ANNEXURE C.

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By email: woan@dtps.gov.za

Dear Mr Ngobeni

CELL C's WRITTEN COMMENTS ON THE PROPOSED POLICY AND POLICY DIRECTION TO THE AUTHORITY ON LICENSING OF UNASSIGNED HIGH DEMAND SPECTRUM

1. We refer to your Government Gazette Notice No 41935 regarding the invitation to provide written comments to the proposed policy and policy direction to the Authority on the licensing of unassigned high demand spectrum **(the draft policy directive)**, issued on 27 September 2018.

2. Cell C submission is attached to this letter and is accompanied by a report by Analysys Mason, marked Annexure A. In summary, Cell C supports the Department's policy on the establishment of the Wireless Open Access Network (WOAN) based on the White Paper on Integrated ICT Policy, 2016 (the **White Paper**).

3. However, Cell C has observed that the draft policy directive demonstrates a significant shift from the policy provisions espoused in Chapter 09, section 9.1.6 of the White Paper, specifically on the spectrum policy which states –

> The Spectrum Policy (*see subsection 8.2 below*) sets out a policy framework to address the assignment of high demand spectrum for a Wireless Open Access Network (OAN). It makes it clear that all high demand spectrum will be assigned on an open access basis, and that all currently unassigned high demand spectrum will be treated in line with this policy.

4. Section 9.2.5.4 of the **White Paper** also states –

- All currently unassigned high demand spectrum will be set aside for assignment to the Wireless Open Access Network (see above) and will be treated in line with the above policy principle.

5. Although Cell C is aware of the need to license radio frequency spectrum to the existing MNOs to address network capacity concerns which some operators claim to be experiencing, the draft policy directive falls short of making the WOAN a potential success. The draft policy directive makes reference to the CSIR study titled, "*Spectrum requirements for Wholesale Open Access Network*" published along with it. Cell C argues that the CSIR Report did not consider certain economic market impediments such as the persistent duopoly when making the assumptions for the licensing of high demand spectrum. In our submission below, Cell C provides a technical analysis on the CSIR Report and its limitations.

6. Cell C submits that there are primary conditions which Cell C has scientifically modelled which constitute the factors for a viable, investible, successful WOAN based on a Strawman Modelling method. The modelling has identified certain pre-requisites for the success of the WOAN Licensee, and these are:

7. **Pre-requisites for a viable, investible WOAN:**

   7.1 **WOAN Market Share of 20% is not adequate to achieve a 100% population coverage target.** The WOAN will lack capability to have the necessary competitive effect, i.e. to lower prices for broadband provision ultimately for the benefit of consumers at a retail level. Analysys Maysons model commissioned by Cell C forecasts about 80% market share by 2030, in a high growth scenario.

   7.2 **Spectrum allocation deficiency.** The CSIR Report states that the WOAN could be allocated 2 x 25MHz of 800 band, 2 x 20MHz of 2600 FDD, and 25MHx of 2600 TDD. Cell C believes that this spectrum allocation is not adequate, and is based on assumptions that are not informed by the White Paper ICT Policy. The spectrum identified above is unlikely to be enough to serve all forecasted traffic scenarios in the South African market by 2030 (the date referenced in the CSIR study).

7.2.1 The success of the WOAN business case will be dependent on the WOAN being allocated adequate frequency spectrum to enable it to achieve 100% population coverage over the period, and reach over 40% market share of the wholesale market by 2030 in a low growth scenario. More spectrum for mobile broadband use will be required for the WOAN prior to the 2030 period, over and above the identified spectrum in the 700MHz, 800MHz and 2.6GHz bands. Our modelling estimates that if the WOAN had a market share of 80%, then a minimum of 135MHz of downlink spectrum would be required. This means that almost all the downlink spectrum available must be assigned to the WOAN.

7.2.2 If the WOAN had a market share of 60%, we estimate that a minimum of 100MHz of downlink spectrum would be required. In this case, the additional bandwidth could be delivered using low-frequency spectrum (e.g. by assigning the 2×30MHz of 700MHz spectrum to the WOAN). Alternatively, a split assignment of 2×15MHz of 700MHz spectrum and 2×15MHz of 2.6GHz capacity would also provide the necessary bandwidth, although with the caveat that the 2.6GHz spectrum is not typically considered as being suitable for wide-area, nationwide coverage (being more suited to delivering capacity in locations where network traffic is high).

7.3 **Timing of WOAN licensing and spectrum allocation to other operators.** The CSIR Report recommended additional studies including, a) Detailed market study to forecast the size of the WOAN up to 2030; b) Experimentation with different spectrum assignment combinations to enable rapid adoption of 5G, and the recalculation of the WOAN spectrum beyond 2020 or at any point where the key assumptions change; c) Technical study to determine spectral efficiency at 5-year intervals; and d) Investigation of deployment models and alternative technologies for delivery of broadband to the sparsely populated areas of the country. Cell C does not support the concept of simultaneous licensing of spectrum to both the WOAN and the existing MNOs, particularly when these tasks have not been carried out. The licensing framework should enable the WOAN to first achieve operational capability including securing its capital financing. The simultaneous licensing policy provision dampens the business viability of the WOAN. In addition the studies listed above are also critical for the WOAN Roadmap.

Cell C proposes that the unassigned high demand spectrum must be allocated to the WOAN first.

7.4 **Level of offtake commitments and adverse impact on funding potential and wholesale rates.** The WOAN will require off-take commitments of at least 85 - 90% of the WOAN's capacity for the first 10 years and preferably for the term of the spectrum licence. Given their combined retail market share of above 80% of the mobile market, Cell C proposes that MTN and Vodacom should collectively commit an off-take at least 60% of the WOAN's capacity; with government and other operators committing to take the rest of the remaining 40%.

7.5 **Infrastructure-Sharing.** The infrastructure-sharing terms to be prescribed by ICASA should include a degree of asymmetrical advantage for the WOAN during the early years (including access to sites and active network-sharing), as well as the necessity to adopt the most efficient possible network sharing methods available, to reduce infrastructure duplication to an absolute minimum level

8. Cell C proposes that the Department revise the "draft policy directive" taking into account the proposals detailed in this submission in line with the National Integrated ICT White Paper Policy of the Department. Our more detailed submission is attached to this letter.

Yours sincerely

Mr Themba Phiri
Executive Head: Regulatory Affairs

CELL C LTD's SUBMISSION TO DTPS

DRAFT SPECTRUM POLICY DIRECTION

Cell C Limited (Cell C) has considered the proposed Policy and Policy Directions to ICASA on licensing of unassigned high demand spectrum[1] (Policy Direction). In preparing this response, Cell C has appointed international experts, Analysys Mason, to assist us in particular, in assessing the approach taken to the assignment of spectrum. Their report is attached to this submission as Annexure A.

Our response to the Policy Direction is set out in the following sections:

1. Introduction and executive summary of key concerns
2. Assessment of national policy and status of the policy direction
3. Licensing the WOAN must contribute to competition
4. Analysis of the policy direction as regards spectrum
5. Other recommendations
6. Annexure A: Report by Analysys Mason

1. Introduction and executive summary of key concerns

1.1 Cell C welcomes a conclusion to the many years of uncertainty concerning the award of spectrum in the high demand mobile bands. We are encouraged by the prospect of assignment of necessary spectrum to enable it to compete in the mobile broadband services market. However, Cell C is concerned that the approach taken by the Department of Telecommunications and Postal Services (Department) in the Policy Direction may not realise the national policy goals or achieve them as quickly as the Department would like.

1.2 This is because there are some critical success factors that have not been taken into account in the Policy Direction. Among others, these are:

i) The Policy Direction does not track the provisions of national policy, and specifically Chapter 9 of the ICT Sector White Paper, as we set out in **section 2** of this submission;

[1] *Gazette* 41935 of 27 September 2018.

ii) The proposal to assign spectrum to all applicants (including existing dominant operators) at the same time does not take account of the recommendations of the CSIR regarding additional market studies, deployment models, and most importantly, does not consider the likely effect on the WOAN of having to compete with existing operators with high demand spectrum. We explain this competitive disadvantage in more detail in **section 3** of this submission;

iii) The obligations on the WOAN to share its infrastructure and to make access to other licensees available on regulated and non-discriminatory terms, is out of step with international best practise when licensing a new entrant, and will overly burden the WOAN while at the same time, not enabling sharing of existing infrastructure by the WOAN until such time as ICASA has published new regulations, which could take years. We deal with this in more detail in **section 3** of this submission;

iv) The requirement that MNOs (or all licensees) should take off capacity of up to or in aggregate, only 30%, will not satisfy the revenue-generating needs of a new entrant, as we set out in **sections 3, 4 and 5** of this submission, read with **Annexure A**; and

v) The assumption that a 20% market share will be adequate to attract investors, render the WOAN competitive, and ensure the commercial viability of the WOAN, is not correct, as we describe in **sections 4 and 5** of this submission read with **Annexure A.**

1.3 In general, the number of matters in respect of which ICASA must still carry out further work integral to the award of spectrum are numerous and are likely to take significant time and resource to deliver. The list set out in paragraphs 1.12 and 2.2 will require detailed consideration by ICASA and many of the issues cannot be dealt with prior to a licence award unless the Minister intends that the ITA process will take place only later in 2019. For example, the imposition of a capacity-uptake obligation in a radio frequency licence as regards the proposed wholesale open access network licensee (WOAN) will have to be considered from a legal, technical, operational, and commercial point of view. Several questions will need to be answered in this regard, such as:

vi) Is the total capacity to be taken up by all existing ECNS licensees to be 30% and which are those licensees?

vii) Or is the total capacity to be taken up by each licensee, 30%? In this case, the total capacity may exceed 100%.

viii) The quality of service requirements referred to in (d) of paragraph 2.2. must be deliberated in the context of whether universal coverage, quality of service or affordability is most important, or all of them are equally important. Increasing quality of service across rural areas which have yet to be covered by any mobile network will result in increased costs to licensees, since these areas are likely to be ones in which population is so low as to make investment in infrastructure unviable– and this could affect affordability of services, taking account of the cost of duplication of equipment and operation of multiple networks in these sparsely populated locations. Consideration would also be needed as to the type of service being referred to, since this will affect the quality of service targets (e.g. voice, low speed data, high speed data, and so on).

ix) ICASA must determine the duration of the relevant licences. Currently licence periods for ECNS and radio frequency spectrum licences are set out in the ECA. The Bill does not amend these legislated periods. ICASA cannot act outside the ambit of its statute and hence we assume that the licence periods as set out in the ECA should be implemented by ICASA.

x) Paragraph 2.2(d) also refers to obligations in relation to universal service, but ICASA is under other duties in the Bill in this regard, for example in section 8(4A), which anticipates that ICASA will take a period of 5 years to review universal service obligations.

xi) We believe the period of 3 years for the obligation in relation to procurement of national capacity from the WOAN is too short, and that this period should be increased to 5-10 years. We have indicated why this is so in Annexure A.

In this submission we identify where the Policy Direction might be improved, and why.

2. Assessment of national policy and status of the Policy Direction

2.1 The Policy Direction is the correct legal process to follow in relation to the execution of policy goals if the law does not specifically mandate the regulatory authority to do something. It is also consistent with the provisions of the current ECA.

2.2 However, as we say in the introduction to this submission, the close linking with and dependence of the Policy Direction on the Bill may affect not only what the Policy Direction says about the licensing of the WOAN and assignment of high demand spectrum, but whether or not ICASA "must consider" or "must" apply it.

2.3 The current provisions of section 3 of the ECA require ICASA to consider a policy direction, whilst the proposed amendments to sections 19A and 31E of the Bill implicitly require ICASA to apply a policy direction by virtue of the obligations on ICASA to carry out activities foreseen in the Policy.

2.4 The invitation to comment on the Policy Direction rightly sets the draft in context by referring to Chapter 9 of the National Integrated ICT Policy White Paper (White Paper), of October 2016. As set out in the invitation, "Chapter 9 of the White Paper deals with the policy frameworks to address the supply side challenges to transform South Africa into an inclusive, people-centred and developmental digital society." It also sets out the goals of the White Paper which include:

- To allow or effective service-based competition and to ensure accessible, affordable, high quality and reliable services for consumers;
- To increase network coverage, and enable the rapid deployment of broadband infrastructure and services across all areas of the country;
- To promote shared and equal access to broadband infrastructure;
- To remove barriers to competition and innovation in the provision of broadband services; and
- To foster innovation and development of applications and services.

2.5 All of these goals are worthy and the outcomes they seek are appropriate. However, Cell C is concerned that the approach taken in the Policy Direction will not achieve these outcomes. We say this for the following reasons:

i) The WOAN and other ECNS licensees are required to give open access to infrastructure while at the same time all are obliged to build out infrastructure according to coverage obligations. These two obligations are contradictory. Extending coverage as an obligation on all licensees and on the WOAN ignores the risks of:

a. unnecessary infrastructure-duplication impacting viability of deployment, especially in rural areas;

b. delaying the availability of services to some locations because operators are having to expend substantial sums on infrastructure rollout; and
c. constricting the WOAN's ability to increase competitive intensity by attaching onerous rollout obligations to its operation at the same time as requiring it to make its infrastructure available on regulated wholesale rates.

ii) The WOAN and other licensees are currently not distinguished from one another on the basis of whether or not they hold market power; so all of them are obliged in the same way to provide access on the same terms and conditions, to their infrastructure, on regulated prices. Regulated prices are usually a remedy of last resort and applicable only to licensees with significant market power. Regulating the prices of the WOAN, which is a new entrant, is likely to restrict its ability to earn revenue and pose a competitive threat to the existing operators. The result is that policy outcomes such as competition and affordable communications may not be realised.

iii) All of the obligations imposed on the WOAN and licensees in the Policy Direction assume that each of them will have adequate spectrum in the appropriate bands, with an appropriate mix of high and low spectrum, to be able to deploy high speed broadband services and achieve the Policy goals of innovation and consumer satisfaction. However, it is far from clear that the current situation (e.g. in relation to the amount of spectrum available for licensing in the 700MHz, 800MHz and 2.6GHz bands) will enable this.

iv) There is little certainty around the obligations on ICASA to implement the Policy Direction in the following ways –
a. the WOAN operator may have to negotiate facilities-leasing under the current regulations while ICASA finalises the open access regulations anticipated in the amendments to the ECA;
b. if spectrum packages (and capacity obligations for licensees to take up capacity on the WOAN) are not carefully constructed, there may be few bidders on an auction, with risk of valuable high demand spectrum being left un-sold; and
c. if the situation regarding licence renewal for existing licensees is not clear, investors in existing licensees may consider exiting the market altogether. It will also be important that the Policy Direction tracks the Bill in confirming that existing spectrum will not have to be relinquished.

2.6 In addition, and importantly, the Policy Direction is couched in the same language as is used in section 19A which is a proposed amendment (Bill) to the Electronic Communications Act, 2005 (ECA)[2]. The Bill is still subject to public consultation comprising a written submission which is only due on 20 November 2018, and public hearings in Parliament which are only scheduled to take place on 27 November 2018.

2.7 If any changes are made to the Bill, then the language of the Policy Direction may also have to change. Furthermore, if Parliament is minded to seek further clarification on the rationale for the approach taken in the Bill regarding high demand spectrum and the licensing of the wholesale open access network (WOAN), this may delay implementation of the Policy Direction or render it invalid. This will also be the case if the Policy Direction is not properly constructed or does not contain sufficient certainty, is not sufficiently clear, and/or does not set out technically appropriate instructions to ICASA. As a result, any prospect of an award of spectrum may be beset by problems even at this early stage.

2.8 From a drafting point of view, we note that the Policy Direction language is framed in the future, and it should be framed in the present. For example, at paragraph 1.14 of the Policy Direction, it states "The Minister intends to direct the Authority... to issue an Invitation to Apply ...". The same language is used in paragraphs 2.1 and 2.4. The use of "intends" is in contrast to the other paragraphs in which ICASA is directed by the use of the word "must", and it suggests that a further policy direction dealing with the matters in paragraphs 1.14, 2.1 and 2.4 is to be expected, and will cover those matters. If this is the case, this would have the effect of delaying the impact of the Policy Direction by splitting in two the stages of preparation for an award of high demand spectrum.

3. Licensing the WOAN must contribute to competition

3.1 Cell C considers that the licensing of a WOAN with sufficient high demand spectrum could positively contribute to competition in a number of important ways such as:

i) creating a viable infrastructure competitor to the larger players, giving all operators an opportunity to expand services efficiently via wholesale access;

ii) reducing network duplication (especially in remote areas) and thus reducing costs to smaller operators;

[2] *Gazette* 41880 of 31 August 2018.

iii) improving the affordability of coverage and capacity extension in rural areas by demand aggregation;

iv) removing infrastructure-based barriers to entry for service-based operators; and

v) providing the opportunity for existing and new service providers to take capacity from the WOAN and resell it to existing mobile subscribers at the retail level.

3.2 However, there are a number of very concerning provisions within the Policy Direction and the Bill which may well restrict, prevent, or complicate the goals of the Policy in licensing a WOAN and increasing competition. These include:

i) the proposed obligations in the Policy Direction such as regulated pricing, mandatory access to its infrastructure, and rural coverage. In the case of rural coverage there is no guarantee that the WOAN will be assigned a large part (or all) of the high demand spectrum and specifically the lower bands which will facilitate this coverage. These sorts of obligations ought to be imposed only on dominant operators in the current market. If these obligations were imposed only on the current dominant operators, the likelihood of the cost of data being reduced would be higher, because their dominance would be (at least in part) constrained by those obligations. Imposing these obligations on a new entrant will ensure its early demise unless in the case of rural coverage, the WOAN is assigned the necessary amount of spectrum;

ii) the obligation to grant access to the WOAN's network. In order to compete at the infrastructure level and to create capacity, the WOAN will have to be able to conclude facilities-leasing agreements with current licensees on favourable terms or at least on terms that are reasonable, non-discriminatory and fair to it;

iii) the WOAN's own terms for access to its infrastructure have to be non-discriminatory. However, an obligation to grant access to its network does not need to be non-discriminatory, as differential pricing is a way of commercially attracting high volume buyers. In addition, as a new entrant, these sorts of restrictive obligations could severely hamper the rollout and use of its network infrastructure;

iv) the regulation of prices of capacity prior to the WOAN having achieved any market share whatsoever. This would be contrary to international best practice in competition and economics. As we say above, price regulation is a remedy in markets where there is no competition, or a competition failure, or a dominant licensee that is abusing its market power. Imposing price regulation on a new entrant at the wholesale level is not sensible and will most certainly deter potential investors in a WOAN;

v) awarding spectrum simultaneously to all licensees. Without an early award of sufficient spectrum, the WOAN will be unable to establish itself in the market – it cannot produce capacity for offtake without a network, and the cost of acquiring network equipment/construction and leasing costs or roaming costs will need to be financed. It is therefore absolutely vital to award spectrum to the WOAN prior to the award of spectrum to other licensees. This will require the other licensees to take capacity from the WOAN from the get-go and afford it a financial benefit while it rolls out its own infrastructure;

vi) whilst in principle we support the findings of the study commissioned by the DTPS from CSIR, we believe that the amount of spectrum required to ensure the viability of the WOAN into the medium term could be in excess of what the CSIR study predicts. We expand on this in section 5 of this submission and in Annexure A in the expert report provided by Analsys Mason; and

vii) restricting the WOAN to wholesale-only activities. This means its 'market' is realistically only existing MNOs – the questions above referring to the amount of capacity that existing operators must take on the WOAN, and the duration of these obligations, need to be addressed to ensure this approach is realistic;

3.3 There are other issues with the Policy Direction (and Bill) as currently drafted which will also impact competition:

i) 4G services to consumers that can be delivered from a WOAN will be dependant to a significant degree on the level of interest of investors in either the WOAN or the market in general and existing licensees. Attracting investors on the basis of a Policy Direction will be extremely difficult and attracting investors once the ITA is issued may also be challenging as the ITA will no doubt be subject to restricted timelines for bids to be submitted. This will limit the time available to potential

investors to interrogate the terms of the ITA, the proposed licences, and the business plan of the applicant (which itself is likely to be difficult to construct in this timeframe);

ii) the Bill provides at section 31E(2)(b) that the award of spectrum to the WOAN (pursuant to an award process following the Policy Direction) should be "non-exclusive". Further clarity as to the intention of 'non-exclusive' would be desirable (e.g. will the spectrum have to be shared with other existing wireless services, or with other 4G services provided by mobile operators, or must it be applied for other uses?). It is also unclear as to whether the Minister considers that the WOAN may share, trade or lease its own spectrum to other licensees;

iii) Cell C supports the capacity offtake obligations on licensees – but again, these obligations should be imposed only on dominant licensees (whilst other licensees could of course take off capacity as they choose). Dominant licensees who take up capacity from the WOAN will contribute to its revenue stream whilst freeing up their own capacity to take on more traffic, thus reducing their overheads and benefitting consumers with rapid deployment of new services; and

iv) since the WOAN would likely only receive a licence after the entire auction or other award process has been concluded, it will be necessary to mandate existing licensees to negotiate with potential applicants for the WOAN licence, and even conclude appropriate facilities-leasing agreements ahead of the award of spectrum. Without a regulatory obligation, licensees will be reluctant to negotiate any such agreements.

4. Analysis of the policy direction as regards spectrum

4.1 The CSIR's modelling shows that 40MHz of DL spectrum is required by the WOAN to support a market share of 20% of projected future traffic; which increases to 75MHz for a market share of 40%, and 135MHz for a market share of 80%. In order to interrogate this report and its outputs, Cell C;sinternational experts, Analysys Mason, created a model. The work was done without all necessary or desirable inputs, but we trust it is sufficient to illustrate Cell C's concerns that the amount of spectrum needed for the WOAN could be in excess of the amounts indicated in the CSIR's findings. More particularly Cell C has concerns with the prospect of the WOAN being licensed at the same time as an assignment of high demand spectrum takes place to existing licensees, unless the majority

of high demand spectrum is allocated to the WOAN as recommended by Cell C later in this section.

4.2 In trying to assess whether the WOAN could be viable with these different spectrum assignments, it is important to consider not just the capacity that the WOAN requires to carry its determined share of traffic, but also the likelihood of South African MNOs having demand for WOAN capacity to serve their retail customers, which is dependent on the spectrum that they might be assigned individually.

4.3 Assigning more spectrum to the WOAN or assigning spectrum to the WOAN prior to any assignment of high demand spectrum to the MNOs should increase the likelihood of MNOs using the WOAN. This is because with more spectrum, the WOAN will have the capacity to carry more traffic, and MNOs will have an incentive to buy the capacity it provides (since the amount of spectrum available for individual assignment to MNOs will be lower or the timing will be later, and hence the MNO costs of carrying traffic individually will increase). Assigning less spectrum to the WOAN or assigning it at the same time as assigning spectrum to the existing MNOs will not only diminish the ability of the WOAN to carry traffic but will also reduce the MNOs incentive to use the WOAN (since with less spectrum assigned to the WOAN there will be more spectrum available for assignment to individual MNOs, enabling them to carry their own traffic, or they will have their own spectrum assignment at the same time as the WOAN is licensed).

4.4 We note there is significant uncertainty regarding the expected future MBB traffic levels, which will drive spectrum requirements for the WOAN. Moreover, some key input data such as the distribution of traffic across sites in a future WOAN are unknown and require estimation. As such, the high-level modelling produces a range of results. Under the most conservative assumptions (i.e. at the lower end of our range), Analysys Mason's modelling suggests comparable WOAN spectrum requirements to the CSIR. However, the remainder of the scenarios suggest greater spectrum requirements, and in some cases significantly so.

4.5 Reflecting that distribution of traffic across sites in the WOAN is unknown, Analysys Mason has modelled alternative scenarios of 'uniform traffic', and 'distributed traffic'. The latter makes modelling allowances for the fact that traffic is unlikely to be uniformly distributed (i.e. a small portion of sites will carry a greater portion of traffic). Under certain assumptions on distributed traffic, the model suggests the spectrum needed for the success of the WOAN could be considerably higher than the CSIR estimates.

4.6 In summary:

i) in the lower traffic scenario using 'uniform traffic' assumptions, 70MHz of DL spectrum is needed for a 40% WOAN market share, increasing to 135MHz for an 80% market share – this supports the CSIR results. By comparison, using assumptions on 'distributed traffic' (which Analysys Mason believe to be a more reasonable estimate of actual traffic distribution) the model suggests the DL spectrum needed for a 40% WOAN market share would be 115MHz, rising to 230MHz for an 80% market share;

ii) in the higher traffic scenario, Analysys Mason estimate is that DL spectrum needed could be in the range of 95-190MHz for a 40% WOAN market share, and 160-320MHz at for an 80% share (relative to whether the 'uniform traffic' or 'distributed traffic' approach is followed, as noted above).

4.7 The report by Analysys Mason attached to this submission as Annexure A provides details of the outputs of their modelling, and their recommendations for the amount of spectrum in each band to be assigned to the WOAN (in order for it to be capable of supporting different market shares of traffic). Key conclusions of Analysys Mason's analysis are that:

i) the WOAN should be provisioned to carry at least 40% of traffic to ensure its successful deployment. Based on proportion of 4G-capable handsets anticipated in the South African market by 2020, this seems a reasonable target to achieve; and

ii) incentives are required for the WOAN to be successful such as if it is intended to carry 40% or more of traffic then it should be assigned at least half or more of the available high demand spectrum, and especially most (all) of the low frequency spectrum; and

iii) the offtake agreements proposed to be included as a regulatory obligation on other licensees should endure for at least 5 to 10 years, as set out in the second part of Annexure A.

5. Other recommendations

There are several issues not addressed in the Policy Direction which should be considered for inclusion:

5.1 Offtake:

i) A typical commercial debt financing structure would require offtake commitments of at least 85% to 90% of the WOAN's total capacity (this is similar to the highly successful independent renewable energy power projects) for a duration of 15 years or more to be mandated so as to underpin and secure the funding;

ii) Given their combined retail market share of > 80% of the mobile market, MTN and Vodacom should collectively offtake at least 60% of the WOAN's capacity;

iii) Government also needs to consider providing an offtake of a substantial proportion of the remaining capacity, for example to provide coverage to SA Connect sites.

5.2 The market for the remainder of the WOAN's capacity:

i) If the operators likely to acquire the remaining spectrum hold more than 90% of the retail market share in the mobile market, and they are collectively only compelled to provide the WOAN with an offtake commitment of 30% of its national capacity, it is entirely unclear who the WOAN would be able to target in order to sell the remainder of its capacity;

ii) The proposed regulation of capacity prices (dealt with in the body of the submission) should be avoided, alternatively should be cost-oriented, but not cost-based, although our view is that price regulation of a new entrant is not appropriate at least in the early years.

5.3 Facilities-leasing:

Government should consider requiring access to facilities and national roaming to be made available by dominant operators on regulated rates from launch and on a national basis.

5.4 Licence fees:

i) Licence fees for spectrum assigned to the WOAN should be waived for some years, or applied only to revenue less costs;

ii) If the WOAN receives only part of the available high demand spectrum then it is accepted practise that payment should be proportionate, and that proportionality should also be gauged by the price intended to be charged to other licensees.

5.5 Spectrum:

Clarity is required on the terms on which sharing and trading of spectrum by the WOAN and other licensees might take place.

5.6 ICASA's tasks:

i) A timetable should be included in the Policy Direction setting out the dates by which ICASA should accomplish the tasks anticipated in the Policy Direction;

ii) The Policy Direction should identify other regulatory support that ICASA should give the WOAN.

Cell C trusts that these submissions have been helpful.

8 November 2018

analysys mason

(ANNEXURE A to Cell C Submission dated 08 NOVEMBER 2018)

Report for Cell C

Comments on the duration of WOAN obligations and on spectrum distribution, in response to proposed policy direction to ICASA

7 November 2018

Ian Streule, Janette Stewart

Ref: 2015442-453

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1 Introduction

Cell C is considering its response to the policy and policy directions proposed to the Independent Communications Authority of South Africa (ICASA) on licensing of high-demand mobile spectrum, and on the creation of a Wireless Open Access Network (WOAN).[1]

As input to its response, Cell C asked Analysys Mason to consider two aspects of the proposed policy direction, having regard to the report on spectrum requirements produced by the Council of Scientific and Industrial Research (CSIR) for the South African Government:

- the amount of spectrum needed for the WOAN, and the reasonableness of the conclusions set out in the CSIR report
- the proposed three-year term over which existing mobile licensees are obliged to purchase capacity from the WOAN and whether this is in line with international best practice for similar types of obligation.

This report summarises the results of our analysis and will be used by Cell C to support its response to ICASA's consultation on its proposed policy direction.

Given the time constraints to provide comments on the proposed policy and policy directions, our analysis has been designed to fit within the available timeframe. Consequently, the spectrum estimation model we have developed is necessarily of a high-level nature, but we have made reasonable assumptions on key parameters – such as traffic growth and distribution of traffic – based on Analysys Mason's extensive experience of working with 4G network operators worldwide. Some of the assumptions made are uncertain due to the relatively long periods considered within the model. Therefore, different assumptions might lead to different conclusions.

The remainder of this document is laid out as follows:

- Section 2 presents the results of our analysis on the amount of spectrum needed for the WOAN
- Section 3 discusses the proposed three-year term for purchase of capacity on the WOAN
- Annex A summarises our modelling assumptions.

[1] https://www.ellipsis.co.za/electronic-communications-amendment-bill-2018/

2 Spectrum requirements for the WOAN

This section sets out the calculations within the model to assess the spectrum requirements for the WOAN and considers the reasonableness of the recommendations made by the CSIR study.

2.1 Modelling approach

Analysys Mason's model calculates the spectrum needed by the WOAN to support a specified market share of LTE traffic. This calculation is done in seven steps, which are described below.

Step 1: Forecast the total amount of mobile data traffic in South Africa

- Analysys Mason's Research division publishes a forecast of total mobile traffic in South Africa to 2023. We have extended this forecast to 2030, based on an assumed growth profile for mobile traffic per connection.[2] We have also extended the forecast in two ways to provide alternative 'higher' and 'lower' traffic forecasts.
- Figure 1 below shows our forecasts for the higher-traffic scenario.

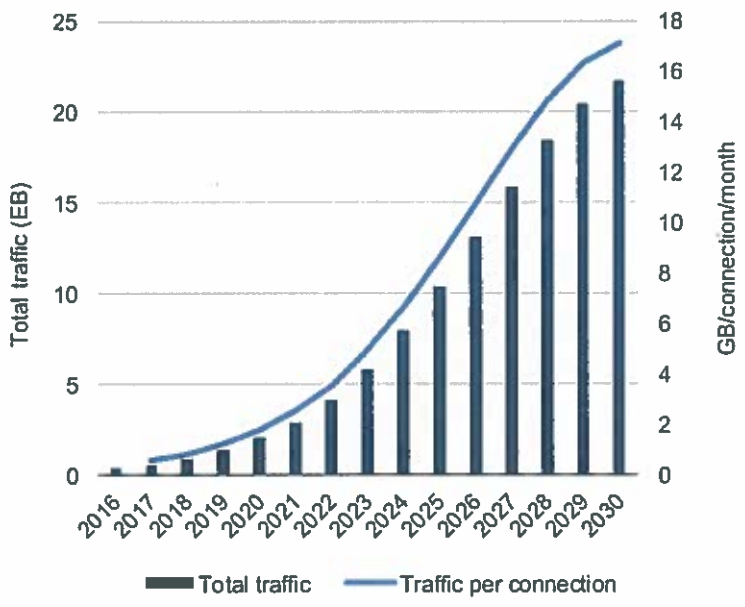

Figure 1: Forecast of total traffic in the South African mobile market to 2030 [Source: Analysys Mason, 2018]

[2] The total number of mobile connections is based on an AMR DataHub forecast to 2023, which has been extended to 2030 using a population penetration forecast. Mobile penetration has been forecast to saturate at ~175% from 2024 onwards.

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Step 2: Split the traffic by generation of mobile technology

- Total traffic from Step 1 is split by mobile technology (2G, 3G and 4G/5G) based on the same ratios that we understand have been used in ICASA's long-run incremental cost (LRIC) model to set mobile termination rates (MTR) in South Africa ('the South African MTR LRIC model'). The values are for a hypothetical efficient operator with a market share of ~40%. The South African MTR LRIC model covers the period 2016–2020; we have extended the ratios to 2030, as shown in Figure 2 below.

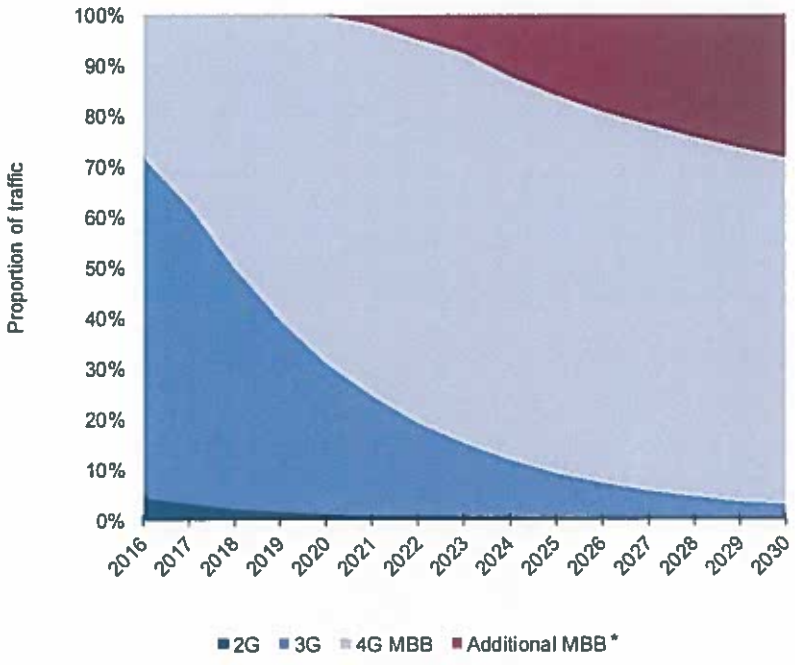


Figure 2: Proportion of traffic ratios by technology[3] [Source: Analysys Mason, 2018]

Step 3: Calculate the traffic to be carried by the WOAN assuming a certain market share of MBB (4G and 5G) traffic

- The total traffic forecast (Step 1) and the traffic ratios by technology (Step 2) are combined to produce the total amount of traffic by technology.
- The traffic to be carried by the WOAN is then calculated by assuming a specified market share of the total MBB traffic.[4]

3 Our traffic estimates suggest some demand for 5G services from 2020 onwards. Given that 5G spectrum is unlikely to be assigned in South Africa by this date, we treat 4G/5G spectrum together in the model (i.e. we assume a total 'MBB' traffic load without splitting between 4G and 5G).

4 See discussion on lower-traffic and higher-traffic scenarios below.

Step 4: Calculate the downlink capacity requirement (in Mbps) of the WOAN during the busy hour

- The yearly traffic (in MB) to be carried by the WOAN (calculated in Step 3) is converted into a downlink capacity requirement (in Mbps) during the busy hour.
- This network-dimensioning step assumes that 90% of LTE traffic is in the downlink direction and 6.1% of daily traffic occurs during the busy hour. These numbers are based on figures used in other mobile models developed by Analysys Mason in other sub-Saharan African countries (and are also consistent with the values used in the South African MTR LRIC model).[5]

Step 5: Forecast the number of base stations in the WOAN

- The forecast number of base stations in the WOAN is equivalent to that assumed by ICASA in the South African MTR LRIC model. The value used is for a hypothetical efficient operator with a market share of ~40%. The South African MTR LRIC model covers the period 2016–2020; we have extended this forecast to 2030, as shown in Figure 3 below.
- Since the WOAN is assumed to begin operation in 2020, the South African MTR LRIC model values for 2016–2019 are not used in our model, and the WOAN operator is assumed to build the sites needed in its first year of operation.

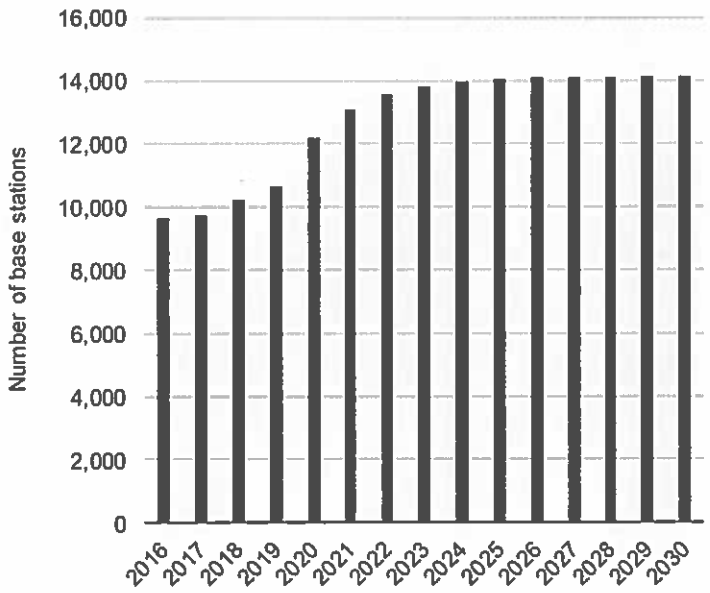


Figure 3: Forecast total number of mobile base stations for the WOAN [Source: Analysys Mason, 2018]

5 The MTR model assumes that 88% of LTE traffic is in the downlink, very similar to the Analysys Mason benchmark. The MTR model dimensions the network assuming that 69.5% of yearly traffic falls within 250 busy days, with 9.7% of daily LTE traffic falling within the busy hour. While these are different parameters to the Analysys Mason values, they correspond to a similar overall effective busy-hour factor.

Step 6: Calculate the WOAN capacity requirement per base station

- The amount of capacity required per base station is derived by dividing the total downlink capacity requirement in Mbps in the busy hour (Step 4) by the number of base stations (Step 5).

Step 7: Calculate the spectrum required by the WOAN using a spectral-efficiency estimate

- We have developed a forecast of LTE spectral efficiency per sector (Bits/s per Hz), which includes adjustments to account for various overheads and inefficiencies, based on Analysys Mason's experience of 4G network deployment. We believe the values shown in Figure 4 below represent reasonable real-world estimates of practically achievable spectral efficiency.

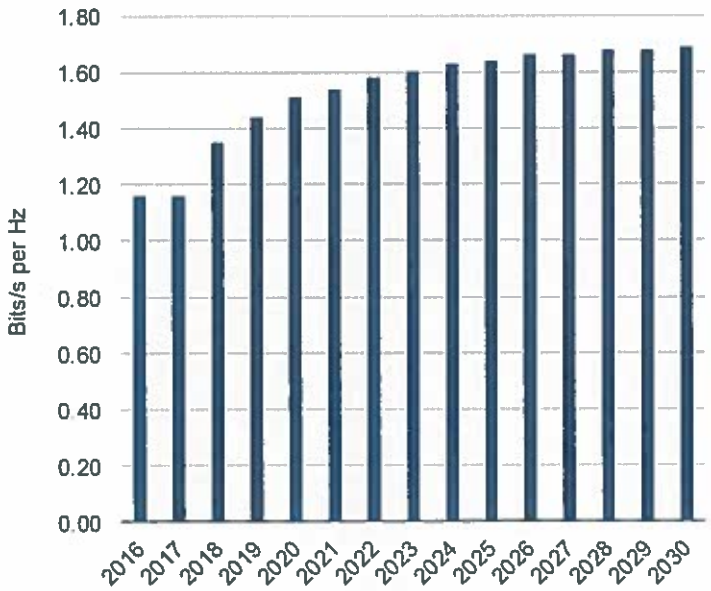


Figure 4: Forecast of LTE spectral efficiency per sector, after adjustments to account for various overheads and inefficiencies [Source: Analysys Mason, 2018]

- Assuming tri-sectored cells, the total downlink spectrum required per base station can now be calculated. A sector non-homogeneity factor is included, which we have estimated as 0.75, to account for the distribution of traffic across sectors within a base station.

- The final value is rounded up to the nearest 5MHz; this reflects the minimum LTE carrier size typically used in mobile networks.

These seven steps are followed for both the lower-traffic and the higher-traffic scenarios.

The calculation outlined above evenly assigns traffic across all base stations in the network (i.e. it calculates the average traffic per base station on the WOAN). However, there will be a distribution of traffic across sites, and the network must be dimensioned to cater for the busiest sites. The 'distributed traffic' sub-scenario accounts for this by multiplying the average traffic per base station by a factor (we assume 2.75), representing a ratio of the average traffic per site to the traffic at the busiest sites. In

other words, in this scenario the model assumes a tolerance whereby congestion is permitted at the busiest sites, but enough capacity should be available to meet demand at all other sites.

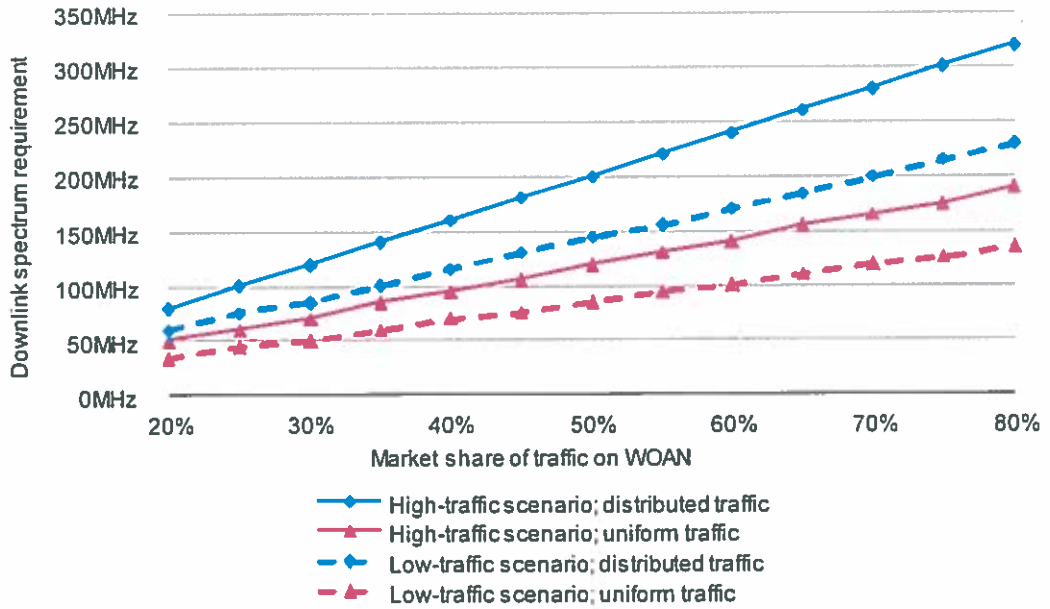
In the 'uniform traffic' sub-scenario, traffic distribution is modelled by using different traffic densities in each of four geotypes: dense urban, urban, suburban and rural. Within each geotype, traffic is considered to be uniformly spread across sites. These are the geotypes modelled in the South African MTR LRIC model. The seven steps outlined above still apply, but Steps 3 to 7 are conducted by geotype. Forecasts for traffic and number of base stations by geotype have been sourced from the South African MTR LRIC model, and extrapolated to 2030.

2.2 Summary of findings

As described above, we have modelled the spectrum requirements for the WOAN under two different scenarios: a lower-traffic and a higher-traffic scenario. Neither scenario can be considered a strict lower or upper bound on future traffic evolution, which is inherently uncertain, but instead they represent two realistic estimates towards the centre of an expected range of outcomes.

In each case, we have modelled two sub-scenarios: a distributed-traffic scenario (i.e. traffic spread across all sites using a typical distribution), and a uniform-traffic scenario (i.e. uniform values of traffic per site within different geotypes). The results of our modelling for each scenario are shown in Figure 5 below.

Figure 5: Outputs of Analysys Mason model: spectrum required by the WOAN to support different levels of market share [Source: Analysys Mason, 2018]



As can be seen in Figure 5 above, in the 'lower-traffic scenario – uniform traffic', 70MHz of downlink spectrum is needed to support a 40% market share, increasing to 135MHz for an 80%

market share. These results are consistent with those in the CSIR study. However, this is likely to be a lower bound, since traffic will not be uniform across sites. The 'lower-traffic scenario – distributed traffic' causes these values to rise to 115MHz and 230MHz for a 40% and 80% market share, respectively, and is in our opinion likely to represent a better reflection of reality.

In the higher-traffic scenario, we get a corresponding range of 95–190MHz for a 40% market share, and 160–320MHz for an 80% market share (depending on whether the 'uniform traffic' or 'distributed traffic' approach is followed).

Conclusions on the amount of spectrum to be assigned to the WOAN

Spectrum in 3GPP LTE bands 7, 20, 28 and 38 is planned to be awarded for 4G mobile use in South Africa. A portion of this spectrum is under discussion to be assigned to the WOAN. As shown in Figure 6 below, there is a total of around 145MHz of downlink spectrum available across these four bands.

Figure 6: Spectrum that could be assigned to the WOAN [Source: Analysys Mason, 2018]

3GPP LTE band	Band and duplex type	Spectrum to be released in South Africa	Amount of downlink spectrum available
7	2600MHz FDD*	2×70MHz	70MHz
38	2600MHz TDD*	25MHz	20MHz[6]
28	700MHz FDD	2×30MHz	30MHz
20	800MHz FDD	2×25MHz	25MHz
Total			**145MHz**

*FDD: frequency division duplex; TDD: time division duplex

We note that this amount of spectrum is unlikely to be enough to serve all forecast traffic in the South African market by 2030 (the date referenced in the CSIR study). Hence, existing spectrum assignments of South African mobile network operators (MNOs) (re-farmed from 2G and 3G use, for 4G) will play a role to support forecast 4G needs. South African MNOs have spectrum assigned in the 1800MHz, 2.1GHz and 900MHz bands – although some of this spectrum is also needed to serve 2G and 3G traffic in at least the short to medium term, we expect that portions of this spectrum will also support 4G. It is likely that additional spectrum will be needed for mobile broadband use in South Africa prior to 2030, over and above the identified spectrum in the 700MHz, 800MHz and 2.6GHz bands.[7]

Spectrum in the sub-1GHz bands (i.e. 700MHz and 800MHz) has better propagation characteristics than spectrum in the higher-frequency 2.6GHz band (which attenuates more quickly in the atmosphere). As such, sub-1GHz spectrum is needed to provide wide-area and in-building coverage,

6 Taking account of the portion of TDD spectrum usable for downlink mobile services when accounting for co-existence with neighbouring FDD spectrum bands.

7 For example, national regulatory authorities (NRAs) in ITU Region 1 (i.e. Africa, Europe and parts of the Middle East) are assigning spectrum for mobile use in the 1.4GHz and 2.3GHz bands, and in the 3.4–3.8GHz band (the latter being suited to 5G).

while higher-frequency spectrum is used to provide additional capacity in more densely populated locations.

A certain amount of sub-1GHz spectrum will therefore be required by the WOAN for it to be viable (i.e. spectrum requirements for the WOAN cannot only be served using the 2.6GHz band, given the wide-area coverage that the WOAN is proposed to be obliged to provide). As such, some sub-1GHz spectrum is needed for the WOAN to ensure that it can reasonably provide coverage over a wide geography, including inside premises.

We also note that the 800MHz band is more readily useable in the short term than the 700MHz band (given the proportion of 4G-capable handsets already in the market place that support this band). As such, it may be desirable to prioritise assignment of 800MHz spectrum to the WOAN to maximise the traffic that the WOAN can carry in the short term. This would suggest that any 700MHz spectrum remaining after the allocation reserved for the WOAN (the amount of which varies depending on our assumptions on traffic to be carried by the WOAN) could be assigned via competitive award to individual MNOs. It is noted in our 'higher-traffic scenario – distributed traffic' that the spectrum needed by the WOAN exceeds the total available spectrum (hence there would be no remaining spectrum to be assigned to individual MNOs). This also assumes that a simultaneous assignment to MNOs is not contemplated.

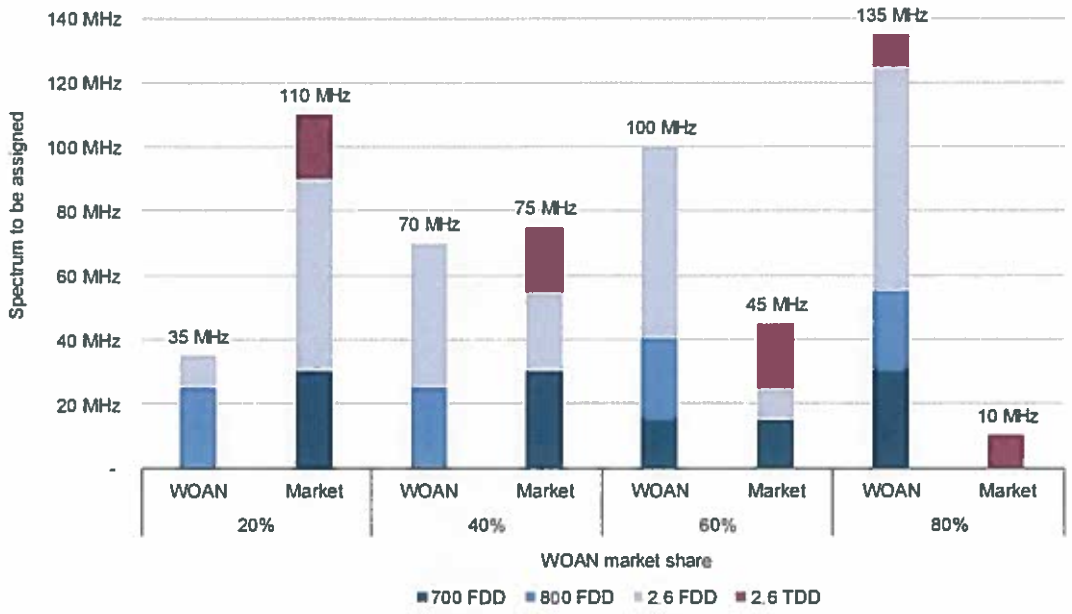
The spectrum requirements for the WOAN under each of the four scenarios considered in our modelling are shown in Figure 7 below.

Figure 7: Outputs of Analysys Mason model: spectrum required by the WOAN to support different levels of market share [Source: Analysys Mason, 2018]

WOAN market share	Higher-traffic scenario – distributed traffic	Higher-traffic scenario – uniform traffic	Lower-traffic scenario – distributed traffic	Lower-traffic scenario – uniform traffic
20%	80MHz	50MHz	60MHz	35MHz
40%	160MHz	95MHz	115MHz	70MHz
60%	240MHz	140MHz	170MHz	100MHz
80%	320MHz	190MHz	230MHz	135MHz

Our recommendations on the amount of spectrum in each band to be assigned to the WOAN (under the 'lower-traffic scenario – uniform traffic') and the remaining spectrum available for other licensees are shown in Figure 8 below.

Figure 8: Estimated spectrum assignment to the WOAN (and remaining spectrum for market assignment) under the 'lower traffic – uniform traffic' scenario [Source: Analysys Mason, 2018]



As can be seen in Figure 8 above:

- If the WOAN had a market share of 20%, then a minimum of 35MHz of downlink spectrum would be required. Under these circumstances, 2×25MHz of 800MHz (i.e. all the spectrum available in the 800MHz band) could be assigned to the WOAN, alongside a portion (e.g. 2×10MHz) of 2.6GHz FDD spectrum to provide (limited) capacity in dense areas. The remaining low-frequency (i.e. the 700MHz band) and high-frequency spectrum in the 2.6GHz band would be assigned to MNOs via a competitive process. It should be noted that if the WOAN is assumed to carry only 20% of traffic, MNOs would need additional spectrum to cater for the remaining traffic. However, it is not clear that there is enough spectrum to accommodate this demand (resulting in high demand for the spectrum if awarded competitively).

- If the WOAN had a market share of 40%, then we estimate that a minimum of 70MHz of downlink spectrum would be required. In this case, the additional spectrum requirement could be met by assigning the WOAN an increased portion of high-frequency spectrum (e.g. a further 2×35MHz of 2.6GHz FDD spectrum, or a split assignment of, for instance, 2×20MHz of 700MHz spectrum plus 2×15MHz of 2.6GHz spectrum). The additional high-frequency spectrum could allow the WOAN to provide further LTE capacity in dense locations. However, the alternative of assigning 700MHz spectrum would be more favourable for providing wide-area nationwide coverage (including in-building use) via the WOAN.

- If the WOAN had a market share of 60%, we estimate that a minimum of 100MHz of downlink spectrum would be required. In this case, the additional bandwidth could be delivered using low-frequency spectrum (e.g. by assigning the 2×30MHz of 700MHz spectrum to the WOAN).

Alternatively, a split assignment of 2×15MHz of 700MHz spectrum and 2×15MHz of 2.6GHz capacity would also provide the necessary bandwidth, although with the caveat that the 2.6GHz spectrum is not typically considered as being suitable for wide-area, nationwide coverage (being more suited to delivering capacity in locations where network traffic is high). The remaining spectrum (in the 2.6GHz paired and unpaired bands) would be available for market assignment to MNOs

- If the WOAN had a market share of 80%, then a minimum of 135MHz of downlink spectrum would be required. This means that almost all the downlink spectrum available must be assigned to the WOAN.

It is important to note that in our higher-traffic scenario, the estimated spectrum needs are higher than those above. It would therefore be prudent to assign a greater amount of spectrum to the WOAN than the amounts suggested above or in the CSIR study.

In assessing whether the WOAN would be viable with a particular spectrum assignment, it is important to consider not just the capacity that the WOAN requires to carry a certain share of traffic, but also the incentives for South African MNOs to access WOAN capacity to serve the demand from their retail customers. Although not considered in detail by Analysys Mason, this mode of analysis might suggest that provisioning for the WOAN to carry a relatively smaller proportion of traffic (e.g. 20%) is unlikely to lead to it being commercially viable in the long run (since MNOs will have less incentive to use the WOAN if there is more spectrum available for individual use). As such, this might support an argument that the WOAN should be assigned a higher portion of spectrum from the outset.

With appropriate spectrum assigned to support a 40% market share (i.e. at least 70MHz depending on traffic assumptions), the WOAN is, in our view, more likely to be viable since it will both be able to support a significant proportion of traffic and is also likely to be used by most MNOs. However, the proportion of traffic that the WOAN should be designed to support is ultimately a policy decision to be taken by ICASA.

3 Obligation to purchase WOAN capacity

This section discusses the proposed period over which existing mobile licensees are obliged to purchase capacity from the WOAN.

3.1 Length of obligation to purchase capacity

In paragraph 1.12, part (b)(iv) of the Government Gazette of 27 September 2018, ICASA proposes to place obligations on each radio frequency spectrum licensee that is assigned currently unassigned high-demand spectrum. These obligations would require these licensees to acquire capacity from the WOAN operator, over a defined period, on a national basis.

The precise nature of these obligations is unclear. However, they appear to suggest that the licensees must collectively or individually (it is currently unclear which) acquire at least 30% of the national capacity of the WOAN for a period of three years from as soon as the WOAN is licensed.

In this context, Cell C has asked Analysys Mason to briefly consider whether the proposed three-year duration of the initial obligation is consistent with industry standards for arrangements of this nature.

We begin by noting that ICASA may determine that, after expiry of the three-year period, a minimum of 30% national capacity must be procured in the WOAN collectively by the radio frequency spectrum licensees, for a further period determined by ICASA. However, this potential extension to the duration of the obligation does not appear to be guaranteed; nor is it clear how much longer the obligation may apply for under such an extension.

In our opinion, it will be very difficult for ICASA to determine ex ante whether an extension to the obligation is required after three years. Furthermore, if the obligation is not extended and the WOAN consequently fails, it is unlikely to be possible for ICASA to 'repair' the damage. As such, a better approach will be for ICASA to put the obligations in place for a longer time from the outset.

We note that there is little international precedent of WOANs, but our view is that the duration of active radio access network (RAN) sharing agreements between MNOs, including spectrum pooling agreements, serves as a reasonable proxy when considering the appropriate length of obligations. In our view, the commitment made by MNOs to ensure the success of a RAN-sharing agreement is analogous to the commitments required to ensure the success of a WOAN. We are aware that this form of sharing is not currently permitted in South Africa, so we use the example purely for illustration purposes.

We have analysed the initial contract duration of active RAN-sharing agreements worldwide for which there is information available in the public domain, as shown in Figure 9 below.

Figure 9: Active RAN-sharing agreements for which there is information on their initial contract duration publicly available [Source: Analysys Mason, 2018]

Date of announcement	Country	Operators involved	Duration	Description
2015	Bulgaria	Mtel and Max	Indefinite	Active RAN share
2013	Czech Republic	T-Mobile and CETIN	20 years	Active RAN share
2012	Poland	Polkomtel and Aero2	5 years	Sharing up to and including backhaul infrastructure
2011	Malaysia	Maxis Mobile and U Mobile	10 years (with cancellation provisions)	Active RAN share
2009	India	BSNL and TTSL	15 years	Entire infrastructure
2009	UK	O2 and Vodafone	10 years	Partial RAN sharing
2007	UK	H3G UK and T-Mobile (now EE)	5 years	MORAN
2004	Australia	Optus and Vodafone	10 years	Multi operator radio access network (MORAN)

Furthermore, there are a number of other active RAN-sharing agreements for which their initial duration does not appear to be publicly available. Nonetheless, Figure 10 shows how long these agreements have been in place to date.

Figure 10: Additional active RAN-sharing agreements for which there is no information on their initial contract duration publicly available [Source: Analysys Mason, 2018]

Date of commencement of agreement	Country	Operators involved	Duration to date (ongoing)	Description
2015	France	Bouygues and SFR	3 years	MORAN
2014	Finland	DNA and Telia	4 years	Active RAN share (with spectrum pooling)
2013	Romania	Vodafone and Orange	5 years	Active 4G RAN share
2012	Denmark	Telenor and Telia	6 years	Active RAN share (with spectrum pooling)
2012	Greece	Vodafone and WIND	6 years	Active RAN share
2011	Poland	Orange and T-Mobile	7 years	Active RAN share (with spectrum pooling)
2009	Sweden	Tele2 and Telenor	9 years	Active RAN share (with spectrum pooling)
2006	Spain	Vodafone and Orange	12 years	National roaming with joint deployment
2001	Sweden	Telenor and Hi3G	17 years	Active RAN share (with spectrum pooling)
2001	Sweden	Telia and Tele2	17 years	Active RAN share (with spectrum pooling)

While the above list of agreements is unlikely to be exhaustive, it does provide further anecdotal evidence that such agreements (i.e. agreements for access to capacity, alternatively as indicated in the examples above, to the RAN) are usually long-term commitments.

3.2 Summary of key findings

Our analysis shows that all active RAN-sharing agreements whose initial contract duration is publicly available (see Figure 9) are for a term of at least five years, and typically much longer. In fact, all but two of the agreements are for an initial period of at least ten years. In general, the contract should be long enough to outlast at least one round of equipment refresh (so at least seven years) and may often be tied to the expected life of the technology – this could be 25 years or more.

The same would be true in relation to the WOAN. This suggests that the proposed period over which existing mobile licensees should be obliged to purchase capacity from the WOAN should be similar to the duration of existing RAN-sharing agreements for which there is information publicly available (i.e. ten years or potentially longer) to ensure the network is commercially viable and financeable.

Annex A Summary of modelling inputs and sources

A summary of the key inputs and sources used in the model is provided in Figure A.1 below.

Figure A.1: Key inputs and sources used in the model [Source: Analysys Mason, 2018]

Source	Key inputs
Analysys Mason Research's DataHub	Forecasts to 2023: • population • mobile connections • total mobile traffic
South African MTR LRIC model	Forecasts to 2020, for a hypothetical efficient operator with a market share of ~40%; data taken in aggregate and by geotype: • traffic split by technology • number of base stations
Analysys Mason's experience in mobile modelling	Based on various mobile models previously developed by Analysys Mason: • busy-hour dimensioning parameters* • proportion of LTE traffic in the downlink* • LTE spectral efficiency by sector (after overheads and adjustments) • non-homogeneity factor for traffic across sectors within a site • ratio of traffic on the average site to traffic on the site at the fifth percentile of (most busy) sites

**Cross-checked against figures used in the South African MTR LRIC model*