Telecommunications Regulatory Affairs Advisory Committee

Mobile Network Sharing and Effective Rollout of Mobile Telecommunications Infrastructure in the 5G Era

PURPOSE

This paper provides Members an update on the various forms of mobile network sharing in the era of the fifth generation mobile ("5G") communications since the last discussion on the subject at the TRAAC meeting on 16 January 2016[1], and sets out some measures and suggestions to encourage the use of mobile network sharing and other means to facilitate the effective rollout of mobile telecommunications infrastructure in the local environment.

BACKGROUND

2. Hong Kong has always stayed in the forefront of global developments in the mobile telecommunications market, with the state-of-art 5G services commercially launched since April 2020. In the 5G era, extensive use of radio spectrum in the high, middle and low frequency bands is required to support high speed data transmissions, and a large number of 5G radio base stations ("RBS") need to be installed at various roof-top, street-level and indoor locations to ensure extensive mobile coverage, as well as to meet data capacity and high speed transmission demands. The Office of the Communications Authority ("OFCA") has adopted regulatory and administrative measures to facilitate cost-effective and efficient establishment of 5G infrastructure in Hong Kong including timely supply of sufficient radio spectrum for provision of 5G services and playing a coordinating role to open up Government venues

[1] Please refer to TRAAC Paper No.2/2016 which is available at: https://www.ofca.gov.hk/filemanager/ofca/en/content_757/traac2_2016.pdf

and public street facilities for installation of RBS with streamlined approval procedures.

3. As explained in TRAAC Paper No. 2/2016, mobile network sharing is an effective means for mobile network operators ("MNOs") to reduce the cost of building and operating mobile network infrastructure. Some overseas jurisdictions encourage or mandate sharing of base station facilities with a view to efficiently using the space occupied and thus reducing duplication of base station facilities (including antennae, masts, shelters, power supply and air conditioning inside shelters, base station equipment, backhaul transmission equipment, etc.) in densely populated areas. In the past few years, local MNOs adopted certain forms of mobile network sharing in situations where cost implications or site-specific constraints warrant doing so.

4. Nevertheless, in rolling out their networks, MNOs install RBS and antennae primarily based on to their own mobile network designs, with less attention paid to the efficient use of space/ancillary facilities of the buildings and the visual impact that RBS installations may bring to the buildings and surrounding environment. Accordingly, at certain buildings, especially those buildings where multiple MNOs have RBS installations, there might be a large number of antennae and radio equipment installed at rooftops, leading to issues such as inefficient and uncoordinated use of building space, structural safety (e.g. floor loading), negative visual impact resulting from large number of antennae, radio equipment and structures on rooftops, leading to dissatisfaction or complaints of the building owners, users, or residents nearby. The need to install more RBS for 5G network rollout with use of spectrum in low, mid and high frequency bands has further intensified these issues.

5. In view of the latest market and technology developments and having regard to the local environment factors, OFCA considers that it is desirable for MNOs to adopt mobile network sharing as far as practicable and technically feasible, and would like to set out some measures and suggestions to encourage adoption of such kind of arrangement among the MNOs and other means to achieve more effective rollout of mobile telecommunications infrastructure in Hong Kong in general.

UPDATE ON VARIOUS FORMS OF MOBILE NETWORK SHARING

6. Having regard to the latest 5G developments, relevant experience in overseas jurisdictions and the actual practices which have been adopted by the industry in Hong Kong, an update is given below on the various forms of mobile network sharing arrangements which may be implemented in the local environment –

Site Sharing

7. MNOs may share the same physical site location as well as ancillary facilities (e.g. electricity supply) when establishing base stations to provide service coverage to a particular area, i.e. co-location of RBS sites. Under this arrangement, MNOs install their own base station equipment, antennae and cabling facilities separate from one another. In Hong Kong, typical examples of site sharing are those installations of base stations at rooftops, where several MNOs may install their individual base station equipment and antennae with sharing of the relevant ancillary facilities only.

Antenna Sharing

8. Apart from sharing the physical space and relevant ancillary facilities of a particular site, MNOs may further share the use of antennae and other radio equipment in establishing their respective base stations at the site. With the development of 5G technology, such antennae may now be passive or active antenna units. The common antenna system may be installed and operated by the MNOs on a cost-sharing basis among themselves, or by other licensed operators which establish the system and provide interface for interconnection with the MNOs' base station equipment. Each participating MNO may install and operate its own base station equipment separately, with control over the output frequencies and power of its radio signals transmitted by the common antennae.

9. In Hong Kong, antenna sharing among MNOs is usually employed in indoor coverage enhancement projects with integrated radio systems installed in shopping malls, railway premises and road tunnels.

In addition, antenna sharing is also adopted for providing outdoor mobile coverage in specific projects, such as COVID-19 quarantine centres where there are space constraints to accommodate four sets of antennae and base station equipment at the rooftop of the buildings concerned.

Radio Access Network ("RAN") Sharing

10. In addition to antenna sharing, MNOs may choose to have shared use of all or part of other RAN equipment and facilities, including remote radio units, baseband units, fronthaul and backhaul transmission, etc., while different MNOs still maintain their own core networks for interconnection with the shared RAN equipment. The participating MNOs may also enter into operation and maintenance ("O&M") agreements under which the shared RAN will be managed and operated by one of the participating MNOs, or any other third party O&M service providers.

11. There are two approaches for RAN sharing, namely Multi-Operator Radio Access Network ("MORAN") and Multi-Operator Core Network ("MOCN"). MORAN enables each participating MNO to share the RAN equipment and facilities using the dedicated spectrum assigned to it (i.e. the RAN is shared without sharing or pooling of spectrum). Under the MOCN approach, the RAN as well as the spectrum are shared and jointly used by the participating MNOs.

12. As far as OFCA is aware, in Hong Kong, MORAN has been adopted by MNOs at some Government venues. As for MOCN, as mentioned in TRAAC Paper No. 2/2016, each MNO participating in the sharing arrangement should only transmit radio signals using the spectrum assigned under its carrier licence without pooling of spectrum for common use by the participating MNOs.[2] Thus, MNOs in Hong Kong are not allowed to adopt MOCN where pooling of spectrum is applied.

Capacity Leasing

13. Apart from physical sharing of site or RAN facilities, an

[2] Please refer to paragraphs 5(c), 13 and 14 of TRAAC Paper No. 2/2016 (see footnote 1 for the hyperlink of the paper).

MNO may enter into capacity leasing agreement with other MNOs in order to expand its service coverage for a particular area or enhance its network capacity. The capacity leasing agreement may involve acquisition of a specified amount of mobile voice and data capacity from another MNO which has established RANs serving specified areas. With deployment of network slicing technology supported by 5G, capacity leasing could be more flexible through sharing of network resources among MNOs at various levels of the core and radio networks.

14. In Hong Kong, there are capacity leasing agreements between some of the MNOs in various frequency bands for provision of different generations of mobile services. It should provide them with a "buy" in lieu of "build" option to serve their own customers efficiently according to their commercial considerations.

Domestic Roaming

15. There is yet another form of mobile network sharing which involves agreement among MNOs such that customers of one local MNO ("first MNO") will be permitted to roam into the network of another local MNO ("second MNO") when the first MNO cannot provide network coverage at a particular geographical location but it can be served by the second MNO. The arrangement is useful for those MNOs who may not have established a territory-wide network and may therefore cooperate with other MNOs through such network roaming agreements to extend or complement its network coverage for provision of better service coverage to their subscribers. Nevertheless, even though such kind of sharing is also feasible in the 5G era, it has not been implemented in Hong Kong.

EFFECTIVE ROLLOUT OF MOBILE TELECOMMUNICATIONS INFRASTRUCTURE

16. As indicated in TRAAC Paper No. 2/2016, in line with the longstanding market-driven regulatory approach adopted by the Communications Authority ("CA"), MNOs may negotiate and agree among themselves on any feasible mobile network sharing arrangements including those described above, as long as they observe the restrictions

and obligations imposed by the law and their licences. Should there be any new form of mobile network sharing which is made feasible with new technologies such as those deployed for 5G networks, operators may approach OFCA to ascertain whether there is any regulatory restriction for adoption of the intended sharing arrangement.

17. Further to the above, having regard to the considerations in paragraphs 2 to 5, OFCA is of the view that MNOs should consider adoption of various forms of mobile network sharing arrangements as far as practicable and technically feasible. This will also be in line with the Government's telecommunications policy objective of facilitating the provision of telecommunications services in the most economically efficient manner possible.[3] To encourage the use of mobile network sharing and other means to achieve more effective rollout of mobile telecommunications infrastructure, OFCA sets out some measures and suggestions in the following paragraphs.

Installation of RBS at Government Venues

18. With the support of relevant Government departments, OFCA has since March 2019 launched a pilot scheme to facilitate the MNOs' use of over 1 000 suitable Government venues for the installation of RBS under streamlined application and vetting procedures ("Pilot Scheme"). A set of Guidance Notes for Submission of Applications under the Pilot Scheme for Installation of Radio Base Stations at Selected Government Venues ("Guidance Notes") has been issued in this regard. Over the last two years, the Pilot Scheme has received good responses from both the industry and the participating departments within the Government. As at end October 2021, there are over 160 applications received from MNOs with nearly 90 venues approved by the Government. As a further step, the Pilot Scheme will be extended based on the demand-led approach to cover more Government venues with the interest expressed by MNOs.

19. Whilst the Pilot Scheme is well received by the MNOs and is progressing well, OFCA has been receiving feedbacks from some user and technical departments raising concerns over the extensive space and

[3] See the Government's telecommunications policy objectives as published by the Commerce and Economic Development Bureau (https://www.cedb.gov.hk/ccib/en/policies/telecommunications.html).

ancillary facilities requested by MNOs, and/or the possible negative visual impact that may result from a large number of RBS installations on rooftops. With the forthcoming extension of the Pilot Scheme to cover more Government venues under the demand-led approach, OFCA considers that MNOs should be requested to adopt mobile network sharing for RBS installations at Government venues as far as practicable and technically feasible. More specifically, for those venues where more than one MNO have expressed interest of access for RBS installation, the interested MNOs have to coordinate among themselves and submit applications with a sharing arrangement of antennae or RAN etc. on top of ancillary facilities with a view to reducing the physical scale of RBS to be installed on site. As applications that do not contain such a sharing proposal may be considered as inefficient use of space at Government venues, access to the Government venues concerned may not be supported.

20. For venues already installed with RBS by one or more MNOs (the "Incumbent MNO(s)"), MNO(s) which intend to apply for RBS installations at those venues under the Pilot Scheme shall first attempt to reach an agreement on the relevant sharing arrangement with the Incumbent MNO(s) before making an application under the scheme. The Incumbent MNO(s) should facilitate sharing of its/their antennae and other ancillary facilities as far as practicable and technically feasible.

Installation of RBS at Private Venues

21. As far as RBS installation at private venues is concerned, applications of MNOs are processed under the "Guidance Note for Submission of Applications by Public Telecommunications Operators for the Installation of Radio Base Stations for Public Telecommunications Services in buildings and on Rooftops". While MNOs may out of their own commercial consideration choose to establish RBS at different locations, in the situation where two or more MNOs are interested in installing RBS at the same private venue, OFCA encourages MNOs to adopt a suitable mobile network sharing arrangement as far as practicable and technically feasible. This will help speed up processing of applications submitted by MNOs for approval of RBS by OFCA and other relevant Government departments, in particular for venues where public members have raised or will likely raise objection to installation of RBS in

their neighbourhood.

Consideration of Visual Impact

22. Adoption of mobile network sharing such as use of common antennae will reduce the quantity of radio equipment and structures installed at a certain venue and in turn contribute to minimising the negative visual impact that multiple RBS installations may bring to the buildings and surrounding environment. In this connection, apart from mobile network sharing, we understand that MNOs have been considering the relevant views of building owners and occupants in past cases and implementing various mitigating measures such as addition of the suitable covers and the louvres for the antennae and radio equipment with a view to matching / blending the RBS installations with the existing structures of the building or landscapes. Such efforts of the MNOs would help reduce the concerns and complaints of public members over RBS installations in their neighbourhood.

23. MNOs should have due regard to the visual impact consideration, as a standard practice, in their installation of RBS at various locations and address the concerns of affected parties through adoption of mobile network sharing and other mitigating measures as far as possible. OFCA will make reference to relevant examples in other jurisdictions and the past cases in the local environment, and provide suggestions to MNOs on the best practice for installation of RBS in respect of minimising the negative visual impact that RBS installations may bring to the buildings concerned or surrounding environment (see also paragraph 26).

Use of More Efficient Network Equipment

24. Under the technology neutral approach adopted by the CA in assignment of radio spectrum for the provision of mobile telecommunications services, MNOs may deploy any generation of mobile technologies based on widely adopted technical standards to provide their services. A new generation of mobile technology is usually more spectrally efficient in using the same bandwidth of spectrum, and advanced mobile network equipment is often designed with more efficient use of space and energy. While the refarming of radio spectrum for providing

more advanced and innovative mobile services depends on the commercial considerations of MNOs, they are encouraged to consider the use of advanced network equipment that can operate in multiple frequency bands and serve multiple generations of mobile services, wherever applicable, in order to achieve more efficient use of radio spectrum, space and energy.

WAY FORWARD

25. In preparation for the implementation of the enhanced Pilot Scheme for use of Government venues for installation of RBS, OFCA will make revision to the Guidance Notes, among others, to reflect the requirement of considering mobile network sharing as a default arrangement at the venues concerned.

26. For installation of RBS in general, whether at Government venues or private venues, OFCA intends to prepare an information note to provide guidance to MNOs on the best practice that should be considered in the local environment including adoption of suitable mobile network sharing arrangement, mitigating measures to minimise the negative visual impact that RBS installations may bring to the buildings concerned or surrounding environment, and use of advanced network equipment that can make more efficient use of radio spectrum, space and energy in provision of mobile services to the public.

VIEWS SOUGHT

27. Members are invited to take note of the content of this paper. Any views or comments from Members would be welcome.

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