ASTRI's Response to Consultation Paper on

Arrangements for Assignment of the Spectrum in the 600 MHz and 700 MHz Bands for the Provision of Public Mobile Services and the Related Spectrum Utilization Fee

15 September 2020

Introduction

1. Hong Kong Applied Science and Technology Research Institute Company Limited ("ASTRI") is pleased to provide its comments to the consultation paper jointly issued by the Communications Authority ("CA") and the Secretary for Commerce and Economic Development ("SCED") on 19 August 2020 regarding the *Arrangements for Assignment of the Spectrum in the 600 MHz and 700 MHz Bands for the Provision of Public Mobile Services and the Related Spectrum Utilization Fee* ("Consultation Paper").

2. The Consultation Paper concerns the proposed amendment to the Hong Kong Table of Frequency Allocations within the frequency range of 614 – 806 MHz ("600/700 MHz bands"), where

- 2 × 10 MHz of spectrum in the ranges of 738 – 748 MHz band paired with 793 – 803 MHz band is to be reserved for Government applications ("Government 700 MHz band");
- 2 × 35 MHz of spectrum in the ranges of 703 – 738 MHz band paired with 758 – 793 MHz is to be allocated for the provision of territory-wide public mobile services ("public 700 MHz band"); and
- 2 × 35 MHz of spectrum in the ranges of 617 – 652 MHz band paired with 663 – 698 MHz is to be allocated for the provision of indoor public mobile services ("public 600 MHz band").

Key Messages

3. At the time of preparing this response, the 600/700 MHz bands are amongst the lowest frequency bands designated by the 5G standardization body 3rd Generation Partnership Project ("3GPP") for the provision of 5G mobile services. While these low frequency bands have long range radio propagation characteristics and thus ideal for delivering 5G over wide coverage areas, the limited available spectrum bandwidth in these low frequency bands alone may not be sufficient to enable 5G-caliber broadband services. Moreover, as the auction for the 600/700 MHz bands is highly competitive, bidders might only be assigned a limited amount of fragmented spectrum.

4. Towards enhancing 5G coverage and capacity, 3GPP has introduced new carrier aggregation mechanisms to combine the 600/700 MHz bands with mid and high frequency bands and optionally support mixed Frequency Division Duplex ("FDD") and Time Division Duplex ("TDD") modes of operation. In addition, the 600/700 MHz bands may also be utilized as additional unidirectional carriers to supplement uplink ("UL") or downlink ("DL") communications.

5. In order to put the 600/700 MHz bands into efficient use for the timely provision of 5G services for the benefit of the general public in Hong Kong, assignees of the 600/700 MHz bands could explore *neutral host* models under which they share the deployment and operations of 5G network infrastructures and have the flexibility to combine their spectrum resources in low, mid, and high frequency bands. A neutral host could collaborate across mobile network

operators ("MNOs") as well as government departments and public sector bodies with rights to use the Government 700 MHz band ("Government 5G users"). For example, on the one hand, a neutral host could deploy 5G network infrastructures in the premises of Government 5G users to enable their enterprise use cases as well as to serve MNO subscribers using the combined spectrum resources of the Government 5G users and the MNOs. On the other hand, the neutral host might exploit under-utilized Government 700 MHz band to enhance MNO network capacities in public facilities. Additional use cases could include complimentary use of the 600/700 MHz bands by government agencies and MNOs, e.g., search and rescue in the country parks in parallel with public safety in the crowded locations, while serving indoor sporting events in the stadiums.

6. In the rest of this response, ASTRI will present the state-of-the-art 3GPP specifications on the 600/700 MHz bands including i) the supported bandwidths and ii) the carrier aggregation mechanisms. An example will be provided to illustrate carrier aggregation using the 600/700 MHz bands in conjunction with 3.5 GHz 5G systems already deployed in Hong Kong.

3GPP Specifications on the 600/700 MHz Bands[1]

7. Figure 1 illustrates the proposed allocation of the public 700 MHz band and the Government 700 MHz band, which collectively is designated by 3GPP as **Band n28**: the 703 – 748 MHz band is used for DL communications and the

[1] Based on 3GPP TS 38.101-1 V16.4.0 (2020-06) and 3GPP TS 38.101-3 V16.4.0 (2020-06).

758 – 803 MHz band is used for UL communications. The UL and DL bands can be used separately as additional unidirectional carriers to supplement UL or DL communications. The 758 – 803 MHz band is designated as the **Band n83** supplementary uplink ("SUL") carrier, whereas the 717 – 728 MHz band is designated as the **Band n29** supplementary downlink ("SDL") carrier.

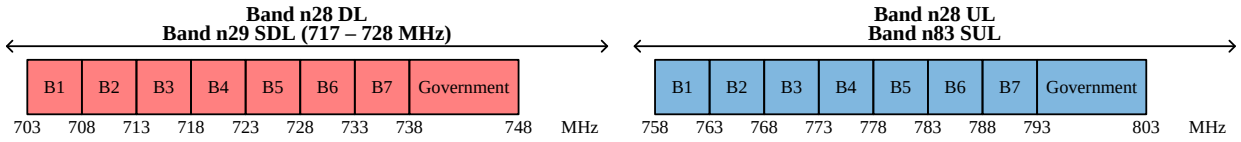

Figure 1: Proposed allocation of the public 700 MHz band and the Government 700 MHz band

8. Figure 2 illustrates the proposed allocation of the public 600 MHz band, which is designated as **Band n71**: the 617 – 652 MHz band is used for DL communications and the 663 – 698 MHz band is used for UL communications.

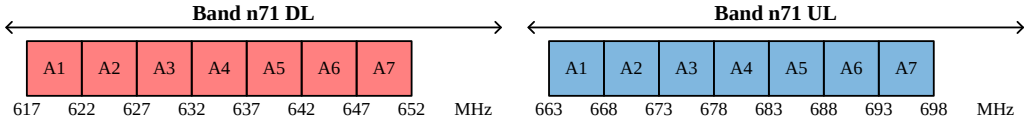

Figure 2: Proposed allocation of the public 600 MHz band

9. Table 1 summarizes the channel bandwidths and subcarrier spacings ("SCS") supported by each band. Note that the maximum supported bandwidth for Band n28 and Band n71 is 30 MHz and 20 MHz, respectively.

Table 1: Channel bandwidths and SCS supported by each band.

Band	Mode of Operation	SCS (kHz)	5 MHz	10 MHz	15 MHz	20MHz	25 MHz	30 MHz
n28	FDD	15	Yes	Yes	Yes	Yes		Yes
		30		Yes	Yes	Yes		Yes
		60						
n29	SDL	15	Yes	Yes				
		30		Yes				
		60						
n83	SUL	15	Yes	Yes	Yes	Yes		
		30		Yes	Yes	Yes		
		60						
n71	FDD	15	Yes	Yes	Yes	Yes		
		30		Yes	Yes	Yes		
		60						

10. Figure 3 shows a sample carrier aggregation configuration for 5G using 3.5 GHz band and Band n28. Under carrier aggregation, Band n28 may use {5, 10, 15, 20} MHz bandwidth.

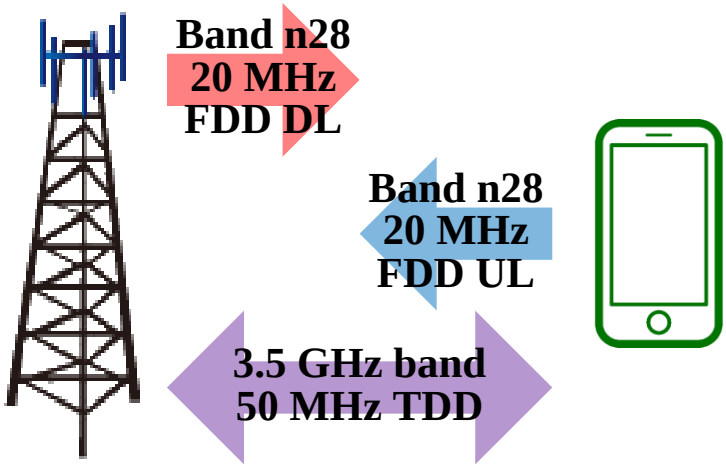

Figure 3: Sample carrier aggregation configuration for 5G network 3.5 GHz band and Band n28

Response to Questions of the Consultation Paper

Question 1:	*Do you have any views on the proposed changes of frequency allocation to mobile service for the entire 614 – 806 MHz band?*

Answer:

We support the proposal. The proposed changes of frequency allocation to mobile service for the entire 614 – 806 MHz band is in line with the objective to facilitate the timely provision of 5G services for the benefit of the general public.

Question 2:	*Do you have any views on assigning the spectrum in the 600/700 MHz bands by way of auction and allowing all interested parties to apply for participation in the auction?*

Answer:

We support the proposal to allow all qualified parties to apply for participation in the auction.

Question 3:	*Do you have any views on the proposal that the spectrum in each of the 600 MHz and 700 MHz bands be divided into seven frequency blocks each with a bandwidth of 2 x 5 MHz?*

Answer:

We support the proposal and encourage OFCA to allow spectrum assignees to swap frequency blocks to achieve the largest contiguous spectrum band and avoid unnecessary intra-band carrier aggregation.

Question 4:	*Do you have any views on the proposed spectrum cap of 30 MHz in each of the 600 MHz and 700 MHz bands to be imposed on each bidder?*

Answer:

Under the proposed spectrum cap of 30 MHz in each of the 600 MHz and 700 MHz bands, the auction may result in one bidder being assigned 30 MHz of spectrum and a second bidder being assigned only 5 MHz of spectrum in a given band, which is insufficient to enable 5G broadband services without carrier aggregation. As explained in Paragraph 5, we encourage assignees of the 600/700 MHz bands to explore neutral host models which could give them greater flexibility to combine their spectrum resources to enable high quality 5G services.

With the support of the Innovation and Technology Commission ("ITC") and ecosystem partners, ASTRI is actively investigating technologies to enhance the efficiency and effectiveness of the proposed spectrum allocation including new methods being standardized in the 3GPP and promising innovations to enable smart contracts among stakeholders such as blockchain. These efforts aim to help support future-proof and technology-neutral methods of spectrum utilization. ASTRI is eager to support relevant stakeholders to explore neutral host models in Hong Kong.

Question 5:	*Do you have any views on the adoption of the SMRA auction format for the assignment of the spectrum in the 600/700 MHz bands?*

Answer:

We have no comments.

Question 6:	*Do you have any views on the network and service rollout obligations proposed to be imposed on the successful bidders of the spectrum in the 600/700 MHz bands and the associated performance bond proposed for guaranteeing compliance?*

Answer:

We have no comments.

Question 7:	*Do you have any views on the proposal in relation to the setting and collection of SUF as specified in paragraphs 32 and 33 above?*

Answer:

We have no comments.

About ASTRI 5G Research

ASTRI's R&D strategic focus covers five areas of applications: Smart City, Financial Technologies, Intelligent Manufacturing, Health Technologies, and Application Specific Integrated Circuits. ASTRI has developed 5G end-to-end

solutions including Open Radio Access Network ("O-RAN") infrastructure and 5G core network. ASTRI is eager to support Hong Kong's public and private sectors to address their 5G technology needs and develop innovative applications.

Submitted by

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