

Telecommunications Regulatory Affairs Advisory Committee

5G Technology Development and Technical Trial

PURPOSE

This paper briefs Members on the fifth generation mobile (“5G”) technology development and technical trials around the world as well as the progress in Hong Kong including similar technical trials and the measures being taken to facilitate the deployment of 5G technologies and infrastructure in Hong Kong.

INTRODUCTION

2. In view of the market demand for higher speed mobile broadband connectivity, massive connections to enable Internet of Things, as well as ultra-reliable and low latency communications, the mobile industry worldwide is actively developing 5G technologies with a view to launching commercial services in the timeframe of 2020. Among others, international standardisation organisations including the International Telecommunication Union (“ITU”) and the 3rd Generation Partnership Project (“3GPP”) have been speeding up the development of new standards for 5G technologies, while equipment vendors and mobile network operators (“MNOs”) have actively conducted or made plans to conduct 5G technical trials in different frequency bands, including the 3.5 GHz band (i.e. 3.4 – 3.6 GHz), the 26 GHz band (i.e. 24.25 – 27.5 GHz) and the 28 GHz band (i.e. 27.5 – 28.35 GHz).

LATEST DEVELOPMENT OF 5G TECHNOLOGIES AND STANDARDS

3. On 21 December 2017, 3GPP approved the non-standalone (“NSA”) 5G new radio (“NR”) specification, which is the first implementable 5G NR specification¹. The 3GPP is currently working on the technical specification 3GPP Release 15, which includes the addition of support for standalone 5G NR operation and enables the first phase of 5G deployment by

¹ The relevant news is available at:

http://www.3gpp.org/news-events/3gpp-news/1929-nsa_nr_5g

http://www.3gpp.org/news-events/3gpp-news/1931-industry_pr_5g

2020 (in particular for the enhanced mobile broadband use case), is targeted to be completed by June 2018. The timeline of developing standards for 5G NR by 3GPP and the work plan of International Mobile Telecommunications for 2020 and beyond (“IMT-2020”) by the ITU are shown in Figure 1 and Figure 2 respectively –

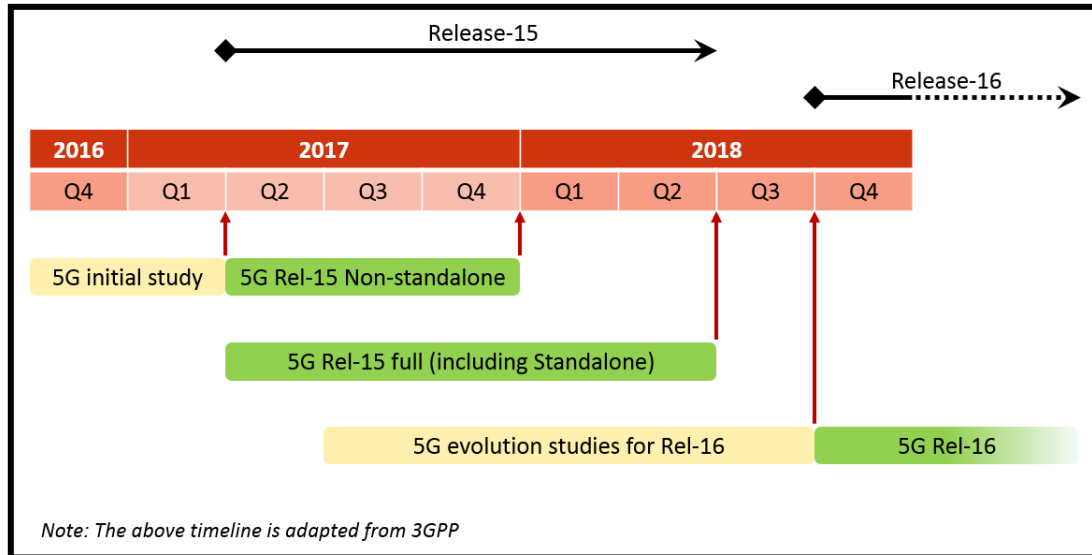


Figure 1: 3GPP 5G NR Timeline²

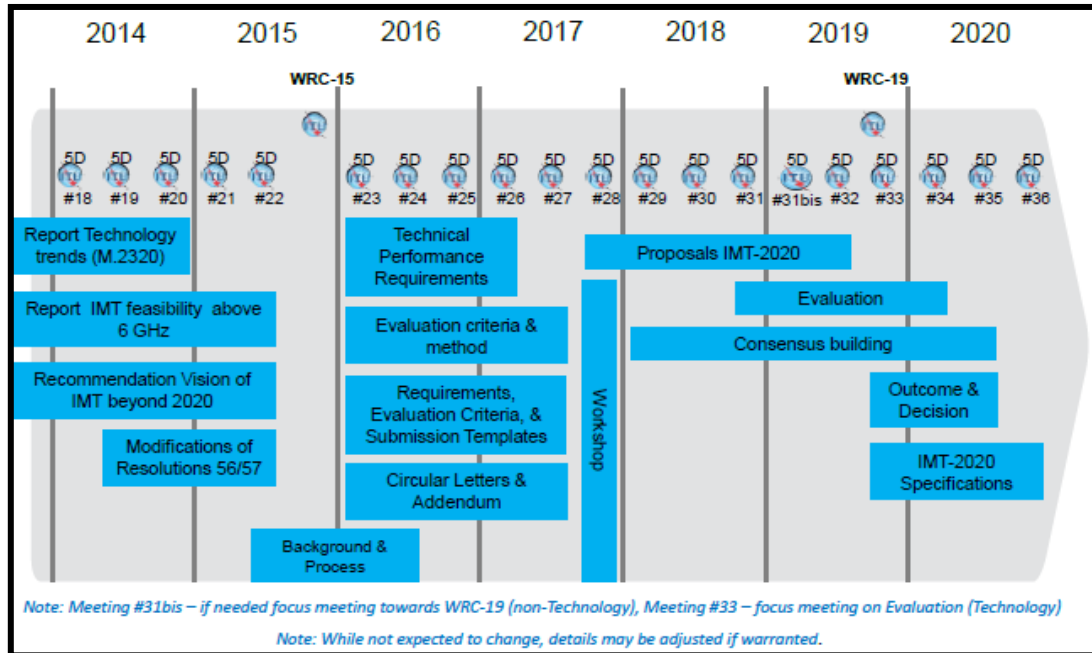


Figure 2: ITU Work Plan on IMT-2020³

² The figure is adapted from 3GPP at:
<http://www.3gpp.org/release-15>

³ The figure is available at:
<https://www.itu.int/en/ITU-R/study-groups/rsg5/rwp5d/imt-2020/Pages/default.aspx>

4. Against the latest timeline for standardisation of 5G radio transmission technologies, major mobile equipment and devices manufacturers and MNOs around the world generally expect that commercial supply and deployment of 5G equipment based on 5G NR technology, including networks, devices and smartphones, could take place as early as in 2019⁴.

TECHNICAL TRIALS IN OTHER ECONOMIES

Australia

5. A major MNO (Telstra) has joined effort with a major equipment vendor (Ericsson) and completed a 5G trial data call over the 26 GHz band spectrum using production core network in a 5G testing centre in the Gold Coast in November 2017⁵. MNOs in Australia (including Telstra and Optus) intend to conduct 5G trials during the Commonwealth Games in the Gold Coast in April 2018⁶.

Mainland China

6. The Ministry of Industry and Information Technology of China approved the additional 5G trial spectrum of 4.8 – 5 GHz, 24.75 – 27.5 GHz and 37 – 42.5 GHz in July 2017 to be used for 5G trials, alongside with the 3.4 – 3.6 GHz band which was already confirmed for such purpose in January 2016⁷.

7. A major MNO (China Mobile) and two equipment vendors (Qualcomm and ZTE) announced that they successfully conducted an end-to-end 5G NR interoperability data test in November 2017⁸ utilising 5G NR pre-commercial base station and 5G NR sub-6 GHz user equipment (“UE”)

⁴ The relevant news is available at:

http://www.3gpp.org/news-events/3gpp-news/1931-industry_pr_5g

⁵ Telstra’s announcement is available at:

<https://exchange.telstra.com.au/world-first-5g-trial-data-call-over-26ghz-mmwave-spectrum>

⁶ The relevant news is available at:

<http://www.zdnet.com/article/telstra-spending-a-lot-of-time-on-5g-penn/>
<http://www.smh.com.au/technology/mobiles/2018-commonwealth-games-spectators-to-get-the-5g-treatment-20170713-gxar3o.html>

⁷ The relevant news (in simplified Chinese only) is available at:

<http://www.miit.gov.cn/n1146290/n1146402/n1146440/c5730538/content.html>

⁸ The relevant news is available at:

<https://www.qualcomm.com/news/releases/2017/11/16/qualcomm-zte-and-china-mobile-showcase-5g-leadership-completion-worlds>

prototype operating in the 3.5 GHz band.

Japan

8. A major MNO (NTT DOCOMO) and an equipment vendor (Huawei) jointly conducted a 5G field trial at Tokyo Skytree (where the 5G base station was located) and Asakusa Station (where the UE was placed) using the 28 GHz band spectrum in December 2017⁹, achieving a 4.52 Gbps downlink throughput and a 1.55 Gbps uplink throughput with a coverage range of 1.2 km.

Korea

9. A major MNO (SK Telecom) announced in June 2017 that it successfully demonstrated 5G communications using the 3.5 GHz band for the first time in Korea through collaborations with two equipment vendors (Samsung Electronics and Nokia)¹⁰, with a 5G end-to-end network based on the 3GPP 5G NR standards elements. Another major MNO (KT) and an equipment vendor (Intel) announced in November 2017 that they would deliver a 5G showcase using the 28 GHz band spectrum at the Winter Olympic Games in PyeongChang 2018¹¹.

United Kingdom

10. A major MNO (Vodafone UK) and an equipment vendor (Ericsson), in partnership with academics at King's College London, successfully conducted a field trial of standalone pre-standard 5G with a prototype device operating in the 3.5 GHz band in central London in December 2017¹².

⁹ The relevant news is available at:

<http://www.huawei.com/en/news/2017/12/NTT-DOCOMO-5G-mmWave-Field-Trial-Tokyo>

¹⁰ The relevant news is available at:

http://www.sktelecom.com/en/press/press_detail.do?idx=1218

¹¹ The relevant news is available at:

<https://www.rcwireless.com/20171101/5g/intel-kt-showcase-5g-2018-winter-olympic>

¹² The relevant news is available at:

<https://mediacentre.vodafone.co.uk/pressrelease/first-uk-live-pre-standard-5g-test/>

United States

11. A major MNO (AT&T) announced in August 2017 that it continued to conduct outdoor pre-standard mobile 5G testing and expanded its fixed wireless 5G trials to additional cities in the United States operating in millimetre wave (“mmWave”) spectrum¹³. Another major MNO (Verizon) and two equipment vendors (Qualcomm and Novatel Wireless) announced plans in October 2017 to collaborate on 5G NR technology development and over-the-air field trials using the 28 GHz and 39 GHz bands for mobile and home broadband wireless access¹⁴.

Others

12. Following the 3GPP’s approval of the NSA 5G NR technical specification as mentioned in paragraph 3 above, two major equipment vendors (Ericsson and Qualcomm) announced on 21 December 2017 that they demonstrated multi-vendor interoperability connection compliant with the new NSA 5G NR specification in both the 3.5 GHz band and the 28 GHz band, using 5G NR pre-commercial base stations and 5G NR UE prototypes.¹⁵

TECHNICAL TRIALS IN HONG KONG

13. In Hong Kong, an equipment vendor conducted a trial of 5G technologies using mmWave spectrum in the 15 GHz band in January 2017. The prototype comprised a 5G base station, a next-generation antenna and a test mobile station. In August 2017, an MNO performed an indoor test with use of spectrum in the 3.5 GHz band.

¹³ The relevant news is available at:
http://about.att.com/story/att_expanding_fixed_wireless_5g_trials_to_additional_markets.html

¹⁴ The relevant news is available at:
<https://www.fiercewireless.com/wireless/verizon-qualcomm-and-novatel-collaborate-5g-nr-trials>

¹⁵ The relevant news is available at:
<https://www.ericsson.com/en/press-releases/2017/12/global-mobile-industry-leaders-achieve-multi-band-5g-nr-interoperability>

MEASURES TO FACILITATE DEPLOYMENT OF 5G TECHNOLOGIES IN HONG KONG

Making Available Additional Spectrum for Public Mobile Services

14. On 21 March 2017, the CA promulgated its work plan for making available additional spectrum for the provision of public mobile services to meet the increasing aspirations of mobile service users towards 2020 and beyond.¹⁶ The Spectrum Release Plan for 2018 – 2020 just promulgated by the CA foreshadows the earliest release dates for additional spectrum to be made available in the 3.5 GHz, 26 GHz and 28 GHz bands after necessary consultation on the proposed allocation and the associated assignment arrangements.

15. In addition to the spectrum in the abovementioned bands, the CA will continue to look for other suitable spectrum for release to the market at a later stage to support the continued developments of the public mobile services.

Facilitating Rollout of 5G Infrastructure

16. The provision of 5G services using the higher frequency bands like the 26 GHz and 28 GHz bands is expected to require a significant increase in the number of small cells or low power radio base stations (“RBSs”) at street level to support high speed, high capacity and low latency connections close to mobile users. The Government supports and facilitates the rollout of telecommunications networks and the provision of innovative telecommunications services for the benefit of the community. As such, in line with present arrangement, the Office of Communications Authority (“OFCA”) will continue to facilitate and provide necessary assistance to MNOs to make use of public facilities such as government buildings, bridges, and street furniture such as public payphone kiosks and lampposts to install RBSs. In addition to the common use of roof tops of buildings for installation of mobile base stations, OFCA will also explore with the relevant government departments with a view to allowing the installation of small cells on external walls of buildings, subject to compliance with building and other relevant legislation to ensure public safety and commercial agreements to be entered into between MNOs and property owners, in order to provide an alternative arrangement for MNOs to achieve satisfactory street level mobile coverage.

¹⁶ The CA’s work plan is available at:
http://www.coms-auth.hk/en/media_focus/press_releases/index_id_1423.html

Issuing Permits for 5G Trials

17. To facilitate the deployment of 5G technologies in Hong Kong, OFCA encourages interested parties to conduct trials to try out the technical capability and performance of 5G equipment, devices and services in the Hong Kong environment for the design and planning of their 5G networks and services. They are welcome to approach OFCA in this regard for application of trial permits and temporary assignment of relevant frequencies to conduct the trials.

Facilitating Mobile Network Sharing

18. Under the existing regulatory regime for mobile services, various forms of mobile network sharing by MNOs are allowed with a view to lowering capital and operational expenses and to expedite the rollout of mobile network infrastructure.¹⁷ As it is expected that the future 5G infrastructure will involve building a large number of small cells and use of large bandwidth of spectrum to achieve localised, high speed connection, OFCA is prepared to consider and facilitate innovative forms of mobile network sharing proposed by MNOs within the existing statutory framework.

VIEWS SOUGHT

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

**Office of the Communications Authority
February 2018**

¹⁷ Reference may be made to TRAAC Paper No. 2/2016 for more information on the possible forms of mobile network sharing and existing regulatory arrangements.