Use of the 5 GHz Shared Band for the Provision of Public Mobile Services

Consultation Paper

1 February 2018

INTRODUCTION

Hong Kong's mobile telecommunications market is one of the most competitive in the world, with a continual expansion of customer base, thriving development of a wide range of mobile services and applications, and ever increasing customer demand for faster access to these services and applications. As at October 2017, the mobile penetration rate reached 247%, with an average Hong Kong citizen consuming about 4 GBytes of mobile data per month. Driven by the strong market demand, mobile network operators ("MNOs") have been seeking to increase their network capacity through more efficient use of their assigned spectrum and network optimization.

2. In view of the sustained demand from the industry for more spectrum to satisfy customer needs, the Communications Authority ("CA") promulgated its work plan[1] on 21 March 2017 for making available additional spectrum for public mobile services to meet the increasing aspirations of service users towards 2020 and beyond. While additional spectrum is expected to be made available for assignment in 2019 at the earliest, new mobile technologies which make use of the shared radio spectrum in the 5 GHz band (the "5 GHz Shared Band") for the provision of fourth generation ("4G") mobile services based on the Long Term Evolution ("LTE") standard in an unprotected and uncoordinated manner are becoming available.

3. At present, a total amount of 580 MHz of spectrum in the 5 GHz Shared Band could be used by unlicensed apparatus and devices meeting the relevant technical criteria, such as those enabled with the popular Wi-Fi access technology. If the above new technology for deploying LTE in the 5 GHz

[1] http://www.coms-auth.hk/en/media_focus/press_releases/index_id_1423.html

Shared Band is implemented for the provision of public mobile services in Hong Kong, there will be a significant addition to the existing amount of 552 MHz of licensed mobile spectrum[2] assigned to MNOs and hence enhancement in service quality to be experienced by mobile service users.

4. This consultation seeks to consult the public and the industry on the CA's proposal to make available the 5 GHz Shared Band for the provision of public mobile services; as well as the associated regulatory and licensing regime. For the avoidance of doubt, all the views expressed by the CA in this consultation paper are preliminary and are meant for the purpose of consultation only. Nothing in this consultation paper represents or constitutes any decision or direction made by the CA. The proposal and the analysis presented in this consultation paper are without prejudice to the exercise of powers by the CA under the Telecommunications Ordinance (Cap. 106) ("TO") or any subsidiary legislation thereof.

BACKGROUND

Existing Use of the 5 GHz Shared Band in Hong Kong

5. At present, the 5 GHz Shared Band comprises four sub-bands of frequencies in 5150 – 5250 MHz (100 MHz), 5250 – 5350 MHz (100 MHz), 5470 – 5725 MHz (255 MHz), and 5725 – 5850 MHz (125 MHz), amounting to a total bandwidth of 580 MHz. The current frequency allocation and utilisation in Hong Kong for these frequencies as set out in the Hong Kong Table of Frequency Allocations[3] are summarised in Table 1 below.

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[2] Currently, radio spectrum assigned to MNOs for the provision of public mobile services includes spectrum in the 850 MHz, 900 MHz, 1800 MHz, 1.9 – 2.2 GHz, 2.3 GHz, and 2.5/2.6 GHz frequency bands.

[3] Hong Kong Table of Frequency Allocations, January 2018 http://www.ofca.gov.hk/filemanager/ofca/common/Industry/broadcasting/hk_freq_table_en.pdf

Table 1 - Frequency Allocation for the 5 GHz Shared Band

Frequency Range (Bandwidth)	**Hong Kong Allocation** [Note 1]	**Band Plan and Existing Utilisation**
5150 – 5250 MHz (100 MHz)	AERONAUTICAL RADIONAVIGATION MOBILE except aeronautical mobile	(a) Telecommunications Apparatus [Note 2]
5250 – 5350 MHz (100 MHz)	RADIOLOCATION MOBILE except aeronautical mobile	(a) Telecommunications Apparatus [Note 2]
5470 – 5725 MHz (255 MHz)	RADIOLOCATION MOBILE except aeronautical mobile	(a) Radiolocation (b) Amateur-satellite (c) Telecommunications Apparatus [Note 2]
5725 – 5850 MHz (125 MHz)	INDUSTRIAL, SCIENTIFIC AND MEDICAL (ISM) Amateur	(a) ISM Equipment (b) Amateur (c) Telecommunications Apparatus [Note 2]
Total Amount of Bandwidth = 580 MHz		

Note 1: In the column entitled "Hong Kong Allocation", services with names printed in capital letters are allocated as "primary" services, whereas services with names printed in normal letters are "secondary" services. Users of a secondary service shall not cause harmful interference to stations of primary services and cannot claim protection from harmful interference from stations of primary services.

Note 2: The use of the frequency bands for telecommunications apparatus is subject to the requirements stipulated under the Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order (Cap. 106Z).

6. In accordance with the above frequency allocation, currently the frequency ranges in the 5 GHz Shared Band can be utilised by telecommunications apparatus without any need for licensing if the apparatus is in compliance with the requirements stipulated under the Telecommunications (Telecommunications Apparatus) (Exemption from Licensing) Order (Cap. 106Z) ("Exemption Order"), including among others the technical criteria set out at Table 2 below. Such apparatus, according to the Exemption Order, should be for private use in an unprotected and uncoordinated manner.

Table 2 - Technical Criteria for the 5 GHz Shared Band Stipulated under the Exemption Order[4]

Frequency Range	**Output Level**	**Spurious Emission**
5150 – 5350 MHz [Note 3]	equivalent isotropically radiated power ("e.i.r.p.") not to exceed 200 mW using only digital modulation	effective radiated power ("e.r.p.") not to exceed 10 μW
5470 – 5725 MHz [Note 4]	e.i.r.p. not to exceed 1 W	
5725 – 5850 MHz	(a) peak e.i.r.p. not to exceed 4 W for frequency hopping spread spectrum modulation or digital modulation systems; or (b) aggregate e.r.p. not to exceed 100 mW for any modulation	e.r.p. not to exceed 10 μW for frequency outside the frequency band in which the fundamental frequencies are located

Note 3: Use of the band 5150 – 5350 MHz is restricted to indoor operations.

Note 4: Use of the band 5470 – 5725 MHz shall comply with the technical requirements in Recommendation ITU-R M.1652 "Dynamic frequency selection (DFS) in wireless access systems including radio local area networks for the purpose of

[4] Please refer to Schedule 2 to the Exemption Order.

protecting the radiodetermination service in the 5 GHz band" approved by the International Telecommunication Union ("ITU") as revised from time to time.

7. Apart from private use, the 5 GHz Shared Band is currently being utilised for the provision of public wireless local area network ("LAN") service (or more commonly referred to as public Wi-Fi service), which is a type of public telecommunications service. As the provision of public telecommunications service is not covered by the Exemption Order, an appropriate licence issued pursuant to section 8(1) of the TO is required. For the provision of public wireless LAN services within private premises not crossing unleased Government lands or public streets (such as shopping malls, coffee shops, university campus, etc.), any person operating relevant telecommunications apparatus in the 5 GHz Shared Band for the provision of Wi-Fi access for the public is deemed to be a licensee under the Class Licence for the Provision of Public Wireless LAN Services and shall comply with the terms and conditions therein. As for provision of public wireless LAN services on or across unleased Government lands or public streets, holders of Unified Carrier Licences ("UCL") may do so after necessary amendments in their licences. In either case, all relevant telecommunications apparatus used by the licensees are required to comply with the same set of technical criteria set out in Table 2 above and to operate in an unprotected and uncoordinated manner.

Emerging Technologies for the Use of the 5 GHz Shared Band for the Provision of Public Mobile Services

8. The CA notes that there are a number of technologies being developed and implemented by the global telecommunications industry to enable the use of the 5 GHz Shared Band to provide public mobile services. They are briefly described as follows –

(a) **Licensed Assisted Access ("LAA")** – this is a technical standard developed by the 3rd Generation Partnership Project ("3GPP"), an international standardisation body. Release 13 of the 3GPP standard covers the downlink operation of LAA using the 5 GHz Shared Band, while Release 14 includes uplink support. In essence, the standard requires the use of an ordinary 4G LTE carrier in the licensed mobile spectrum as the primary carrier

("licensed anchor") for control and signalling, aggregated with one or more LTE carriers in the 5 GHz Shared Band as the secondary carrier(s). The combined data transmission capacity of the licensed anchor and the secondary carrier(s) will enable the provision of higher speed mobile data services to end users. As an essential part of the standard, LAA mandates the implementation of the Listen Before Talk ("LBT") feature to ensure compatibility and effective sharing of the 5 GHz Shared Band with other apparatus operating in the same band;

(b) **LTE-Unlicensed ("LTE-U")** – this is an earlier technology developed by the LTE-U Forum. According to the LTE-U Forum[5], the technology is compatible with Releases 10, 11, and 12 of the 3GPP Standard. LTE-U is similar to LAA with carrier aggregation of the licensed anchor operating in the licensed mobile spectrum and secondary carrier(s) operating in the 5 GHz Shared Band, except that the Carrier-Sensing Adaptive Transmission feature rather than LBT is used to address co-existence issues;

(c) **LTE Wi-Fi Aggregation ("LWA")** – this is adopted in Release 13 of the 3GPP standard. As its name suggests, LWA is a technology which directly aggregates the capacity of LTE carriers operating in the licensed mobile spectrum and that of Wi-Fi channels operating in the 5 GHz Shared Band for end users; and

(d) **MulteFire** – this is a technical standard developed by the MulteFire Alliance founded by a number of major equipment vendors. MulteFire is also based on LTE, but unlike LAA and LTE-U, it does not require the use of any licensed anchors and can operate solely in the unlicensed or shared spectrum. According to the MulteFire Alliance, MulteFire is based on the 3GPP standard for LAA and will continue to evolve and stay aligned with any future enhancements to the 3GPP standard. MulteFire also employs LBT to enable co-existence with other

[5] http://www.lteuforum.org/uploads/3/5/6/8/3568127/lte-u_introduction_may_28_2015.pdf *(See page 5)*

users operating in the same band.

9. According to information available to the CA, among the above-mentioned technologies, the development of LAA is supported by a large number of overseas jurisdictions and operators in the world and seems to be more popular. Major mobile operators in the United States, Italy, South Africa, and South Korea are conducting trials for LAA. It is also expected that new handsets supporting LAA will soon be available and introduced into the Hong Kong market. As regards LTE-U and LWA, other than one LTE-U commercial deployment in the United States and two planned LWA deployments in Singapore and Taiwan respectively, there seems to be no other notable activity at the moment. As for MulteFire, it is noted that there is no trial or commercial deployment around the world yet.

10. In Hong Kong, one MNO has completed a technical trial on the use of the 5 GHz Shared Band for LAA[6], while another MNO is conducting a similar trial, which will be completed in the first half of 2018. The results of the first technical trial indicate satisfactory co-existence of LAA and Wi-Fi devices operating in the 5 GHz Shared Band in an uncoordinated and unprotected manner.

11. Further to the above trials, the CA has received an application from an MNO (the "Applicant") for the use of LAA in the 5 GHz Shared Band for the provision of public mobile services. In view of the increasing interest from the local industry in deploying the new mobile technology such as LAA in the frequency band for enhancing mobile broadband connectivity and the availability of compatible handsets in the market shortly, it is timely for the CA to consider an appropriate regulatory and licensing framework to enable the use of the 5 GHz Shared Band for the provision of public mobile services in Hong Kong.

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[6] The MNO concerned has conducted its trial in an indoor environment, and the trial report is accessible at the Office of the Communications Authority ("OFCA")'s website at https://www.ofca.gov.hk/en/pub_report/technical_reports/index.html. The same MNO is planning to conduct another round of trial in an outdoor environment.

THE PROPOSAL

Issues for Consideration

12. In formulating the regulatory and licensing framework for using the 5 GHz Shared Band for the provision of public mobile services, the CA has taken the following issues into account –

(a) Adoption of widely recognised technology

In authorising the 5 GHz Shared Band for the provision of public mobile services, the CA would as far as possible adhere to a technology neutral approach. Nevertheless, the CA considers that the technologies to be adopted should base on widely recognised international standards and which will promote effective sharing of the spectrum for use with other devices and apparatus in the 5 GHz Shared Band.

As mentioned in paragraph 9 above, the development of LAA appears to be more prominent in the world, with the adoption of LAA as an international standard at a relatively more mature stage compared with other emerging technologies such as MulteFire. It is also noted that LAA has been implemented in some handsets available in overseas markets[7] and is expected to be widely implemented in new handsets in the near future. With the implementation of the LBT feature, LAA would also ensure better compatibility and more effective sharing of the 5 GHz Shared Band as compared with other earlier technology such as LTE-U. As for LWA, since the technology only makes use of ordinary Wi-Fi channels in the 5 GHz Shared Band and remains to be a variant of public wireless LAN services, its operation can be adequately covered under the existing regulatory framework.

[7] LTE in Unlicensed Spectrum: Trials, Deployments and Devices, Global mobile Suppliers Association, October 2017, available at: https://gsacom.com/paper/lte-unlicensed-spectrum-trials-deployments-devices/ *(Registration required)*

(b) Harmonisation with existing regime for public mobile services

Since LAA will make use of carrier aggregation to combine the licensed anchor and secondary carrier(s) in the 5 GHz Shared Band into a single data stream with higher rates, LAA is expected to provide a better usage experience for mobile users in a seamless manner. The situation is similar to the use of carrier aggregation to combine two or more component carriers in the licensed mobile spectrum. From the users' perspective, LAA is essentially no different from ordinary mobile services. As such, the CA considers it reasonable and appropriate for LAA to be licensed and regulated in a manner consistent with the existing regime applicable to the provision of public mobile services using licensed radio spectrum and be subject to the same rights and obligations.

(c) Types of licensees authorised to deploy LTE in the 5 GHz Shared Band

In view of the fact that the operation of LAA would need to make use of the licensed anchor operating in the licensed mobile spectrum for control and signalling, it is noted that only those UCL holders assigned with licensed mobile spectrum would have the capability to provide LAA in an efficient and continuous manner to the satisfaction of the CA throughout the entire tenure of their UCL. Hence, if LAA technology is to be used to provide public mobile services using the 5 GHz Shared Band, only UCL holders assigned with licensed mobile spectrum should be capable of deploying LAA in a satisfactory manner at this juncture. Having said that, as and when other technologies without the need for licensed anchor become standardised and widely recognised internationally, the CA is prepared to consider allowing deployment of these technologies in Hong Kong by other UCL holders who are not assigned with licensed mobile spectrum.

The Proposed Regulatory and Licensing Regime

13. If the 5 GHz Shared Band is to be utilised for the provision of public mobile services, such provision of public telecommunications service is not covered by the Exemption Order and should be authorized by an appropriate licence to be issued pursuant to section 8(1) of the TO. At present, the provision of public mobile services is regulated under the single licensing vehicle, i.e. the UCL. Therefore, it follows that the use of the 5 GHz Shared Band for the provision of public mobile services should similarly be subject to the UCL regime.

14. With the considerations set out in paragraph 12 above, the CA proposes to adopt the following regulatory and licensing regime for using the 5 GHz Shared Band for the provision of public mobile services –

(a) the use of the 5 GHz Shared Band for the provision of public mobile services in Hong Kong shall be licensed and regulated in the same way as public mobile services provided by licensed radio spectrum under the existing regime of the UCL. Licensees shall observe all the rights and obligations under the relevant provisions of the TO and the UCL, and be subject to the same licence fee requirements stipulated under the Telecommunications (Carrier Licences) Regulation (Cap. 106V) irrespective of whether the mobile networks and services are using shared spectrum in the 5 GHz frequency band or licensed spectrum in other frequency bands;

(b) only UCL licensees assigned with licensed mobile spectrum may apply to the CA for the use of the 5 GHz Shared Band for the provision of public mobile services. All relevant base stations, handsets and other radiocommunications installations operating in the 5 GHz Shared Band shall comply with the same set of technical criteria as stipulated in the Exemption Order. Subject to the CA's approval, Schedule 3 to their UCLs will be suitably amended to incorporate the assignment of the 5 GHz Shared Band and to prescribe the associated technical requirements;

(c) given the need to ensure compatibility and effective sharing with other uses and users in the 5 GHz Shared Band, the CA will initially only allow the use of LAA technology with mandatory implementation of the LBT feature. This specific requirement, along with other technical criteria for the operation of public mobile services in the 5 GHz Shared Band, will be set out in the relevant specification(s) to be issued by the CA; and

(d) a new special condition under the UCL will be prescribed to make clear that the use of the 5 GHz Shared Band is shared with other uses and users in an uncoordinated manner and will not be protected from interference caused by other radio equipment operating in the same frequency band.

15. At the time when other technologies not requiring the use of licensed anchor (e.g. MulteFire) become widely recognised and standardised internationally, any interested parties other than MNOs may apply to the CA for the use of the 5 GHz Shared Band for the provision of public mobile services. The CA will duly consider such application(s) and may give approval on a case by case basis if the applicant(s) can demonstrate to the satisfaction of the CA that –

(a) there are widely recognised international standards adopted for these technologies;

(b) there are network and customer equipment supporting these technologies available in the market;

(c) there is proof of effective compatibility with different devices and apparatus sharing the spectrum in the same frequency band; and

(d) the applicant has the capability of providing an efficient and continuous service throughout the validity period of the UCL.

Proposed Amendment to the Hong Kong Table of Frequency Allocations

16. As illustrated in Table 1 above, the 5725 – 5850 MHz sub-band is currently allocated for ISM use on a primary basis; and to amateur service on a secondary basis in Hong Kong. The sub-band is not allocated for mobile services, hence not yet ready to be used for the provision of public mobile services in Hong Kong. In accordance with the Radio Regulations of the ITU, any other radiocommunication services operating within that band must accept interference which may be caused by ISM applications. To allow the use of the 5725 – 5850 MHz sub-band for the provision of mobile services, the CA proposes, pursuant to section 32H of the TO, to allocate the sub-band to mobile service on a primary basis. The proposed allocation is in line with the ITU frequency allocation for the specific utilisation in Mainland China[8]. For reference, the Mainland has allocated that band to mobile service on a primary basis.

17. Apart from the proposed allocation, the condition for use of the frequency band by mobile services should follow that of existing Wi-Fi services, i.e. on an uncoordinated and unprotected basis. To ensure compatibility of LAA with the existing amateur service, the requirements for the emission limits of LAA should follow those of existing Wi-Fi services.

INVITATION OF VIEWS AND COMMENTS

18. The CA would like to invite views and comments on the issues and proposals raised in this consultation paper, including –

(a) the proposed regulatory and licensing regime for the use of the 5 GHz Shared Band for the provision of public mobile services (paragraphs 13 to 15); and

(b) the proposed amendment to the Hong Kong Table of Frequency Allocations (paragraphs 16 to 17).

[8] The allocation was marked under footnote 5.453 of the Radio Regulations of the ITU.

19. Any person who would like to submit views and comments in response to this consultation should do so in writing, preferably in electronic form, on or before **1 March 2018**. **Late submissions will not be considered**. The CA may publish all or part of the views and comments received, and disclose the identity of the source in such manner as the CA sees 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 addressed to –

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