HKT

Proposed Change in the Allocation of the 3.4 – 3.7 GHz Band from Fixed Satellite Service to Mobile Service

Response to Consultation Paper

7 September 2017

HKT

Introduction

1. Hong Kong Telecommunications (HKT) Limited ("**HKT**") welcomes the opportunity to put forward its views regarding the Communications Authority's ("**CA's**") proposals to re-allocate the 3.4 – 3.7 GHz frequency band from Fixed Satellite Services ("**FSS**") to mobile services.

2. The demand for mobile services has grown exponentially in the past number of years, and this has led to an increasingly more spectrum being needed by the mobile operators, to the point that there will soon be (if not already) a spectrum shortage in Hong Kong. HKT is therefore encouraged by the CA's proposals to free up spectrum in the 3.4 – 3.7 GHz frequency band to mobile operators in order to make more spectrum available for mobile broadband services. The release of this frequency band will also facilitate the development of future 5G mobile services.

3. Before HKT responds to the proposals put forward by the CA, it would like to deal with some comments made in the Consultation Paper regarding the current availability of spectrum for mobile services.

Supply of Spectrum

4. In paragraph 3 of this Consultation Paper, OFCA states that although spectrum is a scarce resource, there is 35 MHz of spectrum available in the 1.9 – 2.2 GHz band in Hong Kong which is currently available for assignment, but no mobile operator has expressed any interest in it so far. HKT disagrees with this assessment.

5. The reason why no mobile operator has requested use of this spectrum is because it cannot currently be deployed. The **35 MHz** of spectrum includes: (i) **20 MHz** of unpaired spectrum in the 1.9 - 2.2 GHz range; (ii) **9.7 MHz** of unpaired spectrum in the 2010 - 2019.7 MHz range; and (iii) **4.9 MHz** of unpaired spectrum in the 1900 - 1904.9 MHz range.

6. For (i) above, this refers to the unpaired 3G TDD spectrum which was originally awarded together with the paired 3G FDD spectrum back

in 2001. Each of the four 3G mobile operators was awarded with 1 x 5 MHz of spectrum shown as shaded blocks in the figure below.

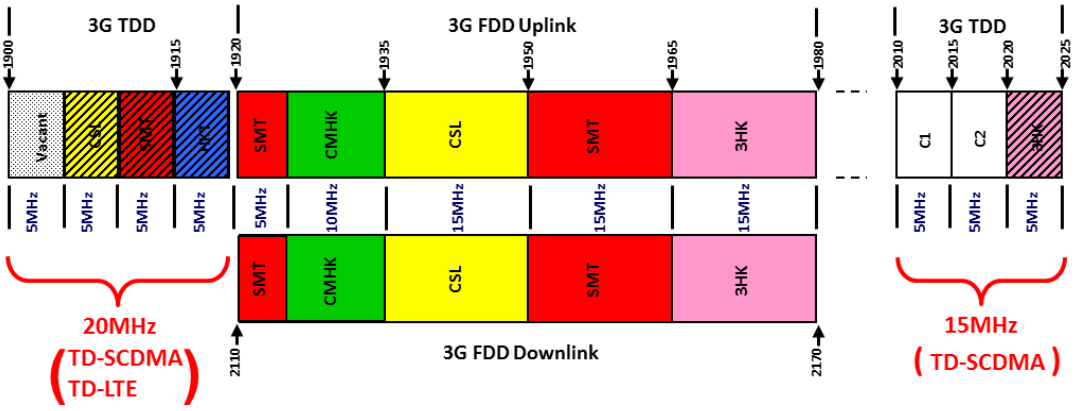

Figure 1: Spectrum available for release

7. However, at that time, these blocks of spectrum were not fully supported in Hong Kong. The lack of availability of 3G TDD handsets and network equipment meant that the four 3G mobile operators were unable to make use of the frequency blocks assigned to them. Even today, there is only one commercial TDD network in the world supporting Band 39 (1880 – 1920 MHz), i.e. China Mobile in China, with its TD-SCDMA network.

8. For (ii) above, this refers to the two blocks of spectrum (4.8 MHz and 4.9 MHz) which the CA attempted to assign via auction in 2011, but there was no interest from the bidders due to its lack of utility in Hong Kong. Today, this spectrum can still not be usefully deployed due to lack of 4G LTE devices supporting this band. These two blocks of spectrum are marked "C1" and "C2" in the above figure.

9. Lastly, for (iii) above, this single block of 4.9 MHz spectrum has never been released. This block of spectrum is marked "Vacant" in the above figure.

10. Collectively, the 35 MHz of available spectrum to which OFCA refers in the Consultation Paper can divided into two blocks, as indicated in the above figure: (i) 20 MHz from 1900 – 1920 MHz ("**Lower Block**"); and (ii) 15 MHz from 2010 – 2025 MHz ("**Higher Block**").

11. The Lower Block has, in recent years, become usable for 4G TD-LTE and is now supported by some of the smartphones in the market. On the other hand, the Higher Block is only usable for 3G TD-SCDMA. Hence, going forward, there is really only 20 MHz (not 35 MHz) of spectrum which is usable for 4G.

12. In addition, this 20 MHz of spectrum is insufficient to accommodate the four existing mobile operators in Hong Kong (or justify the network investment required) and is fairly minimal in view of the total amount of spectrum that has already been assigned for mobile use (i.e. constituting a mere 3.6 % of the total amount of 552 MHz spectrum already assigned per OFCA). It is therefore no surprise that none of the existing mobile operators have expressed any urgent interest in this spectrum so far.

The CA's Proposal

13. The frequency band from 3.4 – 4.2 GHz ("**C-Band**") is currently wholly allocated for FSS. FSS provides a means for delivering external telecommunications either via non cable-based External Fixed Telecommunications Network Services ("**EFTNS**") or the operation of Self-Provided External Telecommunications Systems ("**SPETS**") by companies for their own telecommunications purposes with places outside Hong Kong.

14. Satellite television programme channels are also transmitted via FSS. Around 1,600 Satellite Master Antenna Television ("**SMATV**") systems installed by building management offices/incorporated owners (serving some 890,000 user outlets) and Television Receive-Only ("**TVRO**") systems installed by individual households are set up to receive 75 television programme channels transmitted via satellite over the 3.4 – 3.7 GHz band. Neither the owners nor users of SMATV systems are licensees under the Telecommunications Ordinance ("**TO**"), and no specific frequency assignment has been made by the CA for the use in TVRO systems.

15. At the moment, there are two satellite operators[1] which offer FSS in Hong Kong. These two operators use spectrum which is not only in the C-Band, but also in other higher frequency bands. About 11% of the aggregate FSS downlink capacity of these two operators falls within the 3.4 – 3.7 GHz range in C-Band and, of this capacity, only 3% is provided for EFTNS and SPETS.

16. The two satellite operators also make use of spectrum in the 3.4 – 3.7 GHz band for Telemetry, Tracking and Control ("**TT&C**") of their own satellites in orbit from earth stations set up in Tai Po Industrial Estate and Stanley. Once the satellites are launched, the frequency channels used for TT&C cannot be changed.

17. Per the CA's proposal, in 2020, the lower part of the C-Band (i.e. 200 MHz in the 3.4 – 3.6 GHz range) will be re-allocated for mobile services, while the upper part of the band (i.e. 3.7 – 4.2 GHz) will continue to be used for FSS. A guard band of 100 MHz (i.e. 3.6 – 3.7 GHz) will be introduced in order to minimize any interference to FSS caused by mobile services operating in the 3.4 – 3.6 GHz range, as shown in the figure below.

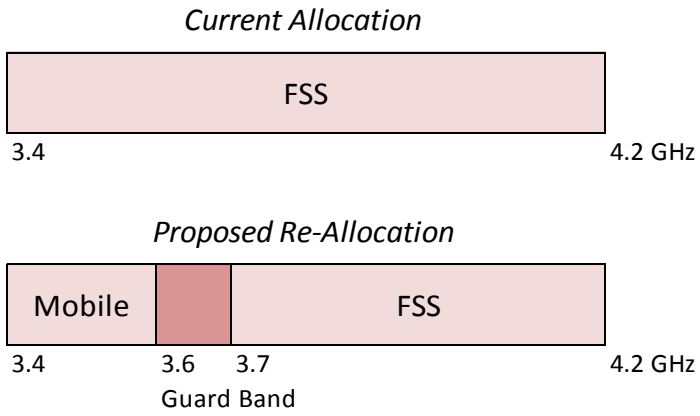

Figure 2: The CA's proposal regarding the C-Band

Question 1: What are your views on the above Proposed Re-Allocation?

[1] Namely, Asia Satellite Telecommunications Limited and APT Satellite Company Limited.

18. HKT supports the spectrum re-allocation as proposed in the Consultation Paper. According to paragraph 15 of the Consultation Paper, the World Radiocommunication Conference held in 2007 has already identified the 3.4 – 3.6 GHz band for use in providing mobile services. At the outset, therefore, mobile operators have a legitimate and primary right to use this band.

19. HKT notes that China is already trialing use of this spectrum with a view to offering mobile services in this band in 2020, so Hong Kong should be doing the same in order to ensure worldwide and cross-border compatibility. HKT supports closer cooperation between OFCA and the Mainland authorities in harmonizing this band for mobile services in order to avoid cross-boundary interference.

20. It is also apparent from the survey of countries annexed to the Consultation Paper that several countries are not simply confining the frequency bands for mobile use to the 3.4 – 3.6 GHz range, and are looking at extending the band for mobile use beyond 3.6 GHz. On this basis, and in light of the value of mobile services to consumers and businesses in Hong Kong, HKT would suggest that OFCA study the possibility of extending the frequency range below 3.4 GHz and beyond 3.6 GHz in order to maximize the amount of spectrum that is available for mobile use. This would entail examining whether it is technically feasible to reduce the currently proposed 100 MHz guard band in the 3.6 – 3.7 GHz range so that more spectrum can be used by the mobile operators.

Possible Impacts on and Mitigating Measures for the Existing Systems and Services operating in the C-Band

21. In order to minimize interference by mobile services to existing systems operating in the 3.7 – 4.2 GHz band, the CA suggests several mitigating measures.

SMATV

22. According to the Consultation Paper, if the CA's proposal is implemented, 9 satellite television programme channels[2] which are currently being transmitted over the 3.4 – 3.7 GHz band will no longer be receivable by SMATV systems in Hong Kong. Accordingly, the affected SMATV systems will need to be re-tuned to receive other programme channels conveyed via the 3.7 – 4.2 GHz band.

23. Modifications will also need to be made to the low-noise block down converter of the SMATV systems so that they only operate in the restricted frequency range from 3.7 to 4.2 GHz instead of the original full range within the C-Band.

24. Further, there may be a need to install additional signal filters in the SMATV systems and external passive shielding structure around the satellite antenna for protection against the relatively strong terrestrial signals from mobile services. TVRO systems would also need to adopt the same mitigating measures.

EFTNS/SPETS

25. For EFTNS/SPETS systems, the concerned licensees may need to lease from the satellite operators FSS downlink capacity solely in the 3.7 – 4.2 GHz range and also implement necessary mitigating measures at their earth stations on the ground so as to withstand the terrestrial signals of mobile services operating in the 3.4 – 3.6 GHz band.

TT&C

26. For existing TT&C earth stations which are already using the 3.4 - 3.7 GHz band to track their satellites in orbit, as the frequency band cannot be adjusted, the earth stations would need to implement mitigating measures to alleviate any impact on their systems arising from use of the 3.4 – 3.6 GHz band by mobile operators.

---

[2] These include: Aljazeera Channel, Dubai Sports 3, Rai Italia Asia, Sahara One, Samay, Samay Bihar/Jharkhand, Southeast Television, Nepal TV and NTV Plus. These 9 programme channels are currently only being received by 11% of the total number of SMATV systems in Hong Kong (1,600).

27. In addition, the CA suggests that restriction zones be imposed on the deployment of radio base stations for mobile services operating in the 3.4 – 3.6 GHz band so that mobile operators will not be able to transmit signals in this band in the vicinity of TT&C earth stations, otherwise the reception of C-Band signals by TT&C earth stations would be adversely affected. On the other hand, satellite operators will not be permitted to use the 3.4 - 3.7 GHz band in any new TT&C earth stations situated outside the restriction zones.

Principle of protecting existing systems

28. The CA states that, as a general principle, if the 3.4 – 3.6 GHz band is re-allocated for mobile services and the incumbent systems are required to move up to the 3.7 – 4.2 GHz band, the operator of the mobile services, being the late comer, should be responsible for any rectification work that may need to be undertaken by the systems relocating to the 3.7 – 4.2 GHz band to eliminate interference from the mobile services.

29. As TVRO systems are not subject to licensing and no specific frequency has been assigned for the operation of TVRO systems, users of such systems are not entitled to protection from any potential harmful interference arising from the operation of mobile services in the 3.4 - 3.6 GHz band.

Question 2:	**Do you agree with the principle of protecting existing SMATV/EFTNS/SPETS systems operating in the adjacent band of 3.7 – 4.2 GHz with the implementation of the mitigating measures?**

30. In the Consultation Paper, the CA has blindly focused on coming up with mitigating measures to protect the incumbent users of the spectrum simply for the sake of protection. It has failed to take a longer term view and consider the underlying question as to what is the most valuable use for the spectrum, and hence which group of spectrum users should be granted primary access/protection.

31. At the very least, the CA should seriously consider the role of SMATV in the future. SMATV once had an important part to play in the past when the public had limited access to viewing content (i.e. only 4

free-to-air television channels being available), although, even then, SMATV systems were not provisioned in all public housing.

32. Today, members of the public have plenty of choices in terms of viewing content, with over 10 (mostly digital) free-to-air television channels, pay television with hundreds of channels, and the Internet which provides an unlimited number of streaming channels. The role which SMATV has to play today has therefore diminished significantly to the point that it has become outdated. Furthermore, given the current plans for Hong Kong to switch-off analogue terrestrial television in 2020, the CA needs to ask itself:

- Will analogue SMATV still be needed in the future? No viewership statistics for the SMATV channels has been provided so it is difficult to verify the demand, if any.

- Should SMATV still be allowed to take up such valuable spectrum, particularly given the importance of mobile services, the difference in spectrum assignment periods for mobile and FSS operators (15 years v. perpetual assignment), and the level of fees which mobile operators are required to pay for the use of spectrum compared to FSS operators (nil for FSS operators)?

33. Accordingly, other than the need to accommodate existing TT&C systems whose frequency bands cannot be altered (and hence must continue to use frequency in the 3.4 – 3.7 GHz band[3]), HKT does not agree that mobile operators should need to accommodate or compensate operators of any systems that are required to move up to the 3.7 – 4.2 GHz band in the event that such systems experience subsequent interference. The requirement for the existing systems to move up to the 3.7 – 4.2 GHz band is the result of a spectrum allocation decision made by the CA, and hence the mobile operators should not be held responsible for any consequences arising from the CA's decision.

[3] Fortunately, such earth stations are only located in two areas which are relatively far from the busy urban parts of Hong Kong, namely Tai Po Industrial Estate and Stanley.

34. In fact, HKT would suggest that, since it is likely that assignment of the 3.4 – 3.6 GHz band to mobile services will result in Spectrum Utilization Fees ("**SUFs**") being paid by the mobile operators to the Government, the Government should be responsible for any costs arising from the implementation of mitigating measures and these can be funded from the SUFs.

35. Mobile services should be treated as the primary user of the 3.4 – 3.7 GHz band in view of the value of such services to Hong Kong users as compared to FSS. Indeed, as stated in paragraph 23 of the Consultation Paper, the owners and users of SMATV systems are not licensees under the TO and hence should not be accorded any special rights associated with their use of the spectrum. In addition, only 9 satellite programme channels (out of a total of 462 satellite channels receivable in the 3.4 – 4.2 GHz Band) are affected by the CA's proposal. On the contrary, given the importance of mobile services to consumers and businesses in Hong Kong, FSS operating in the adjacent bands to mobile services should as far as possible accommodate the operation of mobile services.

36. As the SMATV/EFTNS/SPETS systems are scattered around all parts of Hong Kong, it is also unreasonable and impractical for mobile services operating in the 3.4 – 3.7 GHz band to attempt to avoid interfering with the services that have moved to the upper part of the band or be held accountable for any rectification work required to offer protection to the legacy systems.

37. In any case, the CA has proposed the imposition of a substantial guard band (100 MHz) to separate the operation of mobile services and FSS in the C-Band so the amount of interference should be minimal, if any.

Question 3:	**For implementation of the Proposed Re-Allocation, please suggest or give your views about any mitigating measures to be implemented for the existing systems and services as well as any precautions to be taken for the operation of the new mobile base stations to be operating in the 3.4 – 3.6 GHz band.**

38. HKT considers that, since the CA is already proposing that a fairly sizeable guard band of 100 MHz (from 3.6 GHz to 3.7 GHz) be established to separate the operation of mobile services and FSS in the C-Band, no further mitigating measures should be necessary to avoid interference between the operation of both types of services.

39. The technical adjustments suggested in the Consultation Paper, which should be undertaken by the operators moving to the upper part of the C-Band (i.e. starting from 3.7 GHz), should be sufficient to avoid any drastic interference issues.

40. In any case, HKT notes from the Consultation Paper that a consultancy study has been commissioned by OFCA to obtain advice on the technical mitigating measures and operational precautions that should be implemented in order to enable the co-existence of SMATV systems operating in the adjacent bands to mobile services. Any necessary measures that need to be undertaken should therefore be borne out by this study.

Advance Notice Period for Withdrawal of Allocation to FSS from the 3.4 - 3.7 GHz Band

41. According to the Statement issued by the (then) Telecommunications Authority on 31 January 2008 concerning the *Minimum Notice Periods for Variation or Withdrawal of Spectrum Assignments*, the CA is required to give a notice period of:

- Not less than three years in the case of spectrum assigned to a carrier licensee; and
- Not less than two years where the spectrum is for operation of a network other than for connection between the network and the customers,

although the CA is entitled to depart from the stated minimum notice periods where the circumstances so warrant.

42. The three year notice period applies to the spectrum held by the Space Station Carrier Licensees, Telemetry, Tracking, Control and

Monitoring Station Licensees (collectively "**SSCL Licensees**") and some of the EFTNS licensees, where the spectrum is being used for connection between the network and customers. On the other hand, a two year notice period would apply to the spectrum held by the SPETS licensees and other EFTNS licensees, where the spectrum is not being used for connection between the network and customers.

43. As no frequency has been assigned to SMATV licensees the aforementioned notice periods do not apply.

44. In the Consultation Paper, the CA is considering reducing the notice period to two years for the SSCL Licensees and some of the EFTNS licensees on the grounds that it is required to clear the 3.4 – 3.7 GHz band for mobile services as soon as possible so that there are no interference issues by the time Mainland China starts using the 3.4 – 3.6 band for 5G mobile services in 2020.

45. This would align with the two year notice period the CA is required to give to the SPETS licensees and the other EFTNS licensees so that, effectively, a two year notice period is aimed to be given in early 2018 to all licensees whose spectrum is affected by the CA's proposal.

Question 4: What are your views on effecting the Proposed Re-Allocation in the early 2020, giving an advance notice period of two years if the relevant decision of the CA is made in early 2018?

46. HKT concurs that there are sound reasons to reduce the original notice period from the stated three years and that a maximum two year notice period is appropriate. In fact, if feasible, CA could consider giving a notice period of less than two years as long as this gives the incumbent spectrum holders sufficient time to re-provision their systems for operation away from the 3.4 – 3.7 GHz band and implement any necessary mitigation measures before moving up to the higher part of the C-Band.

47. HKT has recently learnt that the Mainland Chinese Government may decide to make use of the 3.4 – 3.6 GHz band for 5G mobile services as early as 2019, so it may be necessary to accelerate the migration of

FSS to the upper part of the C-Band in order to minimize any interference concerns.

Proposed Change in Frequency Allocation

48. Given that the frequency channels currently used by some of the earth stations for TT&C cannot be altered once the satellite has been launched, the CA suggests that although the 3.4 – 3.7 GHz band will be allocated for mobile services on a primary basis, the primary allocation for FSS in respect of the existing TT&C stations operating in the 3.4 -3.7 GHz band should remain intact where the TT&C stations are currently located. Accordingly, the existing TT&C stations will be protected from harmful interference from mobile services. The CA's proposal will therefore result in the following frequency allocation:

Proposed Frequency Allocation

Hong Kong Allocation	Band Plan & Existing Utilisation
3400-3700	3400-3700
MOBILE Note (i) Legacy TT&C stations operating in the 3400-3700 MHz band at locations designated by the CA are protected from interference of public mobile services. Note (ii) No new frequency assignment in the 3600-3700 MHz band will be made.	(a) Mobile Service (b) Fixed-Satellite
3700-4200	3700-4200
FIXED FIXED-SATELLITE (Space-to-Earth)	(a) Fixed-Satellite

Figure 3: The CA's proposed change in frequency allocation

Question 5: What are your views on the need to protect the TT&C channels of the licensed satellite networks at their specific locations from any harmful interference to be caused by public mobile services?

49. Given that the frequency bands used by the TT&C channels cannot be altered once the satellite has been launched, HKT agrees that the existing earth stations concerned should be permitted to continue using spectrum in the 3.4 – 3.7 GHz band and should be protected from any harmful interference caused by mobile services deployed in this band via the imposition of restriction zones. Obviously, any new TT&C stations would not be subject to such favorable treatment.

50. HKT would, nevertheless, suggest that OFCA: (i) disclose the exact frequencies being used by the existing TT&C stations to facilitate better interference control management; and (ii) be very specific as to the geographical extent of the restriction zones (i.e. based on actual and realistic measurements, not theoretical calculations) in order to avoid any future misunderstanding.

51. In any case, allowing legacy TT&C stations to continue using the 3.4 – 3.7 GHz band is not expected to unduly inconvenience the mobile operators, since the earth stations concerned are only located in two areas which are relatively far from the busy urban parts of Hong Kong, i.e. Tai Po Industrial Estate and Stanley.

Question 6: Do you have any views on other aspects of or issues relevant to this consultation?

Scope of consultancy study

52. Per the Consultation Paper, OFCA states that, as the proposed re-allocation of spectrum may affect the normal reception of satellite television programme channels by hundreds of thousands of households via SMATV systems, it has commissioned a consultancy study on the technical mitigating measures and operational precautions that are required to enable the co-existence of SMATV systems operating in the 3.7 – 4.2 GHz band and the mobile services that will be operating in the 3.4 – 3.6 GHz band. The study is expected to be completed in early 2018.

53. Given that other services (not just SMATV systems) will continue to be operating in the 3.7 – 4.2 GHz band under the CA's proposal, HKT is puzzled as to why the study should be confined to an examination of the impact on SMATV systems of mobile services operating in the adjacent

3.4 – 3.6 GHz band, particularly when: (i) as explained before, the need for SMATV services is dying; (ii) the proper functioning of mobile services should take priority over SMATV systems given the relative importance of mobile services to consumers and businesses in Hong Kong; and (iii) neither the owners or users of SMATV systems are licensees under the TO and hence they have no recourse in the event of interference to the operation of their systems.

54. In any case, if the scope of the consultancy study is restricted to looking at SMATV systems, HKT would suggest that the consultant be required to comment on:

(i) What is the minimum guard band needed between mobile and SMATV systems operating in the C-Band to avoid interference between mobile and such services. This will help ascertain whether it is absolutely necessary to maintain such a generous guard band of 100 MHz in order to safeguard SMATV systems from interference; and

(ii) What practical and cost-effective mitigating measures can be used if such interference is found to exist even with the imposition of a 100 MHz guard band.

55. HKT would also suggest that in designing the required mitigating measures, the consultant base its assessment on a typical scenario involving mobile services and SMATV systems which covers the vast majority of situations in Hong Kong, rather than put forward a solution that can cope with all, including the most extreme, interference cases as such mitigating measures will not normally be required.

Other spectrum bands

56. HKT notes that while this consultation is focused on the release of spectrum for mobile operators in the 3.4 – 3.7 GHz band, OFCA is already taking steps to make available spectrum in the 26 GHz and 28 GHz band, and has, for some years planned to make spectrum in the 700 MHz band (subject to analogue switch off) available for mobile services.

57. Given the amount of spectrum that will be needed in Hong Kong to meet the growing demand for mobile services, and in light of the

plans being made in China to release spectrum in the 4.8 – 5.0 GHz band for 5G services, HKT would suggest that the CA concurrently look into the possibility of releasing the 4.8 – 5.0 GHz band in Hong Kong.

58. The advantage of releasing the 3.4 – 3.6 GHz band at the same time as the 4.8 – 5.0 GHz band for 5G mobile services is that this will make available four carriers of 100 MHz each, which would maximize spectral efficiency for the provision of 5G services and, at the same time, supply sufficient spectrum to the incumbent mobile operators in Hong Kong for the provision of 5G mobile services in the future.

Submitted by
Hong Kong Telecommunications (HKT) Limited
7 September 2017