 2G services on a territory-wide basis post 2020/21 which constitute the overriding public policy reasons for deviating partially from a full-fledged market-based assignment approach required otherwise in accordance with the Spectrum Policy Framework, the CA's considered view is that the hybrid administratively-assigned cum market-based approach under Option 3 (with the RFR Spectrum suitably adjusted as per the Consultant's recommendation) should be adopted for further consultation with the industry and other affected persons in the second round of public consultation, for it is the option that best meets the multiple objectives for the spectrum re-assignment.

90. For the purpose of the second consultation, the CA proposes that a hybrid administratively-assigned cum market-based approach under Option 3, comprising the following elements, should be adopted for the Re-assignment of the 900/1800 MHz Spectrum, viz. –

- (a) 2 x 10 MHz of spectrum in the 1800 MHz band to be re-assigned to each of the four incumbent spectrum assignees through the offer of a right of first refusal, i.e. a total of 2 x 40 MHz or 40% of the 900/1800 MHz Spectrum to be re-assigned as the RFR Spectrum; and
- (b) the remaining spectrum in the 1800 MHz band and all the spectrum in the 900 MHz band to be assigned by way of auction, i.e. a total of 2 x 60 MHz or 60% of the 900/1800 MHz Spectrum to be auctioned.

Question 1: What are your views on the proposals of the CA to adopt the hybrid administratively-assigned cum market-based approach for the Re-assignment of the 900/1800 MHz Spectrum, by re-assigning 2 x 10 MHz of spectrum in the 1800 MHz band to each of the incumbent spectrum assignees through the offer of a right of first refusal, based on the overriding public policy reasons of safeguarding the provision of 4G services in the Remaining MTR Stations, and ensuring territory-wide continuity of 2G services if demands exist post 2020/21, and re-assigning the rest of the 900/1800 MHz Spectrum by way of auction?

THE SCED'S PROPOSAL ON SUF

91. In the First Consultation Paper, the SCED proposed that there should be two sets of SUF for the 900 MHz Spectrum and 1800 MHz Spectrum respectively, and that the SUF in respect of the former should be set at a level higher than that of the latter. As indicated in paragraph 64 above, the specific act of “setting” the SUF is primarily relevant in the context of Option 1 and in relation to the RFR Spectrum in the context of Option 3. The CA’s considered view as set out above is that Option 3 should be adopted for further consultation. As the SUF for the Auctioned Spectrum will be determined by

auction, the ensuing discussion in relation to the SCED's proposal on SUF will focus on the minimum price for the RFR Spectrum, which is proposed to be located in the 1800 MHz band.

Auction reserve price for Auctioned Spectrum

92. The CA proposes that all spectrum in the 900 MHz band and 2×35 MHz of 1800 MHz Spectrum will be put to auction. The SUF of such spectrum should naturally be determined by auction, and the need for the SCED to set the SUF in respect of this spectrum band would not arise.

93. As to the **auction reserve price** to be set by the SCED for the Auctioned Spectrum, for the reasons as discussed in paragraphs 65 above, viz. it would no longer be appropriate to rely on the presumption that the 1800 MHz Spectrum should necessarily be subject to a lower SUF than that of the 900 MHz Spectrum (hence by extension, a lower reserve price to kick-start the bidding process), the SCED proposes that the auction reserve price for both the 900 MHz Spectrum and 1800 MHz Spectrum should be set at the same level.

94. The auction reserve price is not intended to be set as a pre-estimate of an expected market price, but it should be set at a level that represents the minimum base value of the spectrum for the purpose of kick-starting the competitive bidding process. In the First Consultation Paper, it was proposed that in setting the auction reserve price, reference should be made to the levels of SUF as determined in recent auctions. We note from developments since, and that under the revised Option 3 proposed by the CA in this second round of consultation, at least 120 MHz of spectrum, among the largest lot for release through auction in one go, would be made available for competitive bidding in the upcoming re-assignment exercise. We need to be conscious of the effect the release of such a large quantum of spectrum through auction would have on its market value. Taking into account the specific circumstances of the present spectrum re-assignment exercise, the auction reserve price should be set at a level giving due regard to the spectrum supply situation, and with the objective of encouraging all bidders, incumbents and new entrants alike, to take active part in rounds of competitive bidding. With these considerations in mind, the SCED considers that instead of benchmarking the auction reserve price against the **final** auctioned prices of the recent auctions, the **starting** prices, viz. the auction reserve prices for the two most recent auctions in

respect of the 50 MHz of spectrum in the 2.5/2.6 GHz band and 49.2 MHz of 3G Spectrum conducted in March 2013 and December 2014 respectively, could serve as a reasonable starting point for reference.

95. By way of background, the auction reserve prices in relation to the auction of spectrum in the 2.5/2.6 GHz band and 3G Spectrum conducted in March 2013 and December 2014 were \$15 million per MHz and \$48 million per MHz respectively then, and are equivalent to \$19 million per MHz and \$54 million per MHz respectively at 2021 price level having adjusted for inflation. Between the two, the auction of the 3G Spectrum relatively carries a greater reference value than that of the 2.5/2.6 GHz band. The reasons are two-fold. First, it may be noted that both the 900/1800 MHz Spectrum and 3G Spectrum have been used for the provision of public mobile telecommunications services in the whole territory including all stations along the MTR lines, whereas spectrum in the 2.5/2.6 GHz band has yet to be fully deployed along the MTR lines. Second, the auction of the 3G Spectrum was conducted more recently in 2014. Having also considered other relevant factors including but not limited to the uncertainty of supply of new spectrum for public mobile telecommunications services before the Re-assignment of the 900/1800 MHz Spectrum in 2020/21, and that the demand for spectrum would likely be driven up with the advent of future generation mobile services as mentioned in paragraph 63 of the First Consultation Paper, the SCED proposes that the auction reserve price for both 900 MHz Spectrum and 1800 MHz Spectrum may be set between \$19 million per MHz and \$54 million per MHz, and his present inclination is that the final value would be closer to the higher end.

SUF for the RFR Spectrum

96. The CA proposes that 2×10 MHz of spectrum in the 1800 MHz band will be administratively assigned to each of the four incumbent spectrum assignees via the right of first refusal (in other words, a total of 2×40 MHz of spectrum will be set aside as RFR Spectrum).

97. Following the proposal in the First Consultation Paper, the SCED proposes that the SUF of the RFR Spectrum should be set at the average SUF of the Auctioned Spectrum in the same frequency band, subject to a **minimum price** and a **cap**, both to be set by the SCED.

98. The minimum price for the RFR Spectrum is the minimum fee an incumbent spectrum assignee has to pay to be entitled, and to be able to exercise the right of first refusal to be re-assigned part of its current spectrum holdings. The SCED considers that the estimated market value of spectrum in the 1800 MHz band should be close to the value of spectrum in frequency bands with similar propagation characteristics as determined in assignments conducted in recent years, and therefore, in setting the minimum price, is of the view that reference should be made to the levels of SUF for spectrum in the 2.5/2.6 GHz band and 3G Spectrum as determined by the auctions conducted in March 2013 and December 2014 respectively. In addition, the value of the RFR Spectrum in the 1.9 - 2.2 GHz band which was taken up by the operators in 2016 is also relevant as it is the value that MNOs were willing to pay in a keenly competitive telecommunications market in Hong Kong.

99. By way of background, the SUF in relation to the spectrum in the 2.5/2.6 GHz band and 3G Spectrum assigned in March 2013 and December 2014 were \$30.8 million per MHz¹⁵ and \$59 million per MHz¹⁶ respectively then, and are equivalent to \$38 million per MHz and \$67 million per MHz respectively at 2021 price level having adjusted for inflation. Along with the considerations underlying the setting of the auction reserve price (see paragraph 95 above), the SCED proposes that the minimum price for the RFR Spectrum for the 1800 MHz Spectrum may be set between \$38 million per MHz and \$67 million per MHz, and his present inclination is that the final value would be closer to the higher end.

100. As for the cap for the RFR Spectrum, relevant factors that have to be considered include the estimated market value of 1800 MHz Spectrum, the need to provide a level playing field for the incumbent spectrum assignees and the successful bidders of the Auctioned Spectrum, as well as the need to address the concern of the incumbent spectrum assignees over the lack of certainty by the dependence of the SUF of the RFR Spectrum on that of the Auctioned Spectrum. Having considered these relevant factors, the SCED proposes that the cap should be set at around 30% to 40% higher than the minimum price for the RFR Spectrum.

¹⁵ The SUF for spectrum in 2.5/2.6 GHz band was determined entirely by auction, and the value indicated represents the one determined by auction.

¹⁶ The 3G Spectrum was assigned partly by auction and partly by the offering of right of first refusal. The value indicated is the weighted average of the SUF determined through the two methods.

Method of Payment

101. The current re-assignment exercise involves a total of 200 MHz of spectrum, which is more than that in the last re-assignment exercise (namely the re-assignment for the 3G Spectrum in 2016) by some 80 MHz or 69%. The amount of SUF involved is potentially substantial. There are merits to provide flexibility for MNOs to make financial arrangement for the payment of SUF having regard to their individual financial situation. As such, the SCED considers that there is a case to allow the MNOs to have a choice of the method of payment by lump sum payment upfront as is the case in the 3G Spectrum re-assignment exercise or by annual installments.

102. More specifically, the SCED proposes that the spectrum assignees will be given a choice to pay the SUF either by –

- (a) lump sum payment upfront, which is the lump sum amount obtained in auction and/or via right of first refusal as elaborated in paragraphs 92 – 100 above; or
- (b) annual installments, with the first installment equivalent to the lump sum amount obtained in (a) above divided by 15 (i.e. the number of years of assignment), and subsequent installments increased every year by a pre-set fixed percentage which aims to reflect the time value of money to the Government.

Question 2: What are your views and comments on the methods of setting the SUF as proposed in paragraphs 92 – 100 above?

Question 3: What are your views and comments on the method of payment of SUF?

PROPOSED FRAMEWORK FOR SPECTRUM RE-ASSIGNMENT

Proposed Band Plans and Location of the RFR Spectrum

103. As illustrated in the First Consultation Paper, in order to address the problem of the currently fragmented spectrum assignments in the 900 MHz and

1800 MHz bands and to attain higher spectral efficiency, we consider it important for the 900/1800 MHz Spectrum to be defragmented and consolidated into more efficient frequency slots for re-assignment in the new term. In this regard, although the 4G technology supports a range of carrier bandwidths in terms of 1.4, 3, 5, 10, 15 or 20 MHz, spectral efficiency will be higher for carriers with larger bandwidths. On the other hand, the provision of 3G services typically requires a carrier bandwidth of 5 MHz.

104. With the general support of the industry, the CA maintains its position as set out in the First Consultation Paper that the 2 x 75 MHz of spectrum in the 1800 MHz band will be restructured into as many frequency slots of 2 x 10 MHz each as possible, with a few 2 x 5 MHz slots. Frequency slots of these sizes will minimise the degree of spectrum fragmentation after the re-assignment and afford operators the opportunities to bid for spectrum to achieve a larger frequency slot of say 2 x 20 MHz, which is currently the maximum carrier bandwidth supported by the 4G long term evolution or LTE technology.

105. As to the band plan for the 1800 MHz band, it will also take into account the RFR Spectrum proposed to be re-assigned to the incumbent spectrum assignees. To safeguard the provision of 4G services in the Remaining MTR Stations after spectrum re-assignment, which is a major justification for the offer of the RFR Spectrum, the MNOs should be assigned the same slots in the 1800 MHz band they currently occupy as their RFR Spectrum. In this way, any need for system reconfiguration for the POI in the IRS will be obviated or minimised. As shown in the band plan in [Figure 1](#), the location of the RFR Spectrum basically follows the spectrum currently deployed by MNOs for the provision of 4G services at MTR premises¹⁷. The band plan so designed also provides the opportunity for all the four MNOs to bid at auction for the remaining 1800 MHz spectrum and to hold up to 90 MHz of spectrum in the 1800 MHz band subject to the spectrum cap (to be discussed in paragraphs 111 – 112 below).

¹⁷ For better management of the spectrum, the proposed band plan for the 1800 MHz band will incorporate slight adjustments to the existing band plan such that the frequency boundaries of the assignments will start and end at integer values.

Figure 1: Proposed Band Plan for the 1800 MHz Frequency Band

	10	10	10	10	10	10	10	5	
Lower band	1710	1720	1730	1740	1750	1760	1770	1780	1785 MHz
Upper band	1805	1815	1825	1835	1845	1855	1865	1875	1880 MHz

RFR Spectrum to be offered to HKT RFR Spectrum to be offered to CMHK
 RFR Spectrum to be offered to SmarTone RFR Spectrum to be offered to Hutchison
 Frequency slots to be assigned by way of auction

Question 4: What are your views on the band plan proposed above for the re-assignment of the 2 x 75 MHz of spectrum in the 1800 MHz band? Would you consider the proposed frequency slots to be re-assigned to individual incumbent spectrum assignees as the RFR Spectrum an optimal arrangement from the industry's point of view?

106. For the spectrum in the 900 MHz band, the CA maintains its proposal as set out in the First Consultation Paper that the 2 x 25 MHz of spectrum will be restructured into frequency slots of 2 x 5 MHz each, taking into account the scarcity of the sub-1 GHz spectrum and the already satisfactory performance of a 2 x 5 MHz slot in providing service coverage. Under the proposed hybrid approach, all the spectrum in the 900 MHz band will be re-assigned by auction. The band plan in Figure 2 below is proposed accordingly. Subject to the spectrum cap in auction, bidders may bid freely for frequency slots in the 900 MHz band.

Figure 2: Proposed Band Plan for the 900 MHz Frequency Band

	5	5	5	5	5	
Lower band	890	895	900	905	910	915 MHz
Upper band	935	940	945	950	955	960 MHz

Frequency slots to be assigned by way of auction

Question 5: What are your views on the band plan proposed above for the re-assignment of the 2 x 25 MHz of spectrum in the 900 MHz band?

Auction Design

107. Under the hybrid approach proposed by the CA, while at least 2 x 60 MHz of the 900/1800 MHz Spectrum will be available for auction, the exact amount will depend on whether the incumbent spectrum assignees will exercise their right to acquire the RFR Spectrum proposed to be offered to them in the 1800 MHz band. A single spectrum auction is proposed to be conducted for the re-assignment of the spectrum in both the 900 MHz and 1800 MHz bands, such that bidders would be able to bid for the spectrum in these two frequency bands in one go.

Eligible Bidders

108. With the support of the industry, the CA maintains its position as set out in the First Consultation Paper to open the auction to all interested parties for the Re-assignment of the 900/1800 MHz Spectrum, including the incumbent spectrum assignees and any new entrants to the local mobile telecommunications market. For the four MNOs, they may take part in the auction whether or not they have exercised their right to acquire the RFR Spectrum proposed to be offered to them, and both they and any new entrants will be subject to the spectrum cap to be imposed on each bidder as discussed below.

Auction Format

109. It is proposed that the Auctioned Spectrum be assigned by way of auction using the Simultaneous Multiple Round Ascending (“SMRA”) format. Under this format, all the available slots in the two frequency bands will be auctioned simultaneously over multiple rounds with price adjustment on each frequency slot independently. In each round, bidders may bid for one or more slots, hold or withdraw any standing highest bid submitted in the immediately preceding round subject to a potential withdrawal liability, or exercise a waiver. The SMRA format has been adopted by the CA (and the former Telecommunications Authority (“TA”)) in all the applicable auctions of frequency spectrum since 2009. The recent examples are the auctions of spectrum in the 2.5/2.6 GHz band in March 2013 and 3G Spectrum in December 2014. Hence, the industry should be well familiar with this auction format.

Question 6: What are your views on the use of the SMRA format that has been adopted in the spectrum auctions held by the CA in recent years to auction off the Auctioned Spectrum in the 900 MHz and 1800 MHz bands?

Spectrum Cap

110. Under the hybrid approach proposed by the CA, at least 120 MHz or more than one-fifth of the total amount of spectrum (i.e. 552 MHz) currently assigned for the provision of public mobile telecommunications services will be put out for auction. In order to avoid high concentration of spectrum holdings in certain spectrum assignees which may lead to distortion of competition and cause harm to consumers, the CA affirms its view as set out in the First Consultation Paper that a cap should be imposed on the amount of the 900/1800 MHz Spectrum that may be acquired by an independent party or its associated parties as a whole.

111. The industry generally agreed to the spectrum cap proposal. Some operators suggested lowering the spectrum cap to less than 90 MHz. Using the size of the current spectrum holdings of MNOs as the starting point¹⁸, the CA remains of the view that, as per its position as set out in the First Consultation Paper, the overall spectrum cap should be set at 90 MHz, which is equivalent to the holding of the MNO which currently has the largest assignment of 900/1800 MHz Spectrum. The spectrum cap will apply to all bidders and cover both the RFR Spectrum and the Auctioned Spectrum. Thus, if an incumbent spectrum assignee has exercised its right to acquire the 20 MHz of RFR Spectrum, it will be eligible to acquire at most 70 MHz of the 900/1800 MHz Spectrum from auction.

112. The CA also maintains its proposal in the First Consultation Paper that a sub-cap of 20 MHz be imposed on the holding of spectrum in the 900 MHz band, such that the number of spectrum assignees in this band will not be reduced from the present three and there will be room for five at most. This is in view of the superb radio propagation and penetration characteristics of sub-1 GHz spectrum and hence the need to avoid high concentration of the

¹⁸ This refers to the position of MNOs' spectrum holdings as from 22 October 2016 following the re-assignment of the 3G Spectrum. For the reasons for using this as the starting point in setting the size of the spectrum cap, please see paragraph 81 of the First Consultation Paper.

spectrum in just one or two assignees. Again, this spectrum sub-cap will apply to the incumbent MNOs and new entrants alike. It will be counted towards the overall spectrum cap of 90 MHz for the holding of the 900/1800 MHz Spectrum by individual spectrum assignees. As stated in the First Consultation Paper, the spectrum sub-cap will not take into account the spectrum in the 850/900 MHz bands currently held by some of the MNOs¹⁹, as the assignment dates and conditions for those spectrum assignments are different from those of the 900/1800 MHz Spectrum which is subject to re-assignment in this exercise.

Licensing Arrangements

Spectrum Assignment Periods

113. In order to facilitate a smooth handover of spectrum among the incumbent spectrum assignees and any new spectrum assignees, and to simplify future administrative arrangements, the CA proposed in the First Consultation Paper that the new spectrum assignment periods for all spectrum in the 900 MHz band be aligned to 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 calendar days from 20 November 2020, and for SmarTone by eight calendar days from 4 January 2021, subject to their payments of SUF for the use of the spectrum during the extended assignment periods. The proposal has the support of all the four MNOs. The CA maintains its proposal as set out in the First Consultation Paper that the new 15-year term of assignments²⁰ for the 2 x 25 MHz of spectrum in the 900 MHz band will be from 12 January 2021 to 11 January 2036.

¹⁹ HKT currently holds 2 x 7.5 MHz of spectrum in the 850 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 assignments will last until 2026.

²⁰ 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.

114. The SCED proposes in the First Consultation Paper 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. SmarTone had no objection to the proposed arrangements, while Hutchison considered that SUF in general should be set at a minimal level. Since the proposed extensions of existing assignments involve just a short period of time, for the sake of administrative convenience, the SCED maintains his proposal in the First Consultation Paper that the SUF for such extended periods should be based on the level of royalty payment the spectrum assignees have to pay for the year just before the expiry of the existing assignments.

115. 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 also maintains its view as set out in the First Consultation Paper that it is not 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 new 15-year term of assignments for the 2 x 75 MHz of spectrum in the 1800 MHz band will take effect from 30 September 2021 and expire on 29 September 2036.

116. MNOs having exercised their right to acquire the RFR Spectrum and/or having successfully bid for the Auctioned Spectrum, as well as any new entrant(s) having successfully bid for the Auctioned Spectrum will each be granted a new UCL to effect the spectrum assignment upon commencement of the new assignment term. The UCL will authorise a spectrum assignee to provide such fixed, mobile, or a combination of both services as proposed by that assignee. If the spectrum assignee is an existing UCL holder, it may request to merge its existing UCL with the new UCL issued for the Re-assignment of the 900/1800 MHz Spectrum.

Special Condition on the Phasing out of 2G and Other Generations of Mobile Services

117. The CA is concerned that the Re-assignment of the 900/1800 MHz Spectrum may precipitate a premature termination of 2G services in the event that MNOs are not able to secure their desired amount of the 900/1800 MHz Spectrum for the provision of 3G and 4G services, and hence proposed in the

First Consultation Paper to set aside a small amount of the 900/1800 MHz Spectrum for the purpose of incentivising MNOs to continue to provide 2G services during a three-year transitional period from the commencement of the new assignment term. Although the proposal only has the support from the two tourism organisations and a few respondents but not the MNOs, the CA considers that there is a need to safeguard the provision of 2G services so long as there is demand for such services from local users and inbound roamers using 2G-only handsets.

118. As discussed in paragraph 48 above, rather than imposing a three-year transitional 2G service requirement as set out in the First Consultation Paper, the CA proposes to introduce a new SC for incorporation into the UCL of MNOs, upon their exercise of the right to take up the RFR Spectrum, and/or their successful bidding of any frequency slot in the Auctioned Spectrum, requiring them to seek the prior consent of the CA and to make satisfactory arrangements for the affected customers before it moves on to phase out the provision of 2G services. In this connection, a MNO may decide out of its own commercial consideration to phase out its provision of 2G services but before it may do so, it must put in place reasonable and appropriate arrangements for its subscribers which satisfy the CA, such as migration of 2G subscribers to 3G or 4G services, or continued provision of 2G services using the networks of other MNOs by entering into relevant wholesale or other forms of commercial arrangements. In anticipation of the possible need to similarly phase out 3G or 4G services in the future, the CA sees benefits, on public interest grounds, in applying this requirement across the board to different generations of mobile services such that MNOs must seek the prior consent of the CA and make satisfactory arrangements for the affected customers before phasing out any generation of mobile services being provided under their licences. The same requirement will also be applicable to any new entrants. To formalise the requirement, the CA proposes to impose the new SC 10.4 below under the existing SC 10 on all licensees authorised to provide public mobile telecommunications services –

PROVISION OF SERVICE

10.4 The licensee shall seek the prior written consent of the Authority and make proper and appropriate arrangements for the affected customers which satisfy the Authority before ceasing to provide a generation of mobile service.

Question 7: What are your views on the proposed SC requiring all licensees to seek the prior consent of the CA and to make proper arrangements for the affected customers before phasing out their provision of 2G services and other generations of mobile services in the future?

Network and Service Rollout Obligations

119. The CA proposed in the First Consultation Paper that a more stringent network and service rollout requirement be imposed on the 900/1800 MHz Spectrum than that for spectrum in the other frequency bands, due to the superb radio propagation characteristics of spectrum and its current extensive usage for the provision of mobile network coverage. With the general support of the industry, the CA remains of the view that a requirement should be imposed on the spectrum assignees to meet the network and service rollout requirement for any acquired spectrum in the 900 MHz and 1800 MHz bands respectively, i.e. to provide a minimum coverage of 90% of the population of Hong Kong in the case of mobile services, and 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 commencement date of the new assignment term for the spectrum in the 900 MHz band and that this shall be maintained thereafter. The same requirement shall apply for the new assignment of spectrum in the 1800 MHz band.

120. The above network and service rollout obligations will be imposed on successful bidders which newly acquire spectrum in the 900 MHz and 1800 MHz bands and on existing MNOs which acquire the Auctioned Spectrum they do not currently hold. In the case of the incumbent spectrum assignees acquiring the RFR Spectrum and the Auctioned Spectrum currently held by them, to be fair to all the parties concerned, they should provide network coverage figures demonstrating their networks operating with the 900/1800 MHz Spectrum fulfilling the 90% minimum population coverage requirement, and shall maintain such network coverage throughout the new spectrum assignment term.

Performance Bond for Rollout Obligations

121. To ensure compliance with the network and service rollout obligations, each of the spectrum assignees within the following three groups will be required to lodge a performance bond in an amount to be specified by the CA in the information memorandum to be issued for the auction of the Auctioned Spectrum: (a) the successful bidders which have newly acquired spectrum in the 900 MHz and 1800 MHz bands; (b) the existing MNOs that are assigned the Auctioned Spectrum that they do not currently hold; and (c) the incumbent spectrum assignees which are re-assigned the 900/1800 MHz Spectrum currently deployed by them for service provision but whose networks have not reached the 90% minimum population coverage requirement. These are as proposed in the First Consultation Paper and have the general support of the industry.

Question 8: Do you have any views on other aspects of the proposed framework for the Re-assignment of the 900/1800 MHz Spectrum not explicitly asked in the questions set out in the paragraphs above?

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

122. Of the 900/1800 MHz Spectrum, 2 x 4 MHz in the frequency range of 1780.9 – 1784.9 MHz paired with 1875.9 – 1879.9 MHz (“Country Park Frequencies”) has been assigned to three MNOs (viz. CMHK, HKT and SmarTone) for the provision of mobile coverage in the country parks and remote areas specified as the designated areas²¹, and no SUF is payable for such purpose. While most of the assigned frequencies in these areas are used by MNOs for the provision of 2G services, MNOs have also deployed their other assigned spectrum at these sites for the provision of 3G and 4G services, and at other sites in the country park areas for mobile coverage in general.

123. Notwithstanding their own initiatives in providing coverage to the country park areas, the MNOs supported the proposal as set out in the First

²¹ 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.

Consultation Paper, that the Country Park Frequencies should be re-assigned administratively to them free of SUF upon expiry of the existing assignments for another 15 years until 29 September 2036, i.e. the same as the new term of assignments for all the spectrum in the 1800 MHz band. The CA and the SCED consider it appropriate to maintain their position in this regard, to ensure continuous provision of mobile service coverage in the designated areas particularly for the support of emergency communications. MNOs will be invited to apply for such an administrative re-assignment in due course, with a plan showing the use of the frequencies in the next term of the assignments for consideration by the CA. Such an arrangement will not affect the use of the frequency spectrum outside the designated areas, which may be offered as the RFR Spectrum to any of the incumbent spectrum assignees or put to auction for bidding by any interested parties.

WAY FORWARD

124. The CA and the SCED will carefully consider the views and comments received in response to the Second Consultation Paper, and insofar as it is practicable in the circumstances shall endeavour to announce by around the end of 2017 their respective decisions on the arrangements for the Re-assignment of the 900/1800 MHz Spectrum and the related SUF, thereby giving a three-year advance notice to the incumbent spectrum assignees of any possible variation to their existing spectrum assignments.

125. After the announcement of the respective decisions of the CA and the SCED, the Government will prepare for the amendment of the relevant subsidiary legislation and enactment of new subsidiary legislation to enable the Re-assignment of the 900/1800 MHz Spectrum. The current target is to have the new subsidiary legislation ready in 2018, such that both the offer of the RFR Spectrum to the incumbent spectrum assignees and the conduct of any auction for the Auctioned Spectrum could be carried out and completed by end 2018 or early 2019. There will thus be a transitional period of about two years for the incumbent spectrum assignees to prepare for the handover of the spectrum in the 900 MHz band, and more than two and a half years for the handover of the spectrum in the 1800 MHz band. Moreover, the new spectrum assignees will be able to prepare for the roll-out of the network using the newly acquired spectrum during these two to three years.

**Commerce and Economic Development Bureau
(Communications and Creative Industries Branch) and
Office of the Communications Authority
14 February 2017**

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**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**

**Summary of Submissions to the First Consultation Paper and
the Responses of the CA and the SCED**

The views and comments received in response to the 16 questions put forward in the First Consultation Paper are summarised in the following paragraphs, together with the responses of the CA and the SCED.

Option 1: Full-Fledged Administratively-Assigned Approach

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?*

Views and Comments of the Respondents

2. HKT and Hutchison considered that there were overriding public policy reasons justifying the CA not adopting a market-based approach for the Re-assignment of the 900/1800 MHz Spectrum pursuant to the Spectrum Policy Framework, and they both favoured Option 1. Pointing to the large amount of spectrum involved in the present spectrum re-assignment exercise and the envisaged exponential increase in data traffic, HKT contended that there would be a real risk of major service continuity and thus compelling public policy reasons for not adopting a market-based approach. Hutchison also considered there to be overriding public policy reasons as to why an auction should not be conducted for re-assigning the concerned spectrum. These included disruption to customer services especially along the MTR lines,

the possibility of spectrum auction causing reduced data speed and lower spectral efficiency due to “hoarding” of spectrum by successful bidders which aimed to exclude competitors and did not put the acquired spectrum to immediate use, and the creation of an uncertain business environment. Top Express argued that the incumbent spectrum assignees should have a legitimate expectation for spectrum renewal in order for them to make sound business decisions. There were other company respondents and a vast majority of the individuals making submissions in support of Option 1, and they relied primarily on the grounds of ensuring customer service continuity, provision of a stable operation and business environment, and saving the cost and resources for network reconfiguration.

3. CMHK and SmarTone did not consider that there should be any overriding public policy reason justifying the CA not adopting a market-based approach for the Re-assignment of the 900/1800 MHz Spectrum. They did not favour Option 1 as it would meet only one of the four identified objectives in spectrum re-assignment, i.e. ensuring customer service continuity. SmarTone considered that Option 1, by preserving the current asymmetry in spectrum holdings stemming from the merger of two MNOs in 2014, would prevent rationalisation of spectrum distribution in the 1800 MHz band. It held the view that a continued over-concentration of spectrum in the band would harm competition in the market.

The Responses of the CA

4. According to the Spectrum Policy Framework, a market-based approach should be adopted for the Re-assignment of the 900/1800 MHz Spectrum when in the CA’s view there are likely to be competing demands for the spectrum, unless there are overriding public policy reasons to do otherwise. The Spectrum Policy Framework also makes it clear that there is no legitimate expectation on the part of the spectrum assignees that there will be a right of renewal or right of first refusal upon the expiry of a spectrum assignment under the TO.

5. The CA pointed out in the First Consultation Paper that in its view based on its then understanding, there was no overriding public policy reason justifying the adoption of Option 1 instead of any market-based approach for the Re-assignment of the 900/1800 MHz Spectrum. Even if the incumbent

spectrum assignees fail to obtain any of the 900/1800 MHz Spectrum if there were to be an auction of it, they may still provide 3G and 4G services by using spectrum they are holding in other frequency bands including the 850/900 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz bands. In fact, almost 70% of the spectrum currently employed for the provision of 3G/4G services will not be affected by the present spectrum re-assignment exercise. Although the continuity of 2G services is an issue of concern which was highlighted in the First Consultation Paper as it relies solely on the 900/1800 MHz Spectrum, this by itself falls far short of being an overriding public policy reason justifying the adoption of Option 1 as the carriage of 2G voice services requires much less than 2 x 5 MHz of spectrum.

6. Having reviewed the submissions of the MNOs and the Study findings and recommendations, the CA accepts that the need to ensure 4G service continuity in the Remaining MTR Stations is a valid concern which constitutes an overriding public policy reason justifying not adopting a full-fledged market-based mechanism for the Re-assignment of the 900/1800 MHz Spectrum. As explained in paragraphs 39 – 42 of the Second Consultation Paper, a long-lead time will be required for reconfiguring the IRS in the Remaining MTR Stations should MNOs fail to retain any of the spectrum they currently use in the 1800 MHz band, and this would pose a risk to 4G service continuity in those stations for a prolonged period of time in the new assignment term. The CA therefore proposes in the Second Consultation Paper to offer, and to pitch the RFR Spectrum at 2 x 10 MHz, which would be sufficient to safeguard the continued provision of 4G services in the Remaining MTR Stations.

7. The CA considers that the large amount of spectrum involved in the present spectrum re-assignment exercise is not a relevant justification on its own for deviation from the guiding principle under the Spectrum Policy Framework for adopting a market-based approach, as MNOs can freely compete with one another and possibly also new entrants to bid for the necessary amount of spectrum in the auction. The other justifications mentioned by Hutchison and other respondents for not adopting a market-based approach for spectrum re-assignment are not relevant public policy reasons either. As explained in paragraphs 50 – 56 of the Second Consultation Paper, the CA is of the view that the adoption of a market-based approach for the Re-assignment of the 900/1800 MHz Spectrum in fact would achieve higher

efficiency in spectrum utilisation by consolidating the currently fragmented spectrum in the two frequency bands for assignments in the new term. The sizeable amount of spectrum to be put out for auction will help promote effective competition, as the market-based mechanism facilitates the acquisition of additional spectrum by the more efficient MNOs and potentially any new market entrant. All these will stimulate investment and provision of innovative services.

8. The desire for a stable business environment also does not constitute an overriding public policy reason justifying the CA not adopting a market-based approach for the re-assignment pursuant to the Spectrum Policy Framework. For the Re-assignment of the 900/1800 MHz Spectrum, the CA has commenced its engagement of the incumbent assignees and stakeholders about five years prior to the expiry of the existing spectrum assignments, and plans to announce its decision on the re-assignment arrangements at least three years in advance. The industry participants will have ample time to adjust their business plans to cater for any possible change in the assignment of frequency spectrum during the three-year period leading to the commencement of the new spectrum assignment term.

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?

Views and Comments of the Respondents

9. HKT and Hutchison considered that Option 1 would best achieve each of the four objectives identified for the Re-assignment of the 900/1800 MHz Spectrum, especially in ensuring customer service continuity and maintaining a predictable and stable investment environment. They submitted that keen competition in the market already pushed them to use the spectrum efficiently and to be innovative. CMHK and SmarTone considered that Option 1 only met one of the four objectives, i.e. ensuring customer service continuity but not the other three objectives. Other respondents supporting Option 1 also highlighted ensuring customer service continuity as their reason. Three company respondents (Brocade, H3C, and Prime Creation) held the view

that Option 1 could also meet the other three objectives in spectrum management.

The Responses of the CA

10. There is no doubt that among the three options proposed for the Re-assignment of the 900/1800 MHz Spectrum, Option 1 performs the best in ensuring customer service continuity. The CA acknowledges that the certainty that Option 1 may bring may be conducive to a stable environment for the operation of the MNOs and to further investment. It may arguably provide the incumbent assignees with certainty as to their spectrum holdings earlier than the other two options, which will require an auction to be conducted, but it fails to promote a more efficient utilisation of the scarce spectrum resources or more effective competition in the mobile telecommunications market.

11. As explained in paragraphs 50 – 56 of the Second Consultation Paper, the existing state of competition amongst the MNOs cannot be treated as a substitute for the application of a market-based approach in the re-assignment of spectrum in furthering competition in the market. Unlike the perpetual assignment approach implicated under Option 1, periodical spectrum re-assignment exercises enable the CA to keep pace with the growth and developments in the mobile telecommunications market when performing its spectrum management duty. An auction will give an opportunity for MNOs to rationalise their spectrum holdings and possibly may encourage new entrants to join the market by acquiring the Auctioned Spectrum. All market participants will be put on an equal footing and hence be better placed to engage in effective competition and provide innovative services. Specifically for the Re-assignment of the 900/1800 MHz Spectrum, Option 1 does not provide any means for addressing the issues of spectrum fragmentation and attainment of higher spectral efficiency.

Option 2: Full-Fledged Market-Based Approach

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?*

Views and Comments of the Respondents

12. All the four MNOs opposed the adoption of Option 2, because of the substantial risk it posed to the continuity of customer services. Their concern was not so much about the continuity of 2G services, but that of 3G/4G services and in particular those in the MTR stations and adjoining tunnel areas, because the progress in deploying the 2.3 GHz and 2.5/2.6 GHz bands at MTR premises has been slow. Moreover, the Hon Charles Mok requested the CA to give precedence to ensuring the continuity of customer services. Almost all the other companies and members of the public making submissions did not support Option 2, due to a general concern about customer service continuity.

13. China Unicom was one of the few supporting Option 2 and advocated proactive migration of 2G users to the other networks such that all the 900/1800 MHz Spectrum can be re-assigned by auction. HKTb and TIC did not indicate explicit support to any spectrum re-assignment option, but they were concerned about the continuity of 2G services. They pointed out that many overseas economies were still maintaining 2G networks, and the possibility of incoming visitors to Hong Kong, particularly those from the Mainland, still using 2G handsets by 2020/21 could not be ruled out. Accordingly, they urged the CA to consider the 2G service needs of visitors carefully.

The Responses of the CA

14. In the First Consultation Paper, the CA expressed its preliminary view that, while continuity of 2G services beyond 2020/21 could be at risk under the full-fledged market-based mechanism, the continuity of 3G and 4G services would not be a concern in considering the re-assignment arrangements of the 900/1800 MHz Spectrum. This is because the majority (93%) of the 128 MHz of spectrum currently employed for the provision of 3G services in various bands and all the 200 MHz of spectrum in the 2.3 GHz and 2.5/2.6 GHz bands as well as the 20 MHz of refarmed 3G Spectrum currently employed for the provision of 4G services will not be affected by the present spectrum re-assignment exercise. This is borne out by the Study findings as illustrated in paragraph 35 of the Second Consultation Paper, to the effect that, apart from assuring service continuity, the ten different spectrum re-assignment scenarios considered in the Study will not have any adverse impact on the

service quality (a) of the territory-wide network and (b) in the high traffic areas for all 2G, 3G and 4G services for all MNOs as a whole.

15. The CA nevertheless notes the concern of MNOs expressed in their submissions about the slow progress in the deployment of the 2.3 GHz and 2.5/2.6 GHz bands at MTR premises, given that the necessary modification work is expected to be completed by 2019 for just 18 MTR stations having high passenger flows. For the Remaining MTR Stations, they are expected to continue to rely primarily on the 1800 MHz spectrum for the provision of 4G services for the years to come beyond 2020/21. To address the risk to 4G service continuity in the Remaining MTR Stations for a prolonged period of time in the new assignment term, which is likely to occur should the MNOs fail to retain any part of their respective spectrum holdings in the 1800 MHz band, the CA proposes in the Second Consultation Paper to offer a right of first refusal of 2 x 10 MHz of spectrum in the 1800 MHz band to each of the four incumbent spectrum assignees.

16. The CA also notes the views of HKTB and TIC on the need to cater for the service requirement of incoming visitors who may continue to use 2G handsets post 2020/21. The provision of 2G services in the whole territory relies solely on the spectrum under consideration for re-assignment. The proposed offer of 2 x 10 MHz of spectrum in the 1800 MHz band as a right of first refusal to each of the four incumbent spectrum assignees will not only safeguard the provision of 4G services in the Remaining MTR Stations, but also the continuous availability of 2G services on a territory-wide basis if there continues to be demand for such services post 2020/21. The CA recognises the views of MNOs that the pace of phasing out 2G services should be primarily dictated by their commercial considerations. Accordingly, the CA proposes in the Second Consultation Paper to instead introduce a new SC for incorporation into the UCL requiring MNOs to seek the prior consent of the CA and make satisfactory arrangements for affected customers in the case of phasing out of 2G services, such as migrating the 2G users to other networks as suggested by China Unicom. For details, please refer to paragraphs 48 and 118 of the Second Consultation Paper.

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?

Views and Comments of the Respondents

17. Option 2 was regarded by most of the respondents as being the least effective of the options for achieving any of the four objectives identified for the Re-assignment of the 900/1800 MHz Spectrum. As discussed above, they were concerned in particular about its impact on the continuity of customer services. HKT and Hutchison were of the view that Option 2 might not promote further effective competition as the industry is already highly competitive, and it is possible that any new entrants might not put the spectrum to the most efficient use, quoting the acquisition of the spectrum in the 2.3 GHz band by the 21 ViaNet Group Limited (“21 ViaNet”) in 2012 as an example. For a similar reason, CMHK considered that Option 2 was not the only way to stimulate effective competition. HKT opined that spectrum trading and the release of new spectrum would be the best way to encourage new entry and competition. Most of the other industry respondents also considered that Option 2 would not effectively satisfy any of the objectives in spectrum re-assignment, and some of them even considered it may exert adverse impact on the industry or divert resources that could have been used for network expansion.

18. China Unicom, as a mobile virtual network operator, supported Option 2, considering it as preventing the occurrence of spectrum dominance. Another company respondent also supported Option 2, as it considered it would contribute to the enhancement of efficiency in spectrum utilisation, and to the promotion of competition and innovation. The one individual who supported Option 2 regarded it as a fair and non-discriminative approach to spectrum re-assignment, referring also to the holding of a large amount of spectrum in the 1800 MHz band by one MNO and the good propagation characteristics of the 900 MHz spectrum as reasons justifying spectrum re-assignment by auction only.

The Responses of the CA

19. The CA has already responded to concern about the risk to continuity of certain types of mobile services resulting from the adoption of Option 2 in paragraphs 14 to 16 of this Annex. The CA has also explained in detail its views on the likely contributions of a market-based approach in achieving the other three identified objectives in the Re-assignment of the 900/1800 MHz Spectrum, viz. efficient spectrum utilisation, promotion of effective competition and encouragement of investment and promotion of innovative services, in paragraphs 43 – 46 of the First Consultation Paper and in paragraphs 50 – 56 of the Second Consultation Paper. In summary, Option 2 enables the attainment of higher spectral efficiency by consolidating the currently fragmented spectrum assignments and providing an opportunity for MNOs to optimise their spectrum holdings, it is likely to help promote further effective competition by facilitating new market entry and strengthening the competitiveness of the more efficient MNOs through spectrum re-distribution, and all of these factors are likely to stimulate investment and innovation. Moreover, the findings of the Study indicate that the concern about possible impact on service quality or continuity of mobile services is overstated given that a number of effective mitigating measures are available including offloading more mobile traffic to the Wi-Fi networks and increasing the number of sectors at the cell sites, all of which could be implemented by the MNOs.

20. The CA considers that the acquisition of the 30 MHz of spectrum in the 2.3 GHz band by 21 ViaNet in 2012 is not a relevant example for demonstrating whether the market-based approach is effective in promoting efficient spectrum utilisation and effective competition in the mobile telecommunications market for the following reasons.

21. Firstly, in making available the concerned spectrum in the 2.3 GHz for auction, the CA made it clear that the spectrum could be used for either fixed or mobile services. 21 ViaNet elected to provide internal fixed telecommunications services as soon as it was assigned the concerned spectrum through successful bidding in the auction held in 2012, and it was authorised to do so by the CA. 21 ViaNet is now deploying the spectrum to provide wireless fixed broadband services in the rural and remote areas. Overseas experience indicates that wireless fixed technology has commercial advantages

over fibre network in providing broadband services to remote and sparsely populated areas. 21 ViaNet has effectively enhanced competition in the underserved areas in Hong Kong. The 21 ViaNet experience demonstrates the merit of using a market-based approach to encourage new investors to enter the local telecommunications market providing new types of telecommunications services to cater for unmet demands in different market segments. Secondly, the apparently slower progress of the deployment of the concerned spectrum is likely to be due to developments in the technology and equipment supporting the unpaired spectrum in the 2.3 GHz band lagging behind that for paired spectrum in the other frequency bands, as demonstrated by the fact that other successful bidder(s) assigned the 2.3 GHz spectrum in 2012 also took several years to deploy it for the provision of mobile services.

22. In theory spectrum trading should help to encourage new entry and competition, as those who want to enter the mobile telecommunications market may acquire spectrum from the secondary spectrum market. But the reality is that spectrum is a scarce resource and it is unlikely that MNOs would be willing or able to release any spectrum to make trading viable. Further, it should be noted that spectrum trading is a separate matter from spectrum re-assignment, and one is not a substitute for the other. Spectrum trading is where a spectrum assignee transfers the right to use spectrum to another party during the term of its assignment, and this should be distinguished from spectrum re-assignment which concerns the arrangement for the right to use the spectrum after the expiry of the term of assignment. The implementation of spectrum trading in Hong Kong is a policy matter on which the Government has commissioned a consultancy study. The issue will be addressed further once the findings are available.

23. As for the release of new spectrum, the CA is acutely aware of the demand for new spectrum to meet the ever increasing aspirations of the community. The Government has committed to the working target of switching off the analogue terrestrial television services in 2020 with a review of the target date to be conducted in 2017-18, and by then there should be a clearer picture as to the availability of additional spectrum for mobile services. In the meantime, OFCA has been participating in international conferences organised by the International Telecommunication Union and is keeping a close watch on the international and regional efforts and developments in allocation of additional spectrum for mobile services.

Option 3: Hybrid Administratively-Assigned cum Market-Based Approach

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?

Views and Comments of the Respondents

24. Hutchison considered Option 3 carried with it the same negative impacts as Option 2, such as causing disruption to customer services, reduction in data speed and an uncertain business environment. Some other company respondents also consider Option 3 to be no different from Option 2. HKT considered that between the two, Option 3 was more effective than Option 2 in terms of posing lower risk to customer service continuity, but it still could not ensure efficient spectrum utilisation or promote effective competition, and might discourage investment and innovations.

25. SmarTone regarded Option 3 as the best in meeting the objectives in spectrum re-assignment. In particular it offered the long-needed opportunity to address the issue of over-concentration of spectrum in the 1800 MHz band. CMHK also considered Option 3 capable of ensuring service continuity and enabling both the incumbent spectrum assignees and new investors to acquire spectrum in accordance with their business objectives. The eight individuals supporting Option 3 considered that this option, with the allowance of more RFR Spectrum, would serve to ensure continuity of customer services, improve spectral efficiency and promote effective competition.

The Responses of the CA

26. The CA pointed out in the First Consultation Paper, and it affirms this in the Second Consultation Paper, that it considers there are overriding public policy reasons, namely ensuring continuity of 2G services throughout the territory and 4G services in the Remaining MTR Stations justifying deviation from the full-fledged market-based approach for spectrum re-assignment. In this Second Consultation Paper, the CA proposes the adoption of Option 3 for the Re-assignment of the 900/1800 MHz Spectrum, with the RFR Spectrum available to each incumbent adjusted upward to 2 x 10 MHz and located in the 1800 MHz band. It considers that this option would

be best able to meet all the four identified objectives in spectrum re-assignment.

27. The present proposal of the CA, as detailed in paragraphs 89 and 90 of the Second Consultation Paper, will make available at least 120 MHz of spectrum for re-assignment by auction. With such a large amount of spectrum to be put out for auction, Option 3 will likely deliver largely similar benefits as envisaged under the full-fledged market-based approach under Option 2. The offer of the RFR Spectrum to the MNOs will equip them with the necessary spectrum to safeguard the continued provision of mobile services at all locations especially those in the Remaining MTR Stations. However they would need to bid for the desired amount of spectrum in the auction on top of the RFR Spectrum if they consider they need this to ensure service quality and to meet the expectation of customers. There are thus clear differences between Option 2 and Option 3.

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?

Views and Comments of the Respondents

28. The four MNOs considered that ensuring the continuity of 3G/4G services was equally, if not more, important than ensuring the continuity of 2G services, as a substantial proportion of the 900/1800 MHz Spectrum has already been refarmed for the provision of 3G/4G services, and the number of 2G services subscribers would be expected to fall substantially by 2020/21. In order to ensure general continuity of customer services, the four MNOs recommended the amount of the RFR Spectrum for each MNOs to be more than the 2 x 5 MHz of the 900/1800 MHz Spectrum (i.e. 2 x 20 MHz or 20% in total) as proposed in the First Consultation Paper. The total amount of the

RFR Spectrum they counter-proposed ranged from the smallest amount of 2 x 55 MHz as proposed by SmarTone to the largest amount of 2 x 80 MHz as proposed by Hutchison, or 55% to 80% of the total spectrum under consideration for re-assignment. HKT opined that it should be offered a right of first refusal to be re-assigned spectrum in the 900 MHz band, as well as two times more spectrum in the 1800 MHz band than should be made available to other incumbent spectrum assignees, due to its currently larger spectrum holding in this frequency band. Among the individuals supporting Option 3, the total amount of the RFR Spectrum they proposed ranged from 50% to 90% of the 900/1800 MHz Spectrum.

29. No respondent proposed any alternative arrangement in response to the second part of Question 6.

The Responses of the CA

30. The CA considers that the existing spectrum holdings of MNOs should not have any relevance in determining the size of the RFR Spectrum, which for the purpose of the present exercise, is intended to ensure the 4G service continuity in the Remaining MTR Stations as well as territory-wide continuity of the 2G services. It is for each MNO to ensure that it has sufficient spectrum to meet its own service quality requirements and the aspiration of its subscribers. More detailed views of the CA on the offer of the RFR Spectrum are given in paragraphs 58 – 62 of the Second Consultation Paper.

31. Having carefully examined the Study findings and the views received, the CA considers that there is a need to offer the RFR Spectrum to the incumbent spectrum assignees in order to safeguard the provision of 4G services in the Remaining MTR Stations, based on detailed reasoning given in paragraphs 39 – 42 of the Second Consultation Paper. It proposes in paragraph 90 to offer a right of first refusal of 2 x 10 MHz of spectrum in the 1800 MHz band to each of the four incumbent spectrum assignees and this amount of RFR Spectrum will at the same time be able to cater for the provision of territory-wide 2G services. Taking the four incumbent spectrum assignees together, the total amount of RFR Spectrum is equivalent to 2 x 40 MHz of spectrum in the 1800 MHz band, or 40% of the 900/1800 MHz 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?

Views and Comments of the Respondents

32. The four MNOs did not support any of the four hybrid sub-options proposed in the First Consultation Paper. CMHK opined that if the only purpose was to ensure continuity of 2G services, it would support Option 3A, i.e. offering 2 x 5 MHz of RFR Spectrum in the 1800 MHz band for re-assignment to each of the four MNOs.

33. All the four MNOs proposed having the RFR Spectrum located in both the 900 MHz and 1800 MHz bands. Both HKT and SmarTone held the view that the RFR Spectrum should fall within the bands of MNOs' existing frequency holdings. Therefore, they proposed 2 x 5 MHz of spectrum in the 900 MHz band to be offered as RFR Spectrum to them as well as Hutchison which also currently holds spectrum in the band. CMHK and Hutchison proposed 2 x 5 MHz of RFR Spectrum in the 900 MHz band to be offered across the board to all the four MNOs. As to the offer of the RFR Spectrum in the 1800 MHz band, CMHK and SmarTone suggested 2 x 10 MHz for each MNO and Hutchison 2 x 15 MHz. HKT further suggested 2 x 30 MHz of spectrum to be offered to it, and 2 x 10 MHz to each of the other three MNOs.

The Responses of the CA

34. The CA tends to agree with HKT and SmarTone that the RFR Spectrum should fall within MNOs' existing bands of frequency holdings, so that they will be able to continue to use the re-assigned spectrum without the need for any network re-configuration.

35. With the aim of safeguarding the provision of 4G services in the Remaining MTR Stations, the CA proposes in this Second Consultation Paper that 2 x 10 MHz of spectrum in the 1800 MHz band be offered as the RFR Spectrum for re-assignment to each of the four incumbent spectrum assignees. This is mainly because not all the MNOs are currently assigned with spectrum

in the 900 MHz band, and the limited bandwidth in this frequency band may not be enough to cater for the provision of 4G services.

Spectrum Utilisation Fee

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

Views and Comments of the Respondents

36. HKT, Hutchison, several company respondents (Comba, H+S, Macroview, Nokia, NTT, nwStor), the Hon Charles Mok and a number of individuals considered that the level of SUF should not be set too high, since this would increase the financial burden of the spectrum assignees, which might lead to reduction of investment by the operators and increase of service charges. HKT estimated that monthly charges of mobile services could increase by about \$36 per household (or \$12 per subscription) should the 900/1800 MHz Spectrum be re-assigned through auction, and added that high spectrum prices did not necessarily result in higher spectral efficiency. On the other hand, CMHK agreed that SUF should be set to reflect the full market value of spectrum. Some other company respondents (Brocade, Galaxy, H3C, HP, Huawei and Cisco) considered that the SUF should be set at a reasonable or equitable level.

37. As regards whether there should be two sets of SUF for the 900 MHz Spectrum and 1800 MHz Spectrum, SmarTone stated that there was a paucity of empirical and reliable data to establish the precise relative band values between the two bands in the Hong Kong context.

38. On whether reference should be made to the levels of SUF as determined in past auctions in setting the SUF for the 900/1800 MHz Spectrum, HKT suggested that the levels of SUF should not be benchmarked against the results of one or two past auctions locally, but reference should be made to the results of overseas spectrum auctions and the royalty payment payable by the incumbent spectrum assignees at present. SmarTone, H3C, Brocade and a

number of individuals shared similar views. On the other hand, some individuals agreed that local auction results were relevant.

39. HKT, Hutchison and SmarTone objected to the proposal of making reference to the level of SUF for spectrum in the 850/900 MHz band as determined by the auction conducted in March 2011 in determining the SUF for the 900 MHz Spectrum since the SUF fetched was exceptionally high due to the limited supply of spectrum at that time.

40. On the level of the reserve price for the Auctioned Spectrum, SmarTone stated that since the final SUF for such spectrum would be decided in a competitive auction, they did not see how MNOs could possibly manipulate or control the bidding results giving rise to an unreasonably low SUF. They held the view that the determining factor in a competitive bidding was market forces.

41. HKT, SmarTone and CMHK agreed to the setting of a cap for the SUF for RFR Spectrum if Option 3 was adopted. SmarTone added that the cap should not be set too high lest it would lose its function of providing certainty to the incumbent spectrum assignees.

42. HKT did not support the setting of a minimum price for RFR Spectrum and suggested that the SUF for RFR Spectrum could simply be the average SUF fetched for the Auctioned Spectrum. CMHK was of the view that the minimum price should be set as low as possible so that the SUF for RFR Spectrum would likely be determined through auction. SmarTone considered that the minimum price for the RFR Spectrum should not be set at a level higher than the auction reserve price as this would unduly discriminate against the incumbent spectrum assignees from taking up the RFR Spectrum.

43. On the method of payment of SUF, the submissions received indicated that the MNOs were concerned about the tax deductibility of the SUF. HKT considered it more appropriate for the SUF to be paid on an annual basis to reflect the fact that the expenditure was revenue (rather than capital) in nature, but in the case the lump sum payment method was adopted, the Government should discuss with, and seek agreement from, the Inland Revenue Department (“IRD”) that lump sum SUF payments were revenue in nature and hence tax deductible. Hutchison was of the view that SUF payments should

be tax deductible regardless of the method of payment, and it did not object to paying the SUF in a lump sum so long as it is tax deductible. SmarTone requested the Government to obtain confirmation from IRD that any SUF, whether it is payable on annual basis or as a lump sum, would be regarded as revenue expenditure and hence tax deductible. The Hon Charles Mok recommended that the impact of tax treatment of SUF payment towards stimulating investment and the provision of high quality services should be considered.

The Responses of the SCED

44. Frequency spectrum is a scarce public resource, and therefore the SUF should be set to reflect as close as possible the full market value of spectrum to ensure that the spectrum resource is put in the hands of the MNOs which value it the most and which will put it to the most efficient use. Under the Spectrum Policy Framework promulgated by the Government in 2007 after public consultation, a market-based approach is adopted in spectrum management wherever the CA considers that there are competing demands from providers of non-government services. A SUF that reflects the full market value of the spectrum, as determined by the market through a competitive process, is important in ensuring that the spectrum resource is put into the hands of the MNOs which value it the most and which will consequently put it to the most efficient use. This market-based approach in determining SUF is well-trying out in Hong Kong for well over a decade.

45. In response to the allegation that any increase in SUF would lead to decline in investment and increase in service charge, the SCED considers that the needs to set aside funding for investments and keep service charges attractive are considerations that all MNOs will and should take into account when bidding the spectrum in a competitive telecommunications market. According to the operational figures obtained by OFCA from MNOs, SUF only accounts for around 3-4% of the MNOs' overall operating expenditure on average, and the amount of SUF attributable to the 900/1800 MHz Spectrum will be even less (less than 1%). Therefore, even if the SUF of the 900/1800 MHz Spectrum is adjusted after the re-assignment, the effects of which on the operating expenditure of the operators post 2020/21 should be limited. It is misleading and groundless to attribute any substantial increase of service charges by the operators to the payments of SUF. In fact, in the keenly

competitive mobile service market in Hong Kong, adjustments in service charges are subject to market competition rather than based on variation in costs.

46. The SCED notes the responses in respect of the proposal of setting two sets of SUF for the 900 MHz Spectrum and 1800 MHz Spectrum respectively. As explained in paragraph 65 of the Second Consultation Paper, there is no conclusive indication that the value of 900 MHz Spectrum is higher than that of the 1800 MHz Spectrum. Hence, it would no longer be appropriate to rely on the presumption that the 1800 MHz Spectrum should be subject to a lower SUF than that in the 900 MHz Spectrum.

47. The SCED notes that there were suggestions that in relation to the levels of SUF for the 900/1800 MHz Spectrum, reference should not be made to the results of local spectrum auctions but should be made to those of overseas auctions. As explained in paragraph 66 of the Second Consultation Paper, the SCED maintains the views that it would be more relevant and appropriate to set the SUF based on Hong Kong's past market benchmarks which were arrived at through the market mechanism after taking account of local factors (such as local business environment and the associated cost of building and maintaining a mobile network locally) rather than with reference to overseas spectrum auctions.

48. There was also suggestion that reference should be made to the royalty payment by the incumbent spectrum assignees under existing assignments. However, the value thus derived, i.e. \$22 million per MHz for the 15-year assignment, is much lower than the results of recent auctions, and is only one-third of the royalty payment for the 3G Spectrum in the last year of the previous assignment term (i.e. \$66 million per MHz). We note that when the spectrum in the 1800 MHz band was re-assigned in 2006, it was used primarily for the provision of 2G services, and equipment for 3G and 4G services did not support the 1800 MHz band at that time. The SCED therefore considers that such royalty payment is not an appropriate reference in estimating the current market value of spectrum in the 1800 MHz band.

49. As pointed out in paragraph 92 of the Second Consultation Paper, the SUF for all the spectrum in the 900 MHz band will be determined by auction. The SUF of such spectrum should naturally be determined by

auction. There is no need to “set” the SUF and hence the associated need to make reference to the SUF of spectrum in the 850/900 MHz band as determined by the auction in March 2011 does not arise.

50. The SCED notes that the proposal to set a cap for the SUF for the RFR Spectrum was supported by the MNOs, and he agrees with the views in the submissions that the cap should be set at a level that could provide a reasonable degree of certainty to the incumbent operators in regard to the amount of SUF payable for the RFR Spectrum. On the suggestion that a minimum price for the RFR Spectrum is not required, as explained in paragraphs 68 – 70 of the Second Consultation Paper, the SCED maintains the view that the minimum price is necessary and should be set at a higher level than the auction reserve price.

51. As regards the issue of tax deductibility of SUF, this is fundamentally a matter of tax policy independent of the SCED’s determination of the levels of SUF. In their submissions, HKT, Hutchison and SmarTone have asked for clarification with the IRD on the issue. The IRD has advised that our tax law generally allows deduction of revenue expenditure for profits tax purpose, but disallows deduction of capital expenditure unless such deduction is explicitly provided for in the tax law. Given that SUF payment is meant to acquire the spectrum utilisation right for a term of 15 years, it would create an enduring benefit for the MNOs. For this reason, the IRD considers that SUF will be regarded as capital expenditure and therefore not tax deductible irrespective of the method of payment (i.e. either in form of lump sum payment or annual installments). If MNOs have further enquiries on this issue, they should seek the advice of their own tax advisors and take such advice into consideration when making decisions relating to their investment in the upcoming spectrum re-assignment exercise.

Proposed Arrangements for Spectrum Re-assignment

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?*

Views and Comments of the Respondents

52. Three of the four MNOs (viz. HKT, Hutchison, and SmarTone) and a company respondent (Comba) agreed to the proposed slot sizes for spectrum in the 900 MHz and 1800 MHz bands. SmarTone further commented that the band plan should be designed to allow as many contiguous blocks as possible, and to make it compatible with the POIs on the IRS in all the MTR stations. CMHK considered that it would be more appropriate to have frequency slots of 2 x 5 MHz each in both the 900 MHz and 1800 MHz bands, and an individual respondent supporting the full-fledged market-based approach under Option 2 shared the same view. The Hon Charles Mok highlighted the need to take into account technologies such as carrier aggregation in formulating the band plan for spectrum re-assignment.

The Responses of the CA

53. Given the general support of the industry for the proposed band plans, the CA maintains its position as set out in the First Consultation Paper that the 2 x 75 MHz of spectrum in the 1800 MHz band should be restructured into as many frequency slots as possible of 2 x 10 MHz each, together with a few 2 x 5 MHz slots. The 2 x 25 MHz of spectrum in the 900 MHz band will be restructured into frequency slots of 2 x 5 MHz each, due to the limited amount of the sub-1 GHz spectrum available for re-assignment and the good coverage achievable with use of a 2 x 5 MHz slot. Frequency slots of these sizes will facilitate aggregation of the carriers using the 3G, 4G and possibly in future, 5G technologies for achievement of higher spectral efficiency. Details of the band plans proposed for the 900 MHz and 1800 MHz bands are given in paragraphs 105 – 106 of the Second Consultation Paper.

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?

Views and Comments of the Respondents

54. The four MNOs and a few other respondents who provided feedback to the question agreed with opening up the auction to all parties. A member of

the public who supported Option 2 opined that MNOs under the ownership of property developers should not be allowed to hold spectrum in the 900 MHz band.

The Responses of the CA

55. With the general support of the industry, the CA affirms its view, as set out in the First Consultation Paper, that the auction to be conducted for the Re-assignment of the 900/1800 MHz Spectrum should be open to all interested parties, including the incumbent spectrum assignees and any 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?

Views and Comments of the Respondents

56. Hutchison and SmarTone supported the imposition of a spectrum cap in the auction to be conducted for the Re-assignment of the 900/1800 MHz Spectrum, but with the cap lowered to 60 MHz and 80 MHz respectively. SmarTone reiterated its concern about over-concentration of spectrum and the resulting harm to competition in the market, emphasizing that the problem would be difficult to be reversed after completion of the spectrum re-assignment in question as no similar spectrum would be available in the near future. Three respondents (Comba and two individuals) also supported a smaller spectrum cap up to 70 MHz. CMHK was neutral about the proposed 90 MHz cap.

57. HKT did not support the imposition of any spectrum cap unless there was a substantial competition concern, and found the proposal of a spectrum cap inconsistent with the view that the relevant spectrum was less than one-third of the spectrum currently employed for the provision of mobile broadband services. It raised a question about bidding by joint ventures of MNOs, suggesting that the cap should be raised to 180 MHz in the case of a two-MNO joint venture as the successful bidder.

The Responses of the CA

58. With the hybrid administratively-assigned cum market-based approach proposed in the Second Consultation Paper for the Re-assignment of the 900/1800 MHz Spectrum, at least 120 MHz or more than one-fifth of the total amount of spectrum (552 MHz) currently assigned for the provision of public mobile telecommunications services will be put out for auction. In order to avoid over concentration of spectrum holdings in certain spectrum assignees which may lead to distortion of competition and cause harm to consumers, the CA maintains its view as set out in the First Consultation Paper that a cap should be imposed on the amount of the 900/1800 MHz Spectrum that may be acquired by any party including its associated entities.

59. On the size of the spectrum cap, the CA remains of the view that an overall cap at 90 MHz is appropriate. It allows any of the MNOs or new entrants to acquire the 900/1800 MHz Spectrum up to the amount that the MNO having the largest amount of 900/1800 MHz Spectrum possesses today. When the CA granted its consent to the merger between HKT and the former CSL Limited in 2014, it was conditional upon inter-alia HKT divesting 29.6 MHz of the 3G Spectrum upon expiry of the concerned assignment in October 2016, in order to address the concern about over-concentration of spectrum in the hand of the merged entity having the effect of substantially lessening competition in the mobile telecommunications market. With no apparent change in the competition landscape of the market since the merger, the spectrum cap proposed to be adopted will not lead to a higher degree of concentration of spectrum following the spectrum re-assignment.

60. On the issue of bidding by joint ventures of MNOs, it should be clarified that since the spectrum cap will be imposed on a per bidder basis, the cap will still be 90 MHz for a two-MNO joint venture instead of 180 MHz as suggested by HKT. Bidders are also required to observe the relevant connected bidder rules to be adopted in the auction in order to ensure that the spectrum cap restriction will be strictly complied with.

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?*

Views and Comments of the Respondents

61. CMHK and SmarTone agreed to the proposal of a 20 MHz sub-cap for spectrum in the 900 MHz band, due to scarcity of the concerned spectrum. Consistent with its position on the overall cap, HKT did not consider it necessary to have a sub-cap in the absence of any clear competition concern. Hutchison also did not support the proposal.

The Responses of the CA

62. Apart from the reason of scarcity, the superb radio propagation and penetration characteristics of the sub-1 GHz spectrum justify the imposition of a sub-cap for spectrum in the 900 MHz band, and the CA remains of the view that setting it at 20 MHz is appropriate. With all the 50 MHz of spectrum in the 900 MHz band proposed to be put out for auction in five frequency slots of 2 x 5 MHz, a sub-cap at 20 MHz will ensure that the number of spectrum assignees in the band will remain the same or increase as a result of the spectrum re-assignment. More details about the sub-cap are given in paragraph 112 of the Second Consultation Paper.

Licensing Arrangements

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?*

Views and Comments of the Respondents

63. All the four MNOs supported the proposal to align the new assignment term for the spectrum in the 900 MHz band to commence on

12 January 2021, and to have the new assignment term for the spectrum in the 1800 MHz band to commence on 30 September 2021. In addition, HKT and Hutchison suggested extending the spectrum assignment term to indefinite duration so as to allow a stable environment for investment.

The Responses of the CA

64. With the support of the industry, the CA maintains its proposal as set out in the First Consultation Paper that the new term of assignment for the 2 x 25 MHz of spectrum in the 900 MHz band will be aligned to commence on 12 January 2021, which involves an administrative extension of the existing assignments for Hutchison and SmarTone as explained in paragraph 113 of the Second Consultation Paper, while the new term of assignment for the 2 x 75 MHz of spectrum in the 1800 MHz band will commence on 30 September 2021.

65. On the proposal by HKT and Hutchison of extending the new assignment terms for the 900/1800 MHz Spectrum to indefinite duration, the CA needs to point out that currently all the spectrum assignments under the TO follow the term of the new UCLs to be issued for effecting the corresponding assignments, which is 15 years in accordance with Schedule 2 of the Telecommunications (Carrier Licences) Regulation (Cap. 106V). Therefore, the new 15-year term of assignment for the 900 MHz spectrum will be from 12 January 2021 to 11 January 2036, and that for the 1800 MHz spectrum from 30 September 2021 to 29 September 2036.

66. At present, the CA has no intention to alter the regulatory framework by extending the term of frequency assignments to indefinite duration, as this would be tantamount to perpetual assignment of spectrum which is not conducive to inter-alia promoting efficient use of the spectrum. The provision of clear information about the duration of spectrum assignments, coupled with sufficient advance notice of the arrangements for spectrum re-assignment, already provides MNOs with the transparency and predictability required for investment planning during the term of the spectrum assignment and beyond.

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 of the First Consultation Paper?

Views and Comments of the Respondents

67. HKT did not express views on the proposed methods for determining SUF for the extended period of assignments. Hutchison considers that the levels of SUF in general should be set at a minimal level and not be grossly excessive. SmarTone and CMHK had no objection to the proposed arrangements.

The Responses of the SCED

68. As explained in paragraph 114 of the Second Consultation Paper, the SCED maintains its proposal in the First Consultation Paper that the SUF for the extended periods 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.

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?

Views and Comments of the Respondents

69. The four MNOs either agreed or raised no objection to the network and service rollout obligations proposed by the CA to be imposed on the assignees of the 900/1800 MHz Spectrum for the new term of frequency assignments, namely to provide a minimum coverage of 90% of the population of Hong Kong in the case of mobile services, and 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, as well as the imposition of the

performance bond requirement where applicable. HKT suggested that incumbent spectrum assignees, which were re-assigned the 900/1800 MHz Spectrum currently used by them, should not be required to provide coverage figures demonstrating fulfilment of the more stringent coverage requirements.

The Responses of the CA

70. With the support of the industry, the CA maintains its proposal to impose a more stringent set of network and service rollout obligations as set out in the First Consultation Paper, having regard to 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 above network and service obligations will be imposed on successful bidders which have newly acquired spectrum in the 900 MHz and 1800 MHz bands and on existing MNOs which acquire the Auctioned Spectrum they do not currently hold. In the case of the incumbent spectrum assignees acquiring the RFR Spectrum and Auctioned Spectrum currently held by them, notwithstanding the feedback from HKT, the CA remains of the view that to be fair to all the parties concerned, incumbent spectrum assignees should provide network coverage figures demonstrating that their networks operate with spectrum in the 900 MHz and 1800 MHz bands respectively meeting the 90% minimum population coverage requirement.

Proposal for the Re-assignment of Some of the 900/1800 MHz Spectrum for Coverage in Country Parks and Remote Areas

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

Views and Comments of the Respondents

71. The four MNOs either agreed or raised no objection to the proposal of the CA to re-assign administratively the 2 x 4 MHz of Country Park Frequencies in the range of 1780.9 – 1784.9 MHz paired with 1875.9 – 1879.9

MHz free of SUF to the incumbent spectrum assignees for the provision of mobile coverage in the country parks and remote areas specified as the designated areas.

The Responses of the CA

72. The CA notes that apart from the Country Park Frequencies, MNOs have also deployed their other assigned spectrum for the provision of mobile coverage in the designated areas. But to ensure continuous provision of mobile service coverage in the designated areas particularly for emergency communications, the CA maintains its proposal as set out in the First Consultation Paper of re-assigning the Country Park Frequencies to the incumbent spectrum assignees free of SUF upon expiry of the existing assignments for another 15 years until 29 September 2036, i.e. the same as the new term of assignments for all the spectrum in the 1800 MHz band.

Radio Spectrum Policy Framework (April 2007)

1. Introduction

- 1.1 A 3-month public consultation has been conducted by the Commerce, Industry and Technology Bureau on the proposed spectrum policy framework. This document sets out for general information of the public the current policy thinking and key issues identified by the Government in relation to the management of radio spectrum in Hong Kong as a result of the public consultation.
- 1.2 This document is a living document and will be reviewed, revised, modified and updated from time to time by the Government as it thinks fit having regard to all relevant circumstances including but not limited to the latest technological, market and societal developments in Hong Kong and internationally, as well as further deliberations in key issues related to spectrum policy and management.
- 1.3 Readers of this document should seek independent professional advice in relation to the contents of, and any matters arising from, this document. Nothing in this document shall be construed or be relied upon by any person against the Government (including but not limited to all public officers) and the Telecommunications Authority (TA). All rights, powers, remedies and interests of the Government (including but not limited to all public officers) and the TA are hereby expressly reserved.

2. Spectrum Policy Objectives

- 2.1 Without prejudice to section 32G(1) of the Telecommunications Ordinance (Cap. 106) (TO), Hong Kong's spectrum policy and management 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;

- (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 ("Government services").

3. Guiding Principle in Spectrum Management

- 3.1 The policy inclination is that a market-based approach¹ in spectrum management will be used for spectrum wherever TA 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.
- 3.2 If the market-based approach for managing spectrum with competing demands from providers of non-Government services will not be used, the relevant public policy reasons will be published.

4. Spectrum Rights

- 4.1 TA is empowered to vary or withdraw any spectrum assigned by reasonable notice under sections 32H(3) and (4) of the TO. Without affecting the generality of the powers which TA has, the policy inclination is that the said statutory power will be exercised only in exceptional circumstances before the expiry of a spectrum assignment under the TO, including where the public interest or international obligations of the Government so require, there is a serious breach of spectrum assignment conditions or serious interference between legitimate spectrum users has to be resolved or minimised.
- 4.2 There is no legitimate expectation that there will be any right of renewal or right of first refusal of any licence or spectrum assignment upon the expiry of a licence or spectrum assignment under the TO. The decision whether a new spectrum assignment, with the same or varied radio frequencies, should be given to the spectrum assignee would be made and notified to the spectrum assignee within a reasonable time before the expiry of its spectrum assignment or after receipt of its application by TA as it is

¹ "Market-based approach" for spectrum management means methods relying on market forces to ensure the efficient use of spectrum as a public resource.

applicable in the circumstances, after taking into account the spectrum policy objectives set out in paragraph 2 of this document as well as all other relevant factors, including but not limited to any other public interest considerations.

- 4.3 If a spectrum assignment is to be varied or withdrawn before the assignment expires, the spectrum assignee to be affected will be notified before the variation or withdrawal is to take place in accordance with sections 32H(3) and (4) of the TO. For this purpose, the TA may state minimum notice periods for different types of spectrum assignments. In the case of spectrum assignment to a carrier licensee for the provision of mobile or wireless carrier services, a notice period of not less than three years before the date of variation or withdrawal would be given insofar as it is practicable in the circumstances. If a spectrum assignment is to be renewed with different radio frequencies assigned, or not renewed upon the expiry of an assignment, notification would be given as mentioned in paragraph 4.2 above. If the circumstances permit, the minimum notice periods to be stated by TA would also apply in relation to these changes or non-renewal.
- 4.4 Before the conduct of a spectrum reforming exercise, an appraisal of the impacts of different options, including an option of “do nothing”, will be undertaken by TA before a decision is taken. The same minimum notice periods described in paragraph 4.3 above will be given to the affected spectrum assignees insofar as it is practicable in the circumstances.

5. Supply of Spectrum

- 5.1 A spectrum release plan (about the potential supply of spectrum from the TA through an open, competitive bidding or tendering process in the following three years) taking into account all relevant considerations, including spectrum policy objectives set out in paragraph 2 of this document, availability of spectrum for assignment primarily for non-government use, international spectrum allocation guidance, regional spectrum allocation decisions, technology and equipment availability, proposals from the industry, will be published annually. Such plans will be updated every year on a rolling basis or as required taking into account the latest developments. Pursuant to section 32I(1) of the TO, TA will designate by order the frequency bands in which the use of spectrum is subject to the payment of spectrum utilization fee by the users of the spectrum. Pursuant to section 32I(2) of the TO, Secretary for Commerce Industry and Technology (SCIT) will prescribe the method for determining the spectrum utilization fee payable for the use of such spectrum.

- 5.2 Information on unassigned spectrum for which supply exceeds demand, and can readily be made available for assignment upon application will be published and updated regularly by the TA.
- 5.3 The policy inclination is to introduce spectrum trading in Hong Kong in the long term, subject to a feasibility study and resolution of various implementation issues.
- 5.4 The policy inclination is not to introduce spectrum liberalization in the short-term. Developments in and effectiveness of spectrum liberalisation in jurisdictions with comparable circumstances to Hong Kong will be closely monitored for re-consideration in future whether spectrum liberalisation should be introduced in Hong Kong.

6. Spectrum for Government Services

- 6.1 Spectrum to be used by or on behalf of government will continue to be managed administratively. The market-based approach will not be applied.
- 6.2 The efficiency of the use of those spectrum will be reviewed by TA every three years.

7. Spectrum Pricing

- 7.1 In principle, Spectrum Utilisation Fee (SUF) will be applicable to all non-government use of spectrum.
- 7.2 For spectrum not released through auction or other market mechanisms prescribed by SCIT, SUF will be set by the SCIT under section 32I(2) of the TO. Without affecting any of the powers of SCIT, such SUF may be set to reflect the opportunity costs of the spectrum. Where a frequency band is assigned to a spectrum assignee wholly or significantly to support public interest purposes agreed by or at the request of the Government, SUF may be adjusted in the sole discretion of SCIT to reflect the nature of such use.

8. Transitional Arrangements

- 8.1 TA needs time to align the existing spectrum management arrangements with the content of this document. In the interim, the TA would continue to discharge his spectrum management responsibilities under the TO with a mix of the existing command

and control approach² and the market-based approach as appropriate in his reasonable opinion.

**Communications and Technology Branch
Commerce, Industry and Technology Bureau**

² “Command and control approach” for spectrum management is one where

- (a) the Government, or its agency, makes (or accepts from an international body) the allocation of a frequency band for a particular purpose;
- (b) spectrum within the band is assigned to a licensee or licensees via an administrative process;
- (c) a charge may be levied on licensees, normally to cover administrative costs; and
- (d) the licence usually authorizes the licensee to utilize spectrum-using equipment specified as to location, power and other variables, the restrictions being designed to avoid interference with other licensees in adjoining geographical areas or frequency bands.