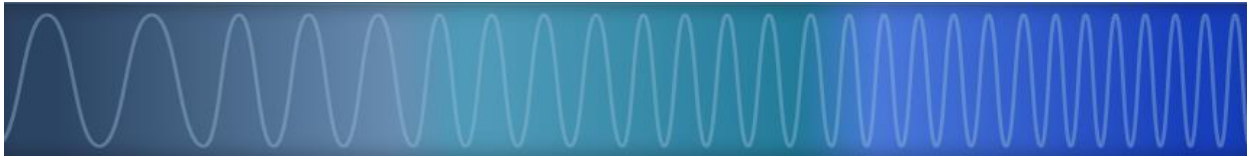




**Telecommunications Regulatory Commission
of Sri Lanka**



CONSULTATION
**Spectrum Assignment for Advanced Broadband Services
including 5G**

AMENDED Consultation Paper

27 March 2024

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1 INTRODUCTION AND OBJECTIVE

The Telecommunications Regulatory Commission of Sri Lanka (TRCSL) intends to assign additional frequency spectrum to telecom operators in the country for the provision of advanced broadband services, including 5th Generation (5G) mobile services.

A Consultation Paper (CP) was published on 22 December 2023 and last revised on 27 February 2024, describing the background for the planned spectrum assignment and outlines different options for how it can be structured.

The market consolidation referred to in chapter 2 of the original CP has now occurred and some existing spectrum holdings have been redistributed among the mobile network operators (MNO). This amended CP dated 27 March 2024 includes those changes.

TRCSL is inviting comments from the industry, with the objective to incorporate the feedback into the planning process and to determine a way forward that will deliver maximum benefits to the users of telecommunication services in Sri Lanka and the country as a whole. The submission deadline and the subsequent timeline for the spectrum assignment have been extended as per chapter 1.3.

Following review of the feedback received in response to this amended CP, TRCSL will publish its decisions made on the matter in a Notice of Assignment (NoA) with detailed instructions how interested parties can participate in the spectrum assignment.

1.1 Requests for clarifications

The platform TRCSL has provided for interested parties to request clarifications regarding the original CP remains in place. Requests for clarification regarding this amended CP must be sent by email in text format to spectrum5g@trc.gov.lk no later than Friday 12 April 2024, 17:00 Colombo time. TRCSL will confirm receipt by email within two business days and publish the requests and its responses on its website www.trc.gov.lk.

Stakeholders are welcome to request clarifications on anything in this amended CP, be it referring to an issue specifically raised in a blue text box or not. Requests for clarification must include the chapter number in this amended CP that they are referring to, and where applicable also the text box number (Q-x).

Requests for clarification must be written in English and avoid disclosing the identity of the sender if such disclosure is not wanted, as TRCSL will copy-and-paste the requests on its website without modification. However, the signature in the email containing the request must clearly identify the author/sender. The signature and the contents of the request itself must be clearly separated in the email.

There will be a similar process for clarifications after TRCSL has published the Notice of Assignment (NoA, see timeline in chapter 1.3).

1.2 Submissions

Submissions with comments/proposals in response to this amended CP must be sent in PDF format (no scans) by email to spectrum5g@trc.gov.lk no later than Friday 19 April 2024, 17:00 Colombo time. By the same deadline, a printed hardcopy must be delivered to

Director General
Telecommunications Regulatory Commission of Sri Lanka (TRCSL)
276 Elvitigala Mawatha
Colombo 8

TRCSL will confirm receipt of submissions by email within two business days and publish submissions on its website www.trc.gov.lk.

Comments in the submissions must indicate the chapter number in this amended CP that they are referring to, and where applicable also the text box number (Q-x).

Stakeholders who have already made submissions in response to the original CP are welcome to make additional submissions in response to this amended CP.

TRCSL welcomes submissions from individuals, businesses, industry associations, community and other interest groups, as well as joint submissions by groups of such entities, consortia or proposed joint ventures.

Submissions must be written in English and clearly identify the author/sender of the submission.

1.3 Timeline

- Deadline for requests for clarification regarding this amended CP: Friday 12 April 2024, 17:00
- Deadline for submissions in response to this amended CP: Friday 19 April 2024, 17:00
- TRCSL publishes Policy Paper (PP) on spectrum assignments: Wednesday 8 May 2024
- TRCSL publishes Notice of Assignment (NoA) “Decision on Spectrum Assignment for Advanced Broadband Services including 5G”: 31 May 2024
- Written Q&A on Spectrum Assignment process: 3 - 14 June 2024
- Information sessions and ‘mock auctions’ (if auction is chosen as the assignment method): 17 - 26 June 2024
- Spectrum assignment: Starting Thursday 27 June 2024

All times are Colombo local time.

2 BACKGROUND AND MARKET ENVIRONMENT

Sri Lanka is recovering from an economic collapse in 2022. Advanced broadband infrastructure, including 5th Generation (5G) mobile technology, can play an important role in the recovery process by improving existing services, enabling new use cases, and promoting the country as an investment destination.

However, telecom operators in Sri Lanka are struggling with higher costs and reduced customer demand/spending as a result of the economic crisis. They have raised concerns about a lack of demand for 5G services in the current economic environment and about high spectrum fees they may have to pay for the new spectrum, especially if it is awarded by auction.

There are currently four mobile network operators (MNO) in Sri Lanka:

- Dialog Axiata PLC – hereinafter referred to as DAP
- Mobitel (Pvt) Ltd – hereinafter referred to as Mobitel
- Bharti Airtel Lanka (Pvt) Ltd – hereinafter referred to as Airtel
- Hutchison Telecommunications Lanka (Pvt) Ltd – hereinafter referred to as Hutch

and three fixed network operators:

- Dialog Broadband Networks (Pvt) Ltd – hereinafter referred to as DBN
- Sri Lanka Telecom PLC – hereinafter referred to as SLT
- Lanka Bell Limited – hereinafter referred to as LB

TRCSL is inviting comments from stakeholders on the current market environment, the potential for a recovery of Sri Lanka's economy from the economic crisis and an improvement of the economic environment for telecom operators in particular, their views of the current and future demand for 4G and 5G services (both fixed and mobile), and on the best way forward for the deployment of 5G services in the given market conditions, with a particular focus on the spectrum required, as further detailed in the following chapters of this Consultation Paper.

2.1 Market consolidation

The market consolidation referred to in chapter 2 of the original CP was agreed on 4 March 2024 when TRCSL's settlement proposal was signed by all parties involved. The merger between DAP and Airtel was approved and will be implemented over the next few months. LankaBell has announced it is closing down its business.

As part of the agreement, the remaining available spectrum in the 2.6 GHz band was assigned to Hutch and will therefore no longer be part of the upcoming spectrum assignment. Spectrum in the 850, 900 and 2300 MHz bands was redistributed among the operators, and spectrum holdings will be aligned to create contiguous blocks for all operators in all bands. For details see chapter 3.1.

Dialog and Airtel will continue to operate as two separate brands but will be allowed to share their spectrum and network infrastructure.

According to the latest available figures, the combined Dialog-Airtel entity will have a mobile subscriber market share of around 63%, Mobitel 25% and Hutch 12%. After the merger, the market will consist of two groups offering mobile and fixed services (DAP-Airtel/DBN and Mobitel/SLT), and Hutch offering mobile services only.

3 FREQUENCY SPECTRUM

5G requires Low, Mid and High frequency bands. Low bands (below 1 GHz) such as 600, 700 and 800 MHz are important for operators to achieve wide-area 5G coverage in non-urban and rural areas which can be attached to spectrum licences as a condition (see chapter 9) and deep indoor penetration in urban areas. Mid bands, particularly the lower mid-bands between 3 and 7 GHz offer a compromise between network coverage and capacity, while the High or millimetre wave (mmWave) bands above 24 GHz have the most bandwidth to support very high data rates and network capacity.

Fig. 1: Low, Mid and High 5G frequency bands



In addition, many network operators around the world are repurposing (“refarming”) their existing spectrum assignments below 3 GHz (such as 900, 1800 and 2600 MHz) from 2G and 3G use to 4G and 5G.

3.1 Spectrum holdings

Some telecom operators had in the past criticised imbalances in the current spectrum holdings and requested to consolidate them into contiguous spectrum blocks to increase spectrum efficiency. The following tables show the spectrum assignments before and after the redistribution as part of the consolidation agreement mentioned in chapter 2.1.

Fig. 2: Spectrum holdings below 1 GHz before market consolidation

Band	Uplink		Downlink		Bandwidth		Tech	Operator
	From	To	From	To	UL	DL		
850	824.415	826.875	869.415	871.875	2.46	2.46	4G	DAP
	826.875	827.5	871.875	872.5	0.625	0.625		
	827.5	830	872.5	875	2.5	2.5	CDMA	LankaBell
	830	830.5	875	875.5	0.5	0.5		
	830.5	835.5	875.5	880.5	5	5	4G	Mobitel
	835.5	840.5	880.5	885.5	5	5	4G	Airtel
900	887.5	892.5	932.5	937.5	5	5	4G	Mobitel
	892.5	897.5	937.5	942.5	5	5	2G	Airtel
	897.5	907.5	942.5	952.5	10	10	2G	Hutch
	907.5	915	952.5	960	7.5	7.5	4G	DAP

Fig. 3: Spectrum holdings below 1 GHz after market consolidation

Band	Uplink		Downlink		Bandwidth		Tech	Operator
	From	To	From	To	UL	DL		
850	824.5	829.5	869.5	874.5	5	5	4G	Mobitel
	829.5	834.5	874.5	879.5	5	5	4G	Mobitel
	834.5	839.5	879.5	884.5	5	5	4G	Airtel
900	887.5	892.5	932.5	937.5	5	5	2G, 4G	Mobitel
	892.5	897.5	937.5	942.5	5	5	2G	Airtel
	897.5	902.5	942.5	947.5	5	5	2G, 4G	DAP
	902.5	907.5	947.5	952.5	5	5	2G	Hutch
	907.5	912.5	952.5	957.5	5	5	4G	Hutch
	912.5	915	957.5	960	2.5	2.5	4G	Hutch

Fig. 4: Spectrum holdings above 1 GHz before market consolidation

Band	Uplink		Downlink		Bandwidth		Tech	Operator
	From	To	From	To	UL	DL		
1800	1710	1725	1805	1820	15	15	4G	Mobitel
	1725	1740	1820	1835	15	15	4G	Hutch
	1740	1747.5	1835	1842.5	7.5	7.5	2G	Airtel
	1747.5	1762.5	1842.5	1857.5	15	15	4G	DAP
	1762.5	1767.5	1857.5	1862.5	5	5	2G	Mobitel
	1767.5	1777.5	1862.5	1872.5	10	10	4G	DAP
	1777.5	1785	1872.5	1880	7.5	7.5	4G	Mobitel
2100	1920	1930	2110	2120	10	10	4G	Mobitel
	1930	1940	2120	2130	10	10	4G	Airtel
	1940	1960	2130	2150	20	20	3G	Hutch
	1960	1965	2150	2155	5	5	3G	Mobitel
	1965	1980	2155	2170	15	15	4G	DAP
2300	2300	2360	2300	2360	60		LTE	DBN
	2360	2385	2360	2385	25		LTE	LankaBell
	2385	2400	2385	2400	15		LTE	DBN
2600	2500	2520	2500	2520	20			
	2520	2620	2520	2620	100		LTE	SLT
	2620	2640	2620	2640	20		4G	Airtel
	2640	2650	2640	2650	10			
	2650	2690	2650	2690	40		4G	DAP

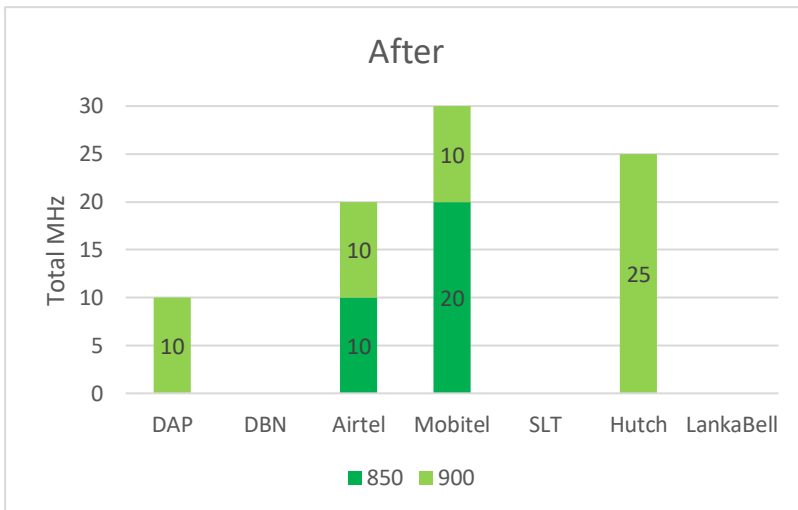
Fig. 5: Spectrum holdings above 1 GHz after market consolidation

Band	Uplink		Downlink		Bandwidth		Tech	Operator
	From	To	From	To	UL	DL		
1800	1710	1725	1805	1820	15	15	4G	Mobitel
	1725	1730	1820	1825	5	5	2G	Mobitel
	1730	1737.5	1825	1832.5	7.5	7.5	4G	Mobitel
	1737.5	1752.5	1832.5	1847.5	15	15	4G	Hutch
	1752.5	1760	1847.5	1855	7.5	7.5	2G	Airtel
	1760	1785	1855	1880	25	25	2G, 4G	DAP
2100	1920	1930	2110	2120	10	10	4G	Mobitel
	1930	1935	2120	2125	5	5	3G	Mobitel
	1935	1955	2125	2145	20	20	3G	Hutch
	1955	1965	2145	2155	10	10	4G	Airtel
	1965	1980	2155	2170	15	15	3G, 4G	DAP
2300	2300	2360	2300	2360	60		LTE	DBN
	2360	2385	2360	2385	25		4G	Mobitel
	2385	2400	2385	2400	15		LTE	DBN
2600	2500	2530	2500	2530	30		4G	Hutch
	2530	2630	2530	2630	100		LTE	SLT
	2630	2650	2630	2650	20		4G	Airtel
	2650	2690	2650	2690	40		4G	DAP

Fig. 6: Total spectrum holdings below 1 GHz before and after market consolidation

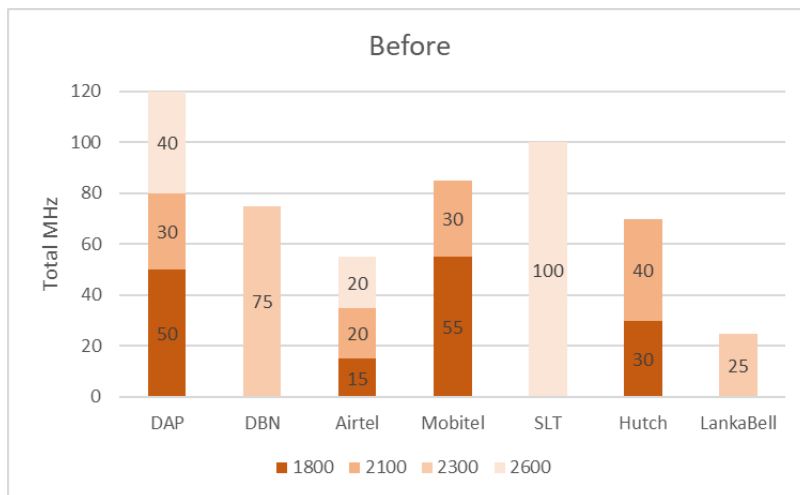


BEFORE	DAP	DBN	Airtel	Mobitel	SLT	Hutch	LankaBell
900	15		10	10		20	
850	4.92		10	10			5

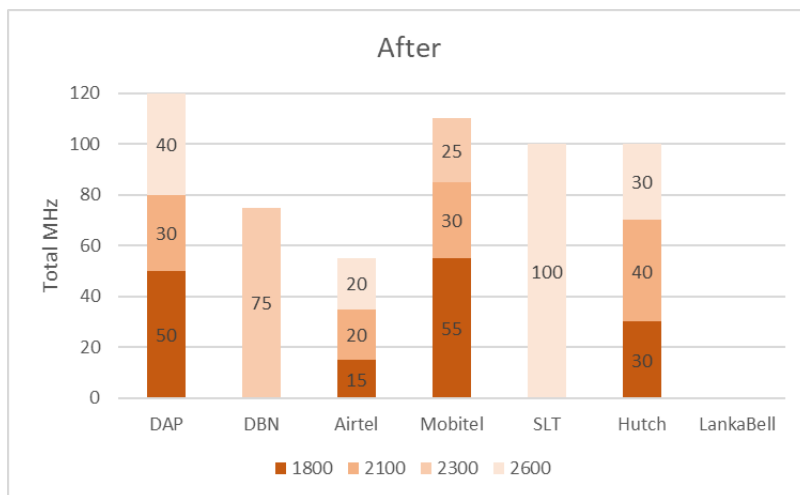


AFTER	DAP	DBN	Airtel	Mobitel	SLT	Hutch	LankaBell
900	10		10	10		25	
850			10	20			

Fig. 7: Total spectrum holdings above 1 GHz before and after market consolidation



BEFORE	DAP	DBN	Airtel	Mobitel	SLT	Hutch	LankaBell
2600	40		20		100		
2300		75					25
2100	30		20	30		40	
1800	50		15	55		30	



AFTER	DAP	DBN	Airtel	Mobitel	SLT	Hutch	LankaBell
2600	40		20		100	30	
2300		75		25			
2100	30		20	30		40	
1800	50		15	55		30	

Q-2

TRCSL is inviting comments from stakeholders on imbalances in current spectrum assignments and proposals for how to address them. Operators are invited to state their current spectrum demand in the different bands and their projections for the next ten years.

Q-3

~~TRCSL is also inviting proposals from operators for how to rearrange the current spectrum assignments to create contiguous spectrum blocks for all operators. Joint submissions by operators who have agreed on spectrum swaps are welcome.~~

Note: Textbox Q-2 and Q-3 are no longer relevant since the operators agreed to the spectrum redistribution as described above on 4 March 2024. For the sake of consistency between the original CP and this amended version, the numbering of subsequent textboxes remains unchanged.

3.2 Regulatory reforms

In addition to the spectrum consolidation described in chapter 3.1, operators have asked for the process for spectrum refarming (changing the use of licensed spectrum e.g. from 2G or 3G to 4G and 5G) simplified, and to be allowed to share the spectrum and Radio Access Network (RAN) resources between their mobile and fixed networks. Unified licensing, which would allow all operators in Sri Lanka to offer fixed and mobile services, has also been discussed.

In view of the planned spectrum assignment and the recent market consolidation, TRCSL is considering regulatory reforms that may help to facilitate even more efficient spectrum assignments in the future.

Q-4

Q-4:

TRCSL is inviting comments from stakeholders on broader regulatory reforms as mentioned above, how such reforms should be implemented, any risks associated with them and how those risks should be mitigated – including but not limited to:

- *Unified licensing*
- *Spectrum refarming*
- *Spectrum sharing*
- *RAN sharing*
- *Spectrum sub-leasing*
- *Spectrum trading*

3.3 Offered spectrum lots, licence period

TRCSL intends to offer the following spectrum lots, all for a ten-year period:

Fig. 8: Offered spectrum lots

Lot 1: 3.40-3.45 GHz	Lot 2: 3.45-3.50 GHz	Lot 3: 3.50-3.55 GHz	Lot 4: 3.55-3.60 GHz
Lot 5: 27.0-27.1 GHz	Lot 6: 27.1-27.2 GHz	Lot 7: 27.2-27.3 GHz	Lot 8: 27.3-27.4 GHz

Note: The lots have been renumbered following the removal of the 2.6 GHz band from the upcoming spectrum assignment (see chapter 2.1).

There is a consensus in the industry, supported by organisations such as the GSA¹ and GSMA², that at least 100 MHz of contiguous mid-band spectrum should be assigned per operator for launching 5G, and 800 MHz of high-band spectrum per operator initially with a plan to make 5 GHz available per market as demand grows. However, given the concerns about low demand for 5G and high spectrum costs that operators raised at the “Sri Lanka 5G Spectrum Assignment Kick-Off Workshop” on 18 July 2023 and the ideas they presented for 5G network sharing, TRCSL intends to offer only the spectrum lots as per the table above at this time and is inviting proposal outlines for network sharing (see chapter 7).

TRC now intends to offer the spectrum in both bands, 3.5 and 27 GHz, in four lots of 50 and 100 MHz each, respectively, in order to give more operators an opportunity to be assigned some spectrum in each band.

Q-5

TRCSL is inviting comments from stakeholders on the offered spectrum lots, the proposed lot sizes, and the proposed licence period of 10 years. Operators are invited to state their current demand for spectrum in the offered bands and their projections for such demand in the next ten years, considering the different options for 5G network deployment in Sri Lanka outlined in chapter 7.

3.3.1 Specific vs. generic lots

There are two options for assigning the lots as listed above if an auction is chosen as the assignment method (see chapters 4, 5 and 6):

1. Bidders bid on specific lots as listed above. Any spectrum consolidation to create contiguous spectrum blocks for each operator within a band will be done separately, if required. This option is suitable if different lots within a band have different value, for example due to their physical characteristics, or because certain conditions are attached to some of them.
2. Bidders bid on generic lots within a band, i.e. on an amount of spectrum with no connection to specific frequencies. The assignment of specific lots to auction winners will be done in a way that maximises spectrum efficiency by minimising band fragmentation. Should there be more than one possible solution for an assignment resulting in minimal band fragmentation, the operators concerned will be invited to reach an agreement, failing which a draw would decide how the specific lots are distributed among the auction winners.
 - 2.a Alternatively, following the initial auction of generic lots, a second auction is conducted to distribute the lots among the winning bidders.

TRCSL assumes that the four lots within each band, 3.5 and 27 GHz, have equal value, so that an assignment of generic lots in an auction and subsequent assignment of specific lots to auction winners through an administrative process is an option.

¹ The Global mobile Suppliers Association (GSA) is a not-for-profit industry organisation that represents suppliers of technology and support services across the worldwide mobile ecosystem.

² The GSM Association (GSMA) is a not-for-profit industry organisation that represents the interests of mobile network operators worldwide.

Q-6

TRCSL is inviting comments from stakeholders on their preference regarding specific or generic lots as described above, and specifically whether they agree with TRCSL's view that that the four lots within each band, 3.5 and 27 GHz, have equal value.

3.4 Backhaul spectrum

New bands, such as the E-band (60-90 GHz) may be required for wireless links to supplement fibre optic networks in satisfying the backhaul and fronthaul requirements of 5G. Given their propagation characteristics and large amount of bandwidth available, many countries around the world have adopted "light-touch" regulation or licence exemptions for these bands.

Q-7

TRCSL is inviting comments from stakeholders regarding their current demand for such spectrum, their projections for such demand in the next ten years, and their preferences for regulatory approaches.

4 ASSIGNMENT METHODS

There are basically four different approaches to spectrum assignments:

- Random Selection (lottery)
- Administrative Assignment
- Comparative Hearings ("beauty contest")
- Auction

Lotteries are widely regarded as not suitable for assigning spectrum in an efficient and legally robust way. They were used to award some analogue mobile licences in the USA in the 1980s but have not been widely repeated since then.

In an Administrative Assignment, the amount of spectrum awarded to operators and the price to be paid for it are set by the regulator, there is no direct competition for the spectrum between the different operators. This method is more suitable than an auction in cases where the demand for spectrum does not exceed the available supply, i.e. the amount of spectrum on offer. It can lead to good outcomes, provided a thorough market assessment and stakeholder consultation has taken place to determine the appropriate parameters for the assignment. However, administrative assignments are vulnerable to being regarded as non-transparent and therefore open to legal challenges.

Beauty Contests are typically used where public policy objectives such as improving coverage are the main concern, more commonly for licensing new network operators rather than assigning additional spectrum to existing operators. They are sometimes also referred to as administrative assignments, but like auctions they do contain a competitive element, expressed in a written proposal, which can include bidding a price for the licence and/or spectrum on offer. However, the criteria for selecting

the winner of a beauty contest are far more complex compared to spectrum auctions, and they are vulnerable to bias by the evaluator and therefore less transparent and more open to legal challenges.

Auctions have become the dominant assignment method for mobile spectrum since the 1990s in competitive markets where the demand for spectrum exceeds the amount of spectrum on offer. They are a transparent, impartial, and legally robust way to achieve efficient assignments.

An efficient assignment is one that assigns the spectrum to those who place the highest value on it, will therefore use it most efficiently and deliver the greatest socio-economic benefits by building high-quality networks with good coverage and offering competitive services to win over customers.

The key advantage of auctions over other assignment methods is that the market players ultimately decide the prices that are paid for the spectrum. As they are driven by market competition, auctions can generate significant government revenue, but they can also lead to inefficient assignments when they are not properly designed for the given market conditions, or fail completely with spectrum remaining unsold, for example when base prices are set too high (see chapter 10).

The telecom operators in Sri Lanka have raised concerns that auctions may lead to inflated prices being paid for spectrum, which would adversely impact their ability to invest in network infrastructure. A closed-bid assignment of 1800 MHz spectrum in Sri Lanka in 2012 has resulted in vastly different prices being paid for the spectrum by the different bidders, a situation referred to as “the winner’s curse” in auction theory. However, there are other options for designing an auction that avoid this and other problems.

The court settlement following the administrative assignment of 2.6 GHz spectrum in 2019 commits TRCSL to assign spectrum through transparent processes, and the 76th Budget of Sri Lanka 2021 requires that 5G spectrum is assigned by auction.

The following paragraphs describe different auction design options and highlight the risks that need to be managed.

Q-8

TRCSL is inviting comments from stakeholders on the suitability of the different auction types described in chapter 5 for the upcoming spectrum assignment in Sri Lanka, in combination with the additional auction design options described in chapter 6. Suggestions are welcome as to whether and how the different options should be applied.

5 AUCTION TYPES

There are two main types of spectrum auctions:

- Single-round
- Multiple-round

The auction design can be further differentiated by using options such as:

- First vs. second price
- Sequential vs. simultaneous
- Single items vs. package bidding

5.1 Single-round sealed-bid auctions

Single-round auctions give bidders just one chance to submit an offer for the spectrum licence(s) they are interested in. Unlike in multiple-round auctions (see chapter 5.2) there is no price discovery, i.e. bidders have no knowledge of the bids of other bidders, so they are essentially bidding blind. Because of this lack of information, winning bidders can end up paying significantly more for the spectrum than they would need to in order to beat the bids of others, a situation called “the winner’s curse”. It creates an incentive for bidders to bid lower than their true valuation³ of the spectrum (“bid shaving”) and thereby running the risk of not being awarded the spectrum despite actually valuing it more.

In the most basic form, the single-round, first-price, sealed-bid auction, the highest bid wins and the winner pays the price he has bid. This auction type is not recommended for spectrum auctions because it can lead to undesirable outcomes: Bid shaving can result in the spectrum being awarded to the bidder bidding most aggressively and not necessarily to the one that can create more socio-economic value, and a significantly higher price paid as a result of the winner’s curse reduces the amount that the winner can spend on network infrastructure.

5.1.1 First-price vs. second-price

The winner’s curse can be mitigated by using the second-price option for single-round sealed-bid auctions, which means the highest bid still wins, but the price paid for the spectrum is the second-highest bid (the highest losing bid). This auction format also eliminates the incentive for bid shaving because it would not reduce the amount paid for the spectrum but would increase the risk of not winning it. However, bidders could still be tempted to bid higher than their true valuation to increase their chance of winning, hoping that the second-highest bid will be at or below their true valuation.

While the second-price principle of this so-called Vickrey auction may seem strange to many at first glance, it is actually similar to the eBay auction format where the price paid is the second-highest bid plus one bid increment, e.g. one dollar. The eBay auction is essentially a Vickrey auction where, instead of a single sealed bid, the bidding is allowed to continue over a certain time period.

5.2 Multiple-round auctions

The simplest form of a multiple-round auction is a sequential sealed-bid auction in which similar or related items, for example different bands or blocks of spectrum, are auctioned in several sequential rounds. The first-price or second-price option can be used (see chapter 5.1.1). Announcing the results after each round allows for a certain degree of price discovery and leads to more efficient bids in the subsequent rounds.

Better price discovery is provided in a simultaneous multiple-round auction (SMRA), also called a simultaneous ascending auction. This method was designed for auctioning a large number of licences at the same time in a series of separate rounds. It solves the problem of the winner’s curse, and in addition it removes the incentive for bidders to bid above their true valuation in a Vickrey auction to increase their chance of winning (see chapter 5.1.1).

After each round in a SMRA, information about the bids is revealed to all bidders. Another round is then opened to allow counterbids, and the process is repeated until there are no more bids. The highest bid wins and is paid, so this is a first-price auction.

³ A bidder’s true valuation is the maximum price he can afford to pay for the spectrum while maintaining profitability targets, taking the revenue potential into account and all other costs of the business, including the cost of building the network infrastructure, or the cost of modifying existing network infrastructure to deliver the same performance if the spectrum was not won.

In each round, bids are submitted for all the licences on offer, which may be divided into spectrum blocks and/or geographic regions. This approach allows bidders to place bids on the licences they need for their business plan, aggregate complementary licences, or consider substitutes if the prices for some licences rise too high. Because of these synergies among the different licences, a bid on one licence will keep the entire auction open for all licences. In auctions with a large number of licences, bidders may have to evaluate a significant amount of information after each round to determine the best strategy for the next round.

Another format is a clock auction, where ascending prices are shown on a 'clock' and bidders quit the auction when the price rises too high for them. The last remaining bidder wins the auction and pays the price on the clock.

5.3 Combinatorial auctions (package bidding)

With package bidding, bidders may place bids on individual licences as well as groups of licenses. This can lead to more efficient assignments when there are strong synergies among items being auctioned and strong and divergent preferences among bidders for different combinations. In other words, licences may be worth more to some bidders as a package than individually, and other bidders may have preferences for different packages.

These combinatorial auctions are particularly suitable for assigning spectrum in small blocks and across multiple bands, allowing bidders to assemble their desired spectrum portfolio without being exposed to aggregation risk, i.e. the risk of winning only part, but not all, of a preferred package, and spending more for individual licences than they are worth to the bidder by themselves.

For example, a bidder may place a higher value on winning two lots of spectrum in a particular band, or across two bands, than on winning only one of those lots. He would then place a bid on the package of two lots that is higher than the sum of his bids for the two individual lots. Or he may not be interested in the bands at all if he can obtain only one lot, in which case he would bid only for the package of two lots and not for the individual lots.

6 ADDITIONAL AUCTION DESIGN OPTIONS

6.1 Spectrum caps

Spectrum caps limit the amount of spectrum a bidder can obtain in an auction. Regulators can use this tool to ensure an equitable distribution of spectrum or to prevent the concentration of spectrum in the hands of one or a few operators who may have the 'deepest pockets' but not necessarily the best use for the spectrum, and in the worst case to prevent 'spectrum hoarding'⁴. However, spectrum caps need to be set with care as they can also conflict with the regulator's primary goal of putting the spectrum to its highest value use.

Caps may be applied to spectrum of a particular type, e.g. sub-1GHz spectrum, and/or the total amount of spectrum a bidder can win in an auction. Existing spectrum assignments need to be taken into account, which may already be asymmetric for historical reasons. However, an equal distribution of spectrum among all operators is not necessarily appropriate or desirable – some operators may

⁴ Spectrum hoarding describes a situation where an operator buys up spectrum not with the primary goal to use it efficiently but to limit other operators' ability to compete or to keep new entrants out of the market.

need more spectrum than others to serve their larger subscriber bases or to pursue business cases that differ from those of other operators.

In the upcoming spectrum assignment, if an auction is chosen as the assignment method, TRCSL intends to impose a cap of 100 MHz in the 3.5 GHz band to increase the chances for each operator to win some spectrum in this band. In the 27 GHz band TRCSL intends to impose no cap, in order to give each operator the opportunity to win all of the spectrum currently on offer if they so wish.

Q-9

TRCSL is inviting comments from stakeholders on the proposed spectrum caps.

6.2 Set-asides

Set-asides can be used for various purposes in a spectrum auction, for example to encourage participation by new market entrants. With this approach, certain parts of the available spectrum are set aside for new entrants, and incumbents are excluded from bidding on the set-aside block(s). This guarantees that a new entrant will win at least the set-aside block. The approach has been used successfully around the world, including in Canada, France, Germany, India, Japan, Mexico, South Korea, the UK, USA, and many other countries.

A particular question to consider for 5G is whether parts of the available spectrum should be set aside for licensing to private 5G networks and/or for unlicensed use (see Option #2 in chapter 7.2). Some countries have allocated parts of the 3.5 GHz band and other mid-bands for local private 5G licences, including Brazil, Canada, Chile, Germany, the Netherlands and the UK. Some countries have also done so with mmWave bands (Brazil, Hong Kong, Japan, UK). In France and New Zealand, parts of the 2600 MHz band have been made available for private 4G and 5G licences.

Q-10

TRCSL is inviting comments from stakeholders on possible set-asides in connection with this spectrum assignment, in particular in relation to Option #2 in chapter 7.2.

6.3 Bidding credits

Bidding credits, i.e. discounts on spectrum prices, can be used to help smaller operators compete with bigger ones that have bigger budgets, or to attract new entrants into the market. They have been successfully used in a number of European countries, North America and South Korea. However, they have also been criticised for being unfair to incumbent operators and for potentially resulting in entry by firms with higher costs and less attractive offerings. Spectrum caps (see chapter 6.1) in combination with adequate base prices (see chapter 10) are seen as a more effective tool.

7 SPECTRUM ASSIGNMENT AND 5G INFRASTRUCTURE OPTIONS

In view of feedback received from telecom operators at the Sri Lanka 5G Spectrum Assignment Kick-Off Workshop on 18 July 2023, TRCSL is proposing the following three options for the assignment of the 3.5 GHz and 27 GHz spectrum as per chapter 3.3:

7.1 Option #1: Auction

The 3.5 GHz and 27 GHz spectrum is offered to all qualified bidders as per chapter 12 in an auction. See chapters 5 and 6 for information on the different auction design options. Operators who win spectrum may form partnerships to share the cost of network deployment.

Pro:

- Relatively simple and fast, transparent process.

Con:

- Depending on lot sizes and spectrum caps (see chapters 3.3 and 6.1), not all operators may succeed in winning the spectrum they want at this time.

7.2 Option #2: Administrative assignment to SWN

The 3.5 GHz and 27 GHz spectrum is assigned to a single wholesale network (SWN)⁵ neutral infrastructure operator for 5G, which could be a Joint Venture of existing operators, or a new market entrant. Regulation will be updated or new regulation introduced as needed to ensure fair and open access for all service providers to the SWN infrastructure.

A single 100 MHz spectrum block of 3.5 GHz spectrum and fewer than four 100 MHz blocks in the 27 GHz band may be sufficient for the SWN operator to start, considering the low demand for 5G services as currently seen by the existing telecom operators in Sri Lanka. The remaining spectrum could be used for private 5G networks, or assigned to the SWN at a later date when the demand for 5G services increases.

Pro:

- This option accommodates preferences that telecom operators have expressed at the kick-off workshop in Colombo in July 2023 for an administrative assignment (instead of an auction), for a shared network to reduce infrastructure costs by avoiding duplication, and for lower spectrum costs if only part of the currently available spectrum is assigned at this time.

Con:

- Establishing and licensing the new SWN entity and the necessary regulatory reforms will take time and may delay the introduction of 5G in Sri Lanka.
- No infrastructure-based competition between multiple operators.
- An administrative assignment instead of an auction would be in conflict with the directive issued in the 2021 National Budget (see chapter 4) and may require an exception to be approved.

⁵ Examples for SWN include DNB in Malaysia, UNN in Brunei and KTRN in Rwanda

7.3 Option #3: Assignment to existing operators with sharing obligations

The 3.5 GHz and 27 GHz spectrum is offered to existing operators in an auction, with sharing obligations attached. Obligations may include spectrum and/or infrastructure sharing with all other network operators, providing national roaming and/or hosting Mobile Virtual Network Operators (MVNO). Operators who win spectrum may form partnerships to share the cost of network deployment.

Pro:

- This option offers various opportunities for operators to share spectrum and infrastructure to reduce the cost of network deployment while maintaining the potential for infrastructure-based competition.

Con:

- Negotiating network sharing agreements between operators and the related regulatory reforms may take time and delay the introduction of 5G in Sri Lanka.

Q-11

TRCSL is inviting statements from telecom operators regarding their preference for one of the three options presented here.

Q-12

TRCSL is further inviting expressions of interest from operators or prospective consortia of operators for shared 5G network deployments under Options #2 and #3, with brief business plan outlines and suggestions for terms or conditions that should apply.

8 2.6 GHZ SPECTRUM ASSIGNMENT

The remaining spectrum in the 2.6 GHz band will no longer be part of the upcoming assignment since it was assigned to Hutch under the consolidation agreement on 4 March 2024 (see chapter 2.1).

Note: Textbox Q-13 and Q-14 have therefore become irrelevant. For the sake of consistency between the original CP and this amended version, the numbering of subsequent textboxes remains unchanged.

Q-13

~~*Telecom operators are invited to state their current demand for this spectrum and their projections for such demand in the next ten years, considering the possible regulatory reforms as per chapter 3.1.*~~

Q-14

TRCSL is inviting comments and alternative suggestions from telecom operators regarding the planned assignment method (auction) for the 2.6 GHz spectrum.

9 USE OF SPECTRUM AND ROLLOUT OBLIGATIONS

Under the current regulatory regime, the spectrum licences will be offered for mobile services using certain technologies. Licences in the 3.5 and 27 GHz bands will be for 5G services.

TRCSL intends to attach only light rollout obligations to spectrum licences for 5G services, considering the extensive 4G coverage that already exists across Sri Lanka, and recognising that the relevant frequency bands are primarily suitable for increasing capacity in high-traffic areas and not for wide-area coverage. However, to ensure that each of Sri Lanka's 25 districts will have some 5G services, holders of spectrum licences for 5G services will be required to launch commercial 5G services at a small number of base station sites in every district in each of the first three 12-months periods after licensing according to the table below. Commercial 5G services will also have to be launched at a certain minimum number of base station sites across the country in each of those 12-months periods.

Bank guarantees will be required to secure the rollout obligations according to the table below.

Fig. 9: Rollout obligations for 5G spectrum holders

Period (months after licensing)	Min. number of new 5G base stations per district	Total number of new 5G base stations	Bank guarantee amount (LKR million)	Bank guarantee validity (months after licensing)
0-12	2	300	300	15
12-24	4	400	400	27
24-36	4	500	500	39

Q-15

TRCSL is inviting comments from stakeholders on the proposed rollout obligations.

10 UPFRONT AND ANNUAL SPECTRUM FEES, AUCTION BASE PRICES

The upfront spectrum fees, annual frequency charges and base station fees for the spectrum to be awarded under the planned assignment will be calculated according to current regulations, with possible adjustments of the Frequency Charge per KHz of assigned bandwidth, the Frequency Charge Multiplication Factor (K1) for bands above 2.2 GHz, and/or the Technology Factor (N) for 5G. TRCSL is considering such adjustments and will announce its decision in the Notice of Assignment (NoA, see chapter 1).

Q-16

TRCSL is inviting comments from stakeholders on adjustments that should be made to the current spectrum pricing formulas.

If an auction is chosen as the assignment method, bidders will bid the upfront spectrum fees they are willing to pay. The base prices for the auction, i.e. the lowest bids TRCSL is willing to accept for the different spectrum lots, will be calculated in accordance with then current regulations.

11 PAYMENT TERMS

The upfront spectrum fee will be payable within 14 days after the spectrum assignment. Annual frequency charges and base station fees will be payable according to the current practice.

Q-17

TRCSL is inviting comments from stakeholders on the suggested payment terms.

12 PRE-QUALIFICATION

Entities wishing to participate in the planned spectrum assignment must meet the following pre-qualification requirements:

Q-18

TRCSL is inviting comments from stakeholders on the proposed pre-qualification requirements.

12.1 Legal qualification

Only telecom operators in possession of a mobile licence under Section 17 of the Sri Lanka Telecommunications Act will be eligible to participate in the spectrum assignment.

12.2 Technical qualification

Only companies operating a 4G mobile network in Sri Lanka will be eligible to participate in the spectrum assignment.

12.3 Financial qualification

Only telecom operators with no outstanding licence fees under Sections 17 and 22 of the Sri Lanka Telecommunications Act will be eligible to participate in the spectrum assignment.

Operators wishing to participate in the spectrum assignment will be required to pay a non-refundable registration fee of LKR 100,000.

Furthermore, a bank guarantee will be required to secure payment of spectrum fees due under the spectrum assignment. TRCSL will announce its decision on the bank guarantee amount in the Notice of Assignment (NoA, see chapter 1).