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**APT REPORT ON
METHODOLOGY AND PRICING OF IMT SPECTRUM IN
ASIA PACIFIC COUNTRIES**

No.

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APT REPORT ON METHODOLOGY AND PRICING OF IMT SPECTRUM IN ASIA PACIFIC COUNTRIES

1. Introduction

Given that spectrum is a finite resource, it is managed by Administrations taking into account international ITU Radio regulations and national IMT requirements. Administrations, as part of national spectrum management, regulate spectrum assignment and the pricing of IMT spectrum resources.

Some Administrations have carried out IMT spectrum auctions in IMT bands. However, there is not any official database on the methodologies used for IMT spectrum prices from such auctions. At the same time, AWG has developed and maintained very useful data on mobile operators' frequencies, technologies, and license durations in Report-15.

This APT report is a compilation of responses to the Questionnaire and would provide useful information to APT members about the informations on IMT spectrum pricing and methodologies adopted by those APT countries that have undertaken to auction their IMT spectrum.

2. Questionnaire and Responses

2.1 Questionnaire

Questionnaire sent out to each of the APT Member Administration is shown below.

Question 1: What are existing regulations and the mechanism for licensing the IMT spectrum?

Question 2: Does your regulation require any payment for the assignment of IMT spectrum to the mobile operator, other than spectrum usage fee/charge/tax, when licensing the IMT spectrum? If an answer is "Yes", please provide in detail those regulations and the purpose of this payment.

Question 3: In your regulation, what methodology is used for the determination of the value of the IMT spectrum for specific bands? Please provide details.

Question 4: Does your Administration willing to share the reserved/starting price and auction price results with the associated requirement to licensees of the IMT spectrum?

2.2 APT Member countries that submitted responses to APT during the development of this Report

The following member countries provided their responses to the Questionnaire.

- 1) Bhutan (as of AWG-31/INP-14)
- 2) China, People's Republic of (as of AWG-31/INP-90)
- 3) India, Republic of (as of AWG-31/INP-74)
- 4) Indonesia, Republic of (as of AWG-31/INP-58)
- 5) Korea, Republic of (as of AWG-31/INP-103)
- 6) Nepal (as of AWG-31/INP-19)
- 7) Palau (as of AWG-31/INP-45)
- 8) Thailand (as of AWG-31/INP-25)
- 9) Vietnam, Socialist Republic of (as of AWG-32/INP-103)
- 10) Sri Lanka (as of AWG-32/INP-11)

- 11) Brunei Darussalam (as of AWG-32/INP-16)
- 12) Pakistan, Islamic Republic of ((as of AWG-32/INP-20)
- 13) Palau, Republic of (as of AWG-32/INP-25)
- 14) Nepal, Federal Democratic Republic of (as of AWG-32/INP-31)

2.3 Responses to Question 1

APT member	Regulations and the mechanism for licensing the IMT spectrum			
	Administrative e.g First-come first-serve	Beauty contest	Auction	Other
Bhutan	Yes	Yes (sometimes)	-	Based on availability and band plans (made after thorough research)
China ¹ China	Yes	-	-	-
India	-	-	Yes	-
Indonesia	Yes (Evaluation)	Yes	Yes	-
Korea	Yes (Local 5G)	Yes (Rarely used after the adoption of auction)	Yes (Most of the IMT spectrum)	-
Nepal	-	-	Yes	Bundled with Service License
Palau	Yes	-	-	-
Thailand	-	-	Yes	-
Vietnam	Yes	Yes	Yes	Renewal
Sri Lanka	Yes	-	Yes	-
Brunei Darussalam	No	No	No	by allocation for a pre-determined fee
Pakistan (Islamic Republic of)	-	-	Yes	-
Palau (Republic of)	Yes	-	-	-
Nepal (Federal Democratic Republic of)	-	-	Yes	-

¹China In China, the 3 400-3 600 MHz band was planned for IMT-2020 in November 2017, and it was licensed for 5G trial in December 2018, and officially for commercial use in June 2019. In China, it was used by Fixed Satellite Service on a primary basis for a long time in this band. There are intra-band and inter-band interferences between 5G station and FSS earth station. In December 2018, MIIT issued the Interference Coordination Regulation between 5G stations and other radiocommunication stations in 3.0-4.2 GHz which took effects from 1st January 2019. There is a description that the costs incurred by various measures taken to prevent 5G base stations from interfering with satellite earth stations in the 3400-4200MHz band shall be borne by the operators setting up and using 5G base stations in the 3400-3600MHz band.

2.4 Responses to Question 2

APT member	Any payment related to the economic value of the spectrum			
	Administrative	Beauty contest	Auction	Other
Bhutan	Yes	No	No	No
China	Yes	-	-	-
India	-	-	<p>Yes (based on final price of spectrum in auction, Bank guarantees (see response to Q4). Winner has to pay the final price discovered in the auction. There are two payment options – (i) Option 1: Full or part upfront payment of the bid amount (ii) Option 2: Payment of 20 equal annual instalments of the bid amount, duly protecting the NPV (Net Present Value) of the bid amount at the applicable rate of interest. Prior to 2022, a percentage of Adjusted Gross Revenue (AGR) of Telecom Service Providers was also levied annually, but the same has been done away with as part of telecom reforms since last auction (July-August 2022)).</p>	-
Indonesia	No (Evaluation)	No	No	-
Korea	Yes (Administrative Pricing)	Yes (Spectrum Incentive Pricing) * See below paragraph 3)	Yes (Winners bidding price) * See below paragraph 1	-
Nepal	NA	NA	No	No
Palau	No Up to 2% of adjusted gross revenues to	-	-	-

	the mobile operator				
Thailand	-	-	No	-	-
Vietnam	Yes	Yes	Yes	Yes (Renewal)	
	<p>- In special cases, the IMT bands could be administratively grant to state-owned enterprises who directly serving national defense and security for a period up to 3 years, extendable up to 12 years more, for providing public service in combination with serving national defense and security.</p> <p>- Beauty contest could be applied to the IMT bands in case to facilitate the large-scale coverage of new technologies within a limited time or to encourage new entry to mobile market for promoting competition.</p> <p>- Auction shall be applied to all IMT bands, except those be licensed through beauty contest or administrative which be decided by the Prime Minister.</p> <p>- Payment for the right to use spectrum, excluding spectrum usage fee.</p>				
Sri Lanka	Yes (Upfront Fee)	Yes	Yes (Upfront Fee)	-	-
Brunei Darussalam	No	No	No	by allocation for a pre-determined fee	
Pakistan (Islamic Republic of)	-	-	Yes	-	-
Palau (Republic of)	Yes	-	-	-	-
	License Type	Description	Application Fee	Annual Fee	Renewal Fee
	Cellular Mobile	Frequencies below 1 GHz (per 10 MHz)	160 or as determined in the tender documents	8,000	As determined by the Bureau at the time of renewal
		Frequencies above 1 GHz, but below 6 GHz (per 10 MHz)	160 or as determined in the tender documents	4,000	As determined by the Bureau at the time of renewal
Frequencies above 24 GHz (per 100 MHz)		160 or as determined in the tender documents	As determined by the Bureau in the spectrum license	As determined by the Bureau in the spectrum license	
Nepal (Federal Democratic Republic of)	-	-	No	No	

2.5 Responses to Question 3

1) Bhutan

Number of user/coverage (Regional Factor), Frequency, Bandwidth, Site location (Rural/Urban), Publicity factor. Please refer NRRR 2021 for detailed explanation on spectrum pricing

(Please refer to [Annex 3 to document 1B/80](#))

2) China, People's Republic of

In China, Frequency characteristic and social/indirect benefits are the main influence factors for the determination of the value of the IMT spectrum for specific bands.

1. Frequency characteristic. Different frequency bands have different characteristics, such as different propagation and different path loss. The lower the frequency band, the larger the coverage of the single base station, and the higher the value provided from the single MHz spectrum.

2. Social and indirect benefits. Social and indirect benefits are important factors in evaluating the importance of the radio spectrum authorization. These factors are reflected in the socio-economic development, the feelings of happiness and convenience of the people. To provide universal services to bridge the urban-rural digital divide and bring broadband to rural areas.

3) India, Republic of

It is well understood that rational valuation and pricing of the precious spectrum resource to enable the orderly growth of the telecom sector is essential. In India, the Government has set itself the following objectives for the auction of spectrum:

- Obtain a market determined price of spectrum through a transparent process;
- Ensure efficient use of spectrum and avoid hoarding;
- Stimulate competition in the sector;
- Promote rollout of the respective services;
- To arrive at optimal price of spectrum to ensure sustainable and affordable access to Digital Communications.

India has 22 service areas, and each service area has its own GDP which is a factor in deciding the reserve price for that service area. The range of frequencies is also an important factor while deciding the reserve price. There are various economic approaches and models which are considered and evaluated before adopting one (or multiple) of them for establishing the reserve price of different IMT spectrum bands for each of the service area. Some of these economic models^{2India} are as follows –

- (i) Multiple Regression Model
- (ii) Producer Surplus Approach
- (iii) Production Function Model
- (iv) Revenue Surplus Approach
- (v) Trend-line Approach

^{2India} https://www.trai.gov.in/sites/default/files/CP_30112021.pdf and https://www.trai.gov.in/sites/default/files/Recommendations_11042022.pdf

- (vi) Extrapolated ADP based on a time-series analysis
- (vii) Use of last auction determined prices

In India, the auction model which has been adopted is “Simultaneous Multiple Rounds Ascending (SMRA)” e-auction, conducted over the Internet. Bidders are able to access the Electronic Auction System (EAS) which is used for participation in the auctions using approved web browser

4) Indonesia, Republic of

IMT bands in Indonesia are licensed based on a bandwidth license with a maximum license duration of 10 years and can be extended for a maximum of 10 years. There are 2 methods used in determining the value of the IMT radio frequency spectrum, namely:

- a. Auction mechanism;
- b. Formula.

A. Auction

Indonesia has conducted auctions on frequency bands for IMT services based on bandwidth licenses. The winning bidder of the auction will be granted a spectrum license for a maximum period of 10 (ten) years, which can subsequently be renewed for an additional 10 (ten) years subject to evaluation. As part of the obligation, the winner is required to pay an upfront fee and an annual fee based on a technology-neutral approach. The spectrum fee is determined by the bidding price of the auction winner and is set as follows:

1. **Upfront fee** is set at 2 times the bidding price of each auction winner and is paid only once during the license period.
2. **Annual fee** is calculated as 1 times the lowest bidding price of the auction winner and is paid every year during the license period.

According to regulation, an auction is conducted when demand exceeds the supply. To determine the level of interest, MCI will request prospective bidders to express their interest. If the expressed interest is greater than the supply, an auction will be held.

Indonesia uses the SMRA (Simultaneous Multiple Round Auction) methods of auction, where the determination of the reserved price is calculated based on the *Discounted Cash Flow* (DCF) or *Cost Reduction* (CR) approach.

B. Spectrum Fee Formula for Bandwidth License

The Spectrum Fee Formula is primarily utilized for the renewal of the spectrum license (from auction after the first 10 years period). Spectrum Fee Formula is also applied in cases where the policy involves the changing of an apparatus license to a bandwidth license for certain radio frequency bands, as described in Annex ITU-Rep. ITU-R SM.2012-6.

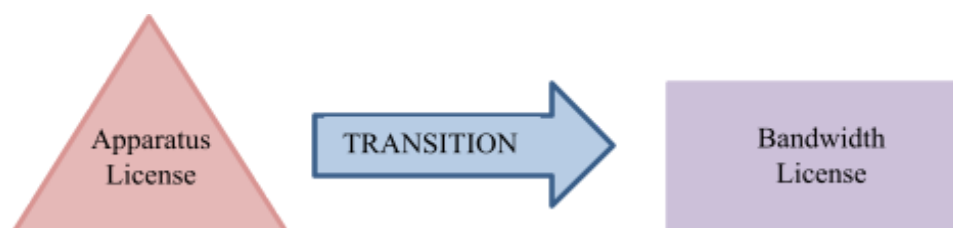
Spectrum fee based on bandwidth license in Indonesia = $N \times K \times I \times C \times B$, where:s

- N*: is a normalization factor to stabilize government revenue from the non-tax sector. The *N*, For the period year, the value of *N* will be adjusted every year by multiplying the value of (*N*-1) by the ratio between the Consumer Price Index in December a year before (*N*-1) and two years before (*N*-2).
- K*: is an adjustment factor for the frequency band considering the economic value of the spectrum used depending on the service and benefits;

- I*: is the basic price index that is adjustable with the propagation of the spectrum (IDR/MHz). The index is settled by government regulation;
- C*: is the last total population in a service area according to the spectrum bandwidth license (kilo population);
- B*: is the bandwidth occupied by the spectrum user, including the guard band (MHz).

The spectrum fee for the license renewal is directly calculated using the above formula. However, when changing from an apparatus license to a bandwidth license for certain radio frequency bands, the spectrum fee is calculated with a transition period.

To ensure the sustainability of the telecommunication industry following the change from the apparatus license to the bandwidth license, the government of Indonesia has implemented a policy to give the spectrum user a 5-year transition period. During this period, the spectrum users are required to make spectrum fee payments based on the spectrum bandwidth license, utilizing the provided formula. This 5-year transition period is considered fair and appropriate as it helps mitigate potential fluctuations in the spectrum fee resulting from the transition.



Within 5 years, the spectrum user will pay the spectrum fee using the formula below:

Year 1	$Y_1 = X + ((20\% \times \Delta) - Z)$
Year 2	$Y_2 = X + (40\% \times \Delta)$
Year 3	$Y_3 = X + (60\% \times \Delta)$
Year 4	$Y_4 = X + (80\% \times \Delta)$
Year 5	$Y_5 = X + (100\% \times \Delta)$

- X = the apparatus license spectrum fee value of the licensee at the time of year 1
- Δ = The different spectrum values of the apparatus license and bandwidth license ($N \times K \times C \times I \times B$)
- Z = the reduction factor that compensates for the excess license term of the apparatus license when implementing the bandwidth license

After the transition period, the spectrum user will pay the spectrum fee using the formula $N \times K \times I \times C \times B$

5) Korea, Republic of

(Please refer to [Annex 3 to document 1B/80](#))

Spectrum Incentive pricing can be calculated in one of three ways. (“Enforcement Decree of the Radio Waves Act” Article 14, 14-2, Attached Form 3)

- the benchmarking method

- the price based on the forecasted revenue
- unit price per unit bandwidth

Spectrum pricing for Local 5G is calculated based on the frequency band, bandwidth, duration, geographic area and geographic location. There are some incentives under related policy and it is imposed as shown below: Annual payment = Base price per MHz $\times (5 \times a_1 + a_2 + 1) \times$ duration \times Number of blocks

Base price per MHz: KRW100,000 per 10 MHz for 4.7GHz and KRW50,000 per 50 MHz for 28GHz

a1: service area in case of metropolitan areas

a2: service area in case of non-metropolitan areas

Number of blocks: blocks to apply for assignment

6) Nepal

By considering the following criteria, the base price for IMT spectrum is recommended by Nepal Telecommunications Authority and it becomes official after approval by the Radio Frequency Policy Determination Committee.

- o Signal propagation characteristics;
- o Global development of telecommunication system in the band;
- o Availability of equipment and ecosystem;
- o National per capita income; and
- o Historical price analysis and comparison of spectrum fee in other bands.

7) Palau

Frequencies below 1 GHz (per 10 MHz)

Frequencies above 1 GHz, but below 6 GHz (per 10 MHz)

Frequencies above 24 GHz (per 100 MHz)

(Please refer to [Annex 3 to document 1B/80](#))

8) Thailand

The NBTC used three different methods to determine the value of IMT spectrum which are business model, benchmarking approach, and econometric model. The business model approach—essentially determine how much is the firm willing to pay for the spectrum band through examination of its potential future cashflows—was employed to set an upper bound of the value of the IMT spectrum. The benchmarking and econometric models were employed to ensure that values of any specific band are in line with other countries. For benchmarking, we computed the average of value per MHz per population using other countries' past auction results for the specific band that we were interested in. The other benchmarking method yields relative value by multiplying a band's past winning bid in Thailand with the average ratio between values of the auctioned band and the specific band that we are evaluating. The ratio is computed using other countries' past auction results. Econometrics modelling follows standard model that explains winning price through auction-related variables, socioeconomic variables, and some dummies variables to differentiate time and regions.

9) Vietnam, Socialist Republic of

(Please refer to [Annex 3 to document 1B/80](#))

- a) Comparative approach (Benchmarking method). Using Benchmarking method to determine the basic amount of Payment for the right to use spectrum. In case of licensing the IMT spectrum by auction, the basic amount of Payment for the right to use spectrum equal the reserve price.
- b) To determine the basic amount of Payment for the right to use spectrum for specific band, the total winning bid of the equivalent frequency band in other countries (so call samples). The basic amount of Payment is the average of amounts converted from winning bids in auctions of valid samples.
- c) The selection of samples from countries or territories for benchmarking:
- Only information on auctions in countries or territories which have been completed before the date of base fee determination shall be collected;
 - Information on each auction collected shall be considered as a sample;
 - Valid sample means a sample which is not removed under the method for removing outliers prescribed in Appendix VII enclosed herewith;
 - Required number of samples: At least 04 samples are collected and there are at least 03 valid samples after removing outliers;
 - Samples of frequency bands of the same type with the subject frequency band shall be taken within duration of the last 07 years before the date of base fee determination which may be extended up to 10 years if the required number of samples cannot be taken in full. Where the number of samples required cannot be achieved, samples of similar frequency bands of the subject frequency band may be taken within duration of the last 07 years before the date of base fee determination which may be extended up to 10 years in order to achieve the required number of samples.
 - If the required number of samples cannot be achieved after samples of both frequency bands of the same type and similar frequency bands have been collected within the last 10 years before the date of base fee determination, the method specified in this Article shall not apply to determination of the base fee.
 - Samples shall be also taken from auctions for frequency bands of the same type and/or similar frequency bands of the subject frequency band conducted in Vietnam within the prescribed sampling duration.
 - The duration of use of the licensed frequency band shall be at least 10 years;
 - The auction for right to use frequency band is conducted nationwide; information on auctions by geographical areas shall not be collected.
- d) Data collected from countries or territories for base fee determination must meet the following requirements:
- Data on the winning bid, bandwidth and duration of use of the frequency band licensed through an auction in a country or territory shall be obtained through consultations with, or from sources announced by, competent authorities of that country or territory. Where there are multiple sources of data, the data obtained through consultations with competent authorities shall be used;
 - Consultation requirements:
- If the list of countries or territories that have conducted auctions for the frequency band on which information needs to be collected can be obtained from the Global System for Mobile Communications Association (GSMA), request for consultation shall be sent to competent

authorities of the listed countries or territories that have not yet published adequate information on the time of publishing auction result, winning bid, frequency band and licensed duration of use of frequency band. If the said list is not available, the request for consultation shall be sent to competent authorities of all countries or territories that have not yet published adequate information on the time of publishing auction result, winning bid, frequency band and licensed duration of use of frequency band.

Within 15 days from the date of the request, if no response is given, it shall mean that requested information is not available. Requests for consultation and responses shall be sent and received via email, by fax or post or in any another appropriate form;

- Data on population and GDP/capita of countries or territories and of Vietnam shall be obtained from the website of World Bank. If data on population and GDP/capita of a country or territory is not available on World Bank, it can be obtained from competent authority of that country or territory;

- Data on exchange rates between currencies used in auctions of countries or territories shall be obtained from financial market websites in the following order of priority; Bloomberg financial market website, X-rates financial market website or another financial market website specializing in providing exchange rates;

For more detail: <https://vanban.chinhphu.vn/?pageid=27160&docid=208534>

10) Sri Lanka

By the Published Rules – Extraordinary Gazette No 1497/23(Radio Frequency) Land Mobile license fee rules and the Upfront fee.(URL: https://trc.gov.lk/images/pdf/5_1497_23e.pdf)

(Please refer to [Annex 3 to document 1B/80](#))

11) Brunei Darussalam

Our current reference for regulation in Brunei Darussalam is the Telecommunications (Radio-communication) Regulations, 2013 and the Telecommunications (Radiocommunication) (Amendment) Regulations, 2022.

There are 2 fees: Spectrum Rights Fee and Annual Fees For Use of Radio Frequency

SPECTRUM RIGHTS FEE

$$\text{Spectrum Rights Fee} = (\text{Unit Price}) (\text{B}) (\text{CF})$$

where,

Unit Price = \$162,500

B = Bandwidth required (assigned bandwidth in MHz or spectrum size in MHz)

CF = Coverage Factor

1.0 for between 1000 MHz and 7100 MHz

2.0 for below 1000 MHz.”.

In Pakistan market analysis and price valuation / assessment for IMT spectrum is usually done by reputed international consultant using various financial / commercial techniques including international benchmarking, NPV etc. Based on consultant recommendations final determination of value of IMT spectrum is done by Government of Pakistan.

ANNUAL FEES FOR USE OF RADIO FREQUENCY

Division 1

Broadcasting, cellular, land mobile or trunked radio wireless broadband access

The annual fee for radio frequency spectrum will be calculated using the following formula –

$$\text{Annual radio frequency spectrum fee} = (\text{Unit Price}) (B) (K1)$$

where,

Unit Price	=	\$1,000
B	=	Bandwidth required (assigned bandwidth in MHz or spectrum size in MHz)
K1	=	Band Factor
		1.0 for Television band
		4.0 for 4.8 GHz to 7.1 GHz band (Cellular and WBA)
		6.0 for Radio band
		8.0 for 2.3 GHz to 4.7 GHz band (Cellular and WBA)
		10.0 for 1.1 GHz to 2.2 GHz band (Cellular and WBA) and land mobile or trunked radio (non-localised use)
		12.0 for 450 MHz to 1 GHz band (Cellular and WBA)
Duplex/Simplex:		For simplex channel, unit price will be half of equivalent duplex channel.”;

12) Brunei Darussalam

In Pakistan market analysis and price valuation / assessment for IMT spectrum is usually done by reputed international consultant using various financial / commercial techniques including international benchmarking, NPV etc. Based on consultant recommendations final determination of value of IMT spectrum is done by Government of Pakistan.

13) Palau (Republic of)

Not available

14) Nepal (Federal Democratic Republic of)

- Supply and demand of Spectrum
- International practices, usefulness, management fee, purchasing capacity of user and per capita income
- Signal propagation Characteristics, Radio coverage and spectral efficiency
- Investment on infrastructure development, availability of equipment, ecosystem development
- Historical price analysis and comparison of spectrum fee in other bands.

2.6 Responses to Question 4

Auctioned bands	Reserved price	Payment term	License & duration	License type	Roll-out obligations
Bhutan (as of AWG-31/INP-14)					
NO. We have not done auction					
China, People’s Republic of					
NO.					
India, Republic of					
Yes. The details of IMT spectrum bands put up for auction along with reserve price details and other terms and conditions (including payment term, license duration, roll out obligations, etc.) of the last auction held in July-August 2022 can be found in the ‘Notice Inviting Applications’ for auctions. Auction results provide key information including final value of spectrum for each service area and different IMT frequency bands. Details of auctions held in India for IMT spectrum bands since 2010 can be found at https://dot.gov.in/spectrum .					
Indonesia, Republic of					
Year 2017, FDD 1970-1975 MHz pair with 2160-2165 MHz	• Auction Price IDR 42.31 billion MHZ/year (around USD 2.8 million MHZ/year)	· The payment amount for the first year is 2x each winner’s bidding price as an upfront fee and 1x the lowest winner’s bidding price as an annual fee · The payment amount for the second year until the tenth year is 1x the	10 years	Nationwide	[-]

		lowest winner's price as an annual fee.			
Year 2017, FDD 1975-1980 MHz pair with 2165-2170 MHz	●-Auction Price IDR 42.31 billion /MHz/year (around USD 2.8 million MHz/year)	<ul style="list-style-type: none"> · The payment amount for the first year is 2x each winner's bidding price as an upfront fee and 1x the lowest winner's bidding price as an annual fee · The payment amount for the second year until the tenth year is 1x the lowest winner's price as an annual fee. 	10 years	Nationwide	[-]
Year 2017, TDD 2300-2330 MHz	●-Auction Price IDR 33.58 billion /MHz/year (around 2.2 million MHz/year)	<ul style="list-style-type: none"> · The payment amount for the first year is 2x each winner's bidding price as an upfront fee and 1x the lowest winner's bidding price as an annual fee · The payment amount for the second year until the tenth year is 1x the lowest winner's price as an annual fee. 	10 years	Nationwide	[-]
Year 2021, TDD 2360-2390 MHz	●-Auction Price IDR 17.69 billion	<ul style="list-style-type: none"> · The payment amount for the first year is 2x each winner's bidding price as an upfront fee and 1x the lowest winner's bidding price as an annual fee 	10 years	Regional	To deploy a minimum of 3 transmitters using 2.3 GHz in each city where Fiber Optic connection is available, utilizing either

	/MHz/year (around USD 1.17 million /MHz/year)	· The payment amount for the second year until the tenth year is 1x the lowest winner's price as an annual fee.			4G (LTE) or 5G (IMT-2020) technology.
Year 2022, FDD 1975-1980 MHz pair with 2165-2170 MHz	● Auction Price IDR 60.5 billion /MHz/year (around USD 4.03 million MHz/year)	· The payment amount for the first year is 2x each winner's bidding price as an upfront fee and 1x the lowest winner's bidding price as an annual fee · The payment amount for the second year until the tenth year is 1x the lowest winner's price as an annual fee.	10 years	Nationwide	[-]
Korea, Republic of ^{3Korea}					
3420-3700 MHz	Reserved/starting price: USD 2,428.8 (KRW 2,654) Auction Price:	· 25% upfront payment · The rest is annually paid	10 years	nationwide	22,500 base stations in 3 years, 45,000 base stations in 5 years

^{3Korea} The Radio Waves Act stipulates that the regulator should consider and reflect the following five factors in setting the reserve price for the auction (Enforcement Decree of Radio Waves Act, Article 14.2):

- ① Assignment charges for radio frequencies of the same or similar use
- ② Characteristics and bandwidth of the radio frequency to be assigned
- ③ License duration, service types, and technical standards of the radio frequency to be assigned
- ④ Turnover expected from the business for which the radio frequencies are assigned
- ⑤ Demand for the radio frequencies to be assigned

	USD 2,741.3 (KRW 2,996) [0.98U SD/M Hz/year]				
Nepal ^{4Nepal}					
[700 MHz] (band 28)	Reserve Price: 13.5 mil NPR/MHz/year Not auctioned yet.	Annually (in advance)	Until the validity of Service License. The Service License is issued for a maximum of 25 years duration (after 3 renewals) and may be reissued thereafter.	Nationwide	-
[800 MHz] (band 20)	Reserve Price: 13.5 mil NPR/MHz/year Not auctioned yet.				-
[900 MHz] (band 8)	Reserve Price: 24 mil NPR/MHz/year Auction Price: 38.88 mil NPR/				- National 4G coverage (in all 7 provinces and 77 district headquarters) within a specified time; - 4G coverage in urban area shall be 95% (by population) within specified period;

^{4Nepal} 1 USD = 130 NPR (approx.) as of April 1, 2023

	MHz/year				
[1800 MHz] (band 3)	Reserve Price: 18 mil NPR/MHz/year Auction Price: 29 mil NPR/MHz/year				<ul style="list-style-type: none"> - 4G coverage in rural areas of municipalities and rural municipalities shall be 90% (by population) within a specified period; - 4G coverage in Tourist Areas/Specified National Parks/High Way shall be 95% within a specified period; - All installed 4G sites shall be of LTE-advanced standard; - User Experience (Download Speed) shall be of minimum of 20 Mbps in Urban and 10 Mbps in rural areas; - In order to ensure that the coverage & capacity requirements in urban and rural areas are met as prescribed above, the Operator shall deploy additional 3,000 new 4G sites within a specified time period;
[2100 MHz] (band 1)	Reserve Price: 12 mil NPR/MHz/year Auction Price: 15 mil NPR/MHz/year				

					- Operator shall report to NTA about the progress of new 4G sites deployment quarterly (including site quantity, population coverage and speed).
[2300 MHz] (band 40)	Reserve Price: 9 mil NPR/ MHz/year Not auctioned yet.				-
[2600 MHz] (band 7, 38)	Reserve Price: 5.5 mil NPR/ MHz/year Not auctioned yet.				-
Palau					
		Annual	[15 years]	[nationwide]	There are no service or coverage obligations associated with this License
Application Fee		Annual Fee		Renewal Fee	
160 or as determined in the tender documents		8,000		As determined by the Bureau at the time of renewal	

160 or as determined in the tender documents		4,000			As determined by the Bureau at the time of renewal
160 or as determined in the tender documents		As determined by the Bureau in the spectrum license			As determined by the Bureau in the spectrum license
Thailand					
2100 MHz	2012 Reserved price: 13,500 million Baht (2x15 MHz) Auction price: DTN – 13,500 million Baht (2x15 MHz) TUC – 13,500 million Baht (2x15 MHz) AWN – 14,625 million Baht (2x15 MHz)	3 terms - 50% at 90 days from the date of receipt notice of the winning bidder - 25% per year until the end of the period	15 years	nationwide	Not less than 50% of population coverage in two years Not less than 80% of population coverage in four years
1800 MHz	2015 Reserved price: 15,912 million Baht	3 terms - 50% at 90 days from the date of receipt notice of the winning bidder	18 years	nationwide	Not less than 40% of population coverage in four years Not less than 50% of

	<p>(2x15 MHz) Auction price: TUC – 39,792 million Baht (2x15 MHz) AWN – 40,986 million Baht (2x15 MHz) 2018 Reserved price: 12,486 million Baht (2x5 MHz) Auction price: DTN – 12,511 million Baht (2x5 MHz) AWN – 12,511 million Baht (2x5 MHz)</p>	<p>- 25% per year until the end of the period</p>			<p>population coverage in eight years</p>
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900 MHz	<p>2015 Reserved price: 12,864 million Baht (2x10 MHz)</p> <p>Auction price: TUC - 76,298 million Baht (2x10 MHz)</p> <p>2016 Reserved price: 75,654 million Baht (2x10 MHz)</p> <p>Auction price: AWN - 76,298 million Baht (2x10 MHz)</p> <p>2018 Reserved price: 37,988 million Baht (2x5 MHz)</p>	<p>4 terms - 4,020 million baht at 90 days from the date of receipt notice of the winning bidder</p> <p>- 2,010 million baht in the next for two the period</p> <p>- Rest of the auction fee in the end of the period</p>	15 years	nationwide	<p>Not less than 40% of population coverage in four years</p> <p>Not less than 50% of population coverage in eight years</p>
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	Auction price: DTN – 38,064 million Baht (2x5 MHz)				
700 MHz	2020 Reserved price: 8,792 million Baht (2x5 MHz) Auction price: NT – 34,306 million Baht (2x10 MHz) AWN – 17,154 million Baht (2x5 MHz)	10 terms - 10% at 15 days before permission - 10% per year until the end of the period	15 years	nationwide	-
2600 MHz	Reserved price: 1,862 million Baht (10 MHz) Auction price:	7 terms - 10% 15 days before permission - 15% per year until the end of the period	15 years	nationwide	Not less than 50% of area coverage in ECC within one year from licensed Not less than 50% of population coverage in center city

	<p>AWN - 19,561 million Baht (100 MHz)</p> <p>TUC - 17,872 .89 million Baht (90 MHz)</p>				within four years
26 GHz	<p>Reserv ed price: 423 million Baht (100 MHz)</p> <p>Auctio n price: AWN -5,345 million Baht (1200 MHz)</p> <p>TUC - 3,576. 89 million Baht (800 MHz)</p> <p>NT - 1,795 million Baht (400 MHz)</p>	1 term within one year from the date of receipt notice of the winning bidder	15 years	nationwide	-

	DTN – 910.4 million Baht (200 MHz)				
Vietnam, Socialist Republic of					
2300 – 2400 MHz	550 mil USD/ MHz/y ear	Within the 4-months period from the date of notification, winner must pay final bidding in one installment.	15 years	Nationwide	<p>1. For 4G network deployment:</p> <ul style="list-style-type: none"> - After 2 years from the date of a license granted: at least 2000 BTSs be deployed. - Average download data speed: at least 50 Mbps. <p>2. For 5G network deployment:</p> <ul style="list-style-type: none"> - After 2 years from the date of a license granted: <ul style="list-style-type: none"> + 5G coverage to at least 200 administrative units at district level and 1000 administrative units at commune level (at least 01 station/unit). + at least 2000 BTSs be deployed. - By the end of the license period: at least 15 000 BTSs be deployed.

					- Average download speed: at least 100 Mbps; Average upload speed: at least 30 Mbps.
Sri Lanka					
No. (Depends on Assigning Methodology)					
Brunei Darussalam					
3400-3500 MHz	Spectrum Rights Fee: BND16,250,000 Annual Fees For Use of Radio Frequency: BND 800,000	Spectrum Rights Fee: One-time payment Annual Fees For Use of Radio Frequency: Annual payment	20 years	Nationwide	None
Pakistan (Islamic Republic of)					
[1800 MHz, 2100MHz] for Year 2021 (previous years details available on Spectrum Auctions PTA)	[31 Mn USD/MHz/15year, 29 MN USD/MHz/15year] Both Reserved/starting price and auction price were same	· 100% at the day license granted or · 50% at the day license granted and remaining in 5 equal installments in the next five years	[15 years]	[Cellular Mobile License, Nationwide]	[3% annual increase in population coverage every year]
Palau (Republic of)					
No					

Nepal (Federal Democratic Republic of)					
900M Hz	24(Base Rate) 38.88(Auction Price)	yearly	Until the validity of Service License		<ul style="list-style-type: none"> • The operator shall ensure that it shall provide national 4G coverage (in all 7 provinces and 77 districts) within a specified period • 4G coverage in urban area shall be 95% (by population) by end of 2022 • 4G coverage in rural areas of municipalities and rural
1800M Hz	18(Base Rate) 29(Auction Price)	yearly			
2100M Hz	12(Base Rate) 15(Auction Price)	yearly			

					<p>municipalities shall be 90% (by population) within a specified period</p> <ul style="list-style-type: none"> • 4G coverage in Tourist Areas/ Specified National parks/ Highway shall be 95% within a specified period. • All installed 4G sites shall be of LTE advance standard. • User experience (Download Speed)
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					shall be of minimum of 20Mbps in urban and 10Mbps in rural areas.
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