Guidelines for Setting the Frame Structure of Mobile Networks Operating in Time Division Duplex Mode in the 3.3 – 3.6 GHz Band

These guidelines are issued pursuant to Special Condition 1.1 of the Unified Carrier Licence ("UCL") for the purpose of providing practical guidance in respect of the control of interference under General Condition 9 of the UCL ("Guidelines") in relation to the operation of the fifth generation mobile ("5G") networks operating in Time Division Duplex ("TDD") mode in the 3.3 - 3.6 GHz band.

Background

2. As stated in the relevant Information Memorandum issued by the Office of the Communications Authority ("OFCA") dated 19 July 2019 for auction of spectrum in the 3.3 - 3.6 GHz band, amongst other things, the licensees are required to take all reasonable measures to install, maintain and operate the network and the service in such a manner as not to cause any harmful interference to any lawful telecommunications services within or outside Hong Kong. The licensees must coordinate and agree with other licensees on the technical measures to be taken to minimise any mutual interference between them. If necessary, the Communications Authority ("CA") may issue relevant directions requiring the licensee to take such measures as may be necessary to prevent interference.

3. OFCA further sent a paper entitled "Technical information and proposals concerning the Mainland's public mobile networks operating in the 3.5 GHz band" along with the Qualified Bidder Notice dated 27 September 2019 to all the qualified bidders for their reference. The paper outlined a frame structure corresponding to a TDD downlink/uplink ratio ("TDD ratio") of around 7:3 as adopted in the Mainland with a view to facilitating cross-boundary frequency coordination and more efficient use of spectrum in the boundary areas.

4. Spectrum in the 3.3 - 3.4 GHz band and 3.4 - 3.6 GHz band were assigned to four mobile network operators ("MNOs") in December 2019 and April 2020 respectively. Under the technology neutrality principle, MNOs may use any widely recognised technology for

provisioning of service within their assigned spectrum. In this regard, all four MNOs decided to implement the 5G service conforming to the 3GPP standard based on a TDD mode of operation in the concerned frequency bands.

5. As in the past, OFCA encourages MNOs to discuss and settle among themselves the relevant technical matters, including the adoption of a common frame structure, and hence the TDD ratio, for use in the 3.3 - 3.6 GHz band. Despite OFCA's request to the MNOs in November 2019 to agree on a common frame structure for their 5G networks, among others, the MNOs could not reach an agreement in this regard.

6. In order to enable the harmonised, interference-free operation of systems in the 3.3 - 3.6 GHz band by the four MNOs, OFCA set up a task force in March 2020 comprising all four MNOs. Among other things, the use of a common frame structure and TDD synchronisation was discussed. It was noted that the setting of frame structure and hence the TDD ratio was a network parameter for radio base stations and it could be readily changed at the network control centre. There was evidence indicating that if two TDD networks operating in the adjacent frequency bands did not use the same frame structure and synchronised in transmission timing, interference between base stations and between handsets of the relevant networks would be resulted.

7. It was further noted that the interference problem concerning integrated radio system ("IRS")¹ was particularly significant without alignment of frame structures in the transmissions in the 3.3 - 3.6 GHz band. As 5G networks continue to roll out in the coming years, the number of radio base stations suffering from radio interference will grow unless more collaborative actions are put in place to facilitate a more conducive environment to the overall 5G network development in Hong Kong.

8. Having regard to the discussion in the task force, it was considered that a default frame structure making reference to that of the Mainland with a TDD ratio of around 7:3 should be followed by the industry for initial service launch of 5G services on 1 April 2020, if no consensus could be reached by the MNOs on the matter. Any MNO deviating from the default frame structure in its service rollout should ensure no harmful interference to the networks of other MNOs adopting

¹ IRS involves the sharing of a set of common antenna and other facilities for provision of indoor radio coverage of public mobile services by relevant MNOs. Due to practical constraints imposed by property owners and others, there is usually one IRS within the same premises.

the default frame structure, and if the interference could not be resolved, should change to adopt the default frame structure.

9. With the launch of 5G services on 1 April 2020, OFCA noted that for two TDD networks operating in the adjacent frequency bands which did not use the same frame structure, interference between base stations and between handsets of the relevant networks did occur and significant resources would be required to deal with the interference problem.

10. Against this background, the CA considers it necessary to provide guidance in the following paragraphs with a view to enable the industry to have more efficient use of the spectrum in the 3.3 - 3.6 GHz bands.

Technical Guidance

11. Having regard to the facts and circumstances as mentioned above and all the relevant factors including,

- (a) MNOs' choice of technical solutions including the frame structure and hence the TDD ratio of their particular networks based on the technology neutral principle;
- (b) the need for the reduction of interference problem within Hong Kong, and between Hong Kong and the Mainland;
- (c) the effort of coordination between MNOs in using a common frame structure;
- (d) the different options of frame structure supported by individual MNOs;
- (e) the established practice of the CA to encourage MNOs to settle technical issues including the setting of a particular network parameters by themselves, with regulatory guidance to be provided only when the issues could not be settled among MNOs after a reasonable period;
- (f) the evidence and technical considerations that interference could occur among adjacent radio base stations and handsets of two MNOs if they adopt different 5G frame structure in their

radio base stations; and

(g) the lack of traffic data of the TDD band for the time being to justify the use of a particular frame structure and hence the TDD ratio,

the CA adopts the following guidance for the operation of mobile networks in the 3.3 - 3.6 GHz band –

- (a) synchronisation of mobile networks in the 3.3 3.6 GHz band should be achieved by using radio-based Global Positioning System solution (or other equivalent navigation satellite system) or network-based IEEE 1588 Precision Time Protocol solution;
- (b) if MNOs cannot agree on the use of a common frame structure and hence a common TDD ratio in a TDD band, and this would result in interference caused to the base station(s) of individual MNO(s), each MNO shall adopt the default frame structure set by OFCA taking into account the above factors or any particular frame structure supported by no less than half of the MNOs, and the MNO shall promptly implement that frame structure at its relevant base station(s) at the material time as instructed by OFCA; and
- (c) the default frame structure set by OFCA shall be as set out in the technical proposal in paragraph 3 and given at **the Annex**, unless specified otherwise in writing by OFCA.

Adoption and Update of Guidelines

12. These Guidelines will take immediate effect and may be further revised by the CA as and when necessary.

Communications Authority 22 April 2020

Annex :

Default Frame Structure

