

8 November 2018

Vodacom's comments on the proposed Policy and Policy Directions to the Authority on licensing of unassigned high demand spectrum, as published in Government Gazette 41935 on 27 September 2018

1. Introduction

Vodacom Pty Ltd (“Vodacom”) wishes to thank the Department of Telecommunications and Postal Services (“DTPS”) for the opportunity to provide written comments on the proposed Policy and Policy Directions (“Policy Direction”) to the Authority on licensing of unassigned High Demand Spectrum (“HDS”), as published in the Gazette 41935 on 27 September 2018.

Vodacom is a committed investor and leading provider of communications services in South Africa and understands the centrality of communications to achieving the Government’s National Development Plan for South Africans in relation to job creation, economic growth, healthcare and education. These opportunities will be realised through new and more widespread mobile and fixed communications technologies, if a supportive climate for investment and appropriate regulatory framework is established.

We encourage the assignment of high demand spectrum as quickly as possible and we support a competitive WOAN as contemplated by the proposed Policy Direction.

The CSIR Study envisages the assignment of too much HDS spectrum to the WOAN and the Policy Direction contemplates other WOAN incentives that are likely to distort competition and/or may be beyond the scope of the Electronic Communications Act 2005 (as amended).

However, we believe that **the Government’s broad objectives can be achieved within the scope of the existing regulatory framework**. Once the Policy Direction is finalised, the Authority should promptly commence the process for the assignment of the high demand spectrum.

Vodacom’s comments are structured as follows:

Section 2: Executive Summary

Section 3: Spectrum assignment

Section 4: Capacity commitments

Section 5: Other incentives for the WOAN

Section 6: Universal access and universal service obligations

Section 7: Other spectrum issues and WOAN-related matters

Section 8: Process, legal concerns and proposals

There are two appendices to our submissions.

In **Appendix A**, we attach a report prepared for Vodacom by Frontier Economics

In **Appendix B**, we attach a Vodacom technical report, addressing specific issues under the CSIR Study.

Glossary

Act (or ECA)	The Electronic Communications Act, No. 36 of 2005
Authority (or ICASA)	The Independent Communications Authority of South Africa
Bill	The Electronic Communications Amendment Bill, as presented to Parliament on 19 September 2018
competitive WOAN	A WOAN that operates in a competitive environment with MNOs under the regulatory framework in the Act and that is assigned sufficient high demand spectrum to compete
Constitution	The Constitution of the Republic of South Africa, 1996
CSIR	The Council for Scientific and Industrial Research
CSIR Study	The abridged final report entitled “Spectrum requirements for Wholesale Open Access Network (WOAN)” issued on 18 September 2018 and attached to the proposed Policy Direction
Department (or DTSP)	Department of Telecommunications and Postal Services
earlier Submissions	Our submissions to the Department, in relation to the amendment bill published in November 2017, in January 2018 and March 2018
HDS licensee	A radio frequency spectrum licensee that is assigned, or to be assigned, currently unassigned high demand spectrum, as contemplated in Paragraph 2 of the Policy Direction
ICASA Act	The Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000)
ITA	Invitation to apply, a process followed by the Authority in assigning radio spectrum
LTE	Long Term Evolution, a 4G wireless broadband technology developed by the Third Generation Partnership Project (3GPP)
MNO	Mobile network operator
Policy Direction	The proposed Policy and Policy Directions from the Minister to the Authority on licensing of unassigned high demand spectrum, as published in the Gazette on 27 September 2018
Section 4B inquiry	An inquiry conducted by the Authority under section 4B of the ICASA Act
UAUSO	Universal access and universal service obligations
WOAN	Wireless or wholesale open access network

2. Executive Summary

2.1 Introduction

The proposed Policy Direction contemplates the licensing of a WOAN and assignment of high demand spectrum to the WOAN and existing licensees, in terms of an ITA to be issued by the Authority under the current regulatory framework.

Vodacom envisages a competitive WOAN that preserves the fundamental principles of market-based competition - operating within the regulatory framework embodied in the Act, while also contributing meaningfully to the transformation of the ICT sector.

2.2 Spectrum assignment

To achieve a competitive WOAN operating under these principles, there should be an assignment of sufficient unassigned high demand spectrum to the WOAN and sufficient unassigned high demand spectrum to other operators. This way, all operators, including the WOAN, can sell their services into the same market on a competitive basis.

In our view, the CSIR Study recommends that a disproportionately large amount of spectrum be assigned to the WOAN, which would provide the WOAN with an unjustified benefit and reduce the value associated with this spectrum. In addition, this will decrease the amount of spectrum available for other operators who wish to bid for high demand spectrum. The WOAN should not, in our view, need more spectrum than the two largest operators in the market, who already have a large market share to serve.

The CSIR Study's recommendation will also exclude at least one of the existing major mobile operators, because there would only be sufficient low frequency spectrum for three operators and not four. This risks significant and unnecessary distortion of the mobile market, through excluding an operator that has committed substantial network investment over the years. Finally, it would also exacerbate the risk that, given the WOAN will be inexperienced in deploying networks in South Africa, the spectrum that it acquires may be used inefficiently.

Vodacom has carried out its own technical analysis of the amount of spectrum needed for the WOAN to be able to serve 10%-20% of LTE customers. The analysis shows that, under a relatively high future data consumption assumption (22GB per month), the WOAN would need:

- 15MHz downlink to be able to serve 10% of customers
- 25MHz to serve 15% and
- 30MHz to serve 20% of customers.

In terms of the actual package of spectrum, based on the technical analysis undertaken by Vodacom, the following amounts should be sufficient for the WOAN to serve 15-20% of LTE customers, under these optimistic data consumption assumptions:

- 2x10MHz of low frequency with 2x10 – 2x20MHz of 2.6 FDD GHz spectrum; or
- 2x10MHz of low frequency with 1x25MHz 2.6GHz TDD.

For ease of reference, we summarise this assessment and our proposals in the following table:

Estimated WOAN capacity requirement		Spectrum Band	Policy Direction/CSIR		Vodacom recommendation	
Policy Direction/CSIR	Vodacom		WOAN	Remainder for auction	WOAN	Remainder for auction
60 MHz downlink (though estimated 40 MHz downlink)	Max 30 MHz downlink	700/800	2x25 (45% of available band) in 800/700MHz	2x30 in 700MHz	2x10	2x45
		2600	2x20 FDD (29% of available band) 1x25 TDD (100% of available band)	2x50 FDD	2x10/2x20 FDD or 1x25 TDD	2x50/60 FDD

Under this allocation, if 2x10MHz of low frequency spectrum is assigned to the WOAN, this would leave 2x45MHz of low frequency spectrum that may be assigned to other MNOs. This would ensure equal opportunity between each of the four existing major mobile operators, who can each potentially win (at least) 2x10MHz of low frequency spectrum. In other words, there should be an objective of five equal blocks of high demand spectrum (WOAN and four MNOs). As noted by Frontier Economics in its attached report “[t]his would be consistent with the ICASA’s previous ITA and would put the WOAN and the MNOs on a more equal footing with regards to providing LTE coverage in rural and under-served areas”.

2.3 Capacity commitments

The Policy Direction directs the Authority to consider incentives around HDS licensees acquiring capacity in the WOAN and instructs the Authority to impose a licence condition in this regard. As already indicated, we accept there should be a capacity commitment that provides an anchor tenancy for the WOAN to support its ability to raise finance.

It doesn’t make sense to us that each HDS licensee is obliged to acquire 30% of the national capacity of the WOAN. The 30% figure was raised by the operators in the discussions with the Government in 2017, but in relation to the aggregate capacity commitment of the operators, not each operator individually. It must be stressed that the capacity commitment must be fully defined by the Authority in due course and Vodacom’s commitment is dependent on a reasonable definition of national capacity. Otherwise the WOAN might be incentivised to deploy significantly more capacity than is needed on the basis of the purchase commitments. This will result in higher prices for South African consumers – the exact opposite of what the Policy Direction seeks to achieve.

If each HDS licensee acquires 30% of the WOAN’s capacity, this would mean that there will be little WOAN capacity available for MVNOs and smaller operators. The purpose of the WOAN is to increase services-based competition and the inclusion of smaller players, not to provide additional capacity for the existing MNOs. It also means that, if the four HDS licensees are obliged to take-up 30% capacity each, it effectively amounts to a total capacity commitment of 120%, which is not logical.

To assist the WOAN to secure funding, we propose that the licensees that acquire high demand spectrum collectively commit to 30% capacity of the WOAN, and therefore act as the anchor

tenant. The WOAN will approach the HDS licensees to purchase capacity and, if the capacity procured collectively equals or exceeds 30%, the above capacity commitment is met. In the instance where the capacity procured by the HDS licensees does not equal 30%, they will be obliged to procure the remainder of the 30% capacity from the WOAN (in proportion to their relative market shares).

2.4 Other incentives for the WOAN

Vodacom is of the view that the WOAN should not be awarded undue, unfair or unreasonable incentives, as this will in all probability cause unnecessary and inefficient distortions in the market place. This includes incentives related to access to facilities, network services and the payment of spectrum fees. The Authority should determine the final incentive package for the WOAN, following an inquiry, with an appropriate cost-benefit analysis. Overall, the assessment of incentives and associated costs and benefits should result in the WOAN being given the appropriate level of assistance to enter and to get established in the market. It should not result in a set of incentives that distort the market and give the WOAN favourable conditions into perpetuity. In a dynamic market like telecoms, it is essential that all operators are able to stand on their own two feet. As such, any incentives should be time-limited.

Payment for high demand spectrum

As part of the Authority's assessment of incentives, it might be deemed appropriate for the WOAN to have different payment conditions for its spectrum. This could be either a discounted price for the spectrum or the ability to pay off the spectrum price over a period of time. If the WOAN has the ability to decide where and when to deploy its network, then this combination of incentives will give the WOAN a fair chance of success and the ability to respond to the needs of its customers.

Access to facilities

Vodacom is of the view that WOAN will benefit from a competitive market for mobile sites and other facilities which will ensure timely access and competitive terms. The obligation to provide immediate access to facilities is therefore not required.

Furthermore, Chapter 8 of the Act, and the Facilities Leasing Regulations, set out clear provisions on the terms and negotiation of such agreements, and enable the regulation of access to facilities (if technically and economically feasible) to the WOAN, as a requesting licensee, on non-discriminatory terms.

2.5 Universal access and universal service obligations on HDS licensees

The Policy Direction contemplates that universal access and universal service obligations (**UAUSO**) are imposed on HDS licensees in rural and under-serviced areas, which must be complied with *before* the assigned spectrum may be used in other areas by the licensees.

If the Authority chooses to follow the recommendations in the Policy Direction, service quality in urban and sub urban areas, where congestion is more prevalent, will decrease because operators will be unable to address capacity constraints. This obligation will delay the deployment of the latest technology and investment, and the provisioning of additional capacity, where the need for it is most prevalent and economic impact is the highest.

Vodacom's view is that HDS licensees should be subject to the UAUSO obligations in rural and under-serviced areas, but this should not prevent licensees from using the high demand

spectrum in other areas at the same time. This condition would be consistent with the twin objects of efficient spectrum use and universal access under the Act. Failure to comply with those UAUSO obligations may result in penalties and other serious consequences for the licensee under the Act.

Licensees should be permitted to satisfy these UAUSO obligations through sharing and roaming arrangements, commercially negotiated with other operators or with the WOAN. This may include a geographical segmentation among the HDS licensees, set by the Authority, where each HDS licensee may be required to deploy network in separate parts of the country and the other HDS licensees may roam on that network in those areas to satisfy its UAUSO obligations.

In setting these UAUSOs as part of an inquiry, the Authority should take into account the unavailability of suitable backhaul and backbone transmission in many parts of the country and that the 2.6GHz spectrum, which should be available before the 700 and 800MHz spectrum, would not be suitable for a broad UAUSO obligation.

2.6 Other spectrum matters, including wholesale open access to spectrum

The Policy Direction requires a licence condition to be imposed that spectrum is assigned “subject to Chapters 8 and 10 of the Act”. It is not clear what this means.

If this implies that all assignments of spectrum will be subject to the principles of wholesale open access (a novel concept for spectrum) and on a non-exclusivity basis, it will hamper licensees’ ability to provide high quality, efficient, high capacity networks, and a reliable customer service experience.

The non-exclusive assignment of spectrum limits a licensee’s ability to manage the use of spectrum unconstrained. It risks harmful interference, limits effective optimisation of spectrum and creates uncertainty over the spectrum rights the licensee has. High demand spectrum should not be subject to wholesale open access and non-exclusive rights to spectrum should not be mandated through licence terms.

2.7 Process issues

Once the final Policy Direction is published, we propose that the Authority commence an inquiry under section 4B of the ICASA Act (or some other formal process that ensures equivalent consultation rights and due process for interested parties), which would investigate, among other things:

- how much unassigned high demand spectrum should be assigned to the WOAN and how much to other operators;
- whether and, if so, what incentives should be provided to the WOAN;
- the key terms for the capacity off-take condition in the HDS licences; and
- the universal access and universal service obligations that would apply to the HDS licensees.

At some point, the Authority may proceed with the selection of a consortium to become the WOAN. It is not essential that the WOAN consortium be appointed at the same time as the

assignment of the high demand spectrum to the operators, as the commitments made by the HDS licensees to acquire WOAN capacity, and any other licence commitments, may be taken up by the WOAN once it is established.

2.8 Coexistence with the Bill

The current parallel processes in relation to the Bill and the Policy Direction, with overlapping but inconsistent provisions, are confusing and risks further undermining Government's policy objectives. Notably, proceeding with an auction of high demand spectrum with the uncertainty that the terms of the license could be materially amended in the short to medium term after the passing of the Bill will be a major concern for possible participants in the auction.

We propose that Parliament suspends the Bill considering its far-reaching implications for the sector and consumers, and we recommend that the Policy Direction process, with the fine-tuning that we suggest in these submissions, continues as quickly as possible. This will promote an investor-friendly environment without detracting from the transformation and universal access objectives, and enable the timely and efficient roll-out of much needed infrastructure and new technologies, for the benefit of consumers and the whole South African economy.

3. Spectrum assignment

3.1 Introduction

The competitive WOAN, and the operators, should be assigned sufficient high demand spectrum in the 700MHz, 800MHz and 2.6GHz bands to allow sustainable investment, market participation and innovation in the provision of LTE-based services, while at the same time ensuring a level playing field.

In this section 3, we submit that the analysis contained in the CSIR Study does not support the CSIR's proposals in relation to the high demand spectrum to be assigned to the WOAN and to the operators.

In the remainder of this section, we discuss the principle that we propose should be applied to assigning high demand spectrum to the WOAN and to the operators¹. We then set out our critique of the CSIR Study. Finally, we apply a principled approach to calculating how much high demand spectrum should be assigned to the WOAN. The result is quite different from the CSIR Study.

3.2 A principled approach

In our earlier Submissions, we submitted there are two factors when we consider a principled approach to the assignment of the unassigned high demand spectrum.

First, the WOAN, and the operators, should be assigned sufficient unassigned high demand spectrum that will enable them to remain competitive and be equally efficient. They should be

¹ Vodacom is of the view that an inquiry under s4B of the ICASA Act is the appropriate way, both in terms of the legal and constitutional framework, and under comparative international best regulatory practice, to determine some of the critical aspects the envisaged ITA would address – this is considered further below. Where we offer Vodacom's views on appropriate parameters or approaches to these issues that should form part of such an inquiry, these are offered either as an indication of what the Authority must take into account in such an inquiry, or, if the notion of an inquiry should incorrectly be rejected, our inputs are offered as the appropriate parameters, approaches and numbers to apply in the envisaged ITA.

able to compete on capacity (download and upload speeds) and coverage, and the latest technology and type of services (related to the specific spectrum assigned), assuming they deploy latest technology efficiently.

Second, the WOAN, and the operators, should be assigned spectrum that enables them to offer competitive wholesale LTE services at comparable unit costs to the corresponding costs of an efficient 4G/LTE operator at a given time in the future. This assessment should, among other things, take into account any coverage obligations on the WOAN and the operators in their licences, the benefit to the WOAN of any capacity pre-commitments and any other support and incentives given to the WOAN which would reduce its unit costs relative to other licensees.

This way, all operators, including the WOAN, can sell their LTE services using high demand spectrum into the same market on a competitive basis. It should also be borne in mind that the WOAN will have no experience in rolling out mobile networks in South Africa, which creates the risk that the spectrum might not be used efficiently if the WOAN is assigned too much high demand spectrum.

It is important to consider relative positions of the WOAN and existing operators in regard to LTE/4G, not in total spectrum terms. The WOAN will be a 4G operator, whereas existing operators have legacy 2G and 3G services that are spectrum hungry and that cannot be simply switched off for some considerable length of time.

Sufficiency also involves consideration of the relative assignments of lower and higher frequencies within the unassigned high demand spectrum bands. Again, in our view, the assignment of lower and higher frequency high demand spectrum should be relatively symmetrical between the WOAN and the operators to enable them to compete profitably and sustainably in the LTE wholesale market.

3.3 Critique of the CSIR Study

Our key critique of the CSIR Study

Our main concerns with the CSIR Study are that the CSIR makes various erroneous assumptions and other errors in reaching their findings, which resulted in the CSIR overstating the amount of spectrum required by the WOAN.

If the Authority acts on the recommendation in the CSIR Study, this will provide the WOAN with an unjustified benefit, which will decrease the amount of spectrum available for other operators who wish to bid for high demand spectrum, as well as having a dampening impact on the value of such spectrum.

The CSIR Study's recommendation would risk significant and unnecessary distortion of the mobile market, through excluding an operator that has committed substantial network investment over the years. Finally, it would also exacerbate the risk that, given the WOAN will be inexperienced in deploying networks in South Africa, the spectrum that it acquires may be used inefficiently.

3.4 Introduction to the CSIR Study recommendations

The CSIR Study recommends that the following spectrum should be reserved for the WOAN:

- 2x25 MHz of 800 MHz
- 2x20 MHz of 2600 MHz FDD
- 1x25 MHz of 2600 MHz TDD

This recommendation is equivalent to 60MHz downlink spectrum. At this point, we note that the CSIR Study itself estimated that the WOAN would need 40MHz downlink spectrum, based on the assumptions and calculations that we discuss below. The CSIR Study did not justify the difference between the requirement of 40MHz as determined and the recommendation, which amounts to an increase of 50%.

3.5 Estimated market share of the WOAN

The CSIR Study considers the market share that the WOAN would require to be sustainable or viable in the long term.

The approach in the CSIR Study is to consider the LTE/4G subscriber market segment as relevant for its analysis. We agree with that approach. Frontier Economics considered this issue further in its attached report. Frontier Economics goes on to discuss that it is appropriate to consider the retail market and retail customers. This means that the WOAN should be able to provide the wholesale capacity to support the demand for the relevant market share (see below) of the retail LTE market segment.

The CSIR Study concludes that the WOAN would need to have a 10-15% market share to be sustainable or viable in the long term. However, it then uses a 20% market share as a basis for calculating the amount of spectrum the WOAN would require.

On this point, Frontier Economics concludes that:

“In summary, 10-15% market share of the forecasted demand generated by LTE/4G subscribers could be sufficient to ensure the sustainability of the WOAN in SA. There may be merits in considering also a more conservative approach, given the 10-15% share comes from international precedents, and the WOAN may require some more flexibility in the longer term to be able to meet data demand growth. Vodacom has therefore considered in their technical analysis the spectrum necessary to serve a range between 10% and 20% of this demand, which also incorporates the assumption used in the CSIR study”.

Frontier Economics recognises that the WOAN’s fixed investment costs will be impacted by its coverage obligations, if it has any, and to the extent that the WOAN is able to negotiate facilities leasing and/or national roaming arrangements. As noted elsewhere in these submissions, we don’t consider the WOAN should have rural coverage obligations, which would then mean that the WOAN should have relatively low fixed investment costs, and therefore would be sustainable with a lower market share.

Frontier Economics also considers that the question of the market share that would make the WOAN successfully viable needs to take into account other incentives the WOAN may be provided with, and the advantages that such incentives will confer on the WOAN, including in terms of reduction in risks and lower coverage costs. This would inform more reliably the market share that the WOAN would require to be viable in the longer term.

3.6 CSIR Study assumptions and errors

Frontier Economics summarised the CSIR methodology as follows:

“The CSIR study attempts to estimate the amount of spectrum the WOAN would need, considering some (but not all) of its other advantages. More specifically, it projects forward the size of the LTE market and the amount of traffic that LTE customers would generate. It assumes that the WOAN would have access to the other MNOs’ sites and estimates how much spectrum the WOAN would need to be able to serve 20% of LTE customers”.

The CSIR’s methodology summarised above relies on certain erroneous assumptions and other errors in reaching their findings, discussed further in the Frontier Economics report. We also set out our reasoning in detail in our attached technical report in Appendix B, which includes:

- CSIR’s methodology leads to an underestimation of the number of sites ideally available to the WOAN, which incorrectly increases the spectrum requirement
- CSIR has underestimated the extent of spectrum deployment on the WOAN sites, which in turn has led to an overestimation of the required spectrum
- CSIR has overestimated the spectrum reuse factor, which means that the amount of spectrum required per site is increased by 50% to accommodate the reuse factor
- CSIR has assumed no site growth in its model, which leads to a substantial overestimation of the amount of spectrum that will be required
- CSIR applies a rounding to its findings, which significantly distorts the outcome.

Frontier Economics, in its attached report, finds that:

“... [t]he spectrum package proposed for the WOAN represents c. 45% of all unassigned HD spectrum, leaving to the existing MNOs only 55%. The CSIR study makes no attempt to assess whether this amount is sufficient for the MNOs to be able to provide high quality services to their customers, i.e. that the market is not distorted by the WOAN being able to offer better quality LTE services or LTE services at lower costs and/or better quality than the four existing MNOs can. This is a serious omission, especially in light of the CSIR recommending a larger spectrum package for the WOAN vis-a-vis its own calculations.

In light of all the flaws identified above, the CSIR study cannot be relied upon as a basis for recommending the amount of spectrum to be reserved for the WOAN.”

3.7 Vodacom’s proposal

Vodacom’s proposals

The actual amount of high demand spectrum to be assigned to the WOAN and to the operators is a matter for the Authority, but we conclude that 2x10MHz of low frequency with 2x10 – 2x20MHz of 2.6 GHz spectrum or 2x10MHz of low frequency with 1x25MHz 2.6GHz TDD should be sufficient for the WOAN to serve 15-20% of LTE customers, under more optimistic data consumption assumptions.

If 2x10MHz of low frequency spectrum is assigned to the WOAN (rather than 2x25MHz), this would leave 2x45MHz of low frequency spectrum that may be assigned to the MNOs. This would ensure that each existing operator can win (at least) 2x10MHz of low frequency spectrum.

3.8 Our principled approach

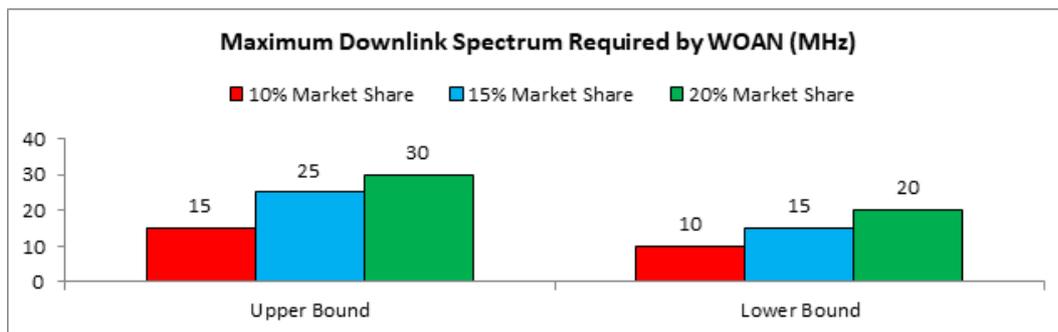
As mentioned above, the WOAN should not be given ‘too much’ spectrum, such that it gains a significant and sustainable cost advantage over other network operators, which would risk competition distortions and long-term inefficient use of spectrum. As a result, the amount of spectrum assigned to the WOAN should not give it a material cost advantage in the provision of LTE services, such that the other operators will not be able to replicate the WOAN’s quality (coverage and capacity) of service without incurring significantly higher costs.

3.9 Vodacom’s analysis and proposals

Given the number of issues with the CSIR Study, we do not consider its recommendations to be credible. Instead, Vodacom carried out its own technical analysis of the amount of spectrum needed for the WOAN to be able to serve 10%-20% of LTE customers². The analysis shows that, under a relatively high future data consumption assumption³ (22GB per month), the WOAN would need:

- 15MHz downlink to be able to serve 10% of customers;
- 25MHz to serve 15% and
- 30MHz to serve 20% of customers.

Figure 1 Maximum Downlink Spectrum required by WOAN to serve 10%, 15% and 20% market shares (MHz)



Source: Vodacom

In terms of the actual package of spectrum, based on the technical analysis undertaken by Vodacom, the following amounts should be sufficient for the WOAN to serve 15-20% of LTE customers, under the more optimistic data consumption assumption:

² See Appendix B

³ Under a more conservative set of assumptions (15GB per month), the required downlink is estimated to be 10MHz, 15MHz and 20MHz respectively

- 2x10MHz of low frequency with 2x10 – 2x20MHz of 2.6 GHz FDD spectrum; or
- 2x10MHz of low frequency with 1x25MHz 2.6GHz TDD.

For ease of reference, we summarise this assessment and our proposals in the following table:

Estimated WOAN capacity requirement		Spectrum Band	Policy Directions/CSIR		Vodacom recommendation	
Policy Direction CSIR	Vodacom		WOAN	Remainder for auction	WOAN	Remainder for auction
60 MHz downlink (though estimated 40 MHz downlink)	Max 30 MHz downlink	700/800	2x25 (45% of available band) in 800/700MHz	2x30 in 700MHz	2x10	2x45
		2600	2x20 FDD (29% of available band) 1x25 TDD (100% of available band)	2x50 FDD	2x10/2x20 FDD or 1x25 TDD	2x50/60 FDD

Under this allocation, if 2x10MHz of low frequency spectrum is assigned to the WOAN, this would leave 2x45MHz of low frequency spectrum that may be assigned to the MNOs. This would ensure that each existing operator can win (at least) 2x10MHz of low frequency spectrum. As noted by Frontier Economics in its attached report “[t]his would be consistent with the ICASA’s previous ITA and would put the WOAN and the MNOs on a more equal footing with regards to providing LTE coverage in rural and under-served areas”.

While this is our view on the spectrum that is sufficient to support the WOAN’s viability, we also consider that the WOAN should be free to bid for additional spectrum or buy spectrum from other sources in line with standard market forces and the applicable provisions of the Act.

4. Capacity commitments

4.1 Introduction

The key incentive to be provided to the WOAN is a capacity pre-commitment, or capacity off-take, to be provided by the HDS licensees.

While we are not aware of other markets around the world where licensees are required as a licence condition to acquire capacity in a wholesale competitor, Vodacom accepts in this case that it makes sense for there to be appropriate WOAN capacity pre-commitments by HDS licensees. It would be a form of anchor tenant arrangement, or underwrite, that would support the WOAN’s ability to raise finance.

In this section, we provide our critique of the Policy Direction in relation to these capacity commitments and then we set out our proposals for changes that may be made to the Policy Direction. As noted earlier, our comments are made on the assumption that the Authority will define national capacity in a reasonable way to ensure that the commitment is sufficient to get the WOAN established and does not distort the market or create incentives for inefficient deployment of infrastructure.

4.2 Critique of the Policy Direction

Our key critique of the Policy Direction

While we accept the spectrum licence conditions may include a minimum capacity commitment as an incentive for the WOAN, we don't accept that it makes sense that each HDS licensee is obliged to acquire 30% of the national capacity of the WOAN.

If each HDS licensee acquires 30% of the WOAN's capacity, this would mean that there will be little WOAN capacity available for MVNOs and smaller operators and there could only be three, rather than four, HDS licensees. The level of capacity commitment should be determined by the Authority as the product of a section 4B inquiry.

4.3 Capacity off-take

The main part of Paragraph 1.12(b)(iv) of the proposed Policy Direction⁴ provides that "a minimum of 30% national capacity is procured from the WOAN as soon as the WOAN is licenced, for a period of not more than three years" by each HDS licensee.

4.3.1 *Minimum capacity commitment*

Vodacom disagrees that each HDS licensee must acquire 30% of the national capacity of the WOAN. If each HDS licensee acquires 30% of the WOAN's capacity, this would mean that:

- there will be little WOAN capacity available for MVNOs and smaller operators; and
- there could only be three, rather than four, HDS licensees.

A key objective for the Government in establishing the WOAN is to provide a platform for MVNOs and smaller operators to indirectly acquire access to spectrum and to enjoy the benefits of scale and facilitate their access into the mobile retail market. If each HDS licensee acquires 30% of the WOAN's capacity, this would mean that there will be little WOAN capacity available for MVNOs and smaller operators. The purpose of the WOAN is to increase services-based competition and the inclusion of smaller players, not to provide additional capacity for the existing MNOs. It also means that if four HDS licensees are obliged to take-up 30% capacity each, it effectively amounts to a total capacity commitment of 120%, which is not logical. Our spectrum proposals in section 3 above are that there should be four HDS licensees, which would potentially allow four established mobile operators and the WOAN to acquire high demand spectrum in equal blocks in the auction.

4.3.2 *Meaning of national capacity*

The Authority should determine, as part of its section 4B inquiry, what is meant by national capacity and what the obligation to procure national capacity means. In this part of our submissions, we discuss the nature of the obligation by HDS licensees to procure national capacity.

⁴ Paragraph 2.2(b) points back to Paragraph 1.12(b)(iv) in relation to the Authority setting a spectrum licence condition for procurement of WOAN capacity

It is an important principle that the WOAN should determine where and when it deploys its network, acting in the WOAN's best commercial interests. This will give the WOAN the best chance of success in the market by enabling it to meet the demand for capacity in the areas where it is needed the most.

If an HDS licensee is acquiring some percentage of the WOAN's national capacity as a condition of its licence, that licensee will want to use that capacity primarily in urban areas and primarily at peak times. It is an important point that HDS licensees should not be required to take capacity from areas where there is no demand for that capacity.

Also, the capacity that must be procured by HDS licensees should relate to the WOAN's own capacity where it has its own operational network. The capacity shouldn't include, for example, capacity that the WOAN acquires from obtaining access to an electronic communications network service, e.g., roaming on another party's network. This would create a perverse outcome, where the WOAN acquires whole network services from an MNO, only to sell it back to that MNO as part of its capacity commitment.

4.4 Vodacom's Proposals

Our key proposals

We propose that the HDS licensees collectively commit to 30% capacity of the WOAN. The WOAN will approach the HDS licensees to purchase capacity and, if the capacity procured collectively equals or exceeds 30%, the above capacity commitment will be met. In the instance where the capacity procured by the HDS licensees does not equal 30%, they will be obliged to procure the remainder of the 30% capacity from the WOAN (in proportion to their relative market shares).

4.5 Terms and conditions of capacity procurement

The 30% capacity pre-commitment figure was raised by operators in the discussions with Government in 2017, but in relation to the aggregate capacity commitment of the operators, not each individually. The optimal commitment should be the product of a section 4B inquiry.

We propose that the HDS licensees collectively commit to 30% capacity of the WOAN. The WOAN will approach the HDS licensees to purchase capacity and, if the capacity procured collectively equals or exceeds 30%, the above capacity commitment will be met. In the instance where the capacity procured by the HDS licensees does not equal 30%, they will be obliged to procure the remainder of the 30% capacity from the WOAN (in proportion to their relative market shares).

5. Other incentives for the WOAN

5.1 Introduction

The WOAN should be capable of succeeding on its own merits and should not be unduly, unfairly or unreasonably benefitted by spectrum and other incentives. As noted earlier, any incentives given to the WOAN should be time-limited and be sufficient to get the WOAN established without distorting the market.

Vodacom supports the following incentives for the WOAN (on the assumption that the WOAN is not assigned excessive amounts of spectrum), which should be considered by the Authority through a section 4B inquiry:

- Time-limited capacity pre-commitment of 30% collectively by HDS licensees (see section 4)
- Discounted price for spectrum or the ability to pay off the spectrum price over time
- No requirement, or an exemption, for the WOAN to comply with universal coverage obligations

Vodacom believes that a combination of these incentives will give the WOAN a fair chance of success and the ability to respond to the needs of its customers.

In the next part of this section, we discuss the question of incentives for the WOAN and our concerns with how this is dealt with under the Policy Direction. Finally, we set out our proposals that would address our concerns.

5.2 Critique of the Policy Direction

Our key critique of the Policy Direction

The Authority must exercise its discretion properly to consider whether and, if so, what incentives should be granted to the WOAN, notwithstanding the list of incentives in the Policy Direction. The Authority should ensure that any incentives that it may consider appropriate do not unduly, unfairly or unreasonably benefit the WOAN so that competition in the market is not distorted. They should also ensure that the WOAN is able to stand on its own two feet and does not rely on incentives into perpetuity.

The WOAN should not be entitled to the assignment of high demand spectrum at no cost, which we consider would unduly, unfairly or unreasonably benefit the WOAN.

The WOAN should be subject to the same facilities leasing rules as any other operator. There is already a competitive market for facilities leasing of mobile facilities and the existing regime under the Act enables the WOAN to acquire facilities leasing on non-discriminatory terms, which would enable the WOAN to quickly establish coverage in those areas where there are facilities and where it is reasonable to do so.

5.3 The Authority to determine whether incentives should be granted

Before we discuss incentives in detail, we note that the Authority must exercise its independent discretion to consider whether and, if so, what incentives should be granted to the WOAN, notwithstanding the list of incentives in the Policy Direction. The Authority should ensure that incentives do not unduly, unfairly or unreasonably benefit the WOAN so competition in the market is not distorted. The Authority should also ensure that the WOAN will be in a position to stand on its own two feet in the market and adapt to technological changes going forward.

The Authority should determine the final incentive package for the WOAN, following a section 4B inquiry, with an appropriate cost-benefit analysis.

The amount of high demand spectrum to be assigned to the WOAN is relevant to the question of what incentives may be granted. If, despite our recommendations in section 3, the WOAN receives an excessive amount of high demand spectrum, then any case for further incentives for the WOAN is substantially weakened.

5.4 Amount payable by the WOAN for high demand spectrum

Whether the WOAN should be entitled to the assignment of unassigned high demand spectrum at a preferential price is a question that should be determined by the Authority in a section 4B inquiry.

In any event, we do not consider that the WOAN should be entitled to the assignment of high demand spectrum at no cost. An incentive of this magnitude, when taken together with the capacity pre-commitments, would unduly, unfairly or unreasonably benefit the WOAN, significantly distorting competition.

Instead, we propose that it might be deemed appropriate by the Authority for the WOAN to have different payment conditions for its spectrum. We discuss this proposal further below.

5.5 Reduced or waived spectrum licence fees

In our view, the WOAN should pay annual spectrum license fees on the same basis as other operators. The Administrative Incentive Pricing Regime applied by the Authority in setting annual licence fees reflects international best practice. This is further discussed by Frontier Economics in their attached report.

5.6 Facilities leasing by licensees

The Policy Direction instructs the Authority to determine an incentive for the WOAN to avail itself of immediate facilities leasing of electronic communications networks and electronic communications facilities of HDS licensees⁵⁶. There are three important issues with this incentive requirement:

- there is already a competitive market for facilities leasing of mobile facilities
- access should not apply to electronic communications networks
- the WOAN should be subject to the same rules of facilities leasing as any other operator

5.6.1 An existing competitive market for facilities leasing of mobile facilities

Vodacom and other MNOs provide leasing of their electronic communications facilities to other operators over thousands of sites all around the country. There are standard industry terms for this service and it is a commonplace, everyday arrangement. While an access seeker can invoke

⁵ This was also referred to in Paragraph 2.2(a) of the draft Policy Direction as a condition that the Authority must apply to HDS licences.

⁶ The Authority cannot expand its specific Chapter 8 and Chapter 10 powers through spectrum licence conditions. Where the Act specifically circumscribes the conditions and requirements for facilities leasing and other pro-competitive conditions in Chapters 8 and 10, purporting to extend or to modify these powers through spectrum licensing conditions would be *ultra vires* the Act.

the powers of the Authority under Chapter 8 in these circumstances, this is rarely required as the parties tend to reach commercial agreement fairly easily.

Vodacom will welcome the WOAN as a customer of our facilities leasing services.

5.6.2 Access should not apply to electronic communications networks

In Vodacom's view, mandated access should not extend to include electronic communications networks.

If an HDS licensee is required to lease its electronic communications network to the WOAN, it would potentially expose and allow the WOAN to use any aspect of the licensee's network. A requirement, or commitment, to provide facilities leasing of potentially the entire communications network, systems and services of a mobile operator is practically the most intrusive intervention possible.

The issue is *mandating* leasing of electronic communications networks to the WOAN. As broadly defined, this may include national roaming, but it could include far more intrusive services.

We have no issues with commercially negotiated roaming agreements. If the WOAN wishes to have national roaming, then we expect there will be competition between the operators for the WOAN's business and that the outcome will be an acceptable commercially negotiated agreement⁷.

Any mandated leasing of electronic communications networks should only apply to operators with significant market power in markets which are proven to fail, following a proper review process under Chapter 10. It should not just be imposed on all HDS licensees as a licence condition.

5.6.3 The WOAN should be subject to the same facilities leasing rules as any other operator

The WOAN should not be entitled to any special privileges as compared to any other licensee that seeks facilities leasing. The processes under Chapter 8 are available for the WOAN as much as any other licensee for obtaining a facilities leasing agreement. The WOAN may, of course, request facilities leasing from all the HDS licensees as soon as it becomes a licensee.

Where appropriate, the Authority should review the facilities leasing regulations and address any bottlenecks which prevent competition and effective use of facilities using the procedures set out in the Act.

5.7 Delayed imposition of wholesale rates

Paragraph 1.12(b)(v) provides that the Authority must determine the "*delayed imposition of wholesale rates that must be charged by the WOAN, for a specific period*".

As mentioned above, we do not consider that the WOAN's prices should necessarily be set by the Authority at cost-oriented rates. Rather, at a minimum the WOAN's prices should be fair, reasonable and non-discriminatory for the minimum capacity commitment but should be under the jurisdiction of the Authority to ensure the WOAN's pricing does not distort the market or introduce inefficiencies that could yield higher prices for South African consumers.

⁷ Cell C and Telkom have both been able to secure successful and enduring mobile national roaming arrangements through commercial negotiations.

Vodacom's view is that, once the time-limited incentive package for the WOAN expires, it would be operating in a competitive market with other providers of wholesale services. Until that point, the Authority will need to oversee and approve the WOAN's pricing to ensure it is not abusing its privileged position of having been granted favourable conditions, especially the capacity commitment from HDS licensees.

5.8 Vodacom's Proposals

Our key proposals

On the assumption that the WOAN is not assigned excessive amounts of spectrum, the Authority should consider whether the WOAN should be entitled to either a discounted price for the spectrum or the ability to pay off the spectrum price over time.

Vodacom is of the view that the facilities leasing market is competitive and the WOAN should benefit from such competition and able to obtain access at favourable rates. Furthermore the WOAN is able to facilitate access through established processes in Chapter 8 and Chapter 10 if necessary.

The WOAN's prices should be fair, reasonable and non-discriminatory for the minimum capacity commitment.

5.9 Payment by the WOAN for high demand spectrum

Our proposal is that, as part of the Authority's assessment of incentives, the Authority should consider different payment conditions for the WOAN's spectrum, either:

- the WOAN acquires the high demand spectrum at a discounted price, paid for up-front; or
- the WOAN acquires the high demand spectrum at the same price as the HDS licensees, but paid over time as a proportion of the WOAN's revenues.

Apart from the capacity pre-commitment and the lack of coverage obligations on the WOAN, **this is the only other major incentive that we consider should be available to the WOAN⁸**. The choice of a discounted purchase price, or payment over time, and the level of that discount or payment profile, should be decided by the Authority as part of the section 4B inquiry.

The reference price, against which the discount or payment profile applies, should be the market value of the high demand spectrum. This can be inferred from the HDS spectrum auction, using the lowest price paid by an HDS licensee for one of the lots in the spectrum auctions. This will result in the WOAN being charged the market value of the spectrum it uses, as other MNOs, reducing the risk of competitive distortions.

⁸ Our views on this change if the WOAN is assigned an excessive amount of high demand spectrum, as proposed by the CSIR Study. In that case, the WOAN should be required to pay for the spectrum up-front and at the same price as the HDS licensees.

Where the payment is to be made over a period of time, perhaps 5-10 years, the amount payable each year should be a proportion of the WOAN's revenues. The period of time, and proportion of revenues, would be determined by the Authority.

HDS licensees should pay their spectrum price up front, if they get commitment to completion of the digital terrestrial television process by a particular date. If that date is not met, there should be rebates of the spectrum price paid. Alternatively, the HDS licensees may pay a portion of the spectrum price up front for spectrum immediately available (e.g., 2600MHz) and the rest when the digital dividend spectrum is released.

6. Universal access and universal service obligations

6.1 Introduction

Paragraph 2.2(d) of the proposed Policy Direction provides that universal access and universal service obligations (UAUSO) are imposed on the licensees to ensure the availability of high quality networks in rural and under-served areas. These obligations must be complied with in rural and under-served areas before the assigned spectrum may be used in other areas by the licensees.

We describe this in our submissions as the “**outside-in**” requirement.

In the following part of this section, we provide our critique of the Policy Direction and then we set out our proposals for changes to address our concerns.

6.2 Critique of the Policy Direction

Our key critique of the Policy Direction

The condition that HDS licensees comply with the universal access and universal service obligations in rural and under-served areas *before* other areas would be highly inefficient. It would not be consistent with the Act's object of ensuring efficient use of the radio frequency spectrum, because licensees could not be allowed to use the high demand spectrum in areas where there is the highest capacity constraints. It would also reduce the value of the spectrum and the auction proceeds.

6.3 Inefficient use of spectrum

This “outside-in” requirement will result in an inefficient use of radio frequency spectrum because it would deny an HDS licensee the right to immediate use of the high demand spectrum, especially the spectrum in the 2600MHz band which would likely to be used for the deployment in the areas where there is capacity constraints, i.e., the urban and sub urban areas. As such, it would be inconsistent with the objects of the Act.

In our earlier submissions, for example on the broadband policy direction, we provided evidence of the pressing need for deployment of further high capacity spectrum to alleviate serious capacity constraints as a result of not having had access to more spectrum, in urban and sub-urban areas.

If the Authority chooses to follow the outside-in requirement in the Policy Direction, service quality in urban and sub urban areas, where congestion is more prevalent, will decrease because operators will

be unable to address capacity constraints. The obligation will delay the deployment of the latest technology and investment, and the provisioning of additional capacity, where the need for it is most prevalent and economic impact the highest. It will also result in inefficient and costly site densification in these areas in order to add more capacity, which drives up the cost to communicate.

Operators in South Africa have been starved of access to high demand spectrum, which is critical for the provision of cost effective high-speed data services⁹. This has led to inefficient levels of densification of networks and refarming of spectrum that could have been used to provide 2G and 3G services.

Licensees should be allowed to use spectrum in a technology and geographically agnostic way. While we support the deployment of broadband services in rural and underserved areas and licensees being obliged to deploy networks in these areas, this should not be done in a way which compromises service delivery in urban and sub-urban areas. We would support a process to create an industry-led approach to coverage to ensure maximum efficiency in remote and uneconomic areas.

6.4 Vodacom's Proposals

Our key proposals

The Authority should set the UAUSO obligations for HDS licensees in rural and under-served areas, but the licensee should be able efficiently to use the high demand spectrum in other areas at the same time.

Licensees should be permitted to satisfy these UAUSO obligations through sharing and roaming arrangements, commercially negotiated with other operators or with the WOAN. This may include a geographical segmentation among the HDS licensees, set by the Authority, where each HDS licensee may be required to deploy a network in a specific part of the country and the other HDS licensees may roam on that network in those areas to satisfy its UAUSO obligations.

6.5 Specific, attainable and measurable UAUSO obligations

The Act clearly anticipates *both* efficient use of spectrum *and* universal access.

We therefore support the notion that the Authority set the UAUSO obligations for HDS licensees in rural and under-served areas, but that the licensee will be able efficiently to use the high demand spectrum in other areas at the same time. This condition would be consistent with the twin objects of efficient spectrum use and universal access under the Act. Failure to comply with those UAUSO obligations may result in penalties and other serious consequences for the licensee under the Act.

In conducting its inquiry into these matters, we propose that the Authority adopts the principle of UAUSOs being "specific, attainable and measurable", which is a form of language borrowed from the Bill.

In setting these UAUSOs as part of a section 4B inquiry, the Authority should take into account:

⁹ European operators are now operating four frequency layer 4G networks with approximately 2x60MHz total 4G deployment. By contrast, Vodacom has 2x38MHz and 1x5MHz in total (all technologies), a sizeable customer base, with many of these being 2G and 3G customers that need to continue to be supported.

- the unavailability of suitable backhaul and backbone transmission in many parts of the country in terms of what is achievable, by when; and
- that the 2.6GHz spectrum, which should be available before the 700 and 800MHz spectrum, would not be suitable for a broad UAUSO obligation.

6.6 Meeting UAUSO obligations through sharing and roaming

Licensees should be permitted to meet these UAUSO obligations through sharing and roaming arrangements, commercially negotiated with other operators (which may be prior to the auction stage) and with the WOAN.

This may include a geographical segmentation among the HDS licensees, set by the Authority, where each HDS licensee may be required to deploy network in separate parts of the country and the other HDS licensees may roam on that network in those areas to satisfy its UAUSO obligations.

The licensee should be able to, if they wish and are able to do so, use other spectrum available to it to meet these obligations.

6.7 The German model

We are aware that Germany implemented something similar to the outside-in requirement in its spectrum auctions relatively recently.

We asked Frontier Economics to examine the German approach. They say:

“However, the requirement to cover rural areas first is largely unprecedented. The one prominent example of “outside-in” style coverage obligations that we have identified – from Germany – applied specifically to low frequency spectrum, which as explained above, is much better suited to coverage rollout in rural and underserved areas than the high frequency spectrum. The German regulator imposed coverage obligations specifically for 800 MHz spectrum, which required licensees to build-out their networks in listed communities (referred to as “white spots”) in four stages in areas with no or low broadband coverage, before deploying frequencies in this band in more populated areas. The fact that licensees had access to 800 MHz spectrum meant that operators could rapidly deploy LTE networks in these white spots.

Further, since the coverage obligations only affected the deployment of 800 MHz spectrum, operators could deploy LTE in cities at the same time, using high frequency spectrum – in the 1800 MHz, 2.1 GHz and 2.6 GHz bands – which was awarded alongside the 800 MHz band. For example, Deutsche Telekom launched services in rural areas using 800 MHz on 5th April 2011 and shortly afterwards in Cologne, on 1st July 2011, using 1800 MHz”.

The German outside-in requirement, with 800MHz spectrum being able to be used to meet rural coverage obligations and allowing the higher frequency high demand spectrum to be used in urban areas, is therefore not comparable to what is being proposed in the Policy Direction.

7. Other spectrum issues and WOAN-related matters

7.1 Introduction

The Policy Direction includes various other references to HDS spectrum and the rights and terms and conditions associated with that spectrum. In this section, we particularly focus on the concepts of non-exclusive spectrum rights and the application of Chapters 8 and 10 to spectrum. We also discuss other issues such as spectrum licence duration or term.

The Policy Direction also includes other provisions related to the WOAN, in particular obligations to provide coverage or offer wholesale access. Noting that the WOAN is intended to be a wholesale-only operator, we set out our view in this section that the WOAN should be subject to the same obligations as other licensed operators.

7.2 Issues arising with non-exclusive spectrum rights

Paragraph 1.4 of the Policy Direction provides that assignment of high demand spectrum must be on a non-exclusive basis.

In the attached report from Frontier Economics, they discuss the inefficiencies associated with shared or non-exclusive use of spectrum.

MNOs can only ensure high quality, efficient and high capacity networks, and a reliable customer service experience, if they are permitted to make full exclusive use of assigned frequencies. MNOs also require control of the spectrum to comply with spectrum-related obligations (quality of service, coverage, etc.). If the licensee has non-exclusive rights to that spectrum, it loses control.

At a practical level, it is unreasonable to expect that a licensee should commit to acquire capacity in the WOAN, and to provide universal access and universal service, where that licensee itself has uncertain, qualified rights to the high demand spectrum that it acquires because of the potential application of non-exclusivity to that spectrum. It is commercially unrealistic to expect commitment and investment when the licensee doesn't have exclusive spectrum rights.

Further, there are no global standards for these matters and no widespread adoption of the required technology, which means that assignment of spectrum other than on an exclusive basis will create insuperable technical problems for any licensee - including the WOAN. This is apart from the debilitating effect it will have on investment incentives on the part of any licensee.

7.3 Assignment of spectrum subject to Chapters 8 and 10

Paragraph 2.2(c) of the proposed Policy Direction requires that a condition be imposed that spectrum is assigned subject to Chapters 8 and 10 of the Act.

It is unclear what this means. If it means that the spectrum is in some sense sought to be made subject to wholesale open access or facilities leasing of the spectrum, then this would be contrary to the provisions of the Act, which apply only to facilities as defined, and are not capable of being applied to spectrum.

Chapter 8 applies to electronic communications facilities. Spectrum is not an electronic communications facility. Therefore, Chapter 8 does not (cannot) apply to spectrum.

The Authority must act consistently with the Act and the Act has a regime for imposing pro-competitive licence terms under Chapter 10. The Authority would be contradicting Chapter 10, and so would be acting inconsistently with the Act, if it were to create a spectrum licence condition that required that Chapter 10 applied to spectrum.

Further, it is contradictory to require wholesale open access to spectrum from other operators where the key aspect of the Policy Direction is the establishment of the WOAN. The purpose of the WOAN is to provide wholesale services to access seekers, yet concepts such as wholesale open access to spectrum applying to HDS licensees would incentivise those access seekers to avoid using the WOAN altogether. This undermines the whole rationale and business case for the WOAN, which cannot be rational where the WOAN is such a key feature of the policy environment going forward and will be the recipient of valuable high demand spectrum.

Spectrum is a statutory right granted to a spectrum licensee; it is not a service and it is not a facility. By its very nature, it is not something that is capable of being provided on a wholesale basis.

The provisions in the Act related to radio spectrum rest on the foundation that a spectrum licensee owns and controls that spectrum. Applying the provisions of Chapters 8 and 10 to spectrum would risk the spectrum licensee losing the required control over the spectrum in favour of the access seeker. This would make it impossible for the licensee to enjoy the rights and discharge the responsibilities on which spectrum assignment is premised.

7.4 Conditions remaining in force and spectrum licence term

We agree with Paragraph 2.5, which states “Any terms and conditions imposed by the Authority shall remain in force for the duration of the radio frequency spectrum licence issued”.

It is important that, once the terms and conditions are determined by the Authority prior to the auction stage, these conditions should not change during the licence term.

Paragraph 2.6 provides that:

“The licences contemplated in this policy and policy direction shall be for such periods as determined by the Authority”.

We note that Regulation 17(2) of the Radio Regulations provides that:

“Unless otherwise specified in a radio frequency spectrum licence, a radio frequency spectrum licence shall run parallel to and not exceed the duration of a service licence contemplated in Chapter 3 of the Act, issued to the person in possession of a radio frequency spectrum licence”.

We agree that the Authority should determine the period for the HDS spectrum licences. We are of the view that the Authority should apply the principle set out in Regulation 17(2). In our experience, 20 years is the normal period internationally for spectrum licences. The Authority should therefore also extend the HDS licensees’ individual licences so that the term is at least as long as that 20 year period.

7.5 Requirement for the WOAN to provide wholesale open access

We consider that the WOAN may be subject to a “wholesale-only” licence condition, but that otherwise its requirement to provide facilities leasing should be subject to Chapter 8 in the same manner that it applies to other operators. If there are market power problems with the WOAN, then Chapter 10 may apply.

7.6 Terms and conditions including universal service and access obligations

Paragraph 1.12(a) provides as follows:

“The Authority must determine the following for the WOAN— (a) the terms and conditions, including universal service and access obligations;”

Vodacom’s view is that the WOAN should not have coverage obligations. The WOAN should have the opportunity to deploy its network where the demand is and in its own best commercial interests.

7.7 Other matters that must be considered and performed by the Authority

Paragraph 1.13(a) and (b) provides as follows:

“The Authority must— (a) consider imposing regulatory remedies on the WOAN, to ensure effective service-based competition, and to avoid any anti-competitive effects; (b) perform strict regulatory oversight ...”

Vodacom is supportive of the oversight role to be performed by the Authority. Such oversight is required to ensure the WOAN does not act anti-competitively given the likely incentives to be awarded to the WOAN. Specifically in relation to the obligation to procure a minimum of 30% capacity from the WOAN.

8. Process, legal concerns and proposals

8.1 Introduction

In this section, we address process and legal issues related to the implementation of the Policy Direction under the Act. We also make proposals to address these issues, including the proposal for the Authority to conduct a section 4B inquiry on key matters related to the Policy Direction, to achieve the envisaged WOAN and ITA in accordance with the applicable law. Some general principles are set out to explain the issues and problems, and solutions offered to address them. Legal observations interspersed in these submissions are understood with reference to the principles set out here, and the substance of the comments we offer on the contents of the envisaged WOAN and ITA can be placed in their appropriate context.

8.2 Respective powers of the Minister and the Authority in relation to licensing

8.2.1 Cardinal principles applying to policy directions and licensing under the Act

Respectfully, it is important that the Minister and the Authority should consider the following when it comes to policy directions and their relationship to licensing under the ECA:

- (a) A vital distinction exists between policy directions that relate to individual licences issued in terms of Chapter 3 of the ECA, and policy directions that relate to spectrum (and spectrum licences) issued under Chapter 5 of the ECA.
- (b) The relationship between section 3(3) and section 5(6) of the ECA must be carefully considered.
- (c) In terms of section 3(3), the Minister is precluded from issuing any policy direction *“regarding the granting, amendment, transfer, renewal, suspension or revocation of a licence, except as permitted in terms of this Act.”*
- (d) In terms of section 5(6), *“the Authority may only accept and consider applications for individual electronic communications network services licences in terms of a policy direction issued by the Minister in terms of section 3.”*
- (e) Section 5(6) does not apply to spectrum licences.
- (f) Even in respect of individual electronic communications network services (ECNS) licences, section 5(6) does not allow the Minister, contrary to section 3(3), to issue a policy direction *“regarding the granting, amendment, transfer, renewal, suspension or revocation of a licence.”* In other words, the prohibition in section 3(3) applies also in respect of ECNS licences. This means that section 5(6) allows the Minister to issue policy directions relating to the process and principles applicable to the licensing of ECNS licences, but not to issue any policy directions relating to the granting, amendment, transfer, renewal, suspension or revocation of any particular ECNS licence or licences. The Minister therefore cannot issue policy directions purporting to direct the Authority in terms of section 5(6) that relate specifically to the licensing of a specific licensee, namely a WOAN.
- (g) Section 3(3) read with section 30(1) means that the Authority has full autonomy in relation to the control and licensing of spectrum, and the Minister may not lawfully issue any policy directives relating to the licensing of spectrum.
- (h) In any event, and whatever the permitted scope and subject-matter of a policy direction, the Authority is obliged only to “consider” policy directions when exercising its licensing powers – it is neither obliged nor permitted to regard itself as bound to implement them. This is the effect of section 3(4) of the ECA. The only potential qualification to this is that, when it comes to licensing individual ECNS licences, the Authority must do so, as far as process and principles are concerned, in accordance with policy directions issued by the Minister in this regard, because of section 5(6).
- (i) The critical thing to appreciate in this regard therefore is that the subject-matter sought to be addressed in this proposed Policy Direction is the proper domain of the free discretion of the Authority, which should properly be the subject of an ITA to the extent that the Authority, exercising its independent discretion, determines that this is so.

8.2.2 Consequences for the Policy Direction

The upshot of the above is that, when it comes to the proposed Policy Direction, these being aimed at an ITA and the licensing of a WOAN:

- (a) the Minister is not permitted to issue policy directions relating to the licensing of spectrum, and the Authority is accordingly not permitted to take them into account.
- (b) the Minister is not permitted to issue policy directions purporting to direct the Authority specifically to issue any kind of licence to a WOAN, and the Authority is accordingly not permitted to take them into account;
- (c) in any event, at most, the Authority must never do more in relation to policy directions than to “consider” them, which means that it may not regard itself as bound to implement them, as this would be an abdication of its independent powers under the ECA; this applies particularly when it comes to the assignment and licensing of spectrum; and
- (d) this means that the Authority must for itself, independently, and without deference to any policy direction the Minister may issue, consider how best to approach the licensing of a WOAN, both with respect to its individual ECNS licence and with respect to spectrum.

8.2.3 Distinction between individual licences and spectrum licences

It is important to distinguish between the conferring of an individual ECNS licence on the WOAN and the conferring of a spectrum licence with assigning spectrum to the WOAN.

Here, the most significant practical legal issue to bear in mind is that assignment of HDS under a spectrum licence must occur in terms of the spectrum regulations. This is because of the following:

- (a) section 31(3) of the ECA requires the Authority to prescribe procedures for radio frequency spectrum licences where there is insufficient spectrum available to accommodate demand (i.e. HDS);
- (b) the Authority has already done so – by prescribing the Spectrum Regulations;
- (c) the Spectrum Regulations exhaustively prescribe how HDS is to be assigned and licensed; and
- (d) in terms of the Spectrum Regulations, this must be done via a competitive ITA: Regulation 7 requires that an ITA be published where a radio frequency spectrum licence will be awarded/granted “on a competitive basis” and for HDS.

Critical to appreciate in this regard is that the Authority is not permitted to create a special ITA aimed at a particular licensee (like an already established WOAN). It must issue an ITA that grants spectrum licences for HDS on a competitive basis.

This means that it will not be permissible for a special individual ECNS licence to be crafted and conferred on a WOAN, and thereafter for the Authority to purport to assign or licence HDS to the WOAN.

8.3 Proposal to address the above process and legal concerns

We respectfully submit the following proposal to address these matters and achieve the objectives of the Policy Direction under the applicable law:

- (a) An ITA aimed at establishing a WOAN and regulating the relationship between the WOAN and operators should be issued.
- (b) The process for assigning the HDS and licensing it should then be stipulated in the ITA – complying with Regulation 7 and the provisions of Regulation 7(2). This must be a competitive process, allowing for competition in respect of the assignment of the HDS intended for the WOAN and the HDS intended for other operators (*the competitive process in relation to HDS to be assigned to the WOAN can be separated from the competitive process in relation to HDS to be assigned to the other operators, as long as both processes are meaningfully competitive*).
- (c) Whether the process entails an auction or a beauty contest, it must be competitive – different potential candidate WOANs must be allowed to vie for the WOAN HDS assignment, and different operators for the other HDS assignment. This means that the requirements for the WOAN licence cannot be crafted in such a manner as to apply only to a particular pre-determined entity or licensee.
- (d) The conditions on which the WOAN spectrum licence is to be assigned and the HDS to be awarded must then be stipulated in the competitive process chosen for the WOAN.
- (e) It is not possible to impose obligations on other operators as part of the conditions of the WOAN spectrum licence.
- (f) The obligations of other operators vis-à-vis the WOAN must be stipulated as conditions to the spectrum licences to be granted with the assignment of the other HDS that is to be assigned to these operators.
- (g) The HDS assigned to the other licensees can be assigned with conditions that these licensees must comply with vis-à-vis the WOAN, as and when the WOAN is established. As long as the conditions are built into the spectrum licences, it is not necessary for the process to license and set up the WOAN to be finalised before the other HDS licensees can commence utilisation. There will be high demand spectrum set aside for the WOAN, and obligations the other licensees will have vis-à-vis the WOAN as part of their spectrum licences that they took on board when they bid for their licences. These can then be activated as and when the WOAN is established and in accordance with the conditions stipulated.
- (h) As long as applicants for the WOAN spectrum licence have standard individual ECNS licences, no special conditions need to be built into the WOAN individual ECNS licence – the WOAN conditions are all stipulated as conditions of the grant of HDS licences and assignment of high demand spectrum as part of this competitive process stipulated in the ITA. Alternatively, the conditions for the WOAN may be stipulated in the ITA as applicable to the high demand spectrum to be assigned to the WOAN, and the WOAN ECNS licence be incorporated in the same ITA process, with the conditions of the WOAN's operation then built into the ECNS licence, rather than in the spectrum licence of the WOAN.

8.4 Conditions to spectrum licensing

Because the establishment of the WOAN, with all its conditions, cannot precede the assignment of high demand spectrum to the WOAN (as explained above), the conditions pertaining to the WOAN must be incorporated as conditions to the assignment of the high demand spectrum under the competitive process envisaged by Regulation 7. This means that the obligations that

would burden the WOAN cannot be crafted as obligations relating to individual licences under Chapter 3, but should be crafted as conditions to spectrum licensing under Chapter 5.

This in turn means that the BEE requirements contemplated in section 9(2)(b) of the ECA, which apply only to individual licences, not to spectrum licences, would not be applicable to the WOAN (as contemplated in Paragraph 1.10(b)). Instead, the minimum BEE requirements set out in the Regulations must apply to the WOAN (and the Authority may in its conditions stipulate other conditions, consistent with Regulation 7(3)(d), which sets out mandatory disqualification criteria)¹⁰.

Here, we note that the amendment of Regulation 7(3)(d) in 2016, effected to rectify a typographical error in the 2015 version, introduced a further clear typographical error. Literally read, the Regulation requires disqualification if an applicant in fact “has a minimum 30% equity ownership”. Fortunately, the remainder of the subregulation clearly and correctly reflects the intention of the Regulation when it states: “alternatively, in instances where an Applicant does not have such 30% equity ownership, must be a level 4 and above contributor (BBBEE status) in terms of the Codes of Good Practice published in terms of section 9(1) of the BBBEE Act.”

It is clear beyond any doubt that the first portion of Regulation 7(3)(d) as amended inadvertently provides “has” instead of the intended “does not have”, and the Regulation must be read as requiring disqualification of an applicant which does not have a minimum 30% equity ownership, except where such applicant is a level 4 and above contributor – in other words, the Regulation requires either 30% equity ownership or level 4 and above contributor status.

This must be applied to the WOAN, as a minimum standard, to comply with Regulation 7(3)(d), read correctly¹¹.

8.5 Responsibilities of the Authority

In a number of respects, the Policy Direction does not take into account the distinctions between sections 3(3), 3(4) and 5(6) considered above. To the extent that they purport to instruct or to direct the Authority to act in any particular way with respect to the grant of a licence (any licence) to a WOAN, they violate section 3(3)¹².

The main point for the DTSPS and for the Authority to consider in relation to these legal submissions is the following: when it comes to the contemplated ITA envisaged in the proposed Policy Direction, it is for the Authority, and for the Authority alone, to consider, by exercising its independent powers of control over spectrum, the optimum approach to licensing and assigning high demand spectrum to a WOAN and to other licensees, applying the requirements of the Spectrum Regulations. The Authority is not entitled to defer to policy directions in this regard.

¹⁰ It should be pointed out that, in terms of sections 10(3) and 3(2) of the BBBEE Act, the BBBEE criteria contained in the ICT Sector Code must be applied by the Authority in relation to spectrum (and individual) licences, and it can deviate from these and impose stricter criteria only if it obtains Ministerial approval as contemplated in section 9(6) of the BBBEE Act. Such approval would be required to implement Regulation 7(3)(d) lawfully.

¹¹ But see the footnote above – Approval must be obtained under s9(6) of the BBBEE Act to deviate from the ICT Charter criteria.

¹² To the extent that they purport to direct the Authority that it “must” act in any way in respect of spectrum, they violate section 30 of the Act (and also, fundamentally, section 192 of the Constitution, which requires the independence of the Authority, as considered in the earlier submissions by Vodacom in January 2018, aimed at the November 2017 suggested ECA amendments).

In light of the above, where the contents of the proposed Policy Direction are addressed in substance in these submissions, these are addressed as the contents of a potential ITA that the Authority may issue, rather than as a potential Policy Direction directing the Authority to act in a certain way, especially when it comes to spectrum licensing.

8.6 Empowerment requirements

Paragraph 2.2(f) of the Policy Direction provides as follows:

“The radio frequency spectrum licences contemplated in paragraph 2.1 must be issued on condition that— ... (f) compliance with empowerment requirements in terms of section 9(2)(b) of the ECA and any regulations issued by the Authority”

We note that section 9(2)(b) relates to applications for an individual licence. It does not apply to spectrum licences. Accordingly, Paragraph 2.2(f) cannot apply to the issuing of spectrum licences.

Subregulation 7(3)(d) of the Spectrum Regulations, which we discuss above, does apply to spectrum licences and it need not be stated in a Policy Direction dealing with spectrum.

8.7 Requirements for a policy direction

Apart from the important overriding observations above about the limits of Policy Directions when it comes to licensing, and particularly spectrum licensing, the following principles generally relating to Policy Directions must also be borne in mind.

A section 3(2) policy direction must be consistent with the objects of the Act. These include:

- to encourage investment, including strategic infrastructure investment, and innovation in the communications sector (section 2(d));
- ensure the efficient use of the radio frequency spectrum (section 2(e));
- promote competition within the ICT sector (section 2(f)); and
- promote an environment of open, fair and non-discriminatory access to electronic communications networks and electronic communications services (section 2(g)).

These objects present a fair and balanced approach to the development of a competitive telecommunications market in South Africa.

8.8 Need for a section 4B inquiry

It is Vodacom’s view that, to be consistent with the legislative and constitutional framework, and with international best regulatory practice, it is necessary for the Authority to conduct an inquiry under section 4B of the ICASA Act (a **section 4B inquiry**) (or some other formal process that ensures equivalent consultation rights and due process for interested parties) in its consideration of the matters set out in the proposed Policy Direction and before it can commence the new ITA process for the high demand spectrum.

There are two key categories of determination that must be made by the Authority in an inquiry.

First, the question how much of the high demand spectrum to assign to the WOAN and how much to the licensees is a matter for the Authority to decide under section 30 of the Act, and as informed by a section 4B inquiry. As we previously submitted, it is important that the WOAN, and other licensees, are assigned sufficient high demand spectrum and that the prospect of a dominant WOAN must be avoided. And, as we set out in our submissions in section 3, the CSIR Study proposes an excessive amount of high demand spectrum be assigned to the WOAN. An issue of this magnitude and complexity, that depends so heavily on the complex dimensions of the relevant markets, needs an inquiry.

Second, the Authority will need to determine the conditions that should apply to spectrum licences for high demand spectrum. As a potential bidder for unassigned high demand spectrum, it is an absolute necessity for Vodacom to know exactly what conditions will apply to such an assignment. This is required to allow us to assess the value of the spectrum available in advance of the auction stage, taking into account the commitments that we would be assuming as part of the conditions attached to the licence. The more onerous or uncertain the commitments, the less valuable the spectrum.

A section 4B inquiry is the most appropriate process for addressing these important and complex issues, which will be central to the future of the electronic communications sector in South Africa. An inquiry by the Authority allows for articulation and careful consideration of the views of all interested parties, and an understanding of the nuance and implications of these issues, before the Authority makes a determination.

We would be supportive of an expedited timeframe for a section 4B inquiry.

AN ECONOMIC ASSESSMENT OF THE POLICY DIRECTION

A report for Vodacom

7 November 2018



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EXECUTIVE SUMMARY

Vodacom have appointed Frontier to review the Policy Direction and the supporting CSIR study to assess whether these proposals satisfy the economic principles of efficiency, promotion of competition and maximising consumer benefits in the South African mobile market.

In brief, the Policy Direction supports the creation of a WOAN and proposes to allocate High Demand Spectrum (HDS) both to the WOAN and the MNOs following the CSIR recommendations:

- to reserve 2x25MHz of 800MHz + 2x20MHz of 2.6GHz FDD + 1x25MHz of 2.6GHz TDD spectrum for the WOAN, and
- to allocate to the MNOs 2x30MHz of 700MHz spectrum and 2x50MHz of 2.6GHz FDD spectrum.

In addition, the Policy Direction proposes to confer a number of other advantages on the WOAN, summarised in the table below:

Figure 1 Advantages conferred on the WOAN (according to the Policy Direction)

	WOAN	MNOs
Annual spectrum fees	Reduced or waived for 5 years	Annual fees
Up-front spectrum payments	Not specified	Auction payment
Access	Immediate access to facilities and networks of MNOs that are assigned unassigned HDS	
Coverage obligation	ICASA to determine	Coverage obligations Rural areas to be covered first
Capacity	Capacity commitment by MNOs that acquire unassigned HDS for a share of the WOAN's capacity for 3 years; ICASA to determine further commitment after first 3-year period	Compete for customers, no demand guarantee

Source: Frontier's interpretation of the Policy Direction

The CSIR study significantly overstates the amount of spectrum needed by the WOAN

The objective of the CSIR study is to assess the amount of spectrum the WOAN would need to be able to serve 20% share of the LTE customers in South Africa.

The CSIR study relies on incorrect and/ or unexplained assumptions

Taking the 20% market share as given, we find that the CSIR modelling significantly overstates the amount of spectrum needed for the WOAN to be able to serve these customers. This is due to:

- **Technical assumptions inconsistent with the industry practices** – the CSIR study makes a number of technical assumptions, which (individually and collectively) inflate the amount of spectrum needed by the WOAN. For example, the CSIR study:
 - excludes some of the sites that could be used (within a 1km radius of the sites which are assumed to be in use) – if these sites are used, less spectrum would be required;
 - imposes a limitation on where low frequency spectrum could be deployed (only on sites higher than 15m) – resulting in a higher requirement for 2.6GHz spectrum;
 - assume a re-use factor of 1.5, while the industry norm is 1 – resulting in a high capacity requirement overall.
- **Recommendations on amount of spectrum for the WOAN are inconsistent with CSIR's own estimates** – the CSIR's recommendations to allocate to the WOAN 2x25MHz of 800MHz spectrum in combination with 2x20MHz of 2.6GHz FDD spectrum and 1x25MHz of 2.6GHz TDD is inconsistent with its own estimate of the downlink required. This recommendation is equivalent to 60MHz downlink, while the CSIR estimate of the spectrum required to serve 20% LTE market share is 40MHz. We appreciate that some minor differences could be justified due to rounding or the fact that FDD spectrum needs to be packaged in 2x5MHz blocks. However, the CSIR recommendation represents a 50% increase on its own downlink estimate. This increase is neither explained, nor justified.

To the extent that the CSIR proposes to reserve more spectrum to the WOAN than needed (according to its own estimates), less spectrum will be distributed to the MNOs – just 55% of LTE spectrum to 4 existing MNOs. This is likely to create a distortion in the LTE market. Indeed, the CSIR recommendation implies that each MNO would only get 2x5MHz or 2x10MHz of low frequency against the WOAN's 2x25MHz. This (in combination with the WOAN's other benefits discussed below) would confer a significant cost advantage upon the WOAN and hamper the MNOs' ability to compete with it.

Assessing the appropriate market share for the WOAN

We have also examined the CSIR motivation and the supporting evidence for its assumption that the WOAN should be able to serve 20% LTE market share. The CSIR considers 20% market share to be sufficient for the WOAN to be sustainable/competitive, as it exceeds an established threshold of 10-15%, below which new entrants might struggle to be sustainable¹. We can see the CSIR's motivation to increase the market share beyond what CSIR itself refers to as a minimum efficient scale – this implies that, if the appropriate amounts of spectrum required to serve 20% of the LTE market were calculated correctly, they would likely be conservative estimates: put differently, the WOAN could be viable even with lower amounts of spectrum, especially if we consider some of the other incentives it may be awarded.

Vodacom's own estimates show that the WOAN should not be allocated more than 25-30MHz downlink spectrum

Given the significant flaws of the CSIR study, its recommendations cannot be considered to be robust. Instead Vodacom carried out its own technical analysis of the amount of spectrum needed for the WOAN to be able to serve 10%-20% of LTE customers.

The analysis shows that the WOAN would need:

- 15MHz downlink to be able to serve 10% of customers;
- 25MHz to serve 15%, and
- 30MHz to serve 20% of customers,

under the assumption of 22 Gb demand per customer/month.

In terms of the actual package of spectrum, based on the technical analysis undertaken by Vodacom:

- **2x10MHz of low frequency with 2x10 - 2x20MHz of 2.6 GHz spectrum; or**
- **2x10MHz of low frequency with 1x25MHz 2.6GHz TDD**

should be sufficient to serve 15-20% of LTE customers.

We further note that allocating 2x10MHz of low frequency to the WOAN (rather than 2x25MHz as recommended by the CSIR) would leave 2x45MHz of low frequency spectrum to the MNOs, which would ensure that each of the four major existing operators can win (at least) 2x10MHz of low frequency spectrum. This would be consistent with ICASA's previous ITA and would put the WOAN and the MNOs on a more equal footing with regards to providing LTE coverage in rural and under-served areas.

Other Policy Direction proposals need to be re-examined

As Vodacom explains in its submission, there is uncertainty over the coexistence of the Policy Direction and the Bill that is currently in passage through Parliament and how they will interact. Even where the Policy Direction does provide some

¹ CSIR refers to a Roland Berger study.

greater clarity, it makes a number of proposals which, if implemented, could result in the distortion of competition and undermine the Government's objectives. In particular:

- **The requirement for HDS licensees to cover rural areas first** before new spectrum could be used in urban and suburban areas would deprive users in urban and suburban areas of better/faster mobile data services in the short to medium term. In particular, it would delay the deployment of 2.6 GHz (which is immediately available) to address capacity constraints in urban and suburban areas.
- **Any assignment of spectrum on a basis that is not consistent with exclusive use** would make it difficult for network operators to manage interference and would most likely lead to a reduction in quality of service. This would in turn undermine the incentives of MNOs to undertake investments in LTE and next generation technologies, as they would expect returns to be lower and more uncertain.
- **The requirement for HDS licensees to offer the WOAN access to communications networks** would represent a significant extension of the Authority's powers in relation to facilities leasing and a shift away from the current evidence-based, proportionate regime. Further, international experience, as well as experience within South Africa, indicates that the benefits of infrastructure sharing can be achieved through commercially negotiated agreements, without the need for regulatory intervention.

The Policy Direction proposal would result in a loss of government revenue

As discussed above, the Policy Direction proposes to reserve significantly more spectrum for the WOAN than is needed for it to be sustainable and was previously recommended by ICASA (in the context of the previous ITA). Moreover, the Policy Direction does not specify whether the WOAN should pay for the spectrum in line with its market value.

Indeed, while MNOs will have to compete for the HD spectrum in the auction (which is expected to reveal the market value of the HD spectrum), the process of allocating spectrum to the WOAN is not explained. In particular, it is not clear whether the Policy Direction envisages any form of competition for the spectrum reserved for the WOAN/ for the WOAN ownership.

We argue that allocating spectrum outside a competitive process could lead to an inefficient outcome. Moreover, there is also a risk of a significant loss of government revenue if the WOAN is not required to pay for the spectrum or if it receives a significant discount compared to the price paid by the MNOs². Under the Policy Direction proposal and assuming that the WOAN is not required to pay the full market value of spectrum, almost half of all government revenues from the spectrum auction could be lost (compared to a scenario where all spectrum is

² Given that the WOAN is a new entrant, a small discount may be appropriate – either in the form of payments being spread over time or a reduced upfront payment (compared to the prices paid in the auction). However, it is important that this discount does not materially affect competition in the market.

allocated using an auction). On the other hand, if the WOAN is allocated a package of spectrum, which is in line with Vodacom's recommendations (2x10MHz of low frequency and 2x10MHz of 2.6GHz), the loss would be significantly smaller.

Government revenues/ auction proceeds are likely to be further affected by whether the effective exclusive use of spectrum is maintained throughout the licences' duration; and that other radical proposals of the 2018 Bill, such as those related to wholesale open access and the dampening of regulatory independence are removed. Indeed, if the 2018 Bill is kept in its current form, government revenue losses are likely to be even higher than estimated above (as the value of spectrum to the MNOs will be greatly reduced).

1 INTRODUCTION

Vodacom has appointed Frontier to review the Policy Direction and the supporting CSIR study to assess whether these proposals satisfy the economic principles of efficiency, promotion of competition and maximising consumer benefits in the South African mobile market.

In brief, the Policy Direction supports the creation of a Wholesale Open Access Network (WOAN) and proposes to allocate High Demand Spectrum (HDS) both to the WOAN and the Mobile Network Operators (MNOs), following the CSIR recommendations:

- to reserve 2x25MHz of 800MHz + 2x20MHz of 2.6GHz FDD + 1x25MHz of 2.6GHz TDD spectrum for the WOAN, and
- to allocate to the MNOs 2x30MHz of 700MHz spectrum and 2x50MHz of 2.6GHz FDD spectrum.

In addition, the Policy Direction proposes to confer a number of other advantages on the WOAN, summarised in the table below:

Figure 2 Advantages conferred on the WOAN (according to the Policy Direction)

	WOAN	MNOs
Annual spectrum fees	Reduced or waived for 5 years	Annual fees
Up-front spectrum payments	Not specified	Auction payment
Access	Immediate access to facilities and networks of MNOs that are assigned unassigned HDS	
Coverage obligation	ICASA to determine	Coverage obligations Rural areas to be covered first
Capacity	Capacity commitment by MNOs that acquire unassigned HDS for a share of the WOAN's capacity for 3 years; ICASA to determine further commitment after first 3-year period	Compete for customers, no demand guarantee

Source: Frontier's interpretation of the Policy Direction

This report is structured as follows:

- Section 2 – We argue that the CSIR analysis is flawed and should not be relied upon. Its recommended amount of spectrum significantly overstates the amount of spectrum the WOAN would need to be sustainable. We also provide an alternative proposal based on Vodacom's own technical analysis.
- Section 3 – We argue that some of the other proposals in the Policy Direction could undermine competition and have other detrimental consumer impacts.

- Section 4 – We show that the Policy Direction proposals could lead to a significant loss of government revenues. In order to minimise this loss, less spectrum should be allocated to the WOAN.

2 THE AMOUNT OF SPECTRUM PROPOSED TO BE RESERVED FOR THE WOAN IS TOO HIGH

In relation to the amount of spectrum to be assigned to a WOAN, the Policy Direction directs ICASA to ‘*consider the recommendations of the CSIR study urgently*’. The CSIR study estimates that the WOAN would need 40MHz downlink spectrum. However, in its recommendations, this amount is then increased to a combination of 2x25MHz of 800MHz together with 2x20MHz of 2.6GHz FDD and 1x25MHz of 2.6GHz TDD spectrum (which is equivalent to 60MHz downlink) without any justification.

In this section, we critically assess the CSIR study and argue that it overestimates the amount of spectrum the WOAN would need to be sustainable (due to a number of incorrect/ unexplained assumptions). Allocating such a disproportionate amount of spectrum to the WOAN would create the risk of distorting competition, and have other unintended consequences.

We also provide an alternative estimate of the amount of spectrum the WOAN would need to be sustainable, without the risk of distorting the market. Vodacom’s technical analysis demonstrates that 20-30MHz downlink spectrum would be sufficient to ensure that the WOAN is sustainable in the medium to short term. This is significantly lower than the CSIR’s recommended package (which is equivalent to 60MHz downlink).

2.1 The CSIR study overstates the amount of spectrum the WOAN needs

2.1.1 The CSIR study has a number of serious flaws and cannot be relied upon for the WOAN spectrum allocation

The CSIR study attempts to estimate the amount of spectrum the WOAN would need, considering some (but not all) of its other advantages. More specifically, it projects forward the size of the LTE market and the amount of traffic that LTE customers would generate. It assumes that the WOAN would have access to the other MNOs’ sites and estimates how much spectrum the WOAN would need to be able to serve 20% of LTE customers. We have identified a number of serious flaws in this study:

- There are several assumptions made in the CSIR technical modelling, which lead to the CSIR overstating the amount of spectrum needed by the WOAN, including³:
 - it understates the number of sites the WOAN will be able to use (by excluding those sites, which are within a 1km radius of the existing site). There is no reason why these sites should be excluded, as the WOAN’s spectrum could also be deployed on those sites (resulting in a denser

³ Please see separate technical Annex.

network). If the spectrum were deployed on those sites (as there is no reason why it should not be), the overall amount of spectrum required would be reduced.

- The CSIR study assumes that 700MHz and 800MHz spectrum will only be deployed on sites with a height greater than 15m. This artificially increases demand for 2.6GHz spectrum where 800MHz spectrum is not deployed. This assumption is not justified. Vodacom, on its network, deploys low frequency spectrum on all sites where demand for capacity is high. If this assumption were removed, it would result in lower downlink spectrum required.
- It uses the spectrum re-use factor of 1.5, while the spectrum re-use factor of 1 is (more) appropriate.

All these issues collectively lead to a significant overstatement of the amount of spectrum required by the WOAN.

Most importantly, the CSIR study estimates that the WOAN would need 40MHz of spectrum (downlink) to be sustainable. However, in its recommendations it then proposes to allocate to the WOAN 60MHz downlink (this corresponds to the CSIR proposal of 2x25MHz of 800MHz + 2x20MHz of 2.6GHz FDD + 1x25MHz of 2.6GHz TDD spectrum), which is 150% of the downlink the CSIR itself has estimated. The reason for this difference is not motivated or explained. Clearly, even under the CSIR existing assumptions, a smaller spectrum package would be sufficient, i.e. a package that provides 40MHz downlink rather than 60MHz downlink.

Furthermore, the spectrum package proposed for the WOAN represents c. 45% of all unassigned HD spectrum, leaving to the existing MNOs only 55%. The CSIR study makes no attempt to assess whether this amount is sufficient for the MNOs to be able to provide high quality services to their customers, i.e. that the market is not distorted by the WOAN being able to offer better quality LTE services or LTE services at lower costs and/or better quality than the four existing MNOs can⁴. This is a serious omission, especially in light of the CSIR recommending a larger spectrum package for the WOAN vis-a-vis its own calculations.

In light of all the flaws identified above, the CSIR study cannot be relied upon as a basis for recommending the amount of spectrum to be reserved for the WOAN.

2.1.2 The WOAN needs to be sustainable and not distort competition

In order to determine the amount of spectrum that the WOAN would require, it is useful to set out the principles that should guide such a determination.

Mobile telecommunications networks are characterised by high upfront fixed costs and subsequent investment to deploy the latest technologies - predominantly the cost of deploying and operating a mobile network to cover a given area or population in a country. Such investment would be required if such a network intends to offer a national service, and especially if an operator is subject to a

⁴ We note that this approach underlined the packaging of the spectrum in the previous ICASA ITA.

coverage obligation – as is typically the case in many mobile markets. Scope and scale are thus, inter alia, important to lowering the average cost of deployment, offer affordable rates and quality service, and achieve sustainability. This is the main reason why most countries have no more than 3-4 mobile network operators.

In this context, economists refer to a concept of a ‘minimum efficient scale’, i.e. the minimum market share (in terms of number of subscribers or traffic/revenues) needed to be able to recover the investment costs of a mobile network and to earn sufficient profits for a mobile network operator to be sustainable in the longer term. The minimum scale may vary by country depending on the mobile coverage required and other market characteristics. In countries with challenging geographies (large rural areas and strict coverage obligations), investment costs may be particularly high. This then requires relatively more customers to recover these investment costs.

On the other hand, in densely populated countries and/or in countries where coverage obligations are not stringent, investment costs may be relatively low. In those countries, new entrants can choose to roll out their networks mainly in metropolitan areas (incurring relatively lower investment costs) and be sustainable even with a small market share.

Therefore, the question of what spectrum should the WOAN be assigned to be viable in the longer term, ‘translates’ into determining first the market share the WOAN would need to be able to serve to be sustainable and cover its investment costs.

At the same time, the WOAN should not be given ‘too much’ spectrum, such that it gains a significant and sustainable cost advantage over other network operators which would risk competition distortions. It is therefore necessary to ensure that the amount of spectrum assigned to the WOAN does not give it a material cost advantage in the provision of LTE services, such that the other operators will not be able to replicate WOAN’s quality (coverage and capacity) of service without incurring significantly higher costs. The reason this matters is because the MNOs are also expected to compete with the WOAN in the provision of LTE services by acquiring the remaining unassigned HDS. Were the WOAN to have a significant cost advantage because of being assigned a disproportionately large share of the currently unassigned HDS, this could be used by new entrants/MVNOs that could purchase capacity from the WOAN and distort competition in the downstream retail market.

The above is consistent with Vodacom’s previously stated position in its support for a competitive WOAN.

VODACOM'S POSITION ON A COMPETITIVE WOAN

Previously Vodacom stated that it supports a competitive WOAN, i.e. “a WOAN that would have the following features:

- a. *be sustainable; able to achieve sufficient scale and scope to become a viable business*
- b. *be an efficient wholesale provider; it must be disciplined, innovative and customer-focused, using assigned spectrum in the most efficient way and deploying the latest technologies*
- c. *can succeed on its own merits in the medium term; not unduly, unfairly or unreasonably benefitted by spectrum and other incentives;*
- d. *operating in a competitive environment with MNOs;*
- e. *be an additional vehicle for broad-based black economic empowerment, through investment opportunities in the competitive WOAN and in MVNOs and resellers facilitated by the WOAN.”⁵*

Vodacom states that a WOAN needs to be a sustainable and efficient provider (which implies that it needs to achieve a certain minimum scale) and it needs to operate in a competitive environment alongside the existing MNOs.

On the other hand, the WOAN should not receive too many advantages (e.g. too much spectrum, spectrum below market value, etc.) in order to avoid a distortion of competition. It is important that the WOAN is “*capable of succeeding on its own merits in the medium term*”. Alternatively, there is a risk that the existing operators would not be able to compete and will be squeezed out of the market in the longer term. As was demonstrated in Vodacom/ Frontier previous submission, this would result in a detriment for consumers.⁶

2.1.3 Estimating the market share needed for the WOAN to be sustainable and not distort competition

The CSIR study did not attempt to estimate the minimum efficiency scale specific to South Africa. Instead it relies on a study by Roland Berger “*Succeeding as a telecoms challenger*”⁷, which estimates empirically the relationship between mobile operators’ market shares and corresponding profitability (EBITDA margins). Generally, the Roland Berger study finds a positive relationship between market shares and profitability, i.e. larger operators tend to be more profitable (in line with economic theory). The study observes that “*EBITDA margins of around 20% are typically needed to cover capex investments, interest payments and tax*”. This corresponds to a 10-15% market share, on average in order to achieve these

⁵ Vodacom’s submission in response to the Department of Telecommunications and Postal Service’s invitation to provide written comments on the Electronic Communications Amendment Bill, Government Gazette Number: 41261 of 17 November 2017], 31 January 2018

⁶ Frontier (2018) “Assessing the Draft Electronic Communications Amendment Bill, Part I: Impact Assessment”

⁷ <https://www.rolandberger.com/en/Publications/Succeeding-as-a-telecom-challenger.html>

margins. Therefore, the study concludes that, based on the evidence it has analysed, mobile operators could in general be expected to need to achieve a 10-15% market share to be sustainable/ viable in the long term.

In the case of the WOAN in South Africa, the Policy Direction does not prescribe any coverage level for the WOAN. Instead, it states that ICASA “*must determine the terms and conditions, including universal service and access obligations*”. If the WOAN is not under a particularly strict coverage obligation, its investment costs may be relatively low and, therefore, it may be sustainable with a lower market share. The Policy Direction proposes that the WOAN should potentially benefit from a number of ‘incentives’⁸. Although these generally seem to be intended to assist the WOAN for a period of time, rather than permanently, some of them (such as preferential access to MNOs’ networks) could also contribute to the WOAN’s longer term sustainability/ decreased risk of failure.

Another question is which ‘market’, or market segment, should be considered. We consider that the relevant market segment is the LTE/4G subscriber market segment, assessed over a sufficiently long period of time, to ensure that the WOAN can serve a sufficiently large share of mobile subscriber demand. This is because (a) the unassigned HDS spectrum it will obtain will be used to offer such services, (b) there is a transition from other technologies to LTE/4G because of its superior qualities in delivering higher quality service at a lower cost and (c) when considered over the medium/longer term, this would allow the WOAN to have sufficient spectrum to serve demand over the lifetime of its licence.

In relation to the point on wholesale vs retail customers, we consider that it is appropriate to look at the retail market and retail customers, i.e. the WOAN should be able to provide the wholesale capacity to support the demand for 10-15% of the retail LTE market segment. We appreciate that in practice, the demand for the WOAN’s wholesale services will consist of MNOs’ demand to serve their own retail customers, MVNO service-based competitors’ retail customers, and potentially new entrants’ retail customers. What we are focussing on is the amount of ‘derived’ demand for the WOAN’s capacity that would be generated, on average, by 10-15% of these retail customers.

In summary, 10-15% market share of the forecasted demand generated by LTE/4G subscribers could be sufficient to ensure the sustainability of the WOAN in SA. There may be merits in considering also a more conservative approach, given the 10-15% share comes from international precedents, and the WOAN may require some more flexibility in the longer term to be able to meet data demand growth. Vodacom has therefore considered in their technical analysis the spectrum necessary to serve a range between 10% and 20% of this demand, which also incorporates the market share assumption used in the CSIR study.

⁸ Such as access to HD spectrum at a reduced price and preferential access to the existing MNOs’ networks.

2.2 ICASA will need to assess the risk of market distortions arising from other privileges proposed for the WOAN

We note that the CSIR study largely ignores most other benefits that the Policy Direction proposes to give to the WOAN, such as reduced spectrum fees, capacity pre-commitments, etc. These additional benefits, in combination with a large amount of 4G spectrum, could result in reduced costs for the WOAN vis-à-vis the MNOs (which do not receive similar advantages). It is important that ICASA, in preparation to the HDS auction, fully assesses the impact of any incentives given to the WOAN on the market and its other participants.

We understand that the motivation for considering preferential treatment for the WOAN, is that as the WOAN will be a new entrant mobile network operator, it will need to gain traffic volumes/demand from other MNOs and MVNOs/ service providers. It is envisaged that this disadvantage would be addressed by the requirement for MNOs that wish to acquire HDS to pre-commit to collectively purchase a certain amount of the WOAN's capacity. ICASA will therefore need to assess whether the level of collective pre-commitment of the MNOs and the period over which it will apply, when considered in parallel to coverage obligations, and the level of spectrum assigned to the WOAN, would be sufficient to provide the WOAN with a reduced risk as a new entrant MNO, whilst minimising the risks of distortion of competition.

2.3 Vodacom's own modelling demonstrates that the WOAN does not need so much spectrum to be sustainable and equally efficient

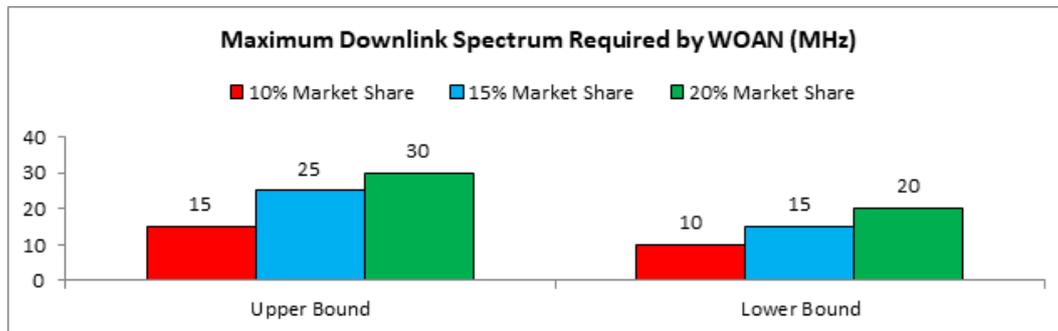
Given the number of issues with the CSIR study, we do not consider its recommendations to be robust. Instead Vodacom carried out its own technical analysis of the amount of spectrum needed for the WOAN to be able to serve 10%-20% of LTE customers⁹. The analysis shows that, under a relatively high future data consumption assumption¹⁰ (22GB per month), the WOAN would need:

- 15MHz downlink to be able to serve 10% of customers;
- 25MHz to serve 15% and
- 30MHz to serve 20% of customers.

⁹ See Vodacom's technical submission

¹⁰ Under a more conservative set of assumptions (15GB per month), the required downlink is estimated to be 10MHz, 15MHz and 20MHz respectively.

Figure 3 Maximum Downlink Spectrum required by WOAN to serve 10%, 15% and 20% market shares (MHz)



Source: Vodacom

In terms of the actual package of spectrum, based on the technical analysis undertaken by Vodacom:

- **2x10MHz of low frequency with 2x10 - 2x20MHz of 2.6 GHz spectrum; or**
- **2x10MHz of low frequency with 1x25MHz 2.6GHz TDD**

should be sufficient to serve 15-20% of LTE customers, under the higher data consumption assumption.

We further note that allocating 2x10MHz of low frequency to the WOAN (rather than 2x25MHz as recommended by the CSIR) would leave 2x45MHz of low frequency spectrum to the MNOs, which would ensure that each existing operator can win (at least) 2x10MHz of low frequency spectrum. This would be consistent with ICASA's previous ITA and would put the WOAN and the MNOs on a more equal footing with regards to providing comparative LTE services, both in terms of price and quality

2.4 Other considerations on the appropriate amount of spectrum for the WOAN

2.4.1 Allocating 2x25MHz of 800MHz to the WOAN is technically sub-optimal and might increase deployment costs

As the max carrier size for LTE is 2x20MHz, to deploy 2x25MHz of 800 MHz, the WOAN would need to deploy two antennas: one for 2x20MHz spectrum and another one for the remaining 2x5MHz block. This would significantly increase deployment costs, with a limited gain in terms of additional capacity/ user experience. Alternatively, if the WOAN chose not to deploy 2x5MHz of 800MHz spectrum at all, it would be an inefficient outcome (given that low frequency spectrum is valuable – see more on the value of spectrum in Section 4).

2.4.2 Reserving 2x25MHz of low frequency for WOAN would preclude the four other MNOs from obtaining sufficient unassigned HDS

An obvious consequence of allocating more unassigned low frequency HDS to the WOAN would be less unassigned low frequency HDS available to the industry. ICASA previously considered it important to place the MNOs on a level playing field with regards to the amount of unassigned low frequency spectrum they receive, and included in each spectrum package 2x10 MHz of low frequency spectrum. One of the consequences of this reduction in spectrum available is that ICASA would no longer be able to package low frequency spectrum in this symmetric way. Whilst MNOs will have access to the WOAN's capacity, we would expect at least four of the existing MNOs to value having sufficient amount (by which we mean at least 2x10MHz) of their own low frequency spectrum to (a) enable them to offer/develop differentiated LTE propositions, including in relation to indoor coverage for which low frequency spectrum is suitable, (b) launch them in a timely fashion, irrespective of when the WOAN launches its services, and (c) be able to compete with the WOAN at a wholesale level.

Furthermore, low frequency spectrum is particularly valuable to deliver rural coverage. The government in South Africa is proposing to increase coverage by placing coverage obligations on MNOs. With 2x30MHz of 700MHz, it is not feasible to split the low frequency spectrum into four 2x10 MHz lots. In this context, a possible allocation would be as follows: three licences containing 2x10MHz of sub 1-GHz spectrum (or two licences containing 2x10MHz and two licences containing 2x5MHz of low frequency). Such an allocation would put the operator acquiring no low frequency spectrum (or two operators acquiring the smaller blocks) at a disadvantage in terms of their ability to compete in the market.

3 THE POLICY DIRECTION PROPOSALS MAY DISTORT COMPETITION AND HAVE OTHER DETRIMENTAL CONSUMER IMPACTS

As Vodacom explains in its main submission, there is significant uncertainty over the coexistence of this Policy Direction and the Bill that is currently in passage through Parliament and how they will interact. Notwithstanding this uncertainty, the Policy Direction makes proposals which, if implemented, could result in the distortion of competition and undermine the Government's objectives. In particular:

- **The requirement for HDS licensees to cover rural areas first** before new spectrum could be used in urban and suburban areas would deprive users in urban and suburban areas of high quality mobile data services in the short to medium term. In particular, it risks delaying the deployment of 2.6 GHz (which is immediately available) to address capacity constraints in urban and suburban areas.
- **The assignment of spectrum on a basis that is not consistent with effective exclusive use/control** would make it difficult for network operators to manage interference and would most likely lead to a reduction in quality of service. This would in turn undermine the incentives of MNOs to undertake investments in LTE and next generation technologies, as they would expect returns to be lower and more uncertain.
- **The requirement for HDS licensees to offer the WOAN access to communications networks** would represent a significant extension of the Authority's powers in relation to facilities leasing. It would also imply a shift away from the current evidence-based and proportionate regime. Further, international experience, as well as experience within South Africa, indicates that the benefits of infrastructure sharing in mobile can in general be achieved through commercially negotiated agreements.

The rest of this section considers in detail each of the above points.

3.1 Coverage obligations targeting rural and underserved areas first

3.1.1 Our understanding of the Policy Direction

Paragraph 2.2(d) of the Policy Direction requires that HDS licences are subject to universal access and universal service obligations and that these obligations *“must be complied with in rural and under-served areas before the assigned spectrum may be used in other areas by the licensees.”*

In other words, licensees may only deploy HDS in urban and suburban areas *after* coverage obligations in rural areas have been fully met.

At the same time, the coverage obligation for the WOAN is more vague - the Policy Direction states that ICASA must determine the terms and conditions for the WOAN, including universal service and access obligations.

3.1.2 Consistency with economic principles and regulatory best practice

The requirement to roll out to rural areas will likely lead to slower network upgrades and reduced investment in urban and suburban areas

While it is not clear how coverage obligations will be implemented in practice, there is a substantial risk that the 'rural first' requirement could lead to inefficient outcomes, for multiple reasons. First, the low frequency spectrum (700 and 800 MHz), suitable for coverage, is currently used and not available for mobile use. The migration away from this spectrum will take time (we understand a realistic date for the migration to complete is 2022, but it could take longer). Throughout this period, MNOs will not have access to suitable spectrum to meet coverage obligations in rural / underserved areas:

- **High frequency** spectrum (above 1 GHz) is generally not suitable/used for coverage rollout, as it leads to higher cost of covering a given area (as more base stations are required than with lower frequency spectrum to achieve the same coverage);
- Existing **low frequency** spectrum (900 MHz) cannot be readily used to deploy 4G services in rural areas and meet the coverage obligations with speed requirements. This is because 900 MHz spectrum is currently used by MNOs to deliver 2G and 3G mobile services and would therefore need to be re-farmed, where practical and possible, before it can be used to deploy 4G services.
 - This process takes time and we understand that Vodacom is planning to only re-farm 2x5 MHz of 900 MHz spectrum for 4G, to maintain sufficient capacity in the 2G and 3G layers. The CSIR study itself indicates that this would be insufficient to meet the SA Connect speed targets.¹¹
 - Further, we note that 900 MHz spectrum is not commonly used to deliver 4G services. For instance, according to the GSA, only 22% of LTE user devices can operate in 900 MHz spectrum, compared with 57.4% which can operate in 1800 MHz spectrum (the most used LTE spectrum band).¹²

Second, MNOs will not be able to quickly deploy additional spectrum where demand for data services is, which will particularly affect customers in urban and sub-urban areas where MNOs may face capacity constraints. As explained above, it will take a period of years before MNOs have access to sufficient low-frequency spectrum to meet their coverage obligations in rural areas. The requirement to roll-out to rural areas first can be expected to delay the deployment of 2.6 GHz spectrum, which is immediately available. As a result, mobile users in urban and sub-urban areas - who would benefit the most from additional network capacity -

¹¹ Table 8 of the CSIR study indicates that providing speeds of 5 – 10 Mbps to 20% of the population would require 7 – 16 MHz of downlink spectrum.

¹² <https://gsacom.com/paper/lte-in-900-mhz-band-8-market-status-report/> and <https://gsacom.com/paper/status-lte-ecosystem-report-5614-lte-devices-announced-455-suppliers/>

will not get access to new services until MNOs meet their coverage obligations in rural areas and/or WOAN becomes fully functional and deploys in urban areas.

Finally, while recognising the importance of improving data connectivity in rural and underserved areas, the requirement to roll-out in rural areas first (on a national basis) will make it more challenging, and inefficient for MNOs to plan and implement network upgrades and deploy new spectrum (which is typically done in local/regional clusters). There are therefore more efficient ways of achieving Government's objectives in relation to digital divide and allowing rural customers to benefit from increasing connectivity without depriving urban and sub-urban areas from the benefits of readily available 2.6 GHz spectrum.

Thus, the requirement for MNOs to rollout in underserved and rural areas first will likely lead to lower investment and slower and more inefficient deployment of new mobile technologies, and likely delay the deployment of high-speed networks in urban and sub-urban areas.

The requirement to roll-out to rural areas first is largely unprecedented

Attaching coverage obligations to sub-1GHz spectrum, to facilitate mobile connectivity in 'challenge areas' (non-profitable areas) is in line with international regulatory best practice. However, the requirement to cover rural areas first is largely unprecedented. The one prominent example of "outside-in" style coverage obligations that we have identified – from Germany – applied specifically to low frequency spectrum, which as explained above, is much better suited to coverage rollout in rural and underserved areas than the high frequency spectrum. The German regulator imposed coverage obligations specifically for 800 MHz spectrum, which required licensees to build-out their networks in listed communities (referred to as "white spots") in four stages in areas with no or low broadband coverage, before deploying frequencies in this band in more populated areas.¹³ The fact that licensees had access to 800 MHz spectrum meant that operators could rapidly deploy LTE networks in these white spots.

Further, since the coverage obligations only affected the deployment of 800 MHz spectrum, operators could deploy LTE in cities at the same time, using high frequency spectrum – in the 1800 MHz, 2.1 GHz and 2.6 GHz bands – which was awarded alongside the 800 MHz band. For example, Deutsche Telekom launched services in rural areas using 800 MHz on 5th April 2011 and shortly afterwards in Cologne, on 1st July 2011, using 1800 MHz. In contrast, the Policy Direction would prevent licensees from deploying newly acquired high frequency spectrum (in the 2.6GHz band) in urban and suburban areas alongside the rural deployment, until the obligations in rural areas had been met.

Finally, we note that the 800 MHz coverage obligations in Germany could be met collectively – in other words, licensees were permitted to deploy 800MHz spectrum in successive priority areas as soon as 90% of the population in previous stage had been provided with access by *at least one* licensee. In contrast, the Policy Direction would require each operator to meet their obligations individually, in rural areas, before rolling out to urban and suburban areas.

¹³ Aetha (2011), Case studies for the award of the 700MHz/800MHz band: Germany
<https://www.gsma.com/spectrum/wp-content/uploads/2011/11/700MHz-800MHz-band-Germany.pdf>

3.2 Non-exclusive use of spectrum

3.2.1 Our understanding of the Policy Direction

Paragraph 1.4 of the Policy Direction endorses the White Paper's assertion that HDS is to be assigned on a non-exclusive basis:

Moving forward, the new spectrum management regime set out in the White Paper encourages that licensees work together as far as it is practicable, including through the deployment of a WOAN. The White Paper states that in bands where demand exceeds the amount of spectrum available, assignment of spectrum must be on a non-exclusive basis. The value of sharing and collaboration between licensees is that it will result in the more effective use of scarce resources such as spectrum and a reduction of the duplication of infrastructure while facilitating service-based competition.

Whilst the Policy Direction itself does not explicitly mandate the provision of spectrum on a non-exclusive basis, paragraph 2.2(c) states that “*the spectrum is assigned subject to Chapter 8 and 10 of the ECA*”, which could potentially imply some form of an ‘access obligation’ requirement imposed on spectrum¹⁴ and hence non-exclusive usage.

3.2.2 Consistency with economic principles and regulatory best practice

Non-exclusivity requirements will hamper MNOs' ability to deliver high-quality services and undermine investment incentives

If the above interpretation is correct and the Policy Direction leads to the introduction of policies/measures which would amount to a removal or reduction of the exclusive use and control of spectrum¹⁵ for new licences (either as a result of open access obligations or non-exclusive spectrum assignment), this would be unprecedented in HDS bands and detrimental to the mobile operators' ability to provide services.

Mobile networks are designed to be run efficiently where a single operator is using one frequency band within a particular geographic area and can therefore manage inter-site interference.

Whilst regulatory bodies are exploring ways of allowing a degree of spectrum sharing, as Professor Martin Cave puts it, there is a “*huge problem of technical and commercial co-ordination*”¹⁶ associated with introducing it on a large scale.

Further, there are currently no global standards concerning this type of sharing and introducing non-exclusive spectrum usage on a large scale. Requiring this type of spectrum-sharing before the significant co-ordination problems have been properly addressed would create technical problems for all licensees, including the WOAN.

¹⁴ For instance as one the conditions of licences for newly assigned HDS.

¹⁵ We do not include in such policies any measures aimed at facilitating voluntary sharing of spectrum.

¹⁶ Cave M. (2017), Why has spectrum sharing been so hard to accomplish?, page 1

This would in turn hamper operators' ability to provide cost-efficient, high quality mobile services and a reliable customer service experience and their ability comply with their spectrum-related obligations – in particular, in relation to quality of service / speed requirements typically attached to coverage obligations.

Non-exclusive access to HD spectrum would therefore undermine materially the incentives of MNOs to undertake investments in LTE and next generation technologies, as they could expect returns to be lower and more uncertain. This, in turn, would also undermine the operators' ability to value and bid for spectrum into the forthcoming spectrum auction.

Given the substantial risks, it is vital that the costs and benefits of any potential opportunities for spectrum sharing are carefully assessed, on a case-by-case basis.

International precedent indicates that non-exclusive use of spectrum should only apply in limited circumstances

Whilst there is some precedent for regulators allowing a degree of non-exclusive spectrum use, this has typically been in a limited number of specific cases where the risks of interference can be managed and necessary provisions put in place to ensure that concurrent usage of spectrum frequencies does not negatively impact upon communications services.

For example, in the UK, whilst Ofcom retains the power to grant additional licences for spectrum that has already been allocated, this does not give other users the automatic right to enter that space.¹⁷ Rather, Ofcom will only consider granting additional licences where this does not degrade the incumbent's licensed access to the band and where safeguards can be put in place to appropriately manage the risk of interference.¹⁸ For example:

- **Local licences:** Ofcom has issued 12 local mobile telephony licences to address areas that are poorly served by national mobile providers. The licensees are required (under the terms of the licences) to work together to coordinate network deployments and thereby avoid radio interference
- **5G trials:** Ofcom has granted a number of non-operational licences to support 5G trials, which are coordinated with incumbent users to allow access to spectrum on a non-interference basis.

Ofcom has designated certain bands of spectrum as licence exempt but only in specific cases where it has been able to show that this would not intrude on the functioning of communications services (e.g. 2.4 GHz and 5.8 GHz spectrum for Wifi).

The prospect of MNOs losing control over spectrum would have an immediate negative effect on investment and other unintended consequences

As noted above, there is still uncertainty if and in what form would any non-exclusivity requirements apply on the newly assigned HD spectrum. Nevertheless,

¹⁷ Cave M. (2017), Why has spectrum sharing been so hard to accomplish?, page 2

¹⁸ Ofcom (2017), Review of the authorisation regime for spectrum access, page 5, para. 1.18.

it can be reasonably expected that this uncertainty will affect MNOs investment incentives today, as operators must make network investments that will support the use of spectrum for years to come: RAN equipment has an economic life that extends to up to 10 years¹⁹, while related investment into supporting fixed infrastructure (e.g. fibre backhaul) has much longer useful economic life (around 20 years for fibre and 40 years for duct). Any prospect of non-exclusivity requirements will likely contribute to the wider investment uncertainty, and will have an *immediate* dampening effect on investment incentives of operators, which will become stronger over time.

Finally, a move towards the use of spectrum not being consistent with exclusive use/control would undermine policies towards spectrum trading, as it would make unclear what it is that MNOs were trading.

3.3 Network access obligations

3.3.1 Our understanding of the Policy Direction

Paragraph 2.2(a) of the Policy Direction specifies that licences for HDS must be issued on the condition that:

“the licensees, must lease its electronic communications networks and electronic communications facilities, if any, to the WOAN upon request, as soon as the WOAN is licenced.”

As explained in Section 5.4 of Vodacom’s submission, this represents a significant extension of the Authorities’ powers as compared to the existing facilities leasing arrangements, under Chapter 8. The current facilities leasing regime only requires a licensee, on request by another licensee, to lease their electronic communications facilities, not their communications networks and only where the request is reasonable. Currently, more stringent pro-competitive measures may only be imposed on licensees with significant market power to remedy that market failure, as set out in Chapter 10.

As such, the above clause broadens the scope of licensees’ leasing obligations to cover entire electronics communications networks, as opposed to just facilities²⁰.

¹⁹ The GSMA estimates that the useful economic lives of Radio Access Network equipment (i.e. base stations, transmission and switching assets) of around 10 years <https://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Tax-Comparison-of-fixed-and-mobile-cost-structures.pdf>. ICASA’s MTR model assumes economic life of RAN equipment between 7.5 and 9 years.

²⁰ We understand from Vodacom that electronic communications facilities, as referred to under Chapter 8, is confined to passive infrastructure. Whilst the Policy Direction does not define “electronic communications networks”, as referred to in paragraph 2.2(a), we assume that this would encompass active as well as passive network components.

3.3.2 Consistency with economic principles and regulatory best practice

The existing regulatory framework and market structure are conducive to both passive and active infrastructure sharing, which we expect to facilitate the establishment of the WOAN

Infrastructure sharing agreements can facilitate the entry of new players, by making it easier for operators that may not possess certain infrastructure assets to offer retail services. Passive access can support network roll out by reducing the costs of network deployment. Certain forms of “active sharing” - in particular, national roaming - can also help new retail market entrants to become established by allowing them to offer a comprehensive set of mobile services on a national basis whilst they are still building out their network.

As Vodacom explains in its submission, network operators are already obliged to provide access to passive infrastructure, under Chapter 8, and passive sharing is well established in South Africa - Vodacom and other MNOs provide leasing of passive communications facilities (e.g. masts) to other operators over thousands of sites all around the country. These sharing arrangements have typically been negotiated voluntarily, on a commercial basis, without the need to invoke Chapter 8. Thus, the WOAN can expect to benefit from similar passive sharing arrangements, without the need for further intervention.

Regarding active sharing/national roaming agreement, it is also reasonable to expect that the WOAN will be able to commercially reach such an agreement with one of existing MNOs and without the need for regulatory intervention. Telkom (with MTN) and Cell C (with both Vodacom and MTN) have both successfully negotiated national roaming agreements. This indicates that operators have (unilateral) incentives to offer access commercially, without the need for intervention. This is also consistent with international experience. 5 out of the 7 national roaming agreements (excluding joint deployments) currently in place across EU Member States are commercially driven.²¹ In addition, there are 16 active sharing agreements currently in place in the EU as part of joint deployment programmes, all of which are commercially driven.²²

Given that the WOAN is expected to be an important new network operator (and hence a significant wholesale customer) we would anticipate that operators will have strong incentives to compete for its business.

In any case, by using the spectrum licensing process to extend the scope of access obligations to essentially cover communication providers' entire networks, without first conducting a careful market review, the Policy Direction diverges from regulatory best practice. Given the intrusive nature of network access regulation, a detailed market analysis (as prescribed by Chapter 10) should precede any such intervention, to assess whether it is justified.

²¹ BEREC (2018), Report on infrastructure sharing

²² Ibid

International precedent does not support the imposition of wholesale access in mobile markets with the same characteristics as SA

In terms of international precedent, we note that a wide range of jurisdictions do not impose access obligations on MNOs, on the basis that markets are generally found to be competitive. The European Commission removed the market for wholesale access to mobile operators' networks²³ (covering active products such as MVNO access and national roaming) from its list of relevant markets susceptible to ex-ante regulation in 2007 because:

"The degree of competition generally observed in this market at the retail level indicates that ex ante regulatory intervention at a wholesale level may not be warranted. In addition, in most Member States the wholesale mobile access and call origination market is effectively competitive as mobile network operators conclude access agreements on commercial terms."

The EU concluded this even though at the time of the decision, there were 14 Member States who had operators with market shares in excess of 40%.²⁴ Furthermore, even though the market for wholesale access to mobile networks was included in the EC's 2003 list of relevant markets, the vast majority of Member States found it to be competitive and therefore did not impose ex-ante regulations in this market.

Mandating access to entire mobile networks will reduce incentives to innovate

Mandating access to the operator's entire network (as opposed to just essential, bottleneck, facilities within the network), means that any competitive advantage that an investment might bring would also be available to the WOAN and, by extension, access seekers, whilst the risks would be borne exclusively by the host MNO.

The inability to differentiate at the network (and thus service) level may, in turn, reduce the expected return from any future investments and innovations and hence the incentive to invest in the first place. This is mitigated to some extent by the fact that the PD does not prescribe how prices and the terms conditions of access and should be set.

However, we note that the 2018 Bill indicates that the government is minded to introduce cost-orientation access obligations for MNOs. This would significantly impact on their ability to recover the costs associated with major new investments, particularly those based on next generation technologies that carry considerable risks. This is because standard cost-based regulation would reduce the potential returns that operators can make from these investments if they are successful, but may not compensate them for the risk of failure (i.e. if demand turns out to be lower than expected or costs higher than expected).

²³ Referred to by the EC as "access and call origination on mobile networks"

²⁴ TeleGeography

4 POLICY DIRECTION PROPOSAL WOULD RESULT IN A SIGNIFICANT LOSS OF GOVERNMENT REVENUE

As discussed above, the Policy Direction proposes to reserve significantly more spectrum for the WOAN than was previously recommended by ICASA (in the context of the previous ITA). The Policy Direction also envisages that the WOAN will benefit from “*reduced or waived radio frequency spectrum licence fees for a period of 5 years*”. We understand that this refers to annual licence fees, which will be imposed on all HDS holders, to prevent spectrum hoarding and, more generally, to incentivise operators to use spectrum efficiently. However, this does not address the issue of whether the WOAN would be required to pay the market value of spectrum in the first place.

Indeed, while MNOs will have to compete for the HDS in the auction (which is expected to reveal the market value of the HDS), the process of allocating spectrum to the WOAN is not explained. It is not clear whether the Policy Direction envisages any form of competition for the spectrum reserved for the WOAN/ for the WOAN ownership. Below, we argue that allocating spectrum outside a competitive process could lead to an inefficient outcome. Moreover, there is also a risk of a significant loss of government revenue if the WOAN is not required to pay for the spectrum its full market value.

4.1.1 Auctions are a widely accepted tool to allocate spectrum

There is a consensus that the best practice in relation to allocating scarce spectrum resources is to use auctions²⁵. There is a significant body of academic literature²⁶ that demonstrates that well designed auctions are preferable in terms of allocating efficiently HDS. That is a well-designed auction would be expected to lead to an allocation of spectrum that would support both (a) the delivery of the most valuable²⁷ services for consumers, thus maximising consumer benefits/welfare and (b) at the lowest cost possible. This is because in a well-designed auction, a bidder that values the spectrum the most and can either generate more revenue from a given spectrum, the same revenue at lower cost, or both, compared to other bidders, will be expected to be prepared to pay more for the spectrum. As a result, an auction would be expected, in general, to lead to an allocation of spectrum to the users that can make the best use of it (also called an ‘efficient’ allocation)²⁸.

²⁵ We note also that spectrum auctions need to be well designed in order to ensure efficient outcomes.

²⁶ See, for example, Peter Cramton (2001) ‘Spectrum auctions’, Handbook of Telecommunications Economics <http://www.cramton.umd.edu/papers2000-2004/01hte-spectrum-auctions.pdf>

²⁷ The idea behind this is that efficiency is driven by competition, both in the auction and subsequently in the market. In the absence of competition, WOAN might still be able to offer the same services, but it will not have incentives to improve them (in the absence of a competitive threat) or offer them at the lowest cost (even if regulated).

²⁸ Note that we do not assume that incumbents are always the most efficient users of spectrum. It is possible that new entrants could win the spectrum, provided they are more efficient and are prepared to pay more for it.

Well-designed auctions are also superior in terms of transparency and the ability to maximise revenue for the government. Auctions can also be designed in such a way as to increase the level of competition (e.g. to reserve some spectrum for a new entrant or limit the amount a single operator can get) or to increase coverage (to attach coverage obligation to some licences). The latter approach has been used extensively in recent 4G auctions, both in Europe and worldwide.

If there is no effective competition for the WOAN ownership/ WOAN spectrum, there is a risk that the spectrum might not be allocated/ used efficiently. It is important that ICASA clearly explains the process of licensing the WOAN and allocating spectrum to the WOAN. If no competition is envisaged, ICASA needs to explain how it would incentivise the WOAN to use the spectrum efficiently and ensure no distortion of competition.

4.1.2 Auction proceeds and annual licence fees

Spectrum auctions have not yet been used in South Africa, but they have been the preferred method of spectrum allocation in Europe, the US and many other countries for almost two decades. As discussed above, well-designed auction typically result in efficient spectrum allocations and also allow governments to raise significant revenues from selling spectrum.

The Policy Direction is not explicit on whether the WOAN would be required to pay for the spectrum it receives. If the WOAN is not required to pay for the spectrum, the government would lose almost half of its potential revenue (as the Policy Direction proposes to allocate 45% of all HD spectrum to the WOAN). On the other hand, if less spectrum is allocated to the WOAN (in line with Vodacom's technical analysis) and more spectrum allocated to the MNOs, the losses would be smaller.

In any case, irrespective of the amount of spectrum allocated to the WOAN, the WOAN should be required to pay for the spectrum it receives, with the payment being established in a competitive process (if there is competition for the WOAN spectrum) or informed by the auction prices paid by the MNOs. As the WOAN is a new entrant into a relatively mature market, such payments could be spread over time, to reduce the upfront cost of entry, or an upfront payment could be reduced (compared to the auction prices). However, giving the WOAN a large discount (or in an extreme case, not requiring the WOAN to pay for the spectrum) would result in a significant cost advantage granted to the WOAN vis-à-vis the MNOs, which could result in a competitive distortion in the mobile market in South Africa.

Government revenues/auction proceeds are likely to be further affected by whether the effective exclusive use of spectrum is maintained throughout the licences' duration; and that other radical proposals of the 2018 Bill, such as those related to wholesale open access and the dampening of regulatory independence are removed. Indeed, if the 2018 Bill is kept in its current form, government revenue losses are likely to be even greater (as the value of spectrum to the MNOs will be greatly reduced).

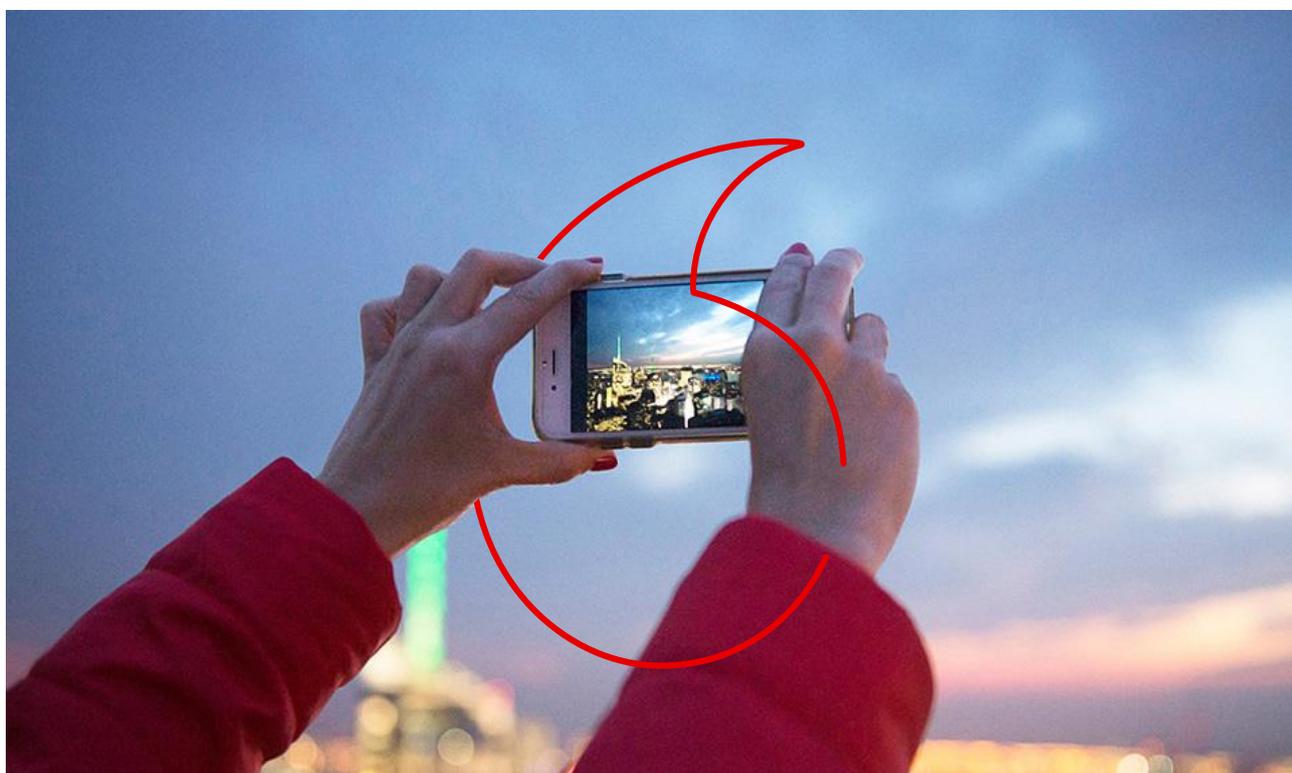
Similarly, there is no reason for the WOAN to pay *reduced* annual spectrum license fees. These fees are currently determined by an Administrative Incentive Pricing Regime applied by the Authority, which is designed to discourage spectrum hoarding and promote the efficient use of spectrum. Therefore, there is no reason

to diverge from this established system when determining annual licence fees faced by the WOAN, as it would increase the risk of spectrum being deployed inefficiently and competition being distorted.





Vodacom Group Technology Technical Analysis



Title : Vodacom Technical Analysis on CSIR Spectrum Sufficiency Study
Author : Christiaan Klopper
Date : 7 November 2018
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1. Introduction

The DTSP published a policy directive on 27 September 2018 and invited public participation and comments. The policy directive is intended to form the basis of ICASA licensing high demand spectrum to a Wholesale Open Access Network (WOAN), as well as other network operators. The Minister commissioned the CSIR to determine how much spectrum would be sufficient for the WOAN to be viable. The DTSP attached a redacted version of the CSIR report, which calculates the amount of spectrum the CSIR deems necessary for the WOAN to be viable and recommends what spectrum should be reserved for the WOAN.

Our understanding is that the following spectrum is under consideration for assignment to the WOAN and/or other network operators:

- 2x30 MHz of 700 MHz
- 2x30 MHz of 800 MHz
- 2x70 MHz of 2600 MHz FDD
- 1x25 MHz of 2600 MHz TDD

According to the CSIR report, the following spectrum should be reserved for the WOAN:

- 2x25 MHz of 800 MHz
- 2x20 MHz of 2600 MHz FDD
- 1x25 MHz of 2600 MHz TDD

Based on the information available in the CSIR report, Vodacom has evaluated the technical model and underlying assumptions of the CSIR report, against the Vodacom technical understanding and additionally, considered how this will impact the assignment scenarios.

When analysing how much spectrum is required, there are principally 3 key factors that underpin any analysis:

1. Capacity and Coverage Demand – driven by subscriber number forecasts, subscriber usage forecasts and terminal penetration
2. Capacity and Coverage Supply – driven by site numbers, technology deployment, geography and population density
3. Network Modelling – developed to match supply to demand in the most efficient and practical manner

2. WOAN Market Assumptions

The input data (subscriber numbers, subscriber usage, as well as subscribers and usage growth rates) is one of the major contributors to a particular spectrum modelling outcome. Before modelling spectrum requirements, Vodacom found it necessary to develop its own technical models to validate the input data in the CSIR model. The first aspect that we consider relates to LTE market sizing.

The following table is an extract from the CSIR model:

WOAN users (%)	Number of Users ('000)	Downlink spectrum required (MHz)
20%	10 248	40
30%	15 371	55
40%	20 495	70
50%	25 619	85
60%	30 742	105
70%	35 867	120
80%	40 990	135

Table 1: CSIR Model Output

While the aggregate South African population forecast used in the CSIR report is largely consistent with the forecasts used within the Vodacom model, the following are some of the key differences in terms of how the traffic model is applied:

- The CSIR model assumes that everyone older than 6 years are part of the addressable market, resulting in 86% of the population using LTE. In contrast, the Vodacom model projects that only a maximum of 79% of the SA population would use LTE, and this is only reached in 2028 in our most aggressive forecast.
- The CSIR model also assumed that all 86% would use 5 Mbps on the WOAN network by 2020. The Vodacom model assumes a more practical subscriber migration trajectory, in which subscribers are gradually migrated from 2G and 3G to LTE over time.

In Vodacom's technical model, the LTE subscriber forecast for SA is informed by the data published by the GSMA [GSMA.01], as depicted in Figure 1 below:

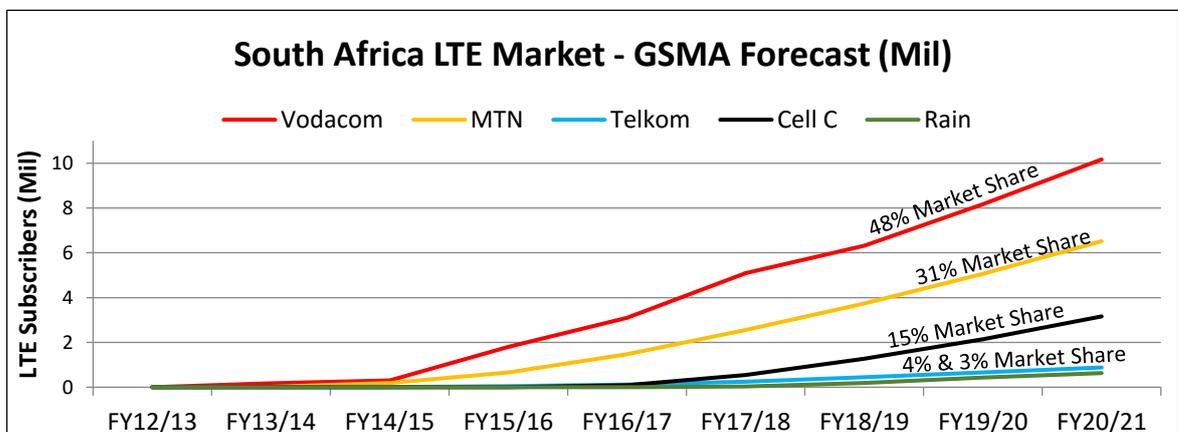


Figure 1: GSMA LTE Subscriber Market for SA

In order to cater for scenarios where real-world growth outstrips forecast, the LTE subscriber forecast used in Vodacom's model is the most aggressive forecast, assuming an LTE subscriber market of 25.4 Mil in 2020 (as depicted in Figure 2 below).

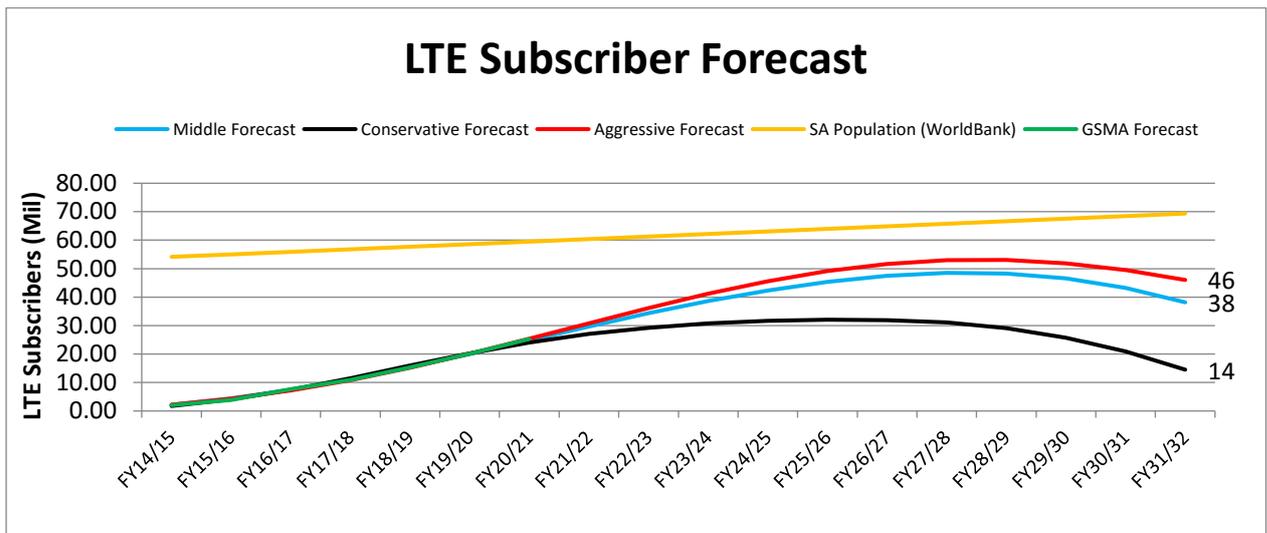


Figure 2: Vodacom Model Subscriber Forecast

The CSIR model approach results in WOAN wholesale share of roughly 10Million LTE subscribers by 2020. As explained above, the LTE market in 2020 (in the most aggressive forecast) is only 25.4 Mil. As such, 20% of the LTE market in 2020 should be no more than 5 Mil – this will result in only half of the subscriber demand the CSIR report projected for the WOAN by 2020. Instead, the WOAN is projected to reach their 10Million LTE subscriber target by only by 2028.

- While in 2028, 20% of the LTE market is \pm 10 Mil (in the most aggressive forecast), it is likely that ICASA would make more spectrum available for LTE after 2020.

Therefore, as a result of the LTE subscriber forecast of the CSIR model being overstated, the outputs of their model would be overly aggressive in terms of LTE capacity demand for the WOAN, consequently resulting in a greater spectrum demand for the WOAN than what may be needed.

3. CSIR Technical Model Review

Vodacom's review of the CSIR technical model that aims to determine the sufficient spectrum for the WOAN, is based on the redacted version attached to the Policy Directive. As such, not all details and assumptions of the CSIR technical model are immediately apparent to Vodacom. That said, the details made visible to Vodacom do warrant commentary.

The CSIR model appears to be use a combination of graphical and arithmetic calculations to derive the output. The following provides a high-level review of some key assumptions of the CSIR Model:

Step 1,2 and 3: When considering usable sites that could be shared from different network operators, instead of using the total sum of all operator sites as being available to the WOAN, the sites useable for the WOAN appear to have been reduced. The CSIR used an assumption to exclude any sites from different network operators that fall within 1km from one another. The principle is depicted in Figure 3 below.



Figure 3: CSIR Virtual Site representation

However, efficient and normal design practice would rather suggest to only exclude physically co-located sites, for example, a site where Vodacom, MTN, Cell C and Telkom are present would only be counted once.

Any other sites within the 1km range, that are not physically co-located can still be used as additional capacity, resulting in efficient use of spectrum. In reality, a large number of urban sites, even from a single operator, have cell inter-site distances of less than 1 km. This approach is further supported by ITU recommendation M1768.1, as referenced in the CSIR report itself, which stipulates the following cell areas per radio element (RE):

Example maximum cell area per Radio Element (km²)

Radio Element	Dense Urban	Sub-Urban	Rural
Macro Cell	0,62	1,5	8
Micro Cell ⁽¹⁾	0,1	0,1	0,1
Pico Cell ⁽¹⁾	1,60E-03	1,60E-03	1,60E-03
Hot spot ⁽¹⁾	6,50E-05	6,50E-05	6,50E-05

Table 2: ITU M1768 Teledensity

Based on the site exclusion principle applied by the CSIR, any sites across operator's sites that fall within the red shaded area are currently excluded, these include Macro's, Micro's, Pico's and Hot spots which are typically deployed more densely for capacity requirements.

Furthermore, a reference used by the CSIR's, IMT-2020 China Report, is based on a study done by China Academy of Telecommunication Research of MIIT to determine how much spectrum must be released in China to meet their 2020 goals [China_14]. In this report, it was assumed that because network operators have similar coverage in China, the total sites, to determine the spectrum needs for China, need to be based on 1/3 of total operator's sites. This was done to ensure that an accurate estimation is calculated.

In the case of CSIR's study, the principle of eliminating exact overlapping sites appears to have been applied incorrectly, and out of context.

Had the CSIR model only excluded exactly co-located sites, and included sites closer than 1 km across network operators, there would have been additional capacity available in highly-loaded areas reducing the spectrum requirement and making more efficient use of existing infrastructure.

Step 4: In this step, once the WOAN sites have been calculated and classified according to the ITU Teledensity framework, the spectral efficiencies are applied, which is a part of the calculation to calculate the total capacity that could potentially be provided by the WOAN network in the best case scenario. The spectral efficiency assumptions used appear reasonable at first glance.

Step 5: In this step, the CSIR model assigns spectrum to the WOAN sites according to the following rules:

- 2600 MHz FDD and TDD can be deployed on all sites
- 700 MHz and 800 MHz can only be deployed on sites with a height greater than 15m, that is not classified as hotspots or indoor sites

A consequence of this approach is that the CSIR model utilises the 2600 MHz FDD and TDD across 100% of the WOAN's sites, and 700MHz and 800MHz on less than 100% of the sites. Within the report, the CSIR further explains that in sites where only 2600 MHz spectrum is used, when more capacity is required, additional 2600 MHz is deemed to be required.

In Fourat Haider's study on the Performance Analysis of LTE-Advanced Network in Different Spectrum Bands [Haider_11], he concluded that an increase in system bandwidth might not necessarily result in a higher system throughput, from his findings for comparing 2x10 MHz on 800 MHz with 2x20 MHz on 2600 MHz. In addition, Haider further concluded that in some cases, low frequency system, i.e. 800 MHz, was superior to a high frequency deployment i.e. 2.6 GHz although the operating bandwidth at 800 MHz was half of 2.6 GHz band.

To make the most efficient use of spectrum, especially in cases where there is a high load, all available spectrum should be deployed (including sub 1 GHz spectrum). Further, the deployment of low band spectrum in urban areas provides significant in-building coverage benefits. The CSIR assumptions in this case overestimates the required spectrum that the WOAN would need, by inefficiently deploying the available spectrum.

Step 6: In this step, the total capacity demand on the WOAN network is calculated, by multiplying the downlink activity factor with the estimated WOAN subscribers per cell. The assumptions used here appear reasonable and in-line with some of Vodacom's own modelling techniques, albeit with flawed input data

Step 7: In this step the total spectrum required per site is calculated using the total capacity supply calculated in step 5, and the total capacity demand calculated in step 6. In addition, the spectrum calculated in the initial equation is then multiplied by the frequency reuse factor. The frequency reuse factor typically relates to a frequency deployment technique that limits adjacent cell interference. This technique, while common in traditional GSM network planning, is mitigated to a large extent with LTE networks.

The CSIR have assumed a reuse factor of 1.5, which means that the amount of spectrum required is increased by 50% to accommodate the reuse factor. This appears to be a flawed assumption.

Practically for LTE networks, operators deploy all parts of a frequency band on all 3 sectors resulting in a reuse factor of 1. For example, if Vodacom has 2x10 MHz for LTE, the 2x10 MHz is deployed on all 3 sectors, however, using the CSIR's reuse factor, their model would determine that Vodacom would need to deploy 2x15 MHz to achieve an equivalent customer experience.

In ITU-R M 2292-0, the ITU states in paragraph 5.1.5, that the typical frequency reuse figures used for IMT networks are either 1 or 3, but a frequency reuse of 1 is the most common one and it is proposed to be used for all scenarios [ITU-R M 2292-0]. Furthermore, in TR 25.814, 3GPP defines that the frequency reuse deployments in 3G networks as 1 [TR 25.814].

Step 8: In this step the model apportions the required spectrum to low and high band values.

Review of CSIR Assumptions: The CSIR model uses the following general assumptions in calculating the spectrum required for the WOAN, as depicted in Figure 4 below:

Parameter	Value
Average Downlink (DL) activity factor	0,025
Busy hour DL activity factor	0,039
Number of Outdoor sites	Calculated using virtual site definition in Annex A (cannot be revealed due to sensitivity of information)
Number of Indoor sites	Provided by operators (cannot be revealed due to sensitivity of information)
Frequency Reuse Factor	1,5
Spectral efficiency macro	3 (bps/Hz/Cell)
Spectral efficiency micro	4 (bps/Hz/Cell)
Spectral efficiency indoor hotspot	7,5 (bps/Hz/Cell)
Number of sectors	3
Number of potential mobile users in 2020	51 238 073
Percentage of potential mobile users served by WOAN	Varies between 20% and 80%

Figure 4: CSIR Model assumptions

In addition to the assumptions that have already been challenged, it appears as though the approach used by the CSIR did not adequately consider progress of the network operators over time. As an example, the CSIR model calculated the number of outdoor sites available to the WOAN, albeit through a flawed process, based on existing site data as was supplied to the CSIR during 2017. In reality network operators continually invest and densify their networks ([GSMA_15],[China_14]).

In contrast to the approach used by the CSIR, in the China IMT 2020 study [China_14], they have assumed additional years' worth of site growth for 3G and 4G, and for 2G up until 2014 (denoted by the red text in Figure 5. The growth profile in sites used within the China report [China_14] are depicted below in Figure 5. An important observation is that the total Base Stations grew by to more than 2 times between 2011 to 2020.

	Total Base Station Number in China												
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
2G BS	688500	875000	1089000	1375000	1650000	1848000	1921920	1921920	2E+06	1921920	1921920	1921920	1921920
3G BS		277000	461000	728500	1019900	1223880	1407462	1548208	2E+06	1706900	1758107	1793269	1829134
4G BS								250000	412500	639375	895125	1074150	1235273
Total BS Number	688500	1152000	1550000	2103500	2669900	3071880	3329382	3720128	4E+06	4268195	4575152	4789339	4986327
2G growth rate		27.09%	24.46%	26.26%	20%	12%	4%	0%	0%	0%	0%	0%	0%
3G growth rate			66.43%	58.03%	40%	20%	15%	10%	5%	5%	3%	2%	2%
4G growth rate									65%	55%	40%	20%	15%
Average growth rate		67.32%	34.55%	35.71%	26.93%	15.06%	8.38%	11.74%	6.45%	7.78%	7.19%	4.68%	4.11%

Figure 5: Base Station Development in China [China_14]

Considering a significant traffic growth against a seemingly static site number, the CSIR model consequently overestimates the spectrum required for the WOAN.

Summary of Review Findings

In conclusion, the following erroneous assumptions all have a direct impact on over estimating the spectrum required for the WOAN:

- An overestimate of the population addressable in 2020 (10.2Mil instead of 5Mil)
- An overestimate of the amount of population to migrate to LTE (86% instead of 79% over 15 years)
- An underestimate of the amount of sites ideally available to the WOAN
- An underestimate of the amount of spectrum deployed on the WOAN sites
- An overestimate of the frequency reuse factor (1.5 instead of 1)
- No estimate for the site growth over time that would increase WOAN capacity without new spectrum

Each of the erroneous assumptions listed above have in the effect of artificially increasing the amount of spectrum required for the WOAN. Therefore, should they be corrected, the amount of spectrum required for the WOAN will decrease significantly.

Lastly, the recommended amount of spectrum needed for the WOAN should be aligned to their model outputs.

4. Vodacom's Technical Model

The Vodacom technical model is based on the following approach:

1. Forecasting the total SA LTE annual traffic volume demand (aligned to [China_14])
2. Converting the annual traffic volume demand to an instantaneous traffic demand in Mbps (aligned to [China_14])
3. Distributing the instantaneous traffic demand between Urban/Sub-urban/Rural sites at an aggregate (aligned to [China_14])
4. Distributing the instantaneous traffic demand in each of the Urban/Sub-urban/Rural site groupings according to traffic per site distribution (aligned to [China_14])
5. Calculating the traffic demand for all sites in Urban/Sub-urban/Rural (aligned to [China_14])
6. Given the traffic demand per site, and technologies deployed per site type, calculating the Spectrum requirement for all sites in Urban/Sub-urban/Rural (aligned to [China_14])
7. Calculate the national spectrum requirement (aligned to [China_14])

Within the China study [China_14], the results were compared to the ITU-R M.1768 approach, and found to be compatible. Therefore, Vodacom's technical model (also aligned with [China_14]) should provide a good reference to benchmark the CSIR's model (also seemingly aligned with ITU-R M.1768).

4.1 Vodacom Technical Model Output

The output of the Vodacom model (as depicted in Figure 6 below), is similar to the CSIR model, in that the output is evaluated for the different market share percentages. The Vodacom model additionally considered two different traffic profiles, an upper bound and a lower bound to model a range of possibilities. In reality, since the Vodacom model was created in 2017, subsequent checks revealed that the historic traffic growth has more closely tracked the lower bound forecast. Therefore, we are led to conclude that the upper bound traffic projection is less likely to materialise, and that it is reasonable to assume that the profile represented by the lower bound traffic projection is more likely to be also experienced by the WOAN.

The Vodacom model evaluated the spectrum requirements for the WOAN with assumptions of 10%, 15% and 20% LTE wholesale market share. From the results (depicted below in Figure 6), for a 20% wholesale market share (up to 2032) the WOAN would not need more than 20 MHz downlink spectrum even with the most aggressive LTE subscriber forecast. However, for a 10% market share the WOAN would only require 10 MHz downlink spectrum.

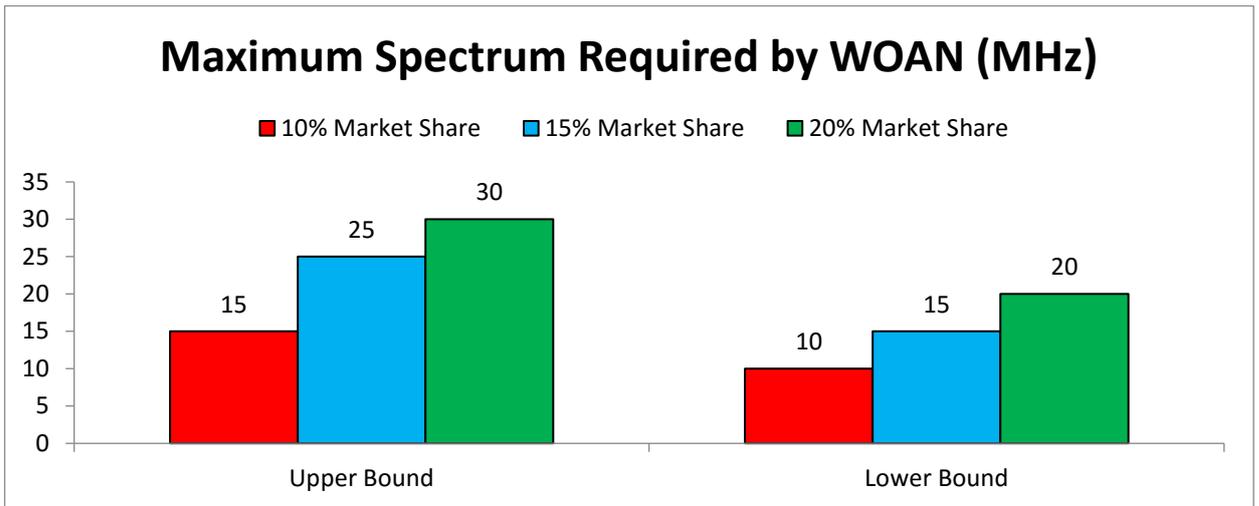


Figure 6: Vodacom technical model outputs for 10%,15% and 20% Market Share

Therefore, it would appear that, even for an assumed market share of 20%, the CSIR model is overstating the sufficient amount of spectrum that the WOAN would require by 2 times.

4.2 Vodacom’s Technical Model detailed assumptions:

Step 1. Vodacom forecasted the LTE subscriber market using the GSMA SA subscriber market data, applying a Technology adoption curve to the data, as depicted in Figure 2.

The technology adoption curve is based on the model documented by Everett Roger in his theory on the Diffusion of Innovation. In essence, Everett designed a model that explains the adoption of new technology, this is depicted in Figure 7 below.

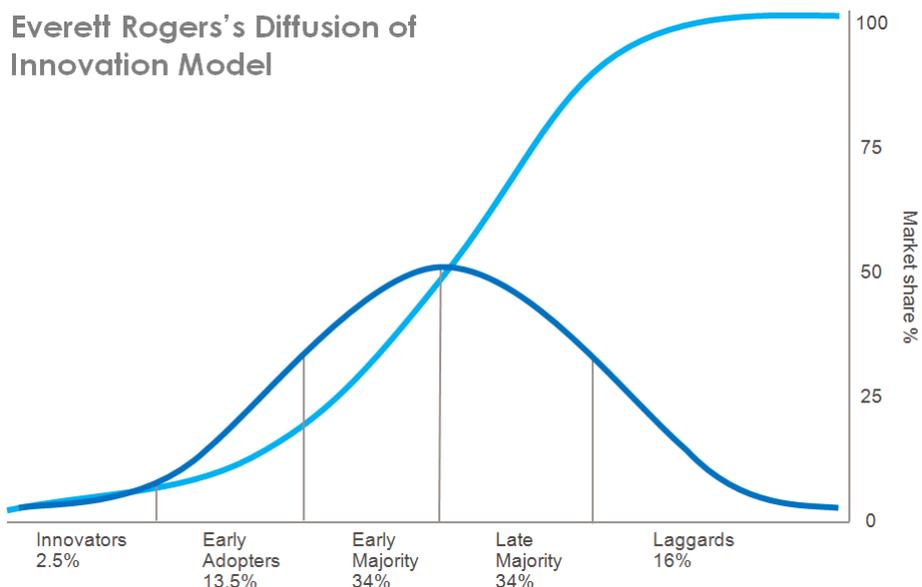


Figure 7: Everett Roger's Diffusion of Innovation Model

In reality, the technology adoption model occurs continuously as new technology is developed, resulting in a series of partially overlapping S-Curves. For example, before all of SA's population have adopted LTE, it is likely that the adoption of a new technology (e.g. 5G) would have increased sufficiently, to cause a declining trend of 4G subscribers, leading to the S-Curve in Vodacom's LTE subscriber market share in Figure 2.

In order to calculate the total annual LTE traffic for SA from the subscriber forecast, Vodacom also forecasted average LTE subscriber usage per month, as depicted in Figure 8 below:

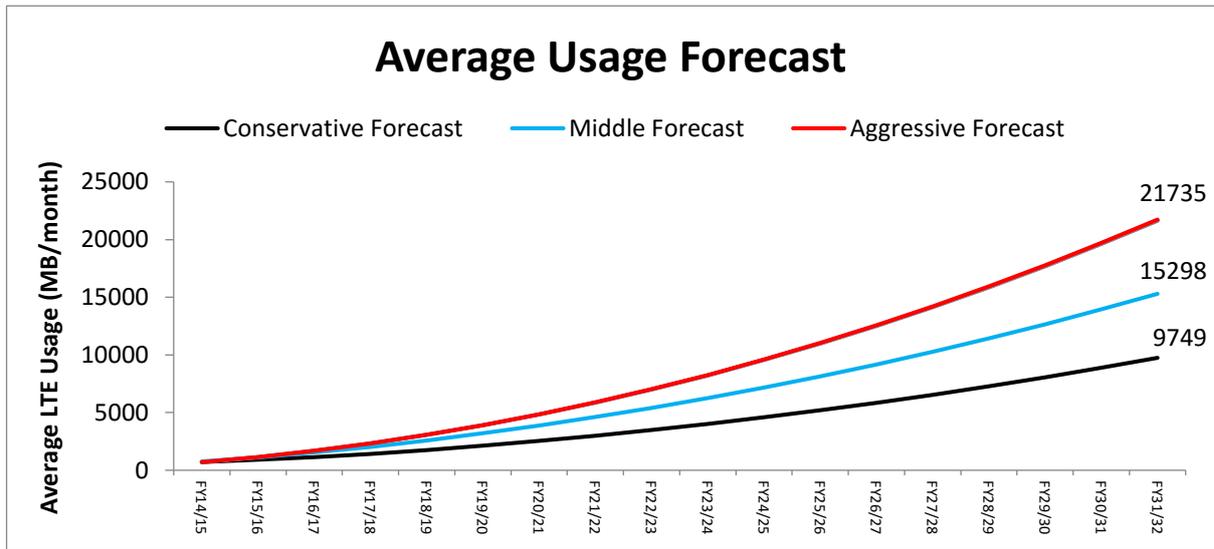


Figure 8: Vodacom Average Usage Forecast

Vodacom calculated a range for the total SA LTE data traffic using the aggressive LTE subscriber forecast, against an Aggressive average usage forecast (to create the Upper bound of the range) and Middle average usage forecast (to create the Lower bound of the range) as depicted below in Figure 9.

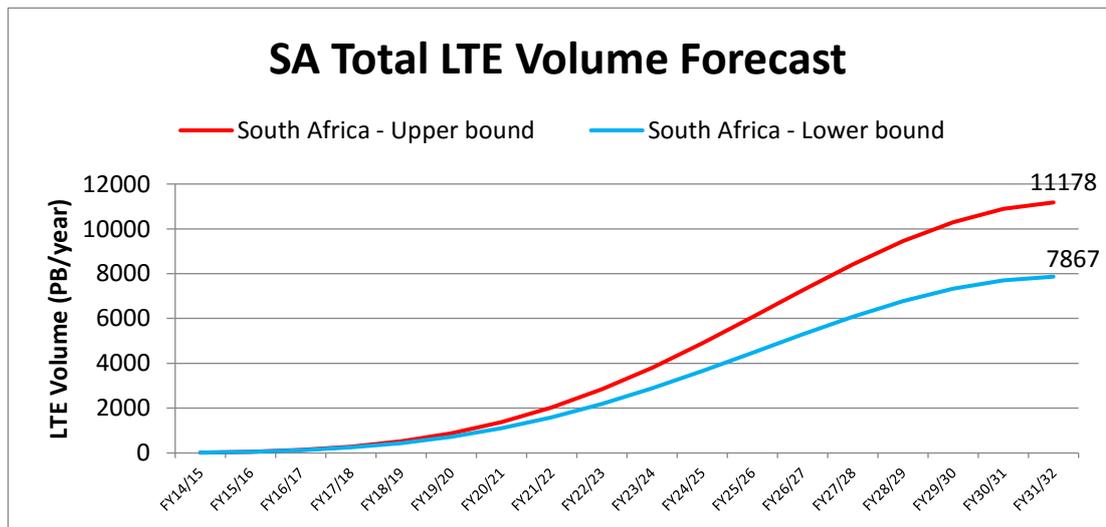


Figure 9: SA Total LTE Volume Forecast

When Vodacom's LTE traffic forecast is compared against some industry predictions (where data is available), when considering CAGRs (Compound Annual Growth Rates) per scenario for 5 years, 10 years and 15 years, Vodacom's forecast for the market is even more aggressive:

Predication	5 year CAGR	10 year CAGR	15 year CAGR
Vodacom (Upper Bound)	64%	43%	30%
Vodacom (Lower Bound)	59%	41%	28%
Cisco VNI South Africa (2016 – 2021)	57%	n/a	n/a
VF Europe (2018 – 2028)	n/a	31%	n/a

Table 3: CAGR Comparison

Step 2. In Vodacom’s technical model, annual volume is converted into instantaneous traffic demand in Mbps by considering busy days, busy hour traffic and peaks in busy hour, and converting PB/hour to Mbps.

Step 3. Once the instantaneous traffic demand has been established, Vodacom’s technical model distributes this instantaneous traffic demand in Mbps between Urban, Sub-Urban and Rural geographies by using the actual percentage of LTE traffic in Vodacom’s network that is carried in Urban, Sub-Urban and Rural areas.

Step 4. Similar to approach in the China Model, [China_14], in Vodacom’s technical model, not all sites carry the same amount of traffic. The traffic is distributed based on a distribution curve that is calculated using typical traffic distribution per site data. Figure 10 below depicts the LTE traffic distribution curves for Urban, Sub-Urban and Rural used to model the Mbps requirements per site.

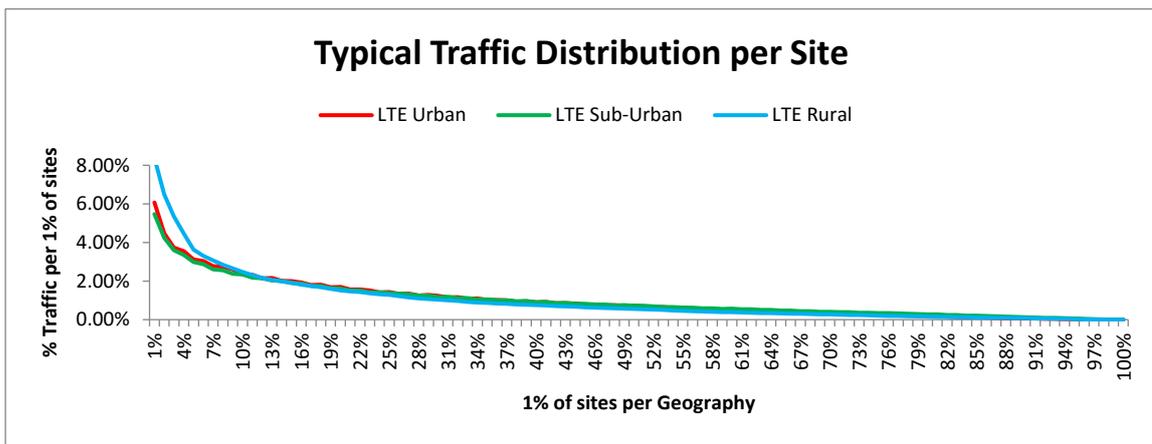


Figure 10: Traffic Distribution per Geography

Step 5. By multiplying the traffic in Step 1, with the PB to Mbps conversion in Step 2, with the Urban, Sub-Urban and Rural percentages in Step 3 and the traffic distributions for Urban, Sub-Urban and Rural, the average traffic demand per 1% grouping of sites was calculated.

Step 6. Assuming that the WOAN will deploy 700MHz using 2x2 MIMO, 800 MHz using 2x2 MIMO, and 2600 MHz using 4x4MIMO, and that the traffic will be carried on all of Vodacom’s sites (a conservative assumption for the WOAN) with 50% densification over 15 years, the amount of spectrum that is required per 1% grouping of sites was calculated.

Step 7. The maximum spectrum required for the WOAN is the maximum in of the results in Step 6 across all sites and all geographies. Steps 2 – 7 were repeated for each market share assumption. The results of Vodacom’s technical model is depicted in Figure 6.

The Vodacom model shows, that using practical and industry accepted assumptions, results in the WOAN needing much less spectrum than was predicted or recommended by the CSIR report.

5. Technical Analysis on assignments in 700 MHz & 800 MHz

Considering that the WOAN is intending to partner with other network operators who receive the unassigned spectrum not reserved to the WOAN, Vodacom evaluated if there are any technical limitations in assigning 700MHz and 800MHz spectrum.

A PIM analysis was conducted looking at the various combinations in 700 MHz and 800 MHz to determine which were the PIM-free combinations, such combinations potentially removing a hurdle to the WOAN sharing antenna infrastructure with other network operators.

5.1 What is PIM

Passive Intermodulation (PIM) represents unwanted signals caused by mixing two (or more) high-power frequency signals, which can cause interference issues at the receiver. The unwanted PIM signals are products of the mixing signals F1 and F2, and are referred to as harmonics (3rd, 5th and 7th), which are depicted in Figure 11 below:

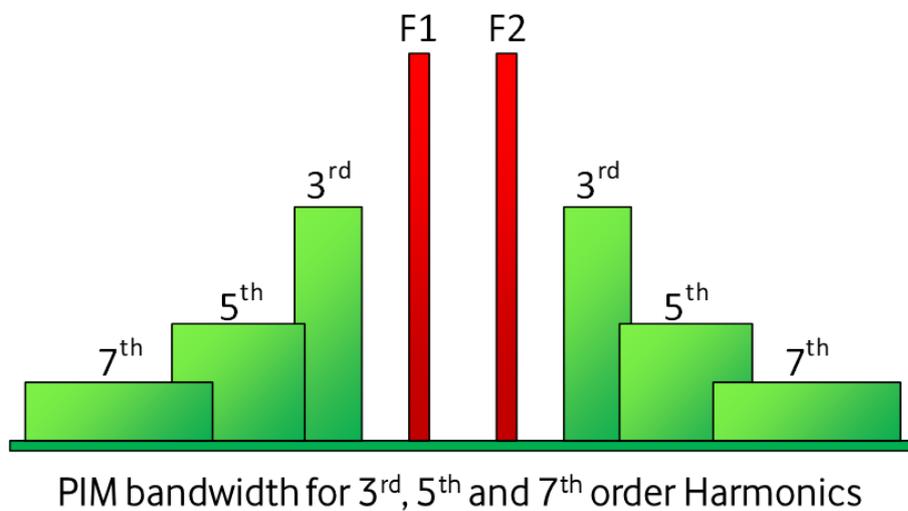


Figure 11: PIM Diagram

PIM is considered a concern if the PIM signals overlap the frequency band in which the device signals are received (This is referred to as the uplink band). The PIM signal can raise the noise floor which will impact coverage or in extreme cases result in complete blocking. This is depicted in Figure 12 below.

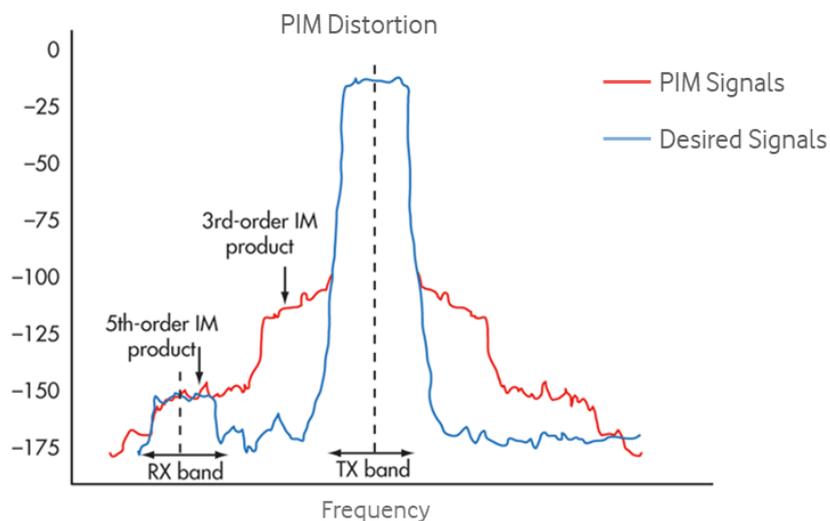


Figure 12: PIM Distortion Diagram

5.2 Technical Analysis on PIM

The PIM analysis considered various different permutations of multiple bandwidths for the WOAN (2x30 MHz, 2x25 MHz, 2x20 MHz, 2x15 MHz and 2x10 MHz) in both 800 MHz and 700 MHz and also multiple bandwidths for other assigned Network Operators (2x15 MHz and 2x10 MHz) in both 800 MHz and 700 MHz. Table 4 below lists the results:

Scenario	WOAN Spectrum 			Operator Spectrum 				PIM	
	700 MHz Band			800 MHz Band					
2x30 MHz WOAN in 800 MHz	2x10 MHz	2x10 MHz	2x10 MHz	2x20 MHz		2x10 MHz		Yes	
2x30 MHz WOAN in 700 MHz	2x10 MHz	2x20 MHz		2x10 MHz	2x10 MHz	2x10 MHz		Yes	
2x25 MHz WOAN in 800 MHz	2x10 MHz	2x10 MHz	2x10 MHz	2x20 MHz		2x5		Yes	
2x25 MHz WOAN in 700 MHz		2x20 MHz		2x5	2x10 MHz	2x10 MHz	2x10 MHz	Yes	
2x20 MHz WOAN in 800 MHz	2x10 MHz	2x10 MHz	2x10 MHz	2x20 MHz				Yes	
2x20 MHz WOAN in 700 MHz		2x20 MHz		2x10 MHz	2x10 MHz	2x10 MHz		Yes	
2x15 MHz WOAN in 800 MHz	2x10 MHz	2x10 MHz	2x10 MHz	2x15 MHz				Yes	
2x15 MHz WOAN in 700 MHz (1)			2x15 MHz		2x10 MHz	2x10 MHz		Yes	
2x15 MHz WOAN in 700 MHz (2)			2x15 MHz	2x10 MHz				No	
2x15 MHz WOAN in 700 MHz (3)			2x15 MHz	2x15 MHz				Yes	
2x10 MHz WOAN in 800 MHz (1)	2x10 MHz	2x10 MHz		2x10 MHz				Yes	
2x10 MHz WOAN in 800 MHz (2)			2x10 MHz	2x10 MHz				No	
2x10 MHz WOAN in 700 MHz			2x10 MHz	2x10 MHz				No	
	703 MHz 758 MHz		733 MHz 788 MHz		832 MHz 791 MHz		862 MHz 821 MHz		

Table 4: Summary of PIM Analysis results

Considering all the permutations, only 3 combinations resulted in PIM-free combining of the WOAN's and the Operator's spectrum

While PIM can be mitigated by deploying bigger more expensive antennas, it is not always practical, since most existing Network Operators also have 900 MHz which will add additional PIM interference, and there are space limitations with a sizeable portion of existing sites.

Furthermore, re-investment in new antennas would be expensive and reduce operational feasibility both for the WOAN as well as any operator that partners with the WOAN. As a result, it is recommended that PIM be avoided to make efficient use of spectrum while minimizing deployment costs. Therefore, it is recommended that no more than 2x15 MHz in 700 MHz or alternatively no more than 2x10 MHz in 800 MHz is reserved for the WOAN.

6. Spectrum Assignment Recommendations

Based on all of the findings and conclusions, the following represent the possible assignment scenarios, from Vodacom's technical model output for 10% wholesale Market Share, to the CSIR model output for 20% wholesale Market Share. This is depicted in Figure 13 below (WOAN spectrum denoted by package A).

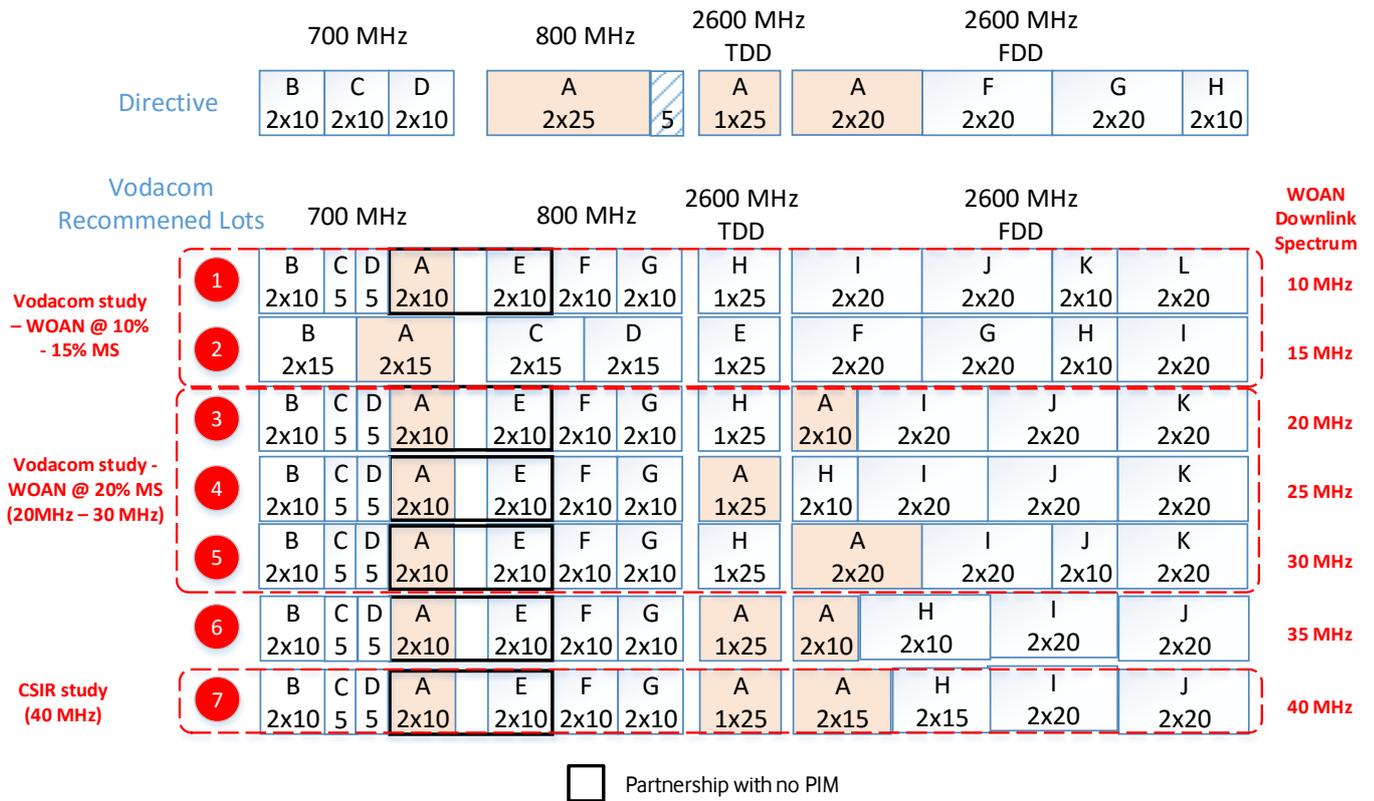


Figure 13: Vodacom Recommended WOAN lots

CSIR Recommendation Review: In their recommendation, the CSIR recommended that the WOAN should receive an equivalent of 60 MHz of Downlink spectrum (25 MHz of 800 MHz + 20 MHz of 2600 MHz FDD + 15 MHz of 2600 MHz TDD), while their model calculated that the WOAN only needs 40 MHz (which is already overstated, for the reasons elaborated on above). There appears to be no reasoning or accounting for the process of assigning additional spectrum to the WOAN between the modelling and recommendation stages.

The following is an overview of the various scenarios that Vodacom has considered (The WOAN packages defined for 700 MHz / 800 MHz are interchangeable, as long as awarding 800MHz spectrum to the WOAN does not result in PIM interference):

Scenario 1 and 2 represent the possible assignment scenarios in-line with Vodacom’s technical model output for 10% and 15% wholesale Market Share.

Scenario 3 and 5 represent the possible assignment scenarios in-line with Vodacom’s technical model output for 20% wholesale Market Share for the upper and lower bound outputs. Scenario 4 represents the middle road between Scenario 3 and 5.

Scenario 7 represents the possible assignment scenario in-line with CSIR’s model output for 20% wholesale Market Share. Scenario 6 represents the middle road between Scenario 5 and 7.

Based on the Vodacom technical model, assuming a target range of 15%-20% market share for the WOAN, it is clear that there are a range of scenarios (scenarios 3 – 5) that should allow sufficient spectrum for WOAN for their capacity and coverage requirements, with much less spectrum than was envisaged in the CSIR report.

7. List of References

1. CSIR Report – “Spectrum requirements for Wholesale Open Access Network (WOAN)”, CSIR, 2018
2. [GSMA_01] – GSMA Intelligence for South Africa, <https://www.gsmaintelligence.com/>
3. [China_14] – “Spectrum bandwidth requirement for IMT services in China by 2020”, China Academy of Technology Research of MIIT, Jan 2013
4. [Haider_11] – “Performance Analysis of LTE-Advanced Networks in Different Spectrum Bands”, Fourat Haider, Erol Hepsaydir, Nicola Binucci, Wireless Advanced, 2011
5. [ITU-R M 2292-0] – “Characteristics of terrestrial IMT-Advanced systems for frequency sharing/interference analyses”, Report ITU-R M.2292-0, 2013
6. [TR 25.814] – “Physical layer aspects for evolved Universal Terrestrial Radio Access (UTRA) (Release 7)”, 3rd Generation Partnership Project, Technical Specification Group Radio Access Network, Sep 2006
7. [GSMA_15] – “Data demand explained”, GSMA - Mobile Spectrum, June 2015

8. Annexure A – Detailed PIM results

The Maximum deployable carrier in LTE is 20 MHz. Therefore, if the WOAN wishes to deploy 2x25 MHz in either 700 MHz and 800 MHz, this would result in two carriers being deployed of 2x20 MHz and 2x5 MHz.

The first analysis was conducted using a 3-tone PIM calculation (3 frequencies mixing) since the WOAN wants to partner with network operators that receive either 700MHz or 800MHz, and the WOAN itself will have 2 carriers.

Figure 14 below depicts the results, all combinations in 700 MHz and 800 MHz result in PIM interference for either the Network Operators, the WOAN, or both.

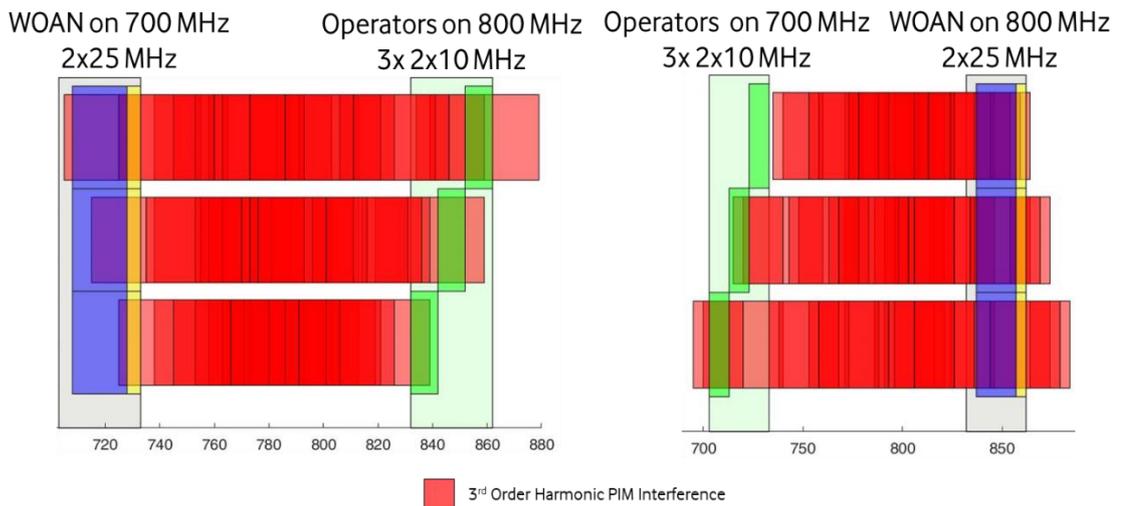


Figure 14: WOAN using 2x30 MHz and Partnering

PIM interference can be mitigated at a cost using one of the following strategies:

1. Deploy the LTE spectrum with Big antennas that have separate RF paths for 700 MHz and 800 MHz
 - a. More expensive antenna with a larger number of Low band ports
 - b. Larger form factor, increased wind loading
2. Deploy the LTE spectrum with 2 separate antennas for 700 MHz and 800 MHz
 - a. Increased cost
 - b. Increased wind loading
 - c. Limited available space on all sites
3. Deploy PIM cancelling radios
 - a. PIM cancelling radios are more expensive.
 - b. Only 3dB improvement (not recommended as the PIM impact largely remain in many cases)

It is not always practical to apply these mitigation measures, since most existing Network Operators also have 900 MHz which will add additional PIM interference, and there are space limitations with a sizeable portion of existing sites. Additionally, re-investment in new antennas would be expensive and reduce operational feasibility. Therefore, it is recommended that PIM be avoided to make efficient use of spectrum while minimizing deployment costs.

The rest of the analyses that was conducted all considered 2 tone PIM calculations.

Since 2x25 MHz cannot be deployed while partnering without resulting in PIM interference, the second analysis considered if the WOAN received a 2x20 MHz carrier in 800 MHz. Figure 15, depicts the result - there is no PIM-free combination here as well.

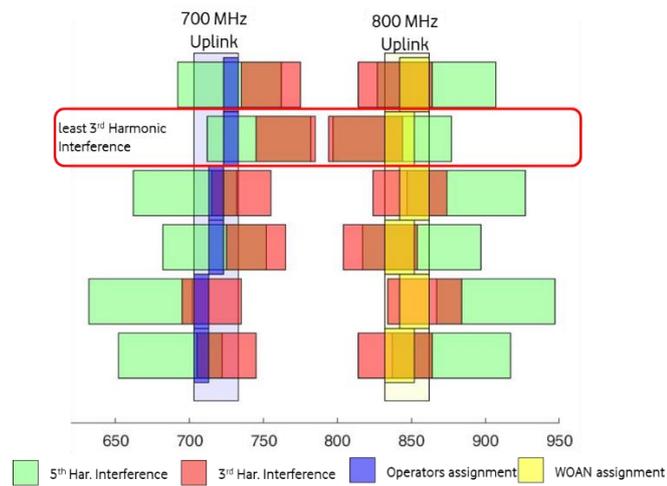


Figure 15: WOAN is using 2x20 MHz in 800 MHz

The third analysis considered if the WOAN received 2x20 MHz in 700 MHz. Figure 16, depicts the result - there is also no PIM-free combination here.

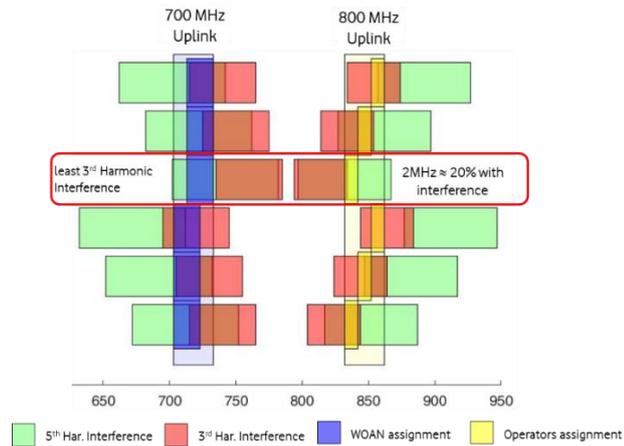


Figure 16: WOAN is using 2x20 MHz in 700 MHz

Since there was no PIM-free combination with 2x20 MHz for the WOAN in either 700 MHz or 800 MHz, the fourth analysis considered if the WOAN received 2x15 MHz in 800 MHz. Figure 17, depicts the result - there is once again no PIM-free combination.

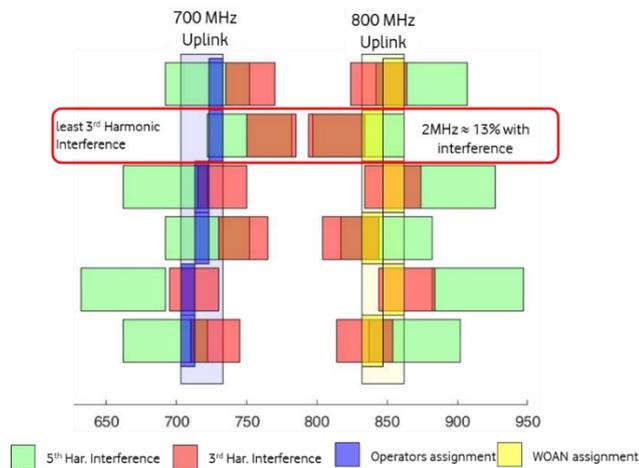


Figure 17: WOAN is using 2x15 MHz in 800 MHz

The fifth analysis considered if the WOAN received 2x15 MHz in 700 MHz. Figure 18, depicts the result - this is the first analysis with a single combination that is PIM-free. Therefore, should the WOAN receive 2x15 MHz in 700 MHz, to ensure that they partner PIM-free, the WOAN would need to take the upper 2x15 MHz, and they can only partner with the operator who receives the lowest 10 MHz in 800 MHz.

The result with 2x15 MHz of 700 MHz appears better than 2x15 MHz of 800 MHz because of a greater duplex separation gap in the 700 MHz band.

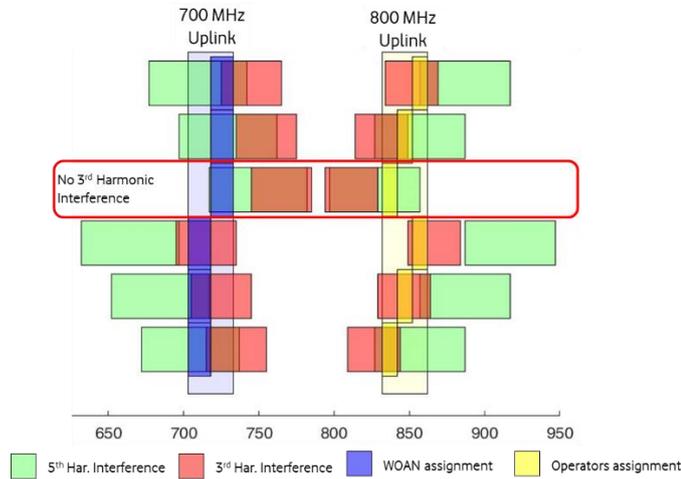


Figure 18: WOAN is using 2x15 MHz in 700 MHz

The sixth analysis considered if the WOAN received 2x10 MHz in 700 MHz or 800 MHz. Figure 19, depicts the result - in this analysis there is also a single combination that is PIM-free. Therefore, should the WOAN receive 2x10 MHz in 700 MHz or 800 MHz, to ensure that they partner PIM-free, the WOAN would need to take the either the upper 2x10 MHz of 700 MHz or the lowest 10 MHz in 800 MHz, and the partner the other block which the WOAN did not take.

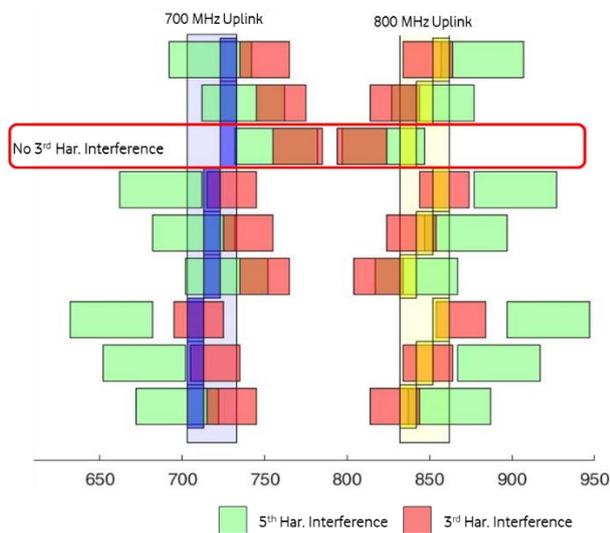


Figure 19: Using 2x10 MHz in either 800 MHz or 700 MHz