

## How the spectrum price affects 5G development in Thailand?

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For mobile operators, the spectrum price is the factor affecting their network investment in an early phase. To say, a reasonable price will help operators to expand their network as planned and be able to set 5G package at a reasonable level. This will also help bolster 5G adoption rate going forward.

EIC assessed the spectrum price for 5G technology development and divided the estimation into 3 scenarios; 1) The spectrum license price around THB 110-130 billion — similar to that of 700MHz bandwidth allocation — with adoption rate expected at around 60% of total postpaid subscribers after the 5<sup>th</sup> year of 5G rollout, 2) The license price between THB 30-40 billion based on the prices of mid-band spectrum licenses in ASEAN countries, with adoption rate of 70%, and 3) The license price more than THB 200 billion — 50% of mid-band spectrum license price during a highly competitive 1800MHz bandwidth auction in 2015 — with adoption rate of around 50%.

A reasonable spectrum price is, therefore, a key concern for NBTC as it needs to balance between government benefits from the spectrum license fee and affordable price for mobile operators. The price will attract investment in 5G network which enables a better and faster data communication in wireless transmission capabilities, and will then benefit the Thai economy in the long term perspective.

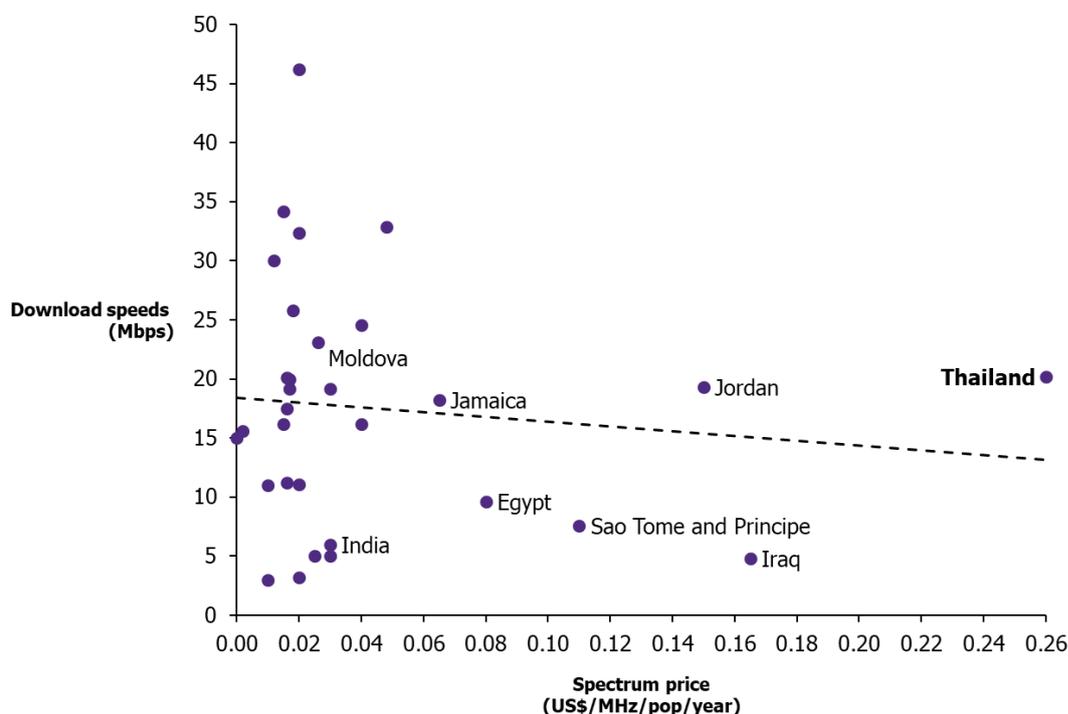
**Time frame, regulation, and price condition for 5 G spectrum allocation remain the concerns that should be followed closely, since they are factors affecting the operator's decision on 5 G-related investment.**

5 G or the fifth-generation wireless technology has been a highly-anticipated trend across the globe with its greater capabilities than 4G, including speed of 10 times faster and data capacity of 1,000 times higher than 4G, and very low latency. With these qualifications, 5 G technology can connect up to 1 million Internet of Things (IoT) devices per square kilometer while enabling a real-time communication. Therefore, 5 G technology benefits not only to mobile phone users but also to industrial sectors which can drive future innovations. According to the International Telecommunication Union (ITU), an international agency in charge of monitoring telecommunication industry worldwide, mobile operators working on 5G development are required to hold spectrum with the combination of sub-1 GHz (low band), 1-6 GHz (mid band), and above 6 GHz (high band). These required spectrum holdings will help maximize data capacity and area coverage. These additional spectrum required also increase the cost burden incurred by operators. Currently, timeline, regulation, and price condition for 5 G spectrum allocation in Thailand remain key factors determining an operator's 5 G investment. This is partly a reason why 5 G technology advancement in Thailand may lag our regional peers, particularly Vietnam and Malaysia who plan to roll out 5G network by mid-2020.

**Refer to the previous auctions, Thailand's spectrum licenses price about 4 times higher than the world's average. A high burden from license cost would indeed affect the operator's network investment and service qualities.**

In 2012, the National Broadcasting and Telecommunications Commission (NBTC) changed the spectrum allocation procedure from concession to auction, which was the starting year of transition to 3G technology. The license of 2.1GHz spectrum — the very first spectrum allocated through the bidding process — price as high as THB 42 billion, a THB 1.1 billion or 3% higher than the reserve price. Then competition became more intense in the 4 G era as operators were wrestling to get 900MHz spectrum. The final price from that auction ended up breaking the world's record at THB 150 billion, a THB 120 billion or 5 times higher than the reserve price. Such phenomenon raised Thailand's average spectrum price to USD 0.26 /MHz/population, higher than the world's average of USD 0.06/MHz/population based on auctions from 102 countries worldwide during the past 10 years (2008-2017). According to the Global System for Mobile Communications Association (GSMA)'s research on spectrum pricing in 31 developing countries found that higher spectrum cost would result in operators slowing their investment in network expansion. At the end, a mobile user is the one who faces knock-on effects via slower service improvement. By comparing the spectrum price to other developing countries with similar mobile internet download speed, Thailand's spectrum price were relatively high and even higher than those in countries with better internet speed. Apart from mobile users, the quality of mobile service in Thailand also affects foreign investors since telecommunication is one of the basic infrastructures involved in business decisions.

**Figure 1: Spectrum price (US\$ per MHz per population per year) and average download speed of mobile internet.\***



Remark: \* data from 31 developing countries worldwide in 2017

Source: EIC analysis based on data from GSMA

**Based on EIC estimation, 5G technology will start its commercial rollout in Thailand by 2021 and will help bolster mobile operator’s revenue from a rising number of postpaid subscribers and Average Revenue Per User (ARPU).** Currently, the number of postpaid subscribers in Thailand accounts for 25% of the total subscribers. Such ratio is far lower than those of developed countries (~80% for the US and ~100% in South Korea). In 2018, postpaid ARPU in Thailand was about 3.5 times higher than prepaid, which means that a high migration from prepaid to postpaid package will increase the operator’s revenue. EIC views that once the 5G technology is deployed, it will increase growth of data usage — such as online streaming service, Virtual Reality (VR) and Augmented Reality (AR) — thanks to its higher capabilities comparing to 4G both in terms of speed and data volume. When it comes to higher data usage, the postpaid package offering will be a better value of money than a prepaid plan. That is why a 5G technology will also induce users to shift from prepaid to postpaid service. The number of users changing to postpaid package is expected to grow by 10%-30% from its 5-year average (2014-2018) at 2.2 million users per year. In addition to a higher number of postpaid subscribers, the growth of ARPU in the mobile industry also tends to accelerate 5G rollout. Ericsson and KGI research found that mobile phone users in Thailand are willing to pay an additional service fee of THB 135-175 per

month for 5 G technology. Based on this research outcome, 5 G technology will boost ARPU growth to around 4%-7% CAGR during the first 5 years of commercial operation (2021-2025).

**Nevertheless, the cost incurred by operators tends to rise from additional network investment. EIC expects that the total Capex of the 3 major operators will range between THB 280-380 billion during the first 3 years of 5G rollout.** 3GPP, an organisation in charge of developing mobile network technical standard, divided 5G deployment into 2 separate tracks: (1) Non-Standalone 5G (NSA 5G) which enhances a network to 5G via existing 4G infrastructure, and (2) Standalone 5G (SA 5G) which develops a network via new core infrastructure specifically for 5G. Capital expenditure (Capex) for SA 5G is likely to be higher than the other option since it needs additional investment in a base station and transceiver system. In the early years of 5G commercial launch, mobile operators are expected to opt for NSA deployment in order to reduce the cost of network expansion before transitioning to SA 5G track. In this case, capital investment in 5G network would be similar or slightly higher than that of 4G. This is in line with a preliminary assessment by GSMA which estimated that investment in 5G technology would be fairly higher comparing to 4G. Meanwhile, based on the capital guidance of South Korean operators launching commercial 5G network in early 2019, total investment capital of the 3 major operators (SK, KT, LG U+) in 2019 was somewhat similar to investment value in 2012 — when South Korea started to run a 4G network. Based on GSMA assessment and evidence from South Korea, the total capital expenditure (excluding a license cost) of Thailand's 3 main operators (AIS, TRUE, DTAC) is expected to reach THB 280-380 billion during the first 3 years of 5G commercial rollout.

**For mobile operators, there are further costs from the 2 next spectrum auction/allocation expected in 2020-2021.** In June 2019, NBTC allocated the licenses of 700MHz spectrum — the first bandwidth that is arranged for 5G development — to the 3 major operators, raising THB 17,584 million from each license. Later in August, NBTC announced its plan of at least other 2 auction/allocation for mid- and high-frequency bands. The first package consists of 700MHz, 2600MHz, and 26GHz, while the second one includes 1800MHz and 3500MHz. Based on Huawei recommendation and case studies from 5G spectrum auction in South Korea, EIC expects that each mobile operator still needs around 80-100 MHz (two way) of mid-frequency band and around 600-800 MHz (two way) of the high-frequency band. These will be further costs that would affect investment in 5G technology. If spectrum prices get too high, mobile operators will have to spend less on network infrastructure or may pass on such burden to customers by setting a high package for 5G service. On the other hand, a reasonable spectrum price will urge operators to expand their network as planned and customers can access 5G technology at a fair price. For this reason, spectrum pricing for 5G technology should be a key concern for NBTC. A reasonable price will encourage operators to compete over service quality which will benefit customers and the economy in the long term.

**EIC has assessed the possible spectrum price which determines a breakeven period of 5G investment of the 3 major mobile operators in Thailand (AIS, TRUE, DTAC). The assessment can be divided into 3 cases; 1) The base case, 2) The case of relatively inexpensive spectrum price, and 3) The case of high spectrum price. The details and assumption of each case are as follows:**

**For case 1 (base case), the total spectrum cost incurred by the 3 operators ranges between THB 110-130 billion and the breakeven period is around 8-9 years.** In this case, the spectrum price is estimated from the cost of 700MHz bandwidth allocated by NBTC to all 3 mobile operators in June 2019. Meanwhile, the 5G adoption rate is based on the performance and guidance of the 3 major mobile operators in South Korea. The guidance reported that an average adoption rate was 7% of total postpaid subscribers in the first year of 5G commercial rollout before climbing to around 15% per annum in later years. Under this assumption, the breakeven period is within 8-9 years which is in line with findings from Telecom Intelligence. The company conducted a survey of more than 500 telecom firms and related businesses worldwide and found that over 55% of executive respondents expected their breakeven period for 5G investment at around 6-10 years.

**For case 2, the total spectrum cost of the 3 operators is within THB 30-40 billion, with a breakeven period of 7 years.** The price in this case is estimated from the mid-band spectrum price in ASEAN countries namely; Malaysia (2100MHz) and Indonesia (2300MHz). Spectrum prices are relatively inexpensive in both countries, so operators are able to increase their investment capital in network infrastructure expansion and marketing in the early phase. This will lead to a higher adoption rate and growth compared to the base case. Besides, a 7-year breakeven period is somewhat matched with a telecom technology cycle, as transitions from 3G to 4G and 4G to 5G usually take around 5-7 years.

**For case 3, a high bidding competition may drive a total spectrum cost to over THB 200 billion and the breakeven period may take more than 10 years.** In case that NBTC allocates a spectrum through the bidding process and the competition becomes very intense, the final price can be considerably higher than the reserve price. In this case, EIC estimated that the spectrum would cost around 50% of the final price from 1800MHz bandwidth auction in 2015. The bidding price war was very aggressive back in that day, with 4 bidders but only 2 slots available from NBTC. Such high spectrum cost will push the breakeven period to over 10 years and weigh on operators' investment in network infrastructure, as their financial burden is already overwhelming. Moreover, mobile operators may shift such burden to consumers by setting a high 5G service package which will then result in a low adoption rate compared to the previous 2 cases.

Based on the 3 assessment cases, a reasonable spectrum price will lead to a shorter breakeven period and get the mobile operators ready to invest in the new technology cycle. Thus and so, Thailand will not be left behind others like the previous 3G and 4G era.

**Figure 2: 3 assessment cases of spectrum prices**

	<b>Case 1 (Base case)</b>	<b>Case 2</b>	<b>Case 3</b>
<b>Spectrum price assumption</b>	Estimated from 700MHz license price	Estimated from mid-band spectrum prices in ASEAN countries	50% of 1800MHz auction price (2015)
<b>Spectrum price* (THB million)</b>	110,000-130,000	30,000-40,000	Over 200,000
<b>Projected average investment per annum during the first 3 years (THB million)</b>	109,000	120,000	98,000
<b>Additional ARPU for 5G package (THB/month)</b>	155	135	175
<b>Adoption rate after the 5th year of 5G rollout</b>	60%	72%	48%
<b>Estimated breakeven period**</b>	8-9 years	7 years	Over 10 years

Remark: \*spectrum license period is 15 years

\*\*the calculation excludes interests and income tax

Source: EIC analysis based on data from J.P. Morgan and KGI Research

There is no doubt that mobile operators' investment decision will determine whether 5G commercial rollout will go on as planned. That is why NBTC are drafting several incentives to relieve operators' financial burden. These include spectrum coverage for specific areas — such as EEC — and for specific industries such as logistics, manufacturing, and healthcare. NBTC also considers accepting the first installment after the 4th year of 5G deployment, which will allow mobile operators to invest in infrastructure improvement and network expansion during an early phase. These proposals are currently under discussion for the next bandwidth allocation in 2020-2021.

**EIC views that infrastructure sharing and a rising number of industrial subscribers will help attract operators' 5G investment, but that might be weighed down by a higher cost from handset sales.** McKinsey Institute found that infrastructure sharing — such as cell tower and base station — can reduce the cost of network expansion by 40%. As a result, Thai mobile operators are anticipating NBTC regulatory approval on infrastructure sharing which is now under discussion and

public hearing process. On demand side, apart from mobile phone users, 5G technology is also developed to support industrial use. Thus a rising number of industrial enterprise subscriptions also helps bolster operators' income growth. Thailand's industrial sectors are eagerly awaiting for 5G deployment to keep up with the world's industry 4.0 era. This is partly thanks to the government initiatives that encourage technology adoption among businesses and promote real use cases for 5G — for example, connecting devices via a wireless sensor to enhance the efficacy of machine-to-machine communication in manufacturing factories. To mobile operators, a lower cost from infrastructure sharing and a higher income from a rising number of industrial subscriptions are indeed significant incentives for 5G investment.

Nonetheless, a higher cost from handset sales promotion may weigh down on investment. Since most of the mobile devices today are not compatible with 5G, mobile operators will have to compete over sales promotion in order to draw both current and new customers into 5G network during the early years of commercial launch. Similar to the 4G era, mobile carriers may offer phone deals at a very low — even unprofitable — price level with certain conditions such as a long-term contract. Such pricing war means a higher burden to mobile operators and may also mark some loss-making players in the field.

Towards the future of digital era, 5G technology is no doubt a key force driving innovation and the new industrial revolution. Technological advancement will enhance the nation's competitiveness, and become a great contribution to the economy in the forthcoming years. For Thailand, whether the 5G rollout will happen as NBTC's plan or not is largely determined by the investment readiness of the mobile operators. Therefore, it is important that the government and regulator should come up with a reasonable spectrum pricing that encourages future investment, or else we will be left behind in this digital era.

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