

**TELKOM'S SUBMISSION ON THE DRAFT IMT ROADMAP AS
PUBLISHED 27th AUGUST 2014 IN GOVERNMENT GAZETTE No. 37948
(NOTICES 729 AND 730 OF 2014)**

1. INTRODUCTION

The Independent Communications Authority of South Africa (“**the Authority**” or “**ICASA**”) published on 27th August 2014 the draft IMT Roadmap in Government Gazette No. 37948 (Notices 729 and 730 of 2014) for consultation.

Telkom congratulates the Authority on preparing a very comprehensive, well thought through and detailed document. This IMT Roadmap will definitely have a positive influence on the rollout of IMT services in South Africa, which is required to bridge the digital divide, in particular in the rural areas and in support of SA Connect. Telkom also supports the holistic approach followed by the Authority in addressing all IMT bands in the Roadmap, even though it is accepted that not all these bands will be made available at the same time due to, amongst others, the need to migrate incumbent services.

Whereas respondents were required to respond to the questions using the template provided in Notice 730 of 2014, Telkom decided to replicate the template as closely as possible in order to be able to add additional information such as pictures, footnotes, headings, etc. Telkom's responses to the questions are contained in Annexure A and follows the exact numbering as contained in the template. Telkom also provided further comments of an editorial/general nature in Annexure B, which we trust will assist the Authority in finalising the IMT Roadmap.

In order to further facilitate the work of the Authority, a brief summary on each frequency band/question is provided under the executive summary.

2. EXECUTIVE SUMMARY

Below is a high level summary of Telkom's key proposals on the various frequency bands/questions addressed in the draft IMT Roadmap.

2.1 450 MHz

- i) Telkom supports the use of this band for IMT; a range of services could potentially be deployed in this band including broadband, PPDR, etc.
- ii) Telkom supports the migration of all incumbent services from the band although the identification of suitable alternatives in terms of technology and spectrum is vital to ensure a successful outcome. Telkom's migration from this band will be facilitated by having access to sub-1 GHz spectrum.
- iii) Telkom requests the Authority to delay the decision between the application of FDD or TDD for a few months until a technical ecosystem has better developed, while focusing on migration.
- iv) Telkom recommends the establishment of a 450 MHz migration workgroup to address the migration of incumbent services from this band.

2.2 700 MHz and 800 MHz

- i) Telkom supports the adoption of 2x30 MHz in 700 MHz and 2x30 MHz in 800 MHz for South Africa as it is considered a balanced use of both bands providing more assignment options and improved spectrum efficiency.
- ii) Telkom is of the view that it is premature to adopt TDD in the centre gap of the 700 MHz band and recommends that this decision be delayed until ITU has concluded on the matter. This also includes a decision on the use of 2x3 MHz in the 700 MHz band.
- iii) Telkom is currently the only national mobile provider without sub-1 GHz spectrum and therefore should obtain at least 2x10 MHz in the 700/800 MHz range to be able to compete with the other/incumbent mobile operators and to facilitate the migration of legacy systems from various IMT frequency bands.

2.3 850 MHz

- i) Telkom supports shifting Neotel downwards by 3 MHz within the 850 MHz band provided that compatibility with adjacent band services are guaranteed.

2.4 900 MHz

- i) Telkom supports the principle of consolidation in this band as it will create equal opportunities for all incumbents in the band and improve spectrum efficiency.
- ii) Telkom recommends a long term view that will support 3G/4G assignments based on a 5 MHz raster and as such supports Scenario 3 (2x10 MHz to each licensee) with no guard bands. Scenarios 1 and 2 are not supported as it may require another re-farming process in future.
- iii) The additional 5 MHz band that will become available could be assigned to another licensee or an existing 900 MHz licensee(s) using existing procedures for awarding high demand spectrum.

2.5 2300 MHz

- i) Telkom recommends that a 10 MHz guard band be adopted in the upper edge of the band to ensure protection with services operating above 2.4 GHz, in particularly Wi-Fi, especially when integrated into the same device.
- ii) The migration of WBS to this band is therefore not supported.
- iii) Telkom does not support the use of the band 2290-2300 MHz for IMT as this band has not been identified as an IMT band and is also needed to protect services operating below 2290 MHz.
- iv) Telkom supports the adoption of a 10 MHz guard band between Telkom's assignment and that of adjacent licensees in order to allow operation of unsynchronised networks; this could be reviewed when ITU has concluded on the matter.
- v) The use of the band 2360-2400 MHz for IMT can only take place once Telkom has completed migration of PTMP TDMA systems from the band, which will take several years and will depend on the availability of suitable alternatives in terms of technology and spectrum.

2.6 2600 MHz

- i) Telkom supports the adoption of the FDD/TDD arrangement (2x70 MHz plus 50 MHz) for this band.
 - ii) Telkom supports the migration of WBS to the TDD portion of the 2.6 GHz band as it is the most viable solution; migration to 2.3 GHz is not supported.
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- iii) A possible alternative band for WBS could be 3.5 GHz under the Managed Spectrum Park model depending on the intended area of operation.

2.7 3500 MHz

- i) Telkom supports the adoption of TDD in this band and supports the migration of FDD assignments from the band.
- ii) Telkom does not support splitting the band between uplink and downlink focused allocations as it is not service neutral and prejudices future commercial requirements; operators should have the flexibility to adapt their deployments based on business needs.
- iii) Telkom supports the assignment of large channels (min 20 MHz) in this band.
- iv) Telkom recommends the adoption of Block Edge Masks in this band to allow unsynchronised use of the band.
- v) The concept of Managed Spectrum Park can be supported in principle, especially in the higher bands such as 3.5 GHz, although more detail will be required before it can be implemented.
- vi) A decision to migrate DECT cordless telephones into the 3.5 GHz band (or any other band for that matter) is not supported at this stage and such decision should be taken with caution.

2.8 Spectrum bundling of IMT450, IMT750 and IMT2600 and assignment to one (wholesale) operator

- i) In principle Telkom does not support the lumping of the listed TDD bands into a package for a single (wholesale) operator mainly because the listed bands are generally not available and have no proven technology ecosystem.
- ii) Consideration of this proposal will also depend on the conditions under which wholesale is to be provided and whether an existing or green field operator is considered. Telkom does not consider a green field operator as a viable option for South Africa.
- iii) Telkom recommends the consideration of assignment of spectrum to individual users and operators pooling spectrum where required to jointly build networks on commercial terms as required.

2.9 Individual IMT3500 assignments per operator or one assignment to one (wholesale) operator

- i) Telkom does not support the single operator model in this band because of the amount of spectrum (200 MHz) in the band and since the band will be used as a capacity layer as and when required, including possibly for small cells.
- ii) A single national operator will find it very difficult to stay abreast with requests for specific deployments from all operators (it will be difficult to pre-provision IMT in this band considering the small cells). A wholesale model for this band is also not proven as viable.
- iii) Telkom supports the assignment of spectrum to individual licensees with licensees having the option to pool spectrum where required to jointly build networks on commercial terms as required.

2.10 Universal service obligations for lower frequency bands (sub-1 GHz)

- i) Telkom in general supports the application of coverage obligations with minimum speed required per user.
- ii) Telkom requests the Authority to clarify the proposed obligations as it is open for interpretation in its current form and could therefore lead to uncertainties and disputes.
- iii) In particular the Authority should, in conjunction with other relevant agencies such as USAASA, clearly list and define the set of areas that should be covered.

2.11 Capacity licence obligations for new and existing IMT bands

- i) Whereas the capacity obligations are not unreasonable, it is not clear how these will be measured and enforced.
- ii) Telkom supports the capacity obligation as the minimum speed experienced by 90% of the users, which is not dedicated bandwidth per user but rather average user experience during busy hour.

2.12 Proposals pertaining to the 1700-2290 MHz band

- i) Telkom supports the continued use of the band according to ITU-R F.1098 for PTP links noting however that this band has been listed as an IMT candidate band under WRC-15 agenda item 1.1.

- ii) Telkom recommends that the band 1880-1900 MHz is continued to be used for DECT cordless telephones. Telkom is in the process of migrating DECT WLL systems although the completion of this migration will depend on the availability of suitable alternative technologies and spectrum.
- iii) The band 1900-1920 MHz has been assigned to Telkom and is used for BFWA systems; Telkom has no immediate plans to migrate these systems.
- iv) Telkom does not support the extension of the 2100 MHz band for terrestrial IMT services; Telkom recommends that this band be retained for IMT satellite services, at least for the time being.

Annexure A:**Invitation to Comment on the Draft IMT Roadmap****1. Cover Sheet**

The requested information is contained in Telkom's covering letter. These comments are submitted on behalf of Telkom SA SOC Ltd by Mr Siyabonga Mahlangu as Group Executive, Regulatory Affairs. Signing the cover letter also implies signing the declaration as contained in section 1.2 of the cover sheet.

2. Invitation to Comment**2.1 IMT450****2.1.1 The Authority invites industry views on IMT usage in general in 450-470MHz**

Telkom supports the Authority's proposal that the 450 MHz band be used for implementation of IMT. This band has unique propagation characteristics and is currently the lowest frequency band identified by the ITU for IMT. It is also clear that the use of this band for IMT is gaining momentum, although it is only in its infancy. Nevertheless, the long term use of this band should be for IMT.

A critical decision to be taken in implementing IMT in this band is whether to adopt FDD or TDD (or both). This decision is not straight forward and is affected by many issues, as also highlighted in the draft IMT Roadmap. Although there are some support for FDD developing, there is not yet a clear winner for FDD or TDD. Making a wrong decision in this regard will be costly to remedy and will negatively affect the use of the band for many years. Several of the systems currently being deployed internationally are also based on proprietary or test systems.

ITU-R recommendation M.1036 provides several options for both TDD and FDD. As noted in this recommendation, the number of different frequency arrangements reflect the fact that most administrations, which have already implemented this band, have customised the band plan in order to accommodate incumbent uses. It is nevertheless noteworthy that most of these options maintain the 10 MHz Tx-Rx separation, which is good for standardisation. On the other hand, 3GPP currently specifies only one plan for the 450 MHz band namely Band 31¹. This band plan is based on an FDD arrangement of 2x5 MHz (452.5-457.5 MHz // 462.5-467.5 MHz). The preference will

¹ Specification TS 36.101 V12.4.0 (2014-06)

be to adopt a channel plan listed in 3GPP as manufacturers generally base their development on these specifications.

If a decision regarding a 450 MHz band plan have to be taken now, Telkom will recommend the adoption of Band 31 (2x5 MHz). However, Telkom is of the view that it is premature, and indeed not necessary, to make this decision at this stage because of the lengthy migration process required to make the band available for IMT. The FDD/TDD decision could therefore easily be delayed for 12 to 24 months while South Africa starts implementing the migration of incumbent services (it is noted that, in accordance with the Detailed Calendar contained in section 9.2 of the draft IMT Roadmap, migration is proposed to start only in 2016 and rollout of IMT in 2018). It is expected that the ecosystem for this band will become much clearer within this period, allowing for better decision making. A premature and possibly compromised decision at this stage, if proven to be wrong, could be very costly taking many years to correct. The reference to a possible 3rd Digital Dividend (although not defined) will also impact this decision, in particularly if it extends the 450 MHz band upwards into broadcasting channel 21 (or beyond).

Any decision on a channel plan based on the discussion of services that could potentially be deployed in this band, for example M2M or PPDR, should therefore also be taken with care. As an IMT band, any or all of the discussed services could potentially find application in this band, although the channel plan adopted will suit some services better than other (for example M2M may be better served by a TDD arrangement). Although a question in the draft IMT Roadmap is steered towards a specific channel plan arrangement, the option to use the opposite arrangement for that service should not be excluded. For example, although question 2.1.2 request views on the use of IMT paired spectrum for PPDR, the use of TDD spectrum for PPDR should not be excluded. Same applies to the question regarding TDD spectrum for M2M; although a relevant question it may be possible that the ecosystem for FDD outstrips TDD development making this question (in the context of TDD) superfluous.

In section 11 of the draft IMT Roadmap, it is concluded that the band should be migrated to be used for IMT, which Telkom supports. The Authority then states that the band should be used especially for M2M and connected car applications and basic broadband coverage in rural areas. Considering current channelling options and band size, Telkom is of the view that the band cannot accommodate both TDD and FDD. The Authority argues that M2M will be better served through a TDD uplink centric network. The Authority also argues against TDD downlink centric services. However, if TDD is used for rural broadband, it should be downlink centric, which goes against the requirement for M2M. It is not clear how the Authority intends to use the band for both M2M and basic broadband coverage. Further possible conflicting arguments are the fact that the coverage and capacity obligations for this band suggest the use of FDD (2x5 MHz) whereas the Detailed Calendar (section 9.2 of the draft IMT Roadmap) refers to a possible TDD assignment (second assignment).

Noting the above and as a way forward, Telkom recommends that the Authority establishes a 450 MHz migration workgroup where all incumbent users must participate (similar to very successful 1800 MHz migration work group that coordinated the migration of fixed links from the GSM1800 band or the recently established JSAC for DTT migration). The Authority provided a very comprehensive calendar and time frame for the migration of incumbent services from and awarding of spectrum to IMT for the 450 MHz frequency band. The objective of the proposed migration workgroup is to refine this plan and to determine the details with regards to its implementation to ensure a successful outcome. To succeed in the implementation of IMT in this band, it is critical that all incumbents in the band, as well as those in adjacent affected bands such as 380-450 MHz, participate in this workgroup to collaborate and ensure that all incumbent services migrate timeously. Each incumbent must perform and submit to the migration workgroup, amongst others, individual assessments of their anticipated time to migrate, considering also the Authority's proposed designation bands, overall time scales, etc. This working group could also address the proposed interference trials as required. This working group will also prove invaluable to coordinate the timing and implementation of the suggested double migrations (first clear designation bands below 450 MHz before those within 450 MHz can migrate). According the draft IMT Roadmap, it seems that the Authority does not intent to develop a RFSAP for this band at this stage. Telkom supports this as it is premature.

2.1.2 The Authority invites industry views on IMT paired spectrum usage for PPDR.

As commented in response to question 2.1.1, Telkom is of the view that it is premature to determine whether the 450 MHz band should be used as FDD or TDD. Notwithstanding this, Telkom will raise a few points regarding the use of this band for PPDR.

ITU Resolution **646 (Rev.WRC-12)**² identified the frequency range 380-470 MHz in Region 1 for consideration of PPDR. Within this range, the frequency bands 380-385 MHz // 390-395 MHz has been identified as the preferred core harmonized band for permanent public protection activities for countries of Region 1. CRASA adopted these bands for narrow band PPDR and the bands 385-390 MHz // 395-399.9 MHz (primary) and 410-420 MHz // 420-430 MHz (secondary) for wideband PPDR applications³. South Africa adopted the bands 380-387 MHz // 390-397 MHz for PPDR (see NRFP, 2013) and also adopted parts of the bands 410-420 MHz // 420-430 MHz for trunking although not specifically for PPDR. At the time of developing the CRASA Framework on PPDR, and on a temporary basis, the bands 4940-4990 MHz were earmarked for Broadband PPDR, pending further studies. Broadband PPDR is

² Public protection and disaster relief

³ Framework for harmonisation of frequencies for Public Protection and Disaster Relief (PPDR) in SADC

discussed further below. The CRASA decisions with regards to narrowband, wideband and broadband PPDR are in line with ECC/DEC/(08)05⁴.

Notwithstanding these identified PPDR bands, ITU-R Report M.2033⁵ provides for IMT as an option for PPDR, in particularly in cases where it is not cost effective to deploy a dedicated PPDR network, albeit the fact that IMT technologies may not meet all PPDR requirements. This report recommends use of IMT from a cost savings potential and advanced features offered. The use of IMT for PPDR is probably a more attractive option for developing countries including South Africa, in particular from an economics point of view. The use of the 450 MHz band for narrow band and wide band PPDR applications could therefore prove to be very valuable. ITU-R Report M.2291⁶ also describes the use of IMT and LTE in particular to support broadband PPDR.

Telkom agrees with the view expressed in section 2.3 of the draft IMT Roadmap that PPDR might be shared with public mobile with pre-emption in case of emergency. Using the 450 MHz band in FDD, with a maximum of 2x5 MHz, may be insufficient for broadband PPDR when considered for both safety and public services, but may be sufficient for narrow band and wide band PPDR applications. For broadband PPDR bands such as IMT700 may be more appropriate, as discussed below.

WRC-12 adopted Resolution **648 (WRC-12)**⁷ to study possible frequency bands for broadband PPDR applications. These studies were conducted within WP5A and the results are contained in the draft CPM Report for WRC-15 (published 19 September 2014). ITU-R studies have indicated a strong requirement for harmonised spectrum for broadband PPDR. WRC-15 will consider this issue under its Agenda Item 1.3. Based on the draft CPM Report, specific frequency bands within the ranges 694-790 MHz (700 MHz) and 790-862 MHz (800 MHz) are the recommend options for harmonised broadband PPDR for Region 1.

It is not clear from the draft IMT Roadmap whether the 450 MHz band is proposed for narrowband, wideband or broadband PPDR. Since Resolution **646 (WRC-12)** however specifies the range 380-470 MHz as the harmonised range for PPDR applications, it is assumed that the intent is for narrow band or wide band PPDR applications. Telkom recommends that the bands identified in Resolution **646 (WRC-12)** be considered for PPDR applications in South Africa specifically for narrow band and wide band PPDR. The use of 450 MHz is however not excluded. With regards to broadband PPDR, Telkom recommends that South Africa aligns itself with the decisions to be made at

⁴ ECC Decision of 27 June 2008 on the harmonisation of frequency bands for the implementation of digital Public Protection and Disaster Relief (PPDR) radio applications in the bands within the 380-470 MHz range

⁵ Radiocommunication objectives and requirements for public protection and disaster relief

⁶ The use of International Mobile Telecommunications for broadband public protection and disaster relief applications

⁷ Studies to support broadband public protection and disaster relief

WRC-15. Based on the draft CPM Report and relevant ITU-R Recommendations and Report, it is noted that all existing and proposed PPDR frequency bands are all FDD.

The ongoing discussions in WP5D pertaining to the use of the 700 MHz in addition to the 2x30 MHz base is also relevant to this discussion as these may be considered for PPDR applications (see also comments in response to question 2.2.3).

2.1.3 The Authority invites industry views on IMT paired spectrum usage for the SA connect initiative.

The use of the 450 MHz band holds significant promise for future IMT services, given the numerous barriers historically faced in providing connectivity in developing countries such as South Africa and developing countries in general. The challenges faced by operators to bridge the digital divide and bring economically viable services to communities in rural areas, are still ongoing and are still to a large extent unresolved. Given the vast areas requiring coverage, coupled with sparse and scattered pockets of subscribers with low ARPUs (Average Revenue per User) off which to build a profitable business case, a terrestrial technology with standardised equipment, economies of scale and harmonised spectrum at this low frequency range could be leveraged towards overcoming the barriers holding back the promised panacea of connectivity for all people. IMT450 therefore may have a role to play in delivering on SA Connect and therefore is supported as an IMT band.

According to Telkom's response to question 2.1.1 above, Telkom is of the view that it is premature to decide whether this band should be used for FDD or TDD; industry to rather focus on the migration of incumbent services out of the band at this stage.

2.1.4 The Authority invites industry views on IMT unpaired spectrum usage for M2M and smart energy/grid applications in South Africa.

According to Telkom's response to question 2.1.1 above, Telkom is of the view that it is premature to decide whether this band should be used for FDD or TDD.

M2M services are set to show strong growth in the immediate future and having all these billions of connections working reliably, calls for sufficient spectrum. Using unpaired spectrum blocks would be suitable for M2M connectivity especially for an uplink-centric traffic flow from the measurement devices to the network. IMT could definitely play a key role to provide M2M services. This discussion could however be futile if an IMT TDD technology ecosystem does not develop in the 450 MHz band and therefore the recommendation to rather focus on the process of migration in the short term.

2.1.5 The Authority invites industry views on the migration of incumbents (Transnet, SAA, Telkom, etc.) out of the 450-470 MHz band.

Migration of incumbent systems/networks from this band must be done in a coordinated manner; i.e. the migration of all relevant incumbent services must be coordinated to coincide with the actual use of the band for IMT. A situation where some users are required to migrate from the band years before others, or when IMT is deployed, should be avoided. Coordinating migration through the proposed working group will avoid this situation.

Telkom have a total of 617 deployed PTP (point-to-Point) low capacity links providing voice and fax services, including low capacity data connectivity, using low bandwidth legacy analogue systems (25 kHz channels). Telkom uses 10x25 kHz non-contiguous channels in the range 451-452 MHz // 461-462 MHz. Telkom's current deployed PTP links are indicated in the figure below. The majority of these links are in rural areas.

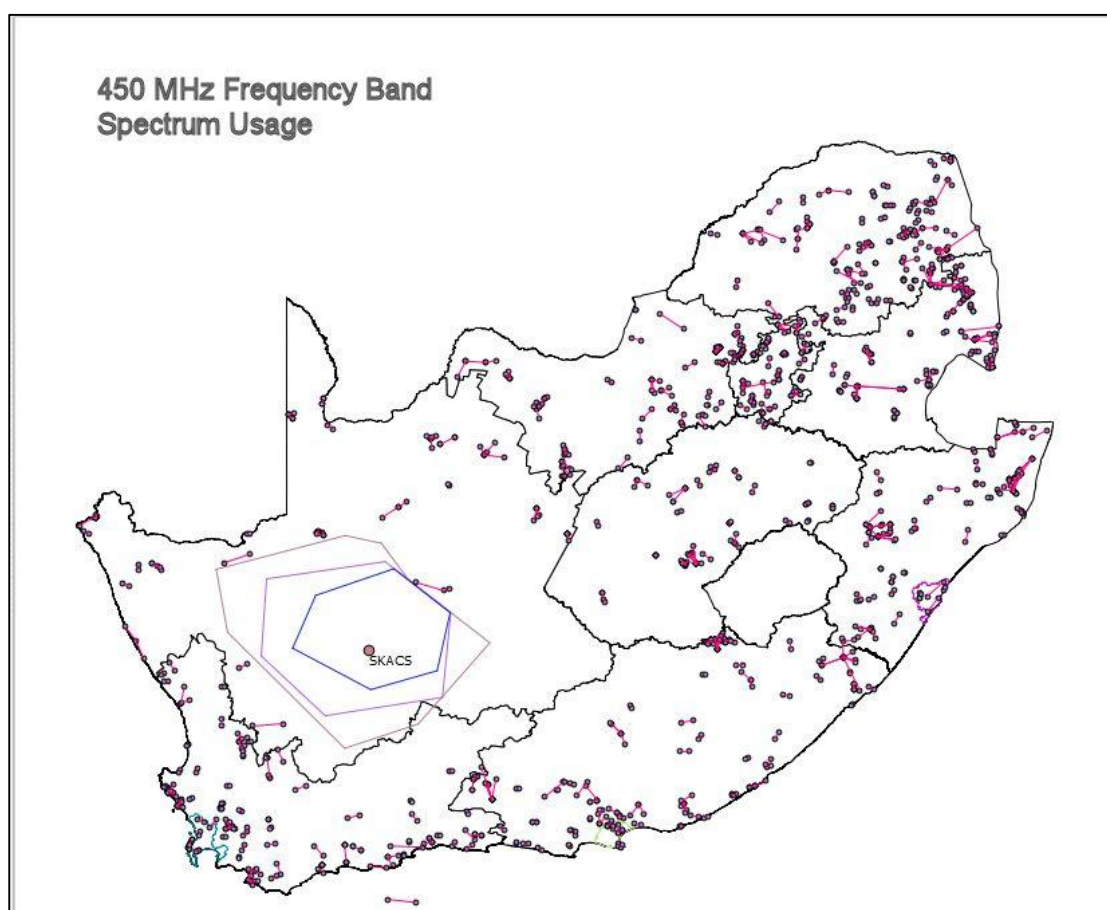


Figure 1: Telkom's deployed 450 MHz PTP links

Whereas Telkom supports the future use of the 450 MHz band for IMT, it must be stressed that the migration of incumbent services, including Telkom's PTP links, will be expensive and time consuming. Although these PTP links are analogue, there is no direct and cost effective replacement immediately available. Access to IMT spectrum

below 1 GHz will greatly assist in the replacement of these services due to the better coverage as compared to Telkom's current IMT spectrum assignments.

Swiftnet have also been assigned 17x12.5 kHz non-contiguous channels in ~452 MHz range (paired with 462 MHz). This has not been addressed in the draft IMT Roadmap.

A further concern for Telkom is the migration of the PMR/PAMR users in this band, which we understood to be several thousands and deployed nationally. These are individually licensed users and operates within the bands 456.65-460.00 // 466.65-470.00 MHz according to Figure 12 of the draft IMT Roadmap. The migration of these users are seemingly not addressed in the draft IMT Roadmap. This need to be addressed as it may have a huge impact on the success of implementing IMT in this band.

2.1.6 The Authority invites industry views on the migration time line.

The migration of Telkom's PTP links will come at a significant cost to Telkom, making migration under the current economic conditions very challenging. A detailed assessment of the total cost to migrate has not yet been done. Notwithstanding these very real and significant barriers, Telkom supports the eventual migration of its legacy PTP links from this band.

The proposed migration time frame between 2016 and 2020 (according to section 9.2 of the draft IMT Roadmap) seems reasonable although this will depend on the availability of suitable alternatives and funding. As discussed in response to question 2.1.7 below, the proposed designation bands are not necessarily viable for PTP links.

It is also noted that, according to section 9.2, the Phase 1 target is to migrate more than 80% of rural-used licenses from this band by 2018 (starting in 2016). This is a concern and Telkom will definitely require sub-1 GHz spectrum to meet this requirement. As noted in Telkom's response to question 2.1.5, most of these PTP links are within rural areas.

2.1.7 The Authority invites industry views on destination bands.

With regard to the migration of "other licensees" the Authority is proposing the bands 403-406 MHz (unpaired), 426-430 MHz (unpaired) and 440-450 MHz (paired and unpaired) as designation bands. Although not clear, it is assumed that the Authority is proposing that Telkom should migrate to the band 440-450 MHz, which is the only band for paired systems. It should be noted that this band is not an internationally harmonised band for PTP duplex links and may therefore be unsuited for such migration. It is not even clear how the duplex arrangement will fit in this band. The use of this frequency band for PTP links needs further assessment. Migration of PTP links

will have to be considered on a link-by-link basis since there is not necessarily a one-size-fits-all solution for all links (e.g. VSAT may be the better solution in some cases).

With regard to safety and security services, Telkom recommends the consideration of the identified PPDR frequency bands as discussed in response to question 2.1.2 above.

2.1.8 The Authority invites industry to give any other inputs that must be taken into consideration when finalising plans for the IMT 450 band

No further inputs.

2.2 IMT700

2.2.1 The Authority invites industry views on Option 1 (ITU Region 3).

The APT channel plan of 2x45 MHz (3GPP Band 28) has been widely accepted globally (in particular Region 3 and some Latin American countries) and is therefore predicted to result in a formidable technology ecosystem. The 800 MHz band (3GPP Band 20) on the other hand has already been widely deployed in Region 1 and therefore already supports a mature technology ecosystem. This band currently constitutes the third most widely adopted band for LTE globally and therefore needs to be considered as a key band for South Africa. A good mix of 700 MHz and 800 MHz is therefore considered to be more suitable for South Africa. Option 1 is considered to be less optimal for South Africa compared to Option 2, and is not supported.

Option 1 provides only 15 MHz in 800 MHz (or 2x18 MHz with additional 3 MHz restricted use). In order to benefit from spectral efficiencies of LTE, it is recommended that assignments must be in 5 MHz blocks and not be less than 10 MHz (although 20 MHz is preferred where possible) in order to fully benefit from LTE efficiencies. This means that only one operator could be accommodated in the 800 MHz band (having 15 MHz or 18 MHz). Having 30 MHz in both 700 MHz and 800 MHz is therefore preferred as it provides more flexibility in assigning spectrum in blocks of 10 MHz in both bands.

Option 1 furthermore also provides less spectrum overall compared to Options 2 and 3, if the use of the gap channel in 700 MHz is considered. The unused portion between 831-845 MHz (see Figure 15) will probably remain unused as there is no TDD or other plan for the use of this non-harmonised portion.

Option 1 is considered better suited to those countries who have widely deployed systems in the 850 MHz band (3GPP Band 5), which is not the case in South Africa.

2.2.2 The Authority invites industry views on Option 2 (ITU Region 1).

Option 2 (2x30 MHz in 700 MHz and 2x30 MHz in 800 MHz) is considered as the optimal configuration for South Africa and is supported, with the exception of the use of the centre gap, as discussed below. Although the channel plan for 700 MHz for Region 1 has not been concluded within WP5D, the adoption of 2x30 MHz (in line with lower duplexer of Band 28) as basis for Region 1 is receiving wide support. This was also confirmed in a Liaison Statement from WP5D to JTG4-5-6-7 (Document JTG4-5-6-7/595). It is therefore considered appropriate to adopt the 2x30 MHz option for South Africa. This position is also in line with the position of SADC, ATU and Europe and is expected to be adopted by ITU-R (and included in ITU-R M.1036).

The decision regarding the use of the centre gap (i.e. 733 MHz to 758 MHz) should however be delayed. The use of the centre gap is currently being discussed in WP5D but no conclusion has yet been reached (JTG4-5-6-7/595). Apart from the TDD option as proposed, WP5D is also considering the implementation of SDL (supplementary down link). Other options may also emerge as part of the WP5D discussions and it is therefore important for South Africa to have the flexibility to consider these alternatives in future to ensure the best possible solution for South Africa (in terms of harmonised use, spectral efficiency, guard bands, etc.).

The draft IMT Roadmap recommends the use of TDD in the centre gap of the 700 MHz band seemingly based primarily on the indication that China may consider TDD for this band. Nevertheless, the technology ecosystem for 700 MHz TDD (3GPP Band 44) remains extremely uncertain and should be considered premature at this stage. The 700 MHz band will not be used in China before 2020 due to pending DTT migration. It is also noted that not all operators in China are supporting 700 MHz TDD; for example, China Telecom has been awarded an FDD trial licence. China Unicom is seemingly also supporting FD-LTE in this band. There are also Region 3 countries outside China who favours the adoption of SDL. As such, proposing a configuration at this stage could potentially align South Africa with a marginalised ecosystem.

2.2.3 The Authority invites industry views on Option 3 (ITU Region 1).

The assignment of the bands 733-736 MHz // 788-791 MHz is not supported for the same reasons that TDD in 700 MHz is not proposed at this stage. This 2x3 MHz is one of the various options being considered by WP5D in addition to the base line 2x30 MHz (see JTG4-5-6-7/595).

The implementation of only 2x3 MHz from the upper duplexer of Band 28 for IMT is also not that evident and needs careful consideration. Although all IMT instruments (end user devices including handsets) will probably be fitted with both lower and upper duplexers regardless of the region of operation, base stations will have to be equipped

with extra radio equipment to enable the operation of this extra 2x3 MHz, which could be very costly.

2.2.4 The Authority invites industry views on 2x3 MHz IMT band of ITU Region 1 solution.

The adoption of 2x3 MHz in the 700 MHz band (i.e. 733-736 MHz // 788-791 MHz) has been addressed in Telkom's response to question 2.2.3.

The adoption of the 2x3 MHz in the 800 MHz band (i.e. 803-806 MHz // 844-847 MHz) is not supported as this could only be implemented under Option 1, which is not supported.

2.2.5 The Authority invites industry views on other ITU Region 1 based suggestions.

No further input.

2.3 IMT750

2.3.1 The Authority invites industry views on IMT unpaired spectrum in the coverage band of 750 MHz.

The use of the centre gap in the 700 MHz band (i.e. IMT750) has been addressed in response to question 2.2.2.

2.4 IMT800

2.4.1 The Authority invites industry views on Option 1 (ITU Region 3).

This question has been addressed in response to question 2.2.1.

2.4.2 The Authority invites industry views on the 2x3 MHz IMT band of Option 1 (ITU Region 3).

This question has been addressed in response to question 2.2.4.

2.4.3 The Authority invites industry views on Option 2 and 3 (ITU Region 1)

This question has been addressed in response to questions 2.2.2 (Option 2) and 2.2.3 (Option 3).

2.5 IMT850

2.5.1 The Authority invites industry views on the migration of incumbents (Neotel, etc.) out of the band.

It is understood that Neotel is not migrating “out of the band” as indicated in the question but rather migrating “within the band”; i.e. shifting downward by 3 MHz while staying within 3GPP Band 5.

The Authority's proposal to move Neotel's assignment in Band 5 downward by 3 MHz seems reasonable and could be supported subject to ensuring compatibility with systems in the adjacent bands.

The Authority addressed the sharing between Neotel and GSM-R at the top end of the band. Telkom recommends that the Authority also considers the sharing with IMT800 at the lower edge of Neotel's proposed new assignment. If Neotel moves down to 824-829 MHz there is only a 3 MHz guardband with IMT800 ending at 821 MHz. This may be sufficient when LTE is deployed in both 800 MHz and 850 MHz but interference may be an issue between IMT operating in the 800 MHz band and CDMA-2000 operating in the 850 MHz band. This needs further consideration.

2.6 GSM900 spectrum consolidation

2.6.1 The Authority invites industry views on spectrum consolidation.

Telkom supports the principle of consolidation within this very important IMT band as it will improve overall spectrum efficiency in the use of the band. Consolidation will also create equal opportunities for all three incumbent operators in the band to deploy advanced services, in particular LTE, which can benefit from contiguous assignments to all licensees. Creating contiguous spectrum blocks of sufficient size will allow the incumbents to refarm their respective assignments to deploy advanced systems such as LTE, if and when required.

Assignments in blocks of 5 MHz is standard practice with regard to 3G/4G services. The adoption of Scenario 3 with 10 MHz assignments is therefore supported, especially for the long term. Although the current licensees in the band may prefer, for example, Option 1 where 10 MHz could be used for 3G/4G and the remaining 1.6 MHz for GSM, this is not the optimal long term solution. When GSM services are terminated in the future, the additional 1.6 MHz will potentially remain unused and wasted. Considering the cost involved in re-farming the band, and with a long term view in mind using this band for 3G/4G services, Telkom supports assignments in blocks of 5 MHz (i.e. Scenario 3 is preferred). The benefit of having larger contiguous spectrum could possible offset the slight reduction in assignment (i.e. 1.6 MHz per licensee).

The further advantage of Scenario 3 is that the additional 5 MHz could be assigned either as a whole or subdivided into smaller parts on a temporary basis until GSM switch-off, after which the complete 5 MHz could be assigned to another operator.

2.6.2 The Authority invites industry views on guard bands.

The decision between the three scenarios depends largely on the need for guard bands to protect GSM-R services, protection internally between the 900 MHz assignments and to protect services above 915 MHz. In principle Telkom agrees that there should be no guard bands between the IMT assignments where 3G/4G is deployed as this is wasteful. In other bands, such as 2100 MHz, there are no guard bands between IMT licensees and this is acceptable.

Telkom supports Scenario 3 (as it is the best long term solution) and therefore does not support guard bands in the band. The guard band between Cell-C (having an assignment in the lower portion of the 900 MHz band) and GSM-R will only be required if Cell-C deploys GSM at the bottom end of the band. If Cell-C deploys 3G/4G services, a guard band will probably not be required. This is due to the frequency re-use of 1:7 of GSM systems with narrow channels (200 kHz) whereas 3G/4G technologies have a frequency re-use of 1:1, and also a much lower spectral density due to the wider channels. If a guard band between GSM-R and Cell-C is required, then it makes sense to provide such guard band in the plan to ensure that Cell-C does not need to sacrifice some of its assignment to ensure protection of GSM-R services. The option to provide a guard band from the GSM-R assignment should also not be excluded.

Scenario 2 is not supported as the proposed guard bands are only relevant in the interim while GSM services are still deployed. In the long term with 3G/4G services deployed these guard bands will be redundant. The guard band at the top of the band is also not supported. Depending on the services deployed above 915 MHz, a guard band, if indeed required, should be implemented above 915 MHz, considering the importance and value of the 900 MHz frequency band.

2.6.3 The Authority invites industry views on the time line of spectrum consolidation, i.e. when it should be done.

Current licensed operators will be best positioned to comment on this but it is Telkom's view that frequency re-planning should not take longer than 12 months. It is in any event beneficial for incumbents to have the migration time line as short as possible to ensure minimum impact on existing services during the transition phase. The Authority's proposal of 2 years seems very accommodating.

2.6.4 The Authority invites industry views on demand for IMT migration of 5 MHz taking into consideration the spectrum for IMT available in the 700 and 800 MHz bands.

Different operators may have different strategies for using this band in terms of IMT technology of choice, time line for implementation and area of deployment. It is well known however that licensees in this band have already re-farmed their respective assignments to deploy IMT utilising at least 5 MHz. The remainder of the assignments are continued to be used for GSM. Although the question assumes that holders of 900 MHz will obtain spectrum in 700 MHz and/or 800 MHz, the optimal efficiency in each IMT band should be ensured. Therefore, notwithstanding the availability of IMT spectrum in the 700 MHz and 800 MHz bands, the re-farming of the 900 MHz band towards IMT is very important and supported.

Telkom is currently the only national mobile network provider without access to sub 1 GHz spectrum. Considering the need for higher broadband throughputs, it is preferable to have larger spectrum assignments, a minimum of at least 10 MHz, Telkom therefore prefers access to either the 700 MHz or the 800 MHz bands considering that the proposed re-farming in 900 MHz will make available a maximum of 2x5 MHz. Nevertheless, depending on the availability of 700/800 MHz, conditions attached to these bands, spectrum price (including the possibility to acquire via auction), etc., Telkom may need access to the 900 MHz band, even if only 5 MHz (as last resort).

2.6.5 The Authority invites industry views on need-based differentiated spectrum assignments in the 880-915 MHz (paired with 935-960 MHz).

It is assumed that this question relates to proposed Scenario 3 and specifically the awarding of the 5 MHz that will become available post re-farming. The administrative overhead and possible legal challenges to assign spectrum on a need-basis should not be underestimated. In the best interest of the Regulator, operators and consumers, need-based differentiation is not supported. Telkom recommends that the existing procedures as contained in the Radio Frequency Spectrum Regulations be used to award this 5 MHz, either as a whole or subdivided into smaller parts on a temporary basis until GSM switch-off. Since this is high demand spectrum, an ITA (Invitation to Apply) will be appropriate.

2.6.6 The Authority invites industry views on demand for IMT migration of 10 MHz, taking into consideration the new spectrum for IMT in 700 MHz and 800 MHz.

Telkom's comments made in response to question 2.6.1 regarding assignment in 5 MHz blocks as well as the response to question 2.6.4 refer.

Only Vodacom currently has a contiguous assignment of minimum 10 MHz in the 900 MHz band. All three incumbents should be allowed equal rights to use any IMT technology in this (and any other) band, which will only be possible after successful completion of the proposed re-farming. Although all three licensees can re-farm their respective spectrum holdings to deploy at least one 5 MHz carrier, the proposed re-farming will allow deployment of at least two carriers of 5 MHz, which is more efficient use of the spectrum and therefore supported as the long term solution. By implementing the proposed re-farming, the most flexible option will be available to all three currently licensed operators.

The flexibility offered to operators after successful completion of re-farming to deploy any IMT technology of choice is one of the main drivers for the proposed re-farming. It is however noted that by limiting assignments to only 10 MHz (as per Scenario 3), could put a constraint on operators using a combination of 3G/4G and GSM (at least 5 MHz should be used for GSM). It is anticipated that most operators will continue to support a mix of GSM and UMTS in this band for several years. Allowing slightly more than 2x10 MHz (Option 1 for example is 2x11.6 MHz) allows more flexibility in this regard, at least in the interim. Nevertheless, in the long term, the use of either 11.6 MHz or 11.4 MHz as per Scenarios 1 and 2 respectively, is not optimal. The extra 5 MHz in Scenario 3 could potentially be used, on an interim basis, for deployment of GSM services, as needed.

2.7 IMT2300 unpaired spectrum TDD

2.7.1 The Authority invites industry views on usage of 2380-2400 MHz.

The band 2300-2400 MHz (3GPP Band 44) has been identified as IMT and is also supported in both SADC and South Africa. The use of the band 2380-2400 MHz for IMT is therefore supported but subject to the provision of a required upper-guard band to ensure protection between IMT systems operating in the 2.3 GHz band and systems operating above 2.4 GHz, in particular, Wi-Fi.

According to ECC Report 172⁸, TDD LTE operating adjacent to WLAN (operating in the ISM band) will cause a degradation in average bit rate. A minimum of 10 MHz upper-guard band is therefore recommended to separate TDD LTE in this band from WLAN systems operating in the adjacent ISM band. This is especially required when an LTE TDD UE (example a desktop router) is equipped also with a Wi-Fi AP (Access Point) to distribute the service in-building on a private WLAN. Based on Figure 32 in the draft IMT Roadmap, countries such as Hong Kong and South Korea have also adopted a 10 MHz upper-guard band at the top end of the 2.3 GHz band.

⁸ Broadband Wireless Systems Usage in 2300-2400 MHz

The sharing between TDD assignments within the band is being discussed within WP5D. Although the use of synchronised networks is preferred to ensure maximum efficiency in spectrum use, this is not always possible as operators can use different uplink/downlink configurations. Operators also need flexibility to change network configuration over time if needed based on market requirements. This could also become more relevant with the use of Carrier Aggregation (CA). Since the WP5D studies are not complete (see Document ITU-R WP5D/726; Chairman's Report to previous WP5D meeting, Chapter 4, section 4.6), it is premature to decide on the size of the required intra-guard band. It is also noted that these studies are considering mainly mobile deployments whereas Telkom is currently deploying mostly fixed systems. It is expected that a minimum of 5 MHz between two unsynchronised TDD assignments will be required, although it is possible that this may increase to 10 MHz. The option to use the intra-guard band on a restricted basis could also be considered. The need for a minimum of 5 MHz intra-guard band between unsynchronised TDD networks is also supported in ECC Report 131⁹, albeit for the 2.6 GHz band.

An assignment to SMMT immediately adjacent to Telkom's assignment can therefore not be supported. Furthermore, it is Telkom's understanding, based on information obtained previously from the Authority while resolving interference issues between SMMT and Telkom's TDMA PTMP networks that this assignment was on a temporary basis and confined regionally to parts of Gauteng only. It was also indicated that SMMT have migrated their networks to frequencies above 2400 MHz. If an assignment is to be made to SMMT this should be done above the proposed 10 MHz intra-guard band.

With 90 MHz of usable bandwidth left in the band (assuming the 10 MHz upper-guard band at the top end of the band), and with Telkom and SMMT already occupying 80 MHz (assuming that an assignment to SMMT was indeed made), it is recommended not to attempt to introduce WBS in this band. The remaining 10 MHz should rather be used as an intra-guard band between Telkom and SMMT (if assigned). Having an intra-guard band is also in accordance with China Telecom findings in the GTI (Global TDD Initiative) white paper¹⁰. This will allow the two networks to operate at different Uplink/Downlink (UL/DL) ratios should it be required.

Guard band implementation instead of synchronisation in this band is recommended due to:

- Only two assignments supported in this band, therefore only one intra-guard band is required and is not inefficient use of spectrum (unlike for example where five or more operators are assigned adjacent spectrum requiring four or more intra-guard bands);

⁹ Derivation of a block edge mask (BEM) for terminal stations in the 2.6 GHz frequency band (2500-2690 MHz)

¹⁰ GTI - TDD Spectrum White Paper (Version 2.0)

- The deployment by Telkom is already large and possible changes to the synchronisation of this network will impact on a large customer base.

Based on the above, Telkom proposes the following for the 2.3 GHz band:

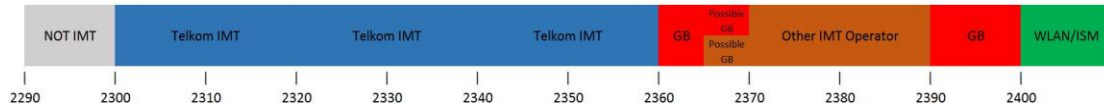


Figure 2: Telkom's proposed layout of the 2.3 GHz band

Apart from the IMT assignment in 2300-2360 MHz, the bands 2307-2387 MHz // 2401-2481 MHz has been assigned to Telkom for PTMP TDMA systems. This band has been used since 1991 and many networks remain in operation nationally (see figure 3 below). The deployment of IMT in this band, in particular the portion 2360-2400 MHz, will be difficult because of these existing PTMP TDMA systems. Migration of these systems is ongoing but will take several years to be completed and has many challenges, in particular finding suitable and cost effective alternatives for the rural deployments. A spectrum assignment for IMT below 1 GHz will greatly speed-up the migration of these 2.4 GHz TDMA legacy systems in that Telkom will have a suitable alternative band and technology to migrate customers to (as well as other legacy technologies). Telkom migrated PTMP TDMA customers operating in the band 2300-2360 MHz in areas where LTE was deployed and in many cases these customers are now operating in the upper part of the band i.e. above 2360 MHz. The current deployed PTMP TDMA networks are indicated in the figure below.

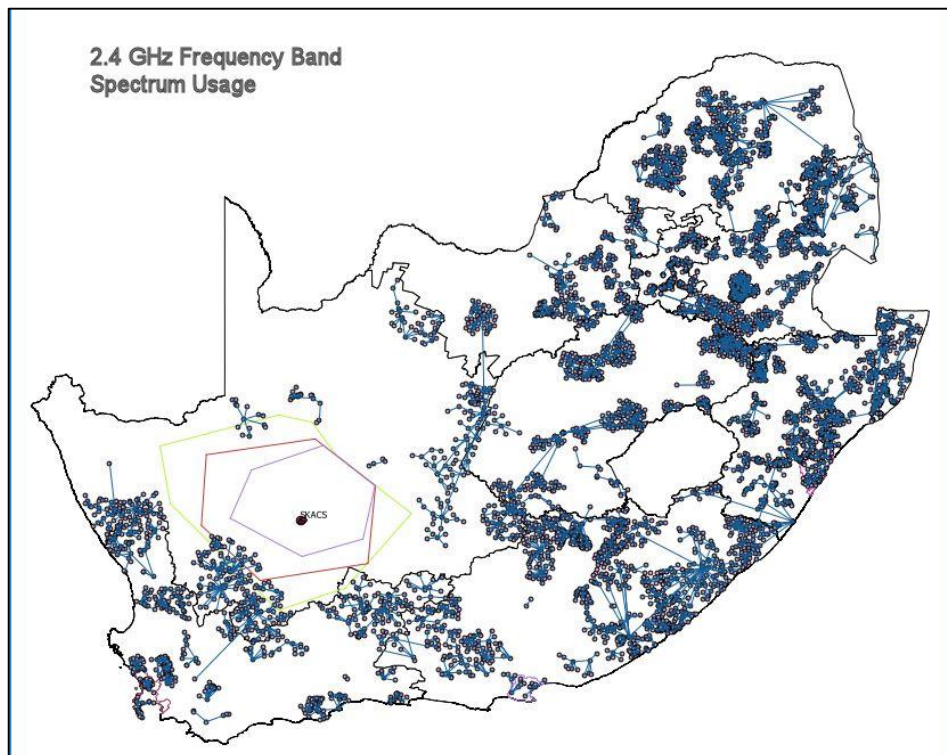


Figure 3: Telkom deployed PTMP TDMA networks

The Radio Frequency Migration Plan also notes that a feasibility study should still be carried out for this band (see Table 28 of draft IMT Roadmap). Assigning spectrum to either SMMT or WBS (or any other licensee) in this band will therefore not be possible in the short term. Sub-1 GHz spectrum will assist Telkom in migrating these legacy systems, a point raised also for other Telkom migrations. According to the draft IMT Roadmap, it seems that the Authority does not intend to develop a RFSAP for this band at this stage. Telkom supports this as it is also in line with our recommendations.

2.7.2 The Authority invites industry views on usage of 2290-2300 MHz for IMT.

The use of the band 2290 – 2300 MHz for IMT is not supported. This band is not part of 3GPP Band 40, which is limited to 2300 – 2400 MHz. The band 2290 – 2300 MHz is therefore not a standard harmonised IMT band, and also has not been identified for IMT by the ITU. There is no interest globally to support IMT in this band and as such there is no supporting technology ecosystem for this band. These issues are also highlighted in the draft IMT Roadmap. Extending the 2.3 GHz band to 2290 MHz for IMT is also not part of the proposed new IMT frequency bands to be considered under WRC-15 Agenda Item 1.1. It is strongly recommended that the Authority adopts global standardised channel plans for all IMT bands to ensure that South Africa can benefit from the economies of scale of a globally embraced technology ecosystem and also ensure that networks deployed in South Africa are enabled to support global roaming.

International trends indicate that the current 10 MHz separation between 2300 MHz LTE and earth station satellite receivers (for both Earth Exploration Satellite Service and Space Research) operating below 2290 MHz is feasible with a 3-7 km separation distance (See ECC Report 172). Moving LTE below 2300 MHz could therefore create interference with services operating below 2290 MHz.

The consideration of using the band 2290-2300 MHz for BFWA is also not an option as it is too little spectrum to sustain BWA/BFWA. Telkom also agrees with the draft IMT Roadmap that interference migration will have to be considered to ensure protection of LTE operating above 2.3 GHz.

Based on the above, Telkom recommends that the band 2290 – 2300 MHz not be used for IMT or BFWA.

2.8 IMT2600 paired FDD spectrum**2.8.1 The Authority invites industry views on demand in the IMT2600 FDD band.**

The IMT2600 FDD band (3GPP Band 7) is well developed and mature with more than 740 devices available today operating in this band. When adopting Option C1, the

centre gap TDD (3GPP Band 38) mode is also well supported with 360 devices available. This band is a key band for deployment of LTE and demand for it will therefore be high.

2.8.2 The Authority invites industry views on the migration of the incumbent (WBS), into 2380-2400MHz.

This proposal is not supported as indicated in Telkom's response to question 2.7.1.

2.8.3 The Authority invites industry views in-band migration of the incumbent (WBS), into IMT2600 unpaired spectrum.

The in-band migration of WBS to the TDD portion of the 2600 MHz band (3GPP Band 38) is supported as it is seen as the most viable solution.

Since Band 38 has only 50 MHz and because the guard bands for protection of FDD must come from the TTD portion, Telkom supports the Authority's view to have no intra-guard bands in Band 38 and make synchronisation between networks mandatory. As this band is not yet used the implementation of synchronised networks could be enforced. The possible use of BEMs in this band could also be investigated.

In order to ensure maximum efficiencies in Band 38, it is recommended that assignments in this band be in increments of 20 MHz, which will provide for two assignments in this band.

2.8.4 The Authority invites industry views on alternative destination bands for the incumbent (WBS).

The 2.6 GHz band is a very important LTE band as also acknowledged in the draft IMT Roadmap and its use should therefore be optimised. Depending on the deployment strategy of WBS (area to provide services) an assignment under the proposed Spectrum Park Model could also be considered. It is therefore possible that WBS be assigned spectrum in the 3.5 GHz band.

2.9 IMT2600 unpaired TDD spectrum

2.9.1 The Authority invites industry views on demand in IMT2600 TDD band.

See Telkom's response to question 2.8.1.

2.10 IMT3500 unpaired TDD spectrum**2.10.1 The Authority invites industry views on migration out of 3400-3600 MHz from FDD usage to TDD.**

With international support concentrated on 3GPP Band 42 (TDD) rather than Band 22 (FDD), the proposal to assign the band 3400 – 3600 MHz to TDD is supported. Although device availability in this band is still very low (24 devices), this can be attributed to the infant use of the band but is expected to grow with the announced support from countries including Canada, UK, Belgium and China. In Europe, based on ECC/DEC/(11)06¹¹ (as amended March 2014), the band 3400-3600 MHz is also supported for TDD (although FDD is also an option). The adoption of TDD in the 3.5 GHz band will require the necessary amendments to the National Radio Frequency Plan, 2013.

2.10.2 The Authority invites industry views on status and time line.

As a current user of this band for FDD FWA (WiMAX), Telkom would require an estimated two years for migrating this FDD assignment, but is welcoming the proposal and is willing to assist the Authority in drafting a detailed migration plan. A spectrum assignment for IMT below 1 GHz will greatly speed-up the migration of some of the 3.5 GHz FDD FWA systems.

2.10.3 The Authority invites industry views on interest in TDD downlink focused spectrum.

Questions 2.10.3 and 2.10.4 alludes to the implementation of synchronised TDD assignments within 3.5 GHz band as there are no guard bands between the 10 MHz blocks. Since most operators interested in this band is for an IMT capacity layer, and considering the vast amount of spectrum available in this band, more than 20 MHz assignment per operator should be considered (preferably 40 MHz). Although synchronised networks are preferable, it may be very difficult to ensure the use of compatible frame structures due to different operator business requirements. Telkom therefore recommends that unsynchronised networks be allowed in this band. Telkom also recommends that the proposed BEMs as proposed in ECC/DEC/(11)06, be adopted for South Africa. With sufficiently large assignments, adjacent operators could implement restrictive use to ensure compliance to the proposed BEMs.

¹¹ Harmonised frequency arrangements for mobile/fixed communications networks (MFCN) operating in the bands 3400-3600 MHz and 3600-3800 MHz

The proposed split in the TDD assignments for downlink and uplink focussed use as proposed is not supported. Although the principle is maybe noble, it is very difficult, if not impossible, to predict the market outcome with regard to the need for uplink or downlink focused requirements. Business requirements of operators may also evolve over time, which will create problems accordingly. Splitting the band between uplink and downlink focussed assignments is also not service neutral and goes against one of the key principles of assigning spectrum. Telkom recommends that spectrum blocks be assigned (on a service neutral basis) and then operators could decide the configuration of their networks based on the evolving business requirements.

2.10.4 The Authority invites industry views on interest in TDD uplink focused spectrum.

This proposal is not supported; see Telkom's response to question 2.10.3.

2.10.5 The Authority invites industry views on interest in the introduction of a Managed Spectrum Park.

It is noted that MSP models have been adopted in countries such as New Zealand in the 2.6 GHz band. MSP model works on the basis of assigning a common band to a number of users on a self-management basis. In theory this model encourages efficient spectrum usage and allows for more innovation and flexibility, although details about MSP is still lacking. With seemingly low adoption globally and a lack of detail within the draft IMT Roadmap, a MSP model does require deeper investigation and analysis. The principle is nevertheless supported, in particular in the higher frequency bands which allows for better frequency coordination because of the higher propagation losses.

In paragraph 8.10.4 of the draft IMT Roadmap it is proposed that the 20 MHz guard band (also considered for MSP) be considered for the introduction of DECT indoors. It is presumed that this proposal refers to DECT cordless telephones (DECT WLL will be migrated to alternative technologies in future), which currently operates in the band 1880-1900 MHz. This proposal is not supported at this stage as the 3.5 GHz band is not a standardised band for DECT cordless telephones.

2.11 Operators opinion on one TDD-operator instead of every operator having parts of TDD spectrum

2.11.1 The Authority invites industry views on the TDD spectrum bundling of IMT450, IMT750 and IMT2600 and assignment to one (wholesale) operator.

Telkom would advise that to the extent that spectrum bands are considered collectively, that the grouping should not be arbitrary, a collection of left overs –

however instead one must have reference to those bands which are candidates for inter-band carrier aggregation either explicitly in the 3GPP roadmaps; or as can reasonably be predicated by looking at markets.

We also note that overall the bandwidth available in the three bands are limited, in particular the 450 MHz and 750 MHz bands (each only 15 MHz). Providers (wholesale or retail) with sub-market speeds will battle to compete effectively in the market. We note that SA Connect in particular is targeting 100 Mbps per user.

If we consider the bands individually the following is noted:

- The 450 MHz TDD and 750 MHz TDD bands have not yet achieved a suitable technology ecosystem.
- The use of the 450 MHz band is very dependent on the successful migration of incumbent services, which will take many years to complete (finally completed in 2022 based on draft IMT Roadmap). It is also not clear if TDD will be the winner in this band.
- With the 750 MHz band it was indicated that the use of this band has not yet been decided internationally and it may be possible that SDL (which is FDD) could be adopted for this band. Availability of this band also depends on successful completion of DTT migration.
- Overall it could be several years before the 450 MHz and 750 MHz bands could be used.

Although in theory these bands could be assigned to a single operator – such a spectrum combination is likely to doom that operator to operational uncertainties and sub-par performance. Telkom therefore would not recommend this course of action. It is also not clear if the single operator will be an existing operator or a green field operator; Telkom is of the view that a 5th or 6th national mobile operator is financially non-viable.

On the matter of wholesale, it is not clear to Telkom if this implies “exclusively wholesale” or “wholesale with retail also permitted”. On the former, we note that internationally the business case for providing wholesale services have not yet been proven. Furthermore, in South Africa such an operator would have to compete with the other vertically integrated mobile operators.

Telkom is of the view that a more practical approach to achieve a single wholesale open access network is for spectrum to be assigned to multiple operators, however in uneconomical areas these operators be allowed to pool their spectrum into a Multi-operator RAN sharing network.

Hence in conclusion, Telkom does not support the proposal for the aforementioned reasons.

2.11.2 The Authority invites industry views on the operator interest in individual IMT3500 assignments per operator or in one assignment to one (wholesale) operator.

As per Telkom's response to question 2.11.1, individual assignments and a wholesale operator option are not mutually exclusive. In fact 3.5 GHz is a good example of a band which would probably see a handful of operators providing services in urban areas, or perhaps using fixed deployments to provide services to businesses in rural areas; however outside of these areas the spectrum would lie fallow.

Presuming there is a single or collection of operators who provide the mobile wholesale open access network as envisaged in SA Connect, that consortium could likely operate in rural towns or settlements where other commercial operators with 3.5 GHz would not be present. It would be wasteful to deny the consortium access to 3.5 GHz in those instances.

Hence Telkom considers there to be two possible approaches that maximize the efficient use of this band:

- In the case of 3.5 GHz being assigned nationally to operators, then the mobile WOAN consortium, liaising with ICASA, should have the right to sublet that spectrum in areas outside the declared scope of the consortium.
- Alternatively 3.5 GHz can be assigned on a metro-by-metro basis for commercial operations with a "rest of the country" assignment to the mobile WOAN SPV.

Telkom furthermore does not support the single operator model in this band for the following:

- Considering the amount of spectrum available in the 3.5 GHz band (200 MHz) and that this band will be used as a capacity layer to provide network capacity as and when required, it cannot be assigned to one provider to deploy.
- This is currently the highest IMT band available (cells are very limited in size) and it is very unlikely that it can be used on its own to support a viable business case, including the option of wholesale (assuming that other bands are not part of this assignment).
- As this is not a coverage band, deployments will generally be capacity driven (high capacity gap fillers) and it is not clear if a single operator will be able to cope with national demand for deployment from many users.
- This band could also play a role in small cell deployments, which will be implemented more easily in-house than to depend on a wholesale provider to deploy as and when required. The business case of a wholesale provider operator in this band only, is not proven.

Telkom therefore supports the multiple operator model where the band (in large blocks of minimum 20 MHz) is assigned to individual operators. It should also be noted that

WRC-15 will consider extending this band to 3600-3800 MHz for IMT (as was already done in Europe), bringing an additional 200 MHz to the market.

2.12 Universal service obligations for lower frequency bands (sub-1GHz)

2.12.1 The Authority invites industry views on universal service obligations for lower frequency bands (sub-1GHz).

The need to provide broadband services to rural areas or traditionally underserved areas nationally is recognised by Telkom. It is also important for the Authority to take due cognisance of the major challenges (theft, vandalism and operational costs to remote areas) faced by all operators in successfully delivering such services to rural areas. It is critical that it not only be possible to establish services in rural areas but also that such services be a sustainable operation. In order to improve the feasibility of rural service delivery the number of facility providers in these areas should be limited, which will enable the consolidation of network rollout infrastructure costs. The use of satellite services will also play a pivotal role in service delivery to certain rural areas as the use of the terrestrial radio access networks will not always be feasible.

Telkom supports the assignment of spectrum classified as capacity bands separately from coverage bands rather than as a “package”. Separate assignments will enable flexibility for operators to apply for spectrum that complements their current holdings and avoid an unrequired mandatory assignment.

Obligations attached with spectrum assignments should be applied equally for all operators; although the Authority should also consider the possibility of operators to meet the obligations collectively in some areas (e.g. commercially less viable areas) through a multi-operator RAN arrangement (e.g. as per Sweden where four operators were awarded 3G licences to cover 99.8% of the population, however with no more than 70% of the network shared).

The proposed coverage obligations are vague with too much room for interpretation. It is also unclear how these obligations interlink with the SA Connect initiative (no real relation between speed and coverage requirements). The Authority may actually be best advised not to formulate a final view on all this until finalisation of the SA National Broadband Plan.

Telkom notes that a number of demographic criteria is used to specify those areas to which obligations apply. However, the history on community service telephones in suggests that a “criteria” approach is prone to disagreements. Instead it would be preferred if the Authority, working in conjunction with all other agencies tasked with Universal Service in South Africa i.e. USAASA and CSIR (obo the DTPS), name and geographically demarcate (with reference to the Stats SA PD codes) the set of areas that constitute obligations attached to spectrum. Telkom further submits that this list, and list of underserviced areas defined by the Authority, should be the same. Telkom

also notes that the amended EC Act requires the Authority to publish such a list every two years; however, if such a list is not used in conjunction with spectrum obligations, the purpose of such list is not clear.

In the event that the Authority does proceed along the current path, Telkom would recommend that the coverage objectives be defined more precise to avoid misunderstanding at a later stage, with specific mention to:

- *“All areas with at least x inhabitants”* – The size of this “area” should be defined. For example: “Any cluster of users where there are more than 100 but less than 1000 users per square kilometre”; “Users” should still be defined.
- The reference to “inhabitants” are also unclear. If the intention is to include scholars and adults as possible broadband users, this should be stated. Inhabitants include infants and toddlers as well, which should not count towards broadband users.
- *“All roads and railways within a 10km belt”* – It is assumed that this 10km belt is around the cluster of users where coverage was required although it is not explicit. “Roads” should be defined as this may include national, regional, district dirt or even private roads.
- *“Smaller centres with less than 100 inhabitants”* – This requirement should also have a lower limit. As-is, this requirement will require coverage even for a single inhabitant. For example: “Any cluster of users where there are more than 50 but less than 100 users per square kilometre”. “User” should also be defined.
- To ensure all involved parties understand the extent of the coverage required, a detailed list of “tourism areas” to be covered should be provided. A tourism “area” could be very small (for example a waterfall site or a very large area for example the Kruger Park). For large areas the Authority will also have to address the difficulties associated with constructing mobile base stations in areas that are classified as Green Zones (National Environmental Management Protection Act).
- The reference to spectrum assignment size, i.e. 2x5 MHz, under coverage obligations is not clear and it is proposed to either omit these references or alternatively elaborate of its purpose. IMT channel size will have very little impact on coverage, and as long as the operator fulfil the minimum speed required, no spectrum assignment size constraint should be levied.

In general, Telkom supports the idea of coverage obligations with minimum speed required per user. We would recommend however more clear and precise areas to be covered in the form of either a list/database or maps/polygons.

Telkom agrees that the existing IMT coverage bands (i.e. 850 MHz and 900 MHz) should also have coverage obligations. Whereas 850 MHz was added specifically, 900 MHz is however excluded (although the proposed targets are probably already met).

The proposed coverage obligations for 450 MHz is specified in the context of rural broadband delivery (SA Connect). It is not clear what obligation, if any, will apply if this band is used for M2M communications or PPDR.

2.13 Capacity licence obligations for new and existing IMT bands

2.13.1 The Authority invites industry views on licence obligations for new and existing IMT bands, including infrastructure sharing.

The Authority's proposals for capacity obligations does not appear unreasonable in principle, although the Authority has given no indication on how fulfilment of such obligations are to be practically measured and enforced. Further it is difficult to comprehend the value of capacity requirements in the frequency bands that do not have any coverage requirements. Operators may just choose to publish smaller coverage maps in these bands to ensure compliance to capacity obligations. This will not necessarily result in better or even faster broadband to users.

It is Telkom's interpretation that the network operator should first fulfil the coverage obligations (when applicable), and then ensure the required data rate for capacity obligation is the minimum speed experienced by 90% of the users. This is not dedicated bandwidth per user, but rather average user experience during busy hour.

The relation between required capacity and spectrum assignment size should be better defined to indicate scaling for operators with either larger or smaller assignments than the precise assignments in the document.

The reference to infrastructure sharing in this question seems misplaced as it is also not even discussed in the draft IMT Roadmap. Whereas it has been included in the capacity obligation question, it also has a role to play in rural areas under coverage obligations. Infrastructure sharing is more and more adopted by operators and is a means to limit costs. Infrastructure sharing should also be defined as it has many different meanings and can include, amongst others, both passive and active sharing. Telkom supports infrastructure sharing on commercial terms as it can assist in reducing costs.

2.14 Additional input

2.14.1 The Authority requests any other inputs that are deemed necessary and appropriate which should be taken into consideration.

Proposals pertaining to the band 1700 – 2290 MHz

ICASA provided detailed information pertaining to the frequency range 1700-2290 MHz in section 8.7 of the draft IMT Roadmap. No specific questions were asked in Notice 730 of 2014 (Government Gazette No. 37948 dated 27 August 2014) pertaining to this frequency range. This frequency range is also not addressed in the executive summary of Notice 729 of 2014 of the same Gazette. It would therefore

seem that this frequency range is not an immediate priority for the Authority. Telkom trusts that the below comments will assist the Authority in addressing these bands as and when needed.

Telkom agrees that the frequency bands 2025-2110 MHz // 2200-2285 MHz be retained for terrestrial PTP links in accordance with Recommendation ITU-R F.1098, Annex 1, which is also in line with CRASA's decision. The use of this band for BFWA could be an option although further consideration regarding frequency sharing with PTP links will be required; detailed frequency coordination procedures will have to be developed.

Telkom wishes to highlight a few issues with regard to Figure 28:

- a. With regard to the 1800 MHz band (1710-1785 MHz // 1805-1880 MHz, the assignments are indicated as $6 * 2 \times 13$ MHz whereas this should be $6 * 2 \times 12$ MHz (as also indicated in section 8.7.4.1).
- b. Not shown is the use of the IMT1800 band centre gap (i.e. 1785-1805 MHz), which is also IMT spectrum and partly assigned to WBS for TDD BWA. For sake of completeness it is recommended that this assignment also be indicated including the need for guard bands to facilitate sharing between this TDD assignment and the adjacent FDD assignments.
- c. The band 2010-2020 MHz is not assigned to Sentech (should be MTN as also indicated in section 8.7.4.2).
- d. The band 2025-2108 MHz is incorrectly indicated as being assigned to Telkom and as TDD. Firstly, this is the lower half of the F.1098 band, which is an FDD band (2025-2110 MHz // 2200-2285 MHz). It is not evident why the band ends at 2108 MHz instead of 2110 MHz, although it is possible that this is a proposed guard band to protect IMT systems deployed above 2110 MHz. This must be clarified. The return band (i.e. 2200-2285 MHz) should also be included in Figure 28 in order to provide the full picture.
- e. The reason for the 20 MHz TDD division at the upper end of the band (i.e. 2088-2108 MHz) is not provided and needs clarification.
- f. It is recommended that the 2x30 MHz for satellite IMT (i.e. 1980-2010 MHz // 2170-2200 MHz) also be added to the figure for completeness.
- g. Finally, it should be noted that the band 2025-2108 (2110) MHz is not assigned exclusively to Telkom as portrayed; Telkom uses only 9x3.5 MHz paired channels on a very limited scale and on a shared basis for PTP links. Telkom's deployed links are indicated in Figure 4.
- h. In the 2100 MHz band, there appear two figures (i.e. 1960 MHz and 2150 MHz), which seems misplaced and should be deleted.

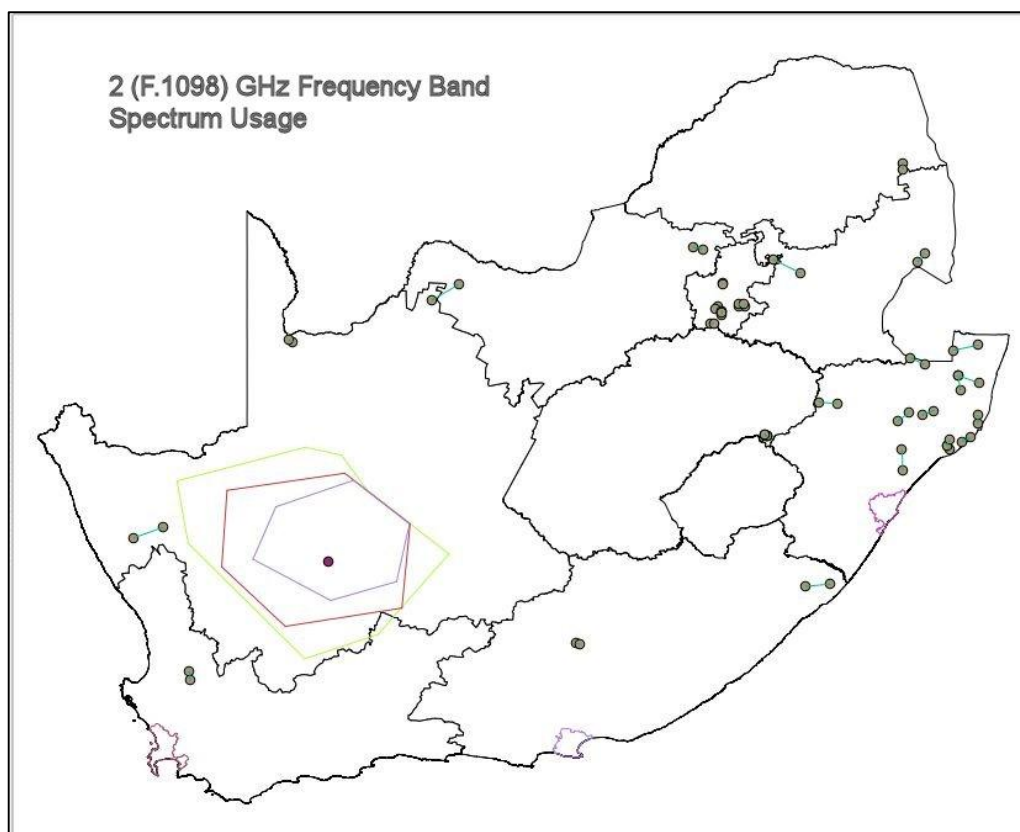


Figure 4: Telkom deployed PTP links in the F.1098 band

It is indicated that the band 1880-1920 MHz is used by Telkom, SAPS and SANDF for DECT-systems and fixed links. This band can be divided into two sub-bands namely 1880-1900 MHz and 1900-1920 MHz. The lower sub band is used for DECT cordless telephones on a licence exempt basis (see Government Gazette No.34172 dated 31 March 2011; Annexure B) as well as by Telkom for DECT WLL systems. DECT WLL was deployed during Telkom's exclusivity period and many of these systems remain in operation today (see Figure 5 below). The full 20 MHz is used by DECT.

It must also be noted that there are probably thousands of DECT cordless telephones already in operation in South Africa and changing this allocation will need several years to implement because these devices are un-licensed. Furthermore, the use of the band 1880-1900 MHz for DECT cordless telephones on a license exempt basis is in line with CEPT/ERC/REC70-03, as also captured in the Radio Frequency Spectrum Regulations, 2011. Moving away from this regionally harmonised position is therefore not supported.

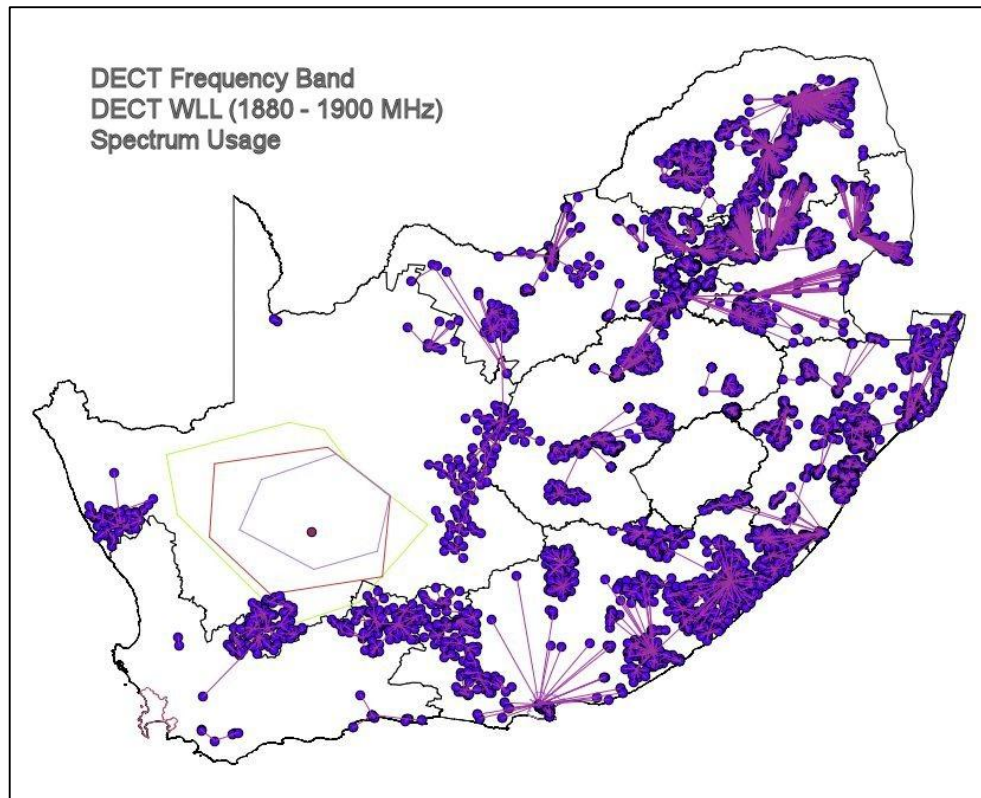


Figure 5: Telkom deployed DECT systems

The upper part of the band (i.e. 1900-1920 MHz) has been assigned exclusively to Telkom. Telkom deployed both MGW and e-MGW FWA systems in this band. Current networks and systems are indicated in Figure 6 below:

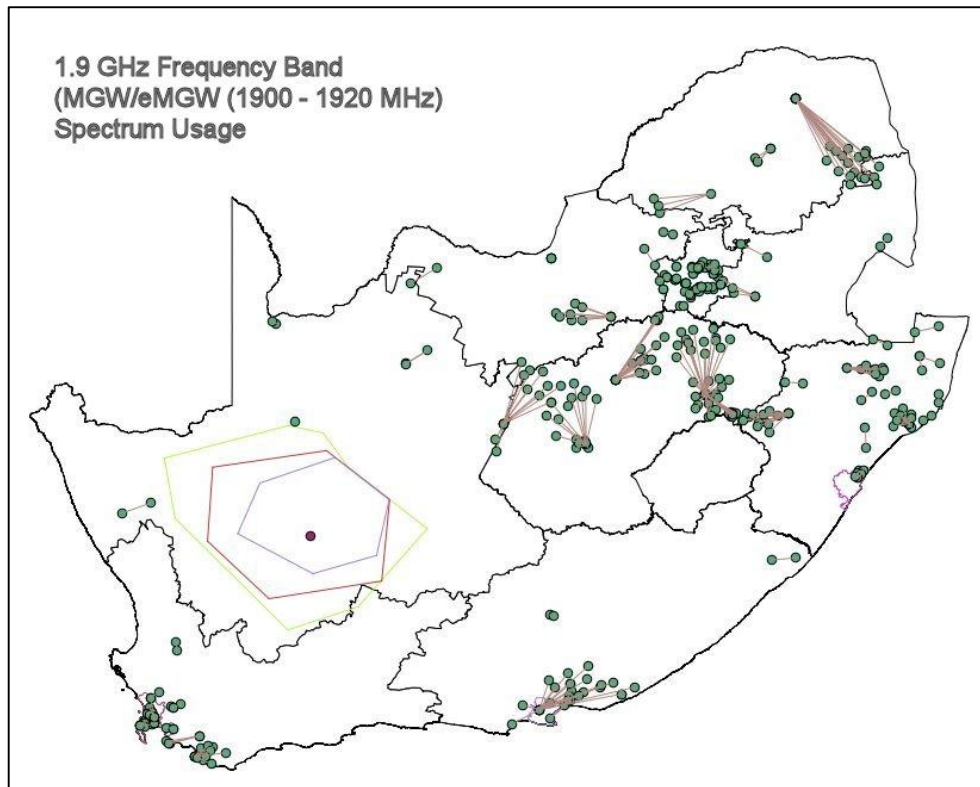


Figure 6: Telkom deployed MGW/e-MGW FWA systems

Telkom is not aware of SANDF or SAPS using either of these sub-bands and has never been requested frequency coordination with these entities in this band. Except for the DECT WLL and MGW/e-MGW FWA systems, Telkom is not aware of any PTP links being deployed in these two sub-bands. The statement that the band 1915-1920 MHz is “free” is factually not correct as DECT (cordless telephones and WLL) occupies the band 1880-1900 MHz and MGW/e-MGW the band 1900-1920 MHz. Telkom has implemented mitigation measures (addition of filters) to ensure adjacent band sharing with IMT systems operating above 1920 MHz.

The proposal to migrate systems from the band 1885-1915 MHz is not clear and need further discussion. Telkom is in the process to migrate DECT WLL systems from the band 1880-1900 MHz but this may take several years to complete. Telkom however have no immediate plans to migrate any systems from the band 1900-1920 MHz. The use of the band 1885-1900 MHz for IMT should also be considered with caution. In Europe it was decided that this band will continue to be used for DECT and not IMT. The migration of DECT (presume to be DECT cordless telephones) to the 2.4 GHz ISM band also needs further consideration; Telkom recommends that DECT cordless phones remains in the band 1880-1900 MHz.

Telkom supports the Authority’s proposal to keep the bands 2025-2110MHz // 2200-2285 MHz for PTP links. It should nevertheless be noted that these bands have been identified as possible candidate bands for future IMT use and will be considered at

WRC-15. Depending on the outcome of WRC-15 this decision may have to be re-visited.

As indicated in response to question 2.7.2, Telkom does not support extending the IMT2300 MHz band to 2290 MHz.

Proposal for extension of IMT2100

The Authority proposes that the current IMT2100 band be “extended” with the IMT satellite bands (i.e. 1920-1980 MHz // 2110-2170 MHz). It is assumed that this “extending” implies adding terrestrial IMT to these band while retaining the IMT satellite allocation. Both Europe and USA do allow the use of these bands, in addition to MSS, for complementary terrestrial services. In Europe this is labelled CGC (Complementary Ground Component), which is ground-based infrastructure used to enhance satellite coverage in highly shadowed areas. In the US this is also allowed and is labelled ATC (Ancillary Terrestrial Component). This is however not an extension of the IMT2100 band. Both ATC/CGC is allowed in South Africa as per NRFP, 2013.

A decision to extend the 2100 MHz satellite band to terrestrial cannot be supported, at least not at this stage. Firstly, these bands have been harmonised internationally for IMT satellite and as developments in this regard is ongoing, its use for satellite services should be retained, at least for the time being. Retaining these bands for IMT satellite is also supported by ITU-R SG4, as evident in a Liaison Statement to SG5 (see Doc. 5/129 dated 24th September 2014). This Liaison Statement indicates that a number of satellite networks have already been deployed in these bands. It also requested SG5 to consider these IMT satellite bands in the context of amendment to ITU-R M.1036. In any event, there is currently no 3GPP terrestrial IMT band for this range and no terrestrial ecosystem and a decision to convert the band to terrestrial is therefore premature.

ANNEXURE B: PROPOSALS OF AN EDITORIAL AND/OR GENERAL NATURE

The below proposals are made to assist the Authority in finalising the IMT Roadmap. These proposals are of an editorial and/or general nature.

Ad 2.1 Purpose of the IMT Roadmap

Following the completion of the consultation process, the conditions for the use of the bands for IMT will be specified in the Radio Frequency Spectrum Plans (RFSPs). These RFSPs may be subjected to a limited consultation specifically, 2 weeks, as they will mainly confirm and consolidate what has already been consulted upon in the IMT road map. The template for the RFSAP is as annexed to the Radio Frequency Spectrum Regulations (RFSR) 2011.

It is assumed that the references to Radio frequency Spectrum Plan (RFSP) in the first two sentences should indeed be “*Radio Frequency Spectrum Assignment Plan (RFSAP)*”. This must be corrected or clarified.

Ad 2.2 Overview

Currently 460 MHz bandwidth is used for IMT in South Africa, mostly for Universal Mobile Telecommunications System (UMTS) and Global System for Mobile Communications (GSM). The overall recommendation proposed for consultation is that an additional 2×138 MHz paired spectrum and 290 MHz unpaired spectrum will be made available over a given schedule. The most important bands for coverage and capacity are IMT700 and IMT800.

It is not clear how the currently assigned bandwidth of 460 MHz was calculated. This is addressed in response to paragraph 7.1 below (comments to Table 9 of the draft IMT Roadmap).

Ad 2.6 Summary of migration requirements

In Figure 1, the current assignment of WBS in 2550-2565 MHz, could be migrated immediately (Phase 0) to 2575-2590 MHz with a 2×5 MHz guard band between the paired and unpaired spectrum. In subsequent phases, WBS could migrate the users to the unpaired IMT spectrum beginning from 2595-2600 MHz to the final 25 MHz. WBS can deploy modernised hardware, but is limited to 5 or 10 MHz in intermediate phases.

Whereas Telkom understands the Phase (0) move, the further move to 2595-2600 MHz (5 MHz) is not obvious. This is also only 5 MHz whereas WBS has currently 15 MHz; the reference to “final 25 MHz” is also not clear. In Figure 1, Phase 1 is

indicated as 2575-2585 MHz, which also does not correlate with the text in the above paragraph.

Ad 7.1

Forecast of overall IMT demand

In South Africa, 380 MHz are currently used for IMT (including UMTS and LTE) and 80 MHz for GSM. In 2020, more than 1011-1036 MHz could be used for IMT (incl. GSM) depending on the decisions on 700-800 MHz band usage.

The calculation of 380 MHz (for IMT) and 80 MHz (for GSM) is not clear and needs further explanation; see comments to Table 9 below. Also, how a total of 80 MHz for GSM was reached is also not evident. Telkom recommends that these be further clarified.

This overview includes additional spectrum of 120 MHz in the 694-862 MHz band, 190 MHz in the 2500-2690 MHz band and 200 MHz in 3400-3600 MHz band. The potential assignments that could be made in the short term within the 2015-2020 MHz band are more than the current spectrum usage (510 MHz > 380 MHz) for a traffic ~5 times than today (Figure 6).

The reference to “2015-2020 MHz band” is not clear; it is possible that the intention was to refer to “2015-2020 period” rather than spectrum but needs to be clarified.

IMT spectrum (incl GSM)																	
MHz	400	700	800	900	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	3400	3500	sum
2014	0	0	30	50	75	75	60	15	60	0	80	0	15	0	0	0	460
2020	15	87	69	50	75	75	60	15	60	0	100	15	100	90	100	100	1011

Table 9: South Africa IMT spectrum assignments

The information in this table is not clear and needs further explanation.

With reference to the 2014 figures (i.e. assumed to be current assignments), Telkom notes the following:

- It is not clear why 30 MHz has already been assigned in the 800 MHz band.
- All spectrum in the 900 MHz band has been assigned; i.e. 2x11 MHz or 22 MHz to each of Vodacom, MTN and Cell-C. It is not clear why this figure is only 50 MHz. Including guard bands this assignment should be 70 MHz.
- 1700 MHz and 1800 MHz is assumed to be the lower and upper bands of the IMT1800 band; correctly all 150 MHz has already been assigned.
- Although not clear it is assumed that the 60 MHz under “1900 MHz” consists of the bands 1785-1805 MHz, 1880-1900 MHz and 1900-1920 MHz.

- 2100 MHz is an FDD band of 2x60 MHz; this should therefore be indicated as 120 MHz (In FDD spectrum both sub-bands are calculated in order to compare with TDD).
- For 3400 MHz and 3500 MHz, assignments have been made to Telkom (2x14 MHz) and Neotel (2x28 MHz); these should therefore be added to the table.

With reference to the 2020 figures, Telkom notes the following:

- For the 400 MHz band (assumed to be 450 MHz), the TDD bandwidth is provided although the draft IMT Roadmap is considering both FDD and TDD as options; FDD obviously will provide maximum 2x5 MHz.
- The figures of 87 MHz and 69 MHz for 700 MHz and 800 MHz respectively is not clear. Based on the proposals for 700 MHz and 800 MHz, these amounts are not evident (see Table 19 for a summary of 700/800 MHz proposals)
- For 900 MHz the same comment as indicated above
- The 15 MHz in “2400 MHz” is not clear as such band has not been discussed in the document (except for references to the 2.4 GHz ISM band. It is not clear to which 15 MHz reference is made.
- The split between “2500 MHz” and “2600 MHz” is not clear. Although the total of 190 MHz is seemingly for the 2x70 MHz plus 50 MHz as per the 2.6 GHz band, the split of 100 MHz and 90 MHz is not clear.

The totals for 2014 and 2020 should be adjusted accordingly.

Ad 7.1.1 Forecast of overall M2M Demand

- Utilities is the fastest-growing sector; it will account for 67% of overall M2M device connections by 2023, growing at a CAGR of 39%;
- Security sector solutions will account for 13% of overall M2M device connections by 2023, growing at a compound annual growth rate (CAGR) of 24%;

- Solutions for the utility sector will account for 62% of overall M2M device connections by 2023, growing at a CAGR of 41%.
- Security sector solutions will account for 18% of overall M2M device connections by 2023, increasing at a CAGR of 26%. Commercial and residential security and surveillance solutions will be the primary drivers of this growth.

The forecasted growth of M2M for utilities and securities sectors are provided on pages 51/233 and 53/233 respectively of the draft IMT Roadmap. Although both are seemingly from the same report, the growth figures are not the same.

Ad 8.1.3 IMT bands considered

Note that the IMT plans for the 1900 and 2200 MHz bands are not yet finalised, therefore, this document does not discuss those two bands.

The reference to the bands “1900 MHz” and “2200 MHz” does not necessarily have the same meaning to everybody and it is therefore recommended that the exact frequency of these bands be specified. Whereas it is possible that 1900 MHz refers to the band 1880-1900 MHz, this is not obvious. The reference to the “2200 MHz” band is less obvious.

A few errors have been noted in Table 11 namely:

- IMT750 should be 733-758 MHz (not 734-758 MHz)
- IMT2000 should be IMT2100
- It is recommended that the available TDD spectrum under IMT750 and IMT2600 be further enhance or explained. Under IMT750, reference to (10-)25 MHz is assumed to mean a 25 MHz gap minus 10 MHz for guard bands (5 MHz each side), which provides 15 MHz for assignment. On the other hand, in the IMT2600 case, the reference to (40-)50 MHz is then not clear as the same logic was apparently not used in this case. In this case it could be interpreted to mean a 50 MHz assignment (the gap) minus the 10 MHz guard bands (5 MHz each side) results in 40 MHz of assignable spectrum.

With reference to Figure 10, the following errors were spotted:

- “IMT400” should be “IMT450”
- For “IMT400”, the TDD band is indicated as 452-466 MHz or 14 MHz; throughout the document, when TDD is discussed, a 15 MHz assignment is indicated.
- For IMT800, the lower frequency block should be 791-821 MHz (not 790-820 MHz)
- “IMT2000” should be “IMT2100”
- The IMT3500 band should be 3400-3600 MHz (not 3400-2400 MHz).

Ad 8.3.5.3 [Scenario 2:] Full Allocation of the band to IMT services

- Special bands might be used only in congestion cases.- 448-450 MHz and 470-478 MHz (currently used by broadcaster) until the final IMT option and potential interferences are known.

The intention of this proposal is not clear and need further clarification. The purpose of these “special bands” have not been indicated.

Ad 8.4.2 Options considered by the Authority

The ITU is considering two, high-level configurations for the 700 MHz band.

- **Option 1:** consists of the following combination of spectrum:
 - 2×45 MHz from 703 MHz to 803 MHz with 10 MHz of centre gap;
 - 2×18 MHz; and

Strictly speaking the ITU is not considering these options. The ITU concluded on the 800 MHz band plan some time ago and this is contained in ITU-R M.1036. The only band that is currently being considered is the band 694-790 MHz for Region 1. The options to be considered between the 700 MHz and 800 MHz bands as proposed are a national matter.

Telkom recommends that the second sub-bullet (“2x18 MHz”) be expanded to state that this is within the band 803 MHz 862 MHz. Telkom suggested text: “*2x18 MHz from 803 MHz to 862 MHz; and*”.

- **Option 2:** 2×30 MHz IMT700 plus 2×30 (or 2×33) MHz IMT800 plus parts of CDMA/IMT spectrum (~2×5 MHz) plus potential IMT-TDD assignments in band gap 733-758 MHz (or other IMT or non-IMT assignments) together with GSM-R and GSM (or their potential IMT900 successors).

Many countries including most of Asia and Latin America have selection Option 1. At this point, European countries have decided for Option 2. Therefore, the main decision expected at WRC-15 is which region schemes to follow:

The decisions to be made at WRC-15 does not involve the selection of channel plan i.e. 2x45 MHz or 2x30 MHz. WRC-15 will consider, amongst others, the lower band edge of 700 MHz, possible regulatory limits to protect broadcasting operating below 694 MHz, etc. The channel plan decisions are made within WP5D. These options will be included in an updated version of ITU-R Recommendation M.1036, from which countries may then choose its implementation.

Ad 8.4.2.1 Option 1: 2x45 MHz (700 MHz band) + 2x15 MHz (800 MHz band)

This option is the ITU Region 3 channelling solution from 703-803 MHz with two 30 MHz bandwidth duplexers from 703-733 MHz or 718-748 MHz respectively.

The two frequency ranges listed are the lower half of the two duplexers; Telkom recommends that the frequency information for both duplexers be provided. Telkom recommend the following text: “...bandwidth duplexers namely from 703-733 MHz // 758-788 MHz (lower duplexer) or and 718-748 MHz // 773-803 MHz (upper duplexer) respectively.”

Telkom notes the following error in Figure 15: the 2x3 MHz restricted allocation should be 803-806 MHz // 844-847 MHz.

With regards to Table 16, the band 803-873 MHz seems incorrect; Telkom suggests that this be changed to 803-862 MHz, which is the end of the 800 MHz band.

Ad 8.4.2.2 Option 2: 2x30 MHz (700 MHz band) + 2x30 MHz (800 MHz band)

In Figure 16, the lower half of the 800 MHz band is indicated as 790-820 MHz; this must be 791-821 MHz.

With regard to Table 17, Telkom notes that the juncture between 700 MHz and 800 MHz is at 803 MHz, which is in the middle of the lower half of the 800 MHz band. The end limit of the 800 MHz band is also incorrect. Telkom recommends the following changes:

- 703-803 MHz changed to 703-788 MHz
- 803-873 MHz changed to 791-862 MHz

The table title should also be changed to reflect the band 703-862 MHz.

Ad 8.4.2.3 Option 3: Variation of Option 2

Figure 17, and in particular the TDD portion in 700 MHz, is not in line with the information in the bullet above the figure. It seems that only 2 MHz guard bands are provided i.e. 736-738 MHz and 756-758 MHz, which is not clear. It is then also not clear where the 10 MHz will be assigned with the band 736-758 MHz (noting that if 2x5 MHz guard bands are taken, there are 12 MHz available for assignment). The upper half of the 800 MHz band should also be 791-821 MHz (not 790-820 MHz).

The title of Table 18 should refer to Option 3. The 2x3 MHz restricted use should also be associated with the 700 MHz band (733-736 MHz // 788-791 MHz).

Telkom wish to make the following points with regards to Figure 18:

- Telkom recommends that the title of Figure 18 be changed to: “*potential ~~IMT450~~, IMT700, IMT750, IMT800, IMT850, 900 solutions*” as this figure does not address the 450 MHz and 900 MHz bands whereas IMT750 is included.
- With regard to the top three options in Figure 18, and specifically the TDD assignments, only 1 MHz guard bands is provided. It is presumed that these should be 5 MHz each.

Ad 8.4.3 Neotel migration

Current CDMA2000 seems not to interfere with the existing GSM-R base stations, even with 1 MHz overlap, however, this is not guaranteed for future stations and for LTE.

The above statement from section 8.4.3 seems to contradict the statement below from section 8.5.1.3.2.

GSM-R assignment to PRASA and the CDMA assignment to Neotel. The overlap has not resulted in technical issues because PRASA has yet to deploy a network in the band.

In section 8.4.3 it is stated that interference seems not be an issue with existing GSM-R base stations whereas, according to section 8.5.1.3.2, PRASA has not yet deployed a GSM-R network. Telkom recommends that the Authority confirms the information and make the necessary adjustments as required.

Ad 8.5 The 876-880 MHz (paired with 921-925 MHz)

This section of the document discusses the Authority's proposed solution to the existing spectral overlap between the CDMA800 and GSM-R.

Telkom recommends that "CDMA800" be changed to "CDMA850".

GSM-R and adjacencies

- The 2*5 MHz at 876-880 MHz & 921-925 MHz have been allocated in Region 1 exclusively for GSM-R
- The uplink of the band (876-880 MHz) is adjacent to CDMA (assigned to Neotel) on the left & GSM (Cell C) on the right
- The CDMA adjacency to the left of the 876-880 MHz overlaps by 1.06 MHz with the GSM-R uplink band

In Figure 19, first bullet, the "2x5 MHz should be changed "2x4 MHz". Also, the overlap between CDMA and GSM-R is indicated as 1.06 MHz, whereas in Figure 20 this is indicated as 1.08 MHz. This should be corrected.

Spectrum overlap

- PRASA recently received a 4 MHz assignment for GSM-R from 876 to 880 MHz (internationally allocated band)
- Neotel has historically held around 5 MHz of spectrum
- Neotel's assignment could be shifted back to 868 MHz at a maximum, affording 3 MHz of guard band to GSM-R

In Figure 20, the last bullet should read: "Neotel's assignment could be shifted back to ~~868~~ 869 MHz at a maximum, affording ~~3~~ 2 MHz of guard band to GSM-R".

With regard to the Neotel assignment of ~5 MHz, Telkom is of the view that this assignment is firstly not national and secondly not 5 MHz in all areas. We believe that only specific CDMA carriers (1.23 MHz each) have been assigned in the areas of Gauteng, Durban and Cape Town (and others later); the same carriers have not been assigned in all areas. For completeness, these facts should be reflected as it will facilitate the coordinating with GSM-R. For example, CDMA assignments at the bottom

of the band will probably not interfere with GSM-R. It is also presumed that the proposed new assignment of 2x5 MHz will be a national assignment, which could be implemented only after the completion of DTT migration and in line with the availability of 700/800 MHz.

Ad 8.6.2.1 Scenario 1: Equal 5 MHz+ blocks with guard bands

8.6.2.1 Scenario 1: Equal 5 MHz+ blocks with guard bands

Telkom presumes that the title should have read “without” guard bands as the in-band guard bands have been removed.

Ad 8.6.2.2 Scenario 2: Equal 5 MHz+ blocks without guard bands

8.6.2.2 Scenario 2: Equal 5 MHz+ blocks without guard bands

Telkom presumes that the title should have read “with” guard bands as in-band guard bands have been added.

Ad 8.7.1 ITU Position on 1700-2290 MHz

8.7.1 ITU Position on 1700-2290MHz

In Figure 27 both “TDD” and “TDD Band 33” spectrum are indicated. According to 3GPP, TDD Band 33 is 1900-1920 MHz. The TDD band indicated in Option B5 of ITU-R M.1036 is 1910-1930 MHz, which is 3GPP 37. The other TDD bands namely 1880-1920 MHz and 2010-2025 MHz could be indicated as 3GPP Bands 39 and 34 respectively. It should also be noted that the band 1900-1920 MHz is 3GPP Band 33. Telkom recommends the adoption of Band 33 rather than Band 39 because of the extensive use of DECT Cordless telephones in the band 1880-1900 MHz.

Ad 8.7.3 Radio Frequency Migration Plan for 1700-2290MHz

The table below is the summary of the Authority’s Frequency Migration Plan as it relates to the 2015-2285 MHz band.

Frequency Band (MHz)	Allocation in NRFP 2013 (Applications)	Proposed Utilisation/ Applications	Notes on migration/ usage
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The reference to the band 2015-2285 MHz above the table is not clear. This migration deals with ITU-R F.1098, which is for the bands 2025-2110 MHz // 2200-2285 MHz, as also reflected in the table. Telkom therefore recommends that the reference to “2015-2285 MHz” be changed to “2025-2110 MHz // 2200-2285 MHz”.

Ad 8.7.4.1 Usage of paired IMT spectrum in the 1700-2290 MHz

In South Africa, the IMT1700 FDD spectrum is solely used for GSM1800 for 2×75 MHz from 1710-1880 MHz for 6 operators with each having 2×12 MHz. There are also 4 operators who already have UMTS 2100 FDD spectrum of 2×15 MHz each.

Telkom recommends that “IMT1700” be changed to “IMT1800” as this band is known in South Africa as the 1800 MHz band. The statements that the band is solely used for GSM1800 could be misleading as re-farming has been done by some operators to deploy technologies other than GSM.

Ad 8.7.4.2 Usage of unpaired spectrum

The TDD bands 2010-2025 are currently assigned to MTN (10 MHz) and Vodacom (5 MHz), but currently not in use due to 5 MHz guard band to FDD. The neighbour band 2015-2100 MHz is sparsely used by P2P-links.

It is indicated that the TDD band 2010-2025 MHz is not being used because there is a “guard band of 5 MHz with FDD”; it is not clear where this 5 MHz is and what the reference to FDD means. Below the TDD band, there is the allocation to IMT satellite and above the TDD band there is the F.1098 PTP band. The reference to neighbouring band “2015-2100 MHz” should also be changed to “2025-2110 MHz”.

Ad 8.7.4.3 Proposal for extension of IMT 2100

This extension of the IMT2100 band would push the paired portion of IMT2100 right against the unpaired portion of the band that extends from 2010 MHz to 2025 MHz. A guard band of 5 MHz is typically required between adjacent paired and unpaired IMT bands. Therefore, the first 5 MHz of the 20 MHz assigned to MTN is from 2010 MHz to 2020 MHz.

The last sentence in this paragraph is not entirely clear as MTN has been assigned only 10 MHz in this band and not 20 MHz (see section 8.7.4.2). In the context of the proposed extension of the IMT2100 band and the need for a 5 MHz TDD carrier, Telkom recommends that this sentence be amended to: “Therefore, the first 5 MHz of the ~~20 10~~ MHz assigned to MTN ~~is from 2020 MHz to 2020 MHz~~ (i.e. 2010-2015 MHz) could be used as a guard band”. The first paragraph on page 101/233 (i.e. “*The band 2015-2025 MHz remains usable for IMT TDD, but might...*”) then flows from the above. It is recommended that this paragraph be moved forward to have the natural flow.

There are two errors in Figure 29:

- The unpaired TDD portion should be 15 MHz (not 25 MHz); i.e. from 2010-2025 MHz.
- The F.1098 band should be 85 MHz (not 75 MHz); i.e. this band is 2025-2110 MHz.

Ad 8.8 2300-2400 MHz

The key proposals in this band include an extension of the IMT2100 band, the migration of fixed links into the band and the introduction of fixed broadband where feasible

First, the various positions of the key bodies such as the ITU, CRASA and ICASA are presented. Next, the action items of the Frequency Migration Plan initiated by the Authority are restated. Finally, the Authority presents its proposals for various sub-bands in the 1700-2290 MHz band

These introductory paragraphs have been copied from the previous section dealing with the band 1700-2290 MHz and should therefore either be updated or deleted.

Ad 8.8 2300-2400 MHz

It is planned to develop a Radio Frequency Spectrum Assignment Plan (RFSAP) with consideration to:

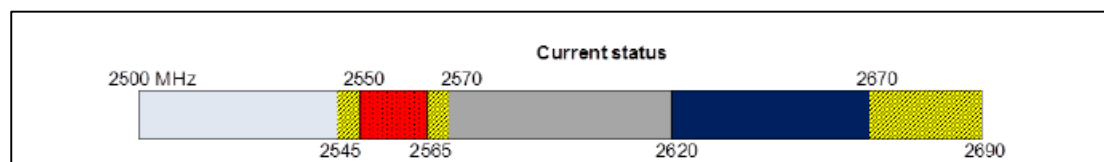
- Current re-planning efforts within the 2.6 GHz band do not seem realistic in order to find 50 MHz spectrum for uplink.

Telkom recommends that the bullet text be amendment to clarify the reference to “*find 50 MHz spectrum for uplink*”, which is presumed to be referring to option C2 of ITU-R M.1036. Telkom recommends the following text as replacing the current text: “Option C2 requires the identification of an FDD downlink assignment external to the 2.6 GHz band. Since this downlink has not yet been identified, this option is not recommended”.

- IMT-FDD 2500-2570//2620-2690 MHz: 2×70 MHz for;
 - 7×2×10 MHz for max 7 operators; or
 - 2×2×20 MHz and 3×2×10 MHz for 5 operators; or
 - 2×2×20 MHz and 2×2×15 MHz for 4 operators.

Another option to be considered could be 3x2x20 MHz and 2x10 MHz for 5 operators.

With reference to Figure 36, Telkom noted errors to some frequency limits in the uplink direction (2500-2570 MHz) in all three options, which must be corrected. These errors are present for both 10 MHz and 15 MHz channels above 2540 MHz.



Telkom noted an error in Figure 37. With regards to the “Current status” diagram, the “overlap with FDD spectrum” portion should be 2665-2690 MHz (not 2670-2690 MHz).

The current assignment of WBS in 2550-2565MHz could be migrated immediately (Phase 0) to 2575-2590MHz with 2x5 MHz guard band to protect IMT-FDD and TDD. In subsequent phases WBS could migrate their users to IMT-TDD beginning from 2595-2600 MHz to the final 25 MHz. WBS can deploy the modernised hardware, but is limited to 5 or 10 MHz in intermediate phases. WBS, as well as the other operator in IMT2600 TDD, have the obligation to use:

With regard to the second sentence, the reference to “*IMT TDD beginning from 2595-2600 MHz*” is not clear. This portion is within the upper FDD band and a move here is also not in line with the options described in Figure 37. Telkom recommends that this be clarified.

Ad 8.10.4 Radio Frequency Migration Plan for 3400-3600 MHz

- the concerns of Inmarsat with BFWA interference with earth stations;

Whereas Telkom agrees that these concerns be addressed in the RFSAP, it should be noted that it is not only “Inmarsat” that should be mentioned; the issue of sharing between BFWA (and IMT) and C-band satellite earth station receivers is a concern with the satellite industry in general. Nevertheless, it must be noted that the band 3400-3600 MHz is not allocated to Fixed satellite (space-to-Earth) services in South Africa (see National table of Frequency Allocations, 2013) and the protection of satellite receivers is therefore limited to those operating above 3600 MHz.

- TDD-bands 42 (3400-3600 MHz) and 43 (3600-3800MHz), currently used for WiMax, but general worldwide trend to LTE;

In the context of the development of the RFSAP, the reference to 3GPP Band 43 is not clear. The consideration of Band 43 is part of the proposed new IMT bands to be considered at WRC-15 under Agenda Item 1.1. It could therefore be pre-mature to add this band to the RFSAP.

Ad 9.1 Time Frame Overview

2014	380-400MHz band has been assigned as PPDR usage band with TETRA as one technological option. SAPS have already started migration for TETRA in 380-387//390-397 MHz together with WiMAX technology. - The remaining 2x3 MHz might be used by emergency, security, and airport services, which are not all essential to be nationwide, so some reuse potential is also valid for optimal spectrum use. - IMT roadmap finished and agreed. 1st assignment of IMT-spectrum finished.
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It is mentioned here that SAPS have deployed WiMAX technology although it is not clear in which frequency band (it is assumed that it is not in the 380-400 MHz band). Telkom recommends that this be clarified as it may impact other frequency bands, in particular the 2.6 GHz and 3.5 GHz bands. Based on the draft IMT Roadmap, SAPS has not been assigned any spectrum in either of these “traditional” WiMAX bands. Based on the last paragraph in section A.1.6 (page 135/233), it seems that the WiMAX assignment is within the band 380-400 MHz; this is however not clear.

The last bullet is very interesting and of concern. Considering the unfolding of events regarding licensing of IMT spectrum (IMT Roadmap, RFSAP, ITA), it is not evident how assignments in the 450 MHz band will be possible within 2014. This should also be read with the substantial doubt as to the use of this band for either FDD or TDD as well as the proposed migration time frame (according to time frame migration out of the 450 MHz band will start only in 2016). It is then also interesting that this is the 1st assignment whereas the 2nd (potential) assignment could take place in 2018. This second assignment is specifically for TDD; it is not clear if the 1st assignment will be for TDD or FDD.

2015	• Start of implementation/rollout of new IMT spectrum. • SAPS has successfully finalised network migration and freed up previous spectrum, esp. 406-410//416-420 MHz and 413-416//423-426 MHz. • 406-410//416-420 MHz, 410-413//420-423 MHz and 413-416//423-426 MHz bands could be used for TETRA or PMR networks and services. • The Authority will co-ordinate the application on new assignments for TETRA and other services in order to focus on sharing and harmonisation of spectrum. • Mid 2015: DTT process is completed within 470-694 MHz.
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According to the first bullet for 2015, rollout of IMT spectrum will start in 2015. However, according to the same calendar, migration from the 450 MHz band is proposed to only start in 2016 with proposed completion of the rural areas by 2018. It is also indicated for the year 2018 that “*IMT450 licensee starts rollout in the 450-470 MHz band*”. This may need further clarification.

2020-2022	• Target of SA Connect broadband initiative in South Africa is reached: (ref IMT coverage and capacity obligations in 10). • Transnet finished migration (deployment) and dual illumination phase (in line with Transnet's option 3: 2012+(7-10 years) = 2019-2022)
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With reference to the first bullet for the period 2020-2022, the targets for SA Connect regarding capacity and coverage obligations are reached. Telkom assumed that this is with reference to the 450 MHz band.