Abstract

Keywords: mobile broadband, spectrum licensing mechanism, regulatory policy

Background

Analyzing the release plans, consideration factors and supporting measures for spectrum resources of the major countries, we take the communications policies, regulatory policies and regulation amendments of those countries in digital economy as a reference for the next wave of wireless broadband release plans in Taiwan. It is expected that through the improvement of spectrum utilization efficiency, it will promote fair competition in the market, accelerate the construction of mobile broadband networks, and provide a better environment for mobile broadband networks development.

Methodology

Using document analysis method, comparative research method, case study method, and industry-government-academic-research seminars, the research team members study and analyze the mobile broadband development trends, spectrum release mechanisms, the closure of 3G or UMTS network services and alternative technologies, and the development trends and regulatory of LEO satellite communications in major countries, including UK, the European Union, America, Canada, Japan, South Korea, Singapore, and China. We also propose policies and regulations suggestions based on our study and opinions gathered in the seminars.

Main Findings

1. The development process of international 5G and B5G technical standards

WRC-19 identified additional frequency bands 24.25-27.5GHz, 37-43.5GHz, 45.5-47GHz, 47.2-48.2GHz and 66-71GHz for 5G mobile communications. In addition, the international community has begun to pay attention to and intensively discuss 6G development. B5G and 6G features "high coverage", " high density", "high bandwidth", "high reliability", "high precision" and "high intelligence" as their vision, and the integration of satellite communications and terrestrial networks has been attracting significant attention.

2. 5G and B5G spectrum release plans in major countries

Compared with the first 5G auction in Taiwan, Taiwan, Japan, South Korea, and Singapore all released mid-band and mmWave for the first wave of 5G releases. EU established the spectrum release and commercialization plan by identifying 700 MHz, 3.5 GHz, and 26 GHz as 5G Pioneer Bands. The United States prioritized the high frequency bands in early stage, and has actively planned and released mid-band resources in the past two years.

In terms of spectrum release mechanism, UK, America, Canada, and Taiwan released 5G licenses by public auction. Call-for-Proposal (CFP), which is similar to public procurement in Taiwan, is adopted by Singapore because of the insufficient spectrum resources and the goal of building two nationwide 5G SA networks. China and Japan have used the evaluation system for many years. It is worth noting that after

the amendment of Radio Act in October 2019, Japan took the economic value of frequency bands into consideration, and moved towards the spirit of public procurement.

3. 5G infrastructure deployment, spectrum sharing, and application development in major countries

There are three main methods of promoting 5G infrastructure deployment in major countries: "improving the infrastructure deployment", "reducing deployment costs and barriers ", and "promoting network upgrades".

As mobile communication technology evolves, more types of network sharing cooperation are available, and cooperation can be one of the solutions to the 5G investment and deployment difficulties such as high costs and insufficient physical space. Taiwan’s Telecommunications Management Act is forward-looking and opens up flexibility to telecommunications business cooperation and frequency secondary transactions.

5G applications can drive social, economic and industrial development and innovation opportunities. In order to encourage 5G applications, all countries have adopted 5G trials and test platforms, opening experimental frequency bands, developing 5G vertical applications, investing in key areas, cultivating talents, public-private collaboration, and transnational technical cooperation. In addition, as information security and network security have received attention, various countries have also actively developed openRAN and advocated the diversification of Netcom equipment supply chain.

4. The closure of 3G or UMTS network services and alternative technologies in major countries

According to the 5G voice/video communication architecture, services are provided based on the IP Multimedia Subsystem (IMS), and IMS voice/video communication services have two access modes: VoLTE and VoNR. With the expansion of 4G network coverage and the increasingly mature terminal systems, global industry players will experience the process of evolving from Circuit Switched Fallback (CSFB) to VoLTE. There are three steps of global 2G and 3G phasing out. Refer to the 3G network closure cases in the United States, South Korea, Germany, Denmark and Norway, the corresponding measures are mainly announced and introduced by the telecom operators, rarely by the government.

5. The development trends and regulatory of LEO satellite communications

The current business models of four major LEO satellite service providers mainly focus on providing global satellite broadband services. Observe the steps of SpaceX's participation in various countries. First, establish subsidiaries in each country and register as a telecommunications company. Then, apply for the licenses required for satellite services in each country, such as spectrum licenses, satellite earth stations licenses, and satellite terminal server licenses. The authorities approved SpaceX's participation in market and issued licenses by evaluation and allocation system. In the United States, Germany, the United Kingdom, and Australia, the existing users have priority for licensing conditions over LEO satellite service providers.

6. Licensing measures and regulatory policy in the future

There are two major international mobile broadband licensing mechanism: market mechanism and administrative mechanism. Taiwan adopted public auction to ensure fair competition in the market for many years. Taiwan's Telecommunications Management Act encourages the effective use of frequency and network resources under the framework of open co-frequency, co-network and co-construction, providing the possibility of cooperation and diversified business models for telecom operators. Regarding the application of cooperating operators to participate in spectrum auction, it is still rare at this stage, and needs continuous attention in the future.

Refer to the UK auction rules for 700MHz and 3.6-3.8GHz, the research team simulated the first 5G auction 3.5GHz frequency band in Taiwan by using eligibility points, which can effectively accelerate convergence. Improving the original acceleration mechanism could achieve similar accelerating effect and the rules are much easier, but it lacks a error-tolerant design like eligibility events.

Main Suggestions

1. Continue to master the development of B5G and 6G international communication technology standards

The development of B5G and 6G towards land, sea and air communications has promoted the rise of new applications such as low-orbit satellites and High Altitude Platform Station(HAPS). Looking at the licensing plans and interference coordination situations of relevant frequency bands by international organizations and major countries, Taiwan also needs to continue grasp the international trends, the direction of each country's promotion, the maturity of equipment, the development of industrial ecosystems and business models, etc., and analyze and plan as soon as possible. In response to the integration trend of 5G and non-terrestrial networks, future related supervision mechanisms will also need to be adjusted accordingly.

2. Improve the efficiency of existing frequencies first, and authorize frequency bands with more potential for application development in the medium and long term

Since 5G key applications have not yet appeared, and there is no clear demand for the next wave of interpretation in Taiwan. At this point, it is recommended to focus on improving the efficiency of existing frequencies, continue to pay attention to the development of technology and standards in the medium and long term, and choose to authorize the frequency with higher maturity, more potential for application development, such as n40 (2300-2400MHz), n77 (3300-4200MHz), n79 (4400-5000GHz), etc.

3. Adopting CSFB closure assisting policy, and the schedule can respect the commercial mechanism

In the short term, it is suggested that the competent authority may refer to the practice of 2G closure, and provide relevant precautions for the industry to close CSFB to guide the industry to follow the direction. From international case studies, it can be observed that major countries are facing a transitional period of replacing old

technologies and upgrading new technologies. For example, South Korea, although telecom operators have already completed VoLTE interconnection in July 2015, for responding to the demand of international roaming and rural networks, the 3G network has not yet been closed. Also, some reports pointed out that the VoLTE interconnection of Taiwan's telecommunications industry may occur after 2023. Therefore, in the medium and long term, as VoLTE gradually becomes the mainstream of voice calls in various countries, in order to improve the efficiency of spectrum use, Taiwan's telecom operators will inevitably consider whether to continue to invest in the maintenance of 3G, 4G and 5G networks in response to the needs of 5G network upgrades, or take measures to promote the adoption of VoLTE terminals and services. The competent authority may adjust relevant policies and measures in a rolling manner at each stage of the transition period, continue to ensure the rights and interests of consumers and encourage smooth transfer of services.

4. Remain flexible of low-orbit satellite communication licensing to avoid interference

Low-orbit satellite communications can refer to major countries for the licensing, adopt review-based licensing, and increase policy flexibility with a short license period. At the same time, it is recommended that the Taiwanese government refer to Ofcom's approach when accepting applications from new low-orbit satellite operators. According to the gateway of NGSO new operators, the competent authority should avoid authorizing new applications that are too close to existing gateways to avoid harmful interference. In the long term, after the low-orbit satellite communications industry enters the Taiwanese market, regular satellite communications market demand surveys or competition analysis can be conducted to grasp the future trend of low-orbit satellites.

5. Mobile broadband frequency licensing in the future should fully reflect the value of the spectrum to ensure fair and effective use

Radio frequency is a rare resource shared by the whole people. The design of licensing needs to comprehensively consider the purpose, use, industry and technological development. In addition to fully reflecting the value of the spectrum, the industry can also flourish and improve the quality of life and social well-being of the whole people. It is recommended to evaluate the international technology, application, market development, the supply and demand situation of spectrum resources in advance before the licensing.

6. If Eligibility Points are adopted in future auction rules, bidders must be informed of the rules and operation methods in advance

If Taiwan intends to adopt a Eligibility Points mechanism in the future, in the short term, it is recommended to regularly hold multiple actual bids to simulate the actual participation of suppliers, or hold briefing sessions to provide sufficient information to the suppliers, and based on their feedback and the suitability of the environment in Taiwan to conduct flexible adjustments to ensure that all participating companies can fully understand rules and operating methods. In addition, since the study of Eligibility Points rules in this study is mainly for a single frequency band scenario, in the future,

it can be aimed at clarifying spectrum requirements or simulating more complex Eligibility Points usage scenarios such as multiple frequency bands in actual interpretation planning. However, at this stage, the number of Eligibility Points for specific frequency bands can be considered in the auction design based on spectrum characteristics and requirements.

7. Improving the clarity of the law, so that 5G network partners have traces to follow

In order to solve the disputes of the calculation of bandwidth which is derived through Article 12, Item 2 of the Regulations Governing the Use of Radio Frequencies, "The actual usable bandwidth described in the preceding Paragraph refers to all bandwidths acquired through the relocation of approved frequencies, public bidding or auction, the use of frequencies from another telecommunications enterprise and frequency sharing.", it is recommended that the formula for each cooperation mode should be clearly defined to increase the clarity of the law.

Even though the Telecommunications Management Act adheres to the spirit of deregulation, the procedurally unprofitable restrictions on the equity of joint applicants can actually avoid the situation of conspiracy to raise prices in the auction market, so consider avoiding excessive concentration of spectrum and maintaining orderly and fair bidding, there is still a need to regulate joint applicants.