MTN Submission

Draft Radio Frequency Assignment Plans for the following: International Mobile Telecommunications (IMT) Spectrum band, IMT450, IMT700, IMT750, IMT800, IMT850, IMT900, IMT1500, IMT2300, IMT3300 and IMT3500 in Government Gazette No. 46160 (Notice No. 1961 - 1970), in terms of section 2 (d) and (e), 30, 31(4) and 33 of the Electronic Communications Act (ECA) (Act No. 36 of 2005), read with regulation 3 of the Radio Frequency Spectrum Regulations 2015 and the International Mobile Telecommunications Roadmap 2019

20 May 2022

Contents

1. Introduction

On 31 March 2022 the Independent Communications Authority of South Africa ("the Authority") published a series of Draft Radio Frequency Assignment Plans for the following International Mobile Telecommunications (IMT) Spectrum bands: IMT450, IMT700, IMT750, IMT800, IMT850, IMT900, IMT1500, IMT2300, IMT3300 and IMT3500 in Government Gazette No. 59160 (Notice No. 1961 - 1970), in terms of section 2 (d) and (e), 30, 31(4) and 33 of the Electronic Communications Act ("ECA") (Act No. 36 of 2005), read with regulation 3 of the Radio Frequency Spectrum Regulations, 2015 and the International Mobile Telecommunications Roadmap 2019.

MTN welcomes the Authority's consultation with the ICT sector towards the implementation of the Radio Frequency Assignment Plans for IMT spectrum bands. The Radio Frequency Assignment Plans provide a framework on how spectrum in these specific bands are to be utilized in line with the allocation contained within the National Radio Frequency Plan (NRFP). These assignment plans must provide the technical characteristics of radio systems, the frequency channelling and coordination, thus it is an important instrument that provides clarity regarding the conditions that must be adhered to for those specific radio frequency spectrum bands.

MTN's submission in respect of the Findings on the Inquiry and the Draft Implementation of the Radio Frequency Migration Plan and IMT Roadmap is structured as follows:

- General comments
- Specific Comments on the Draft Radio Frequency Assignment Plans for the individual spectrum bands
- Conclusion

2. General Comments

1.1. Assignment Plans for other IMT Bands

MTN notes that the Authority has omitted other IMT frequency bands of interest, specifically 24.25 - 27.5 GHz from the Draft Radio Frequency Assignment Plans. MTN suggests that an assignment plan for critical bands like n258 (26Ghz) which was already earmarked for IMT use in Region 1 at WRC-19 be developed. This is a vital band for 5G where licensees, including MTN, already have assignments in the 26GHz which is currently used for backhaul purposes. The inclusion of an assignment plan for this band would indicate the conditions of use in addition to providing any envisioned migration processes and procedures of existing users of the band and the expected method of future assignment. This would enable MTN to have clarity and some much-needed regulatory certainty on future 5G deployments within this radio frequency spectrum band.

1.2. Power Limits

MTN notes that the Authority has maintained the EIRP limit from the 2015 Radio Frequency Spectrum Assignment Plan of 61 dBm / 5 MHz EIRP limit for base station transmissions across all IMT Radio Frequency Assignment Plans (RFSAPs). MTN considers this technical parameter to be very restrictive for Active Antenna Systems (AAS) base stations that have high dynamic beamforming gain and are now commonly deployed for TDD bands including IMT2600, IMT3300 and IMT3500.

It is MTN's understanding that globally the industry is moving towards using Total Radiated Power (TRP) as the metric to specify power limitations for AAS deployments. It is thus vital that the Authority consider the applications to be used for a specific band and have regard to the appropriate technical recommendations for those applications/services. MTN recommends that the Authority include a Total Radiated Power (TRP) limit for AAS base stations into the assignment plans. This inclusion would bring South Africa in line with global industry development. If it is not done, the restrictive nature of the regulations will inevitably have a detrimental effect on the quality of service that can be expected from radio networks

1.3. IMT900 band Harmonization

MTN has considered the fact that the draft IMT900 RFSAP has been updated to reflect that the IMT900 band harmonization to the new assignment plan is to be effective on the 1st of April 2023. While MTN continues to support the planned harmonization, we are of the opinion that the target date of 1 April 2023 is not feasible to achieve without major disruption to existing 2G, 3G and 4G services and we propose that the target date be extended. While the Authority has indicated that the harm to consumers would be mitigated by access to new low-band spectrum which has been made available through the recent auction, this newly acquired spectrum will only be effectively available to MTN from 1 July 2022 and will not be fully useable at a national level. The draft IMT800 RFSAP indicates that the date for switch-off of the analogue TV signal and end of the dual-illumination period is set for 31 March 2022, however a recent High Court ruling ordered a postponement of analogue switch-off by three months, to 30 June 2022. Additionally, e.tv filed papers at the Constitutional Court to appeal the matter and is seeking a postponement of the 30 June 2022 date. Considering these delays (and potential further delays as a result of litigation), and the fact that it is not feasible to activate new low-band spectrum nationwide within 9 months, MTN requests that the target date for the IMT900 band harmonization be extended to 31 December 2024 to allow for sufficient time to deploy IMT800 spectrum.

1.4. ICNIRP Guidelines

MTN notes that previous IMT band RFSAPs indicated that "*ICNIRP compliance is encouraged, where applicable*" and that this has been updated to "*ICNIRP Guideline compliance is required, where applicable*" in the new draft RFSAPs. MTN supports this requirement which will help to create consistency in this regard across operator deployments.

1.5. Spectrum Sharing

MTN notes the comments present in the draft RFSAPs that "*mobile network operators are encouraged to share the spectrum e.g. using the dynamic spectrum sharing (DSS) technologies available in LTE and 5G/NR*". MTN agrees that LTE/NR DSS is expected to play an important part of future technology deployments. It must be noted, however, that there is an overhead incurred in sharing spectrum between technologies and hence the DSS functionality is viewed as an efficient way to migrate spectrum usage from LTE to NR but with the final goal of dedicating the spectrum to the newer technology for maximum potential spectral efficiency. So, the use of LTE/NR DSS should be seen an interim measure to facilitate spectrum migration from 4G to 5G.

1.6. Synchronisation in TDD spectrum bands (IMT2300, IMT3300 & IMT3500)

Both FDD and TDD networks require careful synchronisation, particularly at the RF level to ensure that modulation schemes function correctly. Typically, this synchronisation is achieved through some form of a stratum 1 clock which can be delivered using GPS, caesium standards or some form of network time server (NTP).

In FDD systems, the synchronisation at the RF level is well known and relatively straightforward to deliver. However, in TDD systems, particular attention must be given to both the synchronisation at the RF level and synchronisation at the data frame level. Where network operators use contiguous frequency assignments, there is no need for guard-bands as all base transmitters start the frame burst at the same time. However, issues arise when operators in adjacent frequency blocks are required to use different DL / UL ratio and hence, different frame synchronisation rates. In this case, while all base transmitters start the frame burst at the same time, they will not all finish at the same time, thus causing adjacent-channel interference.

When interference occurs, the performance of the Band Edge Mask (BEM) becomes significant in determining the delivered data rate of the RF channel. Typically, one or two BEMs are specified by regulators and are generally referred to as the "Permissive

mask" and the "Restrictive mask". Where operators agree to use the same or harmonised frame synchronisation rates, then the full bandwidth (Permissive mask) can be used. Where operators either cannot agree on the same frame synchronisation rate or "reserve their option" to change in the future, then the Restrictive mask must be used. The RF channel maximum data rate will be affected by both the Permissive BEM and the Restrictive BEM, but at different levels. The Permissive BEM reduces the maximum RF channel data rate by approximately 5% to 8% whereas the Restrictive BEM will reduce the maximum RF channel data rate by between 20% and 25%.

The approach adopted for managing TDD synchronisation can have a significant impact on the data rates that can be achieved in TDD spectrum. MTN suggests that the Authority includes a section on the network synchronization requirements to ensure that the radio transmissions of adjacent TDD networks shall be synchronised with the uplink and downlink frames aligned in time in order to avoid interference between the networks operating in adjacent frequency carriers as was done in Appendix E of the IMT2600 RFSAP published in 2020.

MTN further recommends that the IMT3300/IMT3500 networks are aligned to an IMT2020 2.5ms periodicity frame structure with 4DL+1UL (DDDSU) uplink/downlink pattern where the special slot pattern S=10DL+2G+2UL (DDDDDDDDDDGGUU).

2. Specific Comments

2.1. IMT 450

MTN fully supports the use of the 450 MHz band for IMT, furthermore MTN agrees with the Authority's recommendation of D14 band plan (3GPP Band 31). B31 band has the advantage of a more developed ecosystem that is currently readily available and deployable.

This is in line with countries adopting ITU harmonized Frequency Ranges for Public Protection and Disaster Relief (PPDR) which requires having access to defined

spectrum in harmonized bands suitable for broadband applications as laid out in Resolution 646 (WRC15) and expanded upon in ITU-R M.2015.

2.2. IMT 900

MTN is of the view that a reduction of spectrum to existing licence holders within IMT 900 band will result in network disruption and by consequence a degraded level of service to their subscribers. While the Authority has indicated that this disruption would be mitigated by the access to additional spectrum acquired in the recently completed auction, the level of disruption due to inaccessibility to the newly acquired spectrum on a national basis will affect quality of service.

Additionally, MTN's spectrum in the 2x10MHz Band 20 (IMT800) is currently not available for deployment nationally due to the analogue transmitters switch off delays, and consequently any deployment of sites in areas which have not completed analogue switch off could cause interference with MTN radios.

MTN is of the view that in order to execute interference mitigation on B20 such that this spectrum band could be utilized to carry network traffic would require substantial human effort and capital resources. Furthermore, the Digital TV Restacking (DTR) process would have to be finalized first, such that licensees are guaranteed that B20 layer is usable for network deployment. Thus, in order to cater for a smooth transition and coordination between operators and the Authority, MTN proposes, as indicated in our general comments above that the period to complete the migration be extended until the 31st of December 2024 to all operators taking into consideration that the expected high Quality of Service thresholds should not unnecessarily be degraded.

Finally, MTN request that the Authority publish a regular progress report that include the current channels being broadcast from each TV broadcast tower so that the affected licensees can plan to enable IMT services in areas without interference if possible.

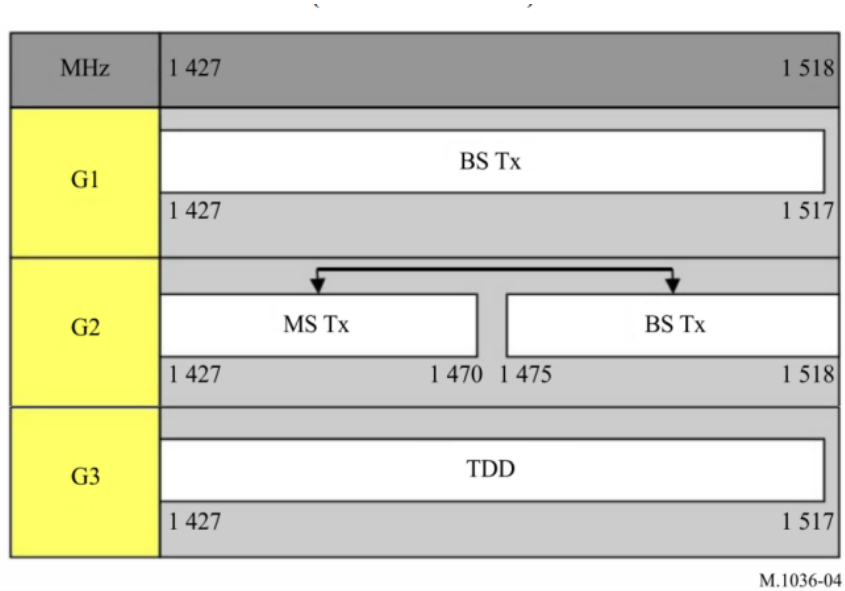
In terms of implementing the radio frequency migration, MTN requests the Authority to outline how it will handle removing the interference caused by undocumented "self-help" TV signal repeaters[i] that are expected to be a significant cause of interference where the spectrum is supposed to be cleared for IMT.

Following the conclusion of the IMT 900 harmonisation process which creates a new 2 x 5MHz channel, MTN would like to suggest the following alternative approach to the Authority for utilization of this block.

- The usage of the 900MHz band is of great interest in the South African telecommunications sector and while we acknowledge that the Authority has identified a trend where operators around the world are shutting down their 2G networks to free up spectrum for upcoming new technologies, this is not quite the case for mobile operators in South Africa. MTN has recognized that portions of our population still make use of legacy devices (feature phones) and benefit from 2G connectivity, and the advantages of legacy devices, such as long battery life (particularly in areas where the provision of electricity is intermittent).
- Inter-operator co-ordination will be a critical factor in the success of this harmonization project, consequently, MTN would support a position where the Authority plays a more active role in the planning, coordination and monitoring of all licensees' activities during the implementation of IMT900 harmonization across the country in order to minimise possible disputes amongst competitors that may further impede this initiative.

2.3. IMT 1500

In the 1452-1492 MHz band, stakeholders have not shown significant interest in this band, which means that the South African ecosystem is not ready for services in this band and hence there is no economic value for licensing this band now. As the Authority has indicated that the ITU frequency arrangement is from 1427 to 1518, it is further noted that the Authority intends to adopt either G1 or G3 channel arrangement as depicted below.



MTN suggests that the Authority reconsiders its near-term intention to assign 40MHz of 1452-1492 MHz and to evaluate, taking cognizance of global developments within this band, the possibility to render the entire spectrum band of 1427-1518 MHz in a G3 channel arrangement for future assignment in the medium term. Such a cautious approach will avoid an inefficient assignment of spectrum in this band.

2.4. IMT 2300

MTN supports the Authority's position that the available spectrum within IMT2300 will be made available through a future ITA assignment process, in-line with the radio frequency spectrum regulations of 2015.

2.5. IMT 3300

MTN supports the IMT identification in this band, as well as that any future assignment of this spectrum band must be through an Invitation to Apply in line with the radio frequency spectrum regulations of 2015. MTN submits that the Authority should support the identification of the frequency bands 3 300 - 3 400 MHz for IMT including possible allocations to the mobile service on a primary basis (Region 2 and amend footnote in Region 1) under Agenda Item 1.2 at WRC-23. South Africa will benefit from the economies of scale that will be derived from the harmonisation of this band for IMT across the different regions.

However, the Authority should consider more relaxed regulatory conditions pertaining to the revision of power limits for this band as well considering that its part of n78 band for 5G NR deployment. MTN suggests that the TRP limit of 44dBm/5MHz be set for AAS base stations (2.496-2.690GHz and 3.3-3.8GHz frequency range).

MTN suggests that the Authority includes a section on the network synchronization requirements to ensure that the radio transmissions of adjacent TDD networks shall be synchronised with the uplink and downlink frames aligned in time in order to avoid interference between the networks operating in adjacent frequency carriers i.e., as was done in Appendix E of the IMT2600 RFSAP published in 2020. MTN therefore recommends that the IMT3300/IMT3500 networks are aligned to an IMT2020 2.5ms periodicity frame structure with 4DL+1UL (DDDSU) uplink/downlink pattern where the special slot pattern S=10DL+2G+2UL (DDDDDDDDDDGGUU).

2.6. IMT3500

The Authority has prescribed in the 2015 Radio Frequency Spectrum Assignment Plan (RFSAP) for IMT services on 2600MHz and 3500MHz bands that "*Base Station transmissions should not exceed 61dBm/5MHz EIRP*". This is repeated in section 5.6 of the Draft Radio Frequency Spectrum Assignment Plan for the frequency band 3400MHz to 3600MHz for public consultation (Notice 1970 of Government Gazette No 46160 published on 31 March 2022). It is MTN's understanding that globally the industry is moving towards using Total Radiated Power (TRP) as the metric to specify power limitations for Active Antenna Systems (AAS) deployments. It is critical that the Authority take into account the applications to be used for a specific band and have regard to the appropriate technical recommendations for those applications/services. Thus, MTN would like to request that the Authority revisit this power emission limit when updating RFSAP regulation as it is very restrictive for AAS's that are now commonly used for 5G deployments in bands such as IMT2600 and IMT3500. Could we add that if it is not done that there will be an inevitable decrease in qos or that we would not be efficiently and effectively address download speeds etc???

2.6.1. TRP versus EIRP Power Limits for AAS base stations

The AAS that are deployed utilise dynamic beamforming where the amplitude and/or phase between antenna elements is continually adjusted to alter the antenna pattern in response to changes in the radio environment. The EIRP[ii] in a dynamic radio beam can be significantly higher in AAS deployments than for non-AAS deployments where the antenna pattern and/or antenna gain is fixed. While an EIRP limit is suitable for non-AAS passive antenna systems, the industry globally is moving towards using TRP[iii] as the metric to specify power limitations for AAS deployments, because TRP is seen as more accurate in assessing interference between AAS systems and other mobile systems (for network level co-existence interference analysis) and has been adopted by OFCOM to specify radiated conformance requirements for AAS systems.

MTN submits the national regulator of the United Kingdom, which is a Region 1 territory, OFCOM[iv] that has applied a 65dBm/5MHz EIRP limit for non-AAS base stations and a TRP limit of 44dBm/5MHz for AAS base stations in the IMT3500 band.

It is MTN's understanding that OFCOM had applied the power emission changes after four license holders (Vodafone, Telefonica, Hutchison and EE) requested OFCOM to vary the technical conditions in C-band radio licenses awarded. By comparison, in Region 2, it should be noted that the Canadian[v] guidelines for TRP limits on C-band are even more relaxed and set at 68dBm/5MHz (for non-AAS) and 47dBm/5MHz (for non-AAS). MTN believes the OFCOM power emission guidelines for non-AAS and AAS base stations are more appropriate considering current technology being deployed for bands such as IMT2600 and IMT3500 in South Africa. We therefore urge ICASA, based on the developments mentioned above that it adopts the same methodology.

2.6.2. Comparison of EIRP power emission limit versus TRP limit for AAS

Regulatory Authority	ICASA	OFCOM	OFCOM
AAS Category	AAS & Non-AAS	Non-AAS	AAS
ICASA Emission limit (5MHz channel)	61dBm/5MHz EIRP	65dBm/5MHz EIRP	44dBm/5MHz TRP
ICASA Emission limit (40MHz channel)[vi]	70dBm/40MHz EIRP	74dBm/40MHz EIRP	53dBm/40MHz TRP
Transmitted Power (40 MHz channel)	EIRP – Antenna Gain[vii] = 70 – 25 = 45 dBm = 31.6 W	EIRP – Antenna Gain = 74 – 25 = 45 dBm = 79.4 W	53 dBm = 200 W
Transmitted Power (5 MHz channel)	~4W	~10W	25W
Transmit Power Difference (TRP versus EIRP)	~6 times	~2.5 times	n.a.

2.6.3. MTN coverage predictions using ASSET tool (from Aircom) utilizing 2.5D VOLCANO topographical model

In the predication maps and comparison table below MTN indicates the expected coverage enhancements that could be expected if the Authority adopted the widely used TRP thresholds for AAS.

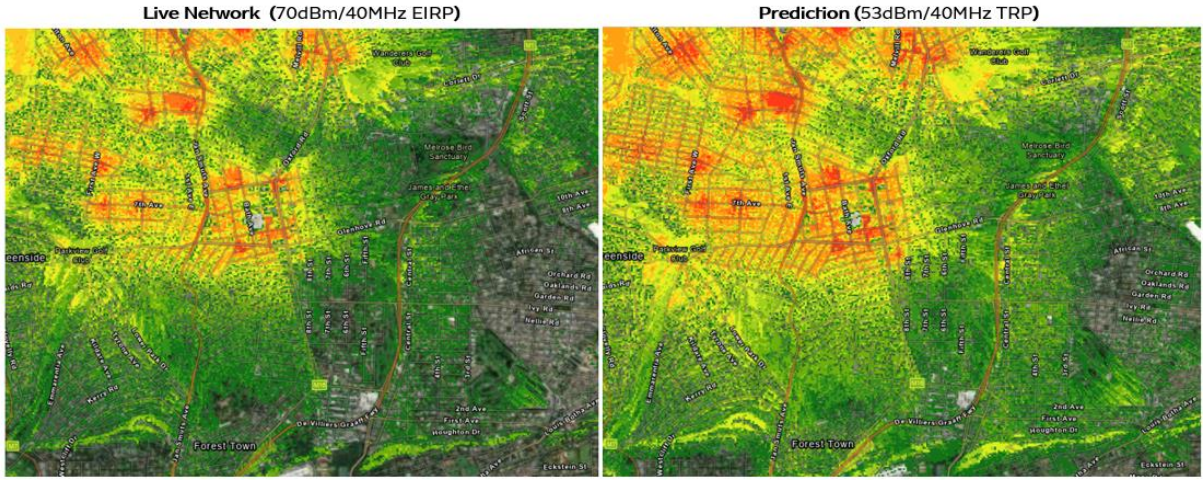


Figure 1 – Coverage prediction comparison for the current MTN 5G live network (70dBm/40MHz EIRP limit per cell) versus the 53 dBm/40MHz TRP limit on NR 3500 MHz band

5G NR SS-RSRP (dBm)	Current % POPULATION COVERAGE (at 70dBm/40MHz EIRP)	% POPULATION COVERAGE (at 53dBm/40MHz TRP)
-60	0.0%	0.2%
-70	0.3%	0.8%
-80	1.2%	2.5%
-85	2.1%	4.0%
-90	3.5%	5.8%
-95	5.1%	8.0%
-100	7.2%	10.6%
-105	9.7%	13.5%
-110	12.5%	16.6%
-115*	**15.6%**	**19.5%**

***Note:** MTN reports 5G population coverage statistics at -115dBm SS-RSRP threshold level*

Note that MTN is not aware of the transmission limits, if any, in place on the 3.7GHz band (3600MHz – 3800MHz) where licenses have been issued for FWA on a secondary usage basis (with the satellite service having primary use of this band).

5G FWA services are being deployed in the 3.7GHz band using the same AAS technology as is being deployed in the IMT3500 band. MTN is also not aware of any RFSAP published governing the operator's deploying FWA services in this band, but it would be expected that the base station transmission limits should be no more than those specified for the IMT3500 band considering that the satellite services in this band have primary use and are expected to be protected from FWA interference. For transparency and clarity, it is recommended that the Authority publish an RFSAP for the 3600MHz – 3800MHz that clearly outlines the transmission limits allowed within this band.

2.6.4. AAS base station power limit recommendation

MTN would like to request that the Authority review and reconsider this power emission limit when updating RFSAP regulation as it is very restrictive for AAS's that are now commonly used for 5G deployments in bands such as IMT2600 and IMT3500. Radio coverage is significantly impacted at present for AAS deployments using the 61dBm/5MHz EIRP emission limit.

2.6.5. Power Limits for Mobile Stations

MTN notes that the draft IMT3500 RFSAP indicates that mobile station transmissions should not exceed 23 dBm EIRP, however 3GPP TS 38.101-1 specifies two power classes relevant to the IMT3500 band: Power Class 2 can transmit max output power as 26 dBm and Power Class 3 max output power as 23 dBm. Power Class 2 is applicable to specific operating bands including n78 (IMT3300 & IMT3500) and n41 (IMT2600), whereas Power class 3 is applicable for all FR1 (sub-6GHz) frequency bands.

MTN also notes that the IMT2600 RFSAP published in 2020 differs from the draft IMT3500 (and IMT3300) RFSAPs 23dBm mobile station EIRP limit in that it indicates

"Mobile Station transmissions should not exceed 35 dBm/5 MHz (e.i.r.p.) and 31 dBm/5 MHz (TRP)".

Hence, MTN suggests that the Authority make allowance for the High Power User Equipment (HPUE) supporting up to 26 dBm maximum output power in IMT3500. This is commonly supported by CPEs used for FWA applications, as well as some flagship smartphones, and can significantly improve quality of service especially for uplink heavy applications such as video conferencing that have become more common since the increase in work-from-home as a result of the COVID19 pandemic. MTN recommends that the mobile station transmissions limit is aligned to cater for the 3GPP HPUE power class to allow for at least 26dBm TRP in the IMT3300 and IMT3500 bands.

3. Conclusion

The proposed RFSAP is a significant step towards the implementation of the Radio Frequency Assignment Plans for IMT spectrum bands. MTN has provided constructive feedback which if incorporated will enhance the assignment plans.

MTN has made several recommendations in this submission, key amongst is that the Authority re-evaluate the power limits on several IMT bands as these proposed technical parameters are considered very restrictive for Active Antenna Systems (AAS) base stations that have high dynamic beamforming gain and that are now commonly deployed for TDD bands.

Total Radiated Power (TRP) is widely used by regulators globally as the metric to specify power limitations for AAS deployments. It is thus incumbent that the Authority take cognizance of global developments and have regard to the appropriate technical recommendations for those applications/services. MTN recommends that the Authority include a Total Radiated Power (TRP) limit for AAS base stations into the assignment plans.

MTN also requests that the Authority clarifies how it will manage synchronisation issues where it assigns spectrum on a TDD basis. As was the case of the RFSAP for

IMT2600, MTN suggests that the Authority includes a section on the network synchronization requirements to ensure that the radio transmissions of adjacent TDD networks shall be synchronised with the uplink and downlink frames aligned in time in order to avoid interference between the networks operating in adjacent frequency carriers.

Finally, in relation to the IMT900 spectrum band which requires existing licensees to return 1MHz of spectrum each, MTN has proposed an extended timeline in order to not cause unnecessarily network disruption which would have a knock-on effect to quality-of-service experience of their subscribers.

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[i] https://mybroadband.co.za/news/cellular/431668-spectrum-chaos-in-south-africa.html)

[ii] *EIRP is Effective Isotropic Radiated Power, also called the Equivalent Isotropic Radiated Power. In antenna measurements, the measured radiated power in a single direction is known as the EIRP*

[iii] TRP is an active measurement, in that a powered transmitter is used to transmit through the antenna. The total received power is calculated and summed up over all possible angles (hence, it is a spherical or 3D measurement) and the result is Total Radiated Power.

[iv] OFCOM notice on "Variation of Spectrum Access licenses in the 3400 to 3680 MHz band". The Maximum power within the Permitted Frequency Blocks is specified in Table 2 (page 6) of the following document; https://www.ofcom.org.uk/consultations-and-statements/category-3/proposal-vary-3.4ghz-radio-spectrum-licences

[v] Canadian gazette notice on "Flexible Use Broadband Equipment Operating in the Band 3450-3650 MHz – RSS-192". The Maximum TRP within the Permitted Frequency Blocks is specified in Table 1 (page 4, Section 8.7) of the following document:
https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/RSS-192i42020-05EN.pdf/$file/RSS-192i42020-05EN.pdf

[vi] MTN has been awarded 40MHz of spectrum on IMT2600 and IMT3500 bands in spectrum auction concluded in March 2022.

[vii] Typical antenna gain of AAS product deployed on MTN 5G live network during National Disaster period using ICASA provisional radio license on IMT3500 is: 25 dBi. Example of AAU deployed: Huawei AAU5639w (3.4-3.6GHz; 200MHz IBW).