

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

Consultation Paper

27 July 2017

FOREWORD

This consultation paper seeks views and comments of the telecommunications industry and other affected persons on the proposal of the Communications Authority (“CA”) to change the allocation of the 3.4 – 3.7 GHz band from fixed satellite service (“FSS”) (space-to-Earth) at present to mobile service (“MS”) in the timeframe of 2020, for the provision of public mobile services. This paper also seeks views and comments on the related timetable and mitigating measures.

Any person wishing to respond to the public consultation should do so on or before 7 September 2017. Please note that late submissions will not be considered. The CA may publish all or part of the views and comments received on or before the deadline, and disclose the identity of the source in such manner as the CA see fit. Any part of the submissions considered commercially confidential should be clearly marked. The CA would take such markings into account in making the decision as to whether or not to disclose such information. Submissions should be sent to –

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An electronic copy of the submission should be provided by email to the address indicated above.

For the avoidance of doubt, nothing in this consultation paper represents or constitutes any decision made by the CA. The consultation contemplated by this consultation paper is without prejudice to the exercise of the powers by the CA under the Telecommunications Ordinance (Cap. 106) (“TO”) or any subsidiary legislation thereunder.

INTRODUCTION

Public mobile services have undergone several rounds of evolution during the past few decades with the advent of technologies and in order to meet the increasing aspiration of service users for higher speed, for multi-media services that extend beyond just voice and data services, and for enhanced user experience.

2. In Hong Kong, the mobile penetration rate reached 236% in April 2017, one of the highest in the world, with an average monthly mobile data usage per capita exceeding 3.3 GBytes. Four mobile network operators (“MNOs”) are offering a wide range of second generation mobile services, third generation mobile services as well as fourth generation mobile services to suit the various needs of their subscribers.

3. Radio spectrum, a scarce public resource, is essential for the provision of public mobile services. At present, a total of 552 MHz of radio spectrum¹ in the 800 MHz, 850/900 MHz, 1800 MHz, 1.9 – 2.2 GHz, 2.3 GHz and 2.5/2.6 GHz bands (viz. all below 3 GHz) has been assigned to MNOs for the provision of public mobile services in Hong Kong. 35 MHz of radio spectrum² in the 1.9 – 2.2 GHz band is currently available for assignment, but no MNO has expressed interest in it so far.

4. All the spectrum that has been assigned for the provision of public mobile services falls within the sub-3 GHz band, allowing distant propagation from its radio sources. Territory-wide coverage of different generations of mobile services is currently achieved through the re-use of frequency with a moderate number of base stations set up across Hong Kong that forms the backbone of Hong Kong’s network infrastructure in serving our 17.5 million mobile service users as of March 2017.

¹ The 552 MHz of spectrum assigned for the provision of public mobile services does not include 8 MHz of spectrum in 678 – 686 MHz assigned in 2010 for the provision of broadcast-type mobile television service and 30 MHz of unpaired spectrum in the 2.3 GHz band assigned in 2012 and deployed for the provision of wireless fixed broadband services.

² The 35 MHz of spectrum includes (a) 20 MHz of unpaired spectrum in the 1.9 – 2.2 GHz band assigned in 2001, which was left idle throughout the assignment period of 15 years and was put back to reserve at the end of the assignment term in October 2016; (b) 9.7 MHz of unpaired spectrum in 2010 – 2019.7 MHz for the provision of public mobile telecommunications services that was put out for auction in 2011 with no interested bidder; and (c) 4.9 MHz of unpaired spectrum in 1900 – 1904.9 MHz, which was released in May 2016 after withdrawal of the licensing exemption for radiocommunication apparatus of Personal Handy Phone System. The Communications Authority will consider releasing the above spectrum should there be market demand.

5. In view of the potential market demand for mobile broadband of even higher speed, massive connections to enable internet of things as well as ultra-reliable and low latency communications, the mobile industry worldwide is now working actively on the development of the fifth generation mobile (“5G”) services. On the global level, the International Telecommunication Union (“ITU”) is co-ordinating closely with its member states on the harmonisation of spectrum in the range of 24.25 – 86 GHz for allocation to 5G, the new generation of mobile services, to facilitate its commercial launch within the time frame of 2020.

6. To support the development of the existing generations of mobile services and the coming 5G services, there is a need for the economies world wide to make available to the market additional radio spectrum which is suitable for the provision of public mobile services in the coming years. Despite that ITU is planning to harmonise new spectrum allocation for 5G services above 6 GHz at the next World Radiocommunication Conference (“WRC”) scheduled for November 2019, many economies are actively working on supplementing radio spectrum at lower frequency bands with wide bandwidth, such as the 3.4 – 3.6 GHz band, for the provision of public mobile (including 5G) services. Spectrum in this frequency range allows for wide area coverage and high data speed, rendering it most suitable for the provision of public mobile services.

7. On 21 March 2017, the CA promulgated its work plan for making available additional spectrum to meet the demand of public mobile services, including 5G services, towards 2020 and beyond. As foreshadowed by the CA in its work plan, this public consultation is launched to seek views and comments on the CA’s proposal and timeline to vacate the 3.4 – 3.7 GHz band (currently allocated to FSS (space-to-Earth)), with a view to re-allocating it to MS, for the provision of public mobile services in 2020.

LEGISLATIVE AND POLICY FRAMEWORK

8. Under section 32G(1) of the TO, the CA shall promote the efficient allocation and use of the radio spectrum as a scarce public resource of Hong Kong. In accordance with section 32H of the TO, the CA may vary or withdraw frequencies or bands of frequencies, or vary the purposes for which and the conditions under which the frequencies or bands of frequencies are to be used, provided that a reasonable notice of the intended variation or withdrawal to the licensees which have been assigned the relevant frequencies or bands of frequencies, is given.

9. In 2007, the former Commerce, Industry and Technology Bureau announced the Radio Spectrum Policy Framework (“RSPF”)³ setting out, among others, Hong Kong’s policy of spectrum management. Section 4 of the RSPF states that there is no legitimate expectation that there will be any right of renewal of any licence or spectrum assignment upon expiry of a licence or spectrum assignment under the TO. The decision on whether a new spectrum assignment with the same or varied radio frequencies should be given to the spectrum assignee would be made and notified to the spectrum assignee within a reasonable time before the expiry of its spectrum assignment, after taking into account the aims of Hong Kong’s spectrum policy management and other relevant factors, including but not limited to any public interest considerations.

10. In January 2008, the former Telecommunications Authority (“TA”) issued a statement (“the TA Statement”)⁴, specifying that insofar as it is practicable in the circumstances, a minimum notice period would be given for variation or withdrawal of spectrum assignments upon or before their expiry. The minimum notice periods vary from one to three years depending on the types of assignments. The former TA (now the CA) is entitled to depart or deviate from the stated minimum notice periods where the circumstances so warrant.

NEED FOR ADDITIONAL SPECTRUM FOR THE DEPLOYMENT OF 5G SERVICES

11. In September 2015, ITU published Recommendation ITU-R M.2083-0 entitled “IMT Vision – Framework and Overall Objectives of the Future Development of IMT for 2020 and Beyond”⁵. This ITU recommendation sets out the framework and overall objectives of the future 5G services, with a variety of capabilities in different applications that require very high data rate communications, connection with a massive number of devices as well as ultra-low latency and high reliability. These innovative applications give rise to an unprecedentedly high demand for radio spectrum.

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

⁴ The TA Statement is available at:
http://tel_archives.ofca.gov.hk/en/tas/spectrum/ta20080131.pdf

⁵ IMT-2020 is a term defined by ITU to cover the International Mobile Telecommunication (“IMT”) services for 2020 and beyond, which is commonly known as 5G.

12. To cope with the huge upsurge of spectrum demand, ITU is actively planning for the global allocation of high frequency bands above 6 GHz, specifically in the range of 24.25 – 86 GHz, to MS, which may accordingly be deployed for the provision of public mobile services. Eleven candidate bands⁶ within the said range were proposed for consideration in the WRC held in November 2015 and they will be discussed further with a view to achieving global harmonisation in the next WRC scheduled for November 2019.

13. Due to their intrinsic transmission characteristics, radio signals of higher frequencies suffer from more severe propagation loss and rain attenuation than those of low frequencies. Rather than providing a wide area coverage, frequencies in the range of 24.25 – 86 GHz is most effectively used to meet high traffic demand for service coverage in confined area/hots spots via a new layer of network infrastructure made up of clusters of small cells (representing a short-ranged coverage) to support high user density and high bandwidth demand.

14. In sum, the existing network infrastructure comprising a territory-wide set up of a moderate number of base stations that are built upon existing mobile spectrum at low frequencies (below 6 GHz), together with a new network infrastructure in the 5G era made up of clusters of small cells built on spectrum at high frequencies (above 6 GHz), will co-exist in future to serve the differing needs of service users. This explains why the mobile industry worldwide has continued to explore additional spectrum below 6 GHz (such as the 3.4 – 3.6 GHz band) on top of ITU's initiative to identify new spectrum above 6 GHz in order to support the continued development of public mobile services, including 5G.

WORLD TREND IN THE USE OF THE 3.4 – 3.6 GHz BAND

15. Back in 2000, a number of economies have considered the use of the 3.4 – 3.6 GHz band for public mobile services. The WRC held in 2007 identified the 3.4 – 3.6 GHz band for use by those economies wishing to implement IMT (International Mobile Telecommunication) services, i.e. public mobile services. With the increasing demand for additional radio spectrum below 6 GHz for public mobile services, the advocacy of using the 3.4 – 3.6 GHz band for public mobile (including 5G) services has gained momentum in

⁶ These candidate bands are: (a) 24.25 – 27.5 GHz; (b) 31.8 – 33.4 GHz; (c) 37 – 40.5 GHz; (d) 40.5 – 42.5 GHz; (e) 42.5 – 43.5 GHz; (f) 45.5 – 47 GHz; (g) 47 – 47.2 GHz; (h) 47.2 – 50.2 GHz; (i) 50.4 – 52.6 GHz; (j) 66 – 76 GHz; and (k) 81 – 86 GHz.

the United States, the United Kingdom, Europe, Australia and the Mainland, among others, over the recent years. Please refer to the **Annex** for worldwide developments on the intended use of 3.4 – 3.6 GHz band for public mobile services.

16. While we are keeping in view this world trend, we are in tandem also monitoring, closer to home, developments in the Mainland on the possible deployment of the 3.4 – 3.6 GHz band for 5G services in the time frame of 2020, for arising therefrom there is a need for Hong Kong to correspondingly review our existing allocation of that same frequency band to FSS, in light of the cross-boundary interference that may arise starting from 2020. In June 2017, the Ministry of Industry and Information Technology (“MIIT”) issued a consultation notice setting out the guiding principles for the use of the 3.4 – 3.6 GHz band, which has been identified for the provision of IMT-2020 services and sought public views on issues related thereto. Please refer to the **Annex** for more information. In sum, there is a need for the Office of the Communications Authority (“OFCA”) to harmonise with the Mainland authorities on the future use of the 3.4 – 3.6 GHz band, i.e. for the provision of the same type of services - public mobile services, on both sides.

CURRENT UTILISATION IN HONG KONG

17. The 3.4 – 3.6 GHz band is the lower part of the 3.4 – 4.2 GHz band (commonly known as the C-Band) which is entirely allocated to and used for FSS in Hong Kong. FSS provides inter-alia a means for external telecommunications. It may be used for the provision of non cable-based external fixed telecommunications network services (“EFTNS”) or operation of self-provided external telecommunications systems (“SPETS”)⁷. Besides, satellite television programme channels are also conveyed via FSS.

18. In Hong Kong, two domestic satellite operators⁸ are offering FSS with 10 satellites under eight Space Station Carrier Licences and two Telemetry, Tracking, Control and Monitoring Station Licence (“TTC&M

⁷ Self-provided external telecommunications systems are external circuit systems (including by the use of very small aperture terminal or larger earth station) self-provided by a company or an organisation for its own telecommunication with places outside Hong Kong. Details are available at: <http://www.coms-auth.hk/filemanager/statement/en/upload/86/i825ae.pdf>

⁸ They are Asia Satellite Telecommunications Limited (“AsiaSat”) and APT Satellite Company Limited (“APT Sat”).

Licences”)⁹ (hereinafter collectively refers to as “SSCL”) granted under the TO. These satellites have FSS downlink capacity not only in the C-Band but also three higher frequency bands as set out below. The aggregate amount of transponder bandwidths provided by them amounts to 21,690 MHz:

- (a) the C-Band;
- (b) 10.95 – 11.7 GHz (commonly known as the X-Band);
- (c) 12.2 – 12.75 GHz (commonly known as the Ku-Band); and
- (d) 17.9 – 18.4 GHz (commonly known as the Ka-Band).

19. About 11% of the aggregate FSS downlink capacity of the two operators fall within the 3.4 – 3.7 GHz band, of which about 3% (about 70 MHz) is currently provided for EFTNS or SPETS in Hong Kong.

20. Apart from providing FSS downlink capacity leasing service to their clients in Hong Kong, the two domestic satellite operators also provide such service to other clients in the Asia Pacific region. To ensure normal operation of the satellites concerned, including manoeuvring satellites in orbits and monitoring the operational status of the satellites, the satellite operators set up earth stations for telemetry, tracking and control (“TT&C”) of their satellites in orbit (“TT&C Stations”). The domestic satellite operators have deployed some channels in the C-Band for TT&C functions, with a few being within the 3.4 – 3.7 GHz band. As the transceivers of the TT&C channels are equipped and pre-configured on board the satellites, there is no prospect of changing the frequencies of these TT&C channels after launching of the satellite. Geographically, TT&C Stations are located at sites¹⁰ far from the densely populated areas in Hong Kong.

21. EFTNS and SPETS licensees lease FSS downlink capacity from the domestic and/or overseas satellite operators on commercial arrangements for the provision of their telecommunications services. Based on the frequency assignment records, about 8% of the total downlink capacity provided for EFTNS is in the 3.4 – 3.7 GHz band. Regarding SPETS licensees, except for two which are using downlinks operating in the 3.6 – 3.7

⁹ Prior to the enactment of the Telecommunication (Amendment) Ordinance 2000 and the Telecommunications (Carrier Licences) Regulation (Cap. 106V), the establishment and operation of space station or earth station for telemetry, tracking, control and monitoring of a space object and for space radiocommunications was licensed and regulated under the TTC&M Licence which was granted by the Chief Executive in Council under the TO. Following the introduction of Space Station Carrier Licence, TTC&M Licence was no longer issued. At present, there are two TTC&M Licences which remain valid until their expiry.

¹⁰ The existing TT&C Stations in Hong Kong are located in Tai Po Industrial Estate and Stanley.

GHz band under their current licence conditions, all the remaining seven SPETS licensees operate their downlinks solely in the 3.7 – 4.2 GHz band.

22. As to satellite TV services, with the open sky policy adopted in Hong Kong, Satellite Master Antenna Television (“SMATV”) systems¹¹ are used to receive unencrypted television programme channels provided that there is no objection from the programme channel owners. There are also television receive-only (“TVRO”)¹² systems set up for viewing by individual households.

23. As of April 2017, there are some 1,600 SMATV systems with 890,000 user outlets in Hong Kong. 462 satellite programme channels are receivable in the 3.4 – 4.2 GHz band, 75 of which are conveyed via frequencies in the 3.4 – 3.7 GHz band. SMATV systems are normally owned and installed by building management offices/incorporated owners (“BMO/IO”) to serve their residents. BMO/IO need to appoint licensed SMATV operators for the installation and maintenance of their SMATV systems. In other words, unlike other licensed telecommunications services, the owners and users of SMATV systems are not licensees under the TO.

24. TVRO systems, on the other hand, are exempted from licensing in accordance with section 8(4)(c) of the TO. Accordingly, there is no specific frequency assignment made or authorisation granted by the CA for their operation. OFCA has no record of the number and locations of these TVRO systems in Hong Kong. Nevertheless, it is understood that some broadcasting operators have installed a number of TVRO systems for receiving overseas satellite television signals.

PROPOSED CHANGE IN FREQUENCY ALLOCATION

The Proposal

25. According to a previous compatibility study conducted by the then

¹¹ A SMATV system typically consists of one or more satellite receiving dish antennas installed at the rooftop of a building. The satellite television signals received by these antennas are distributed via the communal coaxial cable distribution system to individual households with the building.

¹² A TVRO system means a system for receiving satellite television signals for use by a single specified premise and the received signals are not distributed to others.

Office of the Telecommunications Authority (“OFTA”) ¹³, it would be technically infeasible for FSS and the public mobile services to operate in the same frequency range, i.e. co-frequency sharing of FSS and public mobile services. To make it possible for the lower part of the C-Band to be used for public mobile services, there will be a need to withdraw the current allocation to FSS from the 3.4 – 3.7 GHz band, and re-allocate it to MS for the provision of public mobile services. To minimise the interference to those FSS which would continue to operate in the 3.7 – 4.2 GHz band, there will be a need to introduce a guard band in the 3.6 – 3.7 GHz band, the frequency within which will not be assigned to public mobile services or new FSS. **The CA therefore proposes that only 200 MHz of spectrum in the 3.4 – 3.6 GHz Band will be assigned for the provision of public mobile services while the remaining 100 MHz of spectrum in the 3.6 – 3.7 GHz band will be partitioned as a guard band (the “Proposed Re-Allocation”).** The band plans showing the proposed change in frequency allocation is given in **Figure 1** below.

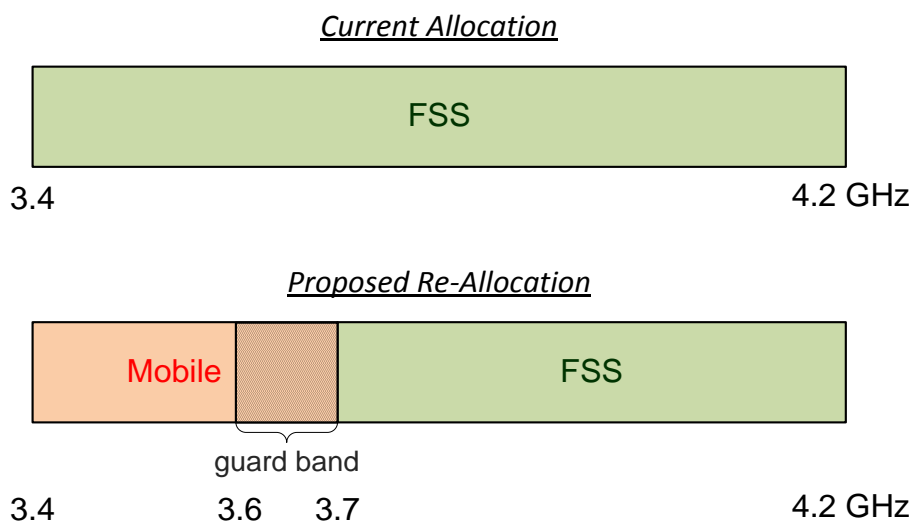


Figure 1: The current allocation and the proposed re-allocation of the 3.4 – 4.2 GHz band in Hong Kong

Question 1:

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

¹³ The then OFTA had once considered allocating the 3.4 – 3.6 GHz band for Broadband Wireless Access (“BWA”) systems. A compatibility study was conducted in 2006 on spectrum sharing between BWA and existing FSS earth stations / SMATV systems operating in the C-Band. As the study concluded that it would be difficult for a wide and cost-effective deployment of BWA sharing the same 3.4 – 3.6 GHz band with FSS in Hong Kong, the 2.50 – 2.69 GHz band was alternatively identified and assigned for the provision of the BWA services in 2009.

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

26. The Proposed Re-Allocation may affect, to differing extents, the existing radio users operating in the C-Band.

27. For the domestic satellite operators, FSS downlink capacity in the 3.4 – 3.7 GHz band provided by their satellites will no longer be available for use in Hong Kong, though they would continue to be so used outside Hong Kong. Regarding the existing TT&C Stations situated at specific locations in Hong Kong, the domestic satellite operators would have the necessary technical expertise and resources to implement mitigating measures to alleviate any impact on their systems arising from the Proposed Re-Allocation. As an additional safeguard, some limitations on deployment of mobile base stations to be operating in the 3.4 – 3.6 GHz band may be imposed. For instance, restriction zones may need to be imposed for constraining the deployment of radio base stations of public mobile services in the 3.4 – 3.6 GHz band, in order to protect the reception of C-Band signals by existing TT&C Stations from harmful interference. However, if the band is re-allocated to MS for the provision of public mobile services as proposed, the satellite operators will not be allowed to use the 3.4 – 3.7 GHz band in any new TT&C Stations situated outside their existing locations.

28. In order to maintain the existing services, the EFTNS and SPETS licensees concerned may need to discuss with the relevant satellite network operators (either domestic in Hong Kong or from overseas) for leasing FSS downlink capacity solely in the 3.7 – 4.2 GHz band. They should also implement the necessary mitigating measures at their earth stations on ground so as to withstand the terrestrial signals of public mobile services to be operating in the 3.4 – 3.6 GHz band.

29. On the other hand, SMATV system owners who are not licensees under the TO generally have no technical knowledge of their systems and they are large in number in Hong Kong. If no appropriate mitigating measures are adopted, the SMATV systems may be overloaded/desensitised by the radio signals of mobile base stations to be operating within the 3.4 – 3.6 GHz band. Should that occur, it will adversely impact on the normal operation of SMATV systems in the 3.7 – 4.2 GHz band and the consequence could be severe and widespread. Given the similar characteristics of TVRO systems and SMATV systems, TVRO systems are subject to the same impact.

30. In order to enable SMATV systems to operate properly under the Proposed Re-Allocation, modifications have to be made in particular for the

low-noise block down converter¹⁴ of SMATV systems, which have to be replaced for operation in the reduced frequency range of 3.7 – 4.2 GHz, in place of the existing full range of the C-Band. There may also 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 public mobile services¹⁵. Given the similar characteristics of TVRO systems and SMATV systems, users of TVRO systems shall need to adopt similar mitigating measures.

31. Even with the implementation of the appropriate mitigating measures, those satellite television programme channels currently conveyed via frequencies in the 3.4 – 3.6 GHz band and in the guard band of 3.6 – 3.7 GHz as elaborated in paragraph 23 above may no longer be receivable in Hong Kong in the presence of continuous interfering signals from mobile base stations to be operating within the 3.4 – 3.6 GHz band. According to OFCA's records as of April 2017, a total of nine satellite television programme channels¹⁶ in the 3.4 – 3.7 GHz band are being received by 173 (or 11%) out of some 1,600 SMATV systems. As these nine satellite television programme channels will cease to be receivable under the Proposed Re-Allocation, the affected SMATV systems will need to be re-tuned to receive other programme channels conveyed via the 3.7 – 4.2 GHz band.

32. As a general principle, for the deployment of a particular radio base station of the public mobile services in the 3.4 – 3.6 GHz band and in case there is interference to an existing system of SMATV/EFTNS/SPETS in the vicinity operating in the 3.7 – 4.2 GHz band notwithstanding that it has already implemented the necessary mitigating measures, the operator of the public mobile services, as the late comer, should be accountable for the necessary rectification work, i.e. in offering protection to the legacy systems with mitigating measures already in place or in adjusting the concerned radio base stations. Given that SMATV/EFTNS/SPETS installations are scattered in Hong Kong in an uncoordinated manner, it may impose certain constraints on the deployment of radio base stations of public mobile services, such as

¹⁴ Low-noise block down converter is a main functional module of SMATV systems. It converts radio signals from satellites as collected by an antenna dish into electrical signals, amplifies them, and down-converts the signal frequencies to lower intermediate frequencies for subsequent signal transmission and processing.

¹⁵ Satellite signals travel from space to Earth through a long distance. Comparing with the receivable signal levels of mobile services for communication with terrestrial base stations, satellite signals receivable on ground are very weak. Mobile signals will likely capture those of FSS if no interference mitigating measure is put in place.

¹⁶ These channels are Aljazeera Channel, Dubai Sports 3, Rai Italia Asia, Sahara One, Samay, Samay Bihar/Jharkhand, Southeast Television (東南衛視), Nepal TV, and NTV Plus.

operation with a restricted radiated power, to ensure their co-existence.

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?

33. As regards TVRO systems, their use are exempted from licensing requirements under the TO. There is no licensing regime, specific frequency assignment or authorisation by the CA of their operation. As such, users of TVRO systems will not be entitled to protection from any harmful interference from public mobile services if the 3.4 – 3.7 GHz band is re-allocated to MS for the provision of public mobile services.

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.

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

34. If the 3.4 – 3.7 GHz band is to be re-farmed, advance notification of a reasonable period should be given to all concerned licensees affected by the Proposed Re-Allocation. According to the TA Statement, an advance period of three years should, insofar as it is practicable, be given to the licensees of SSCL and some EFTNS, where the spectrum as affected by the Proposed Re-Allocation is being used for connection between networks and customers.

35. Nevertheless, in view of the official launch by the Mainland of 5G services in the 3.4 – 3.6 GHz band in 2020, it is incumbent upon us to clear the 3.4 – 3.7 GHz band earlier in order to prevent any widespread harmful interference to existing radio users. Under such circumstances, it would not be practicable or realistic for Hong Kong to withhold action for three years on the Proposed Re-Allocation concerning the 3.4 – 3.7 GHz band. The objective circumstances such as they are, there are justifications for the CA to deviate from the stated minimum period of three years in giving, as its best endeavours, an advance notice period of about two years instead, to the affected licensees.

36. For the other telecommunications licences where the spectrum concerned is used for operation of the network other than for connection between networks and customers, like SPETS and other EFTNS licensees, an advance notice of one or two years should be given insofar as it is practicable to do so. As to SMATV licensees, they are contractors licensed to undertake the installation and maintenance of SMATV systems that may be used to receive satellite television channels of any frequency. As there is no frequency assignment in SMATV licences or for TVRO systems, that obviates the need for any advance notice on possible withdrawal of spectrum assignment.

37. In view of the above, the CA proposes for the Proposed Re-Allocation to take effect in early 2020, with an advance notice of about two years to be given to the affected licensees, counting from the decision of the Proposed Re-Allocation to be taken by the CA in early 2018.

38. During the notice period, the EFTNS and SPETS licensees should re-provision their systems for operation away from the 3.4 – 3.7 GHz band and implement the necessary mitigating measures as set out in paragraph 28 above. Similarly, satellite operators of TT&C Stations and owners of SMATV/TVRO systems should implement the necessary mitigating measures as discussed in paragraphs 27 and 30 above during the same period to minimise any impact arising from the Proposed Re-Allocation after expiry of the notice period.

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?

Proposed Change in Frequency Allocation

39. Under the Proposed Re-Allocation, the 3.4 – 3.7 GHz band will be allocated to MS in the Hong Kong Table of Frequency Allocation. Given the permanent and fixed setup of the TT&C channels of the licensed satellite networks operating in the 3.4 – 3.7 GHz band, and noting their importance to the operation of licensed satellites in orbits, if the 3.4 – 3.7 GHz band is to be re-farmed, the existing TT&C Stations should be protected from harmful interference from public mobile services. In this connection, it is proposed

that while the 3.4 – 3.7 GHz band will be allocated to MS on a primary basis¹⁷ for the provision of public mobile services, the primary allocation to FSS in this band will not be revoked and will remain intact at specific locations where the legacy TT&C Stations are situated. For the avoidance of doubt, the primary allocation to FSS in the 3.7 – 4.2 GHz band will remain intact altogether following the Proposed Re-allocation. The change is depicted in **Figure 2**.

Current Frequency Allocation

MHz 3400 – 4200	
HONG KONG ALLOCATION	BAND PLAN AND EXISTING UTILISATION
3400 – 3700 FIXED-SATELLITE (space-to-Earth)	3400 – 3700 (a) Fixed-satellite
3700 – 4200 FIXED FIXED-SATELLITE (space-to-Earth)	3700 – 4200 (a) Fixed-satellite

Proposed Frequency Allocation

MHz 3400 – 4200	
HONG KONG ALLOCATION	BAND PLAN AND EXISTING UTILISATION
3400 – 3700 MOBILE [1], [2]	3400 – 3700 (a) Mobile Service (b) Fixed-satellite
3700 – 4200 FIXED FIXED-SATELLITE (space-to-Earth)	3700 – 4200 (a) Fixed-satellite

[1] 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.

[2] No new frequency assignment in the 3600 – 3700 MHz band will be made.

Figure 2: The current and the proposed tables of frequency allocation of the 3.4 – 4.2 GHz band in Hong Kong

¹⁷ In accordance with the Radio Regulations of the ITU, different services are classified as “primary” or “secondary”. Stations of a secondary service shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date. In Figure 2, services with the names printed in capitals (for example, FIXED SATELLITE) are “primary” services.

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?

Question 6:

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

WAY FORWARD

40. As elaborated in paragraph 29 above, the Proposed Re-Allocation may affect the normal reception of satellite television programme channels by hundreds of thousands of households via SMATV systems. To minimise the adverse impact, if any, on such reception, OFCA has commissioned a consultancy study (“Consultancy Study”) for advice on the technical mitigating measures and operational precautions to enable the co-existence of SMATV systems operating in the 3.7 – 4.2 GHz band and the public mobile services to be operating in the 3.4 – 3.6 GHz band. The Consultancy Study is expected to be completed in early 2018.

41. The CA would consider thoroughly the views and comments received in response to this consultation. The CA would also review the findings of the Consultancy Study carefully. The CA aims to make a decision regarding the Proposed Re-Allocation in early 2018.

**Office of the Communications Authority
27 July 2017**

Developments in Other Economies on Using the 3.4 – 3.6 GHz Band for the Provision of Public Mobile Services

Australia

According to the Australian Radiofrequency Spectrum Plan 2017 (“ARSP 2017”) issued by the Australian Communications and Media Authority (“ACMA”)¹, the 3.4 – 3.6 GHz band is allocated to fixed service, mobile service and radiolocation service on a primary basis as well as to amateur service and fixed satellite service (“FSS”) (space-to-earth) on a secondary basis. Use of the frequency band is subject to a mixed approach of apparatus licensing and spectrum licensing. The licences for the use of the 3.425 – 3.4425 / 3.475 – 3.4925 GHz and 3.4425 – 3.475 / 3.5425 – 3.575 GHz bands were issued in 2000 and re-issued in 2015 for a new term up to 2030. There are currently three licensees in the band² and they make use of the spectrum for the provision of fixed wireless broadband service in some areas of Australia.

2. The 3.575 – 3.7 GHz band was made available for broadband services in regional and remote areas of Australia in November 2009. At the time, the band was not made available for broadband services in national nor state capital cities (except Hobart) to preserve planning options within these areas³. In October 2016, ACMA issued a discussion paper on the “Future use of the 1.5 GHz and 3.6 GHz bands: Initial investigation of the 1427 – 1518 MHz and 3575 – 3700 MHz bands for mobile broadband services”⁴ to seek public comments on the possible use for mobile broadband service of the spectrum including the 3.575 – 3.7 GHz band. Having reviewed the responses to this discussion paper, ACMA issued another paper “Future use of

¹ The ARSP 2017 is available at: <http://www.acma.gov.au/~media/Spectrum%20Engineering/Information/pdf/ARSP%202017%20-%20with%20general%20information%20pdf.pdf>.

² The respective spectrum, licensees and term of licence are available at: http://web.acma.gov.au/rrl/browse_licences.licence_list?pSV_ID=85&pSS_ID=861.

³ Refer to page 15 of “*Future use of the 1.5 GHz and 3.6 GHz bands: Initial investigation of the 1427 – 1518 MHz and 3575 – 3700 MHz bands for mobile broadband services discussion paper*”, which is available at: <http://www.acma.gov.au/theACMA/~media/A91252334B314FC5AA10E056B7BA9B78.ashx>

⁴ The discussion paper is available at the same hyperlink as cited in footnote 3 above.

the 3.6 GHz band - Options paper” (“Options Paper”) and the associated discussion paper “Future use of the 3.6 GHz band – Highest value use assessment: Quantitative analysis” in June 2017⁵ which outlined the possible outcomes of the future use of the 3.575 – 3.7 GHz band (“the 3.6 GHz band”) and provided a detailed assessment of the highest value use of the 3.6 GHz band. ACMA has decided that the 3.6 GHz band is being progressed from initial investigation stage to preliminary replanning stage. ACMA has also identified nine options for replanning the 3.6 GHz band in the Options Paper for seeking comments from the public. After receiving the feedback on these two papers, ACMA will form a final view on the optimal use of the 3.6 GHz band in the later part of 2017.

European Union

3. With the aim of efficient use of spectrum without prejudicing the protection and continued operation of other existing uses in the 3.4 – 3.8 GHz band, appropriate sharing criteria for coexistence of satellite services and mobile/fixed telecommunications networks operating in the band as well as technical conditions for harmonising frequency arrangements for mobile/fixed telecommunications networks have been developed following the decision made by the European Commission in 2008⁶. So far, technical harmonisation conditions have been developed for fixed telecommunications networks for use in broadband wireless access applications which are operating in the 3.4 – 3.8 GHz band in conjunction with the existing satellite services.

4. In November 2016, the Radio Spectrum Policy Group (“RSPG”) of the European Commission considered the 3.4 – 3.8 GHz band to be the primary band suitable for the introduction of 5G services in Europe even before 2020⁷, noting that this band is already harmonised for mobile and fixed telecommunications networks, and consists of up to 400 MHz of continuous spectrum enabling frequency blocks of wide bandwidth. Following the

⁵ The discussion papers “Future use of the 3.6 GHz band-Options paper” and “Future use of the 3.6 GHz band – Highest value use assessment: Quantitative analysis” are available at: <http://www.acma.gov.au/theACMA/future-approach-to-the-3-6-ghz-band>

⁶ The European Commission Decision on the harmonisation of the 3400 – 3800 MHz frequency band for terrestrial systems capable of providing electronic telecommunications services in the Community (2008/411/EC) is available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:144:0077:0081:EN:PDF>
The relevant technical conditions for harmonising frequency arrangements for mobile/fixed telecommunications networks operating in the 3400 – 3800 MHz band is available at: <http://www.erodocdb.dk/docs/doc98/official/pdf/ECCDec1106.pdf>

⁷ RSPG’s document on Strategic Roadmap Towards 5G for Europe is available at: http://rspg-spectrum.eu/wp-content/uploads/2013/05/RPSG16-032-Opinion_5G.pdf

RSPG's opinion, harmonised technical conditions for spectrum in the 3.4 – 3.8 GHz band will be developed⁸ in support of the commercial deployment of 5G in the European Union by 2020.

France

5. The France's Regulatory Authority for Electronic Communications and Posts (Autorite de Regulation des Communications Electroniques et des Postes, ARCEP), announced in June 2017 that it will award 5G spectrum in the 3.4 – 3.8 GHz band in September 2017, and will launch a consultation on the allocation process in July 2017⁹. The plan involves reorganisation of the frequencies in the 3.4 – 3.8 GHz band assigned to the existing holders, which includes superfast fixed wireless service providers, into contiguous blocks towards the low end of the band. The reorganisation will allow France to have more than 300 MHz of contiguous spectrum available for 5G by 2020, and 340 MHz spectrum by 2026 (and possibly reaching up to 390 MHz spectrum in places where the frequencies are not being used for superfast fixed wireless systems).

Germany

6. The Germany's regulator Bundesnetzagentur published a framework¹⁰ in June 2017 identifying spectrum including the 3.4 – 3.8 GHz bands that could potentially be used for 5G services. It has invited interested parties to express interest in nationwide frequency allocations for these bands, and give feedback regarding the framework by 30 September 2017. Following that, the regulator will develop a spectrum plan and call for an auction in 2018. 400 MHz in the 3.4 – 3.8 GHz band was identified and most of it will become available by 2022 when the current licences expire.

⁸ The development work for harmonising technical conditions for different communication networks operating in the same band rests on the Electronic Communications Committee of the European Conference of Postal and Telecommunications Administrations (<http://www.cept.org/ecc/>). Technical discussion of the subject has also started (<http://www.cept.org/ecc/cept-workshop-on-5g/>).

⁹ ARCEP's press release on the matter is available at: [https://www.arcep.fr/index.php?id=8571&no_cache=0&no_cache=0&tx_gsactualite_pi1\[uid\]=2063&tx_gsactualite_pi1\[annee\]=&tx_gsactualite_pi1\[theme\]=&tx_gsactualite_pi1\[motscle\]=&tx_gsactualite_pi1\[ba ckID\]=26&cHash=0b883993e79c11e684d43c456e864432&L=1](https://www.arcep.fr/index.php?id=8571&no_cache=0&no_cache=0&tx_gsactualite_pi1[uid]=2063&tx_gsactualite_pi1[annee]=&tx_gsactualite_pi1[theme]=&tx_gsactualite_pi1[motscle]=&tx_gsactualite_pi1[ba ckID]=26&cHash=0b883993e79c11e684d43c456e864432&L=1)

¹⁰ Bundesnetzagentur's document "Key Elements for the rollout of digital infrastructures and Identification of Demand for nationwide assignments in the 2 GHz and 3.6 GHz bands" is available at https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/Areas/Telecommunications/Companies/TelecomRegulation/FrequencyManagement/ElectronicCommunicationsServices/201070704_KeyElementsDemandIdentification.pdf;jsessionid=C81133CE2EA07B1AFB1C0B2D44F038D5?blob=publicationFile&v=1

Among them, 3.4 – 3.7 GHz will be available for national use and 3.7 – 3.8 GHz will be available for regional use.

United Kingdom

7. Among others, the 3.4 – 3.8 GHz band was identified by the Office of Communications (“Ofcom”) as one of the major frequency bands to enable 5G roll out in the United Kingdom. At present, frequencies in 3.48 – 3.5 GHz / 3.58 – 3.6 GHz have been assigned to an operator for fixed wireless access use for the provision of broadband services using TD-LTE technology. This fixed wireless service operator was acquired by a mobile operator in May 2017. As for the rest of the spectrum in the 3.4 – 3.6 GHz band, Ofcom issued a statement on 11 July 2017 setting out its decision to auction 150 MHz spectrum (i.e. 3.41 – 3.48 GHz and 3.5 – 3.58 GHz) for the provision of public mobile services¹¹. Ofcom is currently conducting a consultation on the auction regulations and will publish the final statement on the making of the auction regulations in August/September 2017. The auction will be held in October/November 2017.

8. In addition, Ofcom also plans to make available 116 MHz of spectrum in the 3.6 – 3.8 GHz band for use by mobile services following a public consultation in December 2016¹². Ofcom will publish a statement shortly to confirm its intention to make the 3.6 – 3.8 GHz band available for mobile services and set out its proposed arrangement. According to Ofcom’s plan, it is likely that operators can launch mobile services in the 3.6 – 3.8 GHz band in many areas from around 2020, but not necessarily nationwide before 2022.

United States

9. In the United States, the 3.4 – 3.55 GHz band has been used by radars for the provision of radiolocation services. In April 2015, the Federal Communications Commission (“FCC”) established a new Citizens Broadband Radio Service (“CBRS”) for shared wireless broadband use of the 3.55 – 3.7

¹¹ Ofcom’s statement on “Award of the 2.3 and 3.4 GHz spectrum bands – Competition issues and Auction Regulations” is available at: https://www.ofcom.org.uk/data/assets/pdf_file/0022/103819/Statement-Award-of-the-2.3-and-3.4-GHz-spectrum-bands-Competition-issues-and-auction-regulations.pdf

¹² Ofcom’s consultation “*Improving consumer access to mobile services at 3.6 GHz to 3.8 GHz*” is available at: <https://www.ofcom.org.uk/consultations-and-statements/category-1/future-use-at-3.6-3.8-ghz>

GHz band. Rules governing the CBRS were finalised in April 2016¹³.

10. CBRS is made possible through a three-tiered access framework for the 3.55 – 3.7 GHz band. These three tiers are coordinated through a dynamic Spectrum Access System (similar to geolocation database that is capable of dynamically managing the relationships among the three tiers of users in the 3.55 – 3.7 GHz band). Through the CBRS framework, FCC was able to open up 100 MHz of spectrum previously unavailable for commercial uses.

Japan

11. In December 2014, the Ministry of Internal Affairs and Communications (“MIC”) announced that 3.48 – 3.6 GHz TDD licences would be granted to three operators and each of them would be allocated with 40 MHz spectrum in the 3.48 – 3.6 GHz band. It is believed that the 3.48 – 3.6 GHz TDD licences will facilitate the deployment of TDD-LTE technology¹⁴.

The Mainland

12. In February 2013, the IMT-2020 Promotion Group was jointly established by three Mainland ministries (i.e. MIIT, the National Development and Reform Commission, and the Ministry of Science and Technology). It aims to promote the research of 5G technologies and services in the Mainland with members from leading operators, vendors, universities and research institutes in the field of mobile telecommunications.

13. MIIT has announced its 5G trial program covering trials on both technologies and products in two phases. Phase 1 aims at technical trials over 2016 – 2018, while phase 2 aims at product trials over 2018 – 2020. There are three steps in phase 1. The first step on 5G key technology trials was completed. The second step in phase 1 began in September 2016, for assessing the performance of a single base station on 5G technology. The third step in phase 1, scheduled to start in 2017, is planned to assess mainly the performance with multiple base stations in a network. A 5G outdoor trial site in Beijing with planned locations of 30 base stations has been established.

¹³ The announcement made by FCC is available at:
https://apps.fcc.gov/edocs_public/attachmatch/DOC-339104A1.pdf

¹⁴ The relevant announcement made by MIC (in Japanese) is available at:
http://www.soumu.go.jp/menu_news/s-news/01kiban14_02000214.html
Other news about the subject is available at:
<http://www.gtigroup.org/news/ind/2014-12-25/5208.html>

This site is used for trials in the second and third steps of phase 1¹⁵.

14. Technical trials on the electromagnetic compatibility between FSS and IMT services in the 3.4 – 3.6 GHz band as organised by the IMT-2020 Promotion Group will be conducted within 2017. Among others, radio interference to FSS operating in the adjacent band of 3.7 – 4.2 GHz band is a subject of further study.

15. China Mobile, the world's largest wireless provider by subscriber, has announced the timetable for its large-scale 5G field trials. Reportedly, China Mobile has finished trials of 5G key technologies, and its field trials would focus on proof of concept system and then move to pre-commercial trials for interoperability tests in 20 sites in 2018. The scale of trials would be expanded to over 100 sites in 2019, before its service rollout in 2020¹⁶. The telecommunications industry in China is even minded to bring forward the commercialisation to 2019¹⁷.

16. In June 2017, MIIT issued a consultation notice setting out the guiding principles for the use of the 3.3 – 3.6 GHz band and the 4.8 – 5 GHz band, which have both been identified for the provision of IMT-2020 services in the Mainland, and sought views in a month's time¹⁸. In regard to the use of 3.4 – 3.6 GHz band, it is specified that:

- (a) IMT-2020 base stations operating in the 3.4 – 3.6 GHz band should not cause harmful interference to licensed FSS earth stations operating in the same band; and

¹⁵ More details are given in the report in Simplified Chinese issued at the website on State Radio Regulation of China ("SRRC"):
<http://www.srrc.org.cn/NewsShow17155.aspx>

¹⁶ The news report in Simplified Chinese is available at:
<https://www.telegeography.com/products/commsupdate/articles/2017/03/01/china-mobile-to-kick-off-large-scale-5g-field-trials-in-2019/>

¹⁷ More details on 5G commercialisation in China are available at the news report of SRRC in Simplified Chinese:
<http://www.srrc.org.cn/NewsShow17615.aspx>

¹⁸ The MIIT public consultation paper in Simplified Chinese is available at:
<http://www.miit.gov.cn/newweb/n1146285/n1146352/n3054355/n3057735/n3057748/c5672371/content.html>

- (b) Certain protection should be given to FSS earth stations for satellite telemetry applications. The relevant operators of IMT-2020 services operating in the 3.4 – 3.6 GHz band and the satellites operating in the C-Band should liaise among themselves to work out the specific protection measures.