Statement of the Communications Authority and the Secretary for Commerce and Economic Development

Arrangements for the Frequency Spectrum in the 1.9 – 2.2 GHz Band upon Expiry of the Existing Frequency Assignments for the Provision of 3G Mobile Services and the Spectrum Utilisation Fee

15 November 2013

PURPOSE

This Statement promulgates the decision of the Communications Authority ("CA") to adopt a hybrid option between the administratively-assigned and market-based approach in the re-assignment of 2 x 59.2 MHz of paired spectrum in the 1.9 – 2.2 GHz band (the "3G Spectrum") upon expiry in October 2016 of the existing assignments for the provision of third generation ("3G") mobile services. This Statement also announces the methodology in setting the concerned spectrum utilisation fee ("SUF") which will be prescribed by subsidiary legislation proposed by the Secretary for Commerce and Economic Development ("SCED").

EXECUTIVE SUMMARY

S1. A hybrid administratively-assigned cum market-based approach will be adopted for the re-assignment of the spectrum in the 1.9 – 2.2 GHz band in October 2016 upon expiry of the existing assignments for the provision of 3G mobile services.

S2. Each of the four incumbent 3G operators (CSL Limited ("CSL"), Hong Kong Telecommunications (HKT) Limited ("HKT"), Hutchison Telephone Company Limited ("Hutchison"), and SmarTone Mobile Communications Limited ("SmarTone"), referred to collectively as the "incumbent 3G operators") will be offered a right of first refusal to be re-assigned 2 x 9.9 MHz or 19.8 MHz of spectrum (the "RFR Spectrum") in the frequency ranges as specified in Table 1 under paragraph 70 of this Statement.

S3. It is considered appropriate to set the SUF per MHz of the RFR Spectrum at the higher of $66 million at 2016 price level or the SUF per MHz of the Re-auctioned Spectrum as determined by auction, subject to a cap of $86 million.

S4. If all the incumbent 3G operators exercise their right of first refusal to be re-assigned the RFR Spectrum, four frequency slots of 2 x 4.9 MHz or 9.8 MHz each as specified in Table 2 under paragraph 71 of this Statement will be available for re-auction. Should any of the incumbent 3G operators decide not to exercise the right of first refusal to be re-assigned the RFR Spectrum, the spectrum thus becoming available will be pooled together with the frequency slots as specified in Table 2 (collectively "Re-auctioned Spectrum") and assigned through auction.

S5. The auction of the Re-auctioned Spectrum is expected to be conducted in the fourth quarter of 2014. The Re-auctioned Spectrum will be open for bidding by all interested parties. The Simultaneous Multi-Round Ascending ("SMRA") auction format will be adopted.

S6. A spectrum cap of 2 x 20 MHz will be imposed on the individual holding of spectrum in the 1.9 – 2.2 GHz band of spectrum assignees. For an incumbent 3G operator which has exercised the right of first refusal to be re-assigned 2 x 9.9 MHz of spectrum, it may bid for not more than two frequency slots of spectrum in the auction. A new entrant to the band may bid for a maximum of four frequency slots of spectrum in the auction.

S7. All the spectrum in the 1.9 – 2.2 GHz band, be it assigned through right of first refusal or by way of auction, will be assigned with a validity period of 15 years, from 22 October 2016 to 21 October 2031.

S8. Network and service rollout obligations will be imposed only on the successful bidders which are new entrants to the 1.9 – 2.2 GHz band, and on the incumbent 3G operators which obtain spectrum in the auction that was not originally held by them. To guarantee their compliance with these obligations, a performance bond will be required to be given.

S9. The 20 MHz of unpaired spectrum in the 1.9 – 2.2 GHz band, which

has been left idle since the assignment in 2001, will be put back to reserve upon expiry of the existing assignments.

INTRODUCTION

Frequency spectrum in the 1.9 – 2.2 GHz band was assigned through auction to the four incumbent 3G operators on 22 October 2001 for a term of 15 years for the provision of 3G mobile services. It included 2 x 59.2 MHz of 3G Spectrum[1] as well as 20 MHz of unpaired spectrum. The term of these assignments will expire on 21 October 2016.

2. Two rounds of public consultation have been conducted in connection with the re-assignment of the 3G Spectrum upon expiry of the existing assignments and related issues. The SCED and the former Telecommunications Authority ("former TA") jointly issued the first consultation paper in March 2012 ("First Consultation Paper")[2] to solicit the views and comments of the telecommunications industry and other affected persons on the three options proposed for re-assignment of the 3G Spectrum, viz. the administratively-assigned approach, the full-fledged market-based approach and a hybrid of the two, as well as on related issues. The First Consultation Paper clearly specified that the option that could be expected to best meet the multiple objectives of spectrum re-assignment, viz. ensuring customer service continuity, efficient spectrum utilisation, promotion of effective competition, and encouragement of investment and promotion of innovative services, would be selected.

3. Having analysed the views and comments received in the first round of consultation, the hybrid option of the administratively-assigned cum the market-based approach (with the RFR Spectrum proposed to be offered to the incumbent 3G operators through right of first refusal and the Re-auctioned Spectrum to be re-assigned through auction) was put forward for further consultation in the second consultation paper issued in December 2012

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1 Each of the incumbent 3G operators holds 2 x 14.8 MHz of the 3G Spectrum and 5 MHz of unpaired spectrum in the same frequency band.

2 The First Consultation Paper is available at: http://www.coms-auth.hk/filemanager/common/policies_regulations/consultations/papers/cp20120330.pdf.

("Second Consultation Paper").[3] The focus of the Second Consultation Paper was on identifying the arrangements for spectrum re-assignment which would best meet the multiple spectrum re-assignment objectives that had been summarised in the First Consultation Paper. It also proposed two methods for setting the SUF of the RFR Spectrum to be re-assigned administratively, which were premised upon the market-based approach. It invited views and comments of the telecommunications industry and other affected persons. In light of the concerns expressed by the incumbent 3G operators and others, on the possible impact on service quality if the proposed hybrid option were adopted for re-assigning the 3G Spectrum, the Government appointed an independent consultant ("Consultant") in May 2013 to undertake a quantitative assessment on the matter ("Study"). The Consultant's report setting out the findings of the Study is published today.[4]

4. Having taken into account carefully the submissions made in the course of the two rounds of consultation, the findings of the Study, the policy views of the SCED and having conducted its own independent assessment, the CA announces today its decision on the arrangements for re-assignment of the frequency spectrum in the 1.9 – 2.2 GHz band in October 2016. The CA's announcement today enables an advance notice period of about three years to be given to the incumbent 3G operators, for them to prepare for the re-assignment of the concerned frequency spectrum.[5]

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3 The Second Consultation Paper is available at: http://www.coms-auth.hk/filemanager/en/share/cp20121228.pdf.

4 The final report of the Consultancy Study entitled "*Re-assigning the Spectrum in the 1.9 – 2.2 GHz Band – Impacts on Service Quality and Customers of Adopting a Hybrid between Administratively-assigned and Market-based Approach*" is available at: http://www.ofca.gov.hk/filemanager/ofca/common/reports/consultancy/cr_201311_01_en.pdf.

5 The provision of three years' advance notice to the incumbent 3G operators to prepare for spectrum re-assignment is pursuant to paragraphs 4.2 and 4.3 of the Radio Spectrum Policy Framework issued by the Government in April 2007 (the "Spectrum Policy Framework") which requires reasonable notice to be provided where there is not to be a renewal of a spectrum assignment upon its expiry. Paragraph 5 of the statement issued by the former TA in January 2008 on minimum notice periods for variation or withdrawal of spectrum assignments states that, insofar as it is practical in the circumstances, a notice period of three years should be provided. The Spectrum Policy Framework is available at: http://www.cedb.gov.hk/ctb/eng/legco/pdf/spectrum.pdf. The TA Statement is available at: http://tel_archives.ofca.gov.hk/en/tas/others/ta20080131.pdf.

LEGISLATIVE AND POLICY FRAMEWORK

5. Under section 32G(1) of the Telecommunications Ordinance ("TO") (Cap. 106), the CA has the statutory duty to promote the efficient allocation and use of the radio spectrum as a public resource of Hong Kong. Sections 32H(2) and 32I(1) of the TO empower the CA to assign the radio frequency and to designate the frequency bands for the payment of SUF following consultation with the telecommunications industry and other affected persons.

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

7. 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).

8. The Spectrum Policy Framework identifies the policy considerations which the CA should take into account in discharging its spectrum management responsibilities under the TO. Through a statement issued in April 2007, the former TA undertook that, in exercising his statutory power under the TO in future, he would give due regard to the Spectrum Policy Framework to the extent that there would be no inconsistency with the objectives and provisions of the TO.[6] The Spectrum Policy Framework states that the guiding principle in spectrum management shall be that a market-based approach will be used 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.

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

9. The Spectrum Policy Framework states in particular that there is no legitimate expectation on the part of the spectrum assignees that there will be any right of renewal or right of first refusal of any spectrum assignment upon the expiry of a spectrum assignment under the TO.

FIRST ROUND OF PUBLIC CONSULTATION

10. The First Consultation Paper was issued on 30 March 2012. It set out the multiple objectives in spectrum re-assignment, viz. ensuring customer service continuity, efficient spectrum utilisation, promotion of effective competition, and encouragement of investment and promotion of innovative services. The former TA was of the view that there would be competing demands for the 3G Spectrum. The consultation therefore focussed on the re-assignment of the 3G Spectrum, with the following three options proposed for the re-assignment –

Option 1: An administratively-assigned approach
Right of first refusal of all the 3G Spectrum to be offered to the incumbent 3G operators

Option 2: A full-fledged market-based approach
Re-auctioning all the 3G Spectrum

Option 3: A hybrid approach
Right of first refusal to the incumbent 3G operators to retain parts of their spectrum (i.e. the RFR Spectrum), with the Re-auctioned Spectrum to be assigned through re-auction

For the 20 MHz of unpaired spectrum in the same frequency band which had been left idle since the assignment, it was proposed to put it back to reserve upon expiry of the existing assignments.

11. The first consultation was originally scheduled to close on 15 June 2012. In response to requests from the telecommunications industry, the deadline for submission of views and comments was extended by one month to

15 July 2012, allowing altogether a three-and-a-half-month consultation period.

12. In response to the First Consultation Paper, submissions were received from 12 respondents, including all the five mobile network operators ("MNOs"), four equipment vendors/business partners/works contractors of the MNOs, and three members of the public. Subsequently, the five MNOs and two members of the public also made supplementary submissions.[7] The respondents' views were summarised in paragraphs 8 – 14 of the Second Consultation Paper, with the consideration and responses of the CA and the SCED to the submissions given in paragraphs 15 – 45 and Annex 1 of the same paper.

SECOND ROUND OF PUBLIC CONSULTATION

13. The CA and the SCED explained in the First Consultation Paper that they planned to conduct a second round of consultation, in view of the complexities of the subject. Taking into account the submissions which may be received in the first round of consultation, they would put forward a more concrete and detailed proposal in a second consultation paper for further views and comments from the telecommunications industry and other affected persons.

14. In the course of preparing for the second consultation, the Office of the Communications Authority ("OFCA") held meetings with some MNOs at their request and invited all MNOs to provide further information to enable OFCA to make an assessment on the impact of implementing different spectrum re-assignment options. Having taken into account the relevant information and considerations, the SCED and the CA issued the Second Consultation Paper on 28 December 2012.

15. The CA's view that there are competing demands for the 3G Spectrum is re-affirmed in the Second Consultation Paper. The CA has had regard to the sustained robust growth in mobile data traffic, as against the limited supply of frequency spectrum; to date a total of 572 MHz of spectrum

[7] The submissions and supplementary submissions are available at: http://www.coms-auth.hk/en/policies_regulations/consultations/completed/index_id_132.html.

has been assigned for the provision of public mobile services, but further new spectrum release is not envisaged before the switch from analogue to digital terrestrial television services is completed.[8] It is readily apparent from the submissions made in the consultation that there are intense competing demands for the 3G Spectrum: the incumbent 3G operators are keen to be re-assigned all of their existing frequency holdings, and the MNO which has not been assigned 3G Spectrum wishes to have the opportunity to bid for the 3G Spectrum. Given these competing demands, Option 2, a full-fledged market-based approach under which all the 3G Spectrum would be re-auctioned should be adopted as the default approach for the 3G Spectrum re-assignment in accordance with the Spectrum Policy Framework, unless there are overriding public policy reasons to do otherwise.

16. The CA is however conscious of the possible adverse impact of re-auctioning all the 3G Spectrum on the quality and continuity of mobile services which are used by millions of subscribers. This concern was also raised in some of the submissions to the First Consultation Paper. Accordingly OFCA conducted an impact assessment, in terms of the average data download speed and continuity of indoor 3G service coverage under Option 2, the results of which were summarised in paragraphs 22 – 27 and Annex 2 of the Second Consultation Paper. The impact assessment highlighted the potentially severe and long lasting effects on service quality and reception especially in indoor areas during the transitional period under Option 2. The CA shares the view of the SCED, expressed in paragraph 27 of the Second Consultation Paper, that the potential seriousness of these effects constitutes an overriding public policy reason for the CA to deviate from the full-fledged market-based approach under Option 2.

17. The relative performance of the remaining options, Option 1 and Option 3, was assessed against the multiple objectives in spectrum re-assignment set out in paragraphs 2 and 10 above. This assessment was set out in paragraphs 28 – 39 of the Second Consultation Paper. On the basis of that assessment, Option 3, a hybrid of the administratively-assigned cum the market-based approach, was put forward for further consultation in the Second Consultation Paper. It was explained in the Second Consultation Paper that

[8] It is the Government's aim to complete the switch from analogue to digital terrestrial television services at the end of 2015.

under this proposed option, the incumbent 3G operators would be offered the right of first refusal to be assigned the RFR Spectrum while the Re-auctioned Spectrum would be assigned through an open auction.

18. The second consultation was originally scheduled to close on 28 February 2013. However, in response to requests from the telecommunications industry, the deadline for submission of views and comments was extended by approximately one and half months until 11 April 2013. Accordingly, there was a three-and-a-half-month consultation period, as in the first consultation. Before the close of the second consultation, the Panel on Information Technology and Broadcasting of the Legislative Council ("LegCo") hosted a public hearing on 27 March 2013 at which they invited the telecommunications industry and other interested parties to express their views on the subject. A majority of the attendees made formal submissions in the second consultation.

19. In response to the Second Consultation Paper, submissions were received from 43 respondents, including the five MNOs, four consultants, three business organisations, four equipment vendors/business partners/works contractors of the MNOs, two political parties, and 25 members of the public.[9] The views and comments received are summarised in Sections 2 – 5 of **Appendix 1** attached to this Statement under the headings of the four objectives for spectrum re-assignment. Sections 6 – 9 of **Appendix 1** summarise the other views and comments received in relation to the proposed Option 3, the SUF, the spectrum re-assignment framework and other related subjects together with the responses of the CA and the SCED.

POLICY VIEWS OF THE SCED

20. The SCED concurs with the view of the CA that there are competing demands for the 3G Spectrum. As explained in paragraph 15 above, unless there are overriding public policy reasons to do otherwise, a market-based approach should be followed and this would point to the adoption of Option 2 (a full-fledged market-based approach) for re-assignment of the 3G Spectrum.

[9] Submissions to the Second Consultation Paper are available at: http://www.coms-auth.hk/en/policies_regulations/consultations/completed/index_id_175.html.

The SCED recognises that, if Option 2 is adopted, there may be a risk of loss of 3G service coverage in certain indoor areas during the period in which reconfiguration works would have to be undertaken following the handover of the spectrum in October 2016. The SCED is of the view that the risk of potentially severe and long lasting effects on service quality and reception, especially in indoor areas during the transitional period under Option 2 constitutes an overriding public policy reason to deviate from the full-fledged market-based approach for the re-assignment of the 3G Spectrum.

21. While the SCED is of the view that both Option 1 and Option 3 would ensure customer service continuity, he considers that Option 3 is superior to Option 1 in enhancing spectral efficiency, encouraging investment and introduction of innovative services. Furthermore, Option 3 will provide opportunities for both newcomers to enter the market and for the incumbent 3G operators to obtain the amount of frequency they may need through a market mechanism. Option 1 will not provide these opportunities.

22. Having duly considered the views and comments received in the context of the two rounds of public consultation, the findings of the independent consultant commissioned by the Administration, the second report of Plum Consulting ("second Plum report") provided by the incumbent 3G operators to OFCA on 19 September 2013 and other relevant factors, the SCED has come to a policy view that Option 3, the hybrid approach, would best serve the multiple objectives in spectrum re-assignment and therefore should be adopted for the re-assignment of the spectrum in the 1.9 – 2.2 GHz band. The policy views of the SCED on spectrum re-assignment are at **Appendix 2**. The policy views and considerations of the SCED are provided as one of the considerations which the CA may take into account in discharging its spectrum re-assignment responsibilities under the TO.

THE MULTIPLE SPECTRUM RE-ASSIGNMENT OBJECTIVES AND THE CA'S EVALUATION OF OPTION 1 AND OPTION 3 AGAINST THESE OBJECTIVES

23. It is for the CA to decide upon the option to be adopted in spectrum re-assignment. In making its decision, the CA has had regard inter-alia to the

views of the SCED on the policy implications but the CA has made its own independent assessment. The CA shares the view of SCED that there are overriding public policy reasons, in terms of ensuring the service continuity and quality for customers, for it to deviate from a full-fledged market-based approach in re-assigning the 3G Spectrum. Accordingly, the CA considers that Option 2 should not be adopted. The CA has summarised its evaluation in paragraphs 24 – 46 below of the remaining two options, Option 1 and Option 3, against the four objectives in spectrum re-assignment, viz. ensuring customer service continuity, efficient spectrum utilisation, promotion of effective competition, and encouragement of investment and promotion of innovative services.

Ensuring Customer Service Continuity

24. The concern about the possible detrimental effect of the adoption of Option 3 on service continuity and service quality was raised by the CA and SCED in the Second Consultation Paper. The incumbent 3G operators made detailed submissions on this issue and engaged Plum Consulting to address it. Plum Consulting has issued two reports and has made its own submissions in response to the Second Consultation Paper.

25. The Government appointed the Consultant in May 2013 to provide a quantitative assessment of the likely impact on service quality and customers if the proposed Option 3 were to be adopted for re-assigning the 3G Spectrum. As the Consultant was instructed to provide advice to the Government on a specific issue raised in the consultation upon which submissions had been made, the Consultant's findings were not intended to be put to the respondents in the consultation with an invitation to make further submissions.

26. The MNOs have participated in the Study at various stages, including by providing relevant data to facilitate the conduct of the Study, as well as providing their comments on both the assessment model and the preliminary assessment results. In response to the views and comments of the incumbent 3G operators, the Study period was extended by eight weeks to three and a half months. The Consultant has considered the impact of the adoption of Option 3 and compared it with that under Option 1.

27. The incumbent 3G operators provided on 19 September 2013 a full set of the second Plum report for OFCA's review, but were unwilling for it to be disclosed to the Consultant. Notwithstanding its late submission, the CA has considered the second Plum report as an input to its deliberations on way forward with the 3G Spectrum re-assignment arrangements.

28. From the perspective of simply maintaining service continuity, the CA accepts that Option 1, through a perpetuation of the existing 3G Spectrum assignments, has the advantage of maintaining more or less a seamless transition and hence service continuity. However, having taken account of the Study findings, the CA considers that service continuity can also be reasonably assured under Option 3, by which the incumbent 3G operators will be offered (a) the right of first refusal to be re-assigned two-thirds of the 3G Spectrum (i.e. the RFR Spectrum) and (b) the opportunity to bid for and acquire the Re-auctioned Spectrum. Even if an incumbent 3G operator is unable to, or chooses not to, acquire any of the Re-auctioned Spectrum, it may wish to adopt alternative strategies such as reviewing and adjusting its mobile virtual network operator ("MVNO") arrangement with other MNOs, speeding up the migration of its 3G customers to 4G services by adopting initiatives such as price promotion, integrated mobile data plans and handset subsidisation to maintain its competitive edge.

29. The Study findings show that compared with Option 1, Option 3 would not be expected to have an adverse impact on the overall service quality of the Hong Kong mobile and 3G networks. Focusing on 3G hotspots[10] only, the service demand currently exceeds the design capacity. The Study finds that the impact on the quality of service offered by an incumbent 3G operator that does not acquire the Re-auctioned Spectrum can be potentially minimised by it refarming spectrum to meet the demand for 2G, 3G and 4G services. The Consultant finds that service quality under Option 3 is capable of being on a par with that under Option 1, even in the 3G hotspots.

30. Please refer to paragraphs 2.14 – 2.21 of **Appendix 1** for the Study findings.

[10] Hotspots are defined as those cell sites that carry the most network traffic. 3G hotspots account for 15% - 20% of the cell sites of the 3G MNOs and 40% of the 3G network traffic.

31. The CA has noted the Study findings and has made its own independent assessment. The CA observes from the Study findings that, whilst some 3G hotspots are currently congested during busy hours, there is significantly more capacity than demand on the 4G networks. Given that mobile data services can be provided on both the 3G and 4G network platforms, the incumbent 3G operators can always choose, in tandem with their spectrum refarming exercise, to migrate their 3G customers to the 4G networks in order to uphold the service quality. The CA considers that by so doing, any possible impact on service quality would be further mitigated. The Study findings only cite spectrum refarming as a possible mitigation measure and do not take account of the effect of this other measure as above.

32. The Consultant has assumed in the Study that customer churning among MNOs arising from the 3G spectrum re-assignment during the transitional period will be very unlikely. The CA agrees. Any incumbent 3G operator which is unable to, or chooses not to acquire the Re-auctioned Spectrum can be expected to implement strategies to retain its customers and minimise churning. The CA notes that it is already the common sales and marketing practice for the MNOs to entice customers to take up 4G services, for example, through price promotion, integrated mobile data plans and 4G handset subsidisation.

33. The CA notes that those respondents which objected to re-auctioning parts of the 3G Spectrum under Option 3 were concerned about inadequate network capacity in meeting the sustained robust growth in mobile data traffic. However, to put this in its proper perspective, it should be noted that the amount of spectrum to be re-auctioned under Option 3 amounts to only 7% – 10% of the total spectrum holding of the individual incumbent 3G operators, and there is ample capacity available in the 4G networks to meet mobile data service demand. Furthermore, there is nothing preventing incumbent 3G operators from acquiring the Re-auctioned Spectrum through participating in the auction. More importantly, an advance notice of about three years to the incumbent 3G operators will allow them to prepare for the spectrum re-assignment; they will have two years after the auction to adjust their businesses to address any changes to their holding of 3G Spectrum. Once the spectrum re-auction is concluded, those which are unable to or choose not to acquire the Re-auctioned Spectrum may adjust their networks and

business plans to cater for the small reduction in their spectrum holding.

34. Please refer to paragraphs 2.22 – 2.26 of Appendix 1 for the CA's detailed assessment.

35. Having considered the Study findings and its own independent assessment, the CA is satisfied that service continuity and quality can be maintained under both Option 1 and Option 3. With the implementation of appropriate mitigation measures, any degradation in service quality that may ensue from a reduction in individual 3G Spectrum holding can be effectively mitigated.

Efficient Spectrum Utilisation

36. It is the CA's considered view that Option 1 is more likely to be inferior to Option 3 in meeting the objective of ensuring efficient spectrum utilisation.

37. The CA considers that, as compared with Option 3, a perpetual spectrum assignment as in Option 1 provides less incentive for, and exerts less pressure upon, spectrum assignees to strive to enhance spectral efficiency.

38. In contrast, Option 3 could be expected to enhance utilisation of spectrum in at least three different ways. First, as spectrum is a scarce public resource, its auction should lead to it being assigned to those assignees which value it the most and which could be expected to put it to the most efficient use. Option 3 embodies this element of auction, not Option 1. Second, different MNOs are likely to have different spectrum needs. The prospect of an auction provides an opportunity for the MNOs to review and optimise their spectrum holdings. Option 1 would not operate as a catalyst for spectrum holding review. Third, Option 3 also provides an opportunity for the incumbent 3G operators to acquire the maximum contiguous block of 2 x 19.7 MHz of spectrum in the 1.9 - 2.2 GHz band, which would enable them to fully utilise the potential of the Long Term Evolution ("LTE")-Advanced technology at an early stage. Again, a perpetual assignment of 2 x 14.8 MHz of 3G Spectrum to each incumbent 3G operator under Option 1 would not provide this opportunity.

39. Please refer to paragraphs 3.6 – 3.13 of **Appendix 1** for the CA's detailed assessment.

Promotion of Effective Competition

40. Although the mobile market in Hong Kong is already keenly competitive, with five MNOs serving a population of seven million, the CA's view is that the optimal number of MNOs to meet demand for mobile services should be determined by market forces.

41. Option 3 is more likely to promote effective competition by opening up an opportunity for new entrants to enter the mobile market than Option 1 which is likely to foreclose such a possibility. This will particularly be the case when there will unlikely be any supply of new spectrum in the coming few years before the digital dividend, which is subject to the switching off of the analogue terrestrial television services and cross-boundary frequency coordination. The MNOs can also take the opportunity under Option 3 to rationalise their spectrum holdings according to their own commercial considerations which should enable them to compete more effectively in the market.

42. Regarding the suggestion made by the incumbent 3G operators that competition in the mobile market could be promoted through mergers and acquisitions and spectrum trading, the likelihood and effectiveness of these is less certain, as the amount of spectrum that would become available to the market and its timing would be solely dependent on the MNOs exercising their discretion to take these steps and they would unlikely regard enhancing market competition as their concern.

43. Please refer to paragraphs 4.6 – 4.12 of **Appendix 1** for the CA's detailed assessment.

Encouragement of Investment and Promotion of Innovative Services

44. The CA is of the view that as compared with Option 1, Option 3 is more likely to encourage investment and promote innovative services by both the new 3G Spectrum assignees and incumbent 3G operators. Any new 3G

Spectrum assignees will make investments to put the spectrum they acquire to use. The incumbent 3G operators, having been assigned two-thirds of the 3G Spectrum through exercising the right of first refusal, will be able to maintain their current levels of 3G services. They will need to continue to invest to upgrade their 3G network infrastructure. For any incumbent 3G operator which is unable to, or chooses not to, acquire any Re-auctioned Spectrum, it is likely to invest in its infrastructure to upgrade its network capacity to compensate for the reduction in spectrum holding. Option 1 would not stimulate investment in the same way. On promotion of innovative services, the element of auction embodied under Option 3 would provide an opportunity for the incumbent 3G operators to acquire 3G spectrum with a view to securing a contiguous block of 2 x 19.7 MHz of spectrum, thereby readily realising the full potential of LTE-Advanced technology and enabling the provision of more innovative services. Option 1 does not provide that opportunity.

45. The CA does not share the incumbent 3G operators' view that only Option 1 provides a sufficiently certain environment for them to continue to invest. Option 3, by re-assigning to them two-thirds of the 3G Spectrum through a right of first refusal, provides them the certainty that they will continue to have a substantial 3G Spectrum holding for a further 15 years' term thus maintaining the environment that they are likely to need to continue their investment in their 3G networks.

46. Please refer to paragraphs 5.6 – 5.12 of **Appendix 1** for the CA's detailed assessment.

THE CA'S DECISION ON THE 3G SPECTRUM RE-ASSIGNMENT ARRANGEMENTS

47. Having considered the views and comments received in the two rounds of public consultation, the findings of the Study, and the policy views of the SCED, and having evaluated the three options against the multiple spectrum re-assignment objectives, ***the CA has decided to adopt Option 3, a hybrid of the administratively-assigned cum the market-based approach, for re-assigning the 3G Spectrum (the 2 x 59.2 MHz of paired spectrum in the 1.9 – 2.2 GHz band) as it considers that it can best serve the multiple objectives in spectrum re-assignment. The CA has also decided to put the***

20 MHz of the unpaired spectrum in the same frequency band, which has been left idle since the assignment in 2001, back to reserve upon expiry of the existing assignments.

THE SCED'S CONSIDERATIONS ON THE SUF

48. The 3G Spectrum is designated under the Telecommunications (Designation of Frequency Band subject to Payment of Spectrum Utilization Fee) Order (Cap. 106Y) as one of the frequency bands in which the use of spectrum is subject to the payment of SUF. Pursuant to section 32I(2) of the TO, the SCED may prescribe by regulation the level of the SUF or the method for determining the SUF of the 3G Spectrum.

49. 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.

50. Taking into account the relevant comments received in the two rounds of public consultation, the SCED has decided to propose a regulation under section 32I(2) of the TO to prescribe the method for determining the SUF of the 3G Spectrum as set out in paragraphs 51 – 63 below. The SCED's responses to the submissions to the Second Consultation Paper in relation to SUF are detailed in paragraphs 7.7 – 7.21 of **Appendix 1**.

SUF of the Re-auctioned Spectrum

51. For the Re-auctioned Spectrum, its SUF would naturally be determined through auction whereby the bidders would determine the level of their bids based on clear information on the supply of spectrum and their assessment of the business opportunities. The auction price would reflect the full market value of the Re-auctioned Spectrum. The SCED has decided to propose a regulation under section 32I(2) of the TO to prescribe that the SUF of the Re-auctioned Spectrum will be determined by auction.

SUF of the RFR Spectrum

52. The Spectrum Policy Framework states that for the spectrum not released through auction or other market mechanisms, without affecting any of the powers of the SCED, the SUF may be set to reflect the opportunity costs of the spectrum. The RFR Spectrum that will be re-assigned to the incumbent 3G operators if they exercise the right of first refusal fall squarely within the category of spectrum not released through market mechanism.

53. In the light of the policy consideration to ensure efficient spectrum utilisation, the SCED is of the view that the SUF of the RFR Spectrum should be set as close as possible to its full market value. Two methods of determining the SUF of the RFR Spectrum were detailed in the Second Consultation Paper –

- To set the SUF at the royalty payment for the 3G Spectrum in 2015/16 or the SUF of the Re-auctioned Spectrum as determined by auction, whichever is the higher (the "First Method"); and

- To set the SUF at the average between the weighted average of relevant past market benchmarks and the SUF of the Re-auctioned Spectrum as determined by auction (the "Second Method")

Under these two methods, the SUF of the RFR Spectrum will be benchmarked (to different degrees) against the outcome of the Re-auctioned Spectrum auction, i.e., the auction price.

54. As the market value of different parts of the 3G Spectrum should be very close to, if not the same as, each other, the outcome of the auction for the Re-auctioned Spectrum would naturally be the best available indicator of the full market value of the RFR Spectrum for the next assignment term. On the other hand, the royalty payment for the 3G Spectrum in 2015/16, being the actual value payable by the incumbent 3G operators for the use of the 3G Spectrum in the year just before the expiry of the existing assignment, is considered to be a reasonable estimate of the minimum price for exercising the right of first refusal as the value of the frequency spectrum is expected to increase over time amidst the sustained robust growth in mobile data traffic.

55. Compared with the First Method, the averaging out effect under the Second Method may draw the SUF of the RFR Spectrum to a level well below the auction outcome, hence deviating significantly from the full market value.

56. After careful consideration, the SCED considers that the First Method should be adopted in order to reflect the full market value of the RFR Spectrum as far as practicable.

57. Regarding the royalty payment for the spectrum in the 1.9 – 2.2 GHz band in 2015/16, the SCED notes that it covers the 5 MHz of unpaired spectrum assigned to each of the incumbent 3G operators in 2001, in addition to the 29.6 MHz of paired 3G Spectrum. Although the unpaired spectrum has been left idle since its assignment and its application for provision of mobile services as of today still lags far behind that of the paired spectrum, the 5 MHz of unpaired spectrum was taken into account when the SUF of the 3G Spectrum under the existing assignment was determined in 2001. Since the unpaired spectrum would not be re-assigned in this coming exercise, the SCED considers it reasonable to discount this spectrum for the purpose of setting the lower end of the price range for RFR Spectrum under the First Method ("Lower Limit"). The SCED also considers it reasonable to treat this unpaired spectrum as being on a par with the paired spectrum in the 1.9 – 2.2 GHz band for the purpose of calculating the per MHz royalty payment concerned. That is, 1 MHz of unpaired spectrum will be counted as equivalent to 1 MHz of paired spectrum in the calculation of 2015/16 royalty payment per MHz.

58. The SCED considers it appropriate to require the assignees in the coming assignment exercise to pay the lump sum SUF upfront (instead of paying the SUF by annual instalments as in the existing assignment) and to arrive at the Lower Limit for the 15-year period by directly multiplying the 2015/16 royalty payment by 15. In doing so, the SCED has effectively taken into account both the increase in spectrum value throughout the next assignment term, on the assumption that the value of the 3G Spectrum will increase in the future at a rate broadly in line with the cost of capital of the operators, and the necessary adjustment for time value of money.

59. On the basis of the royalty payment of $151 million payable by each

incumbent 3G operator in 2016 and the spectrum holding of 34.6 MHz of spectrum by each of them (including the 5MHz unpaired spectrum), as well as a multiplication factor of 15 to cover the entire 15-year term of frequency assignment, the Lower Limit for the 15-year period is calculated at $66 million per MHz at 2016 price level.[11]

60. In order to address the concern of the incumbent 3G operators over the lack of certainty by the dependence of the SUF of the RFR Spectrum on that of the Re-auctioned Spectrum, the SCED is of the view that a cap should be placed on the SUF of the RFR Spectrum. Incumbent 3G operators will therefore be advised of both the upper and lower limits of their financial commitment under the right of first refusal arrangement.

61. Having considered the Lower Limit for the 15-year period for the RFR Spectrum, the estimated market price of the 3G spectrum, and other factors including providing a level playing field for incumbent 3G operators and the successful bidders of the Re-auctioned Spectrum, the SCED considers it appropriate to set the level of the cap at $86 million per MHz.

62. To conclude, the SCED has decided to propose a regulation under section 32(I)2 of the TO to prescribe that the SUF per MHz of the RFR Spectrum for the next 15-year assignment term will be ***the higher of $66 million at 2016 price level or the SUF per MHz of the Re-auctioned Spectrum*** as determined by auction, subject to ***a cap of $86 million***.

63. The regulation referred to in paragraphs 51 and 62 has to be tabled before the LegCo for vetting.

<u>Auction Reserve Price of the Re-auctioned Spectrum</u>

64. With the aims to shed light on the possible value of the Re-auctioned Spectrum and to forestall non-serious bidders, the SCED considers it appropriate to pitch the auction reserve price for the Re-auctioned Spectrum at a level which is significantly higher than the reserve prices set for the spectrum auctions in the past. The auction reserve price is to be set at a level which would minimise the possibility of an unreasonably low SUF due to strategic

[11] $\frac{\$151 \text{ million}}{34.6 \text{ MHz}}$ x 15 years = around $66 million / MHz

bidding behaviour of the incumbent 3G operators. It is not intended to be set as a pre-estimate of an expected market price and the determination of final SUF which is the full market value of the Re-auctioned Spectrum would be left to the market force in the competitive auction.

65. The auction for the Re-auctioned Spectrum is currently expected to be conducted in the fourth quarter of 2014. Reserve prices in past auctions were normally announced through the Information Memorandum which would be published when applications for bidding are invited. However, in the current exercise, the SUF of the RFR Spectrum would be linked to the results of the auction for the Re-auctioned Spectrum and hence would be affected by the auction reserve price. Given the special circumstances of this case, it may be preferable for early information to be given concerning the auction reserve price.

66. In determining the reserve price of the Re-auctioned Spectrum, the SCED considers it apt to make reference to the levels of the SUF of the spectrum in the 850/900 MHz and 2.5/2.6 GHz bands as determined by the auctions conducted in March 2011 and March 2013. These two frequency bands are chosen as relevant references because they are both deployed for the provision of data services with mature technology support. The average SUF then fetched for the spectrum in these two frequency bands are $98 million per MHz and $31 million per MHz respectively. Taking into account the possible effect of better propagation characteristics of the 850/900 MHz spectrum in lifting the value of its SUF, the SCED considers it appropriate to set the auction reserve price of the Re-auctioned Spectrum at ***$48 million per MHz at 2016 price level***.

67. Nothing in this Statement will affect, limit or prejudice the exercise of the powers by the SCED under the TO or its subsidiary legislation.

ARRANGEMENTS FOR SPECTRUM RE-ASSIGNMENT

68. The arrangements for the re-assignment of the spectrum in the 1.9 – 2.2 GHz band consist of the following components, viz. the method for spectrum re-assignment, the auction rules, and the licensing arrangements. The CA's decisions on the above are set out below.

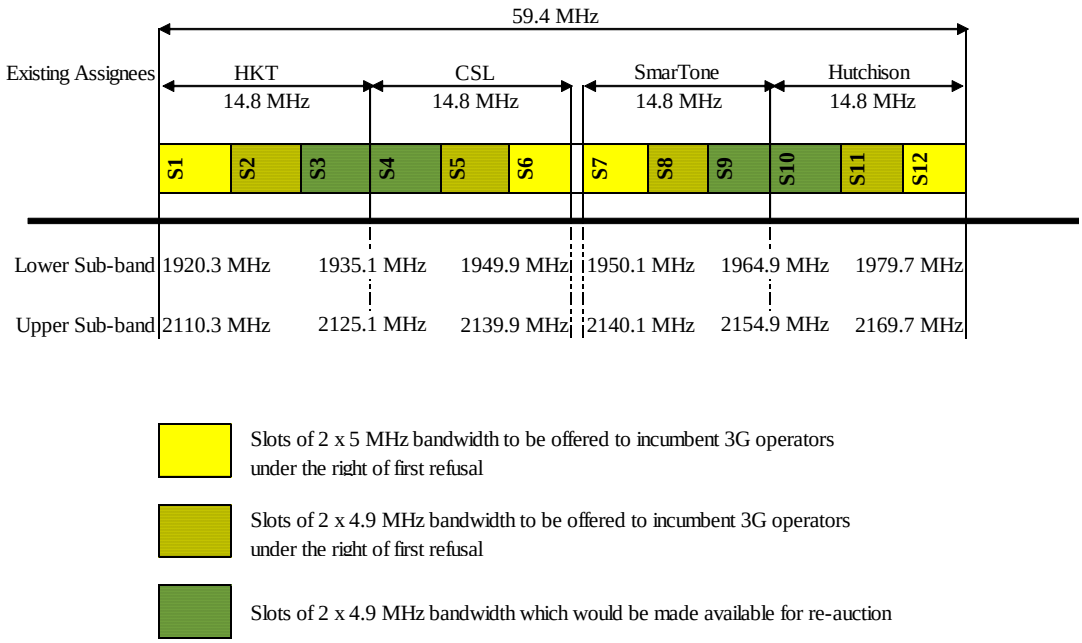
Method for Spectrum Re-assignment

69. There are two categories of 3G Spectrum to be re-assigned, viz. the RFR Spectrum and the Re-auctioned Spectrum. The band plan and the tables in the next sub-section delineate clearly their exact frequency ranges within the 1.9 – 2.2 GHz band.

Band Plan

70. Based on the decision of adopting Option 3, right of first refusal will be given to the incumbent 3G operators for them to be re-assigned two-thirds of their existing 3G Spectrum holdings, and the remaining one-third of the 3G Spectrum will be re-auctioned. The CA decides that the band plan as depicted in Figure 1 below should be adopted as it is most likely to avoid the risk of undue spectrum fragmentation and to promote efficient use of the scarce spectrum resource.

Figure 1: Band Plan for Re-assignment of the Frequency Spectrum in the 1.9 – 2.2 GHz Band



On the basis of the above band plan, the CA decides that each incumbent 3G operator will be re-assigned through right of first refusal 2 x 9.9 MHz or 19.8 MHz of spectrum in the frequency ranges as specified in Table 1 below. This gives a total of 2 x 39.6 MHz or 79.2 MHz of RFR Spectrum. Should

any of the incumbent 3G operators decide not to exercise the right of first refusal to be re-assigned the RFR Spectrum, the spectrum thus becoming available will be pooled together with the remaining one-third of the 3G Spectrum to form the Re-auctioned Spectrum and be re-assigned through auction.

Table 1: RFR Spectrum

Incumbent 3G Operator	**Frequency Slot**	**Frequency Range (MHz)**	**Bandwidth**
HKT	S1 & S2	1920.3 – 1925.3 paired with 2110.3 – 2115.3, and 1925.3 – 1930.2 paired with 2115.3 – 2120.2	19.8 MHz
CSL	S5 & S6	1940.0 – 1944.9 paired with 2130.0 – 2134.9, and 1944.9 – 1949.9 paired with 2134.9 – 2139.9	19.8 MHz
SmarTone	S7 & S8	1950.1 – 1955.1 paired with 2140.1 – 2145.1, and 1955.1 – 1960.0 paired with 2145.1 – 2150.0	19.8 MHz
Hutchison	S11 & S12	1969.8 – 1974.7 paired with 2159.8 – 2164.7, and 1974.7 – 1979.7 paired with 2164.7 – 2169.7	19.8 MHz

71. If all the incumbent 3G operators exercise their right of refusal to be re-assigned the RFR Spectrum, 2 x 19.6 MHz or 39.2 MHz of spectrum in the 1.9 – 2.2 GHz band will be available for re-auction. The CA decides that it will be divided into four frequency slots of 2 x 4.9 MHz or 9.8 MHz each as detailed in Table 2 below.

Table 2: Re-auctioned Spectrum

Frequency Slot	Frequency range (MHz)	Bandwidth
S3	1930.2 – 1935.1 paired with 2120.2 – 2125.1	9.8 MHz
S4	1935.1 – 1940.0 paired with 2125.1 – 2130.0	9.8 MHz
S9	1960.0 – 1964.9 paired with 2150.0 – 2154.9	9.8 MHz
S10	1964.9 – 1969.8 paired with 2154.9 – 2159.8	9.8 MHz

Auction Rules

72. With the adoption of Option 3, a minimum of 2 x 19.6 MHz of spectrum in the 1.9 – 2.2 GHz band will be available for re-auction. Section 32I(4) of the TO empowers the CA to specify the terms and conditions of an auction.

73. Allowing time to implement the necessary procedures for the conduct of a spectrum auction, including introduction of or amendments to subsidiary legislation, gazetting of the auction reserve price and the terms and conditions of the auction, issue of the information memorandum for auction and the invitations for bidding, the auction is expected to be conducted in the fourth quarter of 2014. This will provide a transitional period of up to two years for the incumbent 3G operators and the new spectrum assignees to reconfigure their existing networks and/or to roll out new network infrastructure, as the case may be, so that the Re-auctioned Spectrum can be put to immediate use at the beginning of the new term of spectrum assignments.

Eligible Bidders

74. The existing assignments of the 3G Spectrum will expire on 21 October 2016. The CA decides that the Re-auctioned Spectrum will be open for bidding by all interested parties, including new entrants to the Hong

Kong mobile market, the MVNOs, the incumbent 3G operators irrespective of whether or not they have exercised the right of first refusal to be re-assigned the RFR Spectrum, and the MNO not assigned any 3G Spectrum.

Auction Format

75. The Re-auctioned Spectrum will be assigned by way of a single auction using the SMRA format. As the SMRA auction format has been adopted by the former TA and the CA in a number of previous radio spectrum auctions in Hong Kong, the telecommunications industry is familiar with this auction format.

76. Under this auction format, at least four frequency slots (i.e. S3, S4, S9 and S10 as specified in Table 2) will be auctioned simultaneously over multiple rounds with price changing on each frequency slot independently. If there are frequency slots (some or all of S1, S2, S5, S6, S7, S8, S11 and S12 as specified in Table 1) for which any incumbent 3G operator does not exercise their right of first refusal, they will also be put to auction all together. Bidders may bid for one or more slots subject to the spectrum cap to be imposed for the auction, as discussed in the paragraph below. They may also switch their bids among slots from round to round, and withdraw any standing highest bid submitted in the immediately preceding round subject to a potential withdrawal liability.

Spectrum Cap

77. Subject to the exercise of the right of first refusal by the incumbent 3G operators, a minimum of four frequency slots (amounting to 2 x 19.6 MHz) and a maximum of 12 frequency slots (amounting to 2 x 59.2 MHz) will be put out for re-auction. In order to provide a fair opportunity for all the bidders to acquire the Re-auctioned Spectrum upon expiry of the existing term of assignments, the CA decides that a spectrum cap of 2 x 20 MHz (or four frequency slots) of the 3G Spectrum will be imposed for any spectrum assignee. This means that a new entrant to the band may bid for not more than four frequency slots in the auction. For an incumbent 3G operator which has exercised the right of first refusal for 2 x 9.9 MHz of 3G Spectrum, it may however bid for not more than two frequency slots in the auction.

Licensing Arrangements

78. In line with the current licensing regime, the incumbent 3G operators and new 3G Spectrum assignees will be issued with a new unified carrier licence ("UCL") for frequency holdings in the 1.9 – 2.2 GHz band. An incumbent licensee may apply to the CA to combine its existing UCL with the new UCL subsequent to the grant of the new licence.

Licence Validity Period

79. The CA decides that the RFR Spectrum and Re-auctioned Spectrum will be assigned with a validity period of 15 years, from 22 October 2016 to 21 October 2031, under a UCL for the provision of fixed, mobile and/or converged services.

Network and Service Rollout Obligations

80. The incumbent 3G operators, whether they are using the RFR Spectrum or the Re-auctioned Spectrum which they originally hold, have already had their networks rolled out to utilise the 3G Spectrum. Thus the CA decides to impose network and service rollout obligations only on those successful bidders which are new entrants to the band, and on those incumbent 3G operators which successfully obtain any of the Re-auctioned Spectrum that was not originally held by them. These obligations include the obligation to provide a minimum coverage in terms of a specified percentage of population in the case of mobile services provision, or in terms of a specified number of commercial and/or residential buildings in the case of fixed services provision, within five years from licence grant in accordance with the types of services proposed by the successful bidders in their applications for the auction.

Performance Bond for Rollout Obligation

81. The CA decides that only the successful bidders which are new entrants to the 1.9 – 2.2 GHz band and the incumbent 3G operators which successfully obtain some of the Re-auctioned Spectrum that was not originally held by them will be required to lodge a performance bond as a guarantee of their compliance with the aforesaid network and service rollout obligation.

Open Network Access Requirement

82. Under the current term of assignments for the 3G Spectrum, each of the incumbent 3G operators is obliged to offer an aggregate of 30% or more of its network capacity to qualified MVNOs or content or service providers under the open network access ("ONA") requirement. The CA decides that there is no need to impose any ONA requirement on spectrum assignees under the new term of assignments for the 3G Spectrum from 22 October 2016 onwards as: (a) the market environment has changed rapidly over the past decade or so, and more spectrum has been released to the market subsequent to the assignment of the 3G Spectrum in 2001; (b) the prevalence of facilities-based competition in the mobile market has meant that the CA (or the former TA) has not imposed any ONA requirement in the recent spectrum assignments and has waived the ONA requirement of the second generation spectrum assignees; and (c) there has been no request by industry participants for regulatory intervention under the ONA requirement for the 3G Spectrum. As such, none of the spectrum assignees will be subject to any ONA requirement. MNOs may negotiate freely for the leasing of network capacity on a commercial basis.

IMPLEMENTATION OF THE ARRANGEMENTS FOR SPECTRUM RE-ASSIGNMENT

83. In tandem with the publication of this Statement, the CA has issued letters of notice to the four incumbent 3G operators to notify them of its decision on the 3G Spectrum re-assignment arrangements.

84. Subject to the completion of the necessary legislative process, the CA will offer the right of first refusal for the RFR Spectrum to the incumbent 3G operators in 2014. Upon confirmation as to the exercise or otherwise of their right of first refusal, the total amount of the 3G Spectrum to be put to auction will be determined. The CA will then prepare for the auction which is targeted to be held in the fourth quarter of 2014.

Communications Authority
Secretary for Commerce and Economic Development
15 November 2013

Arrangements for the Frequency Spectrum in the 1.9 – 2.2 GHz Band upon Expiry of the Existing Frequency Assignments for the Provision of 3G Mobile Services and the Spectrum Utilisation Fee

Summary of Submissions to the Second Consultation Paper and the Responses of the Communications Authority and the Secretary for Commerce and Economic Development

Section 1 : Introduction

1.1 On 22 October 2001, the former Telecommunications Authority assigned a total of 2 x 59.2 MHz of paired frequency spectrum[1] in the 1.9 – 2.2 GHz band (hereinafter referred to as the "3G Spectrum") to four mobile network operators ("incumbent 3G operators") for the provision of third generation ("3G") mobile services. The four incumbent 3G operators are CSL Limited, Hong Kong Telecommunications (HKT) Limited, Hutchison Telephone Company Limited, and SmarTone Mobile Communications Limited. The spectrum assignments, which last for 15 years, will expire on 21 October 2016. In view of the forthcoming expiry of the current term of assignments, the Secretary for Commerce and Economic Development ("SCED") and the Communications Authority ("CA") have jointly conducted two rounds of public consultation to seek views and comments on how the 3G Spectrum should be re-assigned upon the expiry of the current assignments and on related issues.

1.2 In the first consultation paper issued on 30 March 2012 ("First Consultation Paper"), the following three options were identified for the re-assignment of the 3G Spectrum:

(a) Option 1: An administratively-assigned approach
Right of first refusal of all the 3G Spectrum to be offered to the incumbent 3G operators

[1] A total of 20 MHz of unpaired frequency spectrum in the same band was also assigned to the four incumbent 3G operators in the same exercise. The unpaired spectrum has been left idle since the assignment and it is proposed to put the 20 MHz of unpaired spectrum back to reserve upon expiry of the current assignments.

(b) Option 2: A full-fledged market-based approach
Re-auctioning all the 3G Spectrum

(c) Option 3: A hybrid approach
Right of first refusal to the incumbent 3G operators to retain parts of their spectrum, with the remaining parts of the spectrum to be assigned through re-auction.

The First Consultation Paper identified the multiple objectives in spectrum re-assignment, viz. ensuring customer service continuity, efficient spectrum utilisation, promotion of effective competition, and encouragement of investment and promotion of innovative services. The CA is minded to choose an option that could be expected to best meet these multiple spectrum re-assignment objectives.

1.3 Having analysed the views and comments received in the first round of consultation, the SCED and the CA jointly issued the second consultation paper ("Second Consultation Paper") on 28 December 2012. In the Second Consultation Paper, Option 3, which is a hybrid between the administratively-assigned and the market-based approach, is considered most likely to meet the multiple objectives in re-assigning the 3G Spectrum (as set out above), and it should accordingly be considered in a further round of consultation with the telecommunications industry and other affected persons. Under the proposed Option 3, the incumbent 3G operators would be offered the right of first refusal to be re-assigned two-thirds of the 3G Spectrum ("the RFR Spectrum"). Should any of the incumbent 3G operators decide not to exercise the right of first refusal to be re-assigned the RFR Spectrum, the spectrum thus becoming available will be pooled together with the remaining one-third of the 3G Spectrum and assigned through auction (collectively "Re-auctioned Spectrum"). By the close of the second round of consultation on 11 April 2013, submissions had been received from the following 43 respondents:

<u>Mobile Network Operators ("MNOs")</u>

1. China Mobile Hong Kong Company Limited ("CMHK")
2. CSL Limited ("CSL")

3. Hong Kong Telecommunications (HKT) Limited ("HKT")
4. Hutchison Telephone Company Limited ("Hutchison")
5. SmarTone Mobile Communications Limited ("SmarTone")

Consultants

6. Certari Consulting Limited ("Certari")
7. Competition Economists Group ("CEG")
8. G&A Management Consultants Limited ("G&A")
9. Plum Consulting ("Plum")

Business Organisations

10. The American Chamber of Commerce in Hong Kong ("AmCham")
11. Hong Kong General Chamber of Commerce ("HKGCC")
12. Hong Kong Information Technology Federation ("HKITF")

Equipment Vendors, Business Partners, Works Contractors

13. Bespark Technologies Engineering Limited ("Bespark")
14. Huawei Tech. Investment Co. Limited ("Huawei")
15. Nokia Siemens Network H.K. Limited ("NSN")
16. NTT Docomo Inc. ("NTT")

Political Parties

17. Democratic Alliance for the Betterment and Progress of Hong Kong ("DAB")
18. Labour Party ("LP")

Members of the Public

19. DDB Worldwide Limited
20. Eric Pang
21. George Joseph Ho
22. James
23. K F Tsang

24. Luen Yick Beaded Plate Co., Limited
25. N Kwan
26. Pro Bike Center Limited
27. Richard Arthus Witts
28. Ricky Chan
29. Ronald Leung
30. Simon Lo
31. VAKA
32. Wah Lee
33. Wilson Kwok
34. Yu Man Ha
35. Zensis Limited
36. 3G 頻譜拍賣關注組
37. 沈桃
38. 阿全
39. 陳紹其
40. 張進展
41. 張潔玲
42. 電盈小股東大聯盟
43. 魏庶光

1.4 Having carefully considered the submissions received, the SCED and the CA set out in this document their respective responses and views. The submissions received from the respondents are categorised by reference to the four objectives for spectrum re-assignment which were set out in the two consultation papers, and are reproduced in paragraph 1.2 of this document. There are also separate sections on submissions received on the proposed Option 3, the spectrum utilisation fee ("SUF"), the spectrum re-assignment framework and other related subjects raised by the respondents. The responses of the SCED or the CA are set out at the end of each section.

1.5 Nothing in this document represents or constitutes a decision made by the SCED or the CA. The views and comments set out in this document are without prejudice to the exercise of the powers by the SCED or the CA under the Telecommunications Ordinance ("TO") or any subsidiary legislation.

Section 2 : Ensuring Customer Service Continuity

2.1 Ensuring customer service continuity is one of the four objectives in spectrum re-assignment. Guided by the policy principles promulgated by the Government in the Radio Spectrum Policy Framework published in April 2007 ("Spectrum Policy Framework"), the CA has concluded that there are competing demands for the 3G Spectrum and accordingly a market-based approach should be adopted for its re-assignment. It is in deference to the concern over service continuity, which is considered further below, that the CA shares the views of the SCED, expressed in paragraph 27 of the Second Consultation Paper, that there is an overriding public policy reason not to follow the full-fledged market-based approach as proposed in Option 2 for the 3G Spectrum re-assignment. Instead, Option 3, a hybrid between the administratively-assigned and the market-based approach, is proposed whereby two-thirds of the 3G spectrum (i.e. the RFR Spectrum) is to be re-assigned through the right of first refusal to the incumbent 3G operators such that service continuity can be assured, especially for indoor coverage, leaving only one-third of the 3G Spectrum to be put out to re-auction.

Views and Comments of the Respondents

2.2 Among the respondents who objected to re-auctioning the 3G Spectrum, possible service degradation was the major concern. Some respondents quoted Cisco's forecast of a 13-fold increase in global traffic between 2012 and 2017, and pointed out that the mobile service quality in busy districts (such as Central, Causeway Bay and Mongkok) or confined areas (such as along the MTR lines) was already of inferior quality. The incumbent 3G operators, Plum and Huawei emphasized the reduction in network capacity and submitted that significant redesign and reconfiguration of the mobile systems, especially the integrated radio systems ("IRS"), were required under Option 3 if high quality customer services were to be maintained. They also expressed the view that the measures to increase capacity, namely using additional spectrum in other bands, cell splitting and use of microcells, would entail additional costs and were of doubtful effectiveness. A number of the respondents, including three incumbent 3G operators, pointed out that apart from decreases in the average data download speed, there would also be an

impact in terms of increases in drop calls, failed connections and interrupted data sessions. Some members of the public who responded to the consultation objected to spectrum re-auction as they were dissatisfied with a prospect of service degradation coupled with higher mobile service charges. There was concern about degradation in the quality of mobile services tarnishing the international image of Hong Kong as a digital city in the region.

2.3 The incumbent 3G operators, Plum and HKITF disagreed with the assessment of the magnitude of the service impact made by the Office of the Communications Authority ("OFCA") in the Second Consultation Paper - "*… even if all the 3G Spectrum is re-assigned to the incumbents through right of first refusal (i.e. Option 1), there would still be a 9% reduction in the average data download speed in October 2016 as a result of the sustained robust growth in mobile data traffic. Should the proposed hybrid option be adopted, the service degradation on data download speed would become 18% on average in October 2016 after the 3G Spectrum re-assignment.*" CSL submitted that the loss of one-third of the 3G Spectrum could result in a capacity loss of 33%. SmarTone considered that the loss of one-third of the 3G Spectrum, coupled with the difficulties of maintaining service quality in busy districts, MTR lines and confined areas, would cause a service degradation of more than 33%. HKT's assessment was that the magnitude of the underlying service degradation would be even more substantial (37.5%), and reducing the 3G Spectrum holdings by one-third would aggravate the situation by 6.5 percentage points, leading to a 44% drop in average data download speed. On the other hand, the incumbent 3G operators considered that refarming the spectrum in the 850/900 MHz band for the provision of 3G services and building more base stations would have only limited potential in compensating for the loss in spectral capacity. In any event, they found the prospect of a reduction in the average data download speed unacceptable. This view was echoed by HKGCC.

2.4 Despite the fact that all the five MNOs have already rolled out their 4G networks and are actively promoting the 4G handsets and services, the incumbent 3G operators and Plum were not optimistic about the likely migration of customers to 4G services in time to relieve pressure on the 3G network even by 2016. CSL opined that there would be continuous strong growth in 3G mobile data traffic over the next few years, and quoted a report

published by the GSM Association saying that 4G connections would represent only 10% of the global connections by 2017. Plum added that 3G networks would also be required for the provision of in-bound international roaming services. They and AmCham were concerned about the additional costs to consumers if there were to be a forced migration to 4G services.

2.5 DAB agreed that Option 3 met the multiple objectives for spectrum re-assignment. In particular, it served to protect consumers in terms of service continuity. Meanwhile, CMHK supported re-auction of all the 3G Spectrum. It was of the view that disruption to customer services should not be a valid reason for re-assigning the spectrum through right of first refusal, as the incumbent 3G operators should have been well aware that there was a real risk of their frequency assignments not being renewed upon expiry and they should have taken this into account in their business plans. Besides, the contract term with customers was generally for two years and the incumbent 3G operators would now have about three years to plan ahead. If the incumbent 3G operators made proper arrangements, it was unlikely that customer services would actually be affected.

2.6 CMHK doubted the need for the incumbent 3G operators to be re-assigned all the 3G Spectrum to maintain customer service continuity, given the continuous refarming of second generation ("2G") spectrum for the provision of 3G and 4G services, and the migration of customers from 3G to 4G services. It regarded the leasing of 3G Spectrum capacity by the incumbent 3G operators under the mobile virtual network operator ("MVNO") arrangement as evidence of spare 3G Spectrum in the hands of the incumbent 3G operators. Some members of the public who responded to the consultation supporting spectrum re-auction opined that, even if the incumbent 3G operators were not able to secure part or all of their 3G Spectrum, they could still maintain their services through the MVNO arrangement and establishment of more Wi-Fi access points.

The Responses of the CA

2.7 As mentioned by some incumbent 3G operators, they are currently leasing capacity on commercial terms to the MNO which is not

assigned any 3G Spectrum, and to many MVNOs. Hitherto, no MNO or MVNO has indicated to the CA any difficulty in leasing capacity from the incumbent 3G operators. In other words, the 3G Spectrum is in fact used by all the MNOs and major MVNOs at the moment. Irrespective of which option of spectrum re-assignment is adopted, the total amount of 3G Spectrum in the 1.9 – 2.2 GHz band will remain unchanged at 2 x 59.2 MHz post October 2016. Should there be any change in individual holdings of the 3G Spectrum as a result of the re-auction, any incumbent 3G operators with a smaller spectrum holding than before could review their capacity leasing arrangements to other MNO/MVNOs. Alternatively they could discuss with other spectrum assignees possible MVNO arrangements by which they could lease capacity to enable them to serve their customers, in much the same way as is already happening today.

2.8 It should be pointed out that mobile data services can be provided on both the 3G and the 4G network platforms. If the incumbent 3G operators consider that their 3G networks are congested, they can also adopt various strategies to move some of the data traffic to their 4G networks which currently have ample capacity.[2] The crux of the matter is therefore to allow sufficient time for the market to make the necessary preparation prior to the spectrum re-assignment becoming effective in October 2016.

2.9 The CA is aware that, under Option 3, the incumbent 3G operators which are unable to, or choose not to, acquire any Re-auctioned Spectrum would need to carry out reconfiguration works on the affected frequencies if they wish to maintain service quality. Of note is that the incumbents can continue to provide 3G services using the RFR Spectrum and the legacy IRS facilities while the reconfiguration works on the affected frequencies are being carried out. The CA is of the view that by so doing, service continuity can be assured. The potentially severe and long lasting effect on service quality and reception, and in particular the risk of a complete loss of 3G service in indoor areas in certain circumstances which could possibly ensue under Option 2 when all of the 3G Spectrum would be re-auctioned, could also be avoided. By notifying the incumbent 3G operators about the re-assignment

[2] As of July 2013, MNOs have deployed much more spectrum for the provision of 4G services (at 260 MHz) than 3G services (at 173 MHz), but the number of 4G service subscribers is much smaller, at 1.6 million as compared to 9.4 million of 3G service customers.

arrangements about three years in advance and conducting the auction of the Re-auctioned Spectrum two years prior to the actual re-assignment, the incumbent 3G operators which are unable to, or choose not to, acquire any Re-auctioned Spectrum will have two years to reconfigure their networks and/or to prepare for the migration of customers to other frequency bands prior to the actual spectrum re-assignment. The CA is of the view that such arrangements would provide the affected incumbent 3G operators sufficient time to prepare for the re-assignment and ensure the transition proceeds in an orderly manner.

2.10 The CA is of the view that it is overly simplistic to say that not acquiring one-third of the 3G Spectrum will result in a capacity loss of 33%. Technically, the 2G spectrum in the 850/900 MHz and 1800 MHz bands can be refarmed for the provision of 3G and 4G services, and the MNOs have indeed been pursuing this already. Based on the base station information submitted by the MNOs to OFCA, as of mid-2013, around 55% of the spectrum in the 850/900 MHz and 1800 MHz bands has already been refarmed for the provision of 3G and 4G services. Subject to the outcome of the 3G Spectrum re-auction, the MNOs may expedite the pace of refarming the 850/900 MHz band to cope with customer demand. Accordingly, in considering any possible impact in practice, the spectrum holdings in the 1.9 – 2.2 GHz band should not be taken in isolation. It is necessary for the incumbents to consider their spectrum holdings in the other frequency bands as well.

2.11 As shown in Table 1 below, currently, a total of 572 MHz of spectrum has been assigned to the five MNOs for the provision of public mobile services.[3] The 3G Spectrum in the 1.9 – 2.2 GHz band amounts to 21% of the total assigned spectrum; and the Re-auctioned Spectrum constitutes only 7% of the total spectrum holding of 572 MHz.[4] Depending on the spectrum holdings of individual incumbent 3G operators, the Re-auctioned Spectrum represents at most 10% of the assigned spectrum of the incumbent with the least spectrum holding, and only 7% in the case of the incumbent with

[3] The figure of 572 MHz does not include the 8 MHz of spectrum in the 678-686 MHz band assigned for the provision of broadcast-type mobile television services and the 30 MHz of spectrum in the 2.3 GHz band assigned to 21ViaNet for the provision of fixed services.

[4] The calculation is based on the assumption that each of the incumbent 3G operators will exercise the right of first refusal to be re-assigned 2 x 9.9 MHz of the 3G Spectrum. The Consultant and Plum made the same assumption in their studies.

the most spectrum holding. This means that, even in the event that an incumbent 3G operator has not acquired any Re-auctioned Spectrum, it can still operate with 90% - 93% of its total existing spectrum holding.

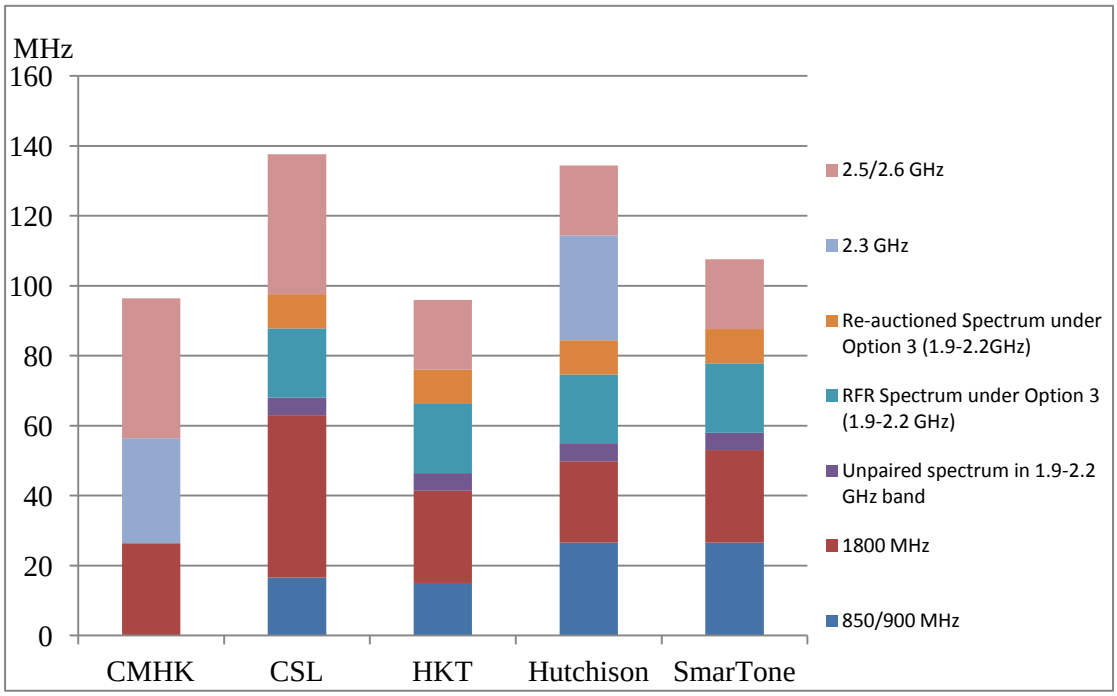
Table 1: Amount of Spectrum in Various Frequency Bands Assigned to Individual MNOs for the Provision of Public Mobile Services

(Unit: MHz)	**CMHK**	**CSL**	**HKT**	**Hutchison**	**SmarTone**	**Industry Total**
850/900 MHz	-	16.6 (12%)	15 (16%)	26.6 (20%)	26.6 (25%)	**84.8 (15%)**
1800 MHz	26.4 (27%)	46.4 (34%)	26.4 (28%)	23.2 (17%)	26.4 (25%)	**148.8 (26%)**
1.9 - 2.2 GHz	-	34.6 (25%)	34.6 (36%)	34.6 (26%)	34.6 (32%)	**138.4 (24%)**
- ***RFR Spectrum under Option 3***	-	*19.8 (14%)*	*19.8 (21%)*	*19.8 (15%)*	*19.8 (18%)*	***79.2 (14%)***
- ***Re-auctioned Spectrum under Option 3***	-	*9.8 (7%)*	*9.8 (10%)*	*9.8 (7%)*	*9.8 (9%)*	***39.2 (7%)***
- ***Unpaired Spectrum***	-	*5 (4%)*	*5 (5%)*	*5 (4%)*	*5 (5%)*	***20 (3%)***
2.3 GHz	30 (31%)	-	-	30 (22%)	-	**60 (11%)**
2.5/2.6 GHz	40 (41%)	40 (29%)	20* (21%)	20* (15%)	20 (19%)	**140 (24%)**
Total	**96.4 (100%)**	**137.6 (100%)**	**96 (100%)**	**134.4 (100%)**	**107.6 (100%)**	**572 (100%)**

Note (*) : The 40 MHz of spectrum in the 2.5/2.6 GHz band was assigned to Genius Brand Limited through the auctions conducted in January 2009 and March 2013 respectively, Genius Brand Limited is indirectly owned by HKT and Hutchison, and hence the concerned spectrum is assumed to be equally shared between the two parties.

( ) : Percentage shares in brackets represent the shares of spectrum in respective frequency bands in the total amount of spectrum assigned to each MNO and to the industry for the provision of public mobile services. Individual percentage shares may not add up to the total of 100% due to rounding.

Figure 1: Distribution of Spectrum among MNOs for the Provision of Public Mobile Services



2.12 The CA notes that some respondents have cited Cisco's forecast of a 13-fold increase of global mobile data traffic over the period of 2012-2017. However it would like to point out that, according to that same Cisco forecast, the global mobile data traffic over the period of 2012-2016 actually increases by eight-fold, as compared to the six-fold increase projected by OFCA in the Second Consultation Paper.

2.13 In response to the estimation made by GSM Association (quoted by CSL) that 4G connections would represent only 10% of the global connections by 2017, it is noteworthy that in Hong Kong, as at July 2013, 4G subscribers already accounted for 10% of the total number of mobile subscribers (or 19% of post-paid mobile subscribers) and the 4G penetration rate had reached 22% of the total population. Indeed, some features of the Hong Kong market are conducive to the take-up of 4G compatible handsets and 4G services. There is currently an ample supply of 4G handset models from all major handset manufacturers available in the Hong Kong market. Prices of 4G handsets with similar hardware configurations e.g. central processing unit, screen display and camera quality are comparable to those of their 3G

counterparts, with differences of less than 10%. As 4G services become more popular globally, such differences are expected to narrow further, and may disappear in the near future. In fact, some handset vendors have already launched new models with only one version that supports both 3G and 4G services. The enhanced functionality of these new handsets will lead to a natural migration with consumers replacing their existing 3G handsets with 4G handsets and switching to the faster 4G services in the coming years. 4G services will enable them to enjoy mobile services which place a heavy demand on network resources, such as high quality video streaming and interactive applications. Furthermore, the service charge for 4G services is not necessarily more expensive. The CA notes that it is already a common marketing practice for MNOs not to differentiate between 3G and 4G mobile data service plans and to offer integrated mobile data plans, underpinned by both 3G and 4G networks, with monthly tariff as low as $118 for data usage of 500MB. MNOs have also been adopting this marketing strategy to subsidize the price of 4G compatible handsets. These factors strongly indicate that the growth in 4G subscribers in Hong Kong will likely proceed at a faster pace than the global average, and this will have effectively relieved the pressure on the 3G capacity by the time of spectrum re-assignment in October 2016.

Advice of the Independent Consultant Appointed by the Government

2.14 Following the publication of the Second Consultation Paper, various interested parties, including the incumbent 3G operators, have emphasized the impact on service quality and customers and have suggested the actual impact would be larger than that estimated by OFCA in the Second Consultation Paper if Option 3 is adopted. The Government therefore appointed in May 2013 an independent consultant ("Consultant") to undertake a study with a view to providing a quantitative assessment of the likely impact on service quality and customers if Option 3 were to be chosen ("Study").

2.15 The assessment model developed by the Consultant covers a six-year modelling period, viz. from 2013 to 2018. This timeframe encompasses the period leading up to the 3G Spectrum re-assignment in October 2016 as well as the two-year transitional period after the re-assignment. The Consultant considers that a transitional period of two years would be

sufficient, taking into account the fact that the re-auction is expected to be conducted in the fourth quarter of 2014 and that any incumbent 3G operators which have not acquired their 2 x 4.9 MHz of Re-auctioned Spectrum will have two years to plan for the provision of services after October 2016 using the RFR Spectrum and spectrum in the other frequency bands.

2.16 There are many possible spectrum re-assignment scenarios under Option 3. The Consultant considers that the following four spectrum re-assignment scenarios are the most likely and thus its analysis in the Study focused on them:[5]

(a) one incumbent 3G operator fails to acquire any Re-auctioned Spectrum and it is taken up by another incumbent 3G operator;

(b) two incumbent 3G operators fail to acquire any Re-auctioned Spectrum and it is taken up by the other two incumbent 3G operators;

(c) one incumbent 3G operator fails to acquire any Re-auctioned Spectrum and it is taken up by CMHK;[6] and

(d) two incumbent 3G operators fail to acquire any Re-auctioned Spectrum and it is taken up by CMHK.

The Consultant believes that the least likely scenario is that CMHK acquires all the Re-auctioned Spectrum. However, the Consultant has also included this extreme outcome in the Study to serve as a reference point. In the Study, the impact on service quality of these four most likely scenarios and of the extreme scenario are assessed against the base case, or *status quo* scenario (equivalent to Option 1), in which all four incumbent 3G operators are re-assigned all their existing 3G Spectrum holdings.

2.17 The model assesses the impact on service quality from different

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5 See Chapter 3 of the Study report.

6 CMHK is the only MNO which is not assigned any 3G Spectrum for the time being and has indicated interest in acquiring the 3G Spectrum in response to the two rounds of public consultation conducted. Currently, CMHK is providing 3G services through MVNO arrangements with some incumbent 3G operators.

perspectives so as to arrive at a more comprehensive assessment:

(a) the impact on the entire mobile network (encompassing the 2G, 3G and 4G networks) versus the impact on the 3G network only;

(b) the impact on the territory-wide network (encompassing all cell sites including hotspots[7]) versus the impact on hotspots only; and

(c) the impact on individual incumbent 3G operators.

2.18 The Consultant sought the MNOs' input in the course of the Study. The Consultant has invited the MNOs to provide relevant data and used as much of this data as practicable in the model. The MNOs have attended meetings with the Consultant to discuss aspects of the Study and have been given opportunities to comment on the assessment model, and subsequently the preliminary assessment results, produced by the Consultant. The Consultant was required to duly consider the MNOs' comments in undertaking the Study.

2.19 The Study findings are summarised below:

(a) Under the base case scenario, in which all four incumbent 3G operators are re-assigned all of their existing 3G Spectrum holdings:

(i) for the entire Hong Kong territory-wide mobile network, as well as the 3G territory-wide network, there is sufficient network design capacity[8] to accommodate all demand;

(ii) for the entire hotspot network, there should be sufficient network design capacity to accommodate all demand through the modelling period to 2017. In 2018, while the network design capacity may be slightly insufficient, all demand should still be met by the total network capacity; and

[7] Hotspots are defined as those cell sites that carry the most network traffic. Based on the operators' traffic data, hotspots account for 15% - 20% of the cell sites, and carry 40% of the network traffic.

[8] For the purpose of this Study, the Consultant defines network design capacity as 75% of the total network capacity.

(iii) for the 3G hotspot network, already the network design capacity is not sufficient to accommodate all demand, giving rise to impacts on service quality. However, it should be pointed out that the insufficiency in network design capacity for the 3G hotspot network under the base case scenario is partly aggravated by the refarming of some of the spectrum in the 850/900 MHz band (which is currently being used for 3G services) to 4G services by some incumbent 3G operators during the modelling period, leading to a reduction of total spectrum available for the provision of 3G services.[9]

(b) Under the four likely spectrum re-assignment scenarios, as well as the extreme (but unlikely) scenario in which CMHK acquires all Re-auctioned Spectrum:

(i) for the entire Hong Kong territory-wide mobile network as well as the 3G territory-wide network, none of the scenarios could be expected to have an impact on service quality;

(ii) for the entire hotspot network, none of the scenarios could be expected to have an impact on service quality through the modelling period to 2017. In 2018, none of the scenarios could be expected to have an effect of worsening service quality compared with the base case situation for the entire hotspot network; and

(iii) for the 3G hotspot network, none of the scenarios could be expected to have an effect of worsening service quality compared with that in the base case scenario.

2.20 On a per operator basis, the Study findings show that the 3G Spectrum re-assignment could be expected to have an impact on service quality for the incumbent operator that does not acquire Re-auctioned Spectrum. The Consultant has evaluated the effectiveness of a number of measures in alleviating the potential adverse impact on service quality, namely (a) acquiring

[9] See Chapter 5.2 of the Study report.

additional spectrum; (b) spectrum refarming; (c) improving spectral efficiency; (d) increasing the number of cell sites; and (e) offloading to WiFi networks. It considers that spectrum refarming would likely be an effective mitigation measure, taking into account the Hong Kong local context.[10] MNOs have already refarmed some of their spectrum to 4G and it is natural that they will continue to do so. As such, the model already takes into account the MNOs' refarming plans of spectrum deployed for the provision of 2G and 3G services to 4G under the base case scenario. The mitigation measure which the Consultant assumed in the model is the refarming of some additional 2G spectrum to 4G as well as the modification to the spectrum refarming plans of the MNOs.[11] In the modified refarming plans, some 2G spectrum originally planned for refarming to 4G would be refarmed to 3G, and the amount of spectrum deployed for 3G services that are planned for refarming to 4G would be reduced. The Study findings show that spectrum refarming as a mitigation measure would be effective in alleviating the service impact for the incumbent 3G operator that does not acquire Re-auctioned Spectrum. It should be noted that the demand data used in the model was based upon information supplied by the MNOs. Given that there is ample capacity available in the 4G networks (as explained in paragraph 2.23 below), if the incumbent 3G operators implement strategies to accelerate the migration of their 3G customers to 4G, the service impact on their 3G networks could be further reduced. In other words, there is in fact much room for mitigating the service impact on the 3G networks.

2.21 As explained above, the objective of the Study is to provide a quantitative assessment of the likely impact on service quality if Option 3 were to be implemented. The Consultant considers that the model would provide a reasonable high level assessment of the impact on service quality for the Hong

[10] For acquiring additional spectrum, the Consultant notes that there would not be any new spectrum to be released in the Hong Kong market during the modelling period. For improving spectral efficiency, the Consultant is of the view that the MNOs in Hong Kong have prioritised investment in Long Term Evolution ("LTE") over Evolved High-Speed Packet Access ("HSPA+") technology and therefore the model assumes that there would not be any increase in 3G spectral efficiency during the modelling period. For increasing the number of cell sites, the Consultant considers that Hong Kong already has a dense mobile network layout especially in hotspots, and therefore the model assumes that the MNOs would not be able to build further cell sites in addition to those that are already planned by the MNOs. For offloading to WiFi networks, the Consultant does not consider that this measure could provide service quality comparable to mobile services offered by the MNOs. The detailed assessment of the mitigation measures by the Consultant can be found in Chapter 5 of the Study report.

[11] See Chapter 5.2 of the Study report.

Kong mobile market to achieve the objective of the Study. The model is different from the network planning models used by MNOs for dimensioning and operating their mobile networks, or models designed to assess quality on a per-site or per-customer basis.

2.22 The CA has noted the Study findings and has made its own independent assessment. The CA acknowledges that the amount of traffic carried may vary from hotspot to hotspot, and there are indeed some 3G hotspots in Hong Kong where the mobile service quality during busy hours may be worse than that estimated in the model developed by the Consultant. As pointed out by some respondents, 3G service quality in busy districts and the MTR is already of inferior quality during busy hours today. In order to provide satisfactory service to their customers and sustain their competitiveness in the market, the CA is of the view that there is an immediate and continuous need for MNOs to upgrade their networks and improve their service quality at these congested hotspots now and in any event. The possible impact of any spectrum re-assignment post October 2016 should not be used as an excuse for not making such improvements in a timely manner.

2.23 In the CA's views, in order to improve and maintain service quality, the incumbent 3G operators should consider using 4G spectrum to provide coverage in these congested hotspots as well as migrating their 3G customers to their 4G networks. In this regard, since 2009, 200 MHz of spectrum in the 2.3 GHz band and the 2.5/2.6 GHz band has been assigned through auctions for the provision of public mobile services, and the incumbents have more than sufficient 4G spectrum for service provision. Furthermore, the MNOs have refarmed some of their spectrum to 4G technology and will likely continue to do so. Coupled with the higher spectral efficiency of 4G spectrum,[12] the Study concludes that there is ample capacity

[12] The spectral efficiency values adopted in the model were based on the inputs provided by the MNOs as well as the research of the Consultant. The model assumes that there is no spectral efficiency increase for 2G and 3G during the modelling period. For 4G, the model assumes that (a) the MNOs would not adopt the MIMO (multiple input and multiple output) technology until 2015 though commercial deployments are already planned in some countries and (b) the MNOs would not deploy LTE-Advanced (3GPP Release 10) until 2015. The Consultant has also assumed that not all customers would have compatible 4G handsets in 2015 and the migration of customers to 4G services would happen gradually over the modelling period. Based on these assumptions and the MNOs' input data, the 4G spectral efficiency figure adopted in the model is around three times of the 3G figure in 2016 and gradually increases to 3.5 times in 2018. For more details, please see Chapter 6.2 of the Study report.

available in the 4G network.[13] In the natural scheme of things, the MNOs are likely to be already in the process of upgrading their networks and migrating their services and customers to 4G, in response to industry developments and customer demand for high-speed mobile data services, to maintain their competitiveness in the market. Considering the current market situation, the CA feels that a more objective assessment of service impact should take into account the entire mobile network encompassing the 2G, 3G and 4G networks. In this regard, as mentioned above, the Study findings show that for the entire territory-wide mobile network encompassing the 2G, 3G and 4G networks, there is sufficient network design capacity to accommodate all demand during the modelling period. For the entire hotspot network encompassing 2G, 3G and 4G, there is sufficient network design capacity to accommodate all demand through the modelling period to 2017; and in 2018, while the network design capacity may be slightly insufficient, all demand can still be met by the total network capacity.

2.24 As explained earlier, the affected incumbent 3G operators will have two years to reconfigure their networks and/or to prepare for the migration of customers to other frequency bands prior to the actual spectrum re-assignment in October 2016. Furthermore, any incumbent 3G operators which are left with a smaller spectrum holding than before may consider reviewing their capacity leasing arrangements to other MNO/MVNOs, or consider leasing 3G network capacity from other spectrum assignees through MVNO arrangements to serve their customers. It is to be expected, in commercial reality, that the MNOs would employ various strategies to maximise customer retention, including actively encouraging 3G customers to take up 4G services, through, for example, price promotion, integrated data plans and handset subsidisation. With MNOs adopting these strategies for customer retention, no customer churning is expected among the MNOs arising from the 3G Spectrum re-assignment albeit customer churning among the MNOs has been a common phenomenon in the normal operation of Hong Kong's mobile market since the introduction of number portability in 1999.

2.25 As explained above, the Study findings show that, considering the entire Hong Kong mobile network (whether on a territory-wide basis or focusing on hotspots only), Option 3 could be expected to either (a) have no

[13] See Chapter 7.1 of the Study report.

impact on service quality or (b) not worsen service quality compared to what it would be in the base case scenario. While there could be some worsening of the quality of the service of individual incumbent 3G operators which do not acquire the Re-auctioned Spectrum, those operators can deploy the sort of mitigation measures recommended by the Consultant to alleviate the service impact. Furthermore, as there is ample capacity in the 4G networks, those operators can also migrate more 3G customers to their 4G networks and hence reduce the traffic using the 3G network. For an incumbent 3G operator with a smaller 3G Spectrum holding than before, it may consider leasing 3G capacity from other MNOs through commercial arrangements.

2.26 In sum, if the incumbent 3G operators which are unable to, or choose not to, acquire any Re-auctioned Spectrum implement appropriate measures in the two years between the spectrum re-auction and the actual spectrum re-assignment, any service degradation that may ensue from a reduction in the spectrum holding can be effectively mitigated. The CA is of the view that service continuity and quality can be maintained under both Option 1 and Option 3.

Consultancy Study Commissioned by the Incumbent 3G Operators

2.27 The incumbent 3G operators independently commissioned Plum to conduct a study of the likely impact on service quality if Option 3 were to be adopted in the 3G Spectrum re-assignment ("Plum's Study"). The concern about the possible detrimental effect of the impact of Option 3 on service quality was raised by the CA and SCED in the Second Consultation Paper. The incumbent 3G operators had already made detailed submissions on this issue and engaged Plum to address it. Plum had made its own submissions in response to the Second Consultation Paper. On 5 September 2013, which was around five months after the Consultation had been completed, Plum released to the public the executive summary of the report which it had prepared setting out the findings of its study ("Plum Report"). The following were the key findings:

(a) OFCA's estimated degradation in data download speed (9%) was seriously under-estimated. 3G mobile users could experience a drop in data download speed which is 3 times more severe than

that calculated by OFCA;

(b) The Administration's proposal could result in a complete loss of voice service on the MTR during peak hours;

(c) Consumer could be forced to spend $5.4 billion prematurely on new 4G smartphones in order to avoid the service disruptions on 3G; and

(d) The total cost, which would eventually be passed onto users, could amount up to $15.5 billion including network upgrade costs and the SUF proposed by the Administration.

2.28 The incumbent 3G operators issued a press release on the same date advocating the adoption of Option 1, i.e. the administrative assignment of the 3G Spectrum to the incumbent 3G operators, upon the payment of a reasonable level of SUF. On 19 September 2013, the incumbent 3G operators jointly submitted the full version of the Plum Report to OFCA. Notwithstanding its late submission, the CA has given due consideration to the findings of the Plum Report as an input to its deliberations on way forward with the 3G Spectrum re-assignment arrangements. The CA's views are set out below.

2.29 First and foremost, the CA observes that the Plum's Study only focuses on the 3G networks and disregards the ample capacity of the 4G networks which are currently available for provision of mobile data services. As explained in paragraph 2.13 above, it is already a common marketing practice for MNOs not to differentiate between 3G and 4G mobile data service plans and to offer integrated mobile data plans underpinned by both 3G and 4G networks. MNOs have also been adopting the marketing strategy of promoting 4G compatible handsets to their customers which would enable them to use both the 3G and 4G networks. If MNOs find that their 3G networks are congested, they may develop this strategy further to move even more data traffic to their 4G networks to ensure satisfactory service quality and better user experience.

2.30 In view of the current market situation therefore, a more objective

assessment of service impact should, in the CA's view, take into account the entire mobile network encompassing the 2G, 3G and 4G networks. Plum's approach of restricting the assessment of service impact to 3G networks only, when it is commercially and technically viable for the MNOs to serve their customers using both the 3G and 4G networks and the MNOs are actively migrating their 3G customers to their 4G networks means that its findings would be incomprehensive, misleading and unreliable.

2.31 We now turn to the key findings of the Plum Report. According to the Plum's Study, there would be an average loss of spectrum of 24% if all incumbent 3G operators do not acquire the Re-auctioned Spectrum, leading to a loss of 27% of capacity. The 3G data download speed would then be reduced by 27% and download time would be increased by 37%.

2.32 The CA notes that Plum's calculation of service degradation, in terms of 3G download speed, only focuses on current capacity, without taking into account such other relevant factors as the potential for the incumbent 3G operators to increase the capacity, as well as any change in demand for 3G services, while, in reality, service impact depends on both the capacity and demand. For example, if capacity decreases and demand also decreases, there may not necessarily be any significant change in service impact. By assuming the capacity and demand figures would remain static, the Plum's Study has artificially inflated the extent of service degradation in arriving at a substantial reduction of download speed. The CA does not agree with this fundamental assumption of Plum, and accordingly has difficulties accepting the findings of the Plum's Study worked out on that basis.

2.33 To further elaborate on the CA's position, in the world of commercial reality, in order for any incumbent 3G operator which has a smaller 3G Spectrum holding than before to stay competitive, it may well need to consider refarming further 2G spectrum to 3G and postponing the refarming of spectrum currently deployed for 3G services to 4G, such that more spectrum, and hence more capacity would be available for the provision of its 3G services. Any incumbent 3G operator which has a smaller 3G Spectrum holding than before may also consider reviewing its capacity leasing arrangements to other MNO/MVNOs, or consider leasing 3G network capacity from other spectrum assignees through MVNO arrangements, so as to make available adequate

capacity for the provision of its 3G services. Also, as explained in the preceding paragraph, if MNOs find that their 3G networks are congested, they may employ various strategies to move the data traffic from their 3G networks to their 4G networks in order to provide satisfactory service quality. The service impact on an incumbent 3G operator which is unable to, or chooses not to, acquire any Re-auctioned Spectrum would be much mitigated if it adopts a combination of the above measures to increase capacity and reduce demand.

2.34 As to Plum's assessment that there would be a risk of a complete loss of voice communications on the MTR and some outdoor locations arising from the 3G Spectrum re-assignment based on Option 3, the CA finds the validity of the assessment questionable. In Plum's analysis, it has already reserved 14% of capacity for voice communications when arriving at the 27% loss in capacity for mobile data services. In point of fact, due to the time-sensitive nature of voice traffic, it is a normal network planning practice for MNOs to prioritise voice traffic over data traffic. The HSPA+ technology deployed by MNOs enables such prioritisation. Even if an incumbent 3G operator fails to acquire its Re-auctioned Spectrum, the RFR Spectrum combined with proper network planning is more than sufficient to ensure a continued provision of voice services.

2.35 As to Plum's assessment that the adoption of Option 3 may lead to 1.5 million 3G subscribers spending $5.4 billion on new 4G handsets to enable them to migrate to 4G services, it is based on the assumption that the migration pace from 3G to 4G will be similar to that from 2G to 3G. The CA is rather doubtful of this underlying assumption. First of all, the speed of migration from 3G to 4G should proceed at a faster pace, as compared to the speed of migration from 2G to 3G. The reason is that the migration from 2G to 3G involved a fundamental change from voice services to data services, i.e. different segments, and hence a longer transition period. In contrast, the migration from 3G to 4G is in effect an upgrade or enhancement of the same service type, i.e. mobile data service, and hence it could be expected to proceed more expeditiously. Furthermore, according to a survey conducted by the Chinese University of Hong Kong ("CUHK") in August 2012, Hong Kong adults change handsets every 21 months on average.[14] Based on CUHK's

[14] The details of the study is available at: http://www.wecareaboutewaste.com/documents/cuhk_aia_e-devices_survery_gen_public_findings_eng.pdf.

survey, more than 80% of the adults in Hong Kong would normally replace their handsets within three years. It can be expected that the majority of mobile data service users of their own free will have replaced their 3G devices with 4G ones in the coming three years whichever option is adopted for the 3G Spectrum re-assignment. The CA is therefore of the view that there should not be any extra cost to consumers which is attributable to the 3G Spectrum re-assignment under Option 3 as alleged by Plum.

2.36 On the network side, Plum estimates that the four incumbent 3G operators would need to spend a total of $853 million ($708 million for 3G and $145 million for 4G) on their networks to alleviate the service impact arising from the 3G Spectrum re-assignment if Option 3 were to be adopted. The CA notes that the cost of network upgrades, in particular at high traffic areas where the 3G service, as acknowledged by some respondents to the Second Consultation Paper, is already of inferior quality during busy hours, is unavoidable regardless of the 3G Spectrum re-assignment in October 2016. Also, for the incumbent 3G operators which are unable to, or choose not to, acquire any Re-auctioned Spectrum, there is no need for them to pay the SUF and they are likely to invest in their infrastructures to upgrade their network capacity to compensate for the reduction in spectrum holdings.

2.37 Regarding Plum's estimation that the total costs of Option 3 could reach $15.5 billion, the CA notes that the total costs are calculated by adding up the SUF for the RFR Spectrum ($6.2 billion), the SUF for Re-auctioned Spectrum ($3.1 billion), the alleged 4G handset costs ($5.4 billion) and the alleged network upgrade costs ($853 million).

2.38 The CA does not agree with Plum's calculation. In assessing the costs of adopting one option over the other, one's focus should not be on the total costs incurred for a particular option, as Plum did. Instead, for comparison purpose, the CA considers that one should take into account only the incremental costs attributable to that particular option over the other. In taking the wrong approach, Plum's calculation of the costs of Option 3 is also faulty in the following ways. First, in assessing the costs of adopting Option 3, Plum has wrongly included the costs which are common to both Option 1 and Option 3. Take for instance the SUF. It is obvious that the SUF for the RFR Spectrum would invariably be incurred under both options, and as such, for

comparing the two, it should not be included in the calculation of the costs of Option 3, as Plum did.

2.39 The CA also notes that Plum has wrongly included the costs of different spectrum re-auction outcomes under Option 3 in its calculation. Take the scenario of all the incumbent 3G operators exercising their right of first refusal to be assigned two-thirds of the 3G Spectrum whilst also successfully acquiring the Re-auctioned Spectrum - the outcome is identical to Option 1 under which they are re-assigned all the 3G Spectrum under the right of first refusal. Under this scenario, the SUF for the Re-auctioned Spectrum is not an incremental cost attributable to Option 3, as Plum did so attribute, as the incumbent 3G operators are also required to pay the SUF involved under Option 1. The incremental cost, if any, should therefore be the difference between the SUF of the Re-auctioned Spectrum under Option 3 and the SUF of the same frequency spectrum assigned through right of first refusal under Option 1. Indeed, under such a scenario, with the 3G Spectrum holdings of the incumbents remaining intact, the alleged 4G handset costs and network upgrade costs would not arise and hence they should not be included in the calculation, as Plum did.

2.40 In another scenario where the incumbent 3G operators are unable to, or choose not to acquire any Re-auctioned Spectrum under Option 3, they would not then be required to pay any SUF for the Re-auctioned Spectrum. The incremental cost of Option 3 over Option 1 would therefore be the excess, if any, of the alleged network upgrade and 4G handset costs over the SUF of one-third of the administratively-assigned 3G Spectrum under Option 1. And as elaborated in paragraphs 2.35 and 2.36, there should not be any significant cost for network upgrade and 4G handsets arising from the adoption of Option 3 as compared to Option 1.

2.41 Against the above, the CA considers that Plum's calculation of the total costs which would allegedly be passed onto users is erroneous, and it results in greatly inflated and misleading figures and as such is unreliable.

Section 3 : Efficient Utilisation of Spectrum

3.1 Under Option 3, which was initially raised as a possible option in the First Consultation paper and then put forward for further consideration in the Second Consultation Paper, a minimum of 2 x 19.6 MHz of the 3G Spectrum will be put out for re-auction.[15] This is expected to enhance utilisation of spectrum in three different ways. First, spectrum is a scarce public resource and an auction should lead to it being assigned to those assignees which value it the most and which could be expected therefore to put it to the most efficient use. Second, the prospect of an auction provides an opportunity for the MNOs to review and optimise their spectrum holdings in the 1.9 – 2.2 GHz band, taking into account their existing spectrum holdings in other frequency bands and the SUF of the Re-auctioned Spectrum. Third, it also provides an opportunity for the incumbent 3G operators to acquire the maximum contiguous block of 2 x 19.7 MHz of spectrum in the 1.9 – 2.2 GHz band, so that the full potential of the LTE-Advanced technology can be readily realised.

Views and Comments of the Respondents

3.2 CSL and Hutchison opined that the incumbent 3G operators had already made efficient use of the 3G Spectrum, in what they consider to be a currently highly competitive market, and that this is evidenced by the high mobile penetration rate, sustained growth in the number of 3G/4G subscribers and robust growth in mobile data traffic. AmCham, HKITF, and a member of the public who made a submission, put forward a similar view that as there is efficient utilisation by existing spectrum assignees, there was no justification for the Government to intervene and assign the spectrum to other parties. Plum in its submission urged the Government to assess whether the 3G Spectrum was being used efficiently. CEG was concerned that assignment of the 3G Spectrum to new entrants might result in under-utilisation of the spectrum as they would need time to establish their network infrastructure.

[15] The assumption that a minimum amount of 2 x 19.6 MHz of spectrum would be put out for re-auction is made on the premise that each of the incumbent 3G operators will exercise the right of first refusal to be re-assigned 2 x 9.9 MHz of the 3G Spectrum. If any of the incumbents decide not to exercise the right, more 3G Spectrum will be available for re-auction.

3.3 All the incumbent 3G operators, CEG and Plum commented that spectrum re-auction would lead to fragmentation of the 3G Spectrum, which ran counter to the efficient use of spectrum. Hutchison commented that the benefit of enhanced spectrum utilisation efficiency based on Option 3 was entirely speculative. SmarTone pointed out that the LTE-Advanced technology using non-contiguous spectrum of a total of 2 x 20 MHz could achieve the same spectral efficiency and peak data rates as that of a contiguous frequency block of the same size. The two equipment vendors, Huawei and NSN, were of the view that more rather than less spectrum would be needed to support further advancement in the mobile technologies.

3.4 HKT did not consider that an auction would put the spectrum into the hands of those MNOs which value it the most and which would use it most efficiently. It did not see that there was any clear linkage between the actions of the "deep pocketed" players in the industry and spectral efficiency. Rather, it focused on the risk of re-auction leading to undue concentration of spectrum in the hands of some market players, and of some participants bidding simply for the purpose of preventing the others from acquiring the spectrum. It went on to advocate spectrum trading to ensure continuous efficient utilisation of spectrum. CSL, CEG, Cetari and Plum also expressed a similar view.

3.5 CMHK pointed out that, with some incumbent 3G operators leasing their 3G Spectrum capacity to MVNOs to provide 3G services, this was indication enough of the existence of spare spectral capacity in the hands of the incumbents. Accordingly, it argued that spectral efficiency could be enhanced by varying the spectrum assignments among the incumbents or inviting new players into the market. It also commented that perpetual holding of the 3G Spectrum by the incumbents would reduce the opportunity for the scarce spectrum resource to be put to the most efficient use.

The Responses of the CA

3.6 It has to be pointed out, first and foremost, that the proposal to re-auction parts of the 3G Spectrum is not premised on a need to address inefficient spectrum utilisation by the incumbent 3G operators. The simple truth is that the existing term of 3G Spectrum assignments will come to an end

in October 2016, and the 3G Spectrum has to be re-assigned, one way or the other, to the MNOs so that they can provide mobile services post October 2016. According to the Spectrum Policy Framework, a market-based approach will be used for spectrum 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. Based on the keen interest of all the incumbent 3G operators to be re-assigned their existing frequency holdings, and that of the MNO which is not holding any 3G Spectrum to have the opportunity to bid for the spectrum, as reflected in their respective submissions, the CA has concluded that there are competing demands for the 3G Spectrum. The CA shares the views of the SCED, expressed in paragraph 27 of the Second Consultation paper, that the potential seriousness of the effects on customer service continuity and quality during the transitional period under the full-fledged market-based mechanism, as proposed in Option 2, constitute an overriding public policy reason for not following a full-fledged market-based approach. Accordingly, the CA decided to put forward jointly with the SCED Option 3, a hybrid between an administratively-assigned and market-based approach, for further consultation with the telecommunications industry and other affected persons.

3.7 The CA agrees that, in theory, in the highly competitive mobile market, one would expect the incumbent 3G operators to endeavour to utilise their spectrum efficiently. That said, the CA considers that in comparison with Option 3, a perpetual spectrum assignment as proposed in Option 1 provides less incentives for, and exerts less pressure upon, spectrum assignees to continue to strive to enhance spectral efficiency. Despite the availability of the MVNO arrangement, the spectrum capacity lessees' interest in having an opportunity to become spectrum holders rather than mere lessees so that they have autonomy in using spectrum resources, coupled with the established policy in Hong Kong of adopting a primarily market-based approach in spectrum assignment, means that re-auctioning parts of the spectrum holdings of the incumbent 3G operators upon expiry of the spectrum assignments would be a fair arrangement which balances the interests of the incumbent 3G operators, spectrum capacity lessees and new 3G Spectrum assignees. We would add that the incumbent 3G operators, having their own well-established network infrastructure and customer bases, are likely to have a comparative advantage in acquiring parts of their original frequency holdings, or in even

successfully bidding for additional slots. The two-year lead-in period for any new entrants to establish and roll out their network infrastructure should significantly reduce the risk of possible under-utilisation of the newly acquired spectrum. All in all, the CA considers that it is through the possibility of re-assigning parts of the 3G Spectrum through auction that more efficient spectrum utilisation will be realised.

3.8 To address the concern about spectrum fragmentation which might stem from re-auctioning parts of the 3G Spectrum, the band plan which was proposed in the Second Consultation Paper has duly taken into account the merits of contiguous spectrum. It provides an opportunity for the incumbents to acquire one or two blocks of 2 x 4.9 MHz of frequency which is/are adjacent to the spectrum which may be assigned to them through exercising a right of first refusal. It would enable them to achieve through auction a maximum contiguous block of 2 x 19.7 MHz of the 3G Spectrum, thereby readily realising the full potential of the LTE-Advanced technology. As for new 3G Spectrum assignees, they may bid for, among others, a single block of 2 x 4.9 MHz, a contiguous block of 2 x 9.8 MHz, or two contiguous blocks of 2 x 9.8 MHz.

3.9 As pointed out by some of the respondents, the spectrum re-auction may result in the incumbent 3G operators holding only 2 x 9.9 MHz of RFR Spectrum. However the incumbent 3G operators will have been given the opportunity to bid for more spectrum and this outcome would be the result of them taking a conscious commercial decision not to acquire any more spectrum in the re-auction perhaps because the cost of the extra spectrum would be beyond their budgetary limits. For any incumbent 3G operator which is unable to, or chooses not to, acquire any Re-auctioned Spectrum, there is no need for it to pay the SUF and it is likely to invest in its infrastructure to upgrade its network capacity to compensate for the reduction in spectrum holding. In view of the different spectrum holdings of MNOs, spectrum re-auction also provides an opportunity for the MNOs to review and rationalise their spectrum holdings. The operators which have heavily utilised the 3G Spectrum will have the incentive to acquire additional spectrum. To put this in context, the 3G Spectrum was assigned to the incumbent 3G operators more than a decade ago and in that period they have utilised the spectrum to a different extent by offering different service plans to attract their target

customers. The number and mix of customers therefore vary from one operator to another.

3.10 The comment by HKT that there is no clear linkage between deep pocketed players and spectral efficiency in fact emphasizes the efficiency of the market-based approach in spectrum assignment. The CA agrees with HKT's opinion on this point. In a freely competitive market, a buyer would not pay more for goods and services than they are actually worth. Any operator, be it a deep pocketed player or otherwise, which acquires the spectrum at an exorbitantly high cost but is unable to use it effectively, will ultimately undermine its own competitiveness in the mobile market. This explains why auction has all along been an efficient method for assigning frequency spectrum when the demand for it exceeds the supply.

3.11 On the concern about undue concentration of spectrum, an analysis was conducted in the Second Consultation Paper of the scenario where all the 2 x 19.6 MHz of Re-auctioned Spectrum is acquired by the MNO with the largest spectrum holding, and the conclusion was that this raises no competitive concern. The initial view of the CA was that a spectrum cap should be imposed only when additional spectrum is put out for re-auction due to non-exercise of the right of first refusal by some of the incumbent 3G operators. However on further reflection the CA considers that a spectrum cap of 2 x 20 MHz of spectrum in the 1.9 – 2.2 GHz band should be imposed even when all the incumbents exercise their right of first refusal to acquire all the RFR Spectrum, and a total of 2 x 19.6 MHz of spectrum is put out for re-auction. Such an arrangement will make it fair to both the incumbent 3G operators and other bidders participating in the 3G Spectrum re-auction in regard to frequency holding in the 1.9 – 2.2 GHz band. Details about the spectrum cap will be discussed in Section 8 of this document on the spectrum re-assignment framework.

3.12 As for spectrum trading, the Government's preliminary review of overseas experience indicates that it is a complicated subject requiring detailed research and a feasibility study into the implementation issues, including but not limited to the issue of how best to guard against anti-competitive trading. The Government remains of the view, consistent with its position set out in the Spectrum Policy Framework, that this subject should be dealt with in the long

term, and in any event it should be considered in detail as a separate exercise from the 3G Spectrum re-assignment.

3.13 It is noteworthy that, on a practical level, the incumbent 3G operators all have strong demand for spectrum, meaning that there is unlikely to be an available supply of spectrum to meet any demand for it in the secondary market. In reality, a secondary market for spectrum could not come about without a ready supply of spectrum. Furthermore, it has to be pointed out that, even if spectrum trading were to be permitted, that would not in itself provide any justification to support the assignment of spectrum, a scarce public resource, to operators on a perpetual basis, which is what the incumbent 3G operators advocate.

Section 4 : Promotion of Effective Competition

4.1 Option 3 (as proposed in the Second Consultation Paper) involves re-auctioning of a proportion of the 3G Spectrum. This is more likely to promote effective competition by providing a fair opportunity for new entrants to enter the mobile market by acquiring 3G Spectrum. The existing MNOs are similarly given a fair opportunity to rationalise their spectrum holdings based on their own commercial considerations.

Views and Comments of the Respondents

4.2 All the incumbent 3G operators opined that the Hong Kong mobile market was already keenly competitive, with consumers enjoying quality mobile services at affordable prices, which were low by international standards. This view was shared by AmCham, Cetari, G&A, HKITF, Plum and some members of the public making the submissions. They were concerned that re-auctioning the spectrum would upset the existing orderly competitive environment. HKT regarded spectrum re-auction as a zero-sum game as the gain of spectrum by one MNO would be at the expense of the one who lost it. It raised the concern that spectrum re-auction could in fact lessen competition, as one of the incumbent 3G operators might obtain more spectrum than it currently holds or CMHK might obtain all the Re-auctioned Spectrum. Hutchison and CEG were also concerned that Option 3 would lessen competition and cause higher prices for consumers.

4.3 CEG made the point that an increase in the number of operators was not equivalent to enhanced competition. In order for consumers to benefit from effective competition, there needed to be sufficient rivalry among MNOs, and that required a modest number of operators. It regarded the MNOs' respective market shares of 20 – 25% as enabling effective competition, due to the economies of scale embodied in the mobile network industry. Based on the law of diminishing returns, AmCham cast doubt on the benefits of introducing additional players to the mobile market, which it considers is already highly competitive, in Hong Kong.

4.4 CSL, SmarTone and Plum were generally of the view that

competition would not be promoted by interfering with the spectrum holdings of the incumbent 3G operators. In their view, it should be done by the release of new spectrum, the MVNO arrangement, merger and acquisition, and the introduction of spectrum trading.

4.5 CMHK objected to the likely foreclosure of new entrants to the Hong Kong mobile market and regarded this as anti-competitive. It held the view that the optimal number of players should be determined by market forces. DAB, LP, and some members of the public making the submissions, opined that spectrum re-auction would promote effective competition as it facilitated the entry of new entrants, and service quality would be enhanced as a result.

The Responses of the CA

4.6 The CA does not agree with the view that spectrum re-auction is merely a zero-sum game. Those incumbent 3G operators which are assigned spectrum in the 850/900 MHz band, which also supports the provision of 3G services, and those having relatively more spectrum in other frequency bands, may well find it not commercially viable to acquire any Re-auctioned Spectrum once the SUF set during the auction has reached a certain threshold. On the other hand, other MNOs or new entrants, based on their business needs, may be eager to acquire the Re-auctioned Spectrum and thus may be prepared to budget for a higher SUF, as otherwise new entrants may have to enter the market in a more expensive way, such as through acquiring an existing MNO. The re-auction therefore offers an opportunity for the assignment of the spectrum to those who value it the most and who can put it to the most efficient use.

4.7 To address the concern about the possibility of incumbent 3G operators gaining additional 3G Spectrum, or CMHK acquiring all the Re-auctioned Spectrum, thereby lessening competition in the mobile market, it is worth considering the outcome of the auction of the 2 x 25 MHz of spectrum in the 2.5/2.6 GHz band that was conducted in March 2013. A few observations may be made on that auction. First, a new player, China Unicom (Hong Kong) Operations Limited, did participate in the auction, but it was outbid by the incumbent MNOs, whose established mobile infrastructure and substantial

customer bases put them at an advantageous position in bidding for additional frequency spectrum. Second, incumbent spectrum holders in the band were keen to acquire frequency blocks adjacent to their existing frequency holdings, where possible, and both Genius Brand Limited and CSL succeeded in achieving just that. Third, CMHK, alleged to be a "deep pocketed player" by some respondents, paid only the second lowest bid in acquiring the additional 2 x 5 MHz of spectrum. It was SmarTone that paid the highest price for the 2 x 10 MHz of spectrum in the 2.5/2.6 GHz band.

4.8 On the comment that promotion of effective competition in the mobile market should not interfere with the spectrum holdings of the incumbent 3G operators, it should be noted that the policy principles outlined in the Spectrum Policy Framework for spectrum management make no distinction between spectrum in different frequency bands, or between newly released and re-assigned spectrum. According to 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 for the spectrum, unless there are overriding public policy reasons to do otherwise. The market-based approach ensures that the scarce spectrum resource will be assigned to operators which value it the most and which can put it to the most efficient use and in turn promote effective competition. Based on the submissions received in the two rounds of consultation, the CA has affirmed that there are competing demands for the 3G Spectrum. It is due to the public policy concern about customer service continuity that only one-third of the 3G Spectrum will be put out for re-auction.

4.9 Re-auctioning parts of the 3G Spectrum provides a good opportunity for all the MNOs to review critically their spectrum holdings as against their spectrum needs, and to optimise their spectrum holdings taking into account the SUF of the Re-auctioned Spectrum. The possibility of upsetting the so-called orderly competitive environment is not a valid reason for maintaining the current status quo indefinitely. If any of the MNOs adopts a maverick strategy in competing for customers, the spectrum re-auction to be conducted will enable it to bid for more spectrum to serve additional customers. It is impossible to predict in particular, when competitive pricing packages will be introduced, and by which operator. A genuinely competitive market will induce operators to react in a timely manner in introducing the most appealing

and affordable services in response to competitive pressure.

4.10 The concern about spectrum re-auction lessening competition is unfounded. Under Option 3, the number of MNOs in the market will not necessarily be reduced. Notwithstanding that the 3G technology is expected to remain important for mobile service development until the spectrum re-assignment in 2016 and beyond, the level of competition in the mobile market in the future will not depend solely on the 3G Spectrum holdings of MNOs. As discussed above, while some MNOs may find it useful to have more 3G Spectrum, others may not find it commercially viable to have holdings in excess of the RFR Spectrum. It all depends on the profile of spectrum holdings of each MNO and its own commercial considerations. Any undue concentration of spectrum resulting from the re-auction will be addressed by the imposition of a spectrum cap where necessary. As to the concern about small operators creating ineffective competition, anecdotal evidence shows that a relatively small MNO can be an effective competitor and also a profitable operator. In the United States, for instance, AT&T's failed attempt to acquire T-Mobile in 2011 illustrates that small size will not necessarily prevent an operator from promoting effective competition in the market. Economic evidence in that case suggests that T-Mobile, despite being the smallest in terms of subscriber numbers of the four national mobile operators, after AT&T, Verizon and Sprint, is a very effective competitor in the US national mobile services market. Based on that economic evidence, it was considered that an effective competitor would be eliminated in the US national mobile market if AT&T were to merge with T-Mobile. The risk of eliminating T-Mobile as an effective competitor in the US national mobile services market was one of the reasons why the merger was eventually opposed by the regulatory agencies overseeing merger applications in the US. In that case, the smallest competitor turned out to be one of the more effective competitors in the relevant market.

4.11 In addition, where there is a market with a small number of firms in competition, as in the case of the mobile services market in Hong Kong, economic theory suggests that a small firm tends to have less incentive to coordinate its own business strategies with those of its rivals. This is because the small firm has the least to gain from such coordinated anti-competitive behaviour precisely because of its small size. The existence of a small firm can therefore promote effective competition, by making it more difficult for the rest

of the rival firms (including the large firms) to engage in coordinated anti-competitive behaviour.

4.12 The release of new spectrum is a legitimate and reasonable proposal raised by some respondents to promote effective competition. Ever since the assignment of the 3G Spectrum in 2001, all the new spectrum available for public mobile services has been released through auctions and this has contributed to fostering a keenly competitive mobile market. Looking forward however, no supply of new spectrum is envisaged in the coming few years before the digital dividend which is expected to result from the switching off of the analogue terrestrial television service and cross-boundary frequency coordination. MVNO arrangements may help promote competition to a certain extent in service provisioning. The likely effectiveness of mergers and acquisitions and the introduction of spectrum trading in promoting competition in the mobile market is less certain as the amount of spectrum available to the market and its timing would be solely dependant on the MNOs exercising their discretion to take these steps and they would unlikely regard enhancing market competition as their concern. Accordingly, promotion of effective competition remains an important objective to be achieved in the re-assignment arrangement for the 3G Spectrum.

Section 5 : Encouragement of Investment and Promotion of Innovative Services

5.1 The CA considers that Option 3 (as proposed in the Second Consultation Paper) is more likely than Option 1 to encourage investment and the provision of innovative services, by both the incumbent 3G operators and new 3G Spectrum assignees.

Views and Comments of the Respondents

5.2 All the incumbent 3G operators were of the view that only Option 1, viz. re-assigning to them all the 3G Spectrum through a right of first refusal would provide to them a stable environment to continue investment in their 3G networks and develop innovative services. In contrast, the incumbents considered that Option 3 would induce uncertainty at least until the spectrum re-auction results were known and hence would deter investment, network upgrade and innovations. Some similar views were expressed by AmCham, HKGCC, CEG, Cetari, Plum, and some members of the public making the submissions.

5.3 The incumbent 3G operators considered investment in network reconfiguration and other measures to mitigate the capacity loss arising from any reduction in spectrum to be a waste of resources. HKT expressed the view that, if an incumbent did not re-acquire its 3G Spectrum in the re-auction, it would have to incur unnecessary investment to make up for its lost capacity. CSL, Huawei and Bespark pointed out that both Options 2 and 3 would likely lead to substantial write-offs of network investment, termination in use of some well-functioning network equipment, and redundancy of workers. Hutchison also opined that Option 3 penalised the incumbent 3G operators that had heavily invested in their networks. CSL and CEG doubted the effectiveness of investment and innovations by new entrants in an already crowded mobile market. Some also opined that Option 3 favoured the new entrants as they would not need to face the risk of writing off past investment.

5.4 While Plum and NSN commented that Option 3 would limit the peak 3G data download speed of the incumbent 3G operators to the current

level of 42 Mbps if they could not acquire any of the Re-auctioned Spectrum, SmarTone opined that innovative services did not necessarily come from ever higher transmission speed. Plum added that Option 3 also necessitated the incumbent 3G operators to rethink their technology, product and service roadmaps and would not bode well for the development of innovative services. CEG was of the view that technological innovation in mobile services was driven predominantly by equipment suppliers rather than by network operators.

5.5 CMHK took the view that the incumbent 3G operators should well expect that their assignment of the 3G Spectrum might not be renewed upon expiry of the assignment, as this was clearly stated in the Spectrum Policy Framework. Hence it was irresponsible of them to regard Option 3 as inducing a high level of uncertainty that deterred investment and innovation. Besides, the decision on spectrum re-assignment would be made by around October 2013. The incumbent 3G operators would then have about three years to undertake investment and network planning. CMHK further opined that the proposal to re-auction the 3G Spectrum would provide an opportunity for the incumbents to acquire additional spectrum for network expansion and for new entrants to invest in new network infrastructure and employ new staff.

The Responses of the CA

5.6 As stated in the Second Consultation Paper, the incumbent 3G operators should be fully aware that their 3G Spectrum assignments would be terminated on 21 October 2016 in accordance with the relevant schedule of the carrier licences. The Spectrum Policy Framework also states that there should be no legitimate expectation on the part of the spectrum assignees that there will be any right of renewal or right of first refusal of any spectrum assignment upon expiry. Accordingly, the incumbents should have factored this timeline into their investment planning and scheduling. Besides, the spectrum to be re-auctioned amounts to at most 10% of the total spectrum holding in the case of the incumbent 3G operator with the smallest spectrum holding, and 7% for the one with the largest spectrum holding. As all incumbent 3G operators will be given the opportunity to bid for the Re-auctioned Spectrum, it is probable that some, if not all, will acquire their original frequency slots, if not additional ones. By giving about three-years' advance notice for the decision on spectrum

re-assignment, including a two-year transitional period post-auction, any uncertainty in relation to investment of the incumbent 3G operators should be mitigated.

5.7 Even if there is uncertainty which might affect investment decisions in the period leading up to the conclusion of the re-auction which is expected to be held in the fourth quarter of 2014, it should not have an overwhelming effect on the overall investment in the mobile network, given the limited amount of spectrum to be put to re-auction compared to the total holding and the likelihood of some, if not all, of the incumbent 3G operators acquiring their original frequency slots through the auction. It is notable that, despite the suggestion in some submissions that uncertainty is inhibiting investment, there are no indications of any holding back on investment by the incumbent 3G operators. Rather, there is evidence of continued investment by the incumbent 3G operators to remain competitive. The re-assignment of the 2 x 9.9 MHz of RFR Spectrum to each incumbent, if they exercise their right of first refusal, has already removed to a great extent the uncertainty. It has provided the incumbent 3G operators with the necessary assurance to continue their investment in the dual carrier technology within the band, which can sustain the current level of 3G services. Looking ahead, the incumbent 3G operators would need to invest in any event to combine the 3G Spectrum with spectrum in the other frequency bands to implement spectrum aggregation as defined in the Third Generation Partnership Project ("3GPP")[16] Release 9 and beyond, in order to enhance spectral efficiency and transmission speed.

5.8 The focus should not be on the possible dampening effect on investment by the incumbents, which the CA considers as improbable for the reasons explained above, but on the likely promotional effect on investment once the incumbent 3G operators succeed in obtaining additional 3G Spectrum through the re-auction. For example, shortly after the assignment of an additional 2 x 5 MHz spectrum in the 2.5/2.6 GHz band to the MNOs originally holding 2 x 15 MHz of such spectrum, some of them had already invested to expand the channel bandwidth to 2 x 20 MHz to offer 4G services with a higher download speed of 150 Mbps. The same may well be the case for the 3G Spectrum with the adoption of Option 3 for spectrum re-assignment.

[16] 3GPP is an international collaboration of groups of telecommunications associations. It produces technical specifications for 2G, 3G and 4G wireless communications technologies.

Furthermore, if part of the Re-auctioned Spectrum is assigned to a new entrant, the network investment to be brought forth will be substantial. It is only through Option 3 that one may foster investment and the provision of innovative services by both the incumbents and new spectrum assignees.

5.9 The CA does not agree with the incumbent 3G operators that, where an incumbent 3G operator has not acquired any of the Re-auctioned Spectrum, its investment in mitigating the impact arising from the reduction in spectral capacity would be a waste of resources and that it would lead to the termination of use or write-offs of some well-functioning equipment.

5.10 The incumbent 3G operators, having an established network and an existing customer base, clearly have the comparative edge over the new entrants in acquiring not only their original frequency slots, but also in having the opportunity to acquire additional slots under Option 3. They have the choice of paying for the SUF or making additional network investment. Depending on the profile of spectrum holding of each incumbent, some of them may find it more cost effective to invest further in the network rather than to bid for any Re-auctioned Spectrum. Hence the outcome of the re-auction may reflect the commercial decision of certain incumbent 3G operators to use their funds to pay for additional network investment instead of for SUF payable for obtaining the Re-auctioned Spectrum. Indeed, given the keenly competitive mobile services market, any incumbent which has not acquired any Re-auctioned Spectrum in the re-auction and which wishes to remain a competitive player in the market could be expected to have a great incentive and commercial need to invest in developing its network to compensate for the reduction in its spectral capacity.

5.11 The argument that incumbent 3G operators would need to write off significant investments and lay off workers if they do not obtain any of the Re-auctioned Spectrum is likely to be unfounded. With re-assignment of the RFR Spectrum to them for another 15 years, the incumbent 3G operators would, in any event, need to maintain their 3G networks and their operating teams to provide services to their customers. Since the existing core networks of the incumbents support multiple technologies, the hardware equipment originally used for the Re-auctioned Spectrum can be readily deployed for use with the other technologies or frequencies. As to the hardware modules at the mobile

base stations, they can be applied for use with different frequencies by software upgrade or deployed for use at some newly built base stations. Although software upgrades may not be possible for some old hardware models, these should have been largely depreciated. The use of one-third less of the 3G Spectrum will be unlikely to affect the return on the investment in the antennas either, as the antennas will continue to support the operation of two-thirds of the spectrum in the band to be assigned to the incumbents if they exercise their right of first refusal. Hardware devices that might need to be written off due to the reduction in spectral capacity are probably spectrum filters, which are customised for the exact frequencies in use in order to avoid radio interference. In any event, the changing demand and traffic pattern, as well as the advancement in technologies, means that there is already an operational need for MNOs to reconfigure their networks from time to time.

5.12 On promotion of innovative services, while SmarTone may be correct in saying that they do not necessarily require ever higher transmission speed, in point of fact, high access speed does enhance user experience and facilitate the adoption of innovative services. It enables, for instance, customers to watch more videos and download/upload more content within a given time period. Cloud computing, mobile video conferencing, online games, and high definition video streaming work well on wide bandwidth and high speed transmission networks. On the other hand, although technological innovations are largely driven by equipment suppliers, MNOs also have an important role to play in making ready the service provisioning chain for the deployment of new technologies and introducing innovative services based on the advanced network functionalities. The spectrum re-auction under Option 3 provides an opportunity for the MNOs to critically review their spectrum holdings and to decide on the amount of the 3G Spectrum they are prepared to pay for. While the MNOs which are assigned relatively more LTE-capable spectrum may choose to acquire less, others may acquire more 3G Spectrum with a view to securing a contiguous block of 2 x 19.7 MHz for higher speed and innovative services.

Section 6 : Option 3 – Proposed Spectrum Re-assignment Option for Further Consultation

6.1 Having taken into account the views and comments received in response to the First Consultation Paper and the assessment of pros and cons of the three options for re-assigning the 3G Spectrum, Option 3, together with a proposed spectrum re-assignment framework, were put forward for further consultation in the Second Consultation Paper. The submissions received in response to the Second Consultation Paper contained wide ranging discussion of the three options.

Views and Comments of the Respondents

6.2 Of the three options proposed in the First Consultation Paper (and reproduced in Section 1 of this document), a majority of the respondents, including four of the five MNOs, supported Option 1, considering it to be the option best able to meet the four objectives in spectrum re-assignment, viz. ensuring customer service continuity, efficient spectrum utilisation, promotion of effective competition, and encouragement of investment and promotion of innovative services. Some of them also considered Option 1 to be in line with local and international precedents. AmCham supported Option 1 as it considered that it served the business and consumer objectives of the organisation. Specifically, CSL favoured Option 1 as it was concerned that, at auction, bidders with deep pockets would push the price of the 3G Spectrum to an exorbitantly high level and customers would need to pay higher service charges in return. The other incumbents and some members of the public supporting Option 1 were also concerned that spectrum re-auction upon the implementation of Option 3 would lead to higher service charges.

6.3 CMHK supported Option 2, as it considered it necessary for there to be a fair and open mechanism for the assignment of frequency spectrum, which renewal of the spectrum assignment for another 15 years under Option 1 would not deliver. Two members of the public making submissions also supported Option 2, on the grounds of promoting competition and improving customer service quality in a free market.

6.4 DAB supported Option 3, as it believed that it took care of the interests of all the parties, including consumers, incumbents and new entrants, and at the same time, ensured customer service continuity. It was hence regarded as a more reasonable option than the other two options. LP also supported Option 3 as it believed that it promoted competition, although it cautioned that the spectrum re-assignment arrangement should not exert an adverse effect on the public.

The Responses of the CA

6.5 According to the Spectrum Policy Framework, a market-based approach in spectrum management should be used 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. With regard to the 3G Spectrum, the submissions received in the two rounds of public consultation show that there are competing demands for it (this will be further discussed in paragraph 9.7 of Section 9(a) in relation to legitimate expectation). On this basis, a full-fledged market-based approach should be used for re-assigning the 3G Spectrum unless there are overriding public policy reasons to do otherwise. However the potentially uncertain outcome for spectrum re-assignment under Option 2, and the concerns about the potentially severe and long lasting effect on service quality and reception (especially in indoor areas where in certain circumstances there may be a complete loss of 3G services during the transitional period), had led the CA to conclude that there are overriding public policy reasons to deviate from the full-fledged market-based approach.

6.6 The Second Consultation Paper sets out an analysis of the pros and cons of the three options against the multiple objectives in spectrum re-assignment, and a detailed comparison of Option 1 and Option 3. The analysis shows that Option 3, apart from ensuring customer service continuity, is also likely to be superior in enhancing efficient utilisation of spectrum, promoting effective competition, encouraging investment and facilitating the introduction of innovative services in the mobile market. Furthermore, Option 3 is likely to provide opportunities for both newcomers to enter the market, and for existing MNOs, including the incumbent 3G operators, to obtain the

amount[17] of the 3G Spectrum they may need through auction. The SUF thus set for the Re-auctioned Spectrum reflects for future reference the full market value of the spectrum in the 1.9 – 2.2 GHz band, which is a further benefit of implementing Option 3. It was against this background that the CA jointly with the SCED put forward Option 3 for further consultation in the Second Consultation Paper.

6.7 The identified advantages of Option 3 over Option 1 as measured against the multiple spectrum re-assignment objectives were disputed by a majority of the respondents, including all the incumbent 3G operators. Sections 2 – 5 above set out the responses of the CA to their adverse comments and views on Option 3.

6.8 In summary, on customer service continuity, after careful consideration the CA remains of the view that Option 3, by offering right of first refusal to the incumbent 3G operators to be re-assigned two-thirds of their existing spectrum holdings, would go a long way towards ensuring service continuity, especially for reception in indoor areas during the transitional period. Based on the Study findings and the considerations explained in Section 2, the CA considers that the overall service quality for the Hong Kong mobile market under Option 3 can be maintained as that under Option 1. Meanwhile, Option 3 is likely to enhance efficiency in spectrum utilisation, as the spectrum re-auction provides an opportunity for the 3G Spectrum to be re-assigned to the MNOs which value it the most and hence will put it to the most efficient use, and for the building up of a contiguous block of 2 x 19.7 MHz of 3G Spectrum so as to realise to the full extent the potential of LTE-Advanced Technology at an early stage. Higher access speed, as enabled by a wider contiguous frequency block, is likely to facilitate the adoption of innovative services. Option 3 should also help stimulate competition in the mobile market, as existing MNOs can rationalise their spectrum holdings according to their commercial needs, and competitive new players are given an opportunity to enter the market. Lastly, Option 3 is likely to have a promotional effect on investment, as new spectrum assignees will roll out their networks and those incumbent 3G operators which are unable to, or choose not to, acquire the Re-auctioned Spectrum will need to invest further in their existing networks to

[17] It is subject to the possible spectrum cap which may be imposed in the re-auction, which will be discussed in Section 8 of this document on the spectrum re-assignment framework.

maintain service quality. The concern about spectrum re-auction leading to high SUF and hence higher service charges will be addressed in Section 7.

6.9 In conclusion, the CA, having considered and taken into account inter-alia views and comments on the Second Consultation Paper, remains of the view that it is Option 3 rather than Option 1 which would best serve the multiple objectives in spectrum re-assignment.

Section 7 : Spectrum Utilisation Fee

7.1 Under Option 3 (as proposed in the Second Consultation Paper), the SCED has proposed two methods for setting the SUF of the RFR Spectrum. Under the First Method, the SUF of the RFR Spectrum was proposed to be set on the basis of the royalty payment for the 3G Spectrum in 2015/16 or the level of SUF as determined by auction of the Re-auctioned Spectrum, whichever is the higher. The Second Method proposed to set the SUF of the RFR Spectrum at the average of the weighted average of the relevant past market benchmarks and the SUF of the Re-auctioned Spectrum as determined by auction.

Views and Comments of the Respondents

7.2 Plum gave detailed comments on the two methods. For the First Method, Plum commented that the 5 MHz of unpaired spectrum assigned to each of the incumbent 3G operators in 2001 should be included in the calculation of the per MHz SUF of the RFR Spectrum, that the entire 15-year royalty payment for the 3G Spectrum should be taken into account instead of just the highest final year payment for 2015/16, and that a discount rate should be applied in arriving at the lump sum payment for the next 15-year usage period. As to the Second Method, Plum disagreed with the choice of the frequency bands for calculating the weighted average past market benchmarks and suggested making reference to auction outcomes in overseas markets. CEG and Certari also supported referencing to international benchmarks. CEG and Plum were concerned about linking the SUF of the RFR Spectrum with the SUF of the Re-auction Spectrum as that would risk distorting the auction outcome and result in sub-optimal spectrum assignment. To provide certainty to the industry, Plum recommended a value of $20 million per MHz as the SUF of the RFR Spectrum for the next 15-year term of frequency assignment.

7.3 CSL and HKT held similar views as Plum on the two proposed methods while Hutchison stated that account should be taken of the comments by Plum. All the incumbent 3G operators opposed linking the SUF of the RFR Spectrum with that of the Re-auctioned Spectrum, as they would not know the amount of SUF at the time when they are required to decide on whether to exercise their rights of first refusal to be re-assigned the RFR Spectrum. They

considered this would give rise to a great deal of uncertainty, which was unfair to them and unreasonable commercially. They also suggested that the bids from both the incumbent 3G operators and new entrants in the auction for the Re-auctioned Spectrum may be distorted as the incumbents will have the incentive to adjust their bids to obtain a lower SUF for the RFR Spectrum while the new entrants may have the incentive to increase the value of the SUF for the RFR Spectrum to unsustainable levels.

7.4 The incumbent 3G operators also had different views on what constituted the relevant past market benchmarks. They opposed the use of SUF of the spectrum in the 850/900 MHz band and some proposed the inclusion of the SUF of the unpaired spectrum in the 2.3 GHz band. CSL and HKT both submitted that there is a lack of transparency in the calculation of the weighted average past market benchmarks under the Second Method. The incumbent 3G operators considered the SUF of $77 – 80 million per MHz mentioned under the two methods as too high, and cautioned that high SUF would lead to high service charges. This latter view was shared by HKITF and some members of the public making the submissions. NTT suggested the level of SUF should be kept to a minimum. HKT expected it to cover only the cost of administering the spectrum and opined that deliberately setting a high SUF which is well in excess of the costs associated with administering the spectrum may be contrary to Section 32I(3) of the TO and that the purpose of the SUF is not to maximise revenue for the Treasury.

7.5 CMHK opined that there existed no direct relationship between the levels of SUF and service charges. It also expressed reservations with the two methods proposed for setting the SUF of the RFR Spectrum, as both of them were based on the SUF as determined by past auctions. It preferred the SUF to be determined solely by the auction for the Re-auctioned Spectrum, as this would reflect the true market value of that spectrum. DAB was of the view that the SUF should reflect the full market value of spectrum as a scarce public resource. It did not support the Second Method as it might result in the incumbent 3G operators paying a lower level of SUF for the RFR Spectrum relative to the SUF of the Re-auctioned Spectrum. That would happen when the SUF of the Re-auctioned Spectrum, as determined by auction, turned out to be higher than the weighted average of the past market benchmark of $80 million per MHz. DAB also noted that the incumbent 3G operators might end up

paying a higher level of SUF for the RFR Spectrum relative to the SUF of the Re-auctioned Spectrum under the Second Method, or under the First Method when the spectrum re-auction determines a level of SUF which is below $77 million per MHz. However, it regarded the situation in which the incumbent 3G operators pay a higher level of SUF for the RFR Spectrum as reasonable, as the extra payment represented the value of the privilege accorded to them in obtaining the RFR Spectrum without competition.

7.6 On the auction reserve price to be set for the Re-auctioned Spectrum under Option 3, CSL and HKT were of the view that it should be set conservatively or that it should reflect the cost of administering the spectrum, and that the market should then be left to determine the value of the spectrum. CMHK proposed that the auction reserve price be set at $50 million for each block of 5 MHz frequency band. DAB agreed that it should be set at a relatively high level in order to prevent the incumbent operators from adjusting their demand strategically with an aim of lowering the SUF for the RFR Spectrum, and to ensure the true value of the spectrum would be reflected.

The Responses of the SCED

7.7 Frequency spectrum is a scarce public resource. To maximise its benefit to the community, the SCED is duty bound to set the SUF at a level to reflect the spectrum's full market value. This ensures that spectrum assignees which run their commercial operations in a fully liberalised market would put the spectrum so acquired to its most efficient use. It is not the SCED's intention to set the SUF at a level that maximises Government revenue. The SCED disagrees with the allegation that setting a SUF in excess of the relevant administrative costs may be contrary to the TO. In fact, the TO provides that the SUF may be calculated on the basis of a royalty or any other basis that includes an element in excess of the simple recovery of the cost of providing a service by the CA.

7.8 The SCED has taken due note of the concern expressed by a number of respondents, including the incumbent 3G operators, about the high degree of uncertainty associated with the proposed link between the SUF of the RFR Spectrum and the SUF of the Re-auctioned Spectrum determined by

auction. However, it should be noted that the incumbent 3G operators are free to decide whether or not to exercise the right of first refusal after evaluating its benefit against the risk of making such a commitment. Should any of the incumbent 3G operators decide not to exercise the right of first refusal to be re-assigned the RFR Spectrum, the spectrum thus becoming available will be put to the market for auction and the concerned incumbent 3G operators can also take part in the auction along with other bidders to acquire parts of the Re-auctioned Spectrum through competitive bidding. It should be noted that certainty as to the supply of spectrum in an auction will ensure that all bidders will be able to make informed bidding decisions and the resulting auction price will more likely reflect the full market value of the spectrum. In the light of the incumbent's concerns over the lack of certainty for them on the SUF at the time when they exercise their right of first refusal, the SCED is of the view that a cap should be placed on the SUF of the RFR Spectrum. Incumbent 3G operators will therefore be advised of both the upper and lower limits of their financial commitment under the right of first refusal arrangement.

7.9 Regarding the concern about the possible strategic bidding behaviour involved in the auction if the SUF of the RFR Spectrum is linked to the auction outcome, the SCED is of the view that all bidders in the auction would have to commit to the bids they submitted. It would not be commercially sound for the new entrants to inflate the bids artificially in the auction with the intention to increase the value of the SUF for the RFR Spectrum to unsustainable levels because the new entrants will need to commit to those "unsustainably high levels" of SUF for the spectrum they obtained in the auction.

7.10 On the proposal to make reference to the SUF which is determined by auctions in overseas markets, the SCED considers it more relevant and appropriate to set the SUF of the RFR Spectrum based on Hong Kong's past market benchmarks taking account of the local business environment and the associated cost of building and maintaining a mobile network locally. 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 over 230% in Hong Kong contributes positively to MNOs' revenue. The level of SUF also reflects the degree of competition in

the mobile market. All these local factors affect the amount of SUF that operators are willing to pay. The SCED therefore considers it more appropriate to rely on the past levels of SUF in Hong Kong as reference in setting the SUF of the RFR Spectrum.

7.11 While the SCED notes the incumbent 3G operators' disagreement towards the choice of 850/900 MHz band as one of the past market benchmarks because of its superior propagation characteristics over spectrum in the higher frequency bands (i.e. 1.9 – 2.2 GHz band and 2.5/2.6 GHz band), he considers its SUF a relevant reference for the SUF for the RFR Spectrum as this spectrum is deployed for the provision of data services with mature technology support. In response to the comment on the lack of transparency in the calculation as proposed under the Second Method, the SCED has in fact set out the relevant past market benchmarks and also the underlying principle. The SCED does not consider it necessary to explain in detail the exact weighting of each benchmark for the purpose of consultation.

7.12 As to the proposal to refer also to the SUF of the unpaired spectrum in the 2.3 GHz band, the SCED notes that the application of unpaired spectrum for the provision of mobile services as of today still lags far behind that of paired spectrum. This is reflected in the SUF of the unpaired spectrum in the 2.3 GHz band which managed to fetch a SUF which was only slightly above the reserve price at the auction conducted in February 2012. Given the significant differences in the pace of application of unpaired spectrum compared to paired spectrum for mobile services, and the market prices they respectively fetch, it is doubtful if the SUF of the unpaired spectrum in the 2.3 GHz band would constitute an appropriate reference directly for arriving at the SUF of the RFR Spectrum.

7.13 The SCED wishes to reiterate his view that the royalty payment in 2015/16, being the actual amount payable by the incumbent 3G operators in 2016 for the use of the 3G Spectrum, gives the best indication of the minimum price for exercising the right of first refusal. Given the envisaged continuous intense demand for frequency spectrum in the years ahead, the value of the 3G Spectrum in the years up to 2031 is expected to worth no less than its value in 2016.

7.14 Moreover, the concern about a high level of SUF leading to higher mobile service charges is more apparent than real. As borne out by past experience in Hong Kong, the "high level" of SUF would not necessarily, as some of the respondents have claimed, lead to an increase in the mobile service charges.[18] The charges for mobile services are primarily determined by demand and supply in the market as a result of competition, instead of the amount of SUF paid. On average, the SUF only represents about 3% of the total annual operating cost of the MNOs. It therefore explains why the charges for mobile services show no sign of increasing, despite the fact that the level of SUF set by auction has been on a generally upward trend.[19]

7.15 As to why royalty payments in the past years of the existing term of assignment are not considered, it is noteworthy that the progressive schedule of royalty payments under the existing term of assignment was designed to reflect the pace of development of 3G Spectrum application, and to capture the rising value of the 3G Spectrum as the technology evolves. Over the past decade or so, the application of the spectrum for the provision of 3G services has undergone several stages of development. It has moved from the situation where the 3G Spectrum was hardly used for data services in 2001, when 3G Spectrum was first assigned, through a rather sluggish start in the following years, up to the most recent few years in which there have been significant developments with the emergence of smartphones, and the blossoming of mobile applications for entertainment, social networking and other data services. Mirroring the pace of application, the royalty payment was set at a very low level for the early part of the assignment term because the 3G technology had yet to mature. It rises progressively during the existing term of spectrum assignments, reflecting the mature and advanced application of the 3G Spectrum. Against this background, it is not appropriate to take into account the royalty payments over the entire term of the current assignment as a relevant benchmark for determining the SUF of the RFR Spectrum, bearing in mind the mature application of the 3G technology and that the time period we

[18] Taking the auction conducted in March 2011 for the 2 x 10 MHz of spectrum in the 850/900 MHz band as an example, the level of SUF reached a record high of $98 million per MHz as a result of intense competitive demand for this valuable spectrum. This spectrum was then deployed for the provision of 3G services, but there has been no sign at all of any increase in the 3G service charges.

[19] As an example, the per MHz SUF of the 2.5/2.6 GHz spectrum, as determined by the auction in March 2013, is 81% higher than that set by the auction conducted for the spectrum in the same frequency band in January 2009.

have in mind for the SUF of the RFR Spectrum spans 15 years from 2016 to 2031. During this period, the 3G band is likely to be refarmed for the provision of 4G services to enable higher transmission capacity, and hence unleash more business potential for the concerned spectrum assignees.

7.16 On the question concerning the 5 MHz of unpaired spectrum in the 1.9 – 2.2 GHz band, the SCED agrees with the comments by the incumbent 3G operators and Plum that the royalty payment under the current term of assignment covers the payment for this frequency slot though it has been left idle ever since the assignment. The SCED considers it reasonable to treat this unpaired spectrum as being on a par with the paired spectrum in the 1.9 – 2.2 GHz band insofar as their SUF is concerned. That is, 1 MHz of unpaired spectrum will be counted as equivalent to 1 MHz of paired spectrum in the calculation of SUF based on the 2015/16 royalty payment.

7.17 On the comments about the need to apply a discount rate to the per MHz royalty payment payable by the incumbent 3G operators in 2016 in order to arrive at the lump sum SUF payment for the RFR Spectrum for the next 15-year period, the SCED considers the value of the 3G Spectrum is expected to increase in the future at a rate which is broadly in line with the cost of capital of the concerned operators. The necessary discount for time value of money will then be offset by the increase in spectrum value. Therefore, by directly multiplying the value of the 3G Spectrum in 2016 by 15 in arriving at the lump sum SUF payment for the 15-year period, the SCED has already taken into account both the increase in spectrum value throughout the next assignment term and the time value of money.

7.18 Turning to the SUF of the Re-auctioned Spectrum, it is to be determined through the auction which is currently expected to be conducted in the fourth quarter of 2014. It is necessary to set the auction reserve price, which is normally announced through the Information Memorandum to be published when applications for bidding are invited. The SCED acknowledges that it is preferable for early information to be given concerning the auction reserve price in order to give the incumbent 3G operators an indication of the lower limit of SUF for the Re-auctioned Spectrum which they can take into account when they make their decision as to whether they would exercise the right of first refusal.

7.19 In order to shed light on the possible value of the Re-auctioned Spectrum and to forestall non-serious bidders, the SCED indicated in the Second Consultation Paper that the reserve price for the Re-auctioned Spectrum would be pitched at a level significantly higher than the reserve prices set for all the spectrum auctions in the past. This remains the guiding principle for setting the reserve price of the Re-auctioned Spectrum.

7.20 The auction reserve price is to be set at a level which would minimise the possibility of an unreasonably low SUF due to strategic bidding behaviour of the incumbents. It is not intended to be set as a pre-estimate of an expected market price and the determination of final SUF which is the full market value of the Re-auctioned Spectrum would be left to the market force in the competitive auction.

7.21 On the concern about spectrum re-auction leading to high SUF and hence an adverse effect on customers in terms of higher service charges, the relationship between SUF and service charges has been discussed in paragraph 7.14 above; the charges for mobile services are determined primarily by demand and supply in the market as a result of competition, rather than by the amount of SUF paid. The SUF paid by the MNOs for all the spectrum taken together (viz. 572 MHz)[20] accounts for only about 3% of their total annual operating cost on average, meaning that the SUF for the Re-auctioned Spectrum (viz. 39.2 MHz in total, or 7% of the total mobile spectrum assigned, if all the incumbent 3G operators exercise the right of first refusal to be re-assigned the RFR Spectrum) will be much less than that. The discussion in paragraph 7.9 also explains that, in a competitive market, an operator, be it a deep-pocketed player or not, would not pay an exorbitantly high price for the spectrum at auction, in order for it to stay competitive in the mobile market. Eight spectrum auctions have been conducted since 2001 to establish the market price for the scarce mobile spectrum, and the level of SUF has once reached a record high of $98 million per MHz as discussed in footnote 18. Nevertheless, mobile service charges in Hong Kong remain highly affordable and competitive by international standards.

[20] See Footnote 3.

Section 8 : A spectrum re-assignment framework

8.1 The Second Consultation Paper posed five questions [21] for consultation on the proposed arrangements relating to the auction of the Re-auctioned Spectrum under Option 3.

Band Plan

Question 1: Do you agree that Slots 3, 4, 9, and 10 in the 1.9 – 2.2 GHz frequency band as depicted in Figure 2 should be put out for re-auction?

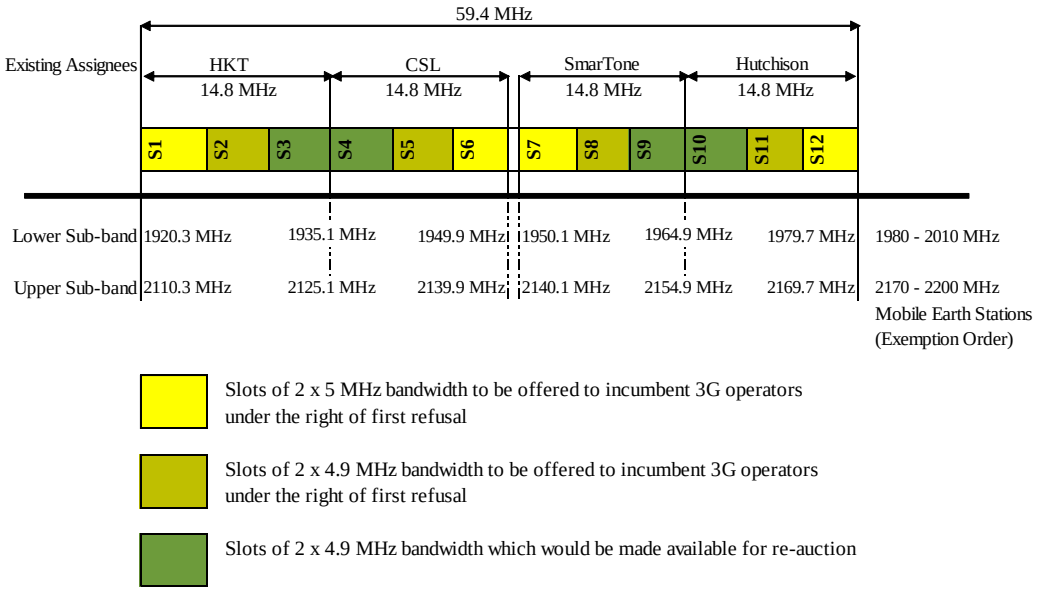

Figure 2 – Proposed Band Plan for Re-assignment of the Frequency Spectrum in the 1.9 - 2.2 GHz Band

Views and Comments of the Respondents

8.2 CMHK supported the proposal of putting out Slots 3, 4, 9 and 10 in the 1.9 – 2.2 GHz band as depicted in Figure 2 for re-auction.

8.3 HKT, as the incumbent 3G operator holding Slots 1, 2 and 3 in the 1.9 – 2.2 GHz hand, did not support the proposal to return Slot 3 for

[21] The other two questions raised for consultation in the Second Consultation Paper relate to the setting of SUF for the RFR Spectrum and reserve price for the Re-auctioned Spectrum. The respondents' views and comments on these issues and the SCED's responses are detailed in Section 7 on SUF.

re-auction. It pointed out that the illegal use of DECT phones in the band adjacent to Slot 1 had caused radio interference to that frequency slot. Therefore, if it was allowed to be re-assigned only two slots, it would prefer retaining Slots 2 and 3 and returning Slot 1 for re-auction. It further suggested a substantial discount on the SUF for Slot 1, if it were to be re-assigned to HKT as part of the RFR Spectrum, in order to take into account the interference issue. A member of the public made a submission which proposed a band plan consisting of five frequency blocks of 2 x 12 MHz each in the 1.9 – 2.2 GHz band, with one of these five blocks put out for re-auction.

The Responses of the CA

8.4 In drawing up the proposed band plan as depicted in paragraph 8.1 above, the CA has taken into account the roadmap for release of the latest available mobile technology. With Slots 3, 4, 9 and 10 in the band plan being put out for re-auction, it provides an opportunity for the incumbent 3G operators to acquire one or two blocks of 2 x 4.9 MHz of frequency which is/are adjacent to the 2 x 9.9 MHz of the RFR Spectrum. It will enable them to achieve a maximum contiguous block of 2 x 19.7 MHz of spectrum in the 1.9 – 2.2 GHz band, so that the full potential of the LTE-Advanced technology can be readily realised. The proposal of HKT that Slot 1, instead of Slot 3, should be put out for re-auction would give rise to non-contiguous frequency slots and it would deprive one of the incumbent 3G operators (i.e. CSL) of the opportunity to acquire a contiguous block of 2 x 19.7 MHz of spectrum in the 1.9 – 2.2 GHz band.

8.5 The CA notes, as pointed out by some of the respondents, that under 3GPP Release 10, the LTE-Advanced technology is designed to achieve the same peak data rates by using non-contiguous spectrum as would be the case with a contiguous spectrum block of the same size. The above notwithstanding, radio equipment supporting 3GPP Release 10 is not yet widely available in the market. Besides, a contiguous spectrum block is able to deliver a higher spectral efficiency. Therefore, the provision of an earlier opportunity to build up a contiguous 2 x 19.7 MHz frequency slot in the 1.9 – 2.2 GHz band should serve to assist the successful bidders to realise early the full potential of LTE-advanced technology.

8.6 In regard to the concern raised by HKT about interference in Slot 1, the CA is of the view that it should be dealt with through enforcement against the users of illegal telecommunications equipment. HKT is at liberty to consider whether it will exercise its right of first refusal to be re-assigned the RFR Spectrum, or bid for the other frequency slots in the re-auction. Given that an application of a discount of SUF to a particular frequency slot will invariably be contentious and subject to disputes, it would be more effective for the incumbent to decide whether to take the relevant spectrum with the right of first refusal or leave it for open auction with a lower reserve price.

8.7 The proposal by a member of the public to subdivide the 2 x 60 MHz of spectrum in the 1.9 – 2.2 GHz band into five equal frequency slots of 2 x 12 MHz each and then to re-auction one of the slots will have the effect of lowering the spectral efficiency, as the bandwidth of each carrier for the 3G technology and its evolved standards is 5 MHz. For this reason, the CA does not find the proposal acceptable.

8.8 In conclusion, the CA decides that Slots 3, 4, 9 and 10 in the 1.9 – 2.2 GHz band, as depicted in Figure 2, will be put out for re-auction.

Eligible Bidders

Question 3: Do you agree that the Re-auctioned Spectrum should be open for bidding by all interested parties, including the incumbent 3G operators?

Views and Comments of the Respondents

8.9 CMHK supported the proposal that the Re-auctioned Spectrum should be open for bidding by all interested parties for fairness.

8.10 HKT disagreed and considered that the Re-auctioned Spectrum should be open for bidding by the incumbent 3G operators only. It added that, if each of the incumbent 3G operators was left with 2 x 10 MHz of spectrum in the 1.9 – 2.2 GHz band, it would create substantial service continuity problems along with less competition, investment and innovation.

The Responses of the CA

8.11 Given that the existing assignments of the 3G Spectrum will expire in October 2016, and to address the concern about customer service continuity particularly for reception indoor, Option 3, instead of the full-fledged market-based mechanism, was proposed for further consultation. Under Option 3, the 2 x 39.6 MHz of RFR Spectrum is proposed to be re-assigned to the incumbent 3G operators through exercise of their right of first refusal. As to the remaining 2 x 19.6 MHz of Re-auctioned Spectrum, it is a fair arrangement to open it for bidding by the incumbent 3G operators, the MNO not holding 3G Spectrum, MVNOs and anyone wishing to enter the Hong Kong mobile market. The CA does not agree to confine the Re-auctioned Spectrum for re-assignment to the incumbent 3G operators only, as it runs counter to one of the principal aims of Option 3, which is to provide an opportunity for newcomers to bid for the spectrum. Regarding the selection of Option 3 for further consultation, the views of respondents and the responses of the CA are detailed in Section 6 of this document under the heading of "Option 3 – Proposed Spectrum Re-assignment Option for Further Consultation".

8.12 As to the concern about service continuity and the effects on competition, investment and innovation in the event that the incumbent 3G operators do not acquire any of the Re-auctioned Spectrum, the responses of the CA are detailed in Sections 2, 4, and 5 (which address ensuring customer service continuity, promotion of effective competition, and encouragement of investment and promotion of innovative services).

Auction Format

Question 5: Do you have any views on the proposed Simultaneous Multi-Round Ascending ("SMRA") auction format?

Views and Comments of the Respondents

8.13 CMHK and HKT agreed to adopt SMRA as the auction format. However, CMHK suggested that, instead of adjusting the round price at the discretion of the CA in each round, as in the previous auctions, it should be

made consistent and prior notice of the round prices should be given to the bidders.

The Responses of the CA

8.14 The SMRA auction format is well-tested and it is one that the industry is familiar with. As to CMHK's comments on the setting of the round price, it has to be pointed out that there is an operational need for the CA to adjust the increment at each round of the auction, taking into account relevant factors such as the intensity of demand for the spectrum and the number of bidding rounds conducted. If the demand for the spectrum under auction remains intense, there would be a need for the auction to apply a larger increment to the round price so as to speed up the pace of the competitive bidding. However, if the round price is at a high level and the spectrum demand becomes lacklustre, a smaller increment may help in concluding the auction at a fair market price for the spectrum.

Spectrum Cap

Question 6: Do you agree that there should be no spectrum cap imposed if all the incumbent 3G operators exercise the right of first refusal to acquire two-thirds of their original frequency holding and 2 x 20 MHz of spectrum will be put out for re-auction?

Question 7: Do you agree that a spectrum cap should be imposed if the amount of spectrum to be put out for re-auction amounts to 2 x 40 MHz or more with some of the incumbent 3G operators deciding not to exercise the right of first refusal?

Views and Comments of the Respondents

8.15 CMHK and HKT disagreed with the proposal that no spectrum cap should be imposed if 2 x 20 MHz of spectrum in the 1.9 – 2.2 GHz band would be put out for re-auction. While CMHK suggested that a cap of 2 x 20 MHz, inclusive of any RFR Spectrum acquired by the incumbent 3G operators before the re-auction, should be applied to each bidder, HKT suggested a cap of

2 x 10 MHz be imposed. In the situation in which 2 x 40 MHz or more of spectrum is put out for auction, both CMHK and HKT agreed to a spectrum cap of 2 x 20 MHz.

The Responses of the CA

8.16 It was already clearly stated in the Second Consultation Paper that, if a spectrum cap of 2 x 20 MHz was imposed, any incumbent 3G operator that had exercised its right of first refusal to be re-assigned the 2 x 9.9 MHz of RFR Spectrum would be allowed to bid for at most 2 x 10 MHz of the Re-auctioned Spectrum.

8.17 On reflection, and taking into account the respondents' feedback, the CA is of view that, even if only 2 x 19.6 MHz of the spectrum in the 1.9 – 2.2 GHz is to be put out for auction, i.e. when all the incumbent 3G operators exercise their right of first refusal to acquire the 2 x 9.9 MHz of RFR Spectrum, a cap of 2 x 20 MHz of spectrum should be imposed on individual holdings of spectrum in the 1.9 – 2.2 GHz band of spectrum assignees. This means that new entrants to the band may bid for a maximum of 2 x 20 MHz of spectrum, and the incumbent 3G operators, having exercised the right of first refusal for 2 x 9.9 MHz of RFR Spectrum, may acquire a maximum of 2 x 10 MHz of Re-auctioned Spectrum. The rationale behind this is that all the 2 x 59.2 MHz of spectrum in the 1.9 – 2.2 GHz band would have been re-assigned through auction under Option 2 had it not been for the concern about the possible effect on customer service continuity of this approach. The incumbent 3G operators, who will already benefit from being able to acquire the 2 x 9.9 MHz of RFR Spectrum through their right of first refusal, should be treated on par with other bidders in terms of overall spectrum holding in the band. With the imposition of a cap of 2 x 20 MHz of spectrum in the 1.9 – 2.2 GHz band, all bidders in the auction, including the incumbent 3G operators, will be given the opportunity to hold a maximum of 2 x 20 MHz of spectrum in the band.

8.18 From a competition perspective, if the incumbent 3G operator which is assigned the largest amount of spectrum were to acquire 2 x 10 MHz of the Re-auctioned Spectrum, its share of spectrum holding in total will increase from 24% to 26%. If the 2 x 20 MHz of Re-auctioned Spectrum all goes to the MNO which currently is not assigned any 3G Spectrum, its share of spectrum holding in total will increase from 17% to 25%. If all the

Re-auctioned Spectrum is going to be acquired by a new entrant to the Hong Kong mobile market, it will hold only 7% of the overall spectrum. Therefore, the imposition of a cap of 2 x 20 MHz of spectrum in the 1.9 – 2.2 GHz band will ensure no undue concentration of the 3G Spectrum, safeguarding the competitive landscape of the Hong Kong mobile market.

Section 9 : Other Related Subjects

Section 9(a) : Legitimate Expectation

9.1 The Spectrum Policy Framework states clearly, "*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*". It also explains that *"the policy inclination is that a market-based approach in spectrum management will be used for spectrum 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"*.

Views and Comments of the Respondents

9.2 CSL, HKT and Hutchison claimed to have a legitimate expectation based on past practices that their assignment of the 3G Spectrum should be renewed. AmCham and HKITF shared this view. They claimed support for this legitimate expectation from inter-alia the re-assignment of the 2G spectrum to the incumbents through right of first refusal in 2004, and the re-assignment of the spectrum originally used for providing analogue mobile services to the incumbents for the provision of digital mobile services back in the early 1990s. They emphasized that the considerations justifying licence renewal in 2004 remained valid, namely the need to provide a stable investment environment, to ensure customer service continuity, and to enable efficient use of the spectrum by the incumbents. CSL and Hutchison considered these precedents to provide overwhelming support for their legitimate expectation of renewal in spite of the clear statement in the Spectrum Policy Framework of no legitimate expectation for right of renewal/first refusal of any spectrum assignment upon expiry and the fixed-term of 15 years for the 3G Spectrum assignment which was specified in the unified carrier licences. They added that, based on their expectation of licence renewal, they had made substantial investments in the networks and services. They also sought support from precedents of licence renewals in overseas economies, including Australia, Canada and the UK, for their argument that they had an entitlement to a right of first refusal for all the 3G Spectrum which was assigned to them.

9.3 HKT and Hutchison also claimed to have a legitimate expectation of a licence renewal drawing on the wording of the Spectrum Policy Framework. First, a market-based approach did not necessarily mean only the use of an auction, but could also include spectrum trading and keen competition in the mobile market. The view of spectrum trading as a market-based approach was shared by Cetari. Second, they challenged the opinion of the CA that there was competing demand for the 3G Spectrum as the demand for it had been satisfied by the MVNO arrangements. According to their views, the Spectrum Policy Framework supported renewal of the 3G Spectrum licences to them.

9.4 Also basing its opinion on the Spectrum Policy Framework, CMHK opined that the incumbent 3G operators should have been well aware that they could not have a legitimate expectation that there would be any right of renewal/first refusal of any licence or frequency assignment upon expiry. The incumbents should therefore have taken into account in their business planning that there was a real risk of the licence or spectrum assignment not being renewed. LP was of the view that the incumbents should not expect auto-renewal of the 3G licences upon expiry, as this would preclude new entrants to the industry and was contrary to the objective of promoting competition. Some members of the public in their submissions opined that, if the Government did not reclaim the spectrum this time, it would be more difficult to do so in the future, and auto-renewal was also inconsistent with the specification of a 15-year term of spectrum assignment.

The Responses of the CA

9.5 As explained in the Second Consultation Paper, it had been expressly stated in the Spectrum Policy Framework promulgated by the Government in April 2007, more than nine years before the expiry of the current 3G Spectrum assignment in 2016, that there would be no legitimate expectation of a right of first refusal of spectrum assignment upon expiry. The former Telecommunications Authority undertook that, in exercising his statutory power under the TO in future, he would give due regard to the Spectrum Policy Framework to the extent that there would be no inconsistency with the objectives and provisions of the TO. In addition, Schedule 3 on

"*Technical Particulars of Radio Stations for the Provision of the Service*" attached to the relevant licences of the incumbent 3G operators clearly reflects the 15-year term of assignment of frequencies in the 1.9 – 2.2 GHz band running from 22 October 2001, to its expiration on 21 October 2016. The incumbents have been aware all along of the finite duration of the 3G Spectrum assignment and should have taken this into account in their investment and business plans. More importantly, neither the SCED nor the CA has ever made any clear and unequivocal promises or representations to the incumbent 3G operators that they would have a right of first refusal for the 3G Spectrum assigned to them.

9.6 The CA takes the view that auto-renewal of the spectrum assignment defeats the purpose of having a fixed-term assignment. The fixed-term spectrum assignment enables a review to be conducted and decision made on the most suitable course of action for re-assignment when the term expires, which would reflect the prevailing circumstances. In the present case of 3G Spectrum re-assignment, the CA is of the view that Option 3 could be expected to best meet the multiple objectives for spectrum re-assignment. The key rationales have been set out in Sections 2 – 5 of this document.

9.7 The CA does not agree that renewal of spectrum re-assignment back in the early 1990s and in 2004, many years **prior to** the promulgation of the Spectrum Policy Framework in April 2007, should fetter or override the guiding principle in spectrum management contained therein. The policy inclination towards a market-based approach in spectrum management was established after thorough consultation with the industry (including the incumbent 3G operators) and other affected persons in 2006/07. The blossoming of mobile applications for entertainment, social networking and other data services in recent years has fundamentally transformed the landscape of the mobile market from that in 2004, or back in the early 1990s when the renewal of mobile spectrum took place. In the 1990s, the mobile spectrum was used predominantly for voice services. At end 2004, the total monthly data usage was just 2.3 Terabytes ("TB") (or 2 Megabytes ("MB") per customer per month). With the advent of smartphones in 2007, mobile data usage soared from 32 TB (or 11 MB per customer) per month at the end of 2007 to 10 629 TB (or 946 MB per customer) per month in July 2013. The total volume of mobile data traffic has experienced upsurges three to five times year on year

during 2008-10, and doubled each year in 2011 and 2012. This robust traffic growth trend has led to a strong demand from MNOs for mobile spectrum to enable them to provide reliable and quality mobile services to their customers. It counters both the suggestion that there is little competing demand for the 3G Spectrum, and the argument that there should be simply auto-renewal of the spectrum assignments.

9.8 In order to satisfy the incessant customer demand for mobile data services, competition has been keen in the bidding for the newly released mobile spectrum. It is readily apparent from the submissions made in the consultation that there are competing demands for the 3G Spectrum: the incumbent 3G operators are keen to be re-assigned all their existing frequency holdings, and the MNO which is not assigned any 3G Spectrum wishes to have the opportunity to bid for the 3G Spectrum. The argument that the MVNO arrangement, which permits those which do not hold 3G Spectrum to nevertheless use it, could displace this competing demand for 3G Spectrum is not convincing. As discussed in Section 3 of this document on efficient utilisation of spectrum, the spectrum capacity lessees have an interest in having an opportunity to become spectrum holders themselves so as to exercise their own autonomy in using spectrum resources. The MVNO arrangement falls far short of meeting that expectation.

9.9 The CA does not agree with the suggestion that the experience of licence renewal in Australia, Canada and the UK would give rise to a legitimate expectation for the incumbent 3G operators in Hong Kong. The overseas practices in spectrum re-assignment will be discussed in more detail in the next sub-section of this document. In gist, the CA considers that it is not appropriate to transplant overseas practices to Hong Kong without giving due regard to our own circumstances. We would add that many other overseas economies, including Ireland, the Netherlands, Sweden, Singapore and Taiwan, do adopt spectrum re-auction or a hybrid option for assigning mobile spectrum upon expiry of the current assignment.

9.10 As to the suggestion that spectrum trading and competition in the mobile market can be treated as alternative market-based approaches, the CA's view is that these are not relevant market mechanisms to be considered in the context of spectrum re-assignment. As discussed in Section 3, spectrum trading

does not per se provide any justification to support the assignment of spectrum, a scarce public resource, to the MNOs on a perpetual basis. Competition in the retail mobile market does serve to maximise the benefits to consumers. However, competition at the retail level only comes about after the spectrum has been assigned to the MNOs. Contrary to the views of some respondents, service competition post spectrum assignment cannot be a valid substitute for the assignment of the scarce spectrum resource through a market-based approach such as auction. To achieve effective competition, it is vital to incorporate a competitive process in the spectrum assignment arrangement to ensure efficient allocation. Once the MNOs have been assigned spectrum, they can then compete for customers in the retail market and the consumers' benefits will more likely be maximised through such service competition.

Section 9(b) : Overseas Practices

9.11 Overseas economies adopt different approaches in spectrum re-assignment. In mapping out the options for re-assigning the 3G Spectrum, the CA has made reference to these overseas practices. However, the CA considers that the distinct Hong Kong circumstances, including the market environment and the guiding principle in spectrum management set out in the Spectrum Policy Framework to be of more relevance. Among the three options, Option 3, as a hybrid administratively-assigned cum market-based approach, is considered best able to meet the multiple objectives in spectrum re-assignment.

Views and Comments of the Respondents

9.12 All the incumbent 3G operators, Plum, HKITF and some members of the public who made submissions opined that direct renewal of spectrum licences or renewal through right of first refusal was an established international practice in spectrum re-assignment. Hutchison and SmarTone submitted that this approach of effecting direct licence renewal for the incumbent operators would lead to spectrum being efficiently used in Hong Kong. Australia, New Zealand, Canada, the US, Italy, Portugal, Spain, the UK, and Singapore were quoted as examples of economies in which there is a practice of granting direct licence renewal to the incumbent operators.

9.13 CEG referred to the results of the study it carried out for the GSM Association in support of a presumption of licence renewal being international best practice. They claimed that the application of this presumption promotes investment, and avoided both service disruption and the incurring of additional costs. CSL also referred to the CEG Report in its submission. Both CEG and CSL reiterated their view, citing a World Bank finding that a majority of the world's legal and regulatory frameworks adopted a regime based on the 'presumption of renewal' or 'renewal expectancy'.

The Responses of the CA

9.14 The CA observes that different economies have adopted different

methods when re-assigning mobile spectrum upon expiry, and that they take into account the relevant local circumstances including the objectives in spectrum management, intensity of demand for mobile spectrum, competitiveness in the mobile market, and supply of new frequency bands after re-assignment. While some economies such as Australia, Canada and the UK have re-assigned the spectrum to incumbent spectrum holders through licence renewal or the grant of perpetual licences, other economies re-auction all or part of the spectrum rights upon expiry. The latter include Singapore, New Zealand, Ireland, the Netherlands, Sweden and Taiwan. Having sought confirmation on the spectrum re-assignment arrangements from the relevant regulatory authorities, we discuss below the methods of re-assignments of these economies which have embodied either in parts or in full an element of auction.

9.15 Some respondents' submissions suggested that Singapore offered right of first refusal to the incumbent operators in re-assigning the 900 MHz and 1800 MHz spectrum in 2008. However, the true position is that the telecommunications regulator in Singapore, Infocomm Development Authority ("IDA"), adopted a market-based approach, which was implemented through auction, to re-assign a total of 2 x 90 MHz of spectrum in the 900 MHz and 1800 MHz bands in February 2008. No right of first refusal was granted prior to the auction. It was only included as an option after the auction had been successfully conducted, i.e. at the spectrum assignment stage to minimise possible churning of the newly assigned spectrum. IDA adopted a similar market-based approach in July 2013 to re-assign a total of 2 x 135 MHz of spectrum in the 1800 MHz and 2.5 GHz bands for the provision of 4G services. In that case the existing licences would expire in 2017 and 2015 respectively and the new licences would have a validity period of 13 – 15 years till 2030. However, in this auction, IDA did not provide for right of first refusal even in the assignment stage. Instead, the assignment stage included a phase where all the winning bidders were allowed to discuss possible assignments. IDA regards auction as an effective means to ensure the most efficient use of the scarce spectrum resources and, as a matter of principle is not inclined towards granting any right of first refusal, which it considers only reinforces incumbency and distorts the market mechanism.

9.16 The reference to New Zealand by some of the respondents as an example of spectrum re-assignment through right of first refusal is likewise not

borne out by the facts. The Cabinet of New Zealand announced its spectrum re-assignment policy in 2003, which is that whether or not the spectrum rights would be renewed would be subject to a case-by-case assessment. Following a case-by-case review, the government decided to adopt a hybrid approach in its re-assignment of the spectrum in the 800 MHz and 900 MHz bands in 2007. Spectrum rights for at least 2 x 5 MHz of spectrum in each of the concerned frequency bands had to be divested by the incumbents to a new entrant on a commercial basis, or alternatively spectrum rights for 2 x 7.5 MHz of spectrum in each concerned frequency band would be re-assigned by way of an auction in the open market. Spectrum renewal rights were granted to the incumbents for the remaining spectrum in the 800 MHz and 900 MHz bands. The New Zealand government considered this approach to be capable of providing certainty to the incumbent operators, while at the same time it would create more potential for new entrants to gain access to the market. Ultimately, the incumbent operators divested 2 x 5 MHz of spectrum holdings in each frequency band to a new entrant on a commercial basis, and the re-auction of the spectrum in both frequency bands did not take place.

9.17 In Ireland, spectrum assignment in the 900 MHz and 1800 MHz bands, which is deployed for the provision of 2G services, will expire over 2013-15. In 2010, the Commission for Communications Regulation ("ComReg"), the Irish regulator, decided to put all the spectrum rights to auction together with the newly released digital dividend in the 800 MHz band. The multi-band spectrum auction successfully awarded a total of 2 x 140 MHz of spectrum in December 2012. Apart from the incumbent 2G operators, an incumbent 3G operator also obtained spectrum in the 900 MHz and 1800 MHz bands. ComReg regarded auction as an open, objective, transparent, non-discriminatory, proportionate and competitive process for the allocation of valuable spectrum that ensured that consumers would benefit. As all the spectrum was assigned on a technology-neutral basis, the winning bidders were free to offer innovative services using the latest mobile technologies. New licences with validity periods up to 2030 were considered appropriate by ComReg to provide regulatory certainty to the operators for their planning of investment and network development.

9.18 The Dutch multi-band spectrum auction was also completed in December 2012, with a total of 2 x 145 MHz of paired spectrum and 70 MHz

of unpaired spectrum awarded to the three incumbent operators and a new entrant for a period of 17 years till 2030. It included the re-assignment/assignment of 2 x 105 MHz of spectrum in the 900 MHz and 1800 MHz bands[22] that was originally employed by the incumbent operators for the provision of 2G services. As the 2G spectrum licences would expire two months after the auction, the Dutch government allowed an extension of two years from the completion of the auction to allow for transition. With the auction resulting in a significant re-allocation of spectrum holdings among the incumbent operators, they made a joint effort after the auction to work out a frequency migration plan. Given the intensive use of the spectrum in the 900 MHz band, the migration was expected to take 14 months from the expiry of the old licences to complete. This process has started and will be completed in April 2014. The migration of spectrum in the 1800 MHz band was completed in June 2013 and took four months. It is the policy of the Dutch government that, if there is a reasonable expectation that spectrum is scarce, it has to be assigned by means of an auction or a beauty contest, but the latter approach will be applied only in specific cases.

9.19 The regulator in Sweden, the Swedish Post and Telecom Authority ("PTS"), adopted a hybrid approach in re-assigning the 2 x 70 MHz of spectrum in the 1800 MHz band. In February 2010, PTS decided to renew the licences of the three incumbent operators with approximately half of the bandwidth they originally held in this frequency band, i.e. 2 x 10 MHz for each licensee, for a 15-year period from January 2013 to December 2027. PTS was of the view that the hybrid approach was able to ensure service continuity and meet the criteria of efficient use of the spectrum resource. A clock auction comprising two stages of bidding was conducted in October 2011 to allocate 2 x 35 MHz of the 1800 MHz spectrum. The three incumbent operators, with the right of first refusal for retaining part of the existing spectrum holdings, could participate in the second stage of the auction to bid for spectral placing for the re-assigned spectrum together with the winning bidders from the first stage auction, or they would receive a placement from PTS. An amendment was made to the Swedish telecommunications legislation in August 2010 to make explicit the principle of no legitimate expectation on the part of the

[22] Among the 2 x 70 MHz of spectrum assigned in the 1800 MHz band, 2 x 13 MHz was newly assigned spectrum, while all the 2 x 35 MHz of spectrum in the 900 MHz band was re-assigned spectrum.

incumbent spectrum licensees for licence renewal. While the legislative amendment also extended the validity of the 1800 MHz spectrum licences by 10 years to 25 years, it specified at the same time that there would be no further extension of a spectrum licence.

9.20 Apart from Singapore, Ireland and the Netherlands, Taiwan is another economy that has adopted full spectrum re-assignment through auction. Its 2G spectrum licences will expire in June 2017. An auction was conducted in September 2013 to re-assign all the spectrum in the 900 MHz and 1800 MHz bands and to assign the newly released digital dividend in the 700 MHz band, thereby giving out a total of 270 MHz of spectrum on a technology-neutral basis for the provision of mobile services. The spectrum auction aimed to reflect the market value of the spectrum and to enhance the spectral efficiency. With seven bidders participating in the auction, the entire auction process was completed recently at the end of October 2013.

9.21 Examples cited in the foregoing paragraphs illustrate that it is not uncommon for spectrum rights to be re-assigned through auction and on a fixed-term basis. They also demonstrate that with the cooperation of the incumbent operators, it is possible to arrange for spectrum migration in a space of less than two years. A hybrid between the market-based and the administratively-assigned approaches for spectrum re-assignment has been implemented in some overseas economies. There are also cases of re-assignment through right of first refusal. The overall conclusion to be drawn from the overseas experience described above is that each economy has to take into account the specific features of its own mobile market when mapping out the most appropriate method for spectrum re-assignment. There is no universally applicable solution or international best practice as such, contrary to what is suggested by some respondents, that fits all circumstances and can be readily transplanted from one economy to another.

Section 9(c) : Miscellaneous Issues

9.22 The foregoing sections and sub-sections have summarised the major views and comments of the respondents on the Second Consultation Paper, together with the responses of the CA which are set out at the end of each section and sub-section. A number of issues raised by the respondents, and not yet covered in this document, are addressed in the following sub-section.

Views and Comments of the Respondents

9.23 CSL opined that the CA had not given due regard to the reasoned views expressed by respondents to the consultation and that it has elected to pre-determine a subset of possible outcomes. It requested the CA to ensure the consultation process is conducted in a fair manner and to give due regard to stakeholders' views. A member of the public making his submission criticised the consultation for being conducted in a hasty manner in order to meet the minimum notification period for the decision on spectrum re-assignment to be announced in October 2013.

9.24 Almost all the incumbent 3G operators and the consultants making submissions requested that a cost-and-benefit analysis, economic impact assessment or regulatory impact assessment be conducted to prove that the benefits from adopting Option 3 would outweigh those of Option 1. HKGCC considered it necessary to show that the benefits of Option 3 would be able to offset the harm to consumers in terms of service disruption.

9.25 HKT was of the view that the Government seemed to favour an approach (Option 3) that would only benefit CMHK. A few members of the public making submissions suspected the Government, by re-auctioning parts of the 3G Spectrum, to have a hidden agenda to make way for CMHK, a giant state-owned enterprise, to strengthen its position in the Hong Kong mobile market.

9.26 Hutchison regarded Option 3 as not satisfying Section 4(4) of the Communications Authority Ordinance ("CAO") which emphasized, inter-alia,

encouragement of innovations and investment in the communications market as one of the duties of the CA. By discouraging investment and innovation, Option 3 would also be inconsistent with Article 118 of the Basic Law, which states "*the Government of the Hong Kong Special Administrative Region shall provide an economic and legal environment for encouraging investment, technological progress ... .*" HKT also regarded Option 3 as inconsistent with Article 118 of the Basic Law. A member of the public making his submission concurred with the views of the incumbents. On the other hand, CMHK considered that Article 118 of the Basic Law supported spectrum re-auction, as it opened up an opportunity for all interested parties to bid for the 3G Spectrum and the successful bidders would make investment.

The Response of the CA

9.27 The consultation exercise on the re-assignment arrangement for the 3G Spectrum was kick started in March 2012 and has gone through two rounds of public consultation, with a combined consultation period lasting seven months. Ample opportunities have been given to all the telecommunications industry and other affected persons to give their views and comments. The First Consultation Paper and the Second Consultation Paper as well as all submissions received in response to the two consultation papers are available on the website of the CA. The CA has considered and taken into account the views and comments as expressed in the submissions, explained their considerations, and given their responses in the Second Consultation Paper as well as this document. It has also been made clear that, after the due consultation process, the CA would endeavour to announce the decision on re-assignment of the 3G Spectrum in October 2013, in order to allow about three years' advance notice for the MNOs, enabling them where necessary, to plan and adjust their business operations and their service provision to customers.

9.28 As pointed out in Section 6 of this document, the Second Consultation Paper has already conducted an analysis of the "pros and cons" of three options against the multiple objectives in spectrum re-assignment. In particular, a detailed comparison has been made between Option 1 and Option 3 as requested by some of the respondents.

9.29 Under Option 3, the status quo position under Option 1 will be one of the possible outcomes, if all the incumbent 3G operators were to be re-assigned the frequency slots they are now holding through the exercise of their right of first refusal and by bidding in the re-auction. The CA has not sought to weigh the business costs and benefits for the incumbents of Options 1 and 3 in terms of dollars and cents. The market mechanism should be a more effective tool in allocating resources and it is up to the operators to make their own commercial decisions on strategy and approach should Option 3 be adopted for spectrum re-assignment. During the conduct of the Study, the incumbent 3G operators requested that the Study should include a cost-and-benefit analysis of the mitigation measures. The Government however does not consider that the cost of mitigation measures is relevant to the Study. After all, whether or not an incumbent 3G operator will implement such measures is a matter for its own commercial judgment which is likely to involve taking into account various considerations, which may include but may not be limited to the cost involved, as well as the amount of SUF which is available for alternative use if it is unable to, or chooses not to, acquire any Re-auctioned Spectrum.

9.30 It was suggested that a regulatory impact assessment be conducted. However, this is an analytical tool which is only relevant where there is to be a change in policy. The CA wishes to make clear that the present spectrum re-assignment arrangement does not involve any change whatsoever of its policy in relation to spectrum management. The guiding principle of using a market-based approach in spectrum management, unless there are public policy reasons to do otherwise, in case of competing demands from providers of non-Government services has been in place since the promulgation of the Spectrum Policy Framework in April 2007, and it remains the policy. Therefore no regulatory impact assessment is warranted.

9.31 The allegation that the CA is adopting a spectrum re-assignment option that favours CMHK or a stated-owned enterprise in the Mainland has no basis. Being part of the highly open and market-based Hong Kong economy, our telecommunications market is fully liberalised. We do not impose any restrictions on foreign investment and ownership for our telecommunications operators. Our MNOs have both Mainland and foreign capital in addition to local investment, and they are all competing for customers in the mobile

services market under the same regulatory framework and on a level-playing field. While Option 2, the full-fledged market-based approach, is not considered to be appropriate, in view of the concern about continuity of 3G mobile services especially indoor, the proposed Option 3 serves to allow any interested parties, whether with local, Mainland or overseas background the opportunity to bid for the one-third of the 3G Spectrum to be released through auction on an equitable basis and in an open and transparent manner.

9.32 On the consistency of Option 3 with Section 4(4) of the CAO and Article 118 of the Basic Law, the primary concern is whether this option would facilitate investment and innovation in the communications sector. As a matter of fact, encouragement of investment and promotion of innovative services is one of the four objectives in re-assigning the 3G Spectrum. It has been explained in Section 5 of this document that Option 3 has a promotional effect on investment by both the incumbent 3G operators and new spectrum assignees. Besides, high speed access facilitates the introduction of innovative services. Option 3 is therefore in line with the objective of the CA to bring about a more vibrant telecommunications sector that maximises the benefits to consumers and the business sector.

Commerce and Economic Development Bureau
(Communications and Technology Branch) and
Office of the Communications Authority
November 2013

The Policy Views of the Secretary for Commerce And Economic Development on the Arrangements for the Frequency Spectrum in the 1.9 – 2.2 GHz Band upon Expiry of the Existing Frequency Assignments for the Provision 3G Mobile Services

PURPOSE

This paper sets out the policy views and considerations of the Secretary for Commerce and Economic Development ("SCED") regarding the re-assignment arrangements.

2. The policy views and considerations of the SCED stated in this paper are provided as one of the considerations which the Communications Authority ("CA") may take into account in discharging its spectrum re-assignment responsibilities under the Telecommunications Ordinance (Cap. 106) ("TO"). For the avoidance of doubt, this paper is without prejudice to any provisions of the TO and nothing in this paper shall be construed as limiting or restricting in any way the powers vested in the CA under the TO for the management of radio spectrum.

BACKGROUND

3. The SCED and the CA have jointly conducted two rounds of public consultation to seek views and comments on how the 2 x 59.2 MHz of paired frequency spectrum in the 1.9 – 2.2 GHz band (hereinafter referred to as the "Relevant Spectrum") should be re-assigned upon the expiry of the current assignments on 21 October 2016 and related issues. Three options were identified for the re-assignment of the Relevant Spectrum –

(a) Option 1: An administratively-assigned approach

Right of first refusal of all the Relevant Spectrum to be offered to the incumbent 3G operators

(b) Option 2: A full-fledged market-based approach

Re-auctioning all the Relevant Spectrum

(c) Option 3: A hybrid between the administratively-assigned and the market-based approach

Right of first refusal to the incumbent 3G operators to be re-assigned two-thirds of the Relevant Spectrum (hereinafter referred to as the "Right-of-first-refusal Spectrum"). Should any of the incumbent 3G operators decide not to exercise the right of first refusal to be re-assigned the Right-of-first-refusal Spectrum, the spectrum thus becoming available will be pooled together with the remaining one-third of the Relevant Spectrum and assigned through auction (collectively the "Re-auctioned Spectrum") (each an "Option" and collectively "Options").

4. The SCED has policy responsibility over telecommunications. At the same time, the SCED also oversees innovation, competition and consumer protection amongst others. He shares an obvious interest on the policy implications of the different Options. Having carefully considered the submissions received in the two rounds of public consultation, the findings of the independent consultant commissioned by the Administration, the second report of Plum Consulting provided by the incumbent 3G operators (the "second Plum report") to the Office of the Communications Authority on 19 September 2013 and other relevant factors, the SCED would like to present to the CA his policy views and considerations regarding the re-assignment arrangements set out in the ensuing paragraphs.

THE POLICY CONSIDERATIONS OF THE SCED

Guiding Principle in Spectrum Management

5. According to the Radio Spectrum Policy Framework ("RSPF") issued in April 2007, the policy inclination is that a market-based approach in spectrum management will be adopted for the assignment of the spectrum wherever the CA (or the former Telecommunications Authority ("TA") before

the establishment of the CA) considers that there are likely to be competing demands, unless there are overriding public policy reasons not to do so.

6. The RSPF provides additional policy considerations to the CA (or the former TA) in discharging its spectrum management responsibilities under the TO. Through a statement issued in April 2007, the CA (or the former TA) undertakes that, in exercising its statutory powers under the TO, it shall give due regard to the RSPF to the extent that there are no inconsistency with the objectives and provisions laid down in the TO.

7. The CA has come to the view that there would be competing demands for the Relevant Spectrum.

The Multiple Objectives

8. In formulating his policy views on which of the three Options is preferred, the SCED has thoroughly evaluated the extent to which the re-assignment Options may meet the objectives of –

(A) maintenance of customer service continuity,

(B) efficient utilisation of spectrum,

(C) promotion of effective competition, and

(D) encouragement of investment and promotion of innovative services.

A. Maintenance of Customer Service Continuity

9. The SCED recognises the importance of maintaining customer service continuity. If a full-fledged market-based approach (i.e. Option 2) is adopted for the re-assignment, there exists the risk of a complete loss of 3G service coverage in certain indoor environment in certain circumstances during the reconfiguration works after the handover of the spectrum in October 2016. In light of the potentially severe and the long lasting effect on service quality and reception especially in indoor areas under Option 2 during the transitional period, the SCED is of the view that there are overriding public policy reasons

to deviate from the full-fledged market-based approach for the re-assignment of the Relevant Spectrum.

10. In this respect, the Administration commissioned an independent consultant to provide an objective assessment on the possible impacts of Option 3 on service quality and customers. Based on the results of the study, the service quality for the overall Hong Kong mobile market, both for 3G hotspots only and for the entire mobile network across the territory as a whole, would not be worsened under Option 3 as compared to that under Option 1, under which the incumbent 3G operators would be offered the right of first refusal for the entire Relevant Spectrum.

11. While the SCED acknowledges that any Option with an re-auction element would likely result in some impact on service quality for individual incumbent 3G operator(s) which do(es)/could not obtain up to its/their existing amount of frequency holding in the Relevant Spectrum, it is also noted that the operator(s) concerned could consider adopting mitigation measures including, amongst others, encouraging early migration of 3G customers to 4G network, reducing the amount of 3G spectrum to be refarmed to provide 4G service, refarming some of the 2G spectrum to provide 3G service instead of 4G service, as well as leasing 3G spectral capacity from other mobile network operators through commercial arrangements, in order to maintain or enhance service to customers. It is also pertinent to note that irrespective of the Option to be chosen, there will not be any loss of 3G spectrum capacity for serving mobile subscribers.

12. The SCED is of the view that while Option 2 does not meet this objective of maintaining service continuity for the overall Hong Kong mobile market given its severe risk on service quality and reception over a prolonged period during and after the handover of the spectrum in October 2016, both Option 1 and Option 3 can fulfil this objective.

B. Efficient Utilisation of Spectrum

13. Hong Kong has over a decade's experience in auctioning off spectrum, a scarce public resource, to the spectrum assignees. Auction has all along been an efficient method for assigning frequency spectrum as the market

mechanism will put the spectrum to the hands of the operators which value it most and hence would put the spectrum to the most efficient use. In this regard, the re-auction of the Relevant Spectrum essentially provides an opportunity for the incumbent 3G operators to review and rationalise their spectrum holdings with respect to their commercial considerations. They can acquire one or two blocks of 2 x 4.9 MHz of frequency, thereby achieving through auction a maximum of a contiguous block of 2 x 19.7 MHz of the Relevant Spectrum and readily realising the full potential of the LTE-Advanced technology.

14. On the other hand, the SCED considers that a perpetual spectrum assignment under Option 1 provides lesser incentive or exerts lesser pressure upon spectrum assignees to strive to enhance spectral efficiency continually as compare to the other two Options that re-assign parts or all of the Relevant Spectrum through auction. Incumbent operators will be under more pressure to better utilise their remaining spectrum if they cannot obtain the Re-auctioned Spectrum. Bidders which obtain the Re-auctioned Spectrum by outbidding others in the re-auction will also put the spectrum to the most efficient use in order to derive the highest economic value. This in turn will drive those rich in spectrum holding to strive to better utilise their own spectrum so as to stay competitive. Mobile virtual network operator arrangement, though allows spectrum holders to make better use of the spectrum they already have at hand, could not replace spectrum assignment through auction in ensuring efficient utilisation of spectrum at the assignment level.

15. The SCED is therefore of the view that Option 2 and Option 3 can better fulfil the objective of promoting efficient utilisation of spectrum as a scarce public resource of Hong Kong.

C. Promotion of Effective Competition

16. The SCED considers that promoting effective competition in the mobile market is not only about ensuring fair competition among the incumbent operators, it is also about providing a fair opportunity for new entrants to enter the market and compete with incumbent operators on a level playing field. Although non-3G spectrum holders can provide 3G service by leasing spectrum capacity from the incumbent 3G operators, the non-3G spectrum holders may

have the interest to become holders of the Relevant Spectrum so as to assume their own autonomy in providing services using spectrum resources.

17. Under Option 1, the prospective new entrants would be deprived of the opportunity to acquire part(s) of the Relevant Spectrum for the provision of 3G service. Spectrum trading, even if implemented, cannot be a real substitute of auctioning off the spectrum, the latter provides the fairest opportunity for interested parties, incumbents or new entrants alike, to obtain their desired amount of spectrum. After all, spectrum trading must be premised on the spectrum holder's willingness to trade in the first place, hence placing the parties who are interested in acquiring additional spectrum at the mercy of the spectrum holder. As against Option 1, through re-auction of the spectrum under Option 2 or Option 3, incumbent 3G operators, current spectrum lessees and also other new entrants will be given an equal opportunity to acquire the spectrum, which is in line with the Government's policy of promoting facilities-based competition so as to bring the benefit of enhanced competition to the public.

18. As mentioned in paragraph 14, the prospect of acquiring additional spectrum under Option 3 will provide an opportunity for the incumbent 3G operators to adjust either upwards or downwards the amount of frequency holding to the desired level after taking into account their respective profiles of frequency holding in different bands. By optimising their level of frequency holding, the incumbent 3G operators should be able to compete more efficiently with their counterparts in service provisions to the benefits of consumers.

19. The SCED considers that when compared to Option 1, Options 2 and 3 can bring about enhanced competition and thus fulfil the objective of promoting effective competition in the mobile market.

D. Encouragement of Investment and Innovation Services

20. The SCED fully appreciates the importance of certainty to all parties who are making (or plan to make) long-term investments in the telecommunications industry. The SCED considers that Option 3 will be able to alleviate the concern about certainty, given that the incumbent 3G operators

are notified sufficiently in advance and that they will have the opportunity to be re-assigned two-thirds of their original frequency holding. The Right-of-first-refusal Spectrum should be able to provide sufficient assurance and certainty for the incumbent 3G operators to continue their investment in the Relevant Spectrum. Option 2 will possess the least certainty among the three Options given that it does not have any Right-of-first-refusal Spectrum and the resultant spectrum holdings after auction may be highly uncertain, hence creating the biggest uncertainty for a period of time which may discourage investment and innovation.

21. The SCED considers that an advance notice of about three years for the decision on re-assignment arrangement including a two-year post-auction transitional period should allow sufficient time for all affected parties to mitigate any uncertainties through early planning. Moreover, if the incumbent 3G operators exercise the right of first refusal, the Re-auctioned Spectrum amounts to at most only 10% of the total spectrum holding in the case of the incumbent 3G operator with the smallest spectrum holding, and only 7% for the one with the largest spectrum holding.

22. The SCED also recognises that investment in the mobile network is a function of many factors. In a keenly competitive mobile services market, so long as the spectrum assignees wish to remain competitive in the market, they should always have the incentive to invest in their network. That said, the auction itself encourages investment further in mobile network by both the incumbent 3G operators and the new entrants. The incumbent 3G operator(s) that fail(s) to acquire sufficient spectrum is/are expected to have a commercial need to invest further in the network in order to compensate for the reduction in spectrum capacity. All spectrum assignees with newly acquired spectrum, be they the incumbent 3G operators or the new entrants, will also bring in additional investment to roll out service based on the newly acquired spectrum. Both scenarios offer incentives and opportunities to provide innovative services.

23. Given the above, the SCED considers that Option 3 has advantage over the other two Options in being able to strike a balance between providing sufficient certainty to the incumbent 3G operators and encouraging investment from all spectrum assignees.

THE POLICY VIEWS OF THE SCED

24. The SCED has assessed the different Options from a qualitative angle. It is however impossible to quantify all the different dimensions for comparison. For example, it is difficult to compare the actual additional cost incurred by some customers for an earlier migration from 3G to 4G services with the benefits brought about by the technology upgrade including possible enhanced customer experience and additional functionalities, the latter two are not quantifiable. Equally, it is difficult to compare quantitatively the benefits of encouraging more innovation and migration versus the service inadequacies due to not pursuing a particular option.

25. On the basis of the above considerations, the SCED considers that under the full-fledged market-based approach for the re-assignment of the Relevant Spectrum, i.e. Option 2, there exists the risk of a potentially severe and the long lasting effect on service quality and reception especially in indoor areas during the transitional period. Hence, the SCED is of the view that there are overriding public policy reasons to deviate from Option 2. As regards Option 3, apart from enabling customer service continuity, it is also superior to Option 1 in enhancing spectral efficiency, encouraging investment and the introduction of innovation services. Also, Option 3 will provide an opportunity for newcomers to enter the market and for the incumbent 3G operators and other interested parties to seek to obtain their desired amount of frequency holding in the Relevant Spectrum through a market mechanism. This is something which Option 1 cannot offer.

26. Having duly considered the views and comments received in context of the two rounds of public consultation exercise, the findings of the independent consultant commissioned by the Administration, the second Plum report and other relevant factors, the SCED has come to a policy view that Option 3 – a hybrid approach, can best serve the multiple objectives in spectrum re-assignment and therefore should be adopted for the re-assignment of the Relevant Spectrum.

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