Public Inquiry (PI) on Allocation of Spectrum Bands for Mobile Broadband Service in Malaysia

Submission by:

U MOBILE SDN BHD

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1 Introduction

MCMC is directly determining Malaysia's mobile market structure due to its use of administrative assignment. In line with global trends, it should rationalise the market towards four mobile network operators (MNOs). Establishing such a market structure via a consistent spectrum allocation approach will enable sustainable competition with resulting benefits for consumers.

1.1 Markets globally are moving to having no more than four MNOs

Mobile markets globally are moving towards having no more than four MNOs to enable sustainable competition that is beneficial for consumers.

► *Across mobile markets globally, there are now typically no more than four MNOs*

There are various examples globally where the number of MNOs in a market has been rationalised to enable sustainable competition, as shown in Figure 1.1 below. There are now typically no more than four national MNOs per market. Taiwan is notably the last remaining developed market which still has five or more national MNOs and saw consolidation from six to five players in 2015.

Type	Country (year of rationalisation)
6 to 5 players	• Taiwan (2015)
5 to 4 players	• Hong Kong (2014) • UK (2010)
5 to 3 players	• Japan (2014/15) • Austria (2006/13) • Netherlands (2005/18) • USA (2013/19)
4 to 3 players	• Italy (2016) • Norway (2015) • Germany (2014) • Ireland (2014) • Portugal (2011) • Australia (2009)

Figure 1.1: Examples of mobile market rationalisation [Source: news articles, press releases]

► *Multiple regulators have assessed that market rationalisation can be beneficial for competition*

Various studies performed for or by regulators and regulatory bodies have revealed that market rationalisation where the number of MNOs has reduced from five to four has had either a positive or no significant effect on retail prices and investment, as shown in Figure 1.2 below.

Regulator / regulatory body	Impact on retail prices	Impact on investment
Centre on Regulation in Europe (CERRE)	No significant effect on prices	Increased investment following merger
Ofcom (UK)	No significant effect on prices	No significant effect on investment
European Commission	Decrease in prices following merger	Increased investment following merger

Figure 1.2: Impact of five-to-four mergers on prices and investment [Source: BEREC Report on Post-merger Market Developments[1]]

In addition, when evaluating proposed mergers, multiple regulatory authorities have stated that the potential market rationalisation is expected to have a positive impact on competition, with benefits to consumers in terms of improved service quality and accelerated deployment of next-generation services – including 5G. In particular, some regulators have stated that market rationalisation allows for the consolidation of spectrum holdings which can drive benefits in terms of enabling the latest generation of mobile technology to be deployed.

Examples of statements from leading regulators globally when evaluating proposed mobile mergers are shown below.

Impending four-to-three merger of T-Mobile and Sprint in the USA (2019)

Federal Communications Commission (FCC) Commissioner Brendan Carr announced his support for the proposed four-to-three merger of T-Mobile and Sprint, stating that "*the **proposed transaction will strengthen competition** in the U.S. wireless market and provide mobile and in-home broadband access to communities that demand better coverage and more choices*" while also facilitating "*an **accelerated buildout of fast, 5G services***".[2] The merger is expected to go through following approval from the Department of Justice in July 2019.

Completed five-to-four merger of T-Mobile and MetroPCS in the USA (2013)

In approving the five-to-four merger of T-Mobile and MetroPCS which was completed in 2013, the FCC stated that "*the **combination of spectrum assets as a result of this transaction** will allow Newco to actively put this spectrum to use in the **deployment of the latest generation mobile wireless services***" and that "*the transaction will **enhance the ability of Newco to compete** against the top three nationwide service providers by enabling it to expand the MetroPCS brand into new geographical markets, **improve service quality, and deploy a more robust network nationally***".[3]

1 See https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/8168-berec-report-on-post-merger-market-devel_0.pdf

2 Emphasis added. See https://docs.fcc.gov/public/attachments/DOC-357536A1.pdf

3 Emphasis added. See https://docs.fcc.gov/public/attachments/DA-13-384A1.pdf

Completed four-to-three merger of Vodafone and Hutchison in Australia (2009)	In approving the four-to-three merger of Vodafone and Hutchison which was completed in 2009, the Australian Competition and Consumer Commission (ACCC) stated that "*with the merger, the **merged entity has an increased incentive to make the investments in its network** given it will have the ability to spread its fixed costs over a larger subscriber base*" and that "*the ACCC considered that the proposed merger may have a **pro-competitive effect over the longer term***".[4]

► *Reducing spectrum fragmentation to enable larger spectrum blocks will enhance mobile data speeds and customer experience*

Market rationalisation reduces spectrum fragmentation, with positive effects for mobile users. In particular, 4G LTE technology involves the use of carriers of up to 20MHz in bandwidth, with larger carriers enabling faster data speeds. For example, while a 20MHz carrier can support theoretical 4G speeds of 150Mbps, a 10MHz carrier can only reach up to half of that value.[5]

As such, reducing spectrum fragmentation can enable improved end-user mobile speeds. Leading regulators have referred to this issue when allocating spectrum. For example, Ofcom has stated that "*(Regarding) the risk of inefficiently fragmenting the spectrum, our main concern is over the likelihood that each competitor can enjoy the benefits of holding large blocks of contiguous spectrum. In particular a 2×20MHz contiguous block allows LTE technology to deliver maximum end user speeds*".[6]

Having a market with no more than four MNOs will thus provide an appropriate balance between enabling higher mobile speeds for users while ensuring that there is a sufficient level of competition present.

1.2 A consistent allocation approach to enable four competitive MNOs in Malaysia

Given MCMC's direct role in determining the market structure via its use of administrative assignment, a consistent allocation approach should be used to enable four competitive MNOs in the market.

► *Having four MNOs in Malaysia is sufficient based on measures of market competitiveness and is in line with global practice.*

Malaysia currently has a highly competitive mobile market with four primary MNOs in U Mobile, Maxis, Digi and Celcom. To illustrate the level of market competitiveness, Figure 1.3 below compares Malaysia's Herfindahl–Hirschman Index (HHI) against those of countries that have undergone mobile market rationalisation via a reduction in the number of MNOs (from Figure 1.1). The HHI is a commonly accepted measure of market concentration, with a lower value representing a more competitive market and a higher value representing a concentrated market (e.g. a monopoly). The

4 Emphasis added. See https://www.accc.gov.au/system/files/public-registers/documents/D09%2B68099.pdf

5 Note that speeds are based on 2×2 MIMO.

6 See https://www.ofcom.org.uk/__data/assets/pdf_file/0023/47930/annex_6.pdf

comparison shows that regulators in other markets have approved consolidation even though the resulting market structure is less competitive than Malaysia's current structure with four primary MNOs.

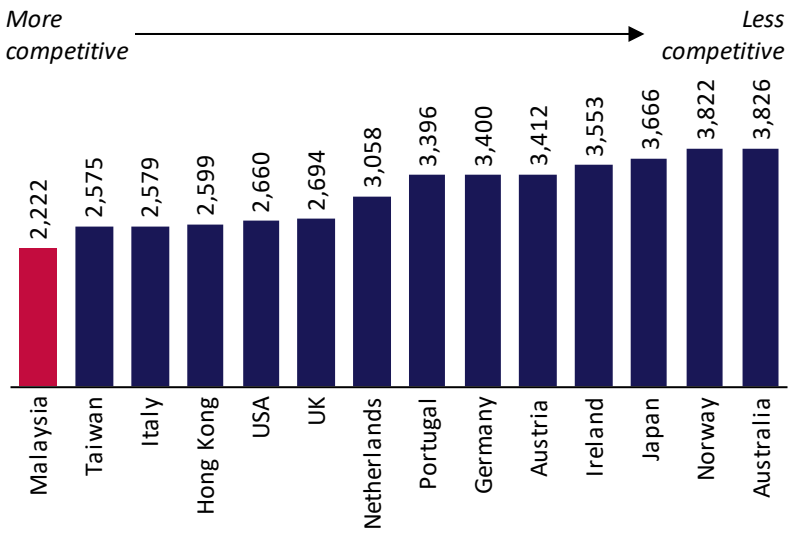


Figure 1.3: Comparison of Malaysia's HHI vs. markets that have undergone market rationalisation as of 1Q 2019 [Source: © GSMA Intelligence (2019)]

While MCMC has assigned spectrum to operators other than the four primary MNOs, these operators have made a limited contribution to competition in the market due to their small subscriber base. Given this, MCMC should rationalise the market towards having four MNOs – this is in line with global trends of having no more than four MNOs as discussed in Section 1.1. MCMC should therefore consolidate mobile spectrum for distribution between four primary MNOs to prevent inefficient spectrum fragmentation, while ensuring that each MNO has an equitable share to enable effective competition in the market.

► *A consistent approach should thus be adopted, involving: (i) the allocation of four licences per band; and (ii) the use of a comparative evaluation process.*

MCMC is directly determining the structure of Malaysia's mobile market through its use of administrative assignment to allocate spectrum and therefore has the responsibility of ensuring that the appropriate structure is in place to ensure effective competition. However, its proposed approach for spectrum allocation as stated in the Public Inquiry (PI) document is inconsistent between bands in terms of: (i) the number of licences per band; and (ii) the assignment approach, as shown in Figure 1.4 below.

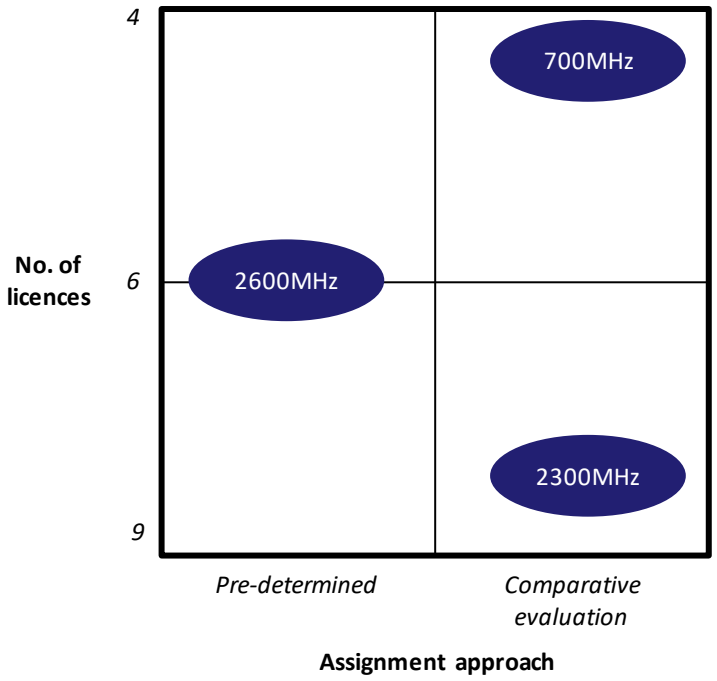


Figure 1.4: MCMC's proposed allocation approach

As discussed in the previous sub-section, MCMC should rationalise the market towards four MNOs to enable sustainable competition with benefits for consumers (e.g. in terms of pricing and mobile speeds). MCMC should perform this rationalisation by adopting a consistent allocation approach for the upcoming spectrum award across all bands, involving:

- allocation of four licences per band; and
- the use of a comparative evaluation process (i.e. a beauty contest) to award spectrum.

Such a consistent allocation approach will facilitate effective and sustainable competition in the mobile market that will be beneficial for consumers.

► *Regulatory measures or obligations can be used to prevent service disruption for consumers when rationalising the market*

While market rationalisation towards four MNOs would result in an exit of selected MNOs that currently operate in Malaysia, MCMC can impose regulatory measures or obligations to prevent service disruption for affected customers.

For example, such measures may include:

Wholesale obligations — MCMC can require successful licensees to offer wholesale capacity to MNOs which have lost their existing spectrum and are thus at risk of exiting the market. The affected MNOs may thus remain in the market by becoming an MVNO via wholesale agreements.

Migration obligations MCMC can require successful licensees to take on subscribers that are migrating away from MNOs exiting the market. A specified time frame may be defined to ensure successful migration before an MNO ceases operation.

1.3 Enabling an equitable share of spectrum based on data usage and existing spectrum

MCMC should seek to ensure an equitable allocation of spectrum across the three main spectrum blocks, while considering the average data usage of each MNO and its existing spectrum holdings.

► *MCMC should allocate three main blocks of spectrum to ensure optimal utilisation of spectrum based on their technical characteristics and also facilitate potential 5G deployment*

As stated in the PI document, MCMC is proposing to allocate spectrum in the 700MHz, 2300MHz and 2600MHz ranges. To facilitate their optimal use, U Mobile recommends that these spectrum bands should be grouped and allocated based on their technical characteristics as shown in Figure 1.5 below:

Block	Spectrum bands	Description
4G coverage block	700MHz	Low-frequency spectrum to drive 4G coverage
4G capacity block	2600MHz (FDD[7])	High-frequency 4G capacity spectrum
TDD[8] / potential 5G block	2300MHz (TDD) 2600MHz (TDD)	TDD spectrum with potential for 5G deployment

Figure 1.5: Overview of key spectrum blocks for upcoming allocation

In particular, allocating the 2300MHz (TDD) and 2600MHz (TDD) bands jointly as a 'TDD block' can facilitate 5G deployment given their similar technical characteristics and potential to be used for initial 5G deployments in Malaysia.

► *When assigning spectrum, MCMC should consider the impact of a Celcom–Digi merger on spectrum concentration*

Axiata Group Berhad and Telenor Group are considering a potential merger of their Asian assets, which could result in a merger of their respective Malaysian operating companies Celcom and Digi. As Celcom and Digi are two of the four primary MNOs in Malaysia and each has significant spectrum holdings, it is imperative for MCMC to consider the potential impact of such a merger during the upcoming award. Figure 1.6 below shows the post-merger spectrum allocations of Malaysia's MNOs based on their existing spectrum holdings. It is evident that a merged Celcom–Digi would have a dominant share of spectrum available in the market, which is likely to lead to anti-competitive effects – with a potential negative impact for consumers.

7 Frequency division duplex.

8 Time division duplex.

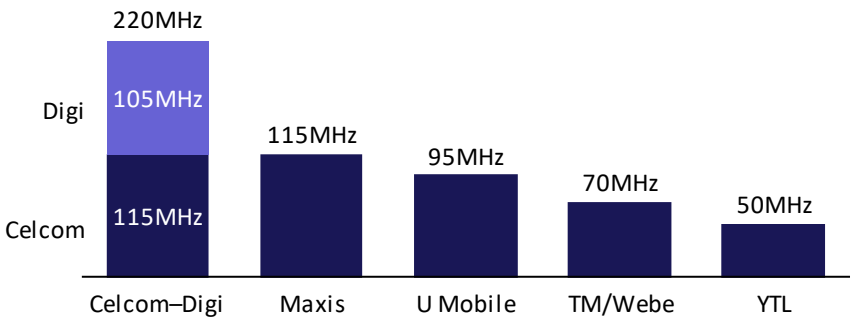


Figure 1.6: Post-merger spectrum allocation based on existing spectrum holdings

As such, MCMC must consider carefully the impact of a Celcom–Digi merger on spectrum concentration when assigning spectrum. Ensuring that there is an equitable spectrum allocation post-merger would facilitate effective competition in the market. To achieve this, MCMC must consider the need for regulatory remedies – such as requiring Celcom–Digi to return selected spectrum for redistribution to the other MNOs.

► *To ensure an equitable distribution of spectrum, MCMC should consider the average data usage by individual MNOs and their current spectrum holdings*

Larger amounts of spectrum enable increased network capacity and higher mobile speeds – as such, average data usage is a more appropriate measure than number of subscribers to use as the basis for allocating spectrum to each MNO. Figure 1.7 below shows the differences in average data usage for each MNO, with U Mobile having the highest average usage due to its innovative data-centric plans. Such differences in average data usage should be considered when allocating spectrum to ensure that each MNO has sufficient spectrum to support continued growth in data usage by its users.

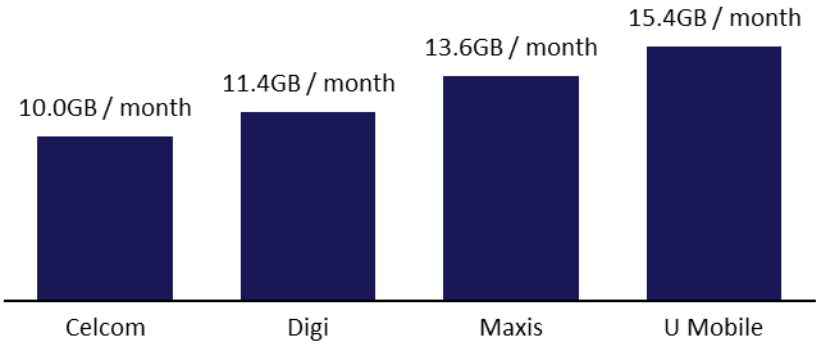


Figure 1.7: Average monthly data usage per subscriber amongst primary MNOs as of Q2 2019[9] [Source: MNOs' financial reports, U Mobile]

In addition, current spectrum holdings should be taken into account when allocating spectrum, with particular regard to the technical characteristics of each spectrum band. For example, enabling four competitive MNOs each with an equitable share of (i) sub-1GHz spectrum and (ii) high-frequency 4G capacity spectrum would help to facilitate effective competition by allowing all four MNOs to provide strong 4G coverage as well as 4G speeds. Similarly, providing an equitable share of TDD spectrum that

[9] Celcom's data usage is calculated based on its reported total data traffic of 264.6 million GB for 2Q 2019 and its average number of subscribers in that same period (reported as 8.95 million at the end of 1Q 2019 and 8.78 million at the end of 2Q 2019)

is suitable for 5G deployment across all four MNOs would facilitate the development of a competitive 5G market in Malaysia.

2 700MHz spectrum

MCMC should allocate four licences in the 700MHz band while accounting for current sub-1GHz holdings by considering the imposition of a 2×20MHz sub-1GHz spectrum cap.

2.1 Making four licences available in 700MHz

MCMC should make four licences of at least 2×10MHz available in the 700MHz band to facilitate the deployment of widespread 4G coverage in Malaysia.

► *700MHz is valuable for enabling widespread 4G coverage due to its strong propagation characteristics*

Spectrum in the 700MHz band has strong propagation characteristics that make it valuable for 4G coverage. As stated in the PI document, 700MHz "*is an ideal band to enhance coverage*".[10] In particular, the larger cell radius of 700MHz as compared to higher frequency bands facilitates the expansion of 4G coverage to rural areas where 4G deployment may otherwise be uneconomical due to the need to deploy significantly more sites.

Given the favourable propagation characteristics of 700MHz and the proposed National Fiberisation and Connectivity Plan ("NFCP") target of enabling 30Mbps average speeds across 98% of populated areas by 2023, MCMC should consider imposing regulatory obligations on 700MHz licensees to achieve this target. For example, an obligation requiring licensees to share their 700MHz networks in highly rural areas (e.g. the bottom 95% – 98% of populated areas by population density) would facilitate achievement of the 30Mbps target across Malaysia.

► *MCMC should thus provide four MNOs with at least 2×10MHz of 700MHz spectrum each to facilitate competition on 4G coverage*

As discussed in Section 1, MCMC should rationalise Malaysia's mobile market towards four MNOs to enable sustainable competition and associated benefits for consumers. In line with this rationalisation, 700MHz should be allocated in licence blocks of at least 2×10MHz to enable four competitive MNOs to each provide a 4G coverage base layer with good quality of service (QoS). An alternative approach of allocating minimum 2×5MHz licence block sizes would lead to fragmentation of the 700MHz band with a resulting negative impact on the MNOs' ability to deliver strong 4G coverage on a competitive basis.

[10] Source: Paragraph 3.1.2.1 of the PI document.

2.2 Imposition of sub-1GHz spectrum caps

MCMC should introduce a low-frequency spectrum cap of 2×20MHz across all sub-1GHz bands to enable each of four MNOs to provide strong 4G coverage.

► *Due to the importance of low-frequency spectrum in enabling widespread coverage, caps on sub-1GHz spectrum have been used in multiple markets to enable effective competition among MNOs*

Many telecoms regulators globally recognise the importance of sub-1GHz spectrum for enabling widespread mobile coverage and so have imposed spectrum caps across these bands – Figure 2.1 below provides examples of countries where such caps have been imposed.

Examples of countries with sub-1GHz spectrum caps	
Austria	Norway
France	Slovenia
Germany	Spain
Iceland	Switzerland
Ireland	Taiwan
Italy	UK

Figure 2.1: Examples of countries with sub-1GHz spectrum caps [Source: national regulatory authorities]

These spectrum caps serve to prevent an imbalanced concentration of valuable coverage spectrum within a specific MNO which could have anti-competitive effects if other MNOs are unable to match the coverage of the dominant sub-1GHz spectrum holder. This rationale has been mentioned by regulators when establishing sub-1GHz spectrum caps. For example:

Ofcom (UK) — "*National wholesalers without sub-1 GHz spectrum suffer a **material competitive disadvantage** because they are unable to develop their networks to offer services sufficiently similar to national wholesalers with sub-1 GHz spectrum*".[11]

ComReg (Ireland) — "*Without access to sub-1GHz spectrum, an operator wishing to provide wide-area coverage would need to deploy a larger number of radio sites than otherwise required. Additionally, such an operator's in-building coverage could be reduced as the lower spectrum bands propagate further into buildings [...] Therefore, highly **asymmetric distributions of sub-1GHz spectrum could be detrimental to competition downstream***".[12]

[11] Emphasis added. See https://www.ofcom.org.uk/__data/assets/pdf_file/0019/55630/combined-award.pdf

[12] Emphasis added. See https://www.comreg.ie/csv/downloads/ComReg1071.pdf

► *Sub-1GHz spectrum caps will allow MCMC to account for the potential to use existing 850/900MHz spectrum for 4G coverage, as seen in many markets globally*

While 'digital-dividend' spectrum in 700MHz (3GPP Band 28) and 800MHz (3GPP Band 20) has been released in many markets globally and plays a key role in facilitating widespread 4G coverage, other sub-1GHz spectrum such as 850MHz (3GPP Band 5) and 900MHz (3GPP Band 8) can be refarmed to use for 4G coverage and have similar propagation characteristics. Various MNOs worldwide have already deployed 4G using non-digital-dividend sub-1GHz bands, as shown below.

Use of 900MHz as only 4G coverage spectrum	The incumbent MNO in Taiwan, Chunghwa Telecom, decided not to acquire 700MHz spectrum at auction and instead elected to acquire only 900MHz spectrum at the same auction. It is now using 900MHz as its only sub-1GHz band for 4G coverage.
Use of 900MHz for 4G coverage in conjunction with digital-dividend spectrum	Various incumbent MNOs in Germany (Deutsche Telekom), Australia (Telstra), and Singapore (Singtel) have leveraged upon their larger sub-1GHz holdings relative to their competitors by refarming 900MHz for 4G use.[13] They have done this in conjunction with the digital-dividend spectrum (e.g. 700/800MHz) which they have also acquired for 4G use.

When allocating 700MHz, MCMC should thus impose sub-1GHz spectrum caps to reflect the potential to use 850/900MHz for 4G coverage. Such an approach would enable each MNO to have sufficient sub-1GHz spectrum for strong 4G coverage while preventing anti-competitive effects.

► *Imposing a 2×20MHz sub-1GHz spectrum cap will enable a more equitable distribution of spectrum for 4G coverage*

MCMC should impose a 2×20MHz sub-1GHz spectrum cap to provide for an equal distribution of spectrum from the 700MHz (2×40MHz in total), 850MHz (2×10MHz in total) and 900MHz (2×30MHz in total) bands across four MNOs. This will ensure that four MNOs each have the spectrum to offer a widespread and competitive 4G coverage base layer with good QoS.

A 2×20MHz cap will allow MCMC to account for differences in existing sub-1GHz spectrum holdings when allocating 700MHz spectrum. Figure 2.2 below shows the current sub-1GHz spectrum holdings of Malaysia's MNOs and reveals the differences between MNOs which must be considered as part of the 700MHz allocation. A 2×20MHz sub-1GHz cap would address the potential of MNOs with larger sub-1GHz allocations (i.e. 2×10MHz) to use such spectrum for 4G coverage, in line with the use of 900MHz for 4G globally (as discussed in the previous subsection). In particular, TM/Webe is already using all of its 2×10MHz of 850MHz spectrum for 4G. In addition, both 850MHz and 900MHz spectrum can be carrier aggregated with 700MHz for 4G based on 3GPP specifications and therefore should be considered in conjunction with 700MHz as 4G coverage spectrum.

[13] Note: The larger sub-1GHz holdings includes both 850MHz and 900MHz spectrum.

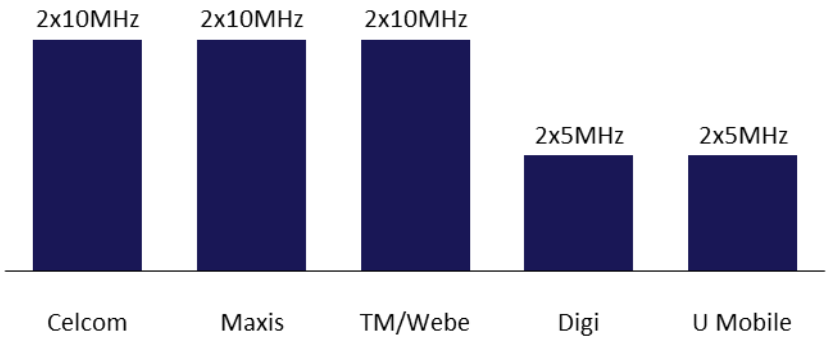


Figure 2.2: Current sub-1GHz (850/900MHz) holdings in Malaysia by MNO

U Mobile understands that an additional 2×5MHz of 700MHz may be made available at a later date, on top of the 2×40MHz allocation being planned now. If the additional 2×5MHz of 700MHz is currently held by an MNO, that entity should not be eligible to receive any of the 2×40MHz of 700MHz during the upcoming allocation to ensure fair allocation of 4G coverage spectrum.

2.3 Consideration of potential Celcom–Digi merger

When allocating 700MHz spectrum, MCMC must consider the potential impact of a Celcom–Digi merger on spectrum concentration.

As discussed in Section 1.3, the parent companies of Celcom and Digi are considering a potential merger of their Asian assets which could lead to the formation of a joint Celcom–Digi entity. MCMC must take this into account when allocating spectrum to MNOs and the resulting concentration of spectrum held by each MNO.

Having a large concentration of 700MHz spectrum held by a single MNO could give that player an unfair competitive advantage in terms of its ability to offer a strong 4G coverage base layer with good QoS. This would likely give rise to anti-competitive effects in the market with negative implications for consumers – such as deterring the other MNOs from network investment.

Given these potential implications, if the Celcom–Digi merger is expected to go through, MCMC should consider assigning a single 700MHz licence to either Celcom or Digi, but not to both. In addition, MCMC must assess whether a merged Celcom–Digi should be required to return a portion of its spectrum for reallocation, to enable a level playing field in the market. In particular, it should evaluate the sub-1GHz spectrum holdings of MNOs to ensure that each player has an equitable share of valuable spectrum for 4G coverage.

2.4 Responses to PI questions

Question 1

MCMC would like to seek views on the proposed allocation plan for the 700 MHz band, in particular on:

(i) Award mechanism
(ii) Timeline for assignment

U Mobile agrees with MCMC's proposed use of a beauty contest to allocate 700MHz spectrum. The beauty contest evaluation for 700MHz should require each interested MNO to submit a new application, rather than being based on the prior 700MHz application in early 2018. Given the time that has elapsed between the previous application and the upcoming 700MHz award, commitments from the previous submission may no longer be valid and thus should not form the basis for spectrum allocation.

As part of the award mechanism, MCMC should impose a sub-1GHz spectrum cap of 2×20MHz that considers spectrum in the 700MHz, 850MHz and 900MHz bands. As discussed in Section 2.2, a sub-1GHz spectrum cap will enable each MNO to have sufficient sub-1GHz spectrum for strong 4G coverage and is in line with global regulatory practice. In particular, a 2×20MHz cap will provide for an equal distribution of sub-1GHz spectrum across four MNOs and will ensure that all four have the spectrum to offer a widespread and competitive 4G coverage base layer with good QoS. Rationalising the market towards four strong MNOs will enable sustainable competition with benefits for consumers (as discussed in Section 1) and is in line with global practice.

U Mobile understands that an additional 2×5MHz of 700MHz may be made available at a later date on top of the 2×40MHz allocation currently being proposed. If the additional 2×5MHz of 700MHz is currently held by an MNO, that entity should not be eligible to receive any of the 2×40MHz of 700MHz during the upcoming allocation to ensure fair allocation of 4G coverage spectrum.

MCMC must consider the potential Celcom–Digi merger when assigning 700MHz spectrum in order to prevent anti-competitive effects. For example, it should consider assigning a single licence to either Celcom or Digi, but not to both, and must assess the need for the merged Celcom–Digi to return sub-1GHz spectrum to ensure that there are four MNOs which are able to compete on the basis of strong coverage.

In terms of the timeline for the 700MHz assignment, U Mobile believes that the spectrum should be made available for mobile use as soon as possible to facilitate the expansion of 4G coverage.

Question 2

MCMC would like to seek views on the optimum spectrum block per operator for assignment of the 700 MHz band.

U Mobile agrees with MCMC's proposed allocation of four licences of 2×10MHz each for the 700MHz band. Providing 2×10MHz of 700MHz to four competitive MNOs would enable each MNO to provide

a widespread 4G coverage base layer with good QoS and is in line with the NFCP's target of enabling 30Mbps average speeds across 98% of populated areas by 2023. U Mobile believes that MCMC should consider imposing regulatory obligations on 700MHz licensees in order to achieve this target. Obligations requiring licensees to share their 700MHz networks in rural areas (e.g. bottom 95% – 98% of populated areas by population density) would facilitate achievement of the 30Mbps target across Malaysia.

In addition, the assignment of four 700MHz licences is in line with the need to rationalise Malaysia's mobile market towards four MNOs to enable sustainable competition (as discussed in Section 1). Such rationalisation can drive benefits for consumers in areas such as: enhanced mobile market competition, lower retail prices and increased network investment.

3 2300MHz and 2600MHz (TDD) spectrum

The 2300MHz and 2600MHz (TDD) spectrum bands are among the primary bands for short- to medium-term 5G deployment in Malaysia and should be allocated as four blocks – three 30MHz blocks in 2300MHz and one 40MHz block in 2600MHz – via a beauty contest.

3.1 Considering 2300MHz and 2600MHz (TDD) as a joint 'TDD block'

MCMC should consider the 2300MHz (TDD) and 2600MHz (TDD) spectrum bands as a joint 'TDD block' which has potential for 5G use.

► *There is precedent for regulators to consider these two bands as a joint TDD block, due to their similar technical characteristics*

Time division duplex (TDD) spectrum bands are technically distinct from frequency division duplex (FDD) spectrum bands. While FDD technology relies on paired spectrum bands in which the downlink and uplink frequencies are separated, TDD technology uses unpaired spectrum where the downlink and uplink transmission is divided by time slots. As such, the 2300MHz (TDD) and 2600MHz (TDD) spectrum bands share similar technical characteristics and are distinct from FDD spectrum bands – including 2600MHz (FDD).

Given the technical similarities between 2300MHz (TDD) and 2600MHz (TDD) spectrum, there are regulators which have considered them as a joint TDD block. For example, the IMDA in Singapore imposed a TDD spectrum cap applicable to total spectrum across both the 2300MHz (TDD) and 2600MHz (TDD) bands in the 2016/17 spectrum action.[14]

► *While the 2300/2600MHz (TDD) bands are suitable for 4G use today, they have been earmarked as potential bands for initial 5G deployment*

While the 2300MHz (TDD) and 2600MHz (TDD) bands have been deployed for 4G in selected markets globally, they have also been included in the initial 5G specifications published by 3GPP.[15] As such, development of 5G-capable network equipment and end-user devices that support these bands is expected.

In particular, the use of 2300MHz (TDD) and 2600MHz (TDD) specifically for 5G has been mooted by leading industry players. For example, leading network equipment vendor Huawei stated in 2019 that

[14] See https://www2.imda.gov.sg/-/media/Imda/Files/Regulation-Licensing-and-Consultations/Frameworks-and-Policies/Spectrum-Management-and-Coordination/Spectrum-Rights-Auctions-Assigment/Final-Information-Memorandum.pdf?la=en

[15] See http://www.3gpp.org/ftp//Specs/archive/38_series/38.101-1/38101-1-g00.zip

"*TDD 2.6GHz/2.3GHz is the global golden spectrum of 5G*".[16] As such, the development of 5G-capable devices with support for 2300MHz (TDD) and 2600MHz (TDD) is likely to accelerate.

► *MNOs that have been awarded such TDD spectrum are planning to use them for 5G*

Interest in using the 2300MHz (TDD) and 2600MHz (TDD) bands for 5G has been voiced by MNOs globally. In particular, MNOs in leading 5G markets are looking to use 2300MHz (TDD) and/or 2600MHz (TDD) for their initial 5G deployments:

Sprint and T-Mobile (USA)	In their regulatory filings to support their impending merger, Sprint and T-Mobile have stated that the merged entity will make use of Sprint's 2600MHz (TDD) spectrum for 5G deployment across both urban and rural areas. In particular, they have committed to deploy mid-band 5G (which includes 2600MHz (TDD)) to cover at least 75% of the country's population.[17]
Optus (Australia)	In its response to the ACMA's 2019–2023 spectrum plan, Optus has pushed for licensing conditions in the 2300MHz (TDD) band to be reviewed to allow for deployment of 5G.[18]

3.2 Allocating four TDD licences of at least 30MHz each via beauty contest

Consistent with the objective of rationalising the market towards having four MNOs, the TDD block should be allocated through four licences via a beauty contest.

► *MCMC should allocate four TDD licences via beauty contest – with one 40MHz licence in the 2600MHz (TDD) range and three 30MHz licences in the 2300MHz (TDD) range*

As stated in Section 3.1, the 2300MHz (TDD) and 2600MHz (TDD) bands should be considered jointly as a TDD block, as they are suitable for initial 5G deployment in Malaysia.

As discussed in Section 1, MCMC should rationalise Malaysia's mobile market towards having four MNOs, to enable sustainable competition with benefits for consumers. In line with this rationalisation, MCMC should facilitate an equitable post-allocation share of spectrum for four MNOs across three main spectrum blocks, one of which comprises the TDD / potential 5G block. MCMC should thus allocate spectrum in the TDD block to four competitive MNOs to facilitate their 5G deployments. This will allow for accelerated deployment and availability of 5G in Malaysia before the refarming of other spectrum bands (e.g. 3.5GHz) for mobile use is completed.

16 See https://www.huawei.com/en/press-events/news/2019/3/huawei-large-bandwidth-distribution-5g-golden-spectrum

17 See https://newtmobile.com/wp-content/uploads/2019/05/FCC-Filing-May-20.pdf

18 See https://www.acma.gov.au/-/media/Strategy-and-Transition/Issue-for-comment/IFC-10-2019/Optus-pdf.PDF

Spectrum in the TDD block should therefore be split into four licences – three 30MHz licences in 2300MHz (TDD), and one 40MHz licence in 2600MHz (TDD). Such a licence structure will allow for the allocation of at least 30MHz of TDD spectrum to four competitive MNOs. Unlike 4G, where individual component carriers are limited to a maximum bandwidth of 20MHz, 5G carriers can reach up to 100MHz in bandwidth. As such, the allocation of 5G-capable spectrum in blocks greater than 20MHz will enable 5G deployments in Malaysia to deliver mobile broadband speeds that substantially surpass current 4G standards.

The allocation of four licences in the TDD block should be done via a beauty contest to ensure consistency with the allocation approach used in other bands such as 700MHz. In contrast, MCMC's proposed allocation for 2600MHz (TDD) involves allocating 20MHz each to TM/Webe and YTL based on their current assignment. U Mobile disagrees with the proposed pre-determined allocation approach as it does not consider that other MNOs may place a higher value on the spectrum and/or may generate a greater public benefit from their use of spectrum, such as via 5G deployment.

If MCMC rationalises the market by assigning four licences across the TDD block, existing MNOs may lose their current spectrum holdings and so could be required to exit the market. However, as discussed in Section 1.2, MCMC can impose regulatory measures on new TDD licensees to minimise service disruption for affected customers. For example, wholesale obligations on new TDD licensees could allow an exiting MNO to remain in the market by becoming an MVNO. Alternatively, migration obligations can be used to ensure that users have the option of moving to a new MNO with limited service disruption.

3.3 Consideration of potential Celcom–Digi merger

When allocating the TDD spectrum, MCMC must consider the potential impact that a Celcom–Digi merger would have on spectrum concentration and implications for 5G.

As discussed in Section 1.3, the parent companies of Celcom and Digi are considering a merger of their Asian assets which could see the formation of a joint Celcom–Digi entity. MCMC must take this into account when allocating spectrum to MNOs, with particular regard to the resulting concentration of spectrum held by the merged entity.

The distribution of spectrum in the TDD block has significant implications for 5G deployment in Malaysia in terms of 5G infrastructure competition. The TDD block should be allocated to four MNOs, so that each MNO has the opportunity to deploy competitive 5G networks. If a large concentration of TDD spectrum is held by a single MNO, this could disincentivise 5G deployments by other players, as it would likely be challenging to match the 5G speeds of the dominant TDD spectrum holder. As such, it is important to provide an equitable allocation of TDD spectrum across four MNOs.

MCMC must take these factors into account when assigning TDD spectrum to ensure that the post-merger TDD allocation is not skewed in favour of a merged Celcom–Digi. MCMC must also assess whether a merged Celcom–Digi should be required to return a portion of its TDD spectrum for reallocation to enable a level playing field in the 5G market.

3.4 Responses to PI questions

Question 3

MCMC would like to seek views on the proposed allocation plan for the 2300 MHz band, in particular on: (i) Award mechanism (ii) Timeline for assignment

U Mobile agrees with MCMC's proposed use of a beauty contest to allocate 2300MHz (TDD) spectrum, and believes that a comparative evaluation process should be used consistently for all bands in the upcoming spectrum award. However, as discussed in Sections 3.1 and 3.2, 2300MHz (TDD) and 2600MHz (TDD) spectrum should be allocated jointly as a TDD block via a beauty contest as they are both potential 5G bands. U Mobile does not agree with the proposed pre-determined assignment of 2600MHz (TDD) based on current assignment, as this is inconsistent with other bands and does not consider that other MNOs may place a higher value on the spectrum and/or may generate a greater public benefit from their use of spectrum, such as via 5G deployment.

MCMC must consider the potential Celcom–Digi merger when assigning TDD spectrum, in order to prevent anti-competitive effects. This is of particular importance for 5G, as a high concentration of TDD spectrum held by a single player could disincentivise 5G deployment by other MNOs and thus hinder 5G coverage expansion. Potential measures that MCMC could adopt include assigning a single TDD licence to either Celcom or Digi and assessing whether the merged Celcom–Digi should be required to return spectrum to ensure there are four competitive MNOs each with an equitable share of spectrum.

In terms of the timeline for 2300MHz (TDD) and 2600MHz (TDD) assignment, U Mobile believes that both spectrum bands should be made available for mobile use as soon as possible to enable accelerated deployment of 5G in Malaysia.

Question 4

MCMC would like to seek views on the optimum spectrum block per operator for assignment of the 2300 MHz band.

As discussed in Sections 3.1 and 3.2, 2300MHz (TDD) and 2600MHz (TDD) spectrum should be considered as a joint TDD block as they are suitable for 5G use. In line with rationalising the market towards four MNOs to enable sustainable competition (as discussed in Section 1), spectrum in the TDD block should be divided into four licences, comprising three 30MHz licences in 2300MHz (TDD), and one 40MHz licence in 2600MHz (TDD). By allocating these licences to four MNOs, MCMC would ensure that each MNO has the spectrum to deploy competitive 5G networks. In addition, the assignment proposed above would provide for TDD spectrum blocks of greater than 20MHz, which would enable

5G deployments in Malaysia to deliver mobile broadband speeds that substantially surpass current 4G standards.

4 2600MHz (FDD) spectrum

2600MHz (FDD) spectrum is a capacity layer for 4G, and the allocation should be considered in conjunction with existing 4G capacity spectrum holdings. An equitable allocation would involve having two blocks of 2×20MHz and two blocks of 2×15MHz, with assignment via a beauty contest process to ensure consistency with the 700MHz and 2300MHz bands.

4.1 Lack of justification for the proposed pre-determined 2600MHz allocation

MCMC's proposed pre-determined allocation is based on spectrum sharing arrangements, which should not form the basis for long-term spectrum assignments.

MCMC's proposed allocation for 2600MHz (FDD) involves assigning Maxis, Celcom and Digi an additional 2×10MHz each on top of their previous 2×10MHz assignment based on their spectrum sharing arrangements with Redtone and Altel. There is no justification for providing each of these three MNOs with an additional 2×10MHz of 2600MHz (FDD) spectrum based on the spectrum sharing arrangements as these arrangements involved reserving some capacity for the actual spectrum licensees – namely Redtone and Altel. As such, the full 2×10MHz of shared spectrum should not be awarded to each of the three MNOs as their existing 2600MHz (FDD) capacity is shared with other players.

In addition, the existing spectrum sharing arrangements in the 2600MHz (FDD) band were facilitated by the specific position of the frequency assignments. As shown in Figure 4.1 below, Maxis's 2600MHz (FDD) frequency assignment is adjacent to that of Redtone, while both Celcom and Digi's assignments are adjacent to Altel – this facilitated spectrum sharing arrangements to form 2×20MHz contiguous blocks.

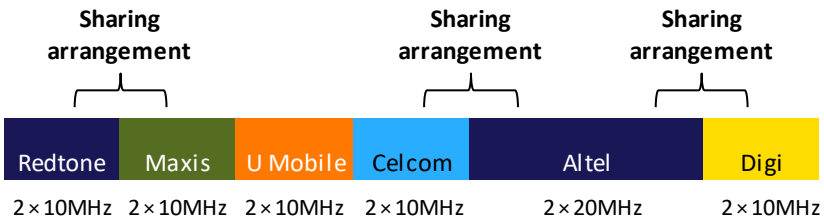


Figure 4.1: Current 2600MHz (FDD) assignments

Both Redtone and Altel failed to deploy significant mobile networks and had limited use for their spectrum, which they thus shared with Maxis, Celcom and Digi. In contrast, U Mobile's frequency assignment is adjacent to those of Maxis and Celcom. Because both these MNOs compete with U Mobile in the mobile market and are actively using their 2600MHz (FDD) spectrum, there is no scope for spectrum sharing. The proposed pre-determined allocation based on spectrum sharing arrangements as shown in Table 3.8 of the PI document is thus not justified. U Mobile should not be prevented from receiving additional 2600MHz (FDD) spectrum due to its frequency assignment being

adjacent to those of the primary MNOs rather than licensees that failed to use their spectrum effectively.

4.2 Assignment of 2600MHz (FDD) in four blocks of at least 2×15MHz via beauty contest

MCMC should use a beauty contest process in the 2600MHz (FDD) band to assign two blocks of 2×20MHz and two blocks of 2×15MHz to enable it to rationalise the market towards four MNOs to enable sustainable competition.

- *Having four blocks of at least 2×15MHz will facilitate 4G competition and enable the most cost-efficient 4G carrier deployment with the highest potential throughput*

2600MHz (FDD) is a 4G capacity band and is critical for enabling greater 4G capacity and throughput to end users. As stated in the PI document, 2600MHz (FDD) "*is seen as an important band to provide additional capacity to mobile broadband networks particularly in dense urban areas where there is likely to be congestion*".[19] As such, MCMC must consider the need to provide four MNOs with an equitable share of 2600MHz (FDD) spectrum to ensure a competitive 4G market – this is in line with rationalising the market towards four competitive MNOs with benefits for consumers (as discussed in Section 1).

The proposed 2600MHz (FDD) allocation set out in Table 3.8 of the PI document involves assigning three licences of 2×20MHz and one licence of 2×10MHz to the four primary MNOs on a pre-determined basis, with U Mobile receiving the 2×10MHz licence. This will result in an asymmetric distribution of 4G capacity spectrum and will affect U Mobile's ability to compete effectively in terms of 4G capacity and throughput. This is likely to have a negative effect on competition in the downstream retail market.

A more equitable allocation for the 2600MHz (FDD) band would involve two blocks of 2×15MHz each and two blocks of 2×20MHz each. Apart from facilitating effective competition among four MNOs in the 4G market, this allocation would enable a more cost-efficient 4G carrier deployment with the highest potential throughput. Deploying a 2×15MHz or 2×20MHz 4G carrier would be significantly more cost effective than a 2×10MHz carrier, as the incremental difference in deployment cost per site is relatively small while enabling a 50–100% gain in 4G capacity and throughput.

- *A comparative evaluation process via a beauty contest should be used to ensure consistency with the 700/2300MHz bands*

U Mobile believes that MCMC should allocate the spectrum in four licence blocks of at least 2×15MHz via a beauty contest, rather than using a pre-determined allocation for the 2600MHz (FDD) band based on past assignment and spectrum sharing arrangements. This will ensure consistency with the allocation approach proposed in other bands, such as 700MHz and 2300MHz (TDD). As discussed in Section 4.1, MCMC's pre-determined allocation of the 2600MHz (FDD) band is not justified. A beauty contest approach would allow for a fairer allocation of the band by considering aspects such as: the

[19] Source: Paragraph 3.3.1.6 of the PI document

expected use of the spectrum by each MNO; the need for and value of the spectrum to each MNO; and the expected public benefit that each MNO would generate from use of the spectrum – such as via higher 4G speeds.

4.3 2600MHz (FDD) allocation to enable an equitable distribution of 4G capacity spectrum

A fairer allocation process for the 2600MHz (FDD) band should also consider existing 4G capacity spectrum holdings to enable an equitable distribution of spectrum.

- *Spectrum caps in the 2600MHz (FDD) band which consider current spectrum holdings in other bands have been used in other markets*

2600MHz (FDD) allocation should be considered in conjunction with existing 1800MHz and 2100MHz spectrum holdings as all these bands can serve as 4G capacity bands. 1800MHz is a key 4G band currently being used for 4G capacity by all the primary MNOs in Malaysia. 2100MHz is currently mainly used for 3G but is expected to be refarmed for 4G use in the near future to enable increased 4G speeds and capacity – particularly as user migration from 3G-to-4G continues.

In line with rationalising the market towards four MNOs (with the consumer benefits discussed in Section 1), MCMC should ensure that total 4G capacity spectrum across all of these bands is allocated equitably to four competitive MNOs. MCMC must therefore consider the differences in existing 1800MHz and 2100MHz spectrum holdings (as shown in Figure 4.2 below) when allocating 2600MHz (FDD) spectrum.

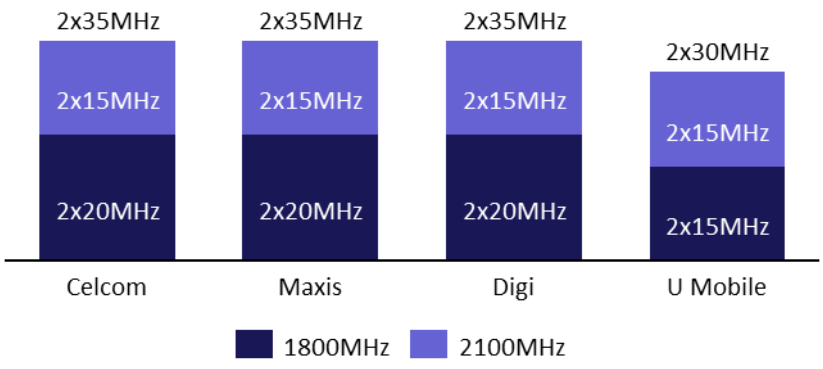


Figure 4.2: Current 1800MHz and 2100MHz spectrum holdings[20]

A 2600MHz (FDD) allocation that considers existing 1800MHz and 2100MHz spectrum holdings has been seen in other markets. For example, in the Netherlands, MNOs were subject to varying spectrum caps for 2600MHz (FDD) spectrum that were dependent on their current holdings in other bands – including both 1800MHz and 2100MHz. MNOs that had larger existing spectrum holdings in 1800MHz

[20] Note that this does not include TDD spectrum in the 2100MHz band as this spectrum is not currently suitable for 4G or 5G use

or 2100MHz faced a more restrictive spectrum cap on the amount of 2600MHz (FDD) spectrum that they could acquire.[21]

- *2600MHz (FDD) is a secondary capacity layer and so potential service disruption is unlikely to be significant – the focus should be on making a more equitable distribution to facilitate increased competition*

The 2600MHz (FDD) band is a secondary 4G capacity band to complement the 1800MHz band, which has stronger propagation characteristics and has been used more extensively in Malaysia for 4G coverage. As such, any changes in the 2600MHz (FDD) spectrum holdings of individual MNOs as a result of the upcoming spectrum award are not expected to cause significant 4G service disruption for the four primary MNOs, since 1800MHz is available as a fallback layer.

Reallocation of the 2600MHz (FDD) band to provide four blocks of at least 2×15MHz may lead to existing MNOs losing their spectrum holdings and thus being required to leave the market. However, as discussed in Section 1.2, MCMC can impose regulatory measures on new 2600MHz (FDD) licensees to minimise service disruption for affected users. For example, wholesale obligations imposed on licensees could allow the exiting MNOs to remain in the market by becoming an MVNO. Alternatively, migration obligations can be used to ensure that users have the option of moving to a new MNO with limited service disruption.

As such, a reallocation of the 2600MHz (FDD) band to create four blocks of at least 2×15MHz is unlikely to cause significant disruption for consumers. The focus for MCMC should therefore be on enabling a more equitable distribution of 4G capacity spectrum by also considering existing 1800MHz and 2100MHz holdings.

4.4 Consideration of potential Celcom–Digi merger

When allocating the 2600MHz (FDD) spectrum, MCMC must consider the potential impact of a Celcom–Digi merger on spectrum concentration. In particular, the proposed allocation would give Celcom–Digi a dominant share of 4G capacity spectrum and could create anti-competitive effects in the 4G market.

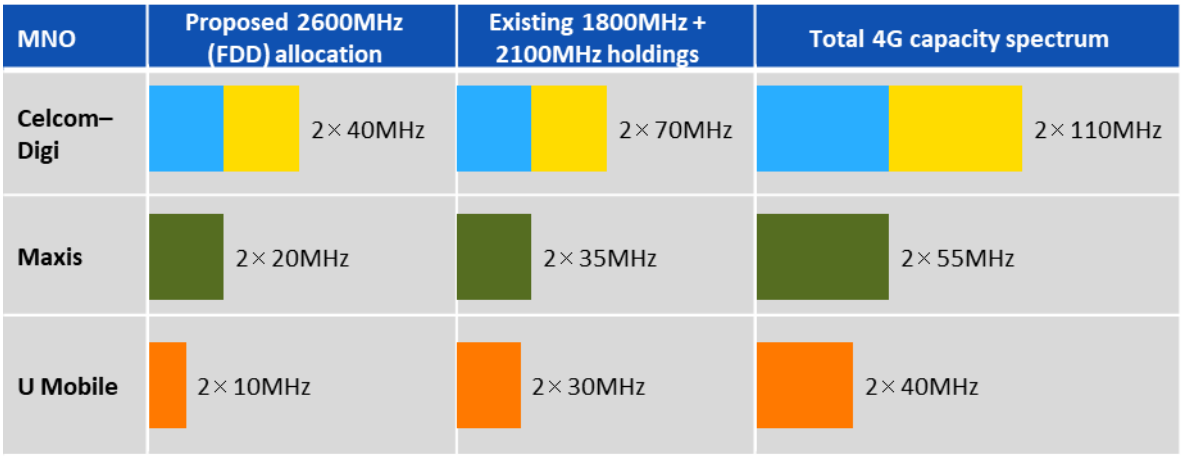
As discussed in Section 1.3, the parent companies of Celcom and Digi are considering a potential merger of their Asian assets which could see the formation of a joint Celcom–Digi entity. MCMC must take this into account when allocating spectrum to MNOs and the resulting concentration of spectrum held by each MNO.

For the 2600MHz (FDD) allocation, spectrum concentration should be considered in conjunction with the 1800MHz and 2100MHz bands, as they can all be used for 4G capacity. Figure 4.3 shows the post-merger allocation of 4G capacity spectrum based on the proposed 2600MHz (FDD) allocation in the PI document and existing 1800MHz / 2100MHz spectrum holdings. Based on the proposed allocation,

[21] See https://www.dotecon.com/assets/images/dp1001.pdf

Celcom–Digi will have over 50% of the total 4G capacity spectrum, which will give it a significant advantage in the 4G market. In particular, the asymmetric distribution of 4G capacity spectrum in favour of Celcom–Digi will affect the ability of other MNOs to compete effectively and will reduce competition in the downstream retail market.

Figure 4.3: Post-merger 4G capacity spectrum allocation based on proposed 2600MHz (FDD) allocation



As such, the proposed allocation of 2600MHz (FDD) to Celcom and Digi as stated in the PI will have significant anti-competitive effects on the 4G market if the Celcom–Digi merger goes through. The reduction in competition is likely to have a negative impact on consumers in areas such as consumer choice, retail prices and network investment. MCMC should account for this by using a beauty contest for allocating the 2600MHz (FDD) band, with existing 1800MHz/2100MHz spectrum holdings taken into consideration when determining the specific assignment for each MNO. In addition, MCMC must also assess if the merged entity should be required to return a portion of its 4G capacity spectrum for reallocation to enable a level playing field in the market. In particular, the merged entity will have over half of the 1800MHz/2100MHz spectrum in the market based on existing holdings and must be required to return part of this spectrum for reallocation to ensure that the Malaysian mobile market remains competitive.

4.5 Responses to PI questions

Question 5

MCMC would like to seek views on the proposed allocation plan for the 2600 MHz band, in particular on: (i) Award mechanism (ii) Timeline for assignment

MCMC's proposed approach of awarding 2600MHz (TDD and FDD) spectrum via a pre-determined approach is not justified. In particular, the proposed 2600MHz (FDD) allocation is based on spectrum

sharing arrangements which fail to account for the reservation of capacity for the actual spectrum licensees (e.g. Altel/Redtone). As discussed in Section 4.1, the full 2×10MHz of shared spectrum should not be awarded to each of Maxis, Celcom and Digi as their existing 2600MHz (FDD) capacity is shared with other players. In addition, the existing spectrum sharing arrangements were facilitated by the specific position of the frequency assignments (as shown in Figure 4.1 earlier). U Mobile should not be prevented from receiving additional 2600MHz (FDD) spectrum due to its frequency assignment being adjacent to those of the primary MNOs rather than licensees that failed to use their spectrum effectively.

In addition, the proposed pre-determined allocation approach for both the 2600MHz (TDD) and 2600MHz (FDD) bands is inconsistent with the beauty contest approach that is proposed for the 700MHz and 2300MHz (TDD) bands. The pre-determined allocation does not consider that other MNOs may place a greater value on the spectrum and/or may generate a greater public benefit from their use of spectrum, such as via 5G deployment.

As such, MCMC should allocate the 2600MHz (TDD) and 2600MHz (FDD) bands via a beauty contest approach to ensure consistency across all bands. The structure of spectrum licences within each band should be aligned with rationalising the market towards four MNOs, to enable sustainable competition with benefits for consumers (as discussed in Section 1).

2600MHz (FDD)

For the 2600MHz (FDD) band, MCMC should allocate two 2×15MHz licences and two 2×20MHz licences via a beauty contest. Having a minimum 2×15MHz allocation in 2600MHz (FDD) will facilitate 4G competition and enable the most cost-efficient 4G carrier deployment with the highest potential throughput. To enable an equitable distribution of 4G capacity spectrum, allocation of the 2600MHz (FDD) band should take existing 1800MHz and 2100MHz spectrum holdings into consideration (in line with practice observed in markets such as the Netherlands).

2600MHz (TDD)

The 2600MHz (TDD) band should be considered in conjunction with the 2300MHz (TDD) band as a joint TDD block with potential for 5G and allocated as four licences of at least 30MHz. The rationale for joint allocation of the TDD bands is set out in Section 3, along with U Mobile's views on the award mechanism and optimum spectrum per operator for this joint TDD block.

Merger considerations

MCMC must consider the potential Celcom–Digi merger when assigning 2600MHz (FDD) spectrum, particularly due to its implications for 4G competition. As shown in Figure 4.3, a post-merger allocation of 4G capacity spectrum based on the 2600MHz (FDD) allocation proposed in the PI document and existing 1800MHz/2100MHz spectrum holdings will give Celcom–Digi over 50% of 4G capacity spectrum in the market. This will provide it with a significant advantage in the 4G market and will reduce competition in the downstream retail market, with a resulting negative impact on consumers in areas such as consumer choice, retail prices and network investment. MCMC should account for

this by using a beauty contest to allocate the 2600MHz (FDD) band, with existing 1800MHz and 2100MHz spectrum holdings taken into consideration when determining the specific assignment for each MNO. In addition, MCMC must also assess if the merged entity should be required to return a portion of its 4G capacity spectrum for reallocation to enable a level playing field in the market. In particular, the merged entity will have over half of the 1800MHz/2100MHz spectrum in the market based on existing holdings and must be required to return part of this spectrum for reallocation.

Similar considerations regarding the potential Celcom–Digi merger are also applicable to the 2600MHz (TDD) band, as discussed in Section 3.3.

Timeline

In terms of the timeline for 2600MHz (TDD) and 2600MHz (FDD) assignment, U Mobile believes that both spectrum bands should be made available for mobile use as soon as possible to enable accelerated deployment of 5G in Malaysia as well as expansion of 4G capacity.

Question 6

MCMC seeks suggestions on approaches to mitigate interference between FDD and TDD blocks to facilitate efficient spectrum utilisation in the 2600 MHz band.

Potential measures that MCMC can adopt to mitigate interference between the FDD and TDD blocks in the 2600MHz band include the use of guard bands, block edge masks, and additional filters. Each measure may be adopted on a standalone basis or in combination with others.

MNOs assigned with 2600MHz (TDD) or 2600MHz (FDD) spectrum may face the need to use operator-specific measures (e.g. filters) to mitigate for interference. Such measures may require the MNO to incur additional costs when using the spectrum for network deployment. The extent to which such filters are required is expected to be affected by the levels of interference faced – this may vary by the specific frequency range assigned to each MNO. MCMC should therefore consider offering subsidies or discounts on the spectrum assignment fees for 2600MHz licensees that incur additional costs associated with interference mitigation measures. The subsidies or discounts on spectrum assignment fees should be determined from the estimated additional costs incurred due to interference mitigation measures – for example, this could be based on the cost of installing filters at affected sites. This should promote a fairer assignment of specific frequency ranges in the 2600MHz band to individual MNOs.

5 Spectrum assignment (SA) fees

SA fees must be set at a reasonable level to facilitate increased network investment by MNOs. Benchmarks of normalised reserve prices should be used to assess appropriate SA fees, with a discount applied to 700MHz due to its late release.

5.1 SA fees must be set at a reasonable level

In line with statements made by MCMC, SA fees must be set at a reasonable level to facilitate increased network investment by MNOs and should not be used to generate high revenues for the government.

MCMC should set reasonable SA fees for the upcoming spectrum allocation exercise – lower SA fees will allow MNOs to channel further investment into their mobile networks and can thus enable benefits for consumers in areas such as mobile coverage expansion and 5G deployment.

Setting reasonable SA fees is in line with recent statements made by MCMC regarding pricing of spectrum as shown below.

MCMC in spectrum allocation PI document	"The auction process may inflate the spectrum price and may restrict operators' ability to invest in network deployment". As such, "a tender with a fixed price is deemed suitable rather than auction in this case to incentivise operators to enhance speeds and QoS". [22]
MCMC Chairman Al-Ishsal Ishak in April 2019	"One important principle is (that) the government does not intend to profit from any spectrum exercise…It is a critical and valuable national resource that must benefit the nation from a variety of facets based on principles of providing pervasive, high-quality and affordable access to industry and society". [23]

5.2 SA fees for Malaysia should consider benchmarks of normalised reserve prices

Benchmarks of reserve prices should be used to assess reasonable SA fees in Malaysia and normalised to account for differences in the value of spectrum in each market.

In markets that utilise spectrum auctions, auction fees serve as a means to reveal each operator's willingness to pay and to enable efficient spectrum allocation – the highest bidders are thus awarded spectrum on this basis. In contrast, spectrum in Malaysia is administratively assigned by MCMC, and there is no need for an auction fee mechanism due to the use of non-price based comparative

[22] Source: Paragraphs 3.1.2.2 and 3.2.2.4 of the PI document

[23] See https://www.thestar.com.my/business/business-news/2019/04/15/ishsal-no-intention-to-profit-from-5g/

evaluation. As such, benchmarks of final auction prices for spectrum in other markets should not be used as the basis to determine SA fees in Malaysia.

Benchmarks of reserve prices for spectrum in other markets are a more appropriate measure to assess suitable SA fees for Malaysia. These benchmarks should be normalised for comparison by considering: (i) the relative population and (ii) the mobile average revenue per user (ARPU) of each market. These factors should be accounted for, as they will both determine the relative value of spectrum to an MNO. For example, MNOs operating in markets with a smaller addressable market in terms of population and a smaller addressable revenue base will place a lower value on the same spectrum.

5.3 700MHz SA fees should be discounted due to its late release

A discount should be applied on 700MHz SA fees as its late release diminishes its value for 4G coverage and is in line with reserve price discounts seen in other markets

As discussed in Section 3, 700MHz spectrum is valuable for 4G coverage due to its strong propagation characteristics. However, the value of 700MHz in enabling 4G coverage in Malaysia is diminished due to its late release of Q3 2020 at the earliest (as stated in the PI document). In particular, 4G coverage in Malaysia is already relatively extensive, with MCMC reporting that this has reached 80% of the population as of 2018.[24]

As such, a discount should be applied on 700MHz SA fees to reflect this diminished value for 4G coverage in Malaysia. This is in line with the reserve price discounts seen in other markets as shown in Figure 5.1 below. In markets where 700MHz was auctioned relatively late vs. an alternative 4G coverage band (800MHz), 700MHz reserve prices were at a discount ranging between 4 – 33% to the alternative band despite having similar technical characteristics – reflecting this diminished value for 4G coverage.

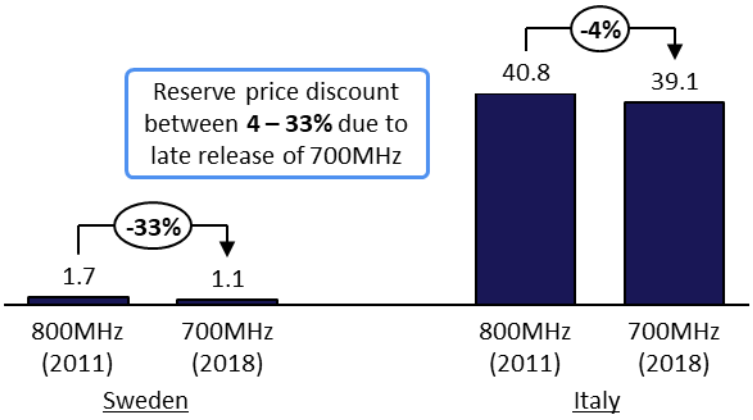


Figure 5.1: Benchmarks of reserve prices in countries with late release of 700MHz vs. alternative 4G coverage band in USD million per MHz [Source: National regulatory authorities]

[24] See https://www.skmm.gov.my/skmmgovmy/media/General/pdf/Industry-Performance-Report-2018.pdf

5.4 Responses to PI questions

Question 7

MCMC would like to seek views on the appropriate range (per MHz) for SA fees (price component and annual fee component) and the rationale for the proposed fees, for the following spectrum bands:

(i) 700MHz;
(ii) 2300MHz; and
(iii) 2600 MHz

As discussed in Sections 5.1 to 5.3, SA fees for the upcoming spectrum award must be set at a reasonable level – MCMC should use benchmarks of normalised reserve prices to assess the SA fees, with a discount applied on 700MHz fees to reflect its diminished value for 4G coverage.

Column (A) of Figure 5.2 below shows the normalised price per MHz / population / ARPU for each band in USD based on reserve price benchmarks. Details of the normalised reserve price benchmarks for each band are provided in Annex A. The benchmarks have been multiplied with Malaysia's mobile ARPU as shown in column (B) to derive the price per MHz / population in USD that is applicable to Malaysia before accounting for a discount for 700MHz as shown in column (C). These figures have then been converted to MYR as shown in column (D) based on an exchange rate of 1 MYR = 0.24 USD.

Figure 5.2: Normalised spectrum price per band based on reserve price benchmarks

Spectrum band	(A) Price per MHz / population / ARPU based on benchmarks	(B) Malaysia's mobile ARPU in USD	(C) Malaysia's price per MHz / population in USD before 700MHz discount	(D) Malaysia's price per MHz / population in MYR before 700MHz discount
700MHz	USD0.0183 per MHz / population / ARPU	USD11.76 / month[25]	USD0.215 / MHz / population	MYR0.896 / MHz / population
2300MHz (TDD)	USD0.0015 per MHz / population / ARPU	USD11.76 / month	USD0.0176 / MHz / population	MYR0.0733 / MHz / population
2600MHz (FDD)	USD 0.0038 per MHz / population / ARPU	USD11.76 / month	USD0.0447 / MHz / population	MYR0.186 / MHz / population
2600MHz (TDD)	USD 0.0017 per MHz / population / ARPU	USD11.76 / month	USD0.0200 / MHz / population	MYR0.0833 / MHz / population

The price per MHz / population applicable to Malaysia before accounting for a discount for 700MHz is shown again in column (A) of Figure 5.3 below. A discount ranging between 4 – 33% as shown in column (B) is applied to 700MHz based on benchmarks (see Figure 5.1) to reflect its diminished value for 4G coverage. The resulting price per MHz / population applicable to Malaysia after accounting for

[25] Based on 2018 ARPU of MYR49 / month as reported by MCMC in its Industry Performance Report 2018 and an exchange rate of 1 MYR = 0.24 USD

a 700MHz discount is then multiplied with Malaysia's population of 32.5 million as shown in column (C). This thus derives the price per MHz applicable to Malaysia in MYR as shown in column (D) on an NPV basis, inclusive of both one-off and annual payments.

Figure 5.3: Price per MHz on NPV basis for Malaysia

Spectrum band	(A) Price per MHz / population applicable to Malaysia before 700MHz discount	(B) Discount due to late release for 4G coverage	(C) Malaysia's population	(D) Price per MHz applicable to Malaysia on NPV basis
700MHz	MYR0.896 / MHz / population	4 – 33% discount	32.5 million	MYR19.51 – 27.96 million / MHz on an NPV basis
2300MHz (TDD)	MYR0.0733 / MHz / population	N/A	32.5 million	MYR2.38 million / MHz on an NPV basis
2600MHz (FDD)	MYR0.186 / MHz / population	N/A	32.5 million	MYR6.05 million / MHz on an NPV basis
2600MHz (TDD)	MYR0.0833 / MHz / population	N/A	32.5 million	MYR2.71 million / MHz on an NPV basis

Based on the SA fees from the 900MHz and 1800MHz reallocation in 2016, the NPV of the total SA fee payments were split between: approximately 60% of the NPV via an upfront price component and approximately 40% of the NPV via the annual fee component. This has been calculated based on a weighted average cost of capital (WACC) of 10% which is in line with MCMC's WACC for mobile services as stated in its Review of Access Pricing in 2017. As such, a similar 60/40 proportion has been applied to derive the proposed price component and annual fee component of SA fees for the upcoming spectrum allocation as shown in columns (B) and (C) respectively in Figure 5.4 below. The annual fee component is calculated based on a licence validity of 15 years which is in line with the current 900 and 1800MHz assignment.

Figure 5.4: Proposed SA fees for Malaysia by price and annual fee components

Spectrum band	(A) Price per MHz applicable on NPV basis	(B) Price component (60% of NPV)	(C) Annual fee component (40% of NPV)[26]
700MHz	MYR19.51 – 27.96 million / MHz on an NPV basis	MYR11.71 – 16.78 million / MHz	MYR1.03 – 1.47 million / MHz annually
2300MHz (TDD)	MYR2.38 million / MHz on an NPV basis	MYR1.43 million / MHz	MYR0.12 million / MHz annually
2600MHz (FDD)	MYR6.05 million / MHz on an NPV basis	MYR3.63 million / MHz	MYR0.32 million / MHz annually
2600MHz (TDD)	MYR2.71 million / MHz on an NPV basis	MYR1.63 million / MHz	MYR0.14 million / MHz annually

[26] The NPV of the annual payments shown in this column across a 15-year period with a WACC of 10% are equivalent to 40% of the total price per MHz applicable to Malaysia on an NPV basis as shown in column (A). This 40% proportion is in line with MCMC's past SA fees from the 900/1800MHz reallocation.

MCMC may consider changing the proportional split of the SA fees between the price component and annual fee component from the approximate 60/40 proportion seen with the 900/1800MHz licences. For example, this could involve a higher proportion of the SA fees charged via the price component with a resulting reduction in the annual fee component. U Mobile is prepared to support any such potential changes in the proportional split of SA fees. However, the total equivalent NPV of the SA fees across both the price component and annual fee component should remain in line with normalised reserve price benchmarks as shown in column (A) of Figure 5.4 above.

Annex A Reserve price benchmarks

The tables below provide benchmarks of reserve prices for the following bands: 700MHz, 2300MHz (TDD), 2600MHz (FDD), and 2600MHz (TDD).

The benchmarks of reserve prices per MHz have been normalised by: (i) dividing with the population of the respective markets to account for differences in market size and (ii) dividing by the mobile ARPU of the respective markets to account for differences in value of their mobile markets. These factors should be accounted for, as they will both determine the relative value of spectrum to an MNO. The figures are reflected in USD based on the LCU:USD exchange rate of each country.

The average of the benchmarks as shown at the bottom of each table have then been used to assess the appropriate SA fees for Malaysia – this is discussed in Section 5.4.

Country	Year	Price per MHz / population / ARPU (USD)
Iceland	2017	0.002
Tanzania	2018	0.004
Sweden	2018	0.005
Norway	2019	0.005
Germany	2015	0.007
Singapore	2017	0.011
South Korea	2016	0.011
Finland	2016	0.011
Paraguay	2018	0.016
Taiwan	2013	0.016
New Zealand	2013	0.018
Uruguay	2017	0.025
France	2015	0.027
Australia	2017	0.033
Peru	2016	0.036
Brazil	2014	0.037
Italy	2018	0.047
Average		USD 0.0183 per MHz / population / ARPU

Figure A.1: Benchmarks of normalised 700MHz reserve prices [Source: National regulatory authorities]

Country	Year	Price per MHz / population / ARPU (USD)
Australia	2011	0.0002
UK	2018	0.0009
Indonesia	2017	0.0015
Singapore	2017	0.0032
Average		USD 0.0015 per MHz / population / ARPU

Figure A.2: Benchmarks of normalised 2300MHz (TDD) reserve prices [Source: National regulatory authorities]

Country	Year	Price per MHz / population / ARPU (USD)
Netherlands	2010	0.00001
Finland	2009	0.0001
Germany	2010	0.0002
France	2011	0.0003
Iceland	2017	0.0004
Latvia	2012	0.0005
Czech Republic	2016	0.0022
Portugal	2011	0.0024
Poland	2015	0.0025
Turkey	2015	0.0034
Italy	2011	0.0036
Spain	2011	0.0046
Singapore	2013	0.0050
Hong Kong	2009	0.0050
Taiwan	2015	0.0058
South Korea	2013	0.0089
Brazil	2015	0.011
Ukraine	2018	0.013
Average		USD 0.0038 per MHz / population / ARPU

Figure A.3: Benchmarks of normalised 2600MHz (FDD) reserve prices [Source: National regulatory authorities]

Country	Year	Price per MHz / population / ARPU (USD)
Germany	2010	0.0002
Latvia	2012	0.0004
Spain	2011	0.0007
Portugal	2011	0.0010
Czech Republic	2016	0.0012
India	2016	0.0017
Taiwan	2015	0.0023
Italy	2011	0.0029
Singapore	2017	0.0032
Turkey	2015	0.0034
Average		USD 0.0017 per MHz / population / ARPU

Figure A.4: Benchmarks of normalised 2600MHz (TDD) reserve prices [Source: National regulatory authorities]

Annex B Glossary of Terms

Abbreviation or term	Definition
3GPP	3rd Generation Partnership Project
4G	The fourth generation of wireless technologies that support higher data rates than 2G / 3G through wider channel bandwidths and higher spectrum efficiency
5G	The fifth generation of wireless technologies which aim to achieve higher speed and capacity than current 4G standards
ACCC	Australian Competition and Consumer Commission, the competition regulator of Australia – including telecommunications
ACMA	Australian Communications and Media Authority, the national regulatory authority of Australia's telecoms sector
ARPU	Average revenue per user
FCC	Federal Communications Commission, the national regulatory authority of the USA's telecoms sector
FDD	Frequency division duplex
HHI	Herfindahl-Hirschman Index (HHI), a measure of market concentration. A lower value represents a competitive market while a higher value represents a concentrated market (e.g. a monopoly).
IMDA	Infocomm Media Development Authority, the national regulatory authority of Singapore's telecoms sector
LCU	Local currency unit
LTE	Long-term evolution, a mobile 4G technology
MCMC	Malaysian Communications and Multimedia Commission
MYR	Malaysian ringgit
MNO	Mobile network operator, a wireless communications service provider that owns the wireless network infrastructure over which it provides service to its subscribers
MVNO	Mobile virtual network operator, a wireless communications service provider that does not own the wireless network infrastructure over which it provides service to its subscribers; it does not own spectrum licences and relies on network capacity leased from MNOs
NFCP	National Fiberisation and Connectivity Plan
NPV	Net present value
PI	Public inquiry
QoS	Quality of service
SA	Spectrum assignment
TDD	Time division duplex
USD	United States dollar
WACC	Weighted average cost of capital