# Roadmaps for awarding 5G spectrum: A focus on Vietnam

July 2022

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# Contents


| | | |
|---|---|---|
| | **Summary** | **2** |
| **1** | **Introduction** | **4** |
| 1.1 | The Vietnam mobile market | 5 |
| 1.2 | A roadmap for 5G | 7 |
| 1.3 | The key role of mid-band spectrum for 5G | 8 |
| **2** | **Progress on Vietnam's spectrum plan for 5G** | **10** |
| 2.1 | Spectrum Management in Vietnam | 10 |
| 2.2 | Launch of 5G services in Vietnam | 13 |
| **3** | **Key issues and challenges to secure sufficient spectrum for 5G services in Vietnam** | **14** |
| 3.1 | Valuing IMT spectrum and award design | 14 |
| 3.2 | Addressing interference and synchronisation issues | 15 |
| **4** | **Recommended action plan to address key issues and challenges in Vietnam** | **16** |
| 4.1 | Near term actions | 16 |
| 4.2 | Future IMT spectrum needs in 2025-2030 | 21 |

# Summary

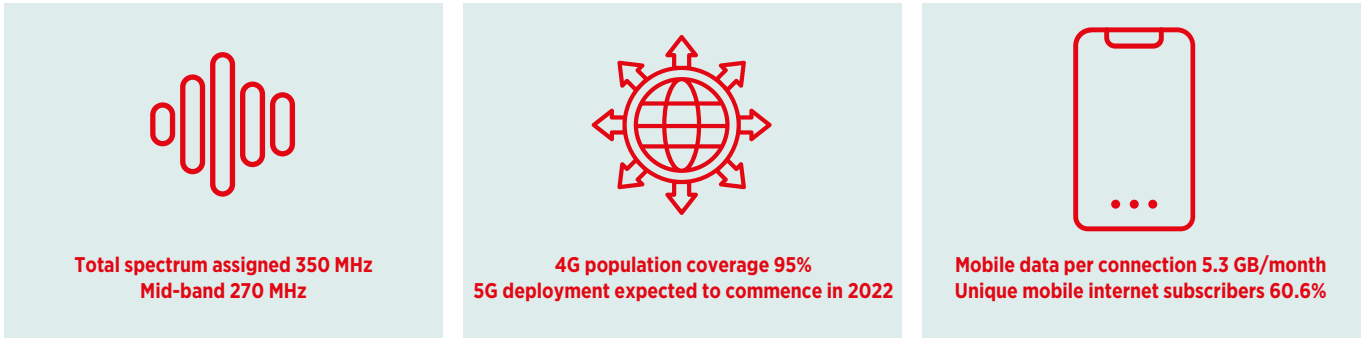
Broadband connectivity and digital services have played particularly vital role in the way people live and businesses operate. during the Covid-19 pandemic. As the world emerges from the pandemic and social and economic activities begin to recover, mobile connectivity will be even more integral to day-to-day economic and social activities. Digital transformation already well underway in many sectors, the 5G era will help to accelerate this process and boost economic growth in the years ahead.

Mobile data traffic per connection in Vietnam (5.3 GB per month in 2020) has been growing strongly in recent years. On the other hand, the supply of mobile spectrum has not kept pace – no new bands have been assigned in the last 10 years.

With commercial 5G networks expected to be launched in Vietnam in 2022, there is much work to be done to ensure the adequate spectrum resources to support the rollout of 5G networks and services.

FIGURE 1

VIETNAM MOBILE MARKET – KEY INDICATORS




Access to mid-band spectrum in the 1-7 GHz will be crucial. The GSMA estimates that mid-band 5G spectrum will drive an increase of more than $610 billion in global GDP in 2030, almost 65% of the overall socio-economic value generated by 5G. To secure these benefits, markets will need around 2 GHz of mid-band spectrum during this decade. In Vietnam, there is currently just 270 MHz of mid-band spectrum assigned for mobile services.

The 5G era promises to unlock a wealth of new use cases across different industries and accelerate economic growth in Vietnam. To realise this, it is important to build on current plans that are in place by prioritising the following actions for 5G development:

- Implement a multi-band award comprising the 700 MHz, 2.3 GHz, 2.6 GHz and 26 GHz bands, instead of auctioning bands in sequence, to avoid creating artificial scarcity.
- Ensure that reserve prices for upcoming auction(s) in Vietnam are set sufficiently below any prediction of market value, in order to allow the auction to fulfil its purpose of determining the market price through competitive bidding.
- Plan to make available at least 300 MHz of spectrum in the globally harmonised 3.5 GHz band. If it is not possible to fully address FSS coexistence issues due to TVRO across the whole country, adopt a phased approach involving the initial release of the 3.5 GHz band in urban areas where demand is highest.
- Ensure synchronisation and use of agreed frame structures for TDD networks between operators in the same country and region to avoid interference and maximise spectrum utilisation.
- Develop a longer term spectrum roadmap for 2025-2030, taking into account future IMT spectrum supply including the 4.8 GHz and 6 GHz bands.

# 1. Introduction

As the world emerges from the pandemic and social and economic activities begin to recover, connectivity will continue to play a vital role in the way people live and businesses operate. Indeed, digital services, underpinned by high speed and high performance networks, are set to become more integral to society in a post-pandemic world. With digital transformation already well underway in many sectors, the introduction of 5G will help to accelerate this process and boost economic growth in the years ahead.

Increasing smartphone adoption and video usage has driven mobile data traffic growth over the last decade and this trend is set to continue in the 5G era with more immersive media-rich services, new online gaming technologies and extended reality (XR) applications. With more than 180 5G networks across 72 countries as of the end of 2021, 5G is rapidly moving towards mainstream adoption and the total number of connections set to reach 1 billion in 2022.[1]

This report takes a closer look at the state of 5G spectrum planning in Vietnam and discusses the key issues and challenges in securing sufficient spectrum resources for 5G, particularly in the mid-bands. It then provides some recommendations on the way forward.

1 Source: GSMA Intelligence

# 1.1 The Vietnam mobile market

High-bandwidth and low-latency Internet connectivity is becoming increasingly important for enhancing productivity, social welfare, and wellbeing. In many emerging markets there tends to be a greater reliance on wireless technology – both mobile and fixed wireless – to meet growing demand for affordable and expandable connectivity. As of the end of 2020, mobile broadband adoption in Vietnam stood at 80.2 per 100 inhabitants compared 17.2 for fixed broadband.[2] As of 2021 network coverage for both 3G and 4G services was at 95% of national population.

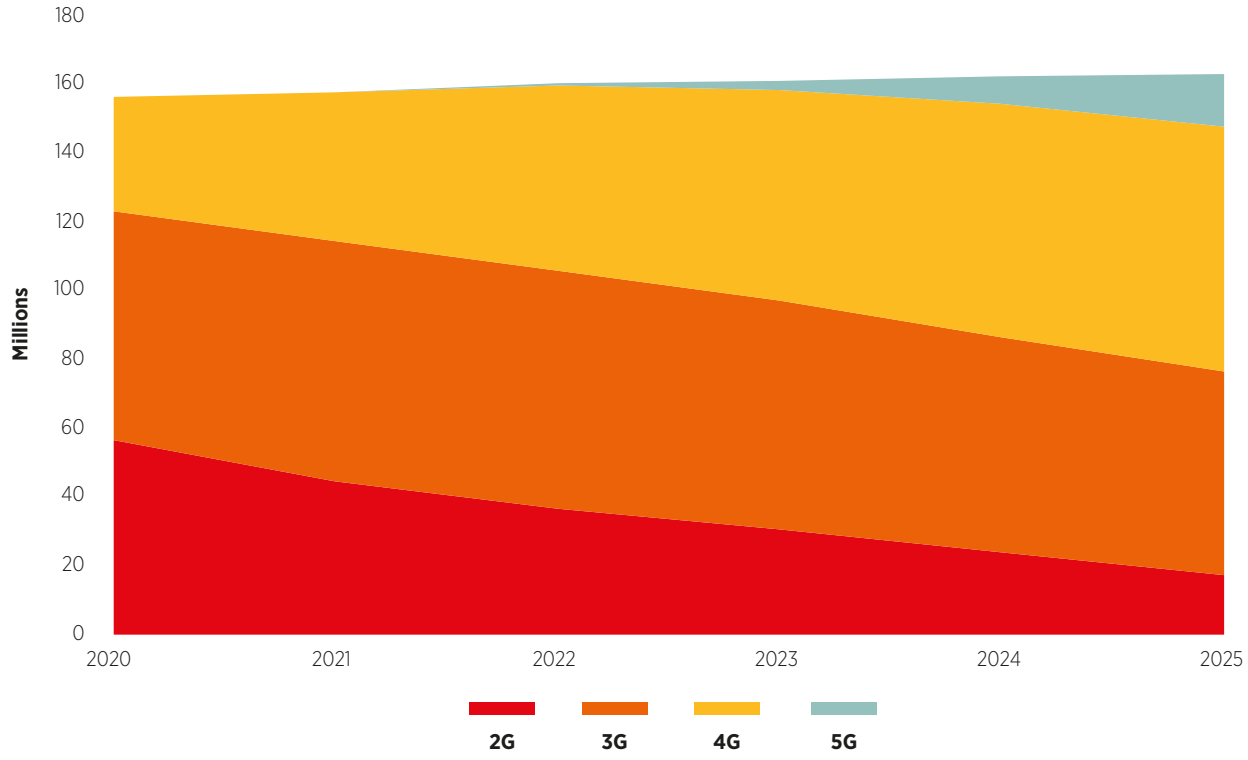
The Vietnam mobile market comprises of the following main players as of end of 2021.

- Viettel Telecom, a multi-play telecoms operator with fixed, mobile and TV services, is the market leader with around 53% share of the mobile market by connections.
- Mobifone has a market share of 19%.
- Vinaphone (VNPT) has a market share of 24%.
- Vietnamobile (4%) and Gmobile (1%) are the other two players in the market. Both have only limited spectrum holdings.

In Vietnam, commercial 5G services have not yet been launched although Viettel have carried out trials across several bands. 5G deployment and adoption is forecast to grow over the next three years – by 2025, the number of 5G connections is also forecast to reach 15.9 million with 5G networks covering 57% of the population.[3]

FIGURE 2

CONNECTIONS BY TECHNOLOGY (VIETNAM)




Source: GSMA Intelligence

2 Source: ITU, World Telecommunication/ICT Indicators Database, August 2021

3 GSMA Intelligence. July 2022.

In Vietnam, monthly mobile data traffic per connection has grown by 2.6 times over the 2018-2020 period, reaching 5.3 GB in 2020.[4] According to Ericsson estimates, mobile data traffic per smartphone in Southeast Asia will grow by 5.8 times over the 2021-2027 period from 8.0 GB to 46.0 GB per month.[5]

At the same time 5G enterprise use cases are also emerging across different industrial verticals which will drive growth in cellular IoT connections. Across Asia Pacific, operators are using the exceptional scale and utility of mobile networks and services to facilitate innovative digital solutions for large and small enterprises in line with Industry 4.0 objectives. In particular, 5G and IoT will play key roles in the implementation of digital transformation projects across different industries, which will further drive demand for 5G connectivity and economic growth for the rest of the decade.

There is currently around 350 MHz of mobile spectrum assigned in Vietnam as shown below. In the mid-band range, only 270 MHz across the 1800 MHz, and 2100 MHz bands has been assigned, compared to an average of 850 MHz in the Asia Pacific region today. There is thus a clear need for more mid-band spectrum in order to support the development of 5G.

The average speeds for 4G services in Vietnam are at around 22-28 Mbps.[6] While higher than the Indonesia and Malaysia, these are significantly below the 5G mobile offerings in places like Singapore , Philippines and Thailand, and regional leaders like Australia, Japan and South Korea.[7]

FIGURE 3

CURRENT IMT SPECTRUM ASSIGNED IN VIETNAM

| Type of spectrum | Bandwidth assigned | Notes |
|---|---|---|
| Low band (sub-1 GHz) | 69.6 MHz | 850, 900 MHz |
| Mid-band (1-7 GHz) | 270 MHz | 1800, 2100 MHz |
| High bands (above 24 GHz) | - | - |

Source: GSMA, APT

4 ITU. World Telecommunication/ICT Indicators Database. August 2021.

5 GSMA. The Mobile Economy 2022. www.gsma.com/mobileeconomy/wp-content/uploads/2022/02/280222-The-Mobile-Economy-2022.pdf

6 OpenSignal. Vietnam Mobile Network Experience Report, September 2021. www.opensignal.com/reports/2021/09/vietnam/mobile-network-experience

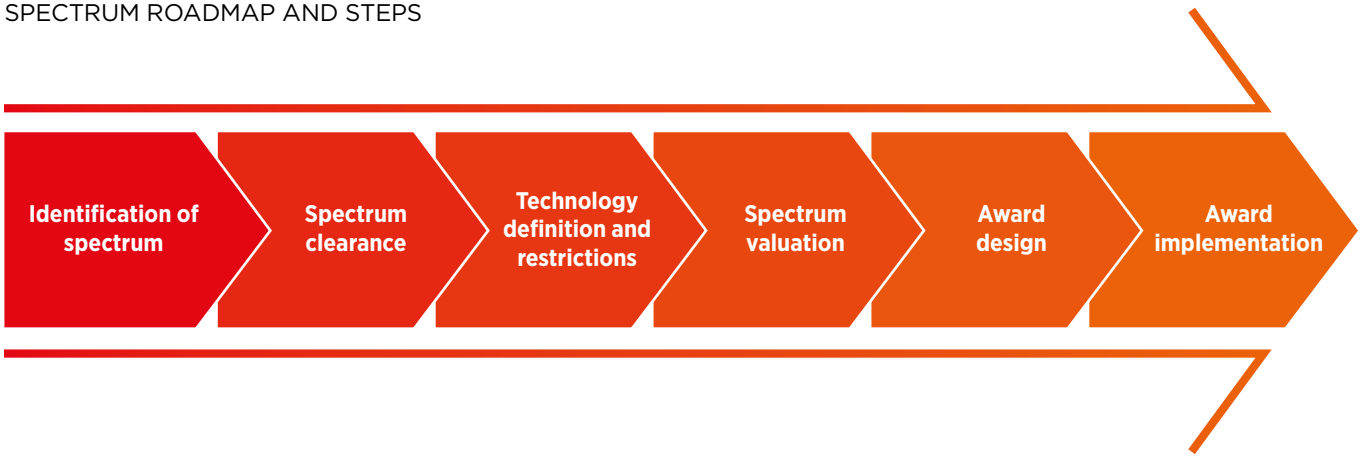
7 Refer to www.opensignal.com

# 1.2 A roadmap for 5G

As with all previous generations of mobile services, the road to 5G in each country starts with the release of spectrum to support the network rollout. A typical spectrum roadmap, as illustrated below, involves the following steps.[8]

FIGURE 4

SPECTRUM ROADMAP AND STEPS




| | |
|---|---|
| 1. | **Identification of spectrum.** Spectrum is essential for the provision of mobile services and 5G needs significant new harmonised spectrum.[9] Care must be taken to consider the socio-economic benefits that arise from both old and new uses of spectrum and in balancing needs of different users. Consultations provide a forum for the perspectives of different industry stakeholders and allow both governments and industries the opportunity to understand the likely effects of different options. Where competing demands arise, cost-benefit analysis should also be carried out to assess the impacts of proposed changes in spectrum allocation and to ensure efficient use of scarce spectrum and achieve optimal outcomes for society.[10] |
| 2. | **Spectrum clearance.** Approaches for clearing spectrum are dependent on factors such as the density of use; ease of moving incumbents to alternative frequency bands or alternative technologies; and impact on services and users. In some cases, geographic sharing with adequate mitigation measures will address interference concerns. For assigned spectrum, it may only be necessary to realign the band assignments to provide contiguous frequencies and maximise spectrum efficiency for 4G and 5G. |
| 3. | **Technology definition and restrictions.** Technical licence obligations should be clearly defined, along with conditions of usage and the amount and geographic availability of the spectrum. |
| 4. | **Spectrum valuation and pricing.** Assessing the value of spectrum guides up-front and annual fees. There are different valuation approaches, including benchmarking and modelling analysis, and both methods should be used to improve accuracy and to capture local market factors. Costs relating to licensing obligations should be taken into account when setting prices for spectrum. |
| 5. | **Award design.** There are three main approaches to awarding spectrum: auctions, beauty contests and direct award.[11] The approach adopted, and associated licence obligations, will need to take account of policy objectives, available spectrum, and market specifics (for example, the number of operators, or current spectrum holdings). Depending on the timescales for availability of different frequency bands and award design, it may be appropriate to have a single multi-band award or several separate ones. |
| 6. | **Award implementation.** The final step is the actual award. This will normally be underpinned by documentation that provides all the necessary details of the award process, spectrum on offer, licence obligations and other essential information for potential licensees. |

8 GSMA. Roadmaps for awarding 5G spectrum in the APAC region. April 2022. www.gsma.com/spectrum/resources/5g-spectrum-in-the-apac-region-roadmaps-for-success/

9 The key frequency bands to prioritise for 5G are outlined in section 1.3.

10 GSMA. Maximising the socio-economic value of spectrum. A best practice guide for the cost-benefit analysis of 5G spectrum assignment. January 2022. www.gsma.com/spectrum/wp-content/uploads/2022/01/mobile-spectrum-maximising-socio-economic-value.pdf

11 For the GSMA auction best practice position see www.gsma.com/spectrum/wp-content/uploads/2021/09/Auction-Best-Practice.pdf

# 1.3 The key role of mid-band spectrum for 5G

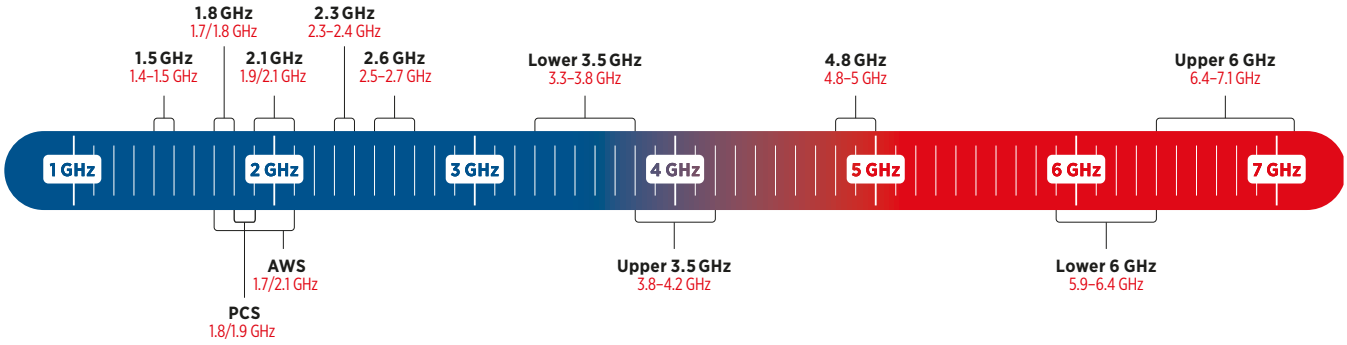
To get the most out of 5G, spectrum is needed across low-, mid- and high-bands to deliver widespread coverage and support all use cases. In the coming years, growth in user take-up, new 5G applications, and the availability of new devices and applications (e.g. new smartphones, embedded OEM V2X devices, sensors, autonomous vehicles, video, IoT, VR/AR) will further drive demand for mobile data services.

Mid-band spectrum, which lie in the 1-7 GHz range, is necessary for the increases in bandwidth and capacity that 5G applications will require. New mobile broadband use cases such as enhanced mobile broadband (eMBB), fixed wireless access (FWA), IoT and Industry 4.0 depend on mid-band spectrum. These use cases will grow the impact of mobile services on society and economies.

Mid-band spectrum resources include both lower mid-bands (i.e. 1500 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2600 MHz) and upper mid-bands (i.e. 3.3–4.2 GHz, 4.5–5.0 GHz and 5.925–7.125 GHz). To deliver a 5G service that is consistent with the ITU's IMT-2020 requirements,[12] each operator will need access to 80-100 MHz of contiguous mid-band spectrum.

FIGURE 5

MID-BAND SPECTRUM OPTIONS




It is estimated that operators will need around 2 GHz of mid-band spectrum during this decade.[13] The latest research by GSMA on the socio-economic benefits of mid-band 5G services indicate that mid-band 5G spectrum will drive an increase of more than $610 billion in global GDP in 2030, accounting for almost 65% of the overall socio-economic value generated by 5G.[14] In Southeast Asia, 5G mid band services will generate addition GDP contribution of $35 billion (which represents 0.64% of GDP).

12 User experience of 100 Mbps DL, 50 Mbps UL rates.

13 www.gsma.com/spectrum/resources/5g-mid-band-spectrum-needs-vision-2030/

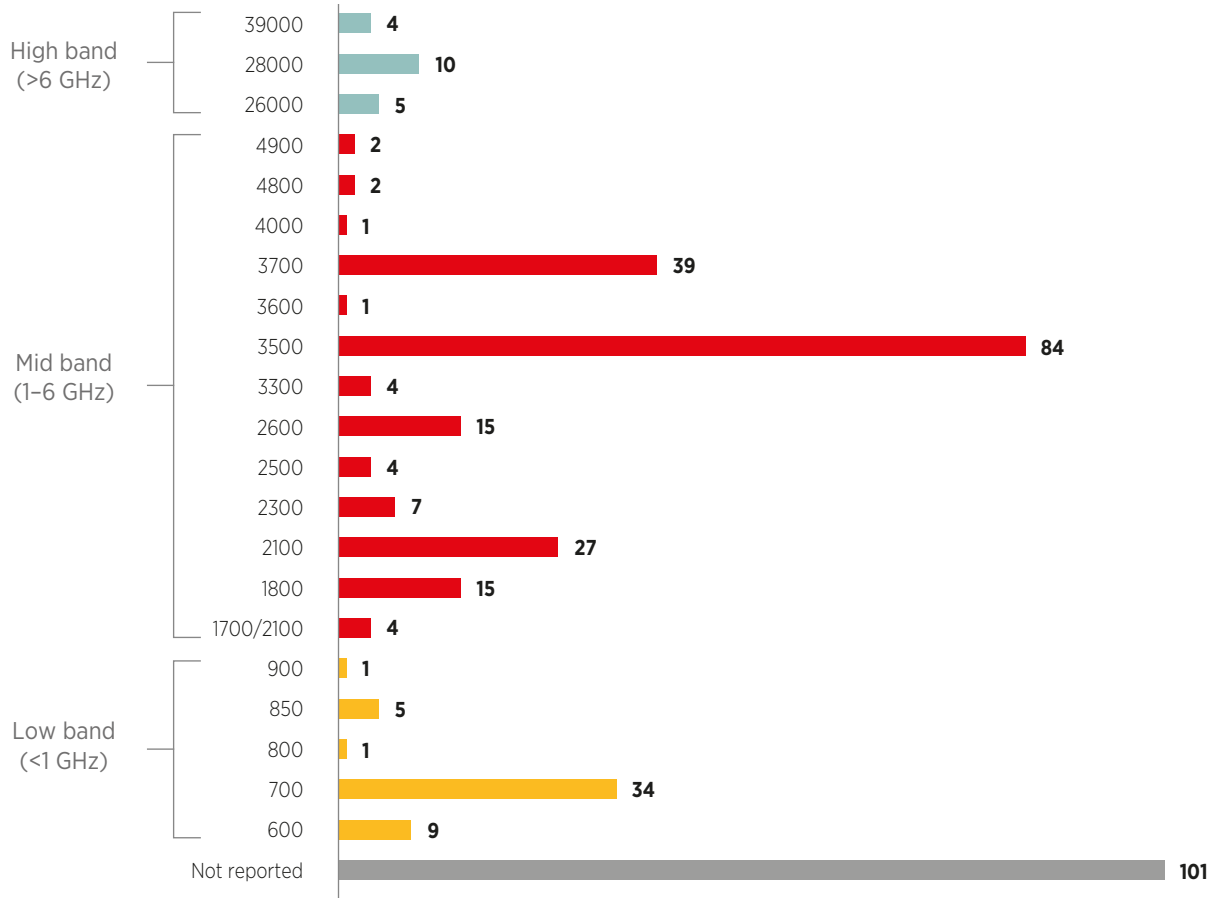
14 GSMA. The Socio-Economic Benefits of Mid-Band 5G Services. February 2022.

### 1.3.1 3.5 GHz as the springboard for 5G

The 3.5 GHz band (3.3-3.8 GHz), which is globally harmonised for 5G, has been the basis for the first phase of 5G rollouts in many markets. To date 3.5 GHz accounts for the majority of 5G network launches,[15] driving the wider ecosystem, device diversity and competition. It has been deployed for eMBB enabling faster data speeds and greater capacity required in urban, densely populated areas, as well as for FWA in sub-urban and rural areas where the availability of fixed broadband tends to be more limited.

FIGURE 6

5G NETWORK LAUNCHES BY SPECTRUM FREQUENCY (UP TO Q1 2022)




Source: GSMA Intelligence

In markets where 5G spectrum has yet to be assigned, operators are using Dynamic Spectrum Sharing (DSS) technology and refarming existing spectrum bands, mainly in 1800, 2100 and 2600 MHz, to support 5G deployments. While these approaches enables more flexible and efficient use of spectrum, further mid-band spectrum supply will be needed to sustain 5G developments for the rest of the 2020s and beyond.

15 Excluding frequencies not reported.

# 2. Progress on Vietnam's spectrum plan for 5G

## 2.1 Spectrum Management in Vietnam

The Ministry of Information and Communication (MIC) is the ministry of the Government of Vietnam responsible for broader telecommunications policy including frequency spectrum management. The MIC has a number of important specialist authorities especially the Viet Nam Telecommunications Authority (VNTA) and Authority of Radio Frequency Management (ARFM). Both operate under its auspices. The most important legislation which applies to the telecommunications, online content distribution, and internet sectors are:

- *Law on Telecommunications* No. 41/2009/QH12 adopted by the National Assembly of Vietnam on 23 November 2009 ("Law on Telecommunications"); and
- *Law on Radio Frequency* No. 42/2009/QH12 adopted by the National Assembly of Vietnam on 23 November 2009 ("Law on Radio Frequency").

Amendments to modernise both laws are currently being contemplated within the MIC/VNTA/ARFM. In November 2021, the MIC released a consultation draft of the proposed amendments to the Law on Radio Frequency. Amendments are proposed to a number of provisions including the method of licence assignment, details on the spectrum auctioning process and licence conditions .[16]

As Vietnam is primarily a civil law country there are also a considerable number of subsidiary legislations in the form of decrees and circulars which implement the key legislation above and other relevant laws.

16 Refer to www.cuctanso.vn/content/tintuc/Lists/News/FW.aspx?ItemID=2981

Vietnam issued Resolution No. 52/NQ-TW dated September 27, 2019 on a number of guidelines and policies to actively participate in the Fourth Industrial Revolution (IR4.0) , including a target that 5G mobile services cover the whole country by 2030. In addition, there is Directive No. 01/CT-BTTTT issued by the Minister of Information and Communications on 3 January 2020. On the key tasks of the telecommunications sector in 2020, it was stated that "the 5G mobile communication network in Vietnam is commercially deployed at the same pace with developed countries in the world".[17]

To facilitate these objectives and targets, the MIC and licensed operators have taken a phased approach to move towards commercialisation of 5G in Vietnam.

On 20 August 2020, the MIC issued two Circulars (No. 18/2020/TT-BTTTT and No. 19/2020/TT-BTTTT) planning the 2.3 GHz, 2.6 GHz and 26 GHz bands for 5G. On 8 September 2020, the Minister of Information and Communications signed and issued Decision No. 1529/QD-BTTTT on the set of technical criteria for terminal equipment, base stations and quality of 5G network services to guide the development of standards in preparation for the commercialisation of 5G in Vietnam.

In November 2020, operators were also licensed by the MIC to deploy commercial 5G trials to prepare for the official commercialisation of 5G in the near future. Concurrently the ARFM and MIC have managed securing the digital dividend in the 700 MHz band following the analogue to digital television transition and refarming of the band.[18]

As at late 2021, the MIC has been considering several new bands for 5G deployment in Vietnam (see Figure 7 below). This is critical as 5G requires the allocation of larger contiguous blocks of spectrum compared to previous generations.[19] However, IMT spectrum assignments in Vietnam have not kept pace with global and regional harmonisation (e.g. ITU WRCs and/or other ASEAN members). The total quantum of mobile spectrum available for assignment is considerably below exemplar markets in the Asia Pacific and the rest of the world.

It is therefore very positive that the ARFM/MIC has already identified a number of bands for 5G, including part of the 700 MHz band and the entirety of 2.3, 2.6 and 26 GHz bands. Final decisions are yet to be made on the release of 3.5 and 4.8 GHz spectrum. These new bands are addition to the existing IMT bands at 850 MHz, 900 MHz, 1800 MHz and 2100 MHz. The ARFM/MIC has proposed a plan to begin switching off legacy 2G and 3G networks from 2022 onwards which will allow operators to refarm existing holdings for deploy 4G/5G services.[20]

FIGURE 7

BANDS IDENTIFIED TO BE RELEASED FOR 5G IN VIETNAM

| Band | Frequency range | Band-planning | Spectrum Review | Spectrum Cleared |
|---|---|---|---|---|
| 700 MHz | 703-733 MHz / 758-788 MHz[21] | Cleared | 60 MHz | 60 MHz |
| 1.5 GHz | 1427-1518 MHz | Considering | 91 MHz | |
| 2.3 GHz | 2300-2400 MHz | Cleared | 100 MHz | 100 MHz |
| 2.6 GHz | 2500-2690 MHz | Cleared | 190 MHz | 190 MHz |
| 3.8 GHz | 3600-4000 MHz | Consulted | 400 MHz | |
| 4.8 GHz | 4800-5000 MHz | Consulted | 200 MHz | |
| 26 GHz | 24.25-27.5 GHz | Cleared | 3,250 MHz | 3,250 MHz |
| All bands | | | 4,291 MHz | 3,600 MHz |

Source: APT, September 2021,[22] page 15 with amendments from WPC, March 2022.

17 Refer to www.cuctanso.vn/content/tintuc/Lists/News/FW.aspx?ItemID=2903

18 Refer to www.cuctanso.vn/content/tintuc/Lists/News/FW.aspx?ItemID=2814

19 Refer to www.gsma.com/spectrum/5g-spectrum-guide/

20 Refer to https://vietnamnet.vn/en/feature/mic-wants-to-stop-2g-3g-in-2022-promote-smartphone-use-749100.html.

21 While 2 x 45 MHz of spectrum is available, the other 2 x 15 MHz is being reserved for Government usage.

22 APT, Report on Current status and future plan of implementation and deployment of IMT-2020 (5G) in Asia-Pacific region, No. APT/AWG/REP-111, September 2021

While none of the additional IMT bands identified has yet been released (these reasons are explored further in section 3 of this report), the Government announced in early March 2022, that the 2.3 GHz band would be released in 2022 and Vietnamese mobile operators would receive their commercial 5G licences. Further, later this year, 5G networks will offer speeds of over 100Mbit/s and cover industrial parks, export processing zones, schools, research zones, provinces and cities with high demand. By 2025 it is expected that 100 percent of the population will have 5G mobile coverage and all adult users using smartphones.[23] There are also Government proposals for a public safety broadband network which will utilise 700 MHz band spectrum and potentially other IMT bands.

Given the rapid growth in mobile traffic volumes in Vietnam, operators will struggle to provide compelling, high quality 5G services and meet the above targets without access to additional spectrum (see Figure 8 for the existing IMT assignments).[24]

FIGURE 8

CURRENT VIETNAM MOBILE OPERATOR IMT SPECTRUM ASSIGNMENTS

| MNO | 850/900 MHz | 1800 MHz | 2100 MHz | Total MHz |
|---|---|---|---|---|
| Viettel | 16.4 | 40 | 45 | 101.4 |
| Vinaphone | 16.8 | 40 | 30 | 86.8 |
| Mobifone | 16.4 | 40 | 30 | 86.4 |
| GTel | 0 | 30 | 0 | 30 |
| Vietnamobile | 20 | 0 | 15 | 35 |
| **TOTAL** | **69.6** | **150** | **120** | **339.6** |

Source: ARFM, 2019

23 Refer to https://ictvietnam.vn/giai-phap-hien-dai-hoa-ha-tang-vien-thong-de-dot-pha-phat-trien-kinh-te-so-20220309161039944.htm

24 It should also be noted, the current spectrum assignments to the smaller operators – Vietnamobile and Gtel – are inadequate for advanced wireless broadband services unless they acquire new spectrum or sign domestic roaming arrangements with larger operators, or there is some form of consolidation.

# 2.2 Launch of 5G services in Vietnam

The MIC plans to issue licenses for 5G wireless service in 2022 with coverage to start in Hanoi, Ho Chi Minh City and other urban areas. Commercial service was originally planned to begin in 2020,[25] but the COVID-19 pandemic and other factors delayed the network rollout.[26]

The nation's three largest mobile operators namely, Viettel, VNPT/Vinaphone and MobiFone, will offer 5G commercial services, having operated trial services in 16 provinces and cities since mid-2019 (see Figure 9 below).[27] In addition to major cities, service initially will be offered in high-demand areas such as industrial parks.

FIGURE 9

OUTCOMES OF VIETNAMESE 5G TRIALS

**Key major information of Vietnamese trials are:**

- Network architecture: 5G NSA (option 3x), EN-DC with existing 4G-LTE
- BTS: DRAN/CRAN with massiveMIMO 64T64R (some with Vietnamese intellectual property)[28]
- Spectrum: 100 MHz 5G TDD in mid-band, with anchor of 20 MHz 4G FDD in 1800 MHz
- Transportation network: Site router 100 Gbps (some with Vietnamese intellectual property)
- TDD synchronization: GNSS synchronization signal and 1588v2 hot-standby
- Use case: Video 4K/Basic AR/VR, Video 8K/Immersive AR/VR, mobile internet access, fixed wireless access

**Results of trials in terms of 5G service:**

- Peak downlink data rate: 1200 Mbps
- Average downlink data rate: 500 Mbps
- Average uplink data rate: 67 Mbps
- User experienced data rate: 300 Mbps at 10% point of CDF; 100 Mbps at 0% point of CDF of user throughput.

Source: APT, September 2021, page 24

It is understood that Vietnamese mobile operators plan to deploy 5G Non-Standalone (NSA) network in the first phase and then deploy 5G Standalone (SA) in second phase when the device ecosystem and demand for massive machine-type communications (mMTC) and ultra-reliable, low latency communications (URLLC) services are more developed. With the MIC facilitating the process, Vietnam's major mobile operators have agreed to share 5G infrastructure in an effort to be more efficient with their capital investment and in order to facilitate the early implementation of nationwide 5G.[29]

Viettel, Vietnam's market leader, is also developing its own 5G equipment and network, and may utilise them as part of its deployment.[30] Thus, the assignment of spectrum is the final step to be taken to enable the launch of 5G services in Vietnam.

25 Refer to https://opengovasia.com/vietnam-approves-5g-trials-for-countrys-second-largest-telco/

26 Refer to https://asia.nikkei.com/Spotlight/5G-networks/Vietnam-to-issue-5G-licenses-in-2022-after-pandemic-delays

27 Refer to https://opengovasia.com/vietnam-ready-for-5g-commercialisation/ . Originally Viettel was permitted to test a commercial 5G network in Hanoi utilising up to 140 basestations, including the 2,500 – 2,600 MHz, 3,700 – 3,800 MHz, and 27,100 – 27,500 MHz bands for 5G commercial testing. MobiFone, meanwhile, was licensed to test at the 2,600 MHz bands with no more than 50 stations in Ho Chi Minh City. Refer to https://techwireasia.com/2020/12/vietnam-is-ahead-of-the-game-with-commercial-5g/

28 Viettel is considered the 6th global gNodeB for 5G NR equipment supplier along with Ericsson, Nokia , Huawei, Samsung and ZTE.

29 Ibid, page 31. See also www.mobileworldlive.com/asia/asia-news/vietnam-operators-agree-5g-sharing-pact

30 Ibid

# 3. Key issues and challenges to secure sufficient spectrum for 5G services in Vietnam

Timely access to the bands identified by ARFM/MIC for 5G, particularly in the mid-band range, is essential for 5G development in Vietnam. The key challenges to securing spectrum access for 5G are both financial and technical in nature. These are explored further below.

## 3.1 Valuing IMT spectrum and award design

Firstly, Vietnam has been working to devise an agreed valuation approach and award mechanism for key IMT spectrum despite extensive discussions involving the MIC, the Ministry of Finance and other stakeholders including mobile operators.

While global best practice supports spectrum auctions where demand exceeds supply, the complication is that the three major mobile operators are all state owned. Therefore, an auction between related companies may not result in a fair and reasonable market clearing price. It is understood that this remains an issue and there are currently proposals for the MIC/ARFM to auction the 2.3 GHz band first (rather than having a multi-band auction including for example, 700 MHz, 2.3, 2.6 and 3.5 GHz band spectrum) in order to establish a local price benchmark for spectrum. However, this will result in a number of adverse outcomes including:

- **higher spectrum prices** as only one band (of 100 MHz) is auctioned when there is considerable market demand for more IMT spectrum in Vietnam. Auctioning only the 2.3 GHz band creates artificial spectrum scarcity as other key bands are currently vacant and available for assignment. Research by the GSMA has shown that high spectrum costs lead to negative consumer outcomes by restricting the financial ability for network investment, thereby slowing network rollout and leading to reduction in overall network quality[31];
- **band fragmentation** – if, for example, 3 mobile operators secure spectrum in the 2.3 GHz spectrum auction, the blocks sizes are likely to range from 20 to 40 MHz. While 4G use is possible over such small blocks, these bandwidths are sub-optimal for 5G deployment. Mobile operators will also end up having higher capital expenditure and operating expenditure to each use a smaller assignment of spectrum and it will make the use of DSS challenging; and
- **additional future costs** when the resulting band fragmentation have to be addressed. Vietnam has an opportunity to avoid such costs, in terms of foregone benefits and costs of reorganisation, a which are now the focus of study in many markets.

By proceeding with a single band auction, the benefits of assigning key IMT spectrum in larger contiguous blocks needed by 5G NR may not being captured by Vietnam, and is likely to lead to inflated spectrum prices to the detriment of operators, industry and consumers.

31 GSMA. The impact of spectrum prices on consumers. September 2019. www.gsma.com/spectrum/wp-content/uploads/2019/09/Impact-of-spectrum-prices-on-consumers.pdf

# 3.2 Addressing interference and synchronisation issues

The second issue is possible harmful interference in relation to domestic satellite services including services delivered by Vinasat-1 and Vinasat-2.[32] Vietnam is currently examining the release of 360 MHz of 3.5 GHz spectrum for 5G use from 3.6 to 3.96 GHz. Both below (from 3.4-3.6 GHz) and above (from 4.0-4.2 GHz) this IMT spectrum allocation, satellite and radar services are proposed.

While 40 MHz guard bands from 3.56-3.6 GHz and 3.96-4.0 GHz have been proposed, there remains other spectrum management challenges to be addressed. These include interference management between IMT and telemetry, tracking, and command (TT&C)[33] and Land Earth Stations (LES) of Inmarsat which are unable to be moved from the proposed 5G allocations. Frequency coordination and exclusion zones with respect to TT&C and LES stations will be required.[34] Further, TVRO services will either need to be moved to other frequencies or other technical measures will be required to address the possible interference issues.[35]

The third issue is possible cross-border interference, in relation to the 2.6 and 3.5 GHz bands. Vietnam has three neighbouring countries namely Cambodia, China and Lao PDR. Specifically, in relation to:

- the 2.6 GHz band, Vietnam is using TDD n41 for 5G. This is similar to China (China Mobile is using its 2.6 GHz spectrum for 5G and 4G services) but Cambodia and Lao PDR utilise the hybrid FDD/TDD configuration (b7/b38) for 4G services in this band. This raises possible co-channel interference between FDD and TDD services and synchronisation issues between TDD networks;[36] and
- the 3.5 GHz band, Chinese and Lao PDR satellites utilise C-Band spectrum from 3.6 GHz while Vietnam currently has satellite and radar services in the C-band band from 3.4 GHz to 3.56 GHz. As such, 5G spectrum assignments in this band will require border frequency co-ordination to determine the appropriate 5G signal thresholds.

32 Vinasat-1 was launched in 2008 and is due to be retired in 2023 but may be extended by 5 years. Vinsat-2 was launched in 2012 and has an expected life of 21.3 years. Both satellites have Ku and C-band transponders. Vinasat-3 is currently in planning. Refer to https://vneconomy.vn/len-ke-hoach-se-phong-ve-tinh-thay-the-vinasat-1-va-vinasat-2.htm

33 There are two TT&C sites in Vietnam: one in area surrounding Hanoi, and the other near Ho Chi Minh City.

34 Refer to www.cuctanso.vn/content/tintuc/Lists/News/FW.aspx?ItemID=2903

35 Refer to GSMA, Roadmap for C-Band Spectrum in ASEAN, August 2019, pages 42/43

36 Refer to www.cuctanso.vn/content/tintuc/Lists/News/FW.aspx?ItemID=2903

# 4. Recommended action plan to address key issues and challenges in Vietnam

## 4.1 Near term actions

While Vietnam has taken significant steps to make IMT spectrum available, including clearing the 700 MHz band and making available for release the 2.3, 2.6 and 26 GHz bands, there continues to be obstacles and material delays to the timely release of large contiguous blocks of IMT spectrum in Vietnam.

There is an urgent need for more spectrum supply to support the development of the country's digital economy and meet the Government's policy objectives in relation to 5G services. The following steps are recommended by the GSMA in order to overcome these challenges:

### 4.1.1 Awarding identified 5G spectrum

Policy makers in advanced digital economies respond swiftly to new mobile spectrum demand and distribute as much spectrum as possible as soon as operators have a business case to use it. A sufficient amount of spectrum, in the right frequency bands, is essential to deliver the affordable, high quality mobile broadband services that consumers want, and businesses need to be competitive on the global stage.

The ARFM/MIC has identified a series of bands for mobile use in Vietnam. Several of them have already been cleared and are ready for assignment as highlighted in Section 2.1 (Figure 7). It is thus recommended that Vietnam considers a multi-band award comprising the 700 MHz, 2.3 GHz, 2.6 GHz and 26 GHz bands, instead of auctioning bands in sequence. This would help to alleviate shortages in spectrum supply and accelerate 5G rollout in Vietnam.

Holding back spectrum when there is demand for it and failing to release future plans for spectrum availability creates a challenge in many countries – especially developing markets. This artificial spectrum scarcity also inflates spectrum prices and leads to fragmented holdings as operators struggle to secure the spectrum they need and has been strongly linked to slower mobile broadband speeds, slower network rollouts and worse coverage.

In addition, mobile operators need assurances that a sufficient amount of spectrum in the right mixture of bands will be made available over a long period to give them the certainty needed to make long-term heavy investment in national mobile networks.

It is thus recommended that ARFM/MIC publish, and regularly update, a spectrum roadmap for at least the following five years detailing exactly what bands will be made available, and when, to meet future demand. This will give operators confidence that policy makers support future mobile broadband growth, and encourage sustainable, long-term investment.[37]

37 GSMA. Roadmaps for awarding 5G spectrum in the APAC region. March 2022.

### 4.1.2 Valuation and pricing

Spectrum is a valuable state asset and governments have the option to use it to raise revenues to fund vital state activities. However, the primary goal in all awards should be to encourage the most efficient use of spectrum through investment in widespread, high quality networks.

Governments and regulators that seek to maximise the revenues from auctions tend to rely on ambitious predictions of the market value of spectrum. However, factors impacting spectrum value vary significantly between markets and there is significant scope for error. These factors include the general economy, the mobile market, competition, national topography and the broader state of spectrum availability. In the Vietnam context, the unique ownership issues of the major operators also need to be taken in account.

While benchmarking (e.g. final prices in comparable markets) are usually considered when assessing the value of spectrum, in practice even small differences in local conditions between countries can make these comparisons wildly inaccurate. There can also be a temptation to choose the highest benchmarks and can then lead to negative outcomes for consumers and the digital economy.

Spectrum valuations should be based on long-term business cases, involving assumptions about network deployment, and technical and commercial trends. Many of these assumptions are uncertain and subject to a variety of external risks, so valuations are typically subject to a wide margin of error. As such, reserve prices for upcoming auction(s) in Vietnam must be set sufficiently below any prediction of market value, in order to allow the auction to function through multiple ascending rounds and fulfil its purpose of determining the market price through competitive bidding.  The risks associated with over-estimating spectrum value – and setting reserve prices or fees that too high – are much more damaging than underestimating the value.

The rising cost of spectrum is unsustainable and poses a major threat to the future development of mobile services. Both the cost of spectrum and the amount that operators require to meet user demand are rising, while at the same time, operator revenues per MHz of spectrum used is falling. Unless this changes it will become increasingly difficult, and ultimately impossible, to fund sufficient investment in future mobile spectrum and networks.

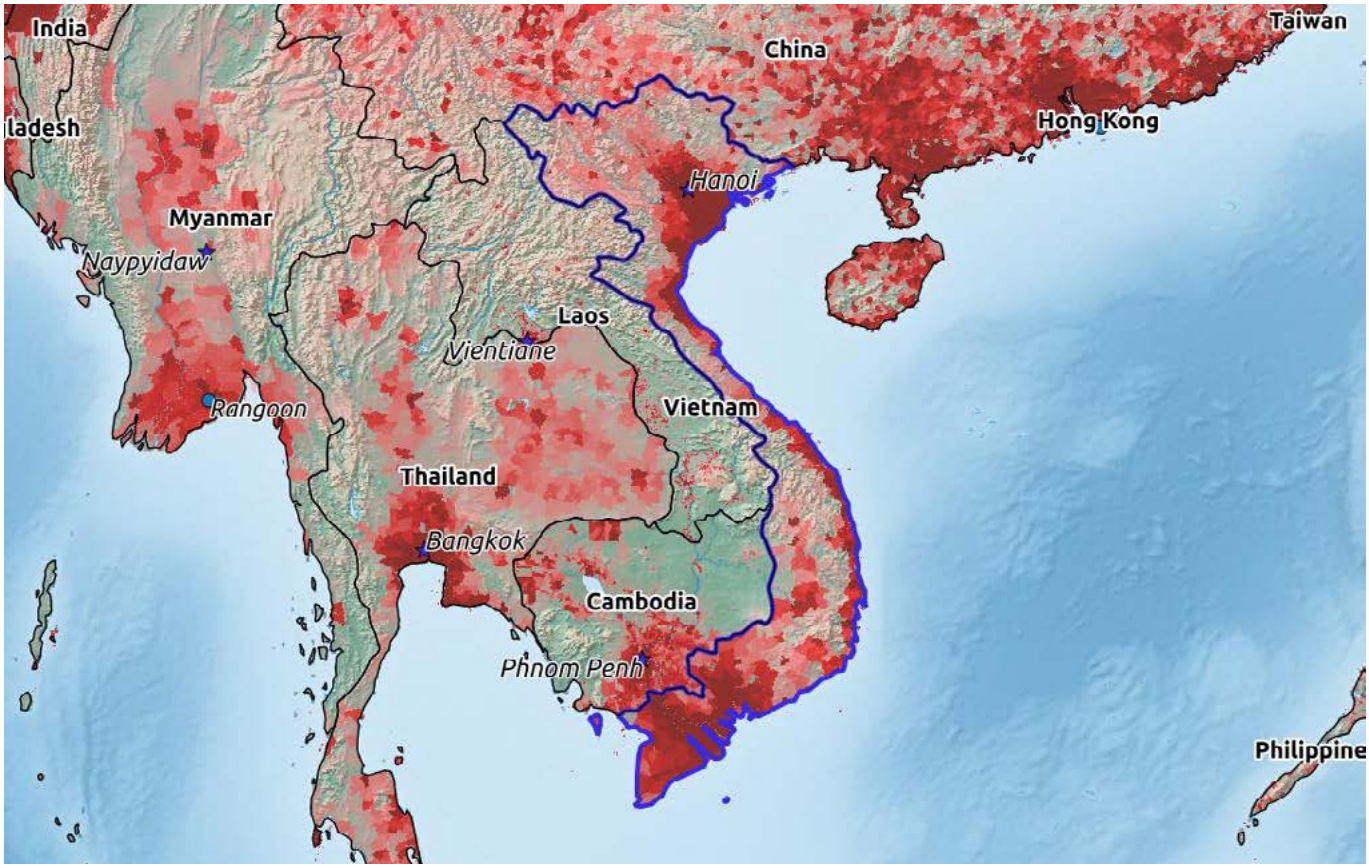
### 4.1.3 Cross-border co-ordination

Geography and population density mean that cross-border interference issues in relation to the 2.6 and 3.5 GHz bands for Vietnam are more likely to exist with Cambodia than any of its other neighbours. The Annamese mountain range[38] known in Vietnamese as Dãy Truong Son, extends approximately 1,100 km through Laos, Vietnam, and northeast Cambodia. Likewise, the border between Vietnam and China to the north is predominantly through isolated mountainous areas.

These geographic features combined with relatively lower population densities along those mountainous borders (as shown in Figure 10 below) mean that the Mekong delta region in southern Vietnam is the most material challenge from a cross-border spectrum management perspective.

FIGURE 10

POPULATION DENSITY OF VIETNAM AND ITS NEIGHBOURS




Source: www.bluemarblecitizen.com/world-population/Vietnam

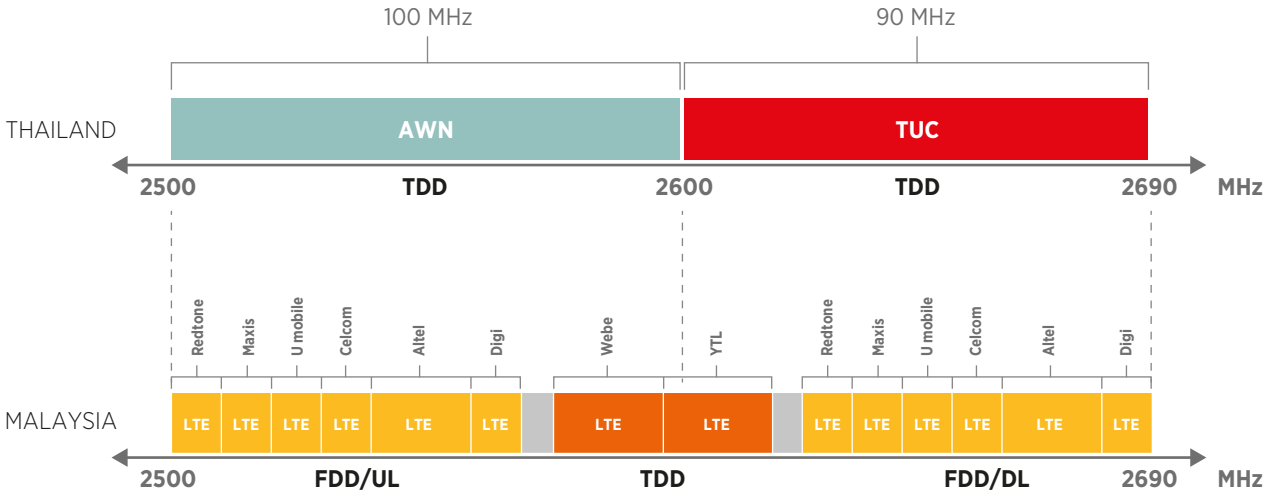
The situation between Malaysia and Thailand is similar to that of Vietnam and Cambodia. Thus, a suggested approach is for Vietnam to adopt the co-ordination parameters in relation to the 2.6 GHz band (see Figure 11) which have been agreed between Malaysia and Thailand. Similar approaches could be adopted in relation to the 2.3 and 3.5 GHz bands.[39]

38 Refer to www.britannica.com/place/Annamese-Cordillera

39 Alternatively, when operators deploy TDD 2.6 GHz (n41) and FDD 2.6 GHz (n7), the co-ordination distance of TDD and FDD sites should be less than 1km with back to back transit and signal level limited less than -110dBm. Ideally, Vietnam and Cambodia should synchronise their TDD 2.6 GHz networks; otherwise 10 km isolation distance is likely to be required.

FIGURE 11

MALAYSIA-THAILAND AGREED CROSS-BORDER CO-ORDINATION APPROACHES




| Frequency band (GHz) | Technology | Co-ordination parameters | |
|---|---|---|---|
| | | Signal level (dBm) | Defined distance from the border (km) |
| 2.6 | LTE/5G TDD – LTE (FDD) | -120 dBm/5 MHz | 1 km |
| | LTE/5G TDD – LTE (TDD) | ECC Rec (11)05/ ECC Rec (14)04 | 1 km |

Source: JTC Thailand-Malaysia 17 May 2021

Vietnam – led by the ARFM/MIC - along with its neighbouring countries have undertaken various information exchanges on frequency planning and 5G deployment plans, joint testing of interference situations and assessing solutions to prevent harmful interference. It is important to continue these discussions to ensure that all operators and relevant stakeholders have the requisite information for the planning of their 5G deployment.

### 4.1.4 Optimal approaches to TDD synchronisation

For Vietnam, 5G will see the introduction of TDD networks for the first time. All TDD networks, whether they are LTE/4G or 5G networks, operating in the same frequency range and within the same geographic area have to be synchronised. Synchronisation is the best way ensure efficient spectrum usage and to avoid harmful interference, which has a major impact on network performance as well as coverage.

With TDD systems (including systems in the 2.3, 2.6 and 3.5 GHz band) there are two levels of synchronisation which are needed, namely inter-operator synchronisation within a country and synchronisation across borders.

For clock synchronisation, there are two options for the MNOs:

- Type 1: distributed synchronisation scheme based on satellite (i.e. GPS) which is used in Japan and other countries; and
- Type 2: centralised synchronisation scheme based on IEEE 1588V2 system (which is used in Europe).

It is also possible to use a combination of methods in order to improve reliability. If the MNOs use the same frame structure, then the frame structure is synchronised.

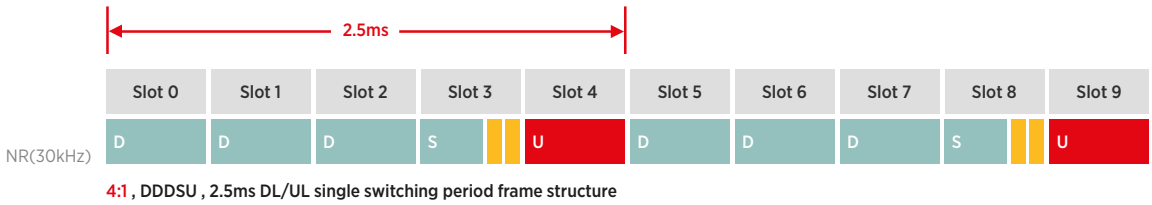
To ensure coexistence at a national level, it is strongly recommended that all 5G networks operating within the 3.5 GHz range use the same synchronisation parameters. The choice of synchronisation parameters is influenced by the required network performance, whether there are incumbent users in the band and the approach of neighbouring countries.[40]

The amount of observed traffic on 4G and 5G networks between the user device and the base station (the uplink) and vice versa (the downlink) is often asymmetrical. Thus, the typical approach is to agree to 4:1 or 3:1 (downlink:uplink) profile. The recommended national frame structure for Vietnam in the future for the 3.5 GHz (n77/78) band is set out in Figure 12 below. This frame structure could also be adopted by mobile operators for the 2.6 GHz band if all operators using the band were to use the spectrum for 5G services.

40 Refer to CEPT, ECC Report 296, National synchronization regulatory framework options in 3400-3800 MHz: a toolbox for coexistence of MFCNs in synchronised, unsynchronised and semi-synchronised operation in 3400-3800 MHz, 8 March 2019. Available at https://docdb.cept.org/download/1381 and GSMA, 5G TDD Synchronisation, Guidelines and Recommendations for the Coexistence of TDD Networks in the 3.5 GHz Range, April 2020. Available at www.gsma.com/spectrum/wp-content/uploads/2020/04/3.5-GHz-5G-TDD-Synchronisation.pdf

FIGURE 12

RECOMMENDED NATIONAL FRAME STRUCTURE FOR 3.5 GHz SPECTRUM




**4:1 , DDDSU , 2.5ms DL/UL single switching period frame structure**

Source: GSMA, Roadmap for C-Band Spectrum in ASEAN, August 2019, page 73

However, if there are existing 4G/LTE TDD networks in the 2.3 GHz and 2.6 GHz bands, a 5 ms frame structure of 8:2 (DDDDDDDSUU) should be adopted in order to be compatible with LTE TDD networks. This may be necessary in the early days of deployment and to address cross-border issues with Cambodia, China and Lao PDR.

### 4.1.5 Specific issues related to the 3.5 GHz band

As detailed above, there are significant challenges for Vietnam to make the 3.5 GHz band available for 5G services especially in the quantum needed to address the country's mid-band spectrum demand.

**a) Supply** –At least 360 MHz of 3.5 GHz spectrum in the 3.6 -4.0 GHz range should be made available by 2023. If this is not possible then consistent with the phased approaches in other markets, 200 MHz should be released first. Additional 3.5 GHz spectrum can be released in future subject to clearance and/or the implementation of adequate mitigation measures. If a phased approach is taken all the spectrum released during such a process should be subject to a condition that provides for refarming to create larger contiguous blocks of spectrum. The aim is for the largest three mobile operators to be secure up to 100 MHz of contiguous spectrum in this band for competition reasons.

**Clearance and/or mitigation measures** – To facilitate the release of 3.5 GHz there is a need to accelerate clearance or to introduce adequate mitigation measures to ensure coexistence with incumbent users in the band. In considering any guard bands, it is important to maximise spectral efficiency. In addition, other possible measures to ensure coexistence between IMT and FSS services include:[41]

- Earth station site shielding;
- Restriction zones to protect FSS;
- Improved FSS receivers;
- Addition of filters to FSS receivers;
- IMT base station location limits;
- Reduced base station transmitter power; and
- Detailed coordination.

41 GSMA, Roadmap for C-Band Spectrum in ASEAN, August 2019, page 5

**b) Phased introduction by geography** – Vietnam should consider whether to adopt a policy of geographical separation for VSAT in regional and rural areas while restricting the use of satellite direct to home (DTH) and TVRO in the 3.4-3.7 GHz spectrum in key urban areas, perhaps greater Hanoi, greater Ho Chi Minh City and/or the top 10 urban areas of the country.[42] This approach would allow 5G to be introduced in the 3.5 GHz in urban areas where demand is highest while permitting continued access to the band for FSS services in other parts of Vietnam where satellite access is more important. A decision on future use of 3.5 GHz in rural regions can be reviewed and taken at a later stage depending on changes in demand. ACMA in Australia adopted such an approach and as such has only cleared and then auctioned the 3.6 GHz (3575-3700 MHz) band in key urban areas.[43]

With European, North American, Japanese and Chinese markets allocating up to 400 MHz of 3.5 GHz band spectrum, if Vietnam was able to assign 360 MHz of this spectrum band for IMT purposes this would also be an exemplar approach.[44]

# 4.2 Future IMT spectrum needs in 2025-2030

It is also important to recognise that the 5G journey is only just starting – for the rest of the decade and beyond, 5G will become central to mobile connectivity and underpin Vietnam's digital transformation and economic growth. It is thus important for policymakers and regulators to also take a longer term view on spectrum supply especially in the mid-band frequencies.

By 2030, an average of 2 GHz of additional spectrum will be needed in mid-bands to deliver 5G services at a performance consistent with the ITU's IMT-2020 (5G) requirements.[45] At present, only around 270 MHz of mid-band spectrum has been assigned for IMT in Vietnam. Even with the release of the 2.3 GHz, 2.6 GHz and 3.5 GHz bands, the total supply of mid-band spectrum in Vietnam will still be significantly below the 2 GHz required for IMT by 2030.

Thus, the following actions are recommended for Vietnam:

- Assess options for expanding the supply of spectrum for 5G in the 2025-2030 timeframe, particularly in the mid-bands. These can include the release of unassigned spectrum in existing mid-bands and identification of new spectrum in potential future bands;
- Plan for the use of 4.8 GHz and upper 6 GHz (6425–7125 MHz)[46] to support further development of 5G;
- Gather information on usage trends for FSS in the 3.5 GHz band and assess possible options for the future introduction of 5G use in this range.

In this context the MIC/ARFM should consider the development of a long term Spectrum Roadmap covering at least till 2030. This roadmap which can be updated annually would incorporate ARFM's work on the release of different frequency bands, and information on evolving trends in technology and spectrum use, and harmonisation and standardisation activities.

This information will be critical for businesses to prepare investment plans, secure financing and develop arrangements for deploying particular technologies. In this way, Vietnam will be better positioned to support the longer term growth of 5G and to realise its full socio-economic benefits for all citizens and enterprises across all sectors of the economy.

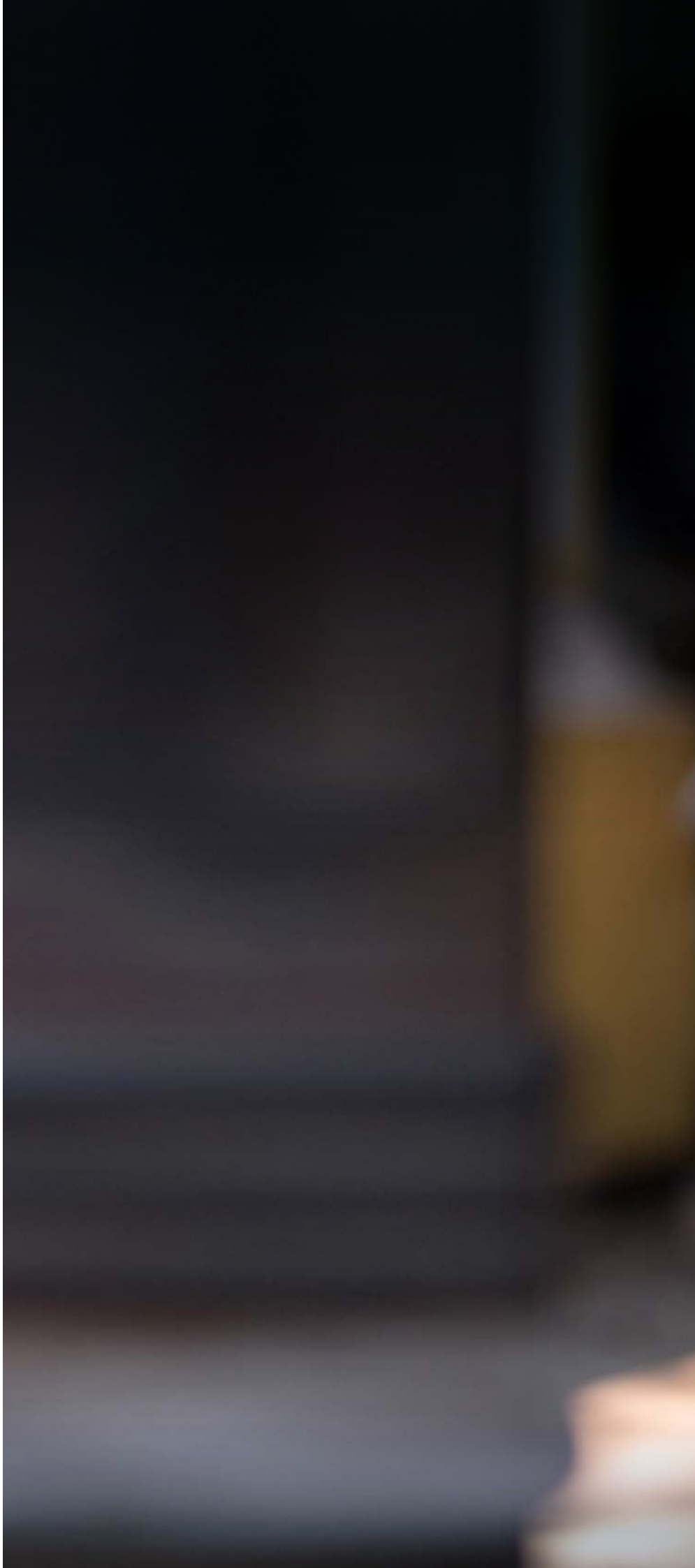
42 Including for example Hai Phong, Can Tho, Da Nang, etc.

43 Refer to ACMA, Future Use of the 1.5 GHz and 3.6 GHz bands, 2016

44 In another regional example, Australia is also trying to increase the current 225 MHz of 3.5 GHz band allocated for 5G/IMT services. Refer to www.acma.gov.au/consultations/2022-03/proposed-spectrum-re-allocation-declaration-34-ghz-and-37-ghz-bands

45 Coleago Consulting. Estimating the mid-band spectrum needs in the 2025-2030 time frame, July 2021. Available at https://www.gsma.com/spectrum/wp-content/uploads/2021/07/Estimating-Mid-Band-Spectrum-Needs.pdf

46 Considerations on the optimal approach for managing spectrum are currently at the forefront of the debate around the 6 GHz band. For example, GSMA Intelligence recently published a cost-benefit analysis for different authorisation models for the 6 GHz band in 24 countries. See GSMA Intelligence. The socioeconomic benefits of the 6 GHz band: considering licensed and unlicensed options. June 2022. Available at https://data.gsmaintelligence.com/research/research/research-2022/the-socioeconomic-benefits-of-the-6-ghz-band-considering-licensed-and-unlicensed-options



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